1st DCH parallel session

Introductory remarks

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Welcome to our new collaborators!

- D. Asner, G. Tatishvili - Carleton University
- M. Roney, J. Franta - University of Victoria

SuperB TDR timeline

- We need to converge on the design of the SuperB *Central Tracker*
- TDR time scale:
  - End 2009 for a preliminary version
  - End 2010 for the complete document
- While in principle not *every technical decision* need be frozen in the TDR yet, we should converge as soon as possible on a definite design (or on a small set of proposals)

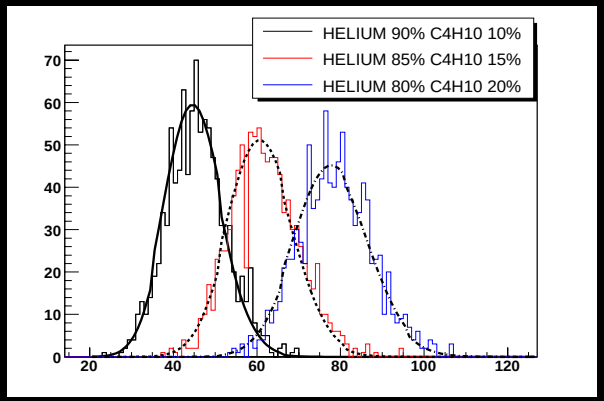
The time for choices has come

- Baseline SuperB main tracker is a *single cell drift chamber* (SC DCH) à la *BABAR*
  - result of optimization for physics at the Y(4S), and a success story
- Other options on the table?
  - TPC (trigger issue)
  - SC DCH with *cluster counting*
  - Both with promises of better performances, and of generating heavy load on DAQ system
    - Need to evaluate the real benefit of e.g. 50μm spatial resolution, or 3% “dE/dx” resolution (see next slide)

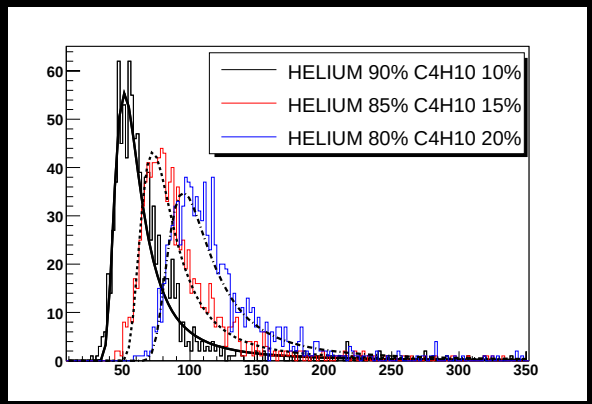
Cluster Counting

G. Chiodini, LE - CluCOU
Feb 2008

- Poisson statistics from counting would allow substantially better PID performances than dE/dx with conventional truncated mean (3% vs 7% resolution)
- Use of all clusters (as opposed to only 1st one) in the time measurement would allow spatial resolutions O(50μm)
  - Would that be useful in SuperB? (multiple scattering)
- This method generates huge amount of data (2Gsample/s, 6-7bit)
  - feature extraction capabilities badly needed
- Slow gas velocity needed
  - we are seeking faster mixtures instead

