nnΛ Analysis Meeting

November 18, 2021

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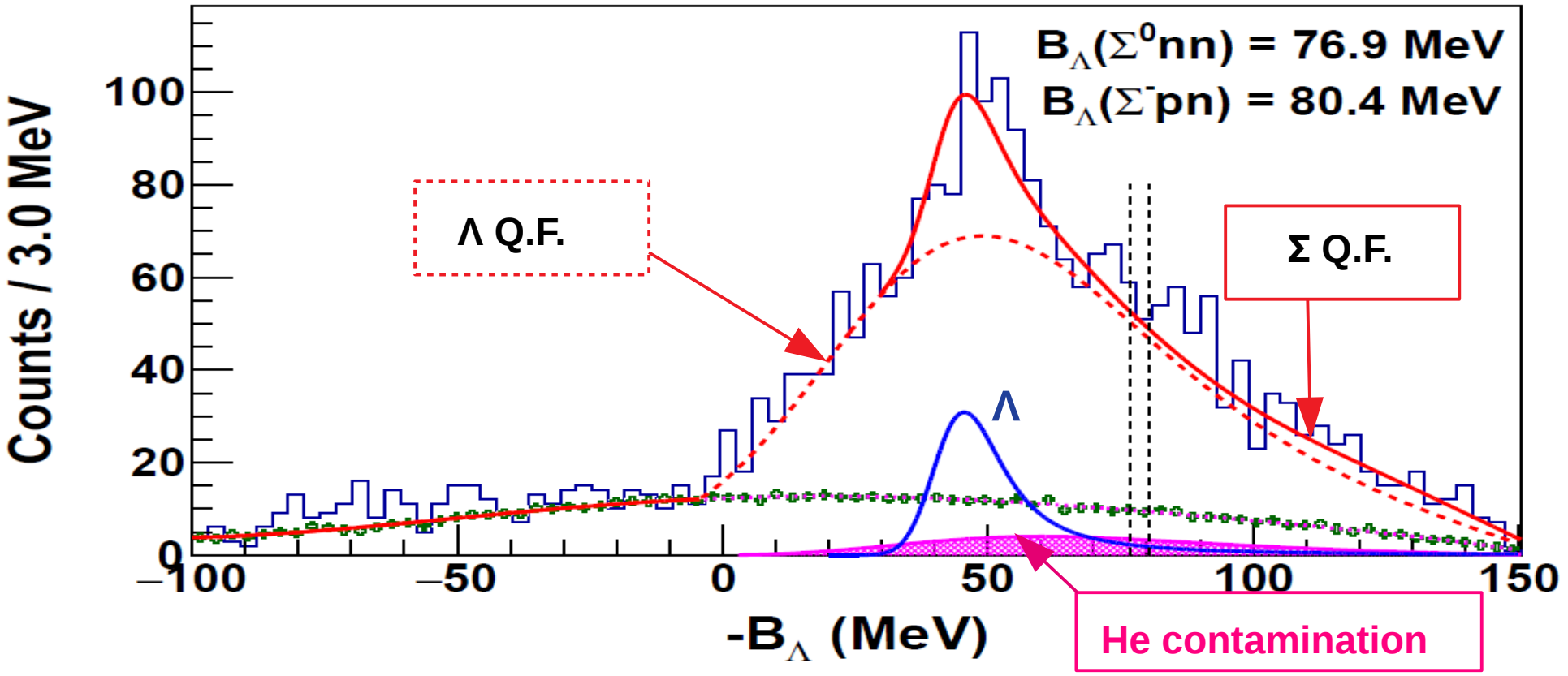
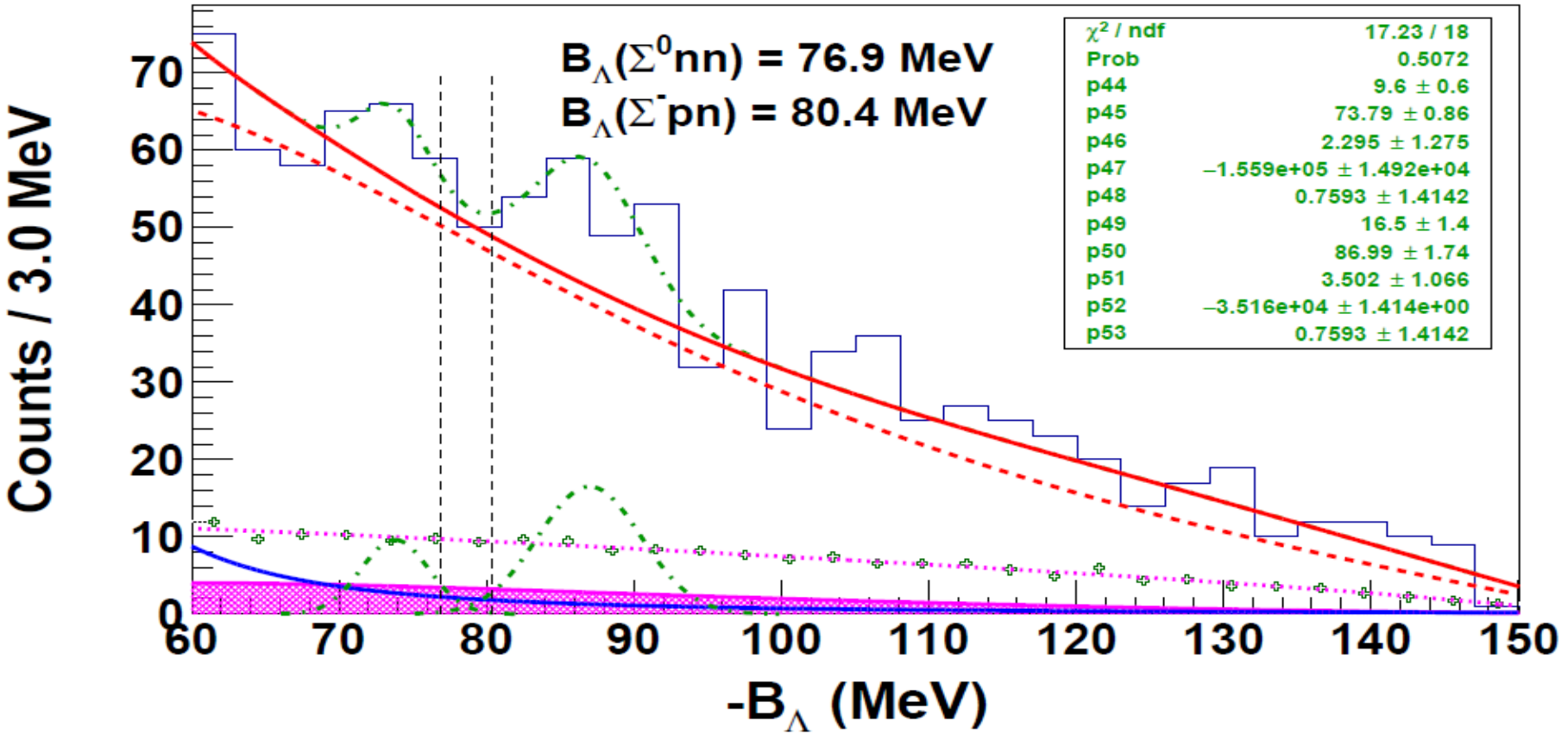
Λnn Spectrum with wider bins



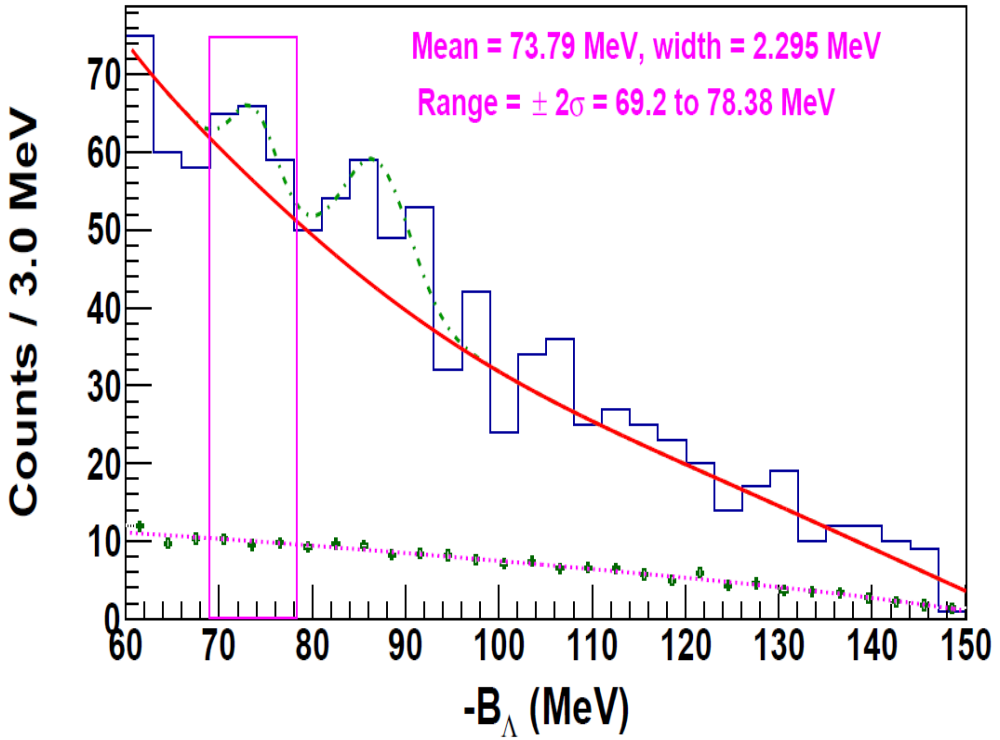
- The Λ/Σ QF shape is obtained by fitting the SIM A simulated data.
- The free Λ curve is obtained by fitting the H data in T kinematics but considering Tritium as target and Λnn as threshold mass.

