Inclusive jets in *p-Pb* and measuring Bjorken x distributions (+ towards R_{pPb})

Jeff Ouellette, CU Boulder

2/6/2018

Last Time

- All triggers now acquired/ being used in analysis

  → trigger inefficiencies were avoided by assuming 100% above p_T+10GeV

  → trigger efficiency analysis now performed, now being used to set trigger thresholds for individual triggers (somewhat arbitrarily, comments appreciated)

  → dividing by efficiency when jet satisfies imposed Pt cut

- Triggers were prescale weighted and luminosity was “uniform”

  → now using lumis from lumicalc (thanks to Martin - this helped a lot)

- Trigger selection now based on most prescale-corrected luminosity instead of most raw counts - should be less biased

Bootstrapping Efficiencies

- Trigger efficiencies calculated with bootstrap method
- HLT_mb_mbts_L1MBTS used for minbias sample to maximize # minbias events
- Lots of triggers → long trigger bootstrap chains
- Length of bootstrap chains reduced by which ones are relevant to each run, separation in η requirements, etc.

Example: Runs 313063-313435

HLT_mb_mbts_L1MBTS

HLT_j15_ion_n320eta490_L1MBTS_1_1

HLT_j25_ion_n320eta490_L1TE5

HLT_j35_ion_n320eta490_L1TE10

HLT_j45_ion_n320eta490

HLT_j55_ion_n320eta490

HLT_j65_ion_n320eta490

HLT_j30_ion_0eta490_L1TE10

HLT_j40_ion_L1J5

HLT_j50_ion_L1J10

HLT_j60_ion_L1J20

HLT_j75_ion_L1J20

HLT_j90_ion_L1J20

HLT_j100_ion_L1J20

HLT_j45_ion_n200eta320

HLT_j55_ion_n200eta320

HLT_j65_ion_n200eta320

HLT_j75_ion_n200eta320

$$\varepsilon_{\text{trig}}\left(p_T\right) = \frac{\text{Times fired}}{\text{Total times}} \sim \varepsilon_{\text{ref}}\left(p_T\right) \times \frac{\text{Times fired}}{\text{Times reference fired}}$$

Example: Runs 313063-313435

HLT_mb_mbts_L1MBTS

HLT_j15_ion_n320eta490_L1MBTS_1_

HLT_j25_ion_n320eta490_L1TE5

HLT_j35_ion_n320eta490_L1TE10

HLT_j45_ion_n320eta490

HLT_j55_ion_n320eta490

HLT_j65_ion_n320eta490

HLT_j30_ion_0eta490_L1TE10

HLT_j40_ion_L1J5

HLT_j50_ion_L1J10

HLT_j60_ion_L1J20

HLT_j75_ion_L1J20

HLT_j90_ion_L1J20

HLT_j100_ion_L1J20

HLT_j45_ion_n200eta320

HLT_j55_ion_n200eta320

HLT_j65_ion_n200eta320

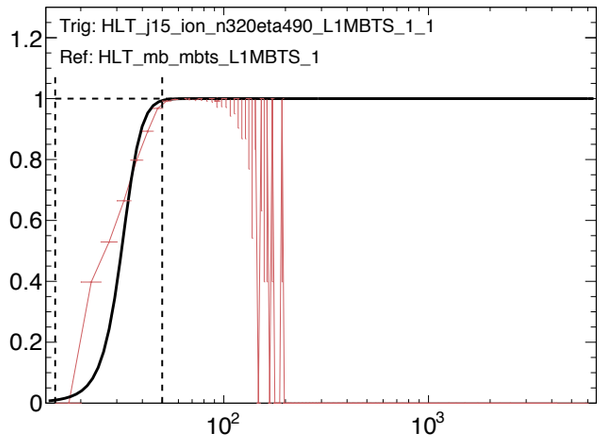
HLT_j75_ion_n200eta320

$$\varepsilon_{\text{trig}}\left(p_T\right) = \frac{\text{Times fired}}{\text{Total times}} \sim \varepsilon_{\text{ref}}\left(p_T\right) \times \frac{\text{Times fired}}{\text{Times reference fired}}$$

- Shown are bootstrapped efficiencies from 15-6000 GeV (for convenience with remainder of analysis)
- Left line = listed trigger threshold
- Right line = additional threshold required in analysis
- Fitted curve is a Fermi-Dirac-esque distribution with parameters λ, p_0

$$\varepsilon_{\mathrm{trig}}\left(p_T\right) = \frac{1}{1 + e^{\lambda(p_0 - p_T)}}$$

