DE LA RECHERCHE À L'INDUSTRIE

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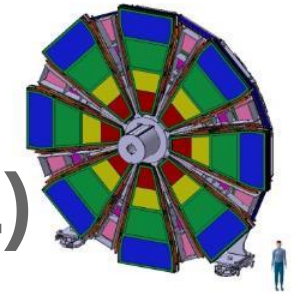
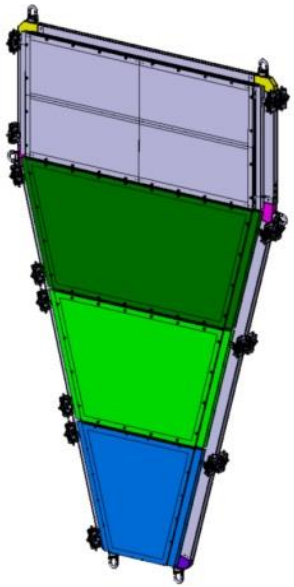
ATLAS - NSW
(NEW SMALL WHEEL)



MICROMEGAS DETECTORS

Mechanical prototypes

Proposal of a list of measurements



Patrick PONSOT

CERN MM workshop – 5-6 of November 2013

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OUTLINE

- Reminder: Purpose of mechanical prototypes
- Purpose of measurements
  - What can we measure according to the specifications about the mechanical precision?
  - Other criteria that can be measured (or tested)
- What can be measured on the CMM at Freiburg?
- Proposal of a list of measurements

PURPOSE OF THE MECHANICAL PROTOTYPES?

- Reminder!

Purpose

- Demonstrate feasibility
- Setup of basic infrastructure
- Gain experience with
  - construction/assembly ideas/schemes
  - Materials
  - Procedures
  - Precision (panel planarity, parallelism of skins, …)
- Produce objects that can be measured
- Establish an Assembly Manual

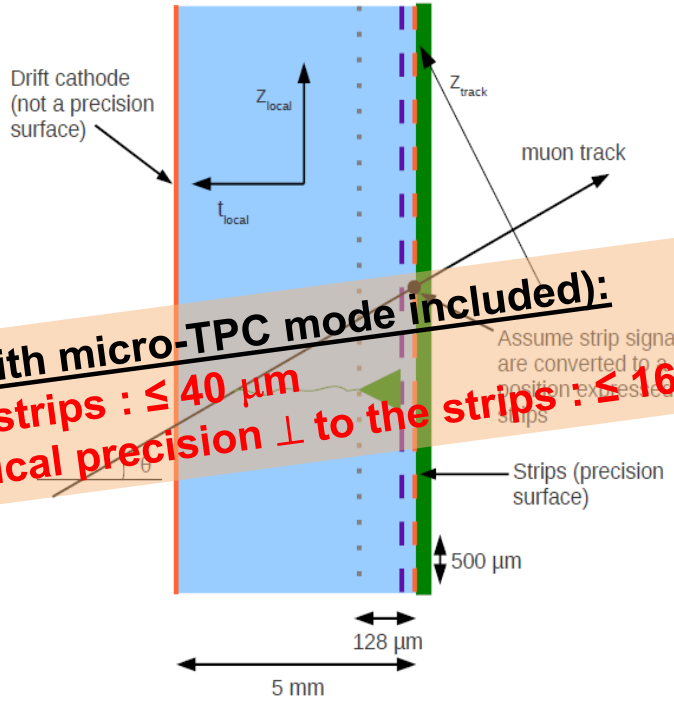
MMM CERN, 24/06/2013 G. Sekhniaidze/J. Wotschack 2

Extracted from Joerg's talk

PURPOSE OF THE MEASUREMENTS?

