Extracting PDFs from ATLAS p-Pb dijets

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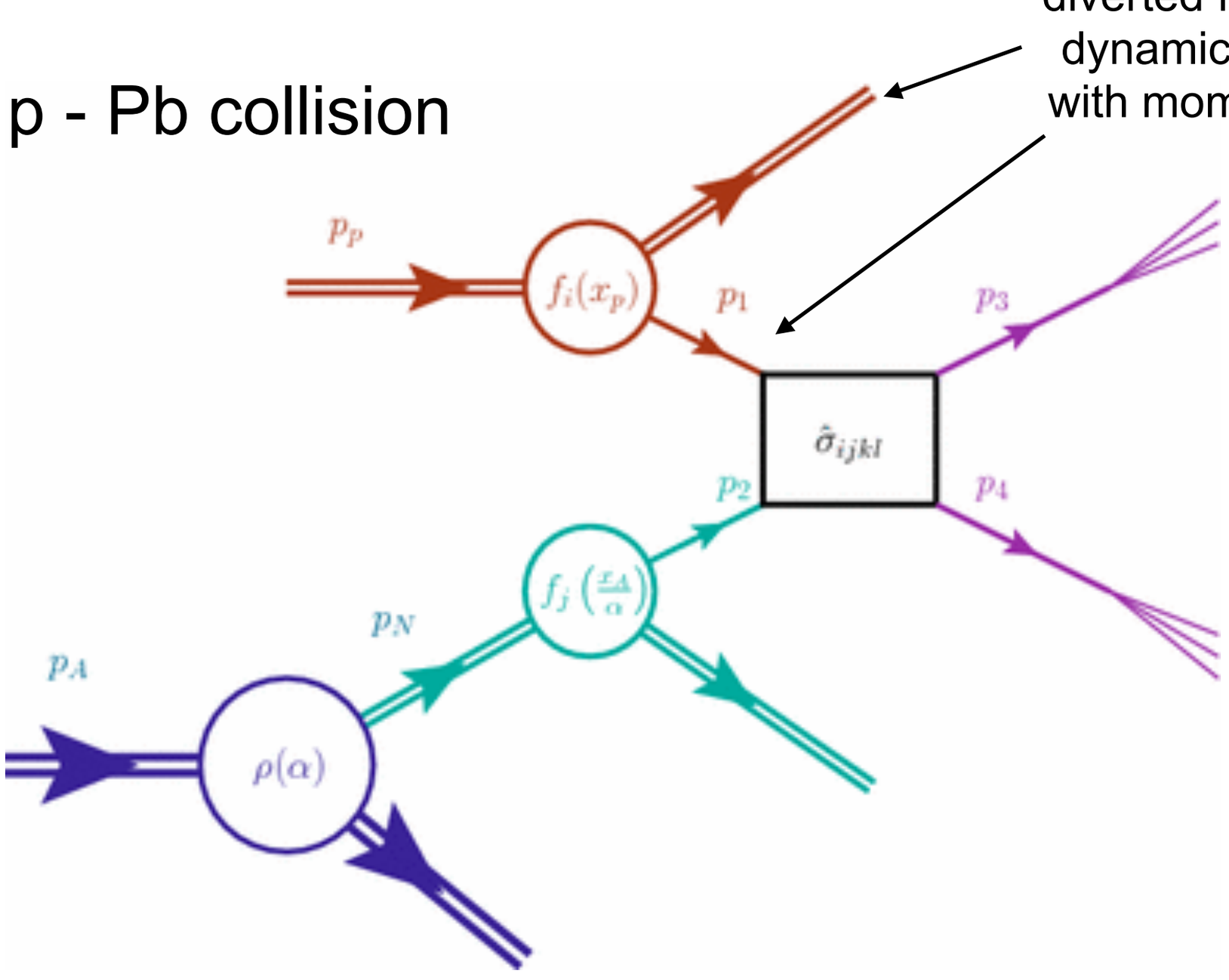
x

p - Pb collision



Some momentum is diverted from the collision dynamics - characterize with momentum fractions

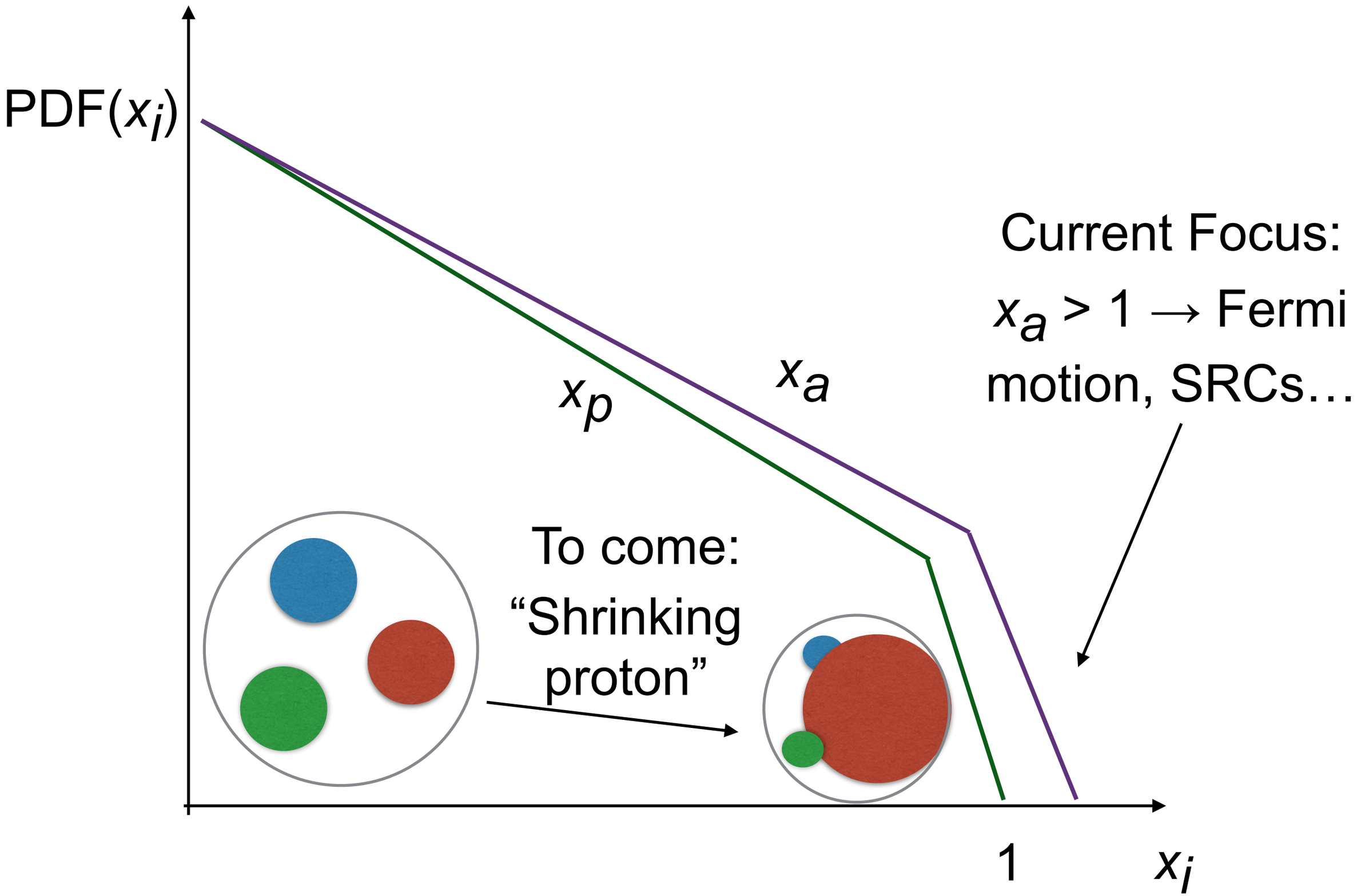
$$x_p = \frac{p_1}{p_p}$$

$$x_A = A\frac{p_2}{p_A}$$

Freeman et al. (2015) arXiv:1411.6605

t

Key Idea: “Superfast quarks”



