Progress in ECLOUD Simulations for the 5.3 GeV e+ Witness Bunch Measurements with the Shielded Pickups

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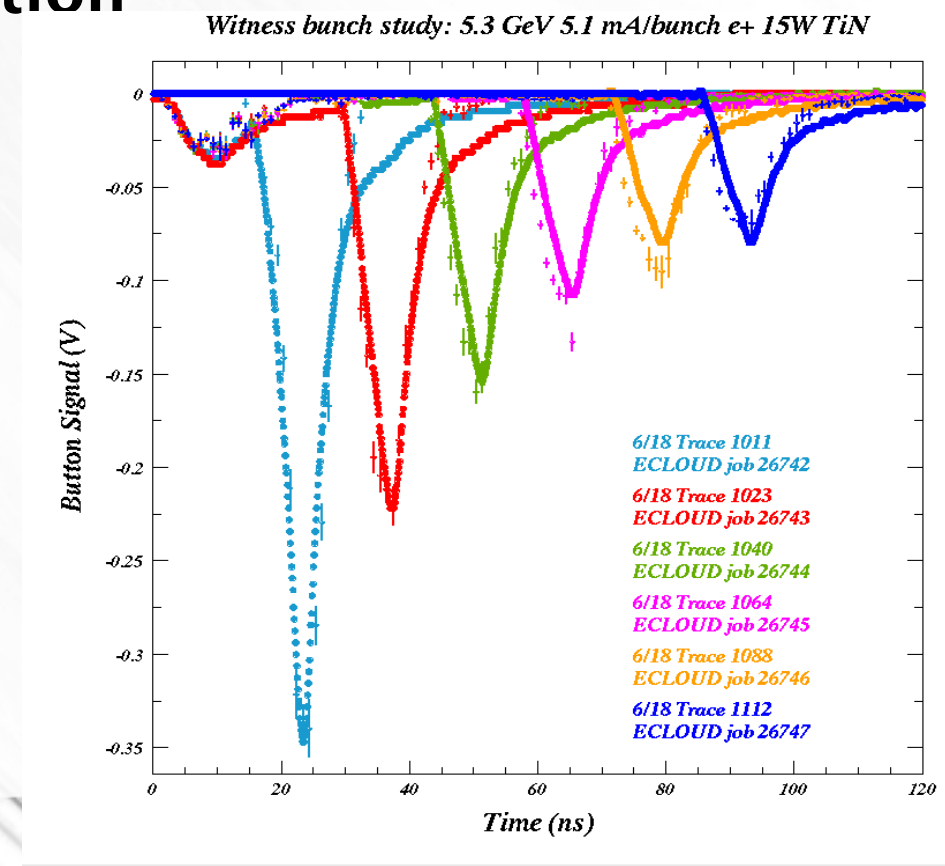
Improvements and End Result

-As mentioned by Jim Crittenden at the 7/13 meeting, the witness bunch simulations have been improved by independently adjusting quantum efficiencies and photoelectron energy distributions for direct and reflected photons, and tuning other input parameters such as the secondary energy distribution.

-The secondary energy distribution will be the focus of this talk, both the functional form and the input parameter SEMAX.

Present status of optimization



Intro to Changes in Secondary Energy Distribution

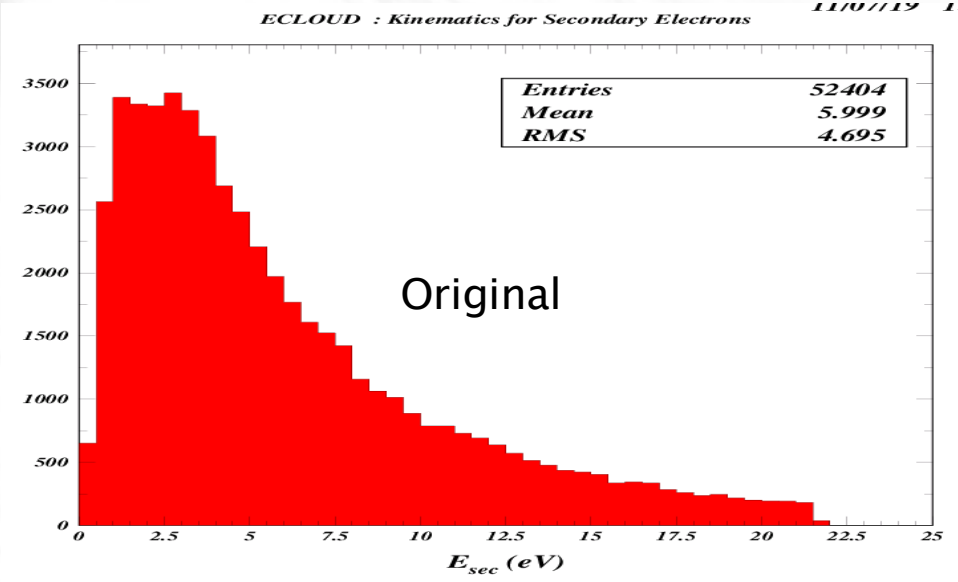
ECLOUD simulations up to now have used the distributions introduced by **Noel Hilleret** based on Phil.J.Res. 50 (1996), 375:

