Electron-Ion Collider, Requirements, Specifications, and Interfaces

Interface Requirements for the EIC Detector Systems

December 12, 2024

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REVISION HISTORY

Revision #	Effective Date	Additional Reviewers	Summary of Change
00	12/11/2024		Initial release

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LIST OF ACRONYMS

AC-LGAD	AC-Coupled Low-Gas Avalanche Detector
ATLAS	Automatically Tuned Linear Algebra Software
CDR	Conceptional Design Report
COTS	Commercial Off the Shelf
DAQ	Data Acquisition
DET	EIC Detector
DIRC	Detection of Internally Reflected Cherenkov Light
DVCS	Deeply Virtual Compton Scattering
EEI	Electrical Equipment Inspection
EIC	Electron-Ion Collider
EMI	Electromagnetic Interference
ESR	Electron Storage Ring
FCC	Federal Communications Commission
FEB	Front End Board
FELIX	Front-End Link Exchange
FEP	Front-End Processor
GEM	Gas Electron Multiplier
HSR	Hadron Storage Ring
HV	High Voltage
HVAC	Heating/Ventilation/Air Conditioning
IP	Interaction Point
IR	Interaction Region
LED	Light Emitting Device
LV	Low Voltage
MAPS	Monolithic Active Pixel Sensor
ML	Machine Learning
MPGD	Micro Pattern Gaseous Detectors
NAS	National Academy of Sciences
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
OS	Operating System
PCB	Printed Circuit Boards
PID	Particle Identification
PWO	PbWO4
RCS	Rapid Cycling Synchrotron
RFI	Radio Frequency Interference
RICH	Ring-Imaging Cherenkov Detector

RPOT	Roman Pots
STAR	Solenoidal Tracker at RHIC
UL	Underwriter Laboratories
VAC	Volts A/C
VME	Versa Module Europa
WAH	Wide Access Hall
WBS	Work Break Down Structure

Interface Requirements for the EIC Detector Systems

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1. PURPOSE AND SCOPE

This document presents the interface requirements for the EIC Detector Systems. This document is a requirement of the Systems Engineering and Requirements Management Plans [6][5]. Interfaces are part of the requirements management process and are collected and maintained in accordance with the Interface Management Plan [7]. The Interface Management Plan specifies the need for Interface Requirement Documents, which are companions to the general/functional/performance requirements documents. Taken together, they provide a complete foundation for designing detector systems that can successfully integrate and operate within the larger EIC environment.

Interfaces are listed by sub-system beginning in section 4. Each subsection within section 4 will contain the interfaces associated with an individual sub-system. Interfaces may be repeated in multiple sub-systems if they are connected with one another.

2. DETECTOR SYSTEMS SUMMARY

The physics program of an EIC imposes several challenges on the design of a general-purpose detector, and more globally the extended interaction region, as it spans center-of-mass energies from 29 GeV to 141 GeV, different combinations of both beam energy and particle species, and several distinct physics processes. The various physics processes encompass inclusive measurements e + p/A → e'+X; semi-inclusive processes e + p/A → e'+h+X, which require detection of at least one hadron in coincidence with the scattered lepton; and exclusive processes e + p/A → e'+N'A'+ γ/h, which require the detection of all particles in the reaction with high precision. The EIC CDR [3] and the Yellow Report [4] discuss in detail how the requirements on the accelerator, the interaction region and the experimental equipment flow down from the EIC science.

The EIC general-purpose detector, ePIC, must be capable to cover the physics program detailed in the NAS review [1] at the full center-of-mass energy range and luminosity (10^{33-34} $cm^{-2}s^{-1}$). The central detector consists of a solenoidal magnet, the central detector with 6 subsystems and a lepton and hadron endcap with each 6 subsystems. Further data-acquisition and trigger, infrastructure, and integration as well as online software efforts are included in the scope. The EIC experimental equipment does not stop at the central detector. To realize the full science program, the design of the IR and the integration of the far backward and forward detectors along the outgoing lepton and hadron beam are equally critical. There are further implications to both the detector and the integration of the detector and interaction region to accommodate the large range of ion species required for the EIC science program, and the various electron and proton/ion beam polarizations. Figure 1 illustrates the EIC accelerator complex, at the time this document was signed the decision was just taken to remove the RCS from the tunnel and build a green-field solution, this is not yet reflected in the figure. Figure 2 shows the EIC general-purpose detector and how it is embedded together with its ancillary detectors into the EIC interaction region at IR6.

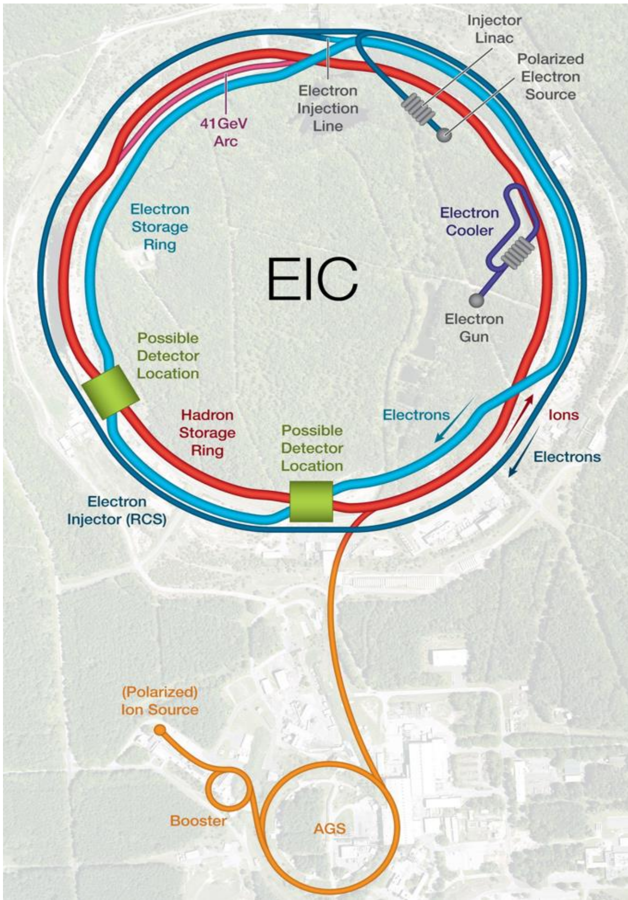

Figure 1: The EIC accelerator complex, the EIC detector is located at the IR6 interaction region

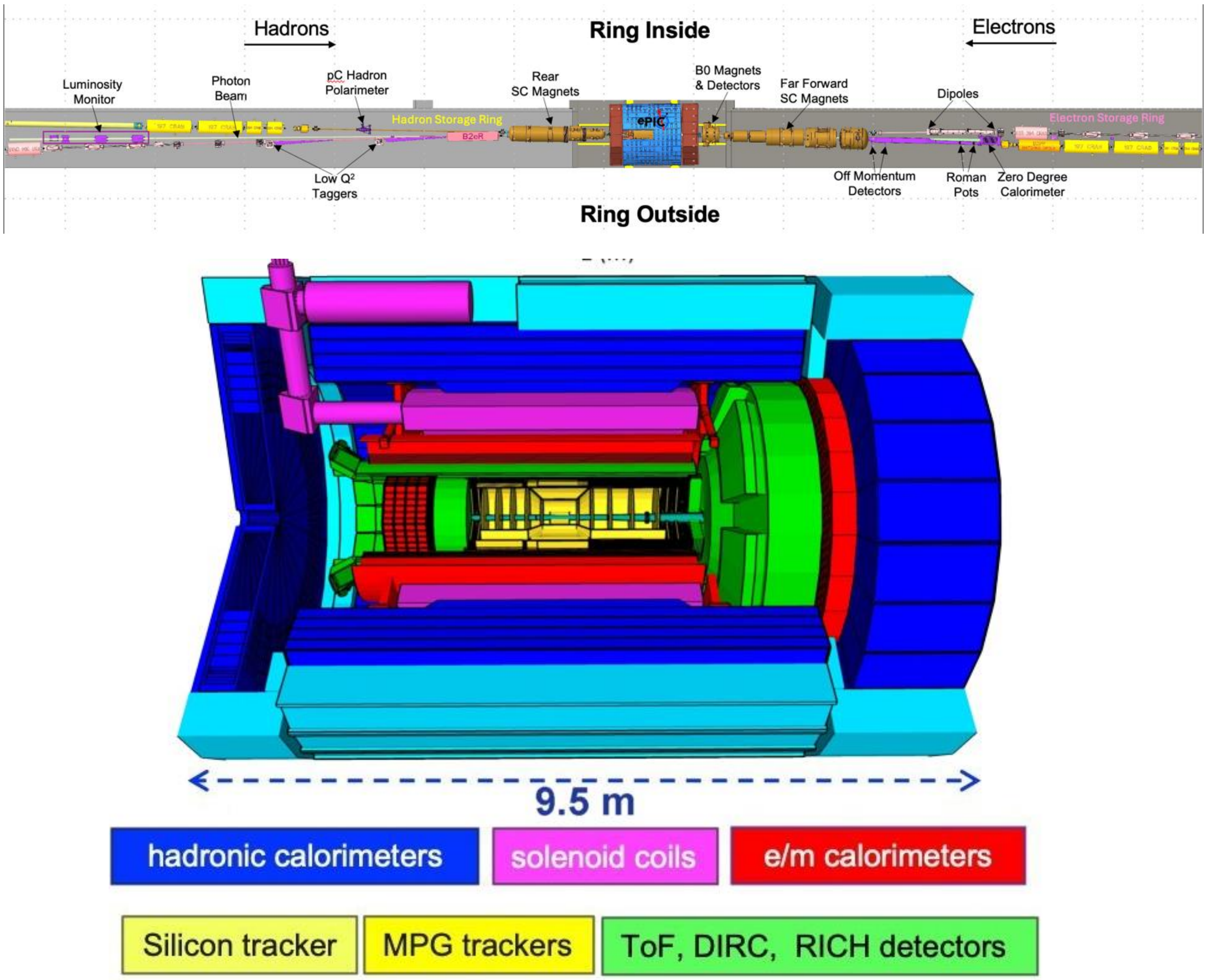

Figure 2: The top shows, how the EIC general-purpose detector, ePIC, is embedded together with its ancillary detectors into the EIC interaction region at IR6. Note that the forward direction is the on the incoming lepton beam side and the backward direction is on the incoming hadron beam side in this figure. The bottom shows the ePIC detector indicating in the different colors the different subsystem detector categories.

3. DETECTOR SUB-SYSTEMS

The detector system consists of ten sub-systems that are aggregated into a single, fully integrated detector package that will operate within the interaction region. Each of these sub-systems has a complete set of requirement and interface documents that describe its functions, performance requirements and interconnectivity both within the detector system and to the larger environment. The following sub-systems are included in the detector.

3.1. Tracking Systems

The compact tracker consists of a MAPS silicon barrel vertex detector augmented by MAPS tracking layers and by a set of forward/backward disks, and several GEM stations, all placed into solenoid with a 1.7 T solenoidal field, with an inner diameter of 2.84 m. To have good, charged particle-identification (PID) at central rapidities, a DIRC is complemented with AC-LGAD layers for tracking and Time-of-Flight. The vertex detector covering the central rapidity range (-1 to 1) has multiple layers of high-resolution MAPS sensors with a 20 μm pixel size and an effective thickness of only 0.3% radiation length per layer. Such a setup enables a momentum resolution better than 3% for scattered electrons and secondary charged hadrons for momenta up to a few tenths of GeV/c in the pseudo-rapidity range –4 to 4. For a compact forward tracker design, it is critical to maintain high spatial resolution.

3.2. Particle Identification Systems

The PID detector systems cover the three main regions of the central detector. These are the magnet bore region and the two regions in the direction of the incoming (backward) and outgoing (forward) hadron beam. The central region is assumed to harbor a high performance DIRC (hpDIRC) detector based on detector components from the BaBar DIRC, in particular the quartz bars. It is optimized by a focusing system to provide proton-kaon separation up to 6GeV/c. The forward region will be equipped with a dual RICH (dRICH) detector optimized for a wide range in particle momenta using Aerogel and gas as the two radiator materials. On the backward side, in the direction of the outgoing electron beam, a modular RICH (mRICH) detector will provide hadron identification at moderate momenta. Alternatively, the mRICH detector could be replaced by a proximity focusing Aerogel RICH. It is expected that these detectors will be constructed by the EIC user community.

3.3. Electromagnetic Calorimetry Systems

A general-purpose EIC detector is supposed to have a 4π hermetic coverage in tracking, PID and calorimetry. For the electromagnetic (e/m) calorimetry there are several technology options available, for both the high-resolution homogeneous and the medium-resolution sampling solutions. The choice will depend on the actual requirements for a given part of the acceptance, driven by the physics requirements and simulations. The e/m calorimetry subsystem can be split into three distinct parts, the electron-going endcap, barrel, and hadron-going endcap. The majority of the e/m calorimeter options were developed within the generic EIC detector R&D program. For the most backward pseudo-rapidities in the electron endcap the highest resolution is required as provided by $PbWO_4$ crystals. The high-energy resolution $PbWO_4$ crystals is a well-established technology, where EIC can rely on the experience of CERN/CMS, GSI/PANDA and also the Jefferson Lab experiments. In the less-backward pseudo-rapidity region extending to the more central barrel region, around pseudo-rapidity of zero, medium- to high-resolution is required.

Starting around pseudo-rapidity near zero, in the positive and forward pseudo-rapidity (hadron endcap) region medium resolution will be required leading to a sampling calorimeter solution. In the barrel region, a hybrid sampling calorimeter of sufficient resolution based on scintillating fibers embedded in lead coupled with imaging calorimetry based on sensors may provide an alternate solution that is complementary to SciGlass. In the forward hadron endcap region, a lead-scintillator shaslik calorimeter is envisioned or alternately a sampling calorimeter based on scintillating fibers with a tungsten powder epoxy mix. It is anticipated that the electron endcap and barrel e/m calorimeters will be an integral part of the central detector, while the hadron endcap e/m calorimeter will be co-located on the hadron-endcap hadronic calorimeter carriage.

3.4. Hadronic Calorimetry Systems

Several physics studies indicate that an EIC detector will require a continuous hadronic calorimetry (HCal) coverage in the polar angular range from approximately 2 to 178 degrees, in order to meet the scientific goals. The HCal subsystem will be naturally split into the barrel part and the two endcaps. As mentioned already, the barrel part is reused from the already existing sPHENIX detector. The endcaps need to be designed and manufactured from scratch, in a close connection to the e/m calorimetry subsystem. The latter typically provides the very first interaction length of the active tower matrix, and in case of the h-going endcap will be assembled on the same heavy duty roller platform. It is currently envisioned that each of the HCal tower matrices in the endcaps will be built utilizing a technology based forming towers from an alternating steel scintillator structure. The photo-sensors will be embedded into the scintillators. The lepton endcap hadron calorimeter will mainly function as a tail-catcher and to identify neutral hadrons.

