

# STAR 2013 W AL Request for Preliminary:

## PWG Presentation II

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# Outline

- Executive Summary
- Production Details
- W cuts
- Background Estimation
- Total Systematic Uncertainty
- W AL Money Plots (Request for W AL preliminary)

# Executive Summary I

- We found that for the official [P16ig] period 2 production the wrong **DbV time stamp** was used [DbV20140805, instead of DbV20140905].
- This has resulted in the assignment of wrong TPChitError tables and some other wrong tracking parameters during the track reconstruction.
- After notifying the S&C group, a new sample for period 2 was produced [Highest luminosity runs / 30 % of period 2 statistics] using the correct DbV time stamp.
- We compared this “re-run” production with the official, prior productions and Yuri’s production.
- The “rerun” period 2 production is significantly different than the official period 2 production (wrong). However, consistency is found between Yuri’s Period 1 and official Period 1 production and Yuri’s Period 2 and “rerun” period 2 production.
- Following the discussion during the last PWG meeting we therefore use **Official P1 production + Yuri’s P2 production** for the release of the STAR 2013 W AL preliminary results.

# Executive Summary II

- For the analysis we use the run13 BEMC calibration gain constants.
- We have scaled the gain constants based on the Z invariant mass data / MC comparison well within the assigned BEMC systematic uncertainty
- We will use 4.5% systematic for the BEMC calibration, taking into account a suggestion from EMC2 group (Will Jacobs), to include the momentum dependence of the HT trigger.
- We have studied the away-side ET cut within a certain window to determine the final value. We found no luminosity dependence of the away-side ET cut.
- The W Embedding production is based on the SL16f library [SL16g used for data production]. We found only a 2% different in the final W yield in comparison to SL16g library. This difference does not impact our background estimation.

# Data/MC Sample

	DATA	Embedding
Sample	pp500_production_2013 st_WB stream	pp500_production_2013 PYTHIA*+st_zerobias stream
Tracking	StiCA	StiCA
Vertex	PPV_W	PPV_W
Geometry	P1(<day128): y2013_2c P2(>day128): y2013_1c	P1(<day128): y2013_2c P2(>day128): y2013_1c
Integral Luminosity	P1(<day128): 125 pb <sup>-1</sup> P2(>day128): 121 pb <sup>-1</sup>	~10 x LT(data)

<b>* PYTHIA</b>	<b>6.4.22</b>	<b>Perugia 0</b>
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# W Selection Cuts

Selection Step	Cuts details
Vertex	Ranking > 0; $ V_z  < 100\text{cm}$
Track	nFitPoints > 15; nHitFit/nHitPoss > 0.51; RxyIn < 90cm; RxyOut > 160cm; track-cluster-distance < 7cm
Isolation	$E_T/E_T(4 \times 4) > 0.95$ ; $E_T/E_T(\Delta R < 0.7) > 0.88$
$p_T$ Balance	Signed $p_T$ Balance > 14 GeV; awayET < 11 GeV
$E_T$ [Range use to calculate AL]	$25 < E_T < 50 \text{ GeV}$

# Background Estimation: P1+P2

4 Eta Bins

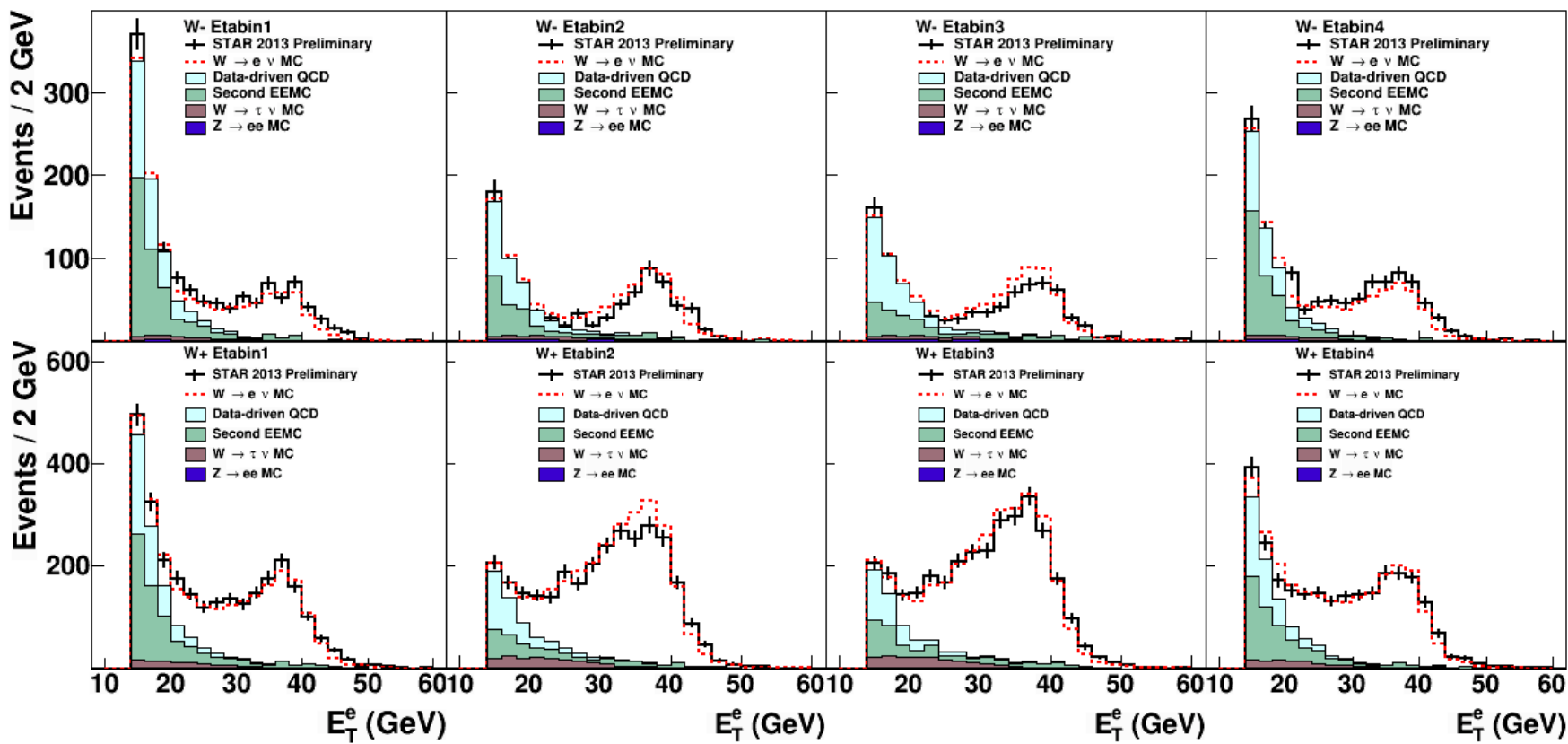
Run 13 Preliminary

-1.0 < Eta < -0.5

-0.5 < Eta < 0

0 < Eta < +0.5

+0.5 < Eta < +1.0

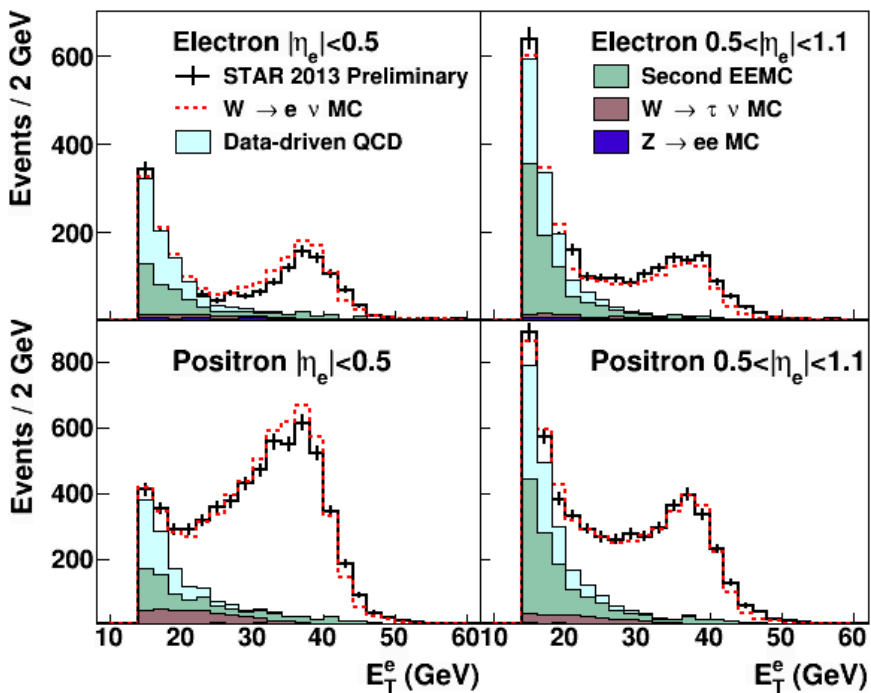


To be shown at INPC2016 / SPIN2016 .

