Hypernuclear Experiments in Hall C with HES/HKS

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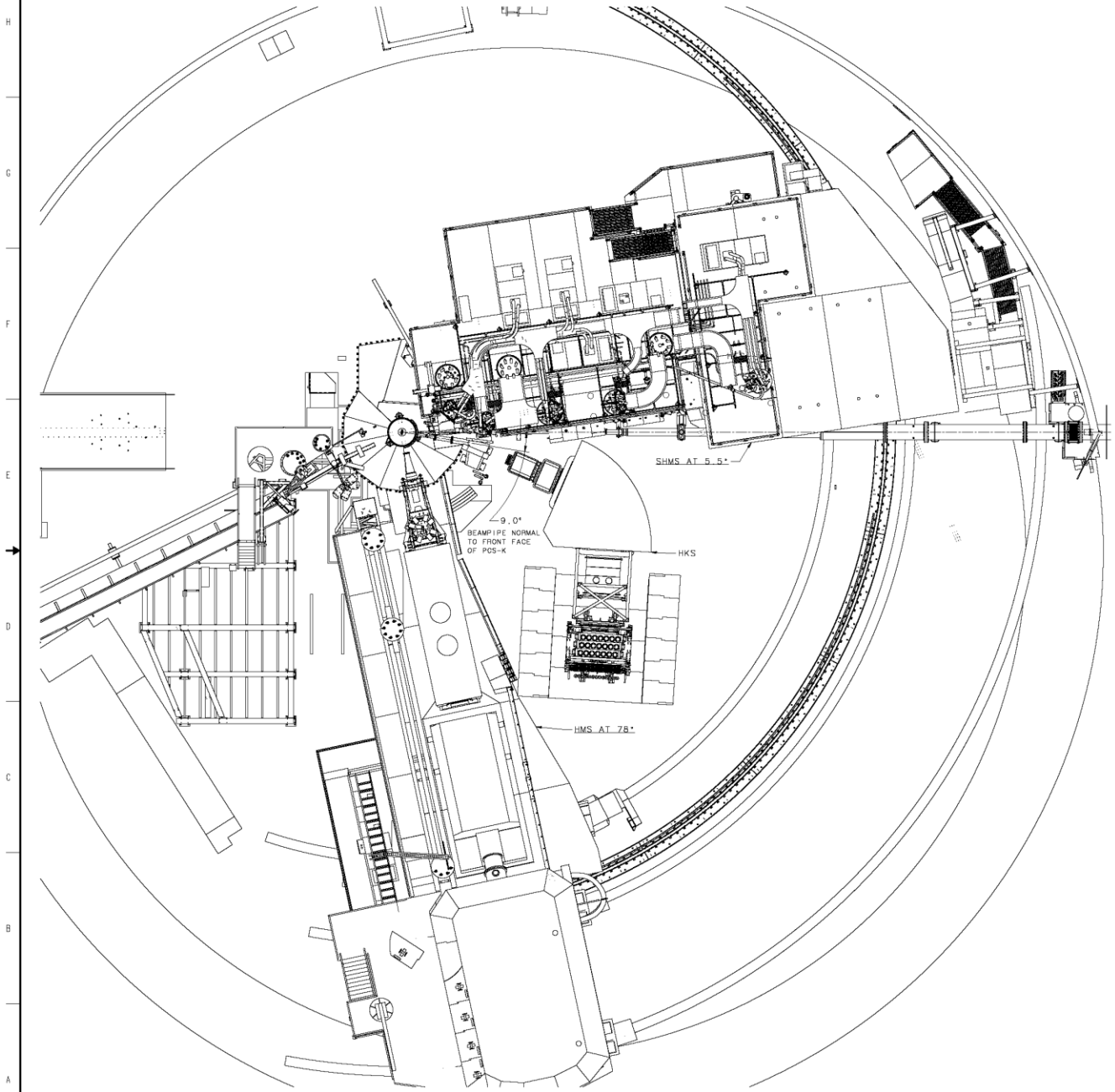
Hypernuclear In Hall C- options

- HKS/HES ran in Hall C during the 6 GEV era. Installation w/o SHMS was straightforward and relatively quick since spectrometers came to Hall C largely in one piece.
- Hall C in the 12 GEV era is less flexible but still has the space for a Hypernuclear experiment albeit with some complications.
- First idea- HKS with SHMS(electrons)
- Second idea- HES/HKS downstream
- Third ideas- HKS and/or HES vertical bend
- HKS vertical + SHMS might work- needs study and layout details



