Test Beam Monte Carlo and Experiment: Comparison of Muons and Electrons

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- **Goal of the studies:**
  to get scale factor between
  - **visible energy, obtained in MC**
  - **current, measured in HEC modules**

- **MC simulation for the HEC 1999 test beam**
  http://wwwatlas.mppmu.mpg.de/HEC/tb31.html

- **Analysis of experimental data (August 1999)**
  by M. Levitsky and A. Minaenko

"Canonical" Scale Factor

- **LAr Calorimeter TDR**
  - **16 gaps LAr — 8 PAs — MIP=224 nA**
  - **16 gaps LAr — MIP=0.027 vis.GeV**
  - **Scale factor C = 8300 nA/vis.GeV**

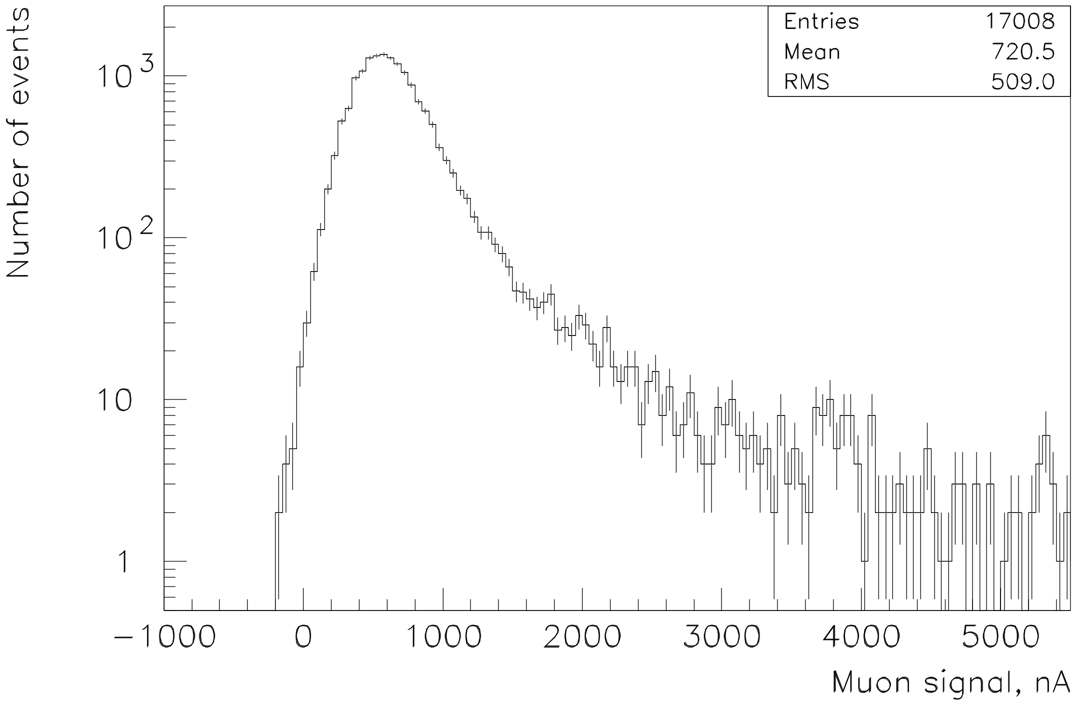
Electron Analysis

- **HEC 1999 test-beam**
- **5-6 channel cluster**
  - **Experiment: α_{em}=0.00395 GeV/nA**
    (talk by A. Minaenko, December 1999 LARG week)
    http://wwwatlas.mppmu.mpg.de/HEC_notes/hec089
  - **MC: α_{MC}=23.45 GeV/vis.GeV**
  - **Scale factor $C = \alpha_{MC}/\alpha_{em}$ = 5940 nA/vis.GeV**

