

Event centrality with TPC, ECAL and FHCAL

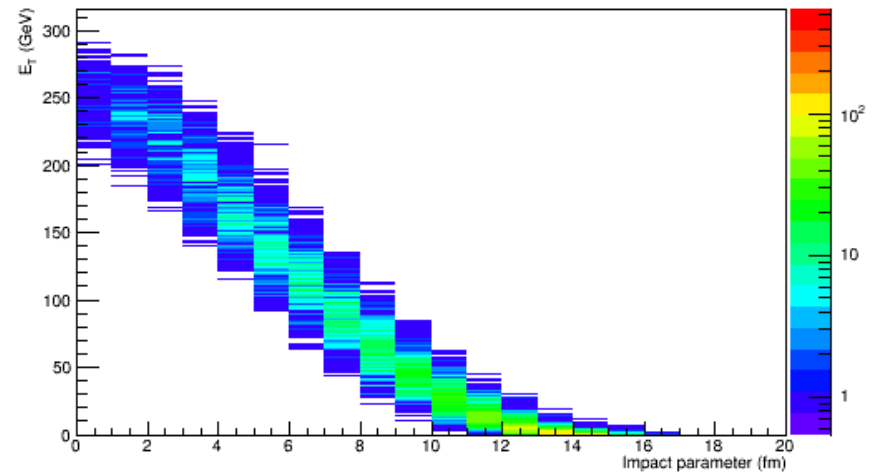
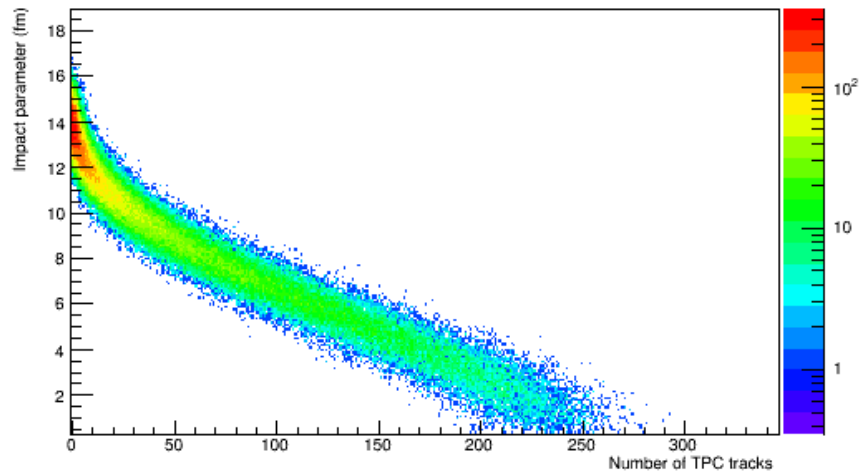
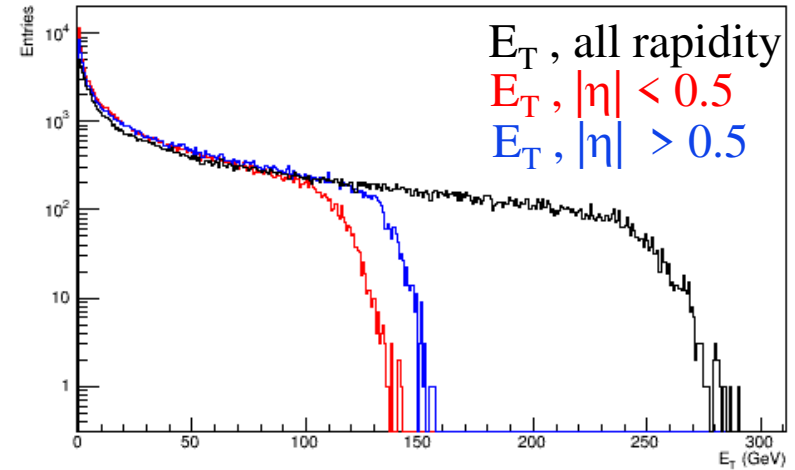
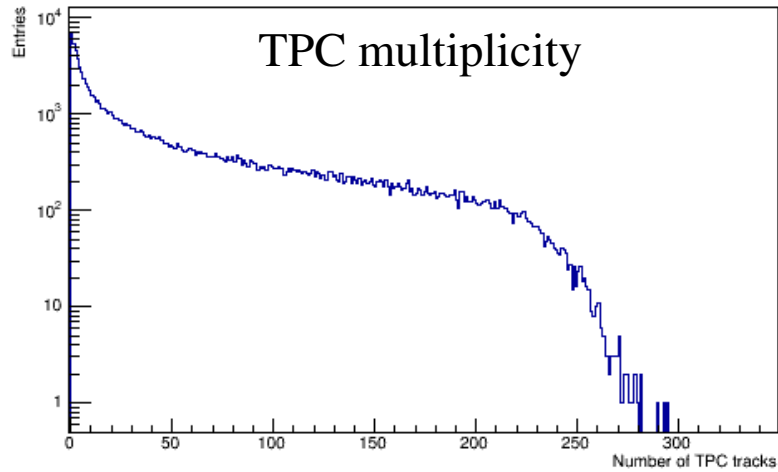
V. Riabov

Selection cuts

NEW

- Event selections:
 - ✓ BiBi@9.2, **DCM-QGSM-SMM** (for central and forward rapidities)
 - ✓ $b = 0-17$ fm
 - ✓ inelastic collisions
 - ✓ z -vertex = 0 to avoid efficiency corrections
- Track selections (for centrality by TPC multiplicity):
 - ✓ n -hits > 10
 - ✓ $|\eta| < 0.5$
 - ✓ $|\text{DCA}_{x,y,z}| < 2$ cm
- ECAL cluster selections:
 - ✓ $E_\gamma > 50$ MeV
 - ✓ n -towers > 1
- **FHCAL:**
 - ✓ standard centrality with event distribution by E_{tot} vs. $E_{\text{max_cone}}$

N_{TPC} , E_T distributions



E_T distributions, CPV

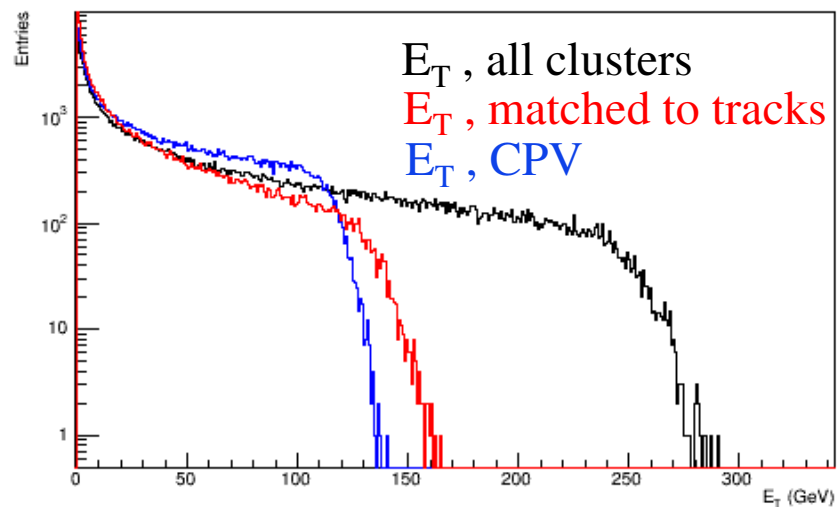
- Transverse energy E_T , all rapidity

Matched clusters:

$|\text{dphi}| < 10$ && $|\text{dzed}| < 10$

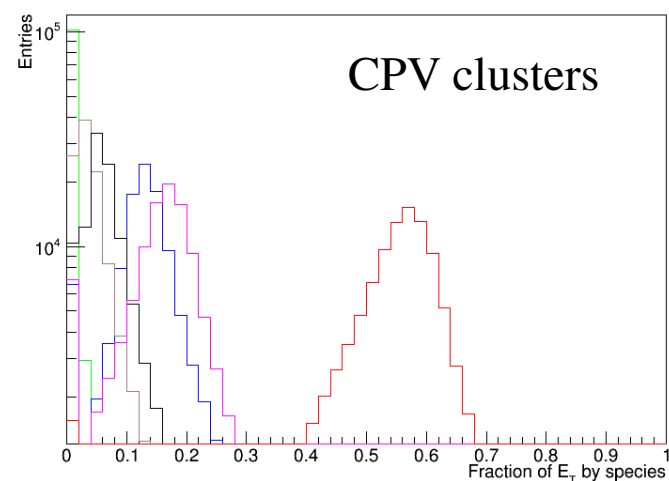
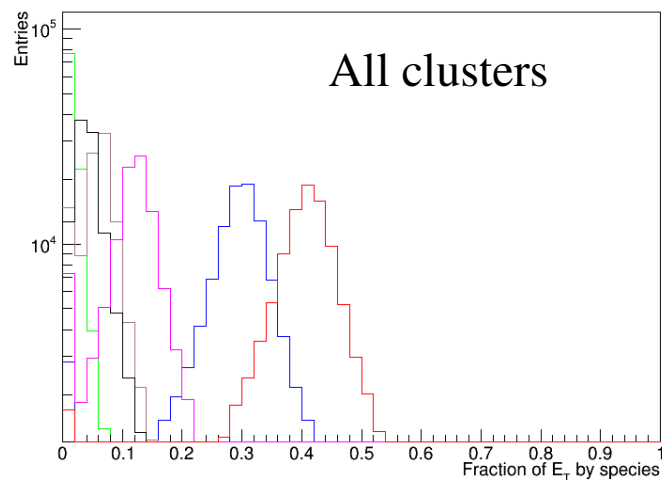
CPV:

!Matched



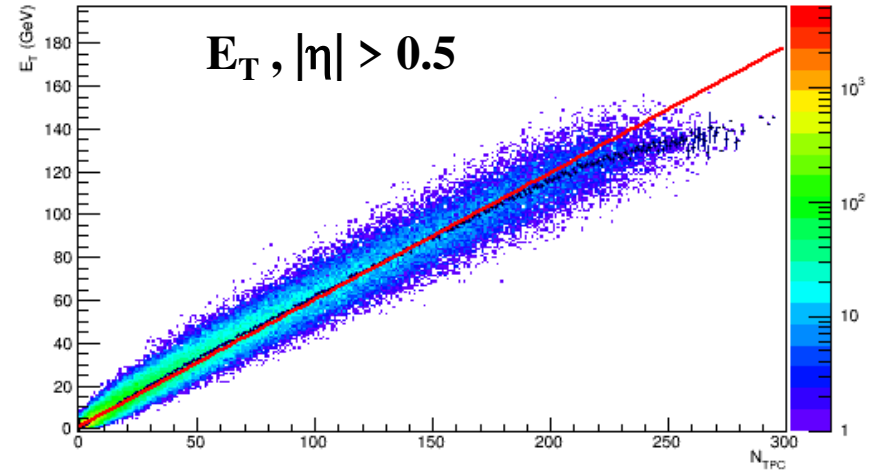
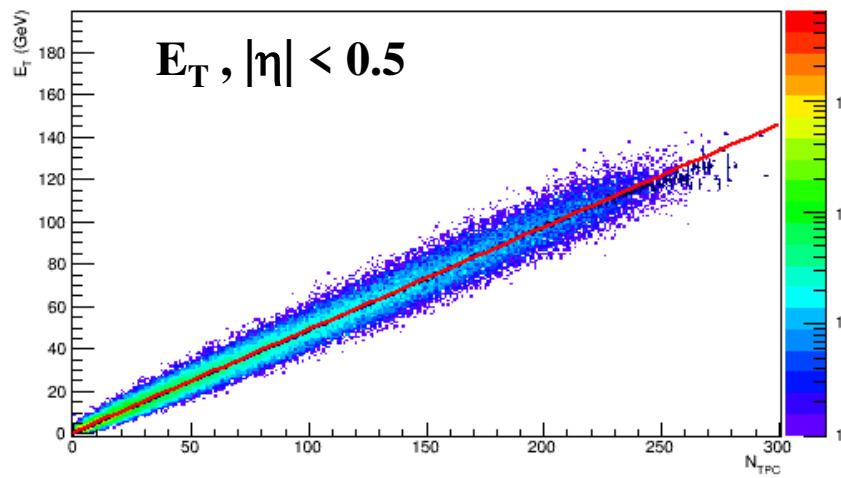
- Contributors:

γ , π^\pm , e^\pm , K^\pm , p^\pm , n

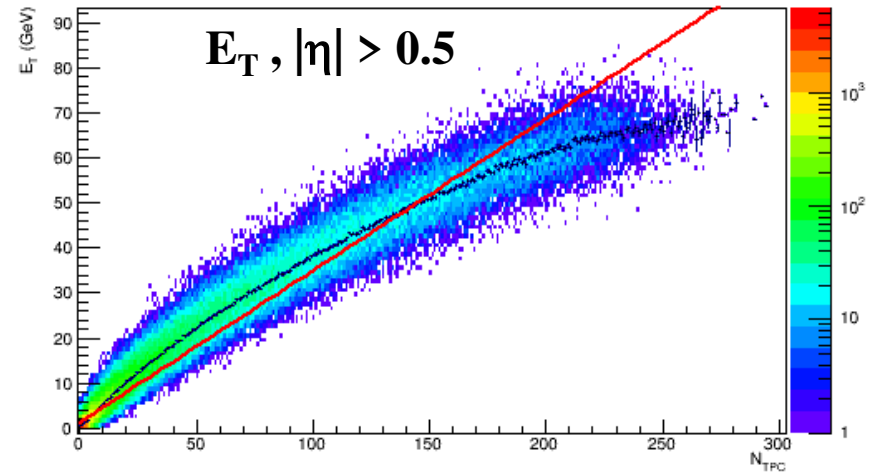
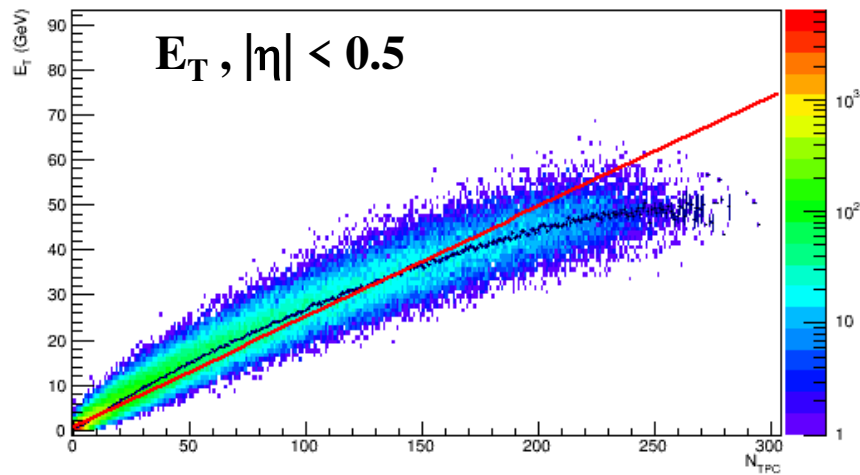