3.5. Solenoid Magnet

This section includes all labor and materials to design, procure, fabricate, cold test, magnetic measurements, surveys, installation & commissioning, and system test & integration of the solenoid magnet system (magnet system includes coils, support structure, cryostat, control & instrumentation for magnet, quench protection, magnet power supply, current leads, trim coil power supply, cryogenic flex-line, and associated connectors). This will also include all the vendor visits for various sub-systems.

3.6. Electronics Systems

This section covers the effort for the front-end electronics integrated on the different sub-detectors. One estimates ~700k channels for a reference EIC detector. Costs cover the final design and construction of all the electronics from the detectors to the input of the DAQ system and include the fabrication and procurement of ASICs; printed circuit boards (PCB) such as FEB and FEP cards; high voltage (HV), low voltage (LV), bias power supply systems; cabling and optical fibers.

3.7. Data Acquisition and Computing Systems

This section covers the effort for the data-acquisition (DAQ) and computing needed to collect all the data from the front-end electronics. The current plan for the DAQ is to not have any trigger, but to collect all the data from the different sub-detectors and only suppress detector pedestals and noise. This type of DAQ is commonly referred to as a streaming DAQ. The cost was estimated based on the FELIX cards developed for ATLAS. In addition, the servers, network switches and network fibers needed to fully collect the data are costed as well. Currently the need of ~88 Felix cards and ~44 servers are assumed to collect the data from the ~700k channels.

3.8. Detector Infrastructure

This section covers the entire effort needed to design and built the support structures for the EIC detector and includes the support to complete the installation scope prior to commissioning.

3.9. IR Integration and Ancillary Detectors

The EIC physics program requires several detectors along the outgoing lepton and hadron beam line. These include the low-Q^2 tagger along the outgoing electron beam. Along the hadron outgoing beam, these include the Zero-degree calorimeter, for neutron and photon detection and the silicon detectors for charged particles scatters at < 20 mrad: B0-tracker inside the BO magnet, off-momentum detectors after the B1-dipole magnet and the Roman Pots integrated into the beam pipe vacuum system between B1 and B2.

3.10. Polarimetry and Luminosity Systems

All design and construction activities needed to integrate the Luminosity Monitor into the IR as well as the construction activities for hadron and electron beam polarimetry in the hadron SR and the lepton RCS and ESR.

4. INTERFACE REQUIREMENTS

Each of the following subsections represents a sub-system within the larger EIC detector system. All internal and external interface requirements that are associated with that sub-system will be provided there. Interface requirements may be repeated if they are relevant to multiple sub-systems.

Note that in some cases the connected sub-system ("To") is identified as TBD (to be determined). This indicates that the sub-system exists outside of the Detector system, and the relationship has not been fully identified yet. As the design continues, these connections will be resolved and the document will be updated to reflect the newest information.

4.1. DET-TRAK : Tracking Systems (WBS 6.10.03)

Interfaces associated with the tracking systems located in the forward, barrel, and backward sections of the central detector.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.081	DET-TRAK	DET-COMP	Cables required to transfer data from the detector to the online data acquisition system.
I-DET-COMP-ONLINE.082	DET-TRAK	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel tracking system's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.083	DET-TRAK	DET-COMP	A network connection will be provided from the DAQ system to the barrel tracking system's slow controls interface.
I-DET-COMP-ONLINE.084	DET-TRAK	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel tracking system's readout board for timing synchronization.
I-DET-ELEC.069	DET-TRAK	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.070	DET-TRAK	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.071	DET-TRAK	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-INF-BAR.016	DET-TRAK	DET-INF	A single structural support system will support the silicon detectors and the micro-pattern gaseous detectors within the DIRC detector.
I-DET-INF-BAR.021	DET-TRAK	DET-INF	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-TRAK	DET-INF	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.012	DET-TRAK	DET-INF	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-FWD.013	DET-TRAK	DET-INF	The interior radius of the tracking detectors is governed by the size of the beamline.
I-DET-INF-INT.098	DET-TRAK	DET-INF	Air, liquid or other cooling technology will be required for the tracking detectors.
I-DET-INF-INT.099	DET-TRAK	DET-INF	Gas will need to be provided to the trackers for detector operation.

Interface ID	From	To	Description
I-DET-INF-INT.100	DET-TRAK	DET-INF	A single structural support system will support the silicon detectors and the micro-pattern gaseous detectors within the DIRC detector.
I-DET-INF-INT.105	DET-TRAK	DET-INF	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-TRAK	DET-INF	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-TRAK	DET-INF	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.110	DET-TRAK	DET-INF	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.
I-DET-INF-INT.111	DET-TRAK	DET-INF	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.
I-DET-INF-BAR.021	DET-TRAK	DET-PID	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-TRAK	DET-PID	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.012	DET-TRAK	DET-PID	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-INT.105	DET-TRAK	DET-PID	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-TRAK	DET-PID	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-TRAK	DET-PID	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.110	DET-TRAK	DET-PID	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.
I-DET-INF-INT.111	DET-TRAK	DET-PID	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-FWD.013	DET-TRAK	TBD	The interior radius of the tracking detectors is governed by the size of the beamline.
I-DET-TRAK-BAR.001	DET-TRAK	TBD	The silicon is in close proximity with the beamline. During bakeout the heat will need to be removed to prevent damage to the silicon.

4.2. DET-PID : Particle Identification Systems (WBS 6.10.04)

Interfaces associated with the particle identification systems located in the forward, barrel, and backward sections of the central detector.

Interface ID	From	To	Description
I-DET-INF-INT.003	DET-PID	DET	The DIRC structure will provide integrated pathways for cabling and services to be delivered from the interior detectors (pf RICH/mRICH and silicon trackers) to the exterior infrastructure.
I-DET-COMP-ONLINE.045	DET-PID	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel PID detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.046	DET-PID	DET-COMP	A network connection will be provided from the DAQ system to the barrel PID detector's slow controls interface.
I-DET-COMP-ONLINE.047	DET-PID	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel PID detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.048	DET-PID	DET-COMP	Signal cables will run from the DIRC electronics to the DAQ system.
I-DET-COMP-ONLINE.049	DET-PID	DET-COMP	Signal cables from environmental sensors will run from the DIRC electronics to the DAQ system to provide detector shutdown/protection system.
I-DET-COMP-ONLINE.050	DET-PID	DET-COMP	Signal cables will run from the DIRC electronics to the DAQ system.
I-DET-COMP-ONLINE.051	DET-PID	DET-COMP	Signal cables from environmental sensors will run from the DIRC electronics to the DAQ system to provide detector shutdown/protection system.
I-DET-COMP-ONLINE.052	DET-PID	DET-COMP	Signal cables will run from the pfRICH/mRICH electronics to the DAQ system.
I-DET-COMP-ONLINE.053	DET-PID	DET-COMP	Signal cables from environmental sensors will run from the pfRICH/mRICH electronics to the DAQ system to provide a detector shutdown/protection system.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.054	DET-PID	DET-COMP	Signal cables will run from the dRICH electronics to the DAQ system.
I-DET-COMP-ONLINE.055	DET-PID	DET-COMP	Signal cables from environmental sensors will run from the cold photosensors to the DAQ system to provide a detector shutdown/protection system.
I-DET-INF-BAR.003	DET-PID	DET-ECAL	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.
I-DET-INF-BAR.005	DET-PID	DET-ECAL	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-PID	DET-ECAL	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-INT.013	DET-PID	DET-ECAL	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.014	DET-PID	DET-ECAL	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-PID	DET-ECAL	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-PID	DET-ECAL	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.018	DET-PID	DET-ECAL	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-PID	DET-ECAL	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-PID	DET-ECAL	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-PID	DET-ECAL	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that

Interface ID	From	To	Description
			provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-ELEC.046	DET-PID	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.047	DET-PID	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.048	DET-PID	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.049	DET-PID	DET-ELEC	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the DIRC.
I-DET-ELEC.050	DET-PID	DET-ELEC	Low voltage power will be delivered from the power supplies on the carriage to the DIRC electronics.
I-DET-ELEC.051	DET-PID	DET-ELEC	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the DIRC.
I-DET-ELEC.052	DET-PID	DET-ELEC	Low voltage power will be delivered from the power supplies on the carriage to the DIRC electronics.
I-DET-ELEC.053	DET-PID	DET-ELEC	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the pfRICH/mRICH.
I-DET-ELEC.054	DET-PID	DET-ELEC	Low voltage power will be delivered from the power supplies on the carriage to the pfRICH/mRICH electronics.
I-DET-ELEC.055	DET-PID	DET-ELEC	Bias voltage DC power will be delivered from the power supplies on the carriage to the photosensors.
I-DET-ELEC.056	DET-PID	DET-ELEC	Low voltage power will be delivered from the power supplies on the carriage to the dRICH electronics.
I-DET-INF-BAR.012	DET-PID	DET-HCAL	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.
I-DET-INF-INT.032	DET-PID	DET-HCAL	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.036	DET-PID	DET-HCAL	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-BAR.003	DET-PID	DET-INF	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.

Interface ID	From	To	Description
I-DET-INF-BAR.005	DET-PID	DET-INF	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-PID	DET-INF	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-BAR.012	DET-PID	DET-INF	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.
I-DET-INF-BAR.017	DET-PID	DET-INF	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-BAR.018	DET-PID	DET-INF	The pfRICH/mRICH will be supported by the DIRC bar box support system.
I-DET-INF-BAR.019	DET-PID	DET-INF	The barrel Time of Flight will be supported by the DIRC bar box assembly.
I-DET-INF-BAR.020	DET-PID	DET-INF	The DIRC support system will provide support for the upstream PID detector system.
I-DET-INF-BAR.021	DET-PID	DET-INF	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-PID	DET-INF	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.011	DET-PID	DET-INF	The interior radius of the dRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-FWD.012	DET-PID	DET-INF	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-INT.003	DET-PID	DET-INF	The DIRC structure will provide integrated pathways for cabling and services to be delivered from the interior detectors (pf RICH/mRICH and silicon trackers) to the exterior infrastructure.
I-DET-INF-INT.013	DET-PID	DET-INF	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.014	DET-PID	DET-INF	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-PID	DET-INF	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and

Interface ID	From	To	Description
			the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-PID	DET-INF	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.018	DET-PID	DET-INF	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-PID	DET-INF	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-PID	DET-INF	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-PID	DET-INF	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.032	DET-PID	DET-INF	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.036	DET-PID	DET-INF	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.088	DET-PID	DET-INF	The heat generated by the photo-multiplier tubes and associated electronics must be removed using a process cooling system.
I-DET-INF-INT.089	DET-PID	DET-INF	The heat generated by the detector and its electronics must be removed using a process cooling system.
I-DET-INF-INT.090	DET-PID	DET-INF	The heat generated by the photomultipliers and associated electronics must be removed using a process cooling system.
I-DET-INF-INT.091	DET-PID	DET-INF	A continuous flow of dry nitrogen will be required to protect the aerogel radiator.
I-DET-INF-INT.092	DET-PID	DET-INF	A fluid cooling system will be required to keep the operating temperature of the photosensors at -30 degrees Celsius.
I-DET-INF-INT.093	DET-PID	DET-INF	A recovery system will need to be included for the radiator gas used by the dRICH to prevent accidental release.

Interface ID	From	To	Description
I-DET-INF-INT.094	DET-PID	DET-INF	Sufficient insulation will need to be added around all coolant lines to prevent condensation and ensure that ice doesn't form.
I-DET-INF-INT.095	DET-PID	DET-INF	A continuous flow of dry nitrogen will be required to protect the aerogel radiator.
I-DET-INF-INT.096	DET-PID	DET-INF	This gas will be required to create a protective atmosphere for the cold photosensors and to prevent condensation and freezing.
I-DET-INF-INT.097	DET-PID	DET-INF	A continuous recirculating flow of radiator gas will be required.
I-DET-INF-INT.101	DET-PID	DET-INF	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.
I-DET-INF-INT.102	DET-PID	DET-INF	The maximum diameter of the barrel Time of Flight detector is limited by the interior bore of the DIRC detector. Modifications to either must be coordinated.
I-DET-INF-INT.103	DET-PID	DET-INF	The exterior radius of the pfRICH/mRICH is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.104	DET-PID	DET-INF	The maximum forward location for the DIRC is limited by the position of the dRICH detector and the cabling plenum between them. Modifications to either must be coordinated.
I-DET-INF-INT.105	DET-PID	DET-INF	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-PID	DET-INF	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-PID	DET-INF	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.108	DET-PID	DET-INF	The maximum backward location for the barrel Time of Flight detector is limited by the position of the pfRICH/mRICH detector and the adjacent cabling pathway. Modifications to either must be coordinated.
I-DET-INF-INT.109	DET-PID	DET-INF	The maximum forward location for the barrel Time of Flight detector is limited by the position of the forward Time of Flight detector and the adjacent cabling pathway. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.110	DET-PID	DET-INF	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.
I-DET-INF-INT.111	DET-PID	DET-INF	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.
I-DET-INF-INT.112	DET-PID	DET-INF	The interior radius of the pfRICH/mRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-BAR.017	DET-PID	DET-MAG	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-INT.101	DET-PID	DET-MAG	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.
I-DET-INF-BAR.021	DET-PID	DET-TRAK	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-PID	DET-TRAK	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.012	DET-PID	DET-TRAK	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-INT.105	DET-PID	DET-TRAK	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-PID	DET-TRAK	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-PID	DET-TRAK	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.110	DET-PID	DET-TRAK	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.
I-DET-INF-INT.111	DET-PID	DET-TRAK	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.
I-DET-INF-FWD.011	DET-PID	TBD	The interior radius of the dRICH is governed by the size of the beamline and its associated flanges and support system.

Interface ID	From	To	Description
I-DET-INF-INT.112	DET-PID	TBD	The interior radius of the pfRICH/mRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-PID-BAR-DIRC.001	DET-PID	TBD	This system will generate light pulses to monitor the response of the photosensors, and to adjust timing correlations within the detector.
I-DET-PID-BAR-TOF.001	DET-PID	TBD	This system will generate light pulses to monitor the response of the photosensors, and to adjust timing correlations within the detector.
I-DET-PID-BCK.001	DET-PID	TBD	This system will generate light pulses to monitor the response of the photosensors, and to adjust timing correlations within the detector.

4.3. DET-ECAL : Electromagnetic Calorimetry Systems (WBS 6.10.05)

Interfaces associated with the electromagnetic calorimeters located in the forward, barrel, and backward sections of the central detector.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.020	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.021	DET-ECAL	DET-COMP	A network connection will be provided from the DAQ system to the barrel ECAL's slow controls interface.
I-DET-COMP-ONLINE.022	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel ECAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.023	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the backward ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.024	DET-ECAL	DET-COMP	A network connection will be provided from the DAQ system to the backward ECAL's slow controls interface.
I-DET-COMP-ONLINE.025	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the backward ECAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.026	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the forward ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.027	DET-ECAL	DET-COMP	A network connection will be provided from the DAQ system to the forward ECAL's slow controls interface.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.028	DET-ECAL	DET-COMP	A fiber connection will be provided from the DAQ system to the forward ECAL's readout board for timing synchronization.
I-DET-ELEC.019	DET-ECAL	DET-ELEC	Bias voltage DC power provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.020	DET-ECAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.021	DET-ECAL	DET-ELEC	Low voltage DC power provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.022	DET-ECAL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.023	DET-ECAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.024	DET-ECAL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.025	DET-ECAL	DET-ELEC	Bias voltage DC power provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.026	DET-ECAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.027	DET-ECAL	DET-ELEC	Low voltage DC power provided from the electronics racks to support electronics in the detector.
I-DET-INF-BAR.001	DET-ECAL	DET-HCAL	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.
I-DET-INF-BAR.002	DET-ECAL	DET-HCAL	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.004	DET-ECAL	DET-HCAL	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.007	DET-ECAL	DET-HCAL	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-ECAL	DET-HCAL	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-FWD.004	DET-ECAL	DET-HCAL	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.

