

Report on Recent FCAL Simulation Studies at SCIPP

Undergraduate **Christopher Milke**,
Professor Bruce Schumm,
Santa Cruz Institute for Particle Physics
University of California, Santa Cruz

Clustering WG Meeting, 11 August 2014

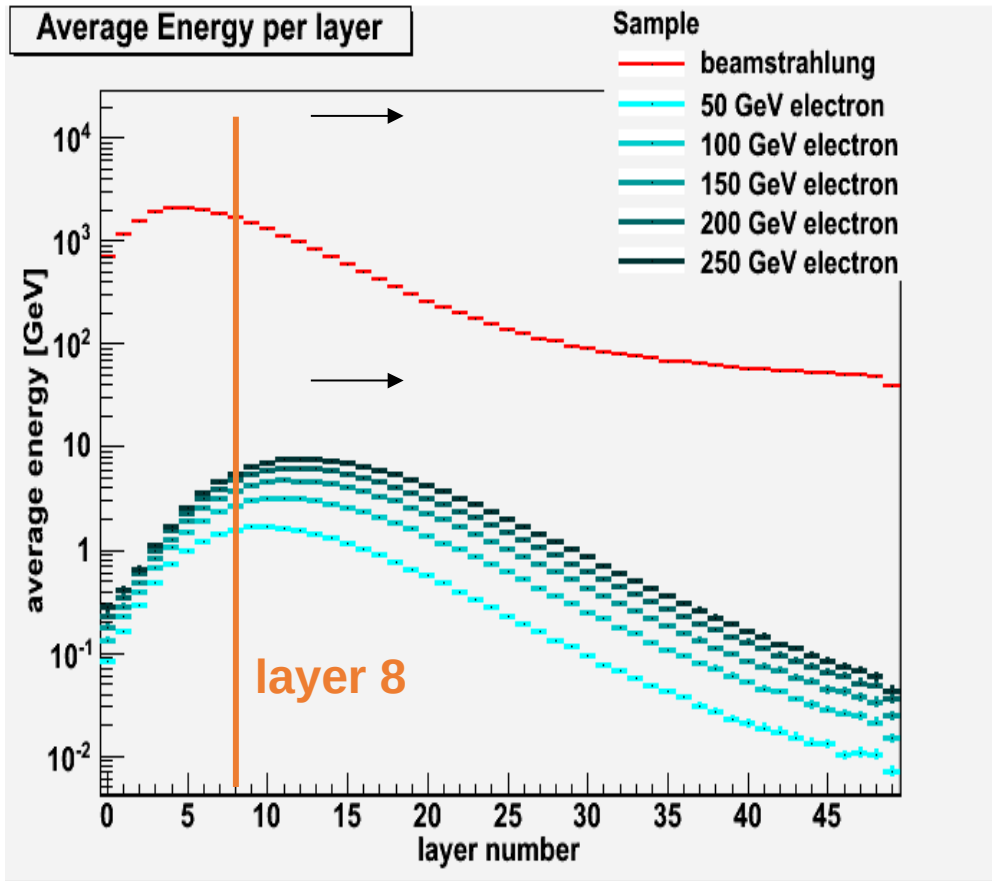
Topics

- Comparison of Background and Signal Electron Energies from Different Detector Models
- Comparison of Clustering Results Between Rectilinear and Radial Segmentation

