Low-mu Electron Calibration Progress – 16/01/24

Summary of Preliminary Results

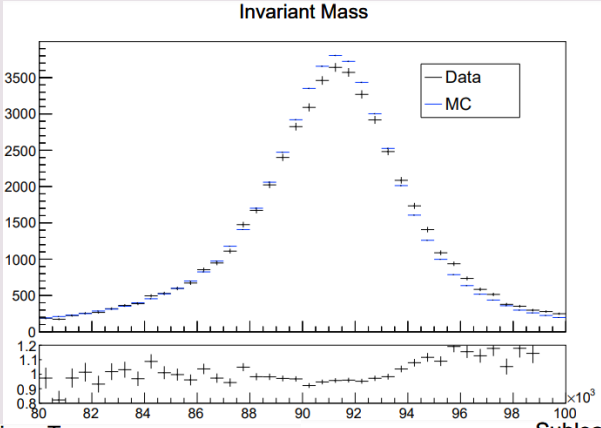
JOSHUA NEWELL

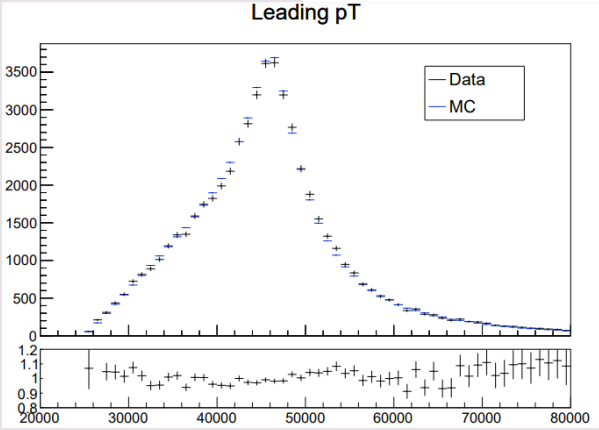
Introduction

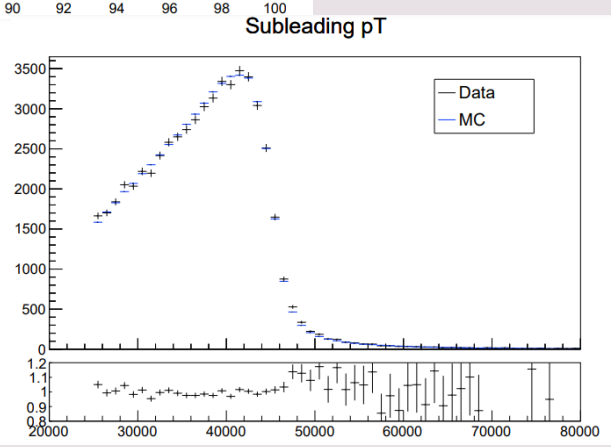
- Energy calibration performed using low-mu Z mass resonance data at 5 and 13 TeV:
  - Energy Shift, α (scale factor): $E^{data} = E^{MC}\left(1 + \alpha(\eta^{calo})\right)$
  - Gaussian Smearing, c (constant term): $\left(\frac{\sigma(E)}{E}\right)^{data} = \left(\frac{\sigma(E)}{E}\right)^{MC} \oplus C(\eta^{calo})$

Data - MC agreement: 5 TeV low-mu data

- Invariant mass resolution already close to MC before corrections
- MC noticeably higher at mass peak and lower at higher end of mass window
- Leading and subleading pT lineshapes are also similar between data and MC