Trigger Selection Method

- Motivation: Higher prescale less statistically valuable than higher counts

- For any kinematic (p_T, η) bin, find the trigger with highest number of counts

- Then look for that trigger to be fired in that bin

1. Illustrate procedure with 10 triggers

2. Add all activated triggers

Data Sets

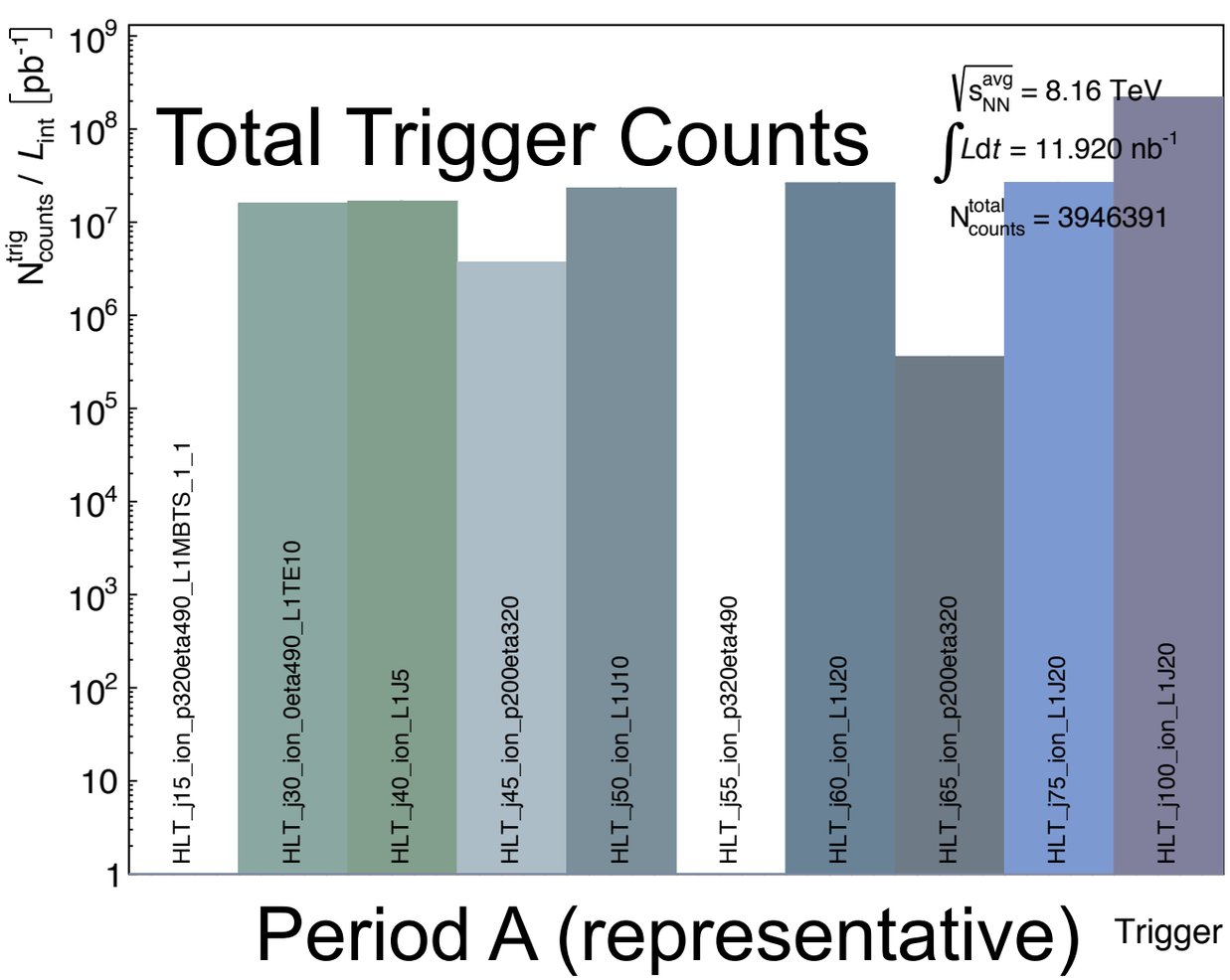
- Using 2016 p-Pb (Pb-p) data (all η's are lab frame, with period A flipped)

- Using runs:

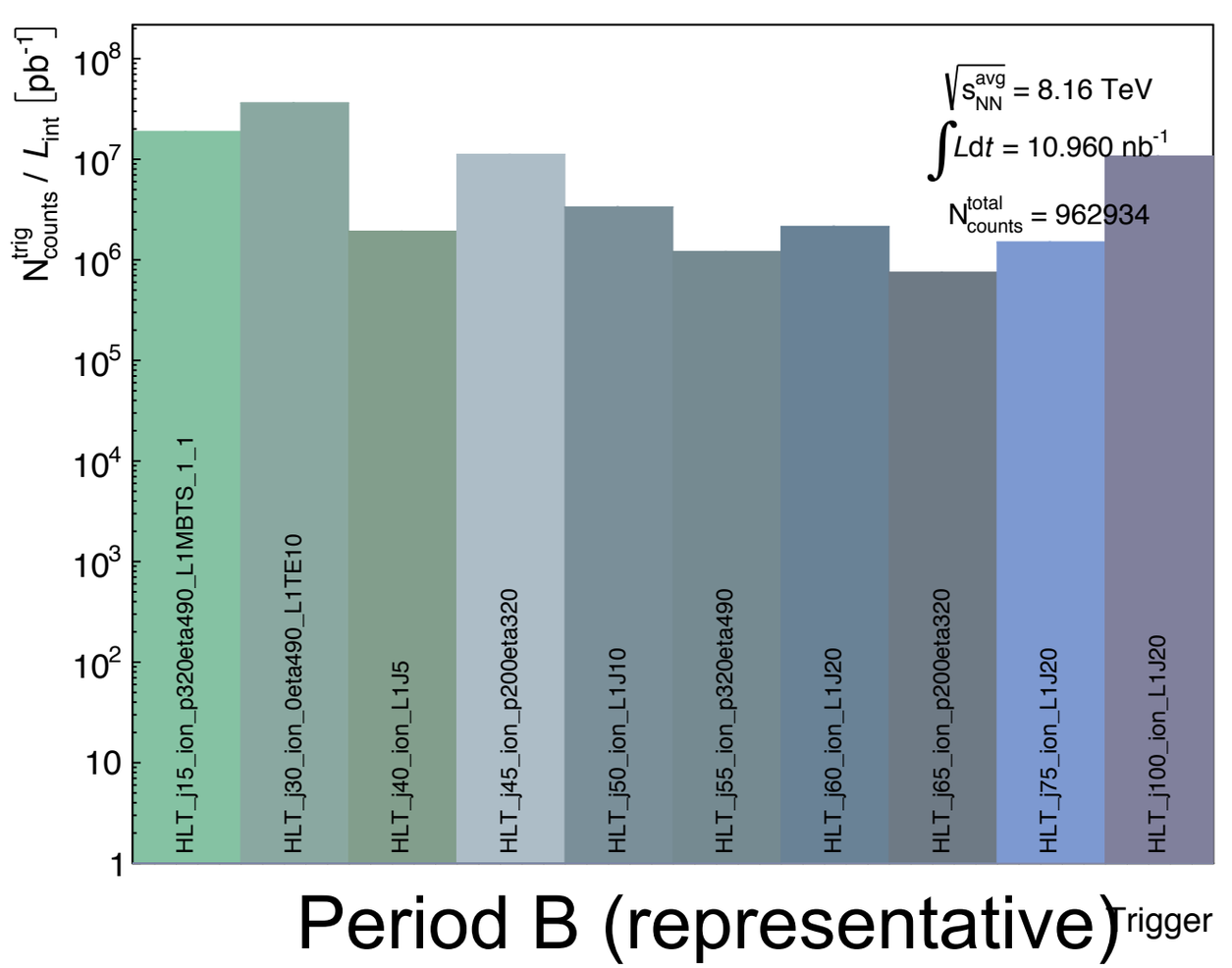
313063, 313067, 313100, **313107**, **313136**, 313187, **313259**, 313285, 313295, 313333, 313435, 313572, 313574, 313575, **313603**, 313629, **313630**, **313695**, 313833, **313878**, **313929**, 313935, 313984, **314014**, 314112, **314157**, **314170** (in analysis with fewer triggers)

313688, 314105 + all above in bold (in analysis with all triggers)

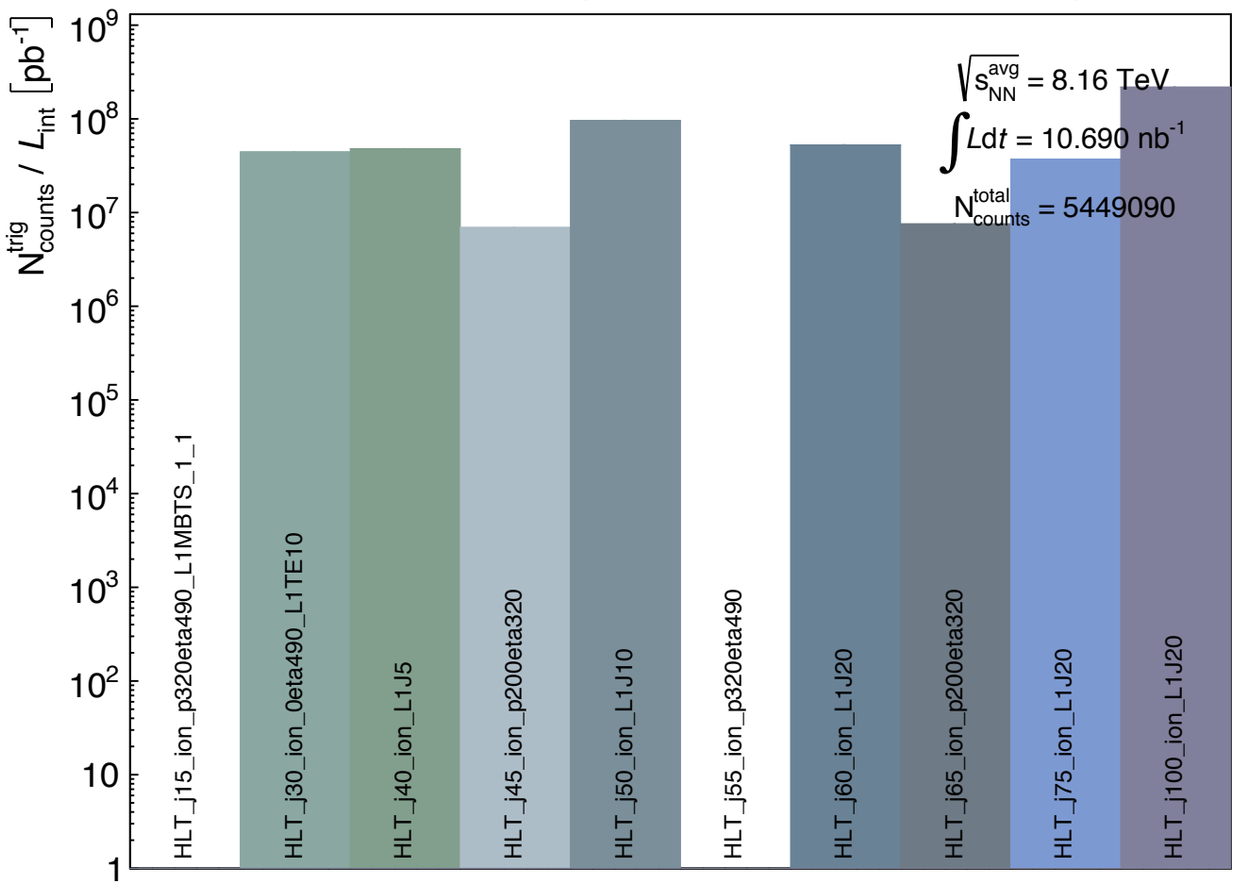
- Luminosity used = Stable beam integrated luminosity

