DCH *Summary*

LNF 7 Apr 2011

G. Finocchiaro, M. Roney

Outline

- Backgrounds
- Update on lab activities
  - Aging
  - Cluster counting studies
  - Update on new prototypes (@LNF)

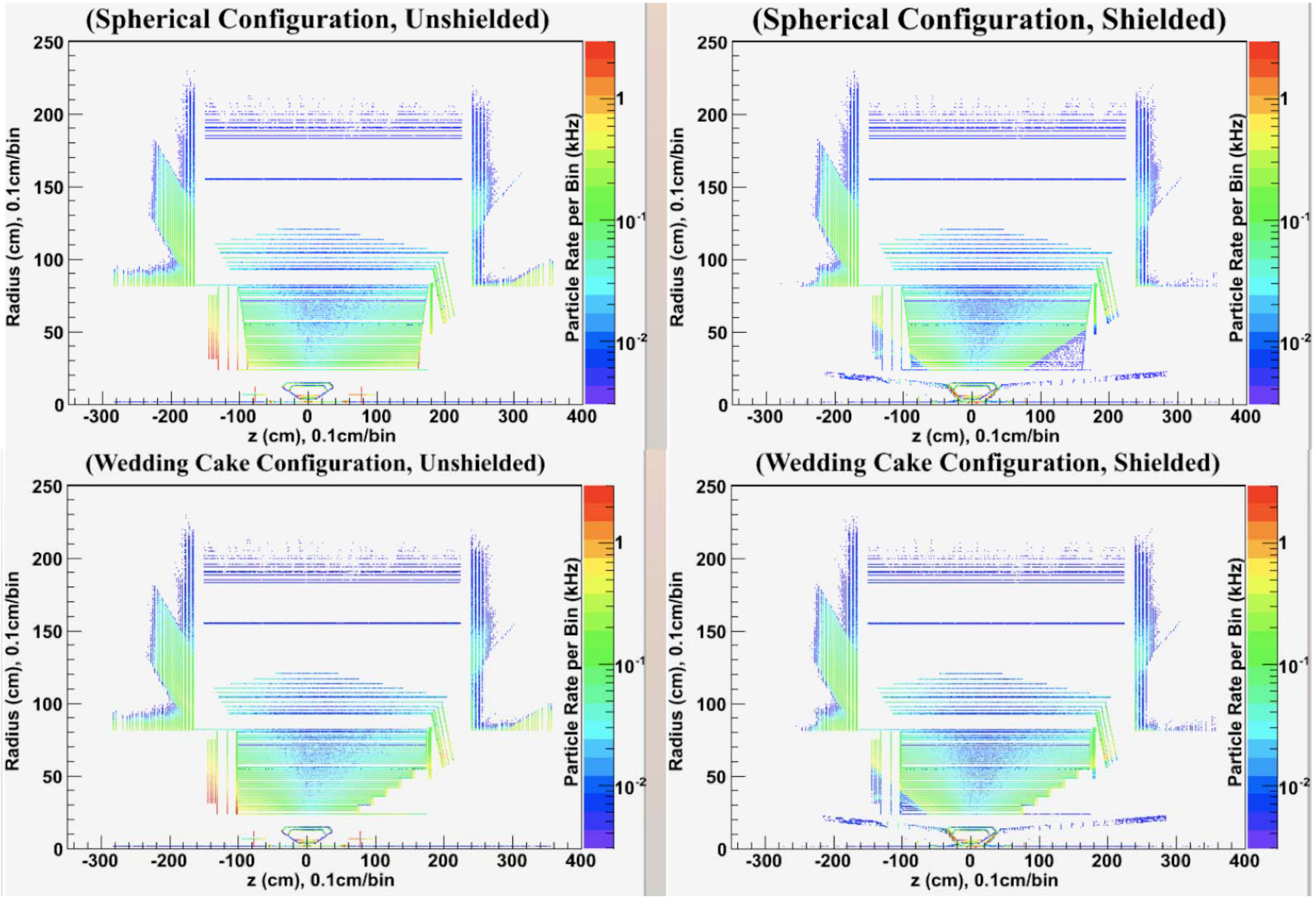
Large-angle Bhabha's in FastSim

D. Swersky

Why we don't need tapered endplates

SPHERICAL ENDPLATES

'WEDDING-CAKE' ENDPLATES



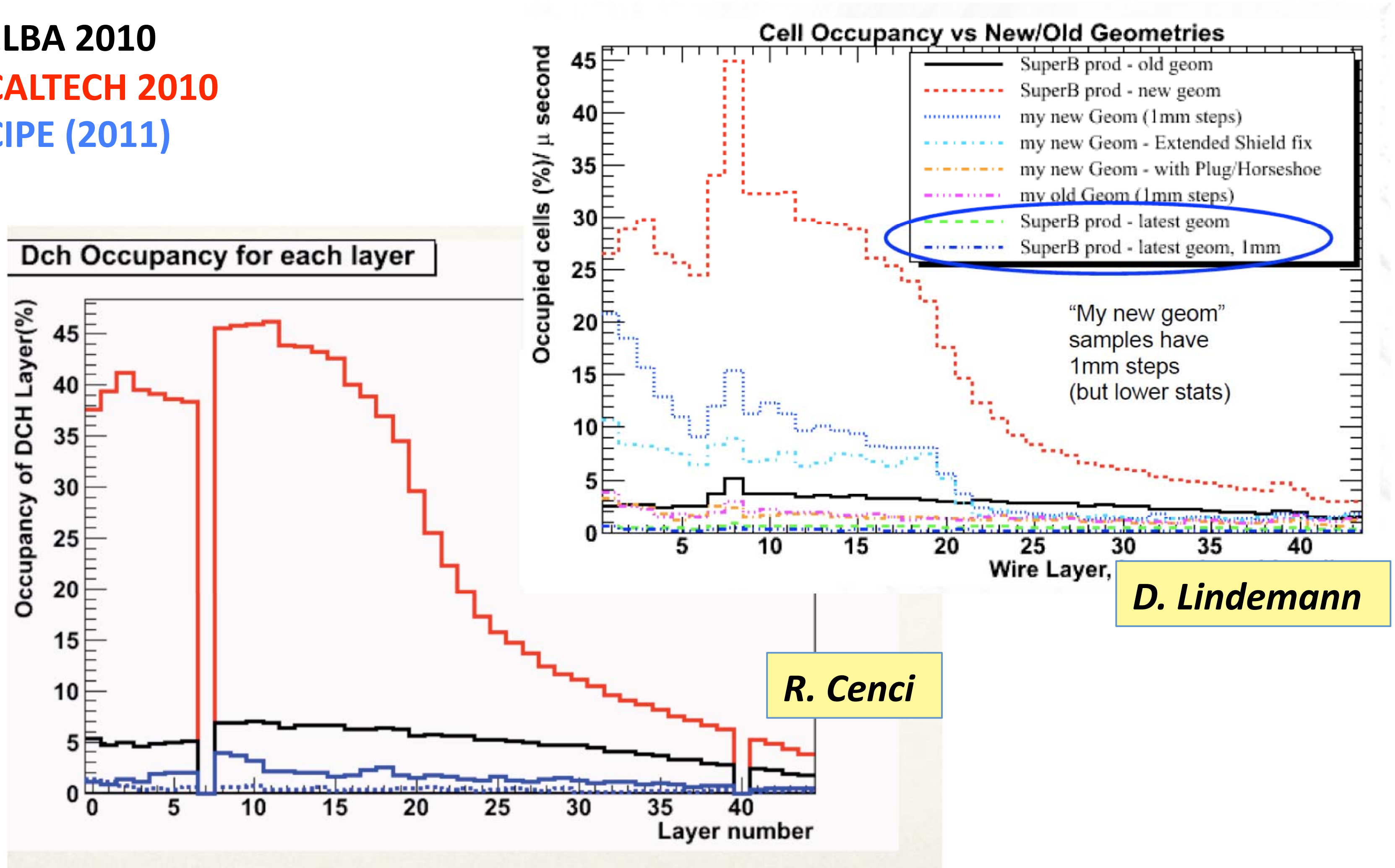
WITHOUT TUNGSTEN SHIELD **WITH TUNGSTEN SHIELD**

***R-z* map of "SimHits" (BHWIDE)**

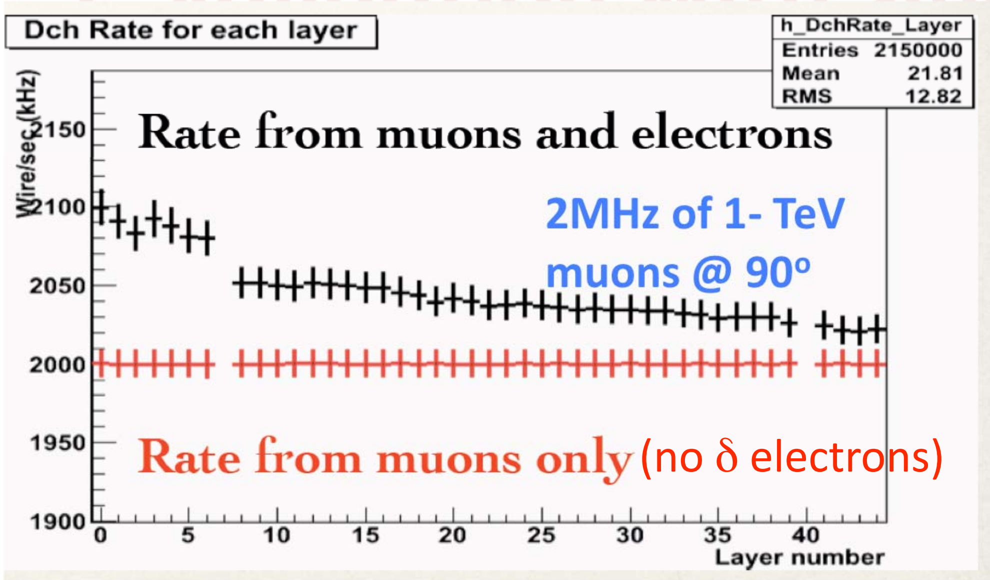
Small angle radiative Bhabha's - FullSim