- What can we measure according to the specifications?
- Firstly, what are the specifications about the mechanical precision?
  - Resolution 40μm

Extracted from Pierre-François's talk



z_{track} is the parameter that should be measured for sagitta and momentum determination:

$$z_{track} = z_{local} \cos\theta + t_{local} \sin\theta$$

Alignment of both z_{local} and t_{local} are thus necessary:

$$\sigma(z_{track}) = \sigma(z_{local}) \cos\theta \oplus \sigma(t_{local}) \sin\theta$$

$$\sigma(t_{local}) \sin\theta = 20\ \mu m$$

$$\Rightarrow \sigma(t_{local}) = 80\ \mu m \text{ at } \theta = 15°$$

$$\Rightarrow \sigma(t_{local}) = 40\ \mu m \text{ at } \theta = 30°$$

(x2)

We need (with micro-TPC mode included):

- **// of the strips : ≤ 40 μm**
- **Mechanical precision ⊥ to the strips : ≤ 160 μm à 15° et ≤ 80 μm à 30°**

PURPOSE OF THE MEASUREMENTS?

- What can we measure according to the specifications?

- Firstly, what are the specifications about the mechanical precision?

  - Resolution 40μm → What does it mean for the final MM modules?

    - Precise positioning of the 5 (or 3) PCBs to build a layer ≤ 40 μm (parallelism of the strips)
    - With a planarity of the layer ≤ 50 μm

    - Alignment of 2 layers glued together to build a doublet ≤ 40 μm
    - With a parallelism of the 2 layers ≤ 80 μm (100μm for modules closed to the beam)

    - Alignment of 2 doublets to build a quadruplet ≤ 40 μm
    - With a parallelism of the 2 doublets ≤ 80 μm (100μm for modules closed to the beam)

    - Perpendicular positioning of the in-plane alignment platforms w.r.t. the position of the strips should be known within 40 μm (glued only on the external side of the quadruplet)

    - We need to know if we can have under control the deformation of the quadruplet by using the alignment systems → deformation modes should be known with thermomechanical loading

PURPOSE OF THE MEASUREMENTS?

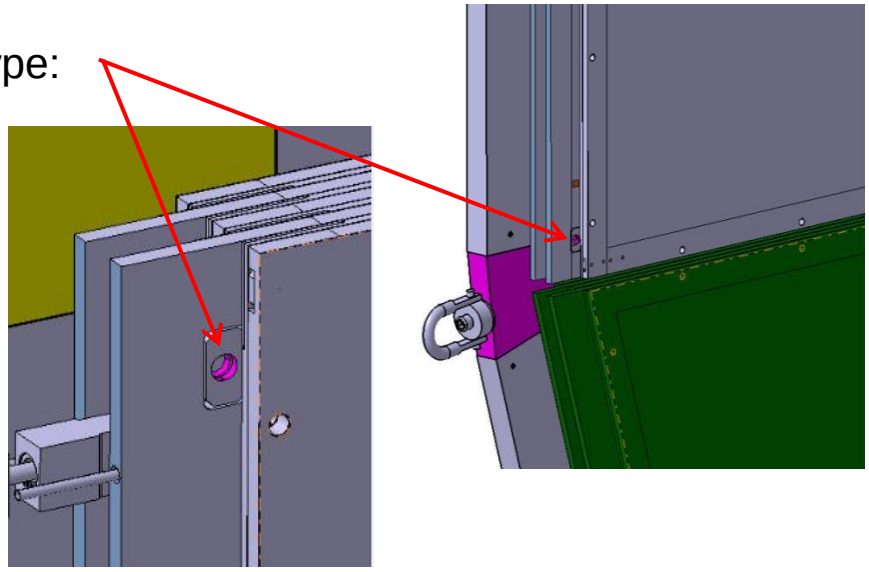
- What can we measure according to the specifications?
- Possible measurements with assembled mechanical prototypes (* if mechanical references are accessible):

Only through the external panels if they are connected to the RO panels (pillars)

- Precise positioning of the 5 (or 3) PCBs to build a layer ≤ 40 μm (parallelism of the strips)
- With a planarity of the layer ≤ 50 μm
- Alignment of 2 layers glued together to build a doublet ≤ 40 μm (*)
- With a parallelism of the 2 layers ≤ 80 μm (160μm for modules closed to the beam)
- Alignment of 2 doublets to build a quadruplet ≤ 40 μm (*)
- With a parallelism of the 2 doublets ≤ 80 μm (100μm for modules closed to the beam)
- Perpendicular positioning of the in-plane alignment platforms w.r.t. the position of the strips should be known within 40 μm (glued only on the external side of the quadruplet)
- We need to know if we can have under control the deformation of the quadruplet by using the alignment systems → deformation modes should be known with thermomechanical loading

PURPOSE OF THE MEASUREMENTS?

