

QCD High p_T Sub-Group: Data workflow & Early Papers

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For the High p_T QCD Sub-Group

◆ QCD High p_T Jets: data workflow

- Primary data-sets (PD)
- Secondary data-sets (SD)
- Group skims
- T2 space requirements

◆ Early papers: a prelude to the first publications

- preview of the drafts
- requirements & needs

8E29 menu

Skim (T2, Group)	Format	HLT selection	Secondary Dataset (T2, DataOps, RECO)	Primary Dataset
Jet6	JetAOD	HLT_L1Jet6U	SD_L1Jet6U	JetMonitor
Jet15	JetAOD	HLT_Jet15U	SD_Jet15U	JetMonitor
Jet30	JetAOD	HLT_Jet30U	SD_Jet30U_Quad_Fwd	Jets
Jet50	JetAOD	HLT_Jet50U	SD_Jet50U	Jets

Analyses PATuples

- **NO central PATuple production by the group** (easier to re-run on the Skims and include improvements in JEC, jet-ID, event cleanup).
- Each analysis is **encouraged** to produce a **PATuple** instead of private ROOTuples.

◆ The JetAOD Event size is estimated to be **less than 50 kBytes**.

◆ For 10pb^{-1} of integrated luminosity we estimate to need a few TBs of space for all Skims.

◆ We would like to have our Skims stored in **one European T2 site and one US T2 site**. The dedicated QCD space at each of these sites is 30 TB which can easily accommodate our Skims.

◆ The required configuration files for the Skim production have been prepared.

◆ Responsible person: not assigned yet.

JetAOD content

- ✓ Jet collections
- ✓ CaloTower collection
- ✓ JetTrackAssociator
- ✓ MET collections
- ✓ Trigger results
- ✓ EventAuxiliary
- ✓ Vertex information

General Infrastructure

1. Stability of the detector conditions.
2. “Good Run” list and access to the lumi sections.
3. Smooth data flow to our dedicated T2s.
4. CRAB reliability.

From JetMET

5. Jet Energy Scale / Jet Resolution (energy, η , ϕ).

From ourselves

6. Co-ordination and alignment between the analyses in order to avoid duplicate work in understanding the trigger behaviour, the jet ID and the event cleanup.
7. Tools to “tune” the MC to match the data, so that we can perform unsmearing of the observables based on MC.
8. Complete the theory calculations and make an estimate of the non-perturbative corrections.

If we have no surprises and if the needs are met, then the time-scale for a first paper draft is ~ 3 months

(1-2 weeks to run and transfer the skims, 1 month to prepare PATuples and perform the analysis, a few weeks to present and discuss the results through the QCD group).

Goals for the October exercise

- Test the full data workflow chain from the T0 to the T2s. Identify problems and estimate the time needed.
- Make a better estimate of our JetAOD size and verify that its content is sufficient for the analyses.
- Test the co-ordination between analyses for common issues (e.g. single jet trigger efficiency measurement, unsmearing techniques, etc).
- Perform benchmark analyses with the Summer09 samples (in particular with the 7 TeV samples): dijet mass cross-section, inclusive jet cross-section, dijet azimuthal decorrelation, event shapes, ...



Early papers summary



IMPORTANT: ALL analyses will start with first data regardless of the early papers exercise !!!

1) QCD-08-003: *“Hadronic Event Shapes at CMS”*

M. Weber, G. Dissertori, F. Moortgat

2) QCD-09-003: *“Dijet Azimuthal Decorrelations in pp Collisions at 10 TeV”*

C. Dragoiu, L. Apanasevich, N. Varelas

3) QCD-09-004: *“Measurement of the Dijet Production Ratio in pp Collisions at 10 TeV”*

D. Miner, A. Harel, R. Harris, R. Demina, M. Zielinski

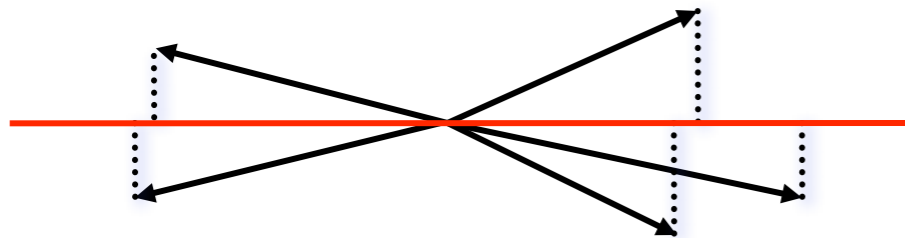
4) QCD-09-005: *“Measurement of the Dijet Mass Cross Section in pp Collisions at 10 TeV”*

K. Kousouris, R. Harris

5) QCD-09-006: *“Measurement of the Dijet Mass Distribution and Search for New Particles in pp Collisions at 10 TeV”*

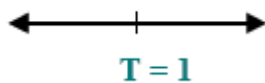
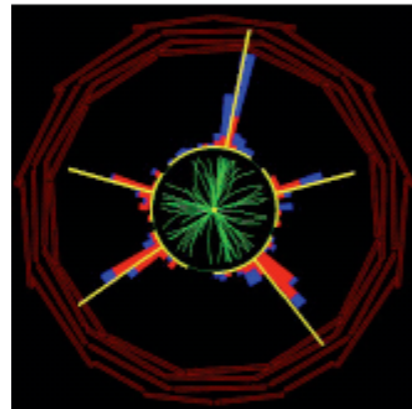
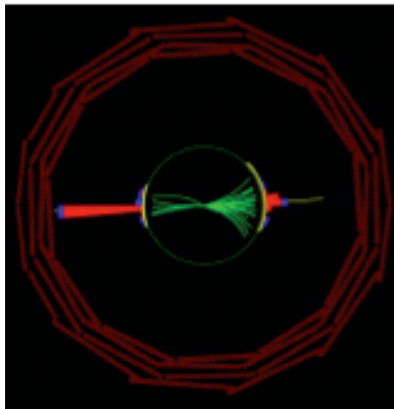
S. Ozturk, C. Jeong, R. Harris, K. Kousouris, S.W. Lee,

Testing the QCD dynamics with the hadronic event shape variables.
Central Transverse Thrust:



$$\tau_{\perp,C} \equiv 1 - T_{\perp,C}$$

$$T_{\perp,C} \equiv \max_{\vec{\eta}_T} \frac{\sum_i |\vec{p}_{\perp,i} \cdot \vec{\eta}_T|}{\sum_i p_{\perp,i}}$$



T = 1/2

CMS PAPER QCD-08-003

DRAFT
CMS Paper

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2009/08/31
Archive Id: 1.6
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Measurement of the Central Transverse Thrust in pp collisions at $\sqrt{s} = 10$ TeV