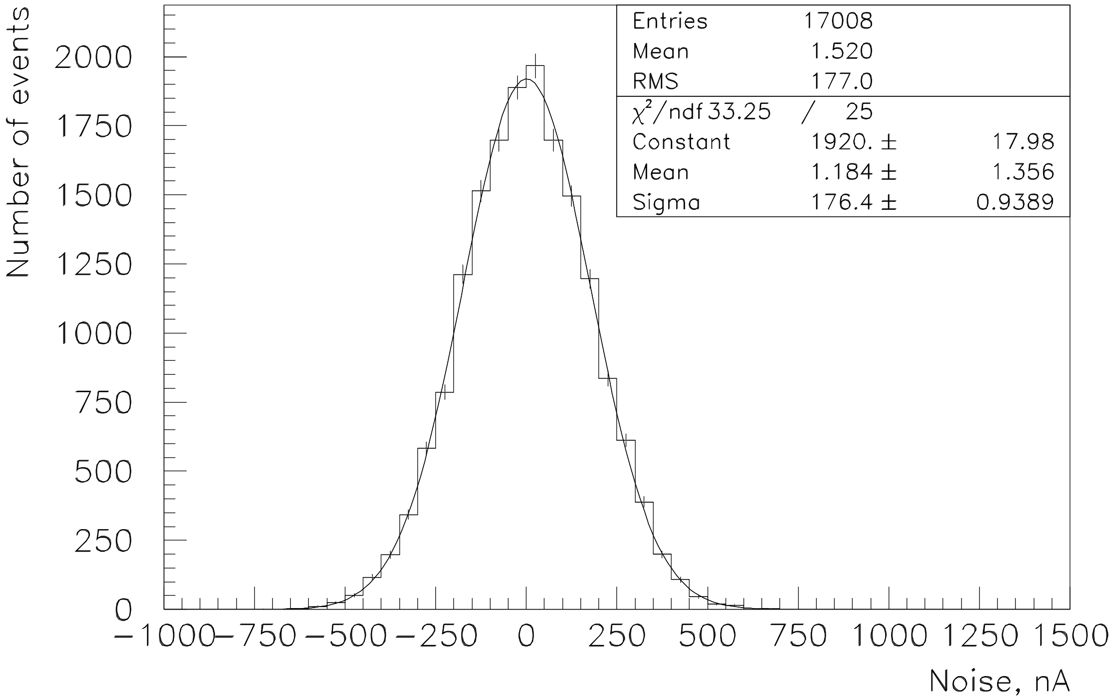
Muon Analysis

- **Thanks to M. Levitsky for experimental spectra**
- **December 1999 analysis:**
  - **200 GeV muons at points H and N**
  - **Gaussian noise**
  - **MC:**
    - **select scale factor and apply it to MC energies**
    - **select level of noise, generate noise according to Gaussian and add it to obtained MC energies**
    - **compare MC and experimental spectra → determine χ^2**
    - **repeat 100 times with different sets of generated noise**
  - **Scale factor — 5400 nA/vis.GeV**

