e/p discrimination with EPICS simulated data

Francesco Palma
(University of Rome ‘Tor Vergata’)

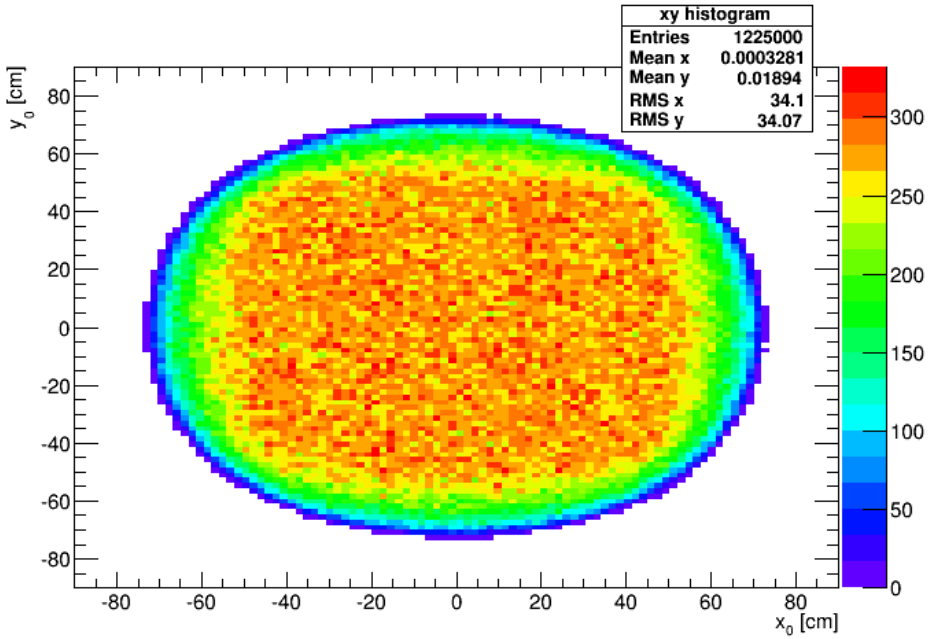
CALET Vidyo Meeting

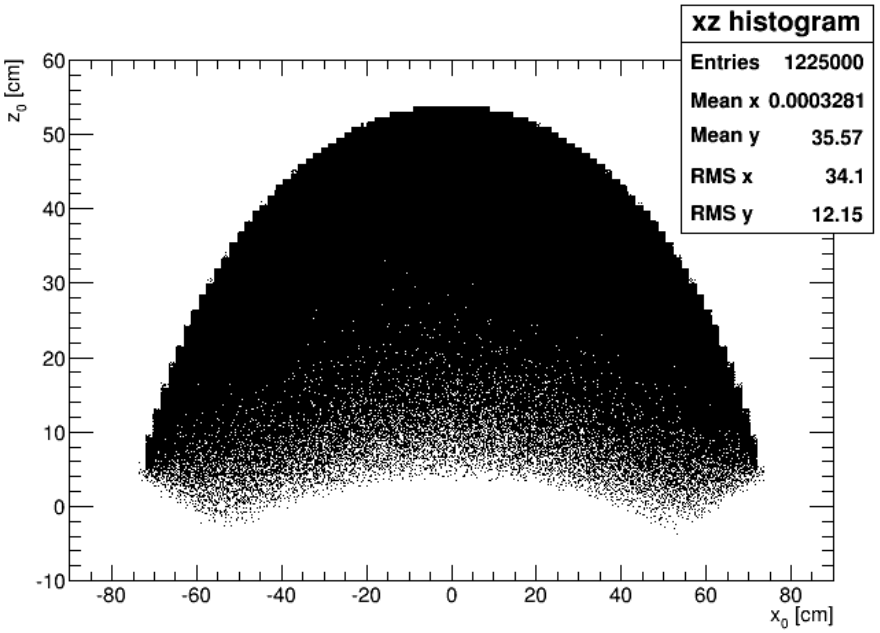
Simulation details

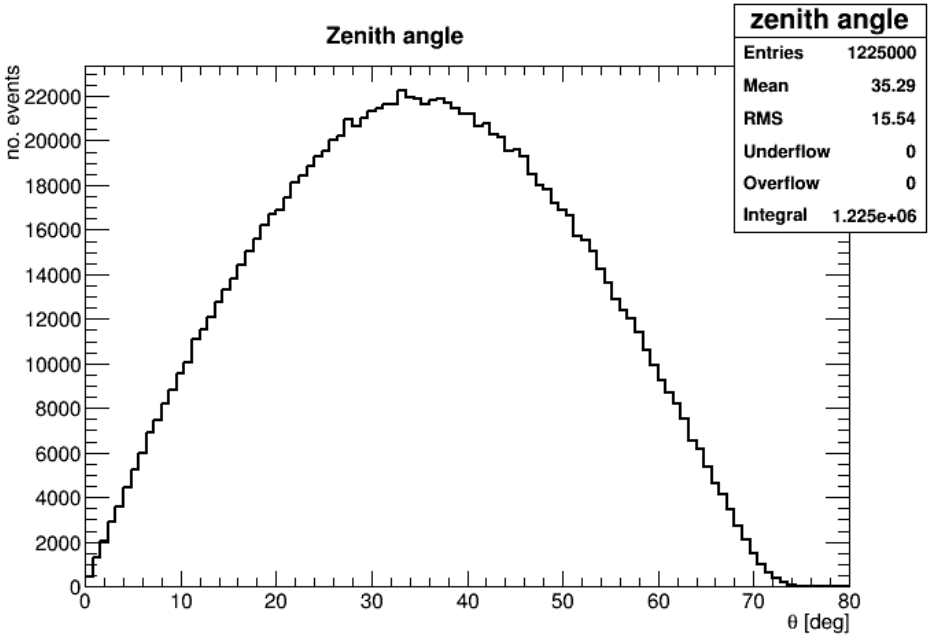
- **EPICS** version **9.165** (July 5, 2014), **COSMOS 7.645** (April 3, 2014);
- **CALET CAD geometry implemented**;
- **Isotropic generation on a hemisphere (R = 78 cm)**;
- **E^{-1} power-law for electrons and protons** (to have enough population in high-energy bins);
- **Dpmjet3** hadronic interaction model.

Particle	Energy range (GeV)	Spectral index	No. events EPICS	Hemisphere radius (cm)
Electrons	20-2000	1.0	**3.0×10^5**	78
Protons	10^3-10^5	1.0	**1.225×10^6** **(up to now)**	78