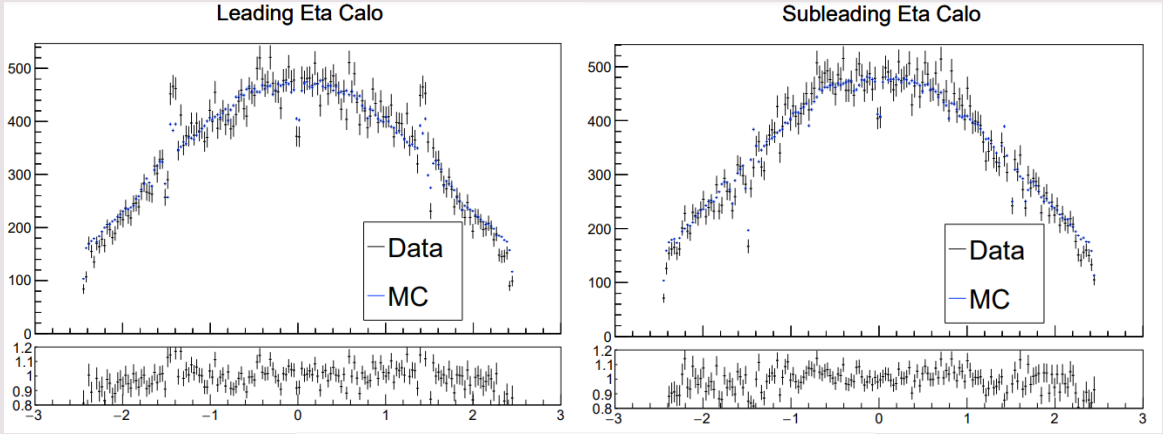


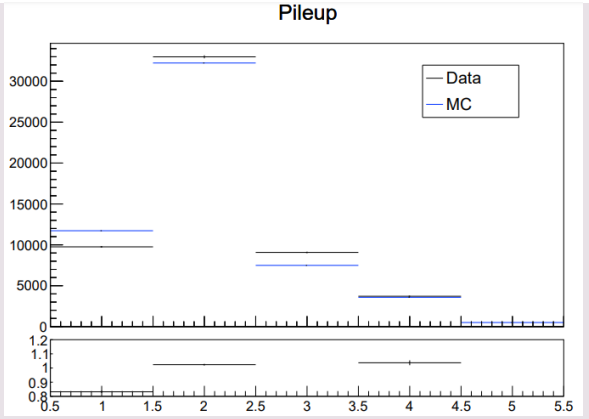




Data - MC agreement: 5 TeV low-mu data

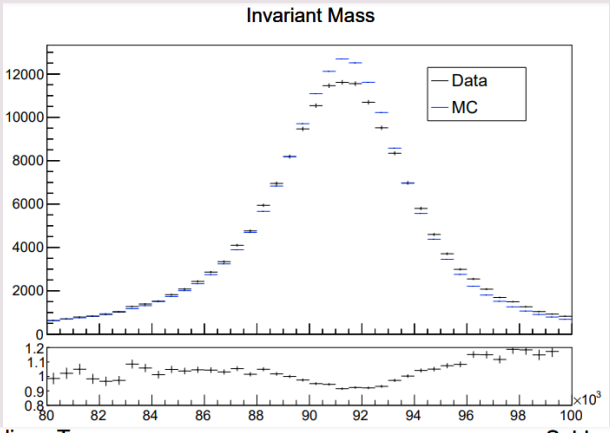
- Lineshapes for leading and subleading eta are very similar
- Low statistics in data means structures are not as noticeable

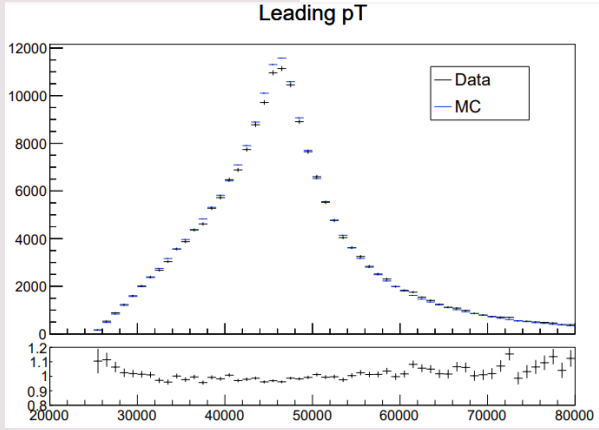


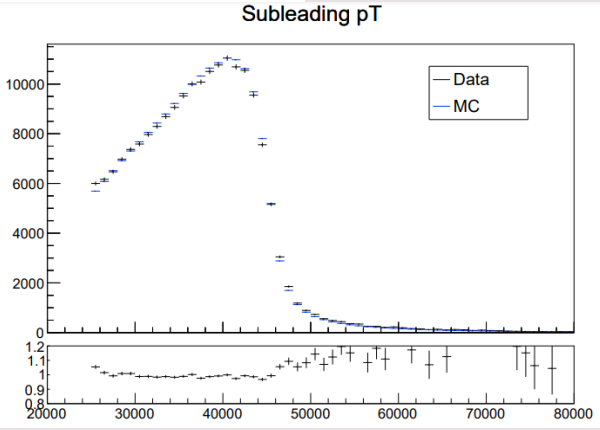


Data - MC agreement: 13 TeV low-mu data

- Invariant mass resolution already close to MC before corrections
- Similar effects in 13 TeV compared to 5 TeV although more exaggerated
- Leading and subleading pT lineshapes are also similar between data and MC

