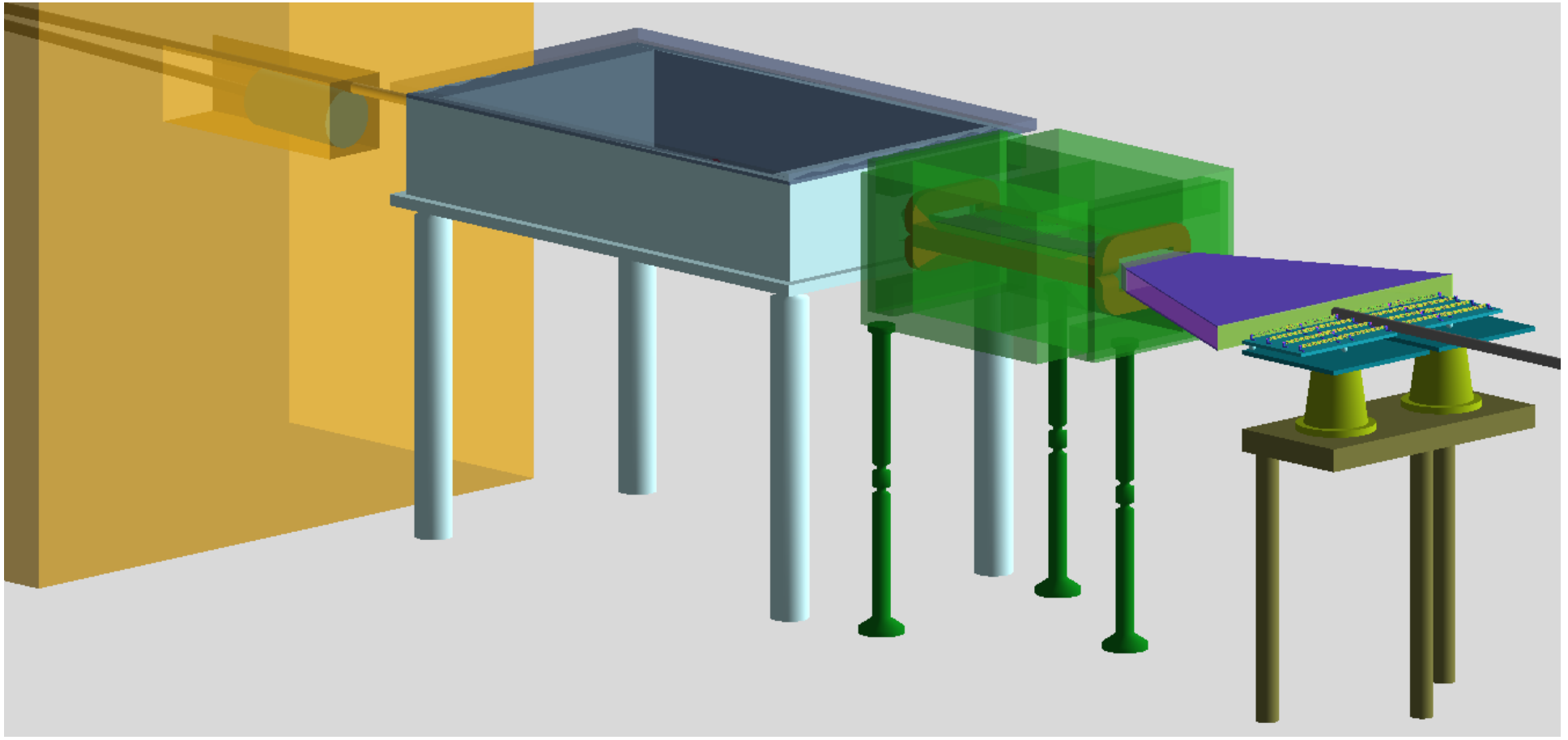
Update on LUXE GEANT4 Simulation

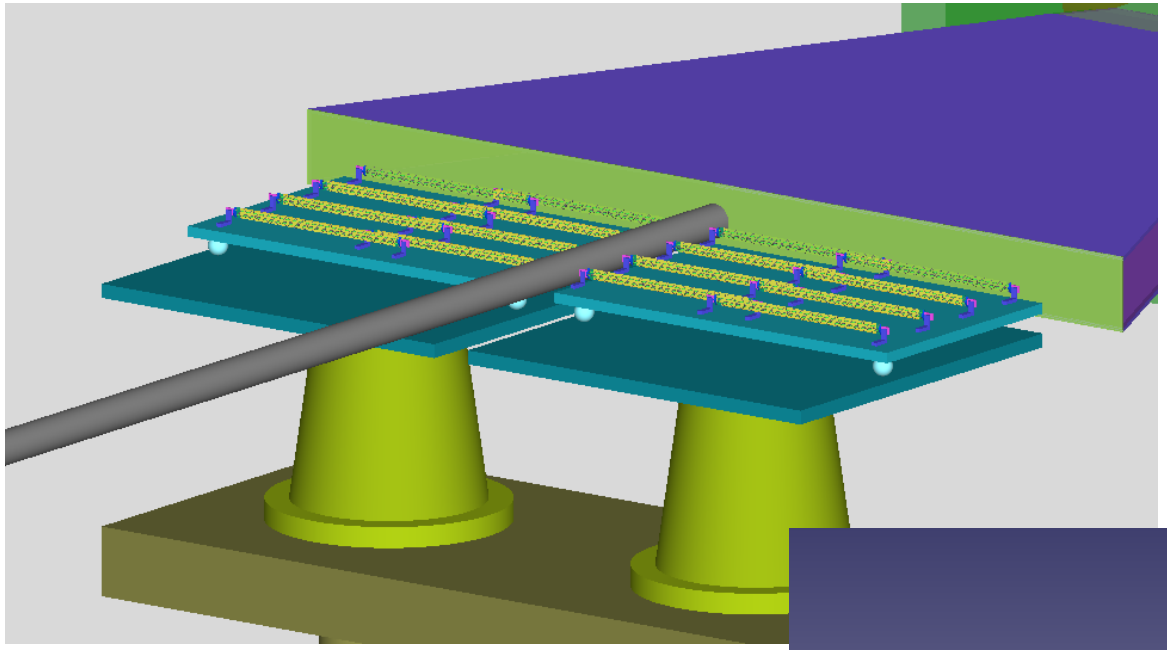
Oleksandr Borysov

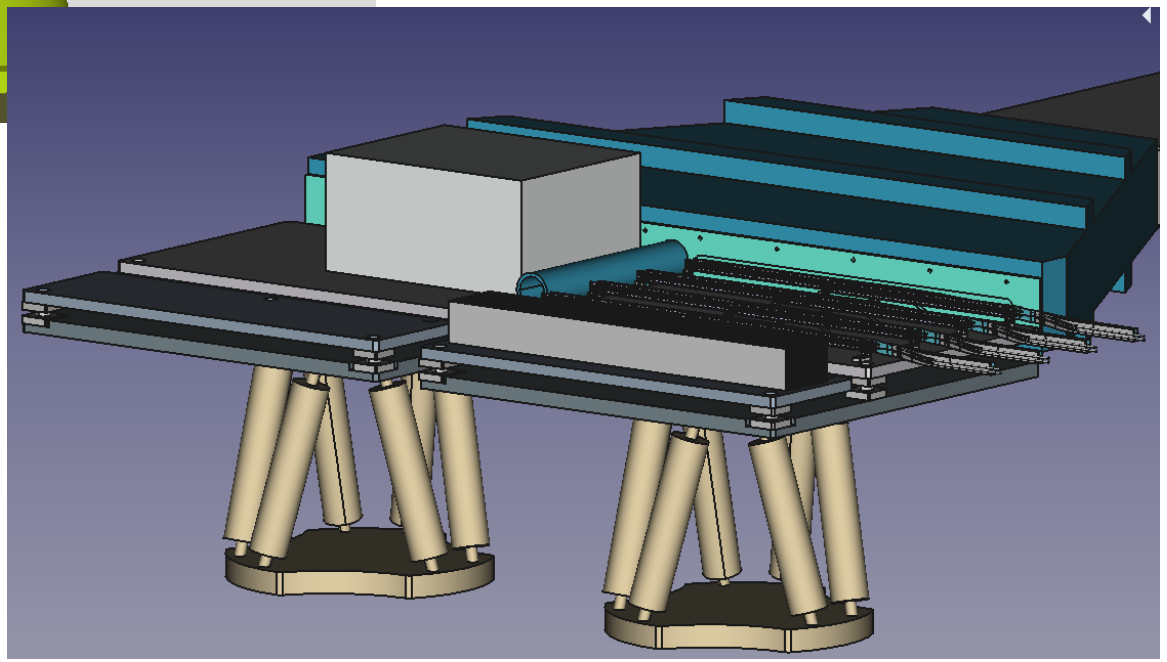
LUXE Meeting
August 11, 2020

