
Results from Run 13 W- test production analysis

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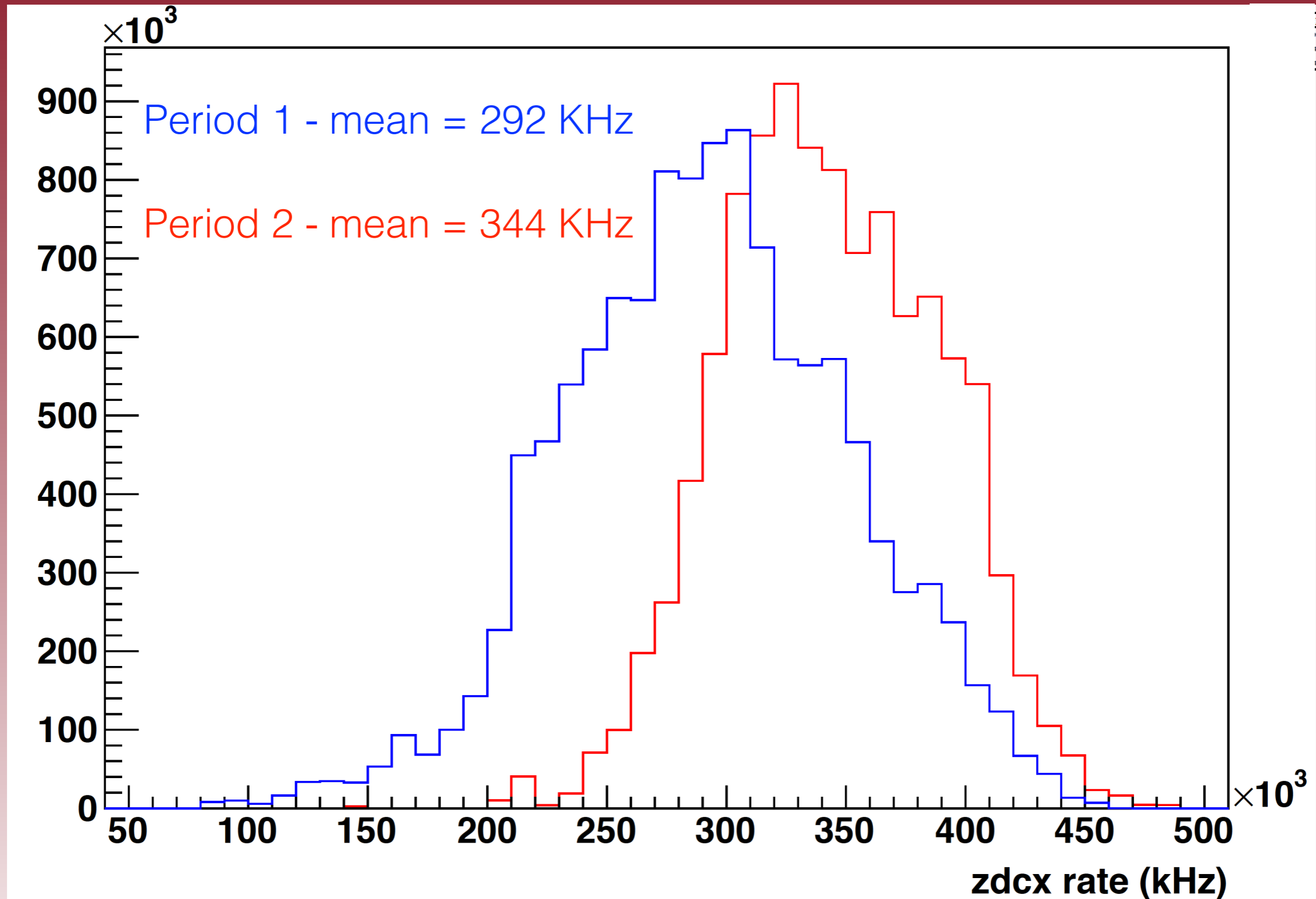
S&C meeting 04-13-2016

W Test Production Details

Production	Library	Vertex-Finding algo	Tracking algo	nEvents (M)
Evals 1	SL16b	PPV_W	STI	~12 [only period 1]
Evals 2	EVAL	PPV_W	STI_updated*	~12 [only period 1]
Evals 4	EVAL	PPV_W	STICA	~12 [only period 1]
Yuri - period 1	DEV2/TFG16a	PPV_W	STICA**	~12 [only period 1]
Yuri - period 2	DEV2/TFG16a	PPV_W	STICA**	~10 [only period 2]
P14ia [run 13 official period 1]	SL14a	PPV_W	STI	~12 [only period 1]
P14ig [run 13 official period 2]	SL14g	PPV_W	STI	~10 [only period 2]

- Yuri's local production was used in the analysis :
 - to evaluate the performance of StiCA in full luminosity range of run 13.
 - to understand if there is any negative interference effect between StiCA and the additional HFT material.

Run 13 Luminosity



- ~90% of Period 2 statistics is above 300 kHz.
- ~50 % of Period 1 statistics is above 300 kHz.

W Test Production analysis- Comparisons

Comparisons	Purpose	Result
EVALS 1 vs EVALS 2	difference between STI vs STI_updated	No difference
EVALS 1 vs EVALS 4	difference between STI vs STICA	18 % enhancement in Final W
Yuri - P1 vs EVALS 4	difference between STICA in EVAL vs STICA in Yuri's code	No difference
EVALS 1 vs p14ia	difference between with and without new HFT material in STAR library	~4 % enhancement in Final W
Yuri's - P1 vs p14ia	difference between STI vs STICA **	22 % enhancement in Final W
Yuri's - P2 vs p14ig	difference between STI vs STICA **	29 % enhancement in Final W

- ** - Yuri's code

Analysis Details / Notes

- All the “evals” productions are from run 13 period 1 (day 76-126)
- 98 runs (0.18 M) have removed from this analysis from each productions [12.2 M] since those runs have failed run QA done for run 13 W AL analysis. 937 runs [12.02 M] were used.
- For period 2 analysis, 716 runs were used. They were also chosen from QA'd run list of run 13 period 2 W AL analysis.
- Official W -AL code were used and run 12 200 GeV BEMC tower calibration gains were used.
- For Each production W code also compiled with the same production library.
- All the comparisons are apple-to-apple [Exactly same # of runs with same # of events that have processed were compared]

Evals 1 vs Evals 2

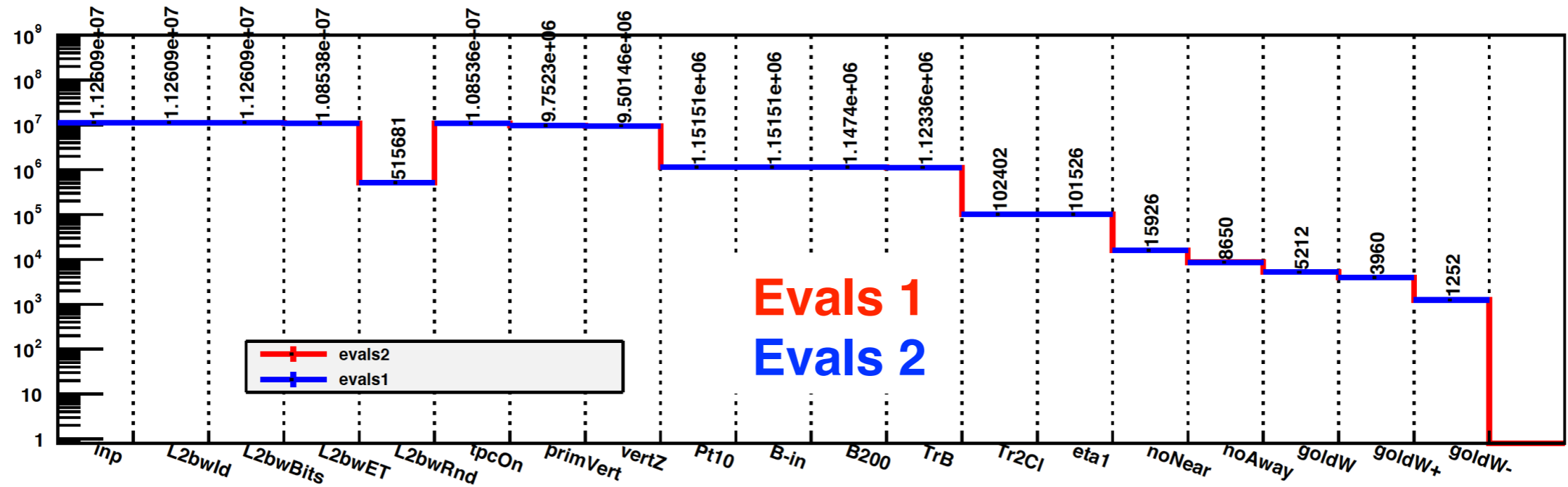
Apple- to -Apple comparison

To investigate the difference between STI vs STI_updated

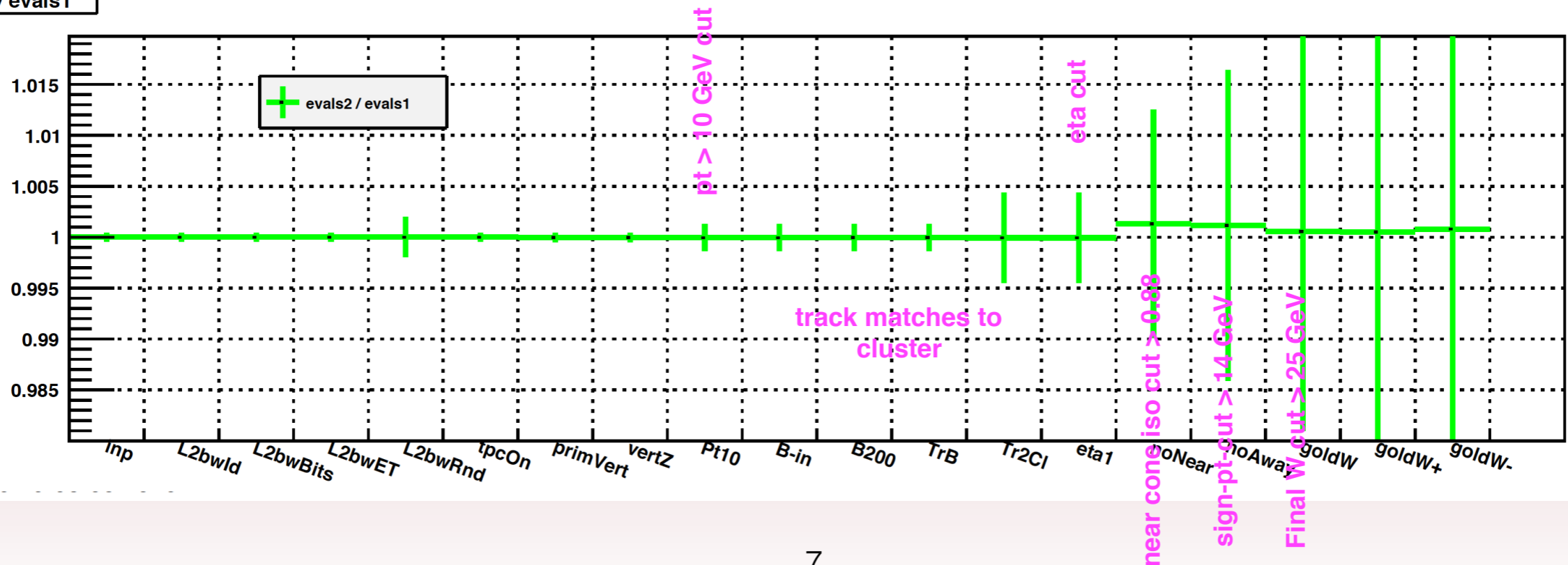
Details / Notes

Production	Production Library [also W-code compiled library]	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
“evals2”	EVAL	Sti [updated]	PPV_W	run 12 - 200 GeV	896	11.26 M
“evals1”	SL16b	Sti	PPV_W	run 12 200 GeV	896	11.26 M

Events Counts as a function of W cuts

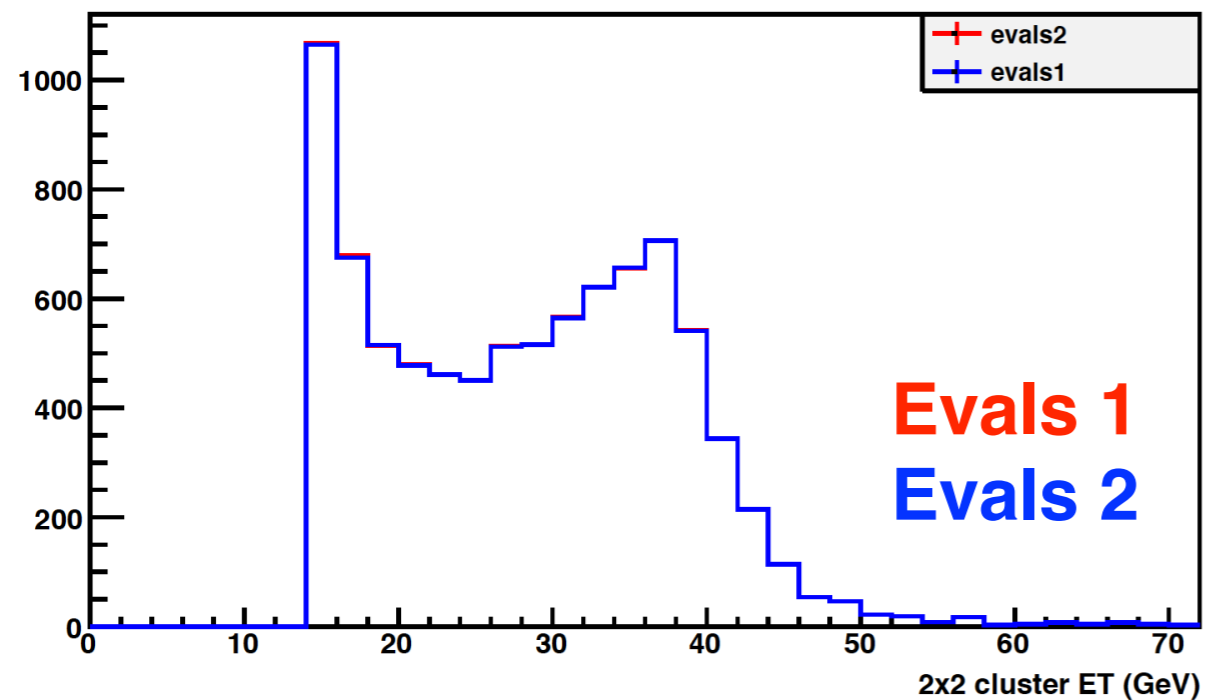


evals2 / evals1

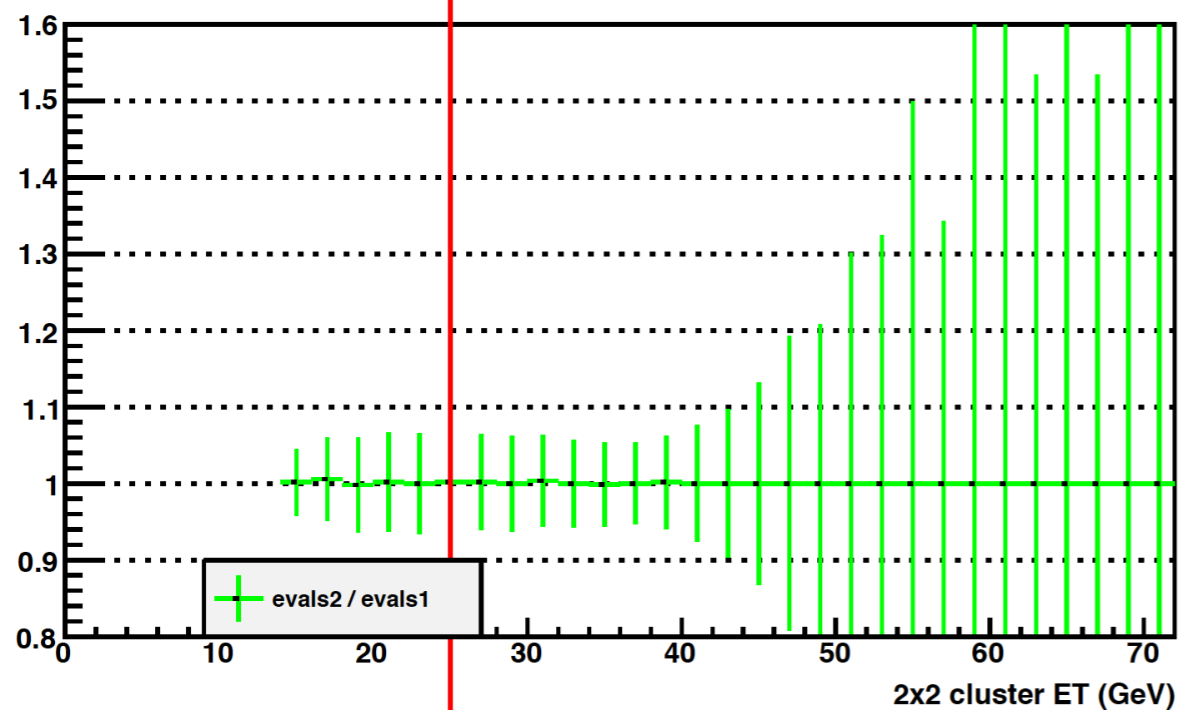


Final W : Et , ZDC

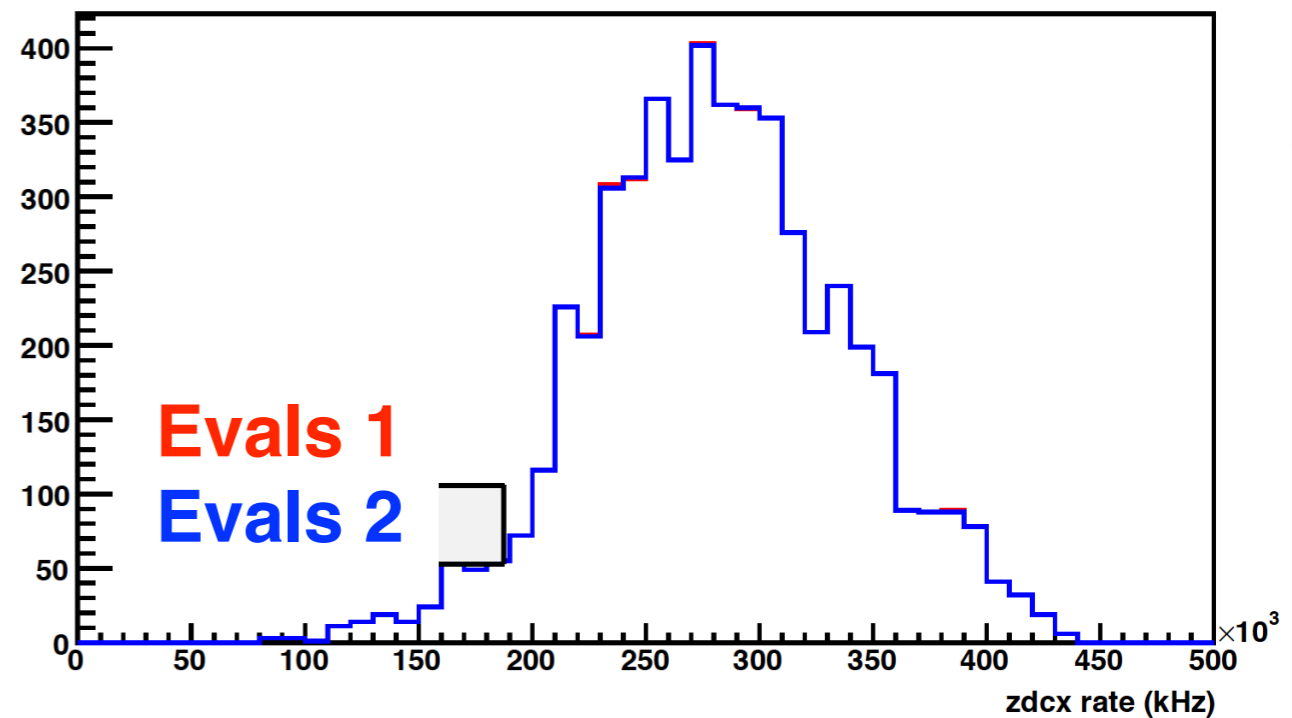
Final W - Et



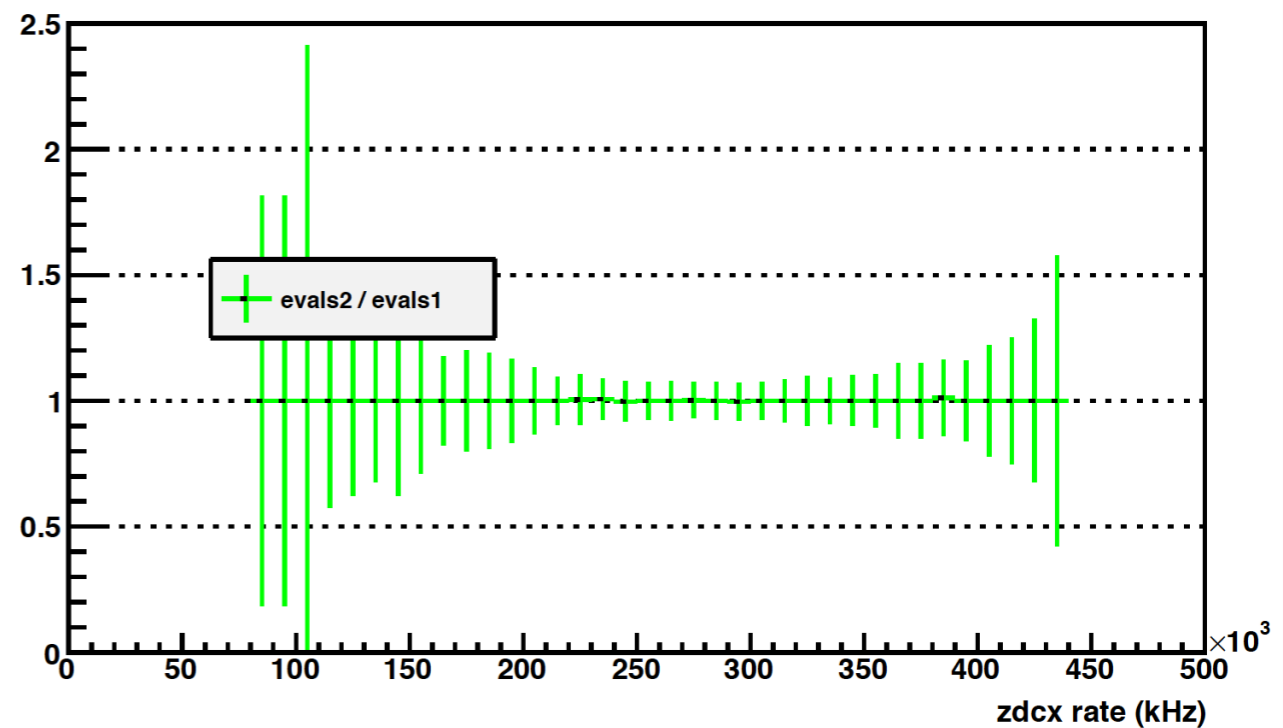
evals2 / evals1



Final W - ZDC



evals2 / evals 1



Summary

- No observable considerable difference between Evals 1 vs Evals 2. Meaning **no difference** between **STI vs STI_updated** [sti_updated]

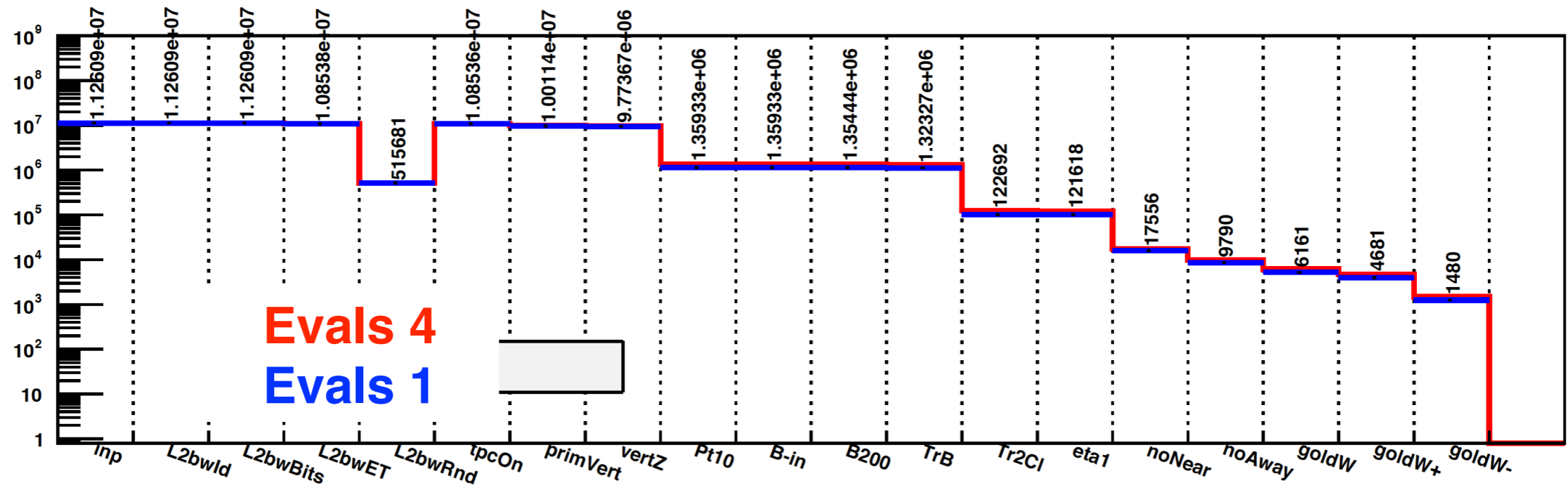
Evals 1 vs Evals 4

Apple- to -Apple comparison

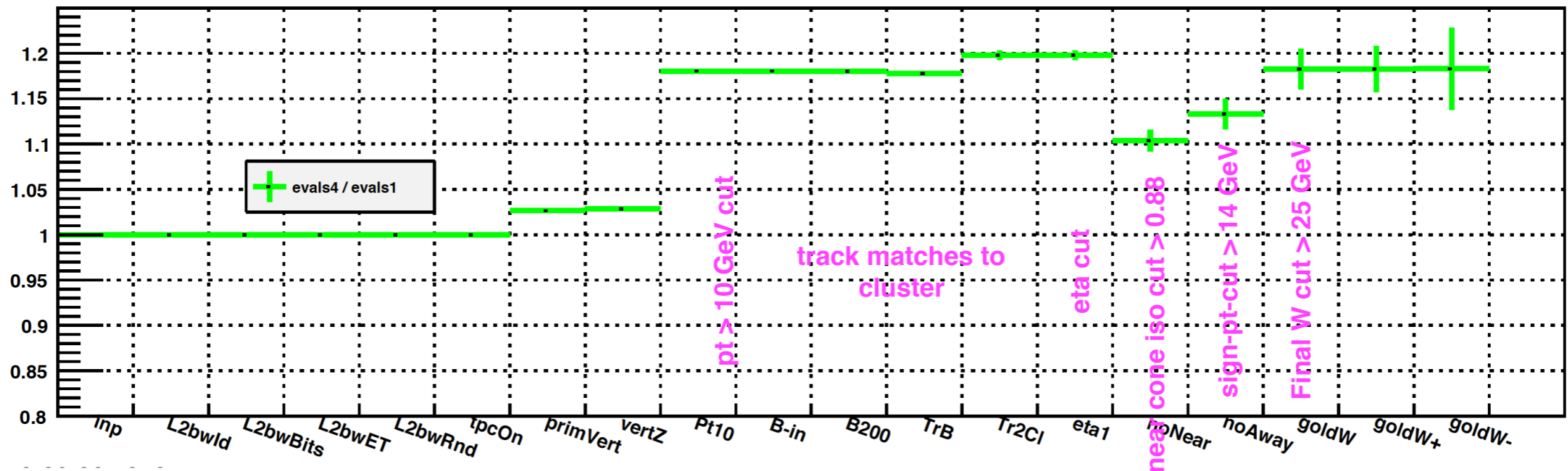
To investigate the difference between STI vs STICA

Production	Production Library [also W-code compiled library]	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
“evals4”	EVAL	StiCA	PPV_W	run 12 - 200 GeV	896	11.26 M
“evals1”	SL16b	Sti	PPV_W	run 12 200 GeV	896	11.26 M

