ILD HCAL

Mechanical Integration

HCAL Main Meeting

11.12.2008

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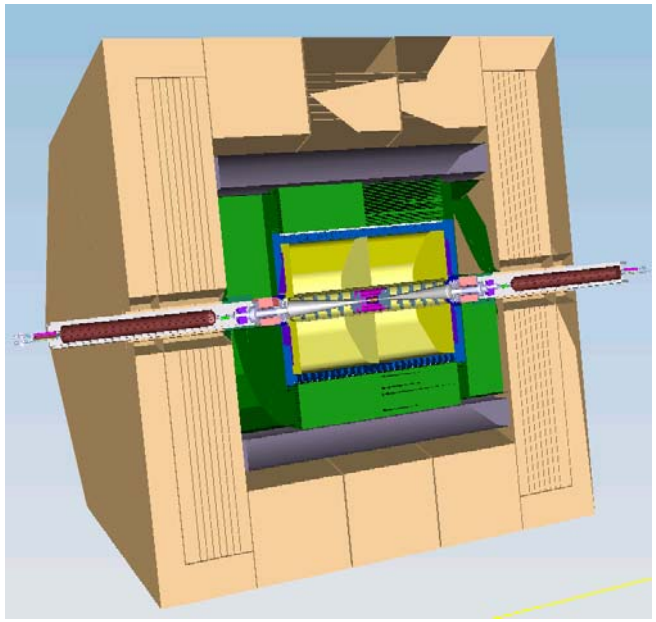
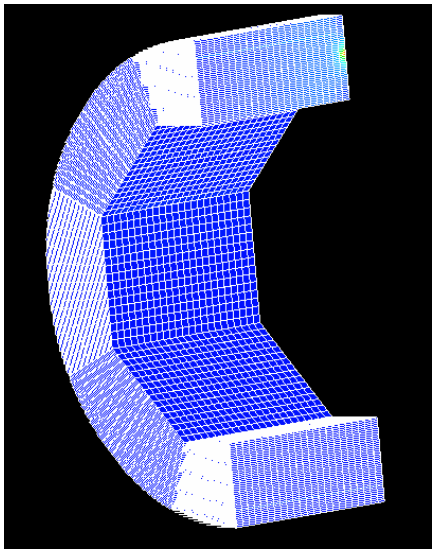
DESY





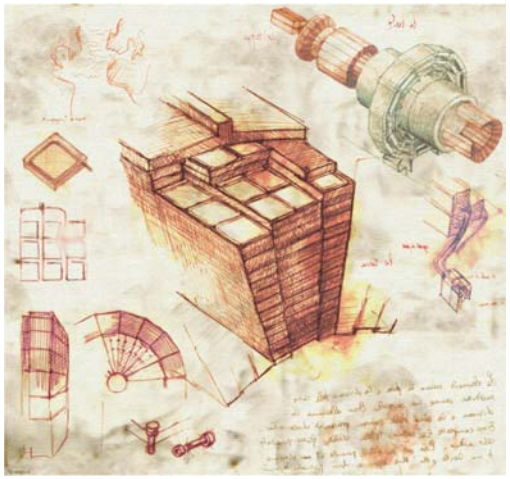
Overview

Way to develop our mechanical concept:

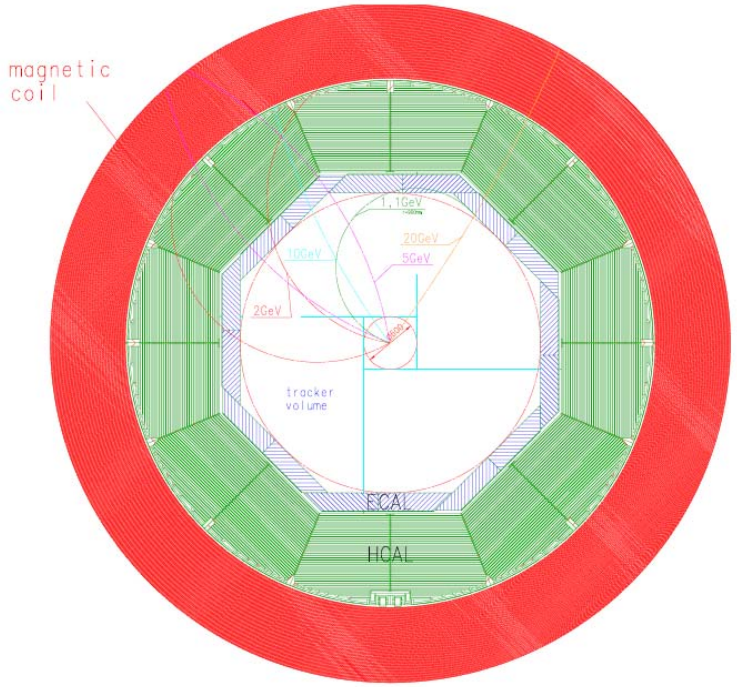
- Rough calculations
  - for general behaviour of the whole system and
  - for first indication of forces in the connections of the modules
- First ideas for mechanical concepts

