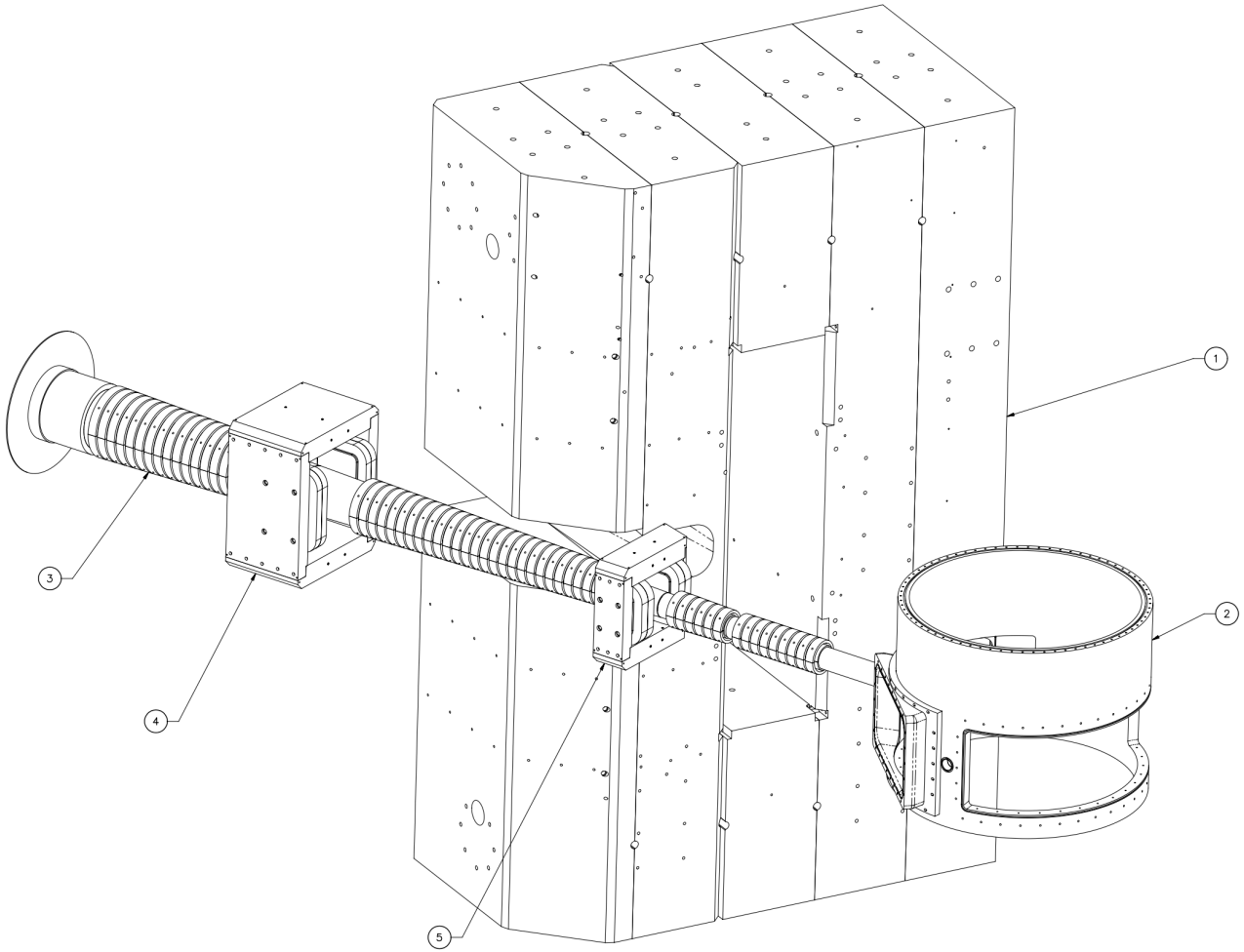
SBS Downstream Beam Line

SBS Collaboration Meeting

July 14, 2020



Yves Roblin, David Flay

Jefferson Lab

U.S. DEPARTMENT OF ENERGY | Office of Science

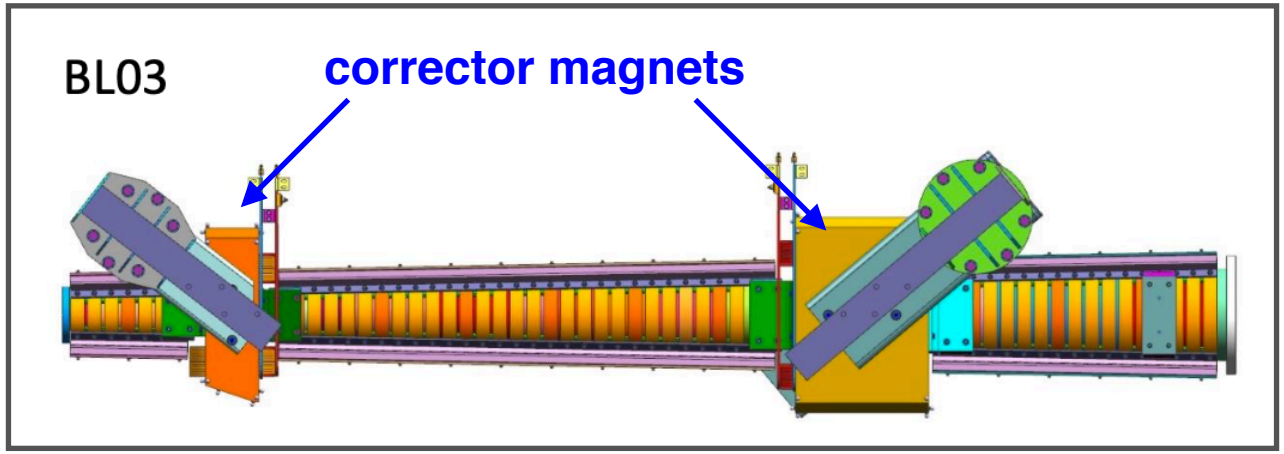
JSA

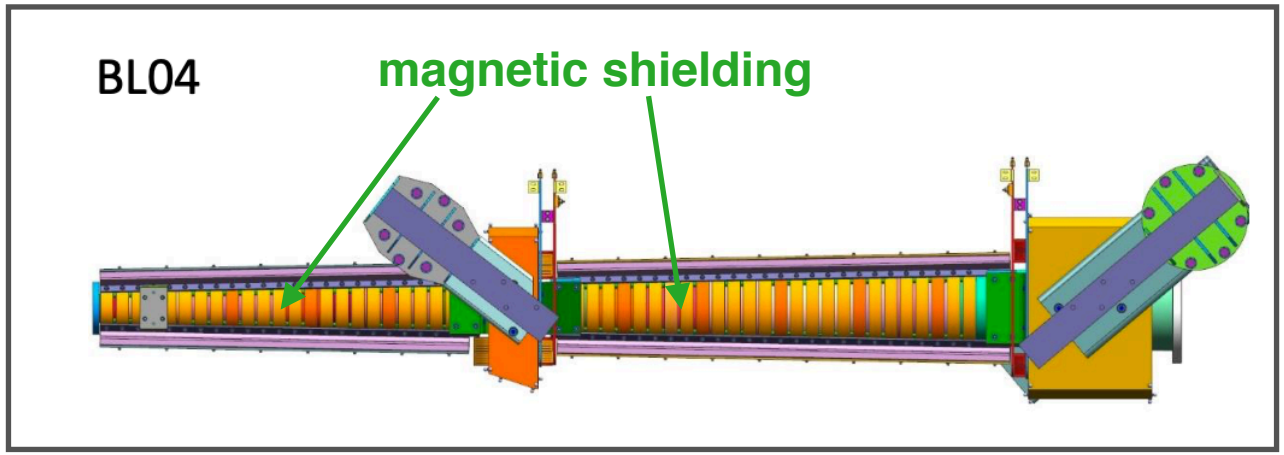
SBS Beam Line Configurations

- SBS program has 4 beam line configurations based on Q^2 bins of a given experiment
  - Different BigBite and SBS magnet (48D48) angles
  - Corrector magnets need to move as well
- 48D48 is very close/on top of the beam line
- Exit beam line needs **corrector magnets** account for fringe fields from 48D48
- **Magnetic shielding** downstream of target to minimize background on detectors

