



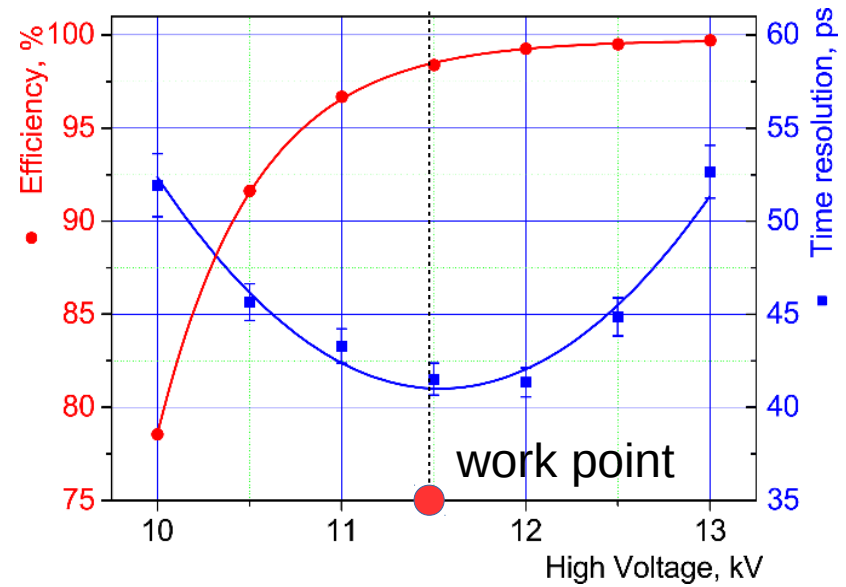
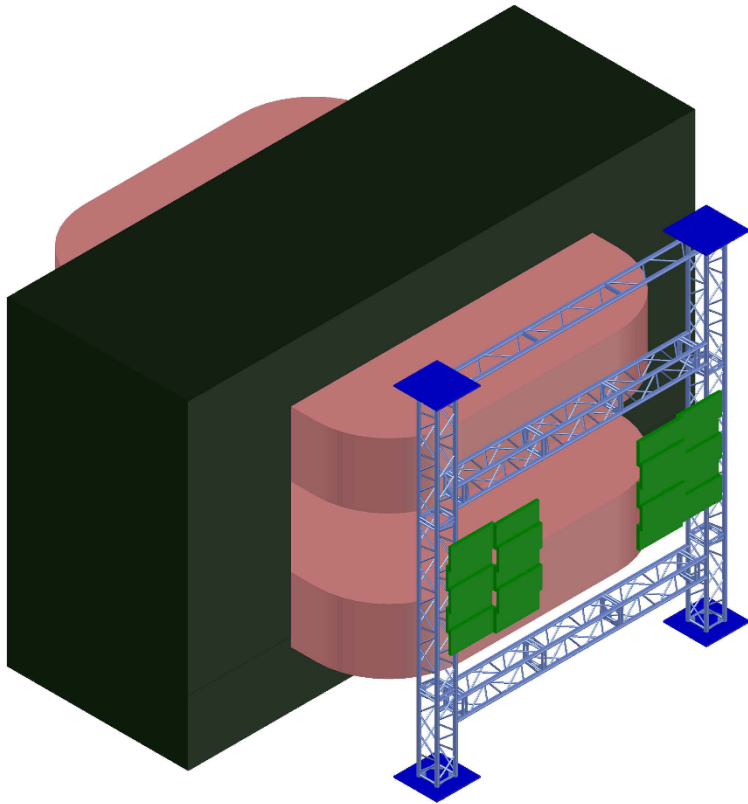
ToF400 performance/efficiency

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A.V. Dmitriev, M. M. Rummyantsev*, V. A. Plotnicov, Tracking group
for BM@N collaboration

Outlook

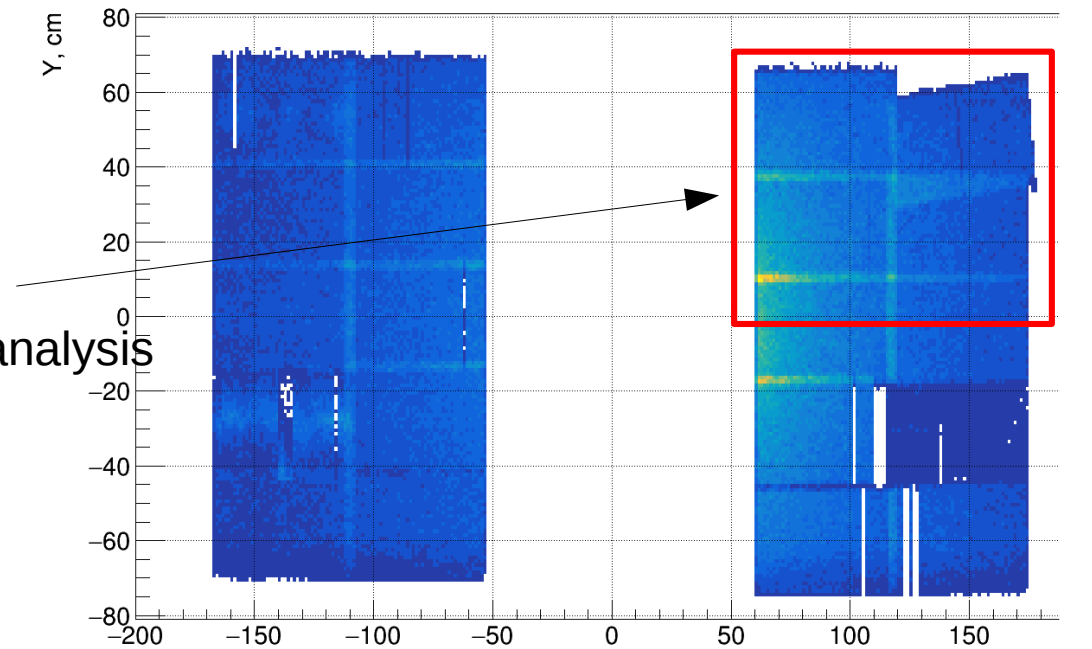
- ToF400 system designe
- Performance of the detectors
- Matching algorithm
- Efficiency of matching Gem \rightarrow ToF /
Gem+Csc \rightarrow ToF / Gem+Csc+Dch- \rightarrow ToF
- Conclusion

ToF400 overview

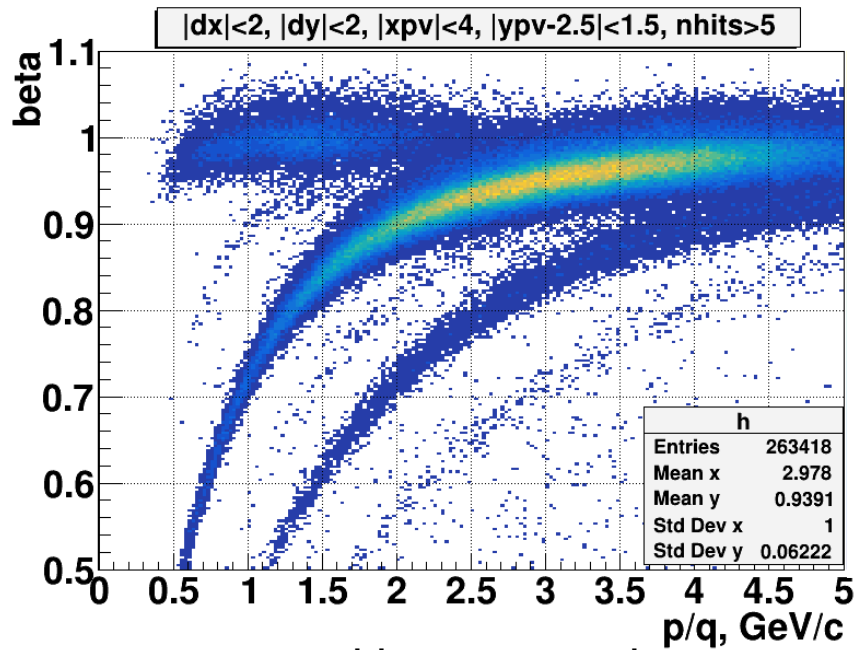


- GEM covers only the upper ($Y > 0$) part of the space
- CSC cover only left side of the ToF system

=> Area for analysis

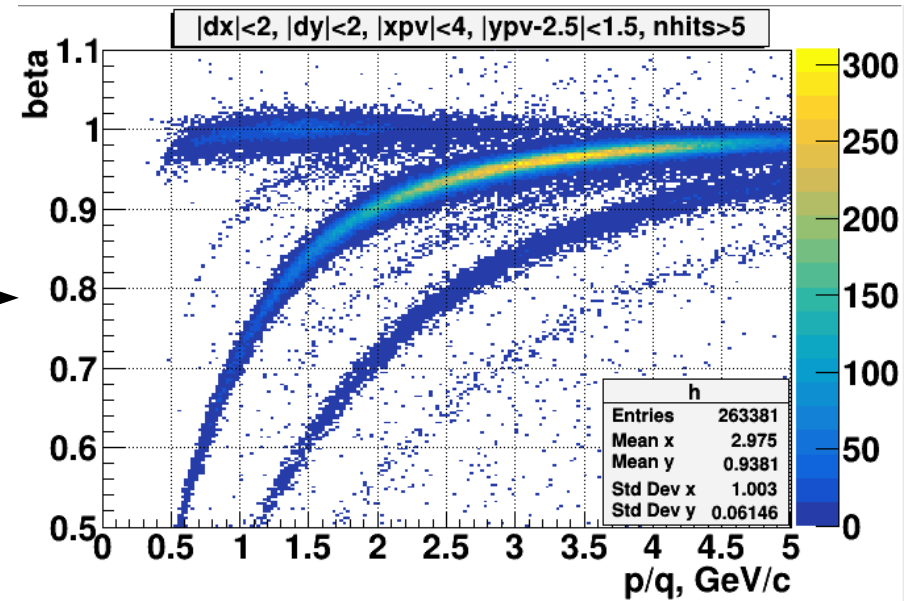


ToF400 time resolution



Without correction.
Time resolution ~350 ps.