Generated protons

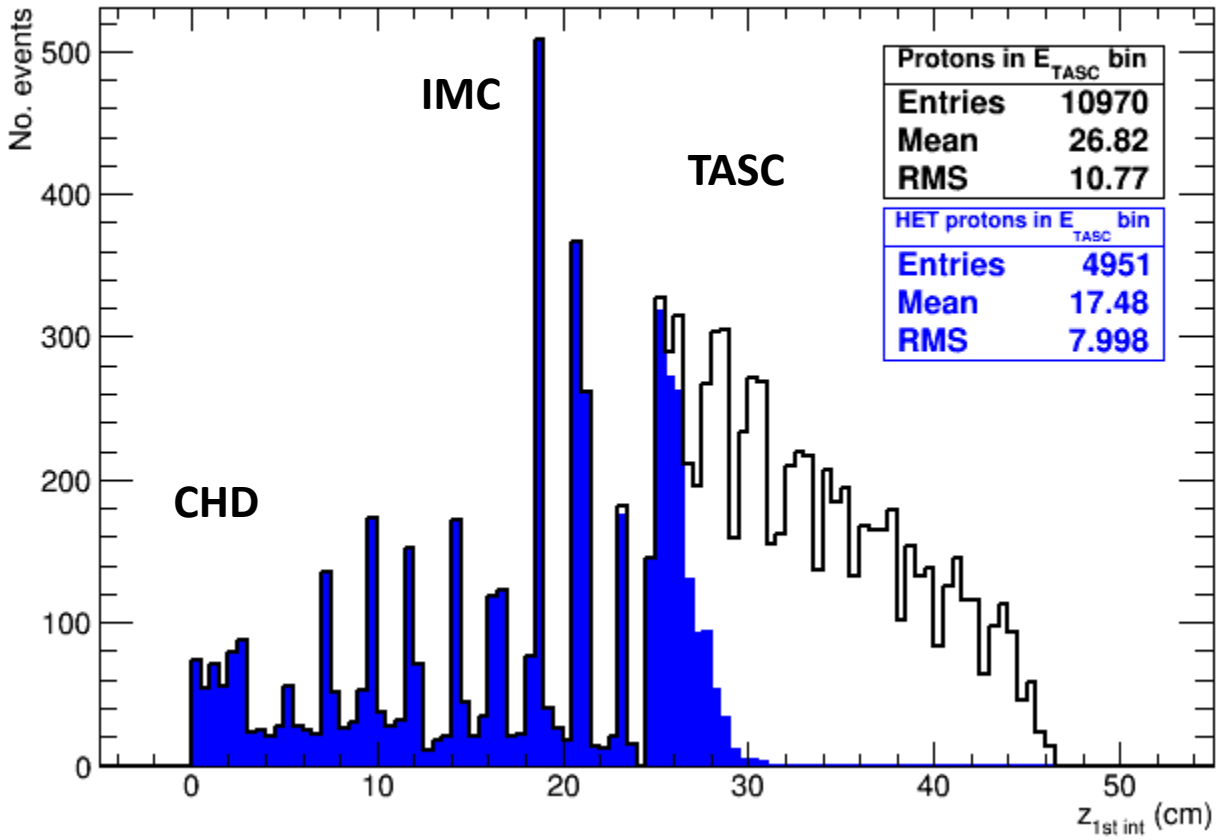






e/p discrimination at 1TeV
