DarkSHINE HCAL Design

--Zhen Wang

Motivation

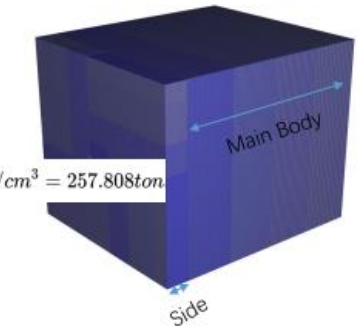
Baseline 1.5 HCAL Weight:

Summary

- HCAL Main Body: $(40 \times 0.5 + 25 \times 2 + 20 \times 3 + 15 \times 5) \times 400 \times 400 \times 7.86 g/cm^3 = 257.808 ton$

  $100 \times 1 \times 400 \times 400 \times 1.05 g/cm^3 = 16.8 ton$

  Total weight: 274.608 ton



- Side HCAL: $(40 \times 0.5 + 25 \times 2 + 15 \times 3) \times 4 \times 45.511 \times 228.041 \times 7.86 g/cm^3 = 37.524 ton$

  $75 \times 45.511 \times 228.041 \times 4 \times 1.05 = 3.27 ton$

  Total weight: 40.794 ton

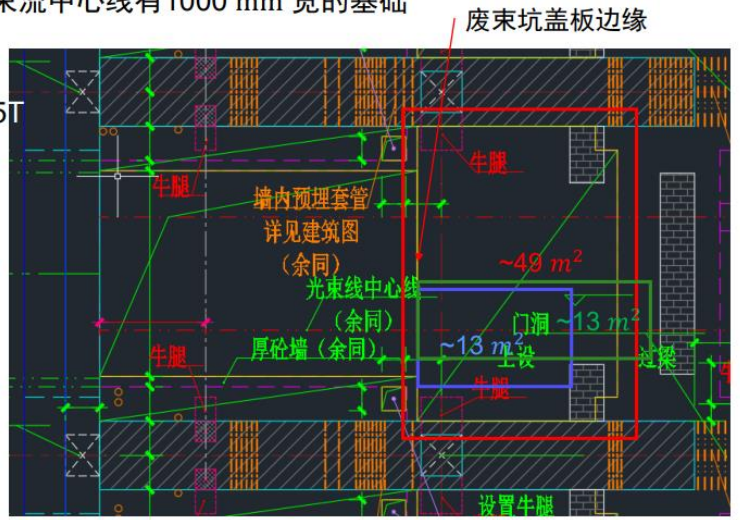
- Total HCAL weight: 274.608+40.794 = 315.402 ton

Too much than we can take. Need to shrink a little bit

Rui Yuan

地下五层

- 1.5 T/m^2 沿束流中心线有1000 mm 宽的基础
- 3 T/m^2
- 起吊重量12.5T
  - 高度3.5m
- 40 ~ 50 T?



Previous Conclusion & Plans

- HCAL alone:
  - 2m width and 160cm absorber thickness is acceptable for 1GeV neutron
- Total weight:
  - 50.37 ton (Abs) + 4.0 ton (Sensitive) [We are capable of **30T** at most]
- Plans:
  - Truth level information with ECAL crossed
  - Full detector simulation(with enough statistics) study with all cuts applied
- Possible solutions:
  - Gas detector? (incapable of handling neutrons)
  - Hybrid? (less absorber means sacrifice in sensitivity)
  - Further reduce detector volumes? Hollow at end or
  - …

Weight

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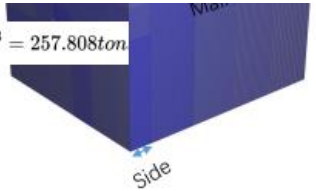

