E01015: Short Range Correlations

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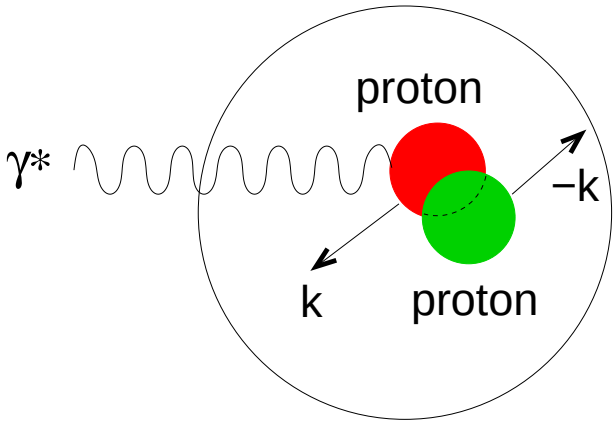
- Experiment overview
- Experimental equipment
- Data taking
- HRS analysis
- Neutron Detector calibration
- Bigbite calibration
- Online results
- Future tasks

Hall A Collaboration Meeting

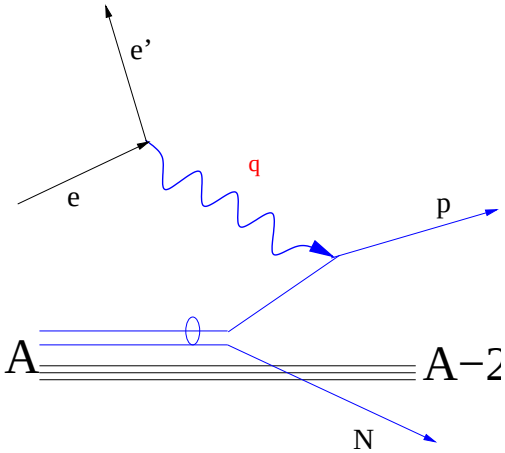
June 23, 2005

Experiment overview

- Short range correlations in nuclei occur when two nucleon wave-functions overlap

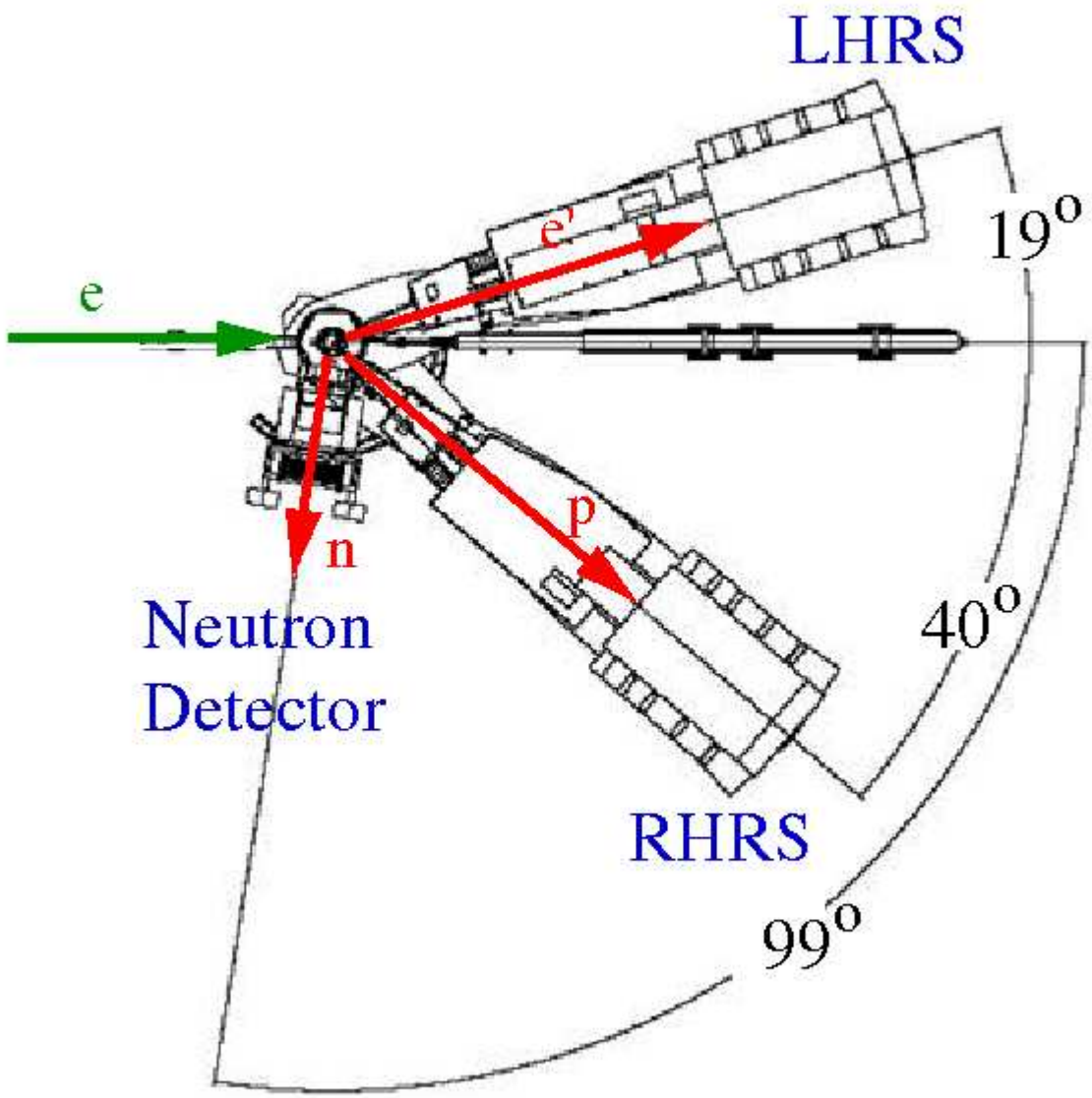


- $x_B > 1$ and $Q^2 = 2$ GeV^2, minimize FSI, MEC



Triple coincidence

- $E_i = 4.6$ GeV, $E' = 3.762$ GeV, $p_p = 1.450$ GeV/c



- Recoil nucleon in Bigbite or Neutron Detector 300-600 MeV/c sign of SRC.