Energy bin: (912 - 1000) GeV

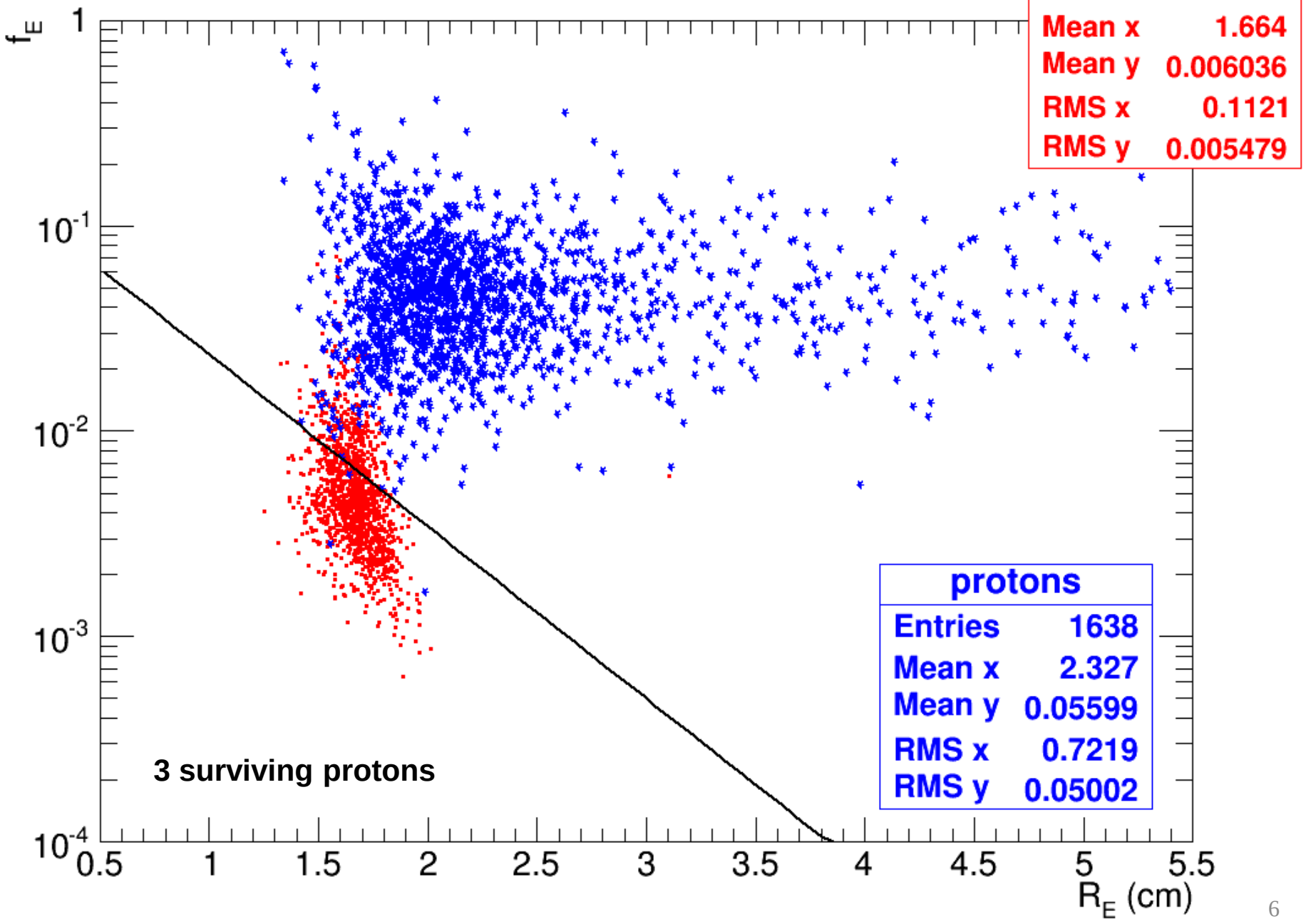
Triggered protons

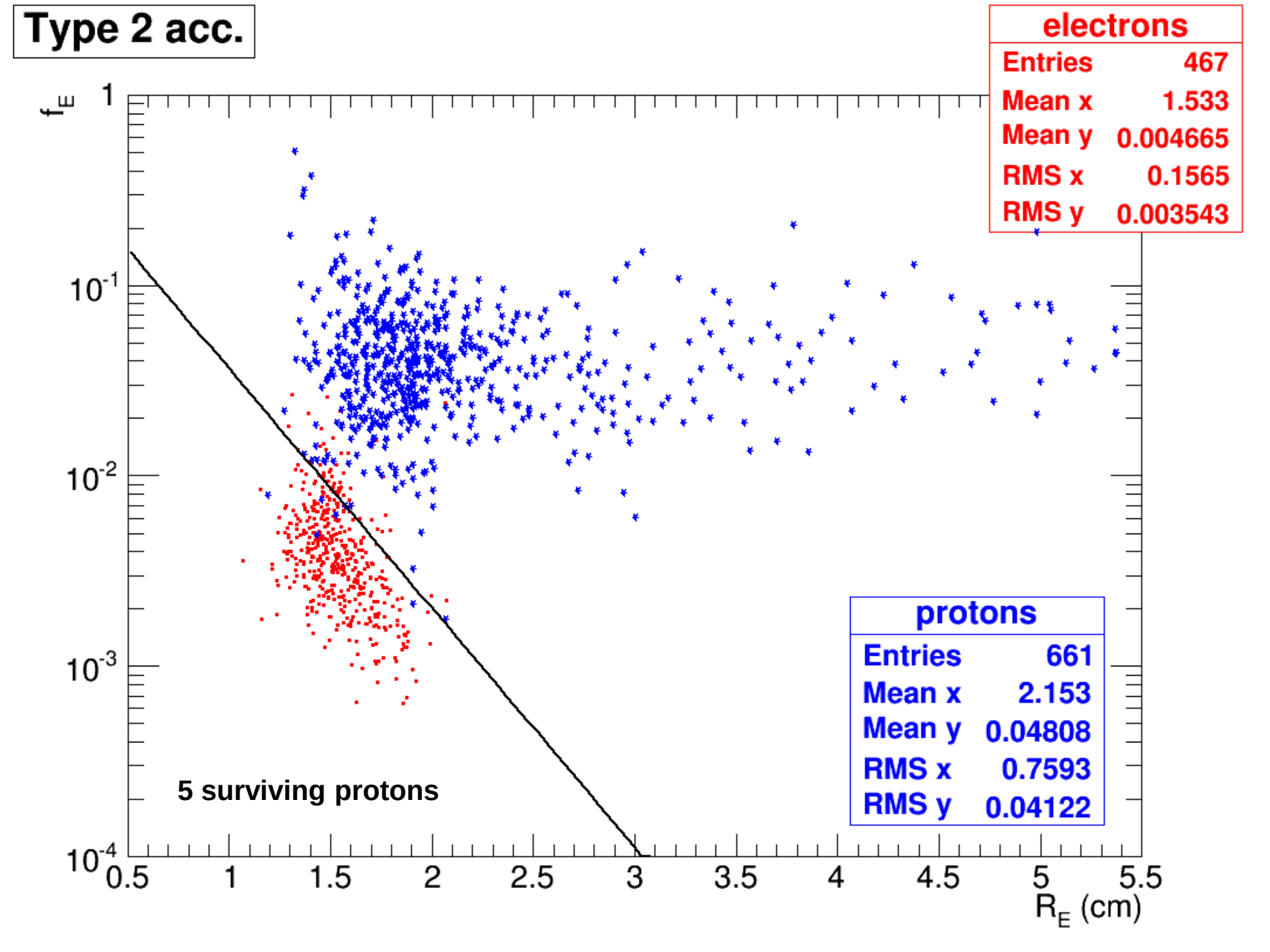