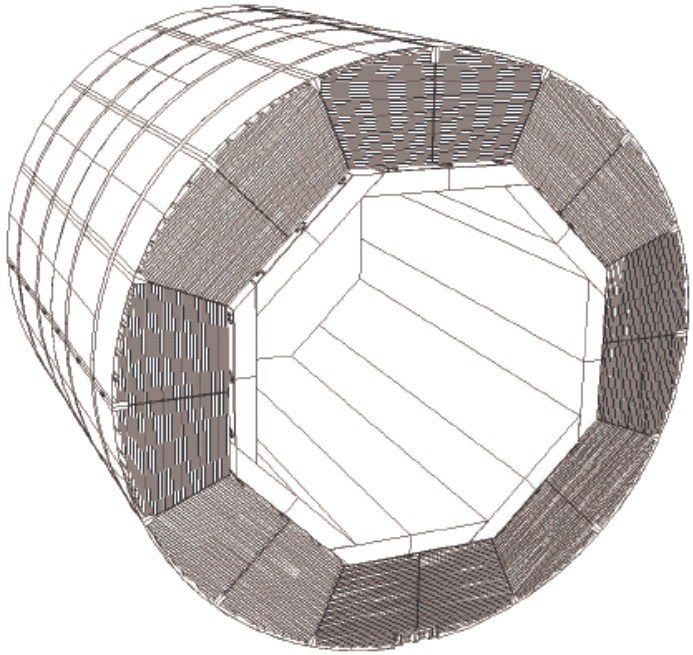
↕ ↕ iterative process ↕ ↕

- Calculations for optimization
- Prototypes (for screw connection)



Calorimeter Barrel



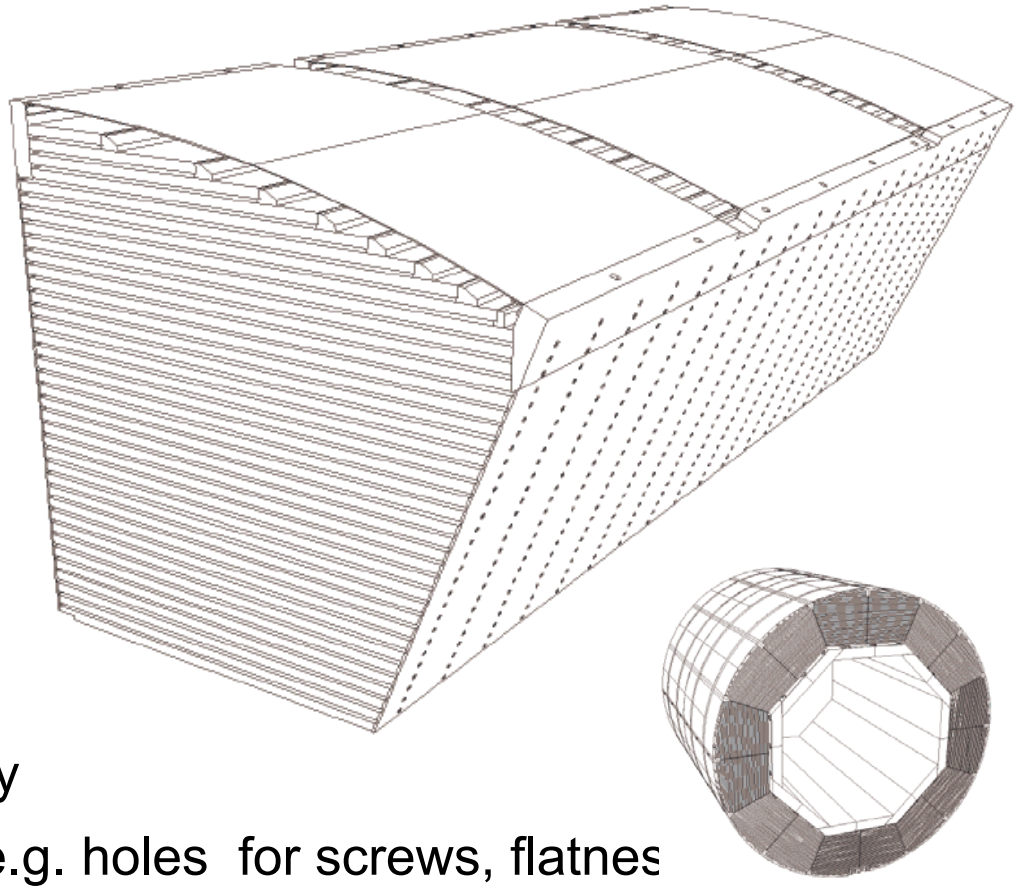


- Height/ length of barrel: ≈ 6.0 m/ 4.6 m
- Weight of one module: ≈ 19 t
- Weight of HCAL: ≈ 600 t
- Weight of HCAL + cassettes + ECAL : ≈ 900 t