E_T vs. N_{TPC}

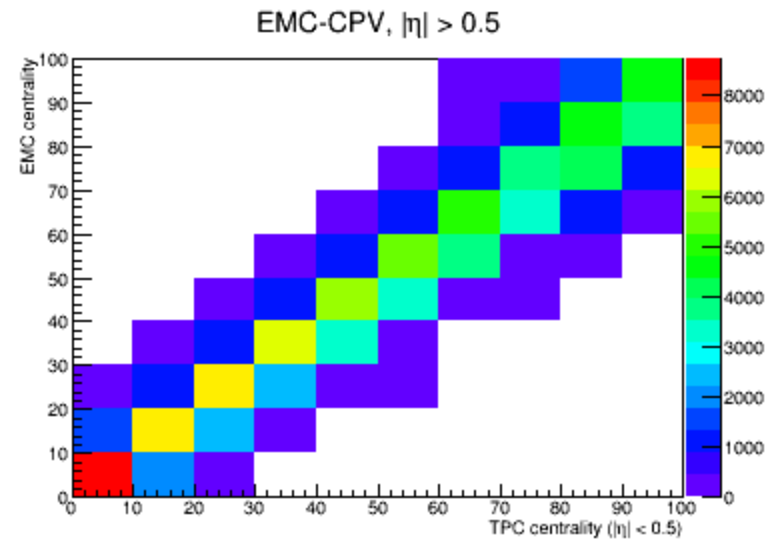
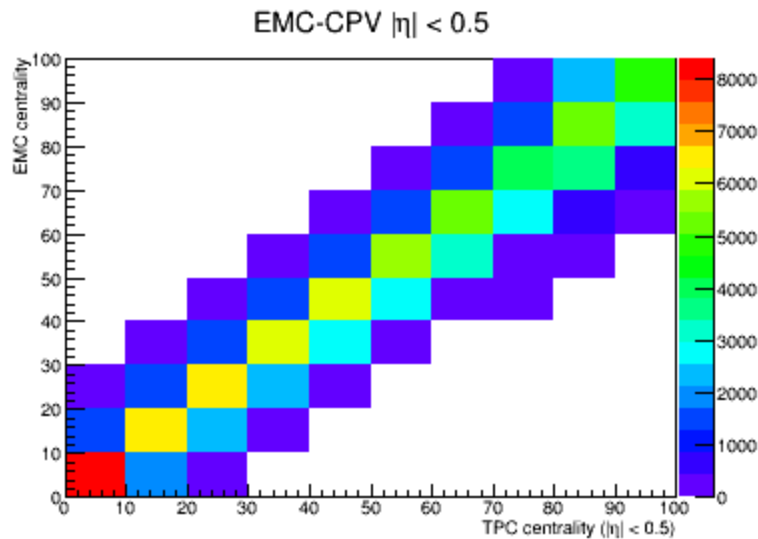
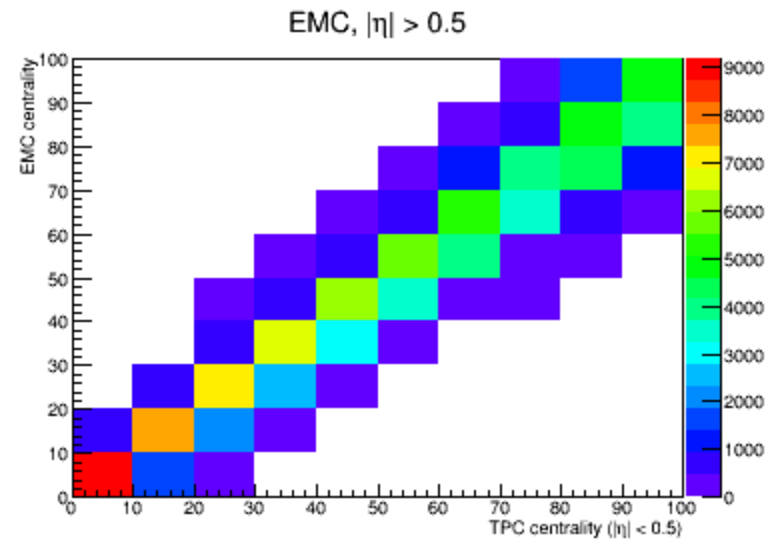
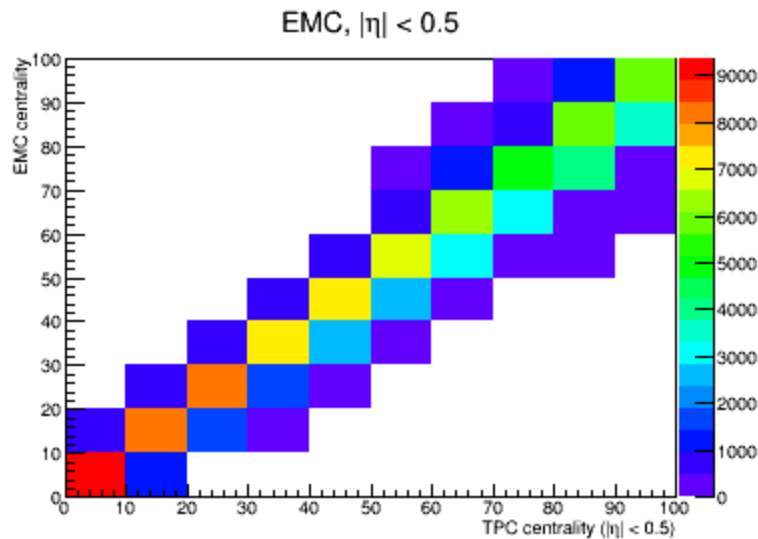
- All clusters



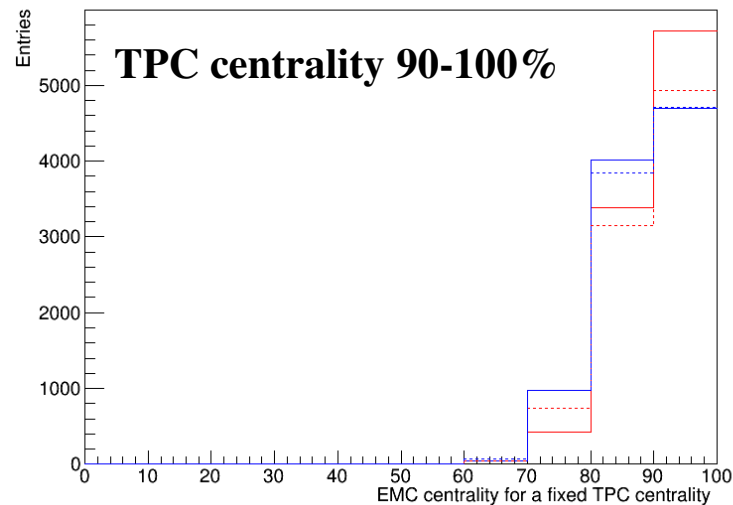
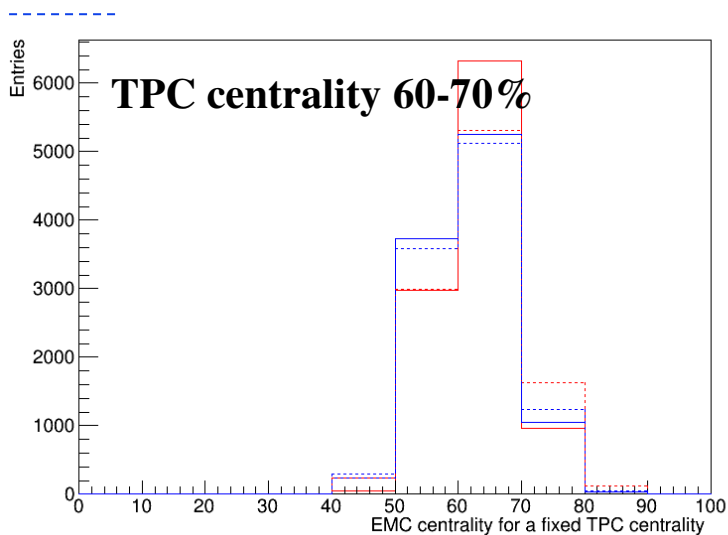
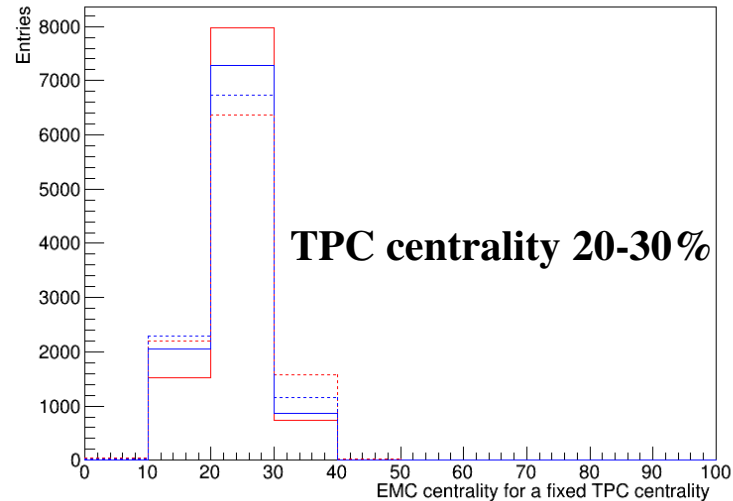
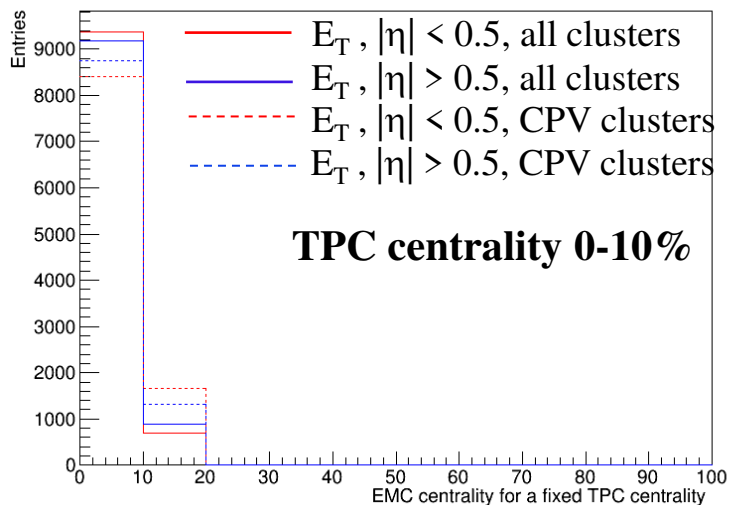
- CPV clusters



