Status of TPOL Reanalysis

- Experiences with MC and Data Calibration

Blanka Sobloher

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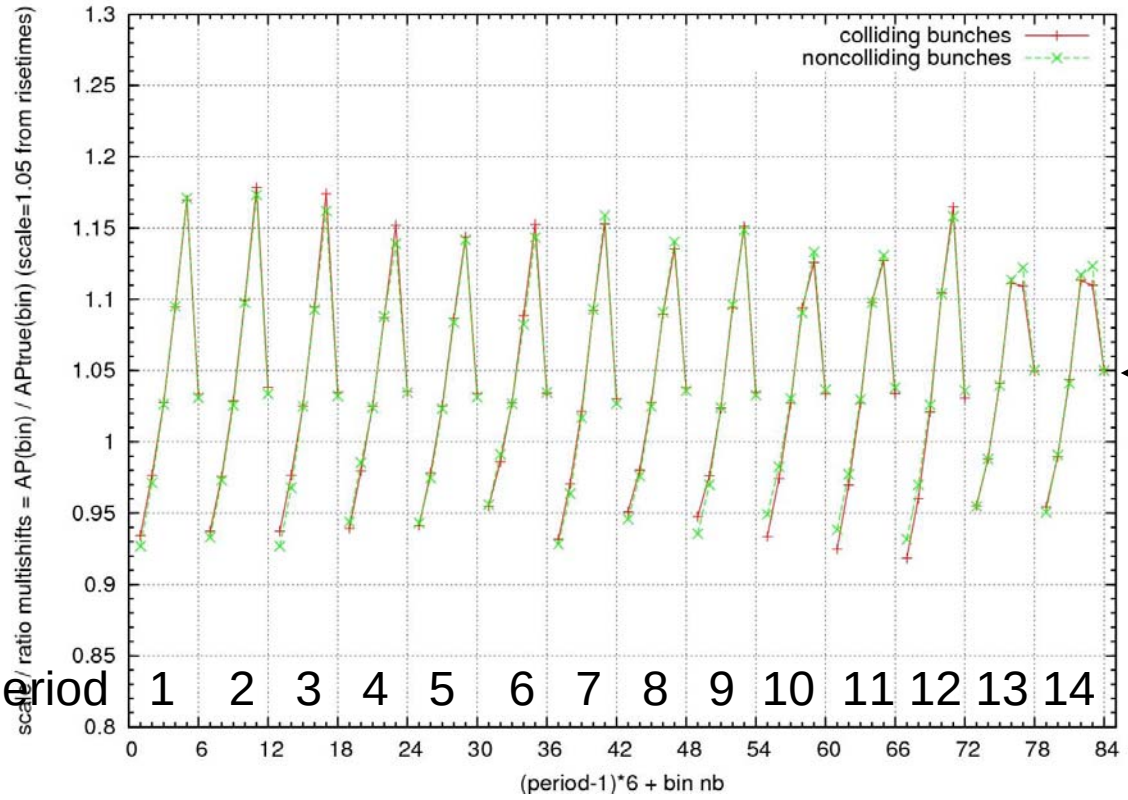
Status as of October

- Given an absolute polarization scale, the ratio of observed shift of means can be calculated into a ratio of MC Analysing Power to ‚true' Analysing Power:

$$R(\text{bin}) = \frac{\text{shift in data(bin)}}{\text{AP}_{\text{MC}}(\text{bin}) \cdot P} = \frac{\text{AP}_{\text{true}}(\text{bin}) \cdot P_{\text{true}}}{\text{AP}_{\text{MC}}(\text{bin}) \cdot P_{\text{true}} \cdot \text{scale}^{-1}}$$

$$\Rightarrow \frac{AP_{\text{MC}}}{AP_{\text{true}}}(\text{bin}) = \frac{\text{scale}}{R(\text{bin})}$$