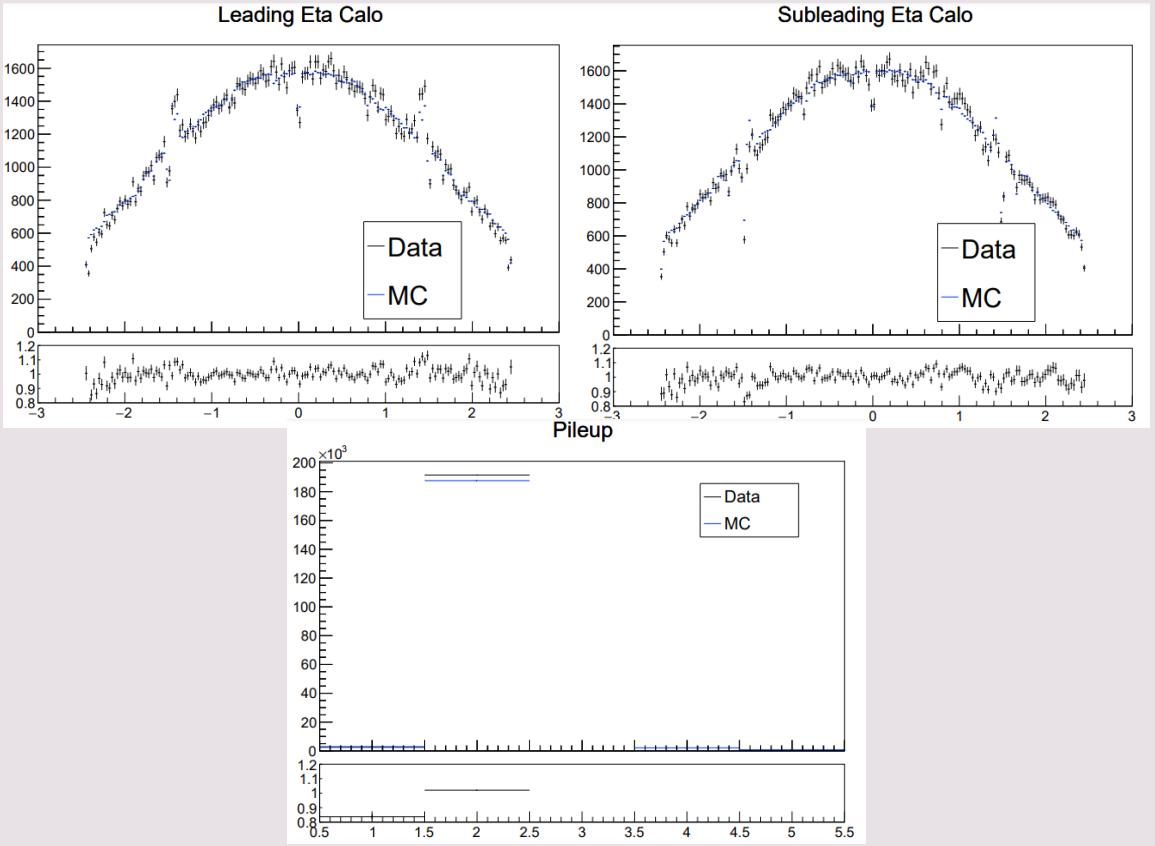




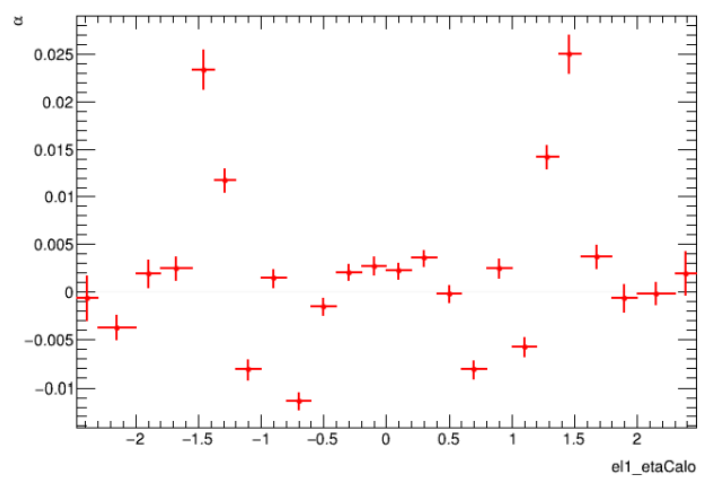


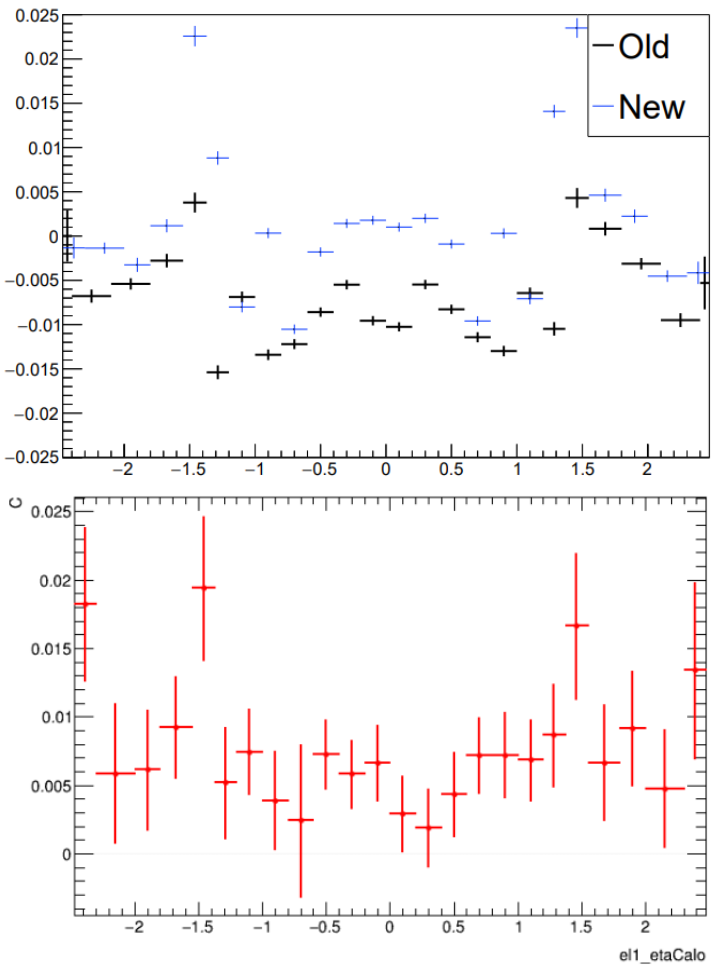
Data - MC agreement: 13 TeV low-mu data

