Cornell University
Laboratory for Elementary-Particle Physics

Progress on Determining the Photoelectron Energy Distribution Using the B_{sol}=0 Shielded Button Data

All material for this talk may be obtained at www.lepp.cornell.edu/~critten/cesrta/ecloud/14jul10

The measurements are described here: https ://webdb.lepp.cornell.edu/elog/CTA+MS/528

See also previous talks on simulations for the shielded button data on 4/21, 4/28, 5/12, 7/7/2010

Addendum 15 July 2010

Prompted by the SYNRAD3D calculations for 15E presented by Gerry at this meeting, I revisited the SYNRAD2D calculations. I discovered that they dated from at time when I had a mistaken value for the position of the shielded buttons. My information on the photon rates was therefore erroneous. The correct values are 0.4 (1.2) photons/m/s for the e+ (e-) beam. As a consequence, the reflectivity values required to reproduce the measured ratio of the shielded button signals are more reasonable: 20% for the e+ beam and about 30% for the e- beam. Three slides have now been appended to this talk: 1) the SYNRAD2D results, 2) the comparison of measured and simulated shielded button signals, and 3) the underlying photoelectron energy distributions which successfully reproduce the measurements.

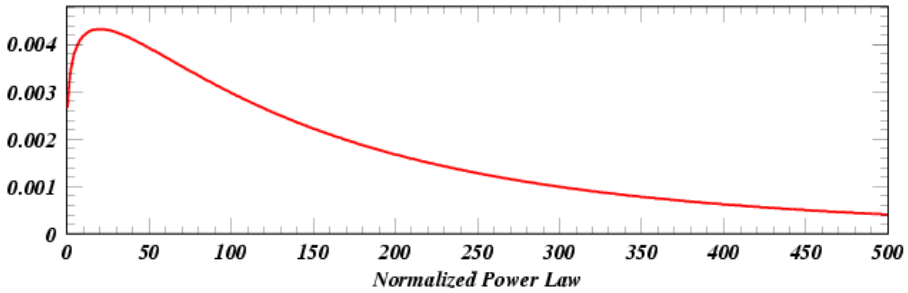
Jim Crittenden and Neboysa Omcikus

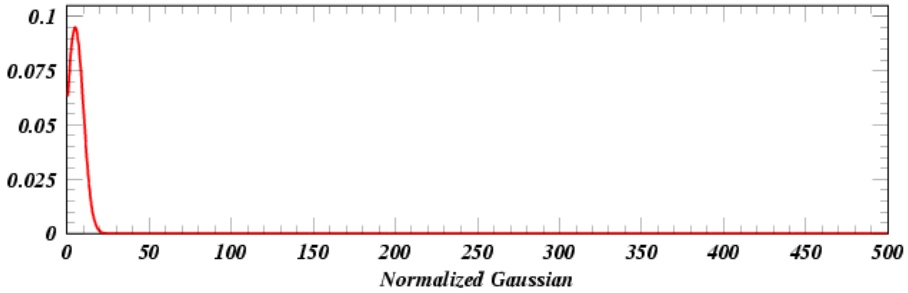
Cornell Laboratory for Accelerator-Based Sciences and Education

