PNPI and CMS Physics

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PNPI CMS Physics Team:
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Outline:

- Search for asymptotic dynamics (BFKL effects): dijet K-factor at large rapidities

- WBF Higgs boson search at CMS: jet activity in $qqH \rightarrow jj\ WW \rightarrow jj\ l\nu\ l\nu$
  $qqH \rightarrow jj\ WW \rightarrow jj\ l\nu\ jj$

- Extra-dimension graviton search at CMS: large rapidity dijets

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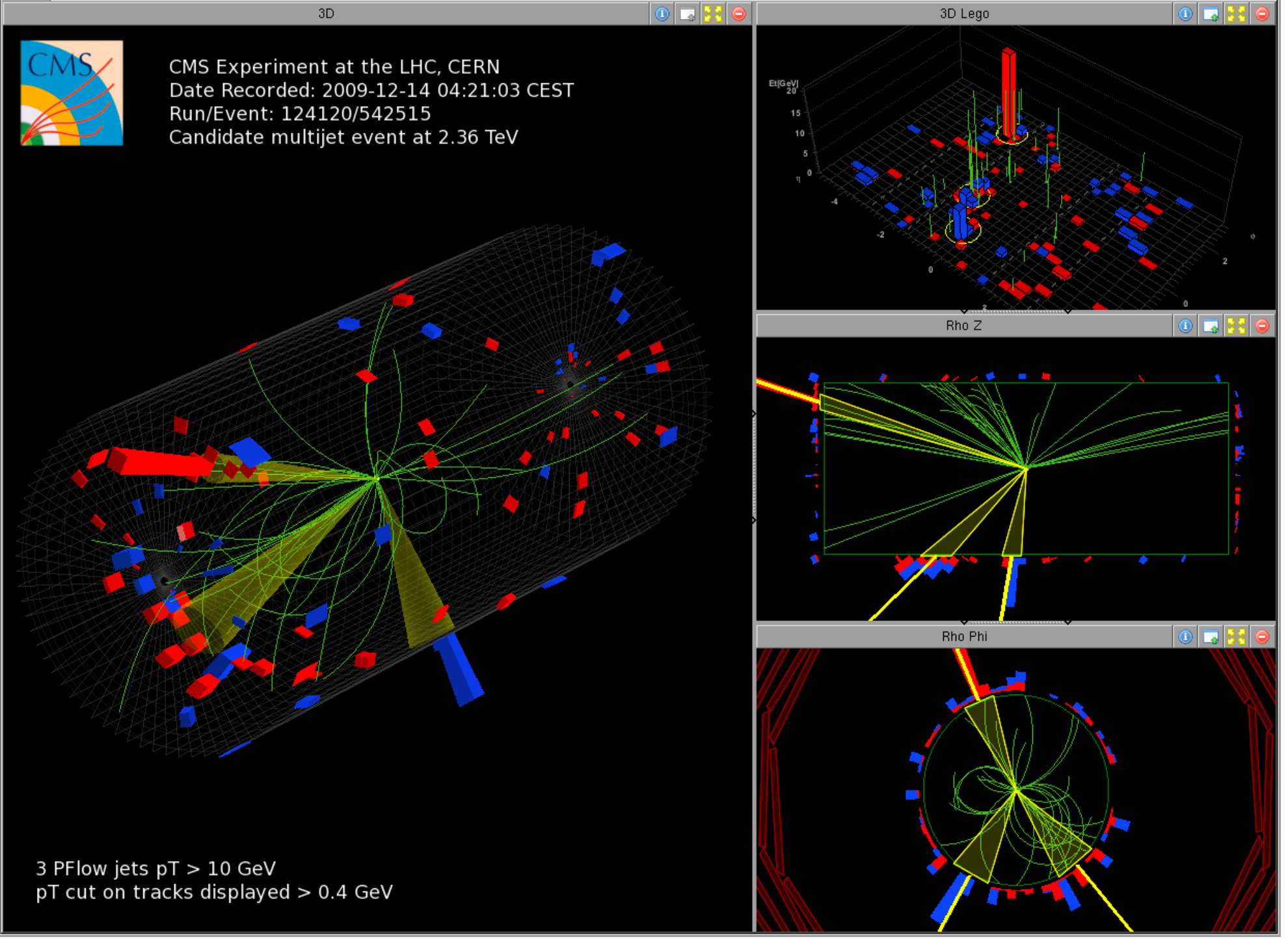