Calorimeter Module

⇨ 3 mm side panel

⇨ M6 screw size



<u>Advantage</u>

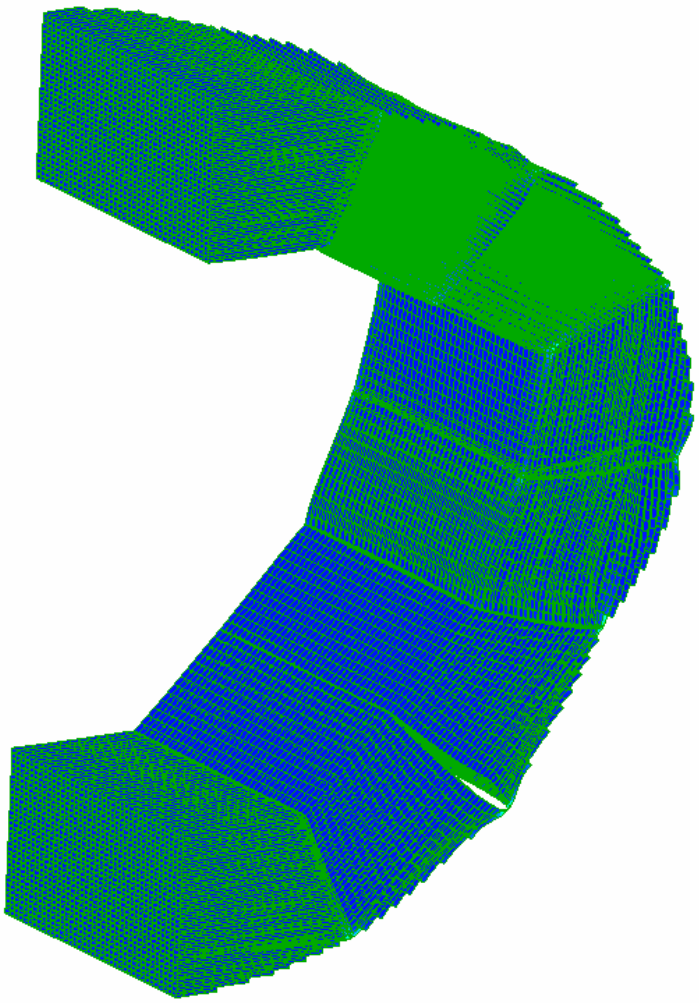
• Slim support structure

<u>Disadvantages</u>

• Uncertainties regarding stability

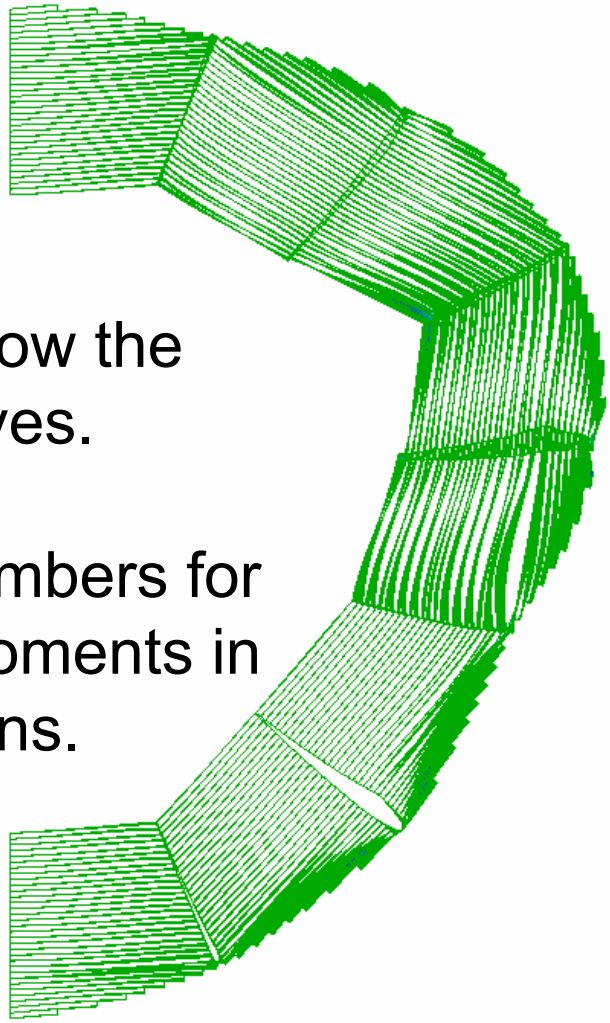
• High tolerance requirements (e.g. holes for screws, flatnes absorber plates)