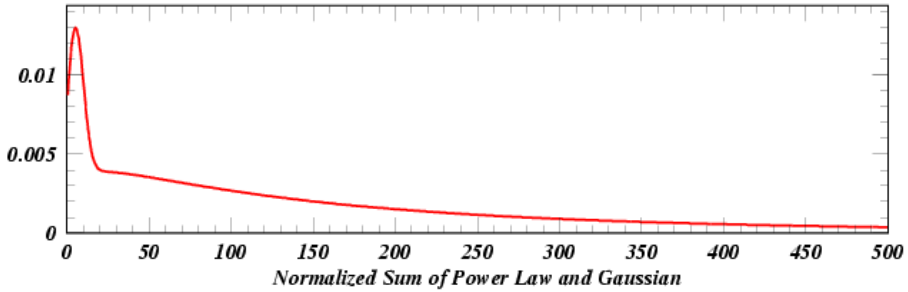
Electron Cloud Meeting

14 July 2010

Hybrid Power-Law/Gaussian Distribution Implemented in ECLOUD





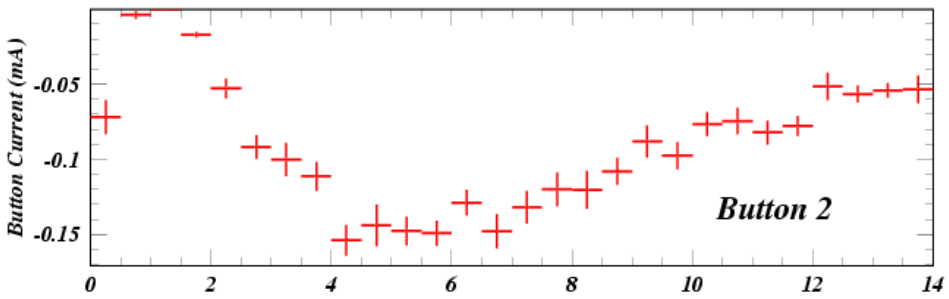


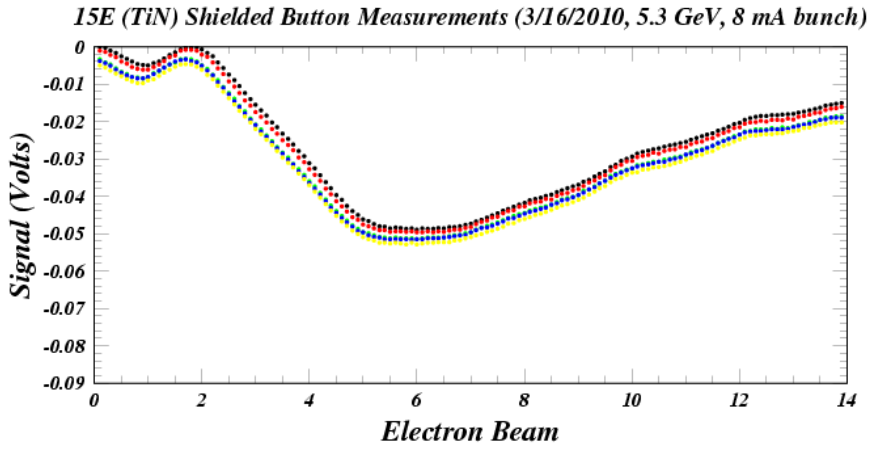
Power-law parametrization: $F(E) = E^{P1} / (1 + E/E_0)^{P2}$

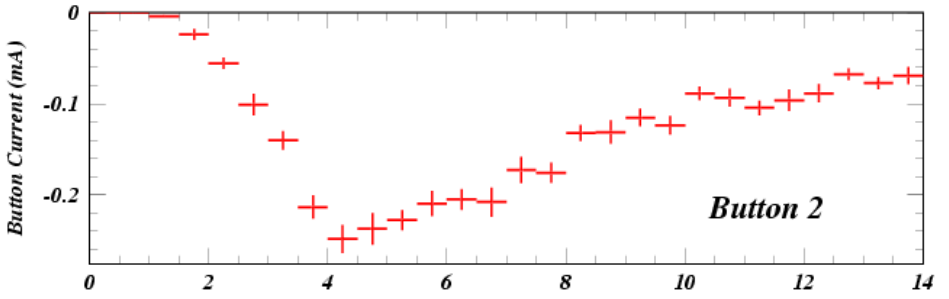
Example shown is for 10% Gaussian with peak and rms values of 5 eV.

