



$\Lambda^*(1520)$ ANALYSIS IN ALICE EXPERIMENT AT LHC

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27/04/13



PLAN OF TALK

- Motivation
- About Lambda*
- Analysis
 - 1.Data set and Track cuts
 - 2.QA Plots
 - 3.Lambda* Signal
 - Mix-Event Background
 - Same Event Like-Sign Background
 - 4.Lambda* Signal form MC Study
- Result

Λ^* (1520) ANALYSIS

- Λ Baryon:

PDG code: 3124

$\Lambda^0(1115)$, $\Lambda(1405)$, $\Lambda(1520)$, $\Lambda(1600)$, $\Lambda(1670)$, $\Lambda(1690)$, $\Lambda(1800)$, $\Lambda(1810)$, $\Lambda(1820)$, $\Lambda(1830)$, $\Lambda(1890)$, $\Lambda(2100)$, $\Lambda(2110)$, $\Lambda(2350)$

$\Lambda(1520)$ D_{03} $I(J^P) = 0(\frac{3}{2}^-)$

Mass $m = 1519.5 \pm 1.0$ MeV

Full Width $\Gamma = 15.6 \pm 1.0$ MeV

Decay Modes: $N\bar{K} = 45 \pm 1\%$

$\Sigma\pi = 42 \pm 1\%$

$\Lambda\pi\pi = 10 \pm 1\%$

$\Sigma\pi\pi = 0.9 \pm 0.1\%$

$\Lambda\gamma = .85 \pm .15\%$

$\Lambda^*(1520)$ ANALYSIS

- Data used: LHC10b, LHC10c ~70M MB accepted events
AOD035 data for P-P at 7 TeV CM energy.

Decay mode $P^+(938.27) + K^-(493.68)$

Track quality cuts::

$p_t > 0.15 \text{ GeV}/c$

$-0.8 < \text{Eta} < 0.8$

DCA Pt dependent formula (" $0.0182+0.0350/p_t^{1.01}$ ")

DCA Zmax 2.0cm

SPD minimum NClusters 1

TPC minimum Nclusters 70

TPC $\text{Chi}^2 < 4.0$

SetRejectKinkDaughters()

Standard ITS TPC Refit (FilterBit 5)

Vertex range (-10cm, 10cm)

Λ^* (1520) ANALYSIS

Cuts on Track

TPC:

3 sigma

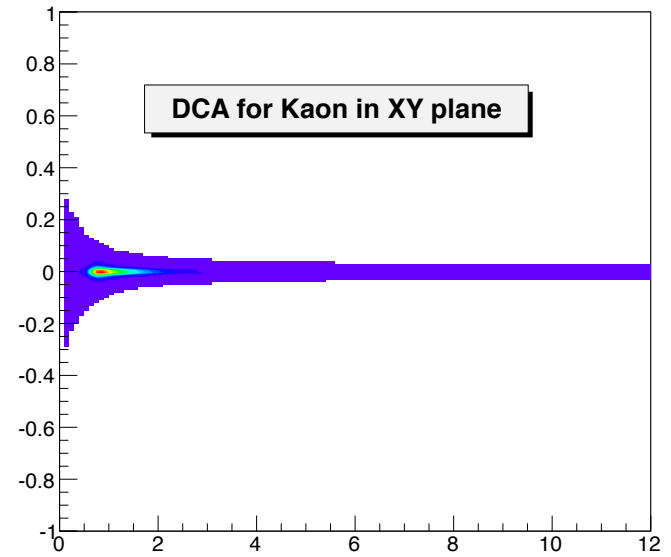
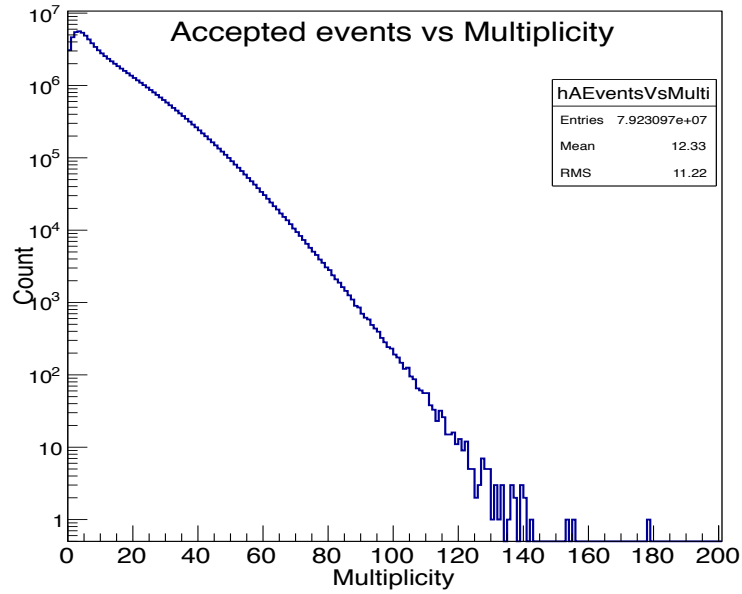
Background: nMix = 5 for $P^+(938.27)$ & $K^-(493.68)$

After background subtraction, fitted with Breit Weigner function and 2nd order polynomial.

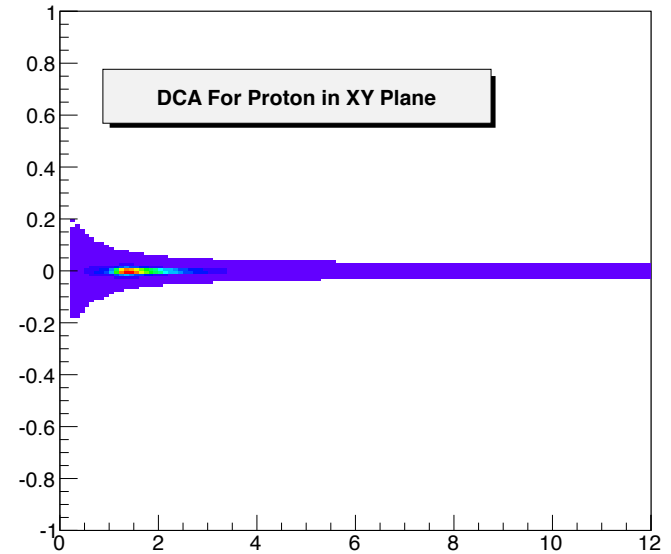
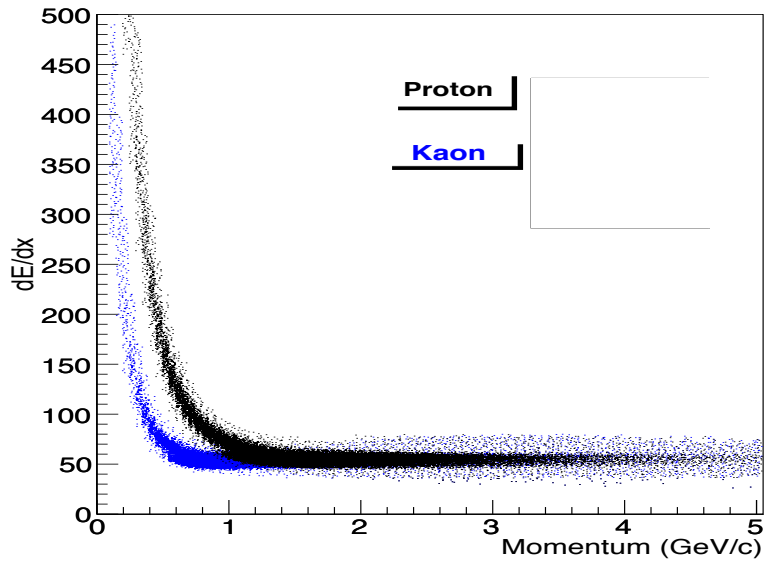
$$\frac{dN}{dM_{inv}} = \frac{A\Gamma}{(M_{inv} - m_0)^2 + \Gamma^2 / 4} + B(M_{inv})$$

'A' is the area under the fit curve, Γ is the FWHM of the peak, m_0 is the resonance mass. B is the background.

$\Lambda^*(1520)$ ANALYSIS

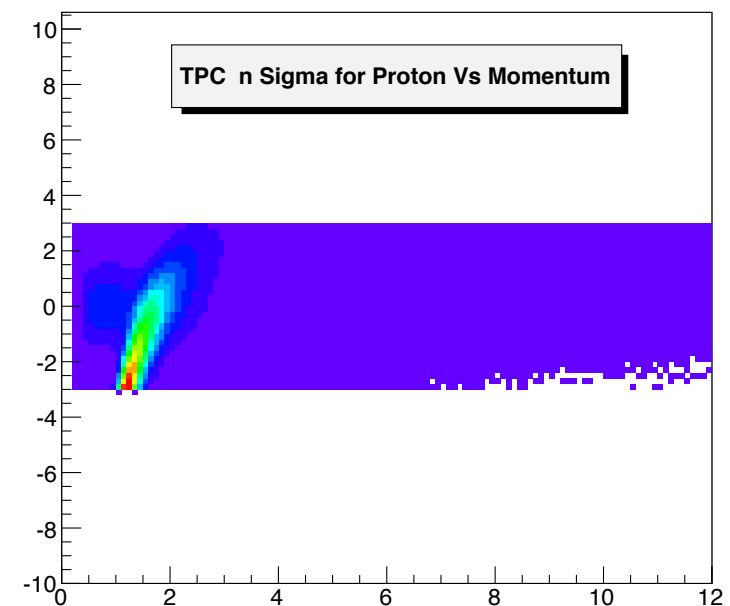
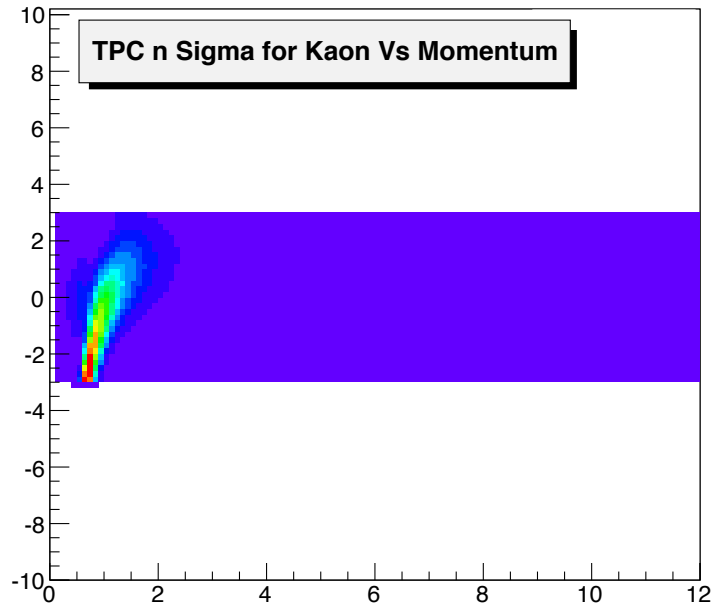
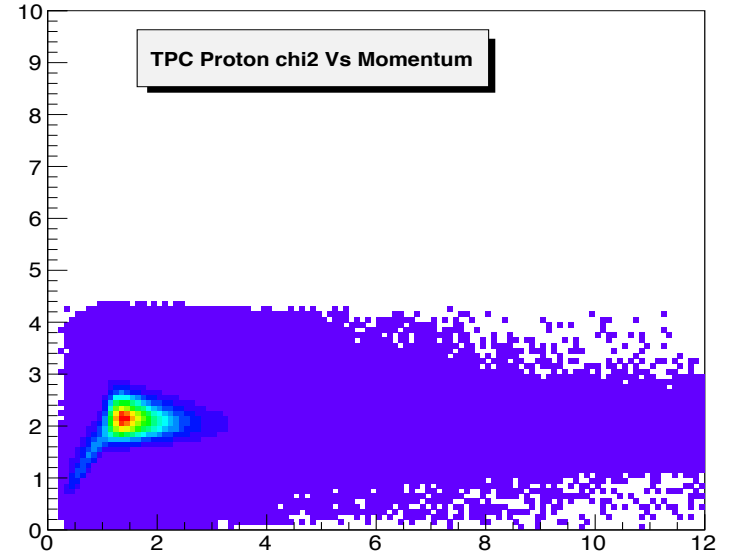
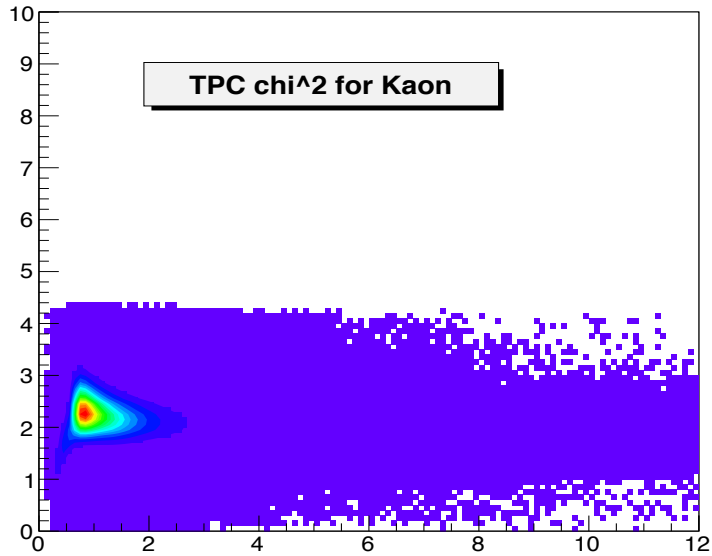


