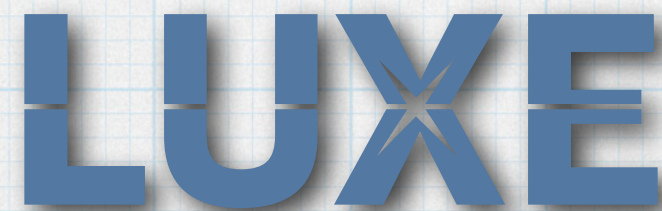


Radiation load

Borysova Maryna (KINR)

07/03/22

LUXE simulation meeting

The logo for the LUXE experiment, featuring the word "LUXE" in a bold, blue, sans-serif font. The letter "X" is stylized with a grey, multi-pointed star or cross shape in the center, creating a focal point. The letters have a slight 3D effect with a darker blue shadow underneath.

Absorbed dose estimation

Absorbed dose is a dose quantity which is the measure of the energy deposited in **matter** by **ionizing radiation** per unit mass.

Absorbed dose of ionizing radiation

Common symbols	D
SI unit	Gray
Other units	Rad, Erg
In SI base units	$\text{J} \cdot \text{kg}^{-1}$

* Energy deposited in sensitive volumes from Hits tree

* $D = E_{\text{dep}} / M$ $\text{Gy} = [\text{J/kg}]$

* M is the mass of sensitive volume (pad, pixel...)

* To convert it to Gray, convert E_{dep} in GeV to Joule: 1 GeV is equal to $\sim 1.6\text{E-}10$ J.

* Samples used for estimations:

The estimations are done using
1x signal + 9x background

Signal MC

Oleksandr Borysov posted on 11. Feb. 2021 10:58h - last edited by Oleksandr Borysov on 05. Oct. 2021 15:17h

PTarmigan_V0.8.1

JET140 (Phase 0, circularly polarized laser)

e_laser 16.5 GeV

MC	# MC out (BX)	Processed (BX)	Location
e0gpc_0.5_g4{0-9}	10	10	/nfs/dust/luxe/group/MCProduction/Signal/laser/phase0/gpc/e0gpc_0.5
e0gpc_1.0_g4{0-9}	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_1.0
e0gpc_3.0_g4{0-9}	10	9	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_3.0

Electron-laser 16.5 GeV

Background

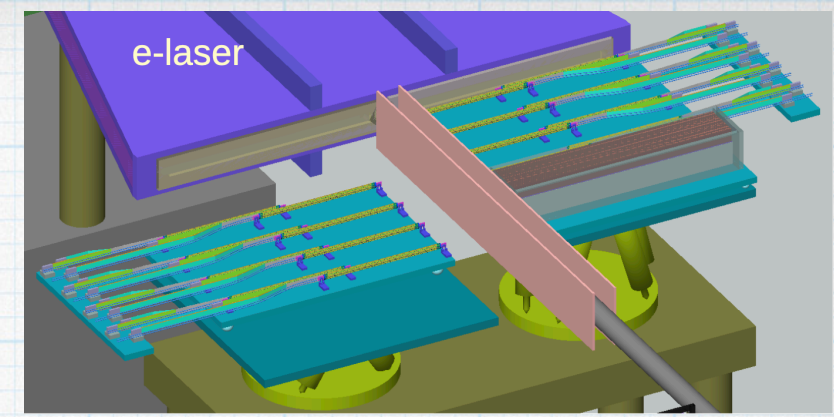
Simulation	ID	# particles	Processed (BX)	Location	Notes
Background for electron-laser setup	tdr_el_01	3.2e9	2.13	/nfs/dust/luxe/group/MCProduction/Background/elaser/31082021_7671ee4c/list_root_7671ee4c.txt	Setup corresponds to commit 7671ee4c305 (hics branch) elaer_tdr_v0.1
Background for electron-laser setup	tdr_el_f_01	1.12e10	7.45	/nfs/dust/luxe/group/MCProduction/Background/elaser/10102021_7671ee4c_fast	Setup corresponds to commit 7671ee4c305 (hics branch) elaer_tdr_v0.1 with the option to stop tracking particles which hit beam dumps or shielding
Background for electron-laser setup	tdr_el_n_01	2.09e8	0.14	/nfs/dust/luxe/group/MCProduction/Background/elaser/03112021_b7acaa6e/ob	Setup corresponds to commit b7acaa6e (hics branch) with additional neutron absorber attached to the electron beam dump. It is made of borated polyethylene concrete.

New

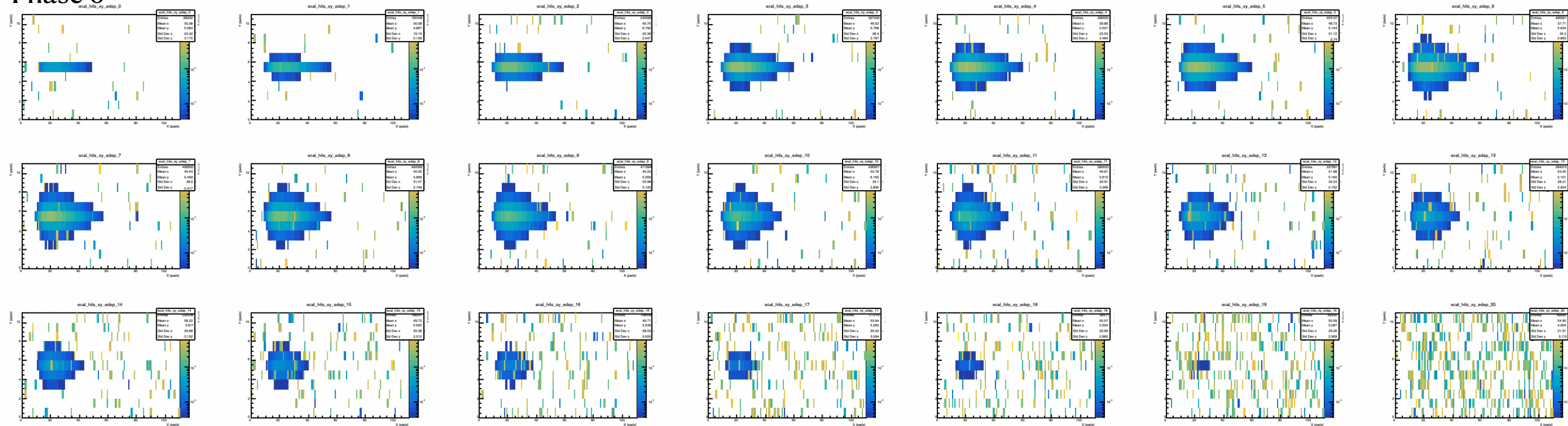
Signal MC Phase 1	intensity param. xi	# MC out (BX)	Processed (BX)	Location	Notes
b1gpc_10.0_g4{0-9}	10	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpc/	G4 hics: beedd92a; MC: b1gpc_10.0_{0-9}
e1gpc_7.0_g4{0-4}	7.0	1	5	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpca/7.0	G4 hics: 406b86e9

ECAL Signal

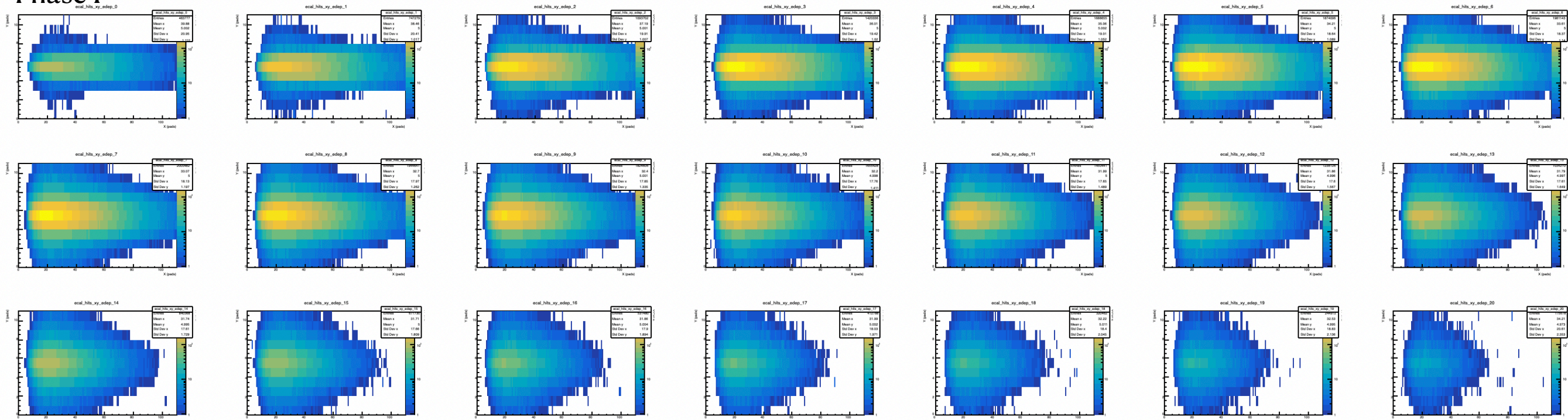
- JET140, 16.5 GeV, $\xi = 3$ vs $\xi = 10$, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan



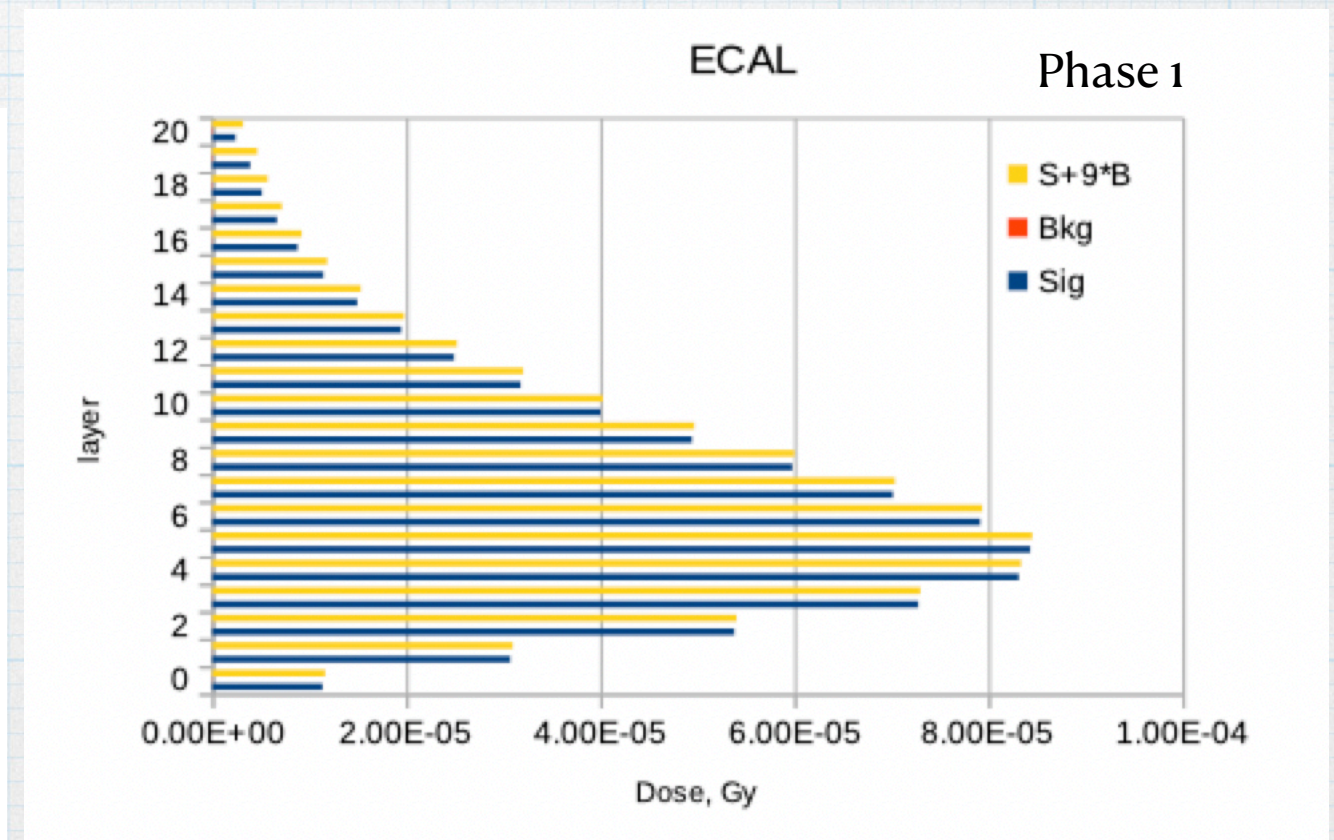
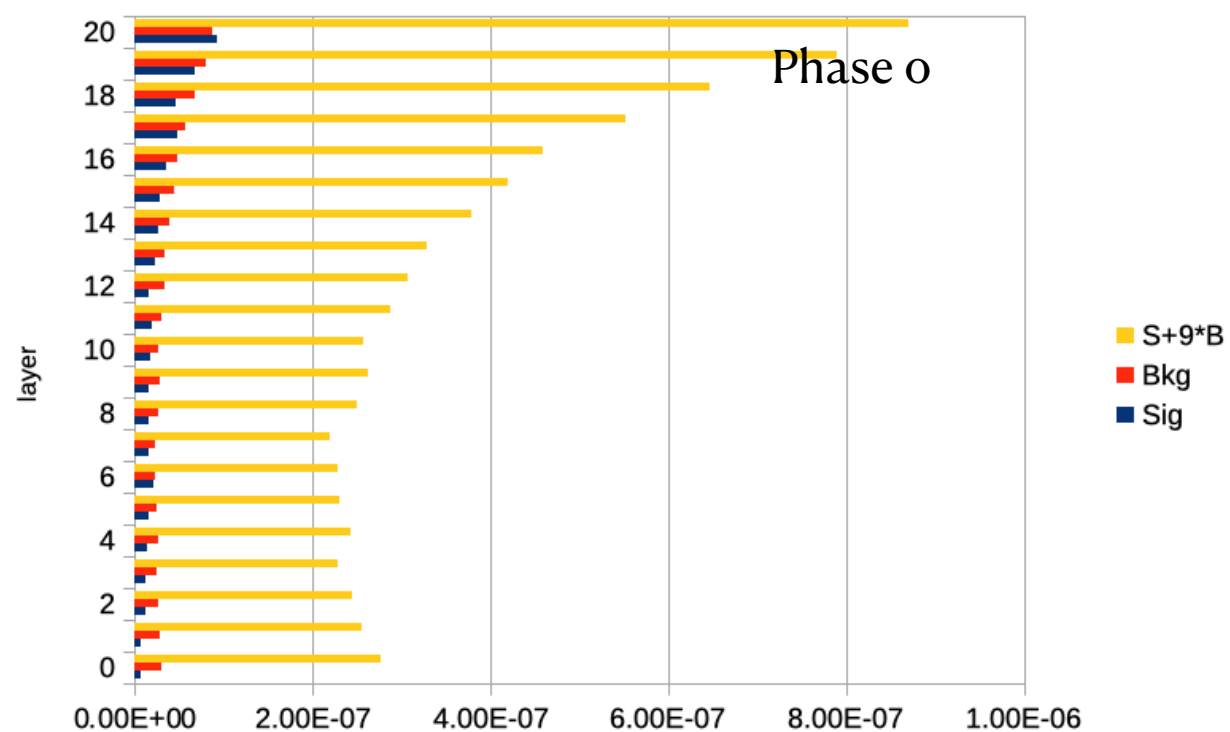
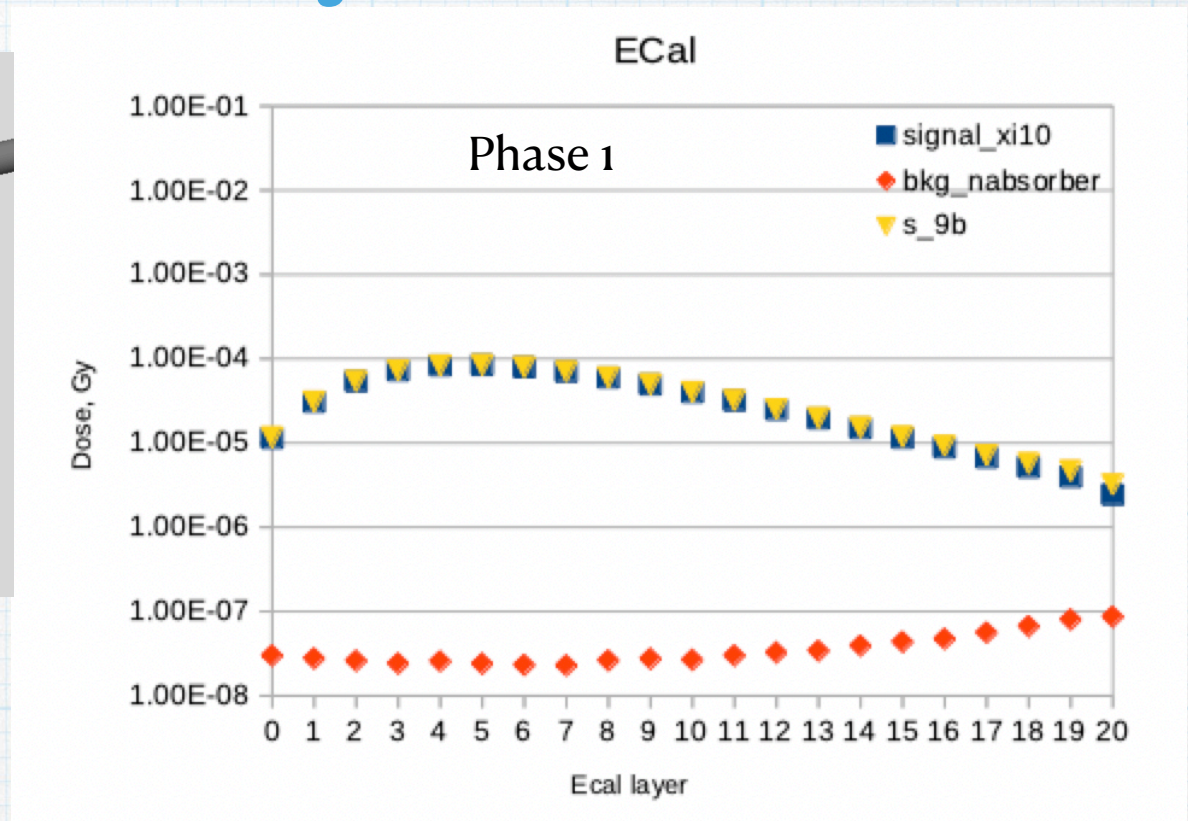
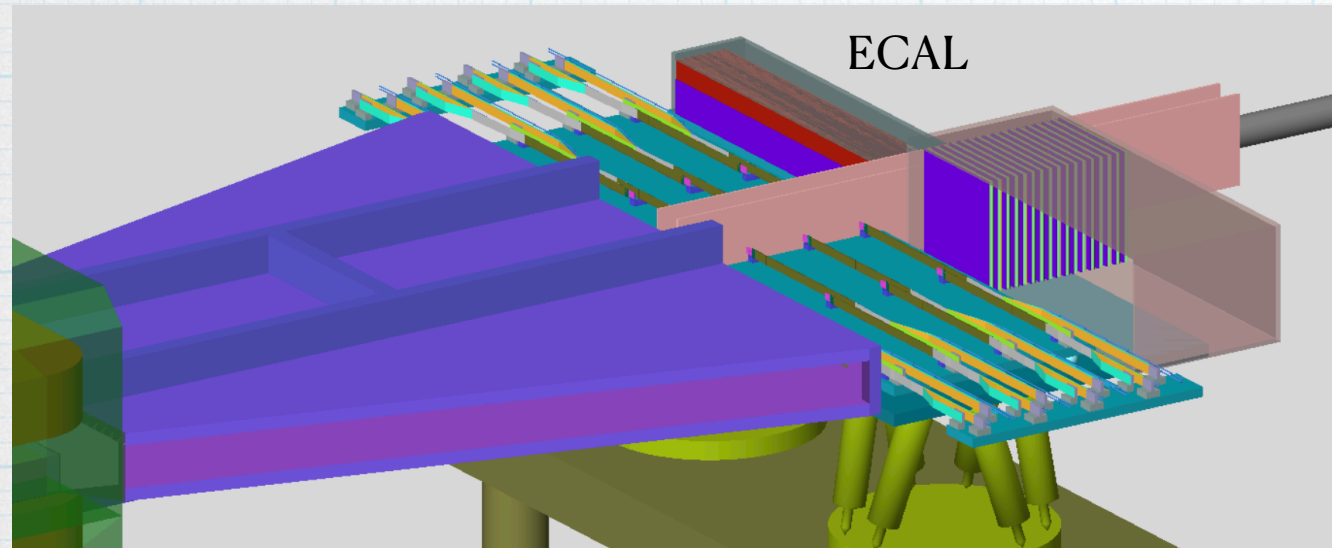
Phase 0