REVISION HISTORY

ZONE	REV	DESCRIPTION	DATE/REVISER

EACH SHEET OF MULTI-SHEET DRAWINGS SHALL ALWAYS HAVE THE SAME REVISION LEVEL.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE AS FOLLOWS:

FRACTIONS	DECIMAL	ANGLES
± 1/8	X ± 1 XX ± .05 XXX ± .010	± .50°

THIRD ANGLE PROJECTION

MATERIAL: SEE PARTS LIST

FINISH: 125 UNLESS OTHERWISE SPECIFIED

REMOVE & BREAK ALL SHARP EDGES

DO NOT SCALE DRAWING

DRAWN: METZGER — DATE: 6/20/11

United States Department of Energy — Jefferson Lab, Thomas Jefferson National Accelerator Facility — Newport News, Virginia

HALL C
HYPERNUCLEAR

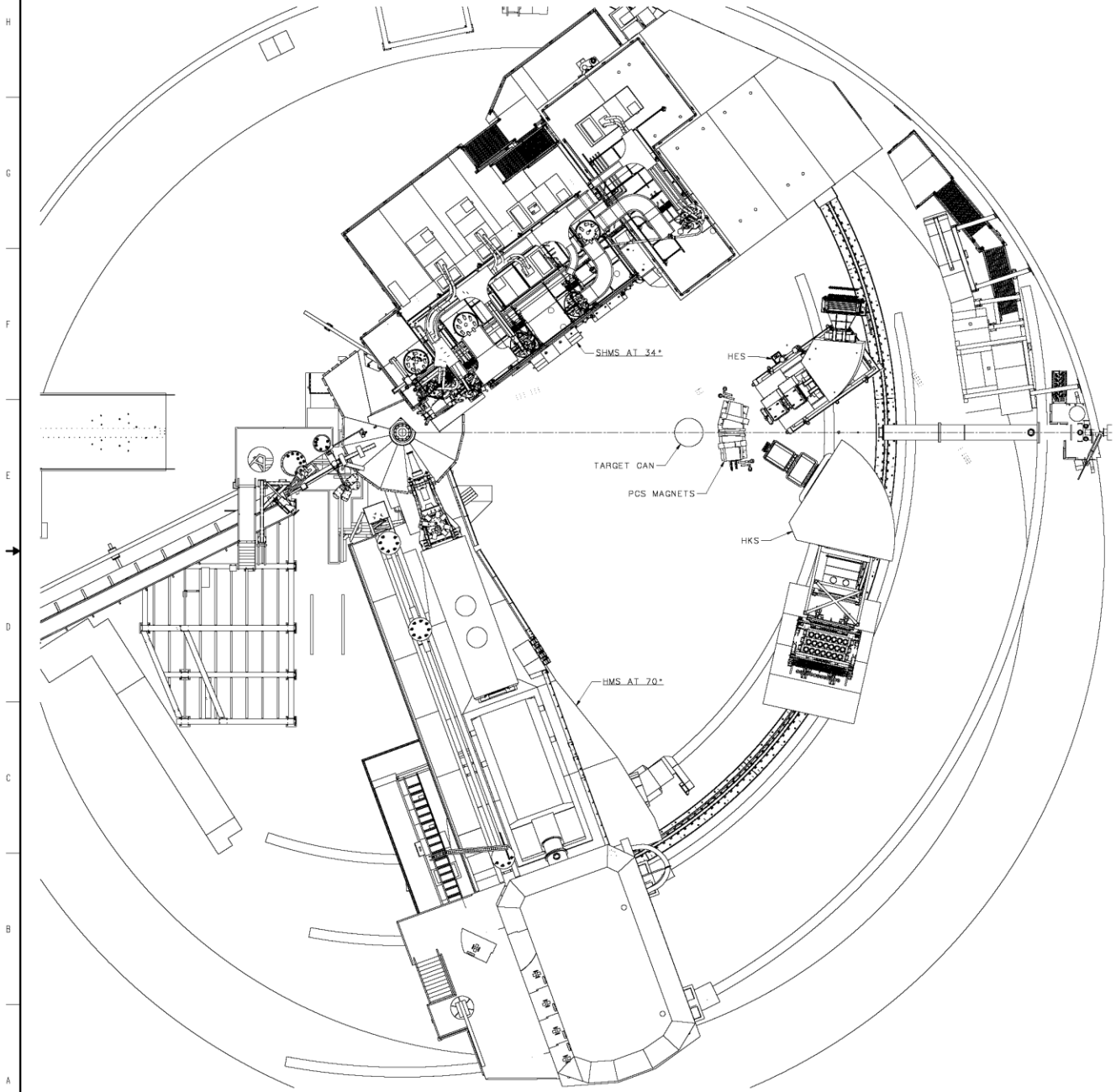
SHMS HKS_KAON

SIZE	DWG NO	REV
E	JL0116919	-

SCALE: N/A — SOLID MODEL NO: - — SHEET 1 OF 1

HKS + SHMS Comments

- This seemed ideal however..