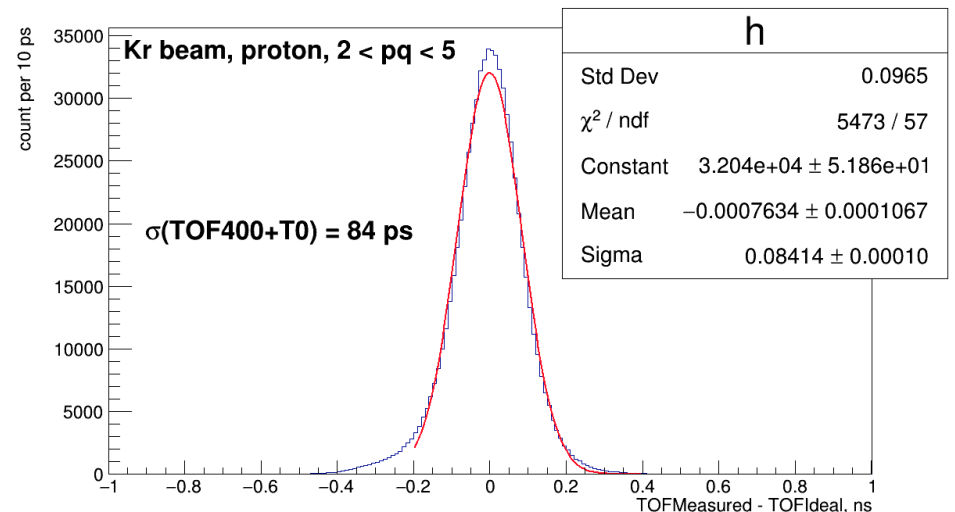
Digits to Hits



With correction.
Time resolution ~ 100 ps

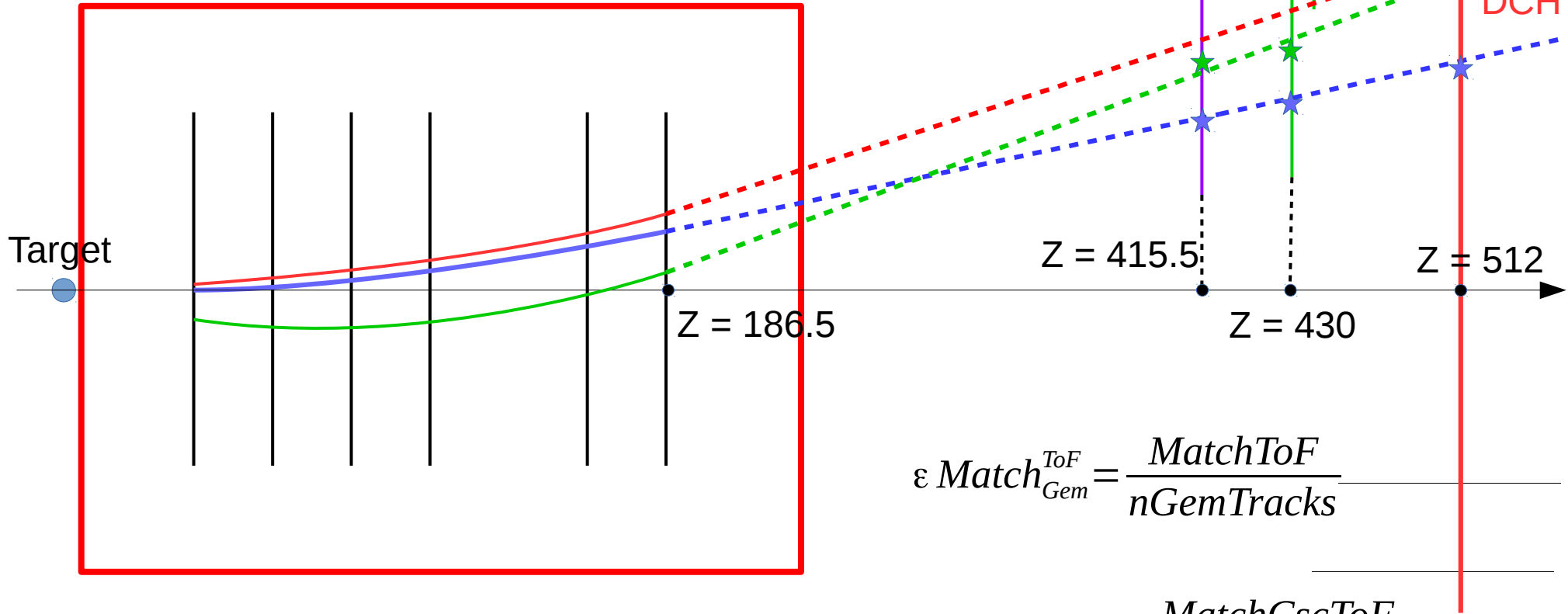
Step of correction

- INL correction of readout electronics
- Time-Amplitud (Slewing) correction FEE
- Correction of the Left-Right time dependency for right Y coordinate calculation
- Time tuning on proton mass in each strip



Matching Efficiency of ToF400

GEMs at the pole of magnet



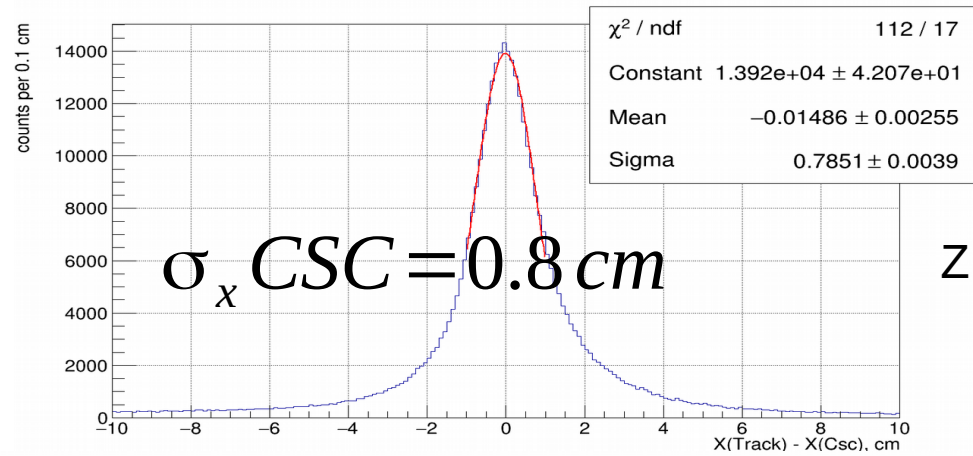
1. Extrapolate track to the Z of the Csc/ToF/DCH.
2. Looking for nearest hit in the gate $\pm 3\sigma$.
3. Each hit may be matched only to one track.

$$\epsilon Match_{Gem}^{ToF} = \frac{MatchToF}{nGemTracks}$$

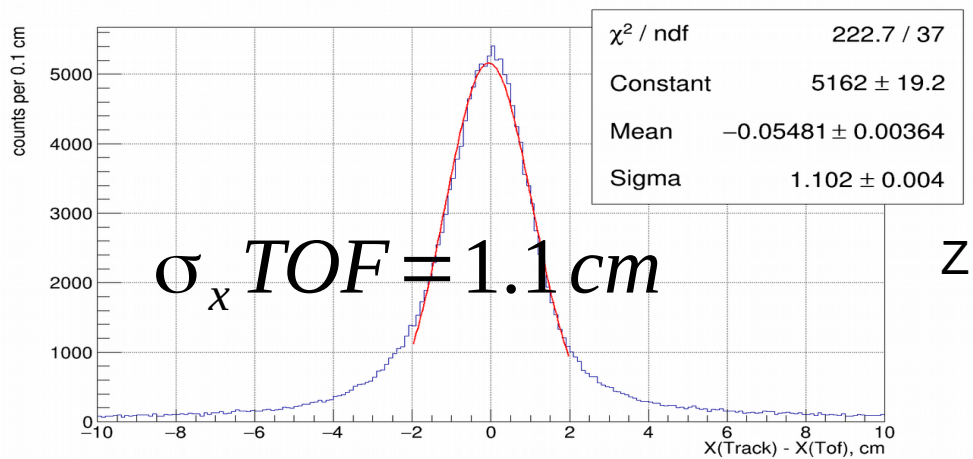
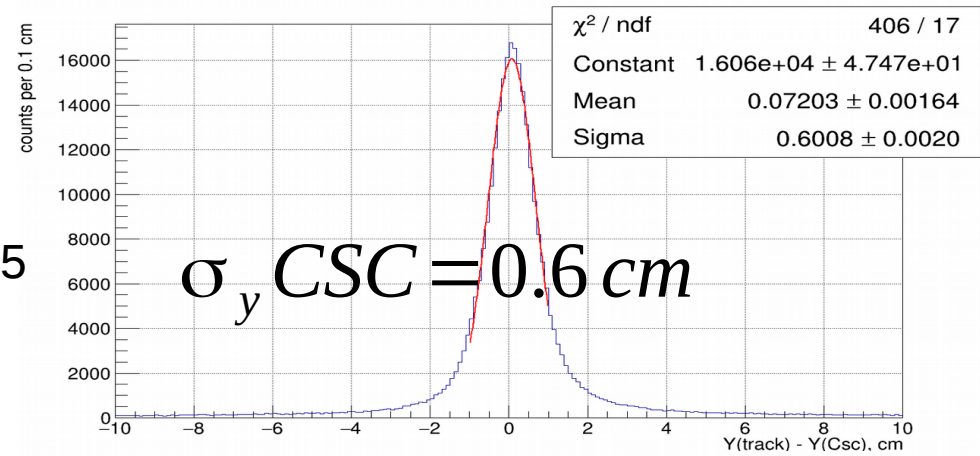
$$\epsilon Match_{GemCsc}^{ToF} = \frac{MatchCscToF}{MatchCsc}$$

