MCS in LH2 (field-off)

Content

- TOF distribution comparison in data/MC has improved
- Compatible MC/data reconstruction in EMR & KL would mean associated PID discriminating variables DS of absorber can be trained with MC,
  - EMR reconstruction behave differently in data/MC
  - Energy propagation methods have been implemented and tested (Bethe-Bloch)
  - A TOF scan across all 3 momentum settings was performed for a momentum dependent evaluation of EMR range reconstruction in data/MC

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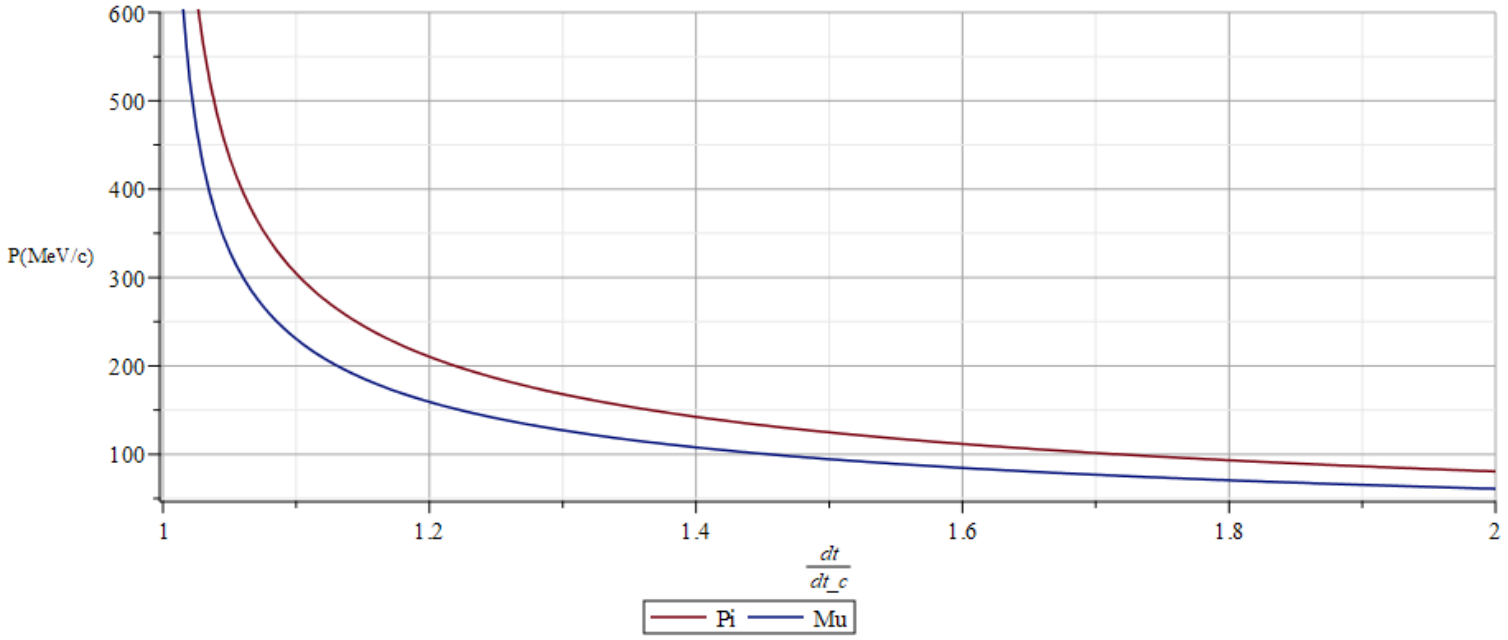
Momentum selection



1. TOF distribution of each run is plotted
2. Peaks are located with Roots TSpectrum (Gaussian approx.)
3. Each run is associated with an e-peak TOF value.
4. Each track's momentum is calculated using the electron time corresponding to that run.