- Also tried a Gaussian error function, but the fits often missed the turn on region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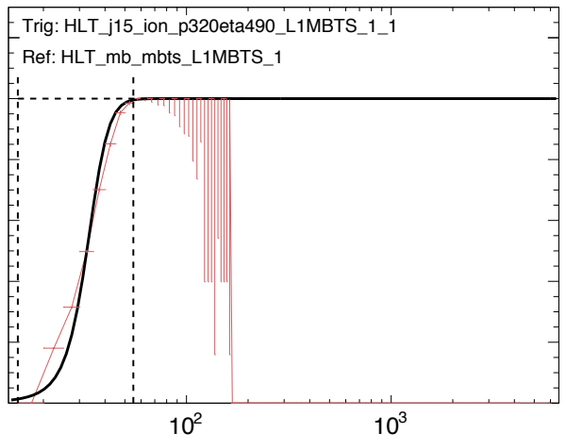
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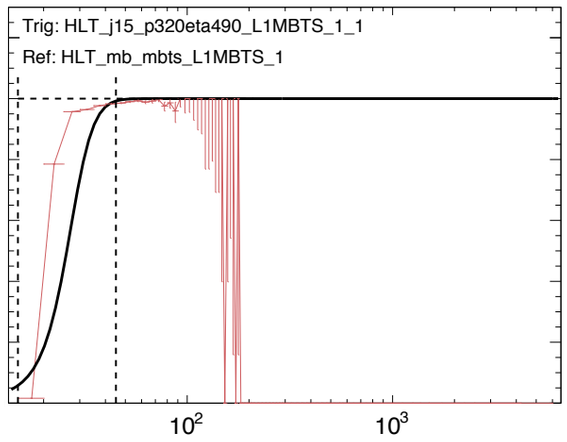
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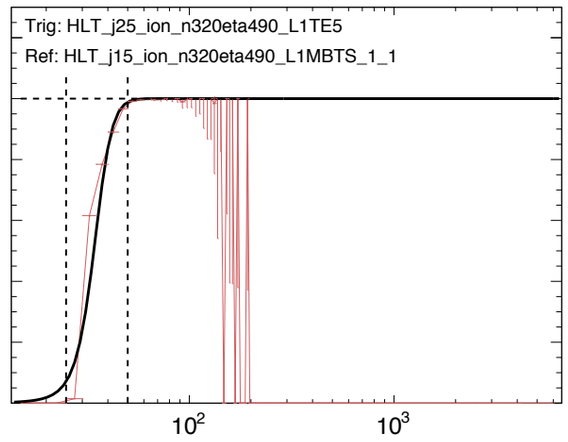
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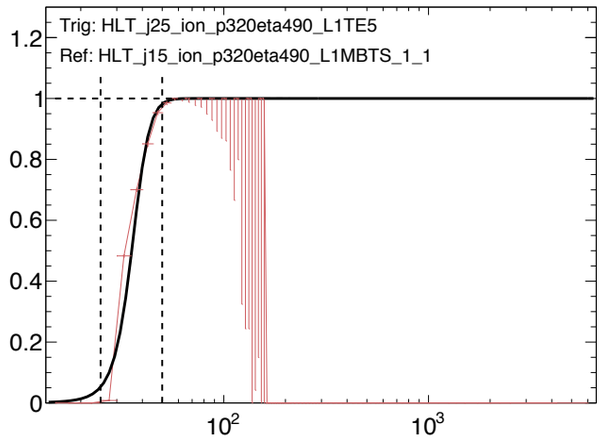
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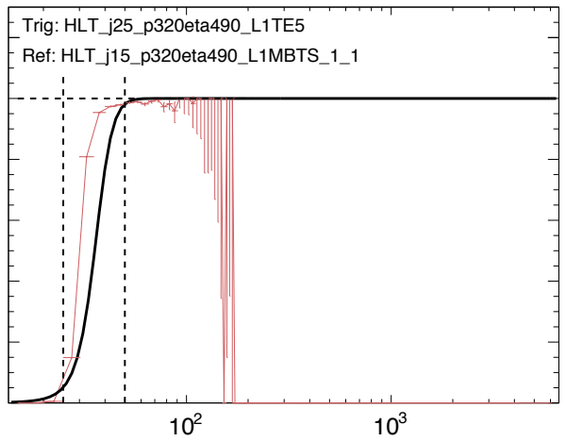
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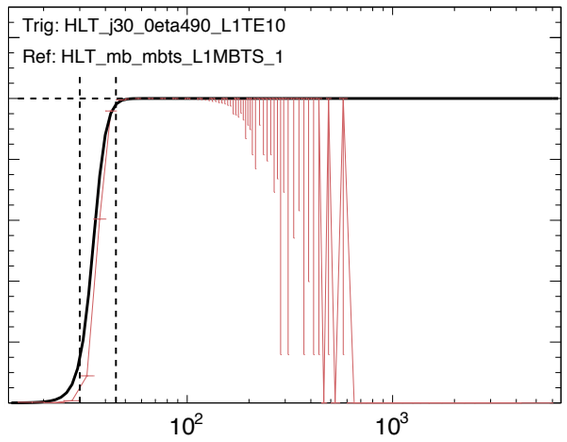
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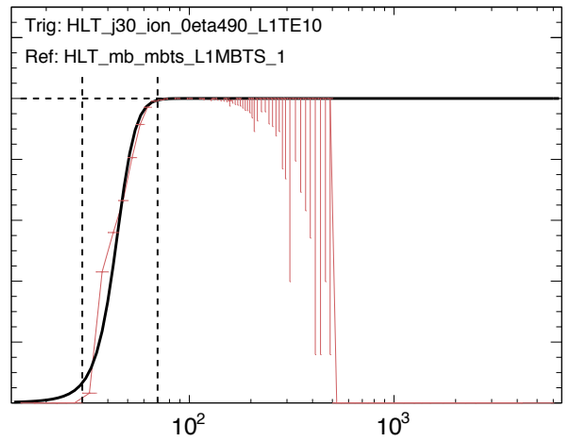
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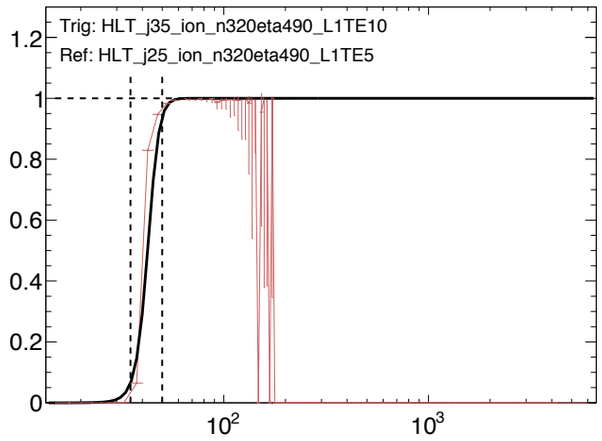
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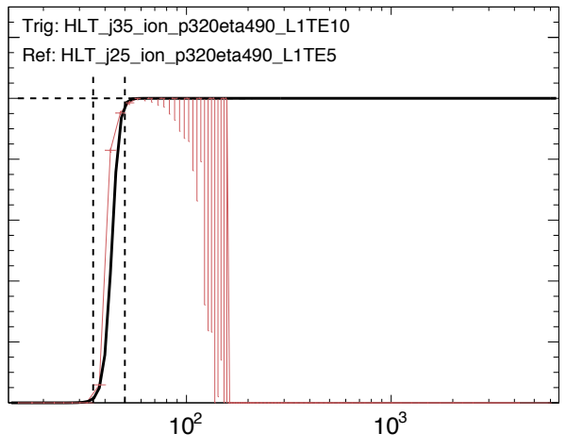
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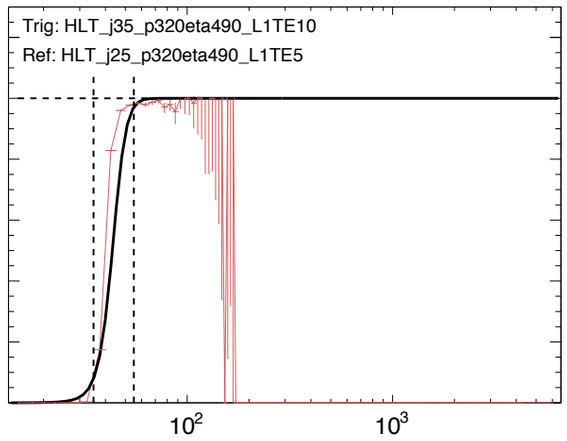
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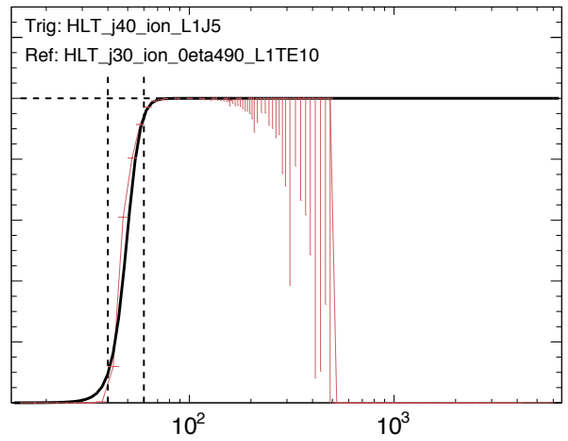
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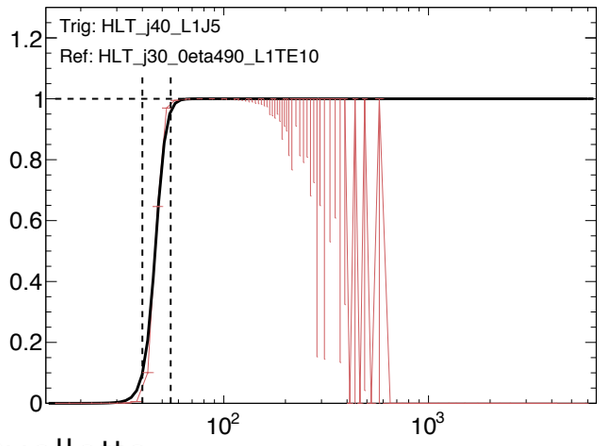
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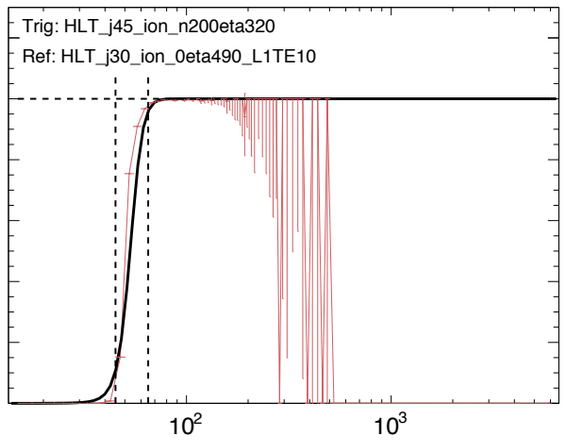
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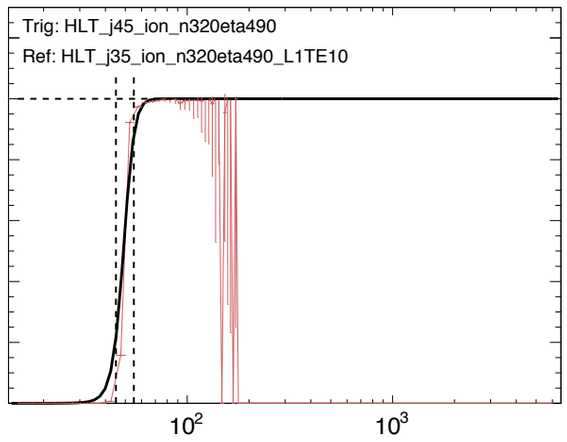
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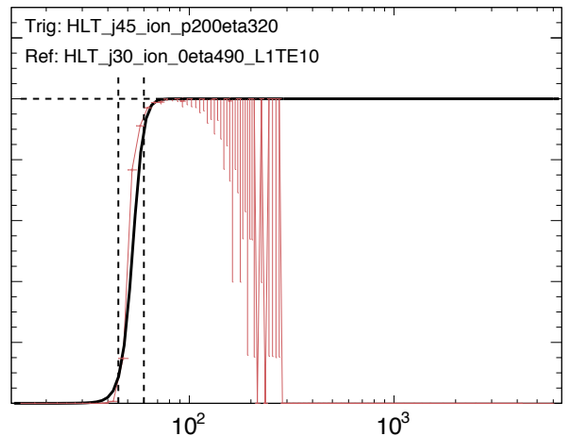
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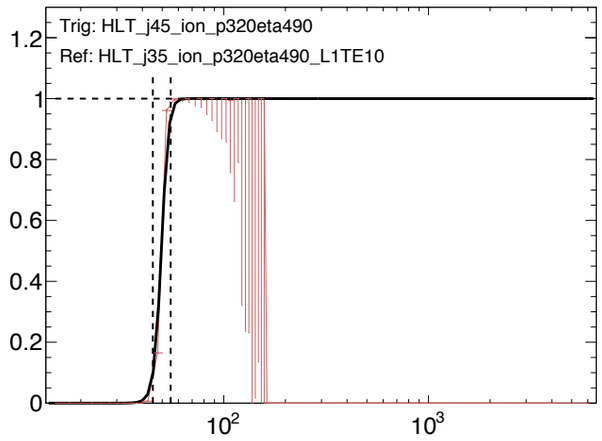
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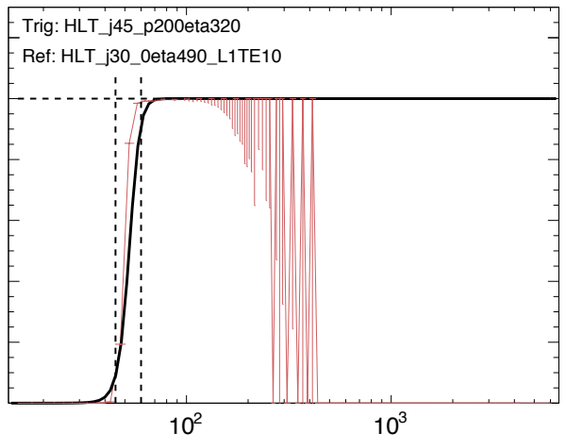
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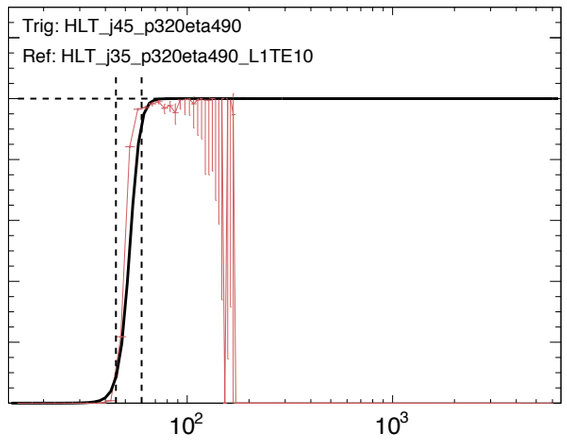
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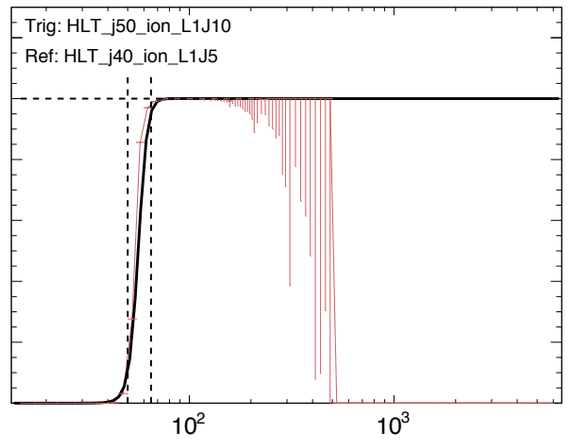
