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SiD silicon tungsten ECAL for ILC

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We present an update on the status of the SiD silicon-tungsten ECAL development effort. The calorimeter design consists of thirty layers of silicon sampling embedded in a stack of tungsten plates. The first twenty tungsten plates are 2.5 mm thick followed by ten 5.0 mm thick plates. The six-inch silicon sensors contain 1,024 channels, with nominal pixel cross sections of 13 mm^2, and are read out by the 1,024 channel CMOS ASIC "System on a Chip"KPiX.[1] A nine-layer prototype was assembled and tested in a SLAC electron test beam. The beam test revealed crosstalk from capacitive coupling among pixels. A novel improved design of the sensor was developed with two metal layers, aimed at significantly reducing the capacitive coupling. A new set of prototypes sensors was fabricated, with an additional improvement of a gold surface stack under bump metallization for KPiX bonding. A new cable with wire bond connections to the sensor has also been developed to simplify the cable bump bonding procedure. Studies of the test beam data have demonstrated excellent isolation of electromagnetic showers, and separation of neighboring showers.[2]

[1] J. Brau, M. Breidenbach et al., "KPiX - A 1,024 Channel Readout ASIC for the ILC," SLAC-PUB-15285 (2013), 2012 IEEE Nuclear Science Symposium, http://slac.stanford.edu/pubs/slacpubs/15250/slac-pub-15285.pdf

[2] A. Steinhebel and J. Brau, "Studies of the Response of the SiD Silicon-Tungsten ECal," Proceedings of the 2016 Linear Collider Workshop (LCWS), Morioka, Japan, arXiv:1703.08605 [physics.ins-det].

Secondary topics

Applications

Design concepts for future calorimeter at the energy frontier

Primary topic

Silicon

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