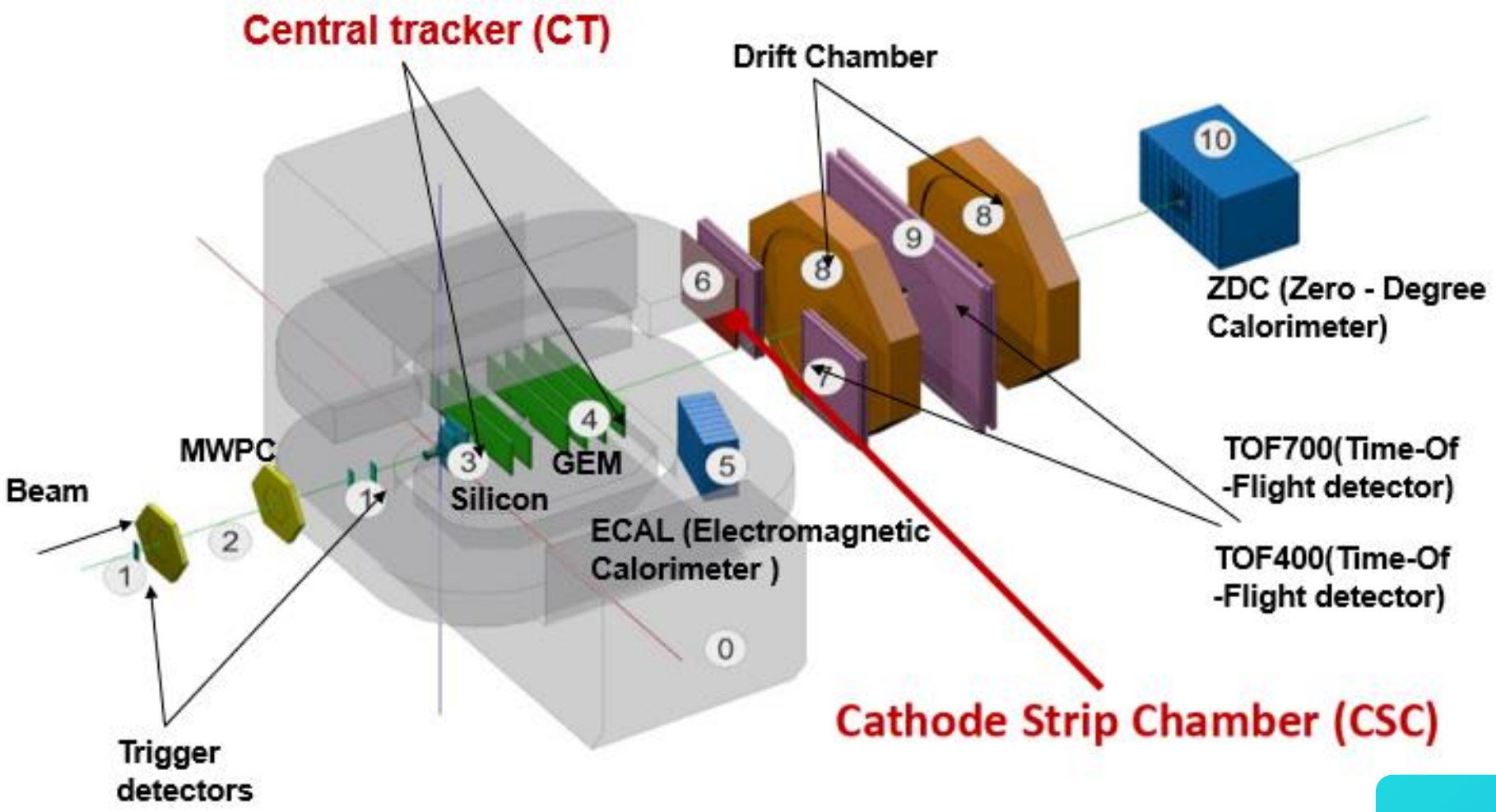
«On TOF-400 fragment analysis in Ar run»

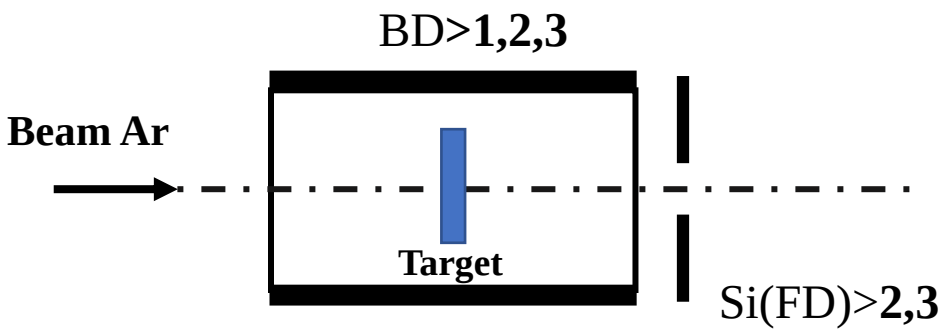


Setup of BM@N for RUN-7 in spring 2018

K. Alishina

JINR, VB LHEP

Trigger efficiency



Procedure estimate trigger efficiency:

1. **Filter by Ar data : select those files that do not contain the trigger condition being investigated.**
2. **Set the criteria by $(m/q)^2$ and p/q for fragments.**
3. **Set a condition on the number of tracks at the vertex (2…20).**
4. **Using formula** $\varepsilon Trig_n = \frac{N(m/q^2)(BD>n;FD>m)}{N(m/q^2)(FD>n)}$, **n=1,2,3;** m=2,3;

Selection criteria for the square of the mass:

p: $0.3 < m^2 < 1.4$,$(GeV)^2$
d: $2.6 < m^2 < 5.5$
He^3: $1.4 < m^2 < 2.6$
t: $5.5 < m^2 < 9.5$

Selection criteria p/q:

p: p/q < 2, GeV/c
He^3: p/q < 3
d: p/q < 4
t: p/q < 5

Primary Vertex Criteria :

-5< Zv < 5 cm,
-2.0 < Xv < 2.6 cm,
0.135 < Yv < 4.88 cm

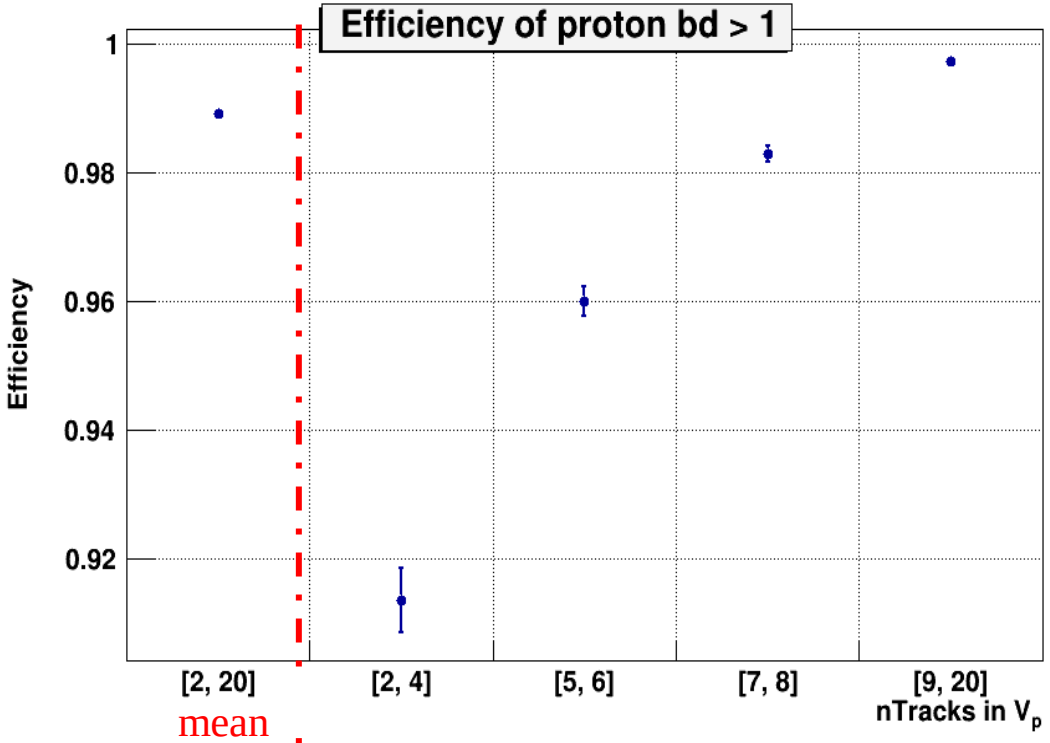
Number of hits per track > 5

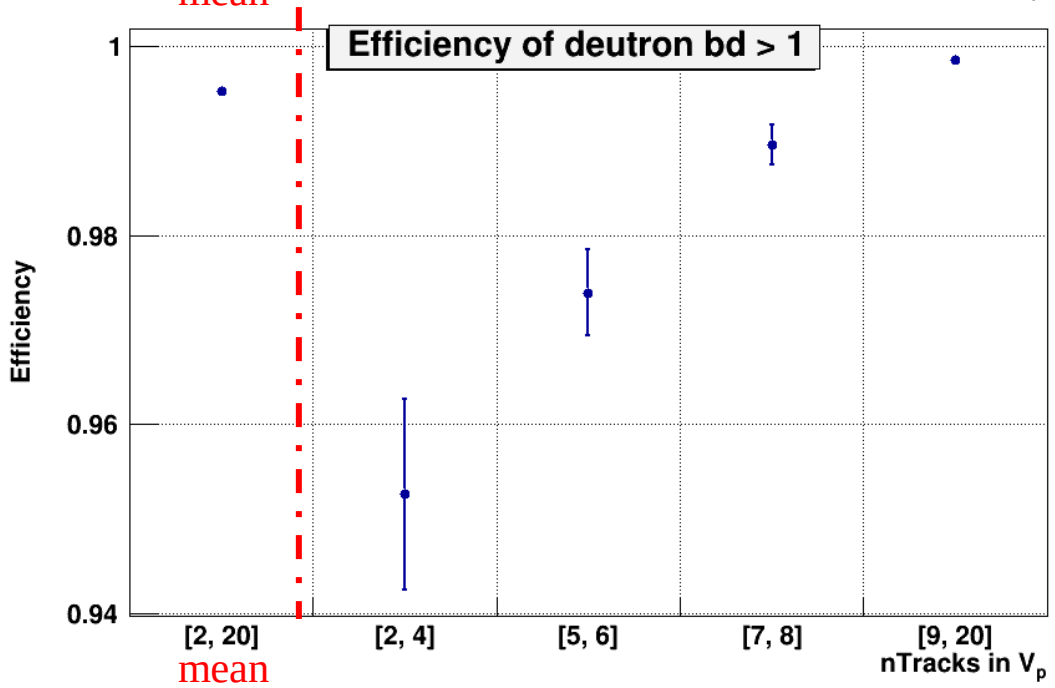
Trigger condition BD>1

$$\varepsilon BD_1 = \frac{N(m/q^2)(BD>1,2,3;FD>2,3)}{N(m/q^2)(FD>1)}$$

	Ntrack in Vp	Num/ Denom	Efficiency	Error
p	(2 ,4)	2893/3167	0.913483	0.0049955
	(5, 6)	6837/7122	0.959983	0.0023225
	(7,8)	10496/10678	0.982956	0.0012527
	(9, 20)	109782/110061	0.997465	0.0001516
	(2, 20)	155625/157322	0.989213	0.0002604
d	(2 ,4)	422/443	0.952596	0.0100963
	(5, 6)	1195/1227	0.97392	0.0045498
	(7, 8)	2190/2213	0.989607	0.0021568
	(9, 20)	25719/25754	0.989607	0.0002296
	(2, 20)	34498/34662	0.995269	0.0003687