Events Counts as a function of W cuts

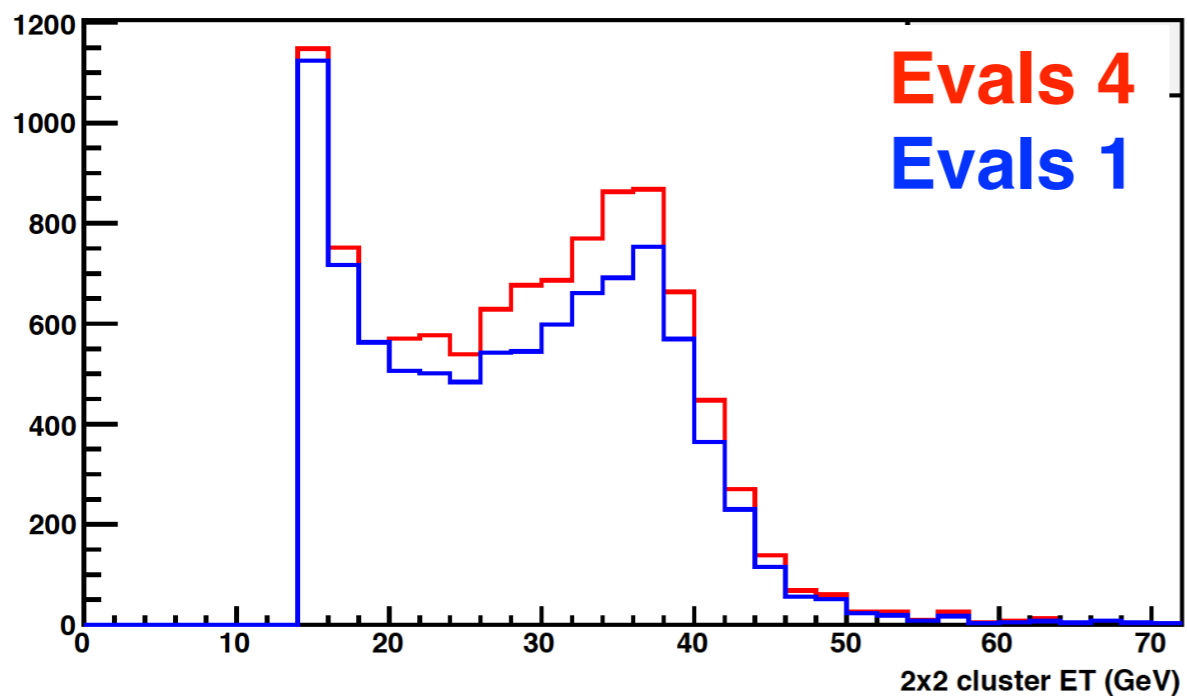


evals4 / evals1

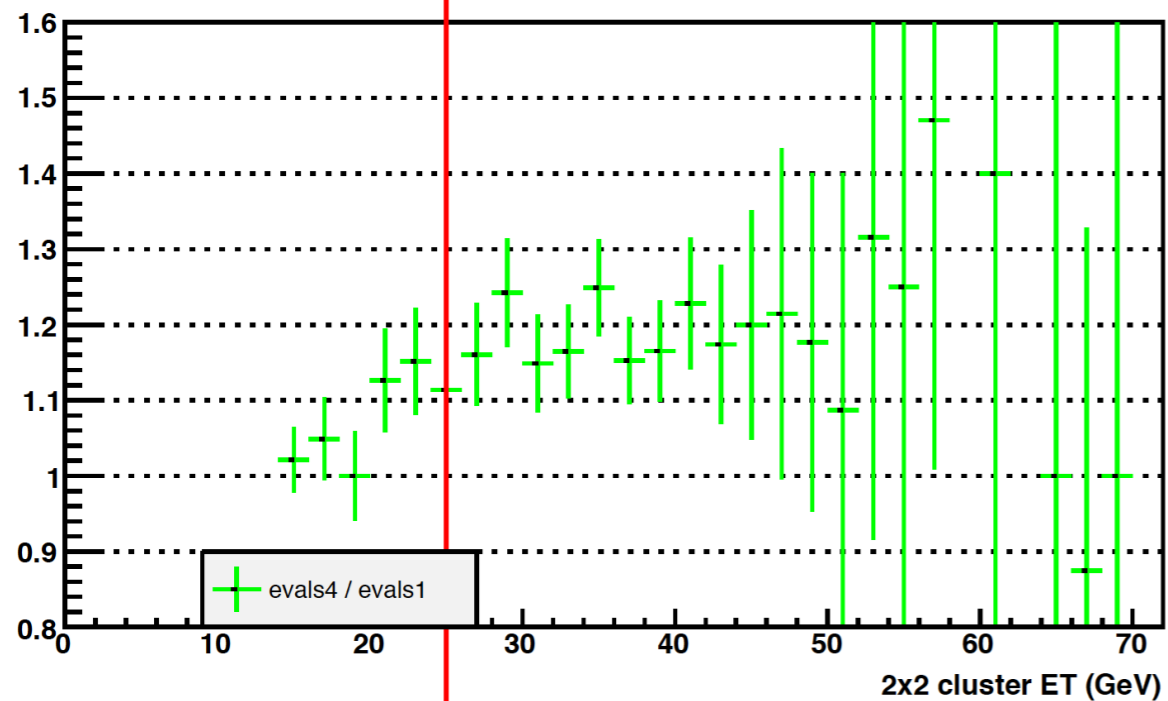


Final W : Et , ZDC

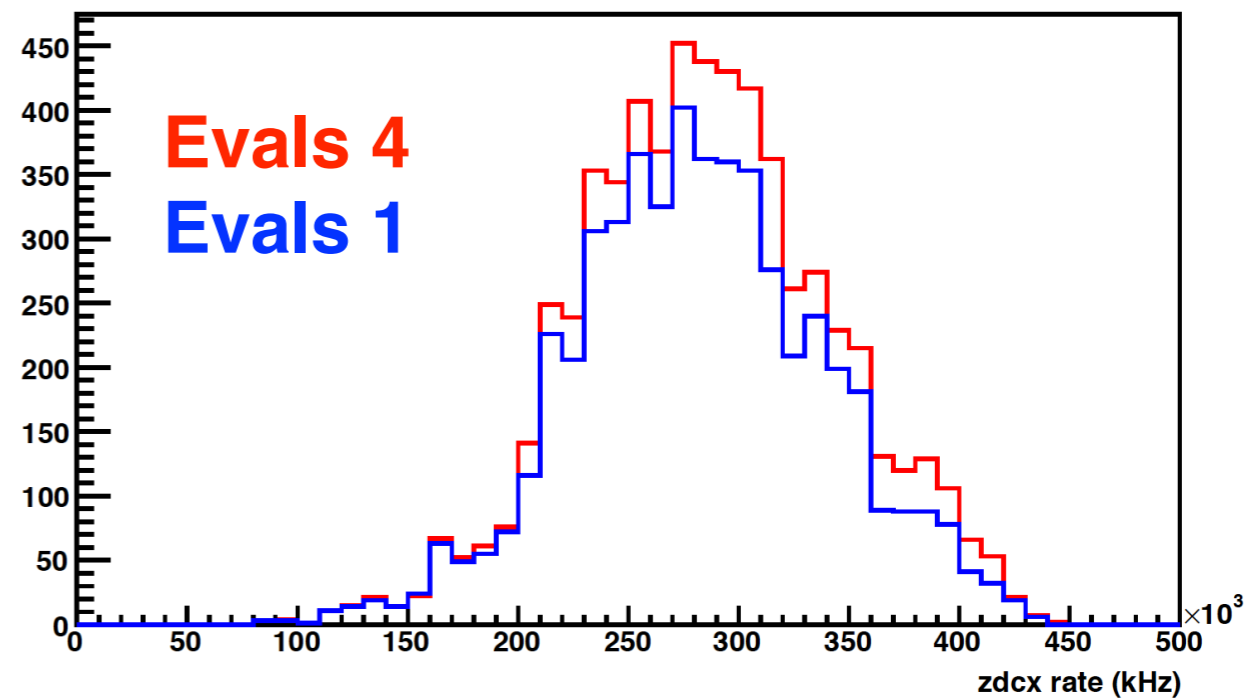
Final W - Et



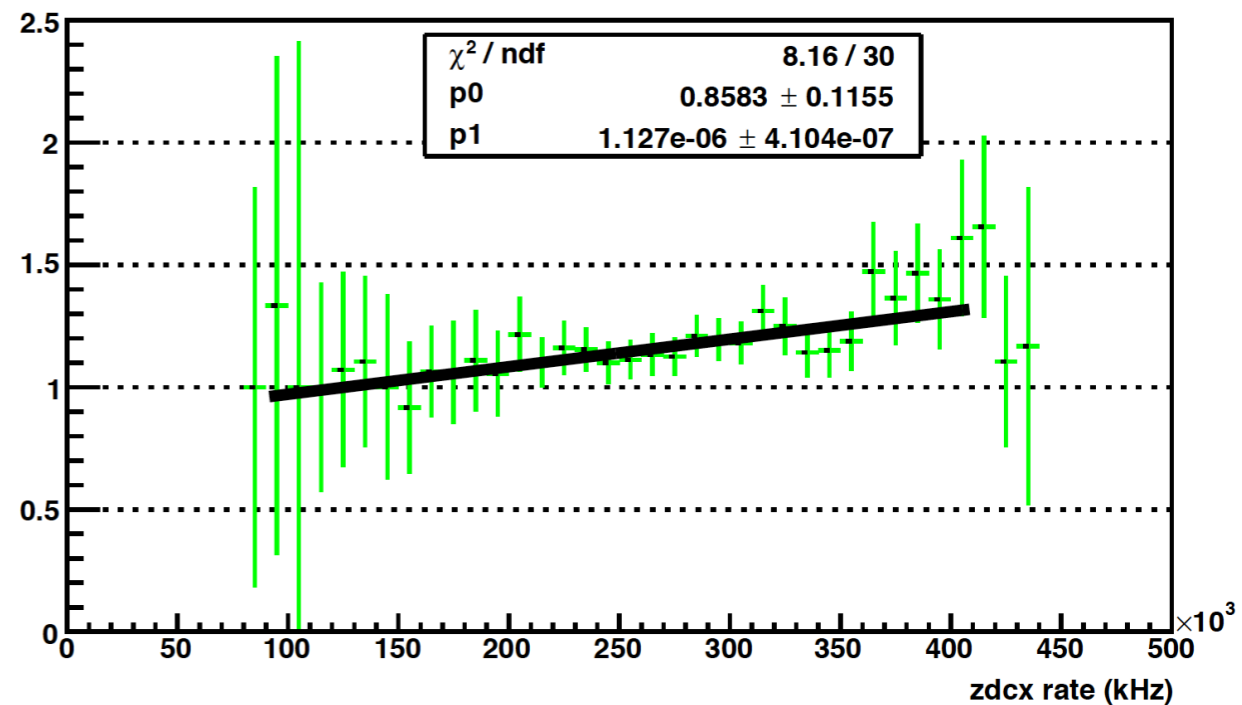
evals4 / evals1



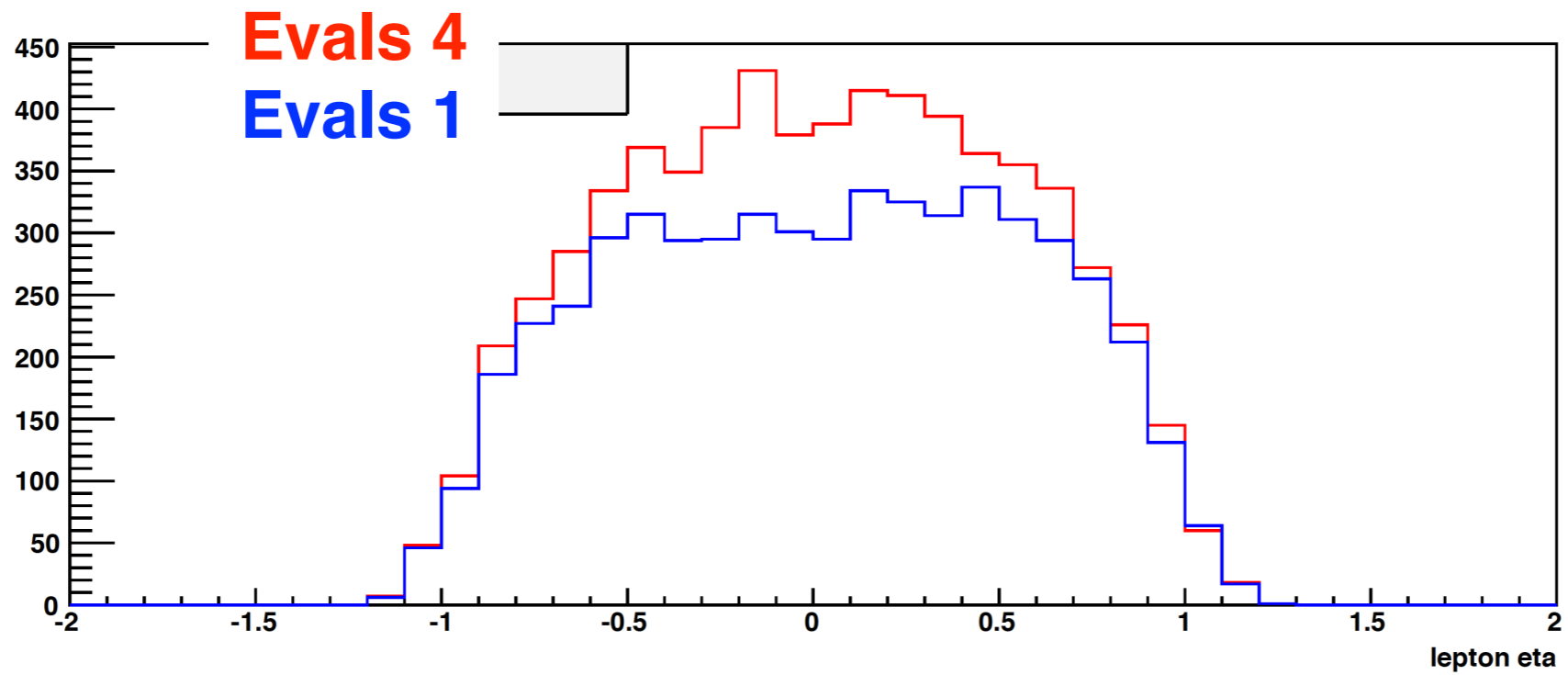
Final W - ZDC



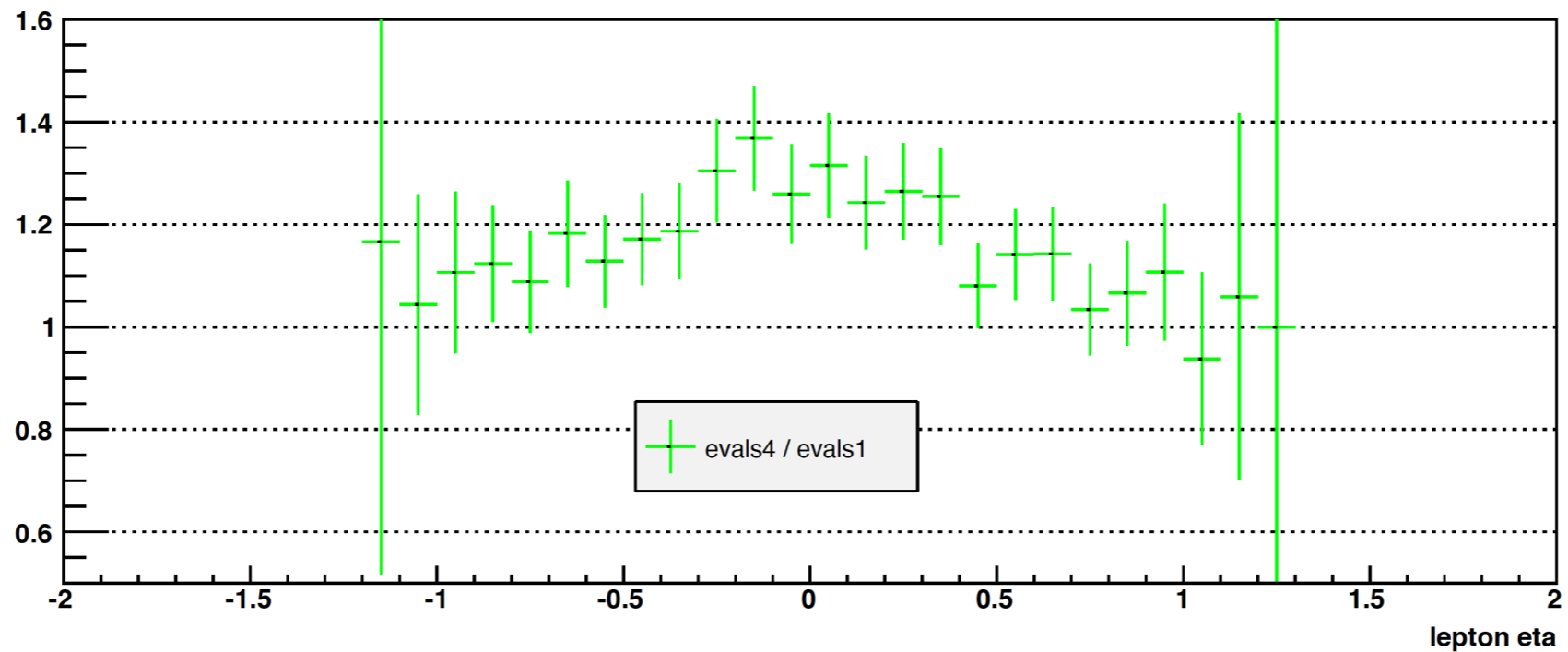
evals4 / evals 1



Final W Eta



evals4 / evals1



Summary

- We see $\sim 18\%$ enhancement in tracks above $P_t = 10$ GeV and similar enhancement in final W [> 25 GeV] tracks.
- Significant enhancement of **final W Eta in mid rapidity** region where a “dip” [data-MC discrepancy] was observed previously.

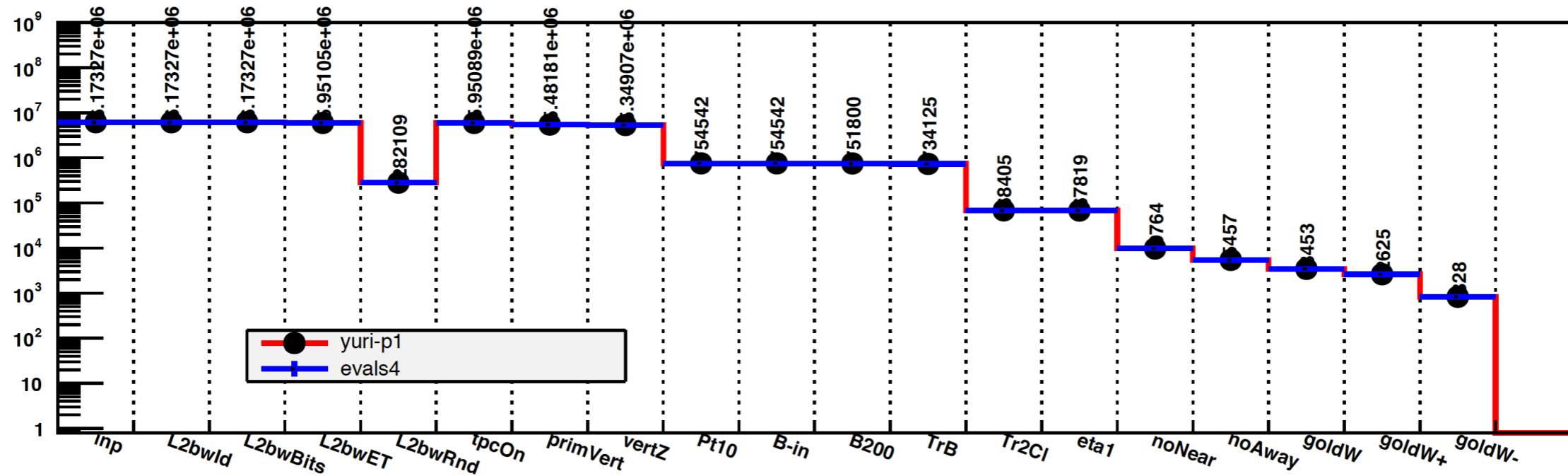
Yuri's-P1 vs Eval4

apple- to -apple comparison

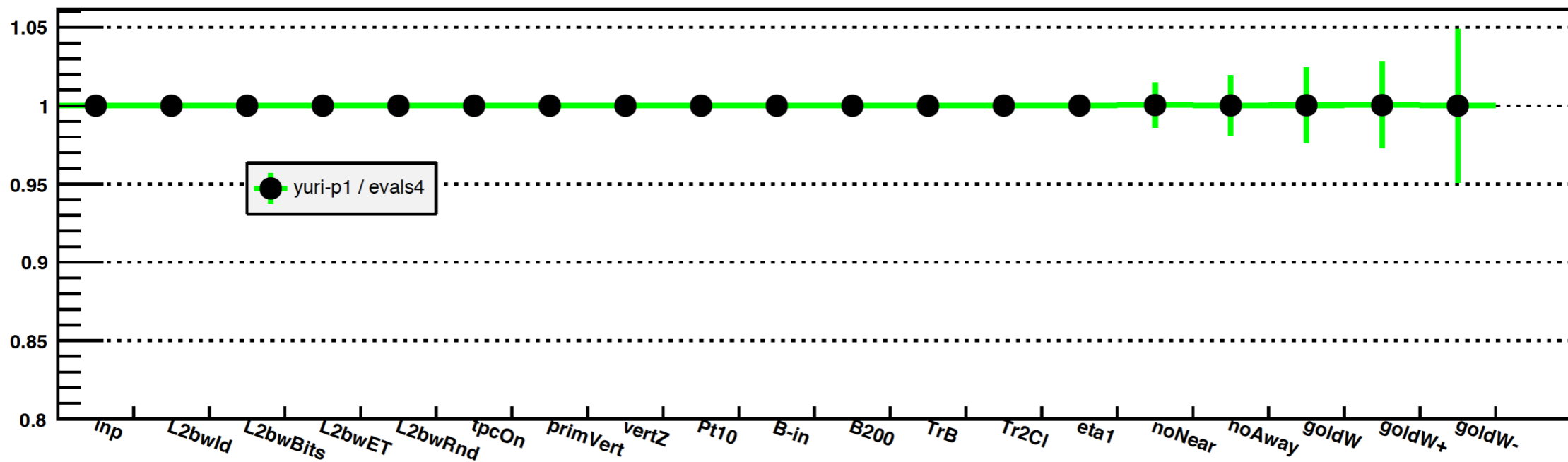
To investigate the difference between STICA in EVAL vs STICA in Yuri's code

Production	Production Library [also W-code compiled library]	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
"evals4"	EVAL	StiCA	PPV_W	run 12 - 200 GeV	896	6172606
Yuri's - P1 (day 129-161)	DEV2/ TFG16a	StiCA [Yuri's code]	PPV_W	run 12 200 GeV	585	6172606

Events Counts as a function of W cuts

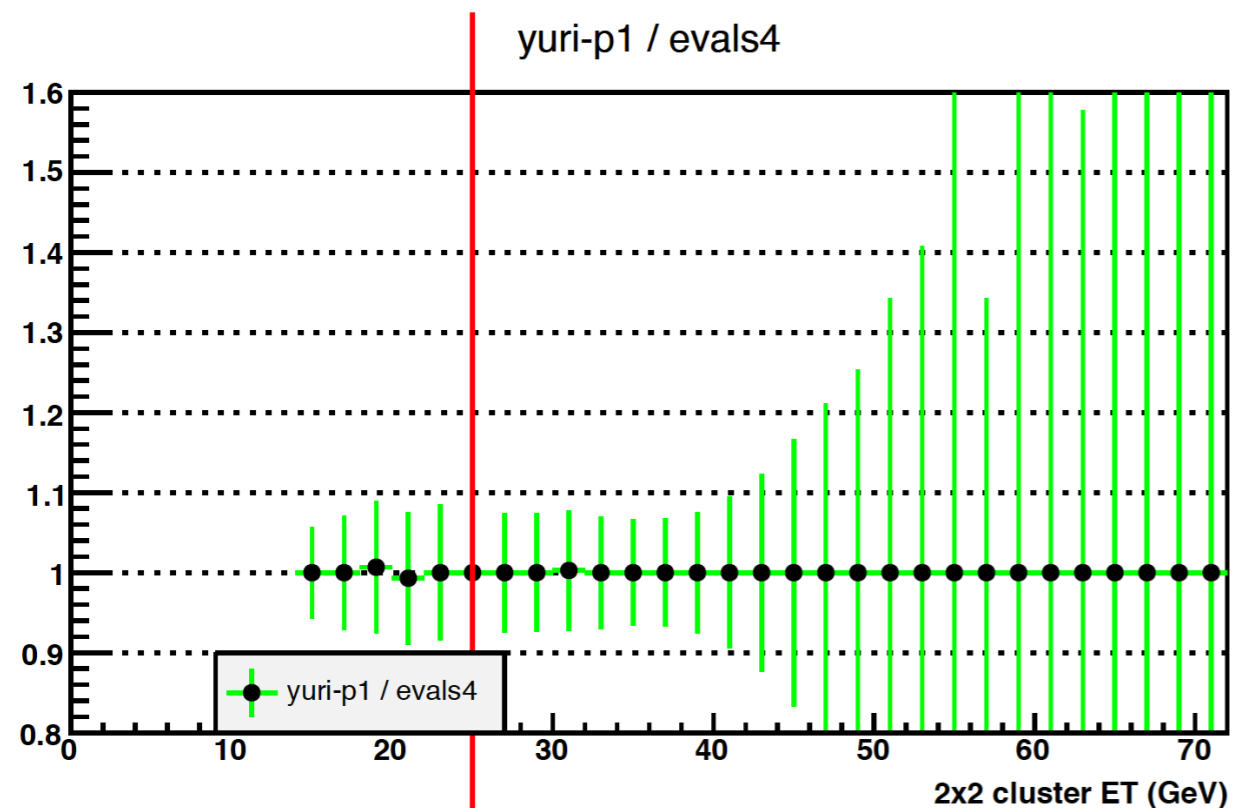
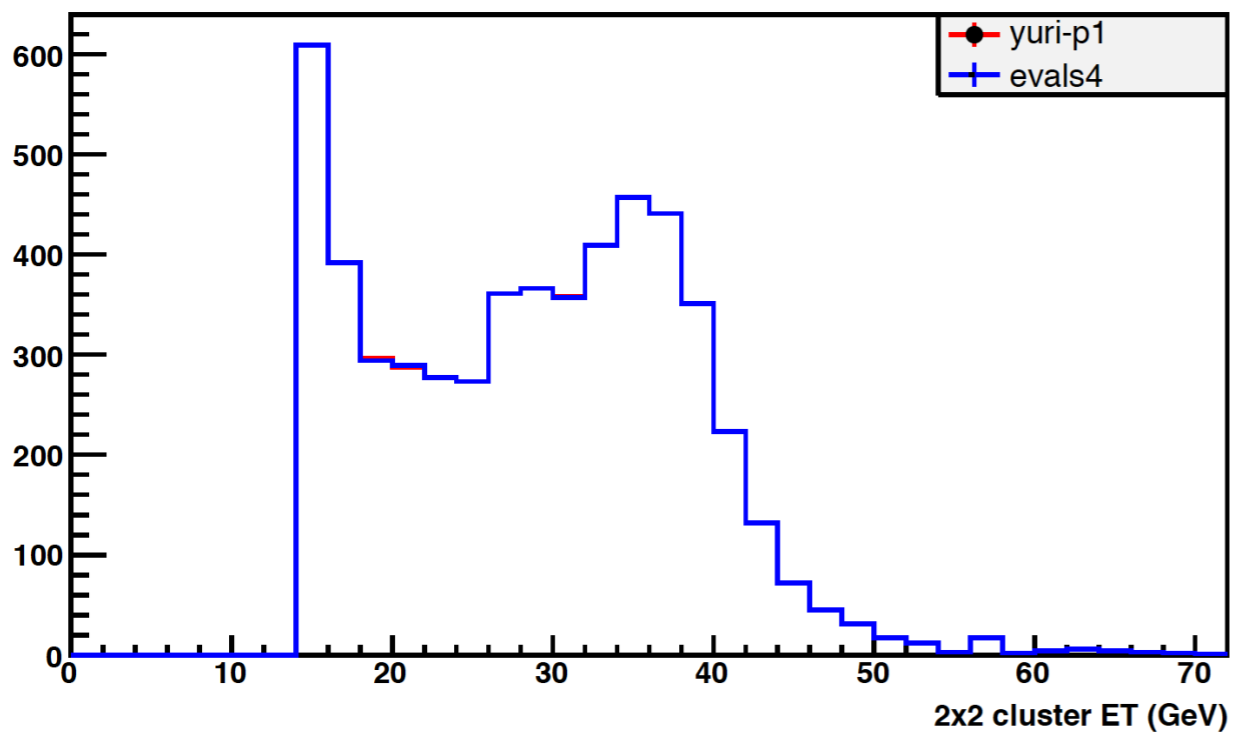


yuri-p1 / evals4

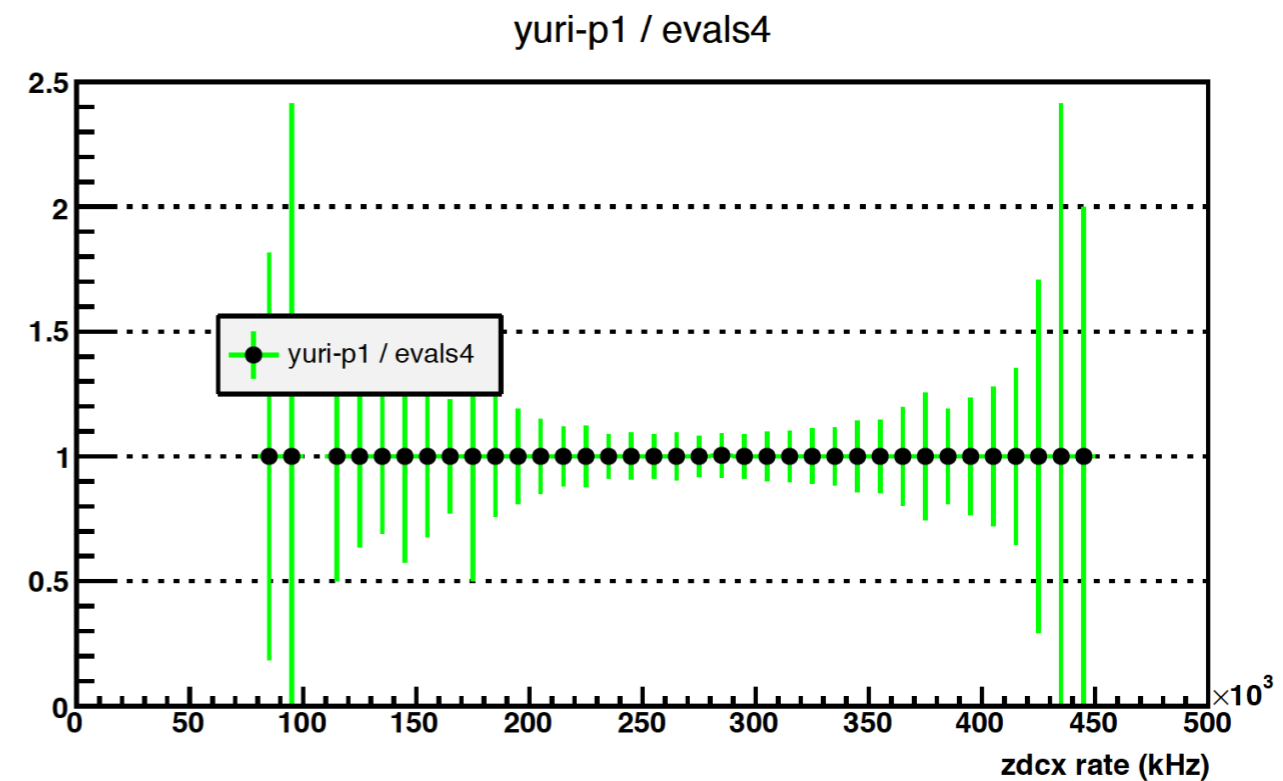
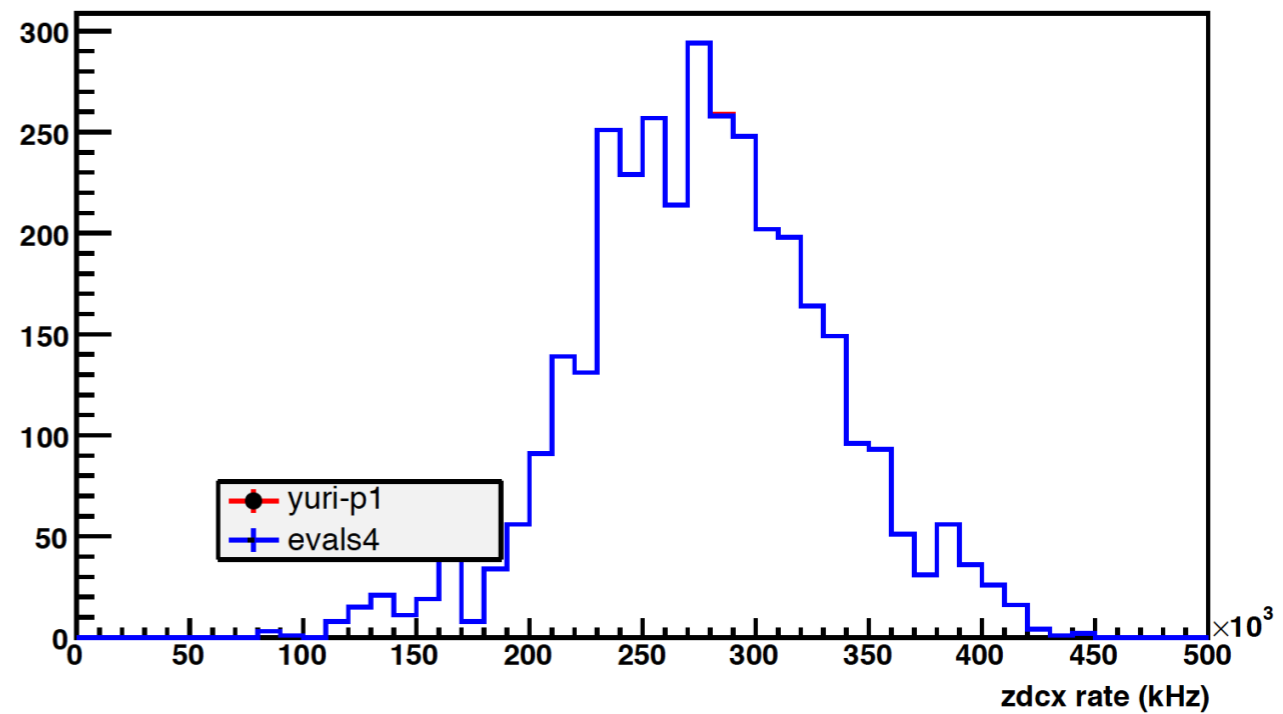


