Status of Neutral Dijet Analysis on Data from 200GeV Proton Proton Collisions using the STAR Detector at RHIC

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for the

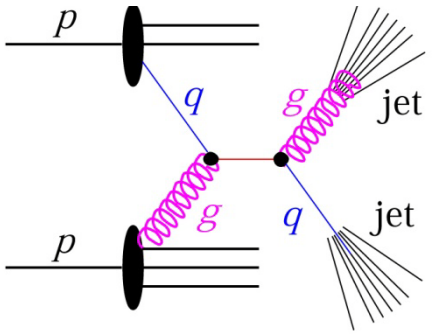
Collaboration

Investigating the Proton's Spin at STAR

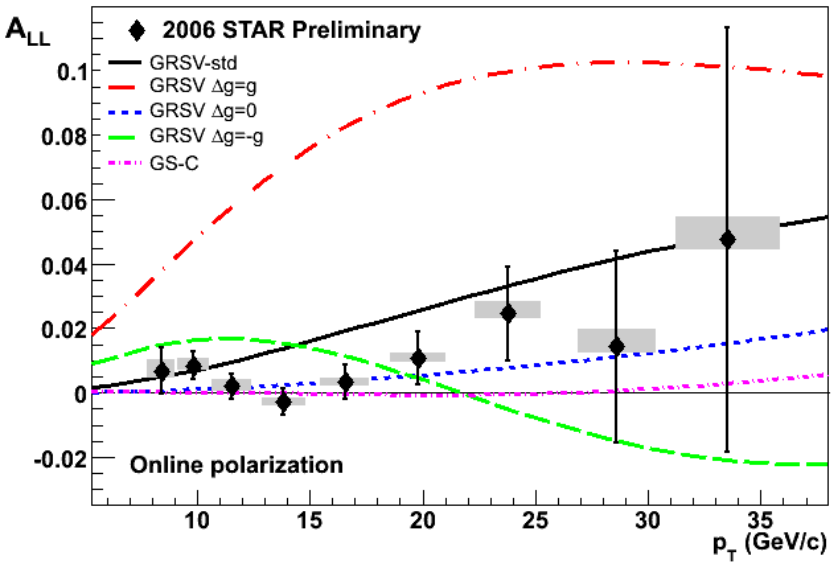
$$S_z = \tfrac{1}{2} = \tfrac{1}{2}\Delta\Sigma + \Delta G + L_z^q + L_z^g$$

Contributions to proton spin from quark spin $\Delta\Sigma$ is smaller than expected

At RHIC we have been measuring the contribution from the gluon spin ΔG primarily via qg or gg scattering



