Update on the Jet Cross Section Ratio: $\sigma(pp \to n\ njets+X\ n \geq 3) / \sigma(pp \to n\ njets+X\ n \geq 2)$

P.Kokkas, I.Papadopoulos, C.Fountas, I.Evangelou, N.Manthos

University of Ioannina, Greece

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Outline

Evaluation of 3Jet over 2Jet cross section ratio vs H_T.

$$R_{32} = \frac{\sigma_3}{\sigma_2} = \frac{\sigma(pp \rightarrow n\ \ jets\ + X;\ n \geq 3)}{\sigma(pp \rightarrow n\ \ jets\ + X;\ n \geq 2)}$$

Analysis done using version CMSSW_2_2_6

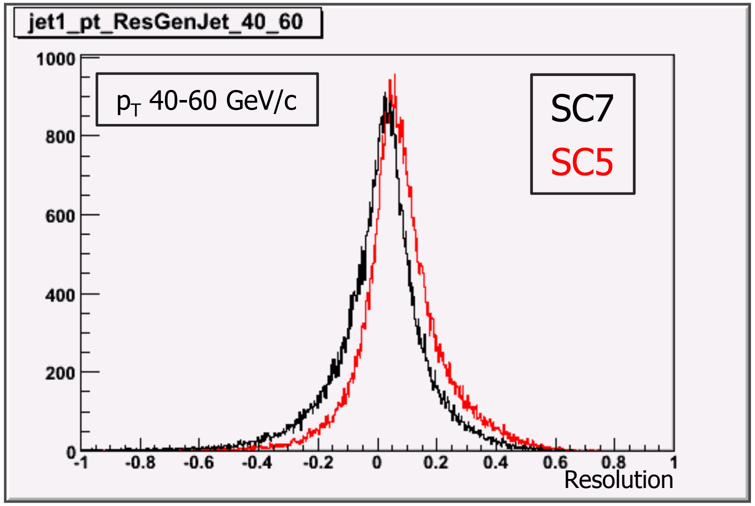
- Jet Algorithms: sisCone7 and sisCone5
- Jet Energy Corrections: L2L3
- QCD DiJet Summer 08
- Bin p_THat:0-15 GeV not used

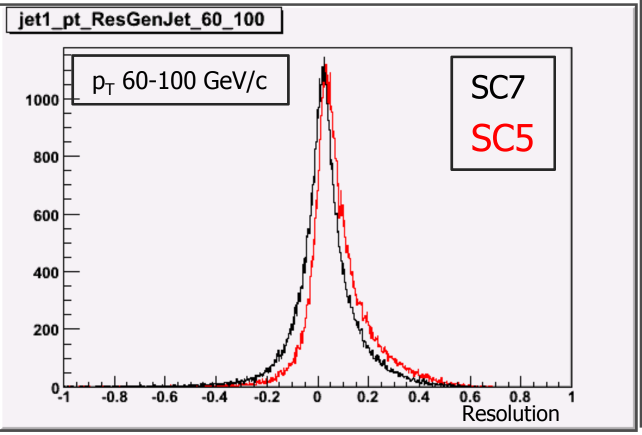
- Jet p_T resolution studies
  - parton-GenJet level.
  - GenJet-CaloJet level.
- H_T resolution studies
- Ratio R_{32}
  - R_{32} at $10pb^{-1}$
  - R_{32} (Calo over Gen)
  - Trigger study
    - Single Jet Triggers efficiencies for R_{32}
    - Single Jet Triggers combination for R_{32}

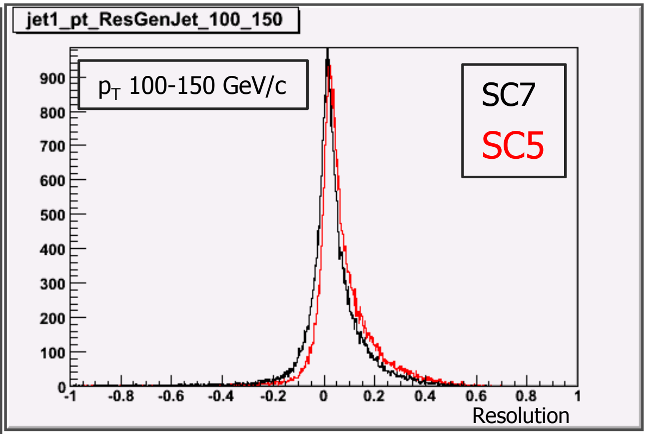
Jet p_T resolution: Parton-GenJet Level

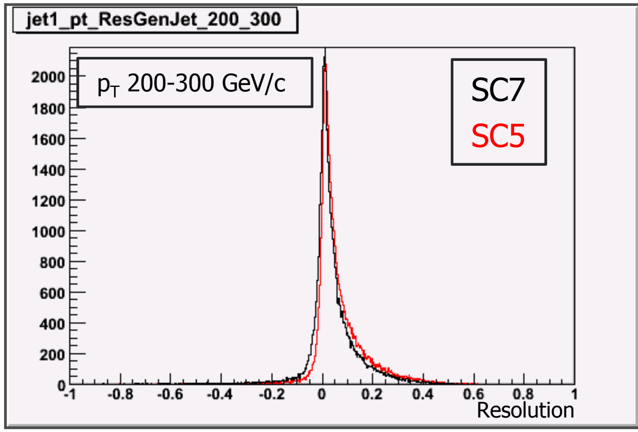
$$p_T \text{ Resolution} = \frac{\text{Parton } p_T - \text{GenJet } p_T}{\text{Parton } p_T}$$

- Splitting Parton p_T interval into bins.
- Non Gaussian shapes
- Tails on the right.

