



ECFA European Linear Collider Workshop 2013, Hamburg, Germany

Engineering studies for the inner region of the CLIC_ILD detector concept

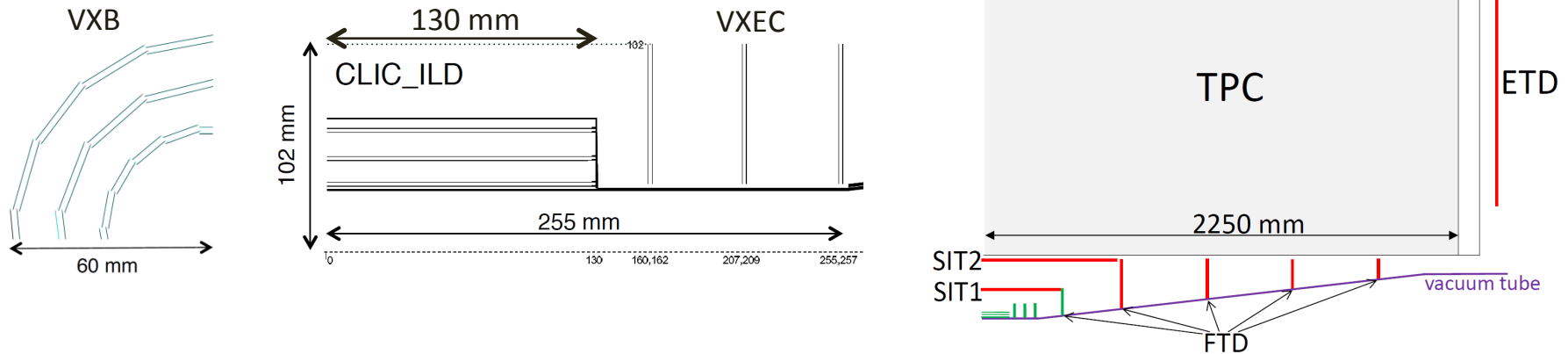
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May 28th, 2013

Outline

- CLIC_ILD layout and challenges;
- Cooling;
- Lightweight mechanical support structures;
- Services;
- Assembly;

CLIC_ILD physics layout



- Vertex detector:

- **Barrel** – 3 double sided silicon pixel layers;
- **Endcaps** – 3 double sided silicon pixel disks;

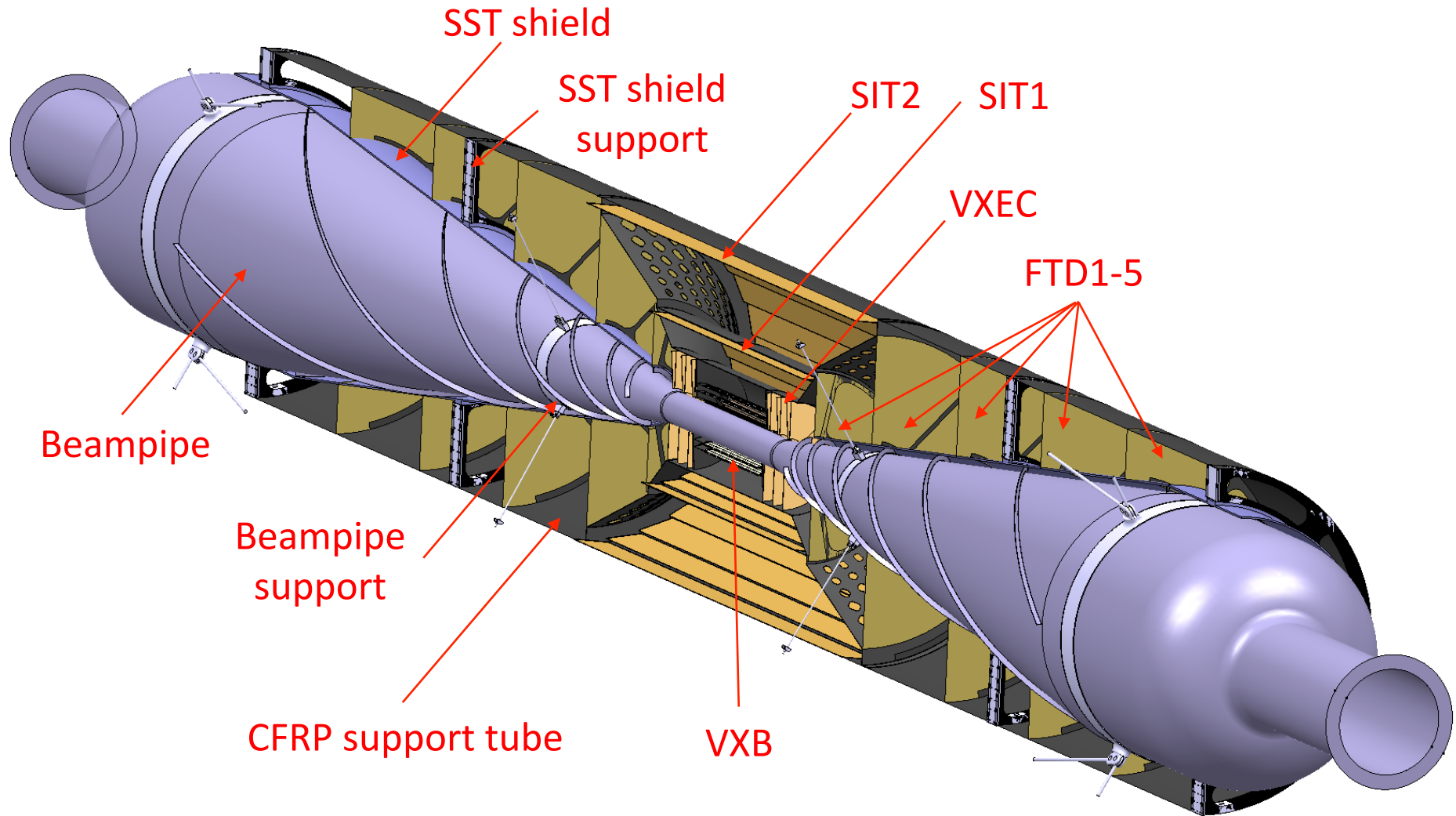
- Inner tracker:

- **Barrel** – 2 silicon micro-strip layers;
- **FTD** – 1 silicon pixel & 4 silicon micro-strip disks;

Engineering challenges

- Low material budget (0.18% X/X0 per layer in VXB of which 0.11% is silicon);
- Proper sensor cooling:
 - ~470 W Heat load to extract;
 - Room temperature operation;
- High dimensional stability;
- Assembly and cabling integration;