Centrality by E_T vs. centrality by TPC

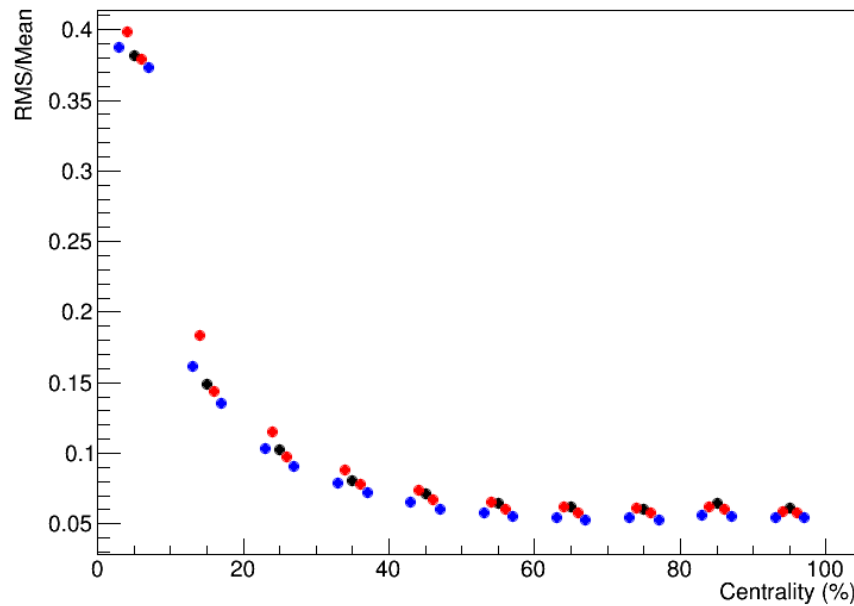
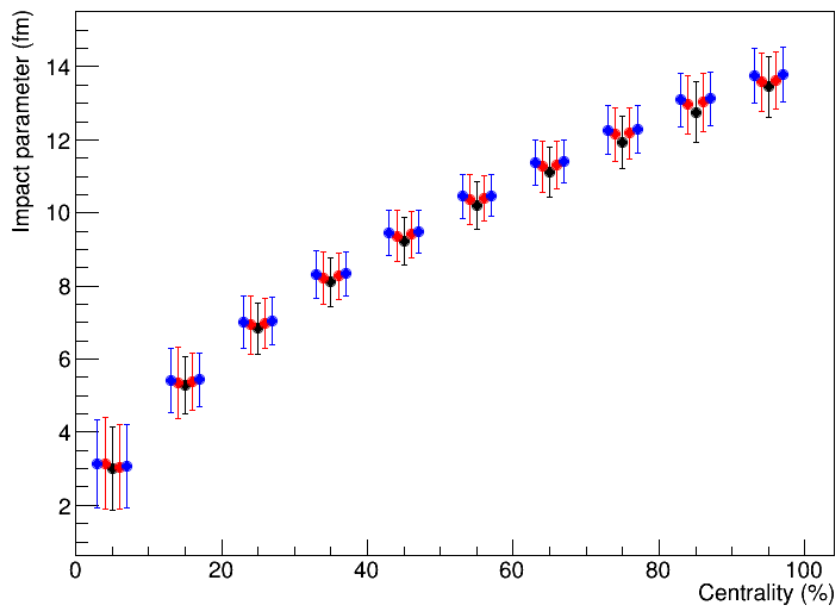


Centrality by E_T vs. centrality by TPC



Sampled impact parameter distributions

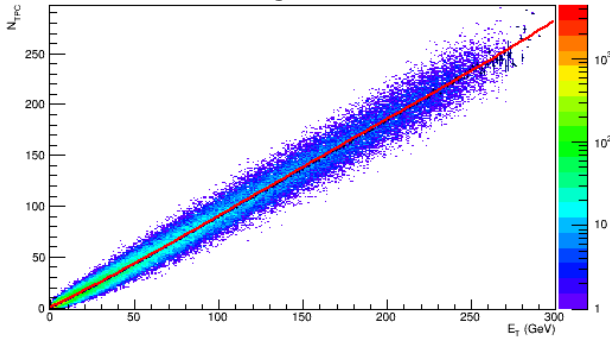
E_T -CPV, $|\eta| > 0.5$, E_T -CPV, $|\eta| < 0.5$, TPC centrality, E_T , $|\eta| < 0.5$, E_T , $|\eta| > 0.5$



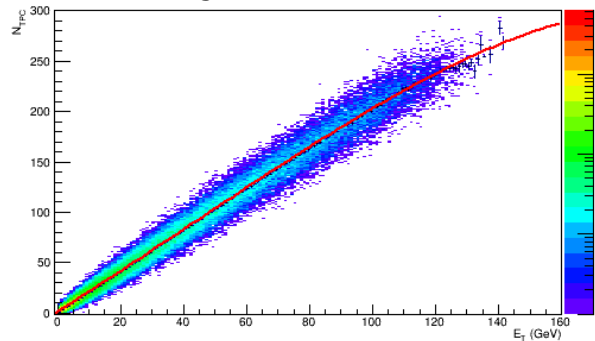
- Sampled impact parameter distributions are similar but event samples are different

N_{TPC} vs. E_T

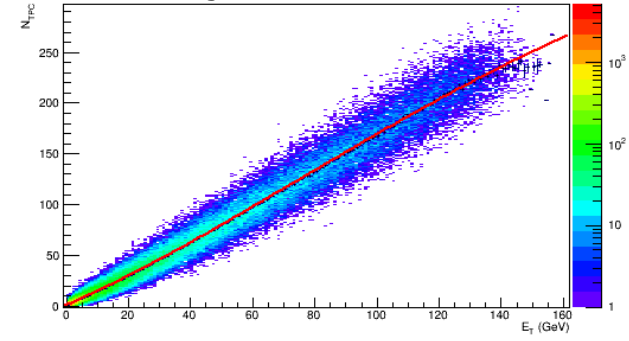
N_{TPC} vs E_T



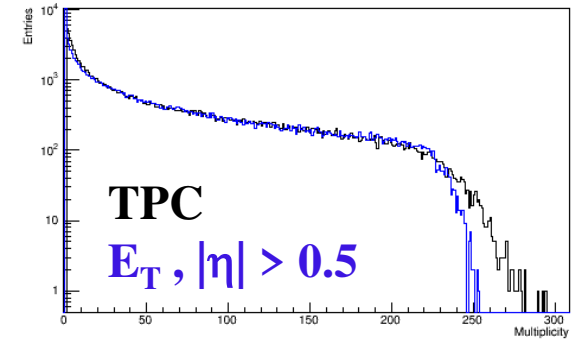
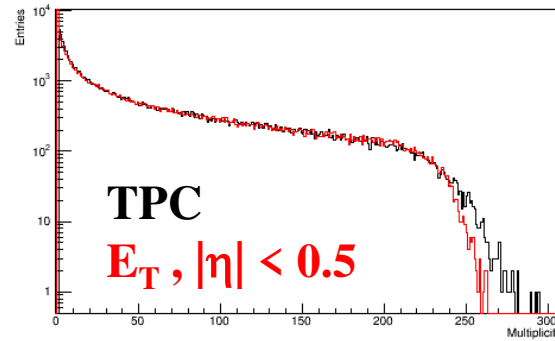
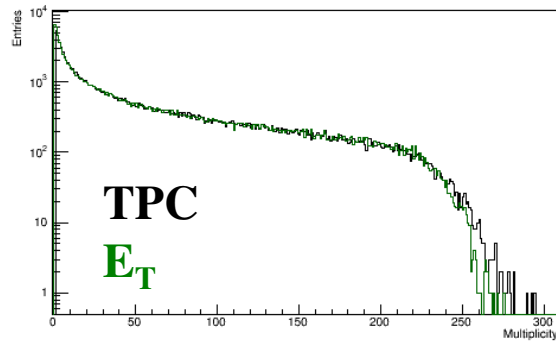
N_{TPC} vs E_T ($|\eta| < 0.5$)



N_{TPC} vs E_T ($|\eta| > 0.5$)

