Quark/Gluon Jet Discrimination

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Introduction

Quark and Gluon jets have different hadronization properties, measured also in previous experiments: gluon-jets are wider, with higher multiplicities and more uniform energy fragmentation.

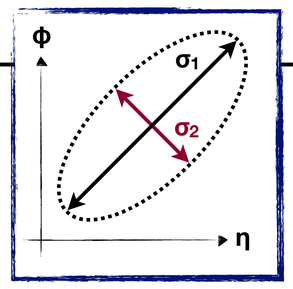
Jet substructure and jet shapes take advantage from the full information provided by the **Particle Flow.**

Variables

A **Likelihood Discriminator** with:

- **Multiplicity variables:** total multiplicity
- **Width variables:** minor axis (in η-ϕ)
- **Energy sharing variables:** $p_T D$

and pdf binned in P_T, η, and pile-up (ρ)

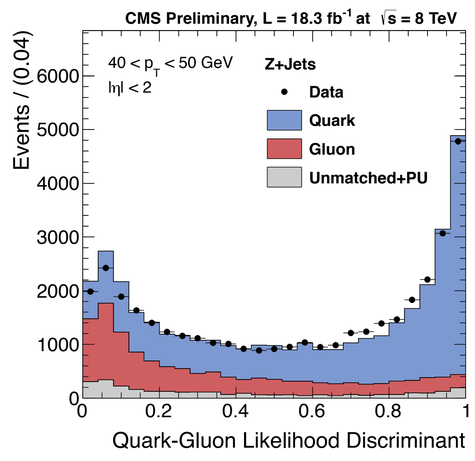


$$p_T D = \frac{\sqrt{\sum_i p_{T,i}^2}}{\sum_i p_{T,i}}$$

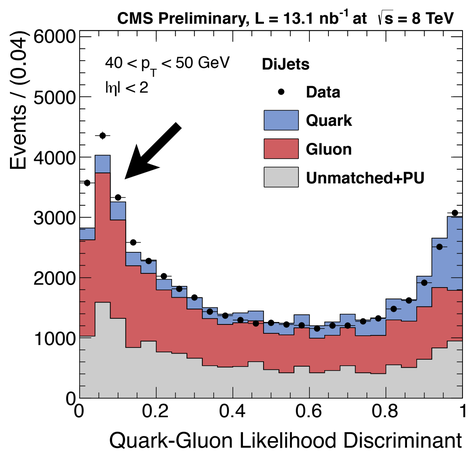
Data

Different MC predictions in low-P_T **dijet** (gluon enriched):

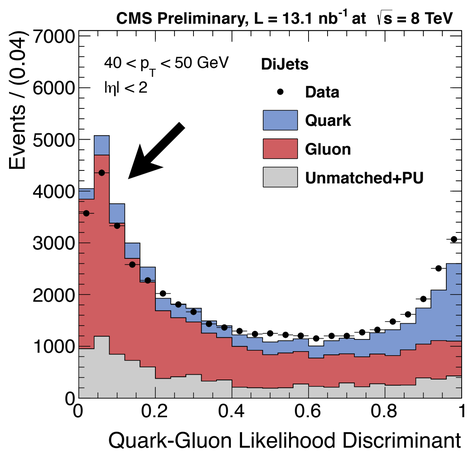
Z+Jets MadGraph+Pythia6
40 < *p*T < 50 GeV, |η| < 2