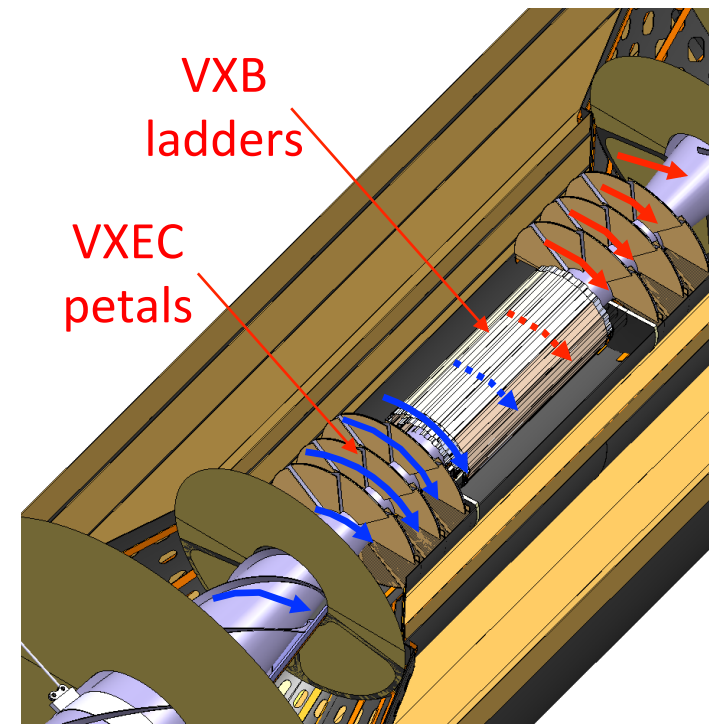
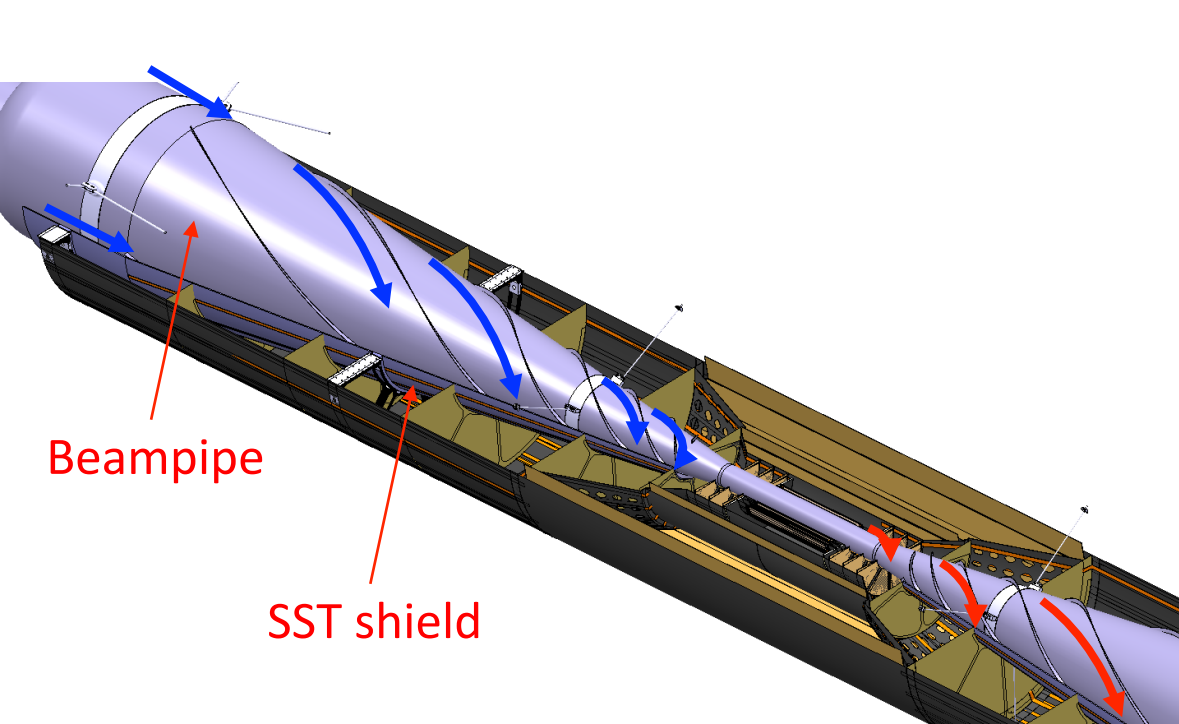
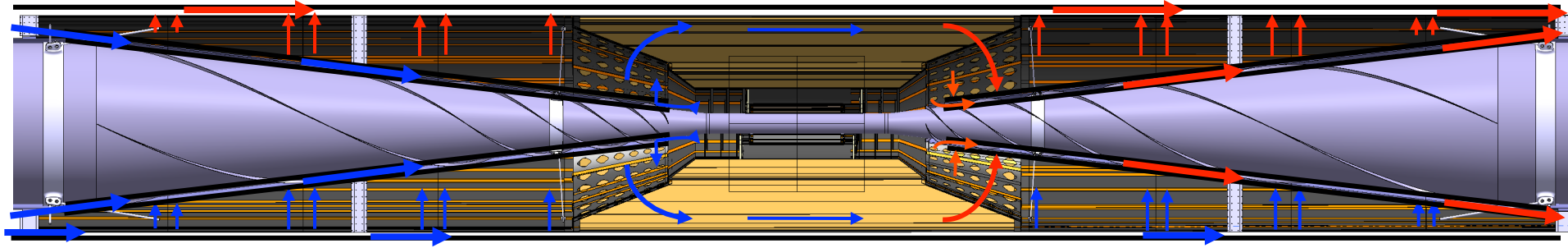
CLIC_ILD engineering layout



