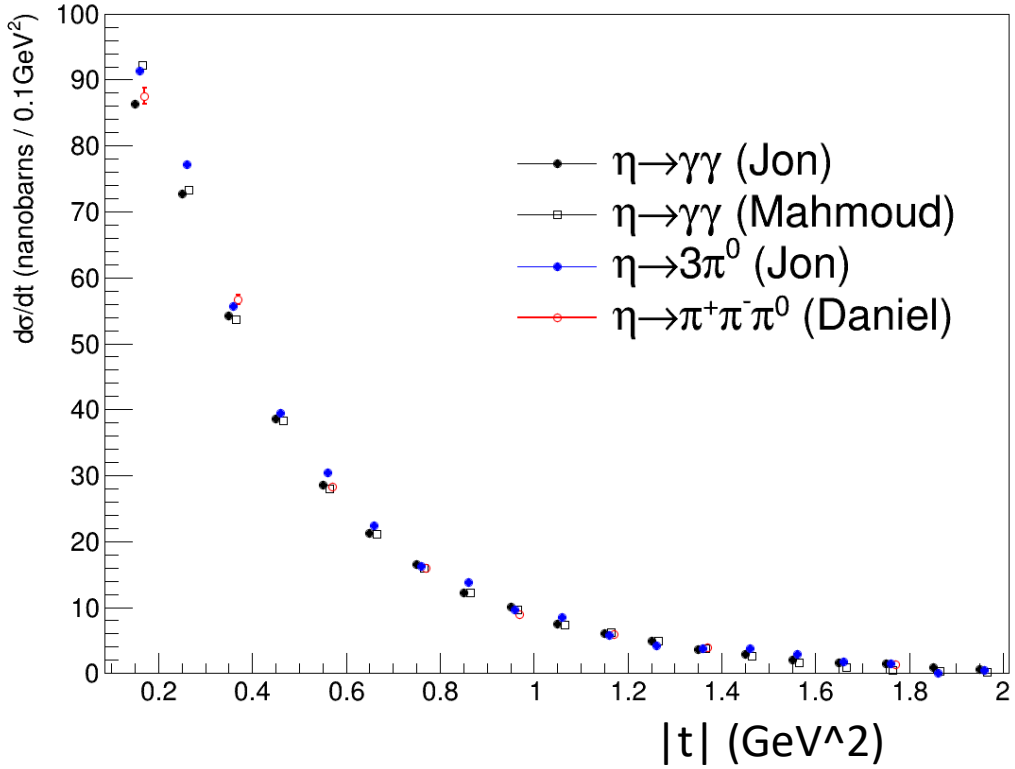
Run Periods, Event Selection

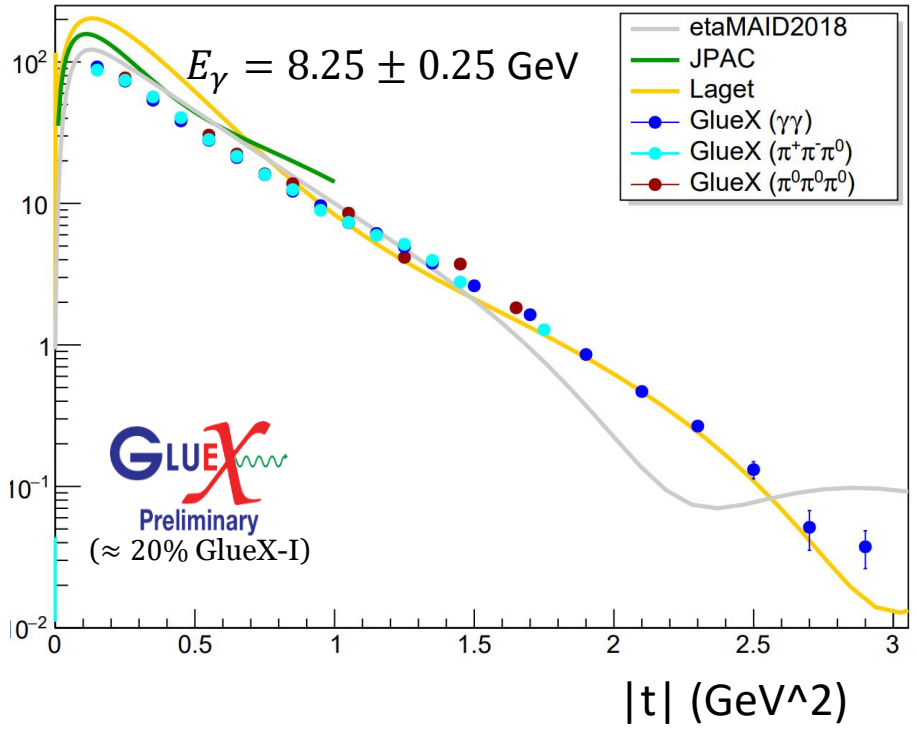
- Spring 2017
- Spring 2018
- Fall 2018

- ReactionFilter standard cuts
- Beam E > 6.0 GeV
- Proton:
  - 52 < measured z < 78 cm
  - measured r < 1.5 cm
  - measured p > 350 MeV
- Kinematic fit: p4+vertex
  - $\chi^2/NDF < 5$
- $0.09 < m_{\pi^0} < 0.16$ GeV

