

Hall A collaboration meeting

June 23rd, 2005

Hall A Detector Status

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Outline

- ★ Status of the detector in High Resolution Spectrometers and some plans of development
- ★ Detector configurations for MAD
- ★ BigBite for electrons in GEN and SDIS
- ★ BigHand for neutrons in GEN and PQE
- ★ BigCal for electrons, photons, and π^0
- ★ Special detectors of DVCS, SRC, DEMC
- ★ Super BigBite

HRS detectors

- VDCs - work well as before, a new amplifier card under development by Chris Cuevas
- S0, S1 are operational as before
- S2m - new TDCs (F1 type commissioning) - good ToF
- Gas Cer. - new windows, new PMT-XP4572Bs on L-arm
- A1/A2 - repair done, yellow blocks replaced, ESR instead of millipore - easy to put and good result
- Shower - all blocks replaced on the R-arm, will be replaced also on the L-arm ("pion rejector")
- S' - trigger scint. counters above VDC for HAPPEX
- 2 atm Gas Cerenkov under design for L-arm in kaon PID above 2.5 GeV
- Stable and very good PID of RICH (operation cost!)
- Perspective - S1m, Silicon MSD for angle/optics

HRS detectors - S2m (Feuerbach)

http://www.jlab.org/~adaq/halog/html/0506_archive/050619171814.html

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User name Markowitz

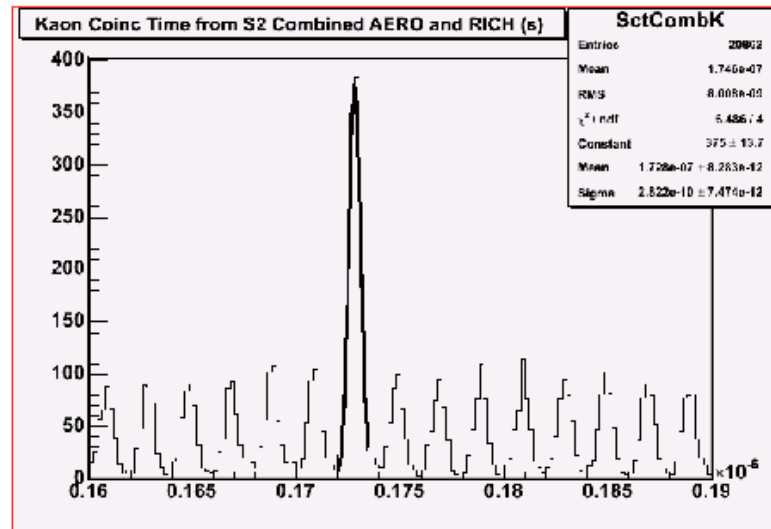
Log entry time 17:18:14 on June 19, 2005

Entry number 146626

keyword=Kaon coincidence timing

coincidence timing for kaons, using the RICH and A1/A2 combo shows very clean spectra, with a narrow TOF peak as well.

Figure 1



HRS detectors - A1/A2, repair results

http://www.jlab.org/~adaq/halog/html/0506_archive/050609233925.html

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User name cusanno

Log entry time 23:39:25 on June 09, 2005

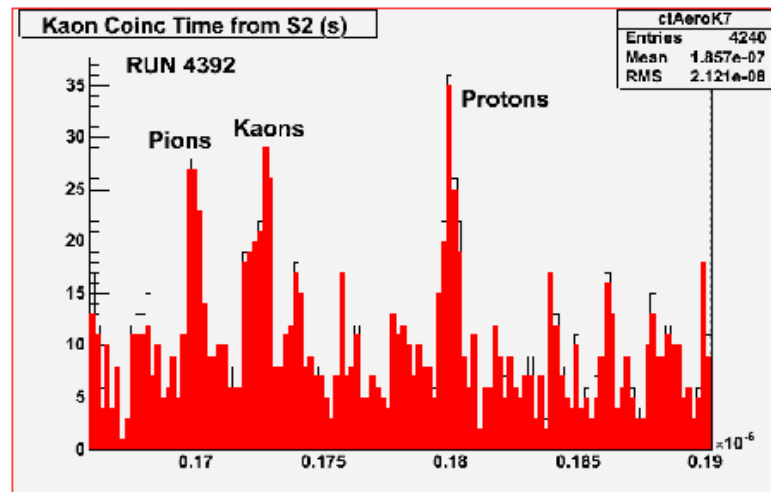
Entry number 145692

This entry is a followup to: [145579](#)

keyword=T7 efficiency and Kaon Identification (no RICH)

I cross checked T7 in his physics interest. The plot shows super-imposition of Coincidence Time when tight kaon selection is applied on A1 and A2. The white histo is T5, the red histo is T7. It shows that the kaon efficiency is almost 100%. The plot shows that Coincidence Time and A1 and A2 are performing perfectly, kaon identification is clear. Unfortunately pions contamination in randoms is still present, as expected with RICH off.