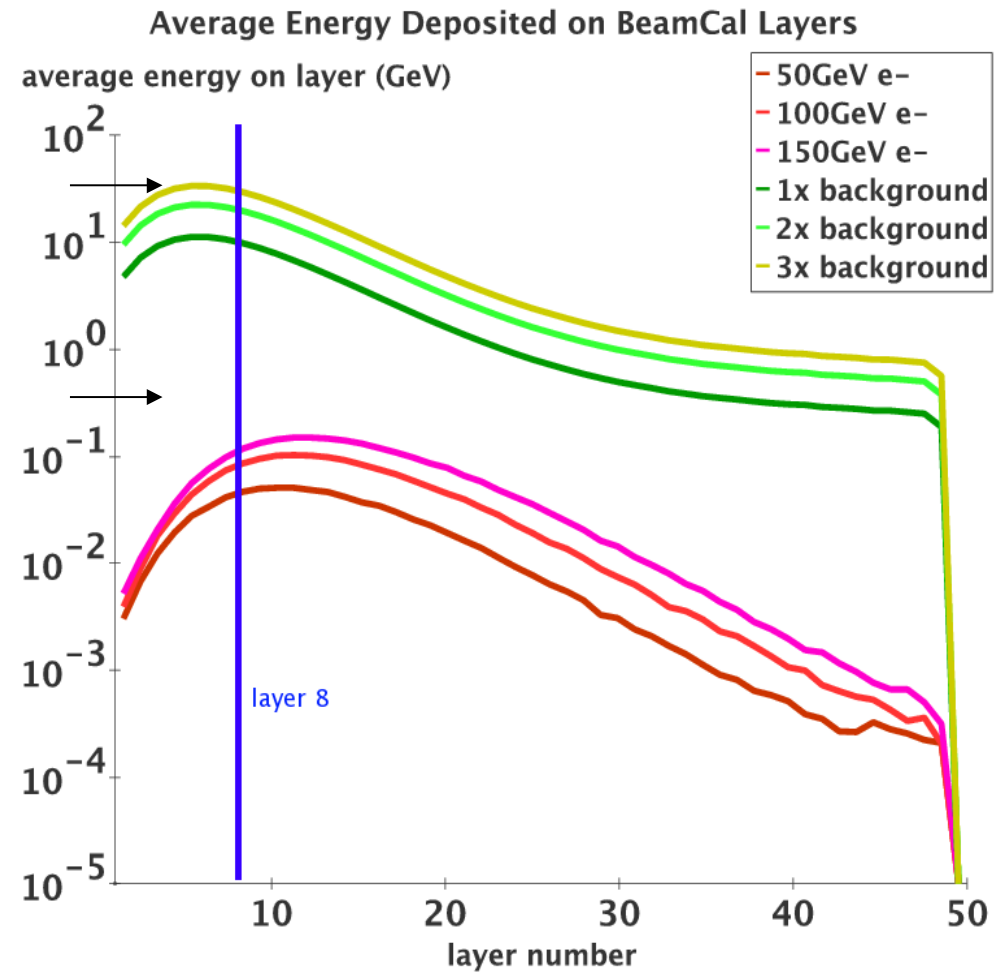
Comparison of Background and Signal Electron Energies from Different Detector Models

- Colorado performed independent SUSY study in the DBD
- SiD02 simulation files produced by SLAC showed a worse Signal to Background energy ratio than those of the Colorado simulation
- Thought including the anti-DID field might resolve this discrepancy
- We simulated the SiDloi3 detector with and without anti-DID, but found S/N ratio worse than before
- Currently looking into differences between SiD02 and SiDloi3 models to determine why