Differential Cross Sections

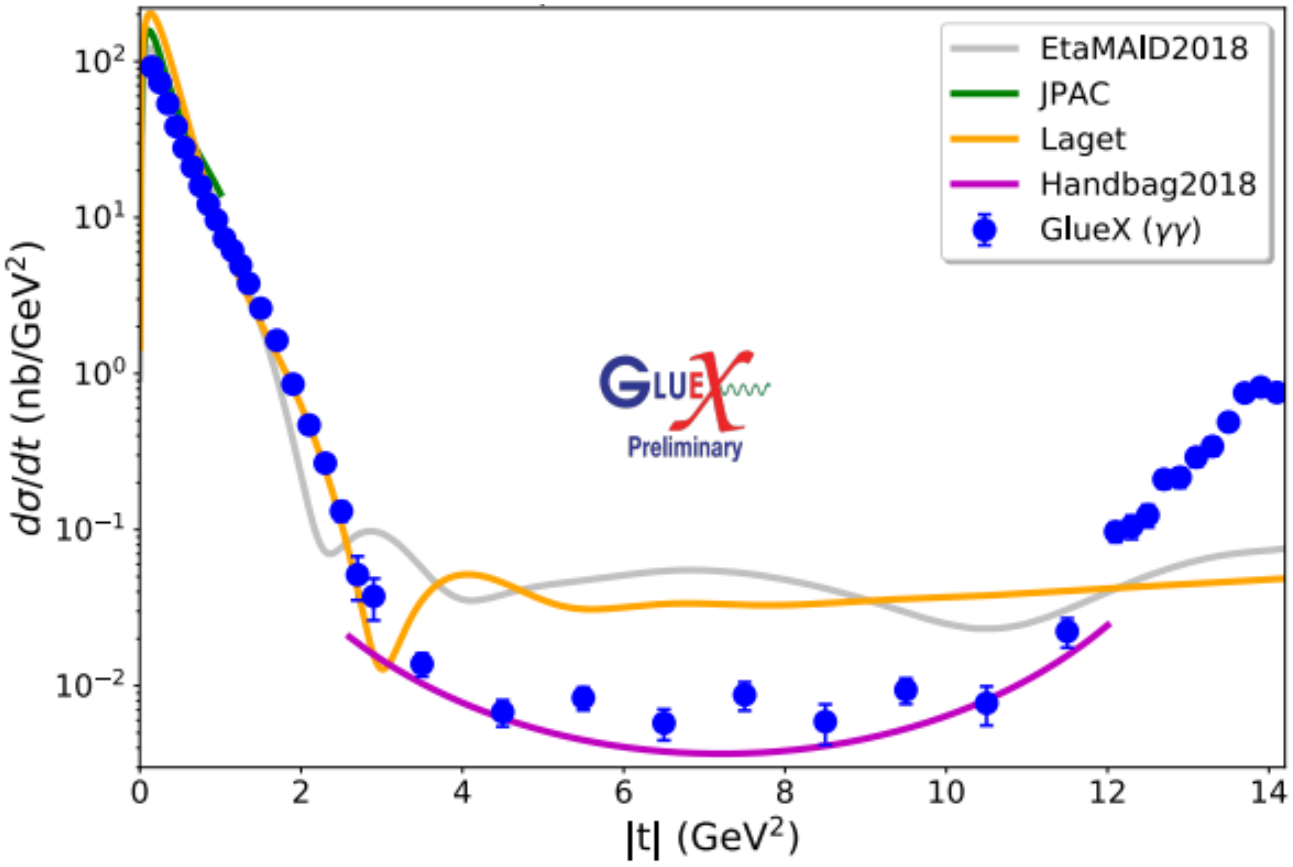
A bit lower than theory