Quark - Gluon (also Gluon - Gluon) Elastic Scattering

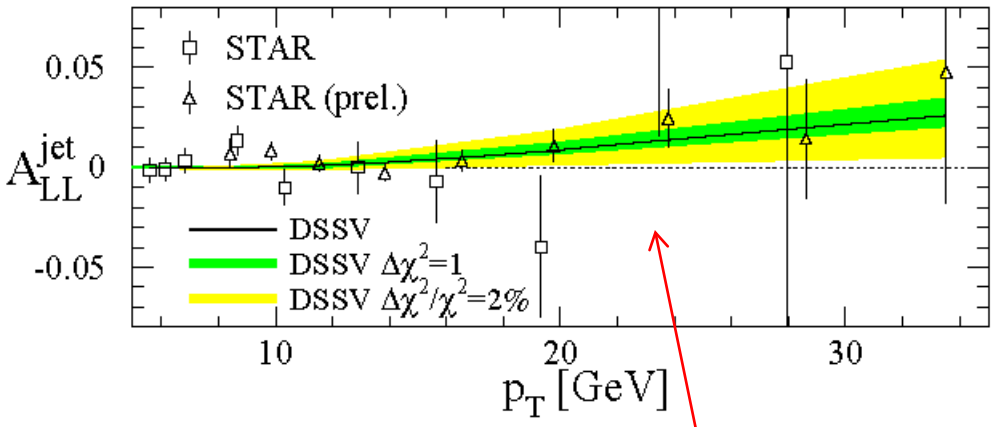


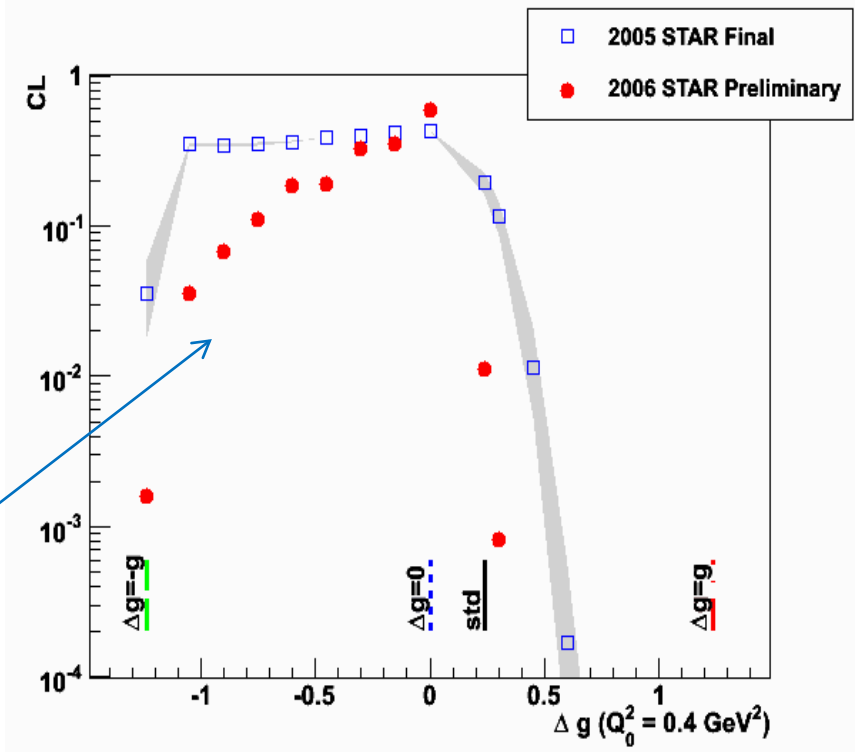
Individual particles or the jets can be detected

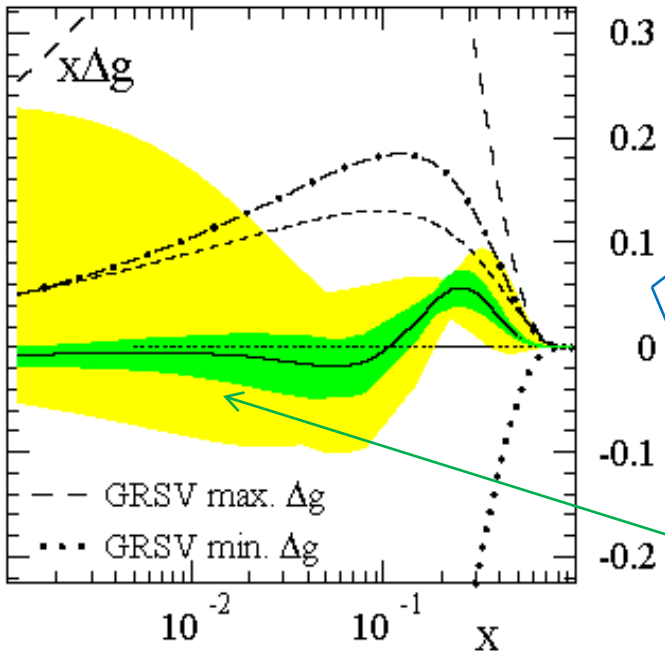
The large solid angle of STAR favors jets

Constraints on ΔG

$$S_z = \tfrac{1}{2} = \tfrac{1}{2}\Delta\Sigma + \Delta G + L_z^g + L_z^q$$







- Work horse of STAR ΔG measurement has been inclusive jets
- Good constraints on ΔG for 0.05<x<0.2
- Low x behavior and shape still poorly constrained

