

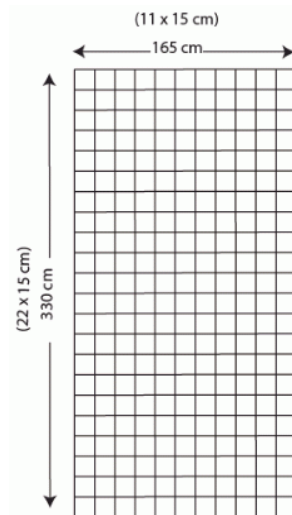
HCAL for SuperBigBite

F. BENMOKHTAR

Talk given at

The Fourth SuperBigbite Spectrometer Meeting
@Jlab

March 19th 2010@Jlab



Importance of HCAL

GEP, Gen, GMn, A1n, SIDIS, $(e, e' \phi)$, etc...

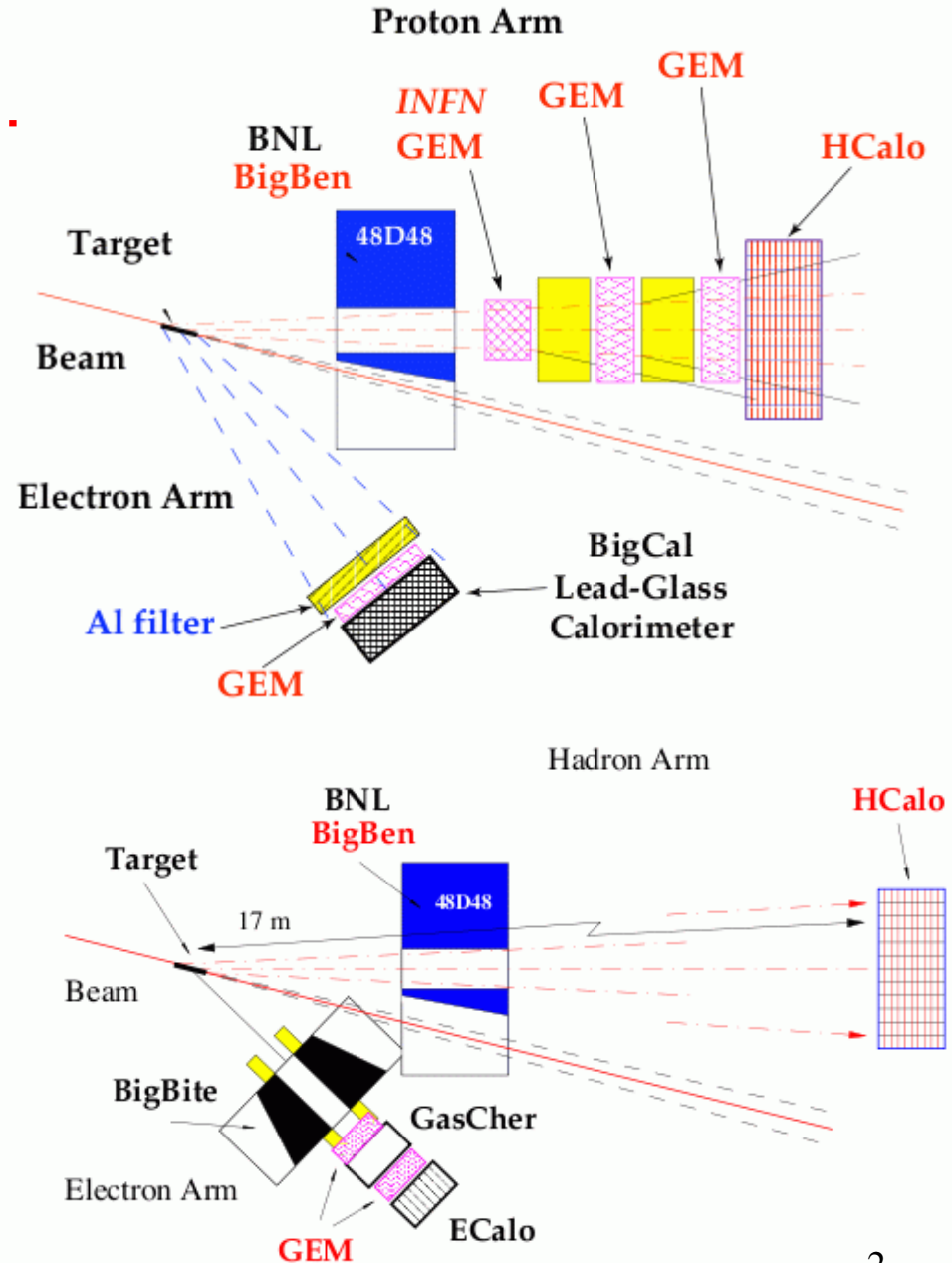