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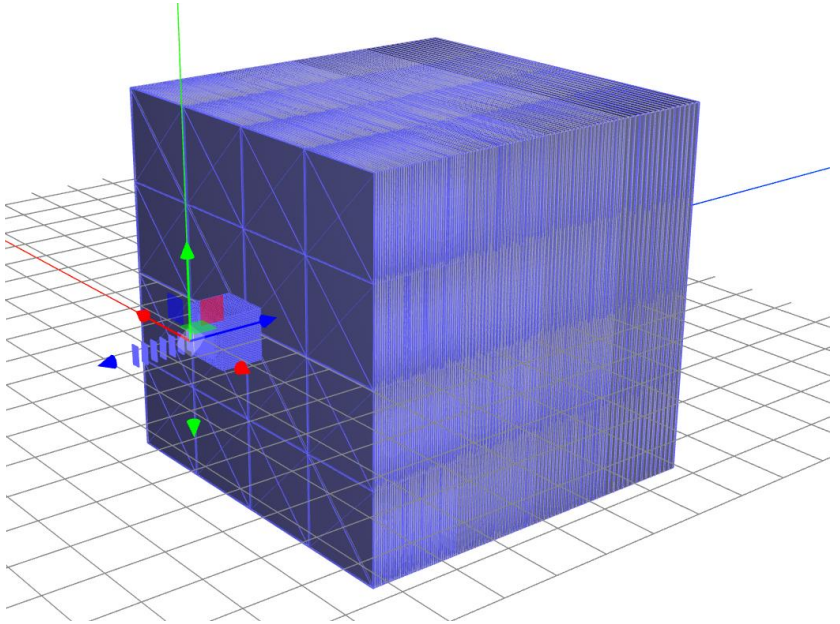
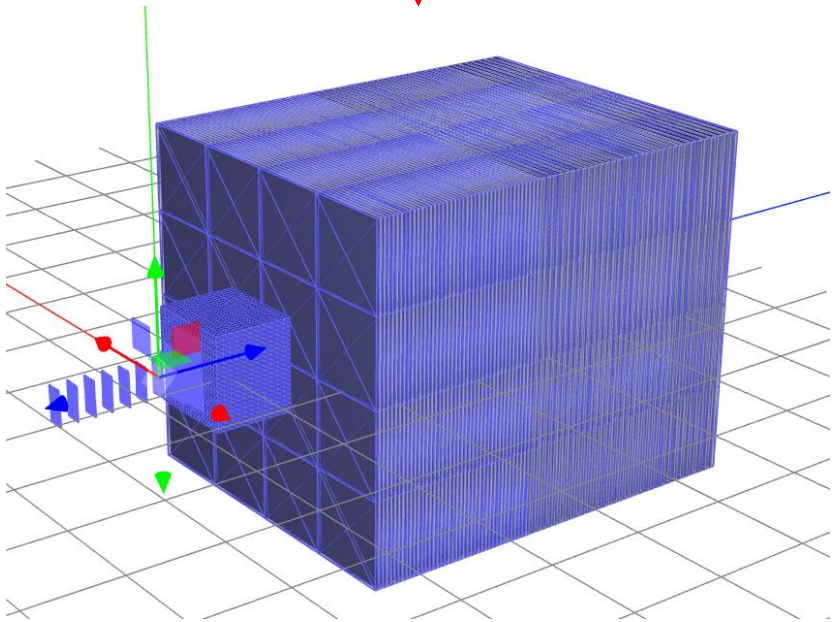




