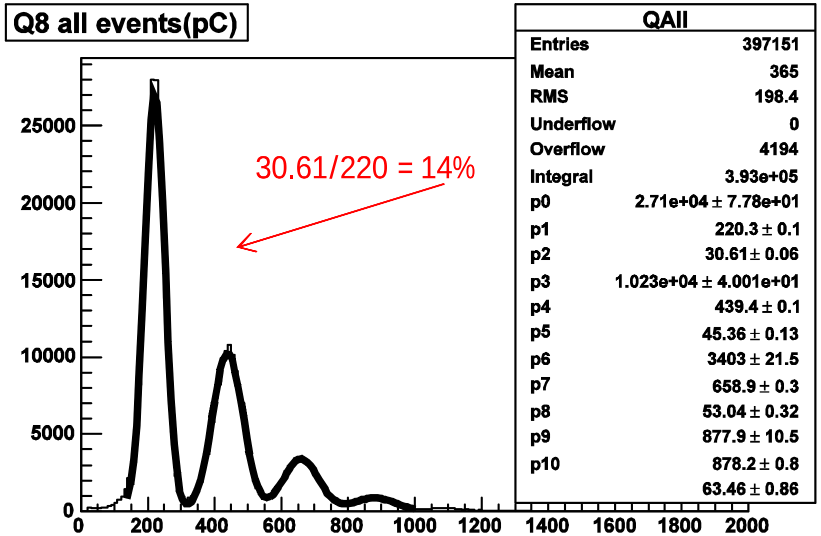
Applying correction factors to BTF data

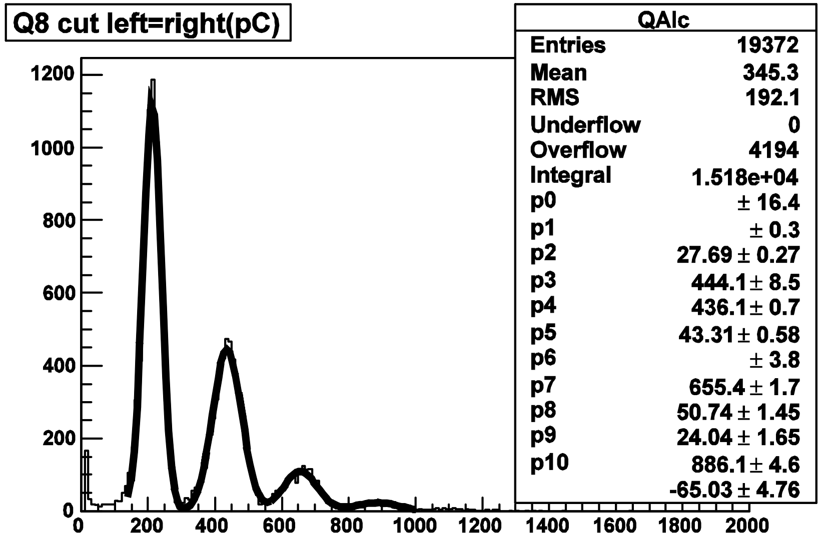
Linearity and resolution of calorimeter “down”