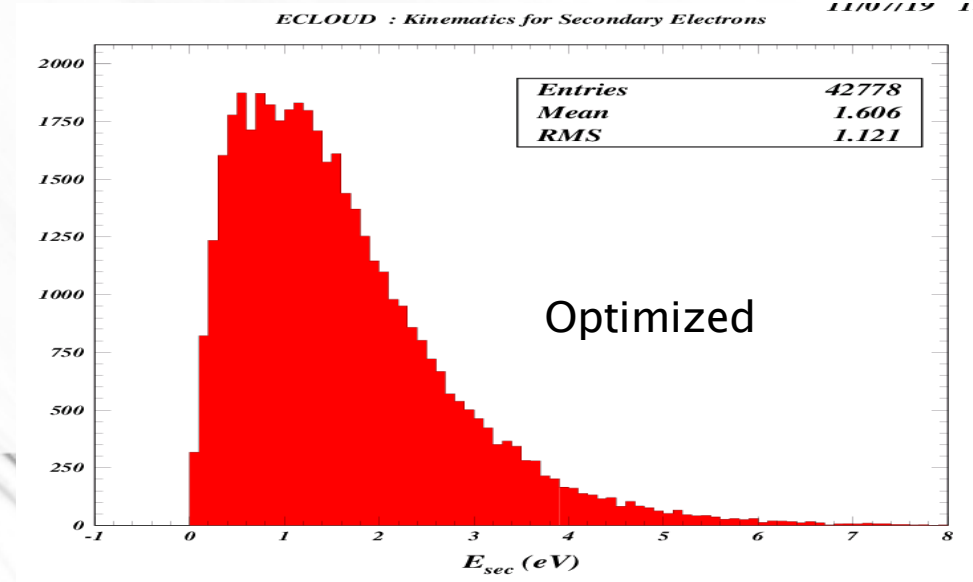
$f(E_{sec}) \sim \exp(-\ln(E_{sec}/SEMAX)^2/2)$, with SEMAX=1.8 eV

Use of a distribution attributed to **Miguel Furman** improved the comparison to data:

$f(E_{sec}) \sim E_{sec} \exp(-E_{sec}/SEMAX)$, with SEMAX=0.8 eV

As the next two slides will show, Noel's distribution has too many high energy e-, giving a broad late signal after the leading bunch which is not seen in the measurements.