Absorber: (40*0.5 + 25*2 + 8*3)*200*200*7.86 = 29.6 ton

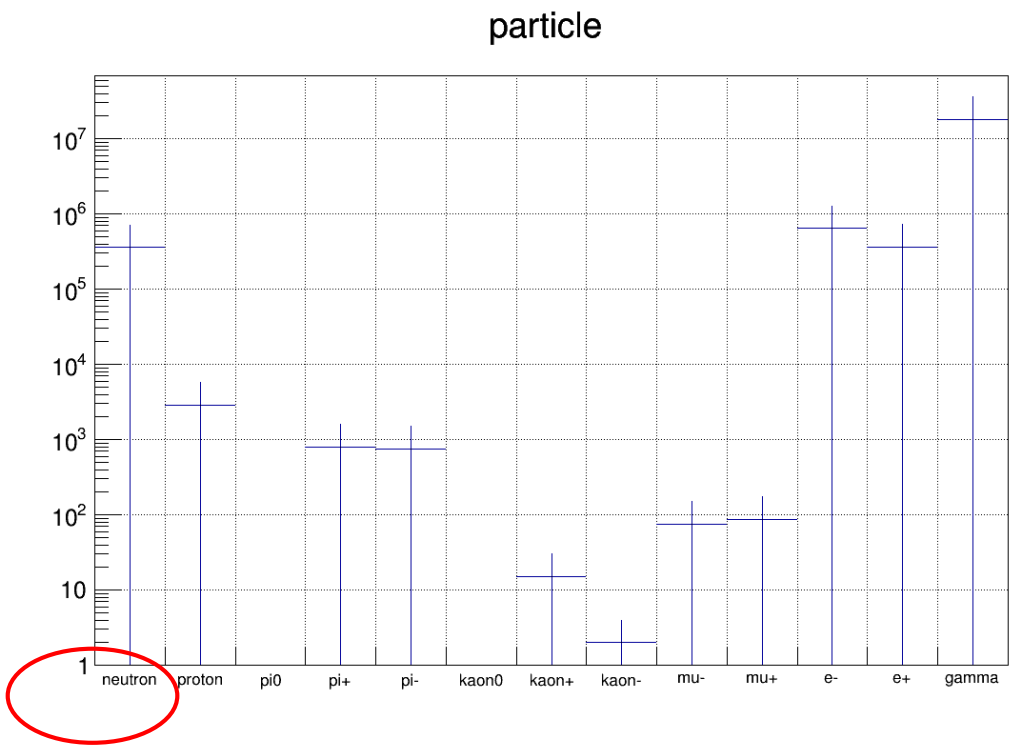
Sensitive: 73*200*200*1.03 = 3.0 ton

Total: 32.6 ton

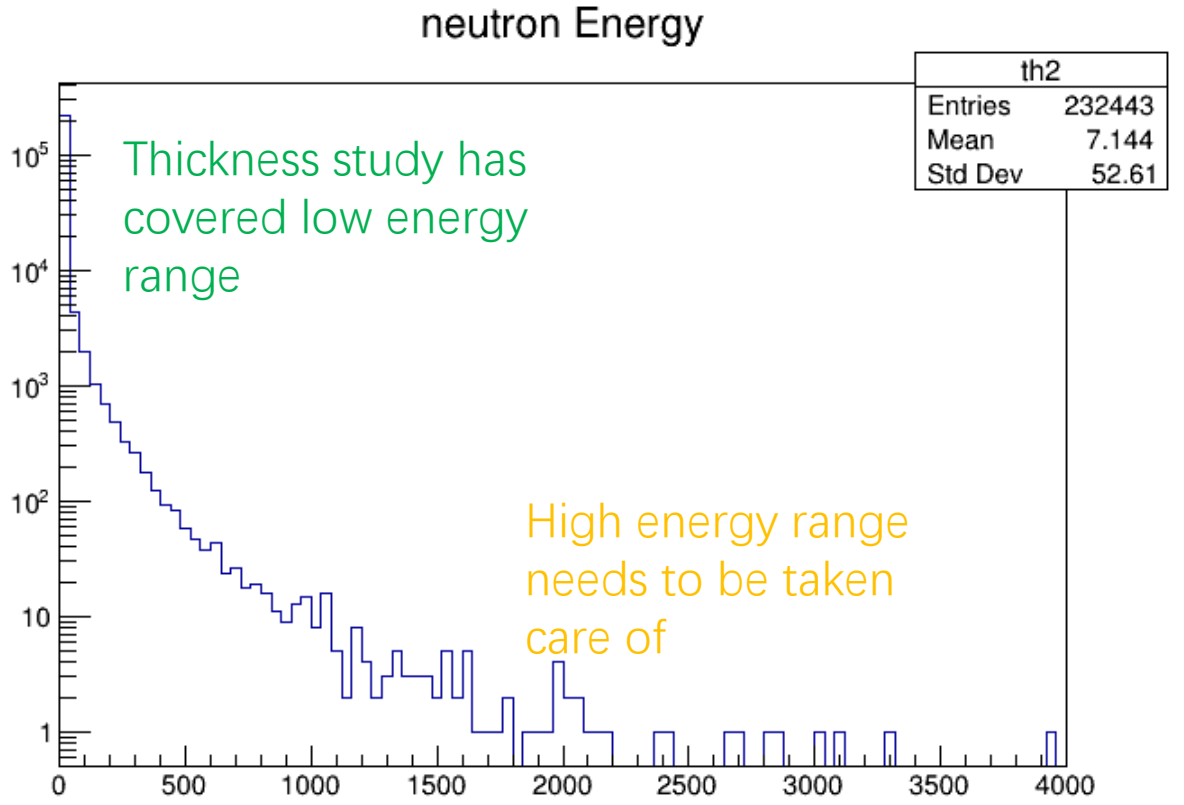
Particles in HCAL

Hanqing

1e7 8GeV incident electrons