***nTracks in Vp - Number Tracks in primary vertex**



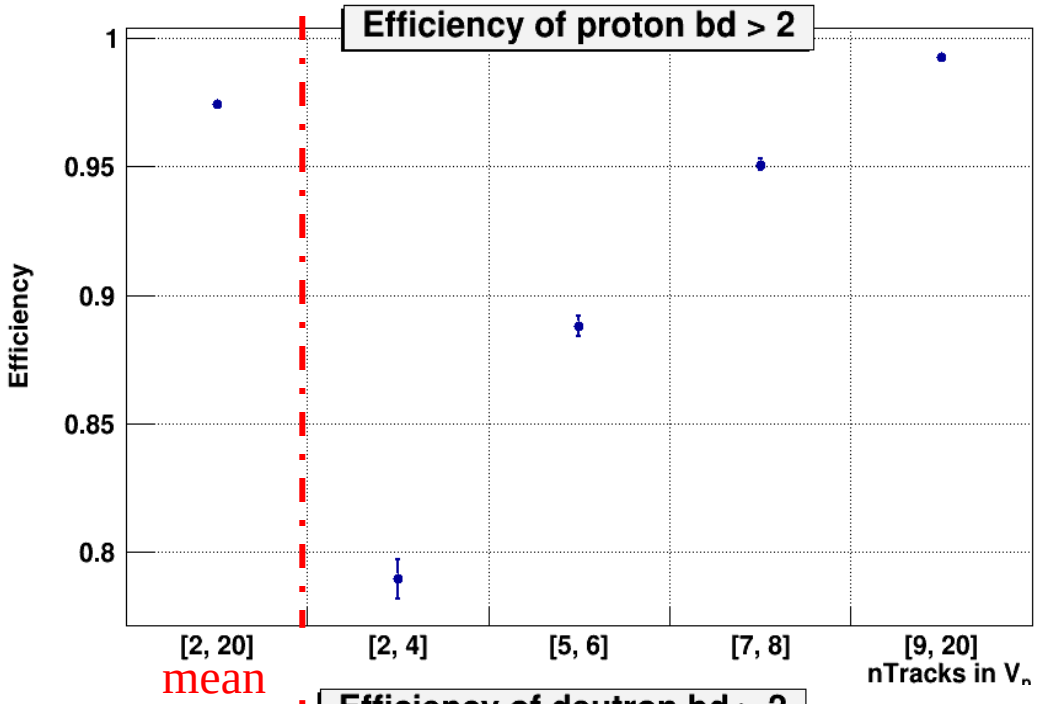


Trigger condition BD>2

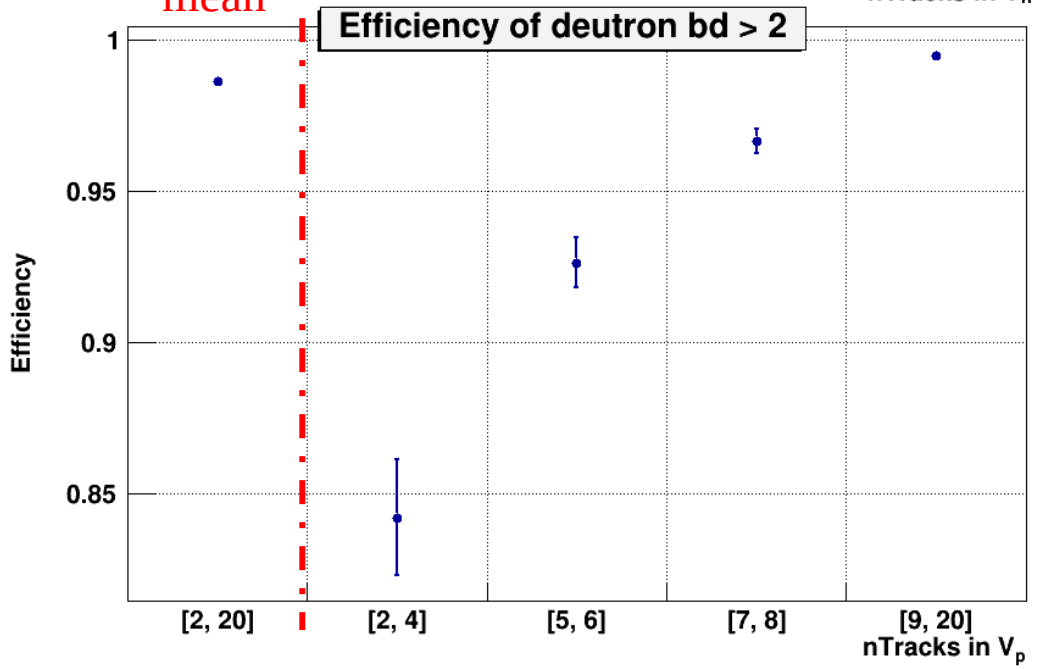
$$\varepsilon BD_2 = \frac{N(m^2)(BD>2,3;FD>2,3)}{N(m^2)(FD>1)}$$

	Ntrack in Vp	Num/ Denom	Efficiency	Error
p	(2 ,4)	2255/2856	0.789566	0.0076273
	(5, 6)	5552/6253	0.887894	0.003989
	(7,8)	9453/9943	0.950719	0.0021170
	(9, 20)	131343/132348	0.992406	0.0021707
	(2, 20)	171701/176205	0.974438	0.000376
d	(2 ,4)	309/367	0.841962	0.0190412
	(5, 6)	916/989	0.926188	0.0083141
	(7, 8)	1964/2032	0.966535	0.00398969
	(9, 20)	30731/30893	0.994755	0.00041097
	(2, 20)	38317/38853	0.986202	0.0005918

***nTracks in Vp - Number Tracks in primary vertex**



mean



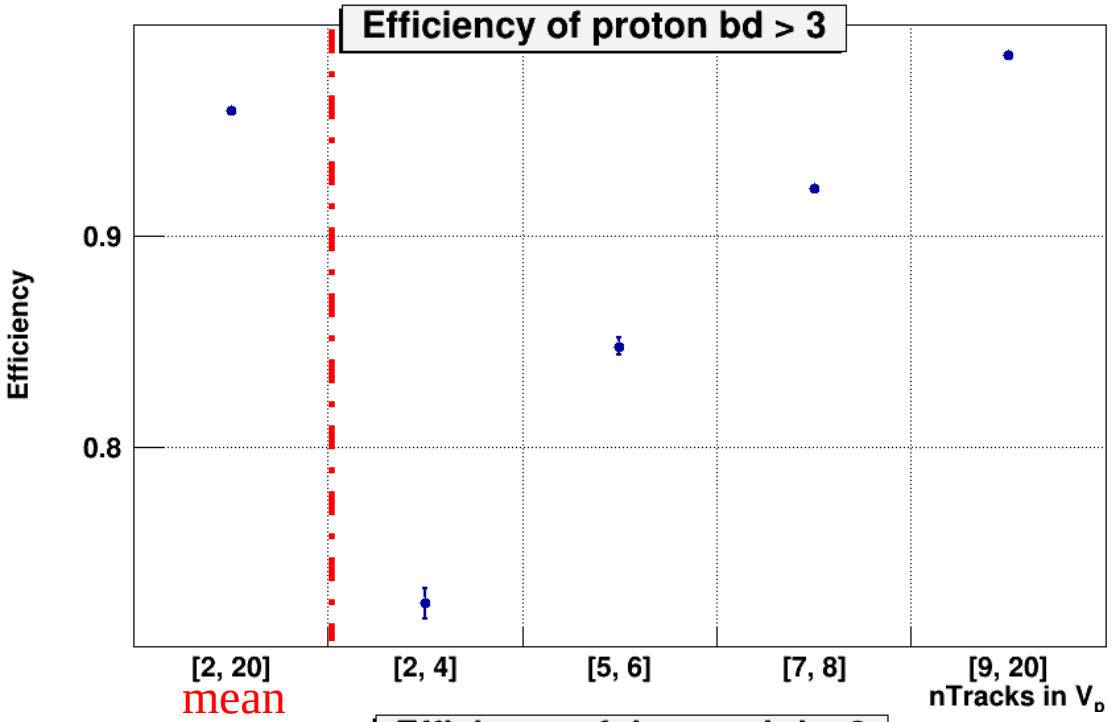
mean

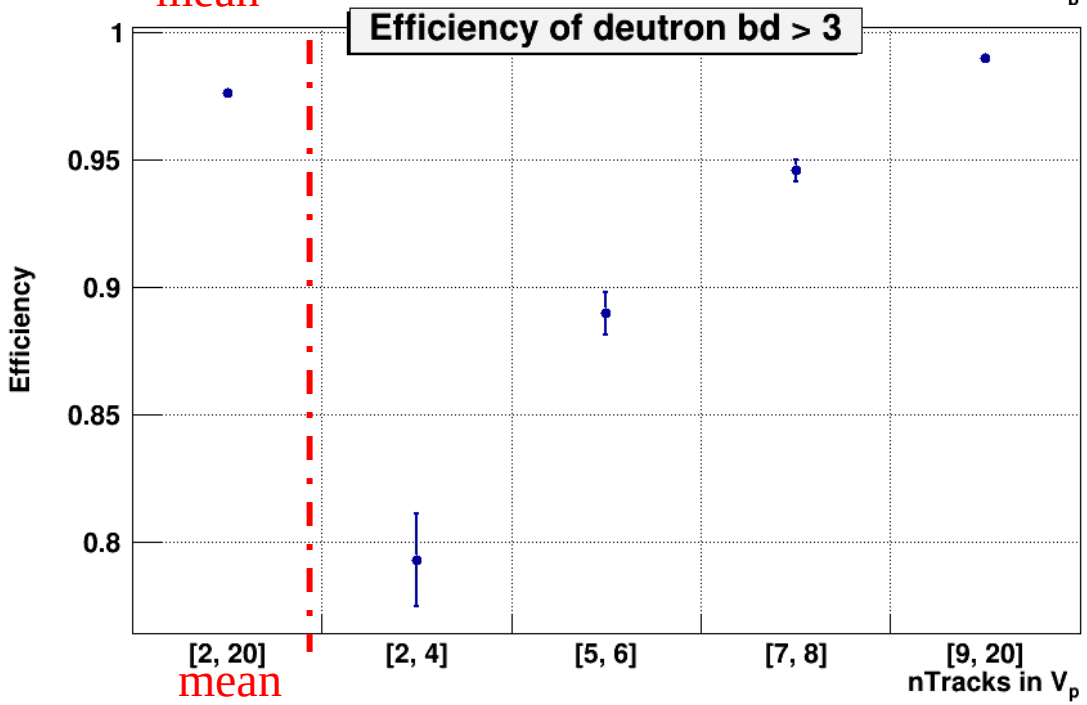
Trigger condition BD>3

$$\varepsilon BD_3 = \frac{N(m^2)(BD>3;FD>2,3)}{N(m^2)(FD>1)}$$

	Ntrack in Vp	Num/ Denom	Efficiency	Error
p	(2 ,4)	2765/3809	0.725912	0.007227
	(5, 6)	7256/8561	0.847565	0.003884
	(7,8)	12429/13473	0.922512	0.002303
	(9, 20)	167142/169648	0.985228	0.0002929
	(2, 20)	219593/229005	0.95589	0.0004148
d	(2 ,4)	402/507	0.792899	0.0072273
	(5, 6)	1243/1397	0.889606	0.0083904
	(7, 8)	2659/2812	0.945571	0.0042789
	(9, 20)	39191/39596	0.98977	0.0005057
	(2, 20)	49406/50625	0.975921	0.00068131