- What can we measure according to the specifications?
- Planarity, alignment and deformation modes of the quadruplets should be measured after assembly on the spacer
  - With kinematic mounts (to get the initial deformation without constraints)
  - Then without kinematic mounts (the final situation)
- Accessibility to the mechanical reference of the 4 RO layers
  - E.g. metallic inserts on M4 prototype:
  - What is the status at Roma, LMU and Pavia?



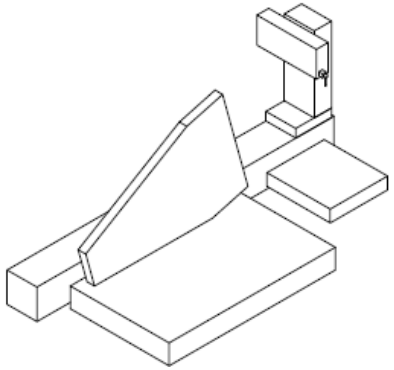
PURPOSE OF THE MEASUREMENTS?

- What can we measure according to the specifications?
- Other criteria that can be measured (or tested)
  - Sealing of the quadruplets with gas pressure ≤ 6mbars
  - Deformation with the gas pressure ≤ 6mbars
  - Weight of the modules (according to the material which are used)

→ Effect of the tension of the mesh ~6N/cm: It will be known at Saclay with the M4 prototype which will be equipped with 4 meshes)

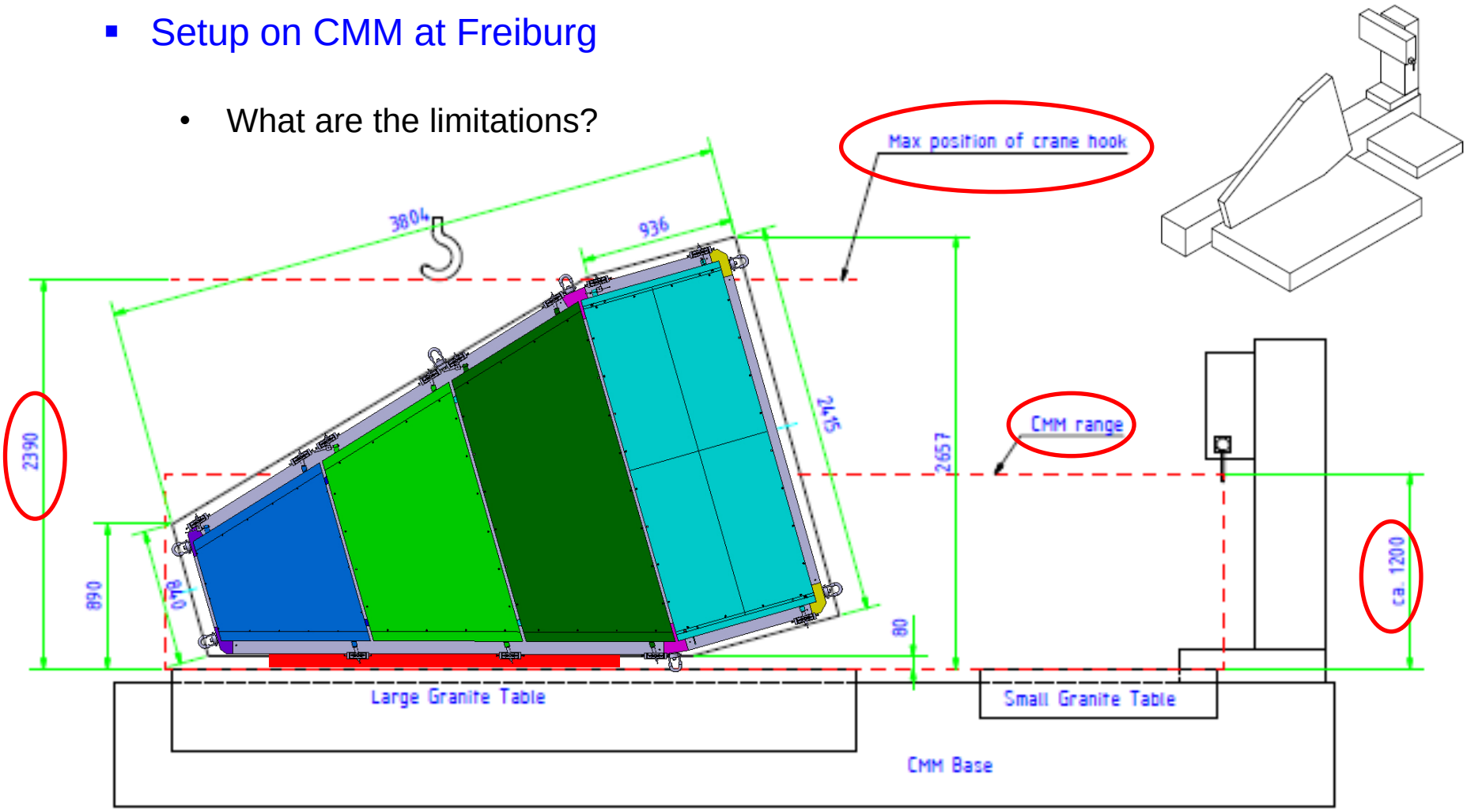
WHAT CAN BE MEASURED AT FREIBURG?

