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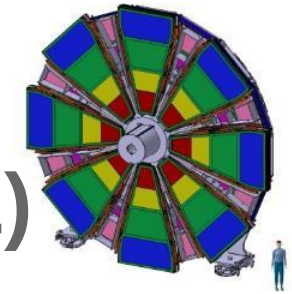
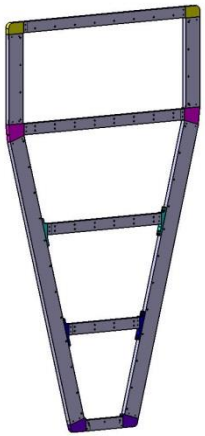
ATLAS - NSW
(NEW SMALL WHEEL)



MICROMEGAS DETECTORS

Design of the spacer



Patrick PONSOT

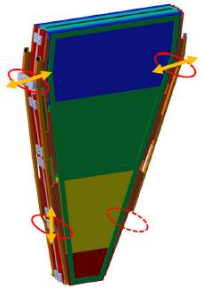
CERN MM workshop – 5-6 of November 2013

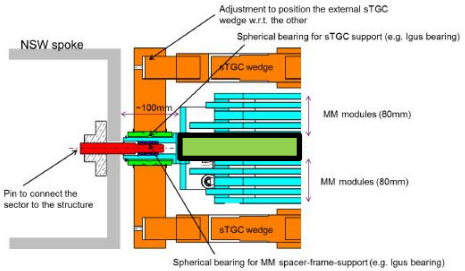
OUTLINE

- Functionalities and interfaces
- Layout and thermomechanical simulations
- Mechanical prototype to test the screwing of the modules at Freiburg
- Proposal for the final design (32 spacers) → CERN responsibility

FUNCTIONALITIES AND INTERFACES

- Fixation of the MM modules
  - By gluing or screwing (the sliding of the modules around the screws is possible → thermal expansion due to the temperature gradient in the cavern)
- Alignment of the 2x2 modules
  - Parallelism of the strips
  - Precise fixed point is needed for each module, and orientation point for the thermal expansion with an elongated hole
- Handling of the MM wedges to do the assembly with sTGC wedges
- Fixation of the common supports
  - The weight of the sTGC must not be supported by the MM wedges
  - A double kinematic mount has been proposed by the Saclay group (TDR)
  - The adjustment of the position of the 2 sTGC wedges must be possible without deformation of the spacer
- Handling of the full sector (MM+sTGC+common supports+services)
  - To install them on all orientation (sector 1 to 16)





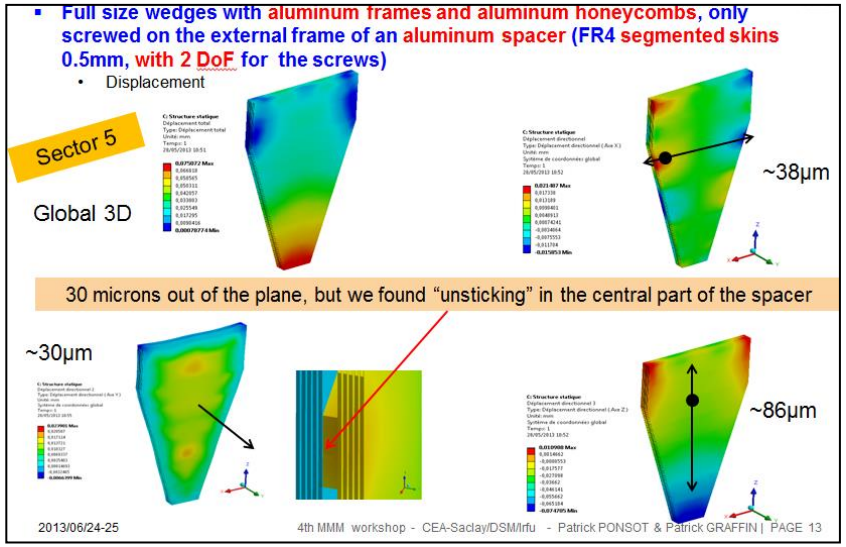
LAYOUT AND THERMOMECHANICAL SIMULATIONS

- A lot of thermomechanical simulations have been done by the Saclay team
  - Complete sectors (sTGC + MM + spacer) with different orientations (0°, 45°, 90°, 180°)
  - Impact of the material of the spacer (aluminum profiles or G10 bars)
    - → Coefficient of thermal expansion
    - → Density and Young modulus
- The results shown that in all cases the stiffness of the MM modules is higher than the stiffness of the spacer
  - But we never consider the segmentation in 2 modules (decided on July after TDR)
  - Not critical, but it should be done to define the geometry of the spacer to limit the stress on the interfaces for the supports (3 kinematic supports to fix the MM wedges on the structure of the wheel)

Nota: The Young modulus of the composite panels that has been estimated and used for these simulations is ~17GPa. It has been measured until to 24GPa (with aluminum honeycombs glued on all the surface).

