

The HCAL barrel absorber structure

Design Status Report

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HCAL barrel absorber structure

mechanical design overview (first loop)

- HCAL barrel absorber structure

- module
- sub-module
- backpack
- support

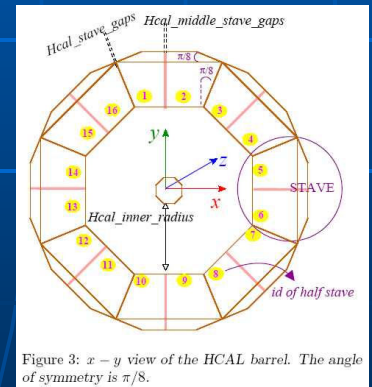
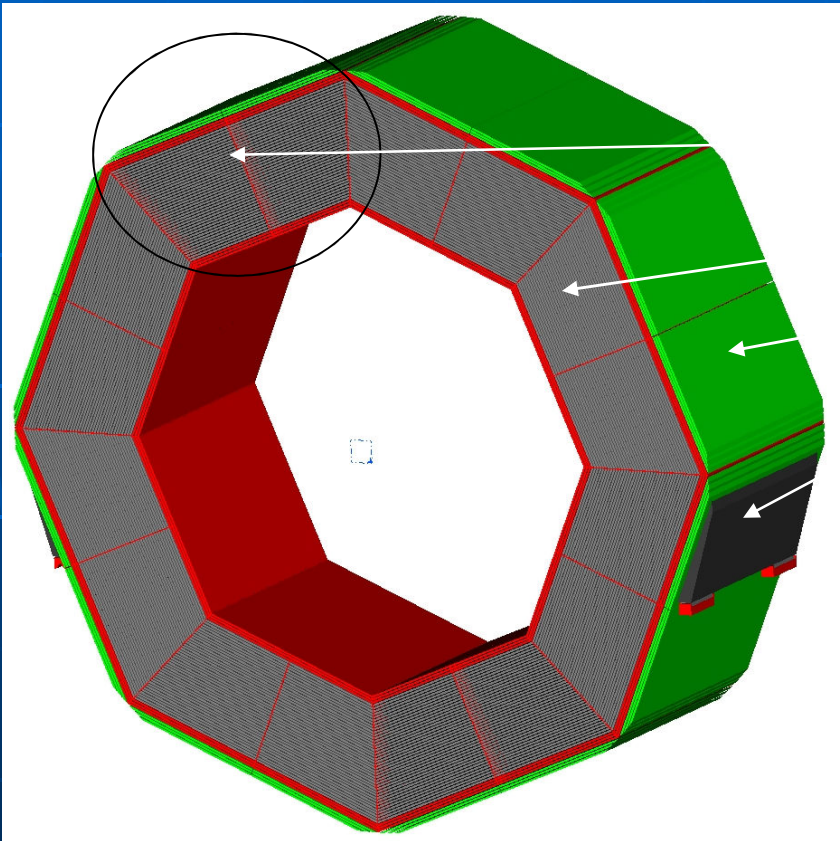
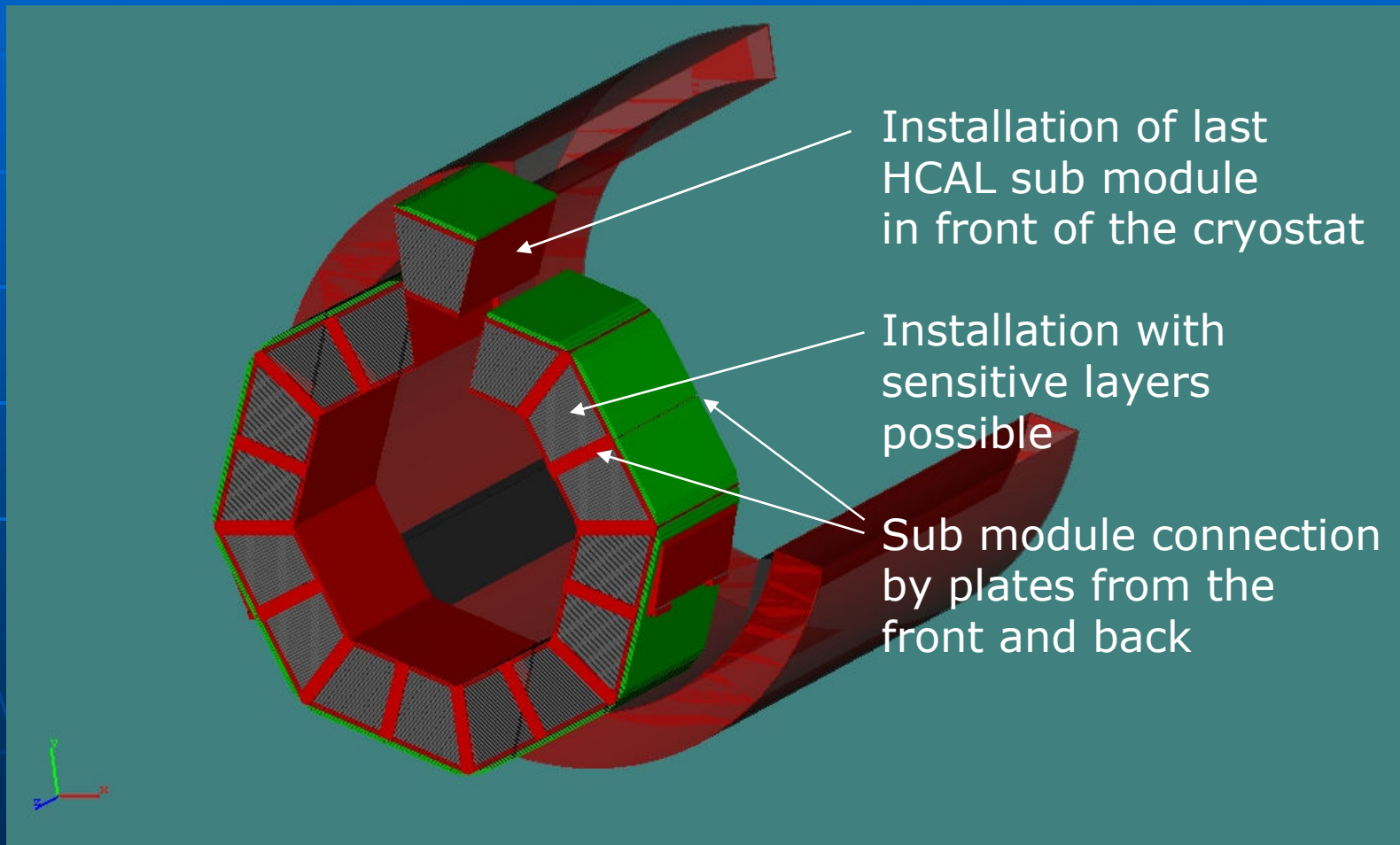