QA
PLOTS

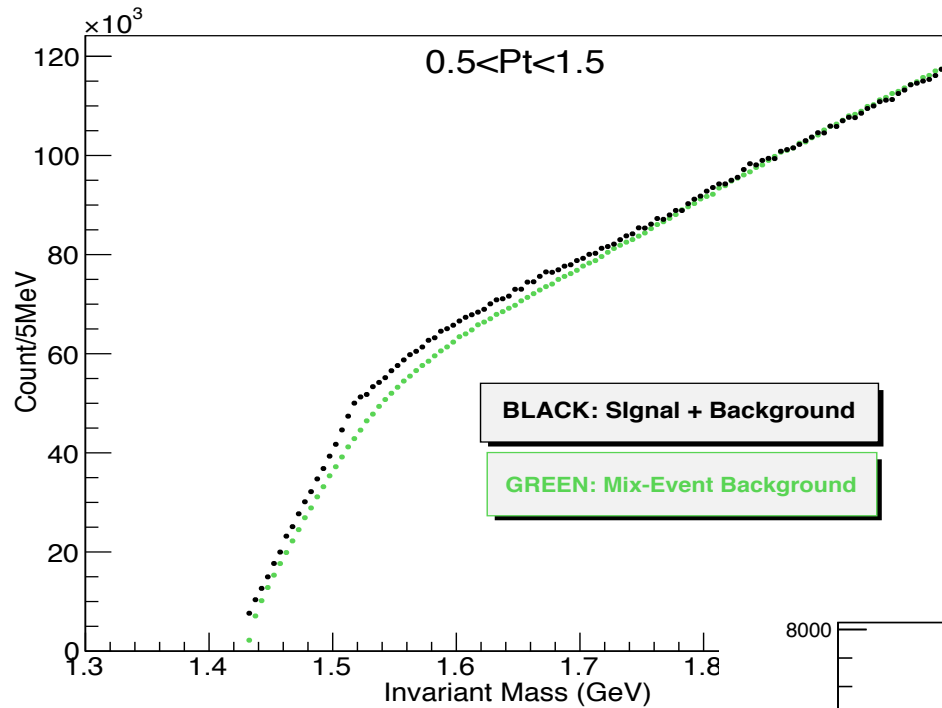


$\Lambda^*(1520)$ ANALYSIS

QA PLOTS



$\Lambda^*(1520)$ ANALYSIS

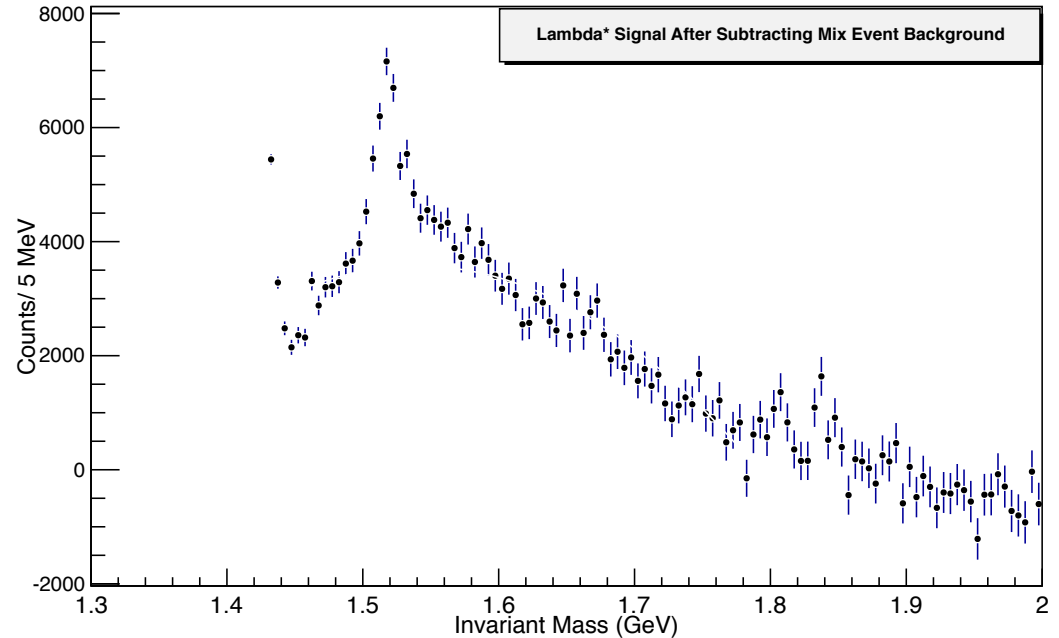


Mix Event Background

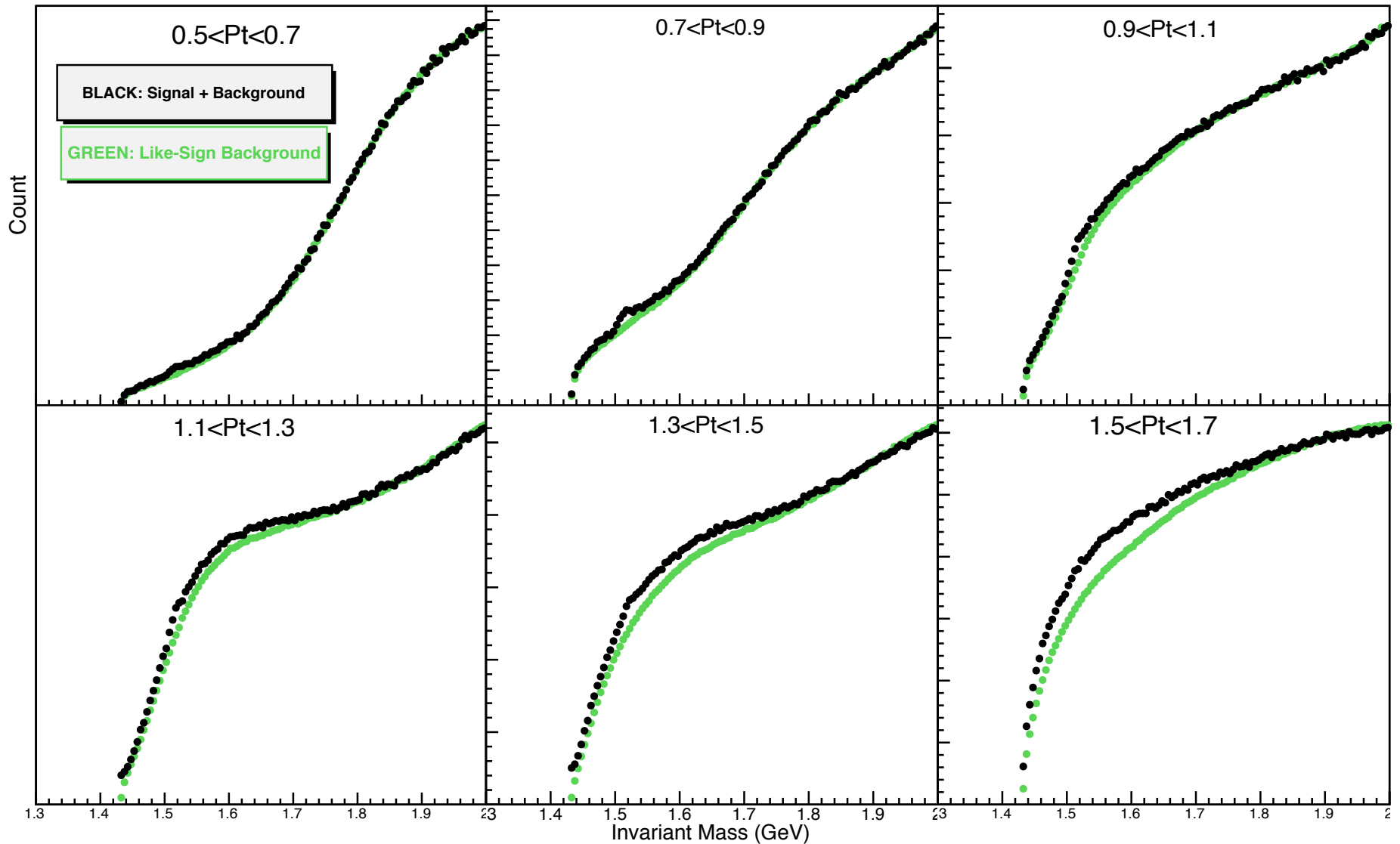
$0.5 < Pt < 1.5$

Fitting Range: 1.46-1.8 GeV

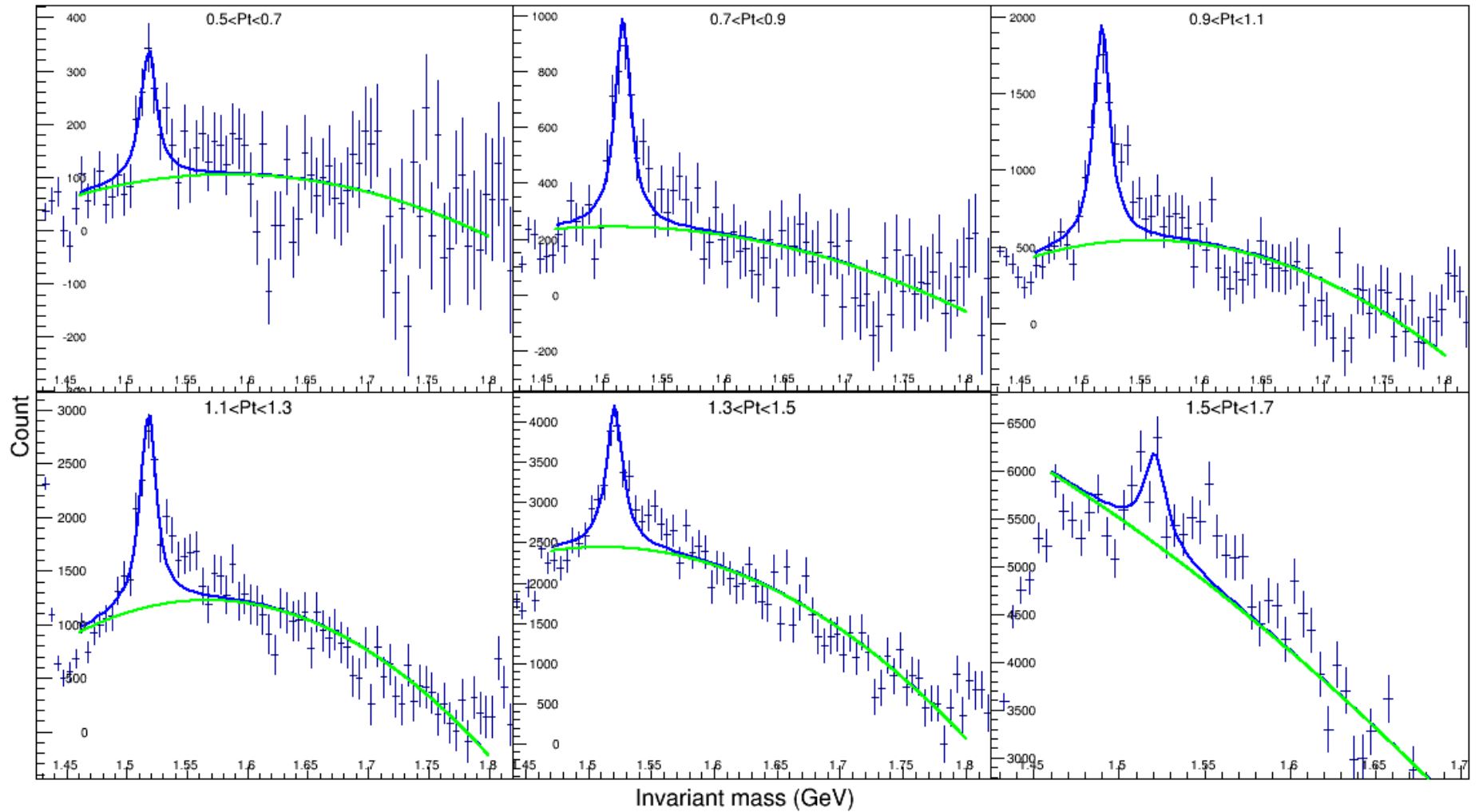
Normalization Range:
1.8-1.99 GeV



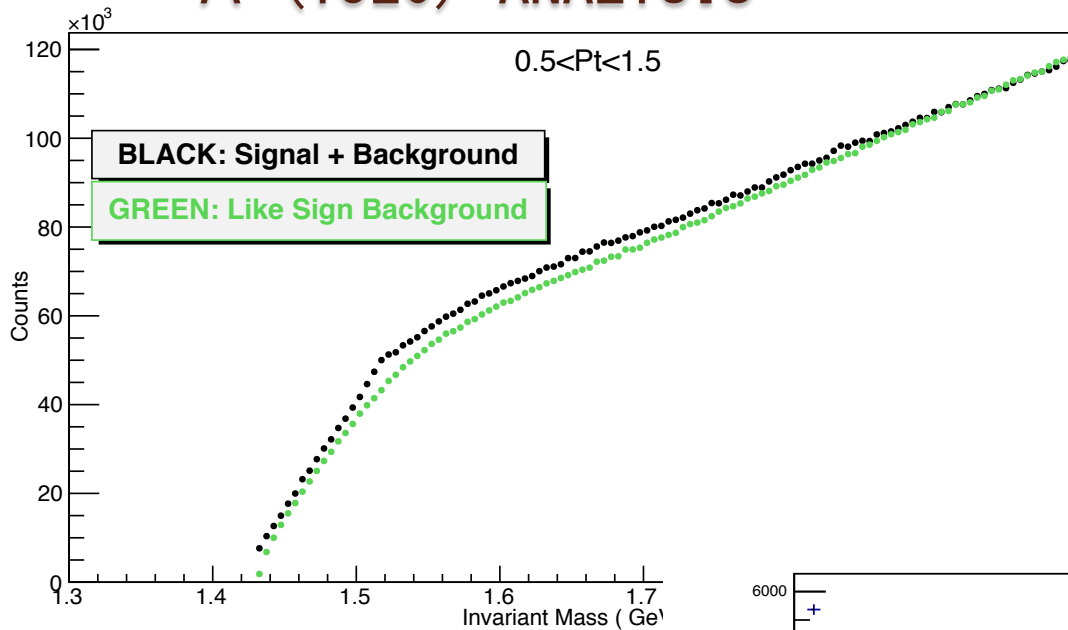
$\Lambda^*(1520)$ ANALYSIS



$\Lambda^*(1520)$ ANALYSIS



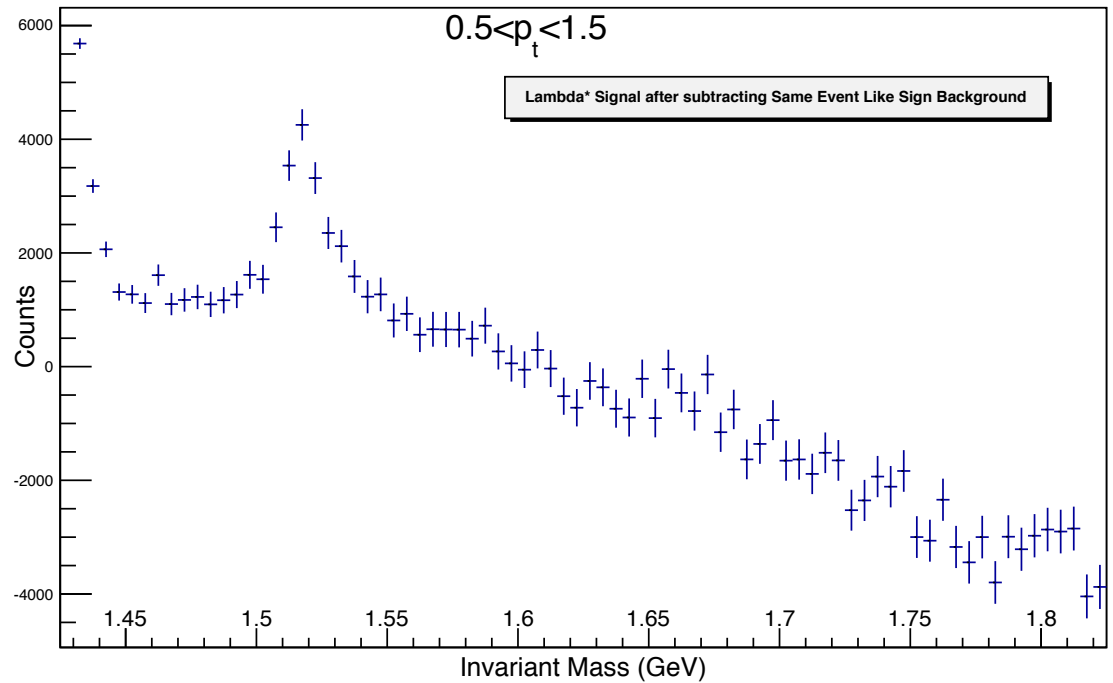