Configuration	Experiment
BL01	GEp
BL02	GEn
BL03, BL04	GMn

For GMn

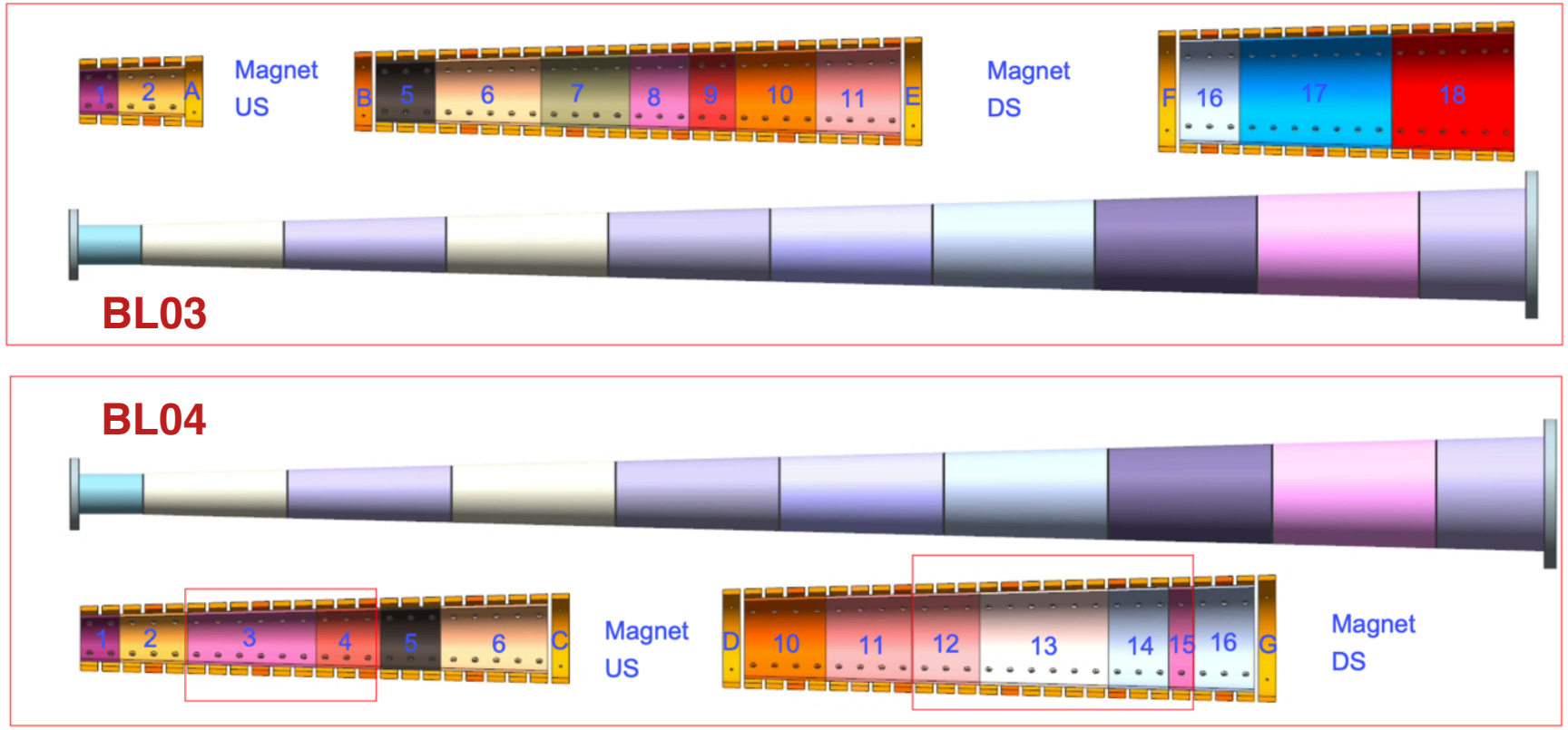




GMn Conical Magnetic Shielding Setup

- To minimize radiation exposure & reduce downtime, have additional components on hand

- Prep for changeover between BL03 and BL04:
  - Preassemble inner/outer segments (3–4) and (12—15)
- Installation steps
  - To set up for BL04, all shielding will be removed from BL03 to allow correctors to be relocated
  - Install BL04 segments around correctors



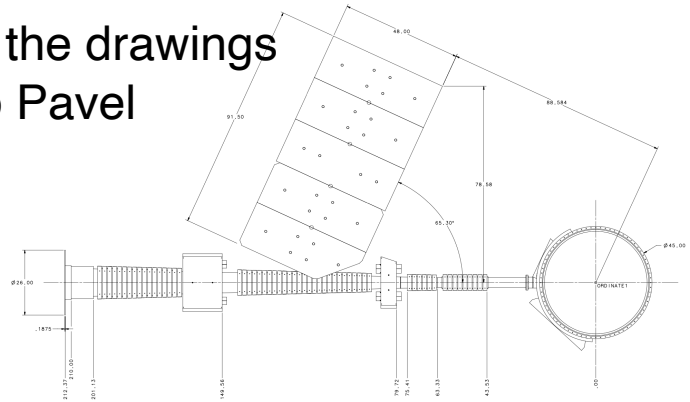
Note: Segment assemblies 1-6 + C will all be assembled as one unit. Same goes for segments 10-16 + D + G

