Minimum Bias Event Shapes

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Tuesday 23rd February, 2021

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1 Event Shape Observables

In order to investigate Minimum Bias events using observables, which describe distribution tracks from charged particles in the event one has several possibilities.

1.1 Transverse Thrust

Let's start with the observable called Transverse Thrust, which is defined as

$$T_T = \max_{\vec{n}_T} \frac{\sum_i \vec{p}_{T,i} \cdot \vec{n}_T}{\sum_i p_{T,i}}, \tag{1}$$

where $\vec{p}_T = (p_x, p_y)$ is the momentum transverse to the beam and $\vec{n}_T = (n_x, n_y)$ is the transverse vector that maximizes the sum.

1.2 Transverse Spherocity

Another related observable is Transverse Spherocity defined as

$$S_T = \frac{\pi^2}{4} \min_{\vec{n}_T} \left(\frac{\sum_i |\vec{p}_{T,i} \times \vec{n}_T|}{\sum_i p_{T,i}} \right)^2, \tag{2}$$

where $\vec{p}_T = (p_x, p_y, 0)$ is the momentum transverse to the beam and $\vec{n}_T = (n_x, n_y, 0)$ is the transverse vector that minimizes the sum

2 Finding Thrust Axis

In case of transverse observables, the task to find unit vector which maximizes the sum can be reduced to just one dimensional problem:

- Lets define $\vec{n}_T = (\cos\phi, \sin\phi)$ or $\vec{n}_T = (\cos\phi, \sin\phi, 0)$
- ϕ is angle from x-axis

- T_T and S_T are now dependent only on angle ϕ
- $\vec{n}_T$ in both cases found using 1D minimization method

Appendices

A Mean p_T

$$\langle p_T \rangle = \frac{1}{N_{sel}} \sum_{i}^{N_{sel}} p_{T,i} \tag{3}$$

Info

Compiled: Tuesday 23rd February, 2021 11:18