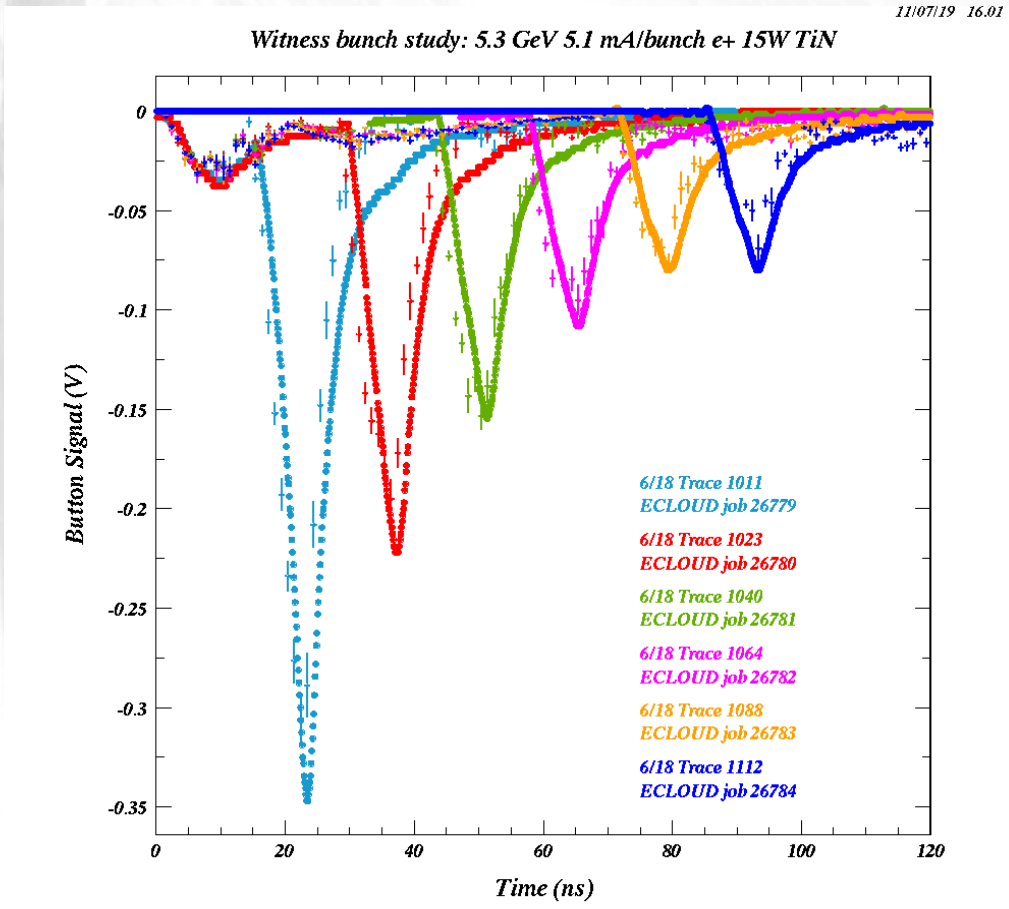




Original vs. Optimized

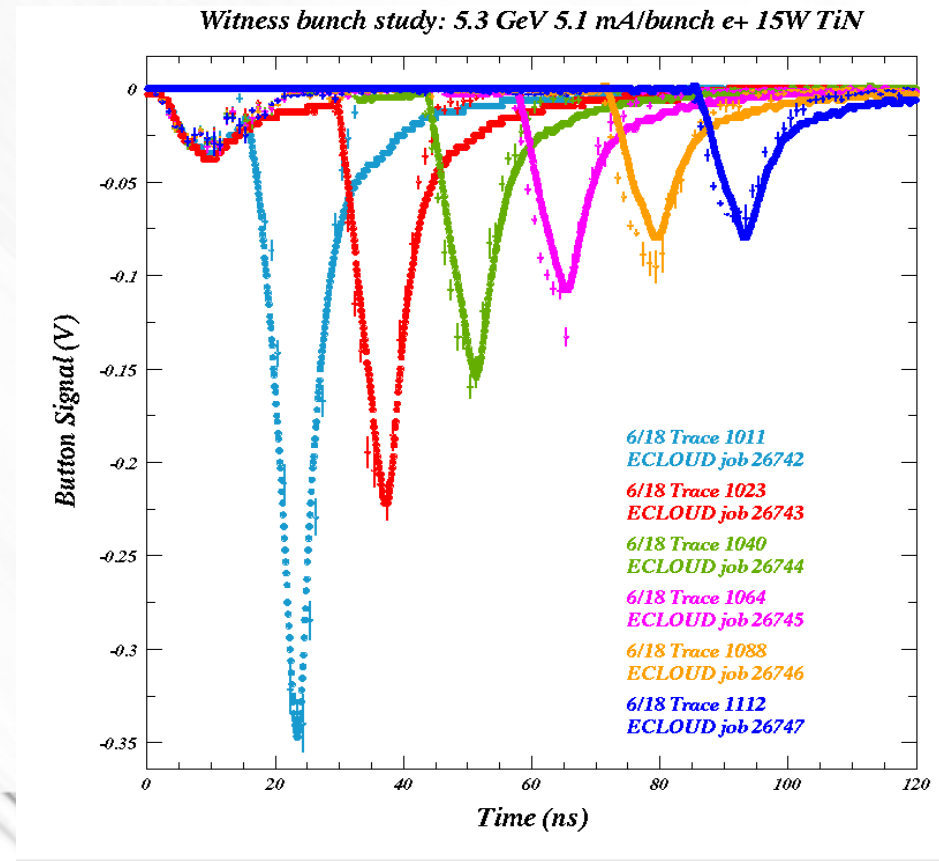
$f(E_{sec}) \sim \exp(-\ln(E_{sec}/SEMAX)^2/2)$