$$\epsilon Match_{GemCscDch}^{ToF} = \frac{MatchCscToFDch}{MatchCscDch}$$

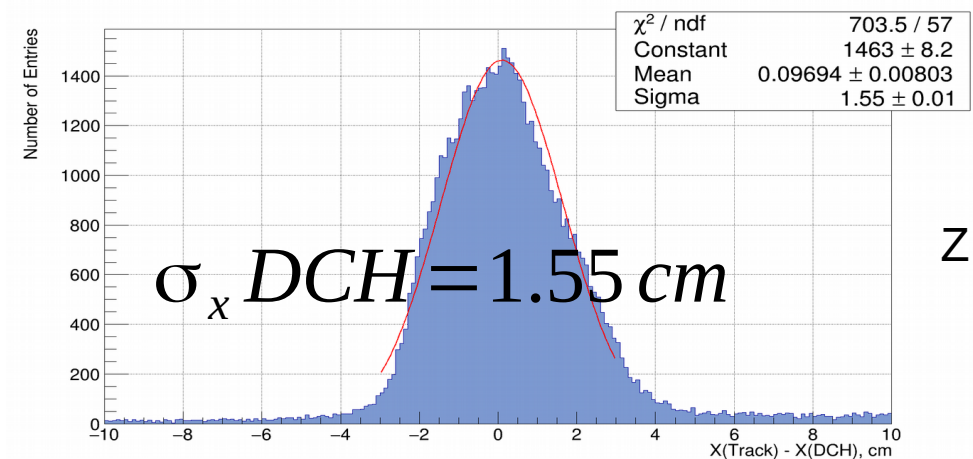
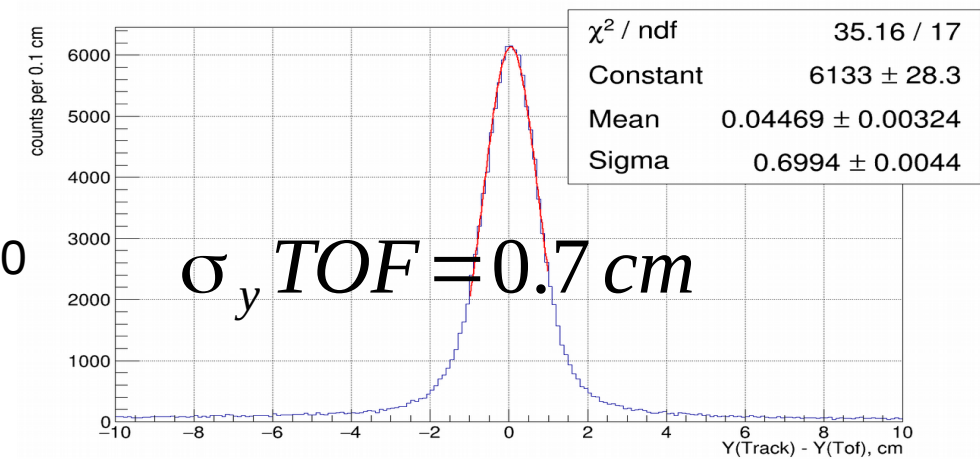
Deviations of Csc, ToF400 and DCH relative to GEM track



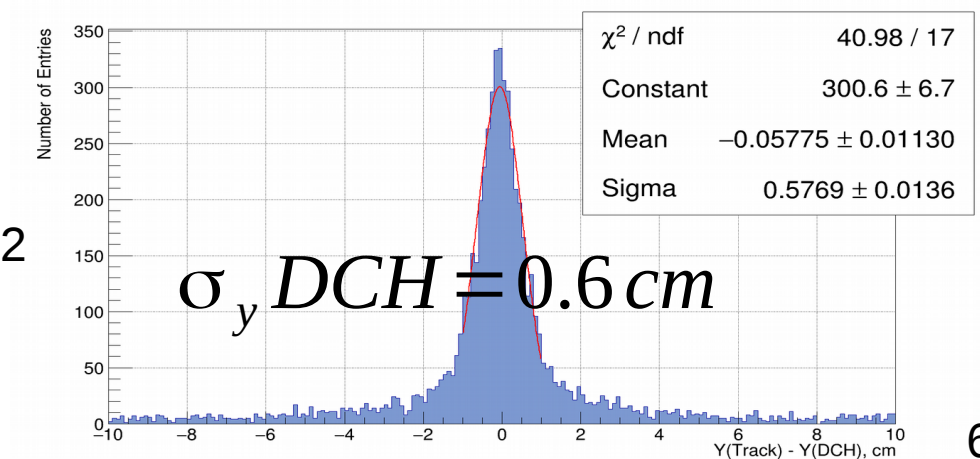
Z = 415



Z = 430



Z = 512

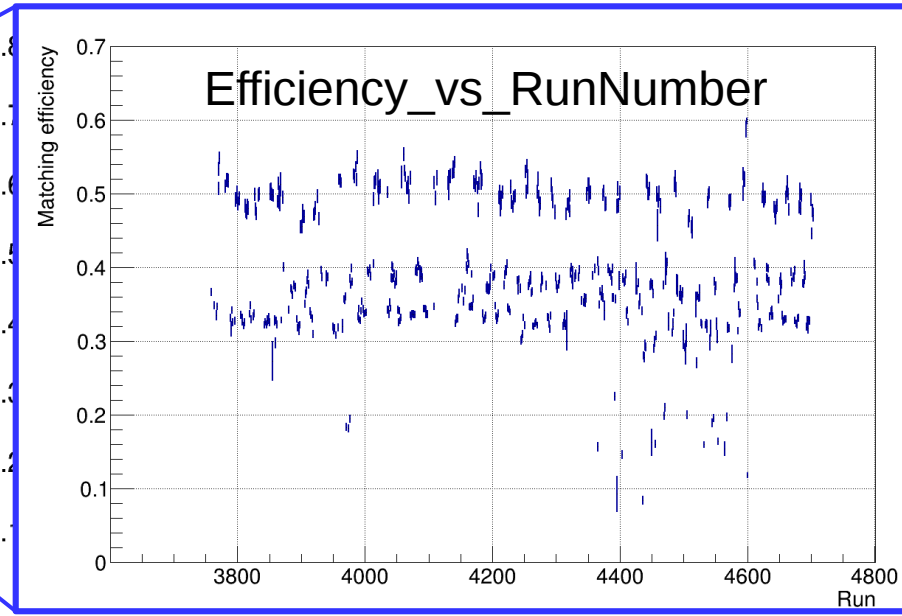
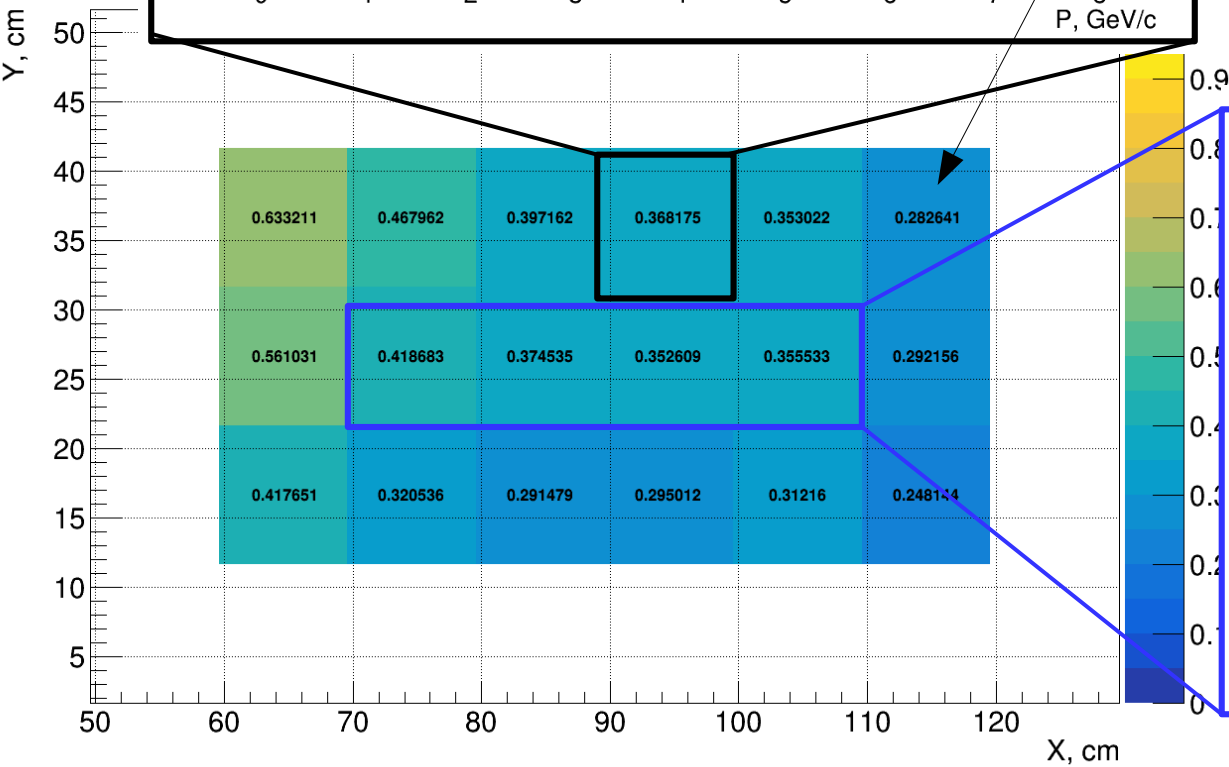
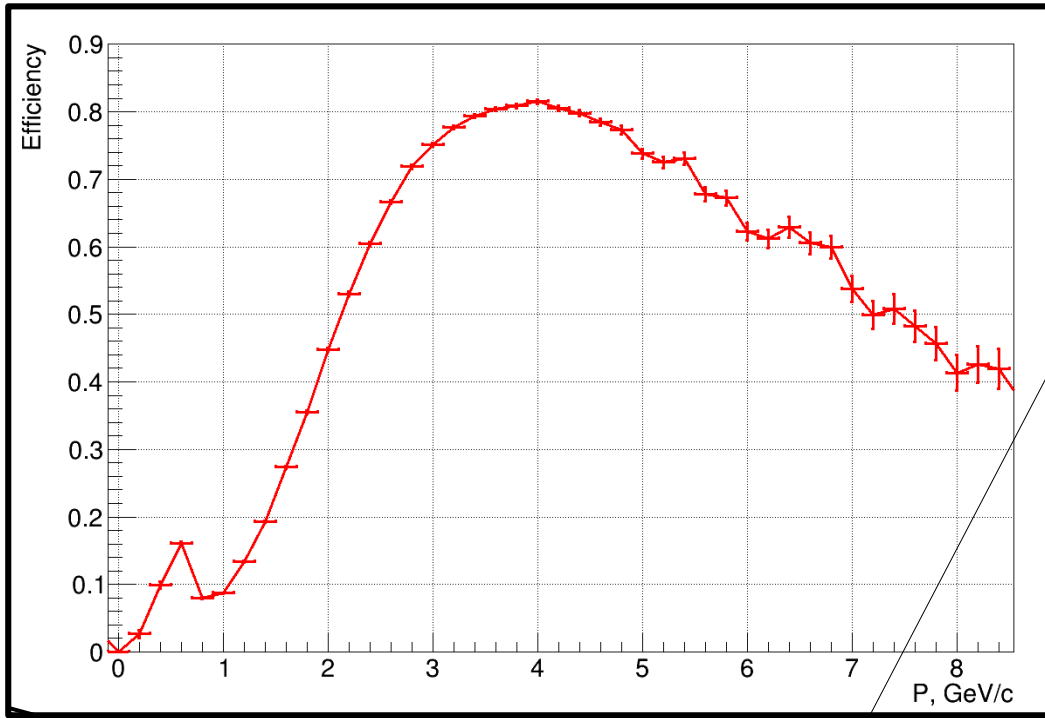