$$P_z = \frac{m}{\sqrt{(\frac{dt}{dt_e})^2 - 1}}$$

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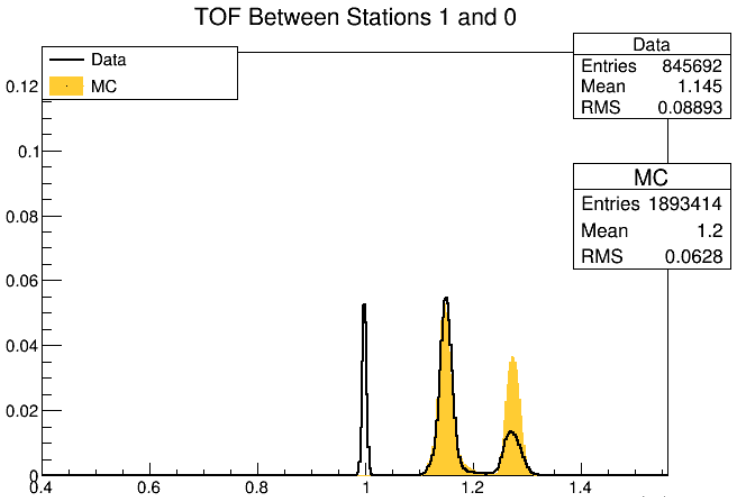
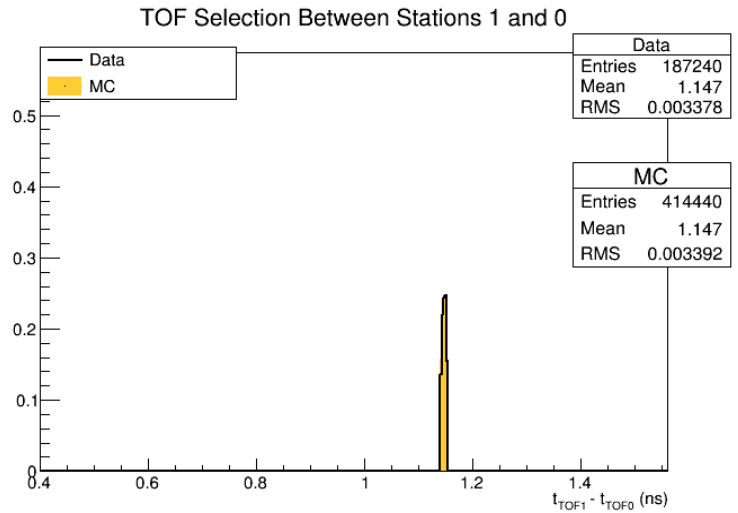
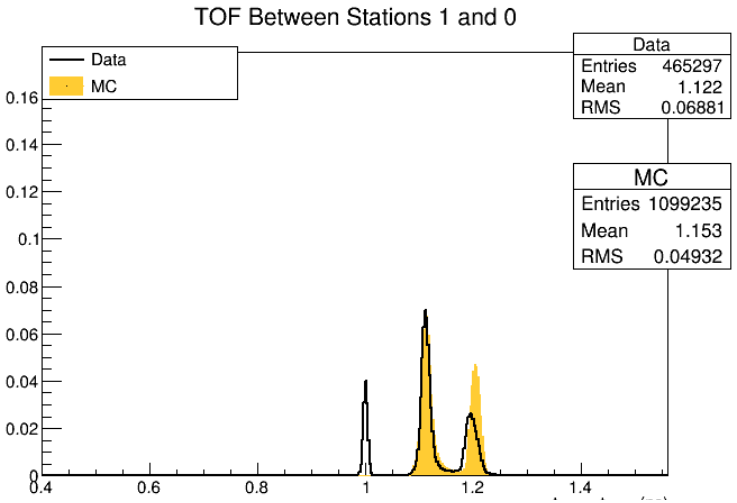
TOF10 MC/data

