Group meeting
June 7th, 2024

Instruction responsibilities

- Classes for Fall 2024:
  - PHY 331:
    - Need to make syllabus
  - PHY 361:
    - Need to make syllabus

Service responsibilities

- Committee:
  - GlueX Compton Analysis Review Committee:
    - Waiting for author response

Group responsibilities

- Undergrad: Nothing this week
- Submitted DOE report

Analysis

Presentations:

- Ξ^* update (bumps): https://meson.hldsite.com/presentations/dugger/Xi-24-06-03-M.pdf
- Ξ^* update (pid): https://meson.hldsite.com/presentations/dugger/Xi-24-06-03-MK.pdf

KKpi analysis:

- Made reaction requests for reaction with $K^+ \rightarrow \pi^+$, or with $K^- \rightarrow \pi^-$
- PWA back on track
- Working to get polarizations in PWA

Ξ^* analysis:

- Made reaction request for reaction with $K^+ \rightarrow \pi^+$
- Vertex analysis started
- Beginning of next talk shown on next slide

Bump hunt part II

$\Xi(1620)$: From 1-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *
J, P need confirmation.

OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
≈ 1620 OUR ESTIMATE					
1624± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

$\Xi(1620)$: From 1-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

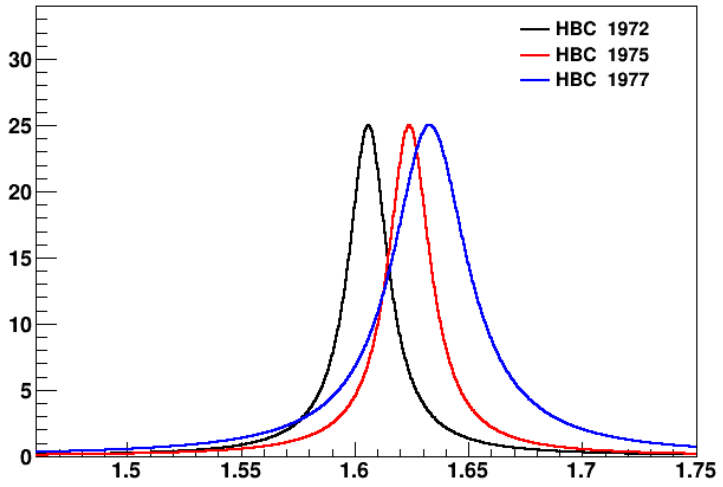
$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *
J, P need confirmation.

OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
≈ 1620 OUR ESTIMATE					
1624± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c



$\Xi(1620)$: From 1-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

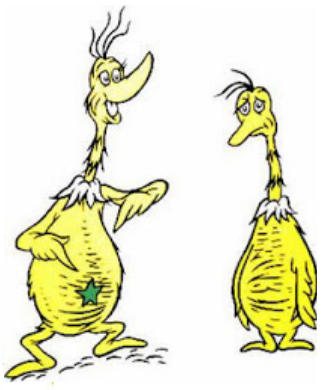
$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *
J, P need confirmation.

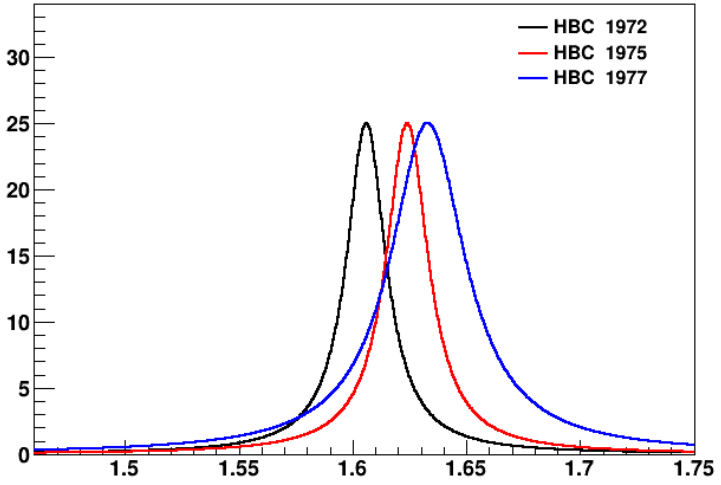
OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
≈ 1620 OUR ESTIMATE					
1624± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c





$\Xi(1620)$: From 1-star to 2-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

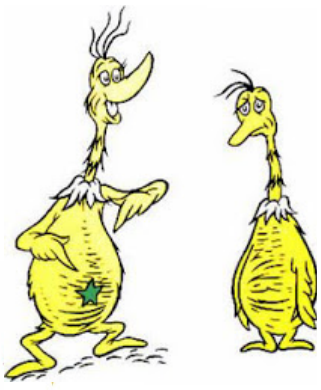
$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *
J, P need confirmation.

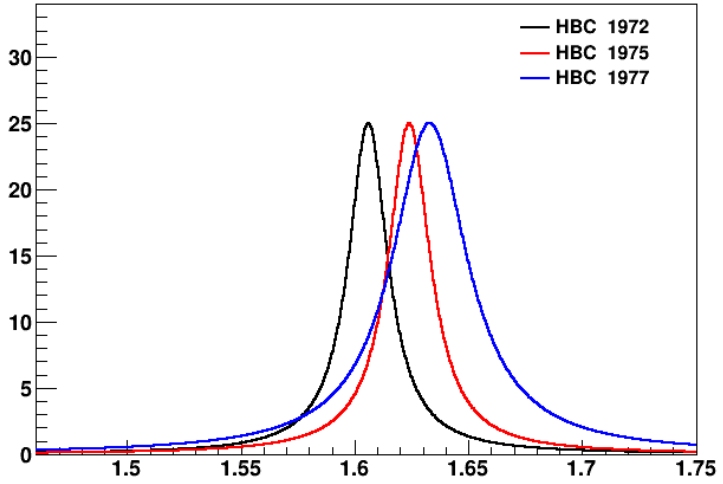
OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
≈ 1620 OUR ESTIMATE					
1624± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c





$\Xi(1620)$: From 1-star to 2-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

** Fair evidence of existence

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *

J, *P* need confirmation.

OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 1620 OUR ESTIMATE					
1624 ± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633 ±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606 ± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

Citation: S. Navas *et al.* (Particle Data Group), Phys. Rev. D **110**, 030001 (2024)

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: **

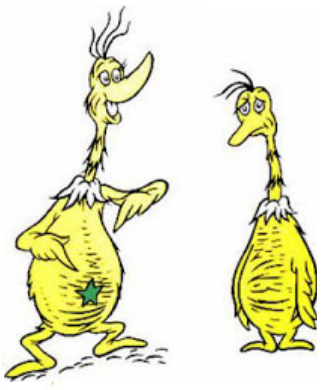
J, *P* need confirmation.

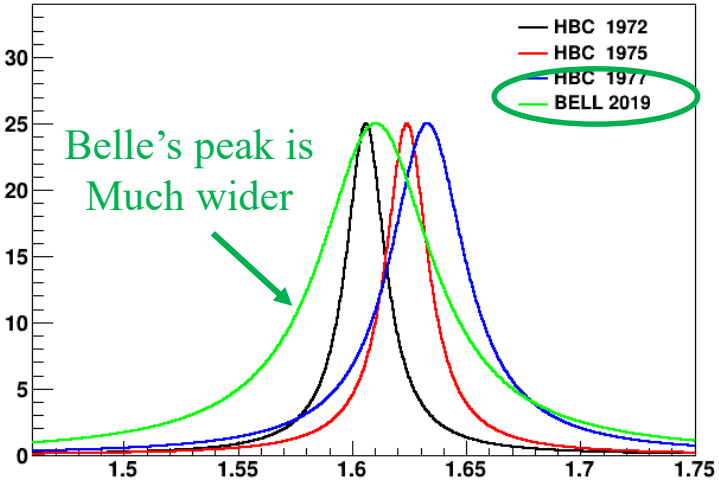
OMITTED FROM SUMMARY TABLE

The clearest evidence is a peak in $\Xi^-\pi^+$ seen by SUMIHAMA 19. Older low-statistics experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for the state but have not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 1620 OUR ESTIMATE					
$1610.4 \pm 6.0^{+6.1}_{-4.2}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
1624 ± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633 ±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606 ± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c





$\Xi(1620)$: From 1-star to 2-star

Nucleon resonances are rated using the "star" system:

* Poor evidence of existence

** Fair evidence of existence

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: *

J, *P* need confirmation.

OMITTED FROM SUMMARY TABLE

What little evidence there is consists of weak signals in the $\Xi\pi$ channel. A number of other experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for but not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 1620 OUR ESTIMATE					
1624± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

Citation: S. Navas *et al.* (Particle Data Group), Phys. Rev. D **110**, 030001 (2024)

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: **

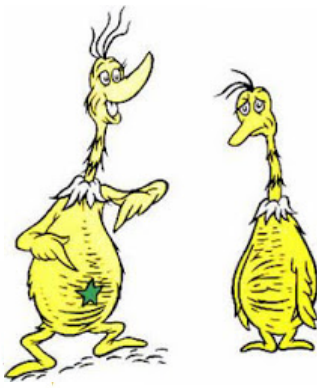
J, *P* need confirmation.