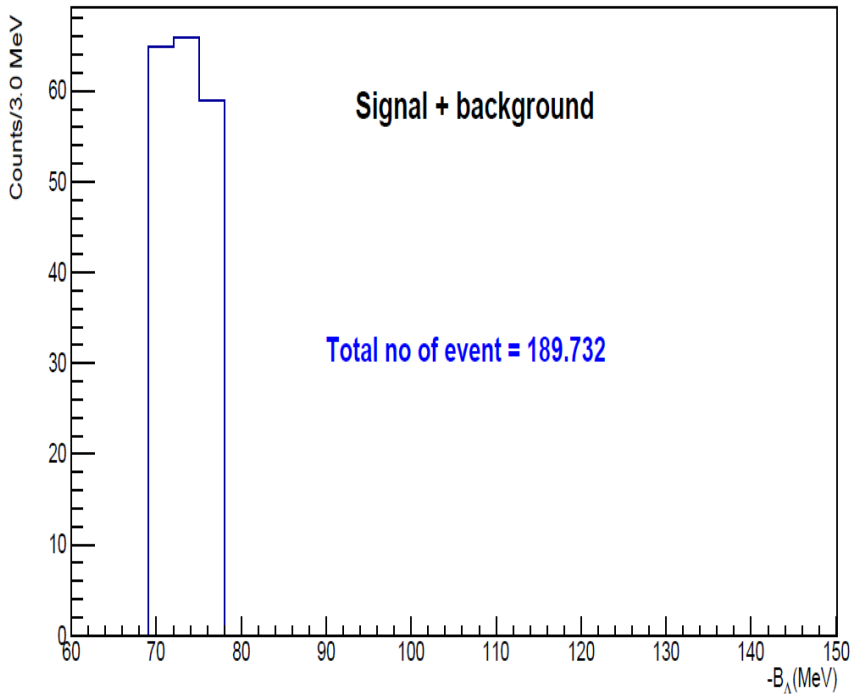
Closer view of Λnn Spectrum (wider bins)



- To make the clear view of the Lnn spectrum, the spectrum is plotted from 60 to 150 MeV.
- The statistical significance each peak is calculated.

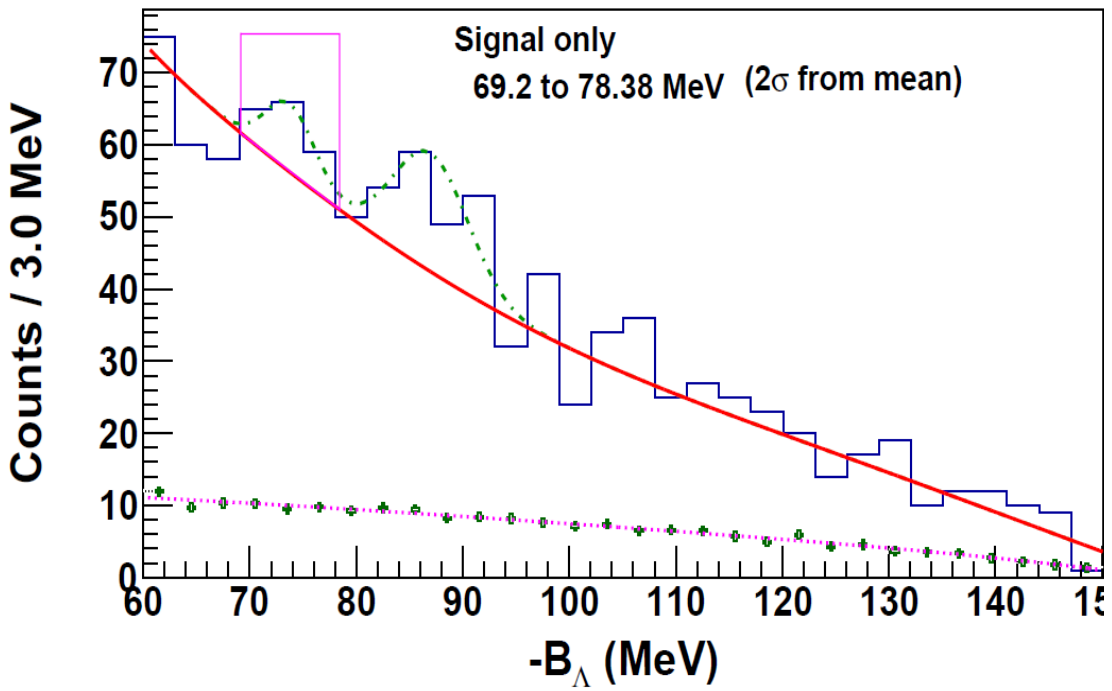
Statistical significance (first enhancement)

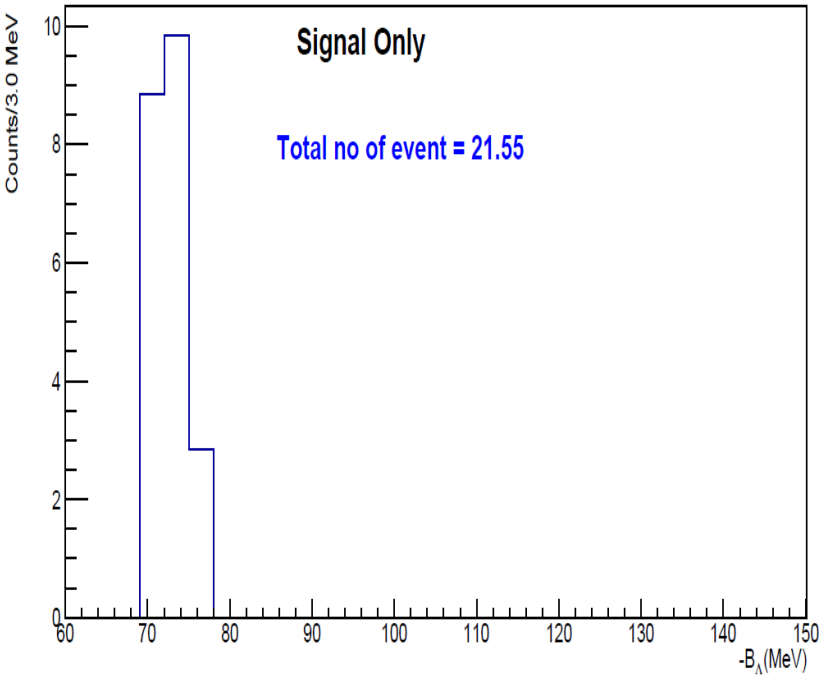




- A region of the ± 2σ from the mean is selected and then integrated. The total no of events (signal + background) is found about 190.

Statistical significance Continue..





- The same region above the red solid line (Sigma QF) is selected and integrated.
- The total number of events (signal only) is found about 22.

Statistical significance Continue..