200 GeV Muons in 1999

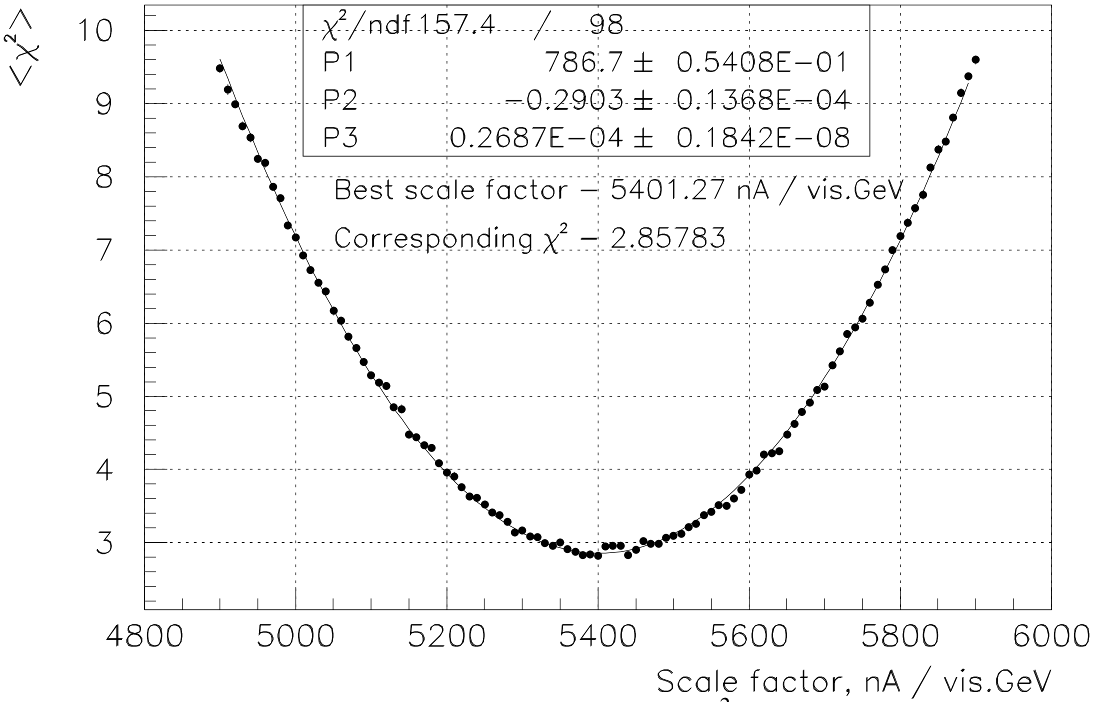


Experimental spectra at points H and N



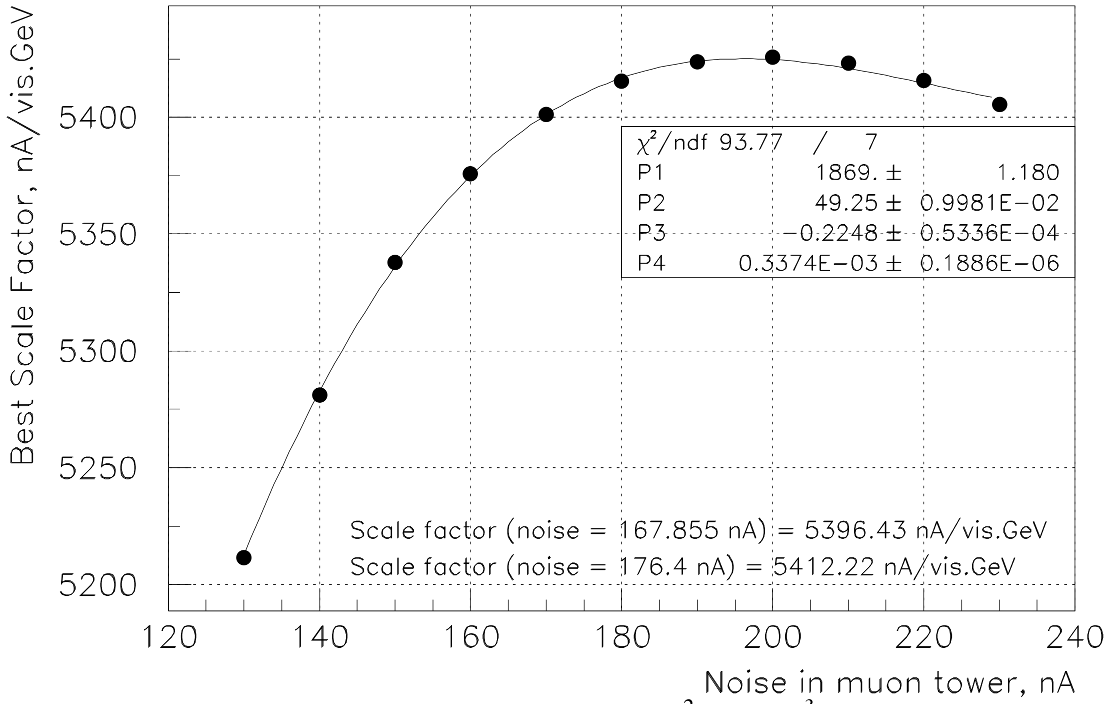
Noise in the corresponding muon tower

200 GeV Muons in 1999 with Gaussian Noise of 170 nA

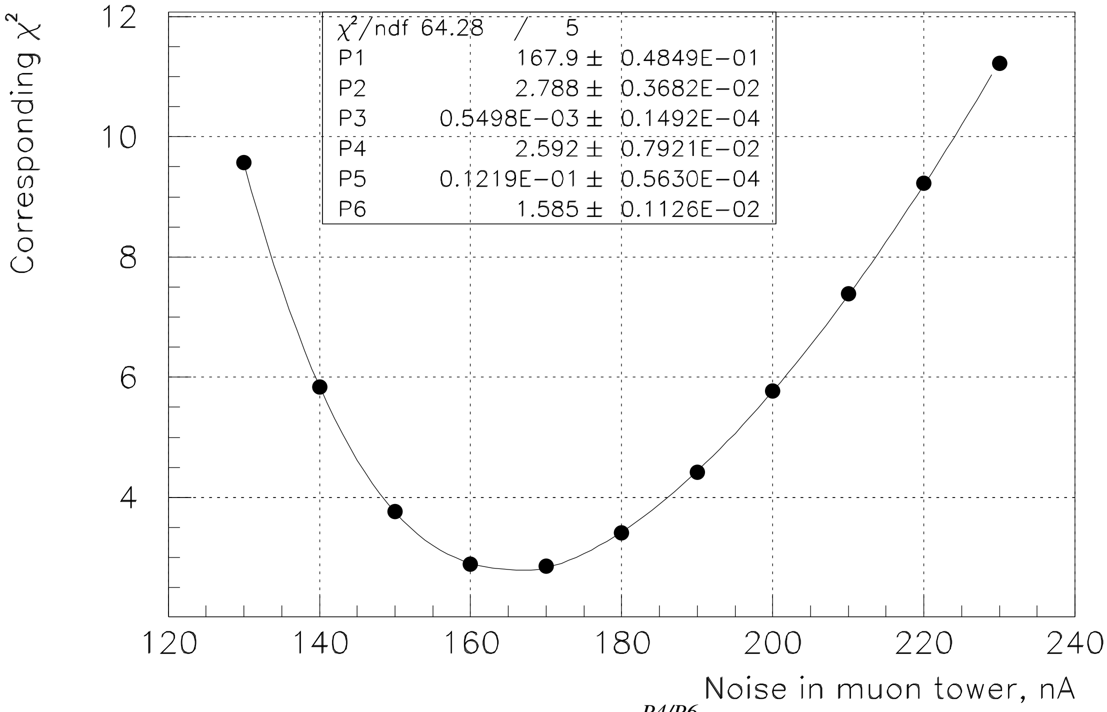


P1 + P2*X + P3*X²

Experiment vs MC : 200 GeV Muons in 1999



*P1 + P2*X + P3*X^2 + P4*X^3*