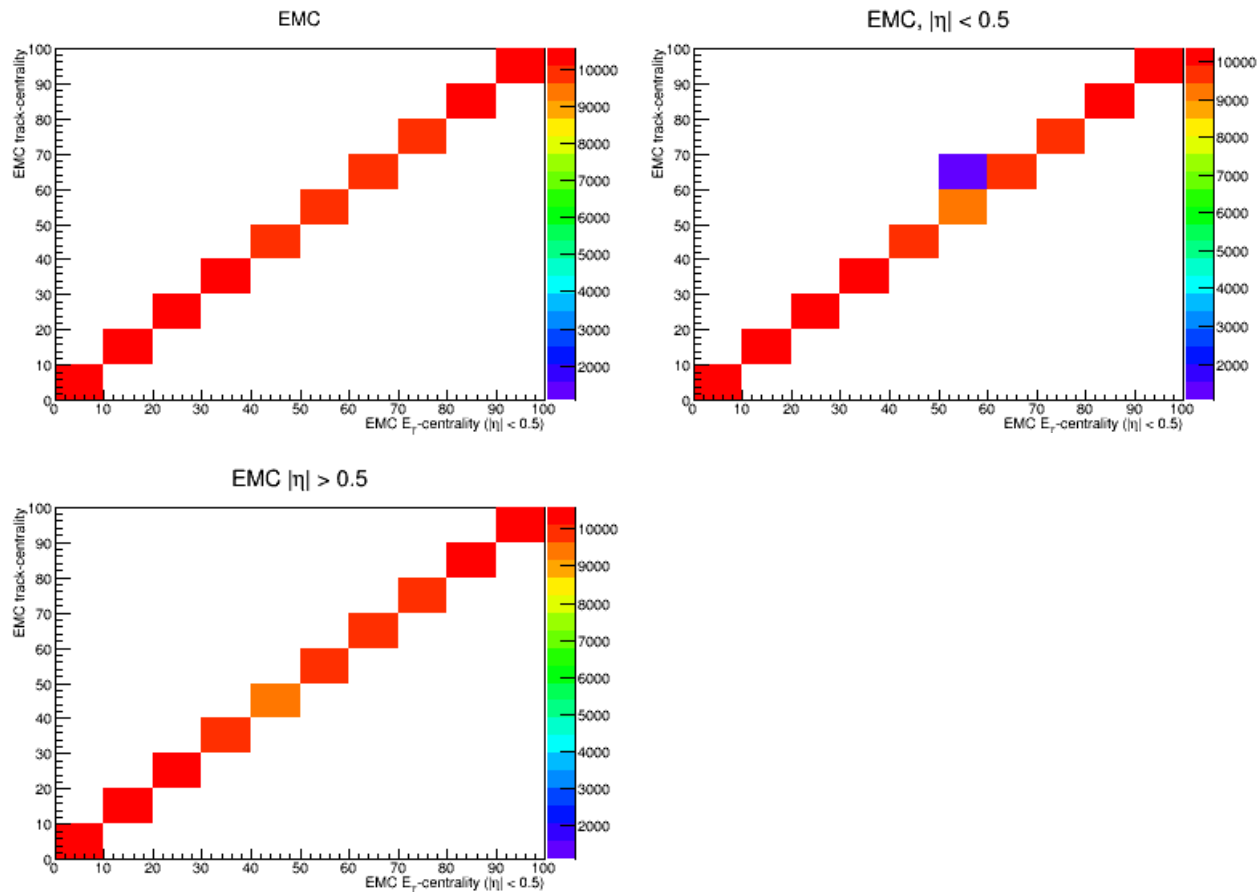


- TPC and “effective-EMCAL” track multiplicity distributions



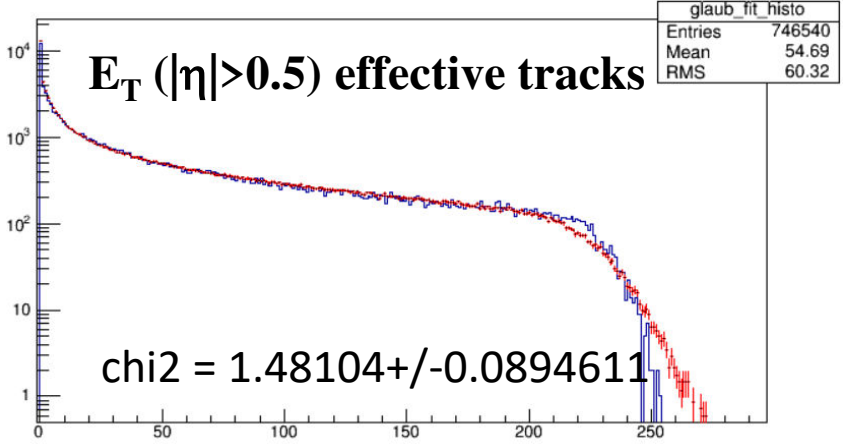
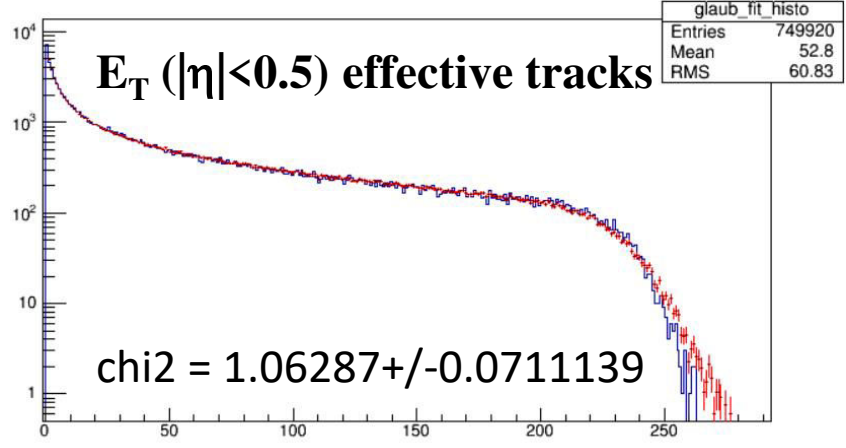
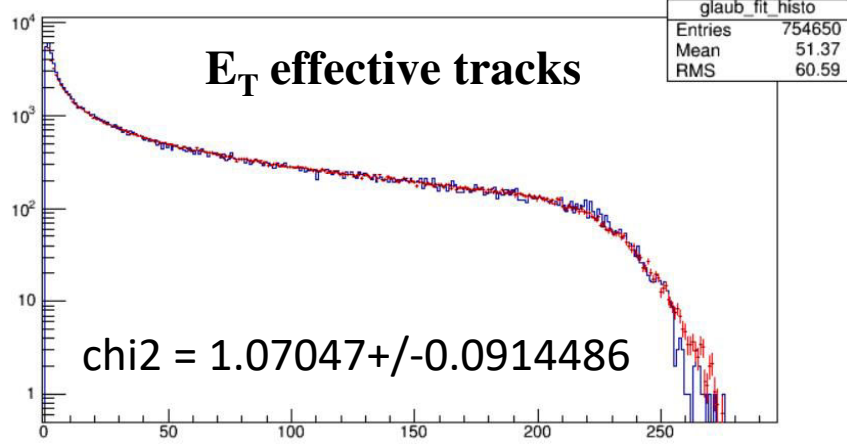
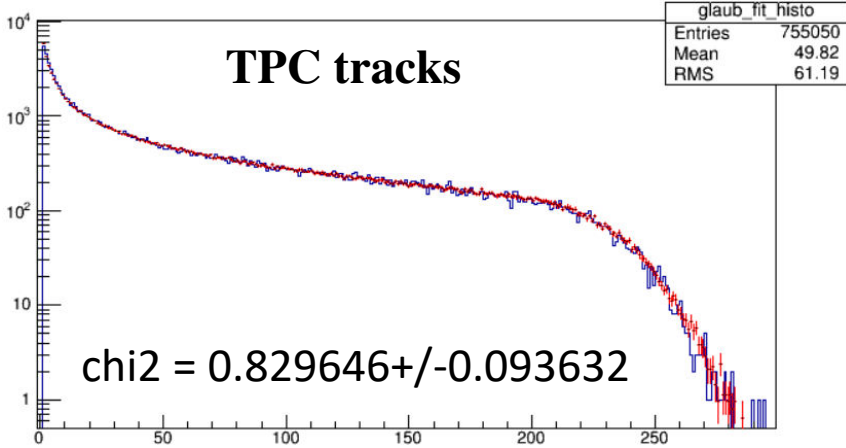
- Not a perfect match.
- The wider the correlation the larger the deviations at low and high multiplicities

Centrality by “effective” track multiplicity vs. by E_T



- It does not matter on what variable to define centrality: measured E_T or “effective-EMCAL” track multiplicity
- Some grass is due to a limited precision of boundaries for the centrality classes

