Dijets in p-Pb: Measuring Bjorken x's + R_{pPb}

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Last Time

- All triggers now acquired/ being used in analysis

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

  → trigger efficiency analysis now performed, now being used to set trigger thresholds for individual triggers

  → also dividing by efficiency when jet satisfies imposed p_T cut

- Triggers were prescale weighted and luminosity was “uniform”

  → now using lumis from lumicalc

- 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

- Purpose: (1) find a reasonable cutoff p_T for each trigger, and (2) correct for inefficiency above that threshold by dividing out the efficiency

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

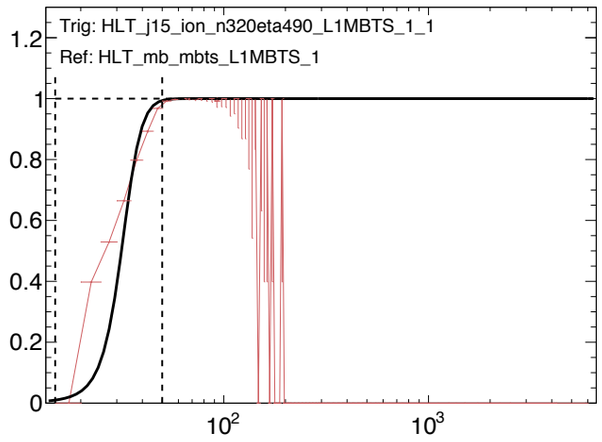
HLT_j75_ion_n200eta320

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

- 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 free 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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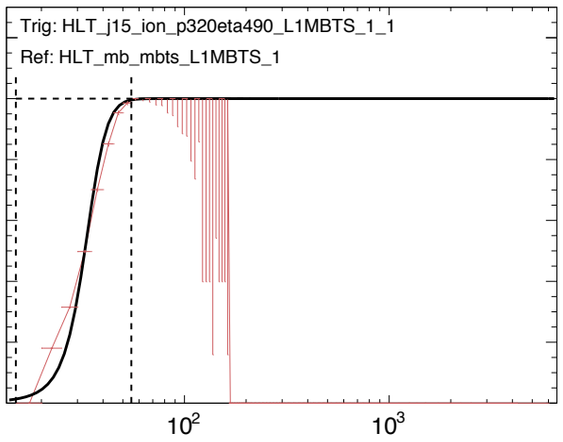
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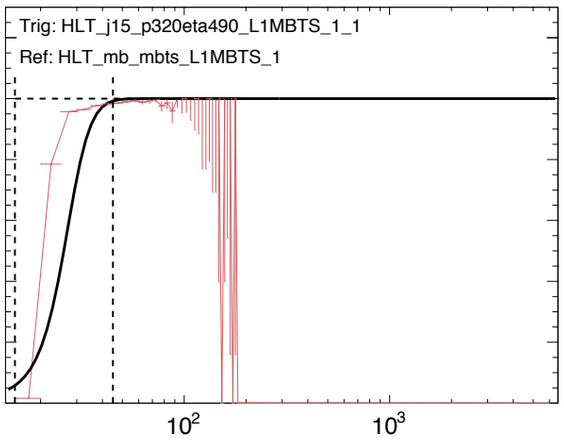