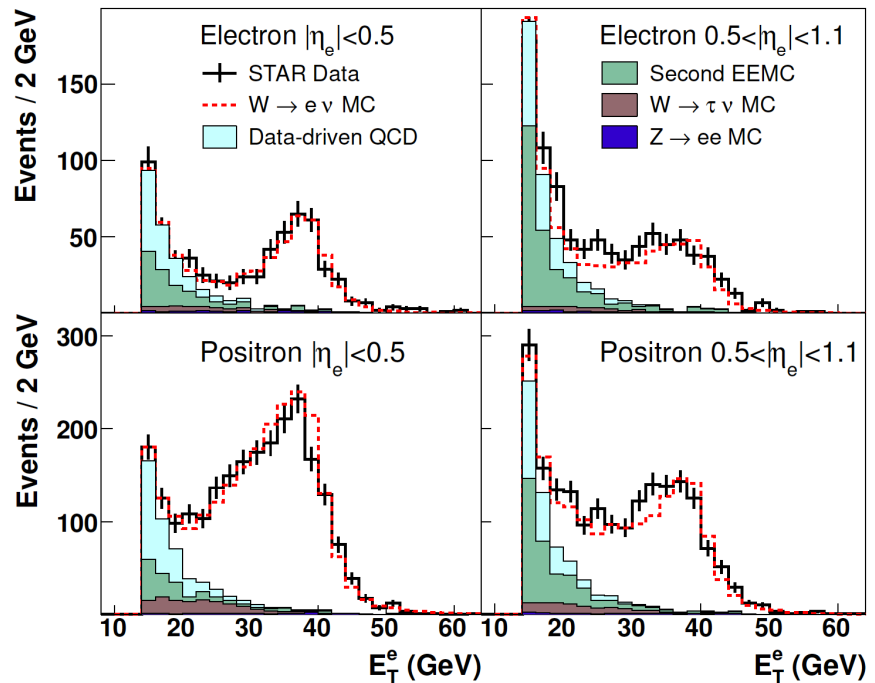
# Background Estimation: P1+P2

## Forward and mid-rapidity eta combined

Run 13 Preliminary



Run 11+12 (published)



To be shown at INPC2016 / SPIN2016 .



# Background Estimation Summary

$$\beta = \text{Single} / (\text{Single} + \text{Background})$$

	EtaBin	rawYield	qcdBkgd	EEMC	zeeBkgd	wTau	$\beta$	err
2013 P1 W-	1	258	7.05	23	4.98	5.86	0.862	0.02
	2	270	11.4	28	7.07	6.31	0.827	0.021
	3	259	12.94	23	5.7	7.31	0.839	0.02
	4	315	8.52	18	4.46	5.05	0.899	0.014

	EtaBin	rawYield	qcdBkgd	EEMC	zeeBkgd	wTau	beta	err
2013 P1 W+	1	781	8.31	60	3.63	13.65	0.908	0.01
	2	1246	9.13	50	9.69	26.75	0.944	0.006
	3	1282	12.2	54	4.44	25.66	0.944	0.006
	4	775	16.59	30	2.96	14.83	0.935	0.007

	EtaBin	rawYield	qcdBkgd	EEMC	zeeBkgd	wTau	beta	err
2013 P2 W-	1	238	9.69	18	3.86	4.41	0.865	0.019
	2	185	5.94	17	7.33	6.17	0.836	0.024
	3	198	7.84	25	7.64	4.57	0.791	0.028
	4	245	5.15	13	3.08	4.25	0.911	0.015

	EtaBin	rawYield	qcdBkgd	EEMC	zeeBkgd	wTau	beta	err
2013 P2 W+	1	581	15.06	42	4.72	12.37	0.894	0.012
	2	835	12.3	33	5.12	20.35	0.939	0.007
	3	998	7.63	41	5.15	23.85	0.946	0.007
	4	653	6.57	43	3.39	13.92	0.918	0.01

# W AL

	Eta range	W+ AL +/- Err	W- AL +/- Err
2013 Period 1	-1.1, -0.5	-0.241 +/- 0.049	0.299 +/- 0.084
	-0.5,0	-0.333 +/- 0.037	0.262 +/- 0.092
	0, 0.5	-0.411 +/- 0.037	0.222 +/- 0.092
	0.5, 1.1	-0.529 +/- 0.047	0.484 +/- 0.082

	Eta range	W+ AL +/- Err	W- AL +/- Err
2013 Period 2	-1.1, -0.5	-0.269 +/- 0.056	0.218 +/- 0.091
	-0.5,0	-0.330 +/- 0.044	0.453 +/- 0.110
	0, 0.5	-0.432 +/- 0.043	0.260 +/- 0.112
	0.5, 1.1	-0.598 +/- 0.054	0.268 +/- 0.091

	Eta range	W+ AL +/- Err	W- AL +/- Err
2013 Combined	-1.1, -0.5	-0.254 +/- 0.037	0.262 +/- 0.062
	-0.5,0	-0.332 +/- 0.028	0.340 +/- 0.071
	0, 0.5	-0.420 +/- 0.028	0.237 +/- 0.071
	0.5, 1.1	-0.559 +/- 0.036	0.386 +/- 0.061

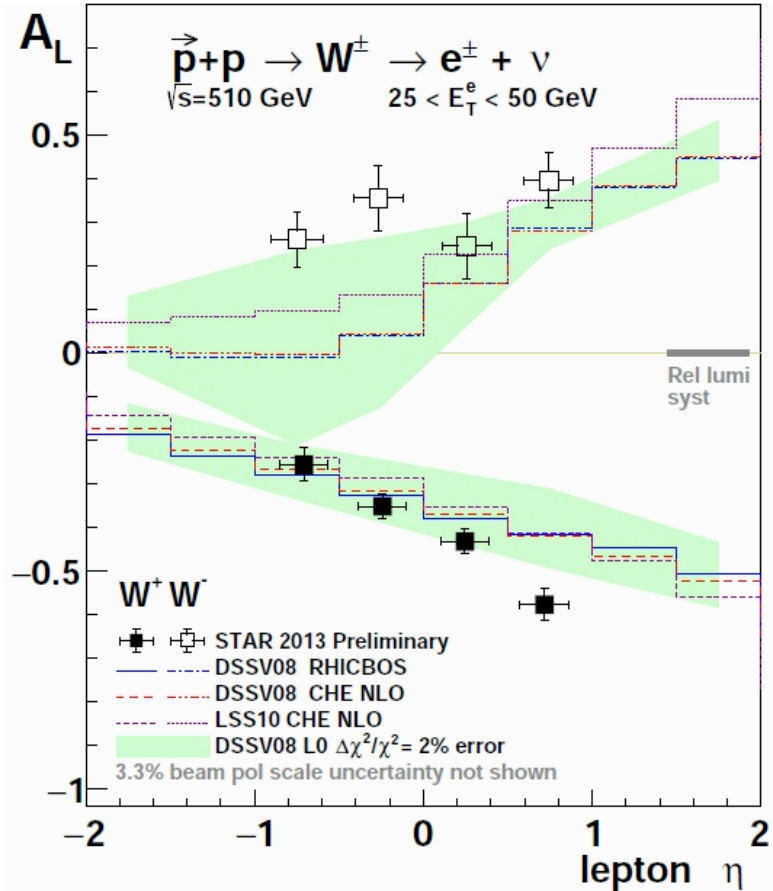
# Total Systematic Uncertainty

Type	Value
Un-polarized Bkgd ( $\beta$ )	Propagated into AL
Polarized Bkgd	Negligible
BEMC Calibration	4.5%
Relative Luminosity	0.004
Wrong charge sign	Negligible

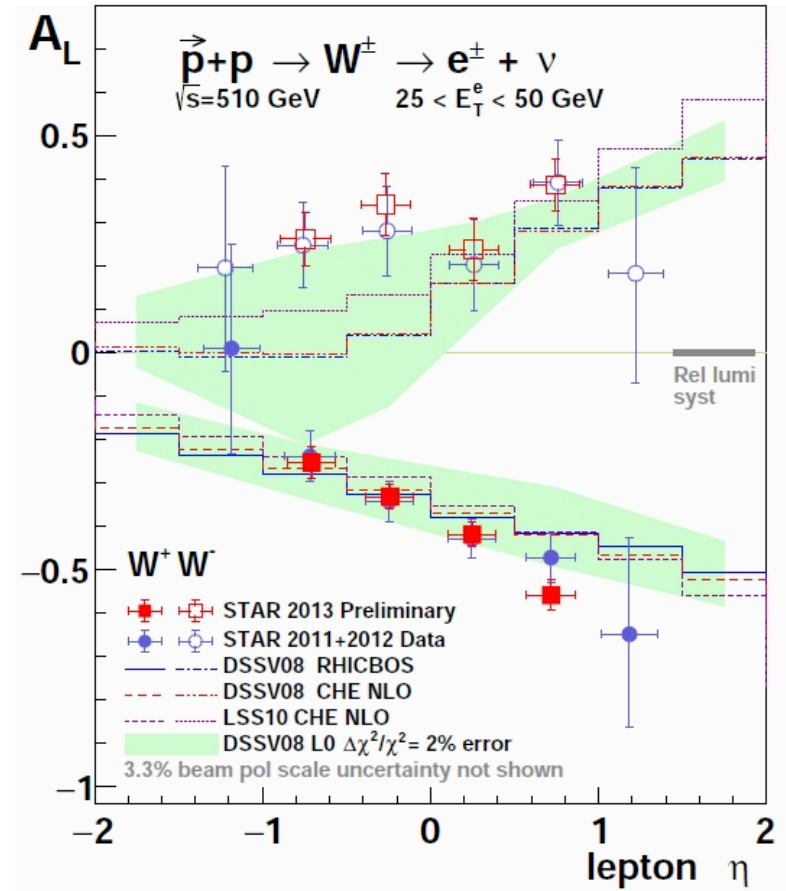
\*Normalization uncertainty due to beam polarization: 3.3%

# W AL Money Plots

## STAR 2013 Preliminary



## STAR 2013 in comparison to STAR 2011+2012



- Statistical Uncertainties reduced by 40% from 2011+2012.
- Systematic Uncertainties at similar level.