Matching Efficiency of Gem track to ToF400

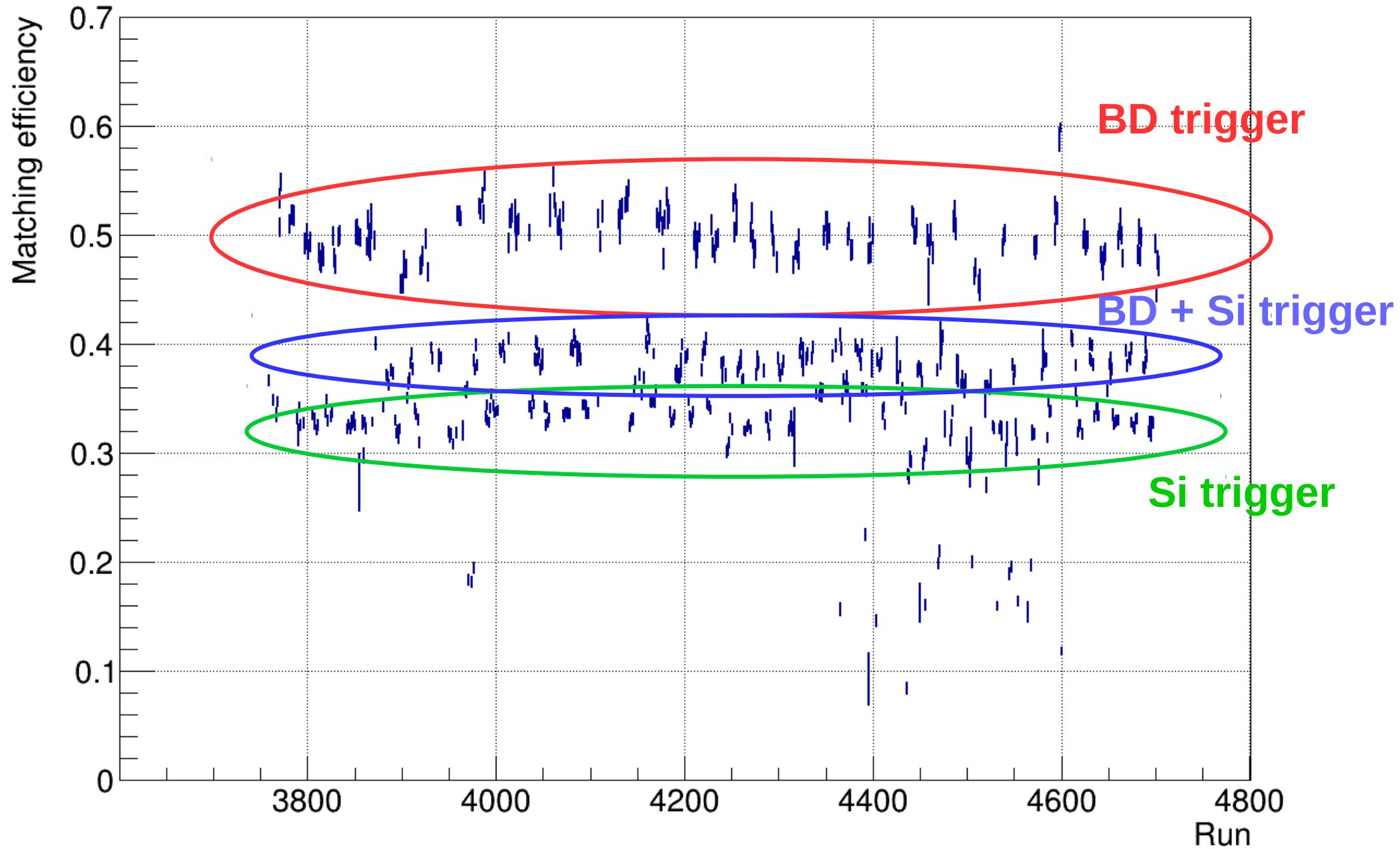
$$\epsilon_{Match} = \epsilon_{ToF} * \epsilon_{algorithm}$$

$$\epsilon_{ToF} = f(HV) = 0.98 (HV = 11.5 kV)$$

$\epsilon_{algorithm} = f(p)$ depend from the track extrapolation (errors) and matching algorithm (gate for looking for hit, rules of choosing from several hits)

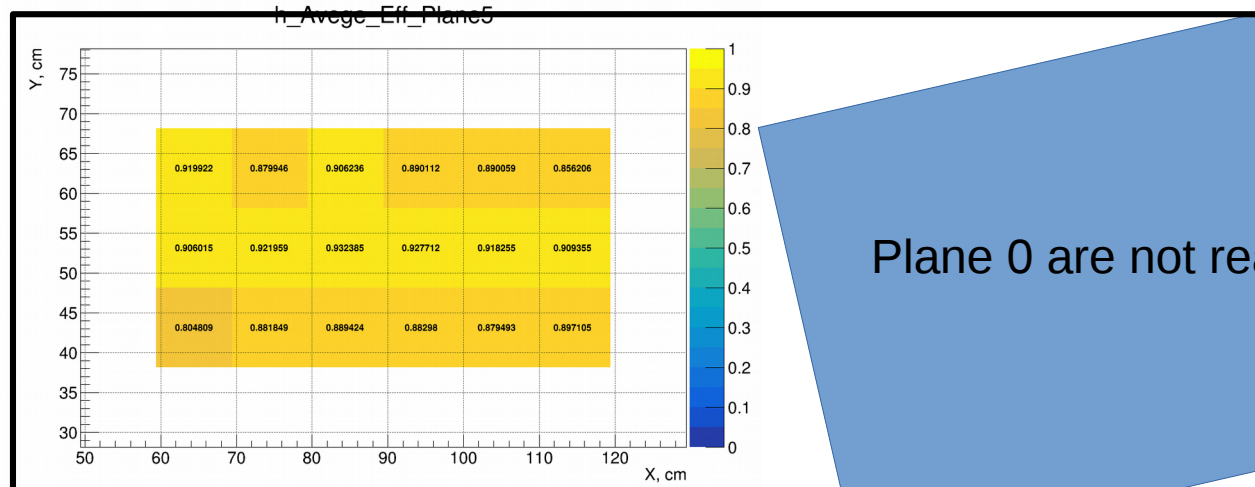


Matching Efficiency of Gem track to ToF400

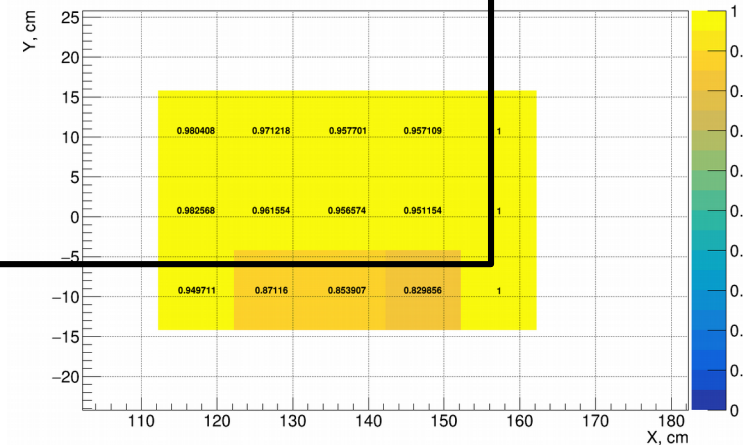
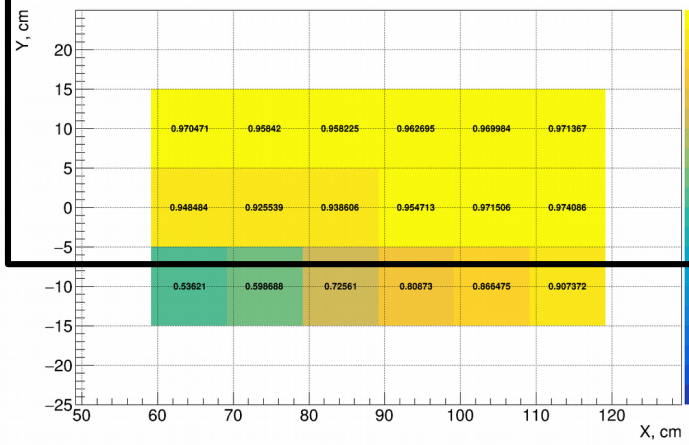
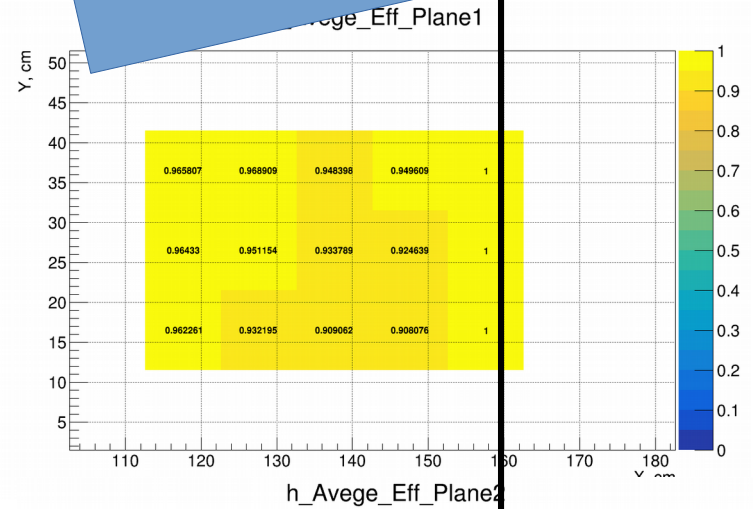
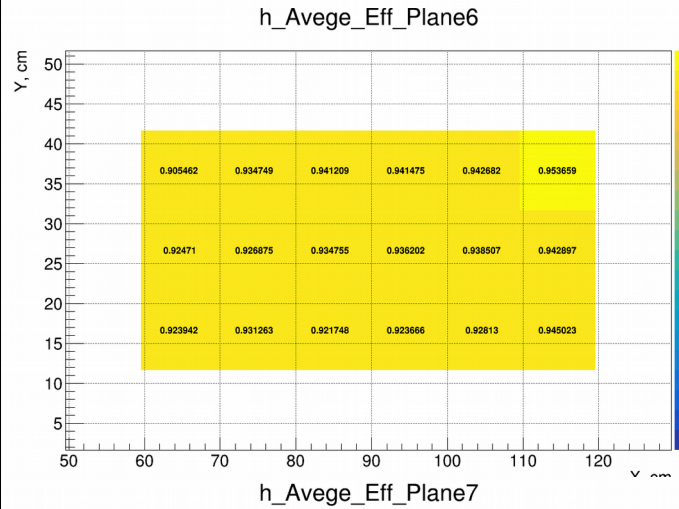