Phase 1



ECAL: phase 0 vs phase 1



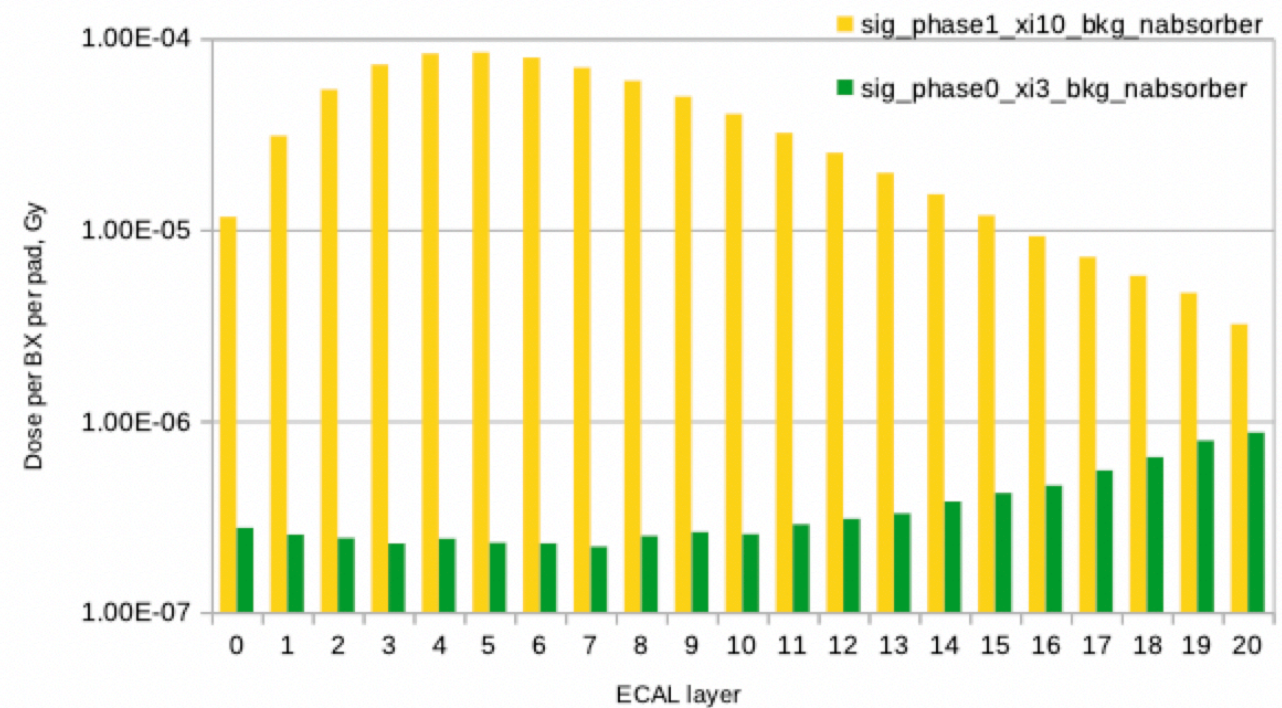
ECAL: phase 0 vs phase 1 (log scale)

Phase 0

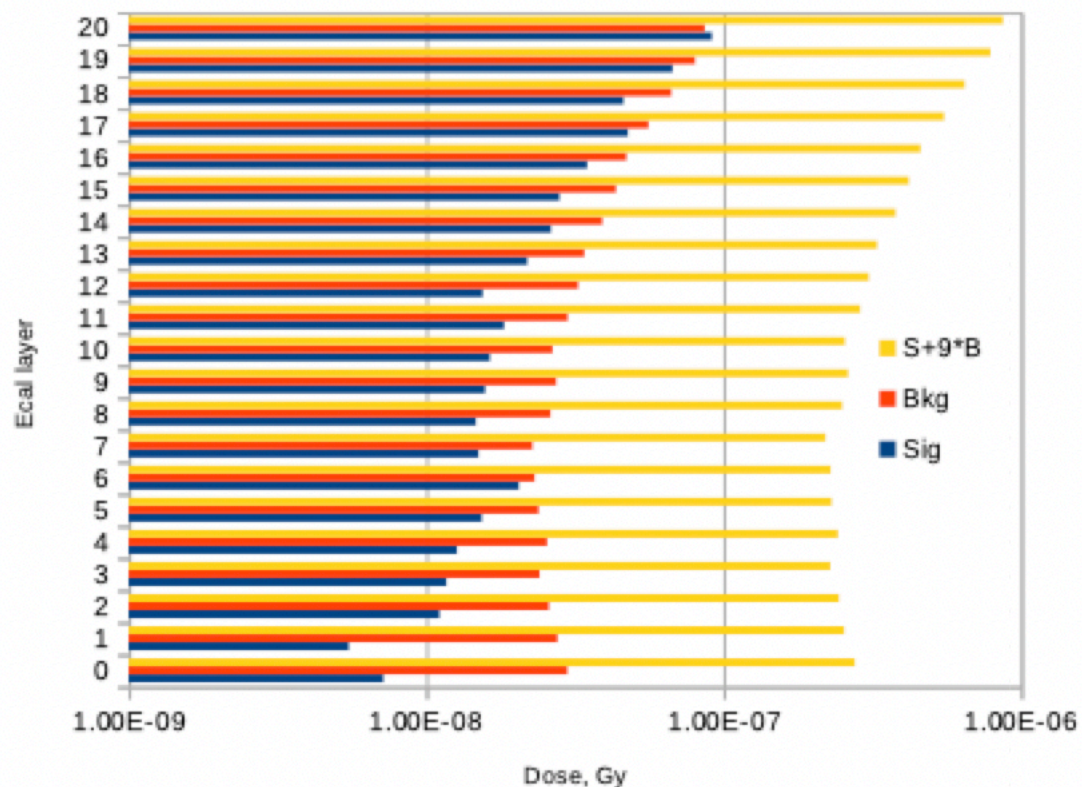
	min	max	av
bkg	2.28E-08	8.65E-08	1.41E-06
sig	5.50E-09	9.14E-08	4.97E-07
sig+9*bkg	2.20E-07	8.70E-07	1.34E-05

Phase 1

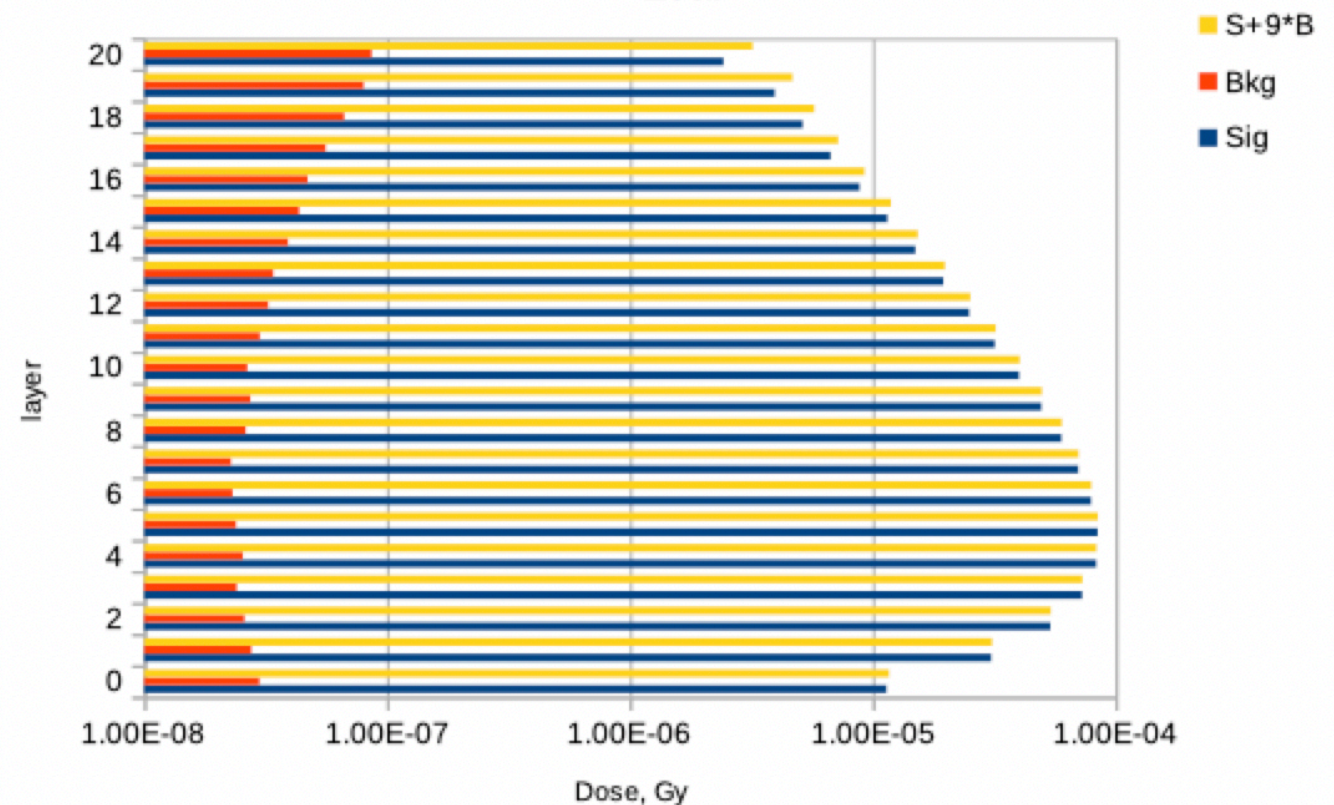
	min	max	av
bkg	2.28E-08	8.65E-08	3.80E-08
sig	2.43E-06	8.43E-05	3.64E-05
sig+9*bkg	3.21E-06	8.45E-05	3.64E-05



ECal Phase 0

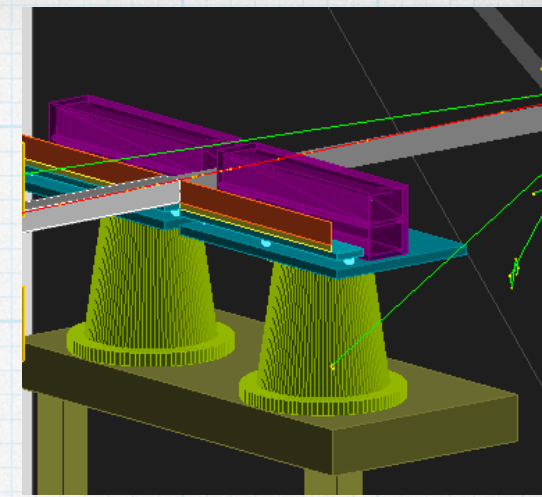


Ecal Phase 1

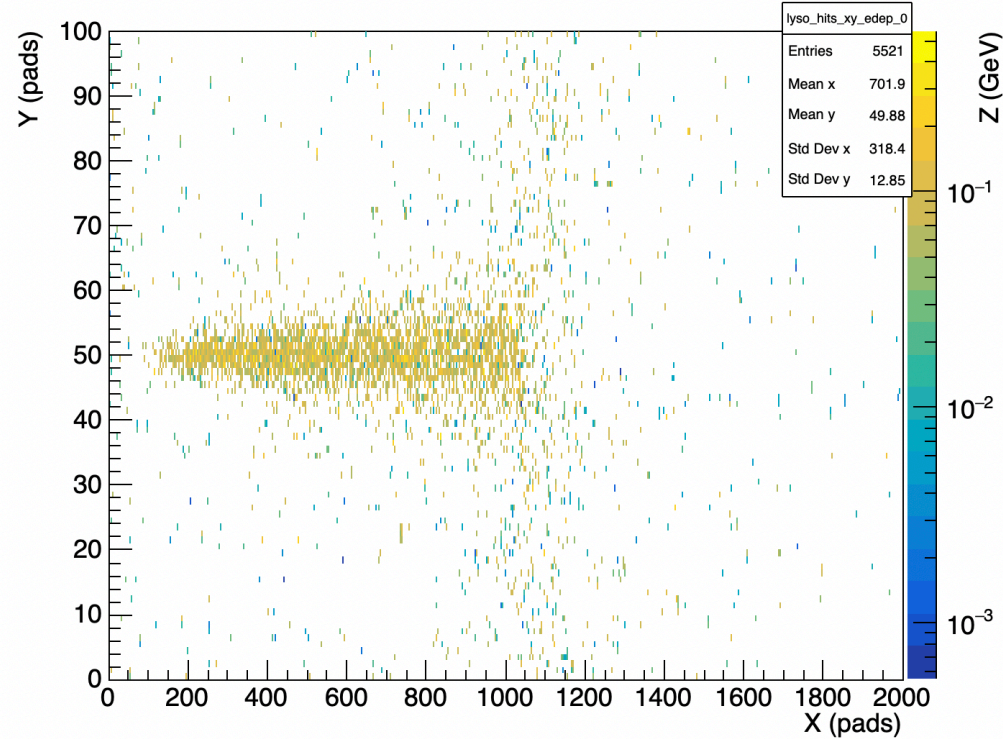


FDS Lanex Spectrometer

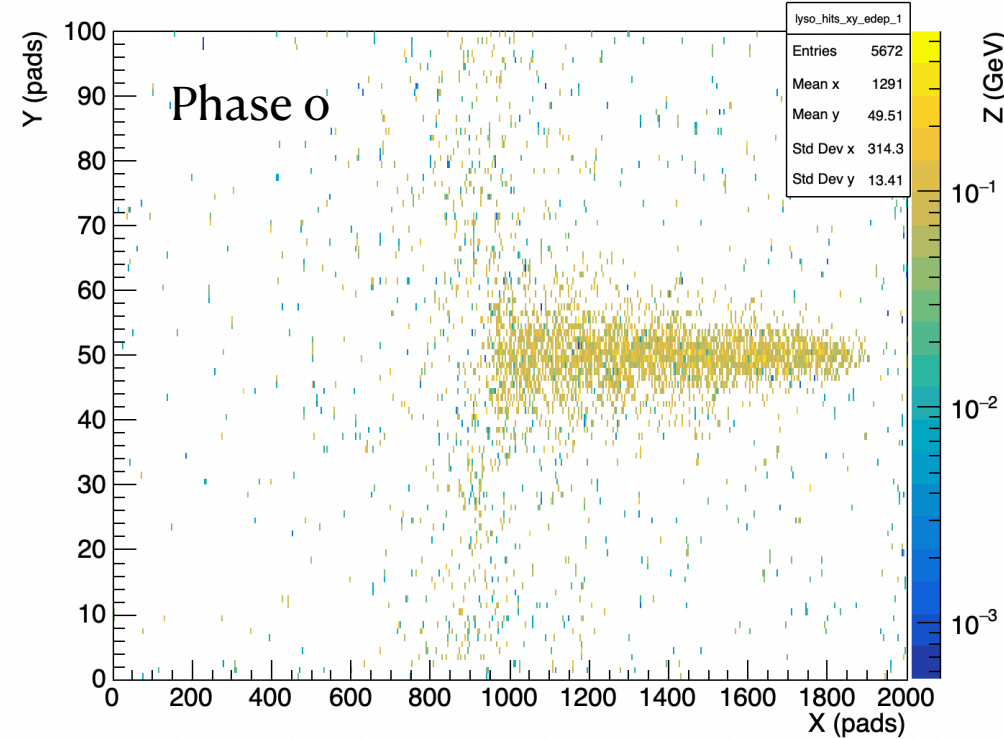
- JET140, 16.5 GeV, $\xi = 3$ vs $\xi = 10$, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan



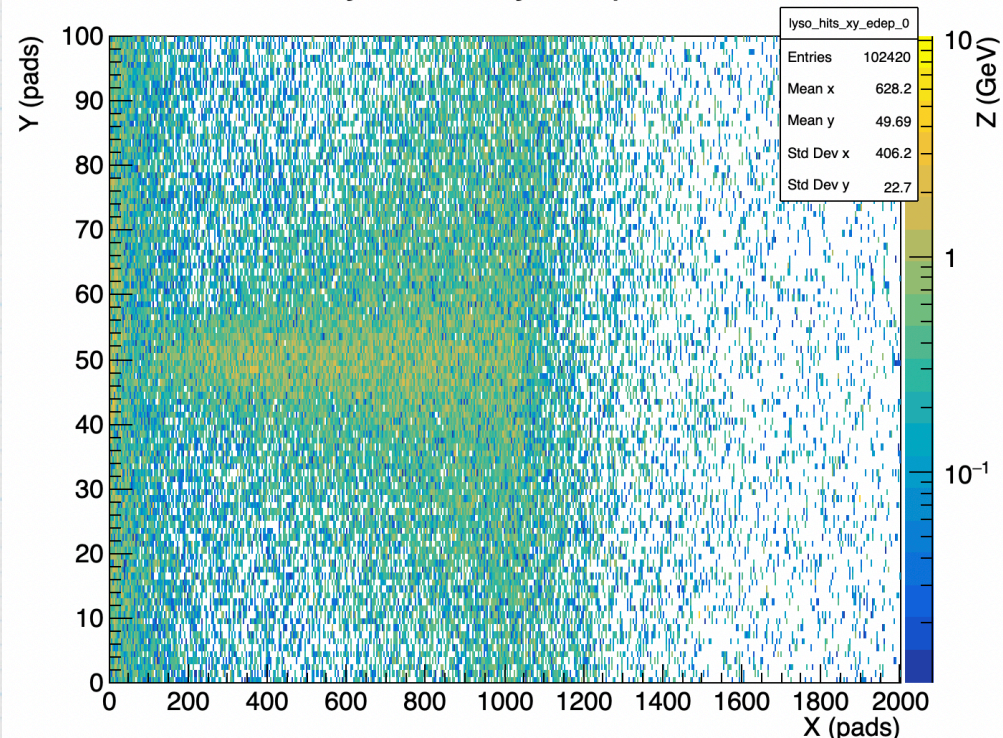
lyso_hits_xy_edep_0



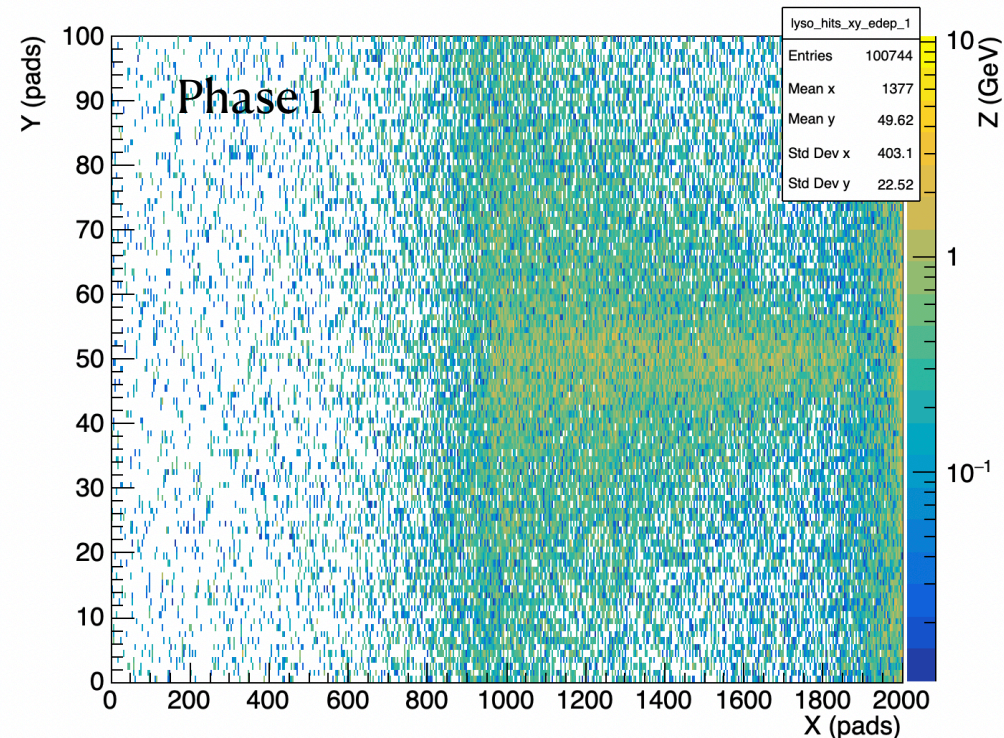
lyso_hits_xy_edep_1



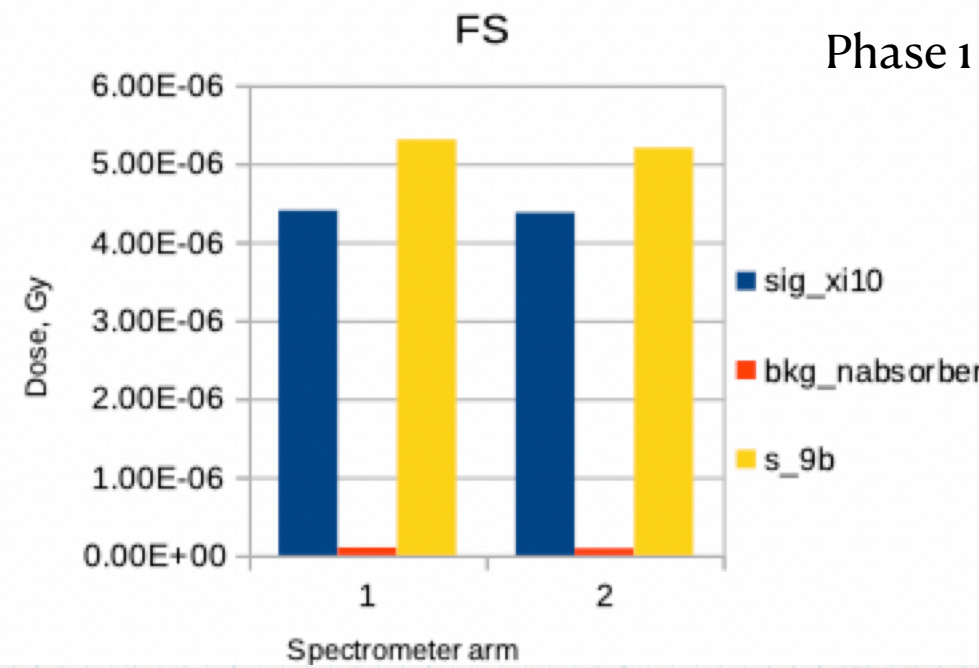
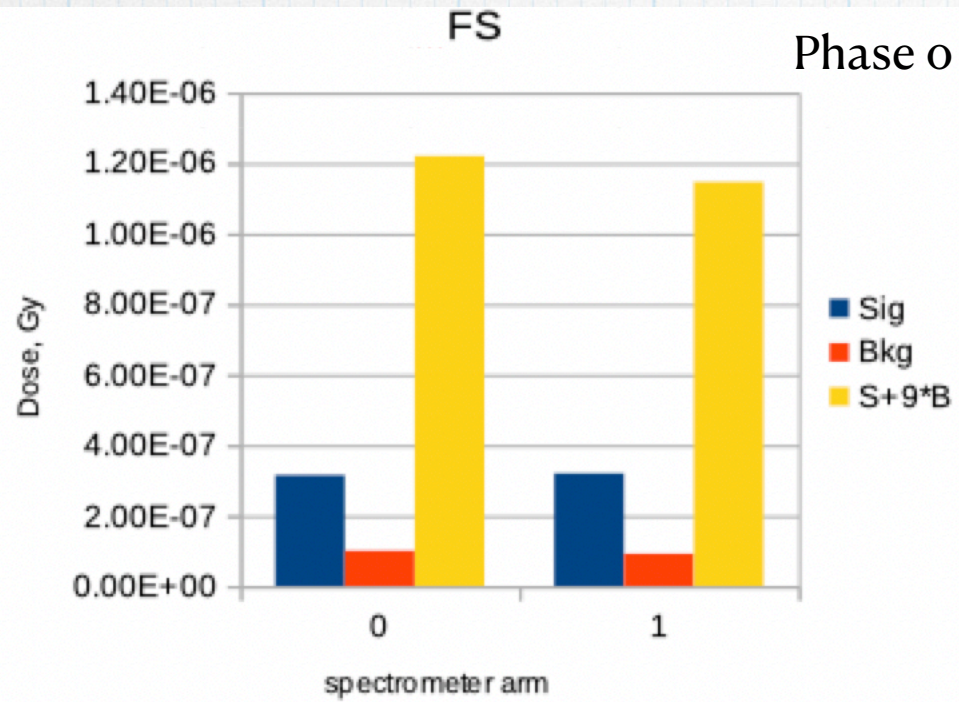
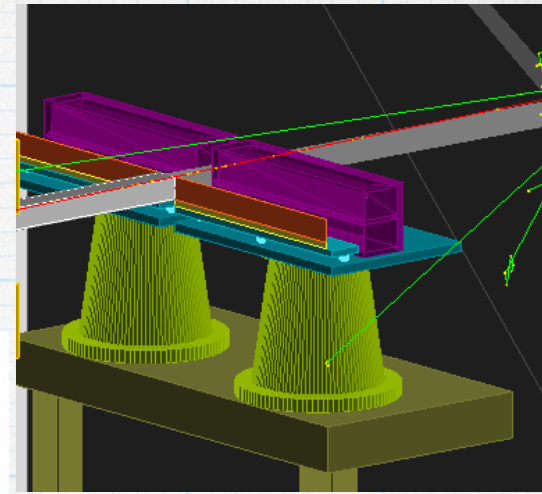
lyso_hits_xy_edep_0



lyso_hits_xy_edep_1



FDS Lanex Spectrometer



FS		Sig	Bkg	S+9*B
Phase 0 xi= 3	0	3.15E-07	1.01E-07	1.22E-06
	1	3.20E-07	9.19E-08	1.15E-06