Signal to Noise Comparison For SiD02 Detector Model



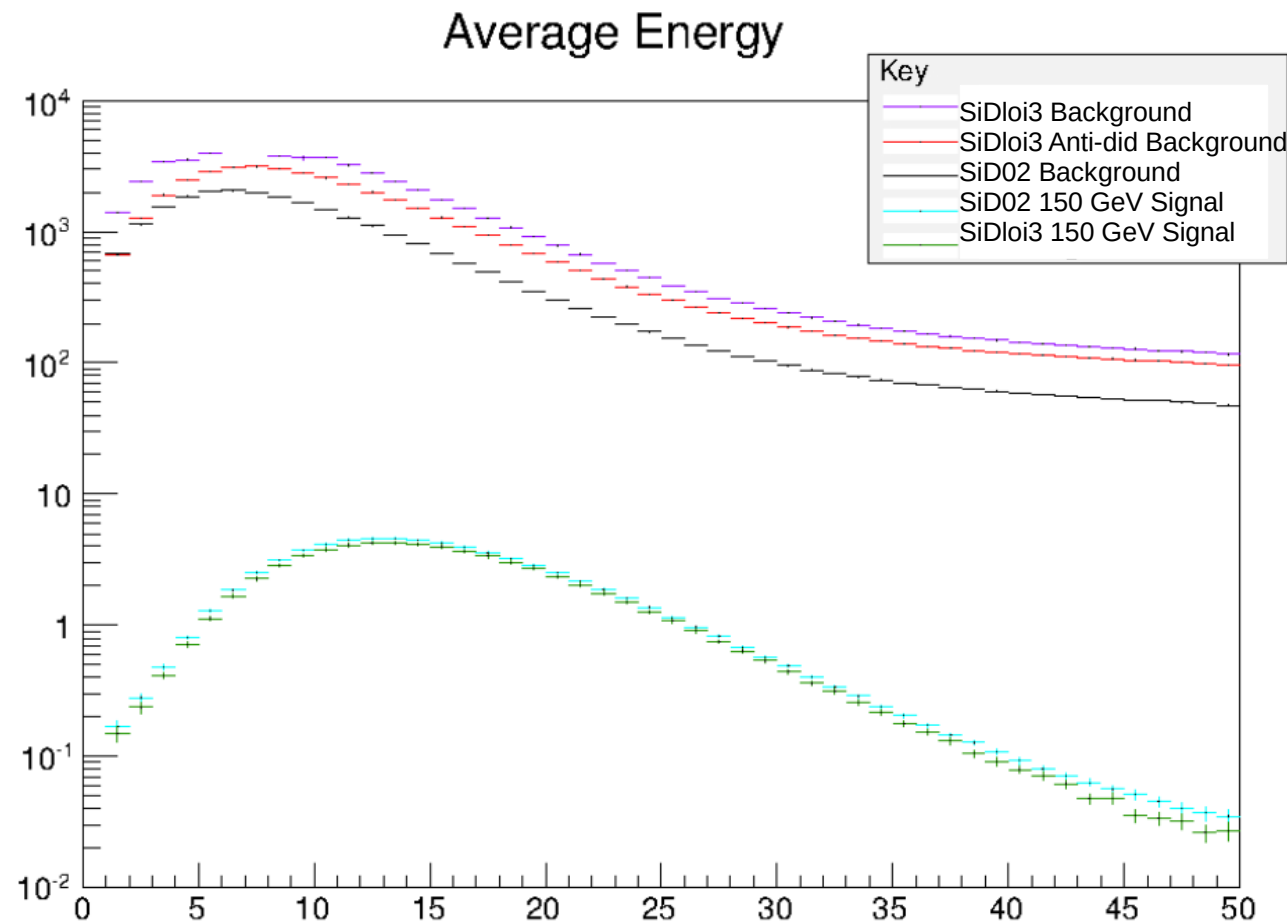
**SCIPP: Mean background
is x500 mean signal**