-GEP(5) Configuration

HCAL used for hadron Trigger

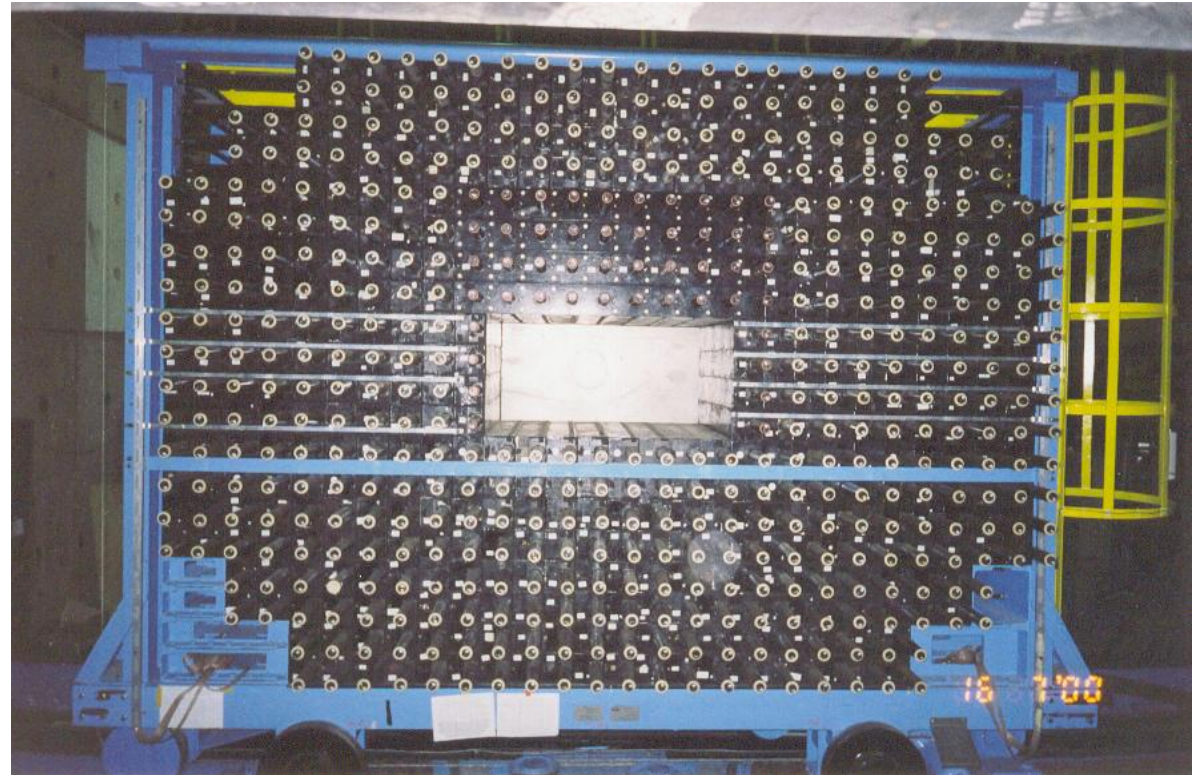
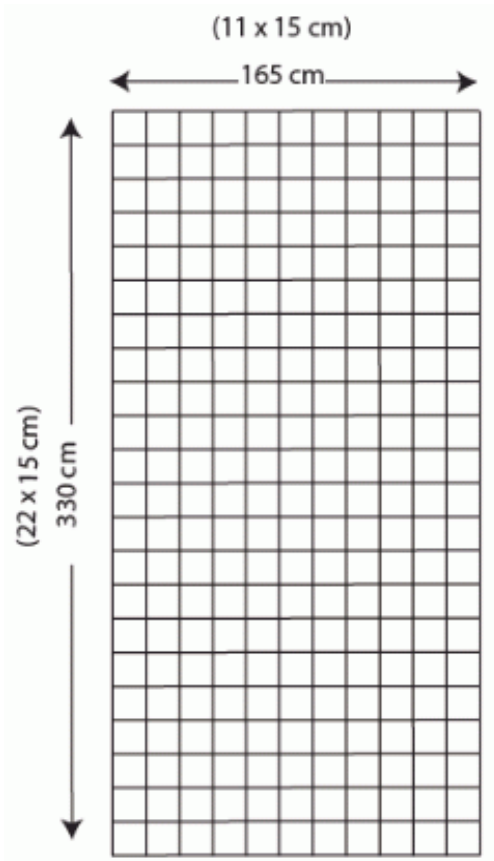
-GMn Configuration

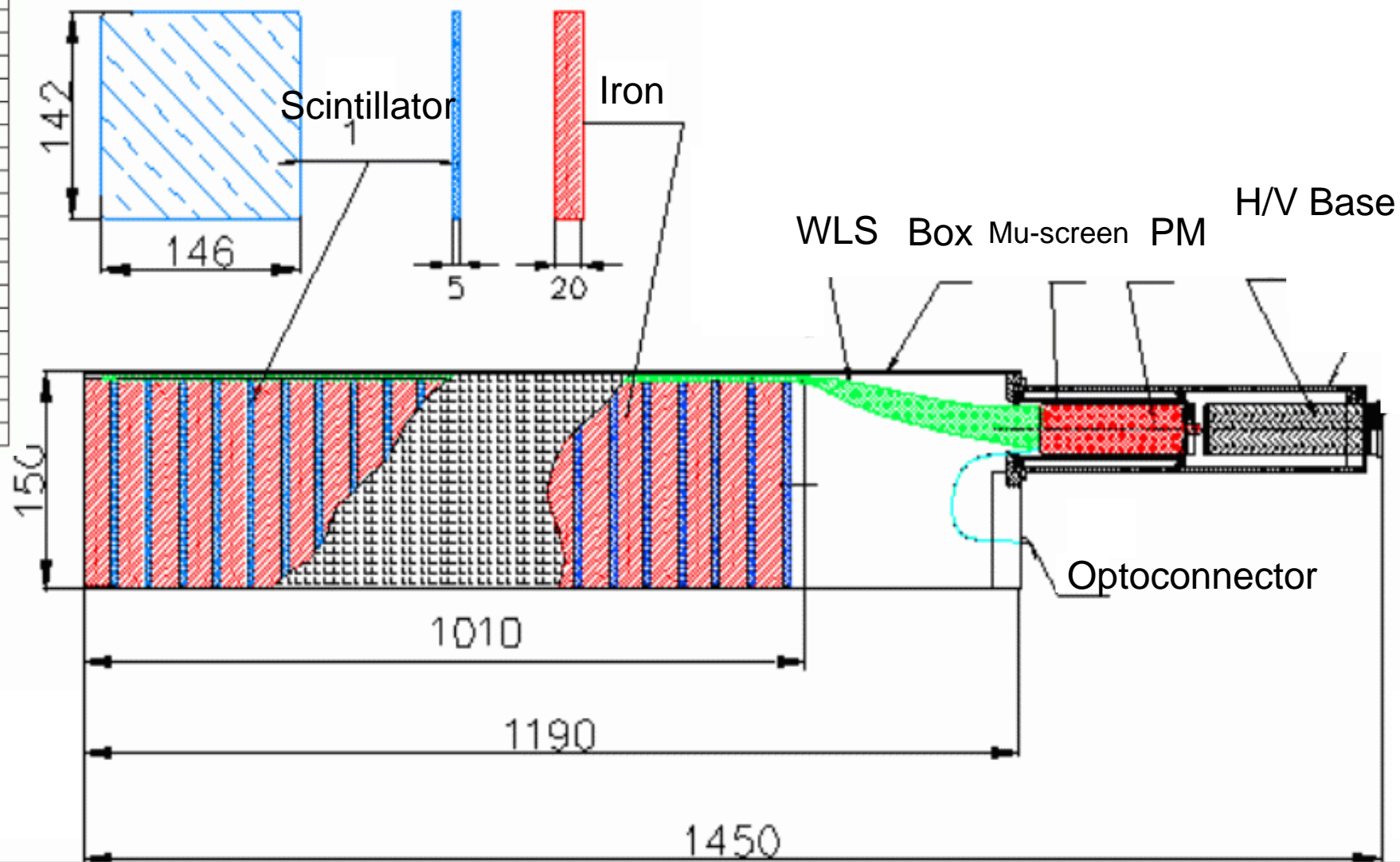
HCAL will replace BigHand for quasi-free Neutron and proton selection