FEM Calculation of the whole system

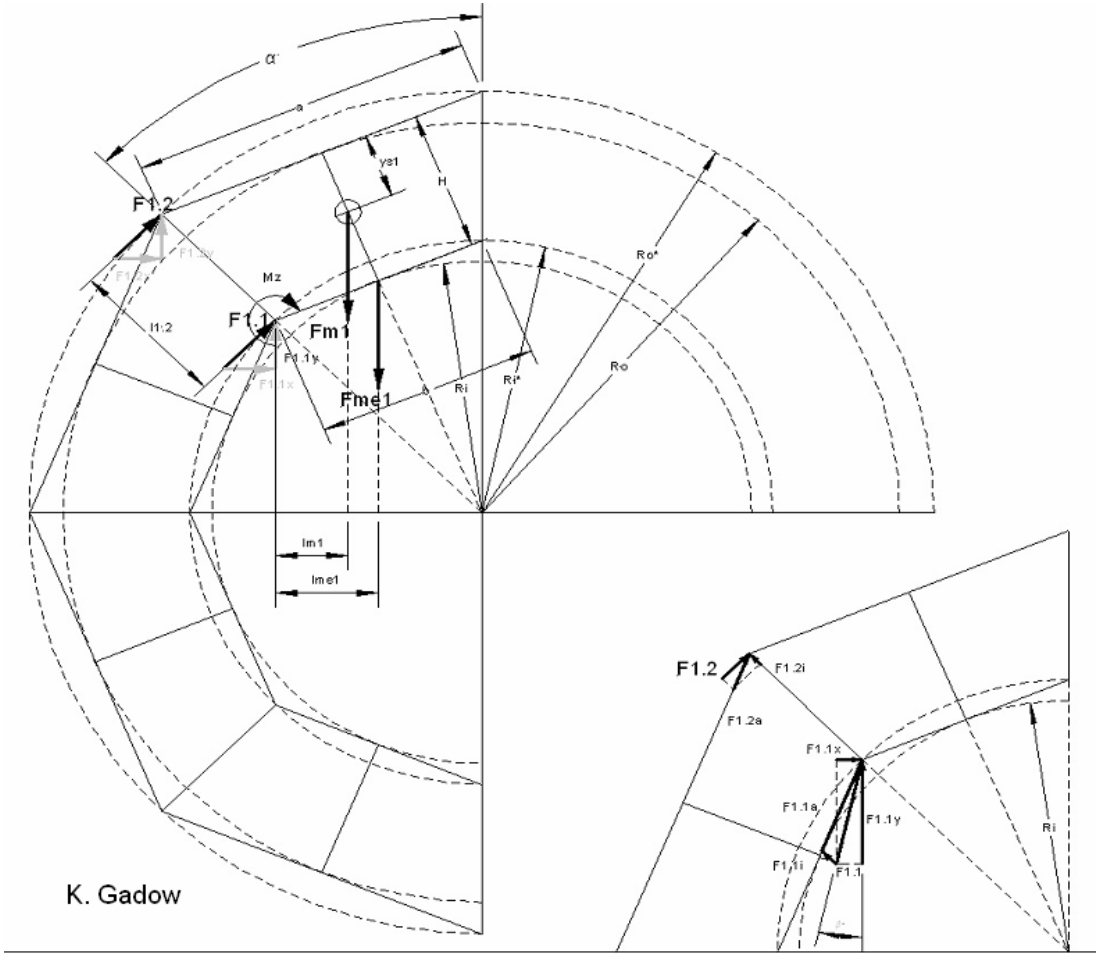


We learned how the system behaves.

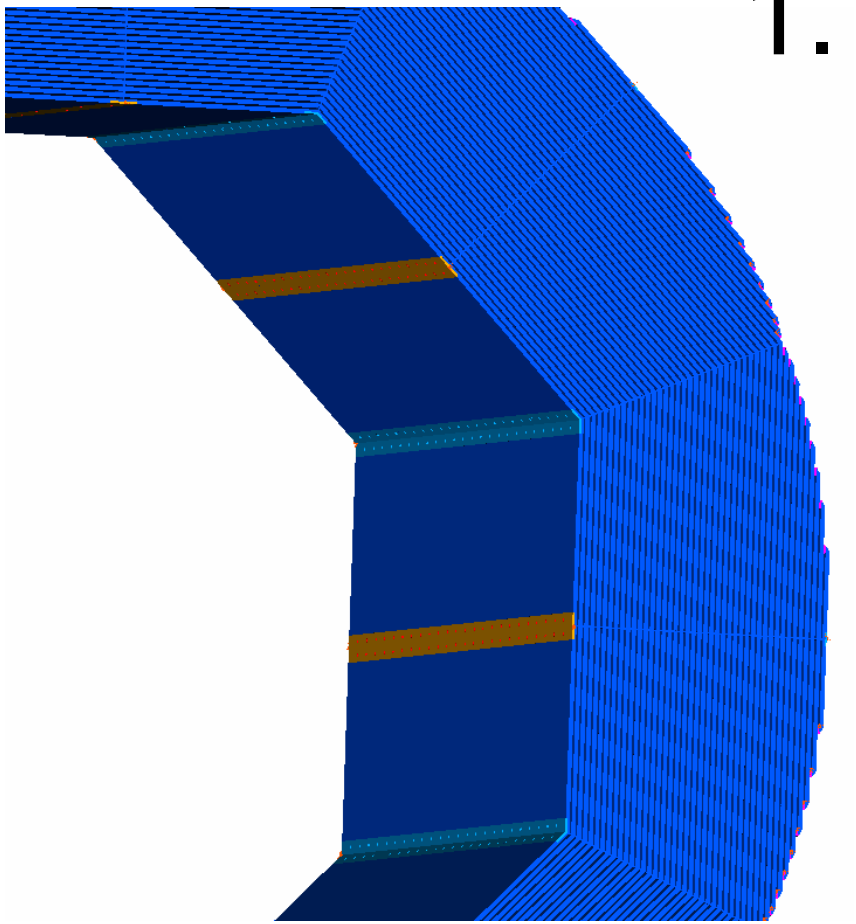
Next step: numbers for forces and moments in the connections.

