

BeAGLE @ JLAB

Good news 1: BeAGLE output format finalized

Good news 2: BeAGLE installed at JLAB

Good news 3: Liang is in the U.S.

Minor discussion points:
Beam crossing angle
PDF (e.g. $xq(x)$) installation

Mark D. Baker

18-JAN-2017

BEAGLE EVENT Changed/New Variables

Particle Record:

As per Charles's suggestion, generalized A & Z.

Now \bar{p} is A=Z=-1 and π^+ is A=0,Z=1 etc.

IDRES(I):	I	Baryon number, or A for a nucleus (IDHKK(I)=80000), fractional B set to 0.
IDXRES(I):	I	Particle charge, Z for a nucleus), 0 for fractional charge.

Event header:

Added the following:

Eexc:	D	Excitation energy in the nuclear remnant before evaporation and breakup.
R _A	D	Nuclear PDF ratio for the up sea for the given event kinematics (x,Q ²), but set to 1 if multi-nucleon shadowing is off (genShd=1)

Based on question from Guohui:

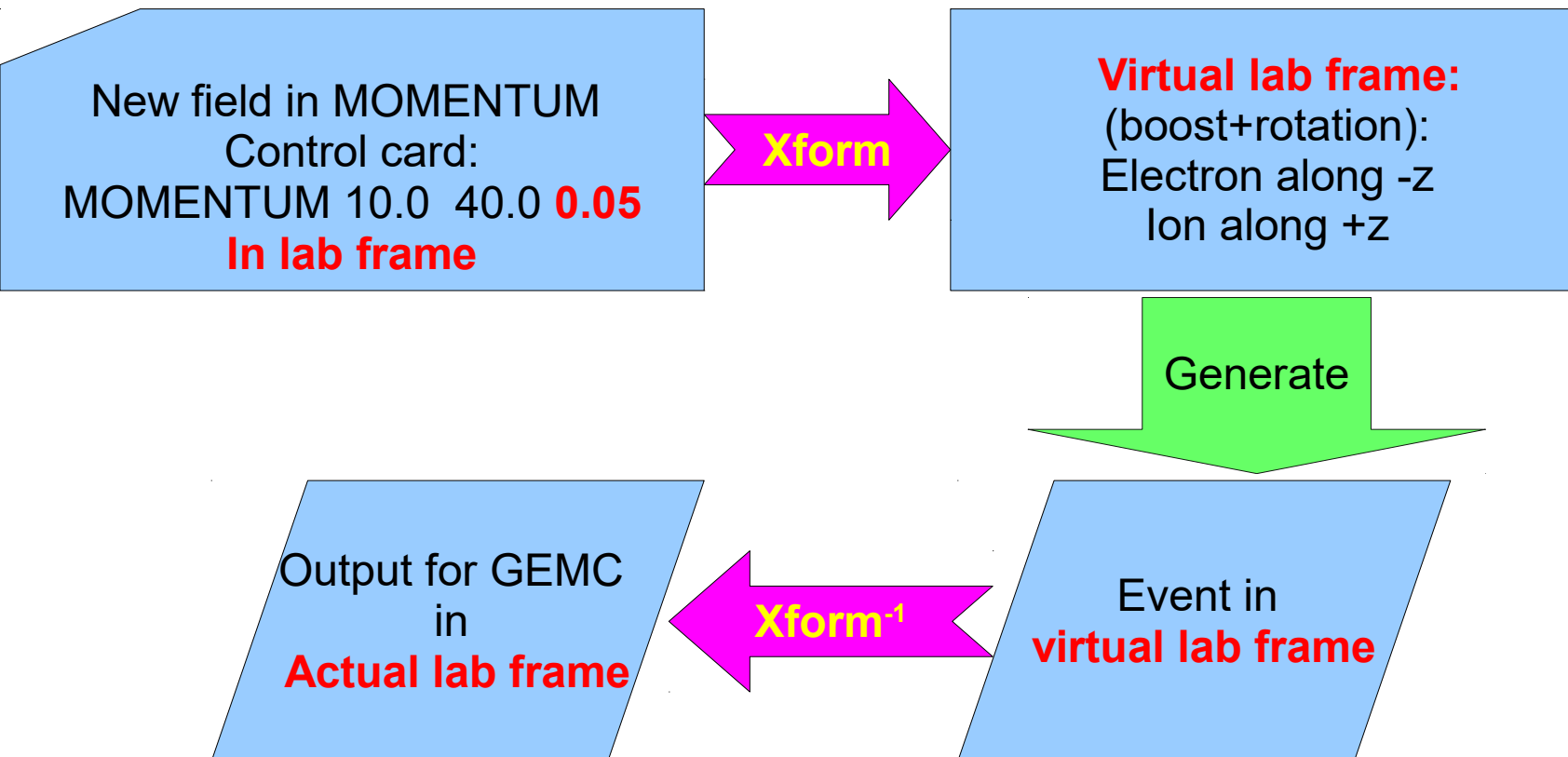
We'll have to decide how to define these variables for non-zero crossing angle.