- Minimizes installation between HMS and SHMS
- HKS is too large to get close to the Hall C pivot
- Kaon yield would be low due to reduced solid angle
- Making HKS vertical could help but this introduces a new structure and a shielding challenge thus offsetting some of the apparent simplicity
- Lets look at conventional HES + HKS layouts



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DIM & TOL PER ASME Y14.5 2009
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TOLERANCES ARE AS FOLLOWS:

DECIMAL	ANGLES
x ± 1	± .50°
.xx ± .01	
.xxx ± .005	

THIRD ANGLE PROJECTION

MATERIAL: SEE PARTS LIST

FINISH: 125 UNLESS OTHERWISE SPECIFIED
REMOVE & BREAK ALL SHARP EDGES

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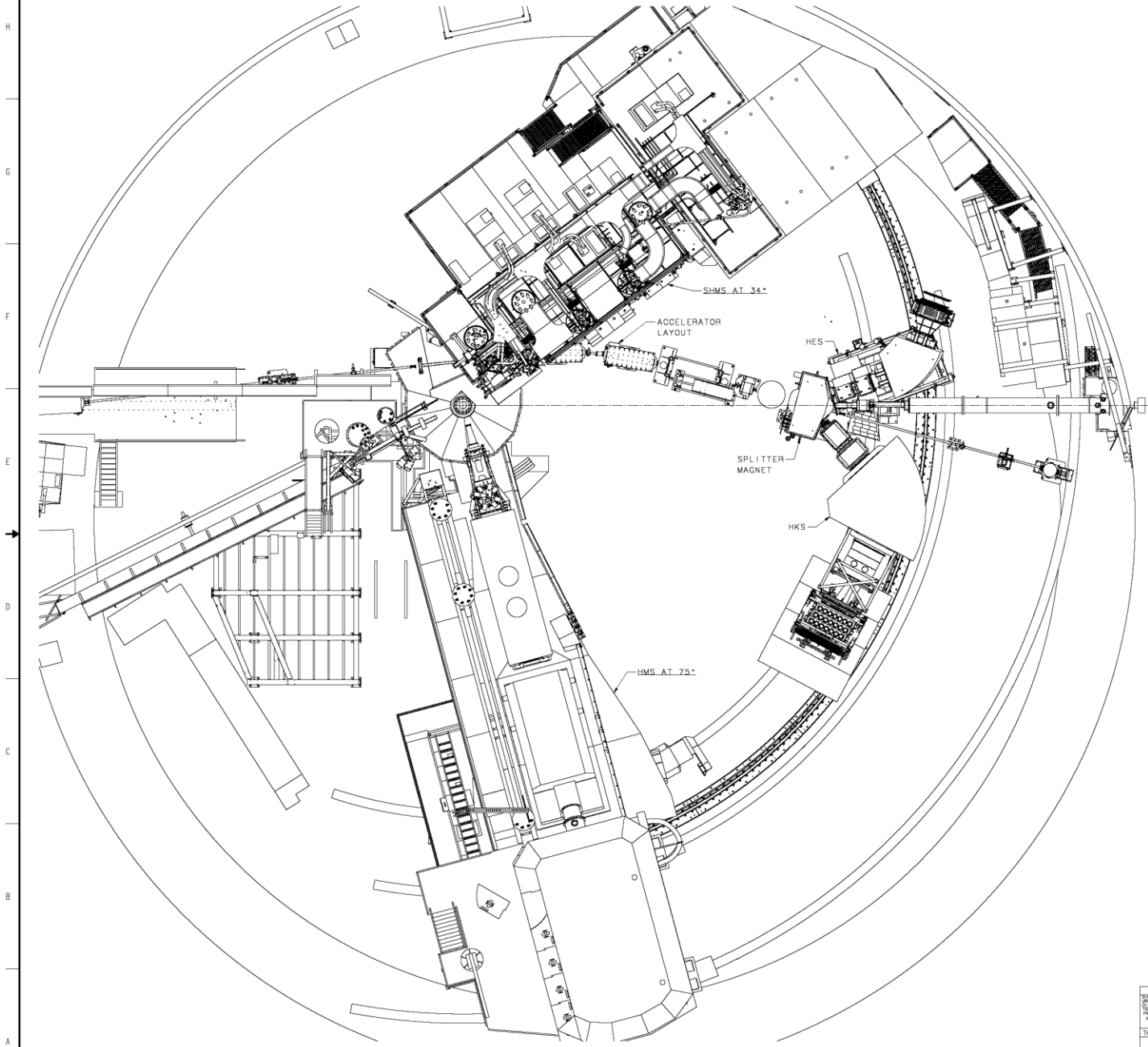
HALL C
HYPERNUCLEAR