# Summary

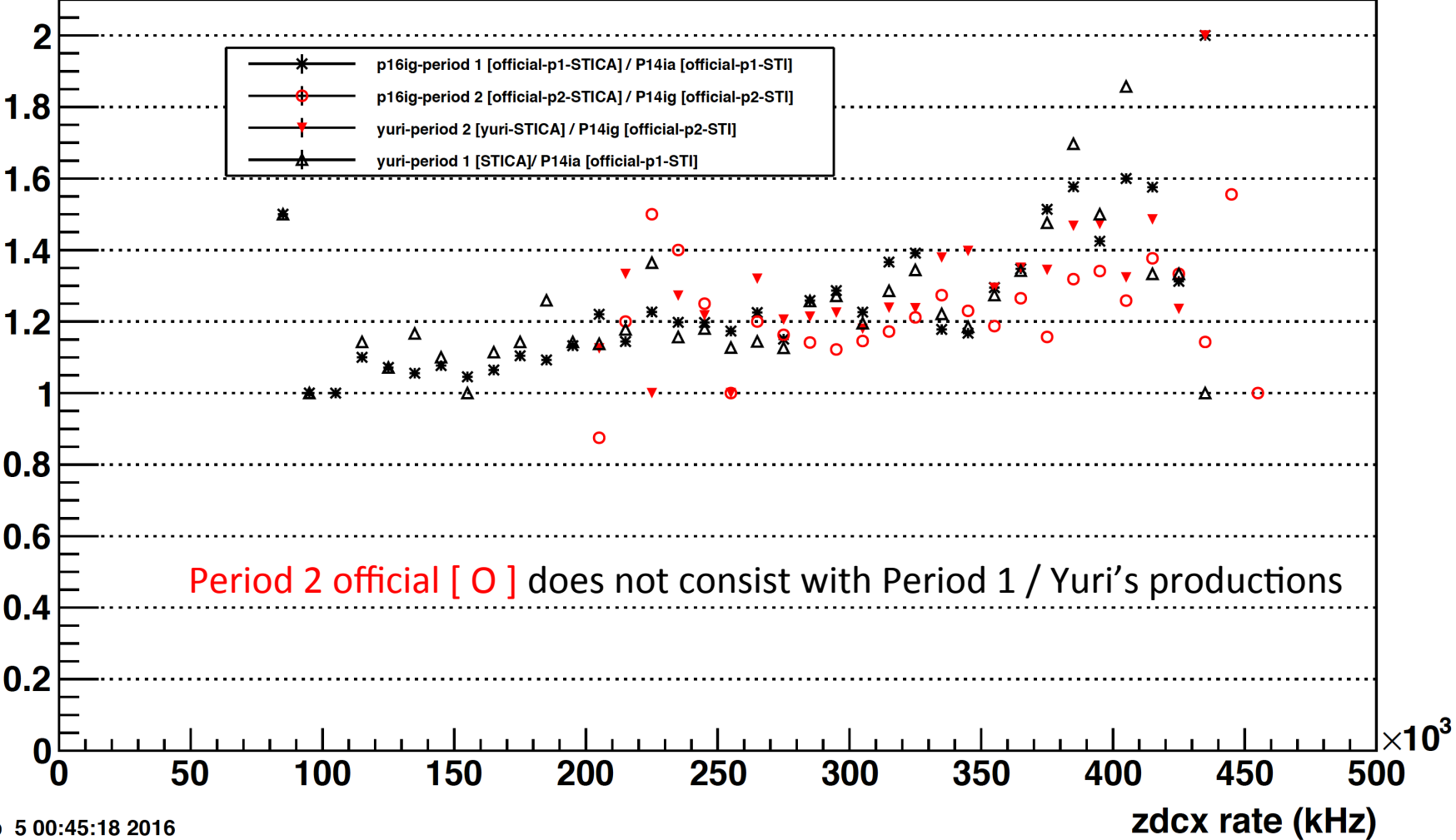
- StiCA official Production is done, with Period 2 using wrong timestamp.
- Yuri's Productions are consistent with Official Period 1 and the re-check production of Period 2 (High Luminosity).
- Official P1 + Yuri's P2 are used for preliminary results.
- STAR 2013 W AL preliminary results are consistent with STAR 2011+2012 W AL results, with **40% smaller statistical uncertainties**.
- After SPIN2016, prepare for publication with all **OFFICIAL** productions.

# Backup



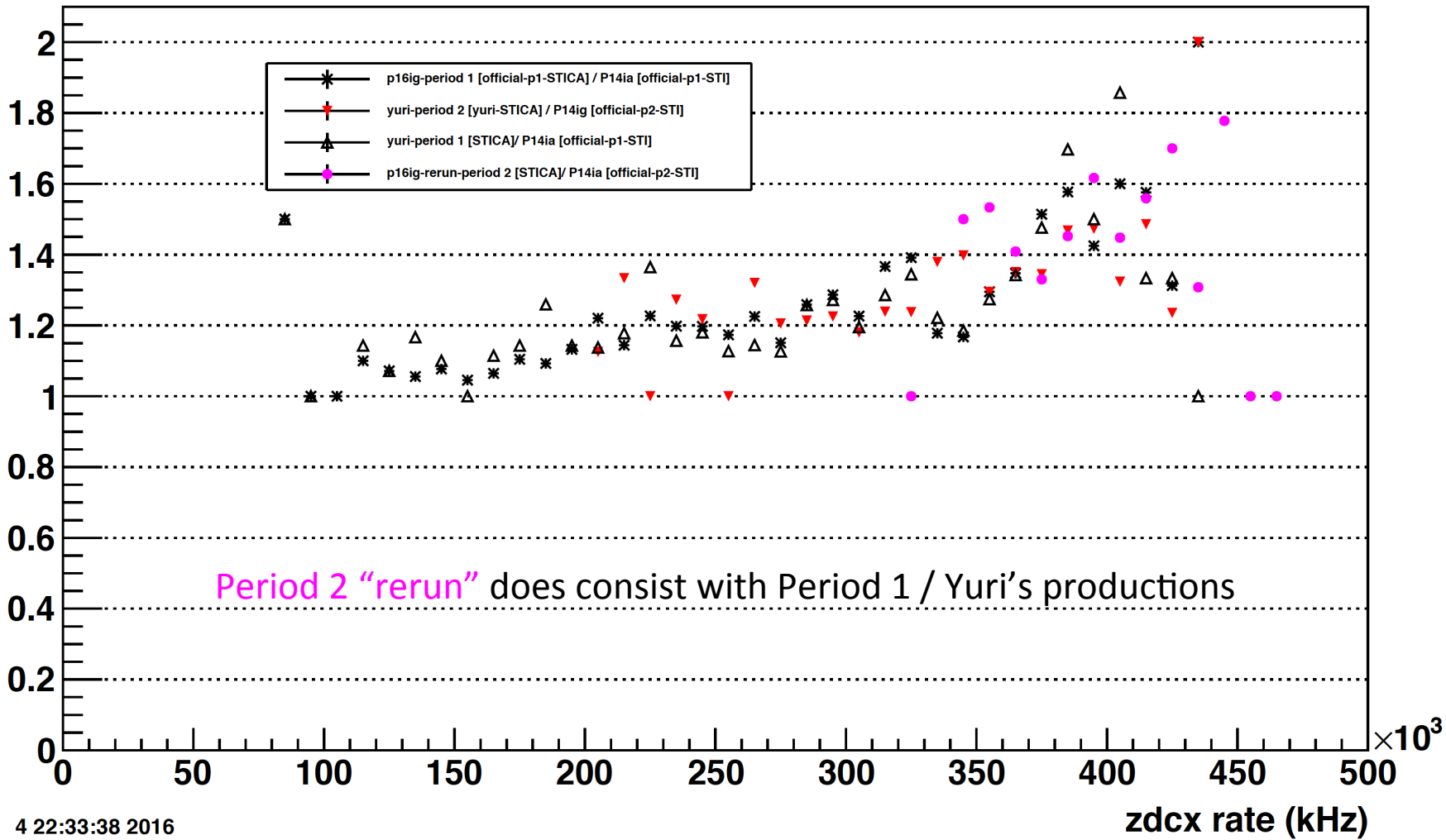
# Final W zdcx – Official P2 with Wrong DbV Timestamp