- Lineshapes for leading and subleading eta are very similar
- Higher statistics in data compared to 5 TeV



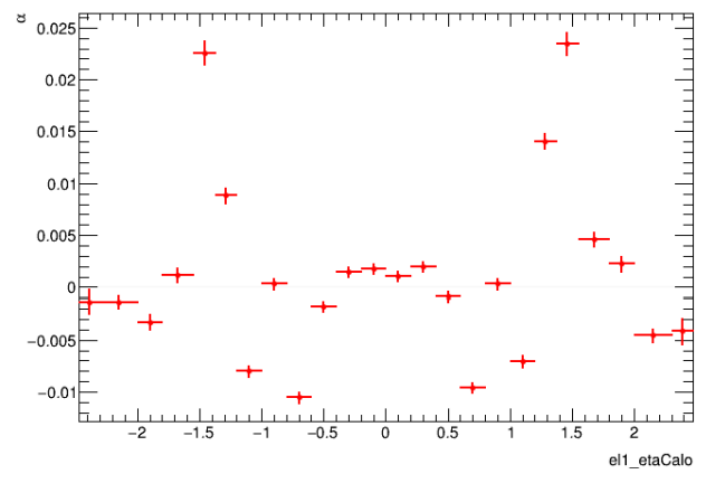
Calibration Framework Results: 5 TeV low-mu data