Geant4 IP, magnet, vacuum chamber, tracker

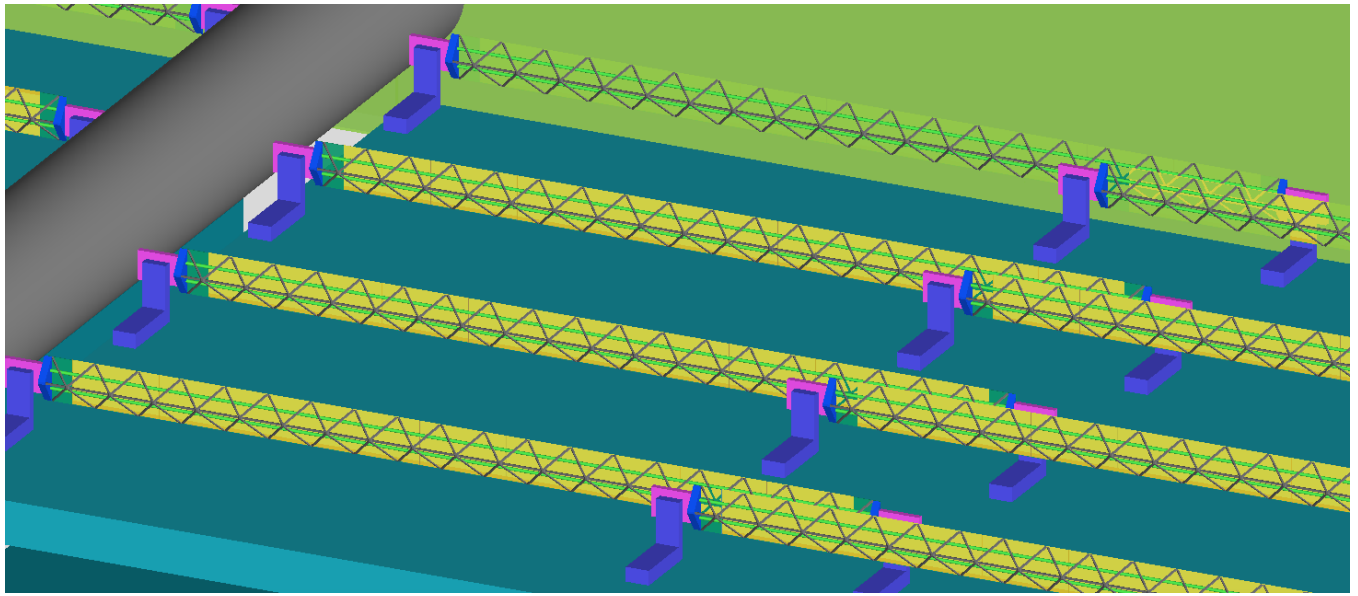


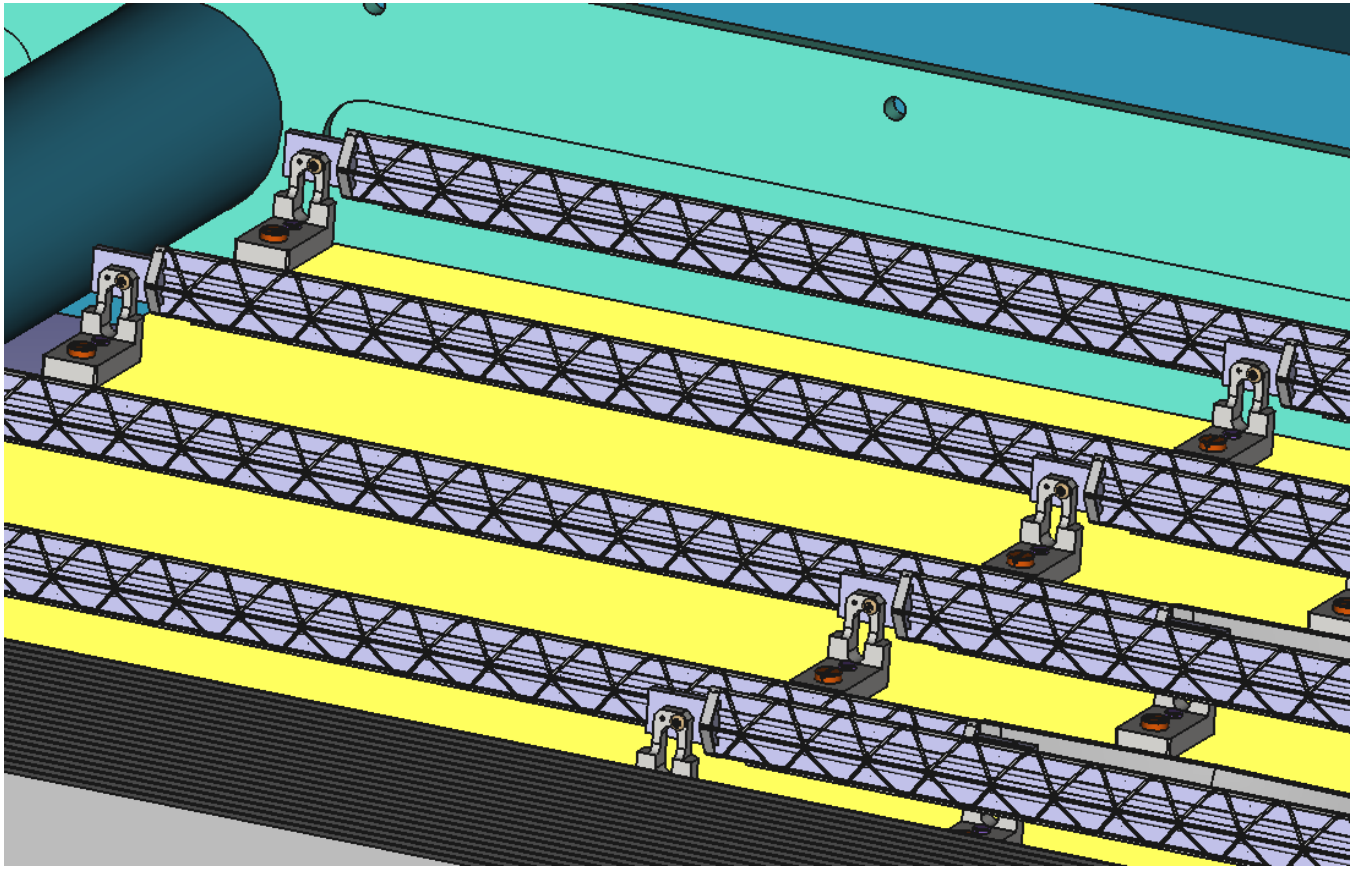
Tracker with support



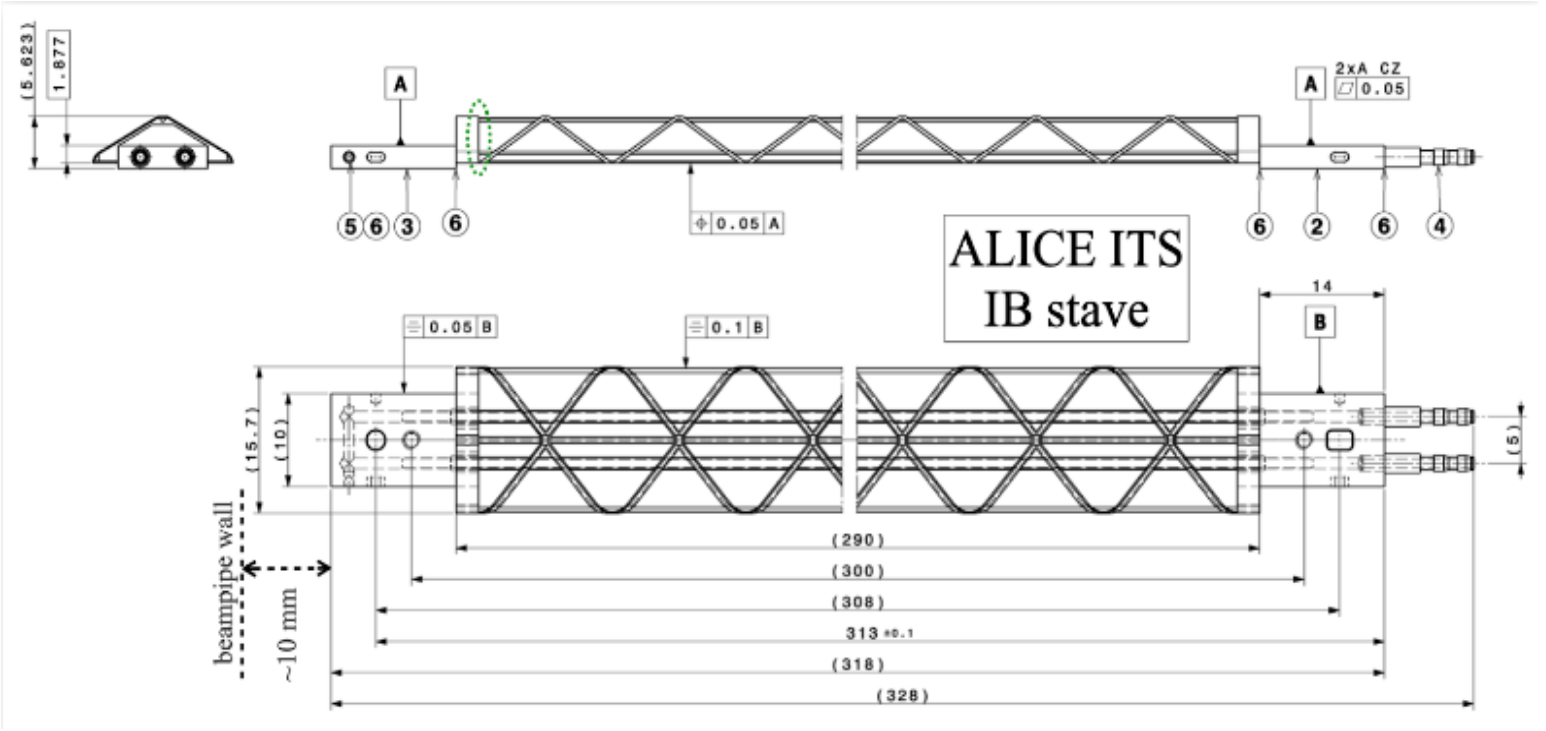


