Support Structure Design and Fabrication

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LBNL

EMCalal Collaboration Meeting
15-16 October 2005
Berkeley

Outline

- EMCal Support structure (EMCalSS) mechanical design approach
- EMCal Detector Design
- System Integration
- Schedule and critical milestones

Mechanical Engineering Team

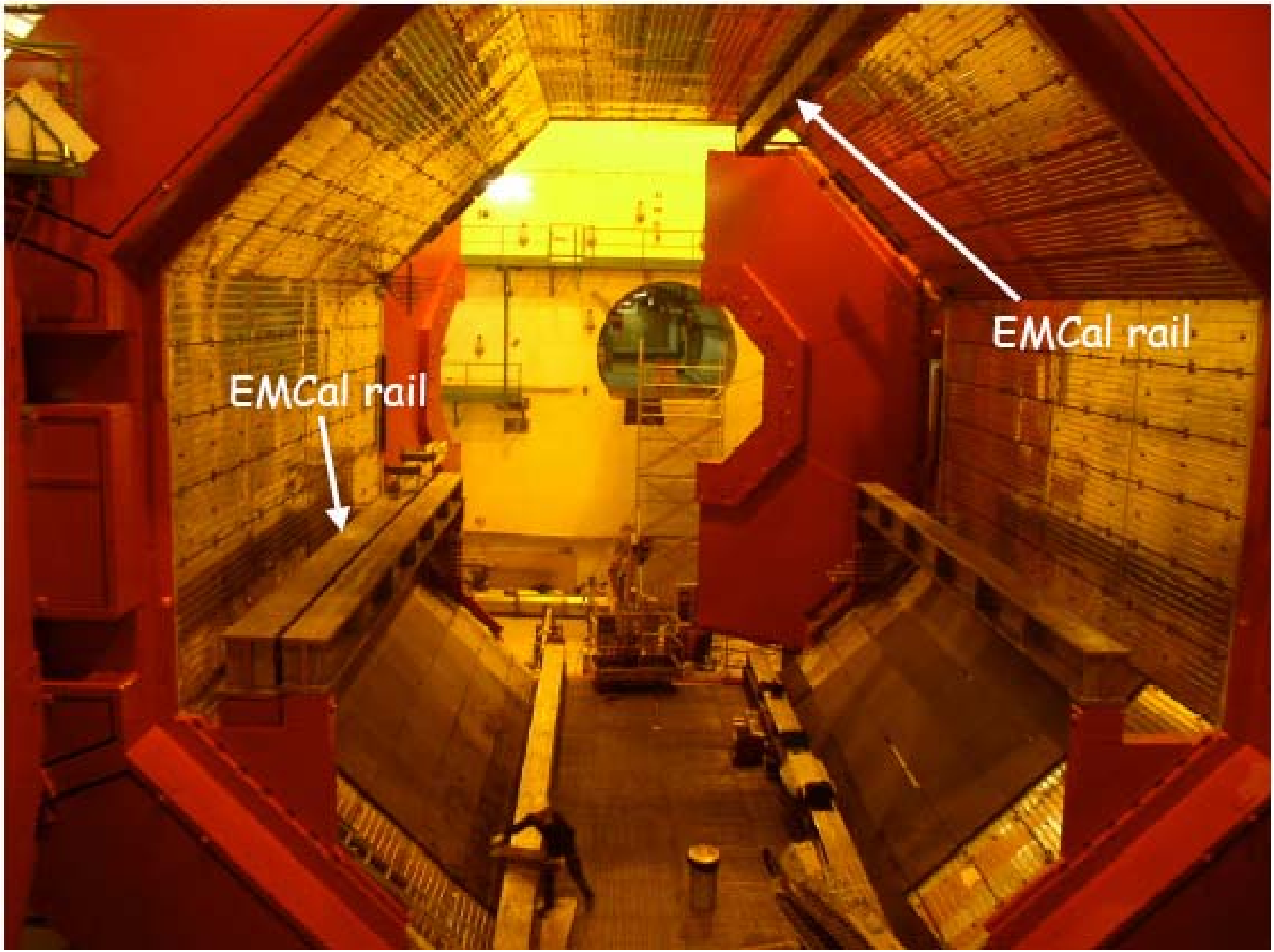
- Mechanical engineering team at Berkeley
  - John Bercovitz: Lead mechanical engineer
  - Robin Lafever: Design engineer
  - Tim Loew: Mechanical engineer

- Supporting Team at CERN
  - Diego Perini: Lead mechanical engineer
  - Team of FEA specialists