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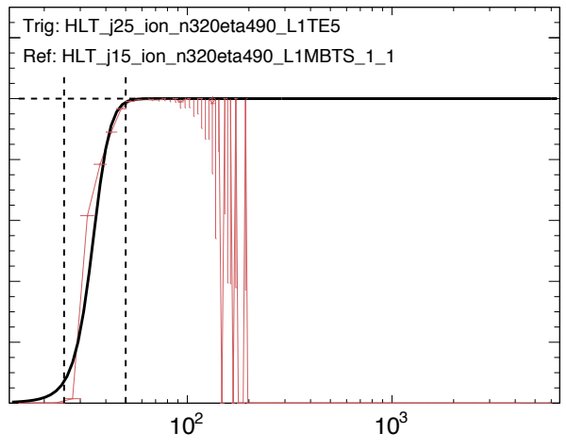
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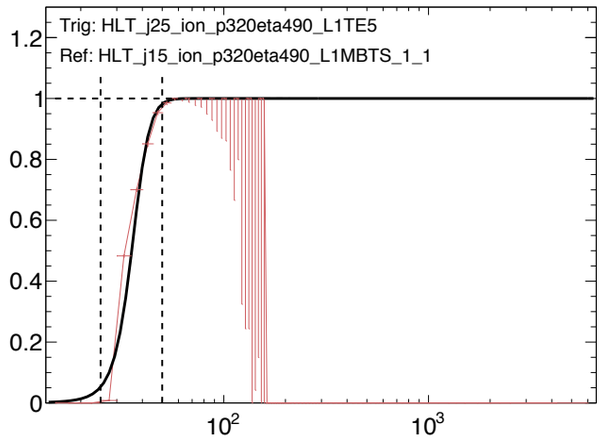
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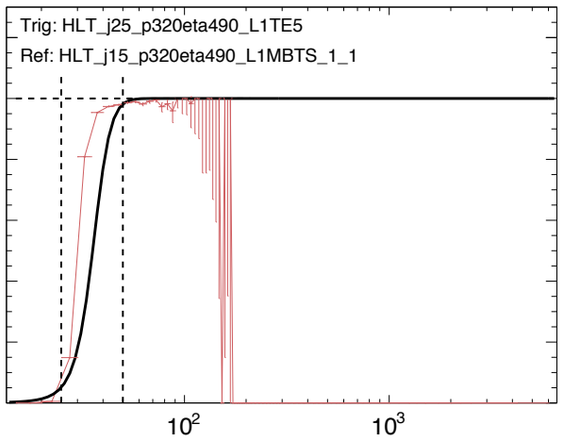
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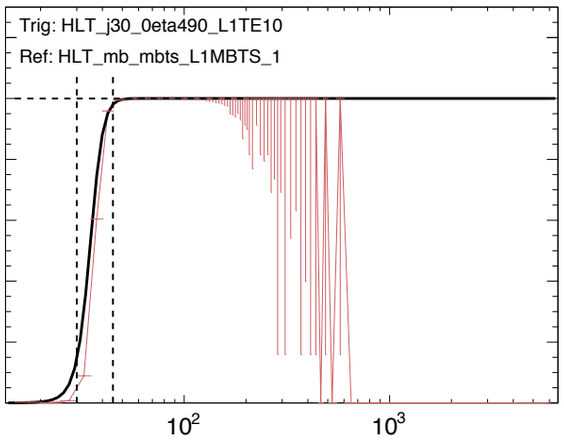
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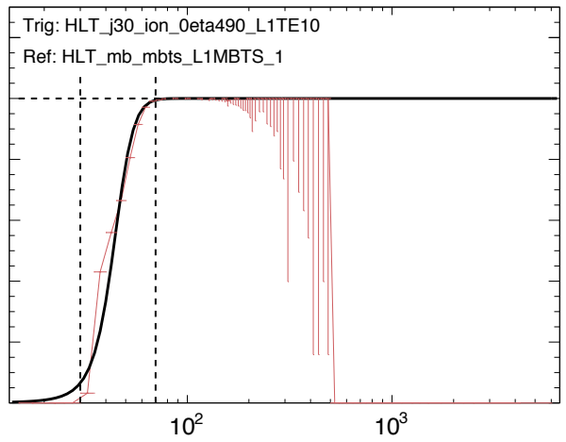
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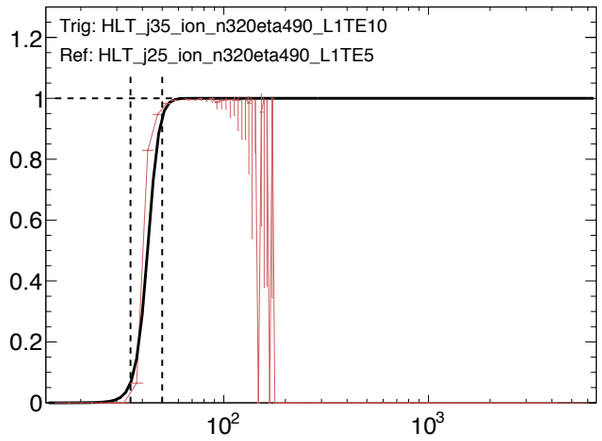
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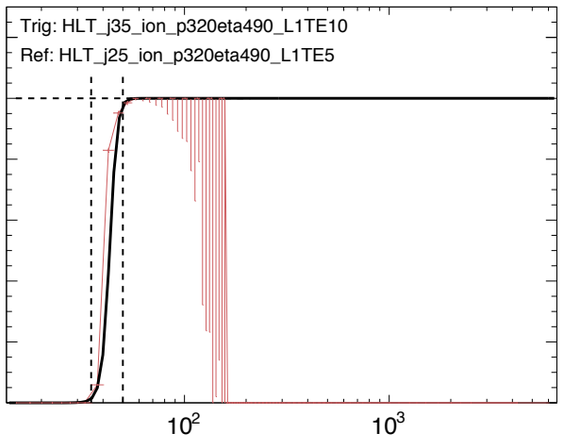
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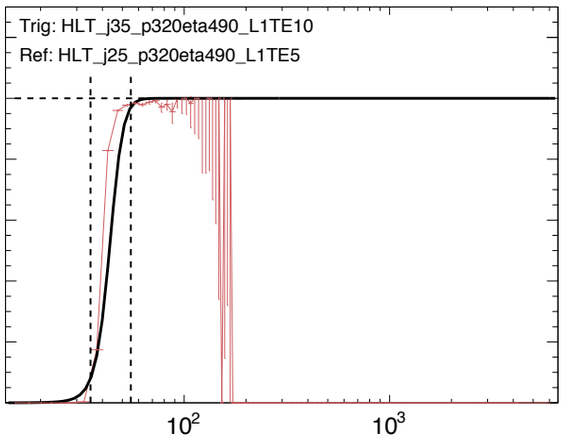
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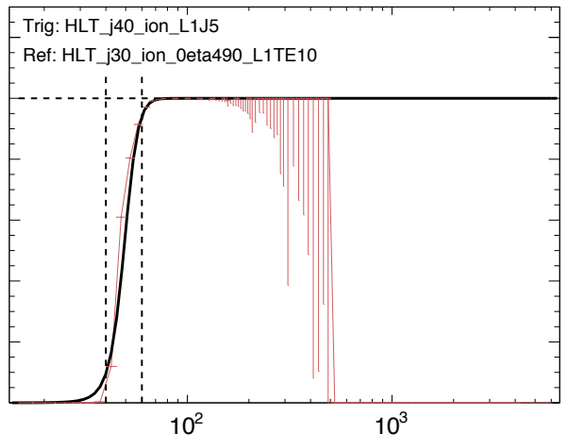
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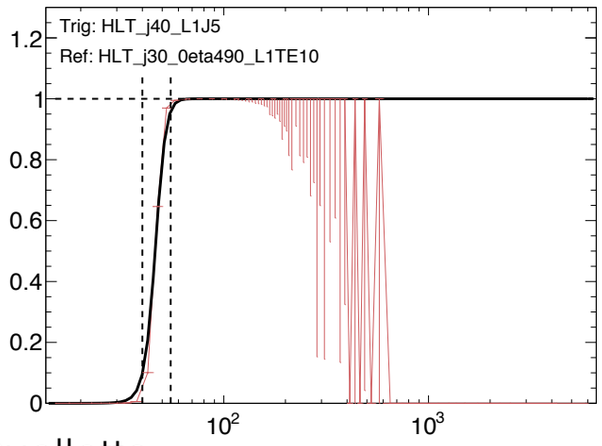
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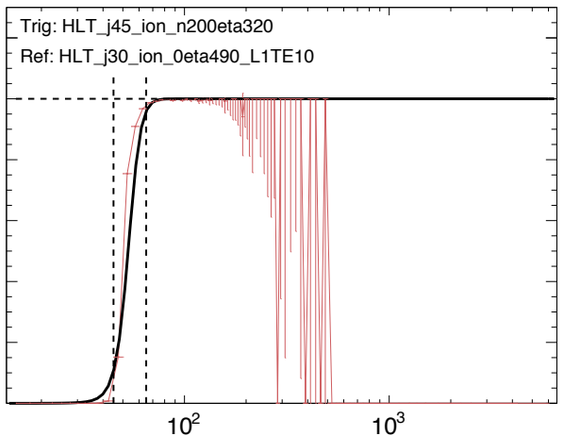
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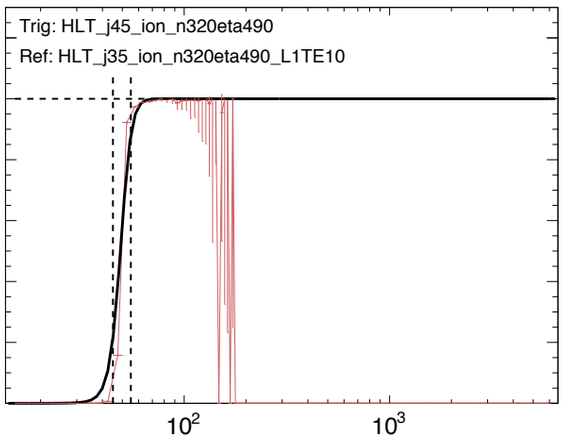