An intense -and rewarding- detective work

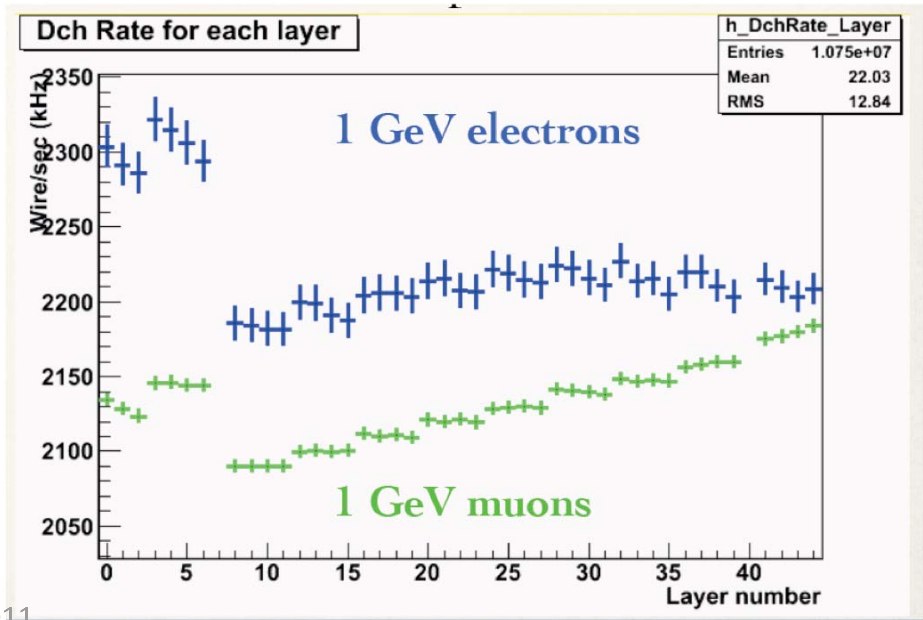
ELBA 2010
CALTECH 2010
CIPE (2011)



1. validation with single particles



R. Cenci



- Electrons radiate more
- Rate depends on cell $\Delta\phi$

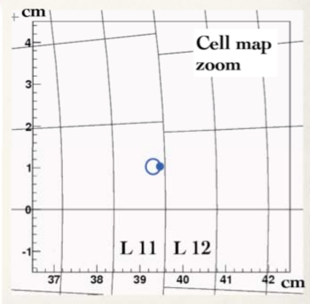
(same # of cells on each S.L.)

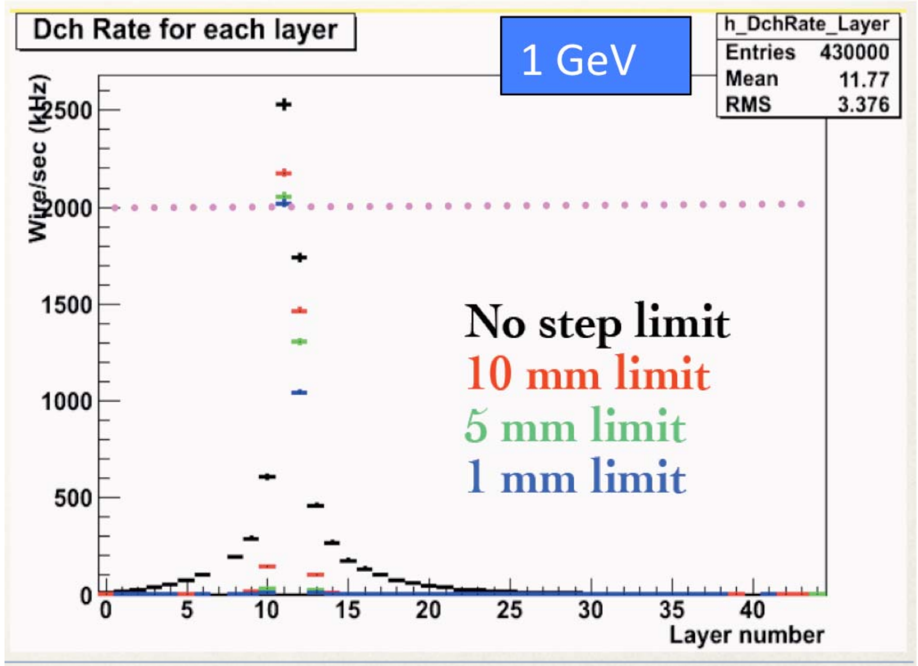
2.a Multiple scattering of single particles

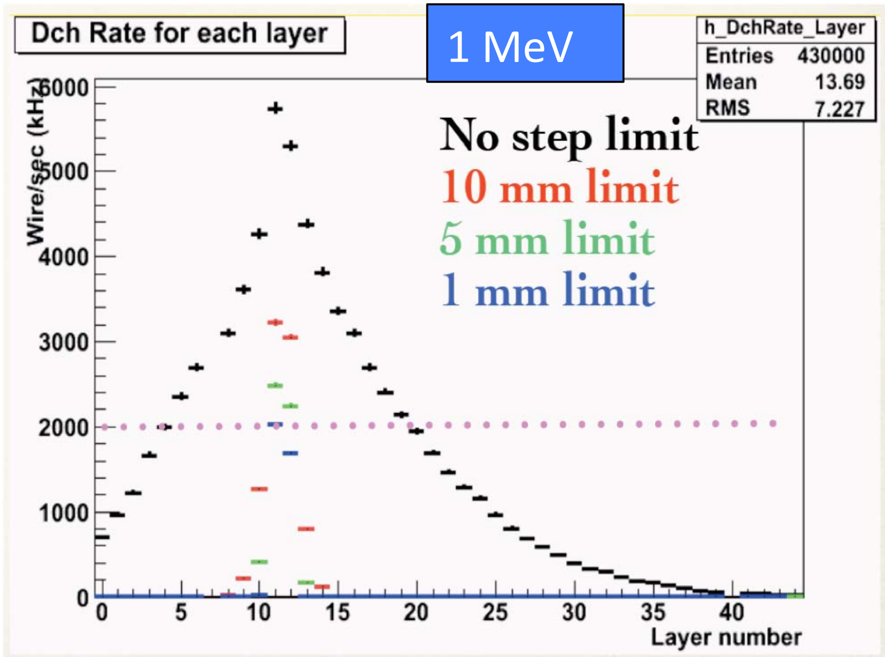
Shoot single muons with:

- 1mm helix radius
- Different momenta
- Different GEANT4 "max. step limit"