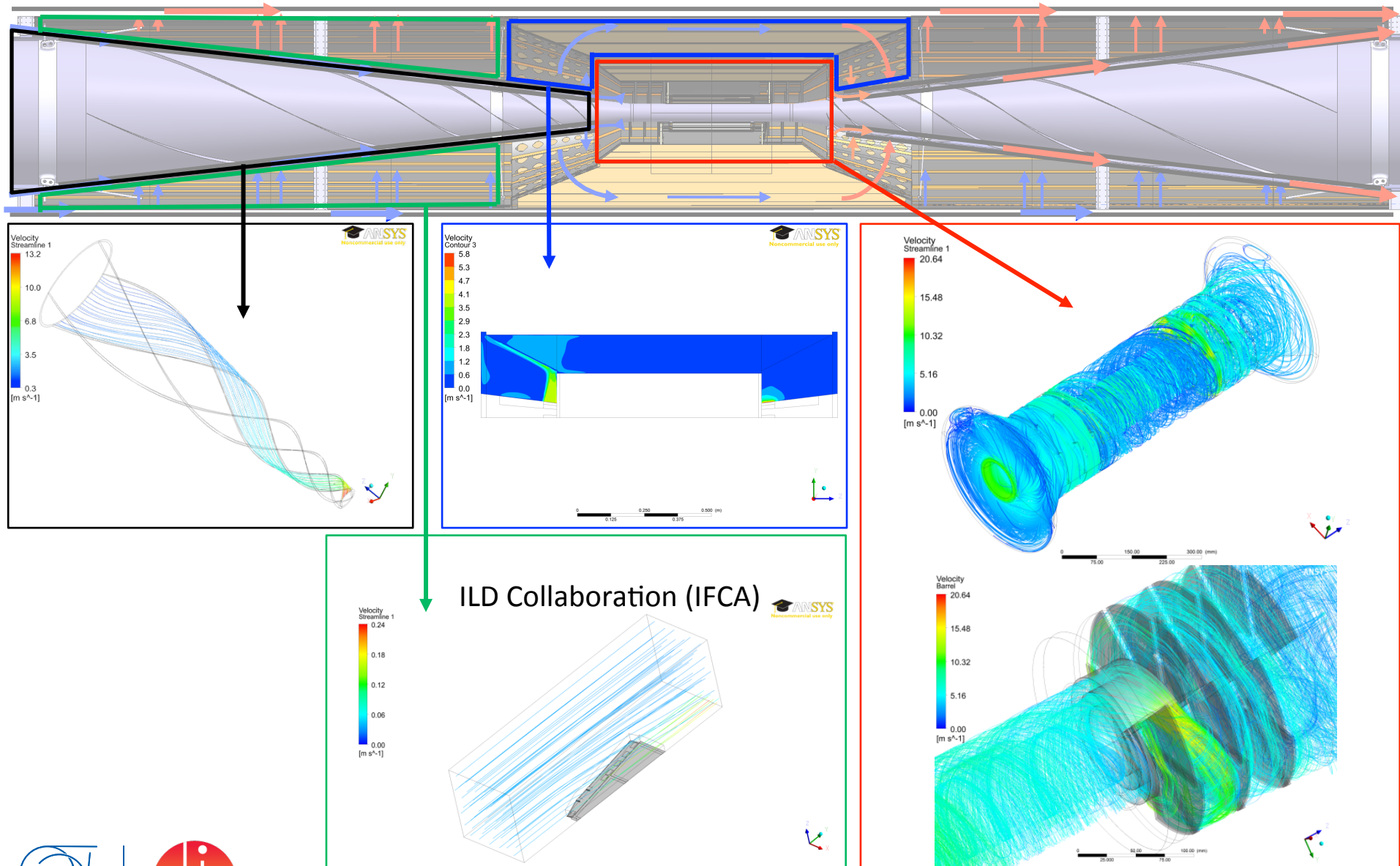
Air cooling

Cold air in

Warm air out

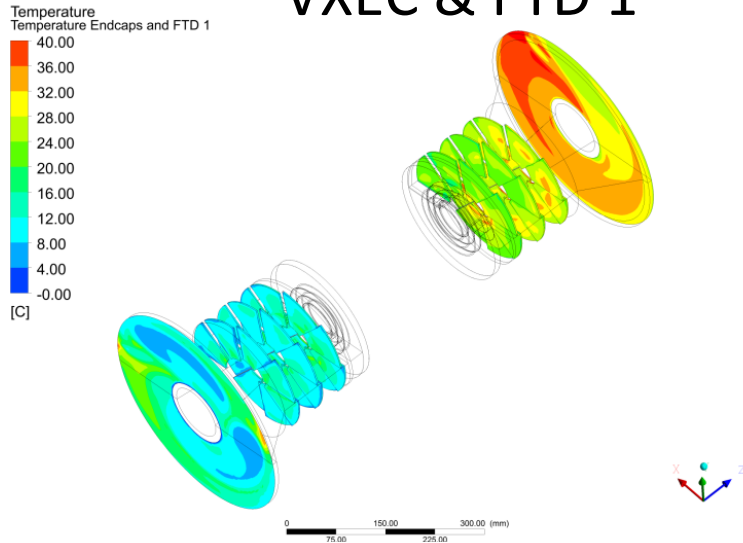


Air cooling performance

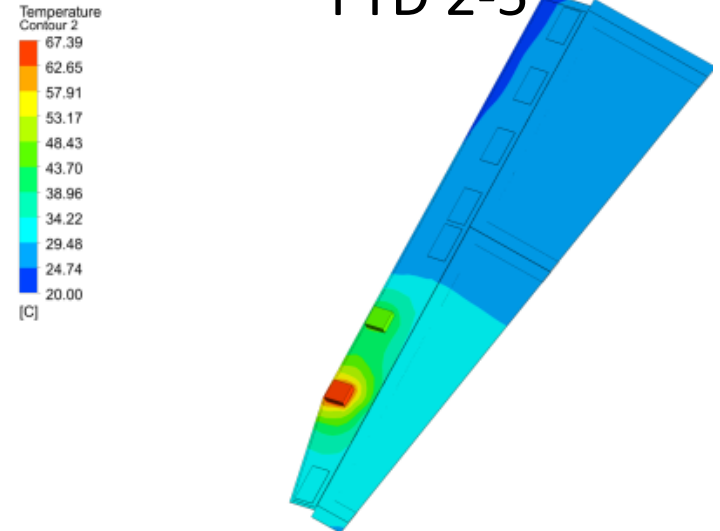


Air cooling performance

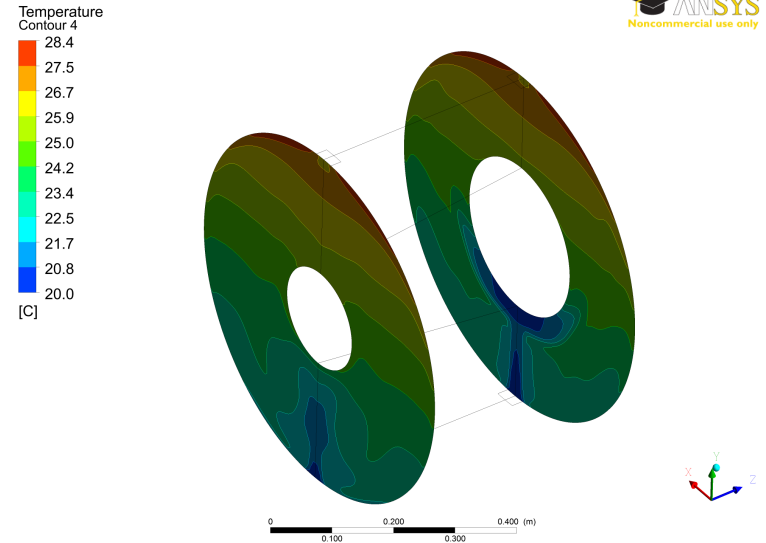
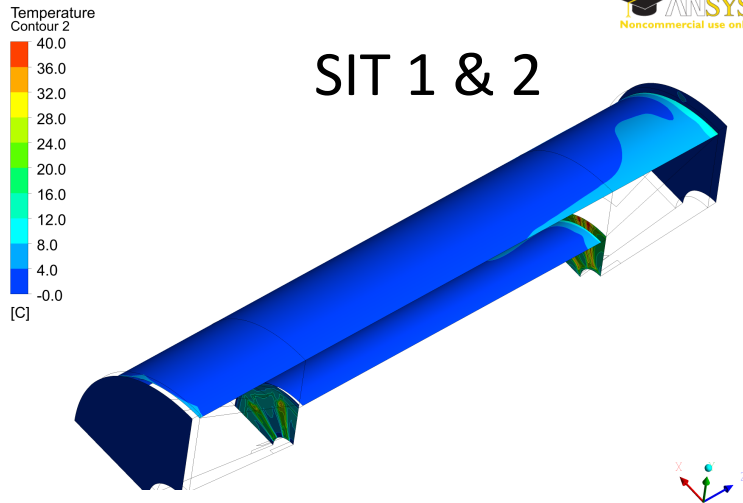
VXEC & FTD 1