HES HKS HYPERNUCLEAR CENTERED LAYOUT

SIZE: E | DWG. NO: JL0116169 | REV: –

SCALE: N/A | SHEET 1 OF 1



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± 1/8	X ± 1 XX ± .1 XXX ± .05	± .50°

THIRD ANGLE PROJECTION

MATERIAL: SEE PARTS LIST

FINISH: 125 UNLESS OTHERWISE SPECIFIED
REMOVE & BREAK ALL SHARP EDGES

DO NOT SCALE DRAWING

DRAWN: M.TIGER — DATE: 5/20/11

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HALL C
HYPERNUCLEAR

HES HKS HYPERNUCLEAR LAYOUT in HallC

SIZE: E — DWG. NO: JL0114415 — REV: –

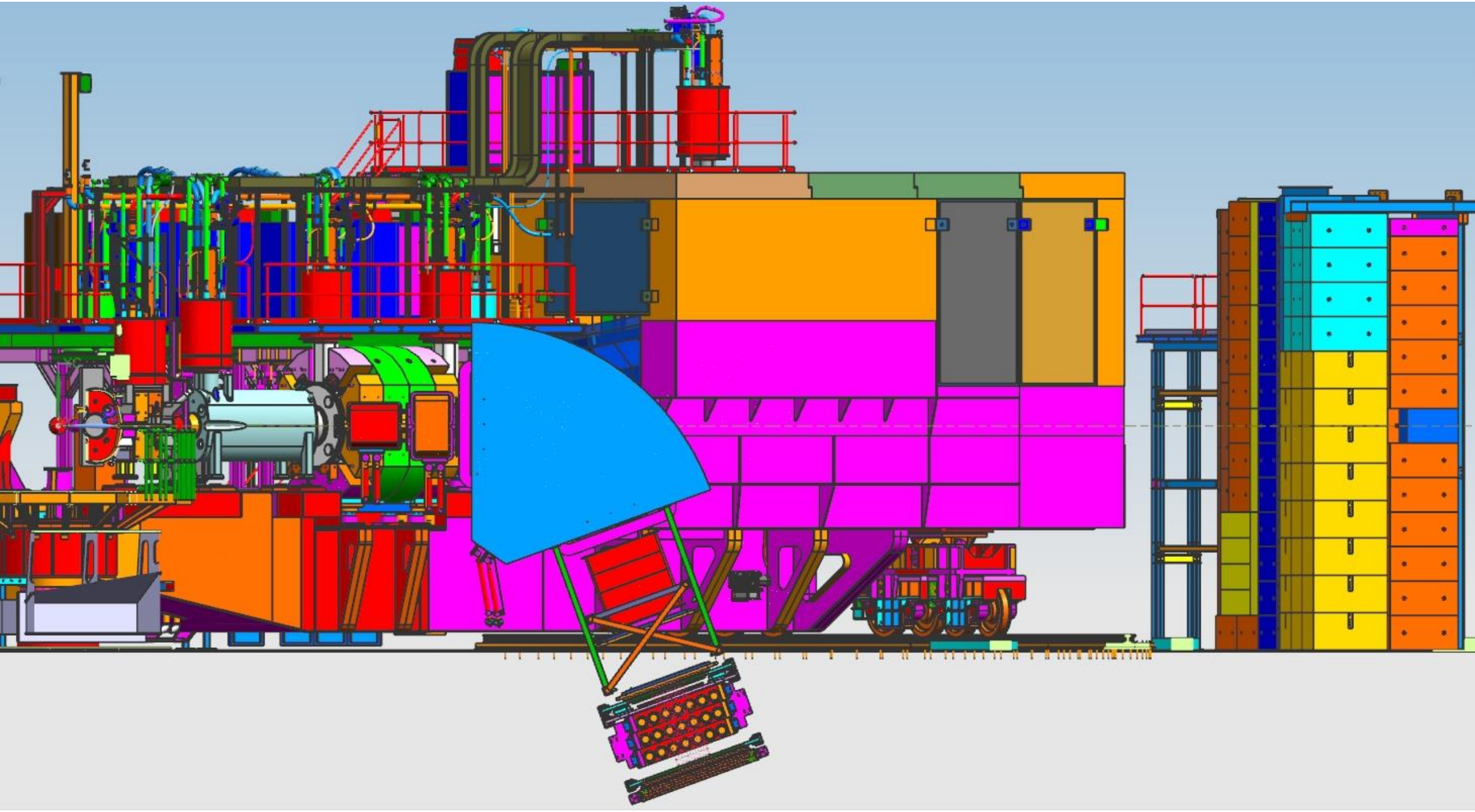
SCALE: N/A — SHEET 1 OF 1

HES + HKS Conventional Comments

- These two versions do not require new equipment, stands or shielding concepts
- HES + HKS horizontally bending fit OK downstream from Hall C Pivot
- The first version relies on a twin magnet splitter that does not bend the primary electron beam
- The second version is almost identical to the previous installation during the ^ GeV era in that the splitter does bend the primary beam.
- The second version requires a beam chicane that passes thru the front of SHMS and requires removal of SHMS HB magnet and Hall C pivot target chamber