Use User1 for crossing angle?

ltype:	I	particle code for incoming lepton
Atarg:	I	A of the target nucleus
Ztarg:	I	Z of the target nucleus
pzlep:	D	lab pz of the lepton beam
pztarg:	D	lab pz/A of the ion beam
pznucl:	D	lab pz of the struck nucleon

Crossing angle(w/ Guohui, Pawel)

BeAGLE assumes head-on collisions at multiple points in the code.



Still need to fix some contents (using PyQM utility functions)

b:	D	Impact parameter (in fm), radial position of virtual photon w.r.t. the center of the nucleus in the nuclear TRF with z along γ^*
Phib:	D	azimuthal angle of the impact parameter of the virtual photon in the nuclear TRF with z along γ^* and $\phi=0$ for the scattered electron
Thickness:	D	Nuclear thickness T(b) in nucleons/fm ²
ThickScl:	D	Scaled Nuclear thickness T(b)/ ρ_0 in units of fm.
Ncollt:	I	Number of collisions between the incoming γ^* and nucleons in the nucleus (same as number of participating nucleons)
Ncolli:	I	Number of inelastic collisions between the incoming γ^* and nucleons in the nucleus (same as number of inelastically participating nucleons)
Nnevap:	I	Number of evaporation (and nuclear breakup) neutrons
Npevap:	I	Number of evaporation (and nuclear breakup) protons
Aremn:	I	A of the nuclear remnant after evaporation and breakup
Ninc:	I	Number of stable hadrons from the Intra Nuclear Cascade
Ninch:	I	Number of charged stable hadrons from the Intra Nuclear Cascade
d_{1st}:	D	density-weighted distance from first collision to the edge of the nucleus (amount of material traversed / ρ_0)
d_{avg}:	D	Average density-weighted distance from all inelastic collisions to the edge of the nucleus
pxf,pyf,pzf:	D	Fermi-momentum of the struck nucleon (or sum Fermi momentum for all inelastic nucleon participants for Ncolli>1)
User1,User2,User3:	D	User variables to prevent/delay future format changes
nrTracks:	I	number of tracks in this event, including event history(not number of tracks minus 4)

JLAB software: a breath of fresh air!

It was much easier than I feared, primarily for one reason:

login.jlab.org - PuTTY

```
> Common Environment Version: <2.0> (Wed Oct 6 2016)
> Running as mdbaker on jlab13.jlab.org
> OS Release: Linux_RedHat6.8-x86_64-gcc5.2.0
> JLAB_ROOT set to: /site/12gev_phys
> JLAB_SOFTWARE set to: /site/12gev_phys/2.0/Linux_RedHat6.8-x86_64-gcc5.2.0
```

JLAB gcc level 5.2.0,
Also man pages work.

```
jlab13.jlab.org> gfortran --version
GNU Fortran (GCC) 5.2.0
Copyright (C) 2015 Free Software Foundation, Inc.
```

```
[mdbaker@eic0004 ~]$ gfortran --version
GNU Fortran (GCC) 4.4.7 20120313 (Red Hat 4.4.7-3)
Copyright (C) 2010 Free Software Foundation, Inc.
```

BNL gcc level 4.4.7
Doesn't work.
Nightmare for Liang.

```
[mdbaker@eic0004 BeAGLE]$ gfortran version
gfortran: error: version: No such file or directory
[mdbaker@eic0004 BeAGLE]$ gfortran --version
GNU Fortran (GCC) 4.6.3
Copyright (C) 2011 Free Software Foundation, Inc.
```

They had to install a
“special” gcc:
BNL gcc level 4.6.3
Minimum acceptable.