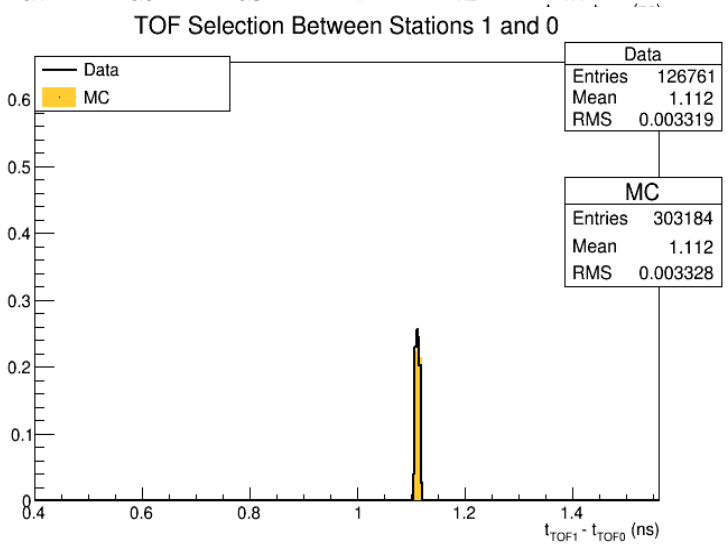
170 MeV/c



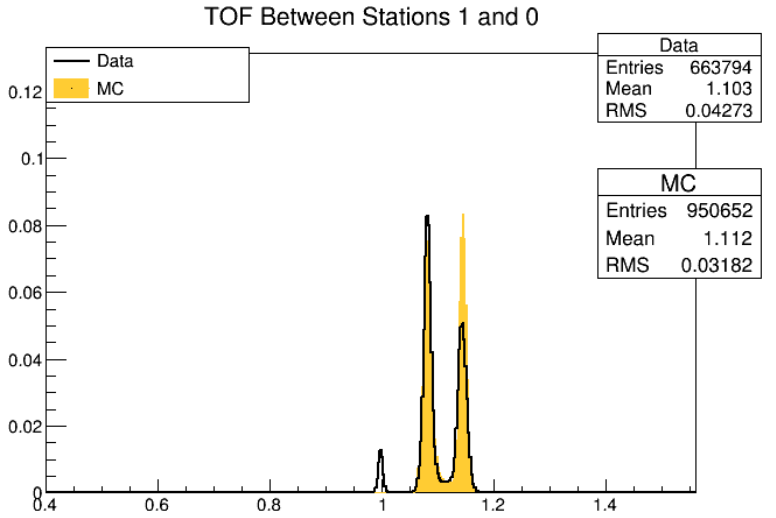


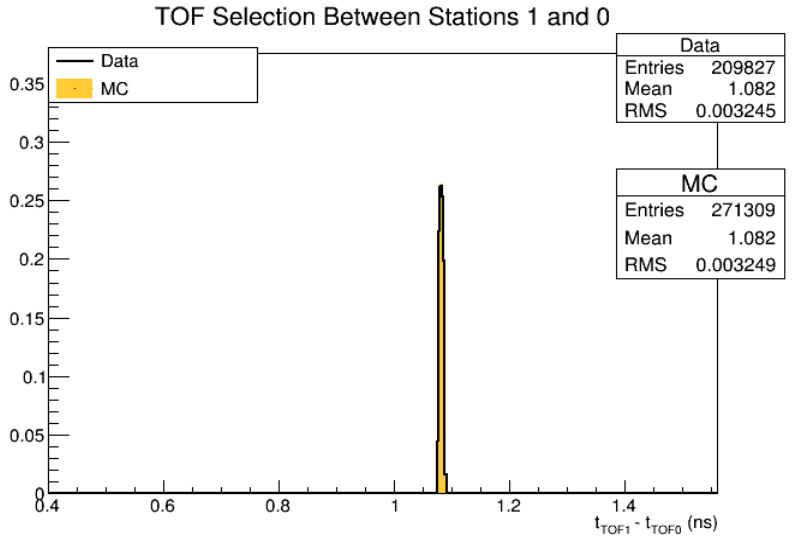
200 MeV/c





240 MeV/c

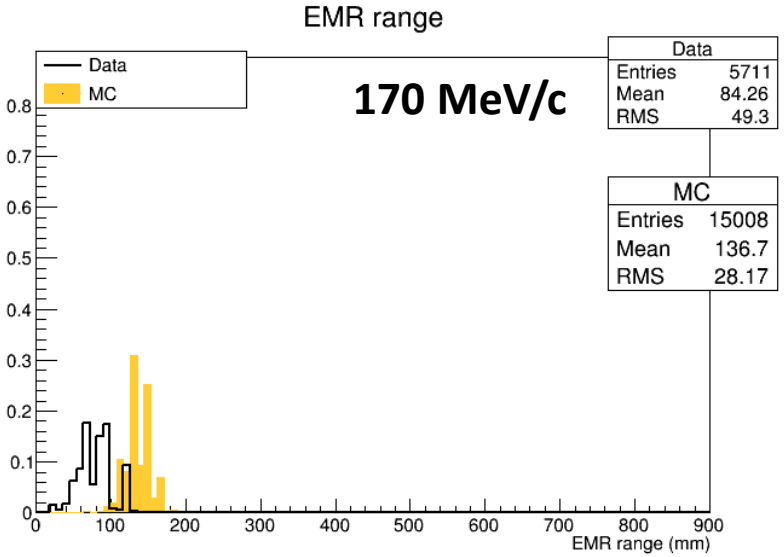


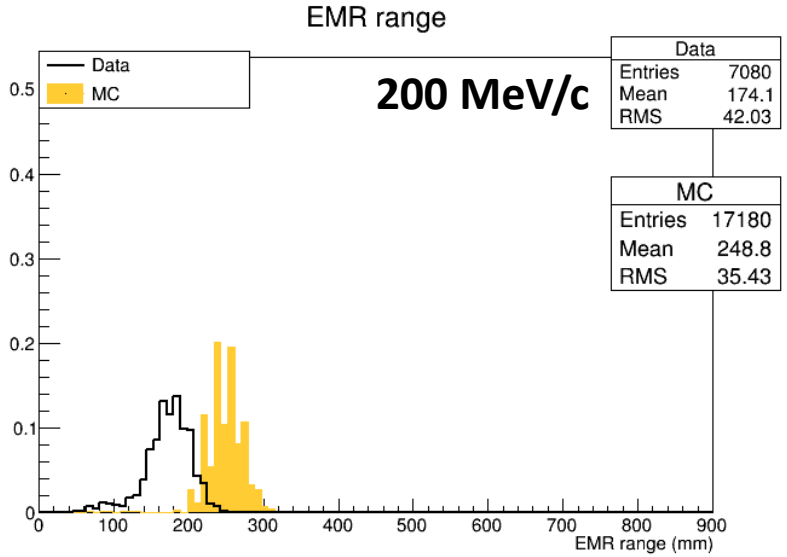


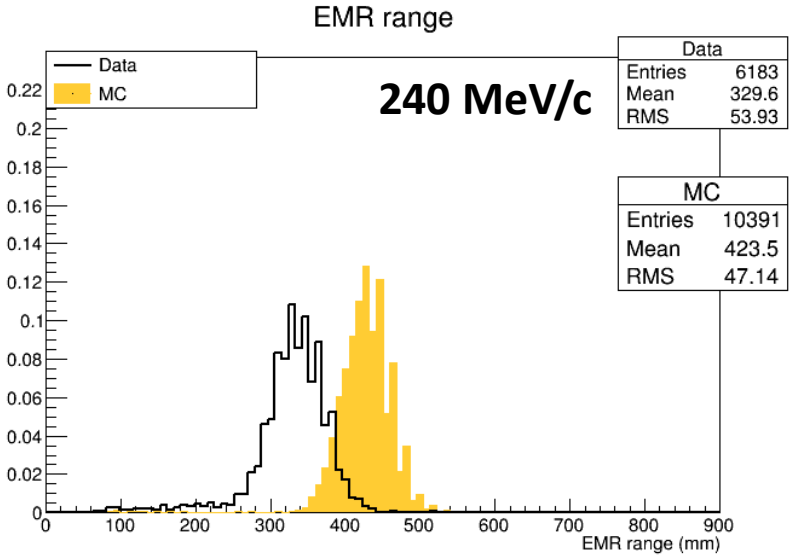
MCS in LH2 (field-off)

EMR

- Incompatible EMR range in data/MC could result from dissimilar momenta
  - TOF selection is eliminated as a source of momenta discrepancy between data/MC
  - Energy evolution DS of absorber could be a source
- KL response to real/simulated beam is compatible (Energy dependent)
- Differences in particle species populations could also cause a different response in data/MC. There are significantly more pions in MC, (but that would – probably - cause the opposite discrepancy)







MCS in LH2 (field-off)