***nTracks in Vp - Number Tracks in primary vertex**



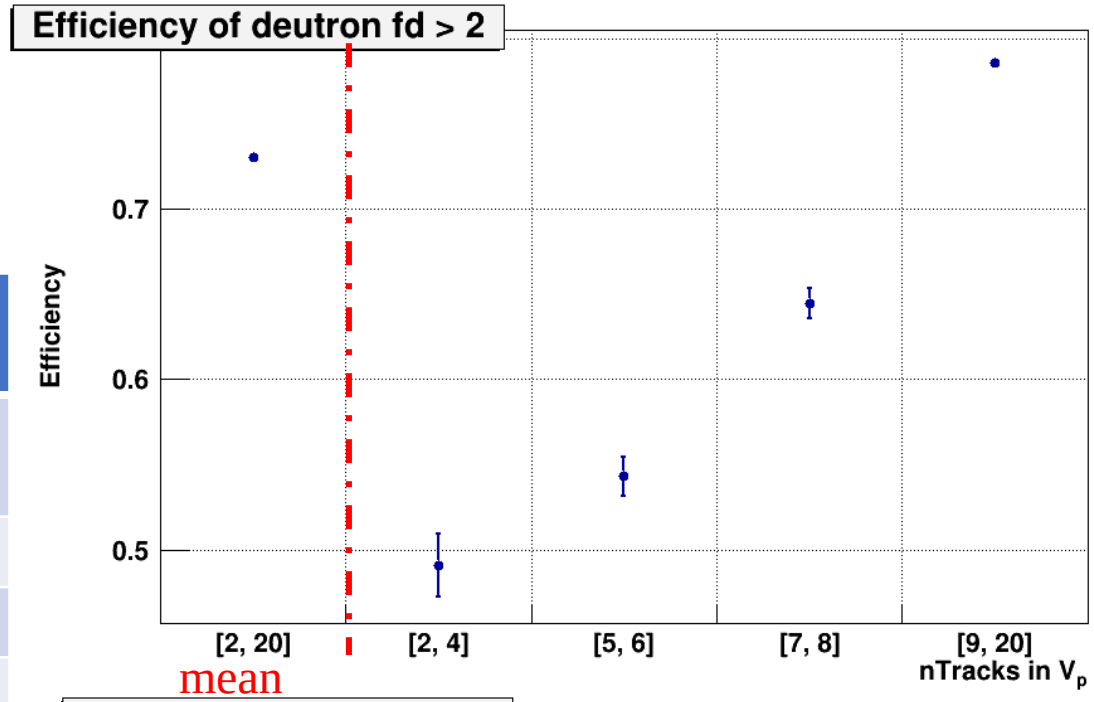


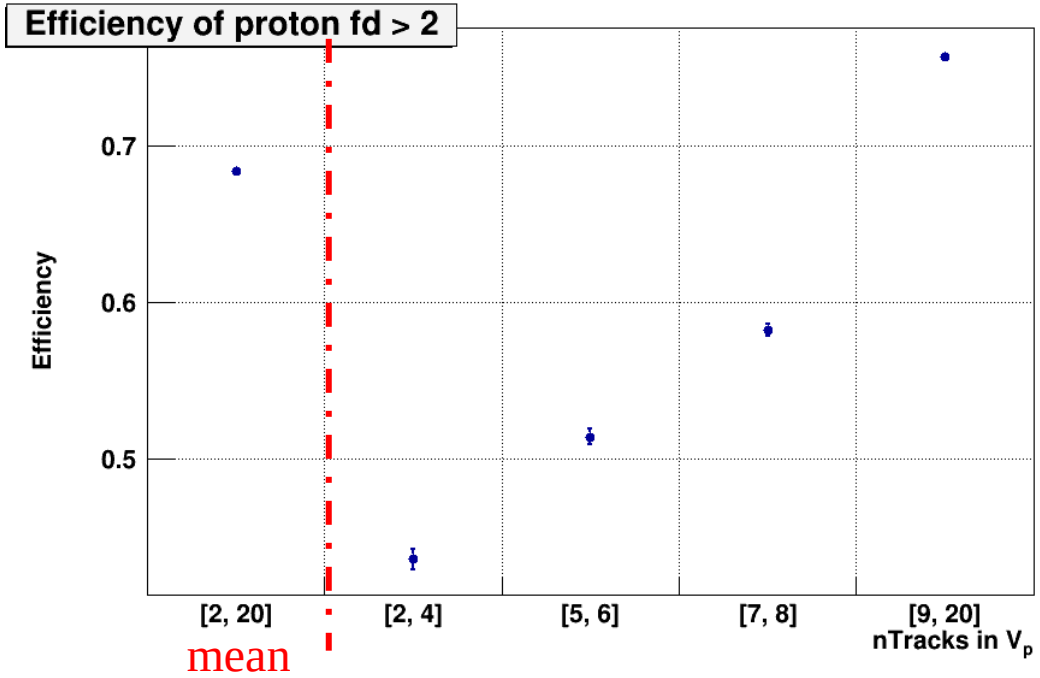
Trigger condition FD>2

$$\varepsilon FD_2 = \frac{N(m^2)(BD>123;FD>2,3)}{N(m^2)(BD>0)}$$

	Ntrack in Vp	Num/ Denom	Efficiency	Error
p	(2 ,4)	2455/5833	0.4358	0.0066
	(5, 6)	5752/11189	0.5140	0.0047
	(7,8)	8888/15263	0.5822	0.00399
	(9, 20)	98688/130400	0.7568	0.00118
	(2, 20)	137790/201450	0.6839	0.0010
d	(2 ,4)	361/735	0.4911	0.0184
	(5, 6)	1004/1848	0.5432	0.01158
	(7, 8)	1903/2954	0.6444	0.008808
	(9, 20)	23334/29703	0.7856	0.00238
	(2, 20)	30839/42241	0.73011	0.00216

***nTracks in Vp - Number Tracks in primary vertex**



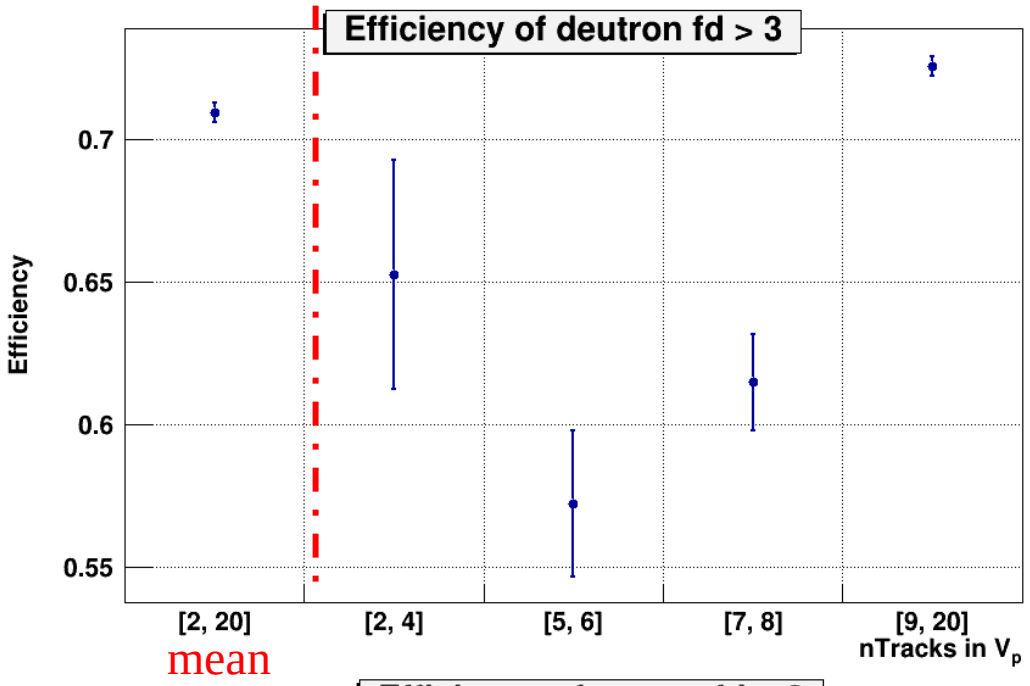


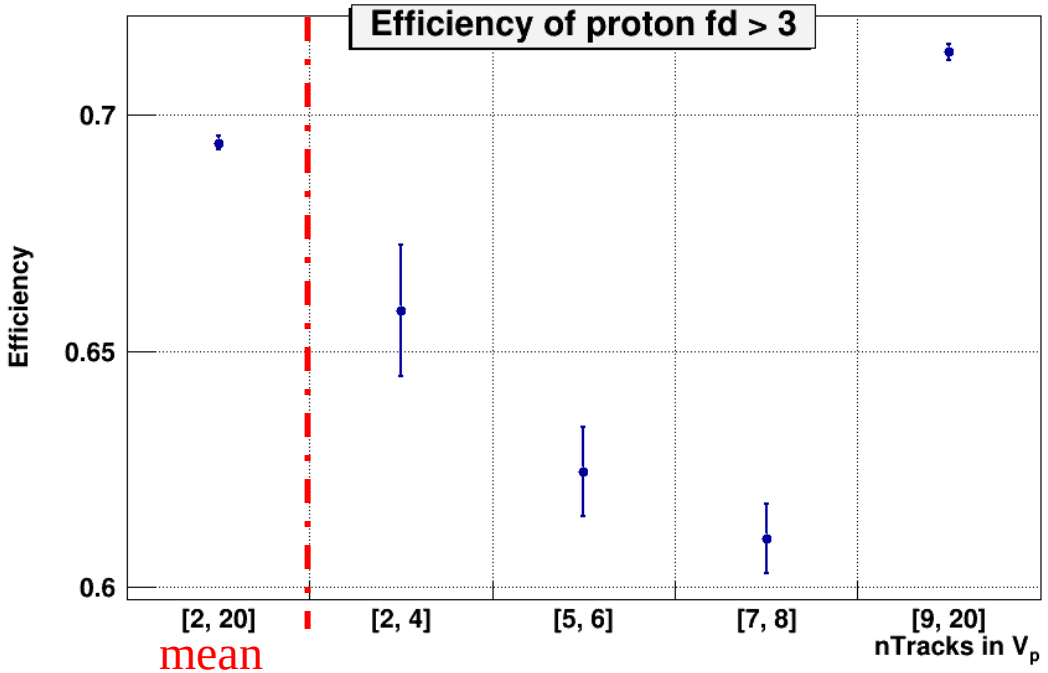
Trigger condition FD>3

$$\varepsilon FD_2 = \frac{N(m^2)(BD>123;FD>3)}{N(m^2)(BD>0)}$$

	Ntrack in Vp	Num/ Denom	Efficiency	Error
p	(2 ,4)	770/1169	0.6586	0.01386
	(5, 6)	1645/2634	0.6245	0.00943
	(7,8)	2710/4440	0.5103	0.007318
	(9, 20)	50063/70178	0.7133	0.00170
	(2, 20)	61960/89260	0.6941	0.001542
d	(2 ,4)	92/141	0.6525	0.04010
	(5, 6)	214/374	0.5721	0.02558
	(7, 8)	517/841	0.6147	0.01678
	(9, 20)	11638/16042	0.7255	0.003523
	(2, 20)	13703/16042	0.7093	0.003267

***nTracks in Vp - Number Tracks in primary vertex**

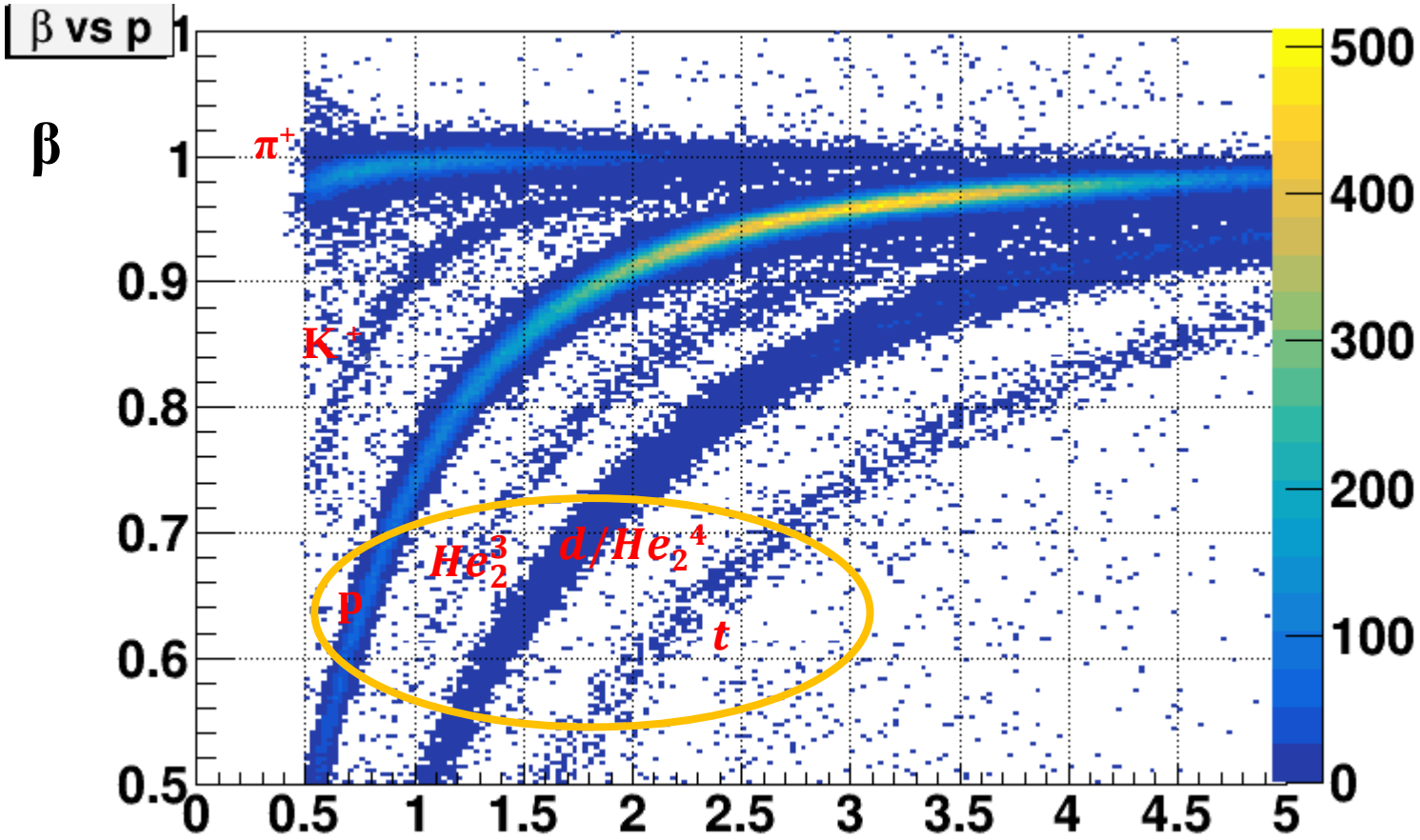




Identification of nuclear fragments with TOF 400. Start.

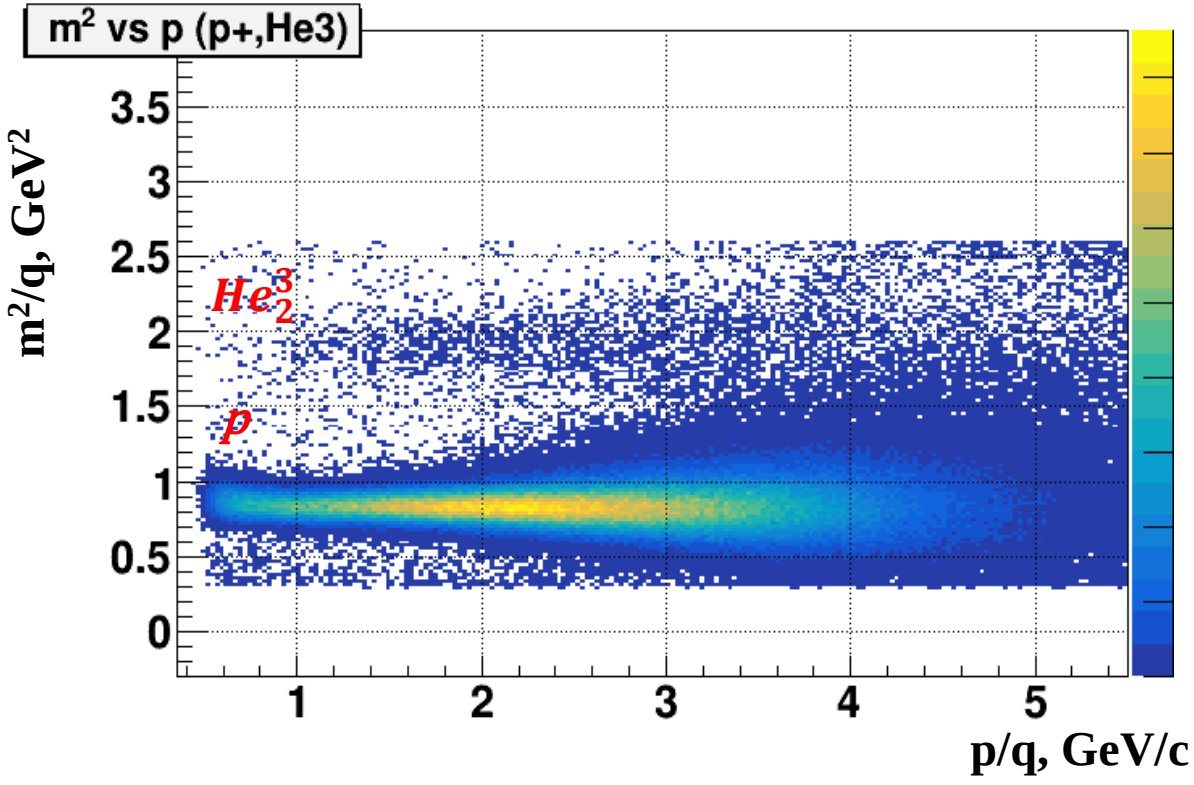
β vs p/q plot bands for π^+, K^+, p, He^3, d/He^4, t (TOF 400).

