

# Exploring azimuthal correlations in multijets events

A. Bermudez Martinez

Short-term studentship project with  
Leif, Torbjörn and Johannes

April, 2018



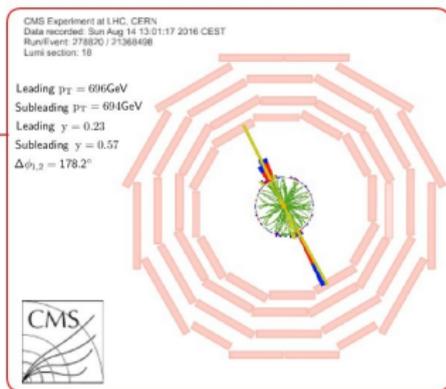
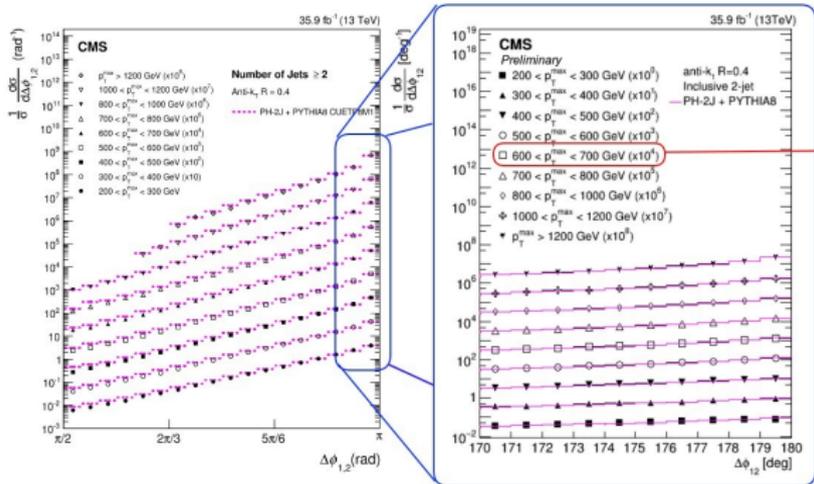
## Outline

- Correlations in 2- and 3-jet events
- Correlations 4-jet events
- Outlook

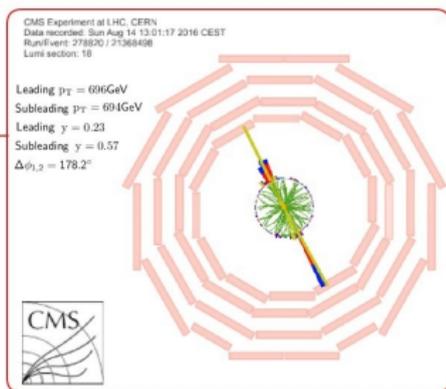
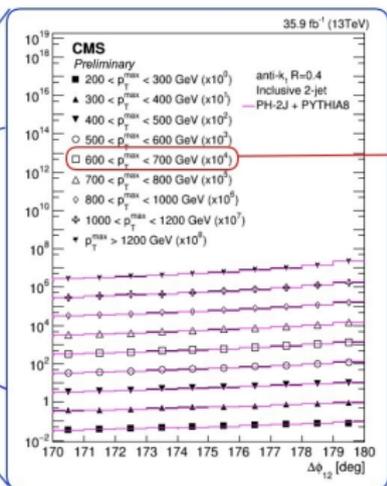
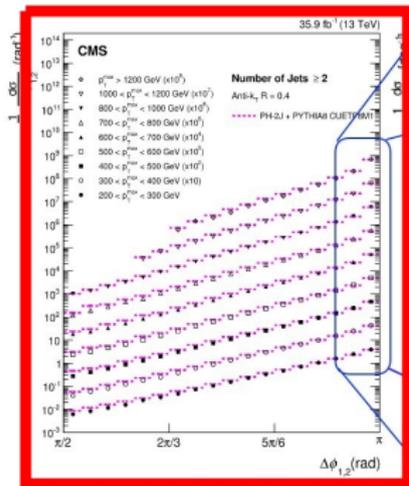


Thank you.

