1.4.2010

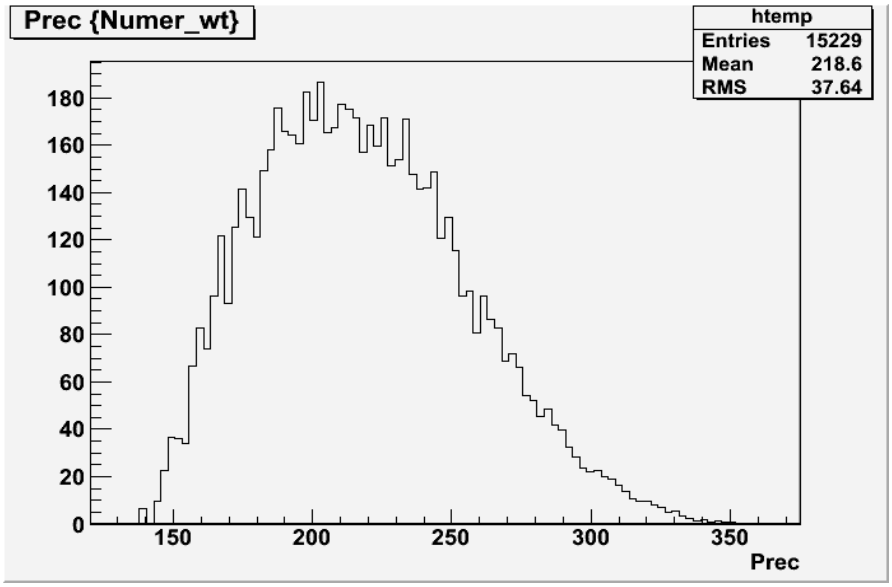
HAND commission

First calibration of HAND will be done by elastic scattering H(e,e'p) when protons detected by HAND.
In this mode the Neutron array will be located at 50 Deg and 15 meters away from the target. No lead wall.
The kinematics set for this measurement:
Incoming beam = 2262 MeV (2 pass).
Scattered electron – 1777.75 MeV, theta(e') – 27.5 Deg (Left HRS).
Scattered proton – 1069.2 MeV/c , theta(p') – -50 Deg (Neutron array (no lead wall).
BigBite at -68 Deg, magnet off.
The range of ~1 GeV/c protons (~400 MeV Kinetic Energy) is 82.81 gr/cm2 in plastic so we expecting to be able to calibrate all the layers.
At this distance we expect the full solid angle of the HAND to be shine with protons.

The second calibration will be made with neutron in order to determine the efficiency (and timing).
In this calibration we need to switch the polarity of HRS arms. This procedure can affect timing so we must be very carefully.
In this calibration we will make exclusive d(e,e'pn) measurement where the scattered neutrons are going to HAND.
BigBite will be located at -99 Deg with magnet on and detector off.
Neutron array will be located behind the BigBite and the lead wall at -99 Deg.

In the original SRC experiment the kinematics that was used:
Incoming beam: 2348.16 MeV
Scattered electron: 1883 MeV, at 17.2 Deg
Scattered proton: 980 MeV/c at - 53.9 Deg
The recoiled neutrons were detected in neutron array with momentum approx. 240 Mev/c.
The target length was 15 cm and current was about 5 μA.