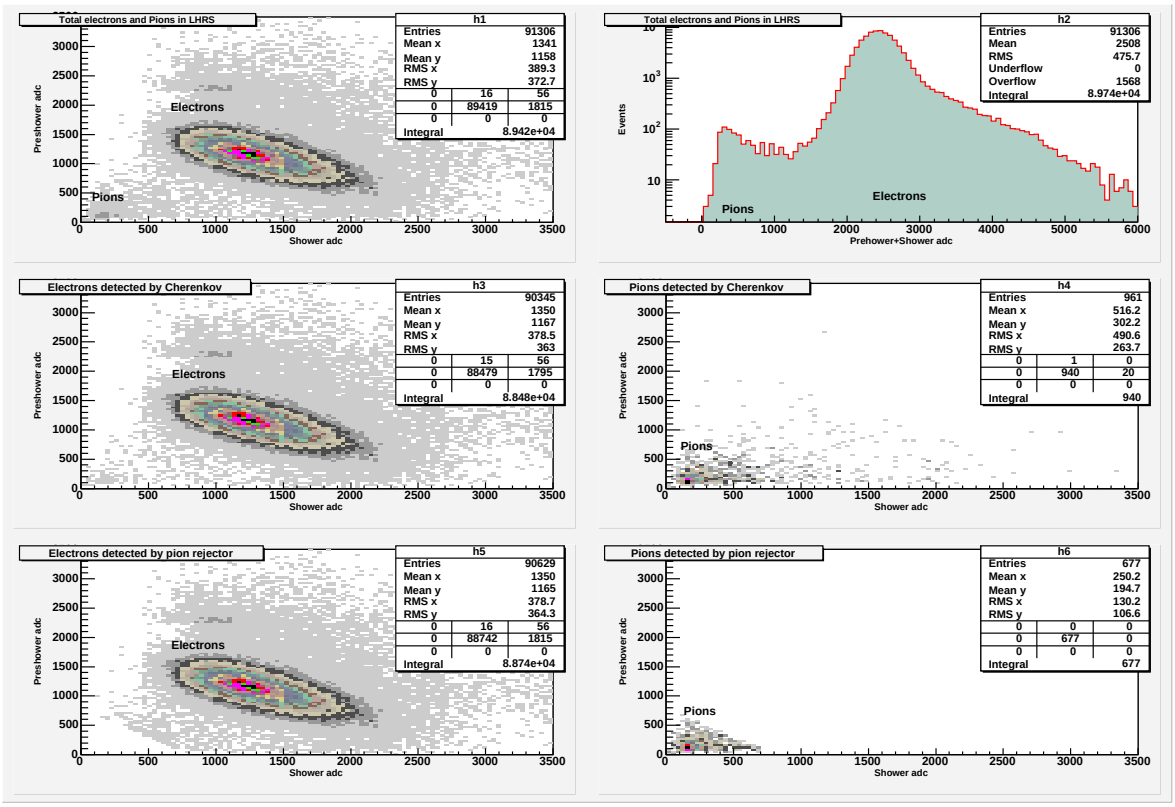
Data taking

- Two run periods: January 10 - January 31 and March 9 - April 12, 2005
- Very good performance of Bigbite and Neutron Detector
- 1-pass: calibration of BB, using $H(e, e'p)$
- 2-pass:
  - ▷ calibration of ND, using $H(e, e'p)$
  - ▷ triple coincidence using $D(e, e'pn)$ at $x_B < 1$
- 4-pass:
  - ▷ triple coincidence using $D(e, e'pn)$ at $x_B > 1$
  - ▷ production $^{12}C(e, e'pN)$
  - ▷ took several settings to improve missing momentum coverage

HRS analysis (Ramesh)