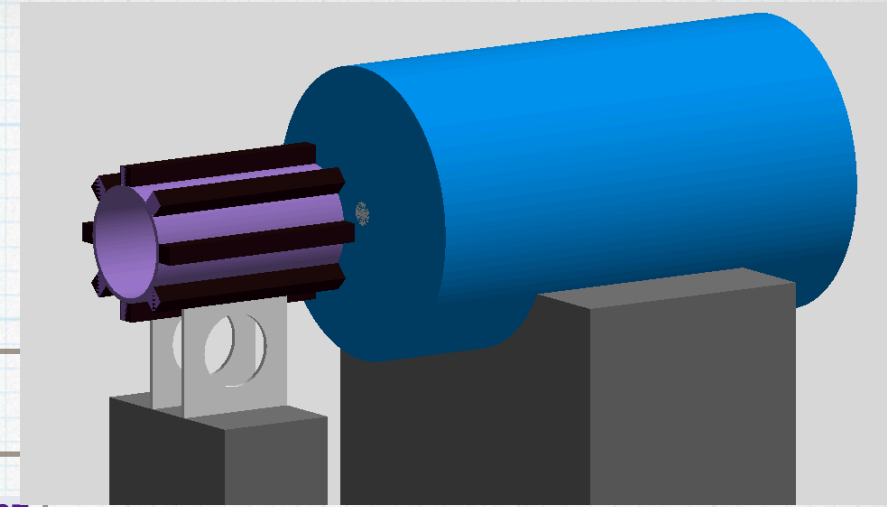
Phase 0 xi =5	0	3.38E-07	1.01E-07	1.24E-06
	1	3.34E-07	9.19E-08	1.16E-06

FS		Sig	Bkg	S+9*B
Phase 1	0	4.40E-06	1.01E-07	5.31E-06
	1	4.38E-06	9.19E-08	5.20E-06

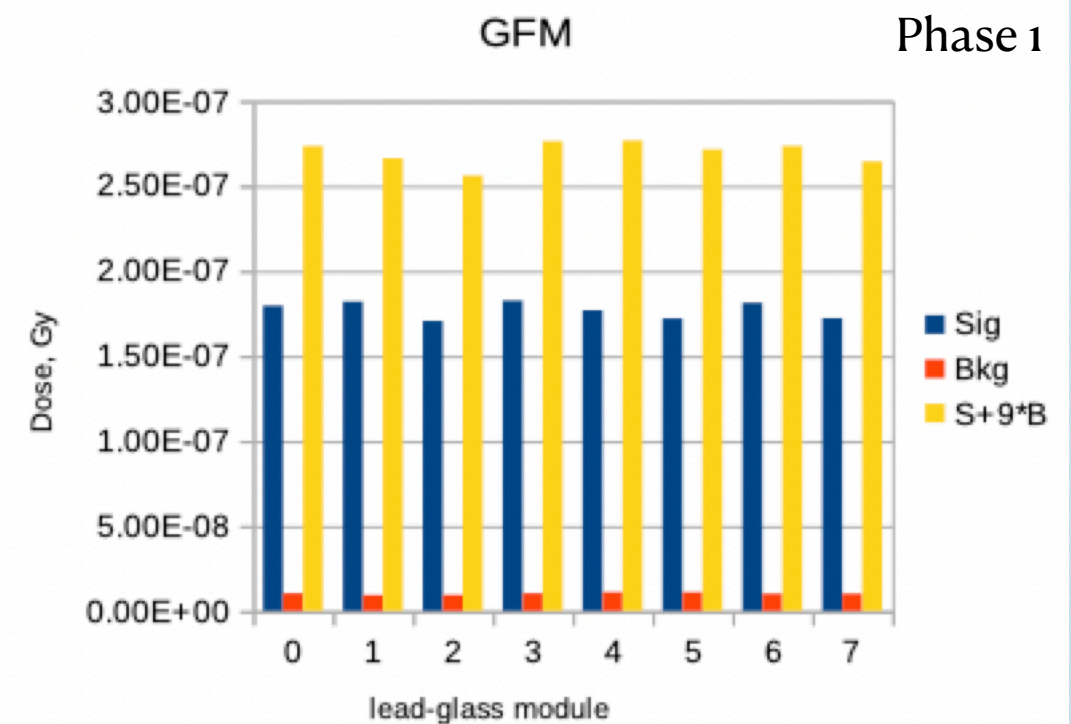
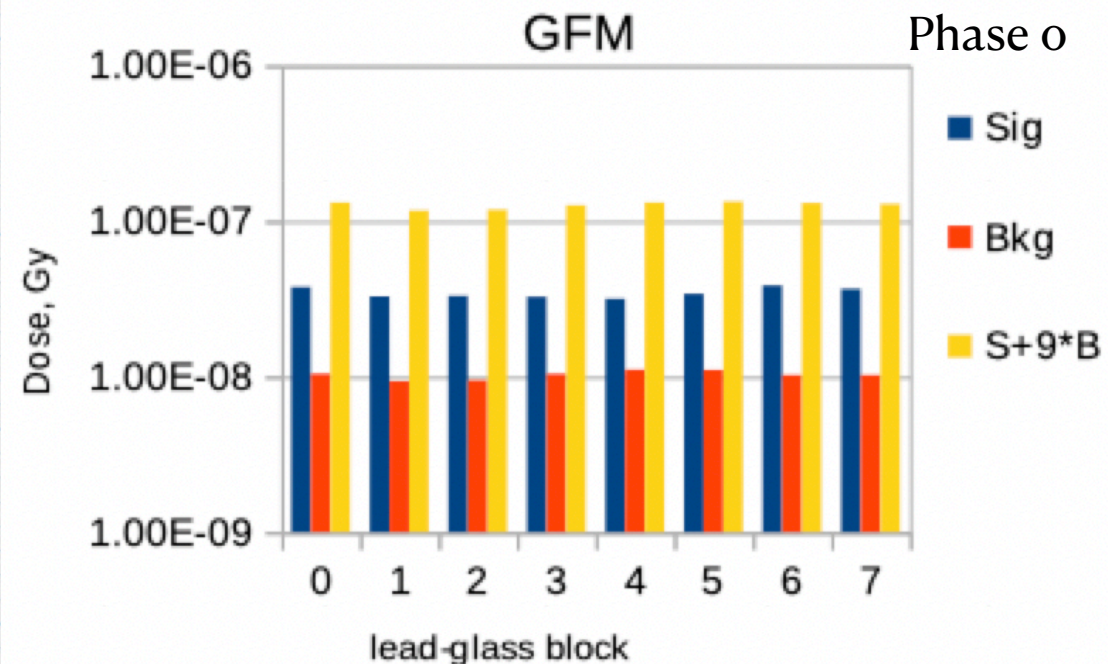
Gamma Monitor

Phase 0

Phase 1

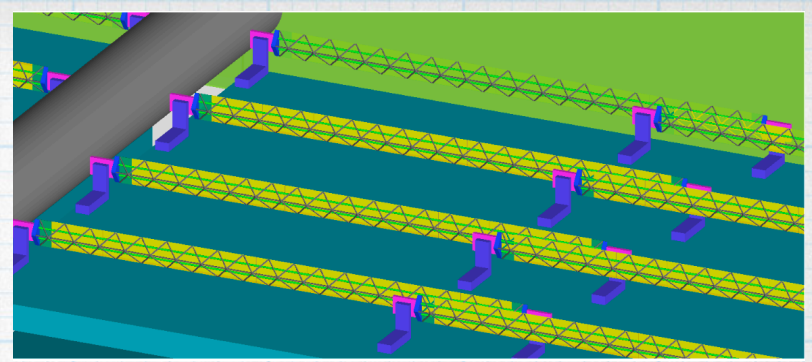


	Sig, $\xi = 3$	Bkg	S+9*B	Bkg w/ nAbsorbe	S+9*B	Sig, $\xi = 10$	Bkg w/ nAbsorbe	S+9*B
0	3.77E-08	1.28E-08	1.53E-07	1.04E-08	1.32E-07	1.80E-07	1.04E-08	2.73E-07
1	3.28E-08	1.19E-08	1.40E-07	9.36E-09	1.17E-07	1.82E-07	9.36E-09	2.66E-07
2	3.31E-08	1.18E-08	1.39E-07	9.50E-09	1.19E-07	1.71E-07	9.50E-09	2.56E-07
3	3.26E-08	1.29E-08	1.49E-07	1.04E-08	1.26E-07	1.83E-07	1.04E-08	2.76E-07
4	3.17E-08	1.37E-08	1.55E-07	1.11E-08	1.32E-07	1.77E-07	1.11E-08	2.77E-07
5	3.41E-08	1.35E-08	1.56E-07	1.10E-08	1.34E-07	1.72E-07	1.10E-08	2.71E-07
6	3.86E-08	1.28E-08	1.54E-07	1.02E-08	1.31E-07	1.81E-07	1.02E-08	2.73E-07
7	3.66E-08	1.28E-08	1.52E-07	1.02E-08	1.29E-07	1.72E-07	1.02E-08	2.64E-07

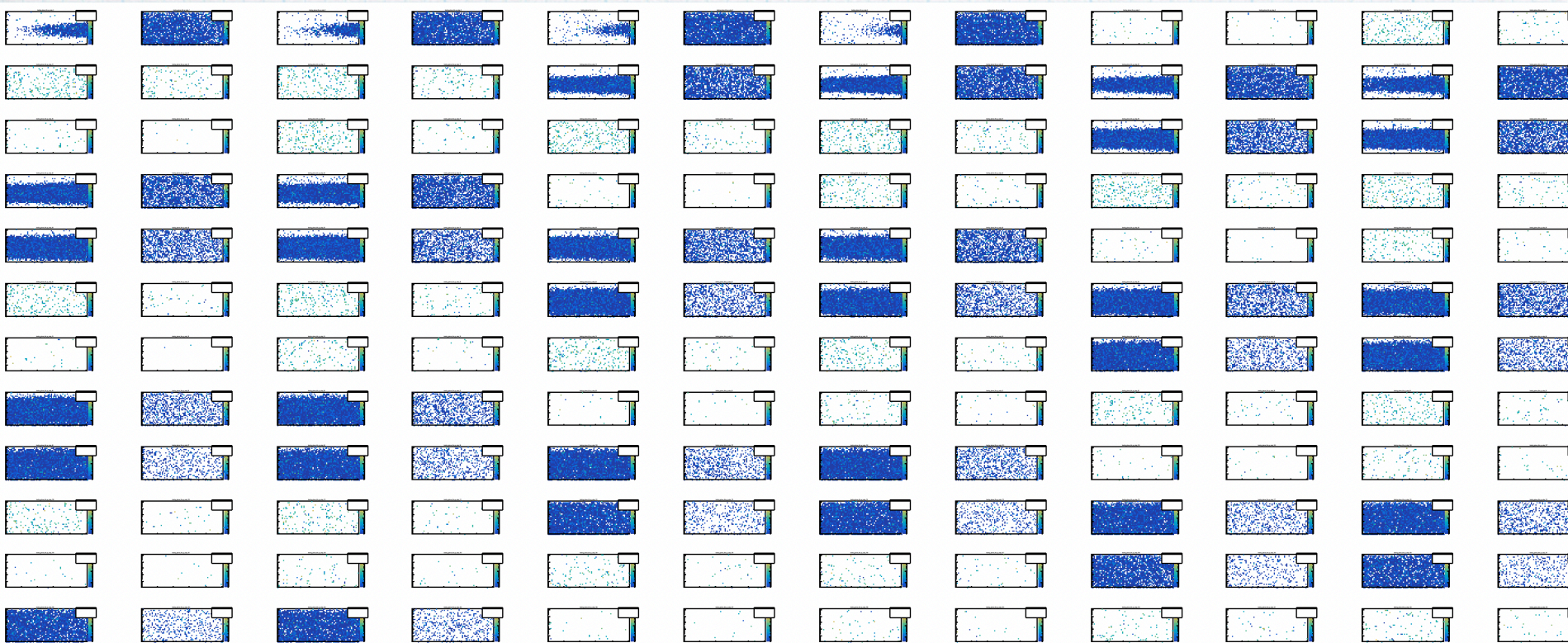


Tracker

- JET140, 16.5 GeV, $\xi = 3$ vs $\xi = 10$, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan

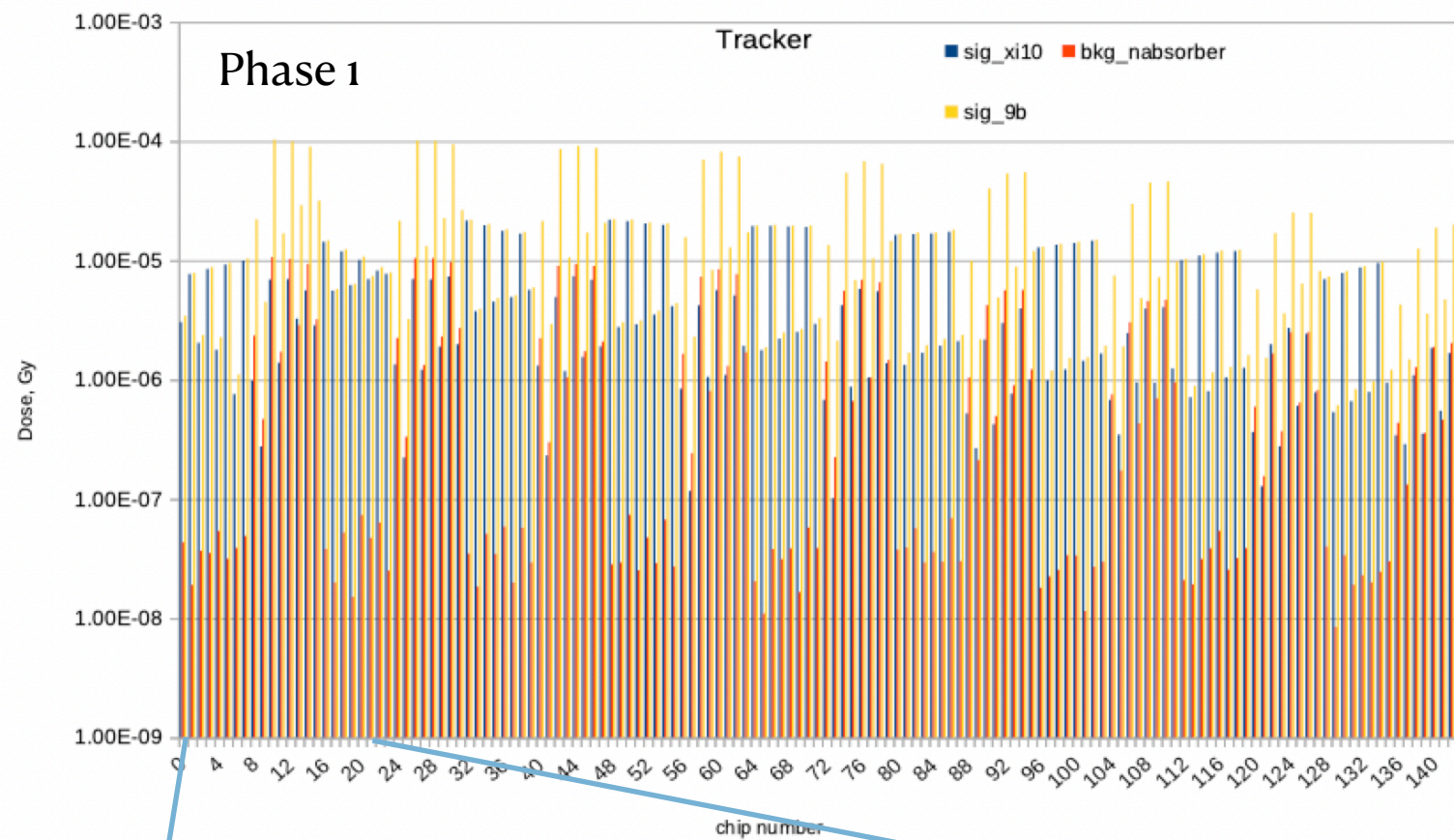
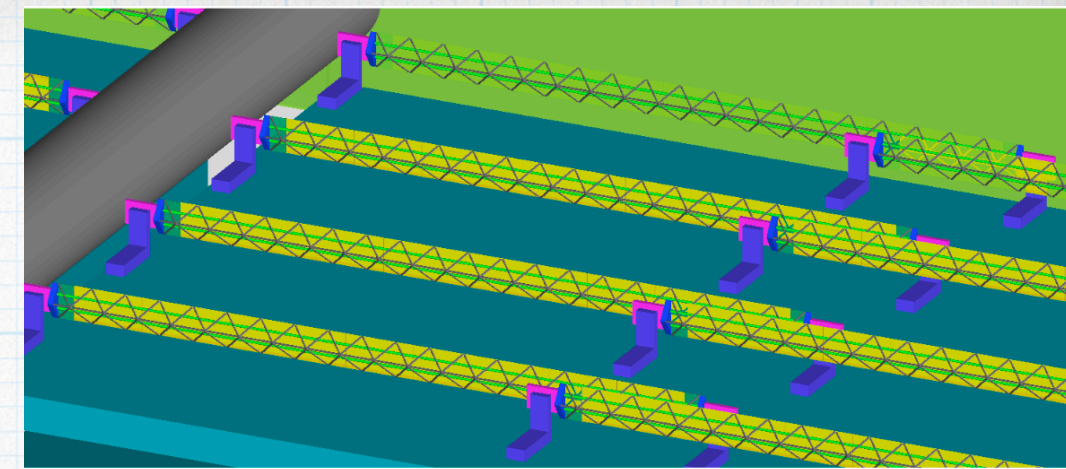