Glauber model fits to “track” multiplicity distributions



- Glauber model fits in the range [10, Nmax] tracks

Glauber parameters - I

- TPC multiplicity

Cent, %	Mult_min	Mult_max	$\langle b \rangle$, fm	RMS	bmin, fm	bmax, fm	$\langle N_{part} \rangle$	RMS	Npart_min	Npart_max	$\langle N_{coll} \rangle$	RMS	Ncoll_min	Ncoll_max
0 - 10	162	293	2.92	1.10	1.36	4.17	338.55	34.35	295.08	388.90	729.31	91.95	611.42	867.56
10 - 20	114	162	5.18	0.73	4.17	6.00	257.19	30.32	223.89	295.08	510.72	68.71	427.81	611.42
20 - 30	79	114	6.71	0.63	6.00	7.37	194.70	25.60	168.41	223.89	357.14	53.55	295.13	427.81
30 - 40	53	79	7.97	0.59	7.37	8.52	145.04	21.84	124.27	168.41	243.46	42.22	198.52	295.13
40 - 50	34	53	9.07	0.58	8.52	9.56	105.34	18.54	88.97	124.27	159.89	32.75	128.29	198.52
50 - 60	21	34	10.04	0.58	9.56	10.51	74.24	15.22	61.17	88.97	100.83	24.43	78.37	128.29
60 - 70	12	21	10.93	0.62	10.51	11.36	50.24	12.74	40.00	61.17	60.34	18.45	44.72	78.37
70 - 80	6	12	11.81	0.69	11.36	12.20	31.17	10.32	24.37	40.00	32.58	13.14	23.71	44.72
80 - 90	3	6	12.64	0.80	12.20	13.24	18.20	7.96	12.27	24.37	16.62	8.74	10.63	23.71
90 - 100	1	2	13.98	1.04	13.24	14.93	6.48	4.64	0.06	12.27	4.88	4.21	-1.96	10.63

- E_T effective multiplicity

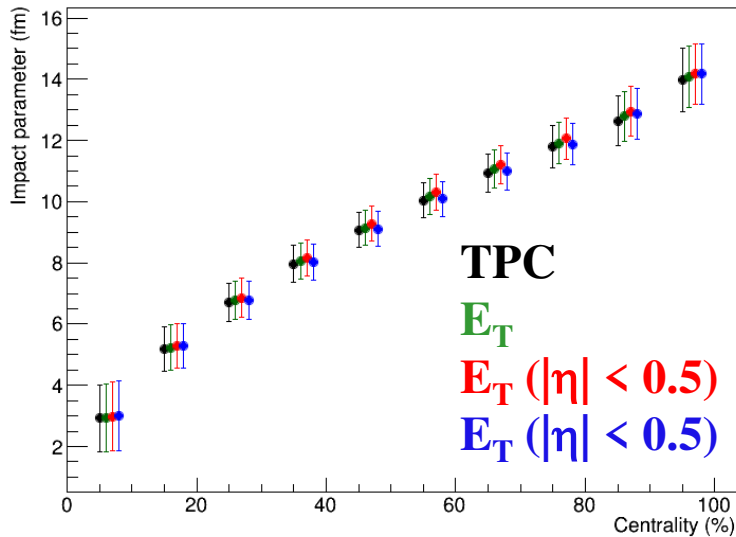
Cent, %	Mult_min	Mult_max	$\langle b \rangle$, fm	RMS	bmin, fm	bmax, fm	$\langle N_{part} \rangle$	RMS	Npart_min	Npart_max	$\langle N_{coll} \rangle$	RMS	Ncoll_min	Ncoll_max
0 - 10	161	285	2.94	1.11	1.32	4.21	338.15	34.32	293.54	390.02	726.85	93.70	606.94	866.78
10 - 20	114	161	5.23	0.74	4.21	6.07	254.98	30.17	221.20	293.54	505.06	71.62	421.41	606.94
20 - 30	80	114	6.79	0.62	6.07	7.45	191.33	25.01	165.28	221.20	349.06	55.25	288.07	421.41
30 - 40	55	80	8.05	0.58	7.45	8.61	141.96	20.82	120.99	165.28	236.77	42.59	191.66	288.07
40 - 50	36	55	9.14	0.57	8.61	9.66	102.59	17.75	85.68	120.99	154.59	33.20	122.20	191.66
50 - 60	22	36	10.16	0.59	9.66	10.63	70.74	14.74	58.01	85.68	94.90	24.90	73.38	122.20
60 - 70	13	22	11.07	0.62	10.63	11.49	46.70	11.81	37.21	58.01	55.04	17.65	40.96	73.38
70 - 80	7	13	11.91	0.67	11.49	12.33	29.25	9.43	22.24	37.21	30.15	12.25	21.22	40.96
80 - 90	3	7	12.79	0.81	12.33	13.37	16.29	7.29	11.00	22.24	14.58	8.02	9.34	21.22
90 - 100	1	2	14.09	1.01	13.37	15.06	5.65	3.76	-0.44	11.00	4.16	3.38	-2.19	9.34

- E_T ($|\eta| < 0.5$) effective multiplicity

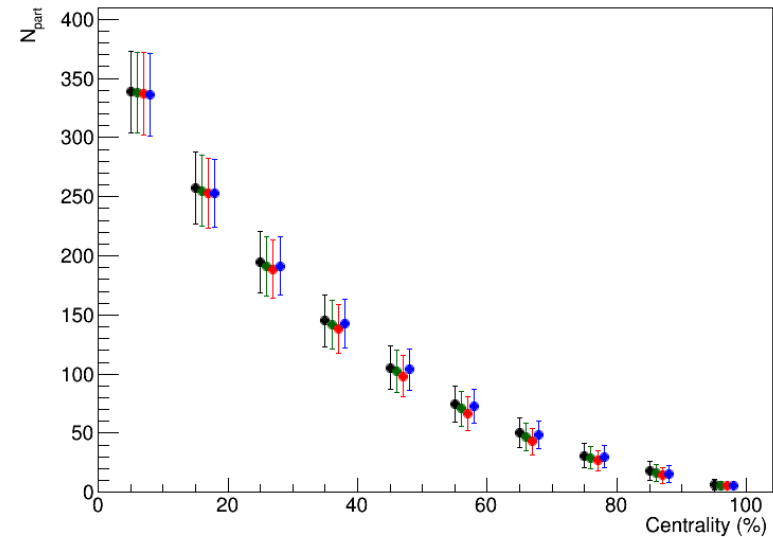
Cent, %	Mult_min	Mult_max	$\langle b \rangle$, fm	RMS	bmin, fm	bmax, fm	$\langle N_{part} \rangle$	RMS	Npart_min	Npart_max	$\langle N_{coll} \rangle$	RMS	Ncoll_min	Ncoll_max
0 - 10	161	275	2.98	1.12	1.39	4.25	336.98	34.74	292.17	388.06	722.67	95.93	602.80	859.96
10 - 20	115	161	5.29	0.73	4.25	6.13	252.73	29.77	218.88	292.17	499.38	72.81	415.83	602.80
20 - 30	81	115	6.86	0.63	6.13	7.54	188.74	24.74	161.81	218.88	343.13	56.44	280.49	415.83
30 - 40	55	81	8.15	0.59	7.54	8.72	138.16	20.72	116.83	161.81	228.60	43.75	183.20	280.49
40 - 50	36	55	9.28	0.58	8.72	9.80	98.16	17.29	81.44	116.83	146.11	33.16	114.37	183.20
50 - 60	22	36	10.30	0.59	9.80	10.77	66.67	14.19	54.20	81.44	87.86	24.38	67.22	114.37
60 - 70	13	22	11.22	0.62	10.77	11.65	43.21	11.23	34.10	54.20	49.87	16.89	36.74	67.22
70 - 80	7	13	12.06	0.68	11.65	12.49	26.58	8.84	19.94	34.10	26.77	11.44	18.61	36.74
80 - 90	3	7	12.95	0.82	12.49	13.49	14.44	6.67	9.76	19.94	12.64	7.26	8.07	18.61
90 - 100	1	2	14.17	1.00	13.49	15.07	5.20	3.35	0.24	9.76	3.77	2.98	-1.16	8.07

