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/1oct10

The measurements of 3/27/2010 are described here: https ://webdb.lepp.cornell.edu/elog/CTA+MS/551
The measurements of 5/17/2010 are described here: https ://webdb.lepp.cornell.edu/elog/CTA+MS/629
See also previous talks in the electron cloud meetings on simulations for the shielded button data on 4/21, 4/28, 5/12, 7/7, 7/14, 8/4, 9/2010

Context

A primary purpose of the shielded pickup project (time-resolved measurements vs RFA) 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.

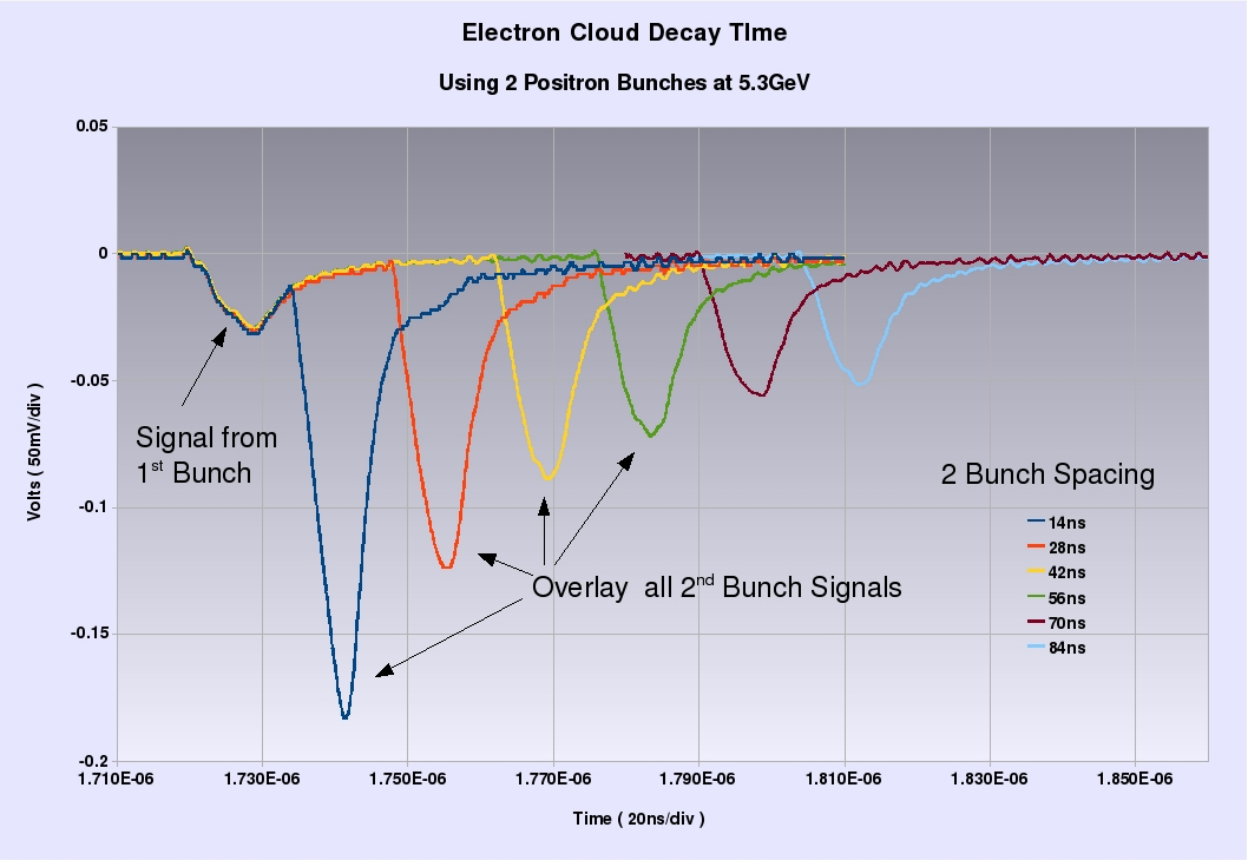
Jim Crittenden

Cornell Laboratory for Accelerator-Based Sciences and Education

CesrTA General Meeting

1 October 2010

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

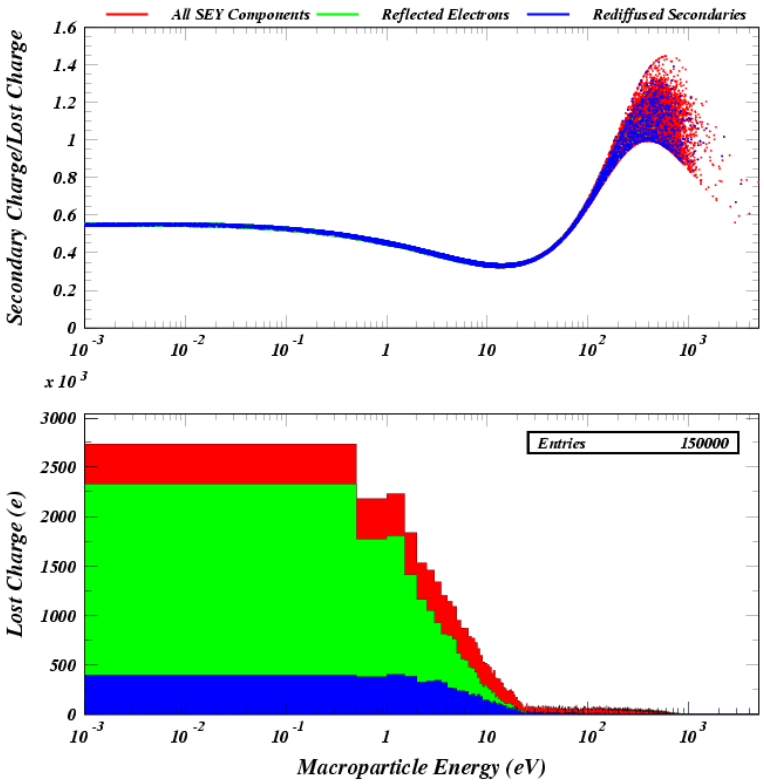
ECLOUD simulation for the cloud lifetime study using 5 mA/bunch e+ data at 15E (TiN)