SEMAX=1.8 eV

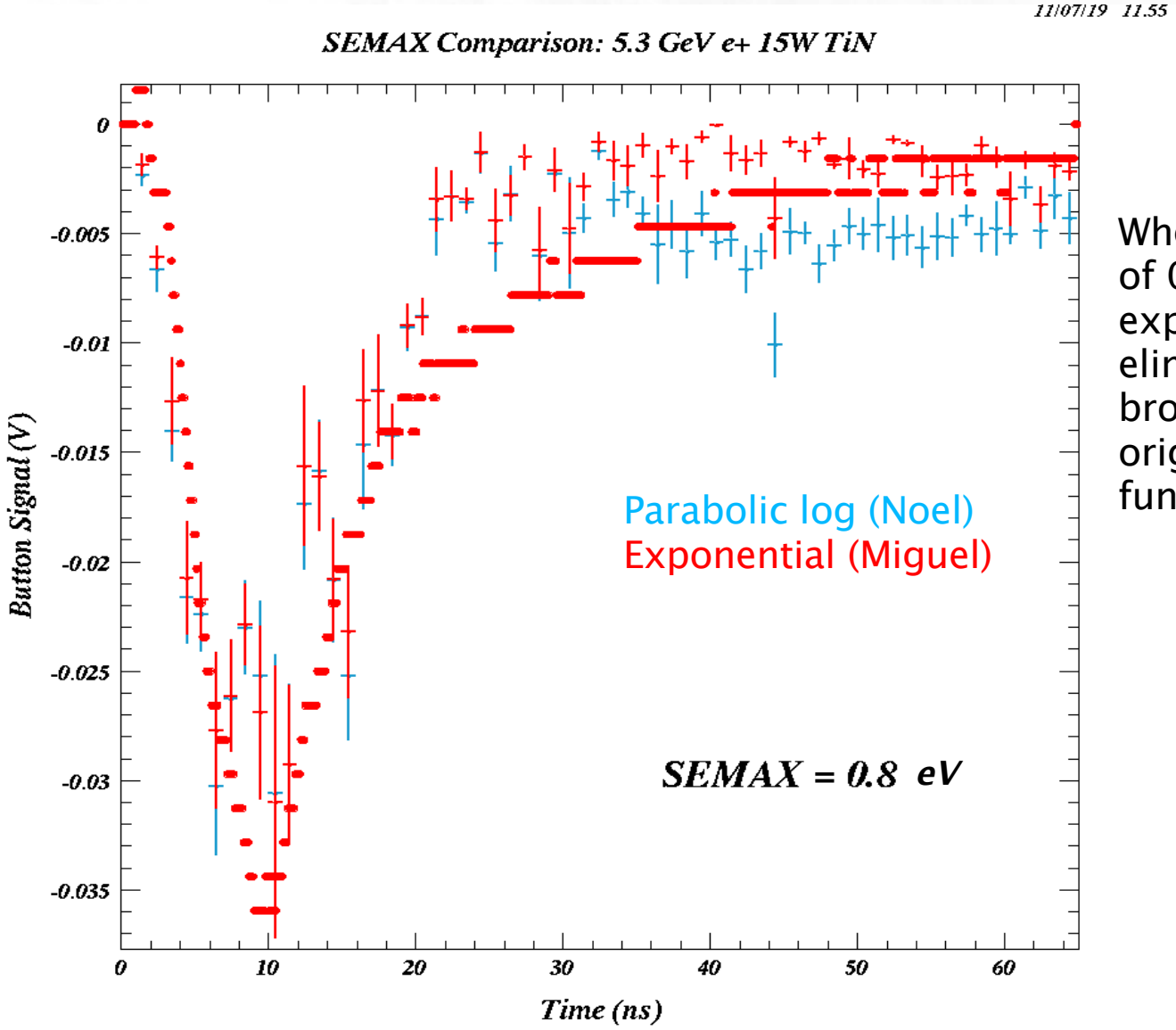


$f(E_{sec}) \sim E_{sec} \exp (-E_{sec}/SEMAX)$

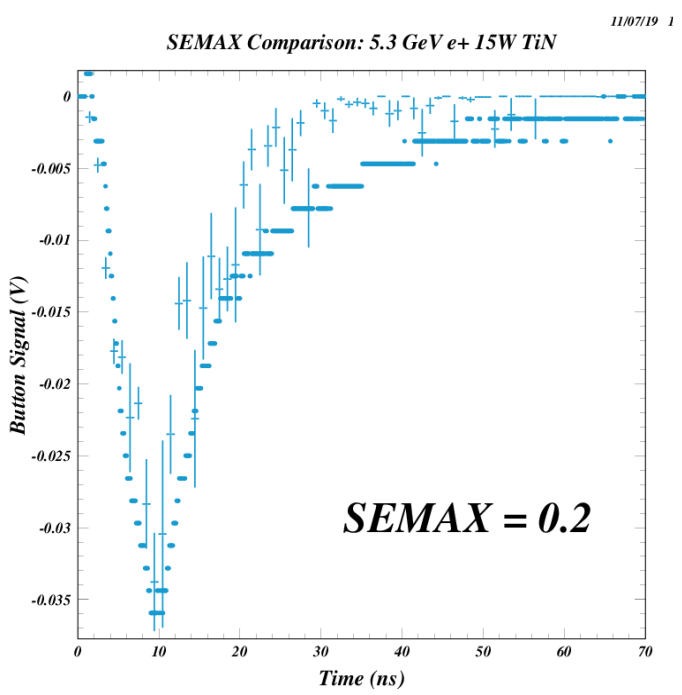
SEMAX=0.8 eV

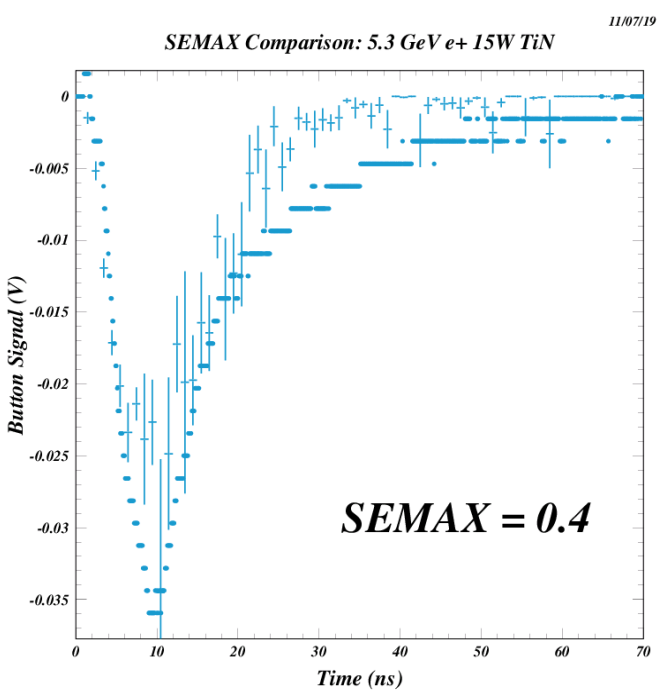


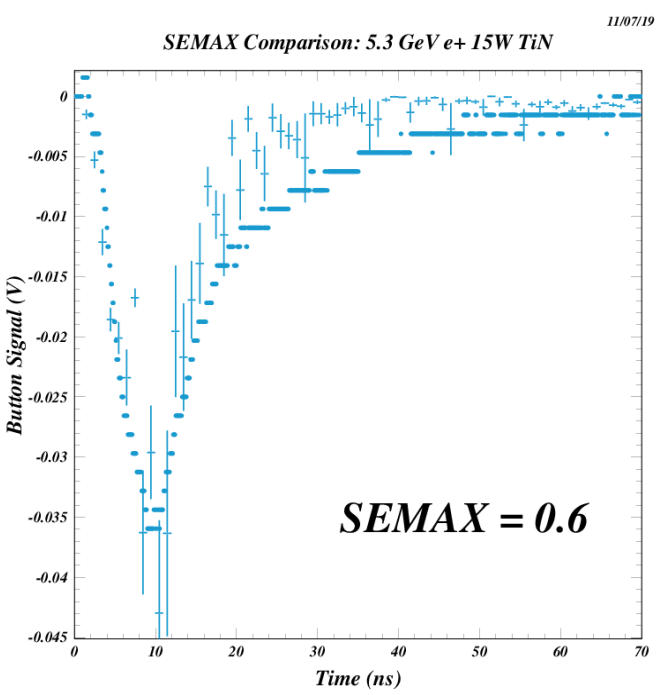
Why Miguel's Distribution is Used