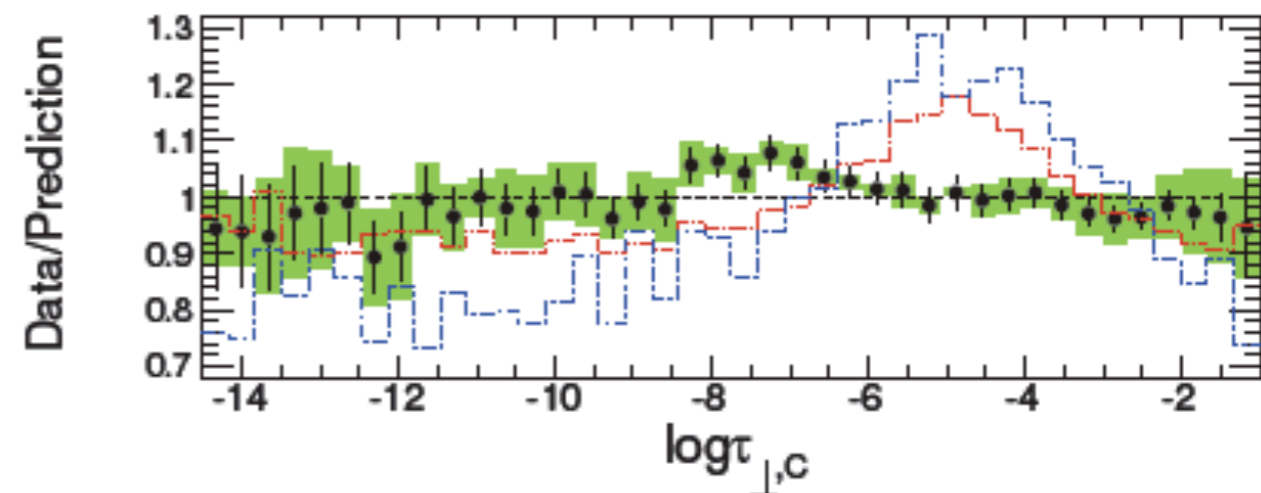
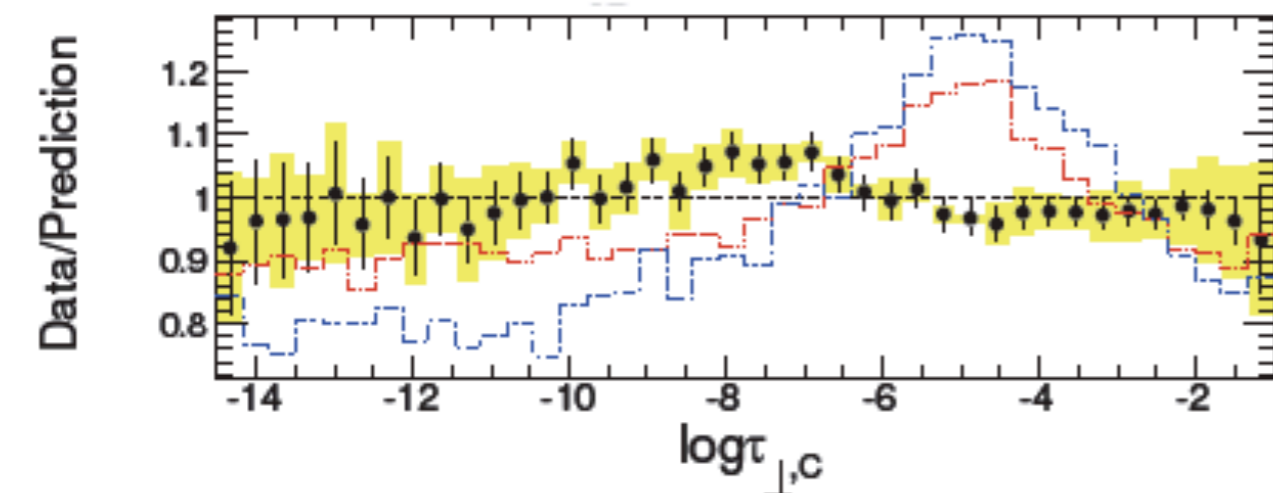
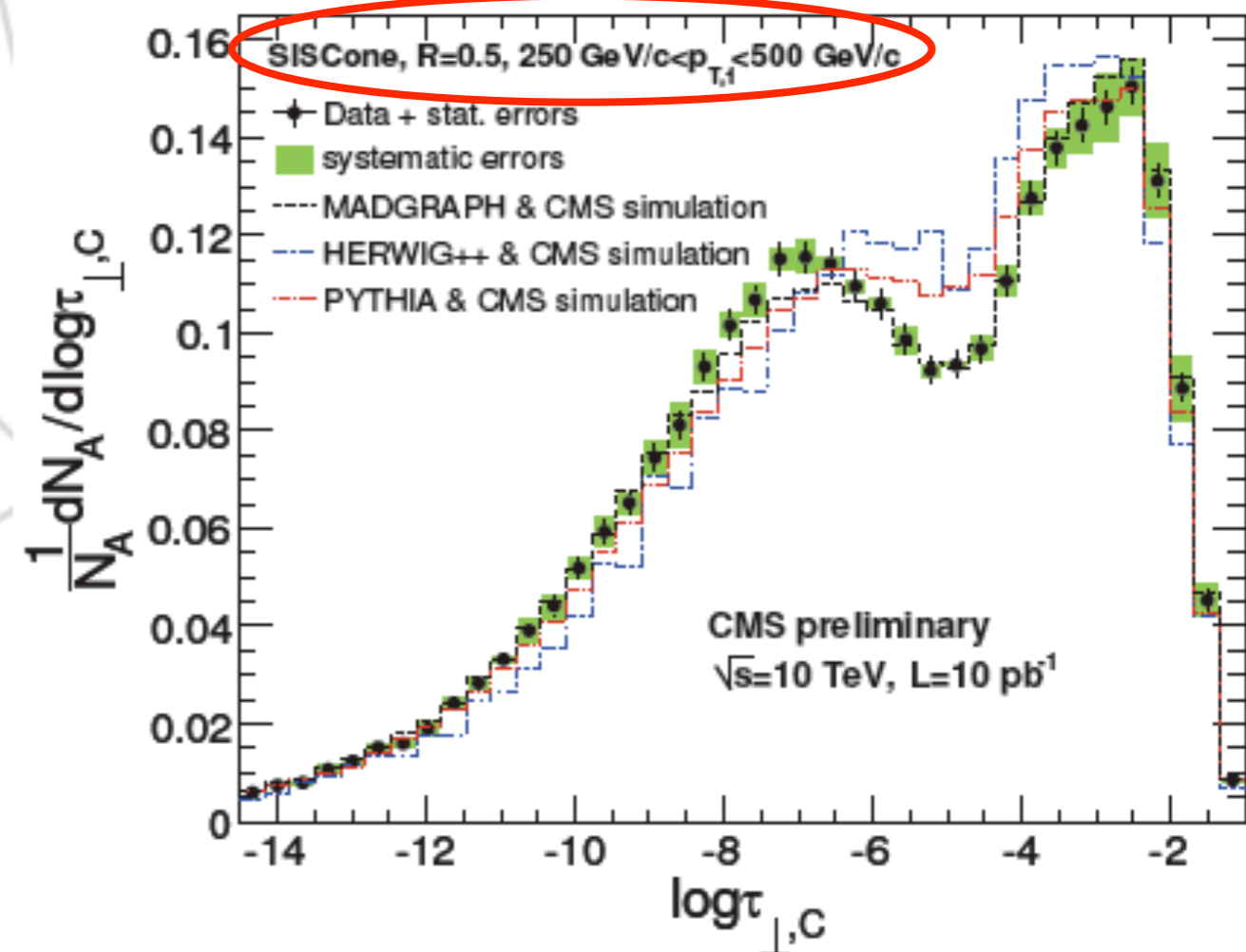
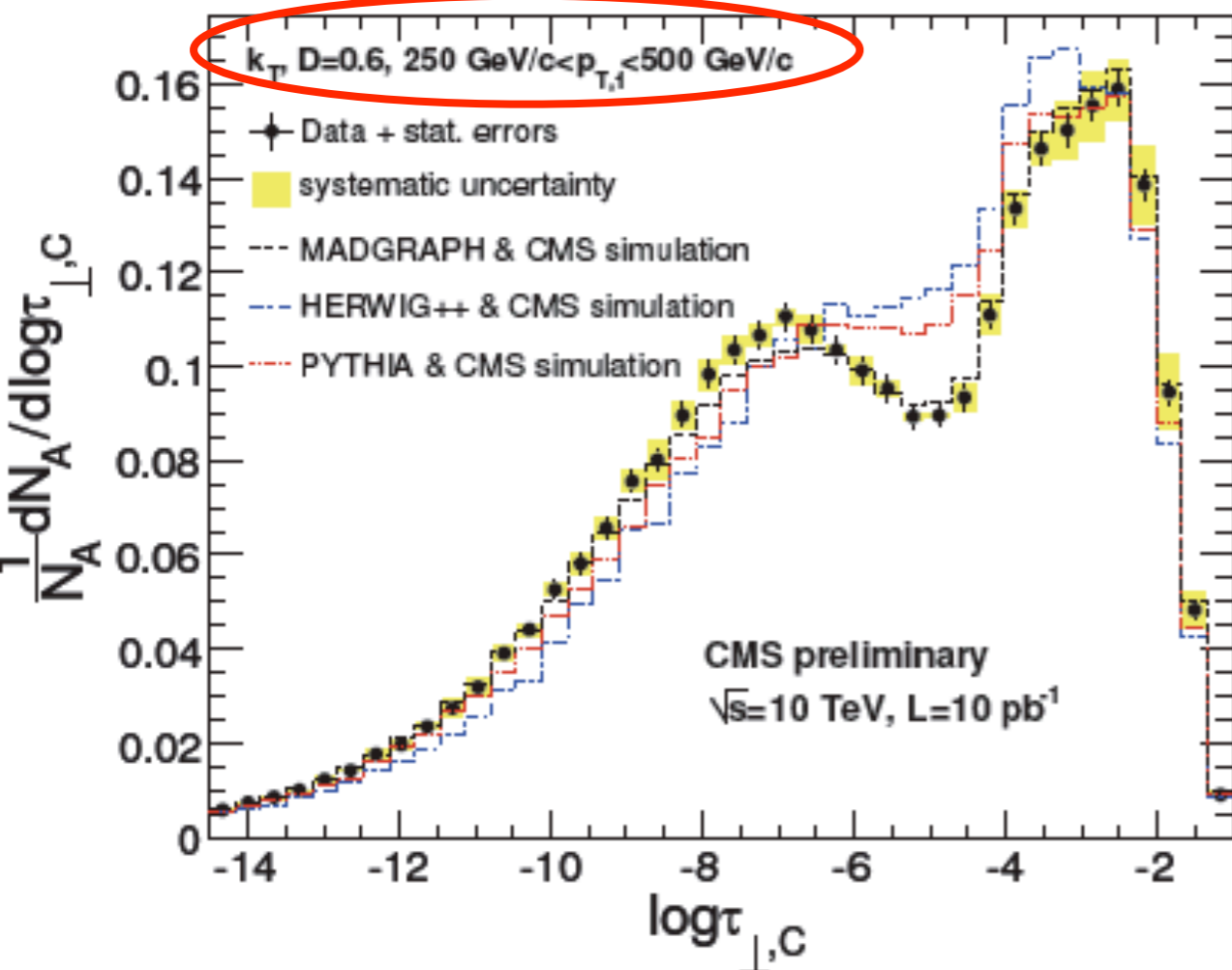
The CMS Collaboration

