Luminosity evaluation. Carbon and Argon Beams.

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The Goal - Luminosity evaluation.

Luminosity evaluation method based on X-Y beam profile distribution at target position.

Since in Run-6/Run-7 there were no beam telescope the beam particle was not seen thus the only information about beam profile would be the distribution of the beam particle interactions with the target material.

The reconstructed primary vertices are considered as a signature of these interactions

Reconstruction Method.

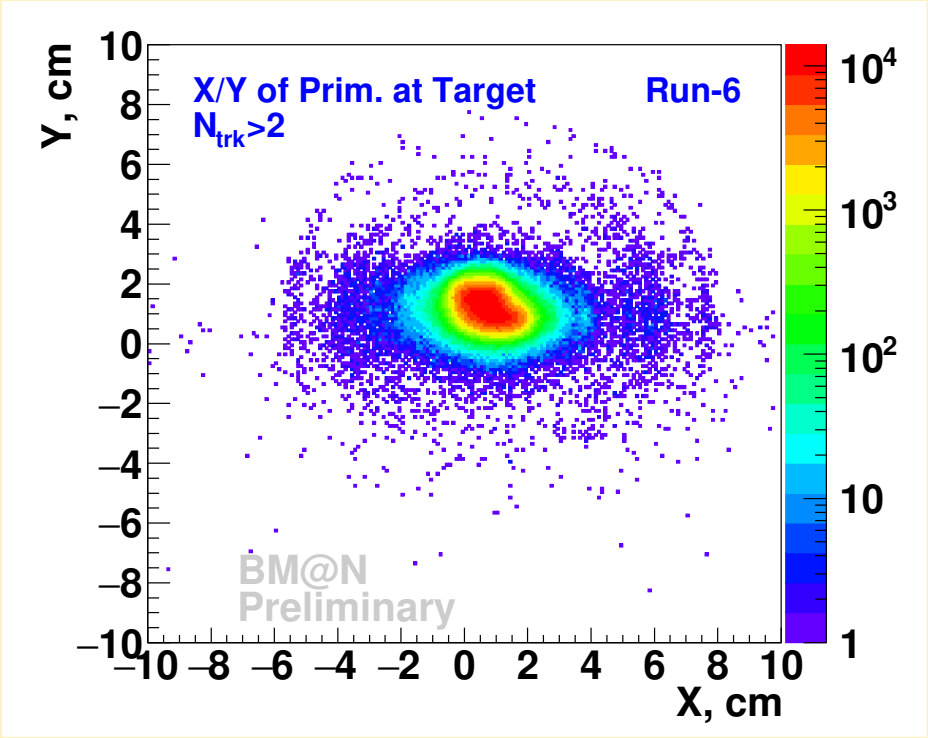
Vertex reconstruction done with the full combinatorial approach.

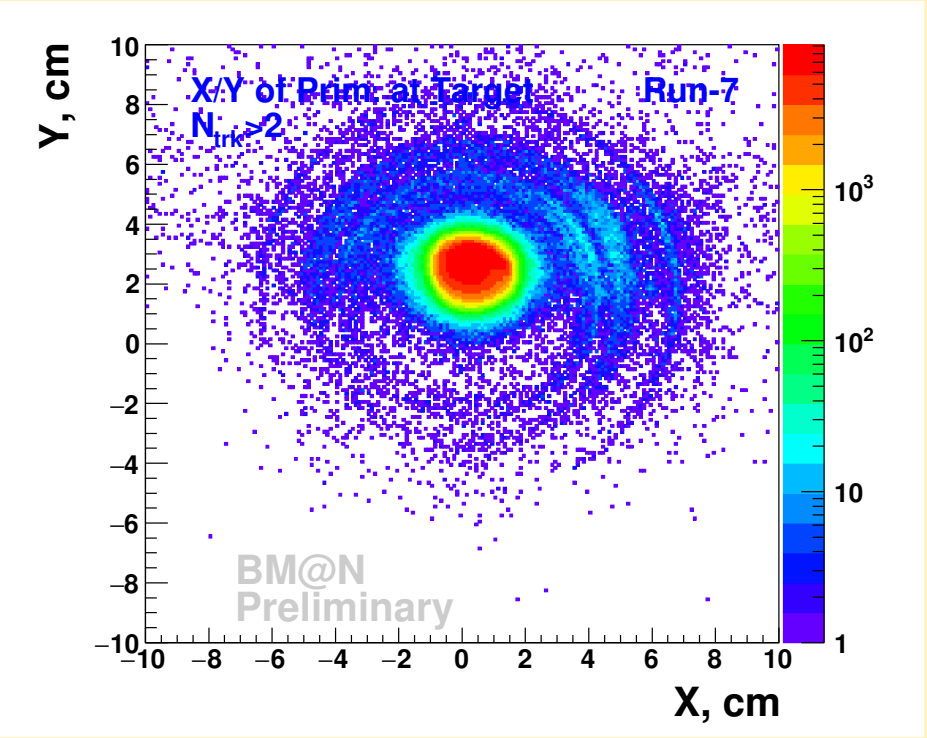
The data set was limited with the events of at least 3 reconstructed tracks and maximum 10 tracks.