Final W : Et , ZDC

Final W - Et



Final W - ZDC



Summary

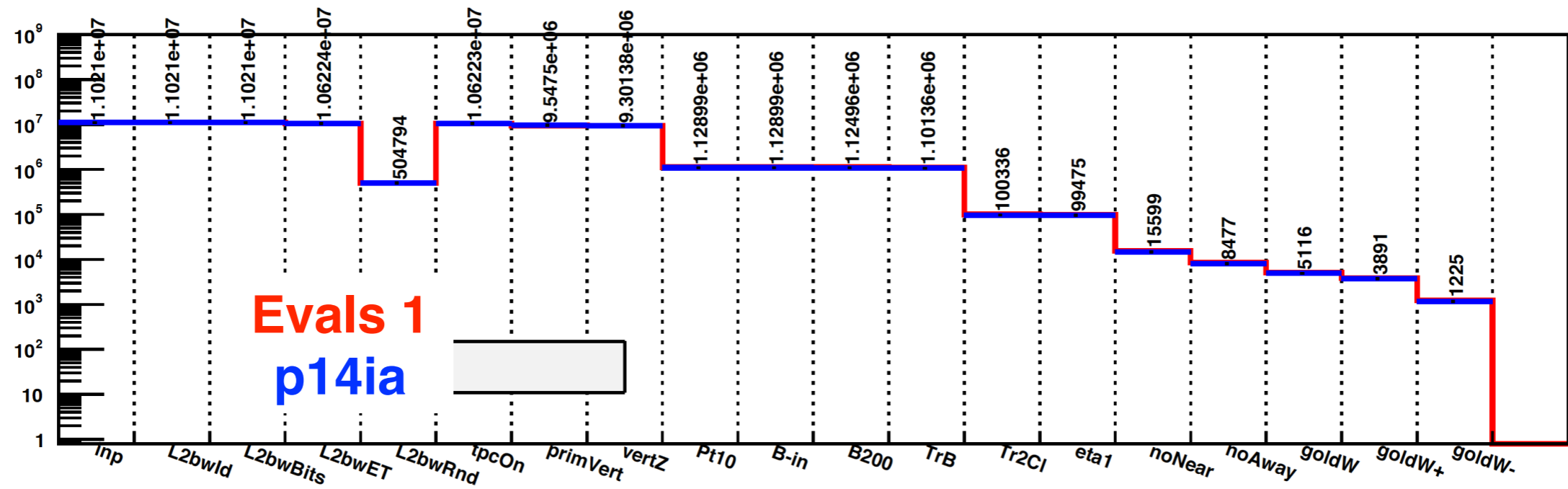
- Absolutely **NO** difference between Evals 4 vs Yuri-p1. Meaning **no difference** between **STICA in EVAL vs STICA in Yuri's code.**

Evals 1 vs p14ia

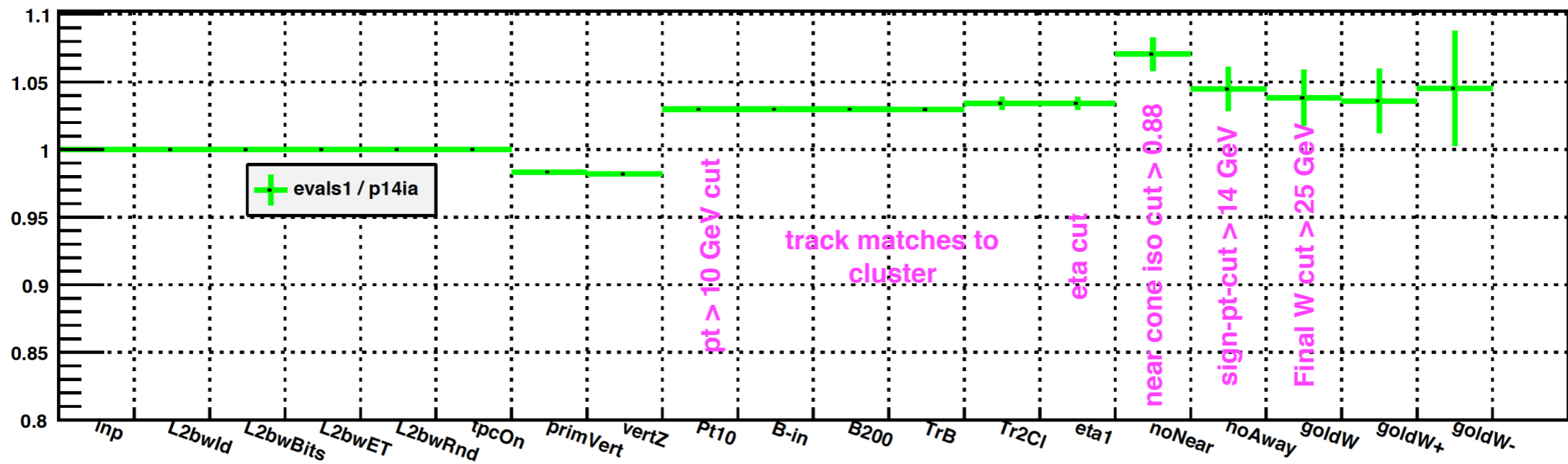
To investigate the difference between STI in newer STAR library (SL16b) with HFT material vs STI in old STAR library (SL14a) without HFT materials

Production	Production Library [also W-code compiled	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
P14ia [official run 13 - P1 (day 76-128)	SL14ia	Sti	PPV_W	run 12 - 200 GeV	885	11.021 M
“evals1”	SL16b	Sti	PPV_W	run 12 200 GeV	885	11.021 M

Events Counts as a function of W cuts

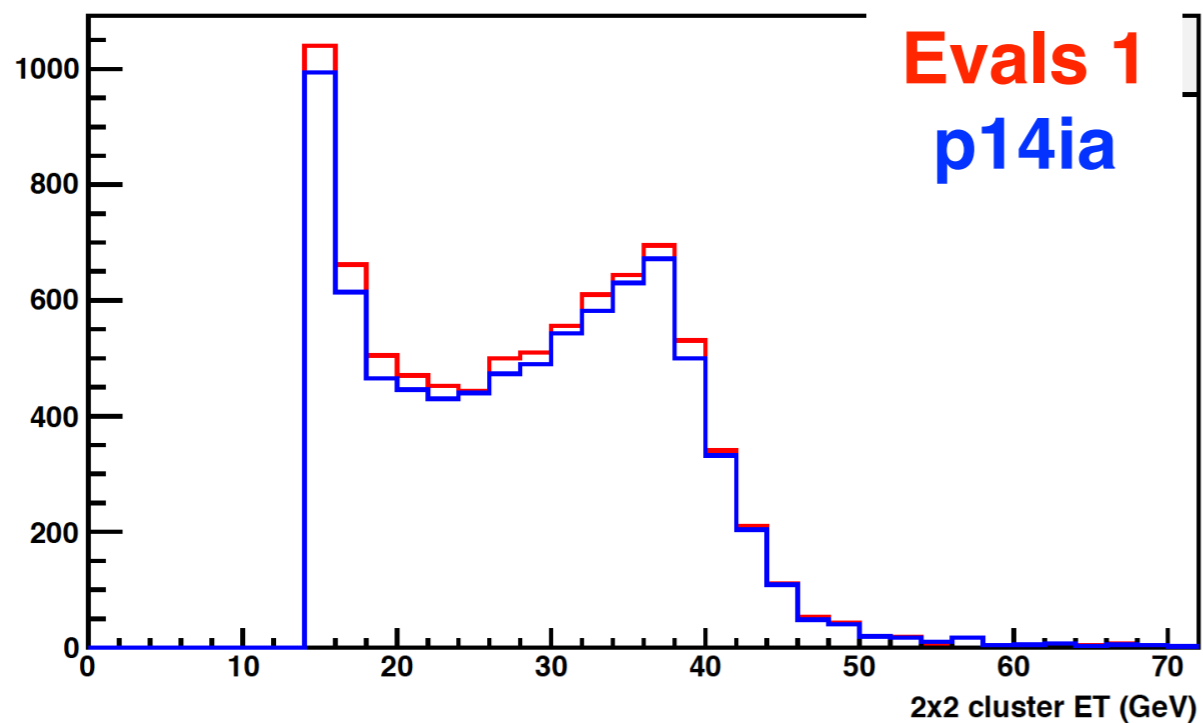


evals1 / p14ia

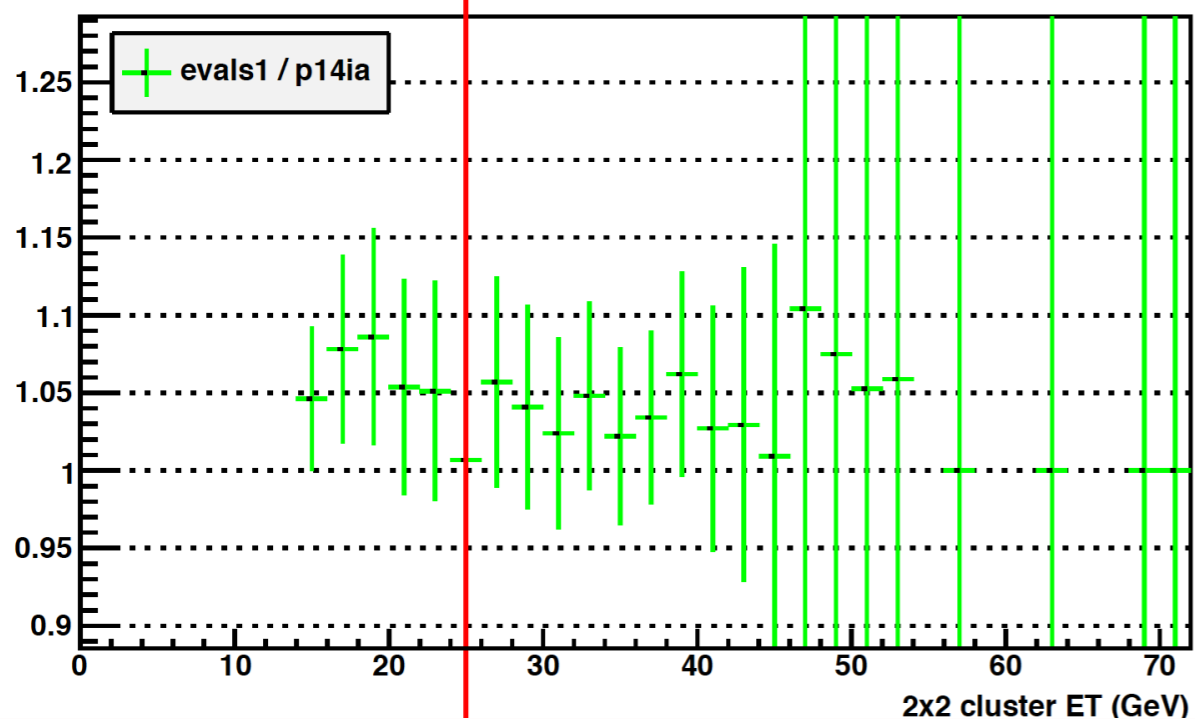


Final W : Et , ZDC

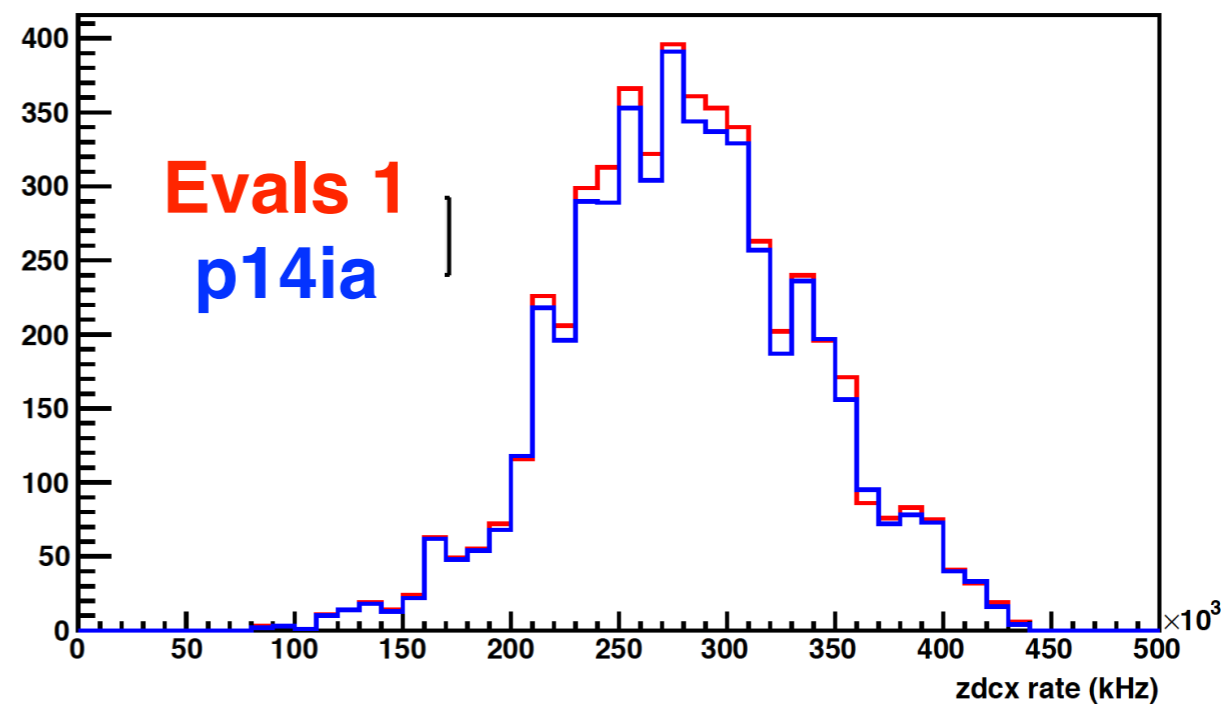
Final W - Et



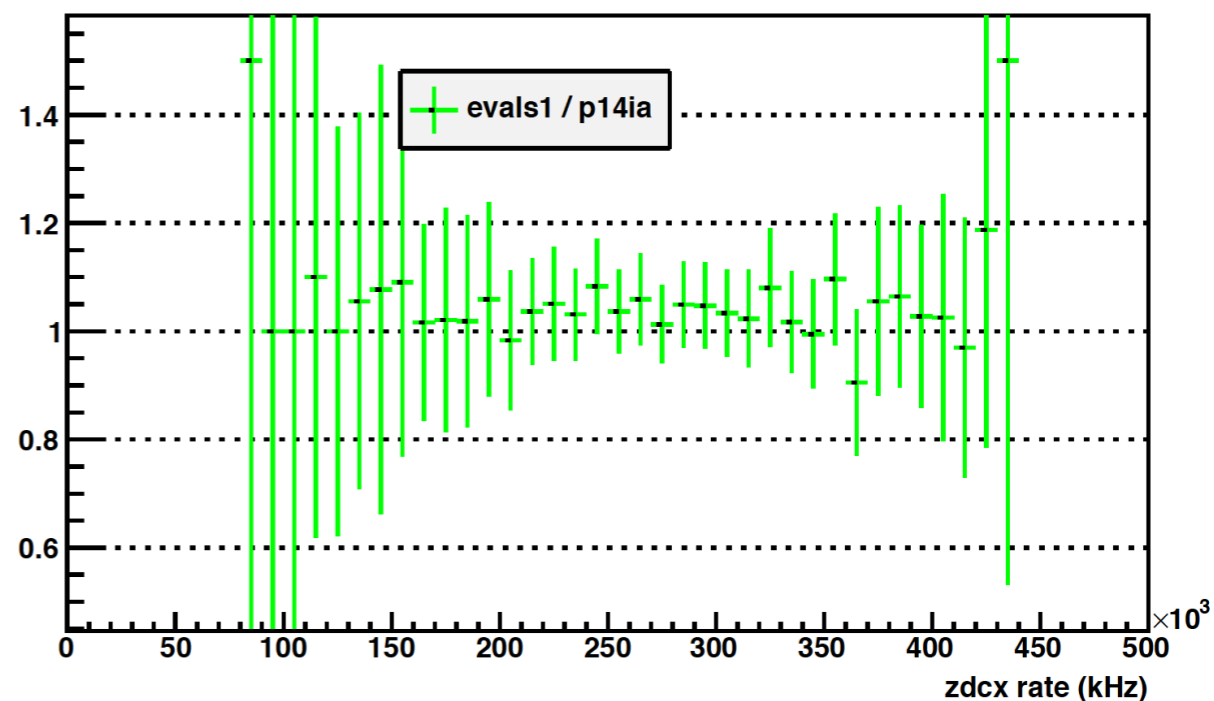
evals1 / p14ia



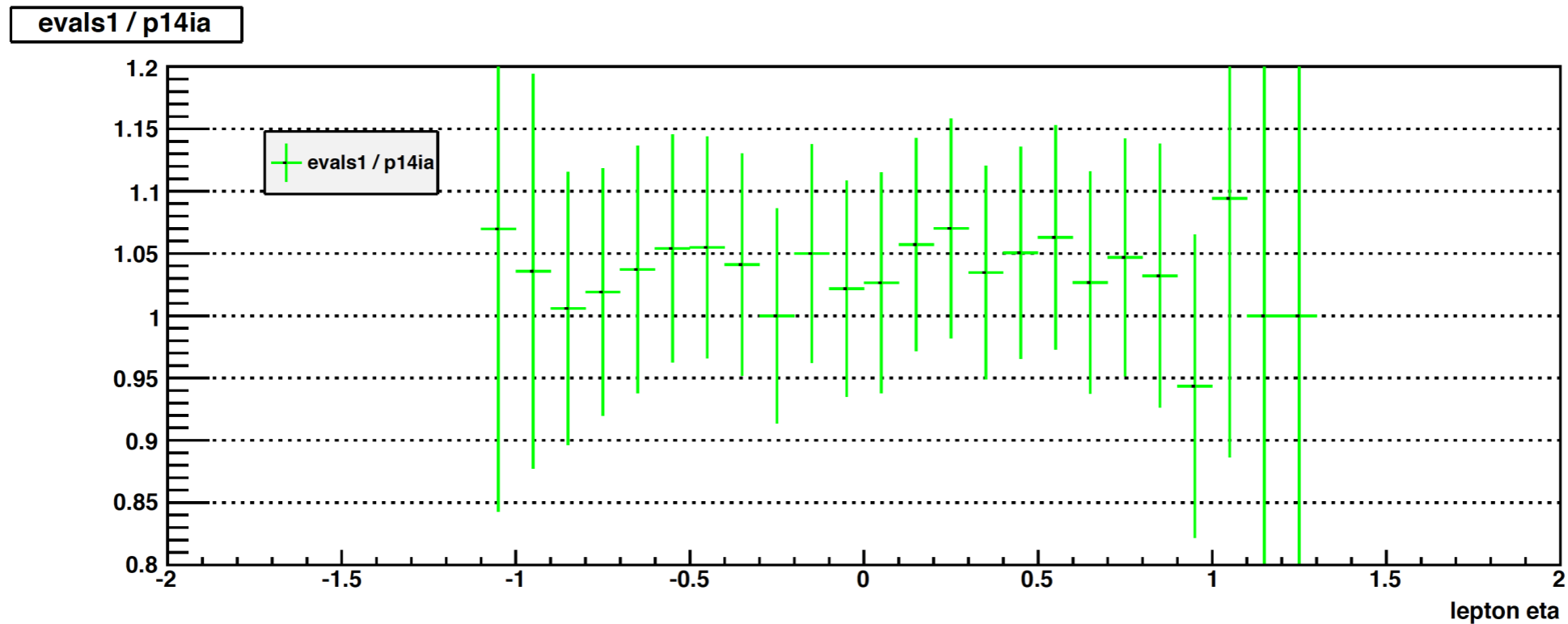
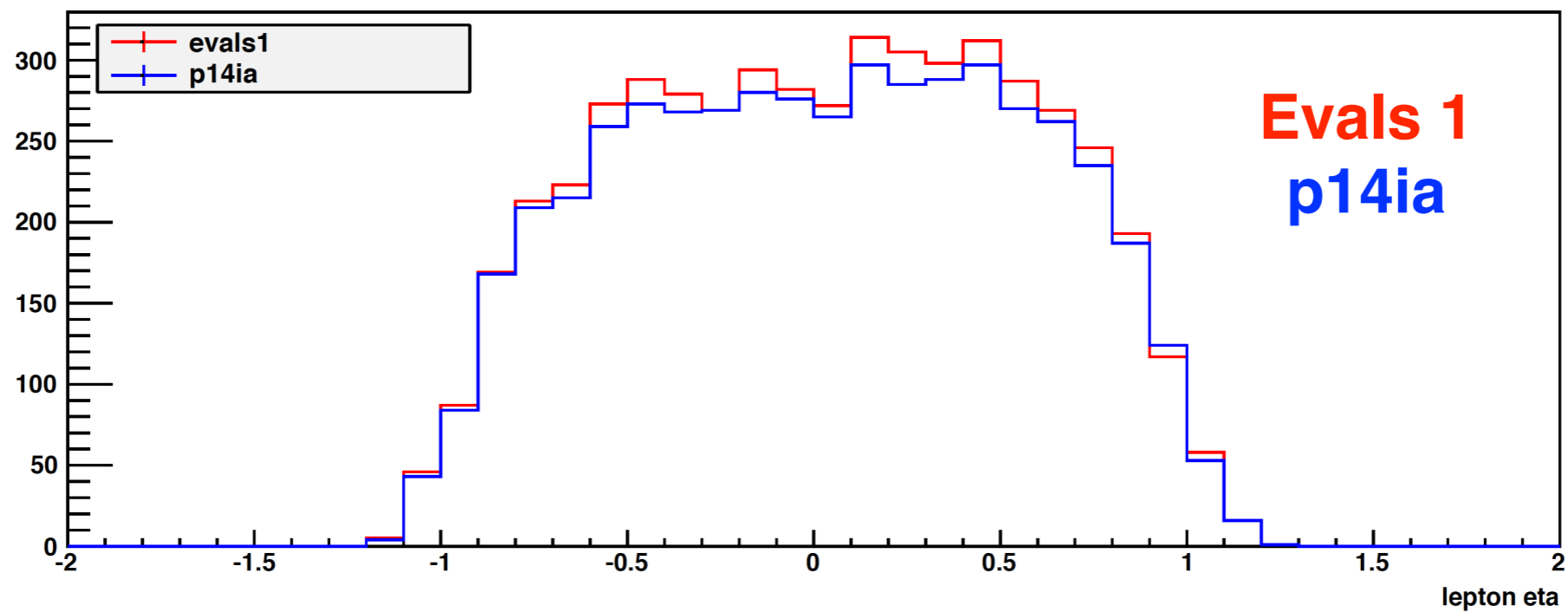
Final W - ZDC



evals1 / evals 1



Final W Eta



Summary

- ~ 4% enhancement in tracks and final Ws.
- This could be caused by new HFT material / tracking definitions in new SL16b library.
- Nothing will change in the physics due to this.

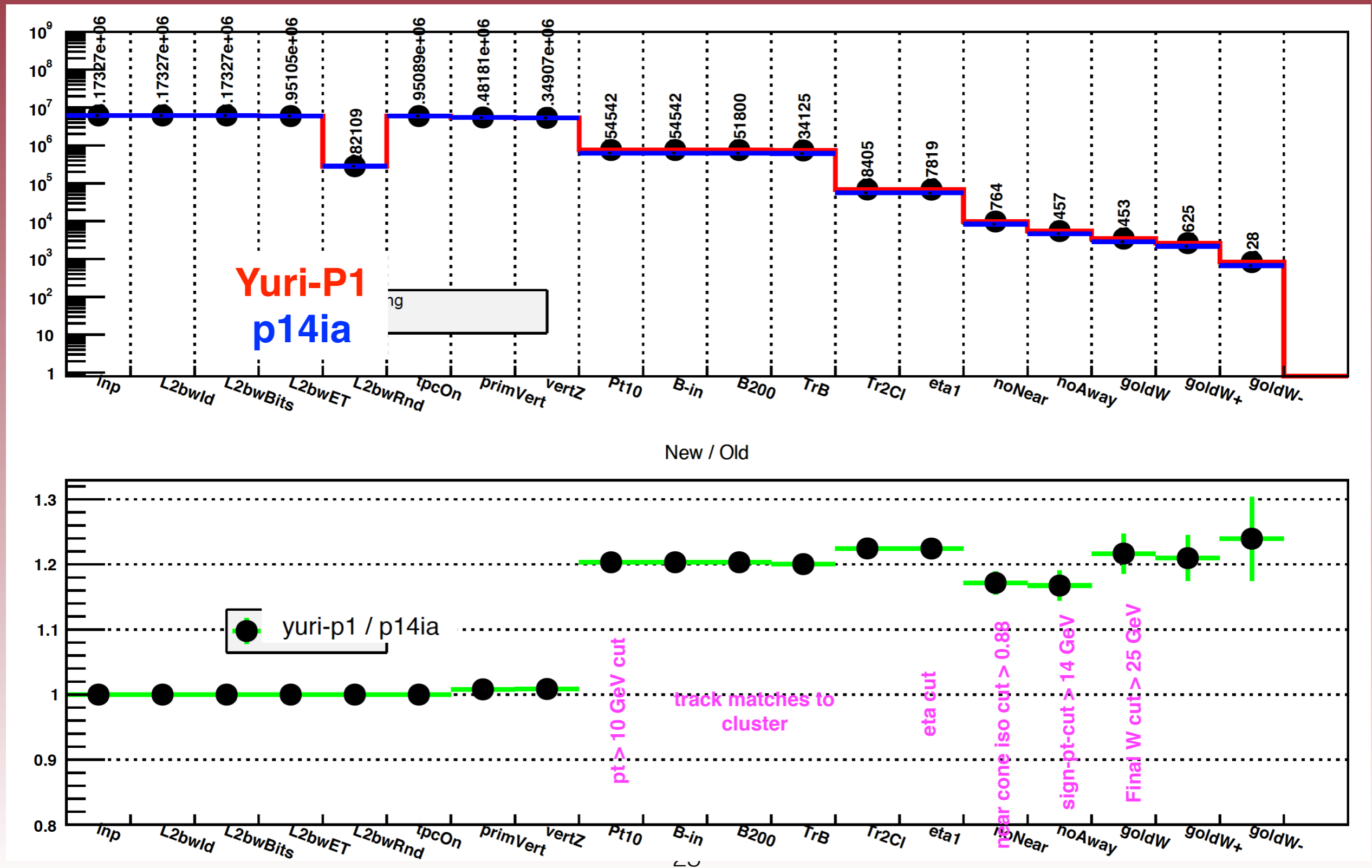
Yuri's-P1 vs P14ia [run 13 - official -P1]

apple- to -apple comparison

To investigate the difference between STI vs STICA [STICA is in Yuri's code] in run 13 period 1 [<ZDC> ~ 290 kHz and 50% statistics is below 300 kHz]