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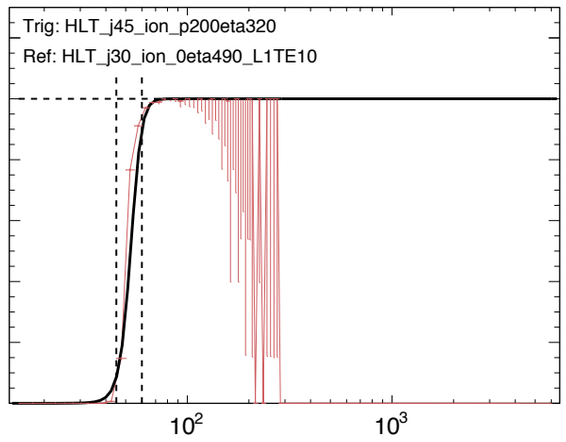
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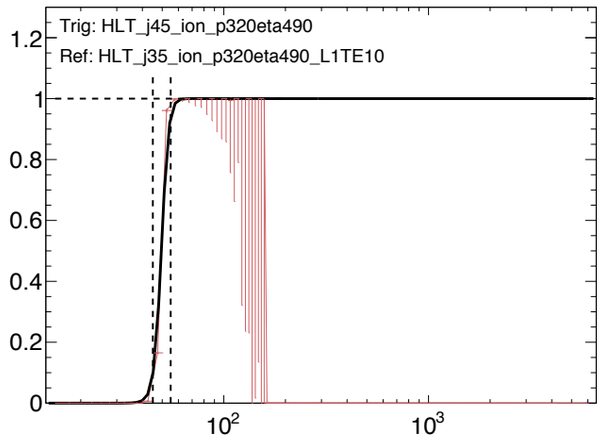
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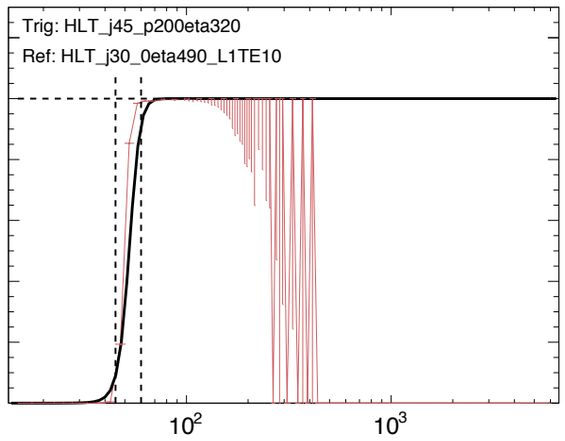
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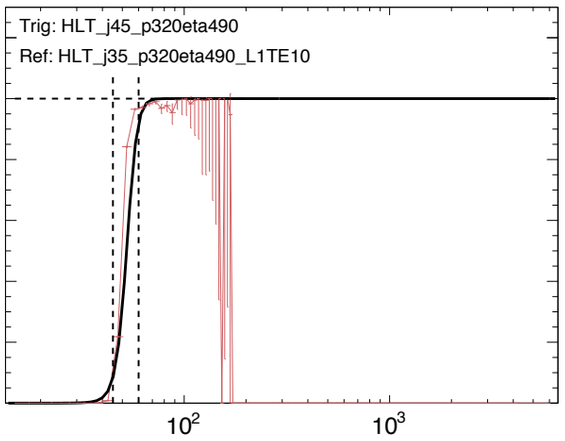
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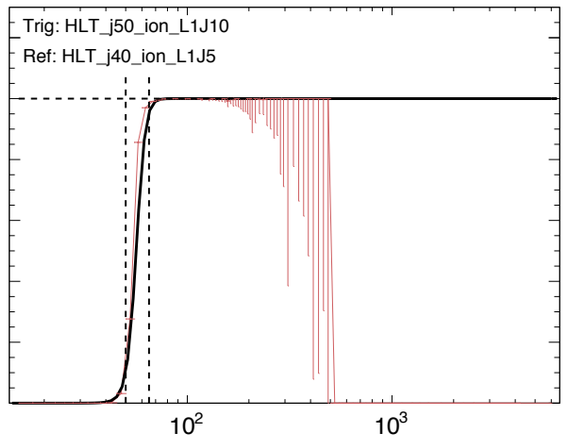
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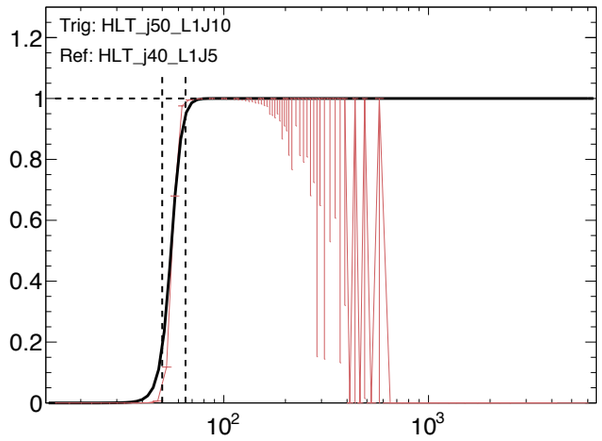
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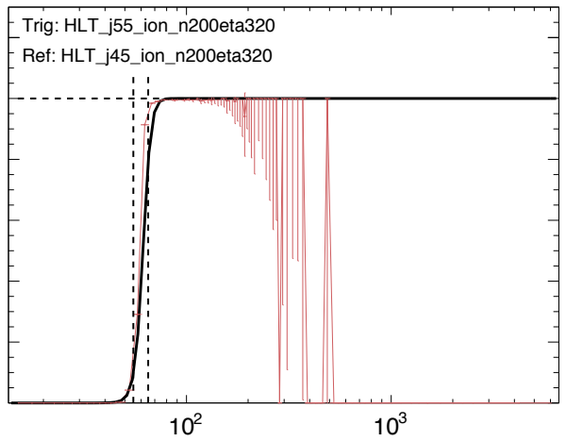
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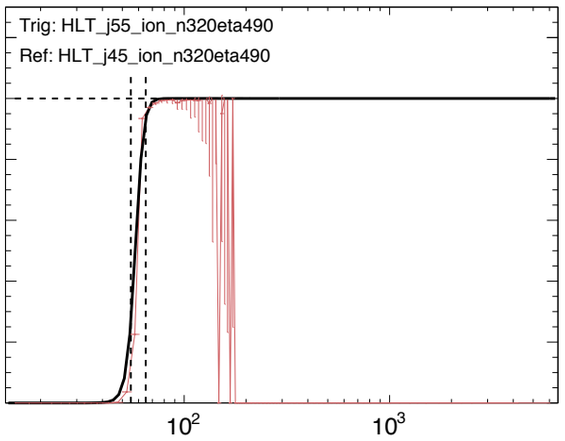
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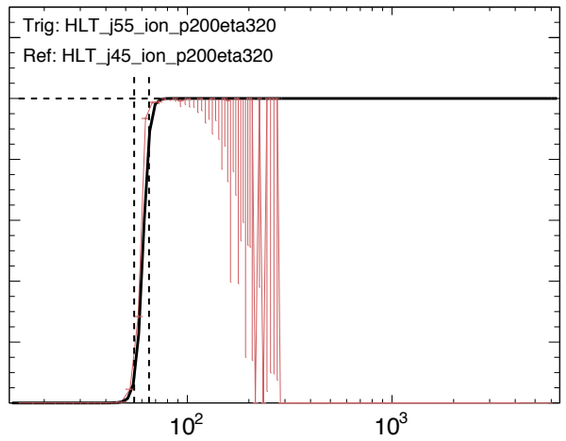
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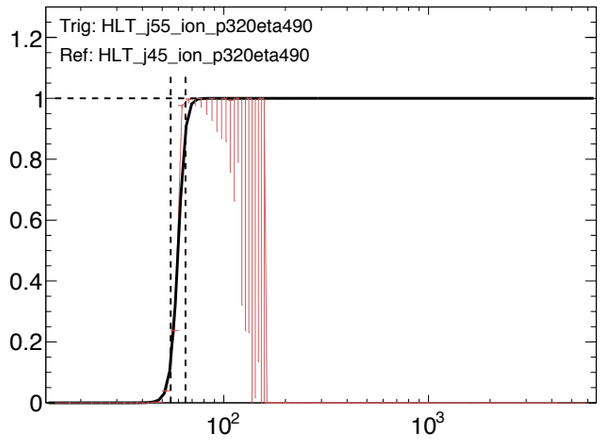
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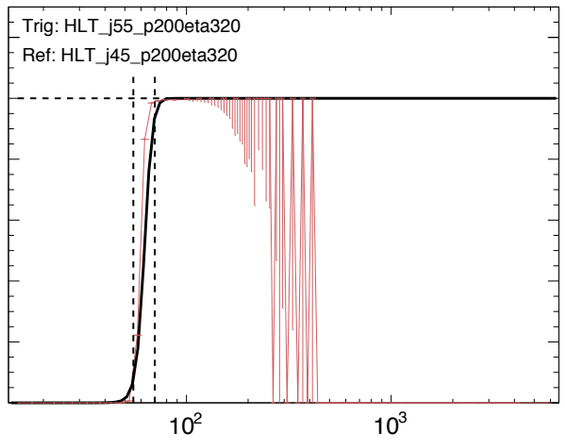
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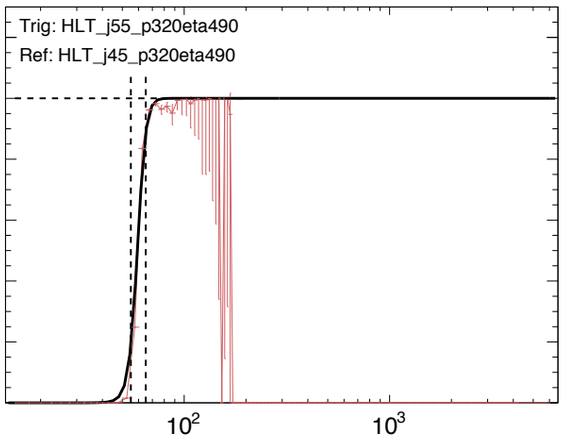