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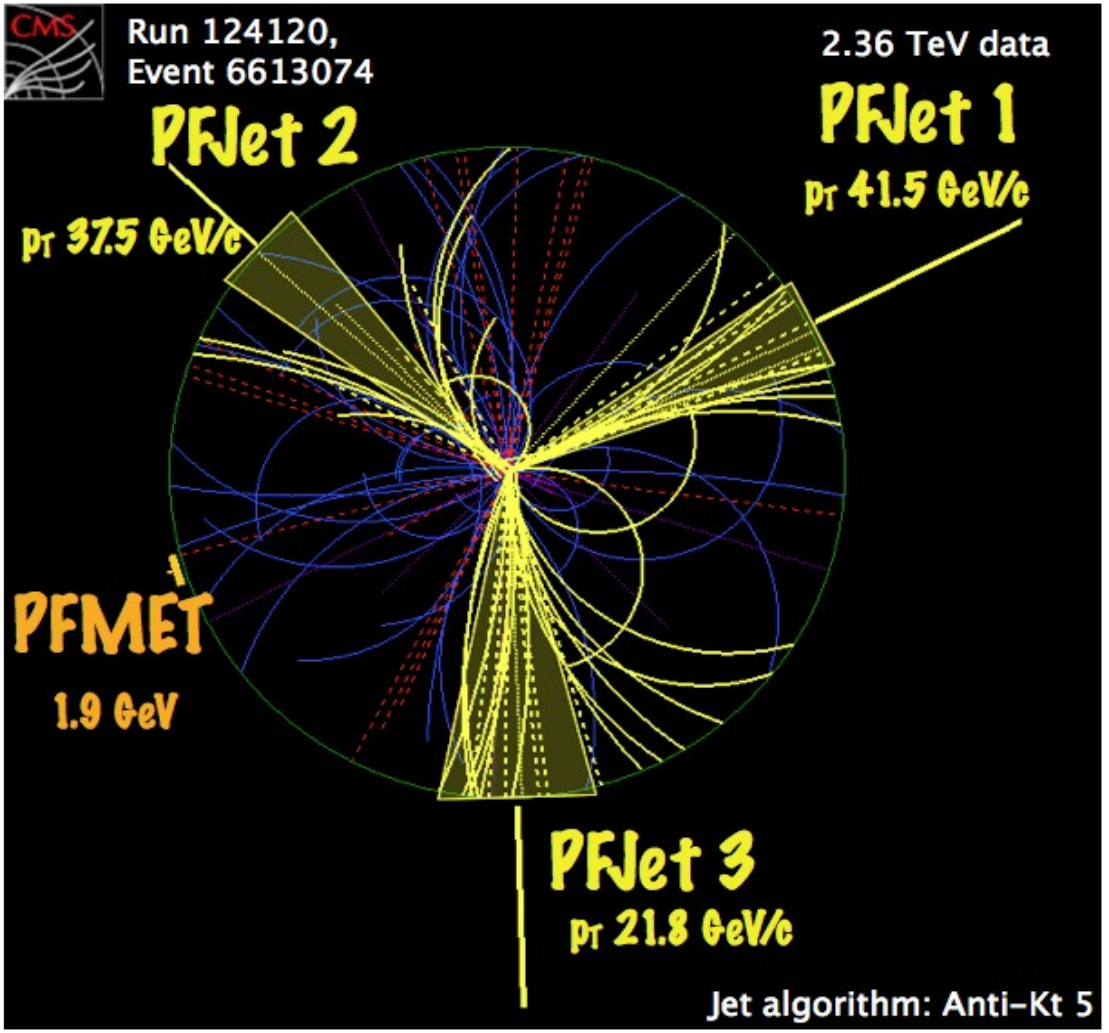

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K-factor = inclusive dijet /"exclusive" dijet

as a function of rapidity between jets

1. $N_{jets} \geq 2$ $E_{Tmin} \geq 35$ GeV
2 "exclusive": $N_{jets} = 2$
3. rapidity between jets in dijets
4. ratio = inclusive / "exclusive"

BFKL → enhanced (α_s y)-terms

- theoretical quantity:
  K-factor = x-section / Born x-section

x-section → $C_1 \alpha_s^2 + C_2 \alpha_s^3 + \ldots$
Born x-section → $C_1 \alpha_s^2$ unobservable(!)