The upper limit was chosen to speed up the reconstruction procedure.

The track multiplicity at primary vertex was limited within the range of 3 to 10 tracks.

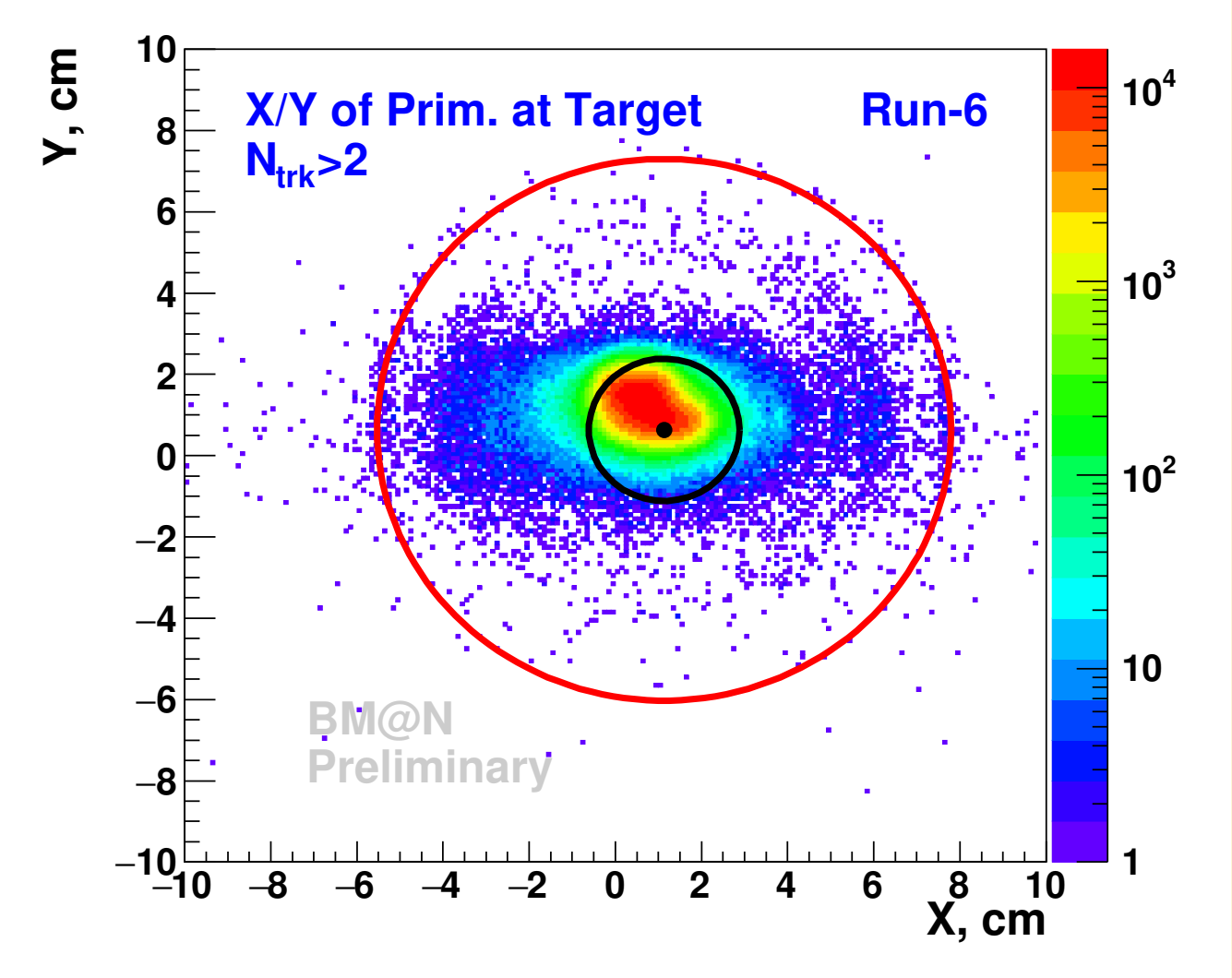
X-Y of the Primary Vertices. Target region