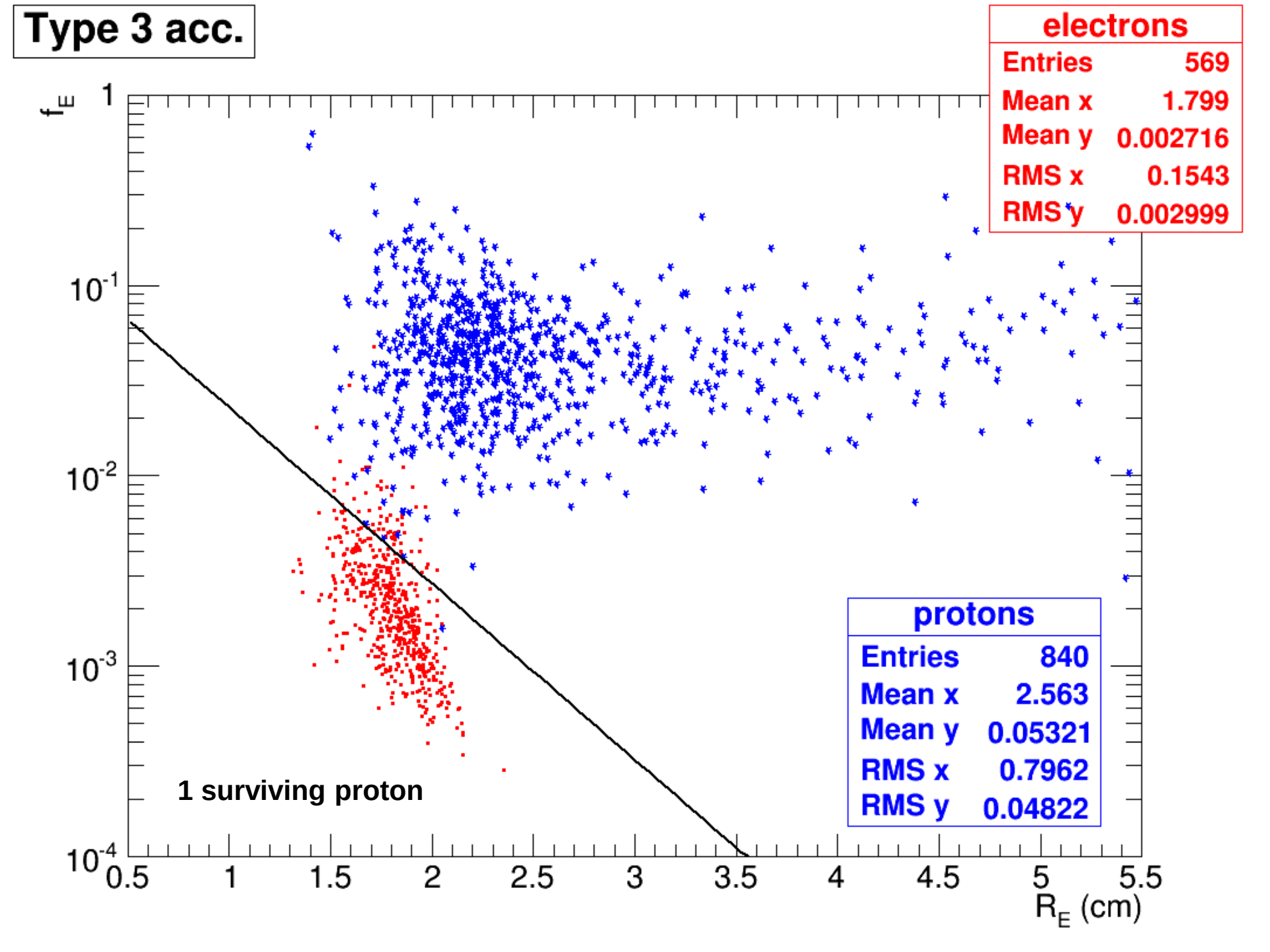
~ 80.3% out of the about 7.1 x 10^5 protons inside acceptance are interacting;
~ 45.1% (FLUKA: ~ 47%) of protons in the chosen TASC energy bin are triggered.

