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# Cylindrical CGEMs mechanical structure's investigations and improvements for the BESIII experiment

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An innovative CGEM cylindrical Gas Electron Multipliers detector with charge and time readout is foreseen to be installed in the BESIII Experiment in Beijing, China, to replace the present inner driftchamber.
The new detector will be able to match the drift chamber tracking performance while improving measurement of the polar angle and the rate capability. The material budget must stay within 1.5% of X0 in order to minimize the multiple scattering. To achieve that, the structure is hold by permaglass rings placed outside the active area and a light sandwich of Kapton and Rohacell (a PMIfoam) gives the mechanical rigidity to the central part of the cylinders. The mechanical design scheme is inherited by the KLOE2 inner tracker.
A quality assurance protocol has been developed during the studies of the prototypes in Italy to check the status of the detectors after every major operation involving touching or moving the structure. They consist in checks of the whole system, gas leakage, HV distribution and shortcuts, readout checks.
To ship the detectors to IHEP, Beijing, an air cargo with custom designed boxes has been used. After the shipment the quality control pointed out some malfunctions compatible with GEMs deformation inside two of the detectors.
Investigation performed to understand the issues include: gas leakage, laser surface measurement to check if malformation on the external surface happened due to the shipment, computed tomographyscan to look inside the detector and check the status of the internal layers and mechanical opening of two detectors to deeply understand the weak points of such mechanical structure.
As result of these investigations, new supporting structure has been chosen for the final detectors. This consist on a carbon fiber and honeycomb sandwich. Its properties have been deeply investigated with respect to the Rohacell by means of tests and simulations. It provides robustness beyond the purpose of a detector for high energy physics and guarantees the strength for the shipment allowing to stay within the material budget requested by the experiment.
The first detector with the new design has been built and safely transported to China. In this talk a review of the construction process, the shipment and the mechanical investigations, tests and simulations that led to the final layout of the detector together with the operating results in laboratory (current stability, discharges, temperature and humidity correlation) will be presented.

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