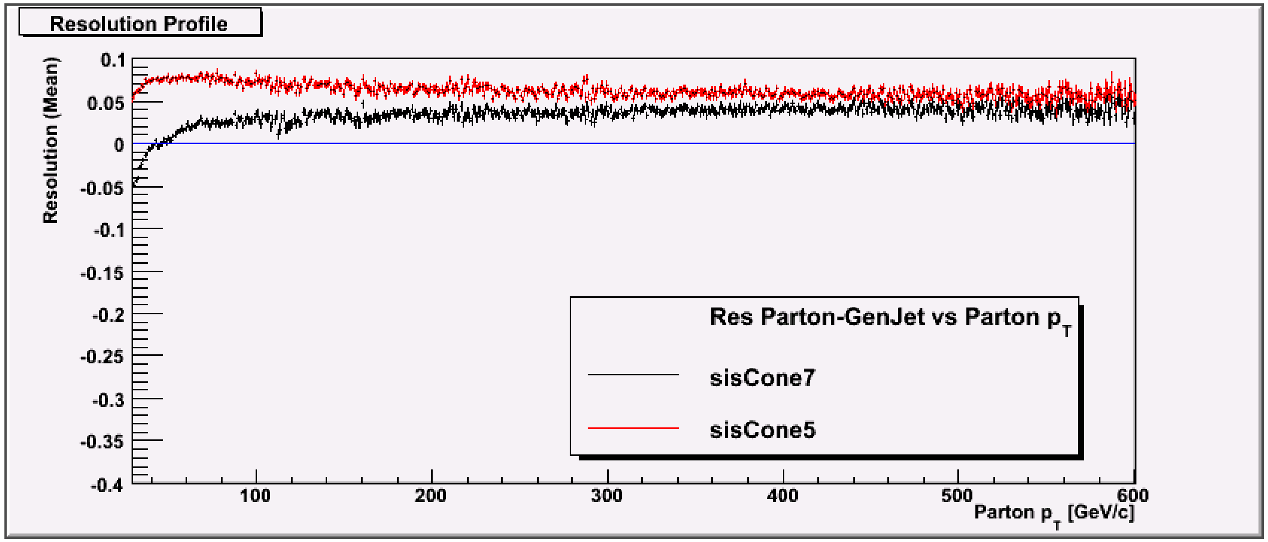




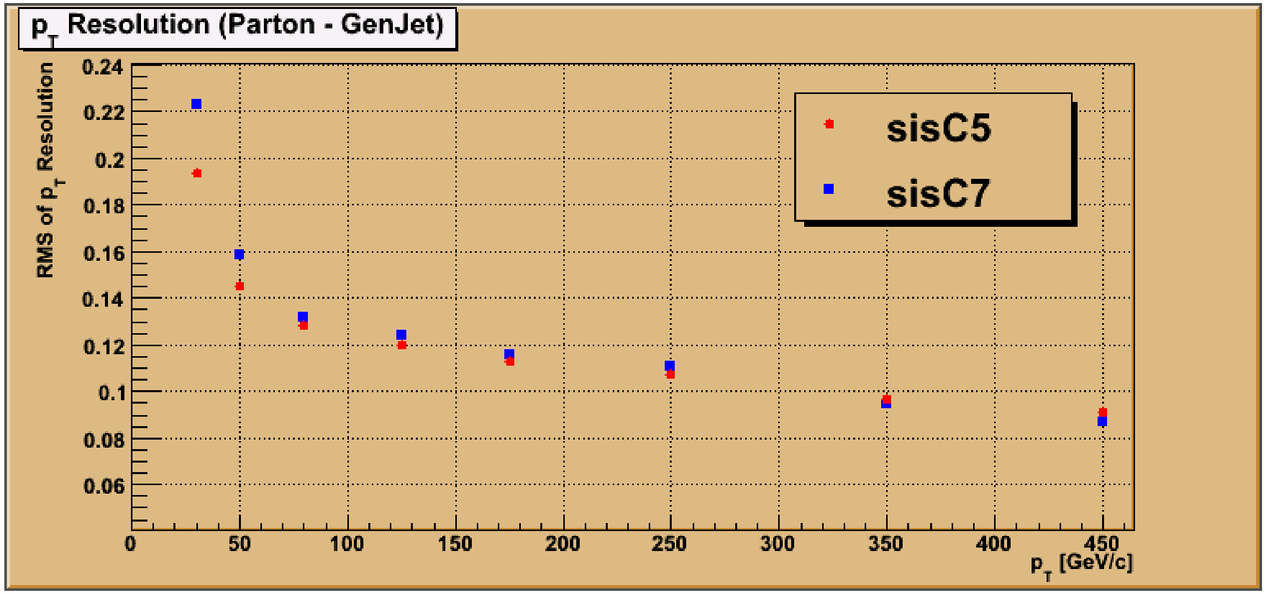




Jet p_T resolution: Parton-GenJet Level



sisCone7 algorithm produces smaller shift than sisCone5 as expected



For p_T>75 GeV/c no difference for sisCone7 - sisCone5

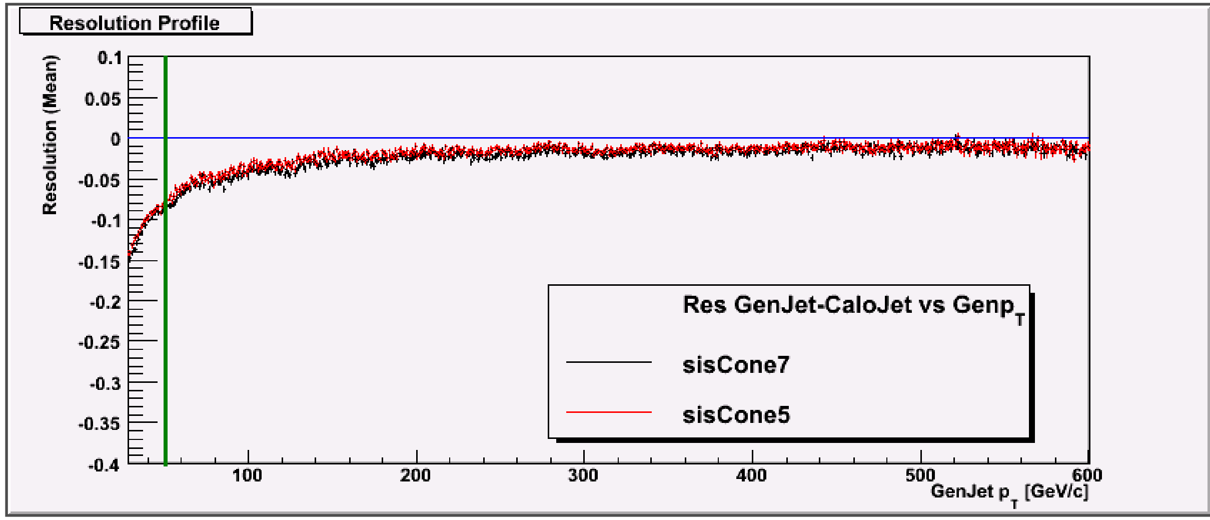
Jet p_T resolution: GenJet-CaloJet Level

