Development of the Service Frame for SBS Tracker GEM and TENDIGEM Development

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The Gas Electron Multiplier (GEM) technology has been tested to tolerate rate larger than 50 MHz/cm^2, without noticeable aging, and to provide the sub-millimeter resolution on working chambers up to 45x45 cm^2 [1]. A new GEM tracker is under development for the upgrade of the SBS spectrometer in Hall A at Jefferson Lab. The chambers of the tracker have been projected in a modular way: each chamber consists o 3 adjacent GEM modules, with an active are of 40x50 cm^2 each [2].

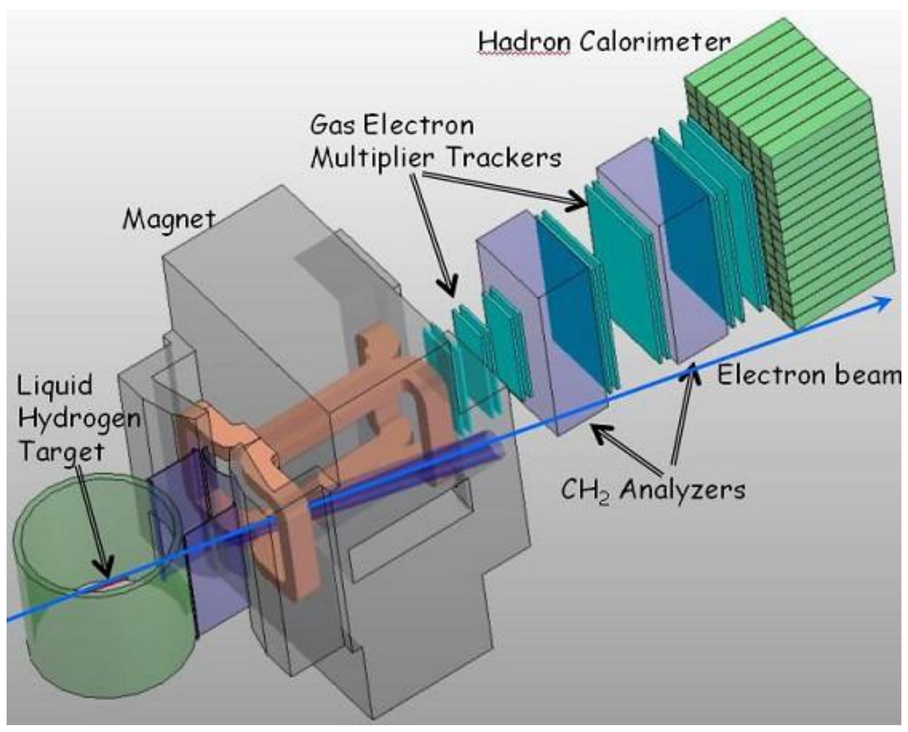

Figure 1. SuperBigbite Spectrometer

FEM analysis, carried out with COMSOL software, determined an structural optimization both from point of view of plate thickness of carbon fiber both from point of view of structural design. In particular, we optimized structure of the points that showed areas of high stress and deformation of structure with points above predetermined limit.

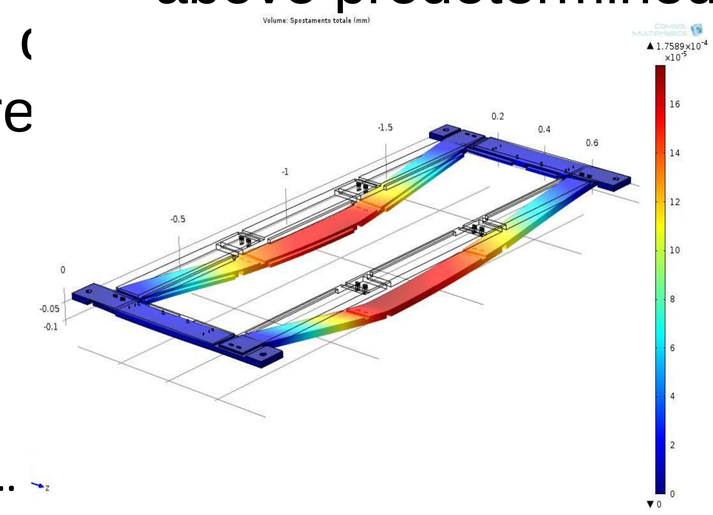

Figure 2. Deformation in horizontal position

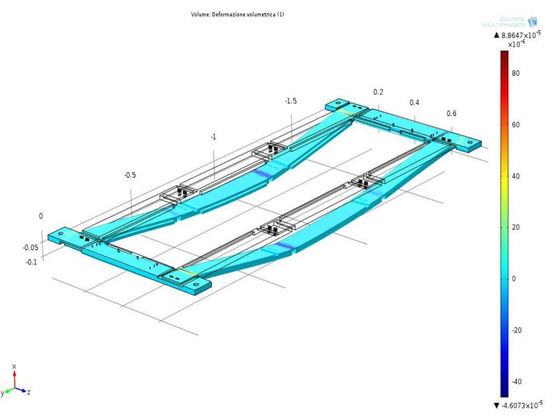

Figure 3. Von Mises stress in horizontal position

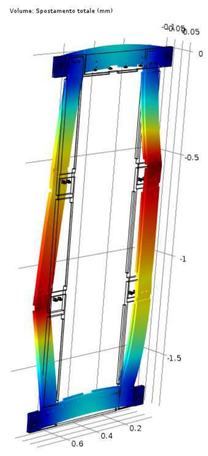

Figure 4. Deformation in vertical position

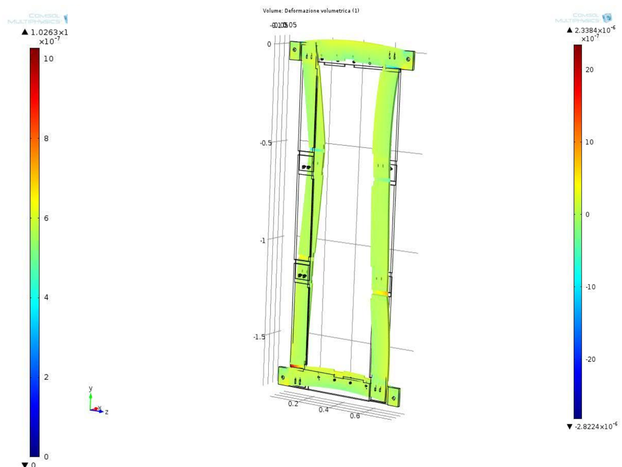

Figure 5. Von Mises stress in horizontal position

Defined **f** the vector of external forces on a node and **u** the vector of DOF, we assume linearity between **f** and **u**:

$$\mathbf{K\,u = f}$$

where **K** is stiffness matrix. This relation identifies the duality between external forces and displacements. Scalar product is associated with value of work done by external forces. Terms force, reaction force and stiffness matrix are extended beyond purpose of mechanical structures in which was born the FEM analysis.

References:

[1] M. Alfonsi et al. “ Activity of CERN and LNF groups on large area GEM detectors” Nucl. Instr. Meth. A 617 (2010) 151.

[2] V. Bellini et al. - “GEM tracker for high luminosity experiments at the JLab Hall A”, proceedings of the MPGD 2012 conference, to be published on JINST.

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