Vertex Reconstruction - Combinatoric Approach.

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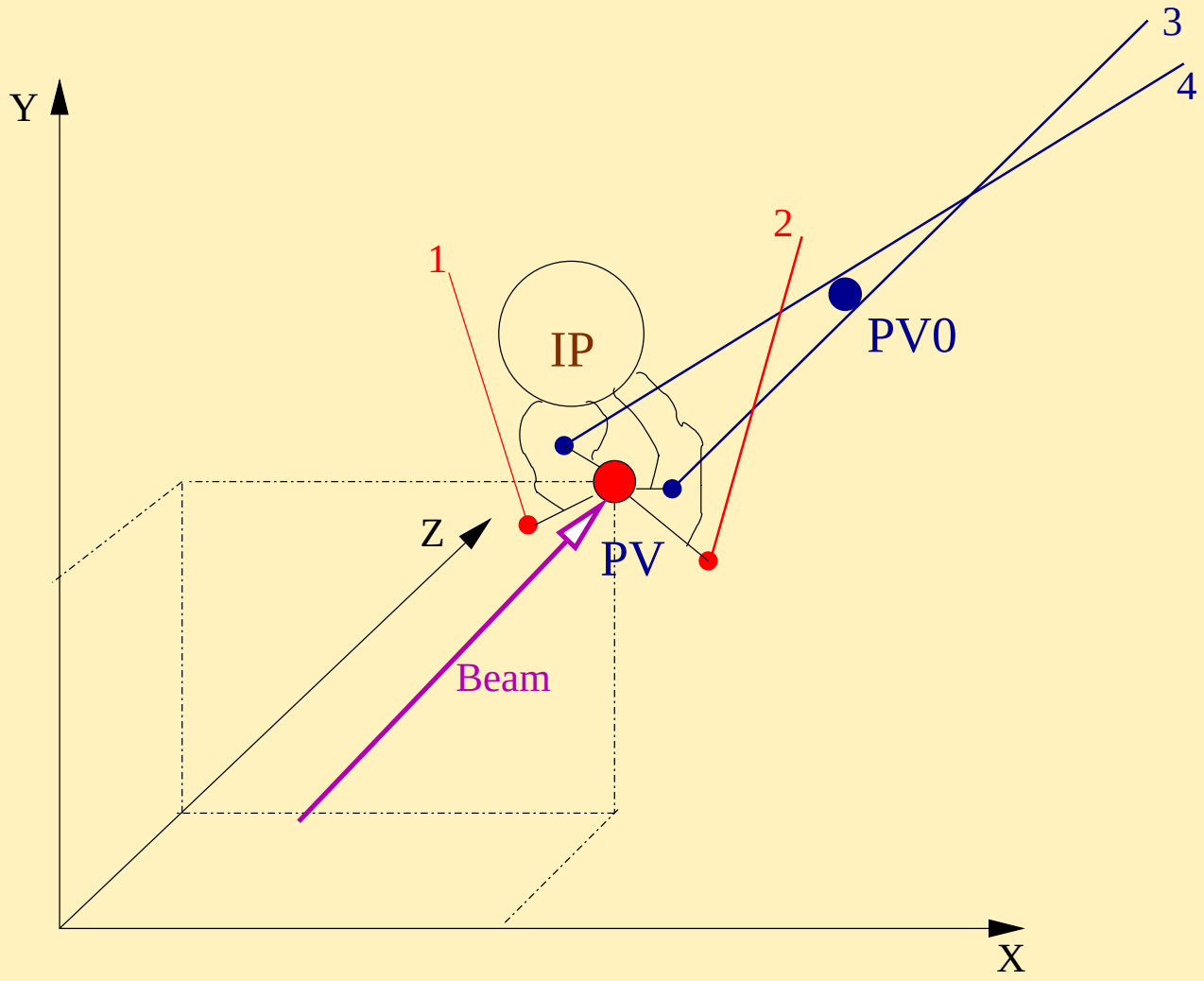
Linear Algorithm.

If track deviated too much - reject it and try the reconstruction with the rest candidates. But the rejected track never comes back to the business.



Full Combinatoric Algorithm.

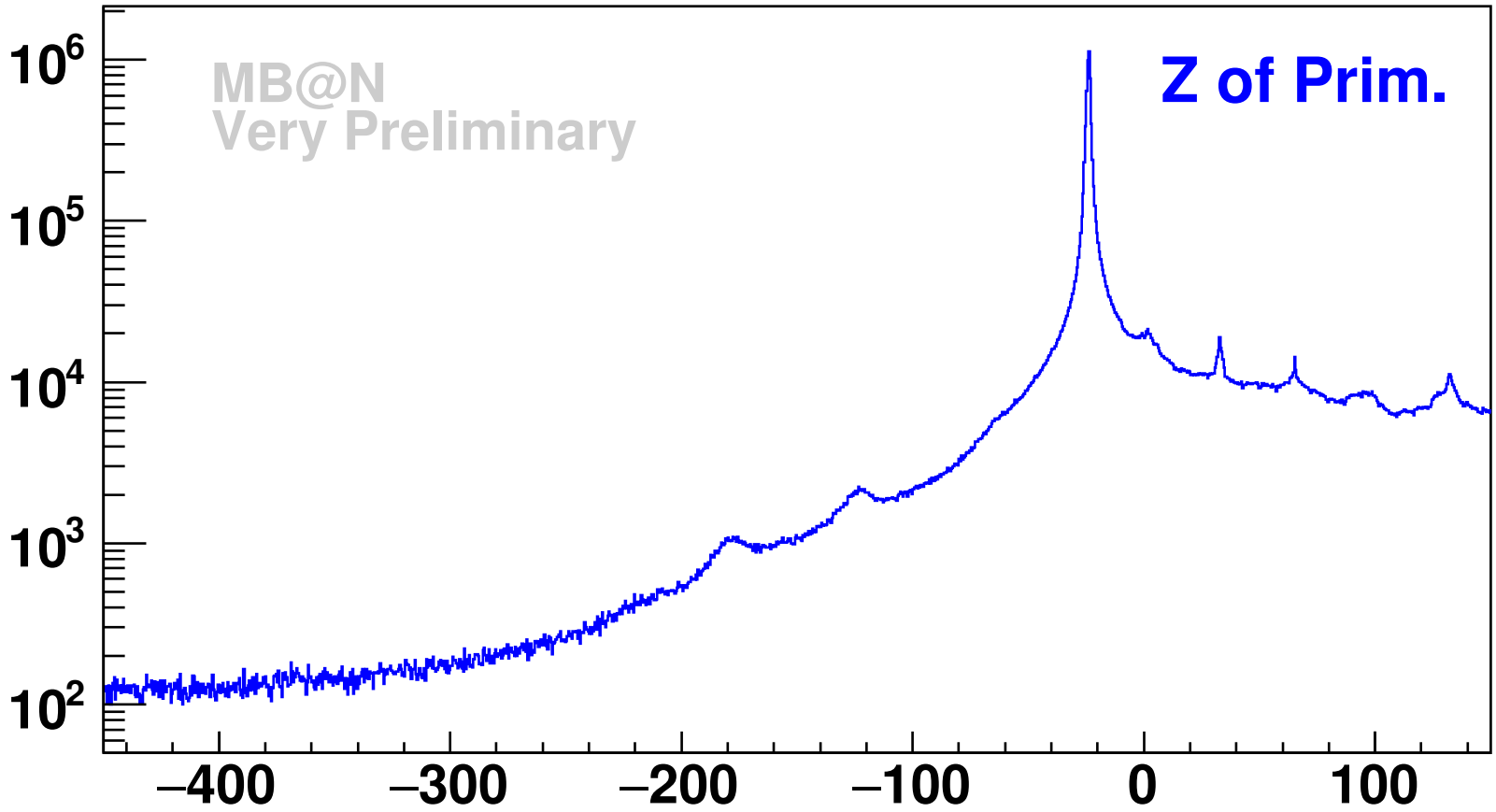
1. The basic principle : if among **N** tracks the deviation of at least one track exceed a certain limit then look through **N** combinations of **N-1** tracks.

