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Isobar hypernuclei

2022/10/14



- Isobar list:

`/star/u/suyuann/pwg/Isobar.Blind/isobar_ana/picoRaw_phy_20220807.list`

- Analysis:

based on `/star/u/xli/pwg/gpc_CSB/02_kfparticle/H4L`

in `/star/u/dsli/pwg/Isobarhypernuclei/02_kfparticle/H3L_mix`

`#evt in buffer = 5, same topo cuts`

`#real evt ~2.9033784e+09`

before:

rotational background is normalized by `#(minbias events)`

mix event background by integral of full mass spectra

now:

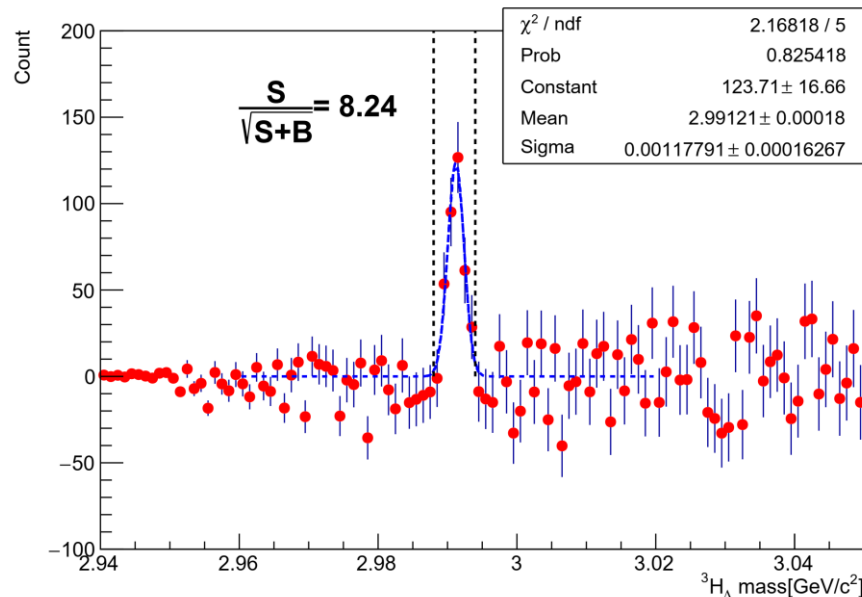
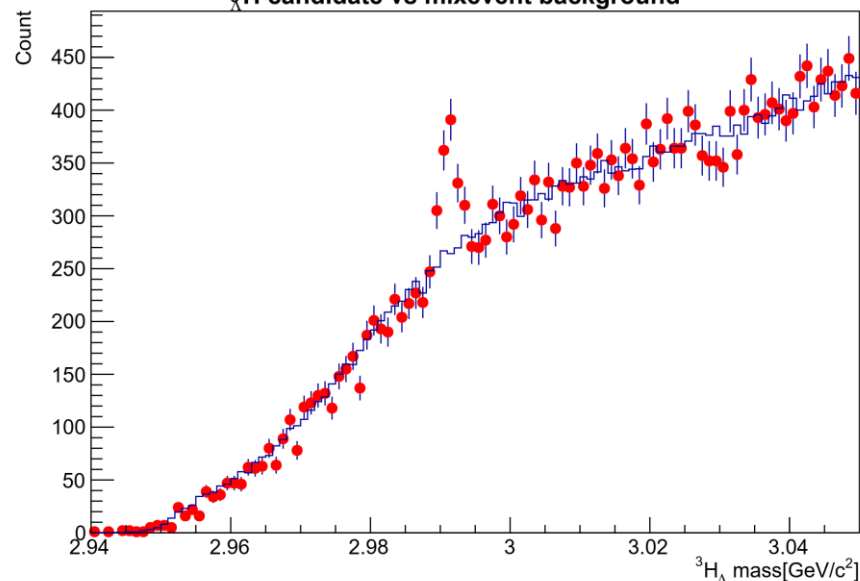
normalized by integral of mass spectra outside of the signal window