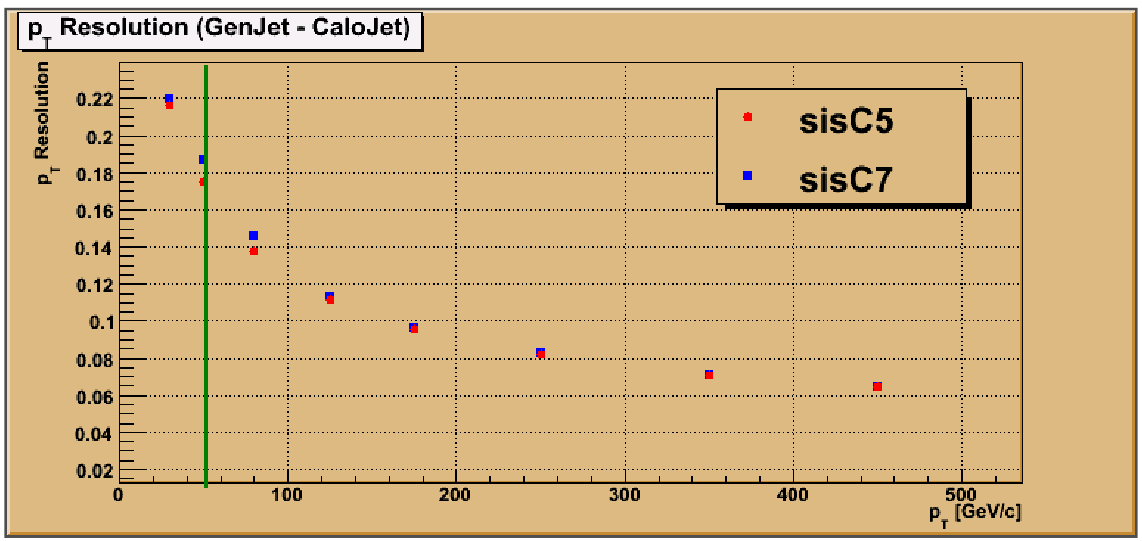
$$p_T\ \text{Resolution} = \frac{\text{GenJet}\ p_T - \text{CaloJet}\ p_T}{\text{GenJet}\ p_T}$$

sisCone7 and sisCone5 algorithms do behave the same

At $p_T \approx 50$ GeV/c mean value is shifted by 8%
(CaloJet is overestimated)

Around 50 Gev/c p_T resolution ~18%





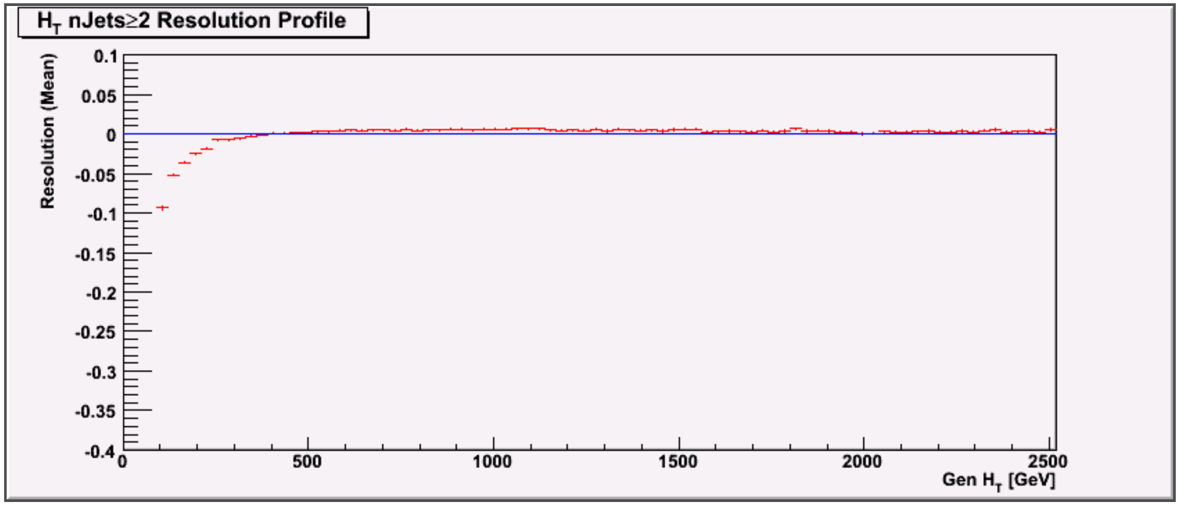
H_T resolution

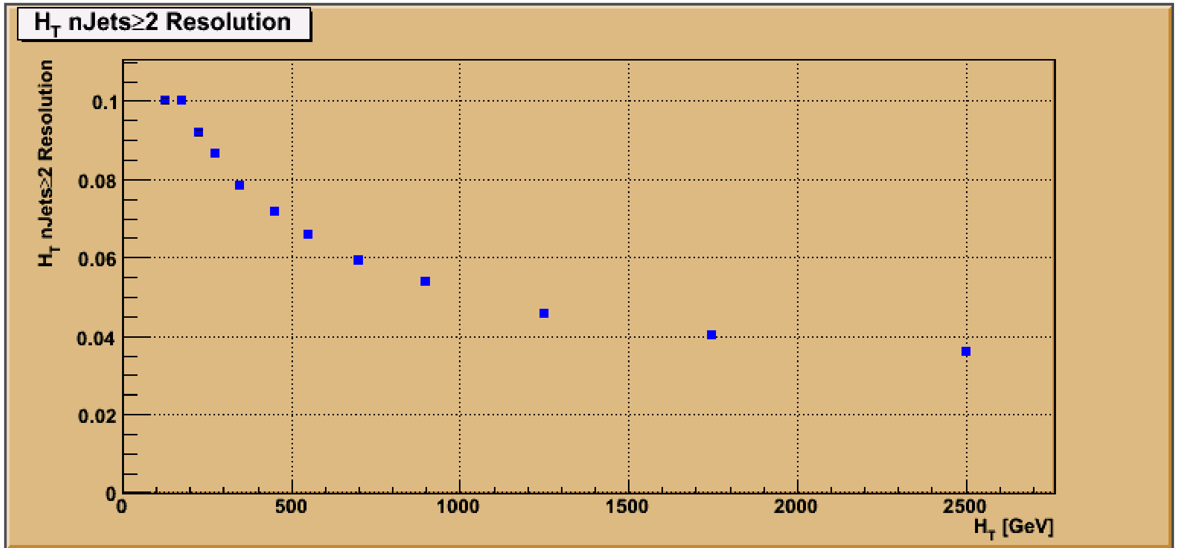
$$H_T \text{ Resolution} = \frac{\text{Gen } H_T(\text{nJets} \geq 2) - \text{Calo } H_T(\text{nJets} \geq 2)}{\text{Gen } H_T(\text{nJets} \geq 2)}$$