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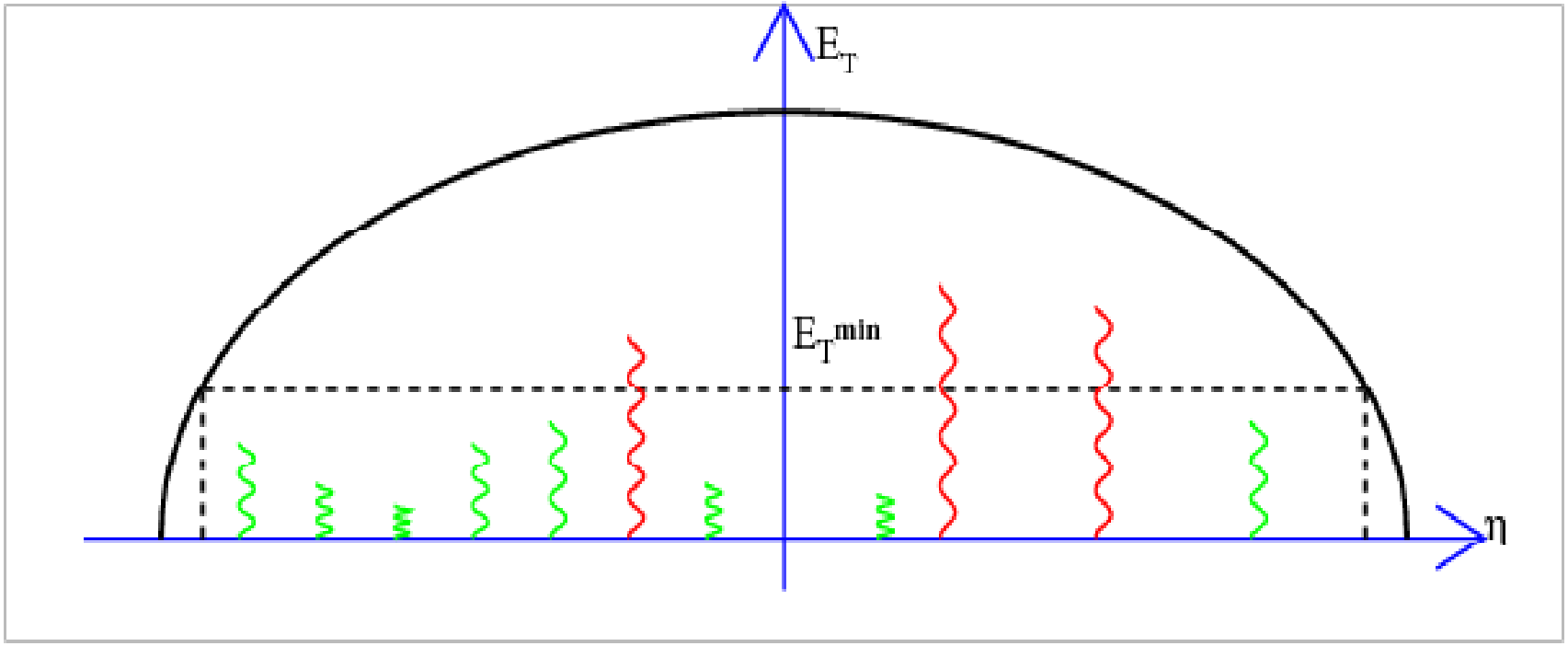
K-factor = inclusive dijet /"exclusive" dijet

