Secondaries parametrisation for lifetime fits

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Data

From
/MC/2016/
Beam6500GeV-2016-Mag(Up|Down)-Nu1.6-25ns-Pythia8/Sim09b/Trig0x6138160F/
Reco16/Turbo03/Stripping26NoPrescalingFlagged/2610408(0|1)/ALLSTREAMS.DST

Ξ_c^0 & $\Omega_c^0 \to$ pKKπ, 1M events per polarity. Unfiltered, mostly prompt.

Generated lifetime 112 fs for Ξ_c^0, 69 fs for Ω_c^0.

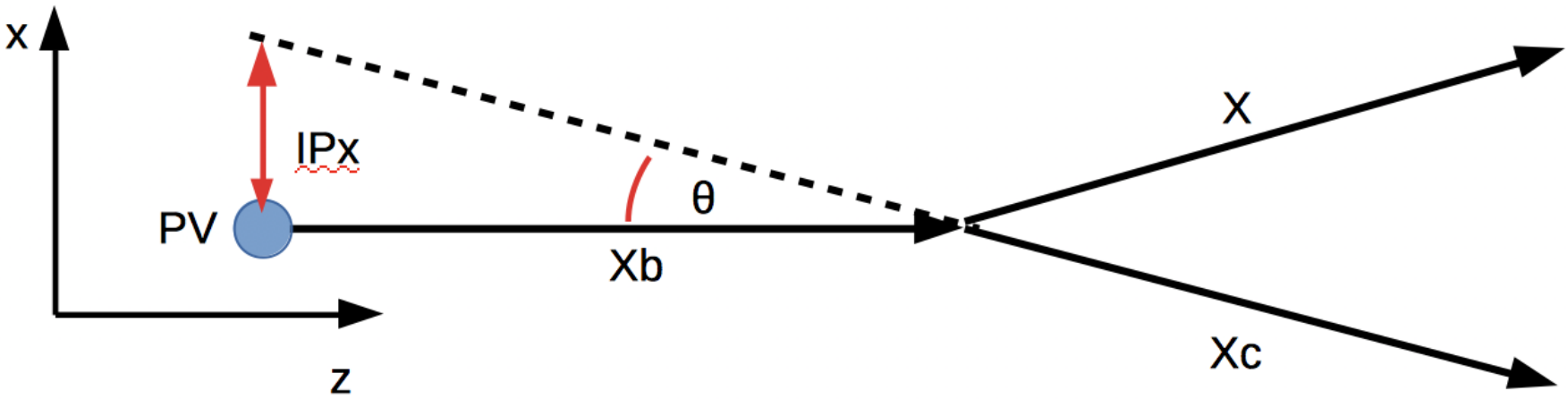
Truth matched & filtered, ntuples at
root://eoslhcb.cern.ch//eos/lhcb/user/m/malexand/
baryons-run-II/data/MC_(Xic0|Omc0)_2016-FilteredMC.root

Stats

Dataset	N. prompt	N. secondaries
Ξ_c^0 lifetime biasing selection	288	965
Ω_c^0 lifetime biasing selection	114	477
Ξ_c^0 lifetime unbiased selection	19300	3919
Ω_c^0 lifetime unbiased selection	16973	2419

Work with LTUNB selection for now.

1D IP



$\mathrm{IP}_x \simeq (B\,\mathrm{flight\,distance}) \times \theta$

Prompt: No, B, just resolution - Gaussian.

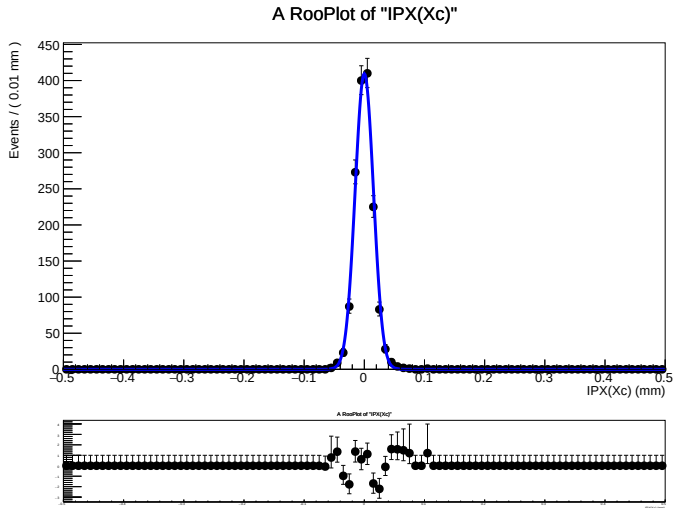
Secondaries: Exponential from flight distance signed by θ - double sided expontential convolved with Gaussian resolution.