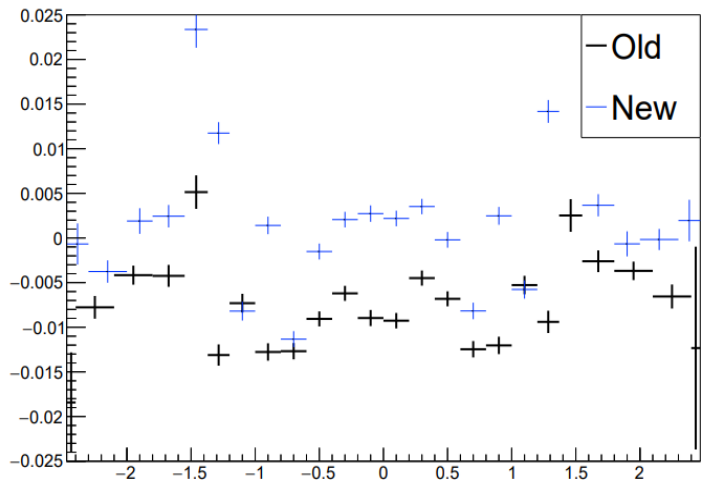


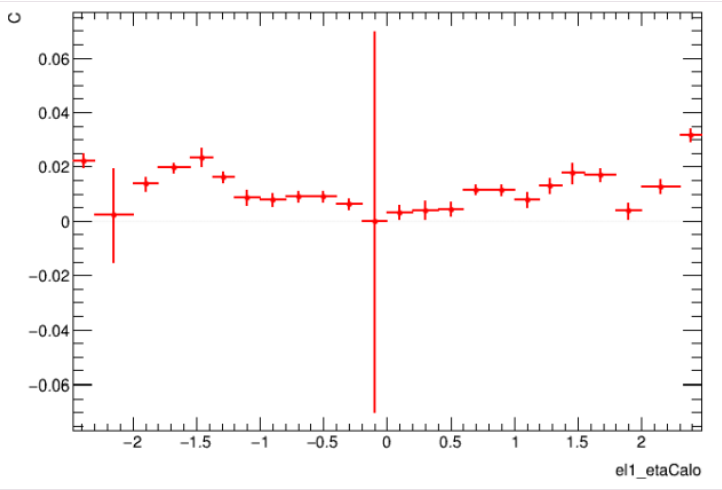


- Calibration results (α and c) as a function of eta.
- α results compared to previous results from Hisham

