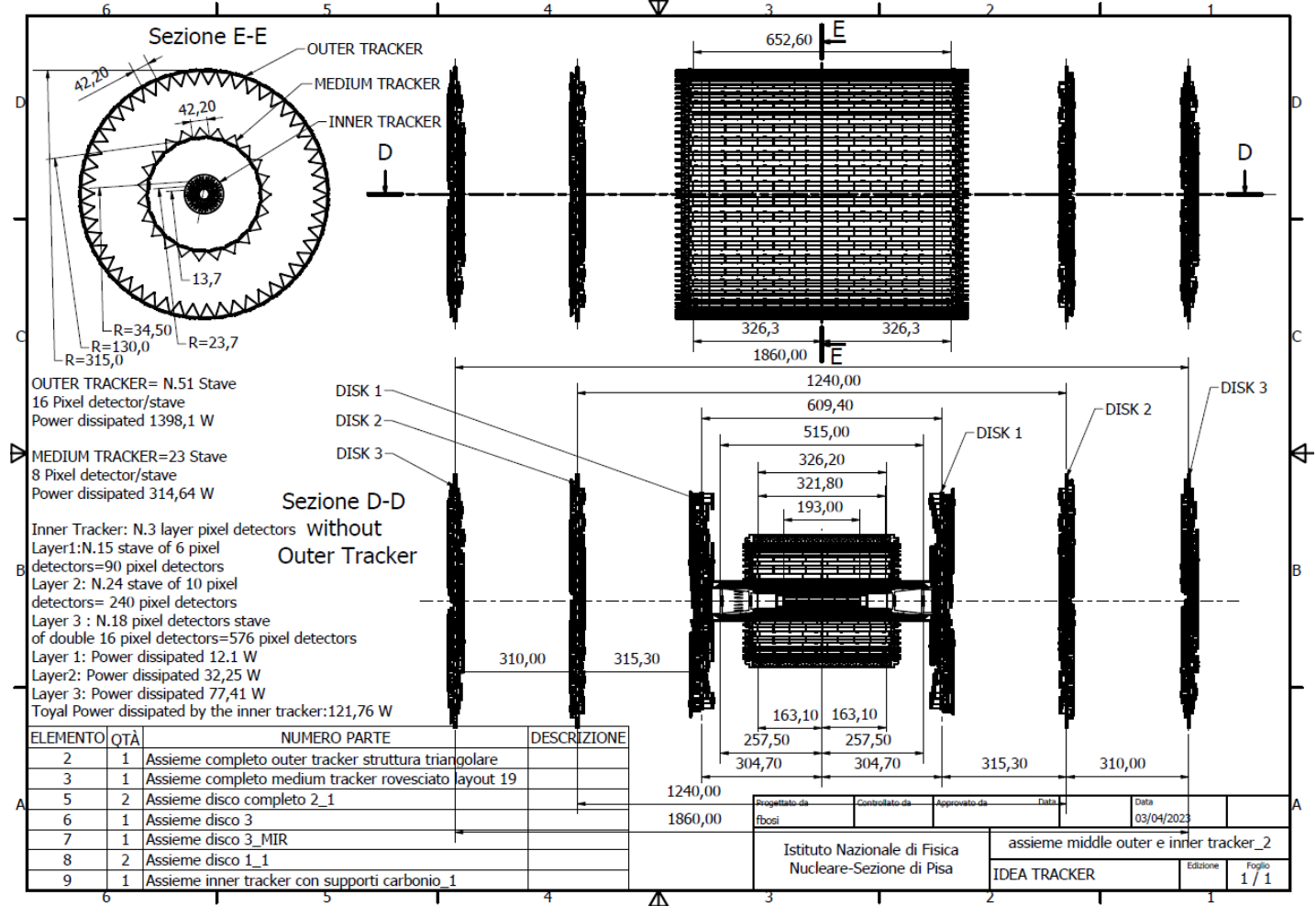


VERTEX AND BEAM PIPE MATERIAL BUDGET FOR FCC-EE

Fabrizio Palla
INFN Pisa and CERN
ECFA WG1 – FLAV meeting
CERN, 18 April 2024

Mid-term feasibility study vertex detector layout (aka “state of the art”)

(IDEA Detector Concept)



Outer vertex tracker:

- Intermediate barrel at 13 cm radius (improved reconstruction for $p_T > 40$ MeV tracks)
- Outer barrel at 31.5 cm radius
- 3 disks per side

Inner Vertex detector:

3 barrel layers at

- 13.7, 22.7 and 34.8 mm radius



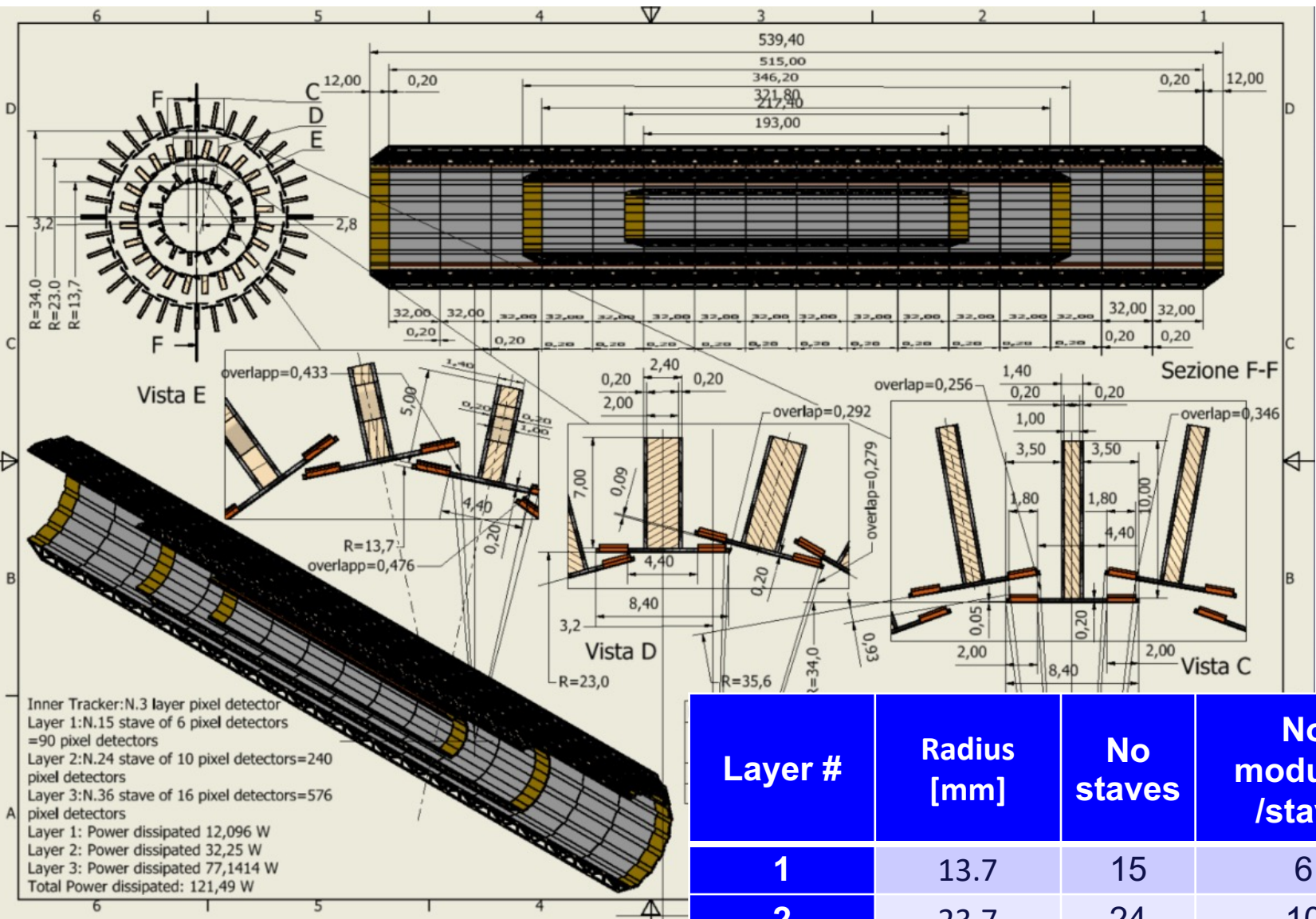
INNER VERTEX DETECTOR

Total thickness per layer ~0.25% X/X0

Carbon Fibre ~60 %

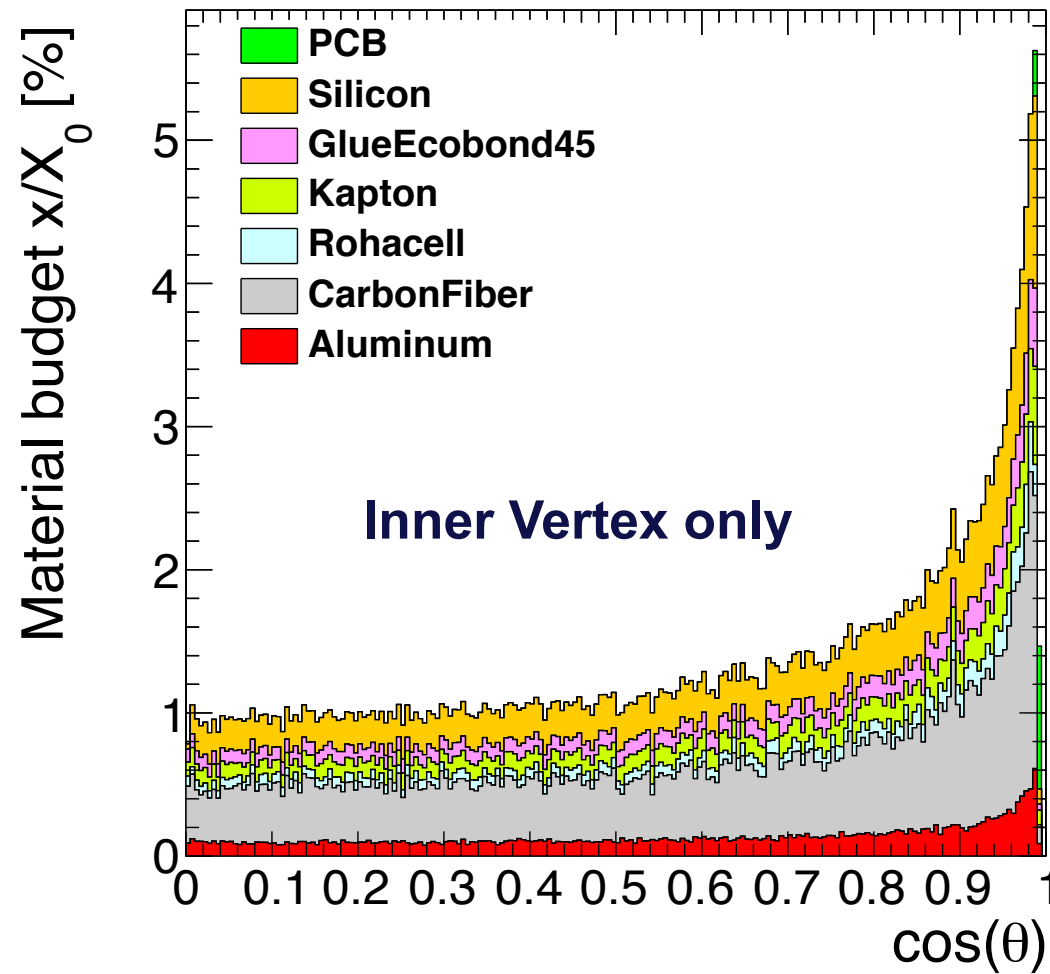
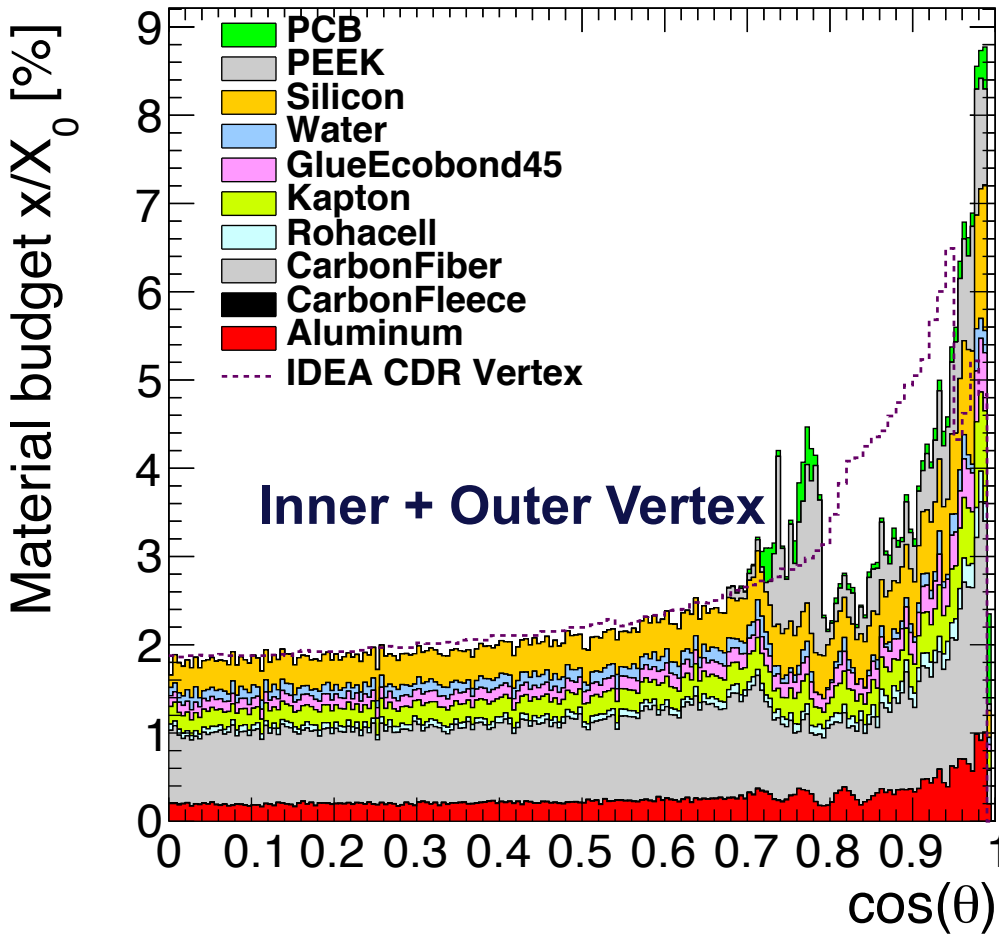
Silicon: ~20%