Left: Carbon beam - Run-6; Right: Argon beam - Run-7

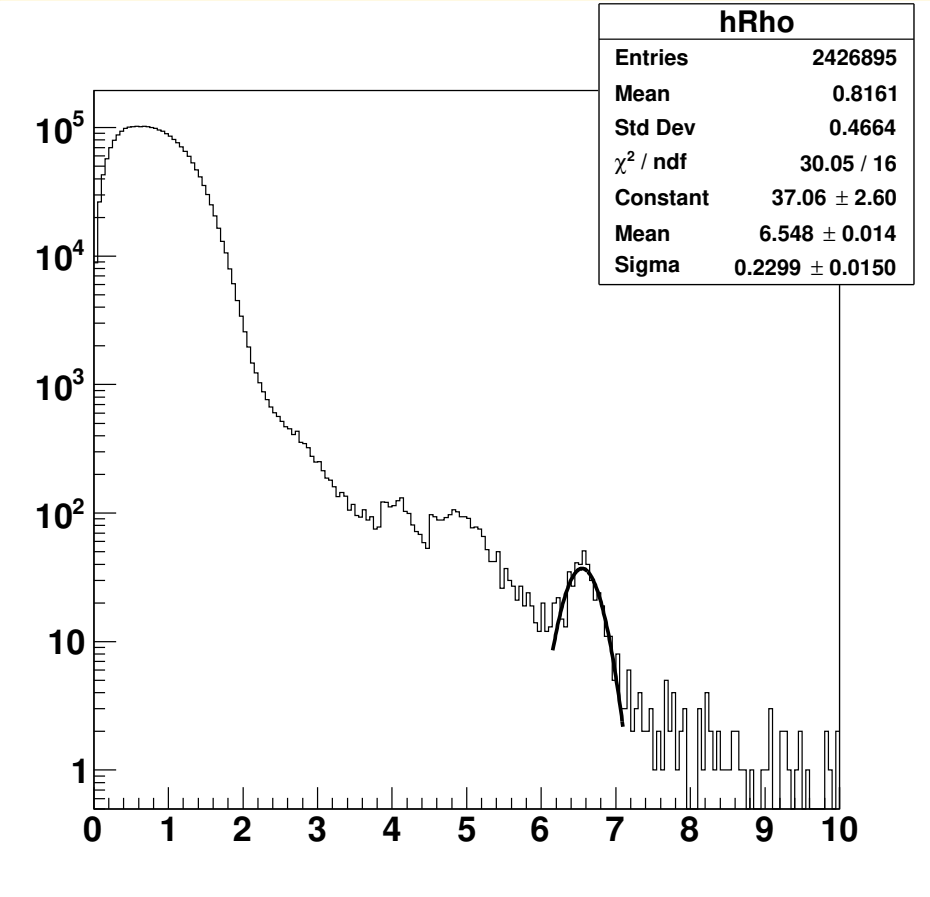
Fit: X-Y of the Primary Vertices. Target region



Red circle - the target support.