/u/group/ldgeom/PACKAGES/

```
jlabl3.jlab.org> pwd
/u/group/ldgeom/PACKAGES
jlabl3.jlab.org> ls --width=25
BeAGLE
fluka-64
lhapdf-5.9.1
LHAPDF-5.9.1-64BIT
LHAPDF-5.9.1-64BIT-BNL
setup.csh
```

In addition to BeAGLE we also have:
LHAPDF-5.9.1-64BIT to interface with PDFs
& we have Fluka

```
jlabl3.jlab.org> pwd
/u/group/ldgeom/PACKAGES/BeAGLE
jlabl3.jlab.org> ls
BeAGLE
Documents
dpmjet.dat
eALS1noq
eALS1re
eAS2tst
eAu_shorttest_Shd2_tau9_kt=ptfrag=0.40.inp
eAu_shorttest_Shd2_tau9_kt=ptfrag=0.40.log
ePb-low_10k_Shd1_tau9_kt=ptfrag=0.32.inp
ePb-low_10k_Shd1_tau9_kt=ptfrag=0.32.rerunSEED2210.inp
errors.dat
fitpar.dat
fort.1
fort.11
include
jlabl3.jlab.org>
linkToRadgen
Makefile
Makefile~
nuclear.bin
obj
outForPythiaMode
PyOM
PYTHIA-6.4.28
radgen-6.4.28
runeA-test.csh
runeA-test.csh~
shadowmapAu.dat
shadowmapCa.dat
src
user-eA3.0-5.f
```

Note for Charles:

BeAGLE can run basically
BNL-PYTHIA for ep or “en”
Sept. 15, 2015 version.

I'll make example control files for
that.

Download more PDFSets?

Due to space limitations (on Tuesday),
I just downloaded a subset of PDFs.
Basically CTEQ* and EPS09*

Should we just download more as we need them,
or match BNL now now that we have 100 GB?

Are there special JLAB-favorite PDFs?