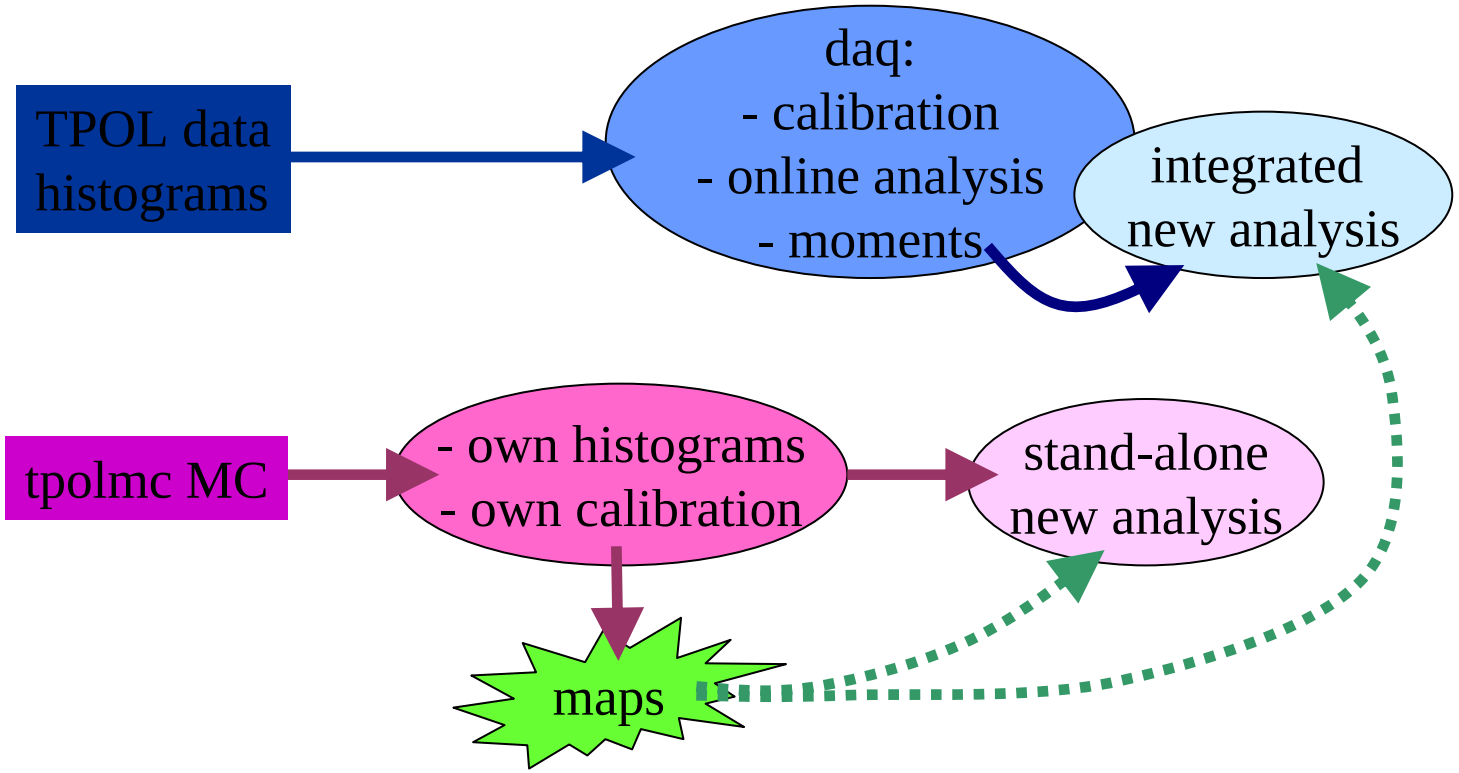


What is the origin of this observed energy dependence?

scale = 1.05 from rise times

Software Issues - Ways Data and MC are going

- Current situation



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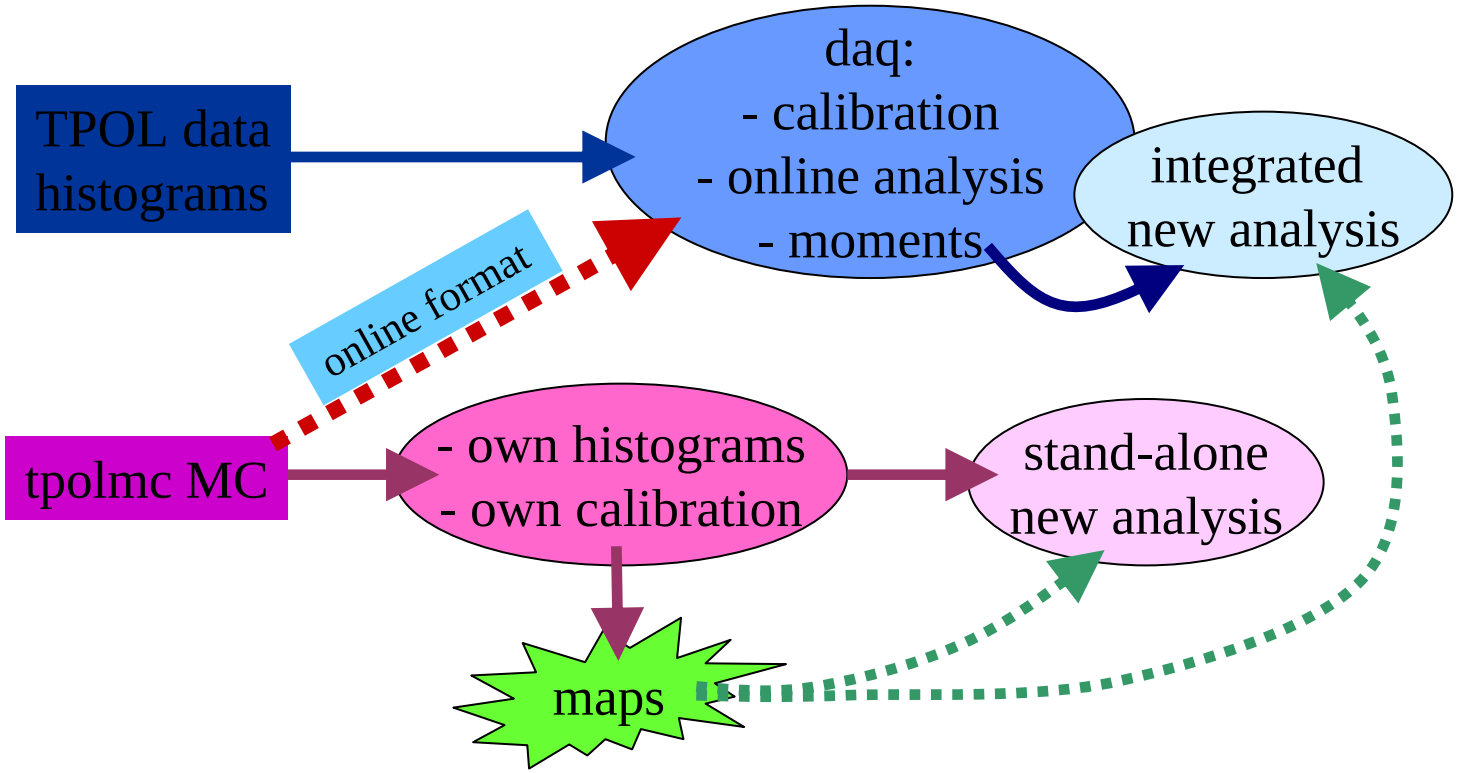
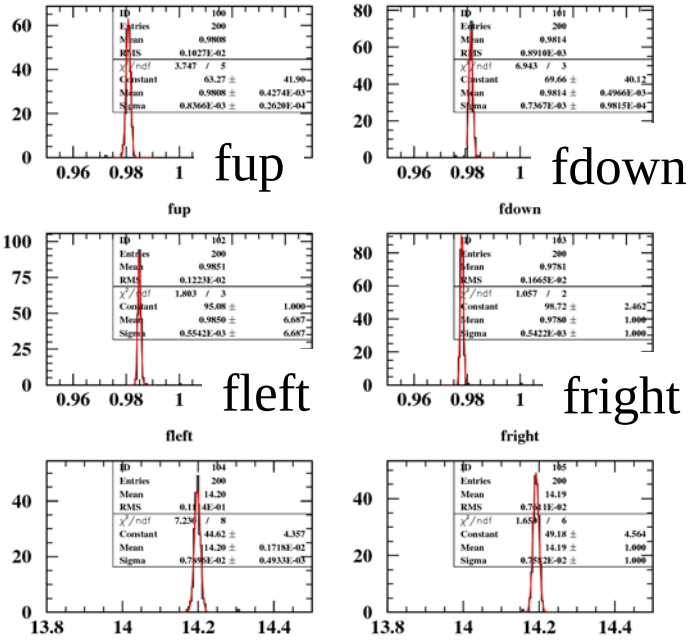