Left HRS PID

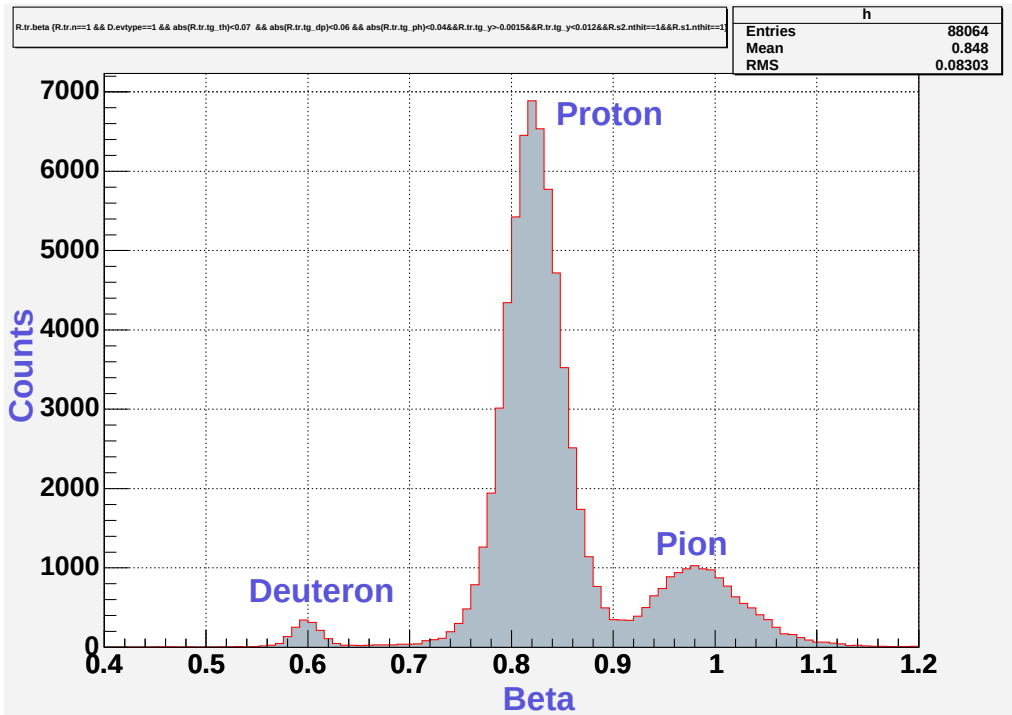
- Shower and gas Cerenkov

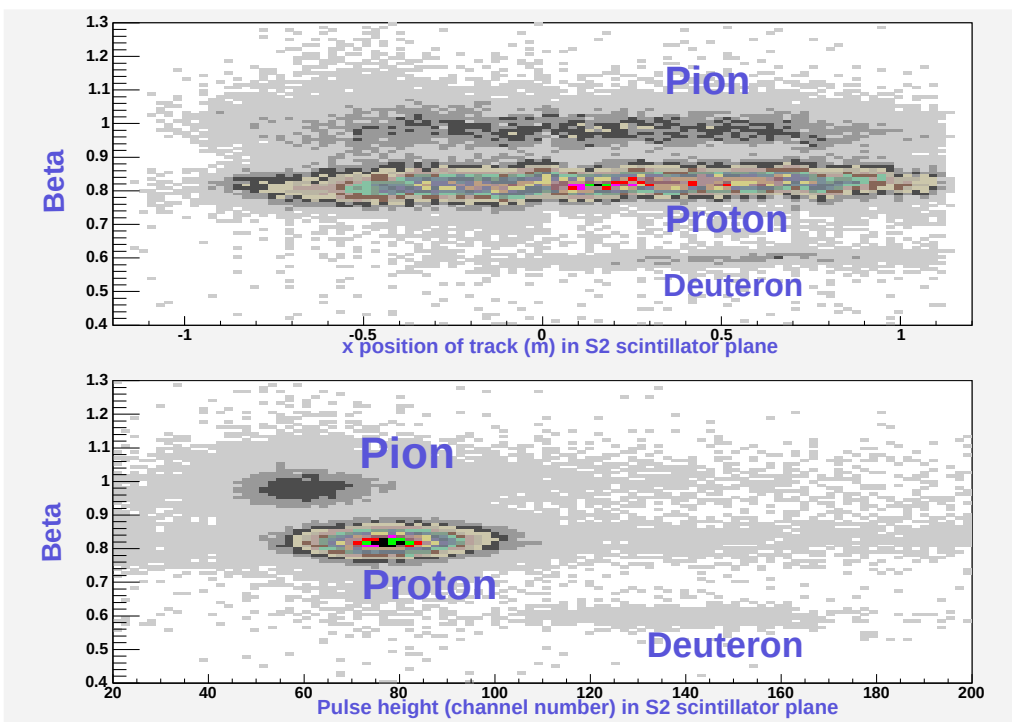


- Very good pion rejection

Right HRS PID

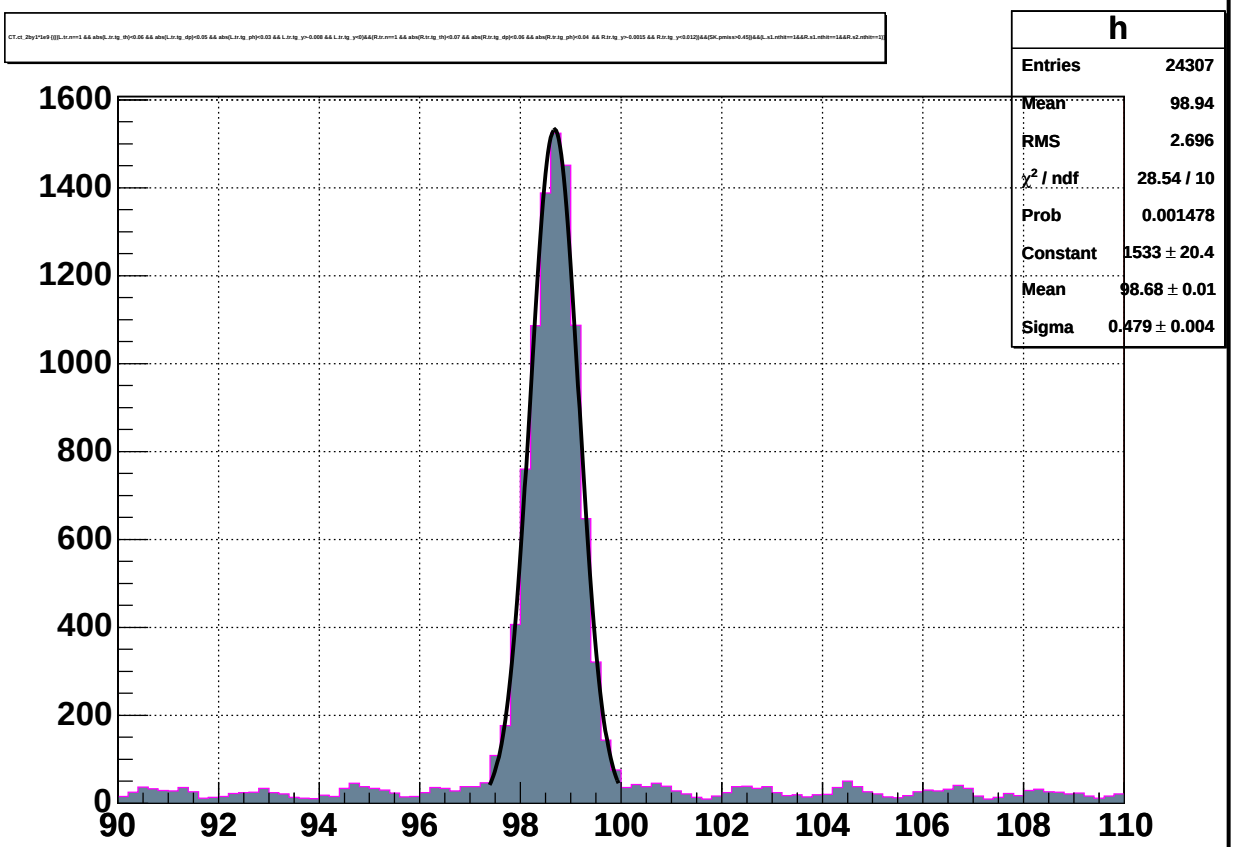
- Only S1 and S2 $\rightarrow$ time of flight