H3I signal&background spectra

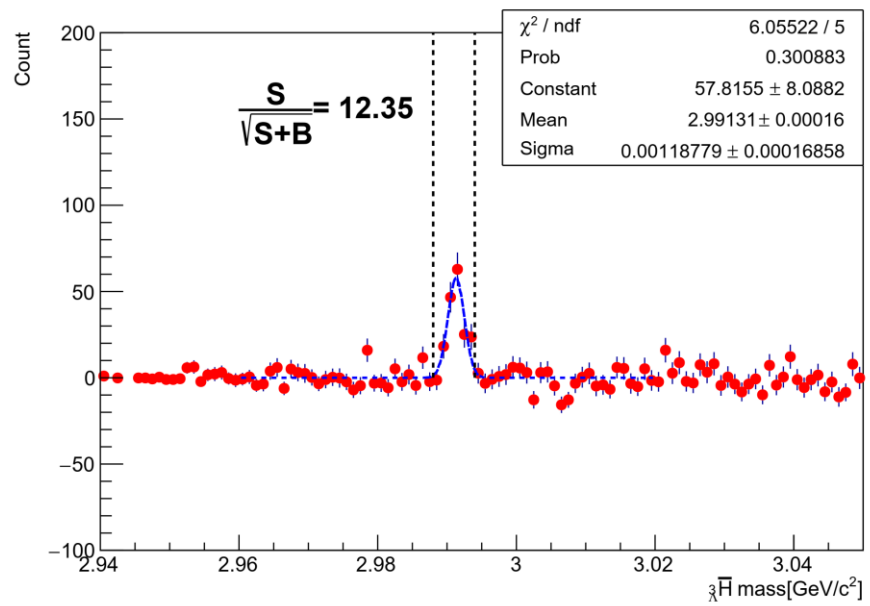
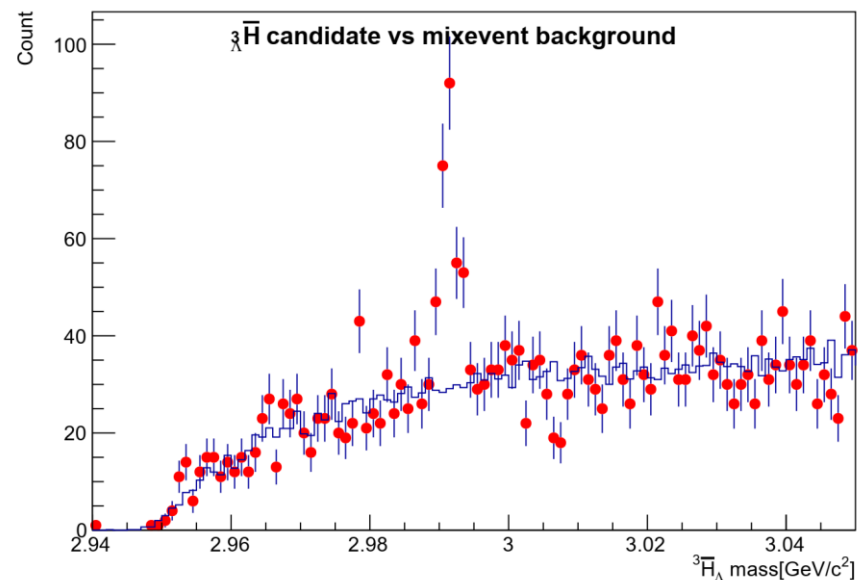


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χ H candidate vs mixevent background



