

(Pre-)TDR effort Tracking progress

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Preliminaries

Pertinent meetings:

- SVT general meetings, work-package coordination meetings, sensor designers' meetings — c.f. <https://indico.bnl.gov/category/496/>,
- MPGD general meetings, simulation meetings, uRWELL meetings, CyMBaL meetings — c.f. <https://indico.bnl.gov/category/497/>,
- Weekly joint track reconstruction, vertexing, and tracking working group meetings — c.f. <https://indico.bnl.gov/category/404/>,

Of further relevance:

- Incremental Preliminary Design and Safety Review of the EIC Tracking Detectors – c.f. <https://indico.bnl.gov/event/21945/>
- EIC R&D day – c.f. <https://indico.bnl.gov/event/22388/>
- Past update at the February 19, 2024 TIC meeting – c.f. <https://indico.bnl.gov/event/21932/>

Steady progress in most areas.

Recent and ongoing track reconstruction development in EICRecon

1. Update to initial covariance matrix in real-seeded tracking. Values placed in configuration file for easier future tuning. **PR merged.**
2. Move tracking EDM conversion into separate factory. **PR merged.**
3. Implement Acts ambiguity resolution solver in EICRecon. **PR under review – several updates made last week; should be merged soon.**
4. Hit-based track to MC particle matching inside EICRecon.
 - Add Geant-level hits to EICRecon output. **PR merged.**
 - Add associations between Geant-level and raw tracker hits. **PR merged.**
 - Create direct link between track and MC particle. **Not started.**
5. Complete implementation of updated track data model, including filling of the edm4eic::TrackSeed collection. **In progress.**

Effect of ambiguity resolution solver

- A set of solved tracks will emerge from the Acts *GreedyAmbiguityResolution* algorithm.
- These solved tracks combine the input tracks which contain a minimum number of shared hits. This is important for removing duplicate seeds.
- In addition, the input tracks will be required to have a minimum of number of tracker measurement hits.

Example: reconstructed azimuthal angles for all (real-seeded) tracks in a DIS event.

30 **unfiltered tracks** before ambiguity solver.

9 **solved tracks** after ambiguity solver.