Figure 1



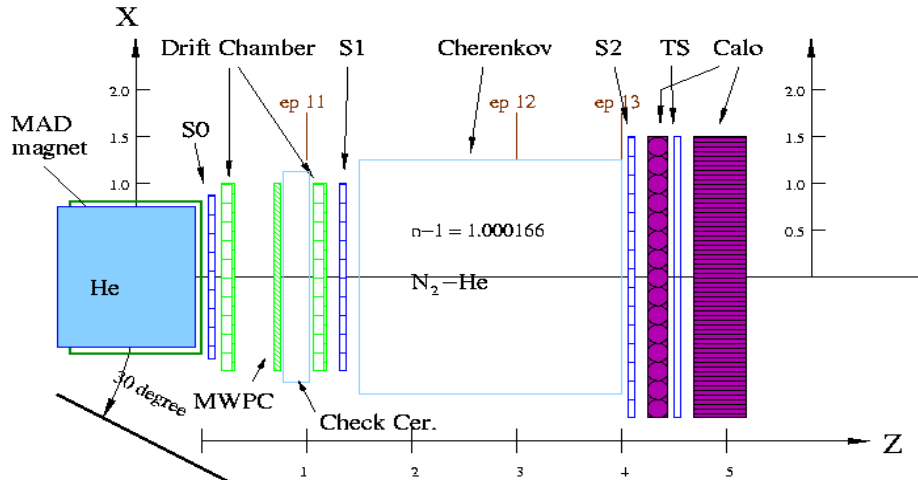
HRS detectors - 2 atm Gas Cerenkov

(Feuerbach + ANL)

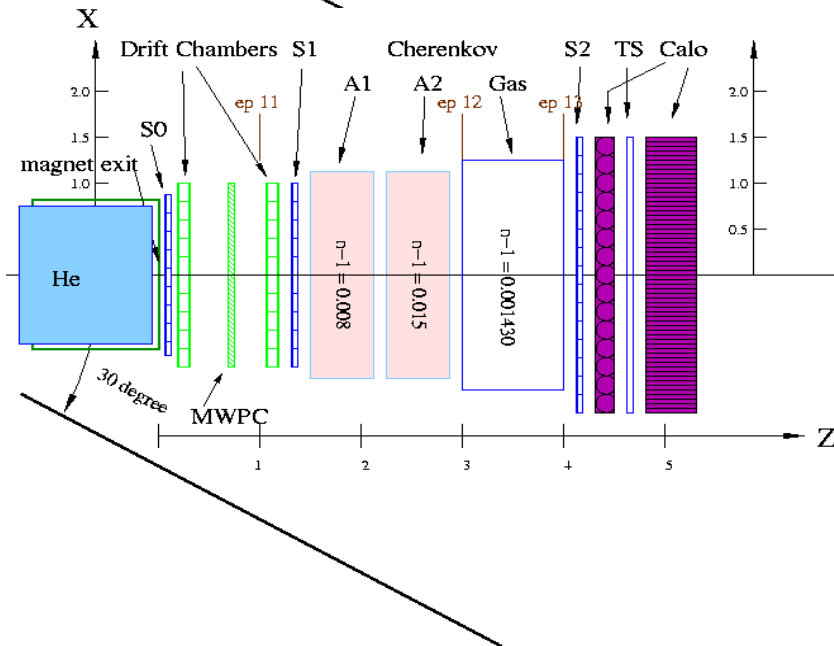
Purpose: separate pions from Kaon for $P > 2.6$ GeV/c.

- Modify existing Gas Cerenkov, reinforcing the box and replacing windows and PMT housing to handle 2atm (1atm differential pressure) of C_4F_{10} .
- Expect average >10 pe for a 2.5 GeV/c pion in the short Cerenkov, pressurized to 1.6atm.
- PMTs isolated from inner (pressurized) chamber, to permit servicing while under pressure.
- Estimated cost is \$37,000.
- Schedule: parts ordered by late July, and could be assembled by the end of 2005.

