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

<u>Context</u>

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.
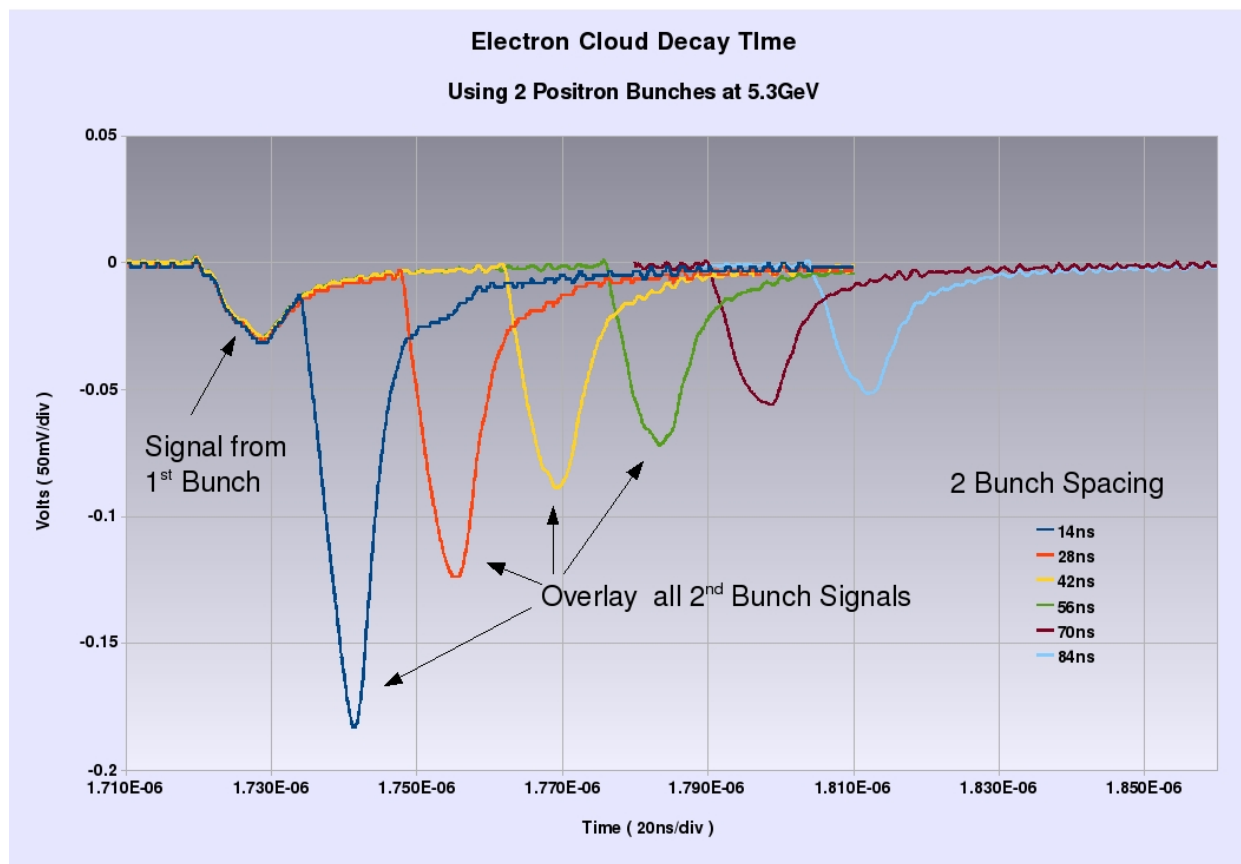
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Electron Cloud Decay TIme

Using 2 Positron Bunches at 5.3GeV

Signal from 1st Bunch

Overlay all 2nd Bunch Signals

2 Bunch Spacing

— 14ns
— 28ns
— 42ns
— 56ns
— 70ns
— 84ns

Volts (50mV/div)

Time (20ns/div)