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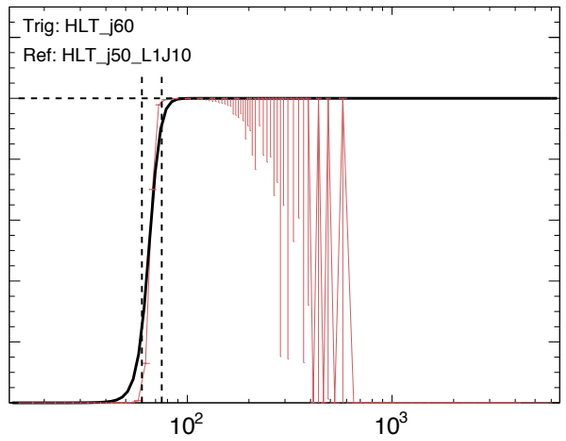
Trig: HLT_j60
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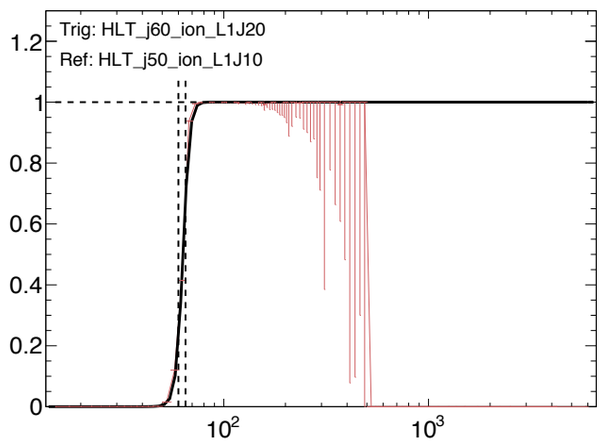
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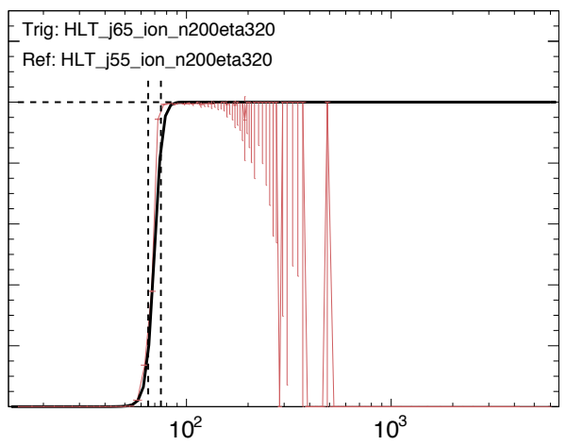
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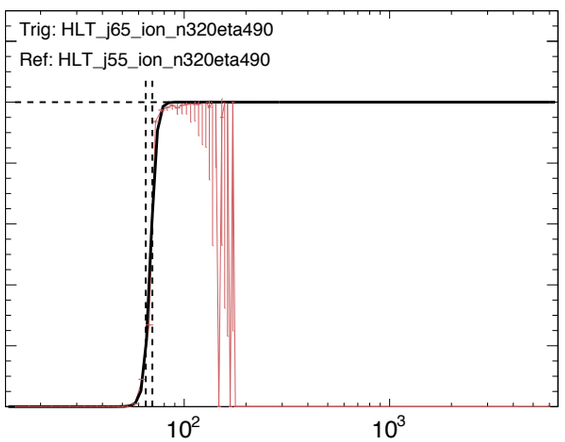
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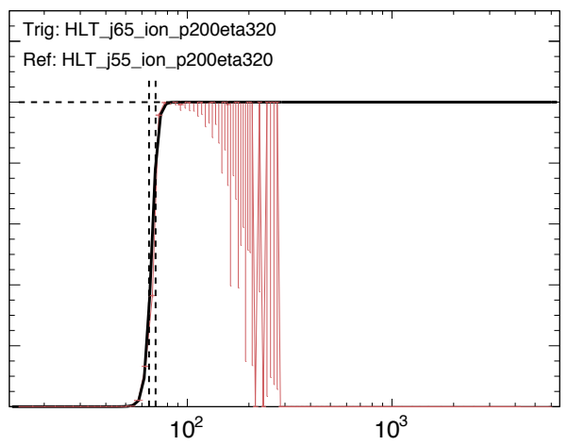
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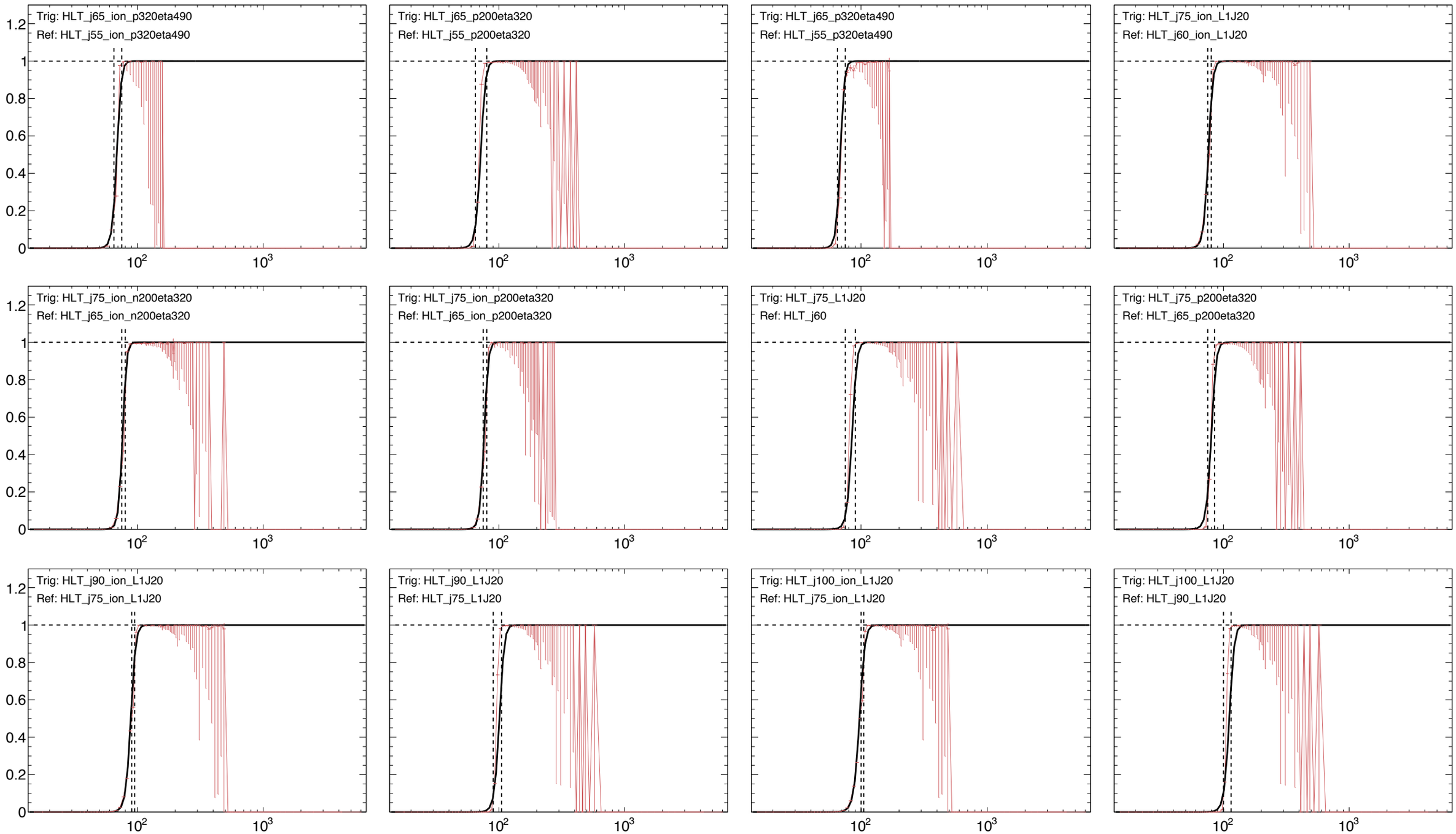
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Ref: HLT_j55_p320eta490
Trig: HLT_j75_ion_L1J20
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Trig: HLT_j75_ion_n200eta320
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Trig: HLT_j75_L1J20
Ref: HLT_j60
Trig: HLT_j75_p200eta320
Ref: HLT_j65_p200eta320
Trig: HLT_j90_ion_L1J20
Ref: HLT_j75_ion_L1J20
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Ref: HLT_j75_L1J20
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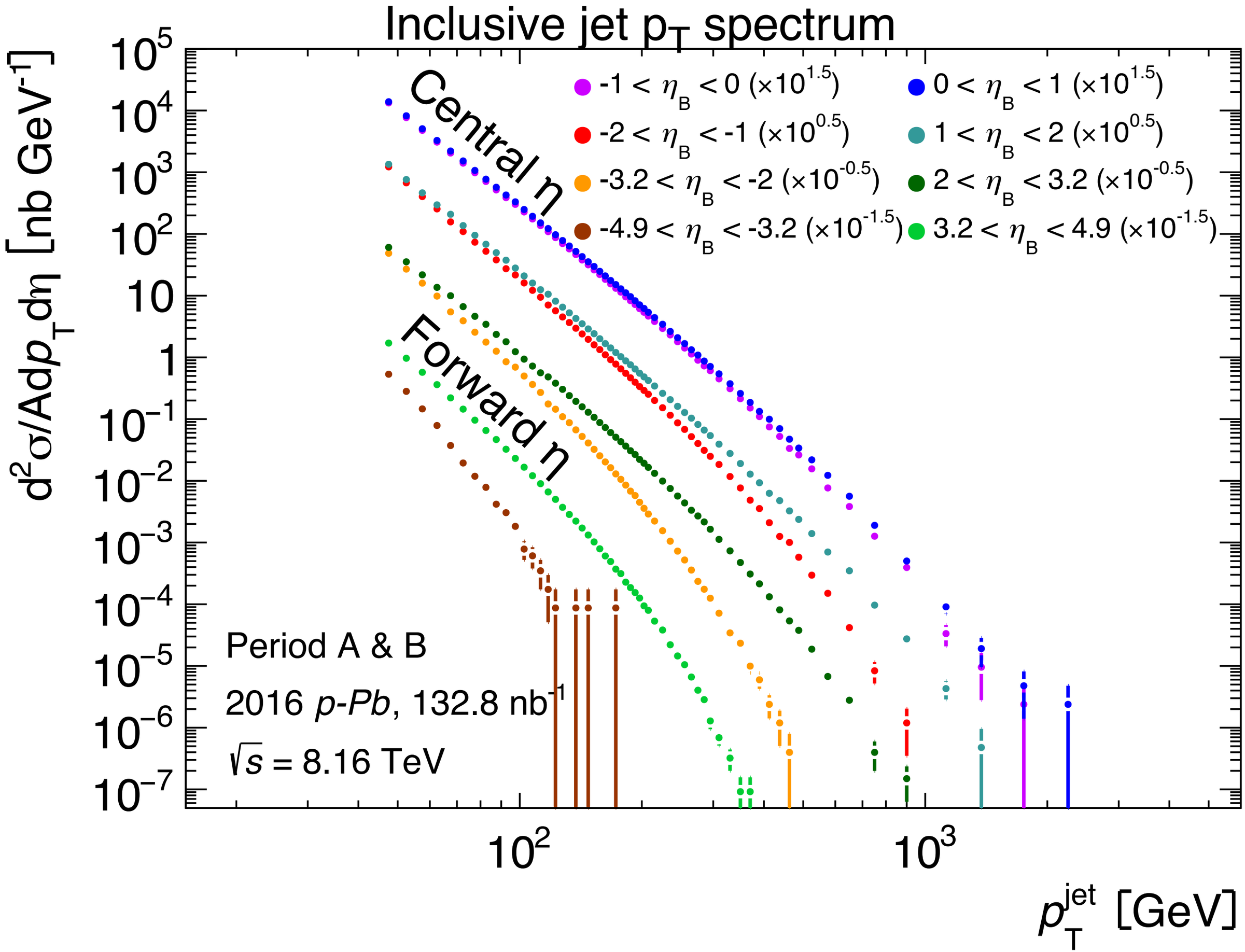
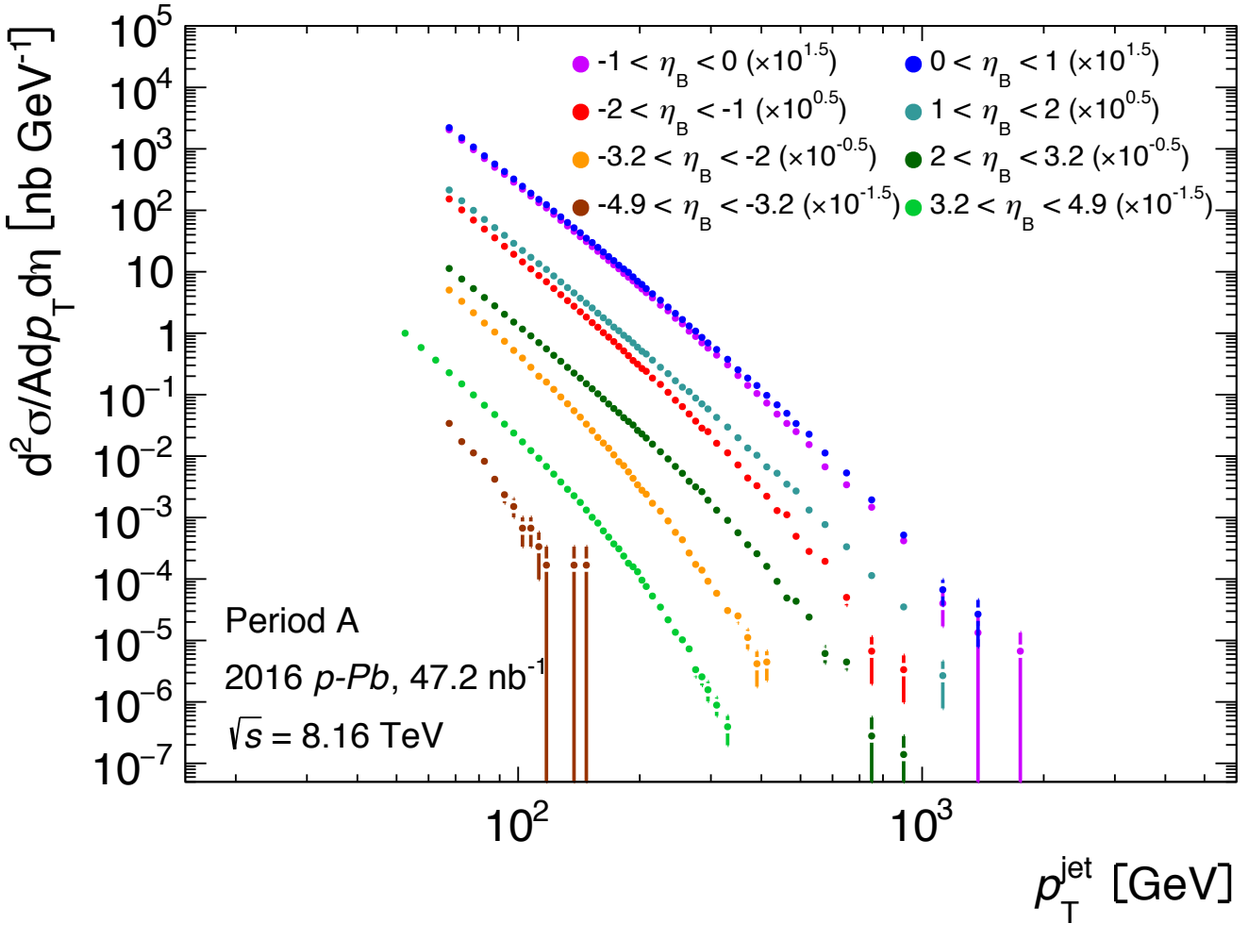
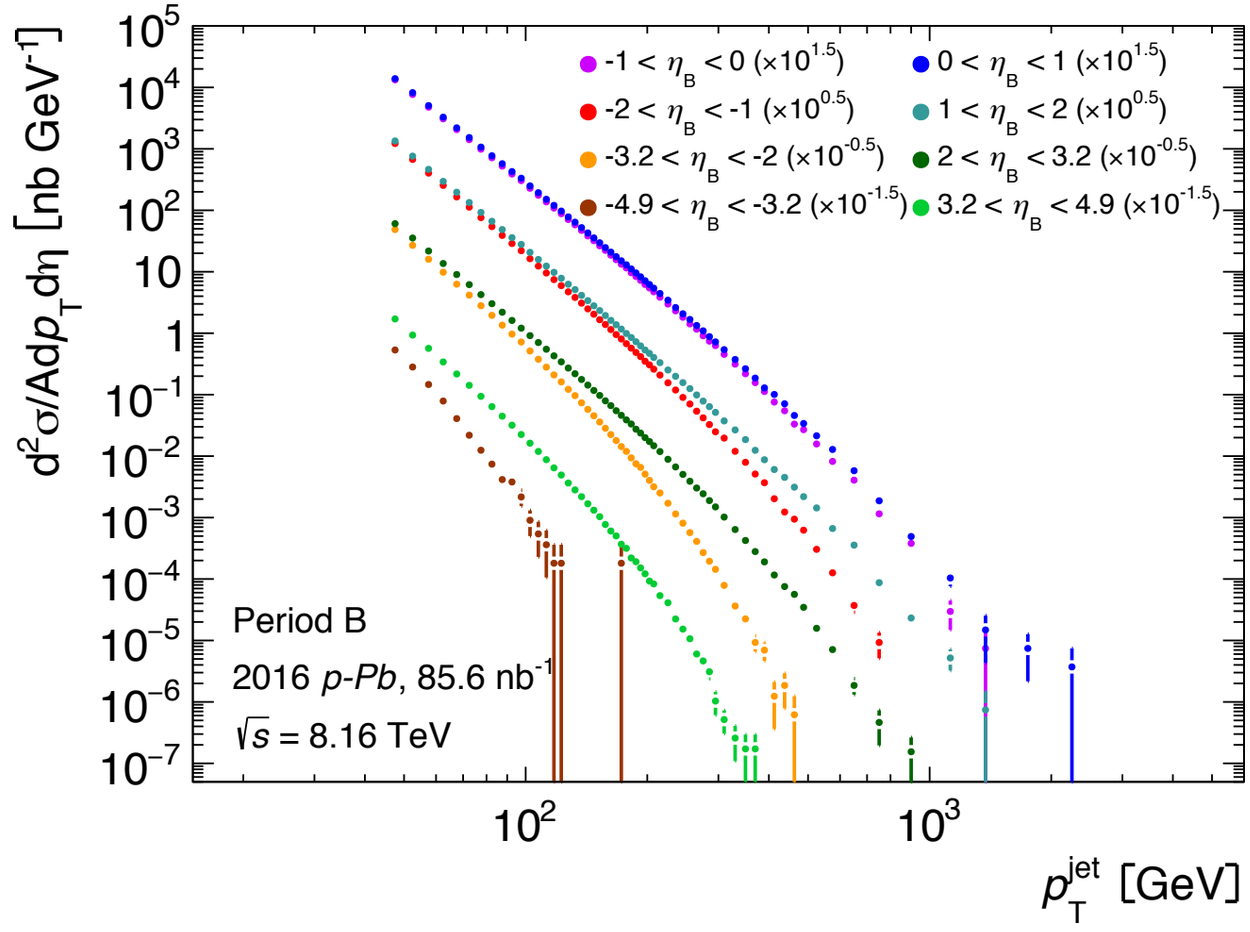