$\Lambda^*(1520)$ ANALYSIS



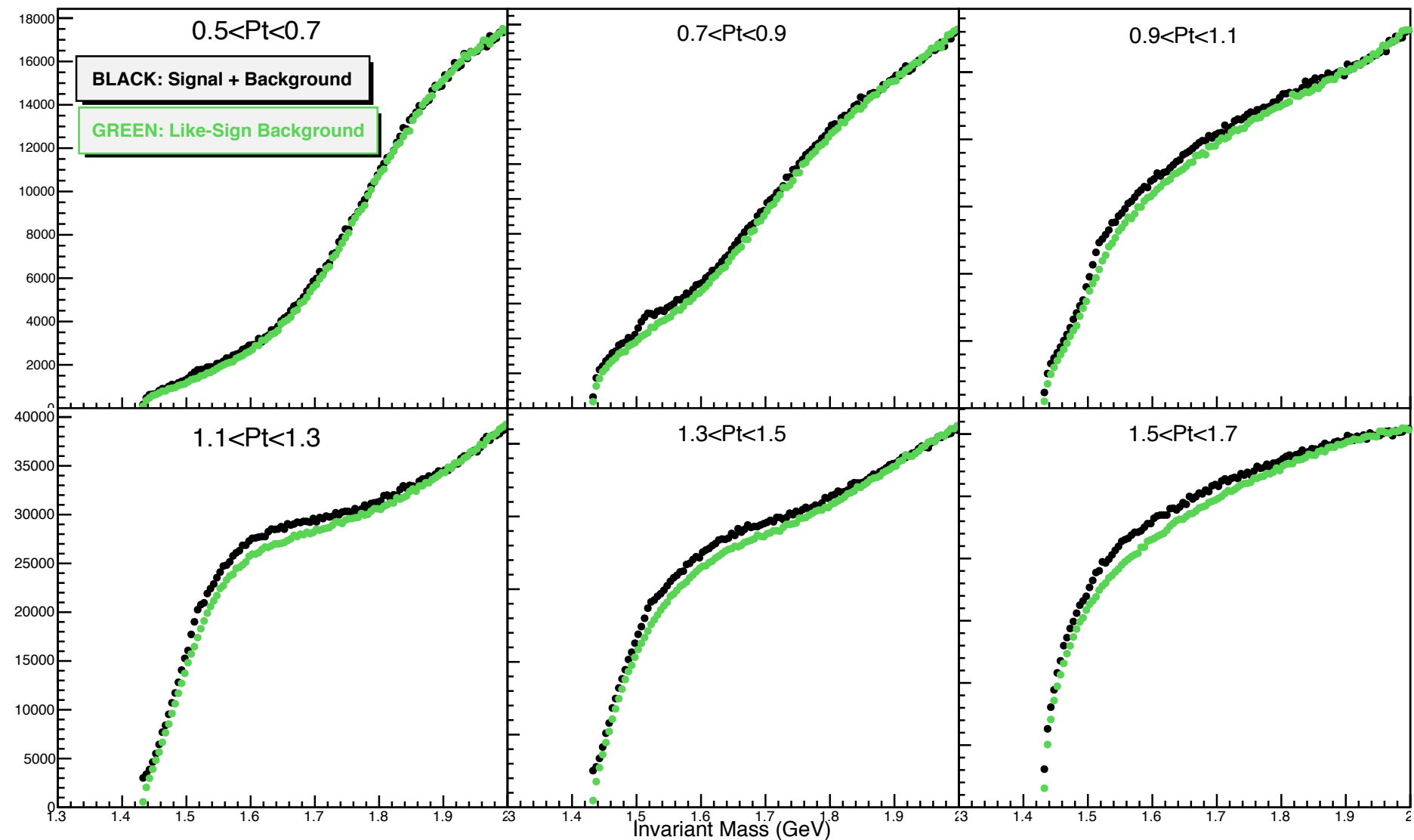
**Like Sign
Background**

Fitting Range: 1.46-1.8 GeV

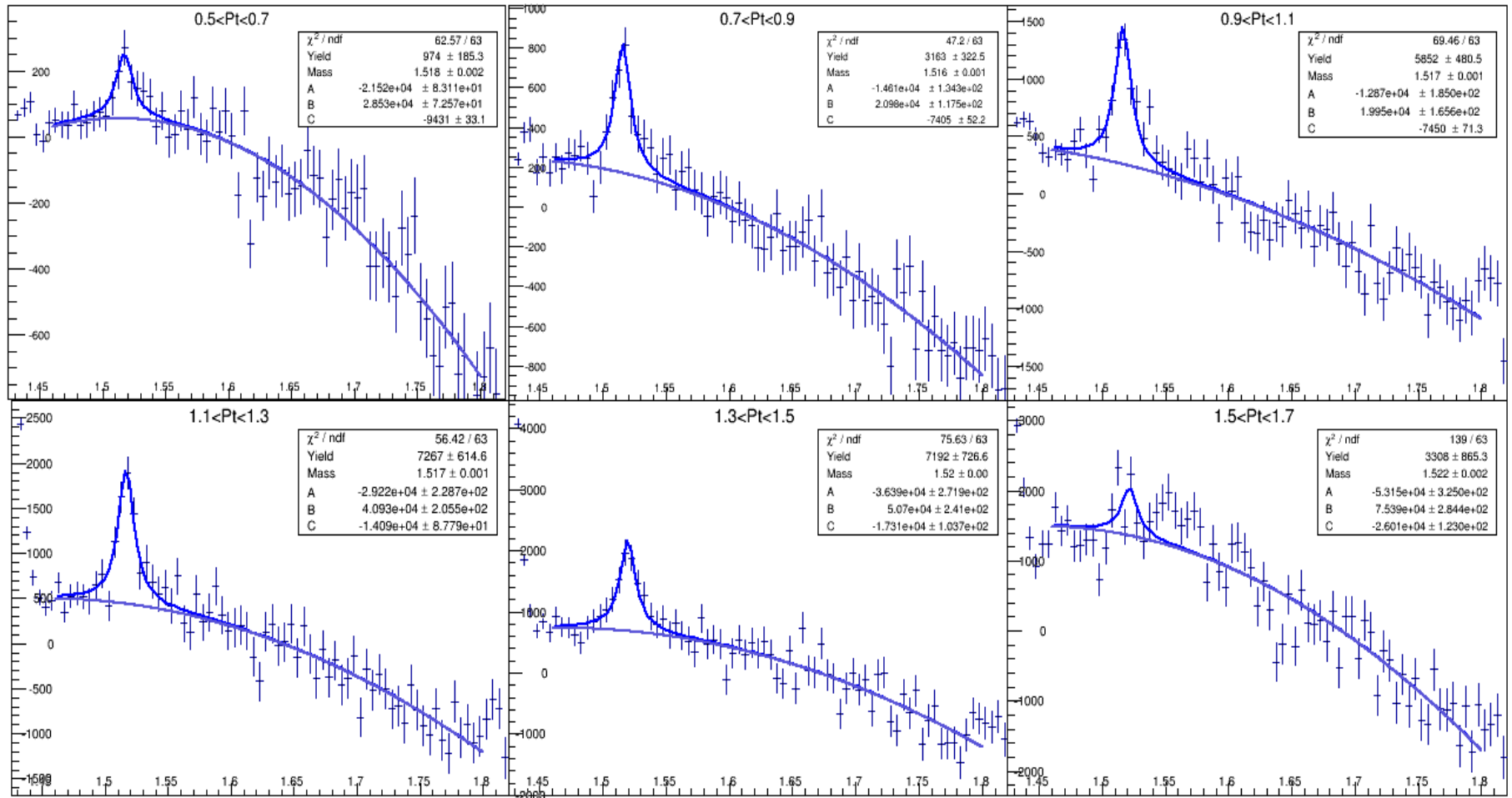
Normalization Range:
1.8-1.99 GeV



$\Lambda^*(1520)$ ANALYSIS



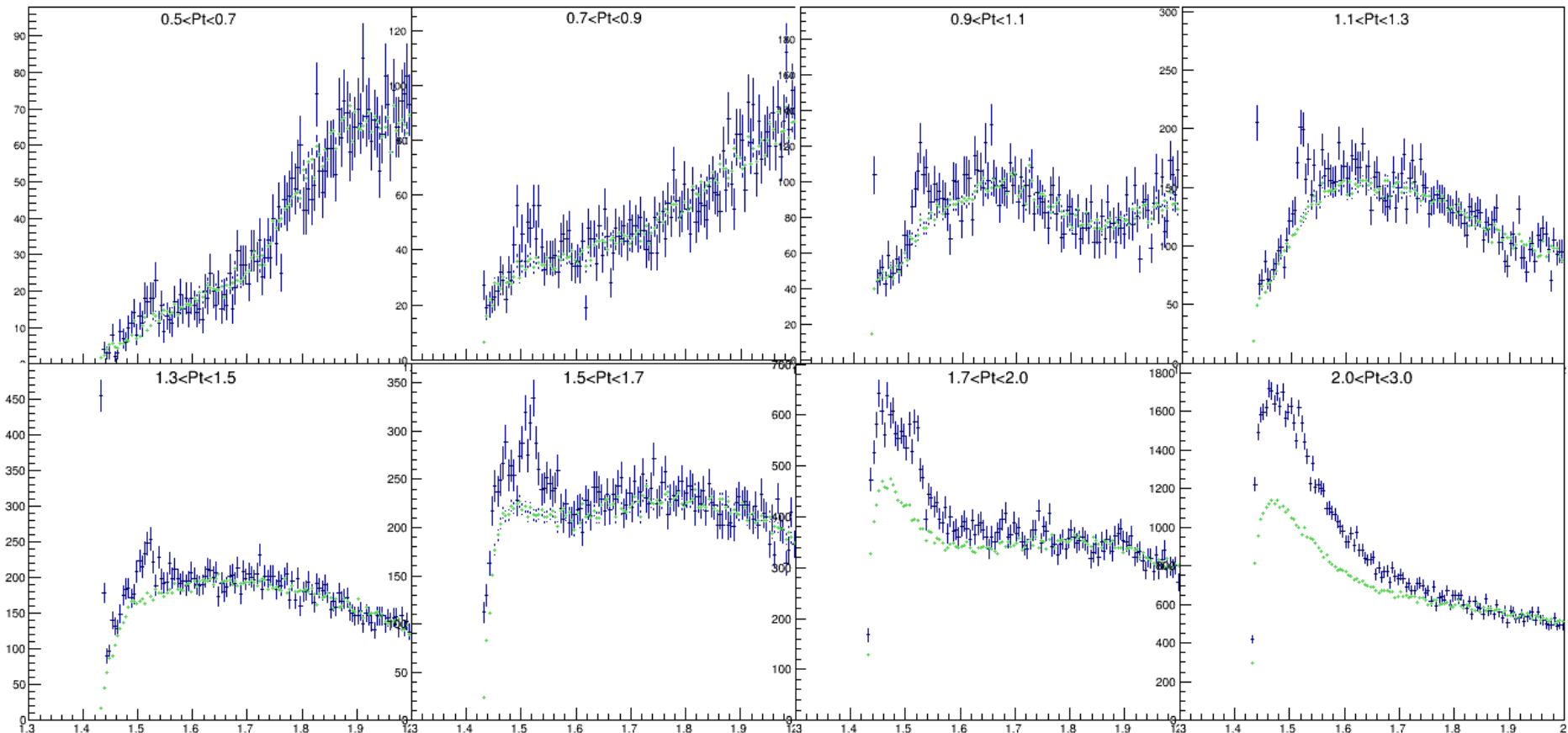
$\Lambda^*(1520)$ ANALYSIS



$\Lambda^*(1520)$ ANALYSIS

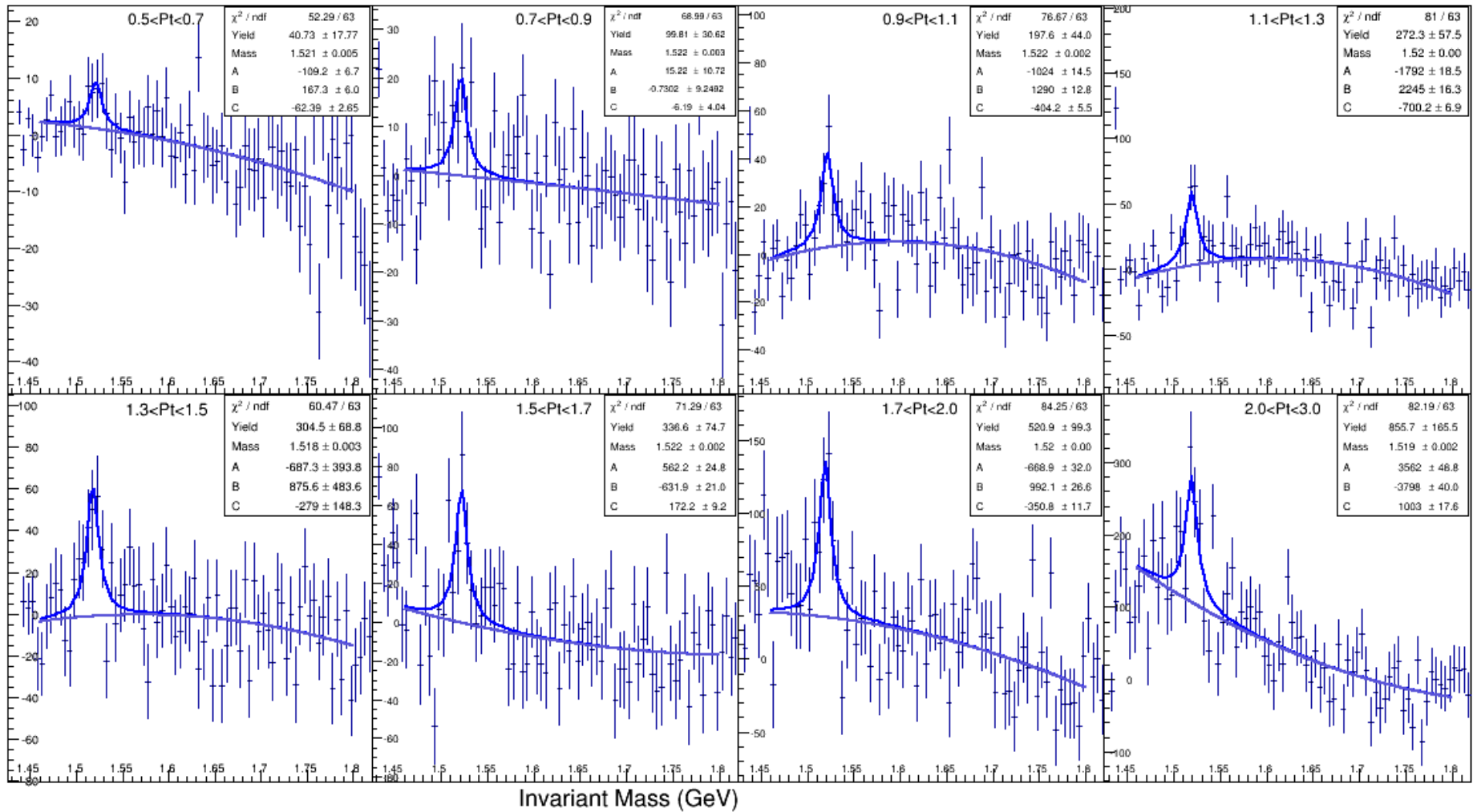
Signals for LHC12a4 simulated data. PYTHIA6 generator
with tune PERUGIA-2011: 0.5T, 7TeV, Lambda(1520) enhancement:
~35 M MB events

