Forward Vertex Detector

- full azimuthal coverage, $1.2 < |y| < 2.4$
- 4 stations in each arm placed between collision point and hadron absorbers (no magnetic field)
- 96 $\phi$ columns of strips with $\Delta r$ segmentation of 75 $\mu$m
- more details in Matt Durham’s poster

measure precise distance of the closest approach projected onto $\mu$ pt (DCA$_{ll}$)

- discrimination btw.
  - $a^+ / K^- = \mu$
  - $D / B = \mu$
- prompt muon identification for
  - $W \rightarrow \mu^+ + \nu$
  - Drell-Yan
- high isolation also determination of
  - centrality
  - reaction plane

Data acquired in 2012 engineering Run and physics tasks

- 510 GeV $p+p$ events: 3.3 billion events
- alignment studies
- remove hadronic background in W analysis
- heavy flavor, quarkonia and Drell-Yan
- 200 GeV U+U: few million events
- high occupancy studies
- centrality, reaction plane determination
- 200 GeV Cu+Au: 9 billion events
- heavy flavor, quarkonia and Drell-Yan $R_C$ in Cu-going and Au-going direction
- azimuthal anisotropy using FVTX reaction plane determination
- cosmic data and field-off run
- high level alignment studies

Improvement in di-muon mass resolution

- di-muon mass distribution in $J/\psi$ region from 510 GeV $p+p$ in north arm
  (1.2 $< y < 2.2$) data sample

- $\Delta$-muon opening angle measured by FVTX is not affected by multiple scattering in hadron absorber

Measuring DCA$_{ll}$ resolution with $J/\psi$ di-muon decays

all di-muon decays from $J/\psi$ should have DCA = 0 $\pm$ detector resolution

Real data 510 GeV $p+p$

Mean: -0.2 $\pm$ 1.3 $\mu$m
Sigma: 26.6 $\pm$ 0.1 $\mu$m

Simulated $D \rightarrow \mu + X$

DCA$_{ll}$ resolution of $\sim 21 \mu$m in agreement with simulation

$\sqrt{s}$=510 GeV $p+p$, $1.2 < |y| < 2.2$

like-sign subtracted distributions

all di-muons matching FVTX

$DCA_{ll}$ < 50 $\mu$m

$DCA_{ll} > 1$ mm

Primary Vertex Determination

U+U event

- primary vertex defined as the point where more tracks share the same crossing (withing DCA resolution)
- method under development

Strategy to count $D$ and $B$ meson decays from single $\mu$ DCA$_{ll}$ distribution

$\frac{J/\psi}{D}$

Components to be fit to total DCA$_{ll}$ distribution

Background = hadrons

$D$ and $B$ from a first guess $p_t$ distribution in

Iterate until converge

Selecting di-muon sources with dimuon DCA$_{ll}$ measurement

$\sqrt{s}$=510 GeV $p+p$, $1.2 < |y| < 2.2$

all di-muons matching FVTX

$DCA_{ll}$<50 $\mu$m: muon pair come from same vertex (resonances, Drell-Yan)

$DCA_{ll}$>1 mm: dominated by correlated muon pairs with two vertices (c\bar{c}, b\bar{b}, jets)

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