as a function of rapidity between jets



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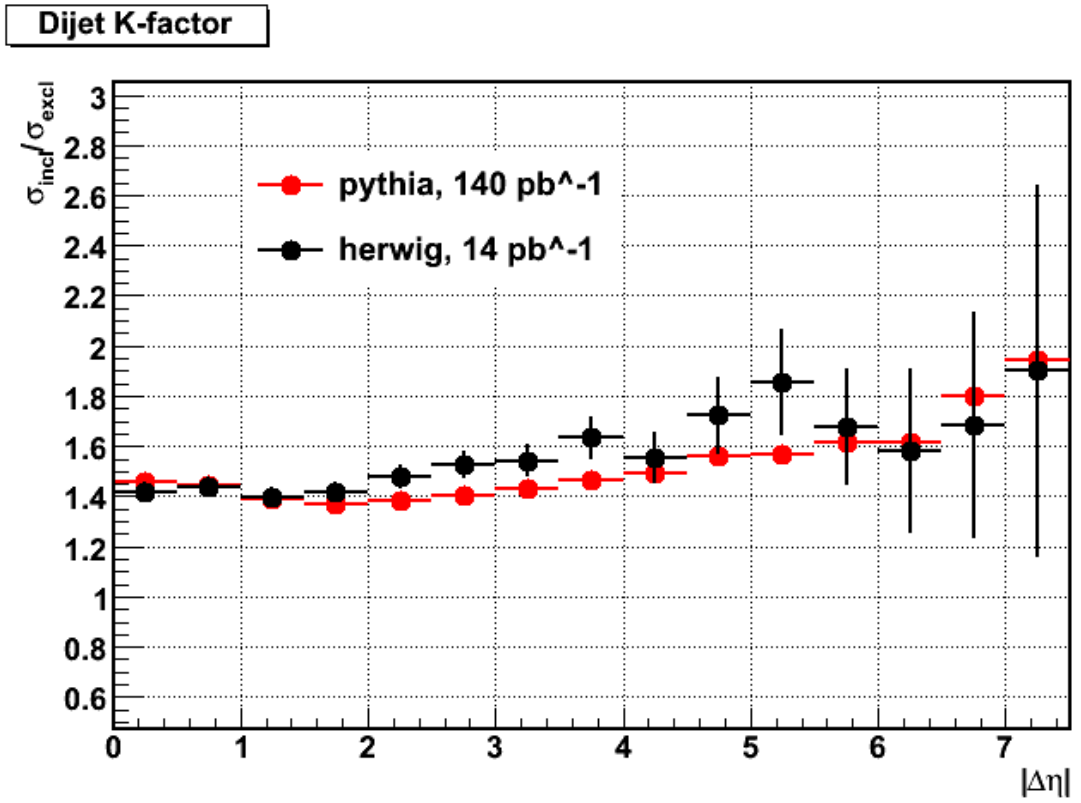
Dijet “K-factor” (2008)

