Dynamic range & Hit Rate from DIS and SiPM Noise

- 1.5 Pixel / MeV

- 14bit ADC & saturate at 100GeV → 6.1 MeV/count

- Digitizing at ~5MHz (~20nsec). Preamp shaping to ~80nsec →12 time samples per pulse

- 12 time samples * 14 bits ADC + 5 bits (32ch) + 19bit (time stamps) = 24 Byte per hit

- FEB limit is 50MB/s = 2MHz/FEB * 24 Byte = 32ch * 65kHz/tower * 24 Byte → Avg 4 hits/event/FEB @ $L=1.0 \times 10^{34}$
  Avg 6 hits/event/FEB @ $L=6.5 \times 10^{33}$

Per FEB Avg Hit Rate vs R

PYTHIA6 0<Q2<1 10GeVx275GeV DIS 1M events

Tower Hit Rate at $L=1 \times 10^{34}$
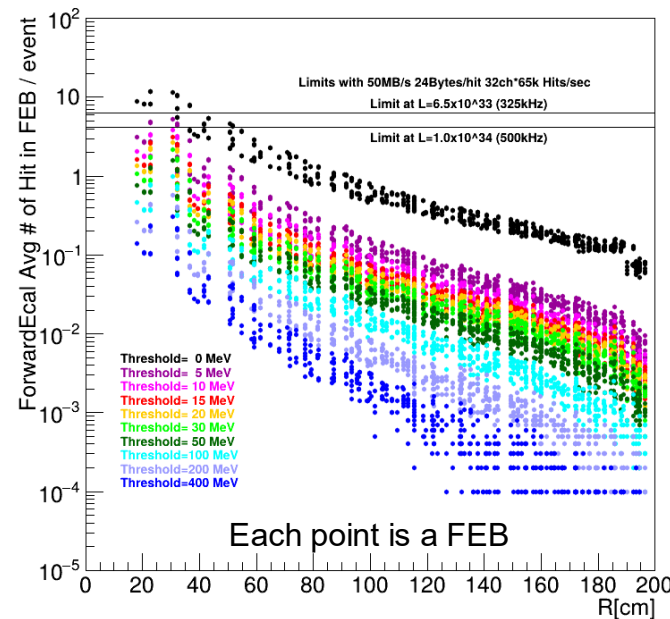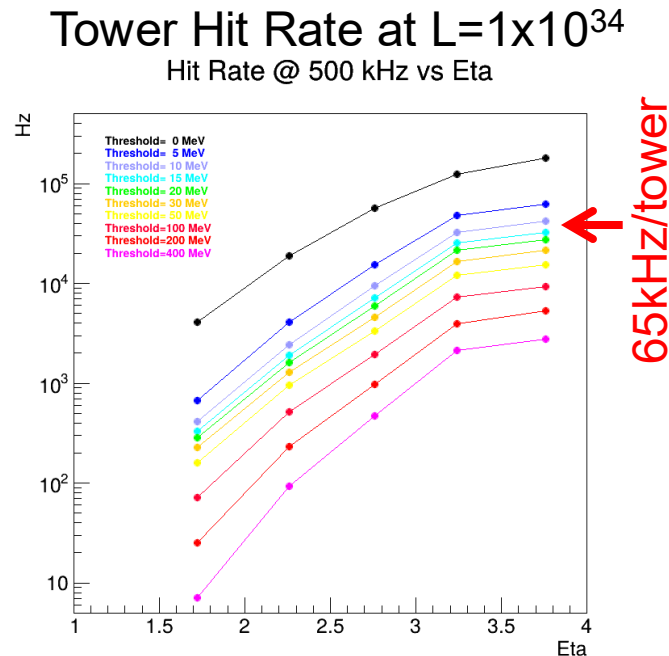
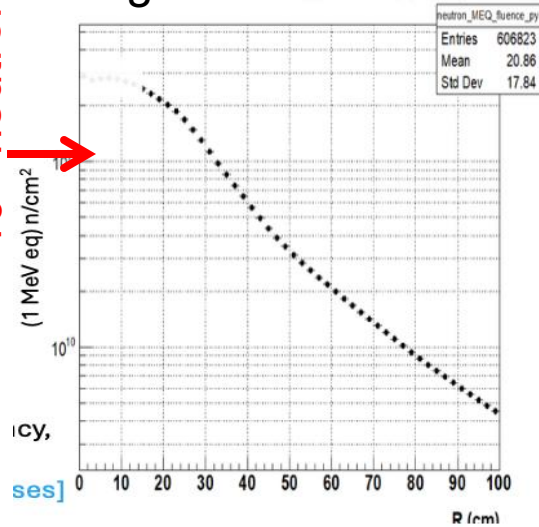Hit rates from backgrounds (dominated by electron beam gas and proton beam gas) are ~10% of DIS