Coincidence time

- Coincidence time between Left and Right HRSs

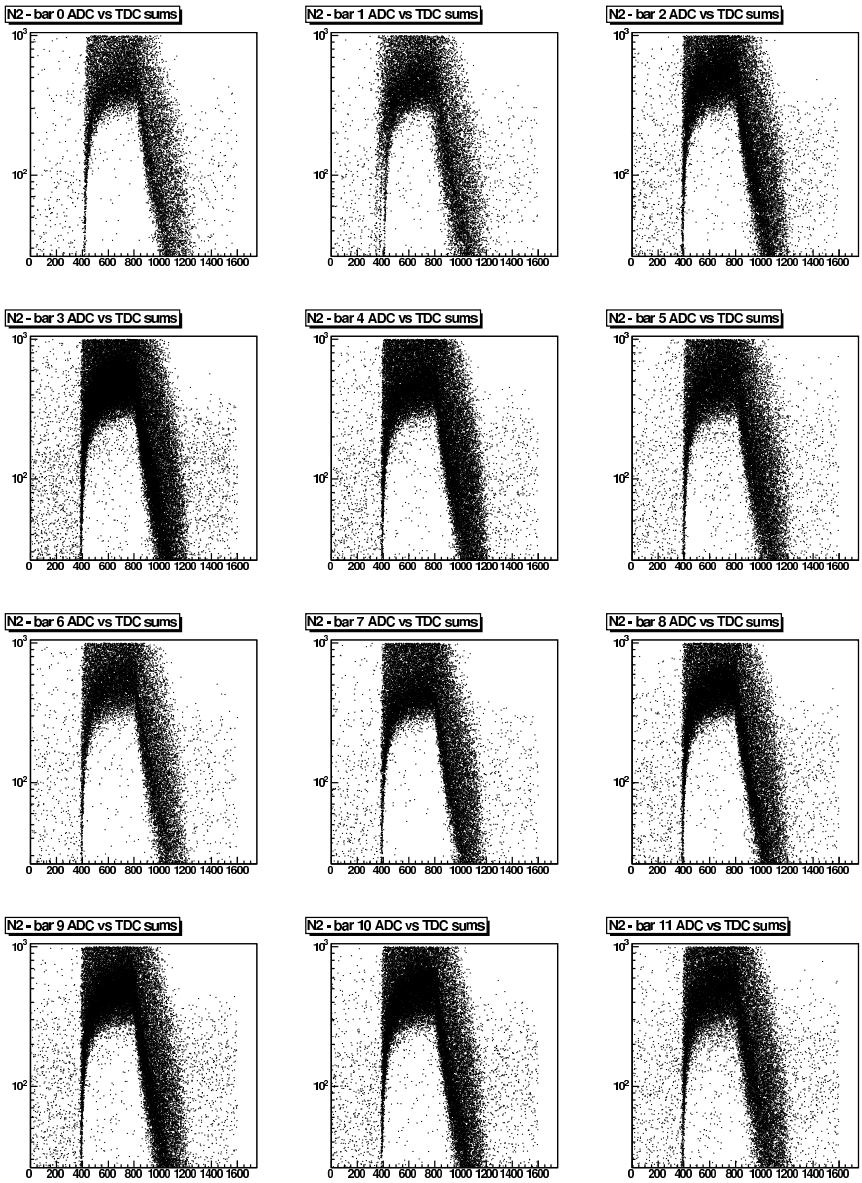


- Timing resolution of 479 ps

Neutron Detector calibration

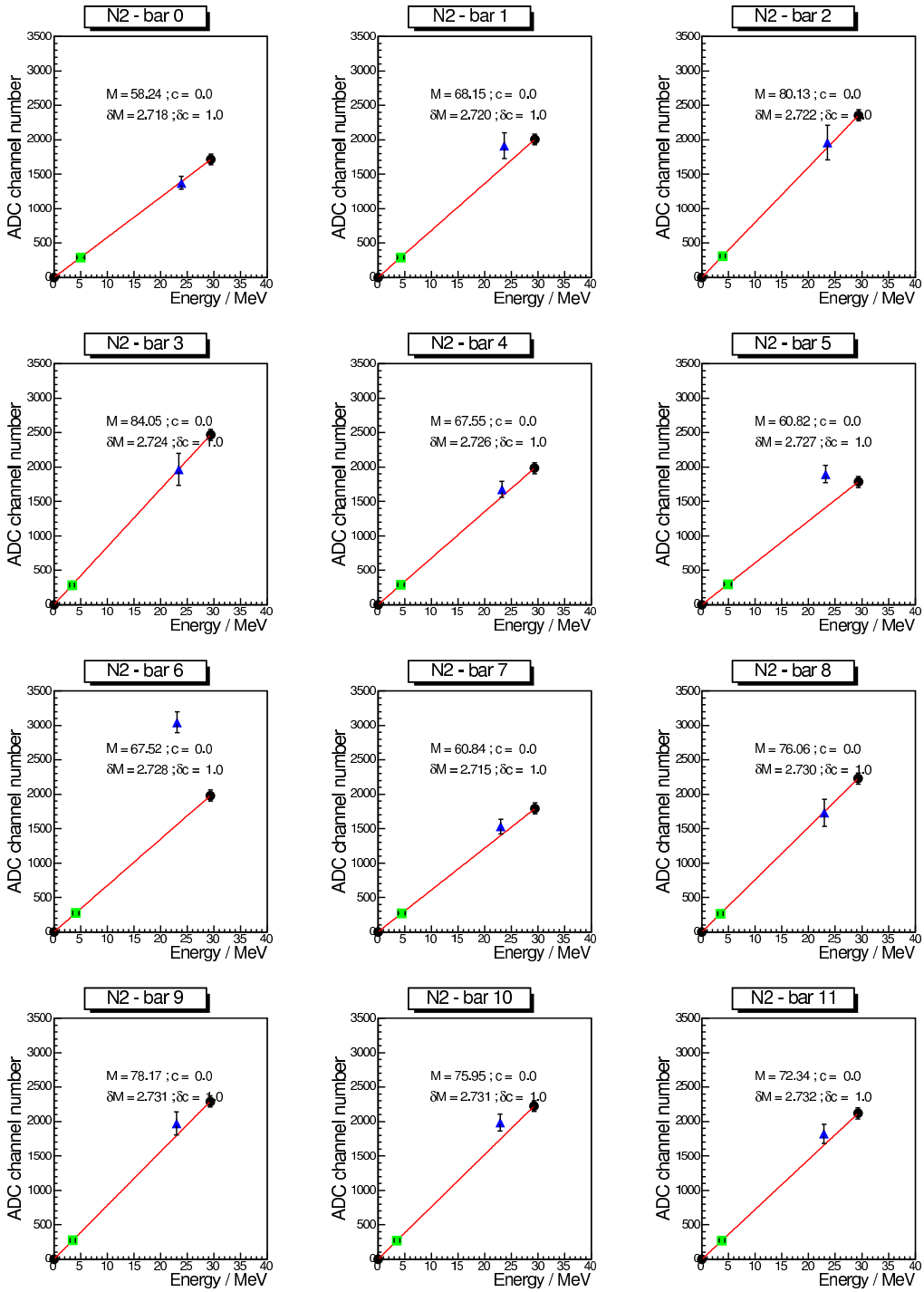
Threshold calculation (Peter)

