FCC-HH EXPERIMENT

INTEGRATION PROCEDURE

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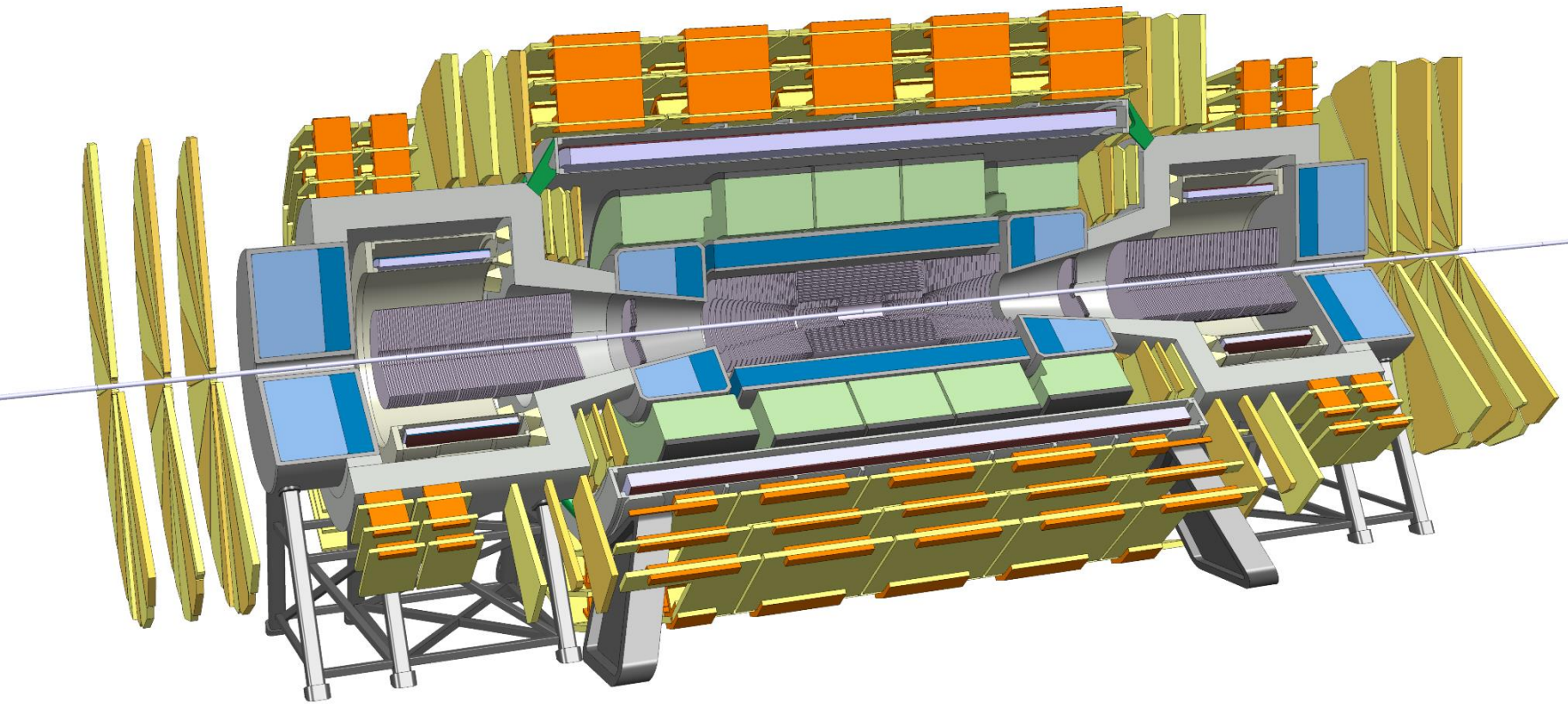
FCC collaboration,

FCC hadron detector meeting

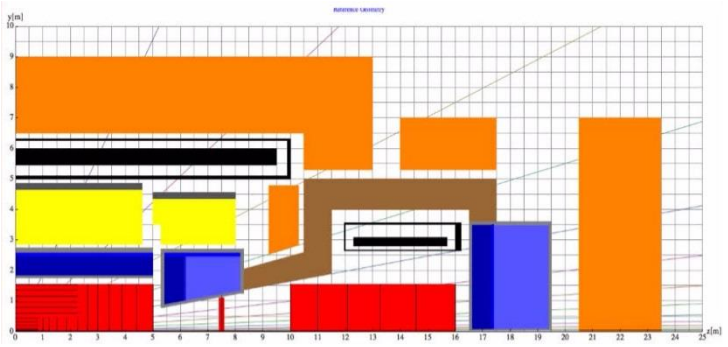
5 April 2017

Detector overview

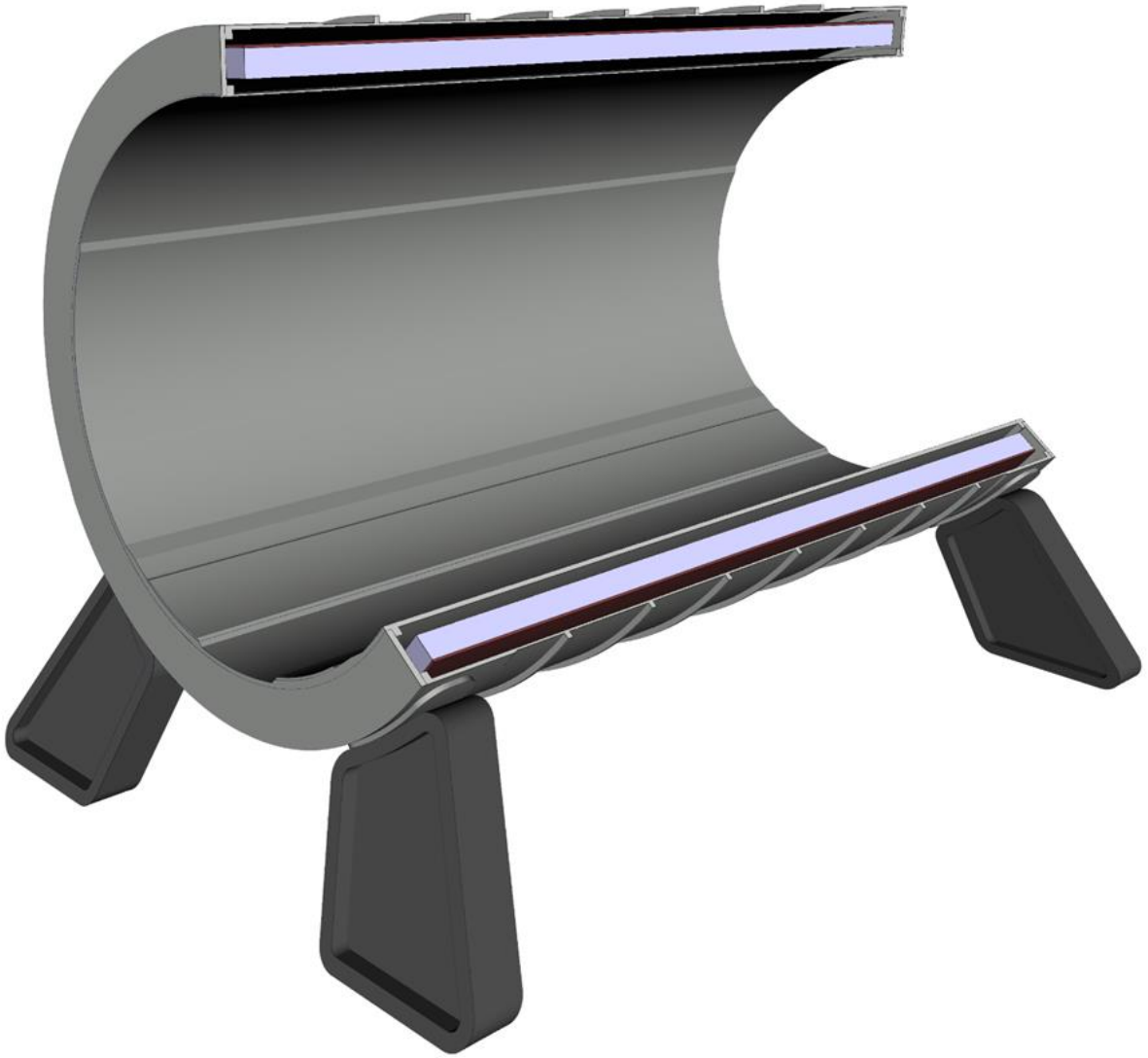


Changes:

- Inner tracker and forward tracker
- Inner and forward E-cal
- Force transfer between forward and main solenoids

