SoLID SIDIS_He3
Hit and Occupancy

Zhiwen Zhao

2017/04/26

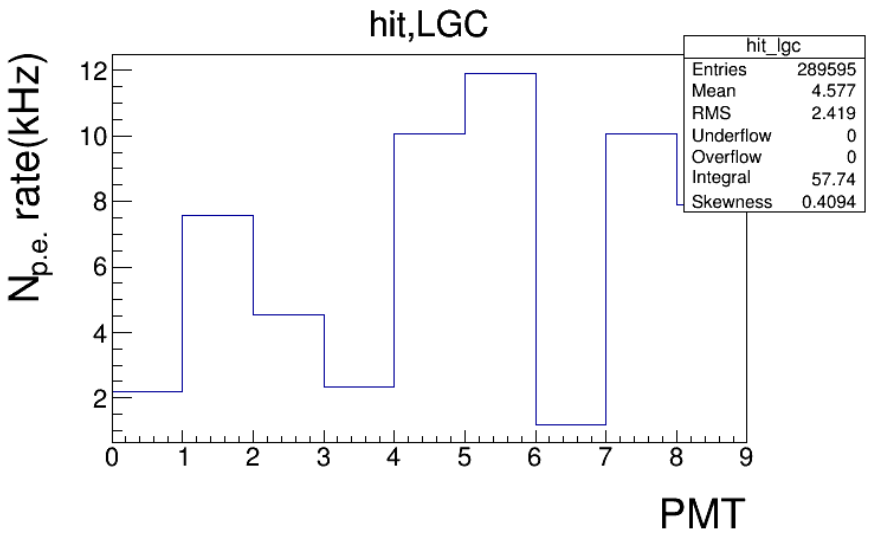
Introduction

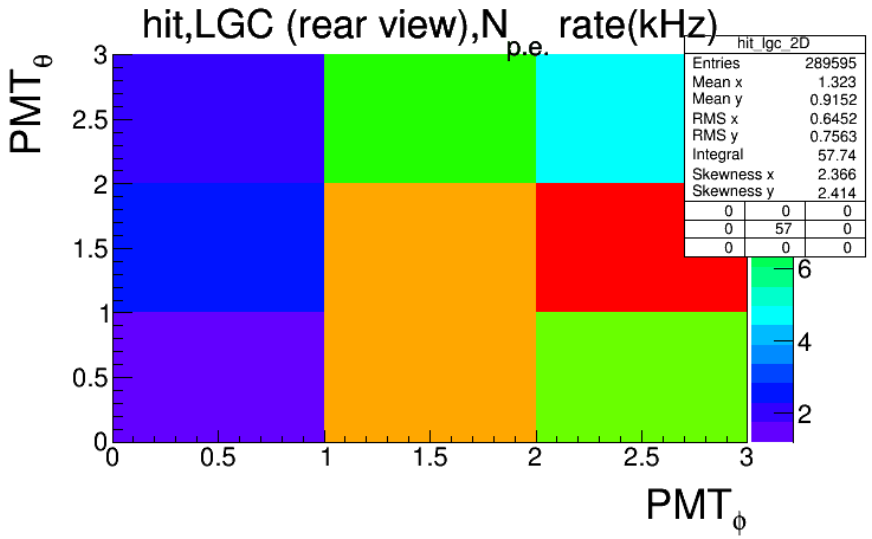
- “Hit”, look at detector response from different source particles to get hit rate
- “Occupancy”, assume certain threshold cut on hit information to get event rate
- We look at each detector channels (no GEM or MRPC yet)
- We assume each particle entering a detector is independent, so no time window for integration yet
- Simulation data of “SIDIS_He3_JLAB_VERSION_1.3/pass7” is used

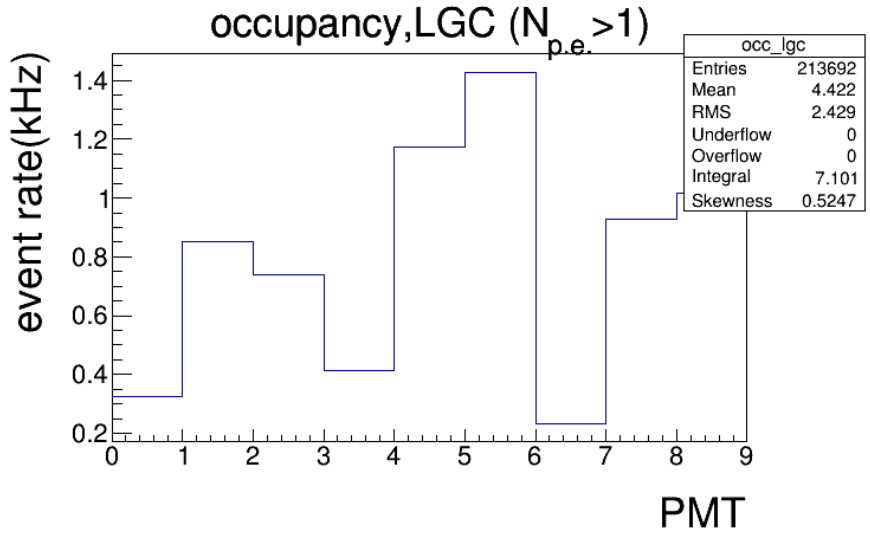
Some sources as example

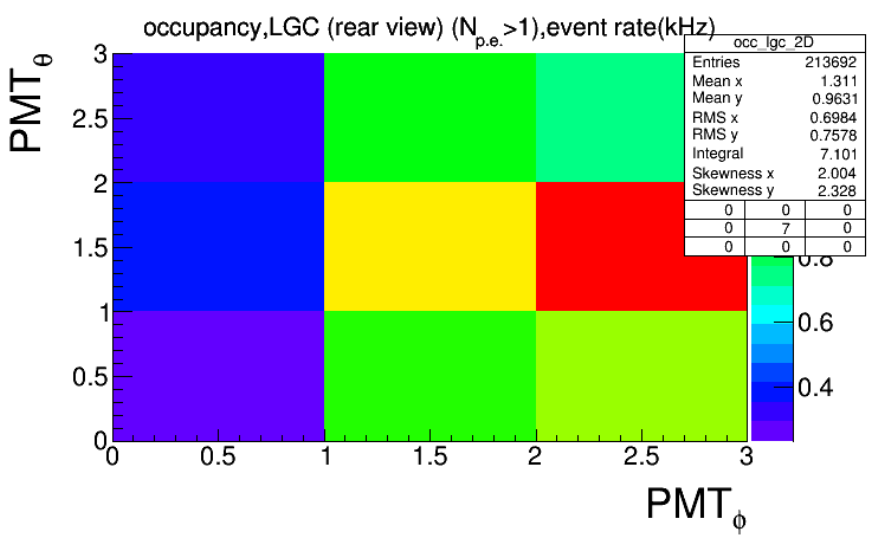
- Look at only source from pi0, eDIS from target

