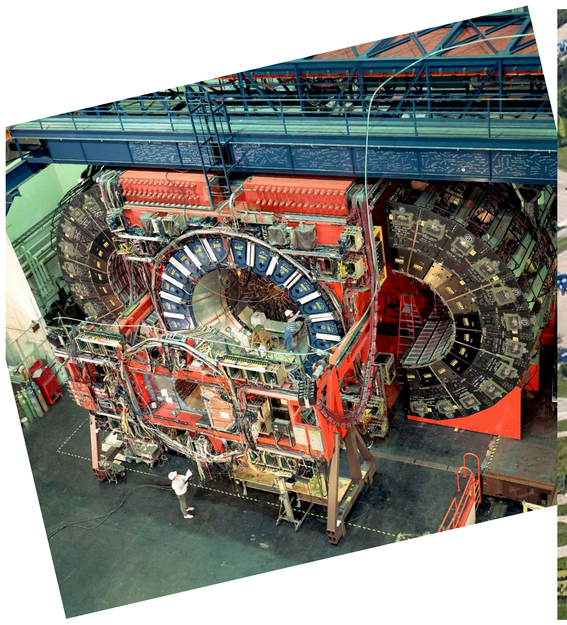
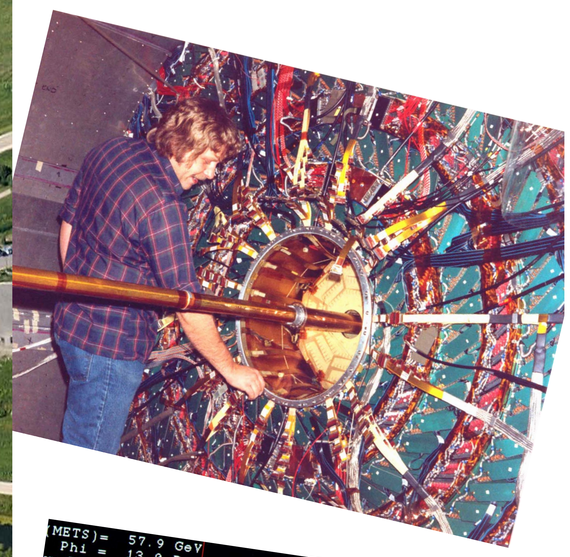
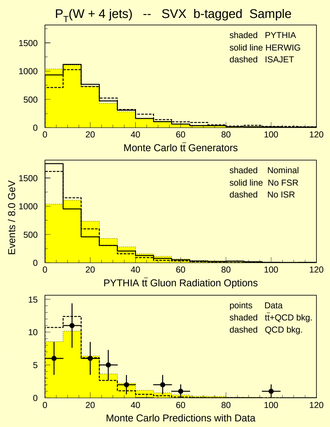