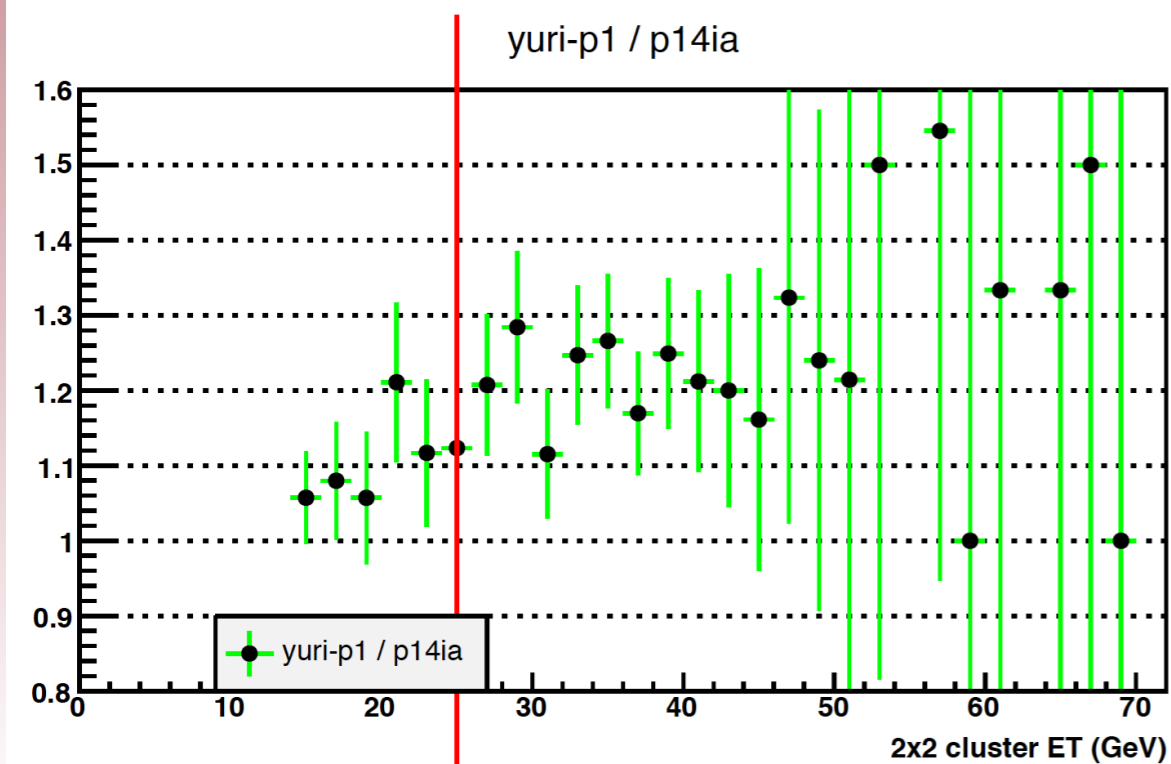
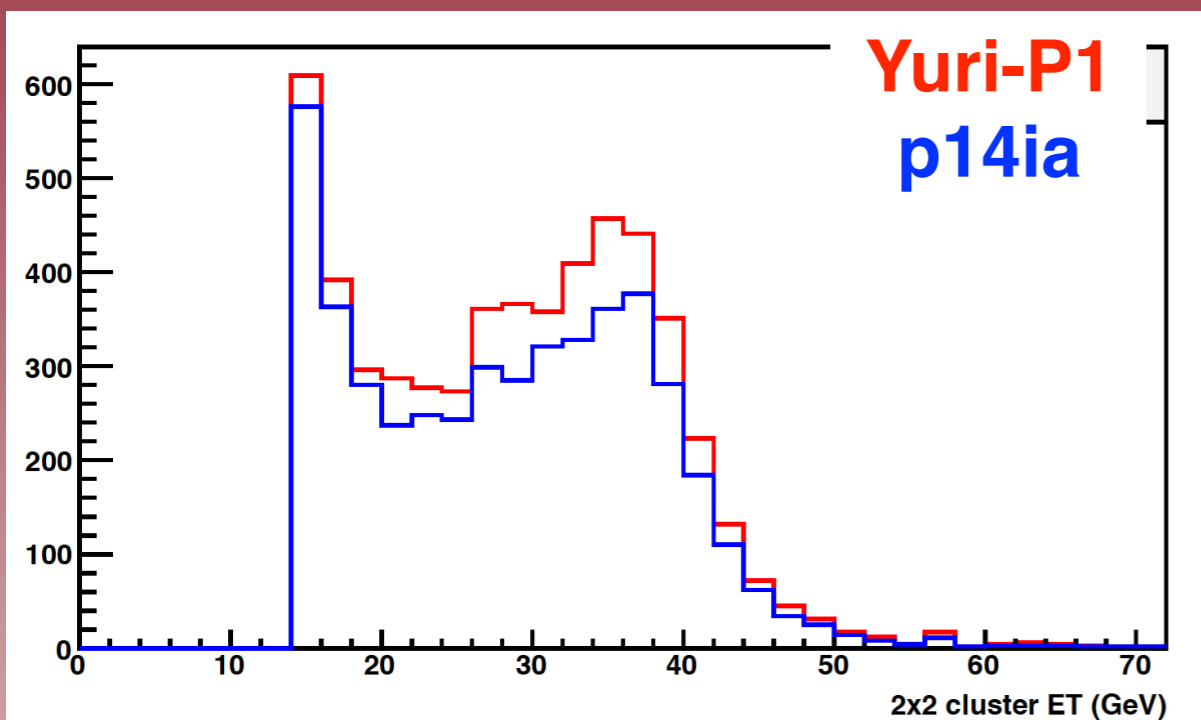
Production	Production Library [also W-code compiled library]	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
P14ia [official run 13 - P2 (day 76-126)]	SL14a	Sti	PPV_W	run 12 - 200 GeV	585	6172606
Yuri's - P2 (day 76-126)	DEV2/TFG16a	StiCA [Yuri's code]	PPV_W	run 12 200 GeV	585	6172606

Events Counts as a function of W cuts

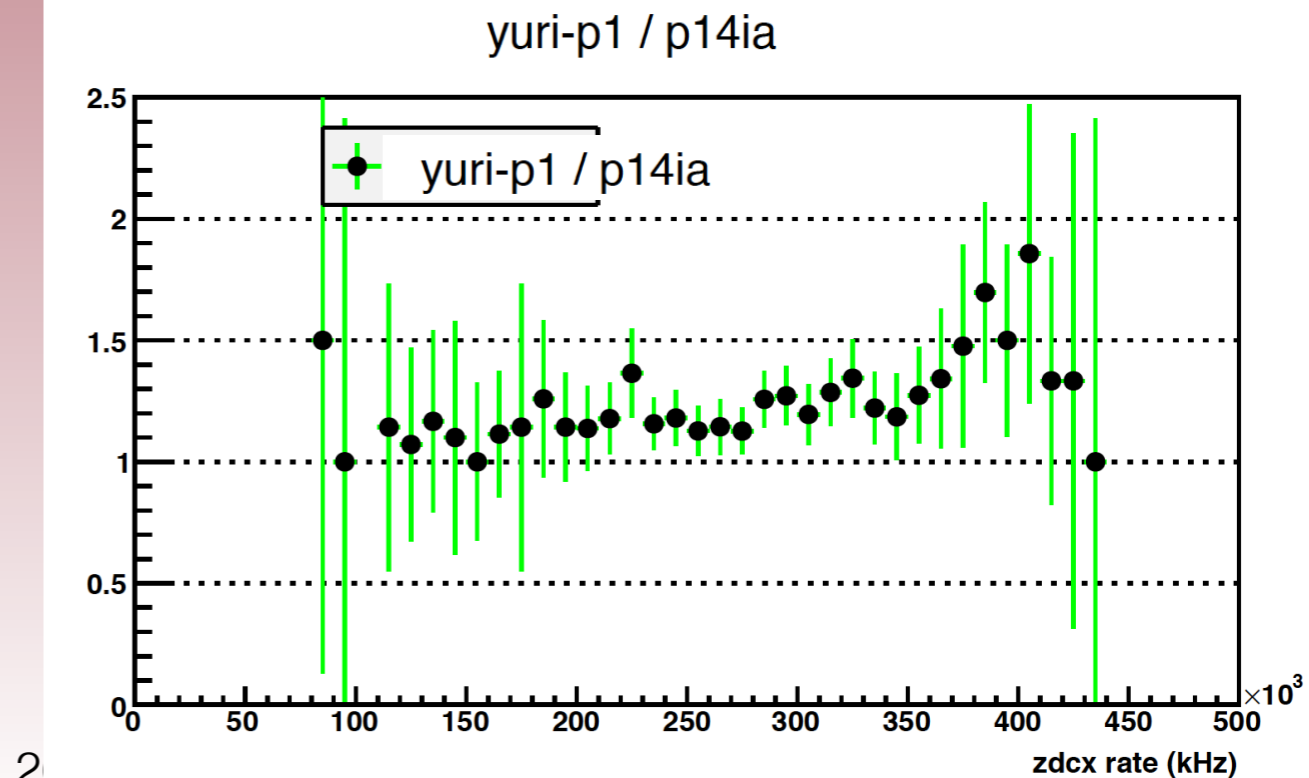
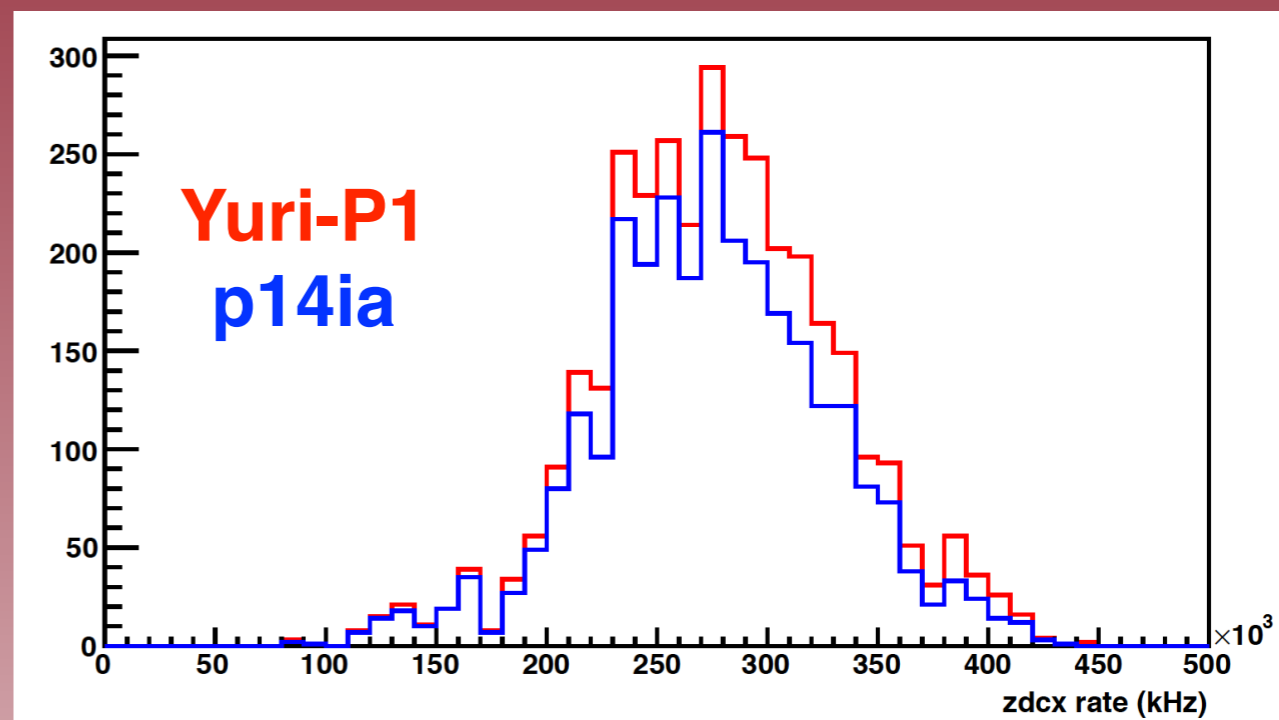


Final W : Et , ZDC

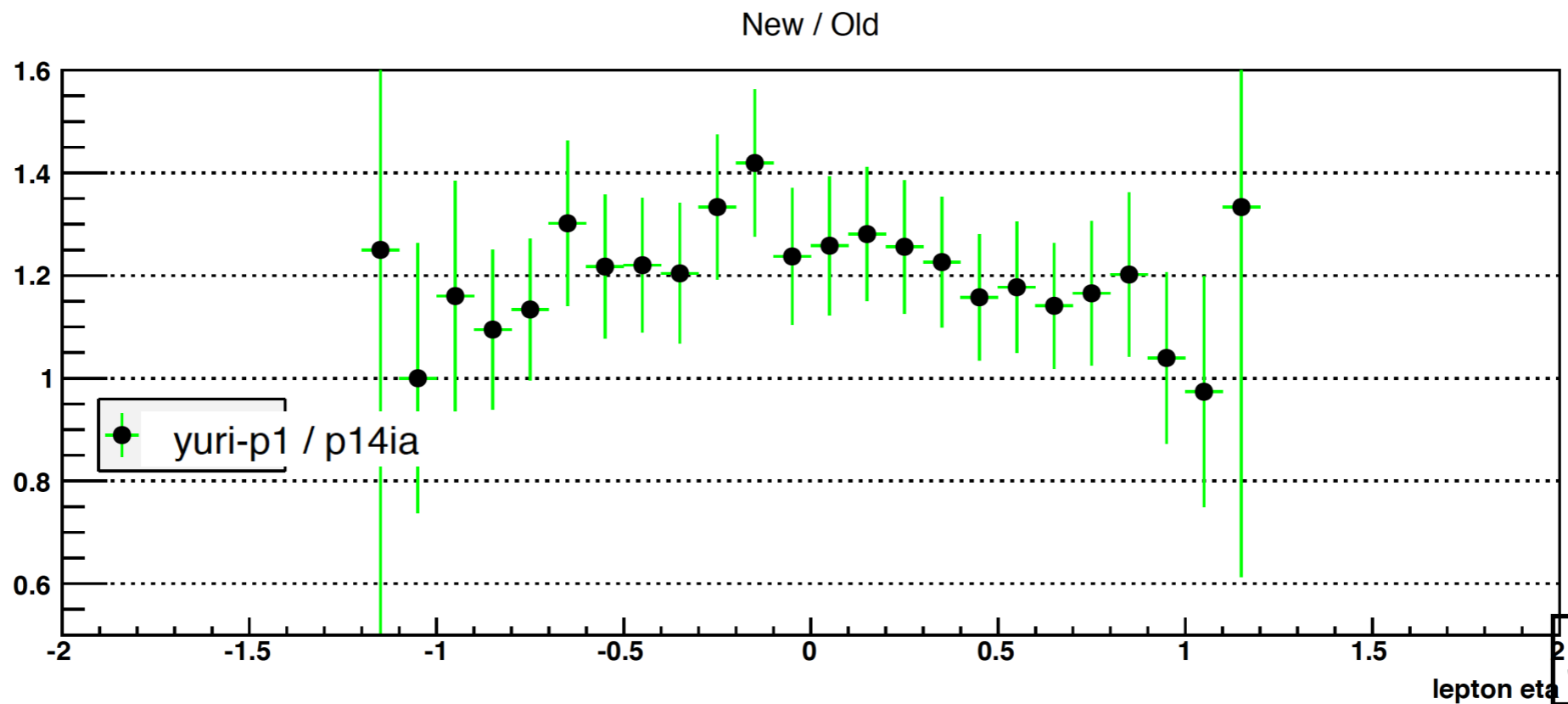
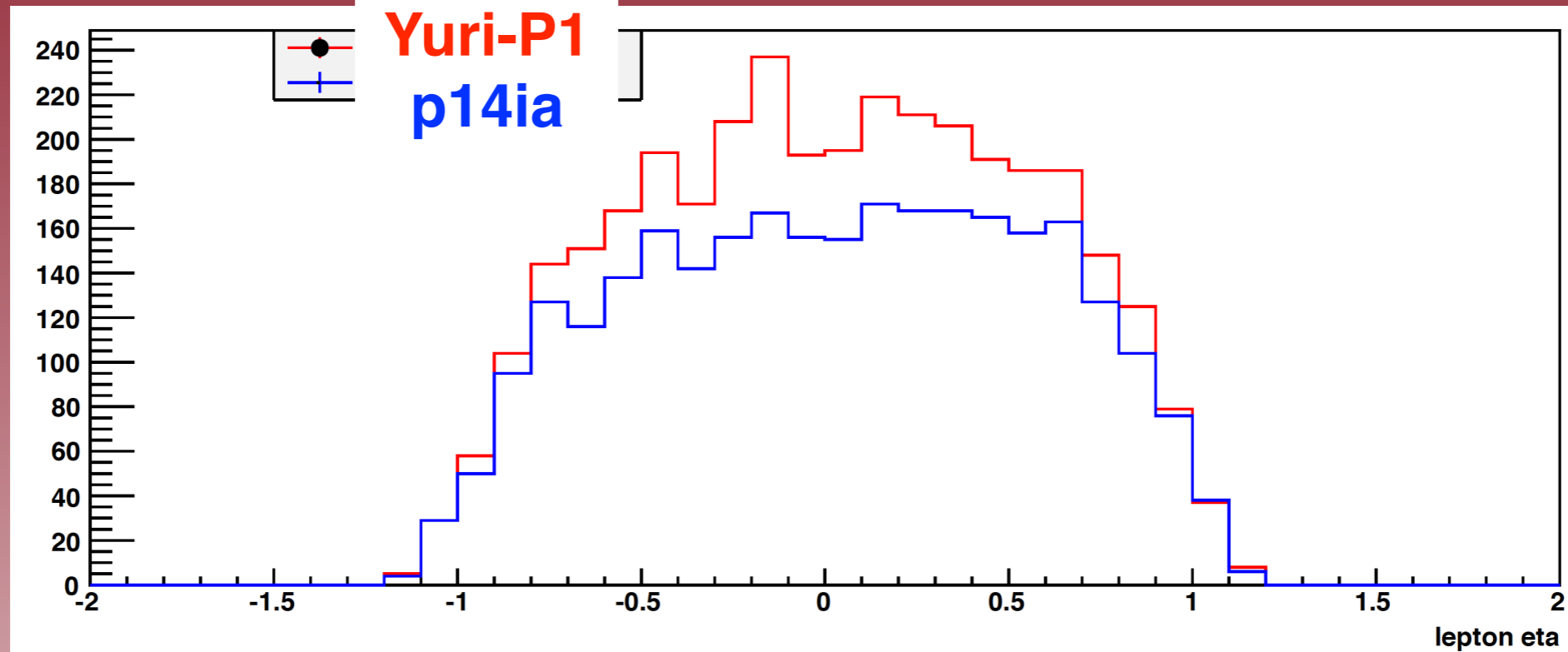
Final W - Et



Final W - ZDC



Final W eta



See Back -up 1

Summary

- ~22 % enhancement in tracks above $P_t = 10$ GeV and similar enhancement in final W [> 25 GeV] tracks.
- Yuri's production period 1 shows similar results to that of "evals4" which also use "STICA" code on period 1.
- ~18 % change in [evals 1 vs evals 4] + ~ 4% change in [evals 1 vs p14ia] added up to **22% change in Yuri -P1 vs p14ia**. So I would say actual changes to W enhancement in run 13 period 1 from tracking improvement [which include HFT material ant STICA] , since official Run 13 production to now is ~ 22% .

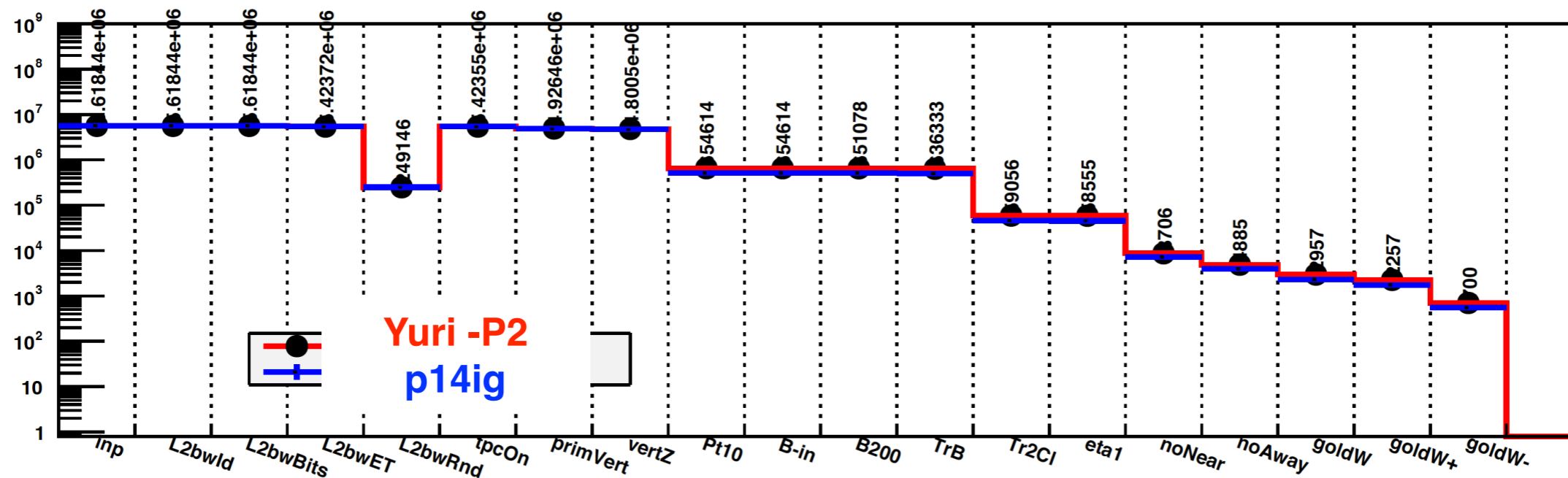
Yuri's-P2 vs P14ig [run 13 - official -P2]

apple- to -apple comparison

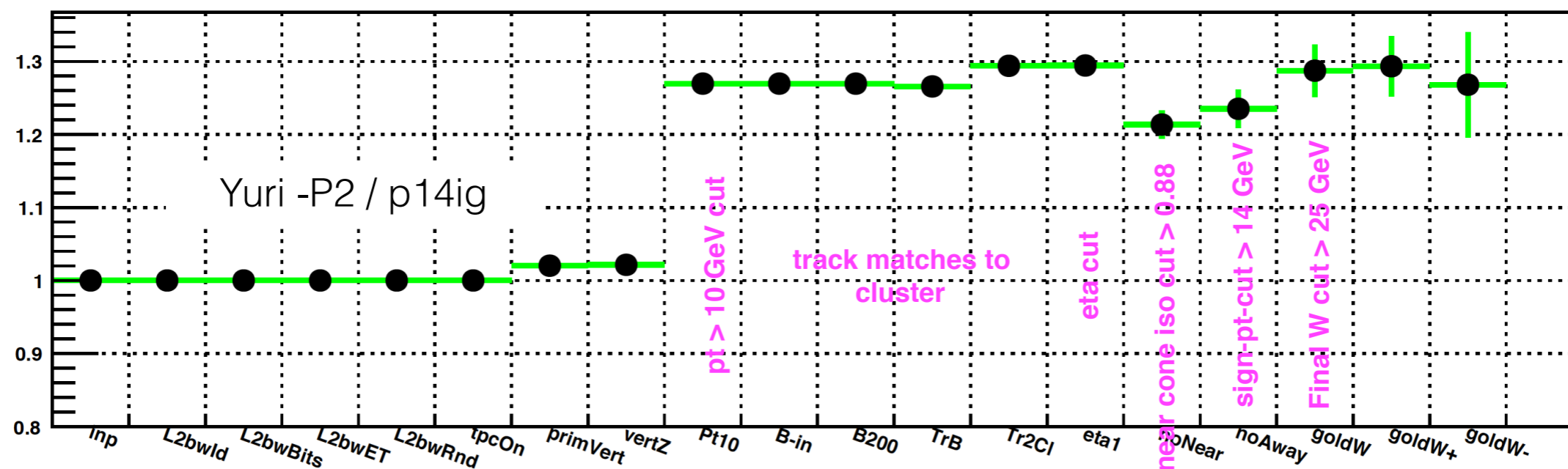
To investigate the difference between STI vs STICA [STICA is in Yuri's code] in run 13 period 2 [<ZDC> ~ 350 kHz and 90% statistics is above 300 kHz] and to test how StiCA deals with the addition HFT materials.

Production	Production Library [also W-code compiled library]	Tracking	vertex finding	BEMC-gains	# of runs used in the comparison	# of events
P14ig [official run 13 - P2 (day 129-161)]	SL14ig	Sti	PPV_W	run 12 - 200 GeV	436	5618340
Yuri's - P2 (day 129-161)	DEV2/TFG16a	StiCA [Yuri's code]	PPV_W	run 12 200 GeV	436	5618485