Important study to define the binning for the ratio.

Below 400 GeV mean value is shifted to negative values (Calo H_T is overestimated)

Around 200 Gev H_T (nJets ≥2) resolution ~10%





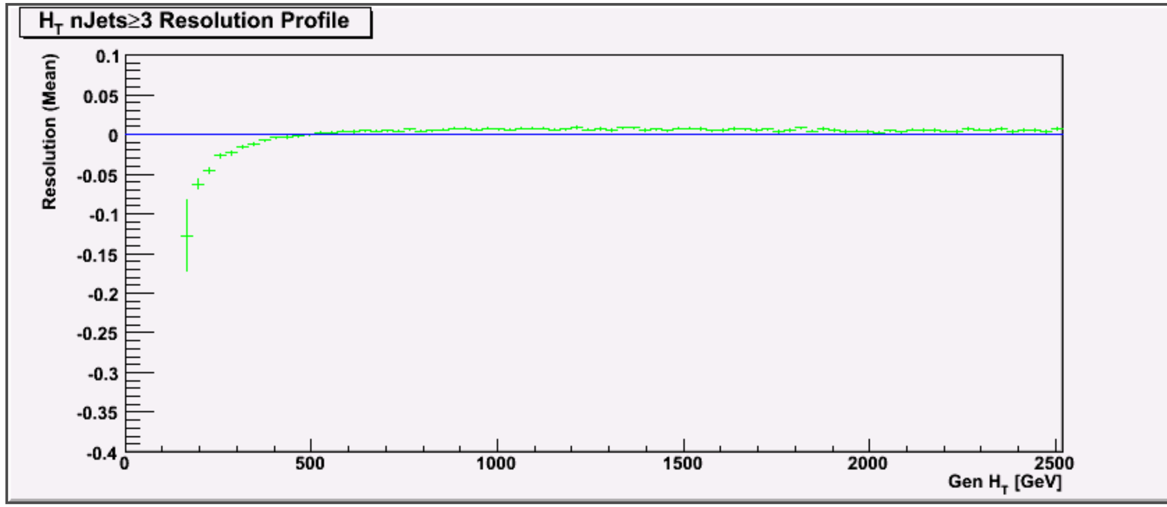
H_T resolution

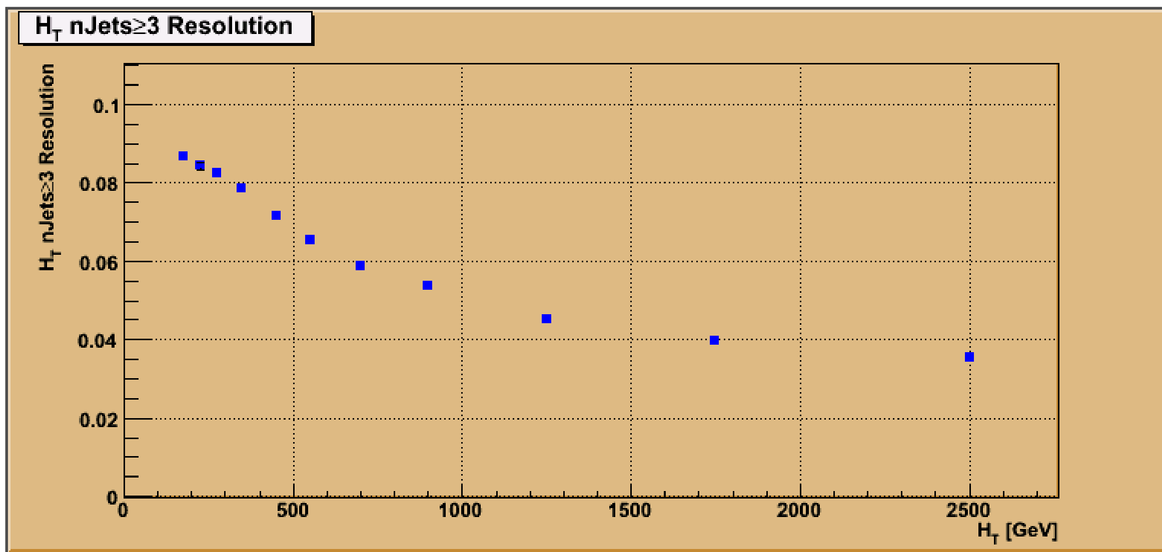
$$H_T \text{ Resolution} = \frac{\text{Gen } H_T(\text{nJets} \geq 3) - \text{Calo } H_T(\text{nJets} \geq 3)}{\text{Gen } H_T(\text{nJets} \geq 3)}$$

Below 400 GeV mean value is shifted to negative values

(Calo H_T is overestimated)