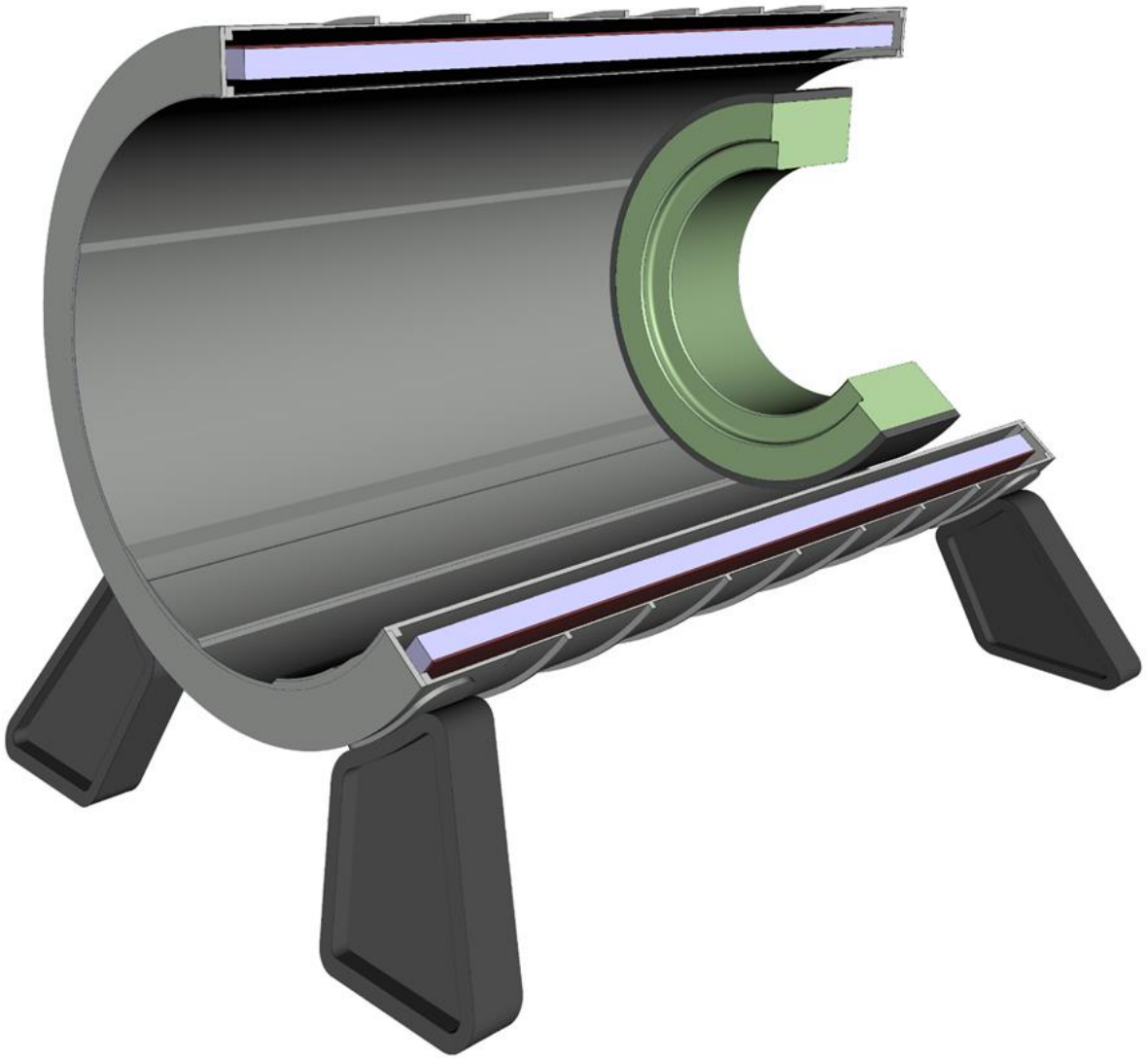


EXPERIMENT INTEGRATION



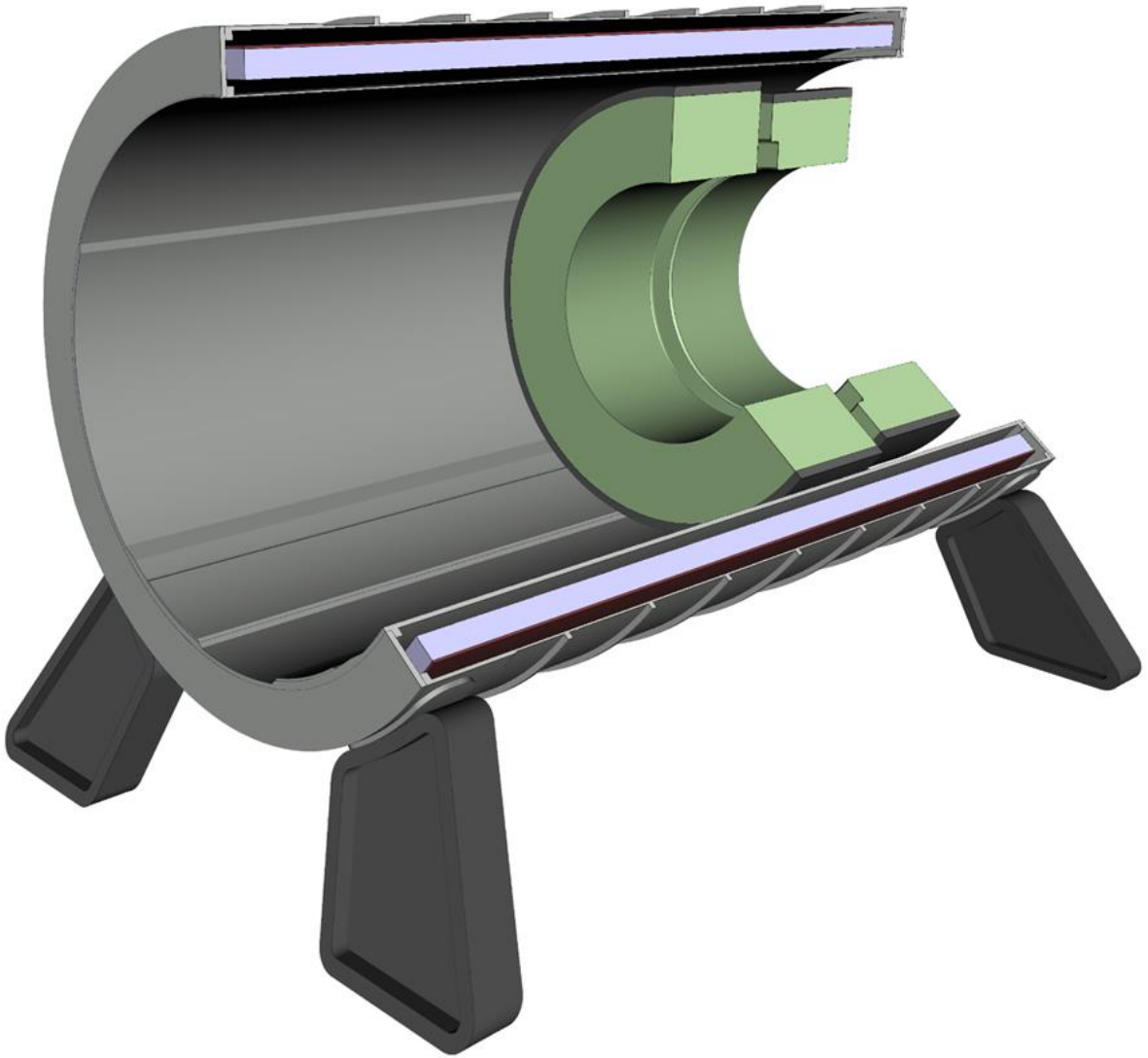
1 - Install Central Solenoid

EXPERIMENT INTEGRATION



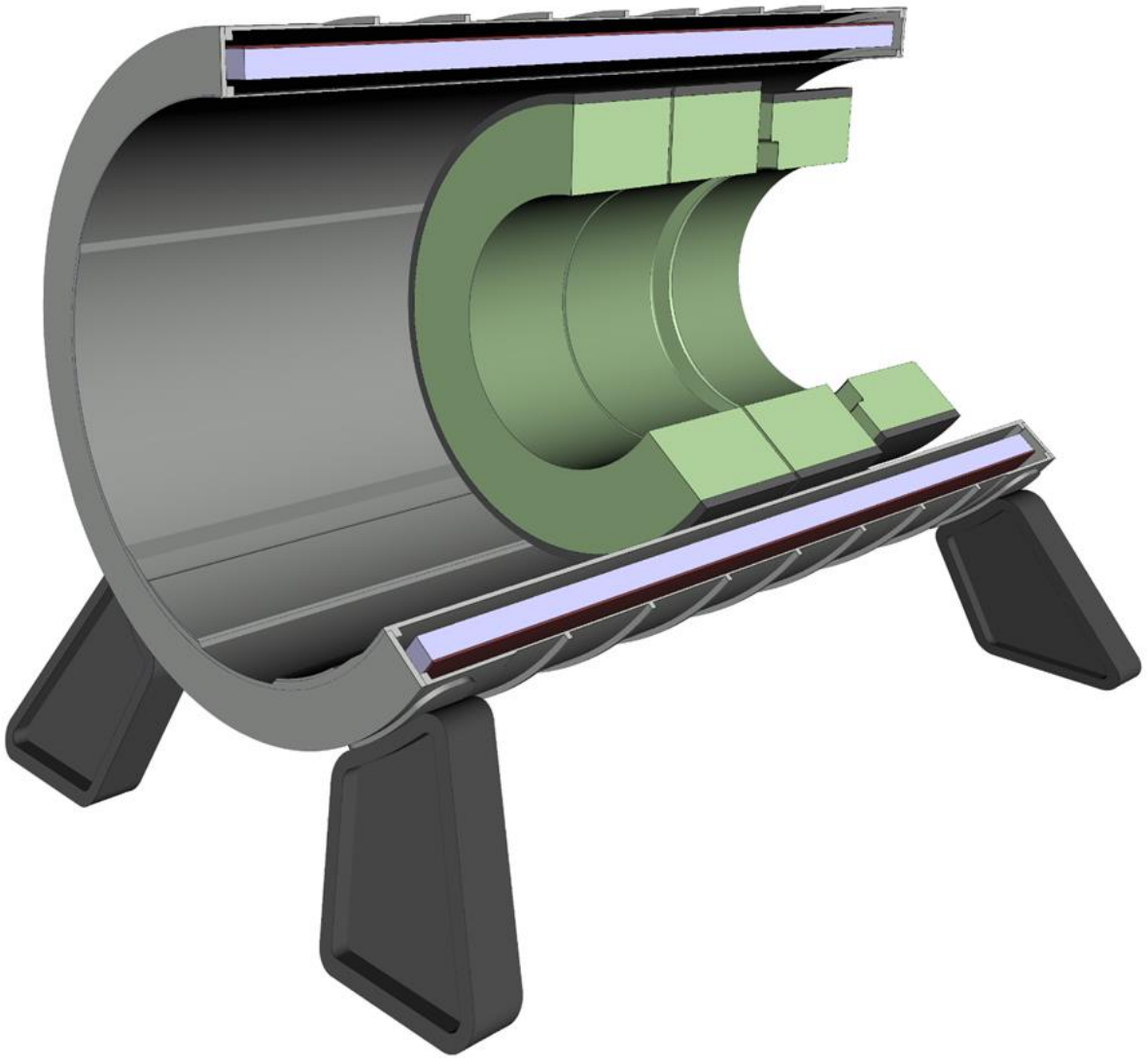
2 - Install 1st HCal module

EXPERIMENT INTEGRATION



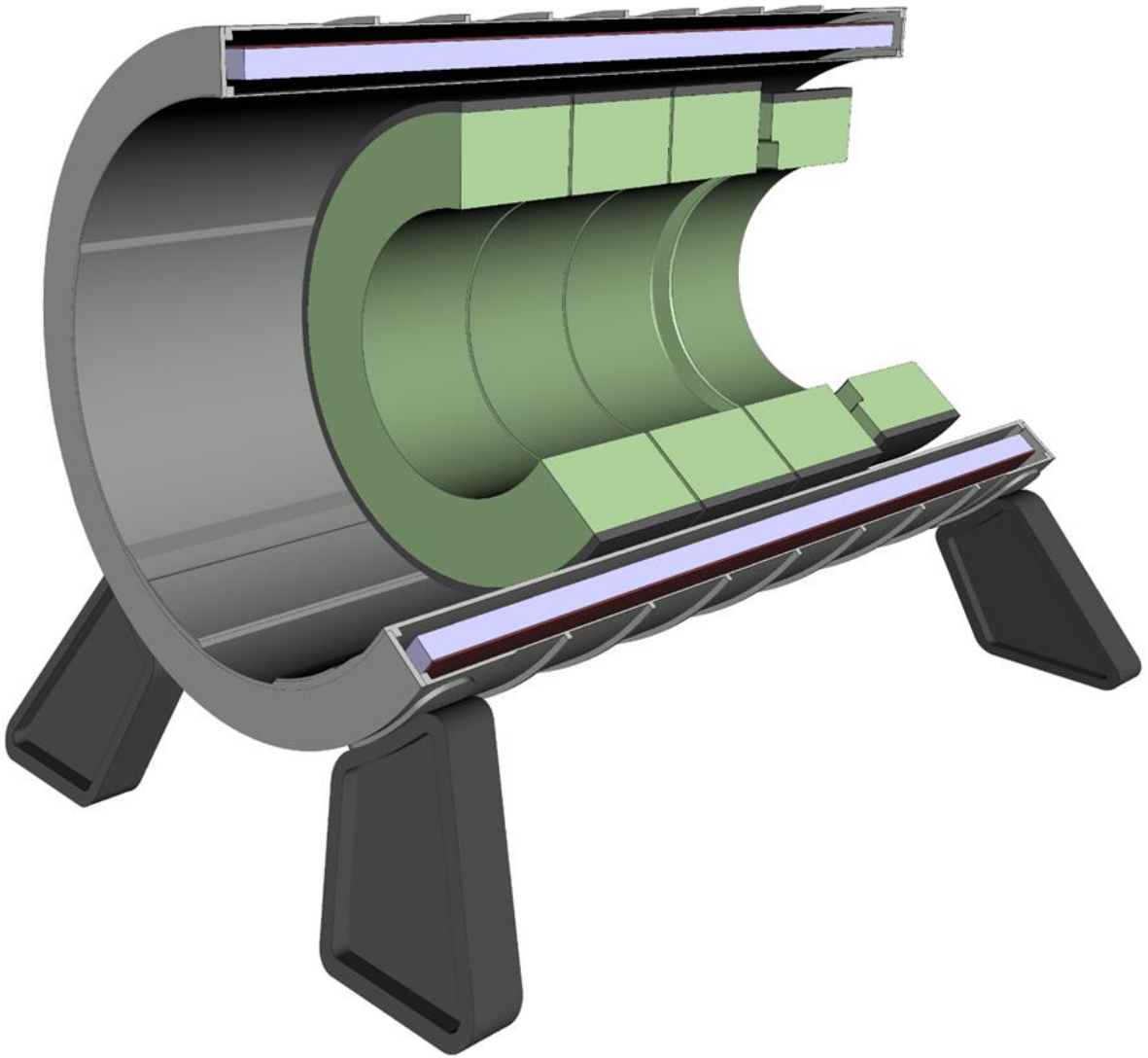
3 - Install 2nd HCal module

EXPERIMENT INTEGRATION



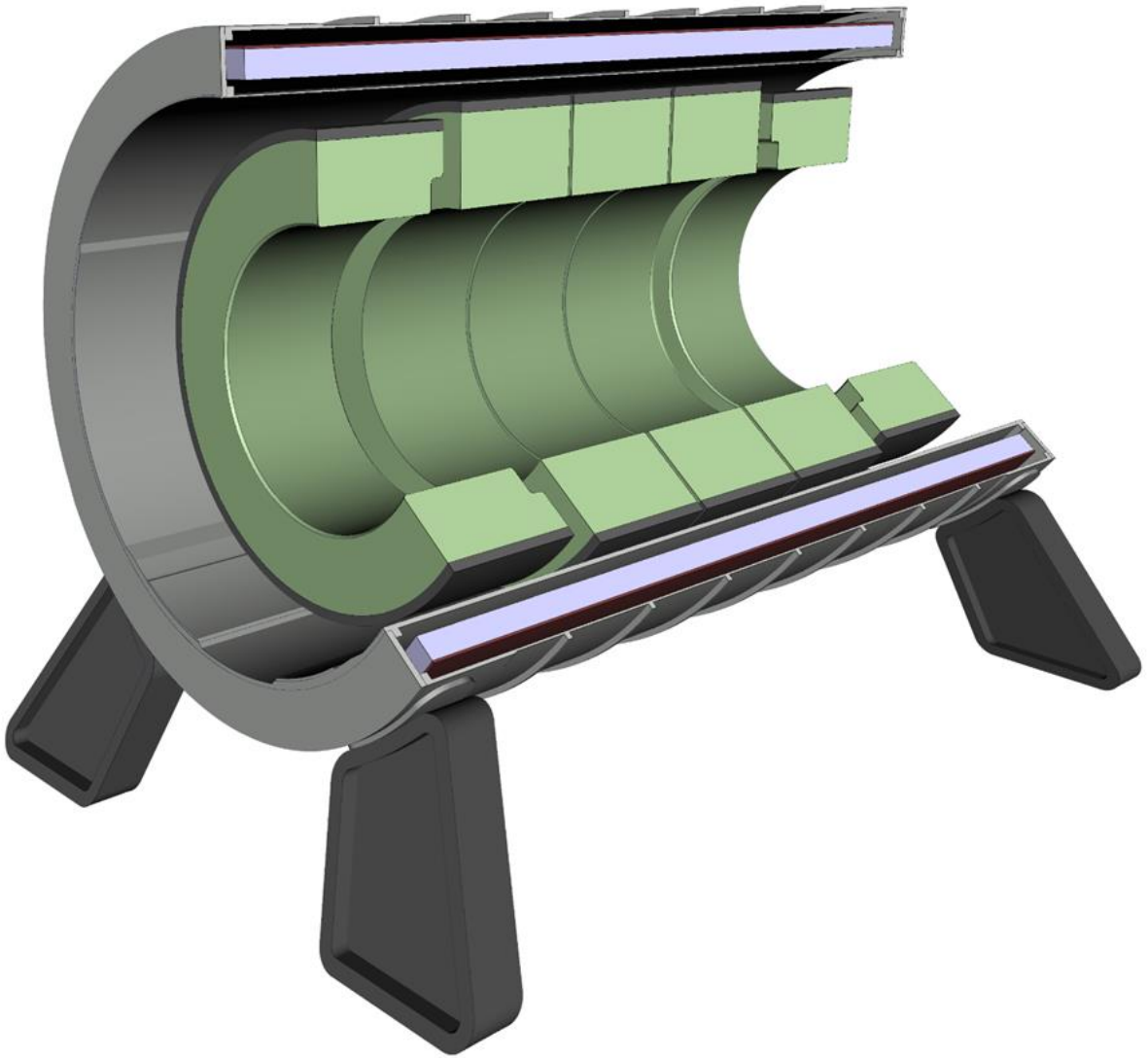
4 - Install 3rd HCal module

EXPERIMENT INTEGRATION



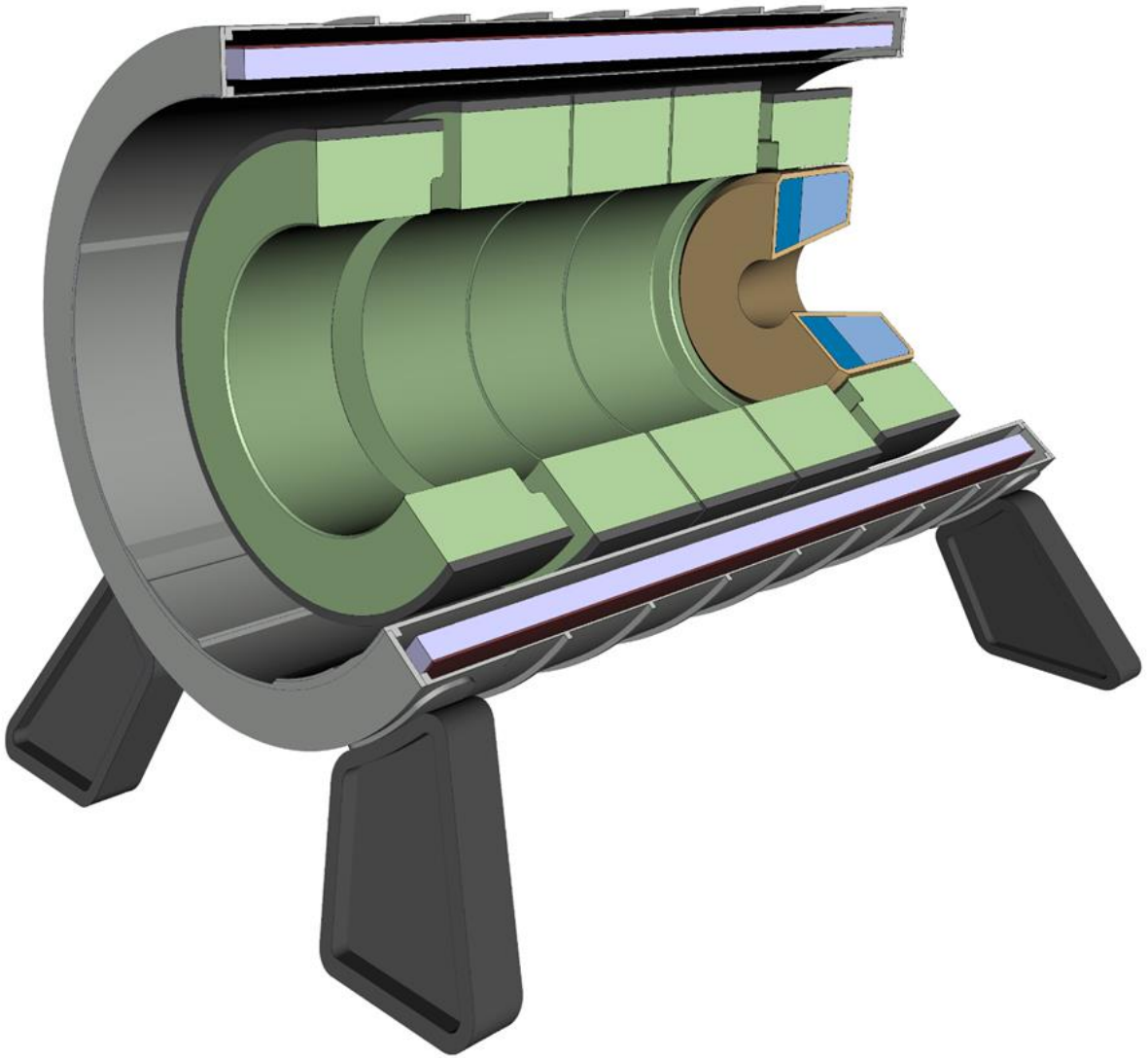
5 - Install 4th HCal module

EXPERIMENT INTEGRATION



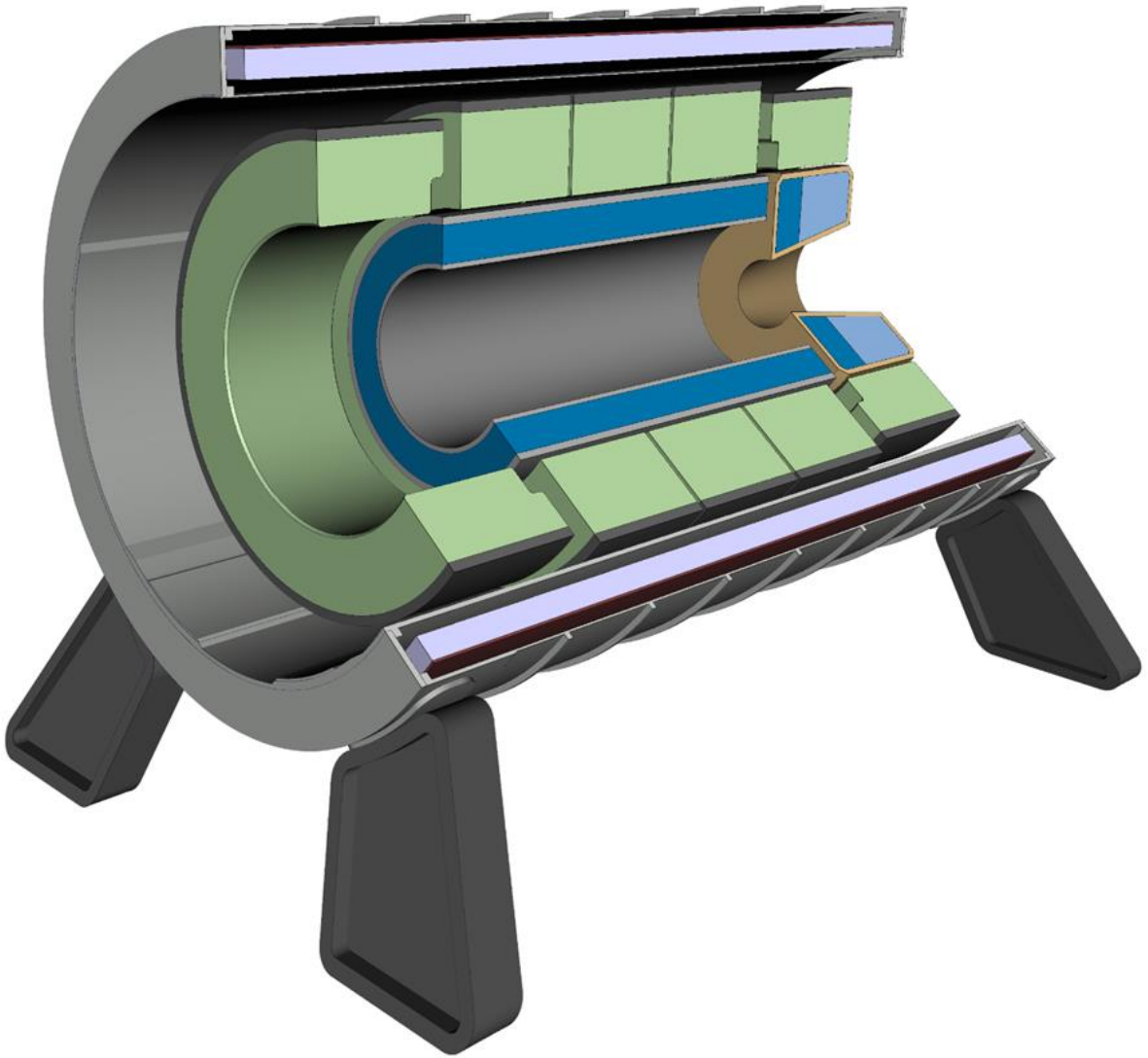
6 - Install 5th HCal module

EXPERIMENT INTEGRATION



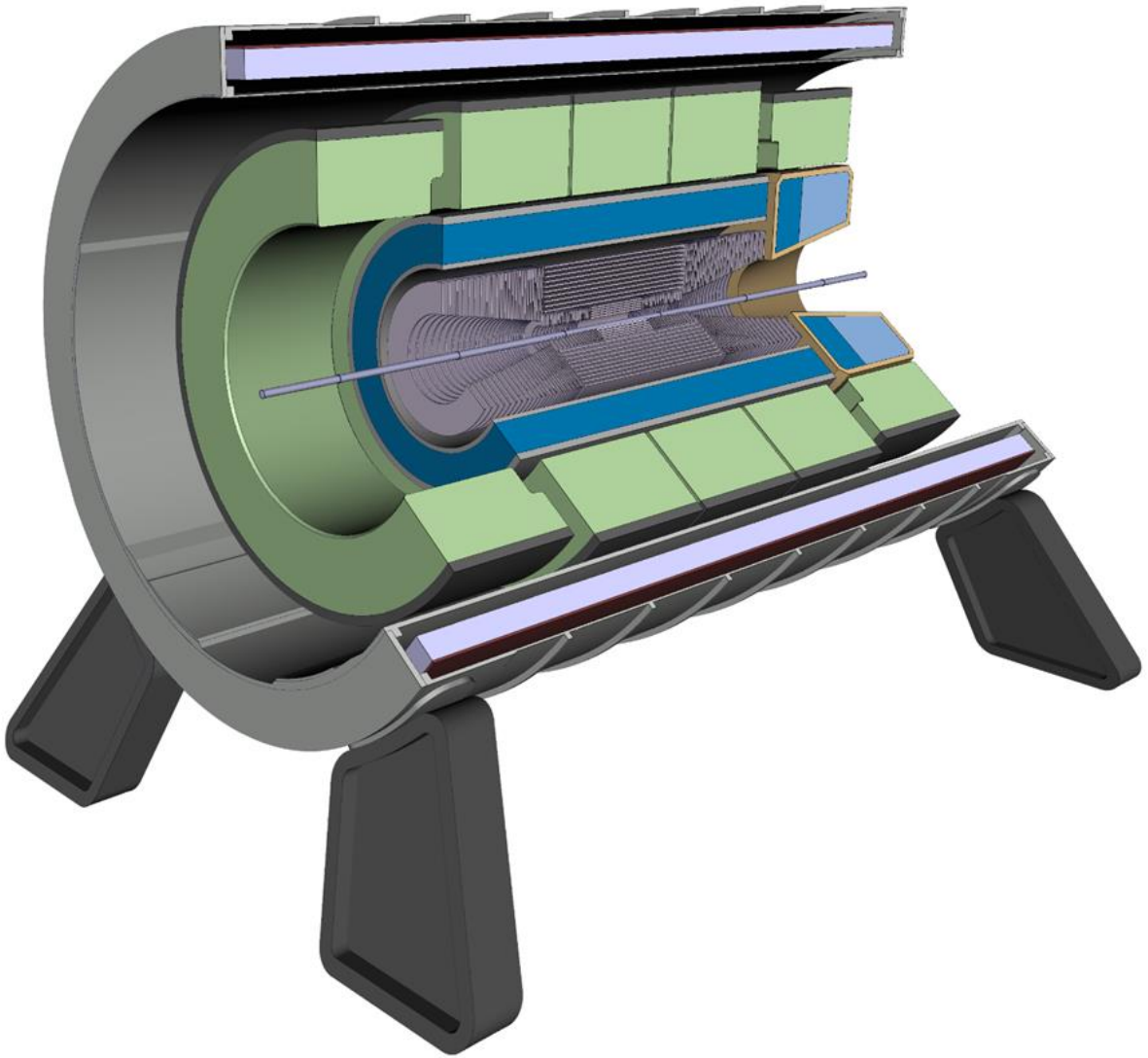
7 - Install 1st ECal module

EXPERIMENT INTEGRATION



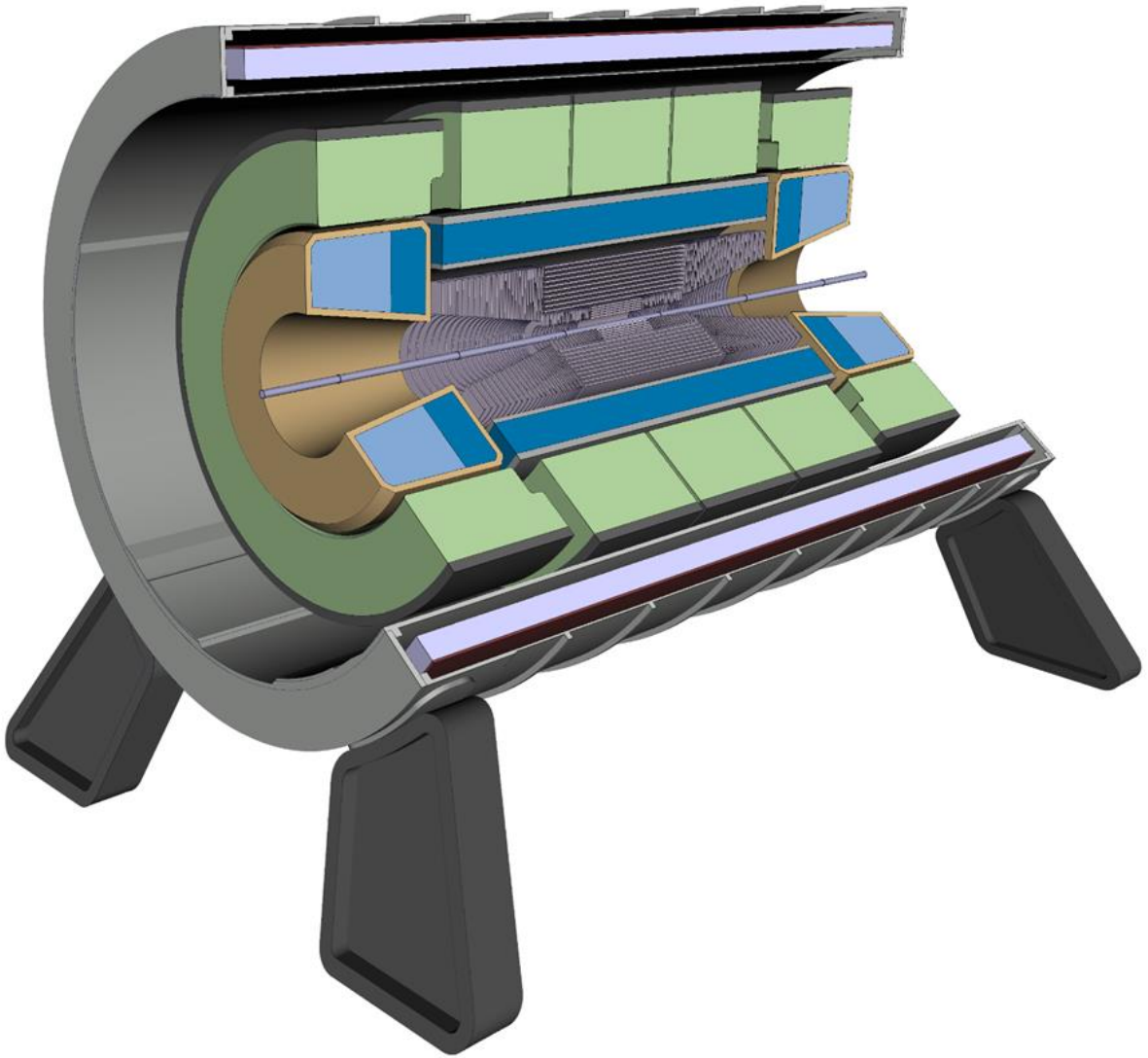
8 - Install 2nd ECal module

EXPERIMENT INTEGRATION



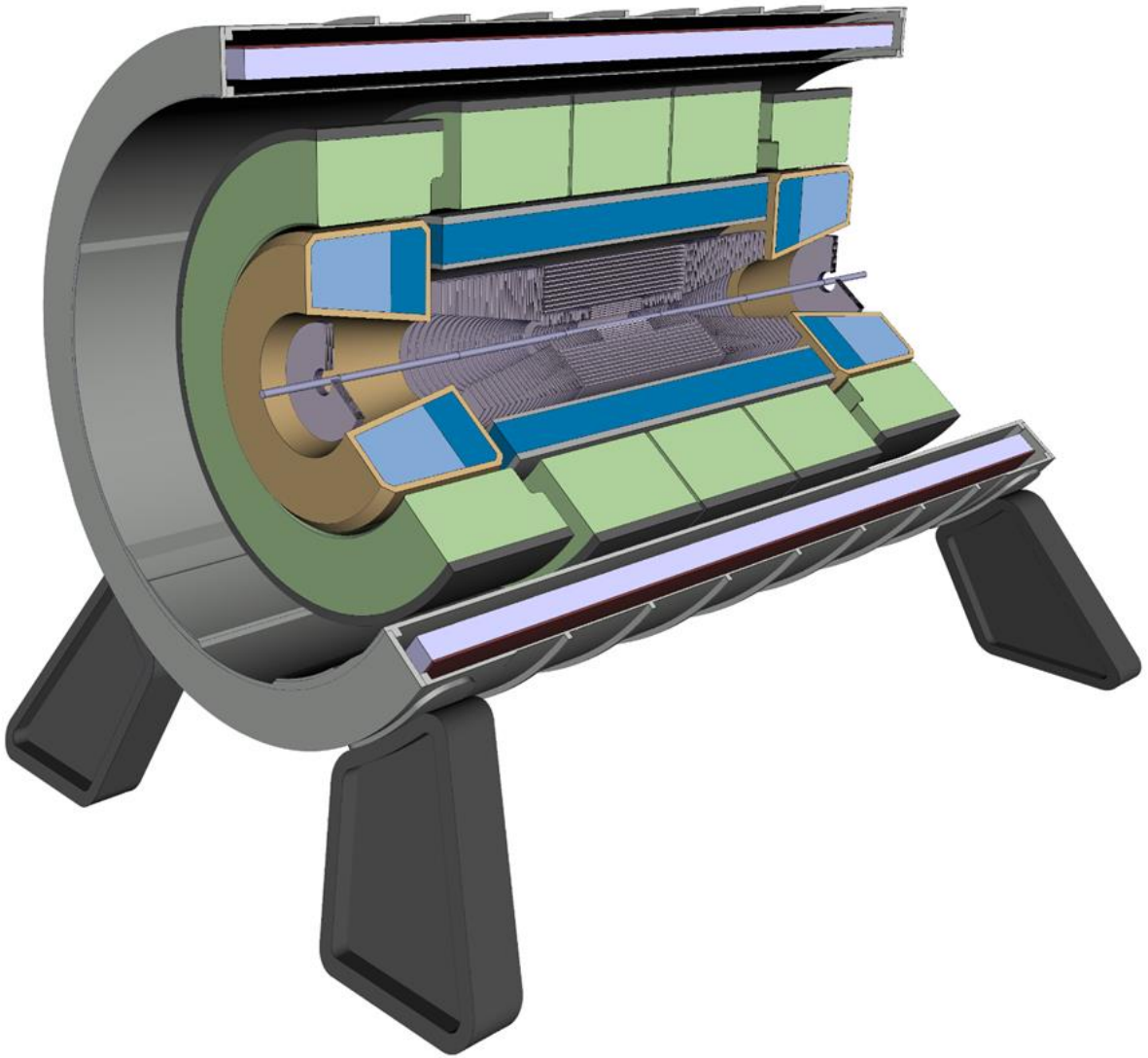
9 - Install Inner Tracker

EXPERIMENT INTEGRATION



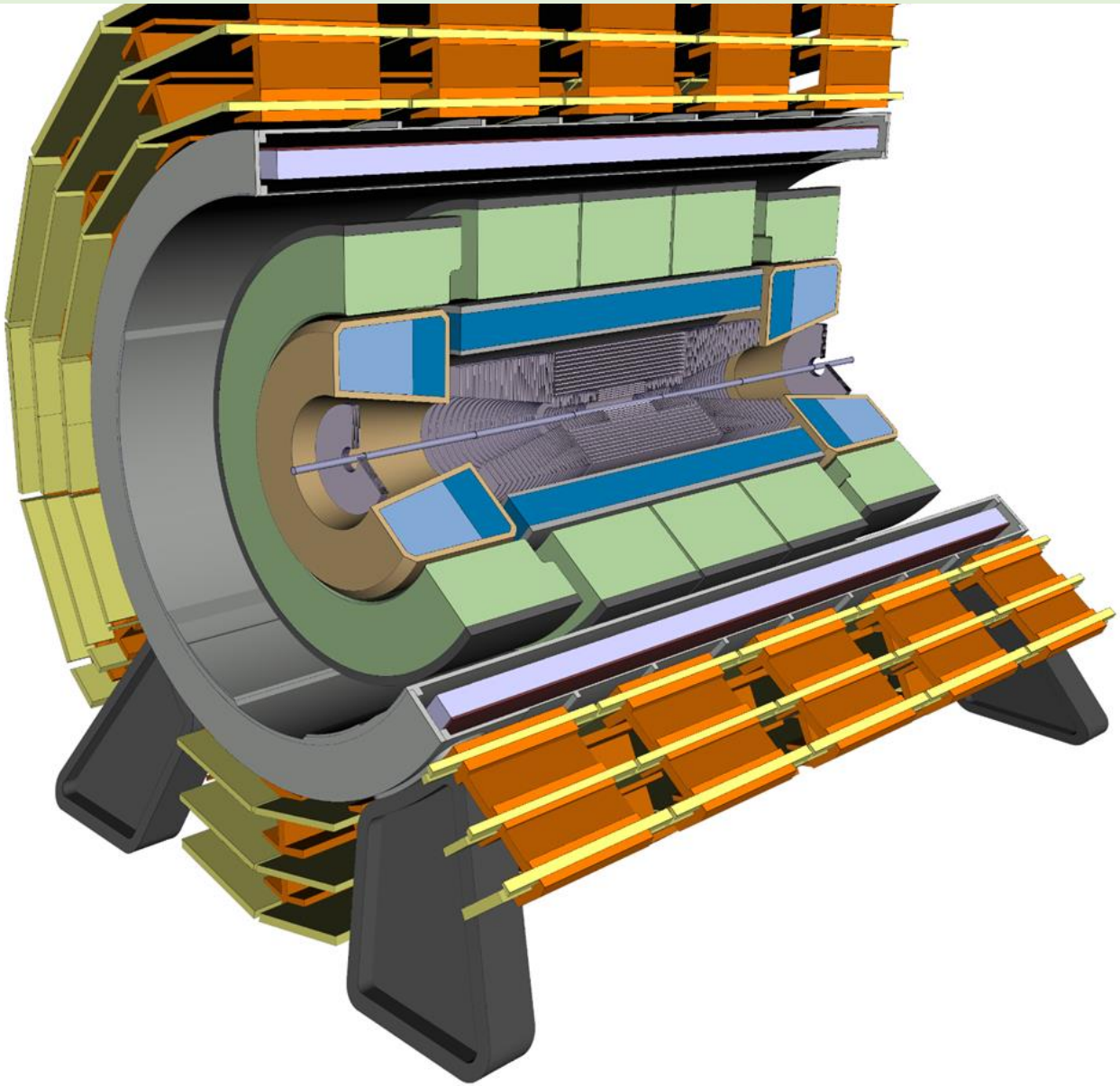
10 - Install 3rd ECal module

EXPERIMENT INTEGRATION



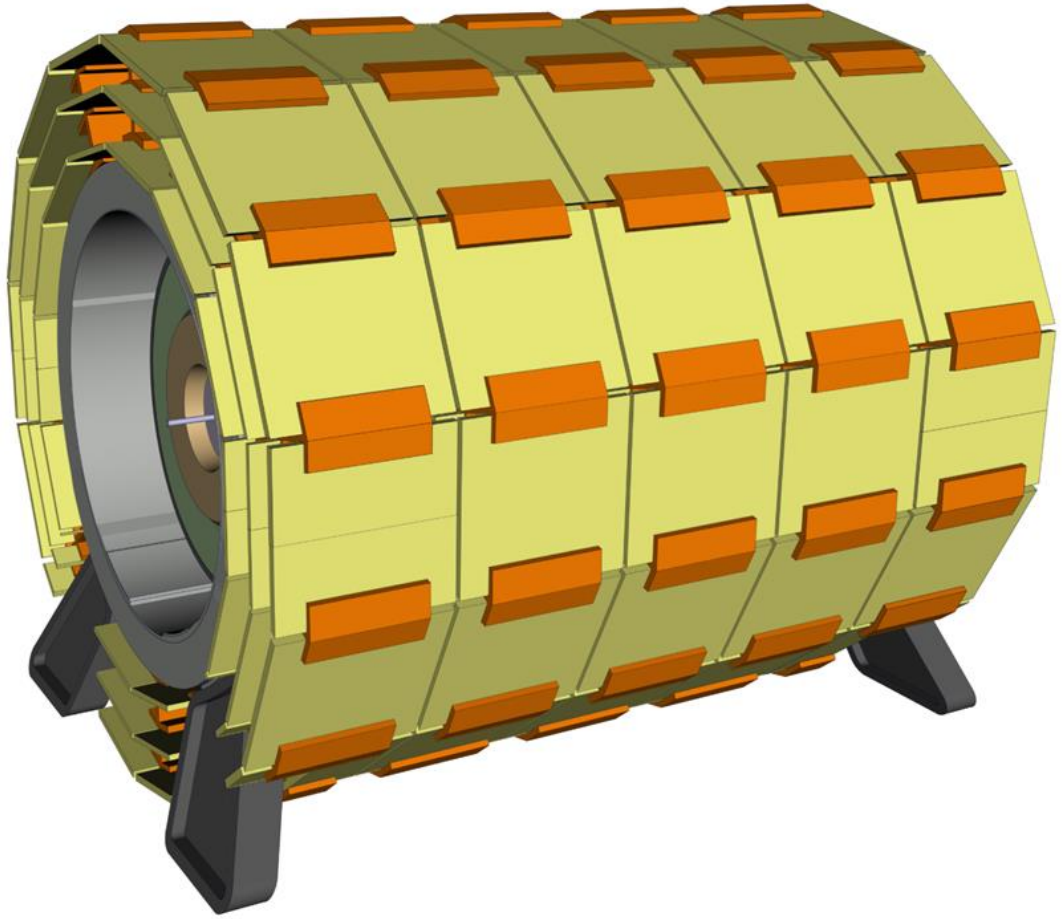
11 - Install 1st Forward Tracker module

EXPERIMENT INTEGRATION



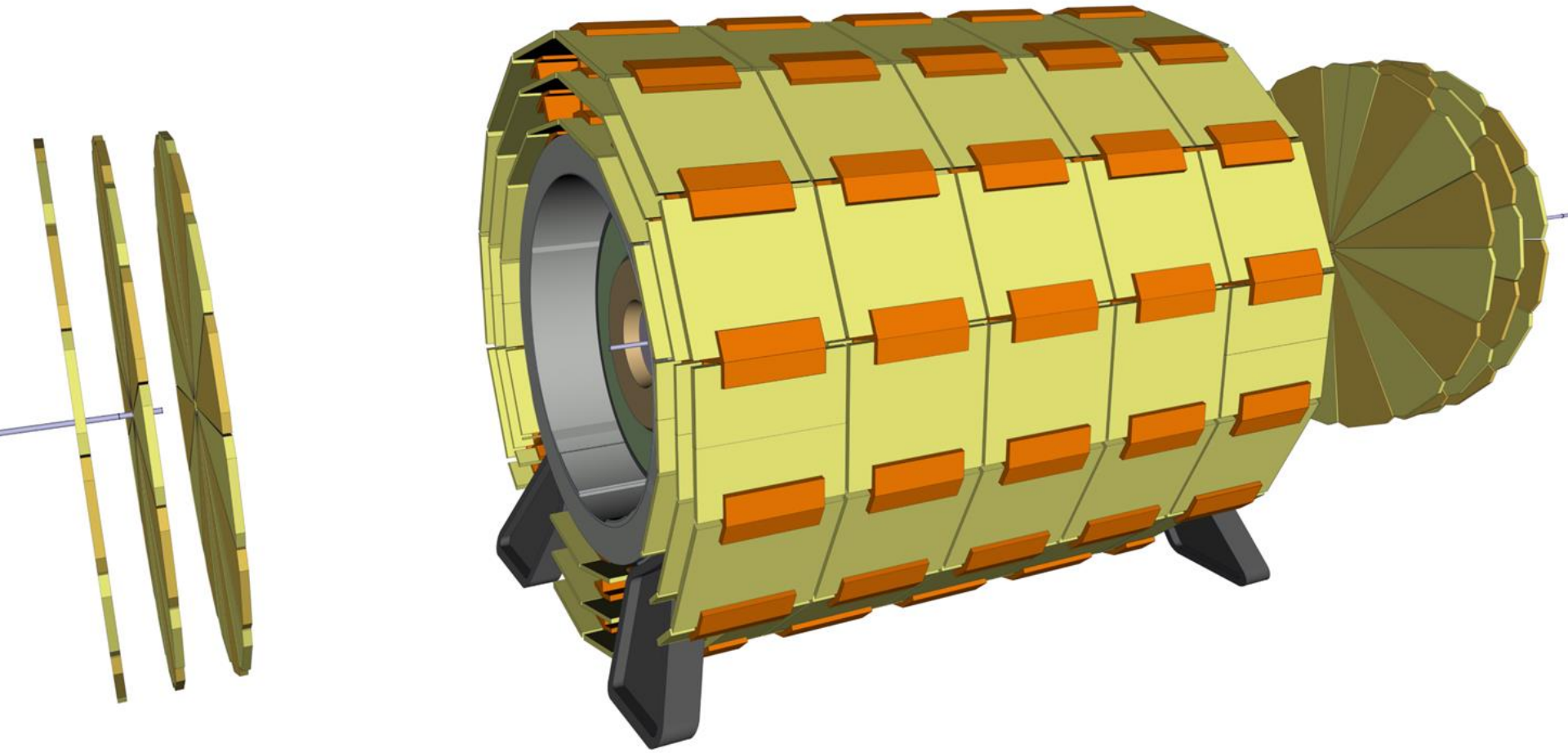
12 - Install Muon Chambers onto the solenoid

EXPERIMENT INTEGRATION



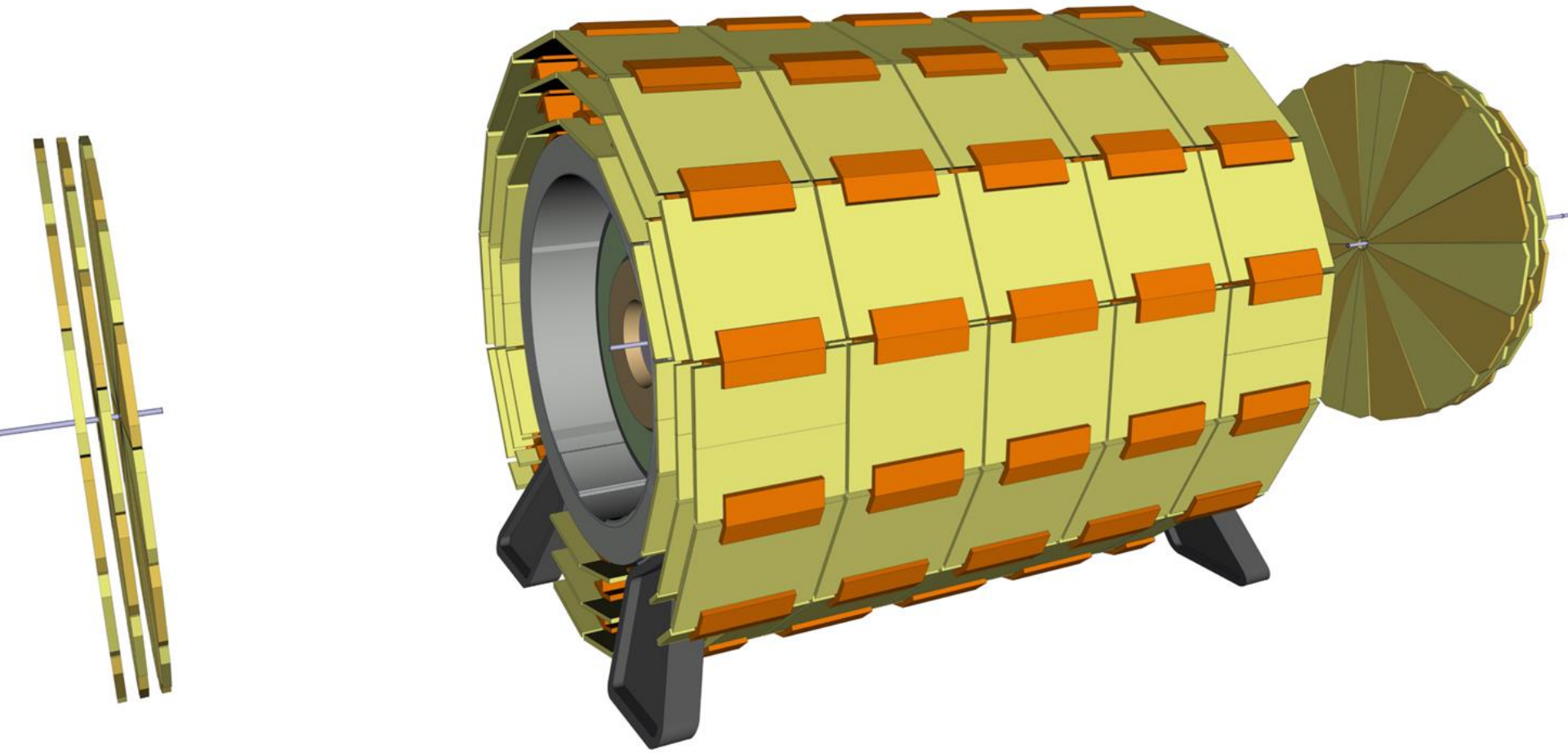
12 - Install Muon Chambers onto the solenoid