Events Counts as a function of W cuts

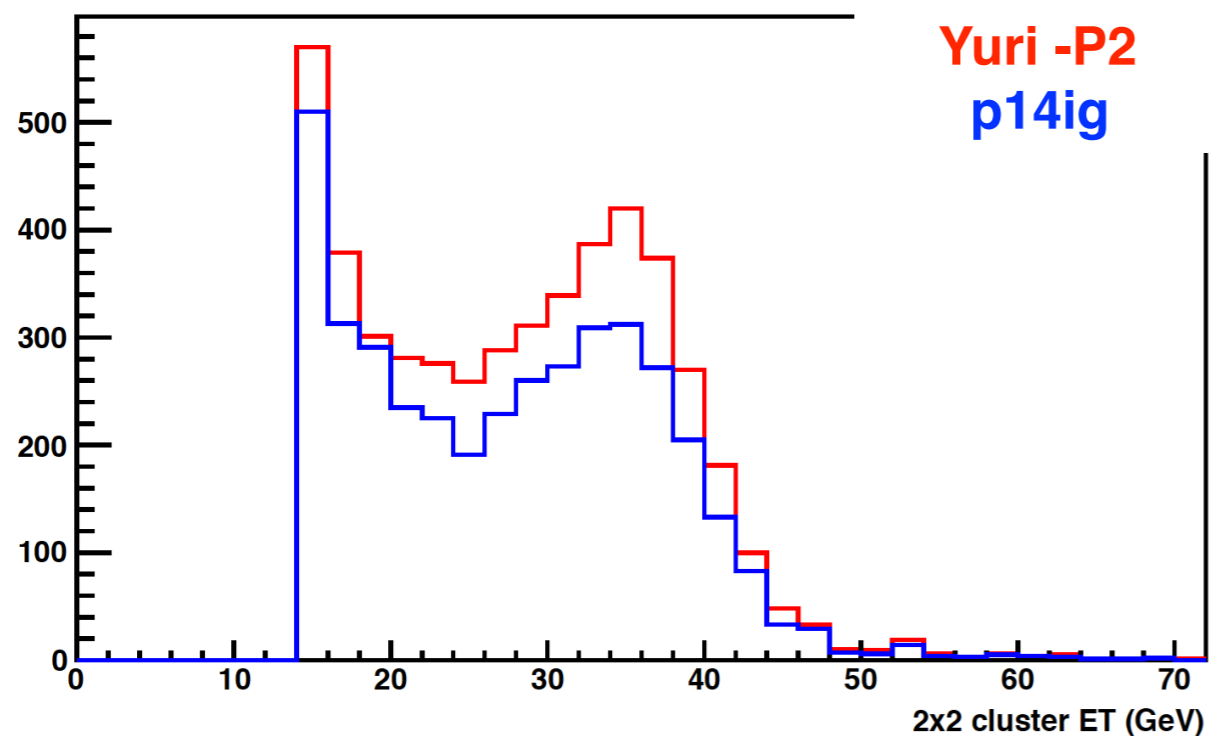


New / Old

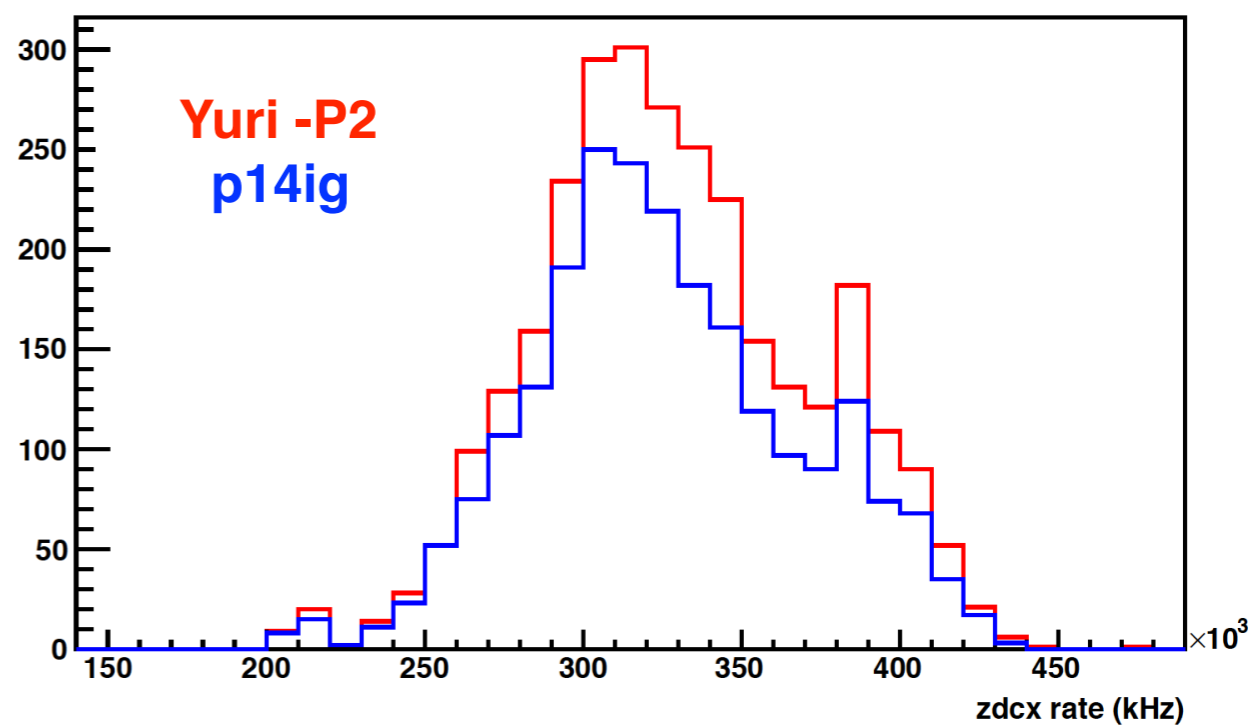


Final W : Et , ZDC

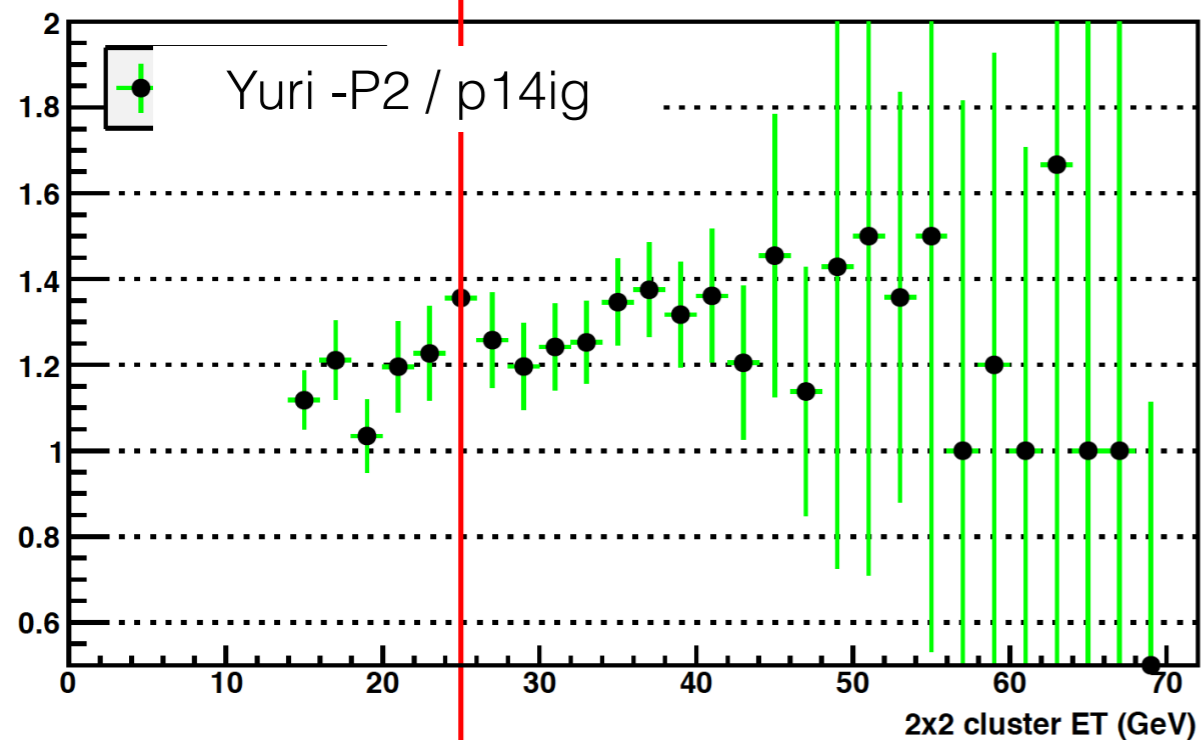
Final W - Et



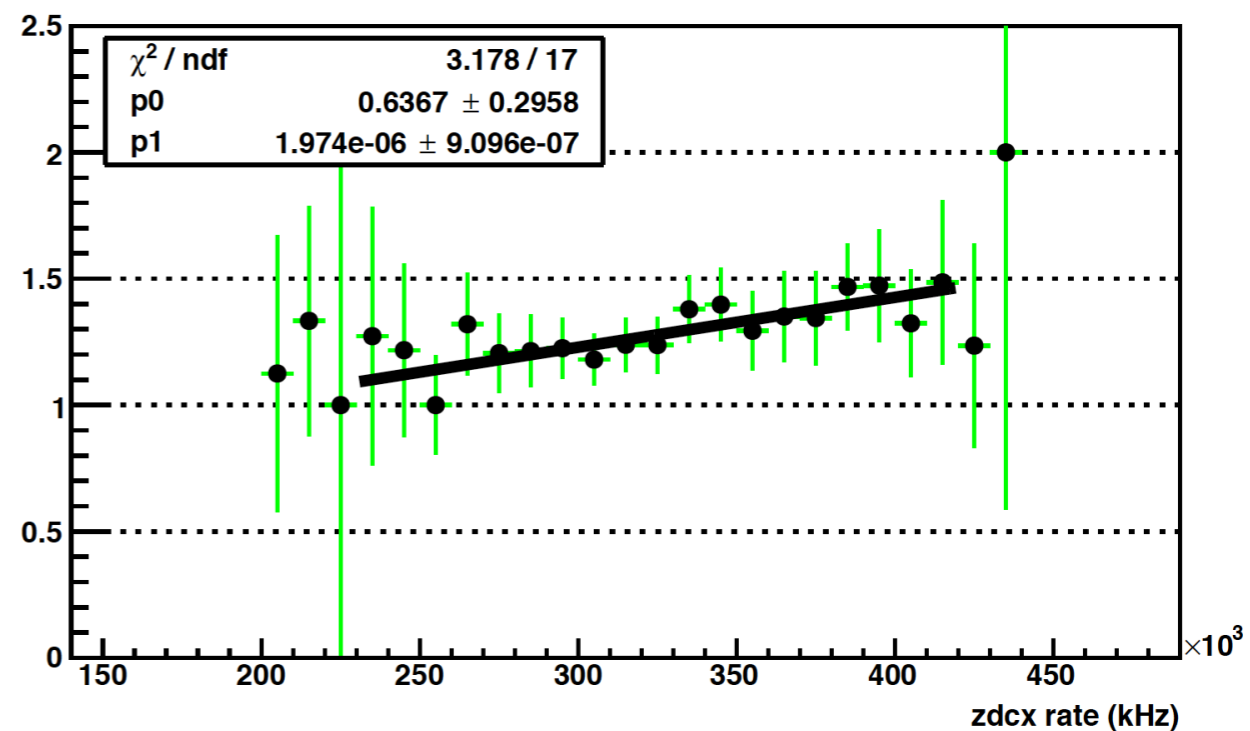
Final W - ZDC



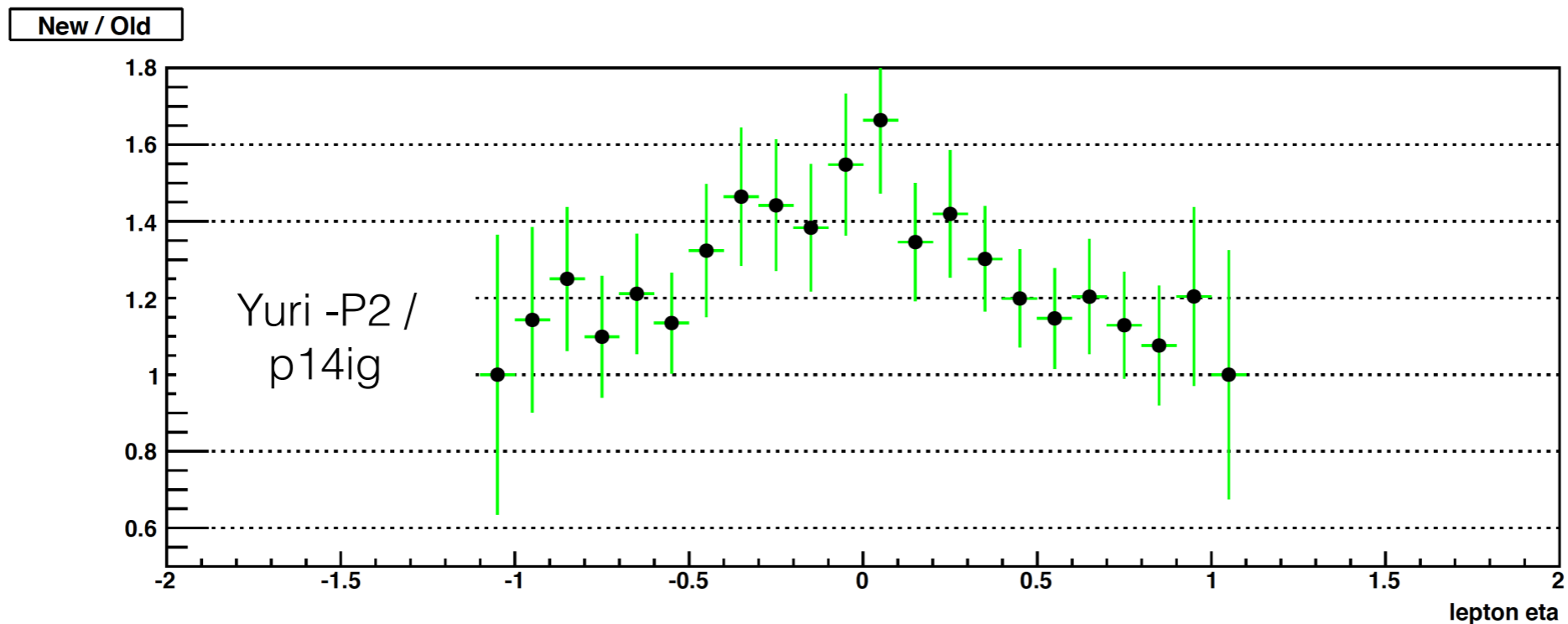
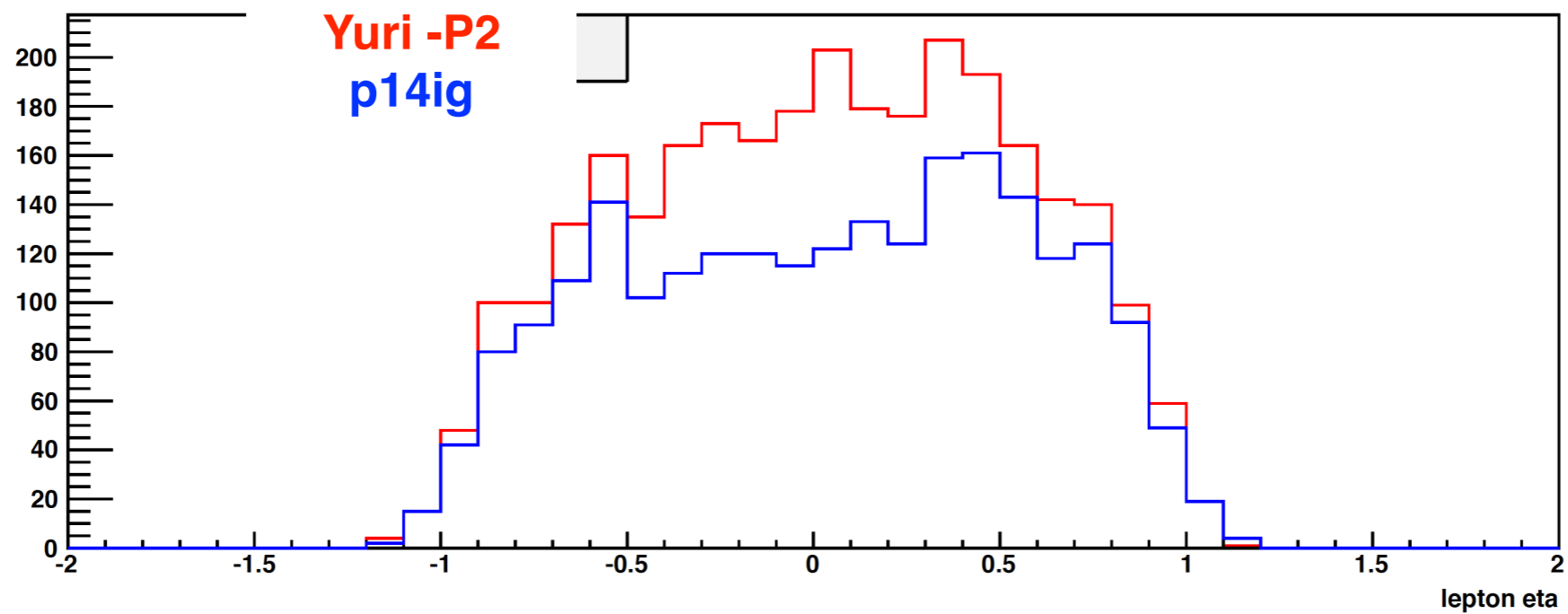
New / Old



Yuri -P2 / p14ig

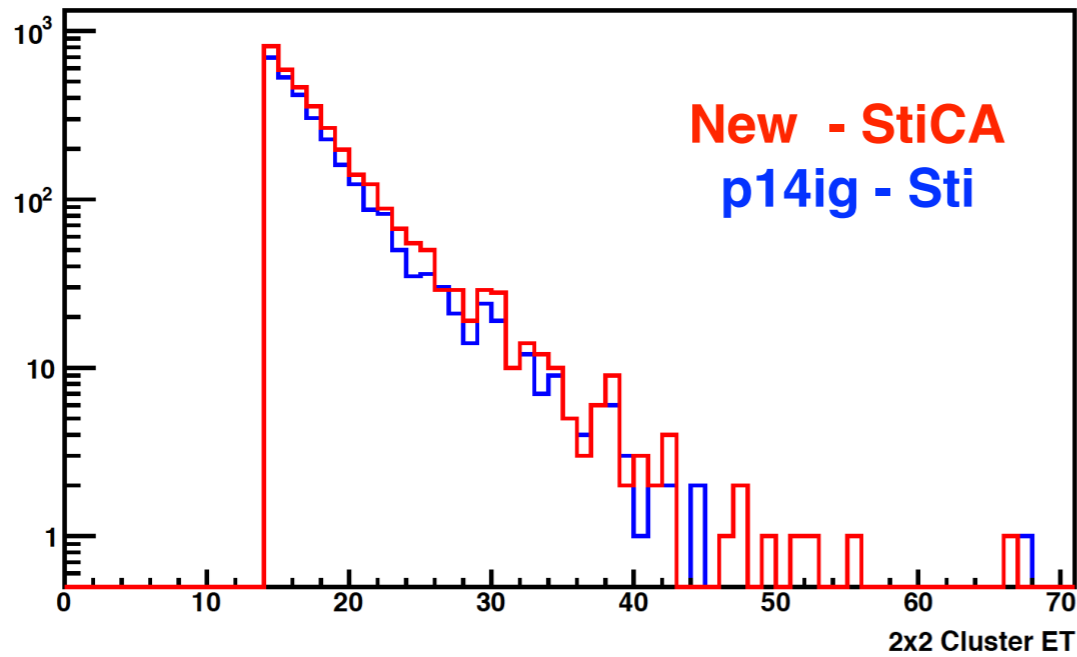


Final W Eta

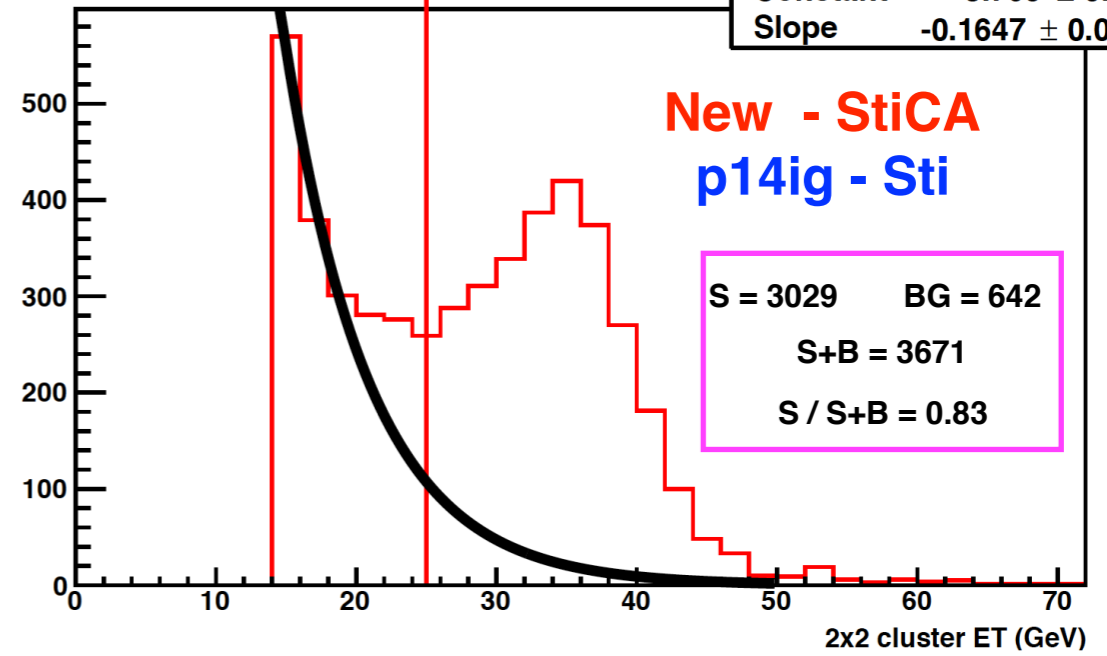


QCD BG

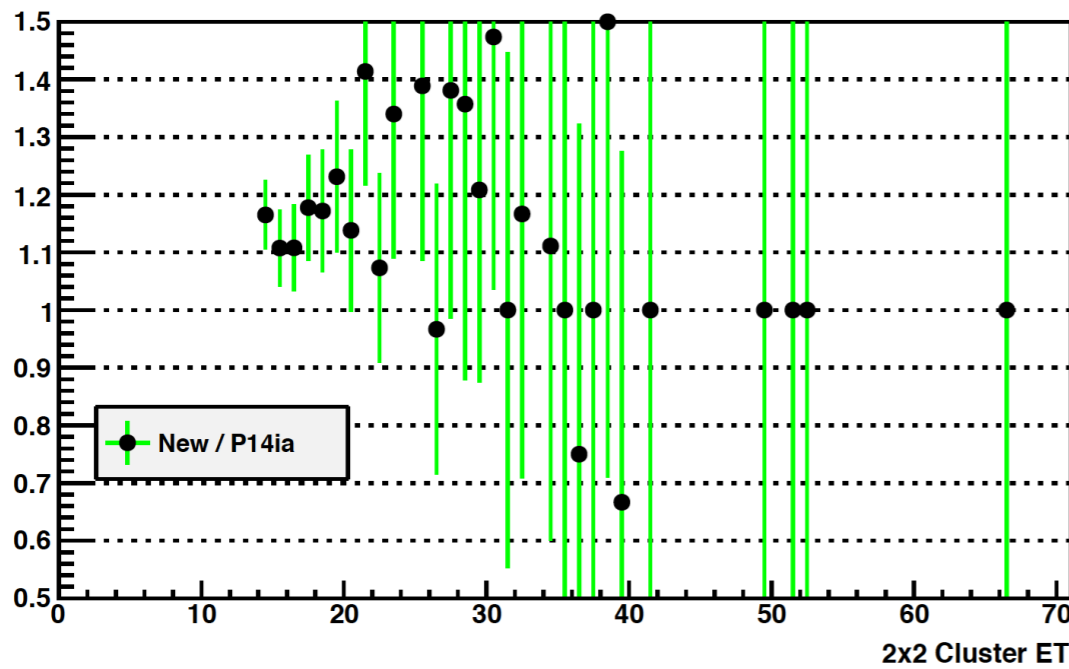
Barrel: PT Balance < 14.0



χ^2 / ndf 2.075 / 1
Constant 8.795 ± 0.308
Slope -0.1647 ± 0.0185

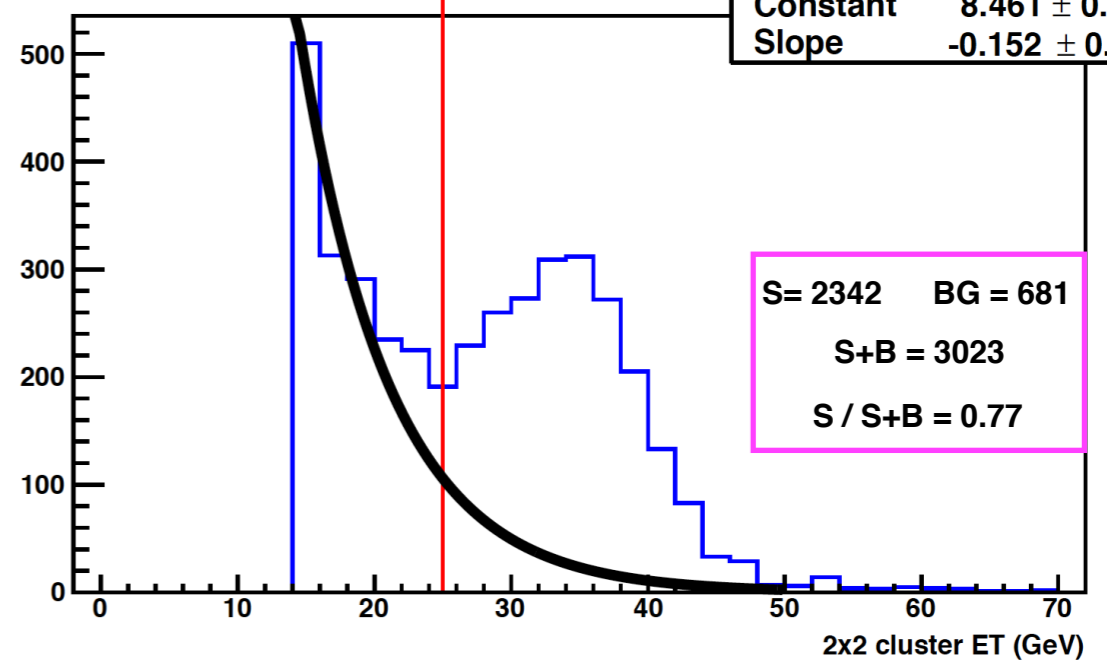


New / Old



Barrel W: Final Selection : 2011Walgo

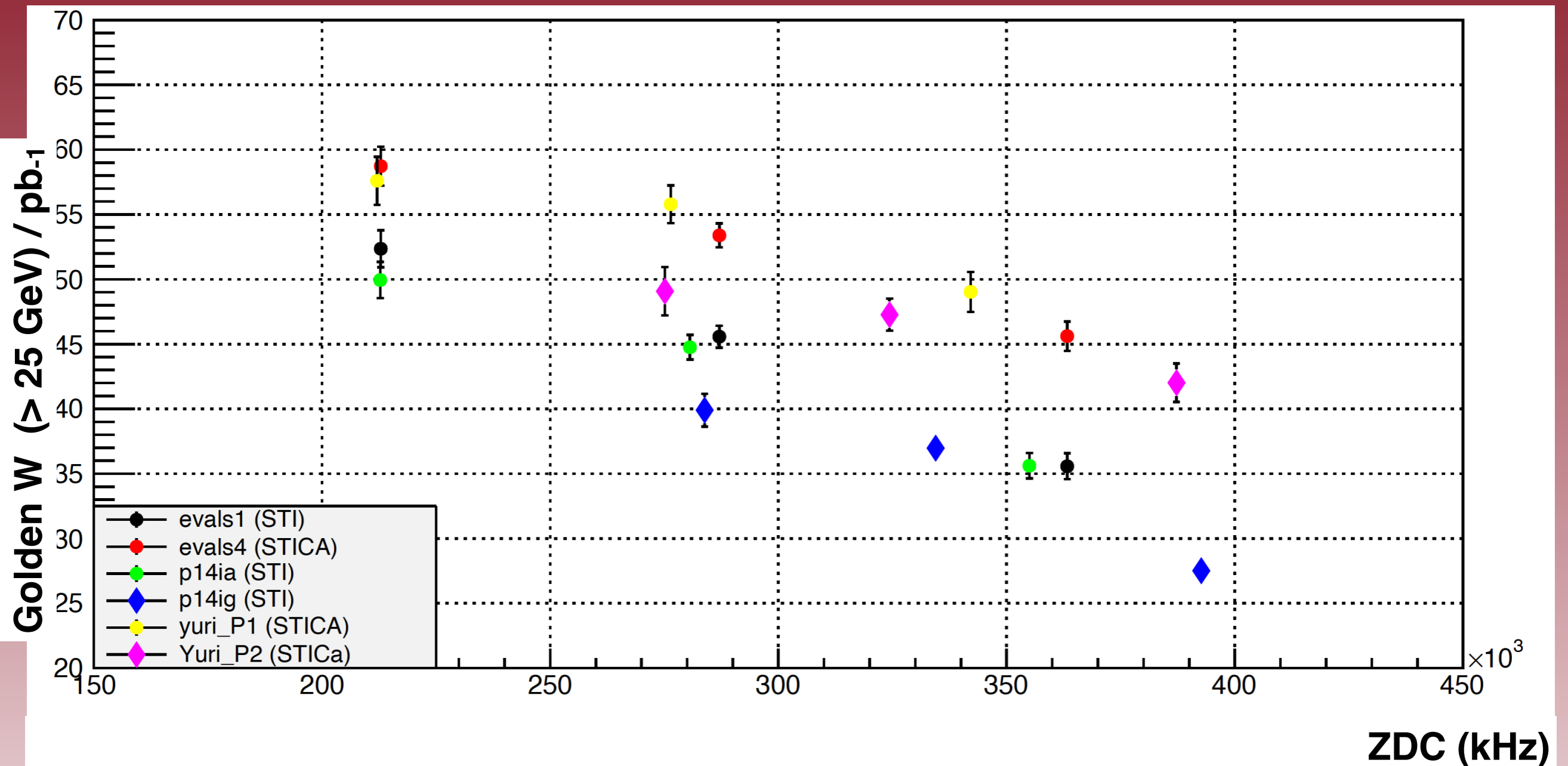
χ^2 / ndf 10.14 / 1
Constant 8.461 ± 0.346
Slope -0.152 ± 0.021



Summary

- ~29 % enhancement in tracks above $P_t = 10$ GeV and similar enhancement in final W [> 25 GeV] tracks. So this enhancement is since the official run 13 - period 2 production. If a new test production were to made using EVAL for period 2 I would expect enhancement of [29% - ~4%] ~ 25 %.
- Significant enhancement of final W Eta in mid rapidity region where a “dip” was observed previously.
- Significant improvement in signal to background ratio .

W efficiency as a function of ZDC



- Black(P1) , Green (P1) and Blue (P2) used STI tracking
- Red(P1) , Yellow (P1), Magenta (P2) used STICA tracking
- Enhancement in efficiency increases with increasing ZDC .

Summary / Conclusions

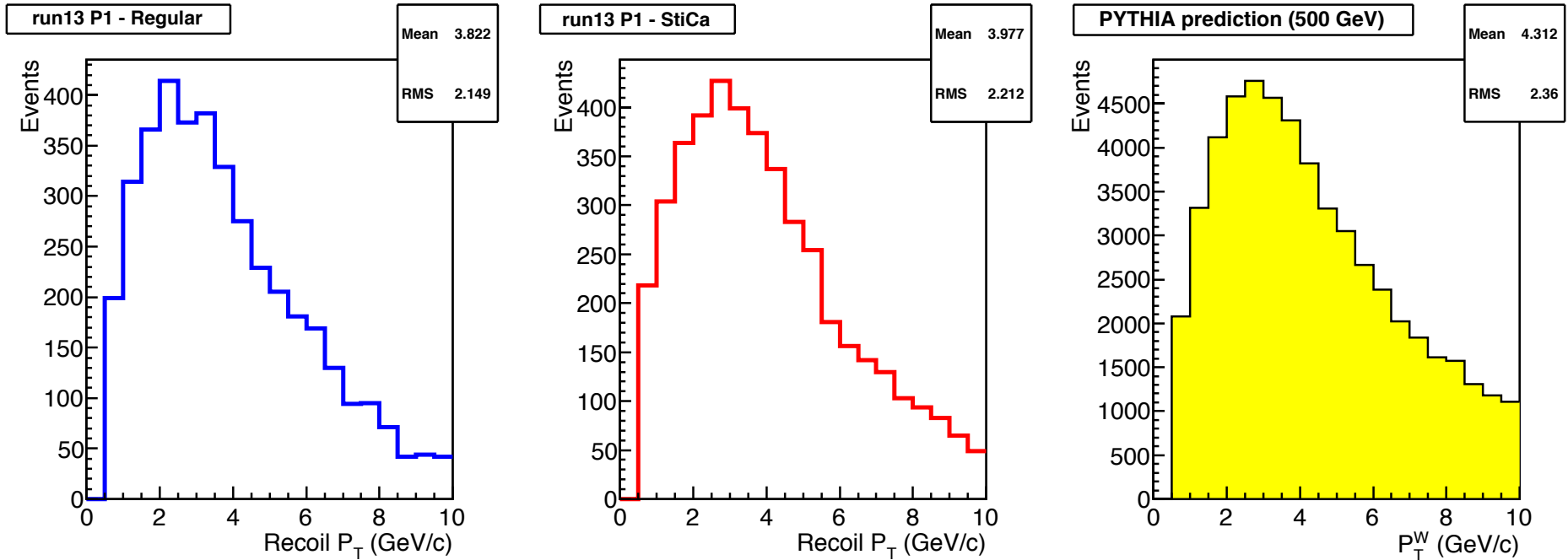
- No difference between STI vs STI_updated codes.
- ~18% enhancement in W in run 13 period 1 from STI to STICA codes in STAR library which include HFT materials.
- No difference between STICA in EVAL library vs STICA in Yuri's code.
- ~ 4 % enhancement from STI code with and without HFT materials.
- Yuri's production allows to investigate the STICA tracking performance for whole luminosity range of run 13 where $\langle ZDC \rangle$ increased from Period 1 to Period 2 by 15 % and 90 % statistics in period 2 lies above $\langle ZDC \rangle$ of period 1 and also to test how StICA deals with the additional material of the HFT material in period 2.
- Enhancement in W from Yuri's period 1 production in agreement with the enhancement in EVALS 4.
- Enhancement in W in period 2 is about ~ 29 % from STI to STICA with No HFT in STI. It would be ~ 25 % from STI to STICA with HFT included in STI.
- **Enhancement in W efficiency is significant from STI to STICA. Improvement increases with increasing luminosity.**

► **Reproduction of Run 13 data with STICA+PPV_W settings is urgently requested follow up by MC Embedding production for W AL analysis and cross section analyses.**

Analysis from Salvatore

reconstruction of the W-recoil

Production comparison



Regular: Sti official production (SL14a)

StiCa: Yuri's StiCa private production (dev2)

All W reconstruction cuts applied

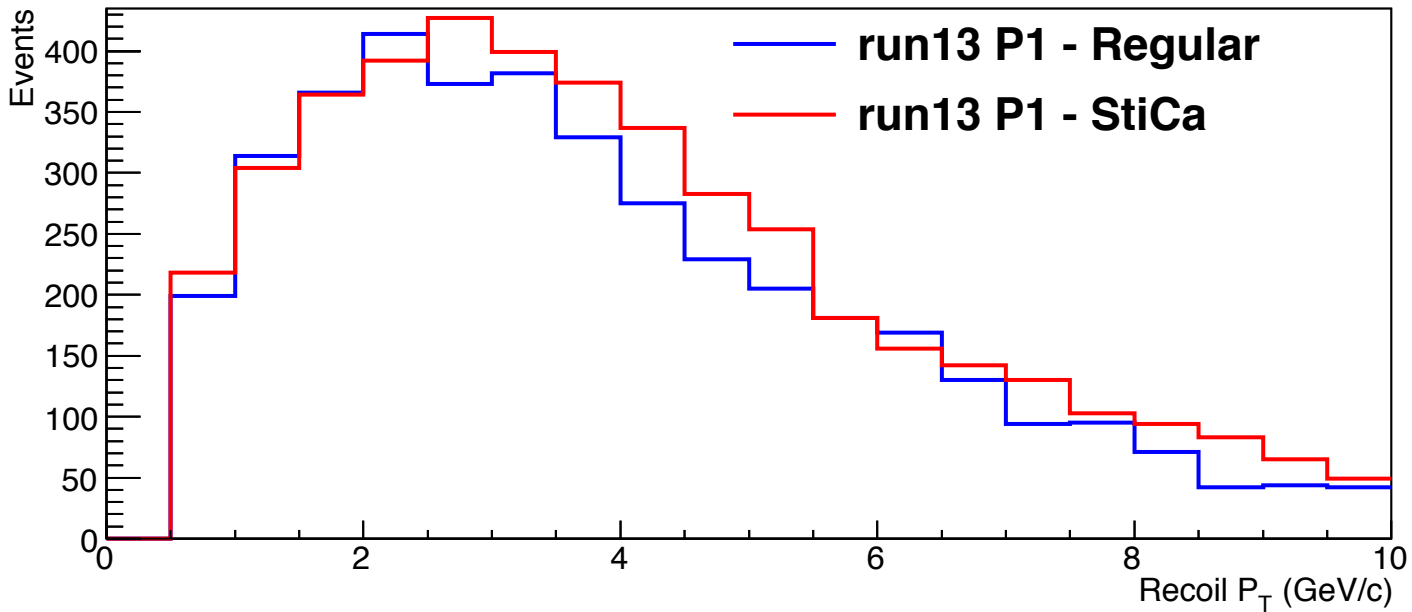
No MC correction to get full recoil Pt done!

Sti Mean = 3.82 GeV

StiCa Mean= 3.98 GeV

PYTHIA prediction = 4.31

Production comparison



Regular: Sti official production (SL14a)

StiCa: Yuri's StiCa private production (dev2)

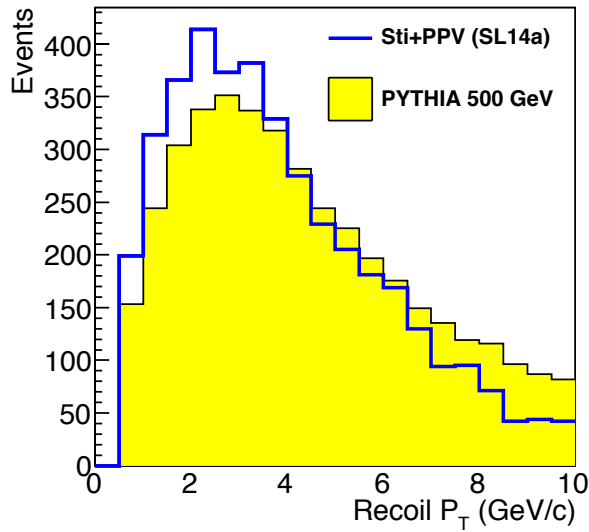
All W reconstruction cuts applied

No Pt correction done!