Around 200 Gev H_T (nJets ≥3) resolution ~9%





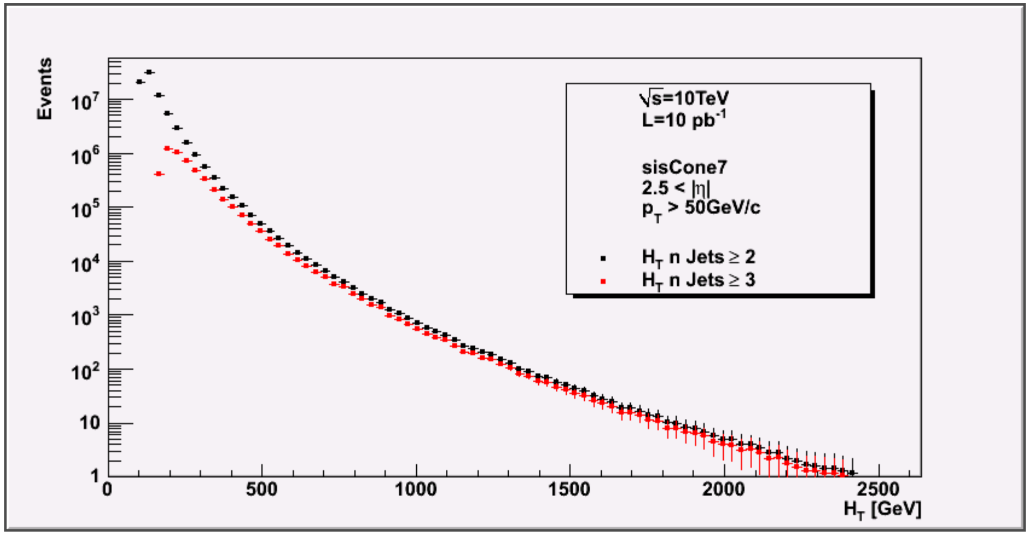
Ratio R32

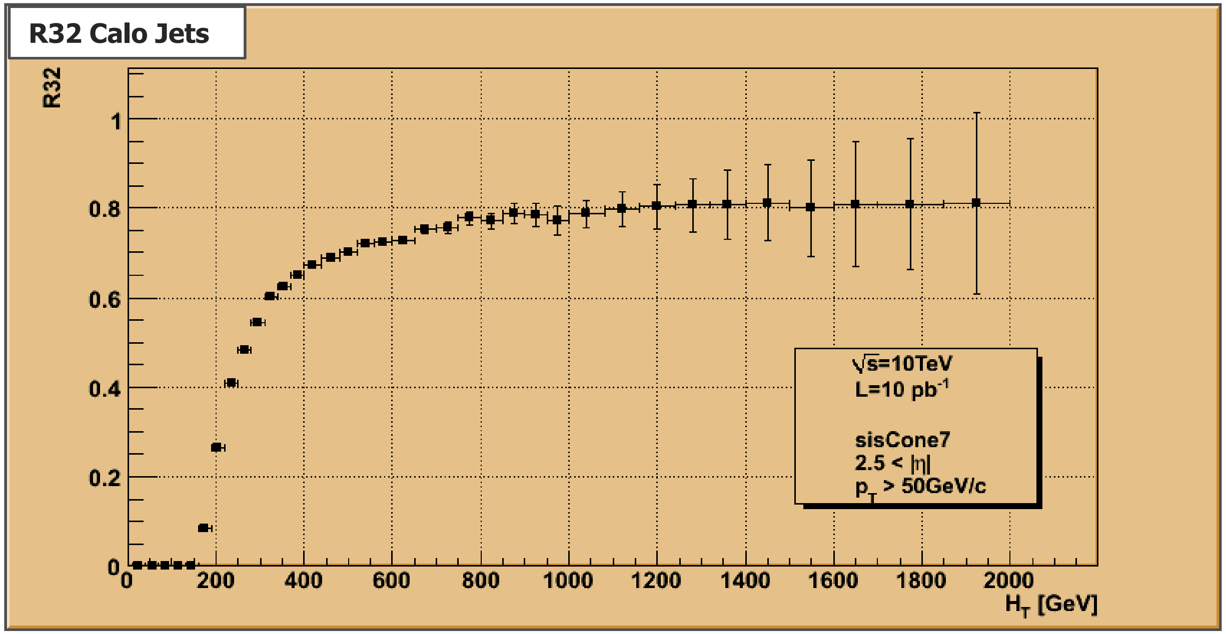
Evaluation of 3Jet over 2Jet Ratio vs H_T.

$$R_{32} = \frac{\sigma_3}{\sigma_2} = \frac{\sigma(pp \to n \ \ jets \ + X; \ n \geq 3)}{\sigma(pp \to n \ \ jets \ + X; \ n \geq 2)}$$

Event Selection cuts:

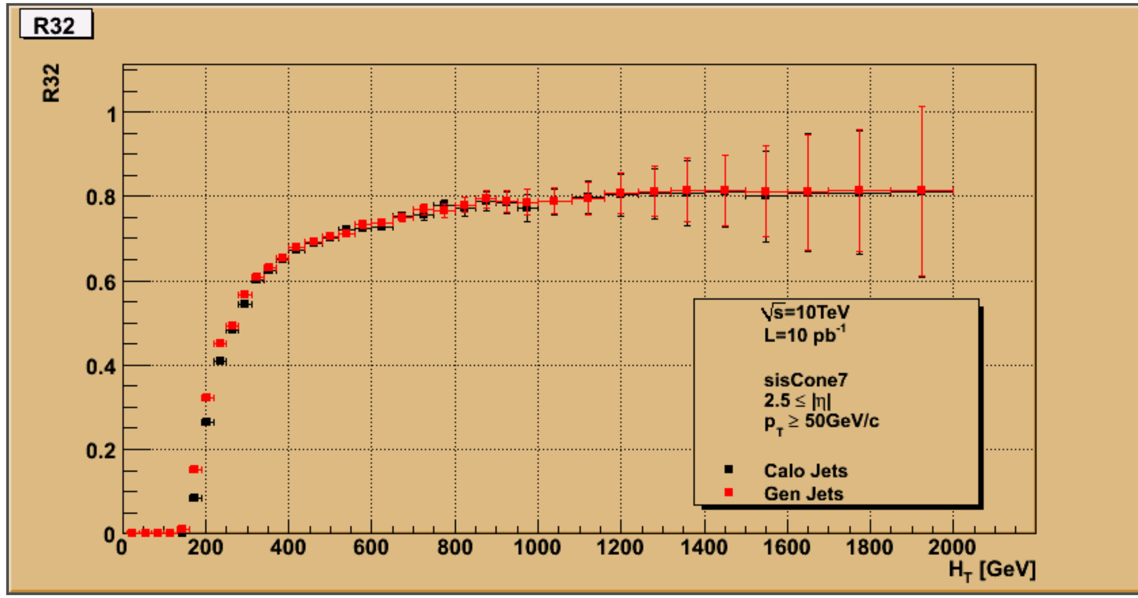
$|\eta|<2.5$ and Jet $p_T \geq 50$ GeV/c