**Colorado: Mean background
is x100 mean signal**

Have been unable to understand what changed

Average Energy Deposited per Layer by Signal Electrons and Background



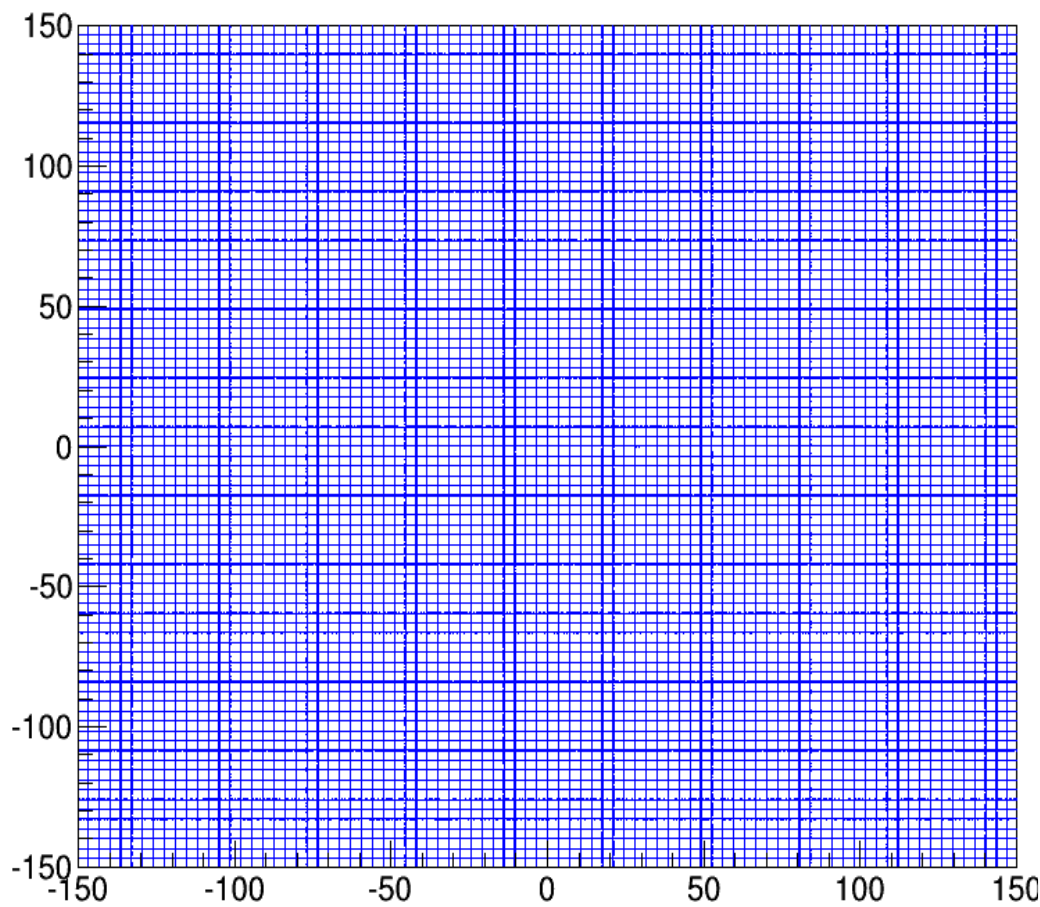
- Comparing three detector models: SiD02, SiDloi3, and SiDloi3 with anti-DID.
- Signal electrons are unaffected by the anti-DID, so the same electrons are used for both versions of the SiDloi3 design.
- Electrons from the SiD02 and SiDloi3 detector models have nearly identical deposition patterns
- SiDloi3 background is much higher than older SiD02 background.
- Anti-DID has reduced backgrounds though