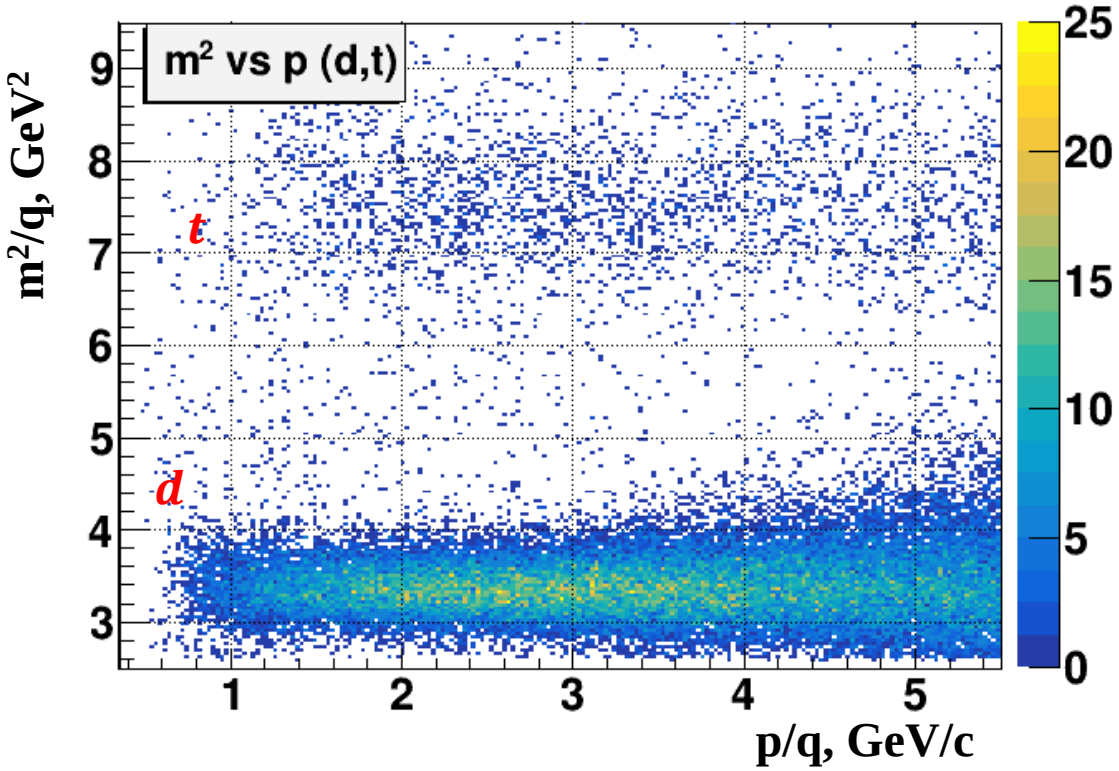
Ar + target→ X on targets C, Al, Cu, Sn, Pb



p/q, GeV/c

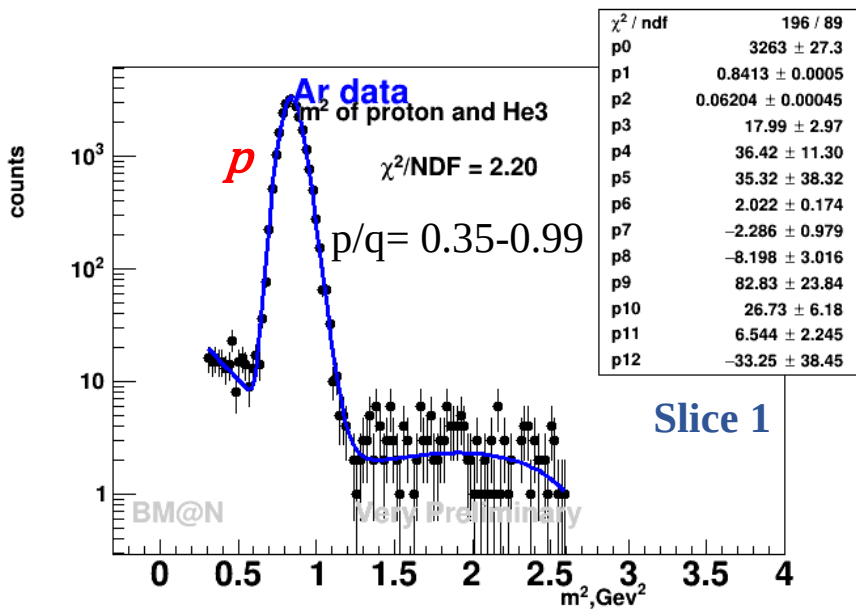
Distribution of the m^2 of the p/q for nuclear fragments

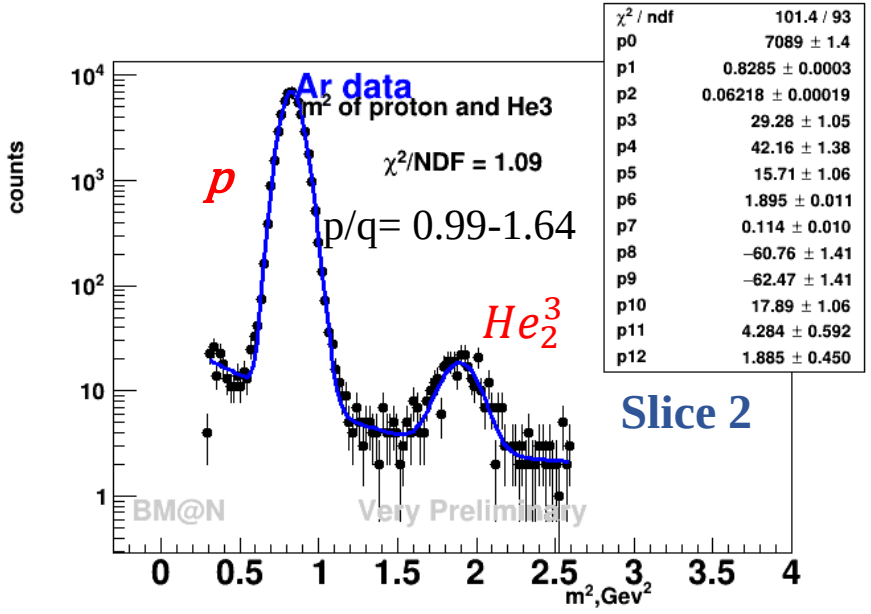


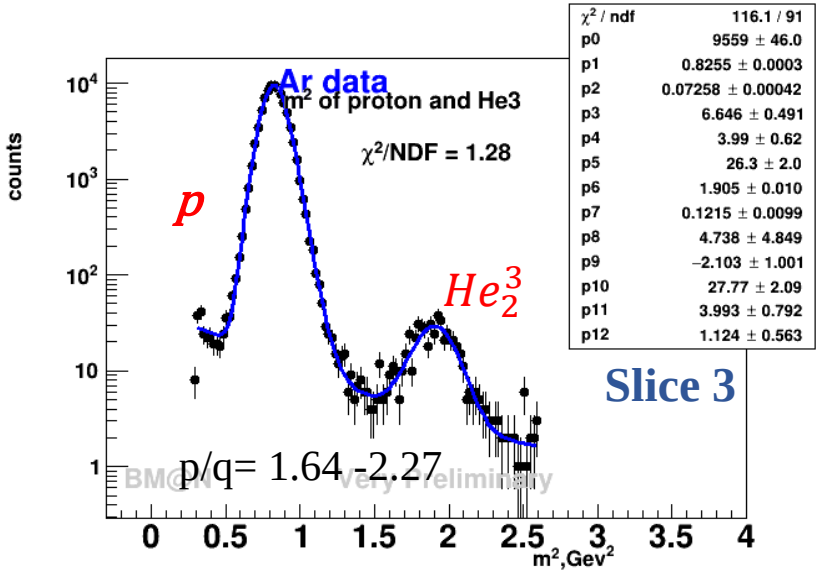


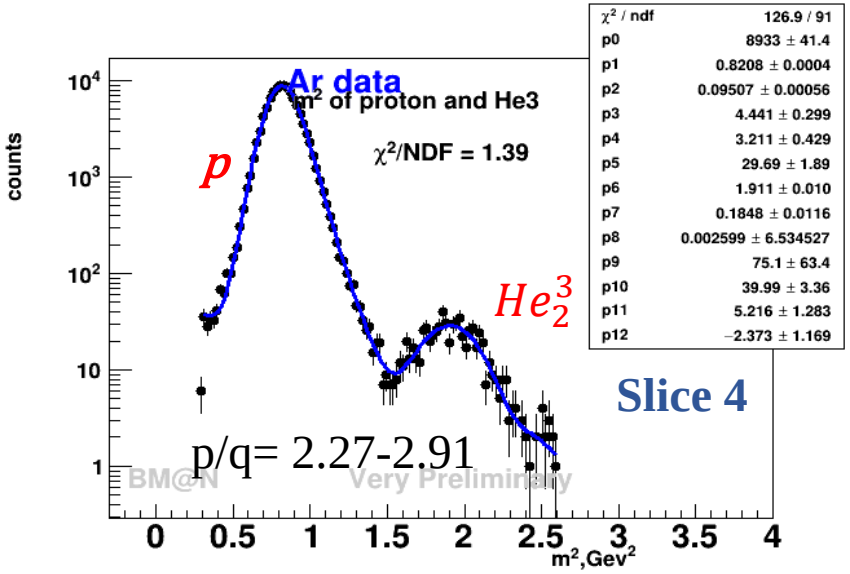
- Get slices along m^2 vs p/q for nuclear fragments
- Fit each slice using ModGauss(1st peak) + ModGauss(2nd peak)+ expo(background) function
- Get Mean & Sigma from the fit
- Make plots: dependencies Mean (m^2) vs p/q, $\sigma(m^2)$ vs p/q, Mean (m^2) $\pm 2\sigma(m^2)$
- Get information about identification fragments

Slice (m^2 vs p/q) fit ModGauss(**1st peak**) +ModGauss(**2nd peak**)+ expo(**background**)

