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Recent Developments on Scintillating Crystal Fibers for Calorimetry Applications

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The recent progress in the micro-pulling-down technique allows heavy scintillating crystals to be grown directly into a fiber geometry of variable shape, length and diameter. Examples of materials that can be grown with this technique are Lutetium/Yttrium Aluminum Garnets. Thanks to the flexibility of this approach, combined with the high density and good radiation hardness of the material, such a technology represents a powerful tool for the development of future calorimeters.
In this work, the most recent results for LuAG:Ce and YAG:Ce fibers are presented. In particular, the tolerance to radiation and the use of co-dopants to improve the scintillation time response are discussed, these two aspects being amongst the most important challenges to be faced for operation in the harsh radiation environment of the next phase of LHC.
As an important proof of concept of the application of crystal fibers in future experiments, a small calorimeter prototype was built and tested on beam in March 2014 at the Fermilab T-1041 beam line. A grooved brass absorber was instrumented with 64 LuAG fibers. Each fiber was readout individually using SiPMs, thus providing a highly granular description of the shower development inside the module as well as good tracking capabilities.
The performance of the module was tested using electrons and pions in the 2-32 GeV energy range. Physics results from this beam test will be presented, together with further ideas for fiber calorimeter prototypes.

Primary author: Mr BENAGLIA, Andrea Davide (CERN)

Co-authors: HEERING, Arjan (University of Notre Dame, Notre Dame, Indiana, 46556, USA); DUJARDIN, Christophe (Institut Lumière Matière, UMR5306 CNRS, Université Lyon 1, 69622 Villeurbanne, France); TULLY, Christopher (Princeton University, Princeton, New-Jersey, 08544, USA); Mrs AUFFRAY, Etiennette (CERN); FERRO, Gabriel (Institut Lumière Matière, UMR5306 CNRS, Université Lyon 1, 69622 Villeurbanne, France); LEBBOU, Kheirreddine (Institut Lumière Matière, UMR5306 CNRS, Université Lyon 1, 69622 Villeurbanne, France); Dr PAUWELS, Kristof (CERN); LUCCHINI, Marco (CERN); AUBRY, Nicolas (Fibercryst, Parc d'Activités Wilson - Bât. A1, 31 Rue Wilson, 69150 Décines Charpieu, France); SIDLETSKIY, Oleg (Institute for Scintillation Materials of NASU, Lenin Ave. 60, Kharkov, 61001, Ukraine); Dr LECOQ, Paul (CERN); FARAJ, Sara (Fibercryst, Parc d' Activités Wilson - Bât. A1, 31 Rue Wilson, 69150 Décines Charpieu, France); MEDVEDEVA, Tatiana (Princeton University, Princeton, New-Jersey, 08544, USA); KONONETS, Valerij (Institut Lumière Matière, UMR5306 CNRS, Université Lyon 1, 69622 Villeurbanne, France); XU, Xiaodong (Institut Lumière Matière, UMR5306 CNRS, Université Lyon 1, 69622 Villeurbanne, France)

Presenter: Mr BENAGLIA, Andrea Davide (CERN)

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