SIDIS_He3, gas (e DIS)
N_p.e. > 1 for occupancy

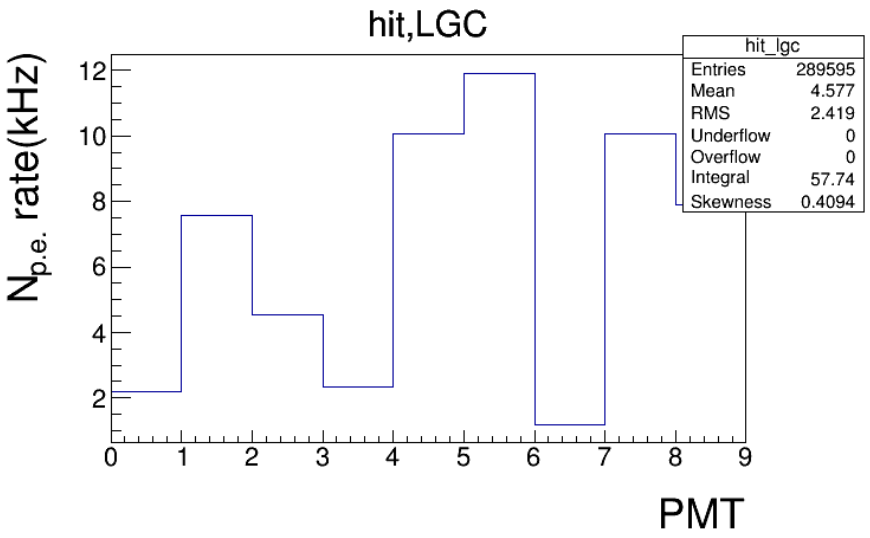


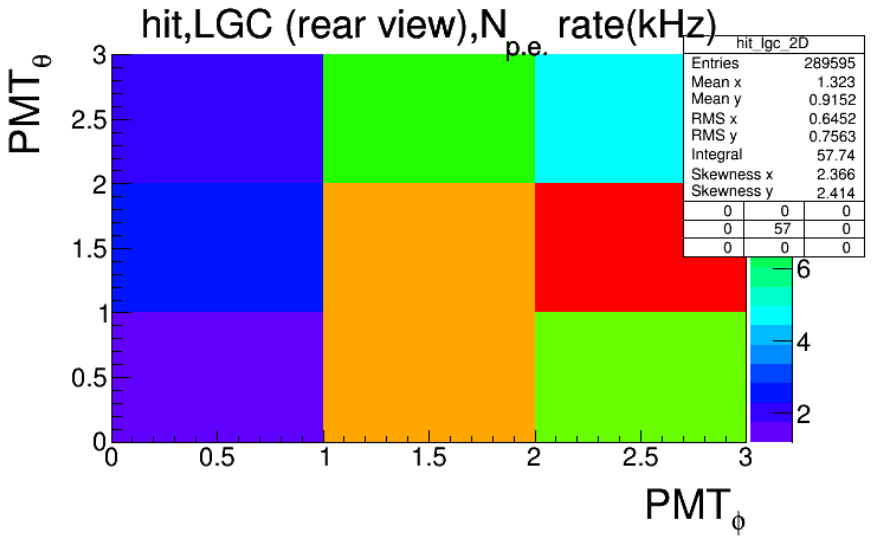


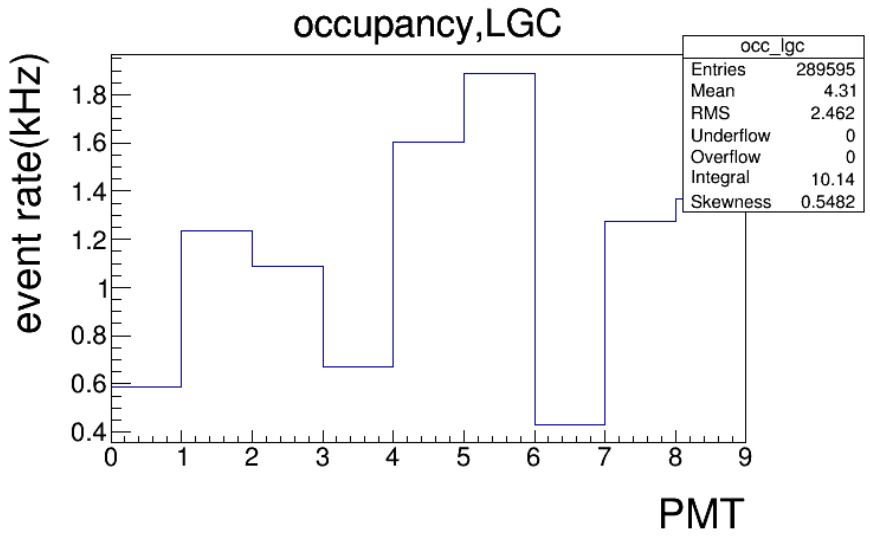


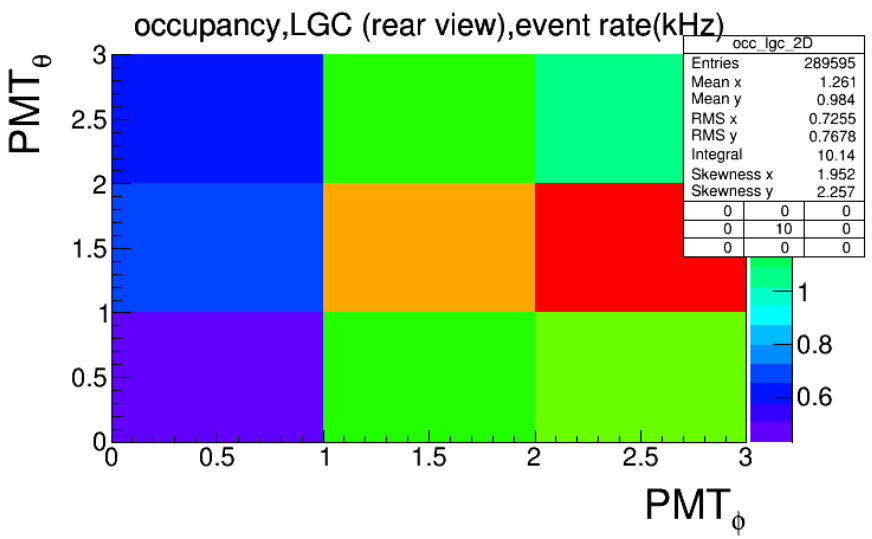


SIDIS_He3, gas (e DIS)
N_p.e. > 0 for occupancy

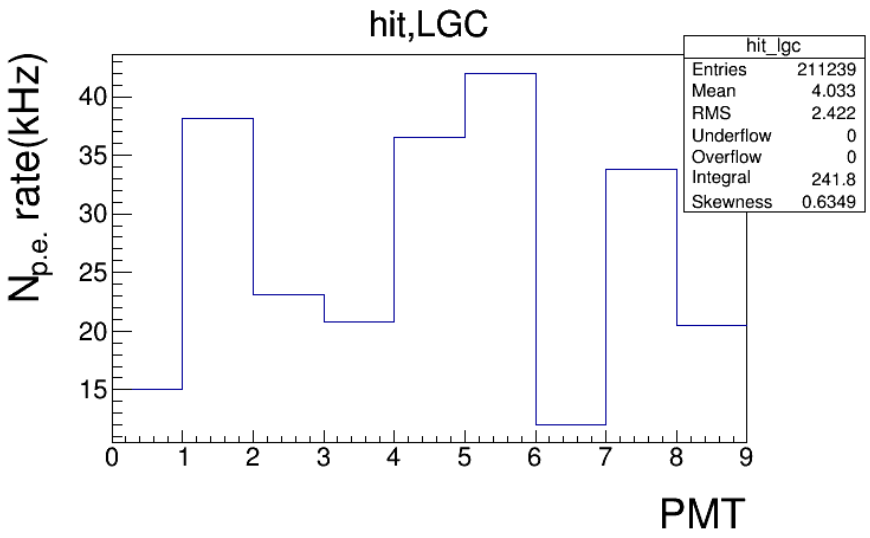


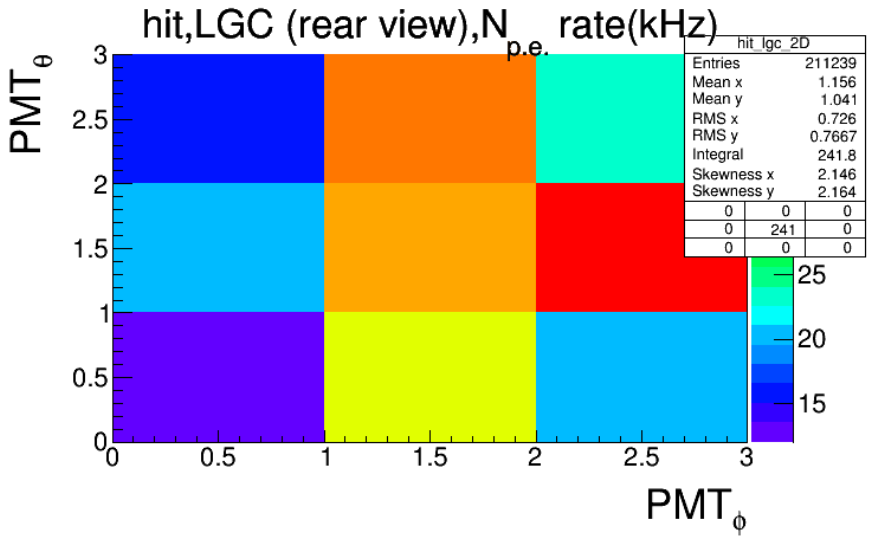


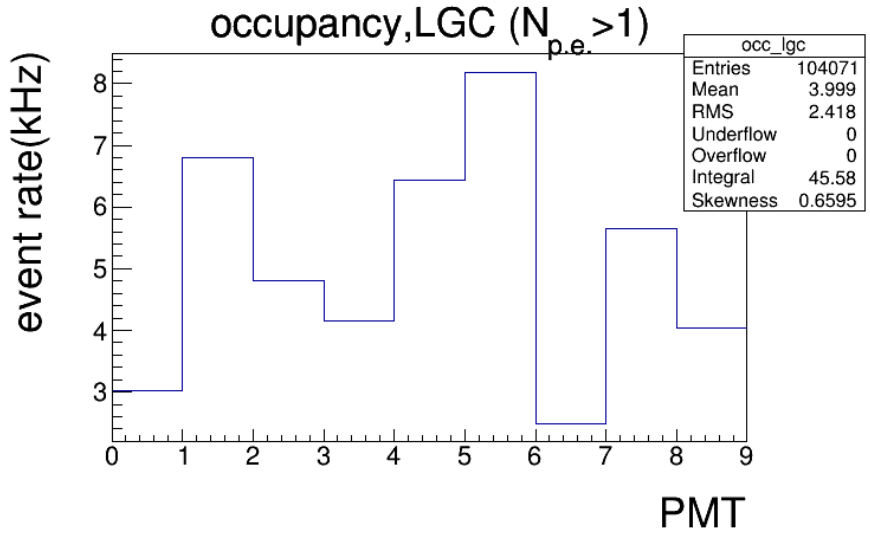


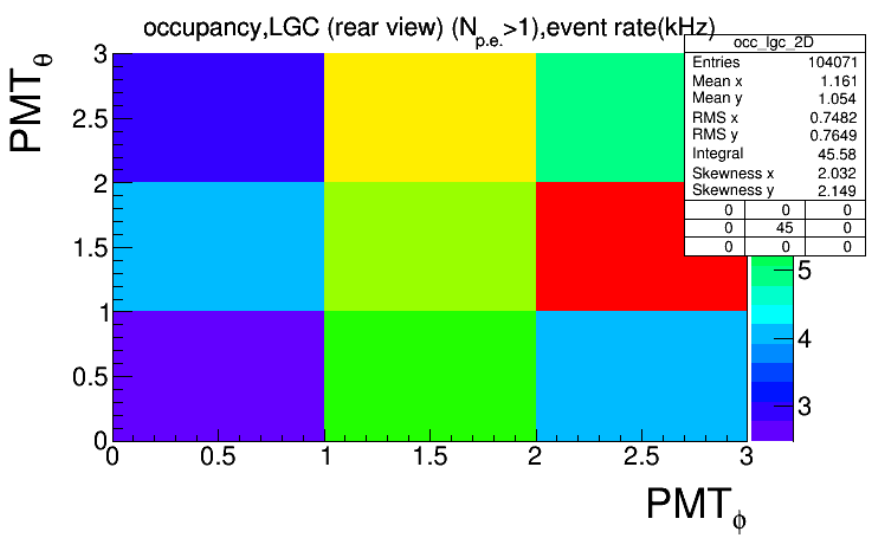


SIDIS_He3, gas (pi0)