Phase 0



Phase 1

Tracker

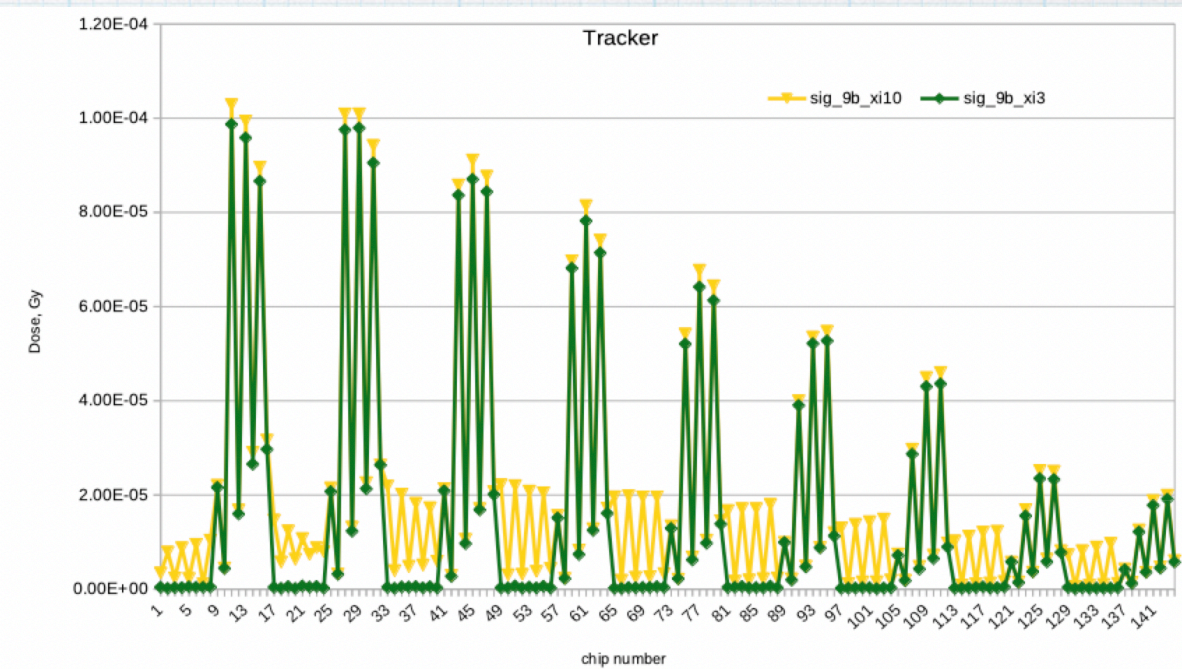
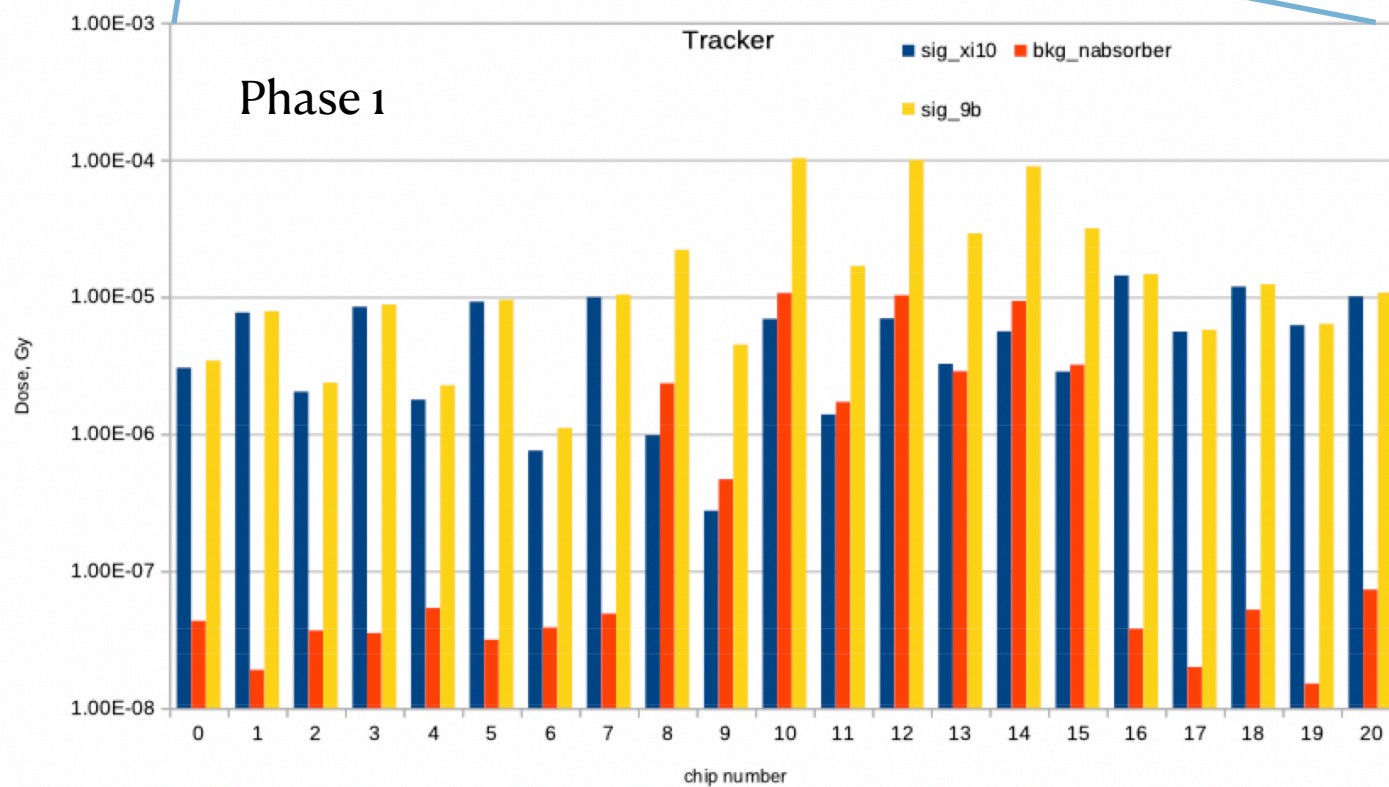


Phase 0

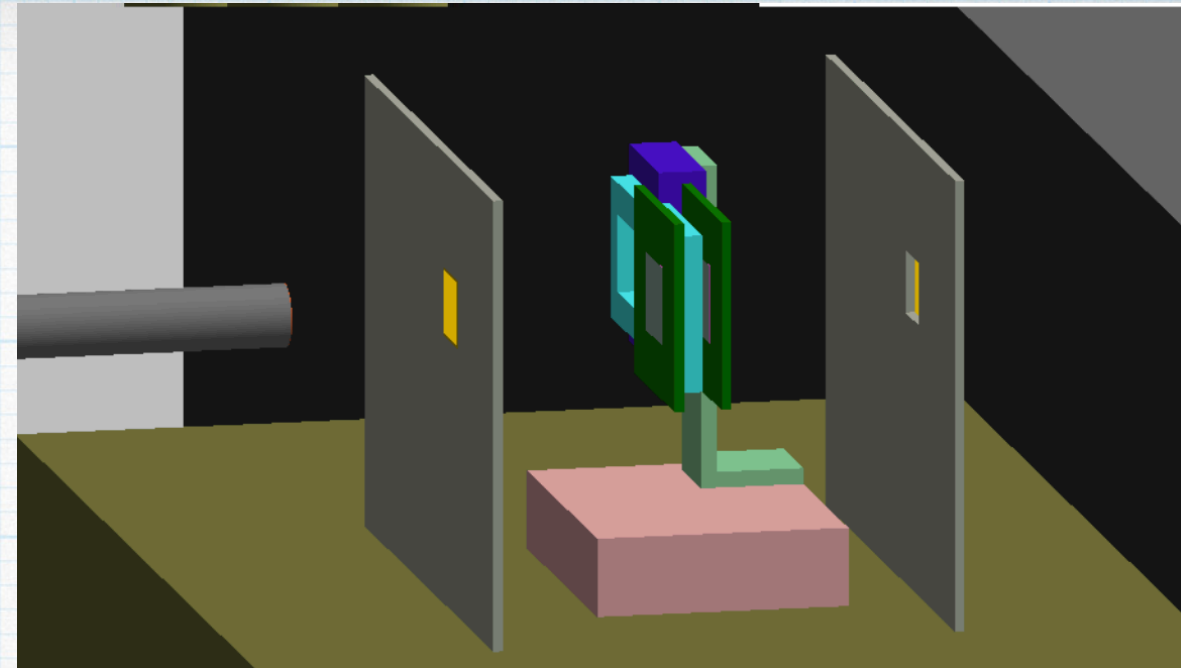
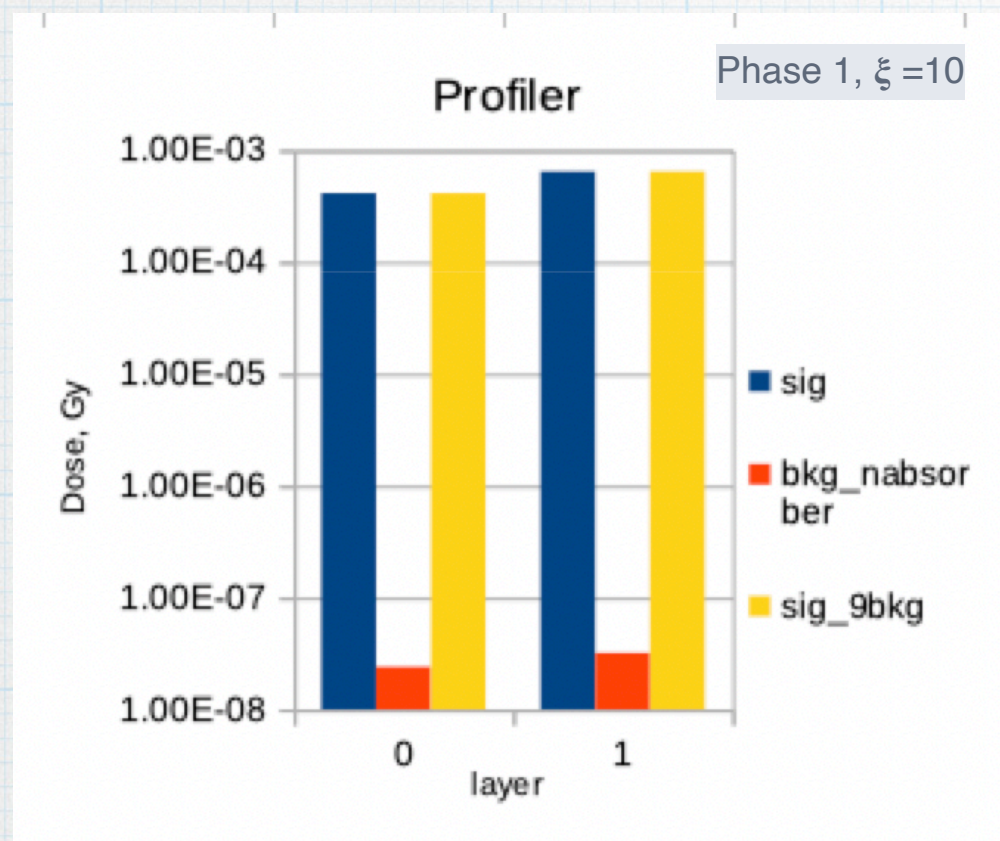
Tracker	min	max	av
bkg	8.43E-09	1.07E-05	1.54E-06
sig	1.06E-13	3.91E-06	5.54E-07
sig+9*bkg	7.58E-08	9.87E-05	1.45E-05

Phase 1

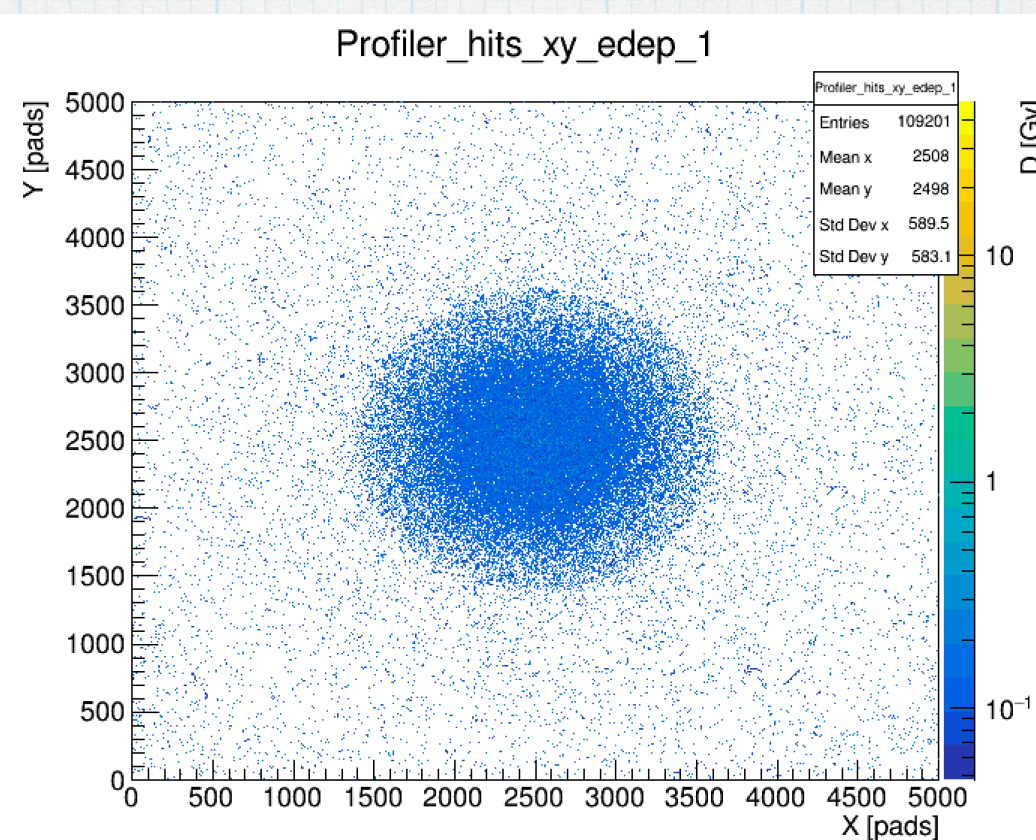
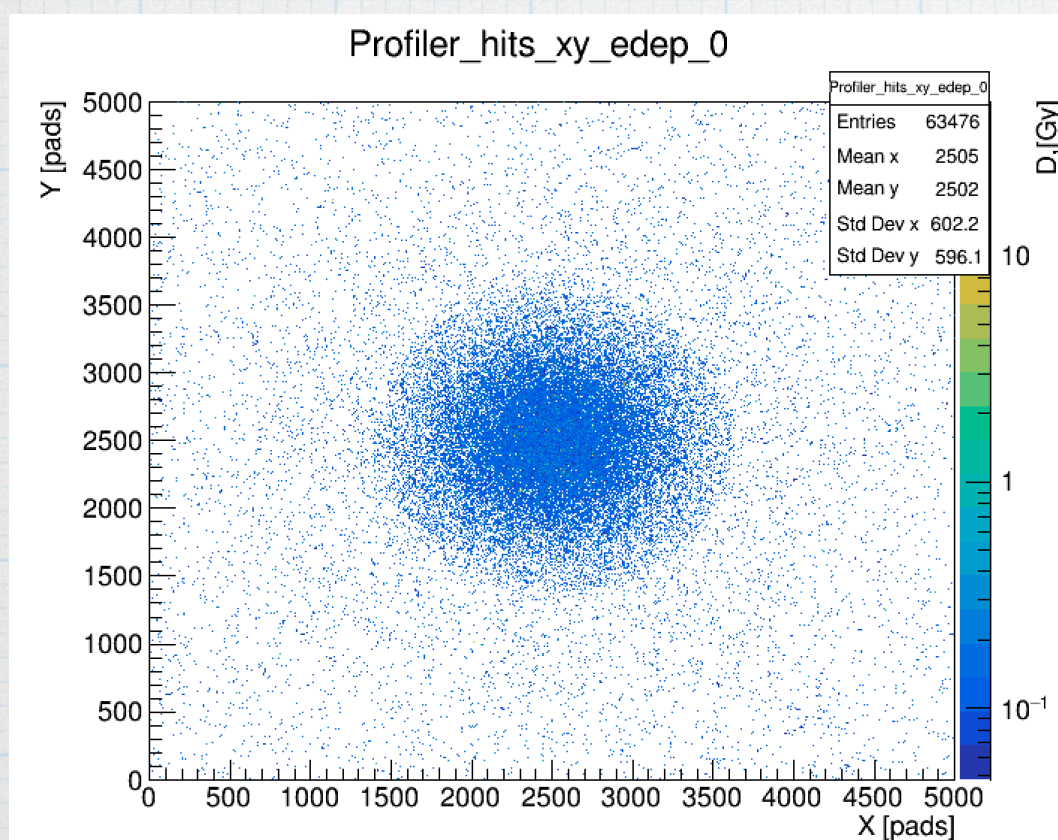
Tracker	min	max	av
bkg	8.43E-09	1.07E-05	1.54E-06
sig	1.01E-07	2.19E-05	5.38E-06
sig+9*bkg	6.10E-07	1.03E-04	1.92E-05



Profiler

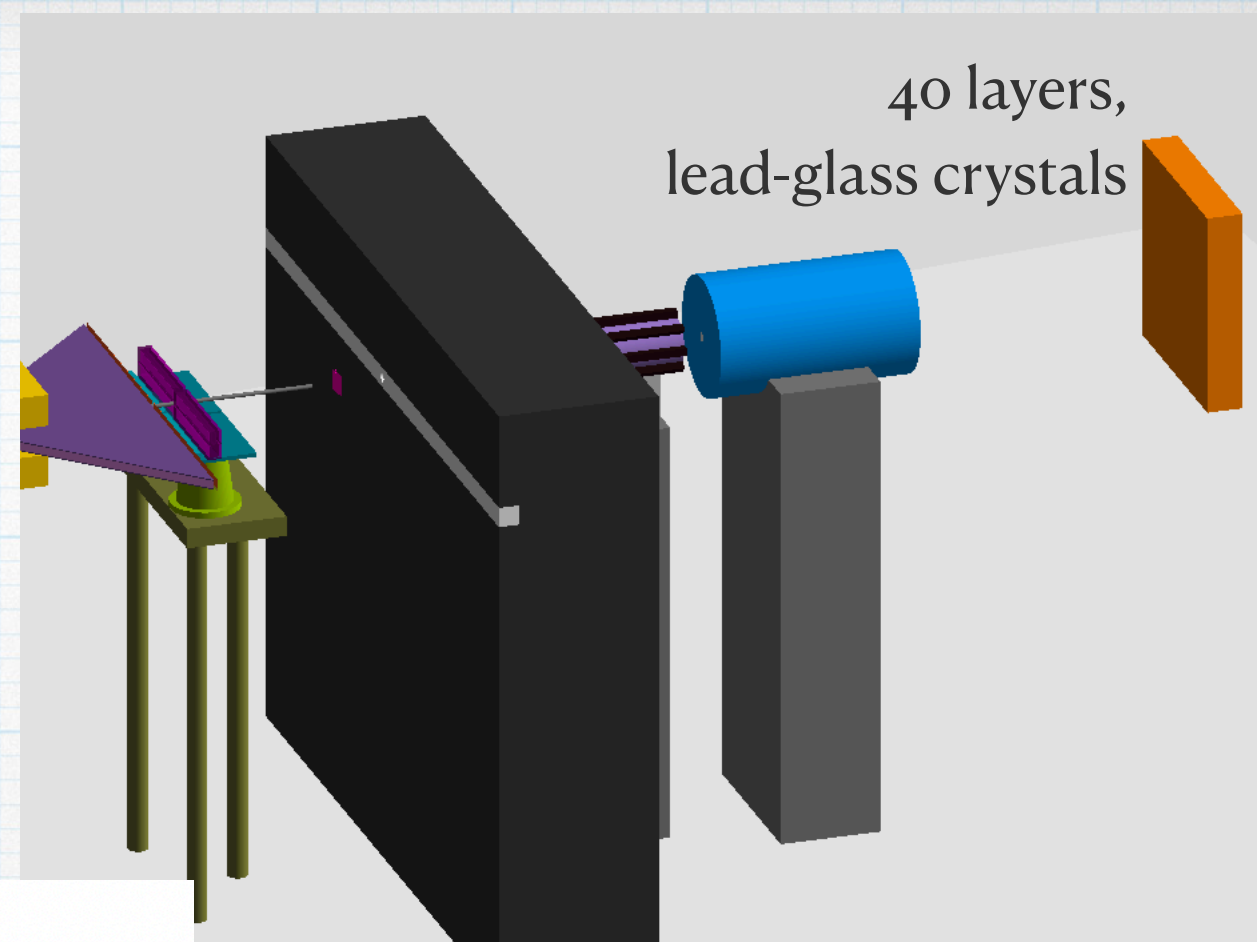
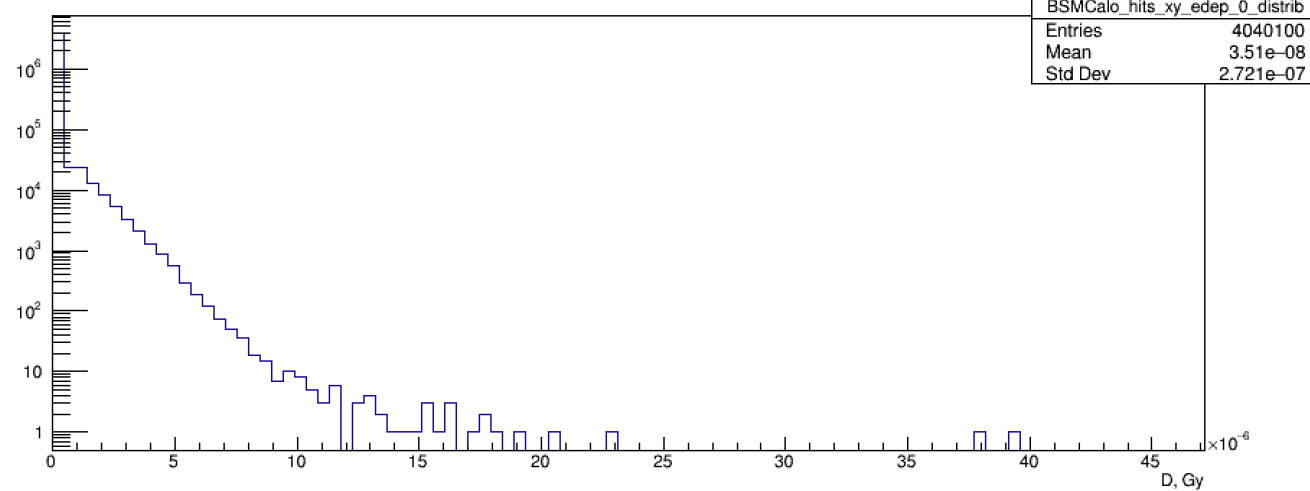


		Sig	Bkg w/ nAbsorber	S+9*B
Phase 0	0	0	2.41E-08	2.17E-07
	1	0	3.21E-08	2.89E-07
Phase 1	0	0.000412671	2.41E-08	4.13E-04
	1	0.000645406	3.21E-08	6.46E-04