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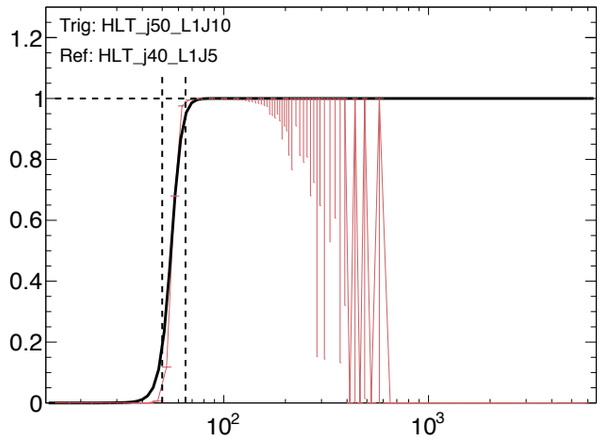
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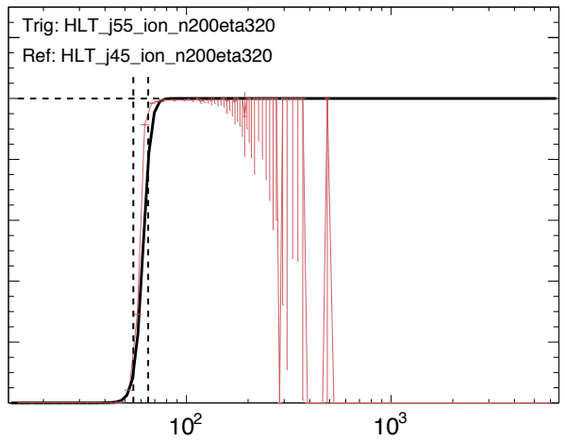
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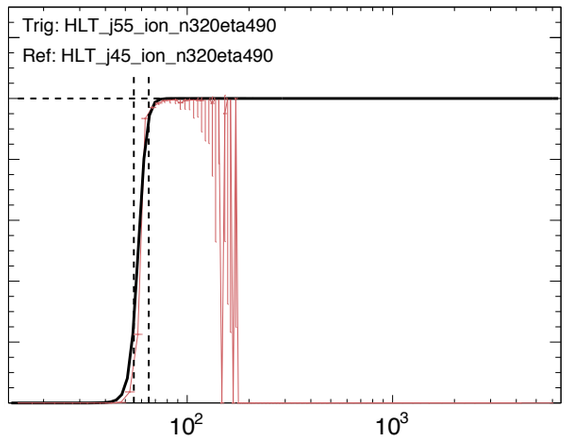
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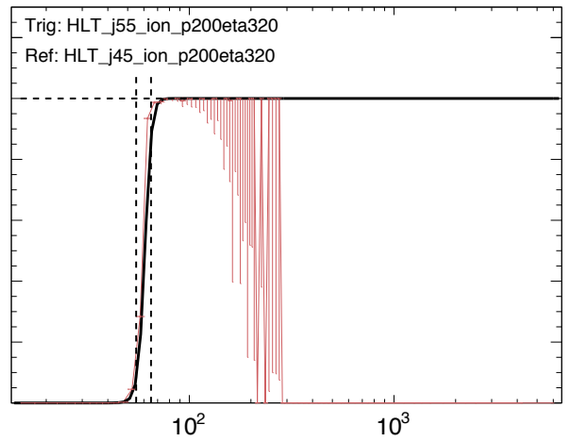
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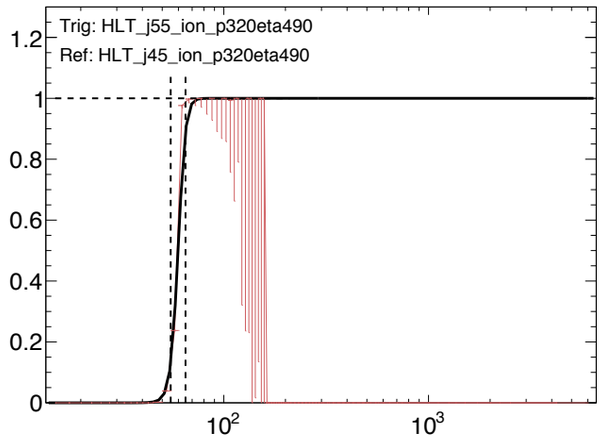
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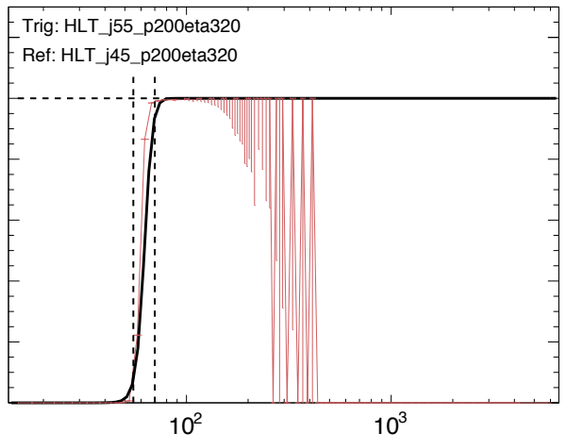
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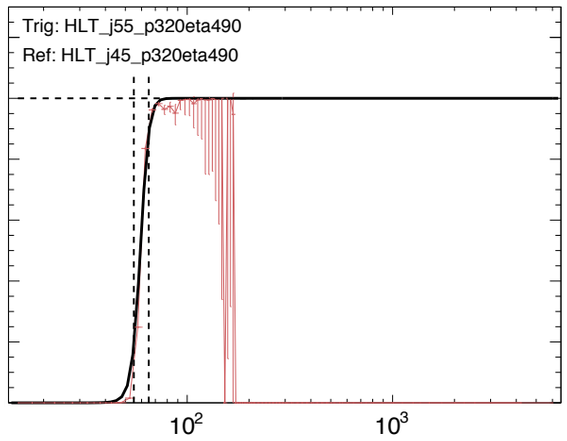
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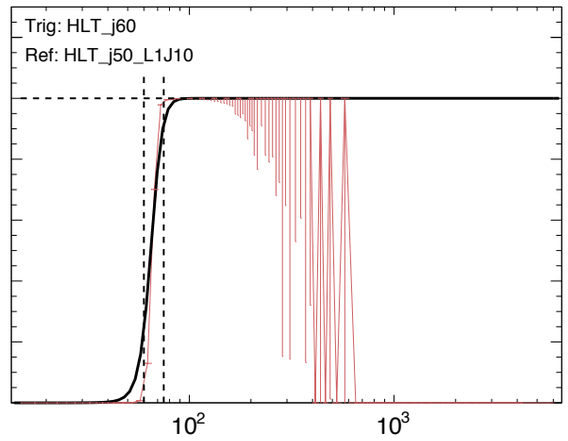
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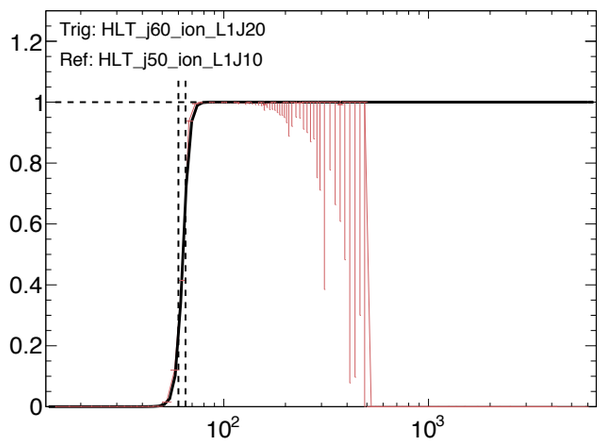
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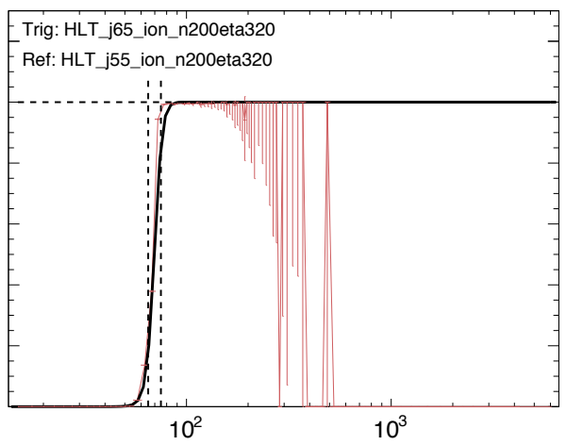
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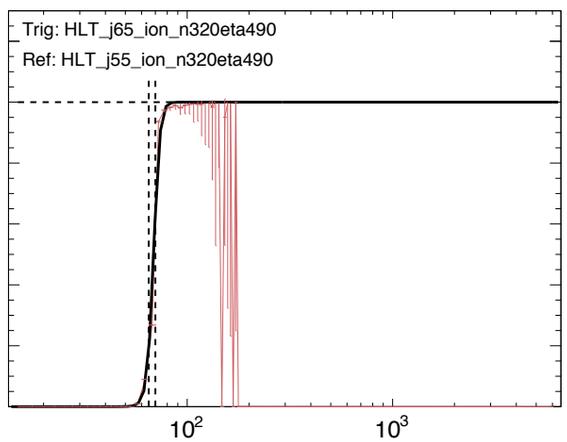
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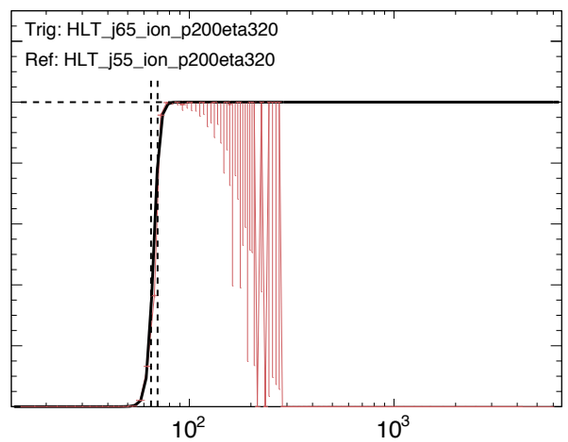
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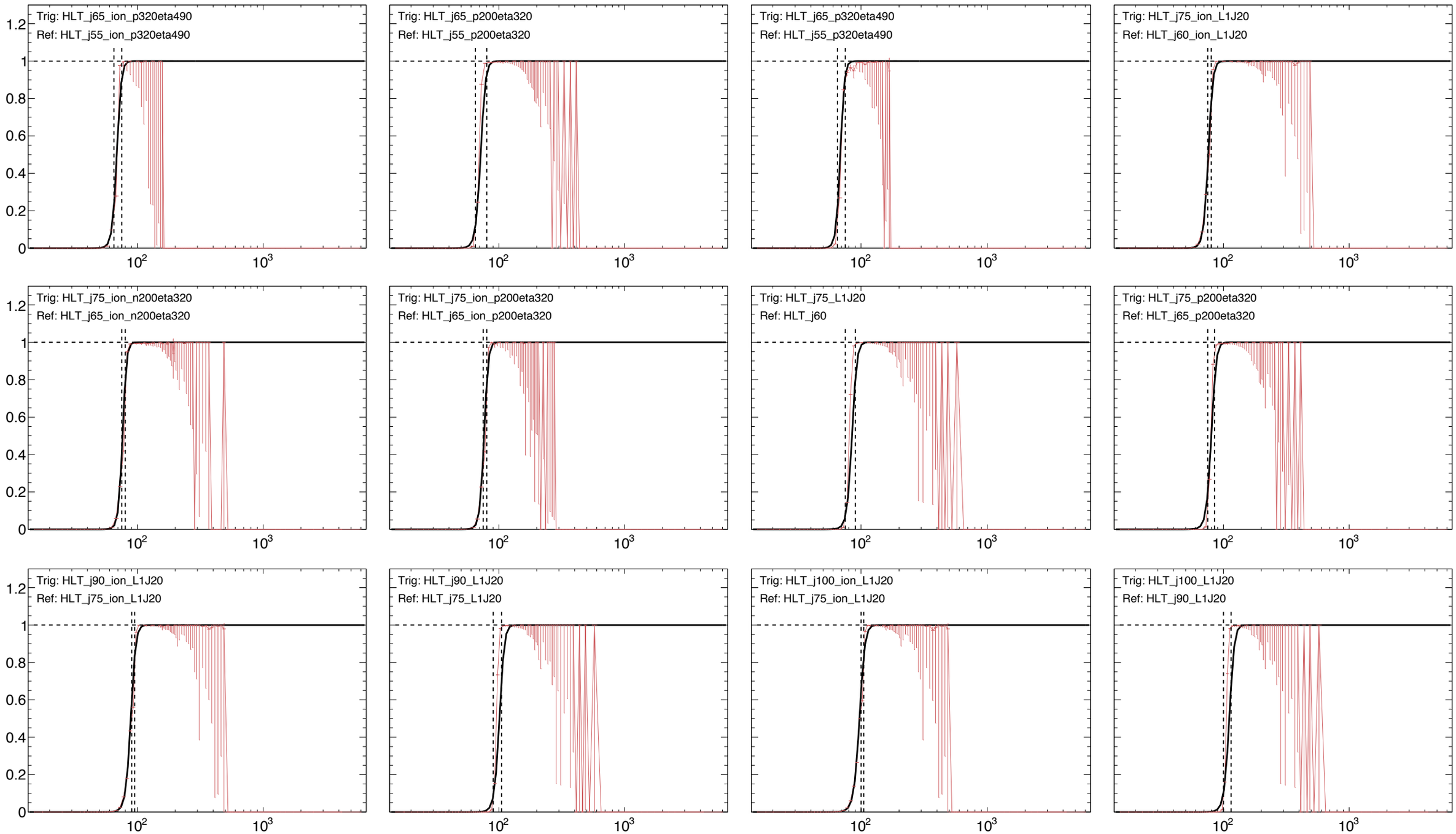
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Trig: HLT_j75_ion_L1J20
Ref: HLT_j60_ion_L1J20
Trig: HLT_j75_ion_n200eta320
Ref: HLT_j65_ion_n200eta320
Trig: HLT_j75_ion_p200eta320
Ref: HLT_j65_ion_p200eta320
Trig: HLT_j75_L1J20
Ref: HLT_j60
Trig: HLT_j75_p200eta320
Ref: HLT_j65_p200eta320
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Ref: HLT_j75_ion_L1J20
Trig: HLT_j90_L1J20
Ref: HLT_j75_L1J20
Trig: HLT_j100_ion_L1J20
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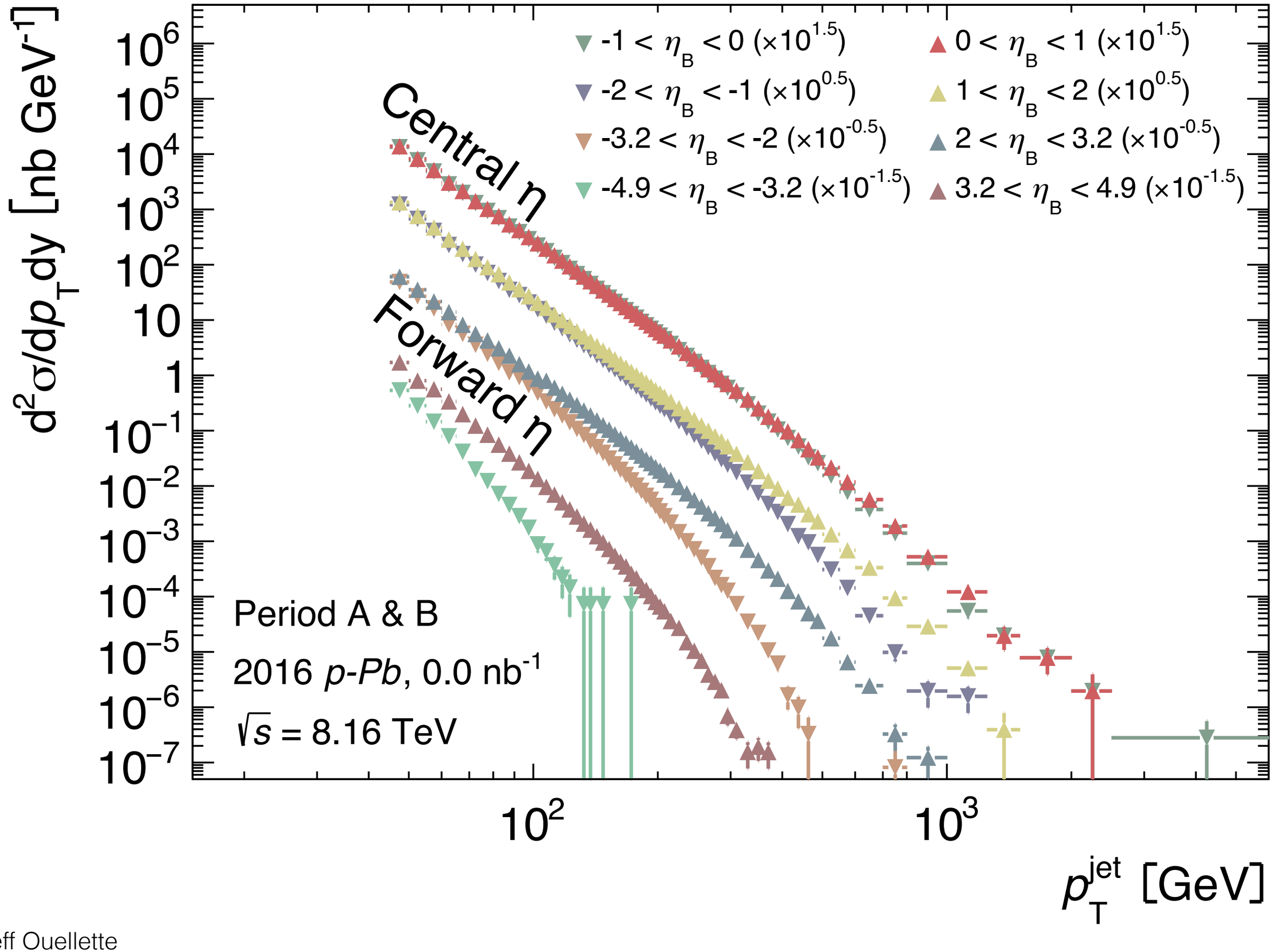
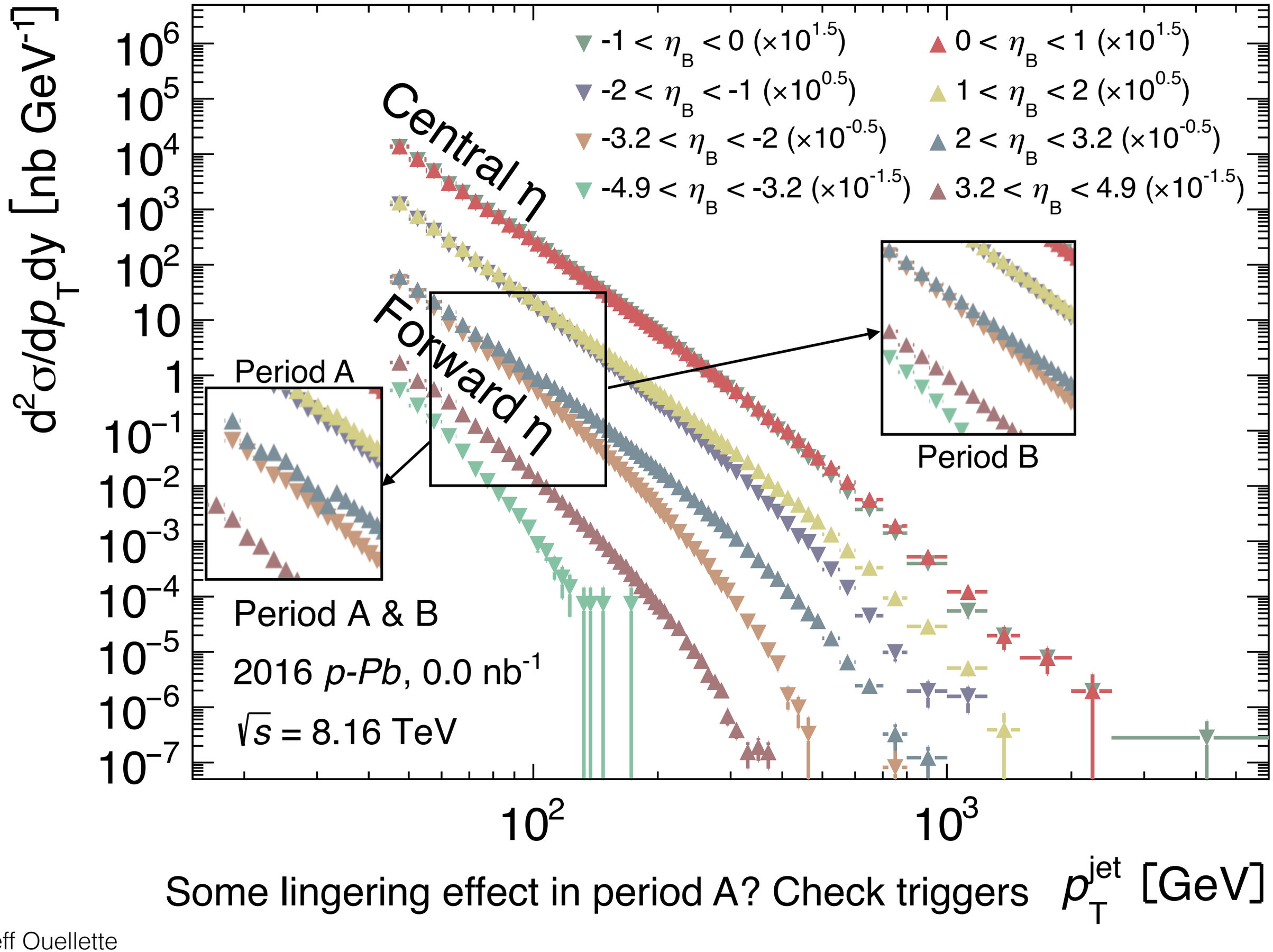
Trig: HLT_j100_L1J20
Ref: HLT_j90_L1J20