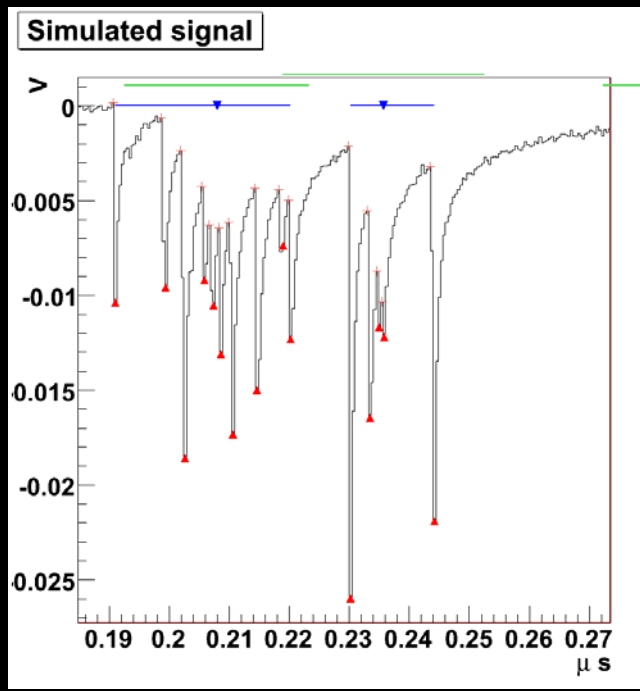


Poisson ionization statistics of clusters



Landau ionization statistics of electrons

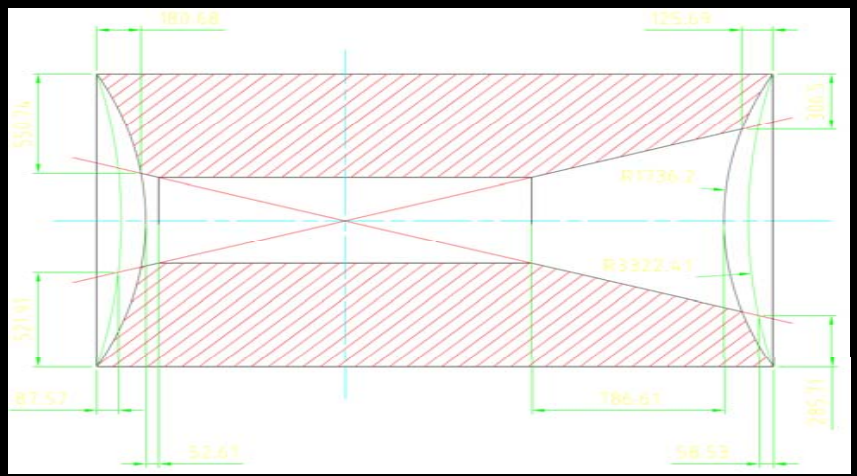
G. Finocchiaro



Peak finder after FE

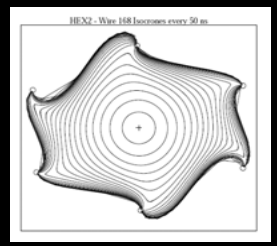
DCH Mechanical Structure

- Preliminary “pre-design” of Carbon Fiber endplates seem to provide adequate stiffness (~ O(1mm) max. deformation) with thickness O(few% of X_0).
  - *Compare with 15%X_0 in BABAR*
- This with endplate shape either
  - *spherical* (à la KLOE) or
  - *sperical+conical* (to reduce forward occupancy)
    - “amplification quencher” an alternative to tapered shape