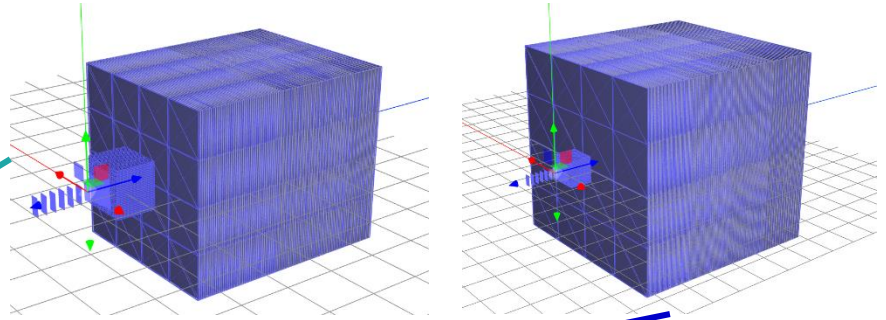


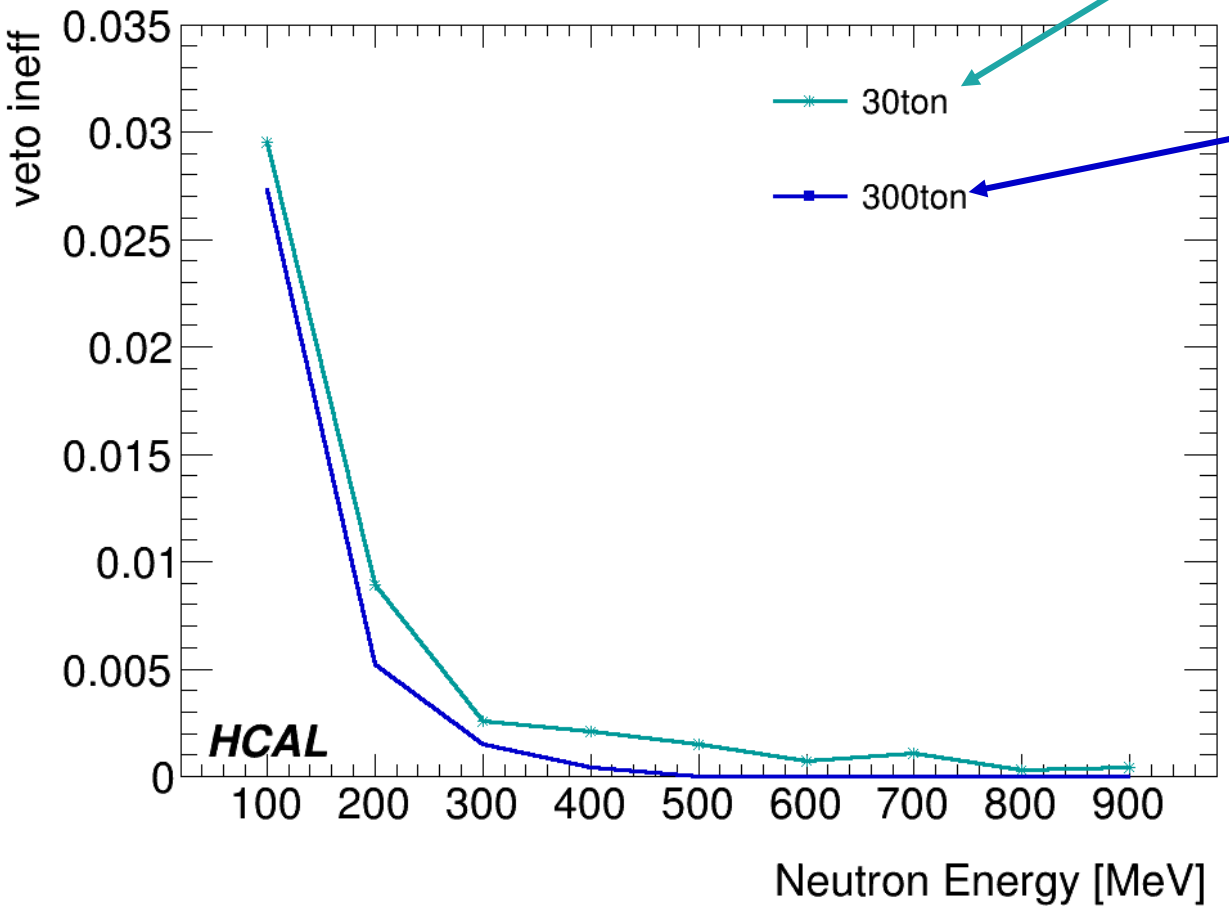
Neutron is the target of HCAL vetoing system



Neutron total energy [MeV]

Performance Comparison





Need to look at veto power in high energy range (up to 2GeV).

