Hadron resolution of SiD

Lei Xia
ANL - HEP

- Hadron resolution of HCal alone
- Combine ECal and HCal information
- Neutral hadron contribution to PFA

Hadron resolution in HCal alone

- Used sidmay05: RPC, Projective (7.4-12.mm barrel cell size)
- Look at neutral hadrons that punch through ECal
  - Need appropriate cut on hits in ECal
    - Too tight cut on ECal energy/number of hits will introduce bias on event sample
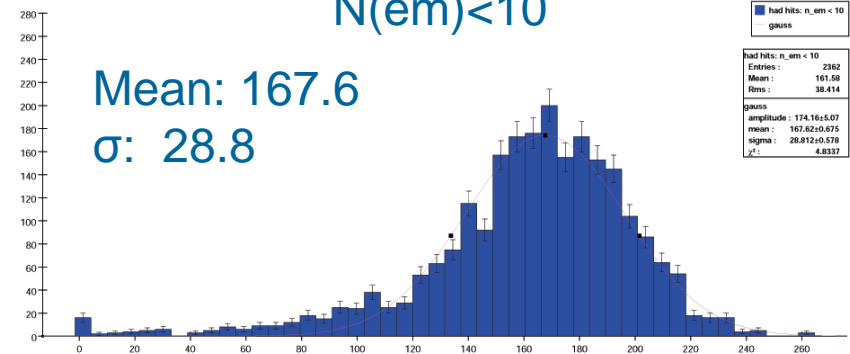   - Too loose cut results in significant energy in ECal

20 GeV neutron

N(em)=0

Mean: 140.7
σ: 46.5
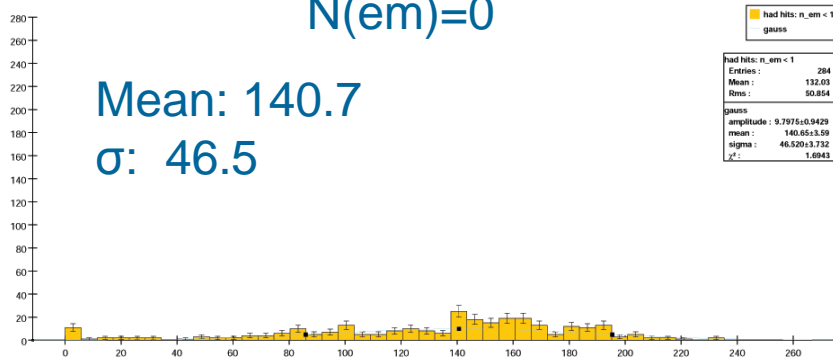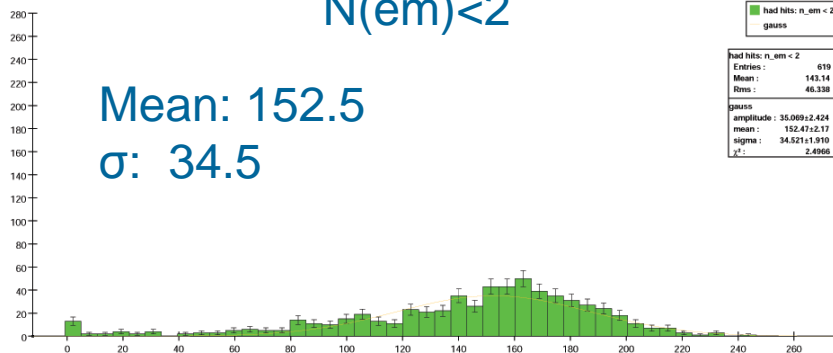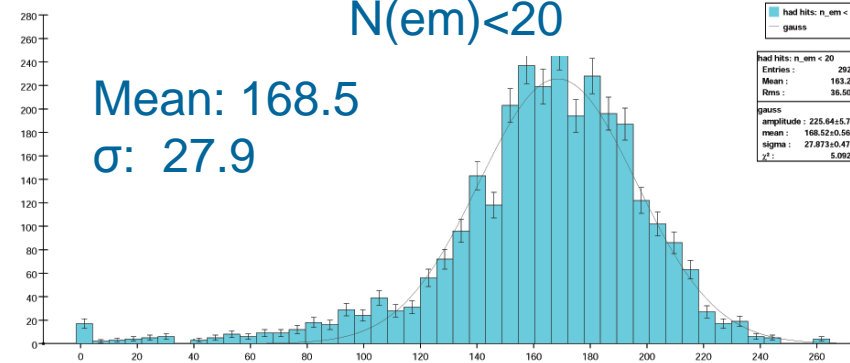
N(em)<10