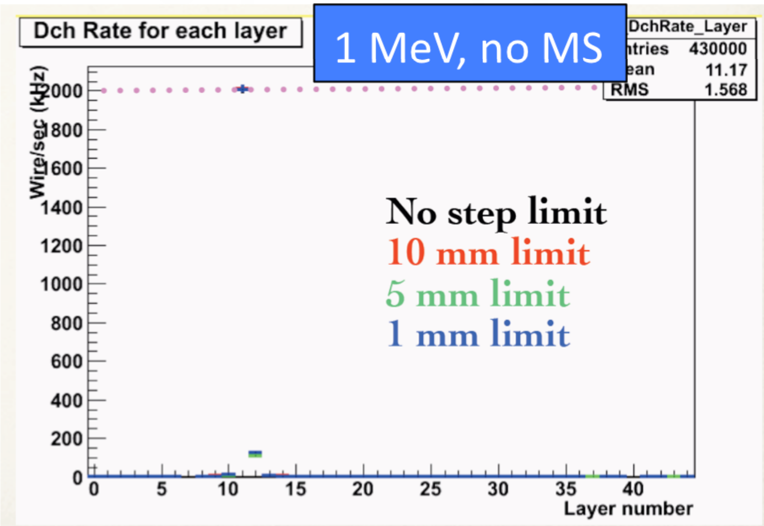
Ideally, only layer #11 should by hit

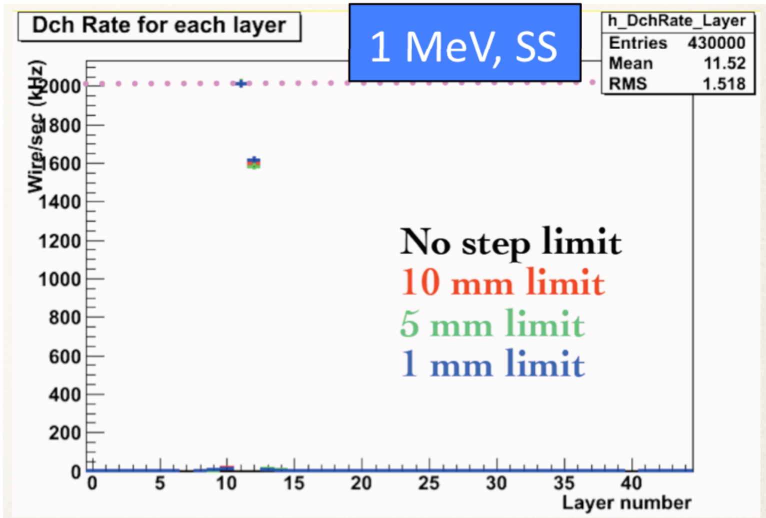


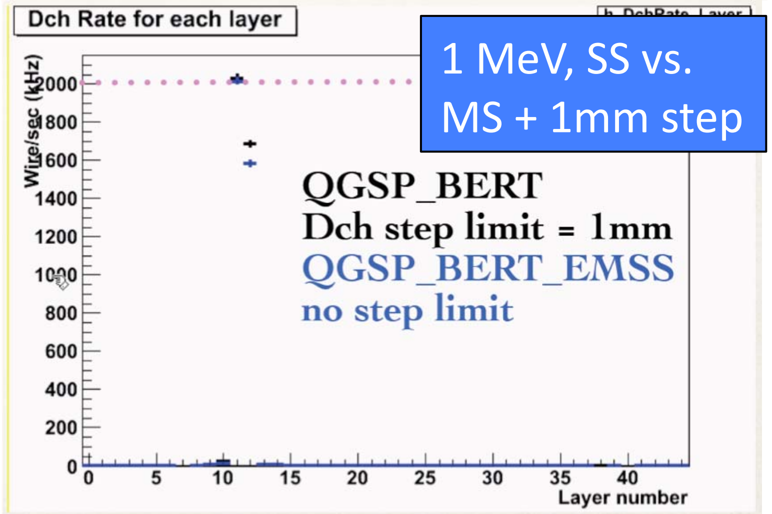




2.b Multiple vs. Single Scattering



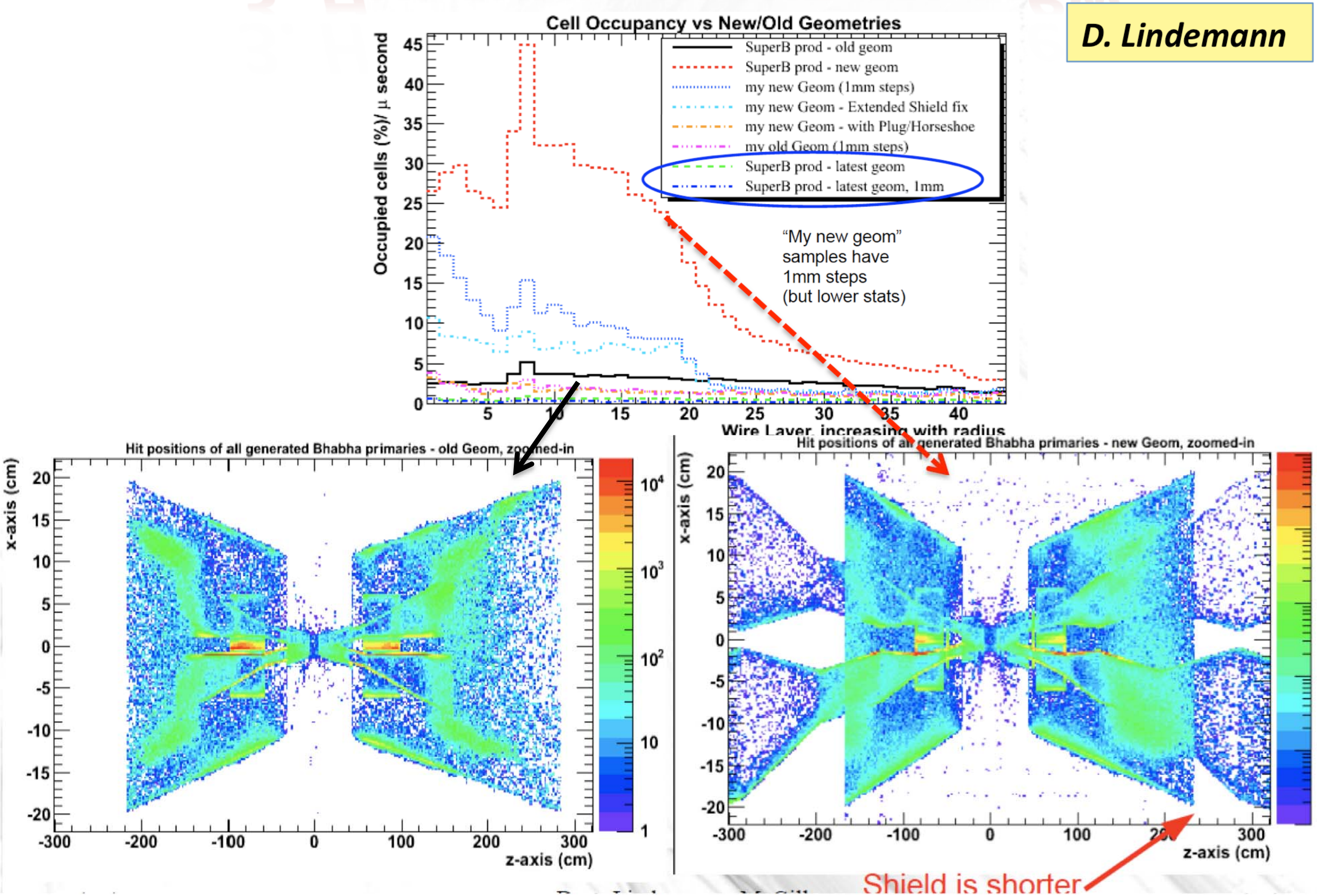




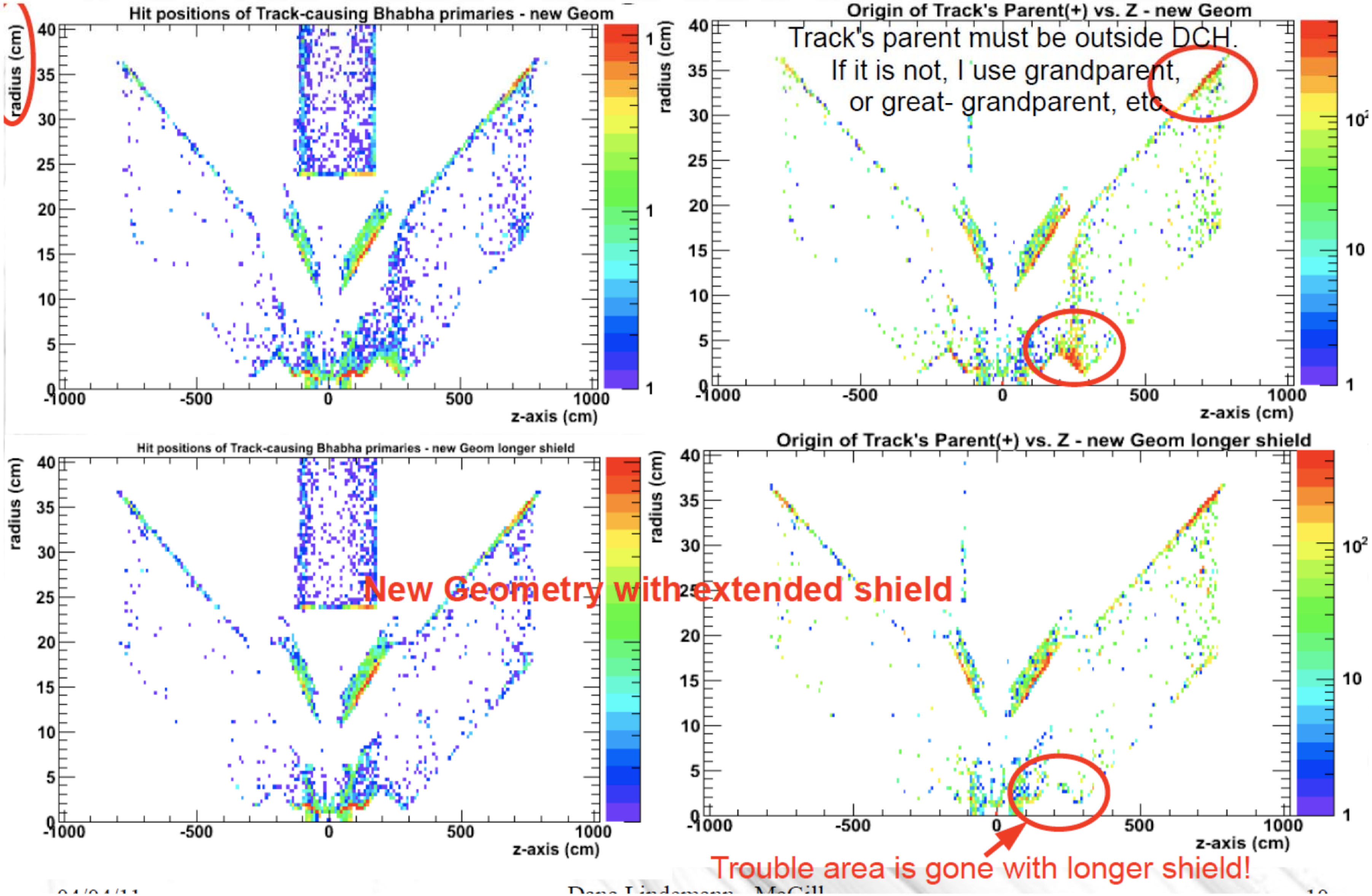
- The GEANT4 default approximation for slow particles traveling in low density material overestimates the multiple Coulomb scattering effect
- GEANT4 builds several particle lists for different physics processes. "Single scattering" seems to provide a sensible modeling