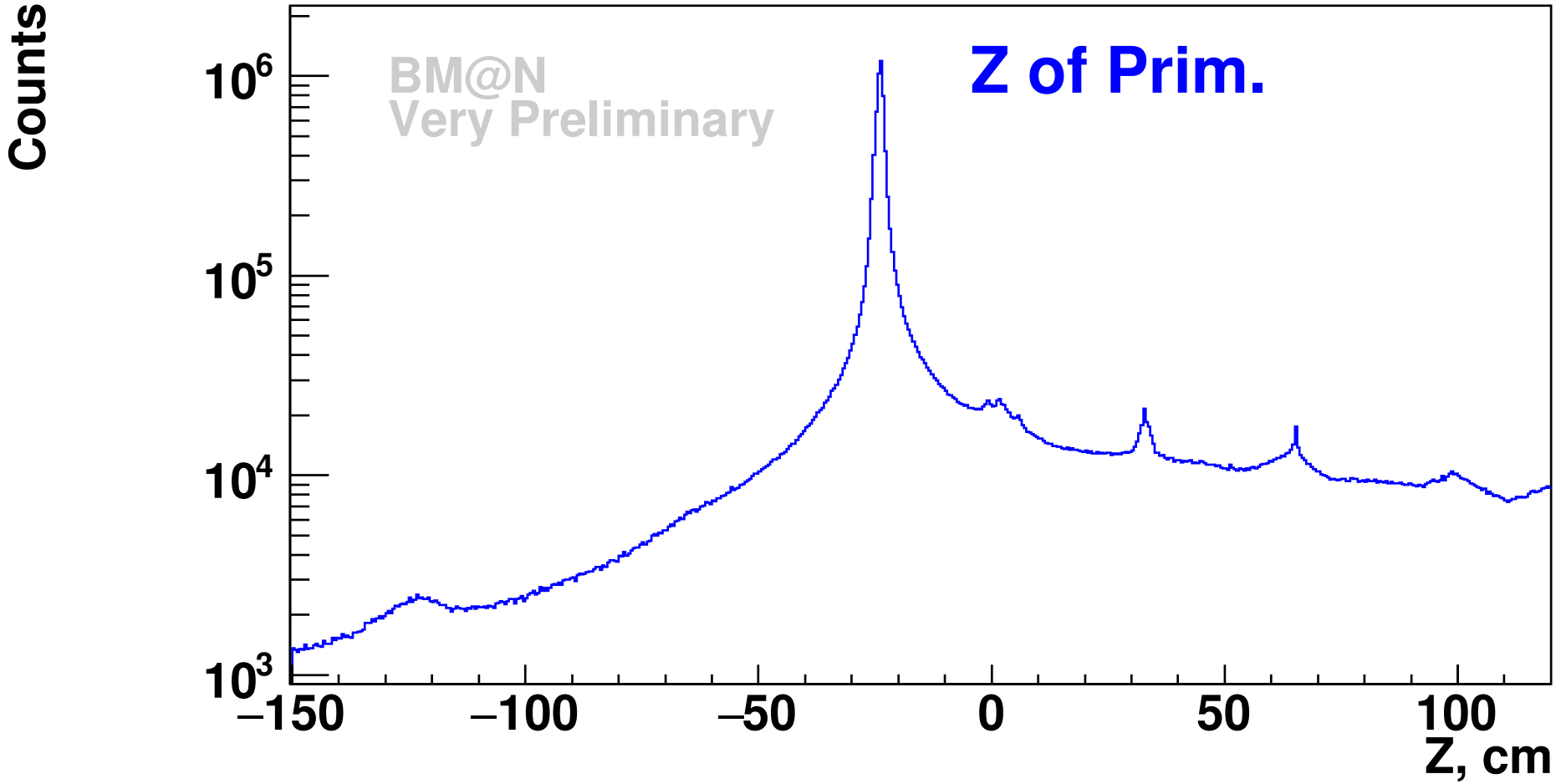
Black circle - the target geometrical size.