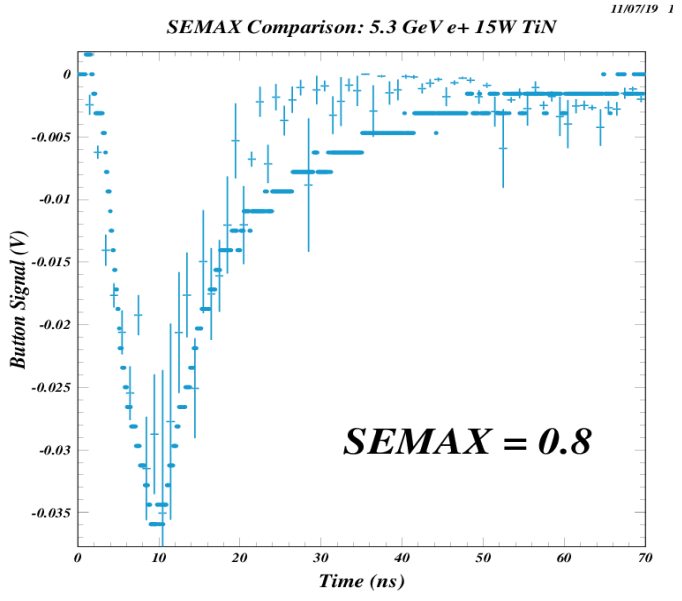


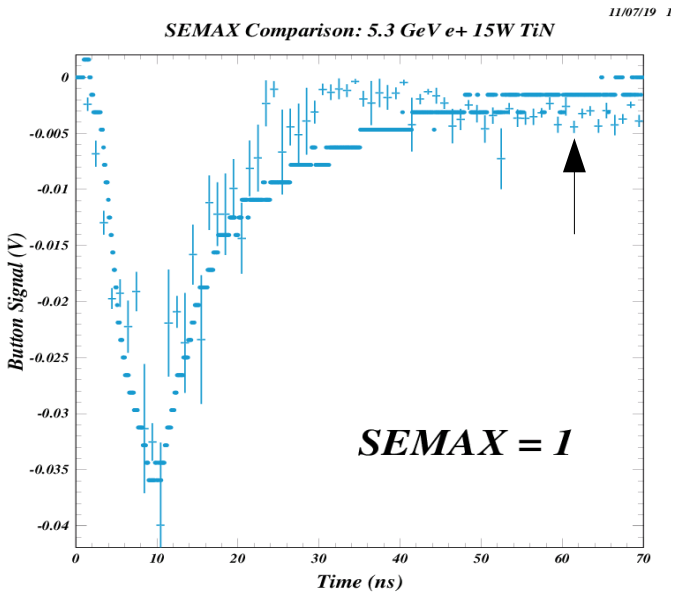
When the same optimal value of 0.8 eV is used for both, the exponential functional form eliminates the nonphysical late broad peak observed with the original ECLOUD parabolic log function.