FTD 2-5

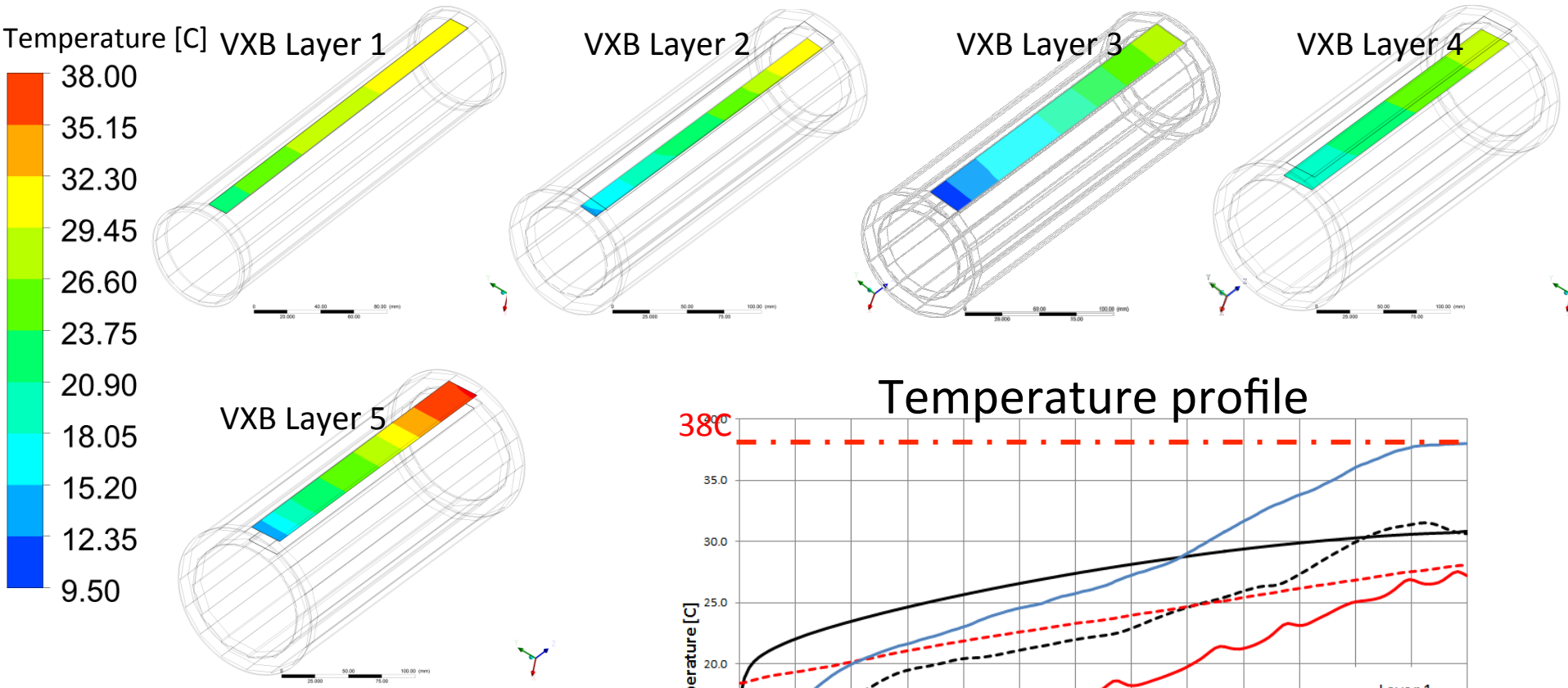


SIT 1 & 2

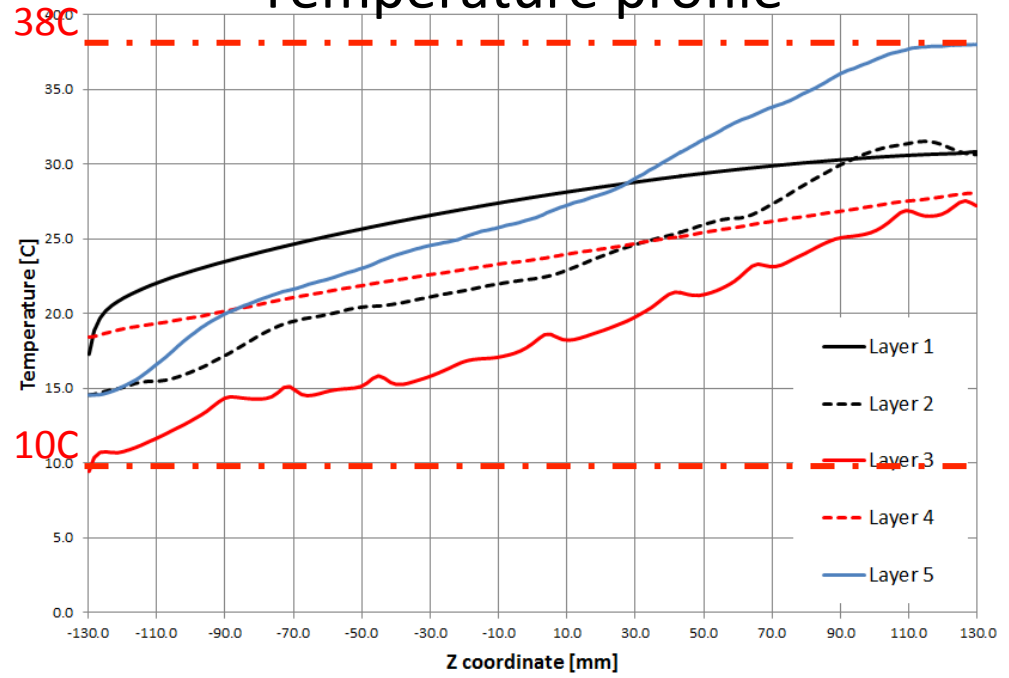


*Conduction h. t. not included in the models

Air cooling performance



Temperature profile

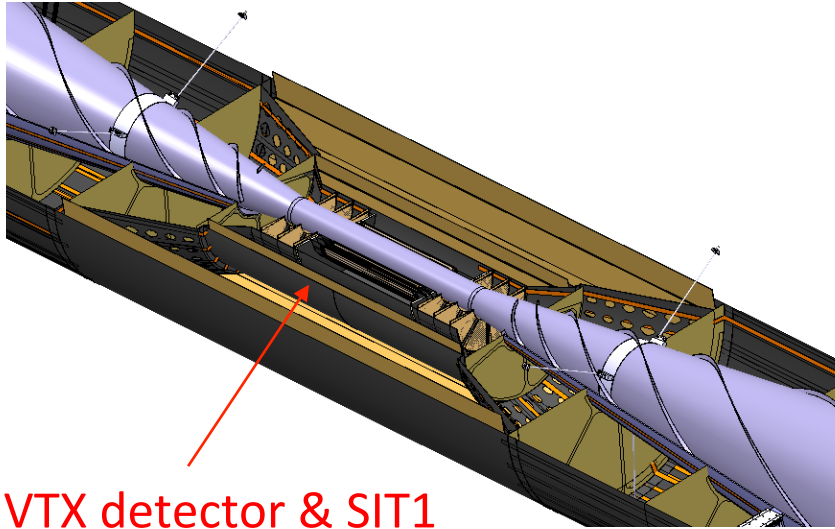


Experimental validation tests will soon start

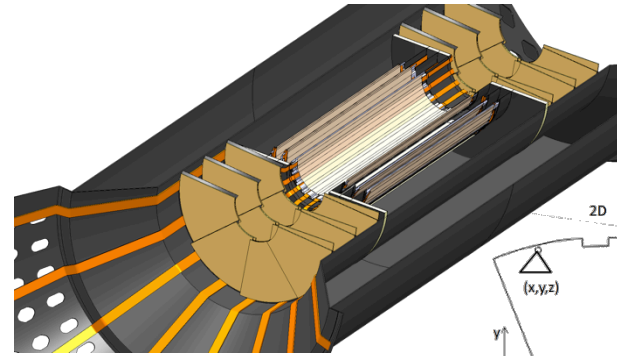
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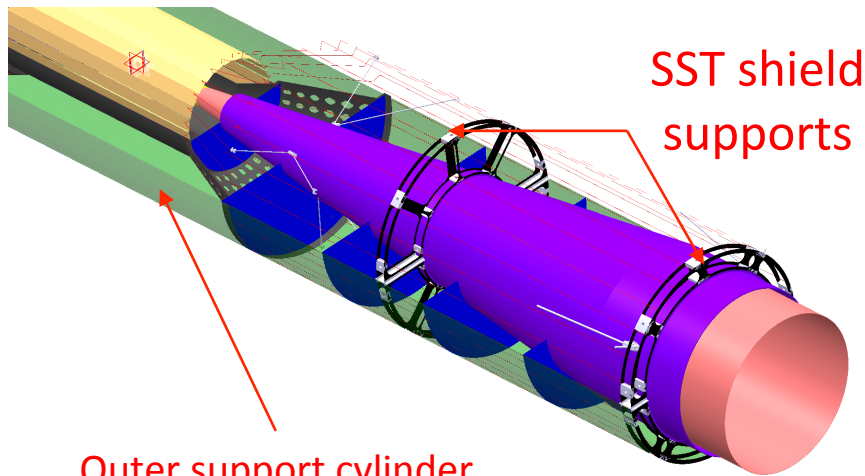