JLAB PDFsets currently 454 MB
BNL PDFsets currently 12 GB

PDFSets
@ BNL

OVERLAP

```
[mdbaker@eic0004 PDFsets]$ ls
a02m_lo.LHgrid      EPS09LOR_115.LHgrid  HERAPDF01.LHpdf      MSTW2008nlo90c1_asmz+90clhalf.LHgrid  NNPDF21_as_0114_100.LHgrid
a02m_nlo.LHgrid    EPS09LOR_117.LHgrid  HERAPDF10_ALPHAS.LHgrid  MSTW2008nlo90c1_asmz-90cl.LHgrid      NNPDF21_as_0115_100.LHgrid
a02m_nnlo.LHgrid   EPS09LOR_12.LHgrid   HERAPDF10_EIG.LHgrid    MSTW2008nlo90c1_asmz+90cl.LHgrid      NNPDF21_as_0116_100.LHgrid
ABFKWPI.LHgrid     EPS09LOR_16.LHgrid   HERAPDF10_VAR.LHgrid    MSTW2008nlo90c1.LHgrid                NNPDF21_as_0117_100.LHgrid
abkm09_3_nlo.LHgrid EPS09LOR_184.LHgrid  HERAPDF15NLO_ALPHAS.LHgrid  MSTW2008nlo90c1_nf3.LHgrid           NNPDF21_as_0118_100.LHgrid
abkm09_3_nnlo.LHgrid EPS09LOR_195.LHgrid  HERAPDF15NLO_EIG.LHgrid    MSTW2008nlo90c1_nf4.LHgrid           NNPDF21_as_0120_100.LHgrid
abkm09_4_nlo.LHgrid EPS09LOR_197.LHgrid  HERAPDF15NLO_VAR.LHgrid    MSTW2008nlo_asmzrange.LHgrid         NNPDF21_as_0121_100.LHgrid
abkm09_4_nnlo.LHgrid EPS09LOR_208.LHgrid  HERAPDF15NNLO_ALPHAS.LHgrid  MSTW2008nlo_mbrange.LHgrid           NNPDF21_as_0122_100.LHgrid
abkm09_5_nlo.LHgrid EPS09LOR_238.LHgrid  HERAPDF15NNLO_EIG.LHgrid    MSTW2008nlo_mbrange_nf4.LHgrid       NNPDF21_as_0123_100.LHgrid
abkm09_5_nnlo.LHgrid EPS09LOR_27.LHgrid   HERAPDF15NNLO_VAR.LHgrid    MSTW2008nlo_mcrange_fixasmz.LHgrid   NNPDF21_as_0124_100.LHgrid
ACFGPG.LHgrid      EPS09LOR_40.LHgrid   HKNLo.LHgrid             MSTW2008nlo_mcrange_fixasmz_nf3.LHgrid NNPDF21_dis_1000.LHgrid
Alekhin_1000.LHpdf EPS09LOR_4.LHgrid    HKNnlo.LHgrid            MSTW2008nlo_mcrange.LHgrid           NNPDF21_dis_100.LHgrid
Alekhin_100.LHpdf  EPS09LOR_56.LHgrid  JR09FFnloE.LHgrid        MSTW2008nlo_mcrange_nf3.LHgrid       NNPDF21_dis+dy_100.LHgrid
Botje_1000.LHpdf   EPS09LOR_64.LHgrid  JR09VFnloE.LHgrid        MSTW2008nlo68cl_asmz-68clhalf.LHgrid NNPDF21_dis+jet_100.LHgrid
Botje_100.LHpdf    EPS09LOR_6.LHgrid   LAGG.LHgrid              MSTW2008nlo68cl_asmz+68clhalf.LHgrid  NNPDF21_FFN_NF3_100.LHgrid
CT09MC1.LHgrid     EPS09LOR_9.LHgrid   MRST2001E.LHgrid         MSTW2008nlo68cl_asmz-68cl.LHgrid     NNPDF21_FFN_NF4_100.LHgrid
CT09MC2.LHgrid     EPS09NLR_108.LHgrid MRST2001E.LHpdf          MSTW2008nlo68cl_asmz+68cl.LHgrid     NNPDF21_FFN_NF5_100.LHgrid
CT09MCS.LHgrid     EPS09NLR_115.LHgrid MRST2001lo.LHgrid        MSTW2008nlo68cl.LHgrid               NNPDF21_lo_as_0119_100.LHgrid
CT10as.LHgrid      EPS09NLR_117.LHgrid MRST2001nlo.LHgrid      MSTW2008nlo68cl_nf3.LHgrid           NNPDF21_lo_as_0130_100.LHgrid
CT10f3.LHgrid      EPS09NLR_12.LHgrid  MRST2001nlo.LHpdf       MSTW2008nlo68cl_nf4.LHgrid           NNPDF21_lostar_as_0119_100.LHgrid
CT10f4.LHgrid      EPS09NLR_131.LHgrid MRST2001nnlo.LHgrid     MSTW2008nlo90c1_asmz-90clhalf.LHgrid  NNPDF21_lostar_as_0130_100.LHgrid
CT10.LHgrid        EPS09NLR_16.LHgrid  MRST2002nlo.LHgrid     MSTW2008nlo90c1_asmz+90clhalf.LHgrid  NNPDF21_mb_425_100.LHgrid
CT10was.LHgrid     EPS09NLR_184.LHgrid MRST2002nlo.LHpdf       MSTW2008nlo90c1_asmz-90cl.LHgrid     NNPDF21_mb_45_100.LHgrid
CT10wf3.LHgrid     EPS09NLR_195.LHgrid MRST2002nnlo.LHgrid     MSTW2008nlo90c1_asmz+90cl.LHgrid     NNPDF21_mb_50_100.LHgrid
CT10wf4.LHgrid     EPS09NLR_197.LHgrid MRST2003cnlo.LHgrid     MSTW2008nlo90c1.LHgrid               NNPDF21_mb_525_100.LHgrid
CT10w.LHgrid       EPS09NLR_208.LHgrid MRST2003cnlo.LHpdf     MSTW2008nlo90c1_nf3.LHgrid           NNPDF21_mc_15_100.LHgrid
cteq4d.LHgrid      EPS09NLR_20.LHgrid  MRST2003cnnlo.LHgrid   MSTW2008nlo90c1_nf4.LHgrid           NNPDF21_mc_16_100.LHgrid
cteq4l.LHgrid      EPS09NLR_238.LHgrid MRST2004FF3lo.LHgrid   MSTW2008nlo_asmzrange.LHgrid         NNPDF21_mc_17_100.LHgrid