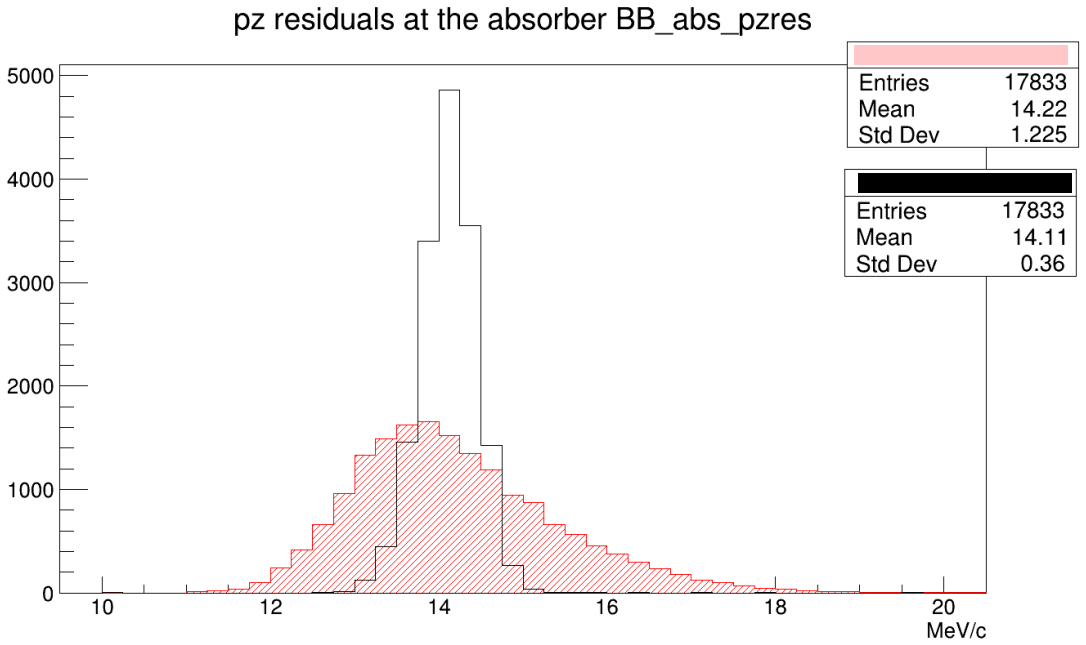
Energy evolution, example

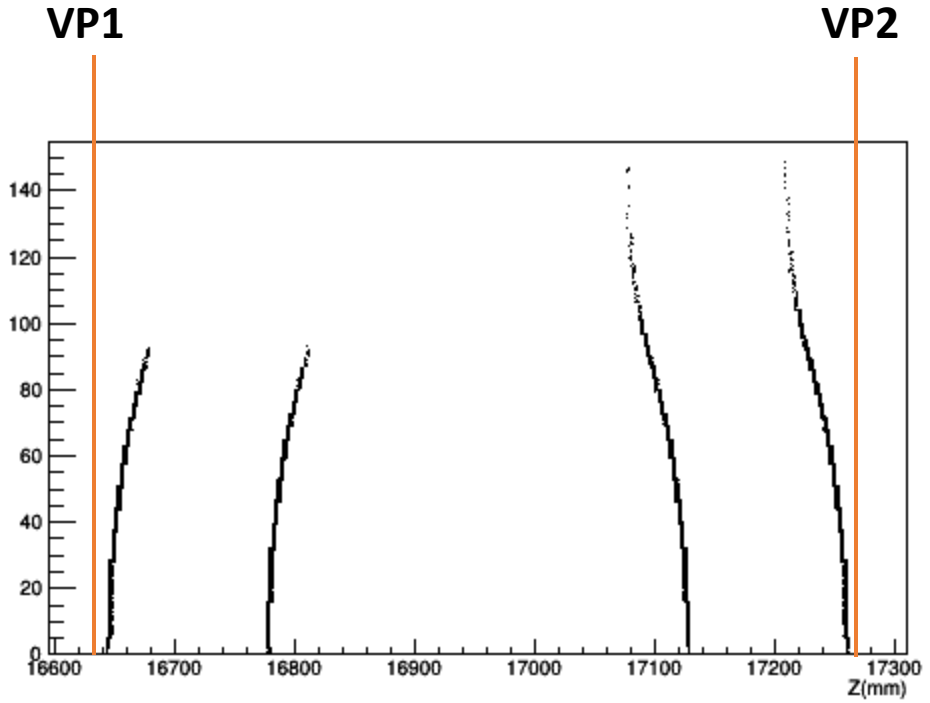
MC

- Bethe-Bloch mean energy loss is used to extrapolate momentum through absorber materials

Pz $_{True}$(**VP1**) - Pz $_{True}$(**VP2**)

Pz $_{True}$(**VP1**) – dx*<dPz>/dx (Bethe-Bloch for Al,LH2 sequentially)