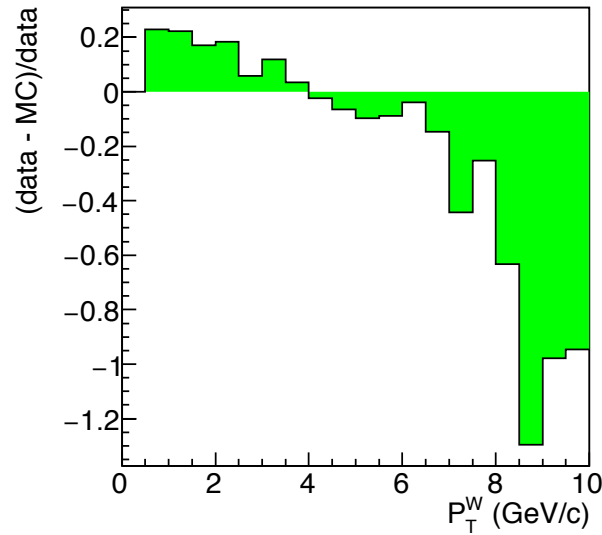
- Overall ratio $\text{StiCa(Yuri's)}/\text{Sti(regular)} = 1.11$ after W reco. cuts for run 13 period 1
- StiCa W-Pt peak and distribution shifted to the right... lets compare to expectation

Production comparison

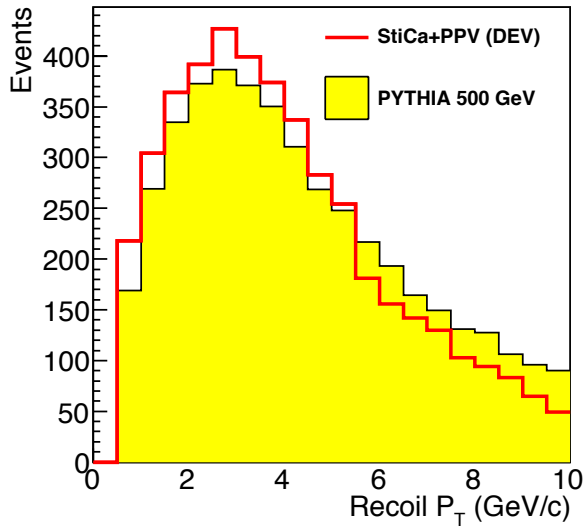
Run13 - Period 1



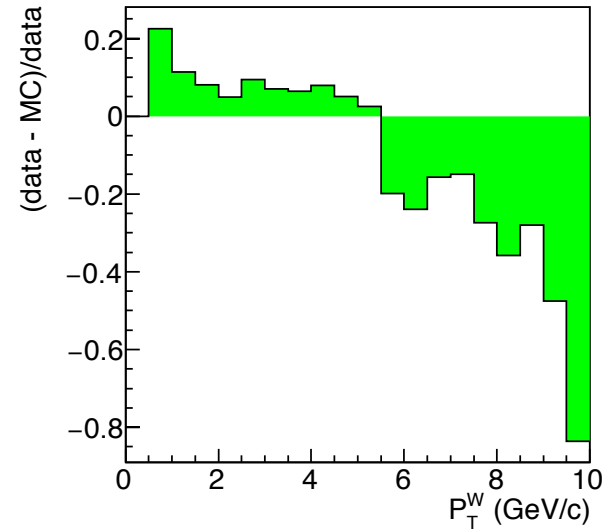
Run13 - Period 1



run13 P1 - StiCa



Run13 - Period 1

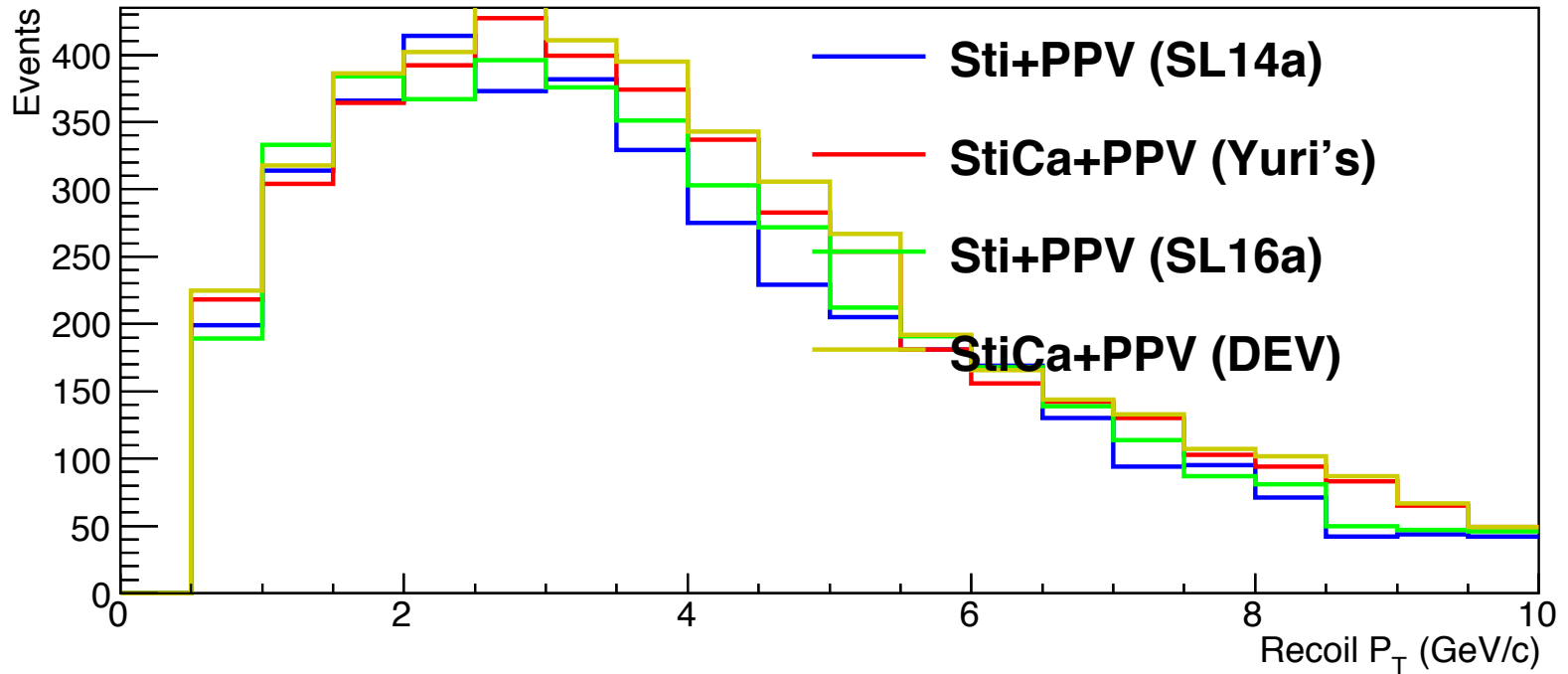


StiCa peak on top of the prediction peak
→ less correction needed!

**Lets look at all the
TEST productions**

Production comparison

Run13 - Period 1



Regular: Sti official production (SL14a)

StiCa: Yuri's StiCa private production (dev2)

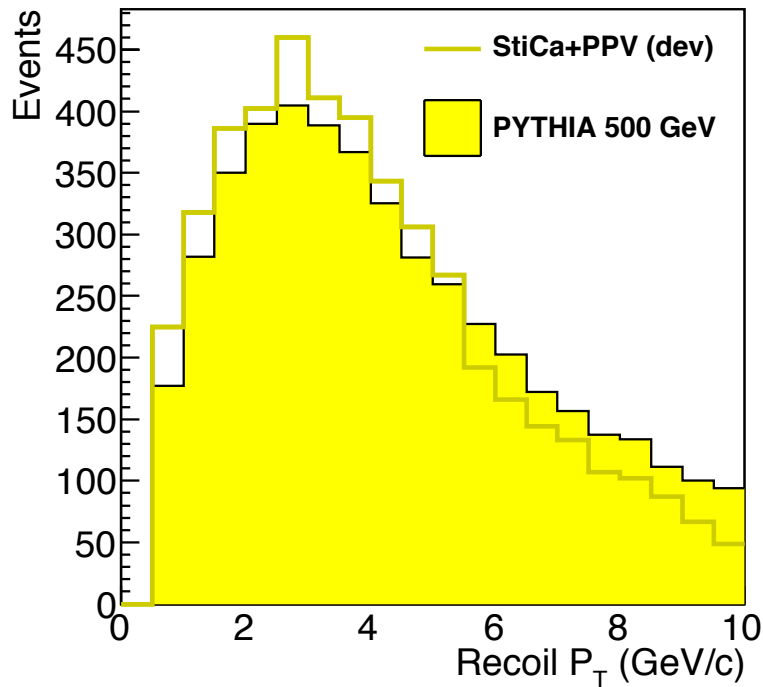
TEST Evals1: Sti+PPV test production (SL16a)

TEST Evals2: Sti+PPV test production (dev)

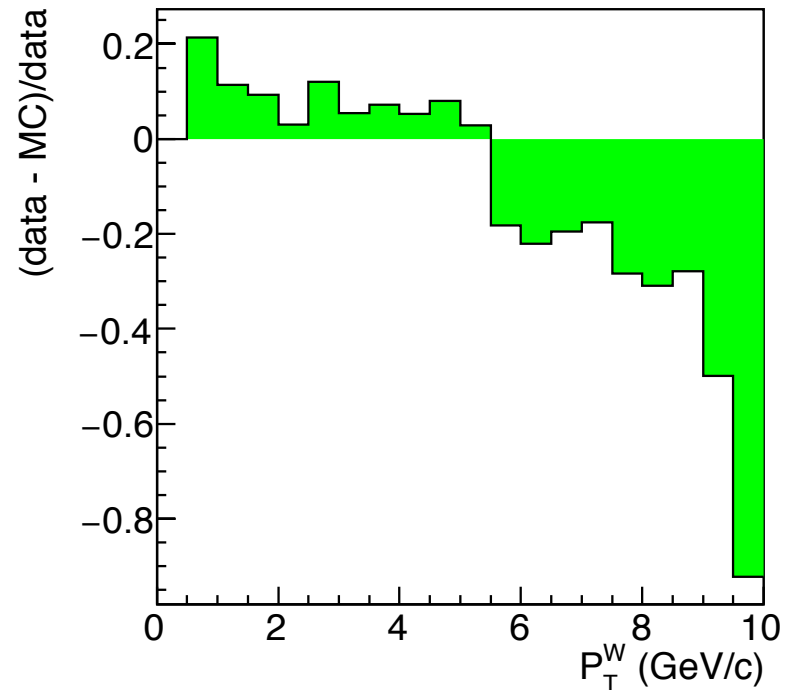
TEST Evals4: StiCa+PPV test production (dev)

StiCa+PPV: evals4

Recoil from Tracks: TPC+emCal (also trackless clusters)



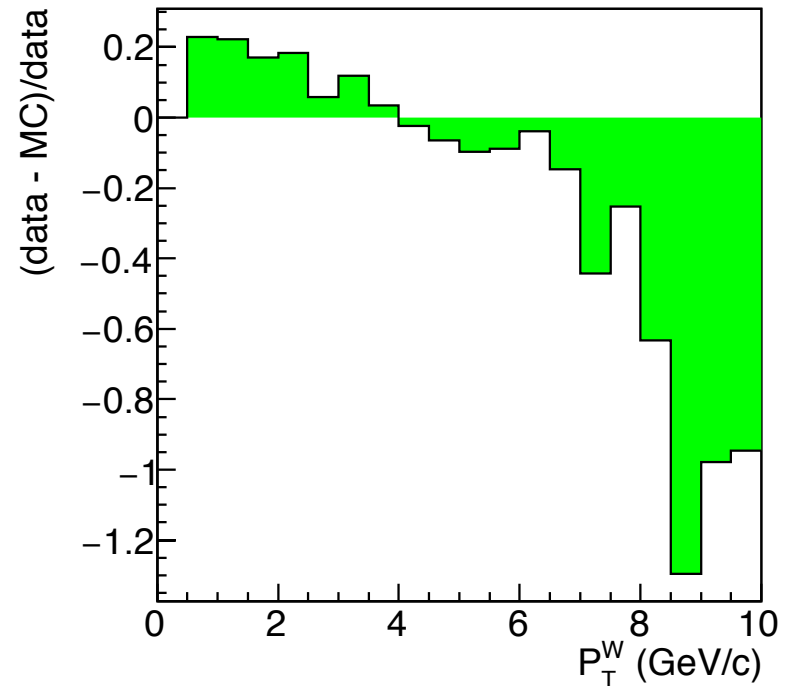
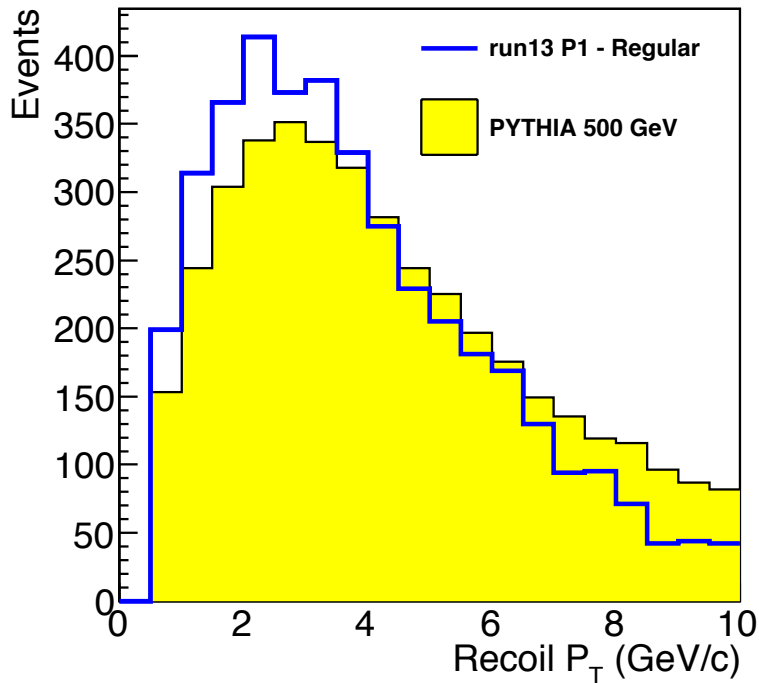
Run13 - Period 1



StiCa+PPV: test production evals4

Yellow filled histo is PYTHIA prediction at generated level (no experimental effects)

Sti+PPv: official current production (SL14a)

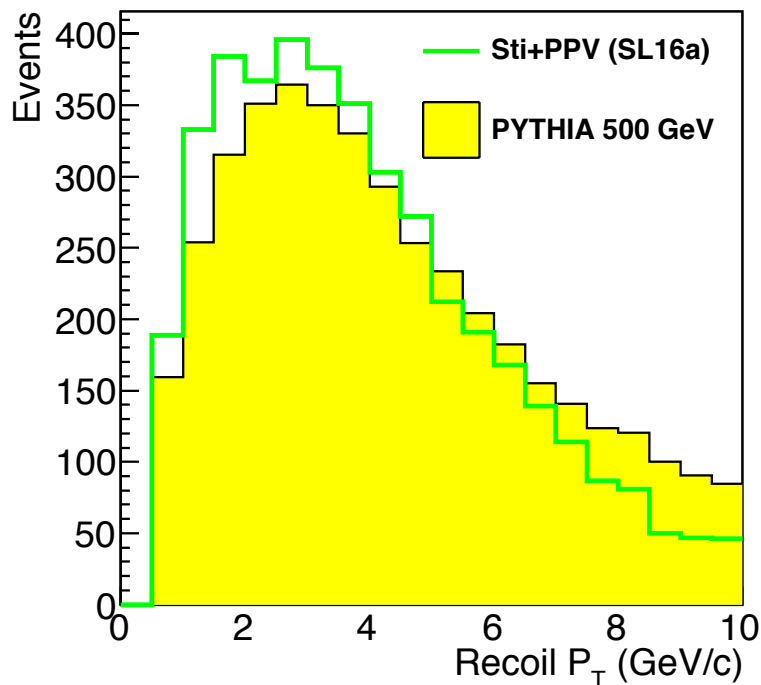


Regular: Sti official production (SL14a)

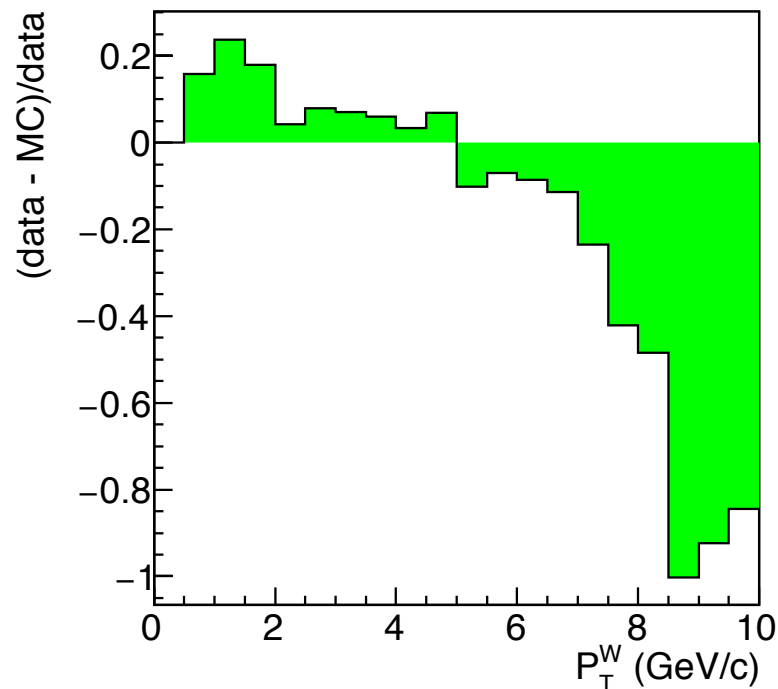
Yellow is PYTHIA prediction at generated level (no experimental effects)

Sti+PPv: evals1

Recoil from Tracks: TPC+emCal (also trackless clusters)



Run13 - Period 1

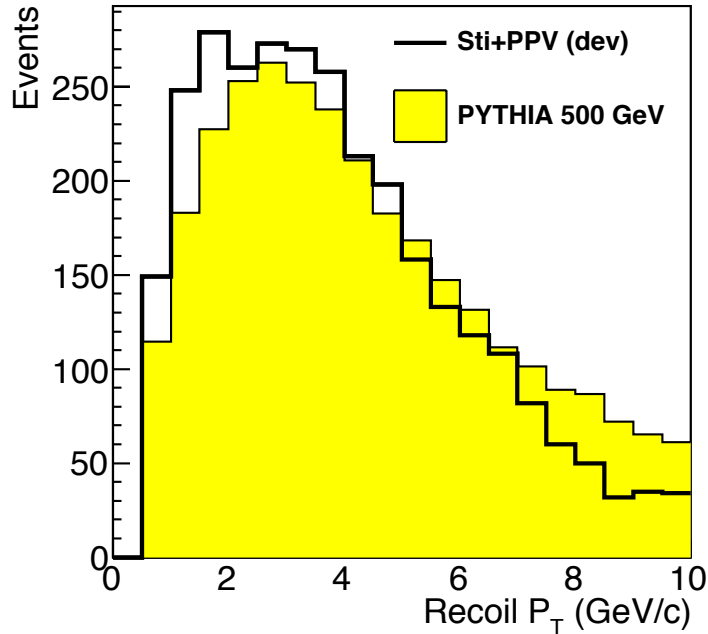


TEST Evals1: Sti+PPV test production (SL16a)

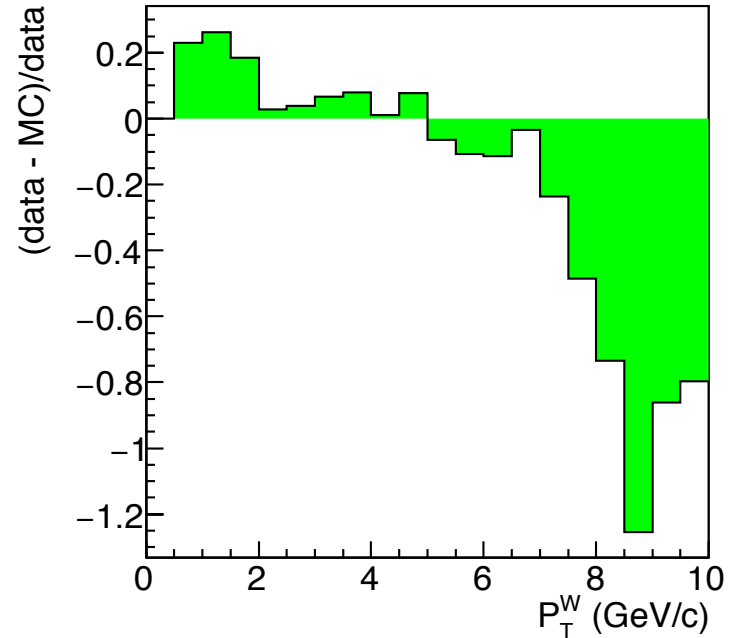
Yellow is PYTHIA prediction at generated level (no experimental effects)

Sti+PPv: evals2

Recoil from Tracks: TPC+emCal (also trackless clusters)



Run13 - Period 1



TEST Evals2: Sti+PPV test production (dev)

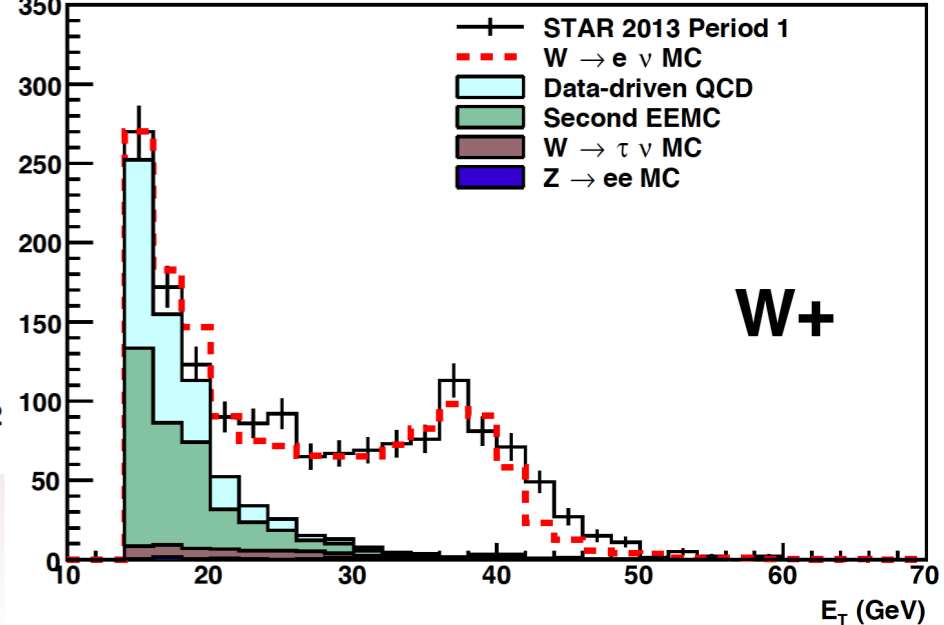
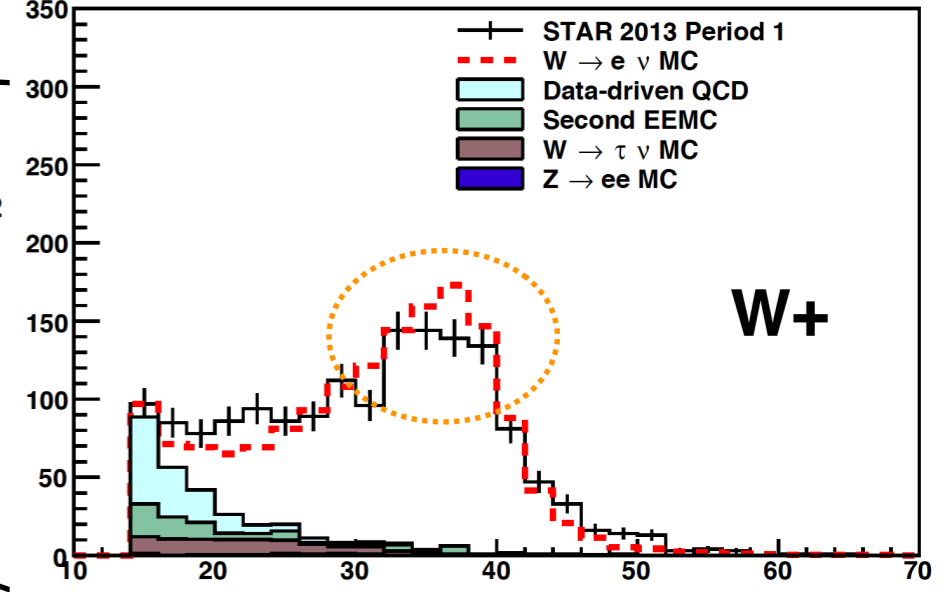
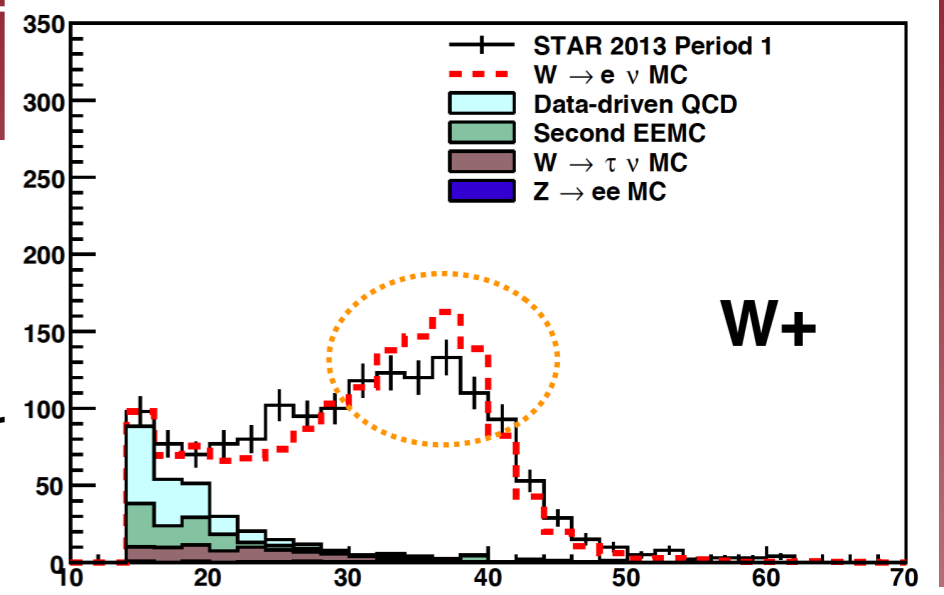
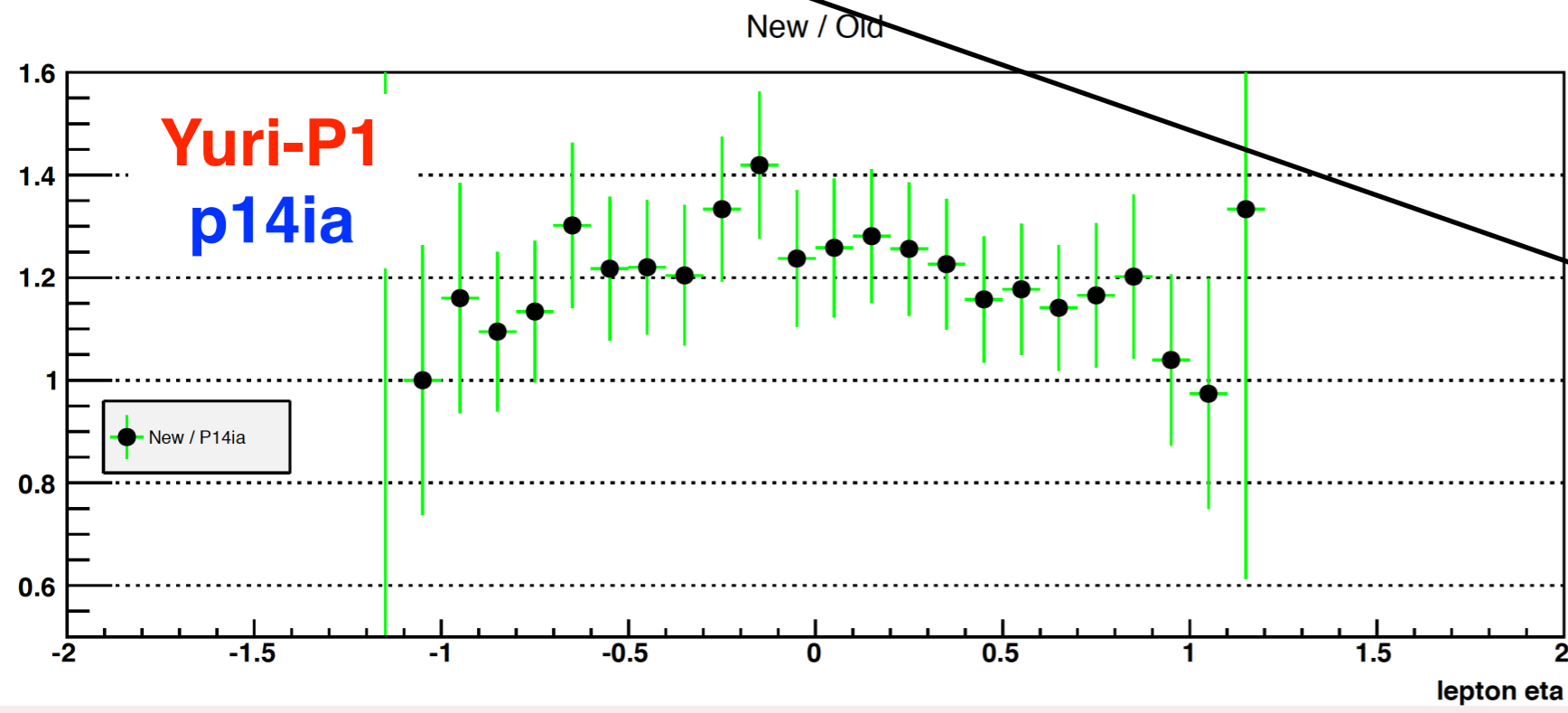
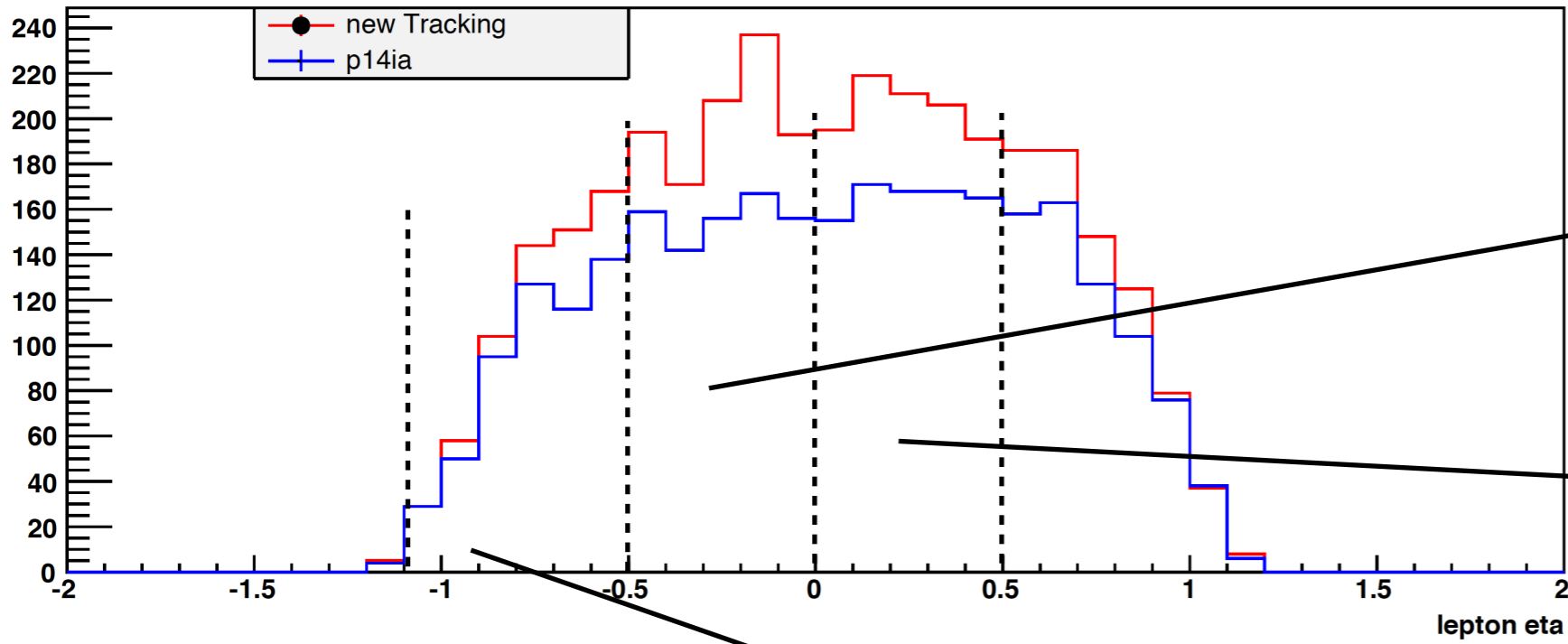
Yellow is PYTHIA prediction at generated level (no experimental effects)