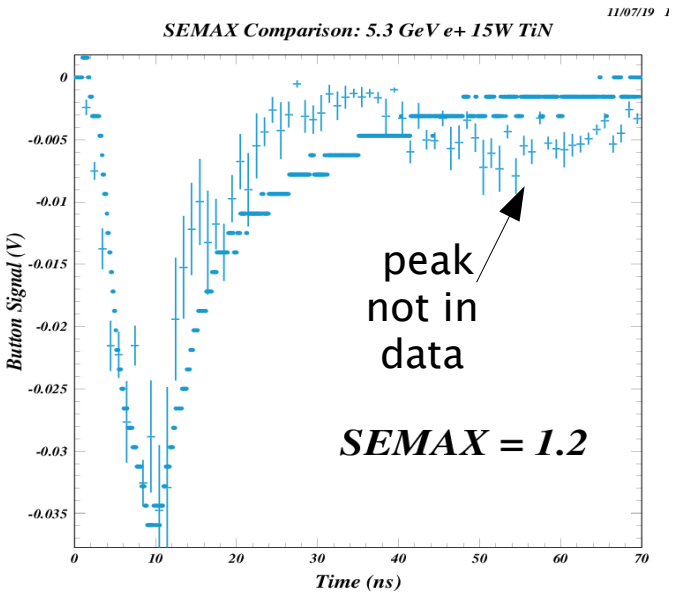








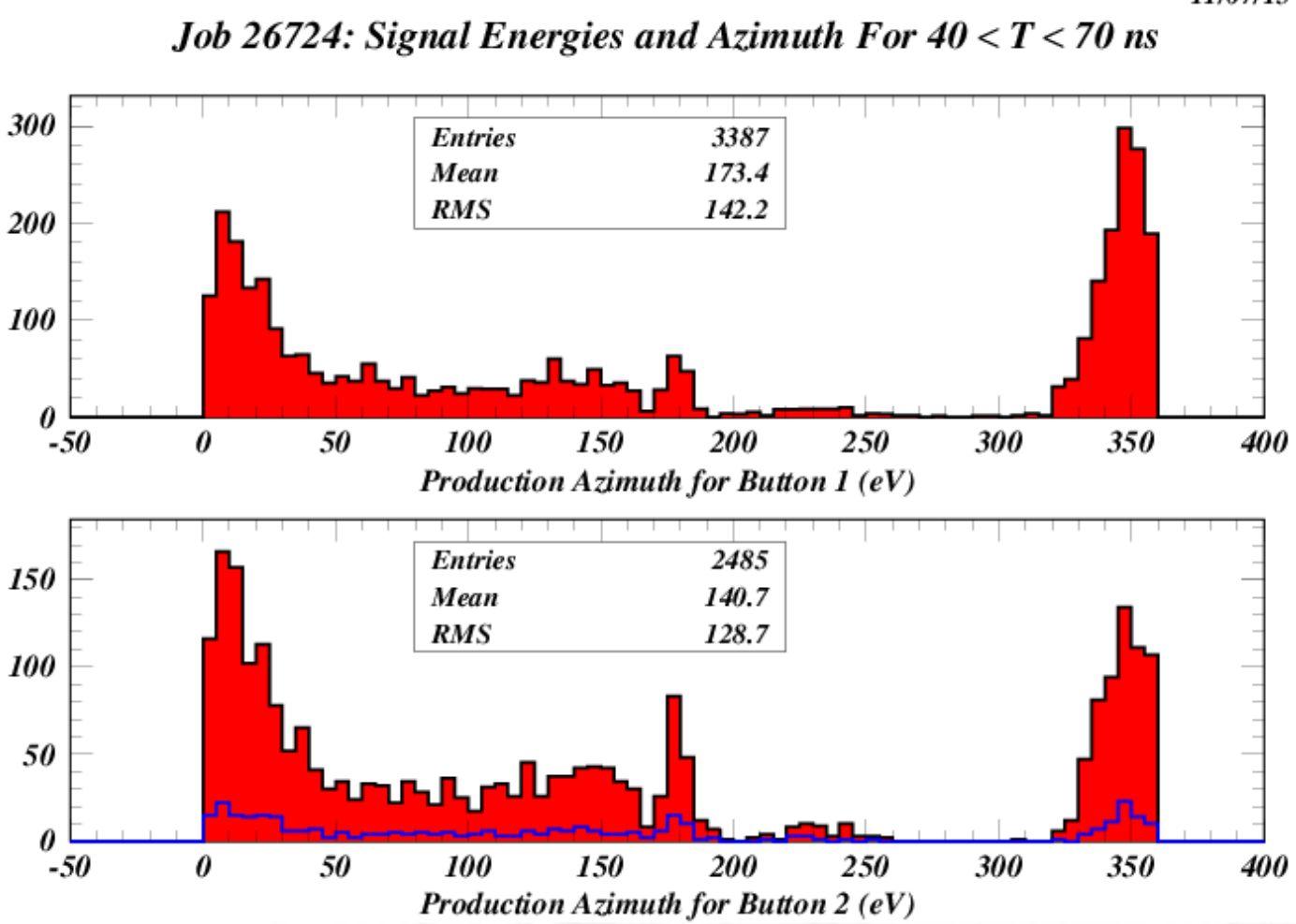




Sensitivity to SEMAX Parameter (Miguel's function)

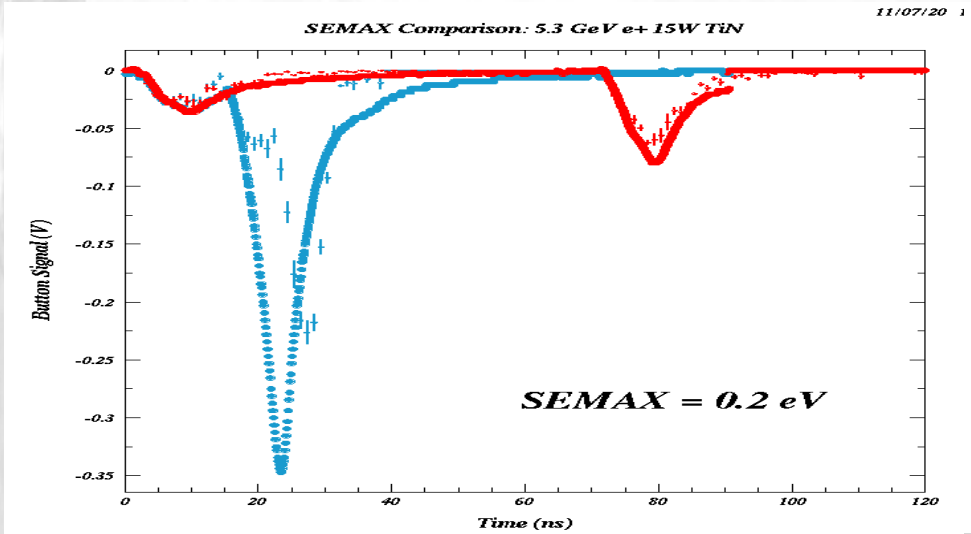
