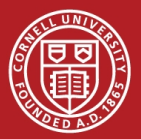


Cornell University
Laboratory for Elementary-Particle Physics

Shielded Button Measurement/ECLOUD Simulation Comparison for the Cloud Lifetime Study Using Witness Bunch Data

All material for this talk may be obtained at www.lepp.cornell.edu/~critten/cesrta/ecloud/22sep10

The measurements of 5/17/2010 are described here: https ://webdb.lepp.cornell.edu/elog/CTA+MS/629
See also previous talks on simulations for the shielded button data on 4/21, 4/28, 5/12, 7/7, 7/14, 8/4, 9/8/2010

Context

Having studied and improved the ECLOUD simulation for passage of a single bunch, we turn now to the trailing bunches, which accelerate the existing electron cloud into the shielded button detector. The signal is therefore more dependent on cloud spatial and energy distributions. In particular, the comparison with the ECLOUD simulation will now require a reasonably accurate secondary yield model.

A primary purpose of the shielded pickup project (time-resolved measurements) is to measure the cloud lifetime. This lifetime is sensitive to the secondary yield for low-energy cloud particles hitting the vacuum chamber wall.

This presentation shows the first results on the sensitivity to the parameter δ_0 using witness bunch data.

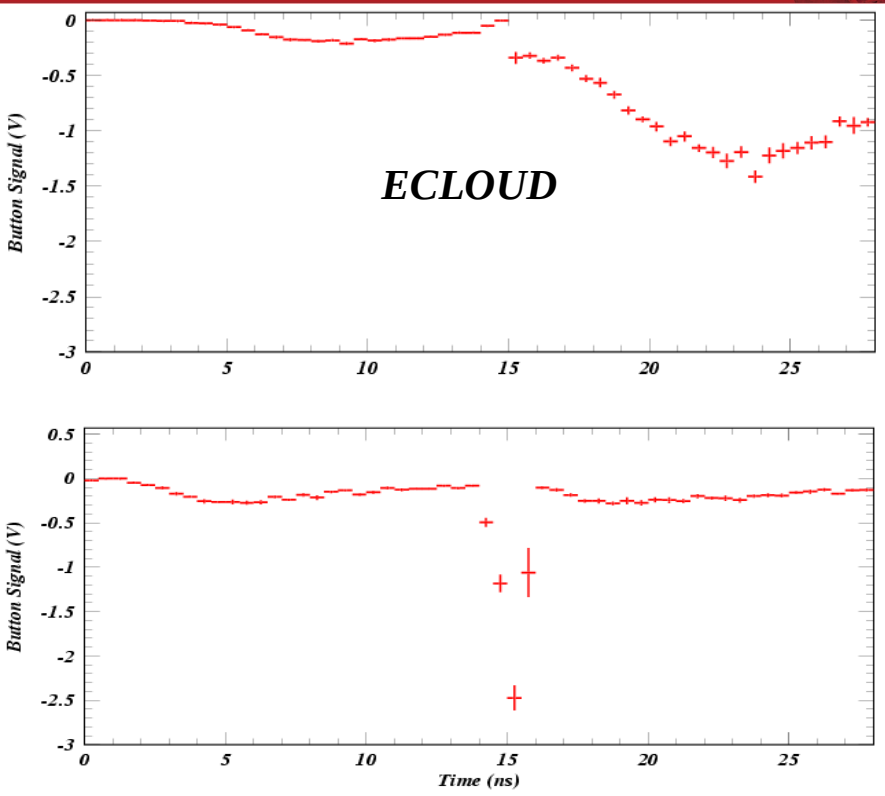
Jim Crittenden

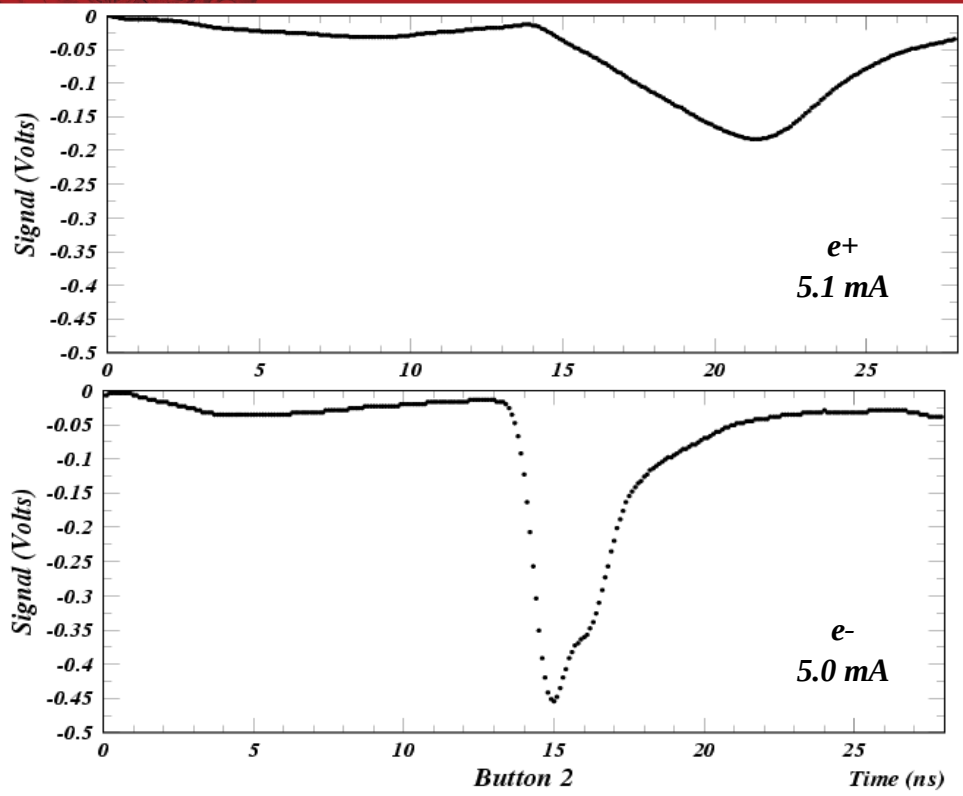
Cornell Laboratory for Accelerator-Based Sciences and Education

Electron Cloud Meeting

22 September 2010

ECLOUD simulation for the 3/27 e+/e- 5 mA/bunch data at 15E (TiN)