N_p.e. > 1 for occupancy

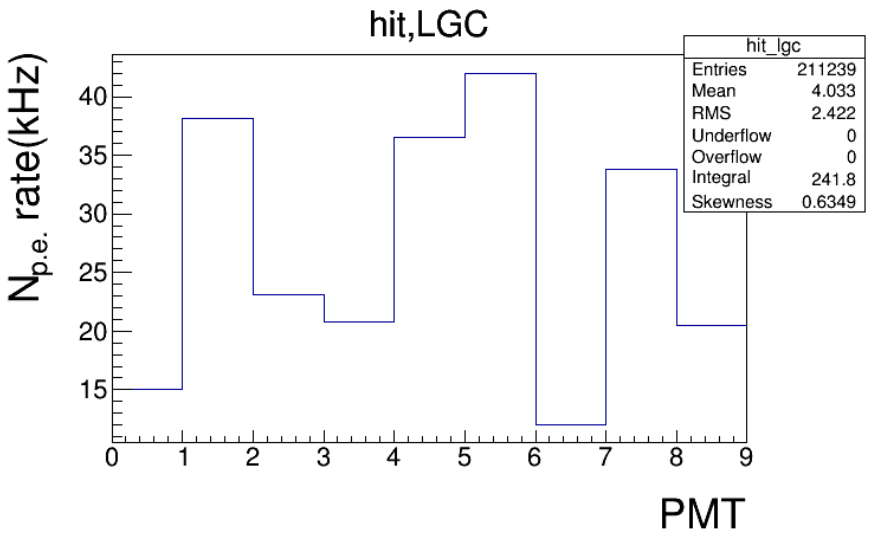


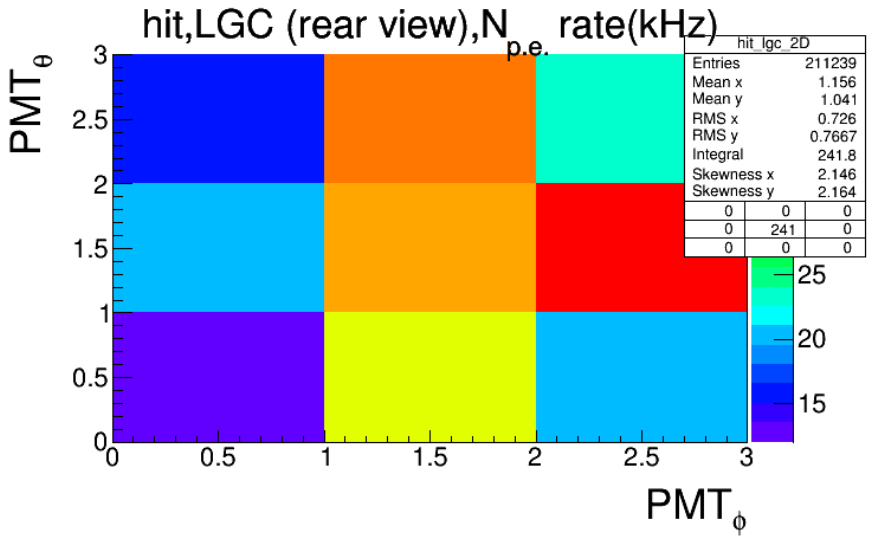


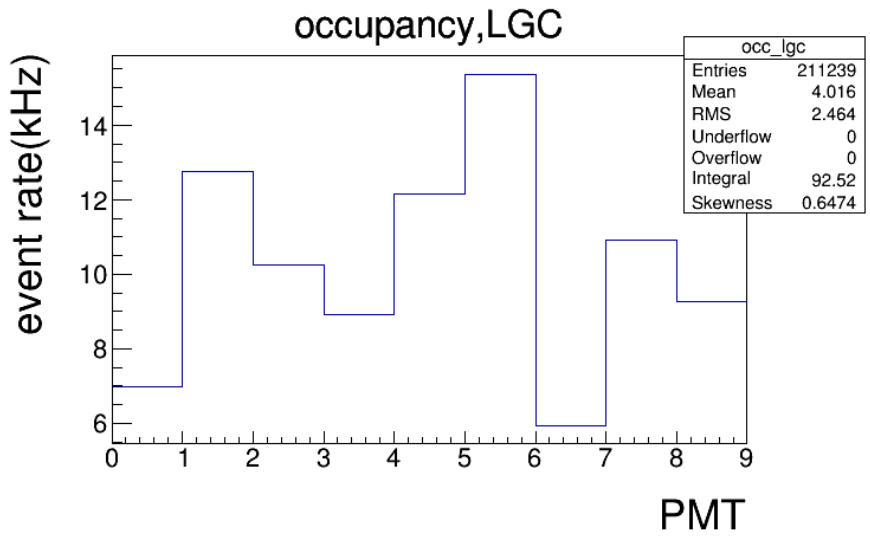


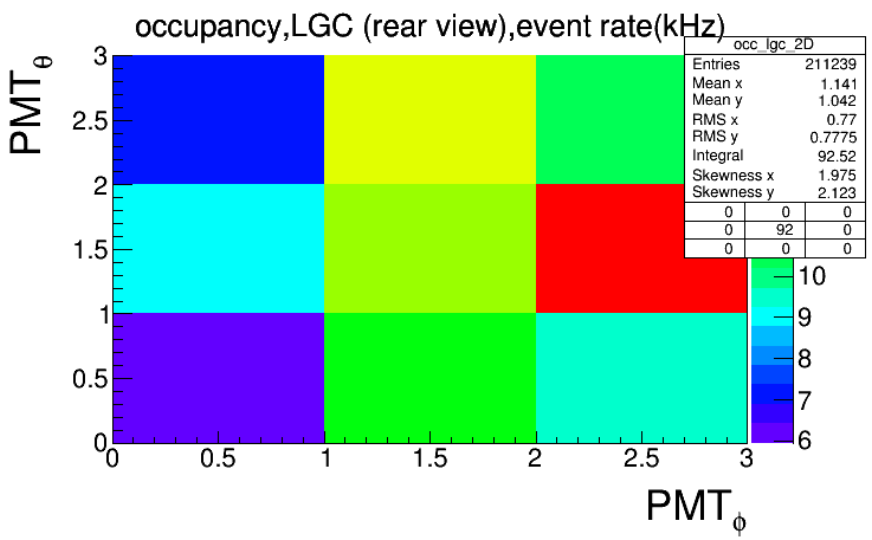


SIDIS_He3, gas (pi0)
N_p.e. > 0 for occupancy



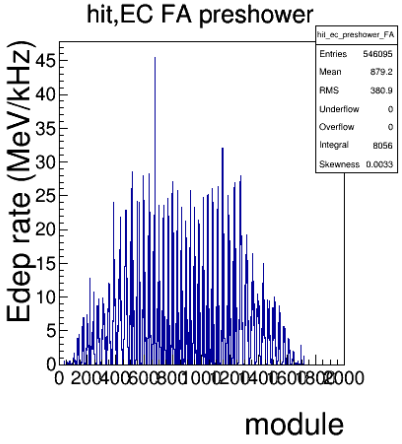


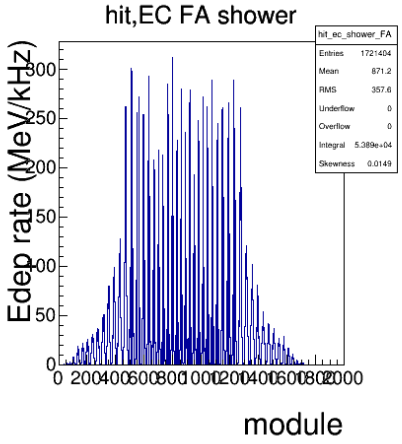


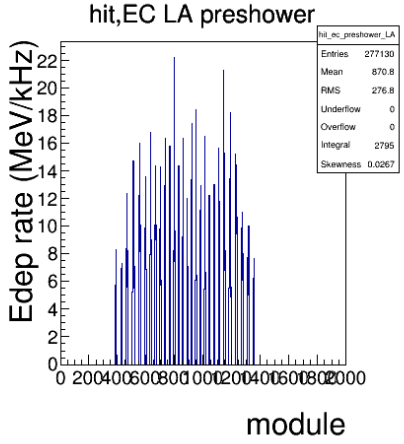


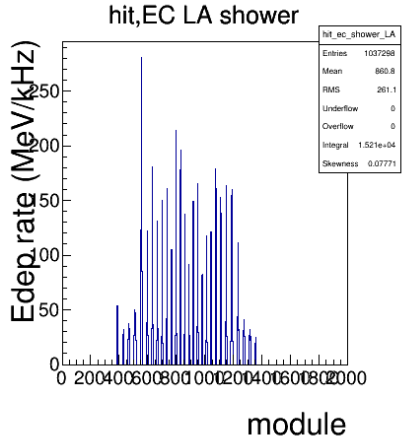
SIDIS_He3, gas (e DIS)

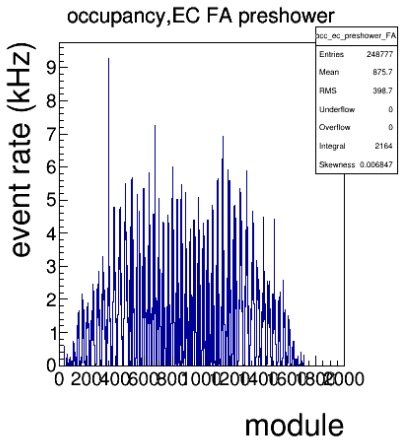