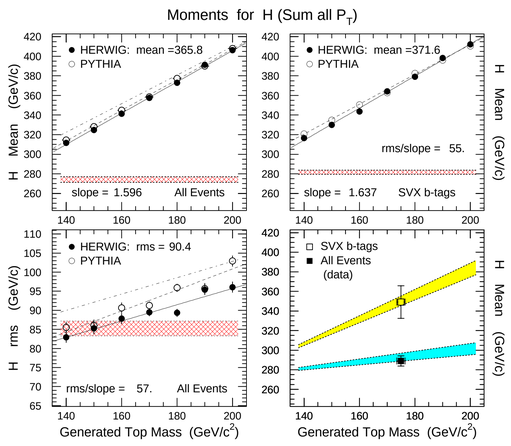
CDF Run I: Top Kinematics

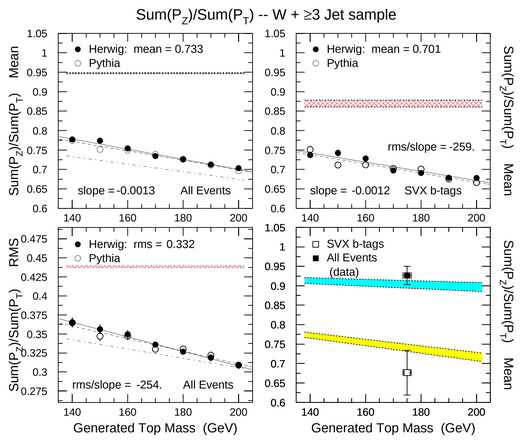


Using the first two moments of a kinematic variable can simplify an analysis. Moments give a measure of a variable's discriminating power against QCD background and a variable's sensitivity to the value of top mass.

Gluon radiation can be studied by looking at kinematic variables. Unfortunately there was not enough data in Run I to constrain the models. The plots at the right show the comparison of data and Monte Carlo for one variable. Other variables with sensitivity are the ratio of energies in different size jet cones or the distance between jets.



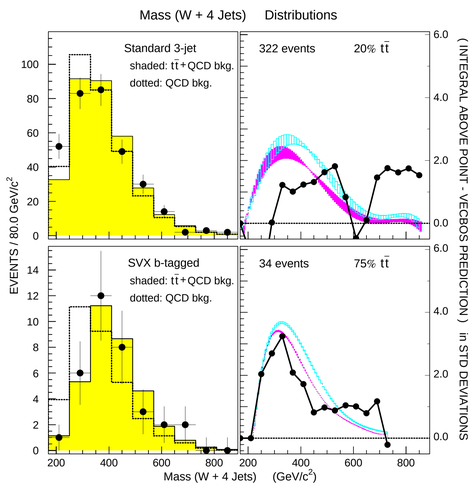


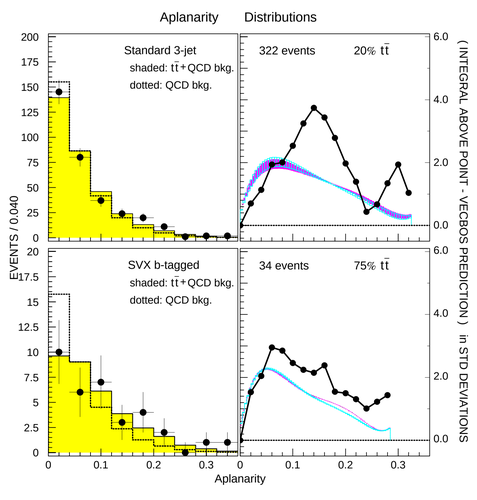


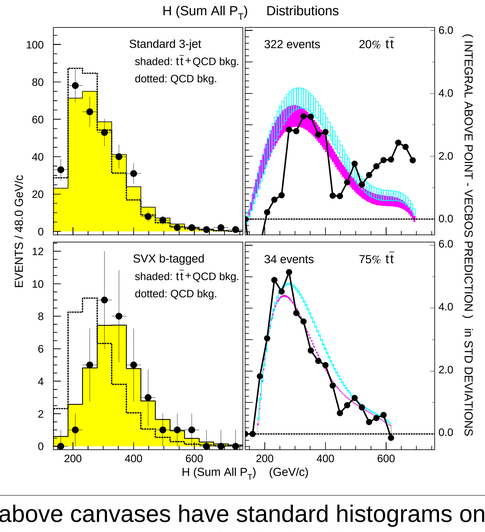
Above is an overview of the mean and rms of H (Sum all Pt) for simulated Monte Carlo events as a function of top mass. The dashed lines are a fit to Isajet results. VECBOS background predictions are the red bands. The two plots on the left are for pre-tagged events, the data is shown in the lower right. H is a good discriminant against background and very sensitive to the value of top mass.