Interface ID	From	To	Description
I-DET-INF-INT.016	DET-ECAL	DET-HCAL	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.023	DET-ECAL	DET-HCAL	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-ECAL	DET-HCAL	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-BAR.001	DET-ECAL	DET-INF	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.
I-DET-INF-BAR.002	DET-ECAL	DET-INF	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.003	DET-ECAL	DET-INF	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.
I-DET-INF-BAR.004	DET-ECAL	DET-INF	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.005	DET-ECAL	DET-INF	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-ECAL	DET-INF	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-BAR.007	DET-ECAL	DET-INF	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-ECAL	DET-INF	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.014	DET-ECAL	DET-INF	Each half of the forward ECAL must be continuously supported and stabilized while it is moved between the opened and closed positions.
I-DET-INF-FWD.004	DET-ECAL	DET-INF	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.

Interface ID	From	To	Description
I-DET-INF-FWD.008	DET-ECAL	DET-INF	Each half of the forward ECAL must be continuously supported and stabilized while it is moved between the opened and closed positions.
I-DET-INF-INT.012	DET-ECAL	DET-INF	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-INF-INT.013	DET-ECAL	DET-INF	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.014	DET-ECAL	DET-INF	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-ECAL	DET-INF	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.016	DET-ECAL	DET-INF	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-ECAL	DET-INF	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.018	DET-ECAL	DET-INF	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-ECAL	DET-INF	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-ECAL	DET-INF	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.021	DET-ECAL	DET-INF	The bore of the backward ECAL must be designed to allow it to be inserted/removed over the existing beamline flanges.
I-DET-INF-INT.022	DET-ECAL	DET-INF	The interior radius of the backward ECAL is governed by the size of the beamline.

Interface ID	From	To	Description
I-DET-INF-INT.023	DET-ECAL	DET-INF	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-ECAL	DET-INF	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-ECAL	DET-INF	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.026	DET-ECAL	DET-INF	The interior radius of the forward ECAL is governed by the size of the beamline. Modifications to either must be coordinated.
I-DET-INF-INT.065	DET-ECAL	DET-INF	The imaging layers must be cooled with an independent system (TBD).
I-DET-INF-INT.066	DET-ECAL	DET-INF	The barrel ECAL will require chilled water or LCW cooling to maintain a safe operating temperature.
I-DET-INF-INT.067	DET-ECAL	DET-INF	The backward ECAL will require chilled water or LCW cooling to maintain the temperature of the silicon photomultipliers, the electronics, and the crystals.
I-DET-INF-INT.068	DET-ECAL	DET-INF	The forward ECAL will require chilled water or LCW cooling to maintain a safe operating temperature.
I-DET-INF-INT.012	DET-ECAL	DET-MAG	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-INF-BAR.003	DET-ECAL	DET-PID	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.
I-DET-INF-BAR.005	DET-ECAL	DET-PID	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-ECAL	DET-PID	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-INT.013	DET-ECAL	DET-PID	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.

Interface ID	From	To	Description
I-DET-INF-INT.014	DET-ECAL	DET-PID	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-ECAL	DET-PID	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-ECAL	DET-PID	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.018	DET-ECAL	DET-PID	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-ECAL	DET-PID	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-ECAL	DET-PID	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-ECAL	DET-PID	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.021	DET-ECAL	TBD	The bore of the backward ECAL must be designed to allow it to be inserted/removed over the existing beamline flanges.
I-DET-INF-INT.022	DET-ECAL	TBD	The interior radius of the backward ECAL is governed by the size of the beamline.
I-DET-INF-INT.026	DET-ECAL	TBD	The interior radius of the forward ECAL is governed by the size of the beamline. Modifications to either must be coordinated.

4.4. DET-HCAL : Hadronic Calorimetry Systems (WBS 6.10.06)

Interfaces associated with the hadronic calorimeters located in the forward, barrel, and backward sections of the central detector.

Interface ID	From	To	Description
I-DET-INF-INT.005	DET-HCAL	DET-ANC	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.031	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.032	DET-HCAL	DET-COMP	A connection from the DAQ system to the barrel HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.
I-DET-COMP-ONLINE.033	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the barrel HCAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.034	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the backward HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.035	DET-HCAL	DET-COMP	A connection from the DAQ system to the barrel HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.
I-DET-COMP-ONLINE.036	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the backward HCAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.037	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the forward HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.038	DET-HCAL	DET-COMP	A connection from the DAQ system to the forward HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.
I-DET-COMP-ONLINE.039	DET-HCAL	DET-COMP	A fiber connection will be provided from the DAQ system to the forward HCAL's readout board for timing synchronization.
I-DET-INF-BAR.001	DET-HCAL	DET-ECAL	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.
I-DET-INF-BAR.002	DET-HCAL	DET-ECAL	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.004	DET-HCAL	DET-ECAL	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.007	DET-HCAL	DET-ECAL	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split

Interface ID	From	To	Description
			into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-HCAL	DET-ECAL	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-FWD.004	DET-HCAL	DET-ECAL	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.
I-DET-INF-INT.016	DET-HCAL	DET-ECAL	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.023	DET-HCAL	DET-ECAL	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-HCAL	DET-ECAL	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-ELEC.028	DET-HCAL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.029	DET-HCAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.030	DET-HCAL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.031	DET-HCAL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.032	DET-HCAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.033	DET-HCAL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.034	DET-HCAL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.035	DET-HCAL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.036	DET-HCAL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-INF-BAR.001	DET-HCAL	DET-INF	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.

Interface ID	From	To	Description
I-DET-INF-BAR.002	DET-HCAL	DET-INF	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.004	DET-HCAL	DET-INF	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.007	DET-HCAL	DET-INF	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-HCAL	DET-INF	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.009	DET-HCAL	DET-INF	The barrel HCAL will be supported by a rolling carriage that allows the central detector to be moved between the assembly area and the experimental hall.
I-DET-INF-BAR.010	DET-HCAL	DET-INF	The barrel HCAL will support the weight of all of the sub-detectors and components within the central detector.
I-DET-INF-BAR.011	DET-HCAL	DET-INF	The cumulative weight of the HCAL and all of the sub-detectors it supports will be transferred to the detector carriage.
I-DET-INF-BAR.012	DET-HCAL	DET-INF	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.
I-DET-INF-BCK.001	DET-HCAL	DET-INF	Adequate clearance must be provided for either of the detector carriages to be rolled aside to allow access to sub-detectors within the barrel.
I-DET-INF-BCK.002	DET-HCAL	DET-INF	The backward HCAL consists of two halves, each of which are support by an independent carriage.
I-DET-INF-BCK.003	DET-HCAL	DET-INF	The weight of each half of the backward HCAL will be transferred to the carriage that is supporting it.
I-DET-INF-FWD.003	DET-HCAL	DET-INF	The forward HCAL consists of two halves, each of which are support by an independent carriage.
I-DET-INF-FWD.004	DET-HCAL	DET-INF	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.
I-DET-INF-FWD.005	DET-HCAL	DET-INF	The weight of each half of the forward HCAL, and its embedded subdetectors, will be transferred to the associated carriage.

Interface ID	From	To	Description
I-DET-INF-FWD.009	DET-HCAL	DET-INF	Adequate clearance must be provided for either of the detector carriages to be rolled aside to allow access to sub-detectors within the barrel.
I-DET-INF-INT.005	DET-HCAL	DET-INF	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.016	DET-HCAL	DET-INF	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.023	DET-HCAL	DET-INF	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-HCAL	DET-INF	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.027	DET-HCAL	DET-INF	The forward position of the backward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.028	DET-HCAL	DET-INF	The exterior radius of the backward HCAL should be consistent with the radius of the barrel HCAL.
I-DET-INF-INT.029	DET-HCAL	DET-INF	The exterior radius of the forward HCAL should be consistent with the radius of the barrel HCAL.
I-DET-INF-INT.030	DET-HCAL	DET-INF	The backward position of the forward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.031	DET-HCAL	DET-INF	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.032	DET-HCAL	DET-INF	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.034	DET-HCAL	DET-INF	The forward position of the backward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.035	DET-HCAL	DET-INF	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.036	DET-HCAL	DET-INF	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.038	DET-HCAL	DET-INF	The position of the backward HCAL is limited in the backward direction by the adjacent accelerator magnets.
I-DET-INF-INT.039	DET-HCAL	DET-INF	The interior radius of the backward HCAL is governed by the size of the beamline.
I-DET-INF-INT.041	DET-HCAL	DET-INF	The interior radius of the forward HCAL is governed by the size of the beamline.
I-DET-INF-INT.075	DET-HCAL	DET-INF	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air.
I-DET-INF-INT.076	DET-HCAL	DET-INF	The exterior radius of the barrel HCAL is limited by the detector carriage, the electronics platforms, and other Hall infrastructure.
I-DET-INF-INT.077	DET-HCAL	DET-INF	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air.
I-DET-INF-INT.078	DET-HCAL	DET-INF	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air. DO WE NEED CW FOR COOLING HERE?
I-DET-INF-INT.031	DET-HCAL	DET-MAG	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.035	DET-HCAL	DET-MAG	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-BAR.012	DET-HCAL	DET-PID	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.
I-DET-INF-INT.032	DET-HCAL	DET-PID	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.036	DET-HCAL	DET-PID	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.038	DET-HCAL	TBD	The position of the backward HCAL is limited in the backward direction by the adjacent accelerator magnets.
I-DET-INF-INT.039	DET-HCAL	TBD	The interior radius of the backward HCAL is governed by the size of the beamline.
I-DET-INF-INT.041	DET-HCAL	TBD	The interior radius of the forward HCAL is governed by the size of the beamline.

4.5. DET-MAG : Solenoid Magnet (WBS 6.10.07)

Interfaces associated with the solenoid magnet.

Interface ID	From	To	Description
I-DET-INF-INT.001	DET-MAG	DET	No detectors or components constructed with magnetic material may be added to the detector without prior consultation with the magnet group.
I-DET-INF-INT.002	DET-MAG	DET	All subordinate detectors are dependent on the continuous operation of the solenoid and on the delivery of a consistent, stable magnetic field.
I-DET-COMP-ONLINE.040	DET-MAG	DET-COMP	Control cabling for the magnet instrumentation will be run from the solenoid to the instrumentation rack on the carriage.
I-DET-COMP-ONLINE.041	DET-MAG	DET-COMP	Live monitoring data from the solenoid's operation must be recorded and maintained for diagnostic purposes.
I-DET-COMP-ONLINE.042	DET-MAG	DET-COMP	A network connection will be provided from the DAQ system to the solenoid cryogenic's slow controls interface.
I-DET-COMP-ONLINE.043	DET-MAG	DET-COMP	A network connection will be provided from the DAQ system to the solenoid's slow controls interface.
I-DET-COMP-ONLINE.044	DET-MAG	DET-COMP	A network connection will be provided from the DAQ system to the slow controls interface of the solenoid's power supply.
I-DET-INF-INT.012	DET-MAG	DET-ECAL	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-ELEC.037	DET-MAG	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the magnet cryogenic systems.

Interface ID	From	To	Description
I-DET-ELEC.038	DET-MAG	DET-ELEC	High voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.039	DET-MAG	DET-ELEC	Lower voltage DC power will be provided from the electronics racks to support the magnet cryogenic systems.
I-DET-ELEC.040	DET-MAG	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.041	DET-MAG	DET-ELEC	High voltage DC power will be provided from the electronics racks to support the magnet power supply.
I-DET-ELEC.042	DET-MAG	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.043	DET-MAG	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support the magnet power supply.
I-DET-ELEC.044	DET-MAG	DET-ELEC	High voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.045	DET-MAG	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support the magnet power supply.
I-DET-INF-INT.031	DET-MAG	DET-HCAL	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.035	DET-MAG	DET-HCAL	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-BAR.015	DET-MAG	DET-INF	Total weight of the solenoid and all embedded components must be supported.
I-DET-INF-BAR.017	DET-MAG	DET-INF	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-INT.001	DET-MAG	DET-INF	No detectors or components constructed with magnetic material may be added to the detector without prior consultation with the magnet group.
I-DET-INF-INT.002	DET-MAG	DET-INF	All subordinate detectors are dependent on the continuous operation of the solenoid and on the delivery of a consistent, stable magnetic field.

Interface ID	From	To	Description
I-DET-INF-INT.012	DET-MAG	DET-INF	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-INF-INT.031	DET-MAG	DET-INF	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.035	DET-MAG	DET-INF	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.042	DET-MAG	DET-INF	The solenoid will require a continuous flow of cryogens to maintain temperature in both the experimental hall and the maintenance area. Interface includes cryogenic source and warm return.
I-DET-INF-INT.079	DET-MAG	DET-INF	The power supply, located in an adjacent electrical room, will need to be cooled with low conductivity water.
I-DET-INF-INT.080	DET-MAG	DET-INF	The solenoid will require a continuous flow of cryogens to maintain temperature in both the experimental hall and the maintenance area. Interface includes cryogenic source and warm return.
I-DET-INF-INT.081	DET-MAG	DET-INF	Solenoid will be provided power via the power supply located in an adjacent room.
I-DET-INF-INT.082	DET-MAG	DET-INF	The instrumentation rack for the solenoid will require backup/UPS power adequate to safely shutdown the system in the event of a power failure.
I-DET-INF-INT.084	DET-MAG	DET-INF	A boundary must be established to identify the extent of the magnet's stray field during operations.
I-DET-INF-INT.085	DET-MAG	DET-INF	An ice management system will be required to melt accumulated ice on the chimney. (Water should evaporate and will not require drainage)
I-DET-INF-INT.086	DET-MAG	DET-INF	The cryogenic connection must be as close as possible to the source.
I-DET-INF-INT.087	DET-MAG	DET-INF	The LCW water cooled leads must be fully supported along their path between the electrical room and the magnet.
I-DET-INF-INT.101	DET-MAG	DET-INF	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.118	DET-MAG	DET-INF	A supply and return of liquid nitrogen must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.119	DET-MAG	DET-INF	A supply and return of liquid helium must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.120	DET-MAG	DET-INF	A supply and return of liquid nitrogen must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-INT.121	DET-MAG	DET-INF	A supply and return of liquid helium must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-BAR.017	DET-MAG	DET-PID	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-INT.101	DET-MAG	DET-PID	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.
I-DET-INF-INT.118	DET-MAG	TBD	A supply and return of liquid nitrogen must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.119	DET-MAG	TBD	A supply and return of liquid helium must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.120	DET-MAG	TBD	A supply and return of liquid nitrogen must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-INT.121	DET-MAG	TBD	A supply and return of liquid helium must be provided to the assembly hall for cooling the solenoid magnet during maintenance.

