

# BeamCal Simulation Studies at SCIPP

#### FCAL Segmentation Working Group Meeting 14 July 2014

#### **Bruce Schumm** UCSC/SCIPP

# The SCIPP/UCSC BeamCal Simulation Group

Includes PI (me) plus three undergraduates; one (Milke) supported by US/DOE R&D funds

A REALING

Bryce Burgess Olivia Johnson Christopher Milke

1 States and

Also enjoy critical support from Norman Graf at SLAC

#### We all know what/where the BeamCal is...



## Immediate Goals of Group

 Confirm/refine estimates of single-electron efficiency as a function of radius and energy

Implement radial segmentation scheme (done)

 Explore effect of anti-DID field on backgrounds and efficiency

**Determine optimal segmentation size** 

Implement realistic IP/BeamCal geometry

Physics analysis?

#### **Reconstruction Algorithm**

- Choose seed layer
- Subtract mean background from all pixels
- Sum energy in sliding window ("tile") of NxN beamcal pixels (N is optimized)
- Chose highest 50 tile depositions in layer

• Reject spurious tiles via longitudinal patterns by choosing radial-dependent cut on total energy that allows 10% of background events to be misidentified as signal

#### **250 GeV Reconstruction Efficiency**

250GeV Efficiency Various Sigma



#### **100 GeV Reconstruction Efficiency**

100GeV Efficiency Various Sigma



#### **50 GeV Reconstruction Efficiency**

#### 50GeV Efficiency Various Sigma Cuts



These results are somewhat worse than those seen by Uriel Nauenberg et al. at the University of Colorado, which were incorporated in the DBD studies

**Could it be that our backgrounds are worse** (see next slide)

Include anti-DID magnet in beam delivery and re-run (should account for some of S/N difference; maybe all?)

Anti-DID files are now available (thanks Norman!)

#### **Signal to Noise Comparison**



Colorado:Mean background is x100 mean signalSCIPP:Mean background is x500 mean signalHave been unable to understand what changed

#### **Re-Segmenting the BeamCal**

• Migrate from rectilinear (x,y) segmentation to concentric segmentation

• Pixel size is adjustable parameter (see next two slides)

• What is meant by "NxN tile" required a little thought (see following two slides)

Done and ready to test

#### 7 mm Pixel Size

Tile Picture



3.5 mm Pixel Size



## **Examples of "2x2" Tiles for Concentric Segmentation**

Tile Picture



## **Examples of "3x3" Tiles for Concentric Segmentation**

**Tile Picture** 



#### **IP Elements and Geometry**

Signal files in use have curious "mask" that occludes the BeamCal (see next slide)

**Elements to confirm/refine:** 

- Beam Cal geometry (Wolfgang Lohmann?)
- Confirm Beam Cal segmentation (Andre Sailer?)
- CLIC\_SiD configuration (Christian Grefe?)
- New Beampipe Geometry (Christian Grefe?)
- Masks (Tom Markiewicz and Takashi Maruyama)

#### Interaction point of 150 GeV signal electrons

150GeV X-Y Position hit Occupancy

150

100

50

-50

-100

-150

-100

-50

0



## **BeamCal Simulations: Next Steps**

• Analyze anti-DID samples with (x,y) segmentation

- Explore effects of pixel size
- Test radial segmentation

 Improve BeamCal and IP model in LCSim framework

• Suggestions?

# Backup

#### **Background Distribution in Radial Bins**

#### BeamStrahlung (e+e-) Truth Frequency



#### **Background Distribution in Phi Bins**

#### BeamStrahlung (e+e-) Truth Frequency



