



University
of Glasgow



Λ_c^+ Stripping 17b Update

Stephen OGILVY, Paul SOLER, Patrick
SPRADLIN,

Charm WG

16/05/2012

Contents

- Relative BR measurement and DCS search.
- Λ_c^+ yields in Stripping 17b:
 - Prompt
 - Semileptonic
 - TISTOS
- (Briefly) other physics potential with Λ_c^+ s.

Λ_c^+ Physics Program

- Glasgow is performing a Relative BR measurement of the primary decay modes of the Λ_c^+ :

$$- \Lambda_c^+ \rightarrow p^+ K^- \pi^+$$

$$- \Lambda_c^+ \rightarrow p^+ K^- K^+$$

$$- \Lambda_c^+ \rightarrow p^+ \pi^- \pi^+$$

Decay Mode	BF from PDG
$\Lambda_c^+ \rightarrow p^+ K^- \pi^+$	0.05 ± 0.013
$\Lambda_c^+ \rightarrow p^+ K^- K^+$	$(7.7 \pm 3.5) \times 10^{-4}$
$\Lambda_c^+ \rightarrow p^+ \pi^- \pi^+$	$(3.5 \pm 2.0) \times 10^{-3}$
$\Lambda_c^+ \rightarrow p^+ K^+ \pi^-$	$< 2.3 \times 10^{-4} @ 90\% \text{ CL}$

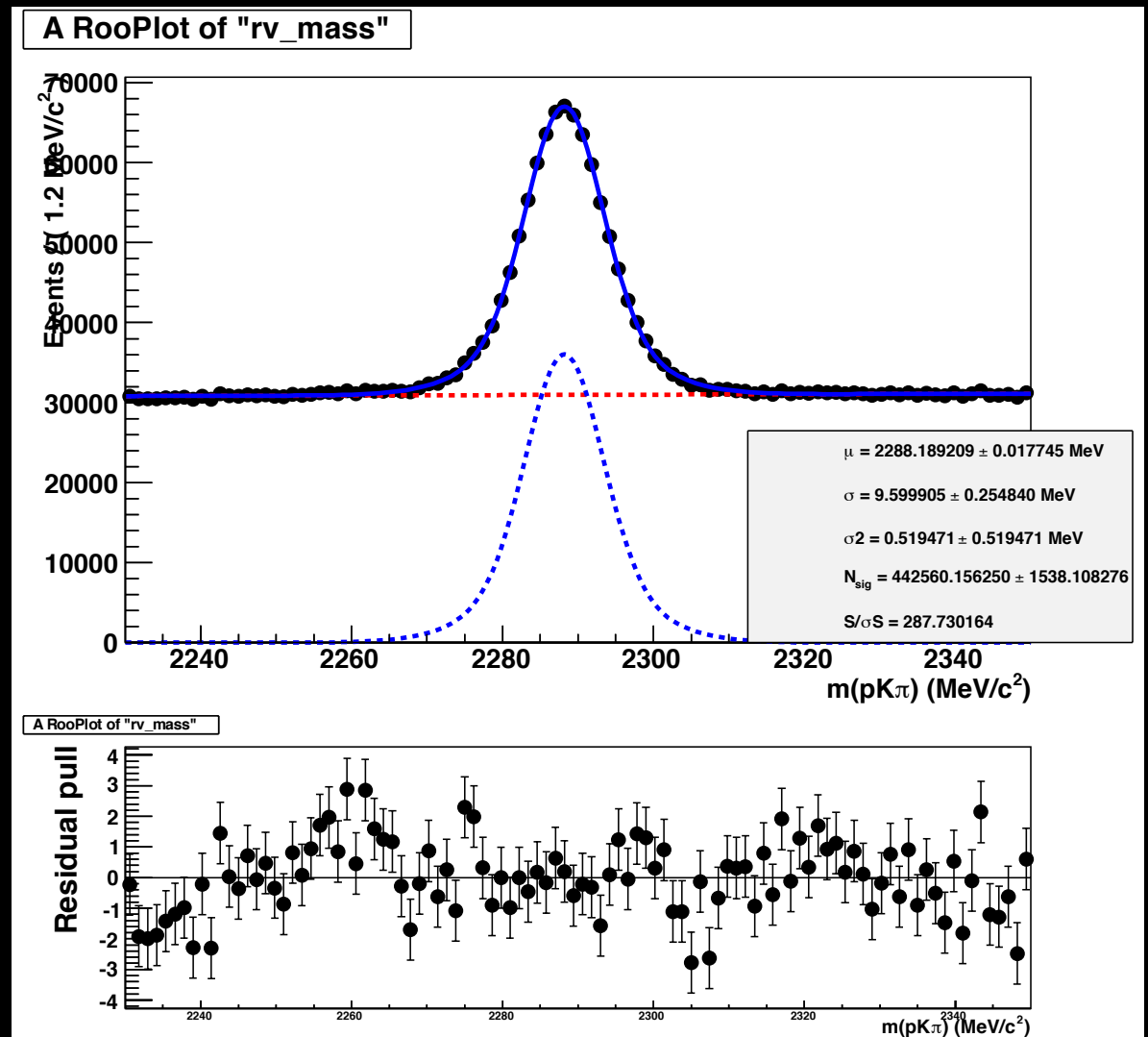
- This will be the precursor to a search for the unobserved DCS decay $\Lambda_c^+ \rightarrow p^+ K^+ \pi^-$.
- BF currently constrained at $< 2.3 \times 10^{-4} @ 90\% \text{ CL}$.