Final W: ratio of StiCA/Sti



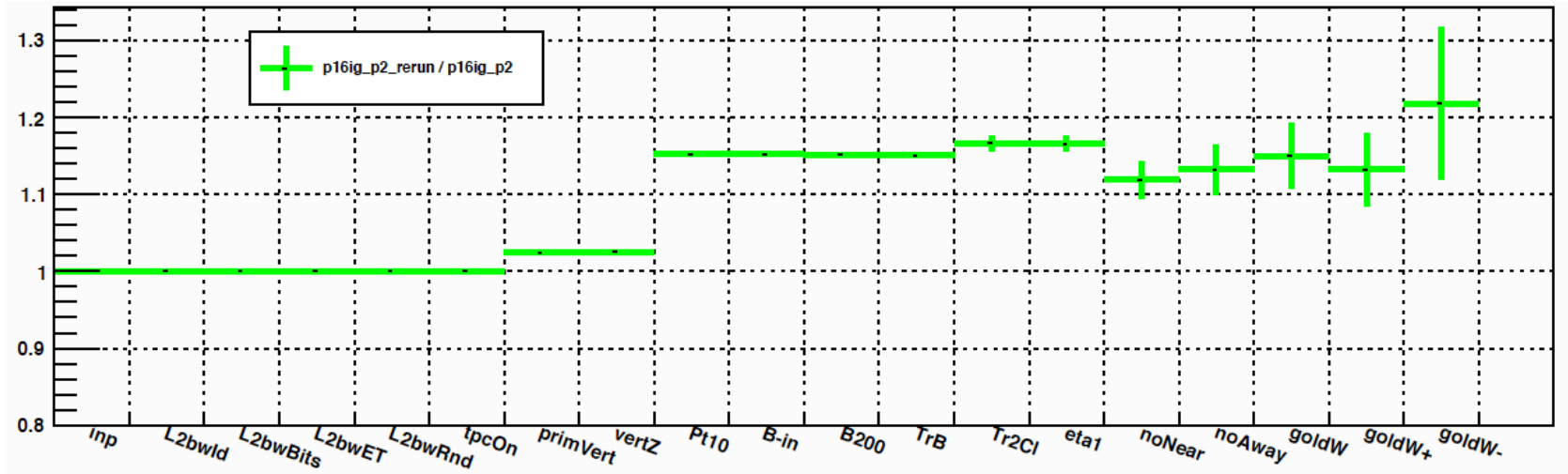
# Final W zdcx – Official P2 with Corected DbV Timestamp

## Final W: ratio of StiCA/Sti



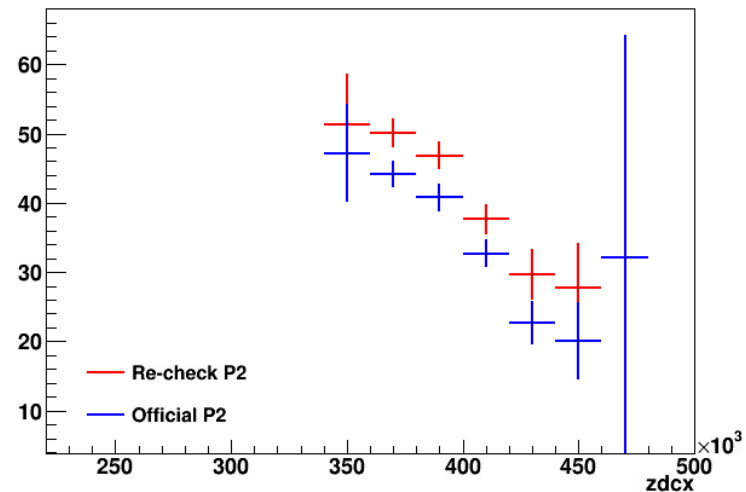


# Official P2 and “rerun”



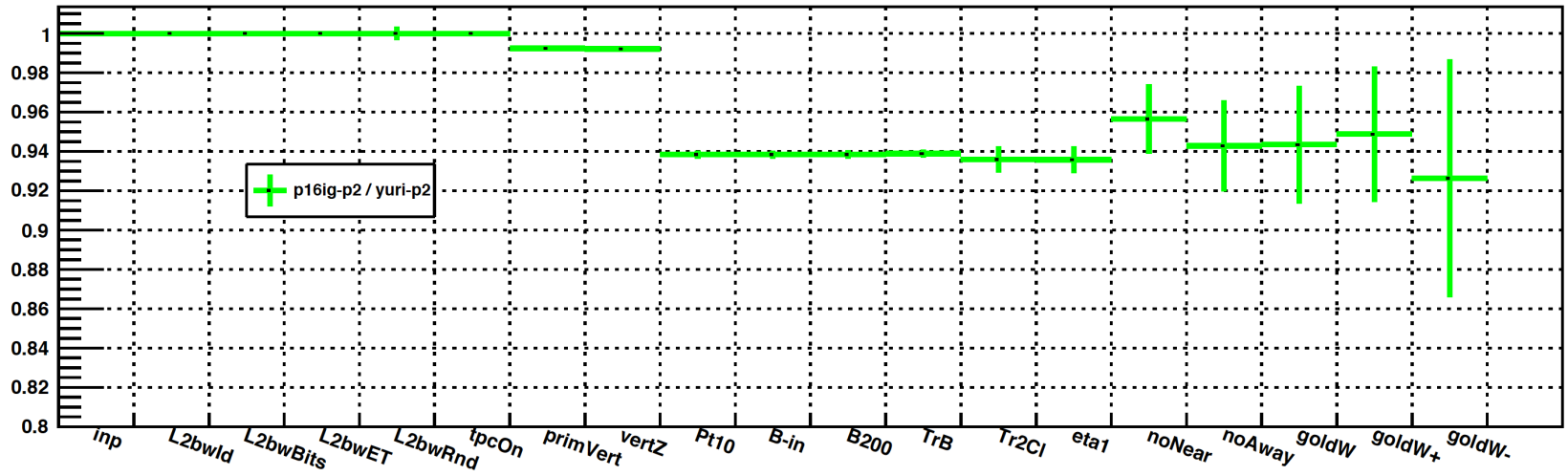
Significant difference after the time-stamp issue being fixed!