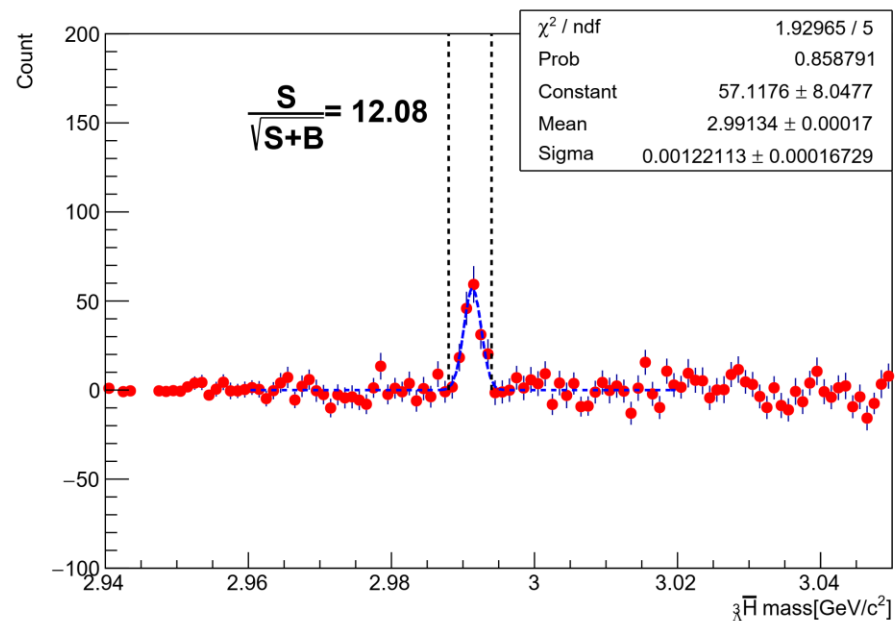
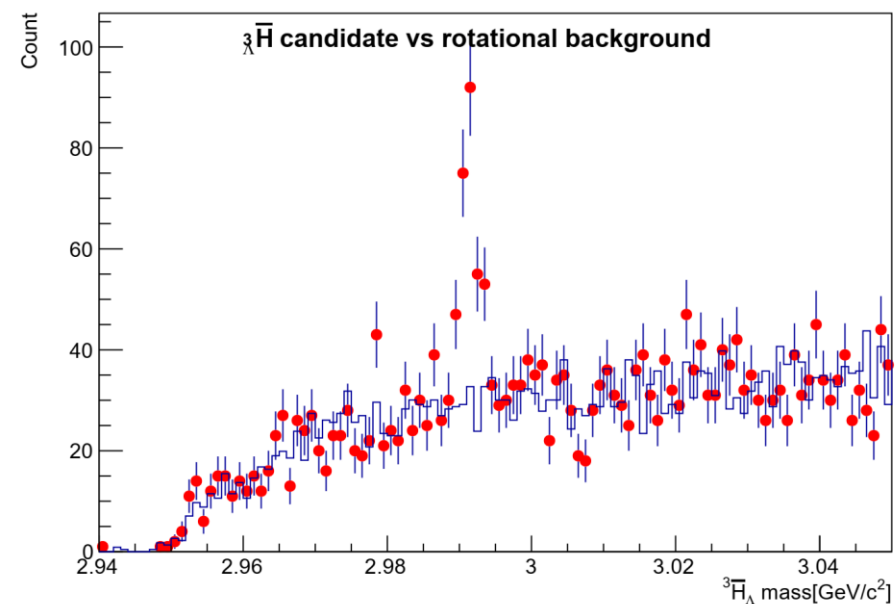
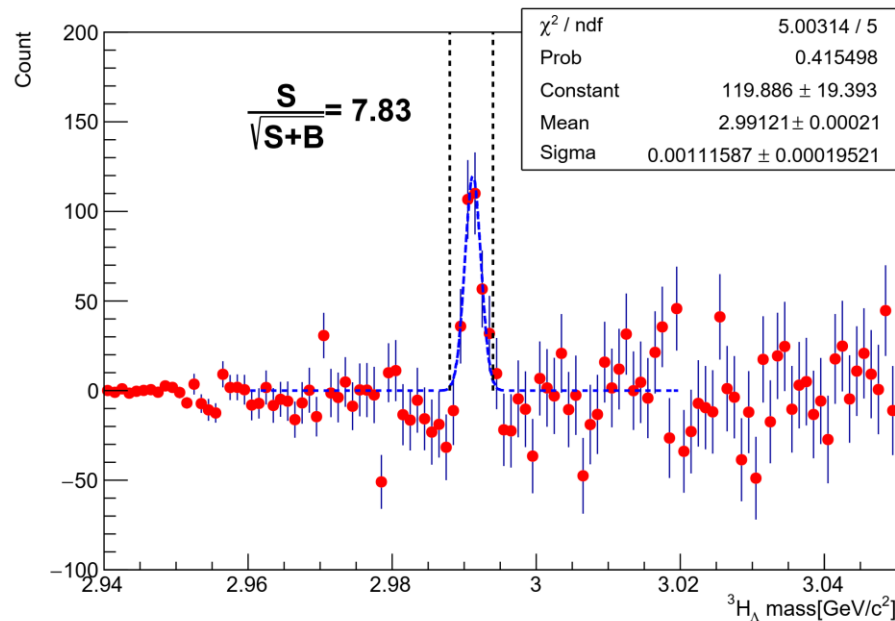