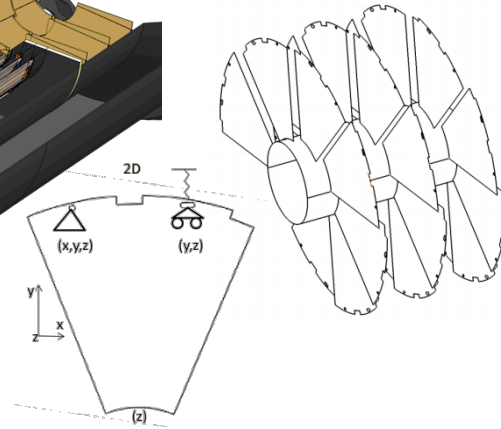
Mechanical support



VTX detector & SIT1 mechanical support

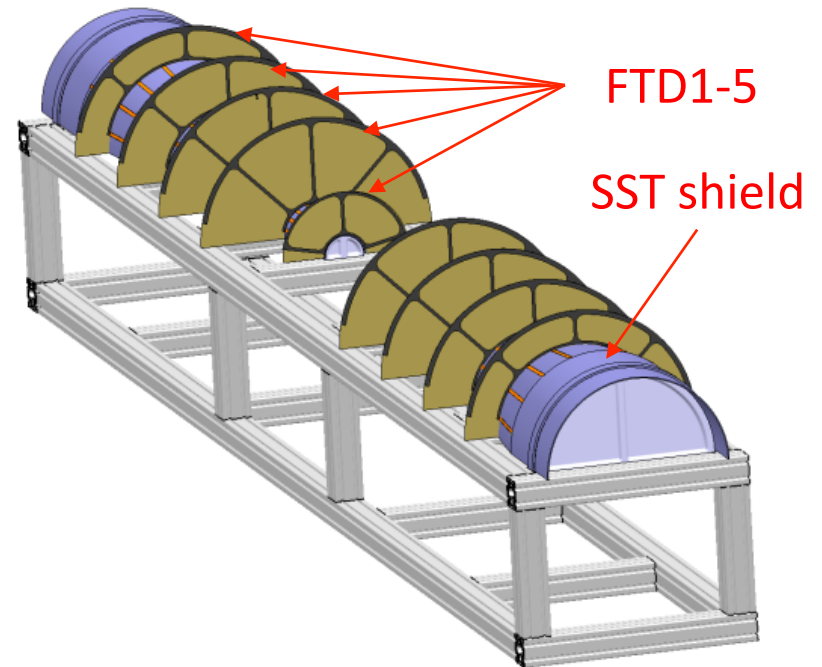


VXE petal support



SST shield supports

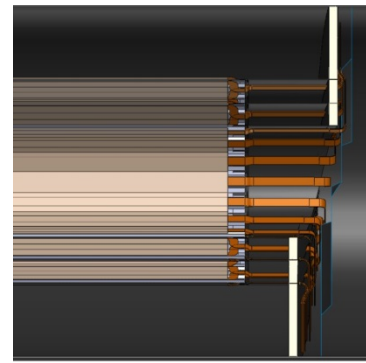
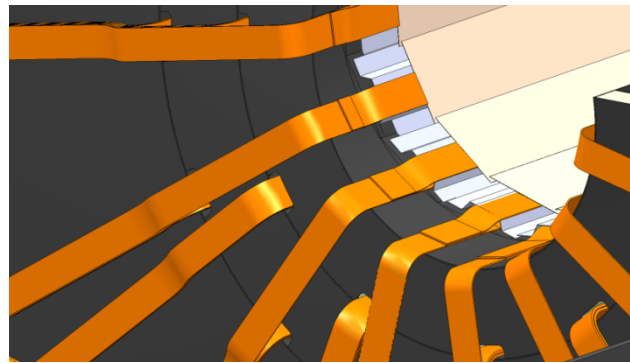
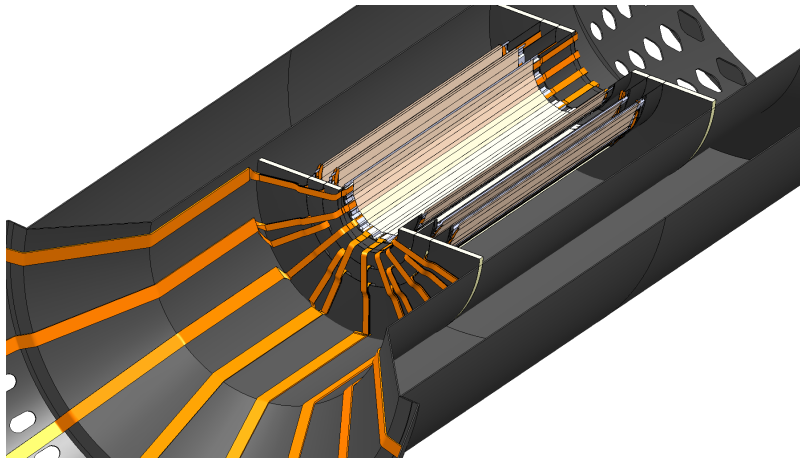
Outer support cylinder



