Contribution ID: **39** Type: **not specified**

Experimental, Analytical and Numerical Analysis of of Insert Debonding in Carbon Fiber Structures for Particle Detectors

Wednesday 31 May 2023 16:05 (30 minutes)

The Inner Tracker detector (ITk), part of the ATLAS High-Luminosity LHC Upgrade, consists of pixel and strips sensors, held in place by rigid structures designed to ensure very high stiffness and radiation length. The main structure, designed at LBNL, consists of a 3 mm thick, 6 m long and 2 m wide carbon fiber cylinder. The critical connections of this cylinder to the external cryostat and the inner structures were tested against nominal and ultimate loads, monitoring deformations and with strain gauges and LVDTs. Good agreement was found between the measurements and the numerical models, validating the design of these interfaces in terms of stability performances. The applied load was then gradually increased up to the failure load, 4 times larger than the ultimate one. Inspection revealed that the collapse of the structure was due to the debonding of the titanium insert supporting the rollers. Analytical and numerical approaches, based on Cohesive Zone Modeling of the failed interface, were used to study the failure process. Both models predictions are very close to the measured load, showing promise for use in future detector designs.

Authors: BIRD, C. (LBNL); BOETTCHER, Dennis Norman (Lawrence Berkeley National Lab. (US)); ANDERSSEN, Eric (Lawrence Berkeley National Lab (US)); VALLONE, Giorgio (Lawrence Berkeley National Lab. (US)); MC GEE TOLEDO, M. (LBNL); JANDA, Martin (Czech Technical University in Prague (CZ)); JOHNSON, Thomas (Lawrence Berkeley National Laboratory); CLAYBAUGH, Todd (Lawrence Berkeley National Lab. (US))

Presenter: CLAYBAUGH, Todd (Lawrence Berkeley National Lab. (US))

Session Classification: Plenary