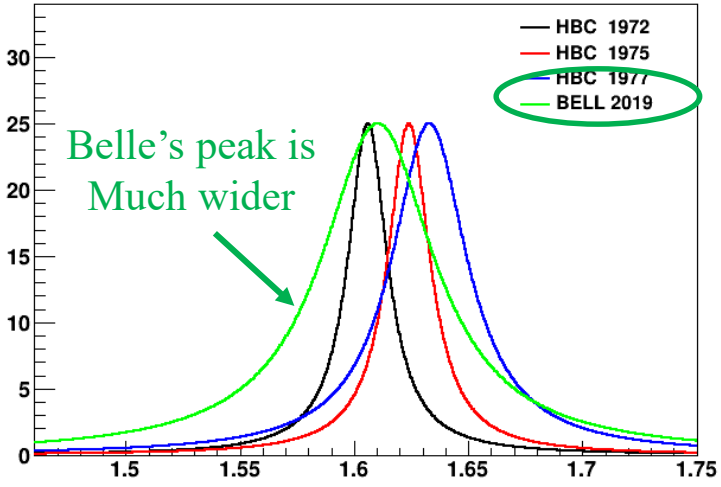
OMITTED FROM SUMMARY TABLE

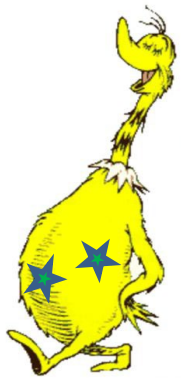
The clearest evidence is a peak in $\Xi^-\pi^+$ seen by SUMIHAMA 19. Older low-statistics experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for the state but have not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 1620 OUR ESTIMATE					
$1610.4 \pm 6.0^{+6.1}_{-4.2}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
1624 ± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633 ±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606 ± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