Glauber parameters - II

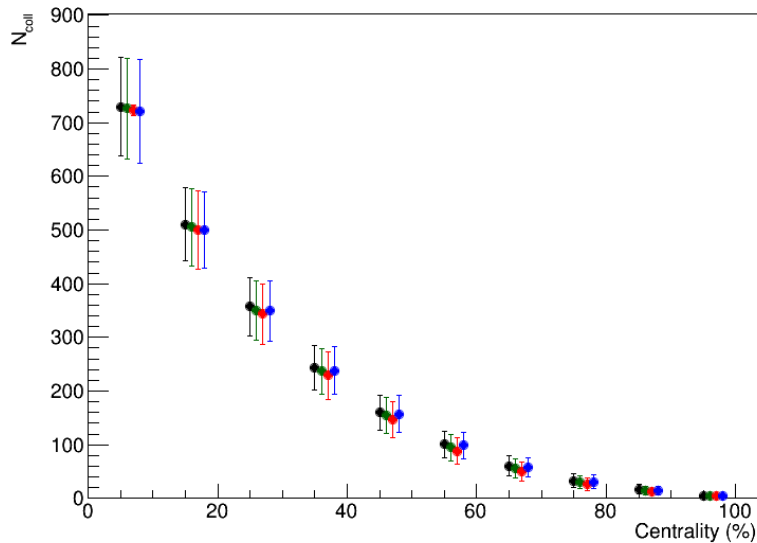
Impact parameter



N_{part}



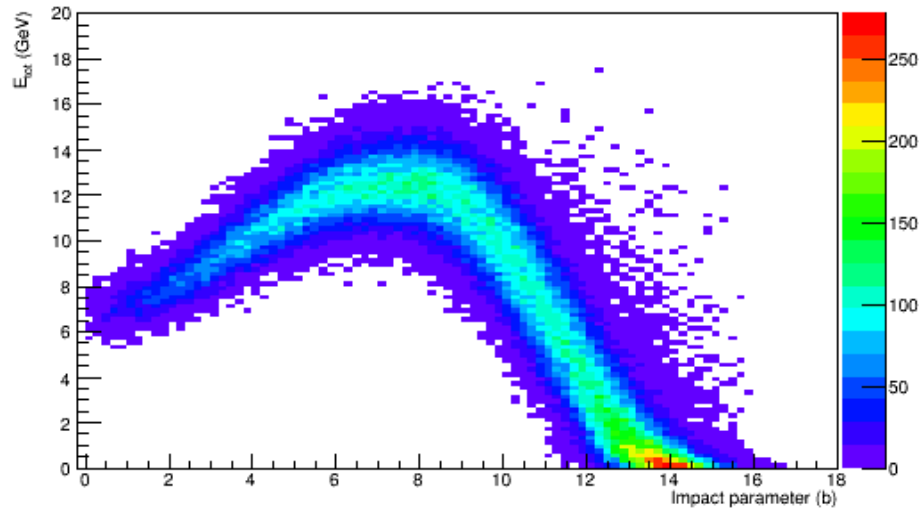
N_{coll}



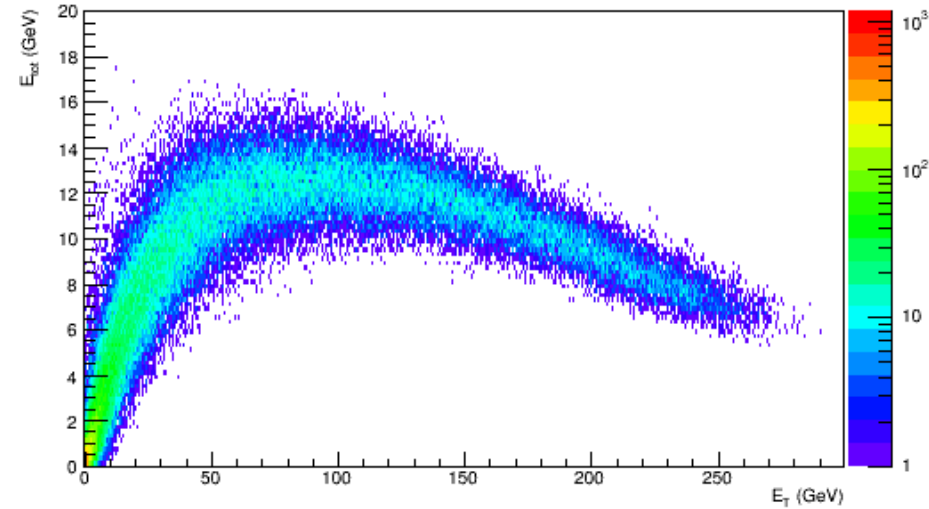
- Glauber parameters are identical
- Selected events are quite different (slide 7)
- Simple fluctuations?

FHCAL

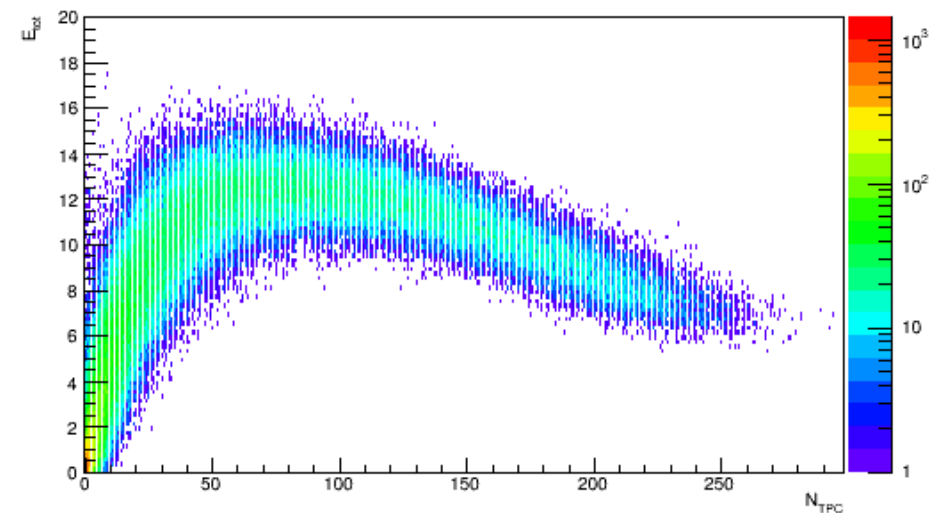
E_{TOT} vs. impact parameter



E_{TOT} vs. E_T



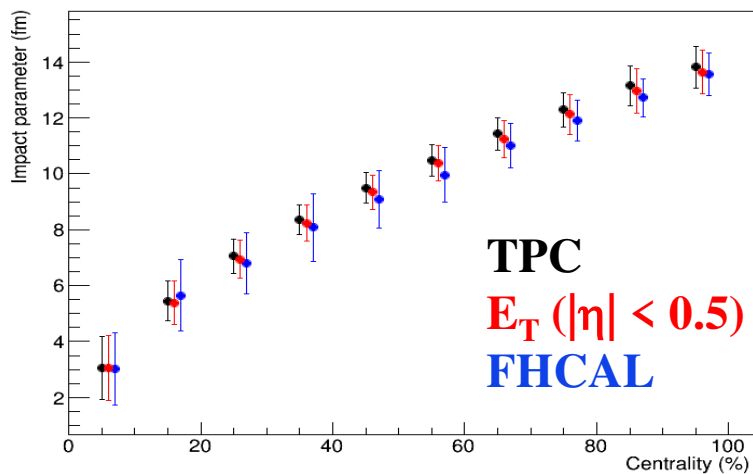
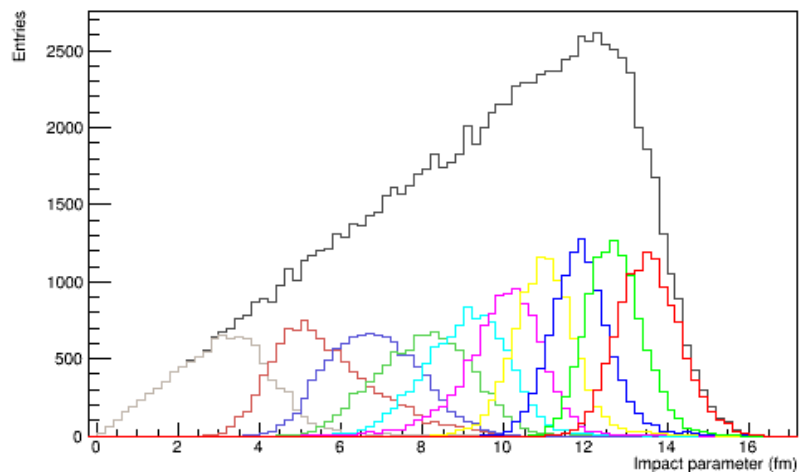
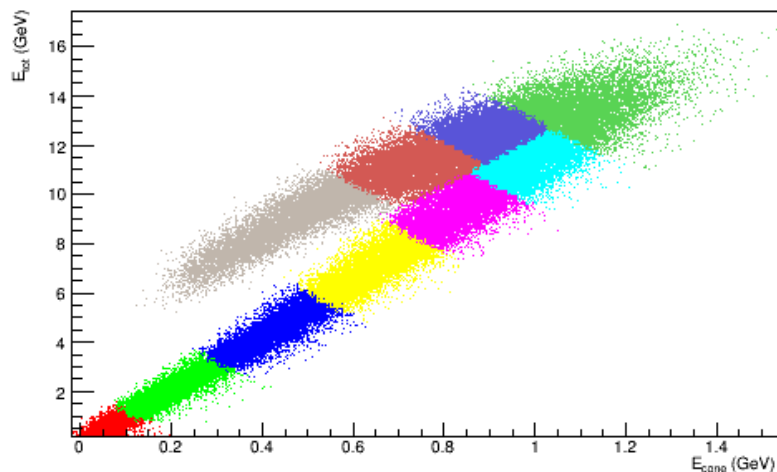
E_{TOT} vs. N_{TPC}



- Ambiguity between E_{TOT} and impact parameter
- Ambiguity between E_{TOT} and E_T and N_{TPC}