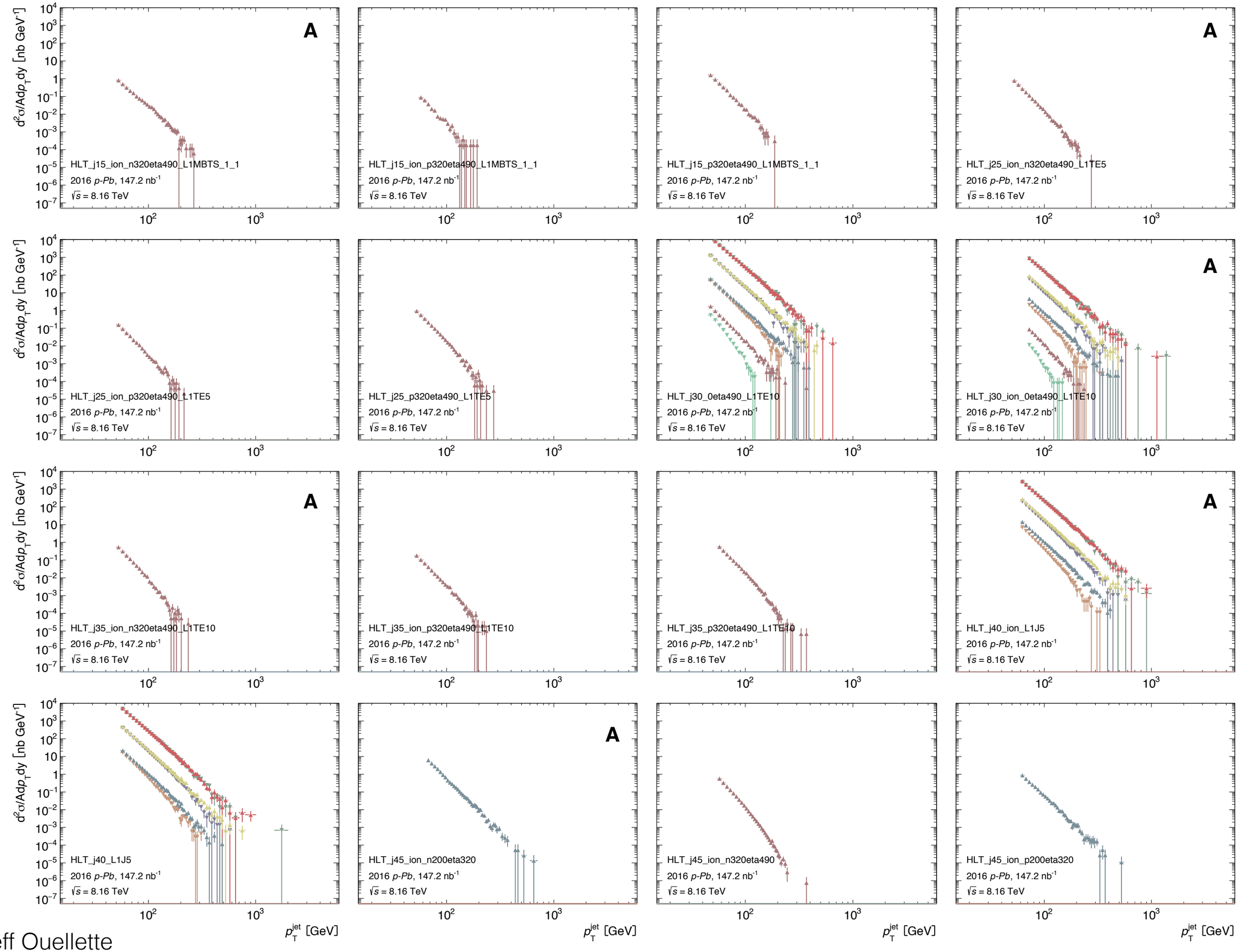
Updated Inclusive Pt Spectrum

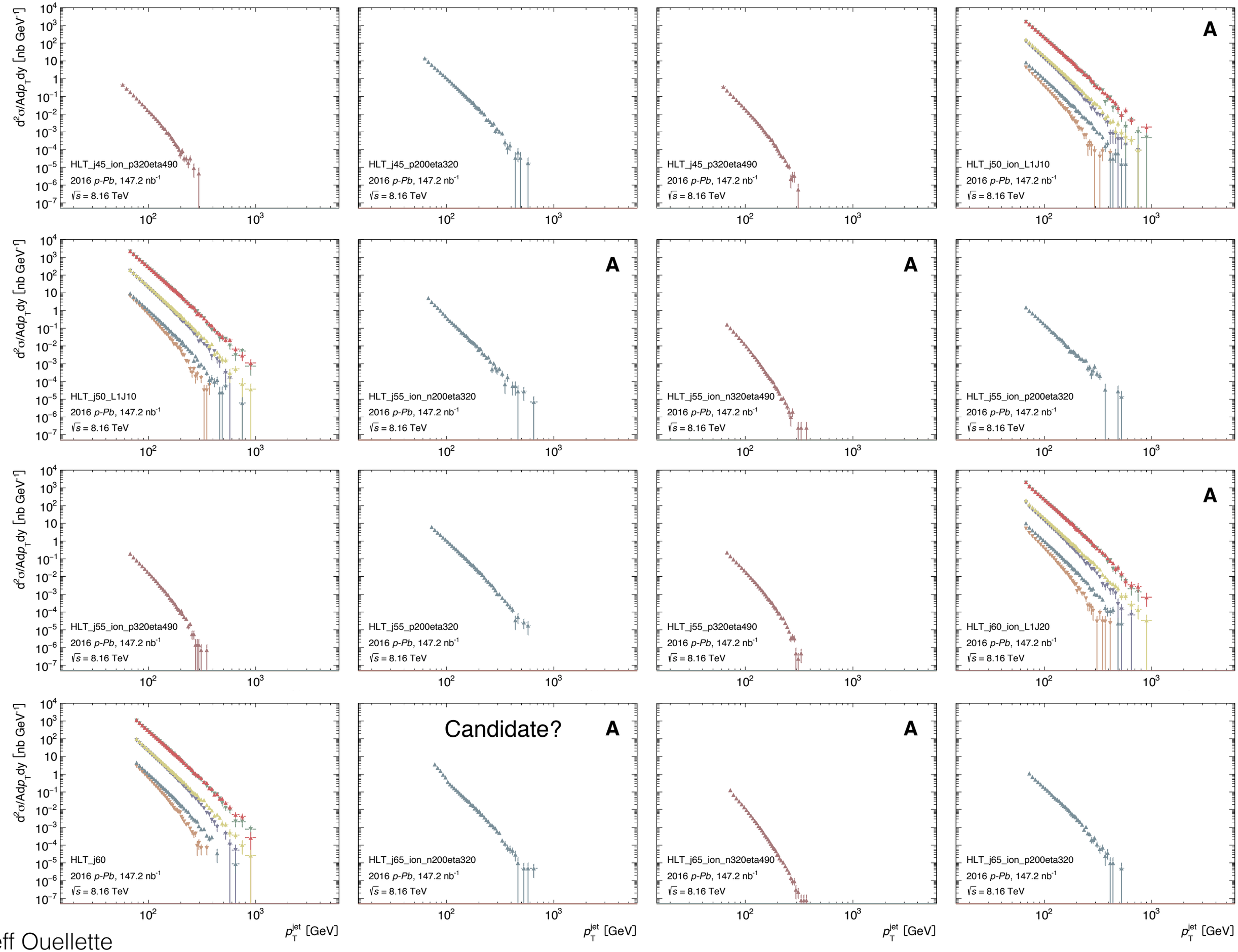


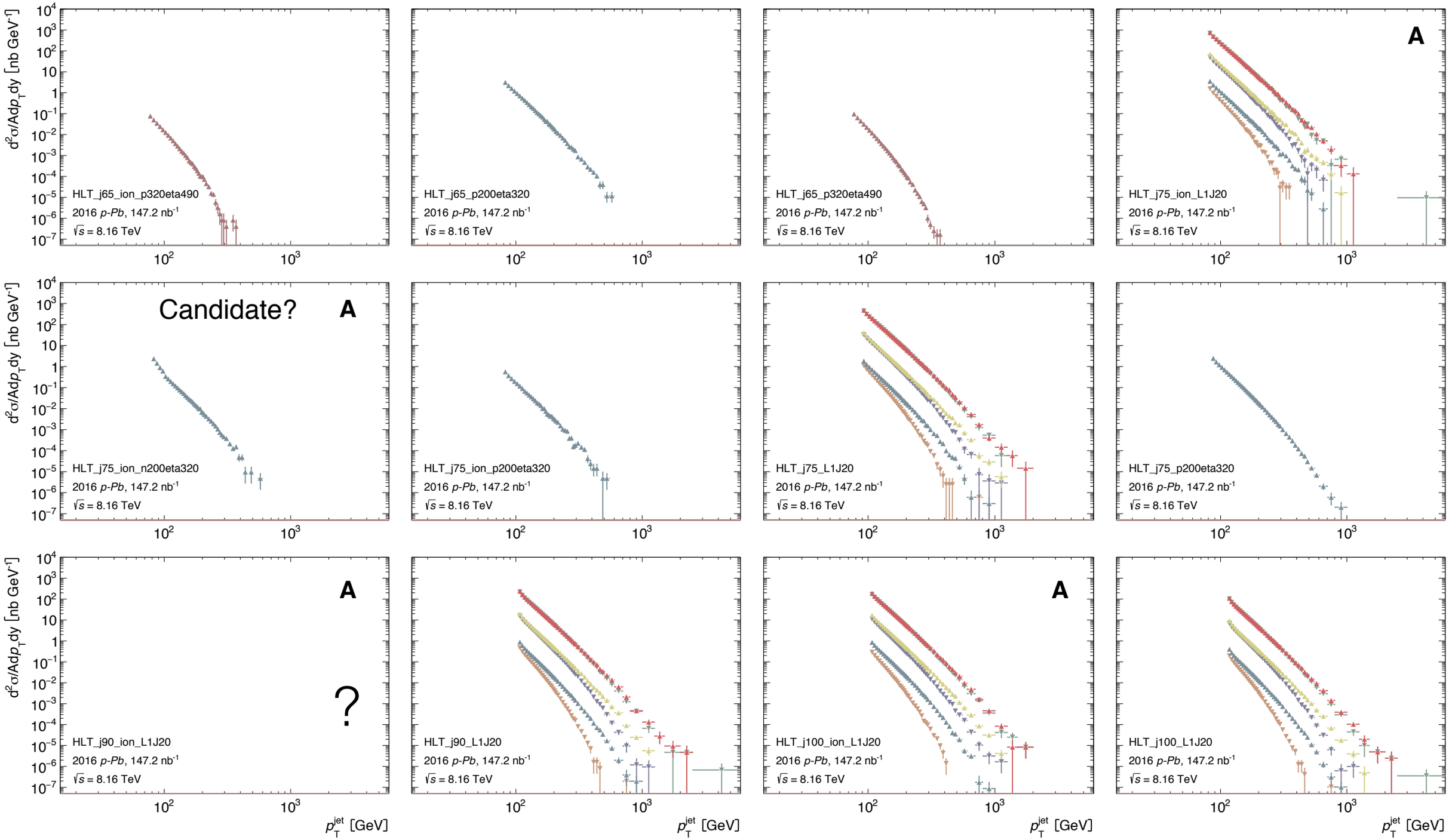
Updated Inclusive Pt Spectrum



Some lingering effect in period A? Check triggers


A
HLT_j15_ion_n320eta490_L1MBTS_1_1
HLT_j15_ion_p320eta490_L1MBTS_1_1
HLT_j15_p320eta490_L1MBTS_1_1
HLT_j25_ion_n320eta490_L1TE5
HLT_j25_ion_p320eta490_L1TE5
HLT_j25_p320eta490_L1TE5
HLT_j30_0eta490_L1TE10
HLT_j30_ion_0eta490_L1TE10
HLT_j35_ion_n320eta490_L1TE10
HLT_j35_ion_p320eta490_L1TE10
HLT_j35_p320eta490_L1TE10
HLT_j40_ion_L1J5
HLT_j40_L1J5
HLT_j45_ion_n200eta320
HLT_j45_ion_n320eta490
HLT_j45_ion_p200eta320
2016 p-Pb, 147.2 nb-1
√s = 8.16 TeV
d2σ/Adpᵀdy [nb GeV-1]
pᵀjet [GeV]