4.6. DET-ELEC : Electronic Systems (WBS 6.10.08)

Interfaces associated with the electronic systems that service all central and ancillary detectors.

Interface ID	From	To	Description
I-DET-ELEC.001	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided from the electronics racks to support electronics.

Interface ID	From	To	Description
I-DET-ELEC.002	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.003	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.004	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.005	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.006	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.007	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.008	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.009	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.010	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.011	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.012	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.013	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.014	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.015	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.016	DET-ELEC	DET-ANC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.017	DET-ELEC	DET-ANC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.

Interface ID	From	To	Description
I-DET-ELEC.018	DET-ELEC	DET-ANC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-COMP-ONLINE.029	DET-ELEC	DET-COMP	Monitoring system cables will run from the south platform to the DAQ control room to allow monitoring of the power supplies and the electronics.
I-DET-COMP-ONLINE.030	DET-ELEC	DET-COMP	Controls cables allowing fast shutdown and machine interlocks will run from the south platform to the DAQ control room.
I-DET-ELEC.019	DET-ELEC	DET-ECAL	Bias voltage DC power provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.020	DET-ELEC	DET-ECAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.021	DET-ELEC	DET-ECAL	Low voltage DC power provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.022	DET-ELEC	DET-ECAL	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.023	DET-ELEC	DET-ECAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.024	DET-ELEC	DET-ECAL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.025	DET-ELEC	DET-ECAL	Bias voltage DC power provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.026	DET-ELEC	DET-ECAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.027	DET-ELEC	DET-ECAL	Low voltage DC power provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.028	DET-ELEC	DET-HCAL	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.029	DET-ELEC	DET-HCAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.030	DET-ELEC	DET-HCAL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.031	DET-ELEC	DET-HCAL	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.032	DET-ELEC	DET-HCAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.

Interface ID	From	To	Description
I-DET-ELEC.033	DET-ELEC	DET-HCAL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.034	DET-ELEC	DET-HCAL	Bias voltage DC power will be provided from the electronics racks to support the silicon photomultipliers.
I-DET-ELEC.035	DET-ELEC	DET-HCAL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.036	DET-ELEC	DET-HCAL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-INF-INT.069	DET-ELEC	DET-INF	Electronics components on the carriage will require clean or transformer isolated power.
I-DET-INF-INT.070	DET-ELEC	DET-INF	Critical systems, such as controls, will require sufficient UPS power to allow them to be shutdown graceful, or to tolerate transients.
I-DET-INF-INT.071	DET-ELEC	DET-INF	The electronics and computing systems will require a stable environment in terms of temperature and humidity.
I-DET-INF-INT.072	DET-ELEC	DET-INF	The electronics and computing systems on the carriage may require some EMI shielding from detectors and other components.
I-DET-INF-INT.073	DET-ELEC	DET-INF	Adequate space for cables and cable trays will be required to deliver low voltage and high voltage, fiber and signal cables from the carriage/platform to the sub-detectors.
I-DET-INF-INT.074	DET-ELEC	DET-INF	Adequate space must be provided for computing enclosures (racks) on the south platform to support the electronics systems.
I-DET-ELEC.037	DET-ELEC	DET-MAG	Bias voltage DC power will be provided from the electronics racks to support the magnet cryogenic systems.
I-DET-ELEC.038	DET-ELEC	DET-MAG	High voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.039	DET-ELEC	DET-MAG	Lower voltage DC power will be provided from the electronics racks to support the magnet cryogenic systems.
I-DET-ELEC.040	DET-ELEC	DET-MAG	Bias voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.041	DET-ELEC	DET-MAG	High voltage DC power will be provided from the electronics racks to support the magnet power supply.

Interface ID	From	To	Description
I-DET-ELEC.042	DET-ELEC	DET-MAG	Low voltage DC power will be provided from the electronics racks to support the magnet instrumentation and control systems.
I-DET-ELEC.043	DET-ELEC	DET-MAG	Bias voltage DC power will be provided from the electronics racks to support the magnet power supply.
I-DET-ELEC.044	DET-ELEC	DET-MAG	High voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.045	DET-ELEC	DET-MAG	Low voltage DC power will be provided from the electronics racks to support the magnet power supply.
I-DET-ELEC.046	DET-ELEC	DET-PID	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.047	DET-ELEC	DET-PID	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.048	DET-ELEC	DET-PID	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.049	DET-ELEC	DET-PID	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the DIRC.
I-DET-ELEC.050	DET-ELEC	DET-PID	Low voltage power will be delivered from the power supplies on the carriage to the DIRC electronics.
I-DET-ELEC.051	DET-ELEC	DET-PID	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the DIRC.
I-DET-ELEC.052	DET-ELEC	DET-PID	Low voltage power will be delivered from the power supplies on the carriage to the DIRC electronics.
I-DET-ELEC.053	DET-ELEC	DET-PID	High voltage power will be delivered from the power supplies on the carriage to the photosensors in the pfRICH/mRICH.
I-DET-ELEC.054	DET-ELEC	DET-PID	Low voltage power will be delivered from the power supplies on the carriage to the pfRICH/mRICH electronics.
I-DET-ELEC.055	DET-ELEC	DET-PID	Bias voltage DC power will be delivered from the power supplies on the carriage to the photosensors.
I-DET-ELEC.056	DET-ELEC	DET-PID	Low voltage power will be delivered from the power supplies on the carriage to the dRICH electronics.
I-DET-ELEC.057	DET-ELEC	DET-POL	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.058	DET-ELEC	DET-POL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.

Interface ID	From	To	Description
I-DET-ELEC.059	DET-ELEC	DET-POL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.060	DET-ELEC	DET-POL	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.061	DET-ELEC	DET-POL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.062	DET-ELEC	DET-POL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.063	DET-ELEC	DET-POL	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.064	DET-ELEC	DET-POL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.065	DET-ELEC	DET-POL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.066	DET-ELEC	DET-POL	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.067	DET-ELEC	DET-POL	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.068	DET-ELEC	DET-POL	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.069	DET-ELEC	DET-TRAK	Bias voltage DC power will be provided from the electronics racks to support electronics in the silicon photomultipliers.
I-DET-ELEC.070	DET-ELEC	DET-TRAK	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.071	DET-ELEC	DET-TRAK	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.

4.7. DET-COMP : Data Acquisition and Computing Systems (WBS 6.10.09)

Interfaces associated with the data acquisition and computing systems that service all central and ancillary detectors.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.002	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the B0 detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.003	DET-COMP	DET-ANC	A network connection will be provided from the DAQ system to the B0 detector's slow controls interface.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.004	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the B0 detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.005	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Low Q2 detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.006	DET-COMP	DET-ANC	A network connection will be provided from the DAQ system to the Low Q2 detector's slow controls interface.
I-DET-COMP-ONLINE.007	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Low Q2 detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.008	DET-COMP	DET-ANC	Fiber connection from the DAQ system to the detector's RDO to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.009	DET-COMP	DET-ANC	Network connection from the DAQ system to the detector's slow controls interface.
I-DET-COMP-ONLINE.010	DET-COMP	DET-ANC	Fiber connection from the DAQ system to the detector's RDO used for timing synchronization.
I-DET-COMP-ONLINE.011	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Off-Momentum detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.012	DET-COMP	DET-ANC	A network connection will be provided from the DAQ system to the Off-Momentum slow controls interface.
I-DET-COMP-ONLINE.013	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Off-Momentum detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.014	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Roman Pot's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.015	DET-COMP	DET-ANC	Network connection from the DAQ system to the detector's slow controls interface.
I-DET-COMP-ONLINE.016	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Roman Pot's readout board for timing synchronization.
I-DET-COMP-ONLINE.017	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Zero-Degree Calorimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.018	DET-COMP	DET-ANC	A network connection will be provided from the DAQ system to the Zero-Degree Calorimeter's slow controls interface.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.019	DET-COMP	DET-ANC	A fiber connection will be provided from the DAQ system to the Zero-Degree Calorimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.020	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the barrel ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.021	DET-COMP	DET-ECAL	A network connection will be provided from the DAQ system to the barrel ECAL's slow controls interface.
I-DET-COMP-ONLINE.022	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the barrel ECAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.023	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the backward ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.024	DET-COMP	DET-ECAL	A network connection will be provided from the DAQ system to the backward ECAL's slow controls interface.
I-DET-COMP-ONLINE.025	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the backward ECAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.026	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the forward ECAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.027	DET-COMP	DET-ECAL	A network connection will be provided from the DAQ system to the forward ECAL's slow controls interface.
I-DET-COMP-ONLINE.028	DET-COMP	DET-ECAL	A fiber connection will be provided from the DAQ system to the forward ECAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.029	DET-COMP	DET-ELEC	Monitoring system cables will run from the south platform to the DAQ control room to allow monitoring of the power supplies and the electronics.
I-DET-COMP-ONLINE.030	DET-COMP	DET-ELEC	Controls cables allowing fast shutdown and machine interlocks will run from the south platform to the DAQ control room.
I-DET-COMP-ONLINE.031	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the barrel HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.032	DET-COMP	DET-HCAL	A connection from the DAQ system to the barrel HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.033	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the barrel HCAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.034	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the backward HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.035	DET-COMP	DET-HCAL	A connection from the DAQ system to the barrel HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.
I-DET-COMP-ONLINE.036	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the backward HCAL's readout board for timing synchronization.
I-DET-COMP-ONLINE.037	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the forward HCAL's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.038	DET-COMP	DET-HCAL	A connection from the DAQ system to the forward HCAL's slow controls interface. CLARIFY with Data acquisition whether a slow control interface will be independent of the regular control interface.
I-DET-COMP-ONLINE.039	DET-COMP	DET-HCAL	A fiber connection will be provided from the DAQ system to the forward HCAL's readout board for timing synchronization.
I-DET-INF-BAR.013	DET-COMP	DET-INF	A fiber support system must be provided that allows the communications cabling to remain connected while the detector is moved from the experimental hall to the assembly area.
I-DET-INF-INT.050	DET-COMP	DET-INF	HVAC systems must be provided to maintain stable temperature and humidity in the computer room.
I-DET-INF-INT.051	DET-COMP	DET-INF	General HVAC systems must be provided to maintain a normal operating temperature in locations where DAQ systems are in use.
I-DET-INF-INT.052	DET-COMP	DET-INF	UPS systems must be provided to support critical systems in order to tolerate transient conditions and to allow for controlled shutdown.
I-DET-INF-INT.053	DET-COMP	DET-INF	Adequate power must be provided to support the DAQ systems and computing infrastructure.
I-DET-INF-INT.054	DET-COMP	DET-INF	Standard electrical service to support consoles and systems in the control room.

Interface ID	From	To	Description
I-DET-INF-INT.055	DET-COMP	DET-INF	Clean power (either transformer or source isolated) should be provided for all DAQ, computing and network equipment.
I-DET-INF-INT.056	DET-COMP	DET-INF	Adequate rack space for the DAQ system will be required on the detector carriages.
I-DET-INF-INT.057	DET-COMP	DET-INF	Adequate raised-floor space with racks will be required to support DAQ computers, communications systems, and computing infrastructure.
I-DET-INF-INT.058	DET-COMP	DET-INF	Space for computing consoles and furniture adequate to manage the system during operation will be required. Consoles and furniture will be provided by DET-INT.
I-DET-INF-INT.059	DET-COMP	DET-INF	Adequate space to route fiberoptic cables from the racks to the detector readout boards will be required.
I-DET-INF-INT.060	DET-COMP	DET-INF	Adequate conduits and cableways must be provided to deliver cabling to the racks on the fixed platforms.
I-DET-INF-INT.061	DET-COMP	DET-INF	Adequate rack space for the DAQ system must be provided on the fixed platforms, tunnels, and in the experimental hall.
I-DET-INF-INT.062	DET-COMP	DET-INF	DAQ systems that are sensitive to magnetism or radiation must be placed at a sufficient distance from sources OR shielding must be provided to protect the equipment.
I-DET-INF-INT.063	DET-COMP	DET-INF	Conduits must be provided in the west and east tunnels to connect the detectors to the DAQ system.
I-DET-INF-INT.064	DET-COMP	DET-INF	A fiber support system must be provided that allows the communications cabling to remain connected while the detector is moved from the experimental hall to the assembly area.
I-DET-COMP-ONLINE.040	DET-COMP	DET-MAG	Control cabling for the magnet instrumentation will be run from the solenoid to the instrumentation rack on the carriage.
I-DET-COMP-ONLINE.041	DET-COMP	DET-MAG	Live monitoring data from the solenoid's operation must be recorded and maintained for diagnostic purposes.
I-DET-COMP-ONLINE.042	DET-COMP	DET-MAG	A network connection will be provided from the DAQ system to the solenoid cryogenic's slow controls interface.
I-DET-COMP-ONLINE.043	DET-COMP	DET-MAG	A network connection will be provided from the DAQ system to the solenoid's slow controls interface.
I-DET-COMP-ONLINE.044	DET-COMP	DET-MAG	A network connection will be provided from the DAQ system to the slow controls interface of the solenoid's power supply.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.045	DET-COMP	DET-PID	A fiber connection will be provided from the DAQ system to the barrel PID detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.046	DET-COMP	DET-PID	A network connection will be provided from the DAQ system to the barrel PID detector's slow controls interface.
I-DET-COMP-ONLINE.047	DET-COMP	DET-PID	A fiber connection will be provided from the DAQ system to the barrel PID detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.048	DET-COMP	DET-PID	Signal cables will run from the DIRC electronics to the DAQ system.
I-DET-COMP-ONLINE.049	DET-COMP	DET-PID	Signal cables from environmental sensors will run from the DIRC electronics to the DAQ system to provide detector shutdown/protection system.
I-DET-COMP-ONLINE.050	DET-COMP	DET-PID	Signal cables will run from the DIRC electronics to the DAQ system.
I-DET-COMP-ONLINE.051	DET-COMP	DET-PID	Signal cables from environmental sensors will run from the DIRC electronics to the DAQ system to provide detector shutdown/protection system.
I-DET-COMP-ONLINE.052	DET-COMP	DET-PID	Signal cables will run from the pfRICH/mRICH electronics to the DAQ system.
I-DET-COMP-ONLINE.053	DET-COMP	DET-PID	Signal cables from environmental sensors will run from the pfRICH/mRICH electronics to the DAQ system to provide a detector shutdown/protection system.
I-DET-COMP-ONLINE.054	DET-COMP	DET-PID	Signal cables will run from the dRICH electronics to the DAQ system.
I-DET-COMP-ONLINE.055	DET-COMP	DET-PID	Signal cables from environmental sensors will run from the cold photosensors to the DAQ system to provide a detector shutdown/protection system.
I-DET-COMP-ONLINE.056	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the ESR Polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.057	DET-COMP	DET-POL	Data transfer lines will be run from the electron detector to a DAQ system.
I-DET-COMP-ONLINE.058	DET-COMP	DET-POL	Data transfer lines will be run from the laser enclosure on the beamline to a DAQ system.
I-DET-COMP-ONLINE.059	DET-COMP	DET-POL	Data transfer lines will be run from the photon detector to a DAQ system.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.060	DET-COMP	DET-POL	A network connection will be provided from the DAQ system to the ESR Polarimeter's slow controls interface.
I-DET-COMP-ONLINE.061	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the ESR Polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.062	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the RCS polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.063	DET-COMP	DET-POL	Data transfer lines will be run from the laser enclosure on the beamline to a DAQ system.
I-DET-COMP-ONLINE.064	DET-COMP	DET-POL	Data transfer lines will be run from the photon detector to a DAQ system.
I-DET-COMP-ONLINE.065	DET-COMP	DET-POL	A network connection will be provided from the DAQ system to the RCS polarimeter's slow controls interface.
I-DET-COMP-ONLINE.066	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the RCS polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.067	DET-COMP	DET-POL	Readout cables need to run from the polarimeter detectors to the data acquisition system at IR-4.
I-DET-COMP-ONLINE.068	DET-COMP	DET-POL	Slow control information should be written to the HSR database (5 second intervals)
I-DET-COMP-ONLINE.069	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the HJET polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.070	DET-COMP	DET-POL	Slow control cables for the HJET target system need to run from the hall at IR-4 to the polarimeter in the tunnel.
I-DET-COMP-ONLINE.071	DET-COMP	DET-POL	A network connection will be provided from the DAQ system to the HJET polarimeter's slow controls interface.
I-DET-COMP-ONLINE.072	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the HJET polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.073	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the proton-carbon polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.074	DET-COMP	DET-POL	Results from the target scan polarimeter runs should be written to the HSR database