Power and readout bus: ~20%



Layer #	Radius [mm]	No staves	No modules /stave	Total Length [mm]	Active Area [cm ²]	Power [W]
1	13.7	15	6	217.40	241.92	12
2	23.7	24	10	346.20	645.12	32
3	34 & 35.60	36	16	539.40	1548.29	77

Simulated material budget of IDEA

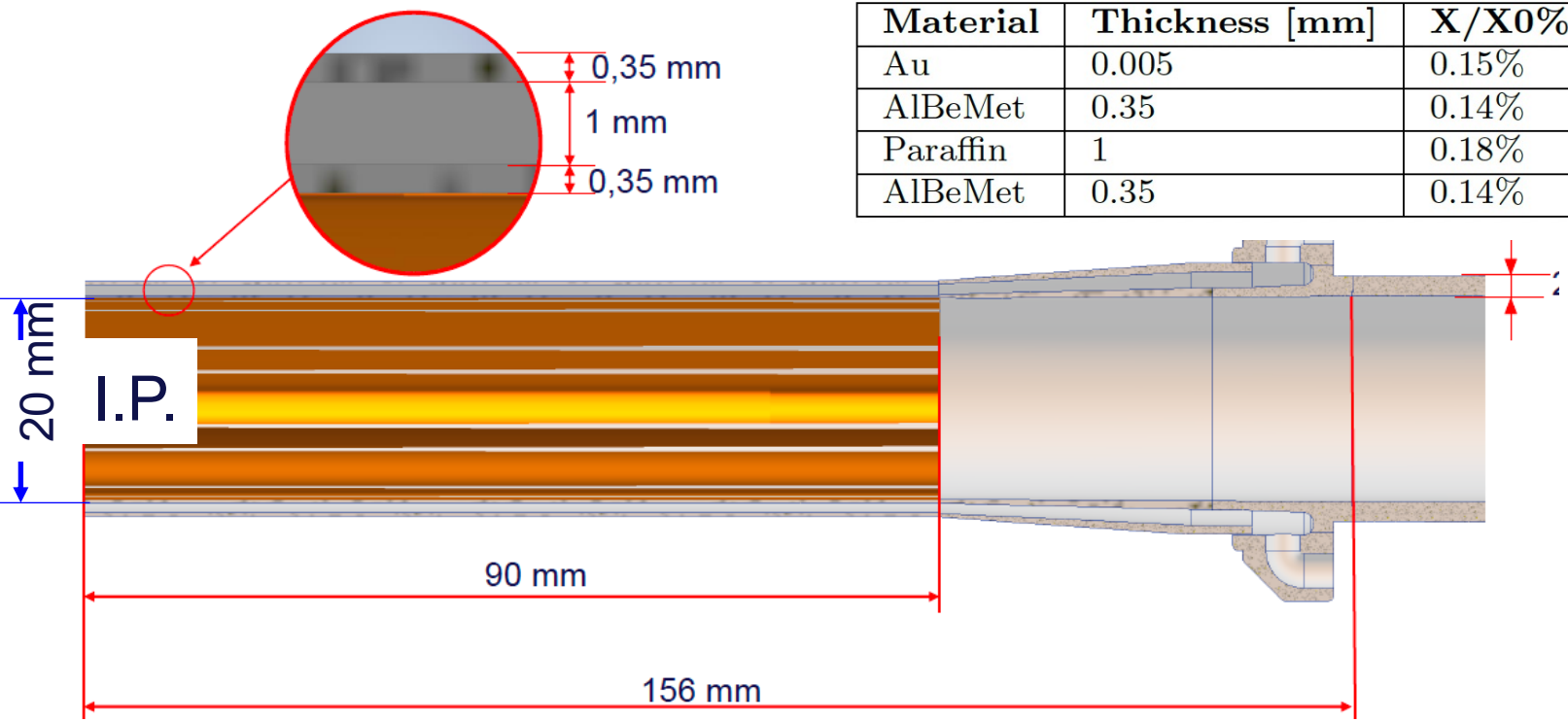


Central beam-pipe layout

Thickness of the chamber

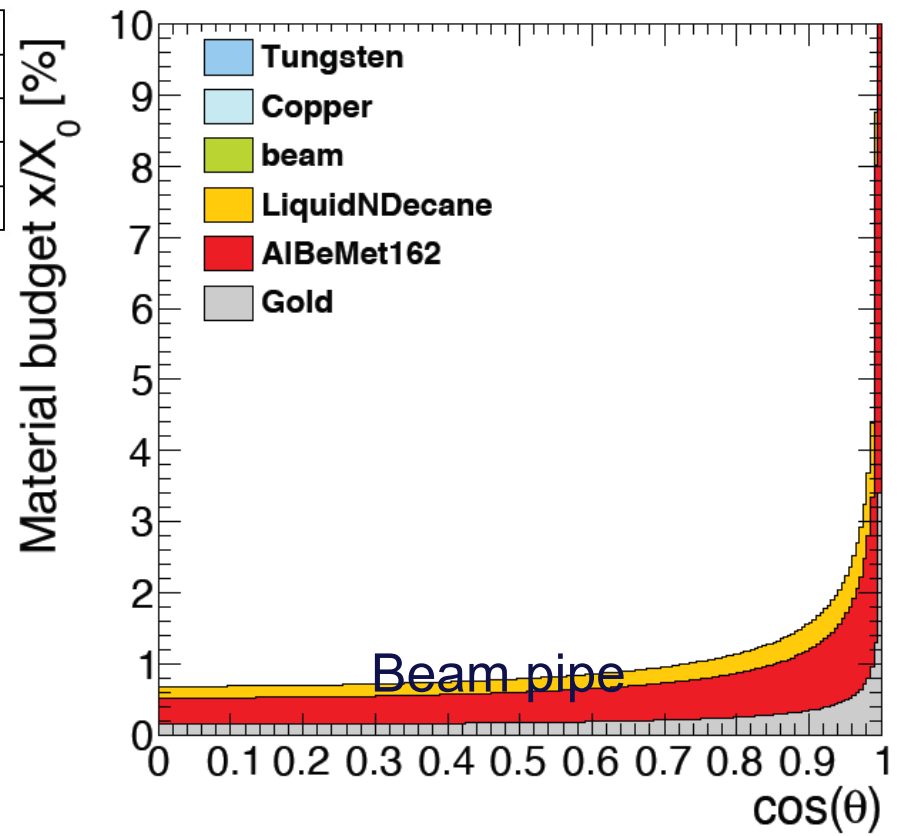
Table 1: Composition of the central beam pipe from the inner to the outer side. The resulting thickness is 1.705 mm for X/X0=0.61%.