- In the following: generated 200 laser ON and 200 laser OFF cycles of Bremsstrahlung corresponding to a trigger rate of 5kHz
- Then generate Compton events to add on top to the 200 laser ON cycles corresponding to a trigger rate (Compton only) of 25kHz
- Merge and analyse those 200(+200) cycles with the online analysis (+ the new analysis)

Full Chain - MC through online, the first

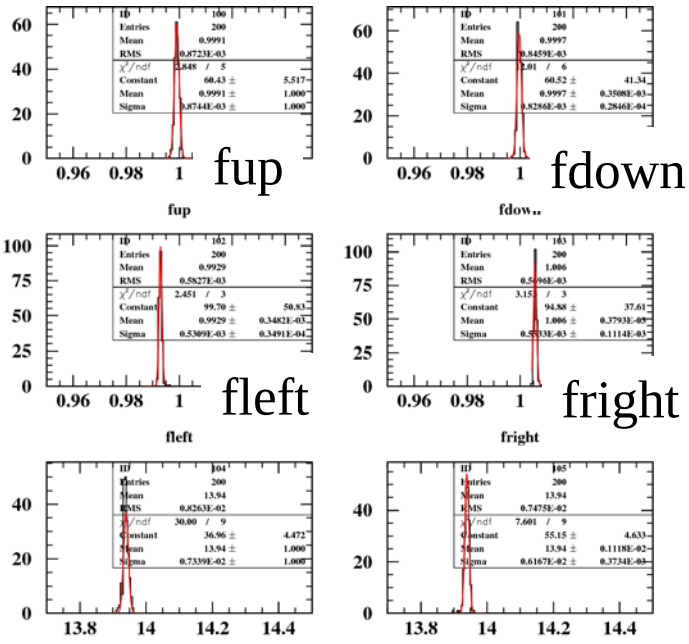
- Calibrated MC fed through online analysis
  - → Calibration constants are ~0.98

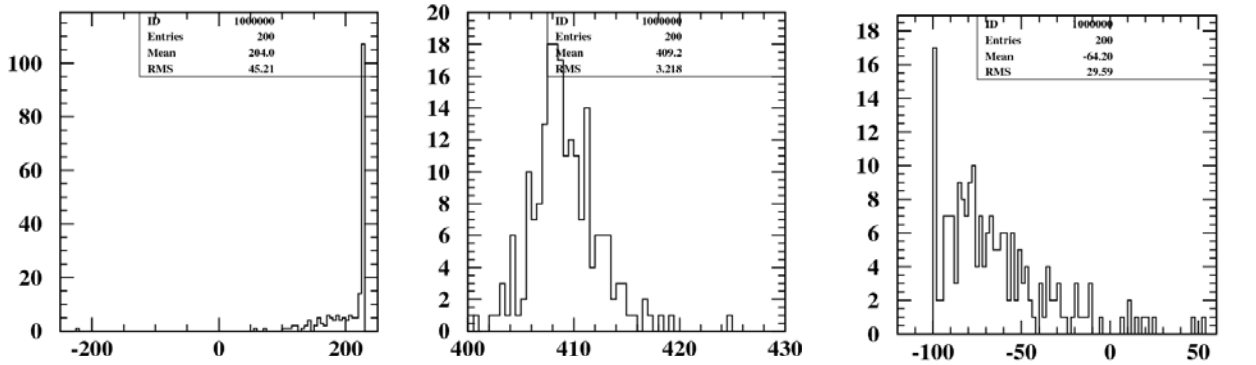


Full Chain - MC through online, the first

- Calibrated MC fed through online analysis
  - → Calibration constants are ~0.98
- Lower calibrated MC
  - → Calibration constants are ok

- Compton edge in online analysis differs from the one the MC routines have
  - → It's lower, appararent mismatch between maps (derived from calibrated MC) and data (calibrated by online analysis)
  - → Mismatch affects reconstructed beam parameters (and RMS and AP values) heavily