Interface ID	From	To	Description
I-DET-COMP-ONLINE.075	DET-COMP	DET-POL	A network connection will be provided from the DAQ system to the proton-carbon polarimeter's slow controls interface.
I-DET-COMP-ONLINE.076	DET-COMP	DET-POL	A fiber connection will be provided from the DAQ system to the proton-carbon polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.077	DET-COMP	DET-POL	Slow control cables for the target motion need to run from the hall at IR-4 to the polarimeter.
I-DET-COMP-ONLINE.078	DET-COMP	DET-POL	Fiber target operation should be controlled from the HSR main control room
I-DET-COMP-ONLINE.079	DET-COMP	DET-POL	Slow control cables for the target motion need to run from the DAQ room at IR-6 to the polarimeter.
I-DET-COMP-ONLINE.080	DET-COMP	DET-POL	Fiber target operation should be controlled from the EPIC control room
I-DET-COMP-ONLINE.081	DET-COMP	DET-TRAK	Cables required to transfer data from the detector to the online data acquisition system.
I-DET-COMP-ONLINE.082	DET-COMP	DET-TRAK	A fiber connection will be provided from the DAQ system to the barrel tracking system's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.083	DET-COMP	DET-TRAK	A network connection will be provided from the DAQ system to the barrel tracking system's slow controls interface.
I-DET-COMP-ONLINE.084	DET-COMP	DET-TRAK	A fiber connection will be provided from the DAQ system to the barrel tracking system's readout board for timing synchronization.
I-DET-COMP-OFFLINE.001	DET-COMP	TBD	The DAQ system must have a network interface that is adequate to transfer collected data from the local systems to an offline storage facility.
I-DET-COMP-ONLINE.085	DET-COMP	TBD	An interface to the accelerator beam databases must be provided that allows the DAQ to read data, and on a limited basis, write data.
I-DET-COMP-ONLINE.086	DET-COMP	TBD	A beam synchronization signal must be provided to the DAQ system that provides beam bunch information.
I-DET-COMP-ONLINE.087	DET-COMP	TBD	An interface should be provided that allows the accelerator control system to read the condition and state of the detector systems.

4.8. DET-INF : Detector Infrastructure Systems (WBS 6.10.10)

Infrastructure systems required to support all detectors located in the central detector, experimental hall, and the upstream and downstream interaction region.

Interface ID	From	To	Description
I-DET-INF-INT.001	DET-INF	DET	No detectors or components constructed with magnetic material may be added to the detector without prior consultation with the magnet group.
I-DET-INF-INT.002	DET-INF	DET	All subordinate detectors are dependent on the continuous operation of the solenoid and on the delivery of a consistent, stable magnetic field.
I-DET-INF-INT.003	DET-INF	DET	The DIRC structure will provide integrated pathways for cabling and services to be delivered from the interior detectors (pf RICH/mRICH and silicon trackers) to the exterior infrastructure.
I-DET-INF-BCK.004	DET-INF	DET-ANC	The LowQ2 detector is supported by a freestanding platform that is adjacent to the outgoing electron beam.
I-DET-INF-BCK.005	DET-INF	DET-ANC	The luminosity detector will be supported by an independent support system.
I-DET-INF-FWD.001	DET-INF	DET-ANC	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.002	DET-INF	DET-ANC	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.006	DET-INF	DET-ANC	The B0 detector will be supported in the interior of the B0 magnet and will be dependent on the B0 magnet design, and must be adequate to support the weight of the crystals and the tracking detectors.
I-DET-INF-FWD.007	DET-INF	DET-ANC	The detector will be supported on a free standing structure.
I-DET-INF-INT.004	DET-INF	DET-ANC	B0 detector must fit entirely within the bore of the B0 magnet.
I-DET-INF-INT.005	DET-INF	DET-ANC	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.006	DET-INF	DET-ANC	The position of and accessibility of the B0 detector in the backward direction is limited by the cryostat containing the final focusing magnets.
I-DET-INF-INT.007	DET-INF	DET-ANC	Access to the B0 detector is constrained by the vacuum valve in front of the B0 magnet. A minimum of 15 centimeters of

Interface ID	From	To	Description
			free space will be required on the IP-side of the B0-dipole for the installation of the B0 detectors.
I-DET-INF-INT.008	DET-INF	DET-ANC	The electron and hadron beam pipes must be contained within the B0 detector.
I-DET-INF-INT.009	DET-INF	DET-ANC	The LowQ2 detector must be upstream in the electron direction from the Q3ER magnet.
I-DET-INF-INT.010	DET-INF	DET-ANC	The LowQ2 detector must be downstream in the electron direction from the B2ER magnet.
I-DET-INF-INT.011	DET-INF	DET-ANC	The LOWQ2 detector must be at the same level as the electron beamline.
I-DET-INF-INT.043	DET-INF	DET-ANC	A cooling system will be required to remove heat from the calorimeter and electronics readouts, to maintain an acceptable temperature.
I-DET-INF-INT.044	DET-INF	DET-ANC	Either a liquid or gas cooling system will be required to remove heat from the calorimeter, tracking and readout electronics, to maintain them at room temperature.
I-DET-INF-INT.045	DET-INF	DET-ANC	The two dipoles in front of the detector will require an infrastructure power source.
I-DET-INF-INT.046	DET-INF	DET-ANC	The beamline between the two luminosity detector dipoles must be under vacuum.
I-DET-INF-INT.047	DET-INF	DET-ANC	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-INF-INT.048	DET-INF	DET-ANC	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-INF-INT.049	DET-INF	DET-ANC	A cooling system will be required to remove heat from the calorimeter and readout electronics to prevent heat buildup.
I-DET-INF-BAR.013	DET-INF	DET-COMP	A fiber support system must be provided that allows the communications cabling to remain connected while the detector is moved from the experimental hall to the assembly area.
I-DET-INF-INT.050	DET-INF	DET-COMP	HVAC systems must be provided to maintain stable temperature and humidity in the computer room.
I-DET-INF-INT.051	DET-INF	DET-COMP	General HVAC systems must be provided to maintain a normal operating temperature in locations where DAQ systems are in use.
I-DET-INF-INT.052	DET-INF	DET-COMP	UPS systems must be provided to support critical systems in order to tolerate transient conditions and to allow for controlled shutdown.

Interface ID	From	To	Description
I-DET-INF-INT.053	DET-INF	DET-COMP	Adequate power must be provided to support the DAQ systems and computing infrastructure.
I-DET-INF-INT.054	DET-INF	DET-COMP	Standard electrical service to support consoles and systems in the control room.
I-DET-INF-INT.055	DET-INF	DET-COMP	Clean power (either transformer or source isolated) should be provided for all DAQ, computing and network equipment.
I-DET-INF-INT.056	DET-INF	DET-COMP	Adequate rack space for the DAQ system will be required on the detector carriages.
I-DET-INF-INT.057	DET-INF	DET-COMP	Adequate raised-floor space with racks will be required to support DAQ computers, communications systems, and computing infrastructure.
I-DET-INF-INT.058	DET-INF	DET-COMP	Space for computing consoles and furniture adequate to manage the system during operation will be required. Consoles and furniture will be provided by DET-INT.
I-DET-INF-INT.059	DET-INF	DET-COMP	Adequate space to route fiberoptic cables from the racks to the detector readout boards will be required.
I-DET-INF-INT.060	DET-INF	DET-COMP	Adequate conduits and cableways must be provided to deliver cabling to the racks on the fixed platforms.
I-DET-INF-INT.061	DET-INF	DET-COMP	Adequate rack space for the DAQ system must be provided on the fixed platforms, tunnels, and in the experimental hall.
I-DET-INF-INT.062	DET-INF	DET-COMP	DAQ systems that are sensitive to magnetism or radiation must be placed at a sufficient distance from sources OR shielding must be provided to protect the equipment.
I-DET-INF-INT.063	DET-INF	DET-COMP	Conduits must be provided in the west and east tunnels to connect the detectors to the DAQ system.
I-DET-INF-INT.064	DET-INF	DET-COMP	A fiber support system must be provided that allows the communications cabling to remain connected while the detector is moved from the experimental hall to the assembly area.
I-DET-INF-BAR.001	DET-INF	DET-ECAL	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.
I-DET-INF-BAR.002	DET-INF	DET-ECAL	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.003	DET-INF	DET-ECAL	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.

Interface ID	From	To	Description
I-DET-INF-BAR.004	DET-INF	DET-ECAL	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.005	DET-INF	DET-ECAL	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-INF	DET-ECAL	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-BAR.007	DET-INF	DET-ECAL	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-INF	DET-ECAL	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.014	DET-INF	DET-ECAL	Each half of the forward ECAL must be continuously supported and stabilized while it is moved between the opened and closed positions.
I-DET-INF-FWD.004	DET-INF	DET-ECAL	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.
I-DET-INF-FWD.008	DET-INF	DET-ECAL	Each half of the forward ECAL must be continuously supported and stabilized while it is moved between the opened and closed positions.
I-DET-INF-INT.012	DET-INF	DET-ECAL	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-INF-INT.013	DET-INF	DET-ECAL	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.014	DET-INF	DET-ECAL	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-INF	DET-ECAL	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.016	DET-INF	DET-ECAL	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling

Interface ID	From	To	Description
			pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-INF	DET-ECAL	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.018	DET-INF	DET-ECAL	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-INF	DET-ECAL	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-INF	DET-ECAL	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.021	DET-INF	DET-ECAL	The bore of the backward ECAL must be designed to allow it to be inserted/removed over the existing beamline flanges.
I-DET-INF-INT.022	DET-INF	DET-ECAL	The interior radius of the backward ECAL is governed by the size of the beamline.
I-DET-INF-INT.023	DET-INF	DET-ECAL	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-INF	DET-ECAL	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-INF	DET-ECAL	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.026	DET-INF	DET-ECAL	The interior radius of the forward ECAL is governed by the size of the beamline. Modifications to either must be coordinated.
I-DET-INF-INT.065	DET-INF	DET-ECAL	The imaging layers must be cooled with an independent system (TBD).
I-DET-INF-INT.066	DET-INF	DET-ECAL	The barrel ECAL will require chilled water or LCW cooling to maintain a safe operating temperature.
I-DET-INF-INT.067	DET-INF	DET-ECAL	The backward ECAL will require chilled water or LCW cooling to maintain the temperature of the silicon photomultipliers, the electronics, and the crystals.

Interface ID	From	To	Description
I-DET-INF-INT.068	DET-INF	DET-ECAL	The forward ECAL will require chilled water or LCW cooling to maintain a safe operating temperature.
I-DET-INF-INT.069	DET-INF	DET-ELEC	Electronics components on the carriage will require clean or transformer isolated power.
I-DET-INF-INT.070	DET-INF	DET-ELEC	Critical systems, such as controls, will require sufficient UPS power to allow them to be shutdown graceful, or to tolerate transients.
I-DET-INF-INT.071	DET-INF	DET-ELEC	The electronics and computing systems will require a stable environment in terms of temperature and humidity.
I-DET-INF-INT.072	DET-INF	DET-ELEC	The electronics and computing systems on the carriage may require some EMI shielding from detectors and other components.
I-DET-INF-INT.073	DET-INF	DET-ELEC	Adequate space for cables and cable trays will be required to deliver low voltage and high voltage, fiber and signal cables from the carriage/platform to the sub-detectors.
I-DET-INF-INT.074	DET-INF	DET-ELEC	Adequate space must be provided for computing enclosures (racks) on the south platform to support the electronics systems.
I-DET-INF-BAR.001	DET-INF	DET-HCAL	The barrel ECAL will be supported by a structural support system that extends through the bore of the solenoid magnet and is supported by the barrel Hadron Calorimeter.
I-DET-INF-BAR.002	DET-INF	DET-HCAL	The weight of the barrel ECAL will be transferred to the barrel Hadron Calorimeter and must be accommodated by all intermediate and subsequent support systems.
I-DET-INF-BAR.004	DET-INF	DET-HCAL	The backward ECAL will be supported by an integrated support structure that is attached to the DIRC support frame.
I-DET-INF-BAR.007	DET-INF	DET-HCAL	The forward ECAL will be supported by the forward Hadron Calorimeter endcap. Because the forward ECAL must split into two parts to provide access to the barrel, each half must be independently affixed to the Hadron Calorimeter halves.
I-DET-INF-BAR.008	DET-INF	DET-HCAL	The weight of the forward ECAL will be transferred to the forward Hadron Calorimeter endcap and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.009	DET-INF	DET-HCAL	The barrel HCAL will be supported by a rolling carriage that allows the central detector to be moved between the assembly area and the experimental hall.
I-DET-INF-BAR.010	DET-INF	DET-HCAL	The barrel HCAL will support the weight of all of the sub-detectors and components within the central detector.