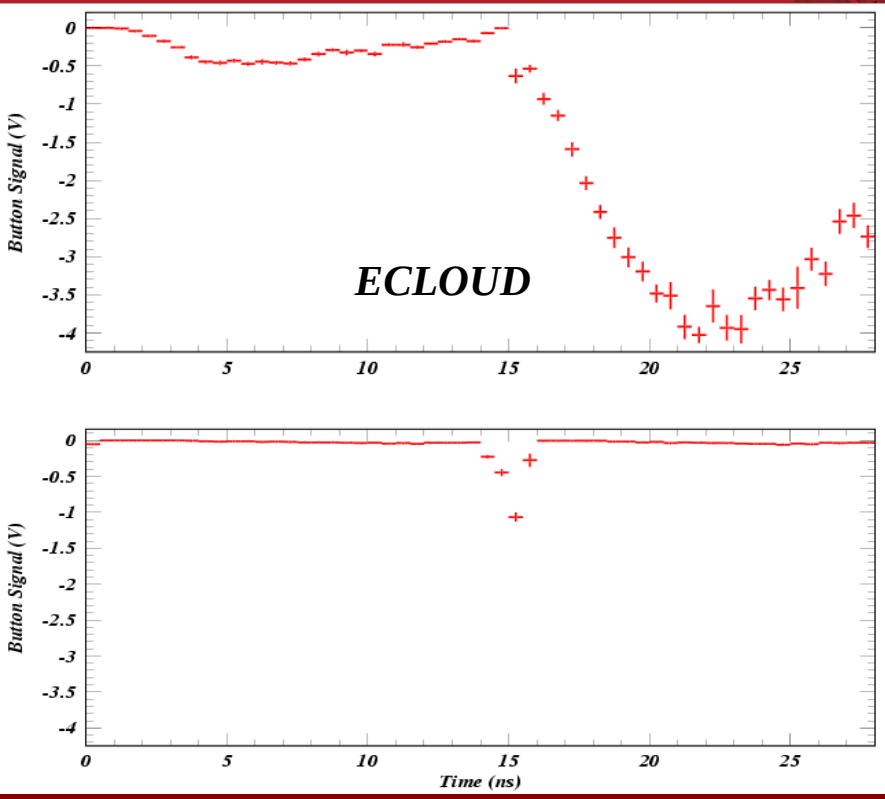


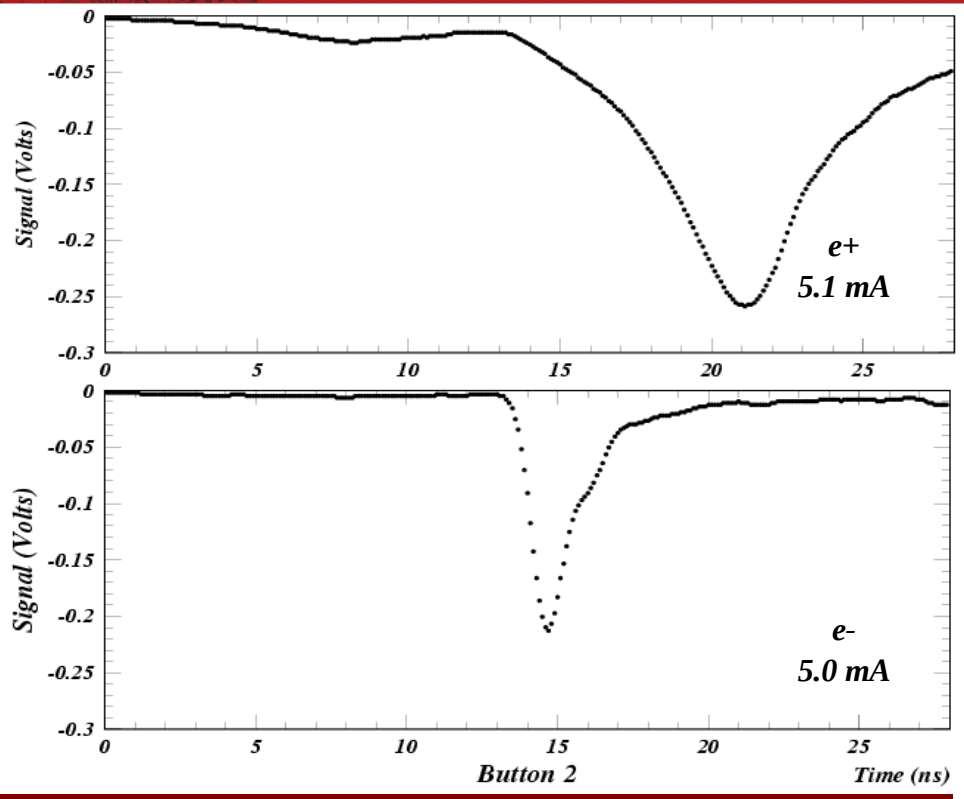


First look at the signal from the passage of the second bunch.

The comparison for the positron beam signal is encouraging, but the simulated signal from the second bunch persists too long.
The simulation for the electron beam shows too little signal and the signal is too narrow.
A preliminary study of the effect of transit time in the shielded button detector for the 50 V bias indicates that the shoulder can arise from such an effect, but the 2-5 ns tail cannot.
One possibility is that there are too few low-energy electrons in the cloud.
Further suggestions more than welcome!

ECLOUD simulation for the 3/27 e+/e- 5 mA/bunch data at 15W (Carbon)