DiJets Herwig++
40 < *p*T < 50 GeV, |η| < 2



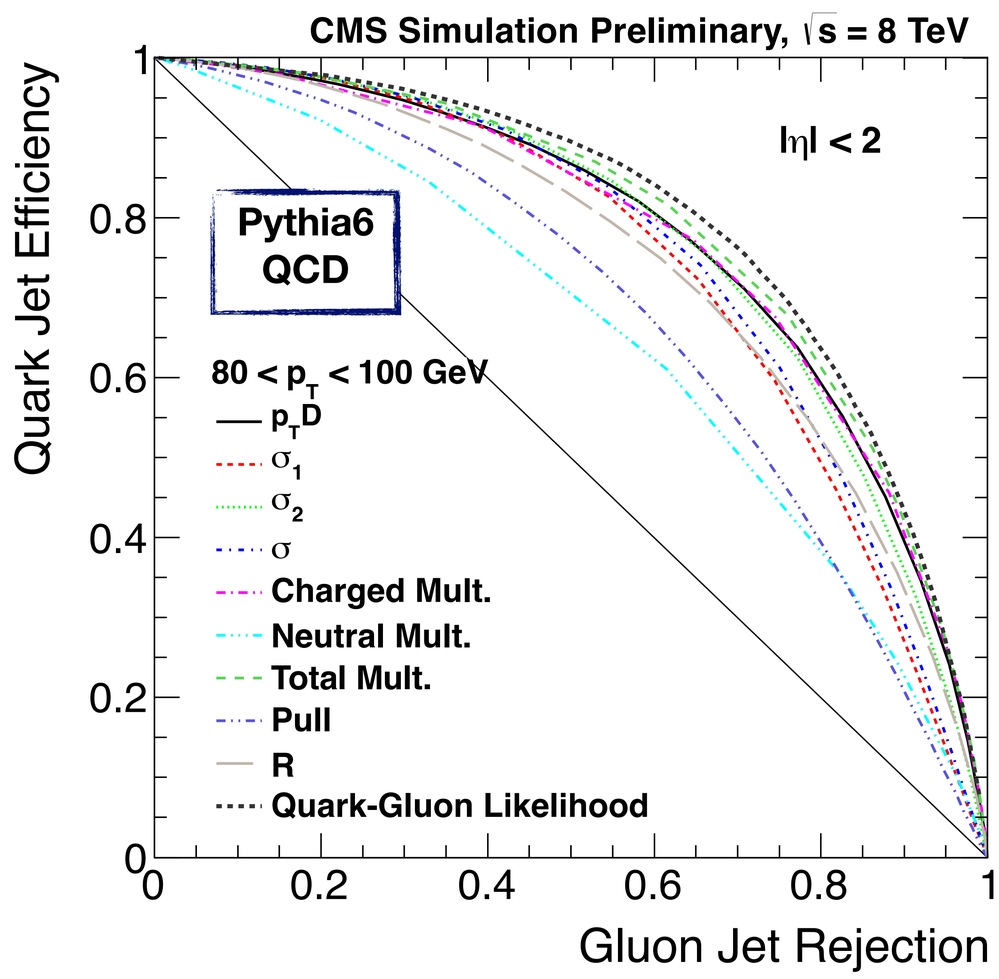
DiJets Pythia6
40 < *p*T < 50 GeV, |η| < 2



MC Performances

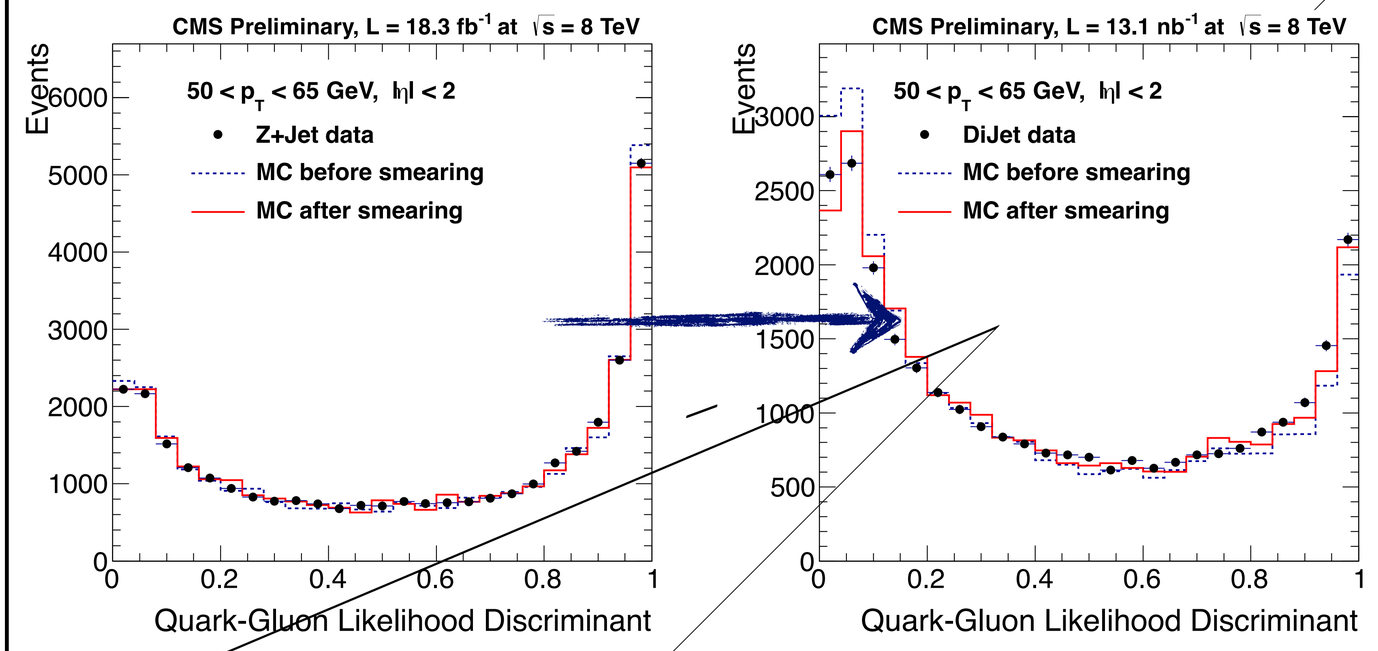
Look at different variables.

How to choose them? Look at RoC curves and correlations.