3. Hot spots in the x-z view

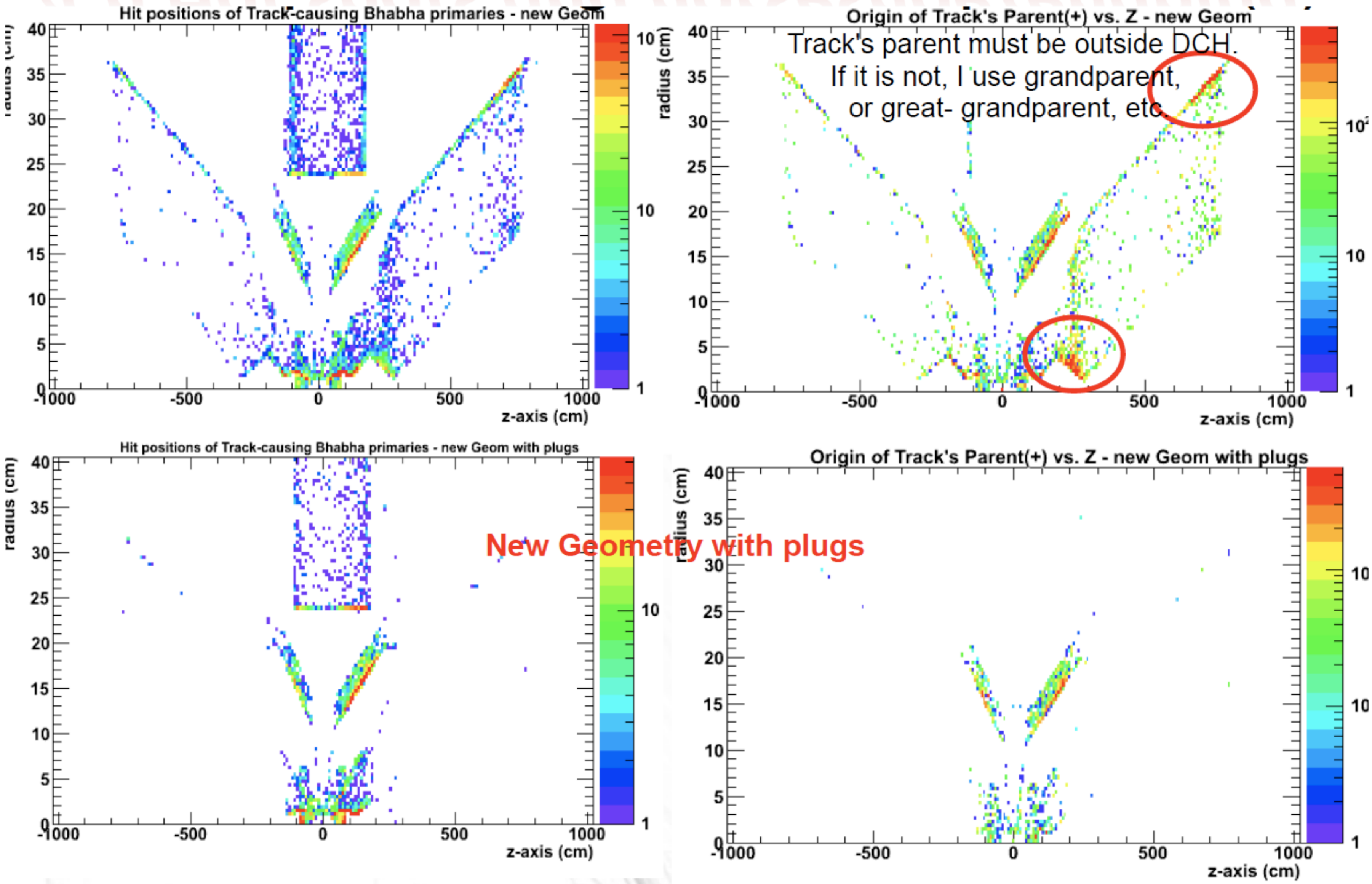
D. Lindemann



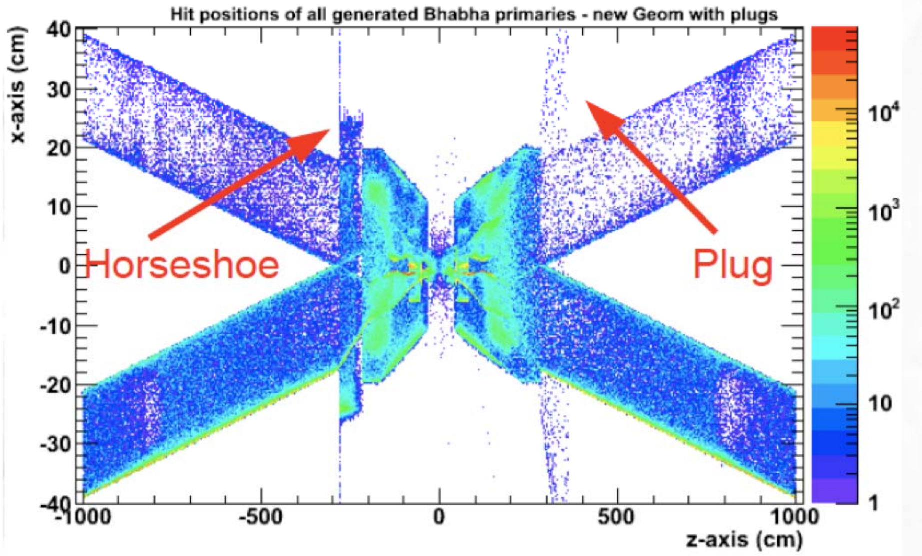
4.a Hot spots and the shield length

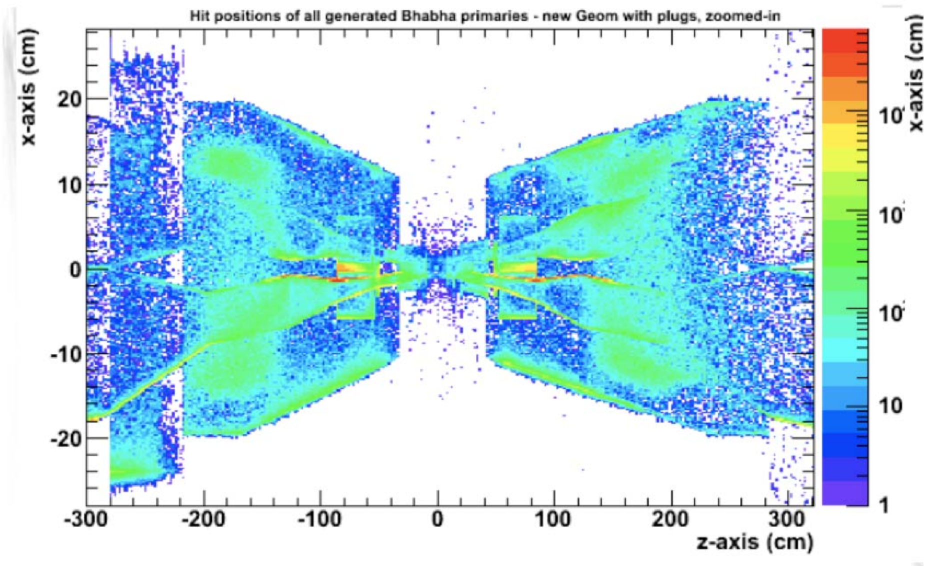


4.b Hot spots and horseshoe/endplug

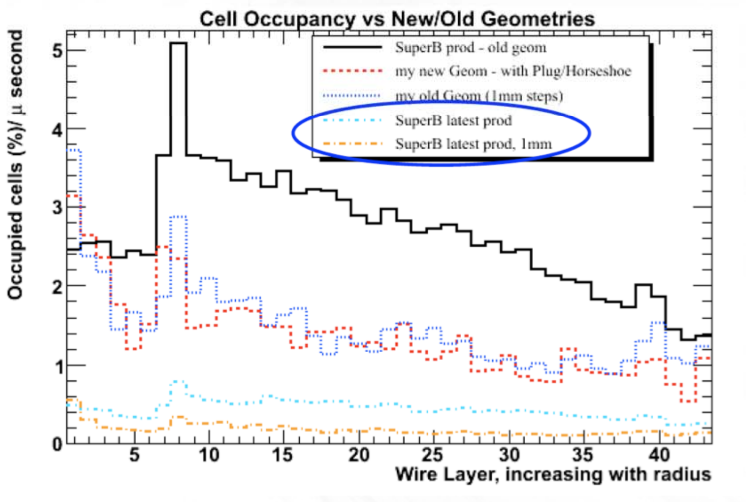


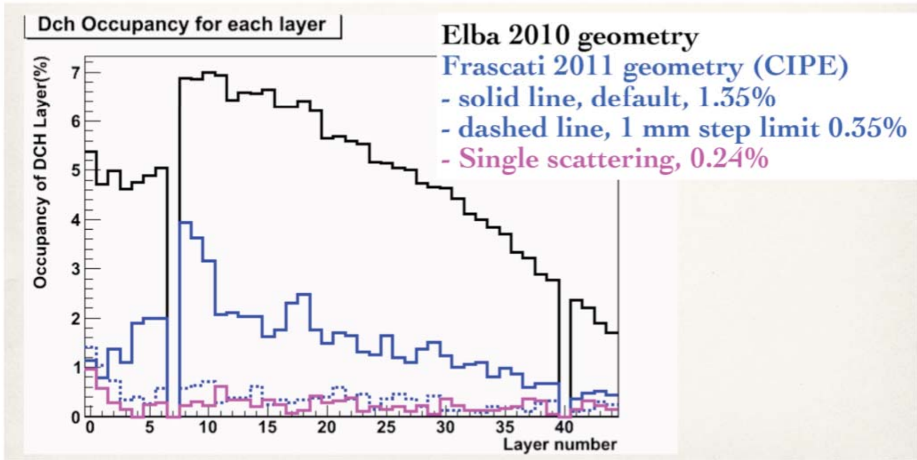
5. All together now





In summary, we're happy (now)

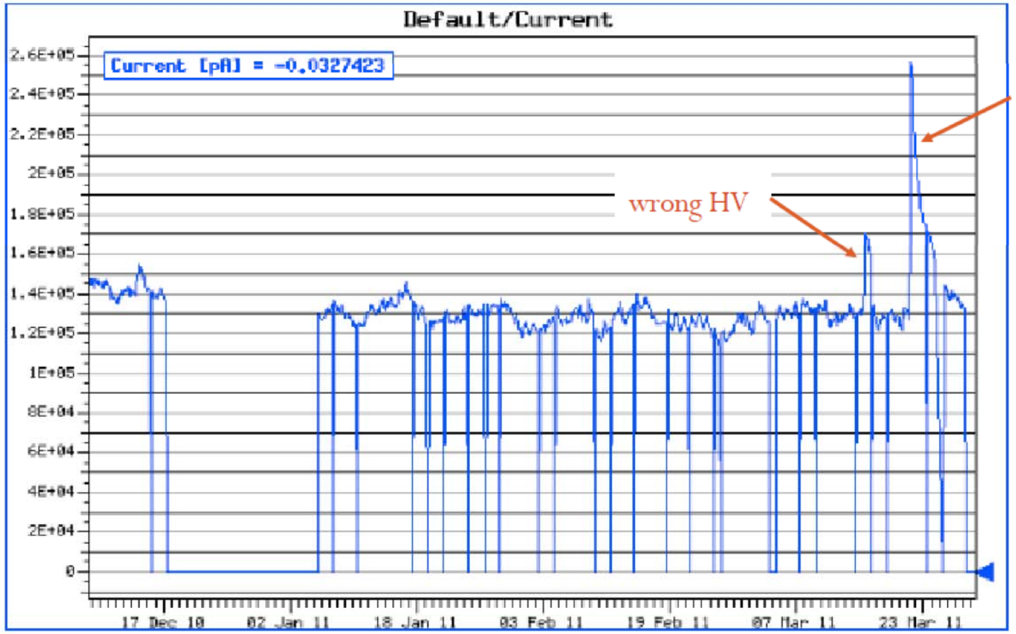




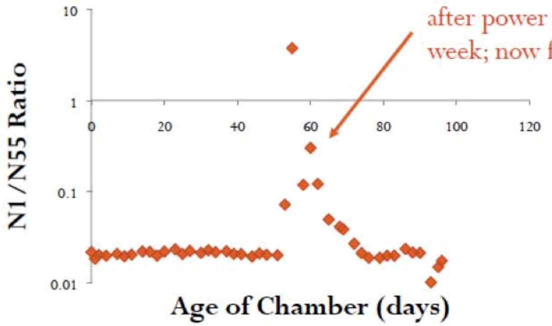
- Next on the TODO list:
  - Effect of stereo angle (a spiraling electron hits many wires)
  - Touschek effect
  - Validation/ evaluation of safety factor

