Statistical Data Analysis, Assignment 1

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Abstract

In this (very) short paper we will present some basic findings regarding the statistical properties of dimuon collisions using an undisclosed dataset. specifically we look at the odds of either one or both of the muon's transverse momenta to be greater than 1 TeV and show the distribution of the sum of their transverse momenta, as well as the their momenta plotted against each other and the invariant mass of the system. The latter shows a possibly interesting signal aroun 2 TeV for whose research we hope to receive a lot of grant money.

1 Introduction

In this report we detail our study of dimoun collisions between μ_1 and μ_2 using (py)ROOT.

2 Momenta sum

For this section we computed and graphed the sum of the transverse momenta P_{T1} and P_{T2} of μ_1 and μ_2. Our results are shown in figure 1

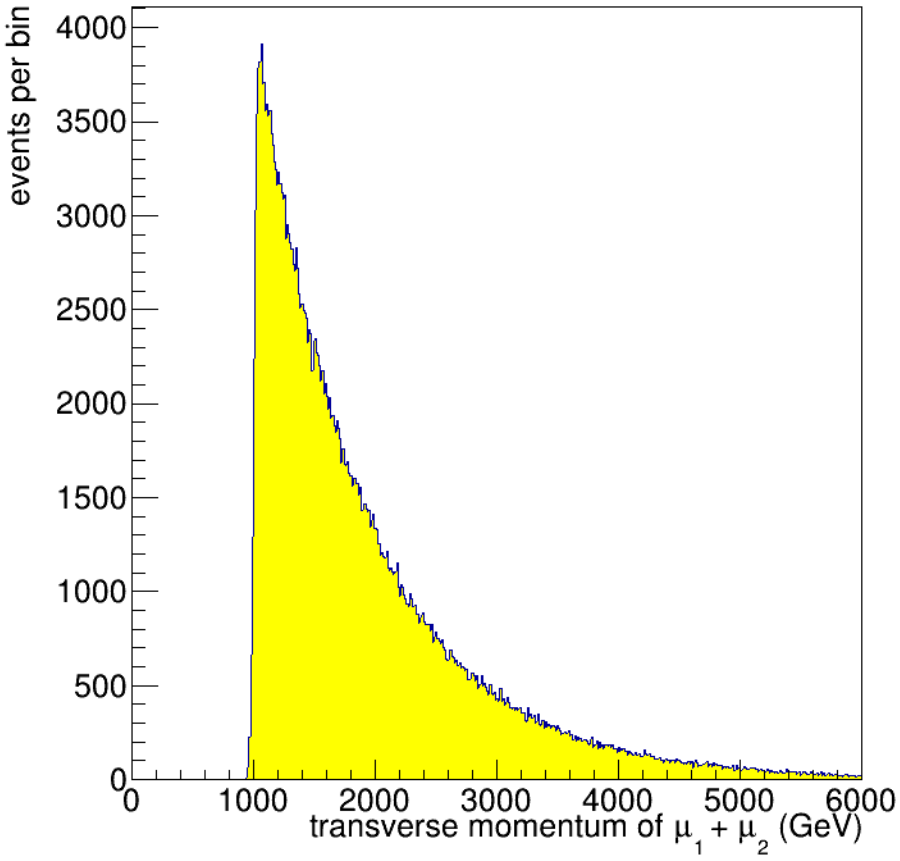

Figure 1: Distribution of $P_{T1} + P_{T2}$ in GeV.

3 Probablities

We computed several probabilities relating to the transverse momentum of μ_1 and μ_2, those results are shown in table 1. The standard deviation σ was calculated assuming a binomial distribution and applying the formula

$$\sigma = \sqrt{\frac{p(1-p)}{n}}$$

Where p is our probablity and n is the number of events used.

P($P_{T1} > 1$ TeV)	0.3390 ± 0.0009
P($P_{T2} > 1$ TeV)	0.3392 ± 0.0009
P($P_{T1} > 1$ TeV or $P_{T2} > 1$ TeV)	0.3686 ± 0.0009
P($P_{T1} > 1$ TeV or $P_{T2} > 1$ TeV)	0.3095 ± 0.0008
P($P_{T1} > 1$ TeV) + P($P_{T2} > 1$ TeV) - P($P_{T1} > 1$ TeV or $P_{T2} > 1$ TeV)	0.3095 ± 0.0008

Table 1: Probablities of the dimoun distribution. Note that the last two expressions are mathematically equivalent.

4 P_{T1} vs. P_{T2}

In figure 2 we present the figure of P_{T1} vs P_{T2}, note that the graph a colour scheme that is actually readable. This is due to the use of ROOT6 instead of ROOT5 which finally introduces a sane default colour scheme.

5 Invariant Mass

In figure 3 we present the figure of the invariant mass of μ_1 and μ_2. One can see a (possibly) interesting bump around 2.2 TeV. However, it is too soon to be able to say whether or not this is a statiticall significant deviation.