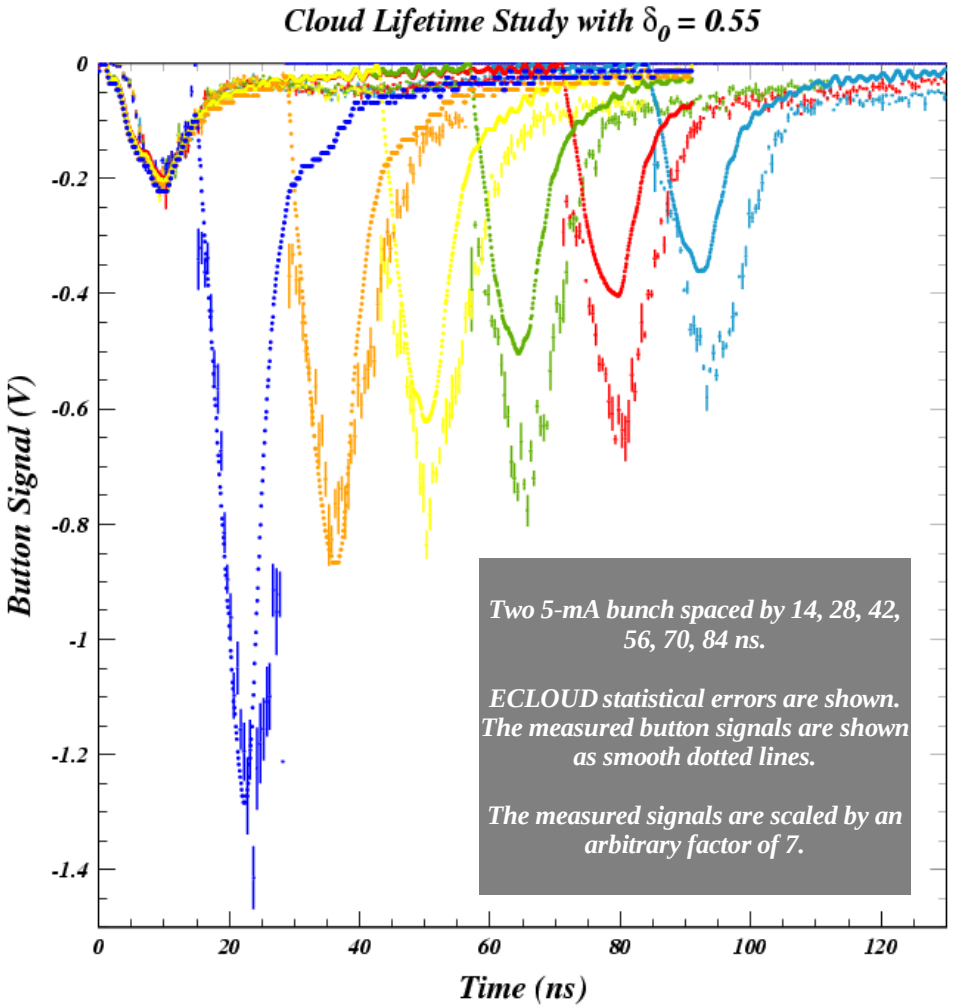
Secondary Yield Model

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

Rediffused yield: 0.1