Aging studies

C. Hearty



- ~100 mC/cm with no obvious signs of aging

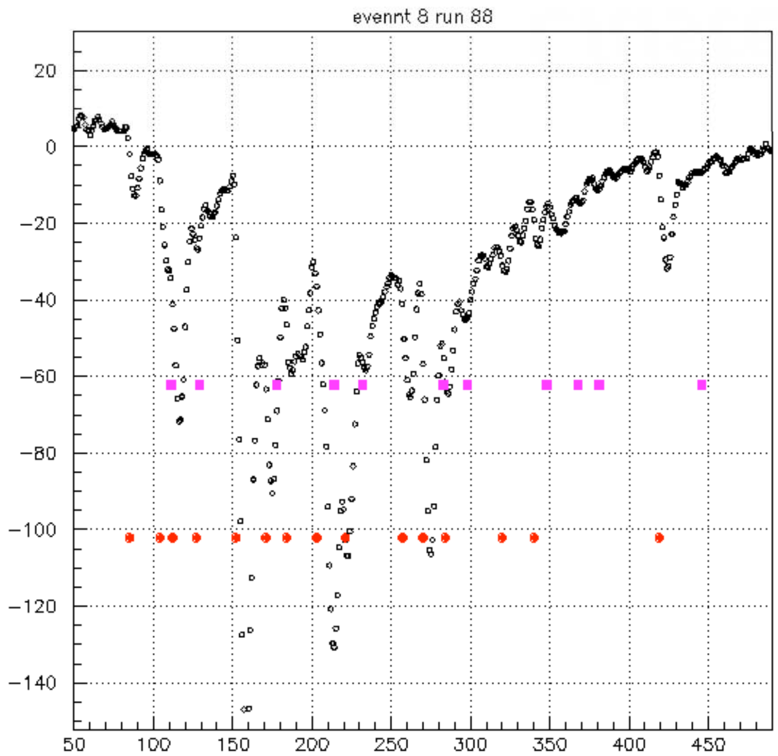


Cluster counting in drift tubes

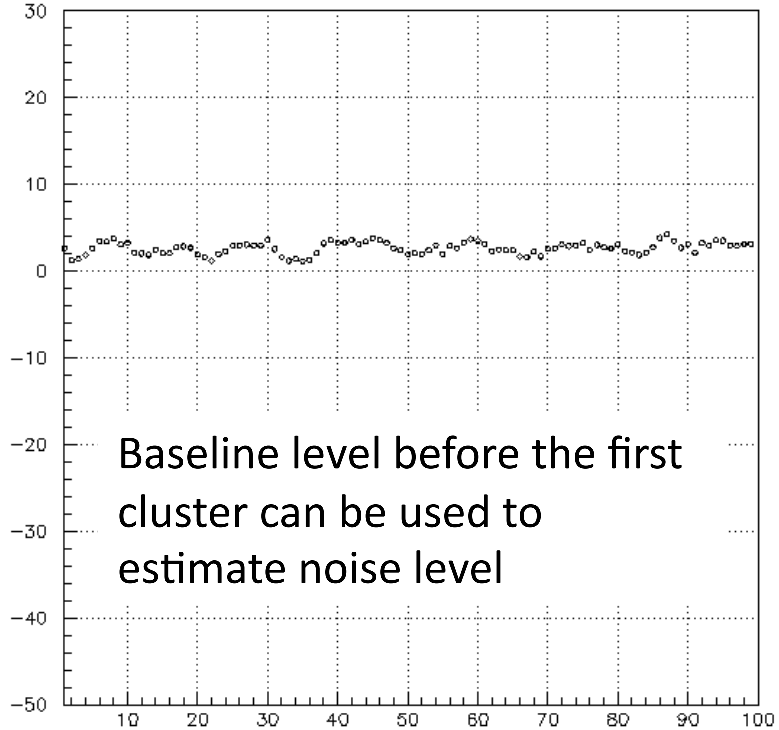
- We used two square tubes with 30/17mm side
  - Better shielding against environmental noise
  - Higher gain at given H.V.
  - Easier to handle
- In order to do a quick (and hopefully) clean job:
  - Used a Sr90 source
  - Trigger with a scintillation counter (4 cm thick)
  - Overall efficiency 70%/22%
- Signal is digitized with the DRS4 SCA

Cluster Counting

M. Piccolo

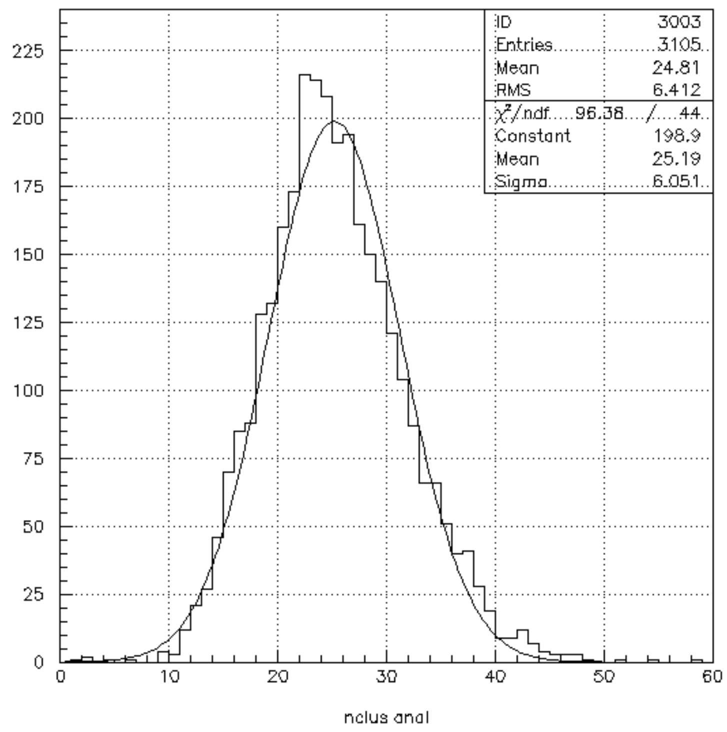


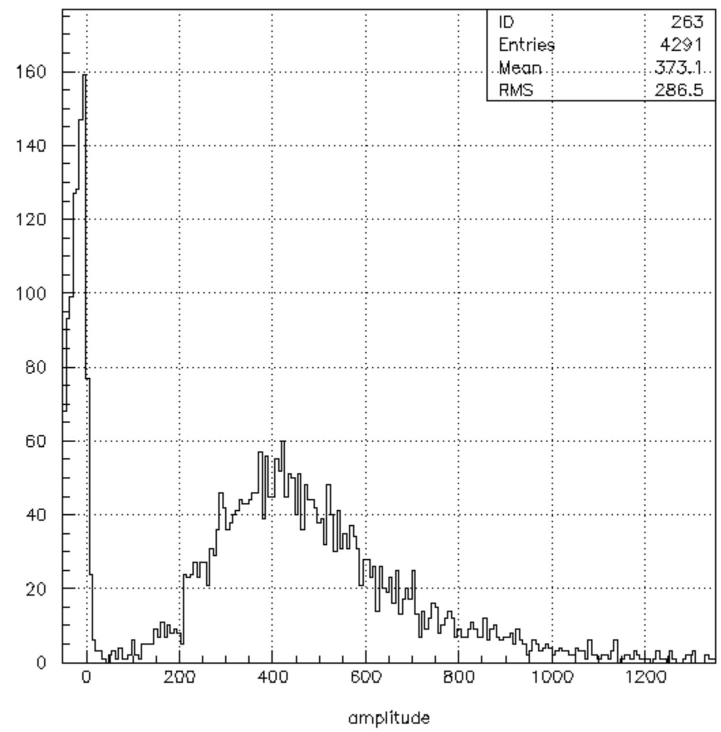
- HW: derivative with Δt=8-10ns and adjustable comparator threshold (8mV)
- SW: difference between adjacent averages (over three time bins)