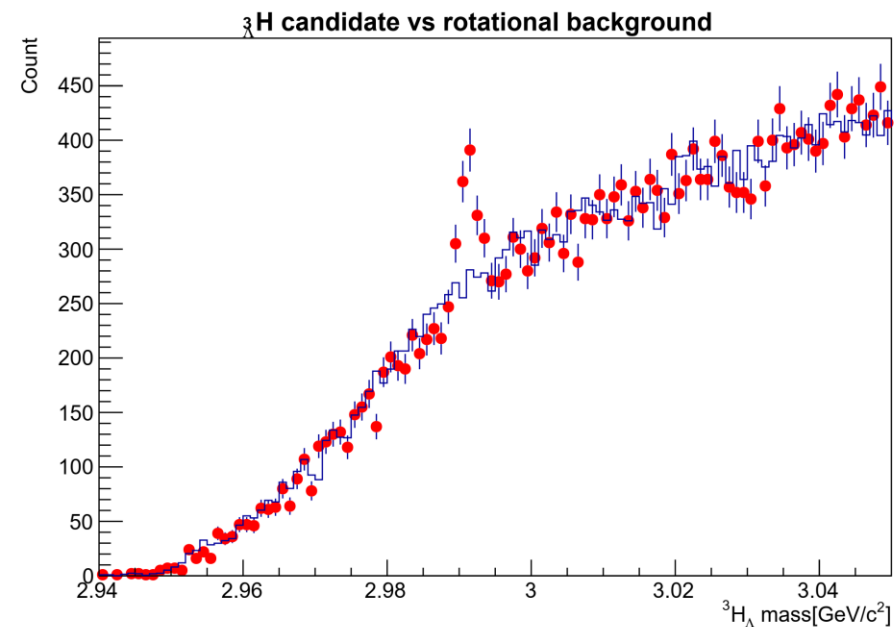
$\chi\bar{\text{H}}$ candidate vs mixevent background



