

ePIC Trunk Fiber Inspection and Test Plan

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Abstract

The primary communications interface between all ePIC experimental sub-systems at IP6 will be implemented via approximately 6000 fibers distributed between the DAQ Room and the Interaction Region Wide Angle Hall and connecting tunnels. A subset of this trunk fiber must also be rigged such that the primary barrel region detectors and solenoid magnet can be rolled out into the Assembly Hall and still have all fiber communications be kept intact. Trunk fiber purchase and installation will be handled via commercial companies. They will be responsible for all fiber terminations at provided patch panel racks as well as link testing.

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1. TRUNK FIBER PROPERTIES

The trunk fiber is a commercial product. The following are the key requirements that will be considered by all tests and inspections.

- 144-Strand trunk fiber (12x12 bundles within a single trunk); Minimum initial length is 600 linear feet
- OM3 or OM4 standard multimode fiber
- Armored cable jacket type
- High performance components and construction
- Cable materials are rated for indoor/outdoor UL listed OFNR and UV
- Water and fungus resistant
- UL listed in accordance with NEC for use in vertical runs in building riser shafts
- Wide operating temperature range of -40C to +85C
- Terminations on each end will be either LC or MTP style connectors at the patch panels.

In addition, after the rigging of the trunk fiber, it will be required to undergo full transition of the main carriage between the Assembly Hall and the Wide-Angle Hall and back to insure there are no tension points, excessive bending or blockage for the trunk fibers.

1.1. Trunk fibers and associated termination connectors

Trunk fibers and connectors may not be provided by the same vendor performing the installation or at the same time as installation is set to begin. Regardless of the source all materials will be inspected.

1.1.1. Incoming Inspections

Upon delivery, all materials will be initially inspected for possible damage in shipping as well as conformance with requirements specified in the purchase order and/or statement of work.

1.1.2. Failures and Non-Conformances

Non-confirming materials will be returned to the vendor for replacement.

2. WIDE-ANGLE HALL RIGGING

The rigging infrastructure in the Wide-Angle Hall is designed to hold and guide fiber optic trunk cable to patch panel racks on the south platform of the detector carriage. In addition, it allows the entire carriage to be rolled between the assembly area and the Wide-Angle Hall without having to disconnect the trunk fiber from the south platform patch panels.

2.1. Rigging Infrastructure

The existing rigging infrastructure needs to be inspected and certified prior to the planned installation of the ePIC trunk fibers. This can be done at any time after the completion of the R&R for Building 1006 and the interaction region.

2.1.1. Verification Testing

Verification testing will include an engineering assessment of the ability of the rigging to support the total weight of the trunk fibers. Engineering will also perform a full operation of moving the rigging

support structures from wide angle hall to assembly area and back again without any fibers in place. An initial assessment of the functionality of the rigging infrastructure will be provided.

2.1.2. Failures and Non-Conformances

Any failures of the verification testing will need to be addressed in coordination with Engineering recommendations.

3. INSTALLATION, TERMINATION AND TESTING

A qualified installation vendor will be required to first pull the trunk fiber to all defined locations in Building 1006. They will then need to terminate and label all fibers at both ends at the patch panels with a project supplied configuration list. After termination, each fiber will need to be tested for adequate signal strength and total length measurements.

3.1. Installation of the Trunk Fiber

Figure 1 gives an overview of the general layout in Building 1006 for trunk fiber pulls and the location of rigging and the racks holding the patch panels where fibers will be terminated. The total number of trunk fibers distributed from the DAQ Room will vary depending on the location of the destination racks. Patch panel racks will be in the Wide-Angle Hall, the South Platform and the East and West accelerator tunnels. Only trunk fibers destined for the South Platform will need to be pulled onto the rigging infrastructure.