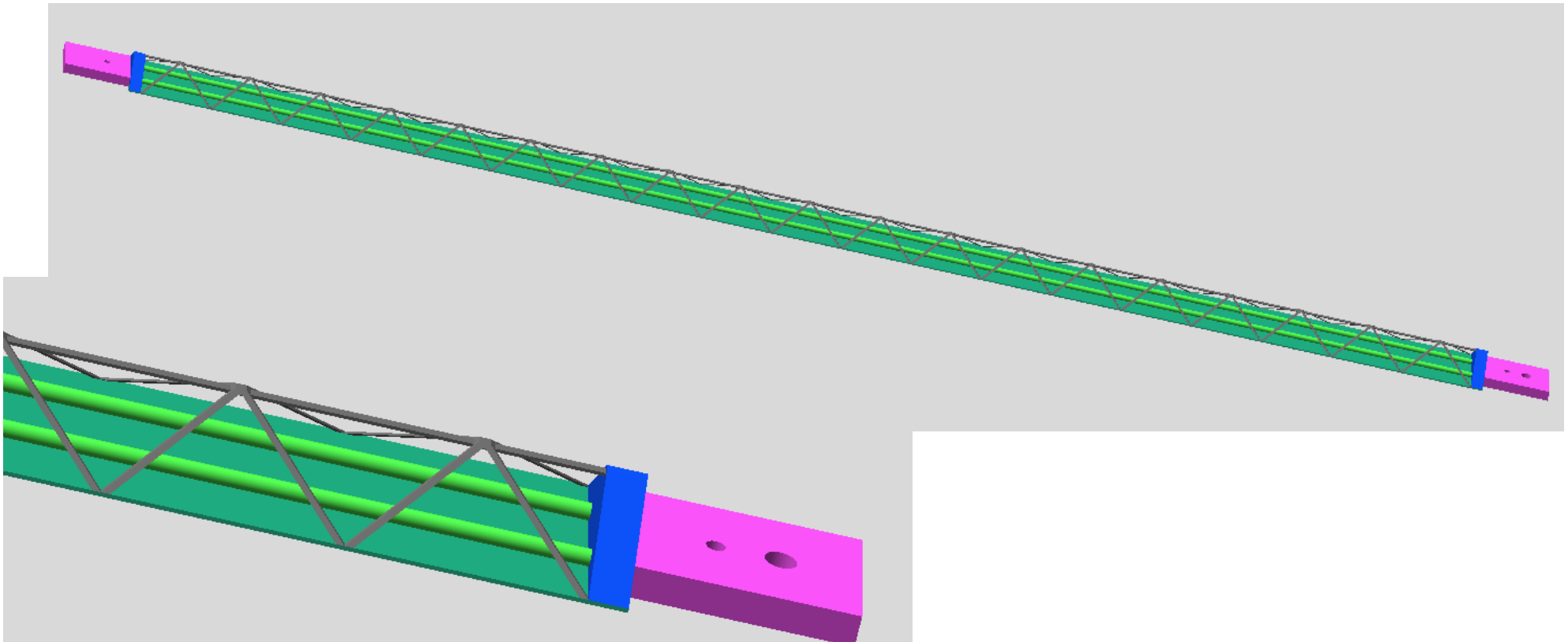
G4 and 3D CAD

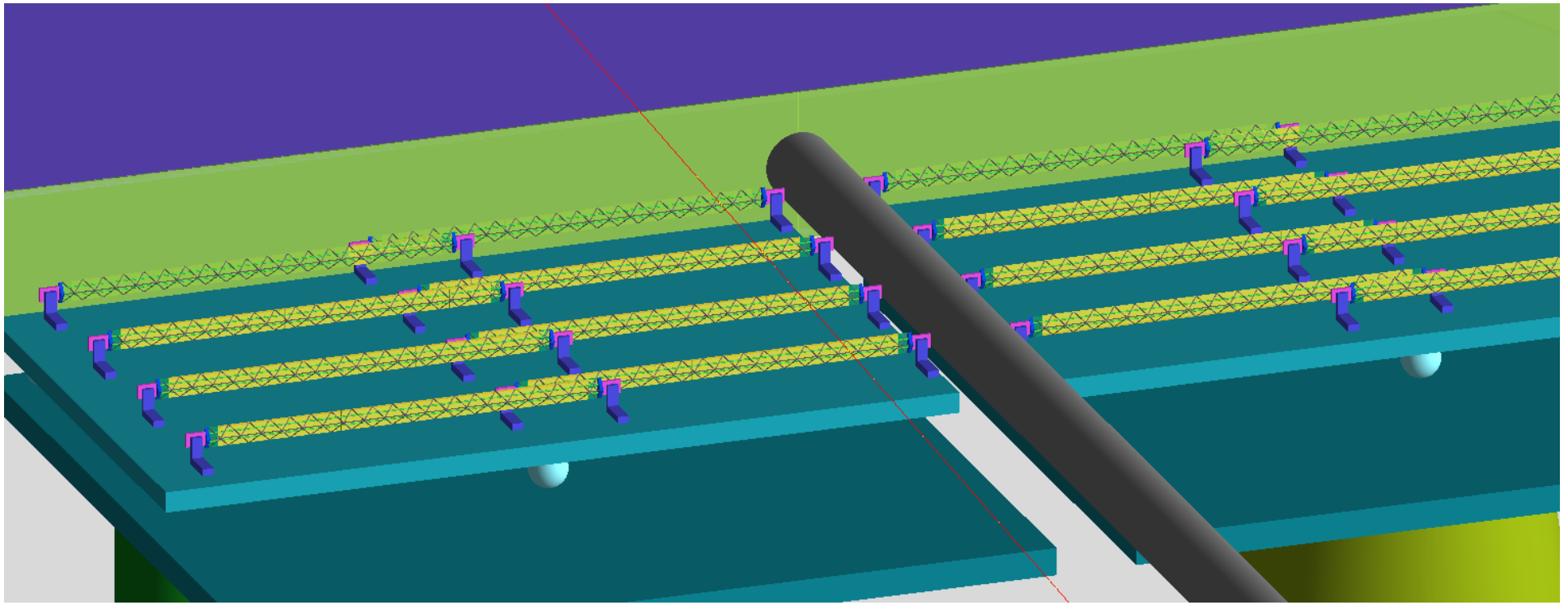




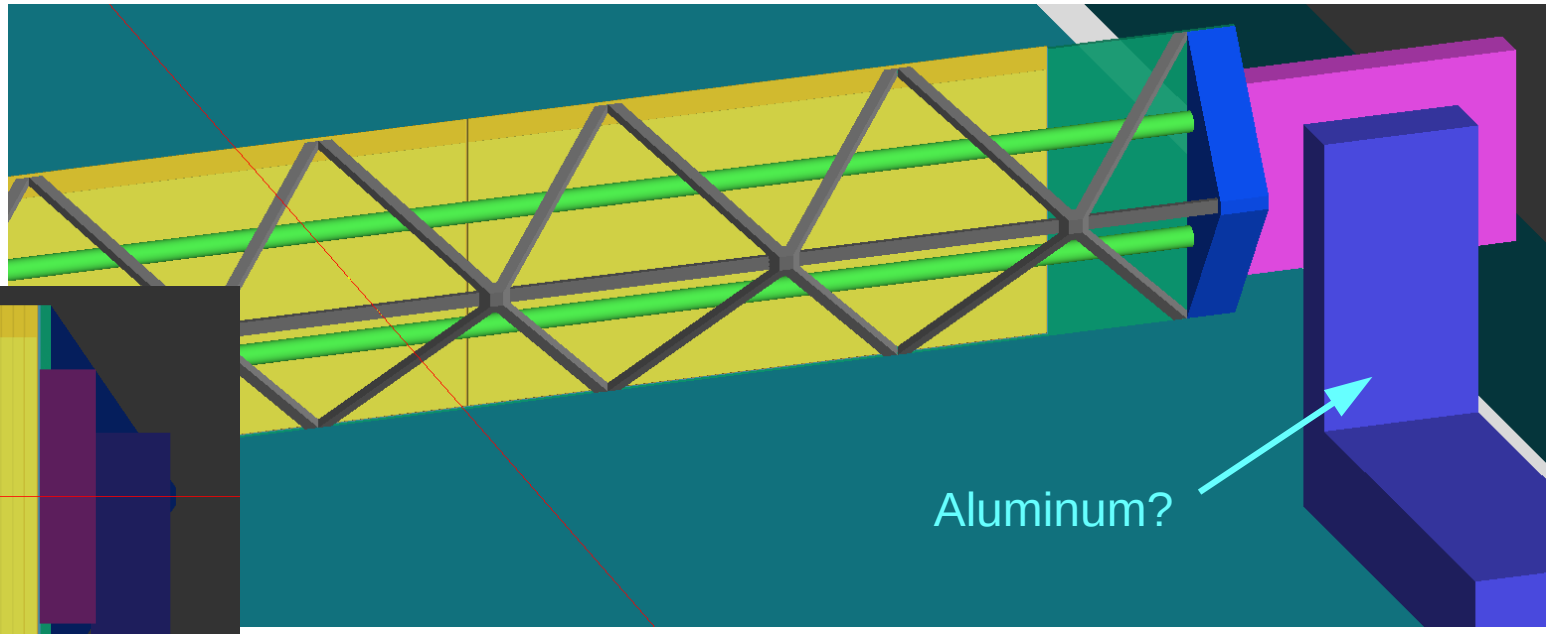
Tracker stave

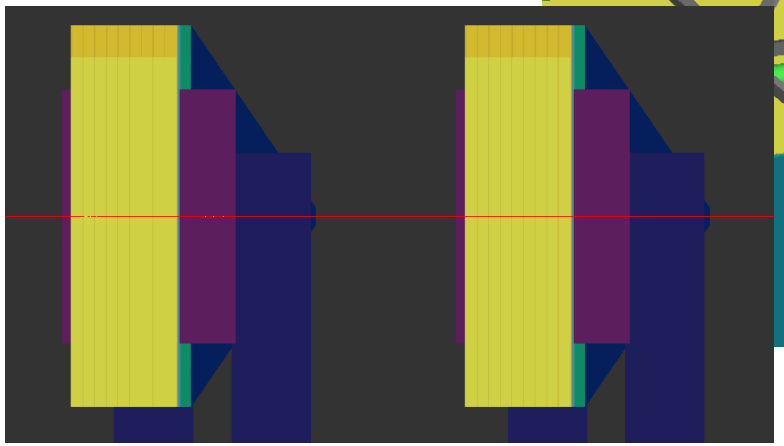