Dedicated Stripping 17b Lines

- Prompt:
 - Lambdac2PHHLambdac2PKPi
 - Lambdac2PHHLambdac2PKK
 - Lambdac2PHHLambdac2PPiPi
 - Lambdac2PHHLambdac2PPiKWS
- Semileptonic, all from $\Lambda_b^0 \rightarrow (\Lambda_c^+ \rightarrow p^+ h^- h^+) \mu^-$
 - b2LcMuXB2DMuNuX
 - b2Lc2pKKMuXB2DMuNuX
 - b2Lc2pPiPiMuXB2DMuNuX
 - b2LcDCSMuXB2DMuNuX
- However, have only had a dedicated HLT2 line in prompt for $\Lambda_c^+ \rightarrow p^+ K^- \pi^+$ and that was deployed roughly halfway through of 2011. Semileptonics should have the edge due to the higher muon trigger TIS efficiencies.

Prompt $\Lambda_c^+ \rightarrow p^+ k^- \pi^+$ Signal Yield

- Direct Stripping output.
- Double Gaussian signal, linear background.
- Signal yield of $\sim 442k$.
- Using this data with sweights to train a BDT to search for the DCS $\Lambda_c^+ \rightarrow p^+ k^+ \pi^-$ mode.



Prompt $\Lambda_c^+ \rightarrow p^+ k^- \pi^+$ TISTOS Info

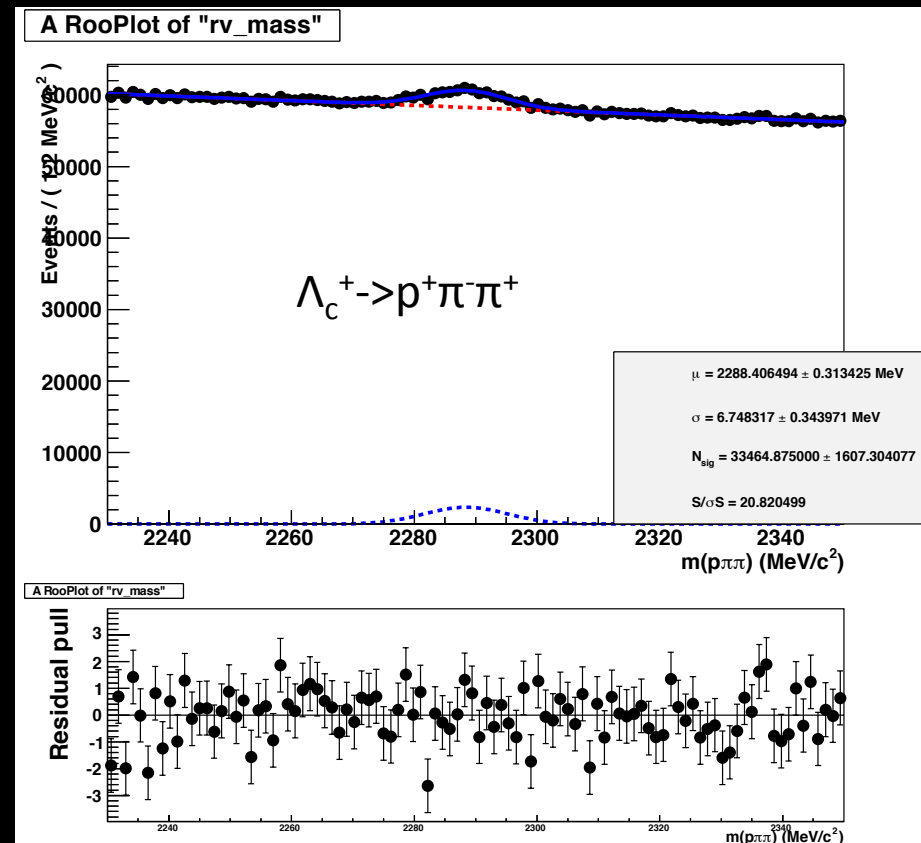
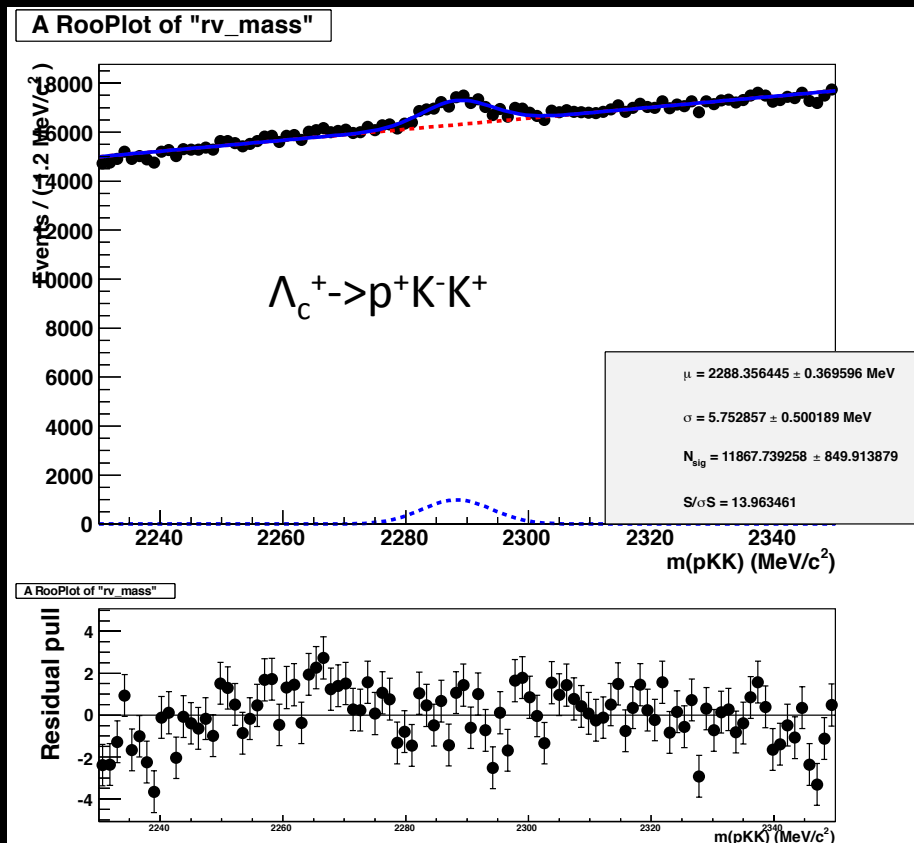
Pre Dedicated Line