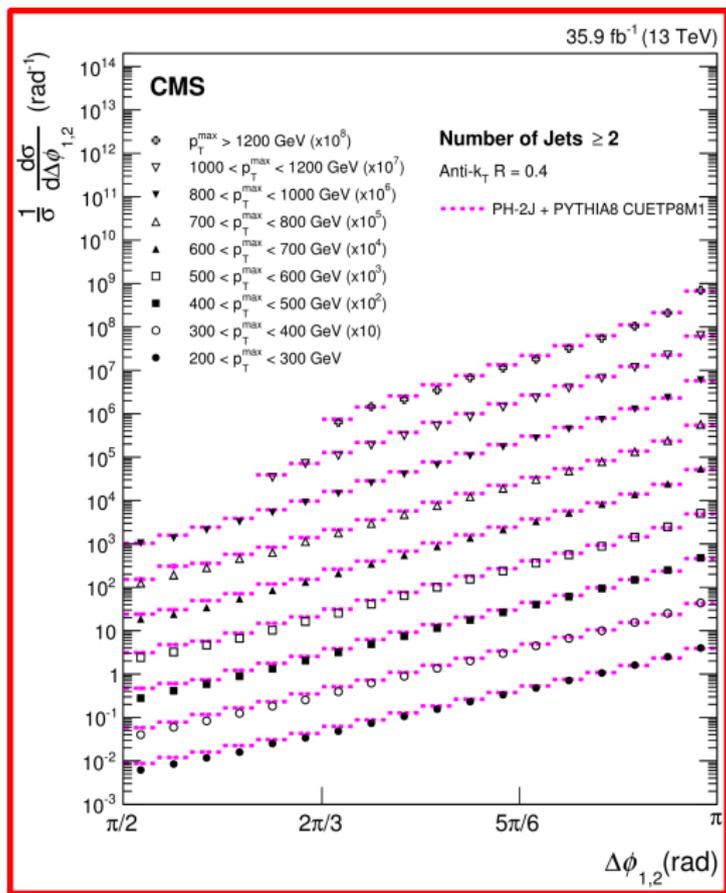
# Azimuthal correlations in 2-jets events