Mean: 167.6
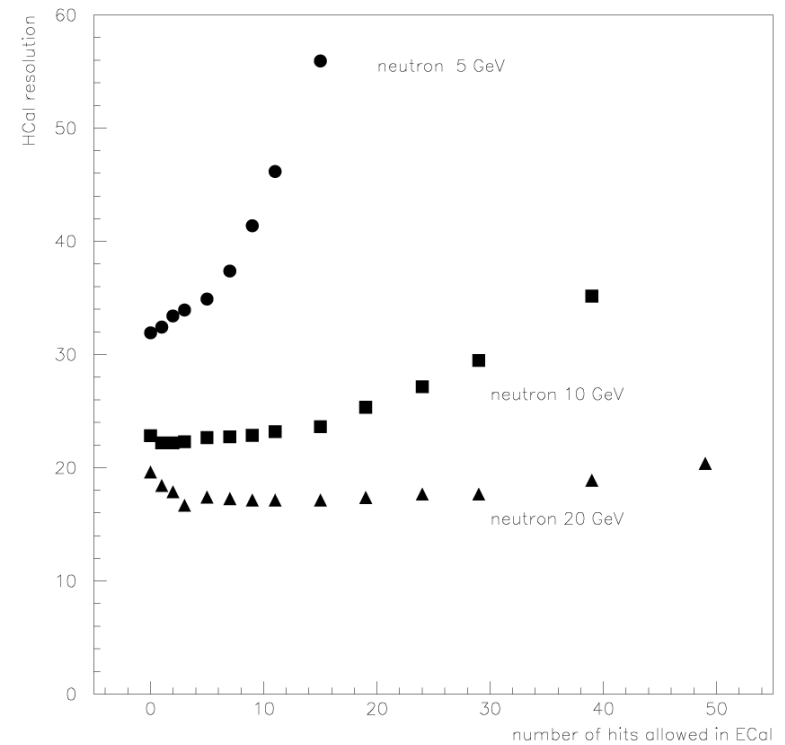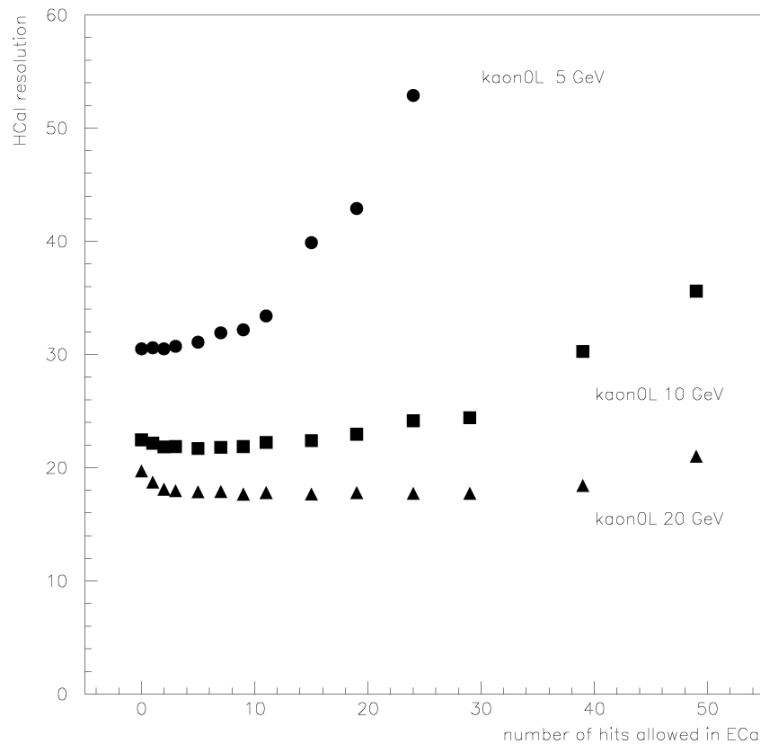σ: 28.8