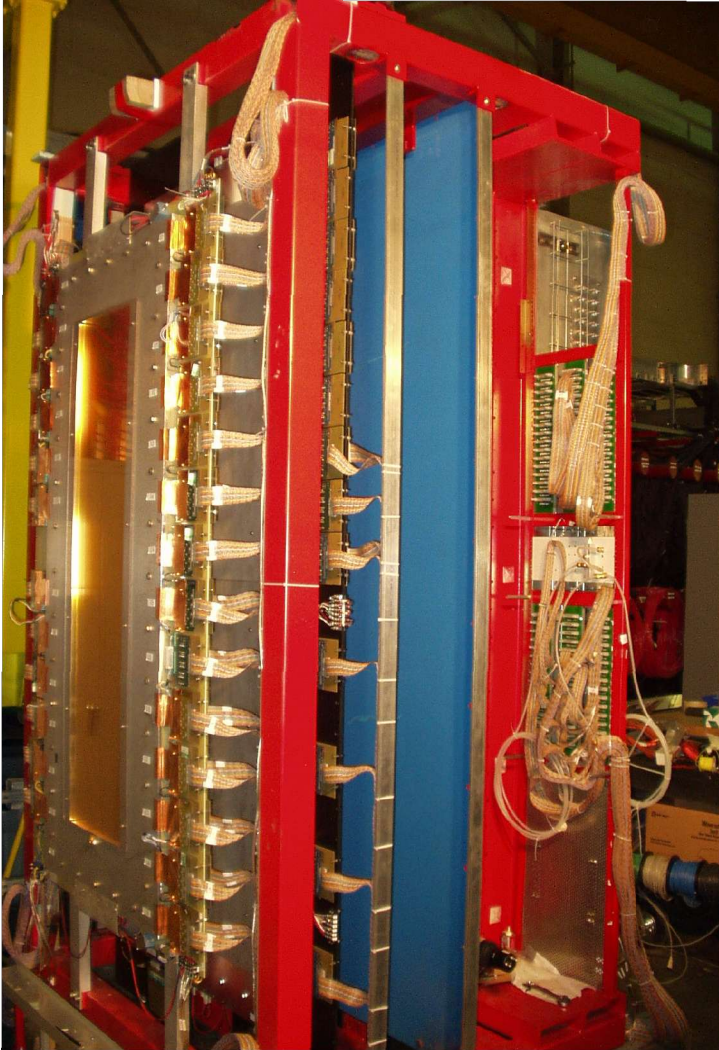
MAD detector packages



- Electron / Hadron PID configurations
- Three DC planes for high rate operation
- Shower detector from accumulated lead glass
- Timing plane protected by preshower layer
- Variable pressure/mixture Gas Cerenkov counter
- Aerogel counters with replaceable radiators
- Focal plane polarimeter
- Silicon MSD as active sieve for optics and absolute angle measurement



BigBite detector for electrons



- 96msr for a point target
- 1% momentum resolution
- 10^{37} luminosity at 50°
- Three planes of DCs - about 2500 sense wires
- Pion rejection factor of 10 in trigger -> up to 50-100 off-line
- Segmented shower and preshower -250 blocks
- Timing plane - 14 counters, protected by preshower 8.5cm l-glass
- Perspective to develop a short gas Cerenkov

