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Precision Mechanics for Calorimeter Structures

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In the context of calorimetry R&D activities developed in the CALICE Collaboration, in synergy with the ILD experiment, and in the AIDA2020 project, one of the important goals is the construction of a new prototype of the Semi-digital Hadron Calorimeter (SDHCAL) with large chambers (similar to the largest proposed for the ILD) using new electronics and a mechanical structure built with the final procedures. This is one of the CALICE milestones in order to address the issues related to build a real detector fulfilling the demands of compactness and hermeticity and to prove its viability.
The compactness and the minimization of the dead spaces are intimately related with the design of the calorimeter absorber, which is also the support structure of the calorimeter modules. It requires to be able of producing absorber plates with very high planarity (less than 1mm) and assembly the structure with the lower deformations possible. For the SDHCAL the material of the absorber is stainless steel.
The use of bolts to fix the absorber plates together has been very common in hadronic segmented calorimeters, but with the very big modules proposed for the ILD, big bolts must be used, resulting on extra dead space that would deteriorate the calorimeter performance. Those dead spaces could be reduced by using welding but the disadvantage is the extra deformations the standard welding usually introduces. The use of electron beam welding could be a solution that is under investigation now.
The high accuracy on planarity needed for the plates is impossible to find in the standard market, mechanizing the raw plates to such planarity is too costly in terms of time and price. Roller leveling procedure has been envisaged as a cheaper, faster and high quality procedure.
In this talk, together with the design of the mechanical structure, the description of the techniques used (roller leveling and electron beam welding) and the obtained results with several small prototypes will be presented. Results obtained till now are promising, and even if this work is guide having in mind the ILD detector all these techniques could be used for any other hadronic calorimeter using stainless steel as absorber material.

Presenter: CALVO ALAMILLO, Enrique (Centro de Investigaciones Energéti cas Medioambientales y Tecno)

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