Occupancy cut, preshower>0.4MeV, shower>6MeV

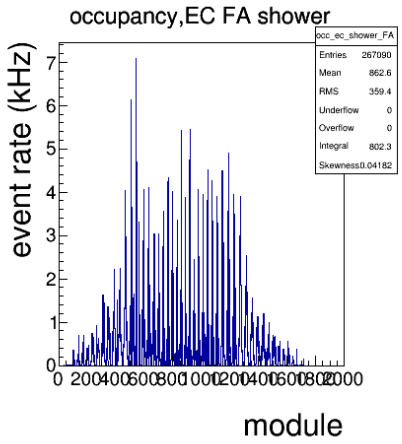


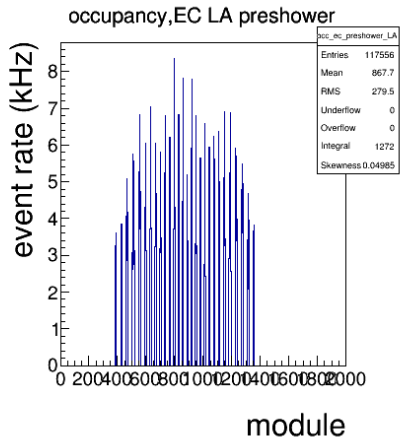


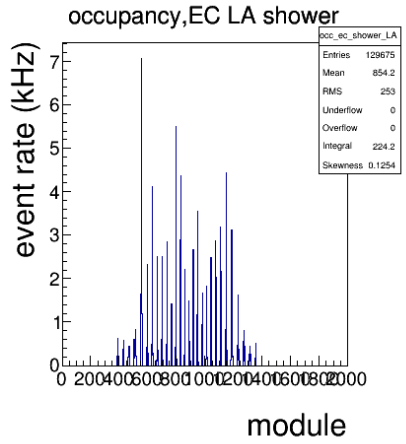






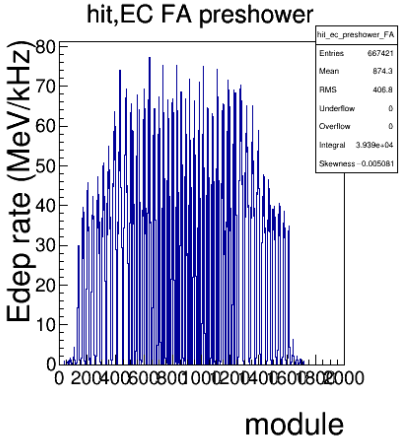


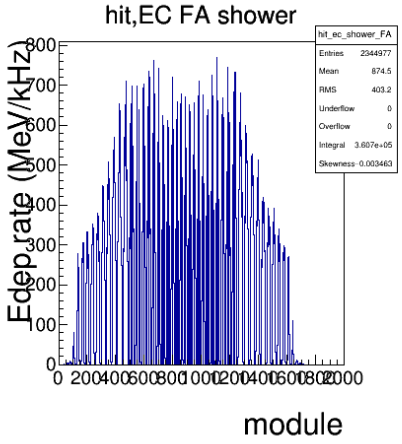


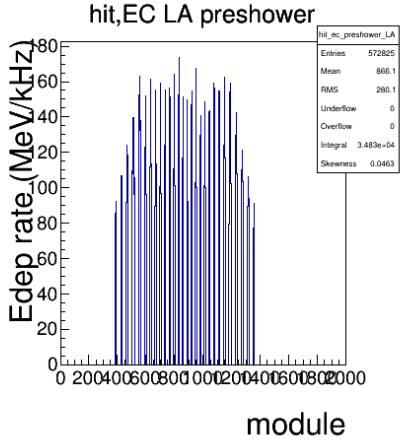


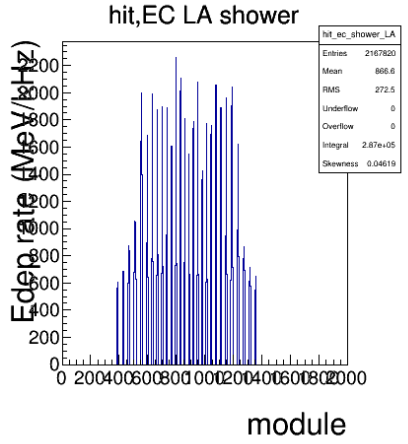
SIDIS_He3, gas (pi0)

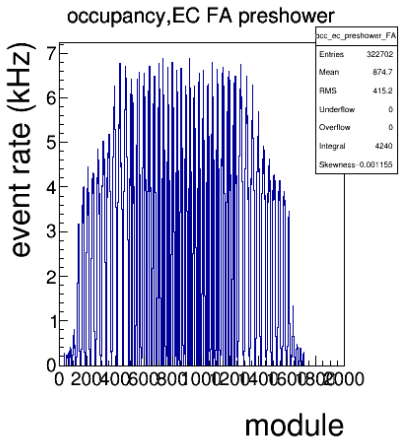
Occupancy cut, preshower>0.4MeV, shower>6MeV