- CMM at Freiburg



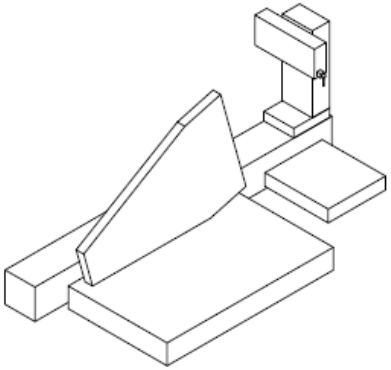
WHAT CAN BE MEASURED AT FREIBURG?

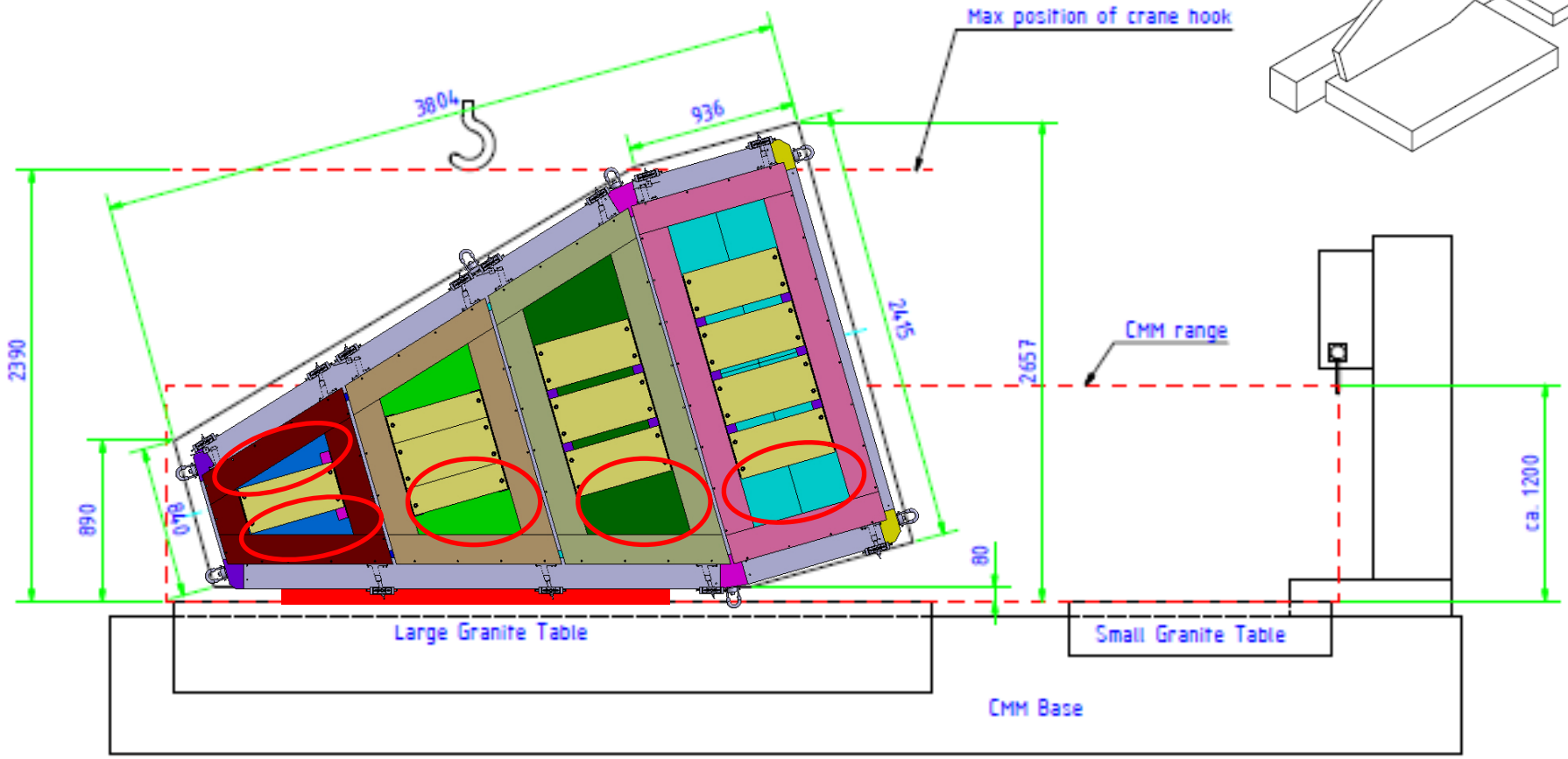
- Setup on CMM at Freiburg
  - What are the limitations?



WHAT CAN BE MEASURED AT FREIBURG?