MIX Event Background



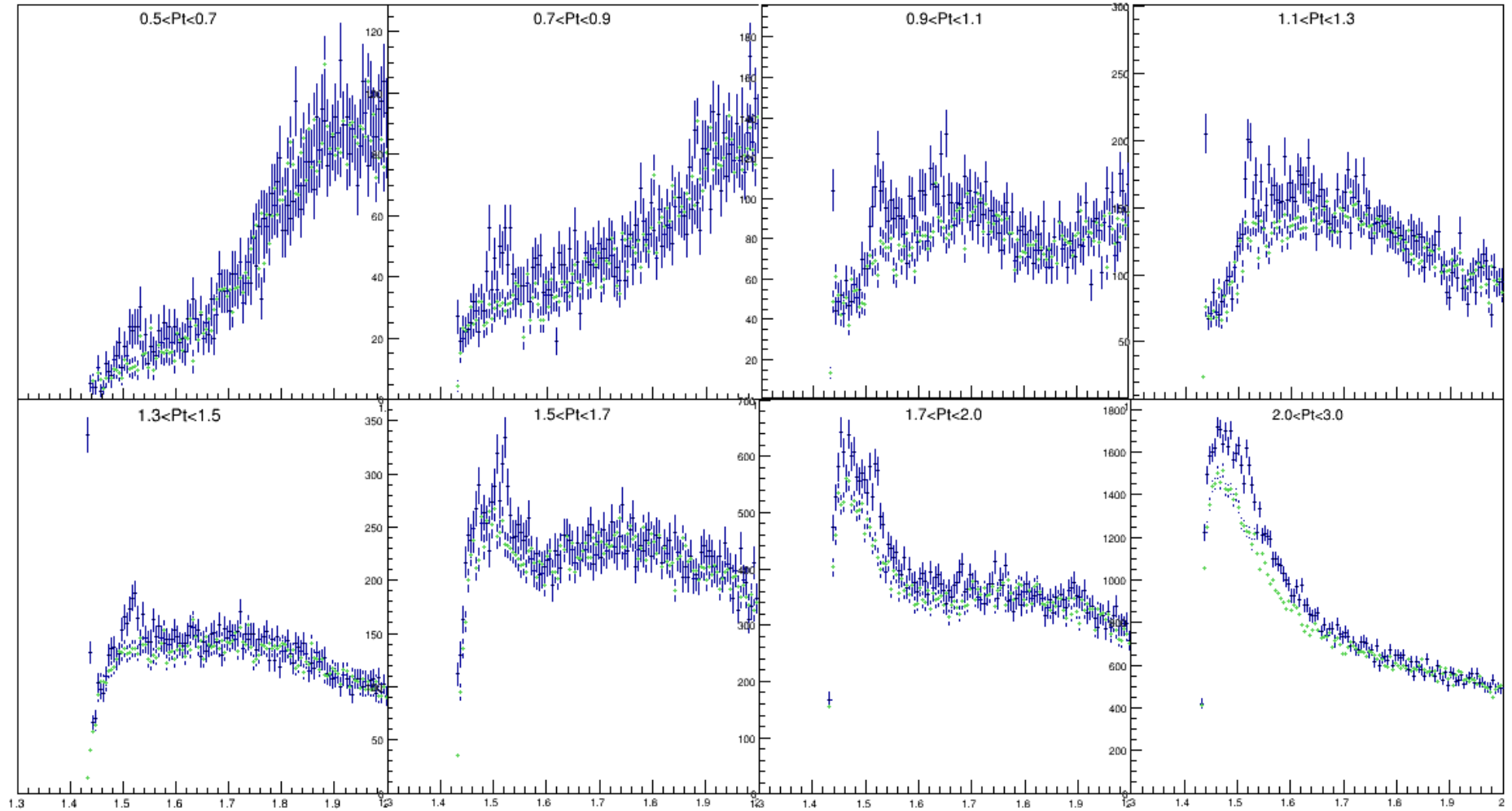
$\Lambda^*(1520)$ ANALYSIS

Fitted with Breit_Wigner and 2nd Order Polynomial



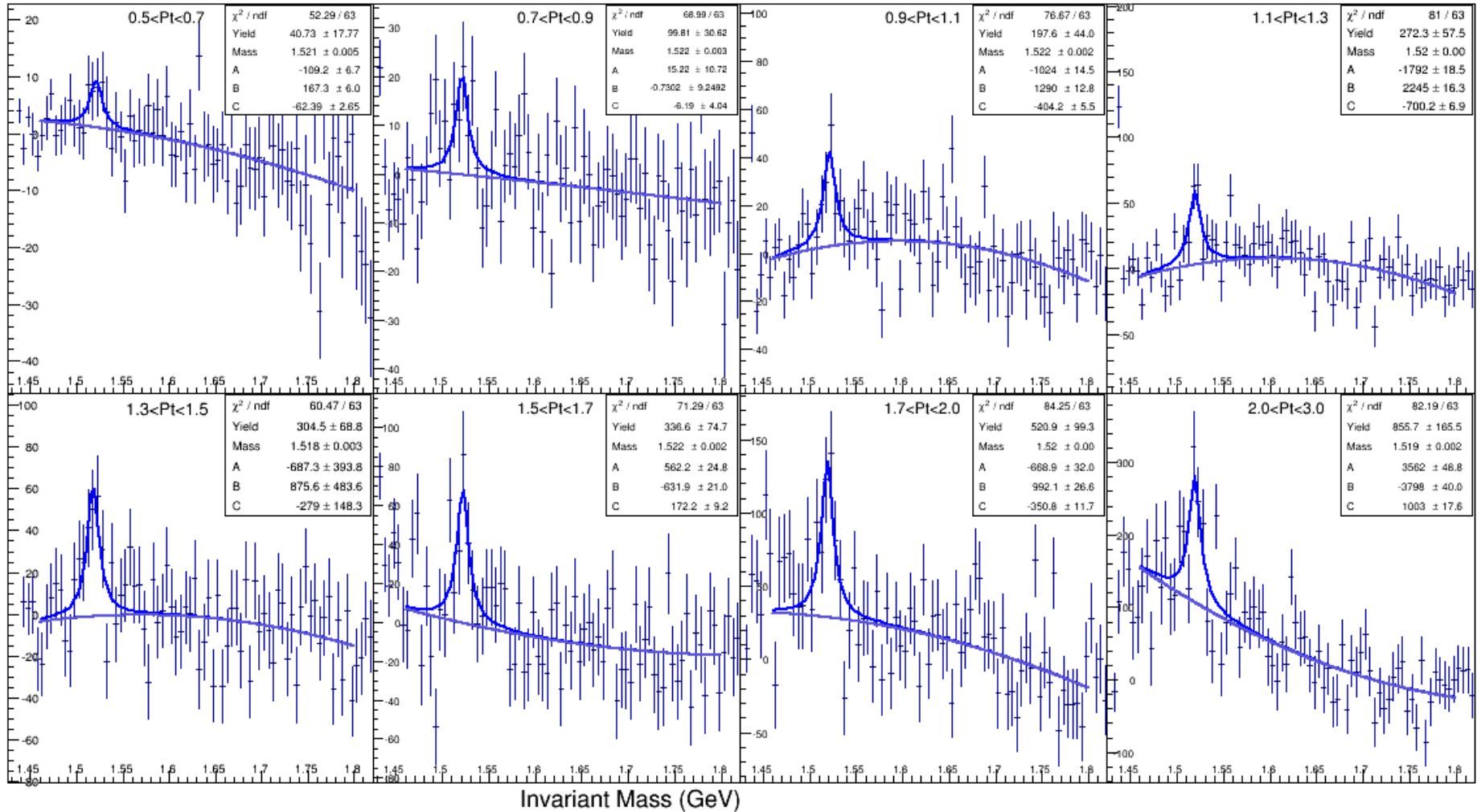
$\Lambda^*(1520)$ ANALYSIS

Like-Sign Event Background



$\Lambda^*(1520)$ ANALYSIS

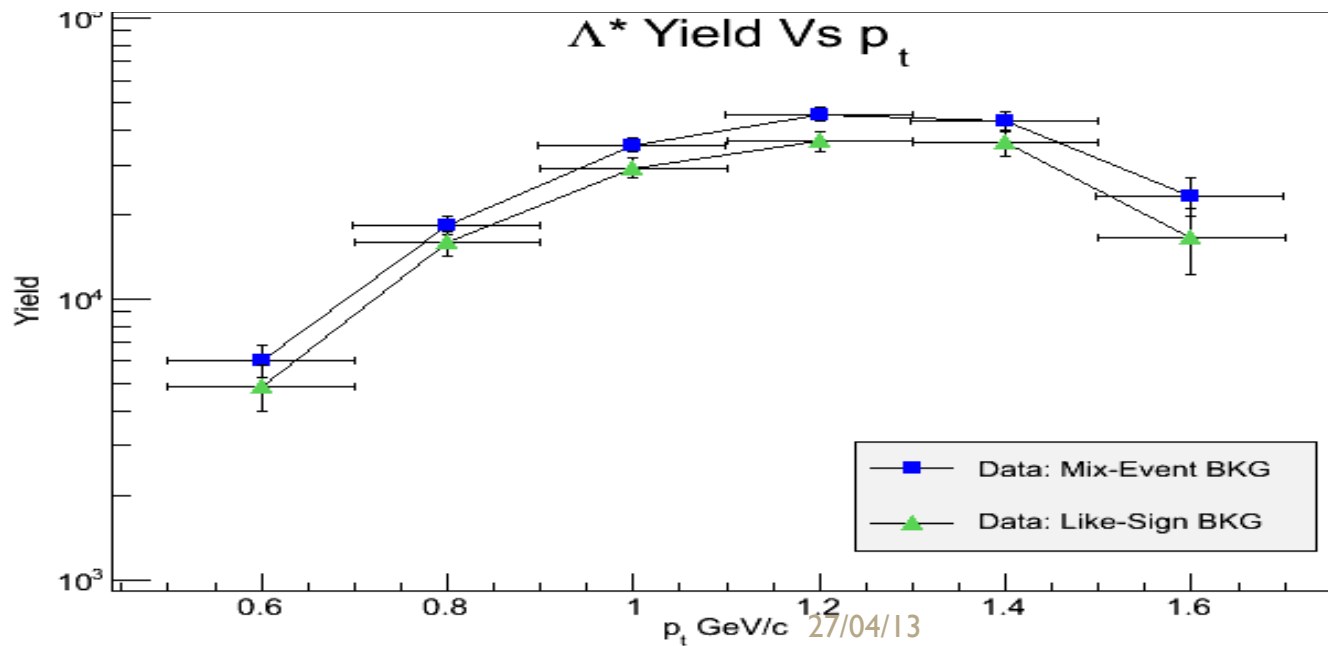
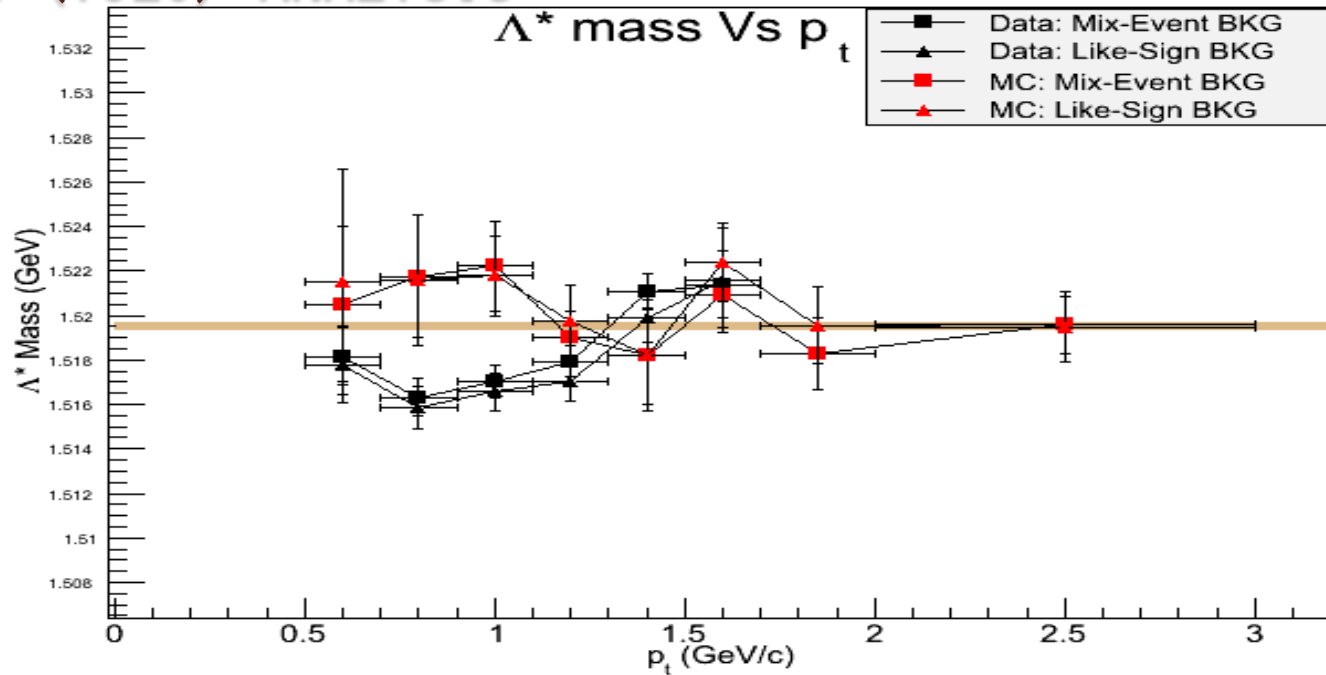
Like-Sign Event Background



$\Lambda^*(1520)$ ANALYSIS

Mix-Event Bkg					Like-Sign Bkg			
P_t GeV/ c	Mass GeV	Yield	Chi ² / ndf	Normali zation factor	Mass GeV	Yield	Chi ² / ndf	Norma lization factor
0.5-0.7	1.51814	6060	79.06/63	0.18603	1.51779	4870	62.57/63	1.08178
0.7-0.9	1.51633	18189	68.06/63	0.18570	1.51586	15816	47.2/63	1.07092
0.9-1.1	1.51701	35215	98.83/63	0.18585	1.51656	29261	69.46/63	1.06401
1.1-1.3	1.51794	45039	94.36/63	0.18575	1.51701	36336	56.42/63	1.05559
1.3-1.5	1.52106	43083	87.55/63	0.18577	1.51988	35961	75.63/63	1.0487
1.5-1.7	1.52138	23139	186/63	0.18688	1.5216	16541	139/63	1.04676

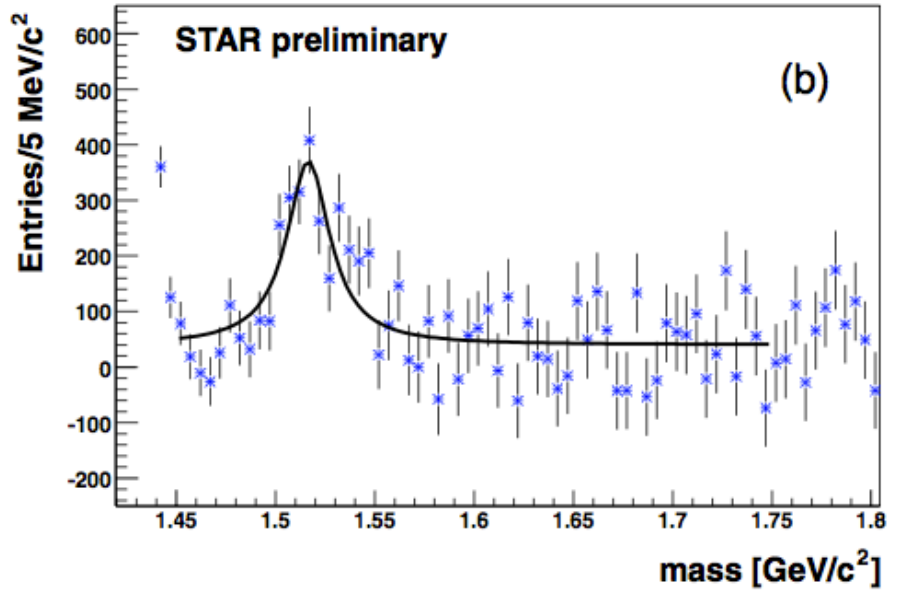
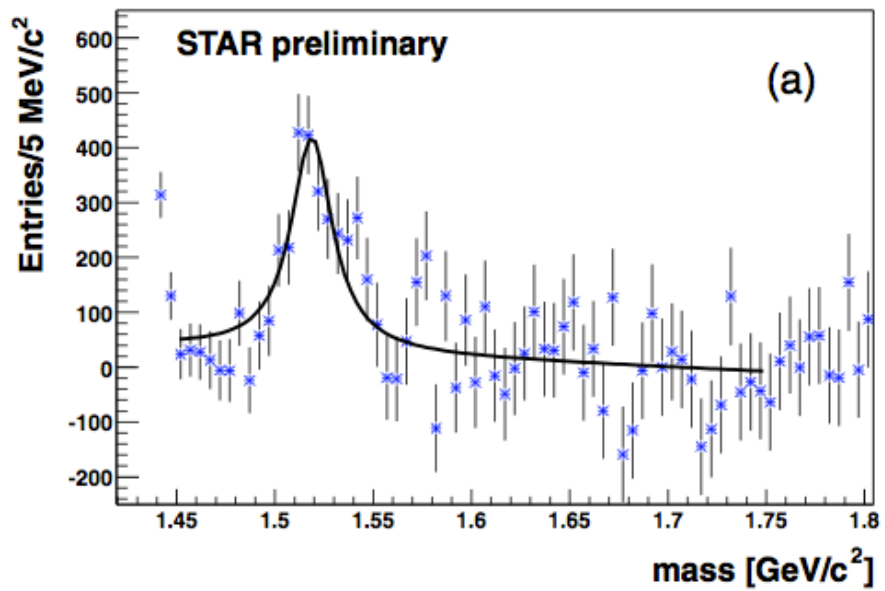
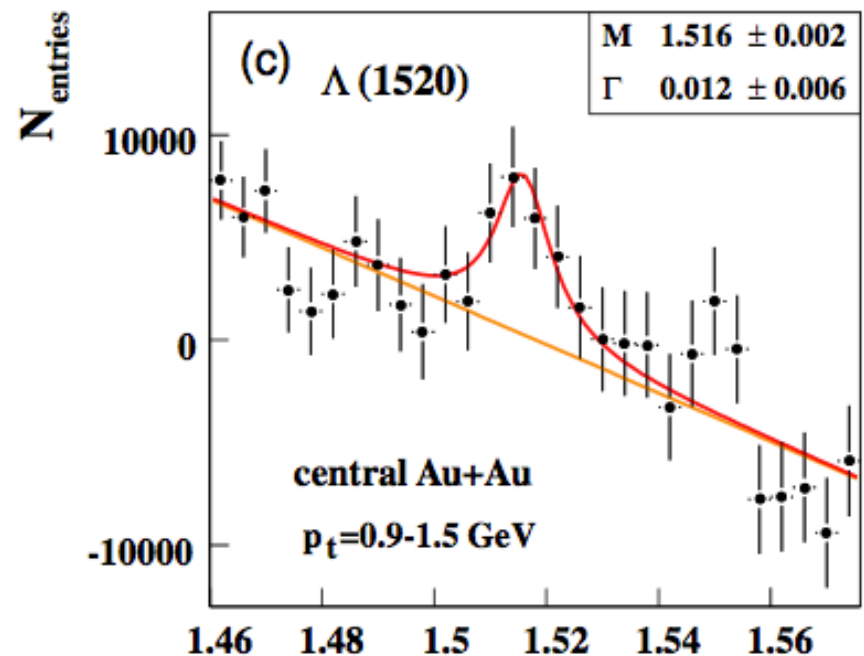
$\Lambda^*(1520)$ ANALYSIS



27/04/13



Result





THANK YOU

$\Lambda^*(1520)$ ANALYSIS

Cuts differently depending on the PID and the momentum

TOF:TPC: 5sigma cut for all

TOF: 3sigma below 1.5 GeV, 2sigma above

TPC: below 350 MeV: 5sigma

between 350 and 500 MeV: 3sigma

kaons between 500 and 700 MeV: 2sigma

kaons above 700 MeV: rejected

protons above 1200 MeV: rejected

Background: nMix = 5 for P^+ (938.27) & K^- (493.68)

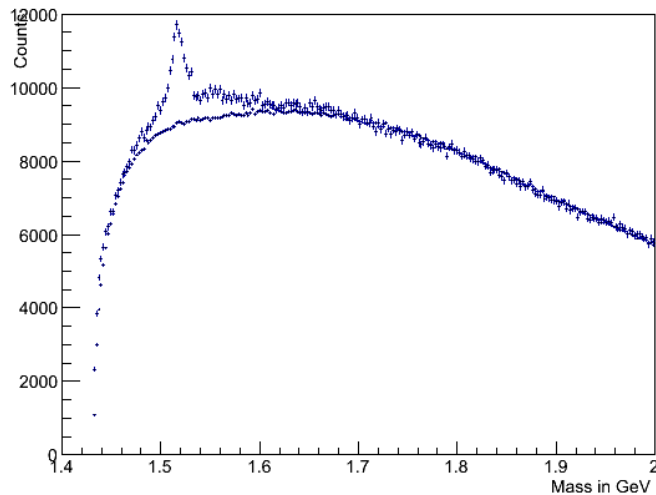
After background subtraction, fitted with Breit Weigner function and 2nd order polynomial.

$$\frac{dN}{dM_{inv}} = \frac{A\Gamma}{(M_{inv} - m_0)^2 + \Gamma^2 / 4} + B(M_{inv})$$

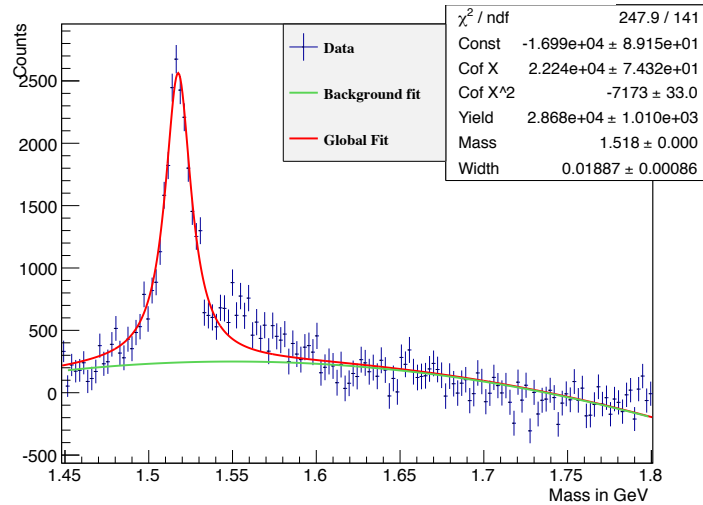
'A' is the area under the fit curve, Γ is the FWHM of the peak, m_0 is the resonance mass. B is the background.