Abstract

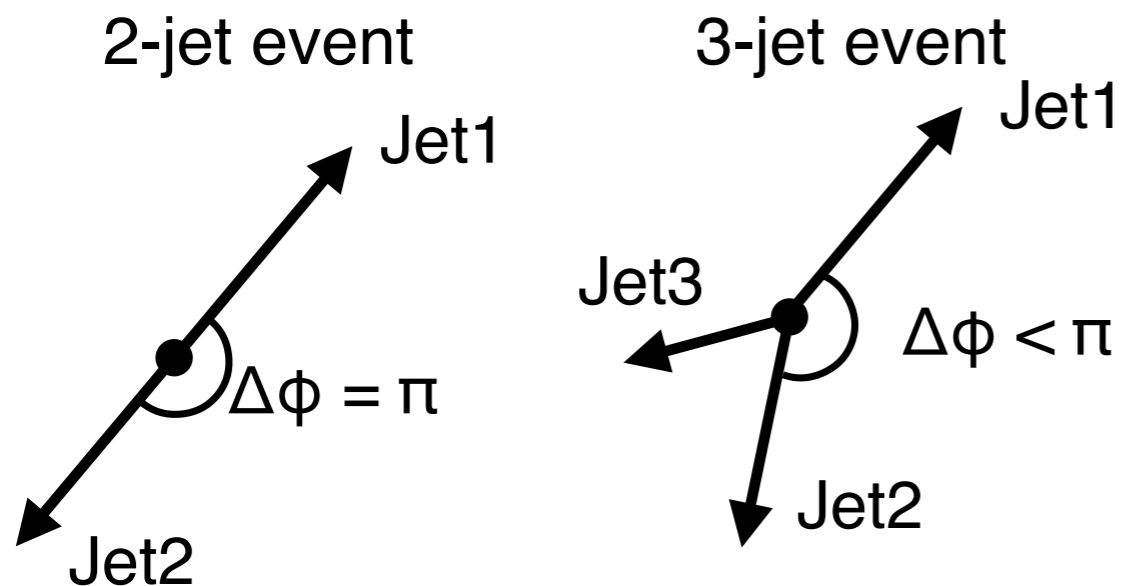
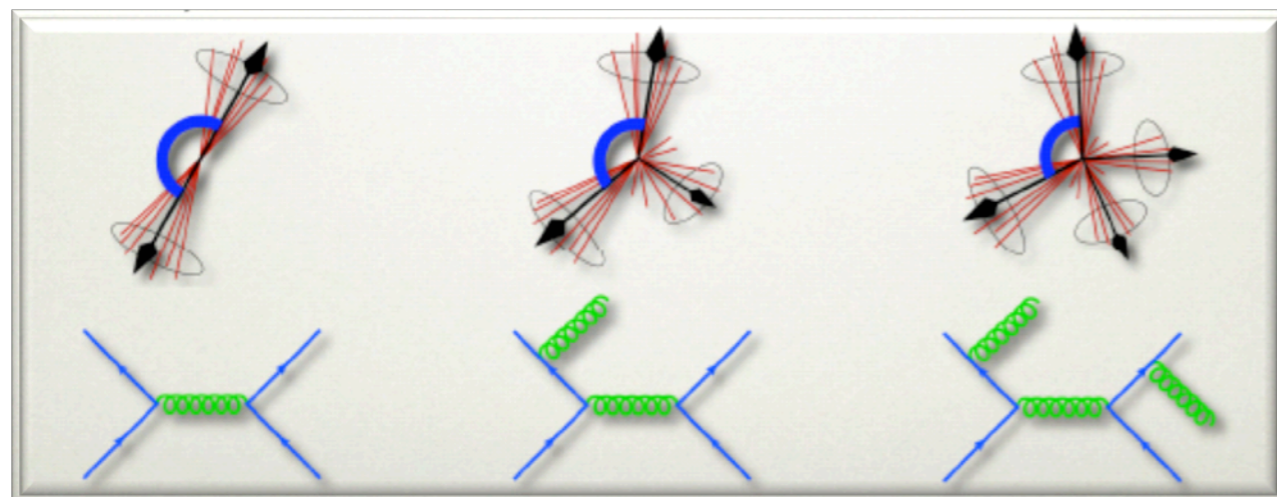
This early paper draft contains only plots based on simulated data. The following pages are formulated as if a real measurement of early CMS data would be described.

A measurement of the central transverse thrust distribution in proton-proton collisions at a centre-of-mass energy of $\sqrt{s} = 10$ TeV is presented. The measurement is based on a data sample of 10 pb^{-1} collected with the CMS detector at the Large Hadron Collider at CERN during the running period 2009-2010. The results are compared with predictions of QCD Monte Carlo Models.

Central Transverse Thrust:



Dijet Azimuthal Decorrelation



The $\Delta\phi$ distribution of the two leading jets is sensitive to higher order radiation w/o explicitly measuring the radiated jets.