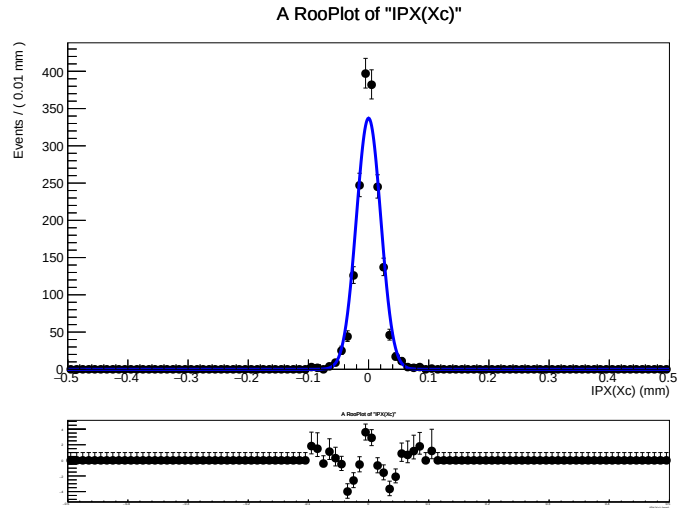
Proof of concept strategy

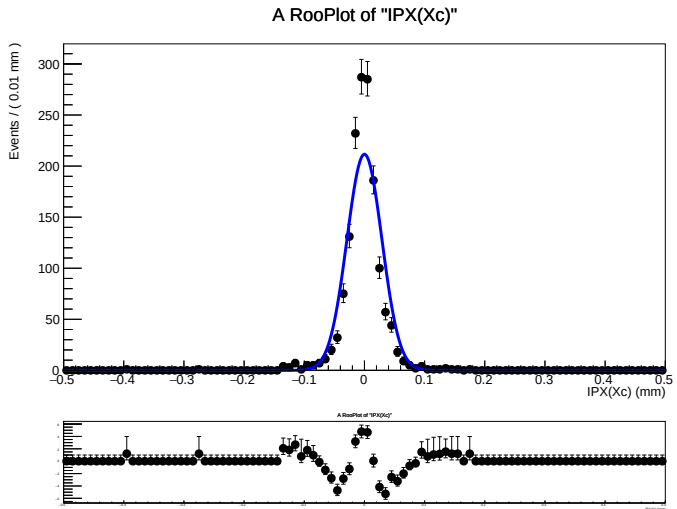
- Fit in bins of decay time with roughly equal prompt yield.
- Fit prompt MC for resolution width.
- Fit secondaries MC for exponential decay constant assuming same resolution as for prompt (fixed from previous step).
- Fit sum of prompt & secondaries for yields & compare with true yields.