2. If in each **N** combinations among **N-1** tracks at least one track exceed a certain limit then look through C^k_{N-k}, k=2, combinations. 3. Process continue up to 2 tracks combinations.

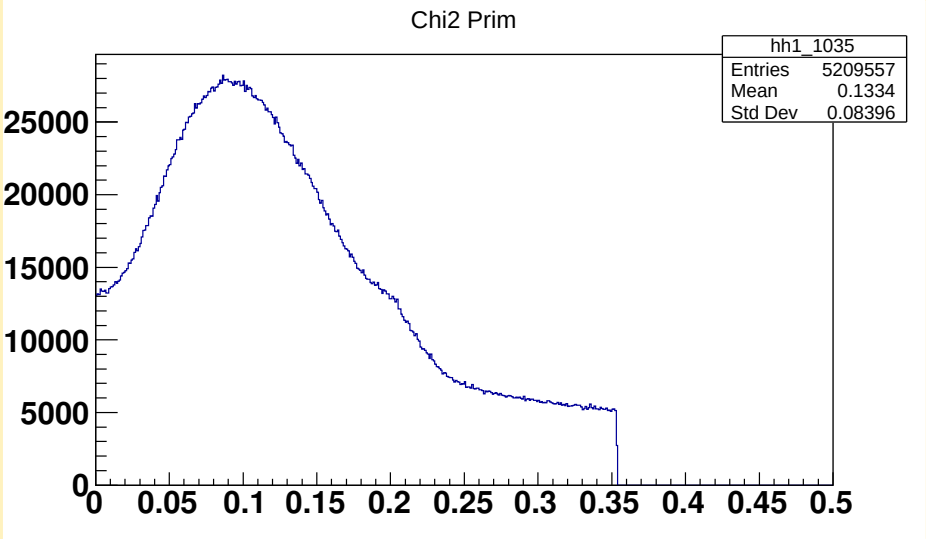
Problem : to run through C^k_{N-k} takes time.

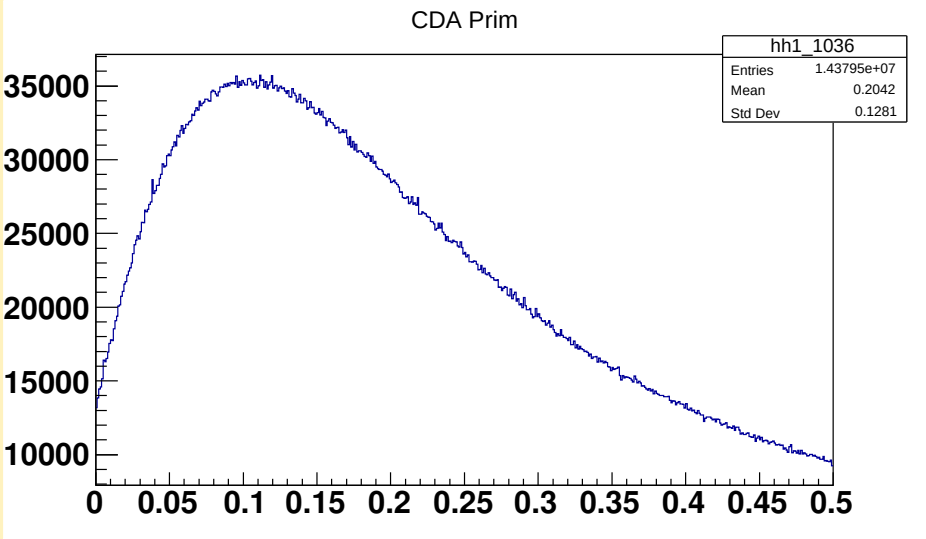
The only tuning parameter is the maximum deviation of the track from the primary vertex.

Z of Primary vertex position.



χ^2 and CDA.