CMS PAPER QCD-09-003

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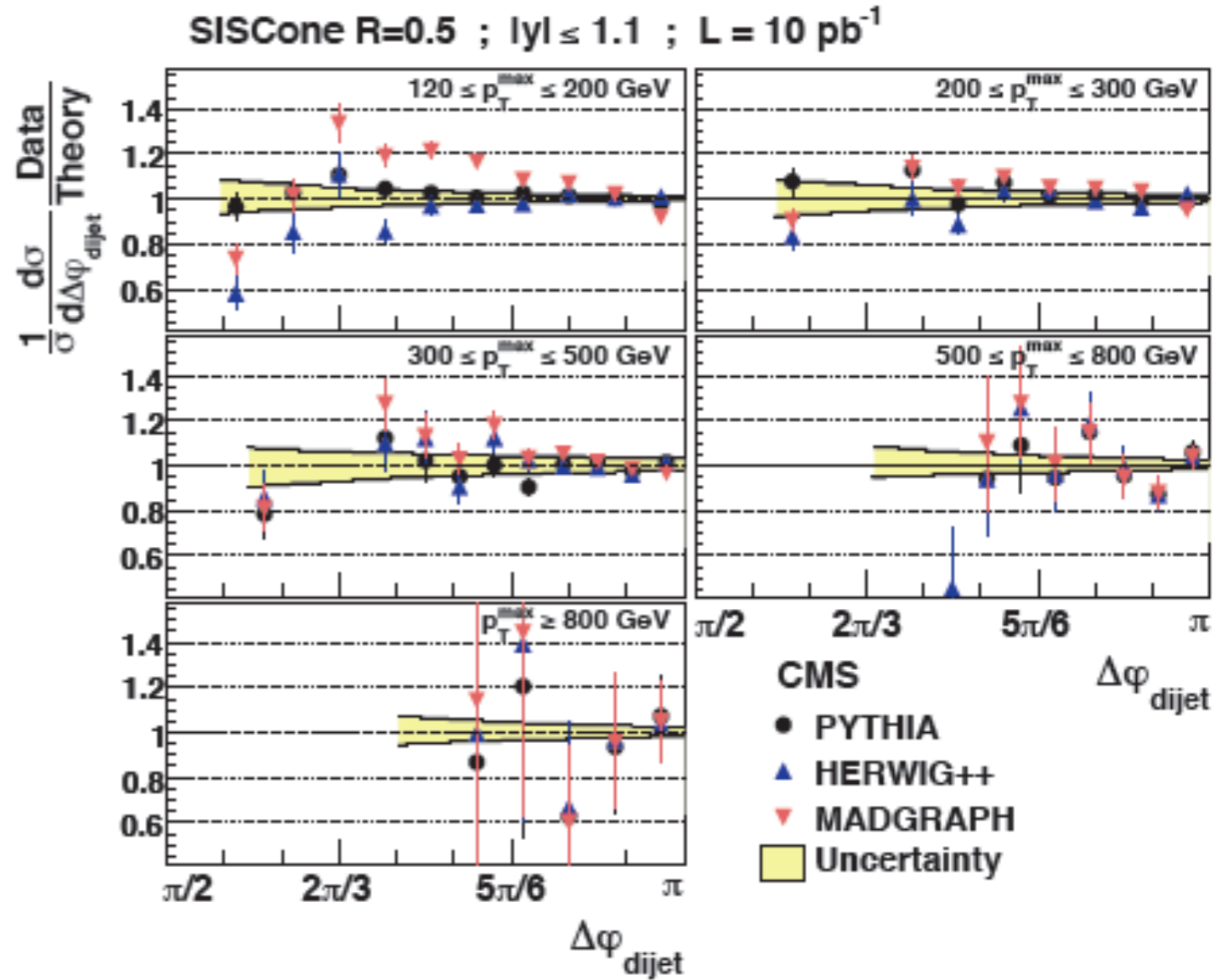
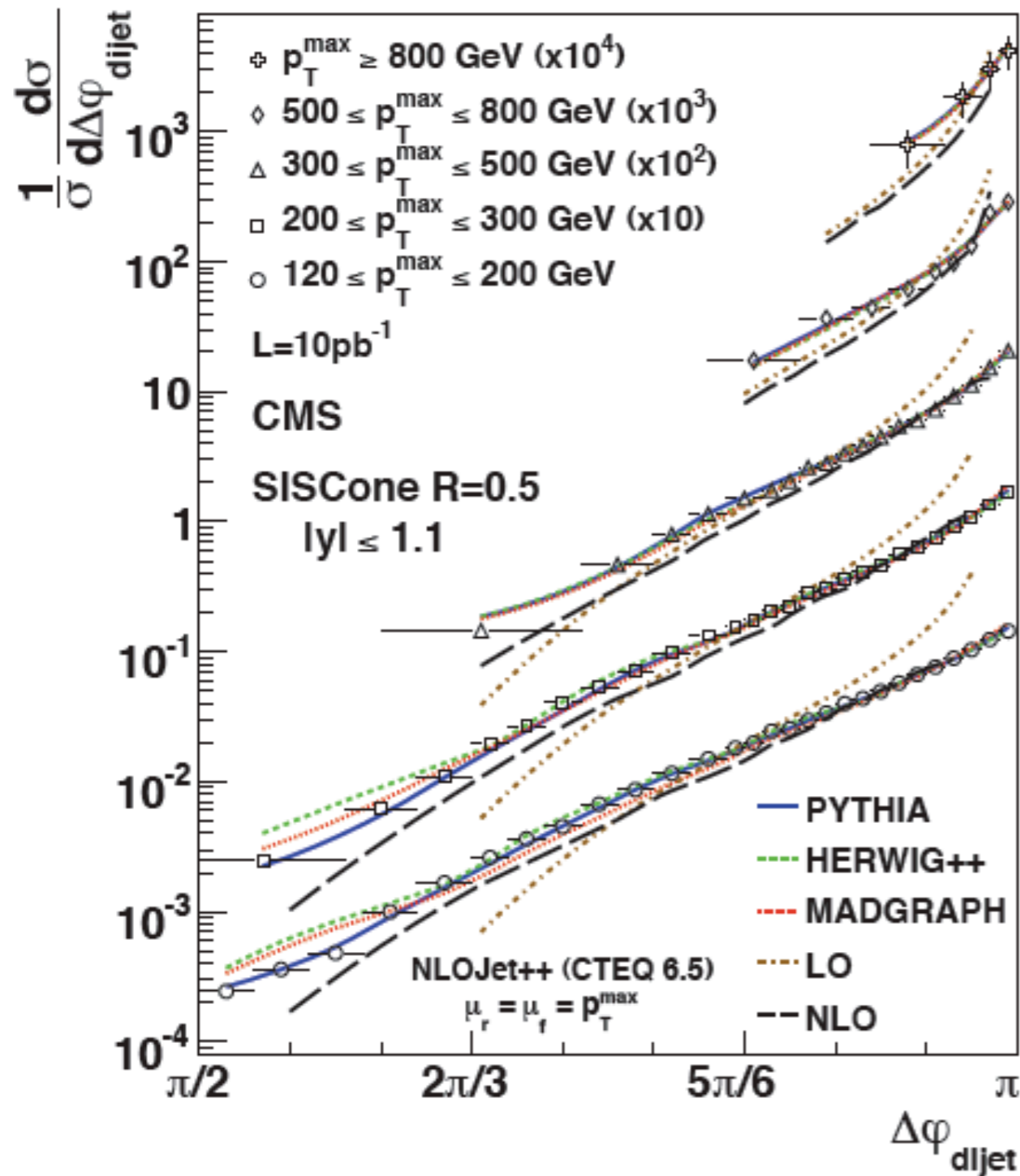
Dijet Azimuthal Decorrelations in pp Collisions at
 $\sqrt{s} = 10$ TeV

The CMS Collaboration

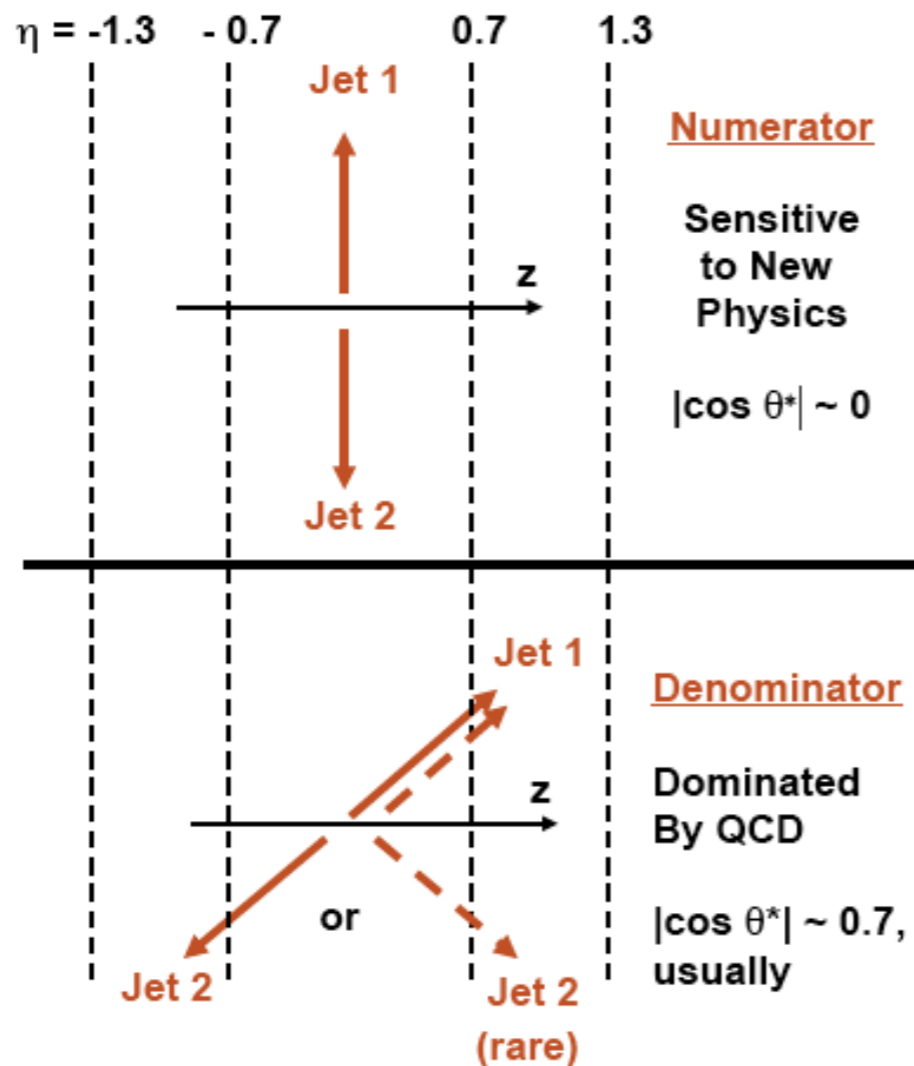
Abstract

We present a study of dijet azimuthal decorrelations for central rapidities in pp collisions at $\sqrt{s} = 10$ TeV using the CMS detector. The analysis is based on an inclusive dijet event sample that corresponds to 10 pb^{-1} of integrated luminosity. The results are compared to predictions from PYTHIA, HERWIG++, MADGRAPH, and perturbative QCD calculations. The sensitivity of the dijet azimuthal distributions to the phenomenological parameters used to model initial and final-state radiation in PYTHIA is also investigated.