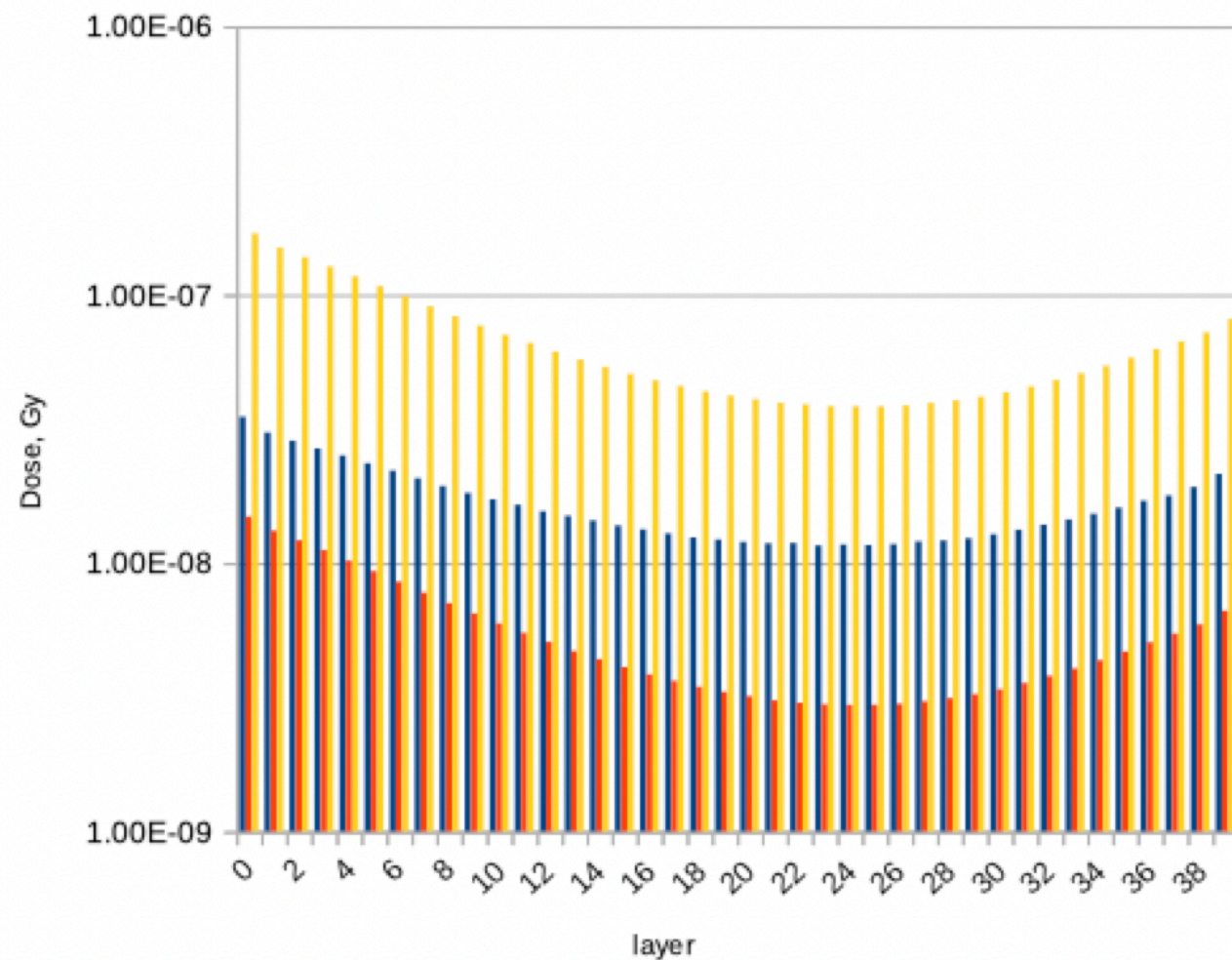


BSM

BSMCalo_hits_xy_edep_0_distrib



BSM detector



BSM	min	max	average
bkg	2.96E-09	1.49E-08	5.56E-09
sig	1.16E-08	3.51E-08	1.69E-08
sig+9*bkg	3.83E-08	1.69E-07	6.69E-08

results on absorbed dose

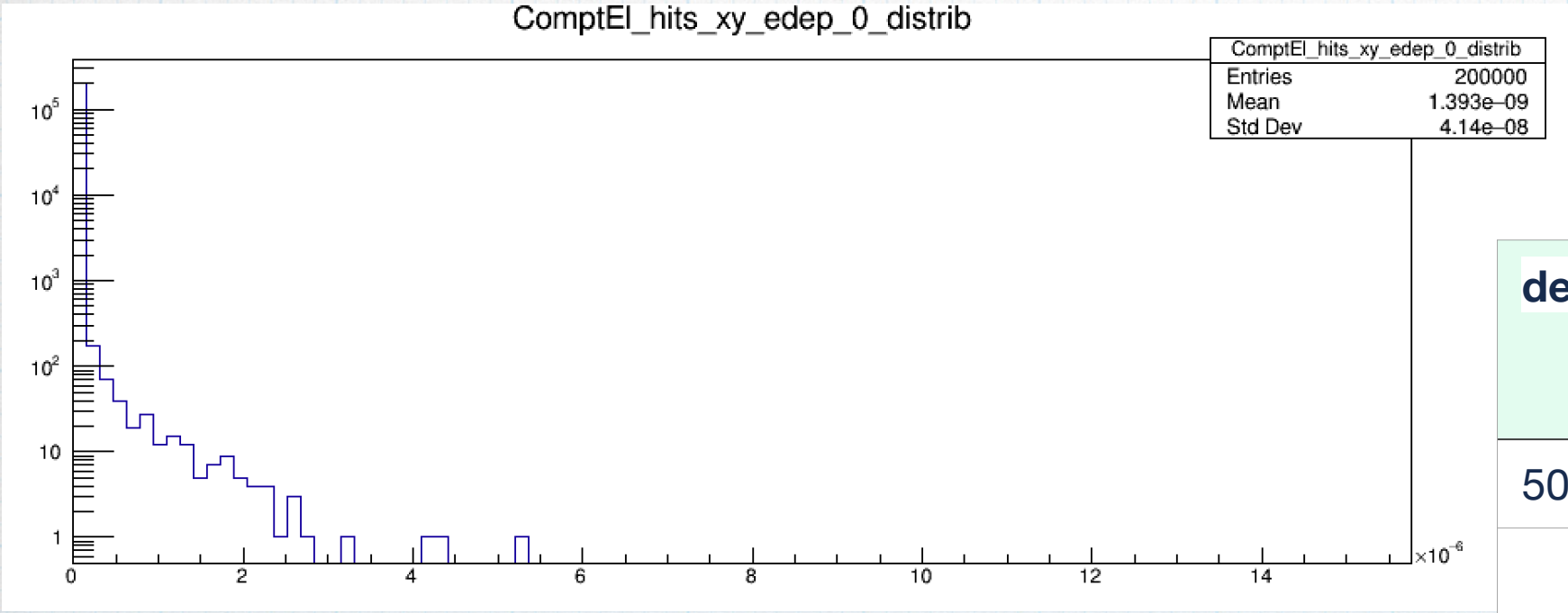
per BX, per sensitise detector

shielding with neutron Absorber

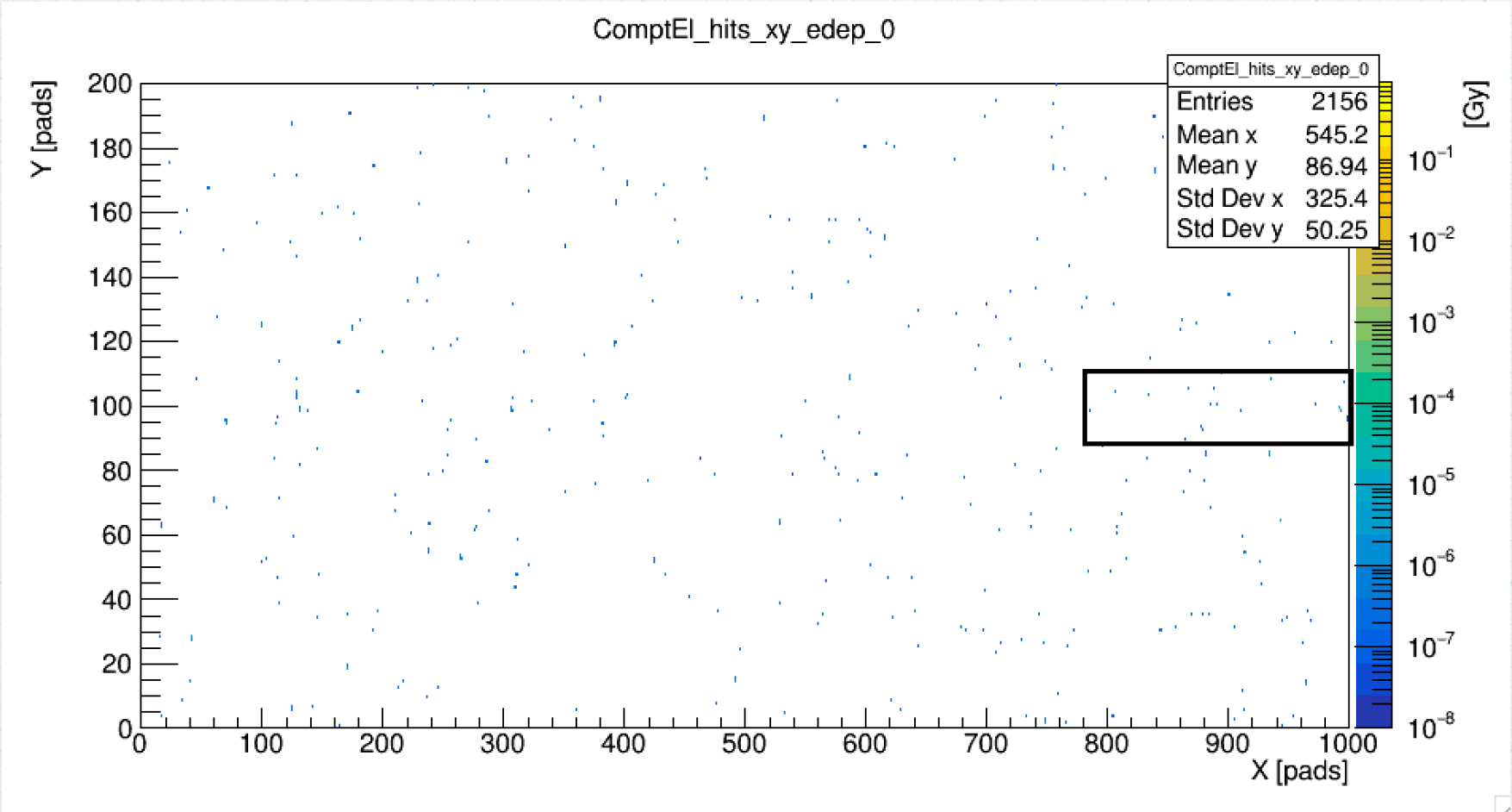
	Phase 0, $\xi = 3$		Phase 1, $\xi = 10$		
det_name	Averaged Dose (BERT), Gy	Per year, 10^7 sec, Gy	Averaged Dose (BERT), Gy	Per year, 10^7 sec, Gy	Tolerable dose, Gy
PDS GadOx Scintillator	1.2e-06	12	3.1e-04	3.1e3	1e8
PDS Backscatter Calorimeter	1.3e-07	1.3	1.3e-05	1.3e2	300
IP Calorimeter	2.2e-07 / 8.7e-07	2 – 9	3.2e-06 – 8.5e-05	32 – 850	1e6
IP Pixel tracker	7.6e-08 / 9.9e-05	0.7 – 990	6.1e-07 – 1.0e-04	6 – 1000	2.7e4
PDS Profiler			6.5e-04	6.5e3	1e7
BSM			3.8e-08 – 1.7e-07	0.4 – 2	300

Brems Monitoring Lanex

- JETI40, 16.5 GeV, $\xi = 5$, QGSP_BERT_HP list, updated g4 setup, MC ptarmigan, 1000 BX



detid	det_name	Average d Dose, Gy	Max Dose, Gy
5001	ComptonEI	$7.7\text{e-}10$	$1.4\text{E-}05$
		$1.7\text{e-}9$	

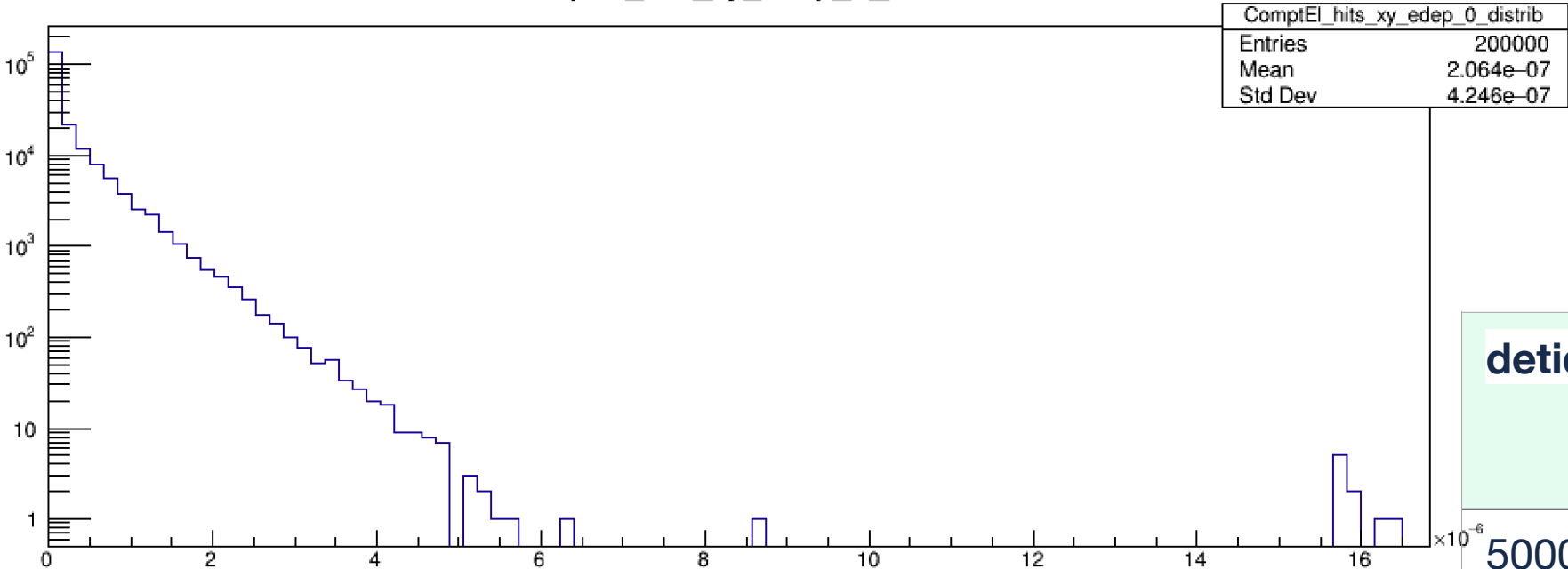


Averaged dose per selected region $\sim 1.7\text{e-}9$ Gy

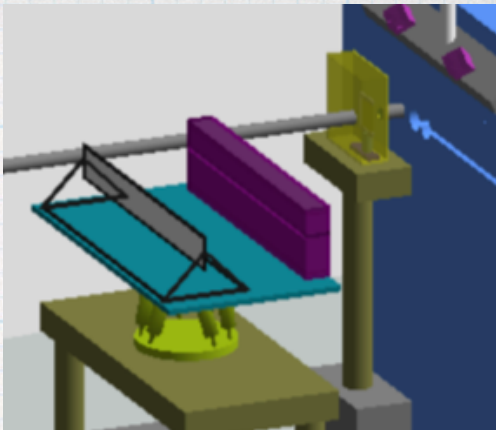
Compton Electron Lanex

JET140, 16.5 GeV, xi =5, 1000 BX

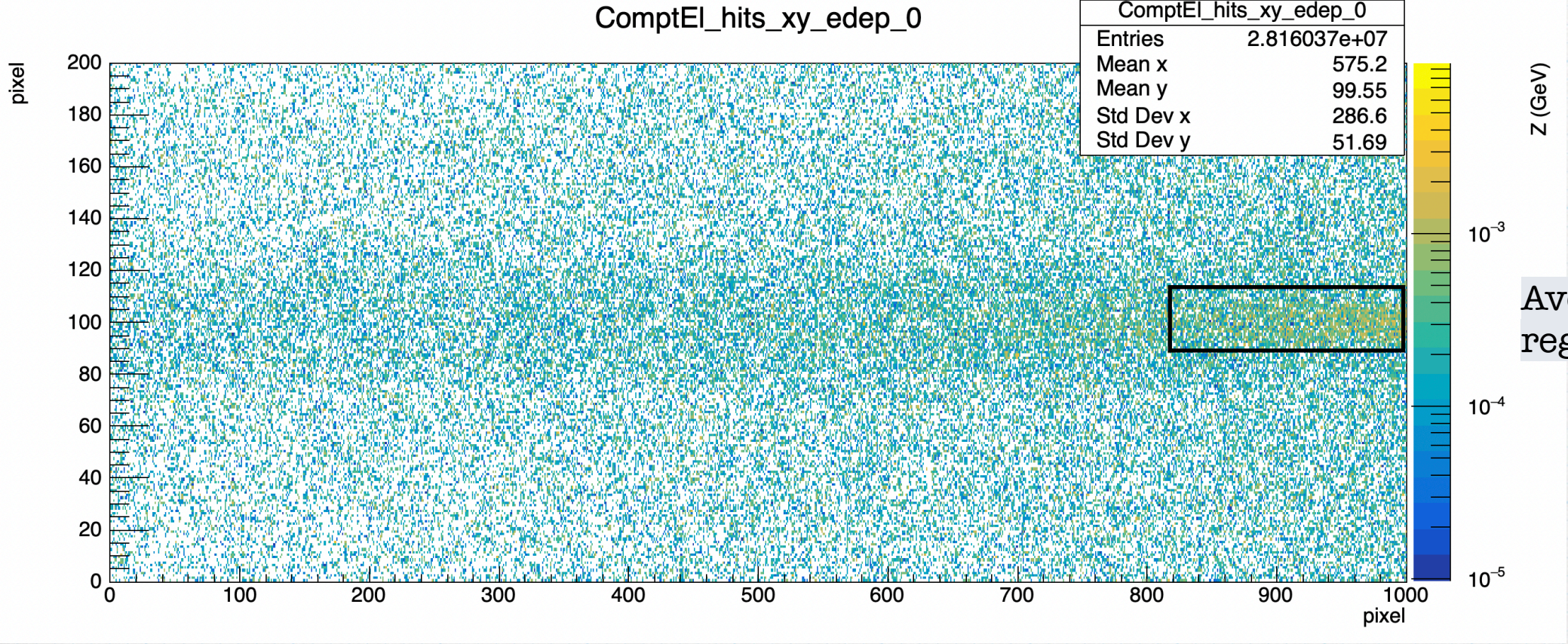
ComptEI_hits_xy_edep_U_distrib



detid	det_name	Average d Dose, Gy	Max Dose, Gy
5000	ComptonEI	$2.07\text{e-}07$	$1.6\text{e-}05$



ComptEI_hits_xy_edep_0



Averaged dose per selected region $\sim 7.5\text{e-}07$ Gy

results on absorbed dose

det_name	Sig, $\xi = 5$	Bkg	S+9*B
PDS GFM	4.27E-08	1.04E-08	1.37E-07
PDS GadOx	3.34E-07	9.19E-08	1.16E-06
Brem Monitor Lanex	1.72E-09- 7.71E-10	0	7.71E-10
IP Calorimeter	5.76E-08	2.99E-08	3.26E-07
IP Pixel tracker	3.80E-06	1.07E-05	9.98E-05
BSM	1.09E-08	0	1.09E-08
PDS Profiler	0.00016454	2.81E-08	1.65E-04

per BX,
per sensitise detector

	Phase 0, $\xi = 3$	Phase 0, $\xi = 5$	Phase 1, $\xi = 10$	
det_name	Per year, 10^7 sec, Gy	Per year, 10^7 sec, Gy	Per year, 10^7 sec, Gy	Tolerable dose, Gy
PDS GadOx Scintillator	12.2	12.4	3.1e3	1e8
PDS Backscatter Calorimeter	1.3	1.4	1.3e2	300
IP Calorimeter	2 – 8.7	3.3 – 7.98	32 – 850	1e6
IP Pixel tracker	0.7 – 987	0.76 – 998	6 – 1000	2.7e4
PDS Profiler		2E+03	6.5e3	1e7
BSM		0.3 – 1.45	0.4 – 2	300
Brems Monitor Lanex		0.02		1e8
Compton El Lanex		2 – 7.5		1e8

Summary

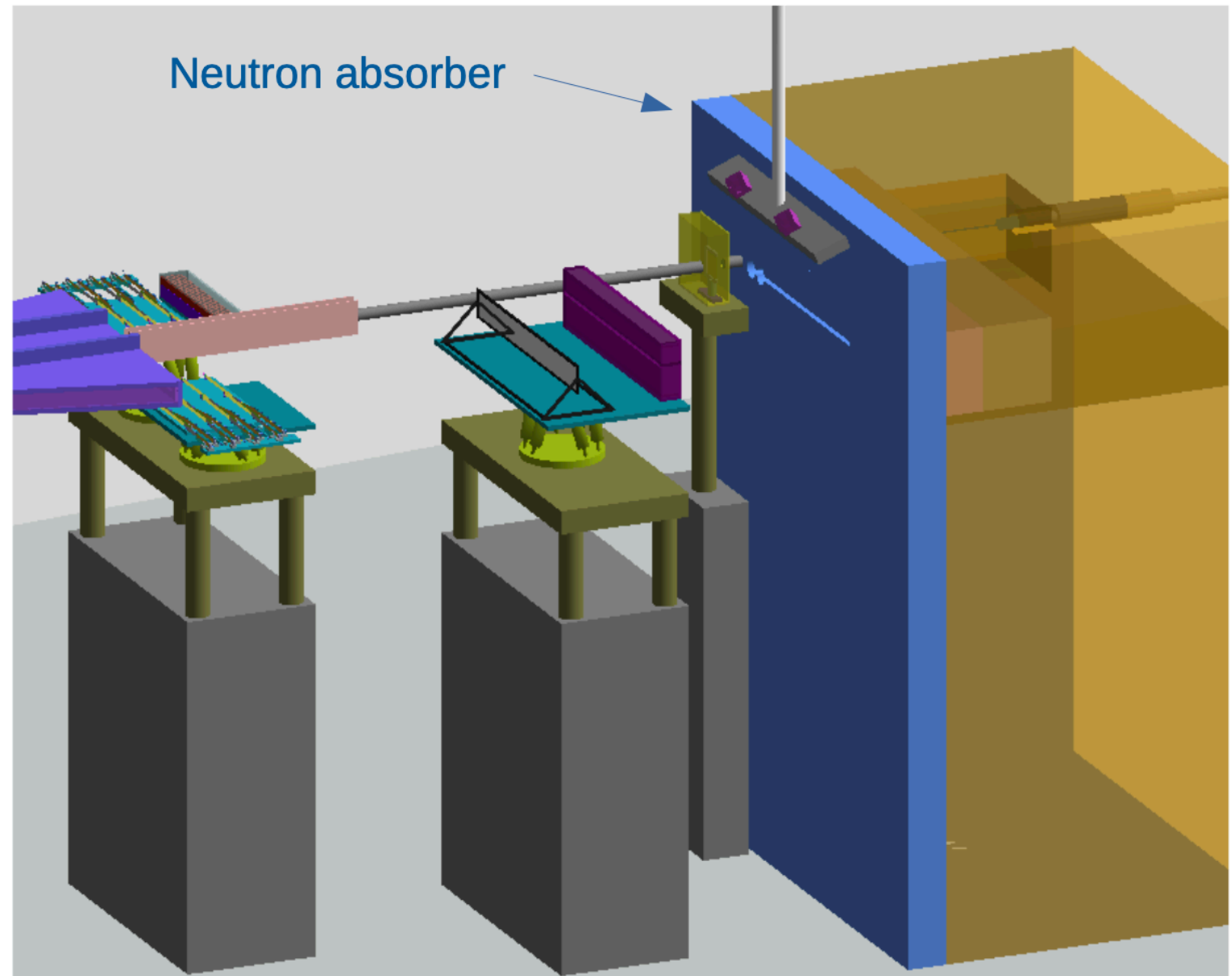
- The estimations were done using **1x signal + 9x background**
- **the signal simulation:** JETI40, 16.5 GeV, $\xi=3$ for **Phase 0** and $\xi=10$ for **Phase 1**, ~10 BX and $\xi=5$ for **Phase 0**, ~1000 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan.
- **for background:** 2 BX, JETI40, 16.5 GeV, e-, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shielding
- **for background:** 0.14 BX simulation with an additional shielding to reduce the **neutron flux**. the radiation analysis with and w/o that extra shielding for the detectors
- **The dose is tolerable** for the detector types for which estimations were done