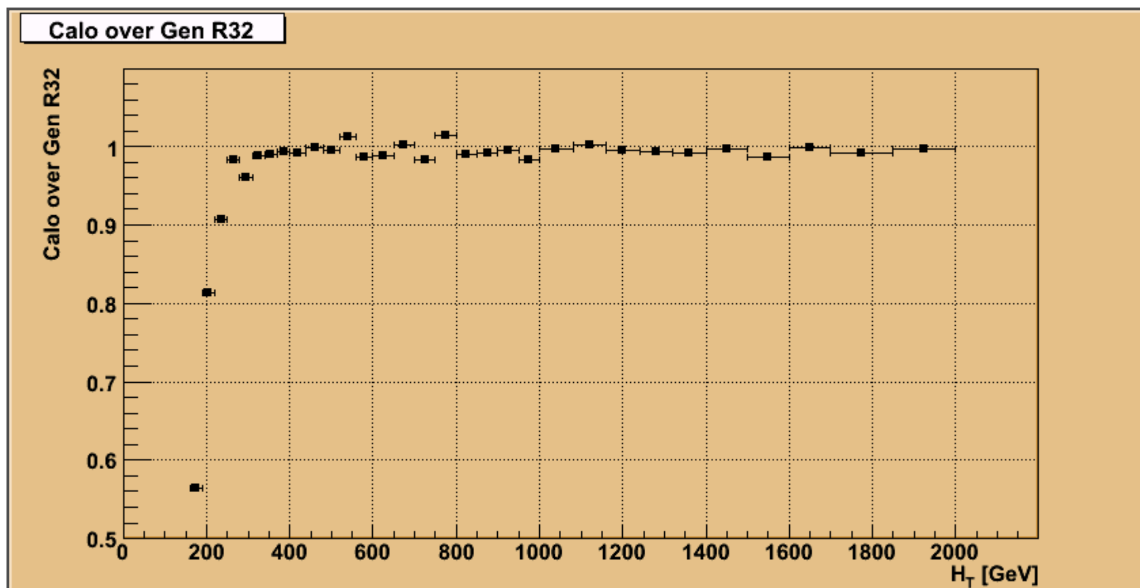


Ratio 32: Calo over Gen

The shift of jet p_T mean value taken into account when plotting the ratio using GenJets

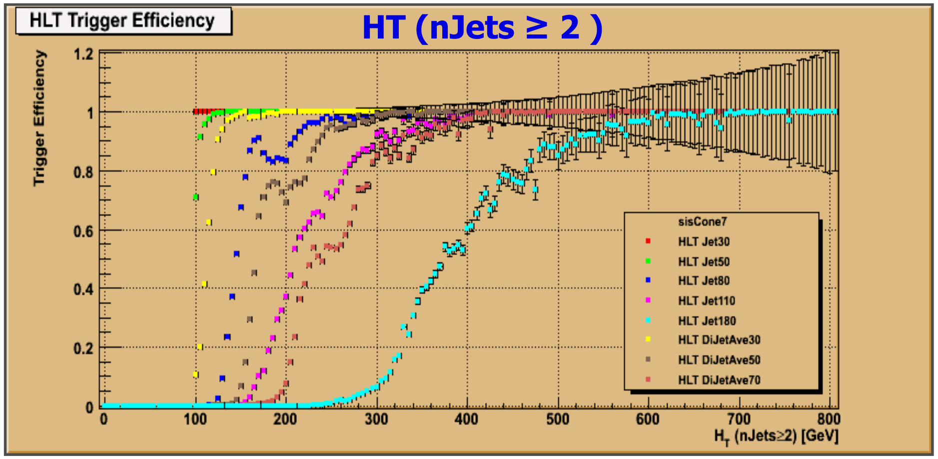


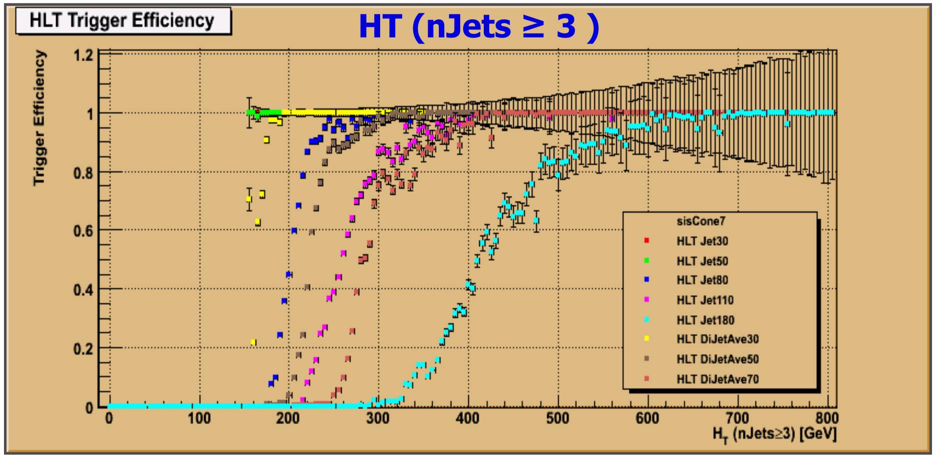
Above 300 GeV practically no detector effect.



Trigger Study : HT (nJets ≥ 2 & nJets ≥ 3)

Transparency from previous presentation





Trigger	HT (nJets≥2) Threshold (99% efficient)	HT (nJets≥3) Threshold (99% efficient)
HLT Jet 30	100 GeV	155 GeV
HLT Jet 50	120 GeV	155 GeV
HLT Jet 80	240 GeV	300 GeV
HLT Jet 110	390 GeV	410 GeV
HLT Jet 180	600 GeV	620 GeV
HLT DiJetAve 30	150 GeV	195 GeV
HLT DiJetAve 50	300 GeV	315 GeV
HLT DiJetAve 70	410 GeV	410 GeV

HLT Jet50 fully efficient from 155 GeV.
HLT DiJetAve30 fully effic. from 195 GeV.