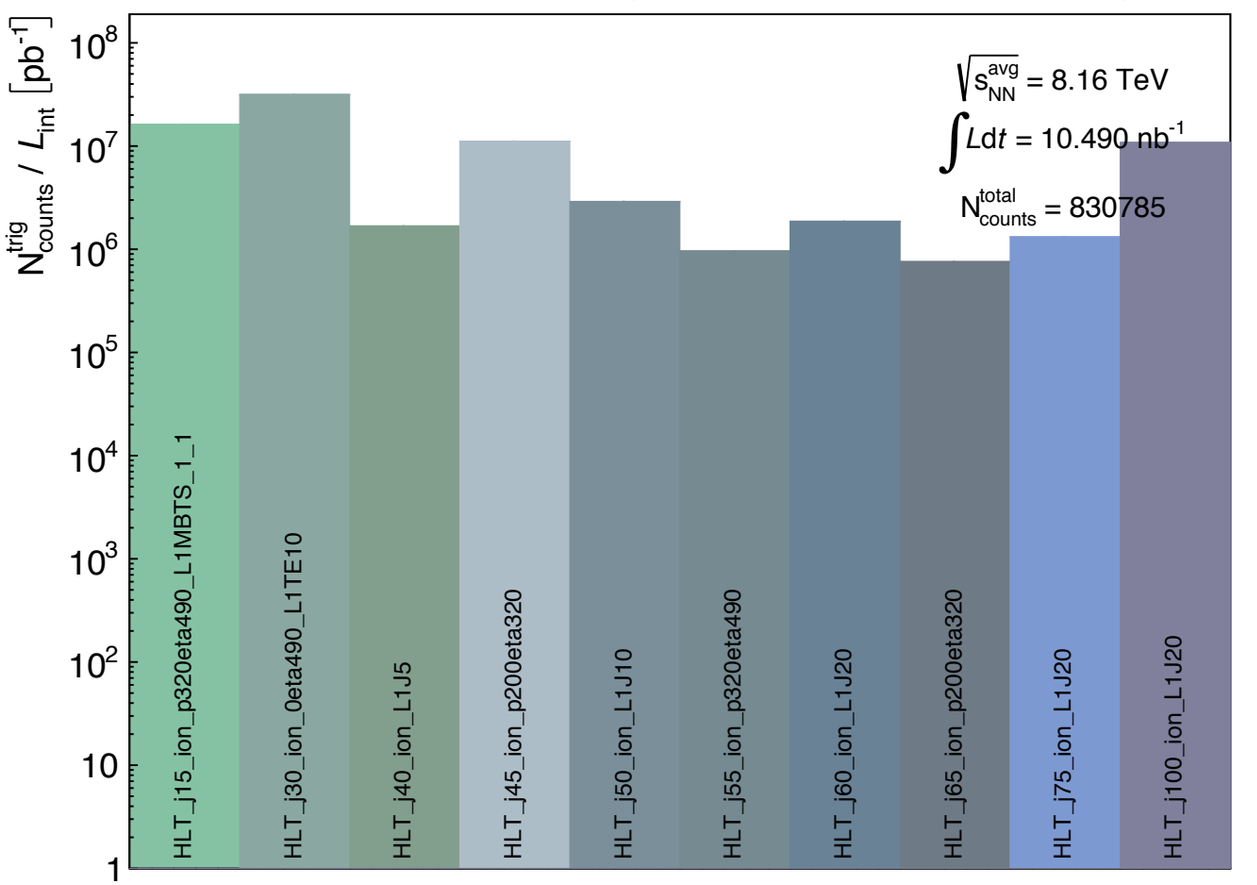


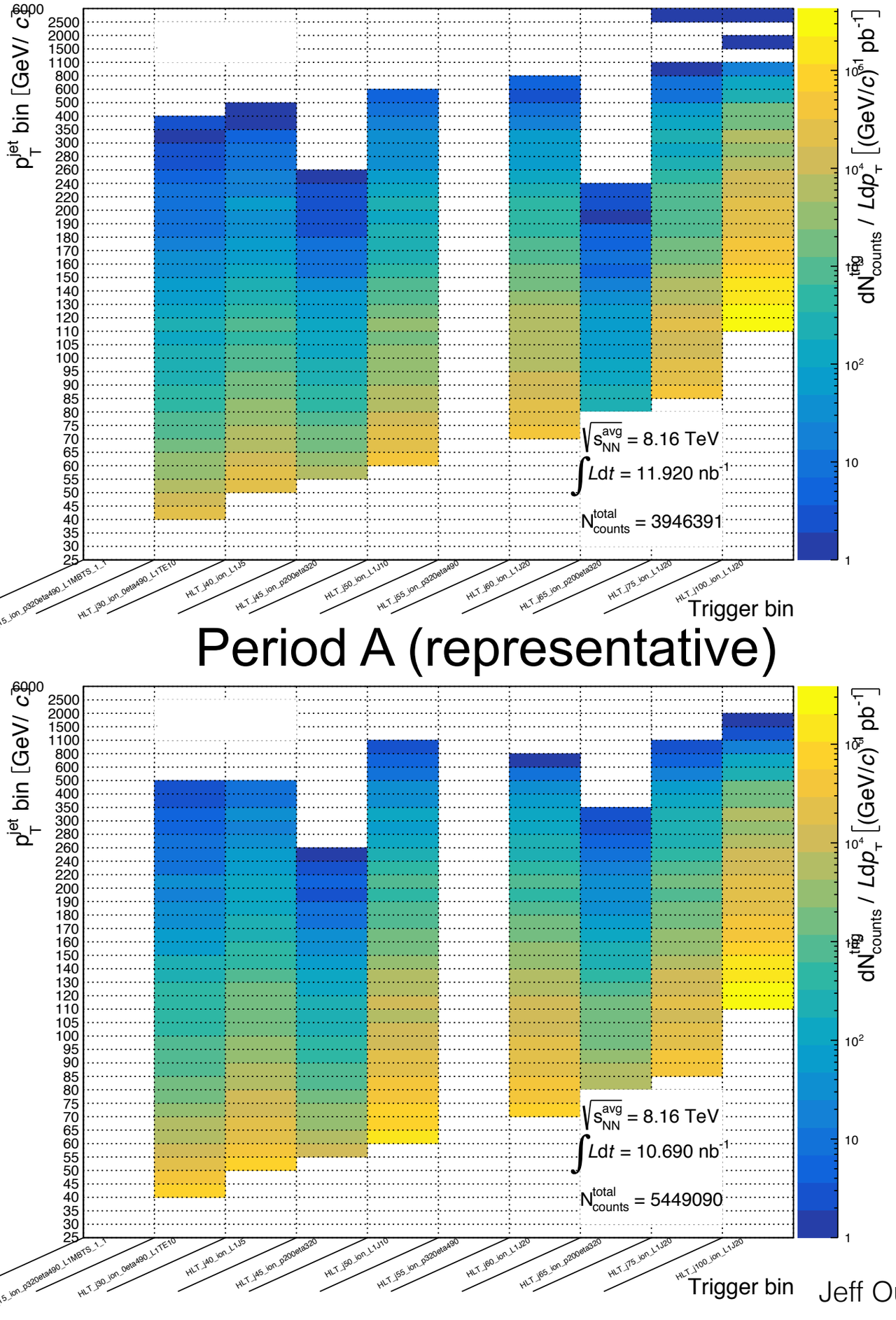
Period A (representative) Trigger



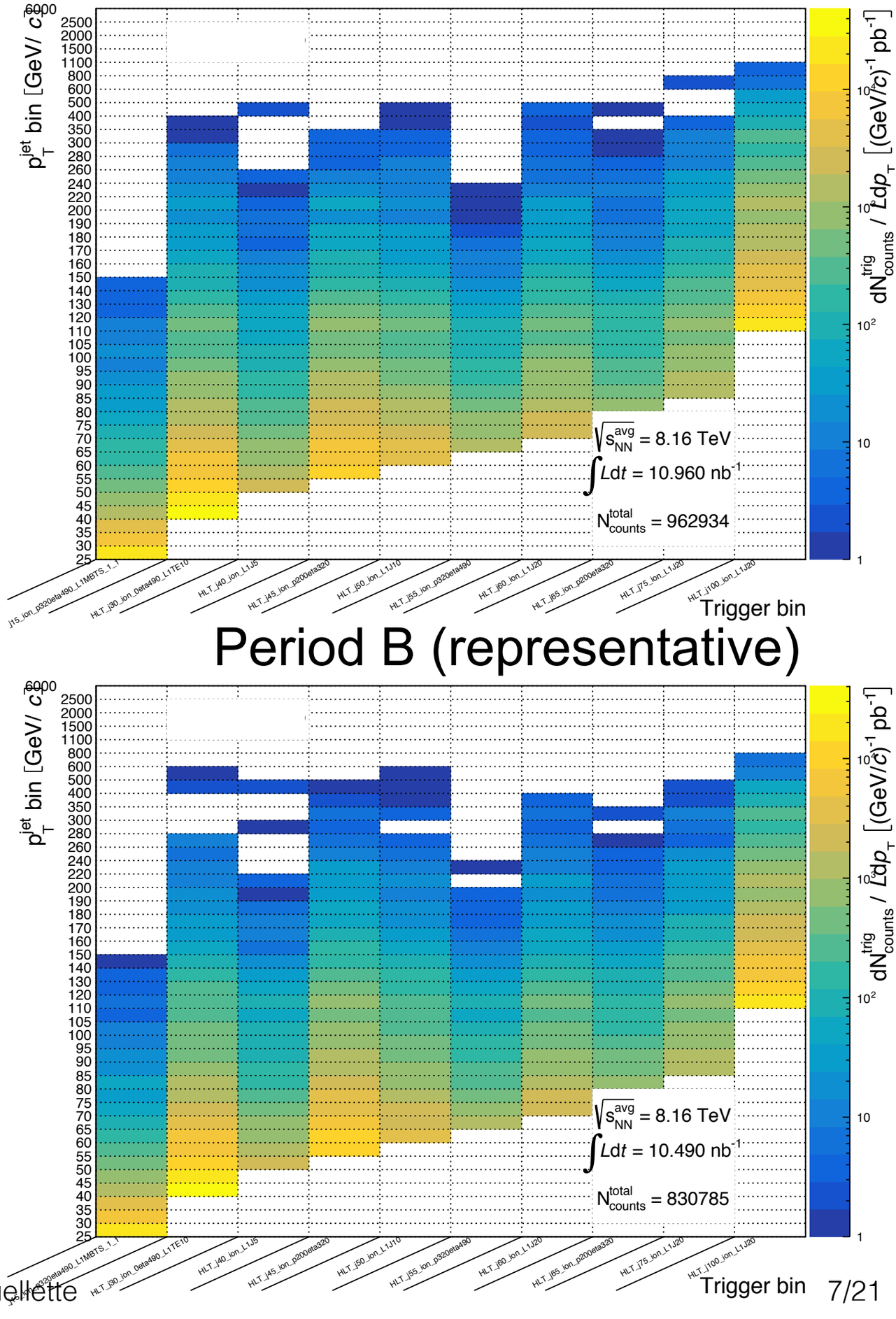