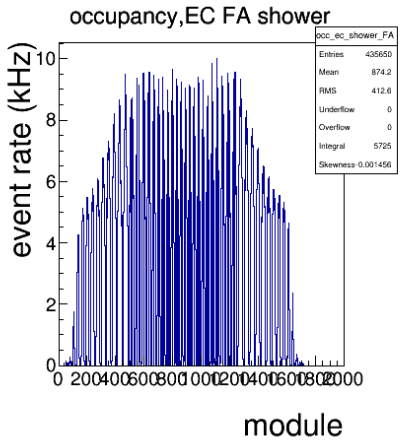


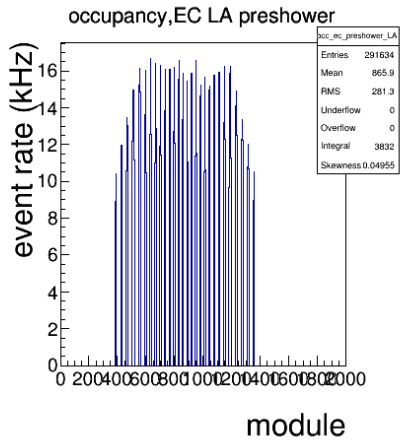


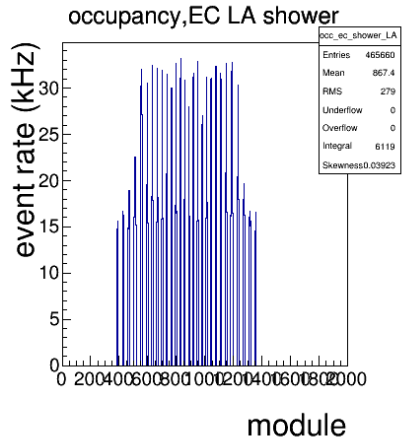










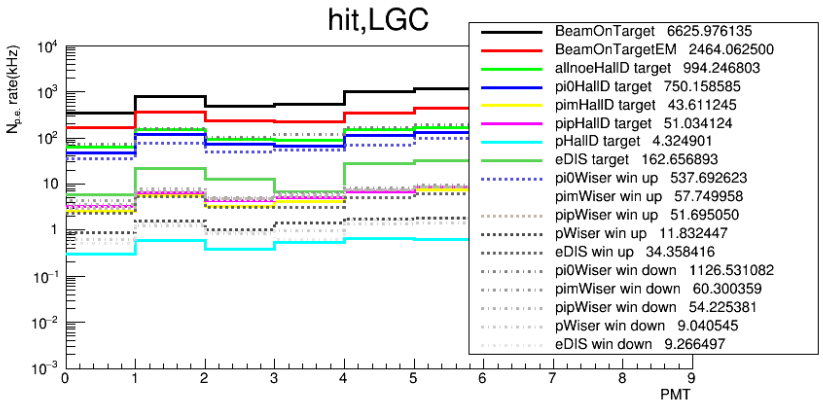


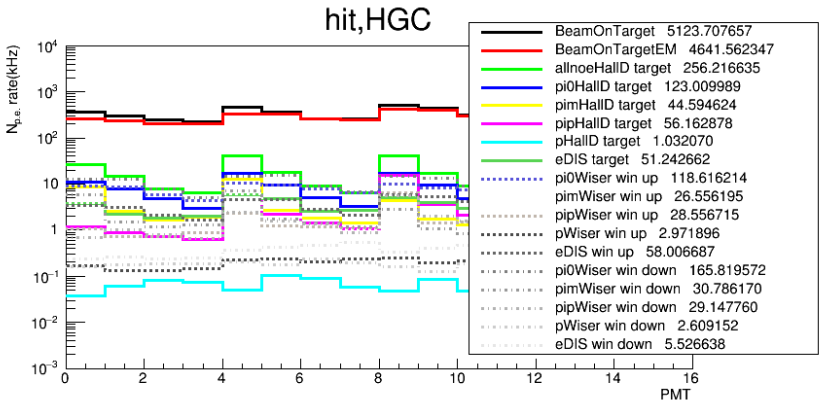
All source

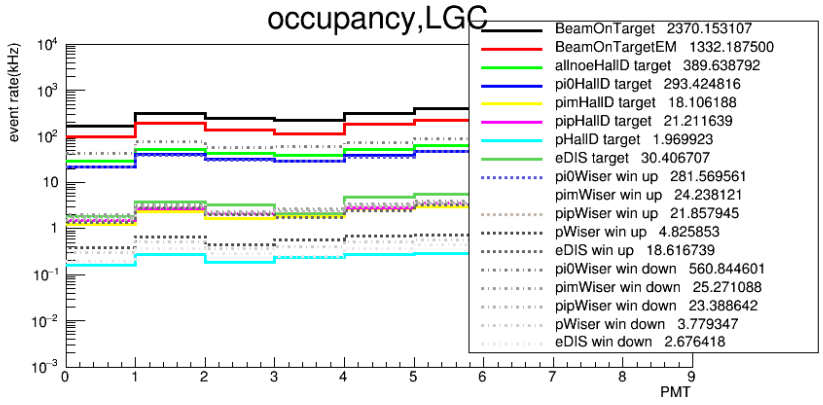
- all source from target and windows
  - BeamOnTarget, BeamOnTargetEM by Geant4
  - eDIS, pions and proton from target by HallD
  - pions and proton from windows by Wiser
- Occupancy threshold cut (low)
  - LGC > 0 N of p.e.
  - HGC > 0 N of p.e.
  - SPD_FA > 0.1MeV (1/5 of trigger cut 0.5MeV)
  - SPD_LA > 0.3MeV (1/5 of trigger cut 1.5MeV)
  - EC preshower > 0.4MeV
  - EC shower > 6MeV
- Occupancy threshold cut (high)
  - LGC > 1 N of p.e.
  - HGC > 1 N of p.e.
  - SPD_FA > 0.25MeV (1/2 of trigger cut 0.5MeV)
  - SPD_LA > 0.75MeV (1/2 of trigger cut 1.5MeV)
  - EC preshower > 0.8MeV
  - EC shower > 12MeV

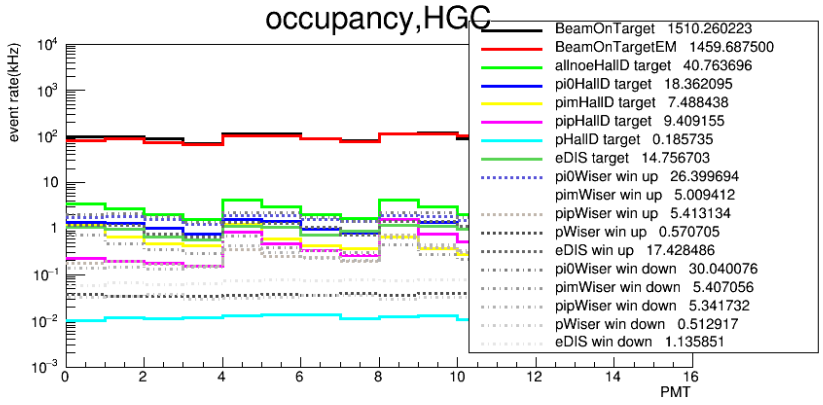
LGC and HGC

Occupancy cut (low), LGC > 0 N of p.e. HGC > 0 N of p.e.