Material	Thickness [mm]	X/X0%
Au	0.005	0.15%
AlBeMet	0.35	0.14%
Paraffin	1	0.18%
AlBeMet	0.35	0.14%



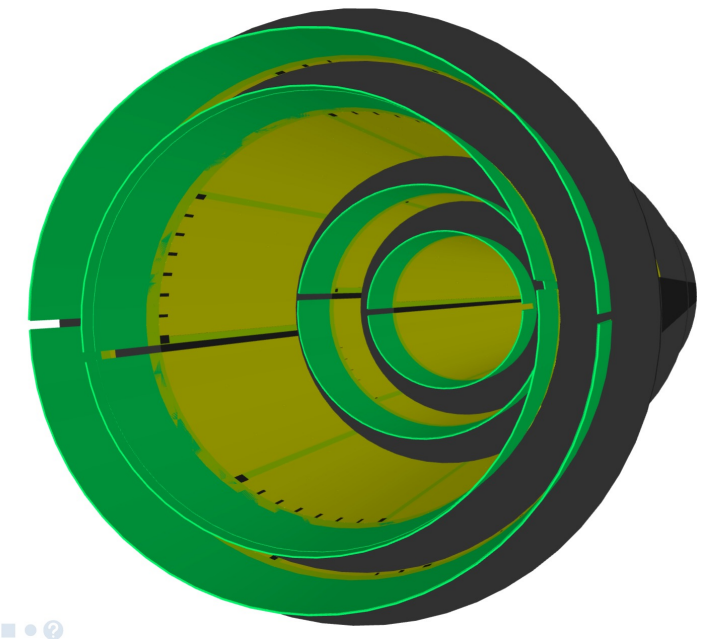
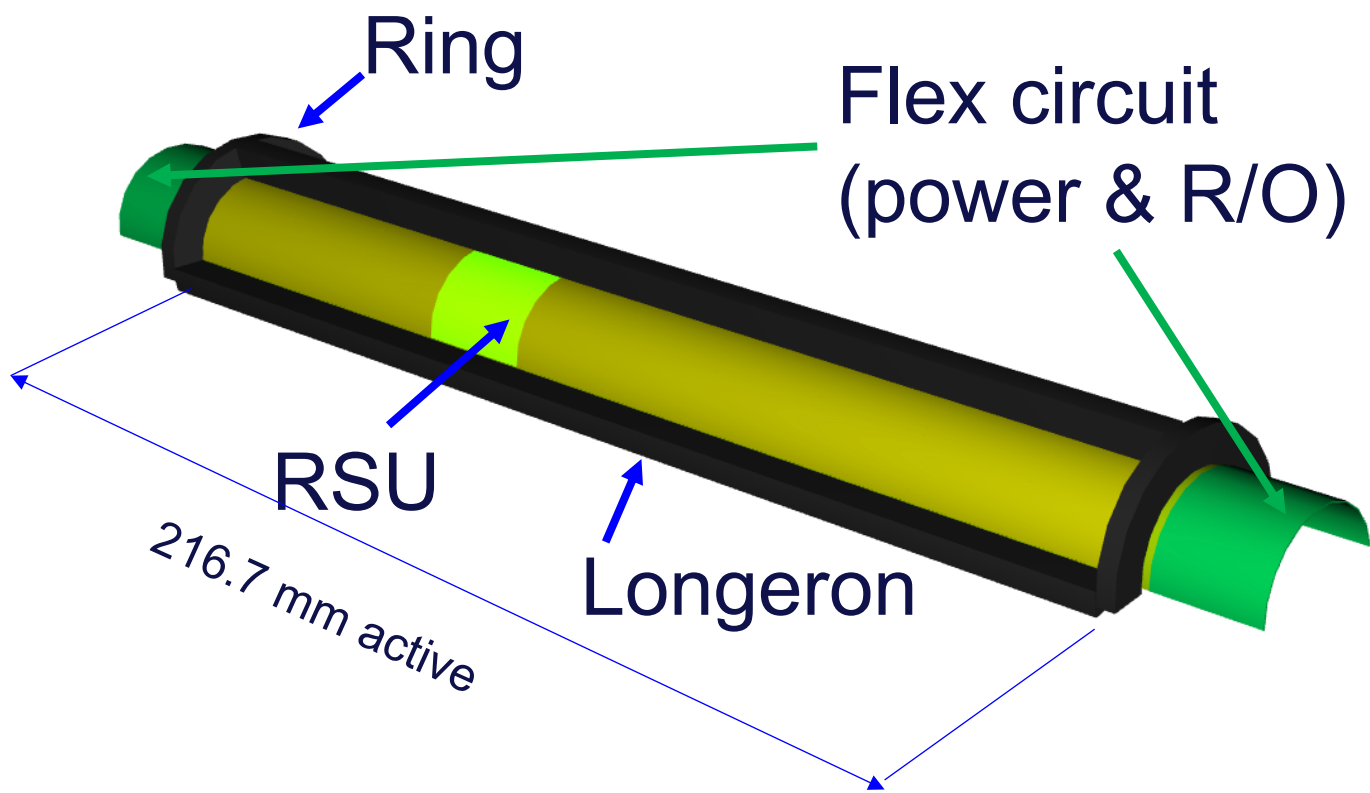
- 5 μm Au to reduce heat load
- Minimum wall thickness for mechanical resistance