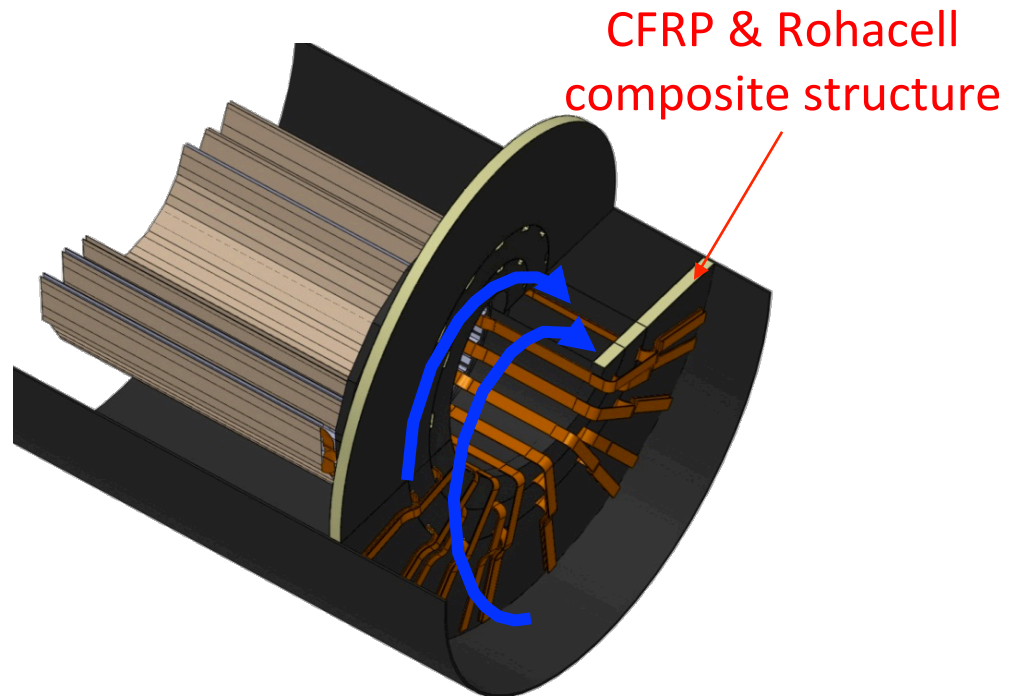
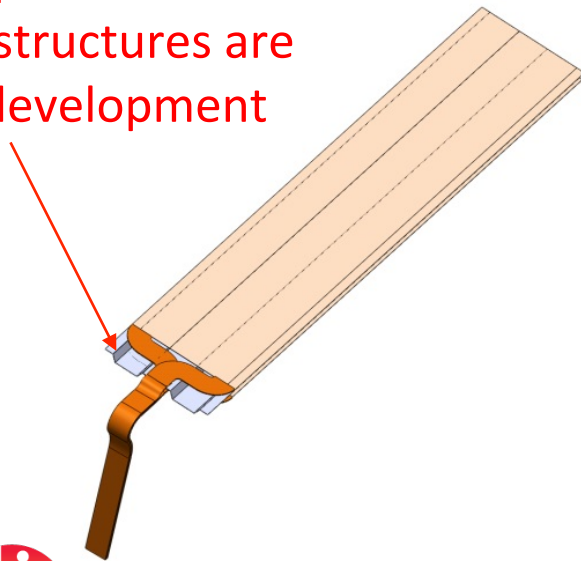
FTD1-5

SST shield

Mechanical support



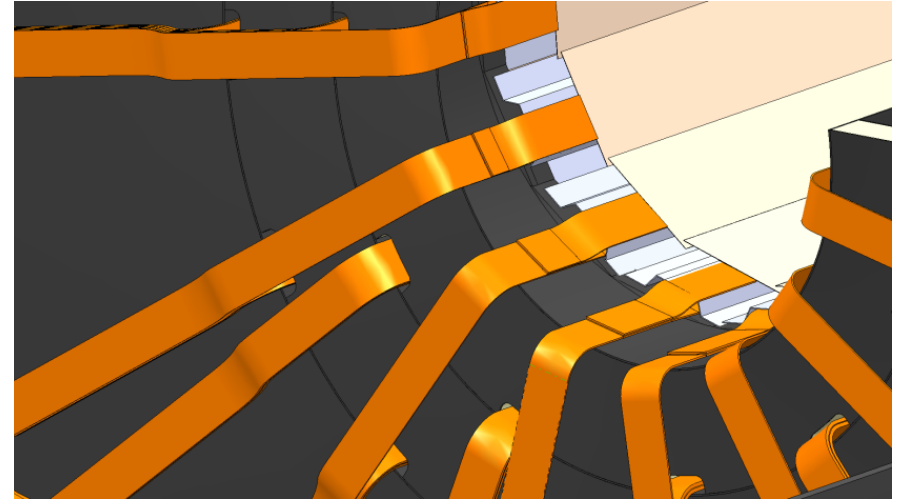
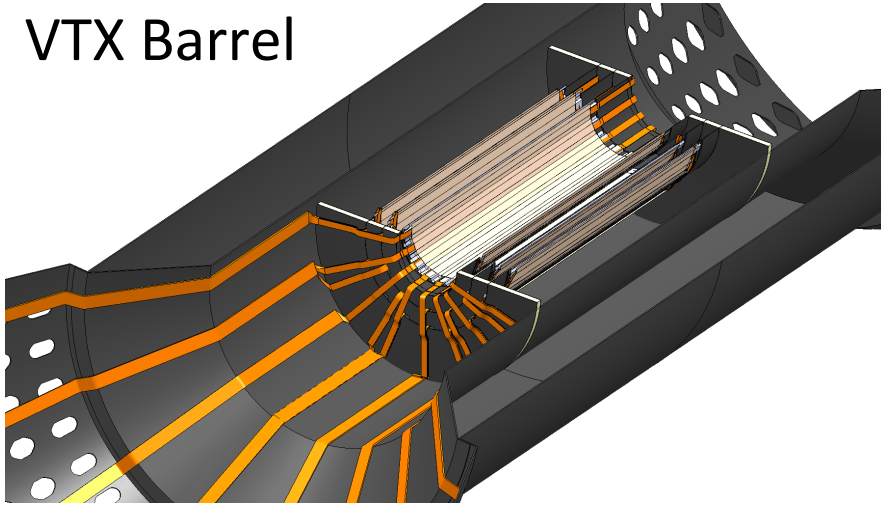
Prototypes of ladder support structures are under development



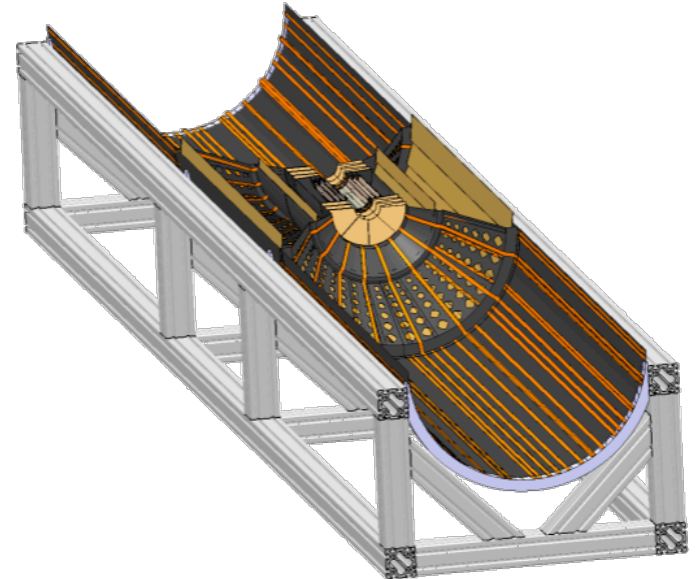
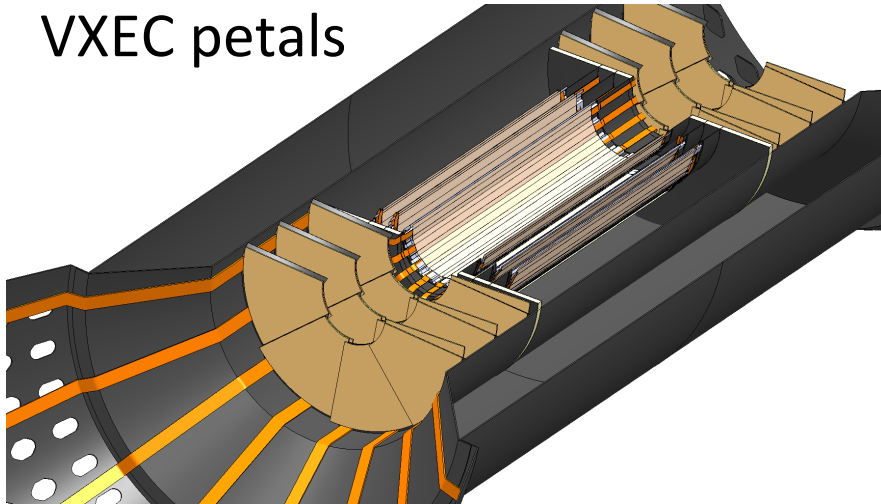
CFRP & Rohacell composite structure