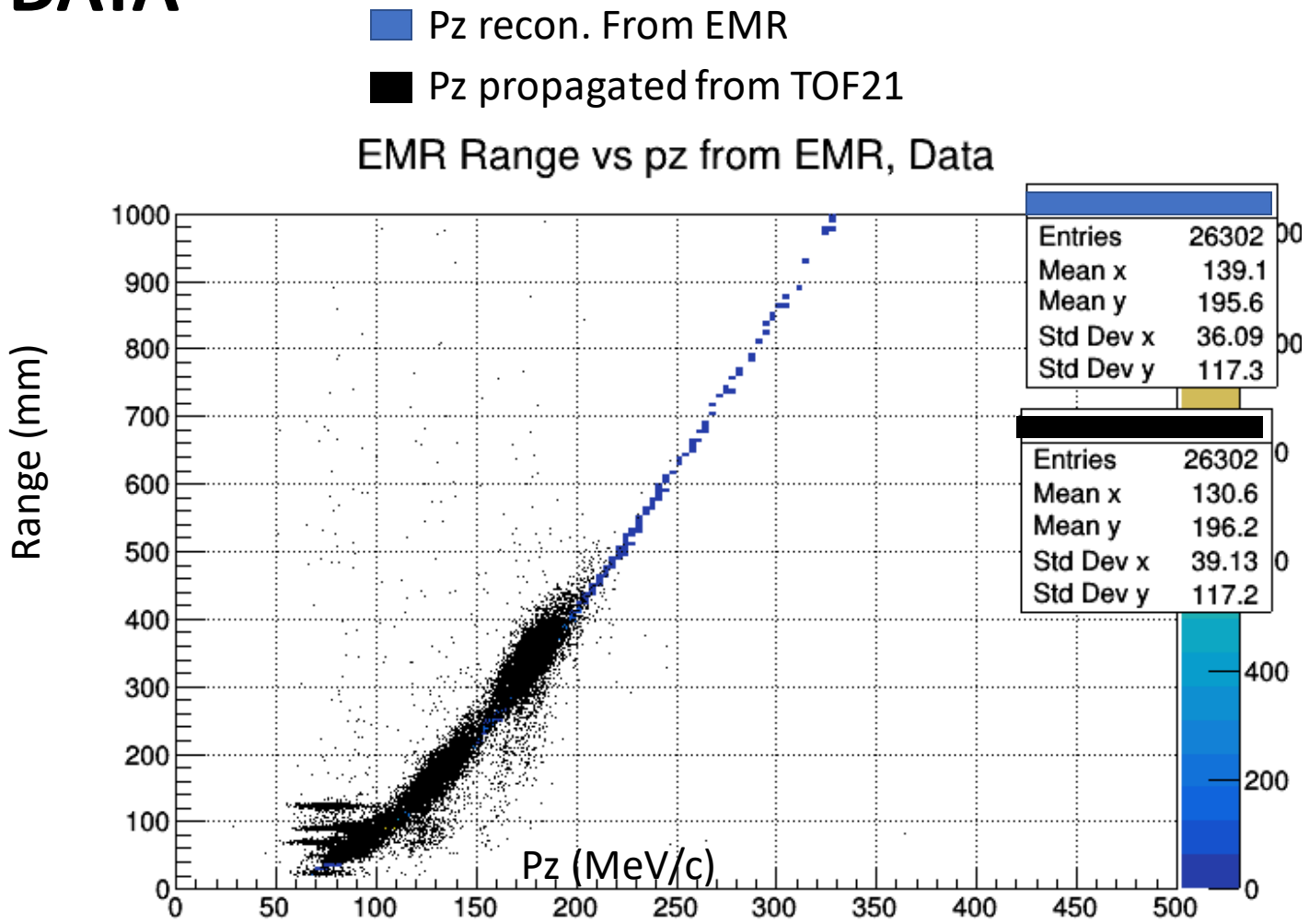




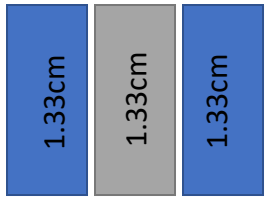
MCS in LH2 (field-off)

Energy evolution TOF21->EMR

DATA



- The EMR also provides a momentum estimate based on range.
- Pz from TOF21 is propagated to the EMR, showing relatively good agreement despite approximations :
  - Only pz is considered,
  - All path lengths except for the absorber materials are paraxially approximated (vertical crossings).
  - KL approximated as:



Polystyrene-> Pb-> Polystyrene

  - Density correction parameters for Sci-Fi material are approximated as polystyrene