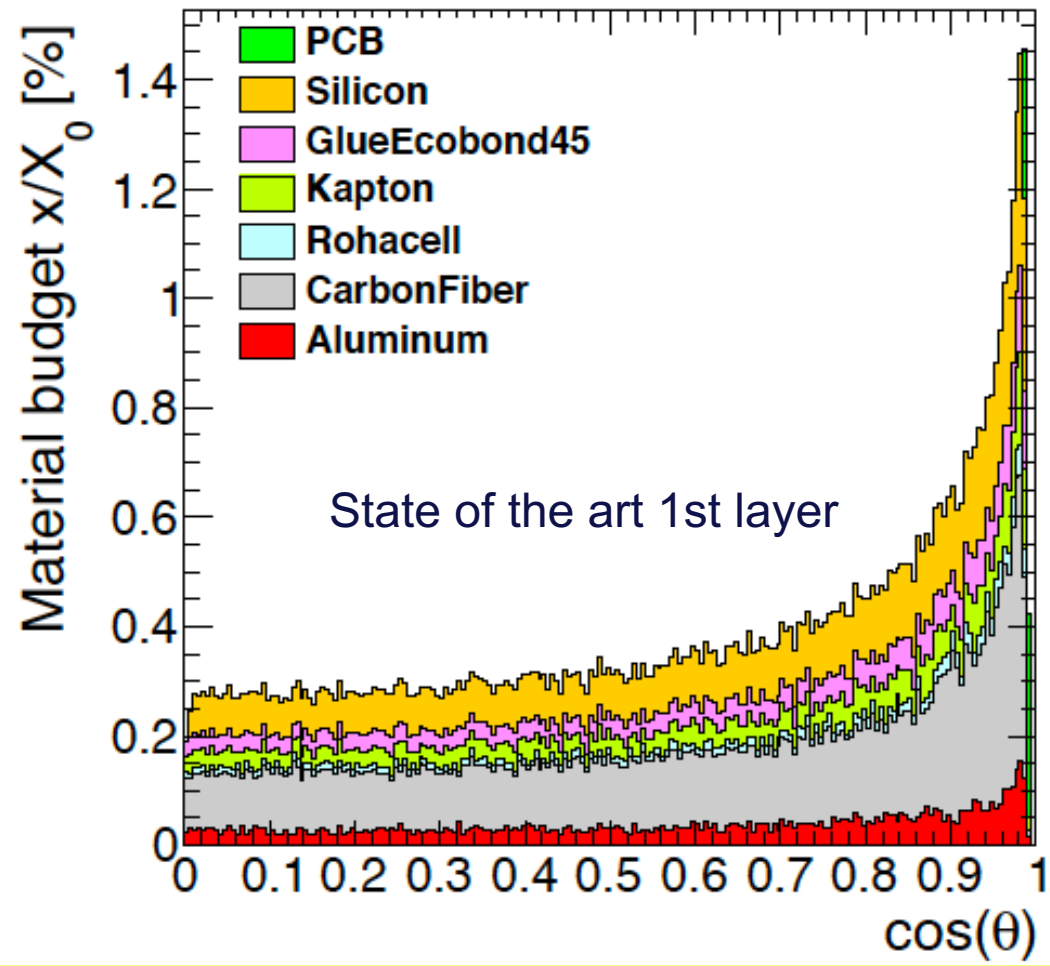
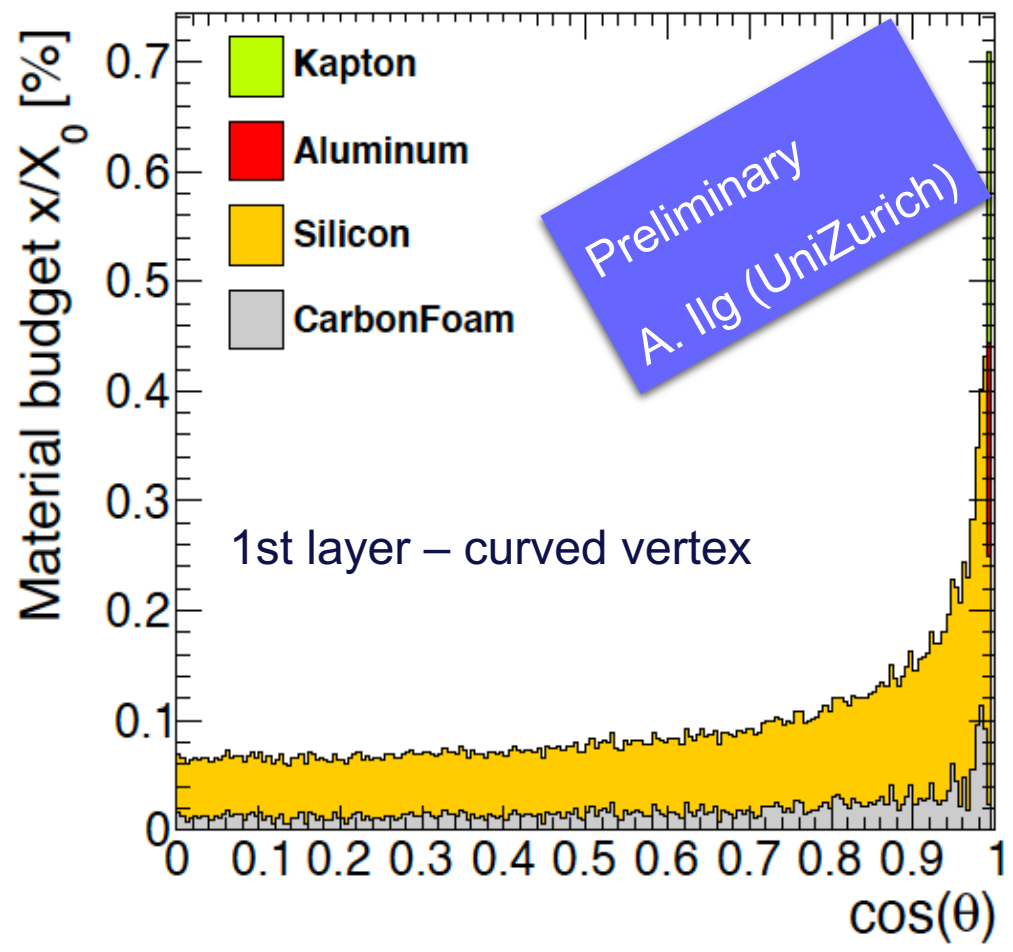
Total 0.61% X/X0



Novel approach inspired to ALICE ITS3

- ongoing study in IDEA (not optimised)
- Curved 50 μm thick silicon layers
- 4 layers @ 13.7, 20.23, 26.76 and 33.3 mm





Material budget reduction of a factor ~ 5

→ m.s. term impact parameter resolution improves by more than a factor 2