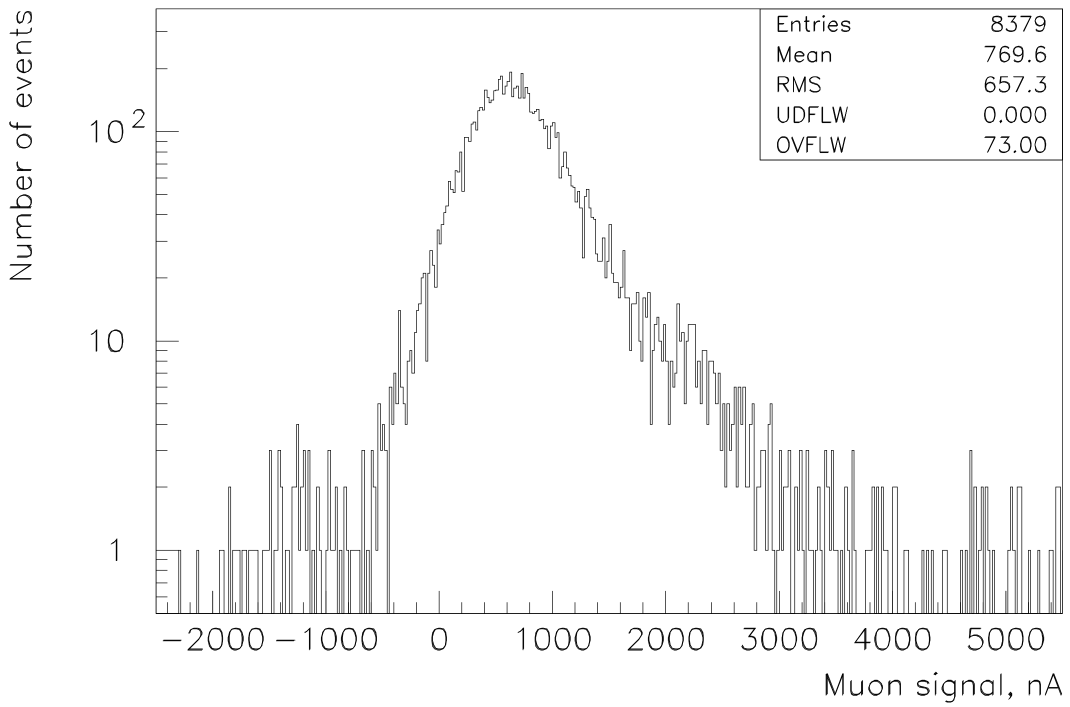


*P2 + P3/P5 * |X - P1|$^{P4/P6}$ (X<P1/X>P1)*

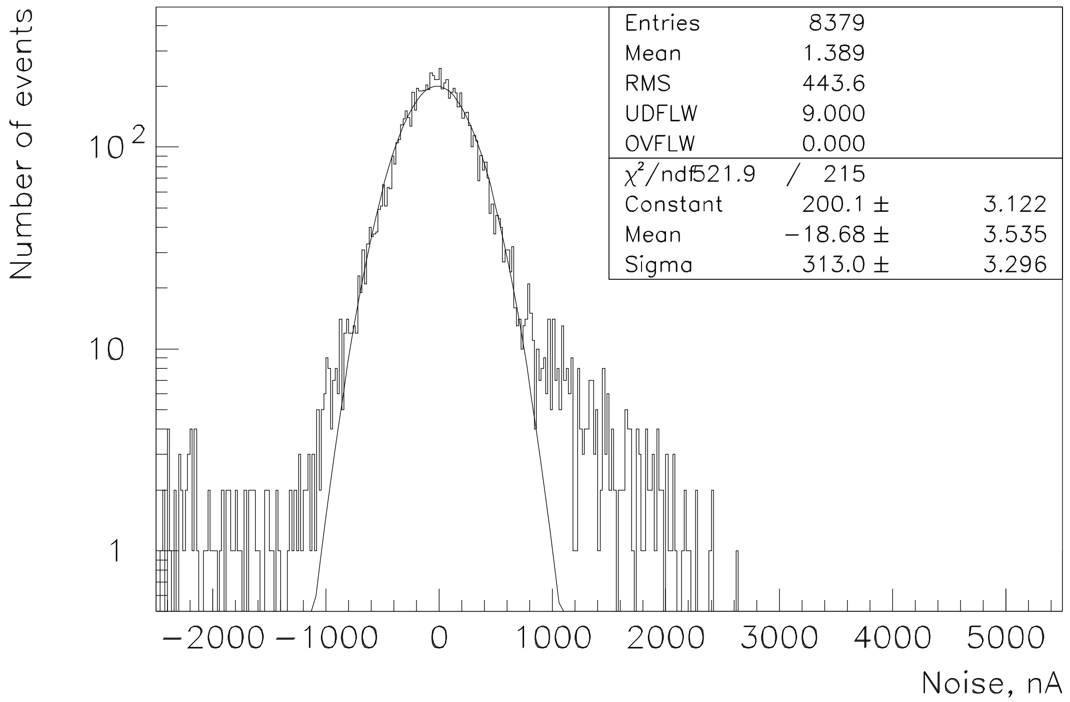
Muon Analysis (cont'd)

- **January 2000 analysis:**
  - **X-talk corrections of experimental muon data**
  - **120 and 200 GeV muons at point M**
  - **Non-gaussian noise**
  - **MC:**
    - **select scale factor and apply it to MC energies**
    - **generate noise according to existing experimental distribution and add it to obtained MC energies**
    - **compare MC and experimental spectra → determine χ^2**
    - **repeat 100 times with different sets of generated noise**
  - **Scale factor:**
    - **5940 nA/vis.GeV — 120 GeV muons**
    - **5840 nA/vis.GeV — 200 GeV muons**
    - **5890 nA/vis.GeV — average value**