$\Lambda^*(1520)$ ANALYSIS Real DATA

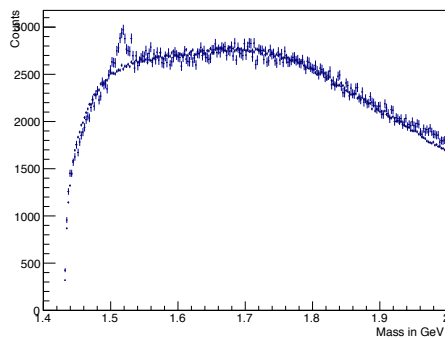
Lambda* Signal+BKG & BKG: 0<Pt<10



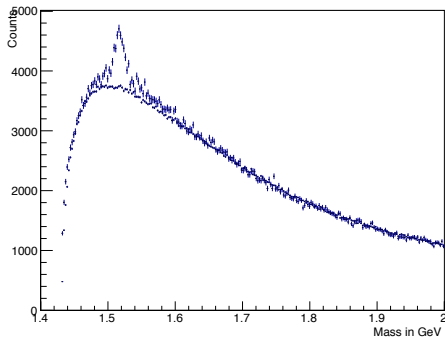
Lambda* signal: 250 Bins: 0<Pt<10 : BKG Mix1



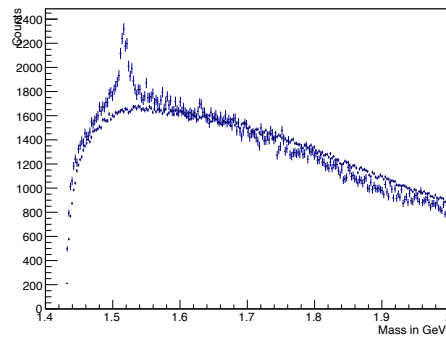
Lambda* Signal+BKG & BKG: .5<Pt<1.0



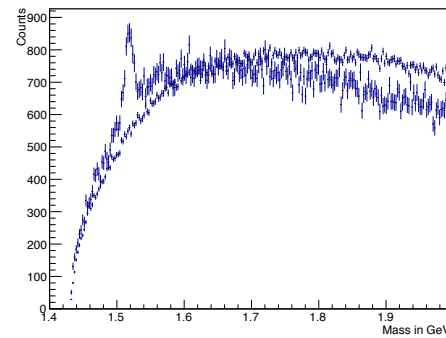
Lambda* Signal+BKG & BKG: 1.1<Pt<1.5



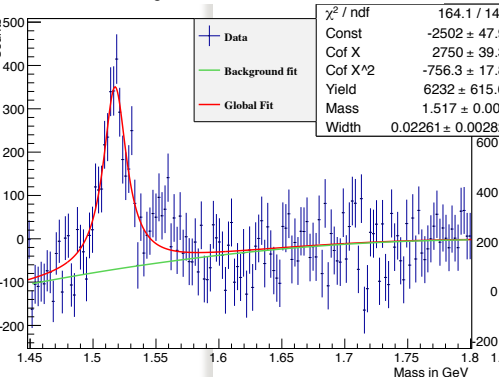
Lambda* Signal+BKG & BKG: 1.6<Pt<2.0



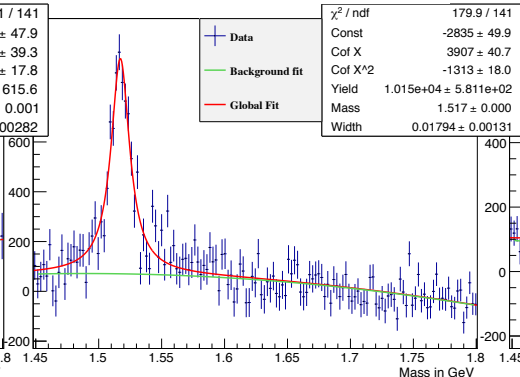
Lambda* Signal+BKG & BKG: 2.1<Pt<2.5



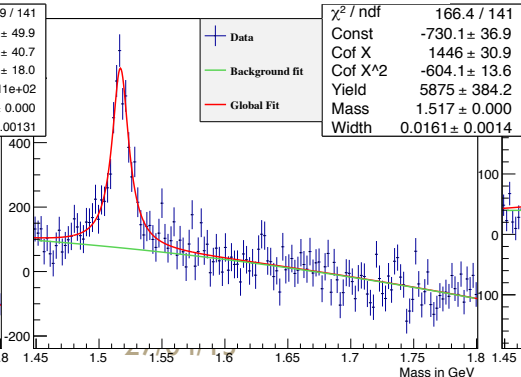
Lambda* signal: 250 Bins: .5<Pt<1.0 : BKG Mix1



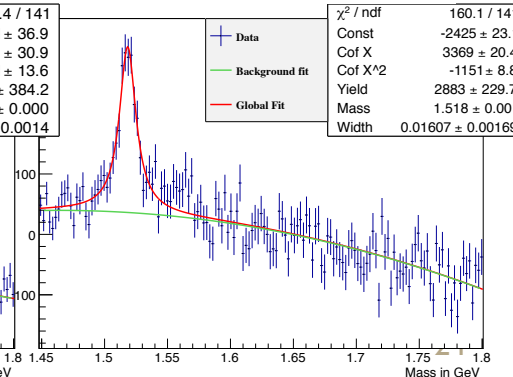
Lambda* signal: 250 Bins: 1.1<Pt<1.5 : BKG Mix1



Lambda* signal: 250 Bins: 1.6<Pt<2.0 : BKG Mix1

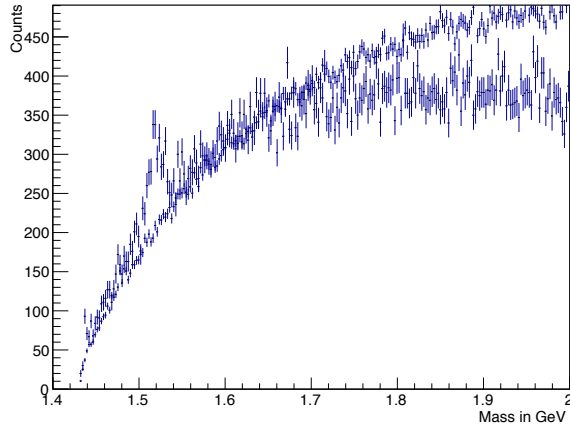


Lambda* signal: 250 Bins: 2.1<Pt<2.5 : BKG Mix1

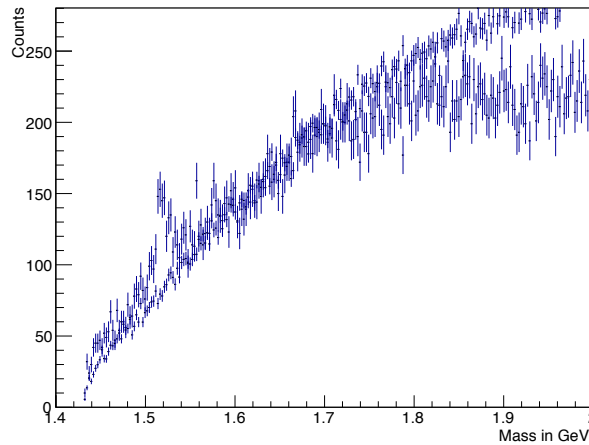


Λ^* (1520) ANALYSIS Real DATA

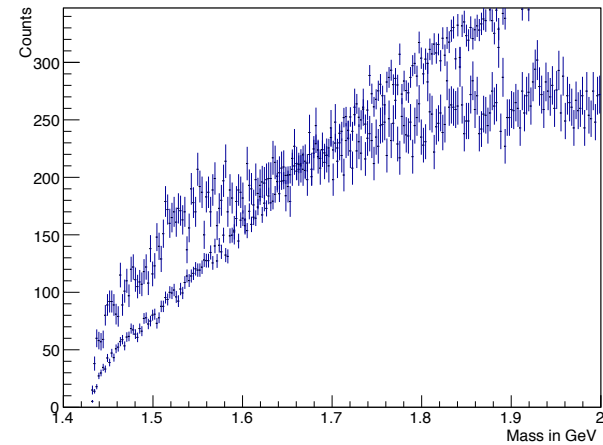
Lambda* Signal+BKG & BKG: 2.6<Pt<3.0



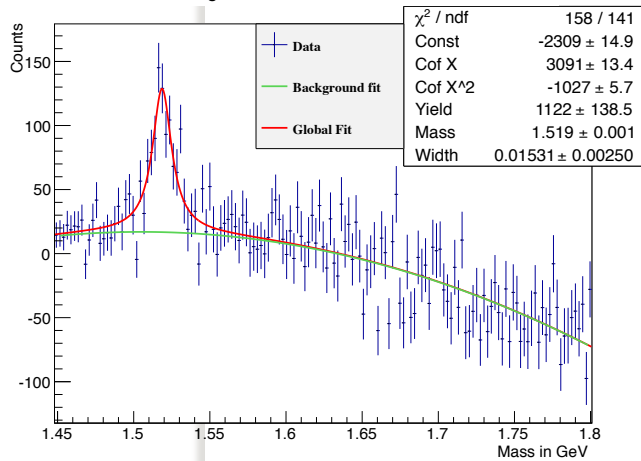
Lambda* Signal+BKG & BKG: 3.1<Pt<3.5



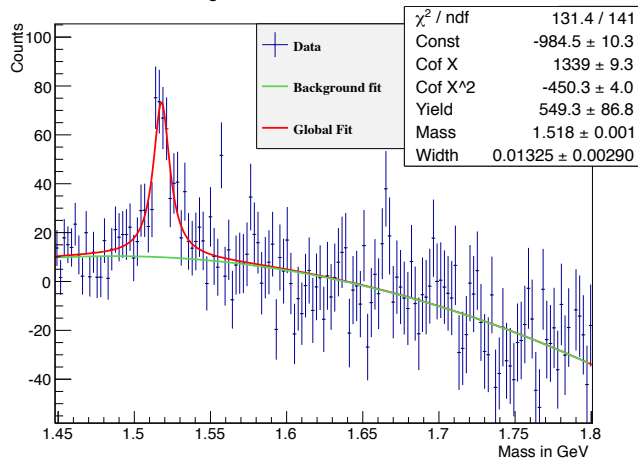
Lambda* Signal+BKG & BKG: 3.6<Pt<5.0



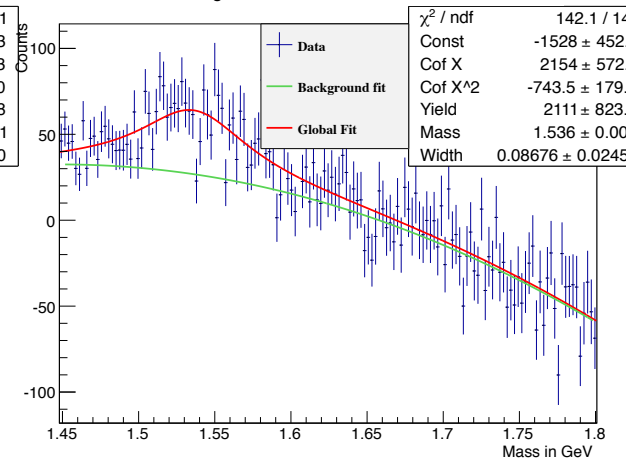
Lambda* signal: 250 Bins: 2.6<Pt<3.0 : BKG Mix1