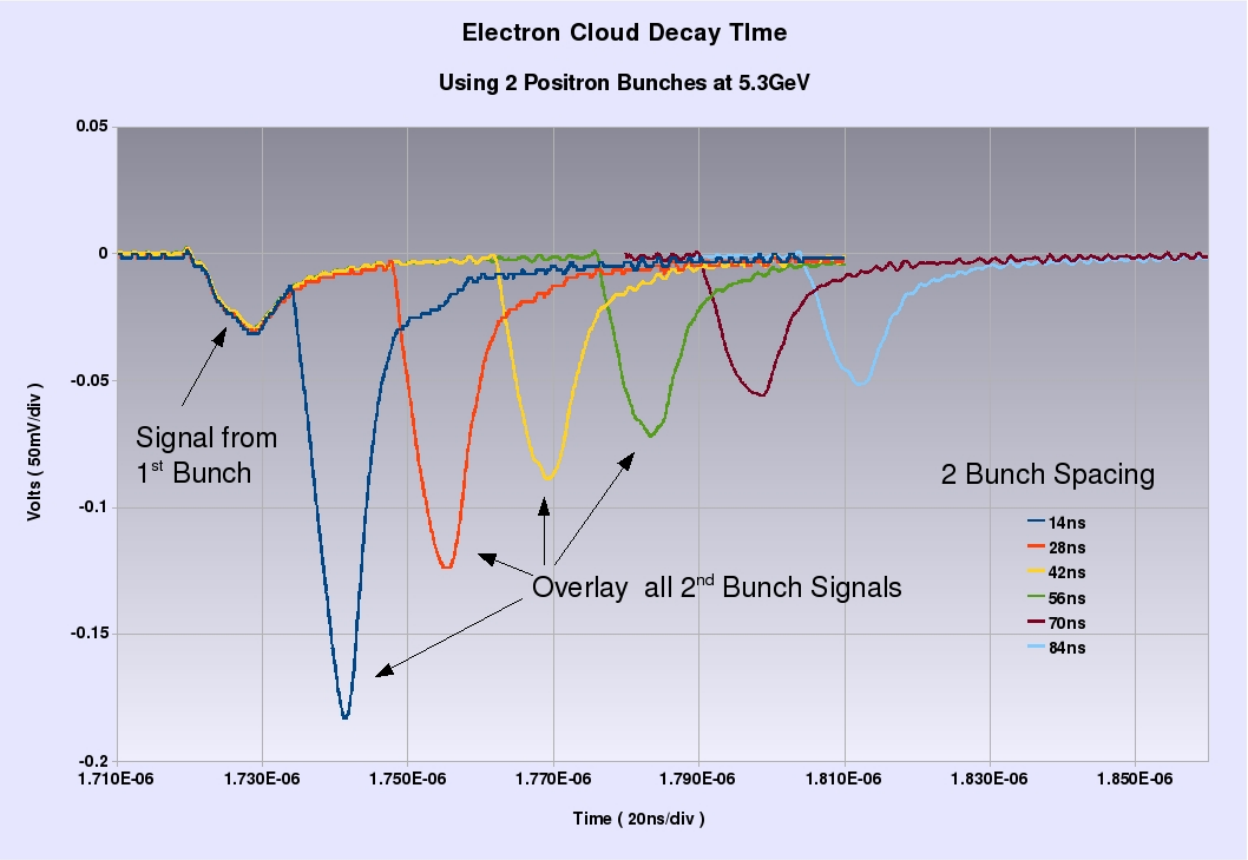




The signal for the positron beam is of similar magnitude to that at 15E. The simulated signal is too broad.

The signal for the electron beam in this carbon-coated vacuum chamber shows problems qualitatively similar to those observed in the TiN-coated chamber at 15E: too small and narrow.

John Sikora's cloud lifetime study on 3/27 using 5 mA/bunch e+ data at 15E (TiN)



https://cesrweb.lepp.cornell.edu/instr/data/shbut/2010/20100327_summary.html

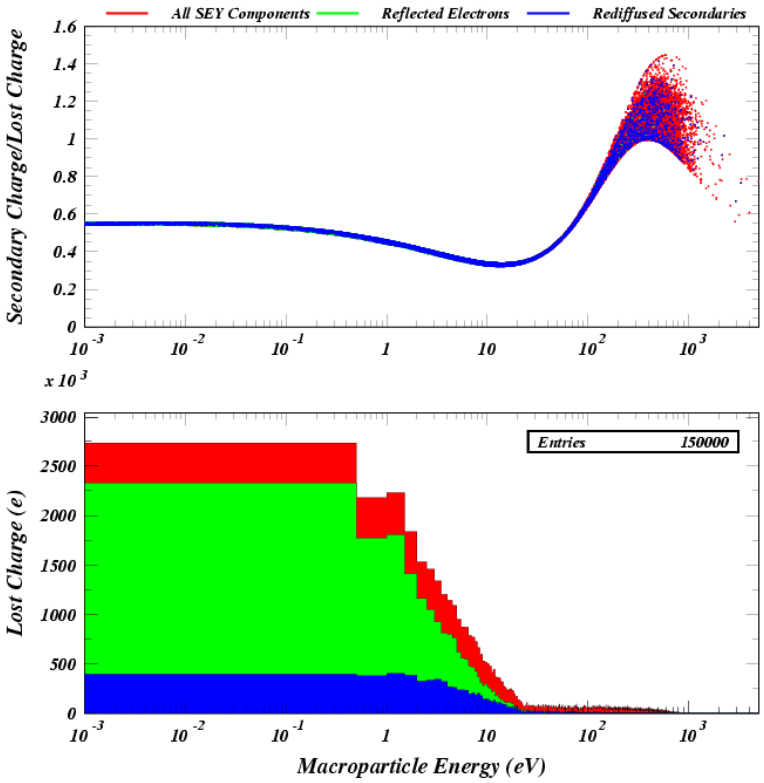
ECLOUD simulation for the cloud lifetime study using 5 mA/bunch e+ data at 15E (TiN)