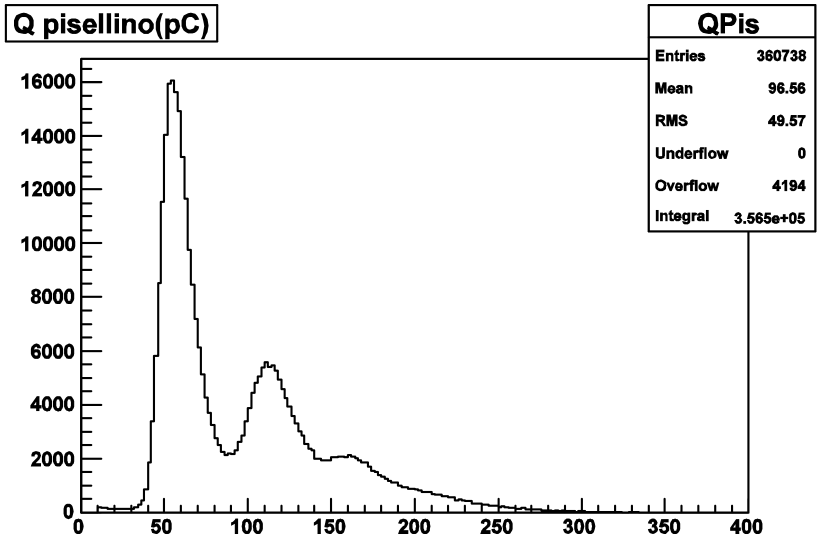
Correcting BTF data

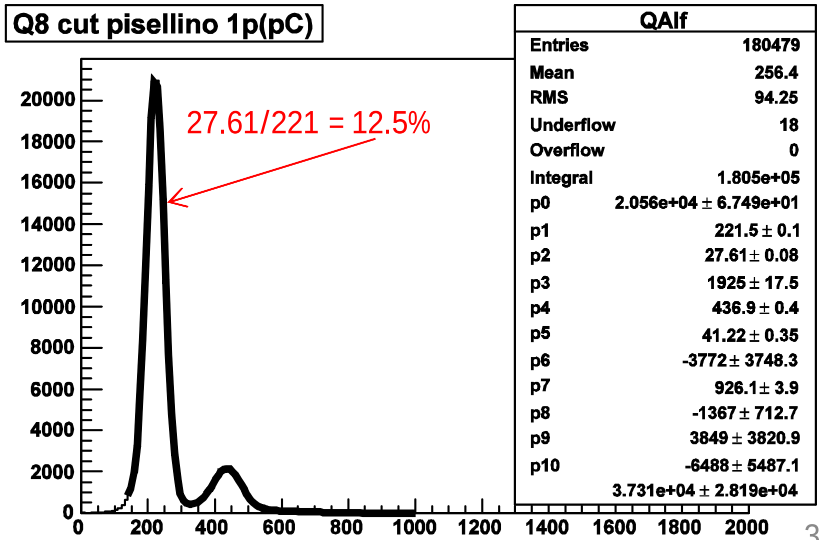
- Runs analyzed: 4 (1.4 kV) 14 and 22 (1.45 kV)
- Compute from cosmic data a set of correction factors
- Read back the BTF data applying individual factors to the 8 channels
- Recompute the sums “Left”, “Right” and “All”.