Services

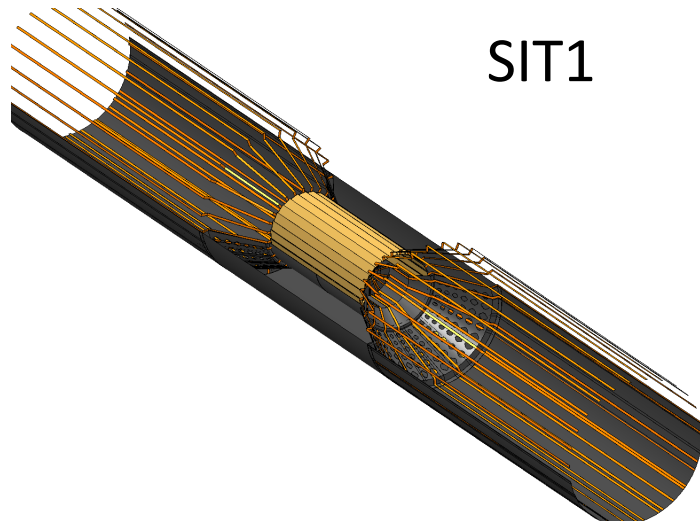
VTX Barrel



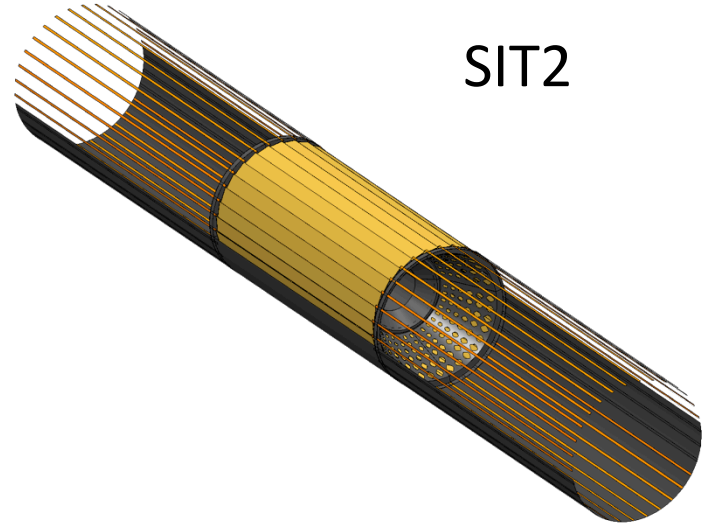
VXEC petals



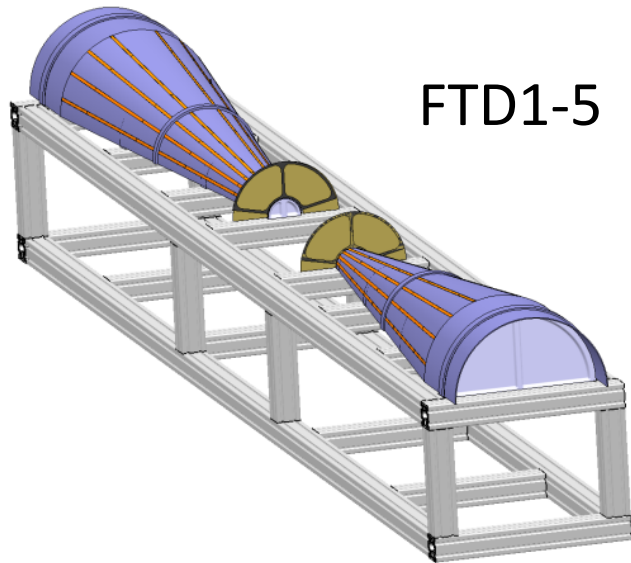
Services



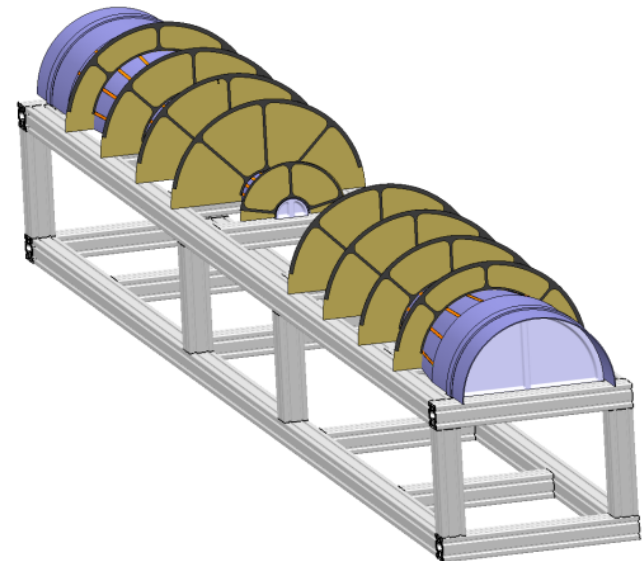
SIT1



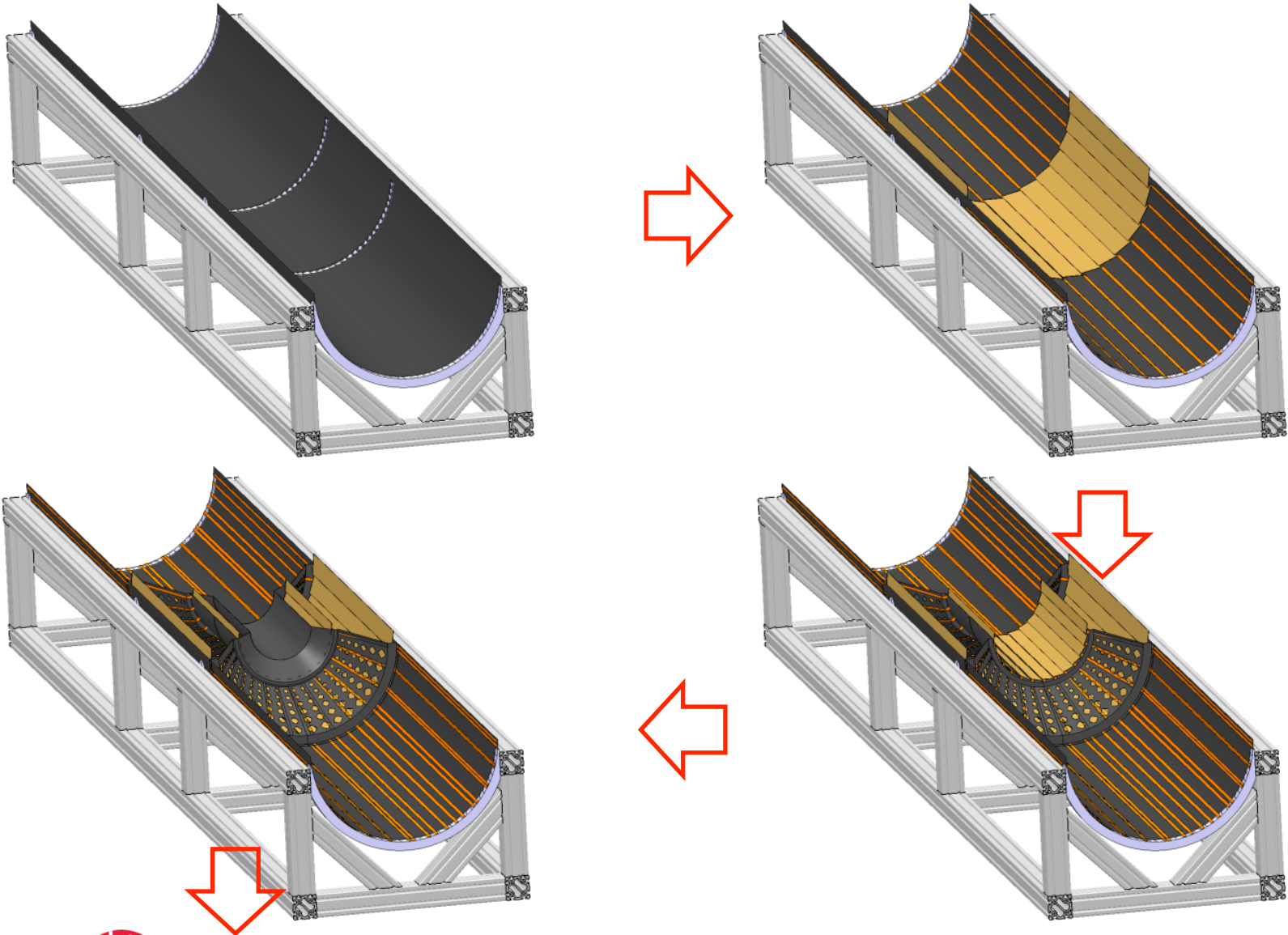
SIT2



FTD1-5

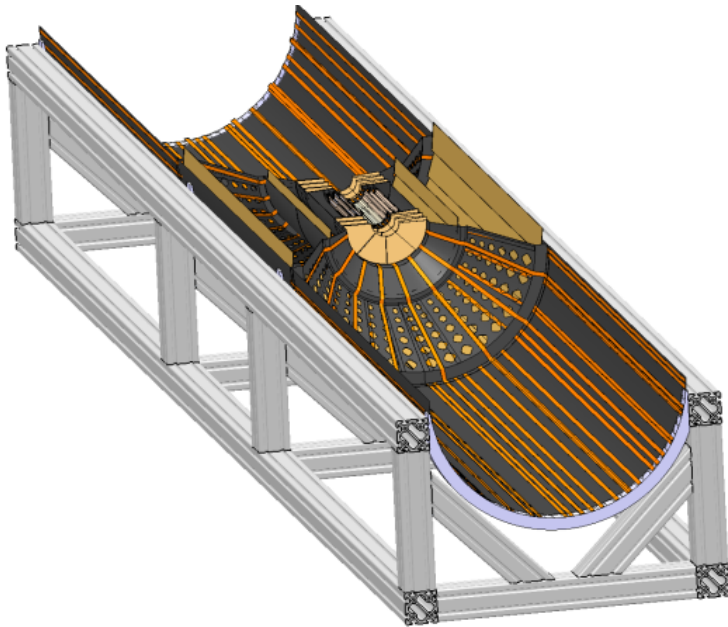
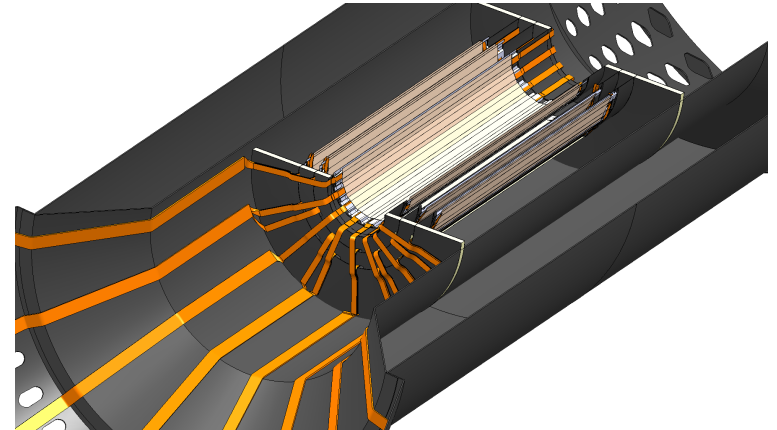
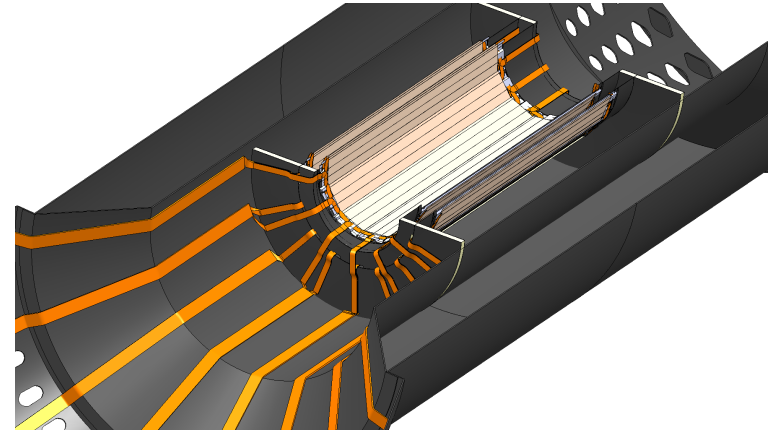
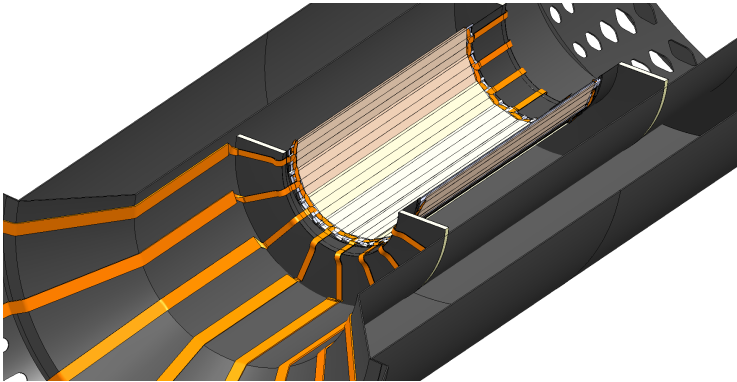