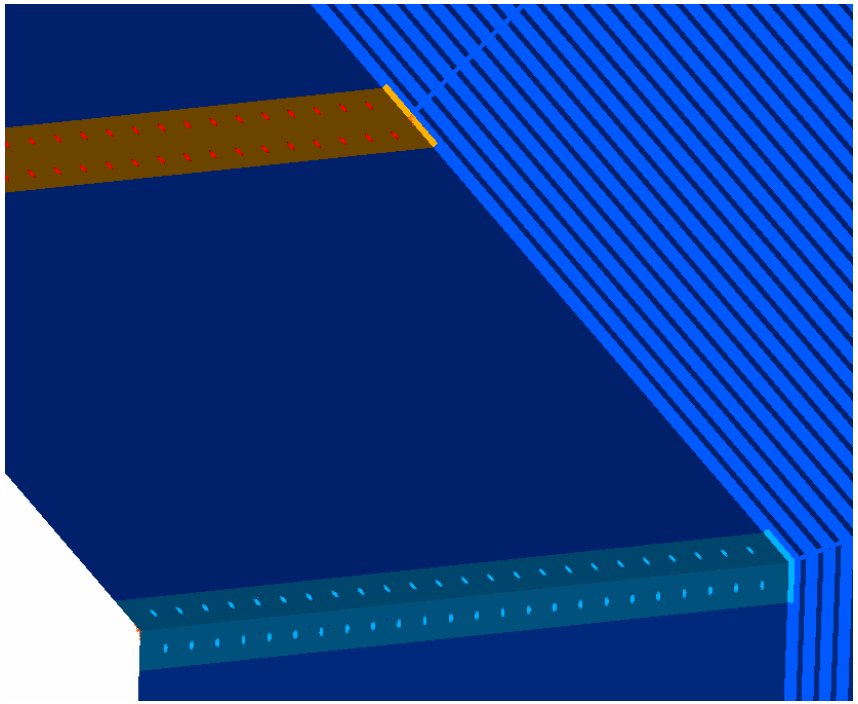


Manual Calculations



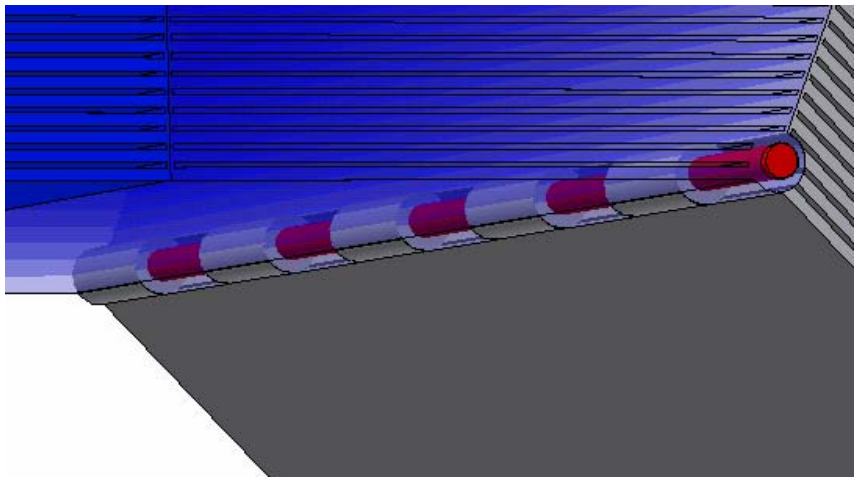
1. Elbow

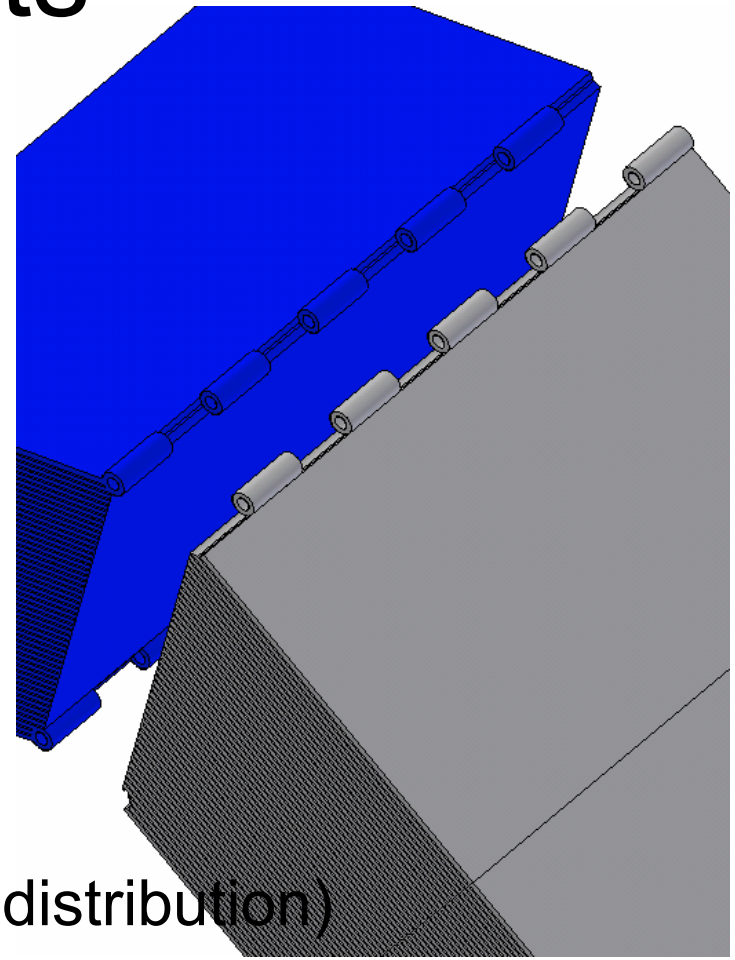




On first sight it looks simple, but:
- overdetermined system: problematic calculation
- problematic assembling: angle error of whole systems depends on tolerances here