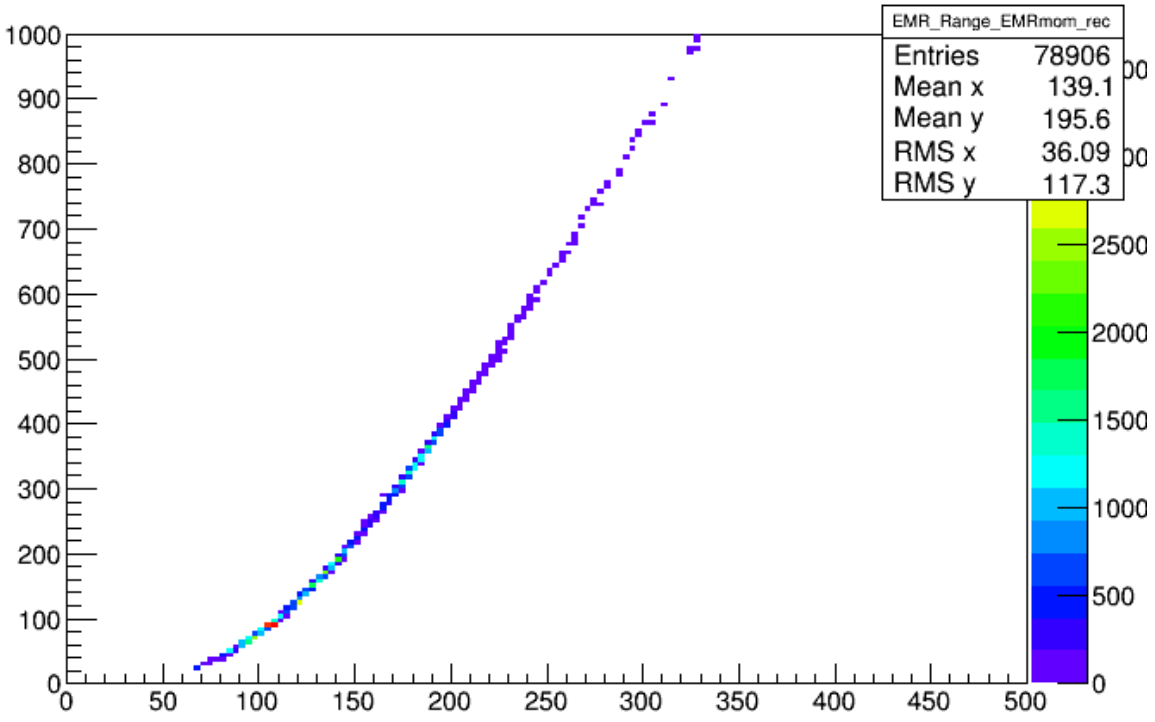
Will be improved

Conclusion: EMR data reconstruction seems OK, except low Pz features.

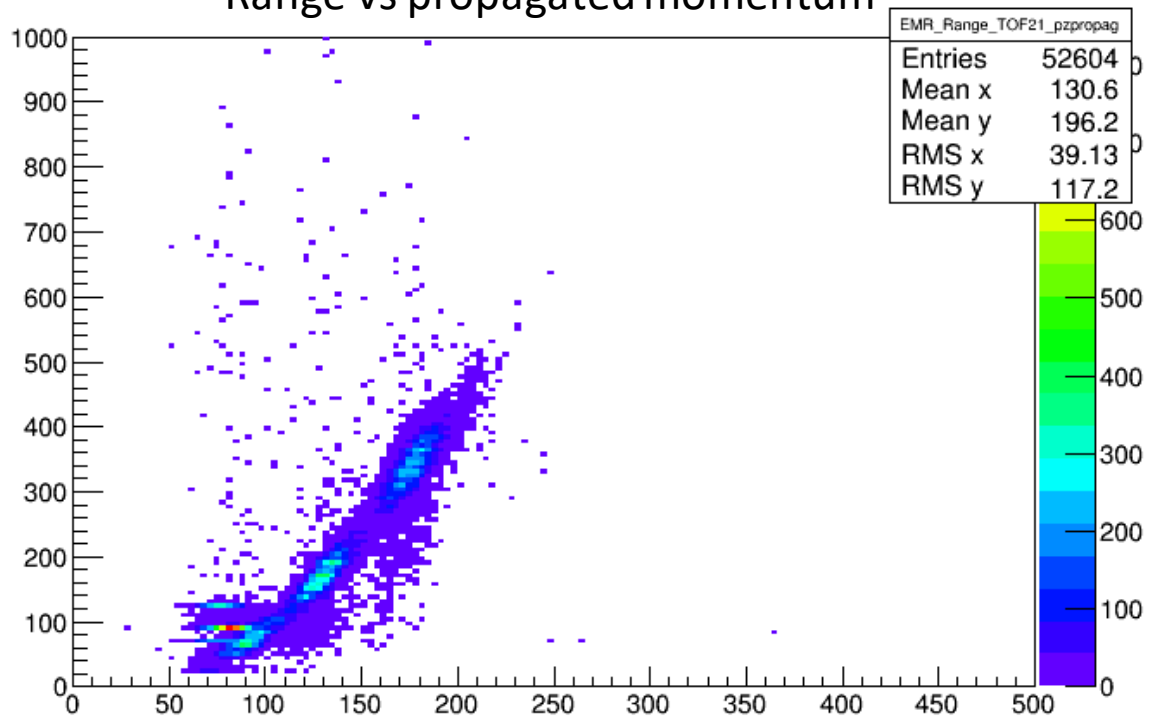
MCS in LH2 (field-off)