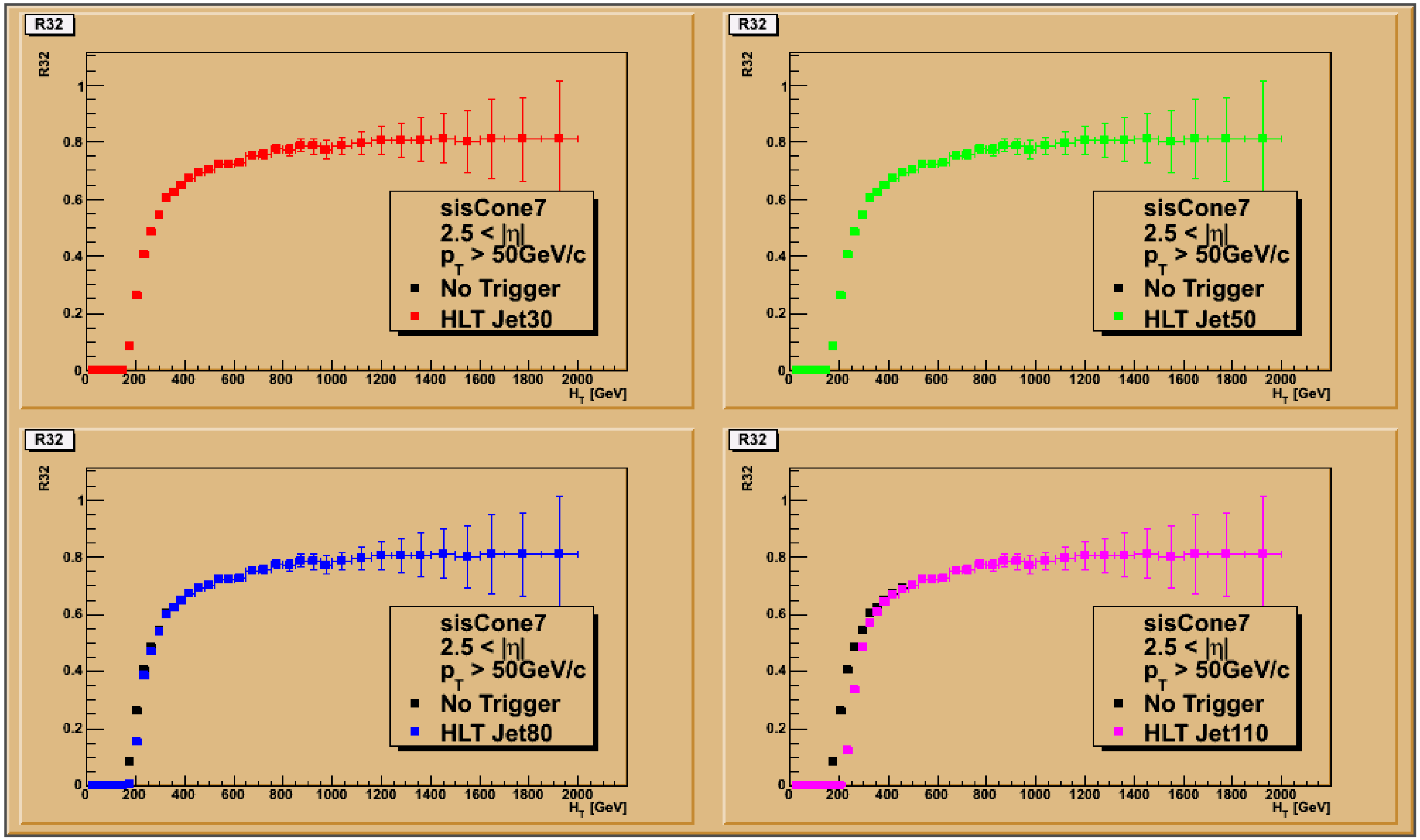
⇓

More suitable for data taking the Single Jet (50 & 110) triggers than the DiJetAve (30 & 70)

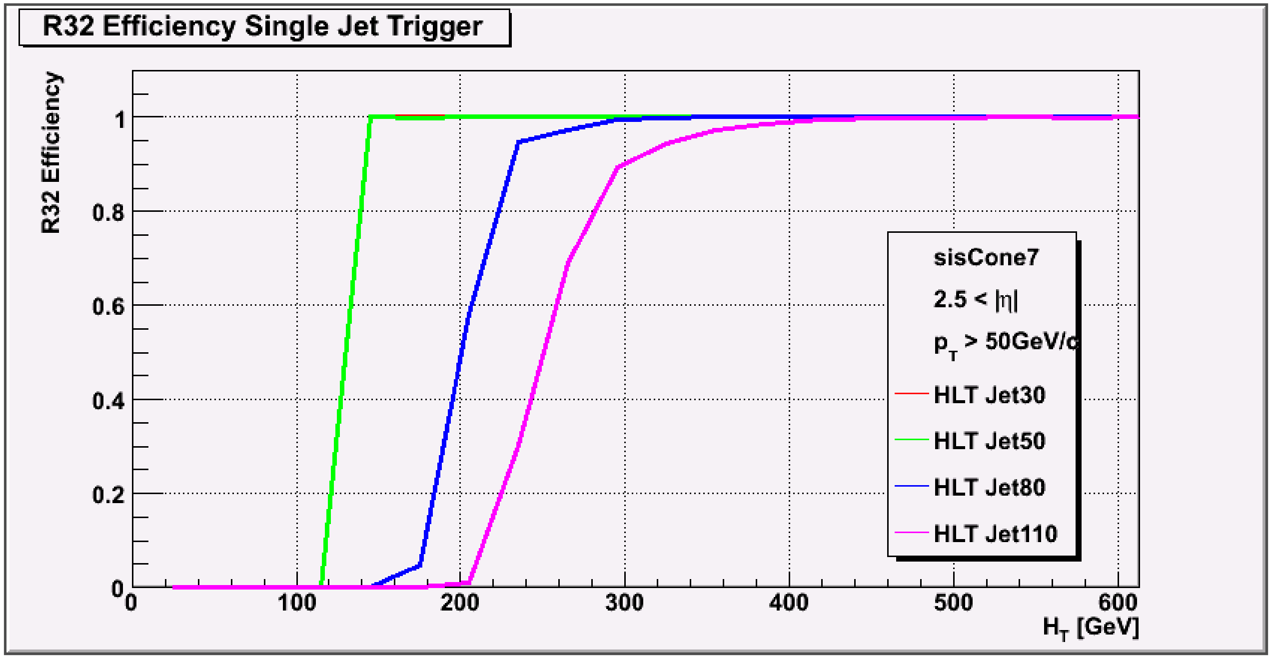
Trigger study: Single Jet Triggers

- Concentrate to Single Jet Triggers.
- Evaluate efficiency for ratio R_{32} .