A QCD test with small systematic uncertainties



Dijet ratio vs mass: a simple way to look at the dijet angular production.



$$R = \frac{N(|\eta| < 0.7)}{N(0.7 < |\eta| < 1.3)}$$

CMS PAPER QCD-09-004

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CMS Paper

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Measurement of the Dijet Production Ratio in pp Collisions at 10 TeV

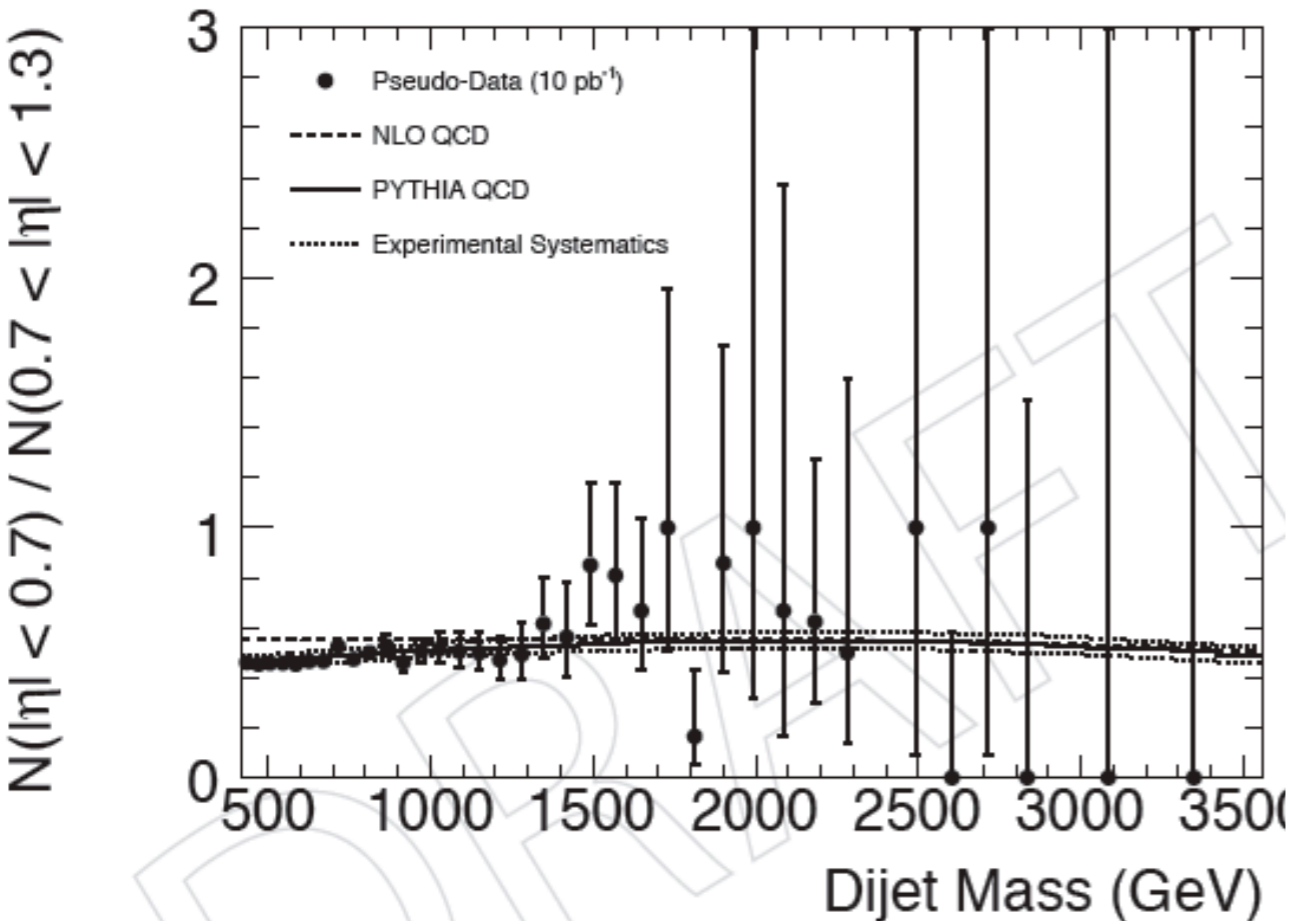
The CMS Collaboration

Abstract

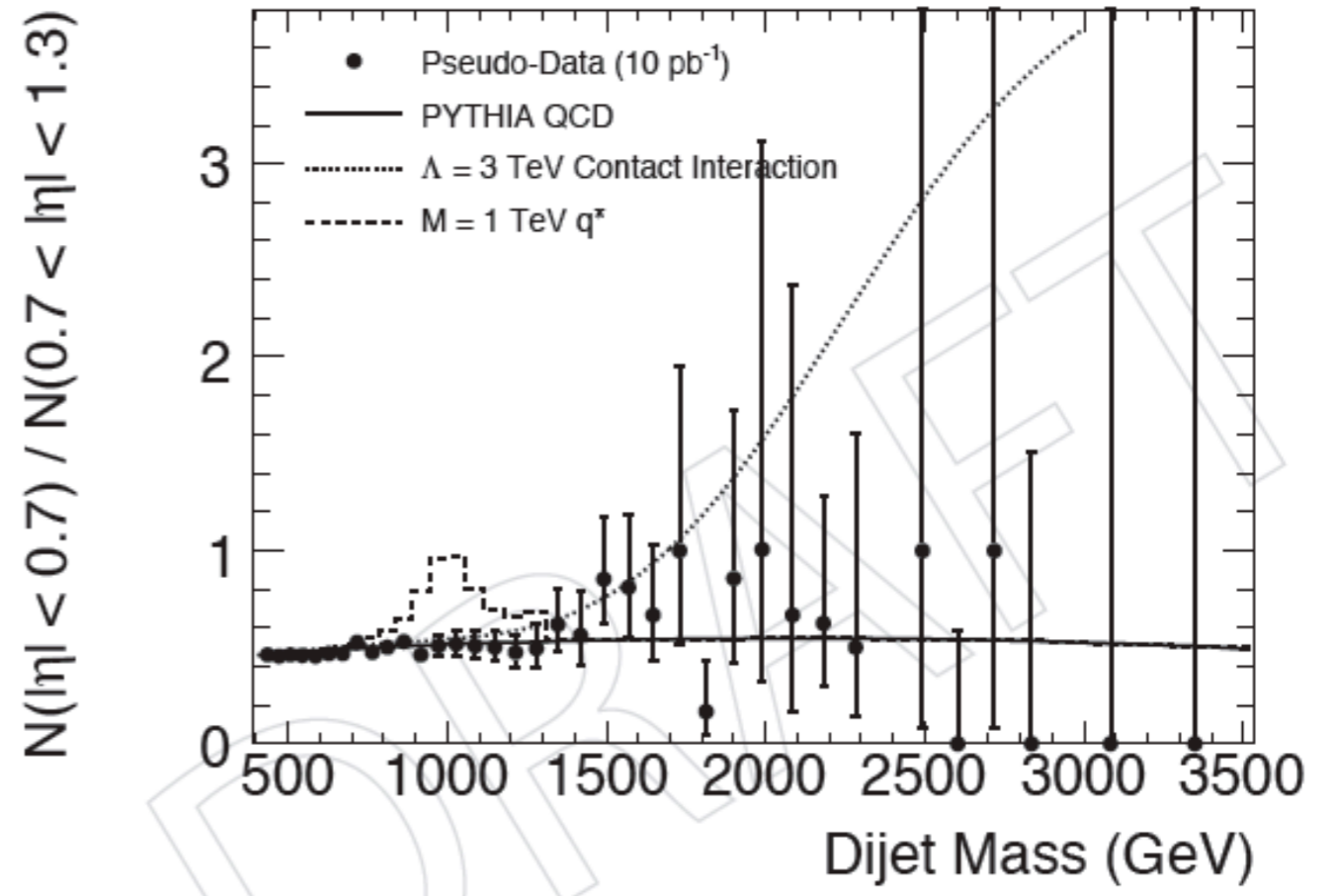
We present an early paper draft, which contains only simulation and theory, but what follows is written as if it were reporting a real measurement of early CMS data.

We have used 10 pb^{-1} of integrated luminosity from the CMS experiment at the Large Hadron Collider at CERN to measure the dijet production ratio in two regions of jet pseudorapidity. The dijet ratio, $N(|\eta| < 0.7)/N(0.7 < |\eta| < 1.3)$, is sensitive to dijet angular distributions. The dijet ratio is measured for dijet mass values between 0.4 and 3.4 TeV and is consistent with the predictions of Quantum Chromodynamics. We exclude at the 95% confidence level the following models of new physics: quark contact interactions with scale $\Lambda < 4.0 \text{ TeV}$ and excited quarks with mass $M < 1.6 \text{ TeV}$.

Dijet ratio compared to the QCD prediction.