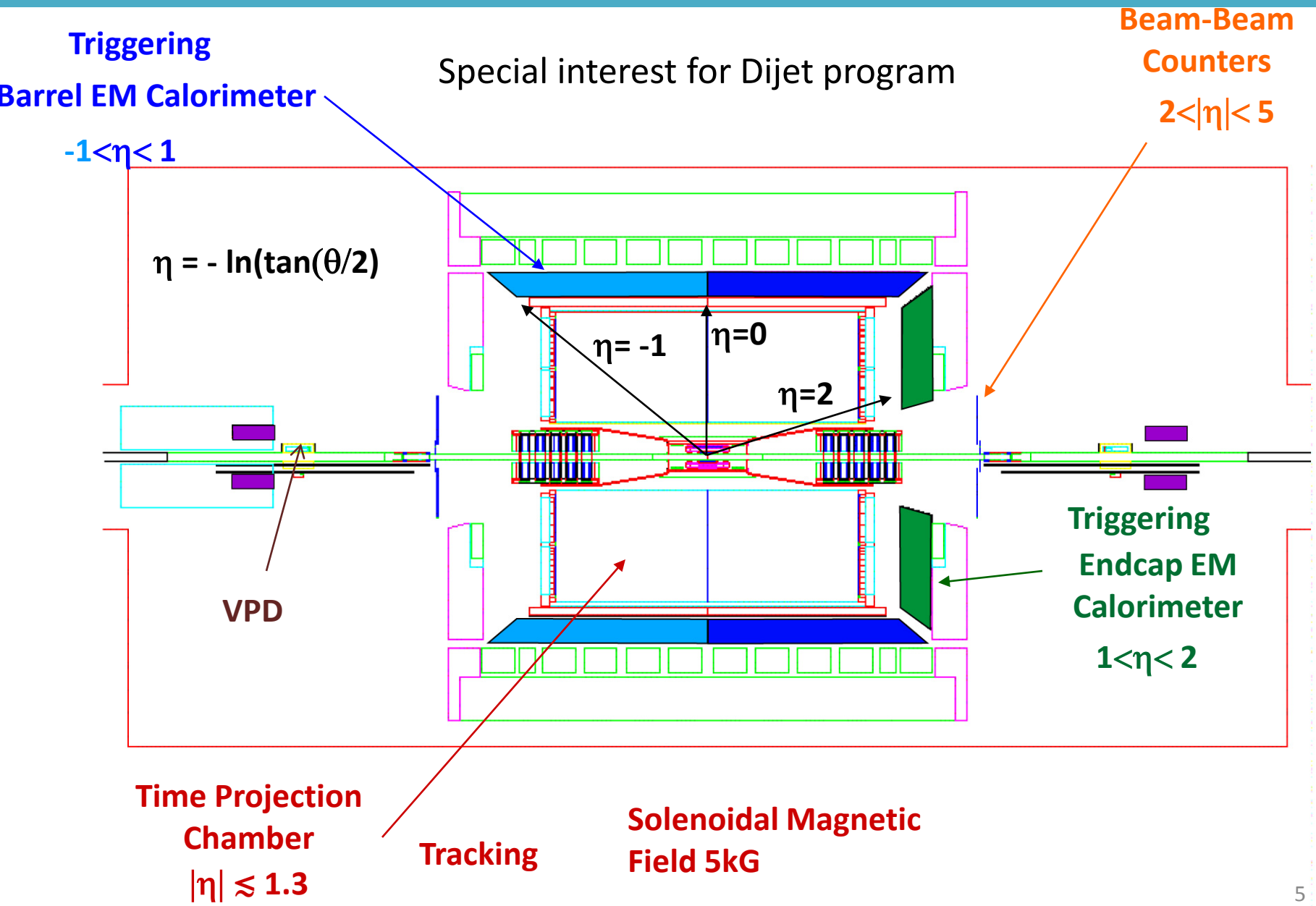
Forward Dijet Advantages

- Dijet kinematics allow access to partonic x at leading order

- Partonic x sensitivity will provide constraints on the shape of Δg as a function of x