Run 4, 450 MeV, uncorrected data

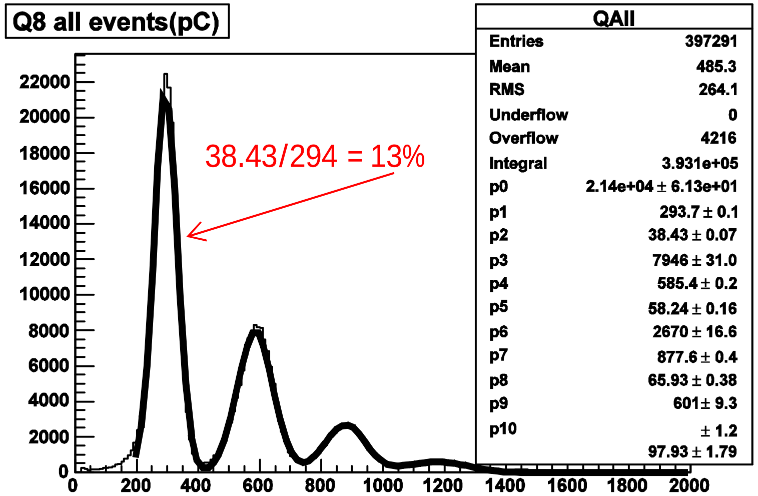


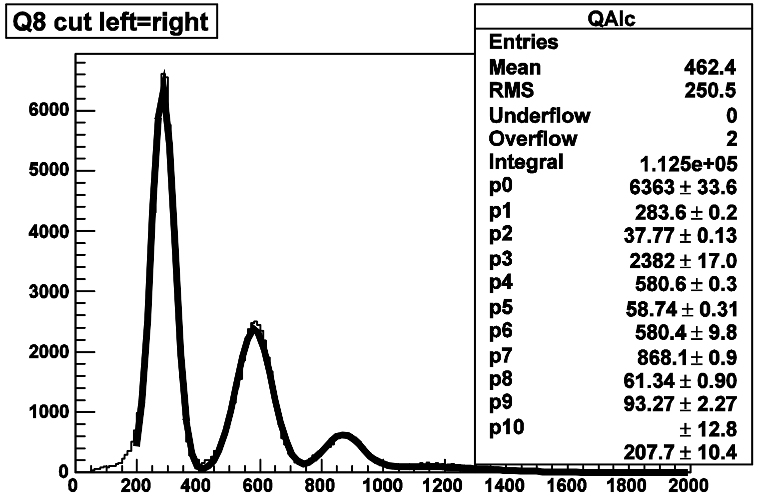


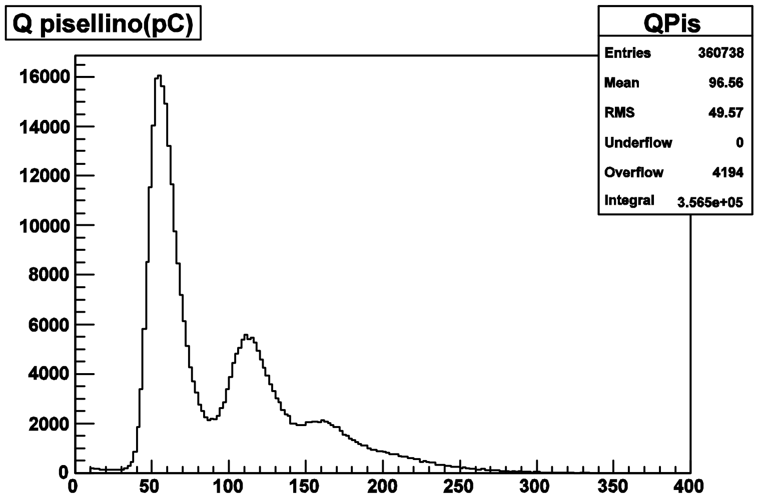


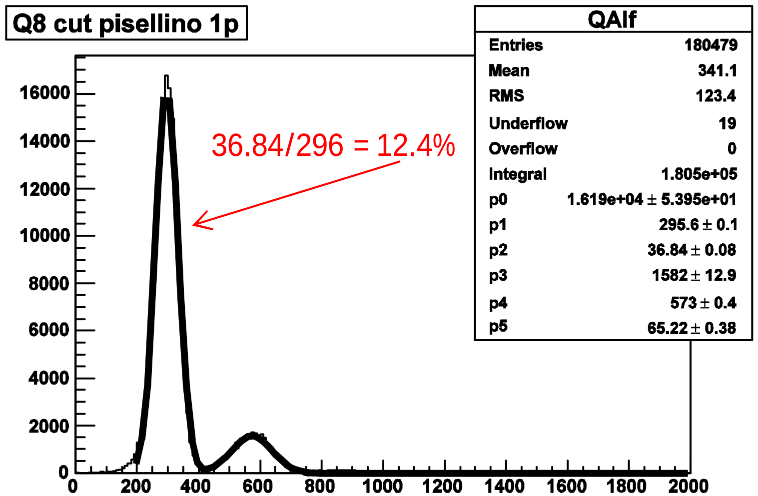