- Essential for detection efficiency calculation
- Use Carbon data to obtain threshold in ADC channels

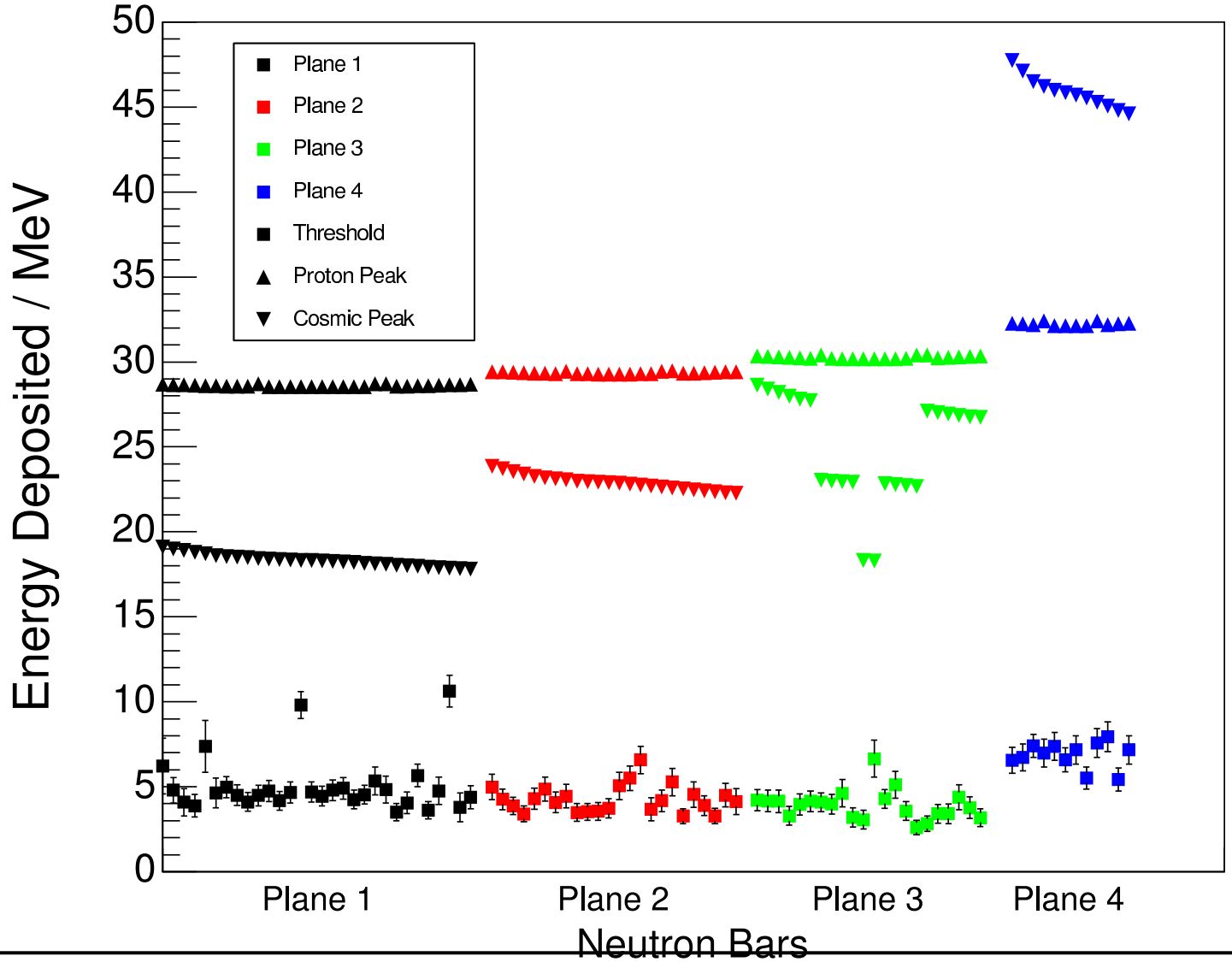


Threshold calculation

- Use proton elastic and cosmic data for ADC calibration

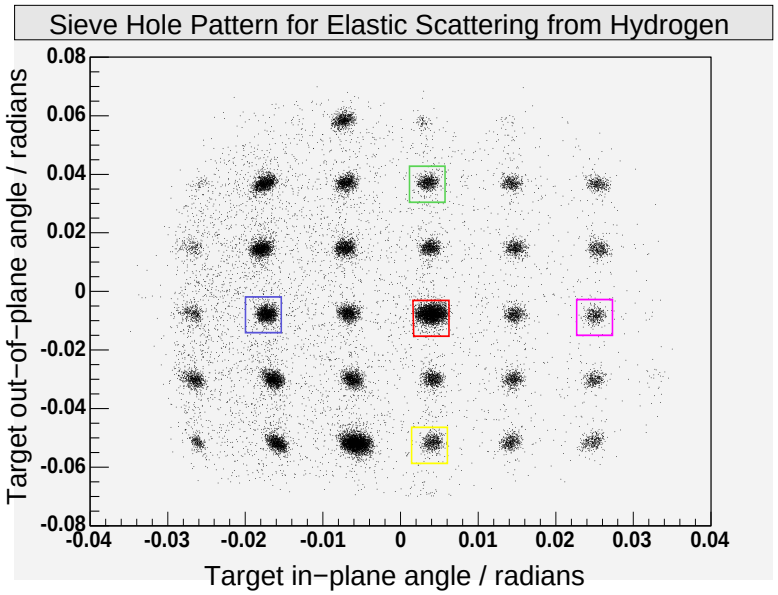


Energy deposited in each Neutron bar



BigBite calibration

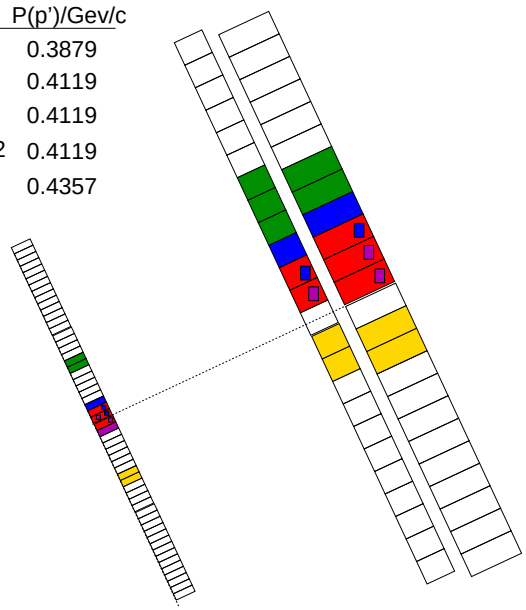
Optics (Peter)