- Selection of favorable kinematics will allow access to lower x values

STAR Detector



Dijet Kinematics By Region

$$x_1 = \frac{p_T}{\sqrt{s}}\left(e^{\eta_3} + e^{\eta_4}\right)$$

$$x_2 = \frac{p_T}{\sqrt{s}}\left(e^{-\eta_3} + e^{-\eta_4}\right)$$

$$M = \sqrt{x_1 x_2 s}$$

$$y = \frac{1}{2}\ln\frac{x_1}{x_2} = \frac{\eta_3+\eta_4}{2}$$

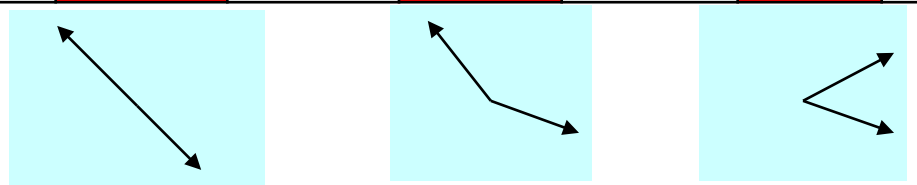
$$|\cos\theta^*| = \tanh\frac{|\eta_3-\eta_4|}{2}$$

x_1/x_2

$\cos\vartheta^*$ $\hat{a}_{LL}$

Select valence q uark

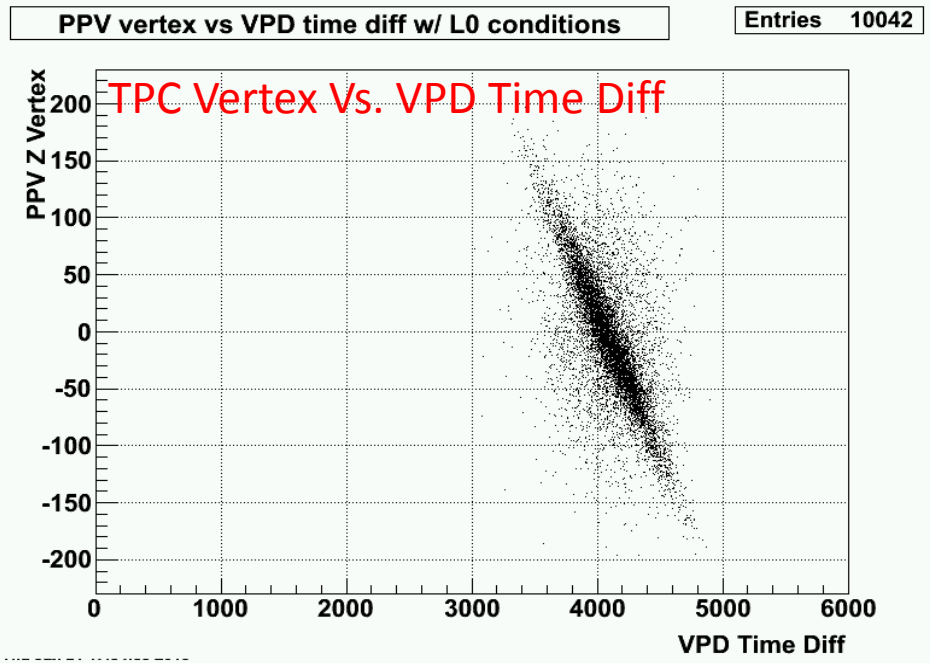
	Symmetric Barrel	Asymmetric Barrel	Endcap-East Barrel	Endcap-West Barrel	Endcap-Endcap	FMS- endcap
$\lvert\eta_3+\eta_4\rvert$	0	1	1	2	3	4.8
$\lvert\eta_3-\eta_4\rvert$	1	0	2	1	0	1.8
$p_T(x_{max}=0.2)$ GeV	17	12	8	7	4	2
x_{min}	0.17-0.06	0.10-0.05	0.10-0.05	0.05-0.02	0.01	.004-.002