Matching Efficiency of Gem+Csc track to ToF400

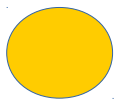
GEM covered space



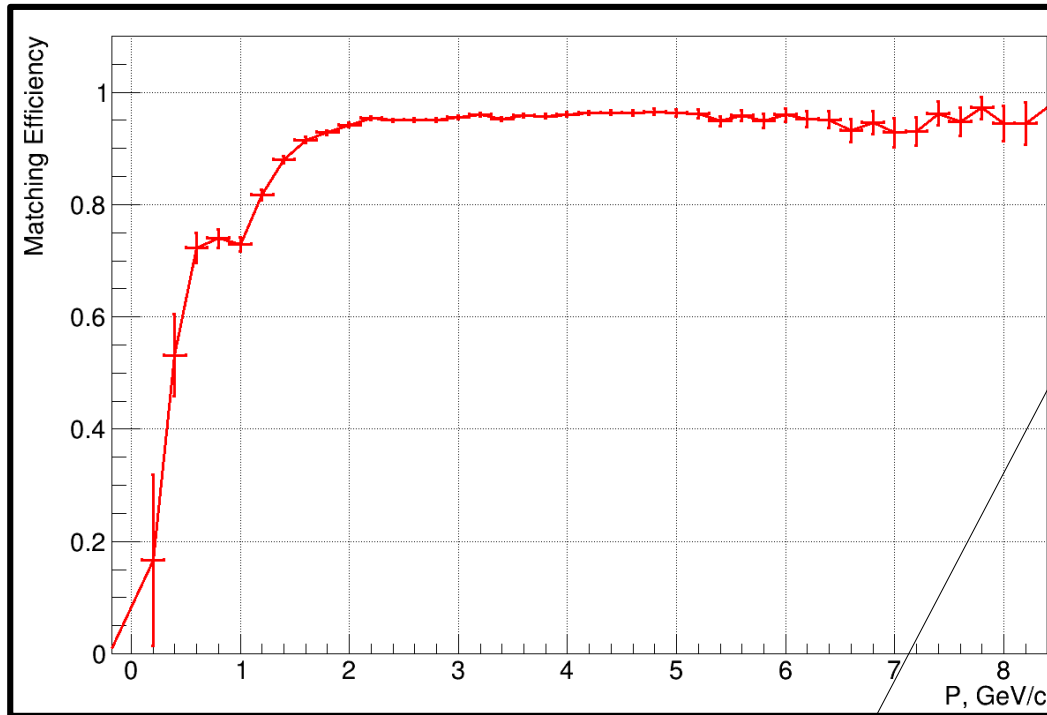
Plane 0 are not ready yet



beam



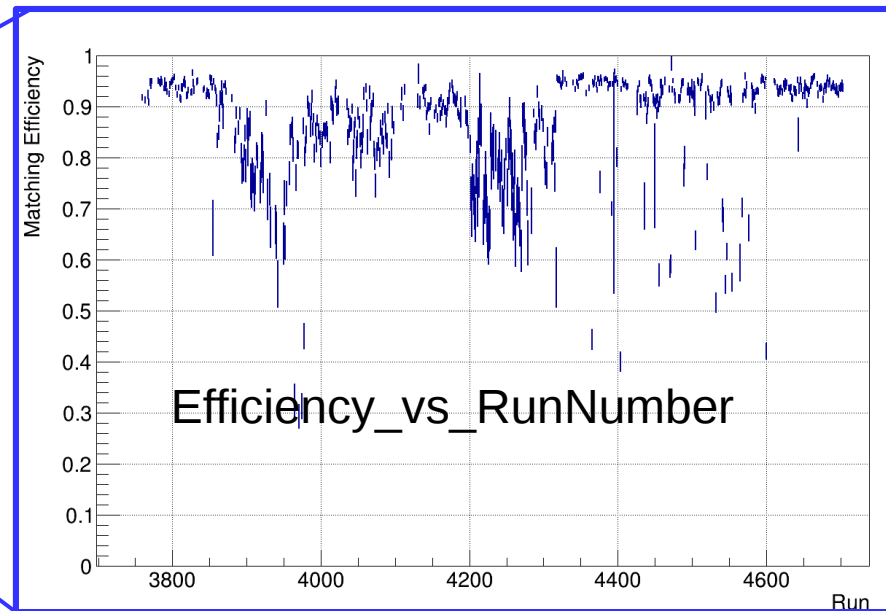
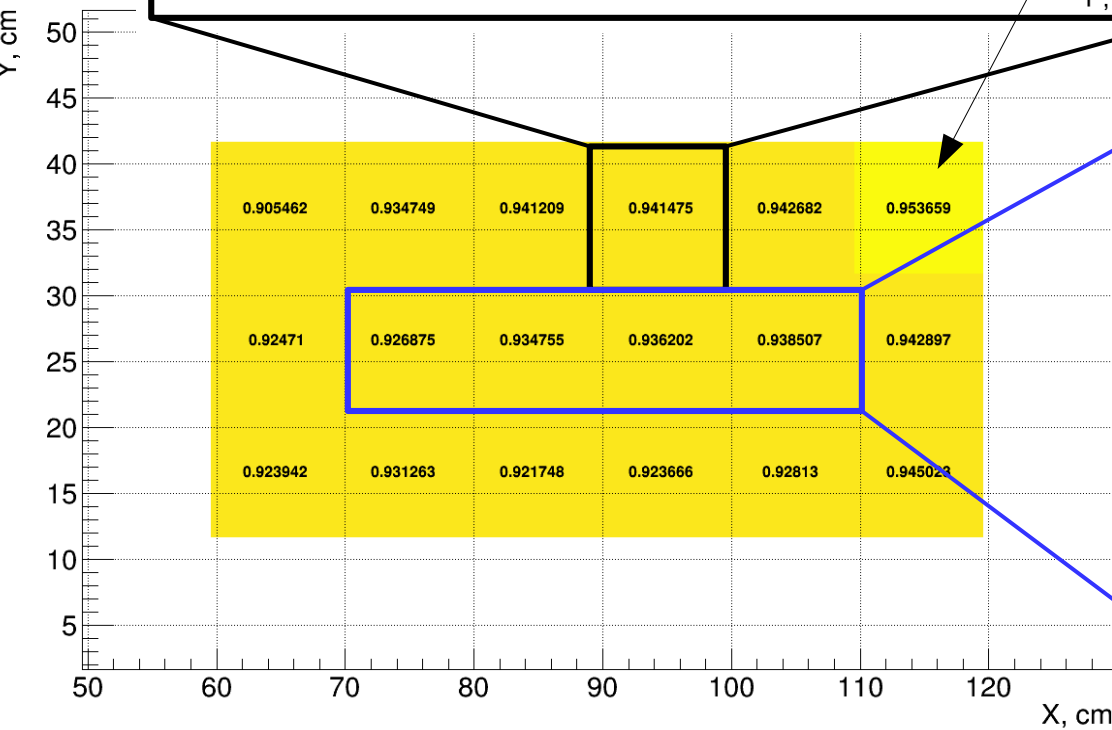
Matching Efficiency of Gem+Csc track to ToF400



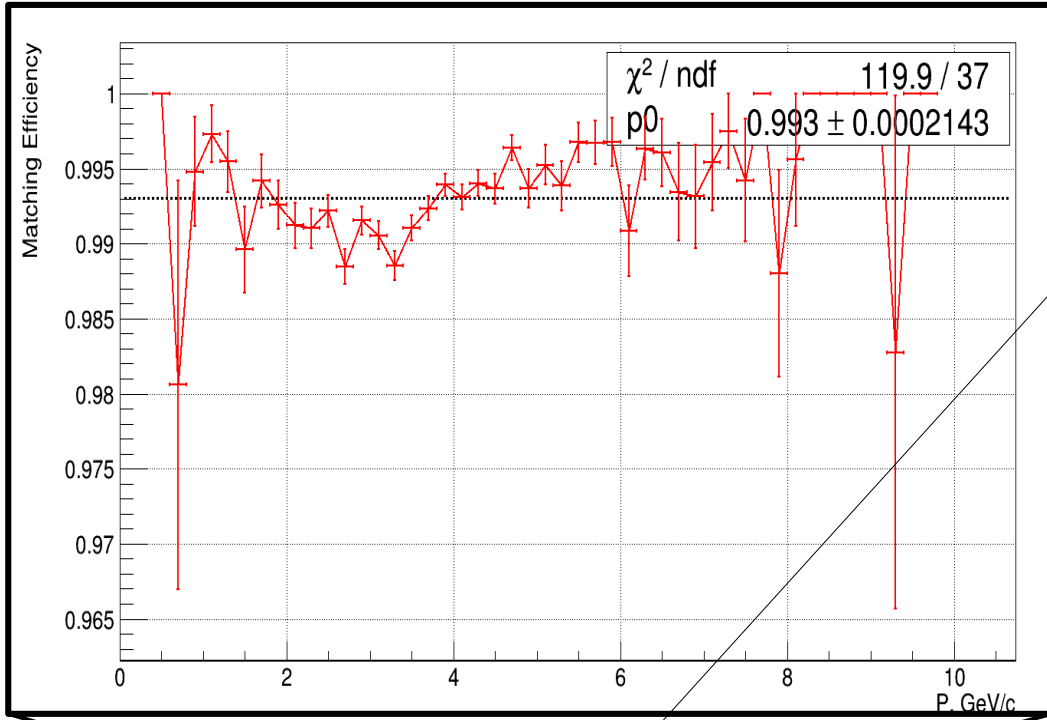
$$\epsilon_{Match} = \epsilon_{ToF} * \epsilon_{algorithm}$$

$$\epsilon_{ToF} = f(HV) = 0.98 (HV = 11.5 kV)$$

$\epsilon_{algorithm} = f(p)$ depend from the track extrapolation (errors) and matching algorithm (gate for looking for hit, rules of choosing from several hits)