Beam energy = 1.2037 GeV
Left HRS: P(e') = 1.1149 GeV/c
theta = 20.0
BigBite: 518 A; 0.93T; 70^0

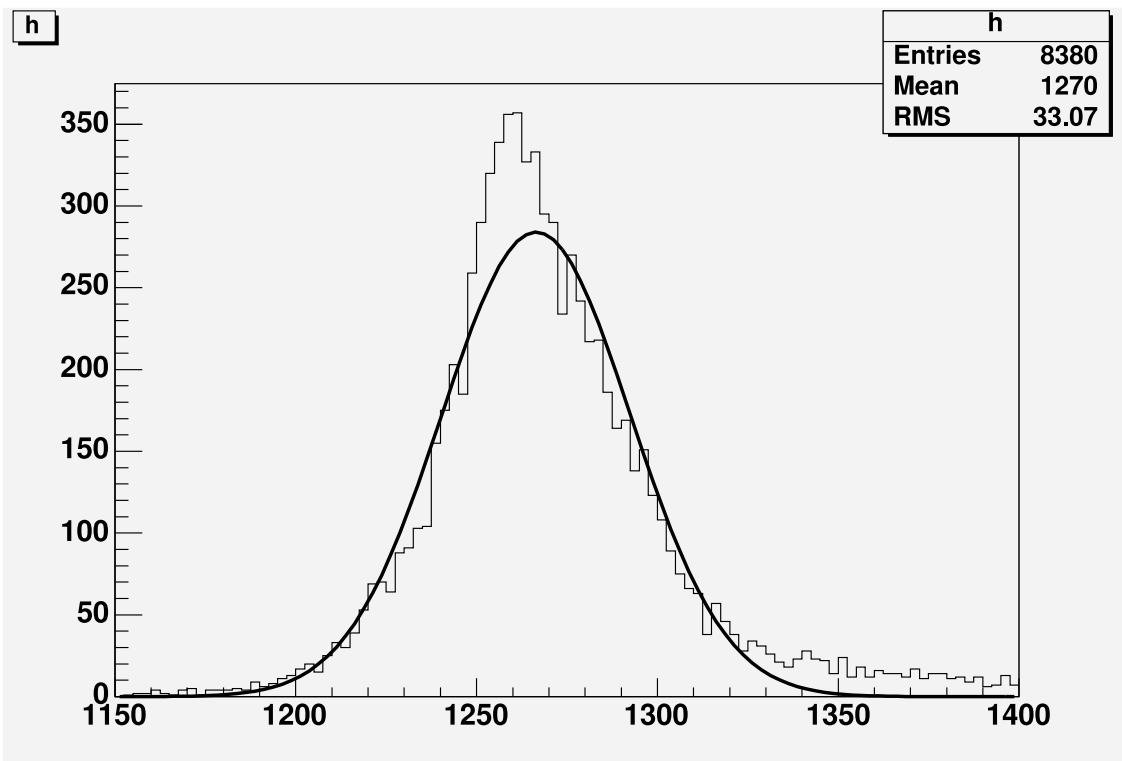
$\theta \rightarrow$ scattered electron angle
$\phi \rightarrow$ out−of−plane proton angle
$\alpha \rightarrow$ scattered proton angle (in−plane)

	θ	α	ϕ	P(p')/Gev/c
	18.79	69.307	0.0	0.3879
	20.0	68.073	0.0	0.4119
	20.0	68.073	2.42	0.4119
	20.0	68.073	−2.42	0.4119
	21.21	66.856	0.0	0.4357



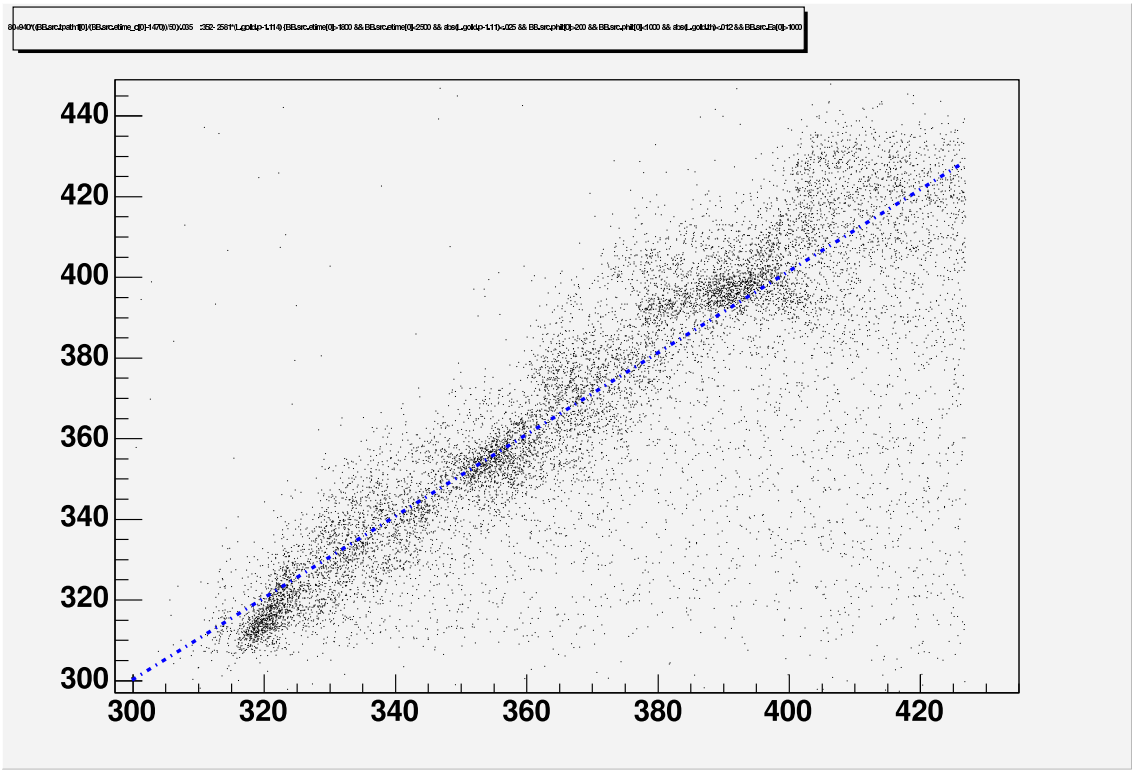
Time of flight calibration (Ran)