Beam Time was reduced because HCAL improved the exp. cond. !



COMPASS HCAL

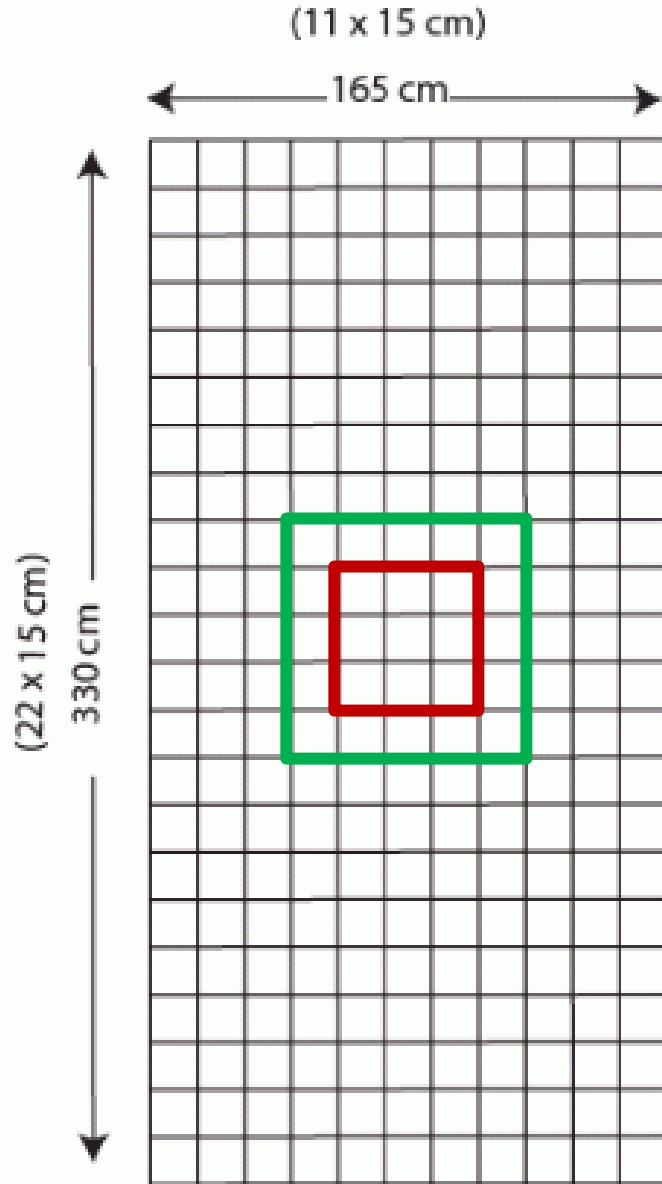




- 40 iron/scintillator layers
 - 2.0 cm iron plates
 - 0.5 cm scintillator plates
 - 14.2 cm x 14.6 cm
 - 120 cm long waveshifter readout along 1 side
 - 6 photo-electrons for min-ionizing thru one scintillator
- PMT Base with