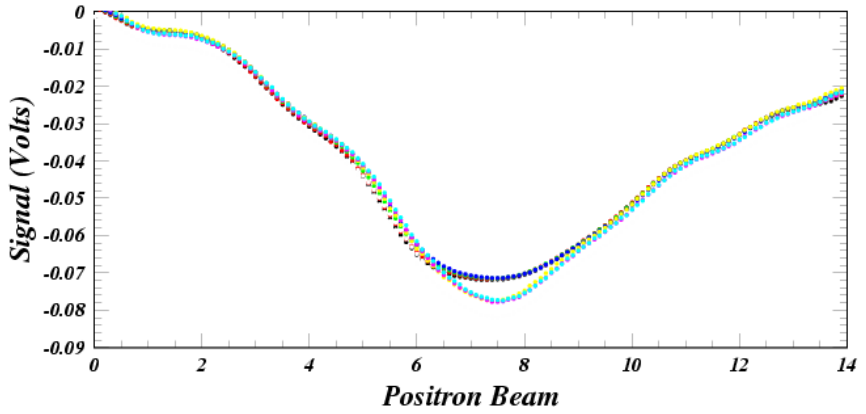
If this is what we need, the power law alone will not work.

Present Status:
Reasonable agreement and realistic cloud model







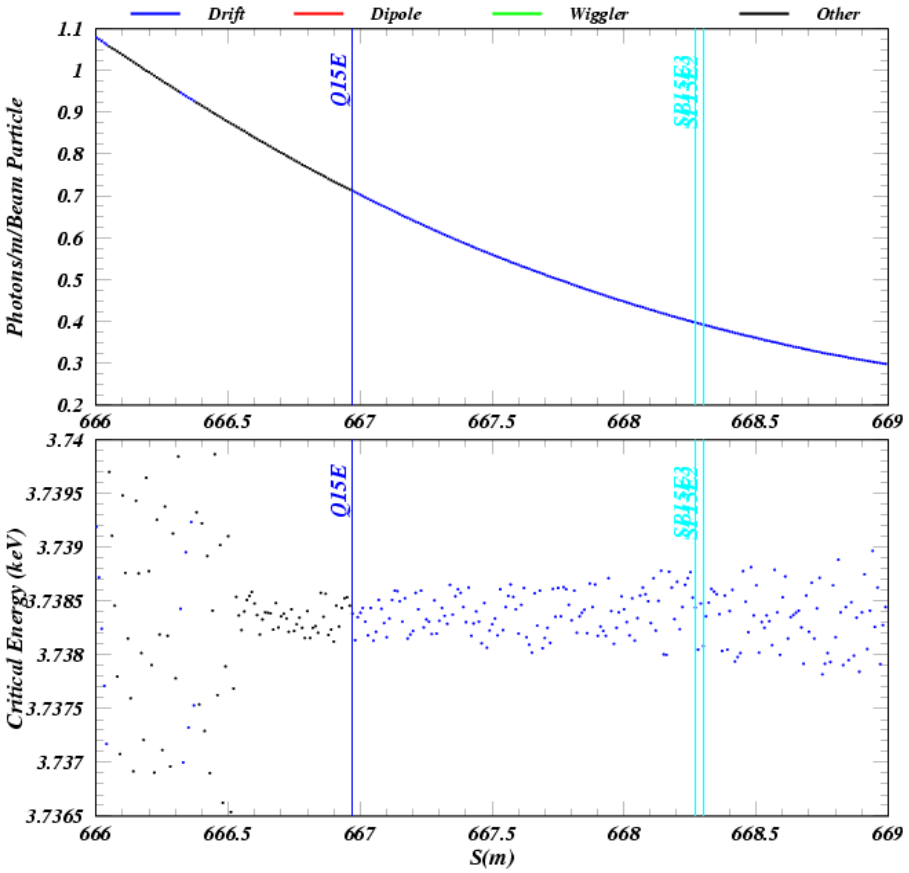


The prompt signal for the electrons will be smeared and delayed by the not-yet-modelled secondary yield in the v.c. port holes. The ratio of the e+ and e- signals depends on the photon rate and reflectivity. Here we use 1.0 photon/m/s for both, and reflectivity values of 20% (e+) and 100% (e-).