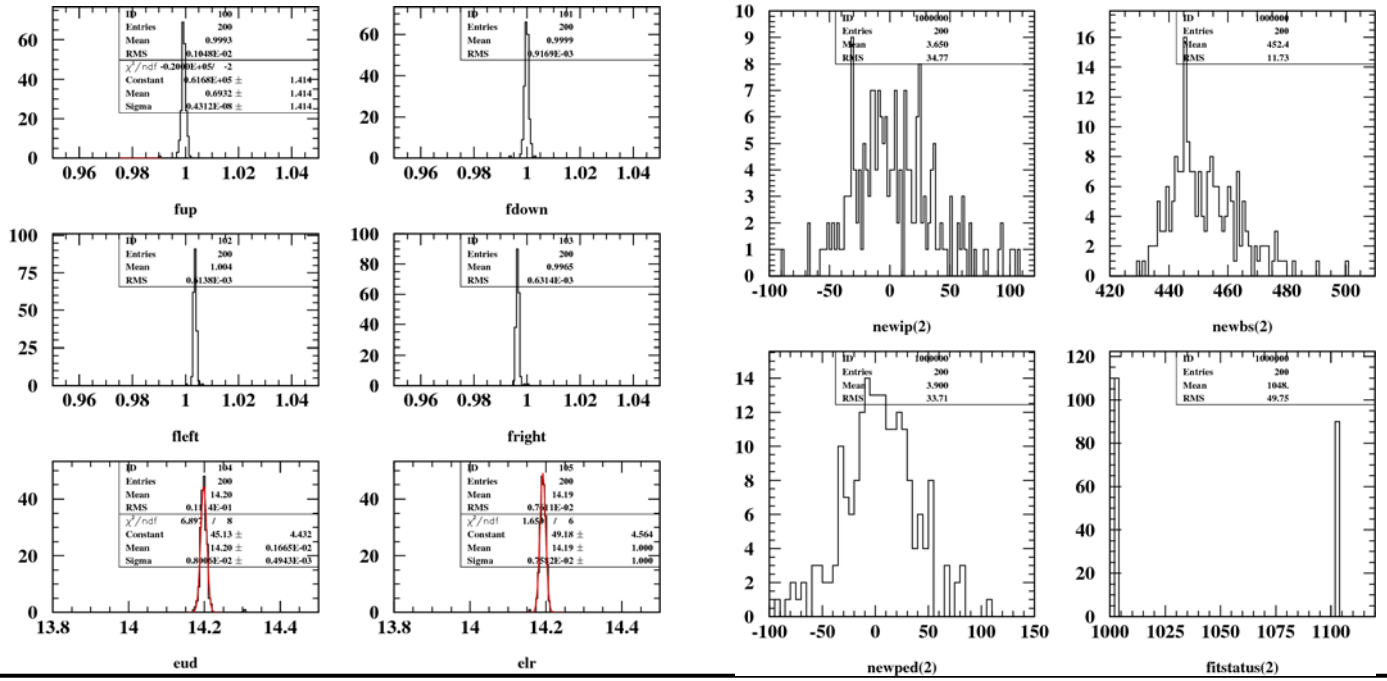




generated:
IP = 0 cm
bs = 450 mum
ped = 0 MeV

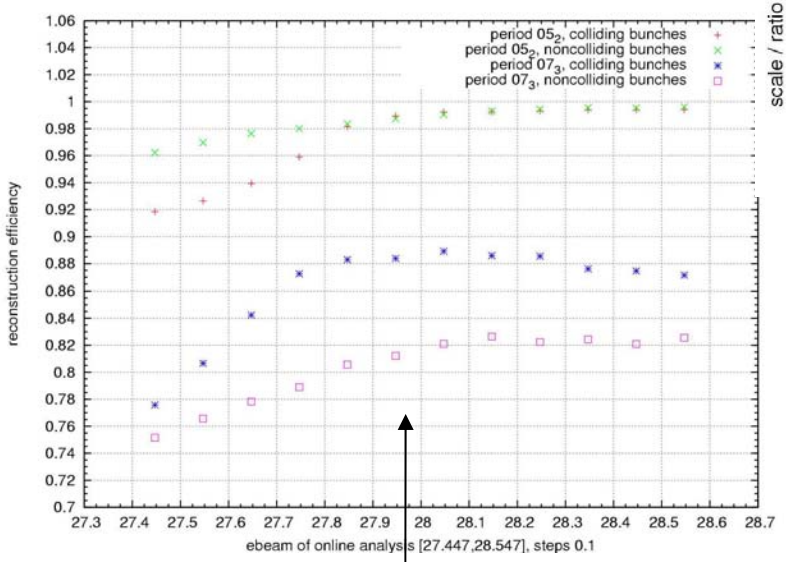
Full Chain - How to cure the Mismatch?

- 1.) Reiterate Monte Carlo generation with lowered edges
  - → Best and cleanest way, but expensive concerning time and computing power
- 2.) Raise Compton edge in data by requiring a higher beam energy in the online analysis
  - → Very inexpensive concerning time and computing power
  - → Leads to resampling of data which might introduce additional systematics
  - → Best value found for beam energy: 27.947GeV (for MC calibrated to 27.6GeV)
    - ➢ Average over 9 points in (IP,beam spot size) with very little spread, so no dependence of the calibration factor on the beam parameters