golden W per 100K L2BW event

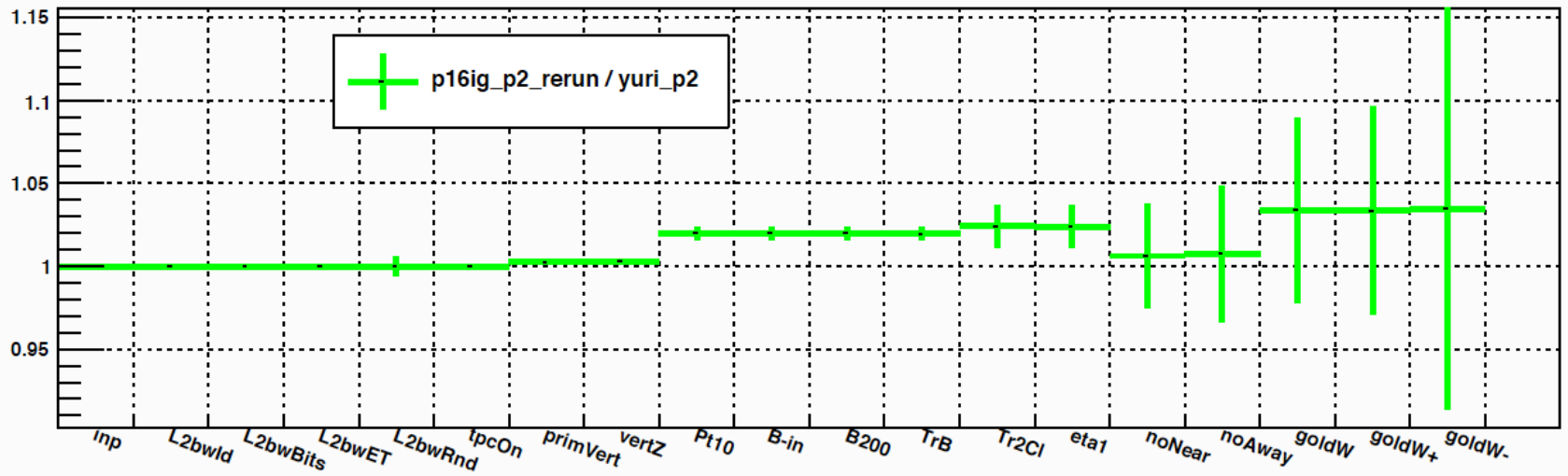


# Yuri P2 vs official P2(wrong) and "rerun"

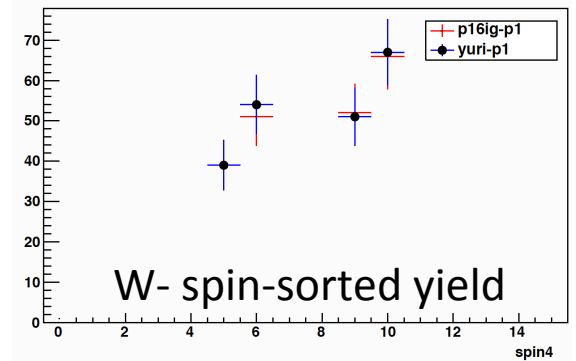
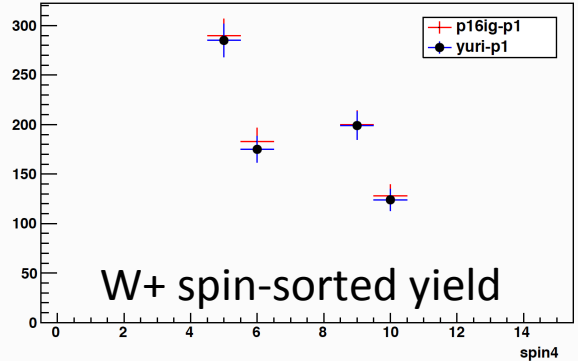
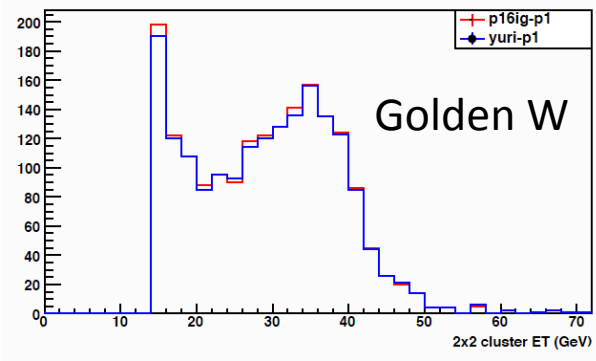
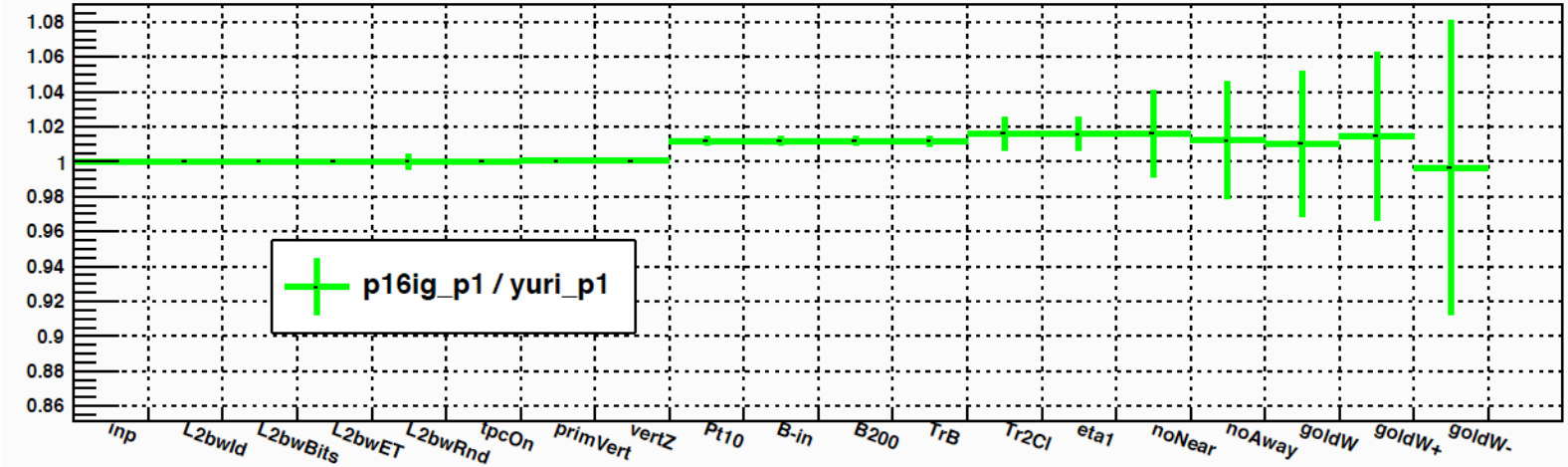
## Official P2 / Yuri P2



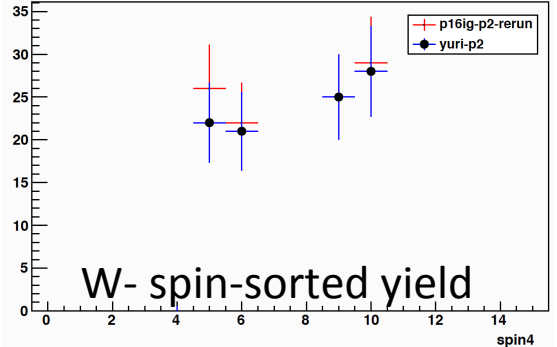
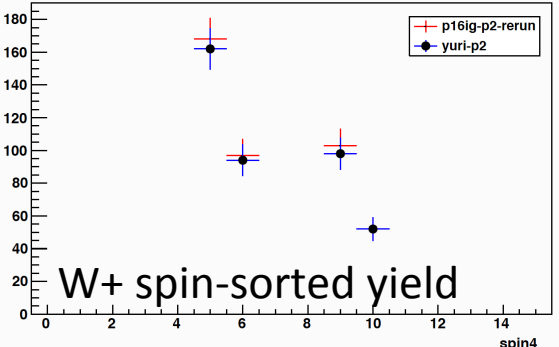
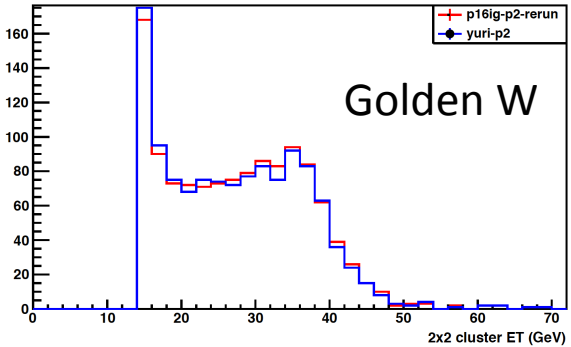
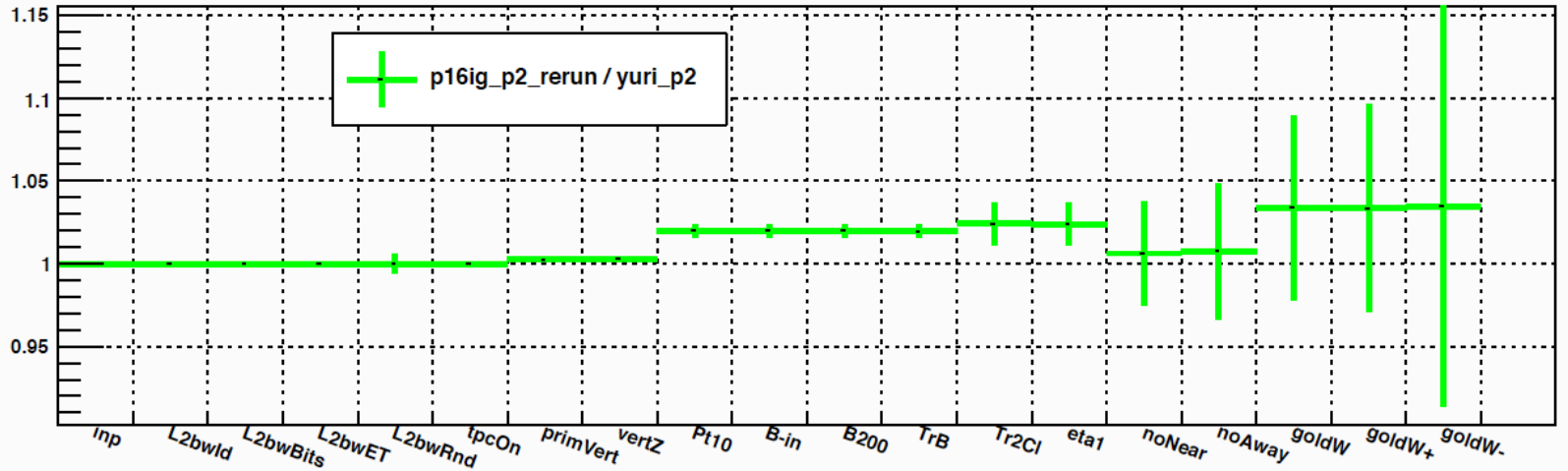
## Official P2 "rerun" / Yuri P2



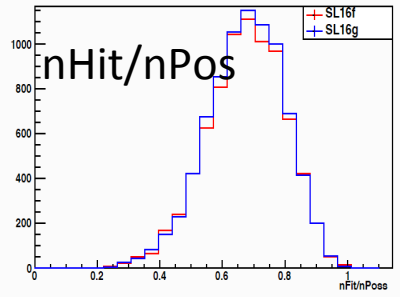
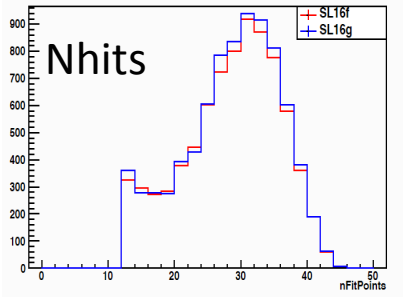
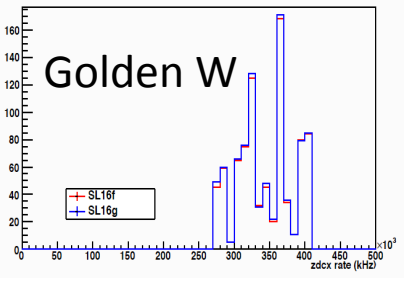
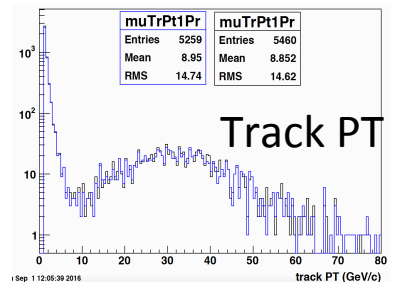
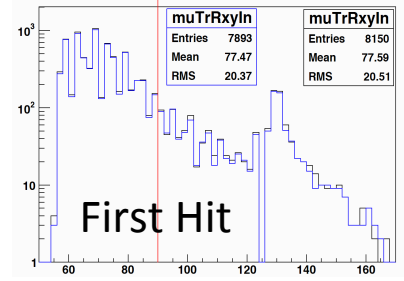
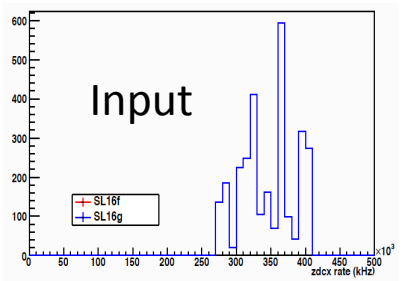
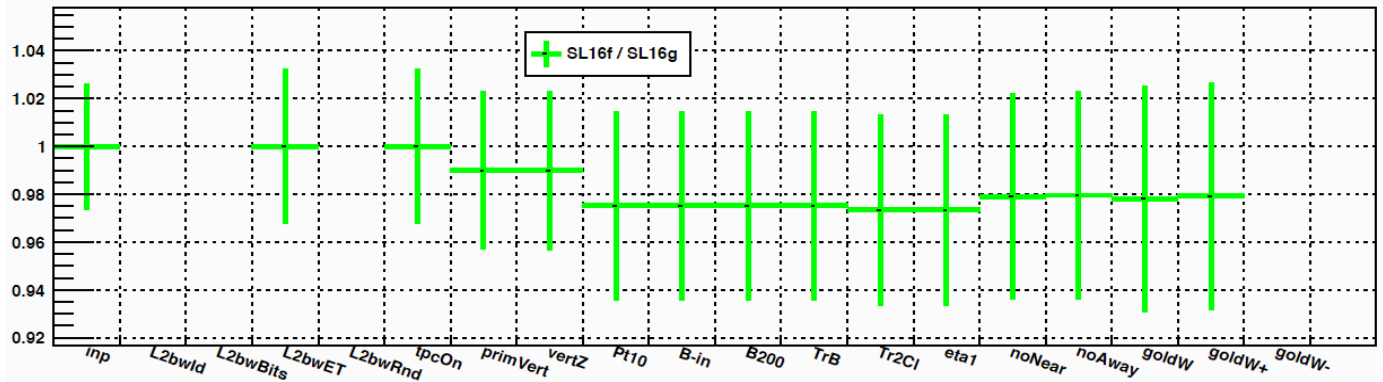
# Consistence: Official P1 vs. Yuri's P1