Run 4, 450 MeV, corrected data





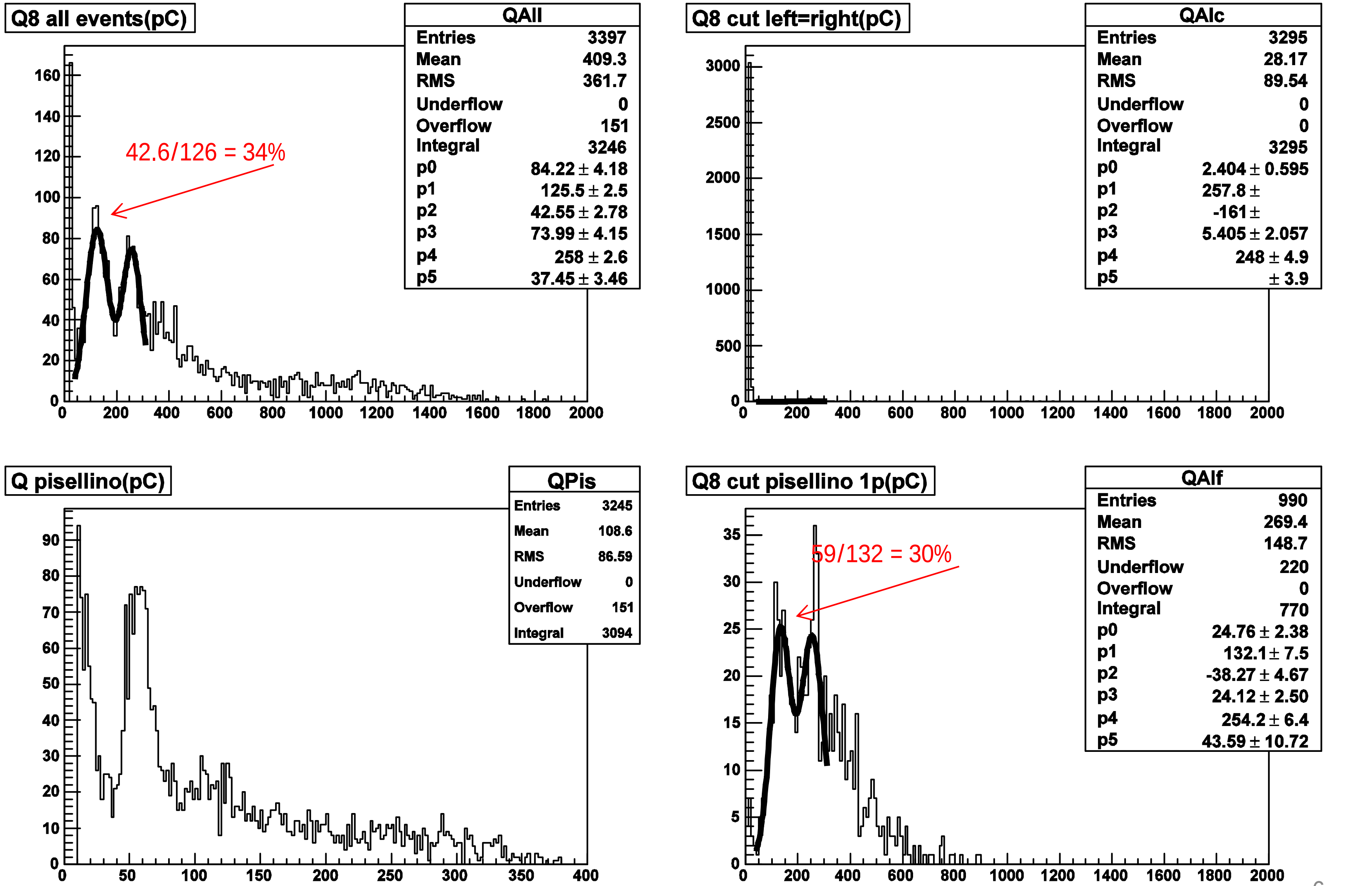




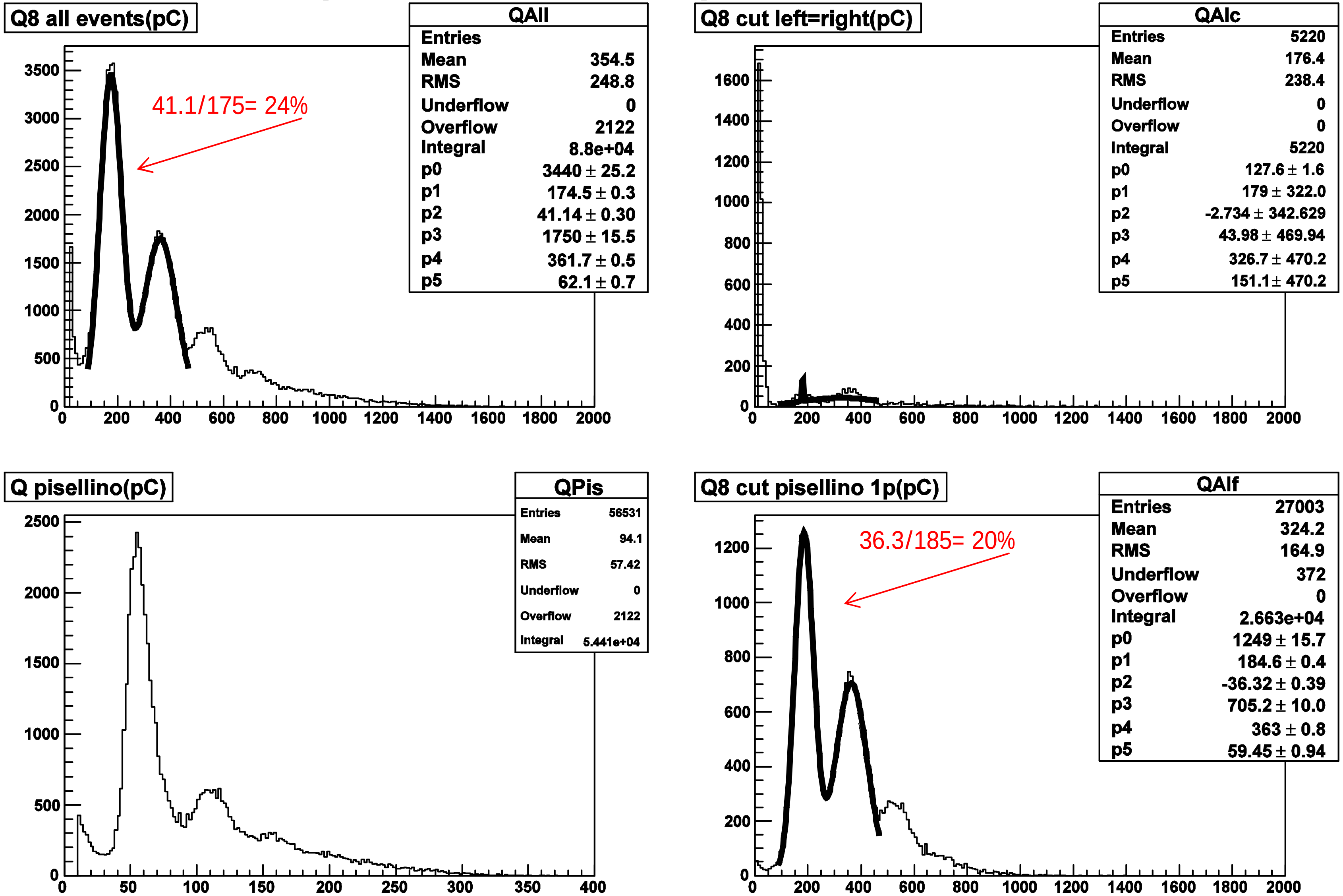
Absolute scale

- According to Montecarlo a 450 MeV electron leaves 0.12*450 = 54 MeV of energy in the scintillator
- If the absolute scale from cosmics is right, we should see 54*5.5=297 pC
- ….and we do! Perfect!
- What about other energies?