First peak

Signal + background (s+b) ~ 190

Signal (s) = 22

Background = 168

$$\text{Significance} = \sqrt{2[(s+b)*\ln(1+s/b) - s]} = 1.66$$

Second peak

Signal + background (s+b) ~ 265

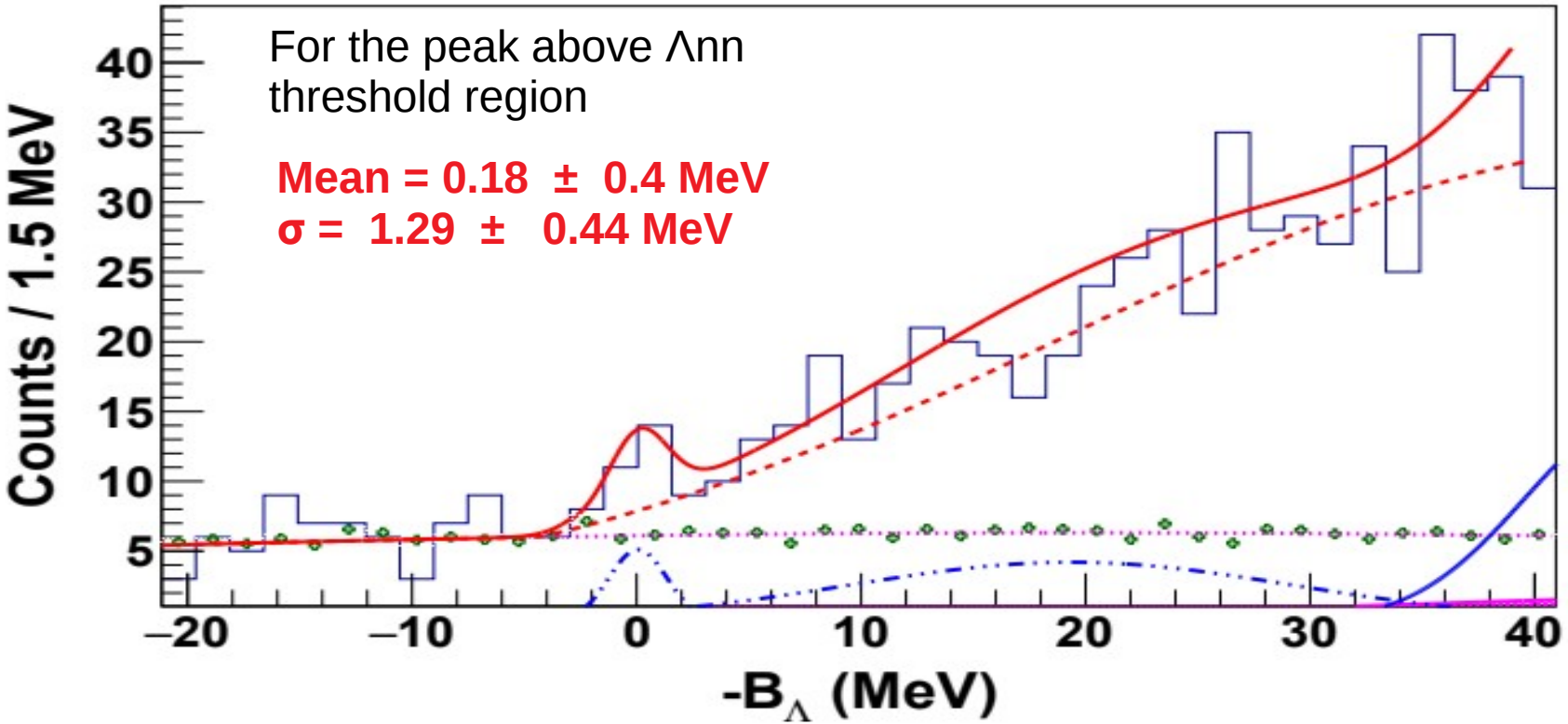
Signal (s) = 53

Background = 212

$$\text{Significance} = \sqrt{2[(s+b)*\ln(1+s/b) - s]} = 3.5$$

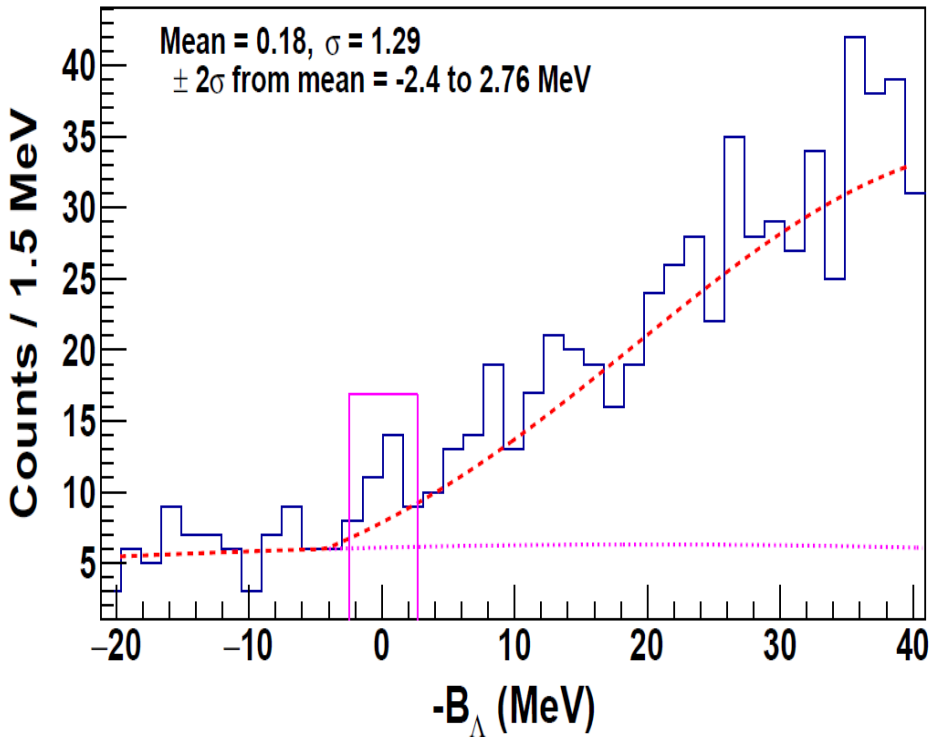
- For the first peak the statistical significance is found about 1.66.
- Same process is repeated for the second peak.
- For the second peak the statistical significance is found about 3.5.

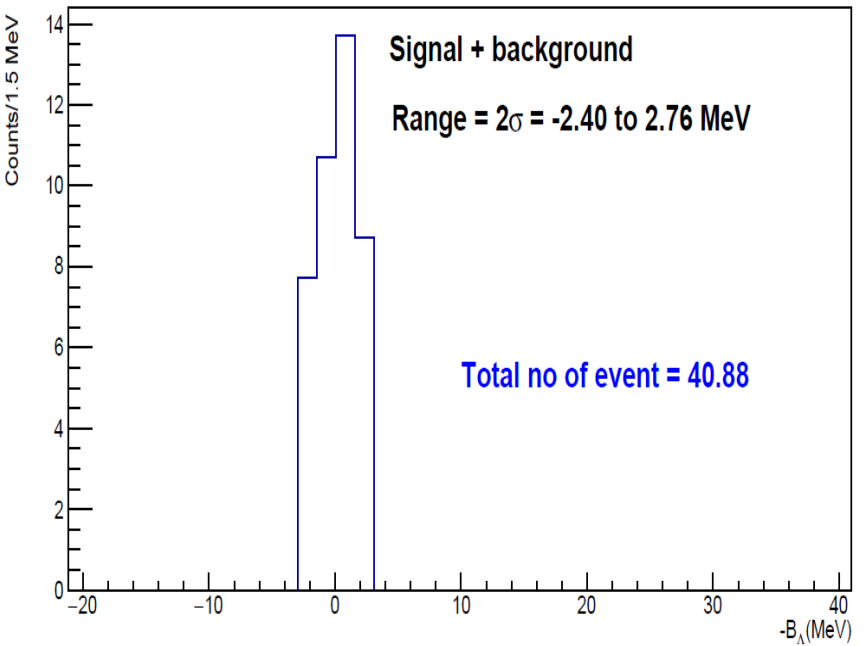
Closer view of Λnn Spectrum (small bins)



- To make the clear view of the Lnn spectrum, the spectrum is plotted from -20 to 40 MeV.
- The statistical significance of the peak is calculated in following slides.