EXPERIMENT INTEGRATION



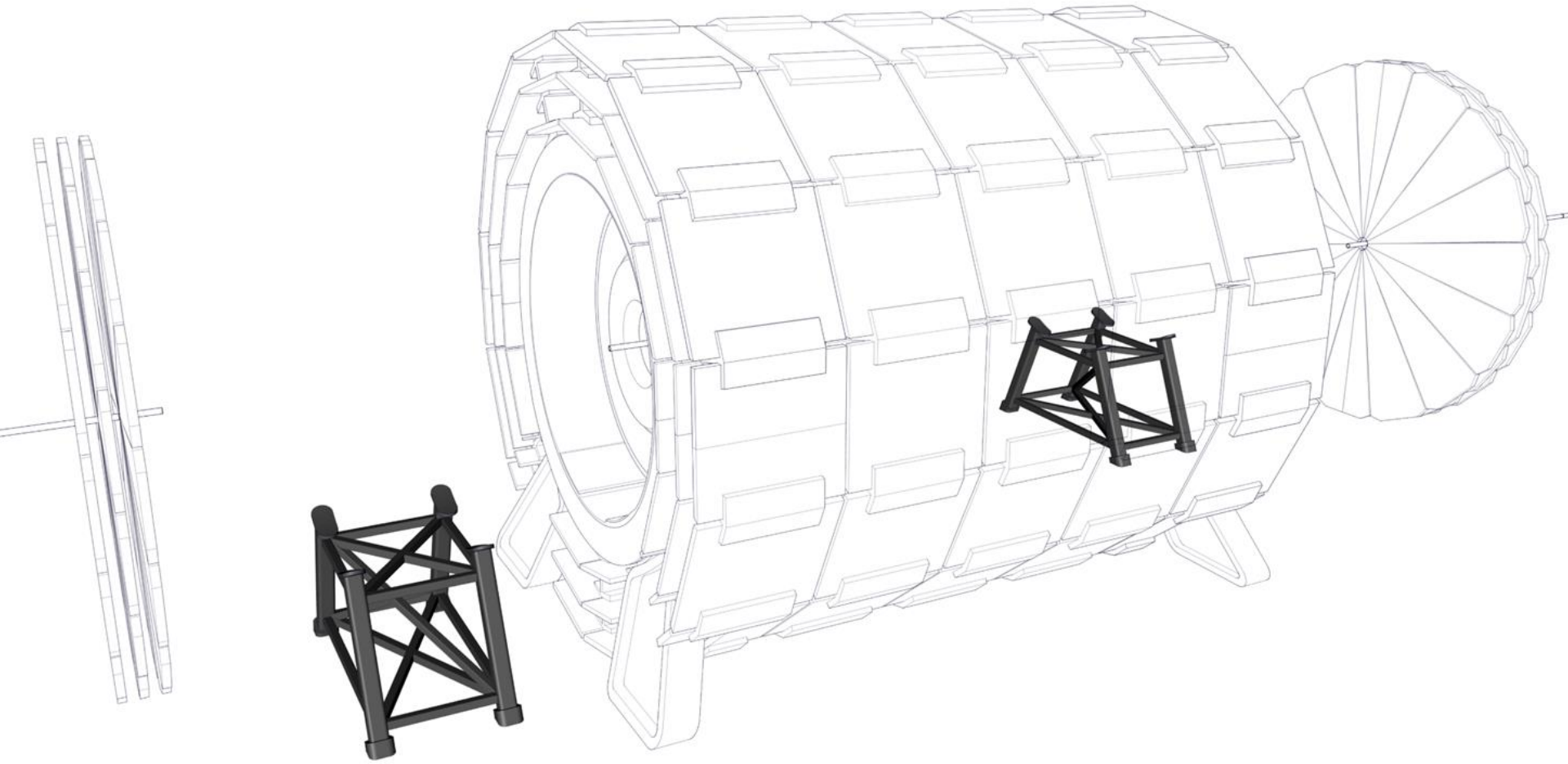
13 – Install Forward Muon Chambers

EXPERIMENT INTEGRATION



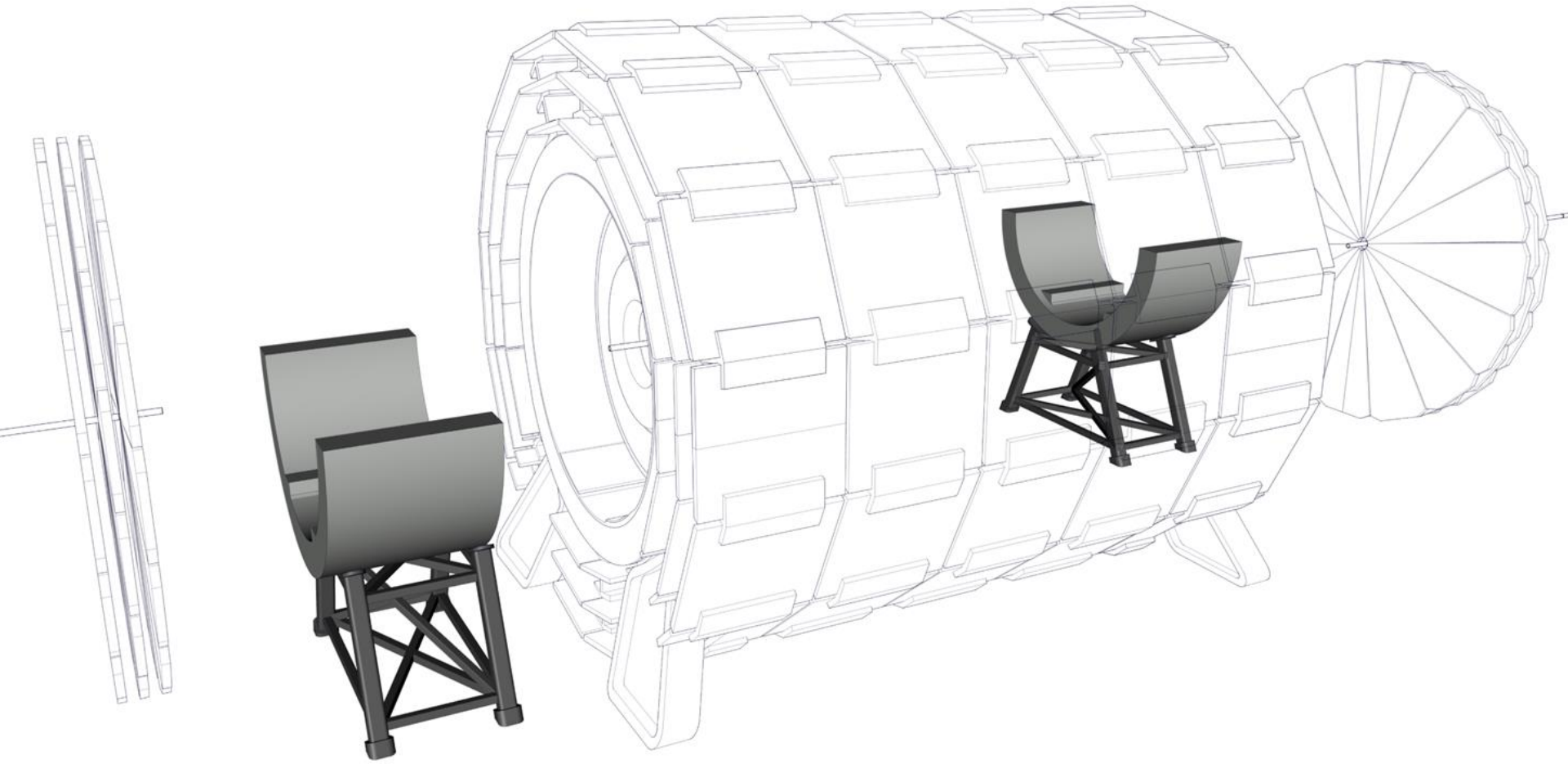
14 – Compact the Forward Muon Chambers

EXPERIMENT INTEGRATION



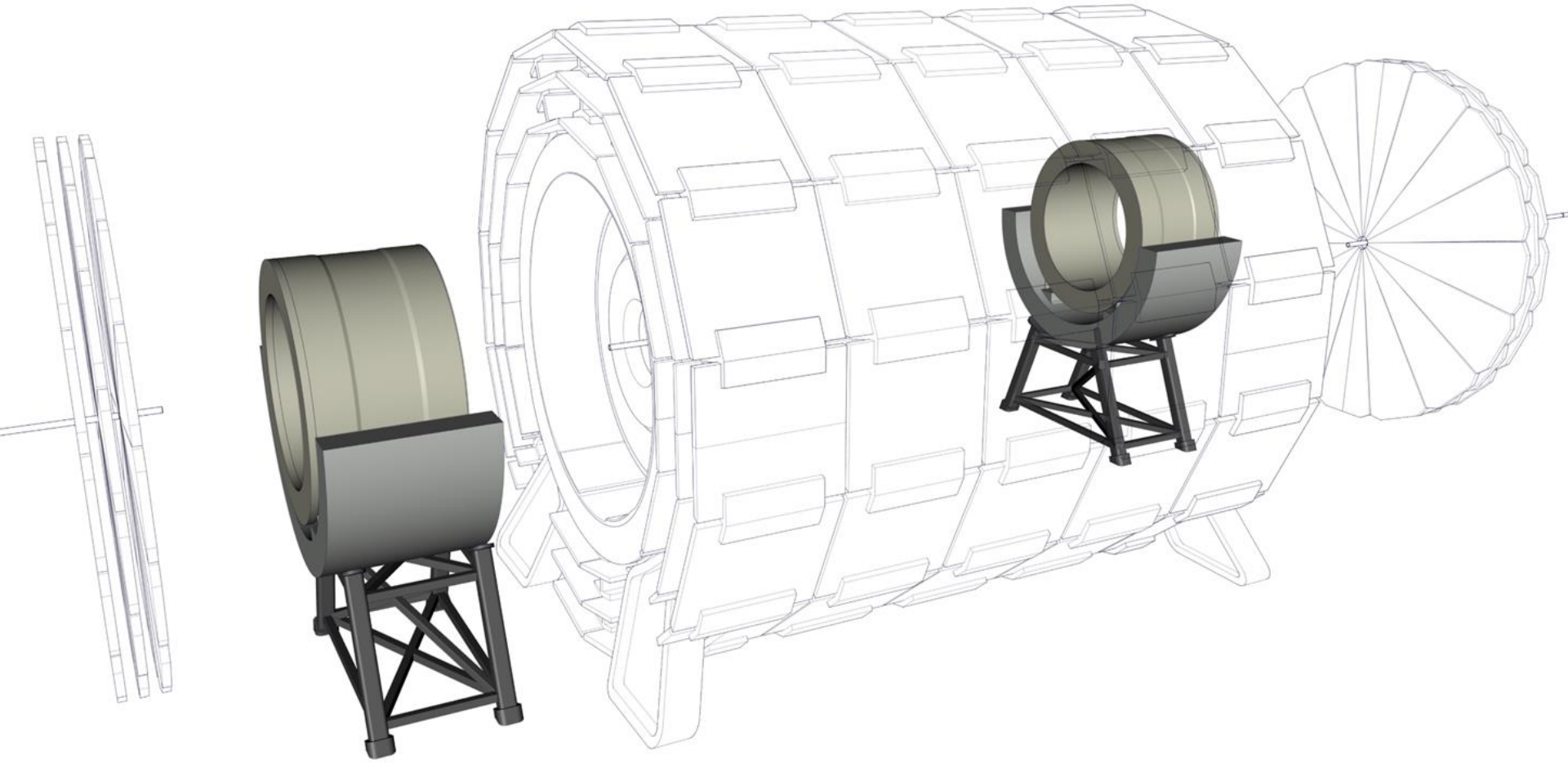
15 – Install the Forward Solenoid support structure

EXPERIMENT INTEGRATION



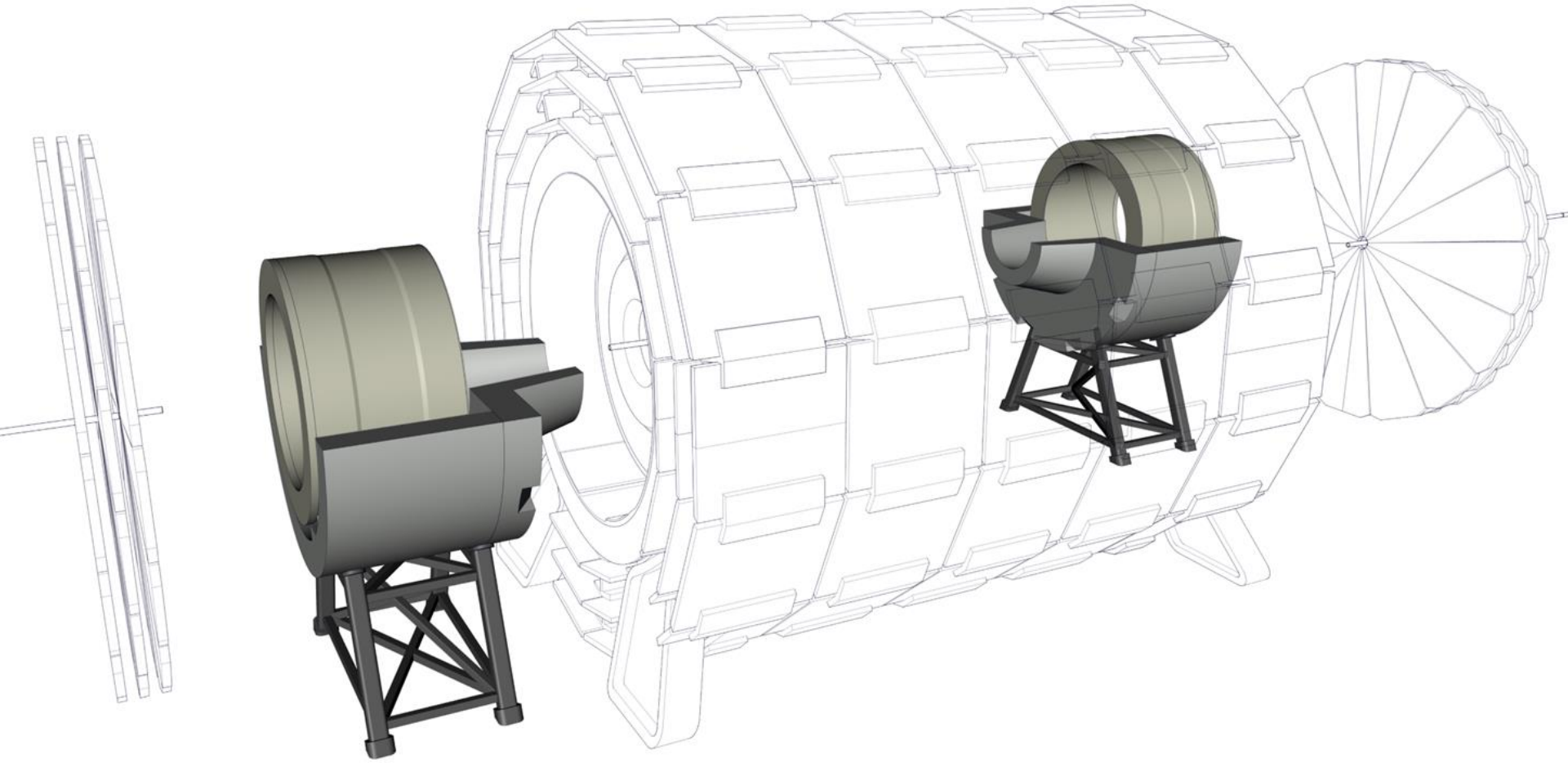
16 – Install bottom half of the Radiation Shield

EXPERIMENT INTEGRATION



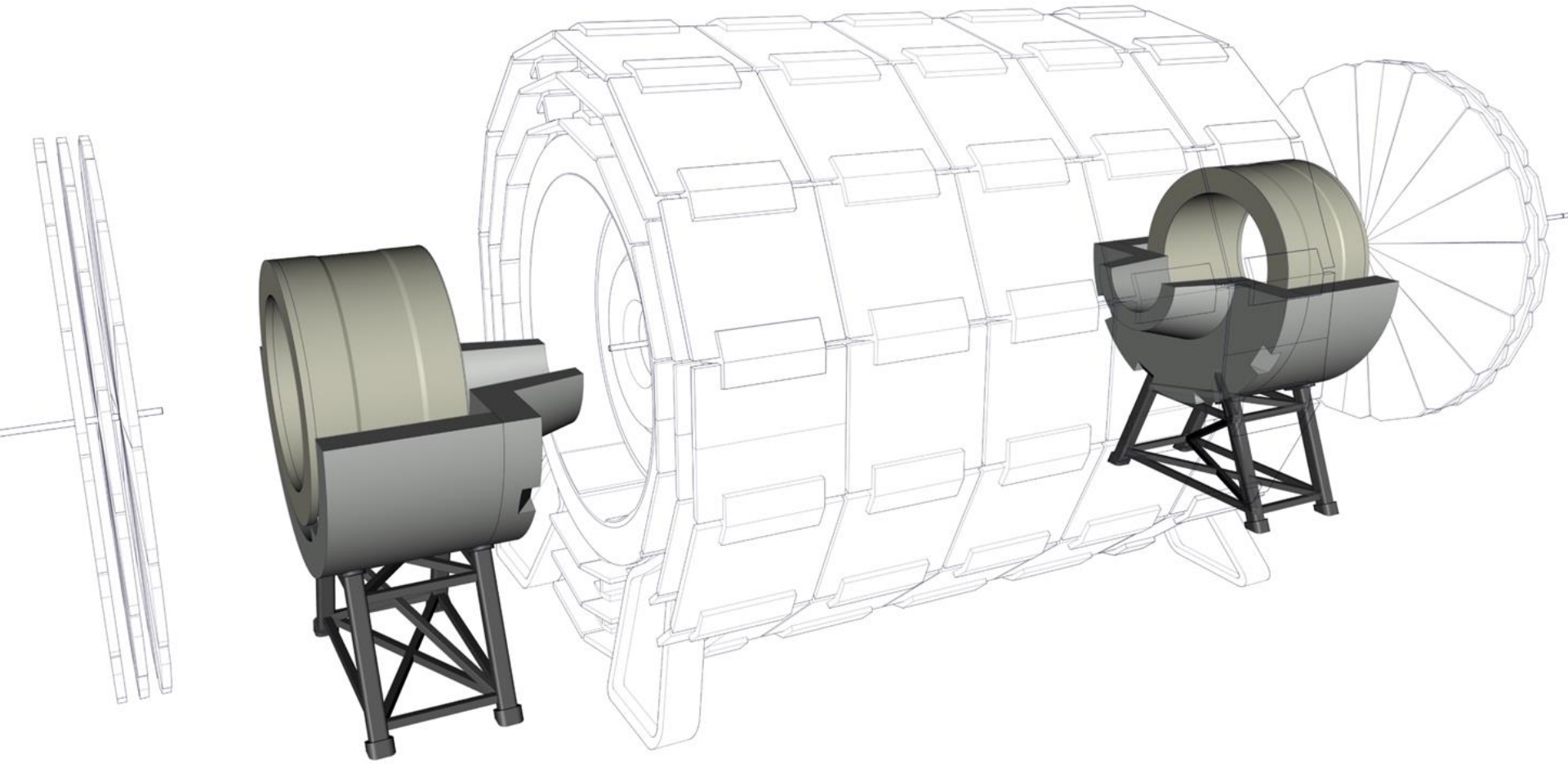
17 – Install Forward Solenoids

EXPERIMENT INTEGRATION



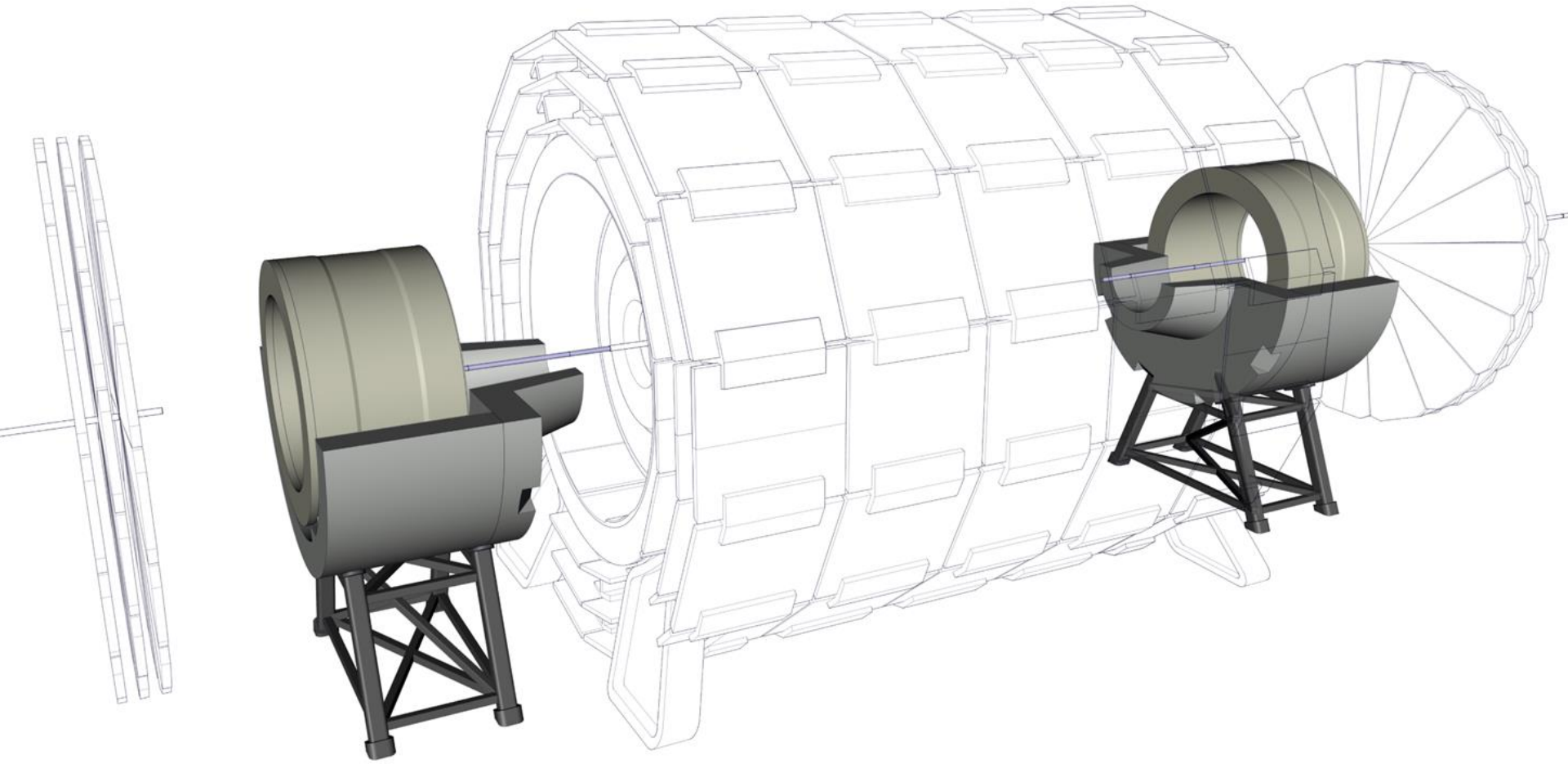
18 – Install bottom half of the radiation shield nose

EXPERIMENT INTEGRATION



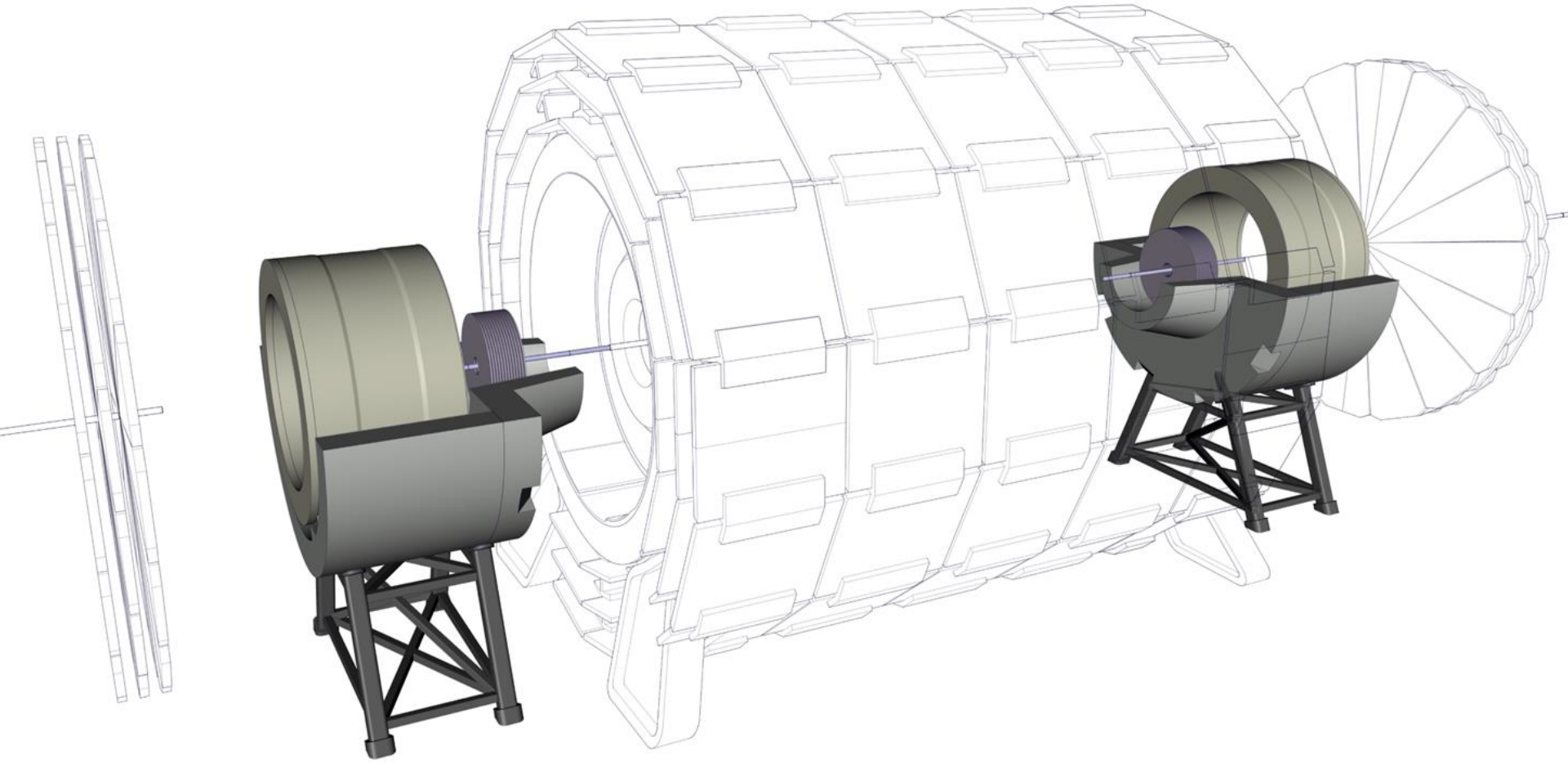
19 – Align the off centered solenoid with the experiment