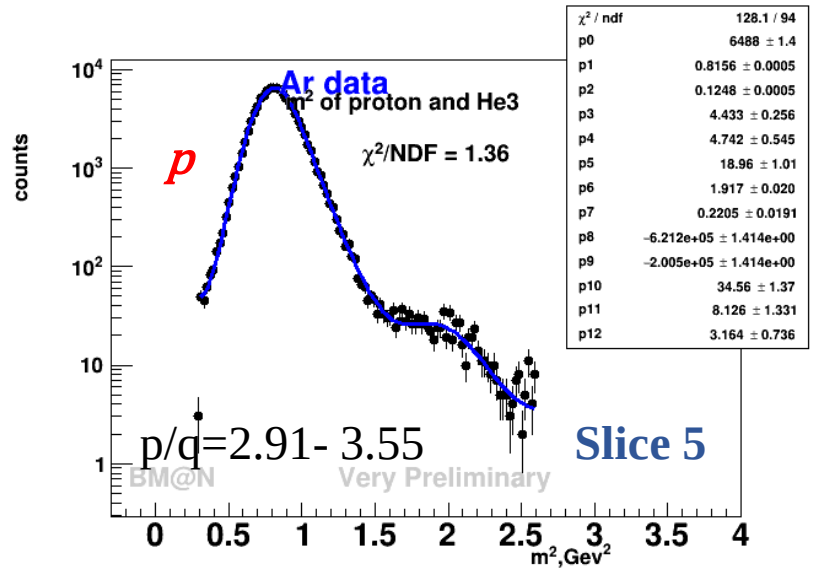


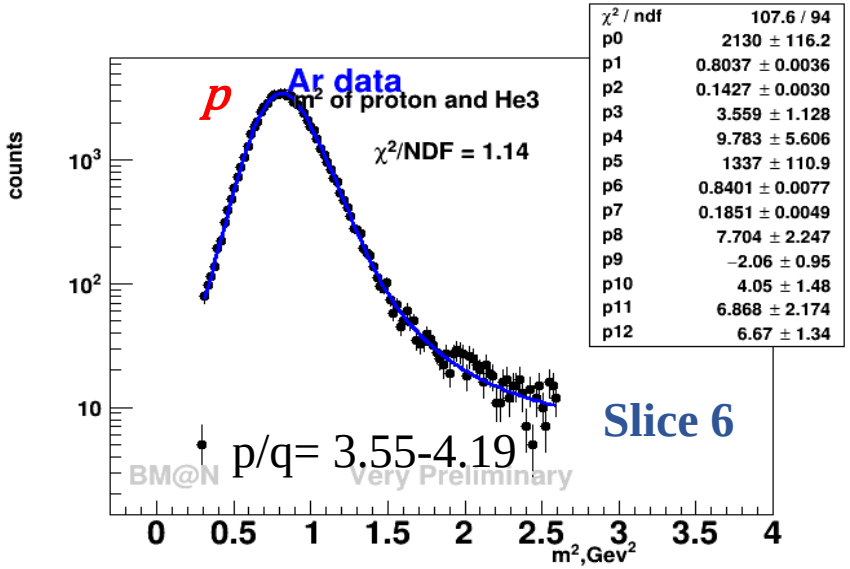


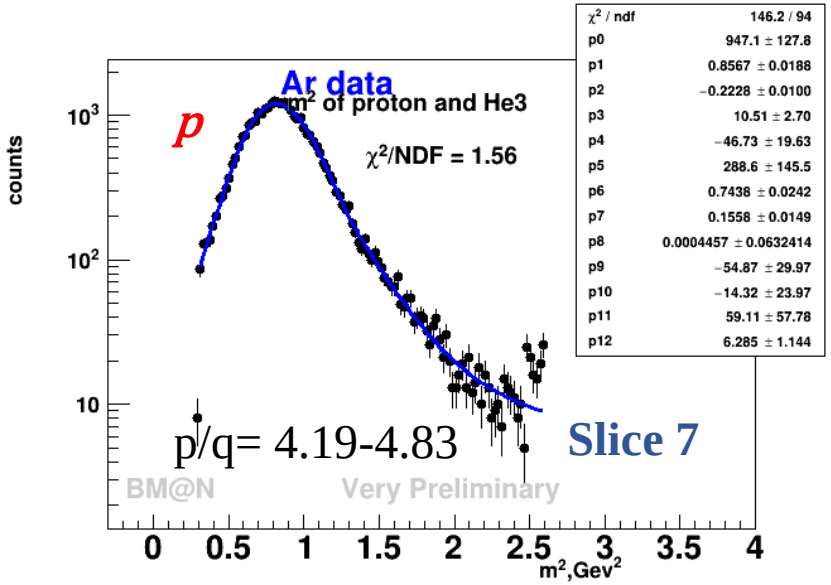


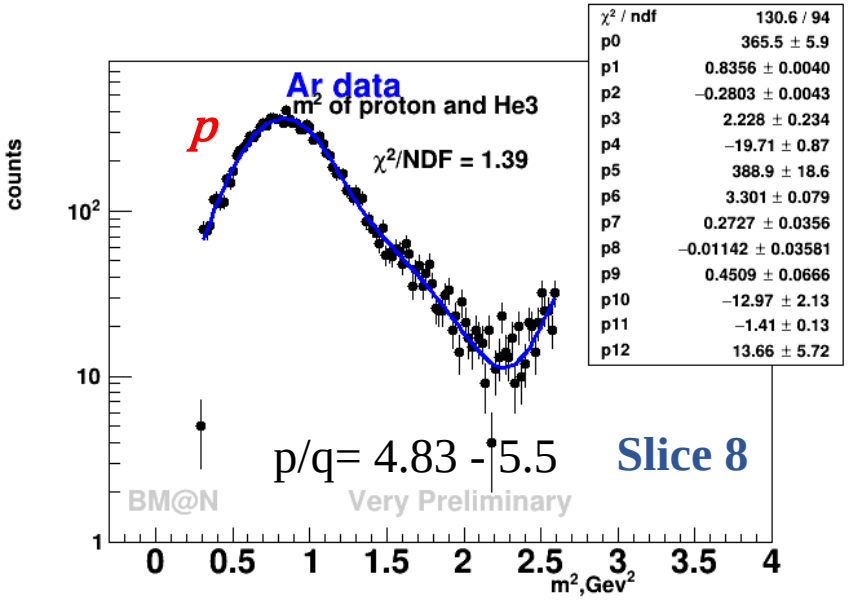


Slice (m^2 vs p/q) fit ModGauss(**1st peak**) +ModGauss(**2nd peak**)+ expo(**background**)





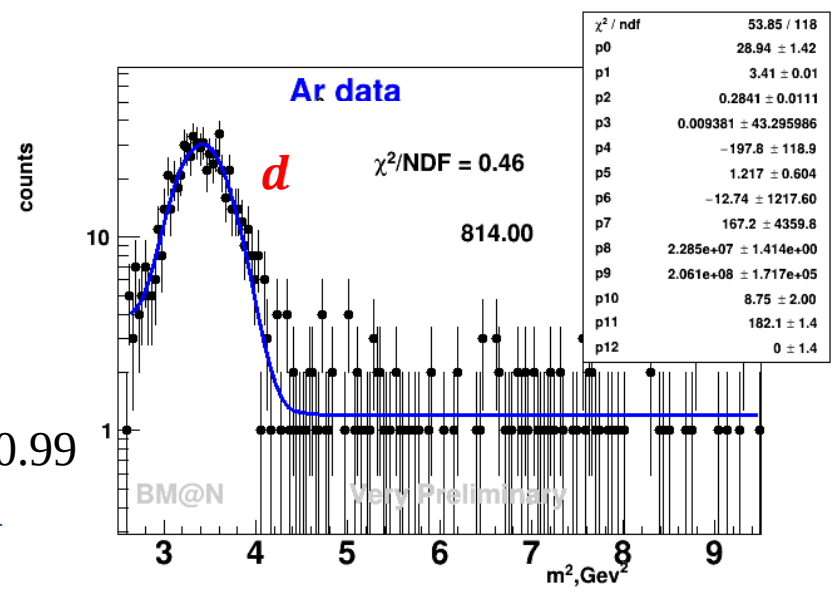


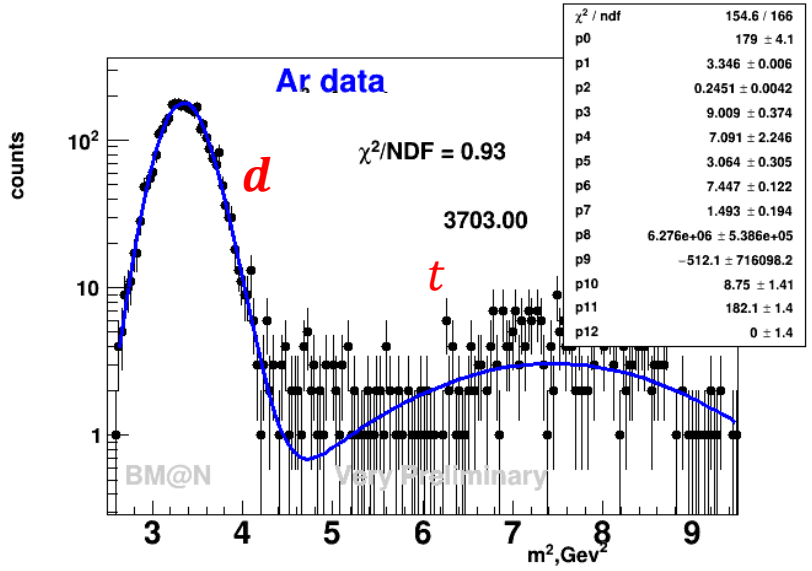


Slice (m^2 vs p/q) fit ModGauss(**1st peak**) +ModGauss(**2nd peak**)+ expo(**background**)

p/q= 0.35-0.99

Slice 1



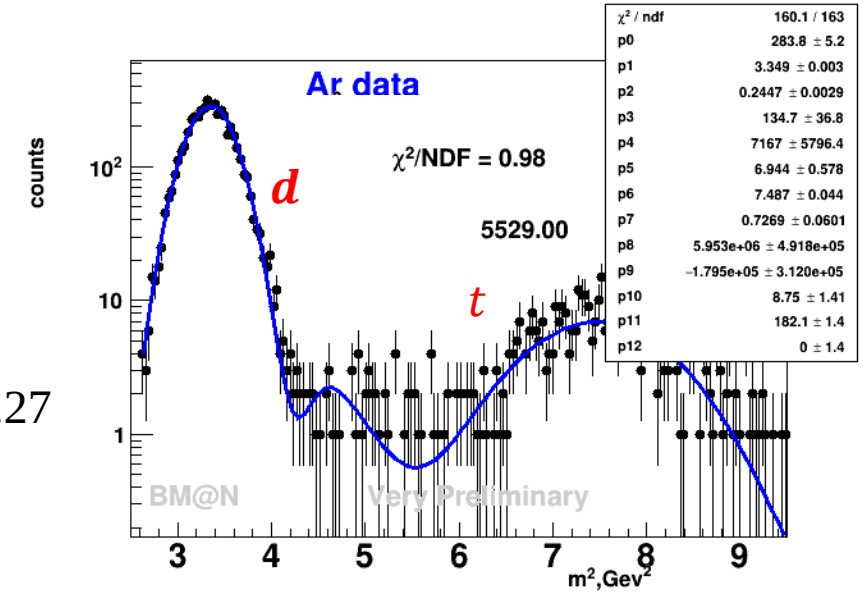


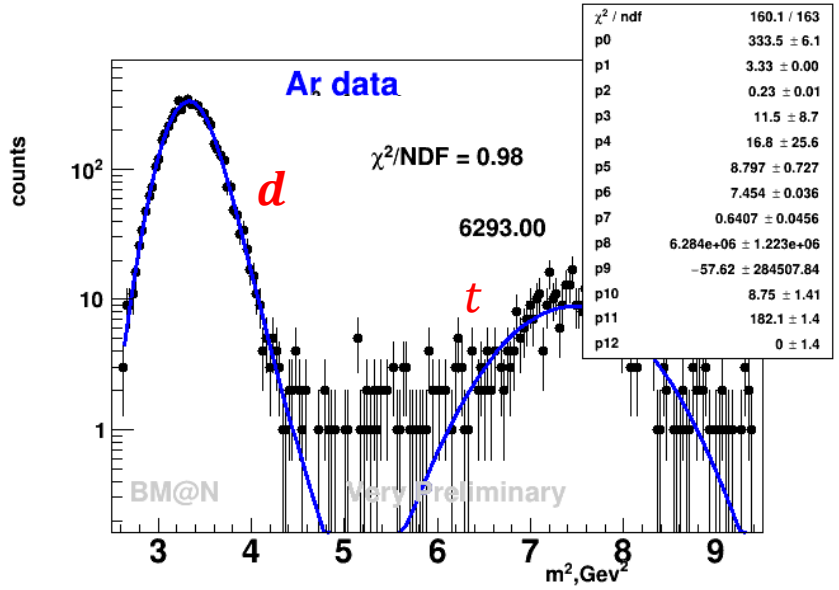
p/q= 0.99-1.64

Slice 2

p/q= 1.64 -2.27

Slice 3





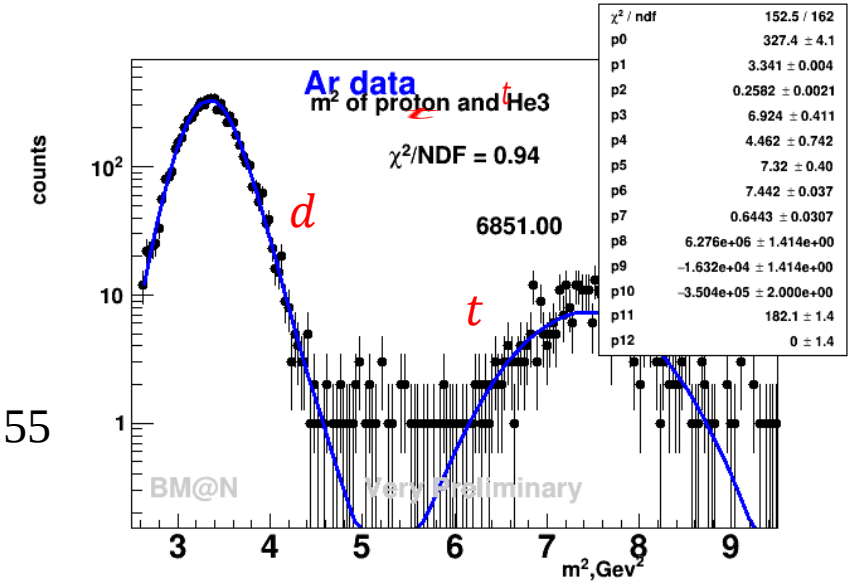
p/q= 2.27-2.91

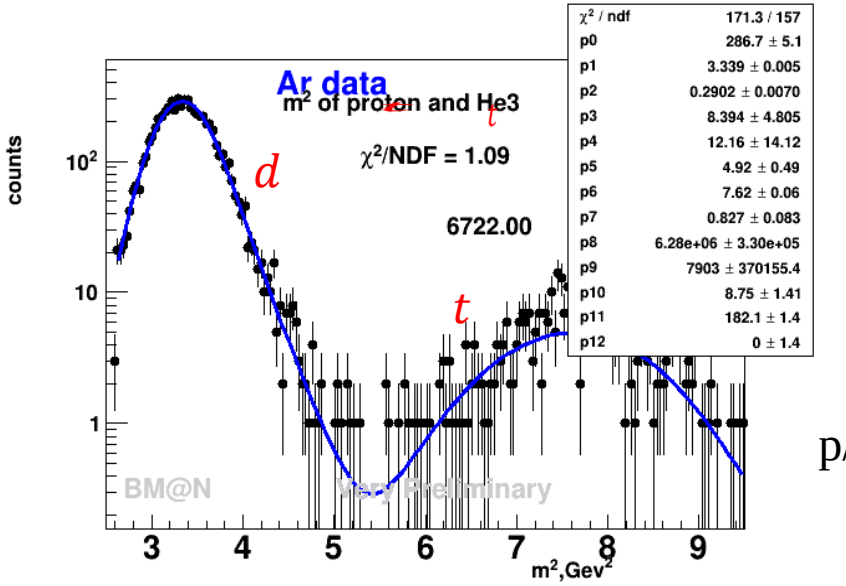
Slice 4

Slice (m^2 vs p/q) fit ModGauss(**1st peak**) +ModGauss(**2nd peak**)+ expo(**background**)