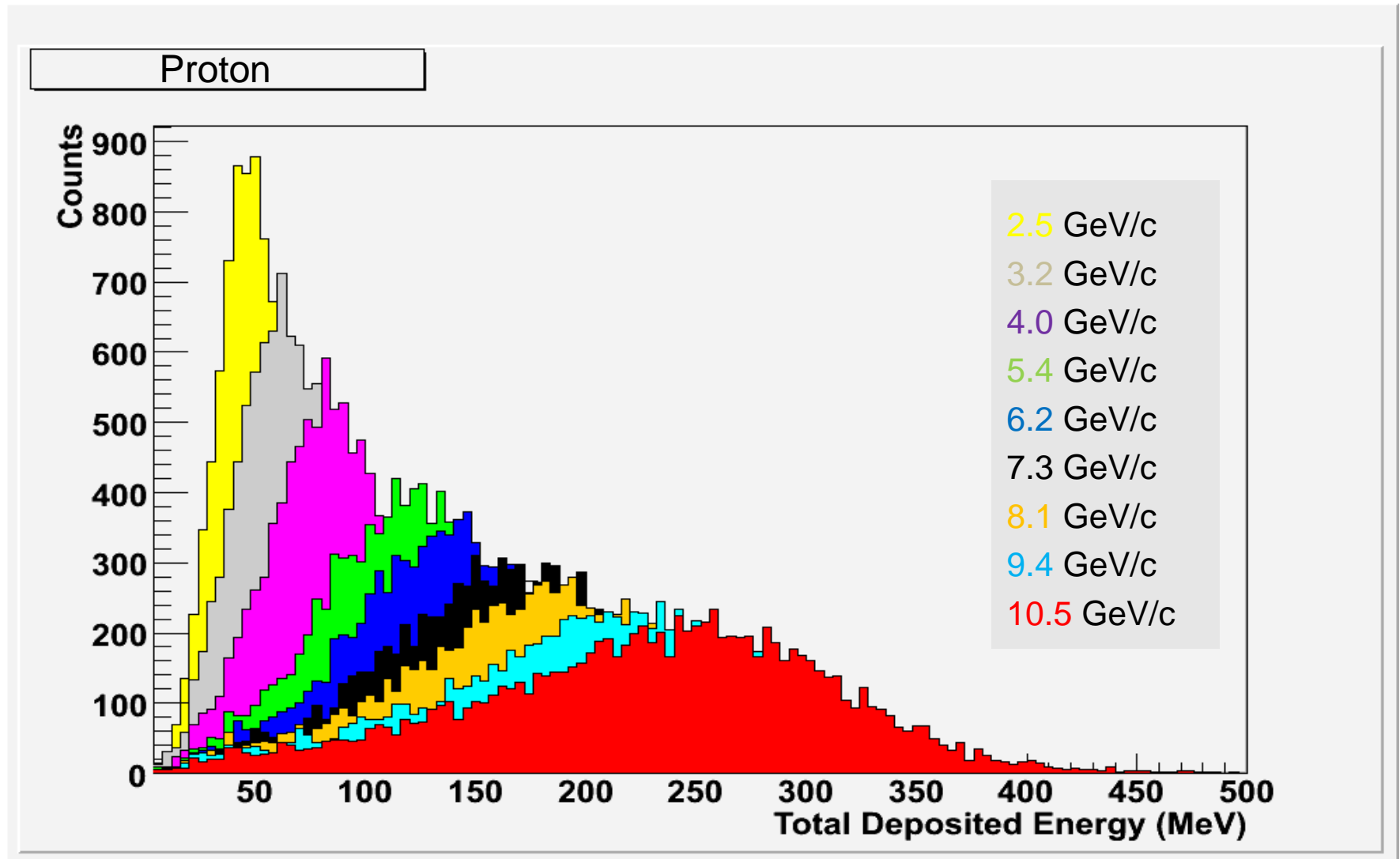
Module Construction:

Geant4 developments

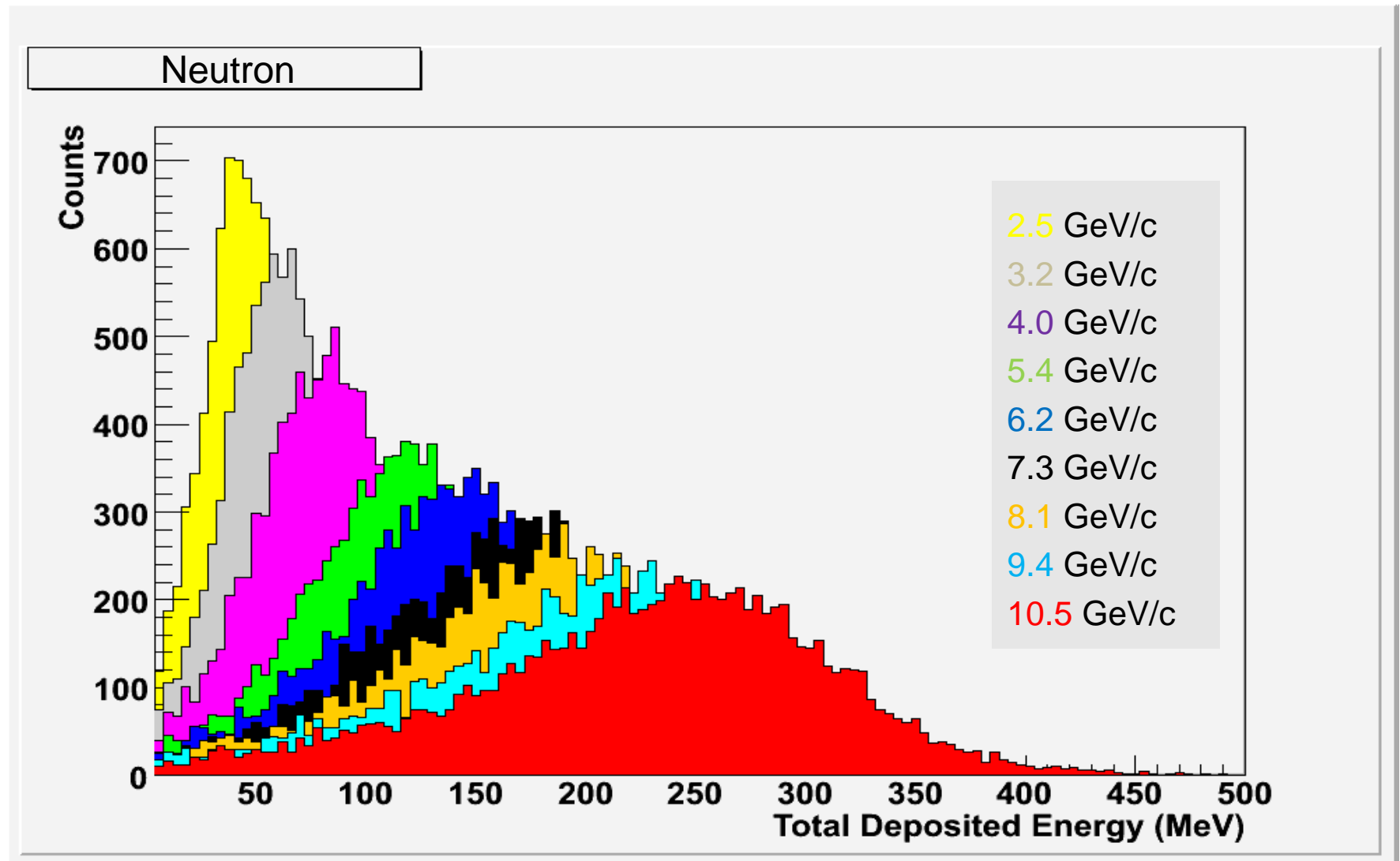


- Complete Geant4 simulation/Analyzer ([AcquMC](#), [AquRoot](#)) for SBS is written by J. Annand.
- Checked, debugged and used by CMU for HCAL.
- Reproduce Compass energy/position resolutions under their conditions: 100GeV pions, beam at the center of a 5x5 cluster, etc..
- Study of HCAL was done for both **3x3 Cluster** and **5x5 Cluster**
- Position resolution 3x3 are better than 5x5 -> decided to go with the **3x3 cluster**