Run 14, 197 MeV, corrected data



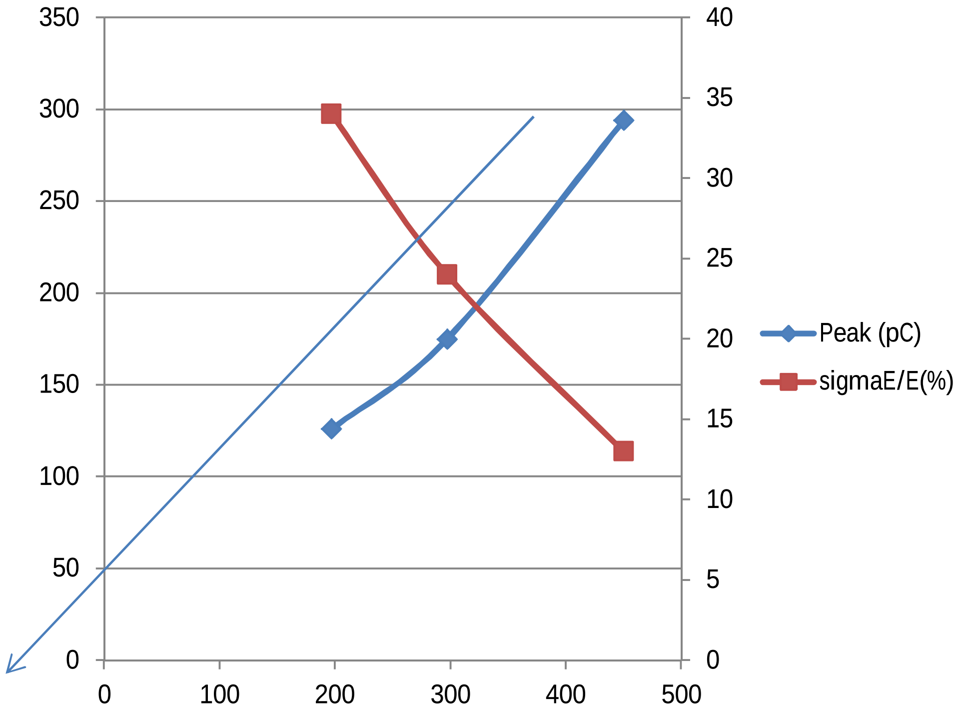
Run 22, 297 MeV, corrected data



Linearity and resolution

HV (V)	E (MeV/c2)	Peak (pC)	SigmaE/E(%)
1450	197	126	34
1450	297	175	24
1400	450	294	13