p/q=2.91- 3.55

Slice 5



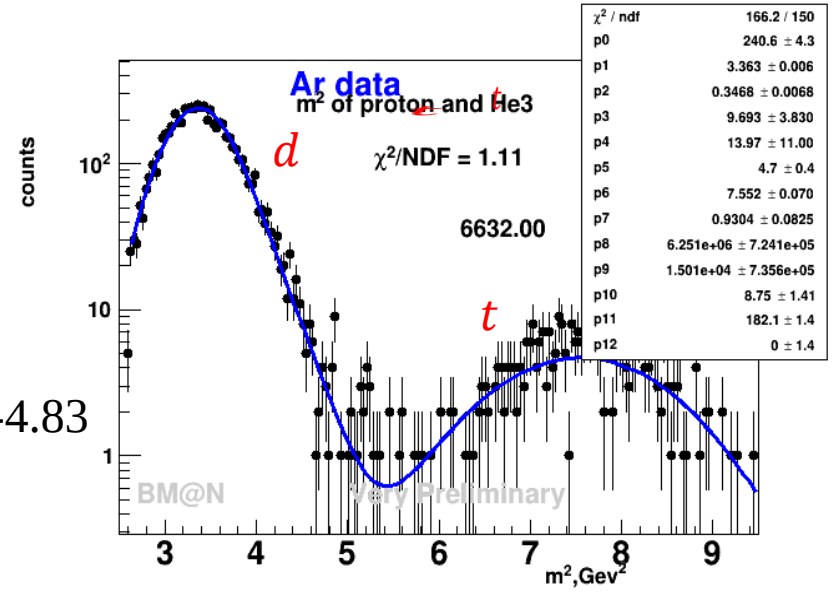


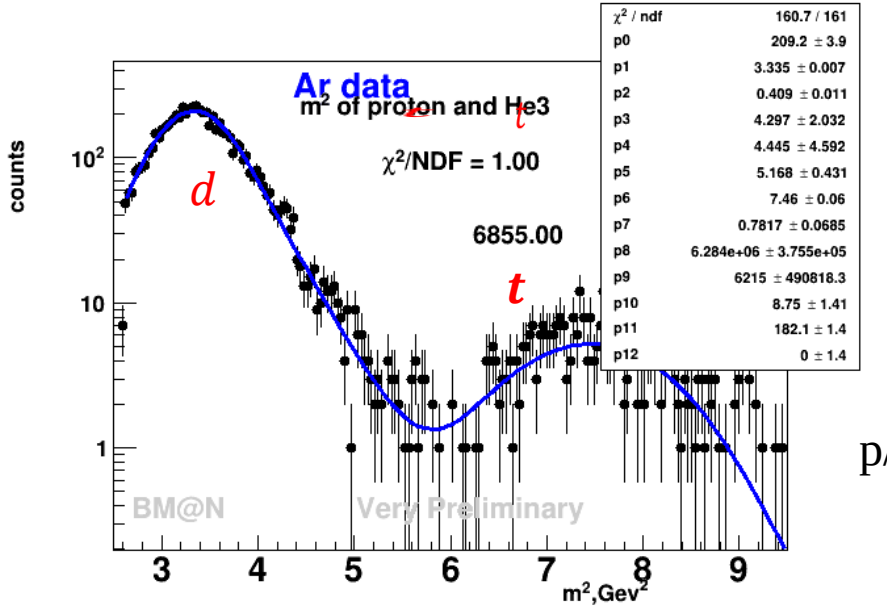
p/q= 3.55-4.19

Slice 6

p/q= 4.19-4.83

Slice 7

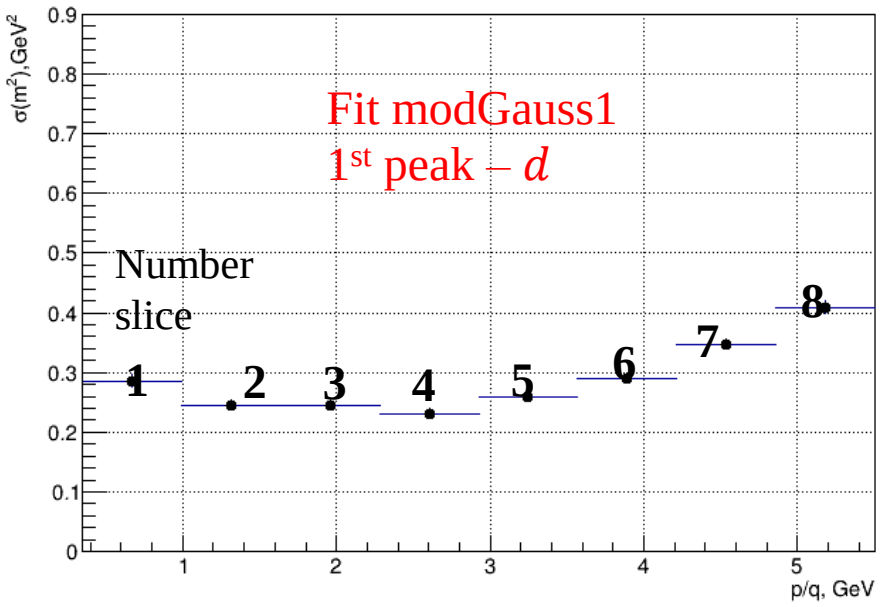




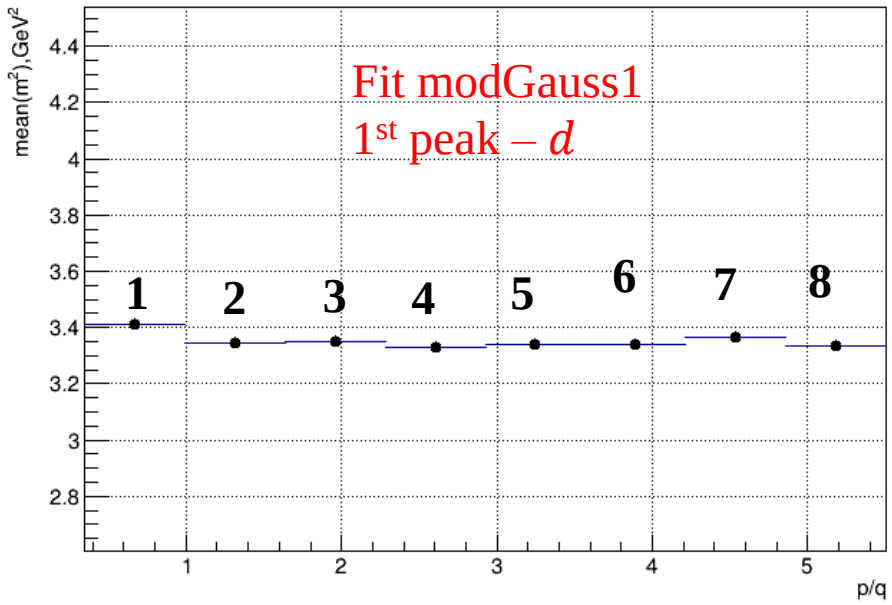
p/q= 4.83 - 5.5

Slice 8

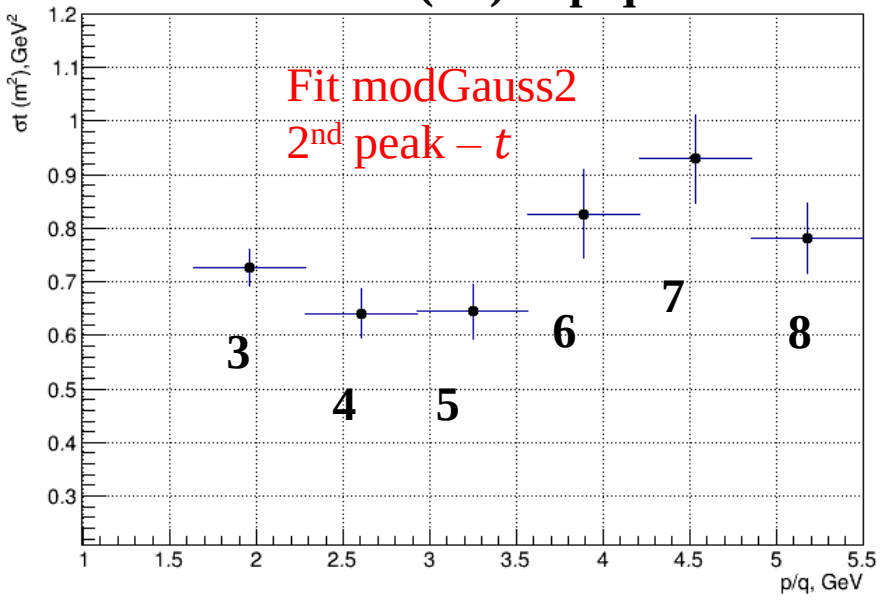
Distribution σ(m²) of p/q for d



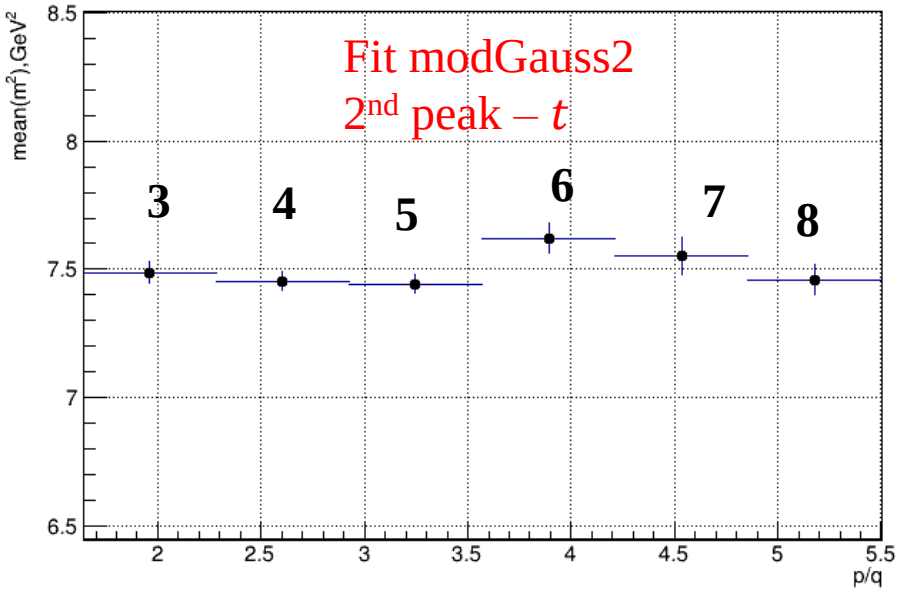
Distribution mean (m²) of p/q for d



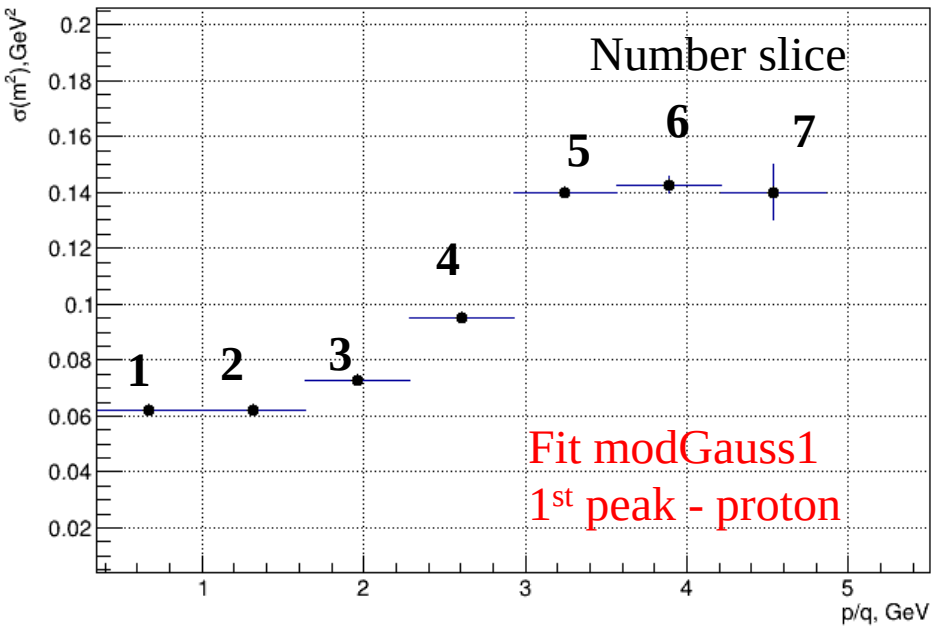
Distribution σ(m²) of p/q for t



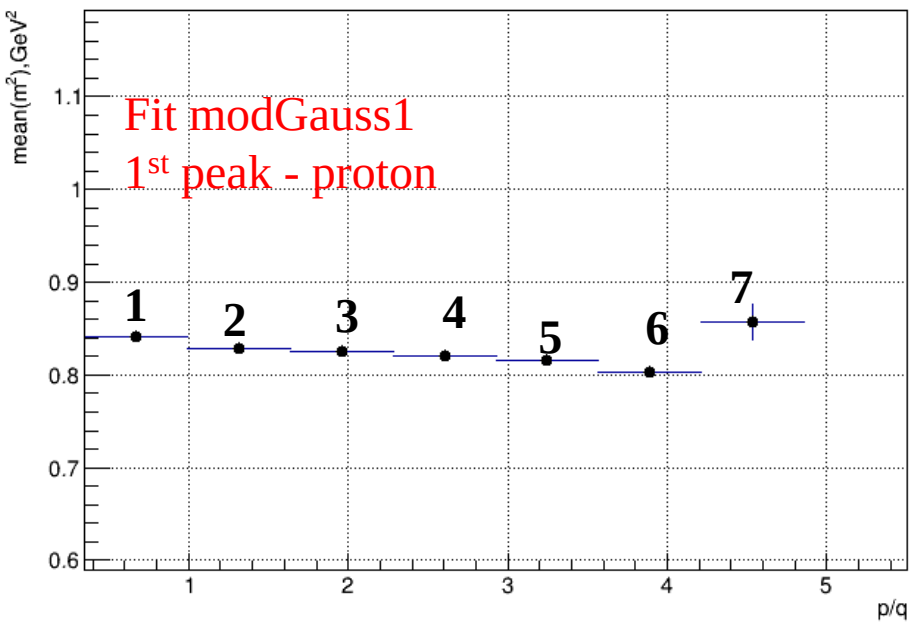
Distribution mean (m²) of p/q for t



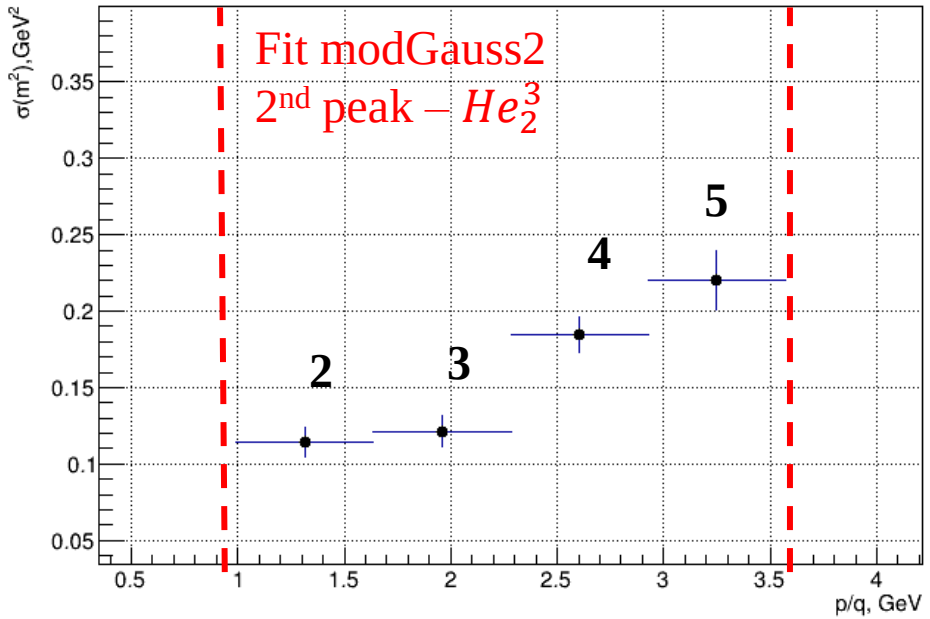
Distribution σ(m²) of p/q for proton



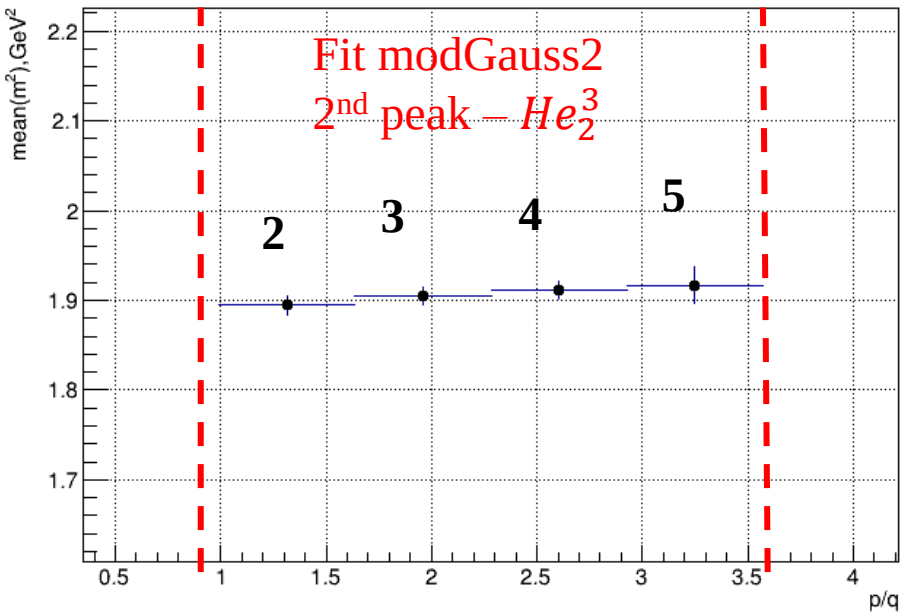
Distribution mean (m²) of p/q for proton