Line	TIS Decision	TOS Decision
Hlt2CharmHadLambdaC2KPPi	0	0
Hlt2Topo2BodyBBDT	0.118	0.004449
Hlt2Topo3BodyBBDT	0.1609	0.0036
Hlt2CharmHadD2HHH	0.09305	0.04902
Hlt2Phys	0.9784	0.09113
Hlt1TrackAllL0	0.6986	0.2601
L0Hadron	0.4626	0.2019

Post Dedicated Line

Line	TIS Decision	TOS Decision
Hlt2CharmHadLambdaC2KPPi	0.08331	0.08101
Hlt2Topo2BodyBBDT	0.1386	0.00475
Hlt2Topo3BodyBBDT	0.1889	0.004049
Hlt2CharmHadD2HHH	0.108	0.04804
Hlt2Phys	0.9774	0.118
Hlt1TrackAllL0	0.791	0.255
L0Hadron	0.5159	0.2295

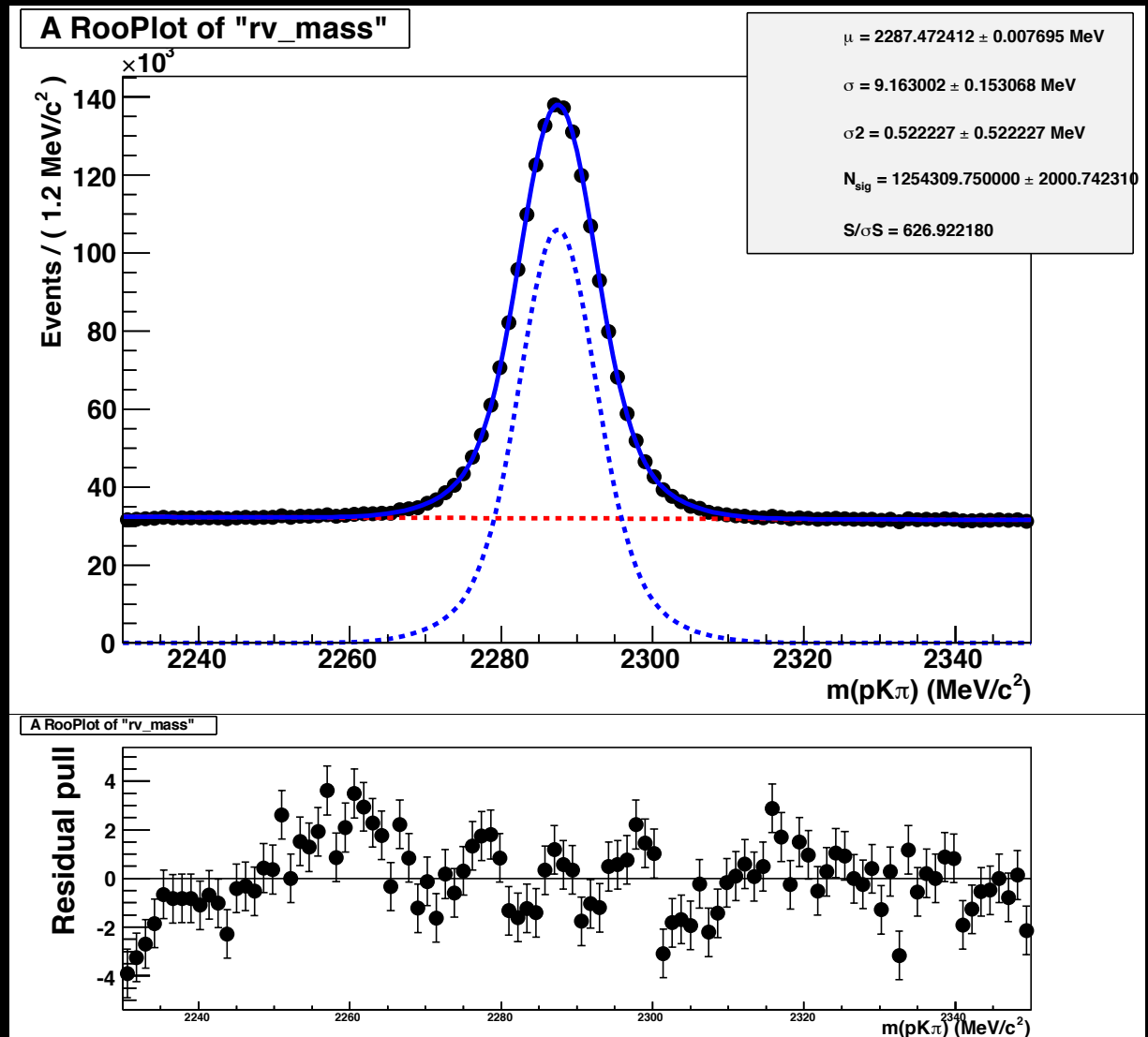
Prompt $\Lambda_c^+ \rightarrow p^+ h^- h^+$ - Yields