How to Proceed

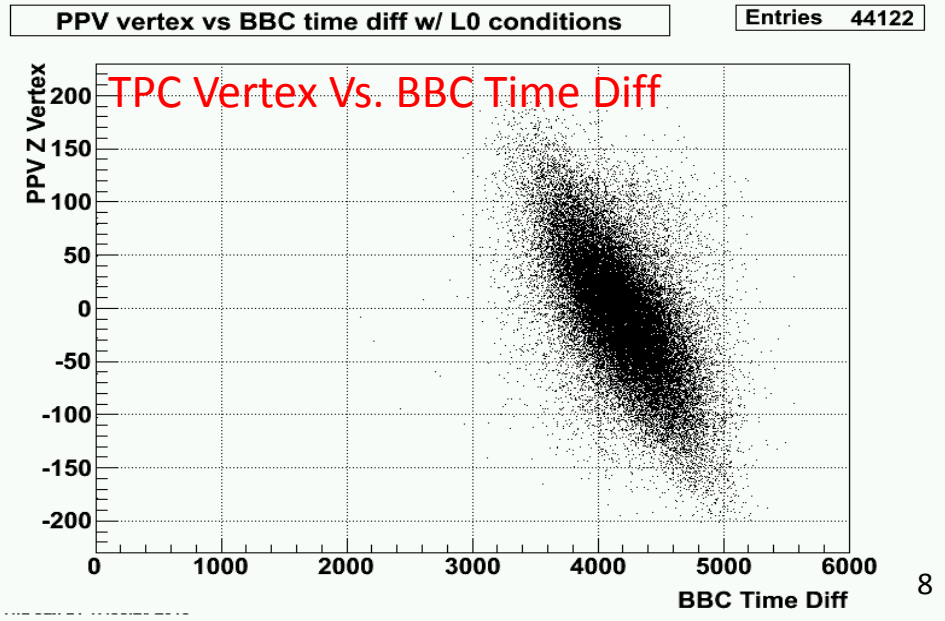
- Favorable kinematics at high pseudorapidity (η>1.3)
  - TPC tracking falls off at high pseudorapidity
  - Forced to use only neutral component of jet
  - Thrust axis still well determined
  - Good $\eta_3+\eta_4$ gives x_1/x_2
- Explore these issues using Trigger Data Files (no TPC)
  - Contains jets found in calorimeters by online jet finder
  - No tracking information: good jet angles but poor P_T
  - Large data set
- Need vertex position to correct particle E_T and pseudorapidity
  - Use VPD and BBC to get vertex

Vertex Finding using VPD and BBC

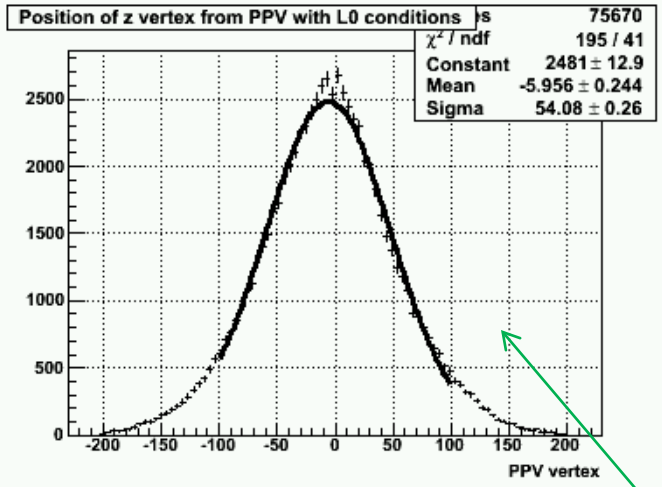


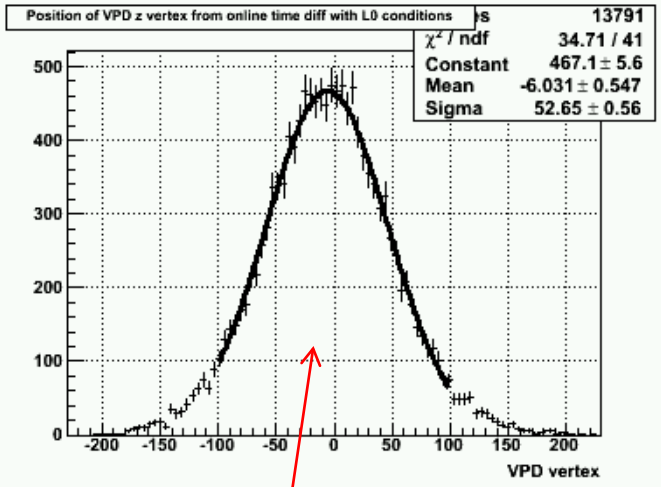
- VPD and BBC detectors located around beam line on both sides of STAR magnet
- Time difference between first hit on each side will give Z vertex of event