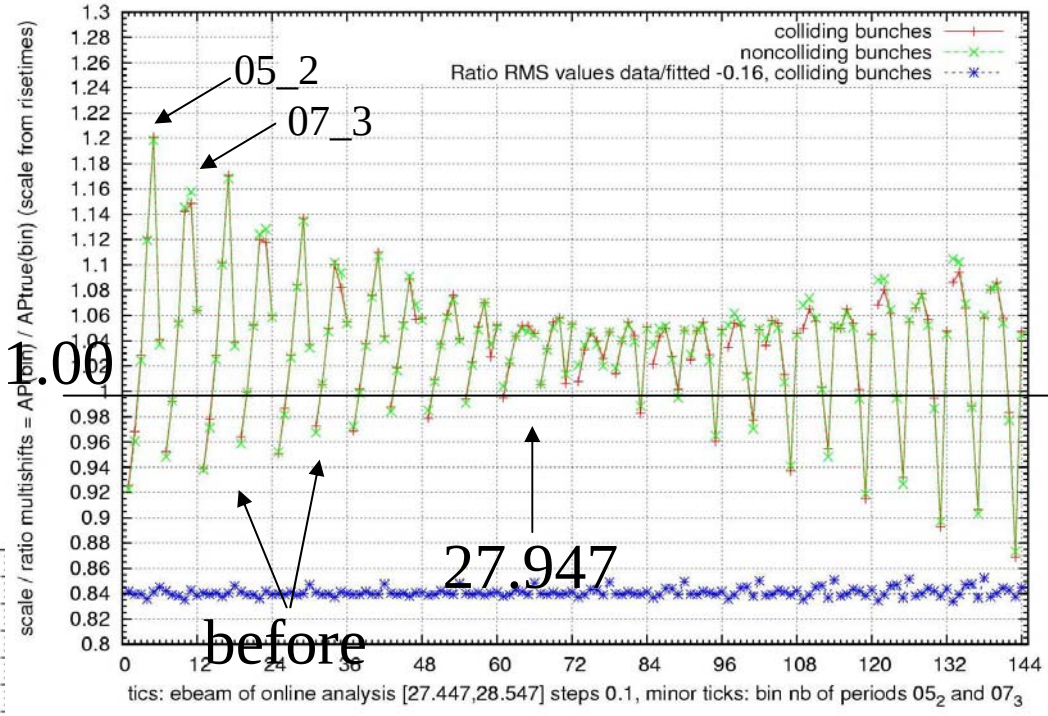


Analysing Data - As Function of Online Analysis Beam Energy

- Scanning two data periods (05_2 and 07_3) with different beam energy settings in the online analysis
  - → Obtained energy derived from MC studies shows indeed the best behaviour when applying it to data
  - → Reconstruction efficiency improves



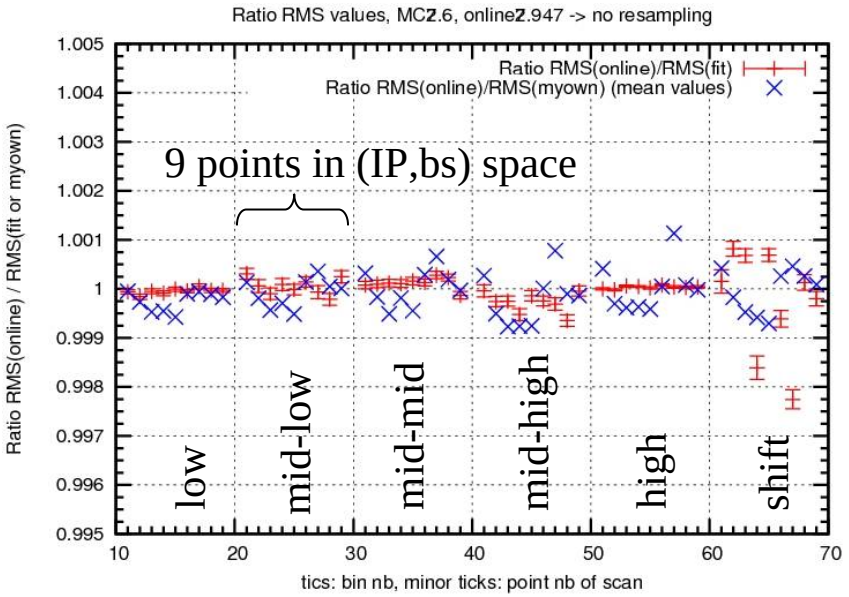
27.947

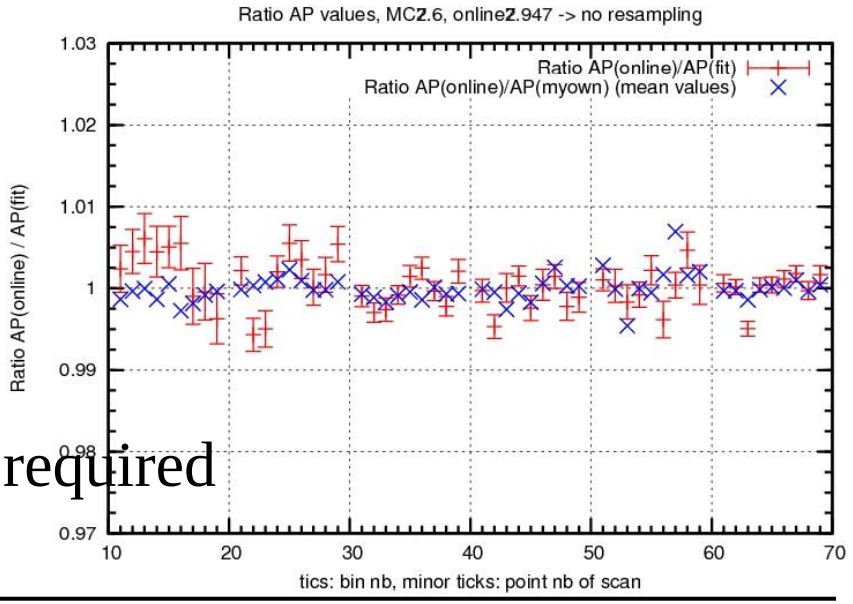


- Observed energy dependence of AP improves
- Scale improves by ~1%

Full Chain - Systematics by Resampling

- How large is the systematic contribution of the resampling (and background subtraction) in data?
  - → Data histograms are collected such, that calibration constants are ~1 with settings using the beam energy supplied by HERA
  - → In MC terms this means that the initial calibration corresponds to 27.262GeV (for 27.6GeV data) and to 27.163GeV (for 27.5GeV data), which has to be resampled now with the online analysis calibrating to 27.947GeV
  - → Calibration constants ~1.02
    - ➢ Histograms are resampled
- In case of no resampling only small impact on obtained RMS and AP values