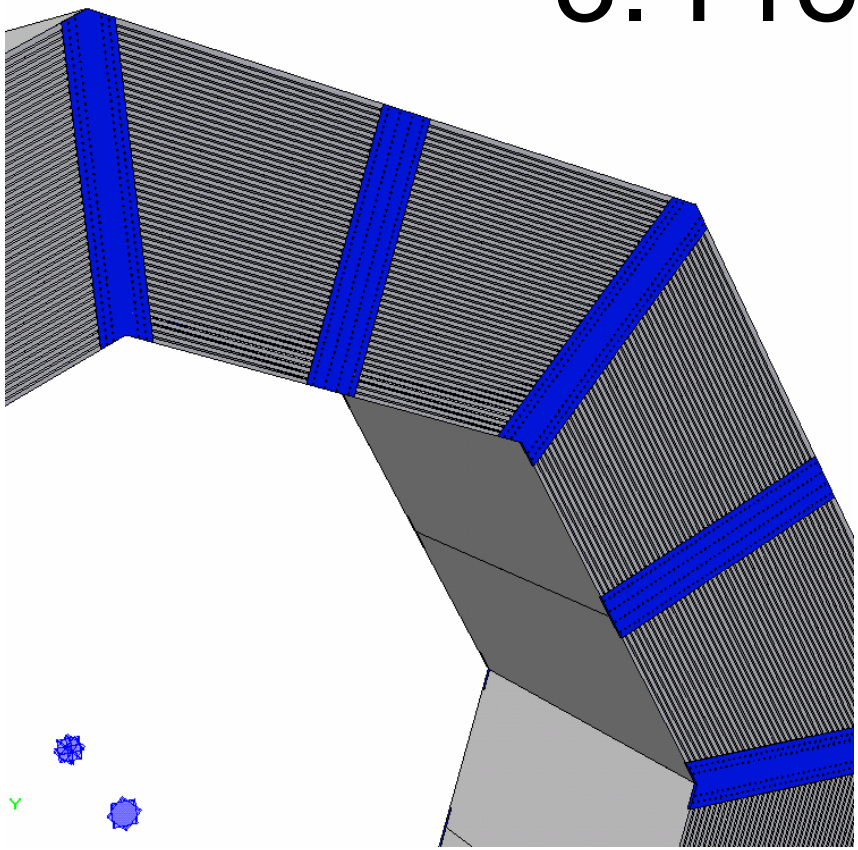
2. Bolts

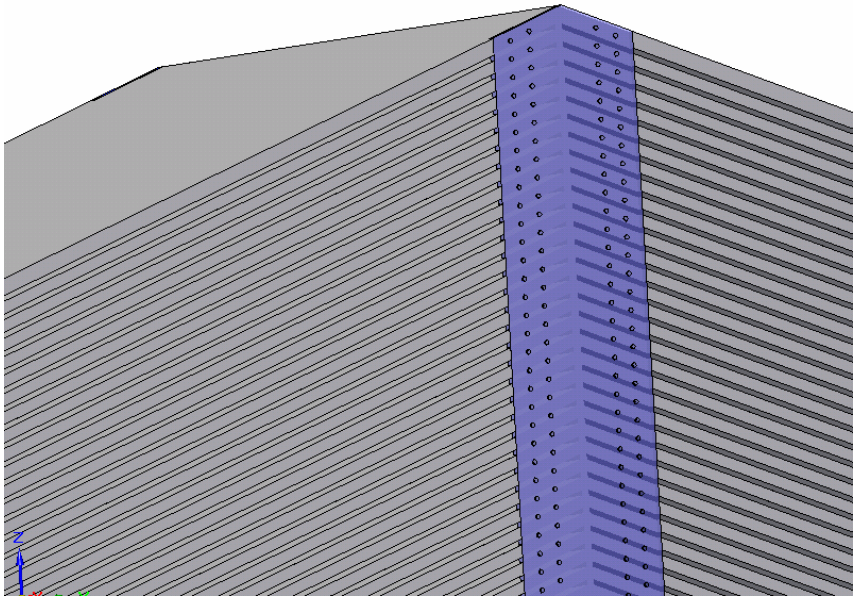




- easier to calculate (defined stress distribution)
- high complexity for assembling
- requires tight tolerances