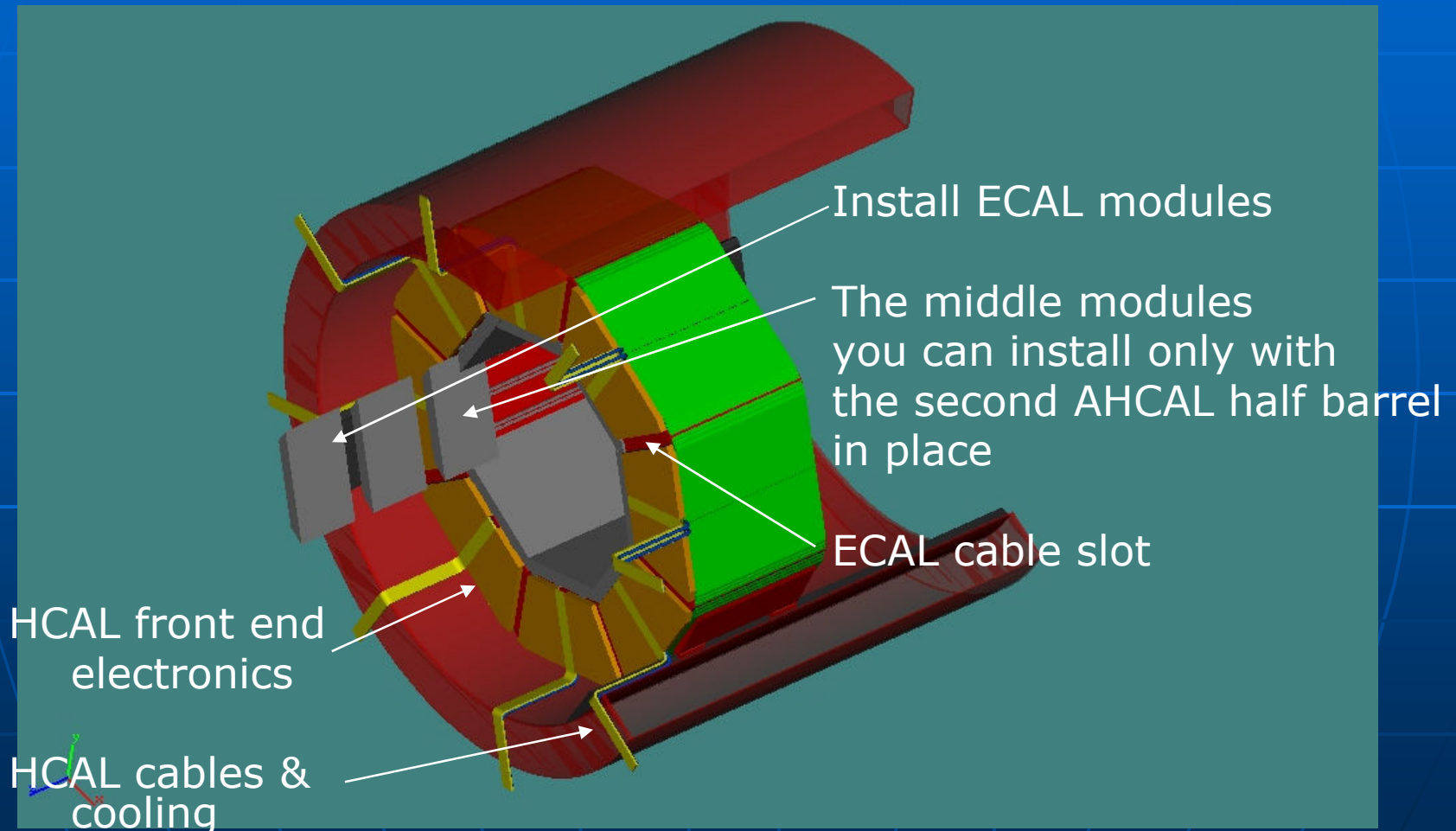
Figure 3: x - y view of the HCAL barrel. The angle of symmetry is $\pi/8$.