Case 1: no resampling required

Full Chain - Systematics by Resampling

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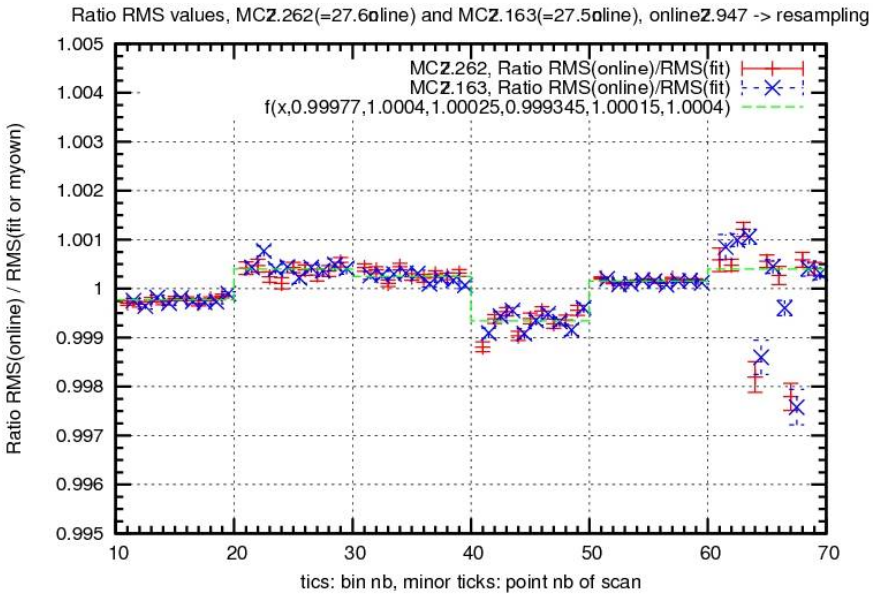
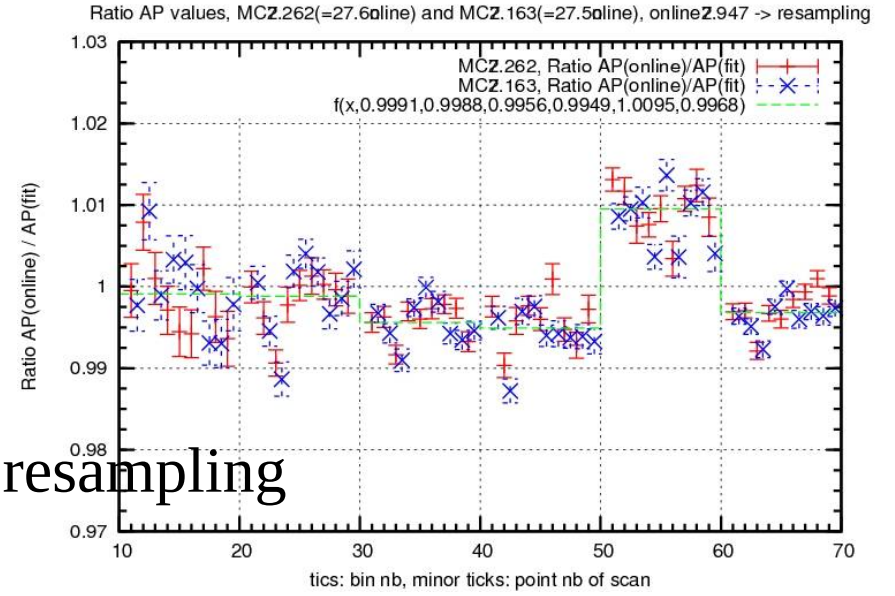
- In case of resampling some impact, especially in high energy bin





Case 2: with resampling

Full Chain - Systematics by Resampling

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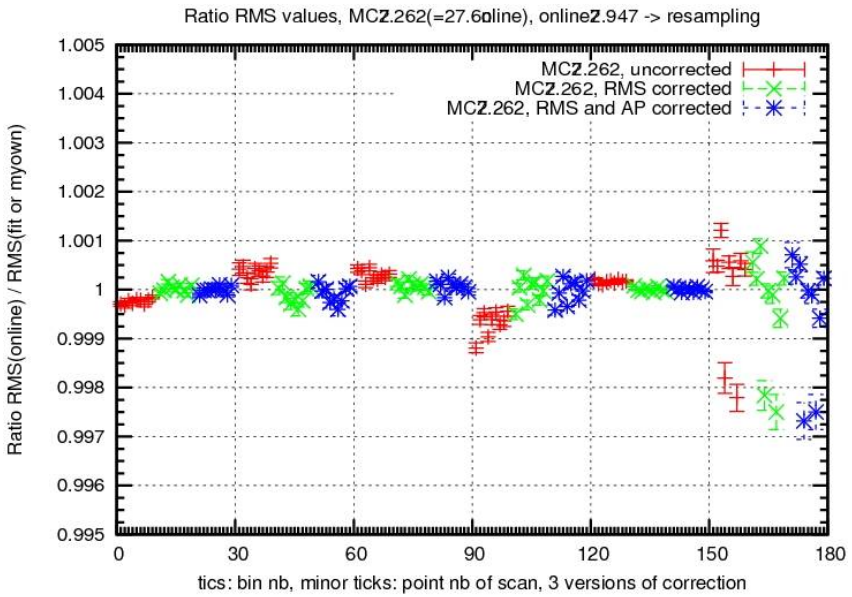
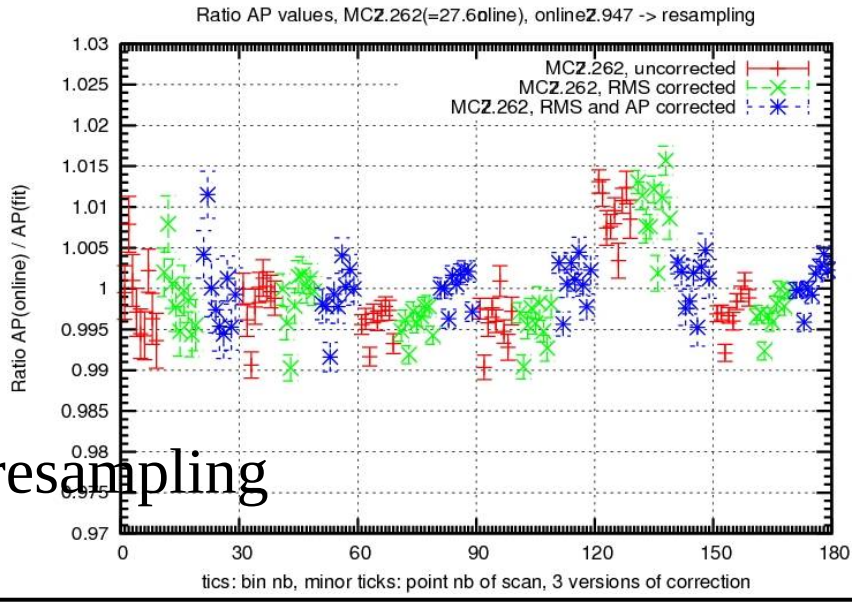
  - → Calibration constants ~1.02
    - ➢ Histograms are resampled
- In case of resampling some impact, especially in high energy bin
  - → Can be corrected for if necessary