# Consistence: Official P2 “rerun” vs. Yuri’s P2

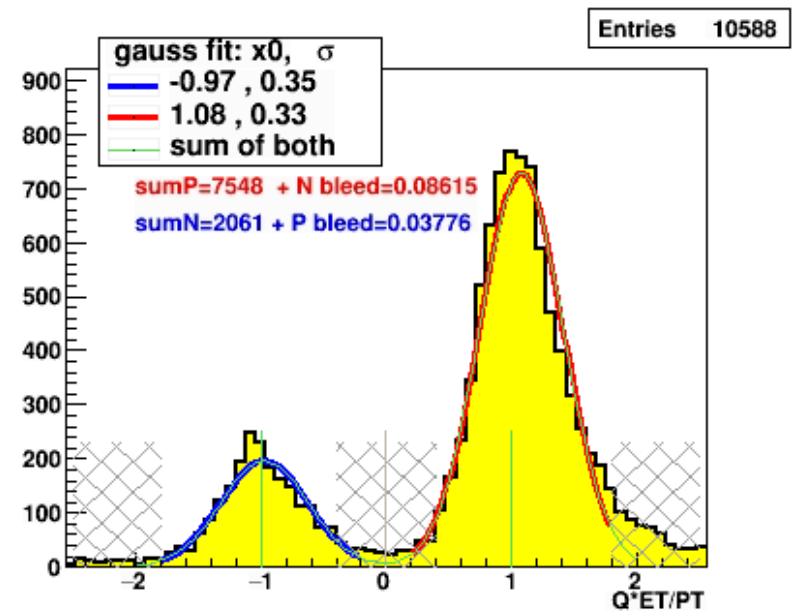
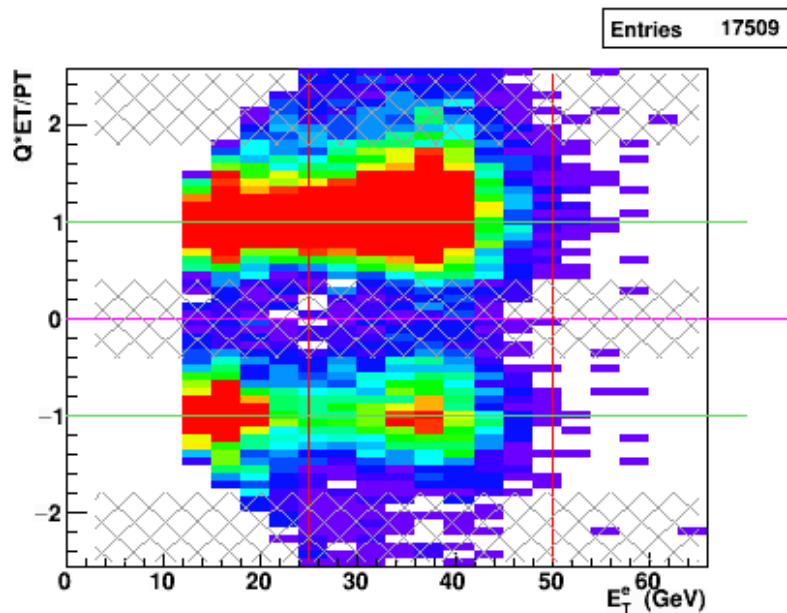


# Embedding SL16f vs. SL16g



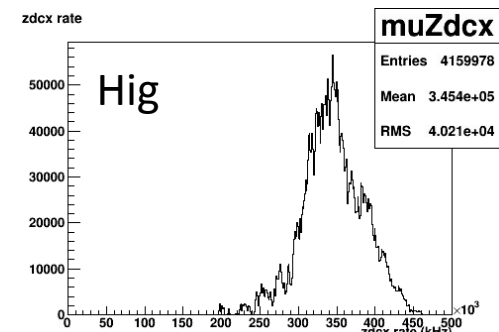
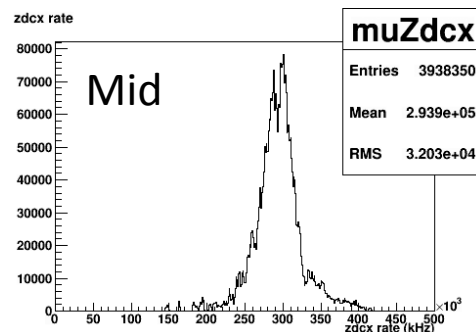
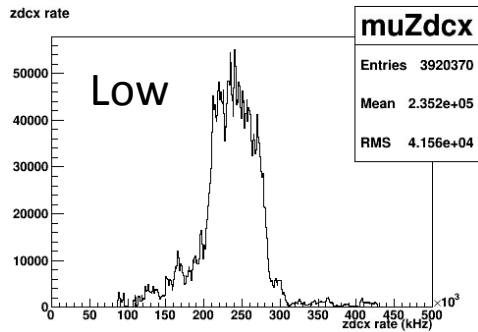
- Consistent at track level, ONLY 2% difference at analysis side
- Safe enough to use for BKGD estimation

# Charge Separation

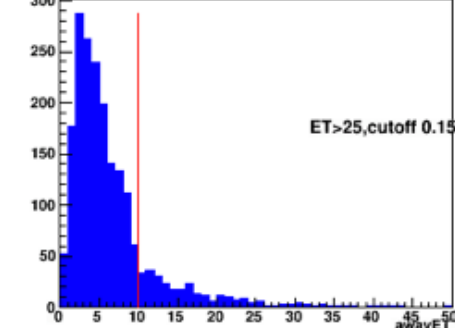
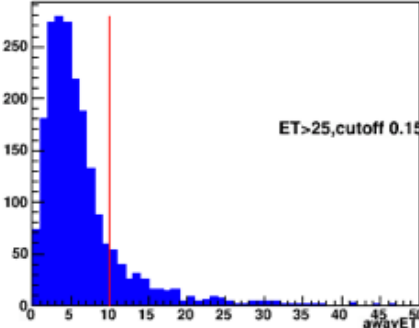
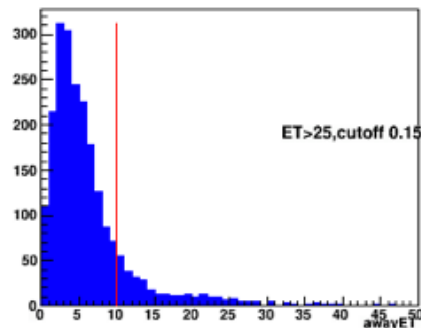
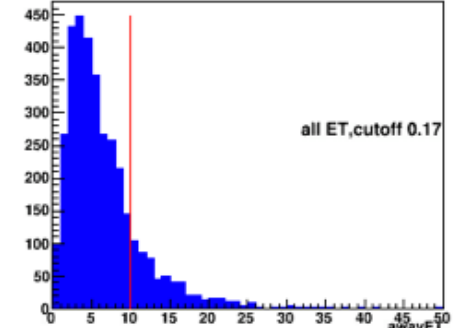
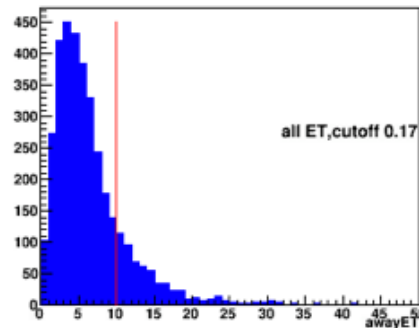
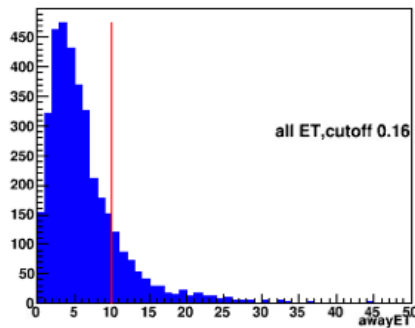


Negligible wrong charge sign contamination after excluding the tails,  $|Q \cdot E_T / p_T| < 0.4$  and  $|Q \cdot E_T / p_T| > 1.8$