Back up

Geometry with neutron absorber

Borated concrete with polyethylene aggregate:

- Boron 1%
- PE 50%
- 170 mm layer thickness



results on absorbed dose

per BX, per sensitise detector

JET140, 16.5 GeV, 3 um, Signal 1 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan

+

JET140, 16.5 GeV, e-, BKG 9 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings

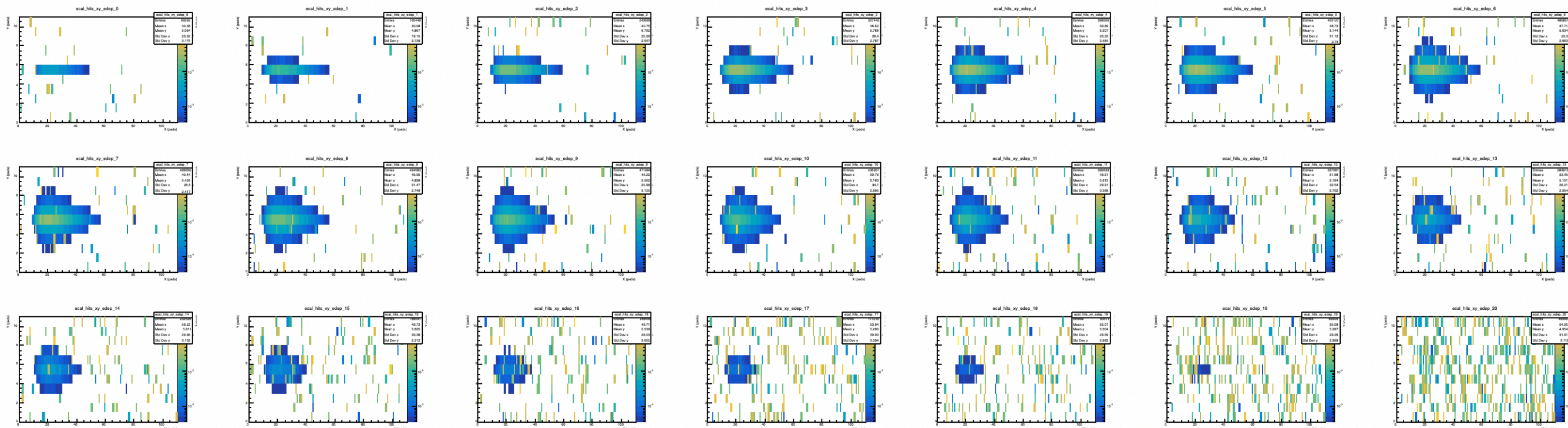
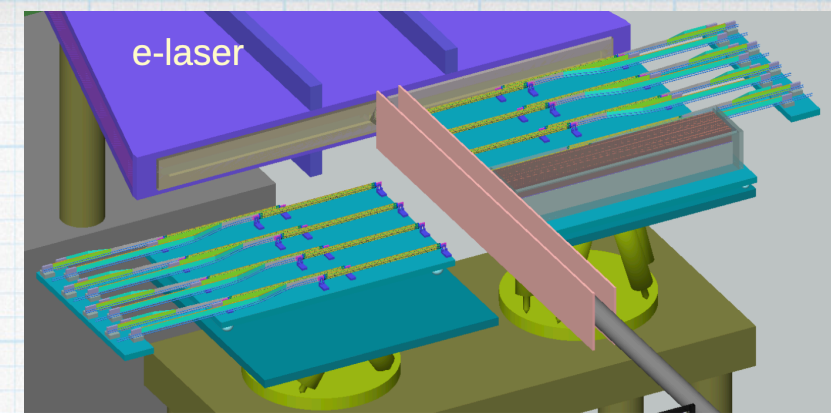
det_name	Averaged Dose (BERT), Gy	Per year, 10 ⁷ sec, Gy	Tolerable dose, Gy
PDS GadOx Scintillator	1.4e-06	14	1e8
PDS Backscatter Calorimeter	1.5e-07	1.5	300
IP Calorimeter	6.4e-07 / 1.8e-06	6-18	1e6
IP Pixel tracker	3.22E-07 / 1.07E-04	3-1000	2.7E+04

det_name	Averaged Dose (BERT), Gy	Per year, 10 ⁷ sec, Gy
PDS GadOx Scintillator	1.2e-06	12
PDS Backscatter Calorimeter	1.3e-07	1.3
IP Calorimeter	2.2e-07 / 8.7e-07	2-9
IP Pixel tracker	7.6e-07 / 9.9e-05	7-990

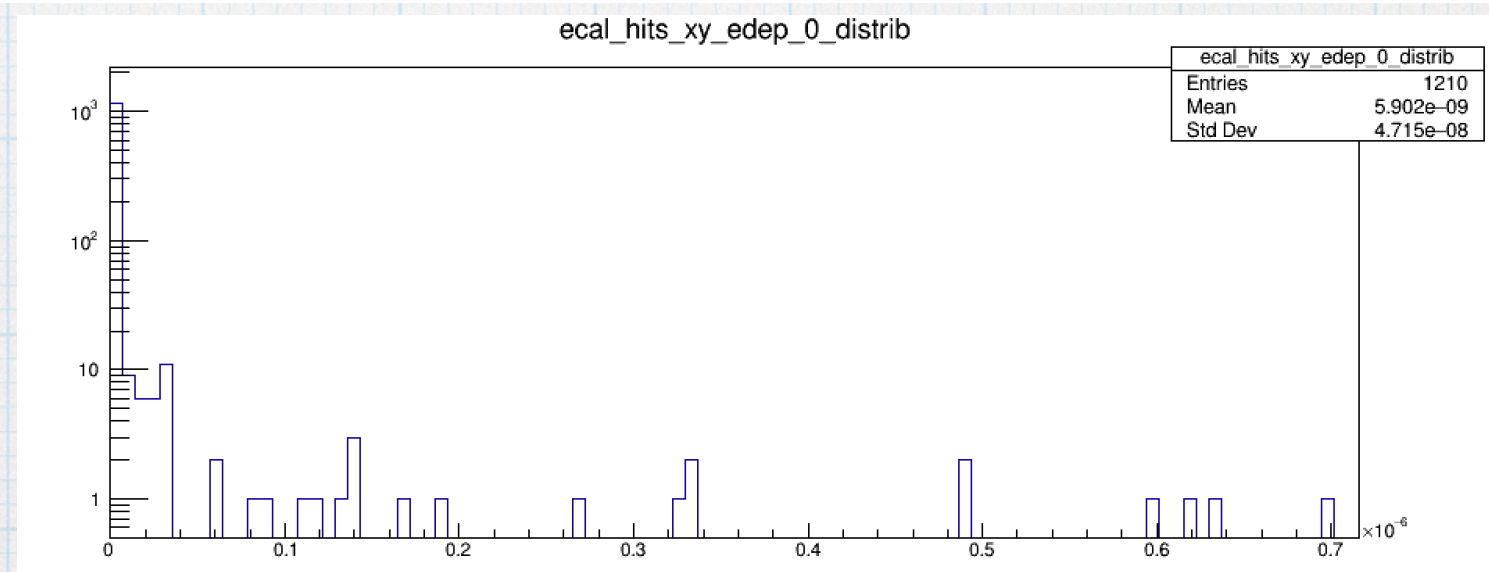
shielding with
neutron
Absorber

ECAL Signal

- JET140, 16.5 GeV, 3 um, 9 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan



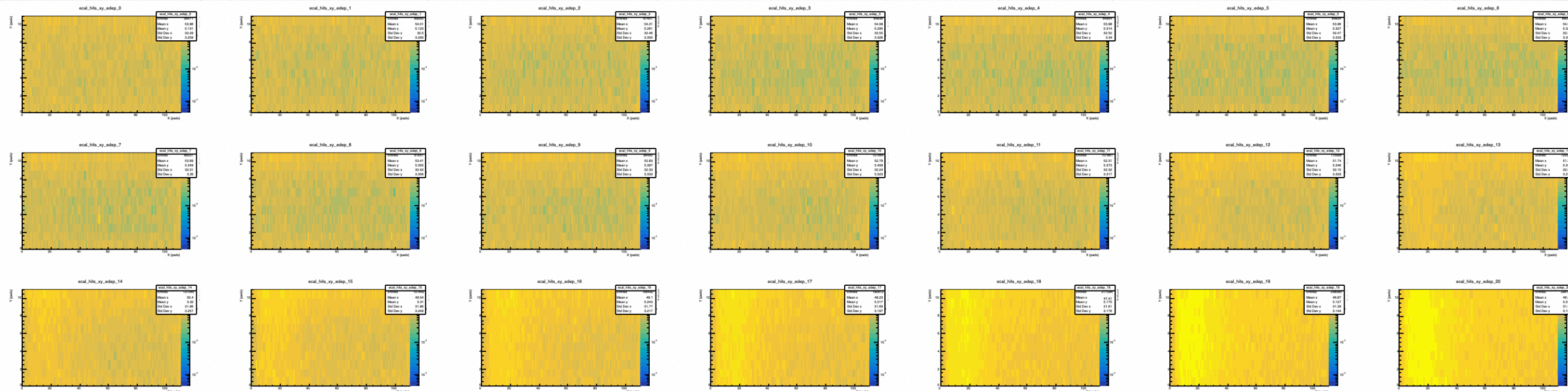
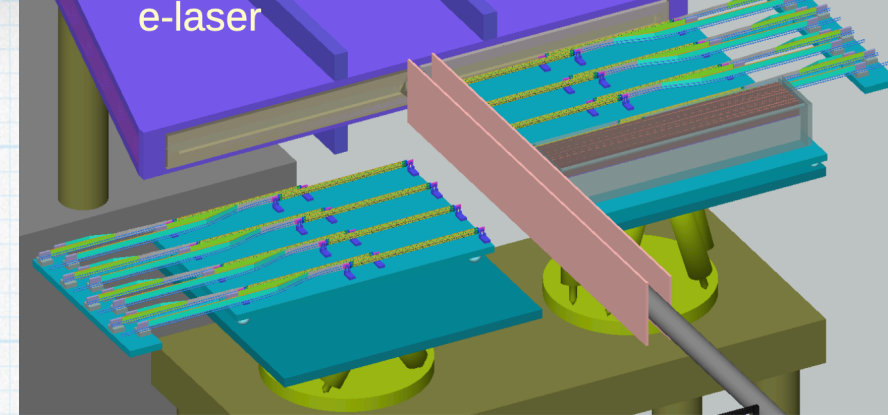
Layer	D, Gy
0	7.19E-09
1	5.50E-09
2	1.11E-08
3	1.17E-08
4	1.27E-08
5	1.54E-08
6	2.05E-08
7	1.50E-08
8	1.47E-08
9	1.58E-08
10	1.64E-08
11	1.83E-08
12	1.55E-08
13	2.19E-08
14	2.63E-08
15	2.81E-08
16	3.48E-08
17	4.77E-08
18	4.61E-08
19	6.74E-08
20	9.14E-08



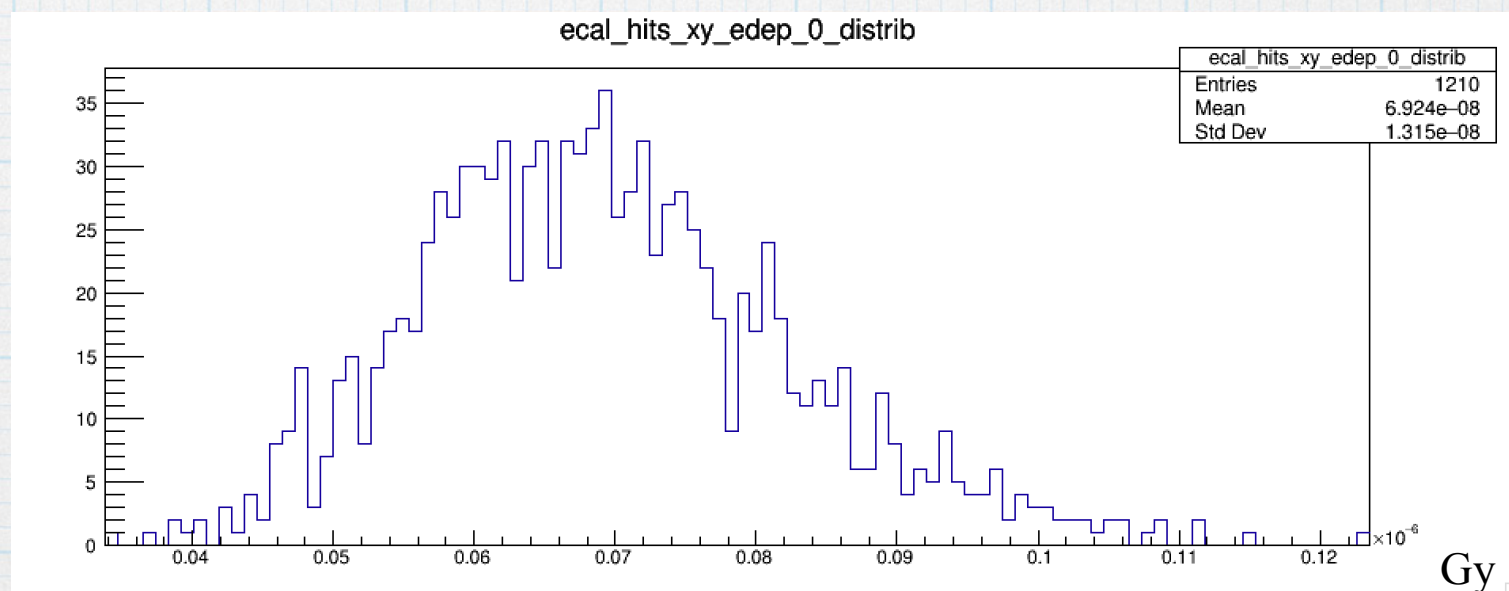
detid	det_name	Averaged Dose, Gy	Max Dose, Gy
2000	Ecal	7.19e-09	7.0e-06
2019	Ecal	6.74e-08	

ECAL Bkg

- JET140, 16.5 GeV, BKG, 2 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings,



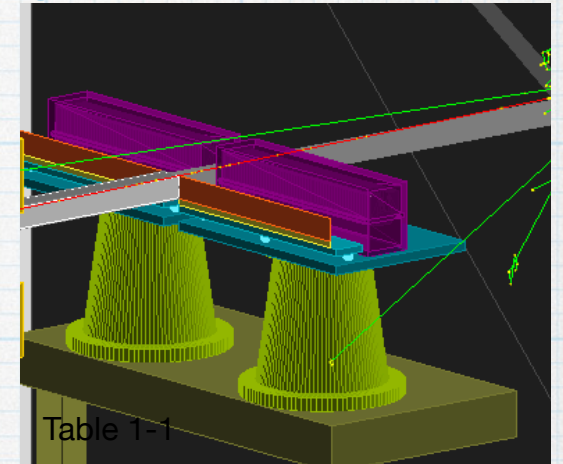
	Sig	Bkg	S+9*B
0	7.19E-09	7.07E-08	6.44E-07
1	5.50E-09	6.52E-08	5.93E-07
2	1.11E-08	6.30E-08	5.78E-07
3	1.17E-08	6.08E-08	5.59E-07
4	1.27E-08	6.08E-08	5.60E-07
5	1.54E-08	6.04E-08	5.59E-07
6	2.05E-08	6.12E-08	5.72E-07
7	1.50E-08	6.30E-08	5.82E-07
8	1.47E-08	6.49E-08	5.98E-07
9	1.58E-08	6.77E-08	6.25E-07
10	1.64E-08	7.18E-08	6.62E-07
11	1.83E-08	7.62E-08	7.04E-07
12	1.55E-08	8.15E-08	7.49E-07
13	2.19E-08	8.83E-08	8.17E-07
14	2.63E-08	9.61E-08	8.91E-07
15	2.81E-08	1.07E-07	9.94E-07
16	3.48E-08	1.20E-07	1.11E-06
17	4.77E-08	1.36E-07	1.27E-06
18	4.61E-08	1.57E-07	1.46E-06
19	6.74E-08	1.81E-07	1.70E-06
20	9.14E-08	1.87E-07	1.78E-06



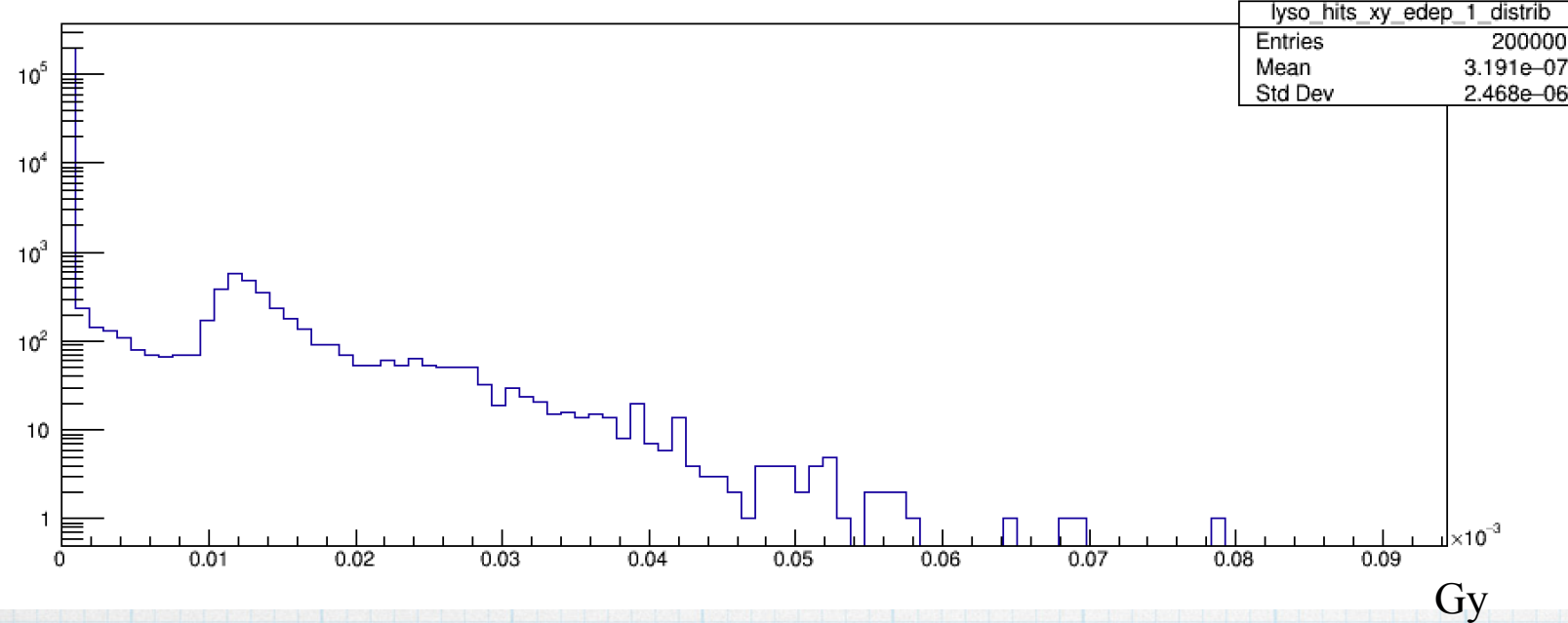
detid	det_name	Averaged Dose, Gy	Max Dose, Gy
2000	Ecal	7.19e-09 +9*7.07e-08 = 6.4349E-07	1.3e-07

FDS Lanex Spectrometer

- JET140, 16.5 GeV, 3 μm , Signal, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan



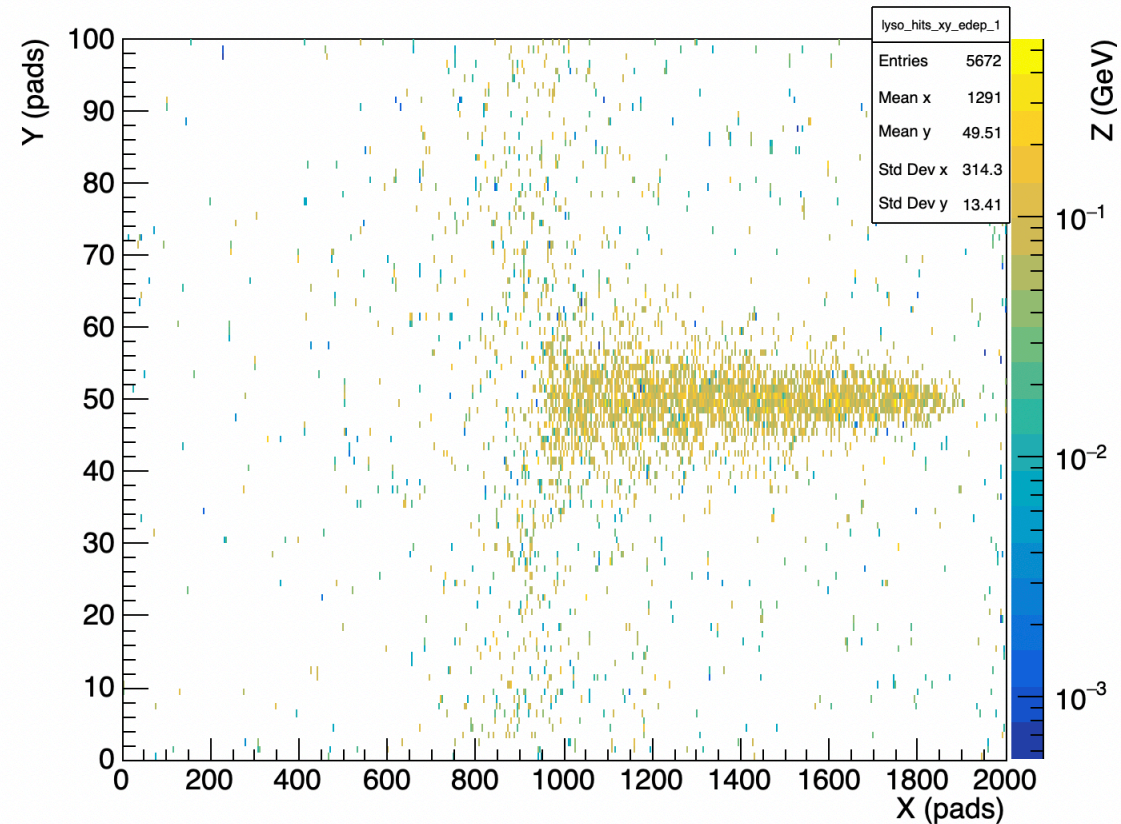
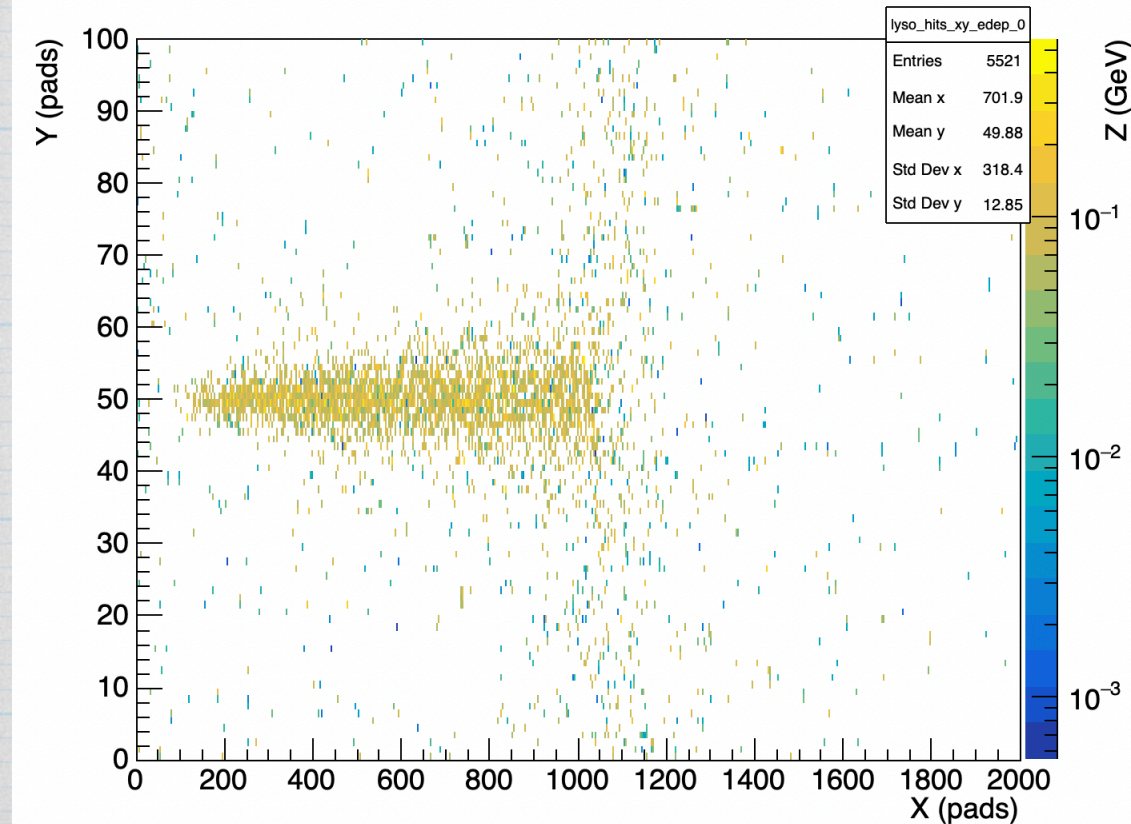
lyso_hits_xy_edep_1_distrib



detid	det_name	Averaged Dose, Gy	Max Dose, Gy
3001	LysoCal	3.15e-07	7.9e-5
3000	LysoCal	3.20e-07	

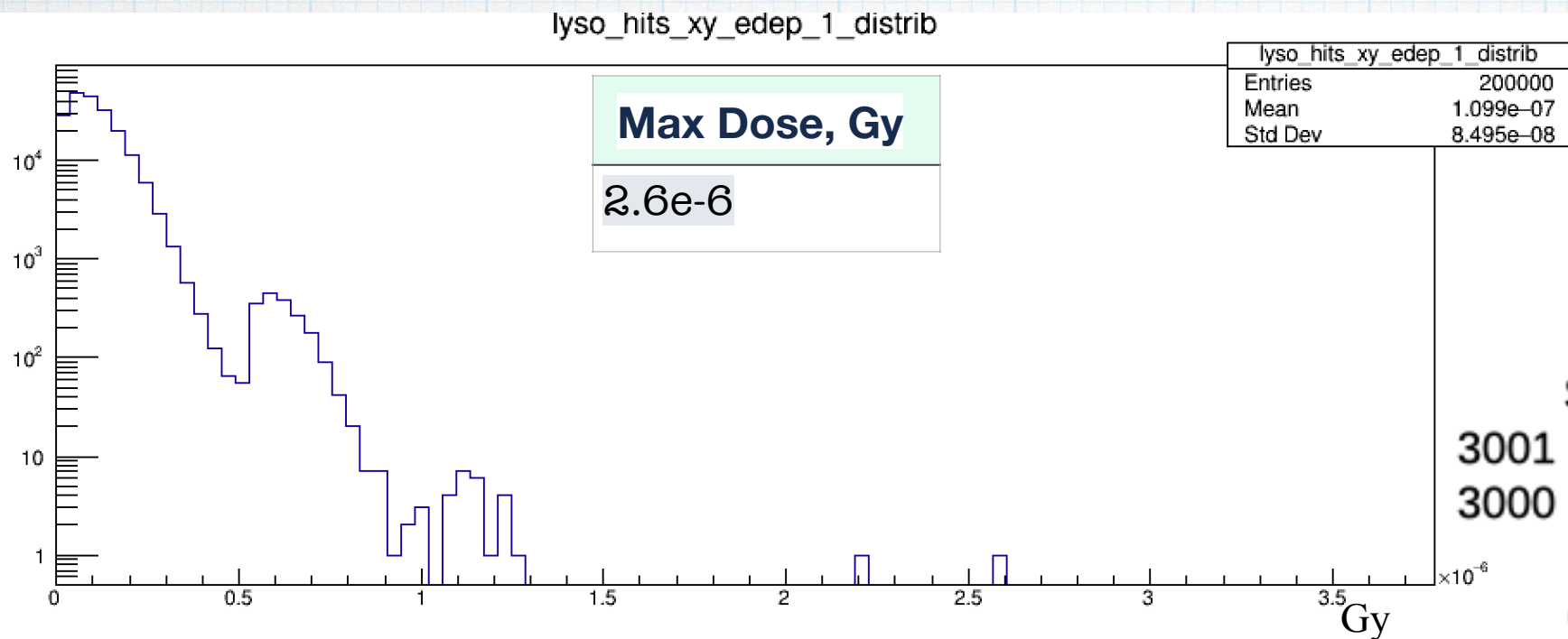
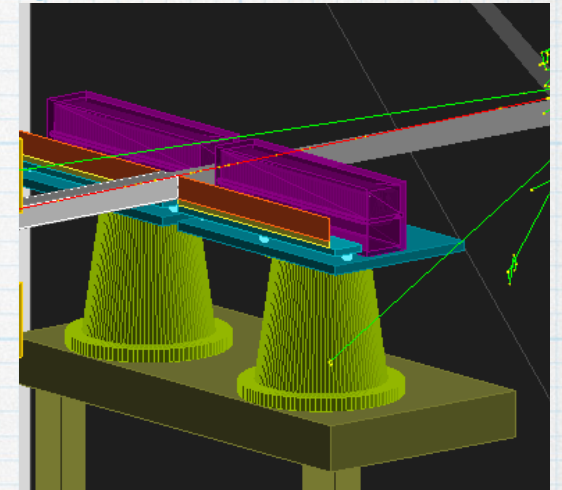
lyso_hits_xy_edep_0

lyso_hits_xy_edep_1



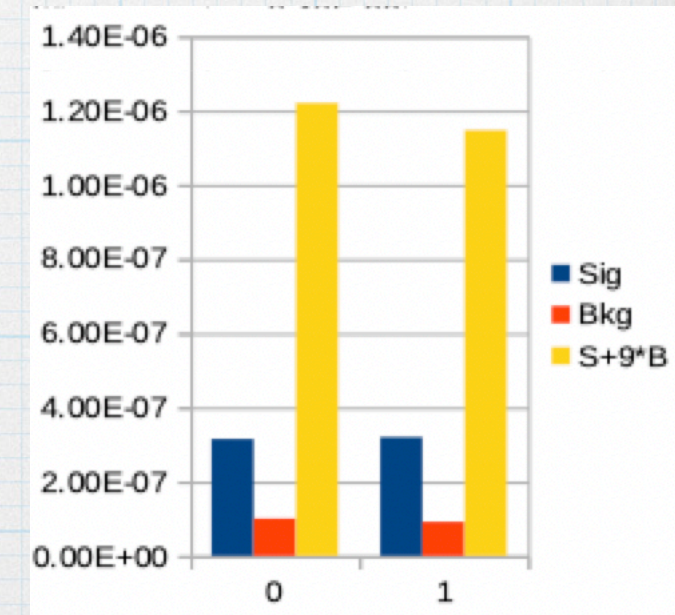
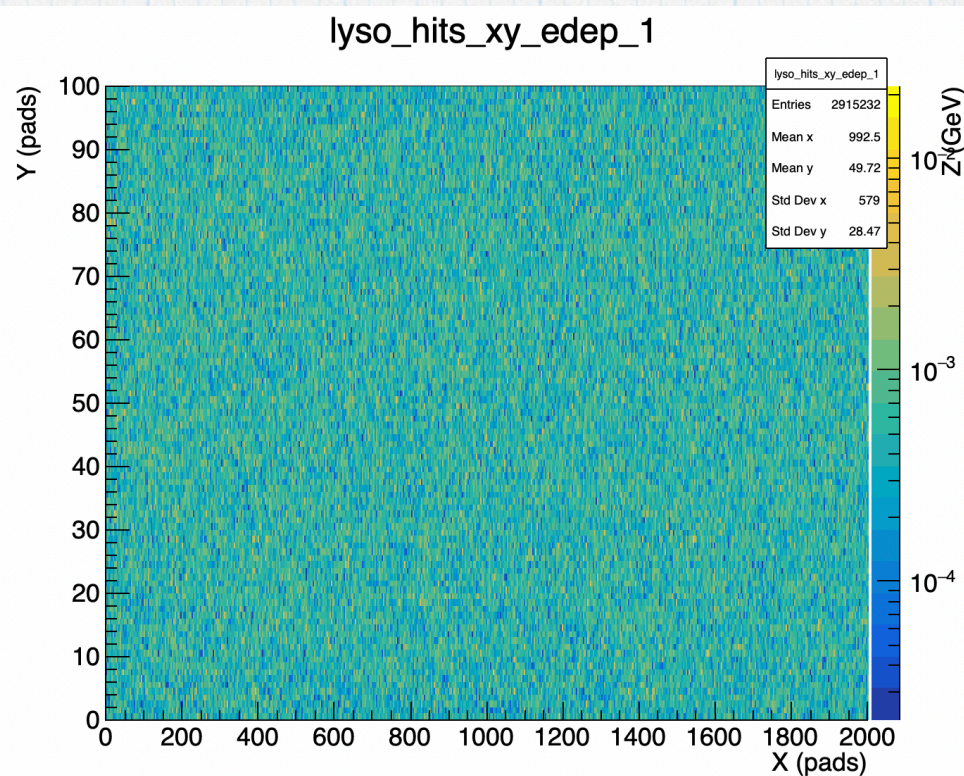
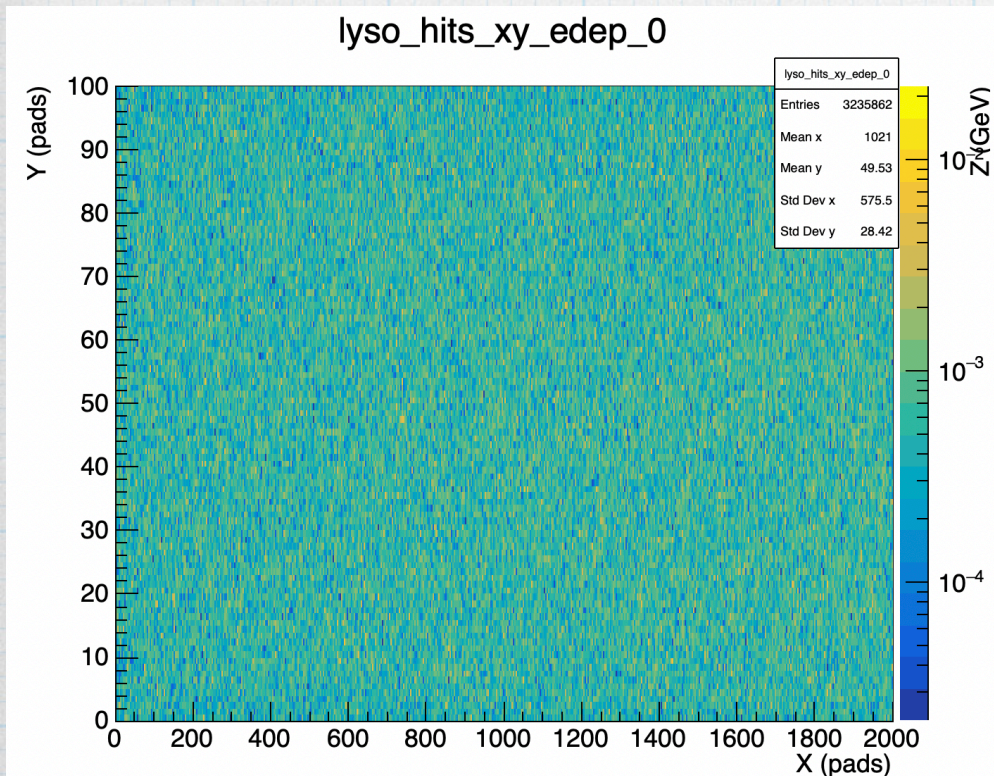
FDS Lanex Spectrometer

- JET140, 16.5 GeV, e^- , BKG, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings



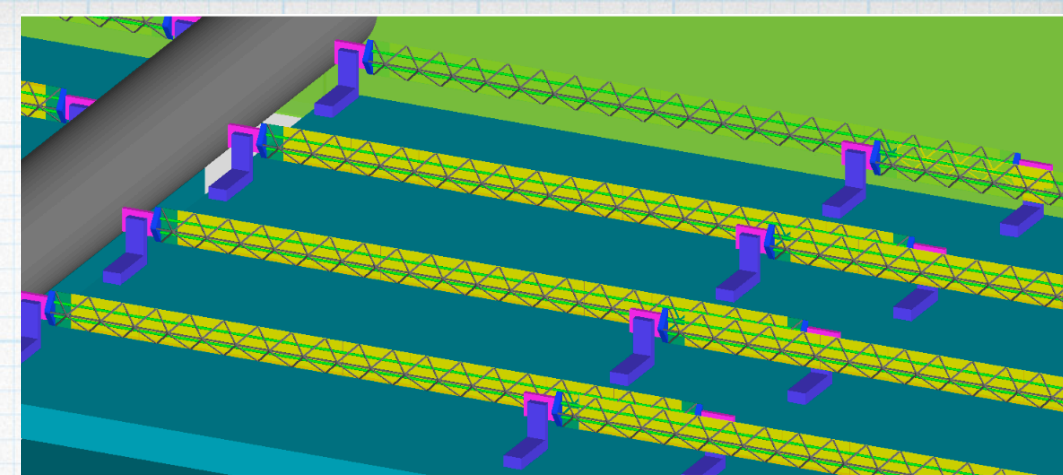
	Sig	Bkg	S+9*B
3001	3.15E-07	1.10E-07	1.31E-06
3000	3.20E-07	1.20E-07	1.40E-06

	Sig	Bkg w/ nAbsorber	S+9*B
0	3.15E-07	1.01E-07	1.22E-06
1	3.20E-07	9.19E-08	1.15E-06

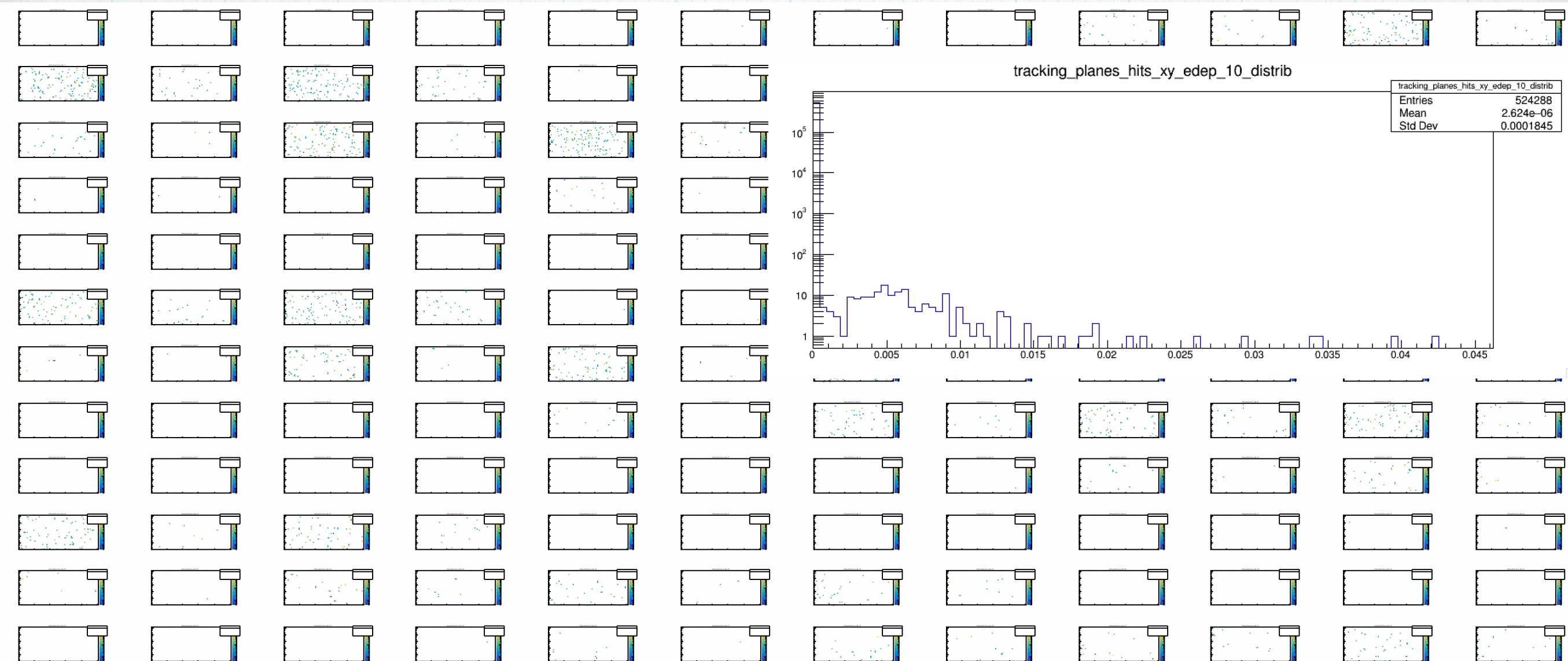


Tracker

- JET140, 16.5 GeV, 3 um, 9 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan

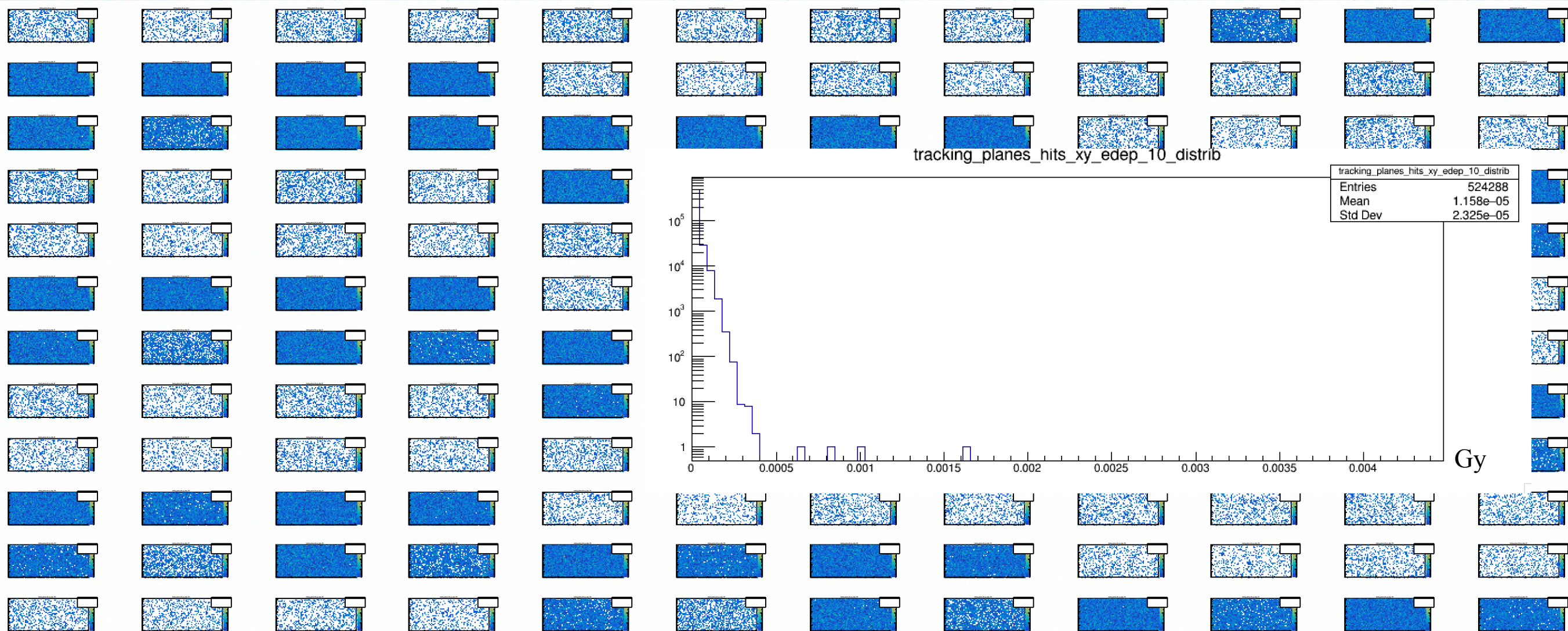
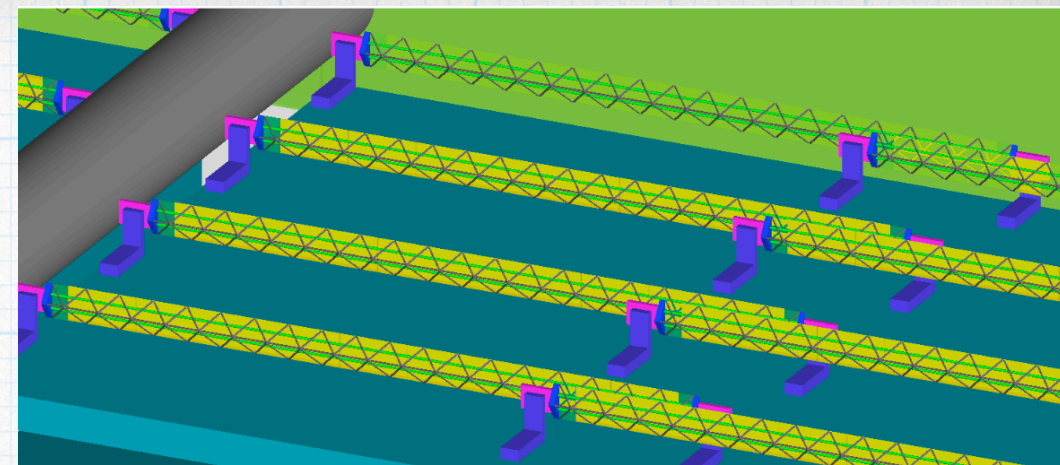


0	1	2	3	4	5	6	7	8	9	10	11
1.23E-10	5.07E-11	6.59E-11	7.55E-11	8.51E-09	1.17E-07	5.14E-08	1.49E-10	5.02E-07	1.92E-07	2.72E-06	5.37E-07



Tracker

- JET140, 16.5 GeV, BKG BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings



Tracker	min	max	Average
bkg, Gy	3.57E-08	1.16E-05	1.66E-06
sig, Gy	1.06E-13	3.91E-06	5.54E-07
sig+9*bkg	3.22E-07	1.07E-04	1.57E-05

Bkg w/ nAbsorber

Tracker	min	max	av
bkg	8.43E-09	1.07E-05	1.54E-06
sig	1.06E-13	3.91E-06	5.54E-07
sig+9*bkg	7.58E-08	9.87E-05	1.46E-05

Back up

results on absorbed dose

per BX, per sensitise detector

- JET140, 16.5 GeV, 8 um, 9479 BX, standart EM physics list, IPStrong
- JET140, 16.5 GeV, 5 um, 976 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, the most recent MC IPStrong
- JET140, 16.5 GeV, 3 um, 9 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, shieldings, the most recent MC ptarmigan

detid	det_name	Averaged Dose (BERT), Gy, TDR	Averaged Dose, (BERT) Gy, CDR	Averaged Dose, (EM) Gy
5000	ComptonEl	—	4.88e-05 / 0.002	6.23e-05 / 0.003
3000-1	LysoCal	3.20e-07	7.15e-07	4.17e-07
4000-7	LeadGlass	3.77e-08	4.49e-08	7.08e-08
2000-20	EcalSensor	5.50e-09 / 9.14e-08	4.65e-08 / 1.13e-07	2.75e-08 / 2.56e-07
1000-143	TrackerSensor	1.06e-13 / 3.91e-06	7.5e-14 / 1.06e-06	8.5e-08 / 1.44e-06

results on absorbed dose

per BX, per sensitise detector

JET140, 16.5 GeV, 8 um, 9479 BX, standart EM physics list

detid	det_name	Averaged Dose, Gy	Per year, 10 ⁷ sec, Gy	Radiation Hardness, kGy
5000	ComptonEI	6.23e-05 /0.003	6e2 - 3e4	~10 ⁵ (Lanex)
3000-1	LysoCal	4.17e-07	4.2	~10 ⁵ (Lanex)
4000-7	LeadGlass	7.08e-08	0.7	1 (TF101)
2000-20	EcalSensor	2.75e-08 /2.56e-07	0.3-3	~1000 (Si)
1000-143	TrackerSensor	8.5e-08 /1.44e-06	1-15	27 (Alpide)

JET140, 16.5 GeV, 5 um, 976 BX, QGSP_BERT_HP list, updated g4 setup with no leaking dump, the most recent MC IPStrong

det_name	Averaged Dose (BERT), Gy	Per year, 10 ⁷ sec, Gy
IP Scintillator	4.88e-05 /0.002	5e2 - 2e4
PDS GadOx Scintillator	7.15e-07	7.2
PDS Backscatter Calorimeter	4.49e-08	0.5
IP Calorimeter	4.65e-08 / 1.13e-07	0.5-1
IP Pixel tracker	7.5e-14 /1.06e-06	7e-7 - 10

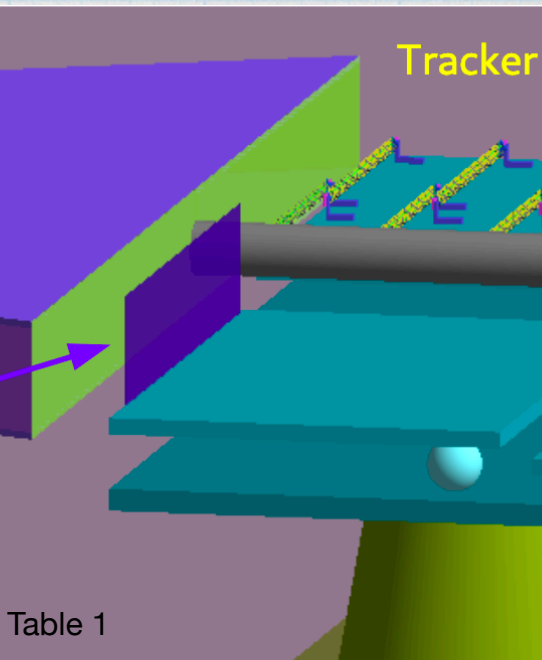
Detector	avg. annual dose [Gy]	tolerable dose [Gy]
IP Pixel tracker	10	$27 \cdot 10^3$
IP Calorimeter	1	10^6
IP Scintillator	2×10^4	10^8
PDS GadOx Scintillator	10	10^8
PDS LYSO Scintillator	10^4	$10^4 - 10^7$
PDS Gamma Profiler	$< 10^7$	10^7
PDS Backscatter Calorimeter	0.5	300

det_name	Averaged Dose (BERT), Gy	Per year, 10 ⁷ sec, Gy
IP Scintillator	4.88e-05 / 0.002	5e2 - 2e4
PDS GadOx Scintillator	7.15e-07	7.2
PDS Backscatter Calorimeter	4.49e-08	0.5
IP Calorimeter	4.65e-08 / 1.13e-07	0.5-1
IP Pixel tracker	7.5e-14 / 1.06e-06	7e-7 — 10

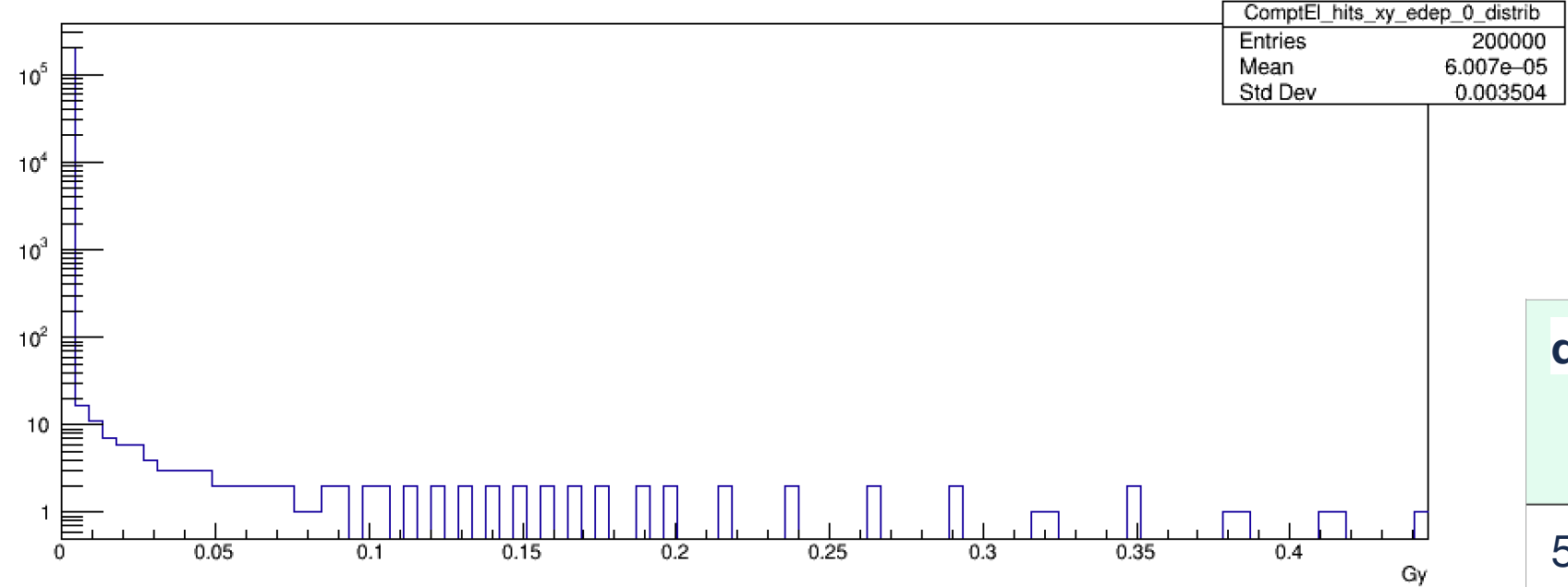
detid	det_name	Averaged Dose (BERT), Gy	Averaged Dose, Gy
5000	ComptonEI	4.88e-05 / 0.002	6.23e-05 / 0.003
3000-1	LysoCal	7.15e-07	4.17e-07
4000-7	LeadGlass	4.49e-08	7.08e-08
2000-20	EcalSensor	4.65e-08 / 1.13e-07	2.75e-08 / 2.56e-07
1000-143	TrackerSensor	7.5e-14 / 1.06e-06	8.5e-08 / 1.44e-06

Compton Electron Lanex

JET140, 16.5 GeV, 8 μm , 9479 BX

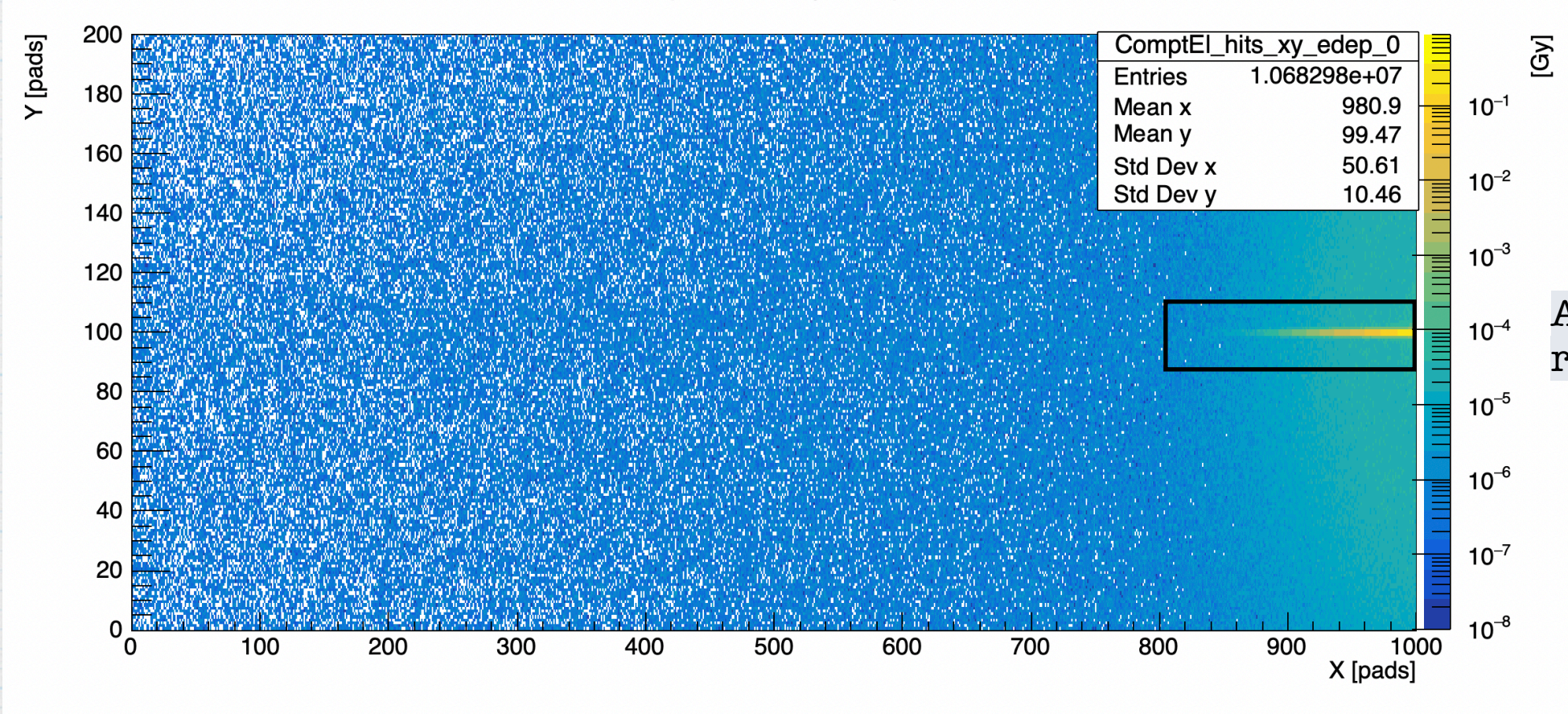


ComptEI_hits_xy_edep_0_distrib



detid	det_name	Average d Dose, Gy	Max Dose, Gy
5000	ComptonEI	6.23e-05	0.42

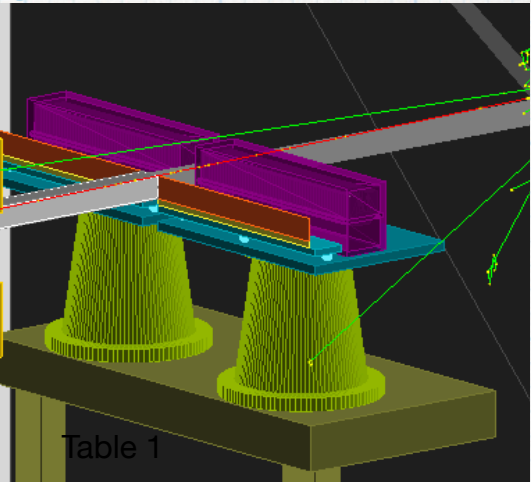
ComptEI_hits_xy_edep_0



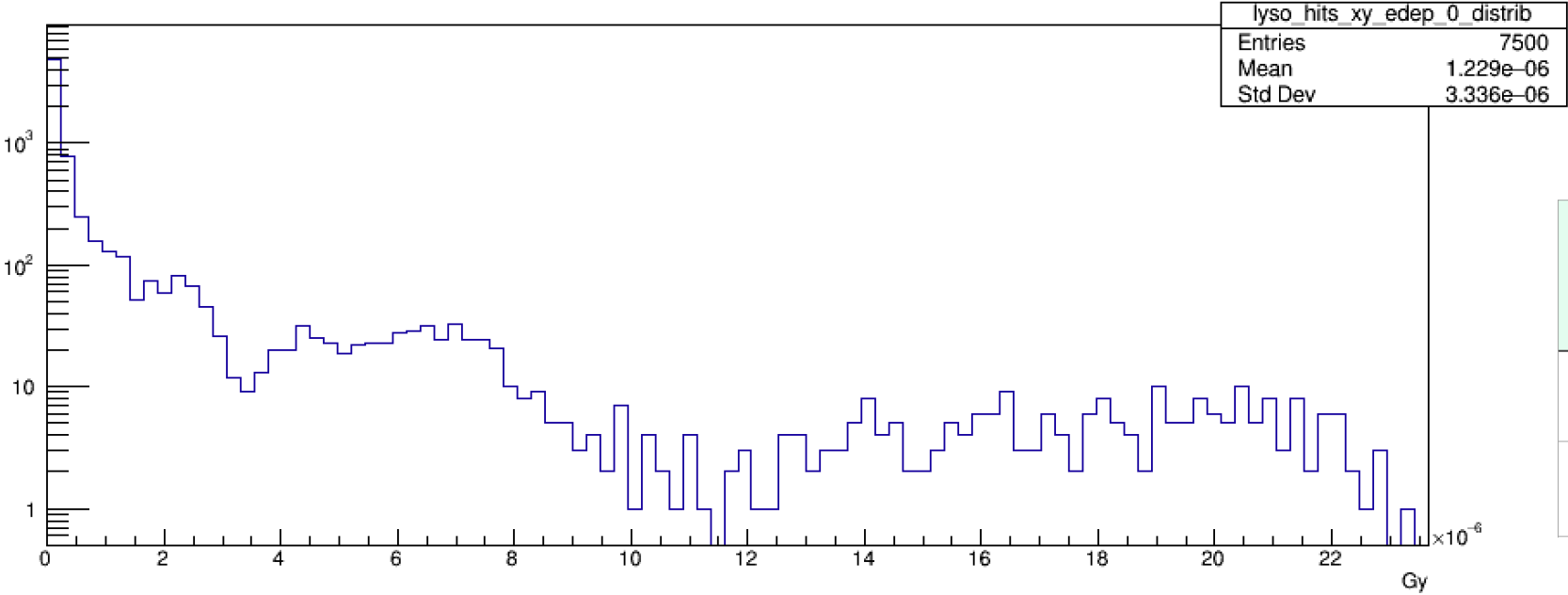
Averaged dose per selected region ~ 0.003 Gy

FDS Lanex Spectrometer

JET140, 16.5 GeV, 8 μm , 9479 BX

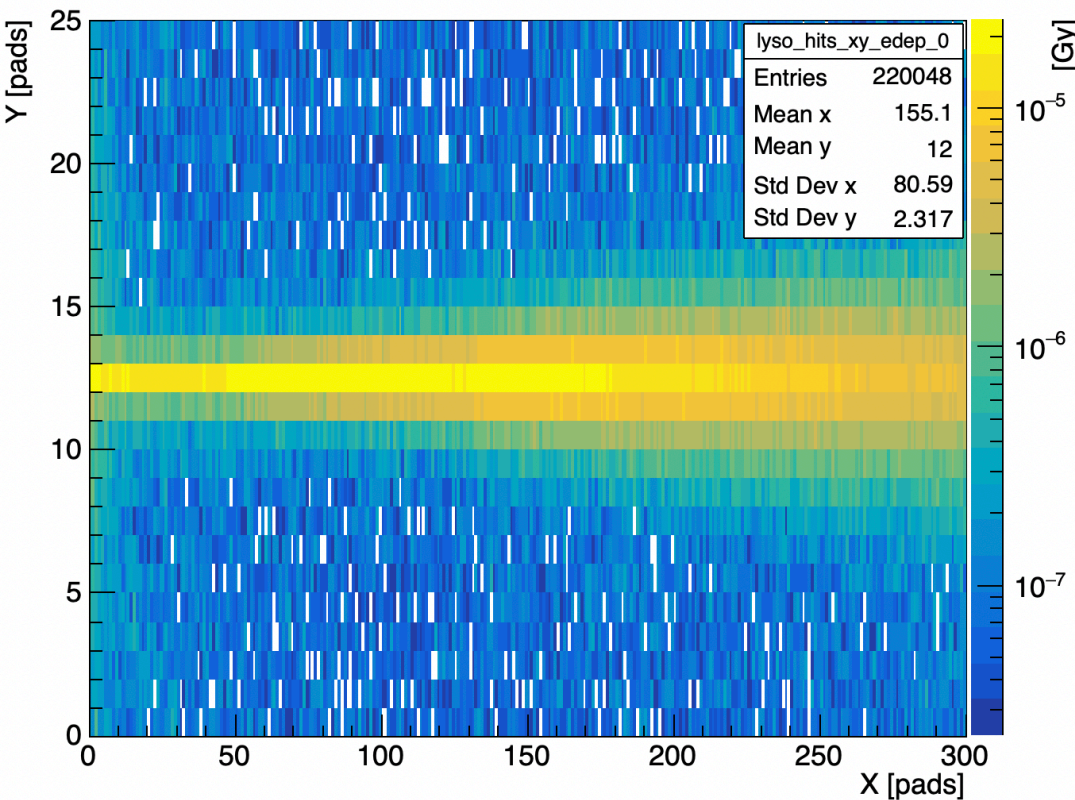


lyso_hits_xy_edep_0_distrib



detid	det_name	Averaged Dose, Gy	Max Dose, Gy
3001	LysoCal	1.24e-6	2.4e-5
3000	LysoCal	1.26e-6	4.1e-5

lyso_hits_xy_edep_0



lyso_hits_xy_edep_1