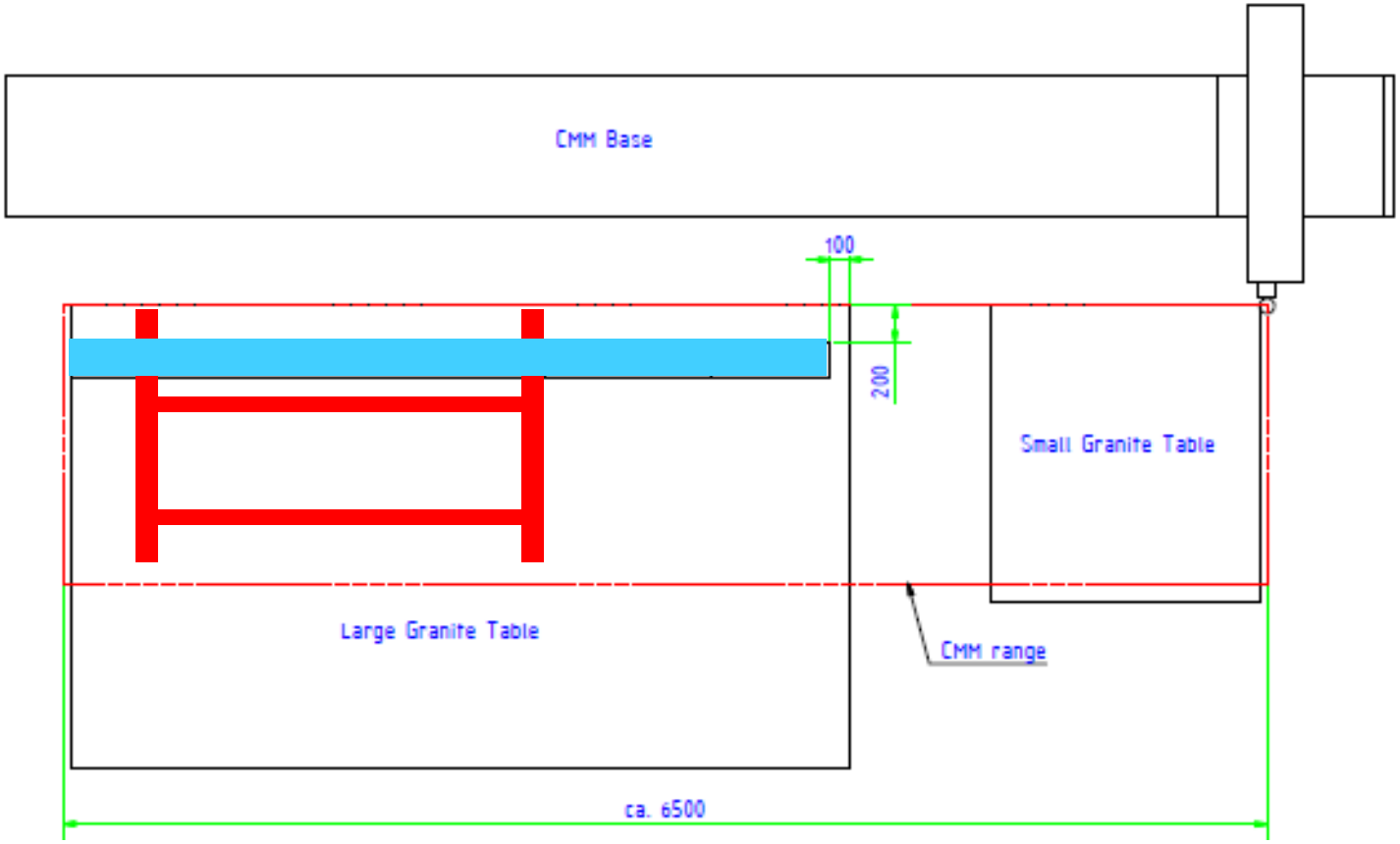
- Setup on CMM at Freiburg
  - To have access on the other side, we need to return the setup

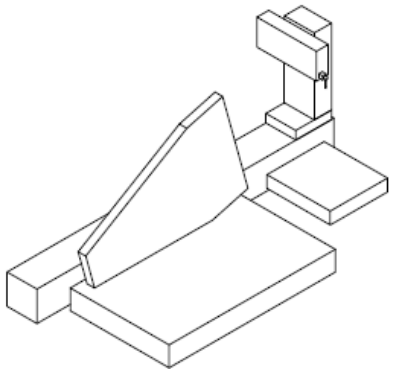




WHAT CAN BE MEASURED AT FREIBURG?