- Use T3 events to calculate time offsets between E and δE bars, and wrt first E bar
- After 1st pass, get 0.9ns resolution, can be improved



Time of flight / momentum calibration (Ran)

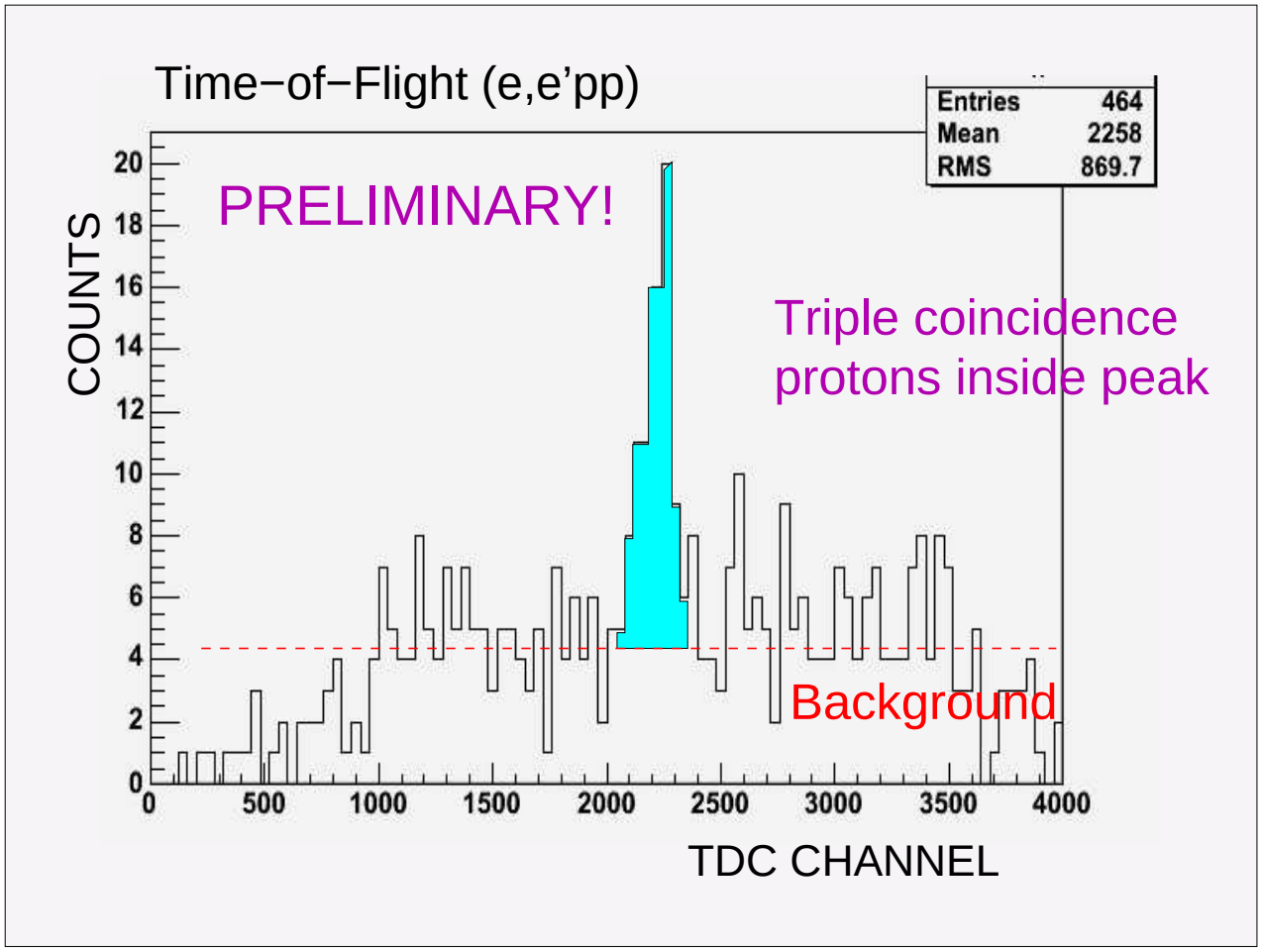
- Use elastic events to calibrate momentum from TOF vs. momentum from HRS, compensated for flight path