    Adam Wrobleski

    Jan Bielski

EMCal Interface

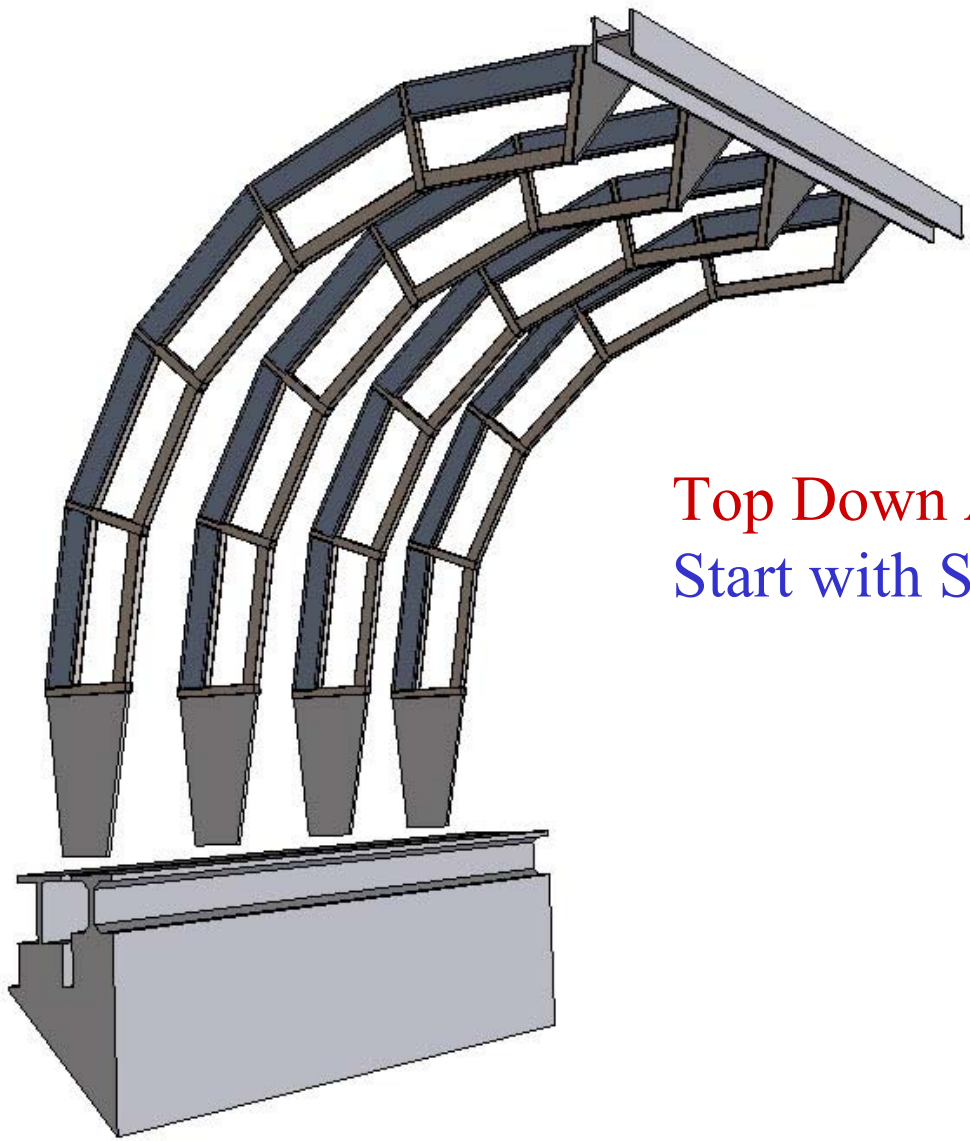


EMSS General Design Guidelines:

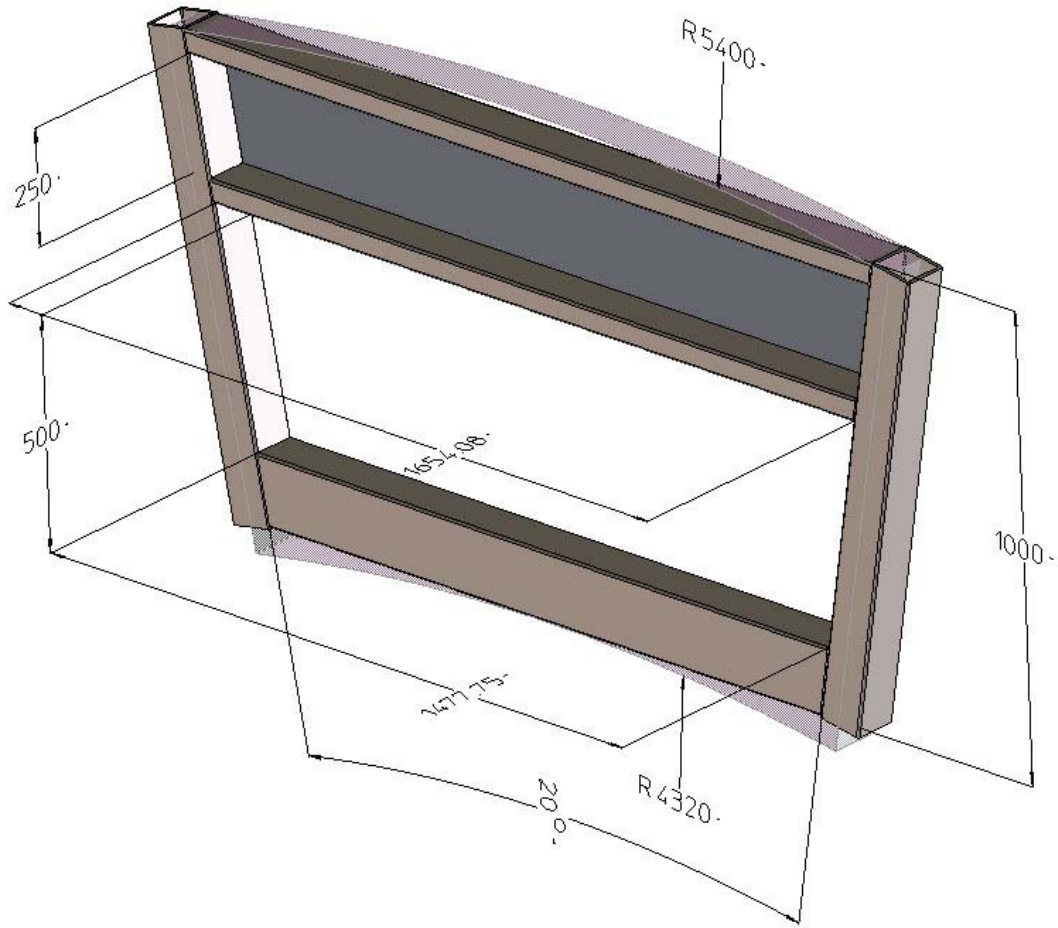
- Fits existing envelope
  - Inner radius 4320 mm
  - Outer radius 5400 mm
- Attaches to exiting rails inside L3
- Provides maximum detector coverage
  - Minimize space volume
  - Minimize manufacturing and assembly tolerances
  - Minimize deflection when loaded
- Allows for room and access to electronics crates
- Ease of super module installation
- Meets cost and schedule constraints
  - Installed before Sep 06
- Installation presents minimum interference with the on going ALICE's5 assembly operation

EMCal SS Design Approach

- Top down and bottom up approaches that will converge to a design meeting requirements
- Design flexible enough to accommodate minor design changes of the supper modules support and installation scheme
- Start with design based on the TPC space frame
  - Known design parameters and stiffness
  - Known manufacturing process and cost
- Explore other deign options meet the tight cost/schedule constraints and maximize the detector coverage