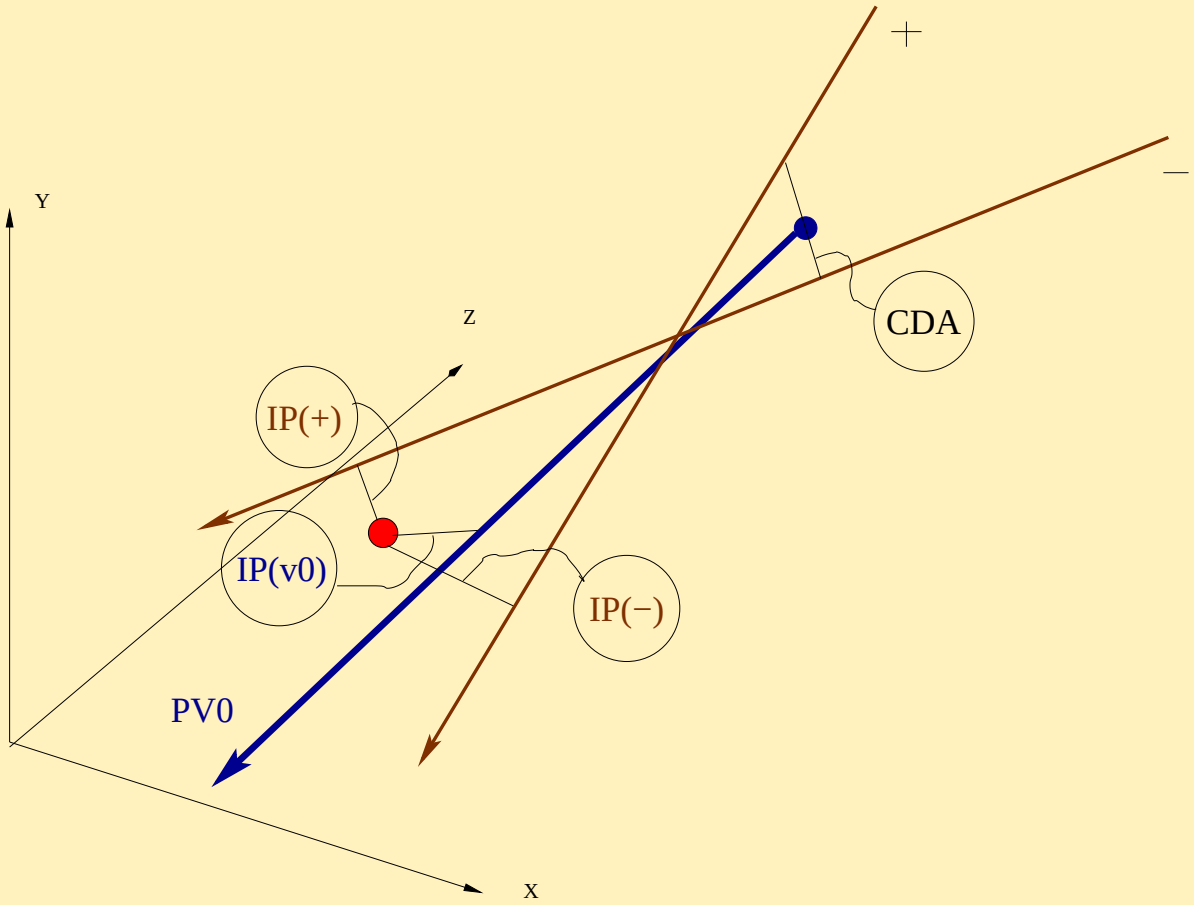




$$\chi^2 = \frac{1}{N}\sqrt{\sum_{n=1}^{N}(X_{Pv} - X_{tr})^2 + (Y_{Pv} - Y_{tr})^2 + (X_{Pv} - Z_{tr})^2}$$

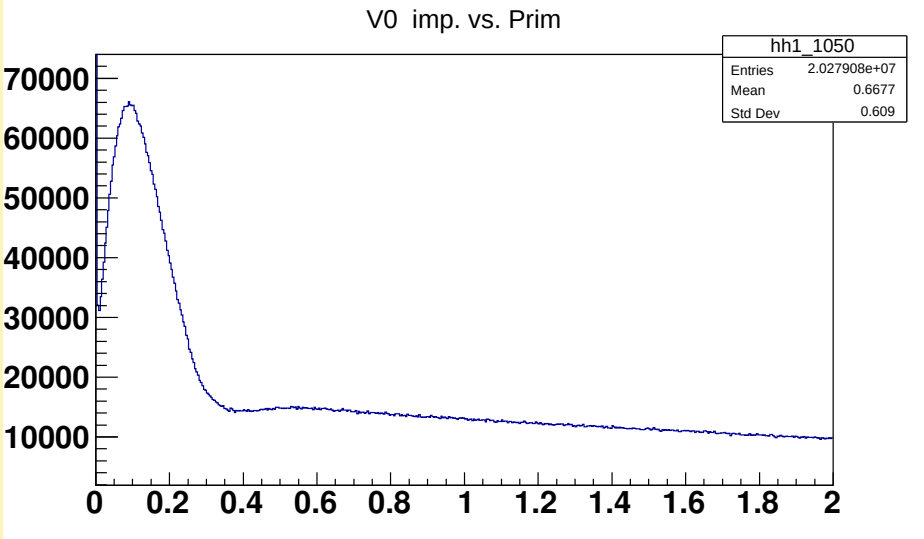
The actual cut on the maximum deviation of the track from the primary vertex is 0.5cm. The bump in χ^2 distribution indicates that the chosen value is too big.

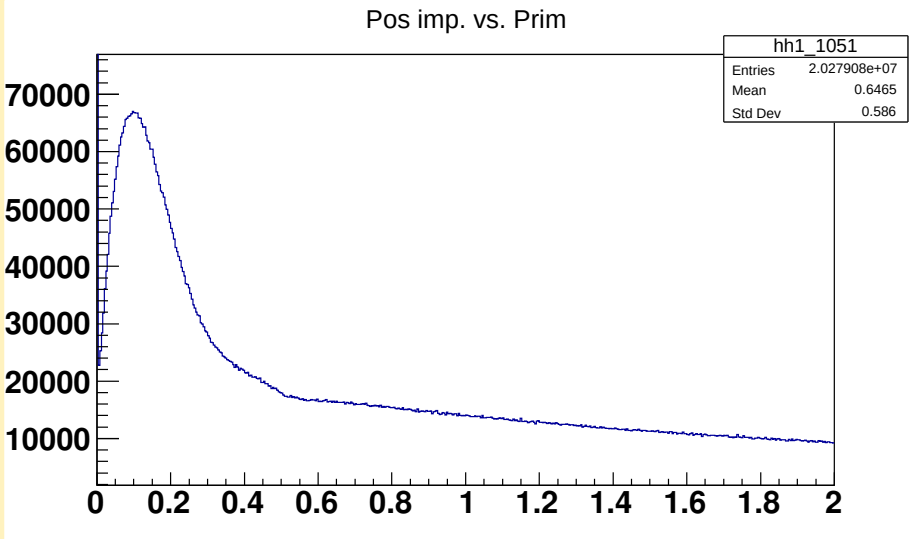
Ω Cut.

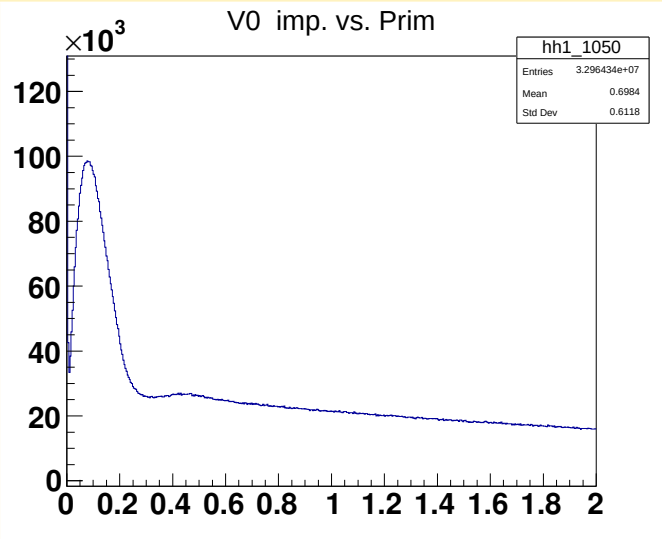


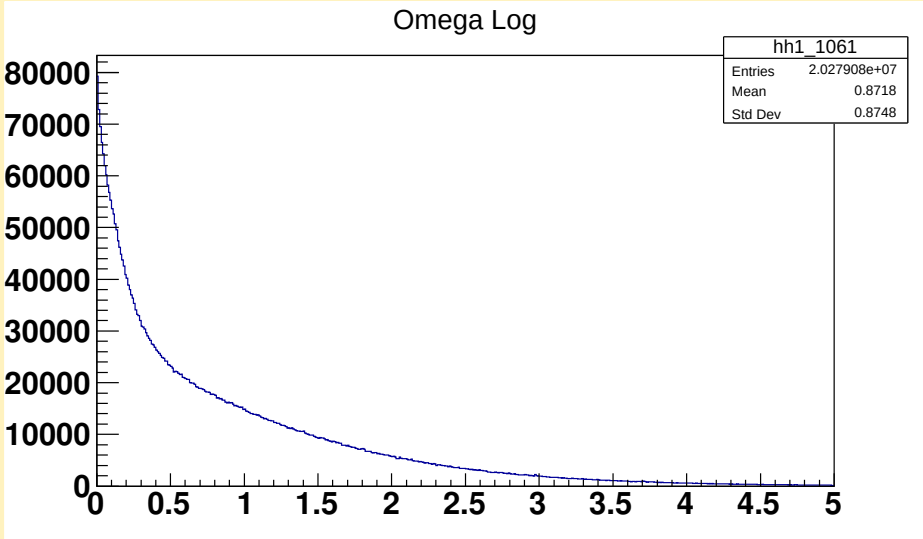
$$\Omega = \frac{IP(+) \cdot IP(-)}{IP(V^0) \cdot IP(V^0) + 4 \cdot CDA_{V^0} \cdot CDA_{V^0}}$$

Cut parameters .