Baseline level before the first cluster can be used to estimate noise level

Cluster Counting

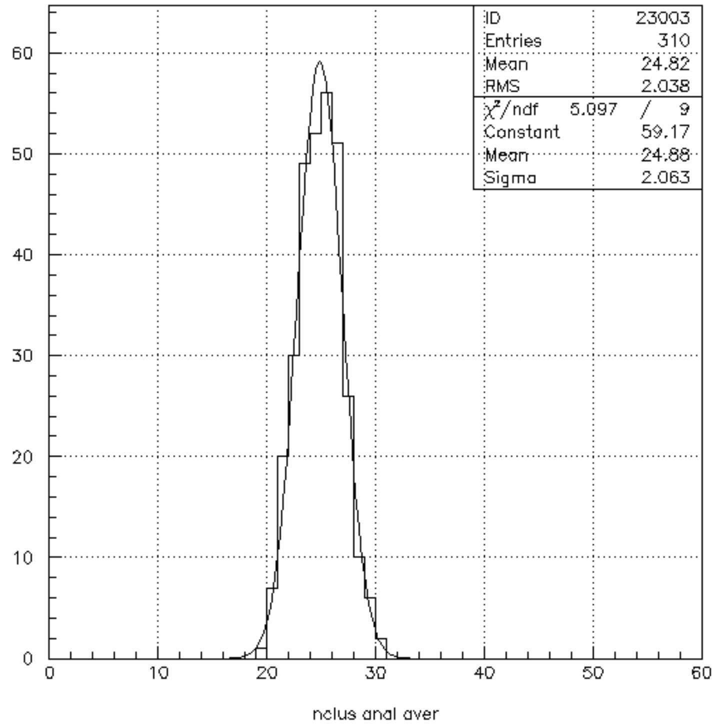


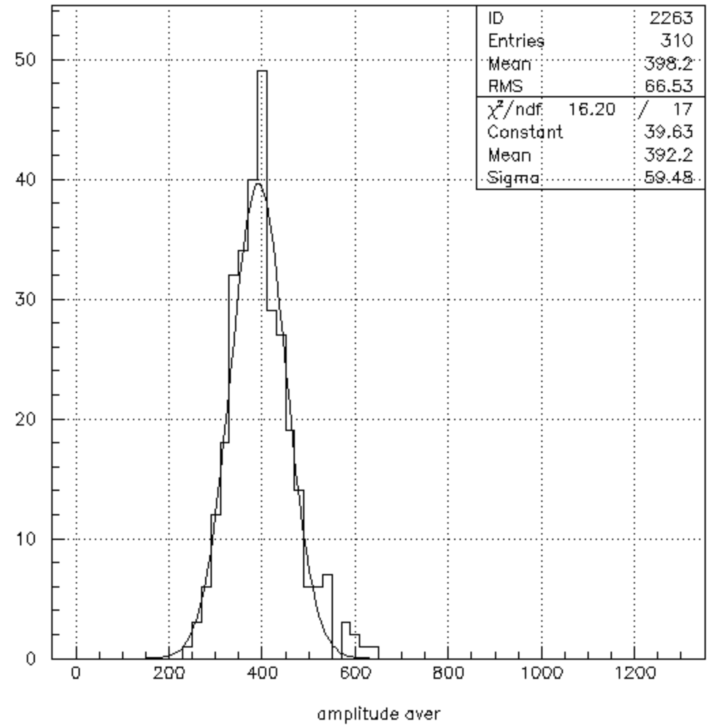


# of clusters in 90%He-10%iC_4H_{10}
30 mm track length

"traditional measurement": total charge in the same experimental conditions

Clusters and dE/dx in 10 samples





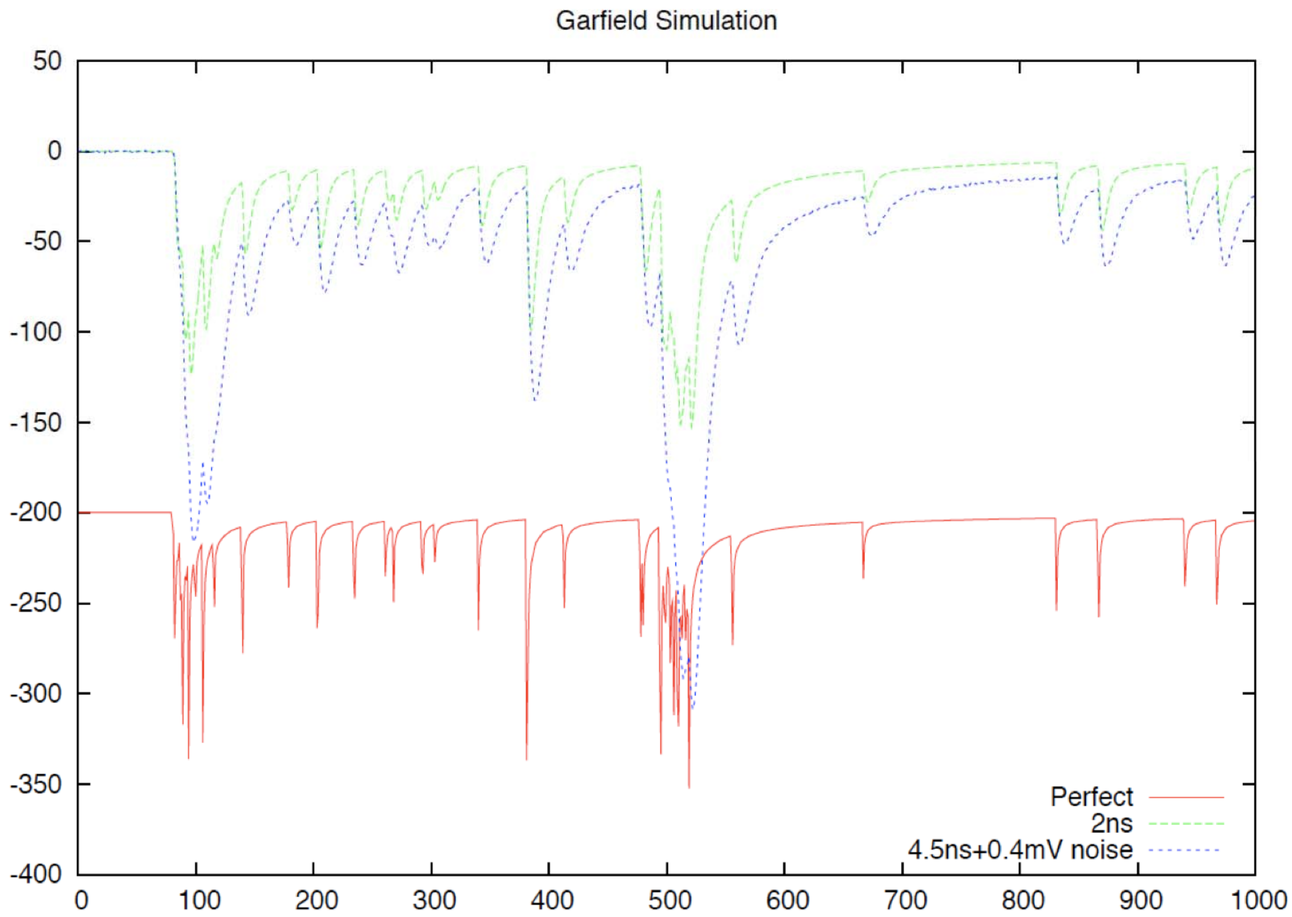
10 samples average on # of clusters
Relative resolution is 8%

10 samples truncated mean on total charge.
Relative resolution is 15%

Cluster Simulation

J.F. Caron

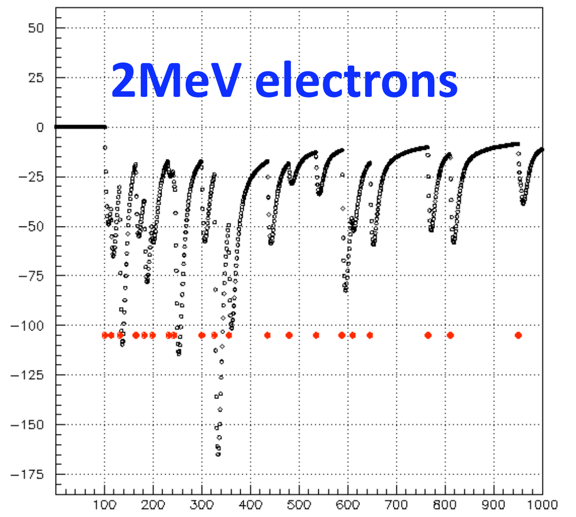
- Use Garfield to simulate signals in our gas mixtures, and apply a (simple, for now) transfer function to model the effect of FEE

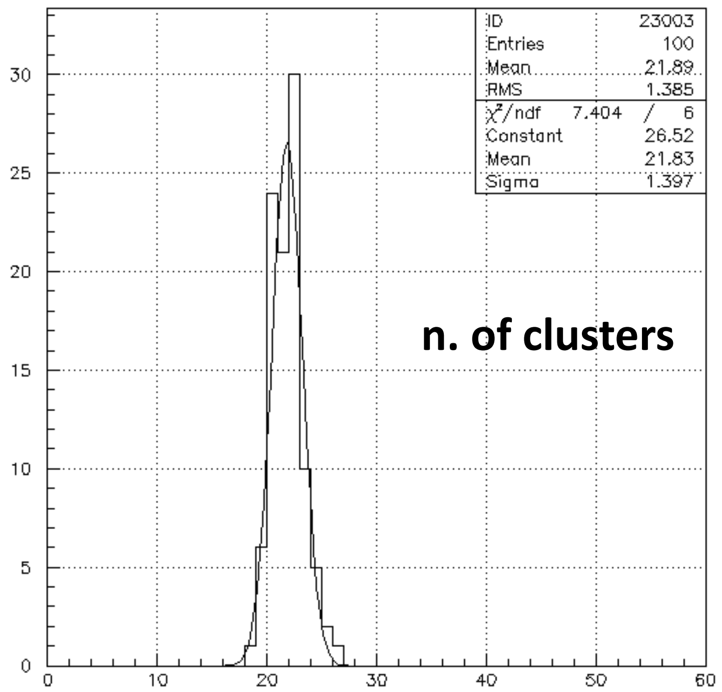


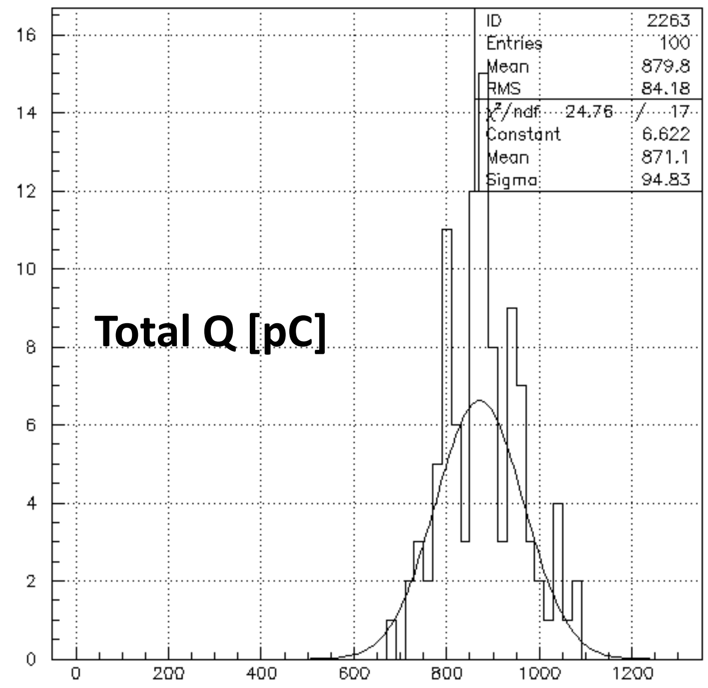
$$s(t) = \frac{t}{\tau} e^{-\frac{t}{\tau}}$$

