

K^+ Mass Measurement with Hydra at LHCb

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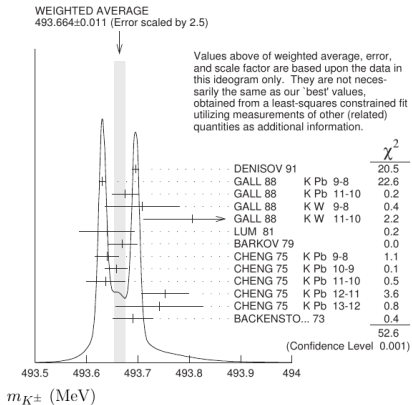
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K^+ mass, a brief introduction

Striking disagreement between two most precise measurements from x-ray energies of Kaonic atoms



Current measurement is
 493.677 ± 0.016 MeV

Uncertainty on the Kaon mass affects many other measurements

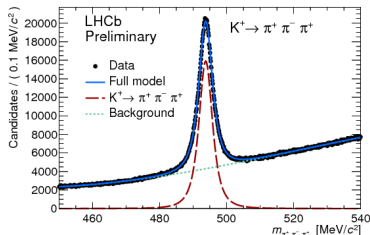
The decay $K^+ \rightarrow \pi^+ \pi^- \pi^+$ is ideal for a precise determination at LHCb, Very large signal yield and purity are needed to have negligible statistical uncertainty and perform systematics studies

Prospects at LHCb

LHCb's $\Sigma^+ \rightarrow p\mu^+\mu^-$ search used $K^+ \rightarrow \pi^+\pi^-\pi^+$ as control channel

LHCb-CONF-2016-013-001

- $\sim 1\text{M}$ events in Run 1 dataset
- No dedicated trigger line
- Selection optimised for Σ^+



Improved flexibility of LHCb's trigger system in Run 2 came to help

- Dedicated trigger selection (in the so-called Turbo stream)
- Boost in efficiency by more the $\mathcal{O}(10)$, expect tens of million events
- Selection can be tighten for very high purity

Coping with high statistics

The main ingredient for this type of measurement will be computing power and tools adequate for high stats fits/toys. GPUs are the obvious solution

- I learned about Hydra 6 months ago and started playing with one of the first releases
- Thanks to Augusto, after a few adjustments I was able to compile it smoothly on my GTX-1080 (which was rather new back then)
- Then I started running the examples and also comparing performances between my CPU (i7-6700K) and the GTX
- Genuinely impressed by the performance and by how easy it was to do all that

We finally decided to pair up for the measurement

Conclusions

- Advantages of Hydra;
 - Relatively easy to use, powerful, great support
 - Runs on multiple architectures with no effort from the user
- We already started working on the analysis
- Code will be available here:
<https://github.com/AnalysisHEP/MassMeasurement>