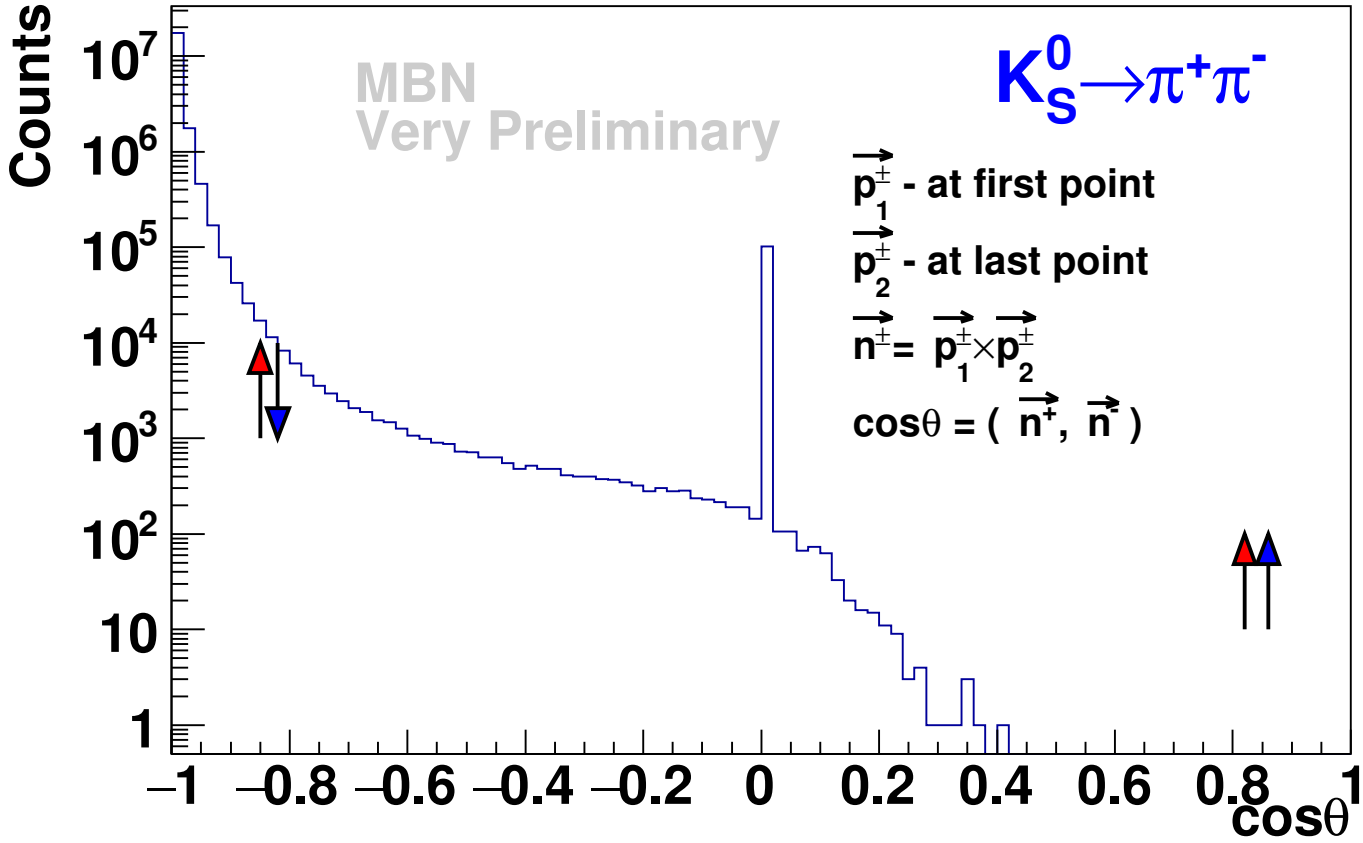






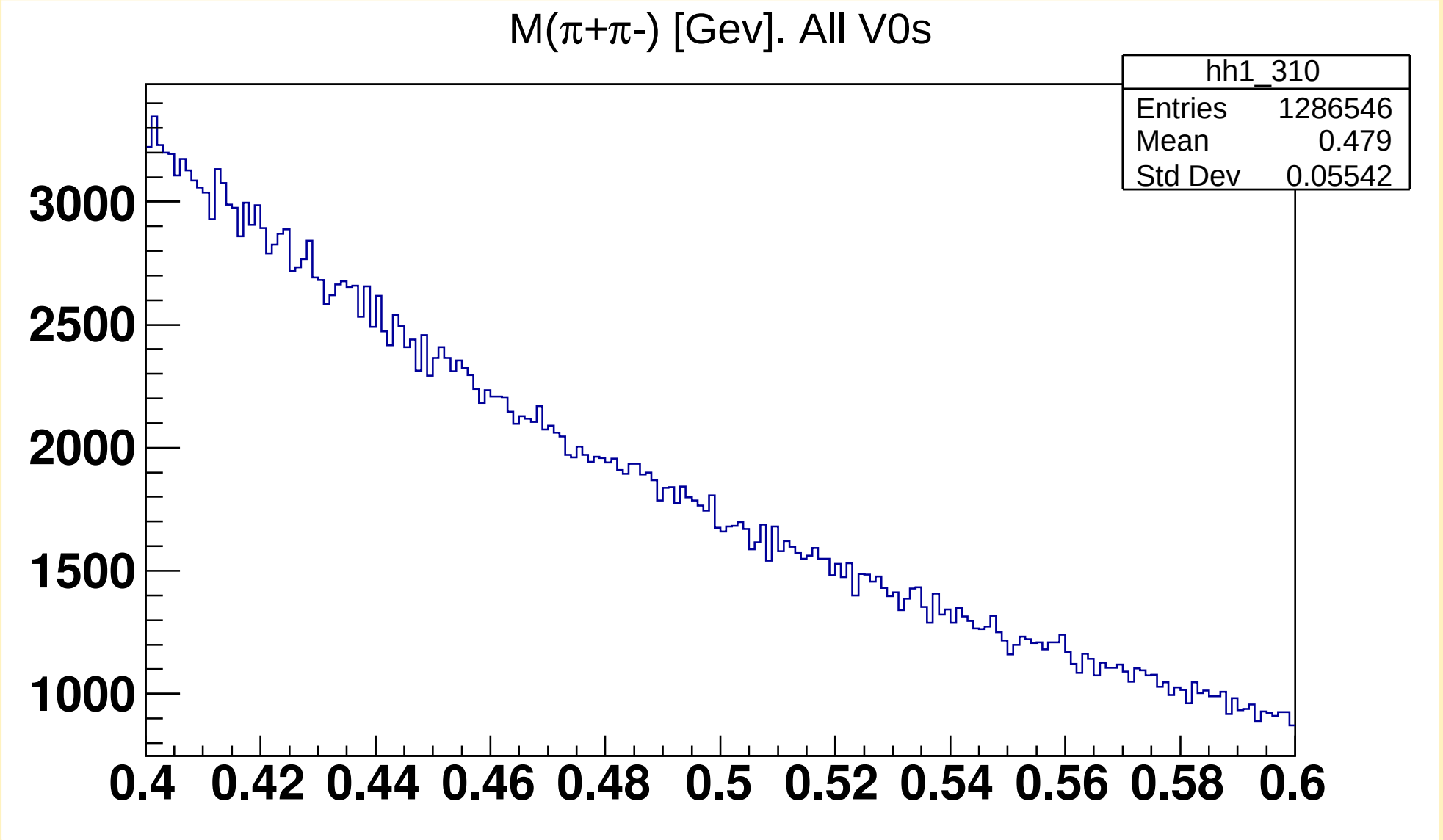


Co-planar tracks.