models predict





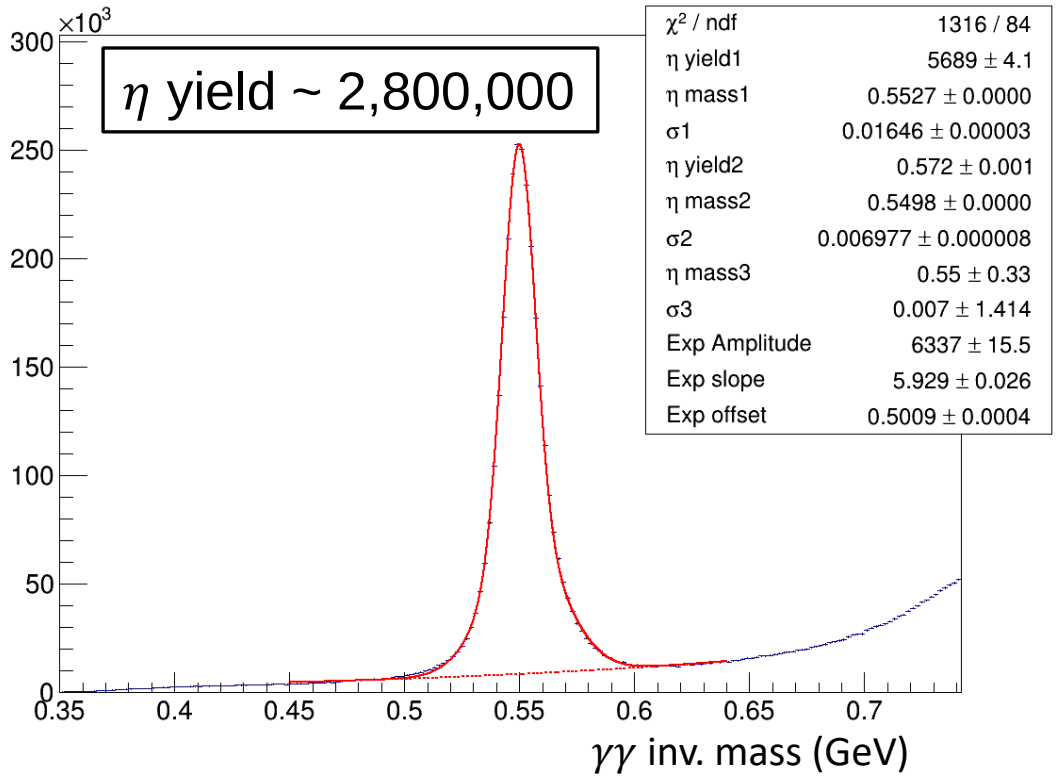
Differential Cross Sections, cont.