For few FEBs near beam, we may need
- Higher threshold than nominal 15MeV
- "Feature Extraction" (i.e peak finder) on FEB to compress data size / hit
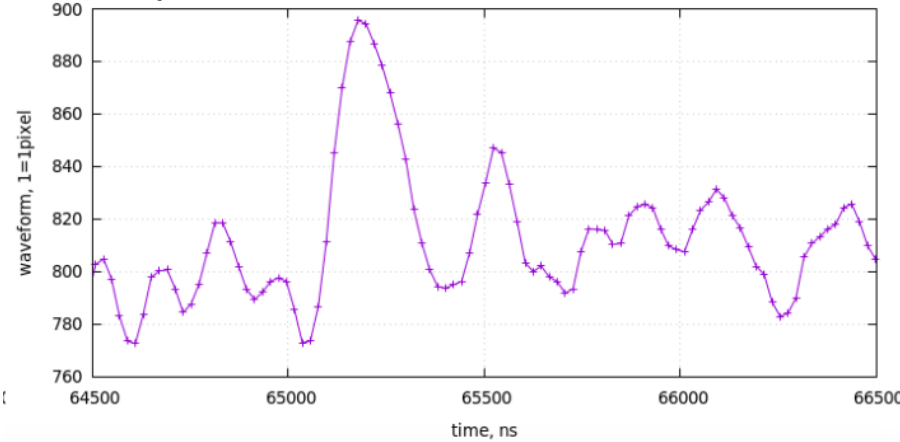
SiPM Noise Simulation (by Gerard)

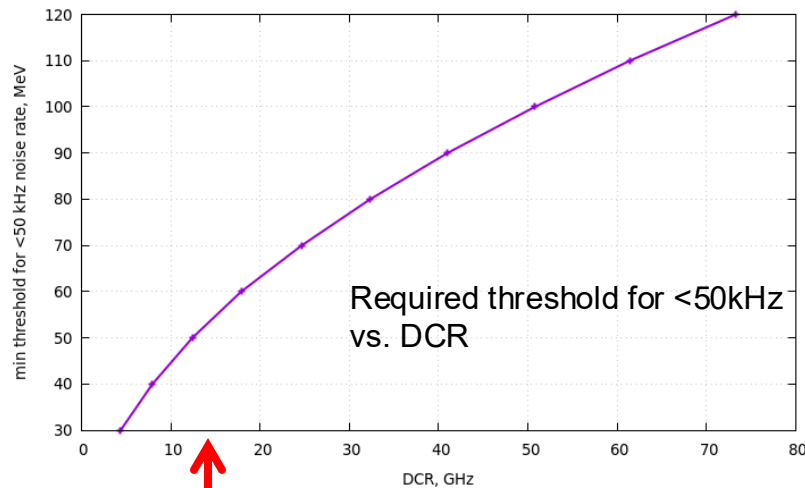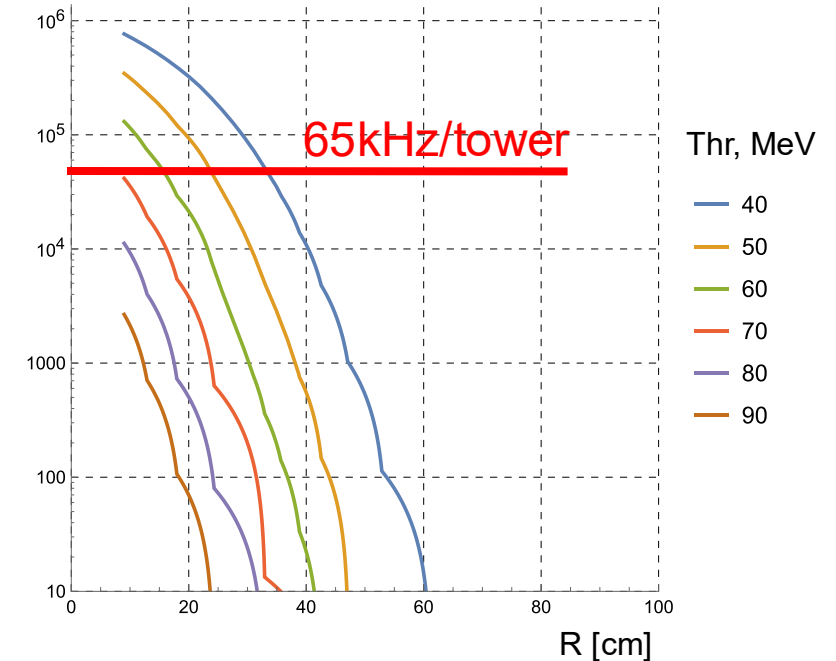Integrated neutron fluence at 100 fb^{-1} after 1st 10 years → Tower DCR = 14GHz @ 10^{11} neutron/cm^2

Example Simulated waveform for 10GHz DCR

Tower noise hit rate at 100 fb^{-1} vs R and threshold

65kHz/tower

Thr, MeV
- 40
- 50
- 60
- 70
- 80
- 90

R [cm]

Required threshold for <50kHz vs. DCR

14GHz

For FEBs within ~30cm of beam, we may need higher threshold than nominal 15MeV → ~100MeV when reaching 100 fb^{-1} after first 10 years of running