Period B (representative) Trigger





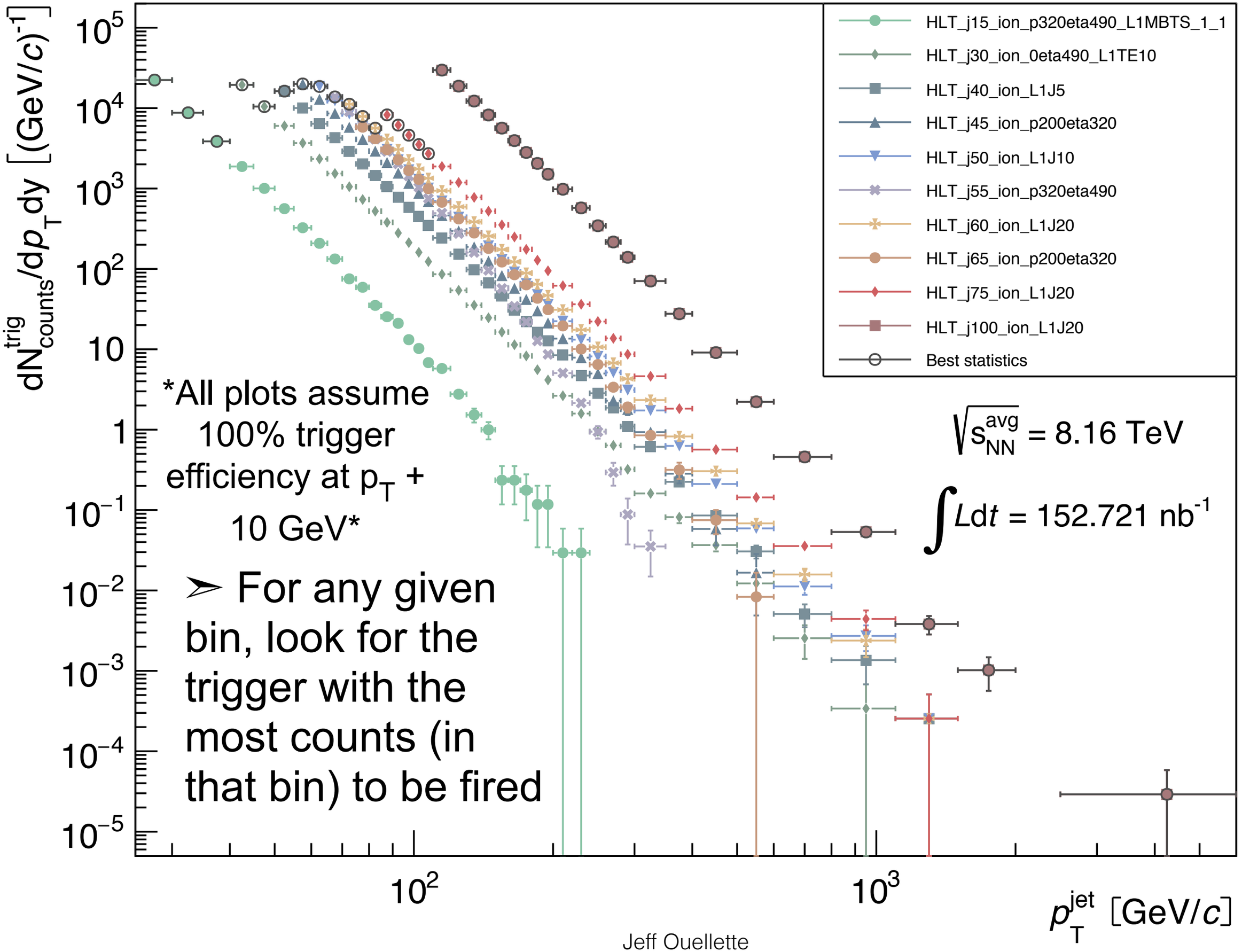


Period A (representative)

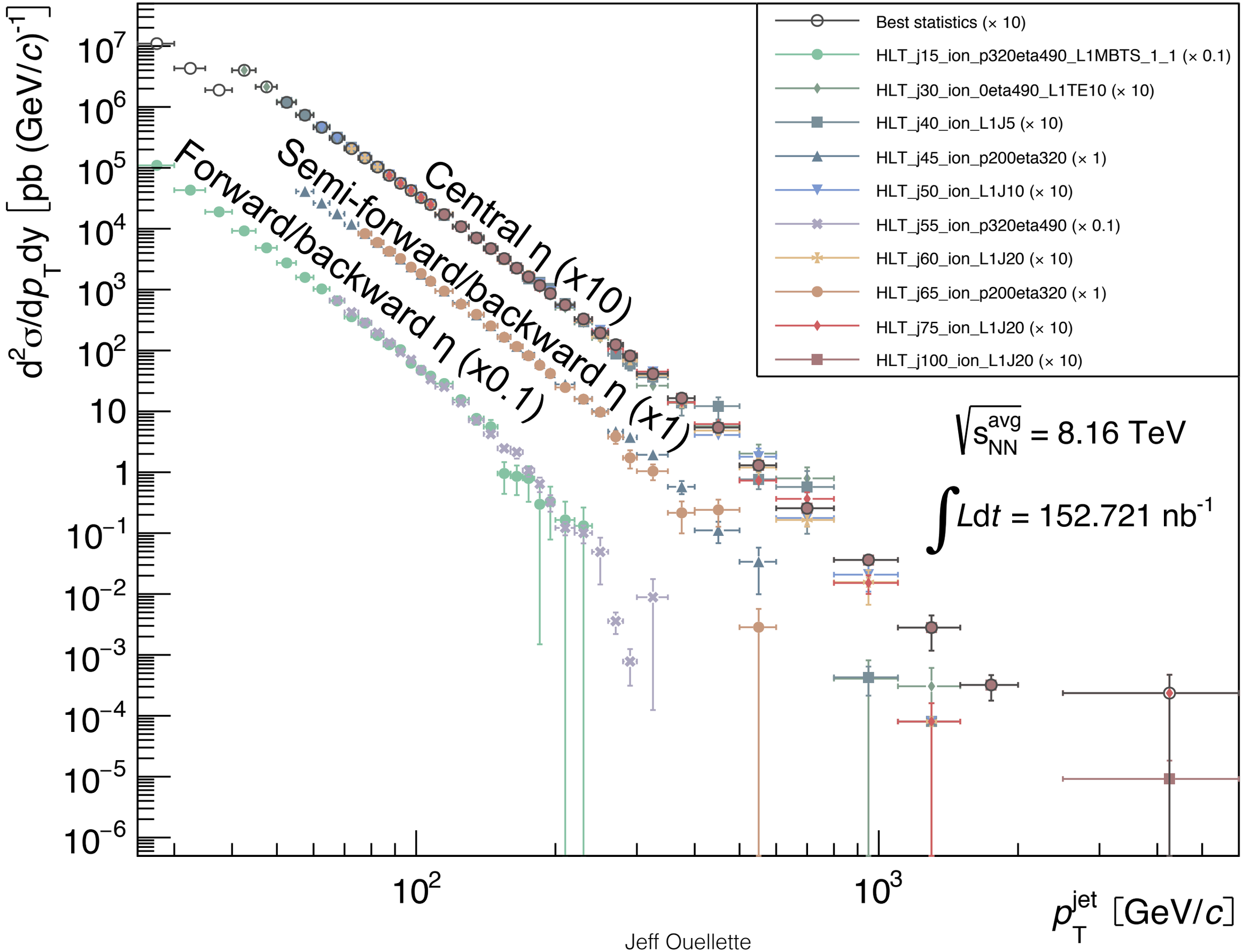


Period B (representative)