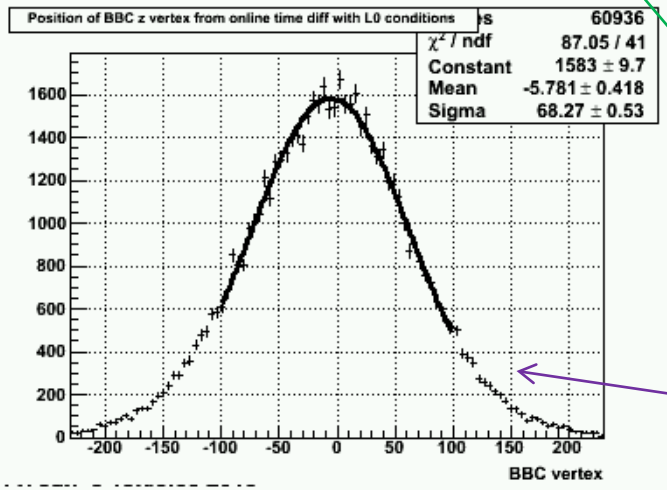
- Use fast offline data files because they have tracking information
- Plot vertex obtained from tracking Vs. VPD/BBC time difference
- Can use linear fit to find Z vertex from time difference information



Corrected Vertex Distributions





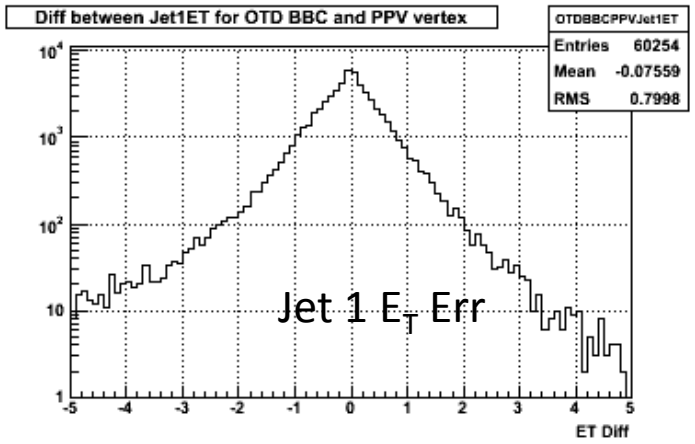


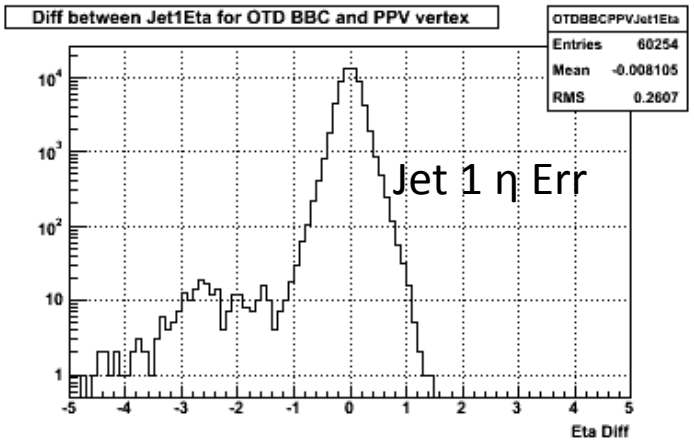
Armed with fits found above, can rerun and compare TPC vertex with VPD / BBC vertex