Energy Deposited by protons



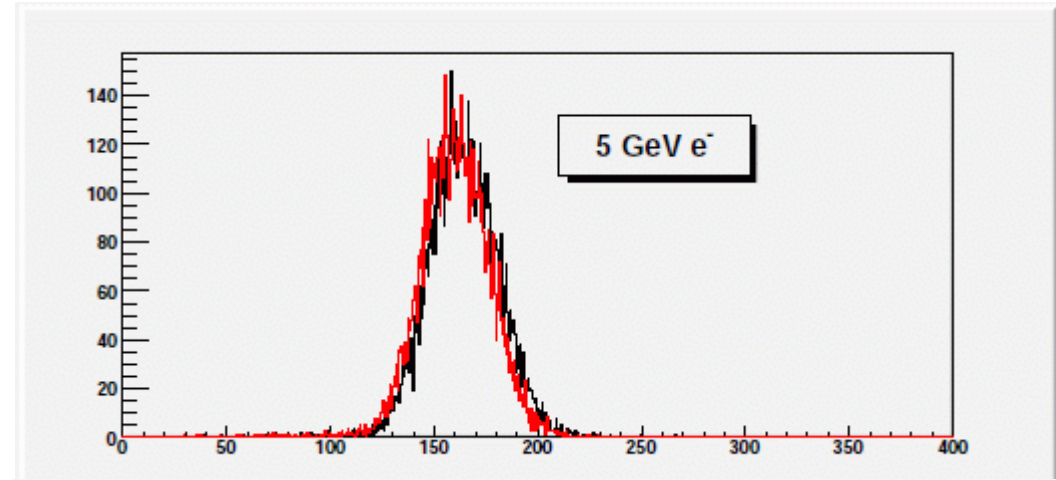
Energy Deposited by neutrons



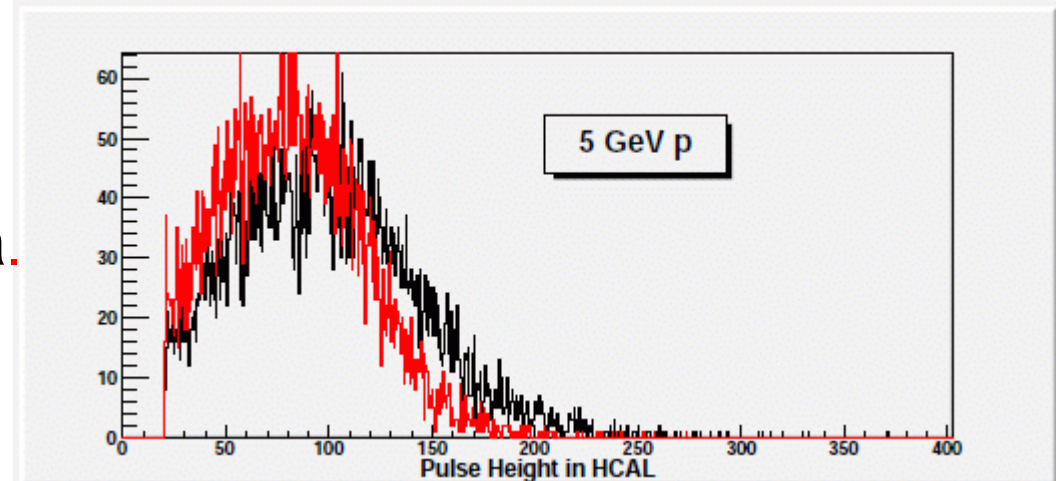
Birk Effect, Geant4 development

Light output depends not only on de-positated energy but also on the density of ionization along the charged particle track. At high ionization densities the scintillation is quenched.