HLT_j45_ion_p320eta490
HLT_j45_p200eta320
HLT_j45_p320eta490
HLT_j50_ion_L1J10
HLT_j50_L1J10
HLT_j55_ion_n200eta320
HLT_j55_ion_n320eta490
HLT_j55_ion_p200eta320
HLT_j55_ion_p320eta490
HLT_j55_p200eta320
HLT_j55_p320eta490
HLT_j60_ion_L1J20
HLT_j60
HLT_j65_ion_n200eta320
HLT_j65_ion_n320eta490
HLT_j65_ion_p200eta320
2016 p-Pb, 147.2 nb-1
√s = 8.16 TeV
A
Candidate?
d2σ/Adpt dy [nb GeV-1]
pjet T [GeV]



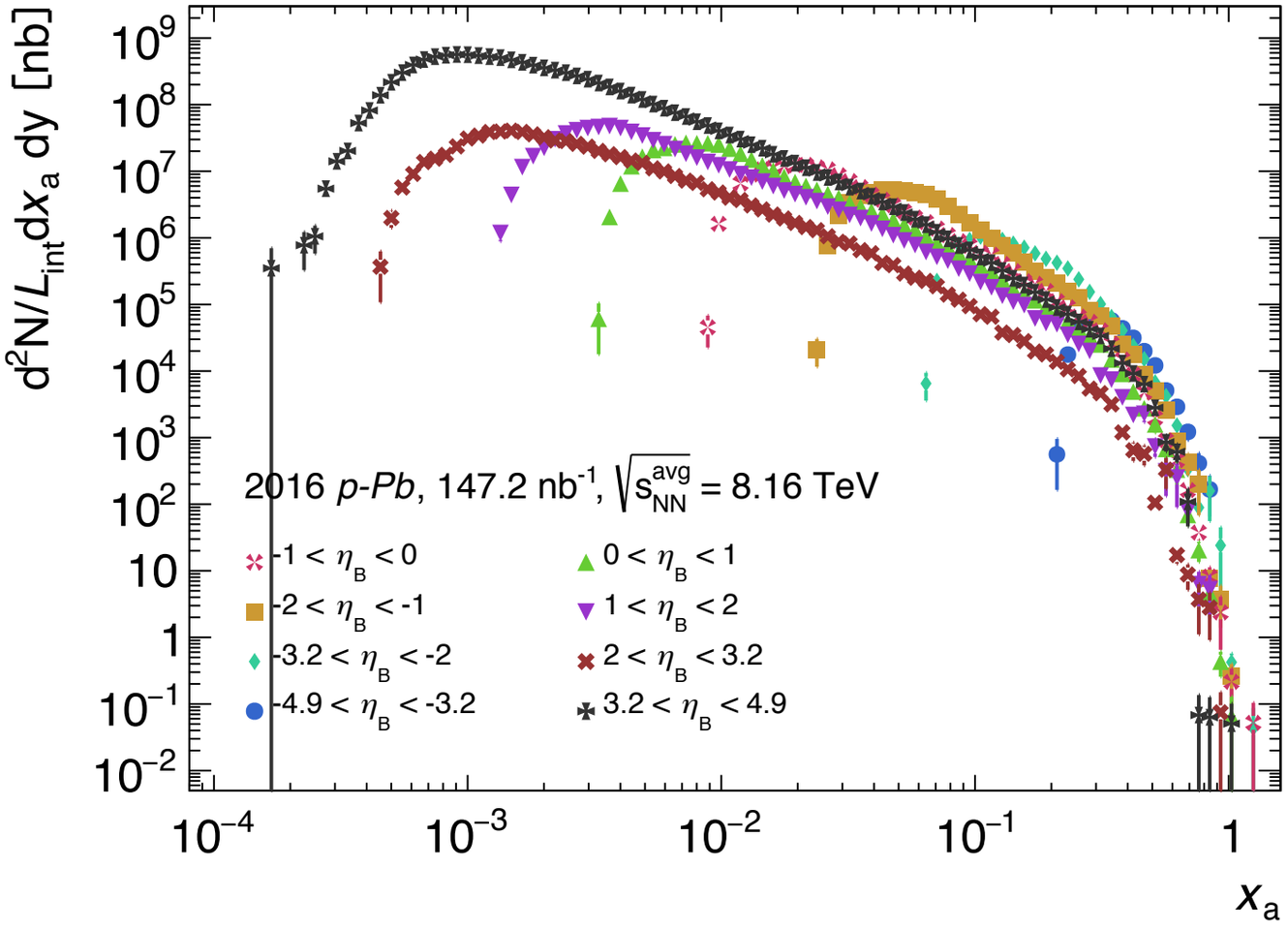
HLT_j65_n200eta320 seems like the culprit? Efficiency fit could be better.

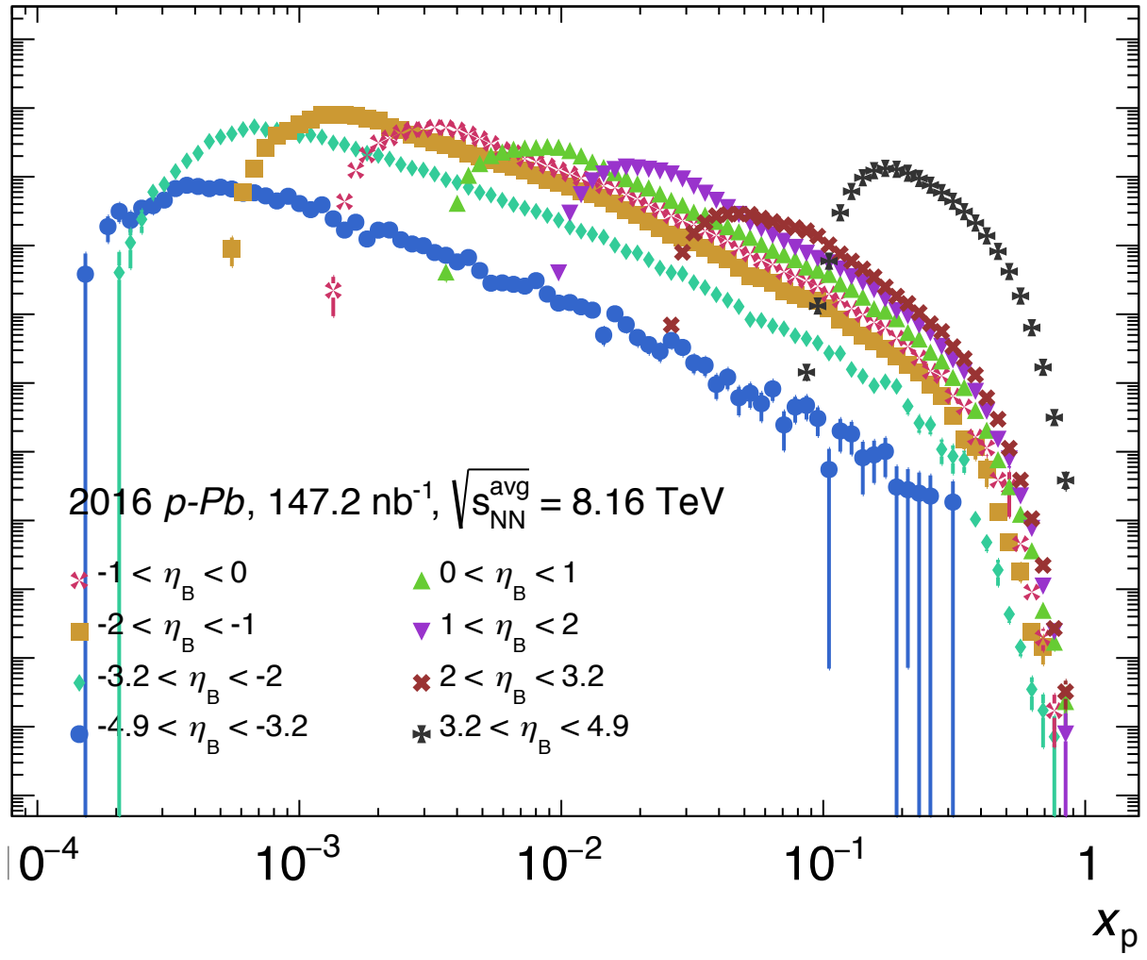
→ Leads to need for systematic threshold selection. Method needs to account for:

(1) error in the turn-on area, and

(2) non-vanishing derivative of functional fit around/above threshold region

Bjorken x's binned by pseudorapidity

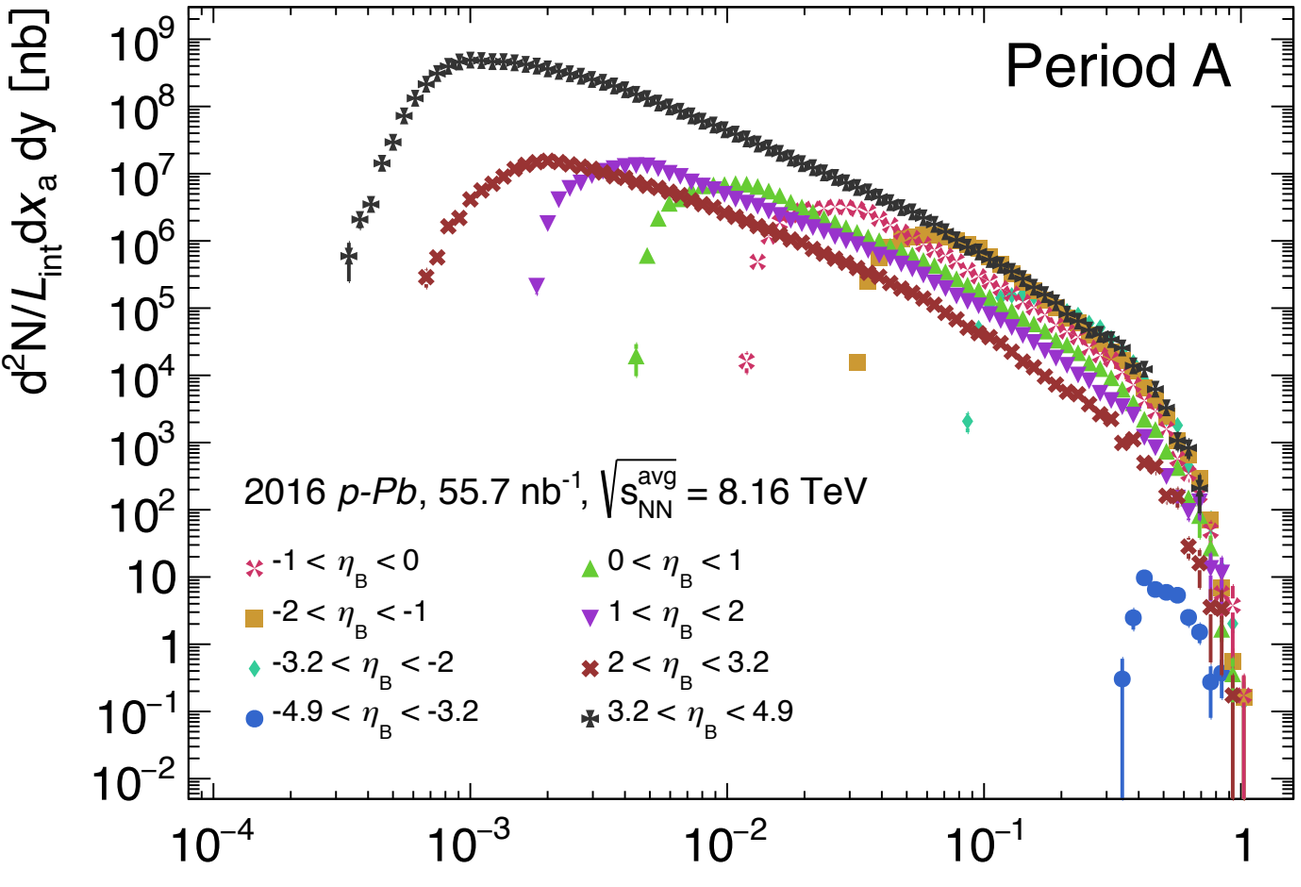


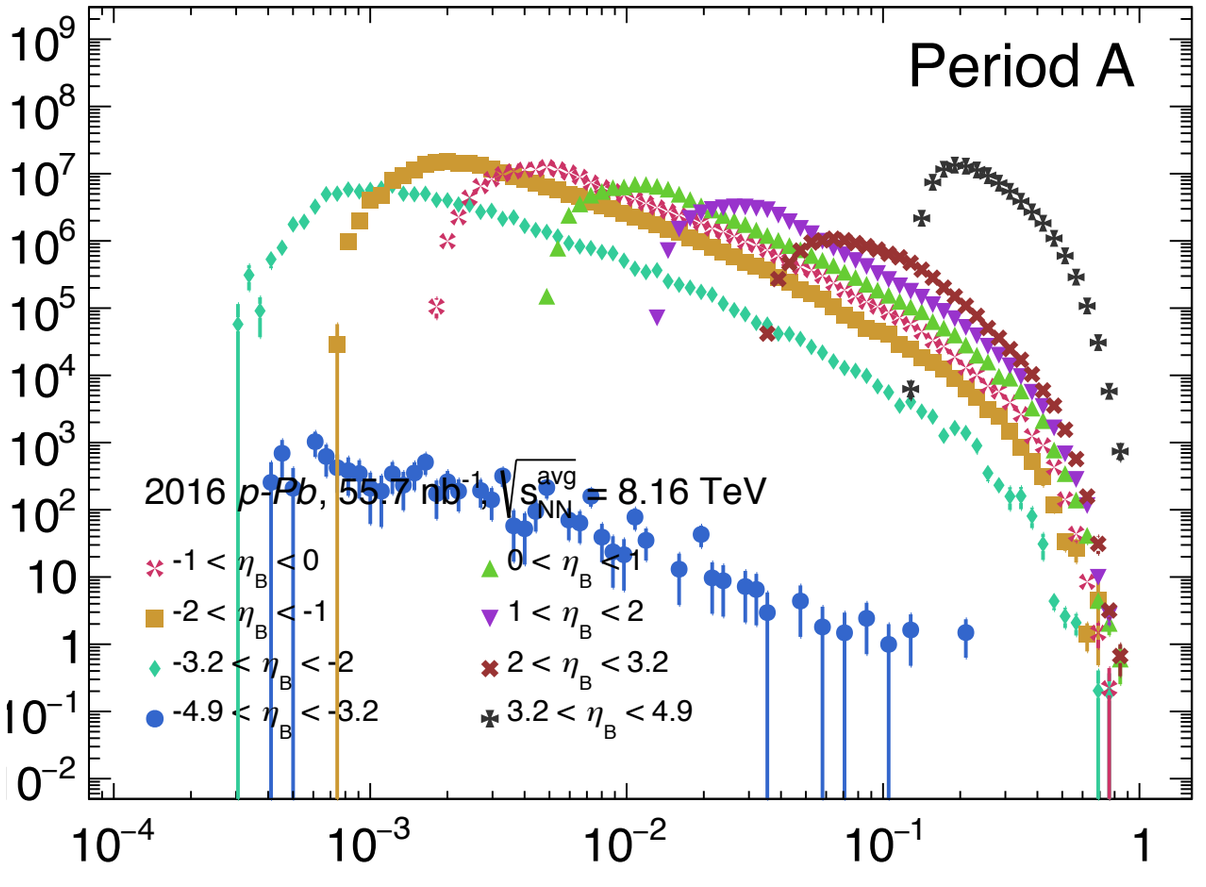


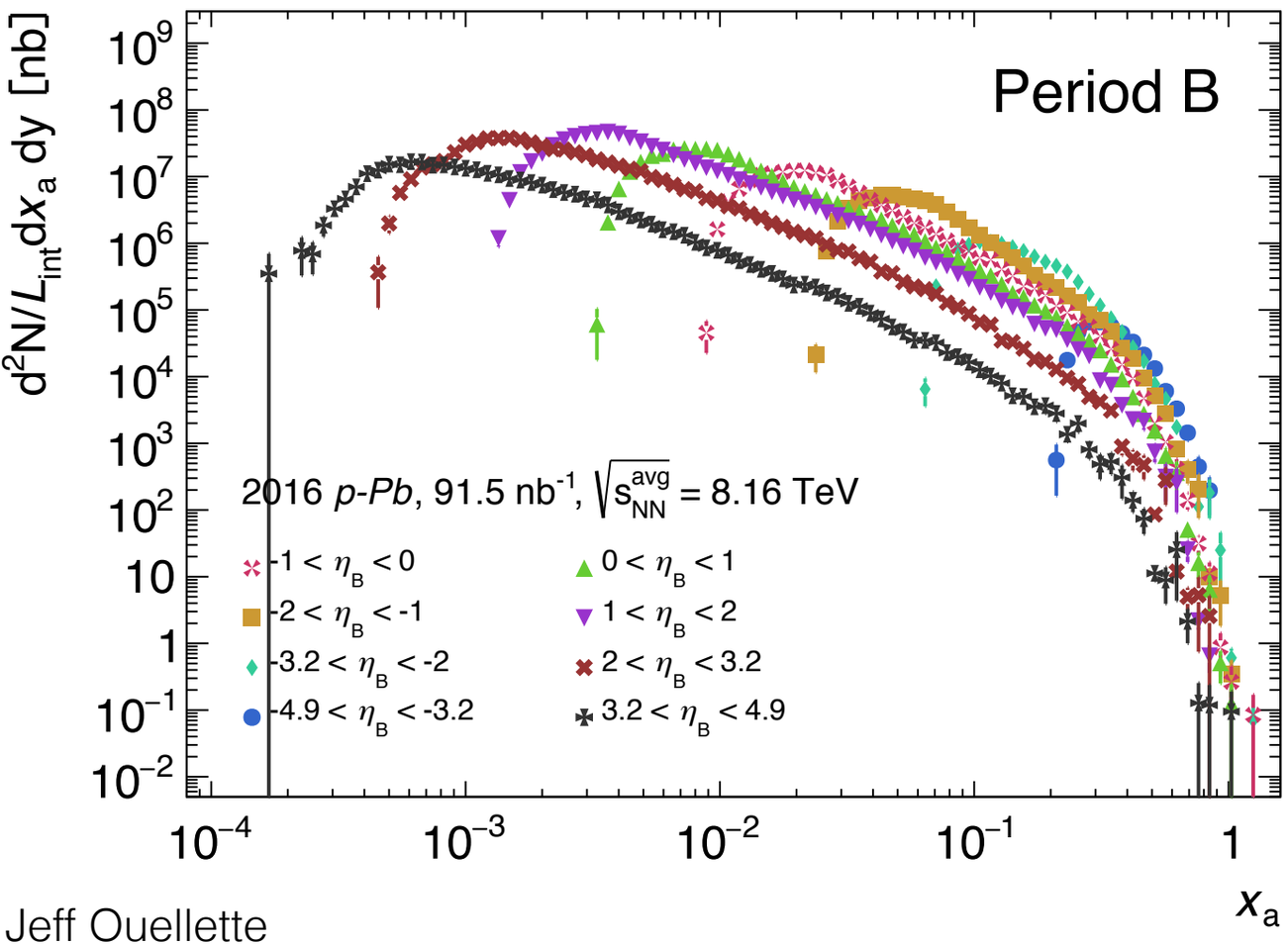
Event selection: Dijet ratio ≧ 0.7, leading jet trigger

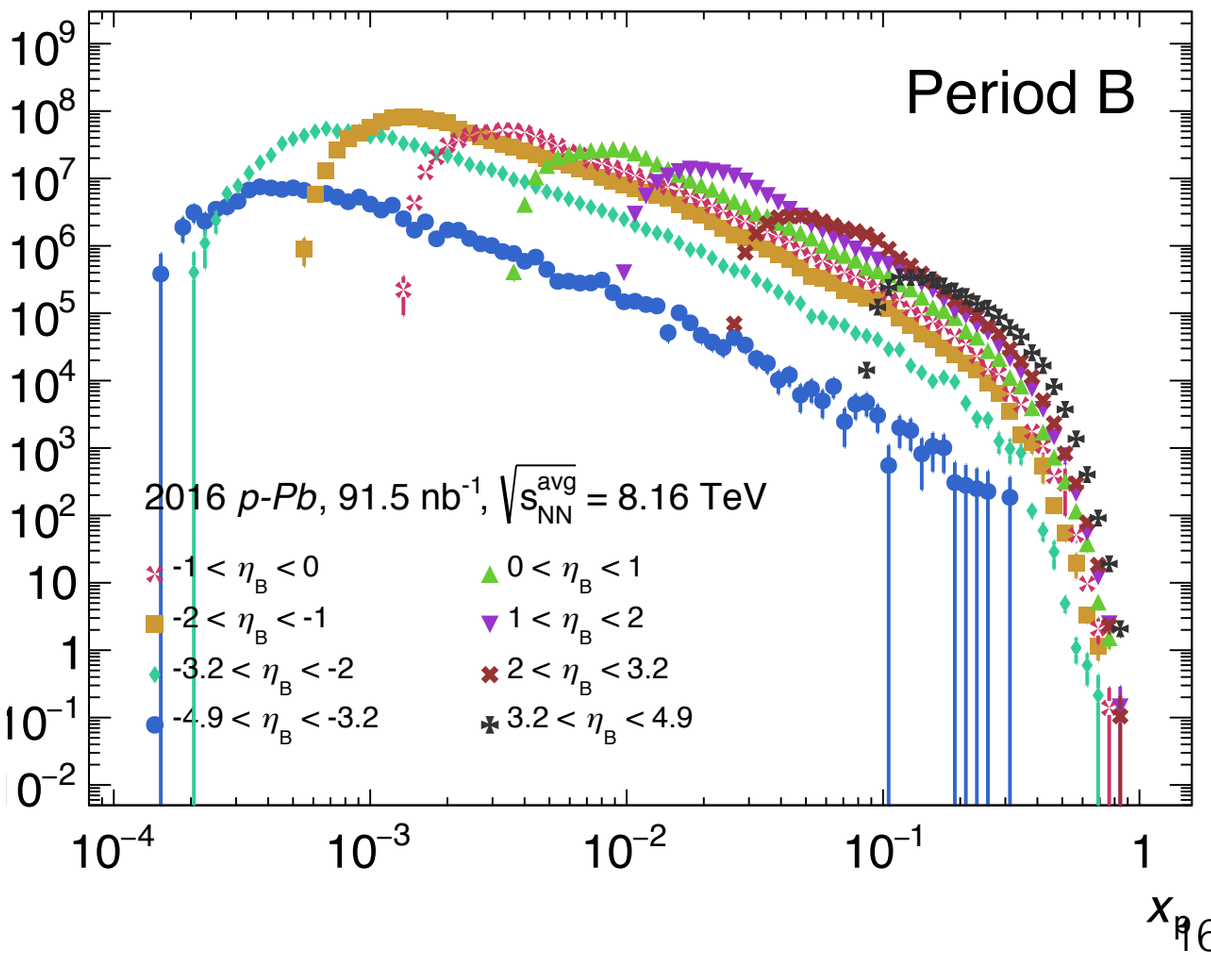
Fill by leading jet, weighted by 1/(luminosity * efficiency)

→ *Still* an excess in 3.2 < η < 4.9 bin? Only present in period A!

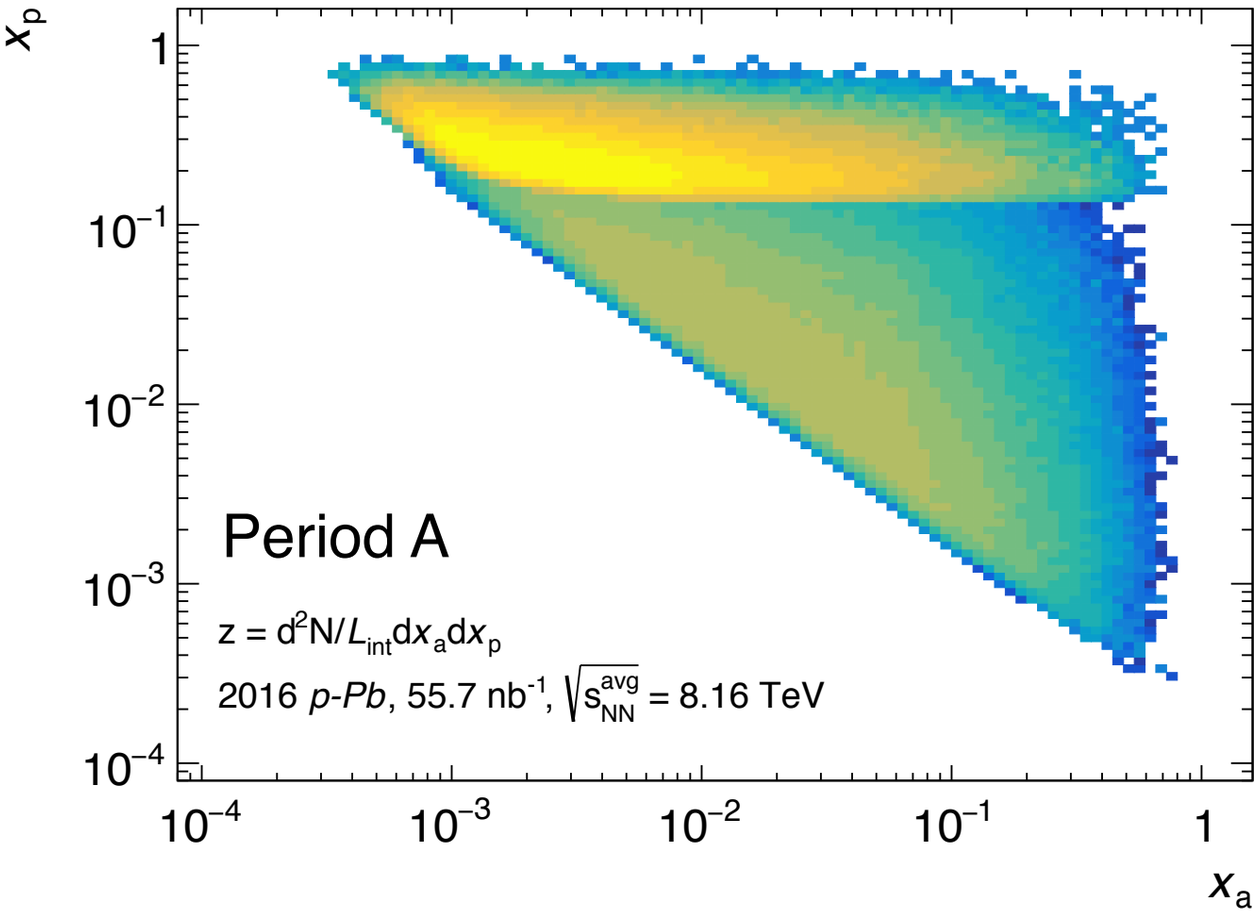

Period A
2016 p-Pb, 55.7 nb-1, √sNNavg = 8.16 TeV
-1 < ηB < 0
-2 < ηB < -1
-3.2 < ηB < -2
-4.9 < ηB < -3.2
0 < ηB < 1
1 < ηB < 2
2 < ηB < 3.2
3.2 < ηB < 4.9
d2N/Lintdxa dy [nb]