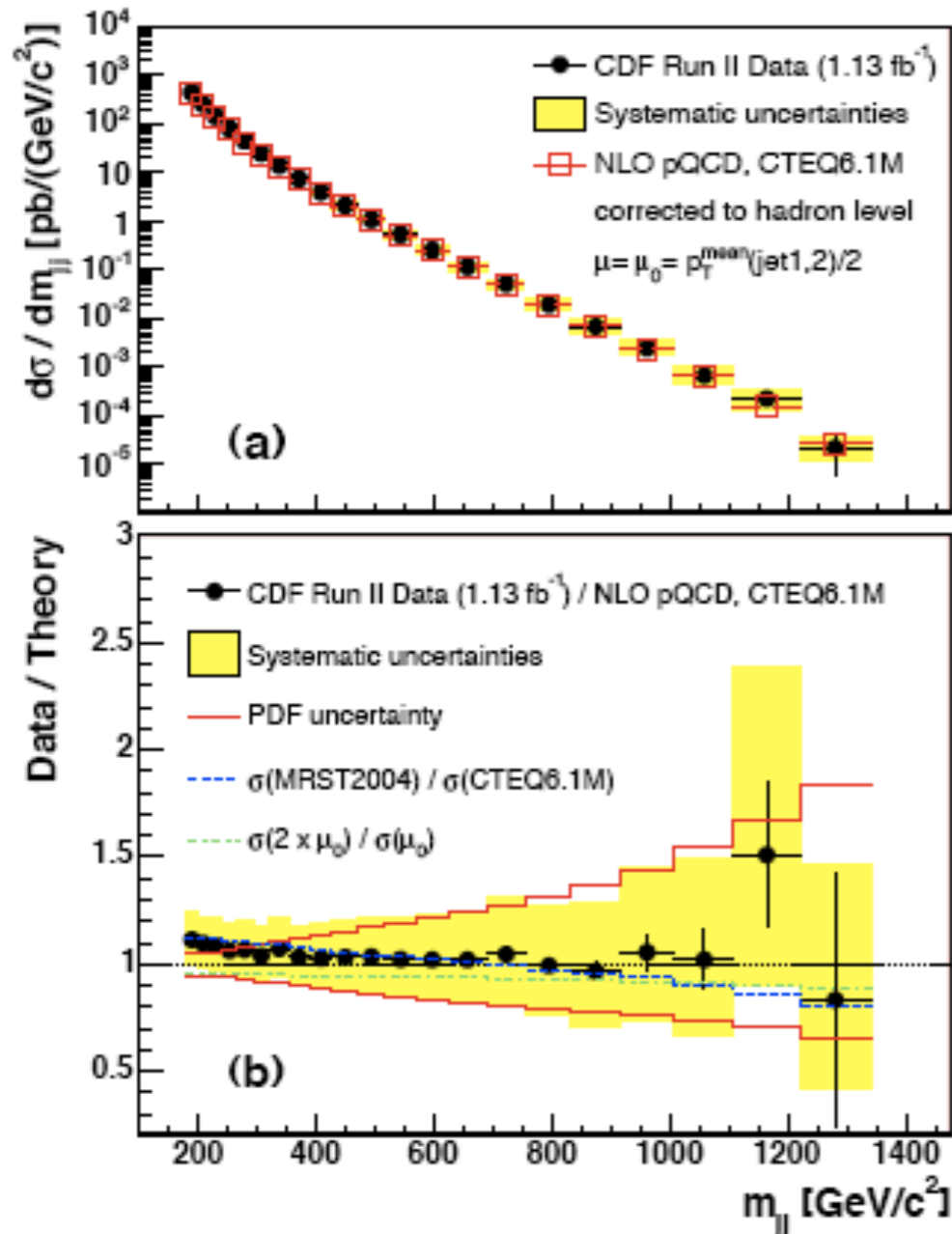
Sensitivity to contact interaction and mass resonances.



- ◆ A precise QCD test because most systematic uncertainties cancel in the ratio.
- ◆ 10 pb⁻¹ @ 10 TeV could exclude excited quarks $M(q^*) < 1.6$ TeV and Contact Interactions $\Lambda < 4$ TeV.
- ◆ Tevatron limits are $M(q^*) < 0.87$ TeV and $\Lambda < 2.7$ TeV (CDF), $\Lambda < 2.8 - 3.0$ TeV (D0).

Measurement of the differential dijet production cross-section.

**CDF Run II:
Phys.Rev.D79 (2009) 112002**



CMS PAPER QCD-09-005

**DRAFT
CMS Paper**

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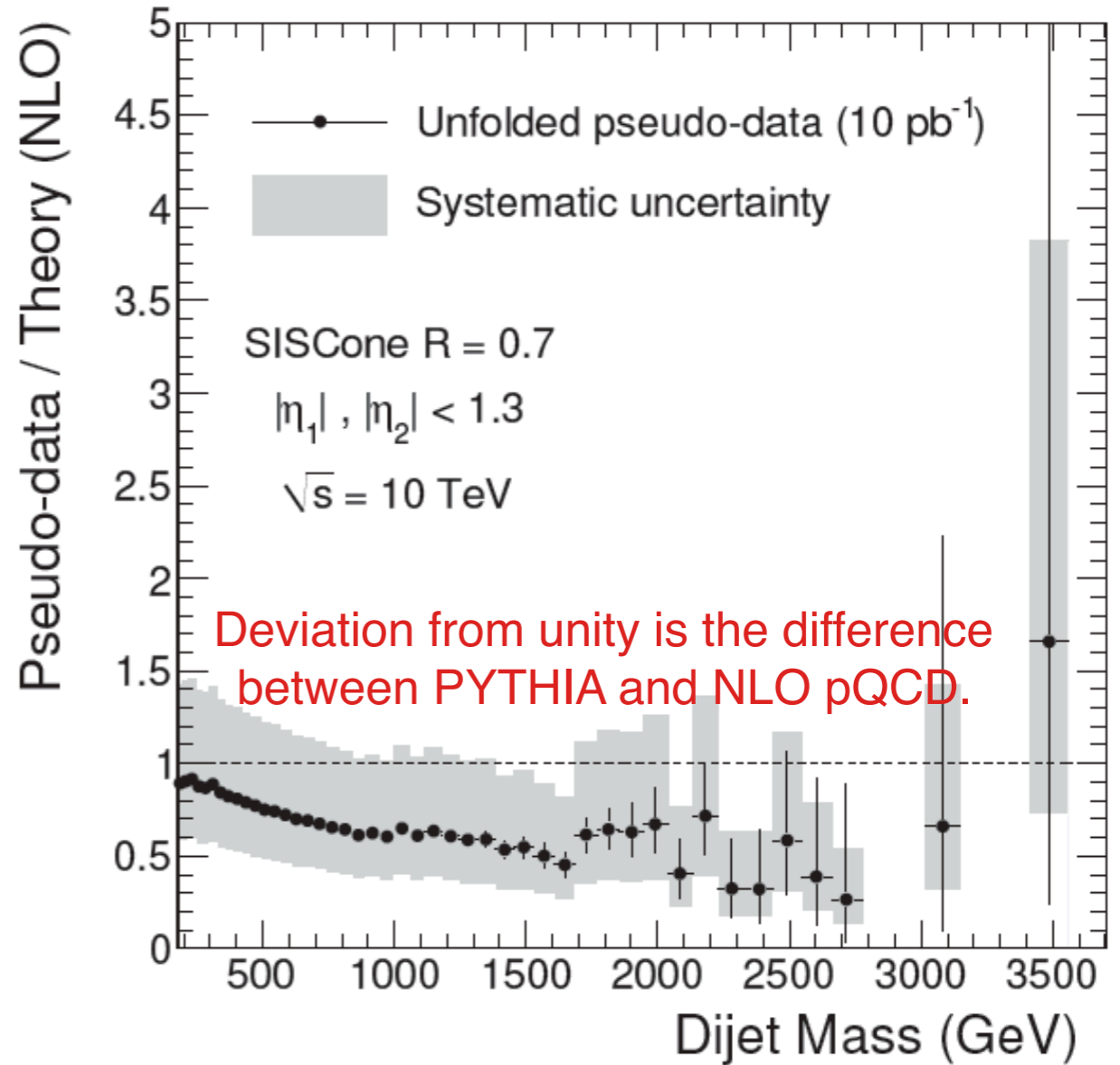
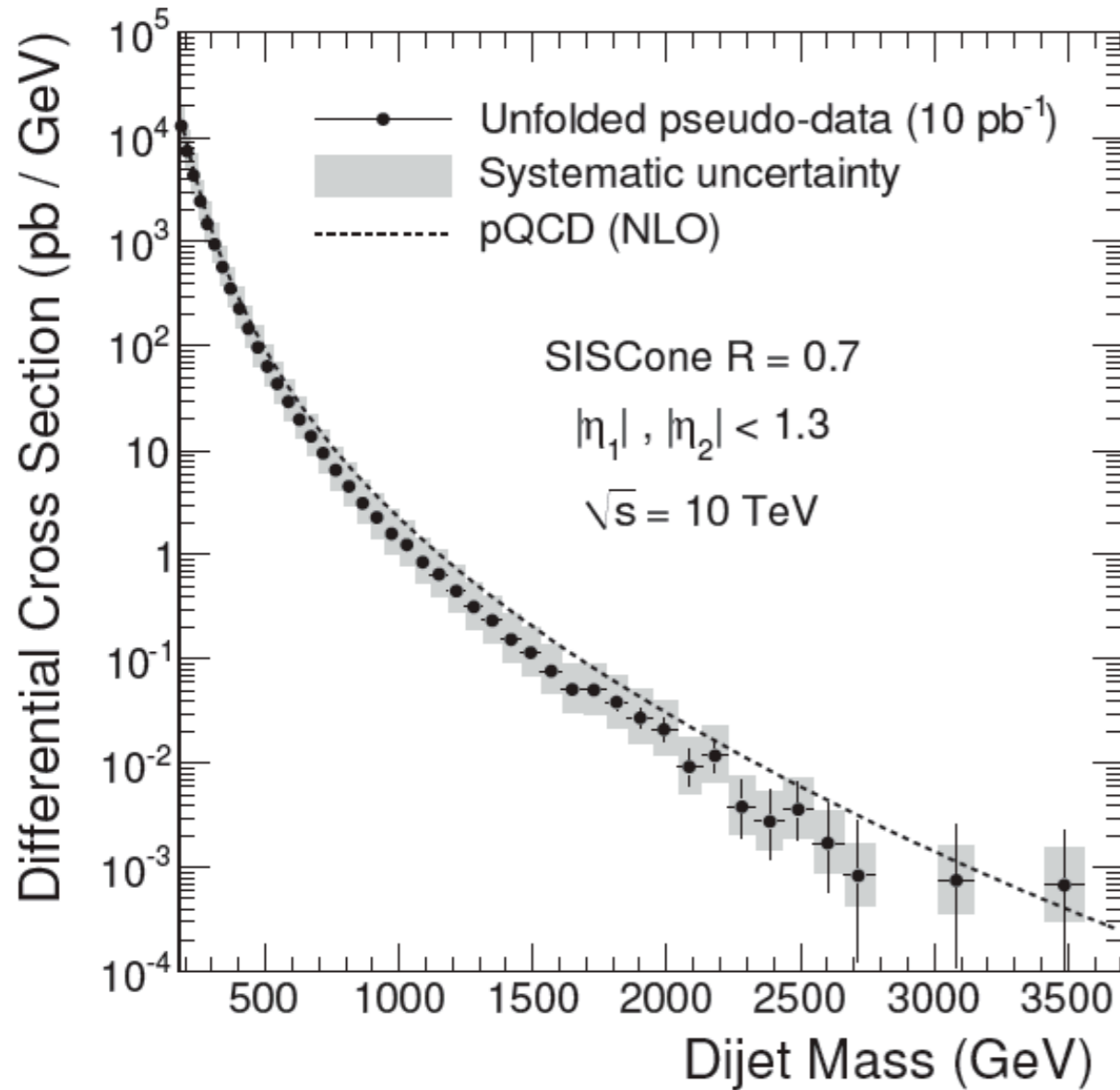
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Measurement of the Dijet Mass Cross Section in pp Collisions at 10 TeV