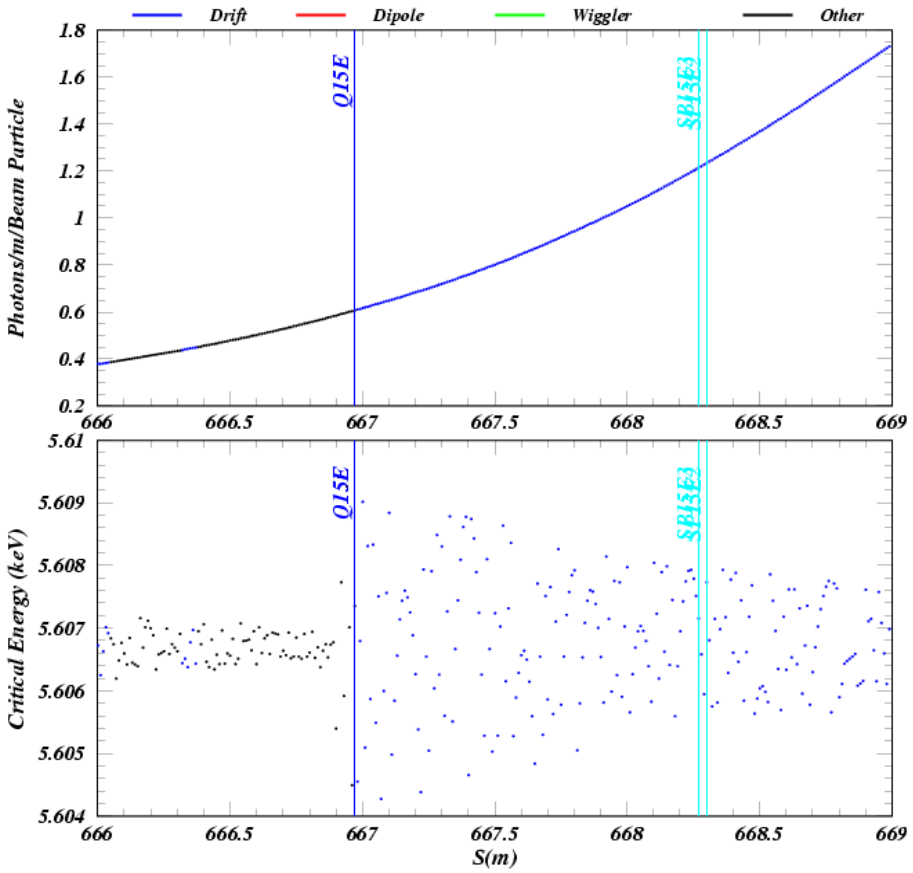
Work on the signal shape for positrons is ongoing. We have a parametrization that works well, but need to reconcile it with the electron beam data. In general, the contribution to the positron signal is from low-energy photoelectrons which do not contribute to the electron signal.