Dijet K-factor = inclusive dijet / “exclusive” dijet



10 TeV
pT_min = 35 GeV

CMSSW 2.2.X

$\Delta\eta=\eta_1 - \eta_2$

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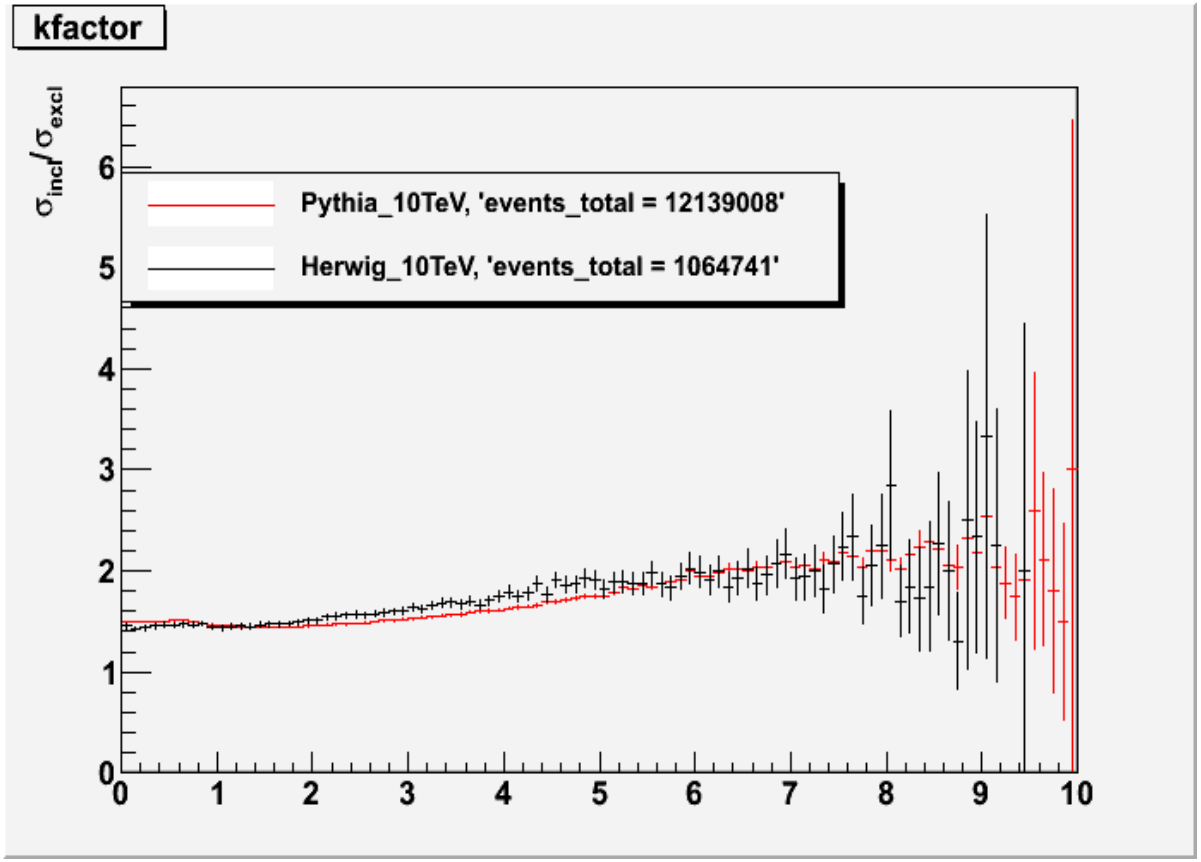
Dijet “K-factor” (2009)

Dijet K-factor = inclusive dijet / “exclusive” dijet



10 TeV
pT_min = 35 GeV
200 pb^{-1}

CMSSW 3.1.2

$\Delta\eta=\eta_1 - \eta_2$

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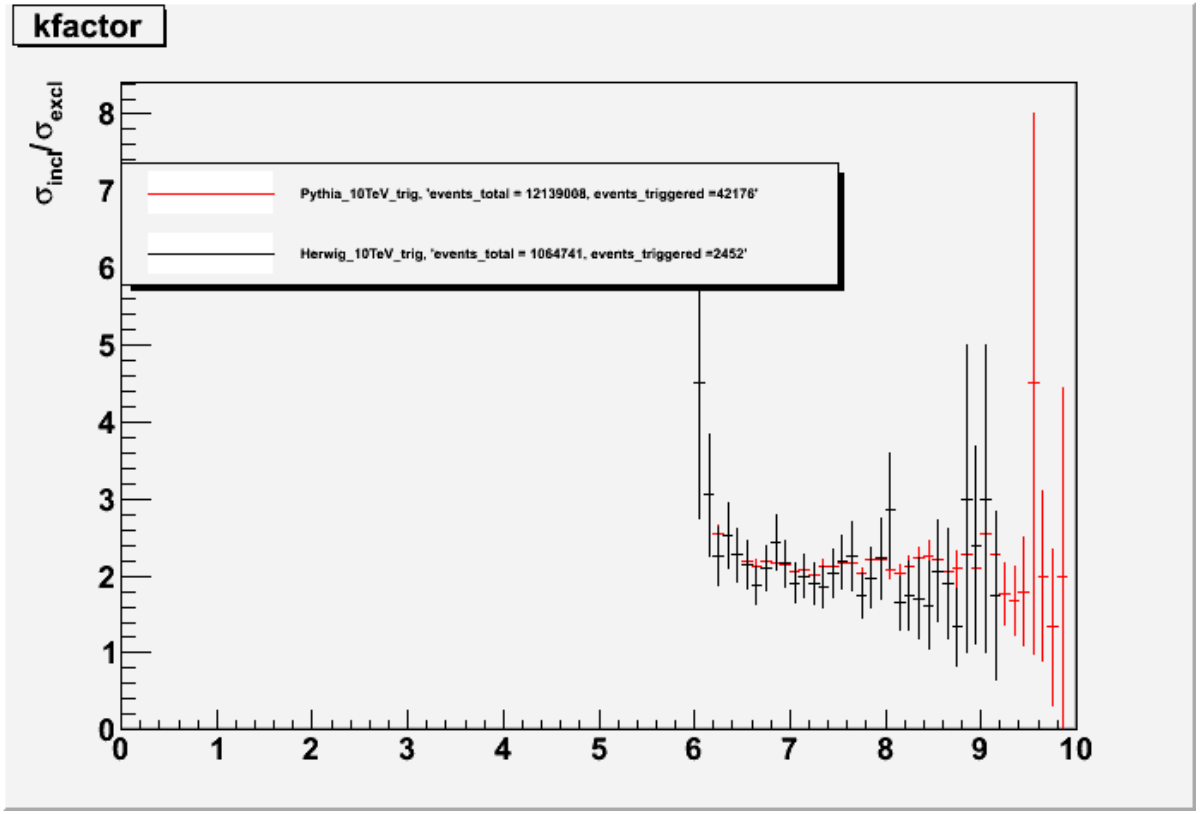
Dijet "K-factor": 10 TeV