cteq4m.LHgrid      EPS09NLR_27.LHgrid  MRST2004FF3nlo.LHgrid  MSTW2008nlo_mbrange.LHgrid           NNPDF21_nnlo_1000.LHgrid
cteq5d.LHgrid      EPS09NLR_40.LHgrid  MRST2004FF3nlo.LHpdf   MSTW2008nlo_mbrange_nf4.LHgrid       NNPDF21_nnlo_100.LHgrid
cteq5f3.LHgrid     EPS09NLR_4.LHgrid   MRST2004FF4lo.LHgrid   MSTW2008nlo_mcrange_fixasmz.LHgrid   NNPDF21_nnlo_as_0114_100.LHgrid
cteq5f4.LHgrid     EPS09NLR_56.LHgrid  MRST2004FF4nlo.LHgrid  MSTW2008nlo_mcrange_fixasmz_nf3.LHgrid NNPDF21_nnlo_as_0115_100.LHgrid
cteq5l.LHgrid      EPS09NLR_64.LHgrid  MRST2004FF4nlo.LHpdf   MSTW2008nlo_mcrange.LHgrid           NNPDF21_nnlo_as_0116_100.LHgrid
cteq5ml.LHgrid     EPS09NLR_6.LHgrid   MRST2004nlo.LHgrid     MSTW2008nlo_mcrange_nf3.LHgrid       NNPDF21_nnlo_as_0117_100.LHgrid
cteq5m.LHgrid      EPS09NLR_84.LHgrid  MRST2004nlo.LHpdf      NNPDF10_1000.LHgrid                 NNPDF21_nnlo_as_0118_100.LHgrid
cteq61.LHgrid      EPS09NLR_9.LHgrid   MRST2004nnlo.LHgrid    NNPDF10_1000.LHpdf                  NNPDF21_nnlo_as_0120_100.LHgrid
cteq61.LHpdf       Fermi2002_1000.LHpdf MRST2004qed.LHgrid     NNPDF10_100.LHgrid                  NNPDF21_nnlo_as_0121_100.LHgrid
cteq65c.LHgrid     Fermi2002_100.LHpdf MRST2006nnlo.LHgrid    NNPDF10_100.LHpdf                   NNPDF21_nnlo_as_0122_100.LHgrid
cteq65.LHgrid      GJR08FFdis.LHgrid  MRST2007lomod.LHgrid  NNPDF11_100.LHgrid                  NNPDF21_nnlo_as_0123_100.LHgrid
cteq65s.LHgrid     GJR08FFnloE.LHgrid MRST98dis.LHgrid       NNPDF12_1000.LHgrid                 NNPDF21_nnlo_as_0124_100.LHgrid
cteq66a0.LHgrid    GJR08lo.LHgrid     MRST98ht.LHgrid        NNPDF12_100.LHgrid                  NNPDF21_nnlo_collider_100.LHgrid
cteq66a1.LHgrid    GJR08VFnloE.LHgrid MRST98.LHpdf           NNPDF20_1000.LHgrid                 NNPDF21_nnlo_dis_100.LHgrid
cteq66a2.LHgrid    GRV98lo.LHgrid     MRST98lo.LHgrid        NNPDF20_100.LHgrid                  NNPDF21_nnlo_dis+dy_100.LHgrid
cteq66a3.LHgrid    GRV98nlo.LHgrid    MRST98nlo.LHgrid       NNPDF20_as_0114_100.LHgrid           NNPDF21_nnlo_heraonly_100.LHgrid
cteq66alphas.LHgrid GRVG0.LHgrid        MRSTMCal.LHgrid        NNPDF20_as_0115_100.LHgrid           OWPI.LHgrid
cteq66c.LHgrid     GRVG1.LHgrid        MSTW2008lo68cl.LHgrid  NNPDF20_as_0116_100.LHgrid           PDFsets.index
cteq66.LHgrid      GRVPI0.LHgrid      MSTW2008lo68cl_nf3.LHgrid  NNPDF20_as_0117_100.LHgrid           SASG.LHgrid
cteq6AB.LHgrid     GRVPI1.LHgrid      MSTW2008lo68cl_nf4.LHgrid  NNPDF20_as_0118_100.LHgrid           SMRSPI.LHgrid
cteq6lg.LHgrid     GSG0.LHgrid        MSTW2008lo90c1.LHgrid  NNPDF20_as_0120_100.LHgrid           USERGRIDQ2.LHgrid
cteq6.LHpdf        GSG1.LHgrid        MSTW2008lo90c1_nf3.LHgrid  NNPDF20_as_0121_100.LHgrid           USERGRIDQ3.LHgrid
cteq6l.LHpdf       GSG960.LHgrid      MSTW2008lo90c1_nf4.LHgrid  NNPDF20_as_0122_100.LHgrid           USERGRIDQ4.LHgrid
cteq6l1.LHpdf      GSG961.LHgrid      MSTW2008nlo68cl_asmz-68clhalf.LHgrid NNPDF20_as_0123_100.LHgrid           WHITG.LHgrid
cteq6mE.LHgrid     H12000disE.LHgrid  MSTW2008nlo68cl_asmz+68clhalf.LHgrid NNPDF20_as_0124_100.LHgrid           ZEUS2002_FF.LHpdf
cteq6m.LHpdf       H12000dis.LHgrid   MSTW2008nlo68cl_asmz-68cl.LHgrid  NNPDF20_dis_100.LHgrid              ZEUS2002_TR.LHpdf
DOG.LHgrid         H12000loE.LHgrid   MSTW2008nlo68cl_asmz+68cl.LHgrid  NNPDF20_dis+dy_100.LHgrid           ZEUS2002_ZM.LHpdf
DOG0.LHgrid        H12000lo.LHgrid    MSTW2008nlo68cl.LHgrid  NNPDF20_dis+jet_100.LHgrid         ZEUS2005_ZJ.LHpdf
DOG1.LHgrid        H12000msE.LHgrid   MSTW2008nlo68cl_nf3.LHgrid  NNPDF20_heraold_100.LHgrid
eps00ca.LHgrid     12000ms.LHgrid     MSTW2008nlo68cl_nf4.LHgrid  NNPDF21_1000.LHgrid
EPS09LOR_108.LHgrid ERAPDF01.LHgrid    MSTW2008nlo90c1_asmz-90clhalf.LHgrid NNPDF21_100.LHgrid
s]$
```