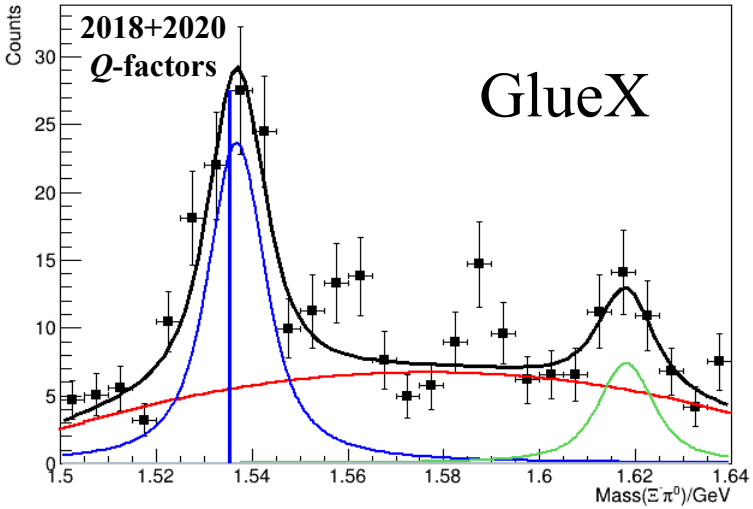


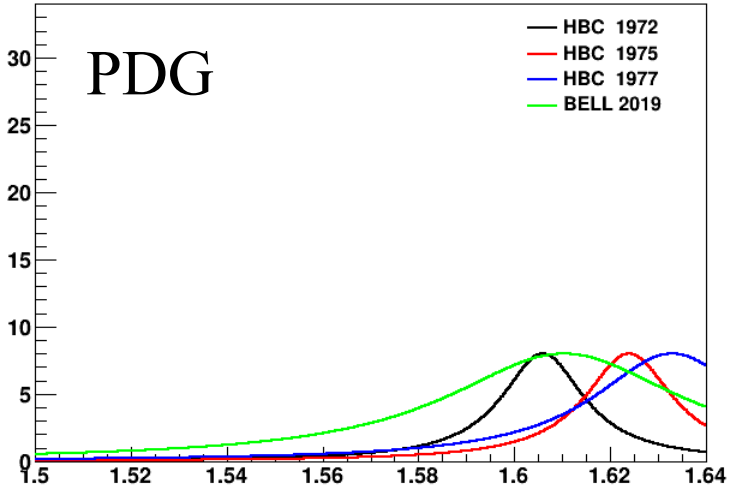




Assumed bump structure, compared to PDG

Narrow bump

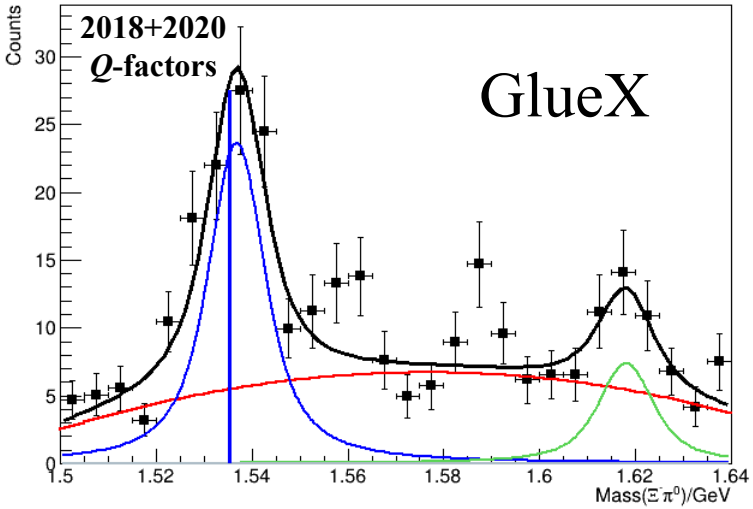


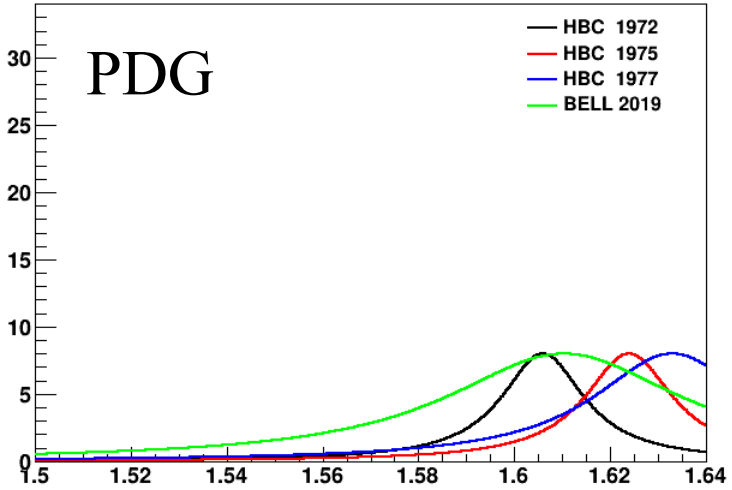


Wide bump

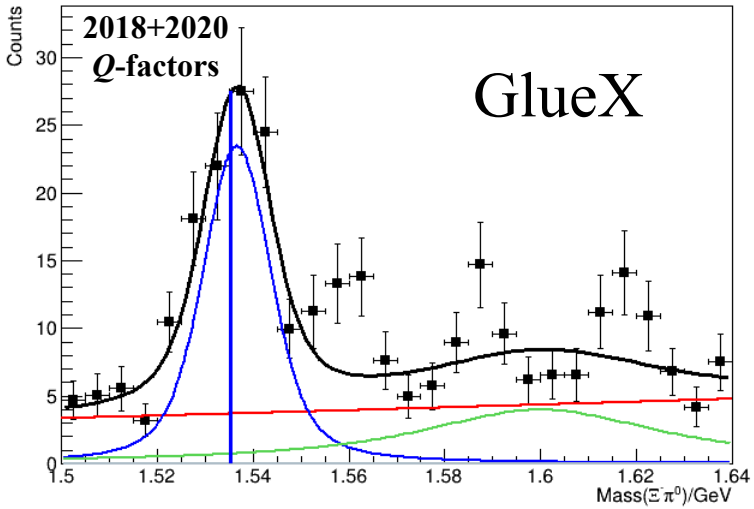
Assumed bump structure, compared to PDG

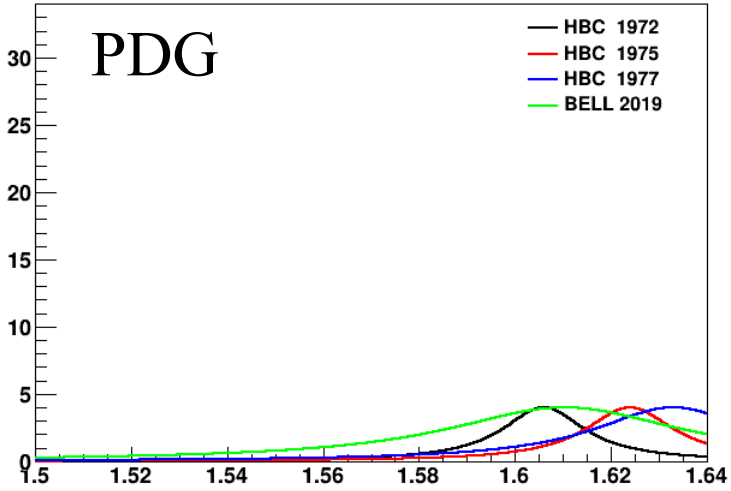
Narrow bump





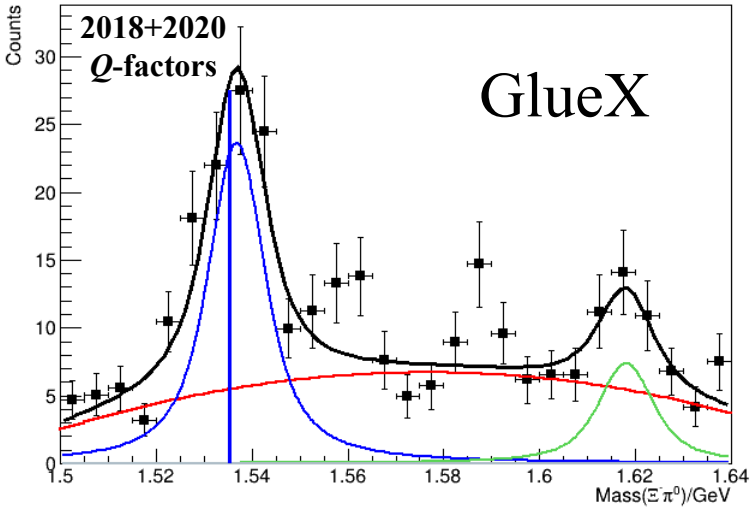
Wide bump

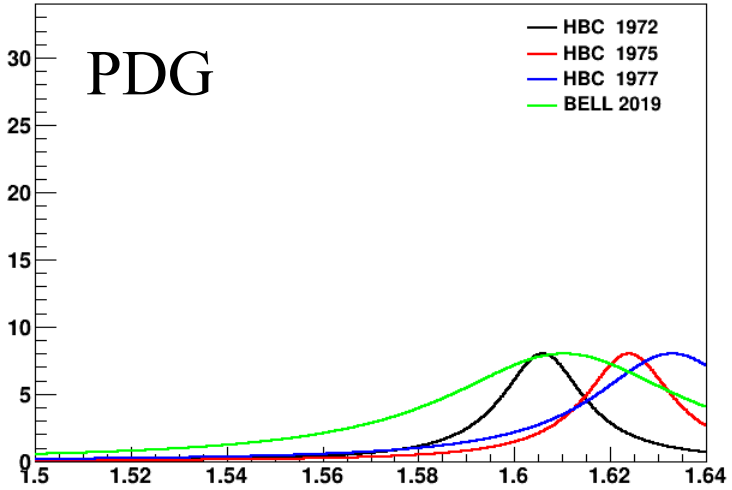




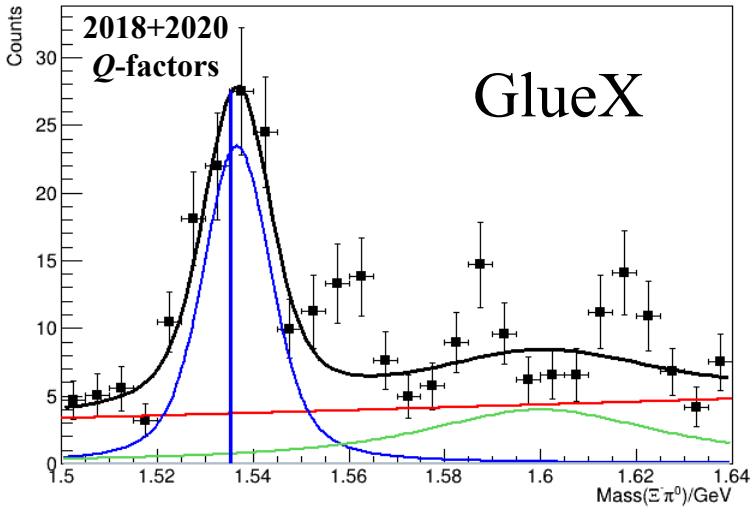
Assumed bump structure, compared to PDG

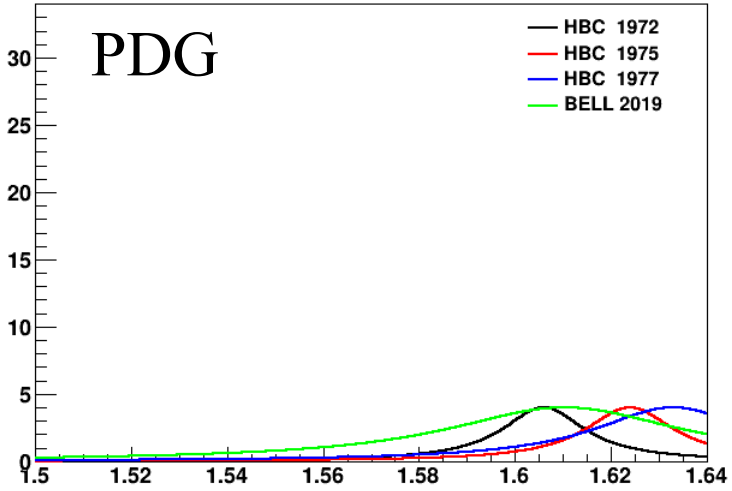
Narrow bump





Wide bump





- Perhaps *Q*-factors are causing trouble ☹

Assumed bump structure, compared to Belle

Target shoot Belle:

Assumed bump structure, compared to Belle

Target shoot Belle:

- Changing CL cut to CL>10^{-2}

Assumed bump structure, compared to Belle

Target shoot Belle:

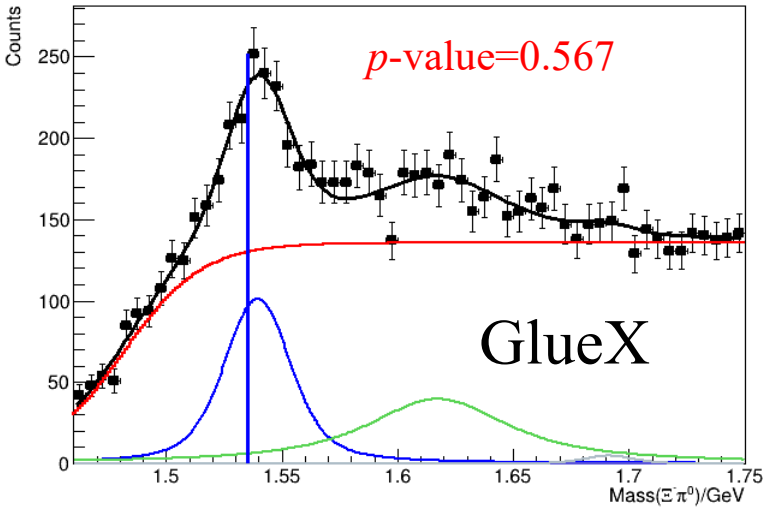
- Changing CL cut to CL>10^{-2}
- Removing *Q*-factors

Assumed bump structure, compared to Belle

Target shoot Belle:

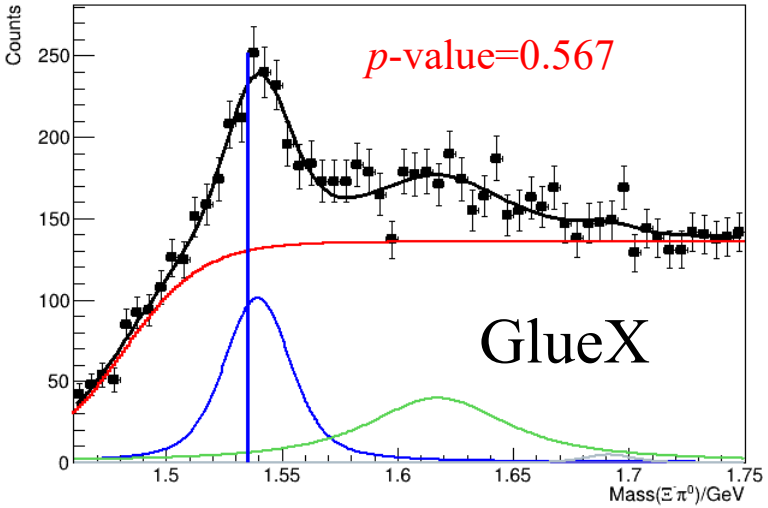
- Changing CL cut to CL>10^{-2}
- Removing *Q*-factors
- Change fit range to match that of Belle

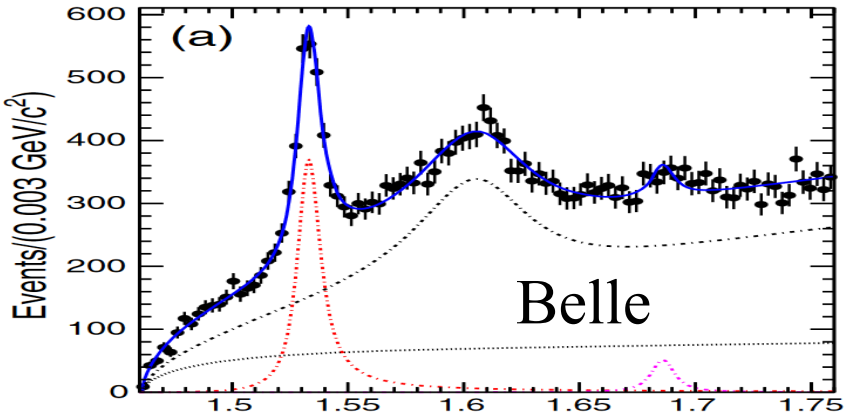
Assumed bump structure, compared to Belle



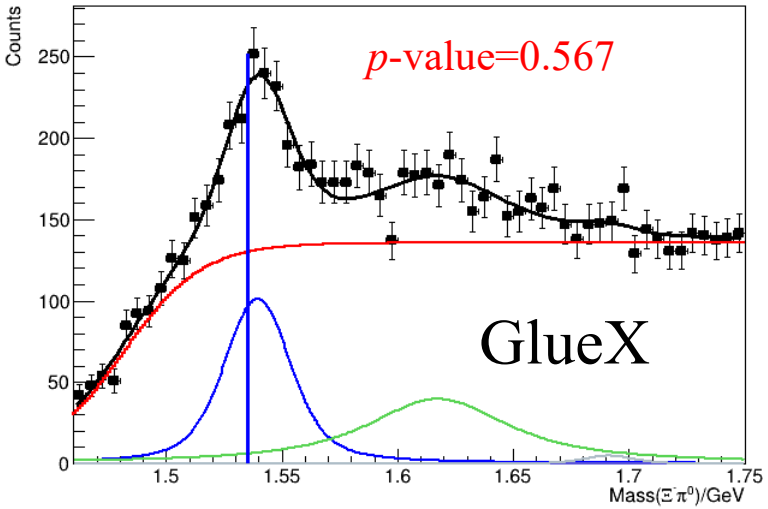
Background (red) :
[First order polynomial]*[sigmoid]

