Distinguishing quark and gluon jets at 13 TeV in the CMS experiment
Posters@LHCC, CERN, Geneva, Switzerland, 22nd February 2017

Giorgia Rauco (UZH), giorgia.rauco@cern.ch
Paolo Azzurri, Christian Contreras Campana, Tom Cornelis, Andrea Carlo Marini, Francesco Pandolfi, John Strologas, Yuta Takahashi, on behalf of the CMS Collaboration

Abstract
At the LHC, many physics analyses study processes characterized by a signal with jets originating from quarks, while the jets in the background are gluon-like. Based on observables sensitive to fundamental differences in the fragmentation properties of gluons and quarks, a likelihood discriminator is built. The performance of the tagger is evaluated on data using 2+jets and dijet events produced in proton-proton collisions at a centre-of-mass energy of 13 TeV recorded in 2015 by the CMS experiment at the LHC. A comparison between the discrimination obtained in Pythia8 and Herwig++ generators is also presented.

theoretical background and motivation
jets from light-flavor quarks → jets from gluons

main differences:
- the particle multiplicity
- the fragmentation function:
- collimation.

the capability of distinguishing between quark and gluon is very important at analysis level: often analyses’ signal final states include quark jets

discriminating variables

building the discriminator

likelihood-discriminator (QGL) built using the variables PDFs from jets in QCD events
- reweighting in 20 bins of $p_T$ and 8 bins of $\eta$ to maximize performances

- training in 13 TeV

- gluon-jet rejection

tagger performances

$0 < \eta < 1.0, 80 < p_T < 100$ GeV
$0 < \eta < 1.3, 40 < p_T < 50$ GeV
$2.7 < \eta < 3.0, 40 < p_T < 50$ GeV

data driven reweighting

to improve the agreement between data and MC, data-driven weights are derived for each QGL bin exploiting the yields in data and MC for the two parton flavor components $Z+jets$, $dijets$.

MC components reshaped to agree with Data

generator comparison

after reweighting same performances obtained with Pythia and Herwig++

conclusions

A discriminant has been developed to separate jets originating from the hadronization of gluons or light-quarks. It is built as the likelihood-product of the PDFs of three input variables and it is trained separately in seven kinematic regions. The discriminator input variables and output distributions have been validated in data and, in order to reproduce the observed data discrimination, Monte Carlo data-driven weights have been derived. Finally, a comparison between Pythia and Herwig++ has been performed and it resulted in similar performances after

References