EXPERIMENT INTEGRATION



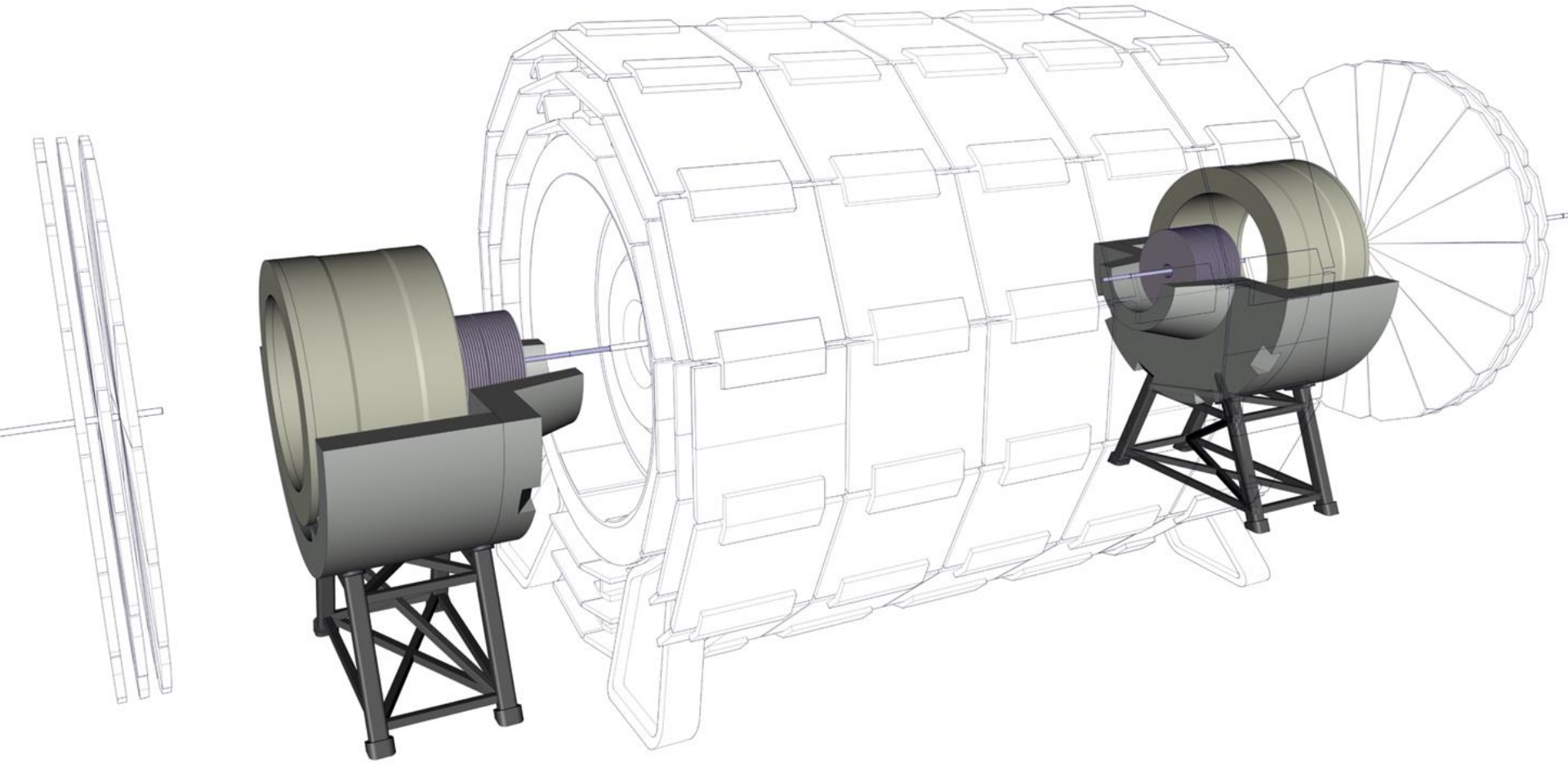
20 – Install another portion of the beam pipe

Experiment integration



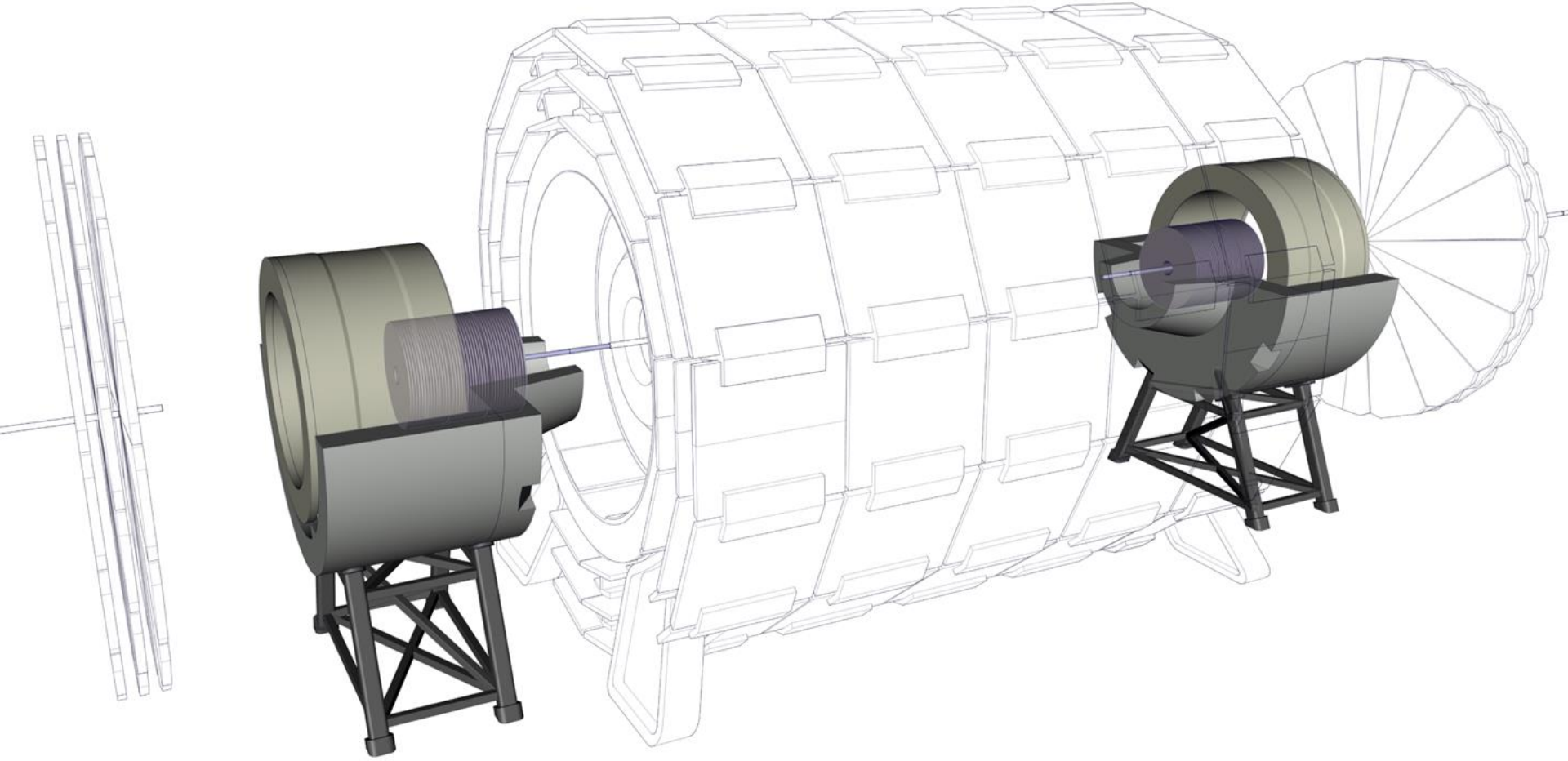
20 – Install Forward Trackers

Experiment integration



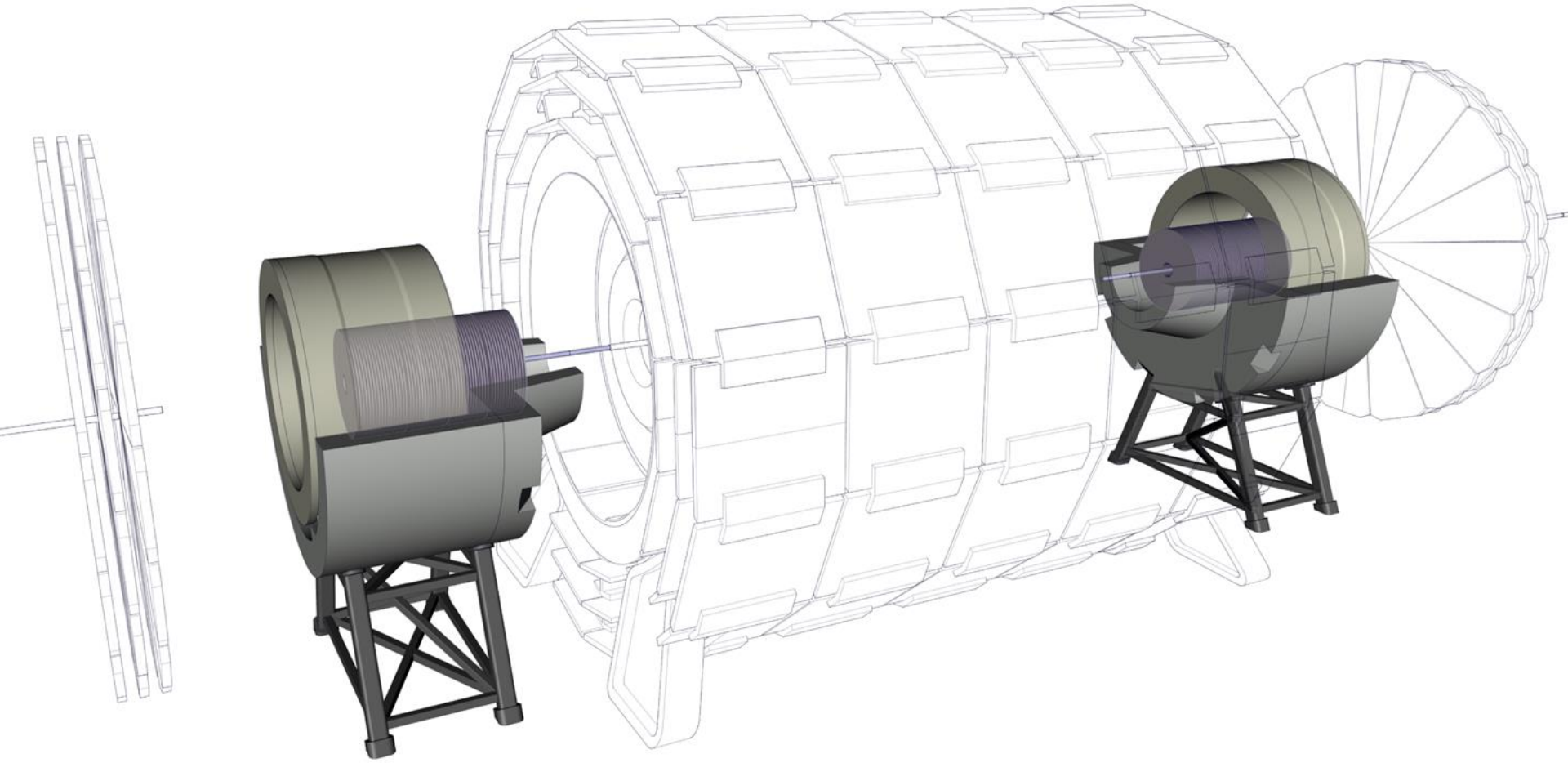
20 – Install Forward Trackers

Experiment integration



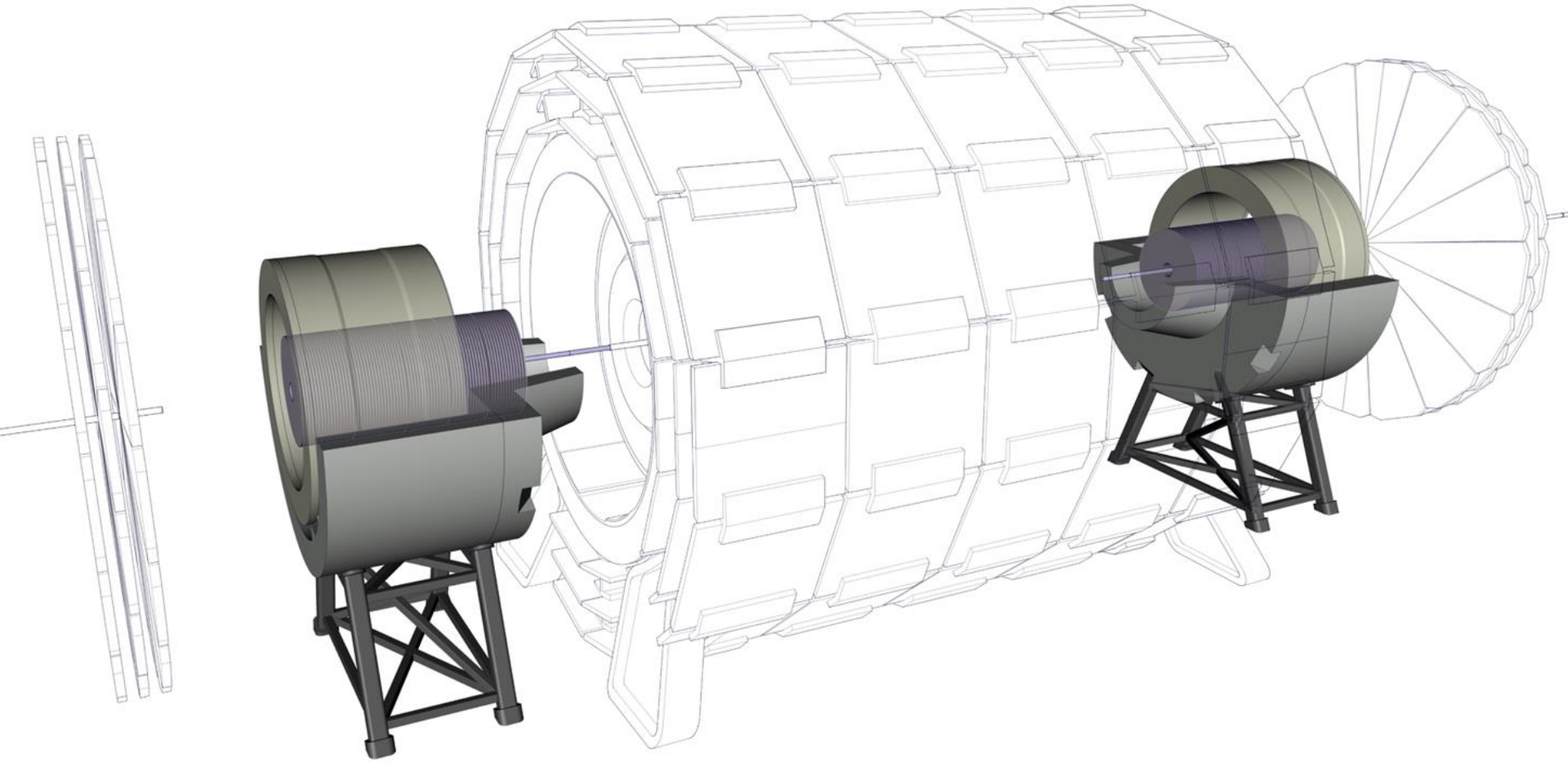
20 – Install Forward Trackers

Experiment integration



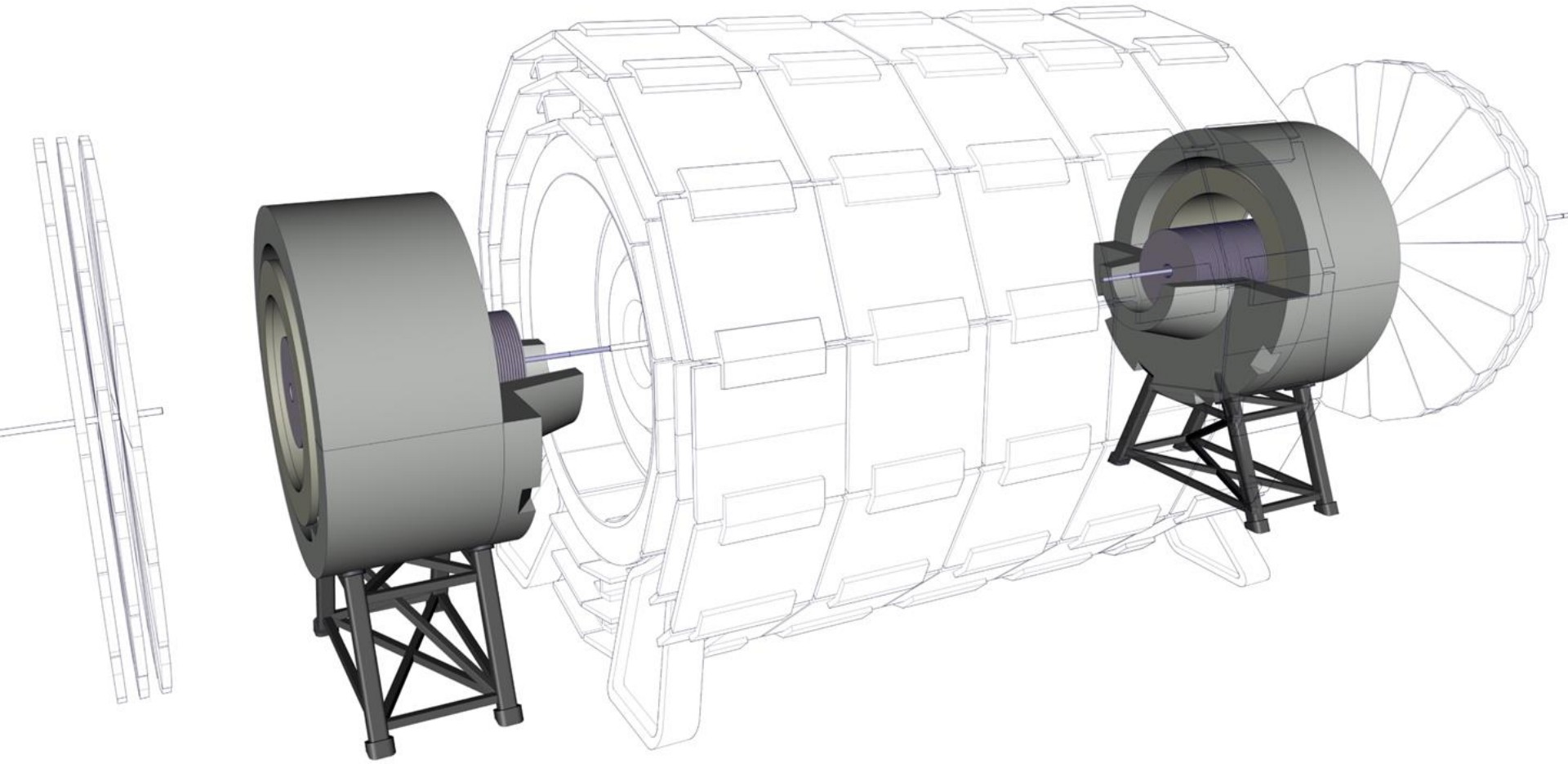
20 – Install Forward Trackers

Experiment integration



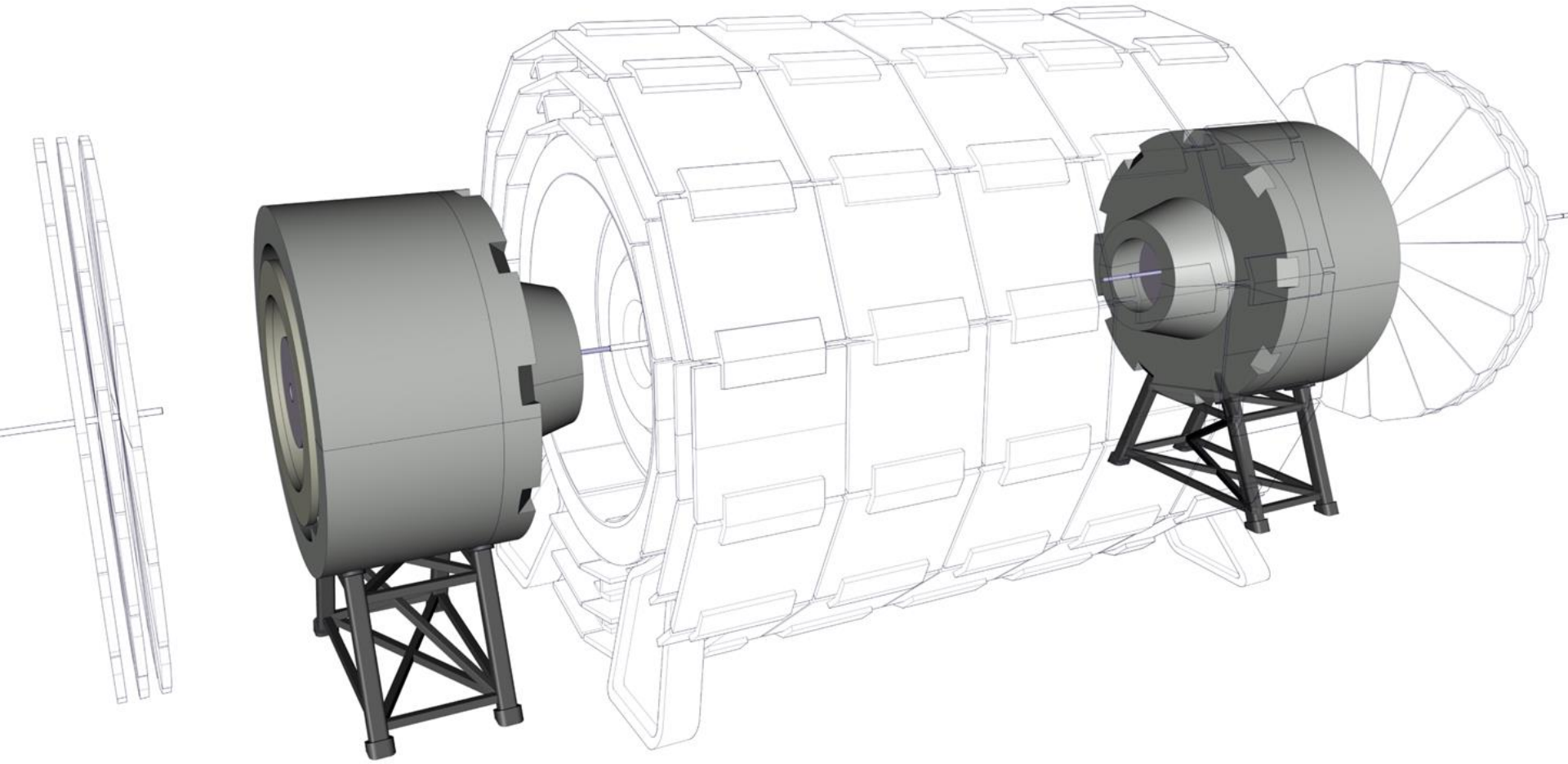
20 – Install Forward Trackers

EXPERIMENT INTEGRATION



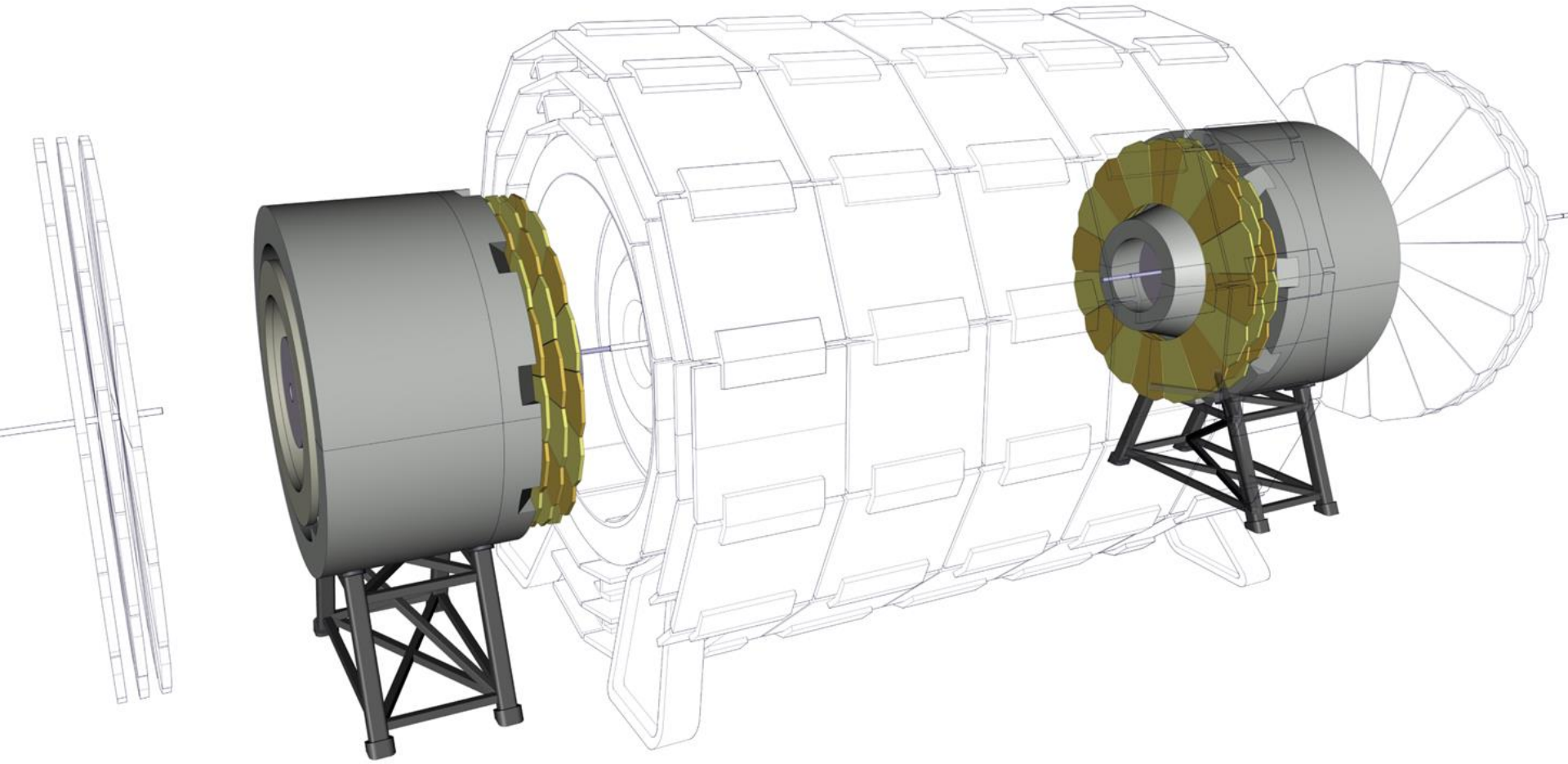
21 – Install top half of the Radiation Shield

EXPERIMENT INTEGRATION



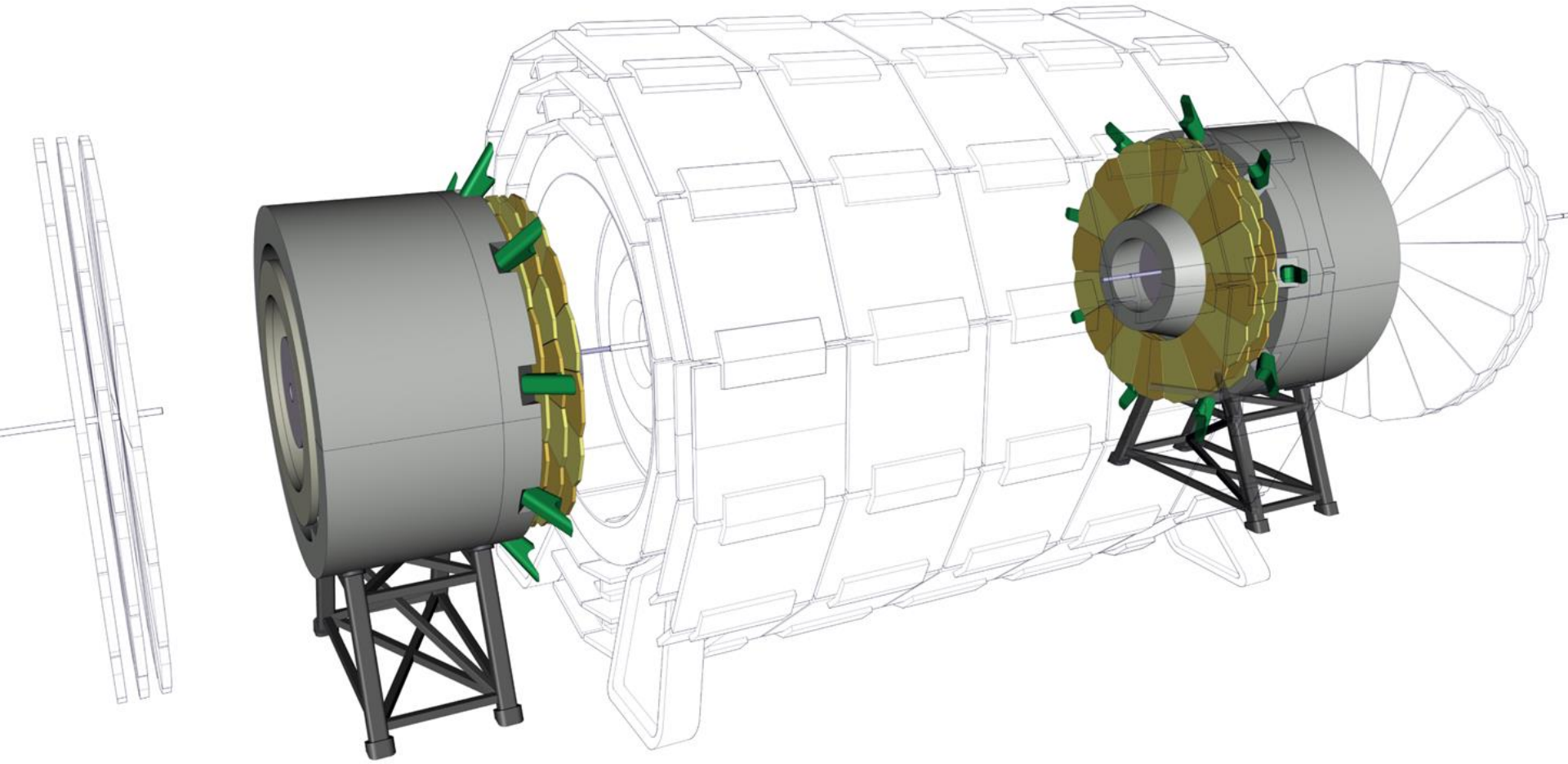
22 – Install top half of the Radiation Shield nose