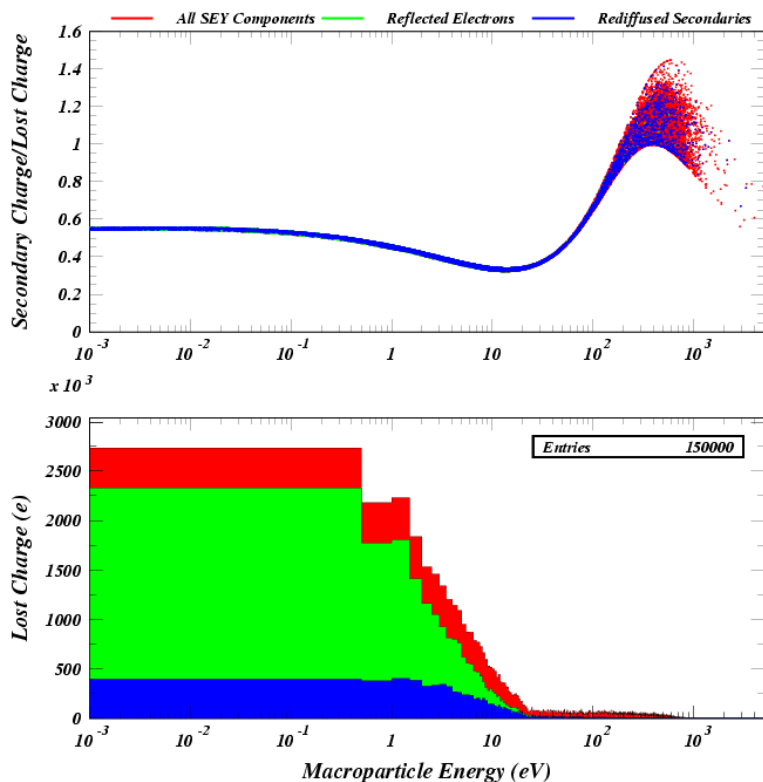*https://cesrweb.lepp.cornell.edu/instr/data/shbut/2010/20100327_summary.html*
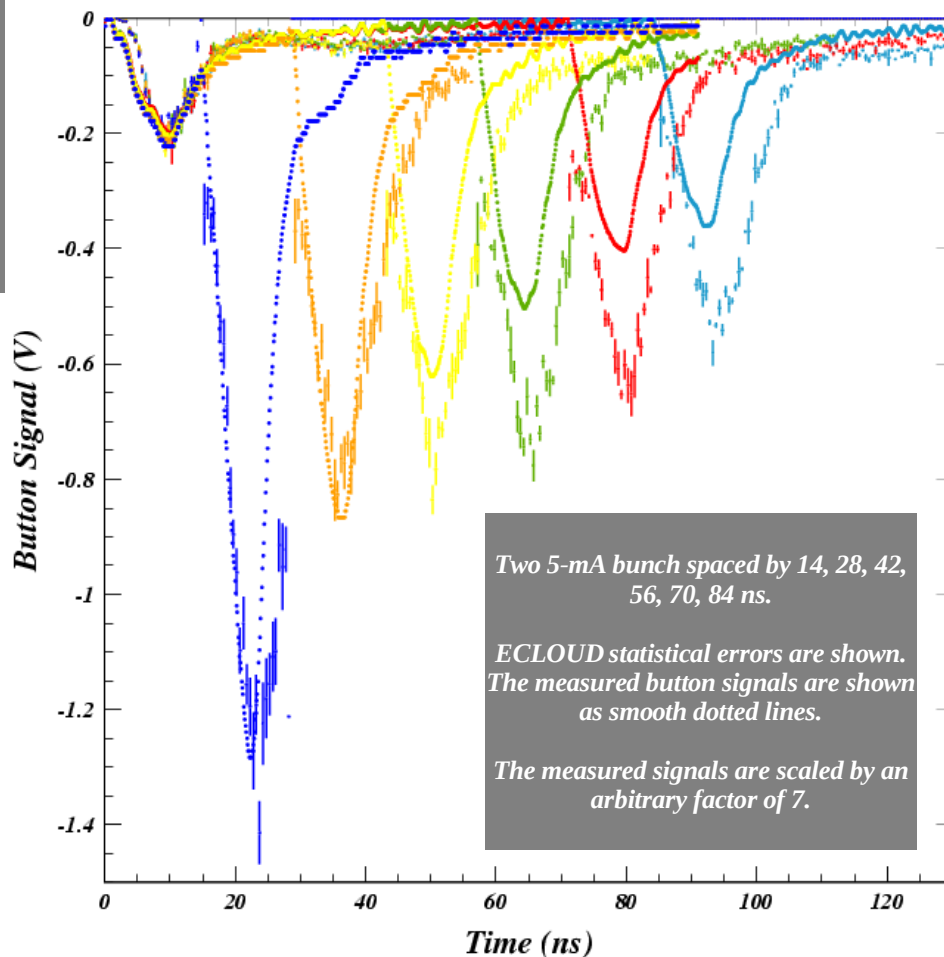
Secondary Yield Model

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

Rediffused yield: 0.1

Elastic yield δ_0: 0.55

Cloud Lifetime Study with $\delta_0 = 0.55$

Two 5-mA bunch spaced by 14, 28, 42, 56, 70, 84 ns.