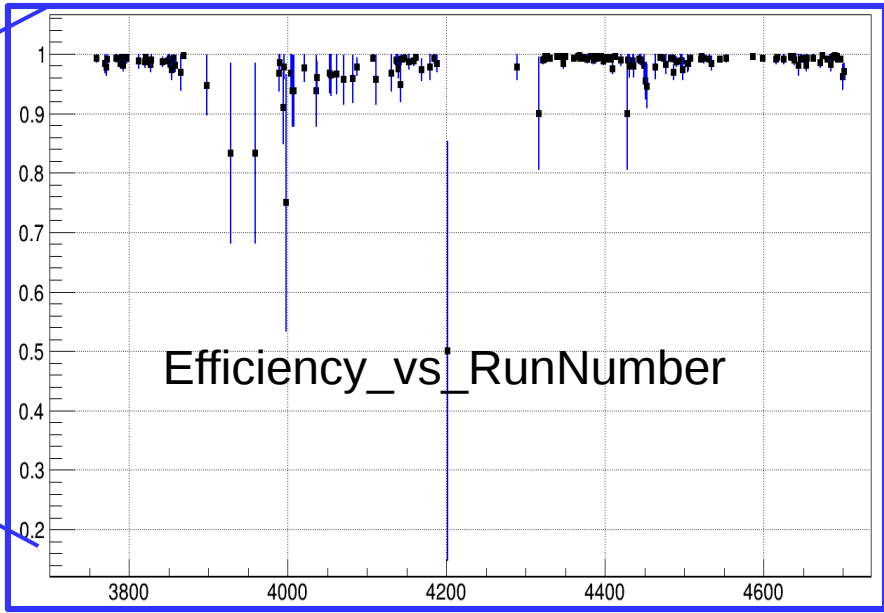
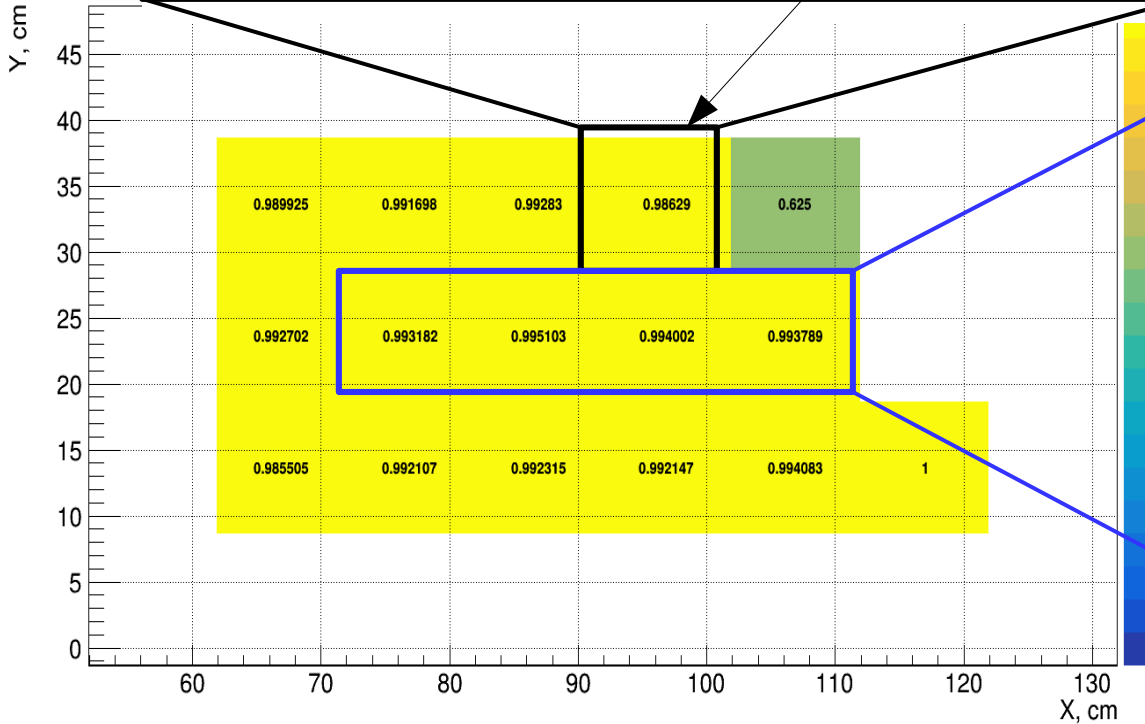
Matching Efficiency of Gem+Csc+Dch track to ToF400



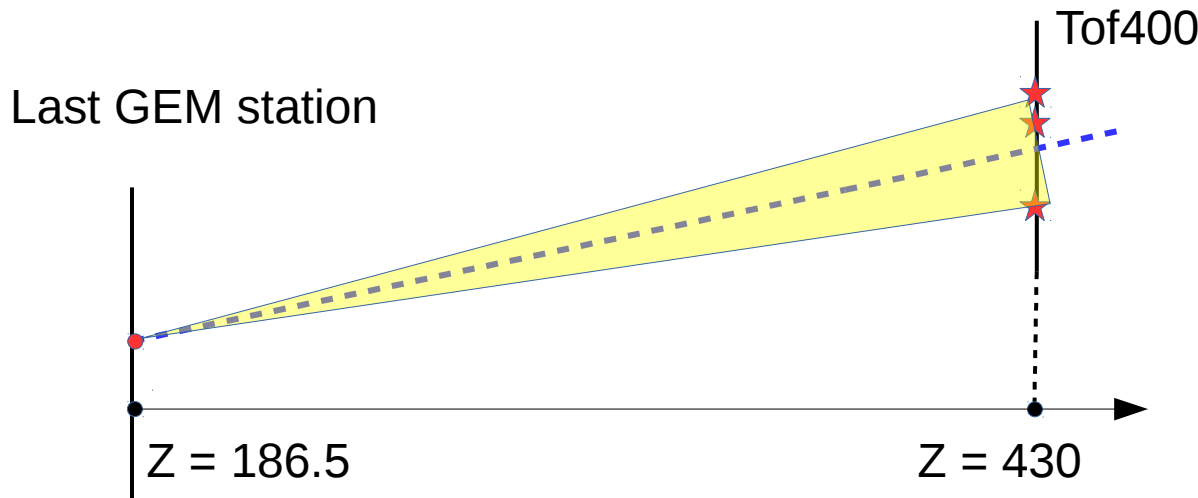
$$\epsilon_{Match} = \epsilon_{ToF} * \epsilon_{algorithm}$$

$$\epsilon_{algorithm} = f(p) \approx 1$$

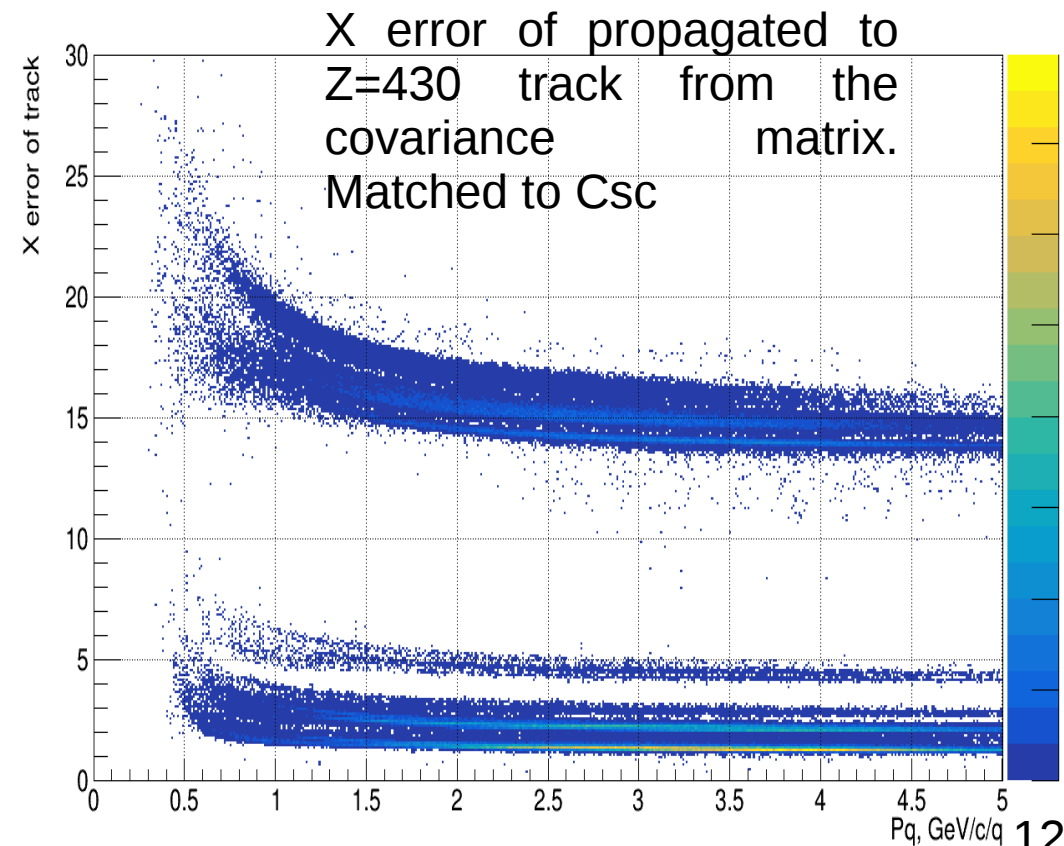
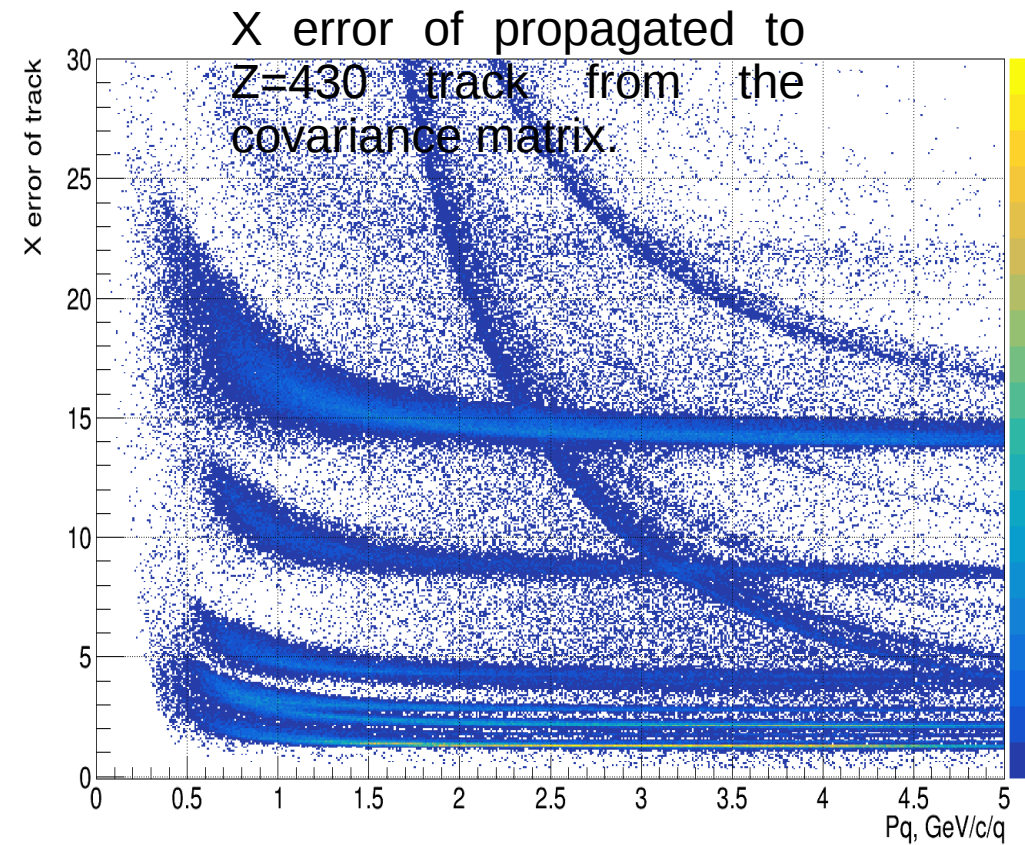
$$\epsilon_{ToF} = f(HV) > 0.99 (HV = 11.5 \text{ kV})$$