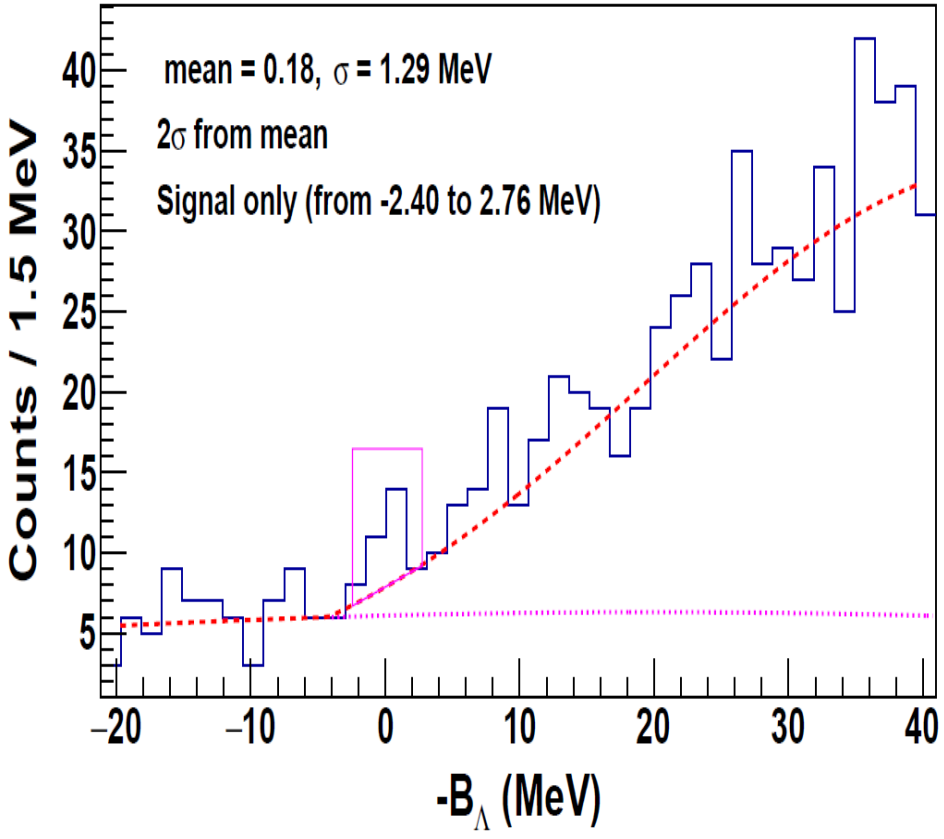
Statistical significance

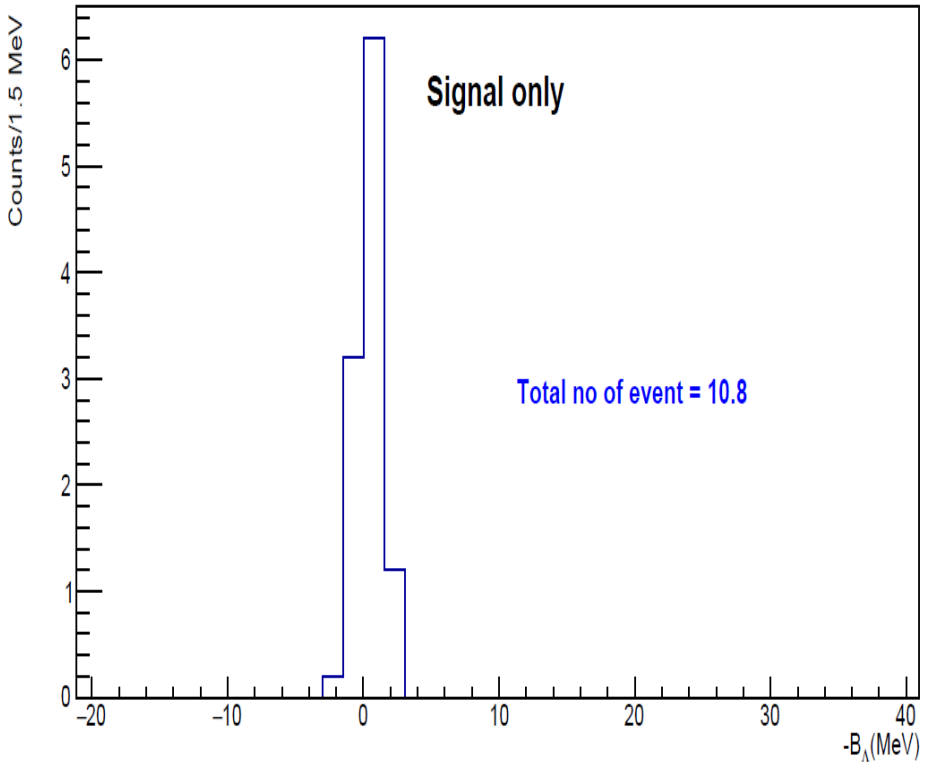




- A region of the ± 2σ from the mean is selected and then integrated. The total no of events (signal + background) is found to be ~ 41.

Statistical significance continue..





- The same region above the red dashed line (Lambda QF) is selected and integrated.
- The total number of events (signal only) is found to be ~ 11.

Statistical significance continue

Statistical significance (Λnn peak)