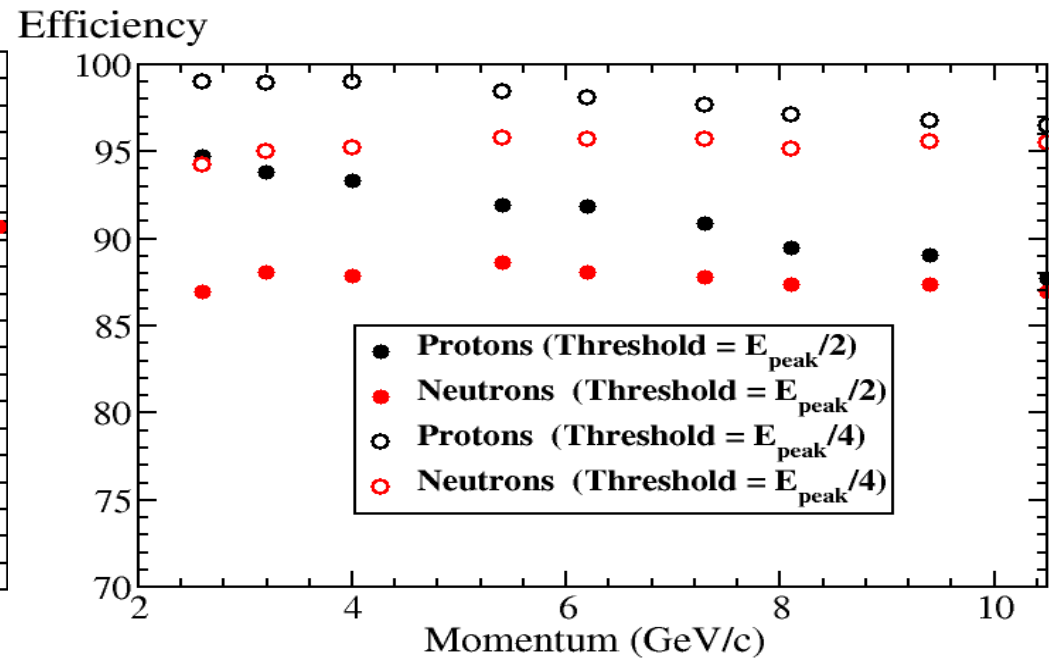
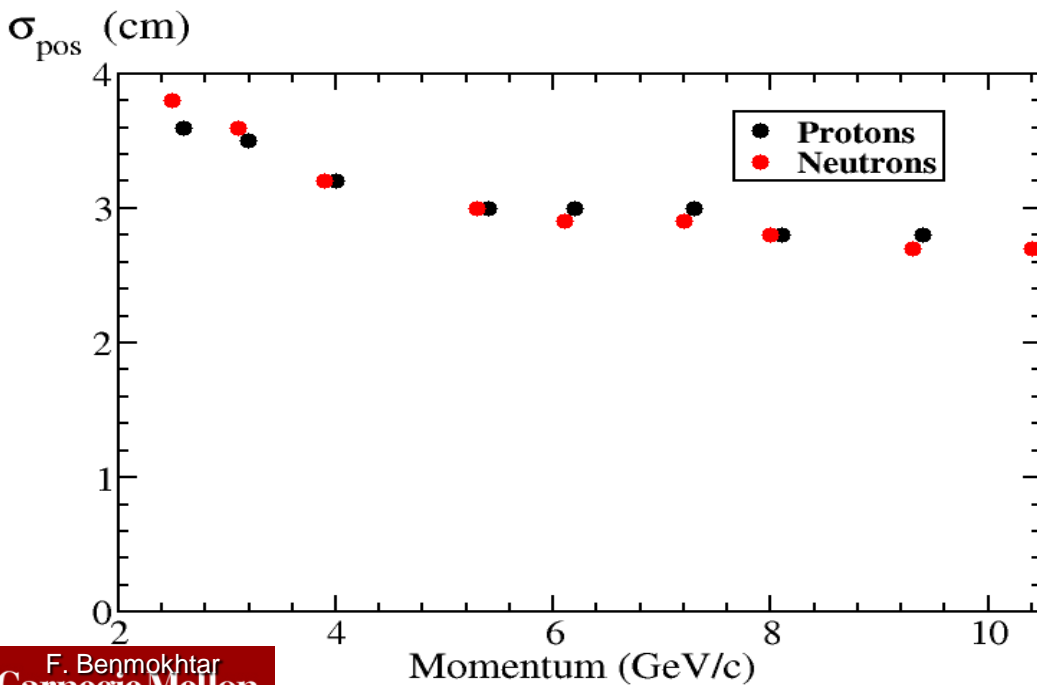
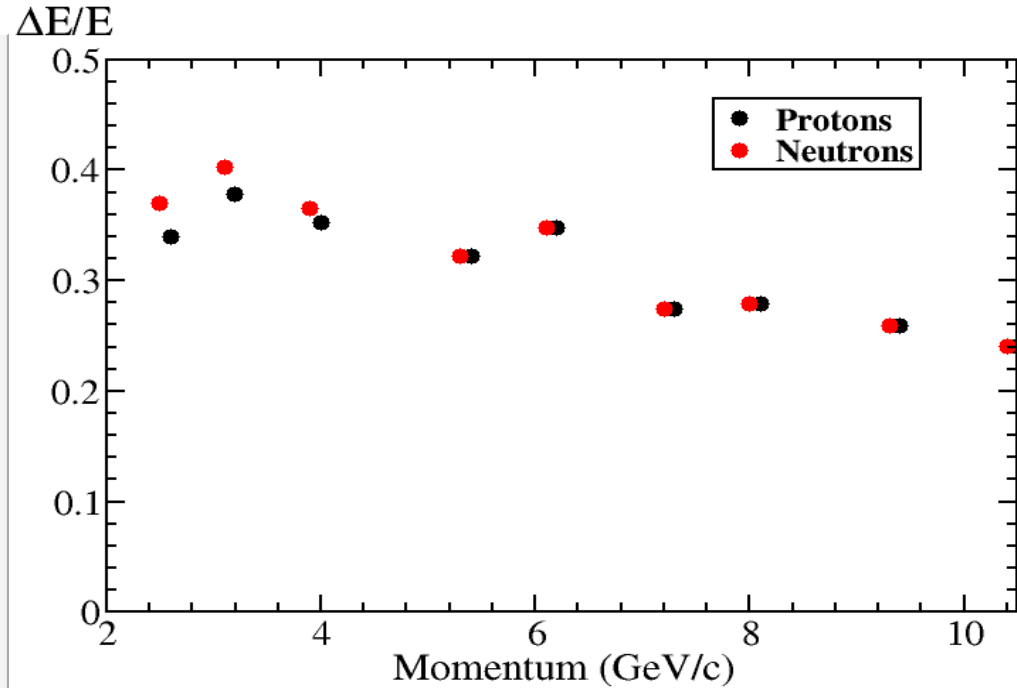
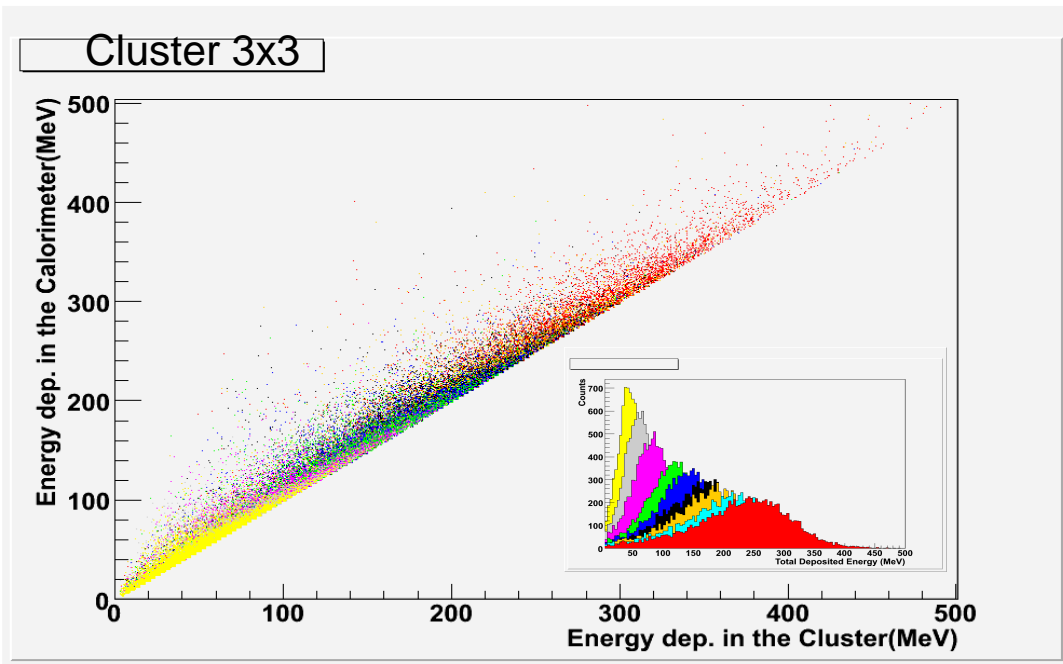
- Birk doesn't change electron deposited energy spectrum,