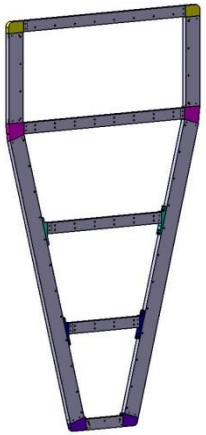
LAYOUT AND THERMOMECHANICAL SIMULATIONS

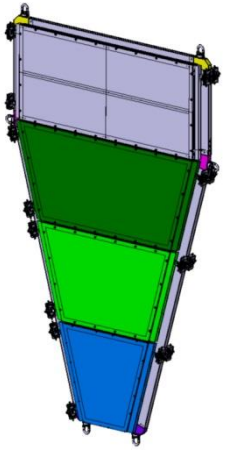
- Another result from the thermomechanical simulations: The symmetry of the sector is very important to avoid enlarged deformation out of the plane with the modules fixed on the 2 sides of the spacer → very good planarity and parallelism of the 2 sides are required
  - Thermal expansions are different on the 2 sides and will deform the spacer which follows the hottest modules
  - A clearance has been found between the HO modules and the spacer within a temperature gradient of 2°

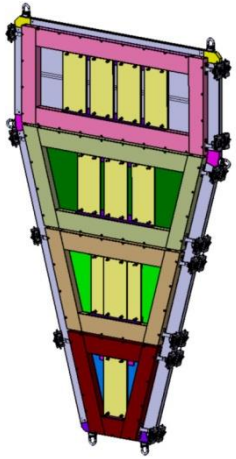


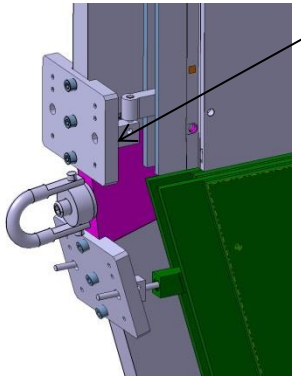
PROTOTYPE FOR TESTING AT FREIBURG

- A prototype has been designed by the Saclay team to test the screwing of the 4 MM modules at Freiburg (only for testing, this is not the final design)
  - Assembly by gluing of aluminum profiles has been chosen
  - Only one flat side to fix the 4 mechanical prototypes
  - 4 dummy modules will be fixed on the opposite side with elastic washers to compensate the default of planarity (to counterbalance the weight)
  - Before testing the screwing, the 4 modules will be mounted with adjustable kinematic mounts (reference measurement without constraints)









Adjustment will be possible (new design in progress)

  - The preliminary drawings are available on the MM mechanical twiki pages (they will be updated and completed with the feedback of the collaboration)

PROTOTYPE FOR TESTING AT FREIBURG

- Status of the machining and assembly of this prototype → under the responsibility of Freiburg

  - Modification of the connection pieces of the profiles to facilitate the gluing (secured with additional pins)
  - Same method to build the dummy modules
  - Modification of the position of the lifting rings according to the environment at Freiburg
  - 24+1 bearing Igus have been delivered at Saclay (pieces to equip the kinematic supports)

  - A lot of pieces to machine:
    - 25 profiles
    - 26 connection pieces
    - 24 kinematic supports (3 parts: on spacer, on module and adjustable plates)
    - 11 loading plates
    - and a support to put the sector on the CMM machine (designed at Freiburg)

PROPOSAL FOR THE FINAL DESIGN

- Deliverable of the 32 NSW spacers is under the responsibility of CERN
  - But Saclay proposed to continue to provide his help to work on the thermomechanical simulations
    - Segmentation in 2 modules
    - Deformation of the wedges for each orientation (0°, 45°, 90° and 180°) according to the position of the 3 kinematic mounts to fix the sectors on the structure of the wheel
    - Impact of the final choice to build the spacer (material, gluing, welding…)

Thank you for your attention !

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