Matching Efficiency of track to ToF400



Different bands may be different particle (for propagation commonly used Proton pdg) or various combination of GEM station used in a track. The tracking and matching algorithms should be improved.



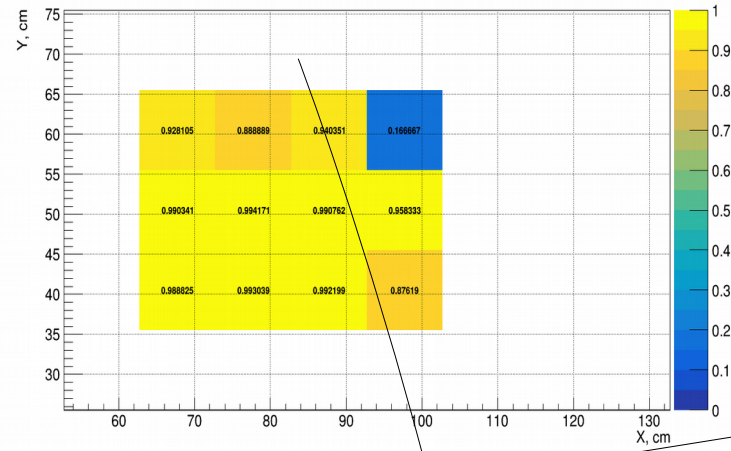
Conclusion

- The 90% of TOF400 area are working. The broken channels/detectors of TOF400 should be fixed.
- System performance as expected (time resolution < 80 ps, efficiency $> 98\%$ declared in ToF400 TDR).
- Matching algorithm should be improved. Add hypothesis about different types of particles during propagation.
- Tracking algorithm should be improved.

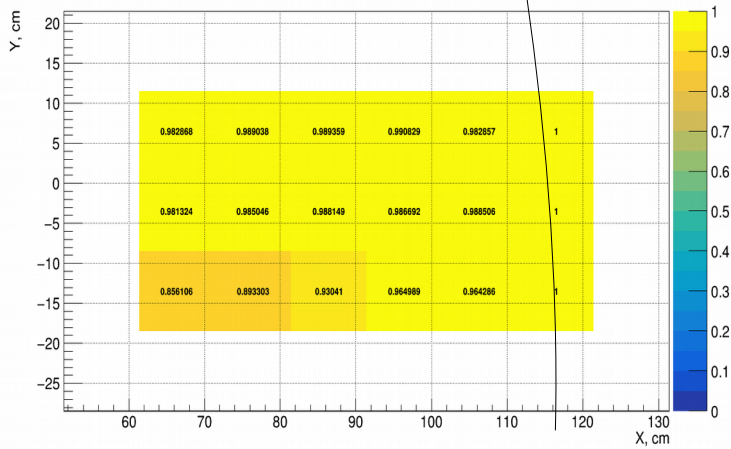
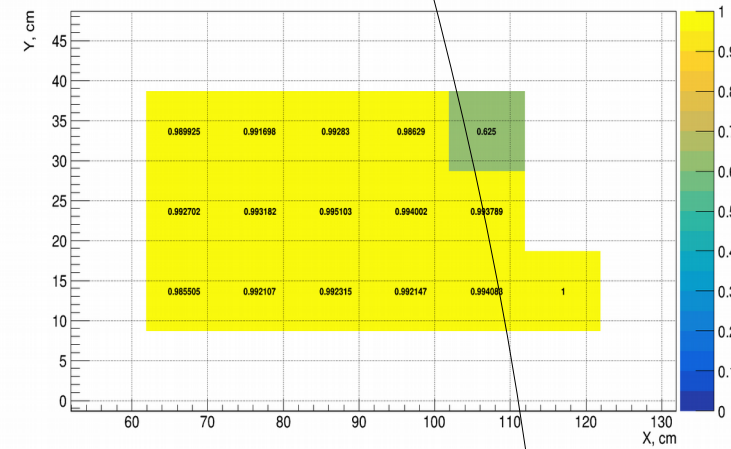
Thank you for attention.

Backup

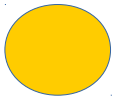
Matching Efficiency of Gem+Csc+DCH track to ToF400



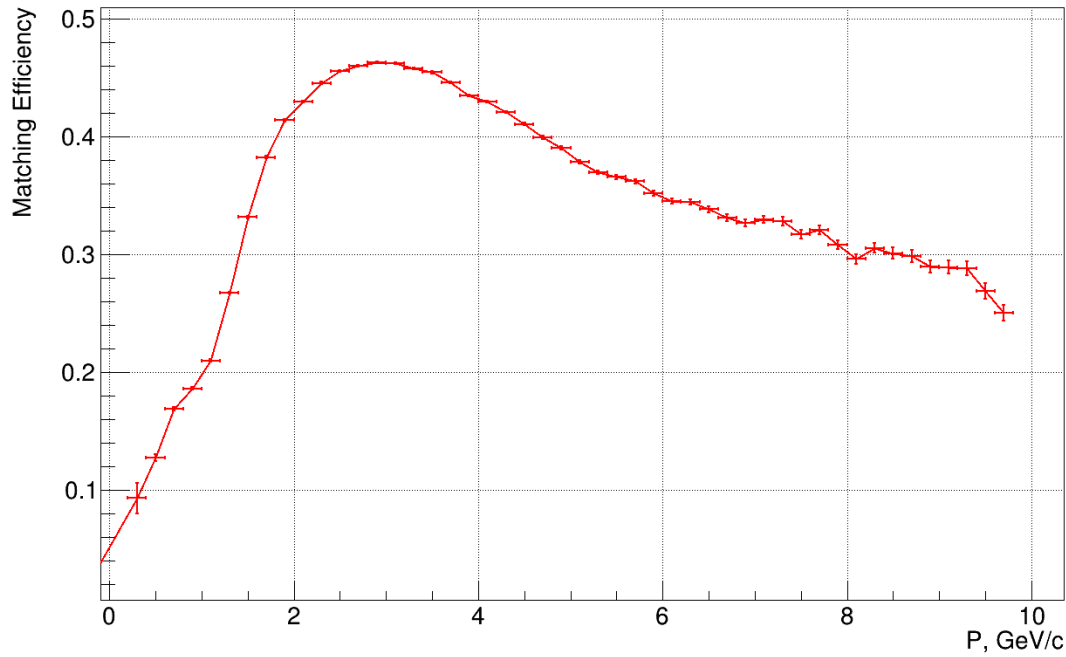
Edge of the DCH active area



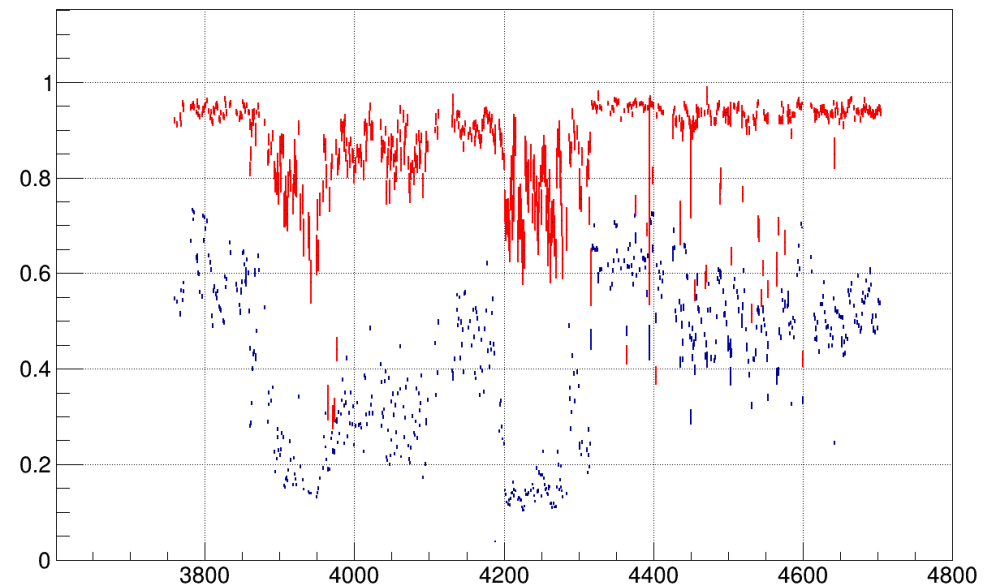
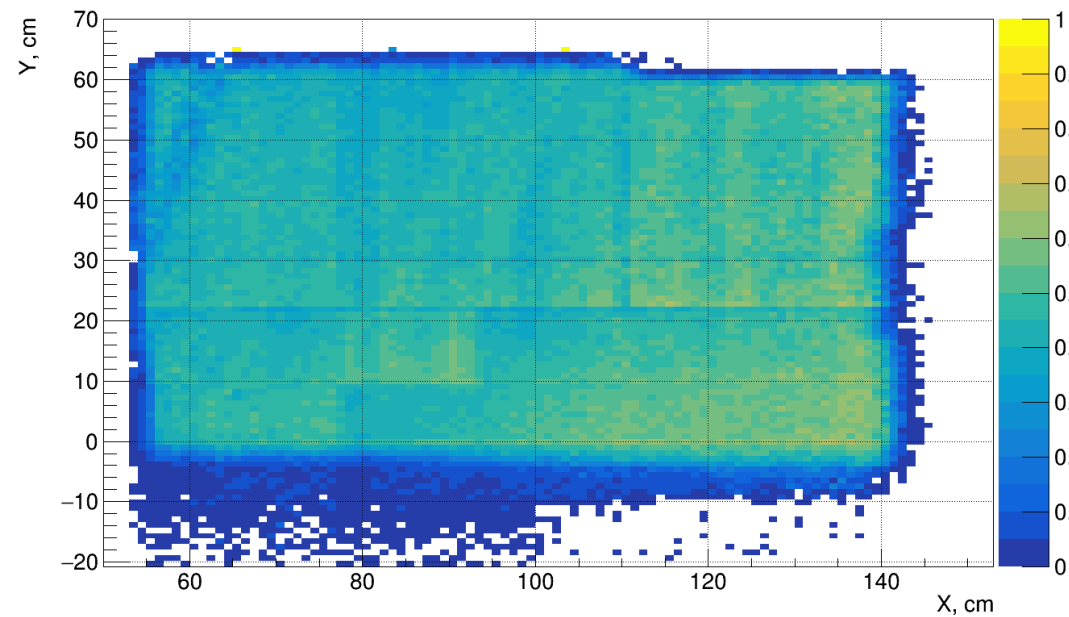
beam