Conclusions

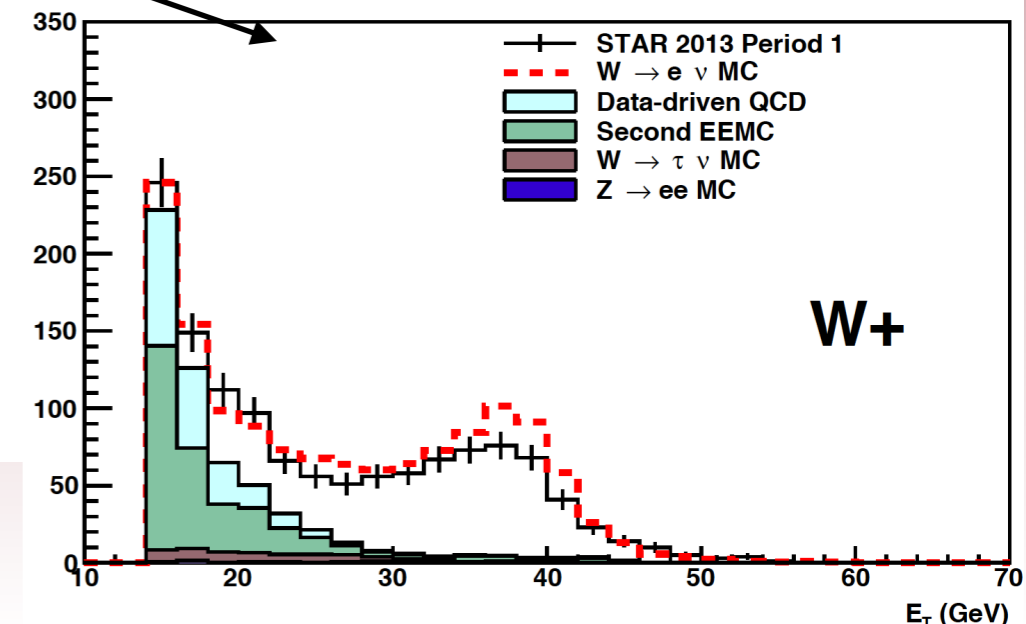
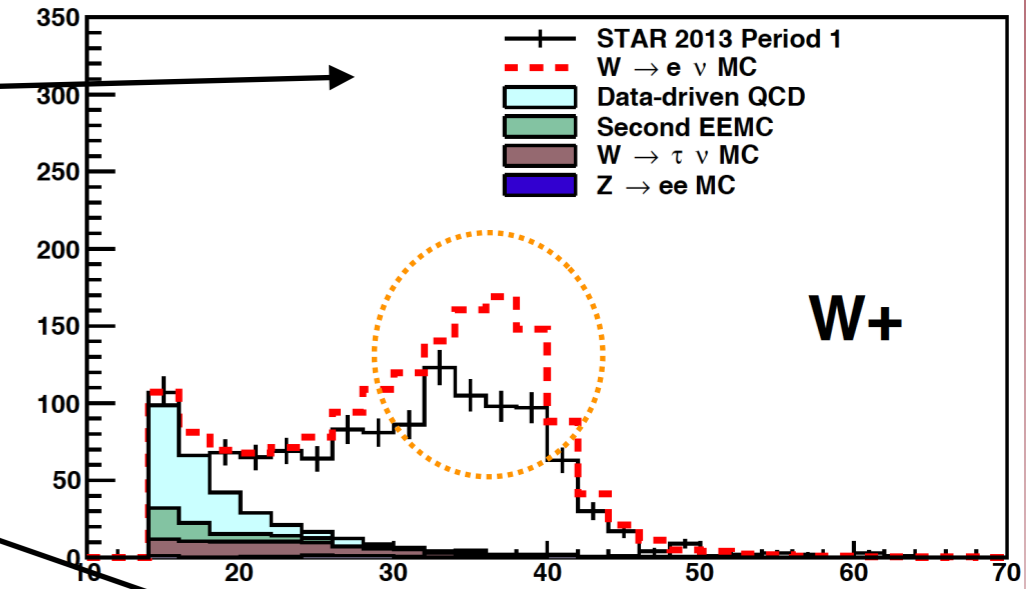
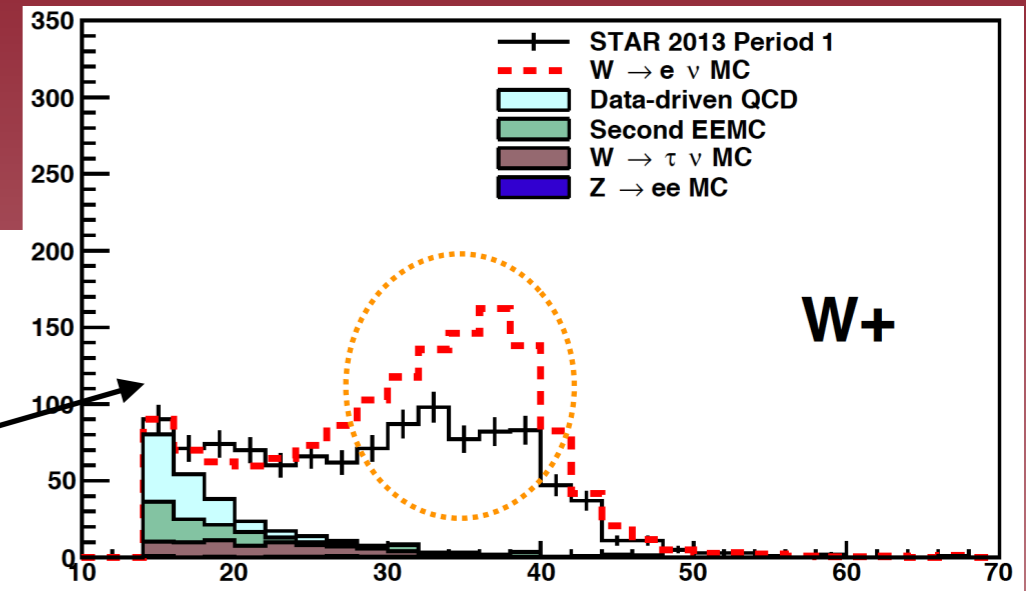
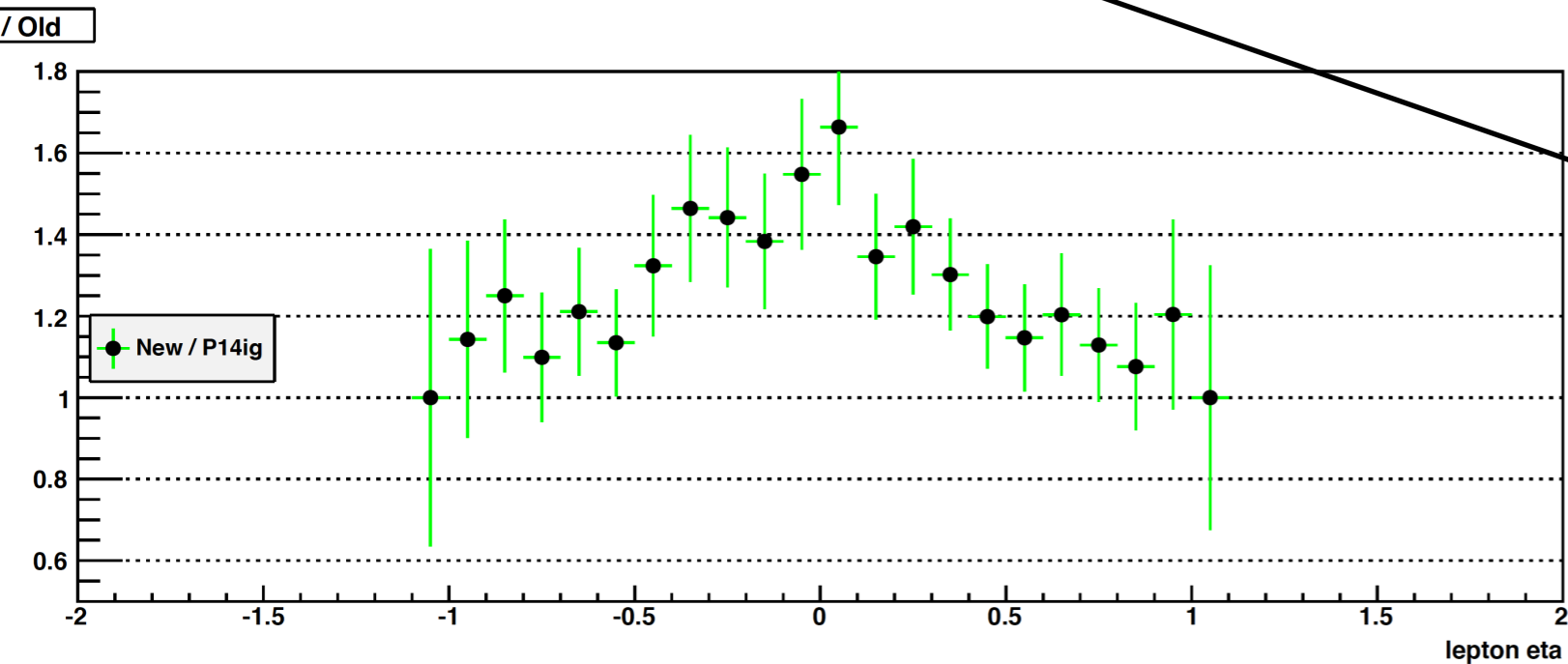
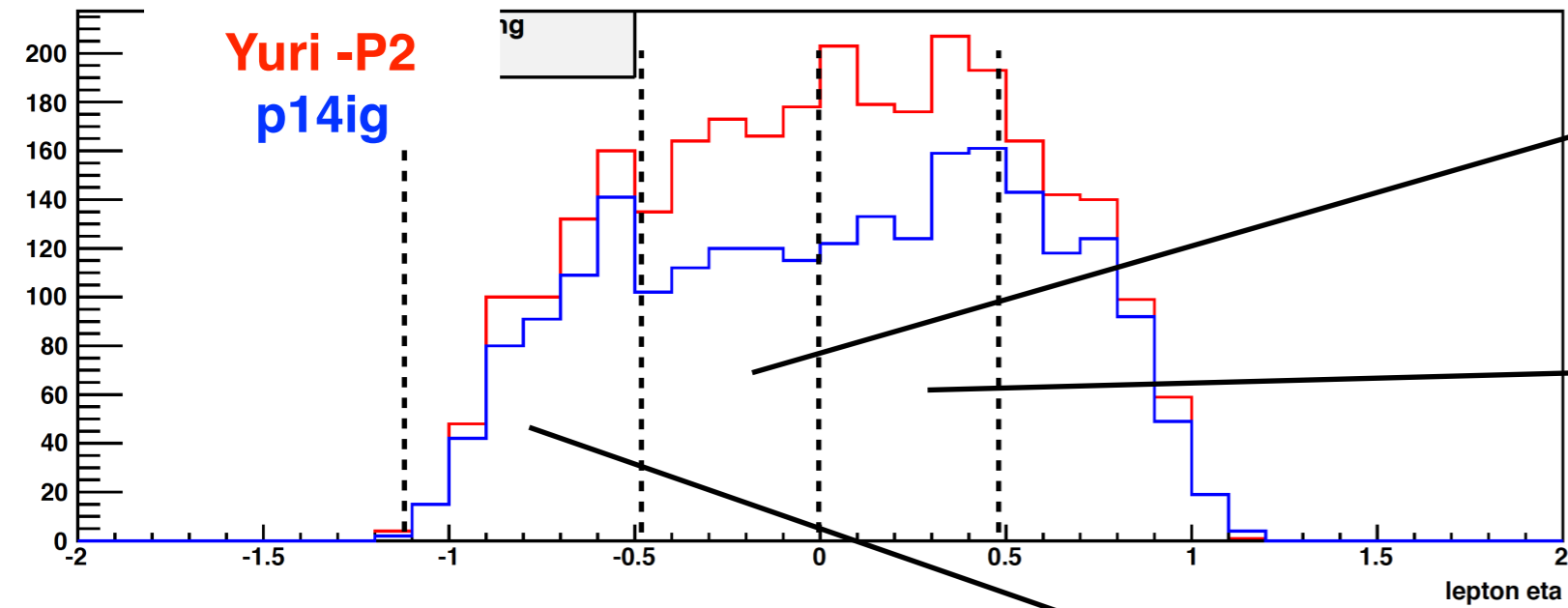
- StiCa shows a better W-selection efficiency also after the reconstruction cuts
- StiCa reconstructs more hadronic recoil → the reconstruction of the boson Pt before any MC correction is better → correction required will be smaller

Back up

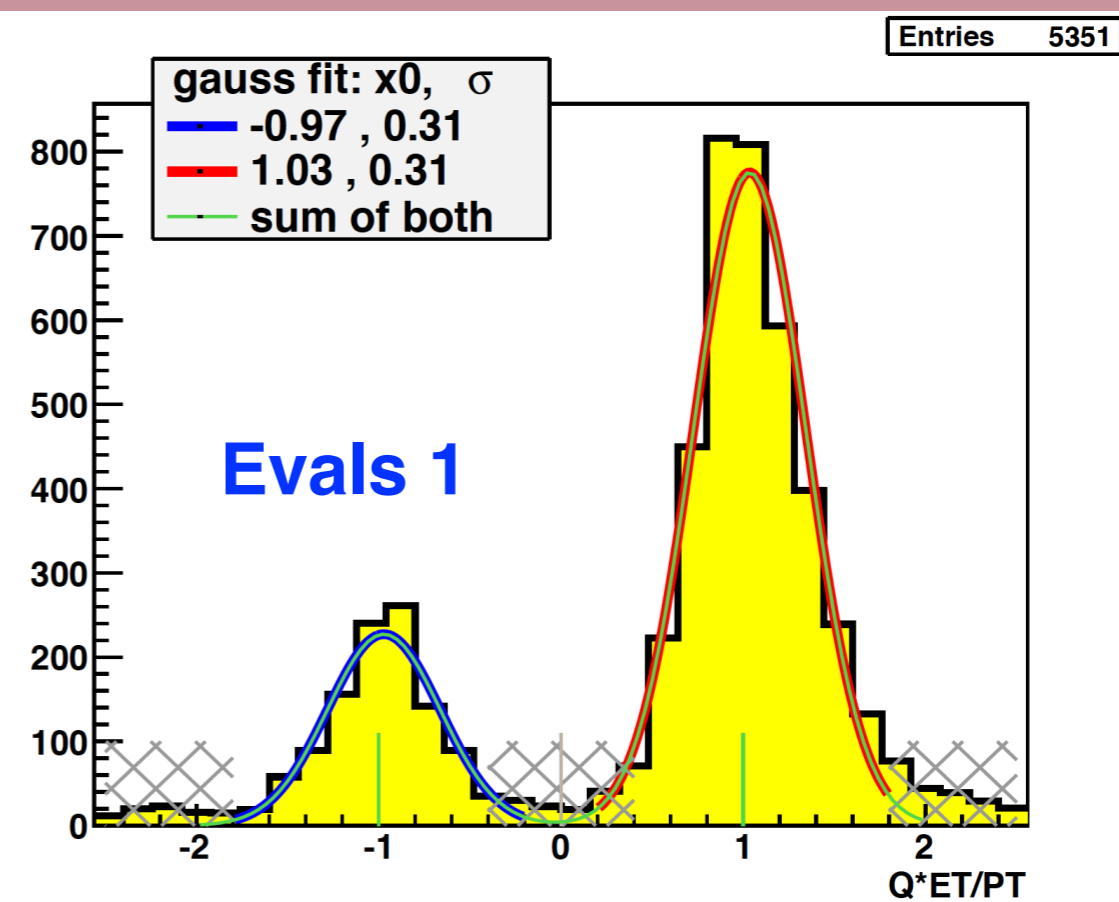
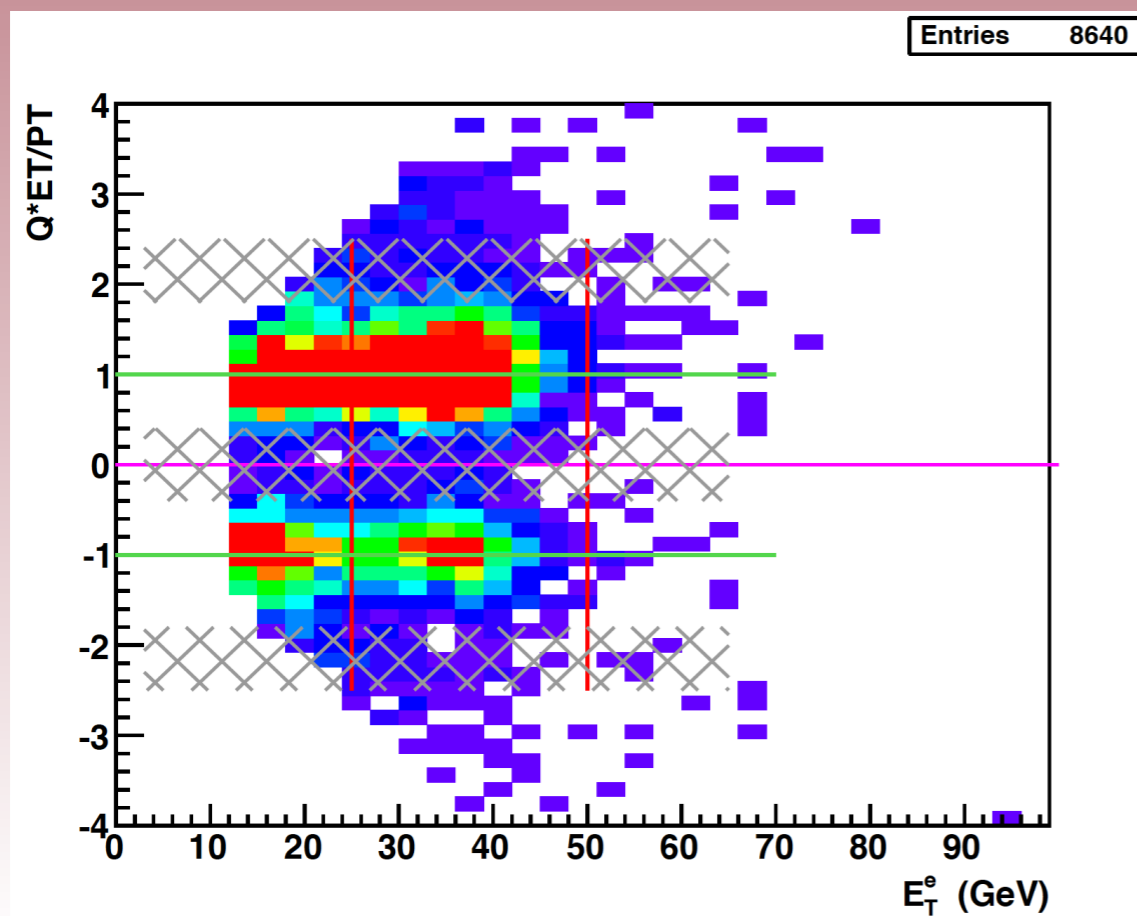
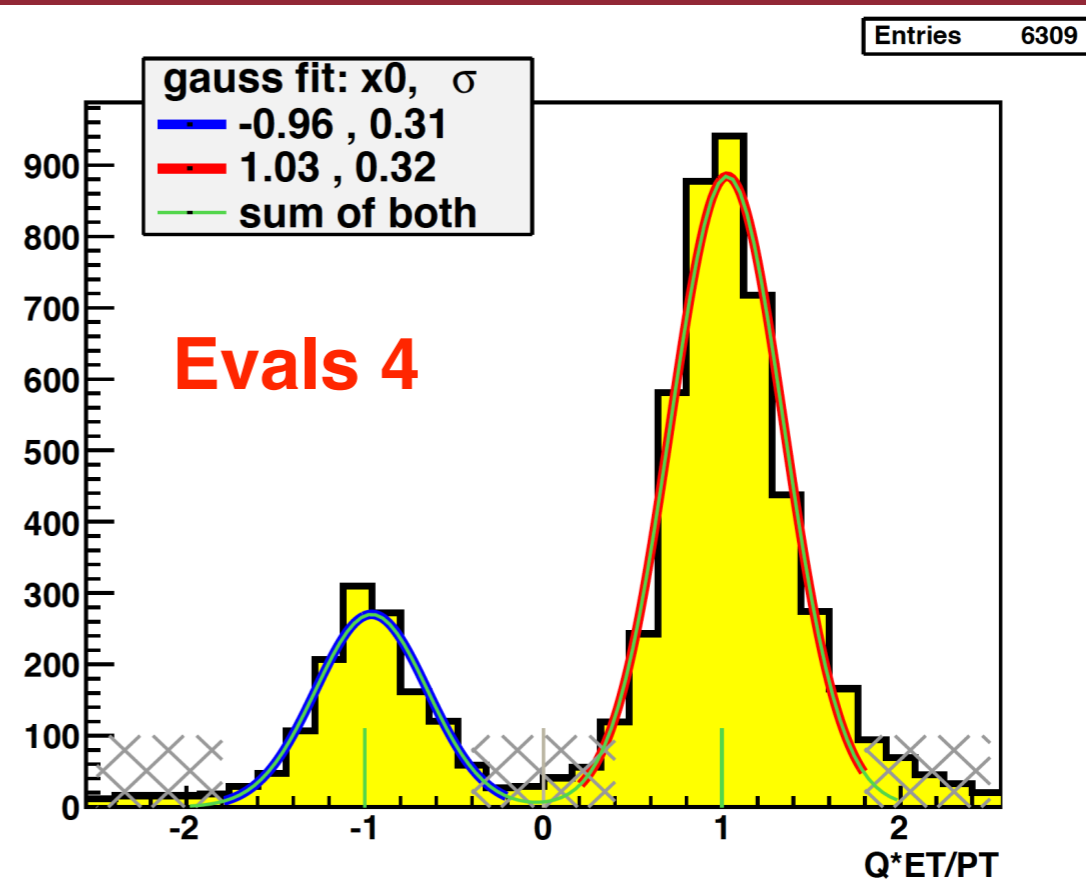
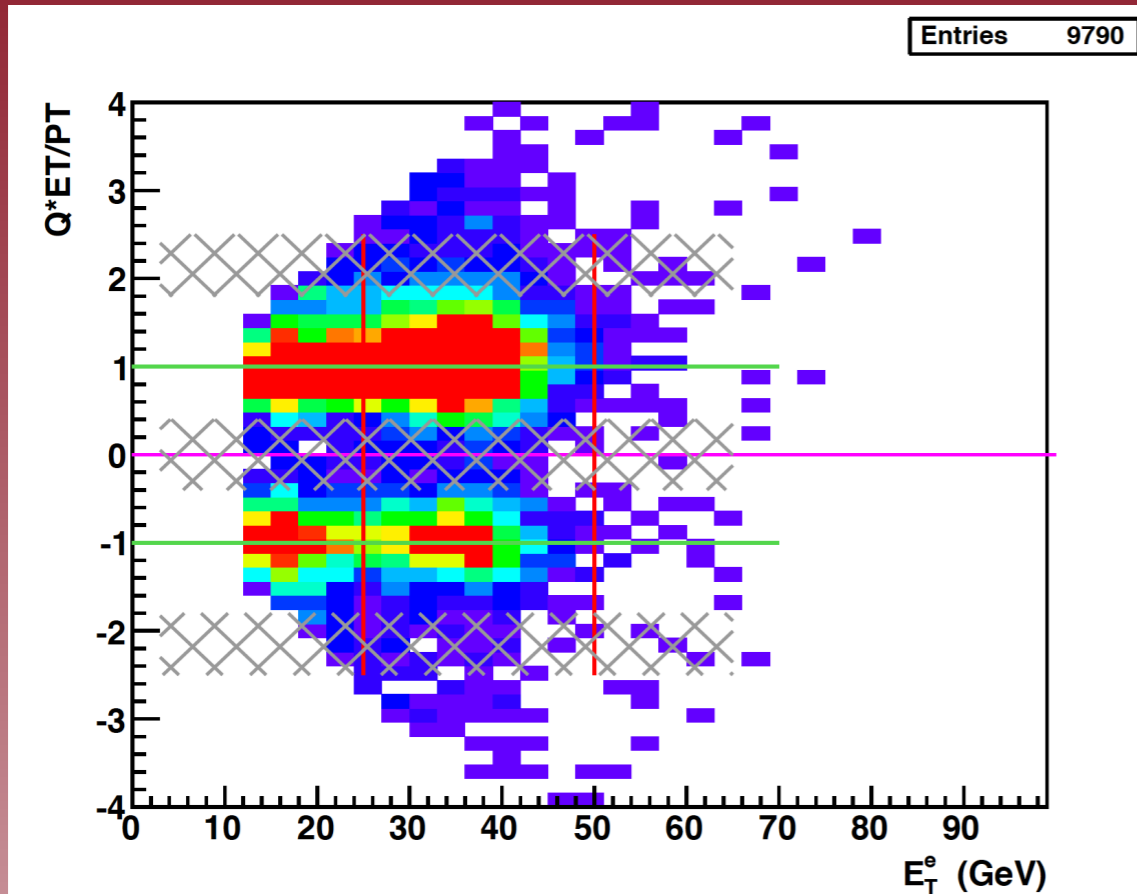
Back up 1 : Final W Eta - P1