Comparison of Clustering Results Between Rectilinear and Radial Segmentation

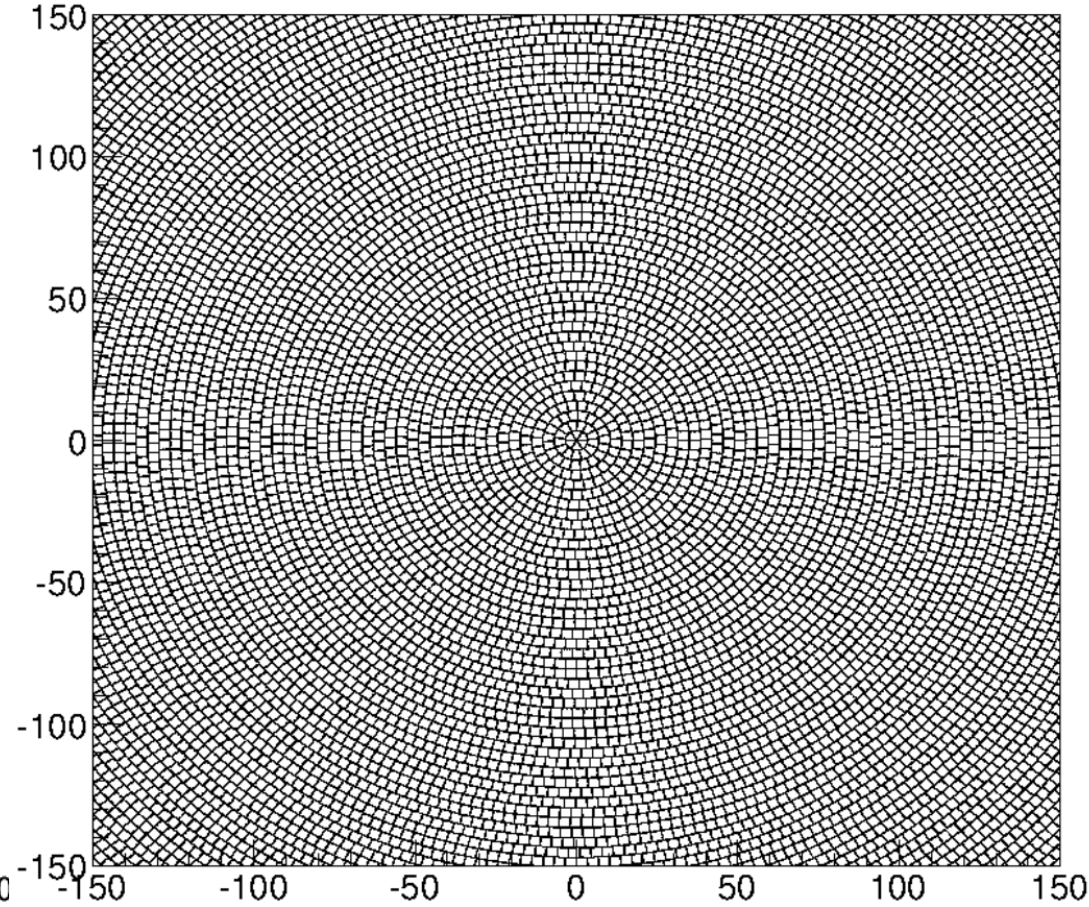
- Seeking to reproduce results of old rectilinear segmentation using new radial segmentation
- Primary objective is reproducing signal efficiency and background purity results, and determining appropriate “sigma cut”
- Sigma cut is the number of standard deviations from background average
- Any events with energy above sigma cut are labeled as signal events
- Original rectilinear studies performed using SiD02 detector model, so initial radial studies have also used SiD02