Drawings from Bogan Wojtsekhowski

Downstream Beam Line Components Status

- One set of shielding rings have been fabricated and assembled
  - Currently in storage (along with conical beam pipe and corrector magnets)
- Need to purchase remaining parts to allow quicker & safer changeover from BL03 to BL04
  - Estimated cost: $20—30k
- Beam line radiation dose considerations
  - BL03 config drawings sent to RadCon for FLUKA calculations (contact is Pavel Degtiarenko)

one of the drawings sent to Pavel



Jefferson Lab

Stray Field Compensation

- SBS

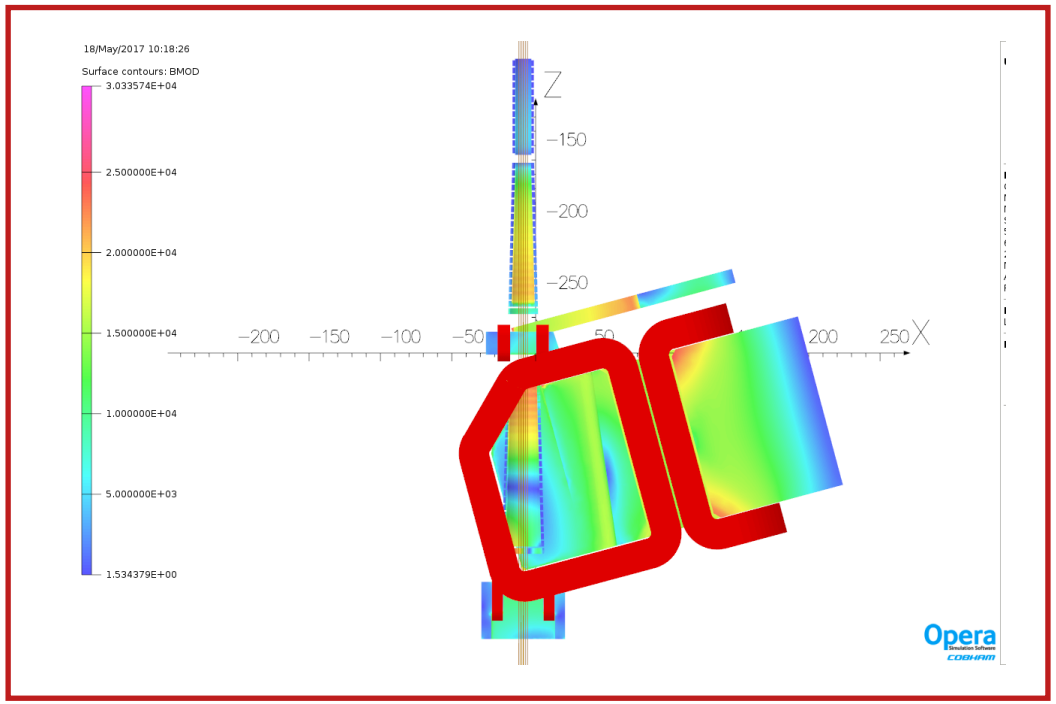
  For GMM ERR (2017), Stray Field compensation was evaluated.

  – TOSCA calculations (Benesch, Wojtsekhowski) evaluated a range of options

  – Benesch : Powering (and cooling) downstream correctors up to 42 KaT will mitigate.

  – Can gang downstream correctors left/right in 6:7 ratio to simplify steering to dump

  – Wines/Wojtsekhowski : Using both upstream/downstram correctors and optimizing for each kinematics (in progress)



Still need to devise a machine protection scheme (FSD) incorporating the correctors

No issues anticipated. Something similar to the FSD system on Hall A diffuser which takes into account beam momentum and uses a window comparator to constraint the setpoint

FSD and interlocks

- SBS power supplies will be interlocked to FSD. Beam will be turned off if they fail.
- SBS correctors should be interlocked during running. Must be able to disengage the interlock for initial commissioning.

- Ion chambers placement may have to be revised. Can be done using the expected radiation map from simulations. Dump ion chambers stay the same

- Procedures are being standardized between Hall A/C and as a result we have a procedure for thick targets and one for gas targets (both of which SBS experiments will use)

Beam alignment vs target

- GEn will use a 60cm long He3 gas target. This is very challenging in terms of beam alignment and incoming angle while providing 4x4 rastering at 8.8 GeV.

- Work to do:

- Full 3D field tracking (using the TOSCA models) of trajectories to determine if one can do this given the Hall A line configuration.
- Very likely one has to redesign the line so that the raster and quads are not interleaved (alternative, build a stronger raster and put it after the quads)
- Target protection for this has to be considered from the get go. Need to form a group (maybe D. Meekins working group has it?) to study it and provide a course of action.

Common theme: Tighter collaboration

- Between Experiments and the Accelerator and CASA groups.
  - *Tighter integration of accelerator and experiment is desirable and necessary to reach higher accelerator reliability and optimize nuclear physics output C. Ginsburg Hall A winter collaboration meeting 1/30/2020.*
- What we have:

- Bteam meetings (every Tuesday 130pm), discusses issues from POV of OPS.
- David Flay's meetings (weekly) discusses beamline config, procedures, protection for Hall A/C (short to mid term)
- Dave Meekins working group approaching the problem on a global scale