Cornell University
Laboratory for Elementary-Particle Physics

First Look at Modeling Photoelectron Energy Distribution for a 2.1 GeV Positron Beam Using Shielded Pickup Data and Introduction of a Lorentzian Option in ECLOUD

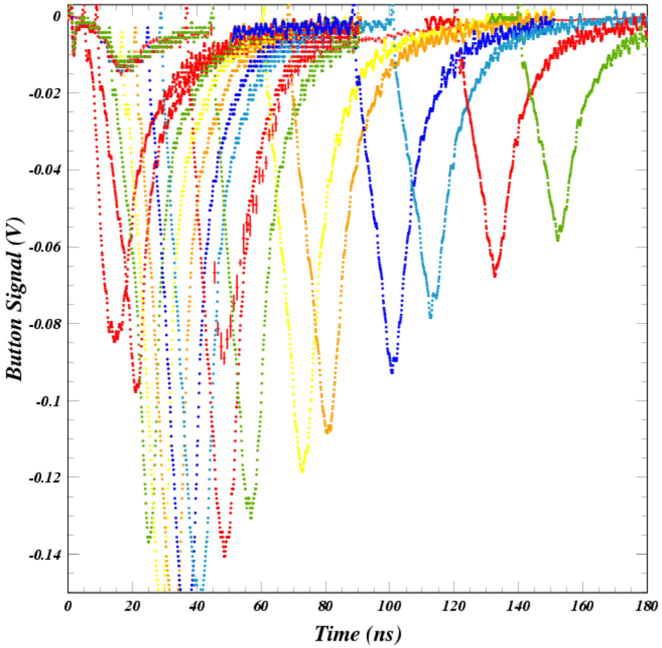
All material for this talk may be obtained at www.lepp.cornell.edu/~critten/cesrta/ecloud/23feb11

See also previous talks on simulations for the shielded pickup data on 4/21, 4/28, 5/12, 7/7, 7/14, 8/4, 9/8, 9/22, 11/3, 11/24, 12/1/2010 and ECLOUD10

Prior modeling has been limited to 5.3 GeV beams. Much work has been done on parameterizing the photoelectron energy distribution. Scaling with the third power of the beam energy, the s.r. photon critical energy is reduced from about 5 keV to about 0.3 keV at 2.1 GeV.

Many other witness bunch studies are available, such as the 2.1 GeV positron 4-ns-spacing data of May 9 shown here.

-- 24 Feb 2011: Added comparison of the 2.1 GeV single-bunch signal shape to a simple Lorentzian in response to a question from Gerry. --