Comparison of Rectilinear and Radial Geometries

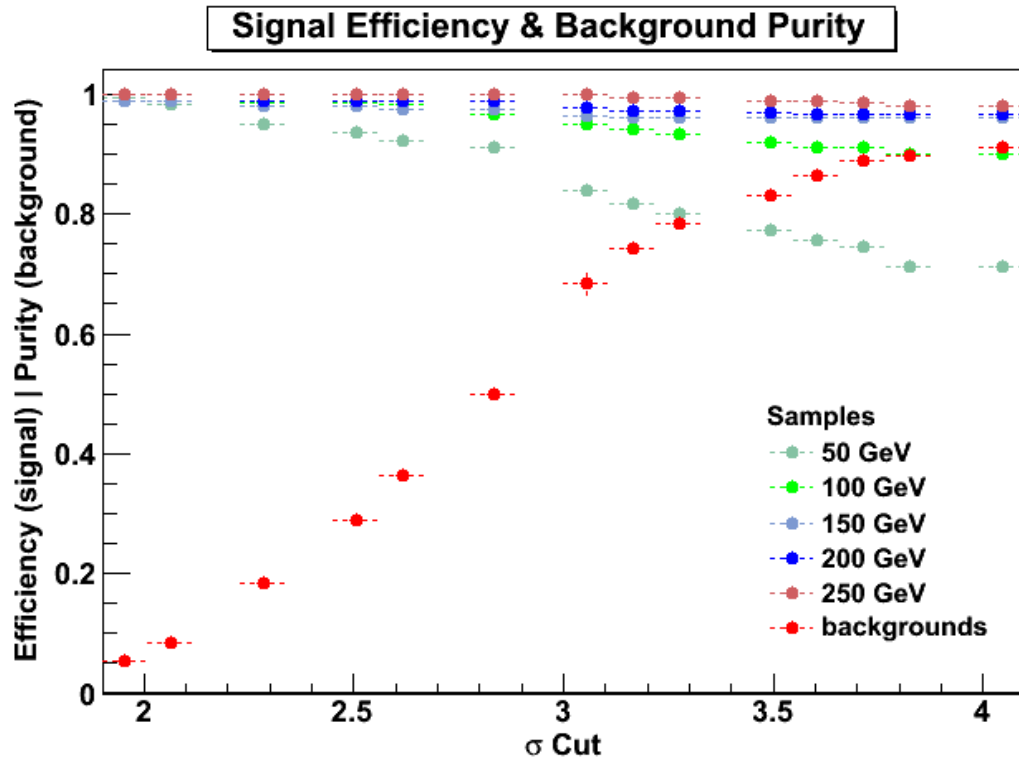
3.5x3.5 mm Rectilinear Segmentation



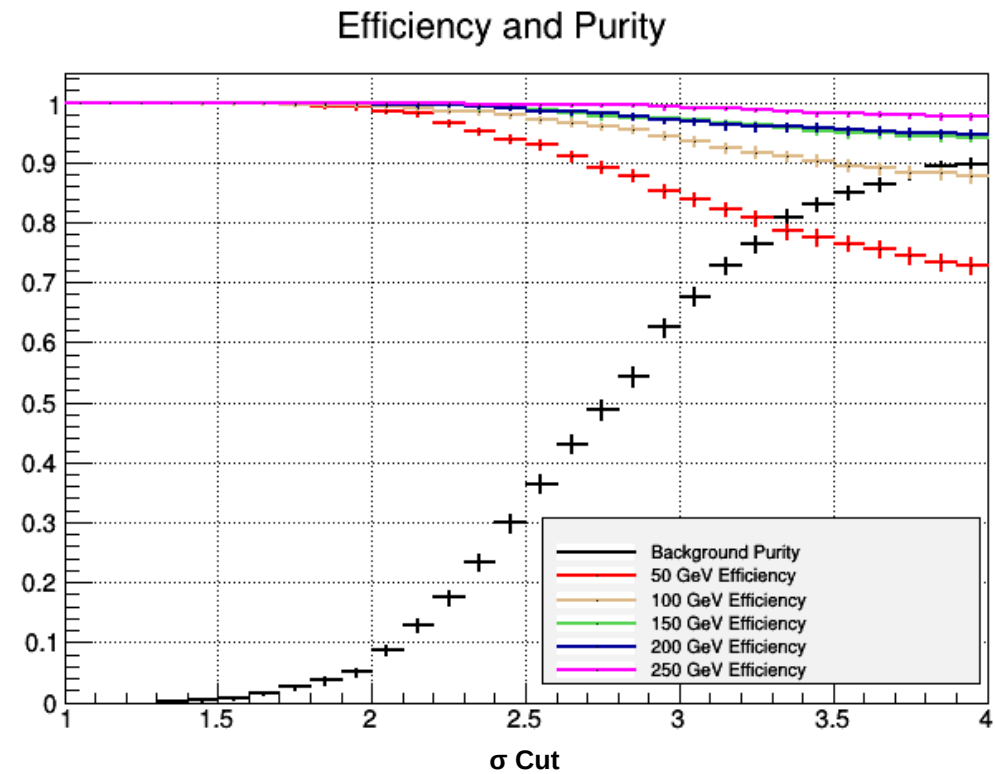
3.5x3.5 mm Radial Segmentation



Efficiency and Purity of Rectilinear vs Radial Segmentation



SiD02 Signal Efficiency and Background Purity for 3.5x3.5 mm Rectilinear Segmentation



SiD02 Signal Efficiency and Background Purity for 3.5x3.5 mm Radial Segmentation