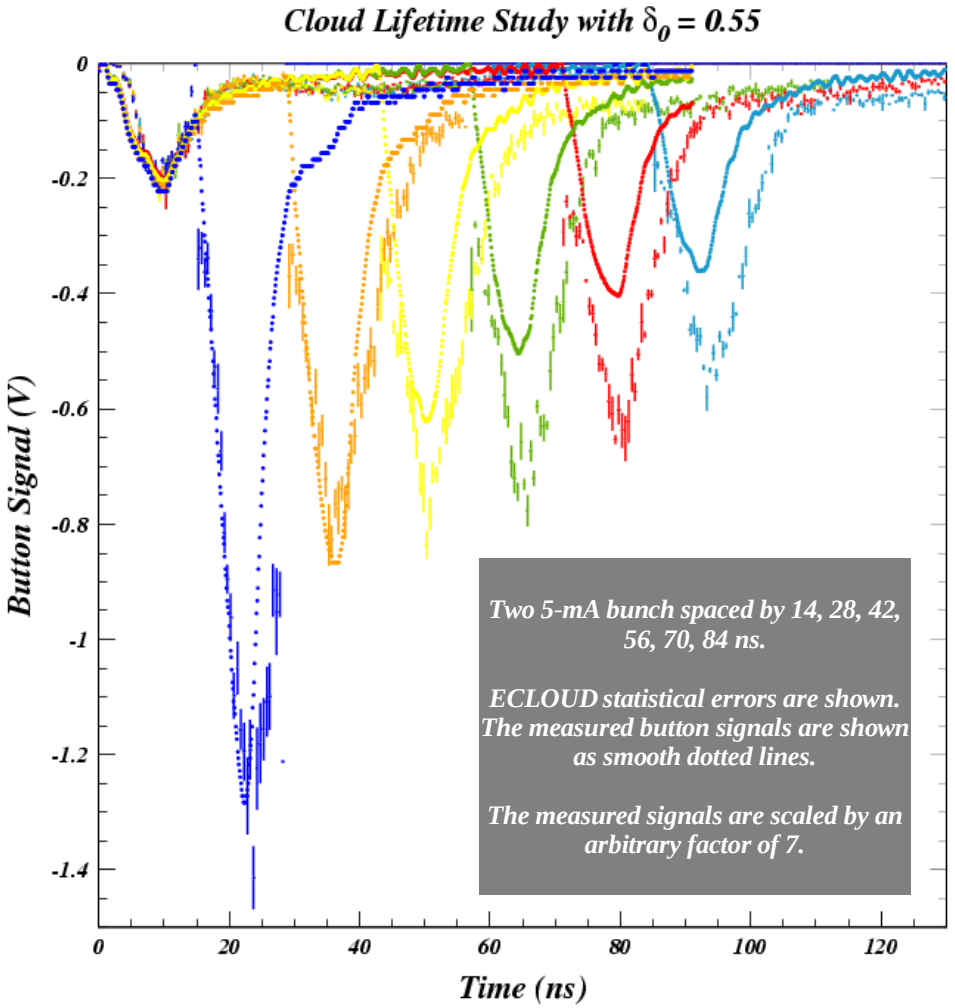
Secondary Yield Model

True secondary yield: 0.9
True secondary peak energy: 400 eV

Rediffused yield: 0.1

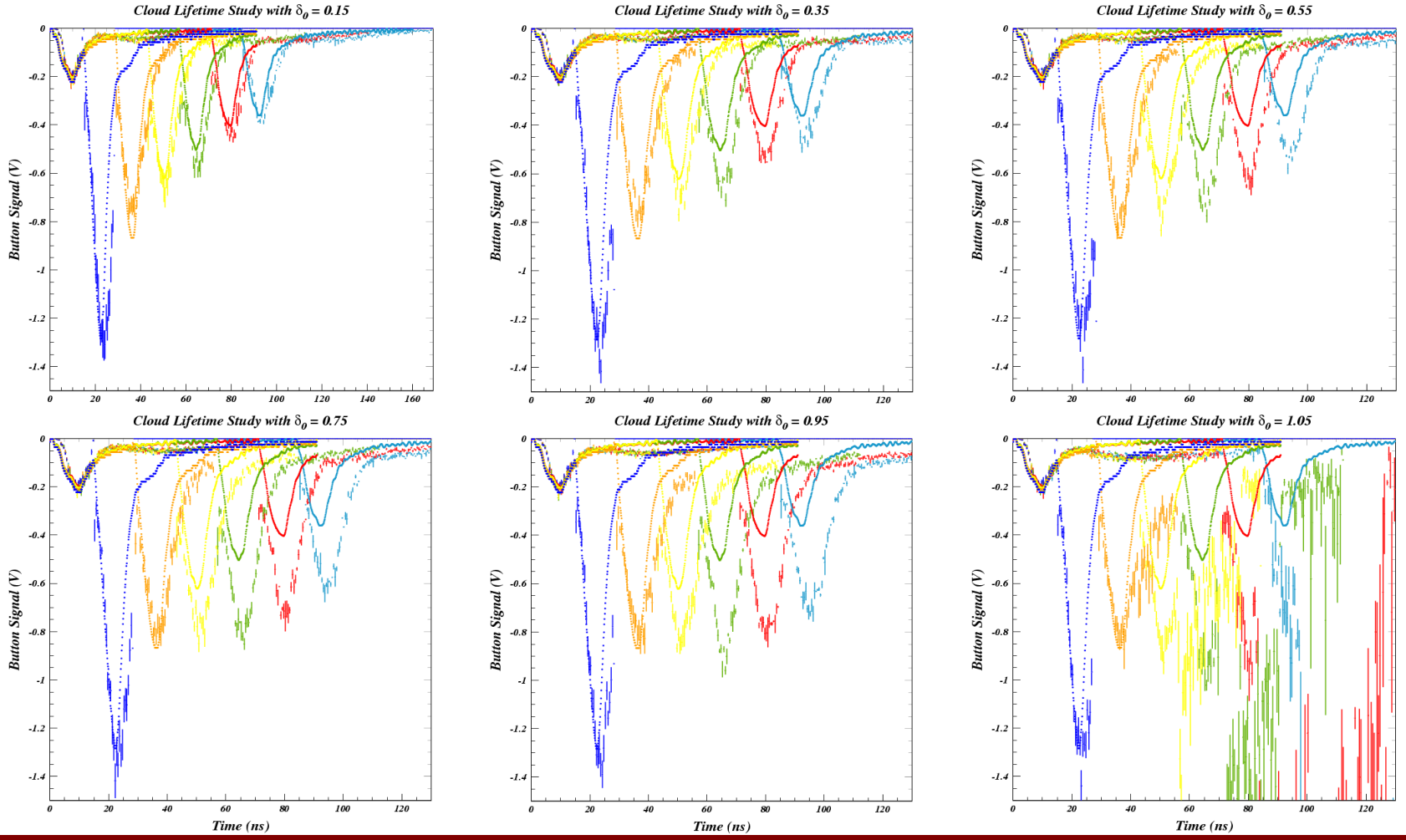
Elastic yield δ_0: 0.55





Simulated cloud lifetime too long: reduce elastic yield?

ECLOUD cloud lifetime sensitivity to elastic yield δ_0



The optimal value for δ_0 (0.15) is lower than has been generally assumed (0.5-0.7).

Note that not only the simulated peak signal value for witness bunch signals is better, but also the width.
Could such a low elastic yield be a characteristic of TiN coating?
Our tune shift simulations gave reasonable cloud decay times with a value of 0.5 for uncoated aluminum chambers.

Summary

Many mysteries remain, but this preliminary investigation of cloud lifetime and the sensitivity of the ECLOUD model to the elastic yield parameter indicates that it may be possible to determine the elastic yield to an accuracy 0.05 or less.

CesrTA experimental run 7 continues.
The vacuum chambers at present are carbon-coated at 15E and TiN-coated at 15W.
We have recorded a complete set of one- and two-bunch measurements with 1, 2, 4, 6, 8, 10 mA/bunch with 14 ns spacing at 5.3 GeV.
These will provide further information on photoelectron energy distributions and reflectivity.

Further witness bunch measurements are planned, as are measurements with solenoidal magnetic field.