change of module orientation ($22,5^\circ$ rotation)

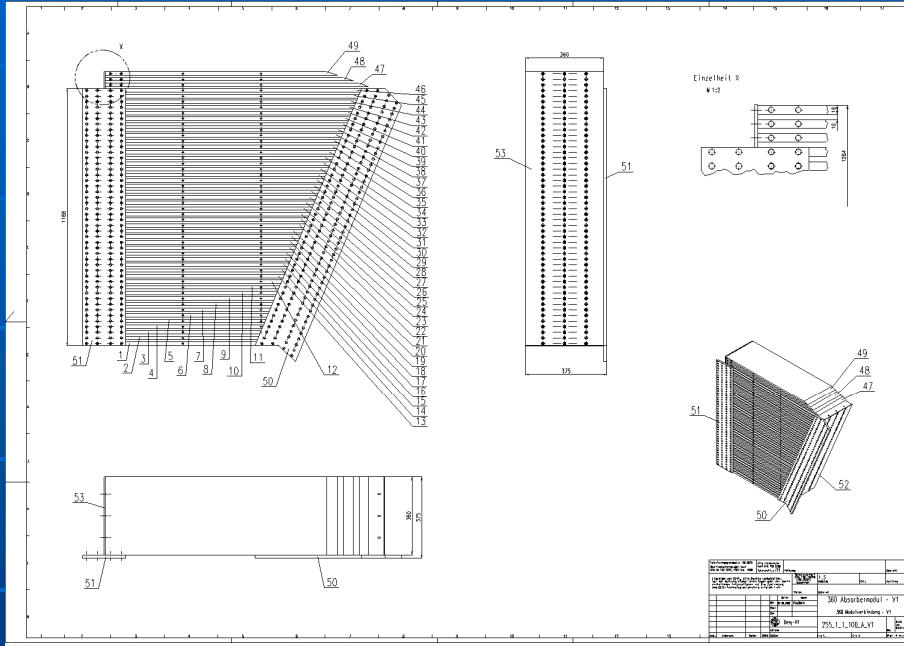
HCAL barrel integration in ILD



ECAL barrel integration in ILD



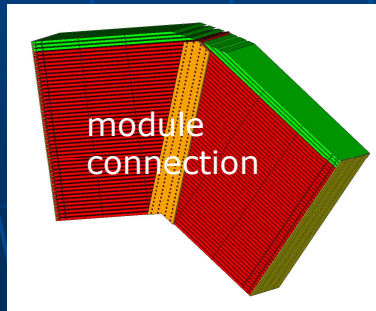
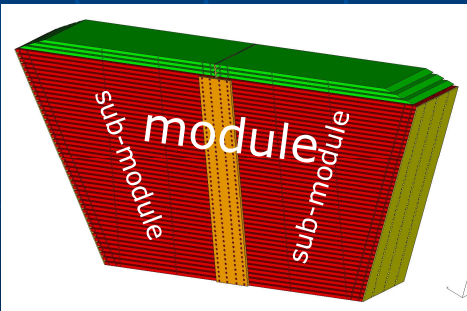
real size test setup vertical