- Some u channel as well,
  (not that we'd use those events for studying η decays)



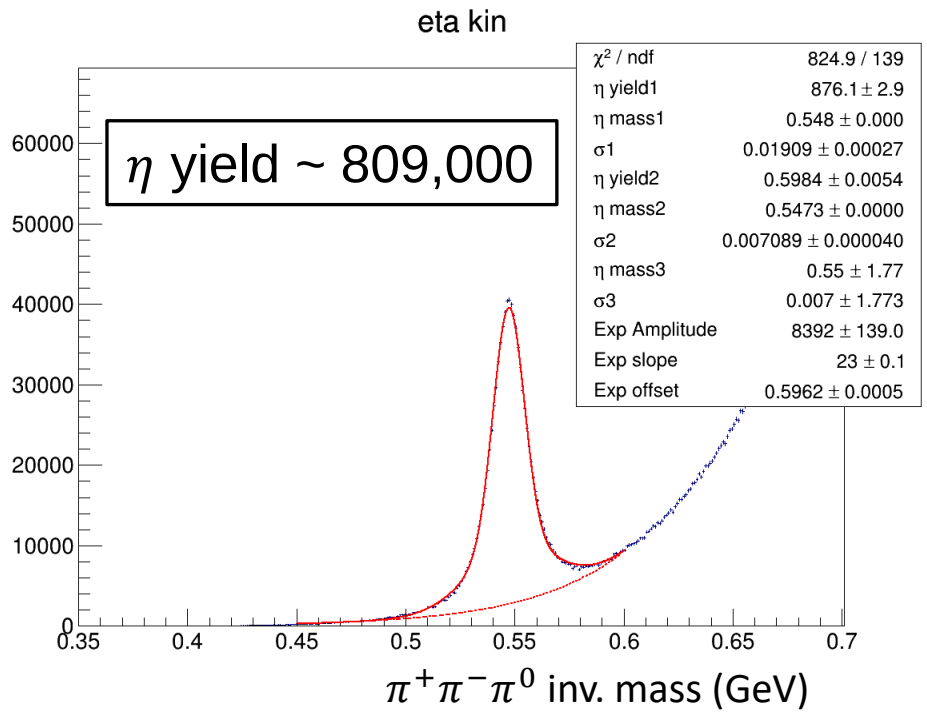
Yields, $\eta \rightarrow \gamma\gamma$

- Spring 2017, spring 2018, fall 2018
- $E_{beam} > 6$ GeV
- $|t| < 3$ GeV^2

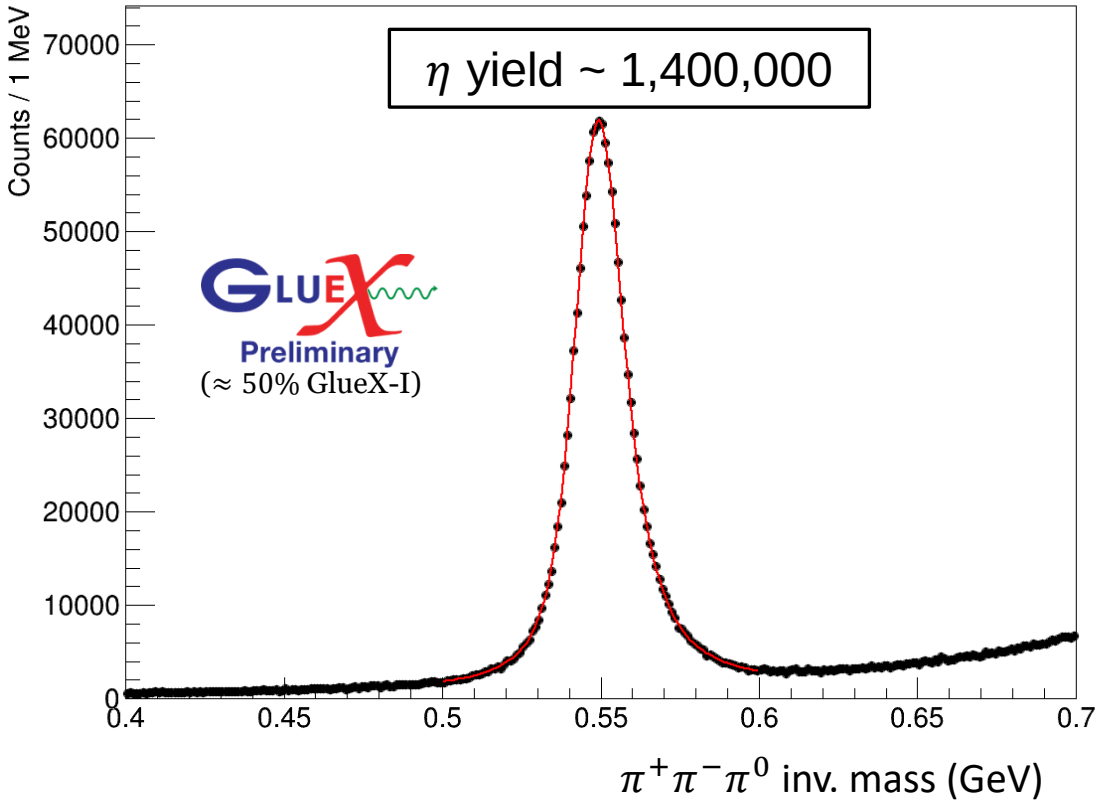