EXPERIMENT INTEGRATION



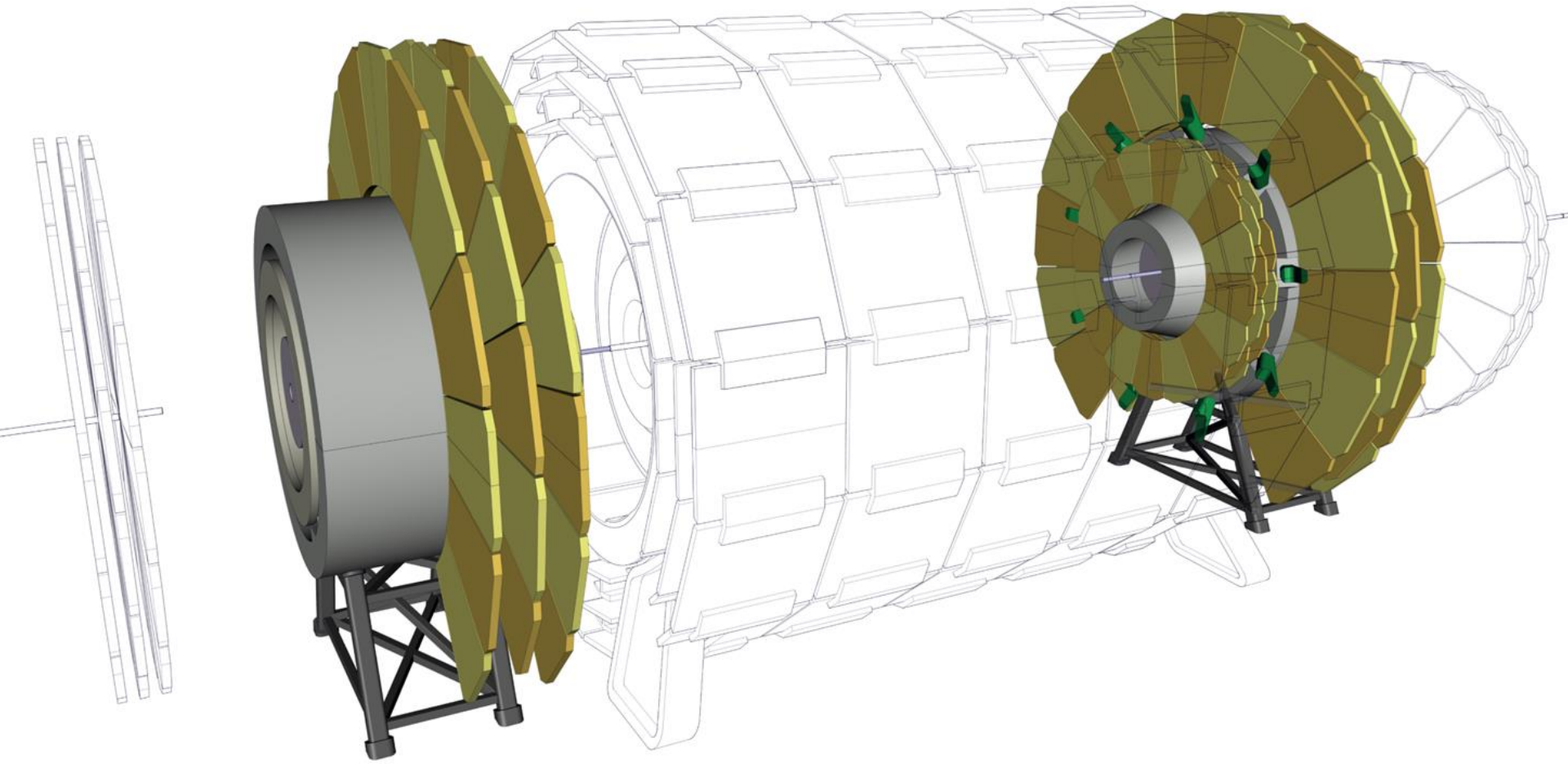
23 – Install Muon Chambers

Experiment integration



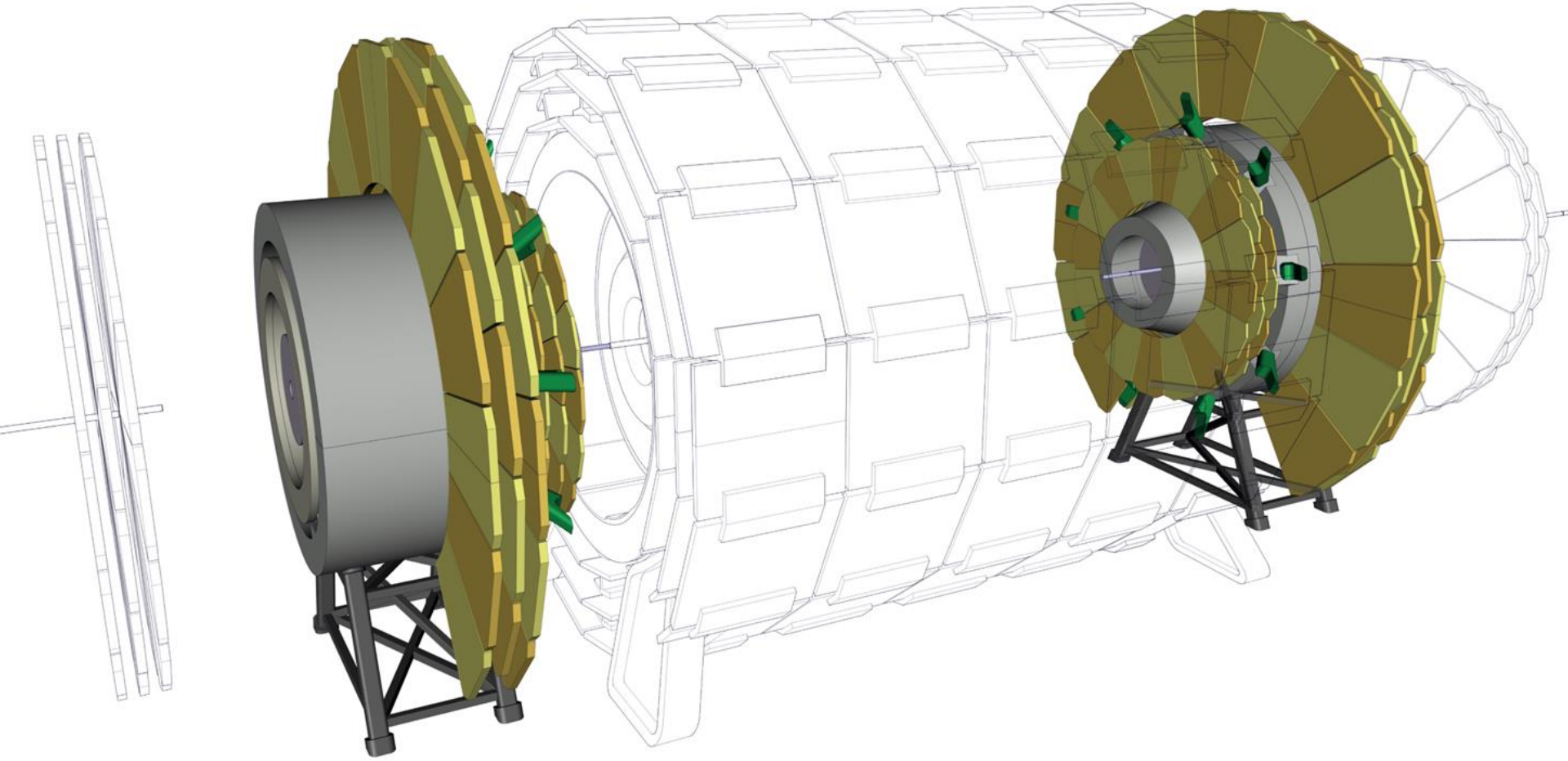
24 – Install Spokes

Experiment integration



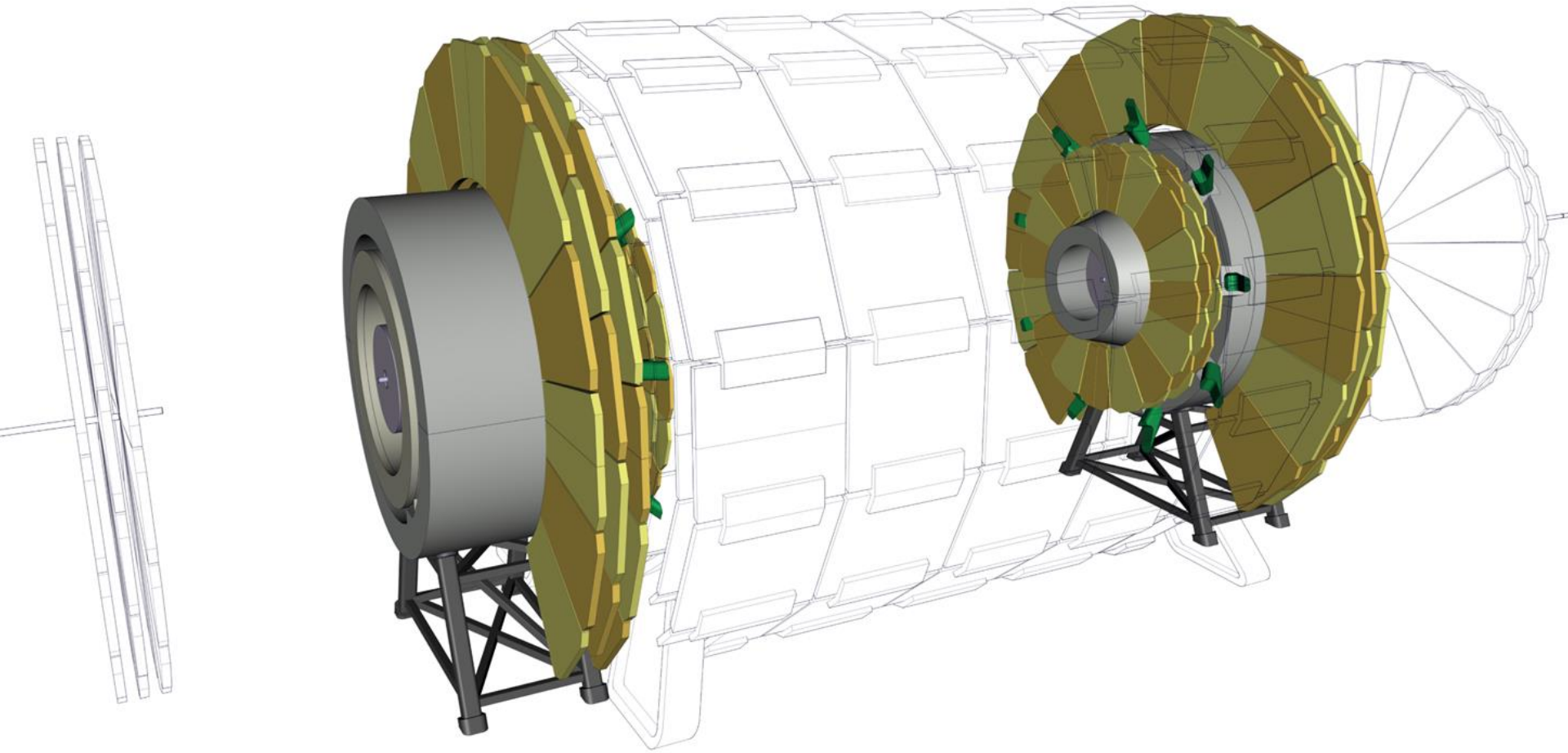
25 – Install Muon Chambers

EXPERIMENT INTEGRATION



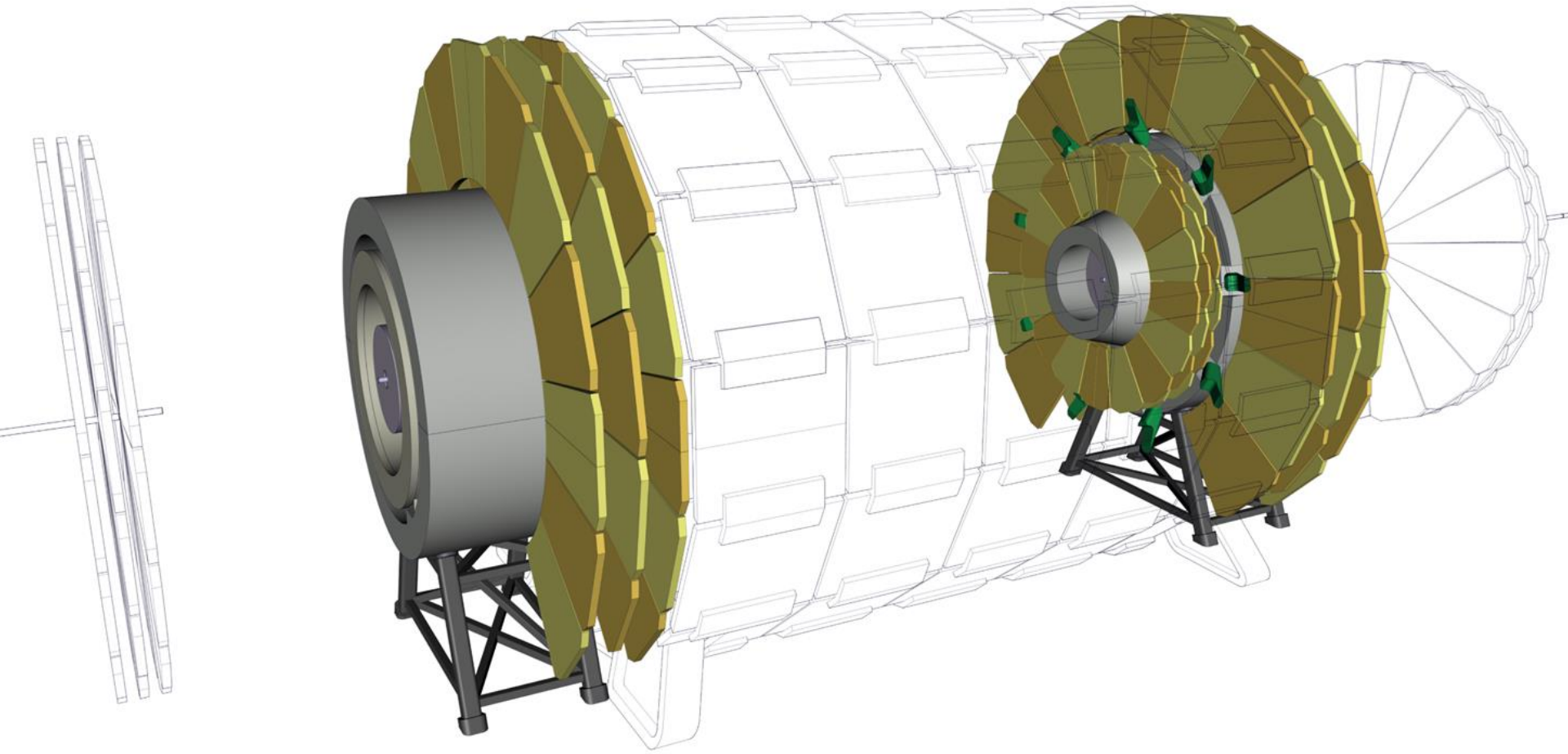
26 – Compact Muon Chambers

EXPERIMENT INTEGRATION



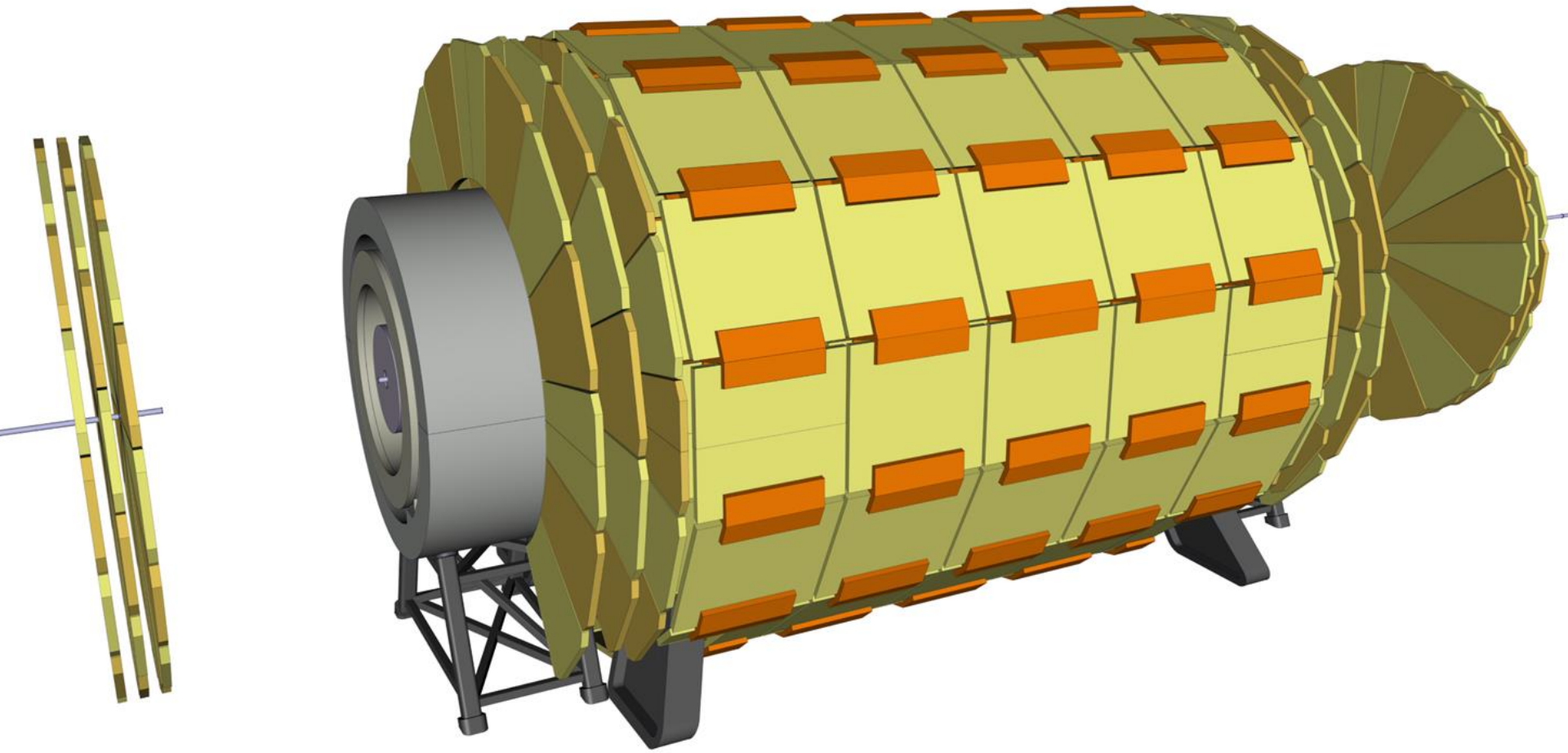
27 – Connect Spokes to main cryostat

EXPERIMENT INTEGRATION



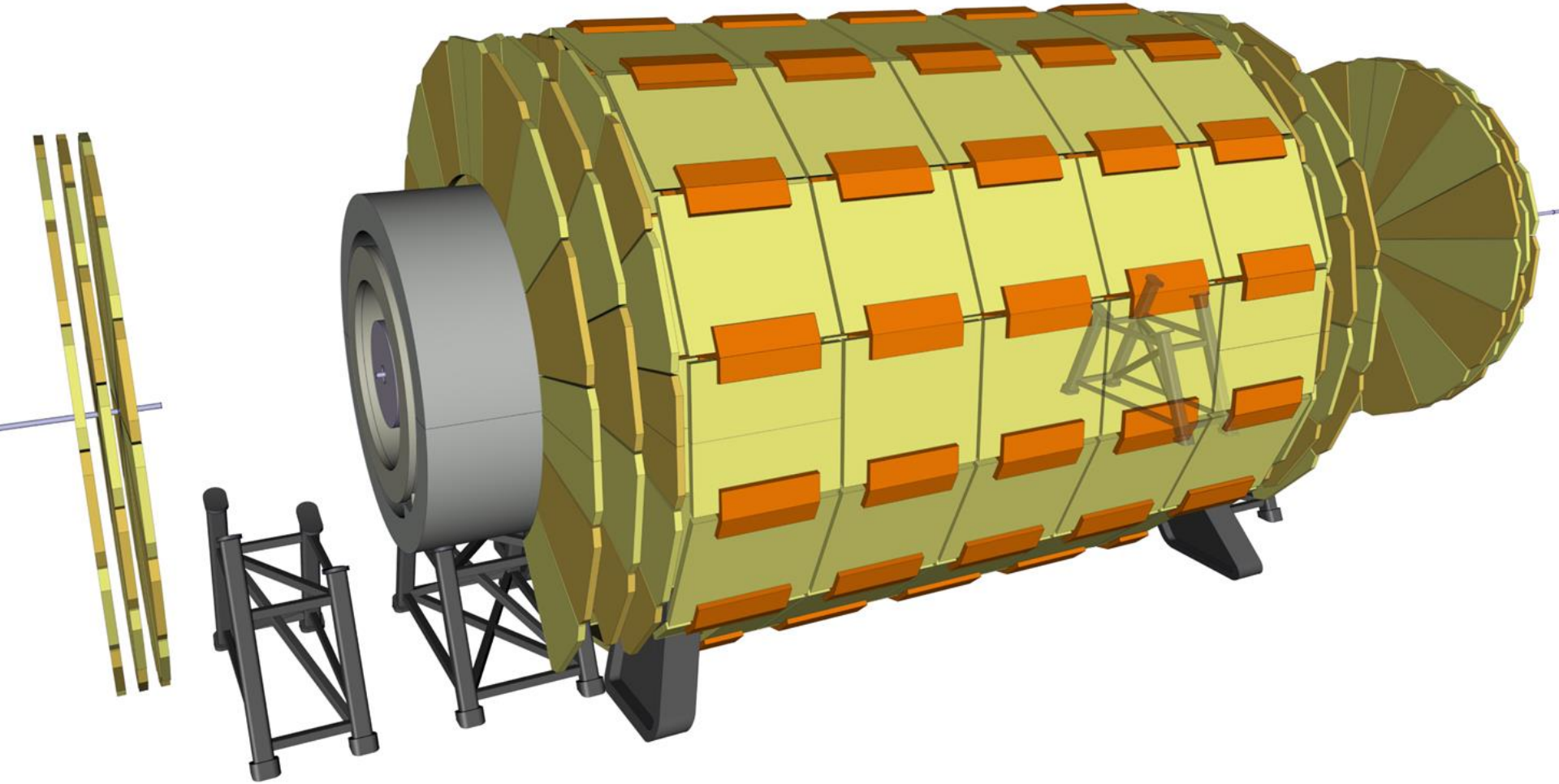
28 – Bring Muon Chambers to their final position

EXPERIMENT INTEGRATION



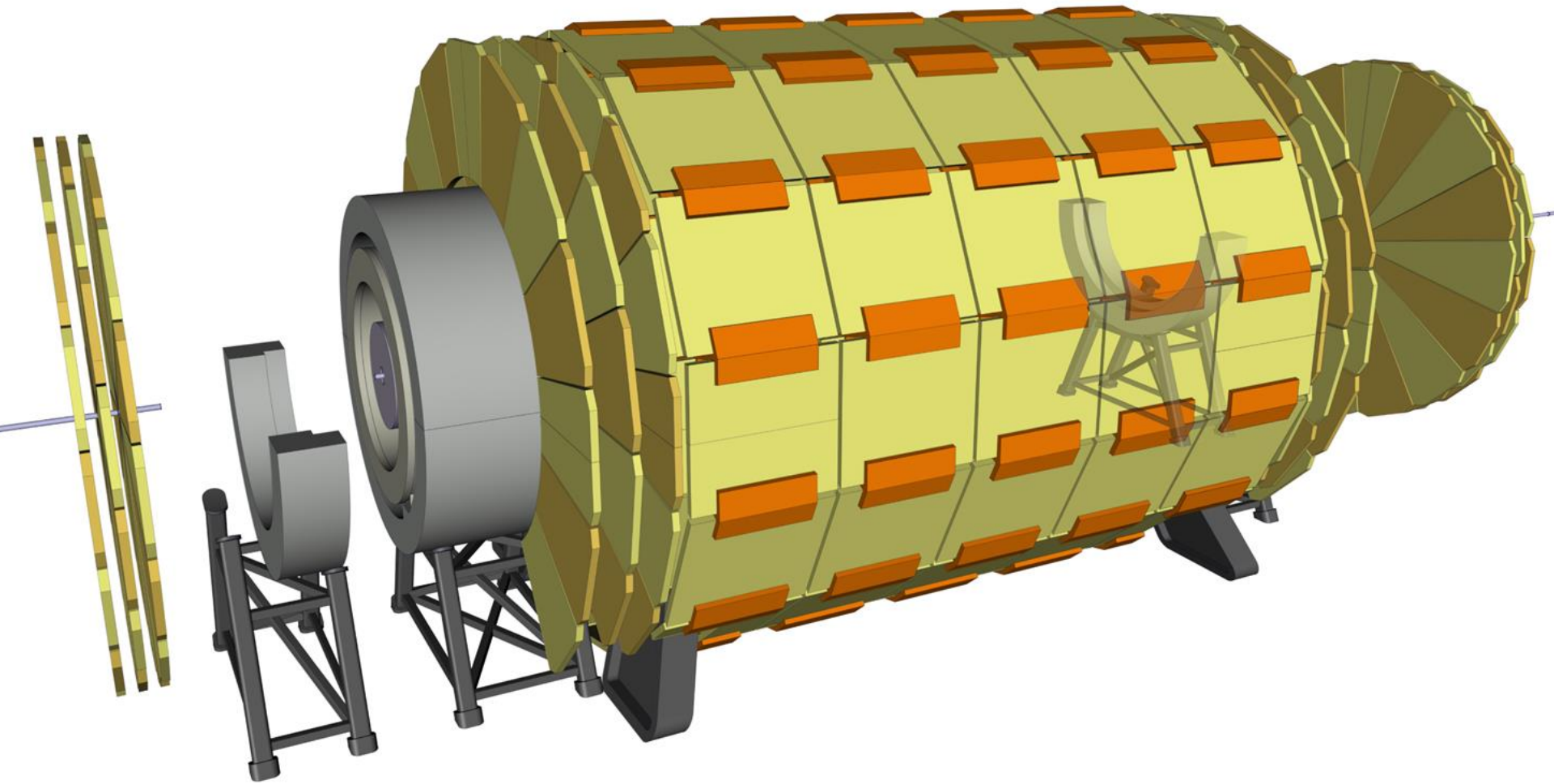
28 – Bring Muon Chambers to their final position

EXPERIMENT INTEGRATION



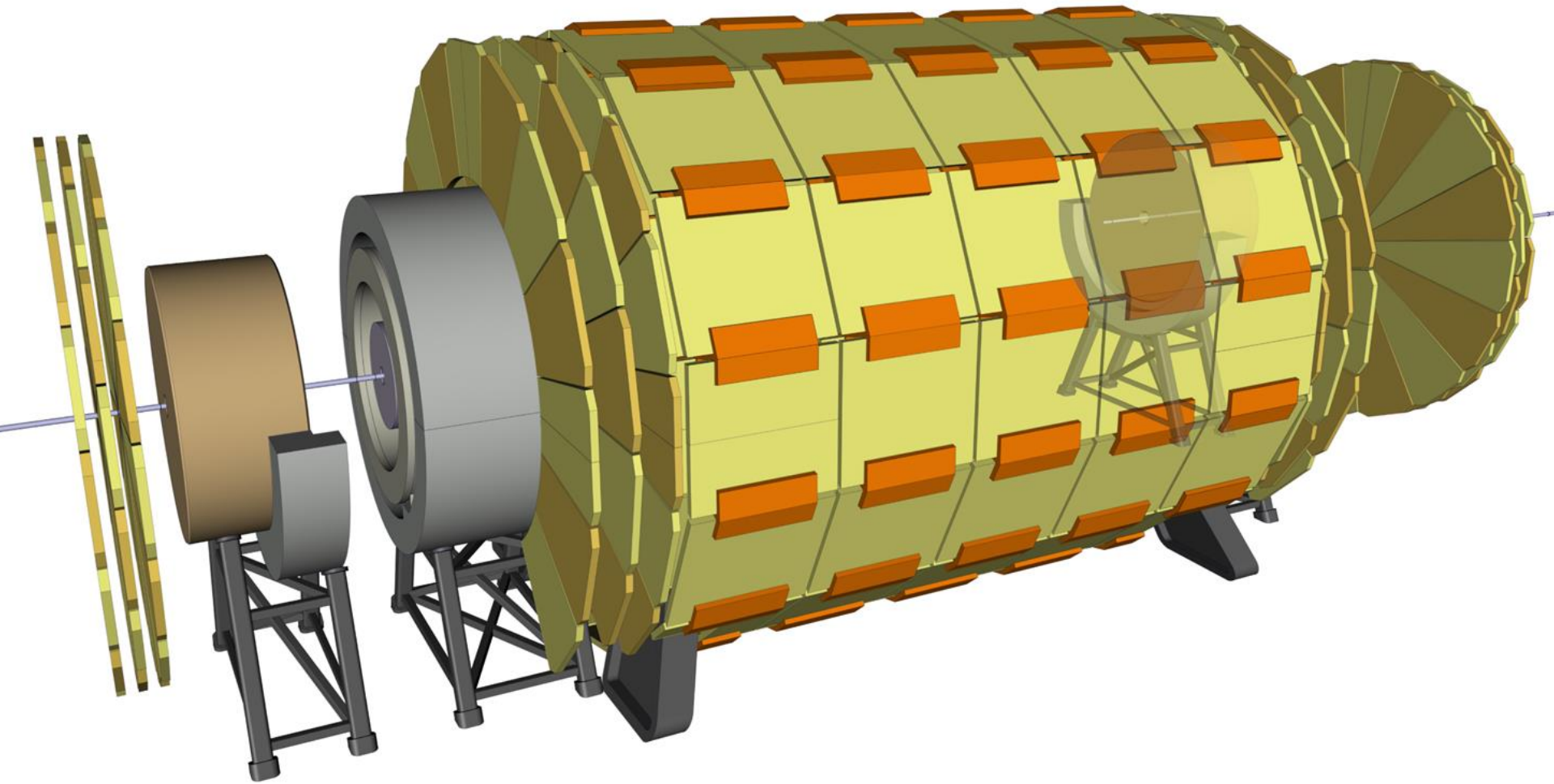
29 - Install Forward ECal support structure