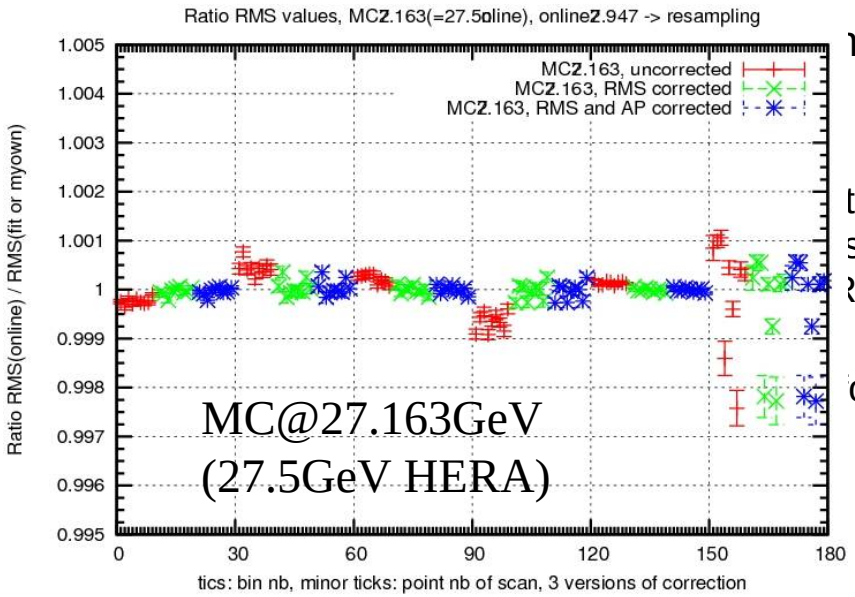


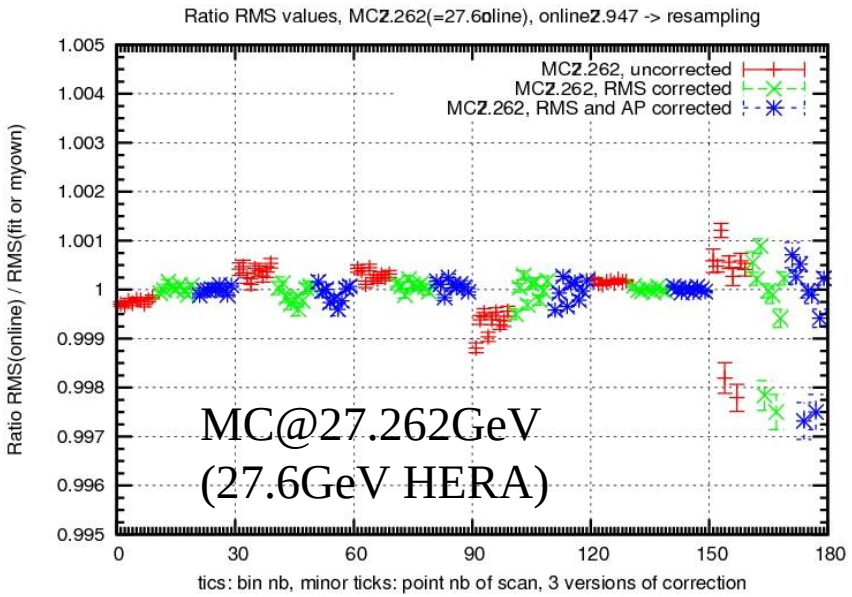


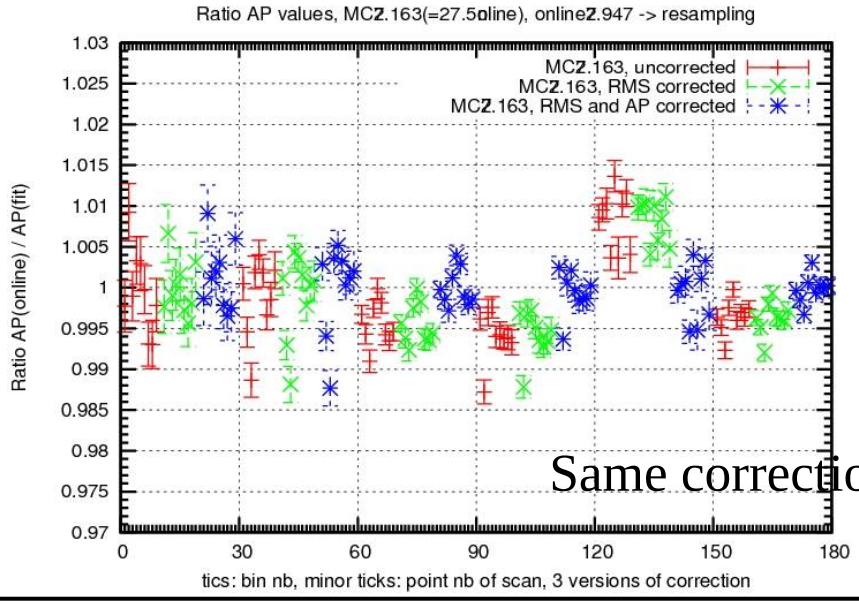
Red: pure resampling
Green: RMS corrected
Blue: RMS and AP corrected

