



Contribution ID: 181

Type: Talk

Particle tracking at 4K: The Fast Annihilation Cryogenic Tracking (FACT) detector for the AEGIS antimatter gravity experiment

Friday, 15 February 2013 15:55 (20 minutes)

The AEGIS experiment is an international collaboration with the goal of performing the first direct measurement of the earth's gravitational acceleration on antimatter. Critical to the success of AEGIS is the production of cold antihydrogen (Hbar) atoms. The FACT detector will be used to measure the production and temperature of Hbar atoms and for establishing the formation of a beam. The operating requirements for this detector are very challenging: it must be able to identify each of the thousand or so annihilations in the 1ms period of pulsed Hbar production, operate at 4K inside a 1T solenoidal field and not produce more than 10W of heat. The FACT detector consists of two concentric cylindrical layers of 400 scintillator fibers with a 1mm diameter and a 0.6 mm pitch. The scintillating fibers are coupled to clear fibers which transport the scintillation light to 800 silicon photomultipliers. Each silicon photomultiplier signal is connected to a linear amplifier and a fast discriminator, the outputs of the which are sampled continuously by FPGAs.

In the course of the developments for the FACT detector we have established the performance of scintillating fibers at 4K by means of a cosmic-ray tracker operating in a 4K cryostat. The FACT detector will be installed in the AEGIS apparatus in October 2012 and will be used to study Hbar formation. This talk will present the design of the FACT detector and provide first results of the detector operation in the AEGIS apparatus.

quote your primary experiment

AEGIS

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Session Classification: Plenary 5