- Signal yield: 11.8k
- Both single gaussian signal & linear bkg.
- Unsure why the $p\pi\pi$ peak is more smeared.
- Signal yield: 33.4k

Semileptonic $\Lambda_c^+ \rightarrow p^+ k^- \pi^+$ - Yields

- Straight out of the Stripping.
- Double Gaussian signal peak, 2nd order poly bkg.
- First fit to get an idea of signal yields.
- Approx 1.254m signal events, more than twice that found in the prompt stream.



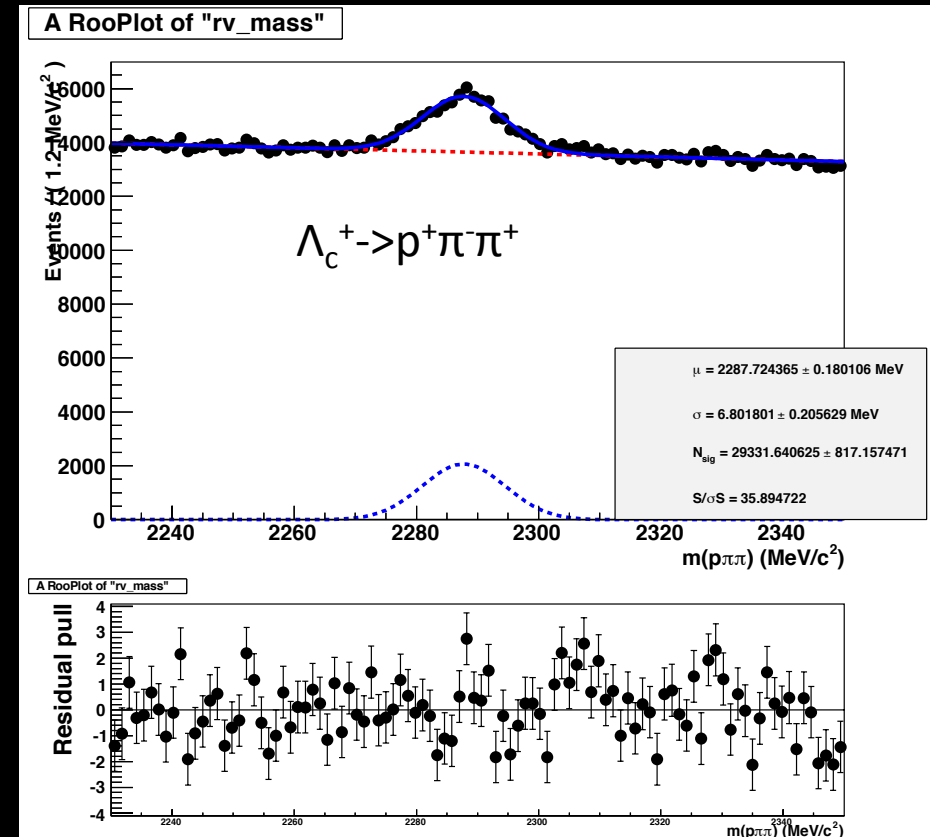
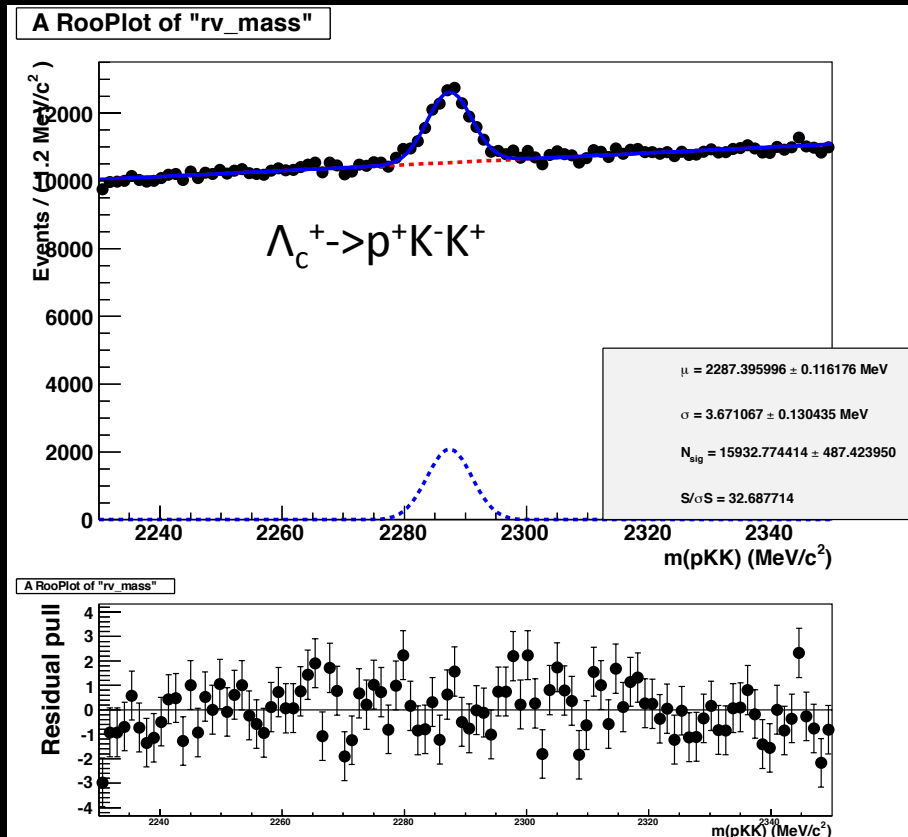
Semileptonic $\Lambda_c^+ \rightarrow p^+ k^- \pi^+$ - TISTOS