Dijet HF trigger: jet in -5>y>-3 and jet in 3>y>5
Uncorrected: 15 GeV, Corrected: 25 GeV
Rate < 1/400
Prescale: upto 1 (single jet trigger prescale: 100)



pT_min = 35 GeV

CMSSW 3.1.2

$\Delta\eta=\eta_1 - \eta_2$

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Weak Boson Fusion Higgs Boson @CMS

Fully leptonic: qqH → jj WW → jj lv lv
Semi-leptonic: qqH → jj WW → jj lv jj

Signal features:

- forward tagging jets — WBF
- central high pT lepton + missing ET — W → lv
- central high pt dijet — W → jj (lv)

Main backgrounds:

- WW + jets — preselection
- W + jets — WBF cuts
- ttbar + jets — central jet veto

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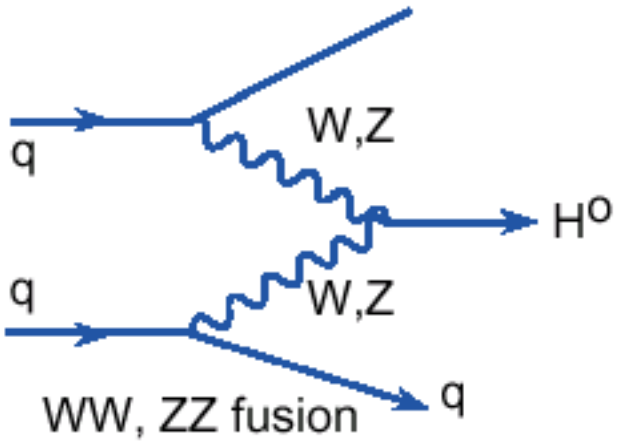
WBF Higgs Boson search strategy

$qqH \rightarrow jj\ WW \rightarrow jj\ l\nu\ jj$

M_H = 160 GeV

Semi-L WBF: 10 events at Fb^{-1}



Preselection $M_{j1j2} > 400$ GeV, $\Delta\eta > 3$, $\eta 1\ \eta 2 < 0$

$pT_J > 30$ GeV

MET > 20 GeV, ...

HLT lepton, lepton isolation pT > 20 GeV, ...