The CMS Collaboration

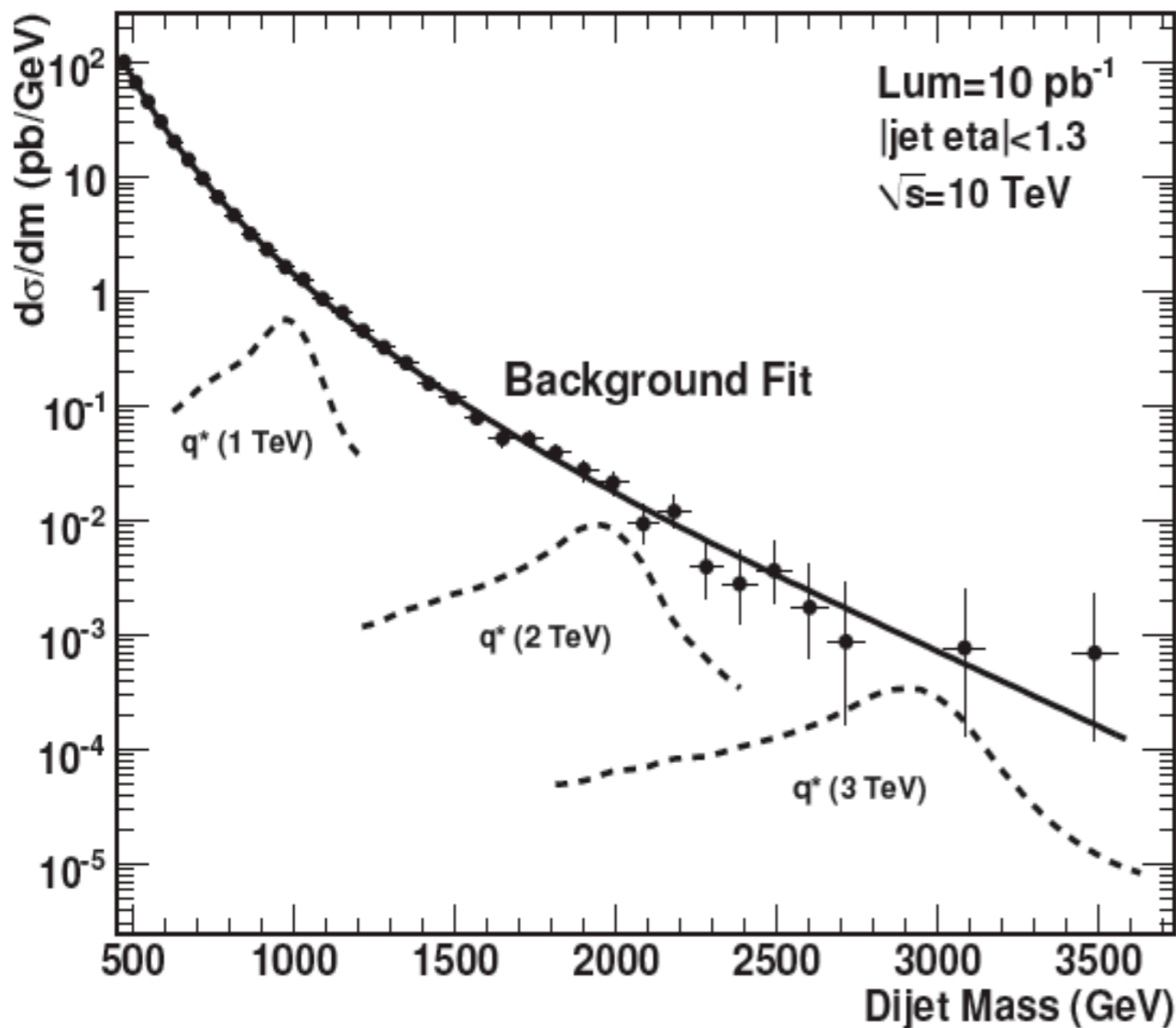
Abstract

The measurement of the dijet mass cross section with the CMS experiment at the Large Hadron Collider at CERN is presented. A data sample corresponding to 10 pb⁻¹ of integrated luminosity from proton-proton collisions at $\sqrt{s} = 10$ TeV has been used to measure the differential inclusive dijet production cross-section $p + p \rightarrow j + j + X$ as a function of the dijet invariant mass. The measurement covers the mass range from 200 GeV to 3 TeV and it agrees with the QCD predictions.



- ◆ The mass spectrum will be measured and compared with QCD in the region 200 GeV to 3.5 TeV.
- ◆ Important measurement to commission jets.

Systematic search for new particles in the dijet mass spectrum.