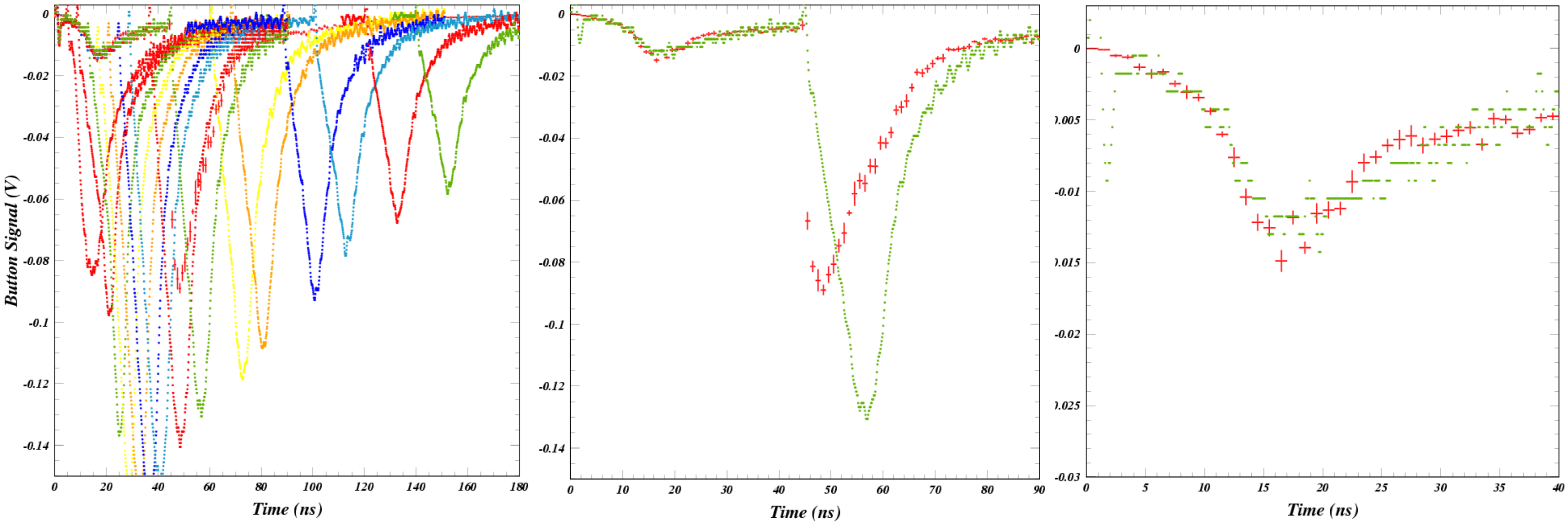
Jim Crittenden

Cornell Laboratory for Accelerator-Based Sciences and Education

Electron Cloud Meeting

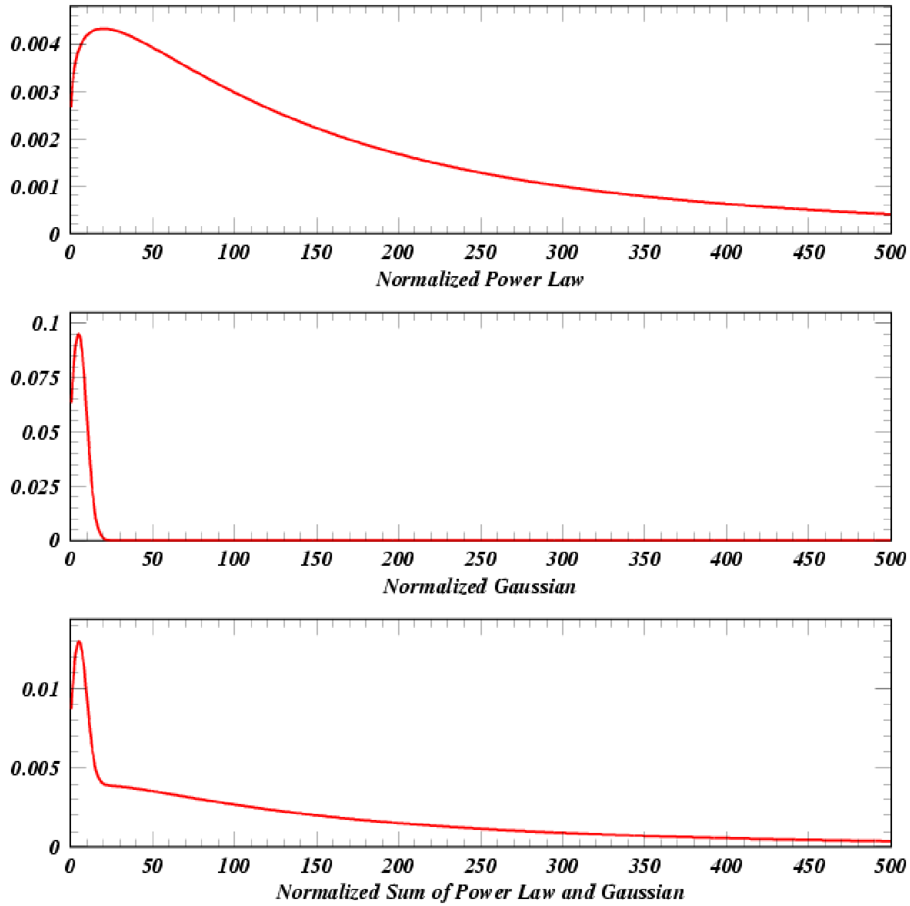
23 February 2011

Single Bunch Signal



The single bunch signal arises from photoelectrons produced on the bottom of the vacuum chamber. Its shape is closely related to the photoelectron energy distribution.

Hybrid Power-Law/Gaussian Distribution Implemented in ECLOUD (see talk on 14 July 2010)



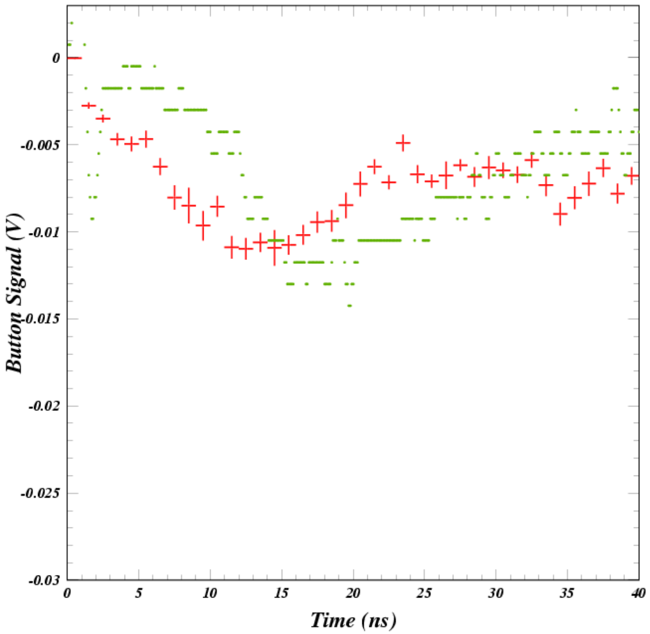
Power-law parametrization: $F(E) = E^{P1} / (1 + E/E_0)^{P2}$