Interface ID	From	To	Description
I-DET-INF-BAR.011	DET-INF	DET-HCAL	The cumulative weight of the HCAL and all of the sub-detectors it supports will be transferred to the detector carriage.
I-DET-INF-BAR.012	DET-INF	DET-HCAL	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.
I-DET-INF-BCK.001	DET-INF	DET-HCAL	Adequate clearance must be provided for either of the detector carriages to be rolled aside to allow access to sub-detectors within the barrel.
I-DET-INF-BCK.002	DET-INF	DET-HCAL	The backward HCAL consists of two halves, each of which are support by an independent carriage.
I-DET-INF-BCK.003	DET-INF	DET-HCAL	The weight of each half of the backward HCAL will be transferred to the carriage that is supporting it.
I-DET-INF-FWD.003	DET-INF	DET-HCAL	The forward HCAL consists of two halves, each of which are support by an independent carriage.
I-DET-INF-FWD.004	DET-INF	DET-HCAL	The forward HCAL will support the weight of the forward electromagnetic calorimeter that is embedded within it.
I-DET-INF-FWD.005	DET-INF	DET-HCAL	The weight of each half of the forward HCAL, and its embedded subdetectors, will be transferred to the associated carriage.
I-DET-INF-FWD.009	DET-INF	DET-HCAL	Adequate clearance must be provided for either of the detector carriages to be rolled aside to allow access to sub-detectors within the barrel.
I-DET-INF-INT.005	DET-INF	DET-HCAL	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.016	DET-INF	DET-HCAL	The backward position of the backward ECAL is limited by the backward Hadron Calorimeter and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.023	DET-INF	DET-HCAL	The exterior radius of the forward ECAL is limited by the interior bore of the barrel Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.024	DET-INF	DET-HCAL	The forward position of the forward ECAL is limited by the forward Hadron Calorimeter. Modifications to either must be coordinated.
I-DET-INF-INT.027	DET-INF	DET-HCAL	The forward position of the backward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.028	DET-INF	DET-HCAL	The exterior radius of the backward HCAL should be consistent with the radius of the barrel HCAL.
I-DET-INF-INT.029	DET-INF	DET-HCAL	The exterior radius of the forward HCAL should be consistent with the radius of the barrel HCAL.
I-DET-INF-INT.030	DET-INF	DET-HCAL	The backward position of the forward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.031	DET-INF	DET-HCAL	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.032	DET-INF	DET-HCAL	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.034	DET-INF	DET-HCAL	The forward position of the backward HCAL is limited by the barrel HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.035	DET-INF	DET-HCAL	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.036	DET-INF	DET-HCAL	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.038	DET-INF	DET-HCAL	The position of the backward HCAL is limited in the backward direction by the adjacent accelerator magnets.
I-DET-INF-INT.039	DET-INF	DET-HCAL	The interior radius of the backward HCAL is governed by the size of the beamline.
I-DET-INF-INT.041	DET-INF	DET-HCAL	The interior radius of the forward HCAL is governed by the size of the beamline.
I-DET-INF-INT.075	DET-INF	DET-HCAL	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air.
I-DET-INF-INT.076	DET-INF	DET-HCAL	The exterior radius of the barrel HCAL is limited by the detector carriage, the electronics platforms, and other Hall infrastructure.

Interface ID	From	To	Description
I-DET-INF-INT.077	DET-INF	DET-HCAL	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air.
I-DET-INF-INT.078	DET-INF	DET-HCAL	Heat from the silicon photomultipliers and front end electronics will be rejected into the outside room via forced air. DO WE NEED CW FOR COOLING HERE?
I-DET-INF-BAR.015	DET-INF	DET-MAG	Total weight of the solenoid and all embedded components must be supported.
I-DET-INF-BAR.017	DET-INF	DET-MAG	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-INT.001	DET-INF	DET-MAG	No detectors or components constructed with magnetic material may be added to the detector without prior consultation with the magnet group.
I-DET-INF-INT.002	DET-INF	DET-MAG	All subordinate detectors are dependent on the continuous operation of the solenoid and on the delivery of a consistent, stable magnetic field.
I-DET-INF-INT.012	DET-INF	DET-MAG	The exterior radius of the barrel ECAL (and its support system) is limited by the interior bore of the solenoid magnet. Modifications to either must be coordinated.
I-DET-INF-INT.031	DET-INF	DET-MAG	The exterior radius of the solenoid magnet is limited by the interior bore of the barrel HCAL and necessary support structures. Modifications to either must be coordinated.
I-DET-INF-INT.035	DET-INF	DET-MAG	The maximum backward location for the solenoid magnet is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.042	DET-INF	DET-MAG	The solenoid will require a continuous flow of cryogens to maintain temperature in both the experimental hall and the maintenance area. Interface includes cryogenic source and warm return.
I-DET-INF-INT.079	DET-INF	DET-MAG	The power supply, located in an adjacent electrical room, will need to be cooled with low conductivity water.
I-DET-INF-INT.080	DET-INF	DET-MAG	The solenoid will require a continuous flow of cryogens to maintain temperature in both the experimental hall and the maintenance area. Interface includes cryogenic source and warm return.
I-DET-INF-INT.081	DET-INF	DET-MAG	Solenoid will be provided power via the power supply located in an adjacent room.

Interface ID	From	To	Description
I-DET-INF-INT.082	DET-INF	DET-MAG	The instrumentation rack for the solenoid will require backup/UPS power adequate to safely shutdown the system in the event of a power failure.
I-DET-INF-INT.084	DET-INF	DET-MAG	A boundary must be established to identify the extent of the magnet's stray field during operations.
I-DET-INF-INT.085	DET-INF	DET-MAG	An ice management system will be required to melt accumulated ice on the chimney. (Water should evaporate and will not require drainage)
I-DET-INF-INT.086	DET-INF	DET-MAG	The cryogenic connection must be as close as possible to the source.
I-DET-INF-INT.087	DET-INF	DET-MAG	The LCW water cooled leads must be fully supported along their path between the electrical room and the magnet.
I-DET-INF-INT.101	DET-INF	DET-MAG	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.
I-DET-INF-INT.118	DET-INF	DET-MAG	A supply and return of liquid nitrogen must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.119	DET-INF	DET-MAG	A supply and return of liquid helium must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.120	DET-INF	DET-MAG	A supply and return of liquid nitrogen must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-INT.121	DET-INF	DET-MAG	A supply and return of liquid helium must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-BAR.003	DET-INF	DET-PID	The DIRC bar boxes will be supported by a frame inside the barrel Electromagnetic Calorimeter, that allows the boxes to be extracted using a system of rollers.
I-DET-INF-BAR.005	DET-INF	DET-PID	The weight of the backward ECAL will be transferred to the DIRC detector support and must be accommodated by all subsequent support systems.
I-DET-INF-BAR.006	DET-INF	DET-PID	The DIRC support system will provide support for the backward electromagnetic calorimeter.
I-DET-INF-BAR.012	DET-INF	DET-PID	The Dual RICH will be supported by a structural system within the barrel hadron calorimeter.

Interface ID	From	To	Description
I-DET-INF-BAR.017	DET-INF	DET-PID	The DIRC prism box containing the photosensor readouts, will be supported by an external structure supporting the ECAL within the solenoid magnet.
I-DET-INF-BAR.018	DET-INF	DET-PID	The pfRICH/mRICH will be supported by the DIRC bar box support system.
I-DET-INF-BAR.019	DET-INF	DET-PID	The barrel Time of Flight will be supported by the DIRC bar box assembly.
I-DET-INF-BAR.020	DET-INF	DET-PID	The DIRC support system will provide support for the upstream PID detector system.
I-DET-INF-BAR.021	DET-INF	DET-PID	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-INF	DET-PID	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.011	DET-INF	DET-PID	The interior radius of the dRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-FWD.012	DET-INF	DET-PID	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-INT.003	DET-INF	DET-PID	The DIRC structure will provide integrated pathways for cabling and services to be delivered from the interior detectors (pf RICH/mRICH and silicon trackers) to the exterior infrastructure.
I-DET-INF-INT.013	DET-INF	DET-PID	The backward position and shape of the barrel EMCAL is limited by the size and shape of the DIRC readout supports. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.014	DET-INF	DET-PID	The maximum size of the DIRC is limited to the interior bore of the barrel ECAL (and its support structures). Modifications to either must be coordinated.
I-DET-INF-INT.015	DET-INF	DET-PID	The forward position and shape of the barrel ECAL is limited by the backward face of the Dual RICH detector and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.017	DET-INF	DET-PID	The maximum backward location for the DIRC is limited by the position of the backward electromagnetic calorimeter. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.018	DET-INF	DET-PID	The exterior radius of the backward ECAL is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.019	DET-INF	DET-PID	The backward ECAL must mitigated the heat generated by the backward RICH detector.
I-DET-INF-INT.020	DET-INF	DET-PID	The position of the backward ECAL in the forward direction is limited by the backward face of the pfRICH/mRICH detector. Modifications to either must be coordinated.
I-DET-INF-INT.025	DET-INF	DET-PID	The maximum forward location for the dRICH is limited by the forward ECAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.032	DET-INF	DET-PID	The size of the dRICH is limited by the interior bore of the barrel HCAL, and must provide adequate space for cables and services to itself and the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.036	DET-INF	DET-PID	The maximum backward location for the DIRC is limited by the backward HCAL and the adjacent cabling pathway that provides services to the interior detectors. Modifications to either must be coordinated.
I-DET-INF-INT.088	DET-INF	DET-PID	The heat generated by the photo-multiplier tubes and associated electronics must be removed using a process cooling system.
I-DET-INF-INT.089	DET-INF	DET-PID	The heat generated by the detector and its electronics must be removed using a process cooling system.
I-DET-INF-INT.090	DET-INF	DET-PID	The heat generated by the photomultipliers and associated electronics must be removed using a process cooling system.
I-DET-INF-INT.091	DET-INF	DET-PID	A continuous flow of dry nitrogen will be required to protect the aerogel radiator.
I-DET-INF-INT.092	DET-INF	DET-PID	A fluid cooling system will be required to keep the operating temperature of the photosensors at -30 degrees Celsius.
I-DET-INF-INT.093	DET-INF	DET-PID	A recovery system will need to be included for the radiator gas used by the dRICH to prevent accidental release.
I-DET-INF-INT.094	DET-INF	DET-PID	Sufficient insulation will need to be added around all coolant lines to prevent condensation and ensure that ice doesn't form.
I-DET-INF-INT.095	DET-INF	DET-PID	A continuous flow of dry nitrogen will be required to protect the aerogel radiator.

Interface ID	From	To	Description
I-DET-INF-INT.096	DET-INF	DET-PID	This gas will be required to create a protective atmosphere for the cold photosensors and to prevent condensation and freezing.
I-DET-INF-INT.097	DET-INF	DET-PID	A continuous recirculating flow of radiator gas will be required.
I-DET-INF-INT.101	DET-INF	DET-PID	The maximum forward location for the solenoid is limited by the position of the Dual RICH detector and the cabling plenum (gap) between them. Modifications to either must be coordinated.
I-DET-INF-INT.102	DET-INF	DET-PID	The maximum diameter of the barrel Time of Flight detector is limited by the interior bore of the DIRC detector. Modifications to either must be coordinated.
I-DET-INF-INT.103	DET-INF	DET-PID	The exterior radius of the pfRICH/mRICH is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.104	DET-INF	DET-PID	The maximum forward location for the DIRC is limited by the position of the dRICH detector and the cabling plenum between them. Modifications to either must be coordinated.
I-DET-INF-INT.105	DET-INF	DET-PID	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-INF	DET-PID	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-INF	DET-PID	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.108	DET-INF	DET-PID	The maximum backward location for the barrel Time of Flight detector is limited by the position of the pfRICH/mRICH detector and the adjacent cabling pathway. Modifications to either must be coordinated.
I-DET-INF-INT.109	DET-INF	DET-PID	The maximum forward location for the barrel Time of Flight detector is limited by the position of the forward Time of Flight detector and the adjacent cabling pathway. Modifications to either must be coordinated.
I-DET-INF-INT.110	DET-INF	DET-PID	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.111	DET-INF	DET-PID	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.
I-DET-INF-INT.112	DET-INF	DET-PID	The interior radius of the pfRICH/mRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-BAR.016	DET-INF	DET-TRAK	A single structural support system will support the silicon detectors and the micro-pattern gaseous detectors within the DIRC detector.
I-DET-INF-BAR.021	DET-INF	DET-TRAK	The DIRC support system will provide support for the silicon trackers in the detector barrel.
I-DET-INF-BAR.022	DET-INF	DET-TRAK	The weight of the barrel tracking systems will be transferred to the DIRC support system.
I-DET-INF-FWD.012	DET-INF	DET-TRAK	The maximum forward location for the tracking system is limited by the position of the AC LGAD Time of Flight Detector. Modifications to either must be coordinated.
I-DET-INF-FWD.013	DET-INF	DET-TRAK	The interior radius of the tracking detectors is governed by the size of the beamline.
I-DET-INF-INT.098	DET-INF	DET-TRAK	Air, liquid or other cooling technology will be required for the tracking detectors.
I-DET-INF-INT.099	DET-INF	DET-TRAK	Gas will need to be provided to the trackers for detector operation.
I-DET-INF-INT.100	DET-INF	DET-TRAK	A single structural support system will support the silicon detectors and the micro-pattern gaseous detectors within the DIRC detector.
I-DET-INF-INT.105	DET-INF	DET-TRAK	Conduits must be provided within the DIRC support system that are adequate to deliver services (power, signal, cooling) to the barrel tracking detectors.
I-DET-INF-INT.106	DET-INF	DET-TRAK	The exterior radius of the silicon trackers is limited by the interior bore of the DIRC support system. Modifications to either must be coordinated.
I-DET-INF-INT.107	DET-INF	DET-TRAK	The maximum forward location for the DIRC is limited by the position of the silicon trackers.
I-DET-INF-INT.110	DET-INF	DET-TRAK	The maximum size of the silicon trackers is limited by the interior radius of the barrel Time of Flight detector. Modifications to either must be coordinated.

Interface ID	From	To	Description
I-DET-INF-INT.111	DET-INF	DET-TRAK	The maximum backward location for the tracking system is limited by the position of the pfRICH/mRICH. Modifications to either must be coordinated.
I-DET-INF-FWD.001	DET-INF	TBD	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.002	DET-INF	TBD	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.011	DET-INF	TBD	The interior radius of the dRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-FWD.013	DET-INF	TBD	The interior radius of the tracking detectors is governed by the size of the beamline.
I-DET-INF-INT.006	DET-INF	TBD	The position of and accessibility of the B0 detector in the backward direction is limited by the cryostat containing the final focusing magnets.
I-DET-INF-INT.007	DET-INF	TBD	Access to the B0 detector is constrained by the vacuum valve in front of the B0 magnet. A minimum of 15 centimeters of free space will be required on the IP-side of the B0-dipole for the installation of the B0 detectors.
I-DET-INF-INT.008	DET-INF	TBD	The electron and hadron beam pipes must be contained within the B0 detector.
I-DET-INF-INT.009	DET-INF	TBD	The LowQ2 detector must be upstream in the electron direction from the Q3ER magnet.
I-DET-INF-INT.010	DET-INF	TBD	The LowQ2 detector must be downstream in the electron direction from the B2ER magnet.
I-DET-INF-INT.011	DET-INF	TBD	The LOWQ2 detector must be at the same level as the electron beamline.
I-DET-INF-INT.021	DET-INF	TBD	The bore of the backward ECAL must be designed to allow it to be inserted/removed over the existing beamline flanges.
I-DET-INF-INT.022	DET-INF	TBD	The interior radius of the backward ECAL is governed by the size of the beamline.
I-DET-INF-INT.026	DET-INF	TBD	The interior radius of the forward ECAL is governed by the size of the beamline. Modifications to either must be coordinated.
I-DET-INF-INT.038	DET-INF	TBD	The position of the backward HCAL is limited in the backward direction by the adjacent accelerator magnets.