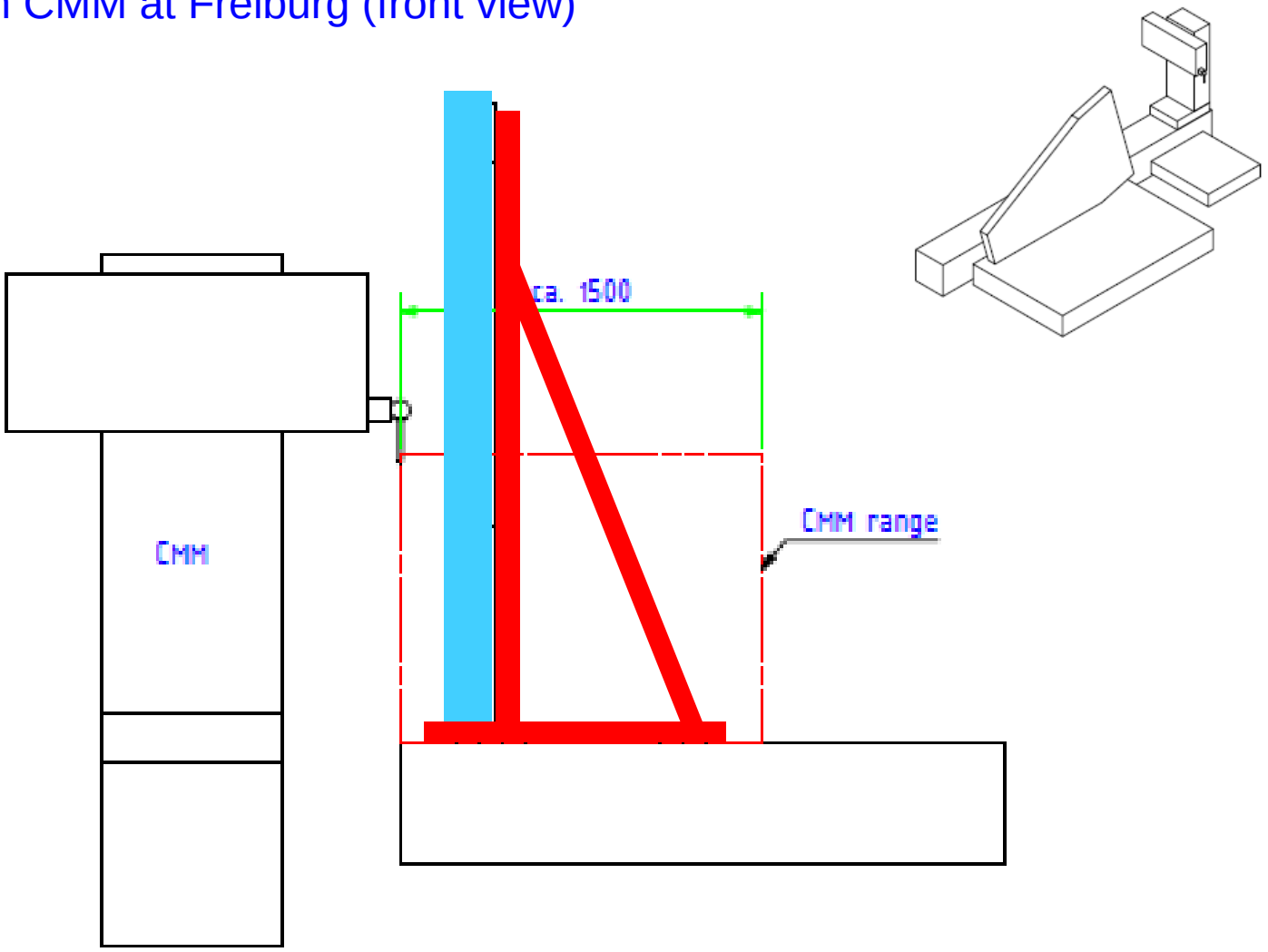
- Setup on CMM at Freiburg (top view)





WHAT CAN BE MEASURED AT FREIBURG?

- Setup on CMM at Freiburg (front view)



PROPOSAL OF A LIST OF MEASUREMENTS

Measurements	Criteria	Method	Comments
3 times: - Without constraints → mounted of the modules on the spacer with 3 kinematic supports - With mechanical constraints → mounted by screwing on the spacer - With thermal loading → one side of the modules should be warmed (e.g. with electrical heaters)			
Planarity (external sides)	50μm	CMM	External panels should be connected to RO panels
Parallelism (external sides) Possible only if we can measure the 2 sides of the setup without loss of the reference plan	80μm to 100μm	CMM	External panels should be connected to RO panels
Alignment of the 2 layers of each RO panel	40μm	CMM	Mechanical reference should be accessible
Alignment of the 2 RO panels	40μm	CMM	Mechanical reference should be accessible
Deformation with the gas pressure	6mbars (max)		With pillars or insert inside the drift gaps
Other measurements	**Criteria**	**Method**	**Comments**
Sealing of the modules	Tbd ?	Gas pressure up to 6mbars	By using a detector of leak
Weight	-	Dynamometer	

Thank you for your attention !

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