Extra PDFSets only at JLAB – downloaded from LHAPDF site.
70MB

Note: I don't really like using NLO or NNLO PDFs with PYTHIA,
So these may not be that useful.

```
CT10nlo_as_0112.LHgrid CT10nlo_as_0126.LHgrid CT10nnlo_as_0119.LHgrid
CT10nlo_as_0113.LHgrid CT10nlo_as_0127.LHgrid CT10nnlo_as_0120.LHgrid
CT10nlo_as_0114.LHgrid CT10nlo.LHgrid CT10nnlo_as_0121.LHgrid
CT10nlo_as_0115.LHgrid CT10nlo_nf3.LHgrid CT10nnlo_as_0122.LHgrid
CT10nlo_as_0116.LHgrid CT10nlo_nf4.LHgrid CT10nnlo_as_0123.LHgrid
CT10nlo_as_0117.LHgrid CT10nnlo_as_0110.LHgrid CT10nnlo_as_0124.LHgrid
CT10nlo_as_0118.LHgrid CT10nnlo_as_0111.LHgrid CT10nnlo_as_0125.LHgrid
CT10nlo_as_0119.LHgrid CT10nnlo_as_0112.LHgrid CT10nnlo_as_0126.LHgrid
CT10nlo_as_0120.LHgrid CT10nnlo_as_0113.LHgrid CT10nnlo_as_0127.LHgrid
CT10nlo_as_0121.LHgrid CT10nnlo_as_0114.LHgrid CT10nnlo_as_0128.LHgrid
CT10nlo_as_0122.LHgrid CT10nnlo_as_0115.LHgrid CT10nnlo_as_0129.LHgrid
CT10nlo_as_0123.LHgrid CT10nnlo_as_0116.LHgrid CT10nnlo_as_0130.LHgrid
CT10nlo_as_0124.LHgrid CT10nnlo_as_0117.LHgrid CT10nnlo.LHgrid
CT10nlo_as_0125.LHgrid CT10nnlo_as_0118.LHgrid
```

/u/group/ldgeom/data/

I'll make instructions for running BeAGLE from your own area.
You can make a directory for yourself here for data that you want to keep.

Total group space now 100 GB due to Vasiliy's request.

```
jlab13.jlab.org> pwd
/u/group/ldgeom/data
jlab13.jlab.org> ls
mdbaker
```

Liang is here at BNL!

- Will anyone be coming to EIC R&D meeting next week?

Conclusion

- Liang is here.
- Great progress on BeAGLE.
 - Hopefully bodes well for Liang & *sartre*
- Short-term tasks (Mark):
 - Instructions for running BeAGLE @ JLAB
 - Implement correct values for d , $T(b)$
 - Implement crossing angle.