Fit: $\rho - \phi$ of the Primary Vertices. Target region



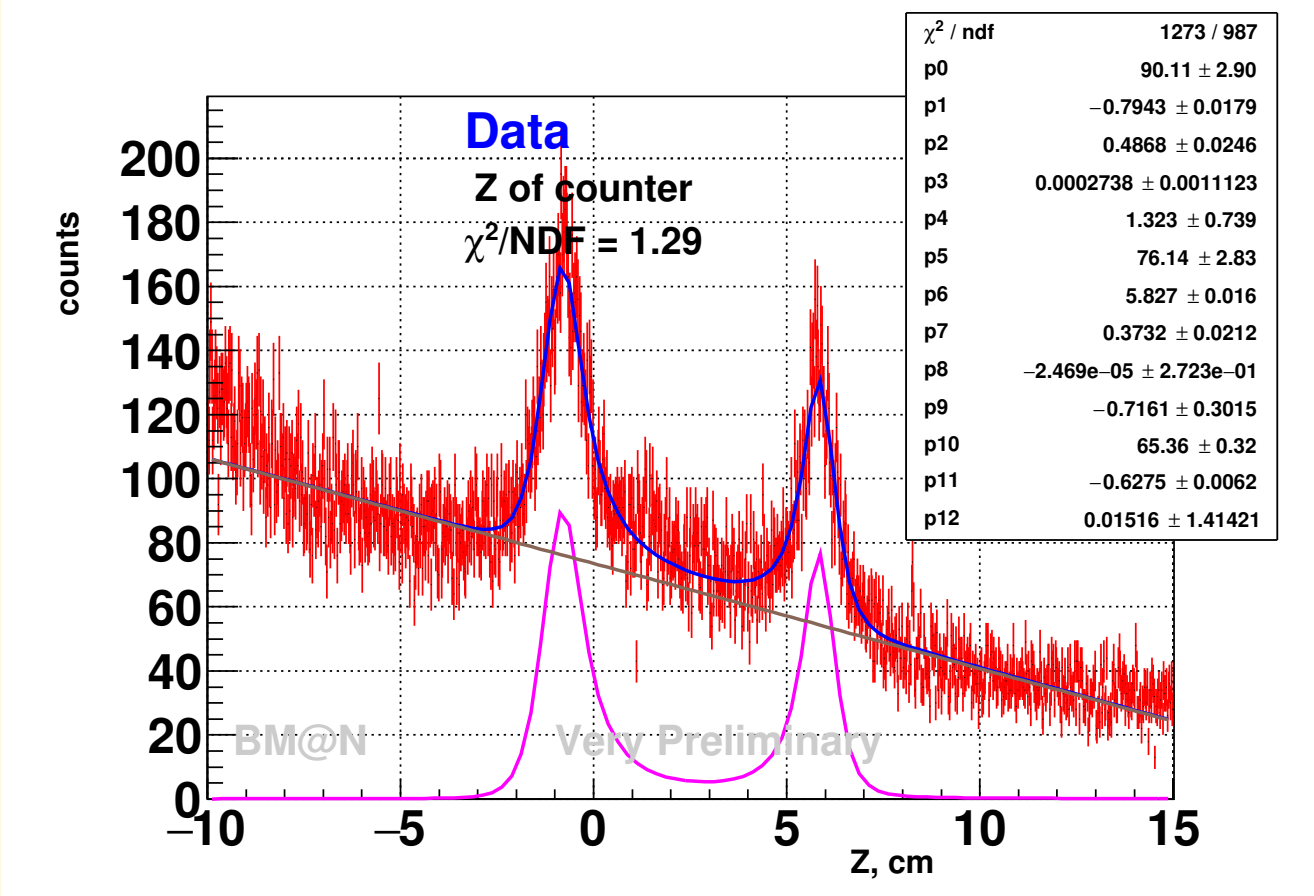
The primary vertices distribution in polar coordinate system.
The sharp peak at 6.56cm fit with the Gaussian function,
$\sigma = (2.3 \pm 0.02)\, mm$.

Z of the Primary Vertices. Wide Scale.



Z of the primary vertices distribution .

Fit: Z of the Primary Vertices



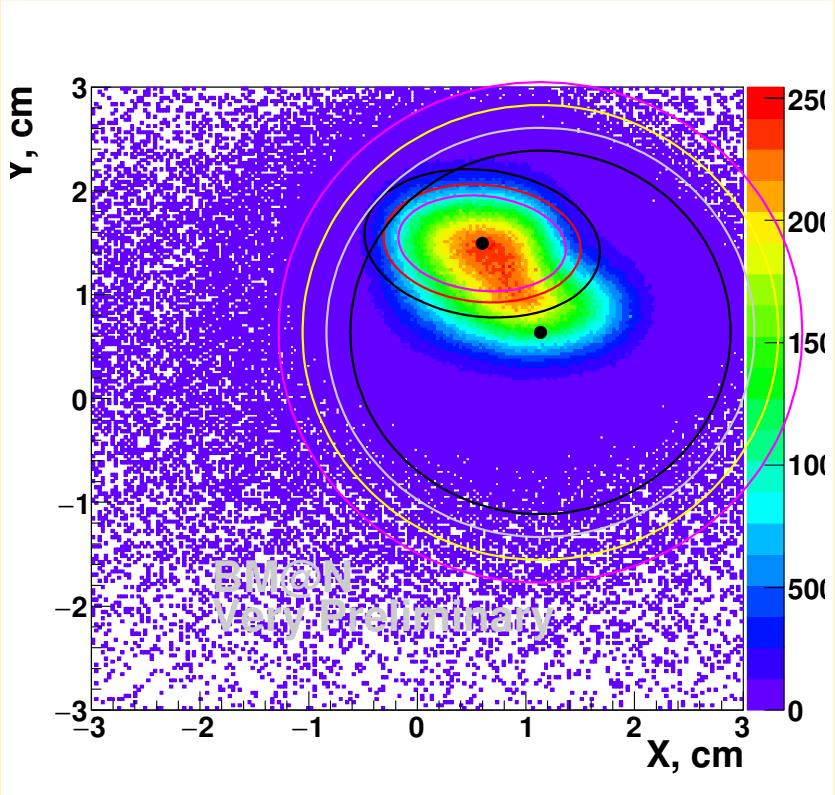
Z of the primary vertices distribution: - double peak at Z≈2cm.