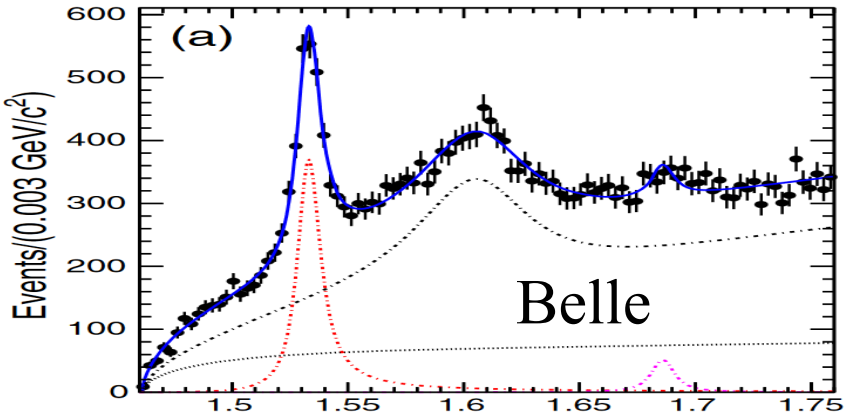
Assumed bump structure, compared to Belle





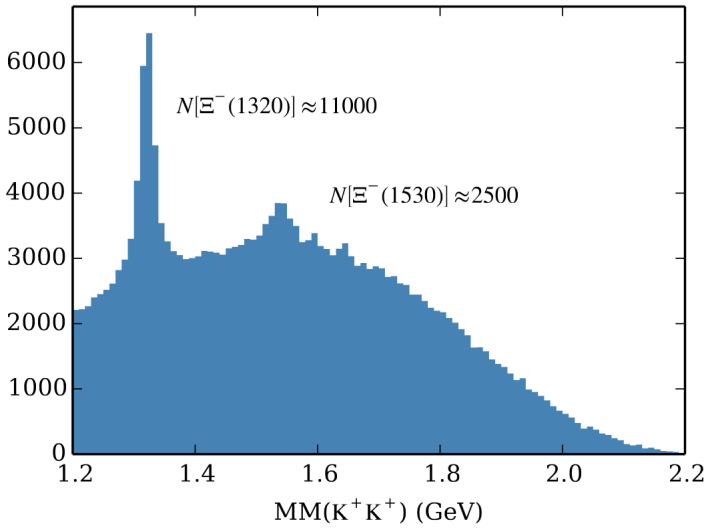
Assumed bump structure, compared to Belle





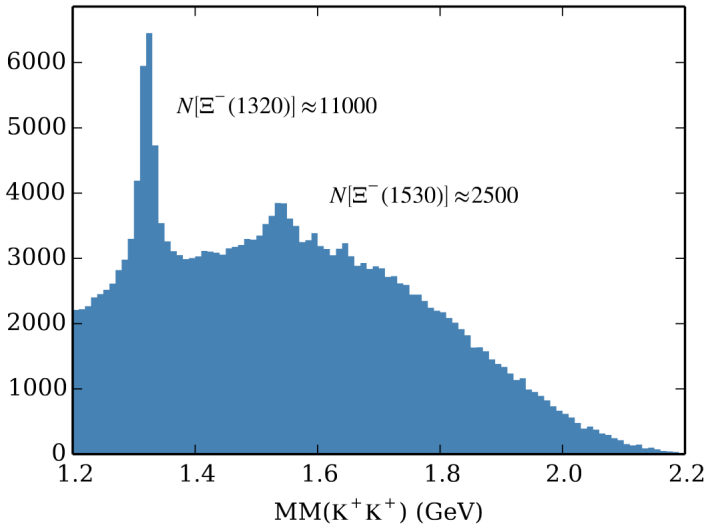
- Looks reasonable ☺

CLAS Ξ and $\Xi(1530)$



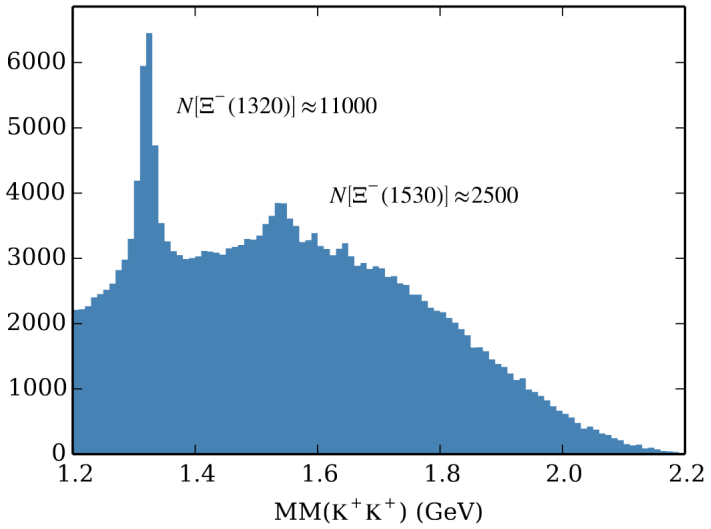
- Reaction: $\gamma\, p \rightarrow K^+\, K^+\, X$

CLAS Ξ and $\Xi(1530)$



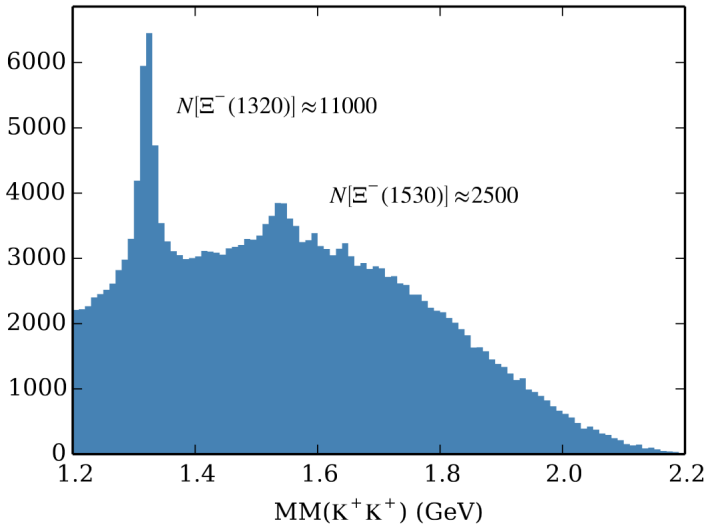
- Reaction: $\gamma\, p \rightarrow K^+\, K^+\, X$
- Here, X represent the missing particle(s)

CLAS Ξ and $\Xi(1530)$



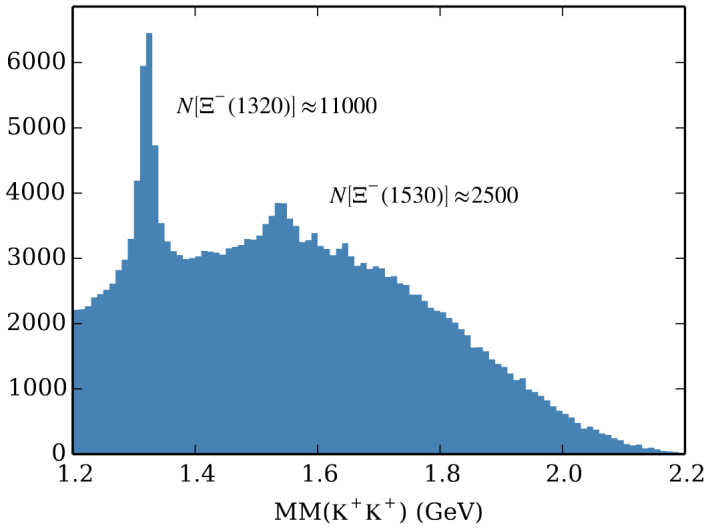
- Reaction: $\gamma\, p \rightarrow K^+\, K^+\, X$
- Here, X represent the missing particle(s)
- Ostensibly, X is Ξ^- or Ξ^{-*}
  - from $\gamma\, p \rightarrow K^+\, Y^*$, where $Y^* \rightarrow K^+\, \Xi^-$

CLAS Ξ and $\Xi(1530)$



- Reaction: $\gamma\, p \rightarrow K^+\, K^+\, X$
- Here, X represent the missing particle(s)
- Ostensibly, X is Ξ^- or Ξ^{-*}
  - from $\gamma\, p \rightarrow K^+\, Y^*$, where $Y^* \rightarrow K^+\, \Xi^-$
- $E_\gamma < 5.4$ GeV