# Away ET cut: Luminosity dependence

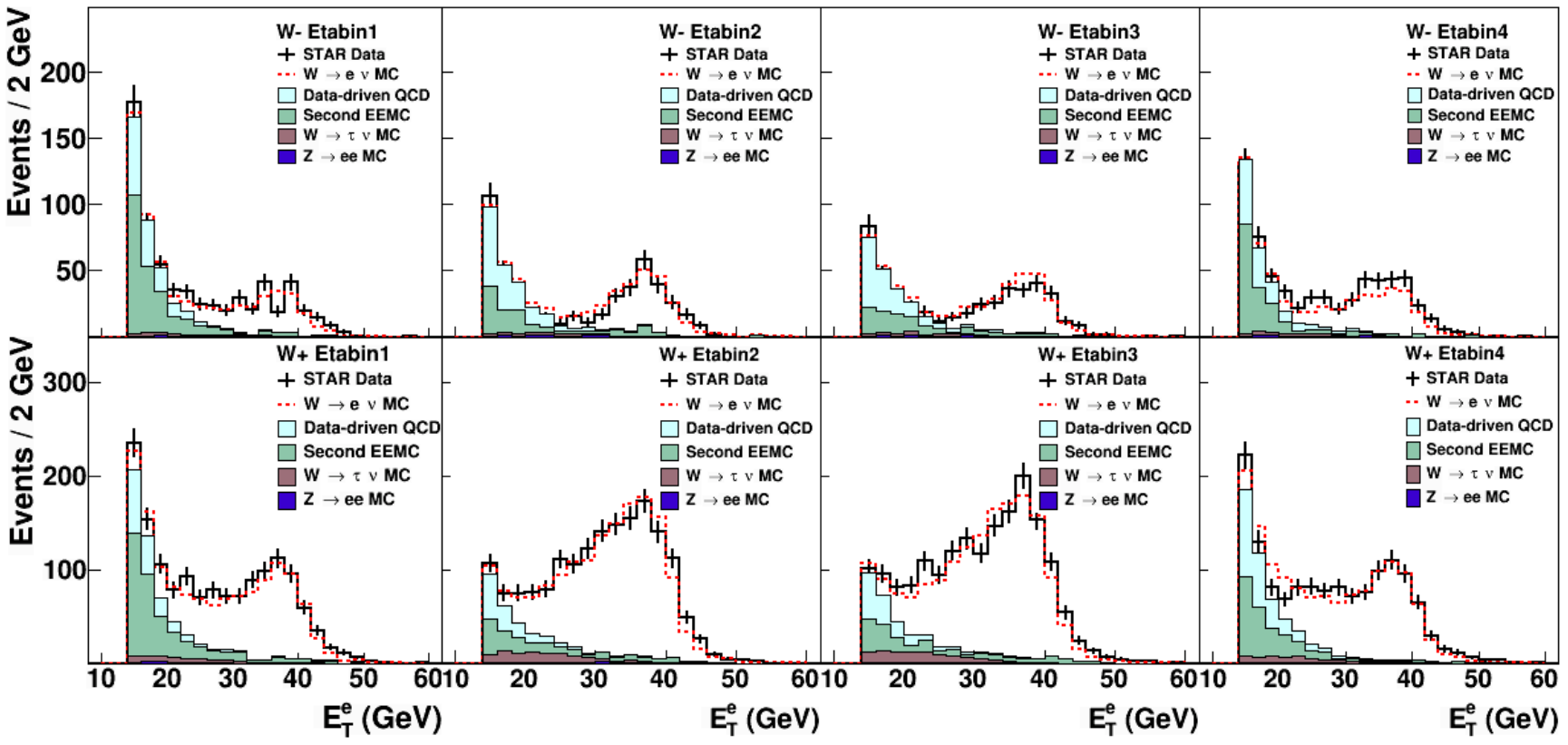


awayET vs. clustET (sPtbalance>14GeV)