Lambda* signal: 250 Bins: 3.1<Pt<3.5 : BKG Mix1



Lambda* signal: 250 Bins: 3.6<Pt<5.0 : BKG Mix1



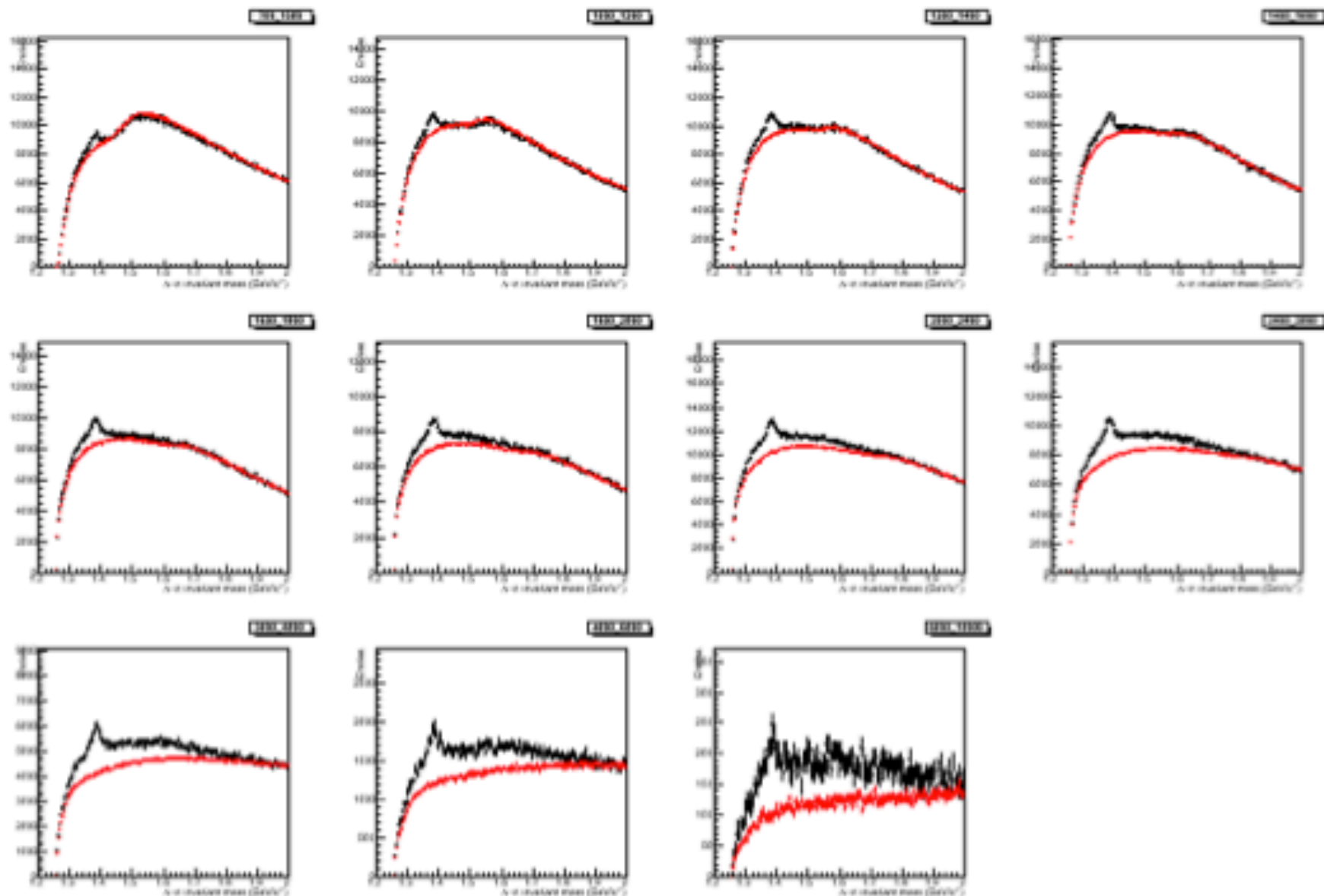
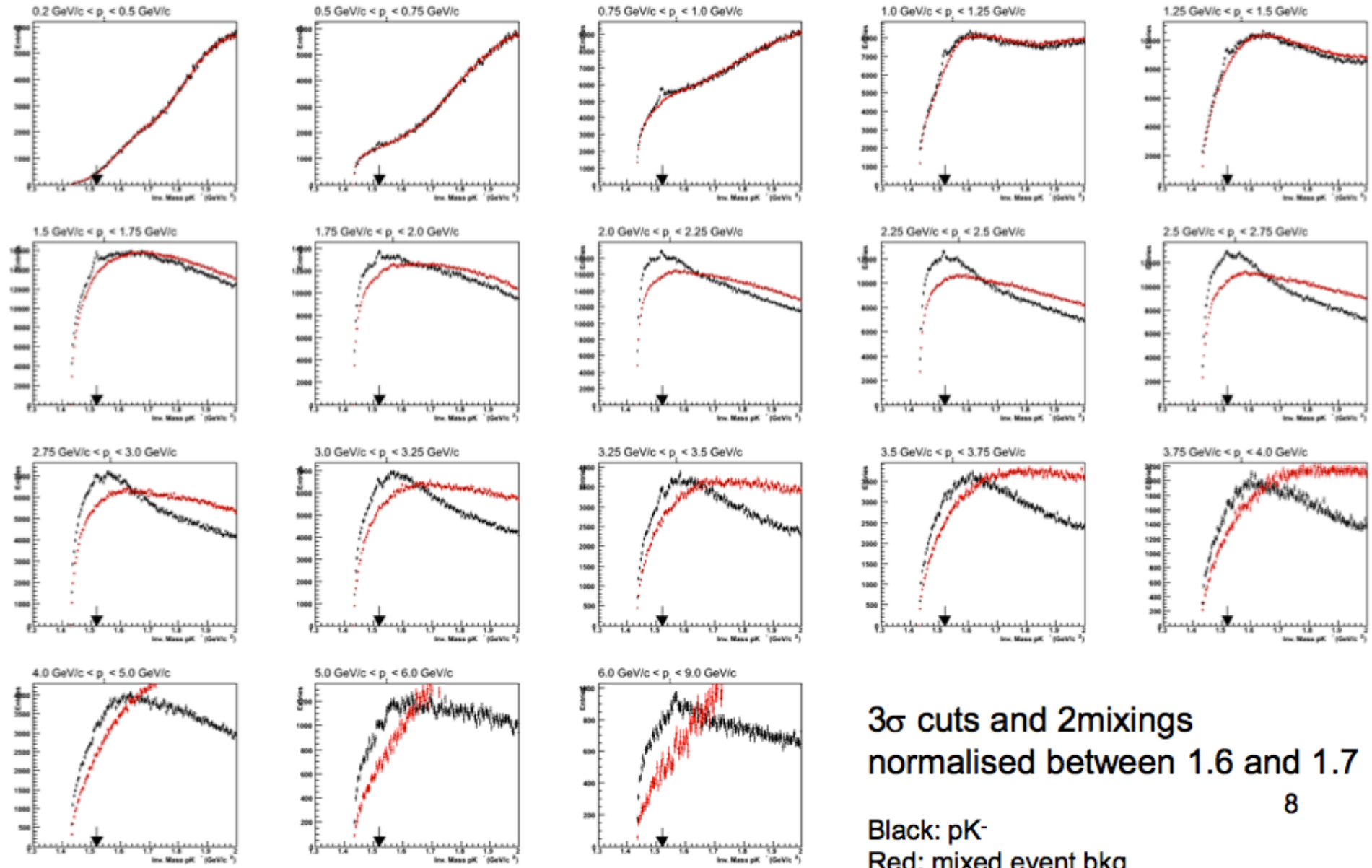


Figure 3: Invariant mass distribution and event-mixed background for the $\Lambda\pi$ candidate pairs.

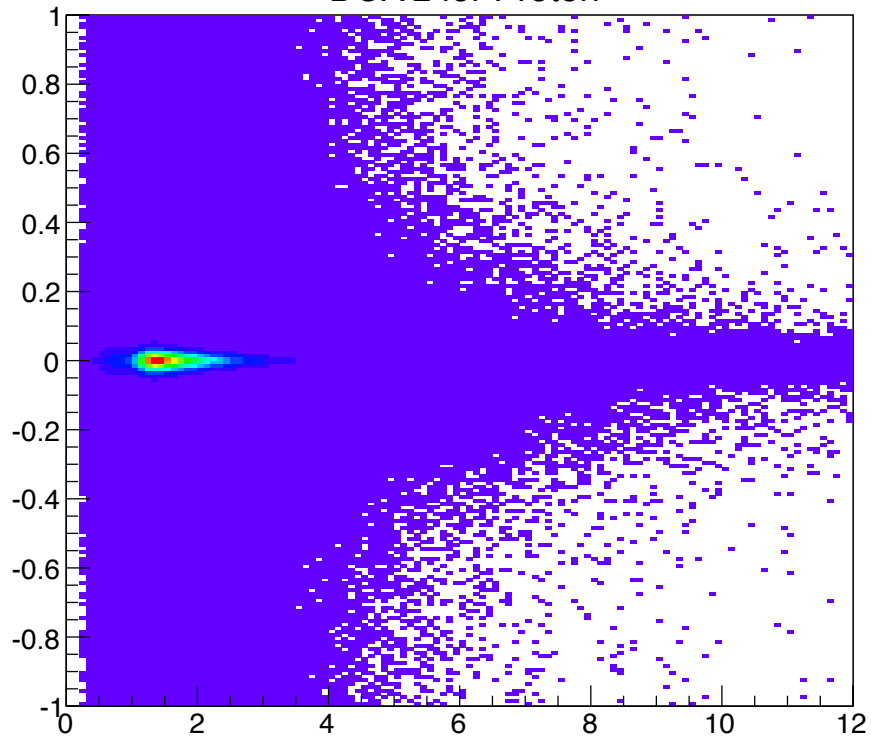


**3σ cuts and 2mixings
normalised between 1.6 and 1.7**

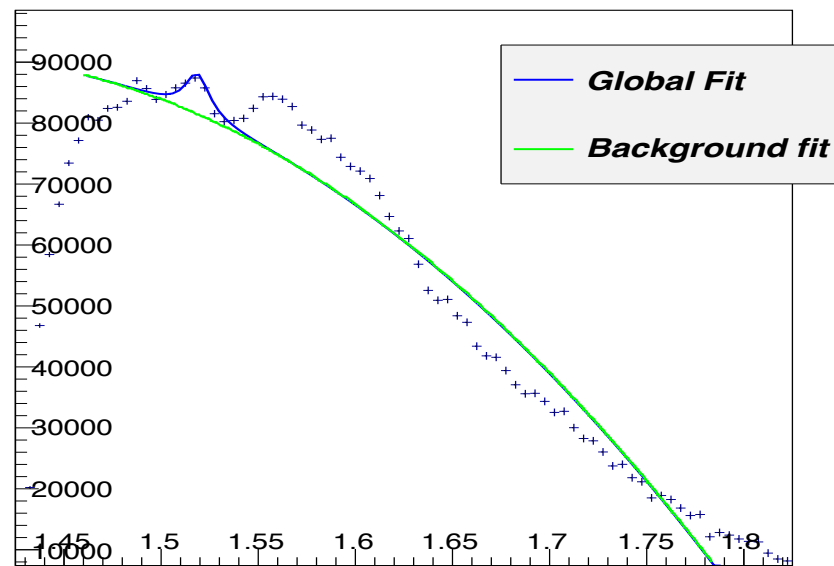
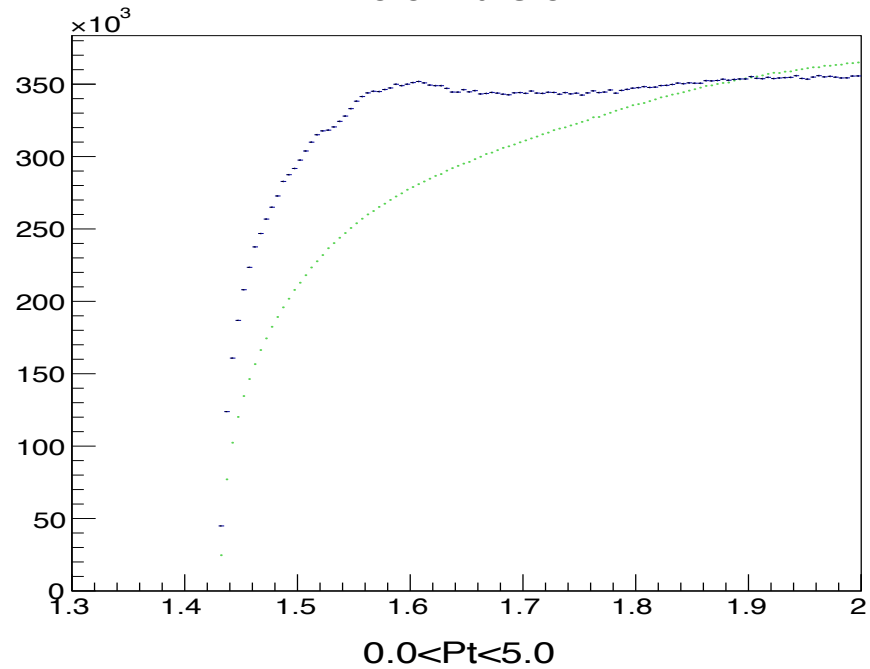
8