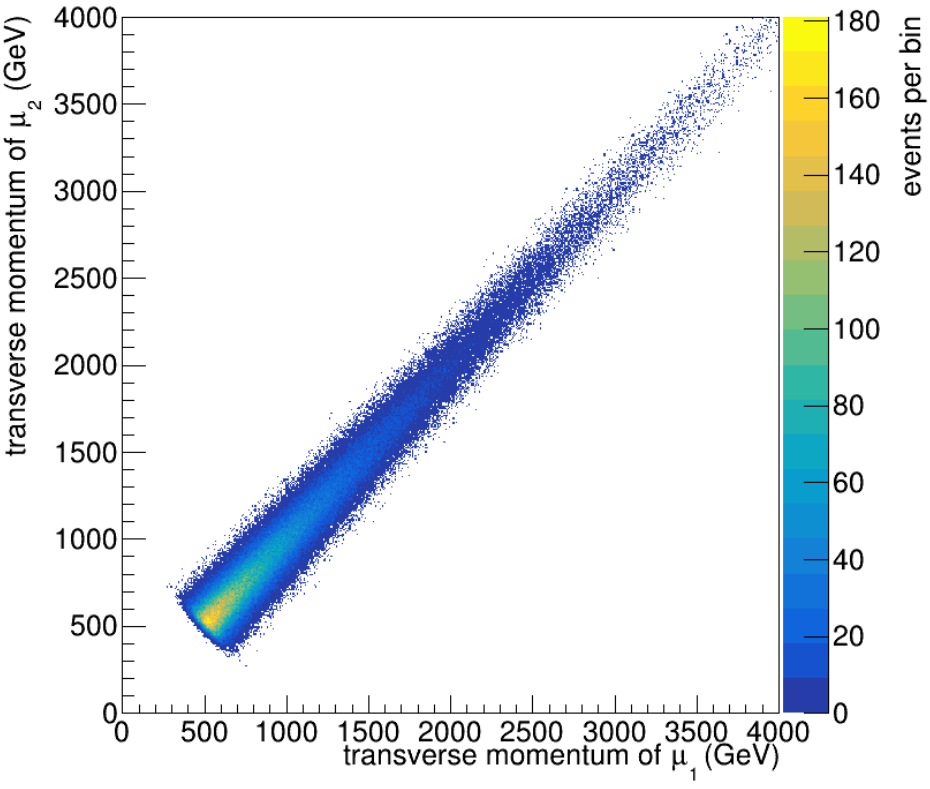

Figure 2: Distribution of P_{T1} against P_{T2}.

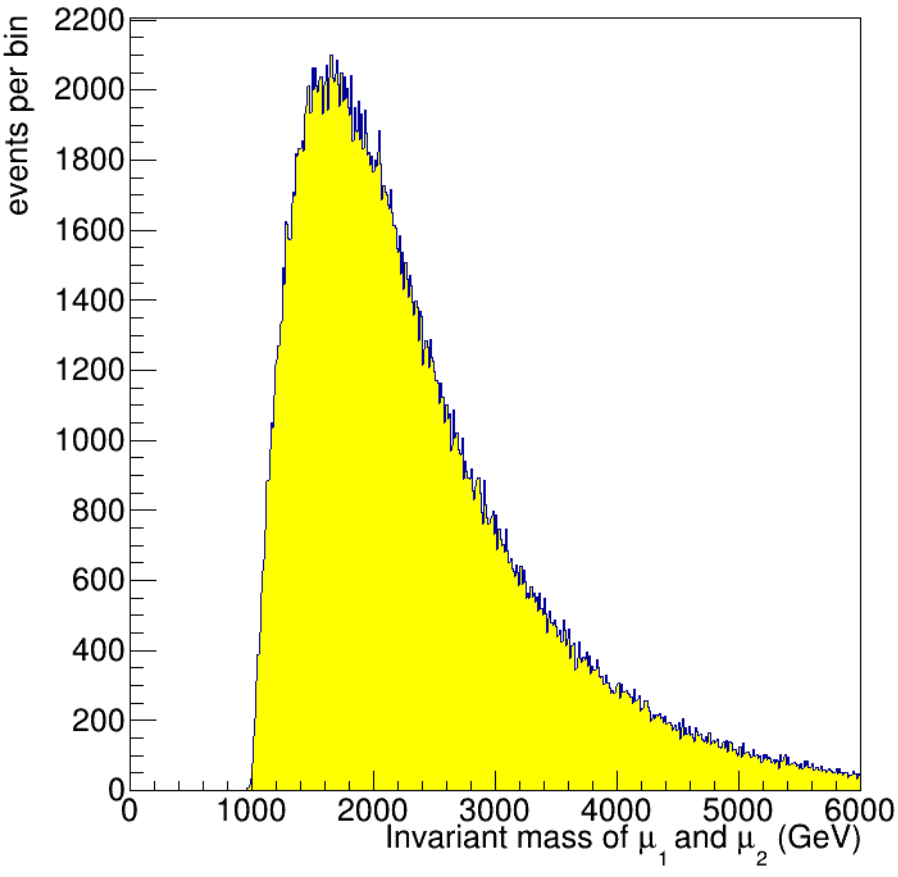

Figure 3: Distribution of the invariant mass off μ_1 and μ_2