Calibration Framework Results: 13 TeV low-mu data



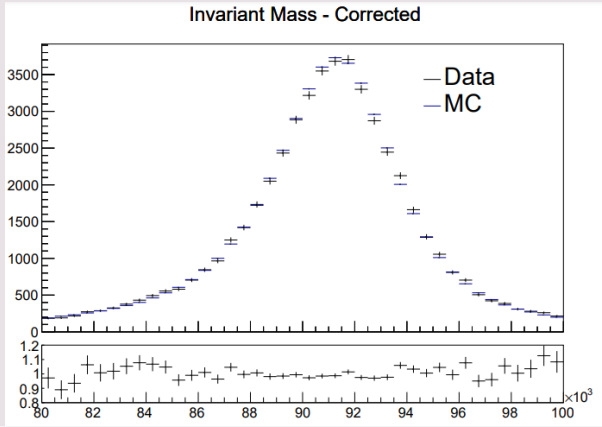


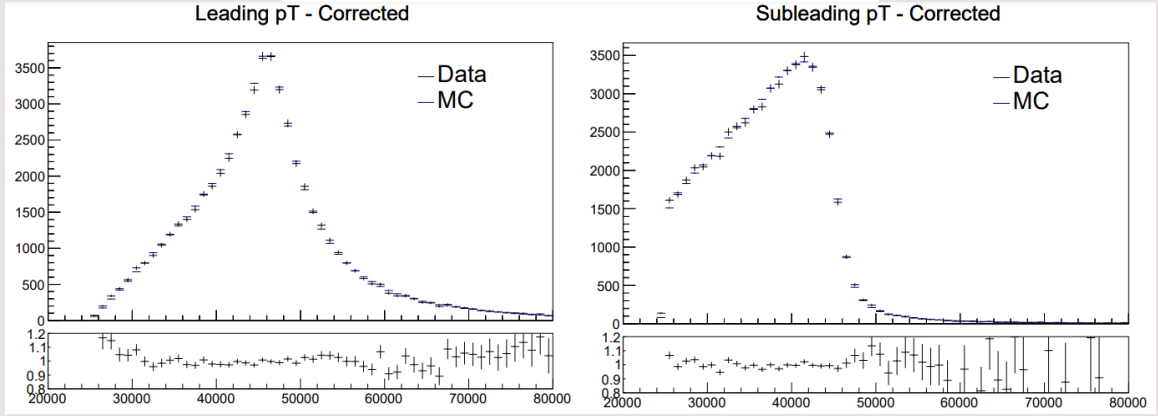


- Calibration results (α and c) as a function of eta.
- α results compared to previous results from Hisham
- Large error close to zero – small tuning needed to help the fit to converge

Data - MC agreement: 5 TeV low-mu data (after correction)

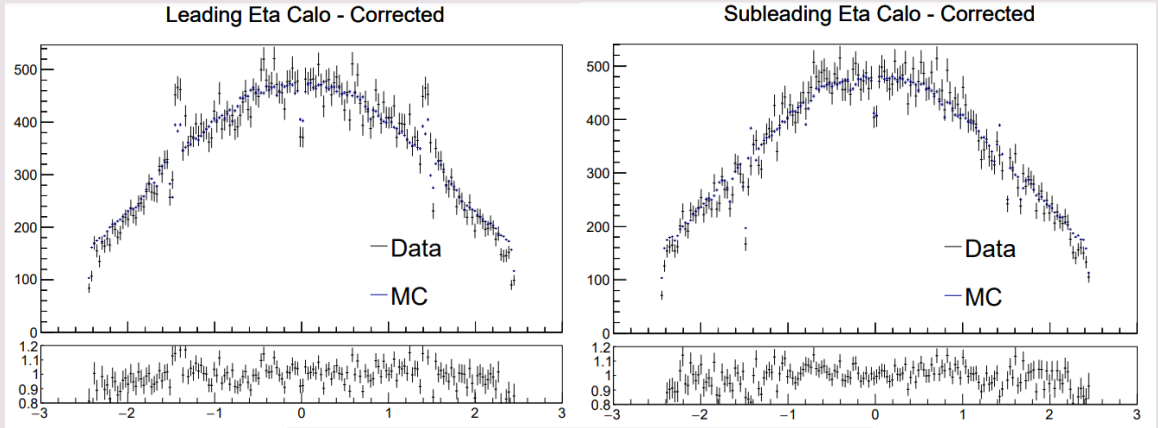
- Invariant mass lineshape shows improvement after correction (data/MC ratio more consistent with 1)
- pT lineshapes also show slight improvement after corrections





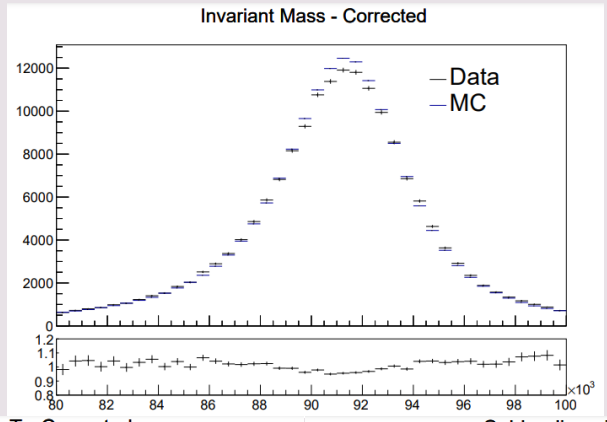
Data - MC agreement: 5 TeV low-mu data (after correction)

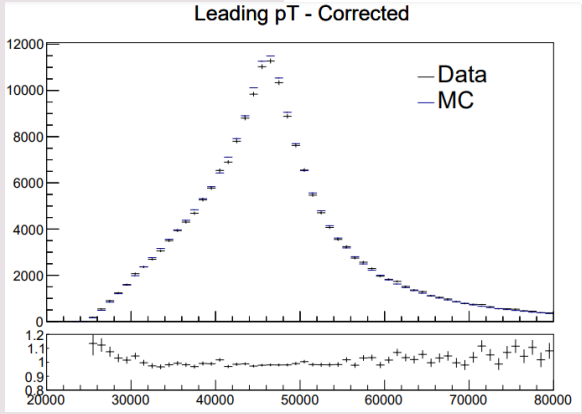
- No changes for eta or pileup after calibration (as expected)