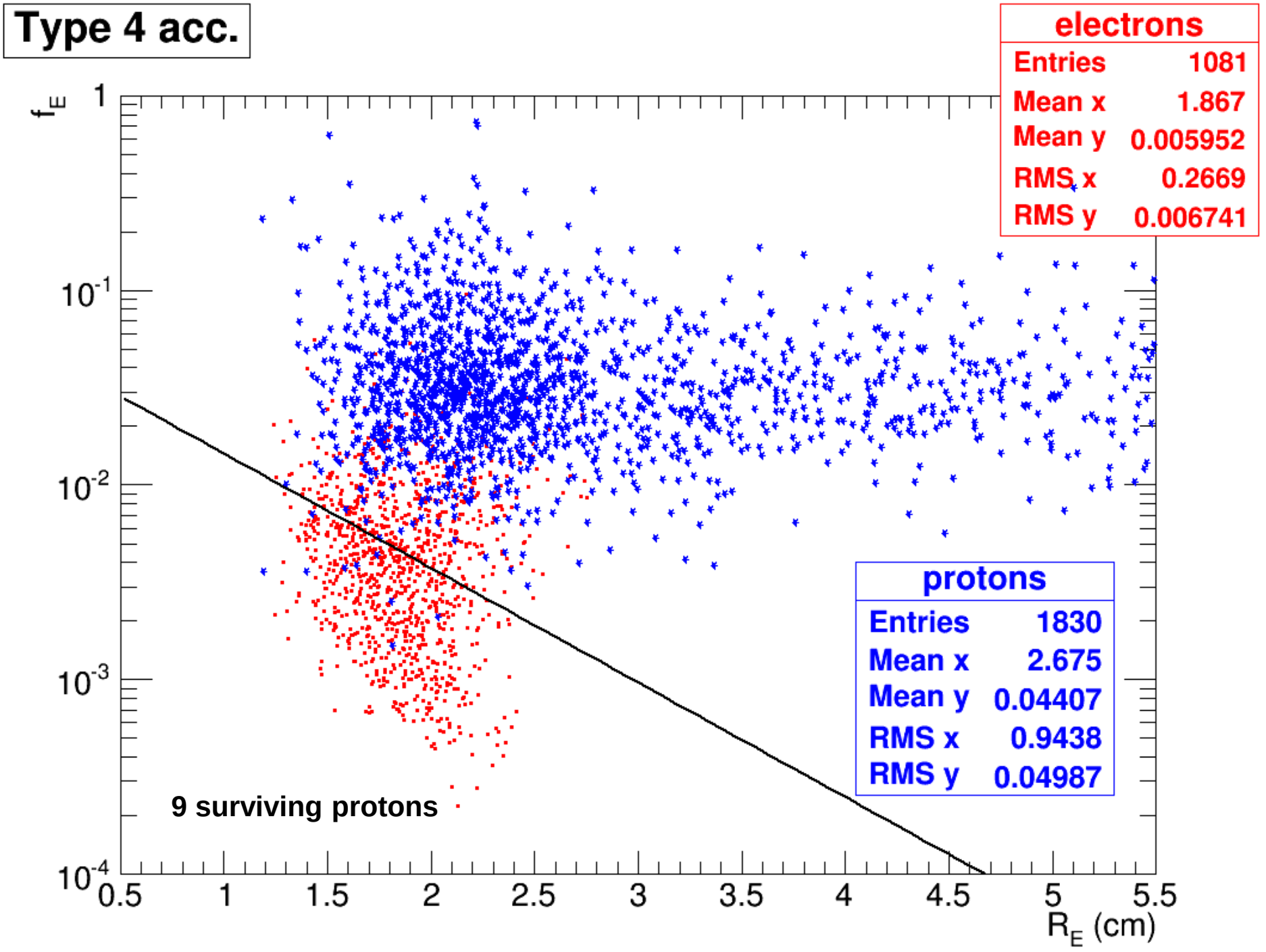
Type 1 acc.