- VPD Vertex Distribution
- TPC Vertex Distribution
- BBC Vertex Distribution

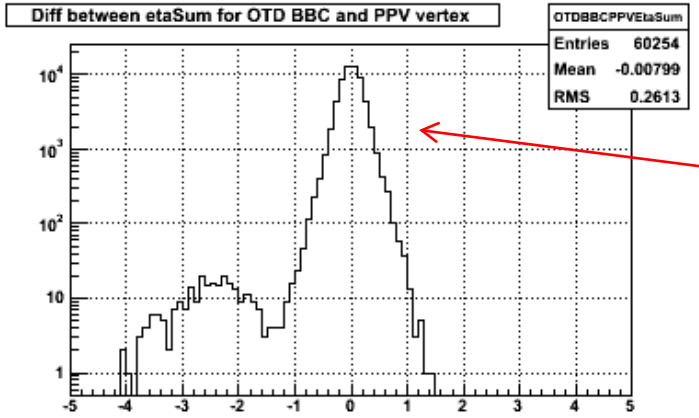
TPC and BBC Vertex Difference

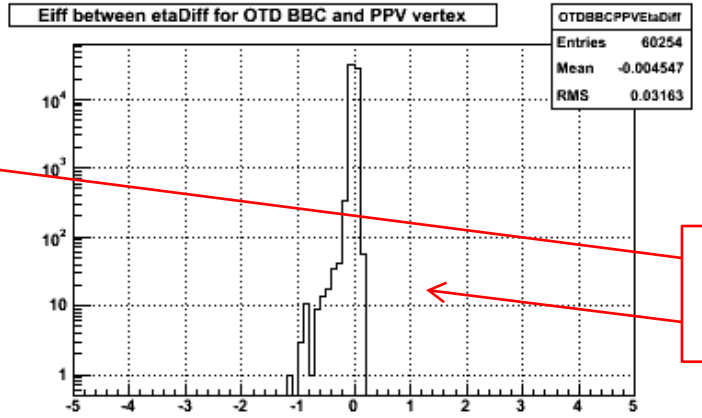
- The previous slide shows that we reproduce the vertex distribution well using BBC and VPD
- How well do we reproduce kinematic variables using BBC and VPD?
- Plots show event-by-event difference in kinematic variables when using BBC Vs. TPC vertex