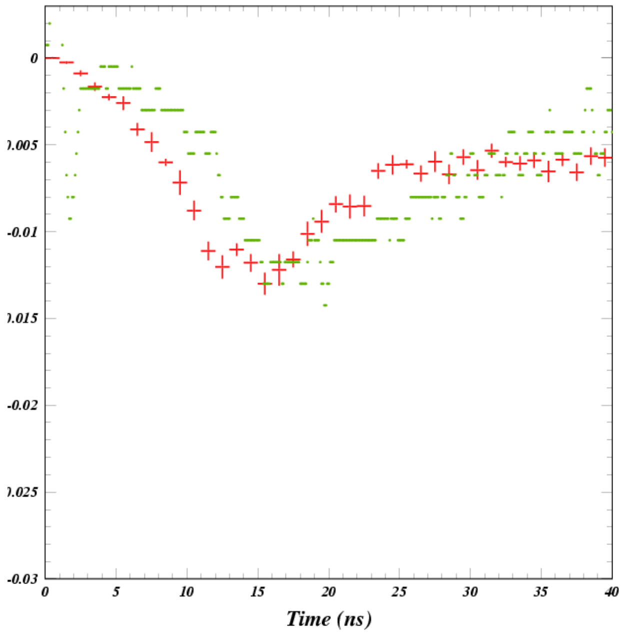
Example shown is for 10% Gaussian with peak and rms values of 5 eV.

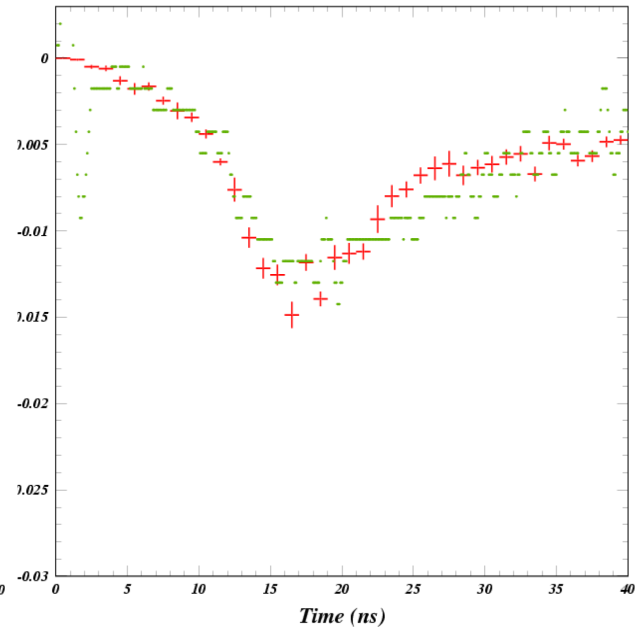
If this is what we need, the power law alone will not work.

Single Bunch Signal

5.3 GeV: Epk, P1,P2 = 4 eV 3.6 5.2	Epk, P1,P2 = 4 eV 3.6 5.6	50%: Epk, P1,P2 = 4 eV 3.6 5.6 50%: Gaussian with Epk, rms = 5 eV 5 eV