Cut at $cos\theta = 0.95$

K^0_S invariant mass, $\Omega > 0.5$.



Fit Functions.

Modified asymmetric "Gaussian" function.

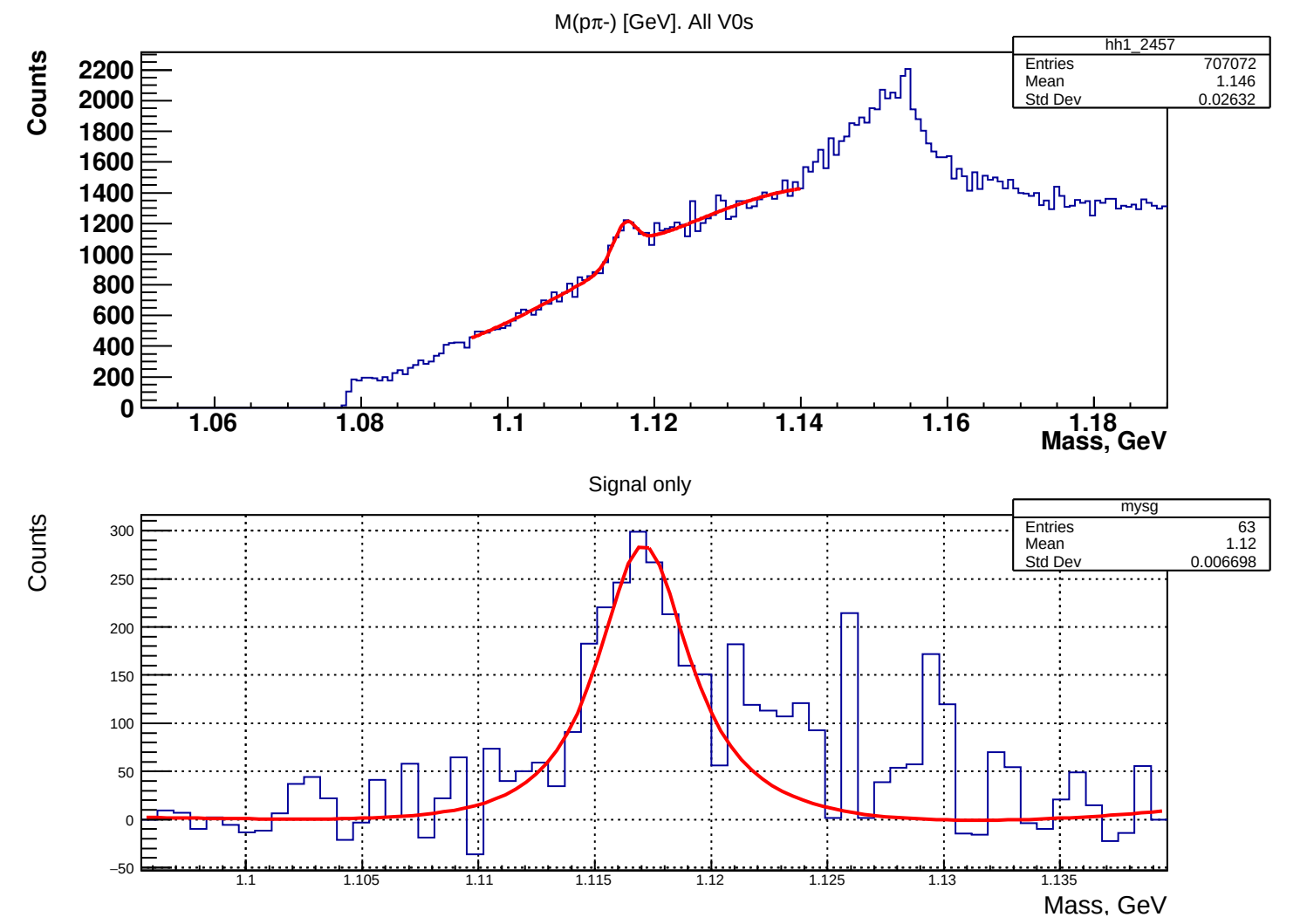
$$f_{sig} = Nexp\Big(- \alpha \cdot ln(1 + \frac{1}{2}\frac{z^2}{\alpha})\Big)$$