EXPERIMENT INTEGRATION



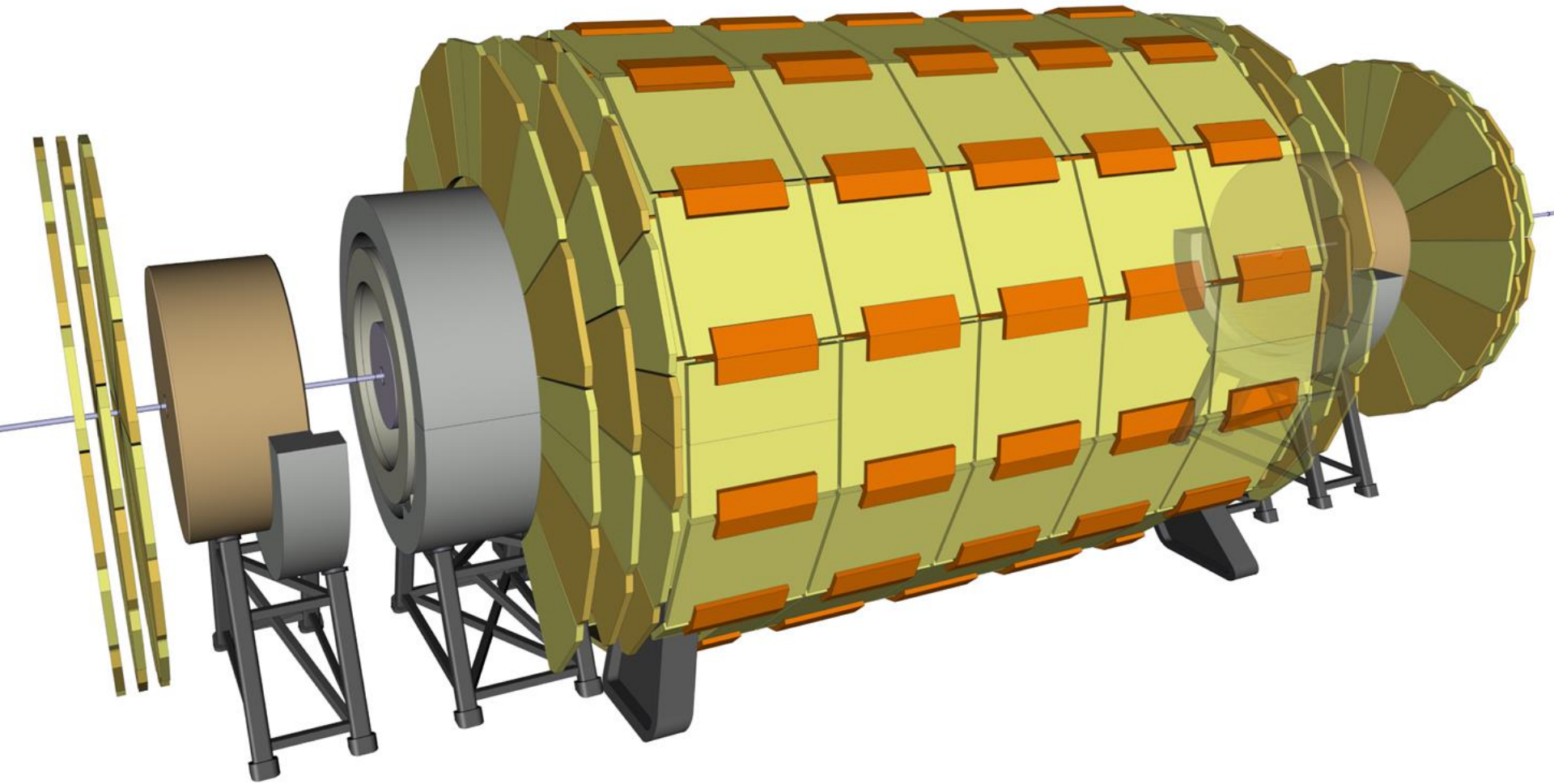
30 - Install bottom half of the Ecal Radiation Shield

EXPERIMENT INTEGRATION



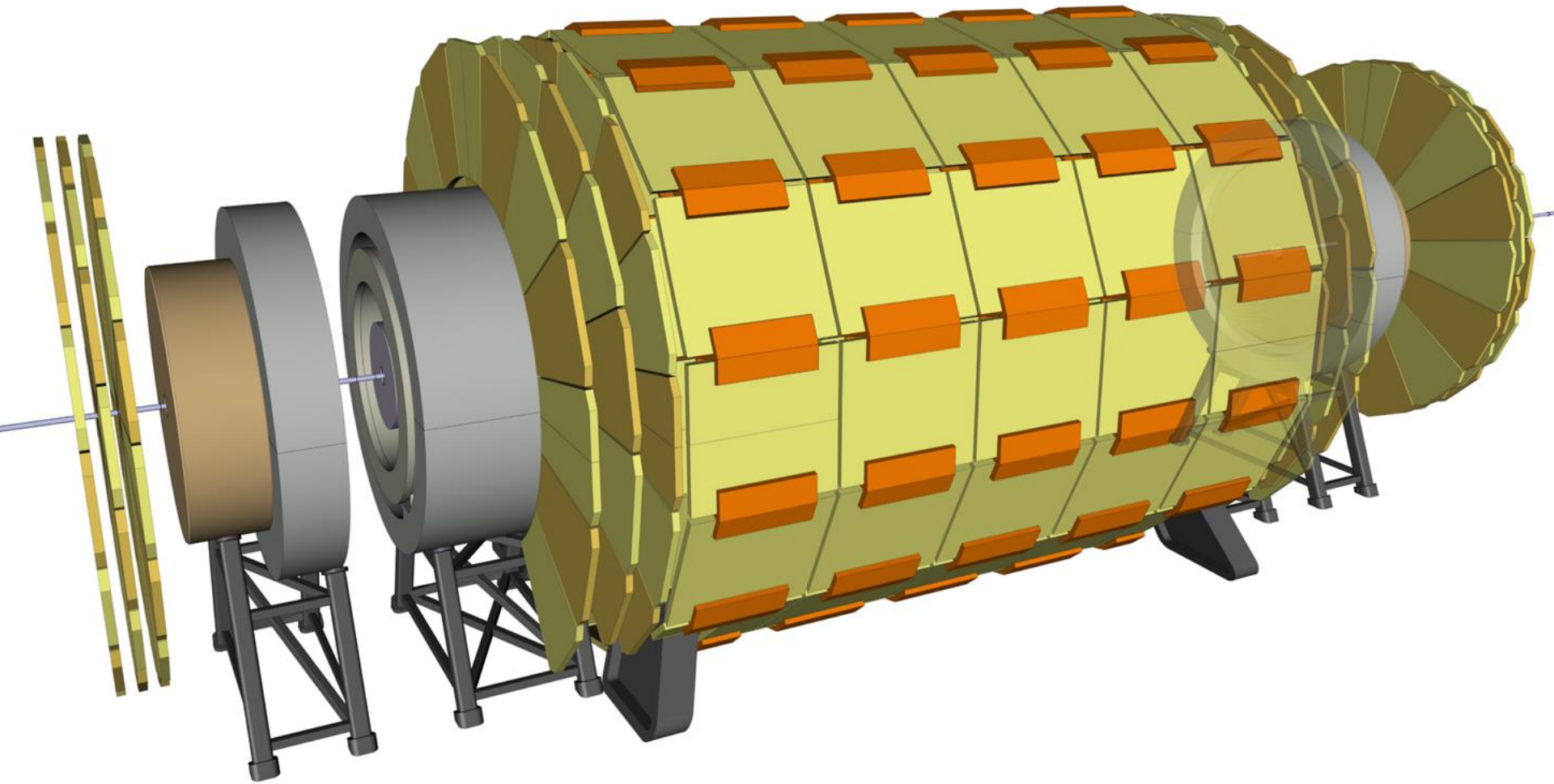
31 - Install Forward Ecal

EXPERIMENT INTEGRATION



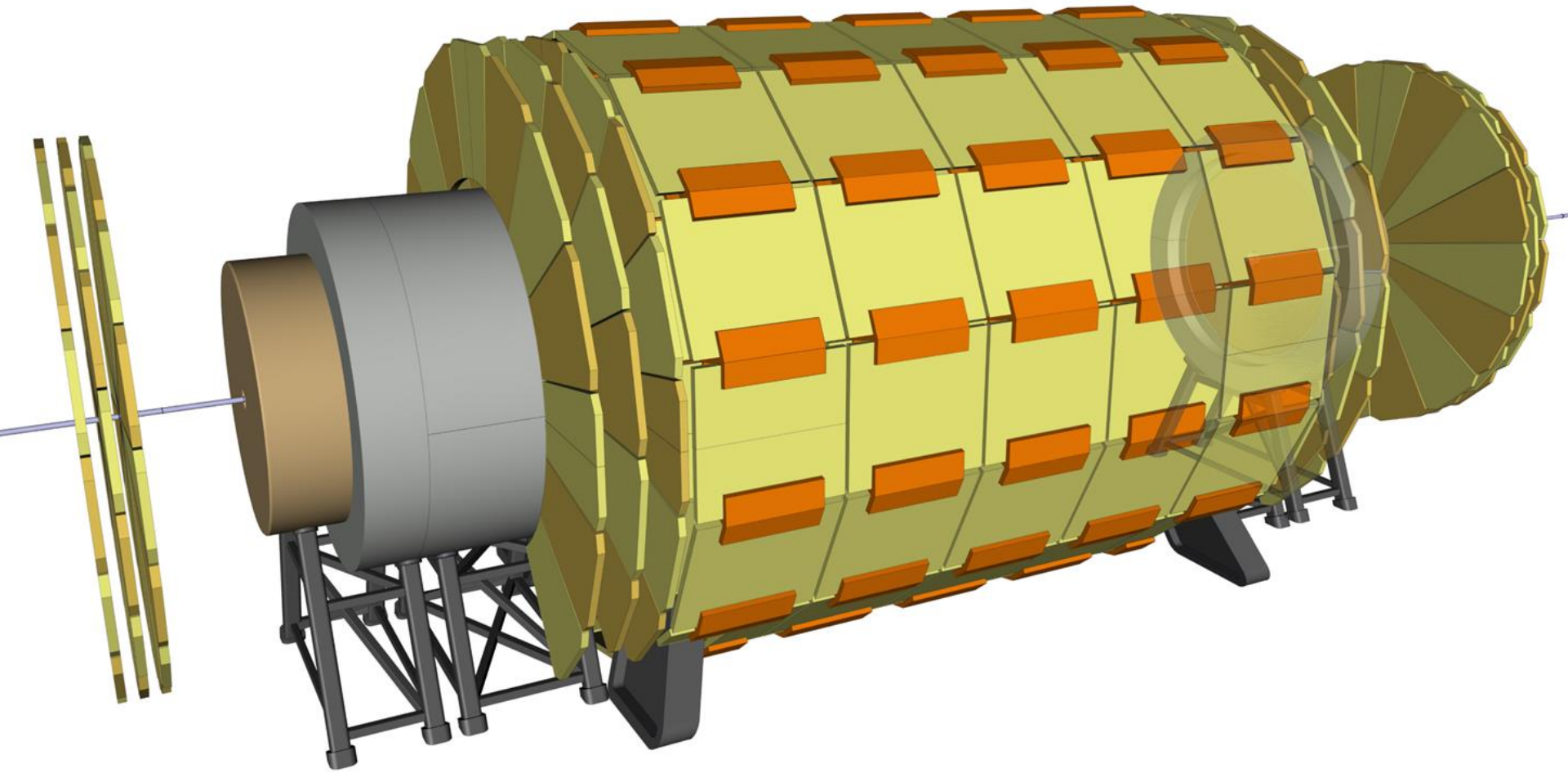
32 – Align the off-centered Ecal with the experiment and close Beam Pipe

EXPERIMENT INTEGRATION



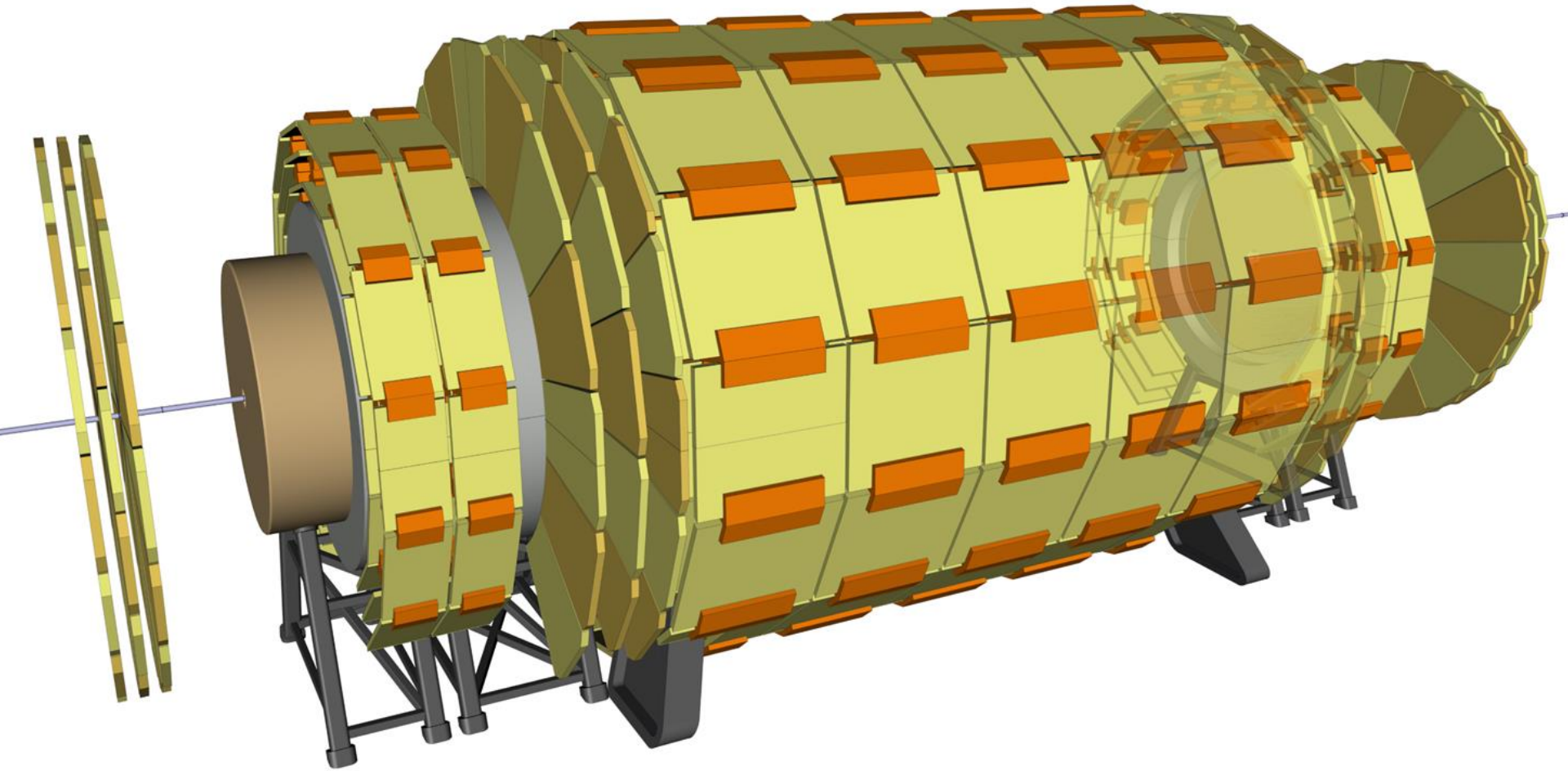
33 - Install top half of the Ecal Radiation Shield

EXPERIMENT INTEGRATION



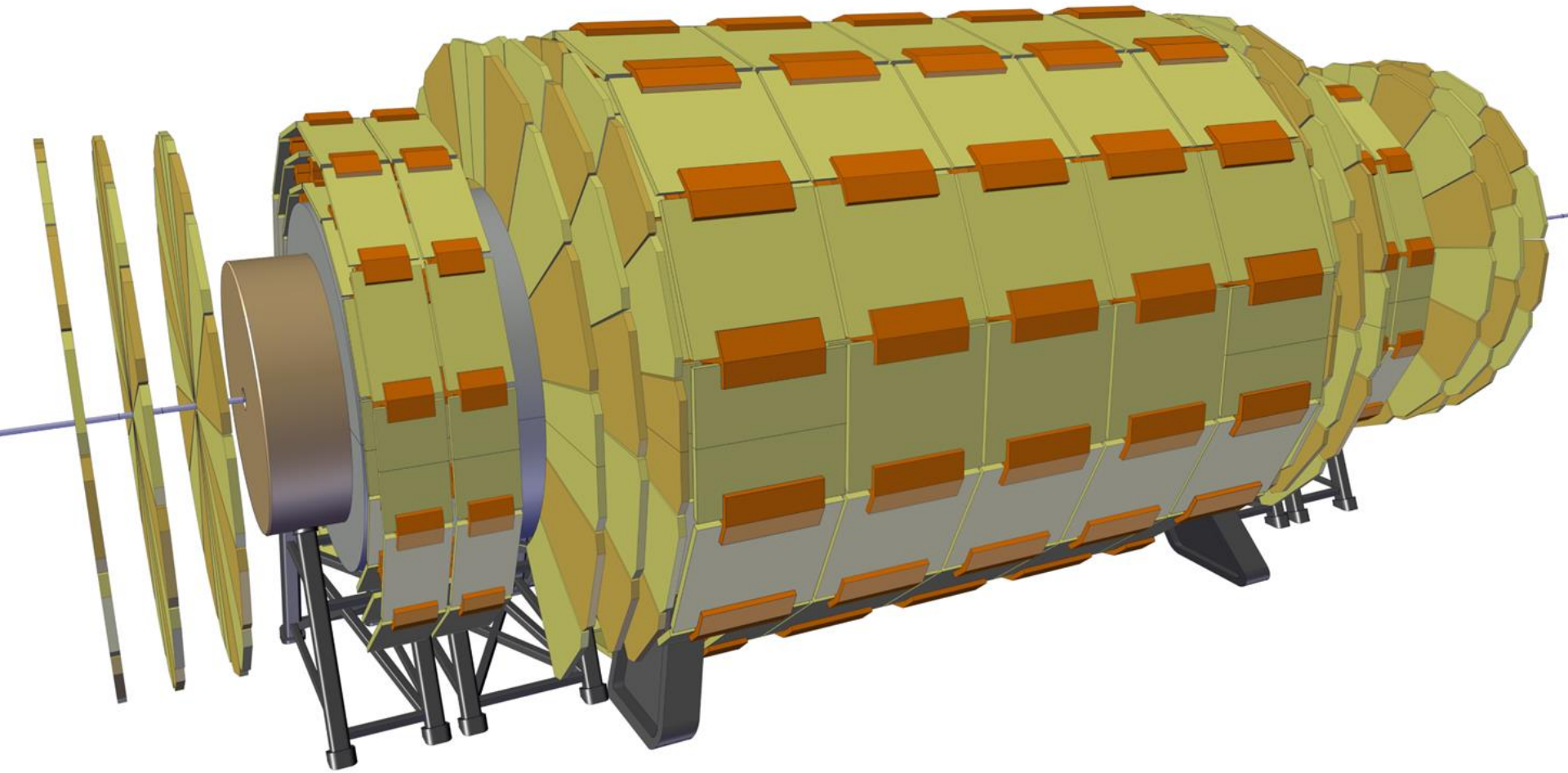
34 – Move Forward Ecal to its final position

EXPERIMENT INTEGRATION



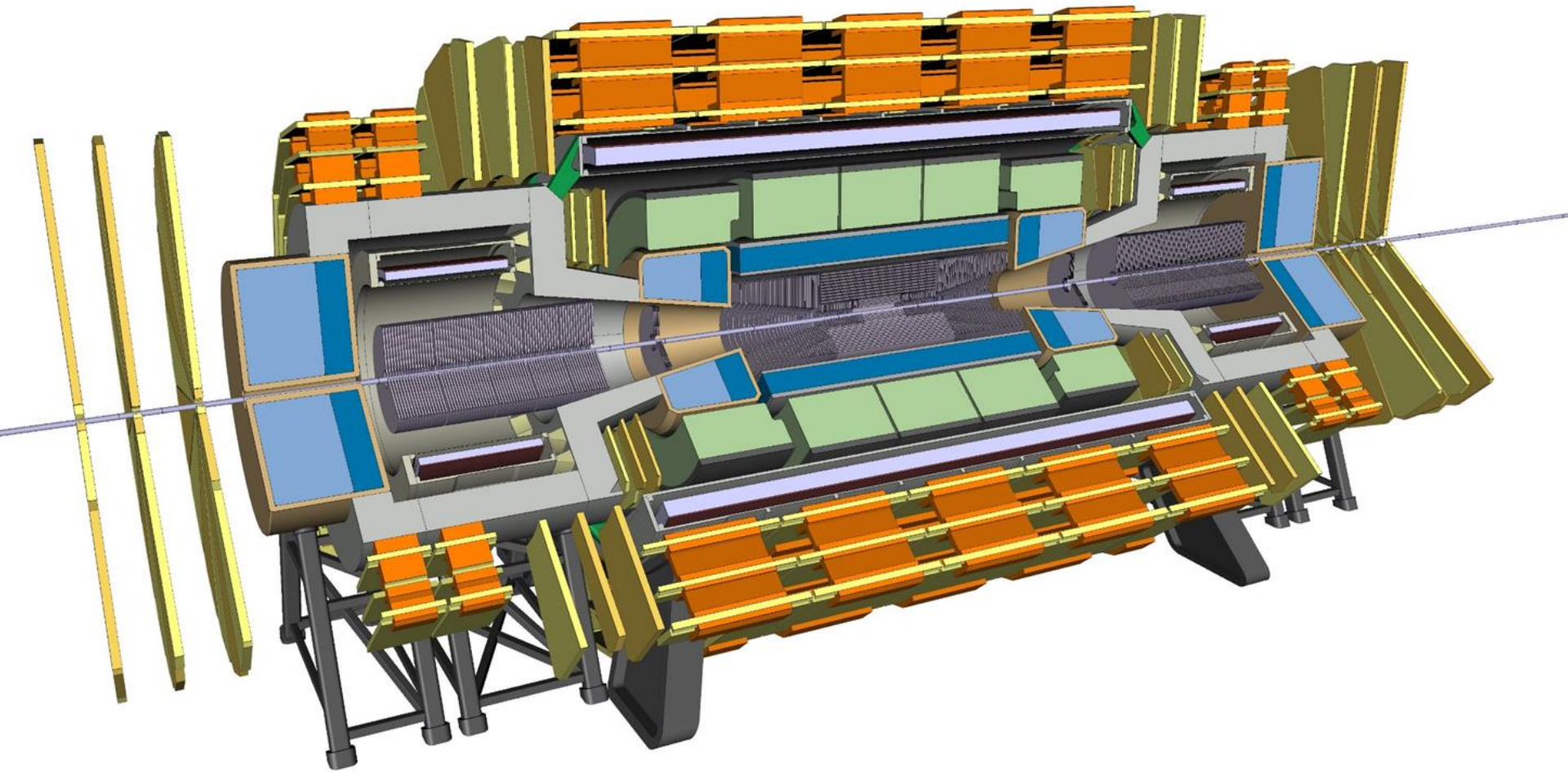
35 - Install remaining Muon Chambers

EXPERIMENT INTEGRATION



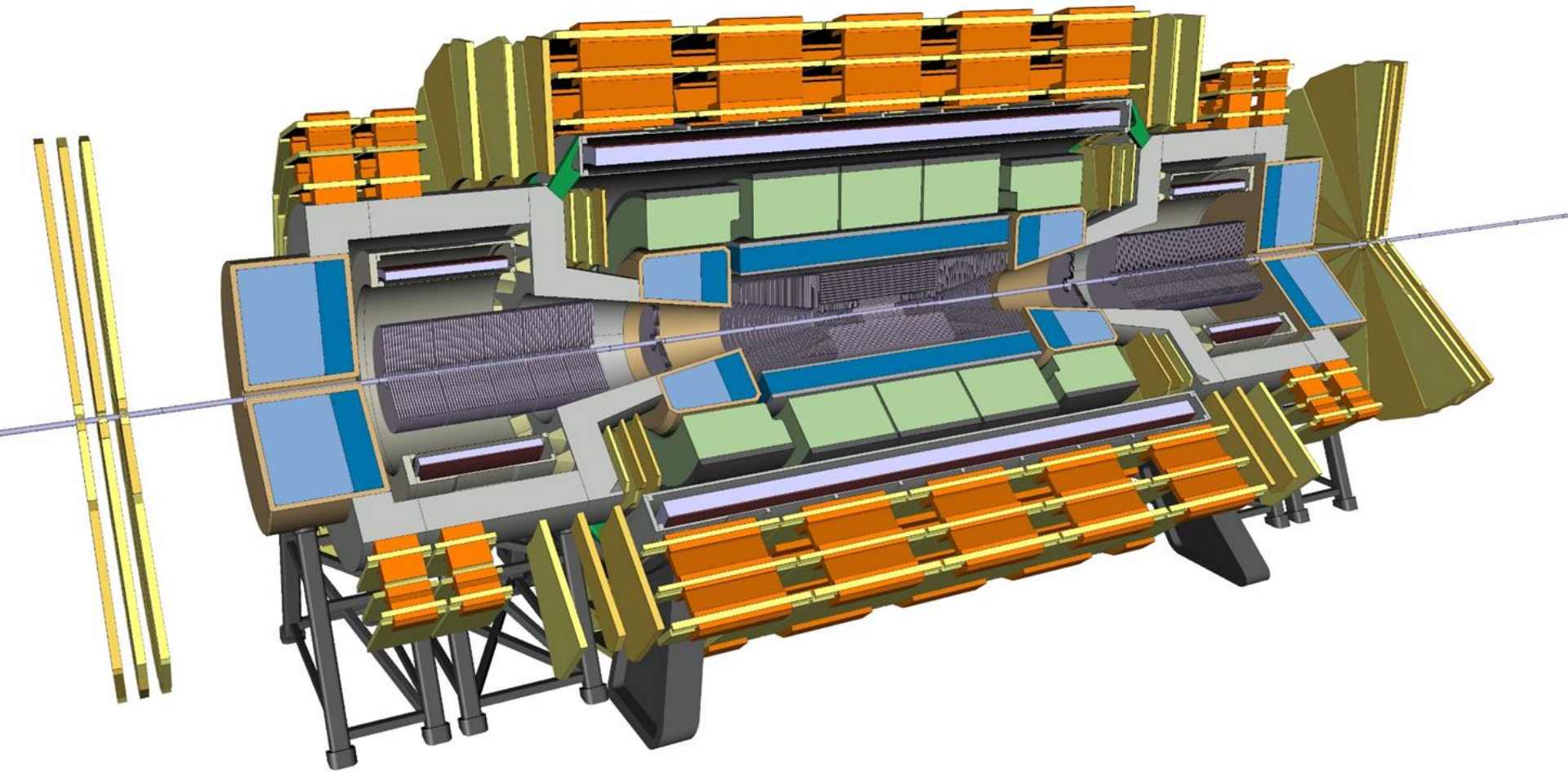
36 – Move Forward Muon Wheels to their final position