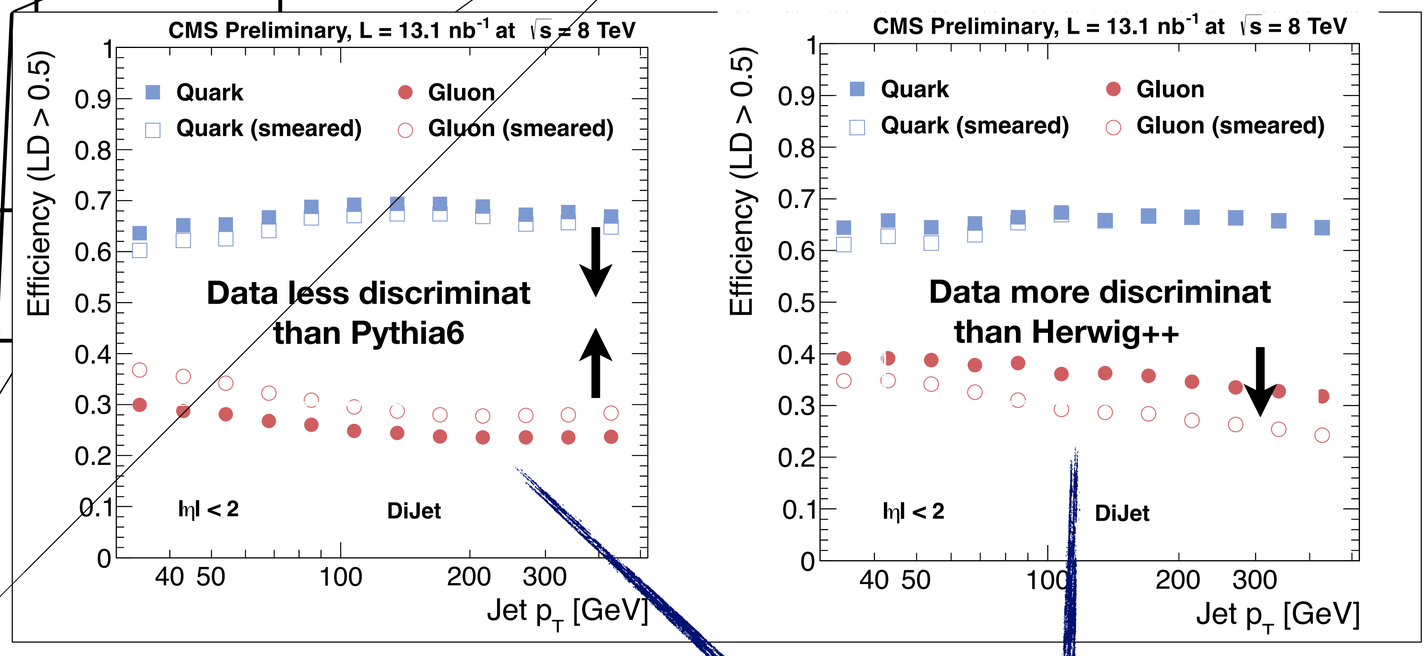


Systematics

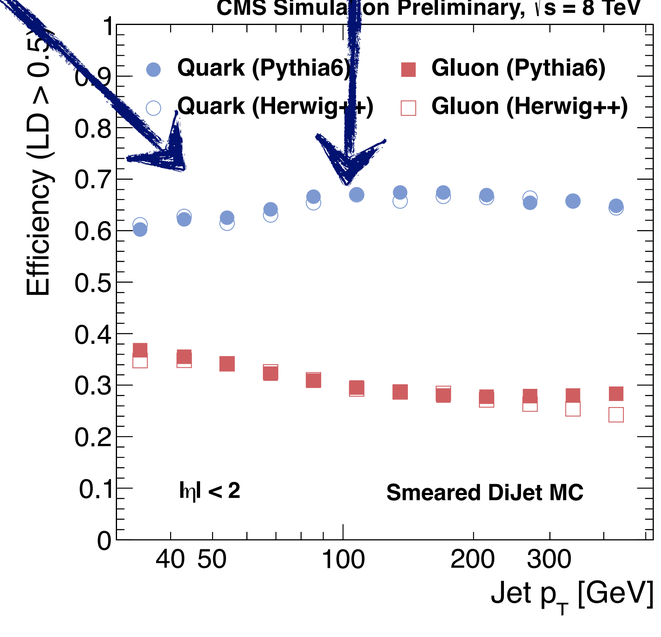
Re-map the value of the tagger output of MC jets to fit the Z+Jets data sample distributions, separately for quark and gluon jets.
Apply the same corrections on the dijet samples: it closes!



Herwig++ and Pythia6 have heir own smearings



... smeared distributions agree



Data: Z+Jets

References

CMS-PAS-JME-13-002
Performance of quark/gluon discrimination using pp collision data at √s = 8 TeV