Distributions from MC

Prompt

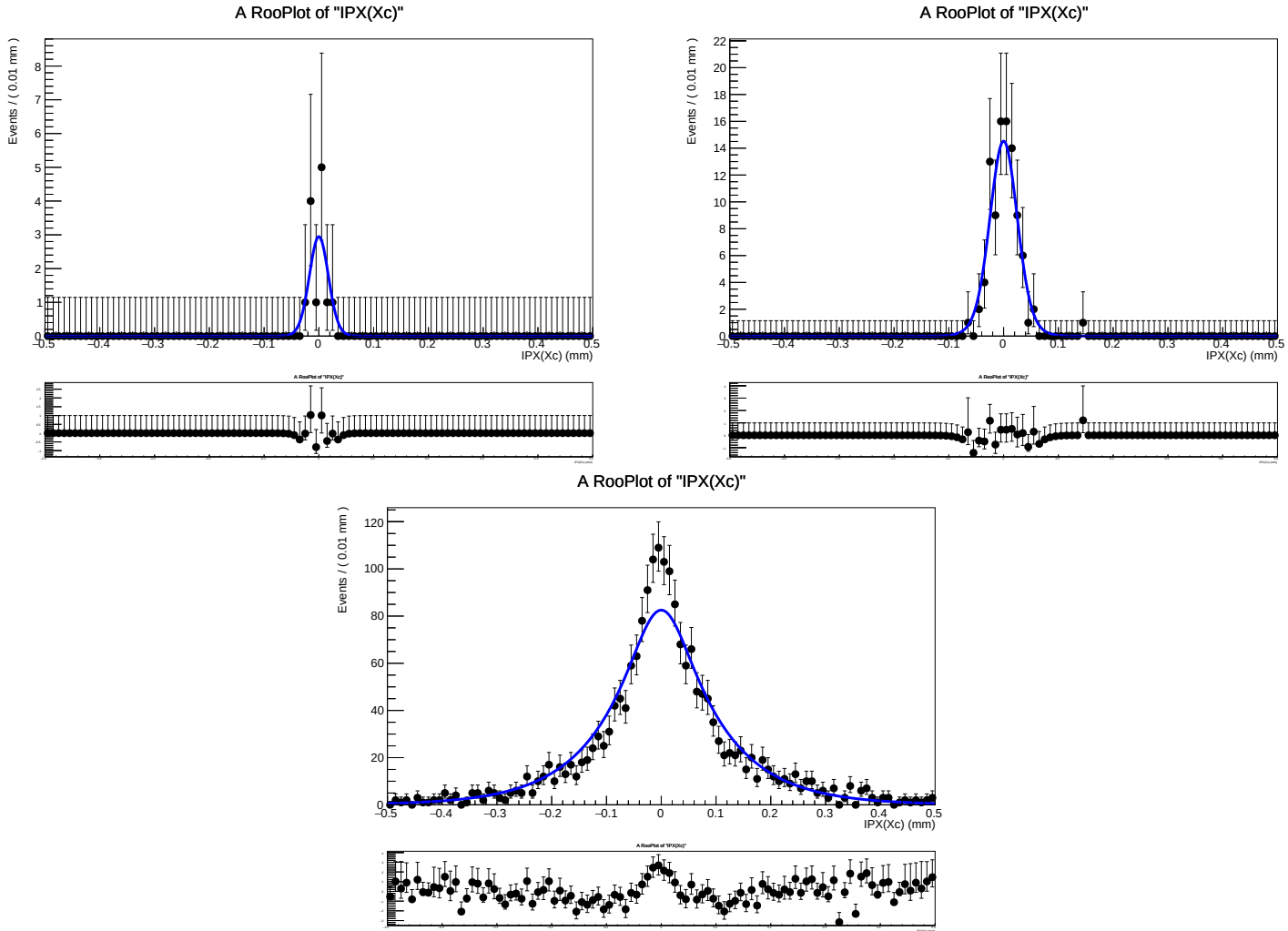






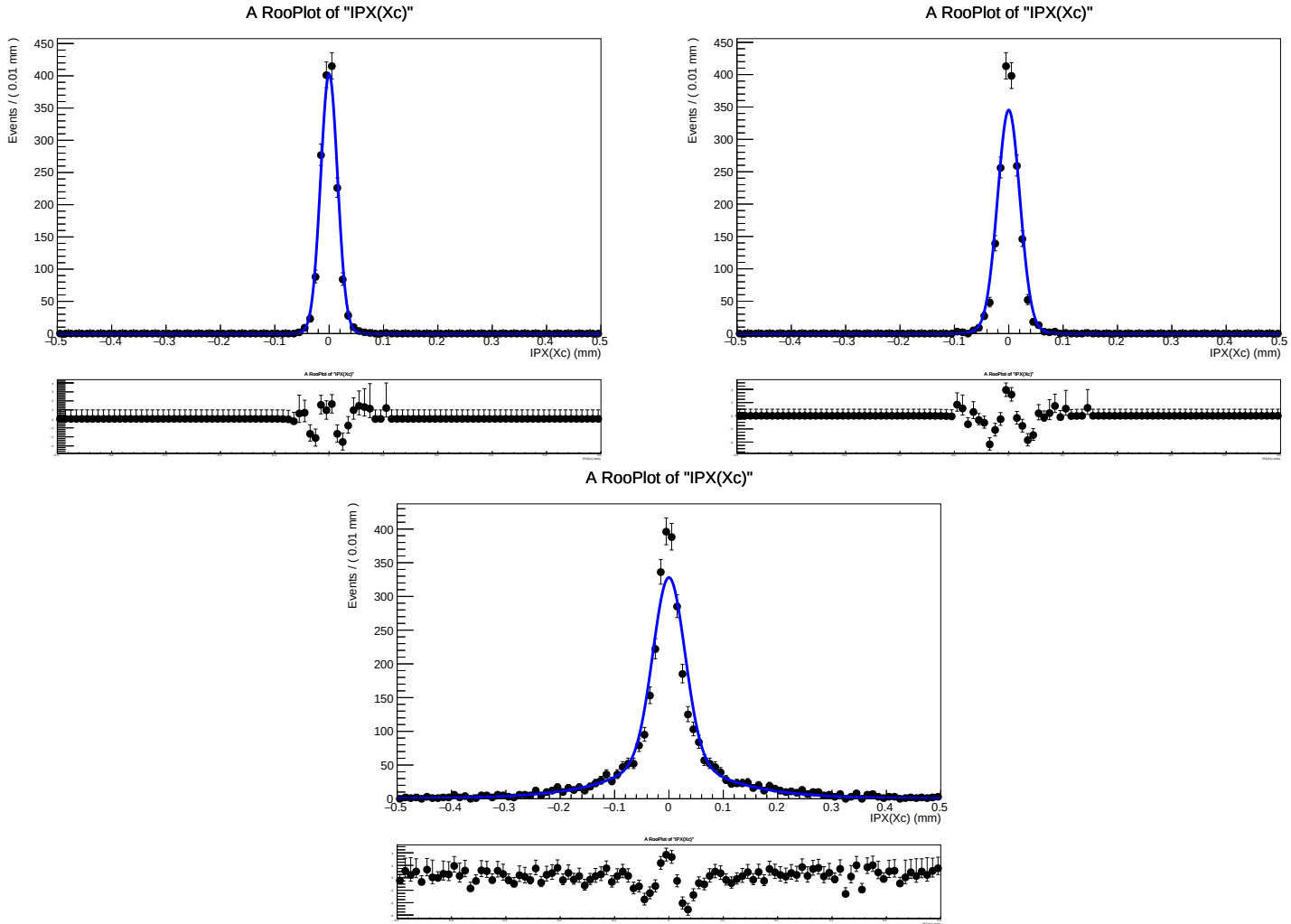
Distributions from MC

Secondaries, assuming same resolution as prompt.

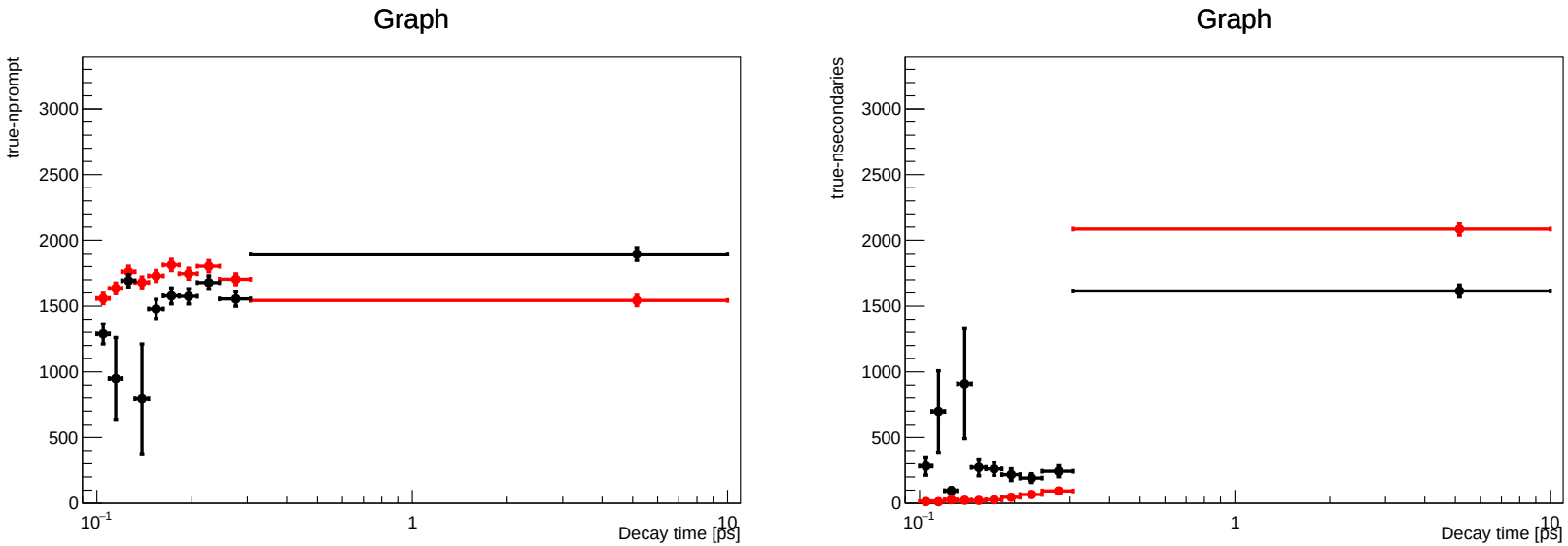


Distributions from MC

Combined prompt & secondaries.



Fits for prompt & secondaries yields



Left: n. prompt, right: n. secondaries.
Black: fitted yield, red: true yield.

Conclusions

- 1D IP is nice to use as it has a well defined shape & is easy to model.
- Prompt: Gaussian.
- Secondaries: double sided exponential convolved with Gaussian.
- Resolution for prompt & secondaries doesn't appear to be the same at high decay times.
- At low decay times, secondaries distribution is essentially just Gaussian, so very difficult to distinguish from prompt.
- Secondaries yield is very small at low decay times (at least in this MC).
- May need to do simultaneous fits across time bins & extrapolate parameters down to low decay times.

Backup