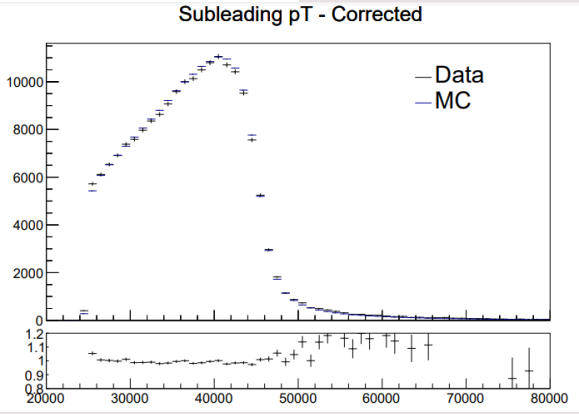


Data - MC agreement: 13 TeV low-mu data (after correction)

- Invariant mass lineshape shows improvement after corrections
- Scale factor correction not large enough to bring inline with MC
- pT lineshapes have a very slight improvement after corrections

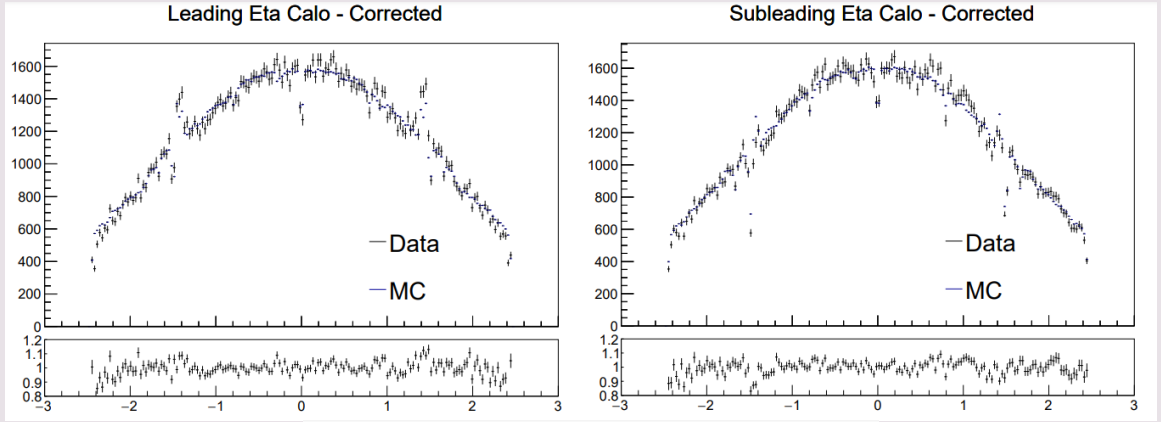


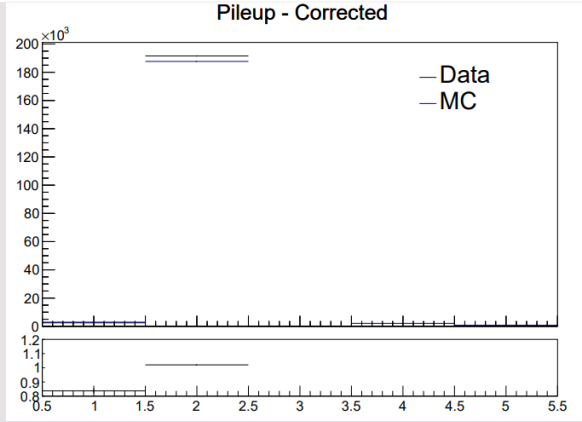




Data - MC agreement: 13 TeV low-mu data (after correction)

- No changes for eta or pileup after calibration (as expected)





Conclusion

- Framework is in place and running smoothly (thanks to Linghua and Filippo)
- Preliminary results are encouraging – nothing unexpected regarding nominal extraction

To – Do:

- Small technical tuning for “c” results at 13 TeV – error increases dramatically around zero
- Systematics – should be simple to extract
- Currently, only high-mu SF are applied (are low-mu SF necessary?)