ECLOUD statistical errors are shown. The measured button signals are shown as smooth dotted lines.

The measured signals are scaled by an arbitrary factor of 7.

Simulated cloud lifetime too long: reduce elastic yield?

Cloud Lifetime Study with $\delta_0 = 0.15$ — Cloud Lifetime Study with $\delta_0 = 0.35$ — Cloud Lifetime Study with $\delta_0 = 0.55$

Cloud Lifetime Study with $\delta_0 = 0.75$ — Cloud Lifetime Study with $\delta_0 = 0.95$ — Cloud Lifetime Study with $\delta_0 = 1.05$
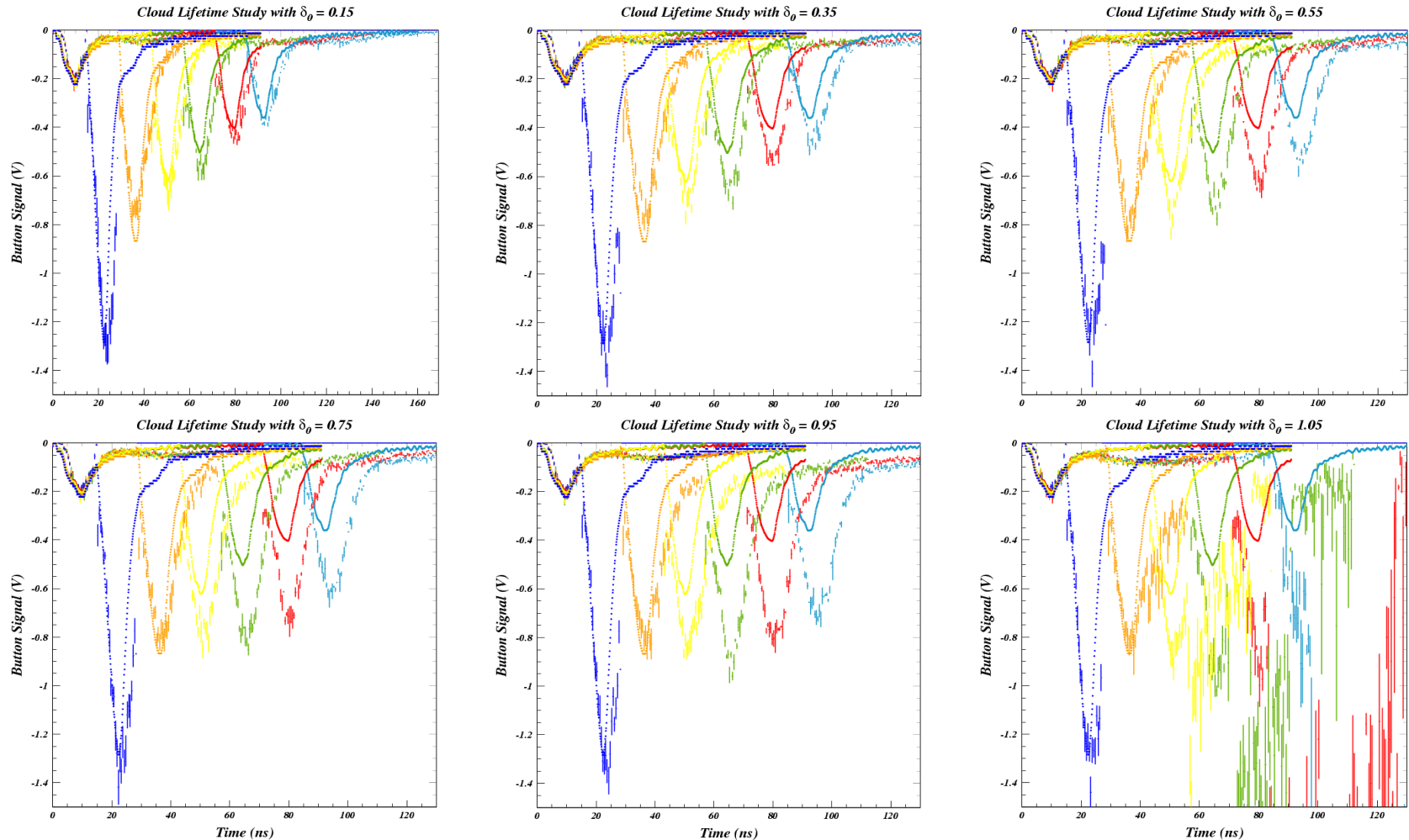
The optimal value for δ_0 (0.15) is lower than has been generally assumed (0.5-0.7).

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.