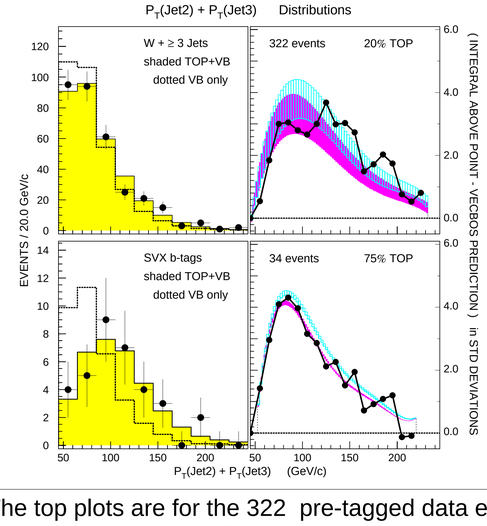
Above is an overview of the mean and rms of Sum(|Pz|)/Sum(Pt) for simulated Monte Carlo events. Top events have more transverse energy and thus a smaller value for this variable. Small magnitudes of rms/slope mean more sensitivity to top mass. This variable is not as sensitive to top mass nor as good a discriminant as H. Again the data means are shown relative to the Herwig+VECBOS predictions at the lower right.

Comparing distributions of variables



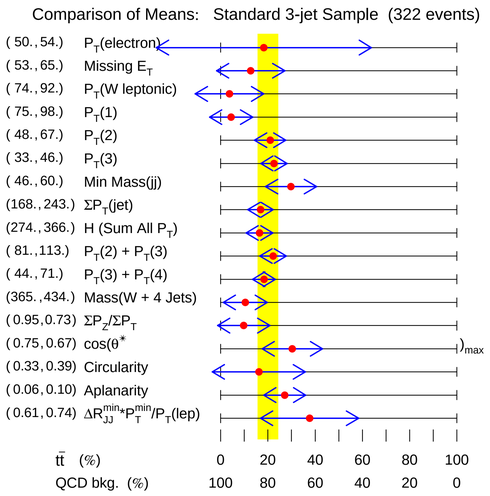


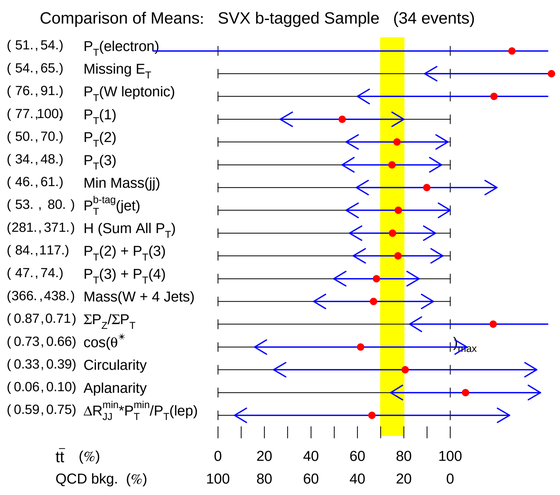




The above canvases have standard histograms on the left. The top plots are for the 322 pre-tagged data events and the bottom plots are for the 34 SVX tagged events. The dotted line is VECBOS only and the yellow histogram is the expected mix of VECBOS + Herwig (175). The integral significance plots on the right show the number of sigma that the integral of the data above a given point is from the VECBOS only prediction. The pink shaded band is the Monte Carlo prediction for 175 GeV top and the blue is for 185 GeV top. Mass(W+4Jets) is sensitive to top production mechanisms; aplanarity would have been more useful for a lower mass top; H is a good discriminant and very sensitive to top mass; Pt(Jet2)+Pt(jet3) is a good discriminant that was used in early top searches.

Comparing the means of an ensemble of variables





The data means relative to the predicted Monte Carlo means. On the left is the pre-tagged sample; the yellow band corresponds to 80% VECBOS and 20% Herwig (175 GeV). On the right is the SVX tagged sample; the yellow band corresponds to 25% Vecbos and 75% top. The length of the arrows correspond to the statistical uncertainty in the mean of the data. Remember that there are correlations!