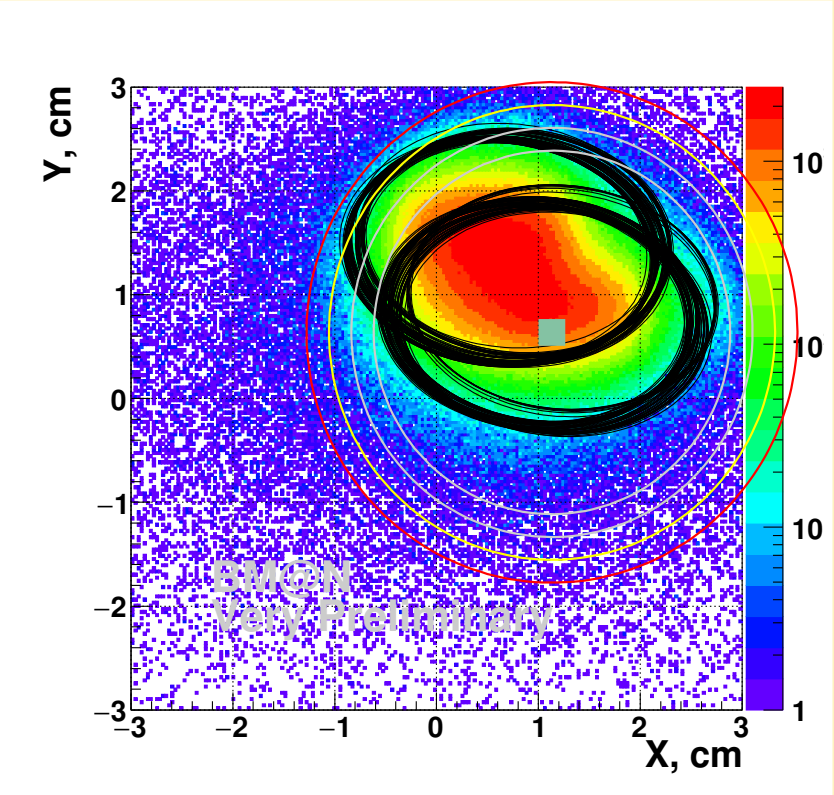
Each peak fit with the Gaussian function. The resolution is:

the first peak: $\sigma = (0.48 \pm 0.02)cm$

the second peak: $\sigma = (0.37 \pm 0.02)cm$

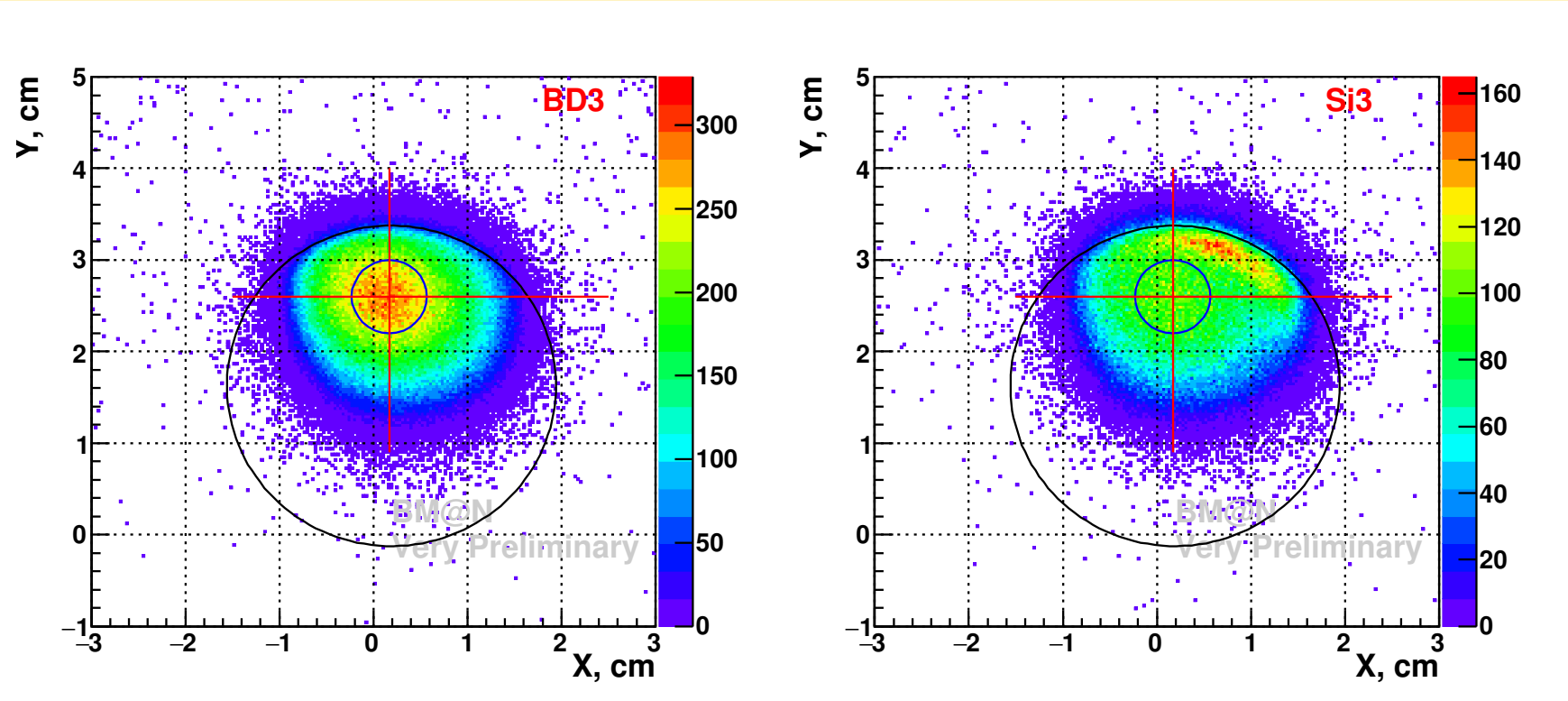
Luminosity evaluation for Run-6.