Online results

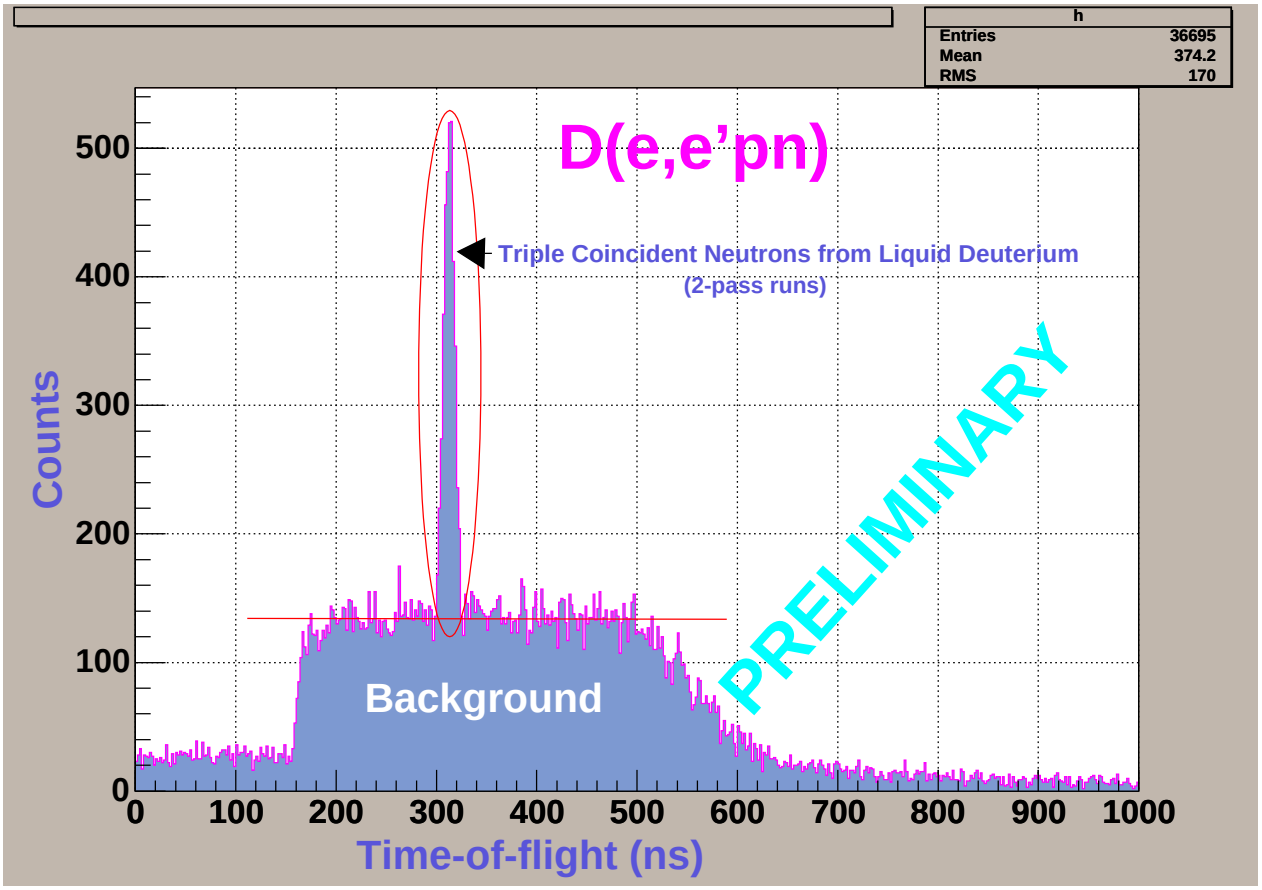
$^{12}C(e, e'pp)$

- Bigbite time of flight for high missing momentum spectrum



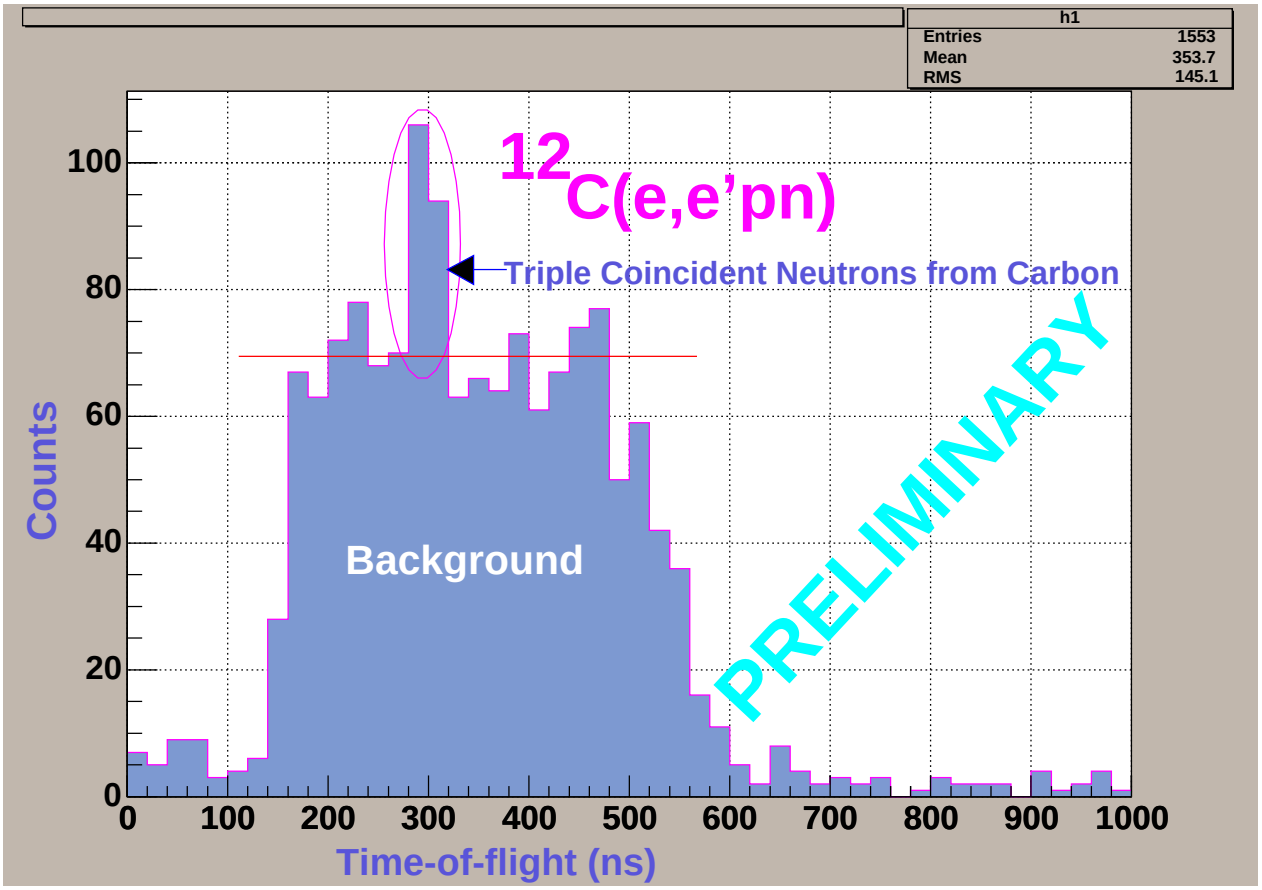
$D(e, e'pn)$

- Neutron detector time of flight for $x_B < 1$



$$^{12}C(e,e'pn)$$

- Neutron detector time of flight



Future tasks

- Finish detector calibration
- Finalize PID in Bigbite
- Refine tracking algorithm in Neutron Detector
- Extract triple coincidence counts
- Calculate triple coincidence cross sections
- Study $(e, e'p)$?
- $\cdots$