Addendum 1
SYNRAD2D Photon Rates and Critical Energies at 15E

Positron Beam

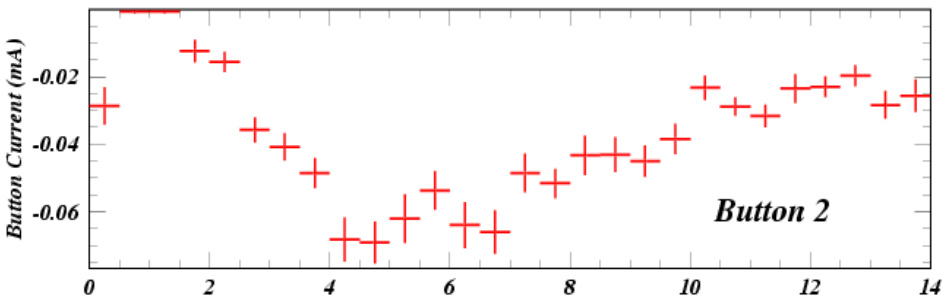


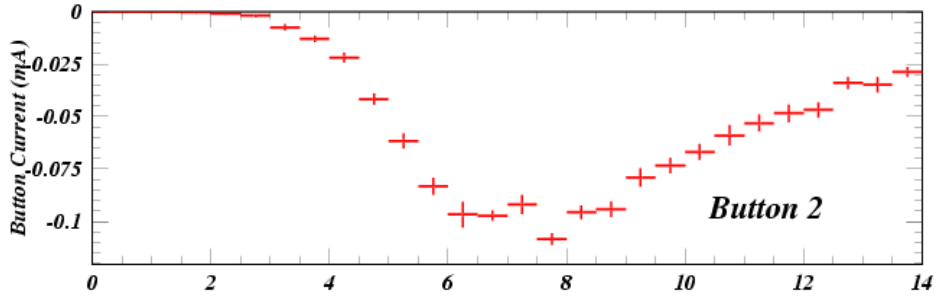
Electron Beam

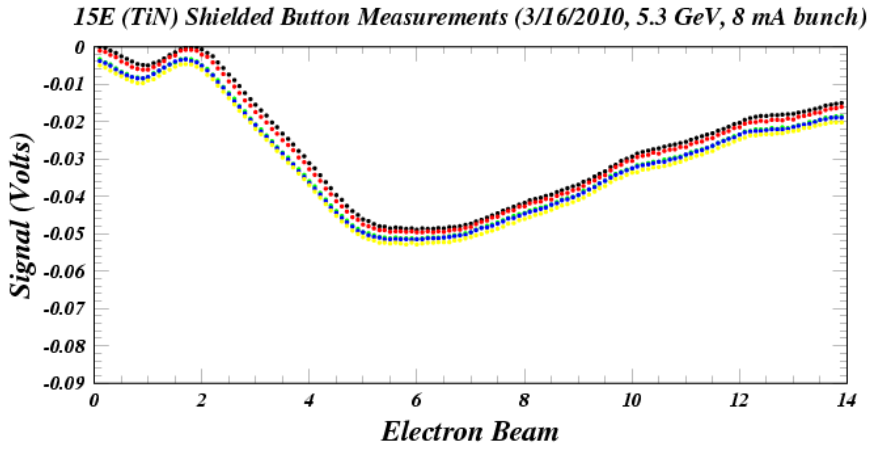


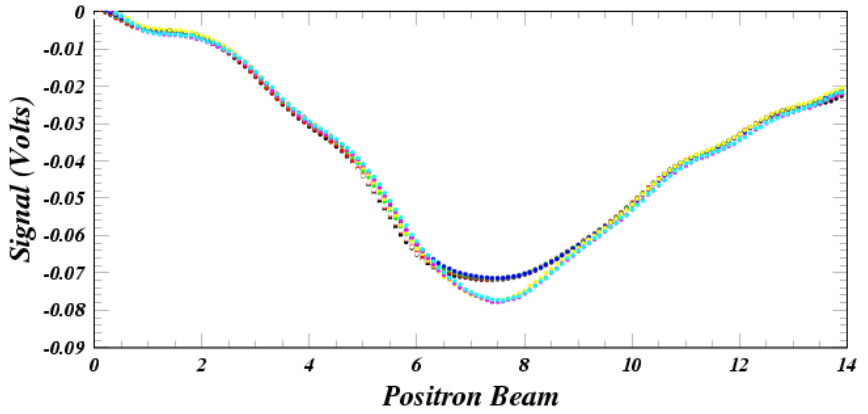
SYNRAD2D results showing the photon rates at the shielded button positions. The longitudinal positions of buttons 1 and 3 differ from button 2 by 3 cm. The radiation originates in the dipole B16E (B15E) with B-field 3.0 kG (2.0 kG) and resulting critical energy 3.7 keV (5.6 keV) for the e+ (e-) beam.