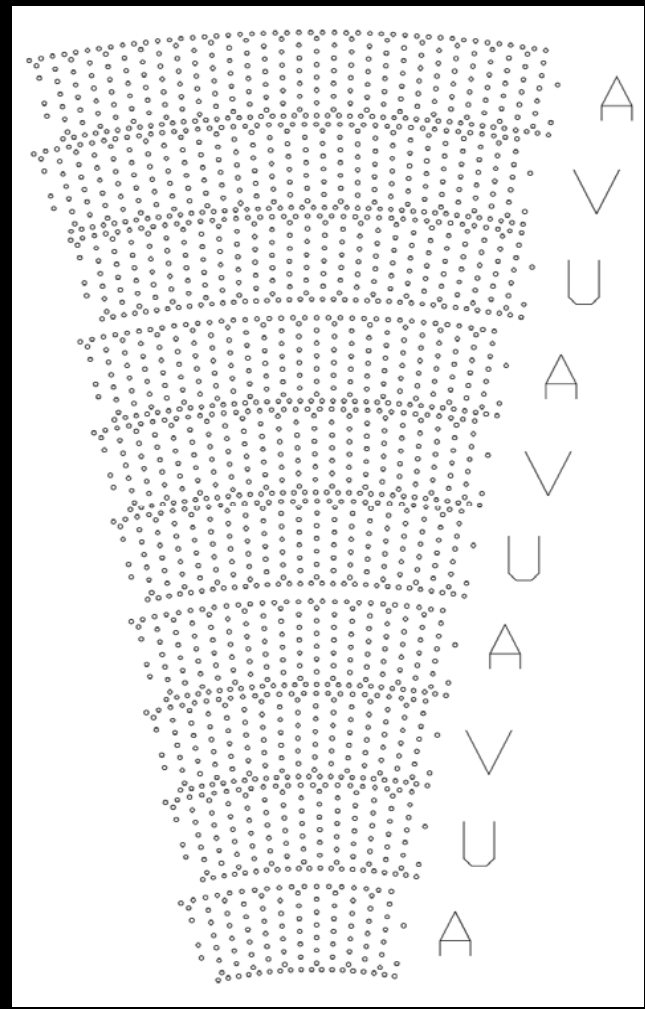


Cell geometry

- *BABAR* has 40 layers of hexagonal cells (2:1 field-to-sense wire ratio), in 10 A-U-V superlayers (SL)

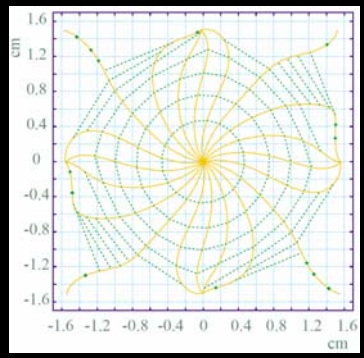


- Can the packing be optimized?
  - 2:1 ratio rather efficient already (e.g., KLOE/CLEO-c square cells with 3:1 ratio)
  - However:
    - 2:1 ratio implies ***thicker field wires***
    - SL structure implies ***guard/clearing wires***
    - The *BABAR* DCH with (7,000 channels) has 27,000 wires (3:1 effective ratio) and same wire load (~3.5 tons) as the KLOE DCH (12,000 sense, 52,000 wires total)

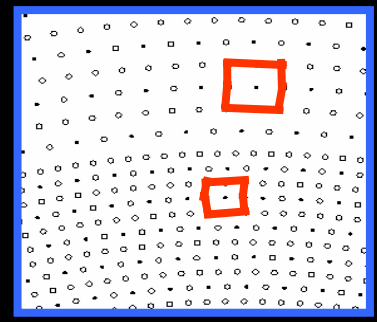


Cell geometry (cont.)

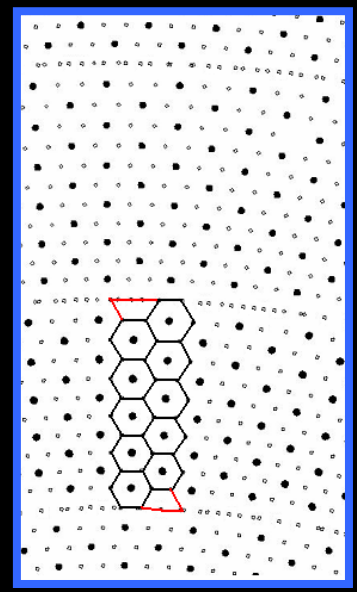
- With only stereo layers, could remove separation among SL
- For fixed cell height, could pack ~6 more active layers
  - ~8% better spatial and dE/dx resolution, all the rest being the same - why not?
- Stereo-only layers could be obtained e.g. with square cell structure



  - for triggering, U-V *superlayers* could be preferable than alternate *U-V layers*
- Same purpose served by hex cells with vertices along the layer
- Tracking without axial layers is clearly possible
  - Need to evaluate if stereo-only pattern recognition/ tracking/trigger add complications which outweight the benefits of having more measurement samples



KLOE square “small” and “big” cell structure with alternating stero layers



Hexagonal cell structure with alternating stero superlayers

G. Finocchiaro

DCH Meetings

- In order to acquire and maintain momentum in our work for the TDR, I propose to set up regular meetings where to discuss issues and present progress.
- Proposed date: every second Monday at 8:00am SLAC time