0 *	-2.745423 *	-2.745423 *
1 *	-2.659463 *	-2.659463 *
2 *	-0.487999 *	-2.973740 *
3 *	-0.515227 *	-0.547968 *
4 *	-0.411117 *	-0.524593 *
5 *	0.6830639 *	-0.487999 *
6 *	1.2292373 *	-3.030914 *
7 *	1.1533687 *	-0.563698 *
8 *	1.6516475 *	-0.515227 *
9 *		-0.377481 *
10 *		-0.411117 *
11 *		-0.367529 *
12 *		-0.411152 *
13 *		-0.558974 *
14 *		-0.515152 *
15 *		-0.358227 *
16 *		-0.411137 *
17 *		-0.551163 *
18 *		-0.514914 *
19 *		-0.517399 *
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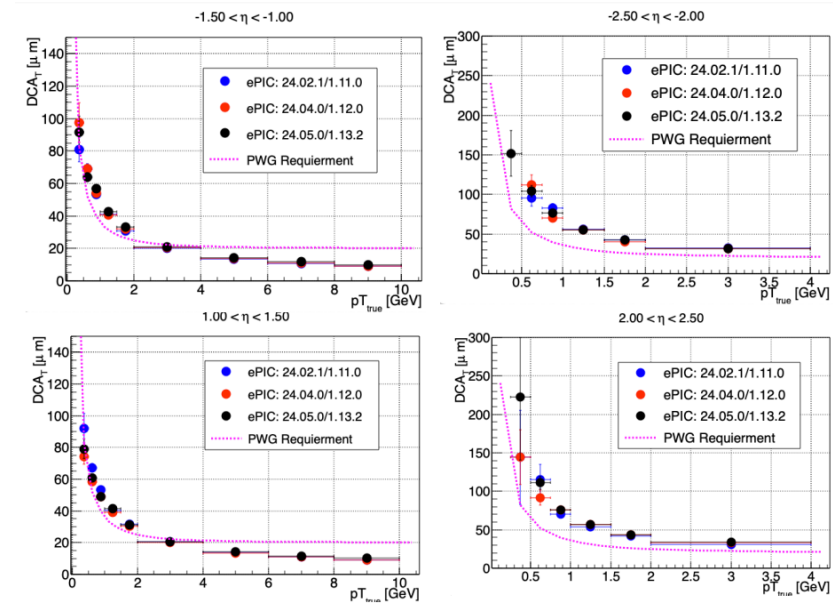
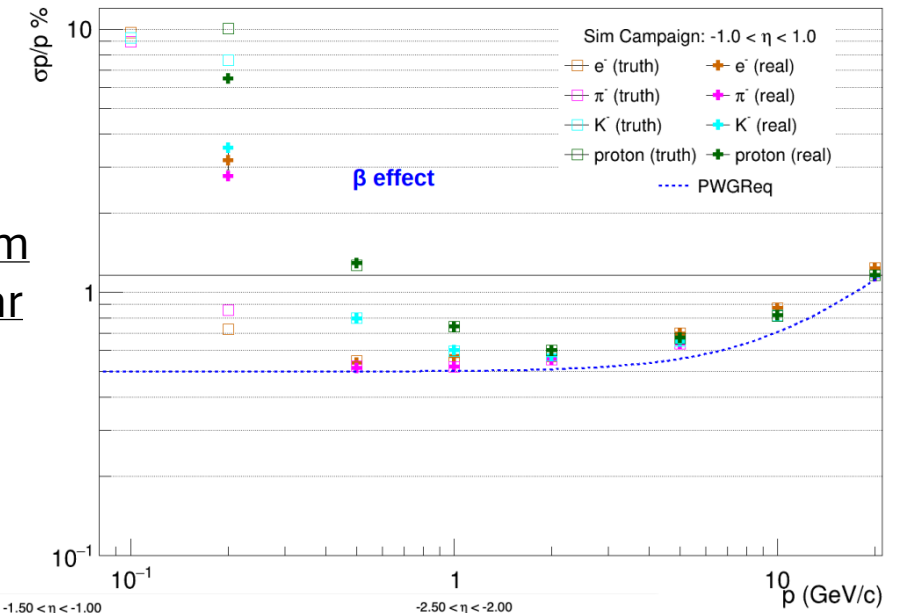
Tracks from duplicate seeds are removed.

```
0 * -2.745423 * -2.745423 *
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```

Ongoing studies

- Resolution studies/plots in ‘Yellow Report’ style