2 short length (360 mm) absorber sub-modules mounted to a short length module

360 mm = 1 HBU length

- **delivery tolerances**
flatness, thickness
- **machining**
tendering, processing, handling, tolerances, costs
- **sub-module mounting**
stacking and shape tolerances, module interconnection, stability
- **sensitive layer installation**
handling, tolerances, vertical and horizontal layer connection, cabling and cooling routing



real size test setup vertical

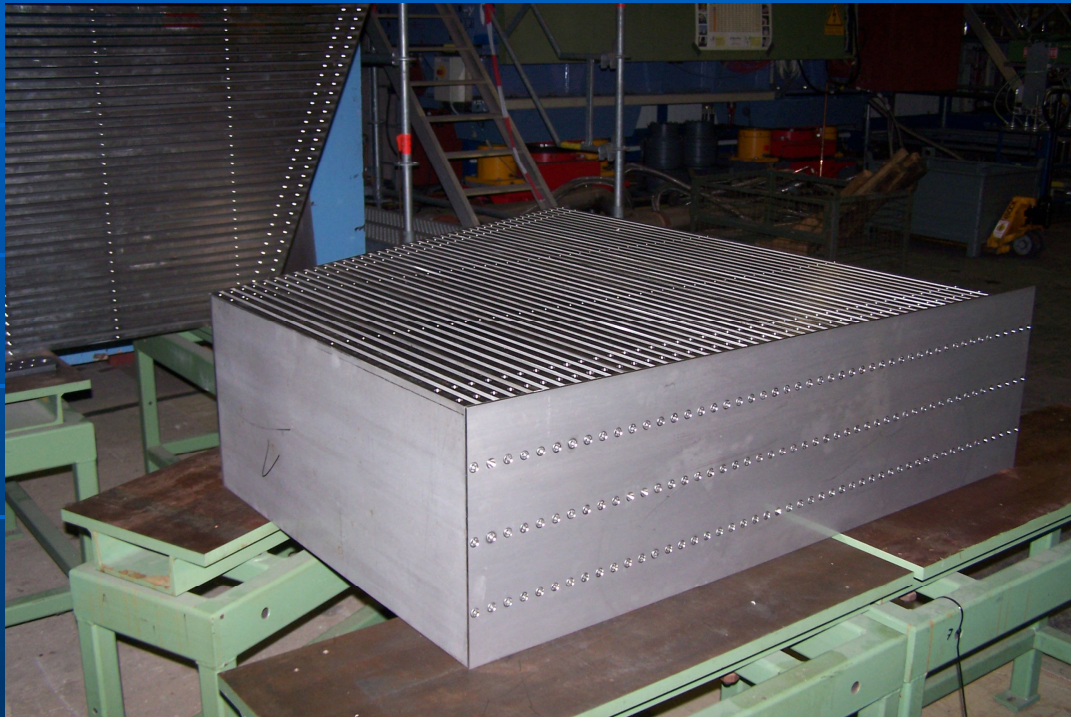
360 mm sub-module



- flatness measured of 4 raw plates 3000 mm x 1500 mm Order 2 batch 1 (not roller leveled)
- order 2 batch 1 water cut to individual plate size
- flatness measured for each plate before machining
- sub-module Nr.1 mounting in horizontal position
- gap size measured in horizontal position (front)
- sub-module Nr.1 turned vertical
- gap size checked by cassette prototype
- 2 positions where the cassette does not fit into the gap
- gaps must be measured also in depth
- plate position must be measured
- flatness measured of 4 raw plates 3000 mm x 1500 mm Order 2 batch 2 (roller leveled)
- production finished of sub-module Nr.2
- mounting started