H3I signal&background spectra



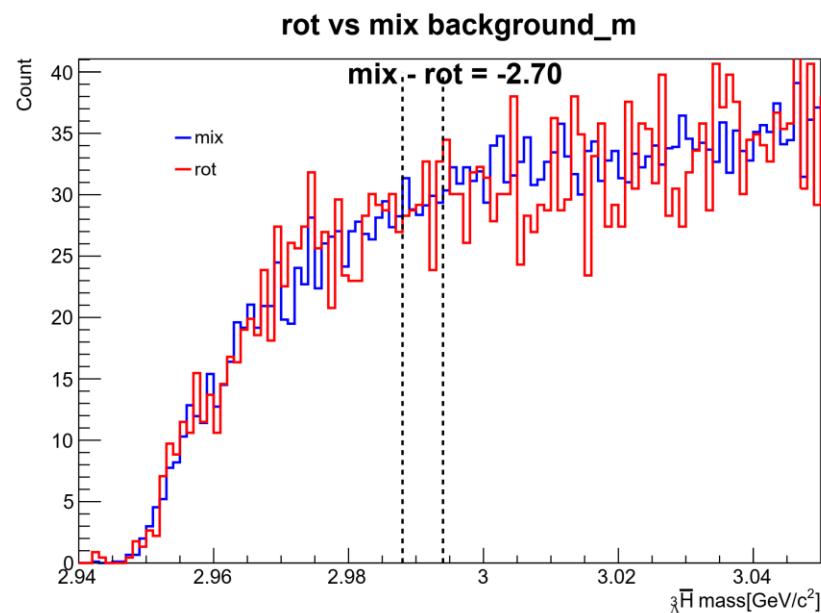
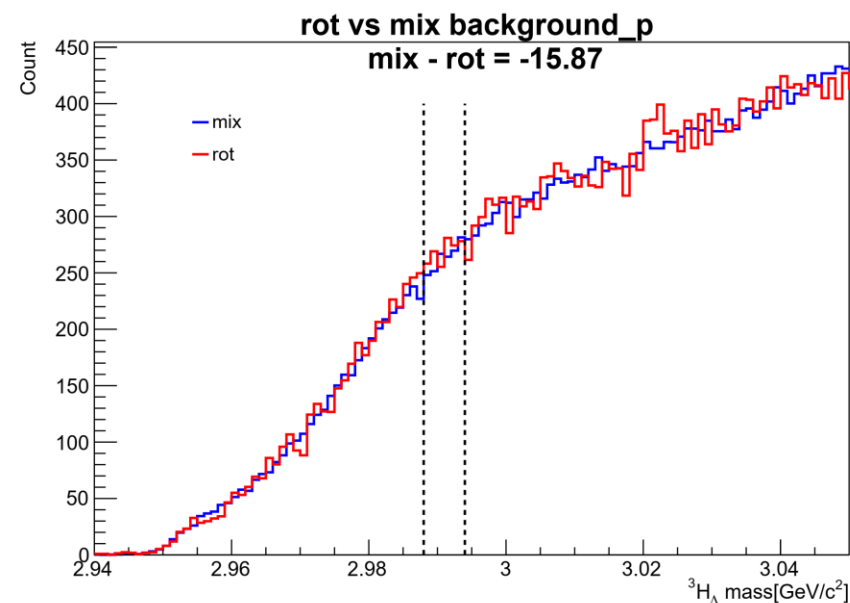
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H3I signal&background spectra



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Significance	rotational	Mix event
Hypertriton	7.83	8.24
Anti-hypertriton	12.08	12.35

H3L mass position



1. The masses of ${}^3_{\Lambda}\text{H}$ and ${}^3_{\Lambda}\bar{\text{H}}$.

$2990.95 \pm 0.13(\text{stat.}) \pm 0.11(\text{syst.})\text{MeV}/c^2$ for ${}^3_{\Lambda}\text{H}$.

$2990.60 \pm 0.28(\text{stat.}) \pm 0.11(\text{syst.})\text{MeV}/c^2$ for ${}^3_{\Lambda}\bar{\text{H}}$.

$2990.89 \pm 0.12(\text{stat.}) \pm 0.11(\text{syst.})\text{MeV}/c^2$ for combined ${}^3_{\Lambda}\text{H}$ and ${}^3_{\Lambda}\bar{\text{H}}$.

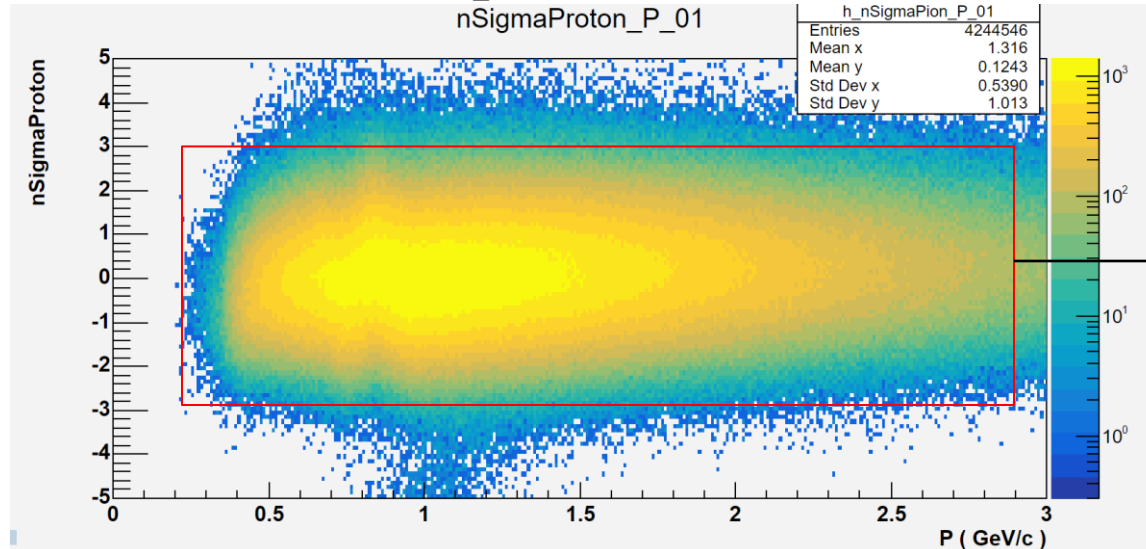
Central value &stat uncertainty	Published (corrected)	Rotational (raw)	Mixed event (raw)
H3L	2990.95 ± 0.13	2991.21 ± 0.21	2991.21 ± 0.18
Anti-H3L	2990.60 ± 0.28	2991.34 ± 0.17	2991.31 ± 0.16

