Run 13 W->e Spin Asymmetry and Cross Section Measurement

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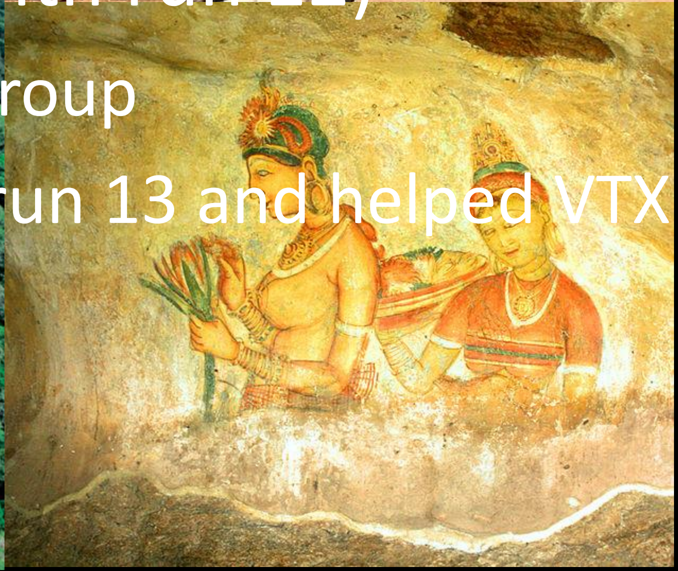
A little about my self…..

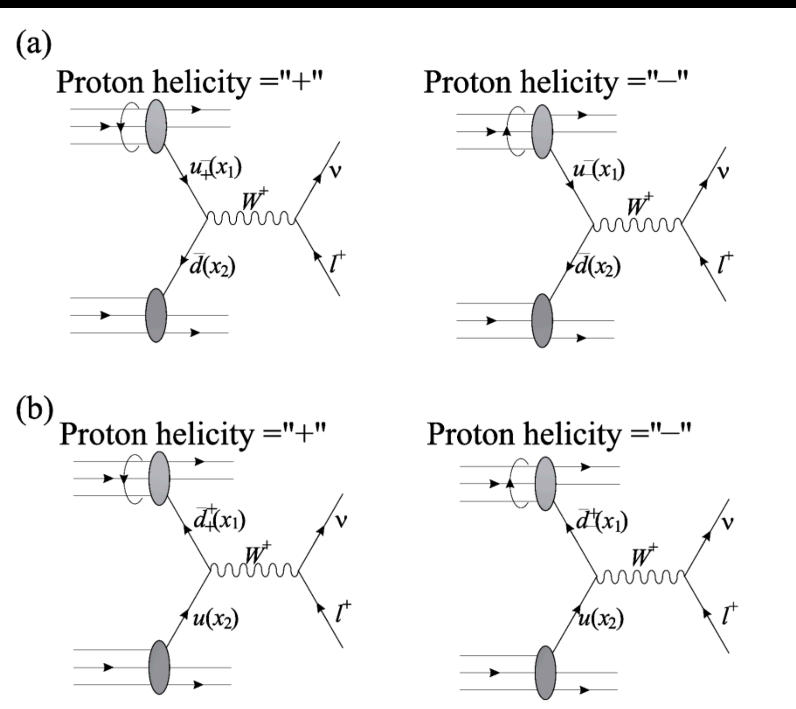
- From Sri Lanka
- Undergraduate studies at University of Peradeniya.
  - Investigated fractal formation in solid state batteries and how to increase battery life
- Joined PHENIX in 2011(started with run 12)
  - Working with the Central arm W group
  - Served as Vernier Scan expert for run 13 and helped VTX calibrations in run 12



Spin Asymmetry

$$\langle S_p \rangle = \frac{1}{2} = \frac{1}{2}\Delta\Sigma + \Delta G + L$$

Spin asymmetry gives access to polarized sea quark distributions



$$A_L^{W^+} = \frac{u_+^-(x_1)\bar{d}(x_2) - u_-^-(x_1)\bar{d}(x_2)}{u_+^-(x_1)\bar{d}(x_2) + u_-^-(x_1)\bar{d}(x_2)} = -\frac{\Delta u(x_1)}{u(x_1)}$$

$$A_L^{W^+} = \frac{\bar{d}_+^+(x_1)u(x_2) - \bar{d}_-^+(x_1)u(x_2)}{\bar{d}_+^+(x_1)u(x_2) + \bar{d}_-^+(x_1)u(x_2)} = \frac{\Delta\bar{d}(x_1)}{\bar{d}(x_1)}$$

$$A_L^{W^+} = -\frac{\Delta u(x_1)\bar{d}(x_2) - \Delta\bar{d}(x_1)u(x_2)}{u(x_1)\bar{d}(x_2) + \bar{d}(x_1)u(x_2)}$$