N(em)<2

Mean: 152.5
σ: 34.5

N(em)<20

Mean: 168.5
σ: 27.9

Energy resolution as a function of ECal cut

Kaon0L

Neutron

Minimum on the curve: gives you an idea of actual HCal resolution

K_L^0 sidmay05   neutron

GeV	1	2	5	10	20
$(\sigma/M) \times \sqrt{E}$	0.57	0.59	0.57	0.66	0.64

GeV	1	2	5	10	20
$(\sigma/M) \times \sqrt{E}$	1.09	0.96	0.78	0.80	0.74

Projection geometry 7.4mm – 12mm cell size

Stand alone simulation: Geant4-5

X

Beam direction
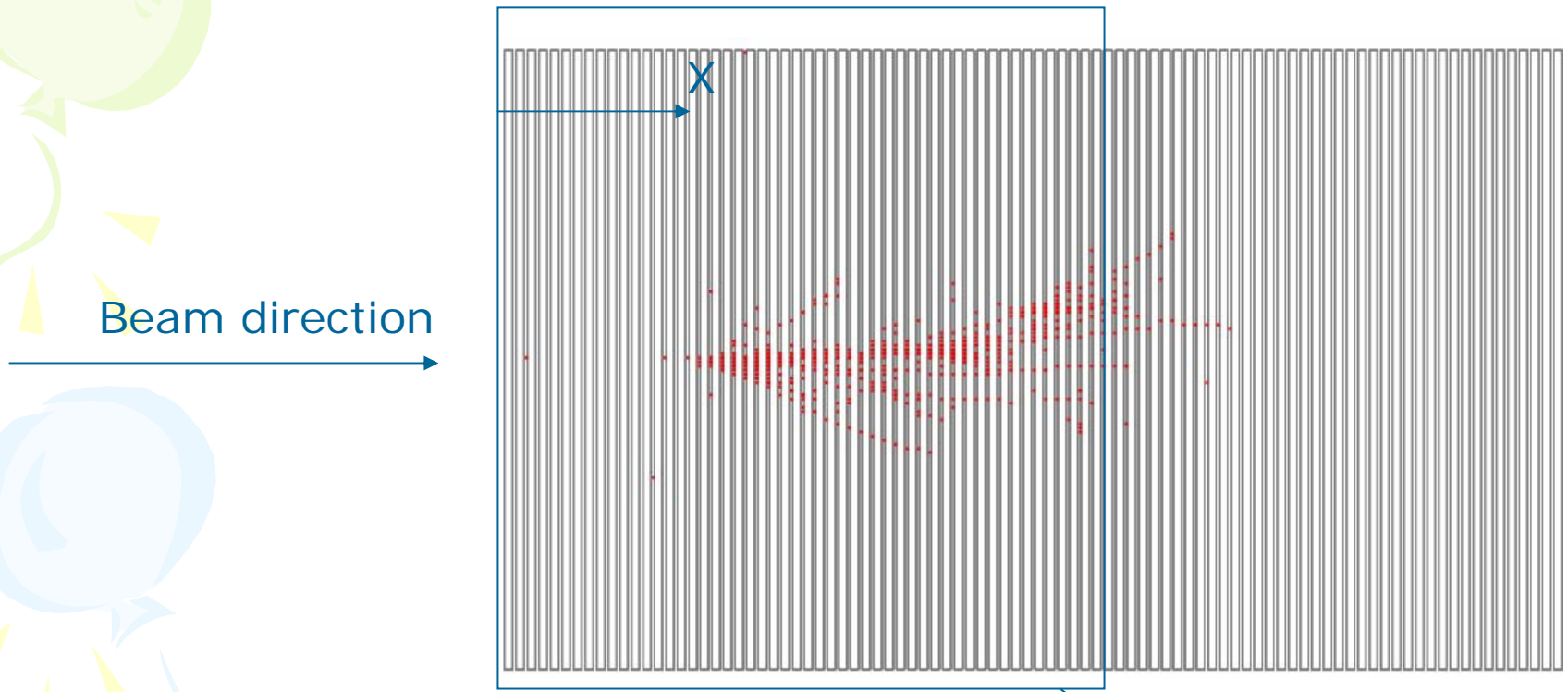
Cell size = 10.0 mm
Identical RPC setup

Readout only
first 34 layers

K_L^0

GeV	2	5	10	20
(σ/M) $x\sqrt{E}$	0.56	0.68	0.63	0.68

neutron

GeV	2	5	10	20
(σ/M) $x\sqrt{E}$	0.68	0.67	0.63	0.64

Combine ECal and HCal information

- Use the following calibration to obtain neutral hadron energy:

$$E = \frac{0.122 \times N_{HCalHit} + 114. \times E_{EMraw}}{1 + 0.00122 \times N_{HCalHit} + 1.34 \times E_{EMraw}}$$