- Single-particle tracking efficiency for different particle types and different generation vertex positions
- Tracking detector performance in the presence of background
- Study on whether tracking hits are being (in)correctly classified as measurements, outliers and/or holes.
- Plan to repeat all these studies once ambiguity solver results are made the default output

Shyam
Kumar



Matt
Posik

Possible impact due to mismatch between Acts material map and Geant-level geometry. Need a better way to ensure consistency when running simulations.

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We plan to have a tracking + vertexing TDR plots working session at the July collaboration meeting. This will allow us to go over the plots we want to include in the TDR; make sure everyone is using consistent definition for efficiency, for example; and make the analysis/plotting codes public in benchmark codes.

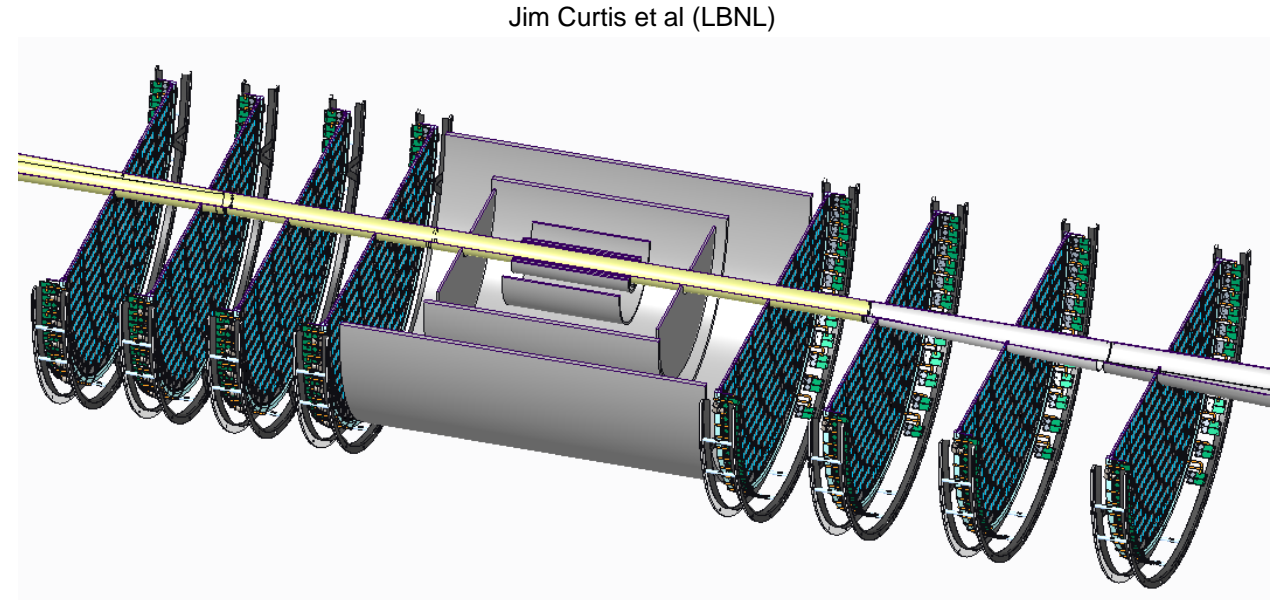
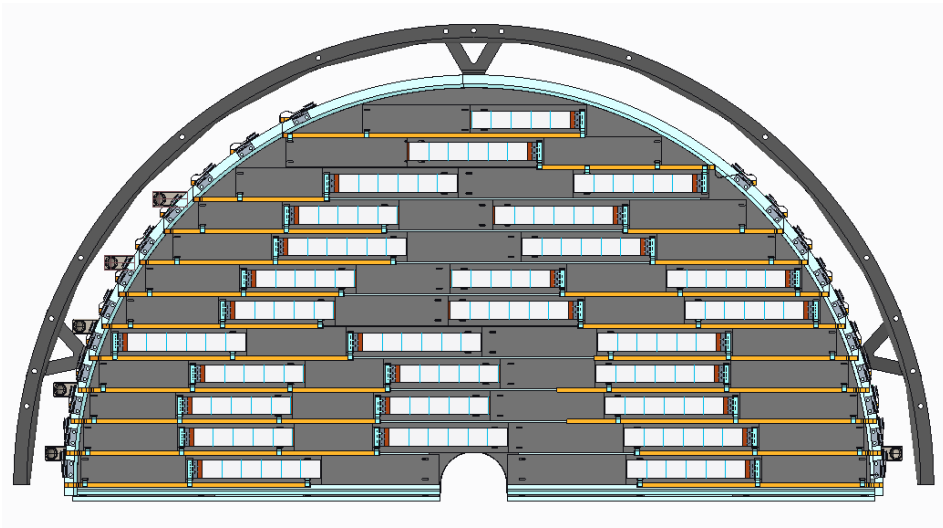
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SVT

Progress on service propagation in simulations, for SVT and other detectors – Update to SVT service model itself is a work-in-progress,
Ongoing work also towards a more realistic SVT detector description in simulations – important e.g. for small-x, Q^2

Steady progress on CAD design:



Shown here is progress on the disks – likewise, considerable progress is being made on the inner and outer barrel,

See also contributions to the 12th Forum on Tracking Detector Mechanics -- <https://indico.cern.ch/event/1336746/> -- and ePIC Satellite event.

SVT

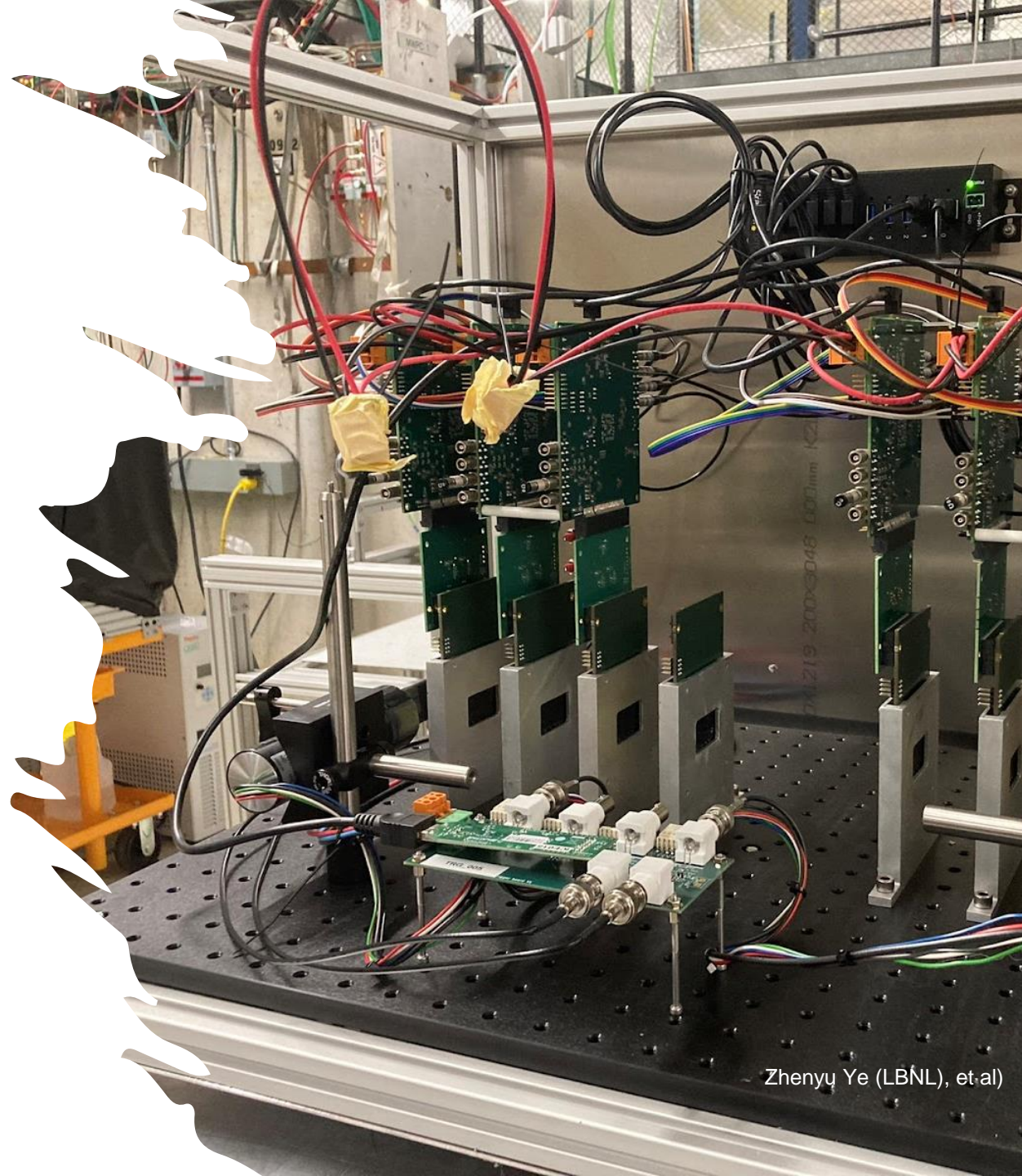