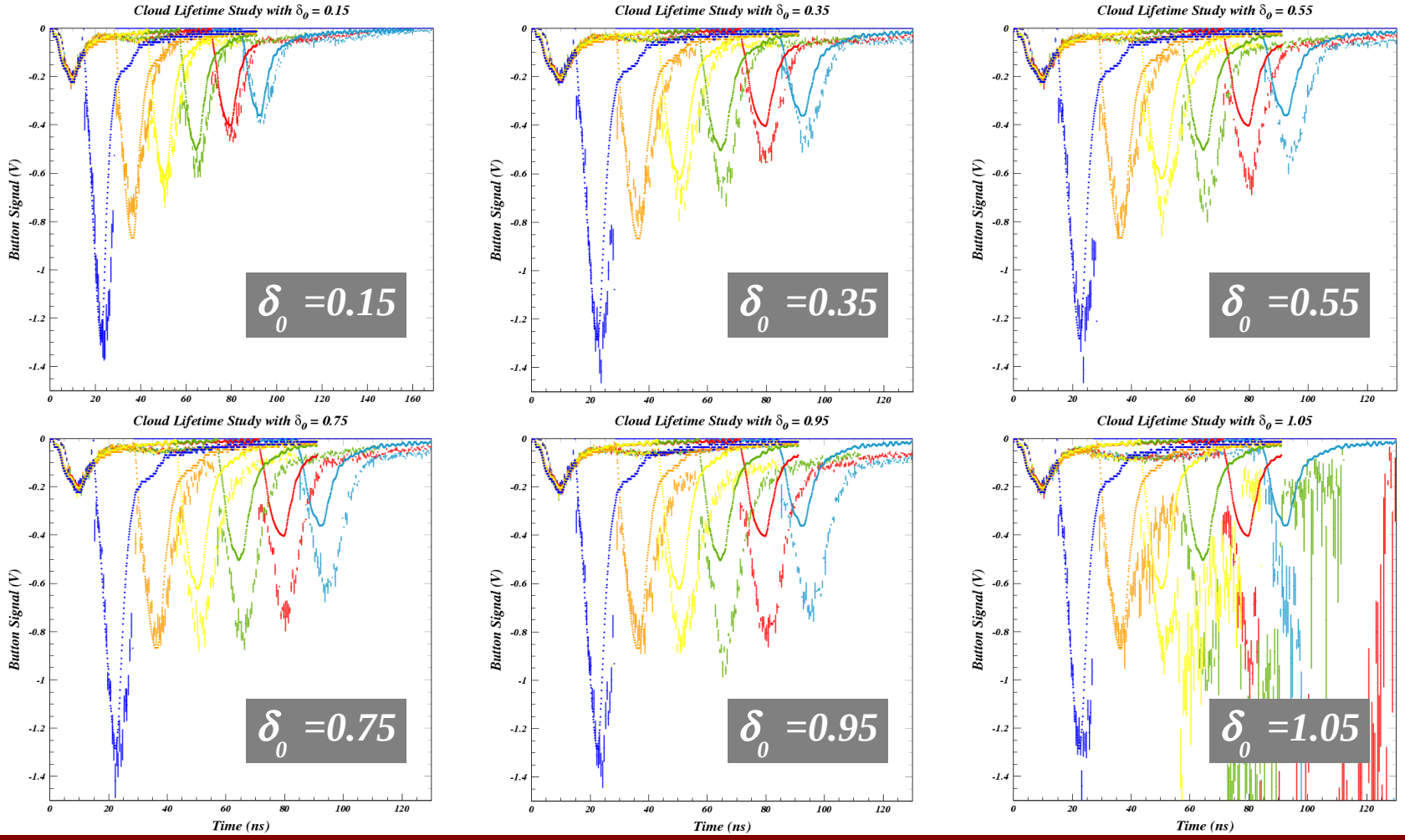
Elastic yield δ_0: 0.55





Simulated cloud lifetime too long: reduce elastic yield?