Mean = 0.18 MeV, σ = 1.29 MeV

Range = $\pm 2\sigma$ = -2.4 to 2.76 MeV

Signal (s) = 11

Signal + background(s+b) = 41

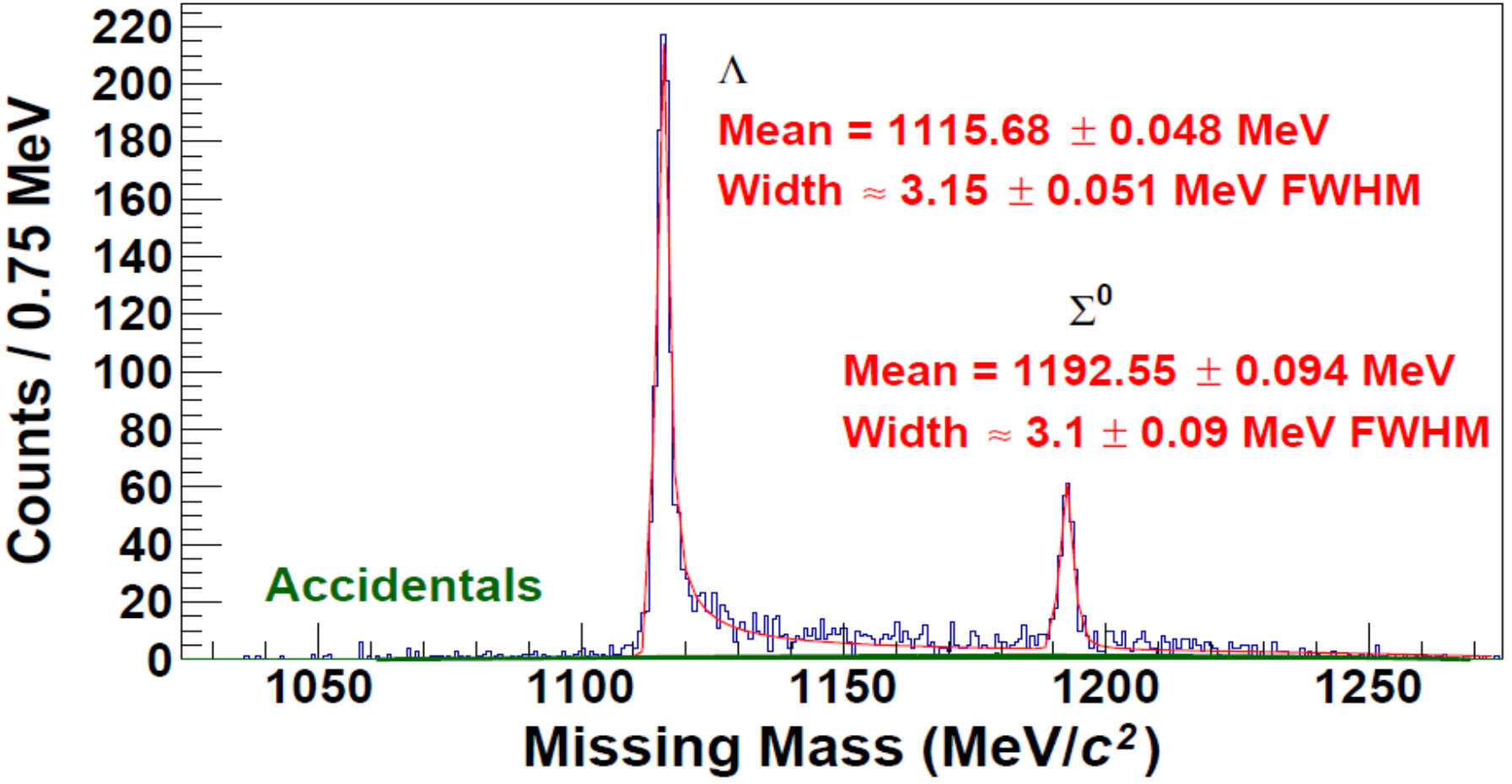
Background (b) = 30

St. Significance (SS) = $\sqrt{2[(s+b)*\ln(1+s/b)-s]}$

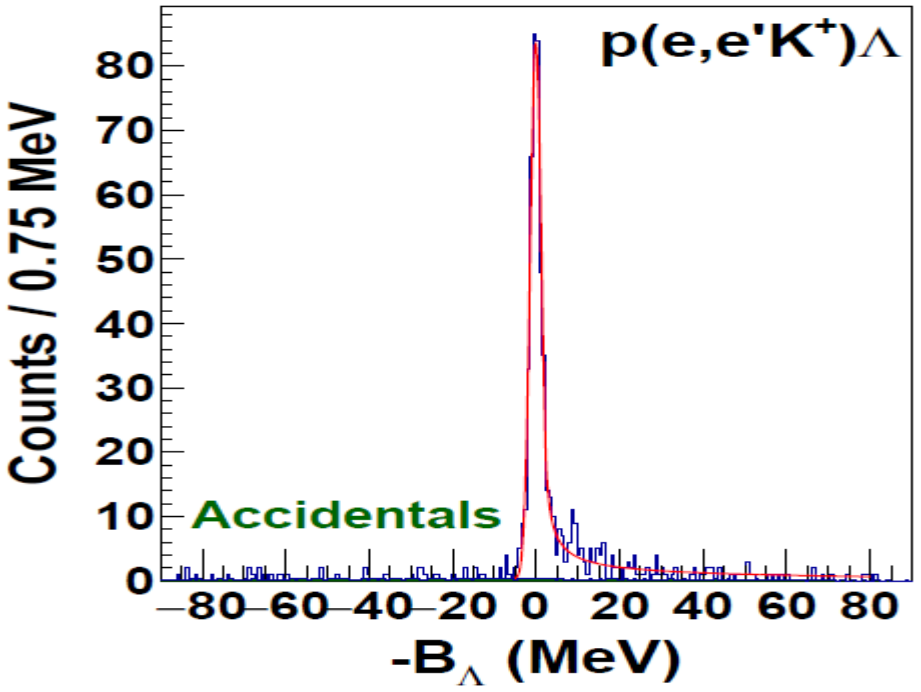
SS = 1.90

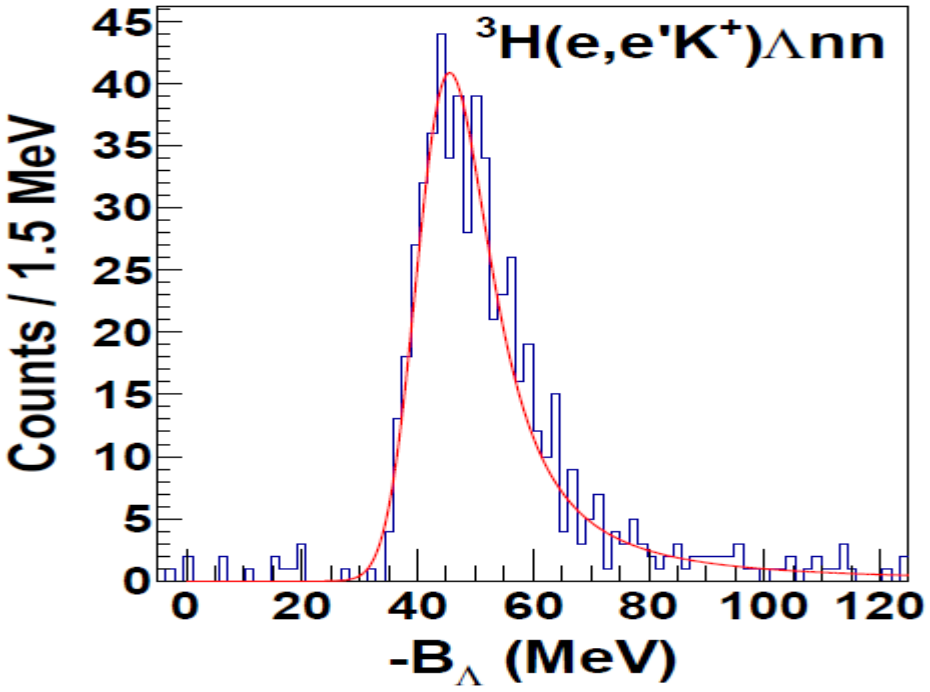
Backup Slide

H data in the H kinematics



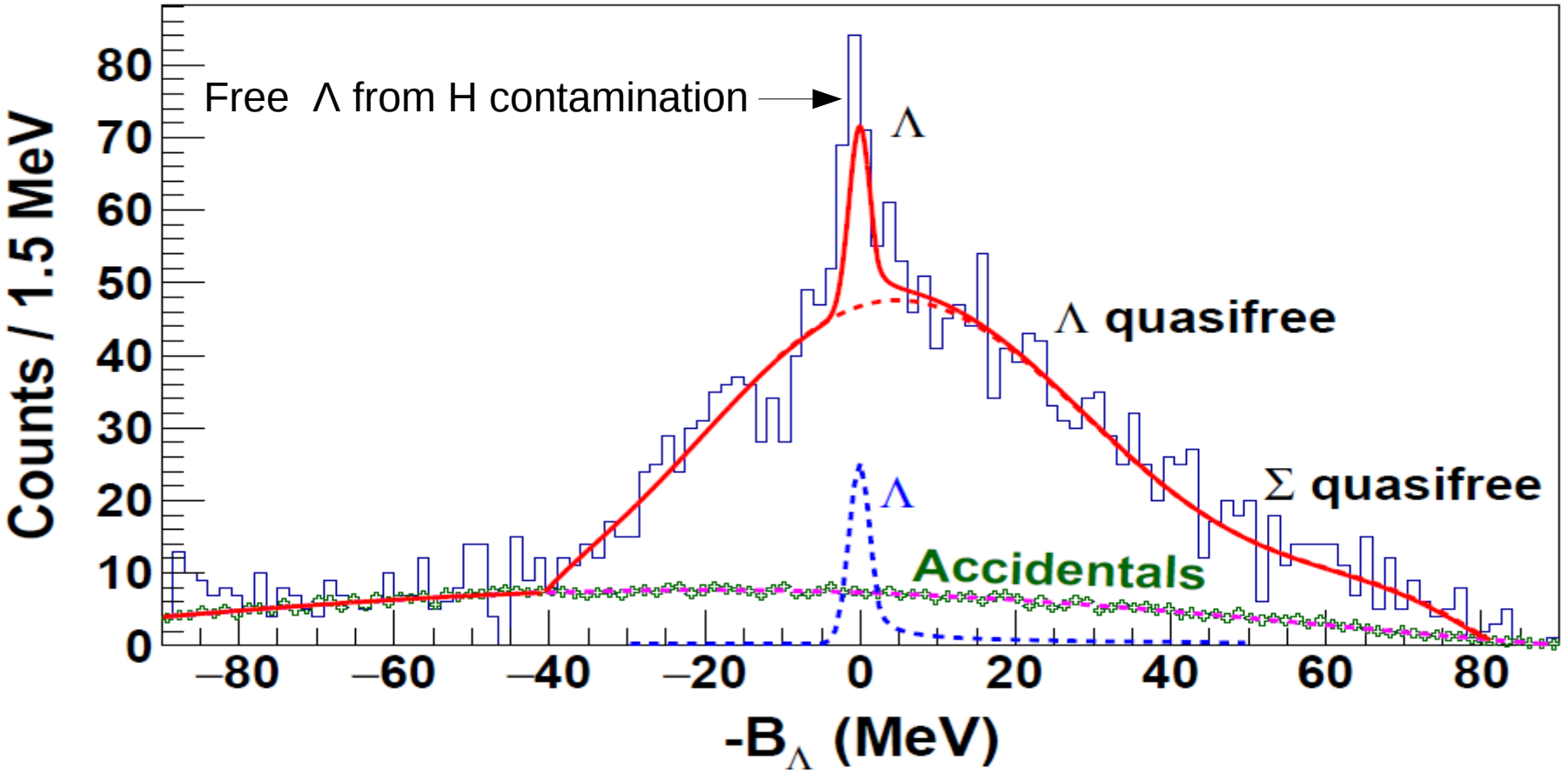
H data in the T kinematics





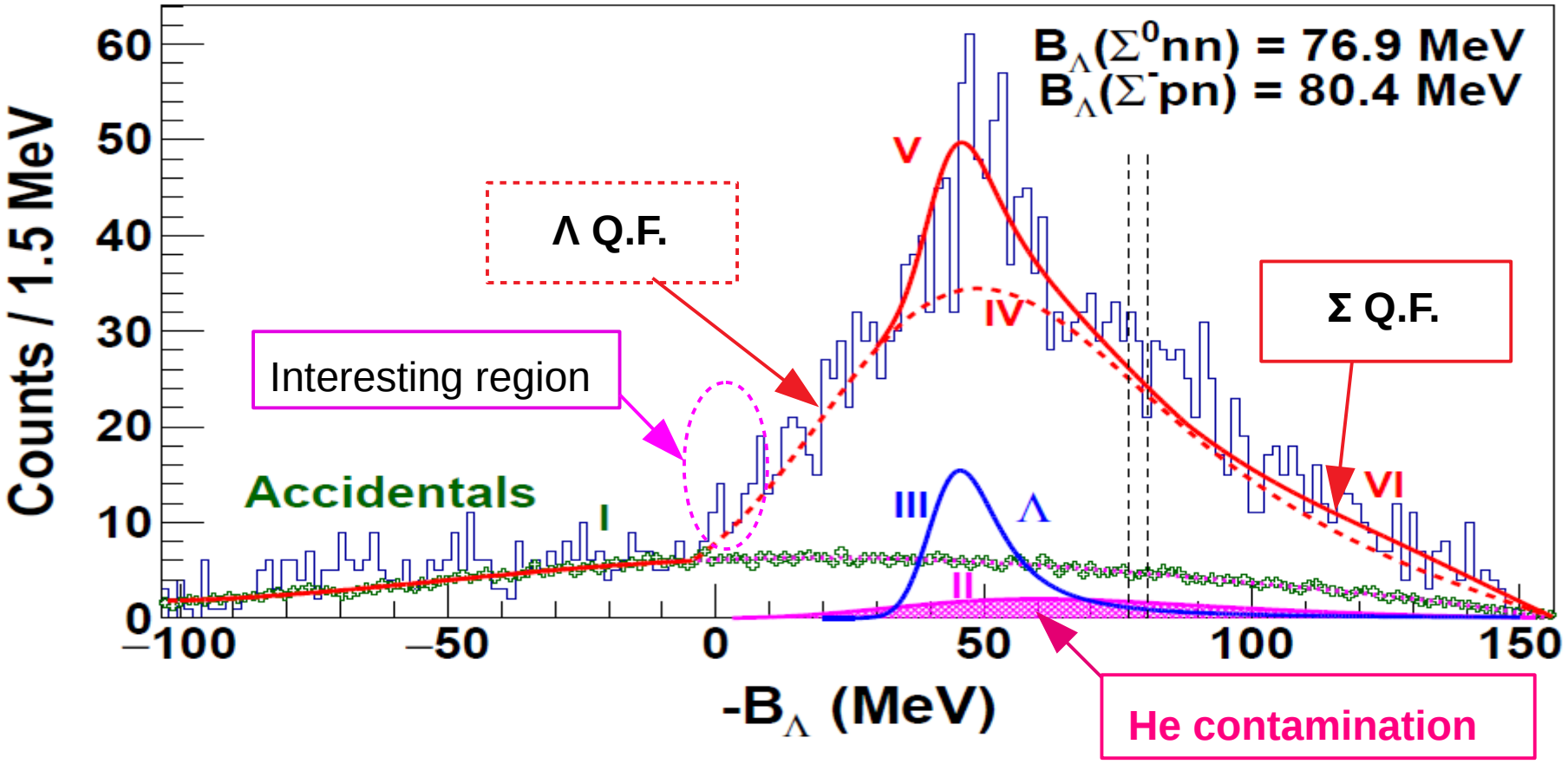
- The first spectrum is analyzed by considering H kinematics and the second one is analyzed considering tritium kinematics.
- The broadening of the second peak is because of the wrong kinematics.