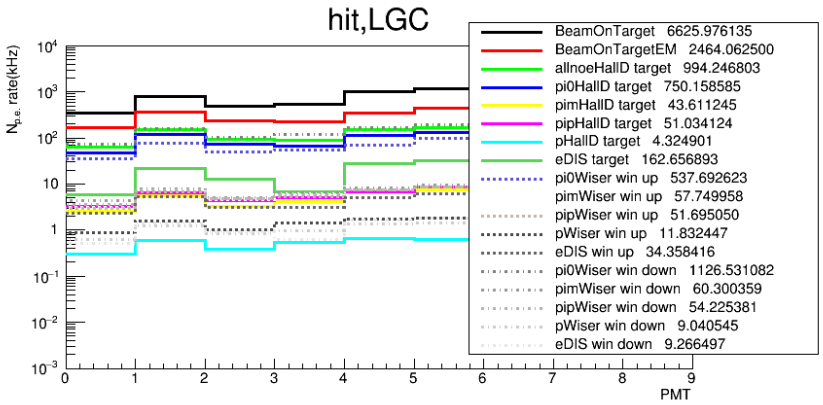


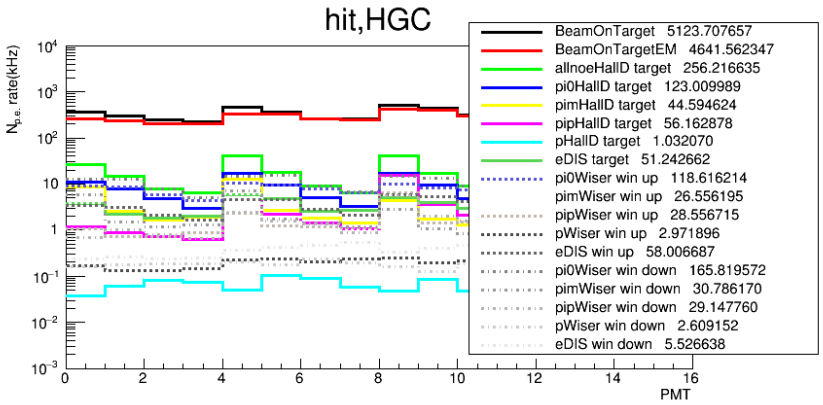


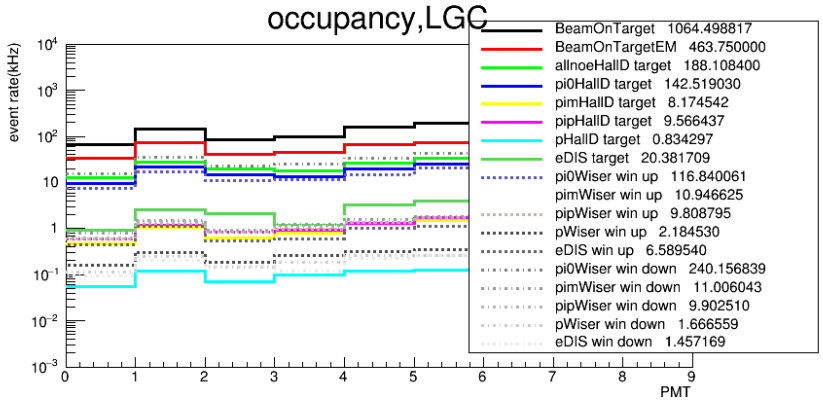


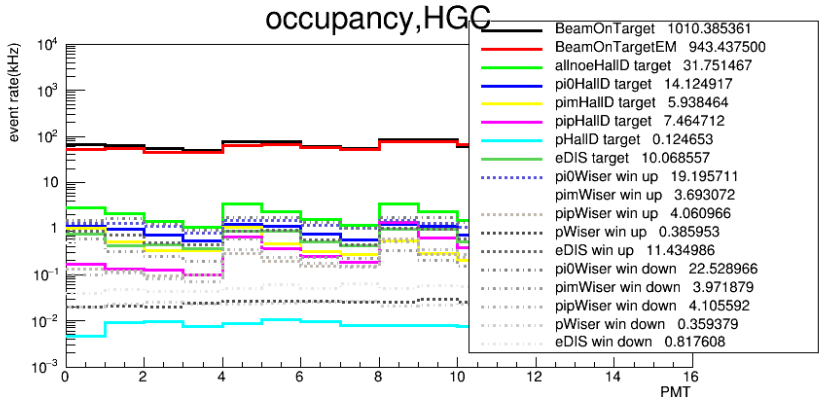
LGC and HGC

Occupancy cut (high), LGC > 1 N of p.e. HGC > 1 N of p.e.