Thinned dummy sensors of various kinds (ITS3-like, EIC-LAS like, capton embedded, heaters) being ordered for thermo-mechanical tests and prototyping, hopefully starting over Summer

Specifications Ancillary IC largely defined and first submission of test structures for negative bias voltage generator and test structures aimed for September 2024

(Very) Recent beam-test at FNAL with a telescope of ITS3 ER1 “baby-MOSS” sensors – c.f. figure on the right

anticipated to give insight into cluster-size versus incident beam-angle, a target figure for the (pre-)TDR

(Very) Recent Irradiation test at LBNL BASE facility of single-event latch-up cross-section as a function of position on the sensor.



SVT

Preparations for IpGBT and VTRx+ final design review next week in progress (Jo Schambach et al, ORNL),

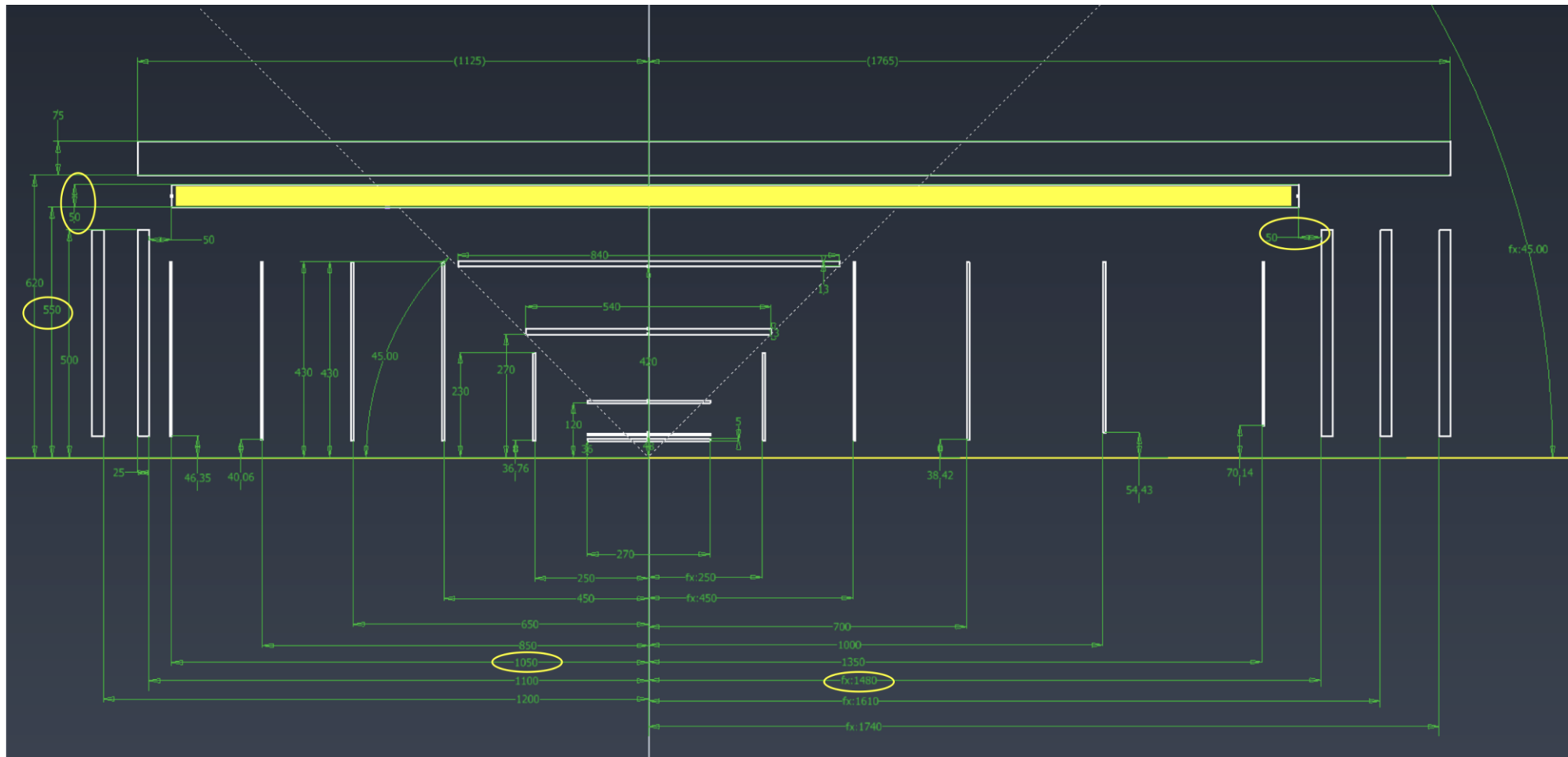