CMS PAPER QCD-09-006

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CMS Paper

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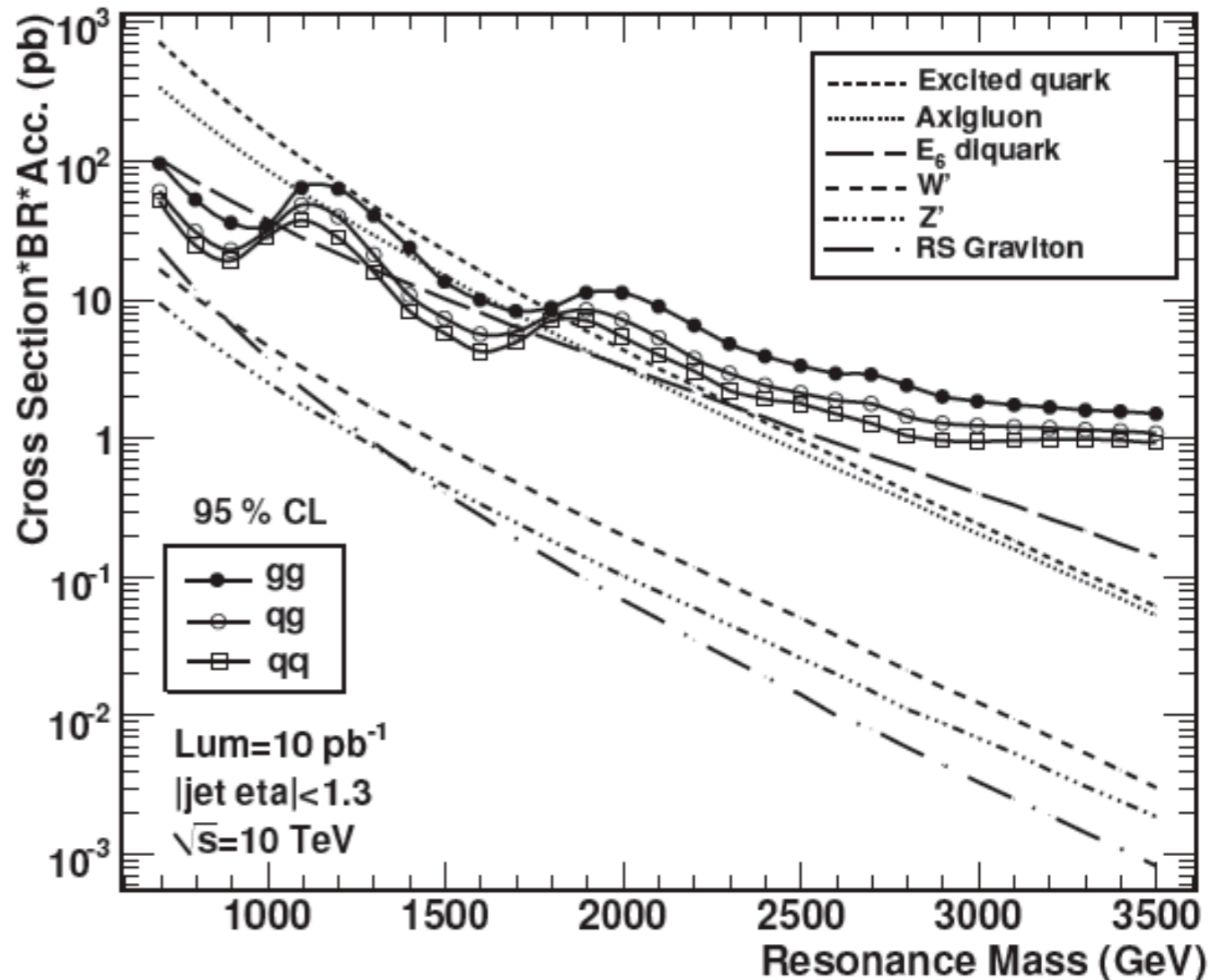
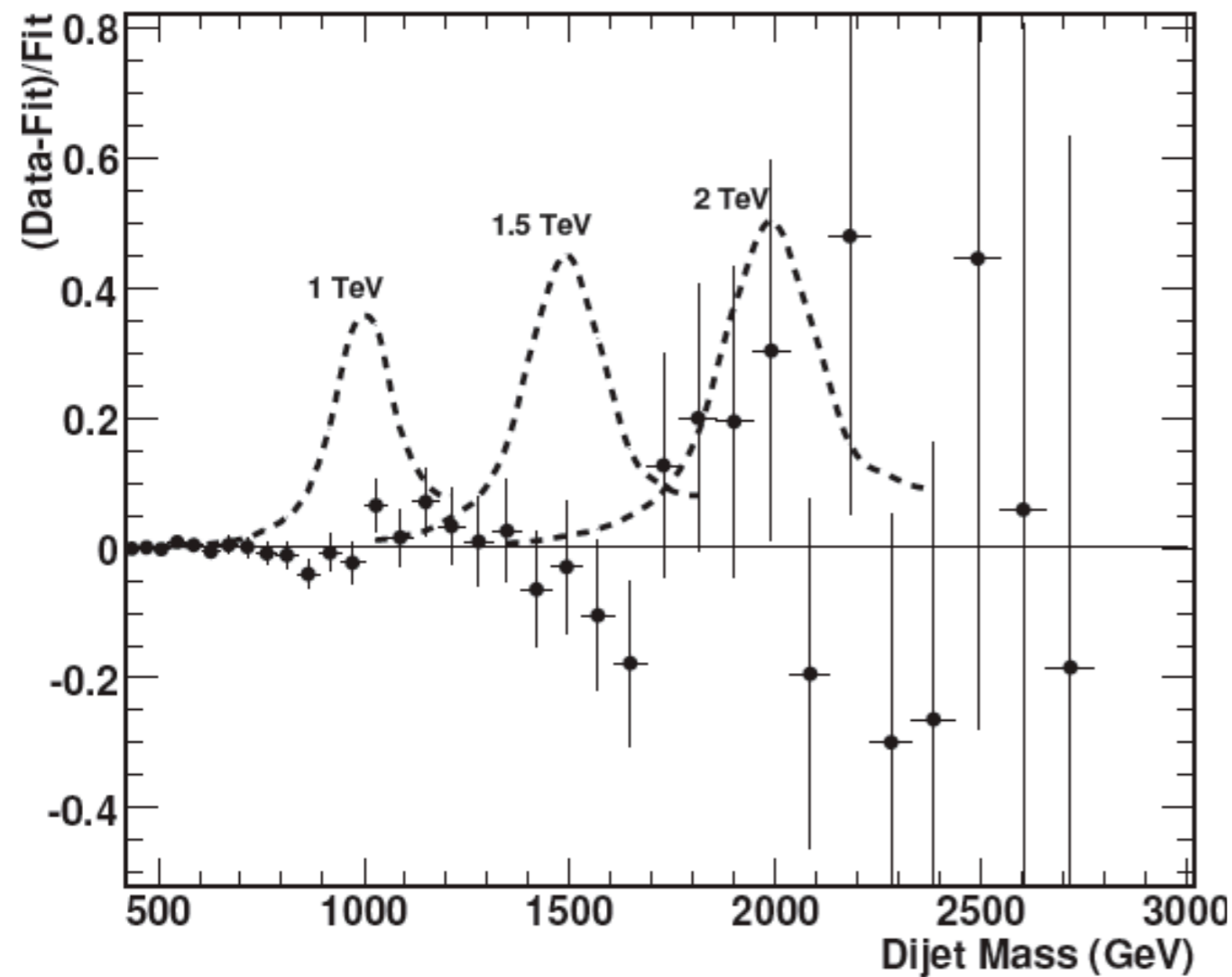
Measurement of the Dijet Mass Distribution and Search for
New Particles in pp Collisions at 10 TeV

The CMS Collaboration

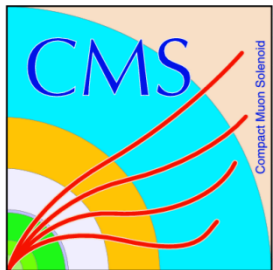
Abstract

We present an early paper draft, which contains only simulation and theory, but what follows is written as if it were reporting a real measurement of early CMS data.

We have used 10 pb^{-1} of integrated luminosity from the CMS experiment at the Large Hadron Collider at CERN to search for new particles decaying to dijets. The measured dijet mass spectrum agrees with QCD predictions. We exclude at the 95% confidence level models containing the following new particles: axigluons and flavor universal colorons with mass below $1.8 \text{ TeV}/c^2$, excited quarks with mass below $1.8 \text{ TeV}/c^2$ and E_6 diquarks with mass below $1.0 \text{ TeV}/c^2$ and within the range $1.3\text{--}1.7 \text{ TeV}/c^2$.



- ◆ If no new particles are found (why not?), limits for particular models will be set.
- ◆ 10 pb^{-1} @ 10 TeV could exclude excited quarks and other models for $M < 1.8 \text{ TeV}$.
- ◆ The dijet ratio is a critical confirmation if we see a signal here !



Summary

- ◆ The High p_T QCD sub-group will create JetAODs based on single jet triggers with reduced Event content. **The goal is to be able to analyse the data fast and reliably.**
- ◆ We plan to have our JetAODs stored in one European and one US T2 site.
- ◆ Each analysis will create a separate PATuple/ROOTuple from the common JetAODs.
- ◆ We have set specific goals for the October exercise that will improve our readiness for the first data.
- ◆ The early papers (5 in total) are ready and they represent only a fraction of the High p_T physics programme.