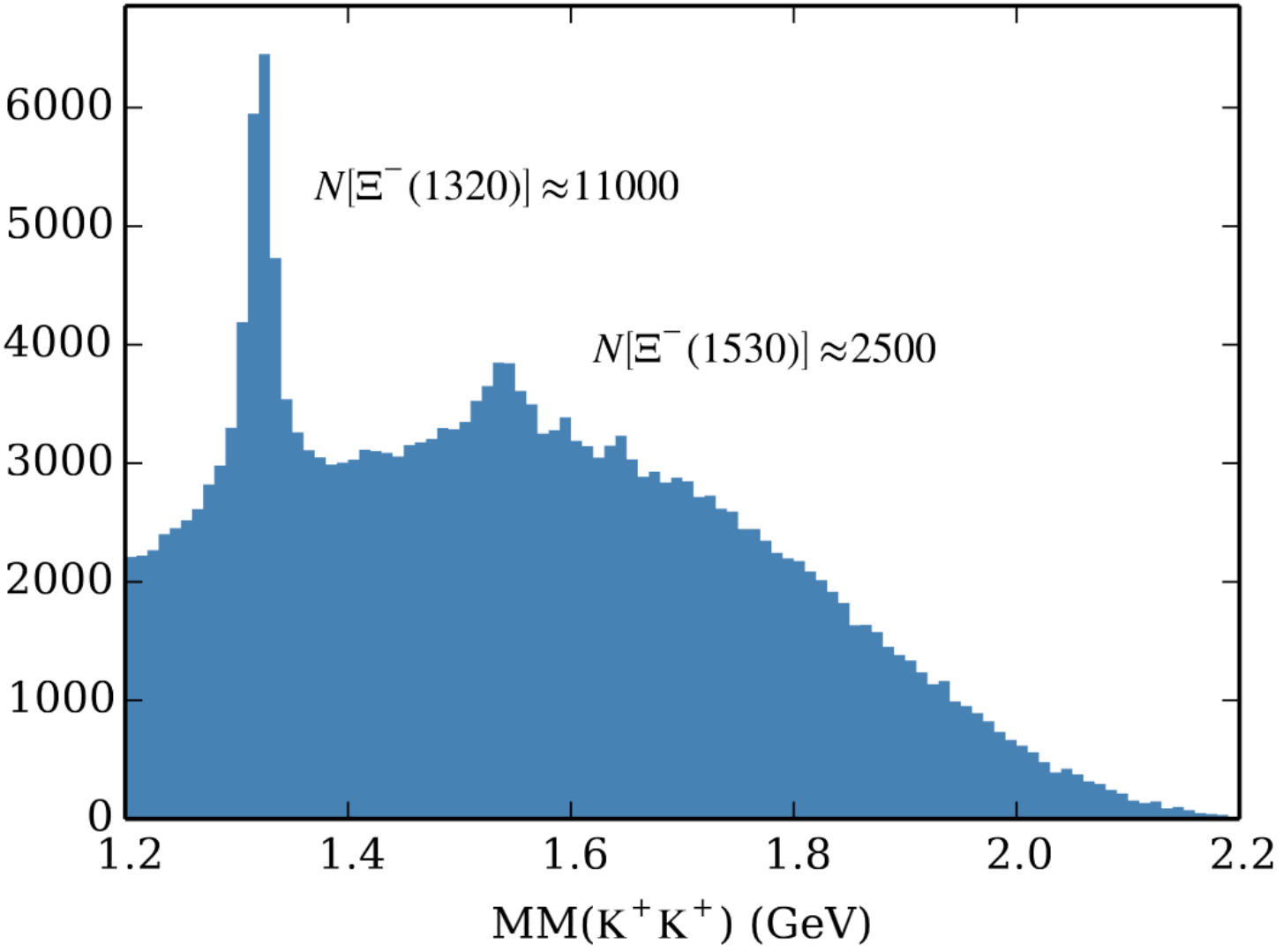
CLAS Ξ and $\Xi(1530)$



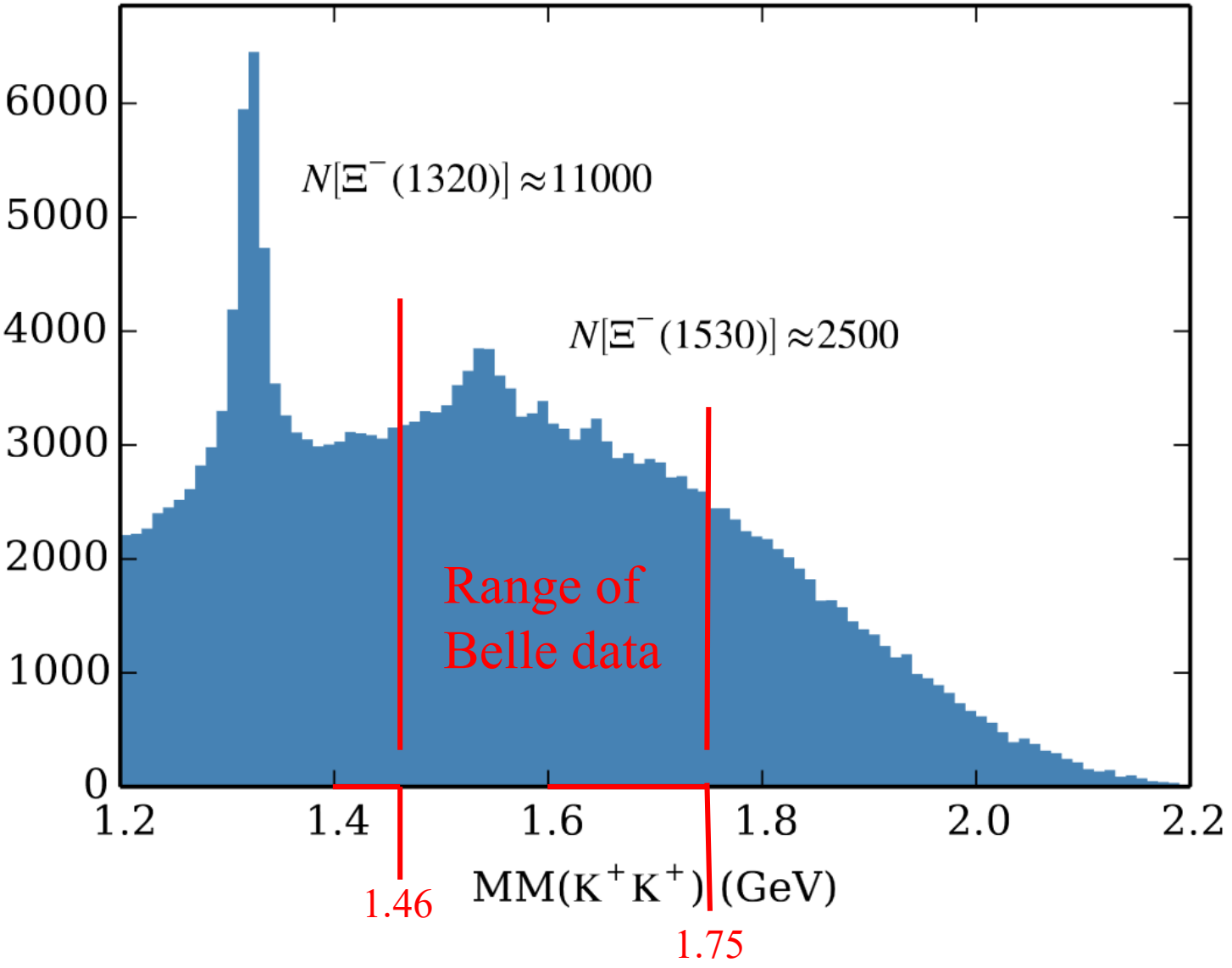
- Reaction: $\gamma\, p \rightarrow K^+\, K^+\, X$
- Here, X represent the missing particle(s)
- Ostensibly, X is Ξ^- or Ξ^{-*}
  - from $\gamma\, p \rightarrow K^+\, Y^*$, where $Y^* \rightarrow K^+\, \Xi^-$
- $E_\gamma < 5.4$ GeV

- A lot of background from many types of final states
  - $\gamma\, p \rightarrow K^+\, K^+\, X$ is very inclusive of Ξ^{-*} type states with decays NOT limited to
    - $\Xi\pi$
    - $\Xi^*\pi$
    - ΛK
    - $K\Sigma$
    - or ?