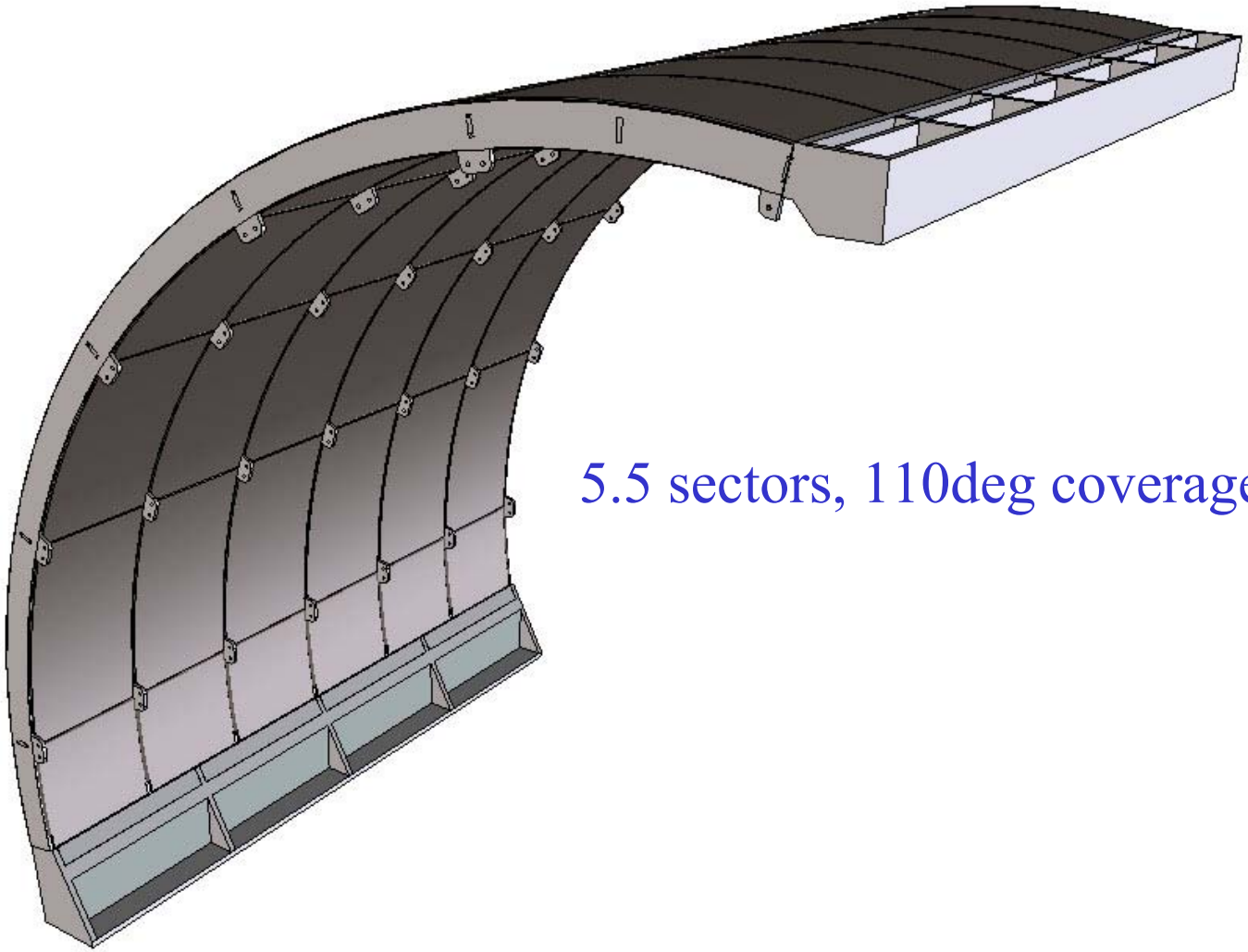


Top Down Approach:
Start with Space Frame Design



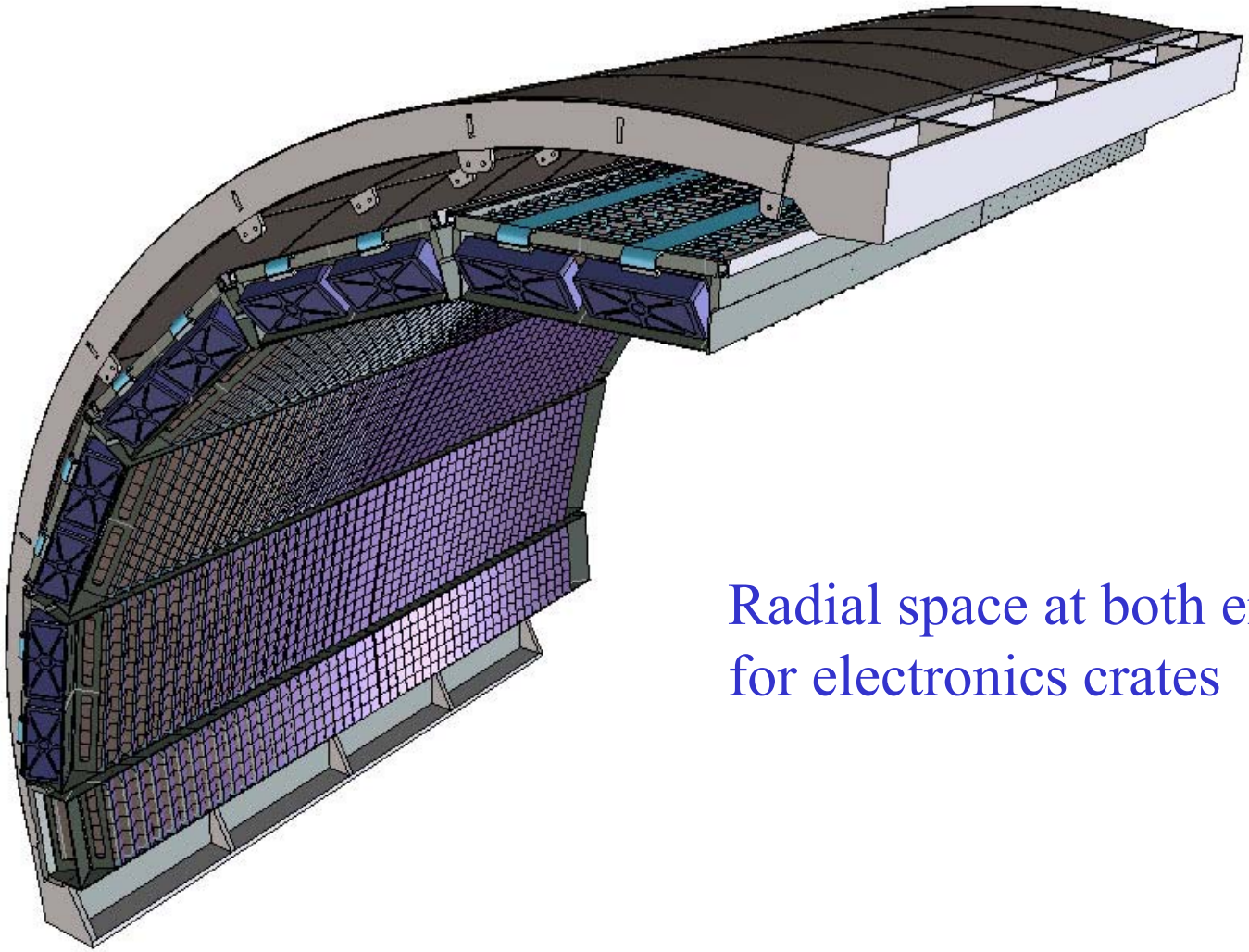
- Limited height for room super module assembly and electronics crate
- Large gaps in gaps in coverage
- Difficult to manufacture