Tritium data in the H kinematics



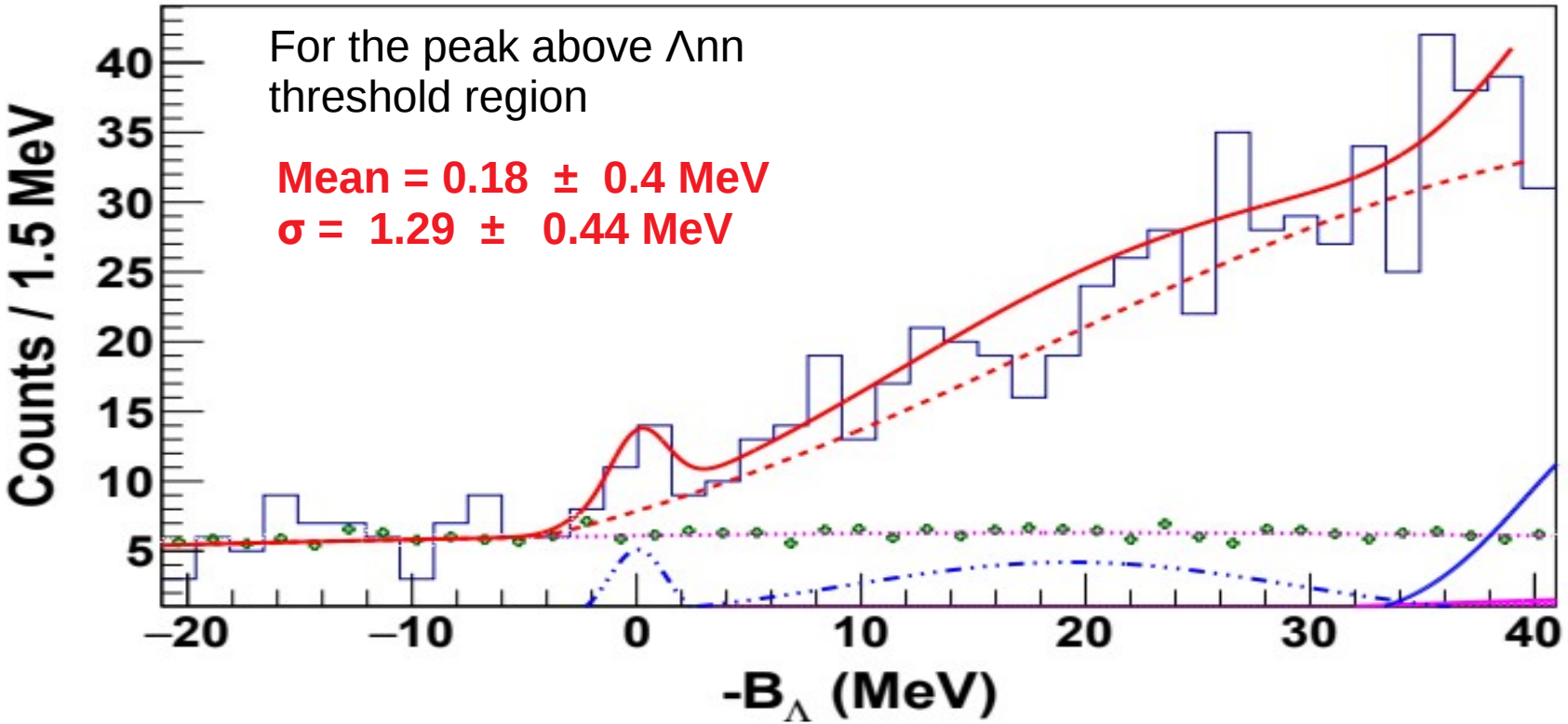
- The tritium data is analyzed by considering the H kinematics.
- The peak shows the presence of H in the tritium gas.

Λnn Spectrum



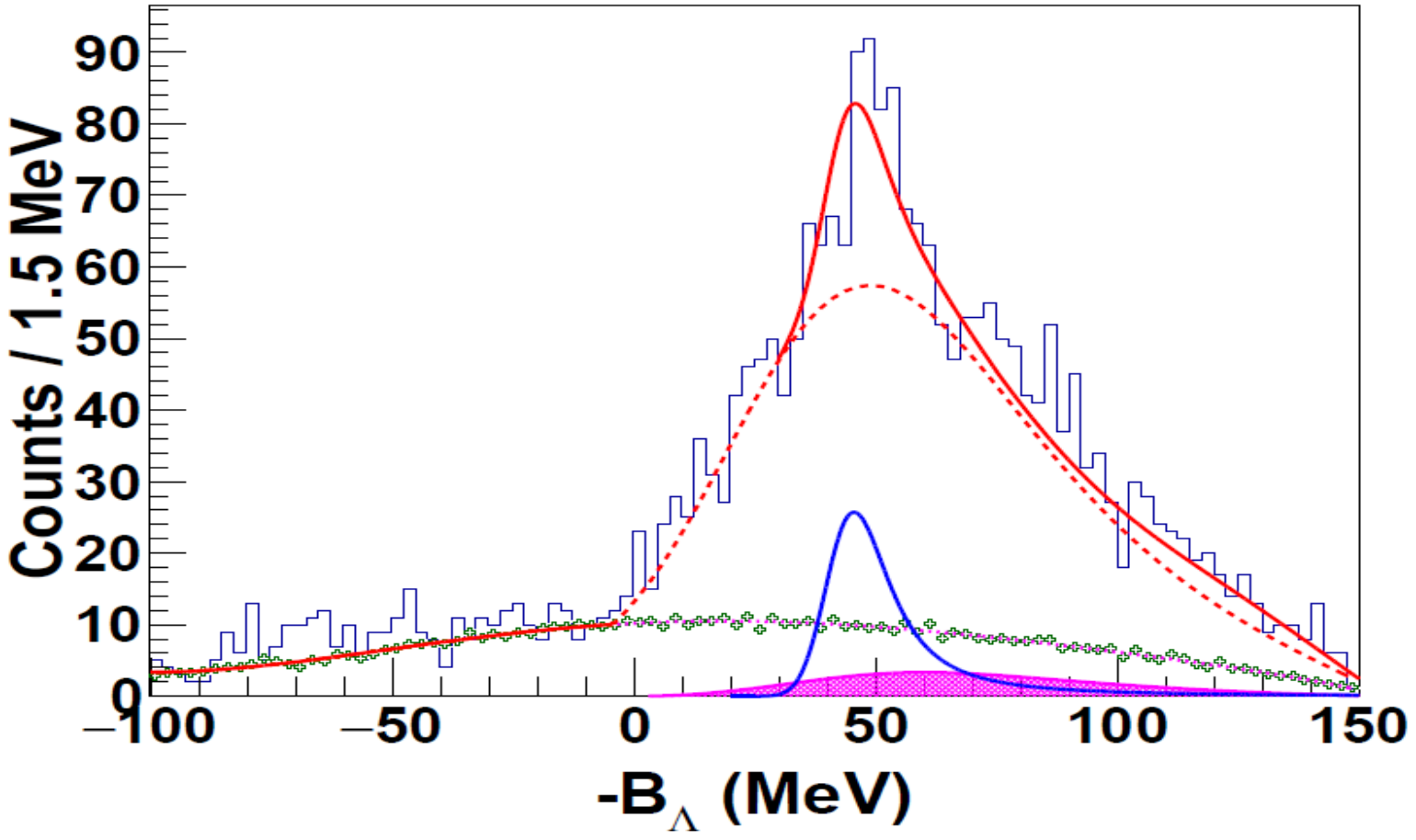
- The Λ/Σ QF shape is obtained by fitting the SIM A simulated data.
- The free Λ curve is obtained by fitting the H data in T kinematics but considering Tritium as target and Λnn as threshold mass.