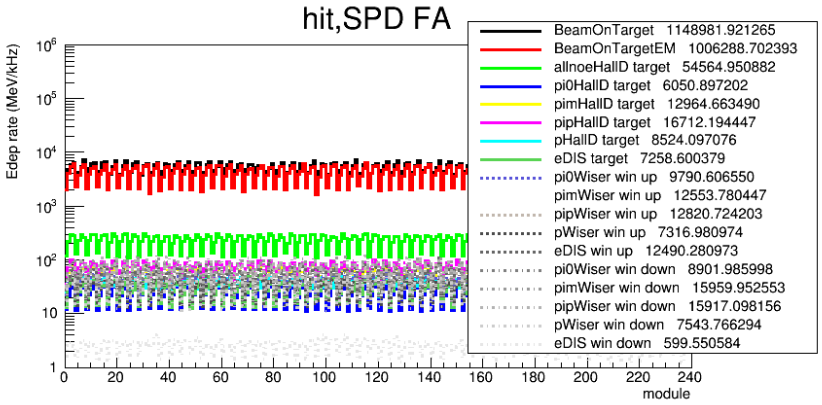


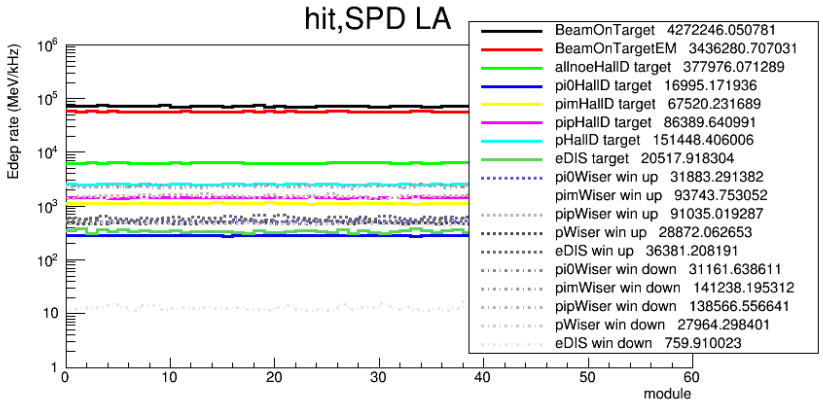


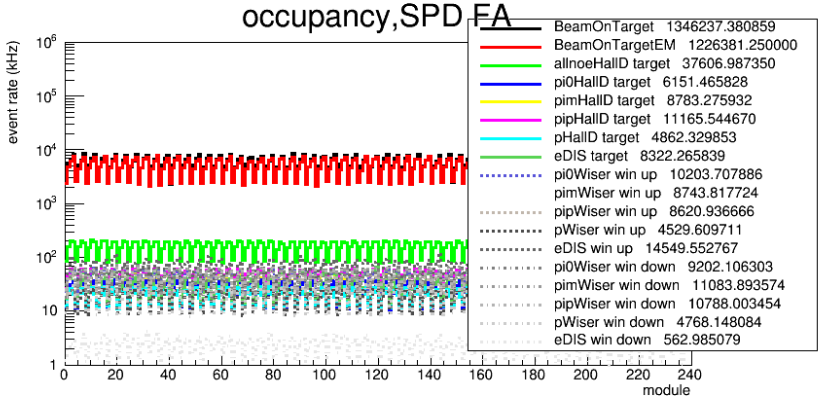


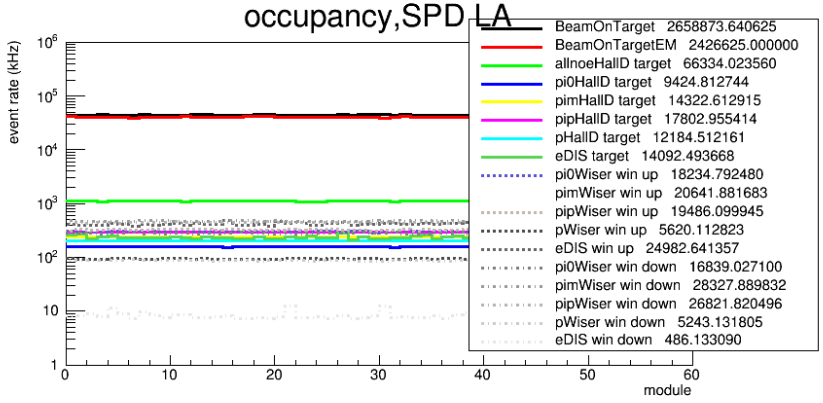
SPD

Occupancy cut (low), FA > 0.1 MeV, LA > 0.3 MeV



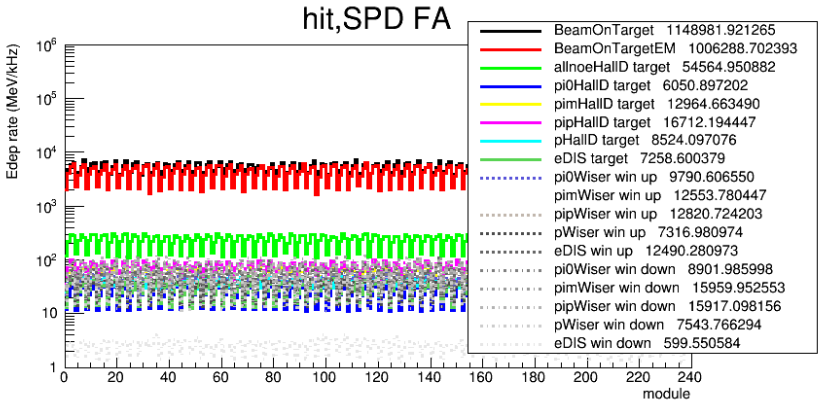


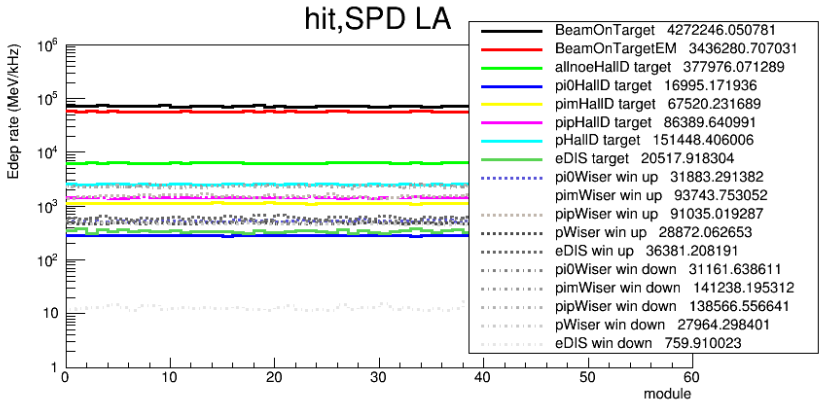


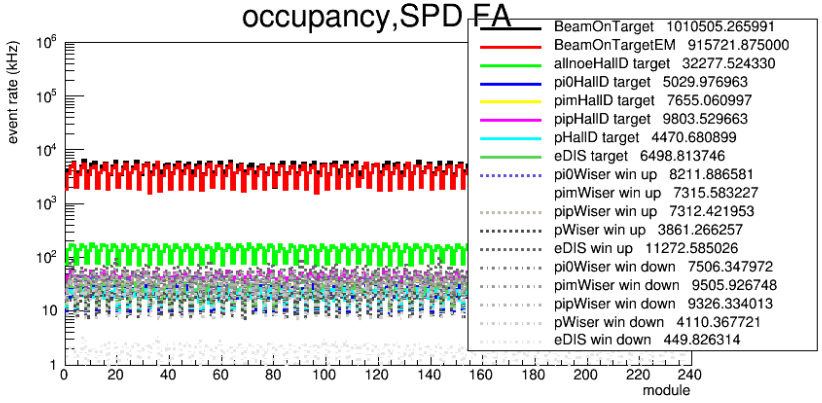


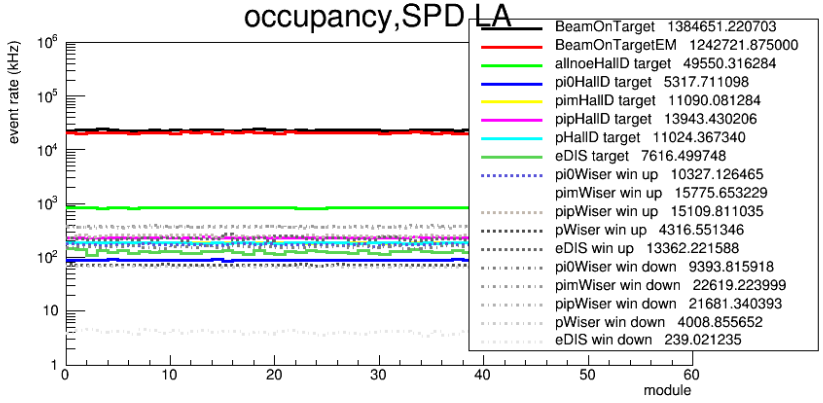
SPD

Occupancy cut (high), FA > 0.25 MeV, LA > 0.75 MeV



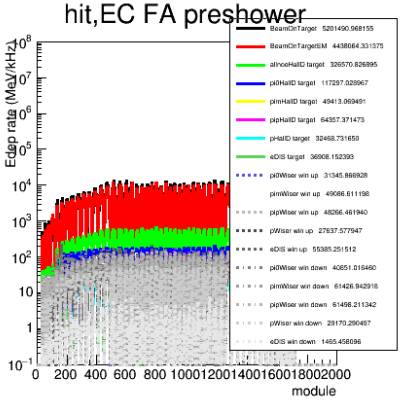


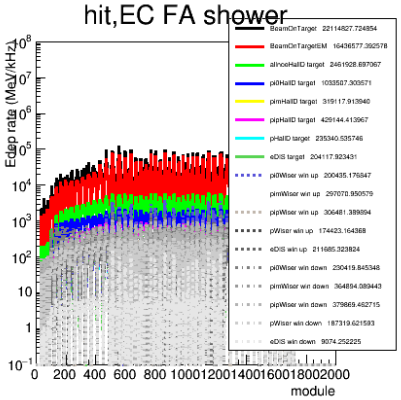


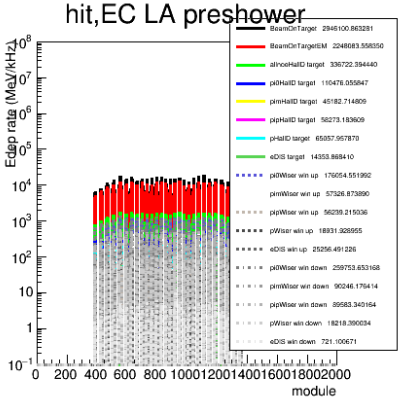


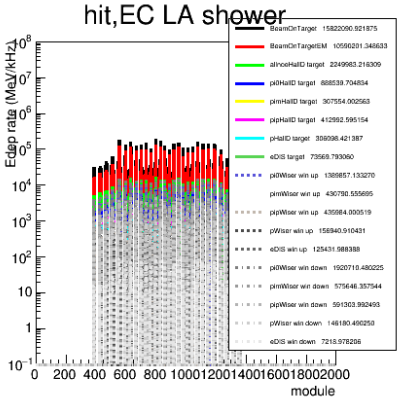
EC

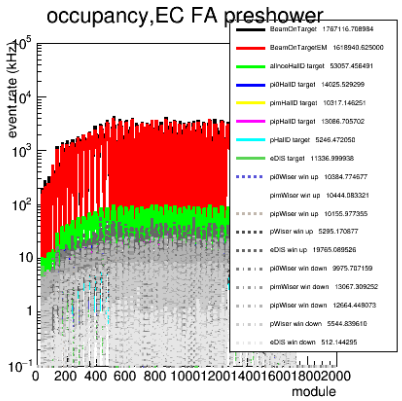
Occupancy cut (low), preshower > 0.4 MeV, shower > 6 MeV