$$z = \frac{x - \mu}{\sigma}$$

$$\alpha = 1 + \sqrt{p_1^2 + p_2^2} + p_3 \cdot th(z)$$

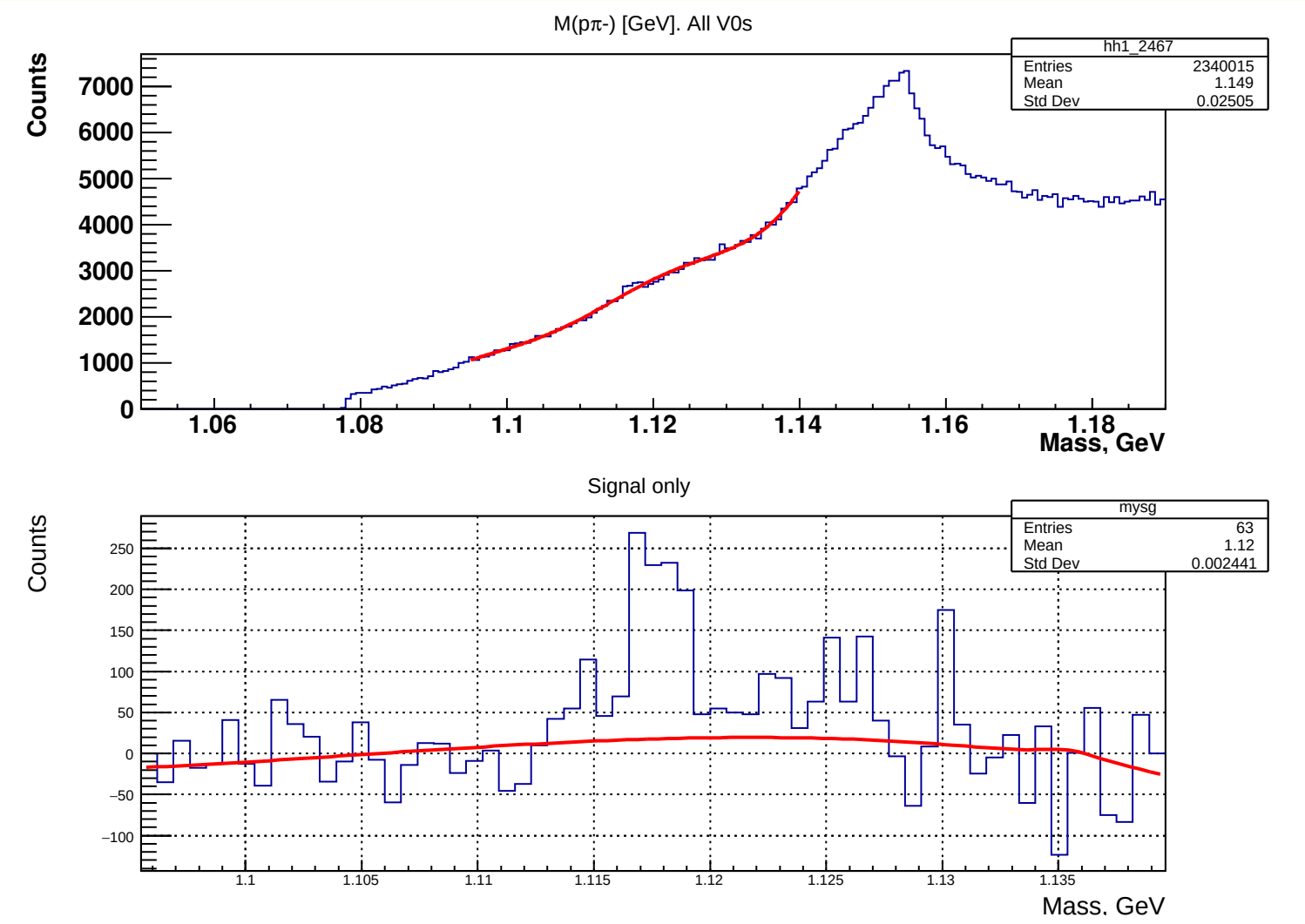
Λ invariant mass, $\Omega > 1.5$. All track multiplicity.

Cut on Armenteros-Podalansky plot: $p_t < 0.15 MeV$.

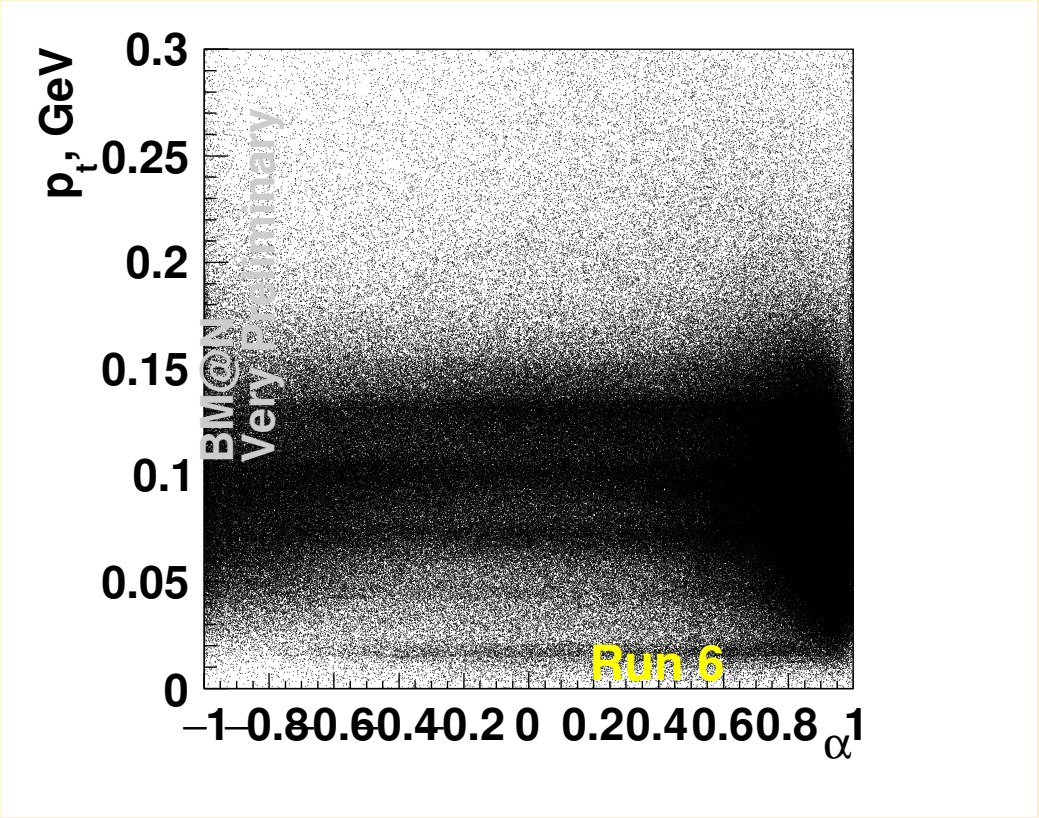


Λ invariant mass, $\Omega > 1.5$. Track multiplicity > 10

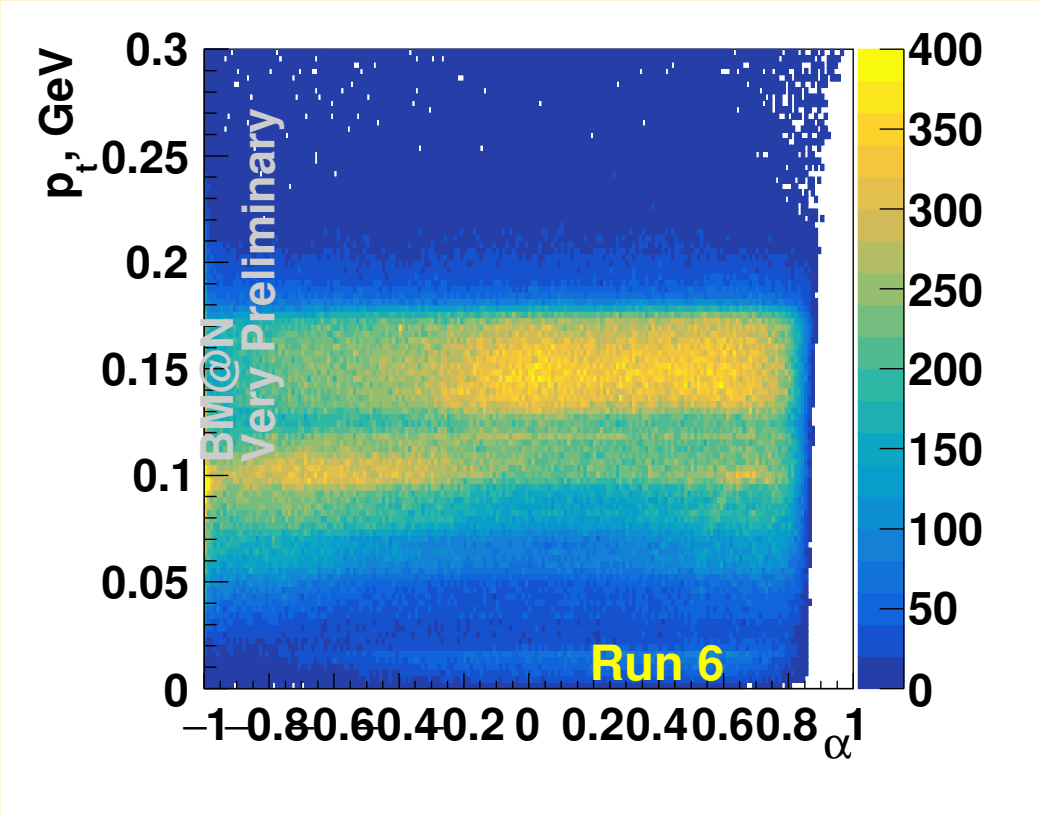
Cut on Armenteros-Podalansky plot: $p_t < 0.15 MeV$. High track multiplicity: $N_{trk} > 10$.