Addendum 2
Updated ECLOUD simulation





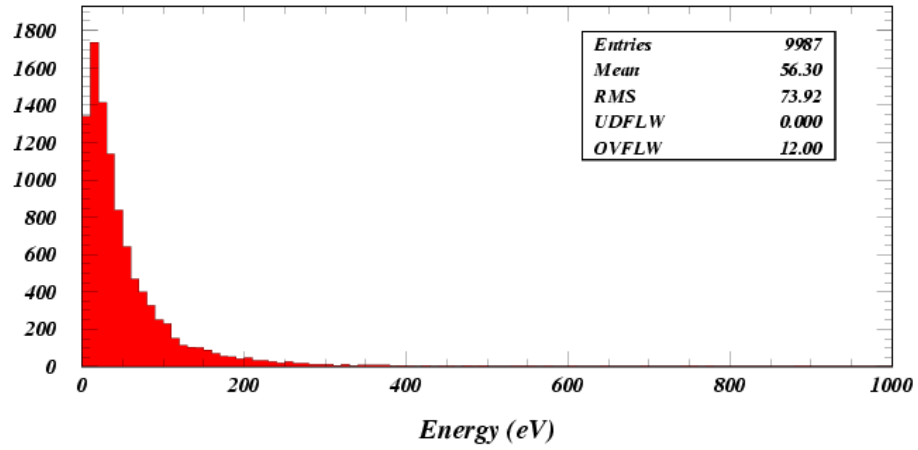




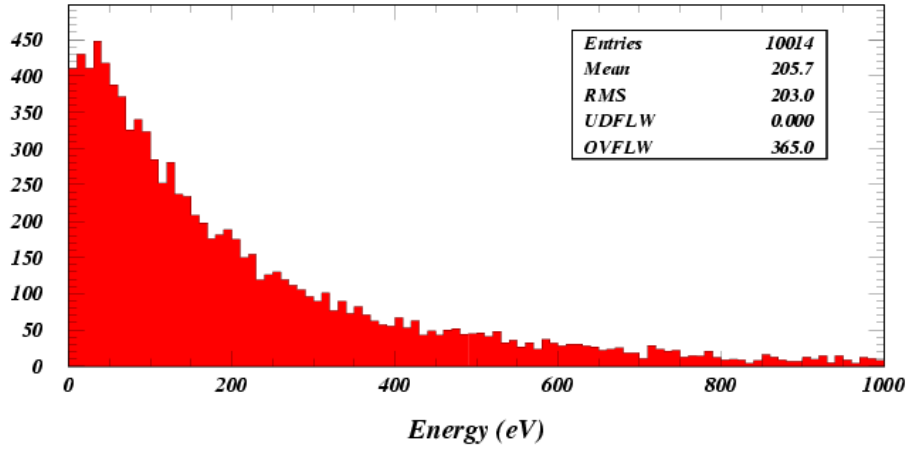
After correcting the photon rates, values for the reflectivity of 20% and 33% for the e+ and e- beams respectively provide a good emulation of the observed shielded button signals.
The parameterizations of the photoelectron energy distributions have also been adapted to reproduce the signal shapes.

Addendum 3
ECLOUD Photoelectron Energy Distributions

Positron Beam



Electron Beam



These are the photoelectron distributions which reproduce the measured shielded button signal shapes. These include all generated photoelectrons, regardless of whether they contributed to the signal or not. The ratio of the average energies is 3.7 is much higher than the ratio of the SYNRAD2D critical energies (1.5). This may indicate that even higher photon energies are contributing to the signal for the electron beam, as predicted by SYNRAD3D