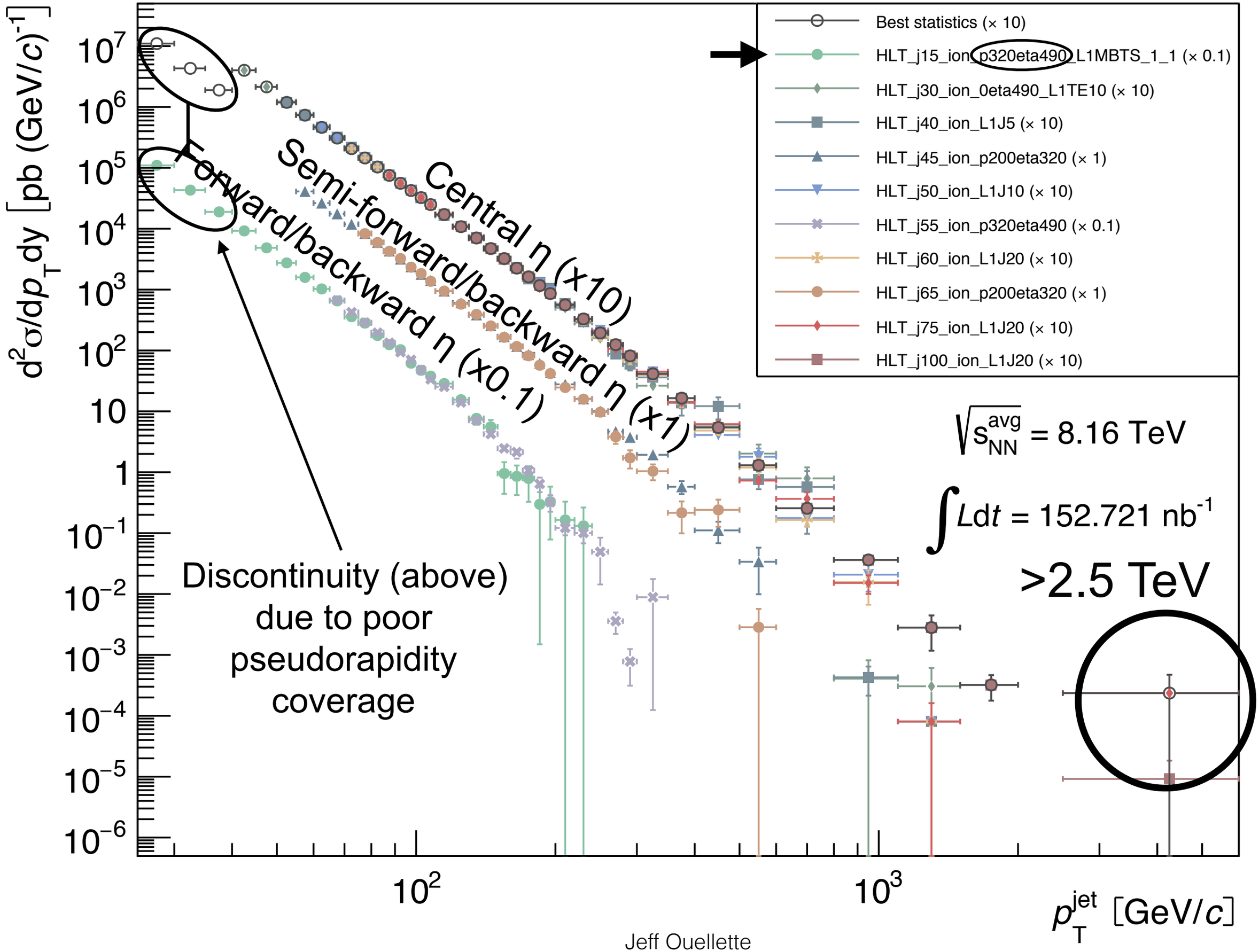
Number of Trigger Firings



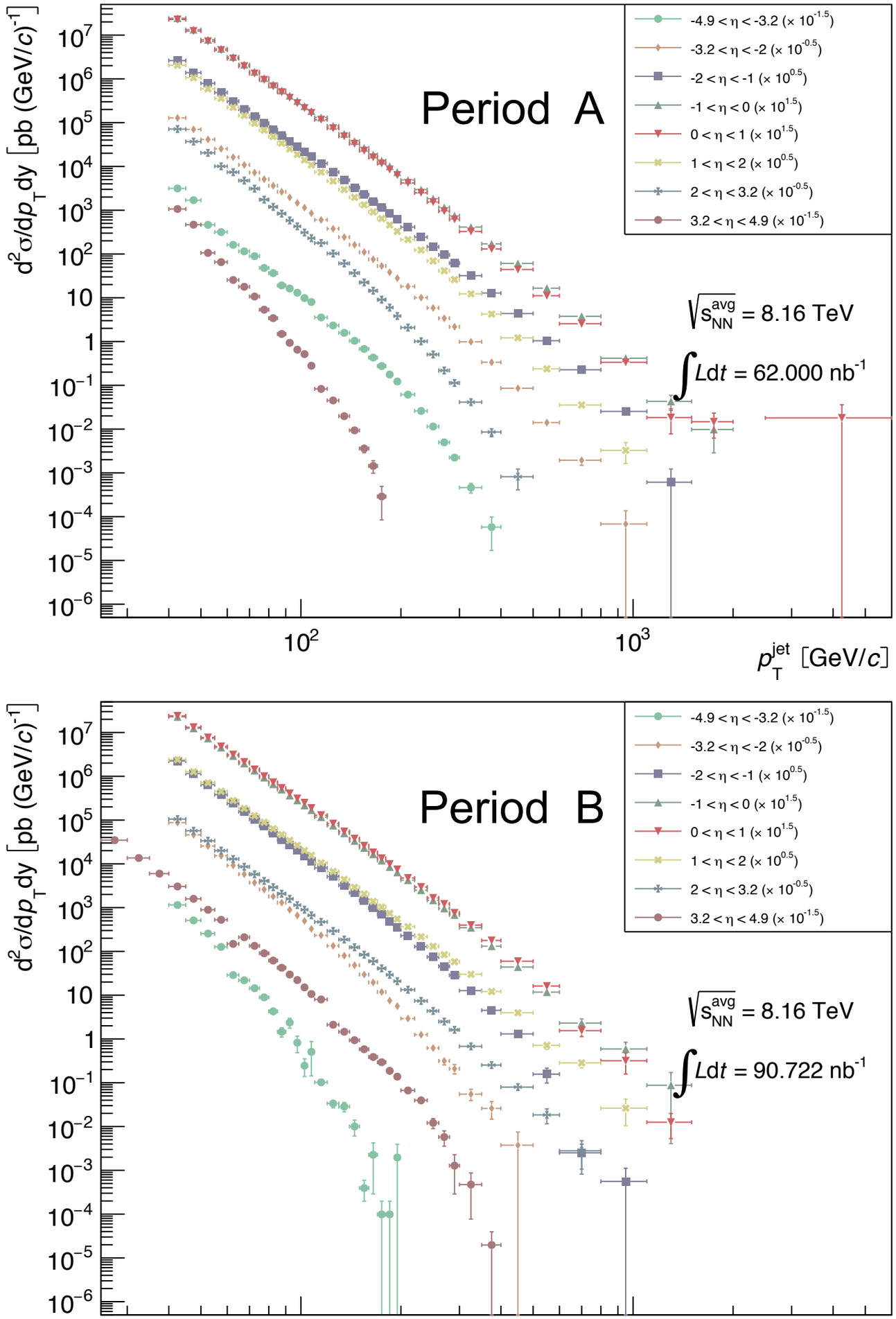
Inclusive Jet p_T Spectra per Trigger



Inclusive Jet p_T Spectra per Trigger



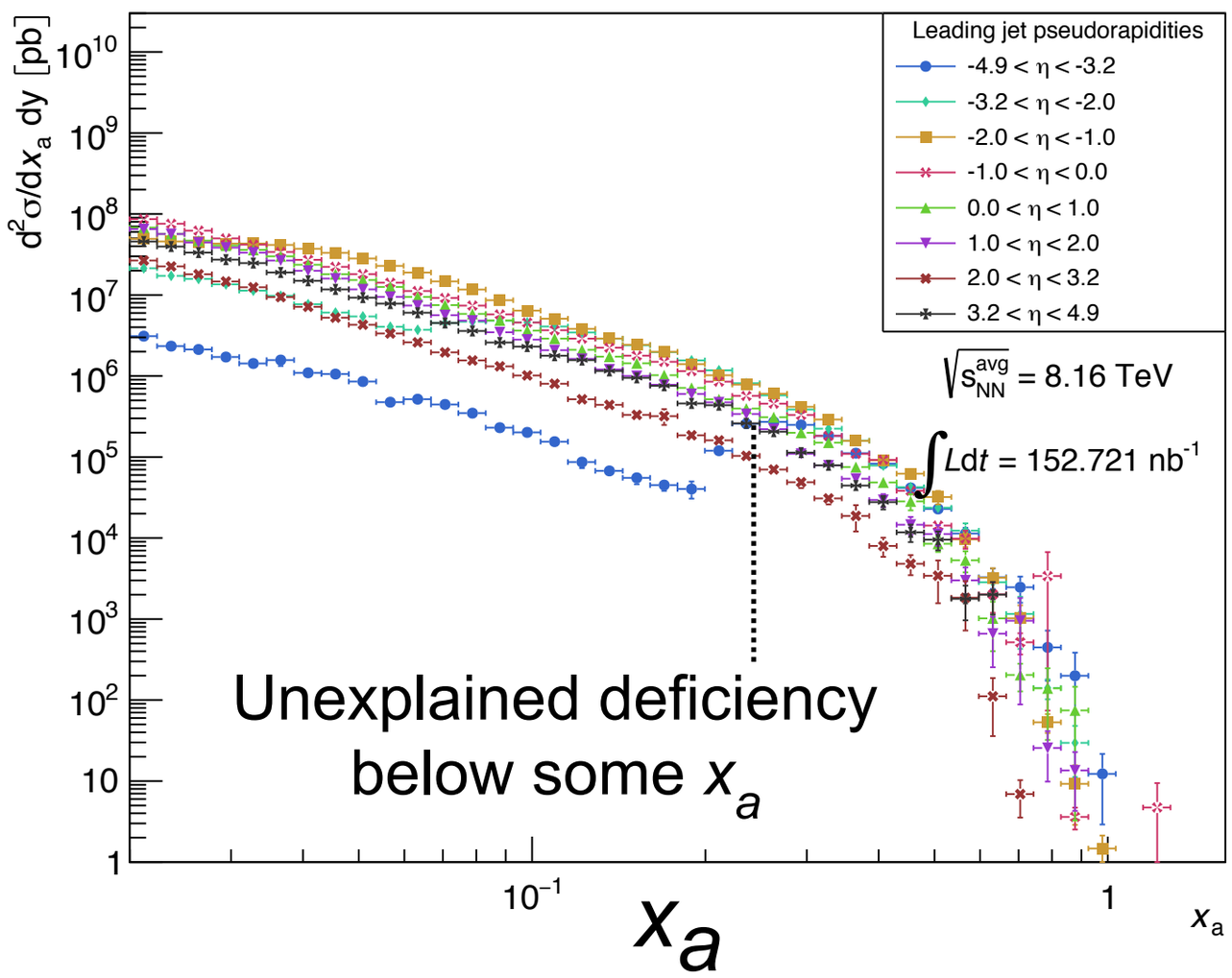
Inclusive Jet p_T Spectra (binned in η) for period A, B



(Less luminosity, fewer triggers)

Kinematics reversed

(Higher luminosity, more triggers)