Closer view of Λnn Spectrum

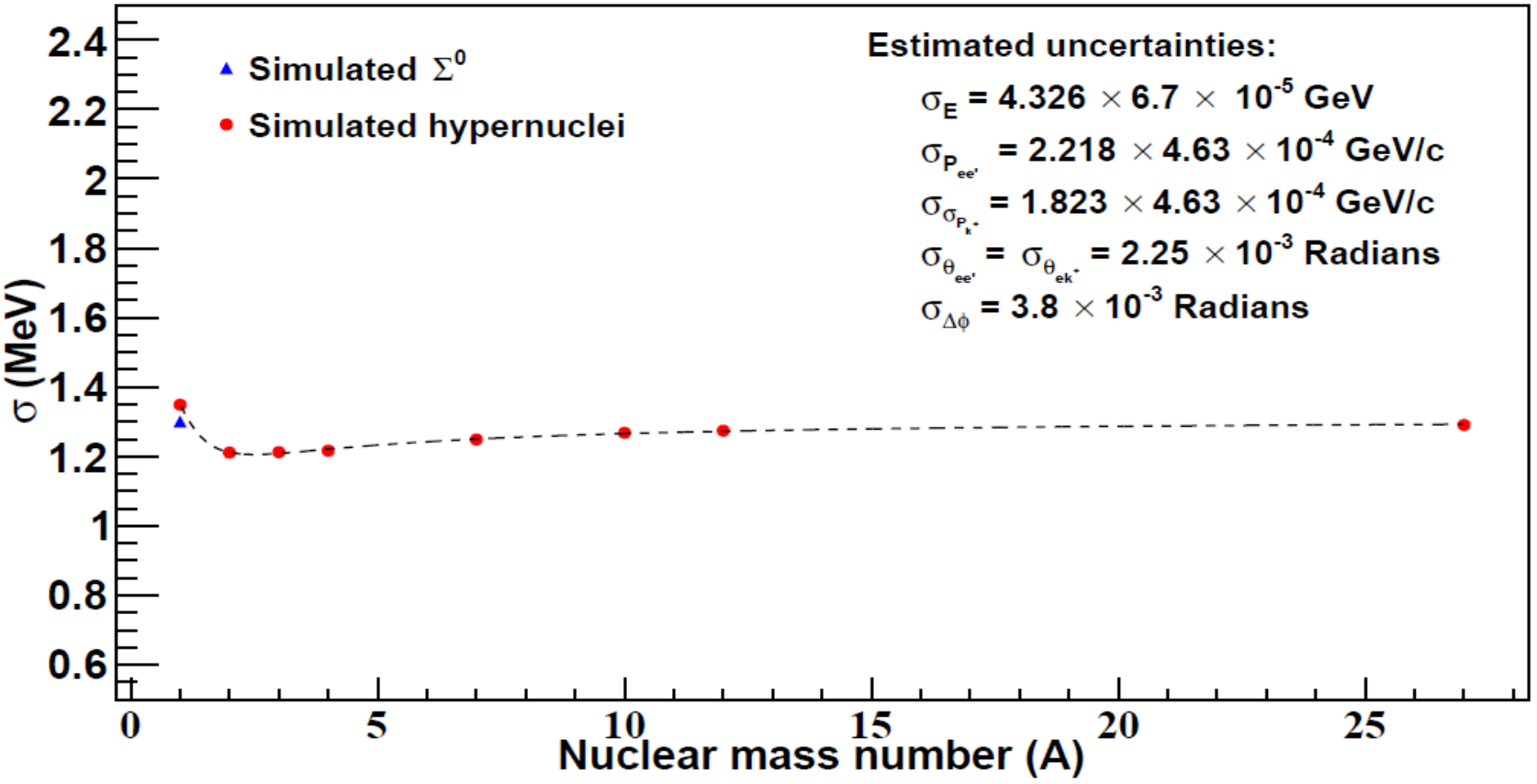


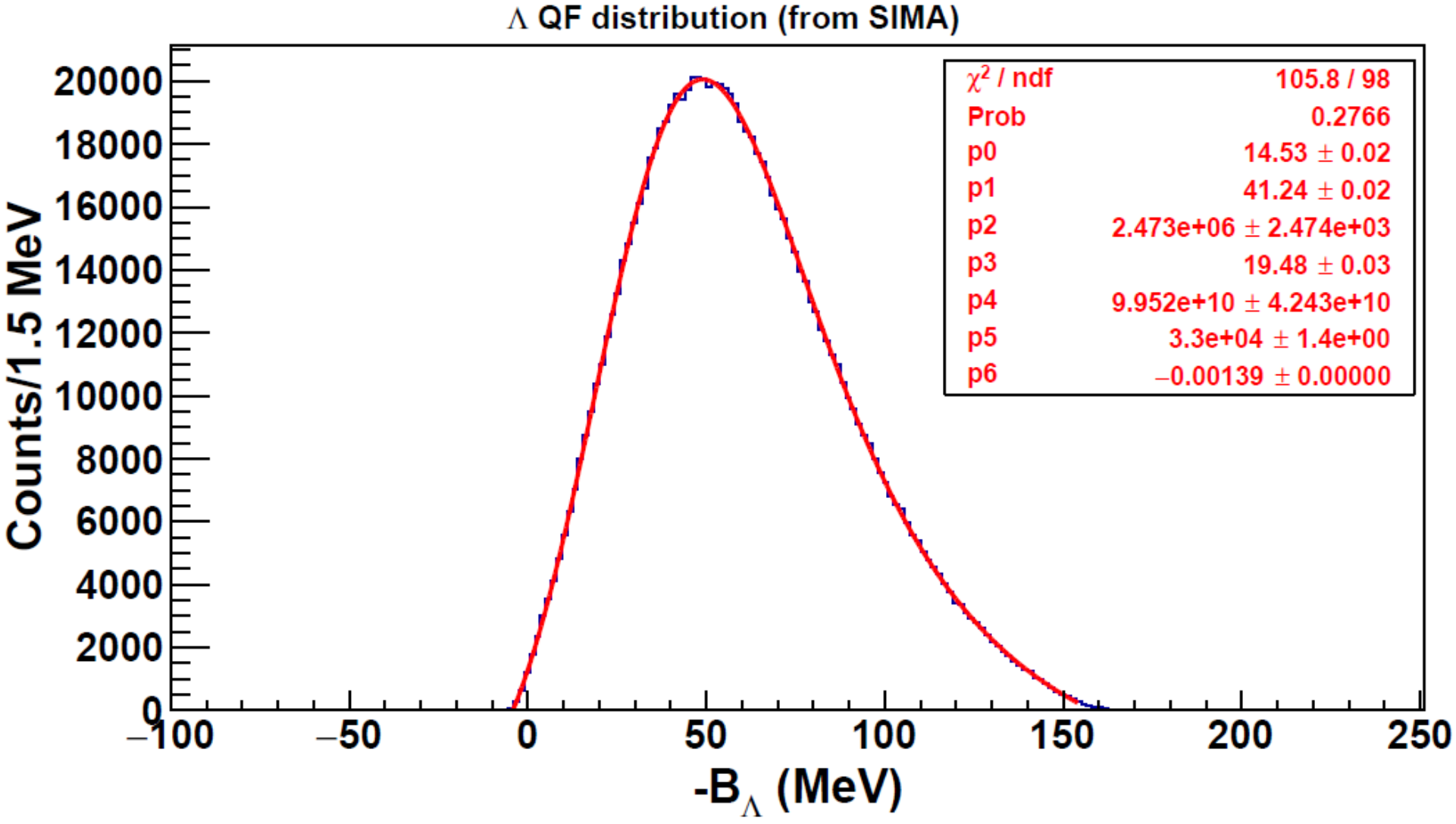
- To make the clear view of the Lnn spectrum, the spectrum is plotted from -20 to 40 MeV.
- The statistical significance of the peak is found about 1.9.