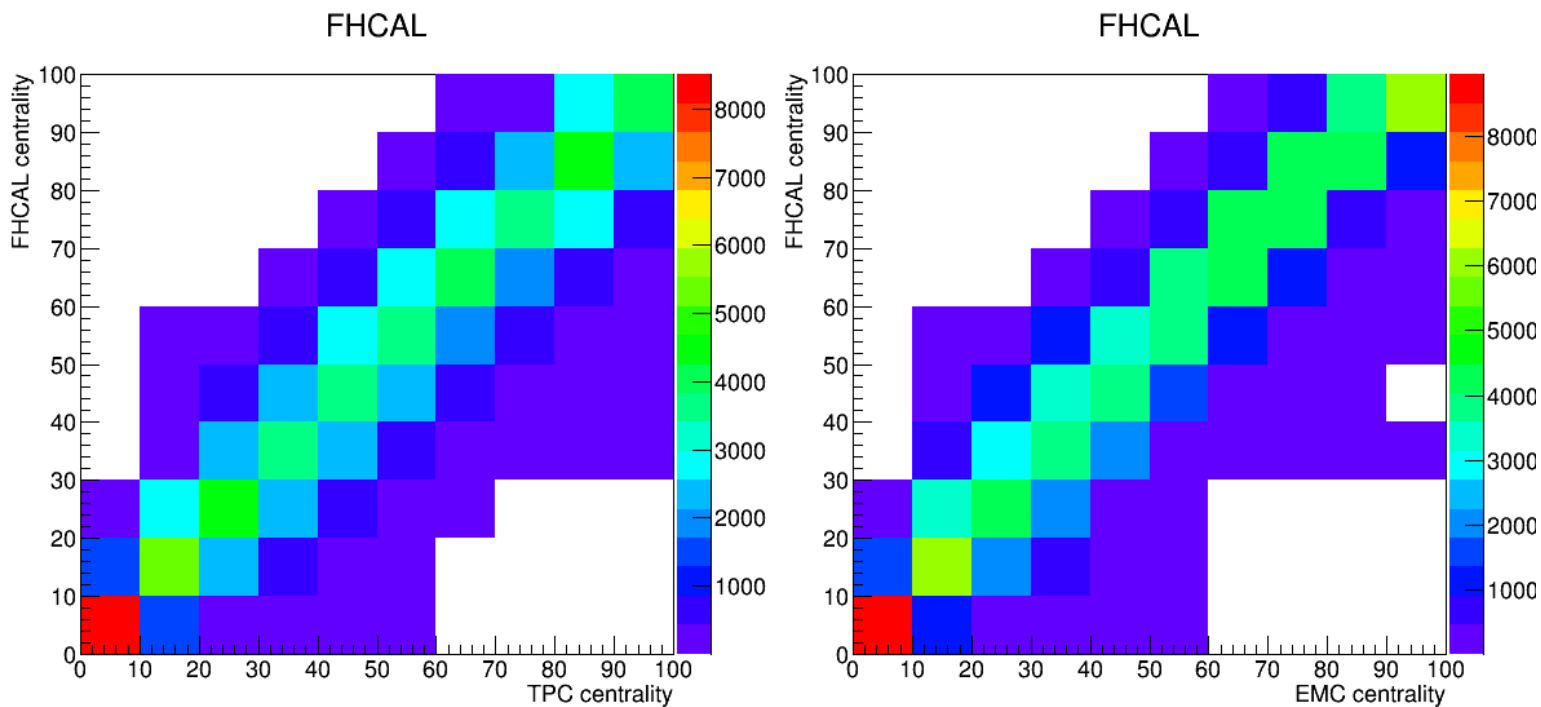
Centrality with FHCAL

E_{TOT} vs. E_{cone}



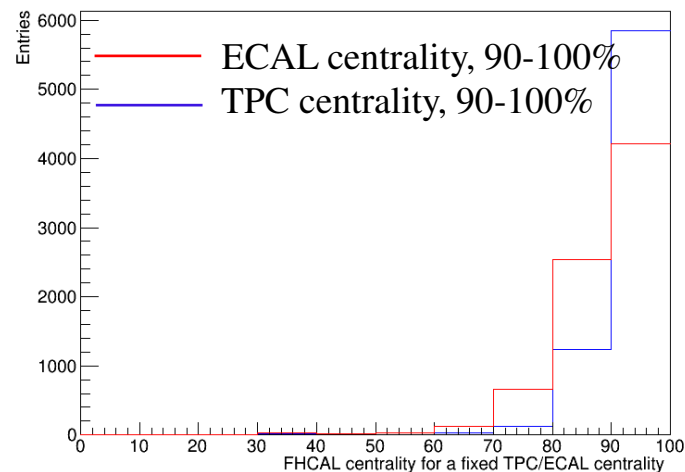
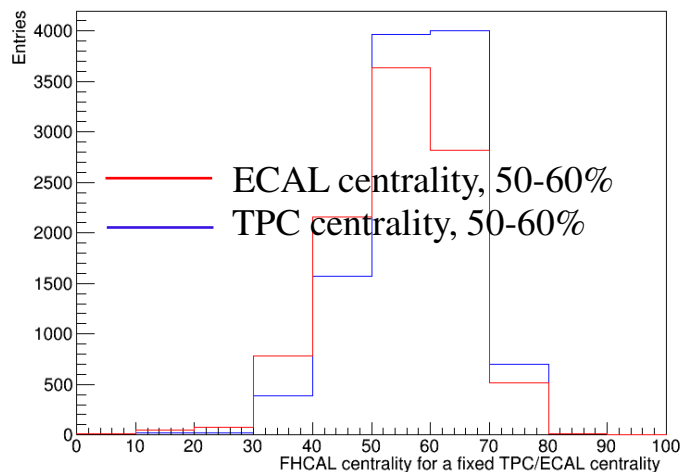
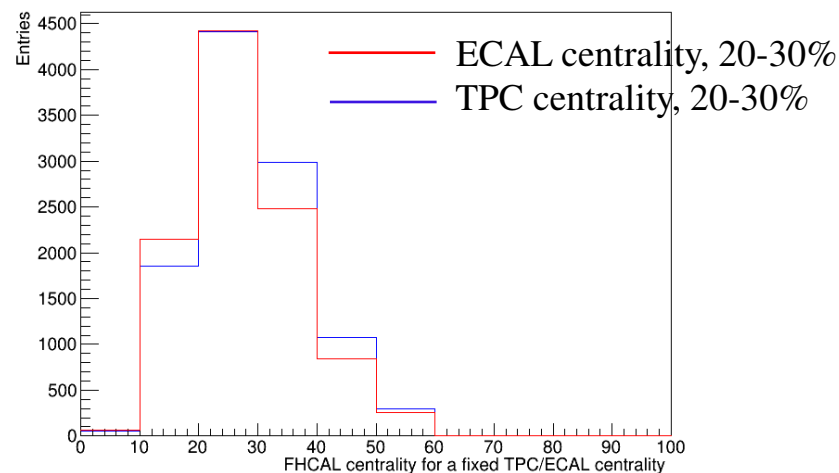
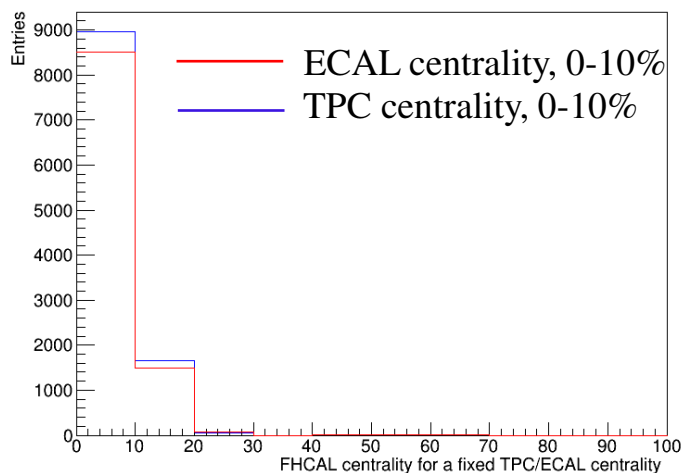
- TPC and ECAL are consistent
- FHCAL returns similar mean impact parameter values with wider spread (RMS) except for peripheral collisions

Centrality by FHCAL vs. centrality by TPC/ECAL



- Very wide correlations between FHCAL centrality and TPC/ECAL centralities

Centrality by FHCAL vs. centrality by TPC/ECAL



- Very wide distributions (much wider compared with ECAL-TPC centralities)
- FHCAL-TPC correlation is slightly narrower

Conclusions

- TPC and E_T can be used for centrality measurements, produce similar results
- FHCAL centrality has a very wide correlation with the TPC/ E_T centrality; resolution by impact parameter is worse