(Note the late simulation peak at SEMAX>0.8 eV that is not present in the data)

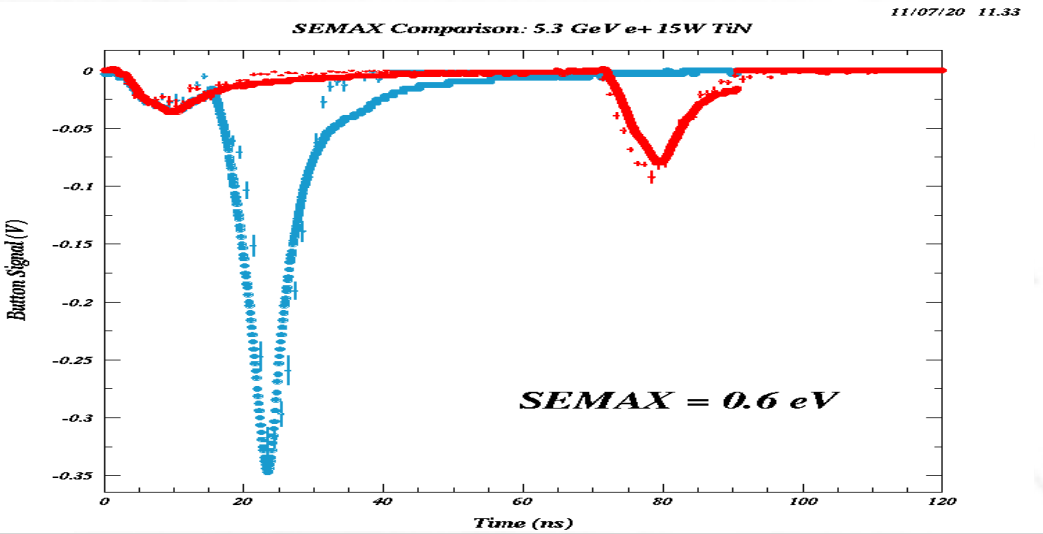
Where does late peak come from?

