Minute of Meeting
The Large Hadron Collider beauty (LHCb) experiment

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Forum on Tracking Detector Mechanics 2018

LHCb Scintillating Fibre Tracker: Comparison of kinematic and structural FEA with measurements on a prototype

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Abstract

Version	Date	***Comments or Description of Changes***
1.0	28/03/18	-
2.0	29/03/18	*Added comments from C. Joram*

During the Long Shutdown 2 of the LHC, the LHCb collaboration will replace the current Outer and Inner Tracker by a single tracking detector, based on 2.42 m long scintillating fibres with a diameter of 250 µm, readout by silicon photo-multipliers (SiPM). The fibres are arranged in mats of 6 fibre-layers with a width of 130.65 mm. Eight fibre mats will form a module and are sandwiched between honeycomb and carbon fibre composite panels to provide stability and support over the module length of 4.85 m. The modules are supported by a C-Frame structure that provide the proper stiffness to the full package. The C-Frames are also used to support electronic boards, cooling systems and services and must fit in the existing bridge / platform structure imposing tight space constraints.

One of the main purposes of the C-Frame supporting structure is to provide the proper stability during the data acquisition, but also during installation and detector opening/closing operations. To meet this goal, the supporting structure must be stiff enough to avoid unacceptable deformations and movements if subjected to variable loads. Furthermore, the fixation of the system has to be properly defined. Two principal studies have been carried out to optimize the design and the structural behaviour of the structure: kinematic and structural finite element. A detailed kinematic analysis allowed to define and optimize the proper constraints of the system during the insertion, the opening and closing phase and the service position. The theoretical fixation concept has been slightly adjusted to guarantee the proper mechanical properties in terms of stability to the supporting structure. Finite element analyses have been performed to assess the mechanical behaviours and stability for different load and constraint configurations.

A comparison with a real scale prototype, that will be assembled at CERN in April 2018, will be provided. Modifications suggested from the comparison and lessons learned will be also reported.