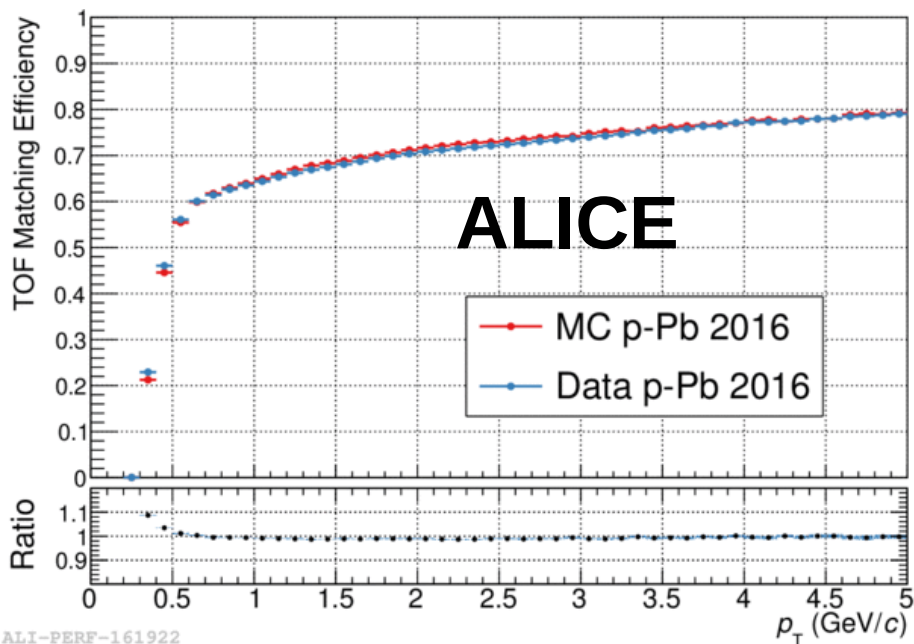
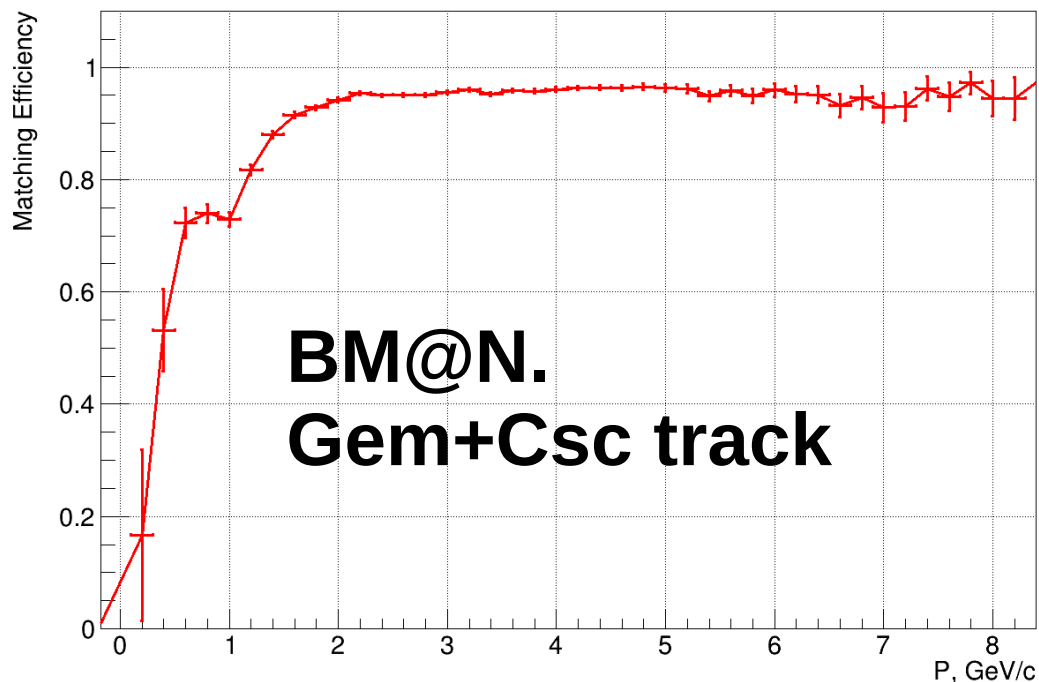
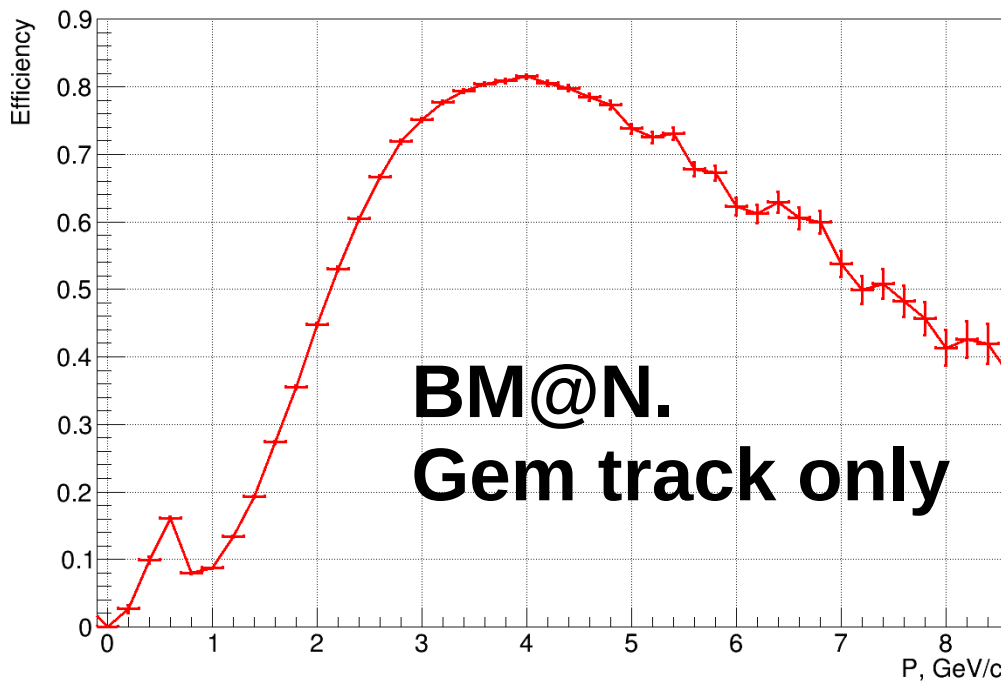
Matching Efficiency of Gem+ToF track to Csc



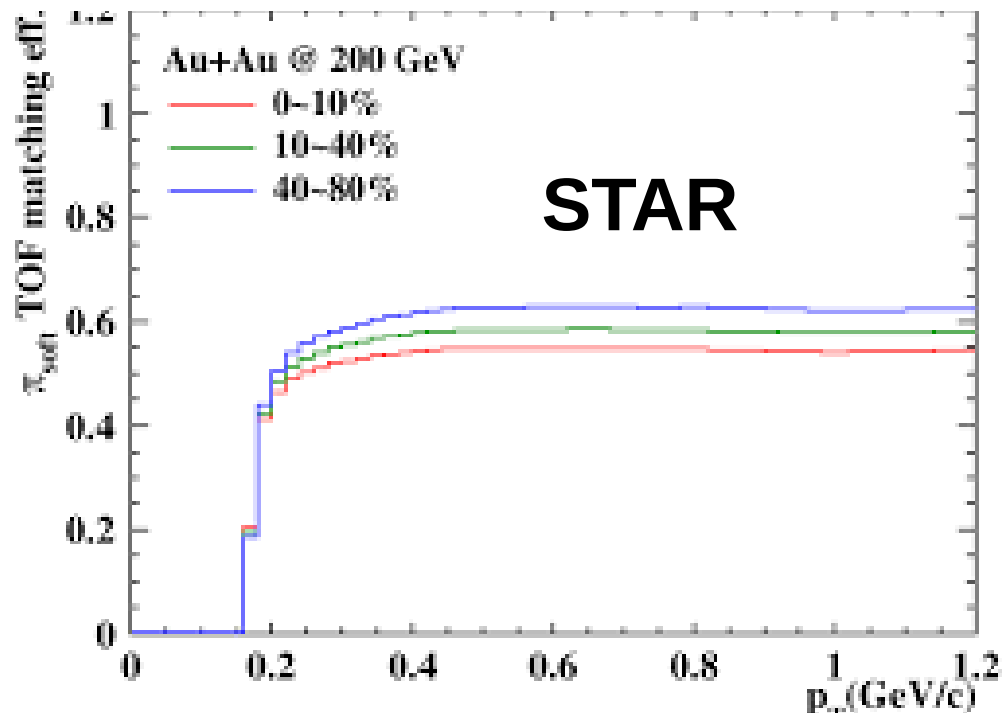
Efficiency_vs_RunNumber
ToF relative to Gem+Csc
Csc relative to Gem+ToF



Compare ToF Matching Efficiency for different experiments



ALI-PERF-161922



Time correction on mass of proton