Problems here....poor linearity, resolution falls down too sharply



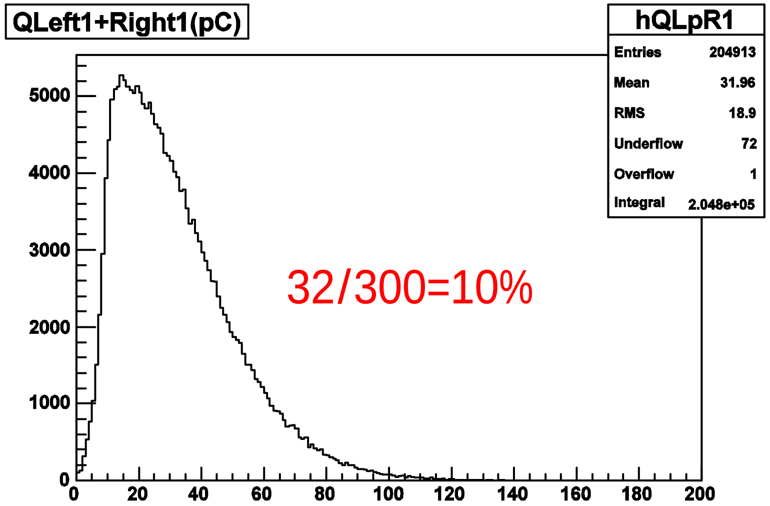
Number of photoelectrons

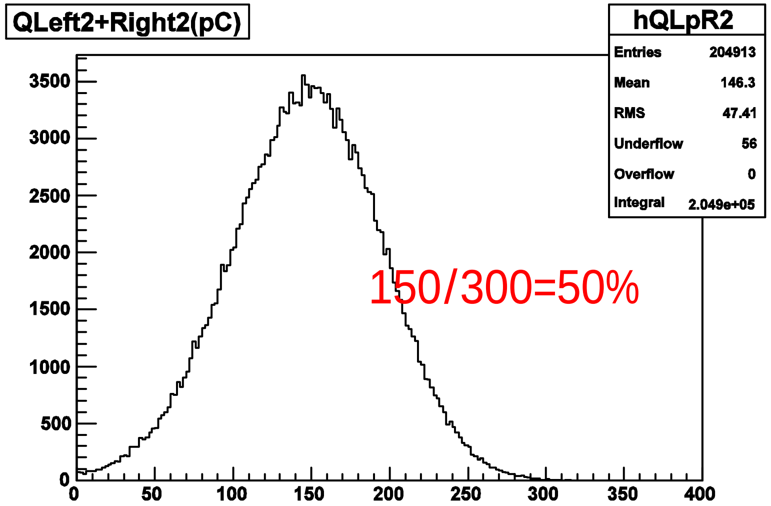
- Assuming a PM gain ≈ $1.4 \cdot 10^6$, the number of photoelectrons at 450 MeV is:

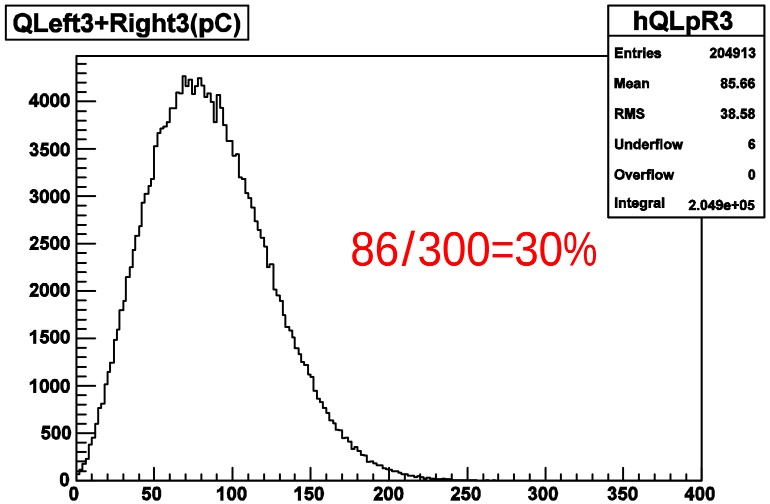
$$N_{pe} = \frac{300 \cdot 10^{-12}}{1.6 \cdot 10^{-19} \cdot 1.4 \cdot 10^{6}} = 1400$$

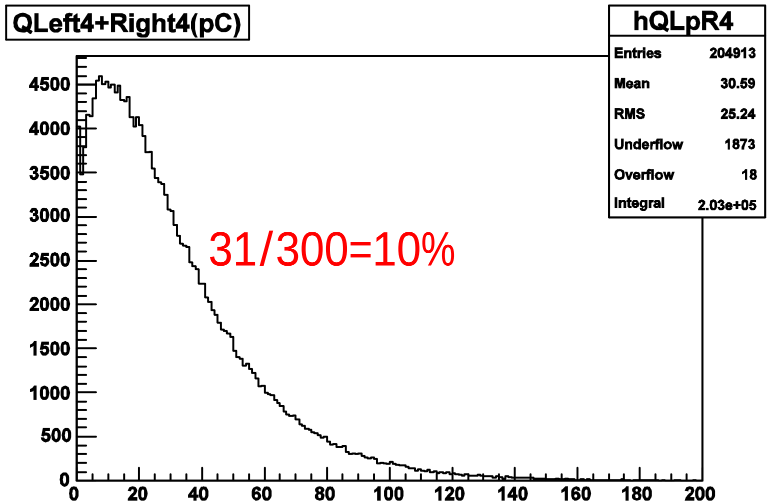
- According to MC (12%·450 = 54 MeV deposited in the scintillator) this means 26 photoelectrons per MeV (24 in cosmics)
- How are these divided among the strata?

Run 4 at 450 MeV, 1.4 kV









Expected resolution

- In absence of fluctuations of the primary energy deposit (shower development) we would expect $\sigma_E/E = 1/\sqrt{N_{pe}}$ = 8% in the first PM (160 photoelectrons), 3.5%, 4.6%, 8% in the others.
- We find much more!
- The primary sources of these errors are shower and PM fluctuations, not “counting statistics”.