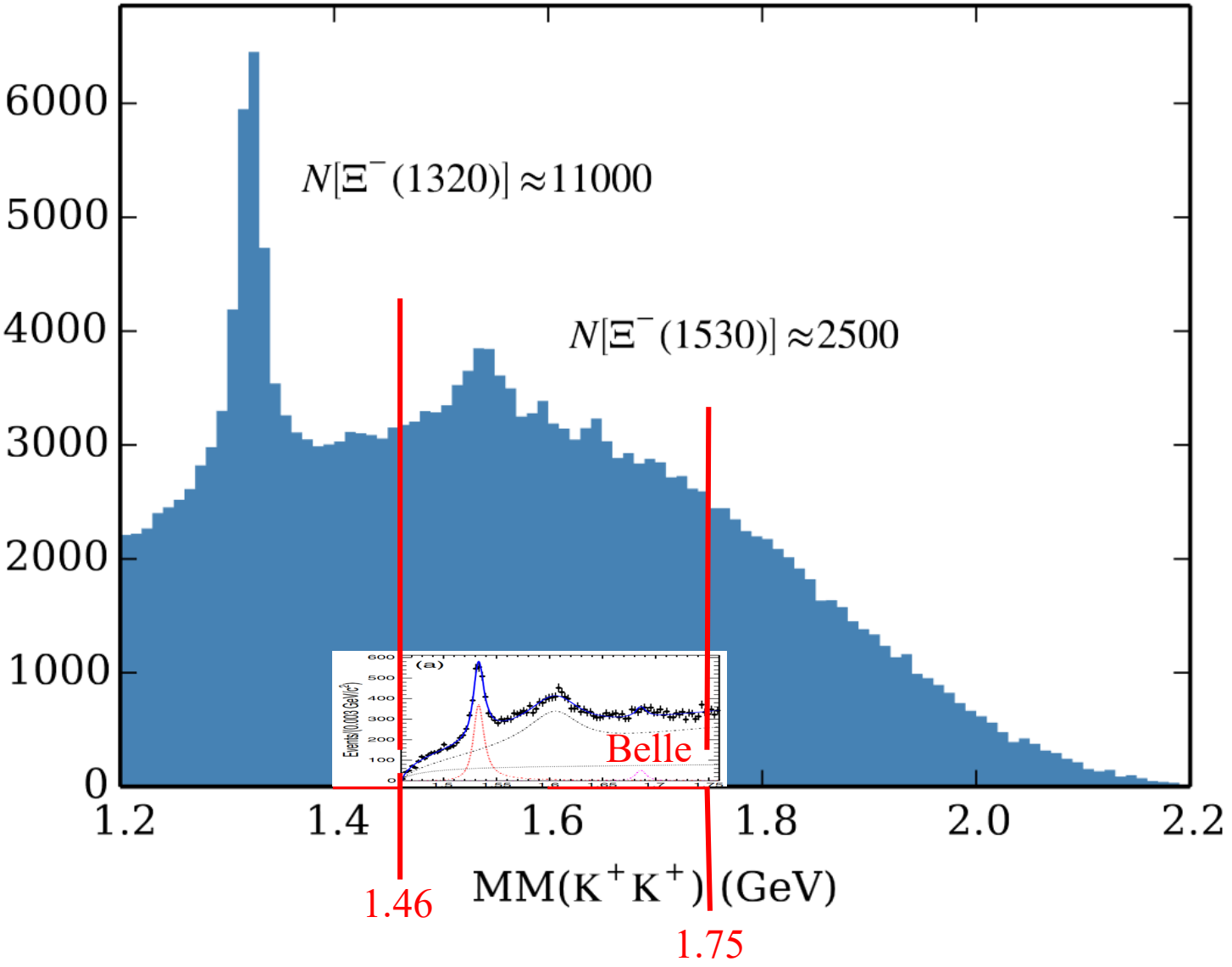
CLAS comparison



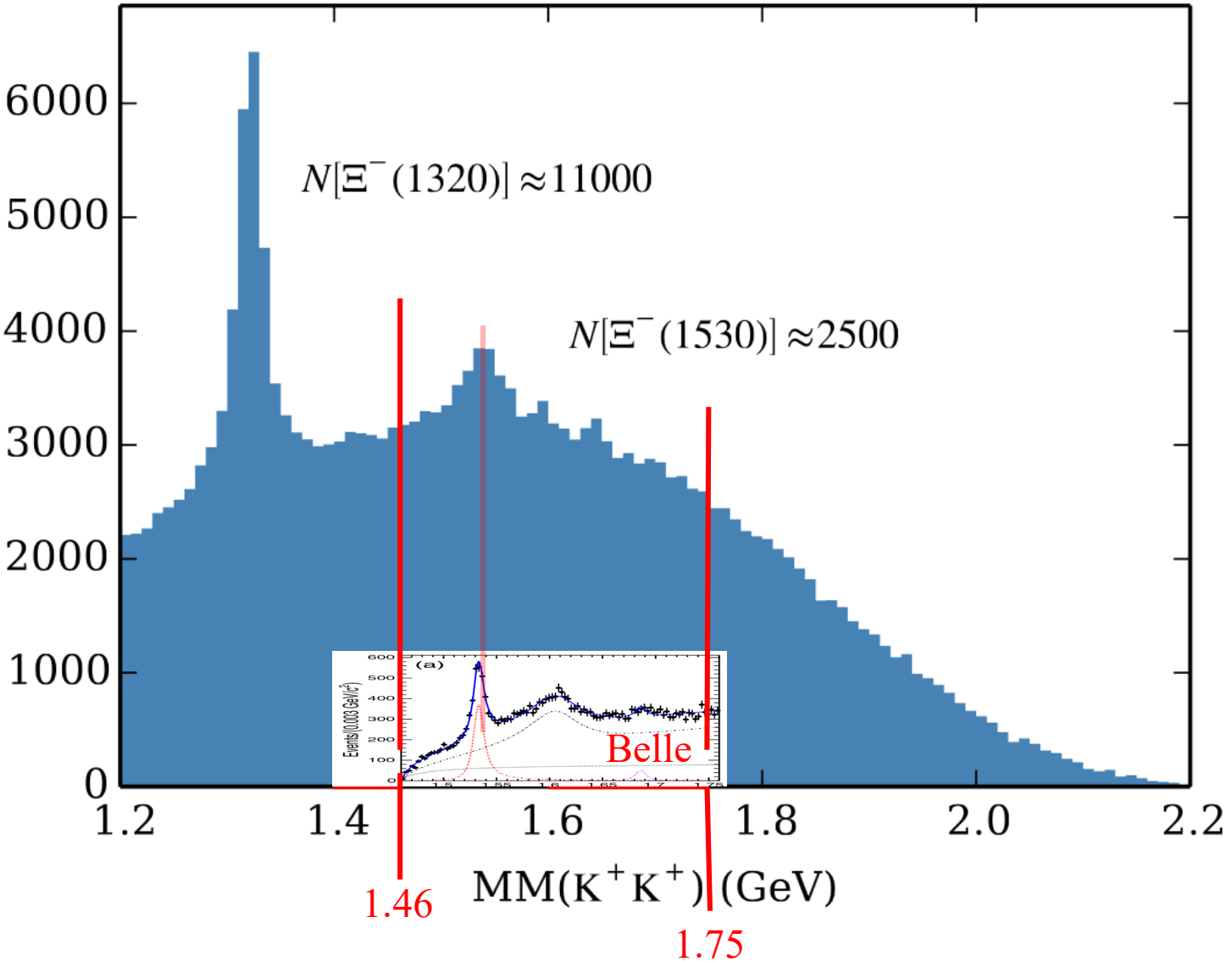
CLAS comparison



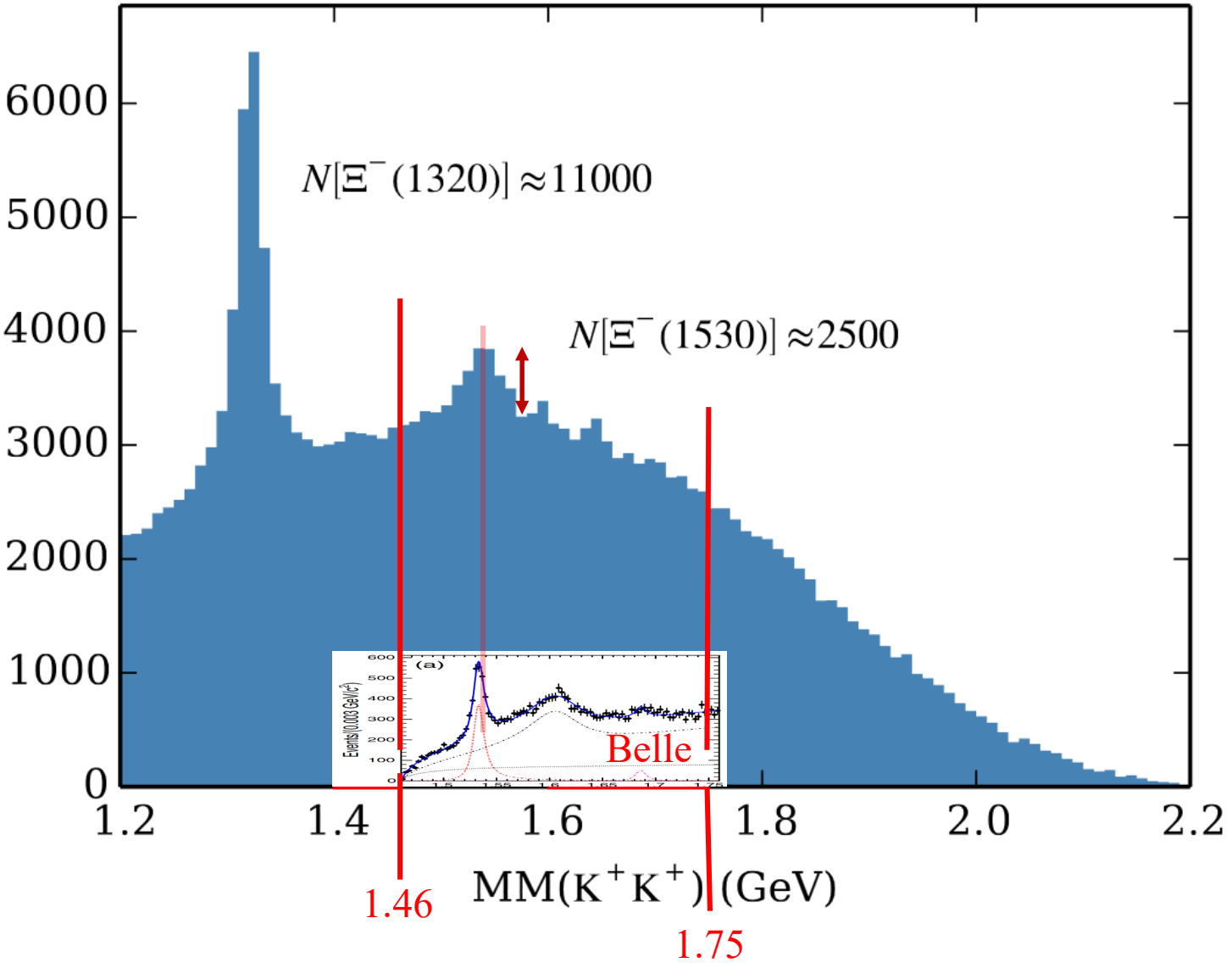
CLAS comparison



