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[Invited] DESIGN AND FABRICATION OF A CRYOSTAT FOR LOW TEMPERATURE MECHANICAL TESTING FOR THE MECHANICAL AND MATERIAL'S ENGINEERING GROUP AT CERN

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Mechanical testing of materials at low temperatures is one of the cornerstones of the Mechanical and Material's Engineering (MME) group at CERN. A long tradition of more than 20 years and a unique know-how of such tests has been developed with a 18 kN double-walled cryostat. Large campaigns of material qualification have been carried out and the mechanical behavior of materials at 4 K has been vastly studied in sub-size samples for projects like LEP, LHC and its experiments. With the aim of assessing the mechanical properties of materials when submitted to higher loads, a new 100 kN cryostat capable of hosting different shapes of normalized samples has been carefully designed and fabricated in-house together with the associated tooling and measurement instrumentation. It has been conceived to be able to adapt to different test frames both dynamic and static, what will be of paramount importance for future studies of fracture mechanics at low temperatures.

The cryostat features a double-walled vessel consisting of a central cylindrical section with a convex lower end and a flat top end closure. The transmission of the load is guaranteed by a 4 column system and its precise monitoring is assured by an internal load cell positioned next to the sample in the load train. This innovative approach will be discussed together with other non-conventional instrumentation solutions such as optical fiber extensometry.

A validation of the whole system has been carried out at both room and cryogenic temperature. Bending efforts have been measured and dedicated tooling fabricated for the device's optimization. The results obtained confirm an excellent performance of the system and enhance the analysis of materials under extreme conditions with state of the art instrumentation.

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