Initial sample of industrially produced FPC in Aluminum – albeit adapted from a circuit not specific to SVT – in hand and being tested (Zhenyu Ye et al, LBNL),

Lots of other ongoing work, e.g. on powering (James Glover, Birmingham) and other areas not listed here.

Likely to aim for a smaller (by comparison to that at the ANL meeting) workfest at the Lehigh meeting.

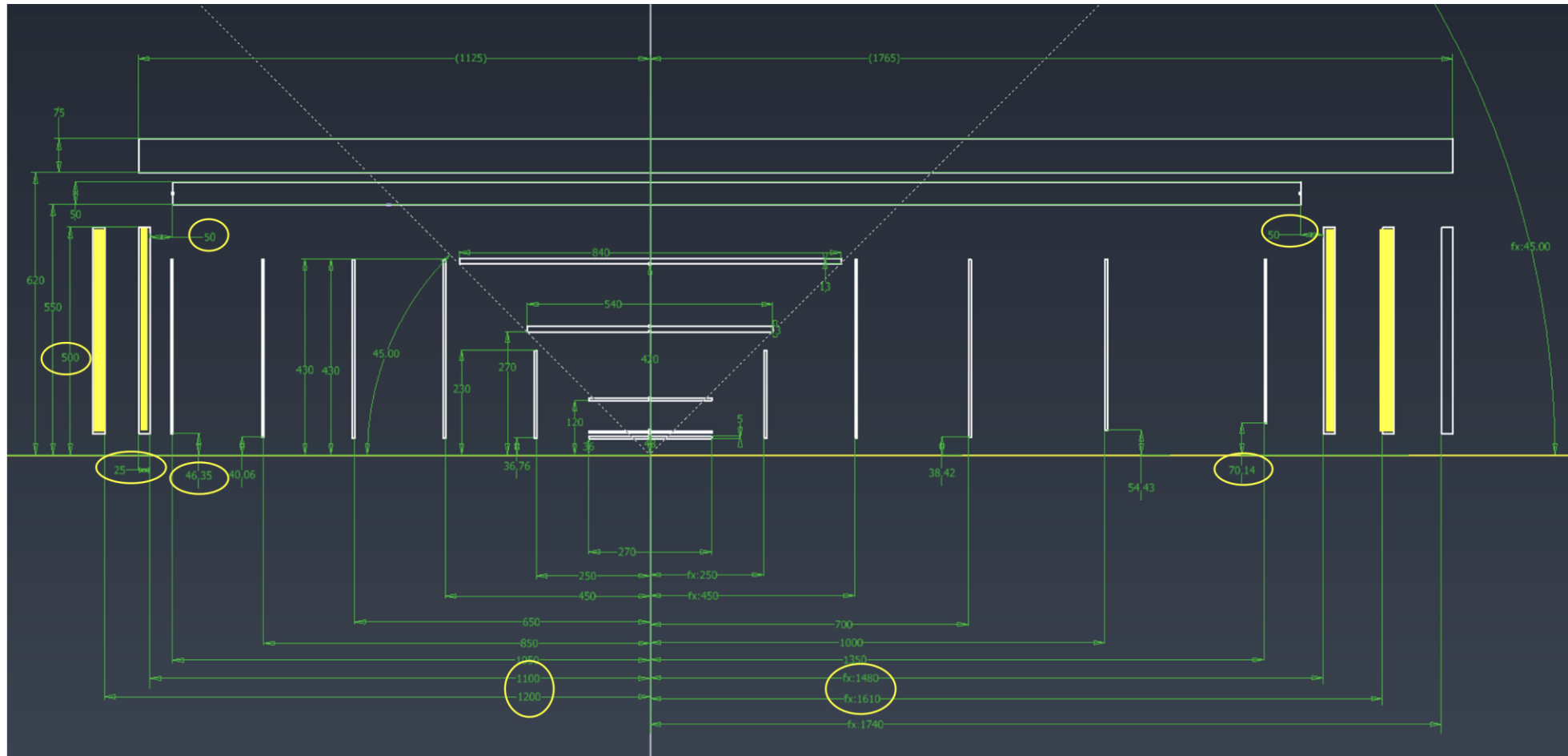
MPGD

Envelopes and dimensions revisited – c.f. <https://indico.bnl.gov/event/22417/> (Roland Wimmer, BNL)



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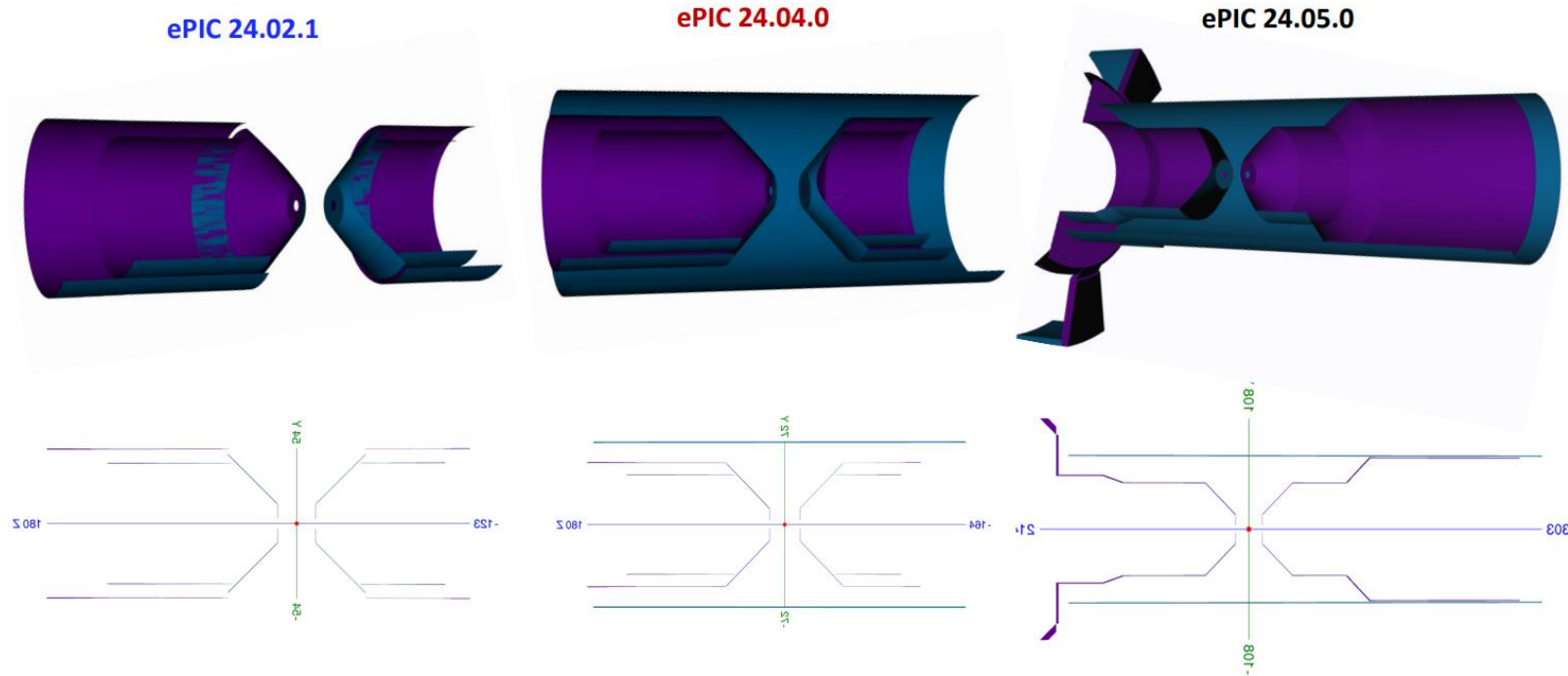
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Det.	Zmin [mm]	Zmax [mm]	Rmin [mm]	Rmax [mm]
CyMBaL	-1050	1430	550	600
uRWell-ECT (LD 1)	-1125	-1100	--	500
uRWell-ECT (LD 2)	-1225	-1200	--	500
uRWell-ECT (HD 1)	1480	1505	--	500
uRWell-ECT (HD 2)	1610	1635	--	500

MPGD

Geometry update and service description (all; not only MPGD) effected in simulations – c.f. <https://indico.bnl.gov/event/23630/> (Matt Posik, Temple)



Initial result updates on angular and position resolutions into PID

Further refinement to follow.

MPGD groups are likewise proposing a workfest at the Lehigh Collaboration meeting this Summer.

Closing Comments

Steady progress in many areas, e.g.

Simulation software – ambiguity solver, data model, detector description

Instruments – SVT ITS3 ER1 beam and irradiation tests, SVT ancillary IC, FPC, CAD, readout, MPGD envelopes, ...

To state the obvious, lots of work remains.

Groups are proposing workfests for the Lehigh Collaboration Meeting in Summer.

Not explicitly covered here, e.g.

Vertex study updates – c.f. <https://indico.bnl.gov/event/22710/> (Sooraj Radhakrishnan KSU, et al)