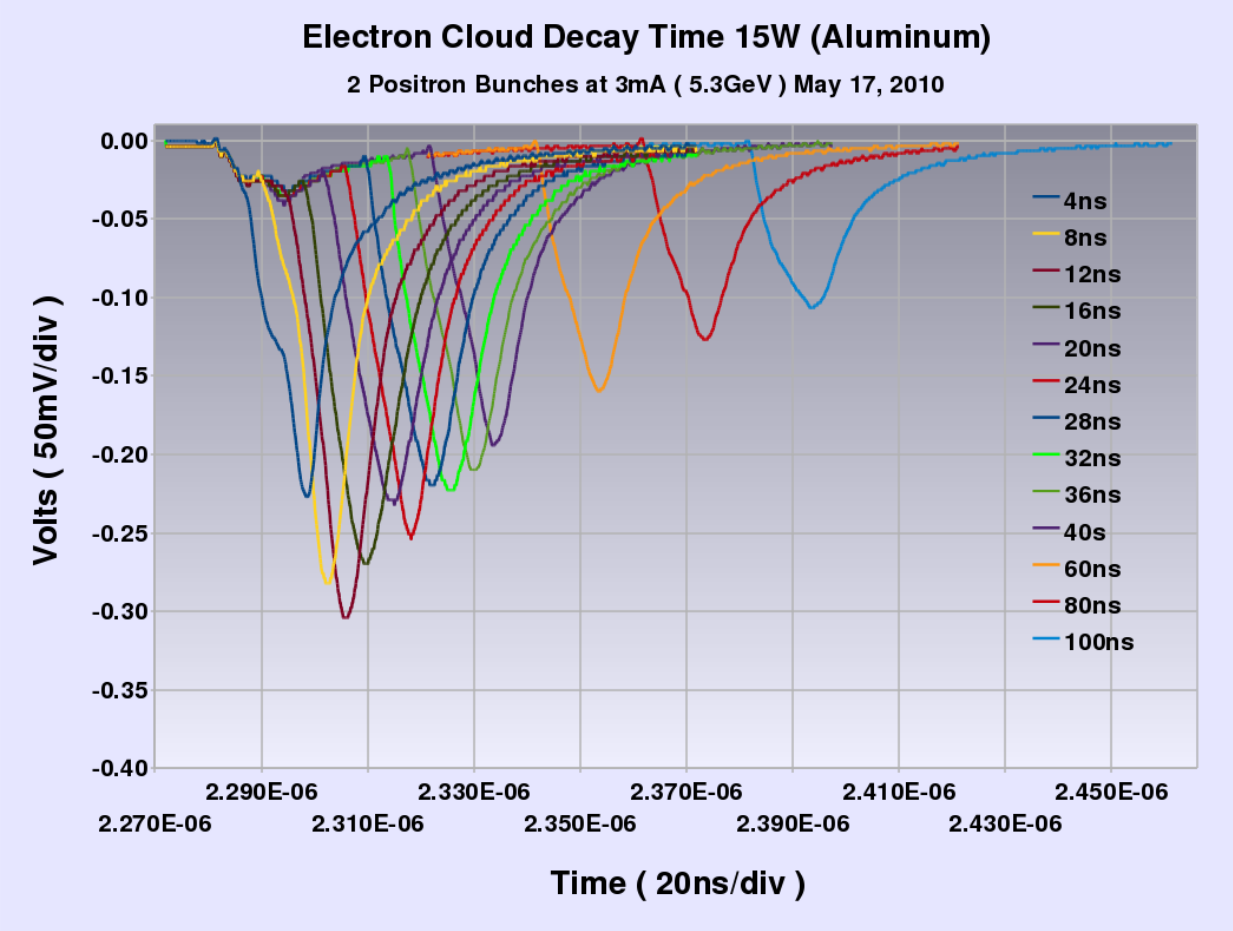
ECLOUD cloud lifetime sensitivity to elastic yield δ_0



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.