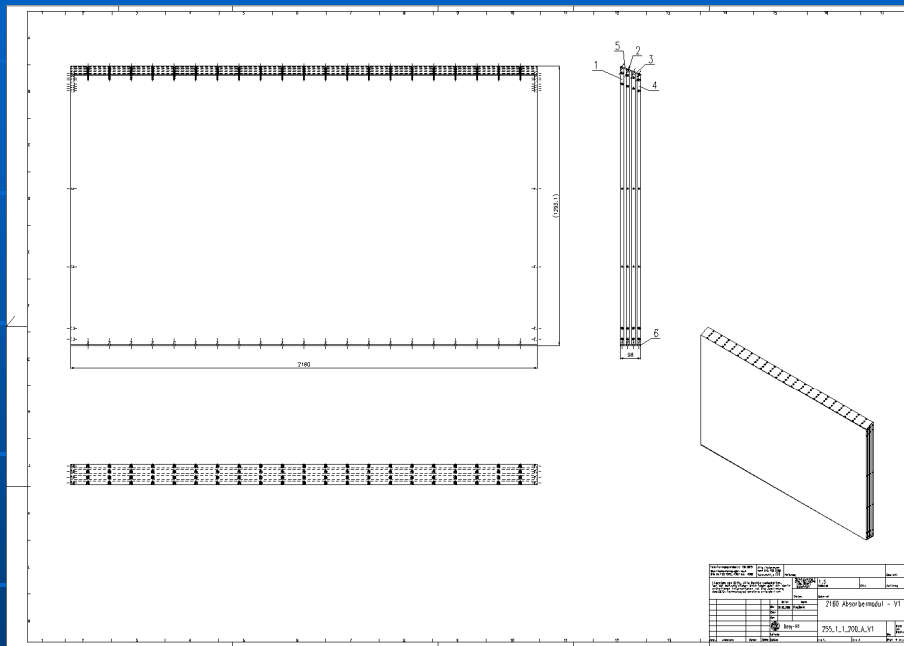
2nd test setup vertical

360 mm sub-module, flattened plates



- All layers can be equipped with cassettes
- 'Much better quality' (K. Gadow)

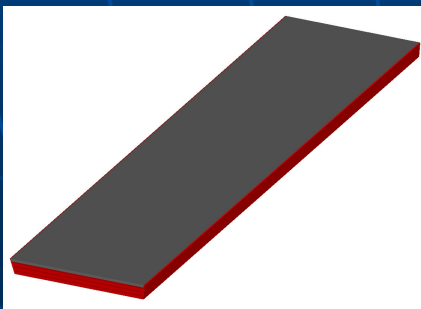
real size test setup horizontal



**4 full length (2160 mm)
absorber plates mounted to
a fraction of a sub-module**

2160 mm = 6 HBU
outer position = broadest plates
(~ 1300 mm)

- **delivery tolerances**
flatness, thickness
- **machining**
tendering, processing, handling,
tolerances, costs
- **sub-module mounting**
stacking and shape tolerances,
module interconnection, stability
- **sensitive layer installation**
handling, tolerances, vertical and
horizontal layer connection, cabling
and cooling routing



real size test setup horizontal

2160 mm sub-module plates layer 43 to 46



- flatness measured from 4 raw plates 2500 mm x 1500 mm Order 1 batch 1 (not roller leveled)
- order 1 batch 1 water cut to individual size
- plate flatness measured
- roller leveling done
- plate flatness measured
- horizontal mounted

plate measurement

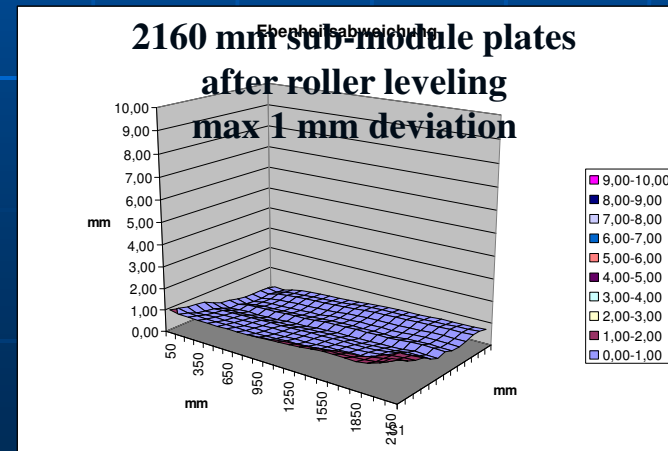
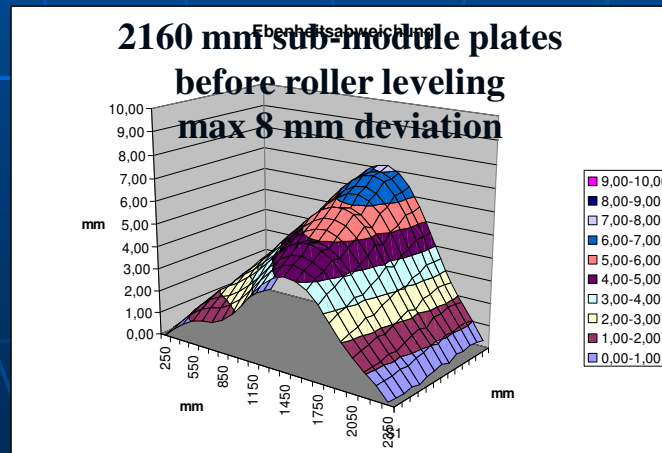
measurement of flatness and thickness deviation according EN10029 (steel plates $t \geq 15 < 25$ mm)