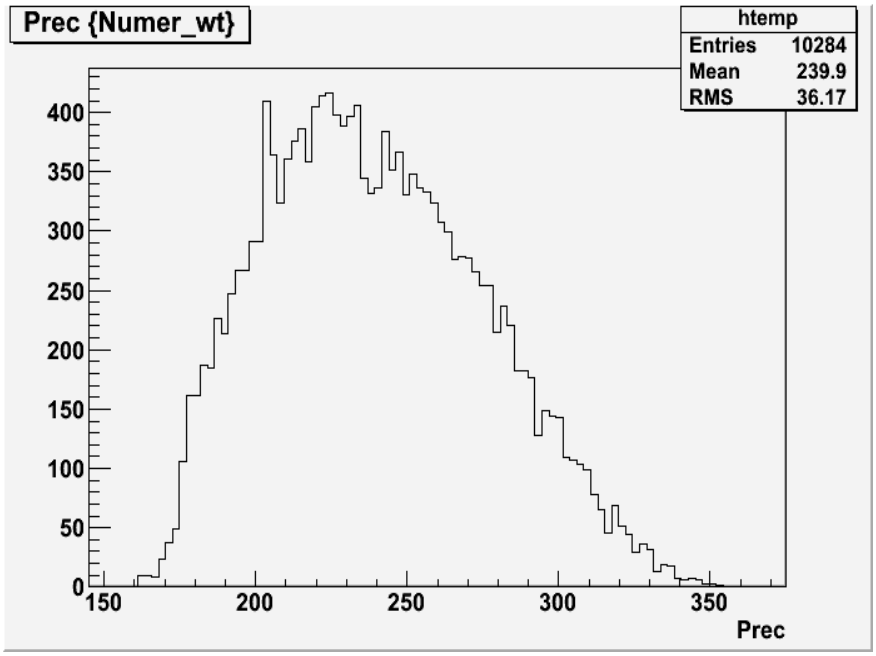
In current experiment we want to detected neutrons with higher momentum. In order to estimate the needed time for such calibration we used real data from previous SRC and MCEEP simulation.
For comparison we took 3 runs 1766, 1768, 1769 from the original SRC.
The total elapsed time was about 1.5 hours, and the accumulated charge 0.025 C.
From these data we found about 850 events with recoiled neutron.
We run MCEEP simulation in such a way that the total charge will be the same.
Original kinematics:



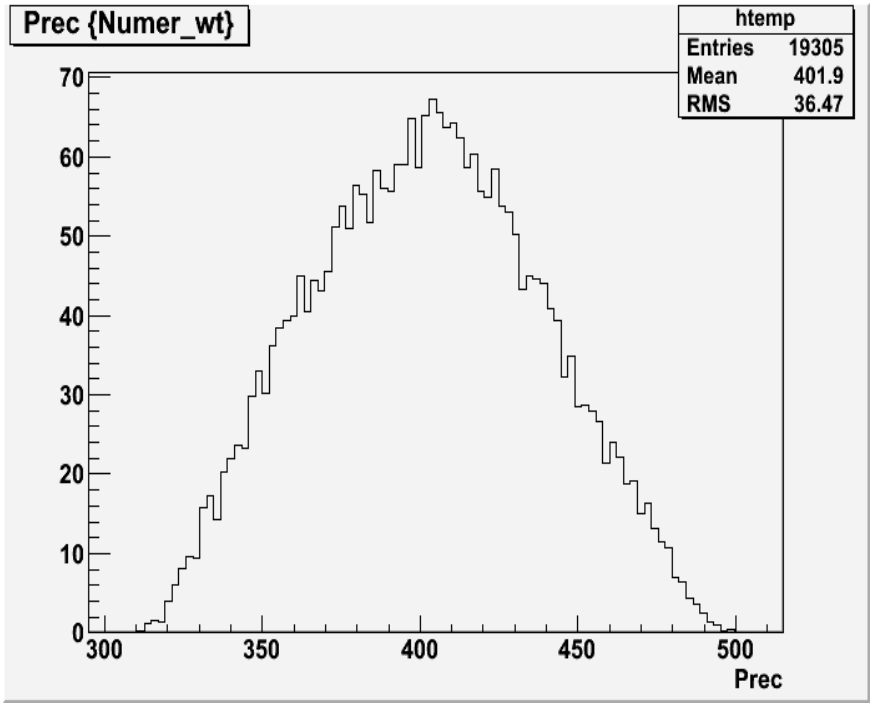
In MCEEP simulation we get approximately 6900 counts for the recoiled neutron.

Kinematics for this experiment:

for recoiled neutrons at 250 MeV/c we have approximately 10284 counts



for recoiled neutrons at 400 MeV/c we have approximately 2850 counts



From the information above we can estimate the required time for the calibration run.

Neutron momentum	MCEEP	DATA	RATE (for real data)
238 MeV/c (original SRC)	6900 Events	850 Events	550 Events/hour
250 MeV/c (new SRC)	10280 Events	*1270 Events (estimation)*	*840 Events/hour*
400 MeV/c (new SRC)	2850 Events	*351 Events (estimation)*	*230 Events/hour*

We have about 130 (88 original + HAND2) scintillator bars for the neutron array. In order to determine the efficiency for them with 10% accuracy we must have about 100 counts in each bar.
This mean that we need about 13000 events total.

We are planning to take one day beam for 250 MeV/c neutrons kinematic and one day beam for 400 MeV/c kinematic. In this way we will get:

	Events	Time	Error per bar
250 MeV/c	10080	12 hours	11.3 %
400 MeV/c	2760	12 hours	21.7 %