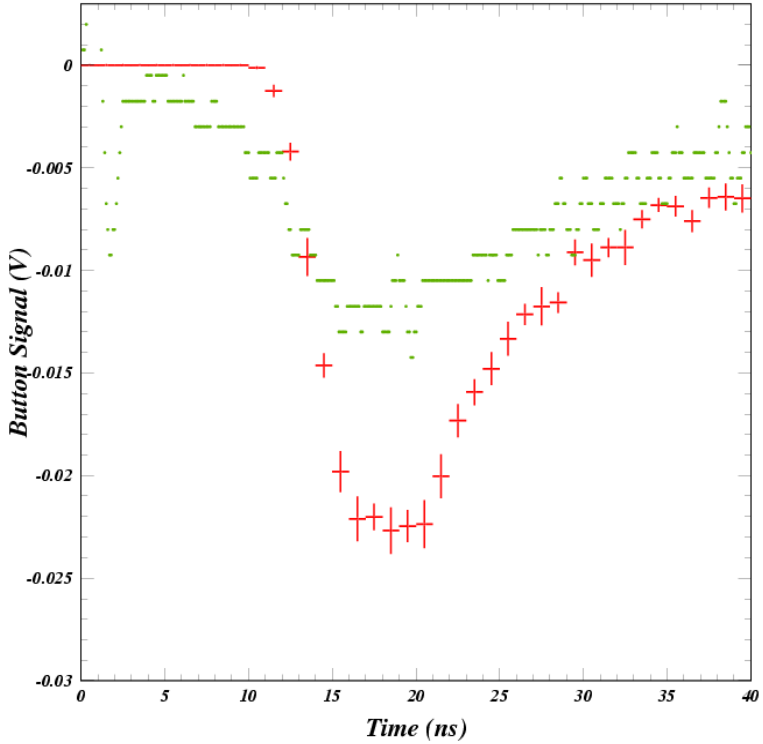




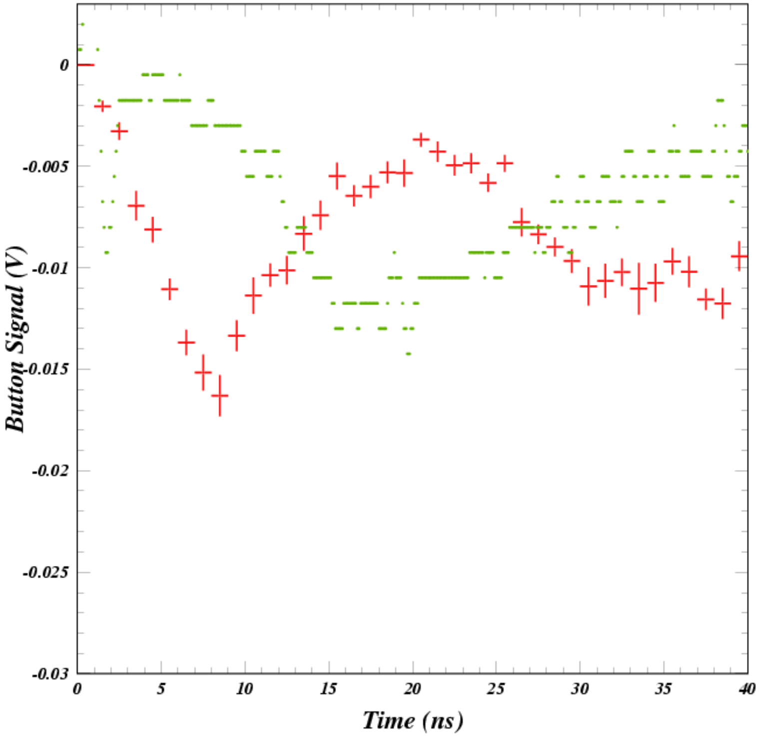
Examples of photoelectron energy distributions

Single Bunch Signal

Gaussian with Epk, rms = 5 eV 5 eV



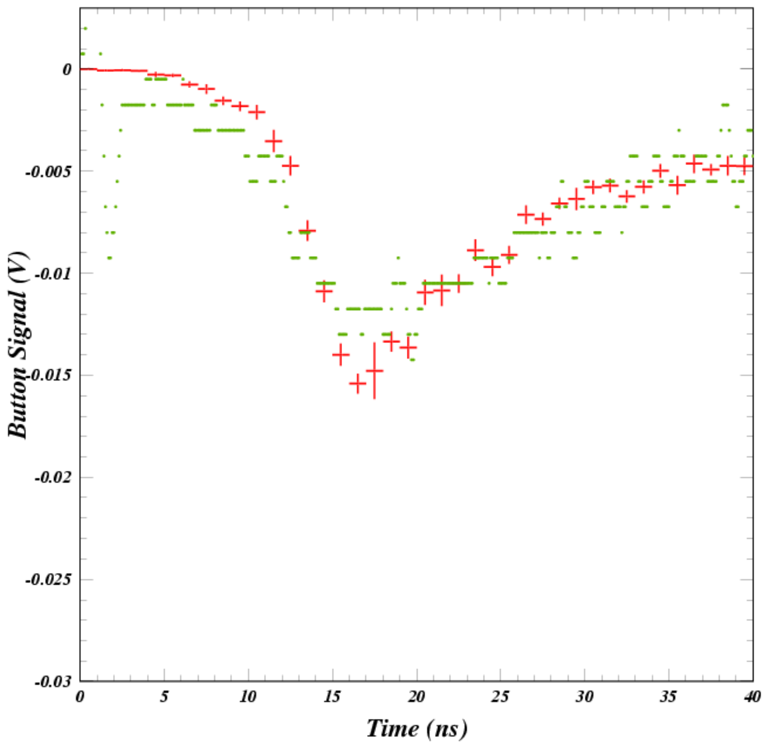
Lorentzian with Epk, width = 5 eV 150 eV



Other examples of photoelectron energy distributions

Gerry: Since the 2.1 GeV data match well to a power of the falling edge (P2-P1) =2.0, might a simple Lorentzian suffice?

Lorentzian with Epk, width = 5 eV 7 eV



YES.