  - Weight ECal raw energy and number of HCal hits in different way
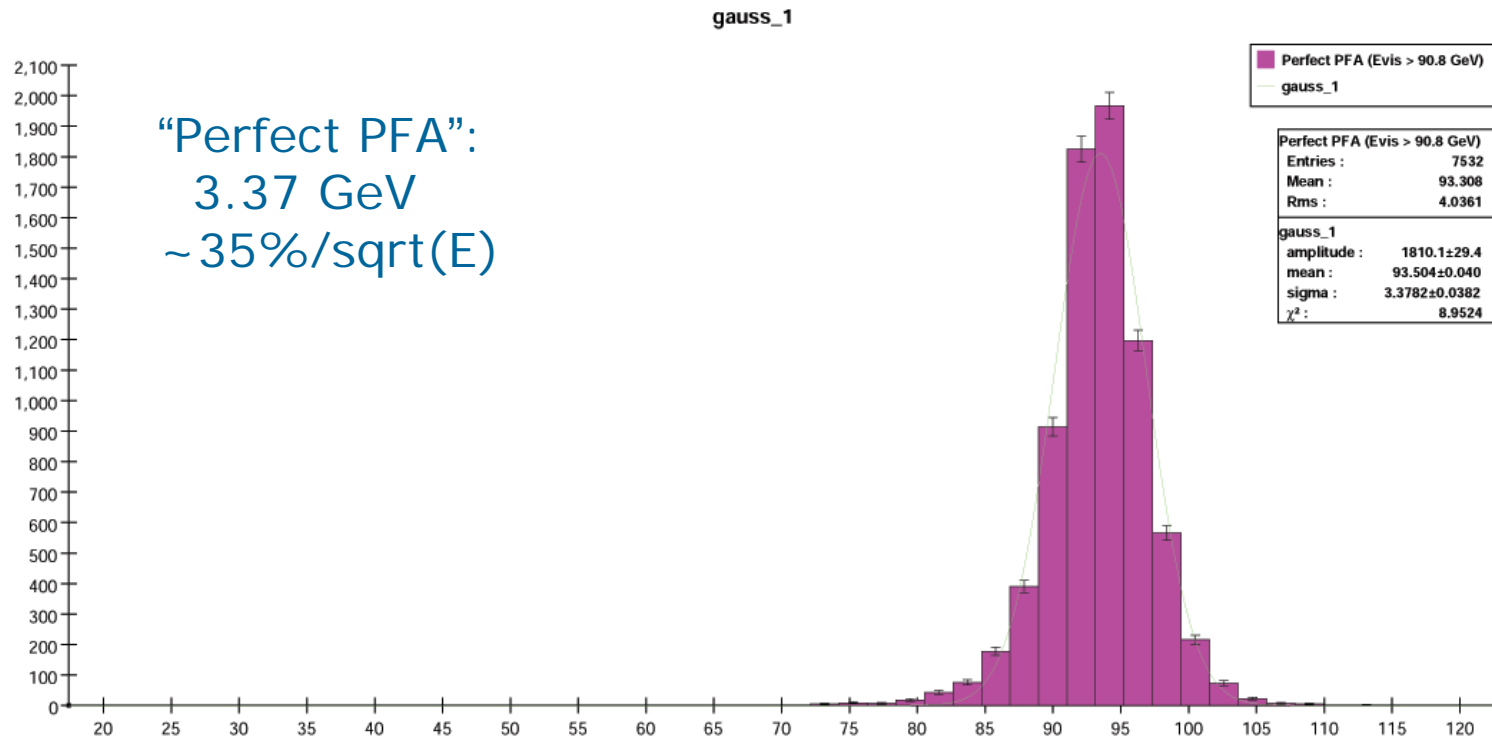 - Corrected for non-linear effect

K_L^0 neutron

GeV	1	2	5	10	20
(σ/M) x√E	0.47	0.55	0.60	0.55	0.48

GeV	1	2	5	10	20
(σ/M) x√E	1.25	0.76	0.70	0.68	0.54

Neutral hadron contribution to PFA

- Neutral hadron 15GeV @ ~70%/sqrt(E)
- Photon 22 GeV @ ~20%/sqrt(E)
- "Perfect PFA" should gives ~2.9GeV