Strong Back Support Concept



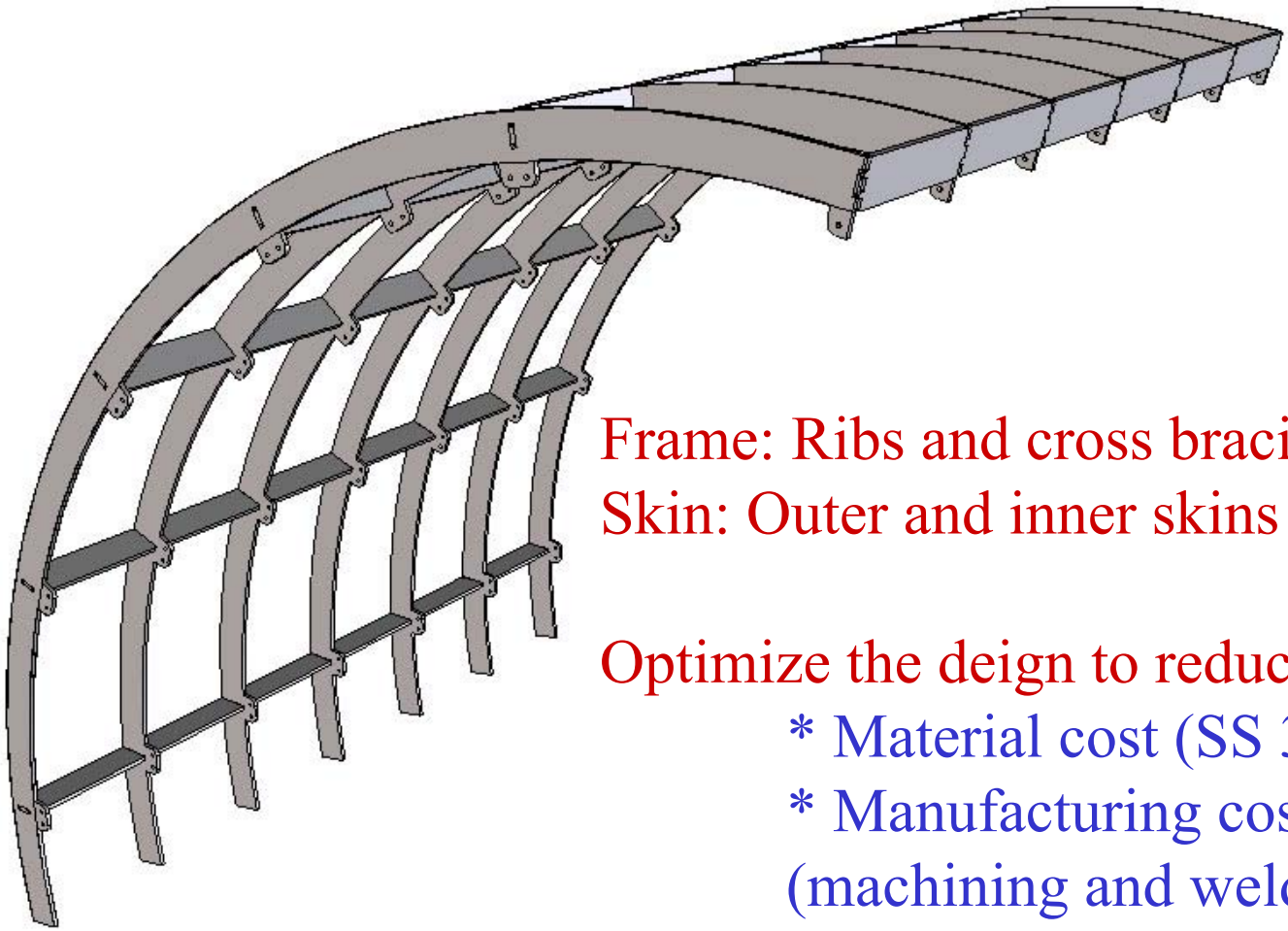
5.5 sectors, 110deg coverage

Strong Back Support Loaded with Super Modules



Radial space at both ends
for electronics crates

Construction of the Monocoque Design

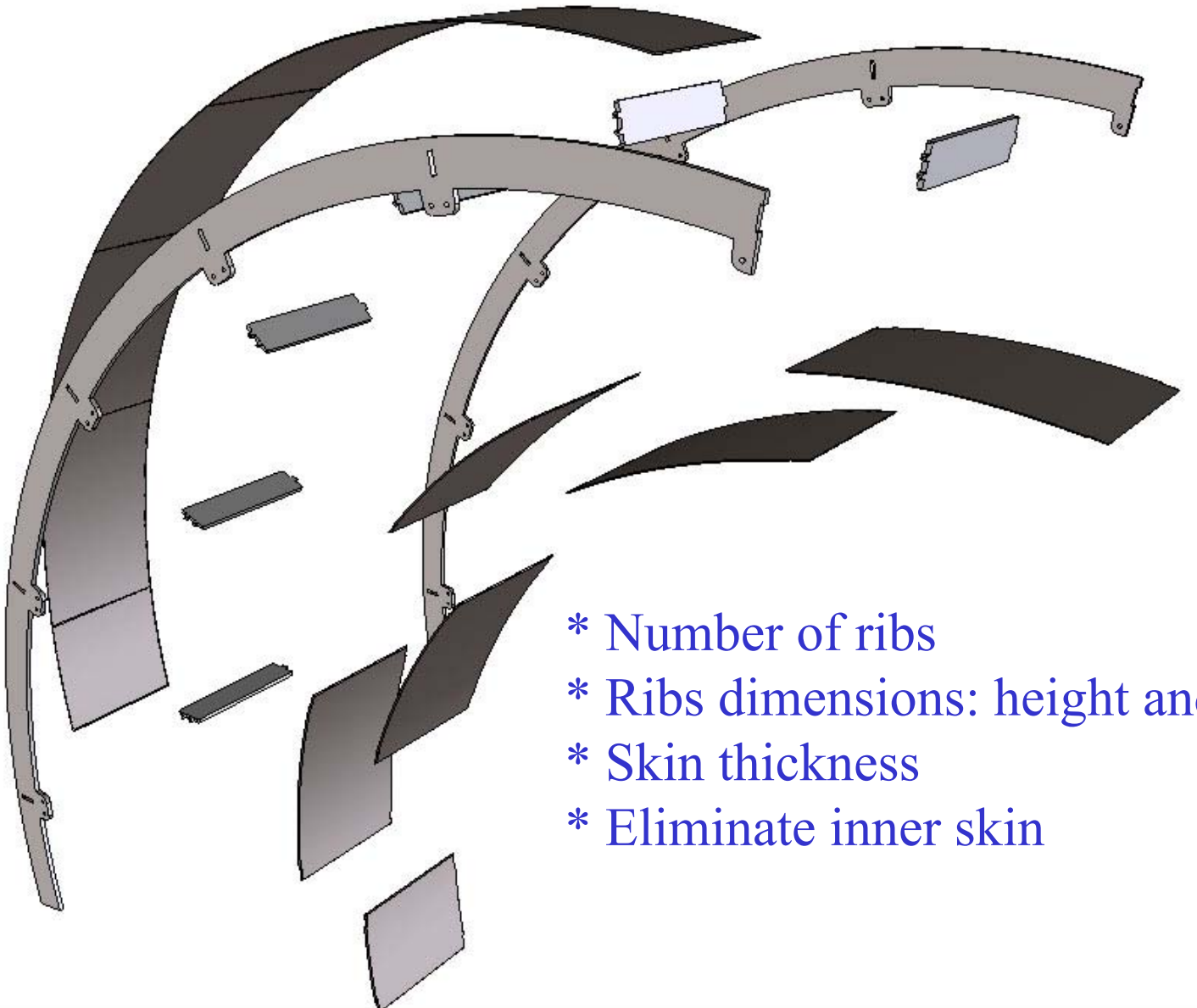


Frame: Ribs and cross bracing
Skin: Outer and inner skins (maybe)

Optimize the deign to reduce cost:

* Material cost (SS 304L)
* Manufacturing cost (machining and welding)