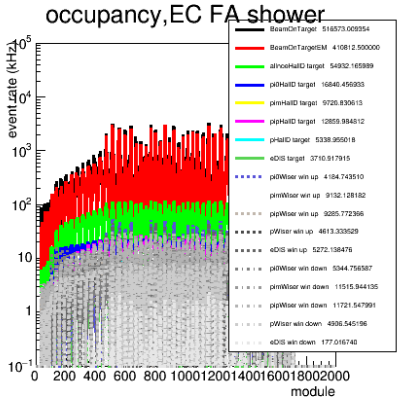


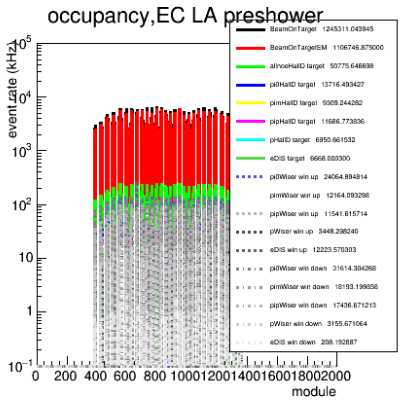


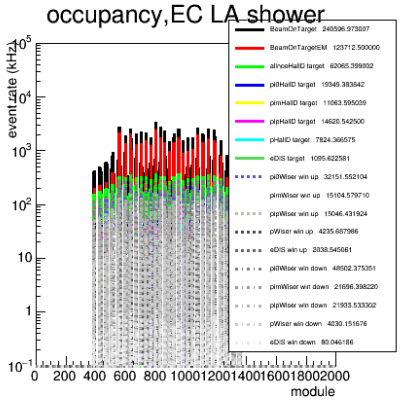






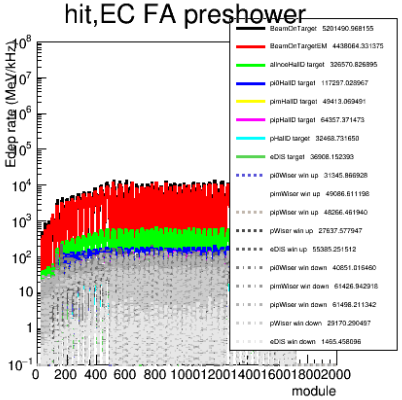


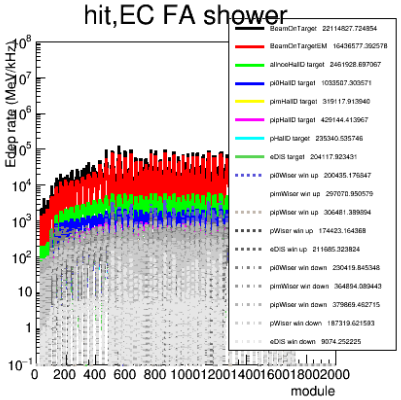


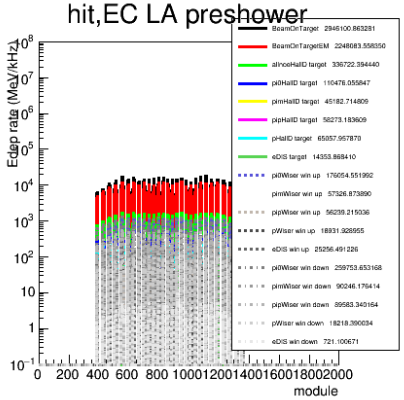


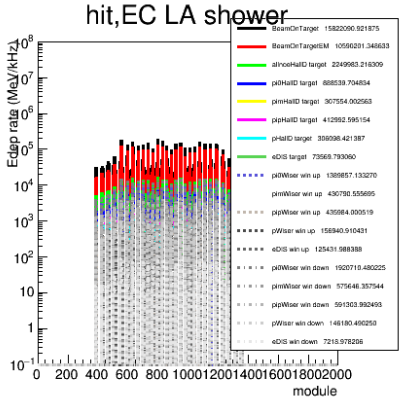
EC

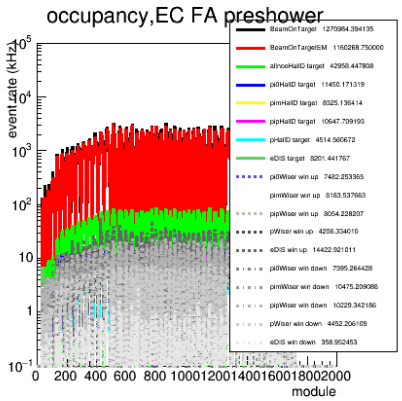
Occupancy cut (high), preshower > 0.8 MeV, shower > 12 MeV

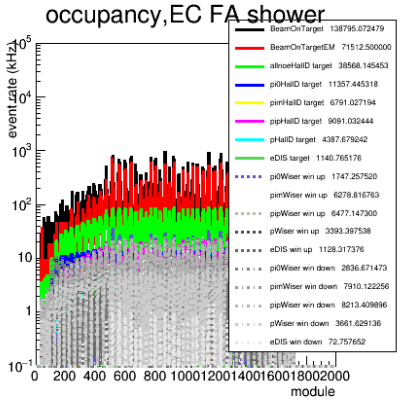


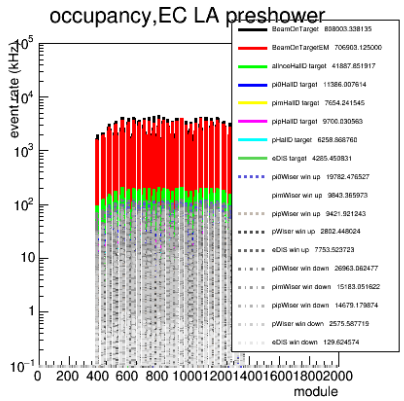


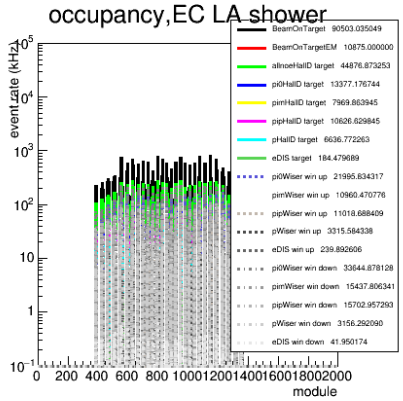












Occupancy Result: LGC and HGC

- The table shows
  - For LGC: sum of 9 channels
  - For HGC: sum of 16 channels

Occ(kHz)	BeamOnTarget	BeamOnTargetEM	Pi0 Halld gas	Pi0 Wiser win up	Pi0 Wiser win down	eDIS Halld gas	eDIS Wiser win up	eDIS Wiser win down
LGC (>0)	2370	1332	293	281	560	30	19	3
LGC (>1)	1064	464	143	117	240	20	7	2
HGC (>0)	1510	1460	18	26	30	15	17	1
HGC (>1)	1010	943	14	19	23	10	12	1

For LGC, EM and hadron contribute half and half
For HGC, EM is dominating

Occupancy Result: SPD

- The table shows
  - For SPD_FA: sum of 240 channels
  - For SPD_LA: sum of 60 channels

Occ(kHz)	BeamOnTarget	BeamOnTargetEM
SPD_FA (>0.1)	1.35e6	1.23e6
SPD_FA (>0.25)	1.01e6	0.92e6
SPD_LA (>0.3)	2.67e6	2.43e6
SPD_LA (>0.75)	1.38e6	1.24e6

For SPD, EM is dominating

Occupancy Result: EC

- The table shows
  - For EC_FA: sum of ~1300 channels
  - For EC_LA: sum of ~500 channels

Occ(kHz)	BeamOnTarget	BeamOnTargetEM
EC_preshower_FA (>0.4)	1.79e6	1.62e6
EC_preshower_FA (>0.8)	1.27e6	1.16e6
EC_shower_FA (>6)	5.16e5	4.11e5
EC_shower_FA (>12)	1.39e5	0.72e5
EC_preshower_LA (>0.4)	1.25e6	1.11e6
EC_preshower_LA (>0.8)	0.81e6	0.71e6
EC_shower_LA (>6)	2.41e5	1.24e5
EC_shower_LA (>12)	0.91e5	0.11e5

For shower, EM and hadron contribute half and half
For preshower, EM is dominating

Result Summary A

- All values from “BeamOnTarget”

	Max Occ(kHz/channel) low cut	Max Occ(kHz/channel) high cut	Average Occ(kHz/channel) low cut	Average Occ(kHz/channel) high cut	Number of channel	Total Occ(kHz) low cut	Total Occ(kHz) high cut
LGC	411	190	263	118	270	71e3	32e3
HGC	120	83	94	63	480	45e3	30e3
SPD_FA	8.6e3	6.3e3	5.6e3	4.2e3	240	1.35e6	1.01e6
SPD_LA	45.6e3	23e3	44.5e3	23e3	60	2.67e6	1.38e6
EC_preshower_FA	4373	3312	1380	980	~1300	1.79e6	1.27e6
EC_shower_FA	3153	920	400	110	~1300	5.16e5	1.39e5
EC_preshower_LA	6644	4533	2500	1620	~500	1.25e6	0.81e6
EC_shower_LA	3415	825	482	182	~500	2.41e5	0.91e5
Total					4650	7.9e6	4.6e6

Result Summary B

- All values from “BeamOnTarget”

	Max Occ(kHz/channel)	Average Occ(kHz/channel) low cut	Number of channel	Total Occ(kHz)
GEM 1			906*30	
GEM 2			1020*30	
GEM 3			1166*30	
GEM 4			1404*30	
GEM 5			1040*30	
GEM 6			1280*30	
MRPC		893	33*50*2	2.95e6
Total			207780	

SIDIS ^{3}He GEM occupancies		
Plane	Total strip number (u+v) per sector	Raw Occupancy (%)
1	906	2.37
2	1020	7.98
3	1166	3.40
4	1404	2.24
5	1040	2.03
6	1280	1.52

Other thoughts

- So far all hit rates and particles rate are based on detector response from individual particles.
- Some detector like SPD and EC have high rate. There are many particles entering them within their integration time windows. If we consider this, the hit rate, occupancy cut value, occupancy rate could be different