In Period B kinematics,

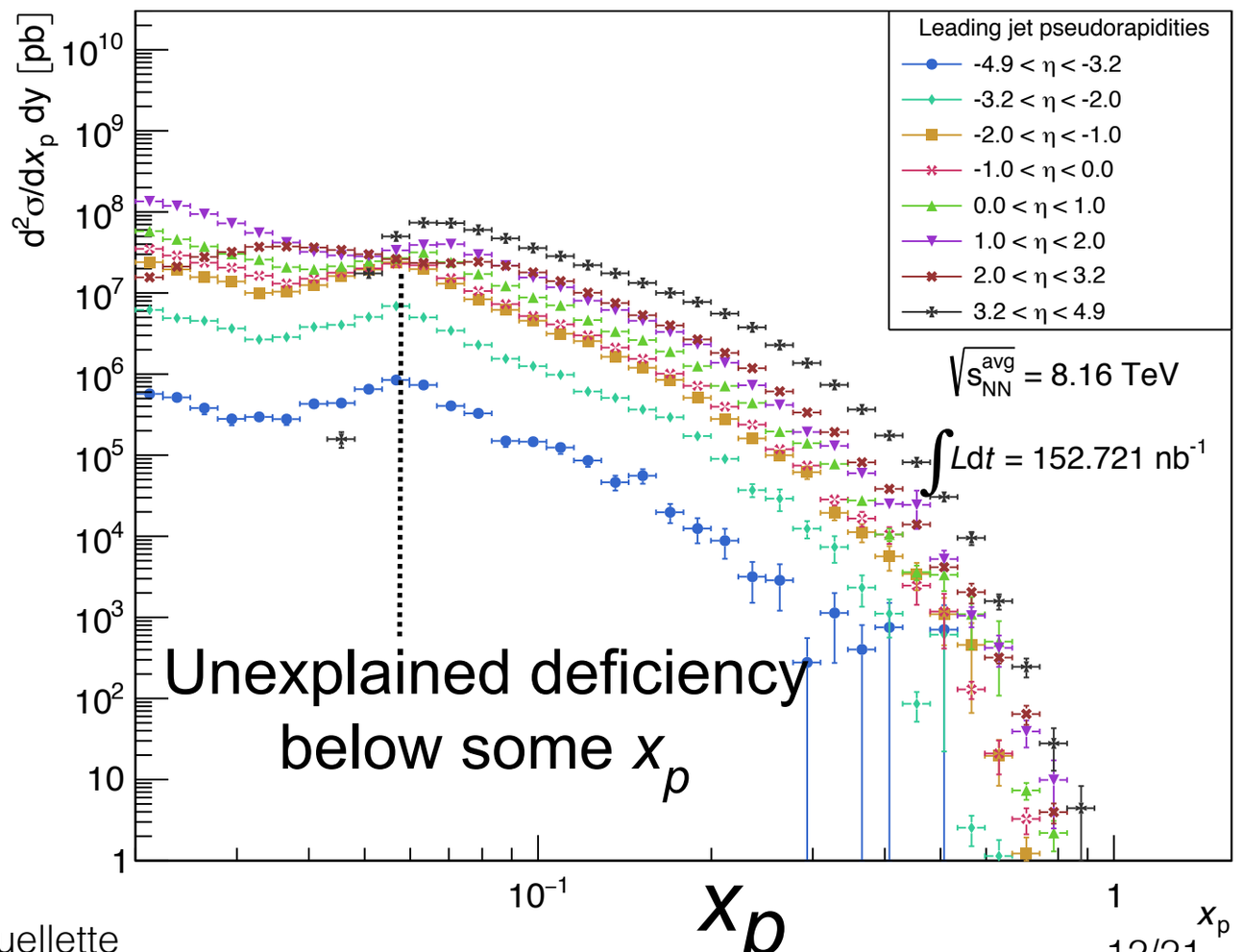
$$x_p = \frac{1}{\sqrt{s_{NN}^{avg}}} \sqrt{\frac{Z}{A}} \left(p_{T3} e^{\eta_3} + p_{T4} e^{\eta_4} \right)$$

$$x_a = \frac{1}{\sqrt{s_{NN}^{avg}}} \sqrt{\frac{A}{Z}} \left(p_{T3} e^{-\eta_3} + p_{T4} e^{-\eta_4} \right)$$

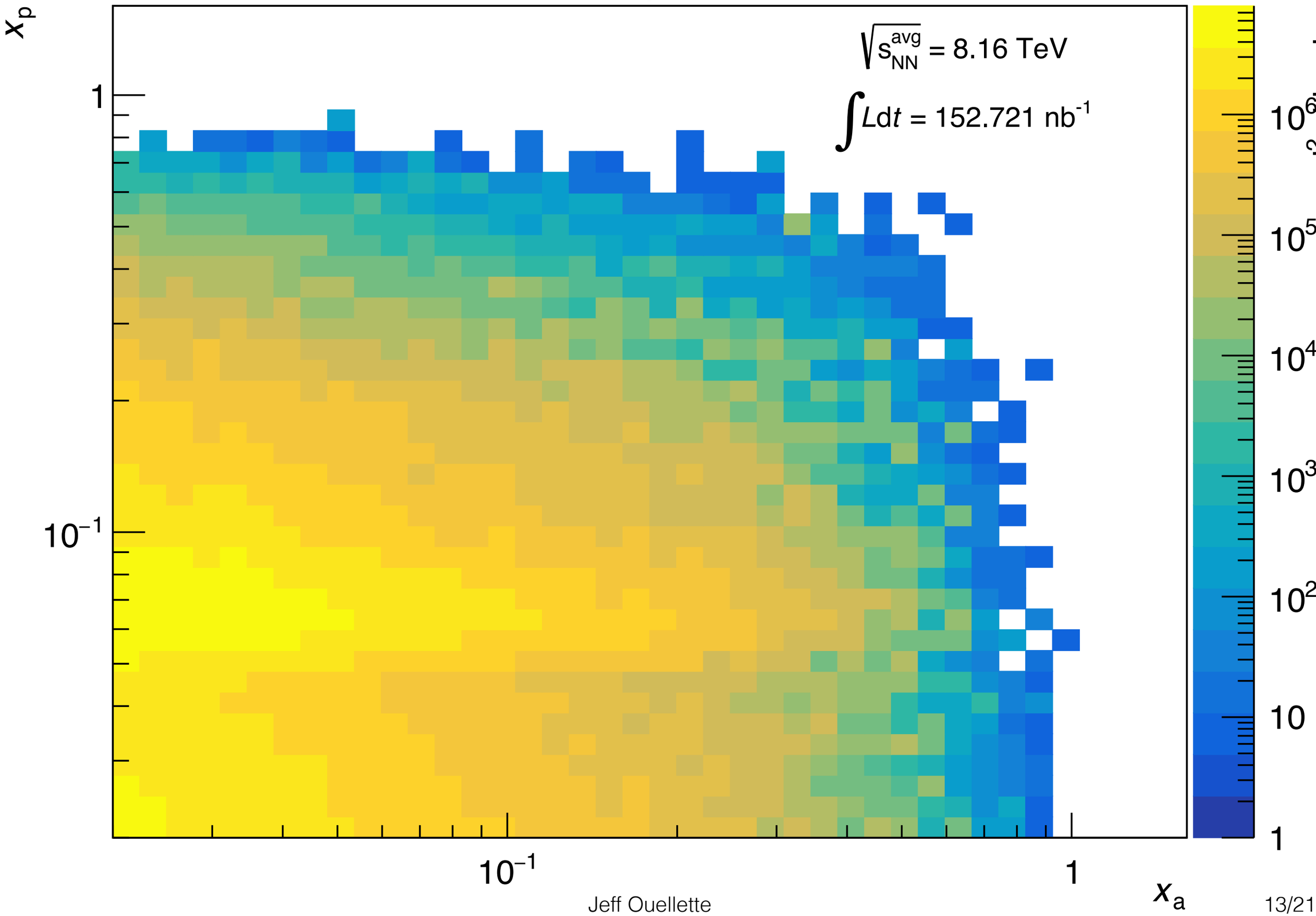
(Factor of A/Z implements boost from lab frame)

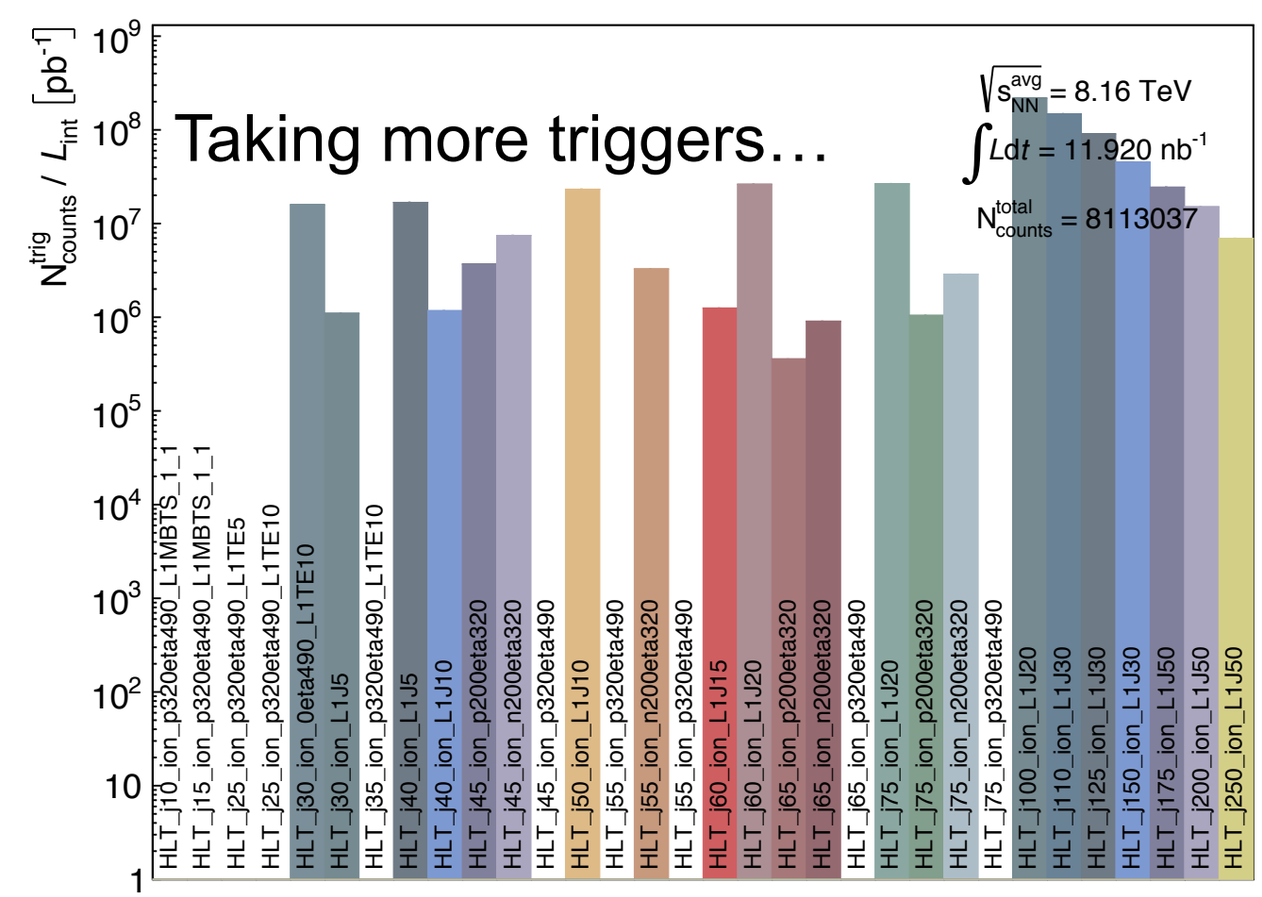
Dijet condition: $\frac{p_T^{subleading}}{p_T^{leading}} \geq 0.7$