Design Optimization Parameters



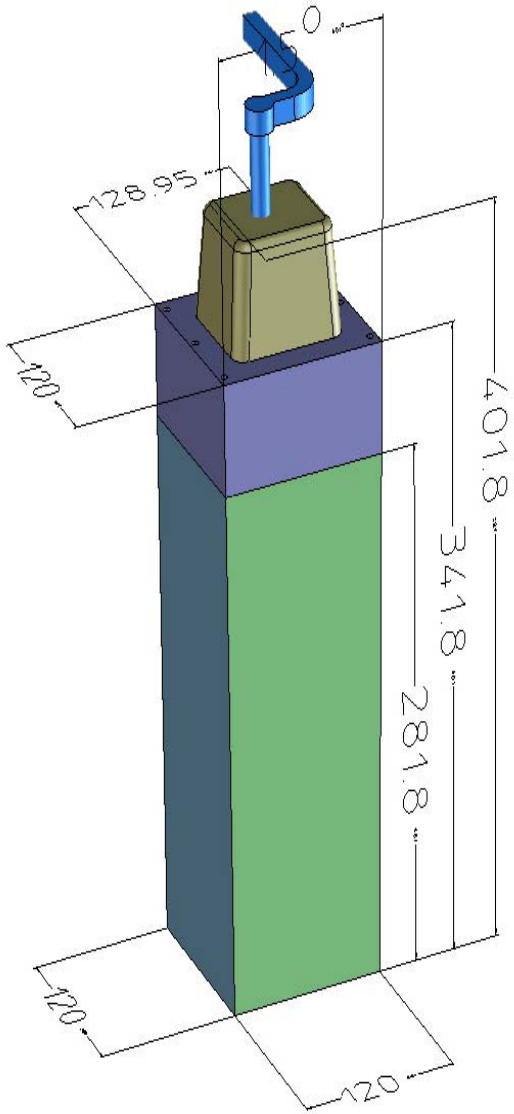
* Number of ribs
* Ribs dimensions: height and thickness
* Skin thickness
* Eliminate inner skin

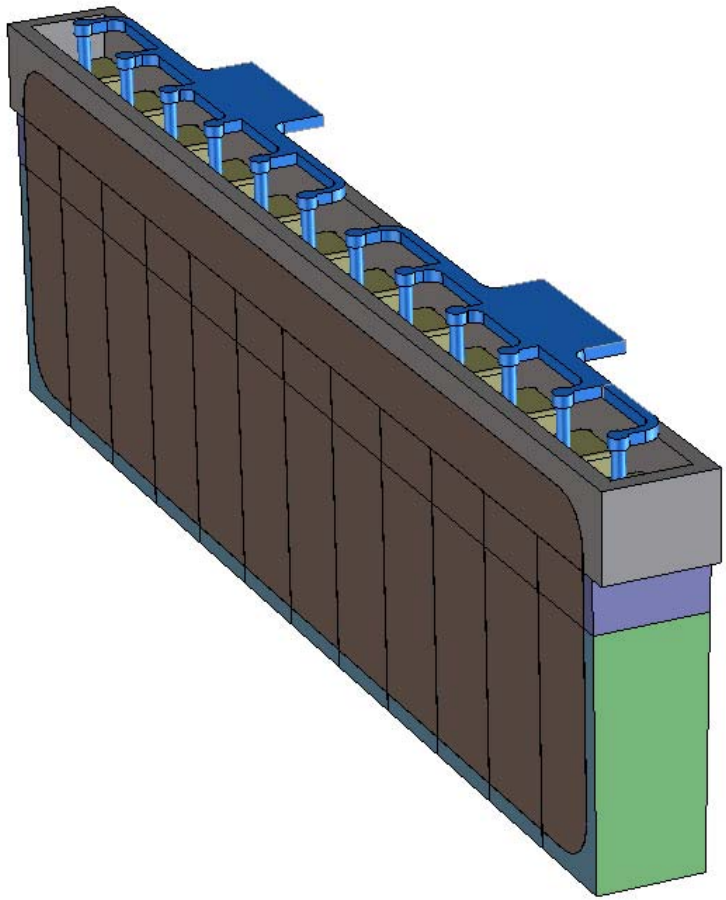
Support Structure Design Status

- General design configuration complete
- Design optimization by finite element analysis is under way
- Manufacturing specification document is complete
- Manufacturing input is sought and will be incorporated into design
- Expect to go out for cost inqueries by end of October 05
- Manufacturing cost estimate will be presented to DOE in the December 05 review