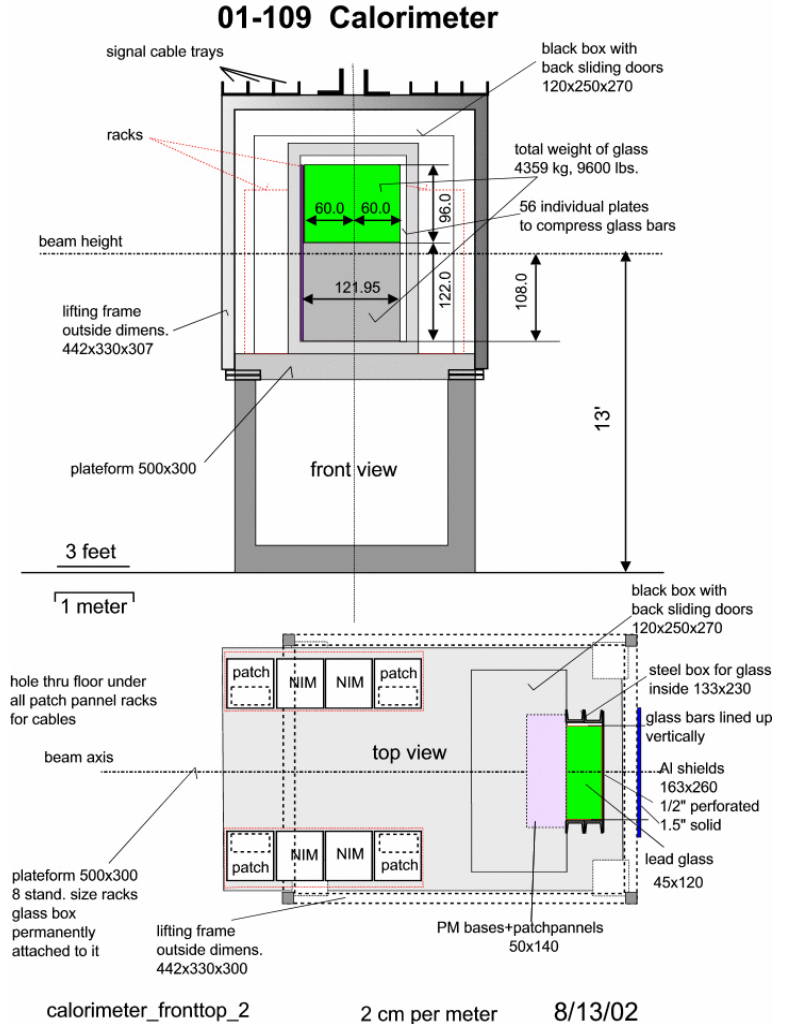
Hall A Neutron Detector - HAND



- Large number (~240) of best quality neutron bars
- Two segmented very good quality veto planes
- Module structure which allow fast installation
- Preassembled DAQ - also reduced installation time
- Optimized local shielding - mobility on the floor
- Total area of 1.6m x 4.7m with total 50cm thickness of sensitive plastic and 0.25ns time resolution

Big Calorimeter

- A joint project of two halls (A and C)
- Hall A contribution is RCS calorimeter and most of RCS electronics
- Total of 1740 lead glass blocks
- Front area of 1.2m x 2.4m
- Lead force is GEP-III collaboration
- Expected energy resolution of $5\%/\sqrt{E[\text{GeV}]}$
- Need UV for recovery after GEP-III run



● **Is BigBite a superior choice for?**

- ✓ **Polarized targets - YES**, both types ^{-3}He and NH_3 targets have $L \sim$ or $< 10^{37}$: GEN, set of SDIS exp., transversity, spin-duality ...
- ✓ **Deuteron EMC - YES**, luminosity is limited by neutron detector to $< 10^{36}$
- ✓ **Pion structure - YES**, need "spectator" neutron
- ✓ **High Q^2 DVCS - YES**, luminosity is limited by recoil proton detector to 10^{37} , but $Q^2 \sim 5 \text{ GeV}^2$
- ✓ **u/d from $T/^{-3}\text{He}(e, e')$ - YES**, luminosity of tritium target is limited by safety considerations
- ✓ **Pentaquark -YES**, kaon decay fast - need special spectrometer, large solid angle, luminosity is limited by neutron detector
- ✓ **ChPT test -YES**, solid angle with simple optics in one settings

***A long list of very good experiments
will be done with BigBite!***

Specialized detectors

- DVCS collaboration had develop and construct a high resolution calorimeter, a recoil proton array, and a neutron veto array
- SRC collaboration had develop and construct a scintillator tracker in BigBite and a neutron detector for the medium energy range
- Deuteron EMC proposers are developing a liquid scintillator array for low energy neutrons
- PQE (E05-009) are developing kaon PID in BigBite

Summary

- To keep readiness of HRS detectors cost to Hall A about \$150k per year - PMTs, electronics, repair ...
- All detectors of specific experiment are based on collaboration efforts, equipment often available after experiment - but transition of know-how and support of operation is much more complicated subject than many are expecting
- Space for preparation and storage of the large systems like BigCal, BigBite, and BigHand is a HUGE PROBLEM
- Super BigBite - large aperture dipole spectrometer like BigBite, with three times larger field integral. It is the best way to do experiments with both ^3He and $\text{NH}_3(\text{D}_3)$ polarized targets!