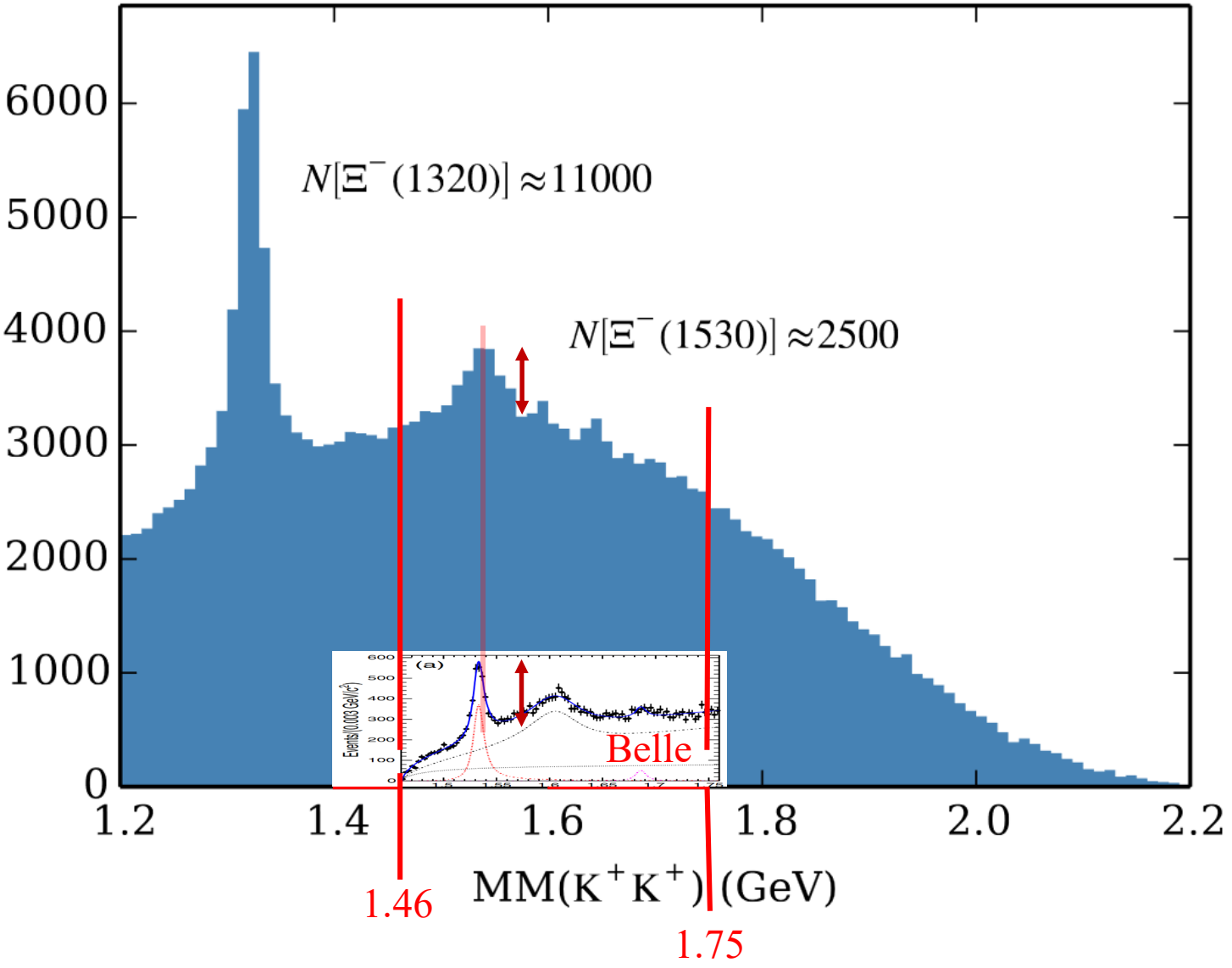
CLAS comparison



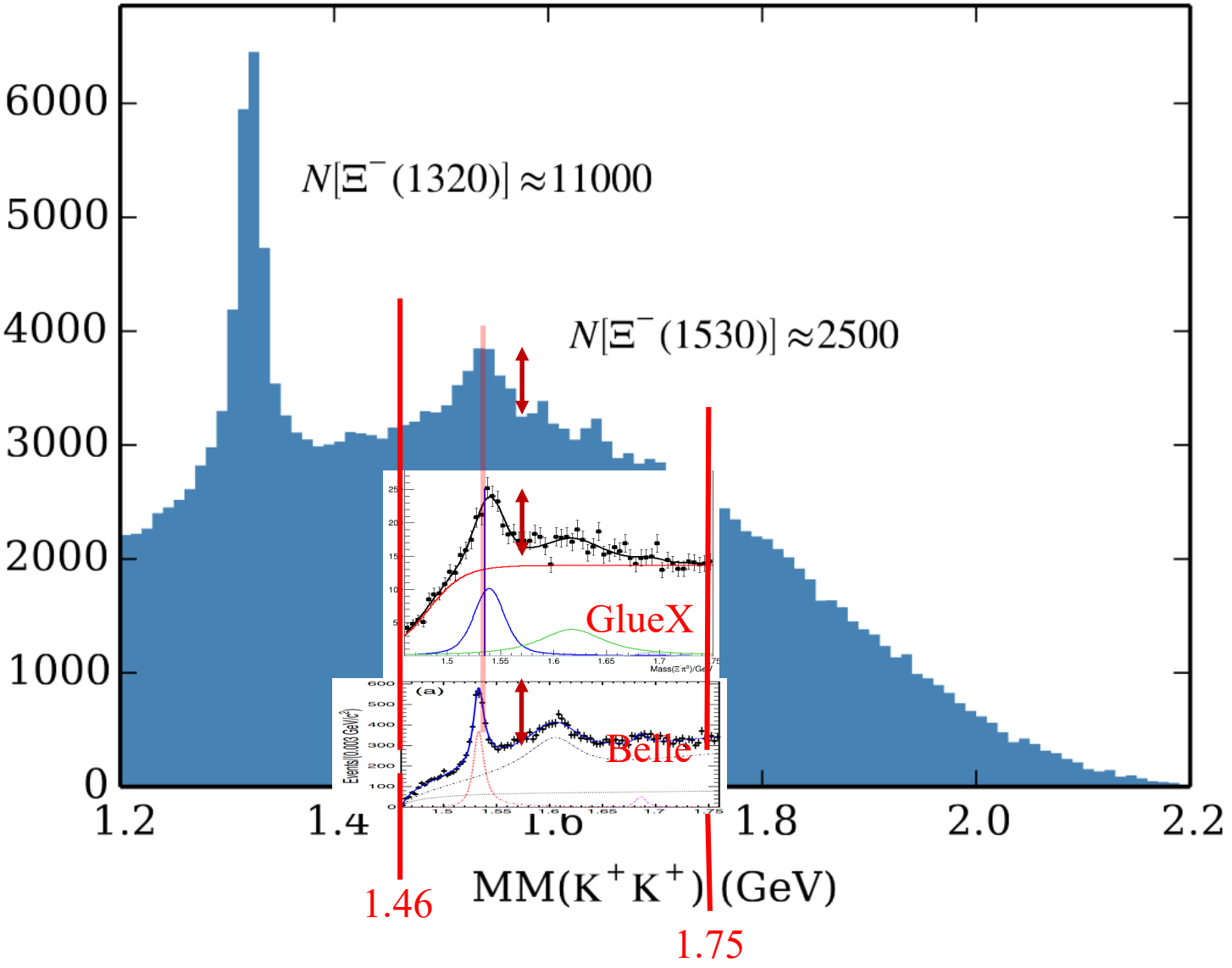
CLAS comparison



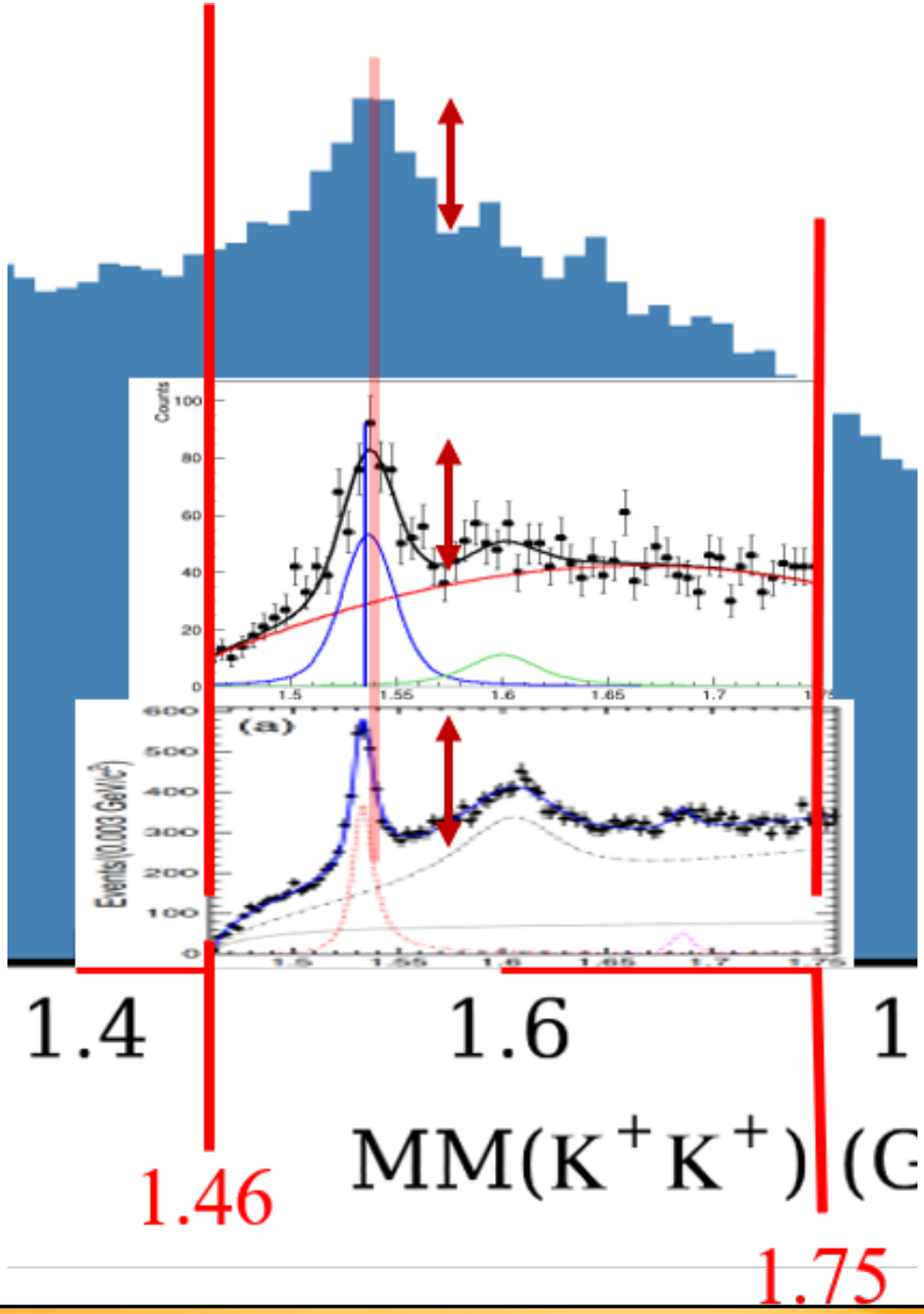
CLAS comparison



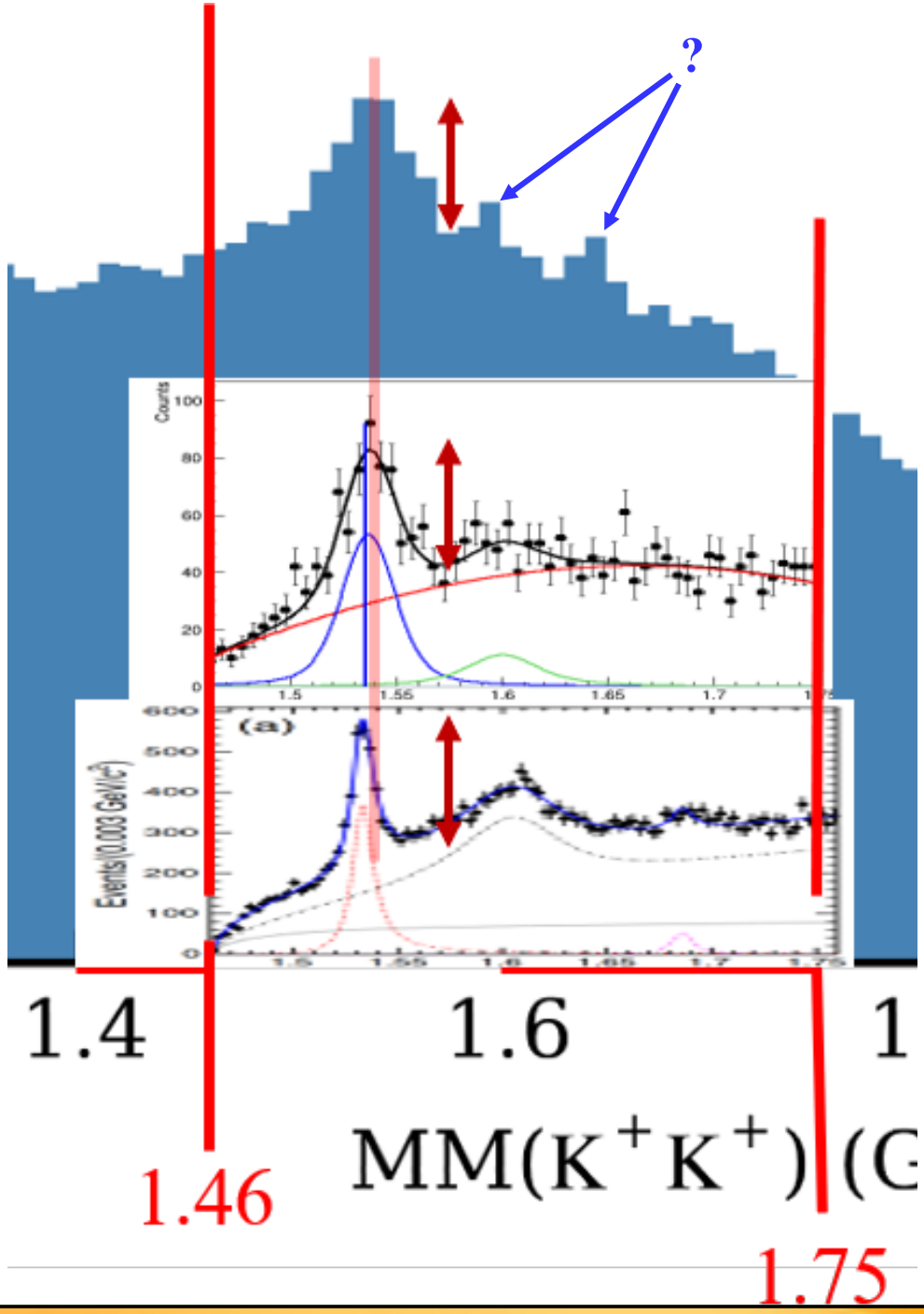