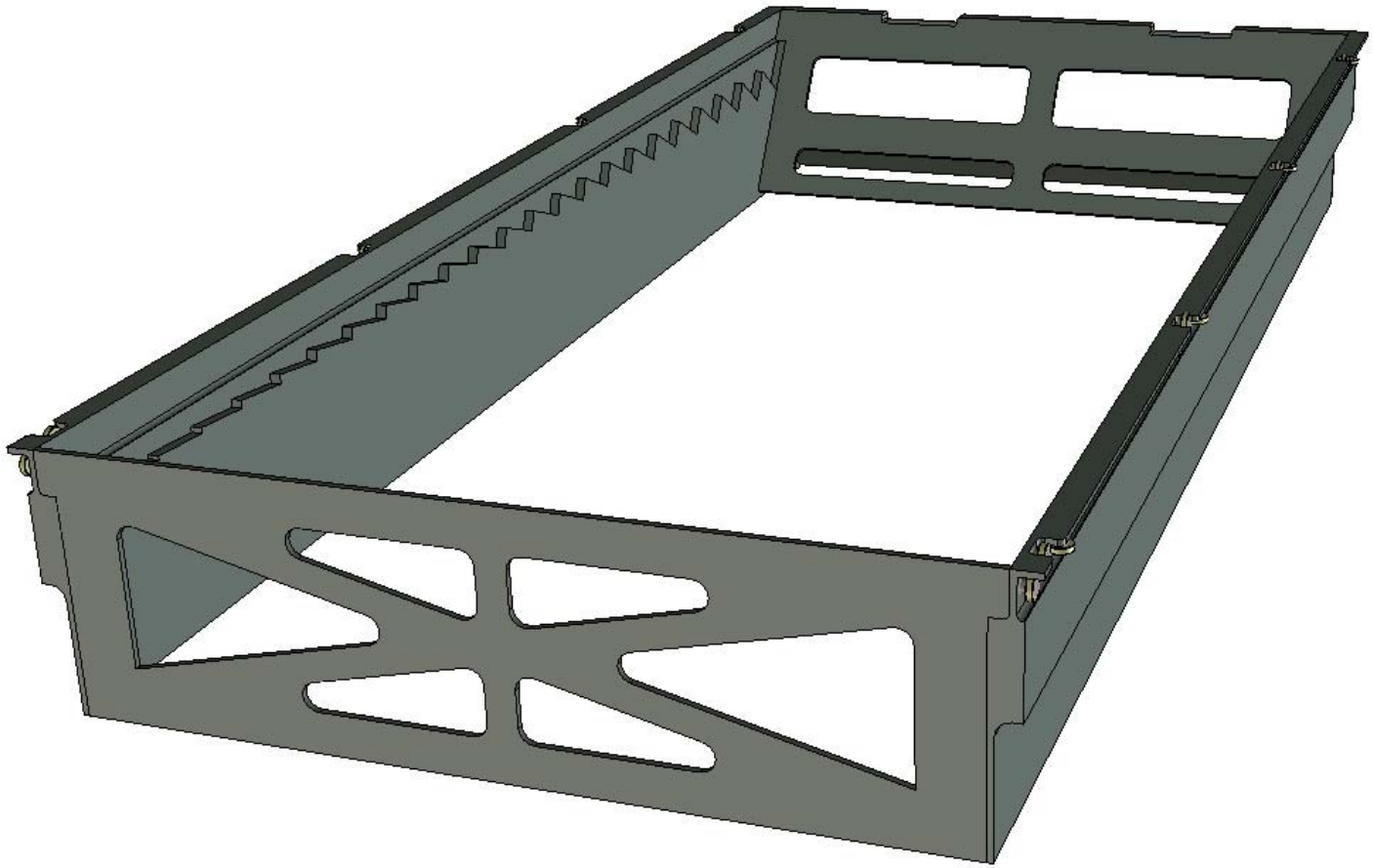
Detector Design

EMCal Module and Mid Module Subassembly

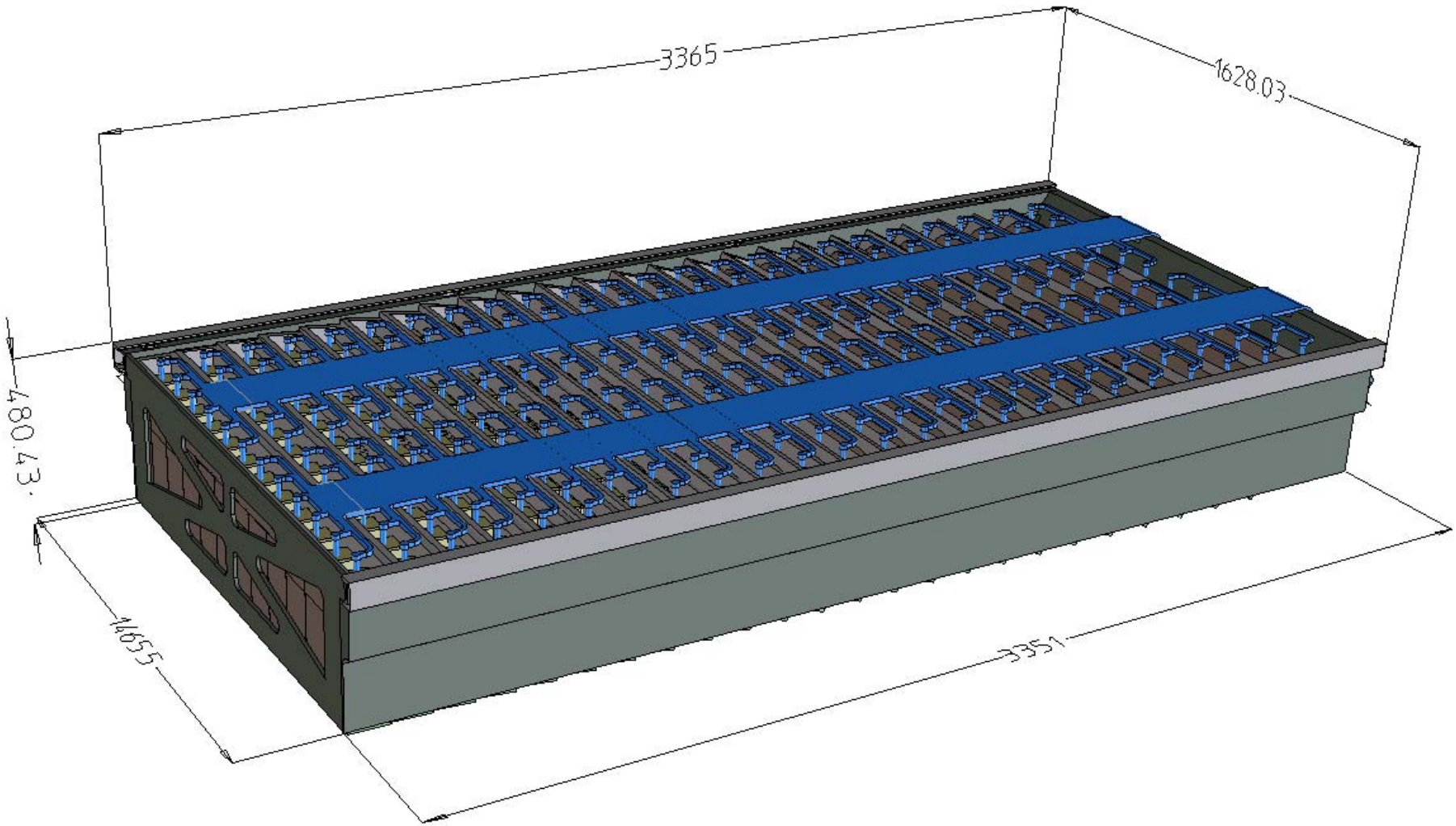




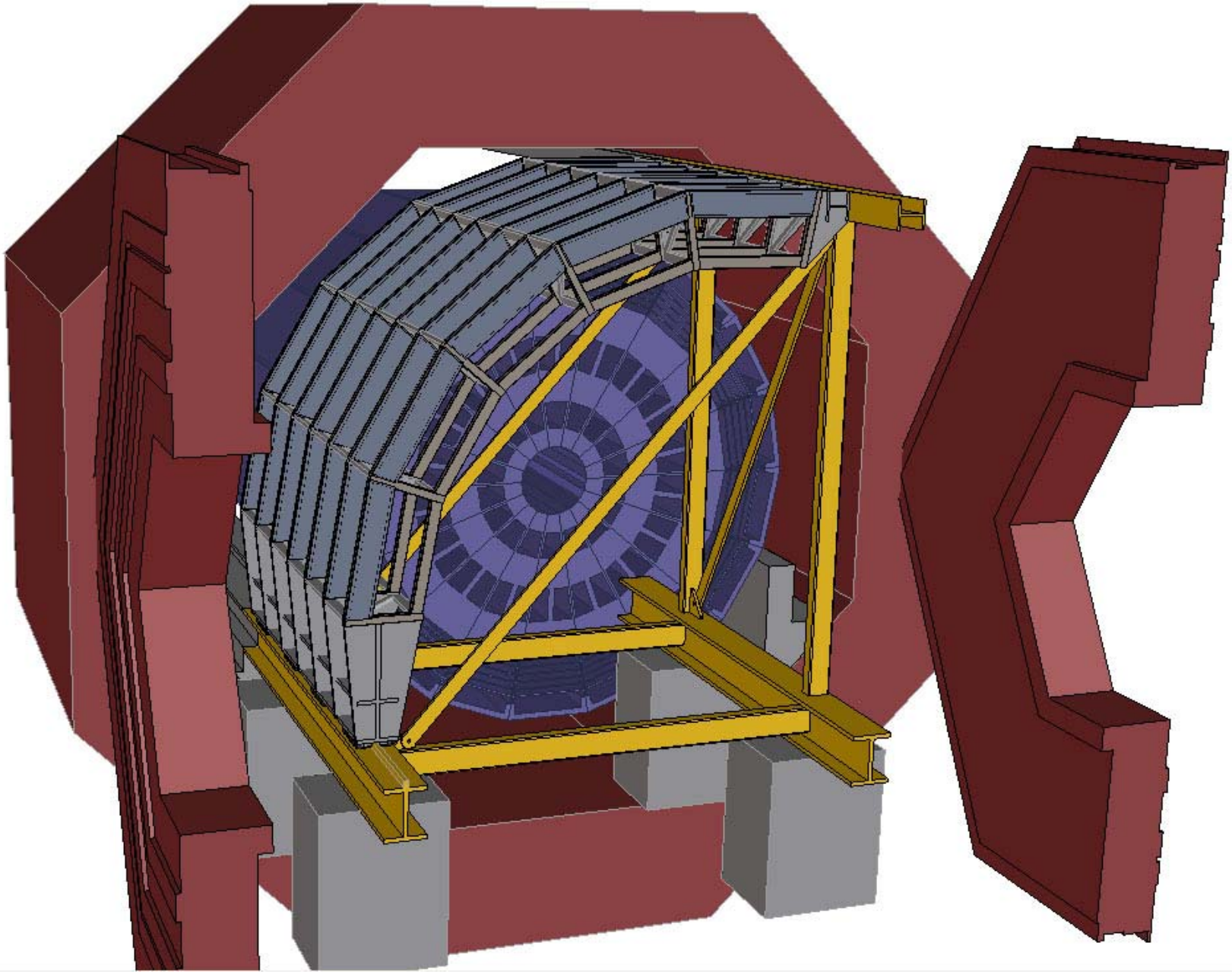
Super Module Loading Rack



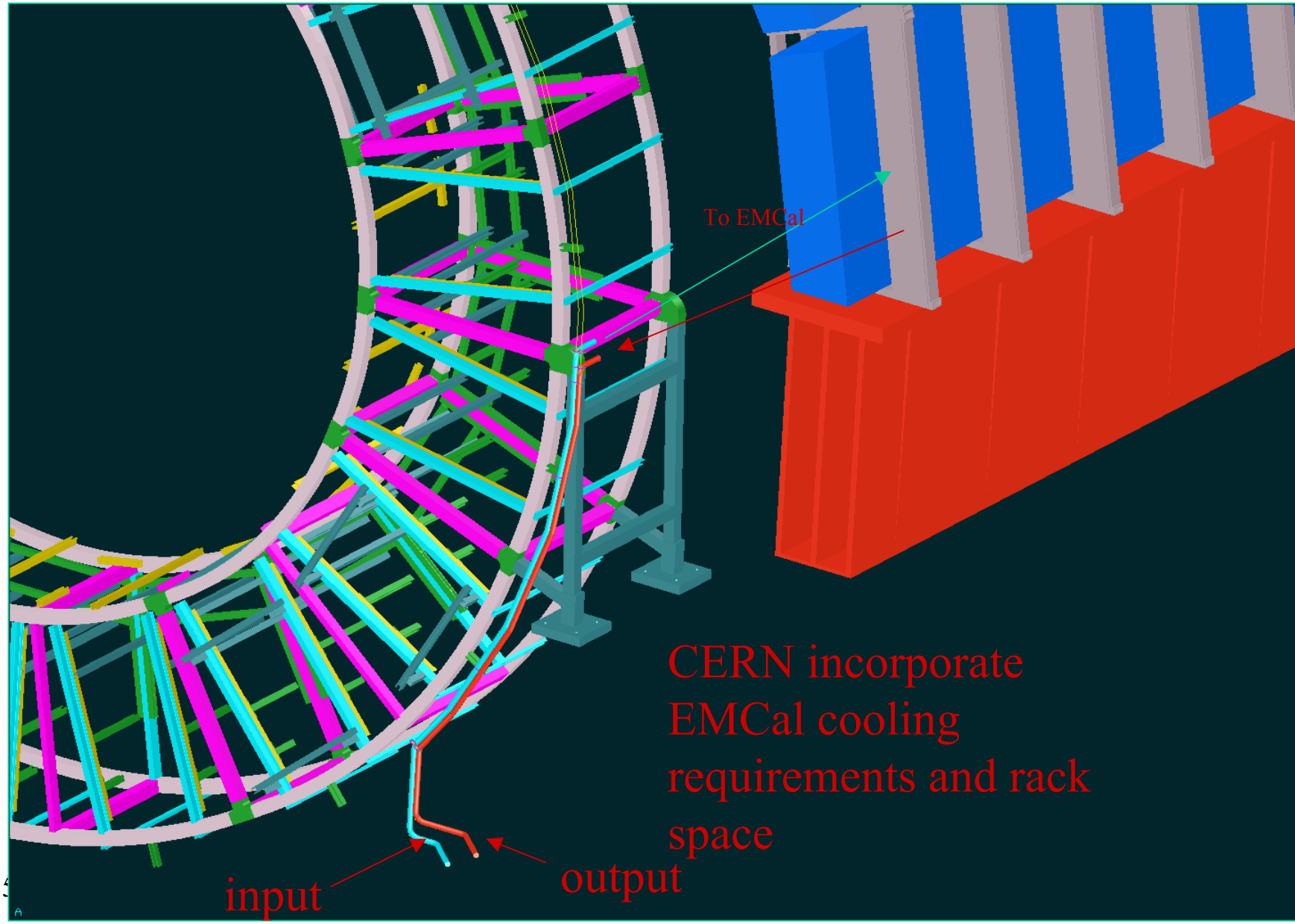
Super Module Assembly