200 GeV Muon after X-talk Correction

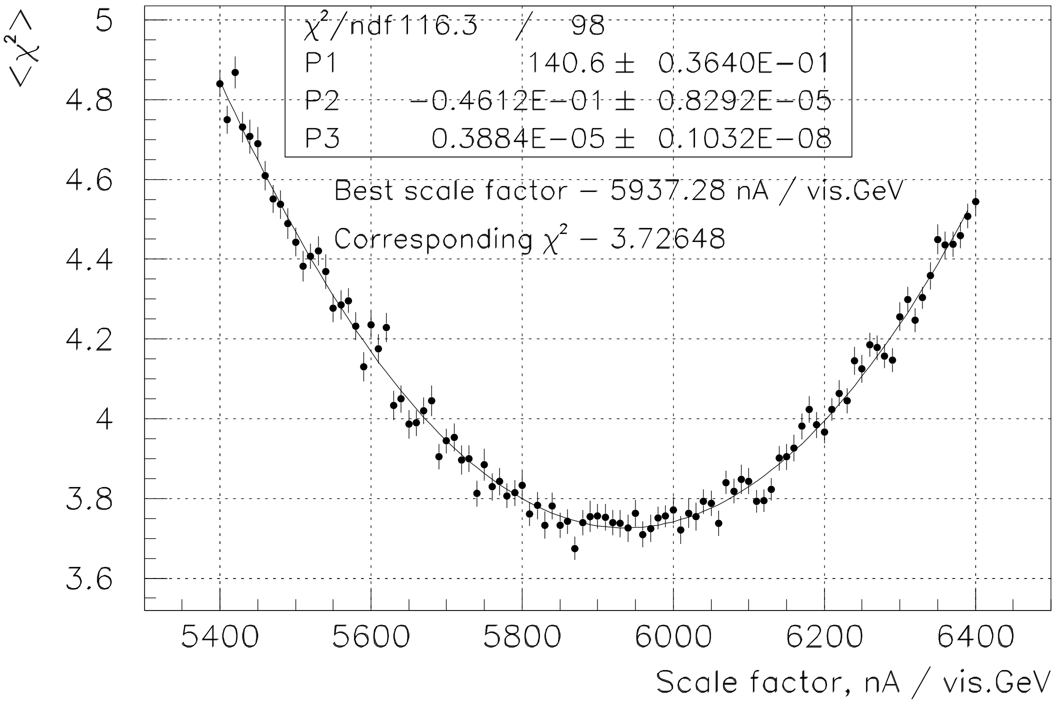


Experimental spectra at point M

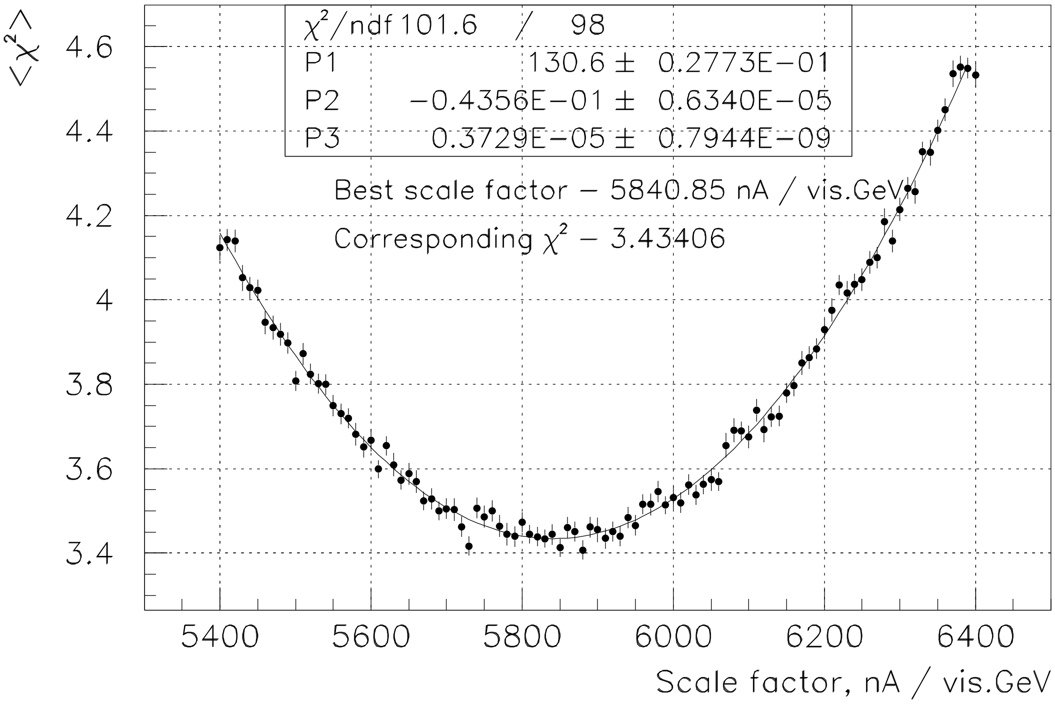


Noise in the corresponding muon tower

Muons after Xtalk Correction with Generated Noise

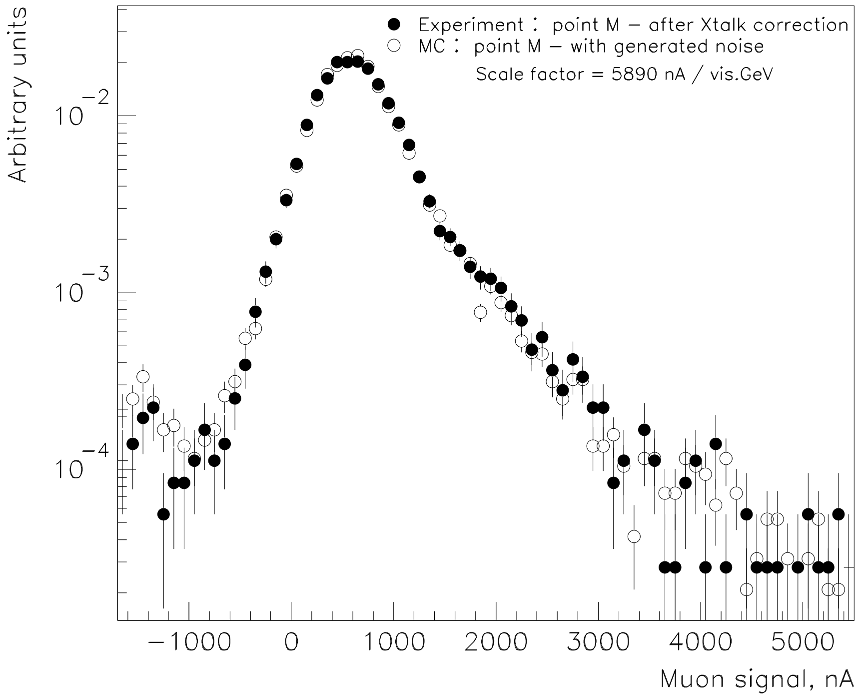


120 GeV muons

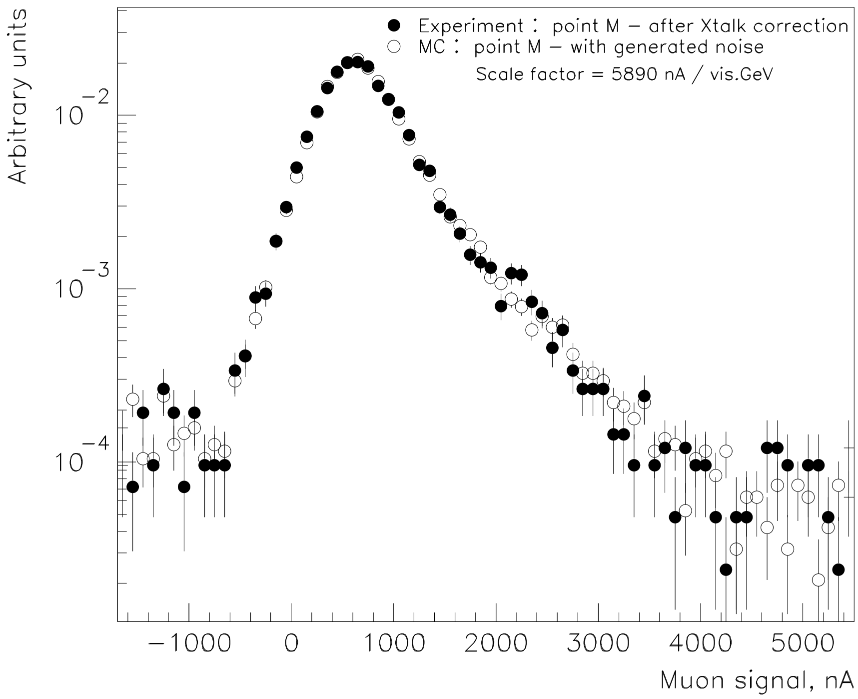


200 GeV muons

Selected scale factor — 5890 nA/vis.GeV



Normalized spectra of 120 GeV muons



Normalized spectra of 200 GeV muons

Summarised Results

- Difference between "canonical" scale factor (8300 nA/vis.GeV) and electron/muon ones:
  - "Universal" calibration constant 1.66 nA/DAC (summer 1999 measurements)
  - Estimated value (preliminary) 2.445 nA/DAC (L. Kurchaninov and P. Striženec in December 1999)
- Expected change of scale factor:
  - 8750 nA/vis.GeV — for electrons
  - 8680 nA/vis.GeV — for muons

Conclusions

- Improvement of muon results after X-talk corrections
- Still existing difference between scale factors, obtained by different methods:
  - between scale factors for electrons and 120 GeV muons and for 200 GeV muons (~2 %)
  - between "canonical" value and results of the analysis (~4-5 %)