Yields, $\eta \rightarrow \pi^+\pi^-\pi^0$

- Spring 2017, spring 2018, fall 2018
- $E_{beam} > 6$ GeV
- $|t| < 3$ GeV^2



Yields, $\eta \rightarrow \pi^+\pi^-\pi^0$ Notes

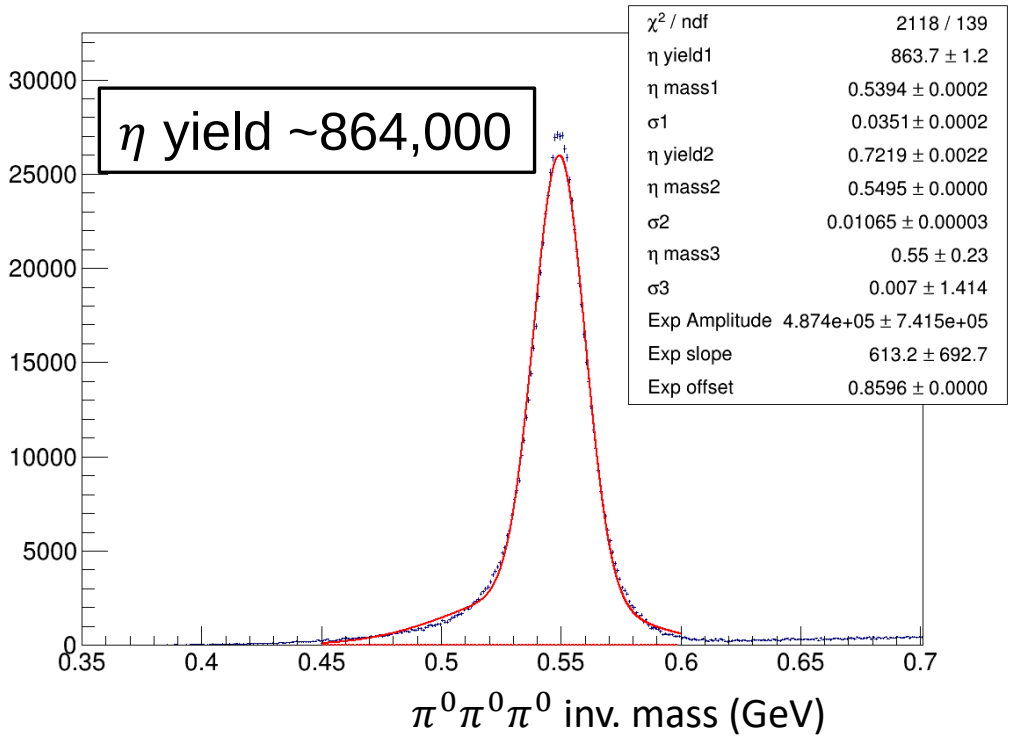


- Talk I gave at DNP last year would have predicted yield of 2,800,000
- I'll have to double check things here