System Integration: Support Frame Installation

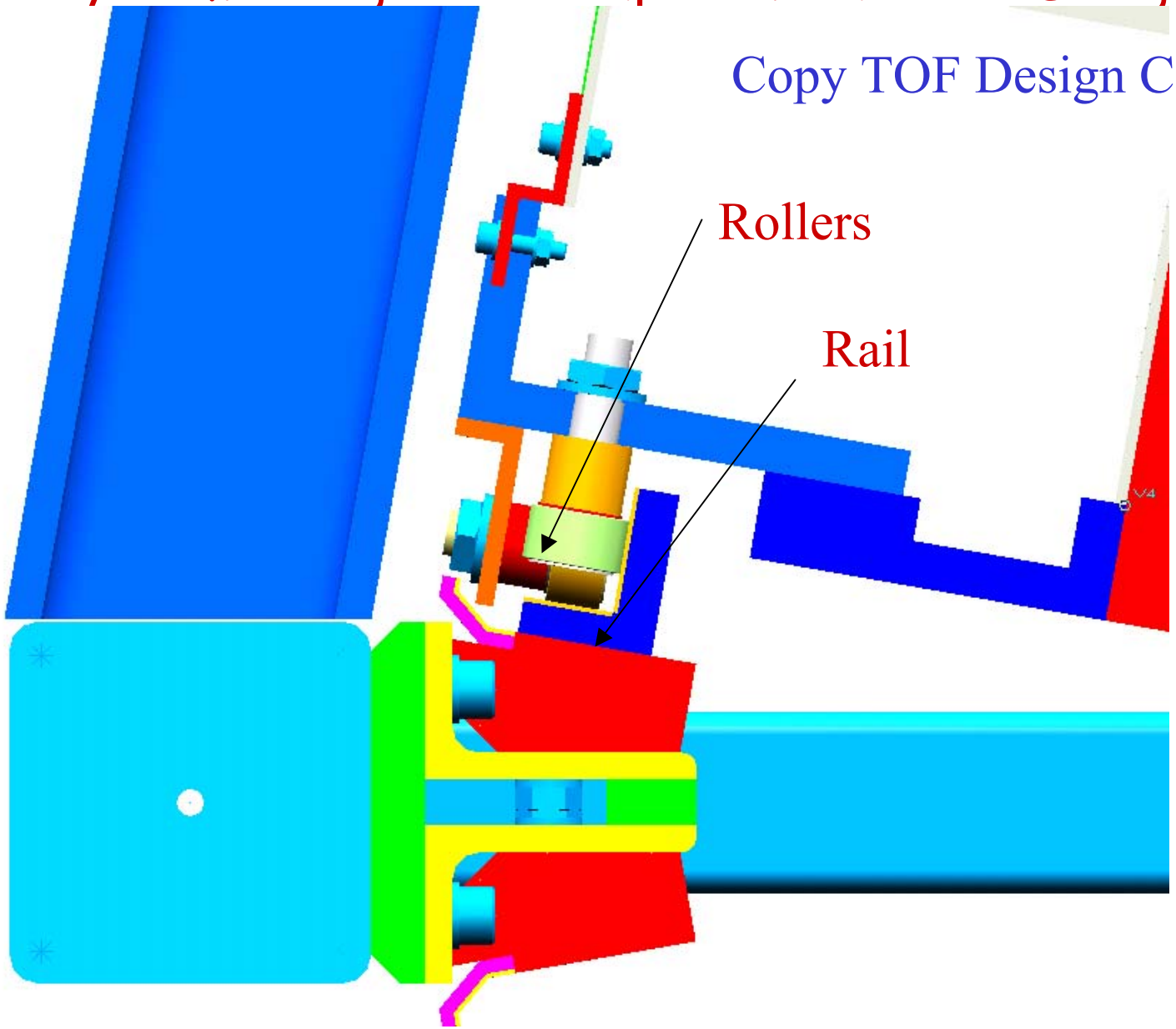


System Integration: EMCal Cooling and rack Space

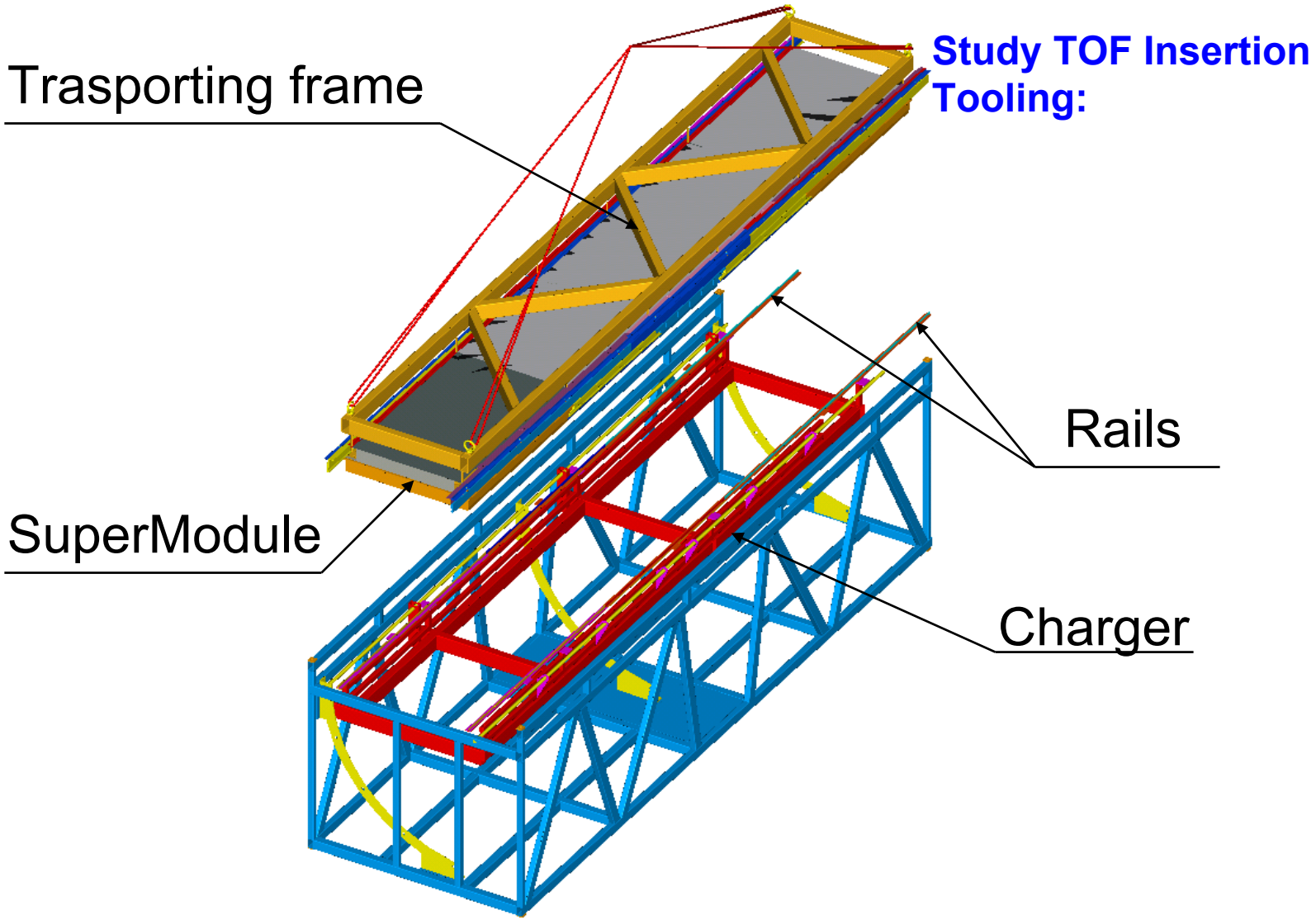


System Integration: Super Module Rail Design

Copy TOF Design Concept



System Integration: Super Module Installation



EMCal Support Frame Schedule

➢ Manufacturing Cost Estimate	Nov 05
➢ DOE Review	Dec 05
➢ Release Manufacturing RFP	Jan 06
➢ Secure 06 Funding	Jan 06
➢ Issue an Award	Feb 06
➢ Manufacturing Complete	May 06
➢ Ship to CERN	Jun 06
➢ Load Test	Jul 06
➢ Installation in ALICE	Aug 06