Data

Range vs EMR rec. momentum



Range vs propagated momentum



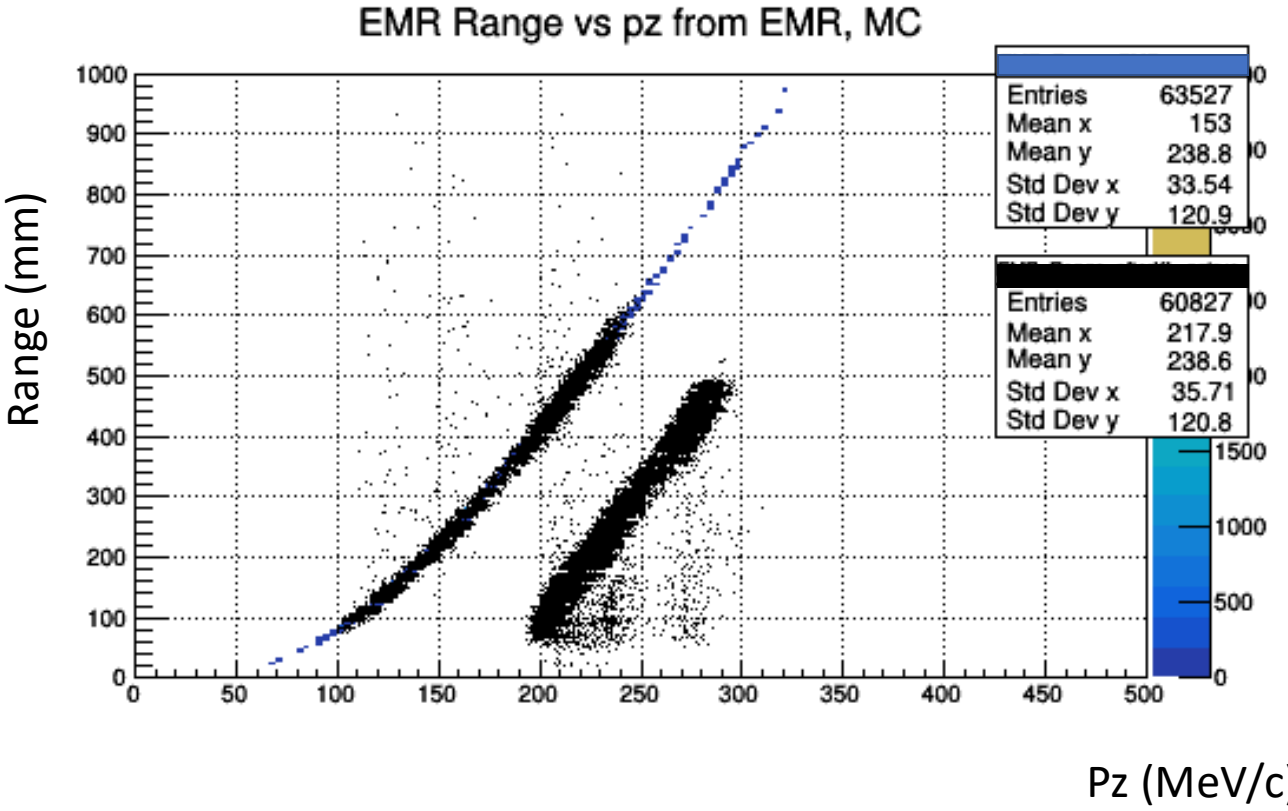
MCS in LH2 (field-off)