Feasibility of HES/HKS vertically bending

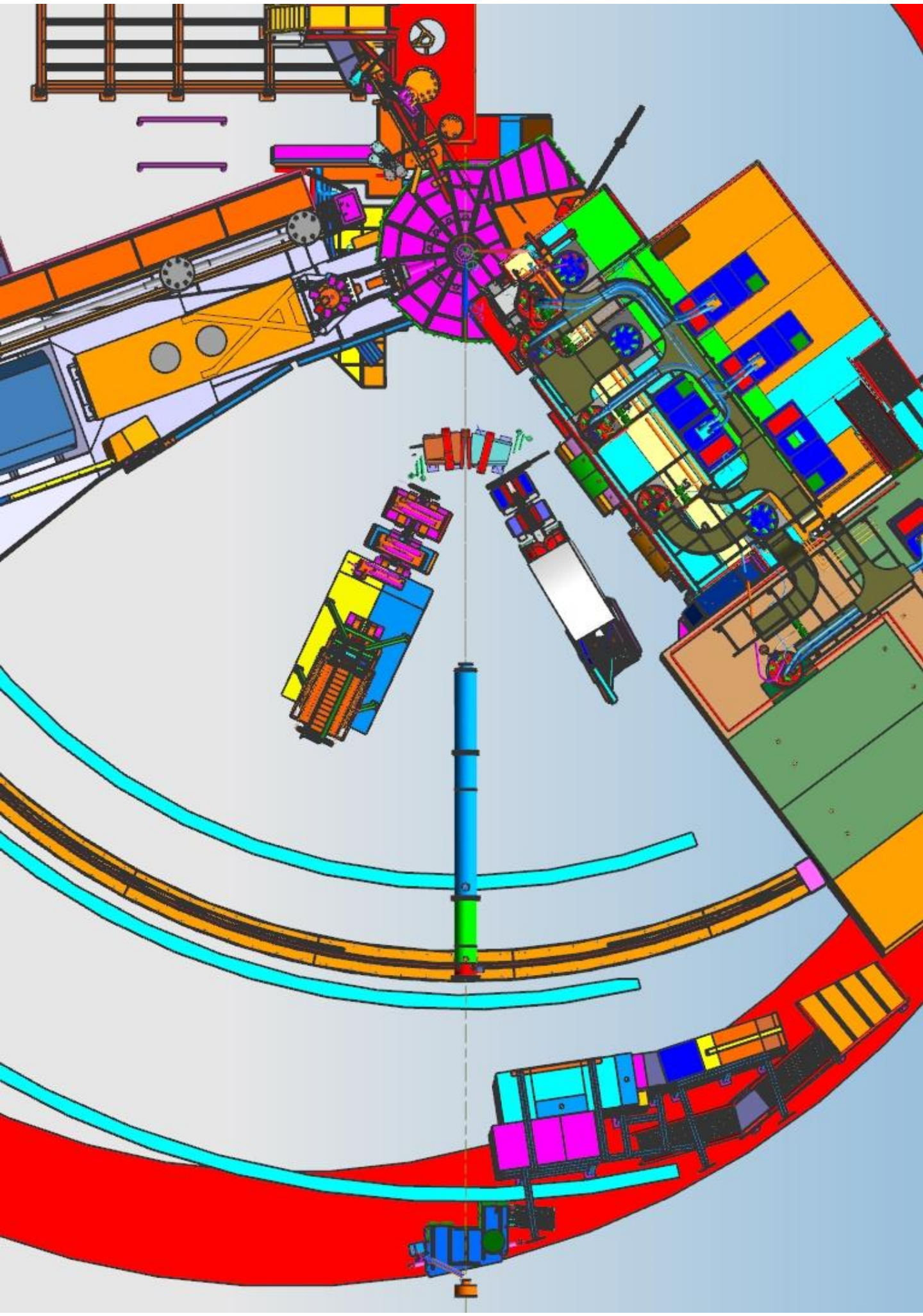
- Vertically bending either or both spectrometers opens up more possibilities
- Scattering angle determination may be better
- Requires substantial stands to hold up the dipoles ~ 100 tons
- Detector access platform for bend up
- Shielding challenge for bend up
- Hall C already has two vertical bend spectrometers, one weighing 500 tons