Interface ID	From	To	Description
I-DET-INF-INT.039	DET-INF	TBD	The interior radius of the backward HCAL is governed by the size of the beamline.
I-DET-INF-INT.041	DET-INF	TBD	The interior radius of the forward HCAL is governed by the size of the beamline.
I-DET-INF-INT.112	DET-INF	TBD	The interior radius of the pfRICH/mRICH is governed by the size of the beamline and its associated flanges and support system.
I-DET-INF-INT.113	DET-INF	TBD	Temperature and humidity control must be provided in the Assembly Hall and IR as detectors need i) cooling by ambient air, ii) temperature stability, and iii) low dew point.
I-DET-INF-INT.114	DET-INF	TBD	A supply and return of deionized cooling water will need to be provided to remove heat from water cooled detectors.
I-DET-INF-INT.115	DET-INF	TBD	A supply and return of specialized, non-corrosive cooling water will be needed to cool detectors using aluminum heatsinks and manifolds.
I-DET-INF-INT.116	DET-INF	TBD	A supply of dry nitrogen will be needed to purge gas detectors or to cool humidity sensitive detectors (as needed).
I-DET-INF-INT.117	DET-INF	TBD	A compressed air source must be provided for the ancillary detectors and to maintain vacuum on other detector sub-systems.
I-DET-INF-INT.118	DET-INF	TBD	A supply and return of liquid nitrogen must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.119	DET-INF	TBD	A supply and return of liquid helium must be provided to the experimental hall for cooling the solenoid magnet during operation.
I-DET-INF-INT.120	DET-INF	TBD	A supply and return of liquid nitrogen must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-INT.121	DET-INF	TBD	A supply and return of liquid helium must be provided to the assembly hall for cooling the solenoid magnet during maintenance.
I-DET-INF-INT.122	DET-INF	TBD	A utility power source must be provided to support the cooling systems on the north platform and for other facility needs.
I-DET-INF-INT.123	DET-INF	TBD	A clean power source must be provided to support the operation of magnet, detectors, detector electronics, and other sensitive equipment.

Interface ID	From	To	Description
I-DET-INF-INT.124	DET-INF	TBD	A source of generator-backed, emergency power must be provided for critical systems that cannot tolerate power outages.
I-DET-INF-INT.125	DET-INF	TBD	An oxygen deficiency hazard (ODH) analysis must be performed to determine the impacts and precautions that are necessary in the event of a cryogen leak.
I-DET-INF-INT.126	DET-INF	TBD	An ODH detection and alarm system must be installed that addresses any concerns identified in the ODH analysis.
I-DET-INF-INT.127	DET-INF	TBD	A leak trace alarm interface will be installed that notifies Facilities Operations of any liquid leaks that are detected in the experimental hall.
I-DET-INF-INT.128	DET-INF	TBD	A flammable gas leak detection alarm interface will be installed that notifies Facilities Operations of any flammable gas leaks that are detected in the experimental hall.
I-DET-INF-INT.129	DET-INF	TBD	A forward magnet platform must be provided to support the B0 magnet, its detectors and installation tooling, and the supporting vacuum valve and bellows.
I-DET-INF-INT.130	DET-INF	TBD	A rear magnet platform must be provided to support the rear magnets, valves and bellows
I-DET-INF-INT.131	DET-INF	TBD	A cryogenic service platform must be provided in the experimental hall to support the detector cryogenics interface cryostat that services the interaction region.
I-DET-INF-INT.132	DET-INF	TBD	A cryogenic service platform must be provided in the assembly hall to support the detector cryogenics interface cryostat that services the maintenance area.
I-DET-INF-INT.133	DET-INF	TBD	A central rail system must be provided to allow the ePIC Barrel to be moved between the experimental hall and the assembly area. Existing rails will be used.
I-DET-INF-INT.134	DET-INF	TBD	An independent rail system will be required for opening the forward endcap halves. New rails will be needed.
I-DET-INF-INT.135	DET-INF	TBD	An independent rail system will be required for opening the backward endcap halves. New rails will be needed.
I-DET-INF-INT.136	DET-INF	TBD	Specified clearances must be maintained between the forward detectors and the accelerator magnets.
I-DET-INF-INT.137	DET-INF	TBD	Specified clearances must be maintained between the backward detectors and the accelerator magnets.

Interface ID	From	To	Description
I-DET-INF-INT.138	DET-INF	TBD	The opening size of the door that adjoins the experimental hall and the assembly area must remain large enough to accommodate movement of the ePIC barrel assembly.
I-DET-INF-INT.139	DET-INF	TBD	Adequate space must be provided in the interaction region to support the hadron polarimetry components and facility.
I-DET-INF-INT.140	DET-INF	TBD	The size, configuration, and clearances of the beampipe, valves and connectors in the ePIC barrel must be coordinated with the design of the interior detector systems.
I-DET-INF-INT.141	DET-INF	TBD	The size, configuration, and clearances of the beampipe, valves and connectors through the forward endcap must be coordinated with the design of the detector systems.
I-DET-INF-INT.142	DET-INF	TBD	The size, configuration, and clearances of the beampipe, valves and connectors through the backward endcap must be coordinated with the design of the detector systems.

4.9. DET-ANC : Ancillary Detector Systems (WBS 6.10.11)

Interfaces associated with the ancillary detectors located in the upstream and downstream interaction region.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.002	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the B0 detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.003	DET-ANC	DET-COMP	A network connection will be provided from the DAQ system to the B0 detector's slow controls interface.
I-DET-COMP-ONLINE.004	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the B0 detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.005	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Low Q2 detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.006	DET-ANC	DET-COMP	A network connection will be provided from the DAQ system to the Low Q2 detector's slow controls interface.
I-DET-COMP-ONLINE.007	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Low Q2 detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.008	DET-ANC	DET-COMP	Fiber connection from the DAQ system to the detector's RDO to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.009	DET-ANC	DET-COMP	Network connection from the DAQ system to the detector's slow controls interface.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.010	DET-ANC	DET-COMP	Fiber connection from the DAQ system to the detector's RDO used for timing synchronization.
I-DET-COMP-ONLINE.011	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Off-Momentum detector's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.012	DET-ANC	DET-COMP	A network connection will be provided from the DAQ system to the Off-Momentum slow controls interface.
I-DET-COMP-ONLINE.013	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Off-Momentum detector's readout board for timing synchronization.
I-DET-COMP-ONLINE.014	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Roman Pot's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.015	DET-ANC	DET-COMP	Network connection from the DAQ system to the detector's slow controls interface.
I-DET-COMP-ONLINE.016	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Roman Pot's readout board for timing synchronization.
I-DET-COMP-ONLINE.017	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Zero-Degree Calorimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.018	DET-ANC	DET-COMP	A network connection will be provided from the DAQ system to the Zero-Degree Calorimeter's slow controls interface.
I-DET-COMP-ONLINE.019	DET-ANC	DET-COMP	A fiber connection will be provided from the DAQ system to the Zero-Degree Calorimeter's readout board for timing synchronization.
I-DET-ELEC.001	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided from the electronics racks to support electronics.
I-DET-ELEC.002	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.003	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.004	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.005	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.

Interface ID	From	To	Description
I-DET-ELEC.006	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.007	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.008	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.009	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.010	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.011	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.012	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.013	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.014	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.015	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-ELEC.016	DET-ANC	DET-ELEC	The detector will receive bias voltage DC power provided by the Detector Electronics group to support electronics.
I-DET-ELEC.017	DET-ANC	DET-ELEC	The detector will receive high voltage DC power provided by the Detector Electronics group to support silicon sensors and calorimeter.
I-DET-ELEC.018	DET-ANC	DET-ELEC	The detector will receive low voltage DC power provided by the Detector Electronics group.
I-DET-INF-INT.005	DET-ANC	DET-HCAL	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-BCK.004	DET-ANC	DET-INF	The LowQ2 detector is supported by a freestanding platform that is adjacent to the outgoing electron beam.
I-DET-INF-BCK.005	DET-ANC	DET-INF	The luminosity detector will be supported by an independent support system.

Interface ID	From	To	Description
I-DET-INF-FWD.001	DET-ANC	DET-INF	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.002	DET-ANC	DET-INF	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.006	DET-ANC	DET-INF	The B0 detector will be supported in the interior of the B0 magnet and will be dependent on the B0 magnet design, and must be adequate to support the weight of the crystals and the tracking detectors.
I-DET-INF-FWD.007	DET-ANC	DET-INF	The detector will be supported on a free standing structure.
I-DET-INF-INT.004	DET-ANC	DET-INF	B0 detector must fit entirely within the bore of the B0 magnet.
I-DET-INF-INT.005	DET-ANC	DET-INF	The position of the forward HCAL is bounded by the B0 magnet in the forward direction. Changes to the size or position of either must be coordinated with the other.
I-DET-INF-INT.006	DET-ANC	DET-INF	The position of and accessibility of the B0 detector in the backward direction is limited by the cryostat containing the final focusing magnets.
I-DET-INF-INT.007	DET-ANC	DET-INF	Access to the B0 detector is constrained by the vacuum valve in front of the B0 magnet. A minimum of 15 centimeters of free space will be required on the IP-side of the B0-dipole for the installation of the B0 detectors.
I-DET-INF-INT.008	DET-ANC	DET-INF	The electron and hadron beam pipes must be contained within the B0 detector.
I-DET-INF-INT.009	DET-ANC	DET-INF	The LowQ2 detector must be upstream in the electron direction from the Q3ER magnet.
I-DET-INF-INT.010	DET-ANC	DET-INF	The LowQ2 detector must be downstream in the electron direction from the B2ER magnet.
I-DET-INF-INT.011	DET-ANC	DET-INF	The LOWQ2 detector must be at the same level as the electron beamline.
I-DET-INF-INT.043	DET-ANC	DET-INF	A cooling system will be required to remove heat from the calorimeter and electronics readouts, to maintain an acceptable temperature.
I-DET-INF-INT.044	DET-ANC	DET-INF	Either a liquid or gas cooling system will be required to remove heat from the calorimeter, tracking and readout electronics, to maintain them at room temperature.

Interface ID	From	To	Description
I-DET-INF-INT.045	DET-ANC	DET-INF	The two dipoles in front of the detector will require an infrastructure power source.
I-DET-INF-INT.046	DET-ANC	DET-INF	The beamline between the two luminosity detector dipoles must be under vacuum.
I-DET-INF-INT.047	DET-ANC	DET-INF	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-INF-INT.048	DET-ANC	DET-INF	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-INF-INT.049	DET-ANC	DET-INF	A cooling system will be required to remove heat from the calorimeter and readout electronics to prevent heat buildup.
I-DET-ANC-LOWQ2.001	DET-ANC	INF-IR	Either a liquid or gas cooling system will be required to remove heat from the calorimeter, tracking and readout electronics, to maintain them at room temperature.
I-DET-ANC-LUMI.001	DET-ANC	INF-IR	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-ANC-OFFMO.001	DET-ANC	INF-IR	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-ANC-ROMAN.001	DET-ANC	INF-IR	A cooling system will be required to remove heat from the tracking and readout electronics to prevent heat buildup.
I-DET-ANC-ZDC.001	DET-ANC	INF-IR	A cooling system will be required to remove heat from the calorimeter and readout electronics to prevent heat buildup.
I-DET-ANC-LOWQ2.002	DET-ANC	TBD	The performance of the LowQ2 detector will depend on the thickness and shape of the electron beam pipe exit window.
I-DET-ANC-LOWQ2.003	DET-ANC	TBD	The LowQ2 detector must be positioned as close as possible electron beam pipe in order to detector particles at a shallow angle from the electron beam.
I-DET-ANC-LOWQ2.004	DET-ANC	TBD	The LowQ2 detector should be position such that it receives minimal magnetic interference from the Lumi-Dipole.
I-DET-ANC-LUMI.002	DET-ANC	TBD	The luminosity detector will provide fast feedback to the accelerator control system, allowing them to monitor conditions at the interaction point.
I-DET-ANC-LUMI.003	DET-ANC	TBD	Detector must be positioned between the electron and hadron beamlines in the far backward area, and it's size and position are governed by the adjacent accelerator components.
I-DET-ANC-LUMI.004	DET-ANC	TBD	The center of the luminosity detector must be positioned along the centerline of the incoming electron beam as it passes through the interaction point.

Interface ID	From	To	Description
I-DET-ANC-LUMI.005	DET-ANC	TBD	The detector must be positioned to avoid magnetic interference from adjacent beamline magnets.
I-DET-ANC-LUMI.006	DET-ANC	TBD	The two dipoles in front of the detector will need LCW cooling. (Confirm this)
I-DET-ANC-LUMI.007	DET-ANC	TBD	The detector electronics enclosures must be positioned near the detector and must be shielded from radiation.
I-DET-ANC-LUMI.008	DET-ANC	TBD	The luminosity detector must be positioned between 30 and 100 meters from the interaction point in the backward direction, and the dectors centerpoint must be positioned at beam level.
I-DET-ANC-OFFMO.002	DET-ANC	TBD	The detector must be positioned after the B1APF dipole in the hadron going direction.
I-DET-ANC-OFFMO.003	DET-ANC	TBD	These detectors will be integrated with the outgoing hadron beamline and will be enclosed within it's vacuum system.
I-DET-ANC-OFFMO.004	DET-ANC	TBD	The detector must be positioned before the Roman Pots in the hadron going direction.
I-DET-ANC-OFFMO.005	DET-ANC	TBD	This detector will generate RF radiation that the accelerator beamline must be shielded from.
I-DET-ANC-OFFMO.006	DET-ANC	TBD	The size and placement of the detector should be designed to have minimal interference with the 4 milliradian neutron cone required by the zero-degree calorimeter.
I-DET-ANC-ROMAN.002	DET-ANC	TBD	The Roman Pot detectors will come within 10 sigma of the center of the beam, and will impact the beam characteristics in a way that must be compensated for.
I-DET-ANC-ROMAN.003	DET-ANC	TBD	The detector must be positioned after the off-momentum detectors in the hadron going direction.
I-DET-ANC-ROMAN.004	DET-ANC	TBD	These detectors will be integrated with the outgoing hadron beamline and will be enclosed within it's vacuum system.
I-DET-ANC-ROMAN.005	DET-ANC	TBD	The detector must be positioned before the B2PF magnet in the hadron going direction.
I-DET-ANC-ROMAN.006	DET-ANC	TBD	This detector will generate RF radiation that the accelerator beamline must be shielded from.
I-DET-ANC-ZDC.002	DET-ANC	TBD	The placement of the Zero Degree Calorimeter is dependent on the neutron cone and should be positioned to optimize detector performance and resolution.
I-DET-ANC-ZDC.003	DET-ANC	TBD	There should minimal interference within the 4 milliradian neutron cone in front of the Zero Degree Calorimeter detector.