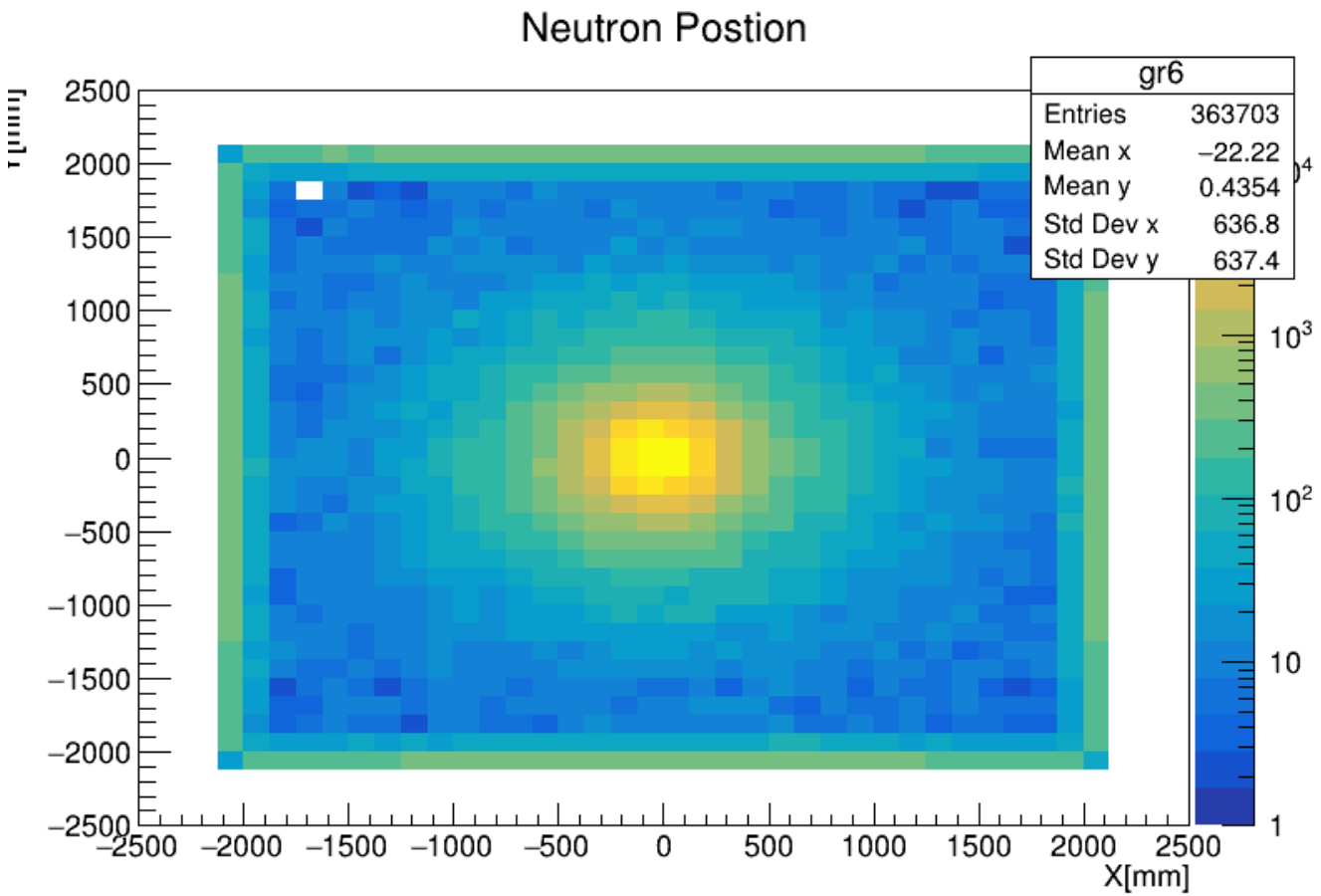
Need more stats. (still running.)

Conclusion

- No huge efficiency loss in low energy region (Have optimized structure last year)

- Need more stats to check efficiency in high energy region (which could be much similar as our signal process)

Neutron Position



Hanqing