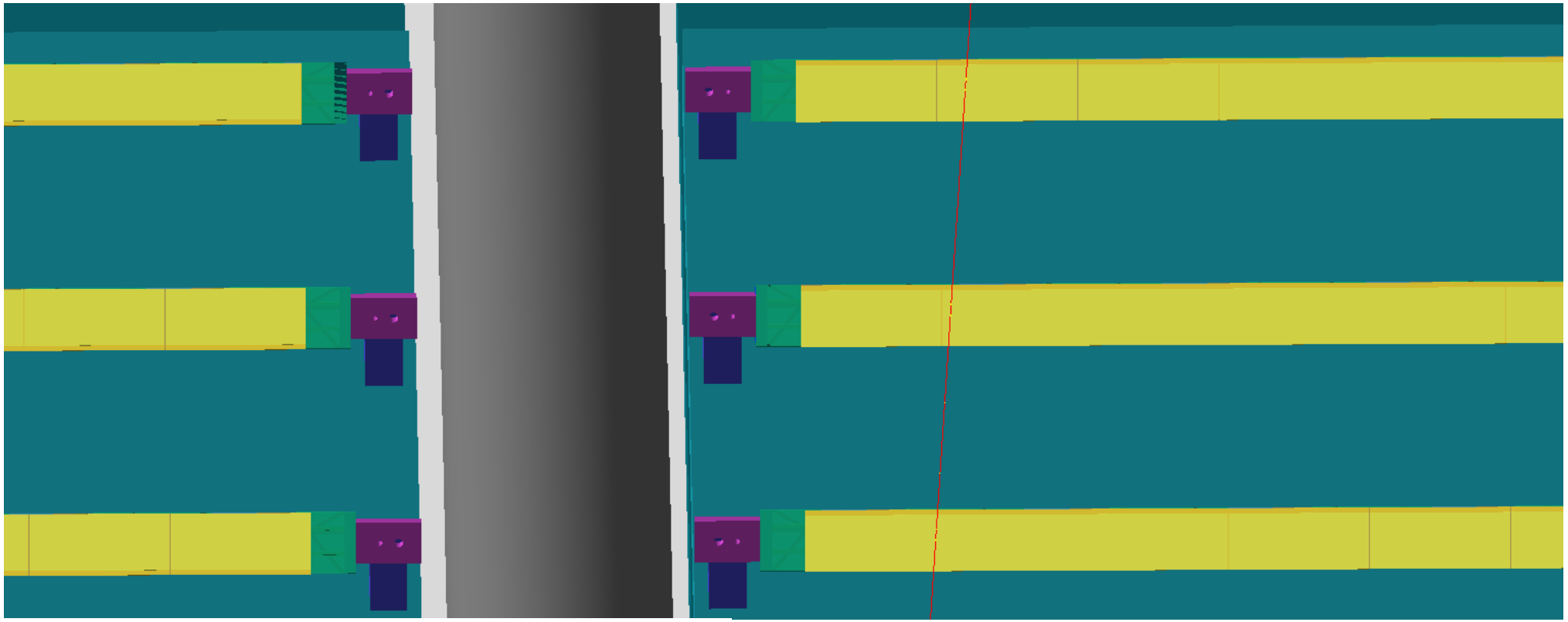


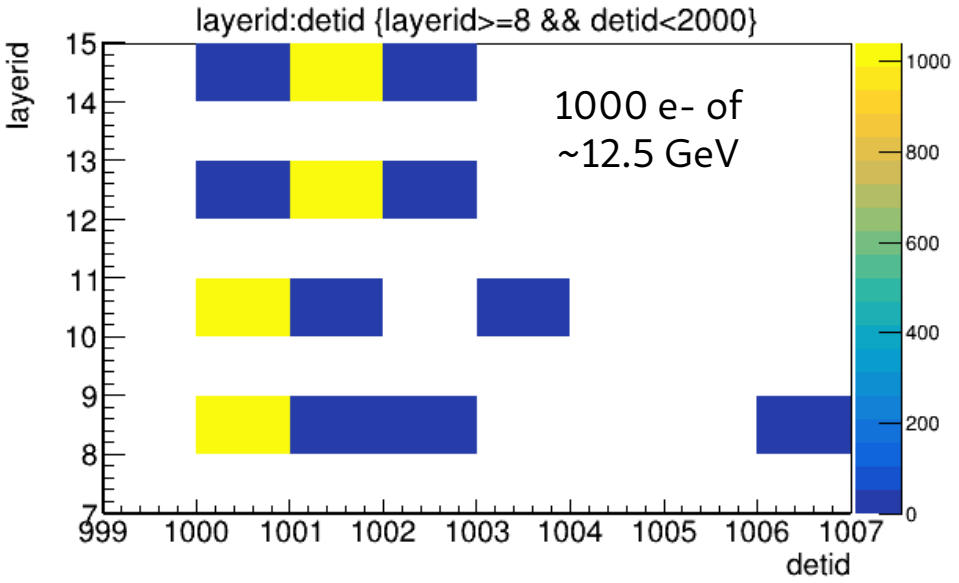
One e- of ~12.5 GeV





e- of ~12.5 GeV





One e- event

Stave Layers

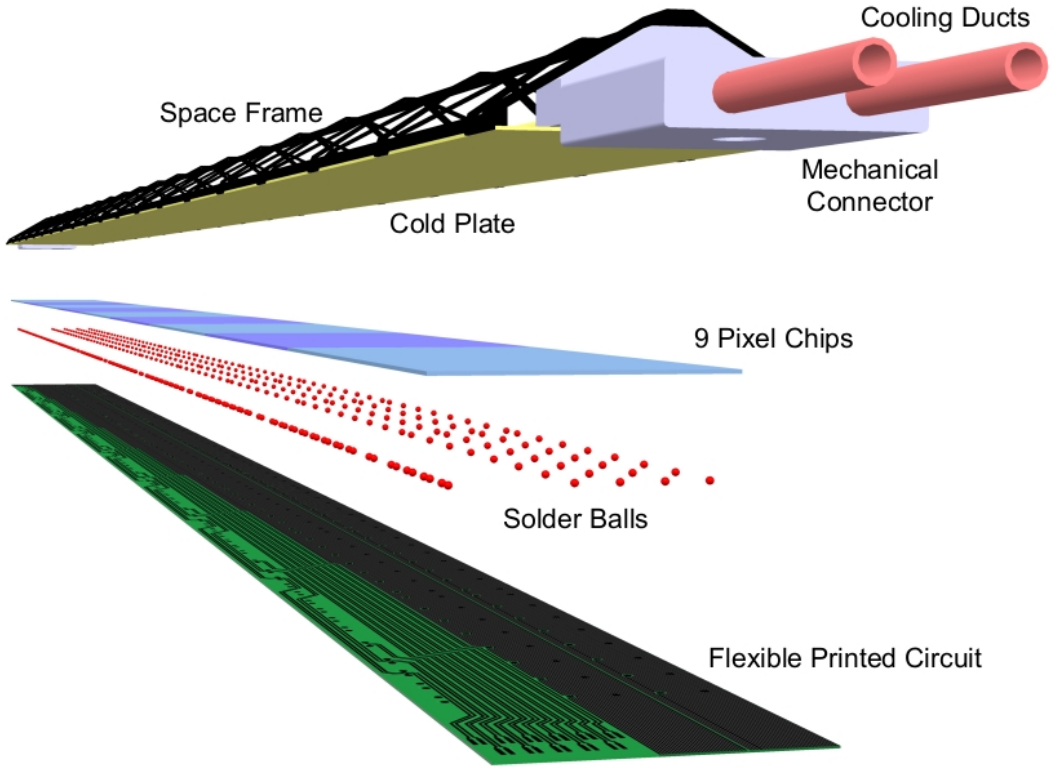