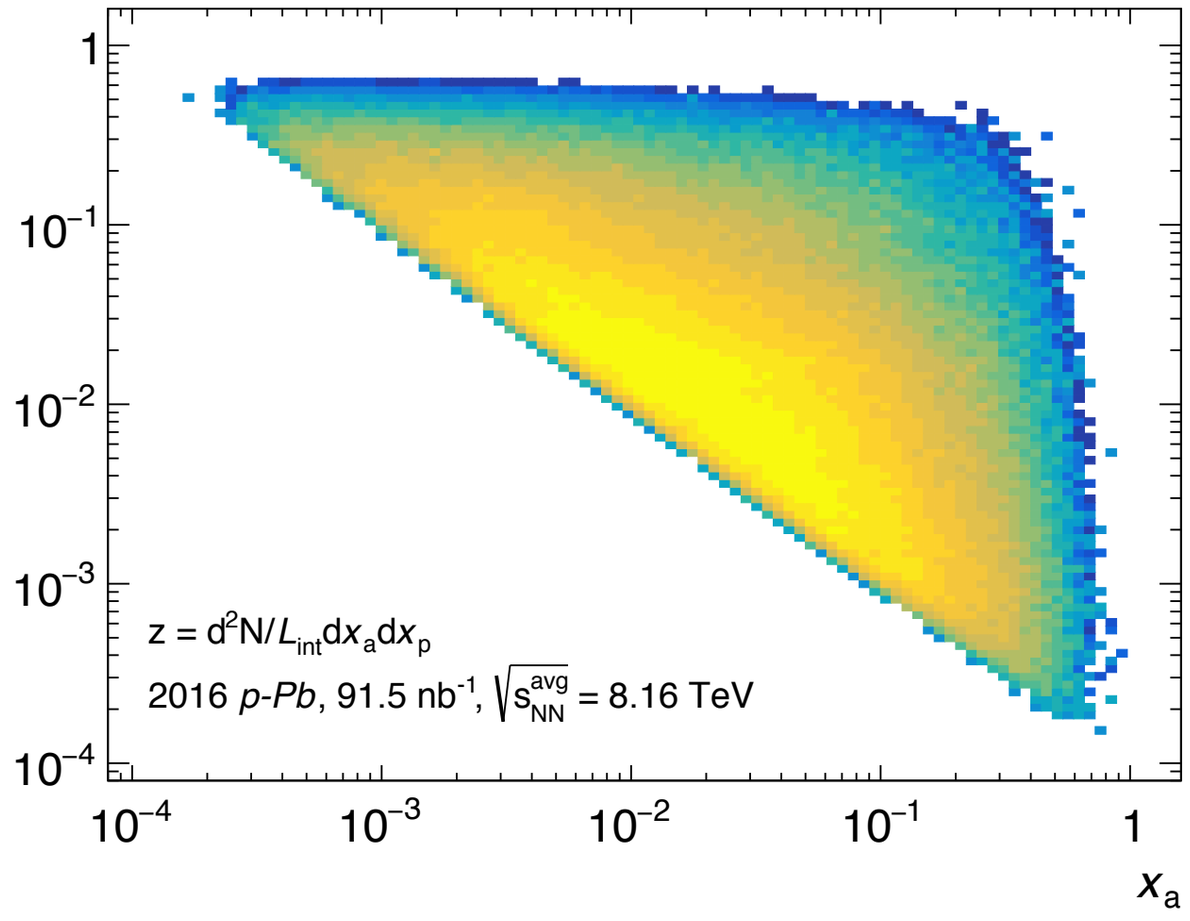

Period A
2016 p-Pb, 55.7 nb-1, √sNNavg = 8.16 TeV
-1 < ηB < 0
-2 < ηB < -1
-3.2 < ηB < -2
-4.9 < ηB < -3.2
0 < ηB < 1
1 < ηB < 2
2 < ηB < 3.2
3.2 < ηB < 4.9


Period B
2016 p-Pb, 91.5 nb-1, √sNNavg = 8.16 TeV
-1 < ηB < 0
-2 < ηB < -1
-3.2 < ηB < -2
-4.9 < ηB < -3.2
0 < ηB < 1
1 < ηB < 2
2 < ηB < 3.2
3.2 < ηB < 4.9
d2N/Lintdxa dy [nb]
xa

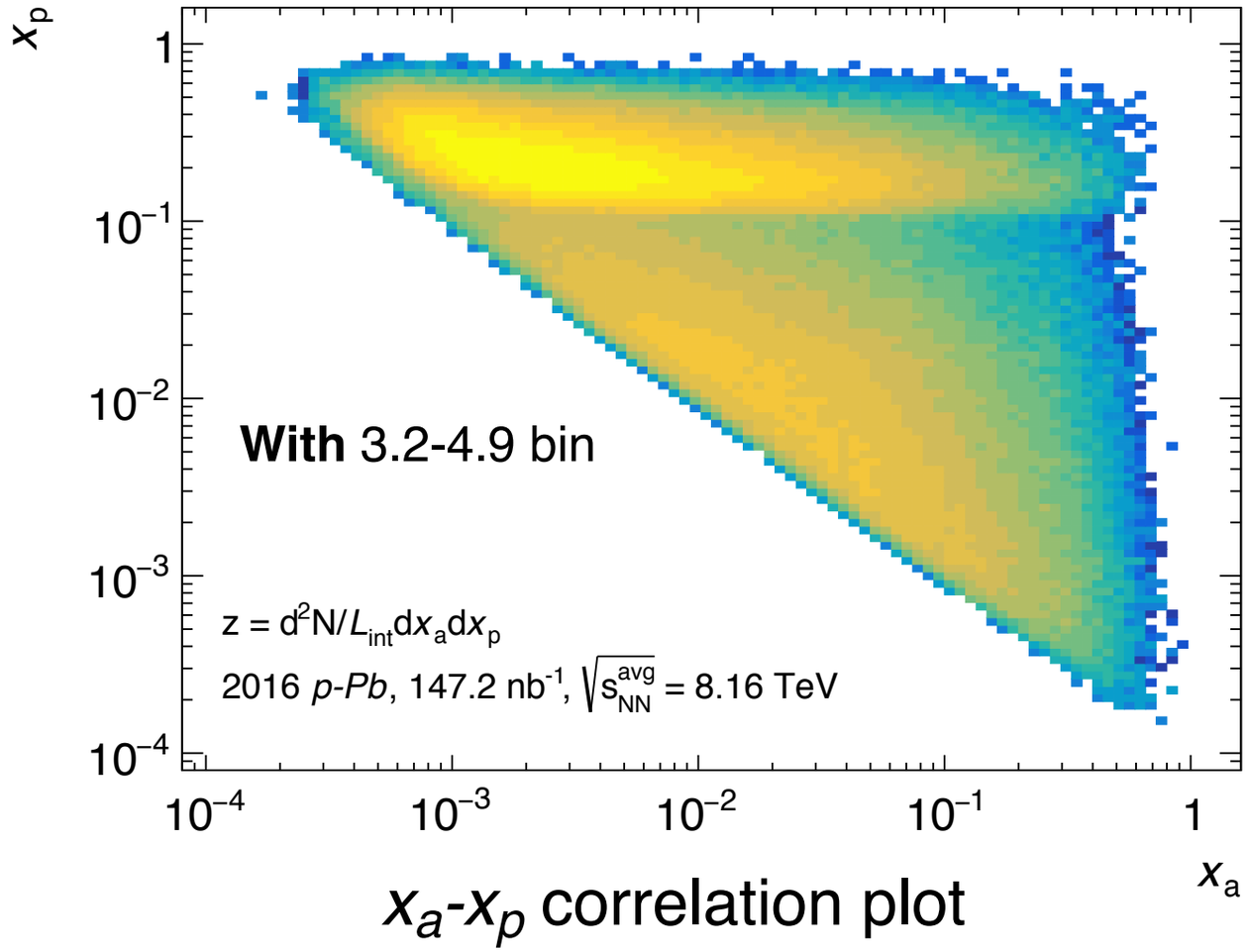

Period B
2016 p-Pb, 91.5 nb-1, √sNNavg = 8.16 TeV
-1 < ηB < 0
-2 < ηB < -1
-3.2 < ηB < -2
-4.9 < ηB < -3.2
0 < ηB < 1
1 < ηB < 2
2 < ηB < 3.2
3.2 < ηB < 4.9
xa

Excess is overwhelming in x_a-x_p correlation plot!

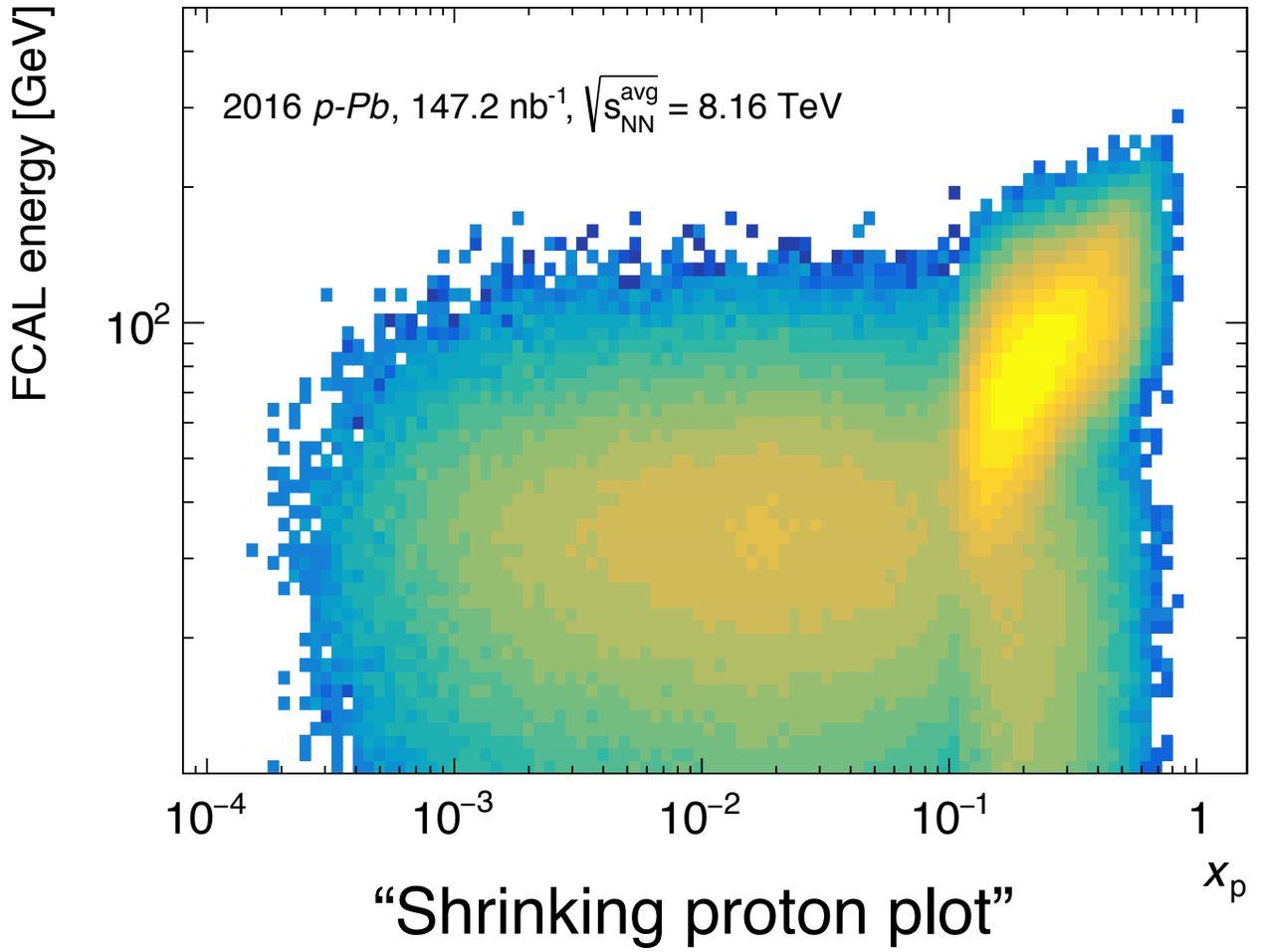




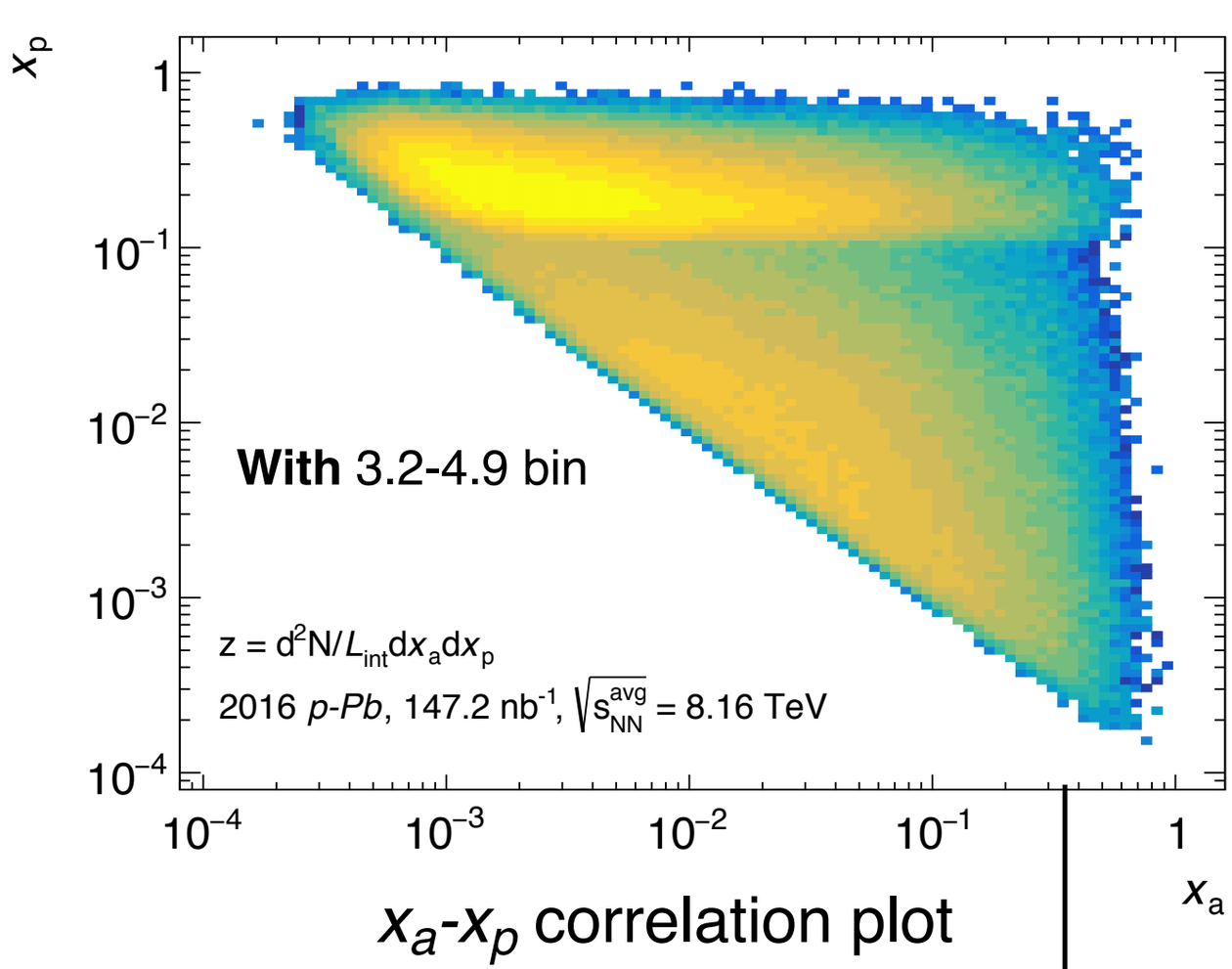
Act of despair: try dropping 3.2-4.9 bin in period A?