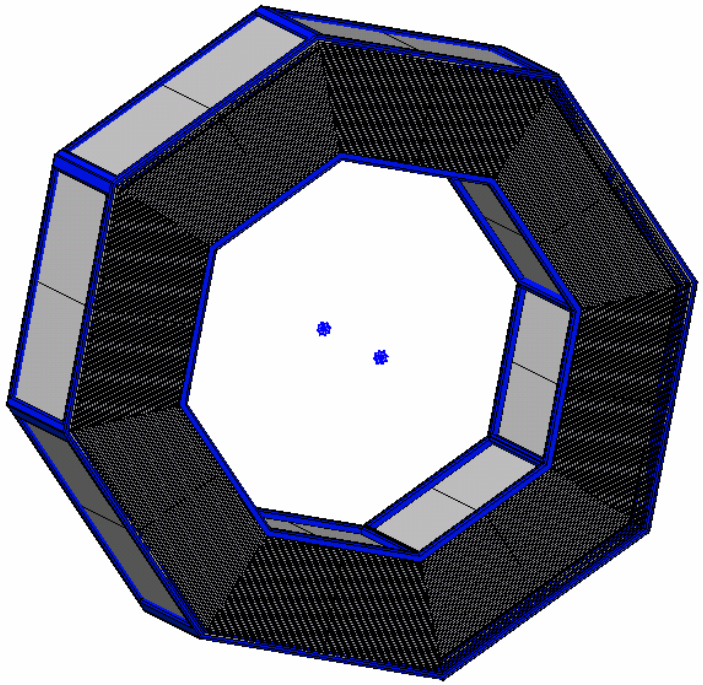
3. Frontplate

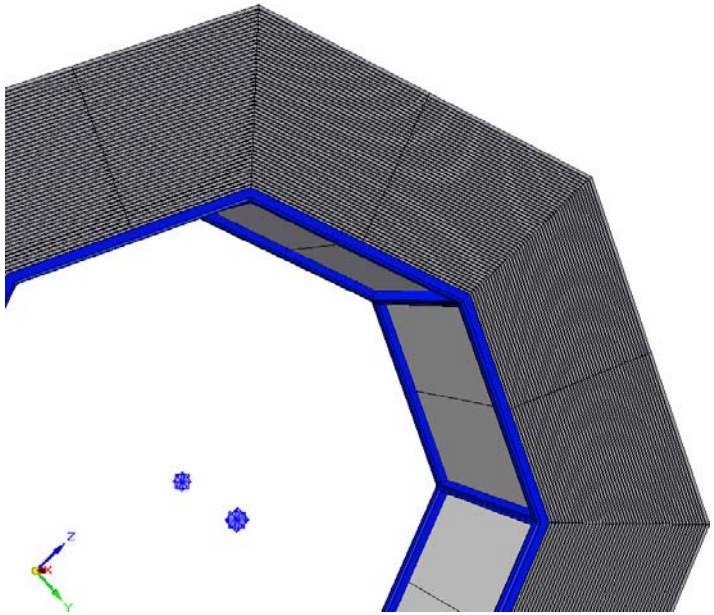


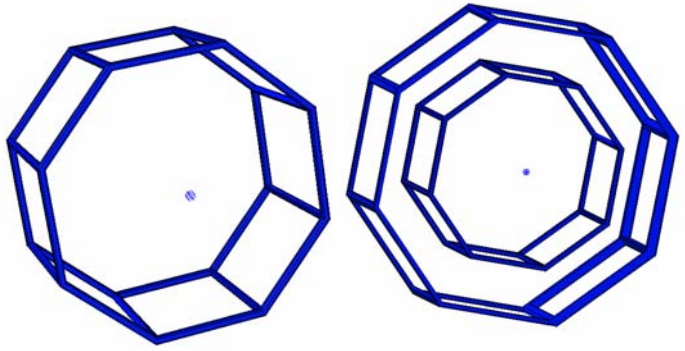


- assembling easier, possibility to adjust inacurracies
- overdetermined system: problematic calculation
- scintillator plates would have to be divided in three parts