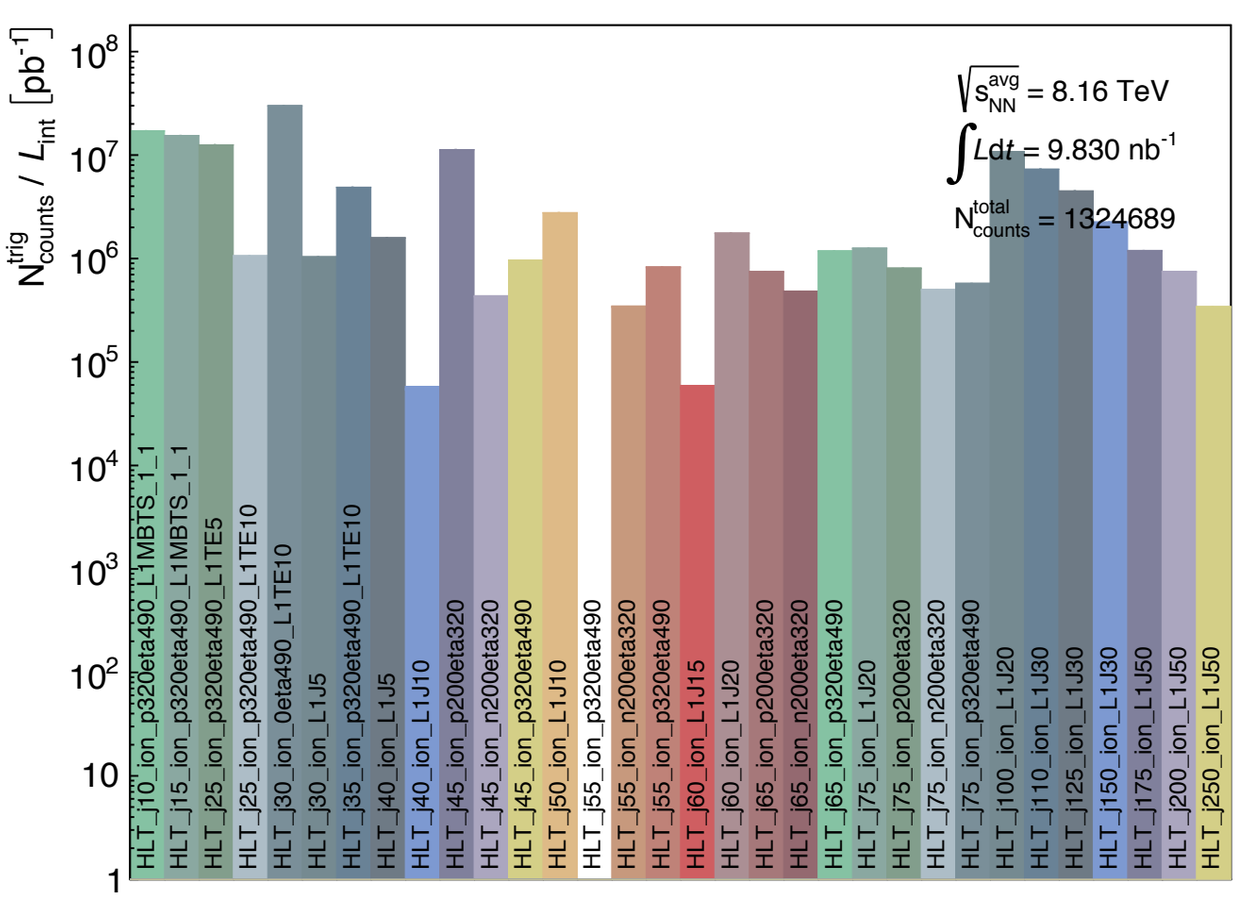
Fill with weight: Trigger prescale/ integrated “trigger luminosity”