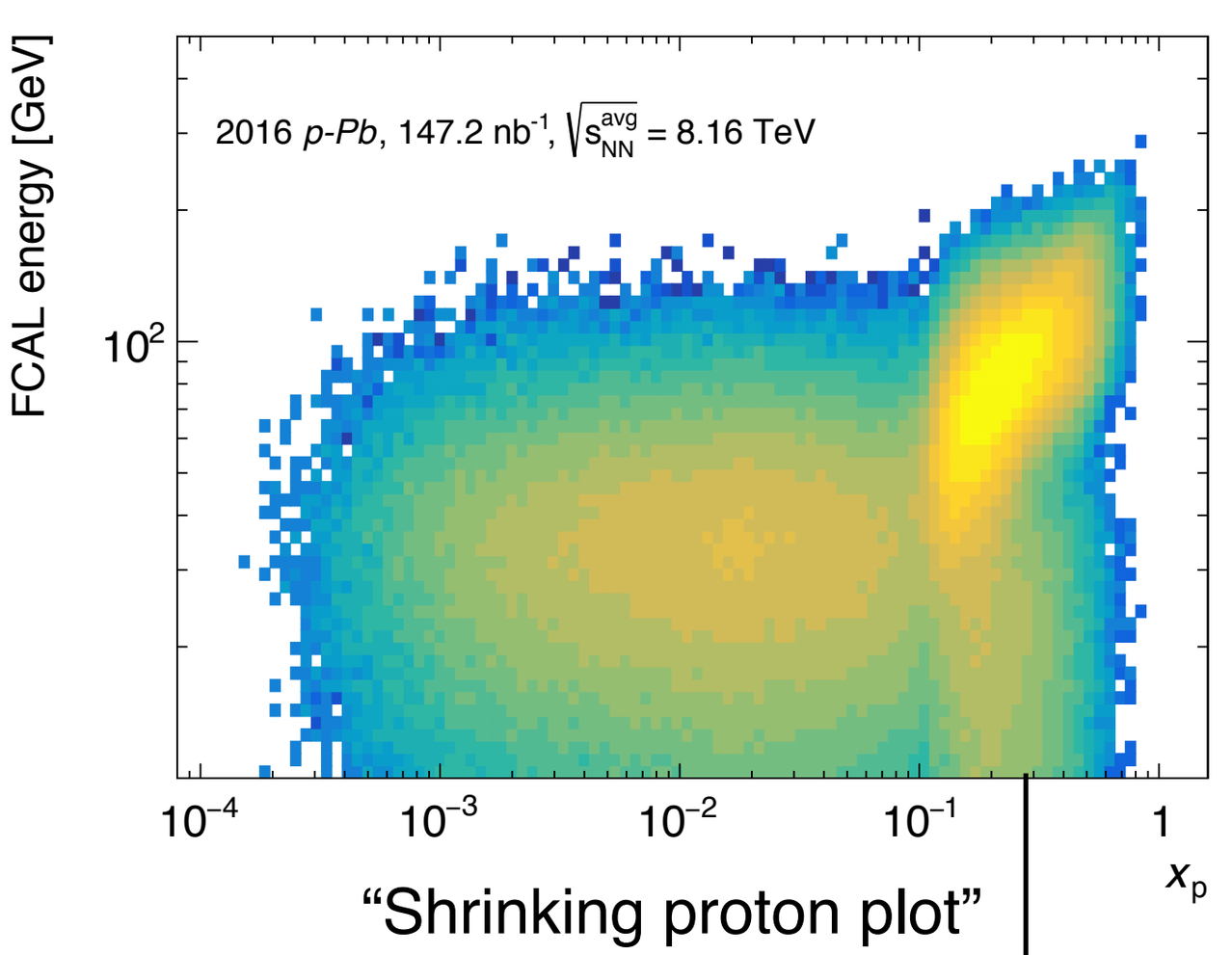
x_a-x_p correlation plot



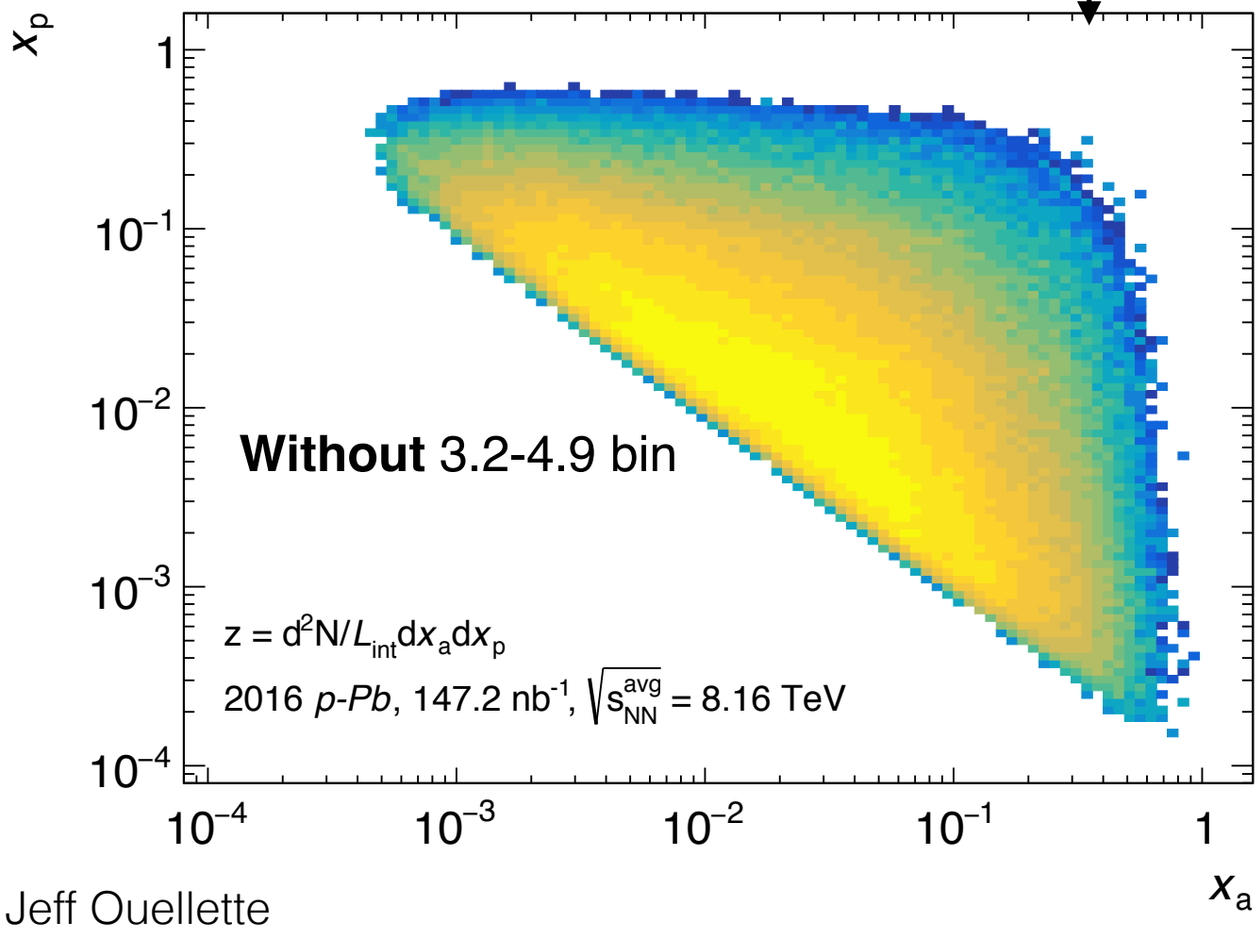
"Shrinking proton plot"

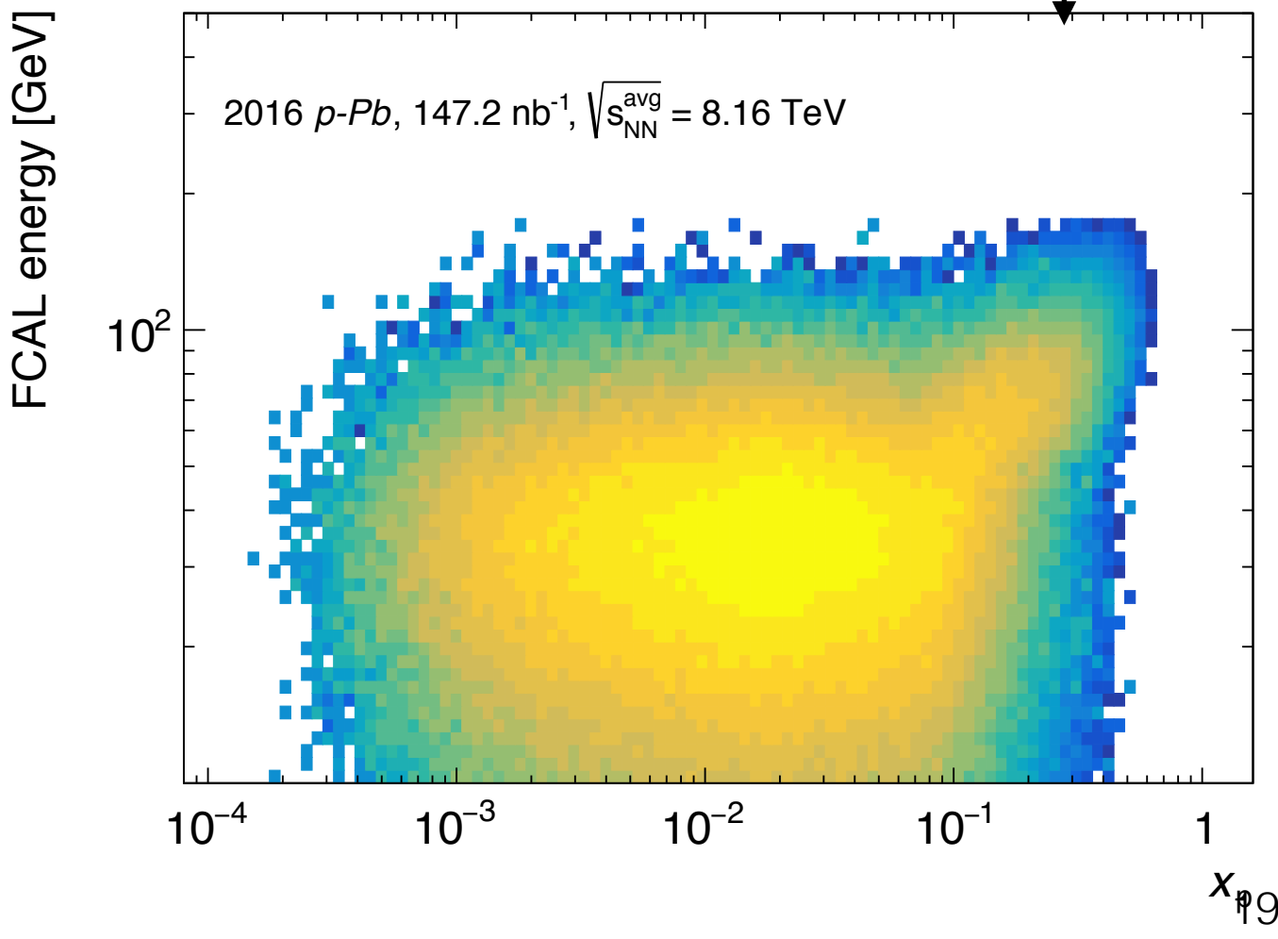


x_a-x_p correlation plot



"Shrinking proton plot"





Current strategy:

- revise trigger minimum pt cuts and efficiency curve calculation

- try binning Bjorken x's in bins of *hardness* Q^2 instead of pseudorapidity - inspired by similar plot from PHENIX - could resolve excess by ignoring/ spreading over other bins?

- start applying jet spectrum to a measurement of R_{pPb} - *pp* reference sample taken from 2012 8TeV published spectrum (arxiv: 1706.03192)

- start requesting DAODs?