$$(f \star s)(i) = \sum_{j=-\infty}^{\infty} f(j) s(i-j)$$

Simulation of the 30mm drift tube

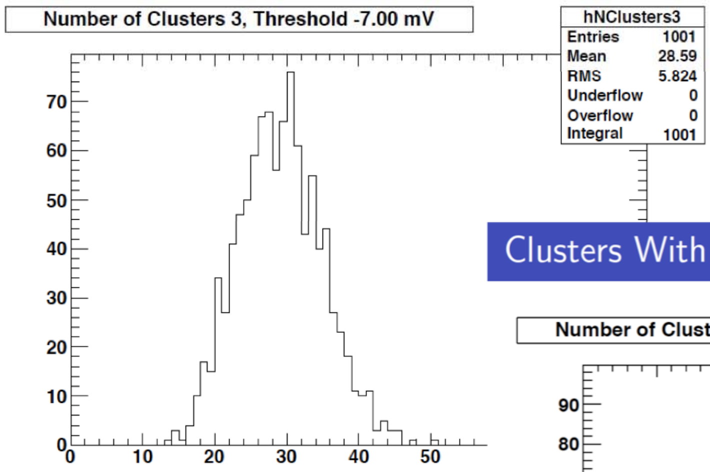




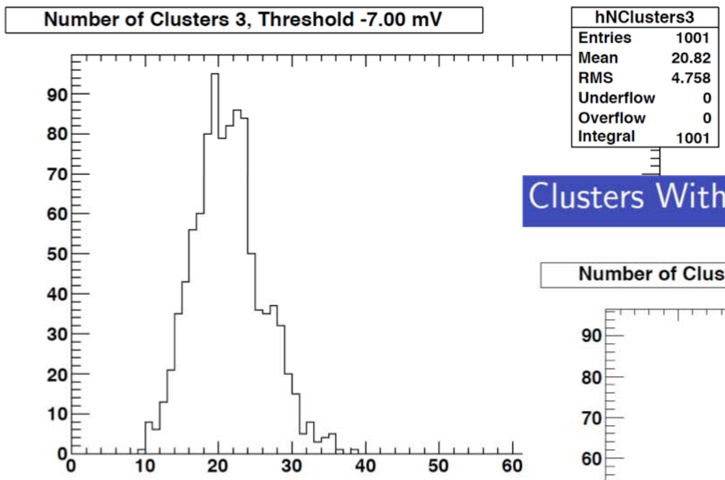


of Cluster vs. shaping time constant

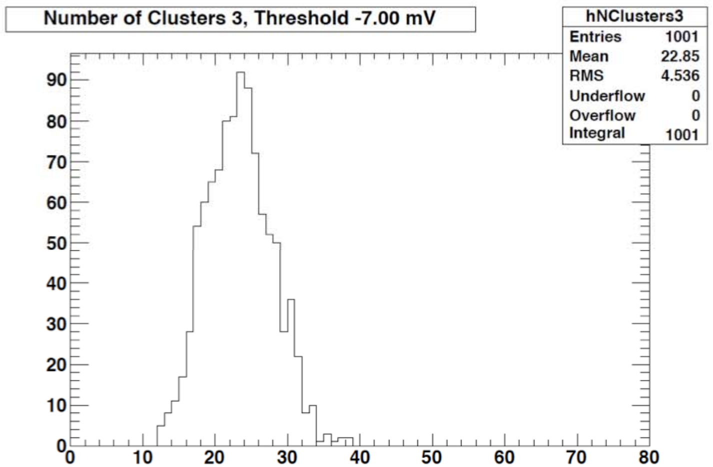
Clusters With "Perfect" Signals



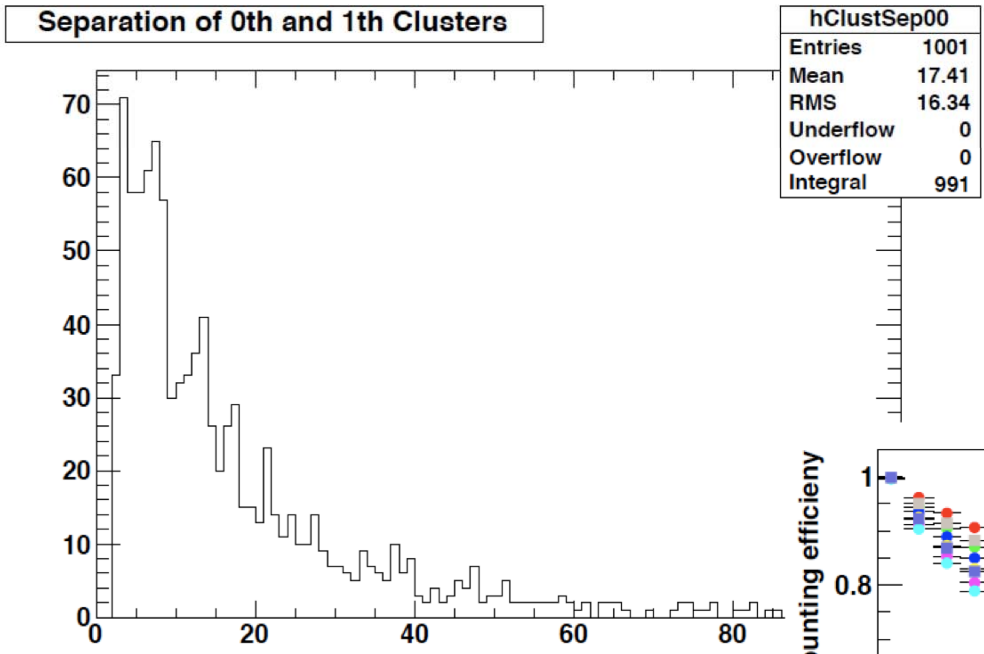
Clusters With $\tau = 2$ns

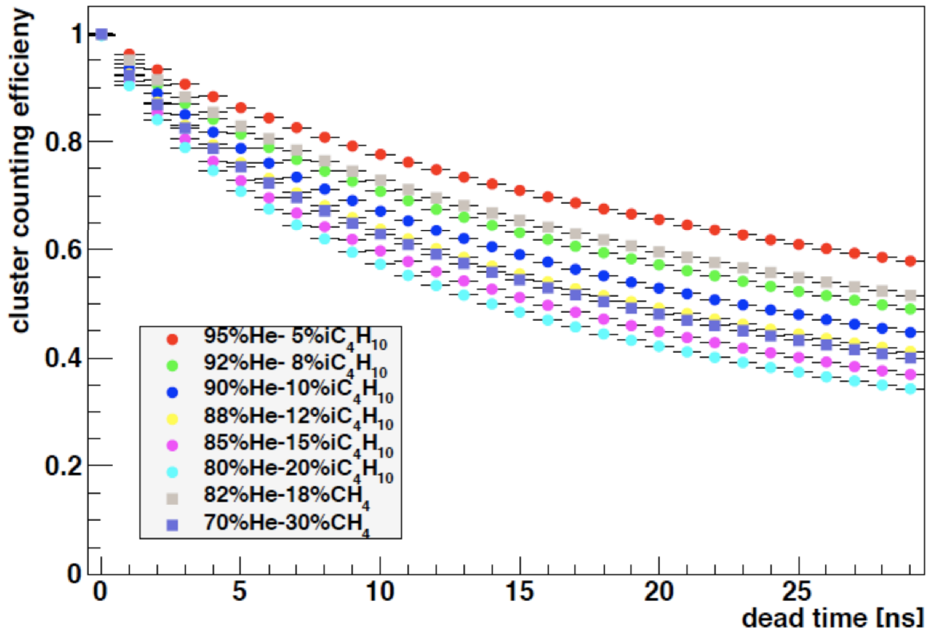


Clusters With $\tau = 4.5$ns and 0.4mV Noise



Counting efficiency vs. Δt

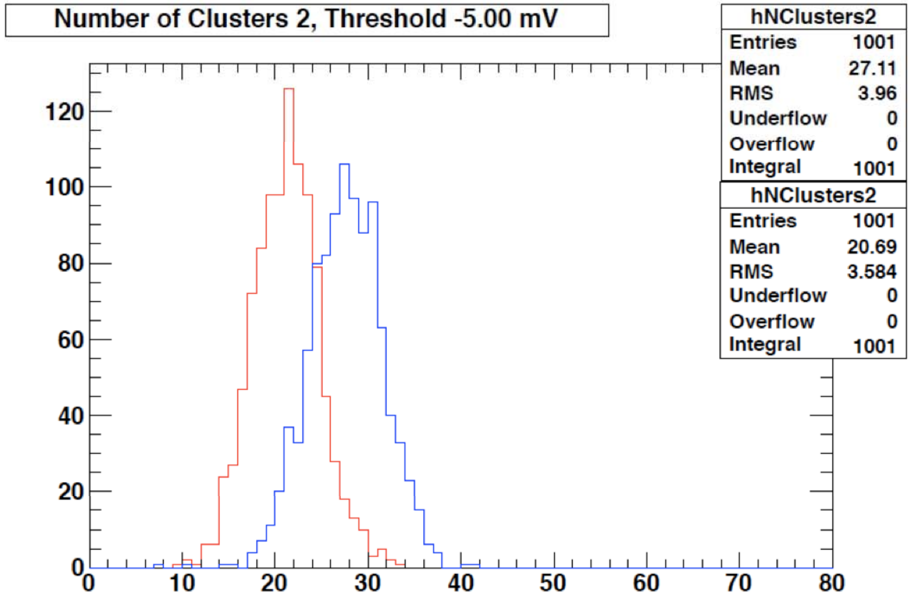


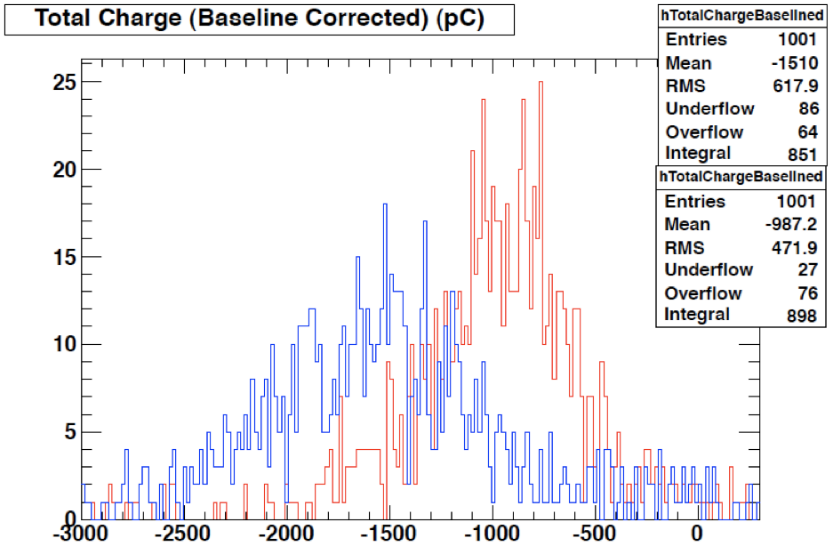


π-K separation

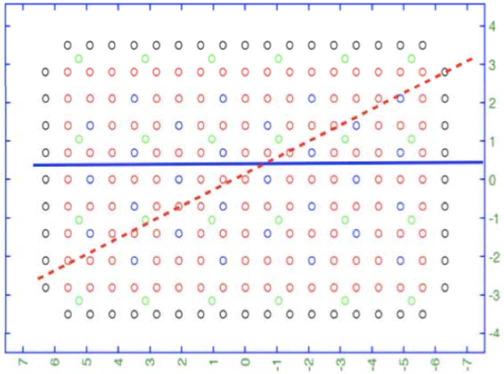
1000 tracks with p=490MeV/c

pions are MIP's, kaons on the $1/\beta^2$ slope

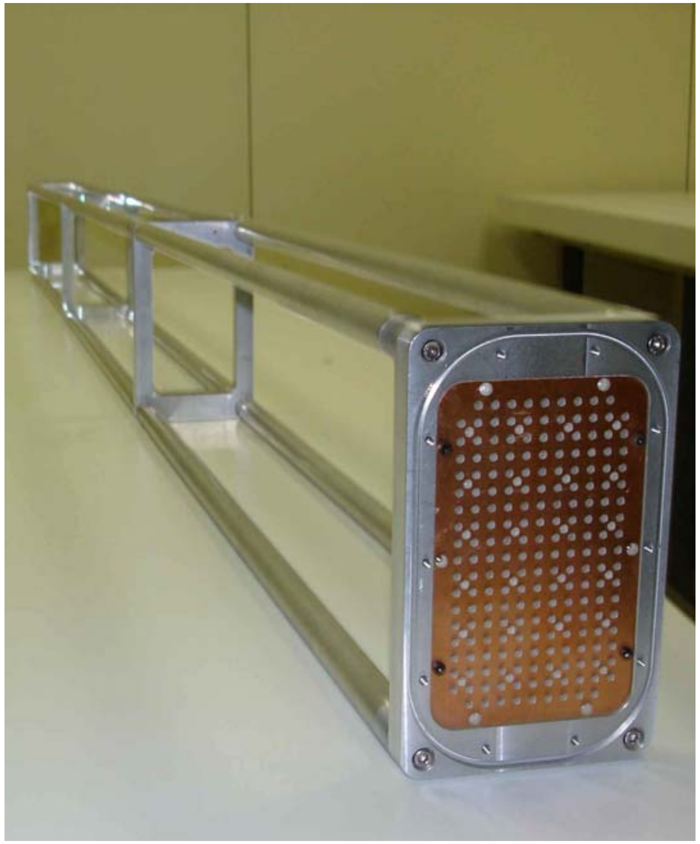




Status of Proto 2



- 28 sense wires arranged in 8 layers of staggered cells
  - Tracks with $\vartheta \in [-20,+20]^{\circ}$ cross all layers
- Mechanical structure is complete
- Clean room is operational