See good agreement between kinematic variables using BBC Vs. TPC vertex



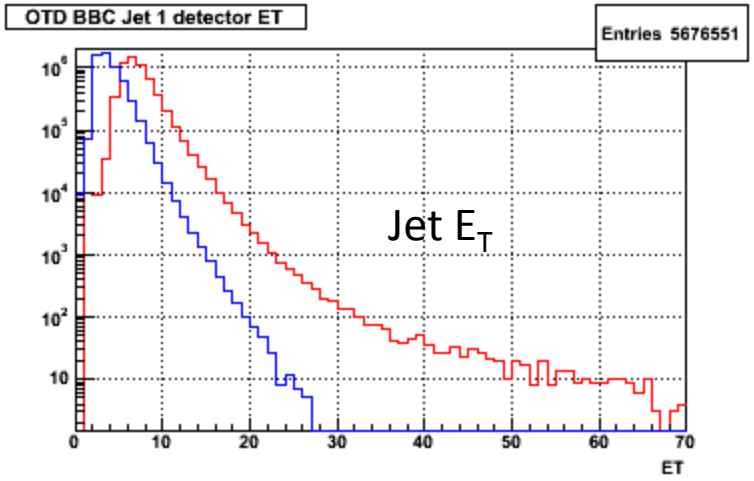


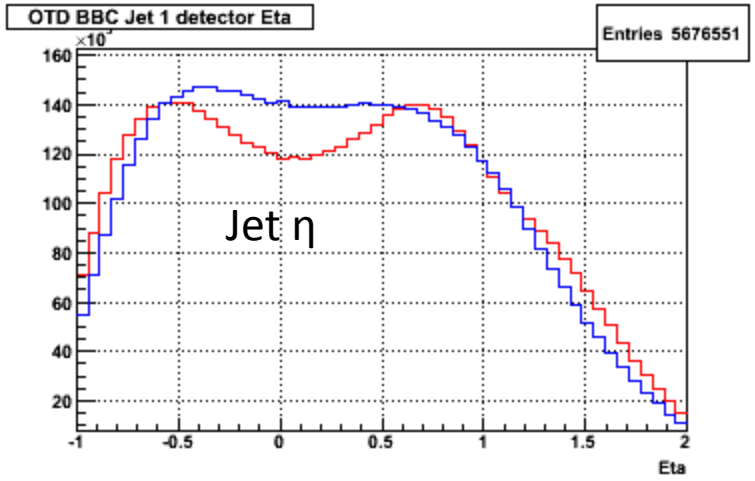
$0.5*(\eta_3 + \eta_4)$ Err

$0.5*|\eta_3 - \eta_4|$ Err

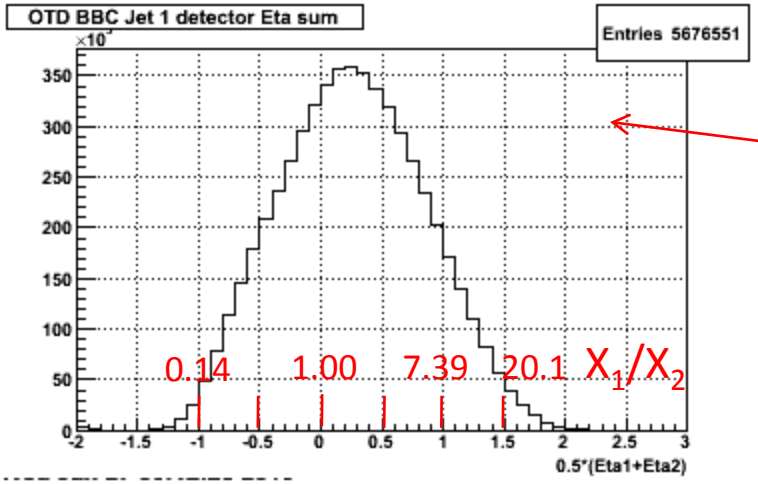
Yields after BBC Vertex Correction

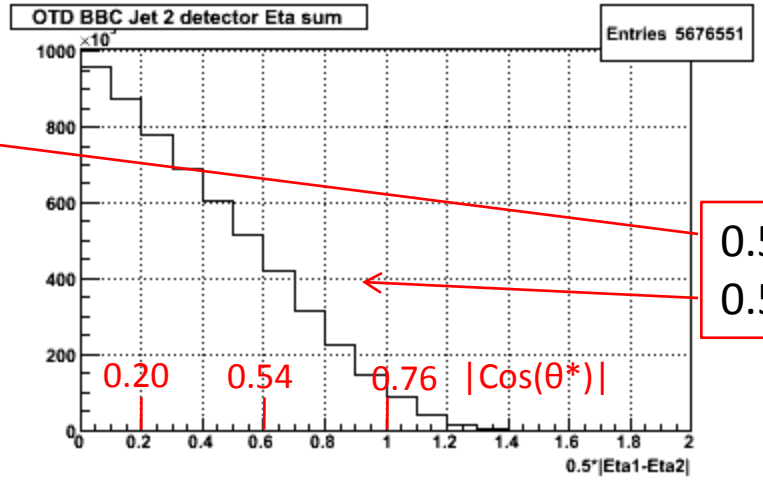
- Spectra of kinematic variables after BBC vertex correction applied
- $0.5*(\eta_3 + \eta_4)$ corresponds to $0.5*\mathrm{Log}(x_1/x_2)$
- $0.5*|\eta_3 - \eta_4|$ corresponds to $|\mathrm{Cos}(\theta^*)|$





High E_T Jet
Low E_T Jet





$0.5*(\eta_3 + \eta_4)$
$0.5*|\eta_3 - \eta_4|$

Summary

- Dijet measurements allow selection of favorable kinematics and sensitivity to x dependence with forward jets giving access to low x values
- Vertex finding using VPD and BBC time difference seems to be viable
- A first look at dijets in the endcap has been made using Trigger Data
- Production of 2009 data is ongoing
- Simulation studies needed to fully understand jet properties without tracking
- Ultimate goal is the extraction of spin asymmetries