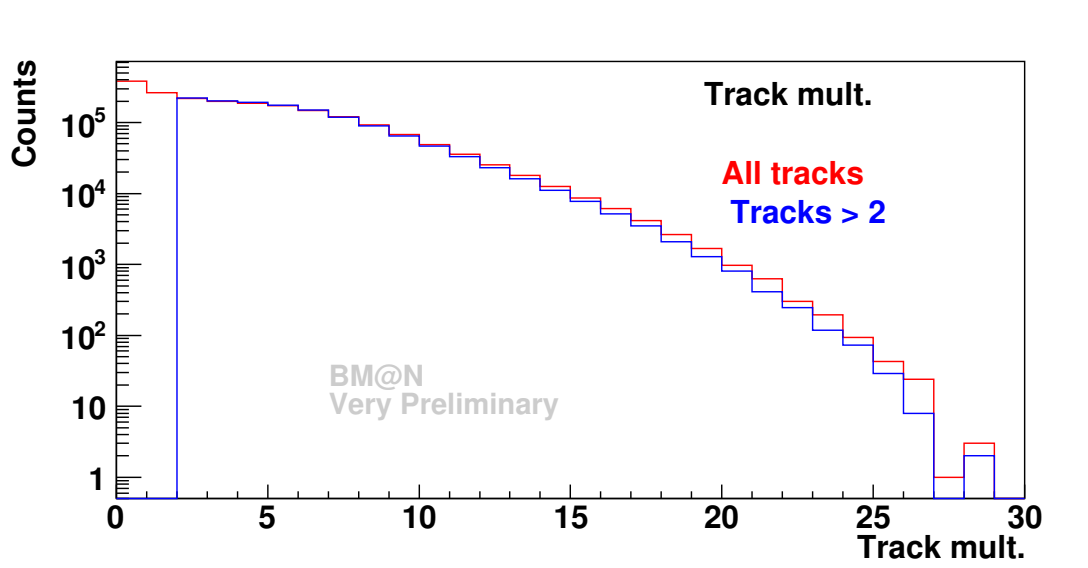
K^0_S on AP plot.

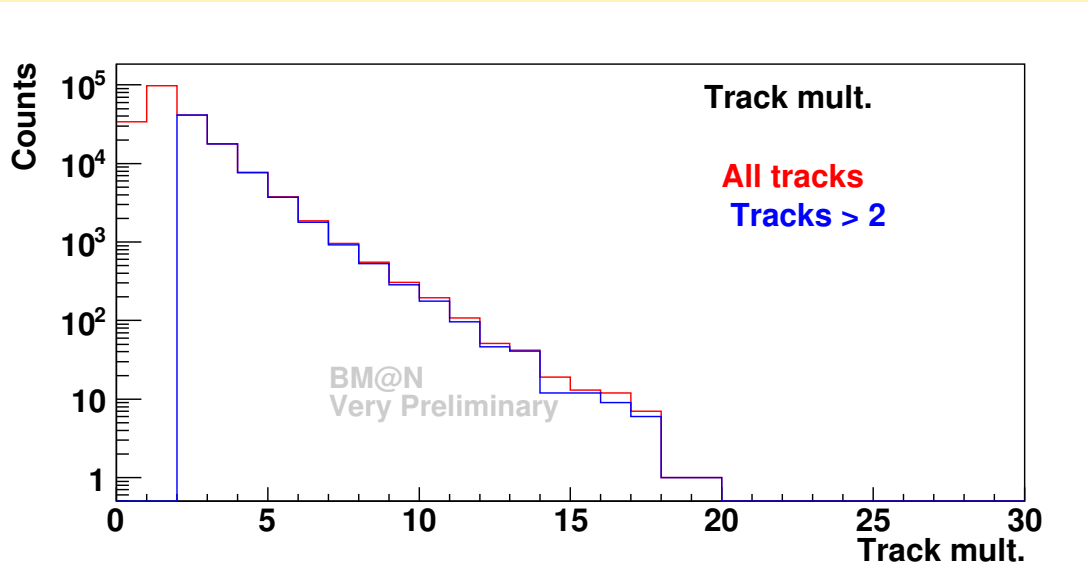


Λ on AP plot.



Track Multiplicity per Event, Data - Beam Data, run 1403.