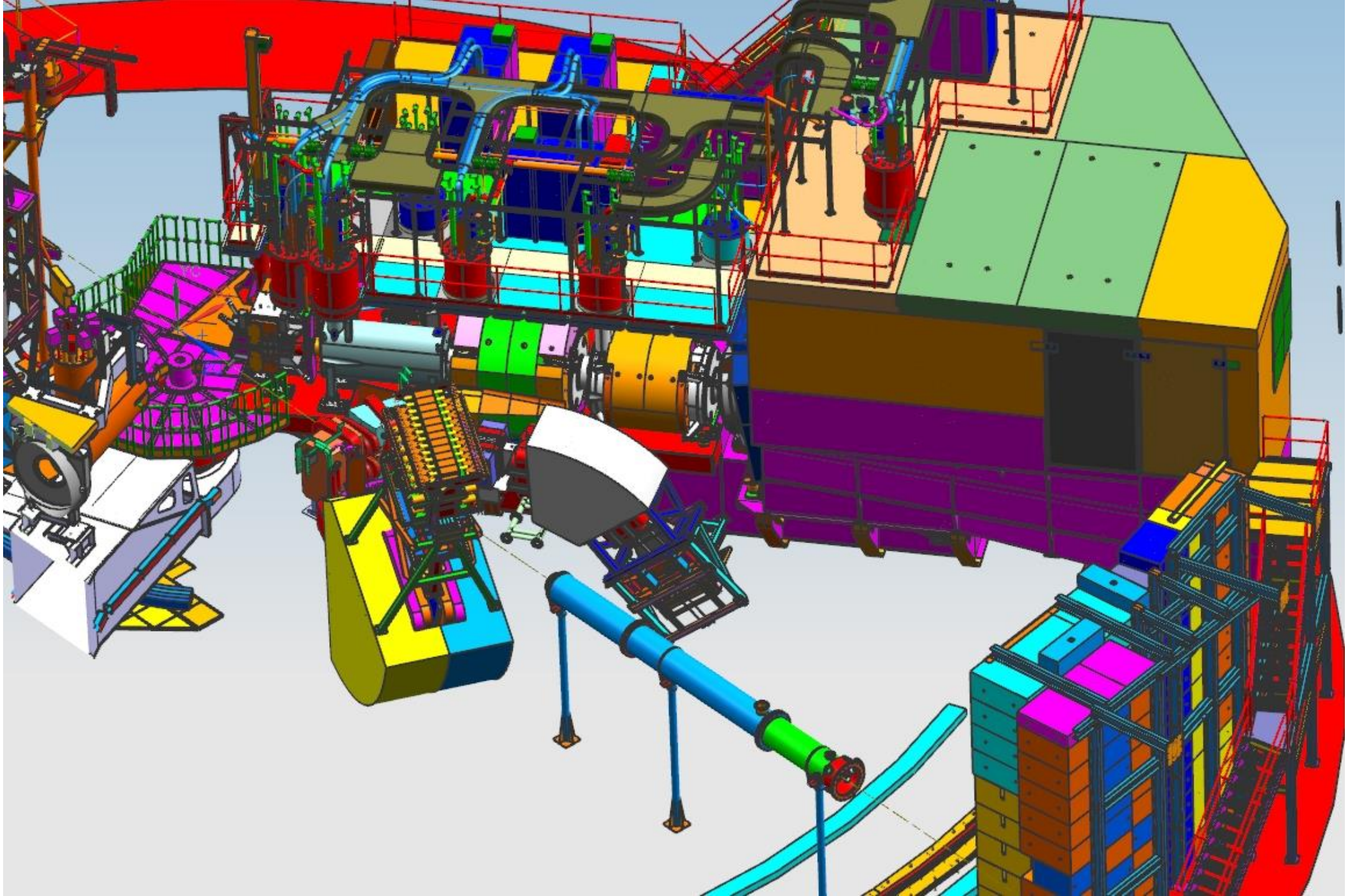


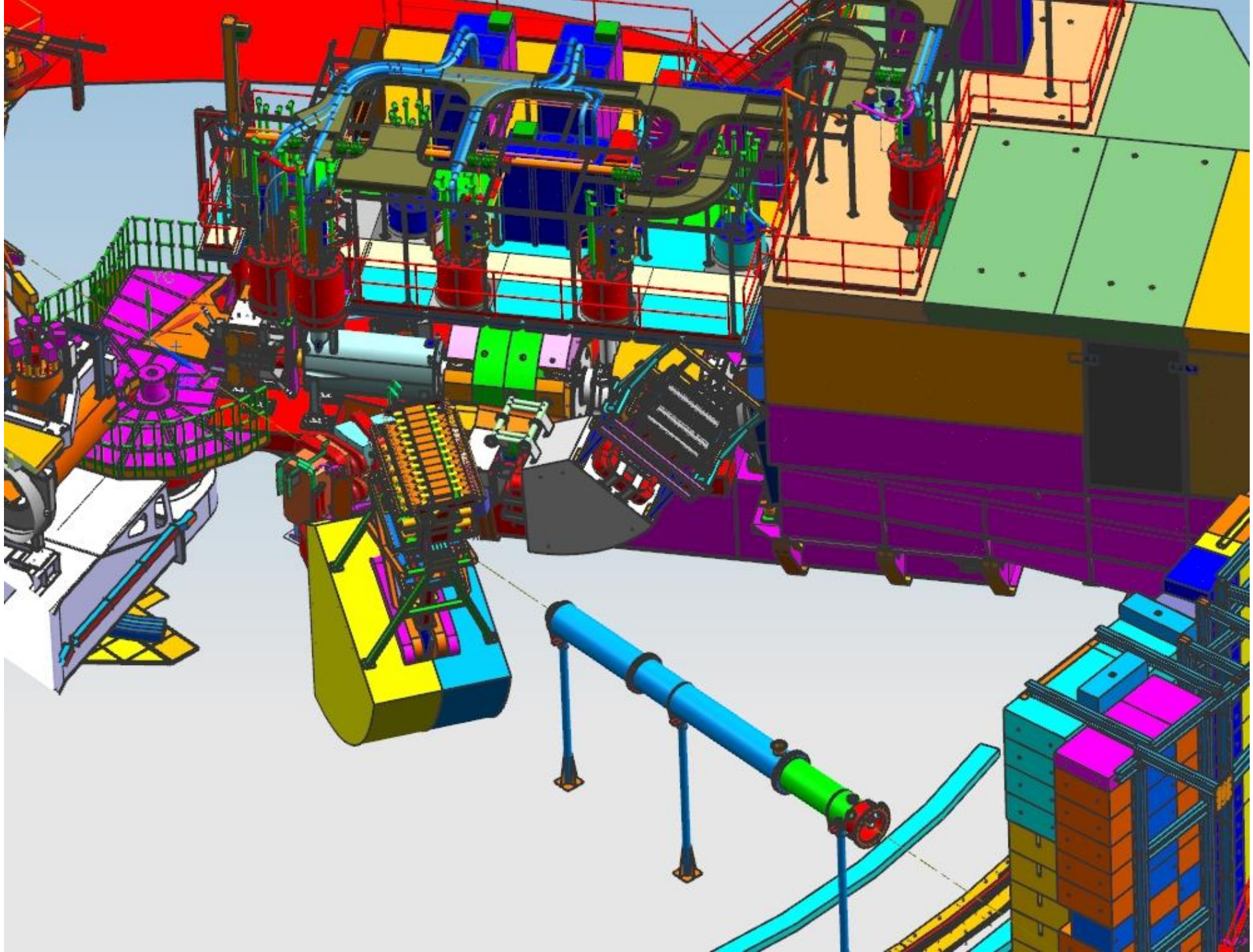

4698T34_MCMASTER in SHMS SHIELD HOUSE ROOF RAILINGS

HES HKS vertical comments

- HES can be either bend up or down
- HKS detector goes below floor level if down so only up.
- Stands for either spectrometer or bend direction are feasible
- HES bend down puts detectors at a convenient height for access
- Shielding HES down is also straightforward
- HKS detector access would require a beam height platform and two levels above beam height to access detectors
- The shielding required would be impressive but feasible
- Let’s look at some vertical spectrometer layouts







What are the complications?

- Installation of HES/HKS in 12 GEV Hall C is feasible but…
- Everything has to be rigged over the top of the SHMS
- This means complete dis-assembly and reassembly in Hall C
- Installing HES/HKS plus splitter and target downstream in Hall C could take 2- 3 months- demounting HES/HKS would be similar.
- A lot of installation overhead so it may be best to plan for a campaign of several back to back experiments to maximize return on the investment.