f_E vs R_E cut




Type 2 acc.
electrons
Entries 467
Mean x 1.533
Mean y 0.004665
RMS x 0.1565
RMS y 0.003543
protons
Entries 661
Mean x 2.153
Mean y 0.04808
RMS x 0.7593
RMS y 0.04122
5 surviving protons
f_E
R_E (cm)
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5


Type 3 acc.
electrons
Entries 569
Mean x 1.799
Mean y 0.002716
RMS x 0.1543
RMS y 0.002999
protons
Entries 840
Mean x 2.563
Mean y 0.05321
RMS x 0.7962
RMS y 0.04822
1 surviving proton
f_E
R_E (cm)
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5


Type 4 acc.
electrons
Entries 1081
Mean x 1.867
Mean y 0.005952
RMS x 0.2669
RMS y 0.006741
protons
Entries 1830
Mean x 2.675
Mean y 0.04407
RMS x 0.9438
RMS y 0.04987
9 surviving protons
f_E
R_E (cm)
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5

e^- efficiency and p rejection

E^{-1} protons	Cut	Acc. Type 1	Acc. Type 2	Acc. Type 3	Acc. Type 4	Total
	In MC acc.	267791	98111	123194	223455	712551
	In E_{TASC} bin	4005	1542	2015	3426	10988
	HET	1638	661	840	1830	4969
	f_E vs R_E	3	5	1	9	18
	IMC 1RM cut (> 0.455)	3	2	0	2	7
	CHD cut (< 0.2)	3	1	0	2	6

E^{-1} electrons	Cut	Acc. Type 1	Acc. Type 2	Acc. Type 3	Acc. Type 4	Total
	In MC acc.	65525	24239	30319	54345	174428
	In E_{TASC} bin	1321	467	569	1081	3438
	HET	1321	467	569	1081	3438
	f_E vs R_E	966	418	502	622	2508
	IMC 1RM cut (> 0.455)	937	400	476	594	2407
	CHD cut (< 0.2)	937	400	476	594	2407

~0.9% (FLUKA: ~1.6%) out of the initial 1.225 x 10^6 protons have an energy deposit in the chosen bin i.e. 912 < E_{TASC} < 1000 GeV.

ε_{ele} = 70 %

$\varepsilon_p = 8.4 \times 10^{-6}$
(but statistics is still increasing)

$R = \varepsilon_{ele} / \varepsilon_p$