Inclusive jet p_T spectrum
$d^2\sigma/Ad\,p_T d\eta$ [nb GeV^{-1}]
Central η
Forward η
-1 < η_B < 0 (×10$^{1.5}$)
0 < η_B < 1 (×10$^{1.5}$)
-2 < η_B < -1 (×10$^{0.5}$)
1 < η_B < 2 (×10$^{0.5}$)
-3.2 < η_B < -2 (×10$^{-0.5}$)
2 < η_B < 3.2 (×10$^{-0.5}$)
-4.9 < η_B < -3.2 (×10$^{-1.5}$)
3.2 < η_B < 4.9 (×10$^{-1.5}$)
Period A & B
2016 *p-Pb*, 132.8 nb^{-1}
$\sqrt{s}$ = 8.16 TeV
p_T^{jet} [GeV]

Inclusive jet p_T spectrum

Pb-p "period A"



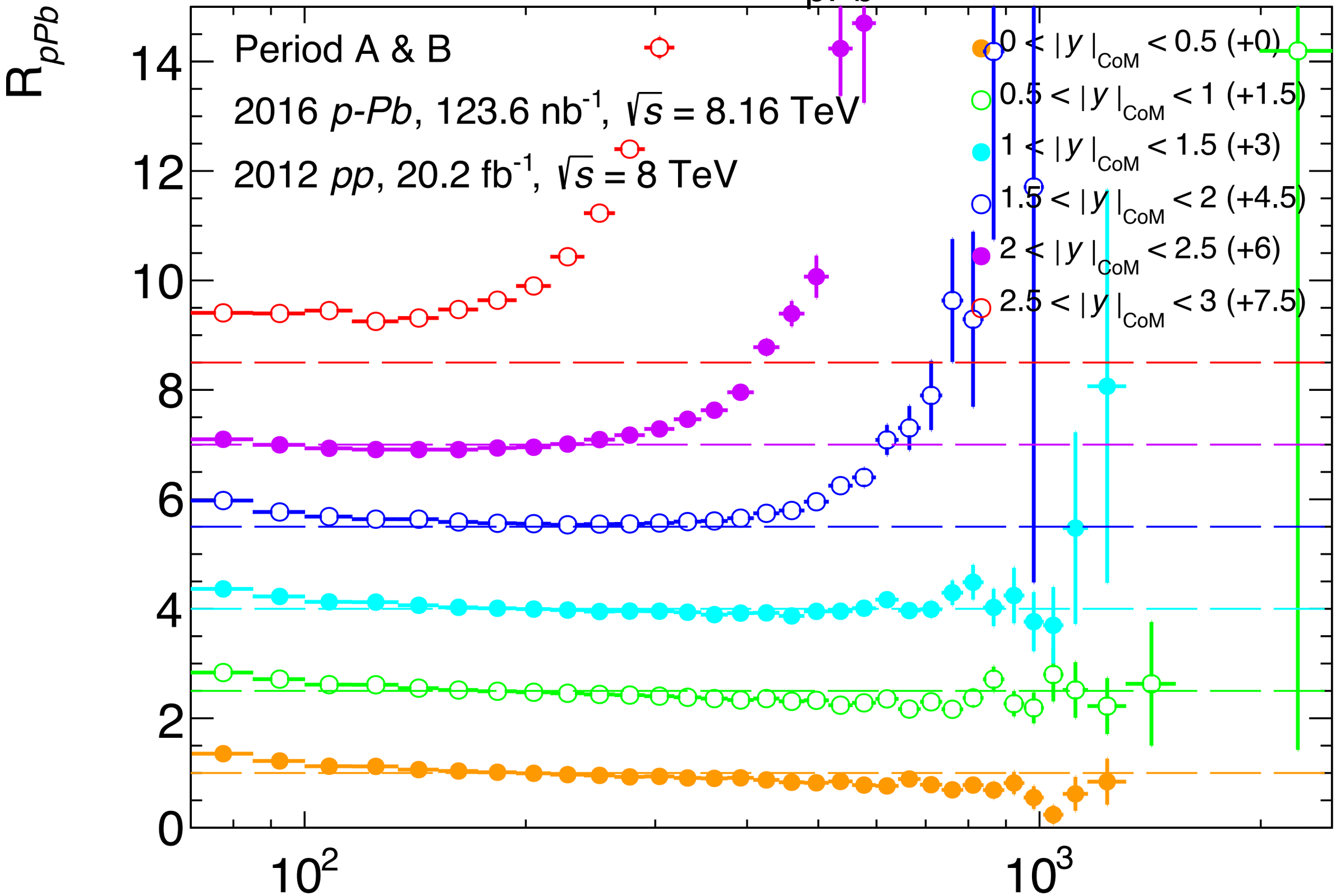
p-Pb "period B"