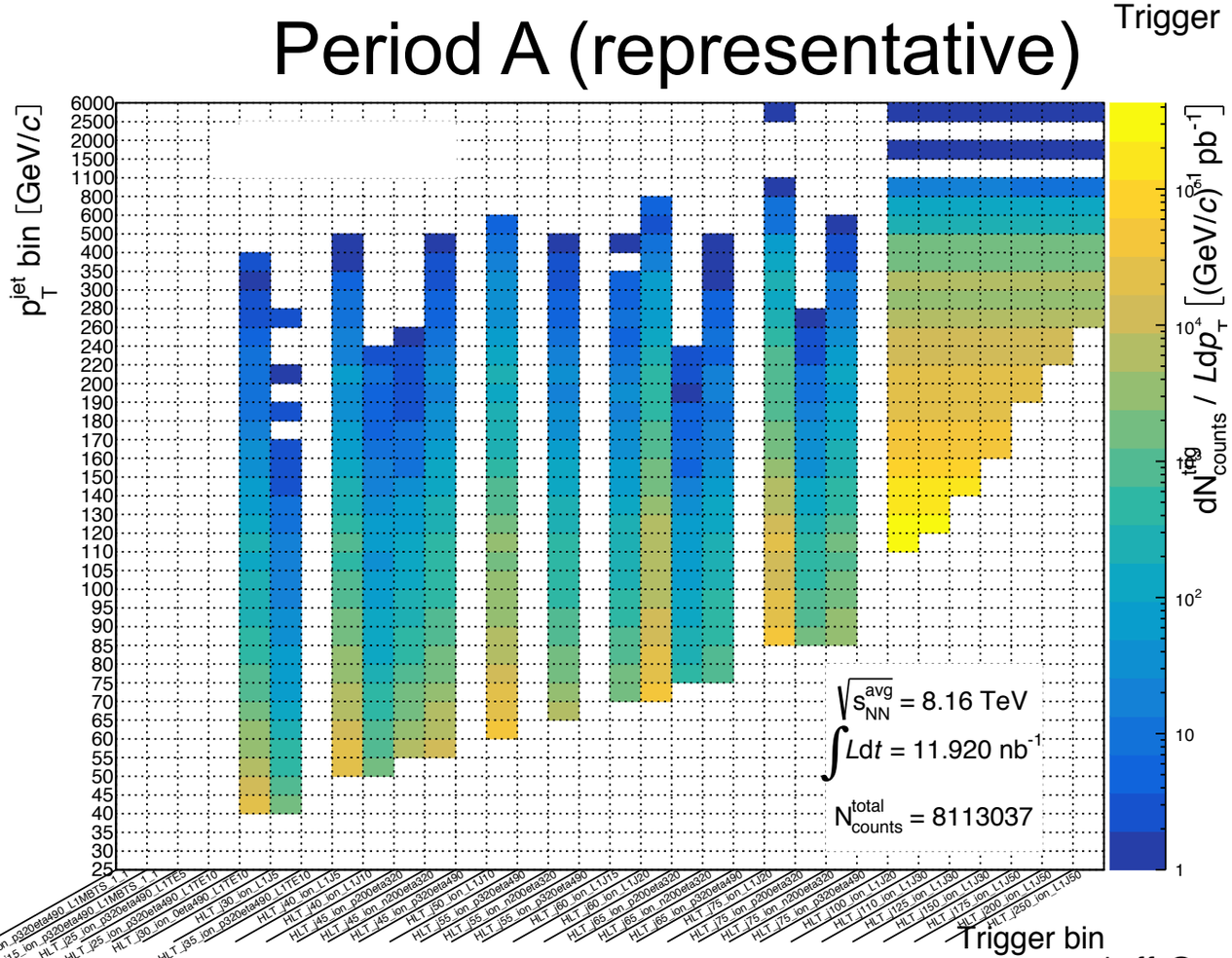
Dijet x_a-x_p cross-correlation



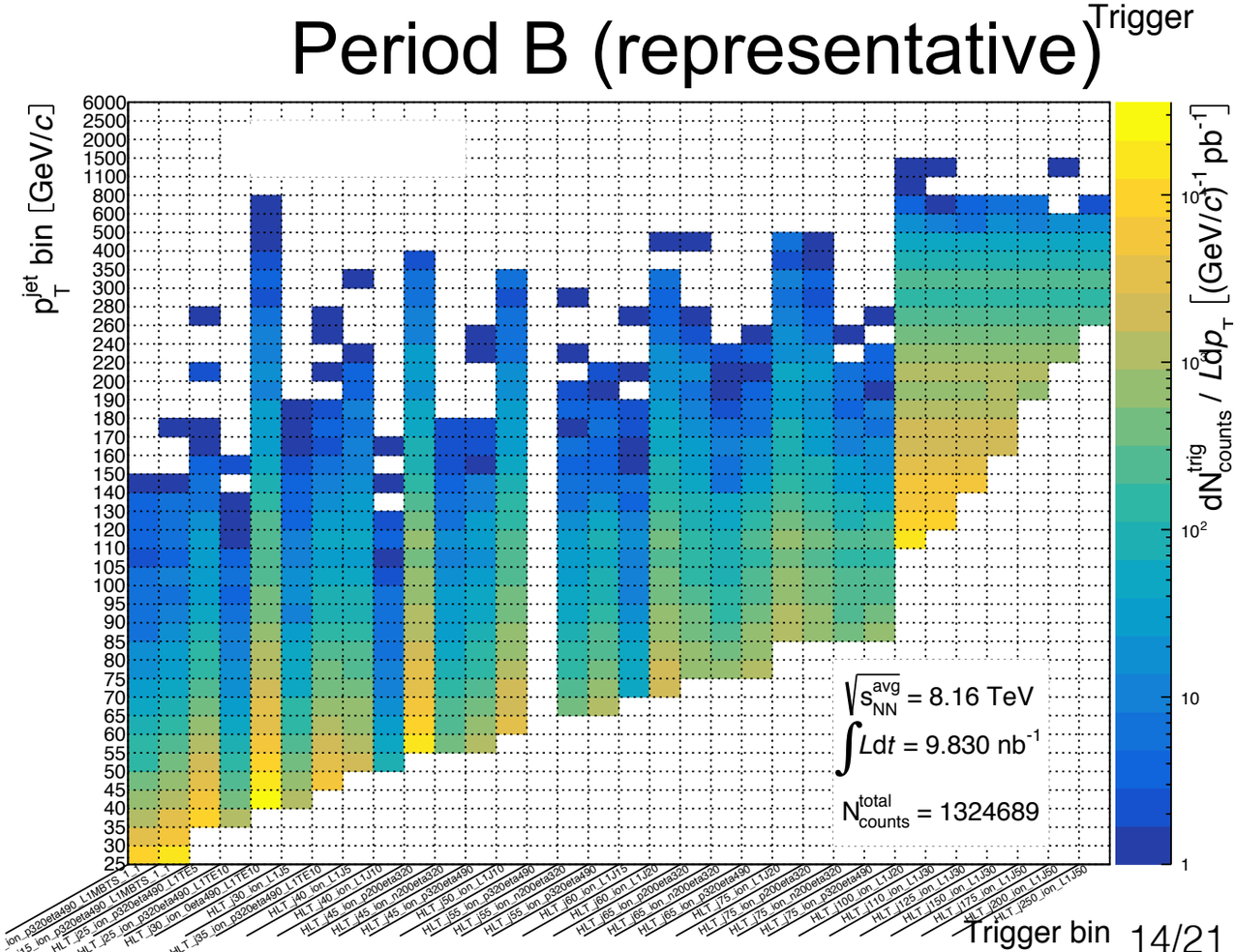




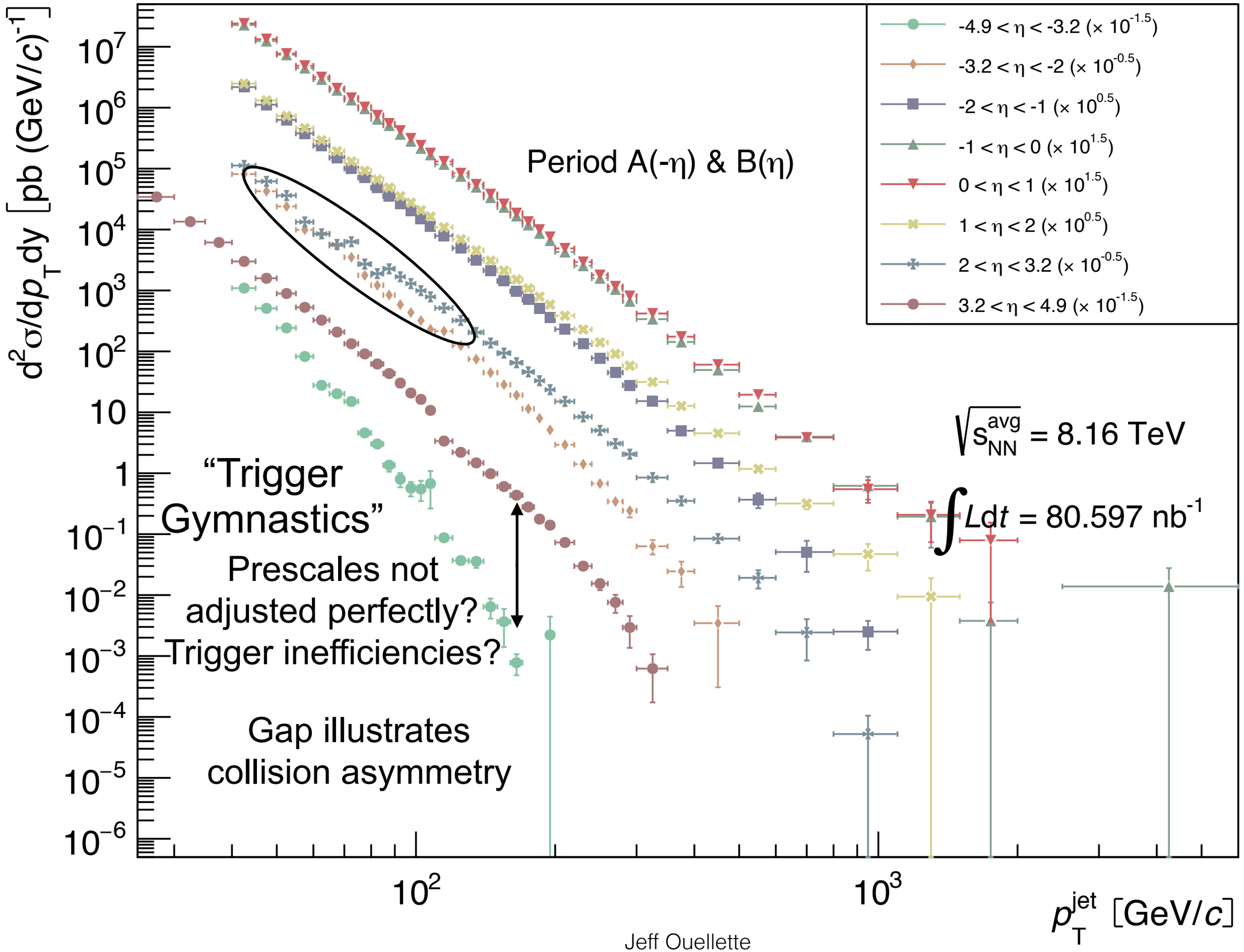
Period A (representative)



Period B (representative)



Inclusive Jet p_T Spectra binned in η



Period A(-η) & B(η)

$\sqrt{s_{NN}^{avg}}$ = 8.16 TeV

$\int Ldt$ = 80.597 nb^{-1}

Leading jet η (lab frame)
- -4.9 < η < -3.2
- -3.2 < η < -2.0
- -2.0 < η < -1.0
- -1.0 < η < 0.0
- 0.0 < η < 1.0
- 1.0 < η < 2.0
- 2.0 < η < 3.2
- 3.2 < η < 4.9

$d^2N/L_{int}dx_a\ dy$ [pb]

Turn-on matches deficiencies at low x_a

In Period B kinematics,

$$x_a = \frac{1}{\sqrt{s_{NN}^{avg}}}\sqrt{\frac{A}{Z}}\left(p_{T3}e^{-\eta_3} + p_{T4}e^{-\eta_4}\right)$$

Trigger turn-on at p_T ~ 20 GeV

→ can find representative x_a

x_a

Period A(-η) & B(η)

$\sqrt{s_{NN}^{avg}} = 8.16$ TeV

$\int L dt = 80.597$ nb^{-1}

Leading jet η (lab frame)
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- -2.0 < η < -1.0
- -1.0 < η < 0.0
- 0.0 < η < 1.0
- 1.0 < η < 2.0
- 2.0 < η < 3.2
- 3.2 < η < 4.9

$d^2N/L_{int}dx_a\,dy$ [pb]

10^{10}, 10^9, 10^8, 10^7, 10^6, 10^5, 10^4, 10^3, 10^2, 10, 1

Similar unexplained deficiency as before below some x_a

In Period B kinematics,

$$x_a = \frac{1}{\sqrt{s_{NN}^{avg}}}\sqrt{\frac{A}{Z}}\left(p_{T3}e^{-\eta_3} + p_{T4}e^{-\eta_4}\right)$$

x_a

10^{-3}, 10^{-2}, 10^{-1}, 1 x_a

Period A(-η) & B(η)

$\sqrt{s_{NN}^{avg}}$ = 8.16 TeV

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Leading jet η (lab frame)
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- 1.0 < η < 2.0
- 2.0 < η < 3.2
- 3.2 < η < 4.9

$d^2N/L_{int}dx_p\,dy$ [pb]

Turn-on matches deficiencies at low x_p

In Period B kinematics,

$$x_p = \frac{1}{\sqrt{s_{NN}^{avg}}}\sqrt{\frac{Z}{A}}\left(p_{T3}e^{\eta_3} + p_{T4}e^{\eta_4}\right)$$

Trigger turn-on at p_T ~ 20 GeV

→ can find representative x_p

x_p

Period A(-η) & B(η)

$\sqrt{s_{NN}^{avg}}$ = 8.16 TeV

$\int Ldt$ = 80.597 nb^{-1}

Leading jet η (lab frame)
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- -3.2 < η < -2.0
- -2.0 < η < -1.0
- -1.0 < η < 0.0
- 0.0 < η < 1.0
- 1.0 < η < 2.0
- 2.0 < η < 3.2
- 3.2 < η < 4.9

$d^2N/L_{int}dx_p\,dy$ [pb]

10^{10}, 10^9, 10^8, 10^7, 10^6, 10^5, 10^4, 10^3, 10^2, 10, 1

X

Similar unexplained deficiency as before below some x_p

In Period B kinematics,

$$x_p = \frac{1}{\sqrt{s_{NN}^{avg}}}\sqrt{\frac{Z}{A}}\left(p_{T3}e^{\eta_3} + p_{T4}e^{\eta_4}\right)$$

x_p

10^{-3}, 10^{-2}, 10^{-1}, 1 x_p

Dijet x_a-x_p cross-correlation

$\sqrt{s_{NN}^{avg}}$ = 8.16 TeV

$\int L dt$ = 80.597 nb^{-1}

Period A(-η) & B(η)

x_p

x_a

$d^2N/L_{int}dx_p dx_a$

Summary

- Implemented best statistics trigger selection
- Generated inclusive p_T spectra and PDFs
- Still to come: shrinking proton analysis by looking at FCAL energy deposition as a function of x_p