Hadronic W ID

Leptonic W ID

Central jet veto $|\eta^*|>2$

Cut based analysis (no multivariate analysis yet)

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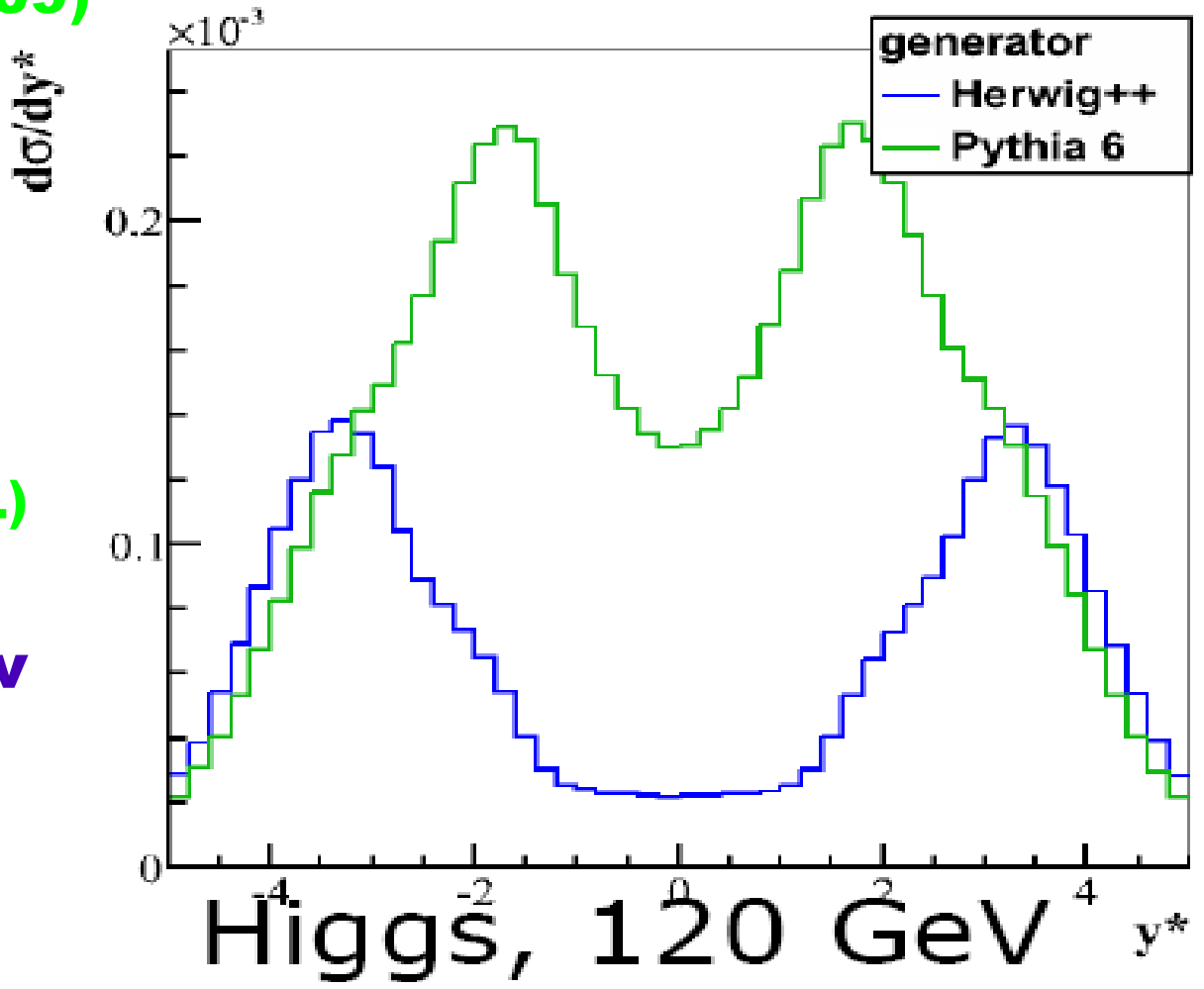
Higgs in WBF: uncertainties

Low central jet activity

Yu. Dokshitzer, V.Khoze & S. Troyan (86-87)

D.Zeppenfeld et al. (98-09)



Ch. Hackstein
(VBF Workshop @ FNAL)