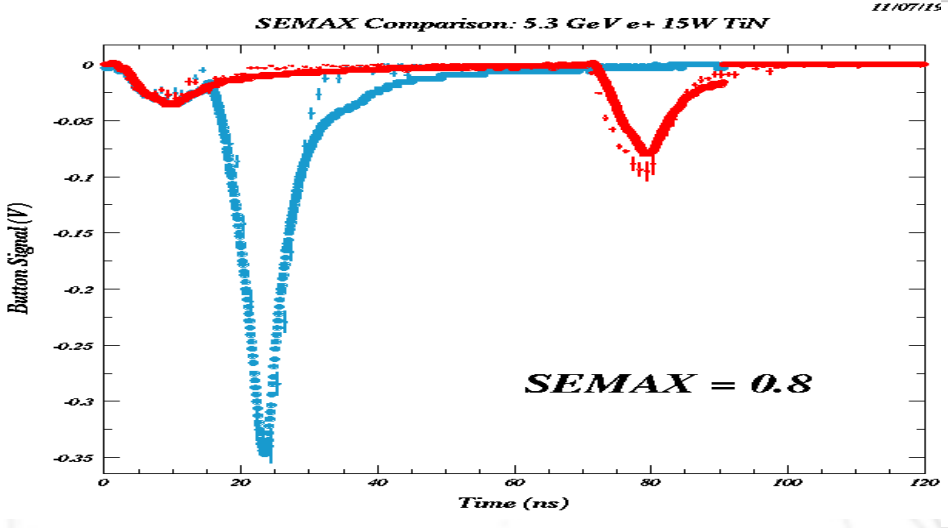


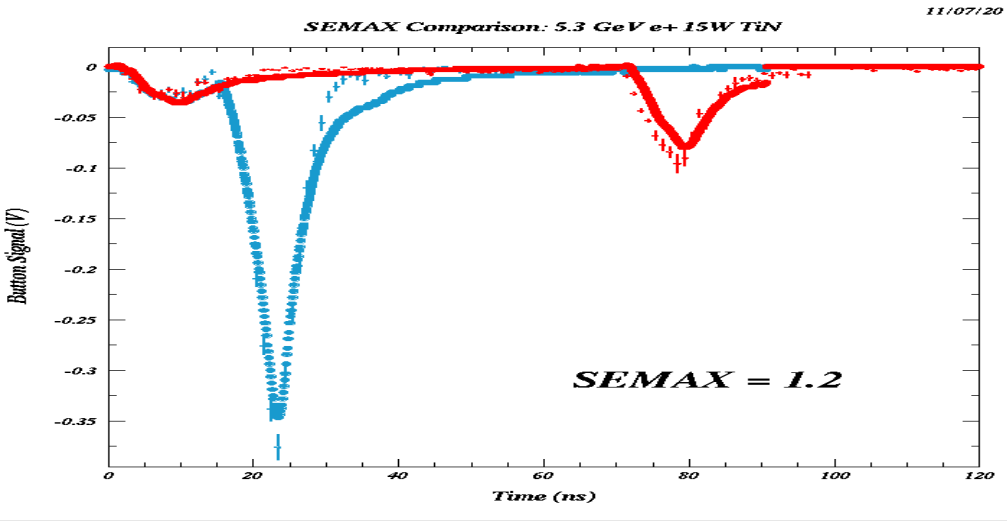
Photoelectrons from the top of the beam pipe and from direct photons produce secondaries that cause this signal.

Lower bound on SEMAX obtained from 14-ns witness bunch signal shape









Summary

1) 5.3 GeV simulations have made great progress in describing the SPU witness bunch data.

2) The best SEMAX value is around 0.8 eV. Above 1.0 eV an unphysical, late, broad peak appears in the simulation. Below 0.8 eV, the 14-ns witness bunch signal shape simulation is poor.

3) The sensitivity to SEMAX appears to be about 0.2 eV.

4) Miguel's exponential distribution gives a better match than the Phil.J.Res. parabolic log function.

5) Future work: Will the 2.1 GeV analysis corroborate this result for the 5.3 GeV data?