Figure 4.1: Schematic view of the Inner Barrel Stave.

- **Cold plate:**
  - carbon fiber 165 um,
  - Epoxy 100 um.
- **FPC – two layers:**
  - Al 100 um,
  - Kapton 50 um.
- **Sensor and FPC are swapped (for testing purpose);**
- **Cooling:**
  - Kapton pipes with water D=1.024 mm wall thickness 25 um

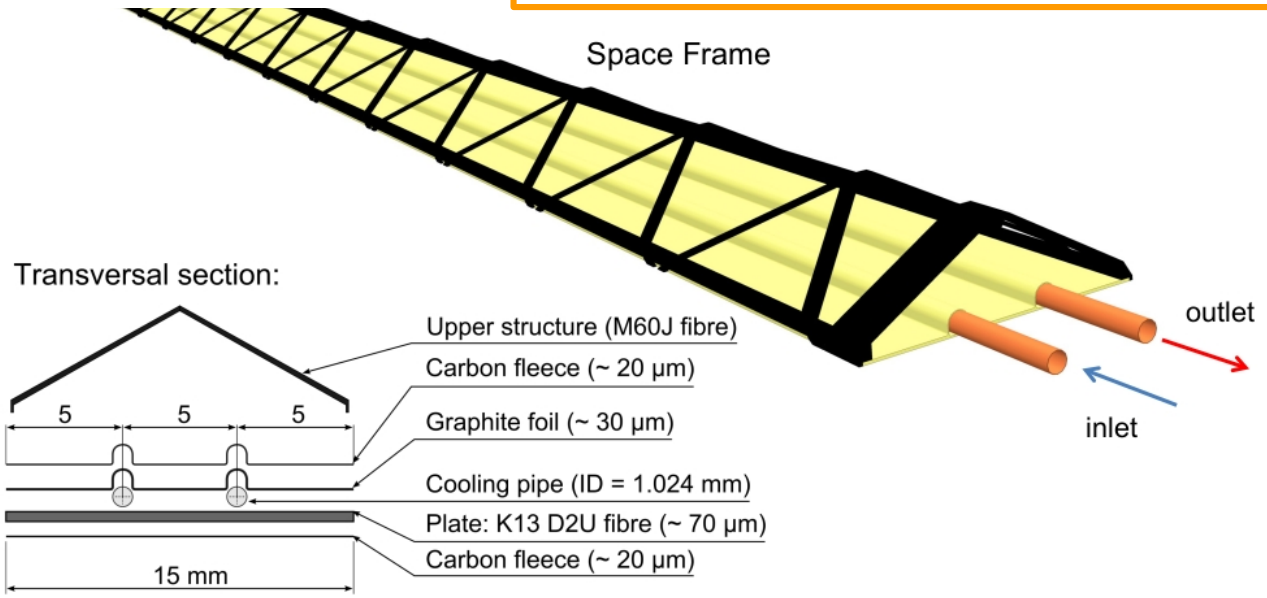
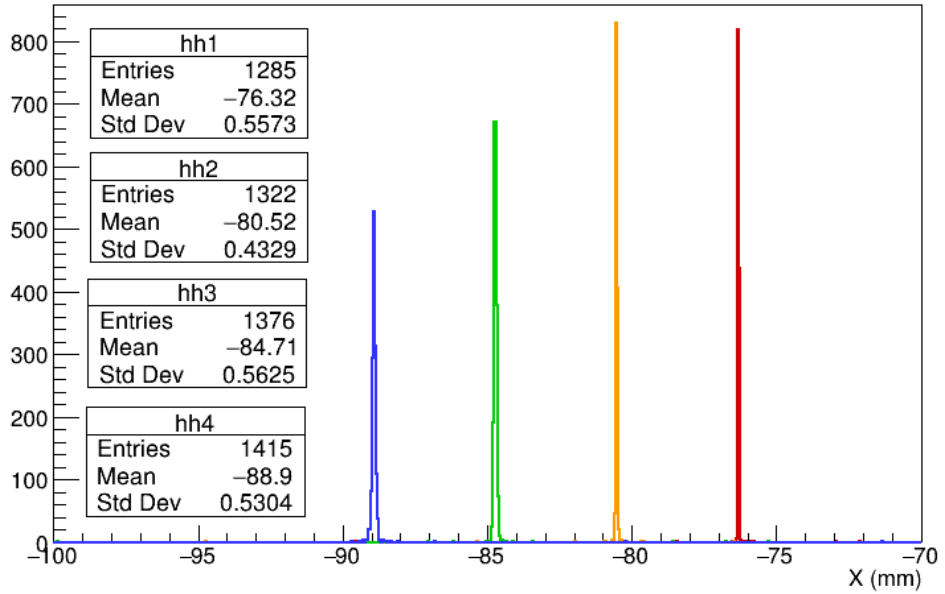
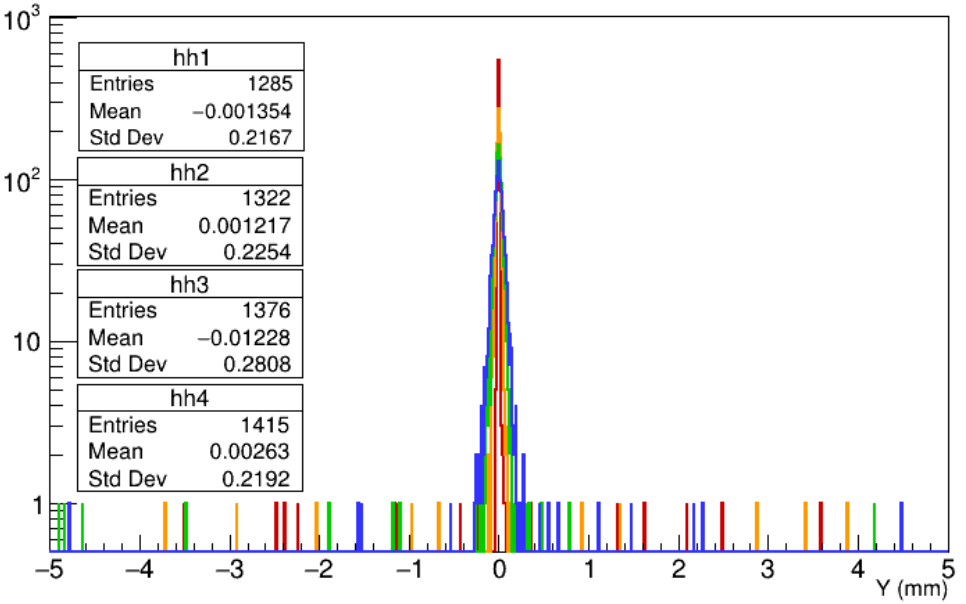