- But squeezes the proton spectra.



Geant4 simulation Results



Timing study Underway

-Compass got a 1.4ns time resolution.
Simulations can just get us intrinsic timing.
One needs to do real tests for complete timing study.

Requirements:

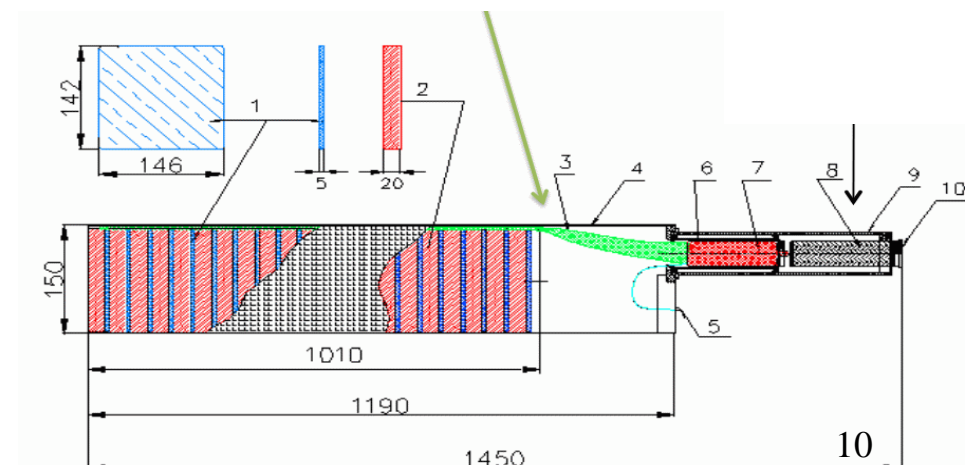
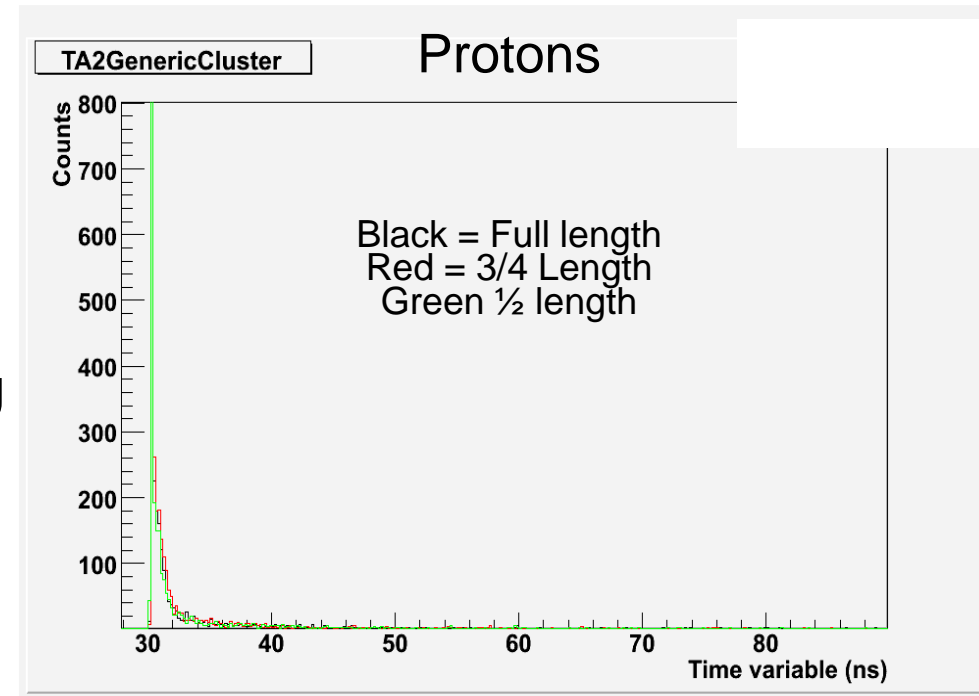
- Chose reasonable length for the module
- Light guide material CO-95 or CO-120
organic glass-> need better?, positioning...

-PMT search:

- Non Uniformity of light collection ~5%

- Communicate with the **Dubna** group

- DAQ: See **Ole Hansen's talk**



Initial Plan: Dubna constructs new “HCAL1” modules

242 modules	\$ 173 k
242 HV bases	36 k
HV Control	8 k
LED Monitoring	5 k
	<hr/>
	\$ 222 k

+ trigger electronics ?

+ stand ?