Interface ID	From	To	Description
I-DET-ANC-ZDC.004	DET-ANC	TBD	The Zero Degree Calorimeter will be positioned between the outgoing hadron and incoming electron beamlines.
I-DET-INF-FWD.001	DET-ANC	TBD	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-FWD.002	DET-ANC	TBD	The detector will be supported by an integrated support stand that is fully integrated with the vacuum system and allows the position of the detector to be adjusted.
I-DET-INF-INT.006	DET-ANC	TBD	The position of and accessibility of the B0 detector in the backward direction is limited by the cryostat containing the final focusing magnets.
I-DET-INF-INT.007	DET-ANC	TBD	Access to the B0 detector is constrained by the vacuum valve in front of the B0 magnet. A minimum of 15 centimeters of free space will be required on the IP-side of the B0-dipole for the installation of the B0 detectors.
I-DET-INF-INT.008	DET-ANC	TBD	The electron and hadron beam pipes must be contained within the B0 detector.
I-DET-INF-INT.009	DET-ANC	TBD	The LowQ2 detector must be upstream in the electron direction from the Q3ER magnet.
I-DET-INF-INT.010	DET-ANC	TBD	The LowQ2 detector must be downstream in the electron direction from the B2ER magnet.
I-DET-INF-INT.011	DET-ANC	TBD	The LOWQ2 detector must be at the same level as the electron beamline.

4.10. DET-POL-EPOL : Electron Polarimetry Systems (WBS 6.10.14.01)

Interfaces associated with electron polarimetry systems located in the interaction region and surrounding areas.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.056	DET-POL-EPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the ESR Polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.057	DET-POL-EPOL	DET-COMP	Data transfer lines will be run from the electron detector to a DAQ system.
I-DET-COMP-ONLINE.058	DET-POL-EPOL	DET-COMP	Data transfer lines will be run from the laser enclosure on the beamline to a DAQ system.
I-DET-COMP-ONLINE.059	DET-POL-EPOL	DET-COMP	Data transfer lines will be run from the photon detector to a DAQ system.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.060	DET-POL-EPOL	DET-COMP	A network connection will be provided from the DAQ system to the ESR Polarimeter's slow controls interface.
I-DET-COMP-ONLINE.061	DET-POL-EPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the ESR Polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.062	DET-POL-EPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the RCS polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.063	DET-POL-EPOL	DET-COMP	Data transfer lines will be run from the laser enclosure on the beamline to a DAQ system.
I-DET-COMP-ONLINE.064	DET-POL-EPOL	DET-COMP	Data transfer lines will be run from the photon detector to a DAQ system.
I-DET-COMP-ONLINE.065	DET-POL-EPOL	DET-COMP	A network connection will be provided from the DAQ system to the RCS polarimeter's slow controls interface.
I-DET-COMP-ONLINE.066	DET-POL-EPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the RCS polarimeter's readout board for timing synchronization.
I-DET-ELEC.057	DET-POL-EPOL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.058	DET-POL-EPOL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.059	DET-POL-EPOL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.060	DET-POL-EPOL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.061	DET-POL-EPOL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.062	DET-POL-EPOL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-POL-EPOL-RCS.001	DET-POL-EPOL	EIS-RCS	A single dipole magnet must be installed between the Compton laser and the photon detector to deflect unscattered electrons from the Compton scattered particles.
I-DET-POL-EPOL-RCS.002	DET-POL-EPOL	EIS-RCS	A protective enclosure will need to be installed in the area to protect personnel from laser radiation.
I-DET-POL-EPOL-RCS.003	DET-POL-EPOL	EIS-RCS	The RCS Compton Laser must be integrated with the rapid cycling synchrotron in a location that is upstream from the RCS Compton photon detectors

Interface ID	From	To	Description
I-DET-POL-EPOL-RCS.004	DET-POL-EPOL	EIS-RCS	The RCS Compton photon detector must be integrated with the RCS beamline and be positioned downstream from the Compton laser.
I-DET-POL-EPOL-RCS.005	DET-POL-EPOL	EIS-RCS	The RCS Compton polarimeter must fit within the available space at the chosen location on the RCS beamline.
I-DET-POL-EPOL-ESR.001	DET-POL-EPOL	ESR	If the background radiation is to high it could damage the polarimeter or render its results unusable.
I-DET-POL-EPOL-ESR.002	DET-POL-EPOL	ESR	Beam size and repetition rate must be consistent with the capabilities of the laser and the detectors.
I-DET-POL-EPOL-ESR.003	DET-POL-EPOL	ESR	THE ESR Compton electron detector must be integrated with the ESR beamline and be positioned downstream from the Compton laser.
I-DET-POL-EPOL-ESR.004	DET-POL-EPOL	ESR	The ESR Compton Laser must be integrated with the electron storage ring in a location that is upstream from the Compton electron and photon detectors, all of which are upstream from IP-6 in the electron going direction.
I-DET-POL-EPOL-ESR.005	DET-POL-EPOL	ESR	THE ESR Compton photon detector must be integrated with the ESR beamline and be positioned downstream from the Compton laser.
I-DET-POL-EPOL-ESR.006	DET-POL-EPOL	ESR	The ESR Compton Polarimeter should be located as close as practical to the main detector in IP-6.
I-DET-POL-EPOL-ESR.007	DET-POL-EPOL	ESR	A single dipole magnet must be installed between the Compton laser and the electron and photon detectors to deflect unscattered electrons from the Compton scattered particles.
I-DET-POL-EPOL-ESR.008	DET-POL-EPOL	ESR	A protective enclosure will need to be installed in the area to protect personnel from laser radiation.
I-DET-POL-EPOL-ESR.009	DET-POL-EPOL	ESR	The ESR Compton polarimeter must fit within the available space at the chosen location on the ESR beamline.
I-DET-POL-EPOL-RCS.006	DET-POL-EPOL	ESR	If the background radiation is to high it could damage the polarimeter or render its results unusable.
I-DET-POL-EPOL-RCS.007	DET-POL-EPOL	ESR	Beam size and repetition rate must be consistent with the capabilities of the laser and the detectors.
I-DET-POL-EPOL-ESR.010	DET-POL-EPOL	INF-IR	Control lines for the electron detector will be run from the laser lab to the electron detector on the ESR beamline.
I-DET-POL-EPOL-ESR.011	DET-POL-EPOL	INF-IR	The laser lab should have a protected pathway that allows it to be accessed during beam operations.

Interface ID	From	To	Description
I-DET-POL-EPOL-ESR.012	DET-POL-EPOL	INF-IR	A laser lab will need to be provided to house the primary lasers for the Compton and RCS polarimeters, and must be within 300 meters of the ESR and RCS Compton lasers.
I-DET-POL-EPOL-ESR.013	DET-POL-EPOL	INF-IR	The laser lab should be shielded adequately that it can be accessed during normal beam operations.
I-DET-POL-EPOL-ESR.014	DET-POL-EPOL	INF-IR	The electron detector is installed in a vacuum and must be actively cooled using either LCW or process cooling water.
I-DET-POL-EPOL-ESR.015	DET-POL-EPOL	INF-IR	High voltage cabling will deliver power to the electron and photon detectors from a high power supply located in a shielded area.
I-DET-POL-EPOL-ESR.016	DET-POL-EPOL	INF-IR	Controls lines for the slow control system will be run from the laser lab to the laser enclosure on the beamline.
I-DET-POL-EPOL-ESR.017	DET-POL-EPOL	INF-IR	The laser lab should have an HVAC system that maintains a comfortable temperature.
I-DET-POL-EPOL-ESR.018	DET-POL-EPOL	INF-IR	The laser lab must have an safety interlock system to control access to the room during operation.
I-DET-POL-EPOL-ESR.019	DET-POL-EPOL	INF-IR	The equipment in the laser lab will require standard single phase power.
I-DET-POL-EPOL-ESR.020	DET-POL-EPOL	INF-IR	The lasers should be provided with UPS power to allow them to be shutdown gracefully in the event of a power failure or electrical transient.
I-DET-POL-EPOL-ESR.021	DET-POL-EPOL	INF-IR	Low voltage cabling will deliver power to the ASIC from a low noise power supply located in a shielded area.
I-DET-POL-EPOL-ESR.022	DET-POL-EPOL	INF-IR	The photon detector will need to be cooled by either a forced air system, or a fluid cooling system.
I-DET-POL-EPOL-ESR.023	DET-POL-EPOL	INF-IR	The slow controls located in the laser enclosure on the ESR beamline will be powered using standard single phase power.
I-DET-POL-EPOL-RCS.008	DET-POL-EPOL	INF-IR	The laser lab should have a protected pathway that allows it to be accessed during beam operations.
I-DET-POL-EPOL-RCS.009	DET-POL-EPOL	INF-IR	A laser lab will need to be provided to house the primary lasers for the Compton and RCS polarimeters, and must be within 300 meters of the ESR and RCS Compton lasers.
I-DET-POL-EPOL-RCS.010	DET-POL-EPOL	INF-IR	The laser lab should be shielded adequately that it can be accessed during normal beam operations.
I-DET-POL-EPOL-RCS.011	DET-POL-EPOL	INF-IR	High voltage cabling will deliver power to the photon detectors from a high power supply located in a shielded area.

Interface ID	From	To	Description
I-DET-POL-EPOL-RCS.012	DET-POL-EPOL	INF-IR	Controls lines for the slow control system will be run from the laser lab to the laser enclosure on the beamline.
I-DET-POL-EPOL-RCS.013	DET-POL-EPOL	INF-IR	The laser lab should have an HVAC system that maintains a comfortable temperature.
I-DET-POL-EPOL-RCS.014	DET-POL-EPOL	INF-IR	The laser lab must have an safety interlock system to control access to the room during operation.
I-DET-POL-EPOL-RCS.015	DET-POL-EPOL	INF-IR	The equipment in the laser lab will require standard single phase power.
I-DET-POL-EPOL-RCS.016	DET-POL-EPOL	INF-IR	The lasers should be provided with UPS power to allow them to be shutdown gracefully in the event of a power failure or electrical transient.
I-DET-POL-EPOL-RCS.017	DET-POL-EPOL	INF-IR	Low voltage cabling will deliver power to the ASIC from a low noise power supply located in a shielded area.
I-DET-POL-EPOL-RCS.018	DET-POL-EPOL	INF-IR	The photon detector will need to be cooled by either a forced air system, or a fluid cooling system.
I-DET-POL-EPOL-RCS.019	DET-POL-EPOL	INF-IR	The slow controls located in the laser enclosure on the RCS beamline will be powered using standard single phase power.

4.11. DET-POL-HPOL : Hadron Polarimetry Systems (WBS 6.10.14.02)

Interfaces associated with hadron polarimetry systems located in the interaction region and surrounding areas.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.067	DET-POL-HPOL	DET-COMP	Readout cables need to run from the polarimeter detectors to the data acquisition system at IR-4.
I-DET-COMP-ONLINE.068	DET-POL-HPOL	DET-COMP	Slow control information should be written to the HSR database (5 second intervals)
I-DET-COMP-ONLINE.069	DET-POL-HPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the HJET polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.070	DET-POL-HPOL	DET-COMP	Slow control cables for the HJET target system need to run from the hall at IR-4 to the polarimeter in the tunnel.
I-DET-COMP-ONLINE.071	DET-POL-HPOL	DET-COMP	A network connection will be provided from the DAQ system to the HJET polarimeter's slow controls interface.
I-DET-COMP-ONLINE.072	DET-POL-HPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the HJET polarimeter's readout board for timing synchronization.

Interface ID	From	To	Description
I-DET-COMP-ONLINE.073	DET-POL-HPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the proton-carbon polarimeter's readout board to perform configuration, control, and data acquisition.
I-DET-COMP-ONLINE.074	DET-POL-HPOL	DET-COMP	Results from the target scan polarimeter runs should be written to the HSR database
I-DET-COMP-ONLINE.075	DET-POL-HPOL	DET-COMP	A network connection will be provided from the DAQ system to the proton-carbon polarimeter's slow controls interface.
I-DET-COMP-ONLINE.076	DET-POL-HPOL	DET-COMP	A fiber connection will be provided from the DAQ system to the proton-carbon polarimeter's readout board for timing synchronization.
I-DET-COMP-ONLINE.077	DET-POL-HPOL	DET-COMP	Slow control cables for the target motion need to run from the hall at IR-4 to the polarimeter.
I-DET-COMP-ONLINE.078	DET-POL-HPOL	DET-COMP	Fiber target operation should be controlled from the HSR main control room
I-DET-COMP-ONLINE.079	DET-POL-HPOL	DET-COMP	Slow control cables for the target motion need to run from the DAQ room at IR-6 to the polarimeter.
I-DET-COMP-ONLINE.080	DET-POL-HPOL	DET-COMP	Fiber target operation should be controlled from the EPIC control room
I-DET-ELEC.063	DET-POL-HPOL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.064	DET-POL-HPOL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.065	DET-POL-HPOL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-ELEC.066	DET-POL-HPOL	DET-ELEC	Bias voltage DC power will be provided from the electronics racks to support electronics the silicon photomultipliers.
I-DET-ELEC.067	DET-POL-HPOL	DET-ELEC	High voltage DC power will be provided from the electronics racks to support silicon sensors and gas detectors.
I-DET-ELEC.068	DET-POL-HPOL	DET-ELEC	Low voltage DC power will be provided from the electronics racks to support electronics in the detector.
I-DET-POL-HPOL.001	DET-POL-HPOL	INF-IR	Beam background may affect the detector performance (absorber installation)
I-DET-POL-HPOL.002	DET-POL-HPOL	INF-IR	Low voltage cabling for electronics and detectors needs to run from the hall at IR-4 to the location of the polarimeters.
I-DET-POL-HPOL.003	DET-POL-HPOL	INF-IR	Space for the data acquisition and electronics is needed in the hall at IR-4.

Interface ID	From	To	Description
I-DET-POL-HPOL-HJET.001	DET-POL-HPOL	INF-IR	The HJET must fit at the location at IR-4 between the HSR triplet and D0 magnet.
I-DET-POL-HPOL-HJET.002	DET-POL-HPOL	INF-IR	The ZDC must be located downstream of the HJET target and the D0 magnet with sufficient drift space to allow separation of 3He and breakup products.
I-DET-POL-HPOL-HJET.003	DET-POL-HPOL	INF-IR	The HJET target system needs to be integrated into the HSR vacuum interlock system.
I-DET-POL-HPOL-HJET.004	DET-POL-HPOL	INF-IR	HJET target must be able to be closed off from HSR vacuum during warm-up of cold nozzle (regular maintenance operation)
I-DET-POL-HPOL-PC-IR4.001	DET-POL-HPOL	INF-IR	The target chamber for the fiber target at IR-4 shall be upstream of the HJET and there shall be no magnet between the HJET and the fiber target.
I-DET-POL-HPOL-PC-IR4.002	DET-POL-HPOL	INF-IR	Accessibility for target replacement during maintenance time (vacuum separation)
I-DET-POL-HPOL-PC-IR6.001	DET-POL-HPOL	INF-IR	The target chamber for the local polarimeter shall be located near the backward detectors at IR-4 in the incoming hadron beamline.
I-DET-POL-HPOL-PC-IR6.002	DET-POL-HPOL	INF-IR	The data acquisition for the local polarimeter shall be integrated into the experimental readout.
I-DET-POL-HPOL-PC-IR6.003	DET-POL-HPOL	INF-IR	Accessibility for target replacement during maintenance time (vacuum separation)

5. REFERENCES

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