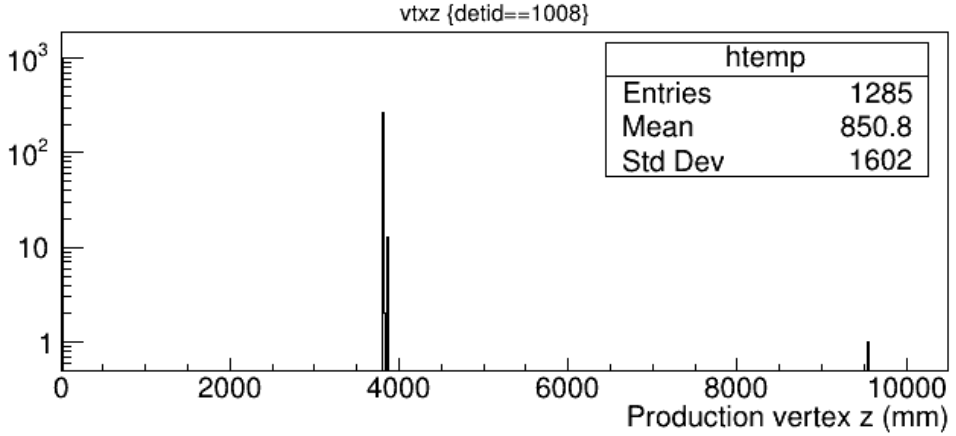
Figure 4.7: Schematic layout of the mechanical and cooling structure of the IB Stave.