W measurement

In central arm

$$W^{\pm} \longrightarrow e^{\pm} + \nu$$

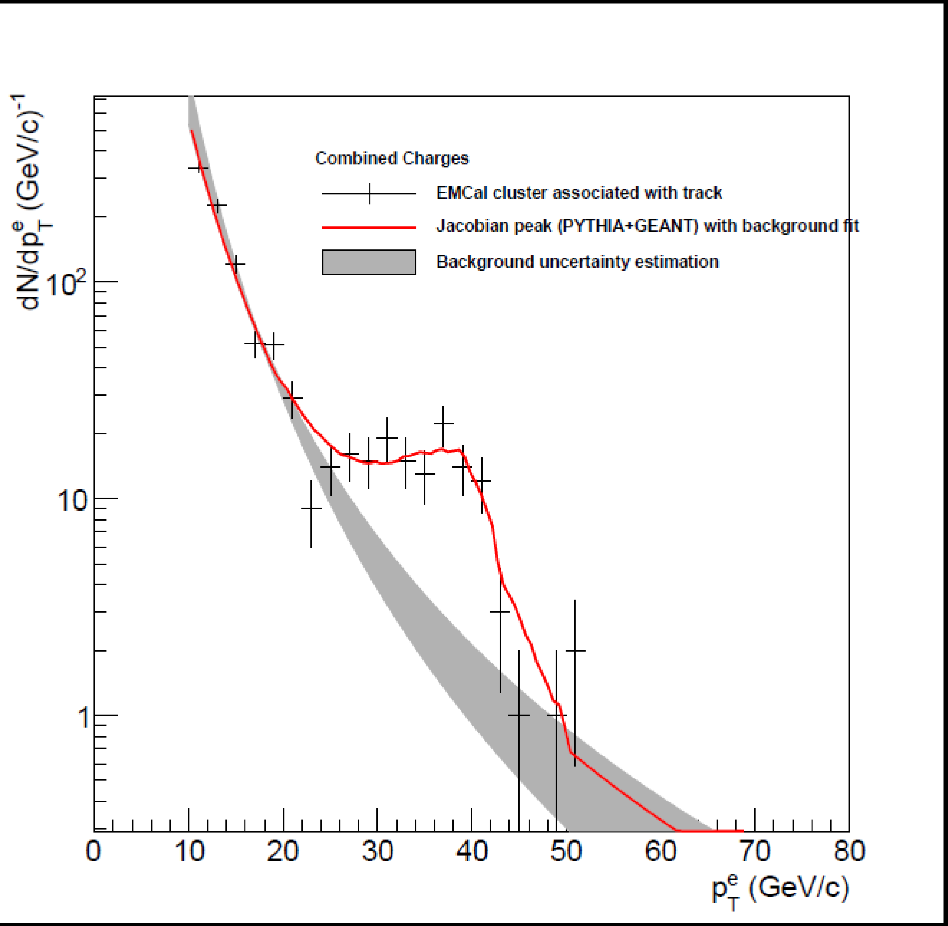
$$A_L^W \equiv \frac{\sigma_+ - \sigma_-}{\sigma_+ + \sigma_-} = \frac{1}{P} \frac{N^+(\ell)/\mathcal{L}^+ - N^-(\ell)/\mathcal{L}^-}{N^+(\ell)/\mathcal{L}^+ + N^-(\ell)/\mathcal{L}^-}$$

Background

- cosmic rays
- photon conversions Υ -> e^+e^- (specially at VTX)
- $W \rightarrow \tau \rightarrow \mathrm{e}$
- $Z \rightarrow e^+ + e^-$

Basic cuts used

- reco z vertex < ±30 cm
- events near DC anode wires removed
- events with tracks with small α removed
- relative isolation cut

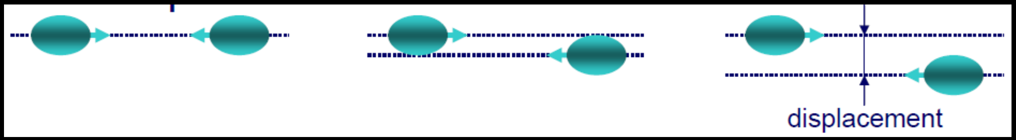


- signal region 30-50 Gev
- Jacobian peak ~ $\frac{1}{2} M_W$
- Back ground estimation using power law fit

prepared by Ciprian

Cross section measurement

- Use Vernier scans to calculate σ_{BBC} and $L_{machine}$ (run 12 & 13)



- Measure BBC rate by displacing one beam w.r.t. to the other, in both horizontal & vertical
- Plot BBC rate vs displacement (bpm)
- Fit with gaussian and obtain σ_H, σ_V and peak rate

$$L_{\text{machine}} = \frac{f_{\text{beam}}}{2\pi\sigma_H^v\sigma_V^v} \cdot N_{\text{blue}} \cdot N_{\text{yellow}}$$

$$\sigma_{\text{BBC}} = \frac{R_{\text{max}}}{L_{\text{machine}} \cdot \varepsilon_{\text{vertex}}}$$

Improvement of results

- Corrected for beam intensity loss, BBC efficiency and multiple collision effect
- Use simulation to correct for crossing angle and hour glass effect