Parameter estimation (1)

- Consider the dataset provided in „data.root”
  - Muon decay time measurements
  - Data is not calibrated
- Using that data, fill a 1D histogram with a fine-grained binning (4096 bins) and perform a Likelihood fit
  - Look at the chi² to quantify the fit quality. Restrain the fit to the proper range to get something „reasonable”
  - What is the chi² probability? Does it make sense? Try to calibrate the „chi² distribution” in this case.

Parameter estimation (2)

- Rebin the histogram and repeat the analysis starting with a chi² fit.
- Compare with the result from the ML estimator of the lifetime.
- Build the likelihood curves for your fit
  - Consider the amplitude as a nuisance parameter and do a 1D profile likelihood
  - Do a full 2D likelihood.

Limits, confidence, intervals (1)

- Construct a confidence belt in the following case:
  - Mass measurement with a resolution that depends on the mass (sigma = 1GeV + mass[GeV]/10.) for a resonance of width 2GeV.
  - Model: „Voigt function” (gamma=2, sigma as above).
- What is the „1σ” confidence interval for a measured mass of 45 GeV ?
- Note: you can vary the definition of the interval.

Limits, confidence, intervals (2)

- In the context of the CLs method, compute the value of -2lnQ, the expected CLs and the observed CLb, CLsb, CLs in the following case:
  - S=16.0, B=71.7, D=70
- Repeat the calculation in the case where data Calculate „-2lnQ” and MC are binned.

Bin	1	2	3	4	5
Signal	1.8	4.0	5.5	4.0	0.7
Background	26.1	27.9	14.0	3.4	0.3
Data	24	30	13	3	0

- Note: use the class TLimit from ROOT. It does all the „toy-MC” for you.