EXPERIMENT INTEGRATION



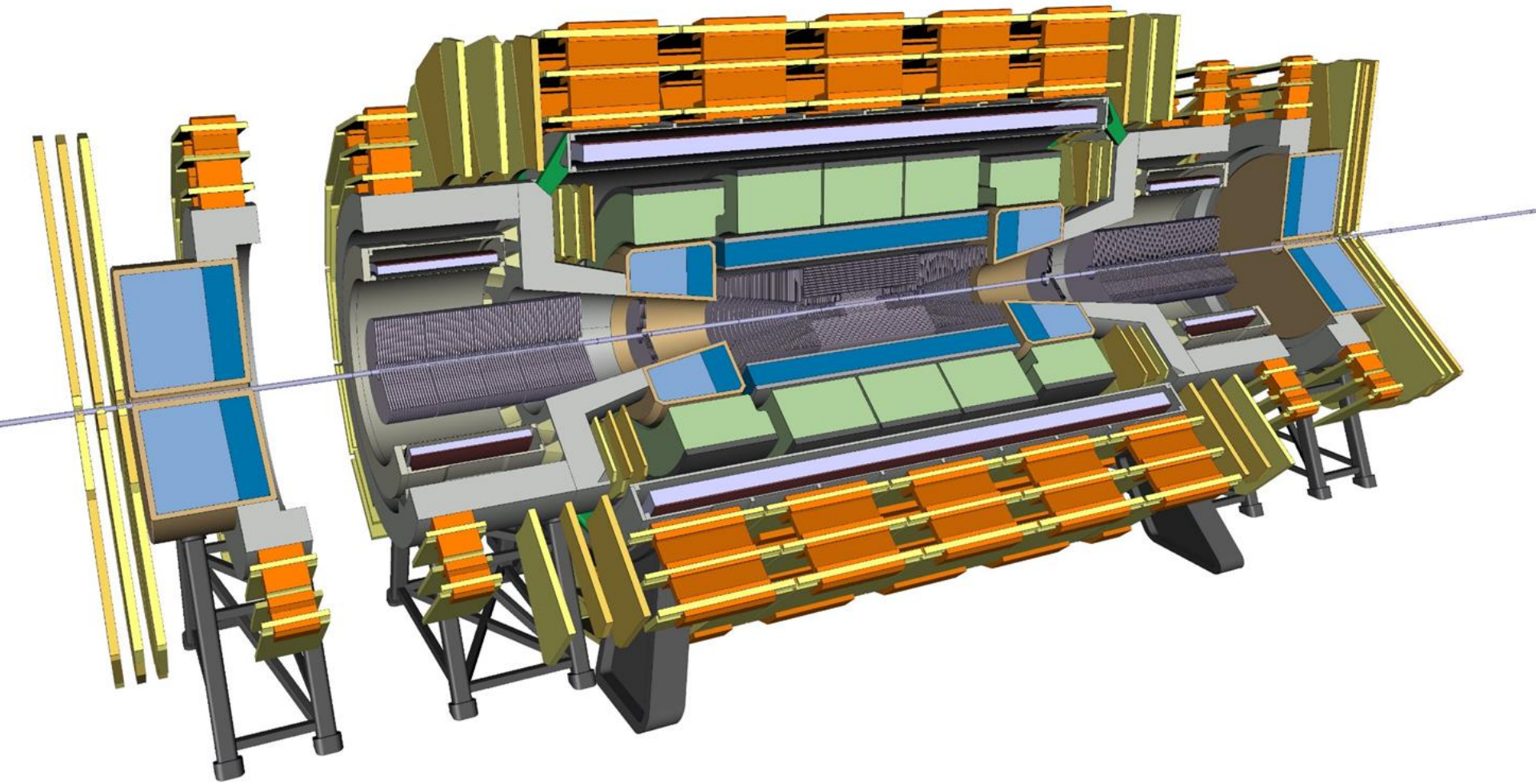
COMPLETE ASSEMBLY

SHORT OPENING SCENARIO



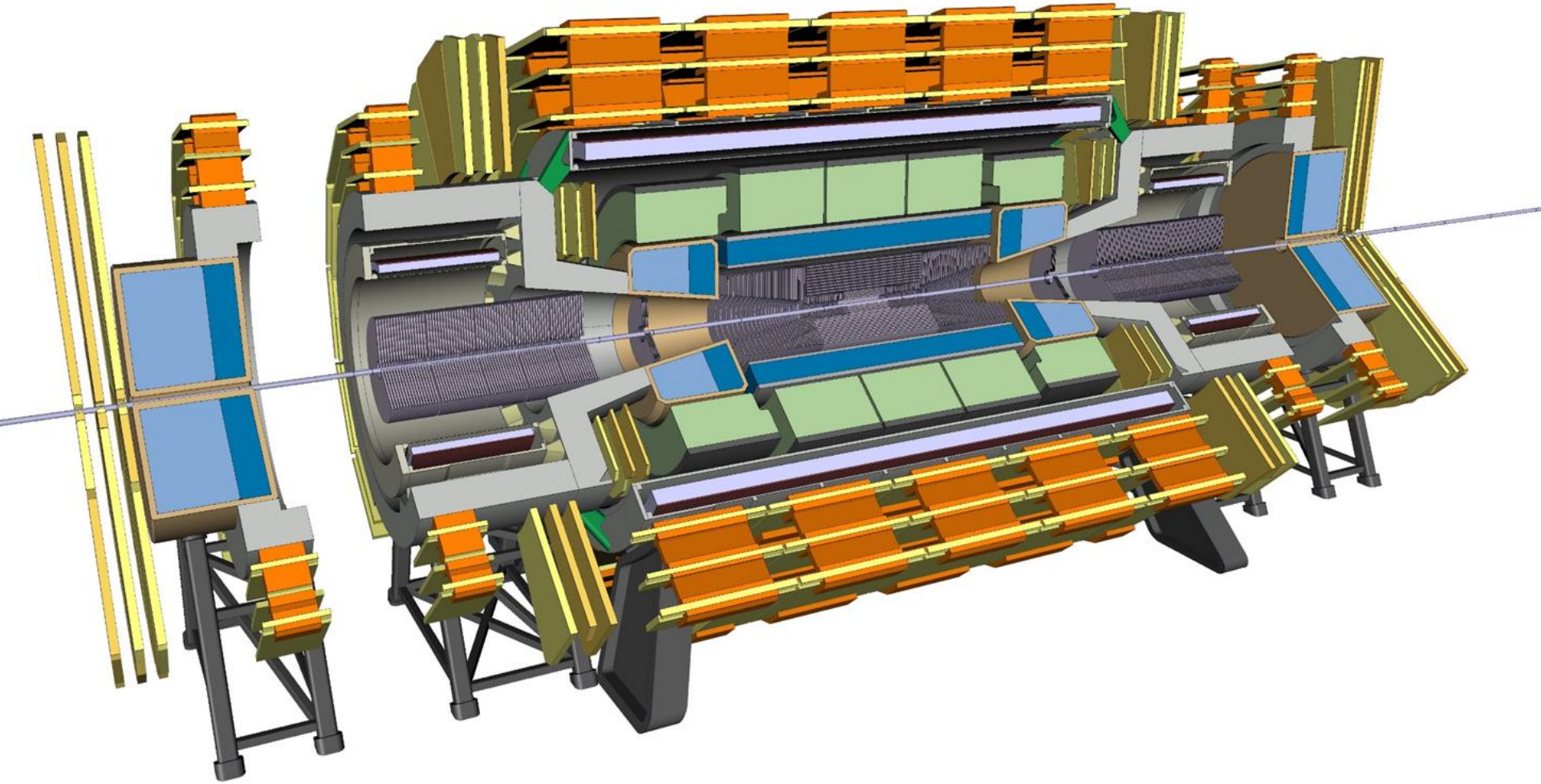
1 – Compact forward Muon Wheels

SHORT OPENING SCENARIO



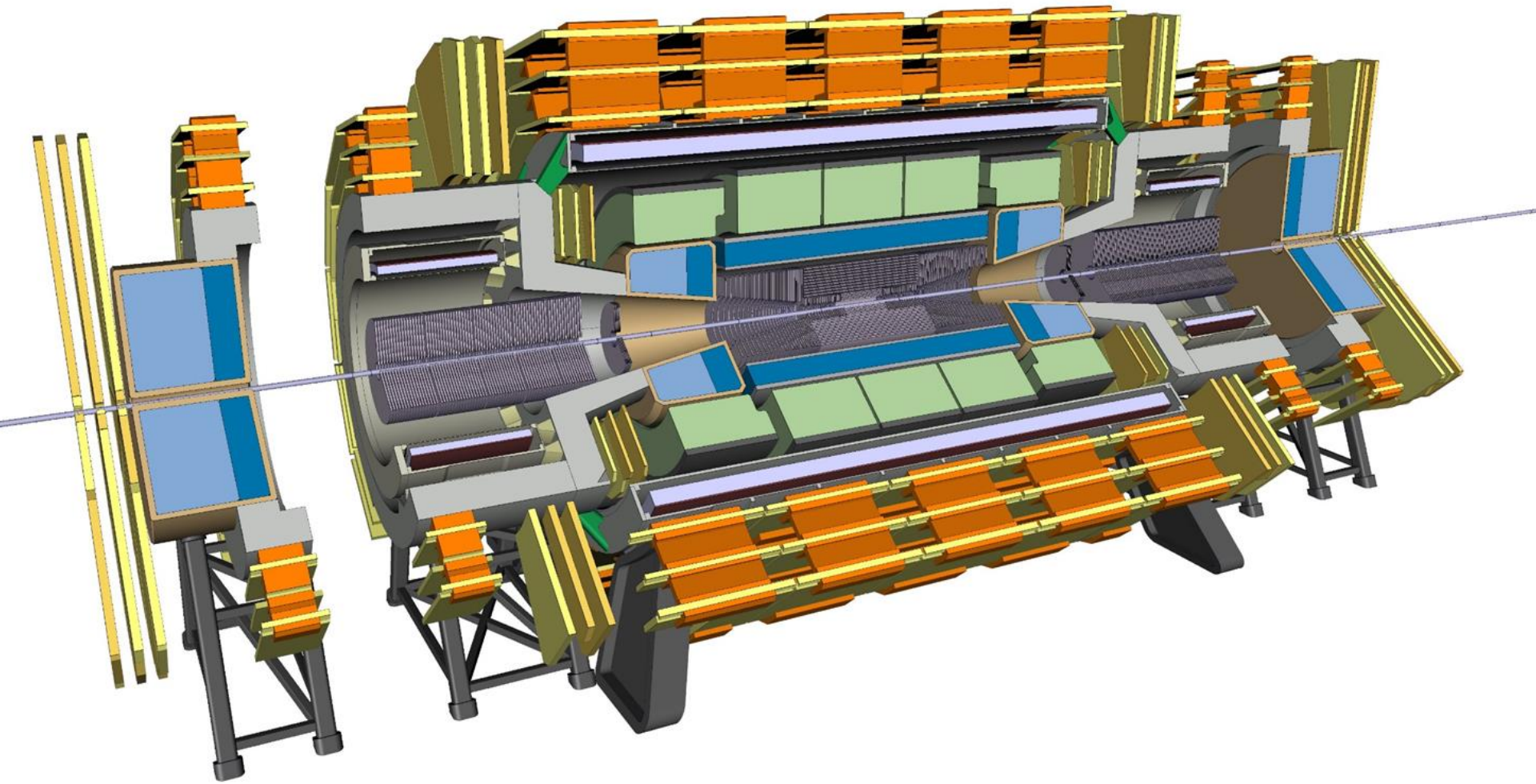
2 – Open Radiation Shield

SHORT OPENING SCENARIO



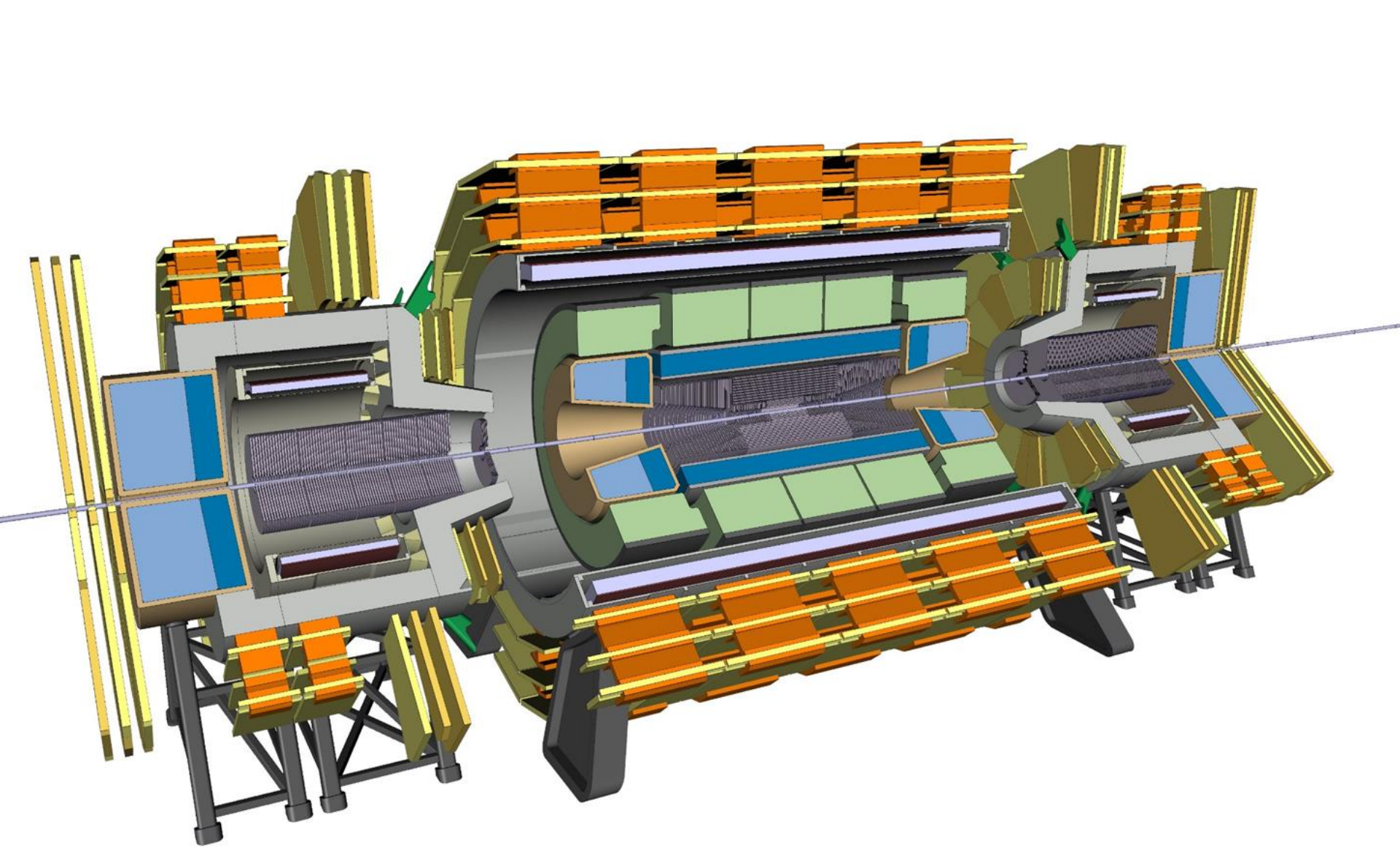
3 – Compact Muon Chambers and disconnect Spokes

SHORT OPENING SCENARIO



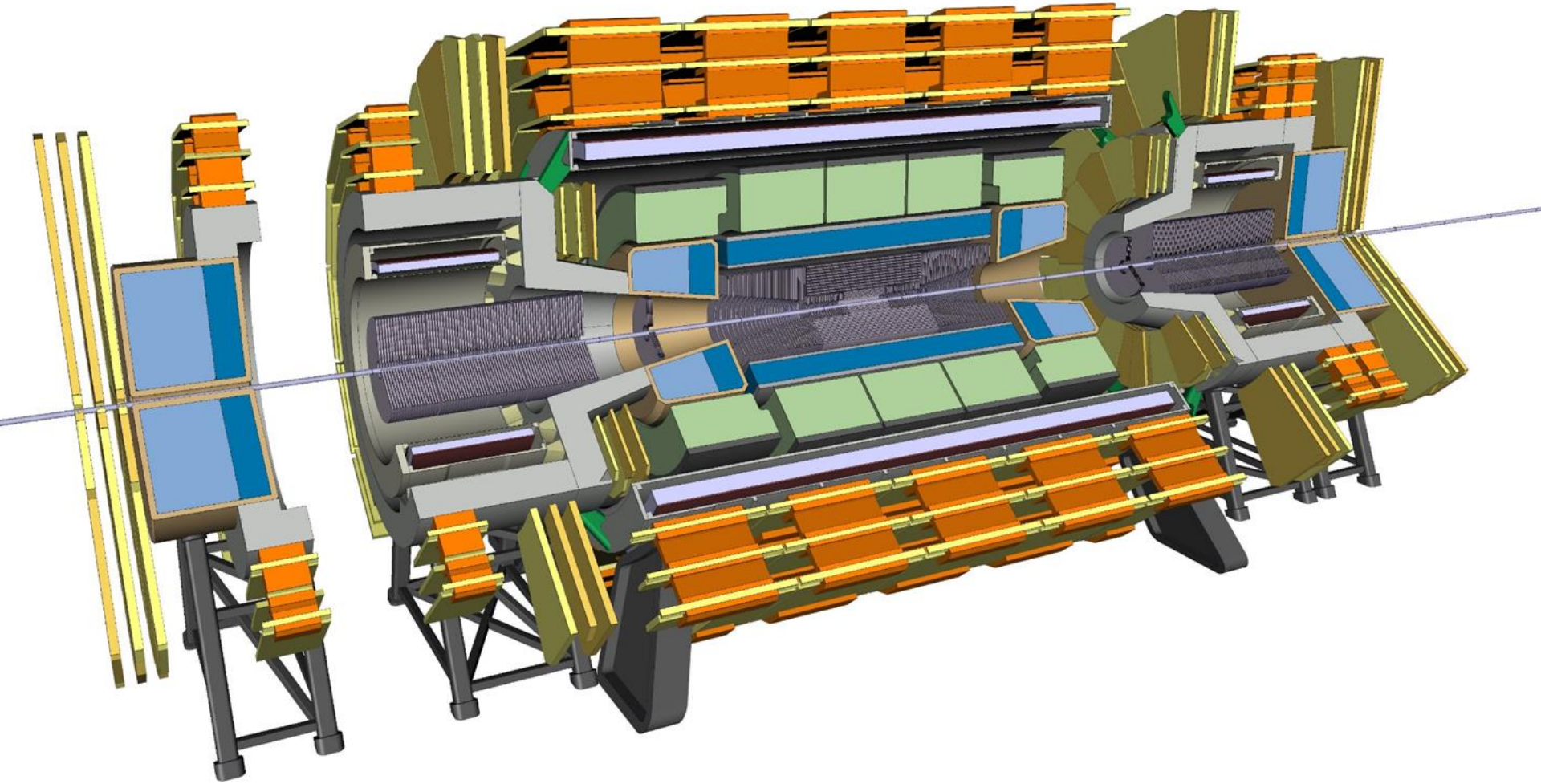
4 – Slide trackers module inside Radiation Shield

SHORT OPENING SCENARIO



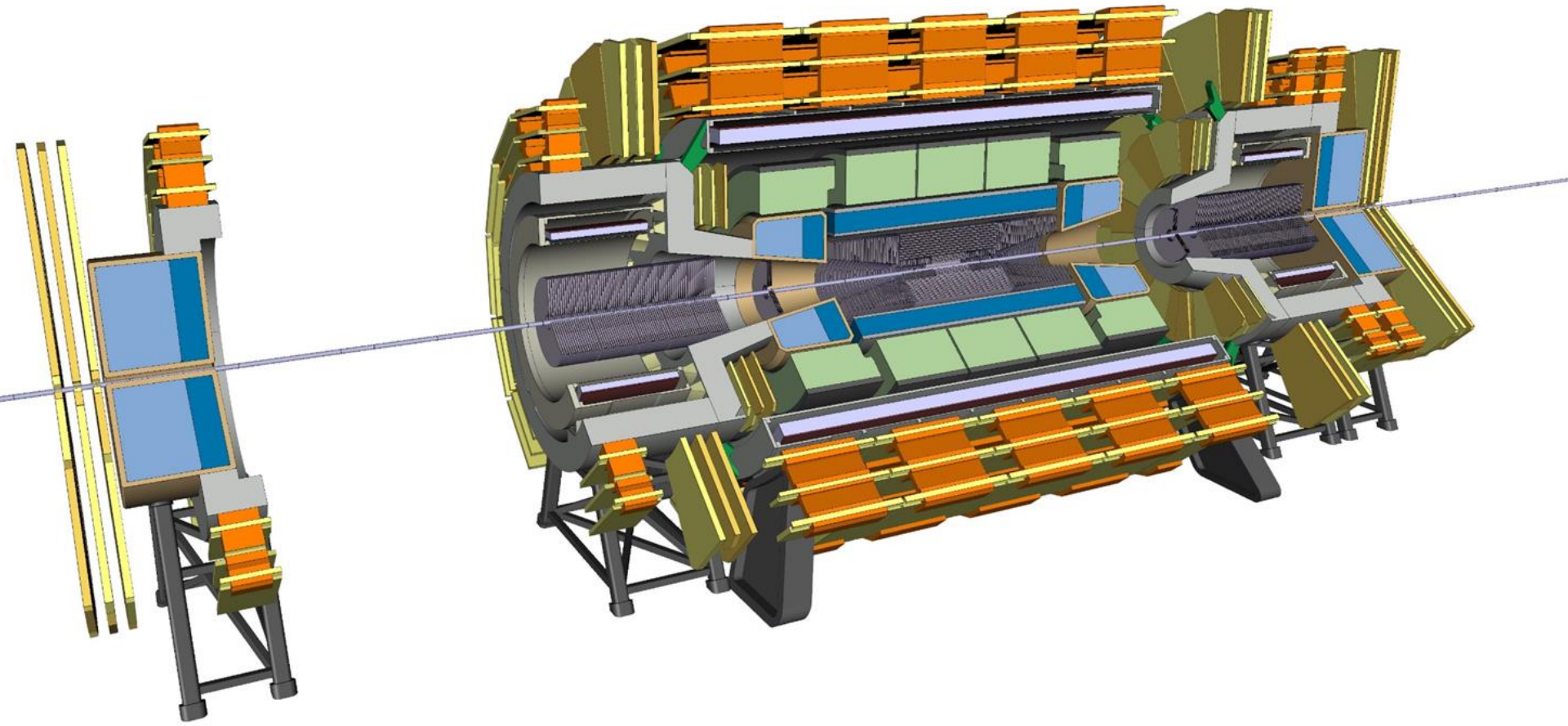
5 – Slide the Forward Solenoid structure

LONG SHUTDOWN SCENARIO



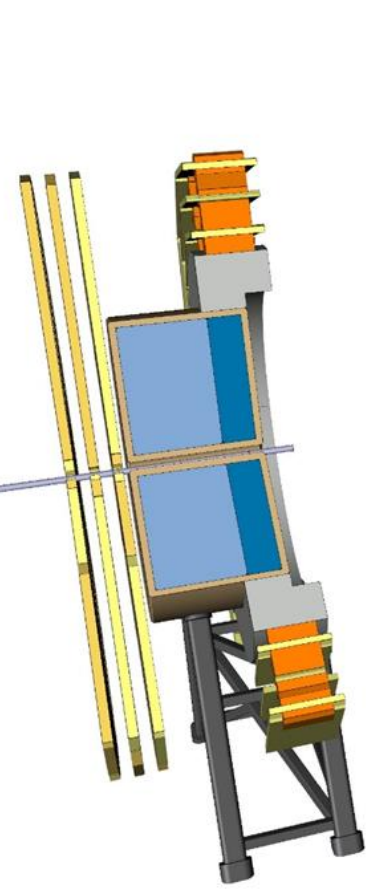
1 – 3rd step of the short opening on one side, and the final step on the other end