Wider band gap in period A vs in period B

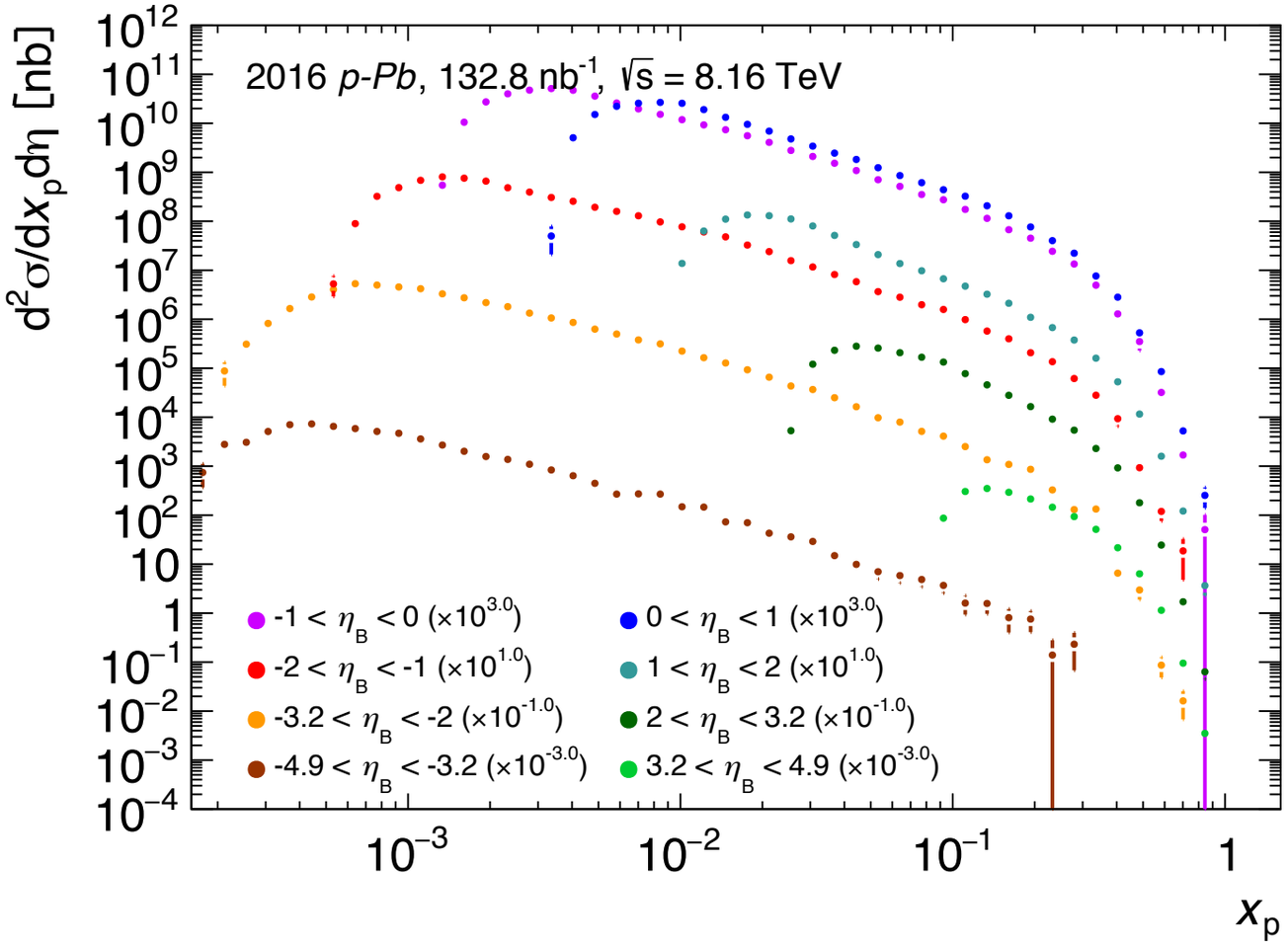
Worth investigating slight η dependence of triggers near boundaries?

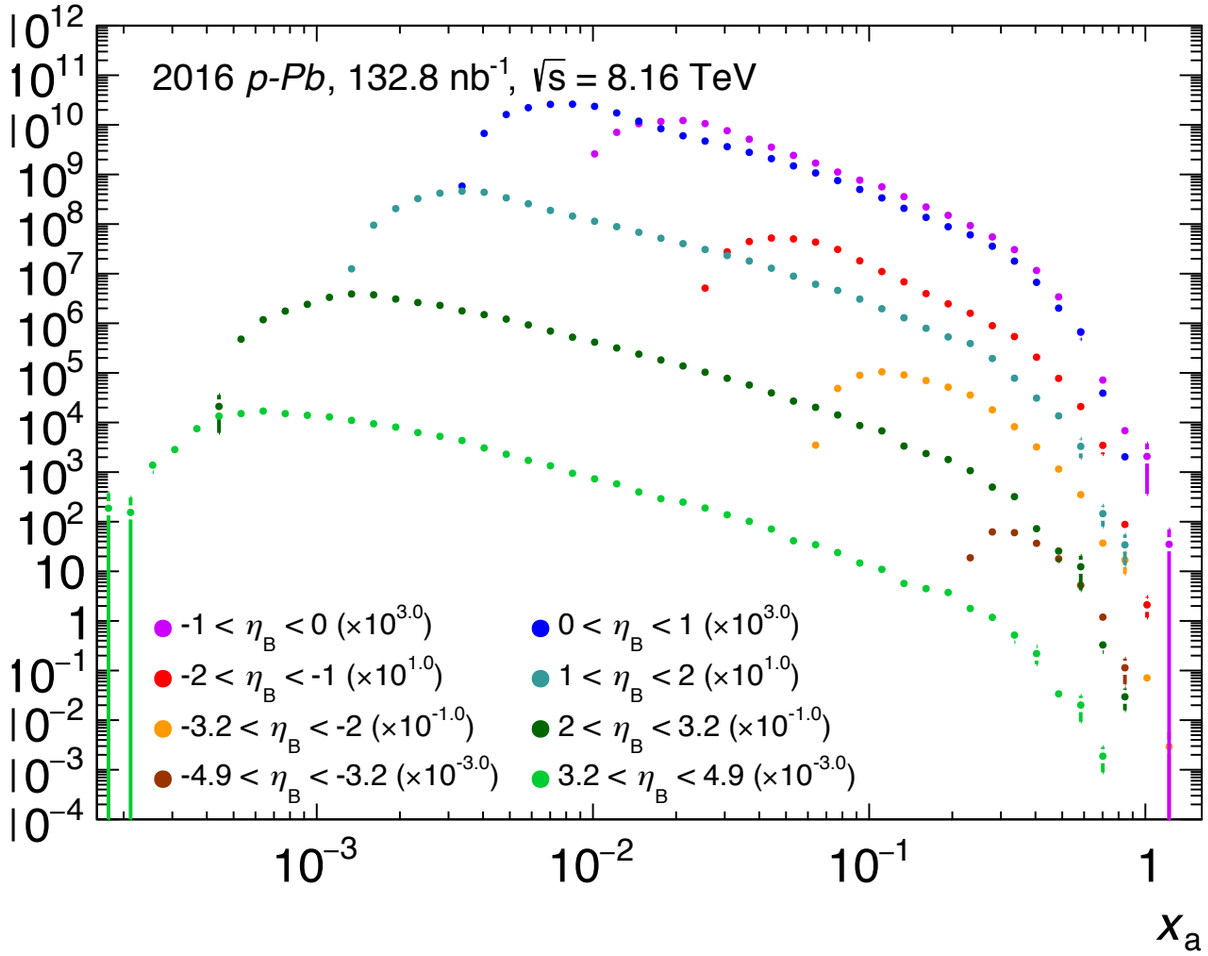
Inclusive jet R_{pPb}



pp data: arxiv 1706.03192

Bjorken x's binned by pseudorapidity





Event selection criteria:

- Dijet ratio ≧ 0.7
- Leading jet trigger
- Good run list (GRL)
- "Clean" events
- Cleaned jets

Fill by leading jet, weighted by:

(luminosity * efficiency)$^{-1}$

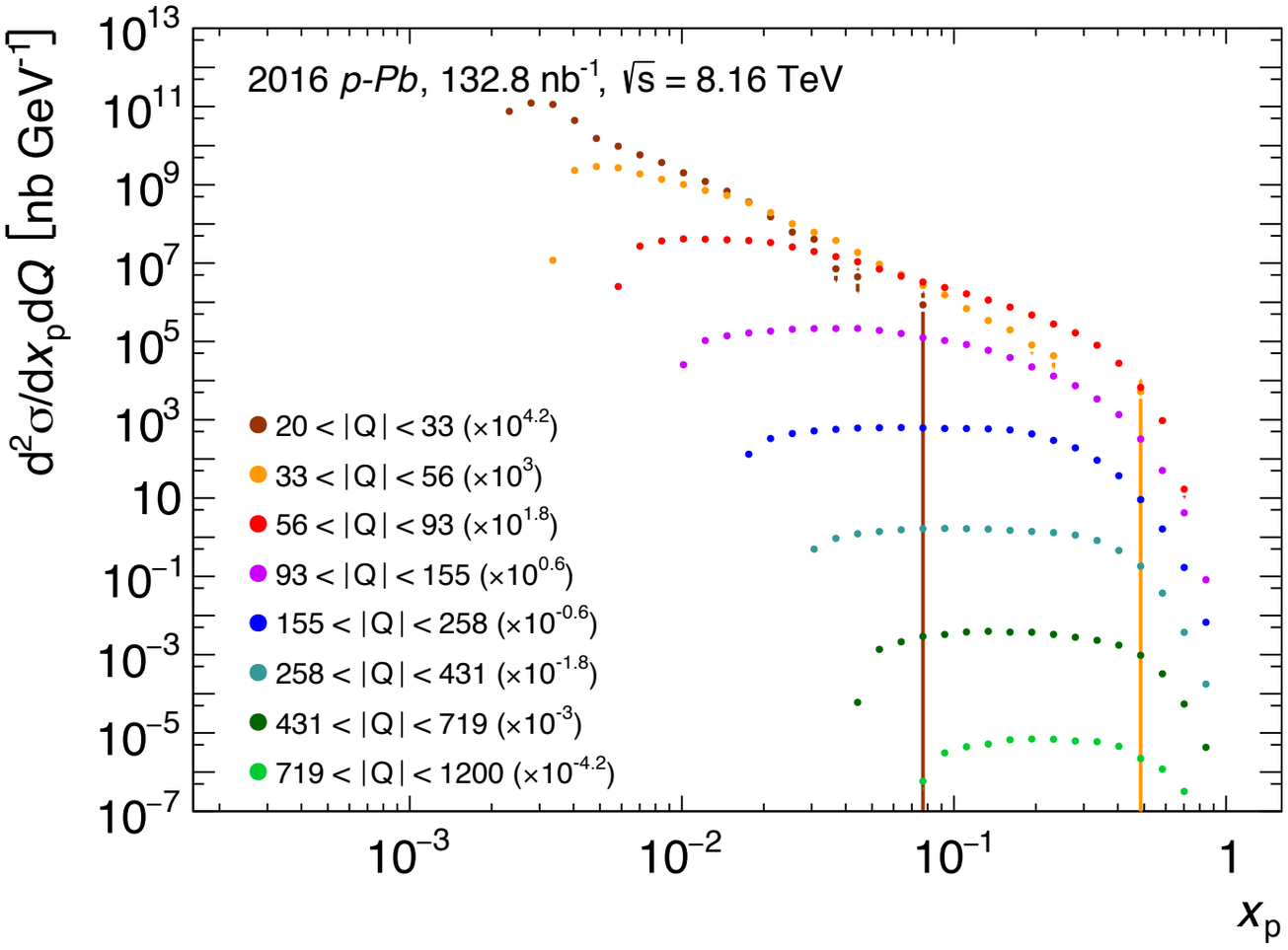
Efficiency correction always ~1 by construction → error introduced should be *very* small

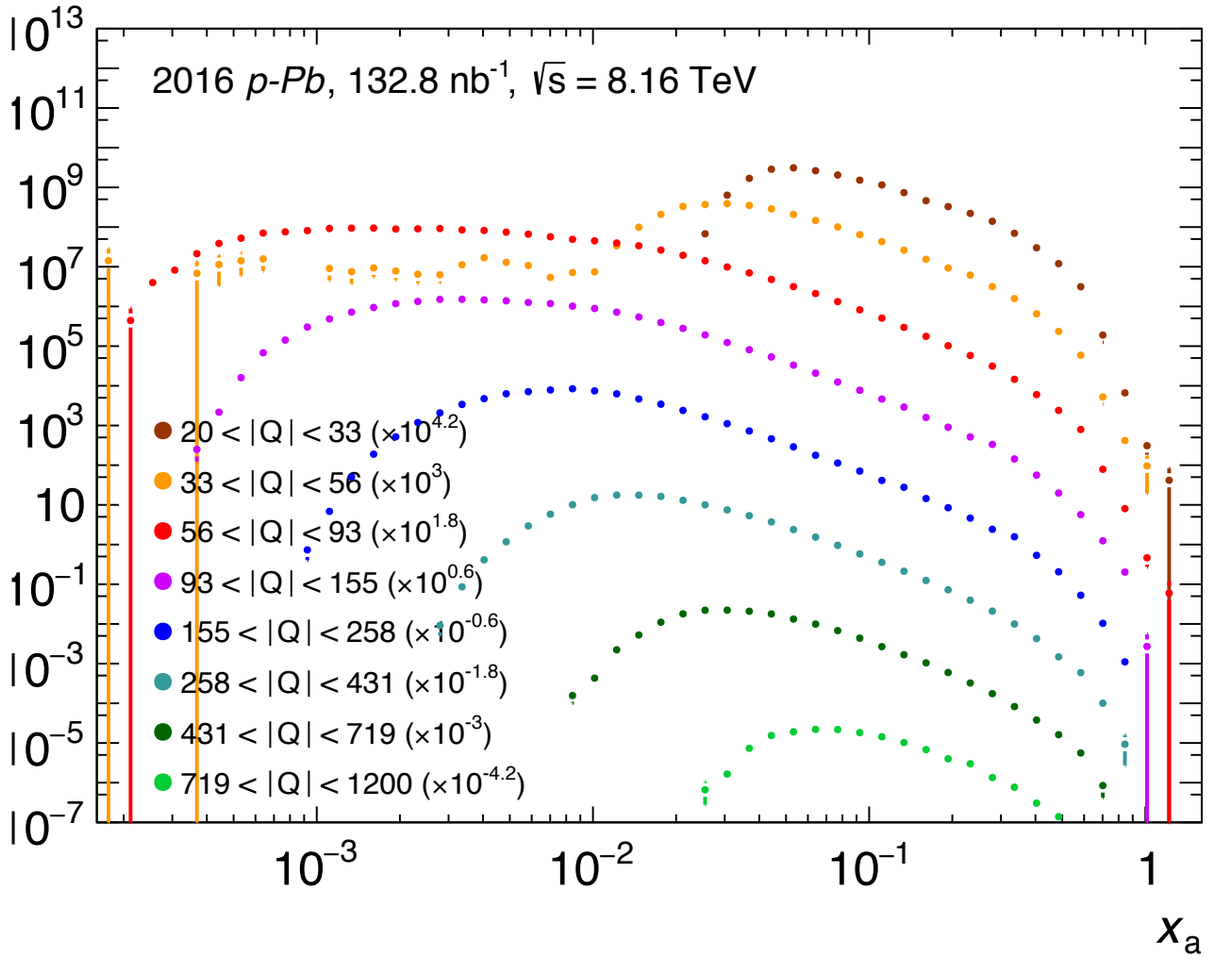
Recall:

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

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

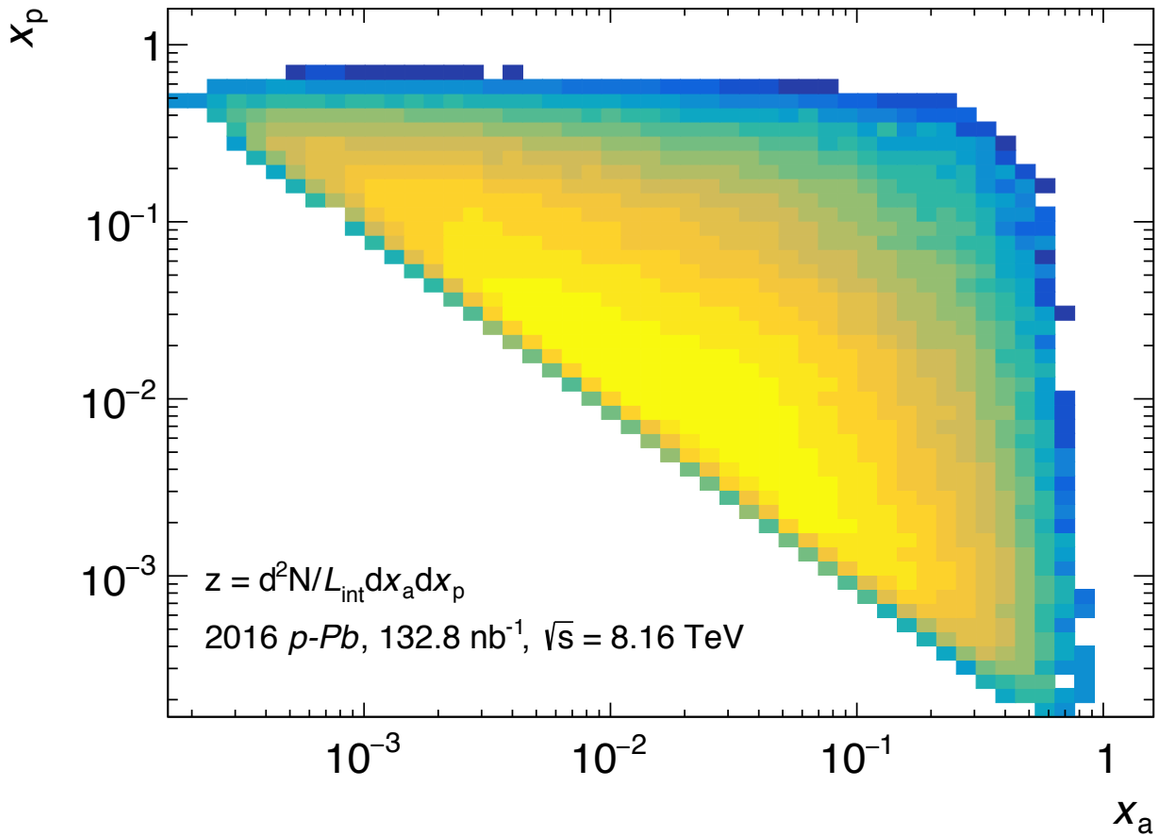
Bjorken x's binned by hardness



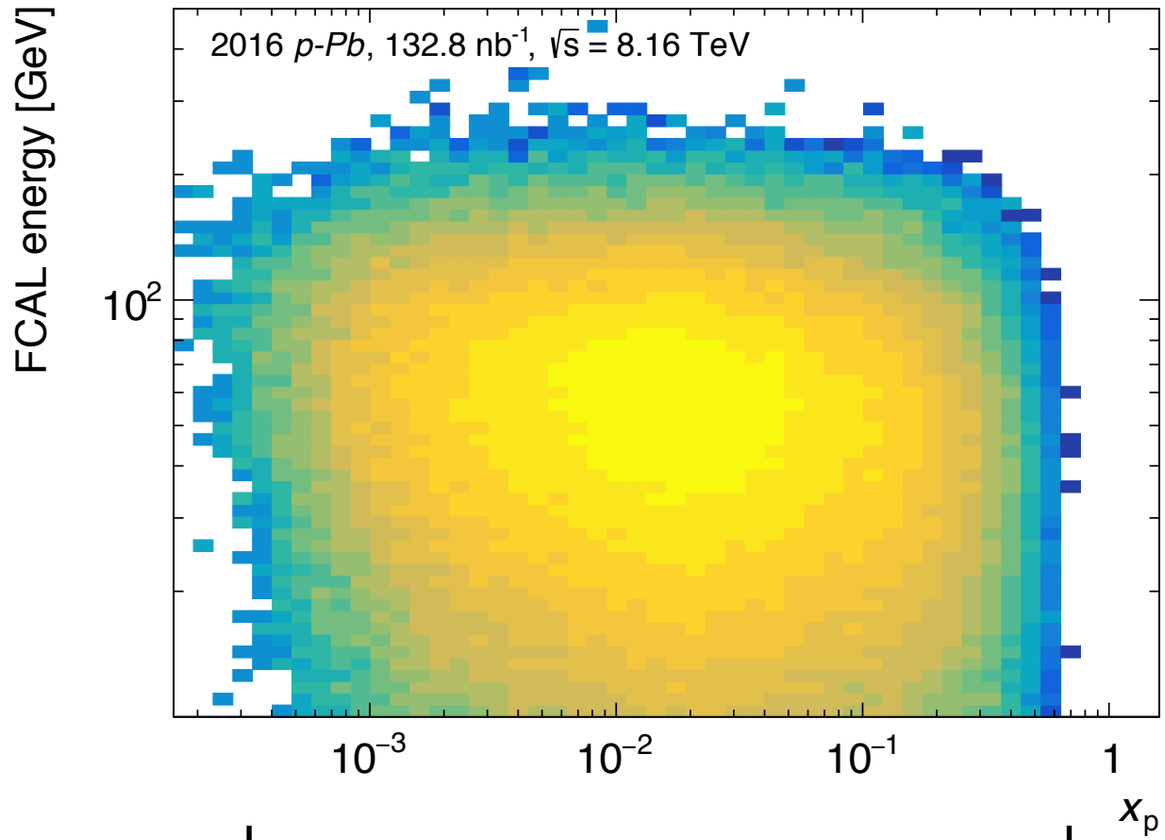


Important note: Q depends on the arrangement of the hard process - i.e., it depends on which jet is "which" (calculating with a different jet gives a different Q)

→ account for this by taking the *average* Q over the two leading jets

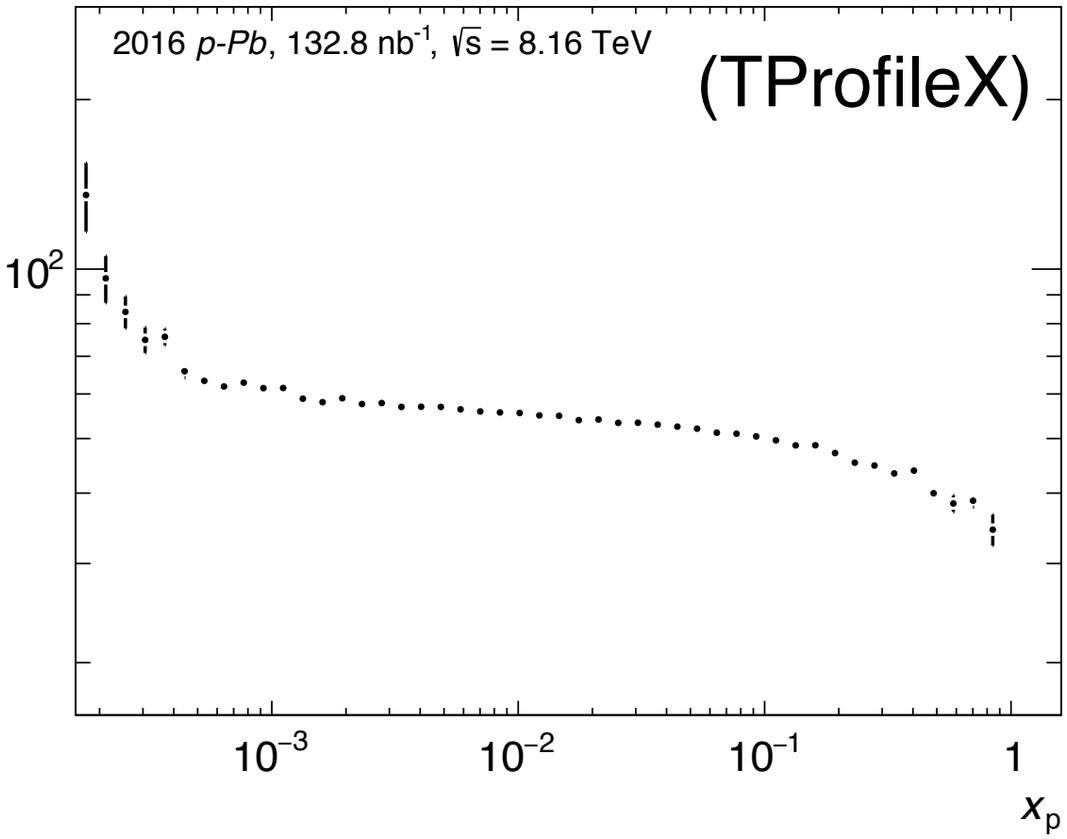


x_a-x_p correlation plot

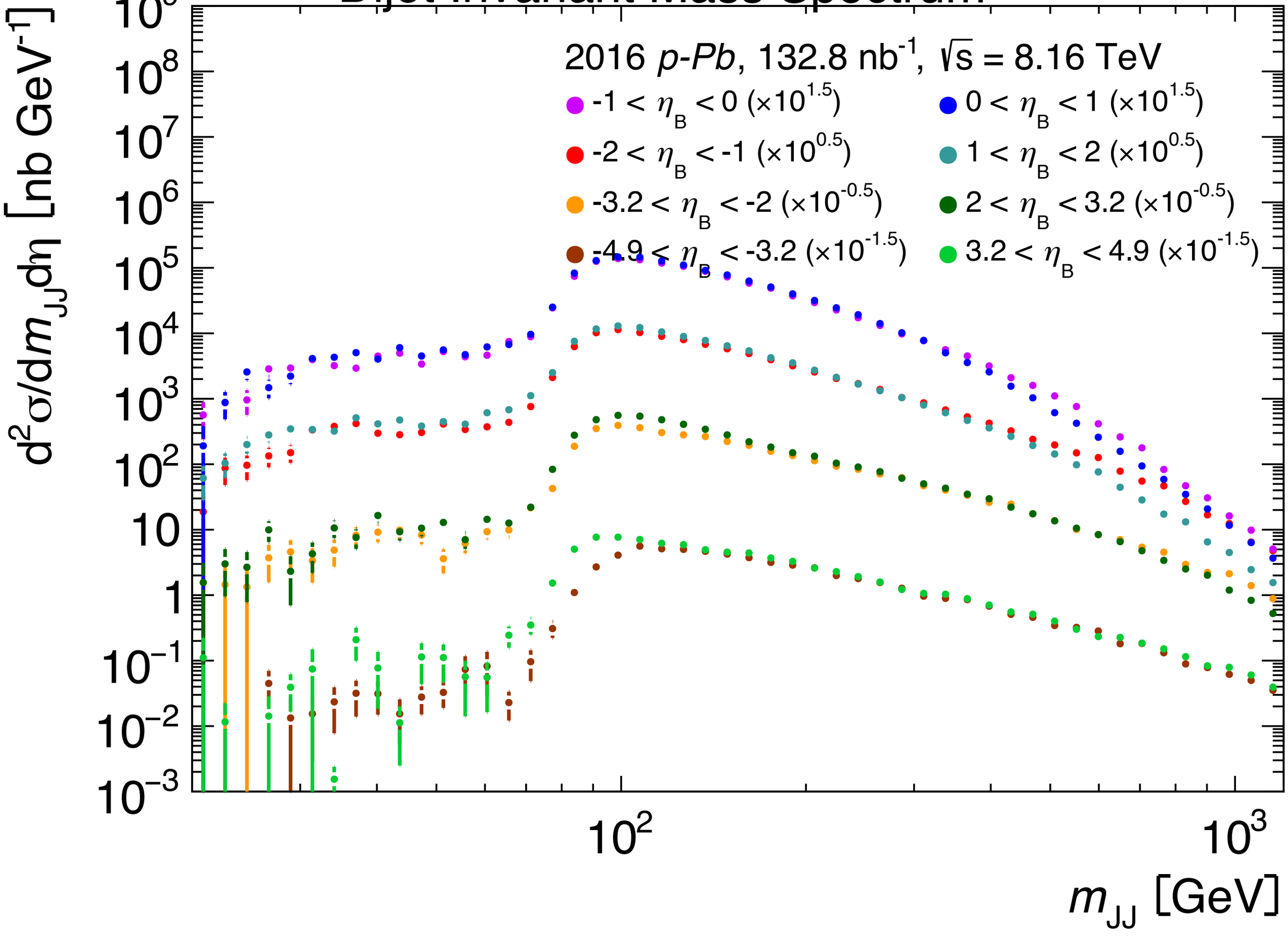


“Shrinking proton plot”

Higher xp:
→ less soft scattering
→ less energy deposited in FCAL



Dijet Invariant Mass Spectrum



Current strategy:

- Investigate pseudorapidity dependence of trigger efficiency?

- Keep pushing grid jobs through (maximum 26/30?)

- Have started requesting DAODS