

MIP-to-GeV factor

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Meaning of MIP-to-GeV factor

- In **experimental** data:

- consider muons as minimum ionizing particles (MIP)
- measure energy depositions of muons in AHCAL (in ADC counts)
⇒ MIP constants
- measure energy depositions of other particles in AHCAL (in ADC counts)
- then convert this energy to MIP using the above MIP constants

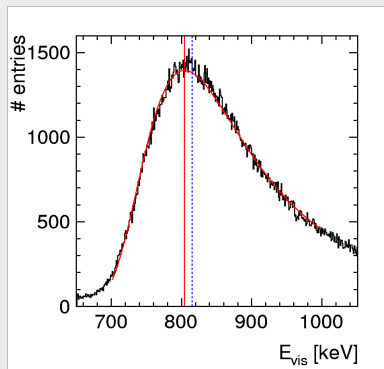
- In **simulated** data:

- Use GEANT4 to simulate passage of particles through AHCAL
⇒ energy measured in GeV
- Convert energy in GeV to energy in MIP using corresponding muon energy ⇒ MIP-to-GeV factor

History of MIP-to-GeV factor

Values used in CAN-036 and CAN-044: **805 keV**

- Given by the **maximum** (red) of Landau fit to energy spectra of generated (raw) muon → energy directly from GEANT4, expressed in GeV (blue: position of the most probable value obtained with ROOT)

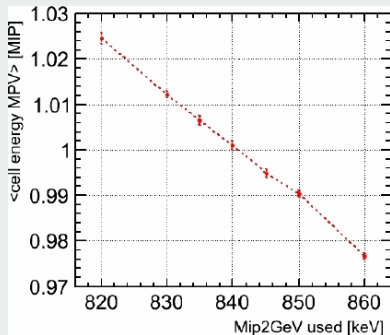


- Method described on DESY flc wiki:
▶ <http://www-flc.desy.de/flc/flcwiki/MipPerGeV%20and%20Mokka%20rangeCut>
- Considered now to be a **wrong approach**

History of MIP-to-GeV factor

New method

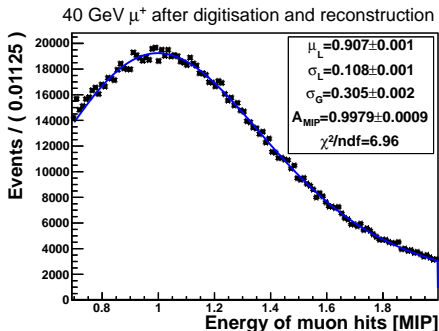
- Choose MIP to GeV factor such that energy spectra of reconstructed muon peaks at 1 MIP
- **840 keV** determined by Clemens with 8 GeV muons
- Plot from Clemens (DESY AHCAL meeting 1 Oct. 2013)



- Technically, the new method means using an 'educated guess' for an initial value of the MIP-to-GeV factor, then running the digitisation (i.e. conversion from energy in GeV to energy in ADC) and the reconstruction (i.e. conversion from ADC to MIP, same as in experimental data), then finally checking that the energy spectra of reconstructed muon peaks at 1 MIP

MIP-to-GeV factor for 2011 W-AHCAL data

- Current value: 840 keV
- Example: 40 GeV μ^+ in W-AHCAL
- Muon hits identified with Lars Weuste track finder algorithm
- Muon hits energy spectra has maximum close to 1 MIP (A_{MIP}), as it should (fit of a Landau convoluted with a Gaussian, using fitMIP from the calice_calib software package, used also to measure MIP constants)



MIP-to-GeV and cross-talk factors

Note:

- Both factors have a direct impact on simulated data
- Counter-balancing effect: increased MIP-to-GeV factor results into less energy, increased cross-talk factor results in more energy

Cross-talk factor

- Several measurements available (but not for all SiPMs)
- Original ITEP measurement: 8% for all tiles (i.e. 2% per tile edge), arXiv:1012:4343
- Measurements by Clemens at DESY: 15-18%
- My choice: cross-talk value of 13% (guess based on comparisons of positive-polarity data with simulation)
- Note: my choice is just a choice, not a measurement
⇒ large systematic uncertainty