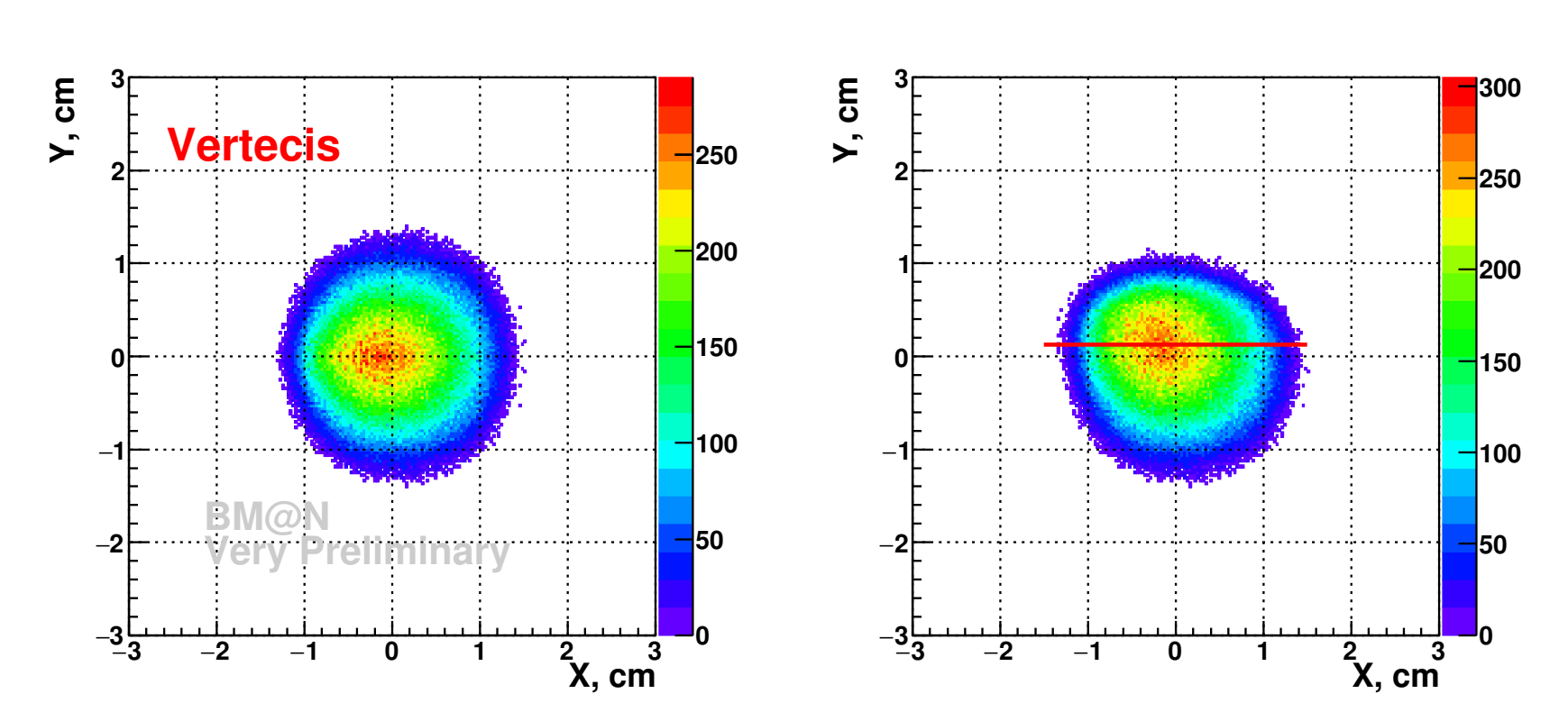
Ellipses : Black - 98%, Red - 85%, Blue - 75% of Vertices inside the ellipse
Target : Gray - $+1\sigma$, Yellow - $+2\sigma$, Magenta - $+3\sigma$
Left - individual run, Right - all runs in RUN-6.