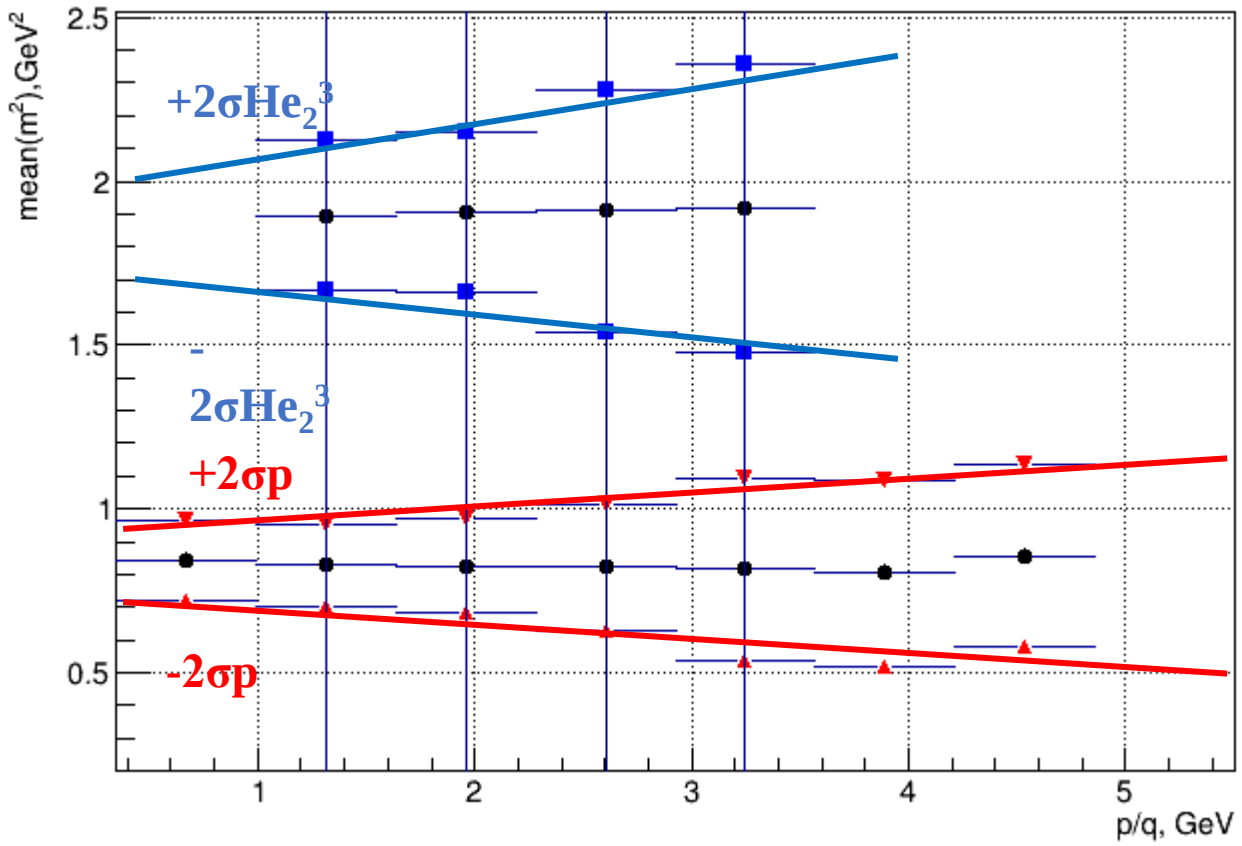
Distribution σ(m²) of p/q for He_2^3

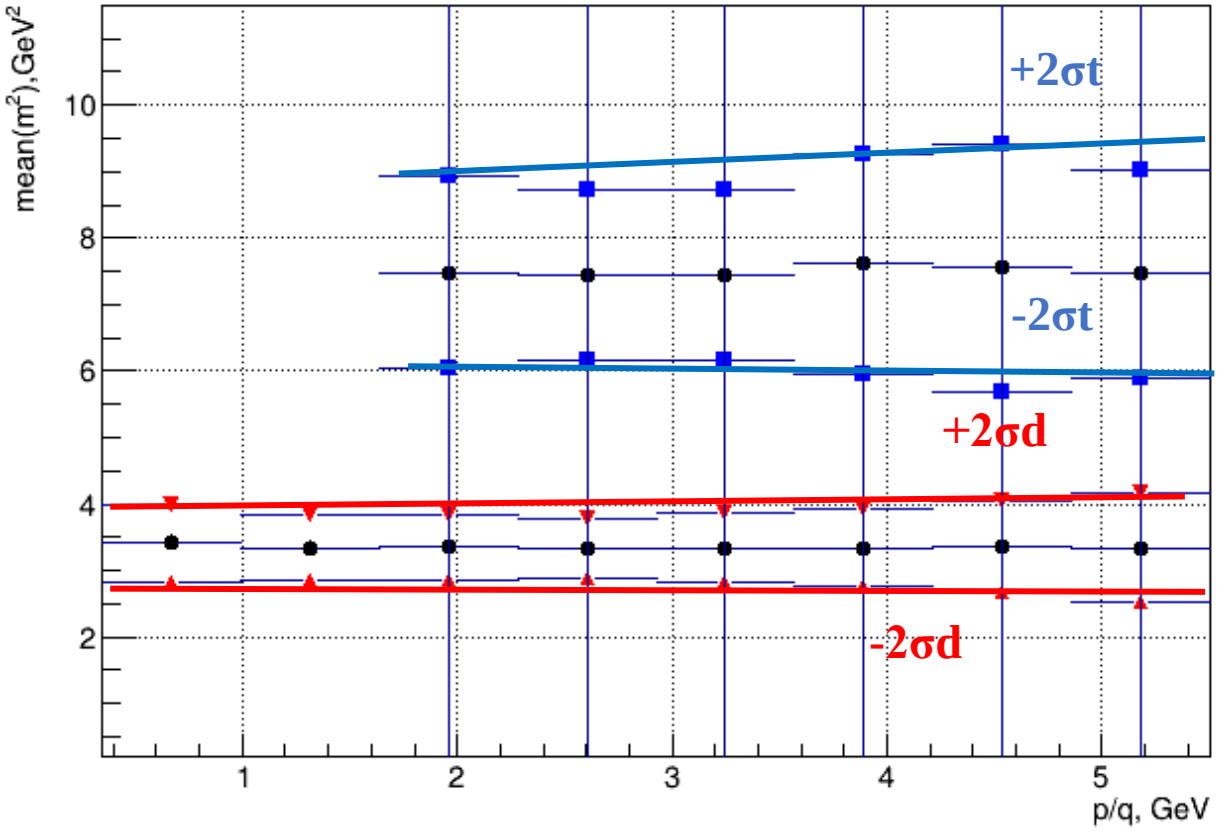


Distribution mean (m²) of p/q for He_2^3

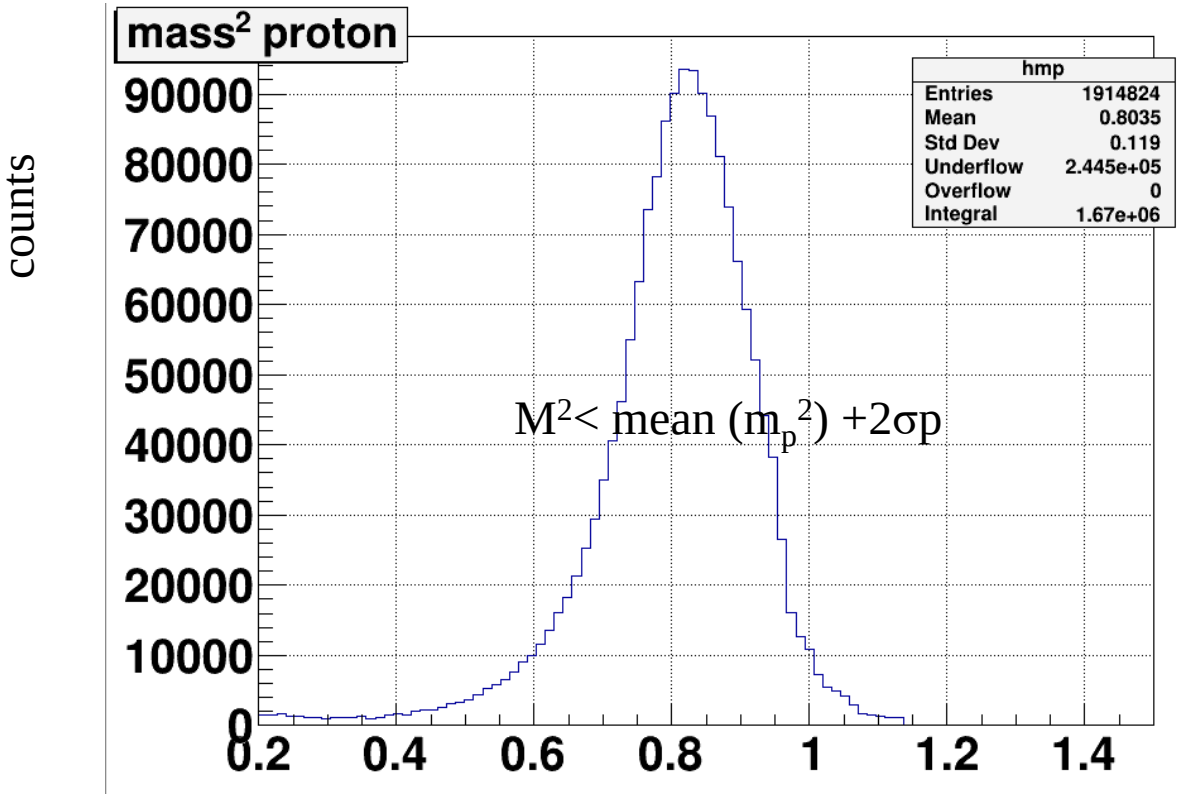


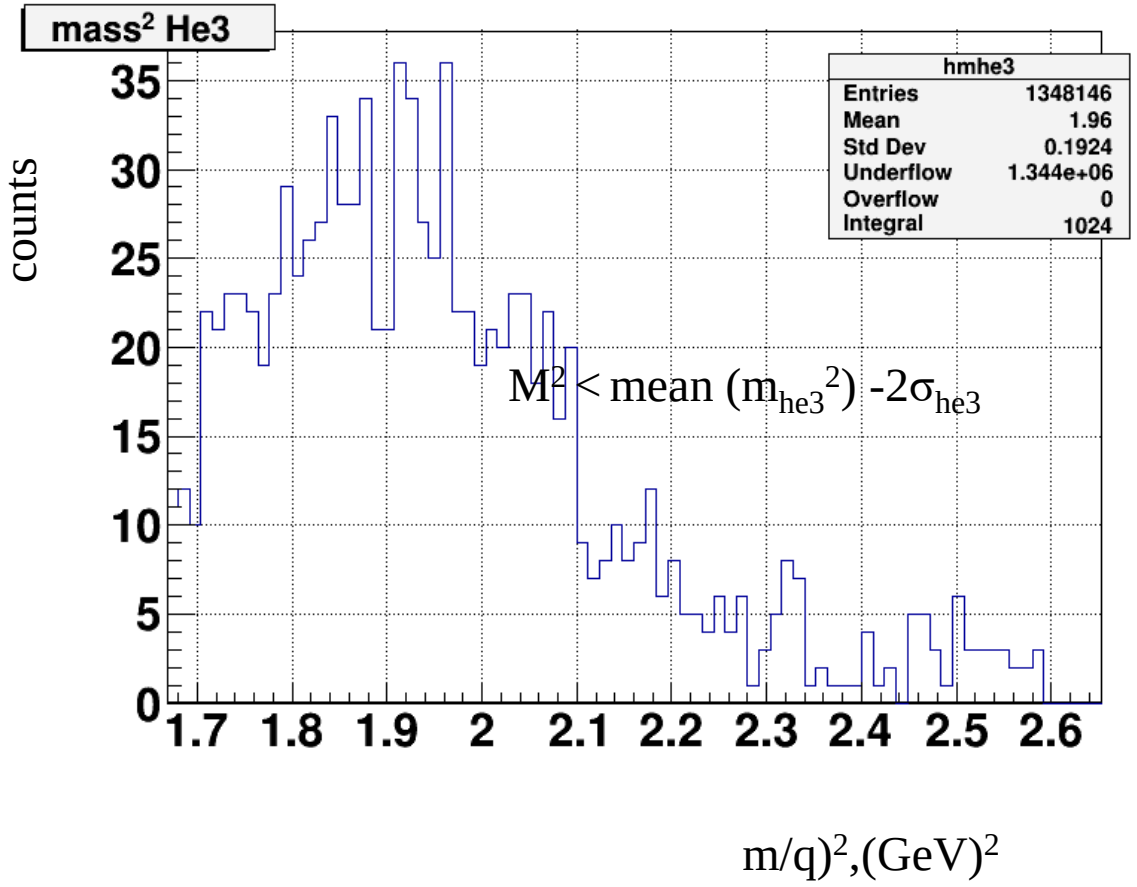
Distribution mean (m^2) vs p/q, mean (m^2) ±2σ



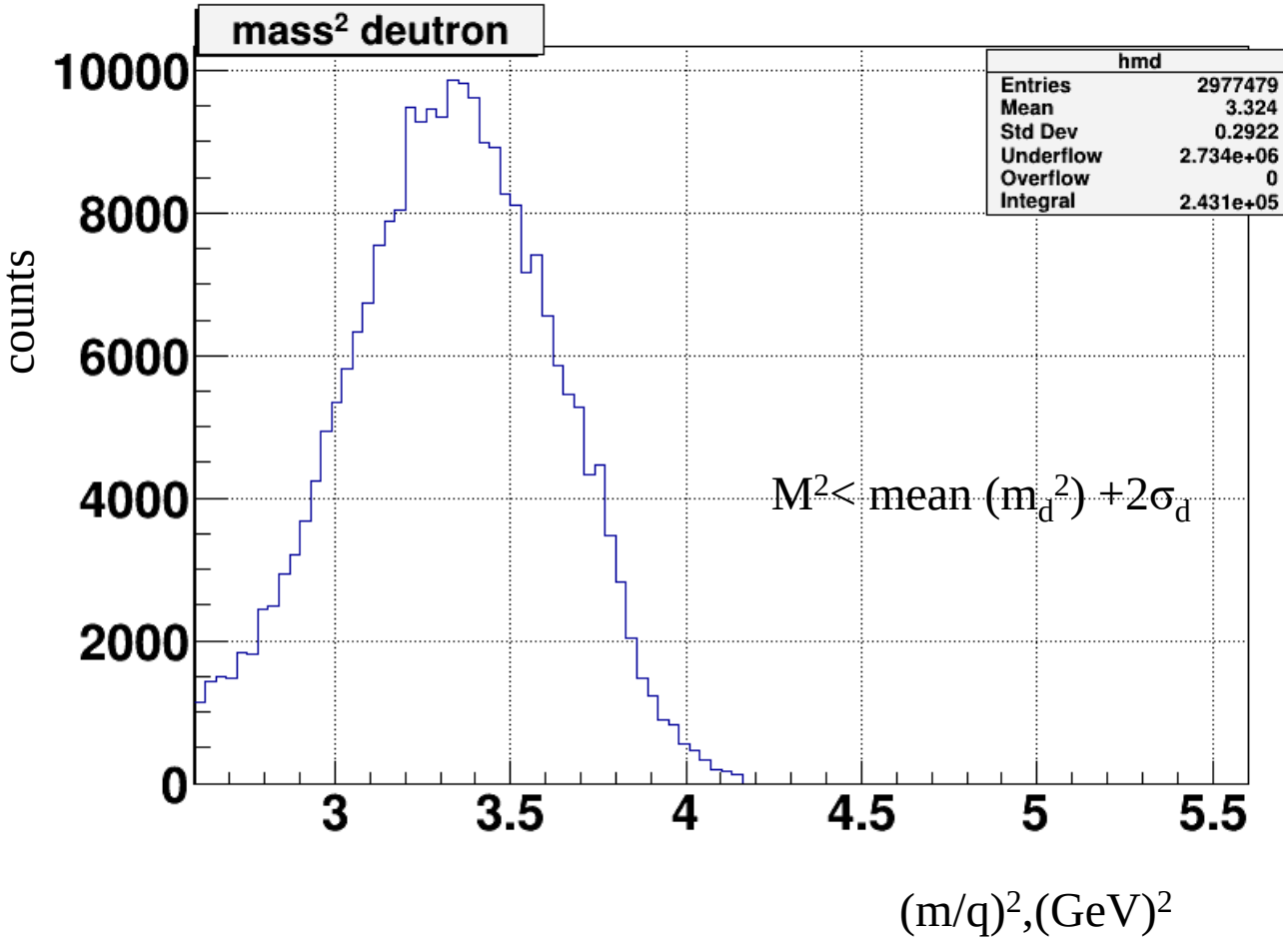


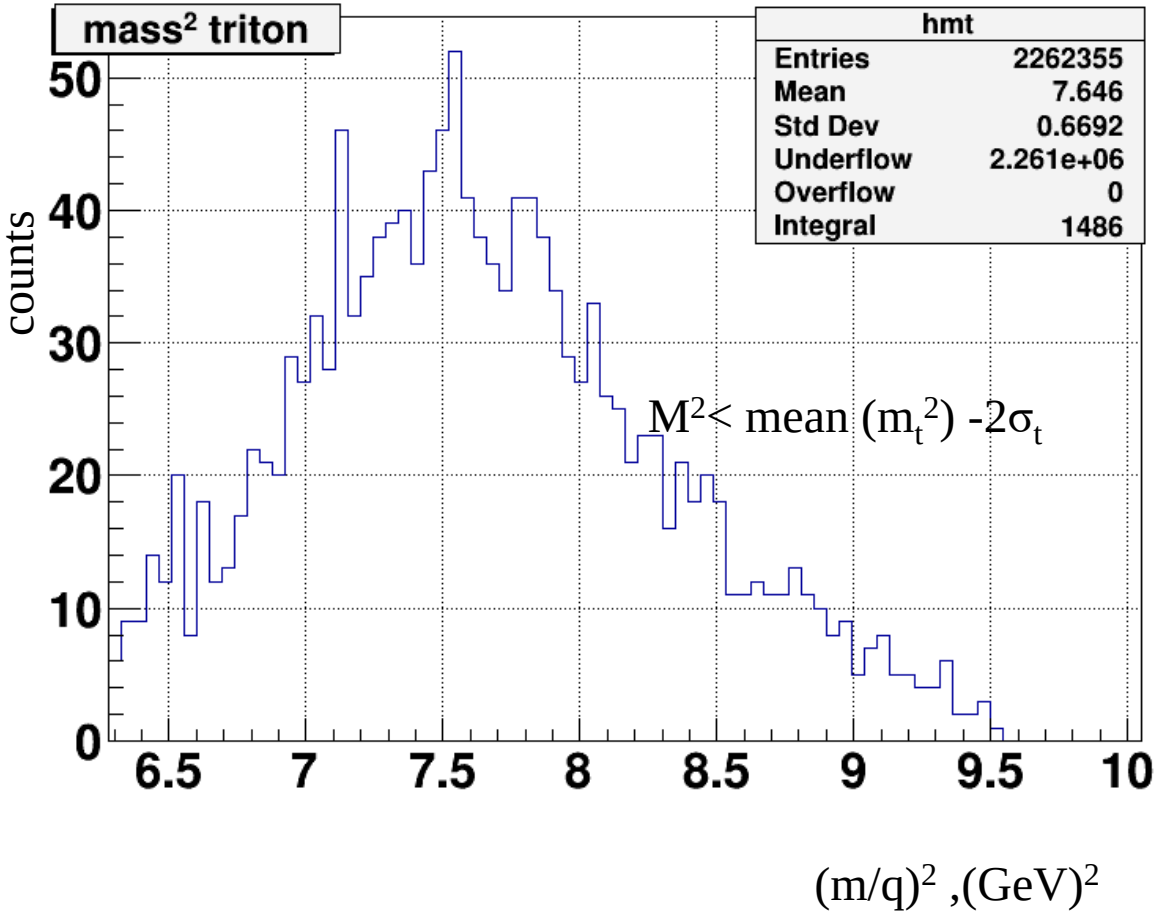
Distribution by (m/q^2)





Distribution by (m/q^2)





Summary

The result :

- The efficiency of the triggers for the proton and deuteron has been evaluated
- Fit m^2 vs p/q function(ModGauss(**1st peak**) +ModGauss(**2nd peak**)+ expo(**background**)
- Preliminary: $\sigma(m^2)$ and mean (m^2) were obtained in the range of momenta 0.35-5 GeV/c for (p,He^3,d,t)
- Preliminary: bounds mean(m^2) $\pm 2\sigma(m^2)$ were obtained in the range of momenta 0.35-5 GeV/c for (p,He^3,d,t)

The plans:

- Pt spectra of fragments (p,He^3,d,t) for Data and MC
- P and Y spectra of fragments (p,He^3,d,t) for Data and MC

Distribution of the p/q for nuclear fragments