Lambda reconstruction



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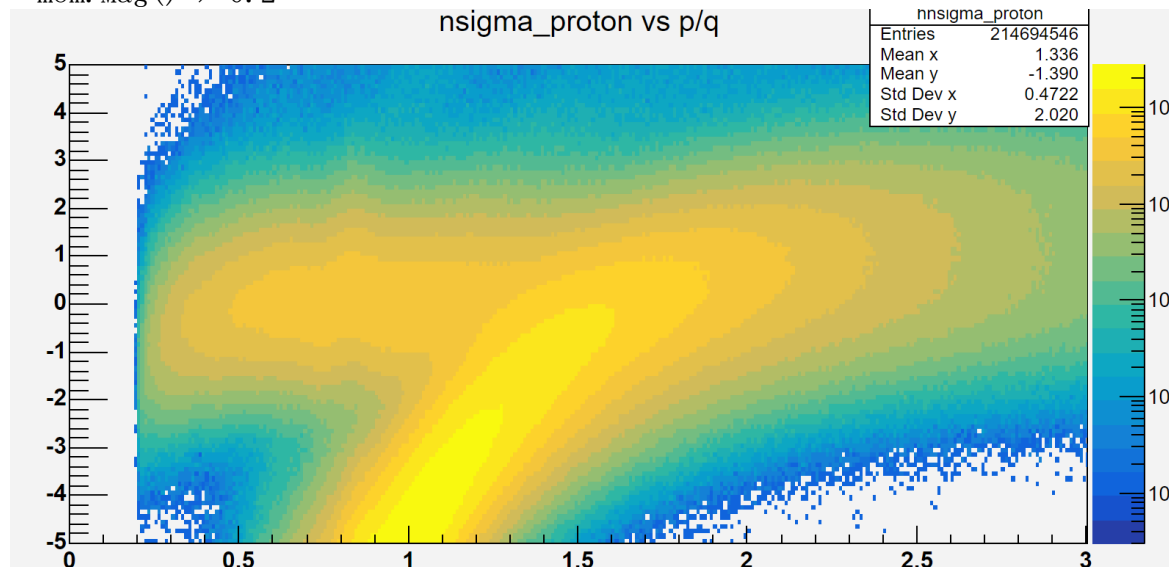
```
fabs(1.0 / beta - sqrt(pow(M_proton, 2) + pow(mom.Mag(), 2)) * 1.0 / mom.Mag()) < 0.01 && mom.Mag() > 0.2
```



|Nsigma_proton| < 3

~ 20 picofile (~ 2.6M events, 0.1%) gives
a very large tree
Only Lambda reconstructed (no anti-Lambda)

mom.Mag() > 0.2



Topo cuts:

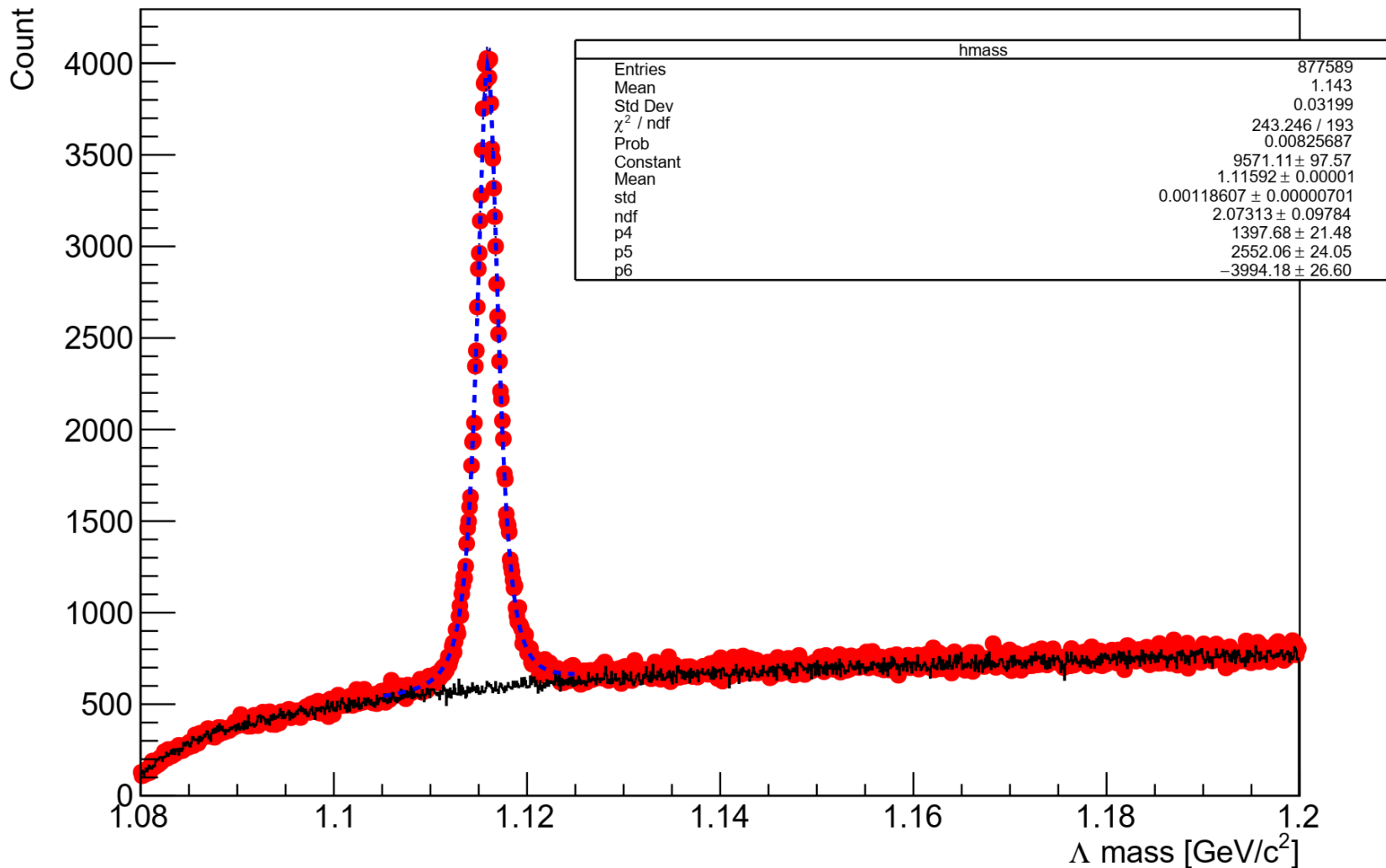
```
if (chi2ndf > 4.) continue;  
if (chi2primary_pi < 10.) continue;  
if (chi2primary_proton > 500) continue;  
if (chi2topo > 3.) continue;  
if (lifetime < 0) continue;
```

Lambda reconstruction



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Student t + 2nd order polynomial