CLAS comparison



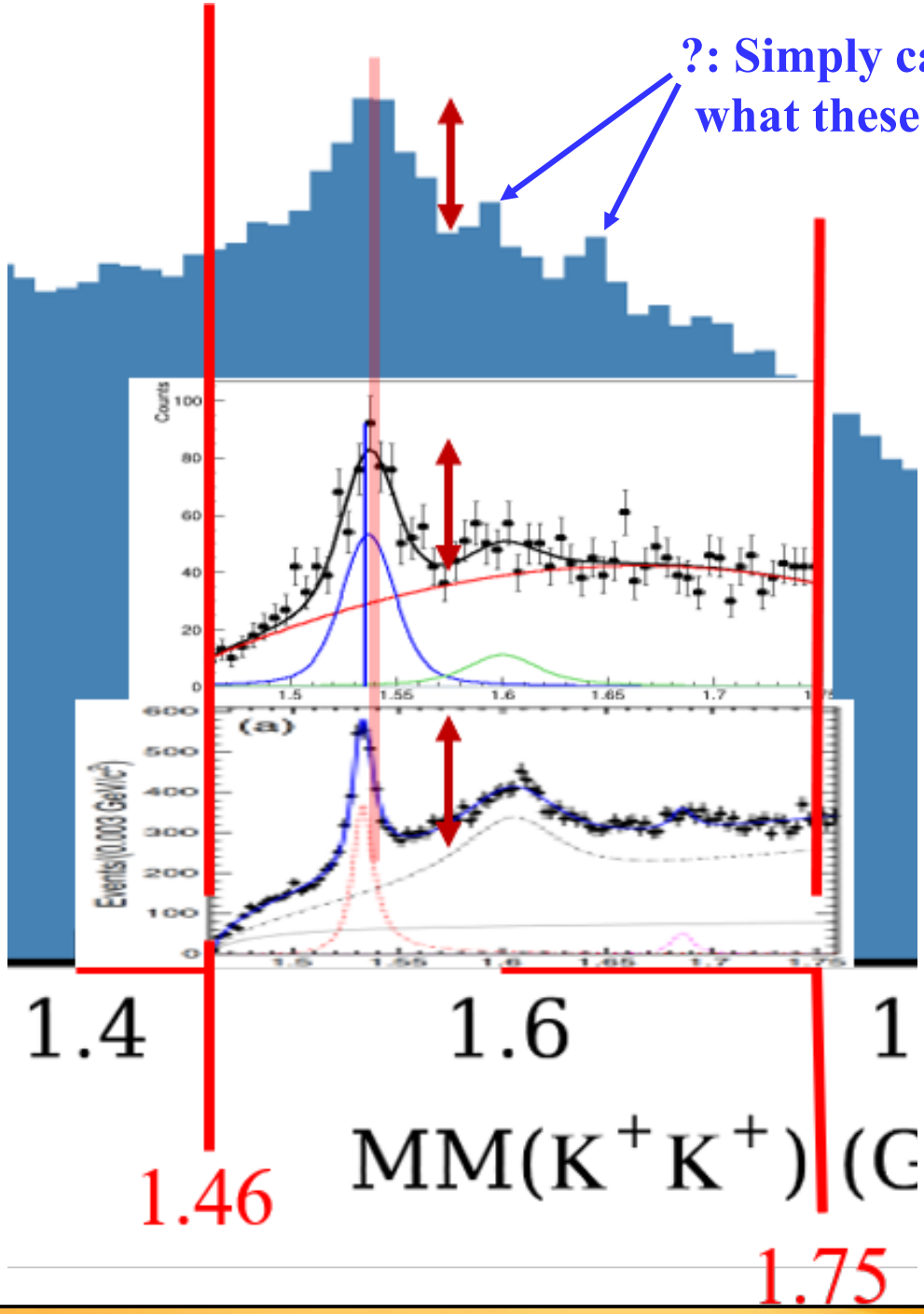
Zoomed in



Zoomed in



Zoomed in


?: Simply can't know what these are from
Counts
(a)
Events/(0.003 GeV/c²)
1.4
1.6
1
MM(K⁺K⁺)
1.46
1.75