MC

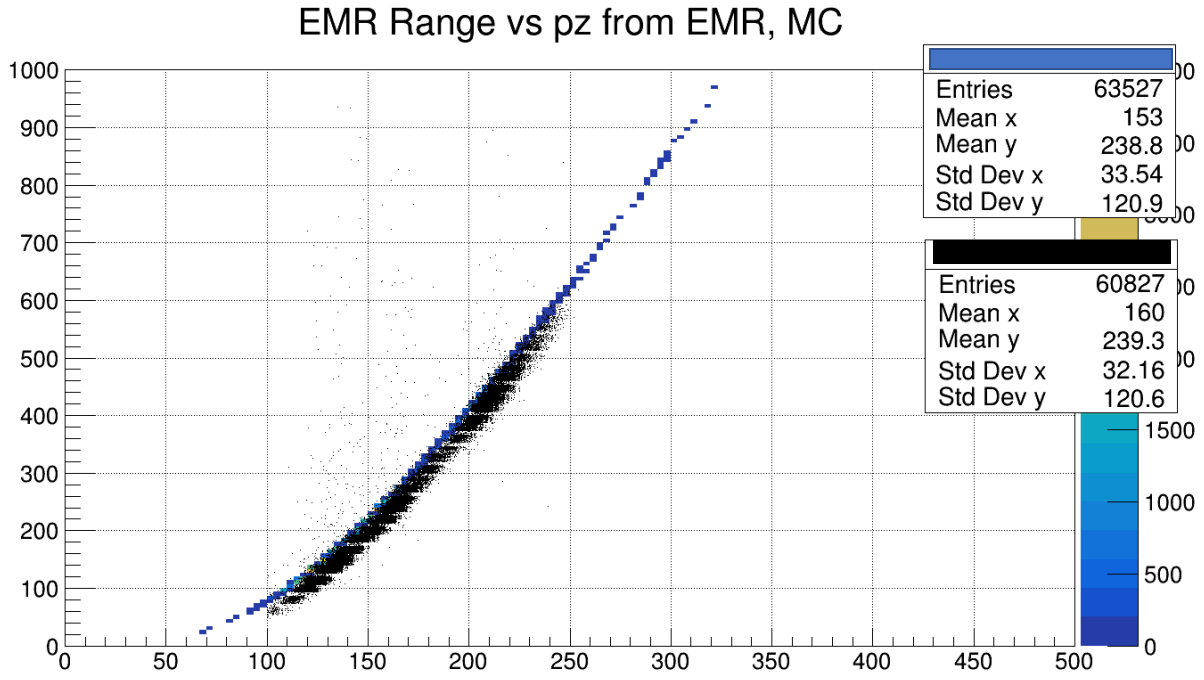
- **Using virtual plane after the KL**

Pz recon. From EMR

Pz truth

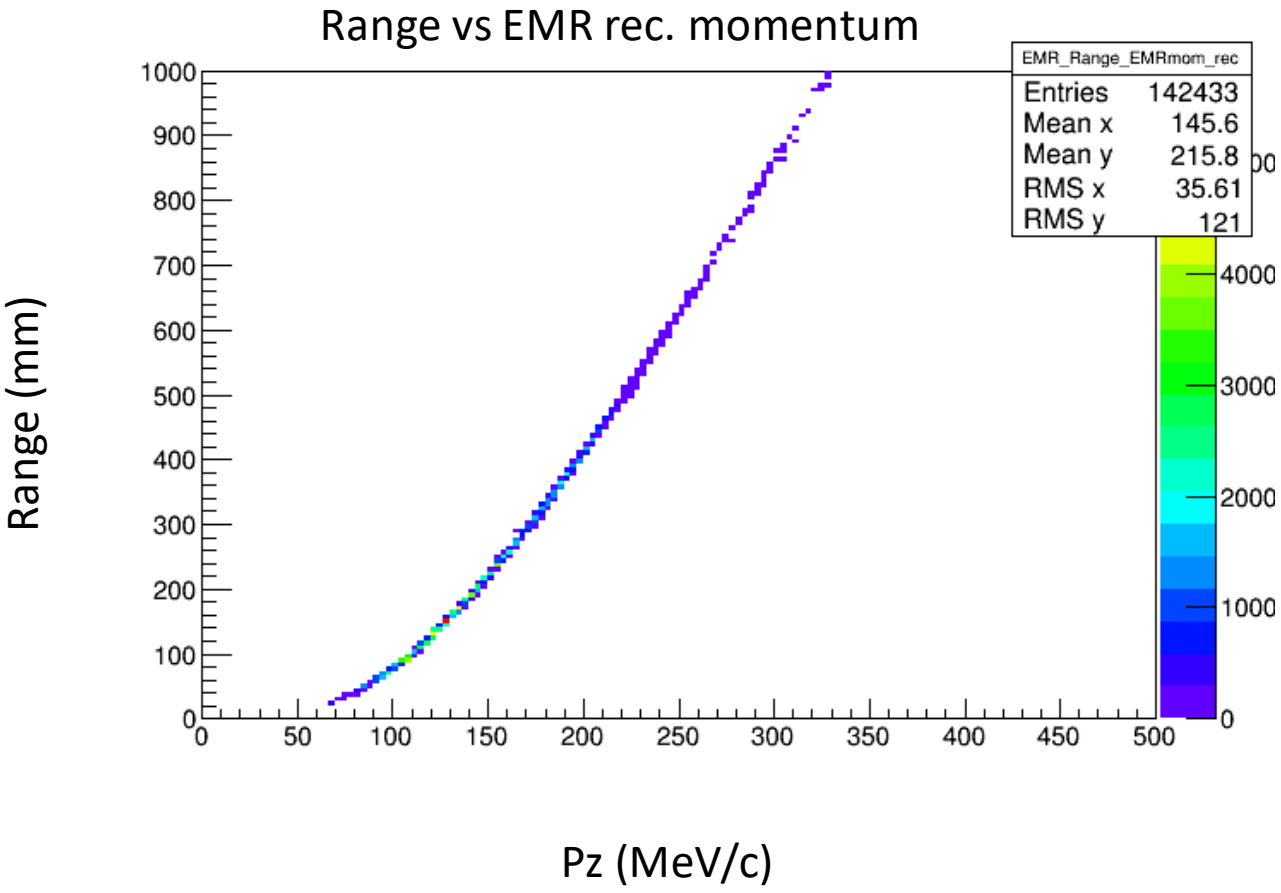


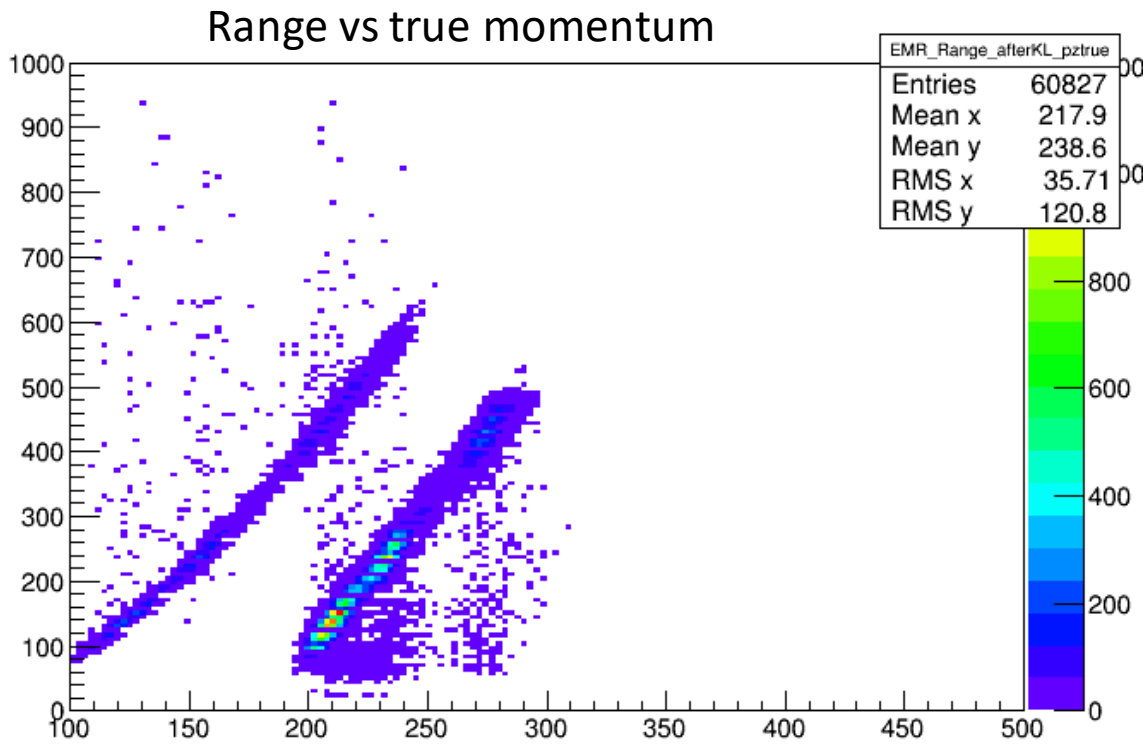
- **Using virtual plane before the KL**



MCS in LH2 (field-off)

MC





MCS in LH2 (field-off)

MC

Pz_{truth}(US of KL) – Pz_{truth} (DS of KL)