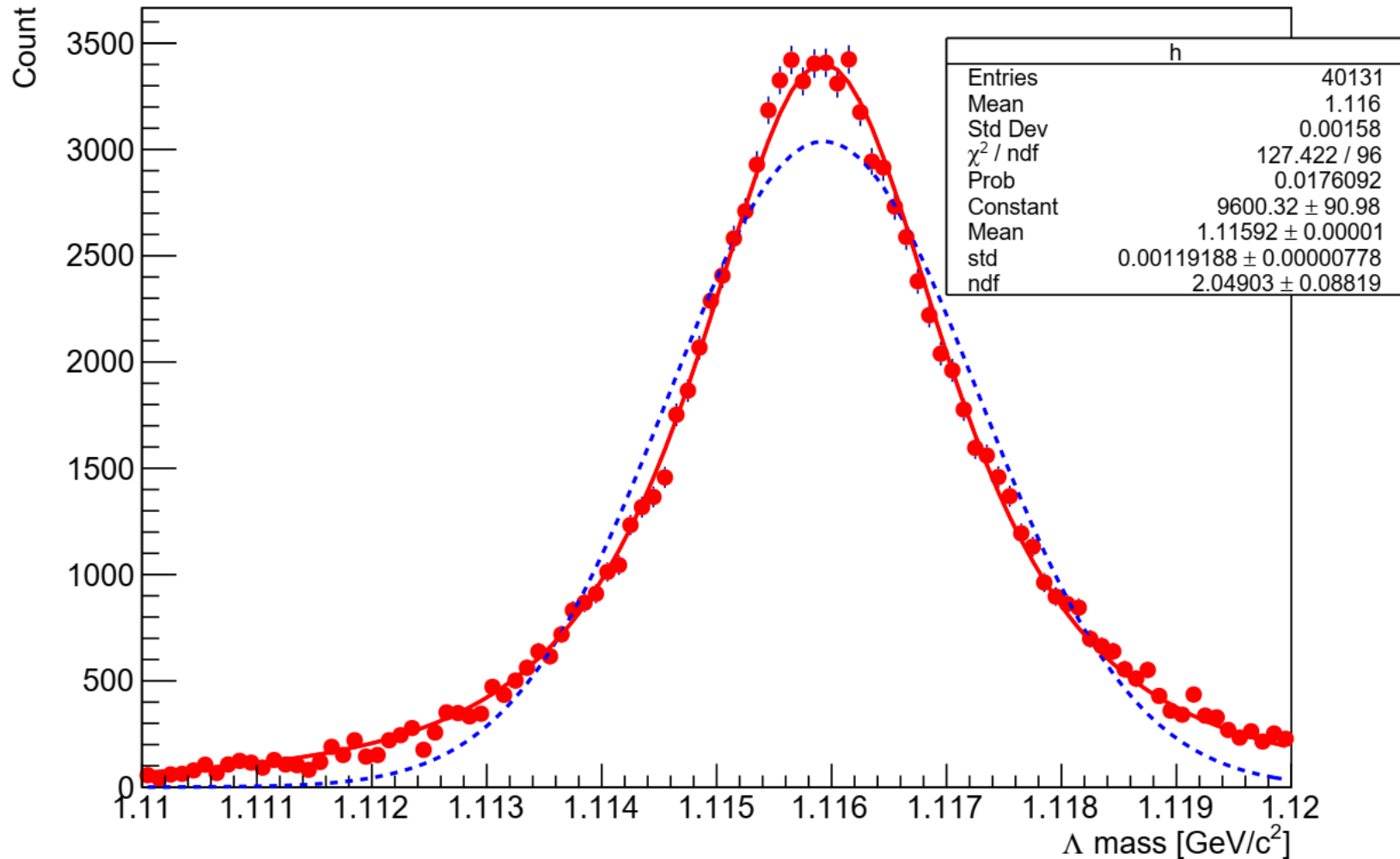


Lambda reconstruction



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Pure gaussian & student t



Lambda reconstruction



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Central value & stat uncertainty	PDG mass	Fit_1	Fit_2
Lambda mass	1115.683 ± 0.006	1115.92 ± 0.01	1115.92 ± 0.01

Central value & stat uncertainty	Published (corrected)	Rotational (raw)	Mixed event (raw)
H3L	2990.95 ± 0.13	2991.21 ± 0.21	2991.21 ± 0.18
Anti-H3L	2990.60 ± 0.28	2991.34 ± 0.17	2991.31 ± 0.16

Hypertriton phase space



Λ H phase-space distribution