- **flatness class N, steel group H**

- L(1000): max 10mm
- L(2000): max 13mm

- **thickness class B**

- min: -0,3 mm
- max: +1,6 mm
- measured at the edges only



Roller leveling

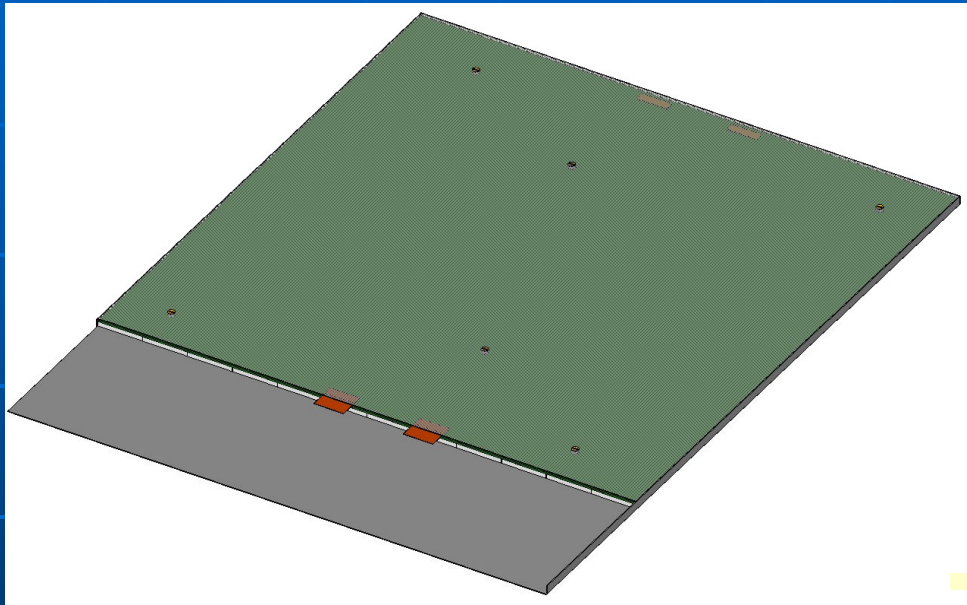


FlatMaster from company arku



capacity: $t \leq 50$ mm
flatness: ± 1 mm

sensitive layer housing



■ 362 mm x 462 mm standard width housing

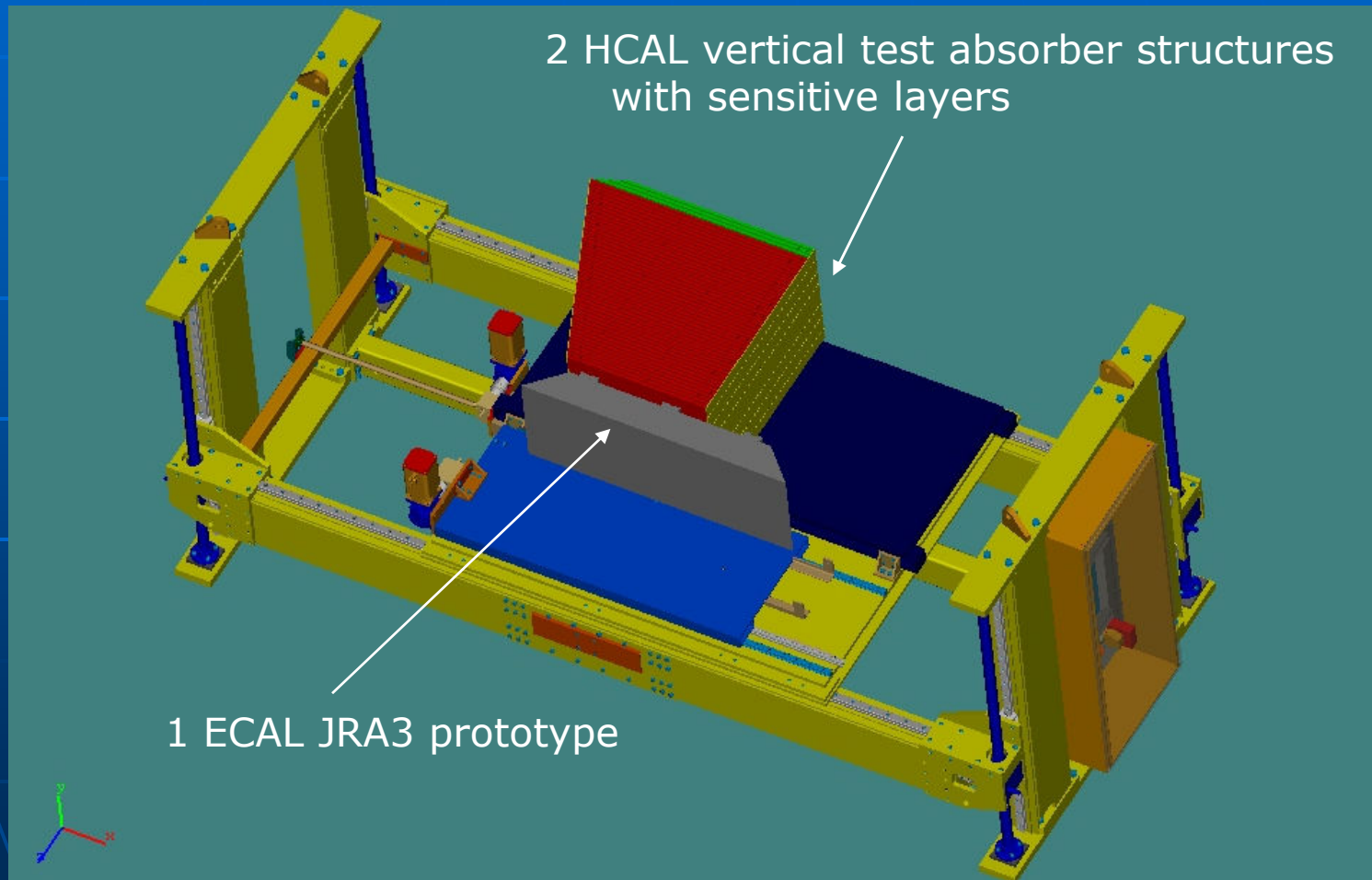
- contains 1 HBU unit for 360 mm sub-module
- 0.5 mm stainless steel
- One side border per bottom/cover plates
- 100 mm bottom plate extension for front end electronic
- 6 point welded fixation/distance bolts per HBU unit
- Cover plate and HBU fixed by 6 M2.5x4 screws per HBU unit
- total thickness 7 mm +-0.1 mm