Luminosity evaluation for Run-7, 1.



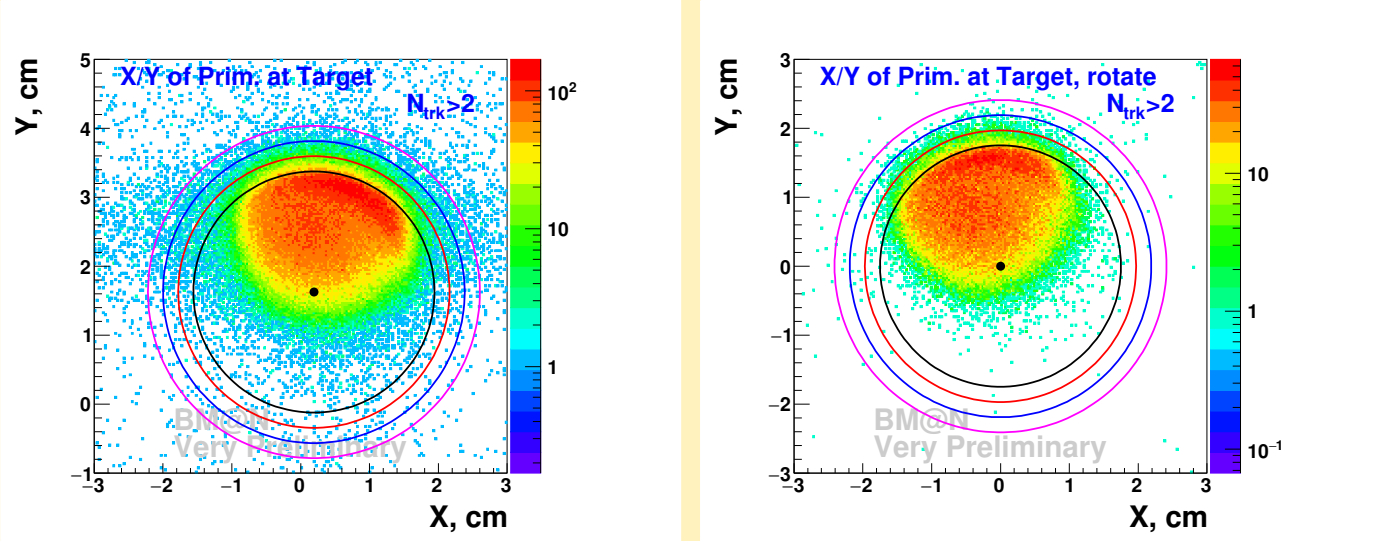
Run-7, X-Y of the primary vertices for different trigger conditions.
Left: $BD \geq 3$, Right: $Si \geq 3$

Luminosity evaluation for Run-7, 2.



Run-7, X-Y of the primary vertices for $BD \geq 3$ trigger condition.
Left: Bottom to Top reflection, Right: Bottom - Top asymmetry.
Top-Bottom difference : 27%, stat. uncertainty well below 1%.

Luminosity evaluation for Run-7, 3.



Run-7, X-Y of the primary vertices within $3 \cdot \sigma$ limits around the target. Left - original distribution, Right - distribution rotated around the target center.

CONCLUSION.

- Primary vertex reconstruction is operational.
- Precision of the reconstruction procedure:
  in radial direction : $\sigma = (2.3 \pm 0.02)\, mm$
  in Z direction : $\sigma = (3.7 \pm 0.2) mm$
- Luminosity in Run-6 - 98% of the beam located within $3 \cdot \sigma$ around the target edge.
- Luminosity in Run-7 - 83% of the beam located within $3 \cdot \sigma$ around the target edge.
- The systematic uncertainty estimated as 2% for both runs.