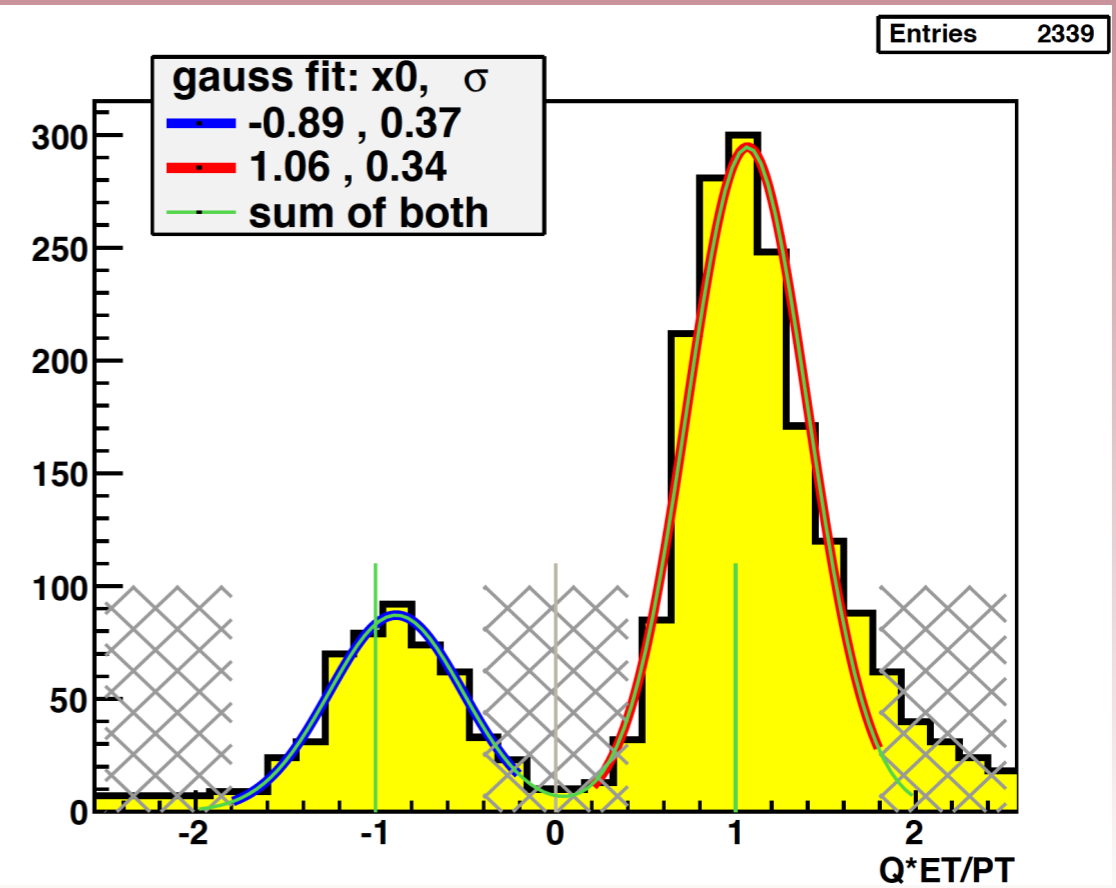
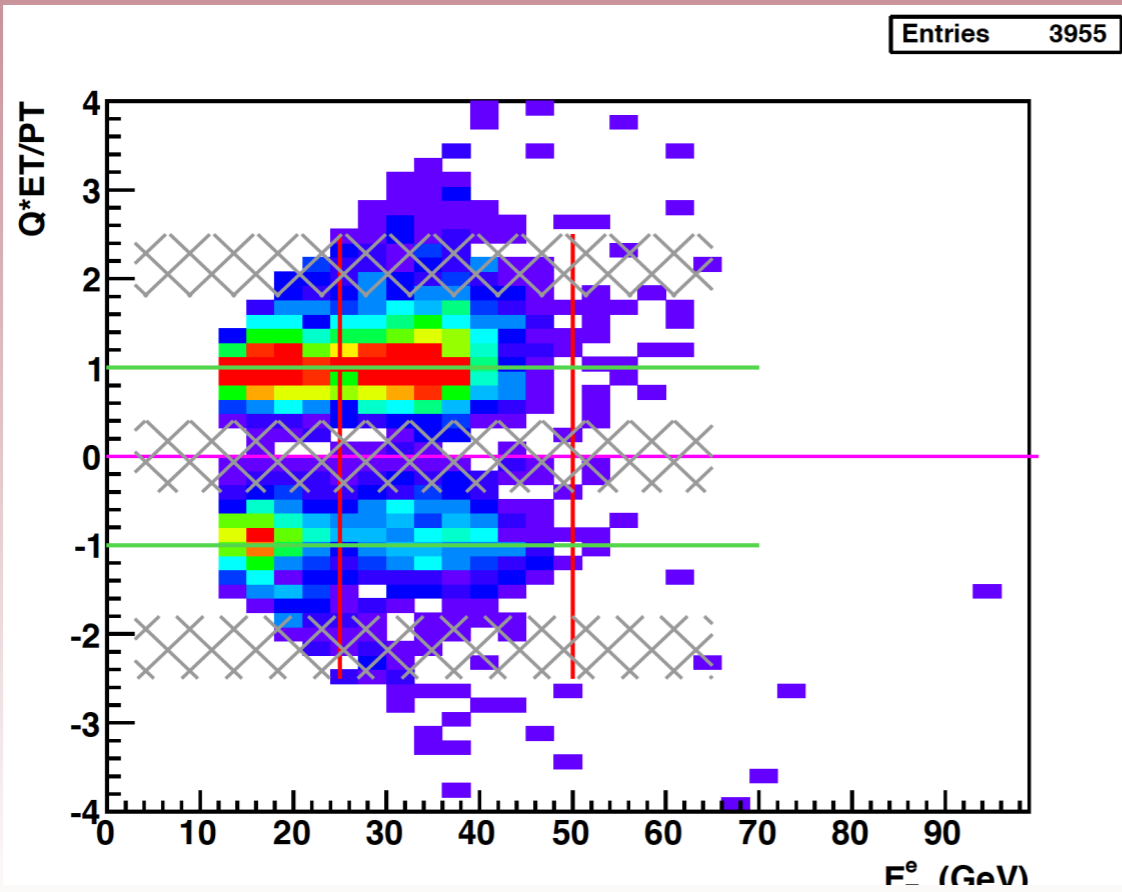
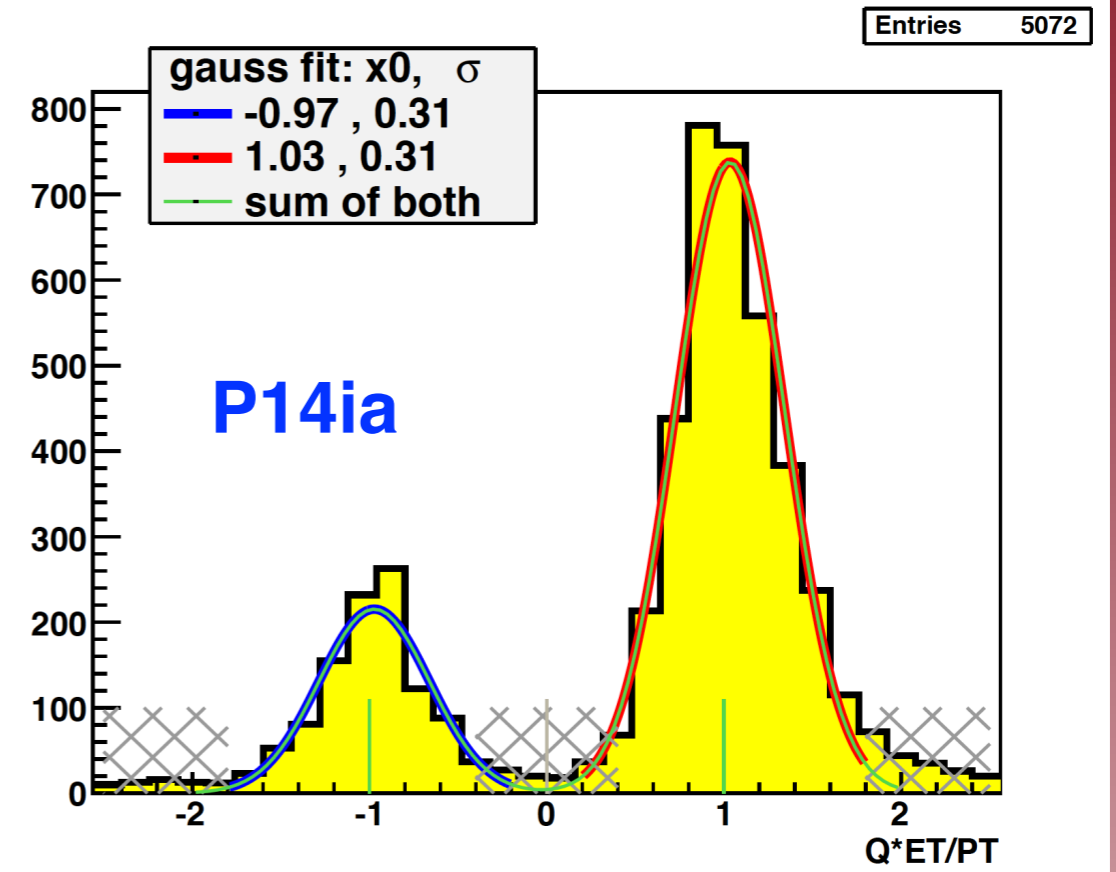
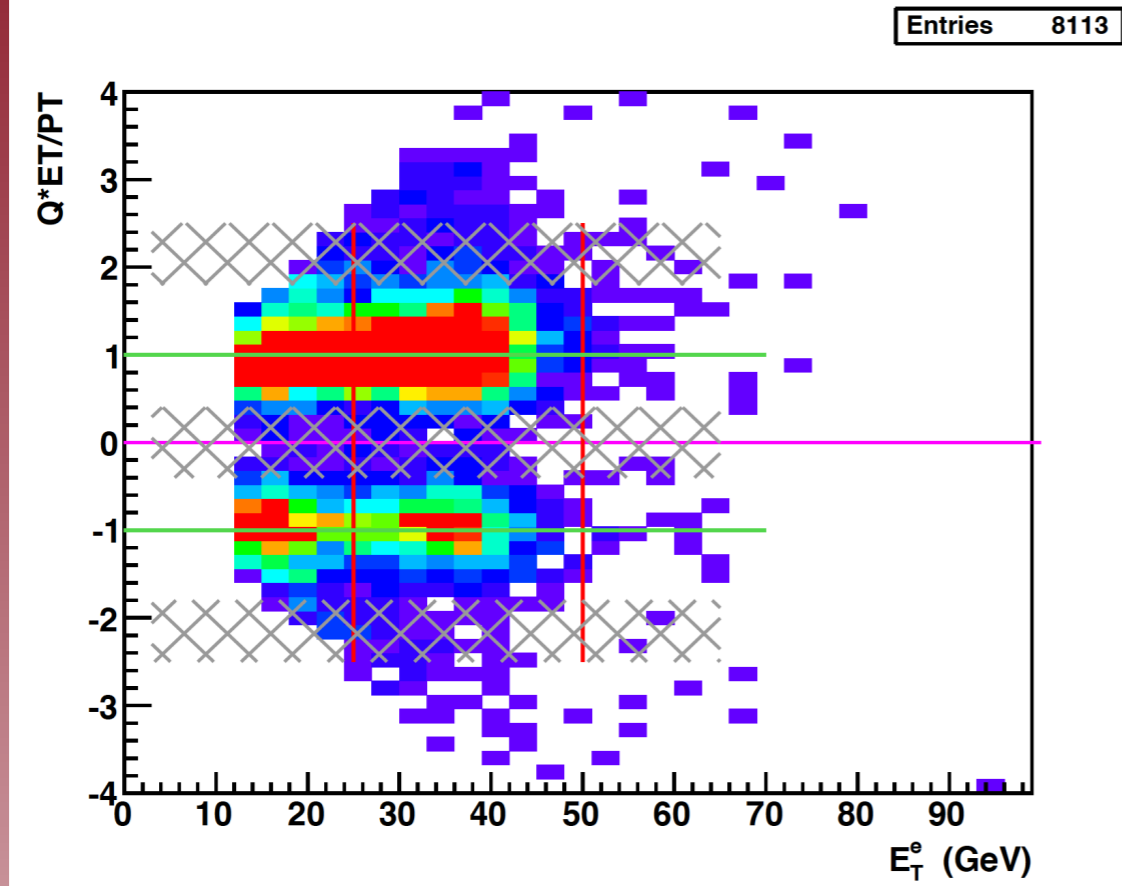
Back up 2 : Final W Eta - P2



W charge Separation

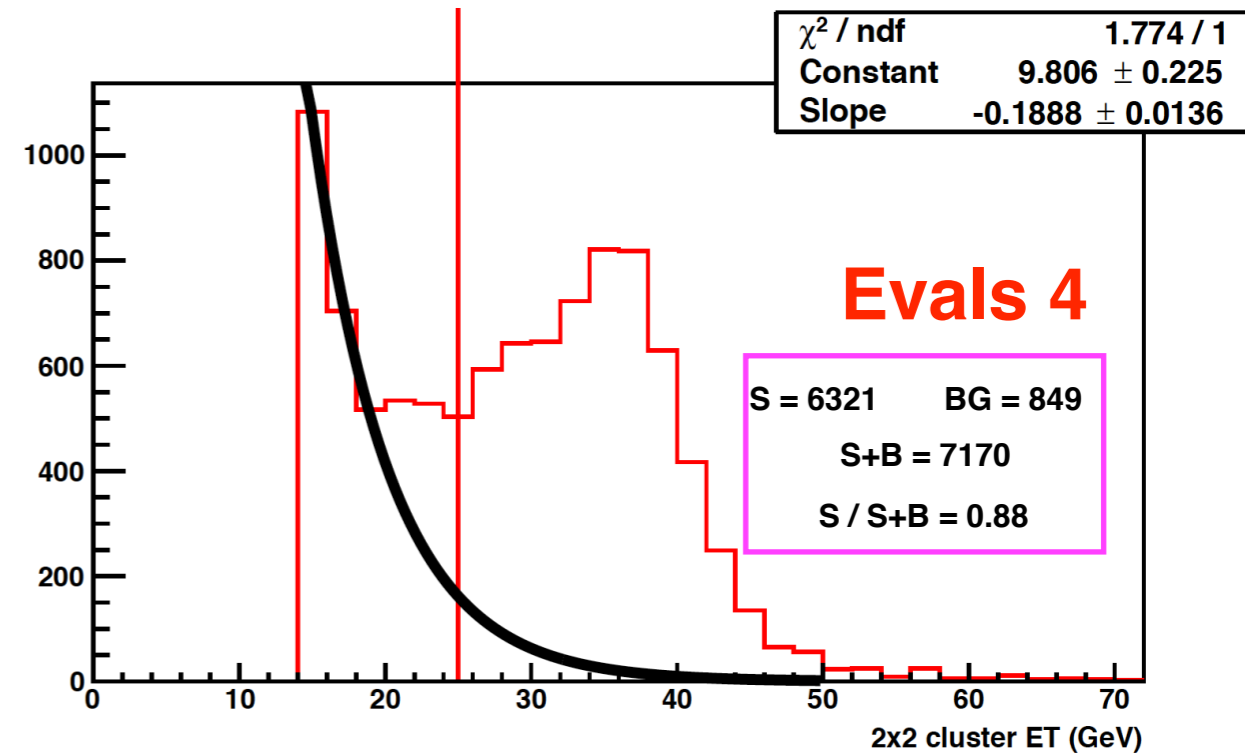
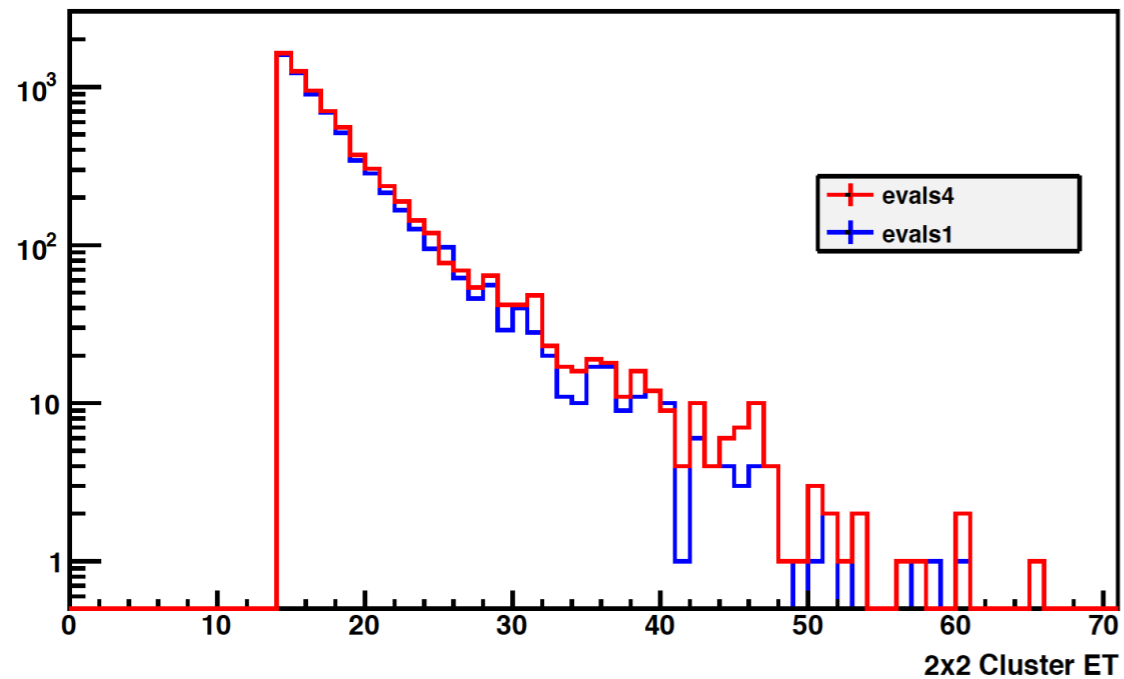


W Charge Separation

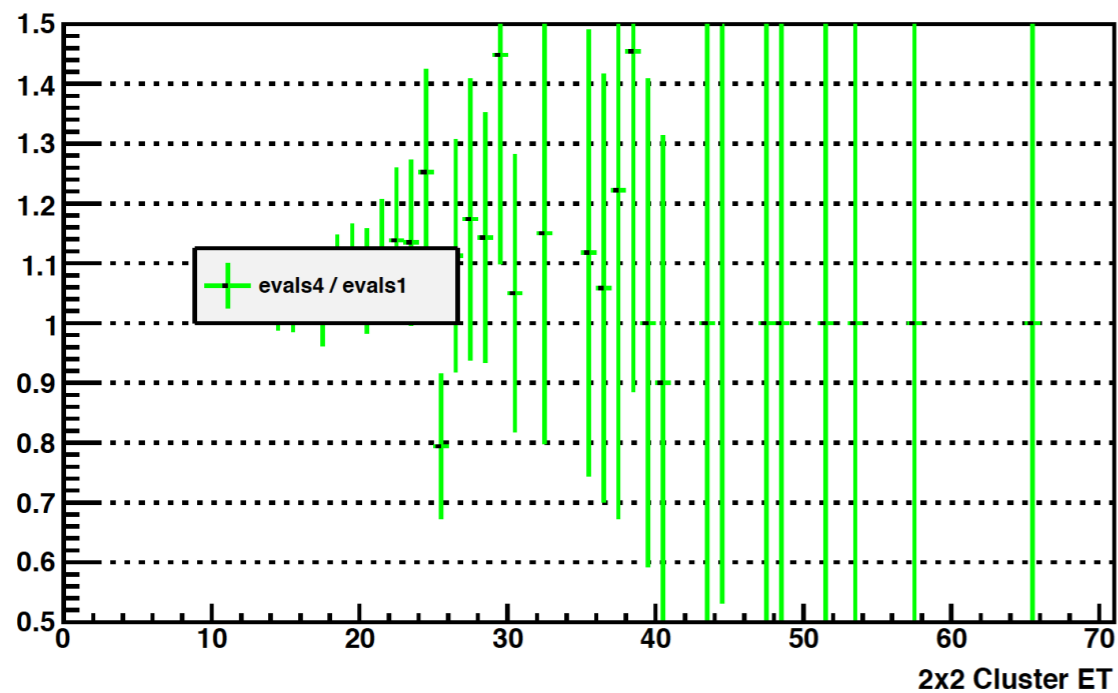


QCD BG

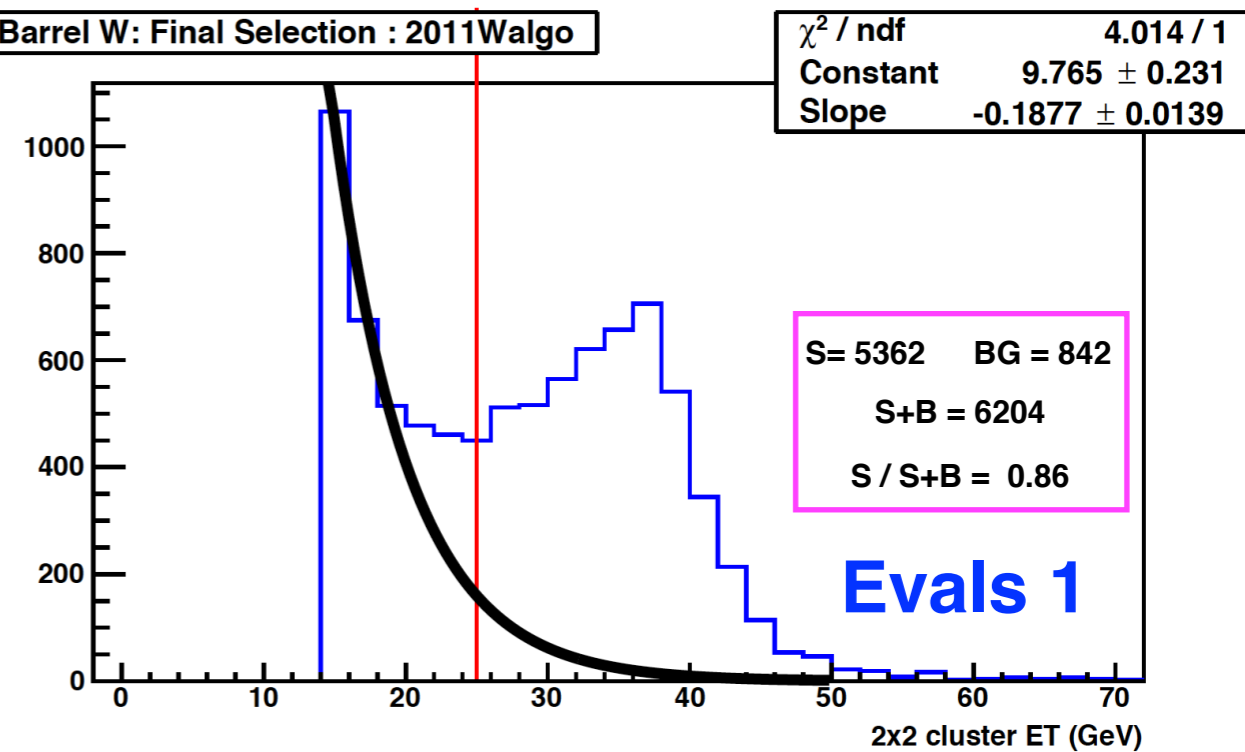
Barrel: PT Balance < 14.0



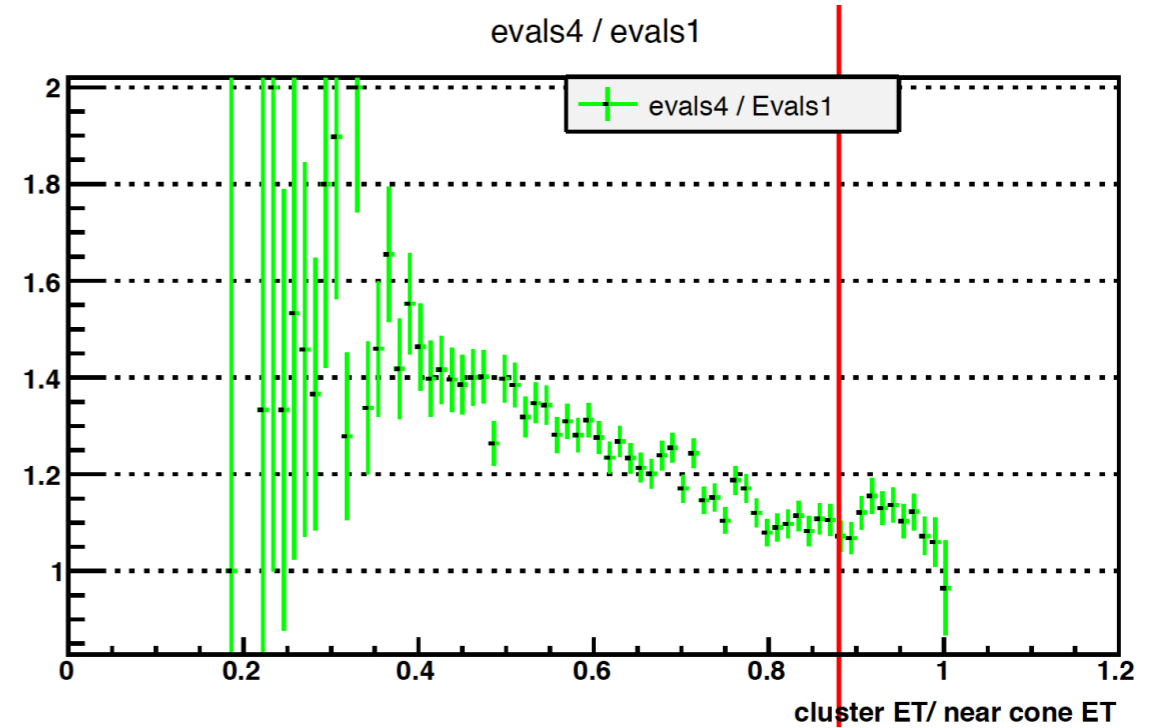
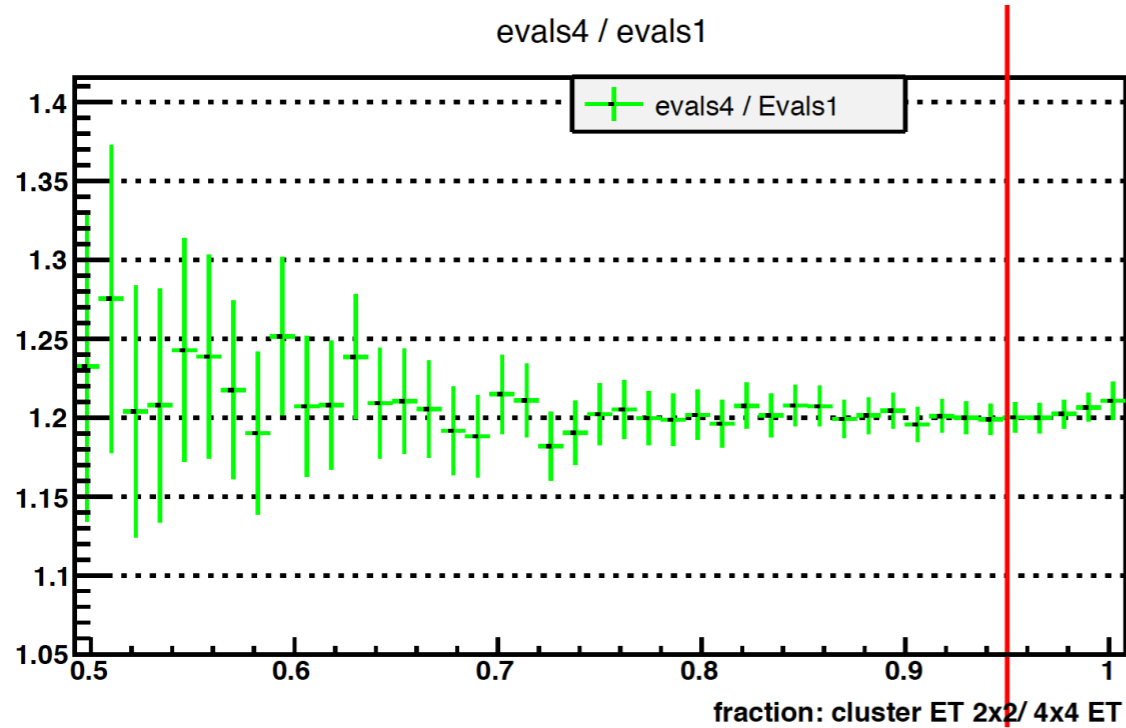
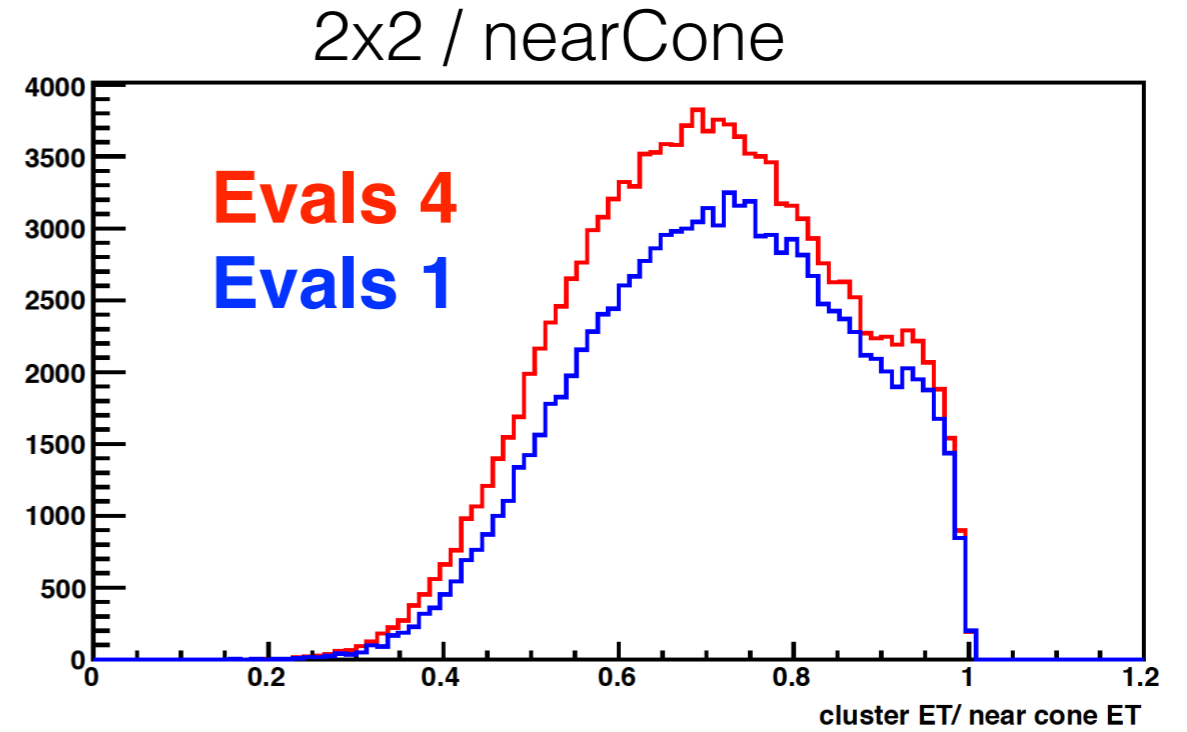
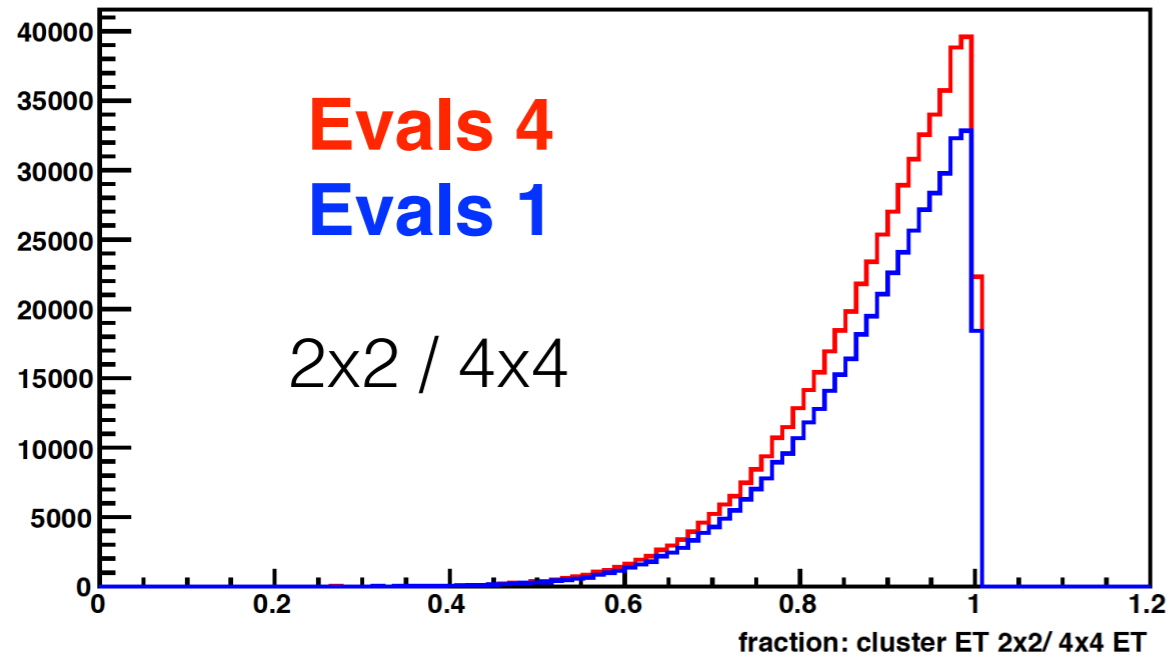
evals4 / evals1



Barrel W: Final Selection : 2011Walgo



Isolation cuts



Isolation cuts