4. Inner/ Outer Frame

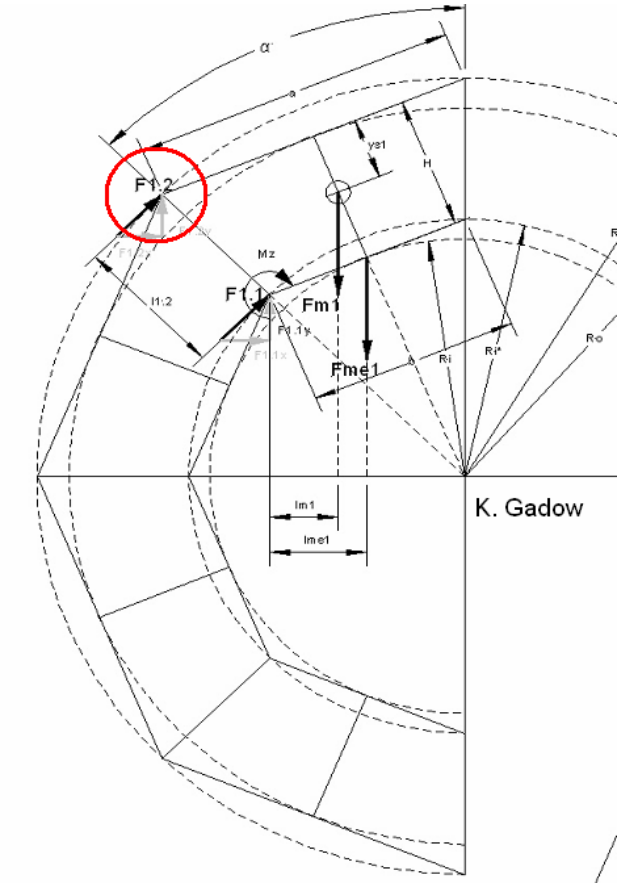


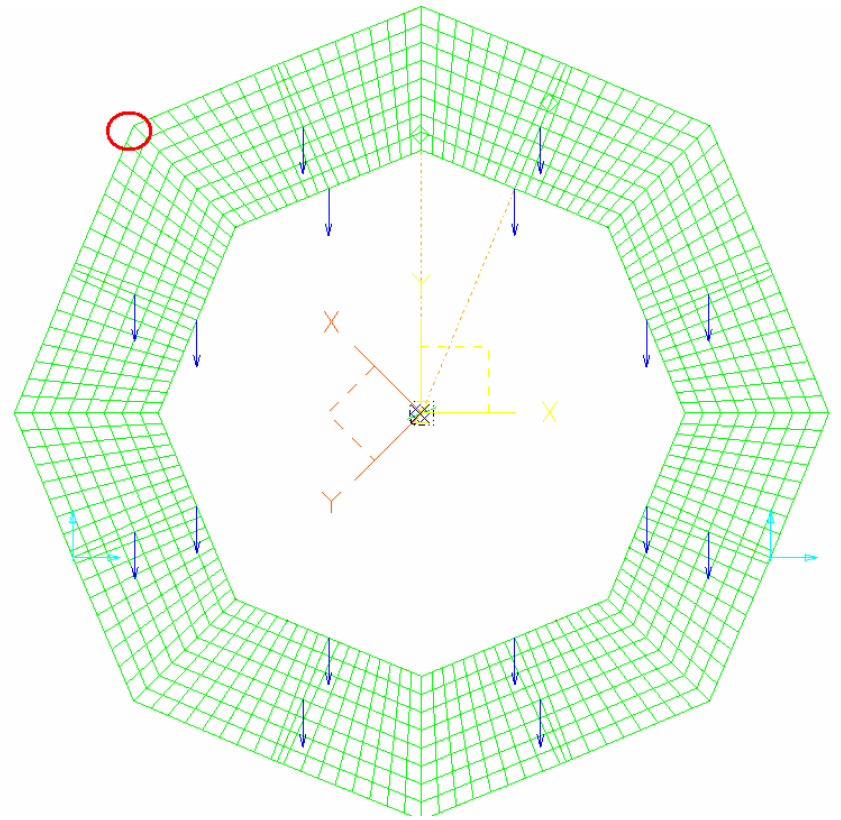




- stable
- could cause problems for ECAL
- needs a lot of space

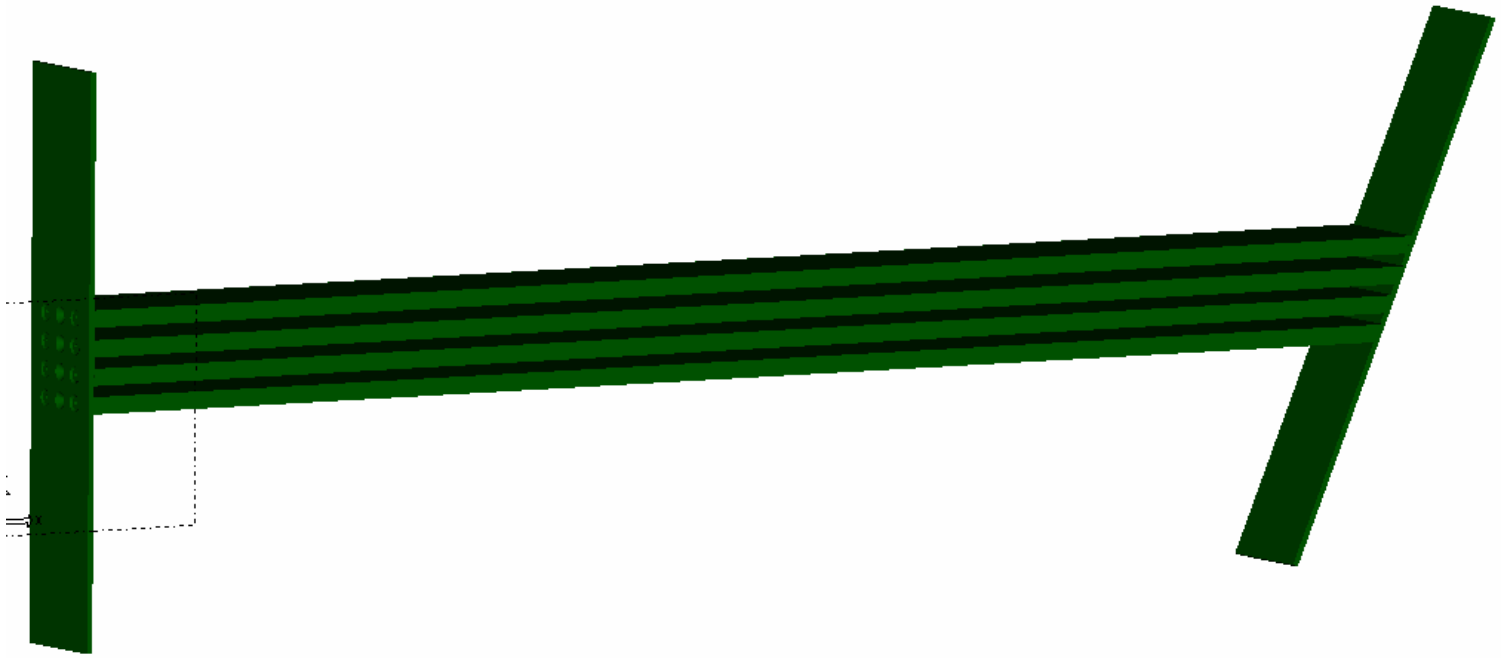
Manual Calculations ↔ FEM Calculations





We need values for forces and moments to dimension and optimize the connection between the modules.

1. Model: Screw Connection



First ideas about:

- forces in screws and side panel
- reasonability of srew size and thickness of side panel
- general behaviour/ handling of screwed connection and side panel sizes

Reality

Next steps

1. To implement prototypes‘s information:
   - screws or welded design
   - side panel thickness
   - flatness problem
   - general behaviour
2. To optimize the concepts:
   - further investigation in FEM
   - meeting with an expert for statics