Vertical bend HKS options?

- HKS-Vup + SHMS may be a good choice but needs careful analysis
- Requires a new stand for HKS-Vup
- Requires a work platform for detector access
- The angle from the target to the detector is very large so maybe heavy shielding is not necessary- requires study
- Shielding from ground up would require a lot of shielding and installation time
- HKS-Vup stand $150,000 plus extra for a detector access platform
- HKS yoke would need dowel pins in all joints to prevent slipping
- Adjustment mechanisms may need rework or replacement

HES Vertical bend options

- HES could bend up or down – both fit
- HES-V stand not a big challenge due to smaller size/weight
- HES-V down places detectors near floor for easy access
- HES-V down easy to shield
- HES-V stand ~ $75,000
- HES yoke would need dowel pins in all joints to prevent slipping
- Adjustment mechanisms may need rework or replacement

Path Forward

- Study spectrometer options and select best fit to the physics
- Hall C will assist with planning drawings and layouts
- Prepare **Hypernuclear In Hall C** proposal
- Pac Approval
- Secure funding for new items and modifications
- Spread new fabrications over two fiscal years to keep funding reasonable
- All stands can be designed and built at JLAB
- Yoke mods for vertical may have to done at outside machine shops due to machining large pieces. Excellent shops 15 miles from JLAB
- Minimum time before installation of vertical bending spectrometers start is about two years to permit design, fabrication, yoke modifications and installation planning. Standard HES/HKS requires less lead time.

Some conclusions

- Several of the Hypernuclear configuration options look good
- All options are at least mechanically feasible
- It is beyond my scope to pick the best configuration for the physics but Hall C can help with the decision process
- Guestimates for the stands for vertical bending will be sensitive to the current high cost of materials and inflation
- A lead time of one year for the HES/HKS downstream versions seems reasonable
- A longer lead time of two years for the various vertical options seems reasonable.