**Black: pK
Red: mixed event bkg**

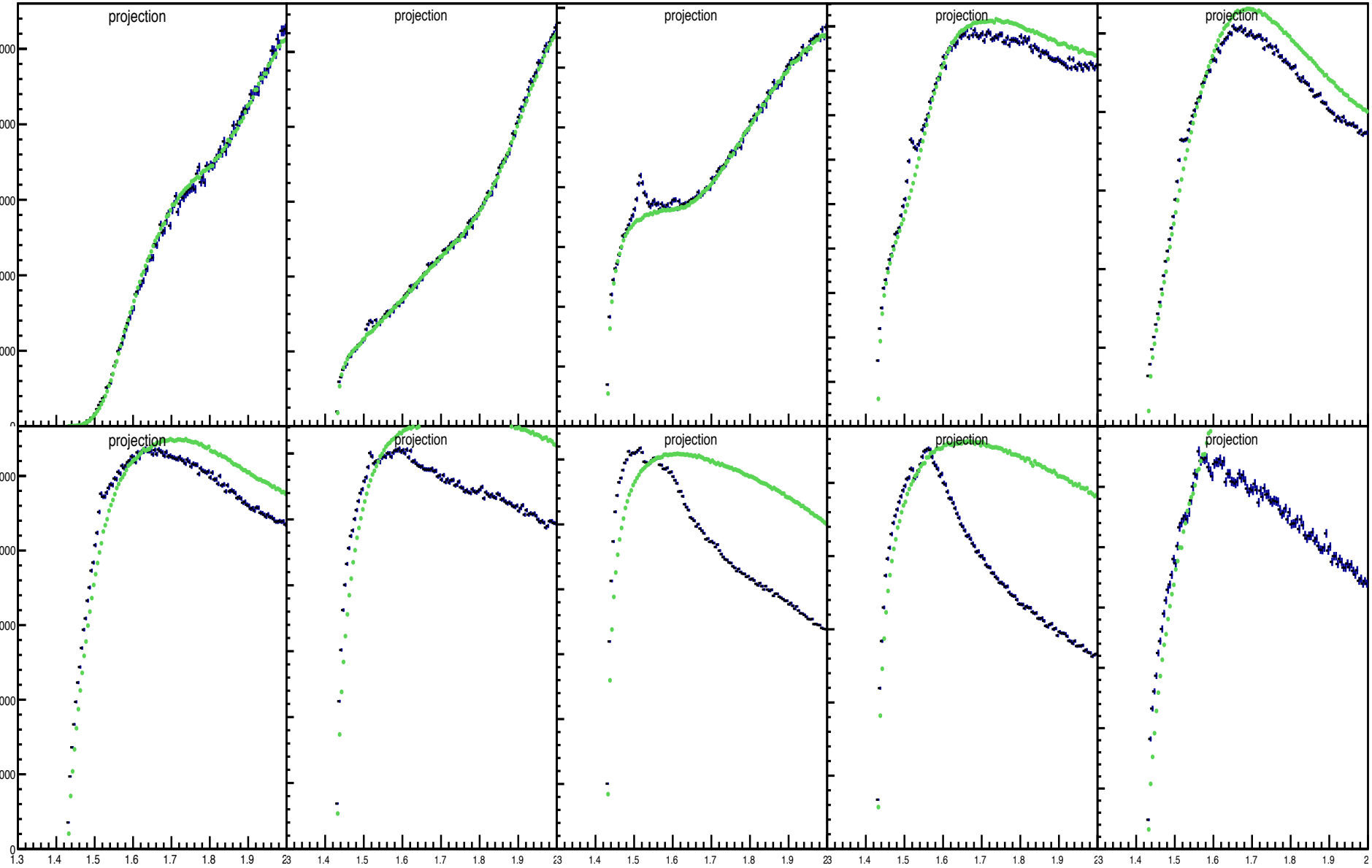
DCA z for Proton

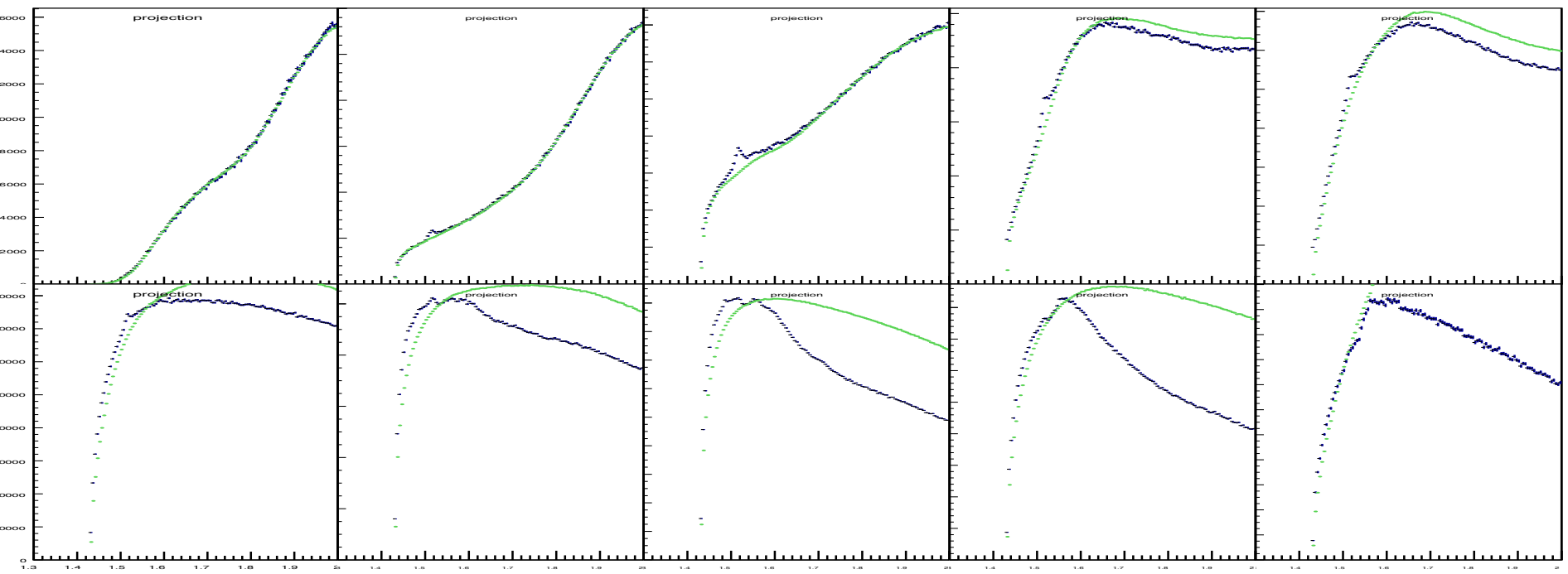
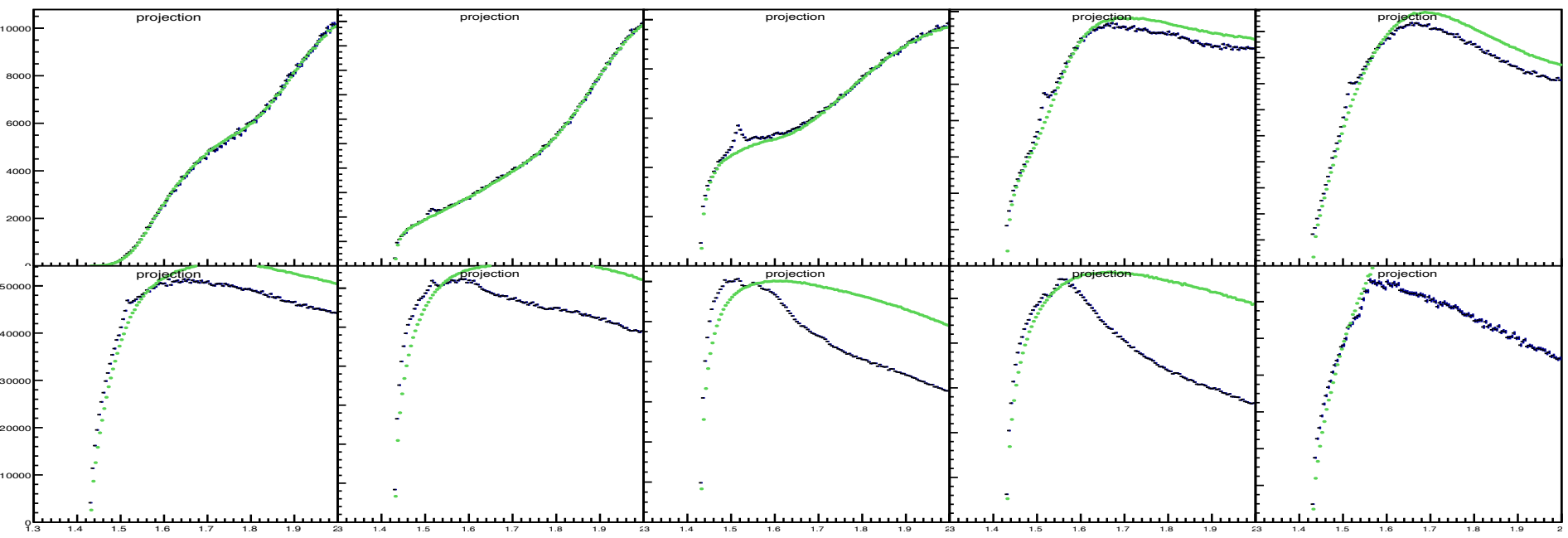


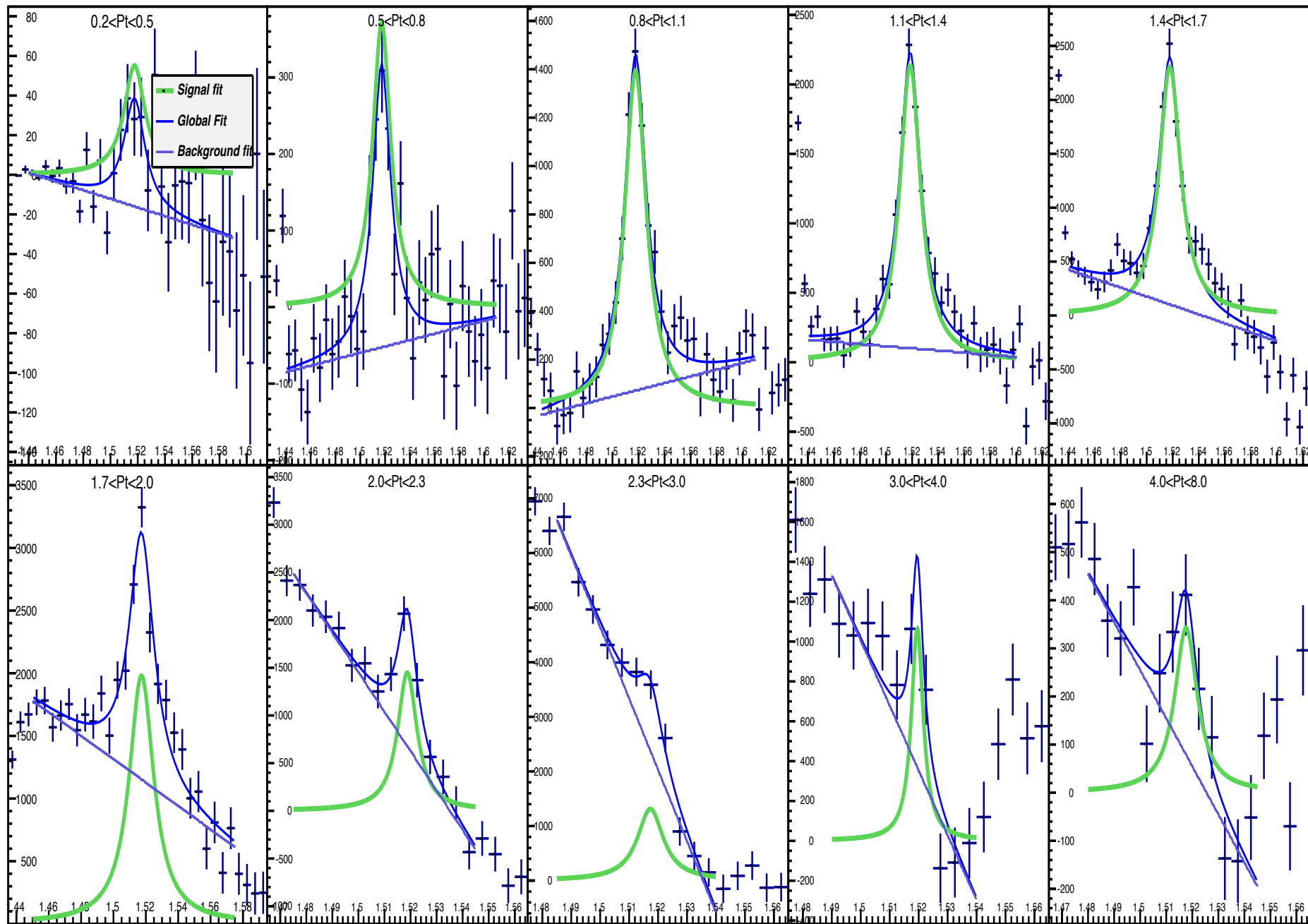
$0.0 < Pt < 5.0$

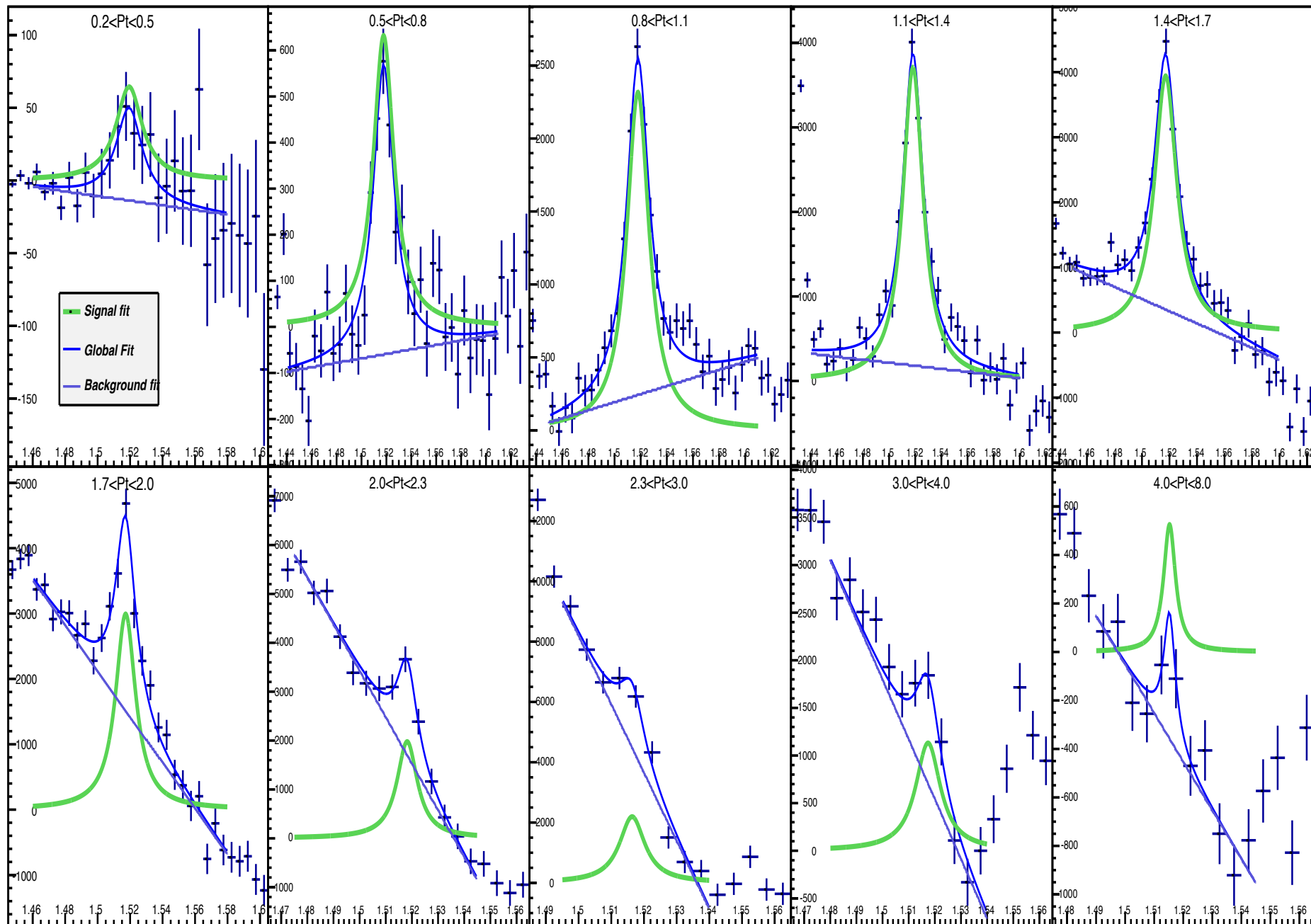


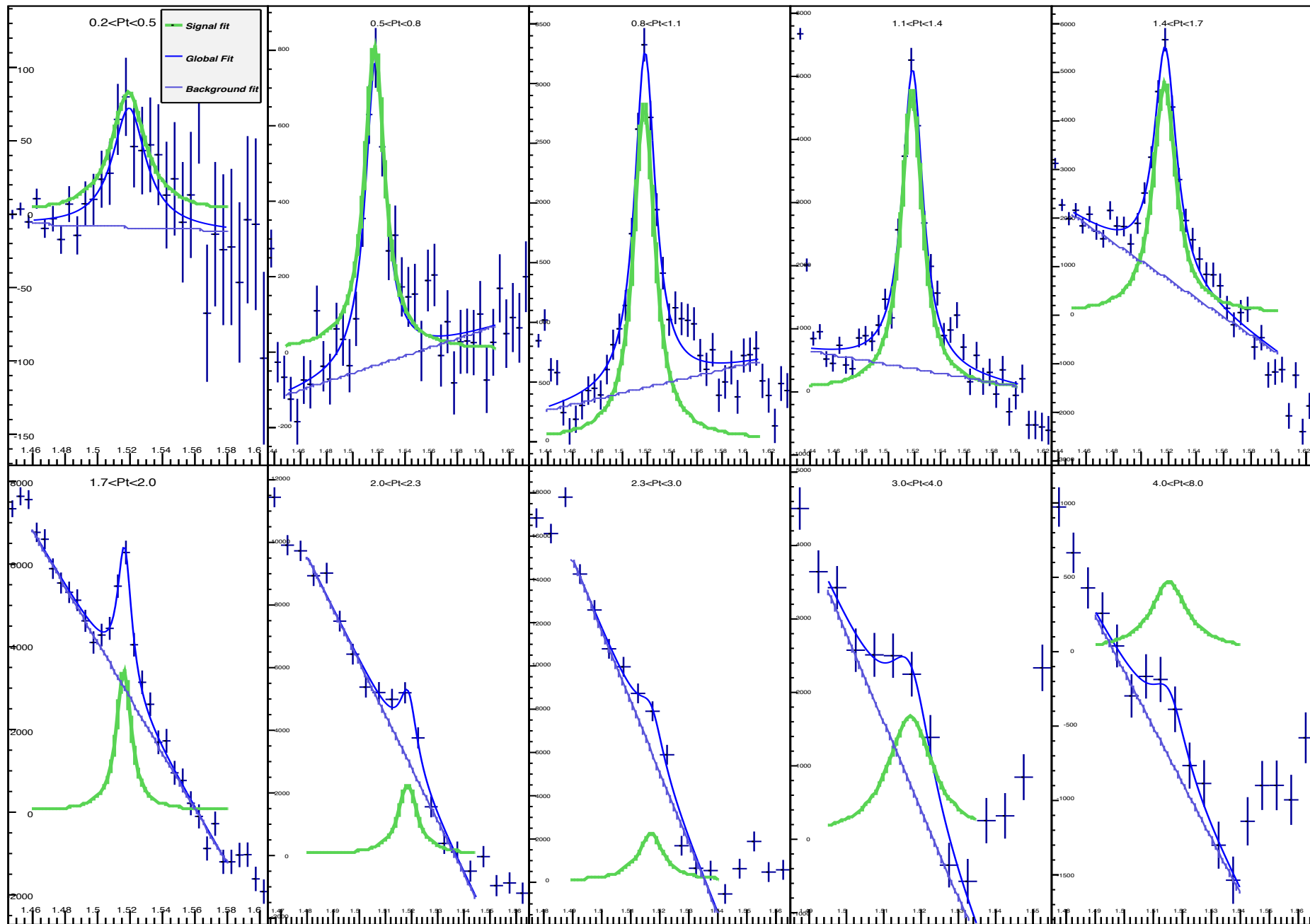
Pt Range { .2, .5, .8, 1.1, 1.4, 1.7, 2.0, 2.3, 3.0, 4.0, 8.0 }