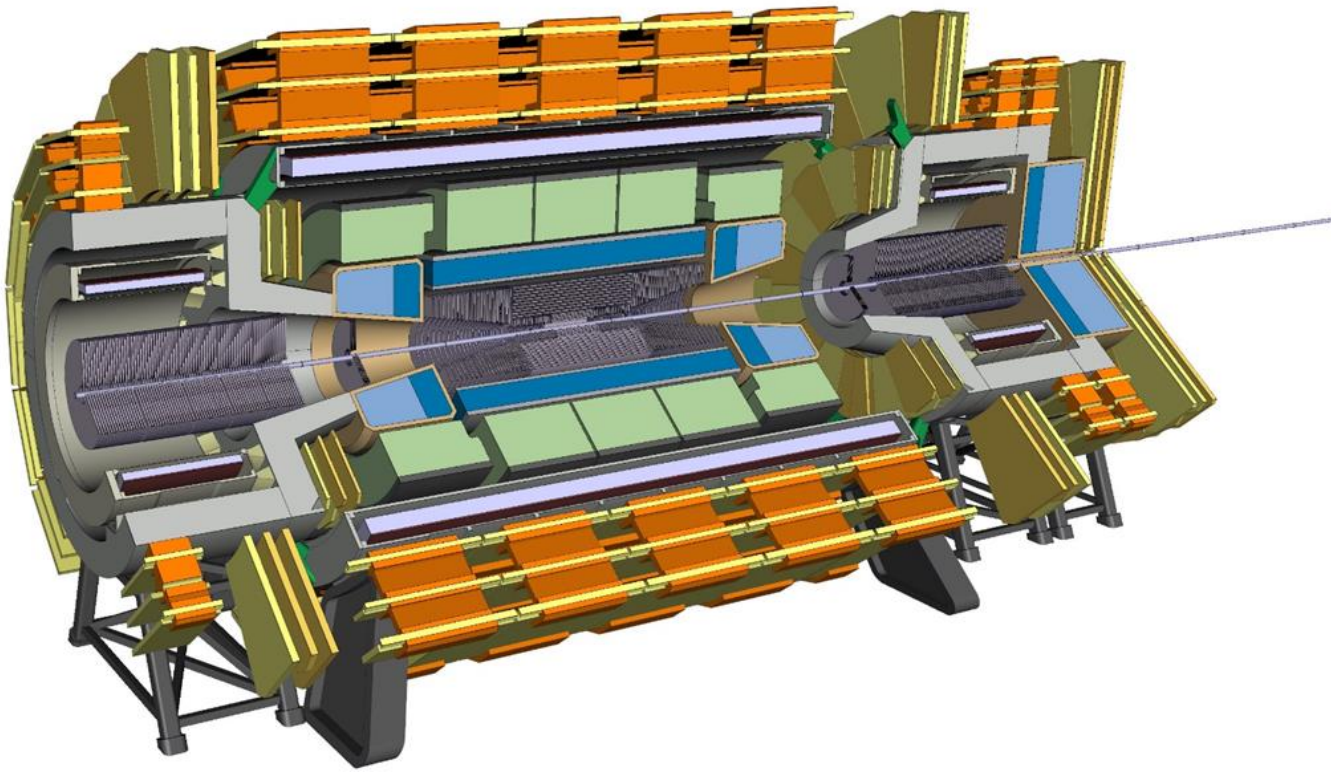
LONG SHUTDOWN SCENARIO



2 – Slide the Ecal 10.2m from the Forward Solenoid

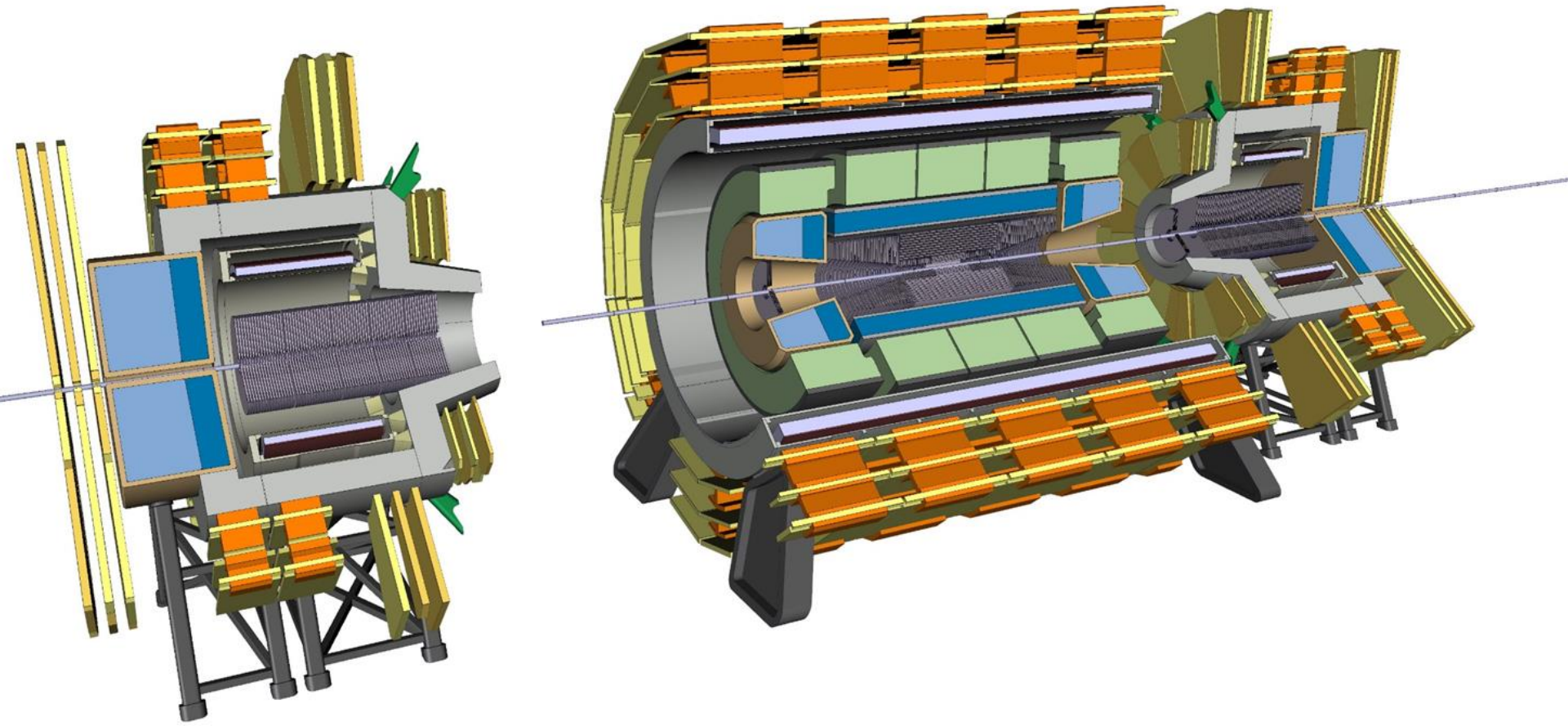
LONG SHUTDOWN SCENARIO





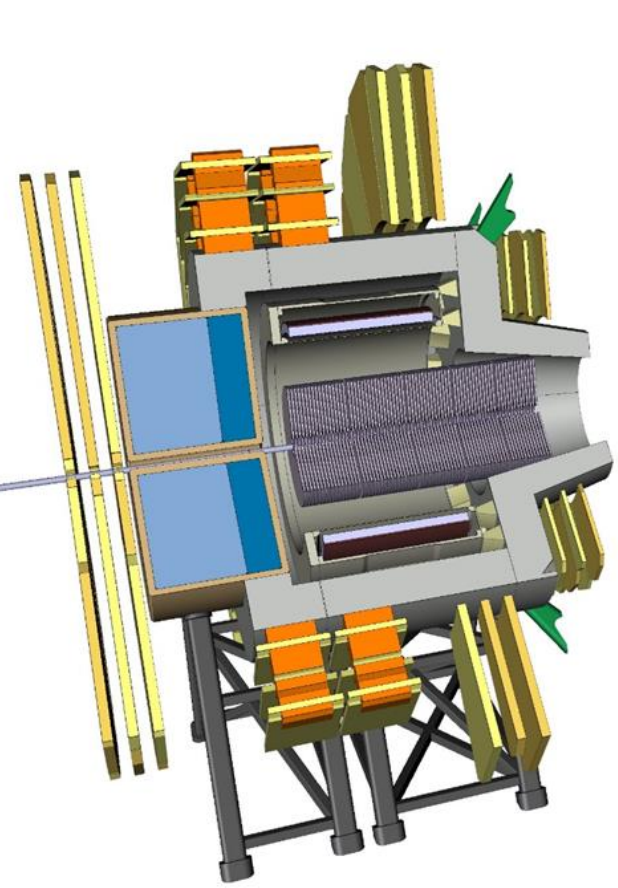
3 – Remove part of the Beam Pipe

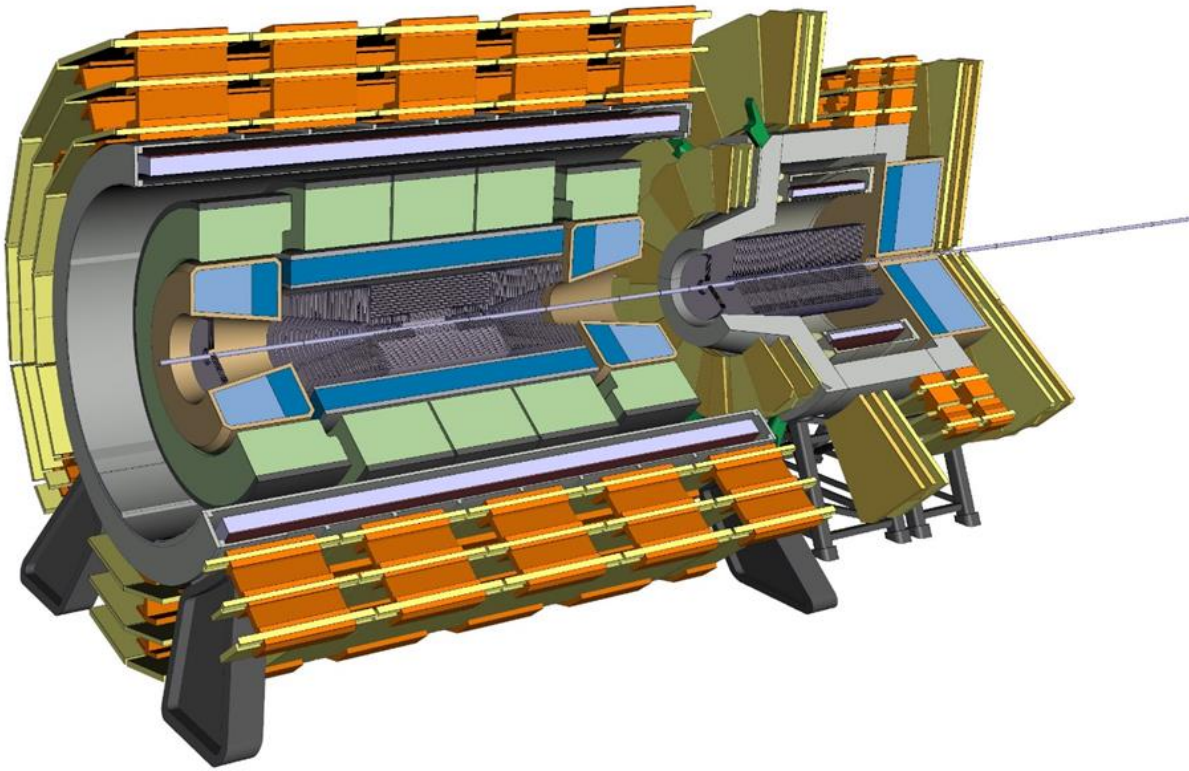
LONG SHUTDOWN SCENARIO



4 – Slide the Forward Solenoid structure

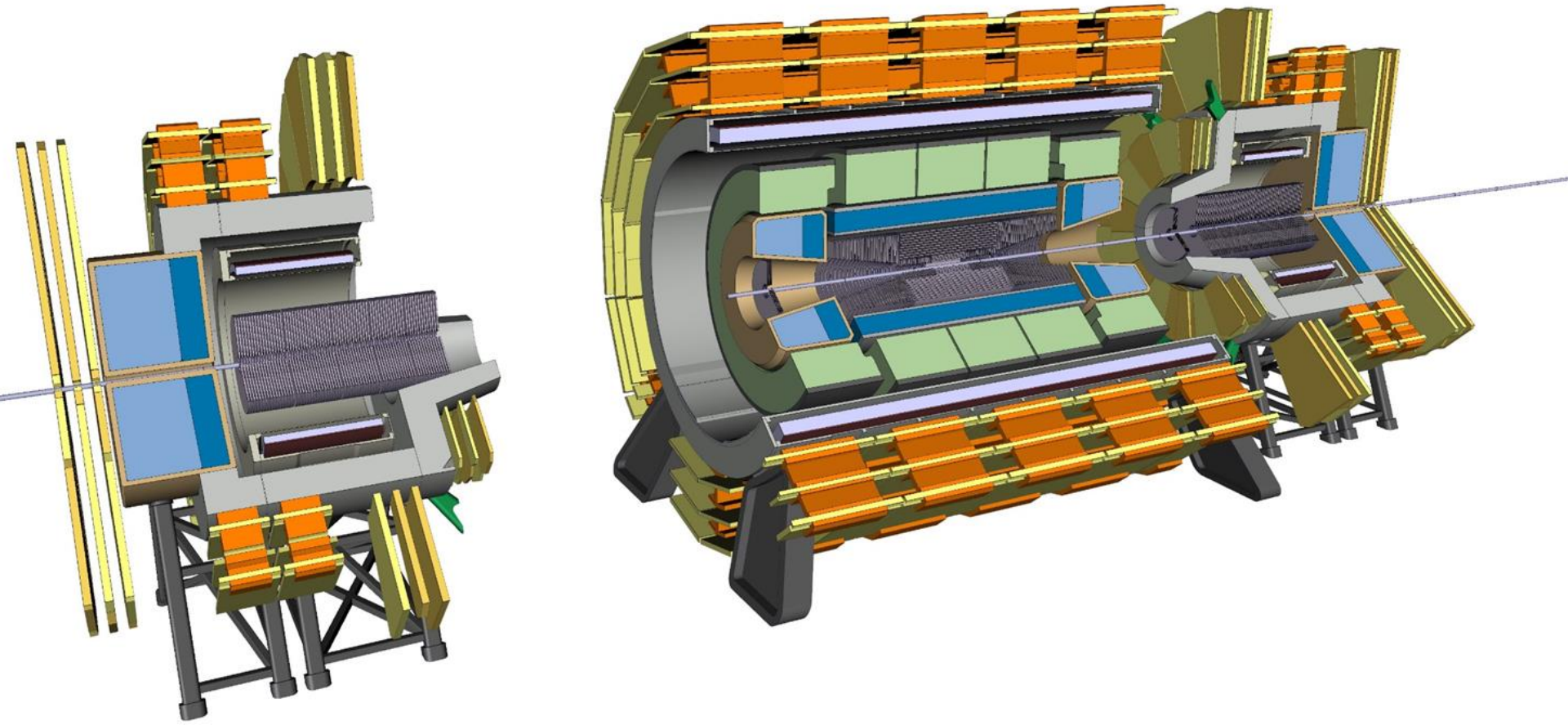
LONG SHUTDOWN SCENARIO





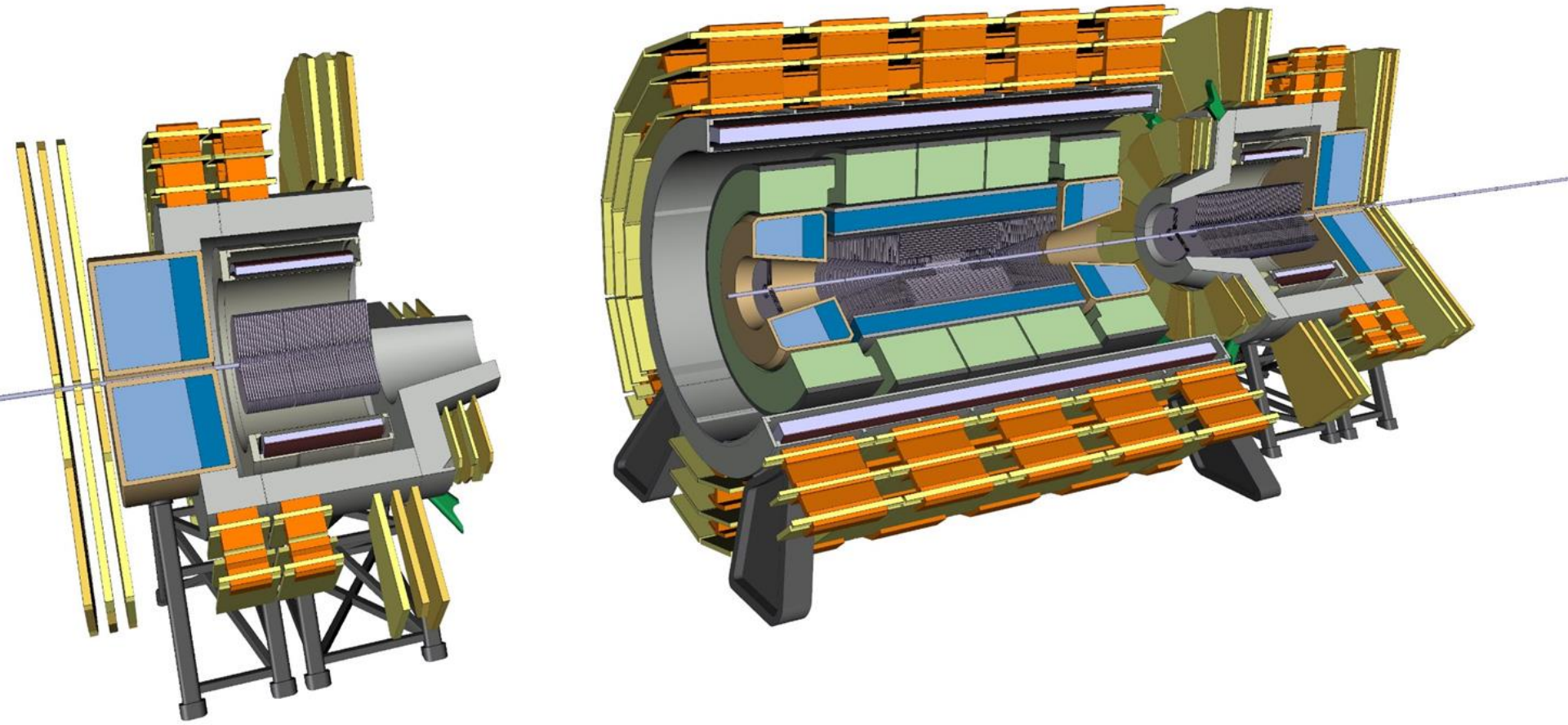
5 – Remove another portion of the beam pipe

LONG SHUTDOWN SCENARIO



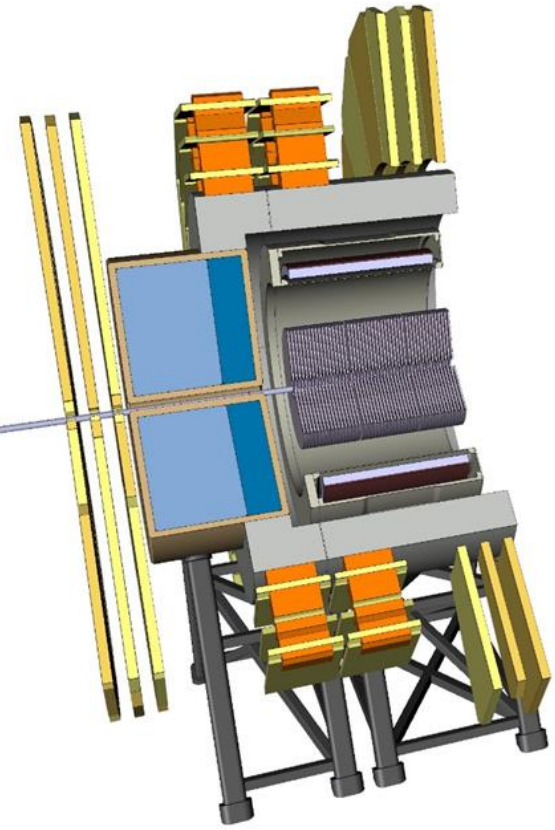
6 – Remove the top part of the Radiation Shield nose and its Muon Chambers

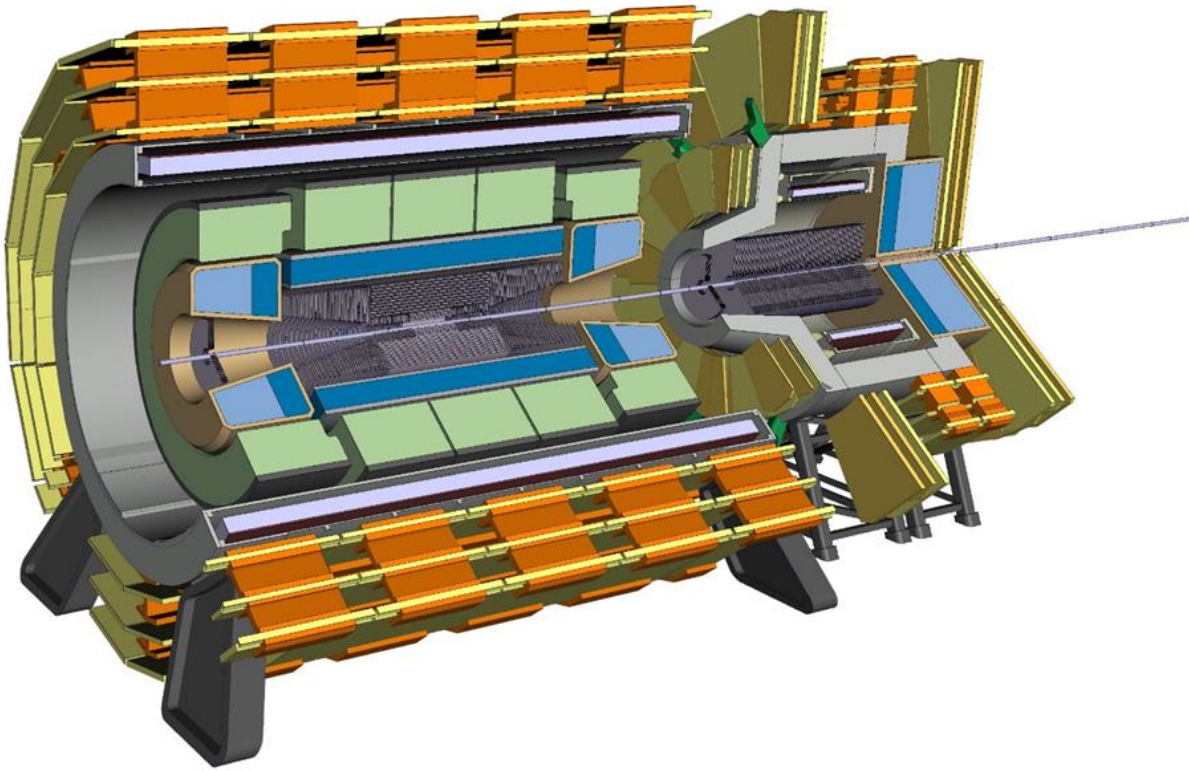
LONG SHUTDOWN SCENARIO



7 – Remove two modules of the Forward Trackers

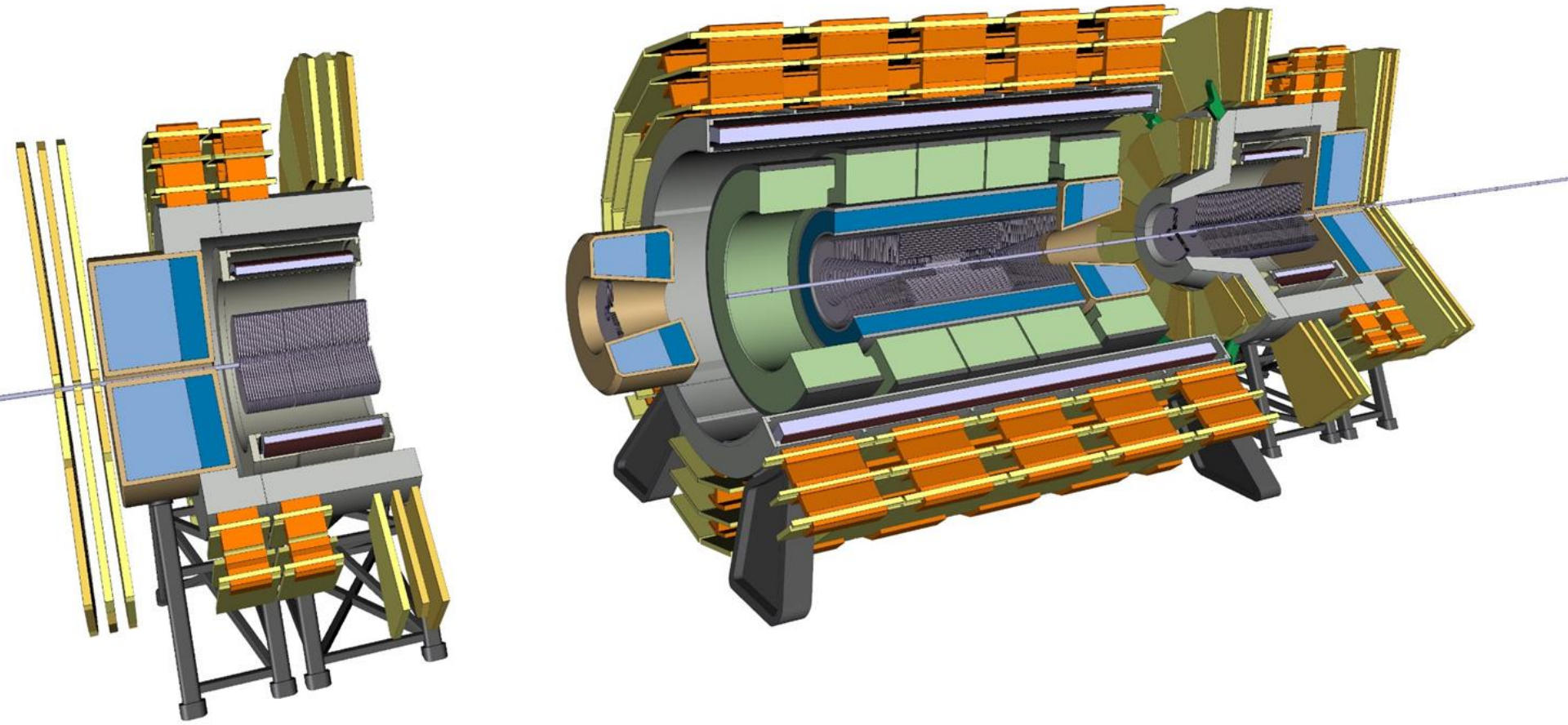
LONG SHUTDOWN SCENARIO





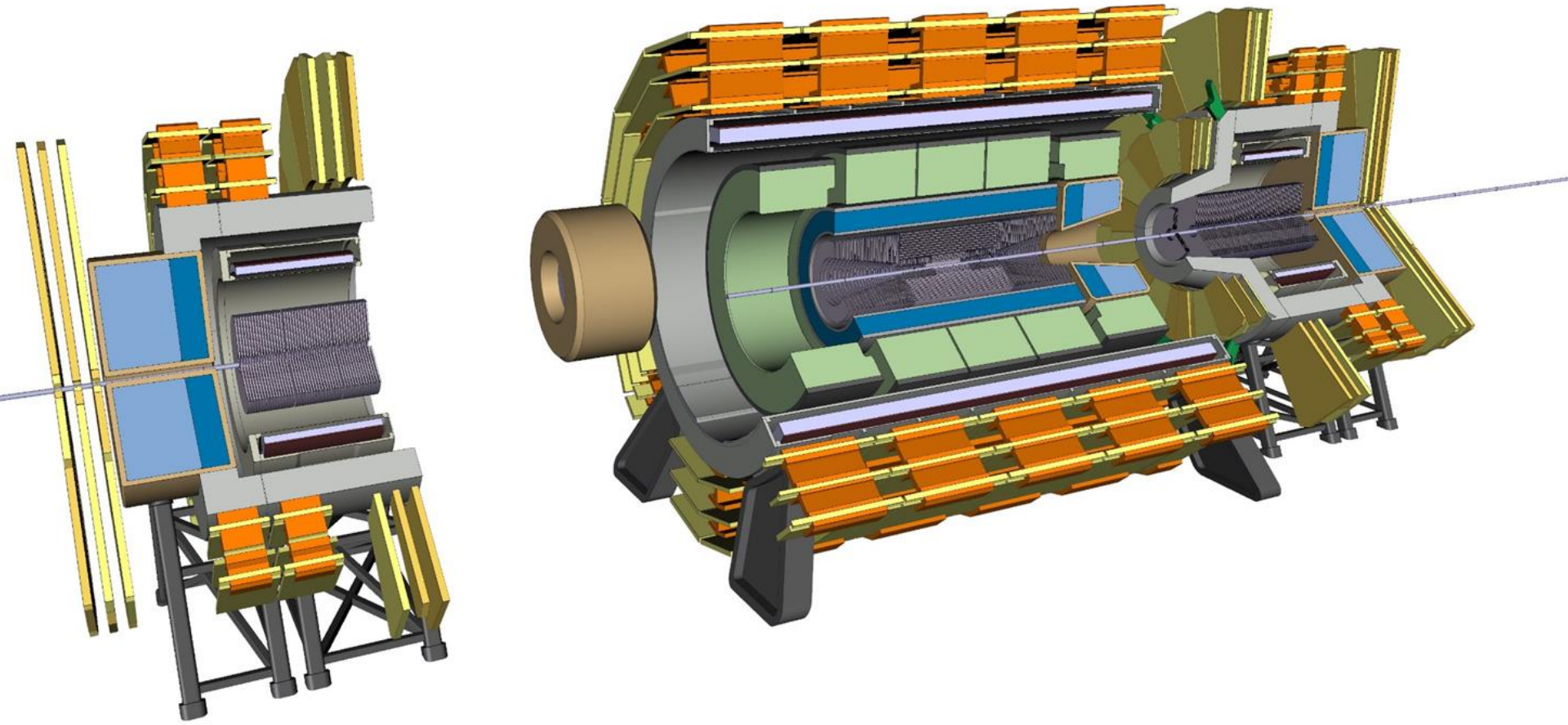
8 – Remove the bottom part of the Radiation Shield nose and its Muon Chambers

LONG SHUTDOWN SCENARIO



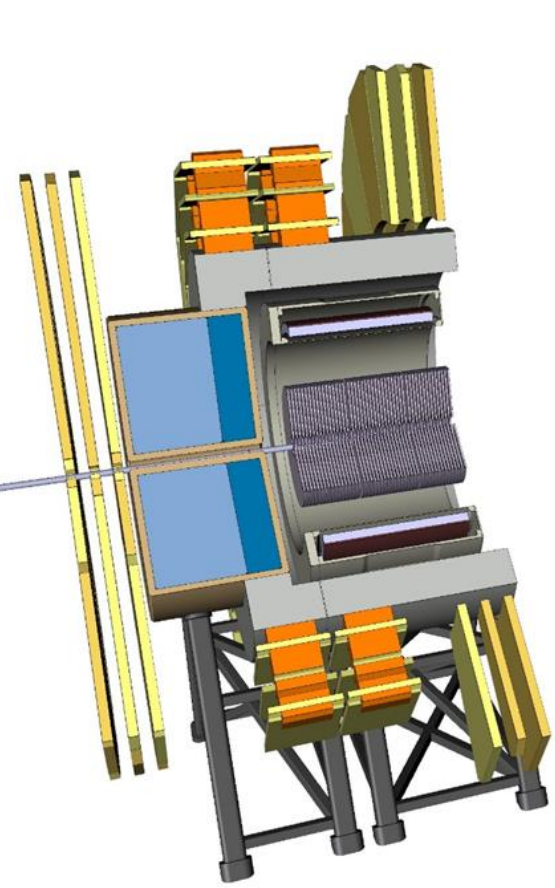
9 – Remove the Ecal Module and the Tracker module inside

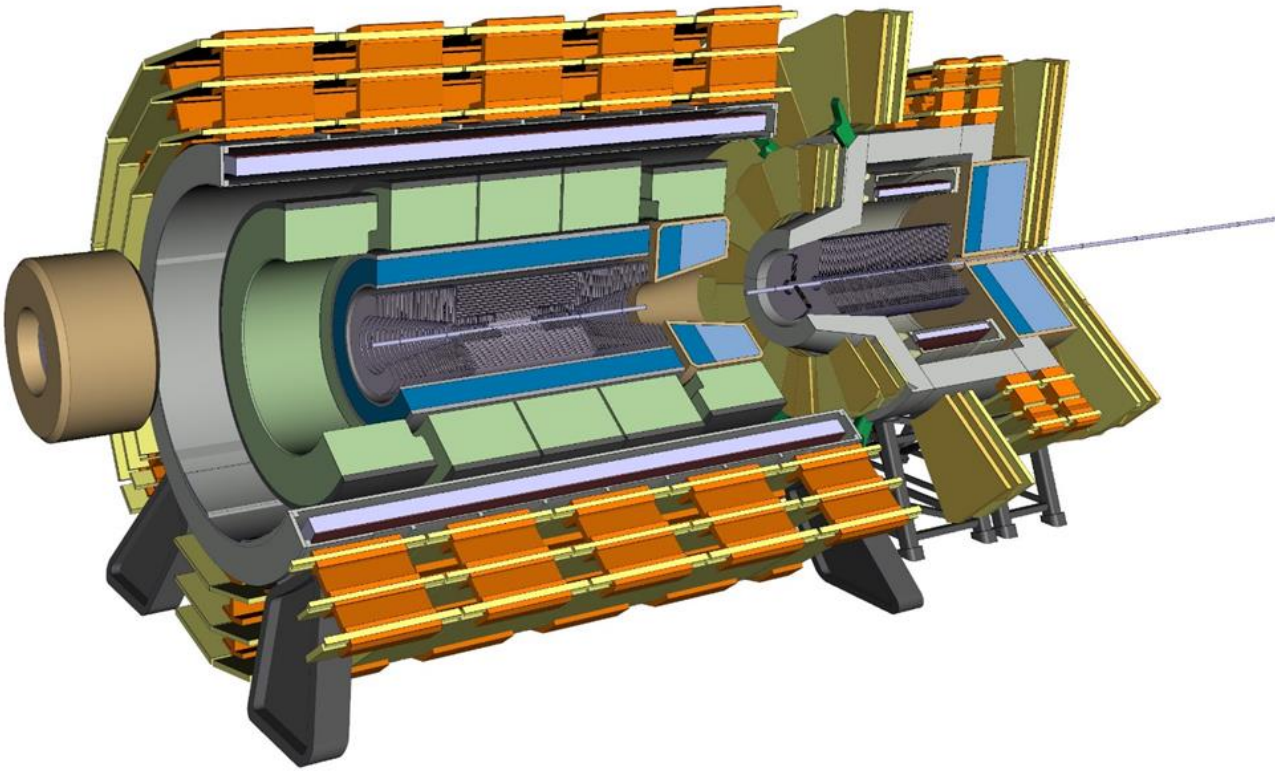
LONG SHUTDOWN SCENARIO



10 – Move the Ecal Module and the Tracker module sideways

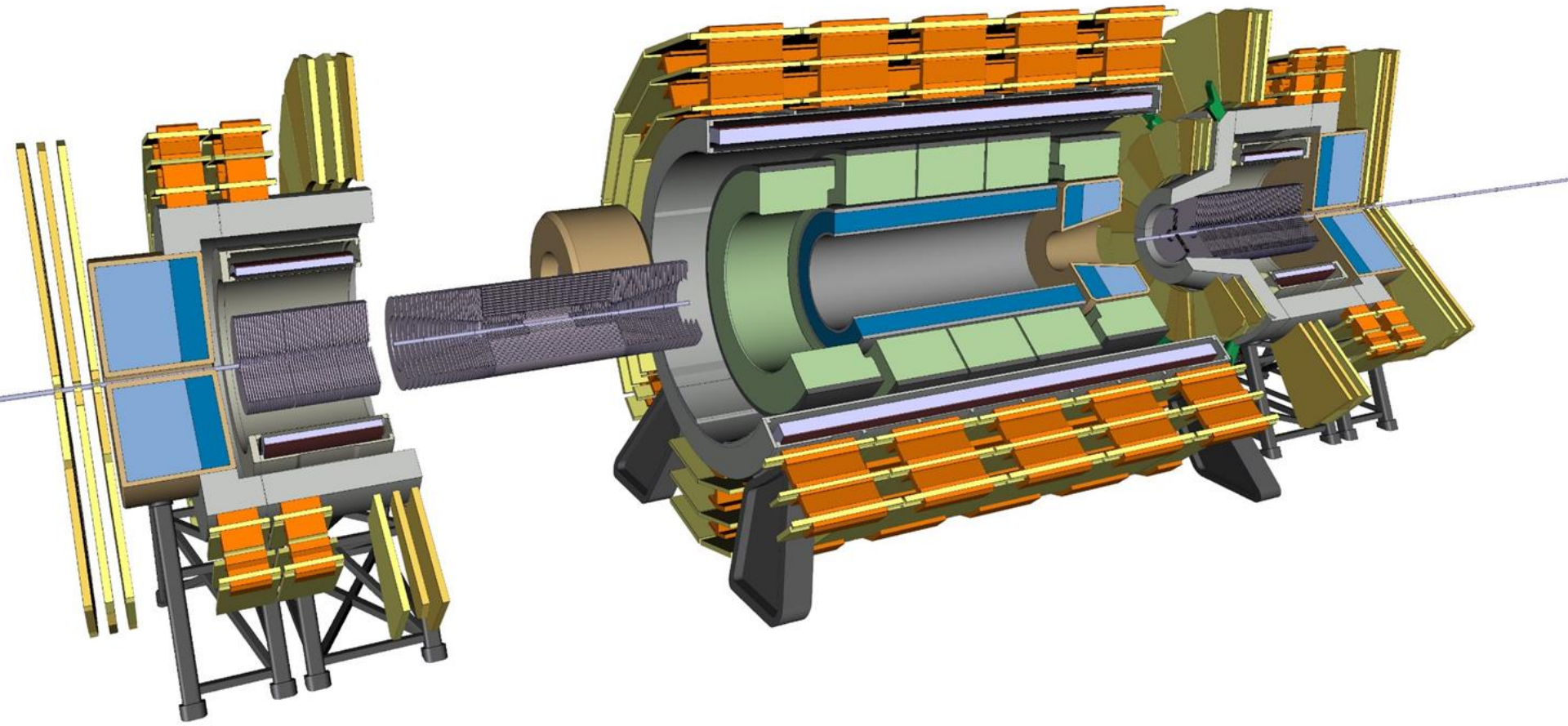
LONG SHUTDOWN SCENARIO





11 – Remove another portion of the Beam Pipe (on both ends of the tracker)

LONG SHUTDOWN SCENARIO



12 – Slide the Trackers Outside

Cavern

Detector envelope (L x W x H) [m^3]	54 x 18 x 18.5
Cavern Size (L x W x H) [m^3]	65 x 28 x 28
Main Shaft diameter [m]	12
Secondary shaft diameter [m]	10
Main shaft crane requirement [kt]	2 or 3 (depends on Hcal modularity)
Secondary shaft crane requirement [kt]	0.6