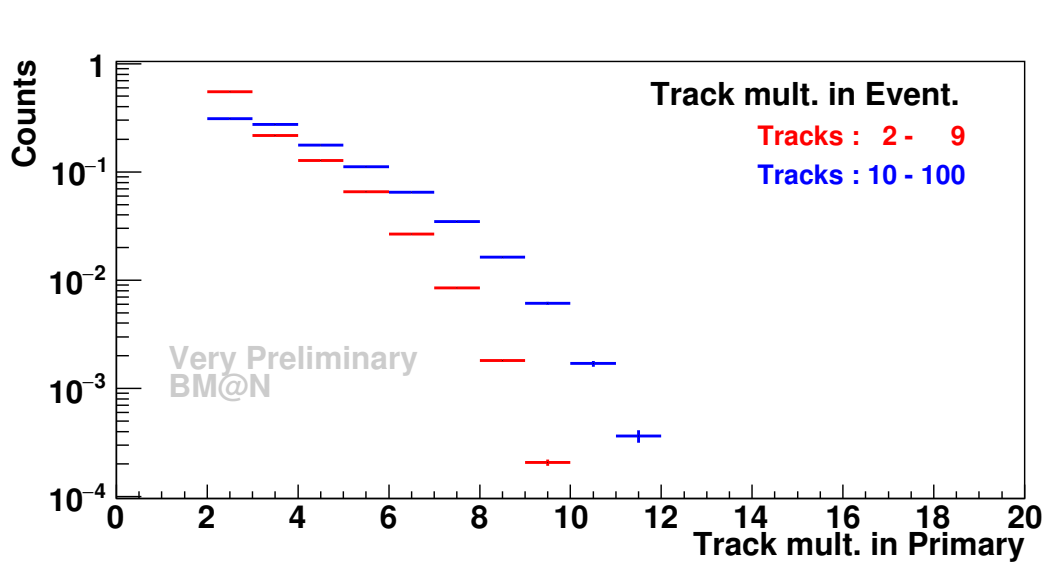


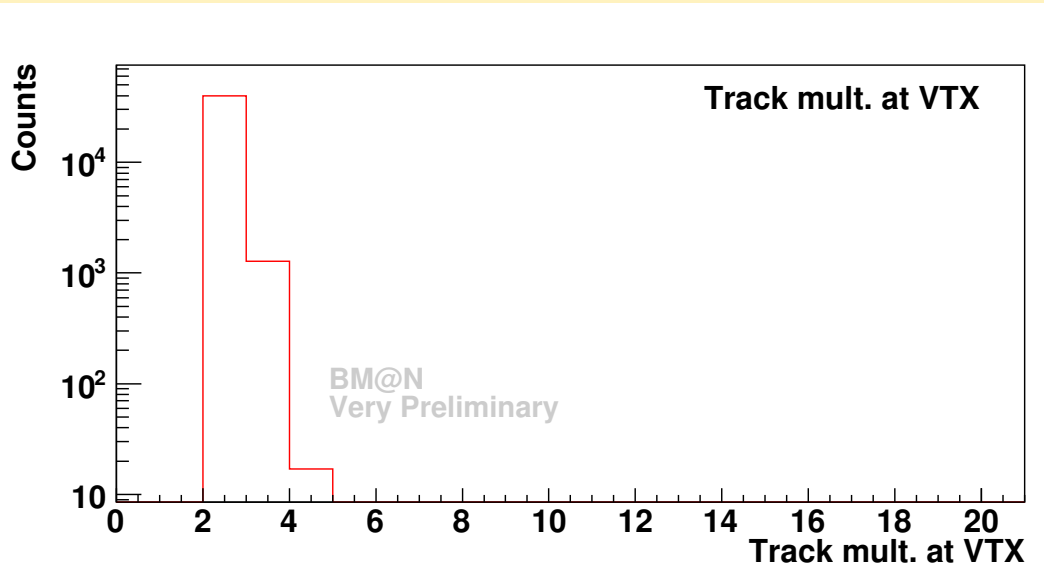


Top - Interaction Data.
Bottom - Beam Data.

In Beam Data there is a sizable part of the events with one track only.

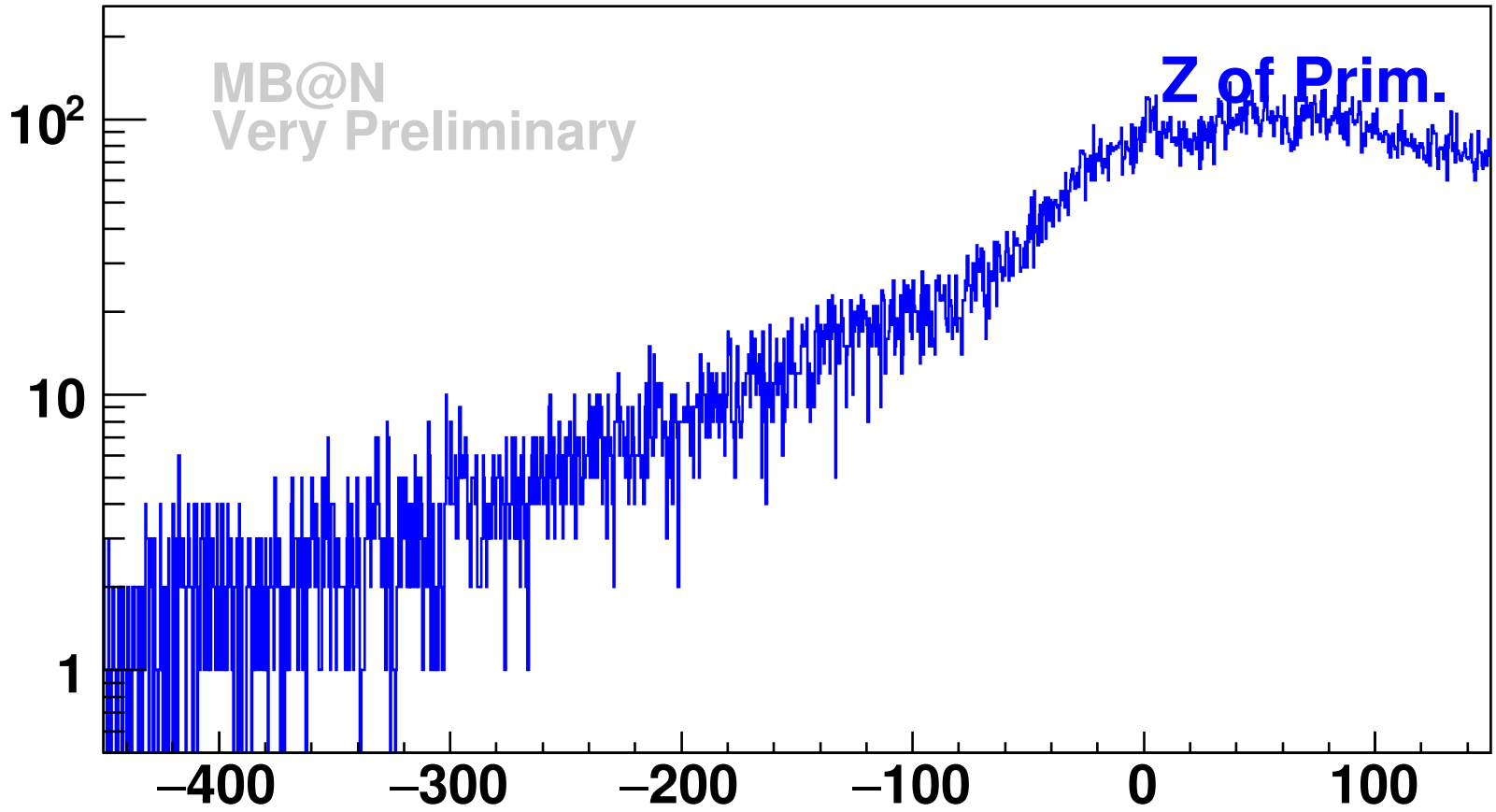
Track Multiplicity at Vertex, Data - Beam Data, run 1403.





Top - Interaction Data.
Bottom - Beam Data.

Z of Primary vertex position. Beam Data, run 1403.



Primary Vertex: X-Y position. Beam Data, run 1403.

All values are given in $\mathbf{cm}$.

Z range	$< Z >$	X	σ_X	Y	σ_Y
-190 : -170	-179	0.99	0.33	1.75	0.66
-135 : -115	-123	0.63	0.41	1.39	0.52
-90 : -40	-65	1.01	0.72	1.12	0.48
-26 : -21	-24	1.04	0.60	0.92	0.47
25 : 35	33	1.34	0.83	0.66	0.72
125 : 140	133	3.77	0.52	0.43	0.35

Luminosity Evaluation Procedure.

- The position of the beam counter is visible in the vertices positions.
- The $X - Y$ of the vertices distribution at beam counter gives the information about beam profile.
- The $X - Y$ of the vertices distribution at target gives the information about beam profile.
- Cut on $X - Y$ at beam counter and target positions for the events with the only one track let us evaluate the number of beam particles at target and finally calculate the luminosity.
- The efficiency of the beam track reconstruction will be taken from simulation.

CONCLUSION.

- Primary vertex reconstruction algorithm works.
- Primary vertices coordinates are in agreement with the detectors positions.
- The signature of the Λ decays is visible.
- The beam data analysis gives the possibility to evaluate the luminosity.