Sub-assembly #1

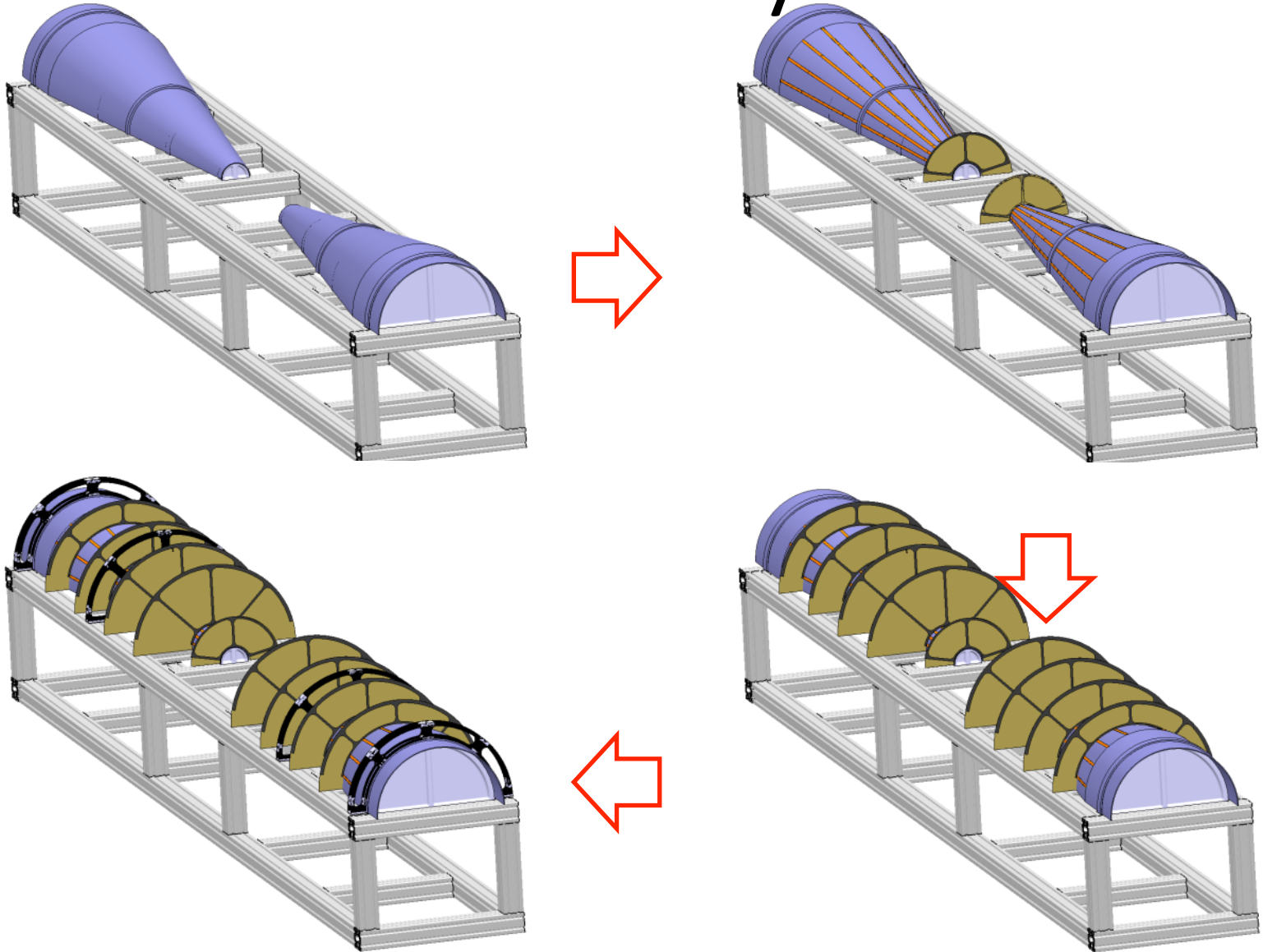




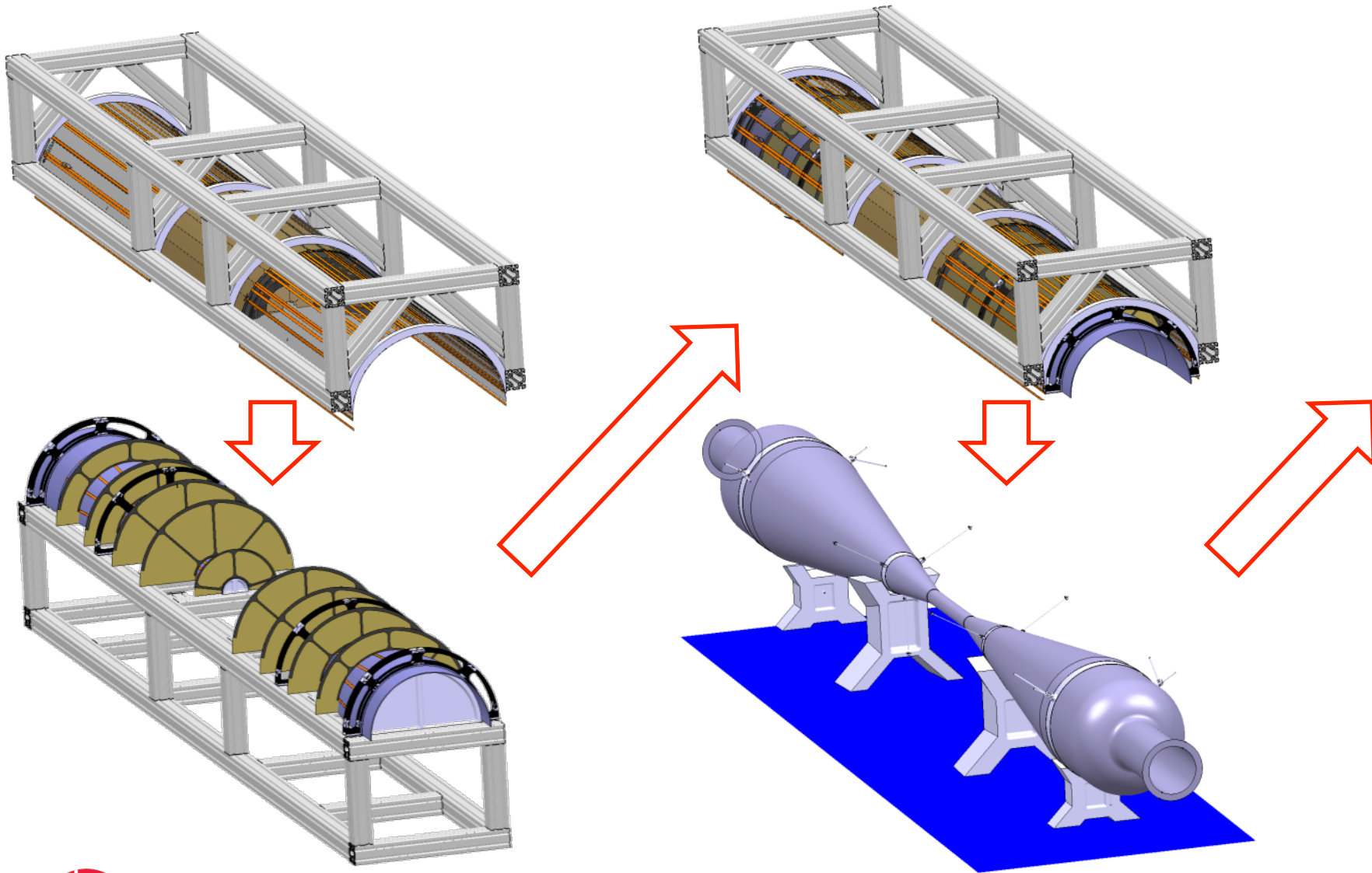
Sub-assembly #1



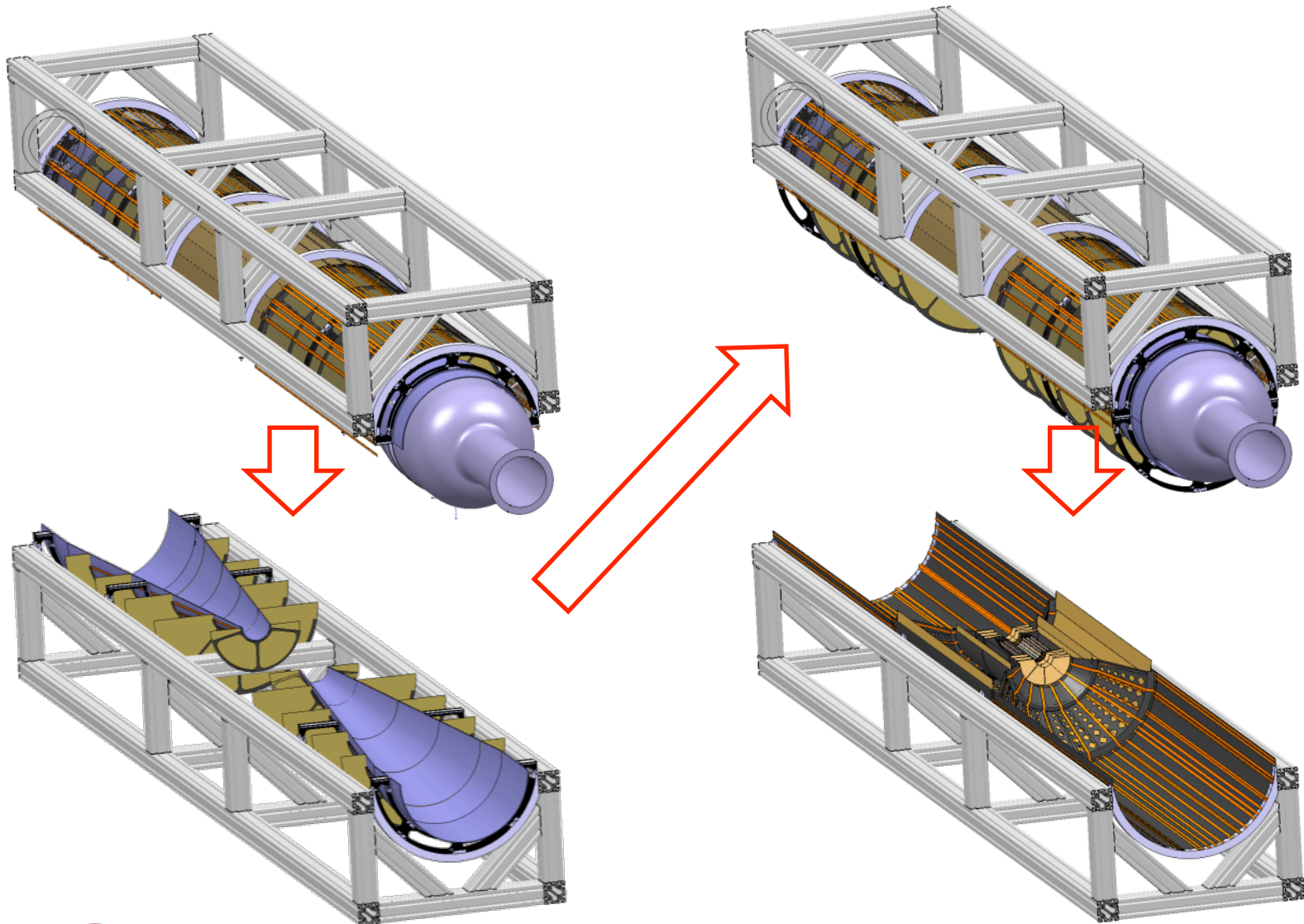
Sub-assembly #2



Final assembly



Final assembly



Summary (1)

- Engineering studies on cooling, mechanical support and integration are underway;
- An air cooling approach has been developed:
 - Simulations indicate that air cooling is feasible (provided that power pulsing is possible);
 - Next steps will involve small scale prototype testing;
- Mechanical support solutions that are compatible with cooling approach have been designed:
 - Small scale prototypes are being developed (emphasis on low mass solutions for the ladder support structures);
 - Air induced vibration amplitudes are unknown (testing is foreseen);

Summary (2)

- Integration of inner region with the rest of the detector not yet addressed (air supply, cable routing, CFRP tube support insertion, ...);
- Layout of services inside the inner region has started:
 - Working in parallel with power delivery studies;
 - Air flow degradation due to cables layout is unknown (large scale cooling tests will help us evaluate their impact);
- Modular assembly sequence has been defined.

Thank You.