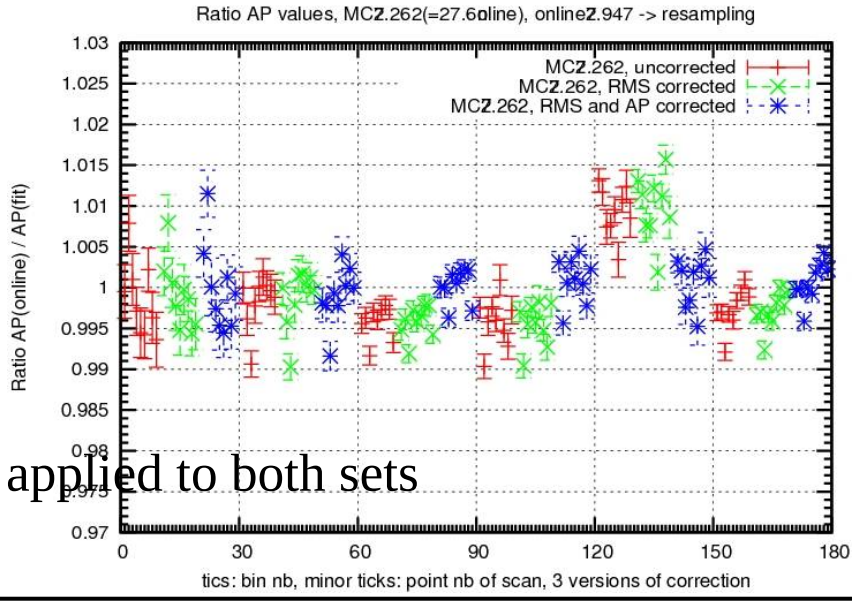
Case 2: with resampling

Full Chain - Systematics by Resampling





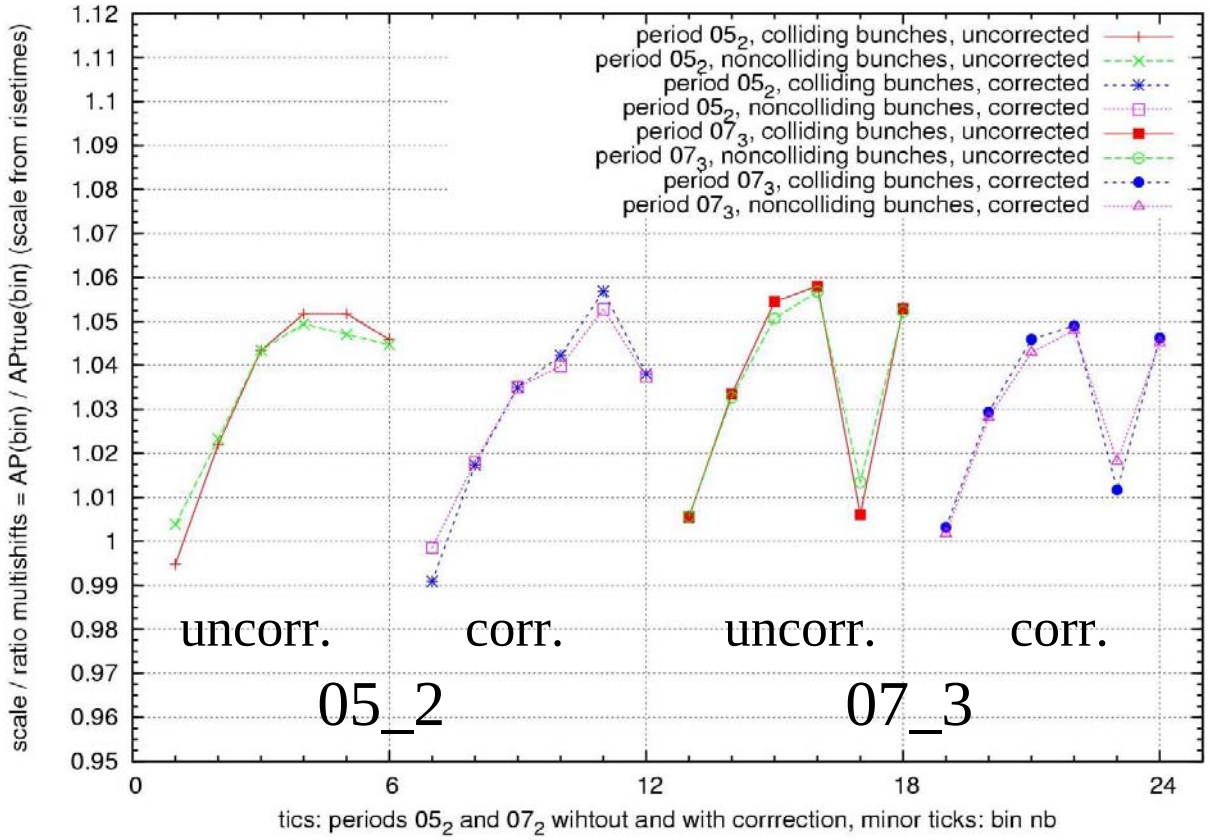




Same correction applied to both sets

Analysing Data - Implying Corrections

- Close look a the two chosen data periods 05_2 and 07_3
  - → Compare performance with and without the derived corrections



Summary - So far…

- Unexpectedly data calibration by online analysis differs from MC calibrations used in the maps
  - → Compton edge is factor 0.981728 lower than in MC and constant for both HERA energies 27.6 and 27.5GeV
- By matching the data calibration to fit to the maps, nearly half of the energy dependence in the APs observed is reduced and the scale improves by ~1%
- Systematic influence of resampling the data is small, mostly affecting the high energy bin, nevertheless correction is possible (if necessary/desirable)

- Where does the rest of the energy dependence and the scale mismatch come from?