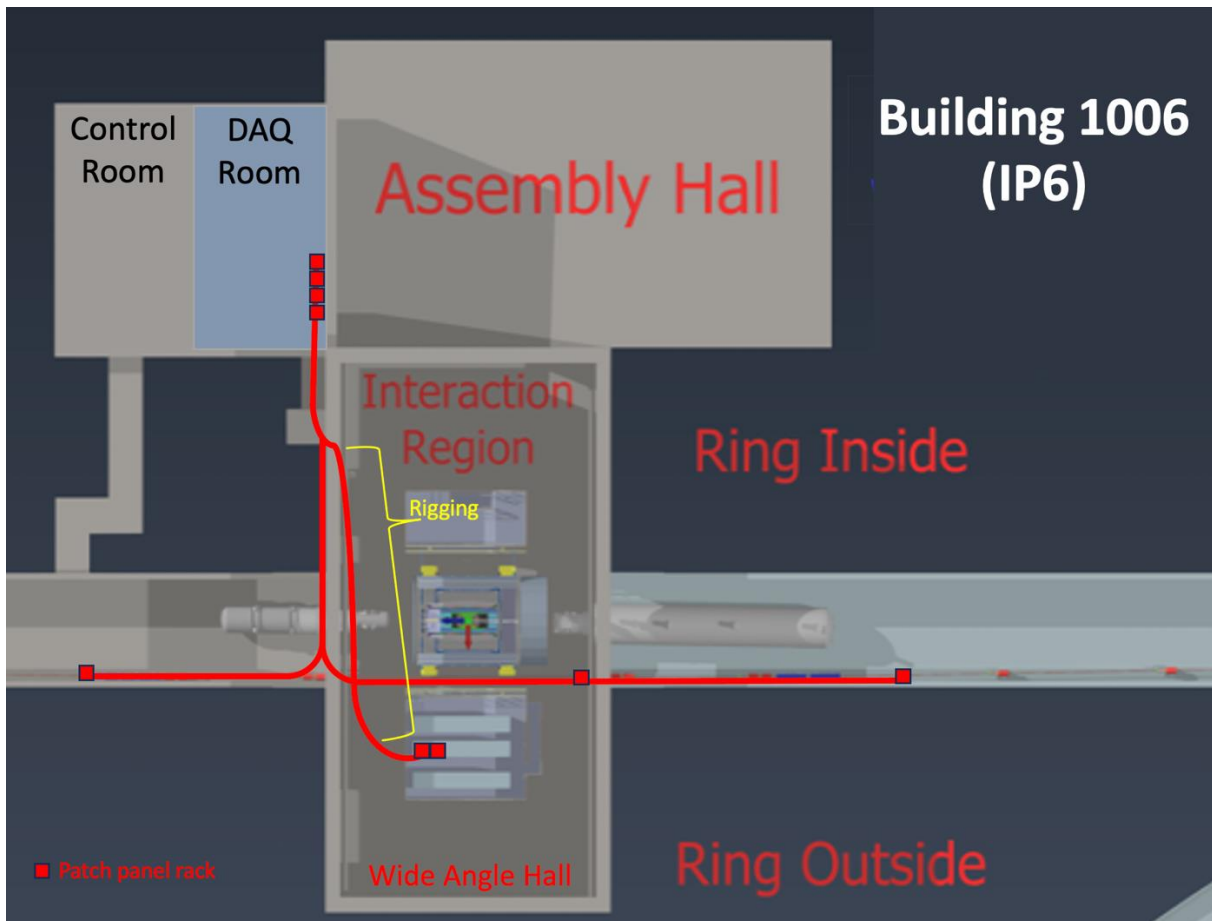


Figure 1. Overview of IP6 and general locations of fiber pulls and patch panels

3.1.1. Resource Requirements

Prior to the installation process, all rigging structures, cable trays, racks and patch panels should be in place within Building 1006. In addition, there should be coordination with the Rigging group at BNL to be available to work with the fiber installation vendor during the pull.

3.1.2. Test Conditions

The detector carriage including North and South Platforms should be positioned in the Assembly Hall. The Wide-Angle Hall should be clear of any equipment that may impede the pulling of the trunk fiber.

3.1.3. Equipment

This needs to be confirmed with the vendor and BNL Rigging. The vendor should supply appropriate strain relief hardware at the patch panels.



Figure 2. Rigging infrastructure in the existing STAR experiment at IP6

3.2. Testing of Rigged Trunk Fiber Transitions

After all trunk fibers have been pulled to their respective destination racks, there will be an additional test of the rigging transition between Assembly area and Wide-Angle Hall with all trunk fibers in place on the rigging.

3.2.1. Resource Requirements

Qualified BNL personnel to operate equipment along with the fiber installation vendor will be present.

3.2.2. Test Conditions

The detector carriage including North and South Platforms should be positioned in the Assembly Hall.

3.2.3. Equipment

Mobile man-lift capable of reaching the approximate height of the patch panel racks on the south platform and a large enough platform to secure trunk fiber bundles for transition testing.

3.3. Termination of Trunk Fibers

The project will provide a layout plan for all fiber termination connections at each patch panel rack. There will be LC pair connections as well as multiple MTP standards (including 12, 24 and 48 fiber options). Terminated fibers will be visually inspected upon completion. Testing of the functionality of the fiber termination is integrally linked to the testing of the fiber described in section 3.4.

3.4. Testing of Trunk Fibers

Each fiber must be labeled at terminations in the DAQ room and in the experimental Areas. Each must be tested to verify the integrity of the fiber and the quality of the termination. The attenuation and **SR-4731 reflectivity files (this needs to be confirmed)** data must be documented for each fiber.

3.4.1. Resource Requirements

The qualified vendor will be responsible to provide all necessary equipment to test all fiber terminations for both signal strength and attenuation defined by the OM3 or OM4 specifications.

3.4.2. Test Conditions

No special conditions are required in the hall.

3.4.3. Equipment

Industry standard fiber optic power meters (OPM) and Optical Time Domain Reflectometer (OTDR) should be used to test the integrity of the cable and termination connections shall be performed for all terminated fibers.

4. ENVIRONMENT, SAFETY & HEALTH CONSIDERATIONS

The procedures will be implemented in a way consistent with the environment, safety, and health policies of the relevant work areas. Within BNL the process is described in the SBMS: “Work Planning & Control for Experiments and Operations”.

5. RECORDS AND DOCUMENTATION

The EIC project will provide documentation describing the description, type and layout of all required fiber terminations at the patch panels including labeling of racks, panels and ports.

5.1. Manufacturer/Producer Records

For trunk cable and termination connectors, the manufacturer/reseller will provide documentation identifying the specifications and origins for the delivered materials.

5.2. Deliverable Documentation and Records

Documentation to be presented as part of the deliverables for this ITP include:

- Engineering assessment and test results for rigging infrastructure.
- Fiber installation vendor will provide test results (signal strength, timing) for all terminated fibers.

6. REFERENCES

Fiber Optical Standards: <https://www.thefoa.org>