- All material for stringing is in place
  - Will use Mo wire(*) for most of the sense wires (21), W-Rh for a few others for comparison
  - Stringing will start next week

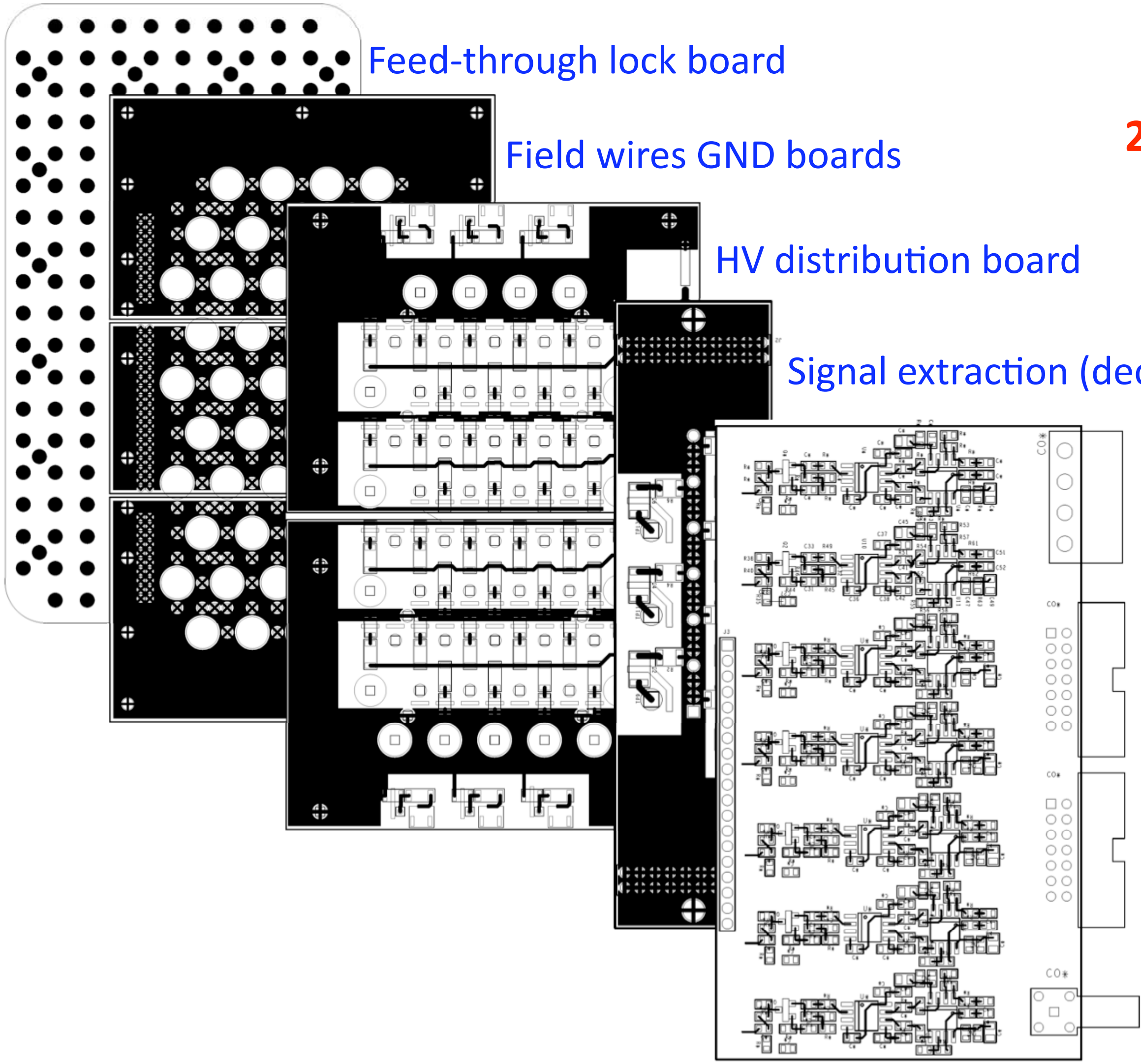


(*) Molybdenum wire has lower resistivity (less signal distortion for C.C.) and lower density (effective X_0(gas+wires) 12% bigger)

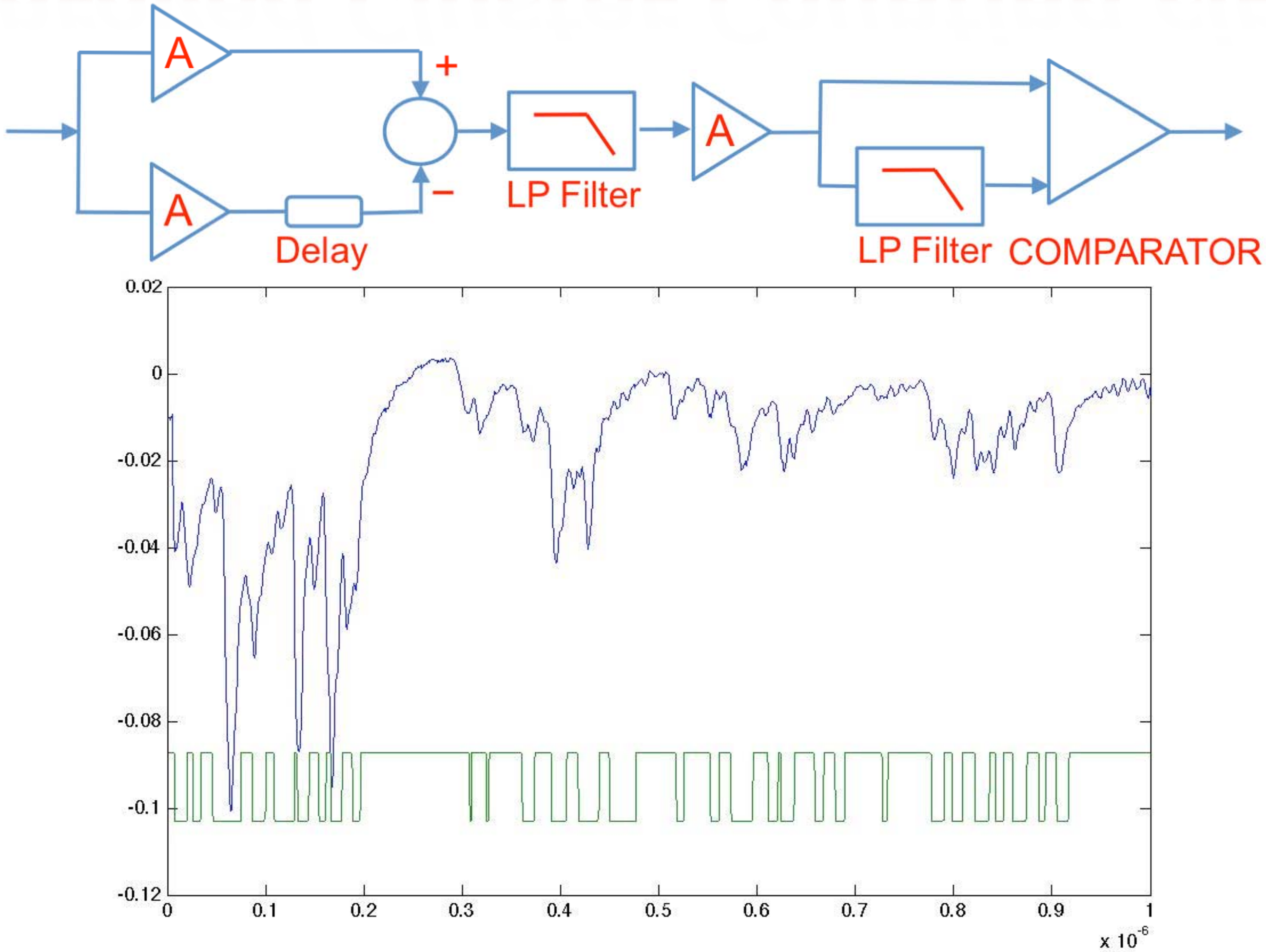
FEE Boards for DCH prototype2

G. Felici

28 channels



Improved Cluster Counting circuit



- HW implementation of more sophisticated peak-finding algorithm will be implemented on Proto2

Summary

- Good progress in simulation of background rates in the DCH
- First interesting results on cluster counting from experimental setups and simulation
  - counting efficiency limited by minimum detectable cluster separation (HW & peak detection algorithm)
  - estimate resolving power with simulation next weeks
- More accurate exp. studies soon possible with full-length prototype