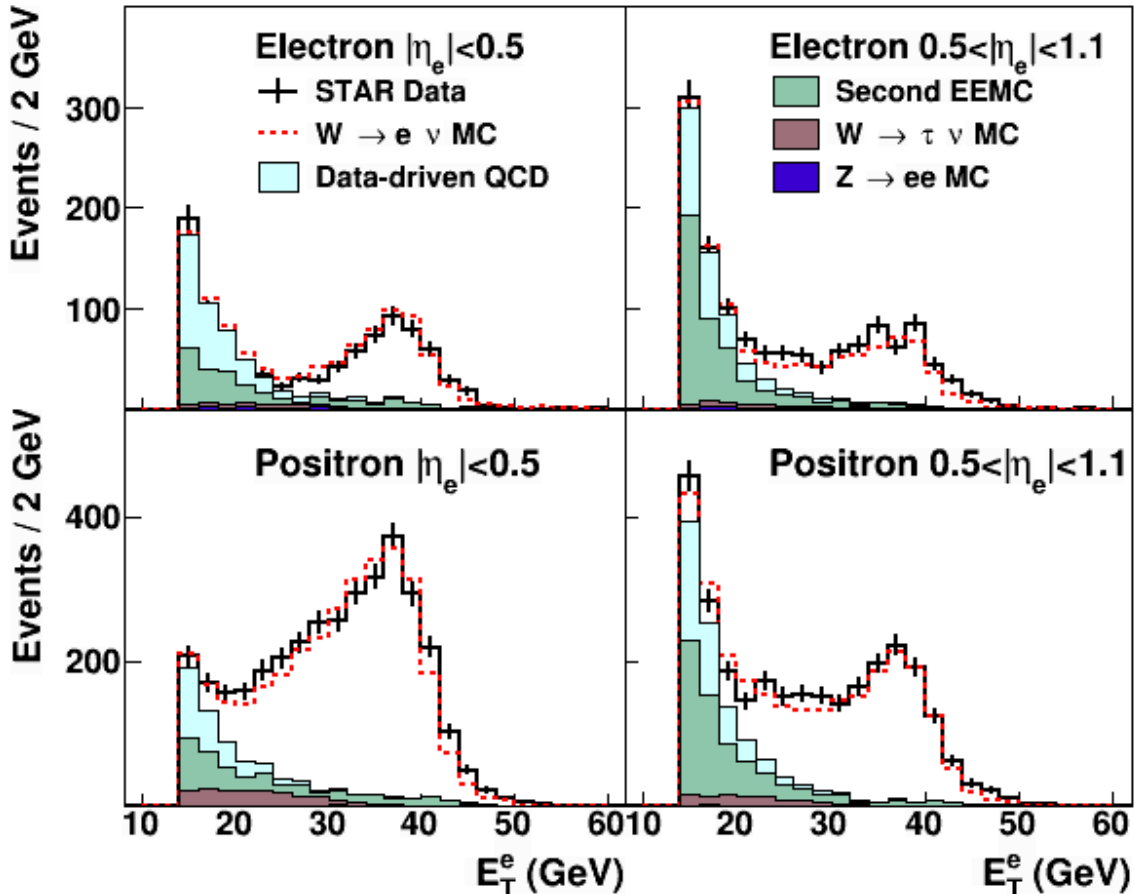
- No significant Luminosity dependence

# Background Estimation: Period 1

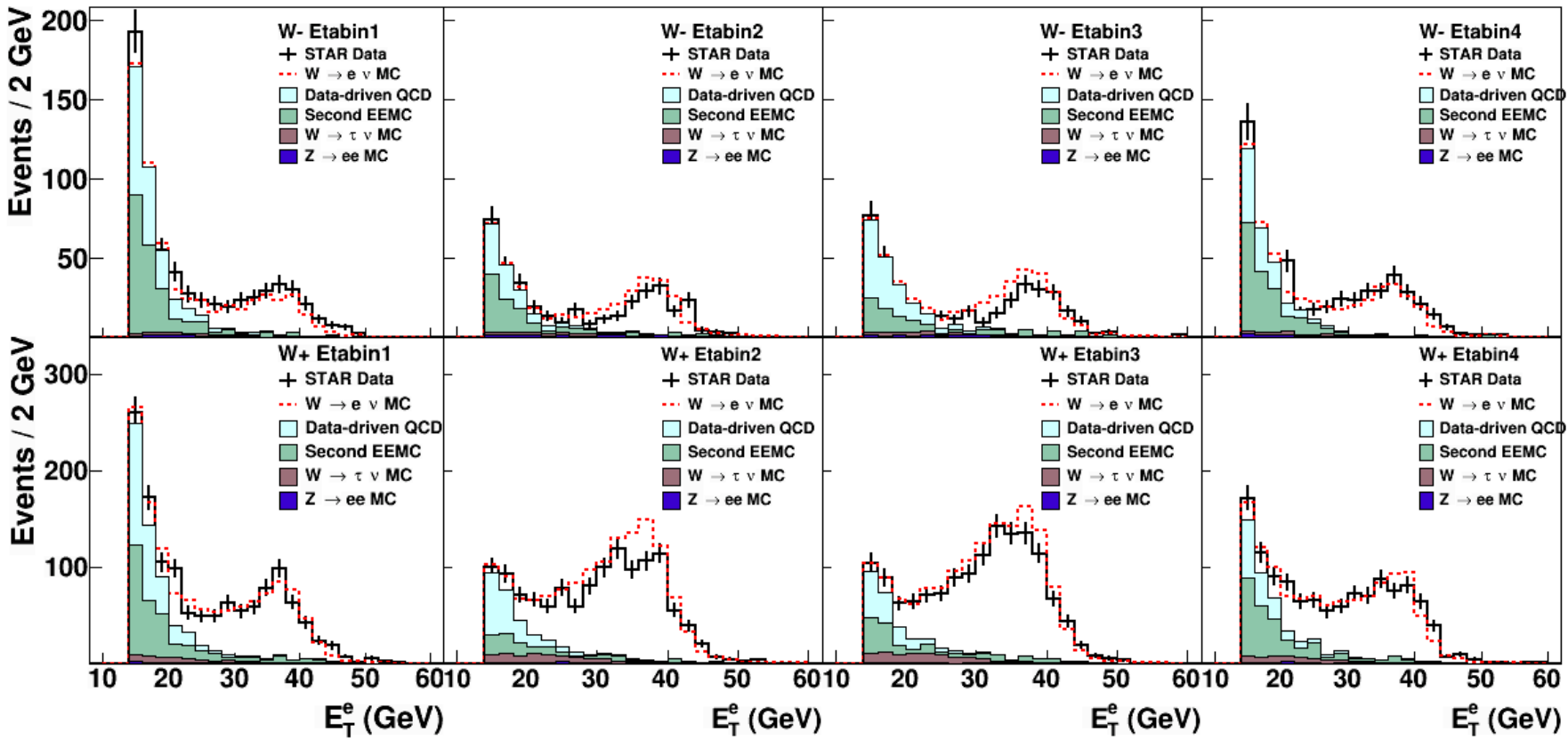




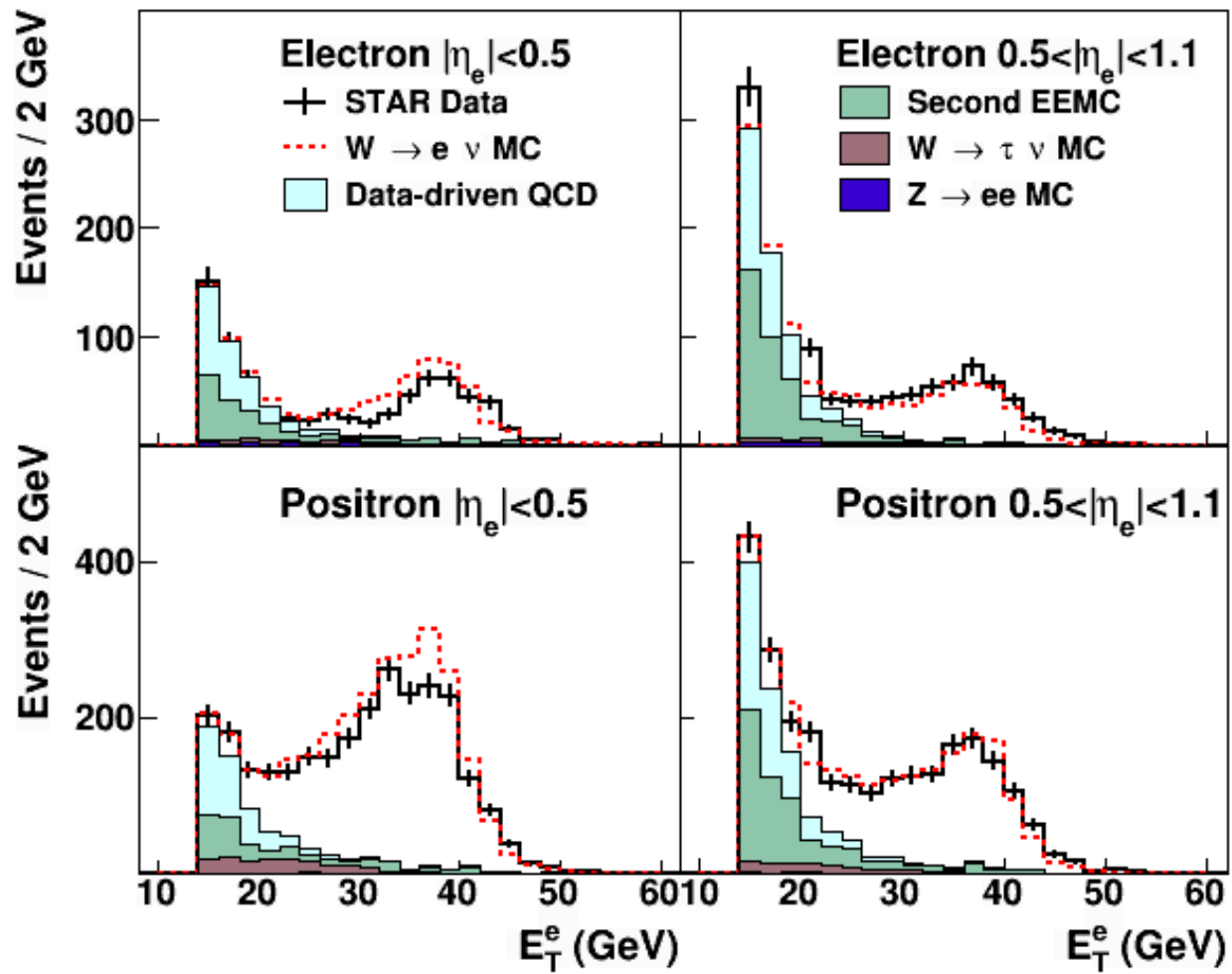
# Background Estimation: Period 1



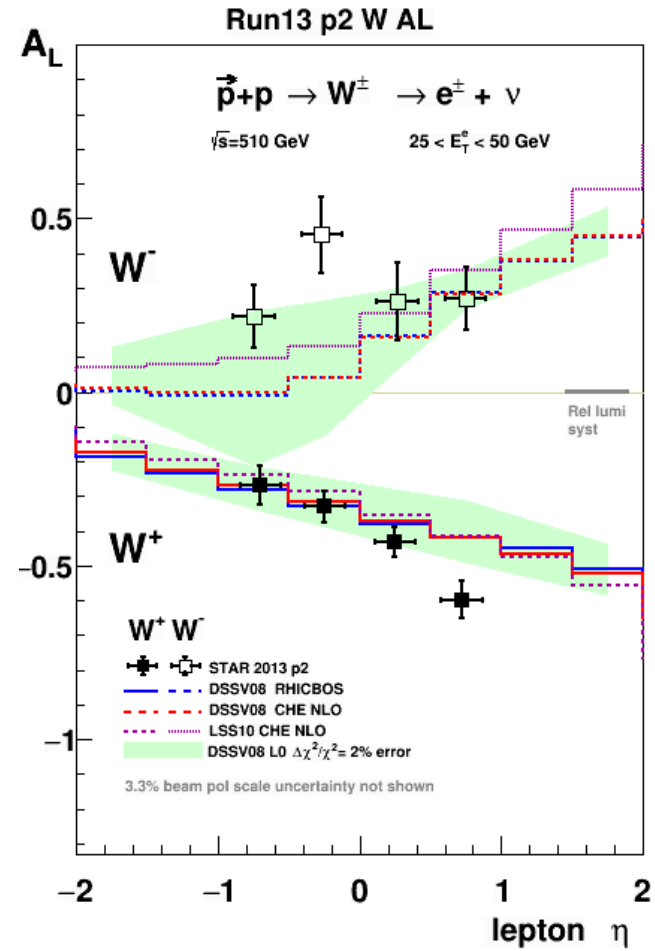
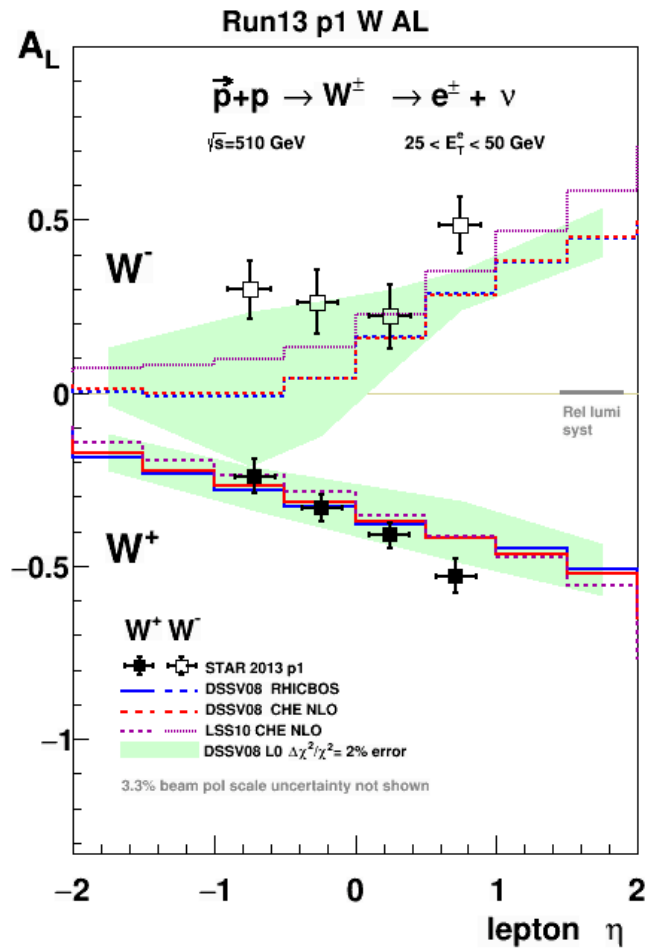
# Background Estimation: Period 2



# Background Estimation: Period 2



# W AL: Period 1 and Period 2



# Chi2 Test

$$\chi^2 = \sum_i \frac{(A_{1i} - A_{2i})^2}{\sigma_{1i}^2 + \sigma_{2i}^2}$$

Period 1 vs. Period 2

W+ AL, /ndf	W- AL /ndf
1.21/4	4.96/4

Run13 preliminary vs Run11+12

W+ AL, /ndf	W- AL /ndf
1.83/4	0.32/4