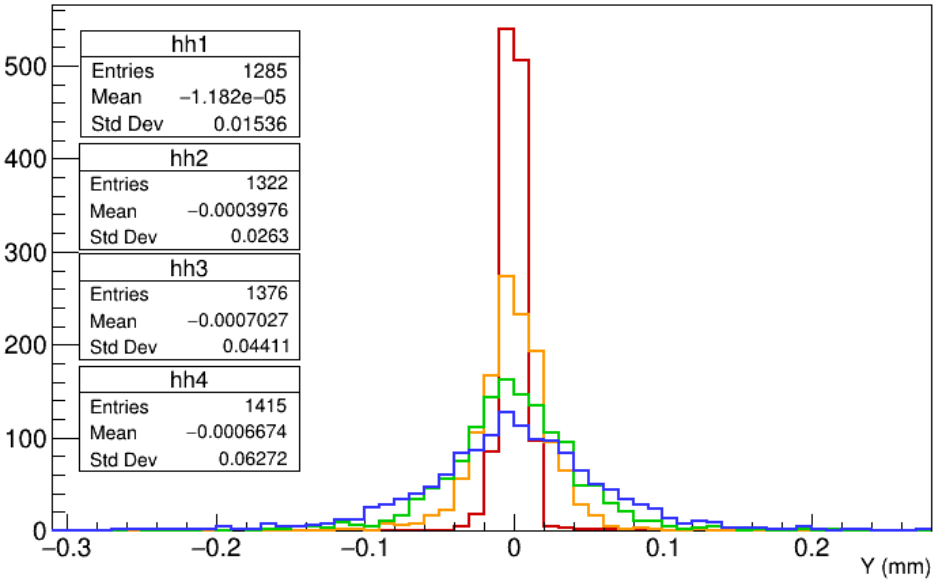
Electrons in tracker planes

1000 e- of ~12.5 GeV







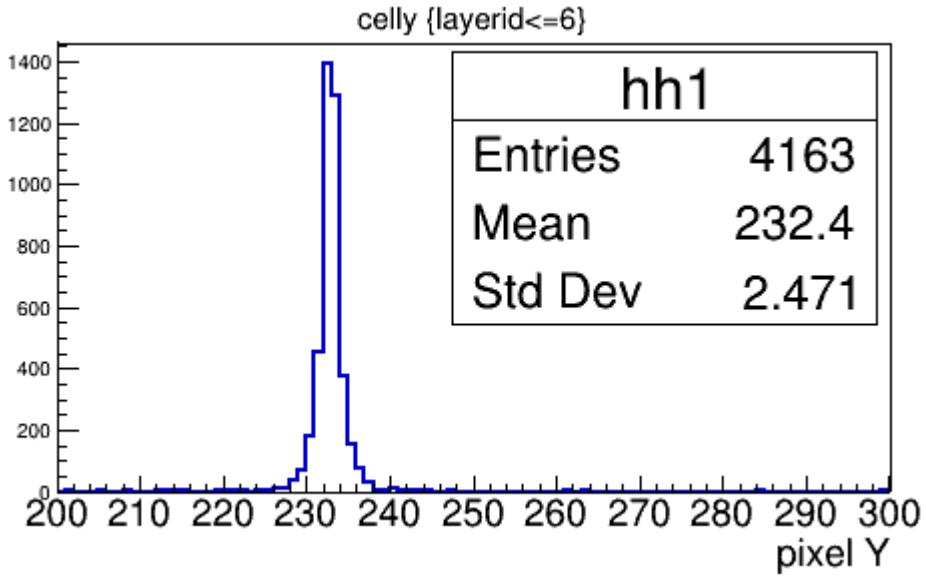


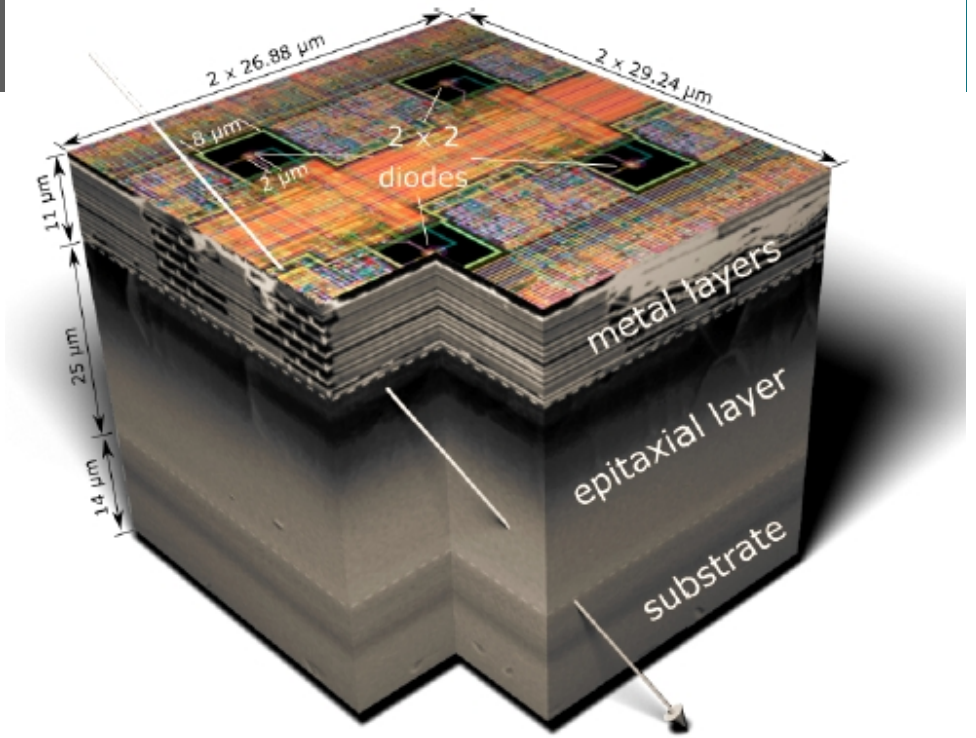
Sensor implementation

Sensor 30 mm x 15 mm

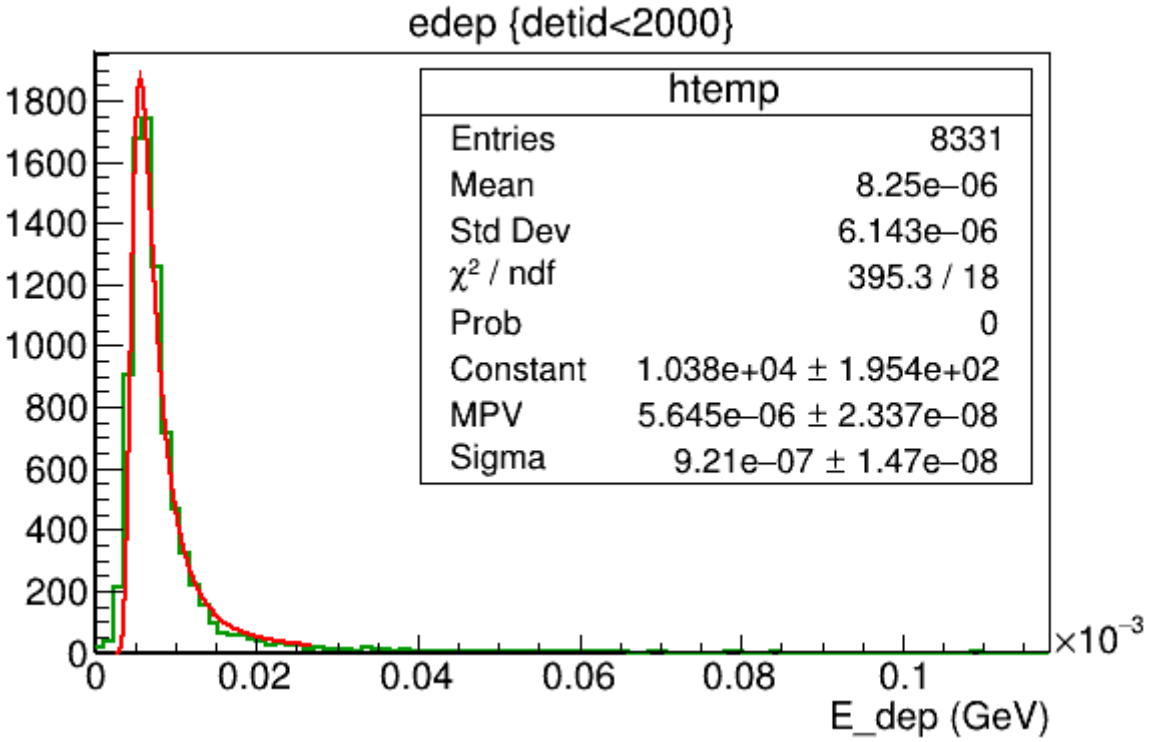
Sensitive area:
1024 x 29.24 um = 29.94176 mm
512 x 26.88 um = 13.76256 mm

100 um gap





Deposited energy in sensitive layer of 25 um



Summary and plans

- Tracker geometry is implemented and produce reasonable results in simple tests.
- Small details on stave, sensor design and material might be needed, though probably they would have small effect on the background.
- Finalize calorimeters (today).
- Run signal and background simulations.

Stave material budget

Table 4.1: Estimated contributions of the Inner Layer Stave to the material budget.

Stave element	Component	Material	Thickness (µm)	X_0 (cm)	X_0 (%)
HIC	FPC Metal layers	Aluminium	50	8.896	0.056
	FPC Insulating layers	Polyimide	100	28.41	0.035
	Pixel Chip	Silicon	50	9.369	0.053
Cold Plate		Carbon fleece	40	106.80	0.004
		Carbon paper	30	26.56	0.011
	Cooling tube wall	Polyimide	25	28.41	0.003
	Cooling fluid	Water		35.76	0.032
	Carbon plate	Carbon fibre	70	26.08	0.027
	Glue	Eccobond 45	100	44.37	0.023
Space Frame		Carbon rowing			0.018
Total					**0.262**