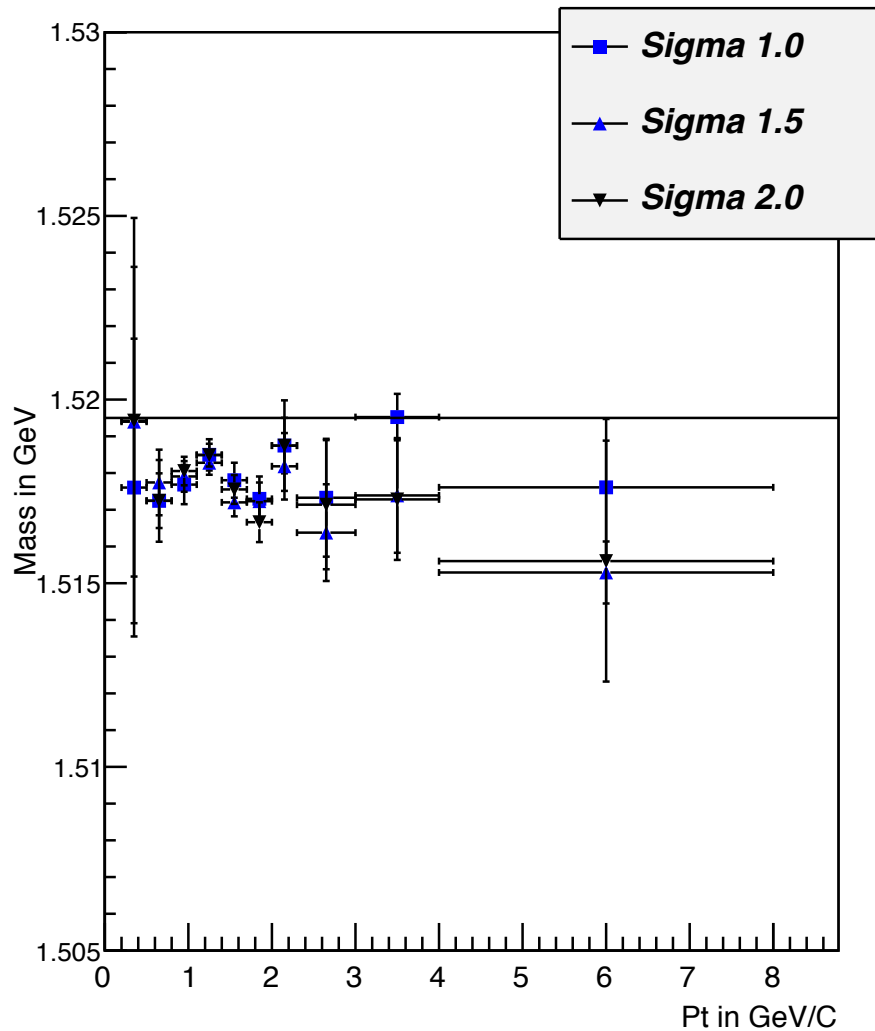




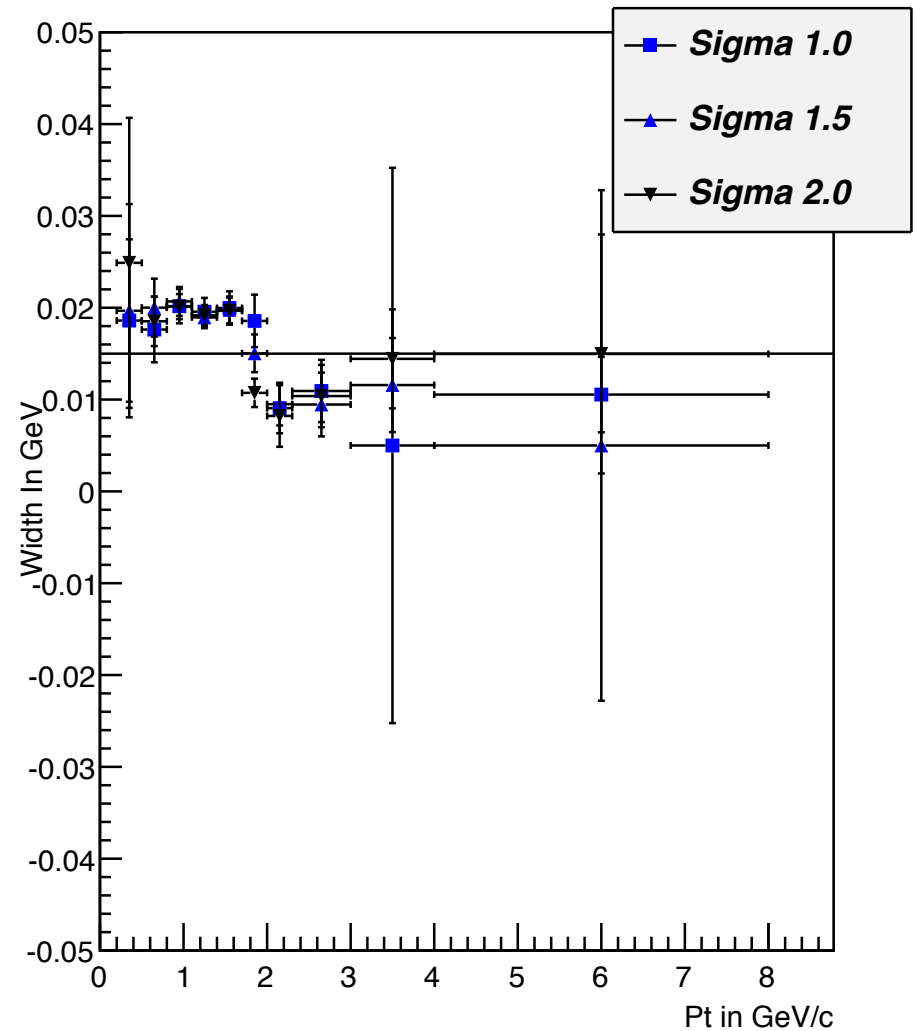


Mass and Width Vs Pt

Graph

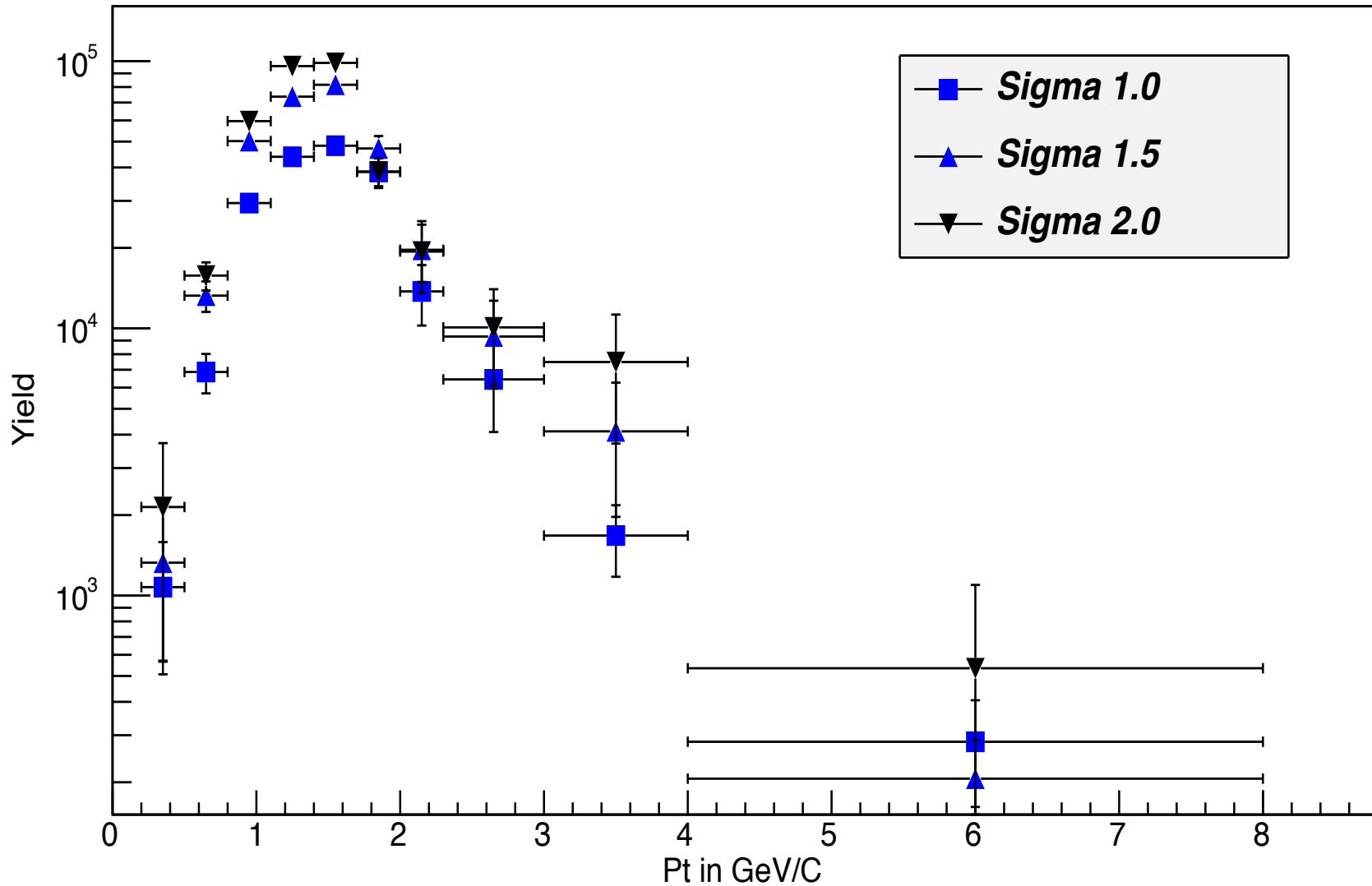


Graph

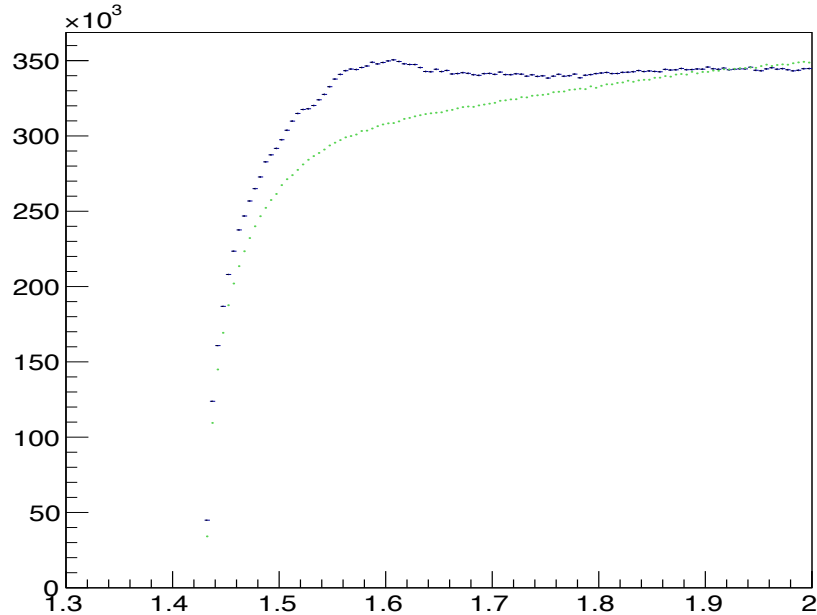


Uncorrected Yield Vs Pt

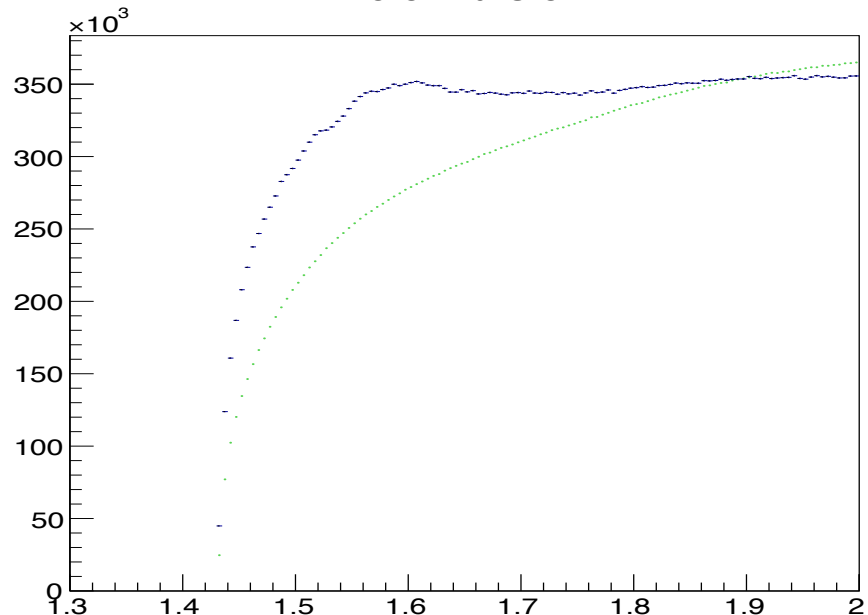
Graph



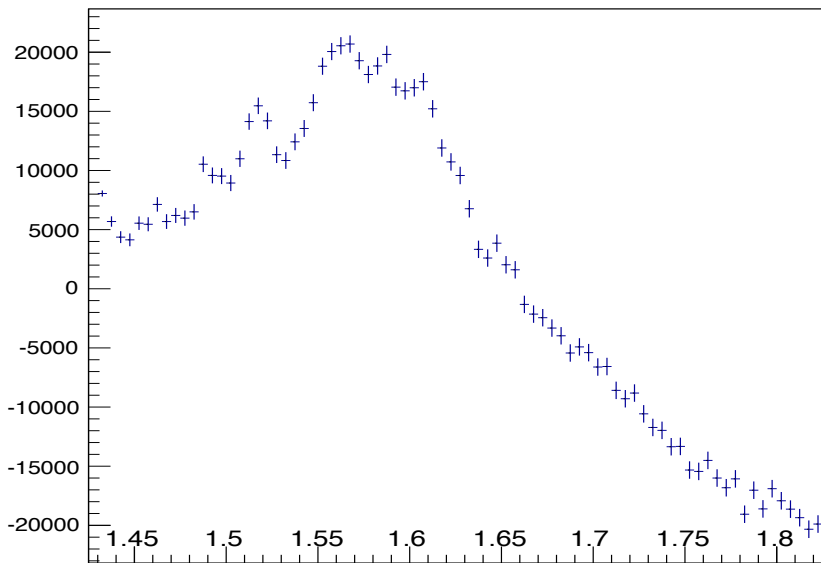
0.5 < Pt < 5.0 Same Event Bkg



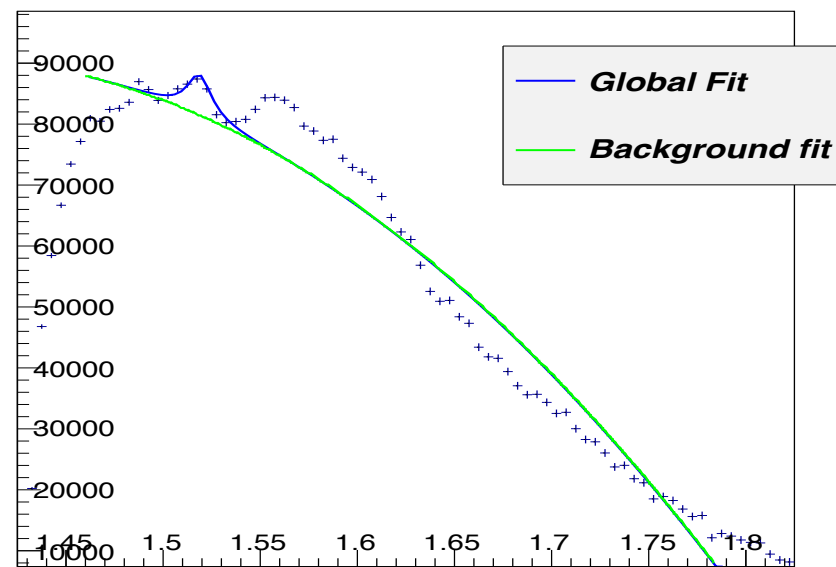
Mix Event Bkg 0.0 < Pt < 5.0



0.5 < Pt < 5.0



0.0 < Pt < 5.0



Run # used for the analysis

LHC10c pass_2 7_Tev 120829 120825 120824 120823 120822 120821 120820 120758 120750
120741 120671 120617 120616 120505 120503 120244 120079 120076 120073 120072 120069
120067 119862 119859 119856 119853 119849 119846 119845 119844 119841 119163 119161
119159 119086 119067 119061 119057 119055 119047 119041 119037

LHC10d pass2 7_Tev 126158 126097 126090 126088 126082 126081 126078 126073 126008
126007 126004 125855 125851 125850 125849 125848 125847 125844 125843 125842 125633
125632 125630 125628 125296 125134 125101 125100 125097 125085 125023 122375 122374

LHC10e pass2 7_Tev 130840 130834 130799 130798 130795 130793 130704 130696 130519
130517 130480 130356 130354 130343 130342 130179 130178 130172 130158 130157 130149
129983 129961 129960 129959 129744 129742 129738 129736 129735 129729 129726 129725
129723 129667 129666 129659 129654 129653 129652 129650 129647 129641 129639 129599
129587 129586 129540 129528 129527 129523 129520 129514 129513 129512 128913 128855
128853 128843 128836 128835 128833 128824 128823 128820 128778 128777 128678 128677
128615 128611 128609 128605 128582 128507 128504 128503 128495 128494 128486 128483
128452 128260 128192 128185 127942 127941 127940 127937 127936 127935 127933 127822
127718 127714 127712

LHC12a4 MC 7_Tev 114931 115186 115193 115393 115401 115414 116102 116288 116402
116403 116562 116571 116574 116643 116645 117048 117050 117052 117053 117054 117059
117060 117063 117065 117077 117086 117092 117099 117109 117112 117116 117220 117222
119159 119161 119163 119841 119842 119844 119845 119846 119849 119853 119856 119859
119862 120067 120069 120072 120073 120076 120079 120244 120503 120504 120505 120616
120617 120671 120741 120750 120758 120820 120821 120822 120823 120824 120825 120829
122374 122375 124751 125023 125085 125097 125100 125101 125134 125296 125630 125632
125633 125842 125843 125844 125847 125848 125849 125850 125851 125855 126004 126007
126008 126073 126078 126081 126082 126088 126090 126097 126158 126160 126167 126168
126283 126284 126285 126350 126351 126352 126359 126403 126404 126405 126406 126407
126408 126409 126422 126424 126425 126432 126437 127719 127724 127729 127730 127814