**+ installation & testing
?**

Manpower

- **CMU:** Design, (future) hardware, etc...
F. Benmokhtar, G. Franklin, B. Quinn
(B. Byler: undergrad and we looking for a new postdoc)
- **Glasgow:** J. Annand (simulations, Geant4)
- **Armenia:** S. Abrahamyan (simulations, Geant3)

Joining soon:

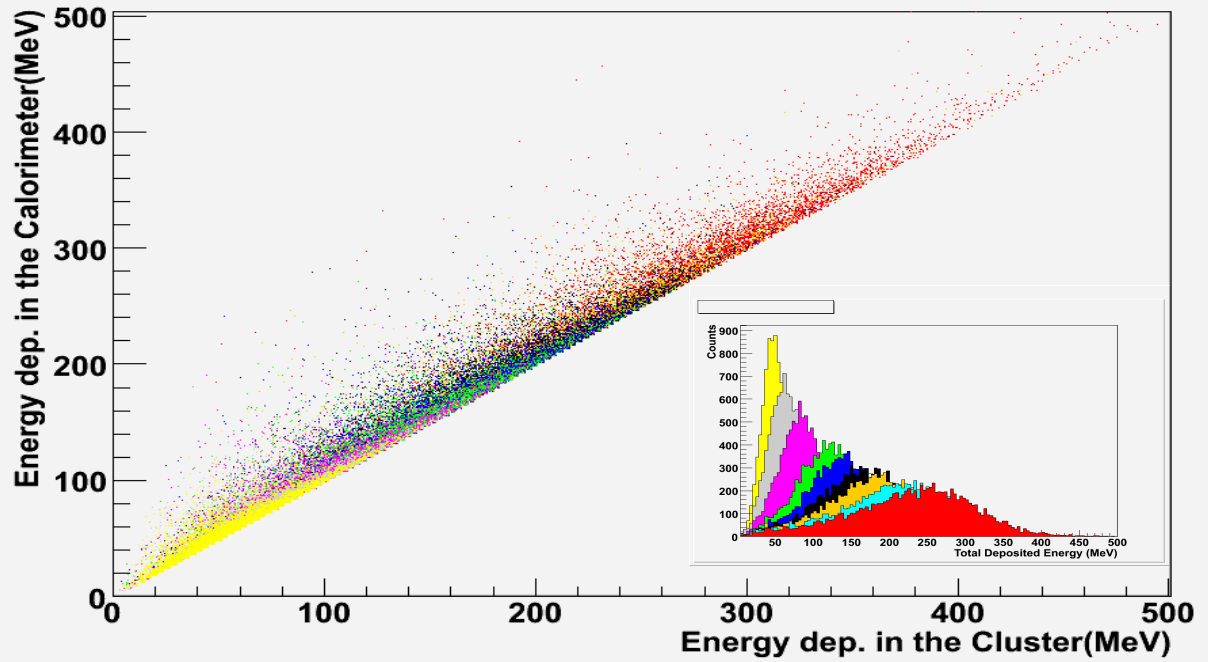
- **Dubna:** I. Savin, V. Krivokhizhin and N. Vlasov
Byler
Expertise + provide modules
- Seamus Riordan showed interest on doing work on the Wave Shifter .

BACKUPS

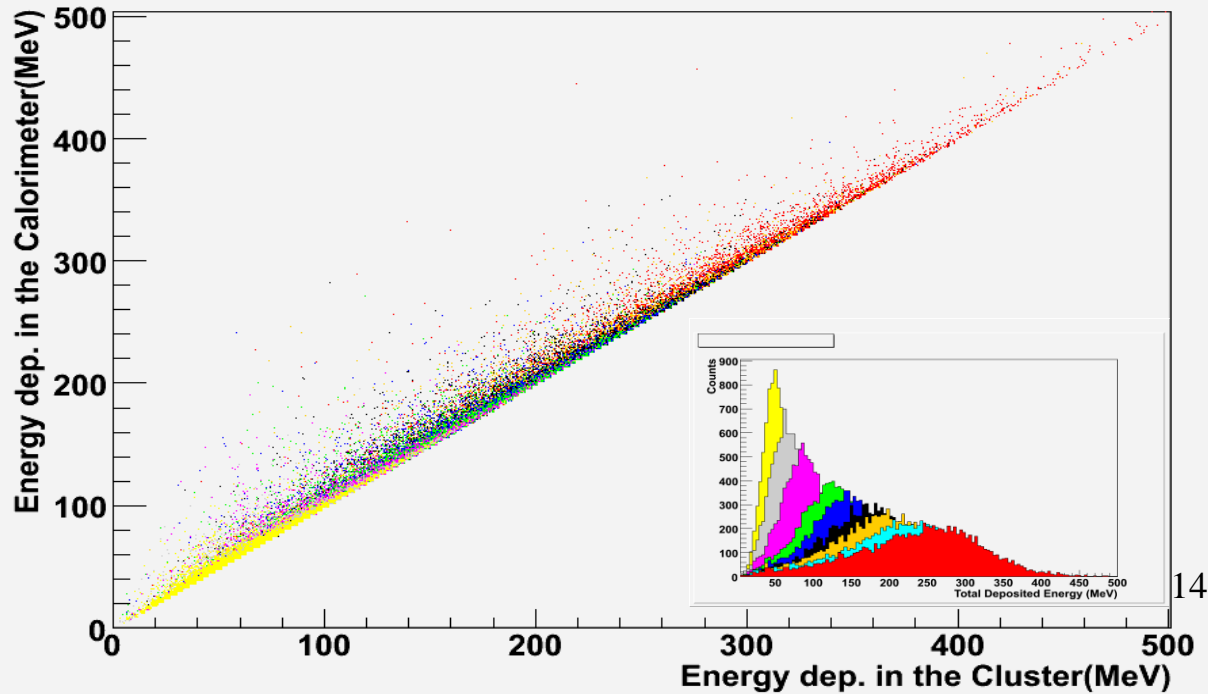
Protons

Total deposited Energy in the calorimeter versus Total deposited energy in the Cluster

Cluster 3x3



Cluster 5x5



Neutrons

Total deposited Energy in the calorimeter versus Total deposited energy in the Cluster