Next project
Bare aluminum chamber with 4 ns spacing
5/17/2010

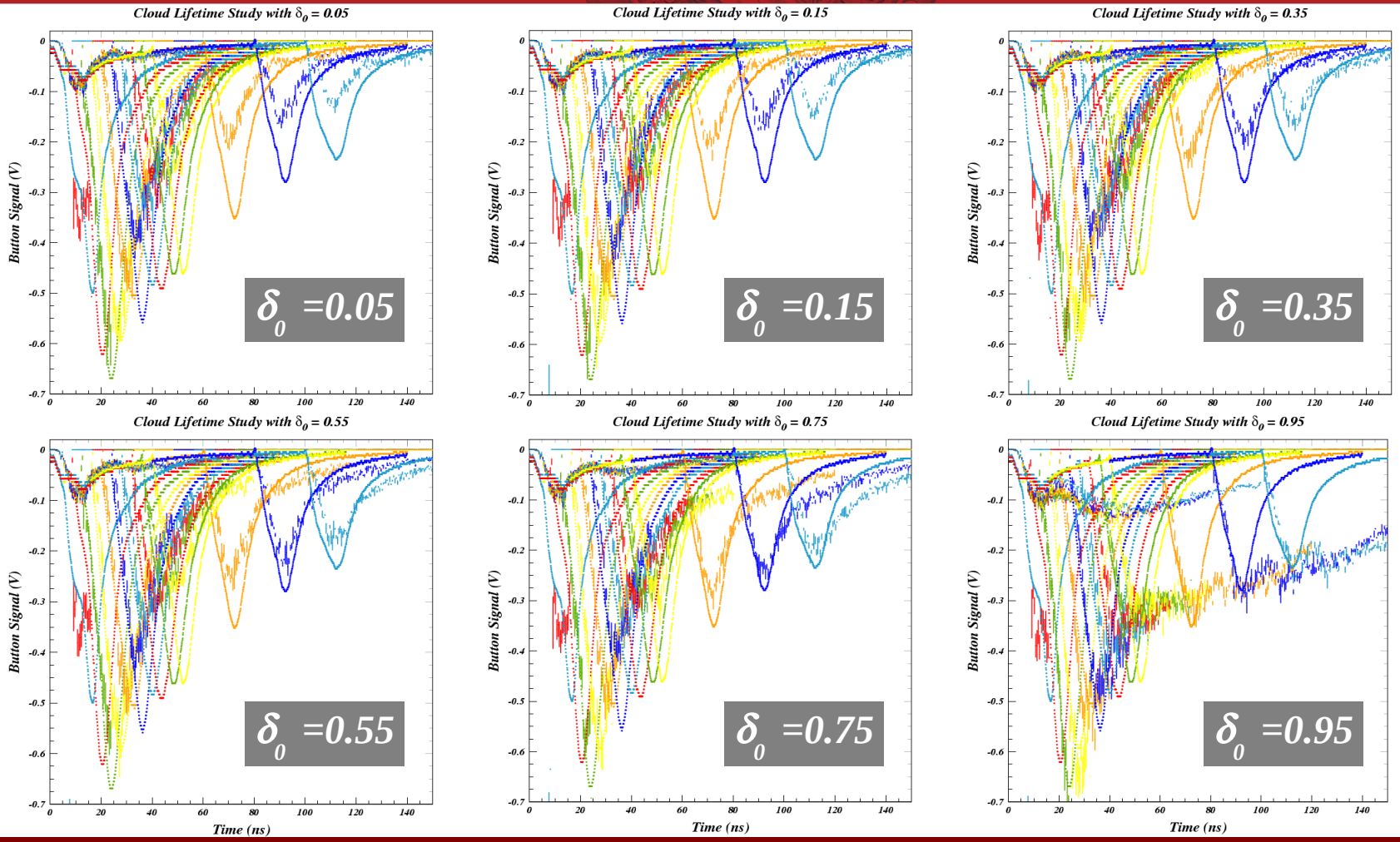


NB: nonmonotonic! The narrower spacing gives sensitivity to the cloud buildup and motion.

Will we find the higher value for δ_0 (about 0.5) which was found to be compatible with our tune shift simulations?

YES

δ_0 is much higher for aluminum than for TiN



Many systematic checks remain before a value for δ_0 can be precisely given, but the sensitivity is obvious.

This study was difficult because an unexpected extreme sensitivity to the photoelectron energy distribution had to be discovered.

The simulation for the 4- and 8-ns spaced bunches still needs work.