Path name	L1 Trigger
HLT Jet30	L1_SingleJet15
HLT Jet50	L1_SingleJet30
HLT Jet80	L1_SingleJet50
HLT Jet110	L1_SingleJet70



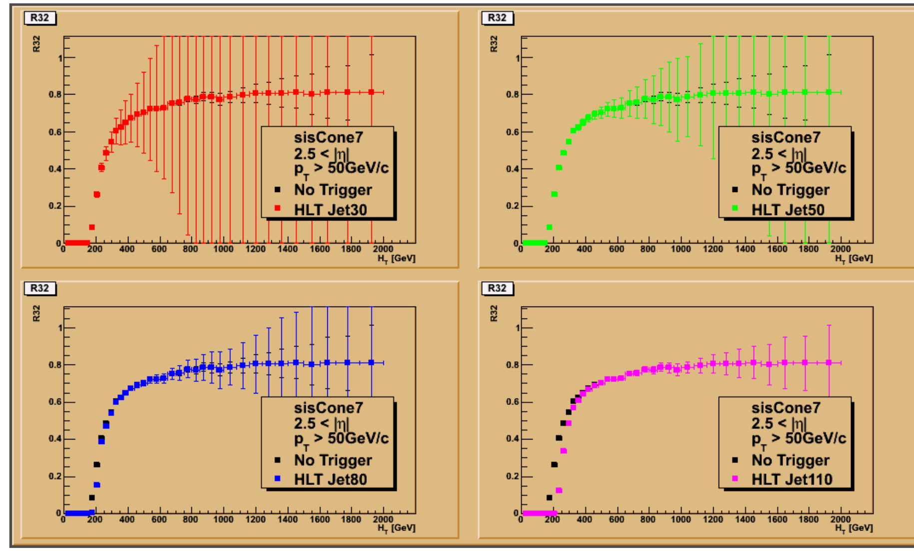
Trigger study: Single Jet Triggers



Trigger Path name	Threshold (99% efficient)
HLT Jet30	150
HLT Jet50	150
HLT Jet80	350
HLT Jet110	500

Trigger study: Single Jet Triggers

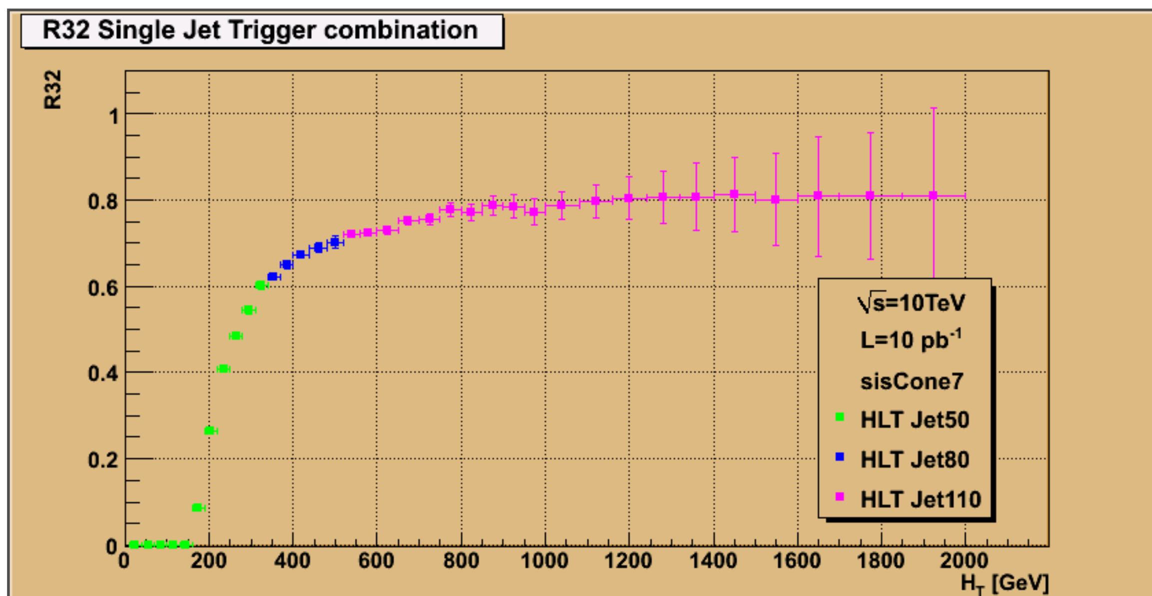
Path name	L1 Trigger	Prescale (L1xHLT)
HLT Jet30	L1_SingleJet15	500x5
HLT Jet50	L1_SingleJet30	50x1
HLT Jet80	L1_SingleJet50	5x2
HLT Jet110	L1_SingleJet70	1



Triggers for data collection

- HLT Jet50 (prescale 50x1)
- HLT Jet80 (prescale 5x2)
- HLT Jet110 (prescale 1)

Trigger HLT Jet50 can be tested using trigger HLT Jet30



Summary & Plans

- sisCone7 and sisCone5 algorithms do behave very similar. We select to work with sisCone7
  - because it produces smaller shift (Parton-GenJet level)
  - we want also to be compatible with Tevatron.

- With a Luminosity of $10pb^{-1}$ is possible to extend the measurement of the ratio up to H_T~1500 GeV (~3 times the scale of Tevatron).

- The ratio can be measured with a combination of three HLT Single Jet Triggers: (HLT Jet50, HLT Jet80, HLT Jet110).

Next steps (following the initial plan):

- Estimate the dominant systematics on the experimental measurement (Jet Energy Scale…)
- Estimate the magnitude of hadronisation correction
- Compute the theoretical rate with NLO programs and estimate the uncertainty due to μ_R, μ_F