Full leptonic signal:
qqH → jj WW → jj lνlν

$y^* = y - (y_1 - y_2)/2$

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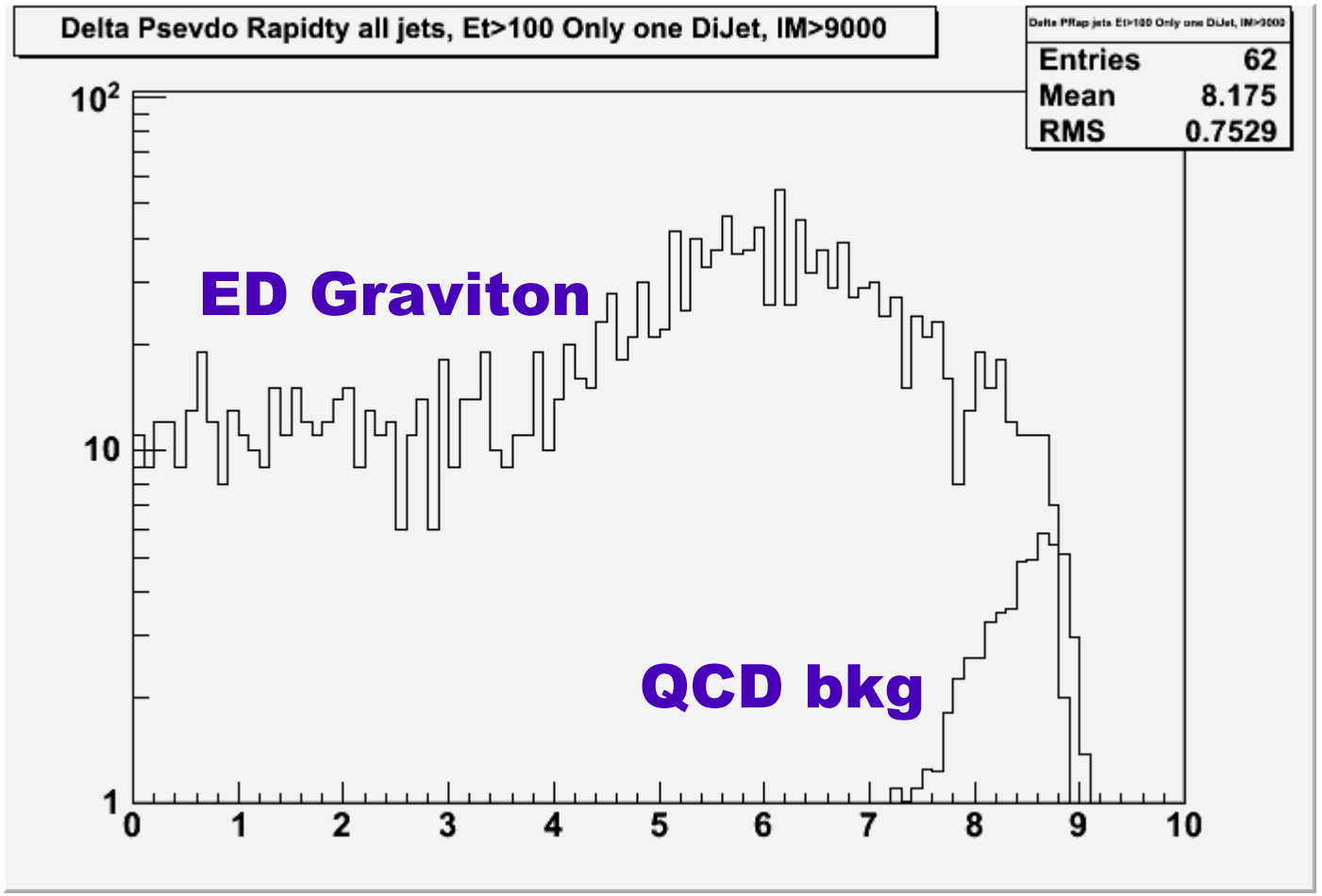
Trans-Planckian Extra-Dimension Graviton

MG = 1.5 TeV **14 TeV 300 Fb^{-1}**

dijet mass > 9 TeV, pT > 100 GeV



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Outlooks for 2010:

- **BFKL search: dijet K-factor ongoing analysis**

  Dedicated dijet HF trigger: prescale = 1

  - **0.9 TeV**
  - **2.36 TeV**
  - **7 TeV**
  - **10 TeV**

  Contribution to the first CMS physics publications

- **Higgs search in Weak Boson Fusion in progress**
- **Graviton signal in dijet production in progress**

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