- Other modes come out exactly $2 \times$ DNP results

Yields, $\eta \rightarrow \pi^0\pi^0\pi^0$

- Spring 2017, spring 2018, fall 2018
- $E_{beam} > 6$ GeV
- $|t| < 3$ GeV^2



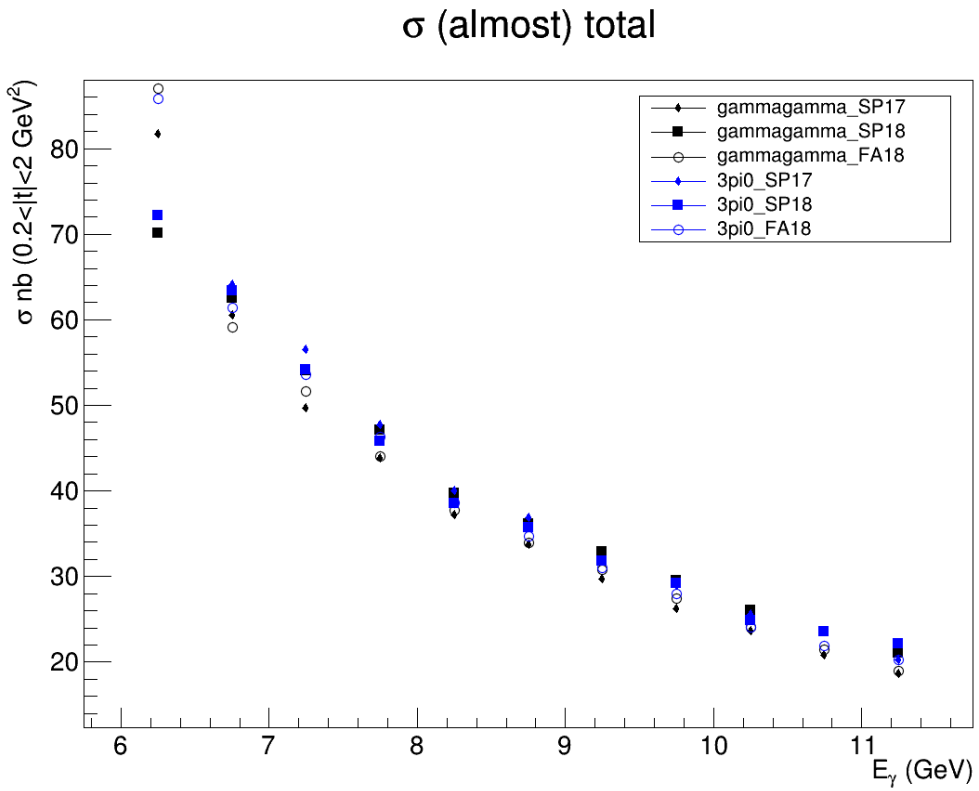
Yield Summary Table

Mode	Yield	Branching Fraction
$\eta \to \gamma\gamma$	2.8 million	0.39
$\eta \to \pi^+\pi^-\pi^0$	809 k – 2.8 million ?	0.23
$\eta \to \pi^0\pi^0\pi^0$	864 k	0.33

- GlueX phase I (spring 2017, spring 2018, fall 2018)
- $E_{beam} > 6$ GeV
- $|t| < 3$ GeV^2

(Nearly) Total Cross Section

- 0.2 < |t| < 2 GeV^2
  - No Primakoff peak, no u-channel in this range



VERY preliminary

- A few of the poorer fits drive variation here
- This can, will be improved for xsec publication

Table of Cross Section

$0.2 < |t| < 2$ GeV^2

Beam E range	Cross Section (nb)
6.0-6.5 GeV	79.6
6.5-7.0 GeV	60.7
7.0-7.5 GeV	52.3
7.5-8.0 GeV	45.0
8.0-8.5 GeV	37.9
8.5-9.0 GeV	34.5
9.0-9.5 GeV	30.8
9.5-10.0 GeV	27.7
10.0-10.5 GeV	24.3
10.5-11.0 GeV	21.9
11.0-11.5 GeV	19.8

Averaged over run periods

- Statistical uncertainty suppressed
- Final result will be systematic dominated anyways

Fun Aside

- Clear $\eta' \rightarrow \pi^0\pi^0\pi^0$ signal (B.F.=0.0025)