■ 362 mm x 2260 mm standard width housing

- contains 6 HBU units for 2160 mm sub-module
- other parameters see above

1HBU and 2HBU standard width housing prototypes available

Test beam setup V2

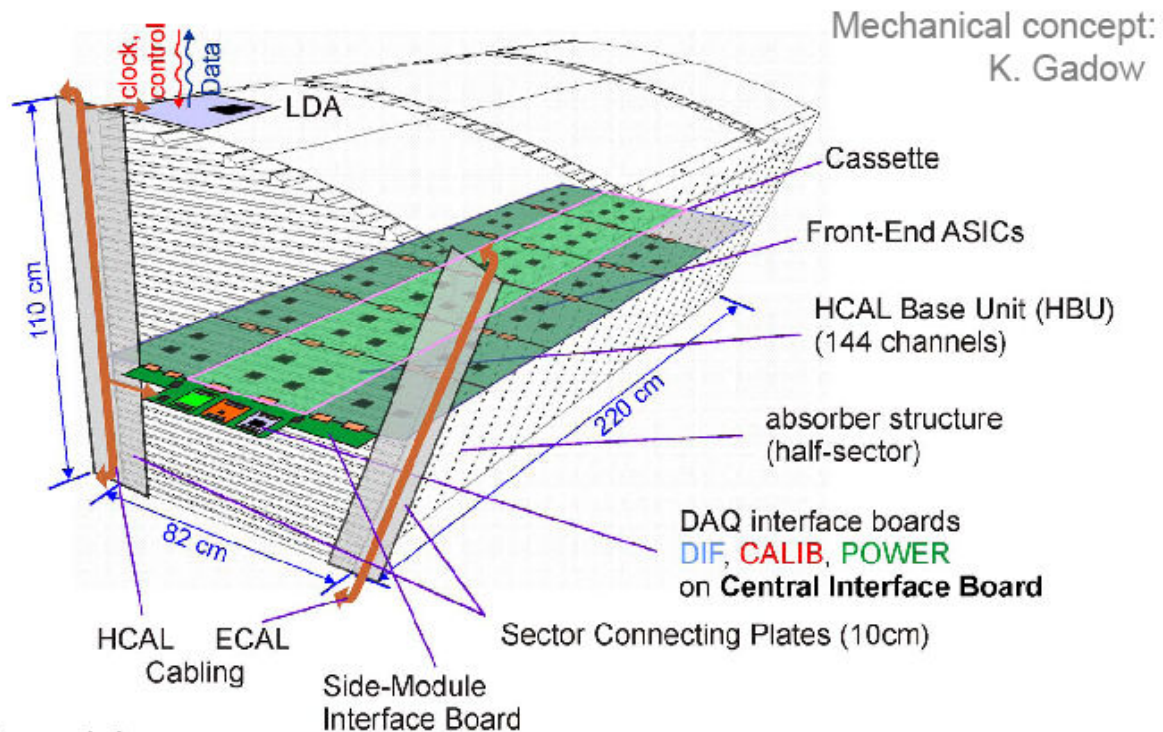


Summary

- economic absorber plate production process achievable
- deeper investigations of deformation and internal forces at the test setups are needed for global understanding of the barrel structure
- therefore the interface (forces and dimensions) to the ECAL must be defined
- sensitive layers with front end electronics are needed to continue the housing production design and to start the installation-, cabling-, cooling-tests
- combined test beam setup must be discussed

Backup sensitive layers

The Next Generation



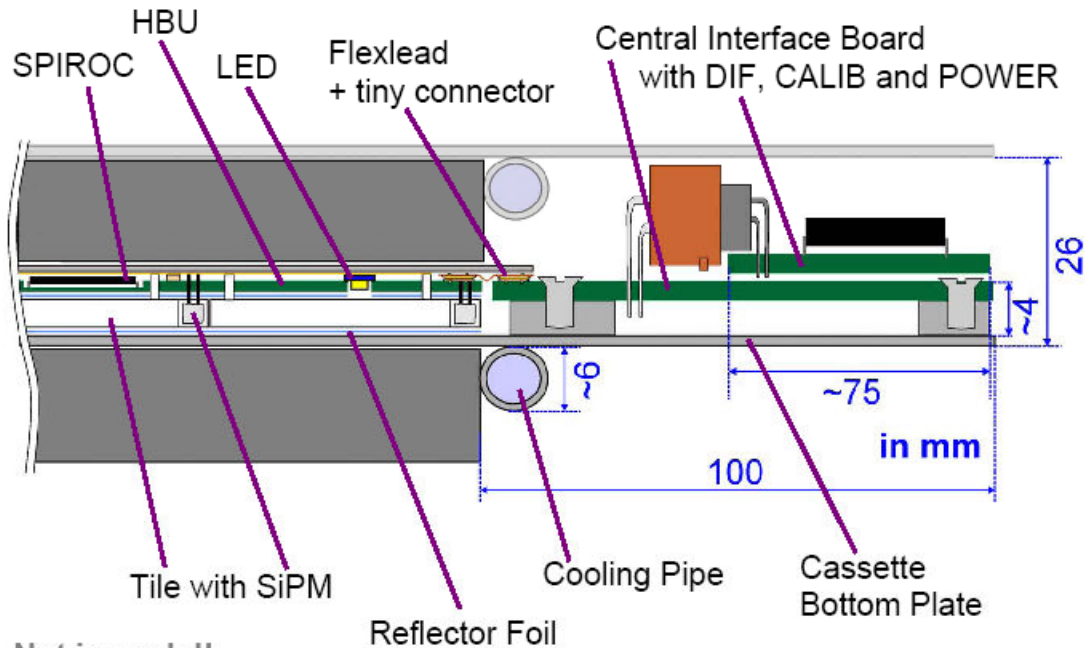
Not in scale!

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Backup front end electronics

The Next Generation



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Backup absorber structure data evolution

2x8=16 shape		V0	V1	V2
absorption factor		5	5.2	5.2
material		Fe	Fe	1.4401
number of layers		47,6	48	48 (+ 1 cover layer)
absorption layer	mm	17,5	18	18 (17 + 2 x 0.5)
detector layer	mm	6,5	6,5	6 (3 mm sensitive)
layer step distance	mm	24	24,5	26 (18+6+2 air gap)
module thickness	mm	1159,9	1194	1266
inner radius	mm	2000	2000	1948 (material saving)
outer radius	mm	3342	3378	3394