Line (pertains to Λ_b^0 unless otherwise stated)	TIS Decision	TOS Decision
Λ_c^+ L0Hadron	0.2469	0.09414
L0Muon	0.1659	0.7339
Hlt1TrackAllL0	0.2426	0.7264
Hlt1SingleMuonNoIP	0.000724	0.006144
Hlt1SingleMuonHighPT	0.00703	0.07951
Hlt1TrackMuon	0.051	0.6605
Hlt2Phys	0.08893	0.6719
Λ_c^+ Hlt2CharmHadLambdaC2KPPI	0.01048	0.073
Hlt2Topo2BodyBBDT	0.01651	0.1805
Hlt2Topo3BodyBBDT	0.01921	0.2151
Hlt2Topo4BodyBBDT	0.01763	0.1366
Λ_c^+ Hlt2CharmHadD2HHH	0.014	0.02751
Hlt2SingleMuon	0.008272	0.1415
Hlt2TopoMu2Body	0.00895	0.2982
Hlt2TopoMu3Body	0.009354	0.308
Hlt2TopoMu4Body	0.007546	0.1971

TISTOS Comments

- Unsurprisingly the semileptonic have much higher TOS efficiencies than the prompt.
- Still not really sure what specifically to talk about with TISTOS...

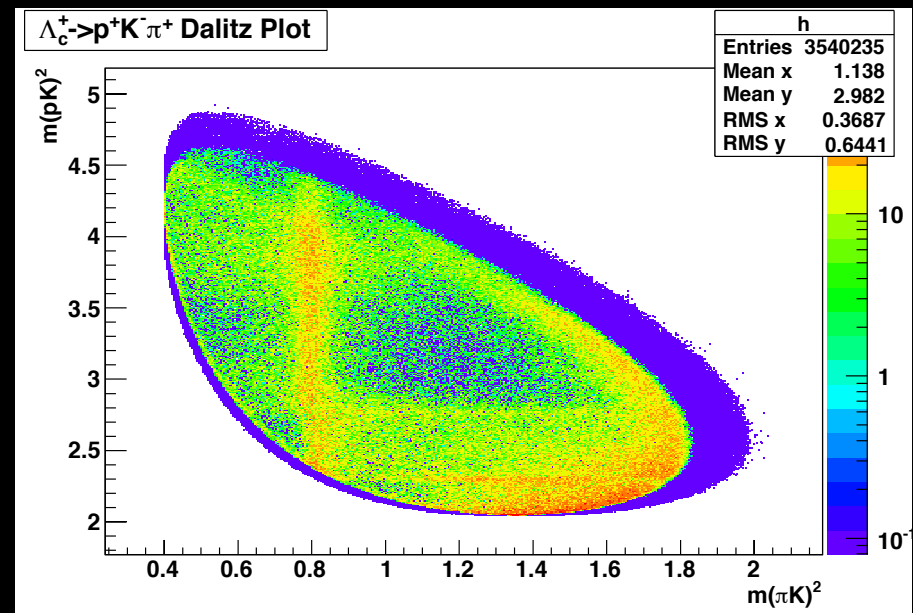
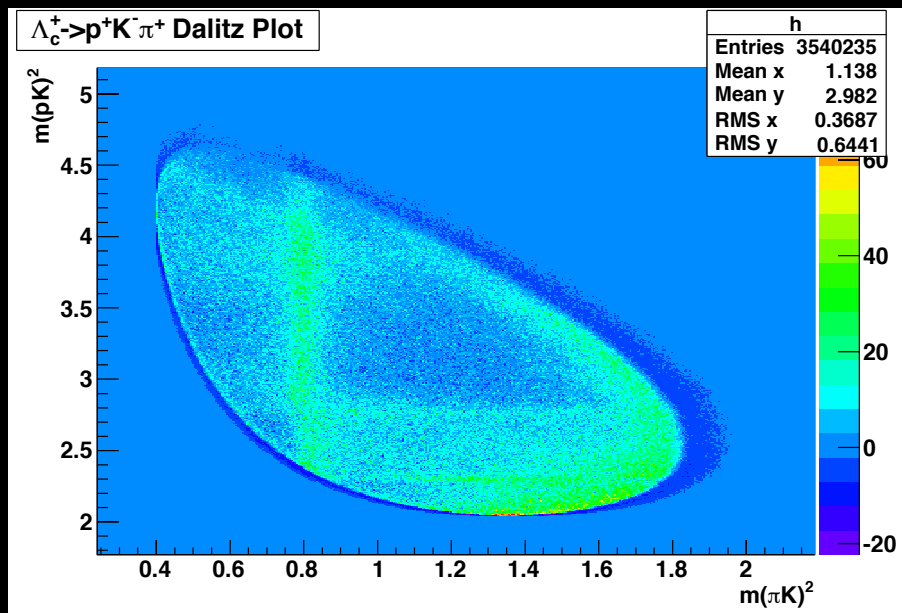
Semileptonic $\Lambda_c^+ \rightarrow p^+ h^- h^+$ - Yields



- Signal yield: 15.9k
 - Both single gaussian signal & linear bkg.
 - As with prompt encouraging for the DCS search given current constraints.
- Signal yield: 29.3k

$\Lambda_c \rightarrow p K \pi$ Prompt Dalitz

- Potential for a variety of analyses with Λ_c :
 - Existing understanding of the decay is relatively poor, LHCb could perform a world best amplitude fit of the decays.
 - Potential for direct CPV searches analogous to the work done with charged D mesons.



S-weighted sideband subtracted Dalitz plots of $\Lambda_c \rightarrow p K \pi$. Linear scale left, log right.