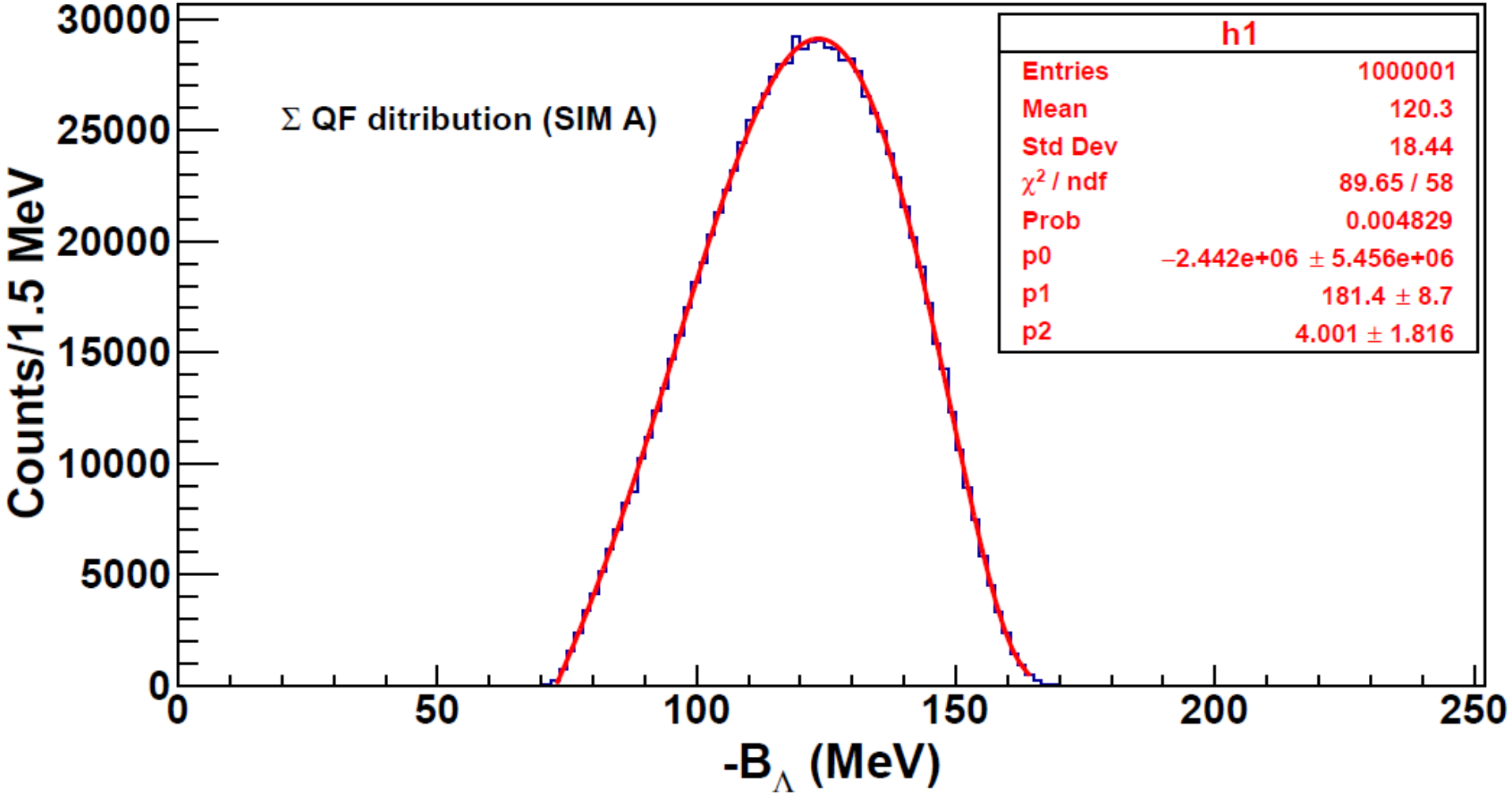
Λnn Spectrum with Wider Bins

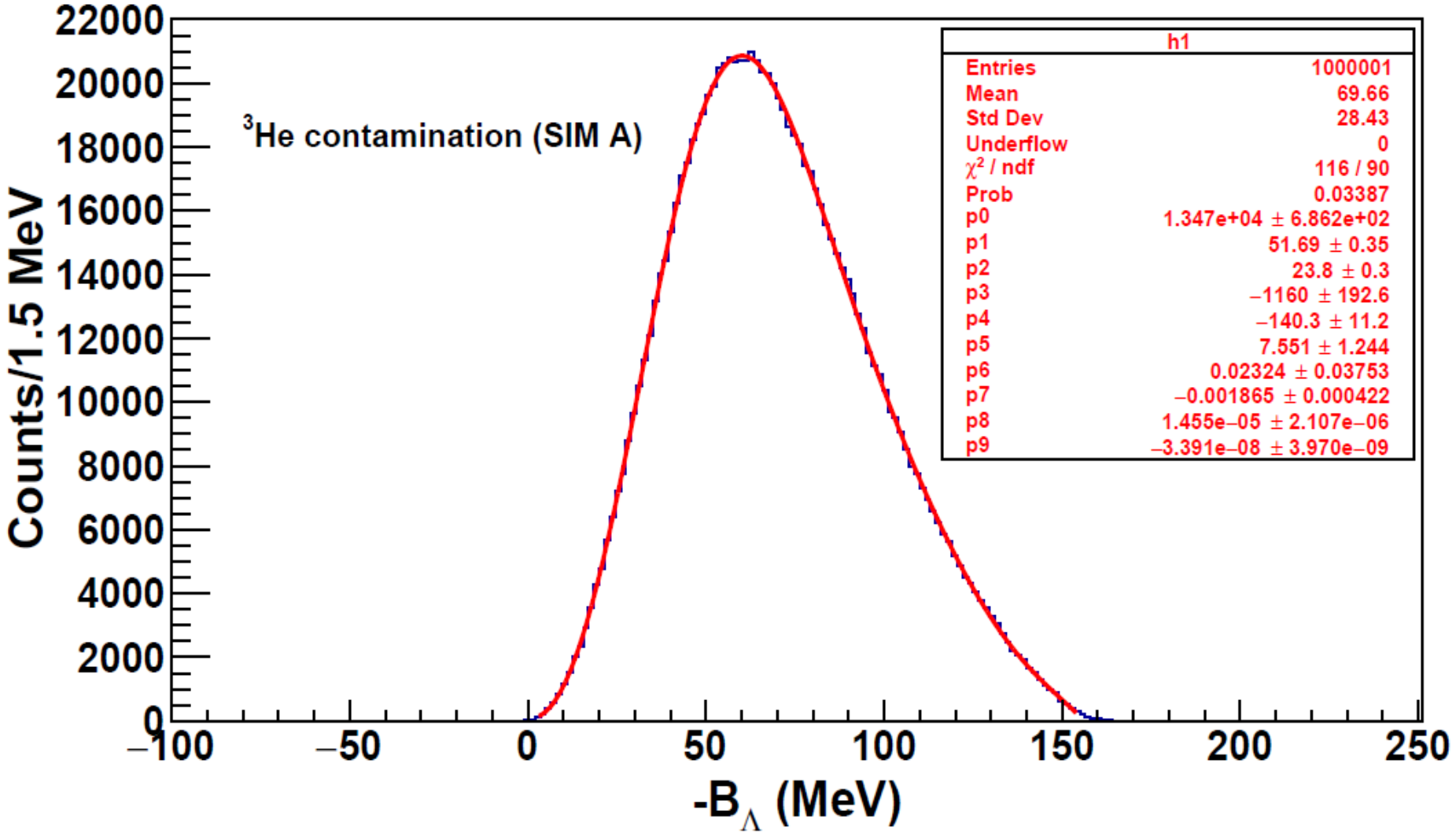


Simulation


Simulated Σ^0
Simulated hypernuclei
Estimated uncertainties:
σ_E = 4.326 × 6.7 × 10^{-5} GeV
$\sigma_{P_{ee'}}$ = 2.218 × 4.63 × 10^{-4} GeV/c
$\sigma_{\sigma_{P_{k^+}}}$ = 1.823 × 4.63 × 10^{-4} GeV/c
$\sigma_{\theta_{ee'}}$ = $\sigma_{\theta_{ek^+}}$ = 2.25 × 10^{-3} Radians
$\sigma_{\Delta\phi}$ = 3.8 × 10^{-3} Radians
σ (MeV)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0
5
10
15
20
25
Nuclear mass number (A)


Λ QF distribution (from SIMA)
Counts/1.5 MeV
-B_Λ (MeV)
χ² / ndf 105.8 / 98
Prob 0.2766
p0 14.53 ± 0.02
p1 41.24 ± 0.02
p2 2.473e+06 ± 2.474e+03
p3 19.48 ± 0.03
p4 9.952e+10 ± 4.243e+10
p5 3.3e+04 ± 1.4e+00
p6 −0.00139 ± 0.00000


Σ QF ditribution (SIM A)
h1
Entries 1000001
Mean 120.3
Std Dev 18.44
χ² / ndf 89.65 / 58
Prob 0.004829
p0 −2.442e+06 ± 5.456e+06
p1 181.4 ± 8.7
p2 4.001 ± 1.816
Counts/1.5 MeV
-B_Λ (MeV)
0
5000
10000
15000
20000
25000
30000
0
50
100
150
200
250


^{3}He contamination (SIM A)
h1
Entries 1000001
Mean 69.66
Std Dev 28.43
Underflow 0
χ^2 / ndf 116 / 90
Prob 0.03387
p0 1.347e+04 ± 6.862e+02
p1 51.69 ± 0.35
p2 23.8 ± 0.3
p3 −1160 ± 192.6
p4 −140.3 ± 11.2
p5 7.551 ± 1.244
p6 0.02324 ± 0.03753
p7 −0.001865 ± 0.000422
p8 1.455e−05 ± 2.107e−06
p9 −3.391e−08 ± 3.970e−09
Counts/1.5 MeV
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
−100
−50
0
50
100
150
200
250
-B$_\Lambda$ (MeV)

H/T data analyzed by considering the tritium kinematics