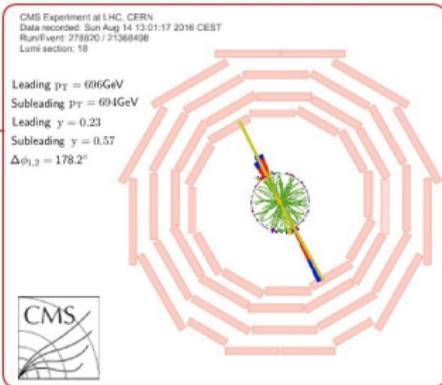
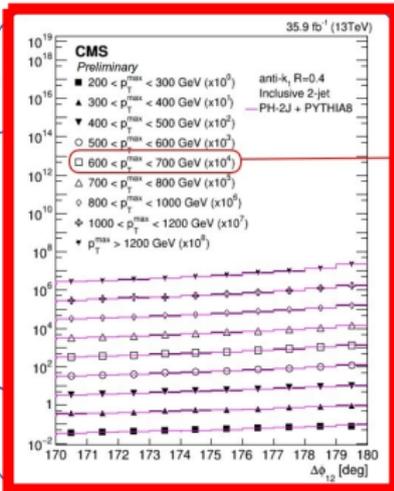
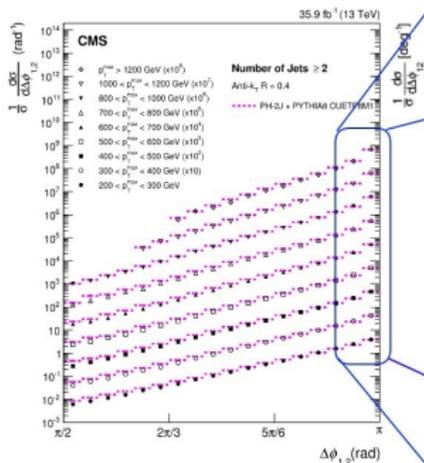
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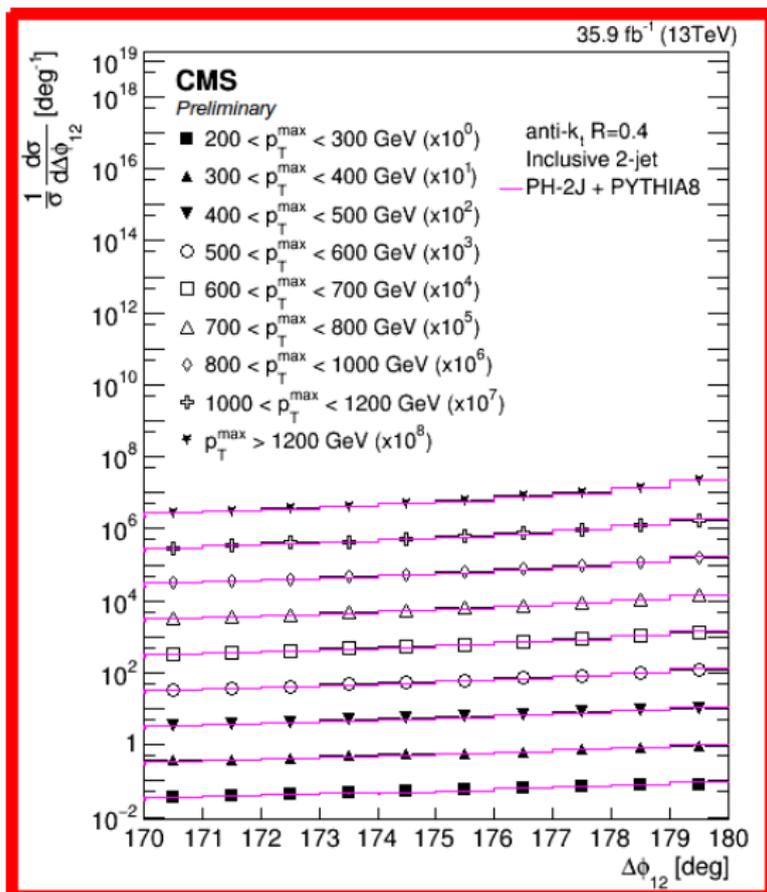
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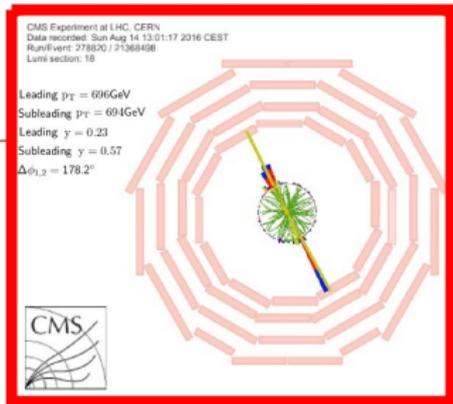
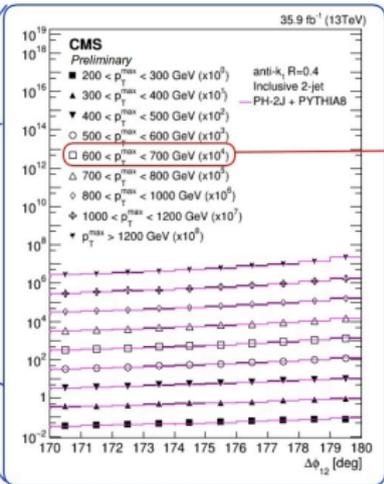
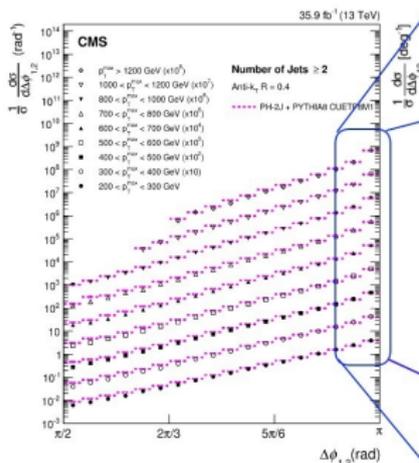
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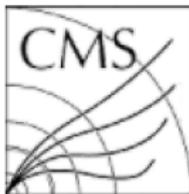
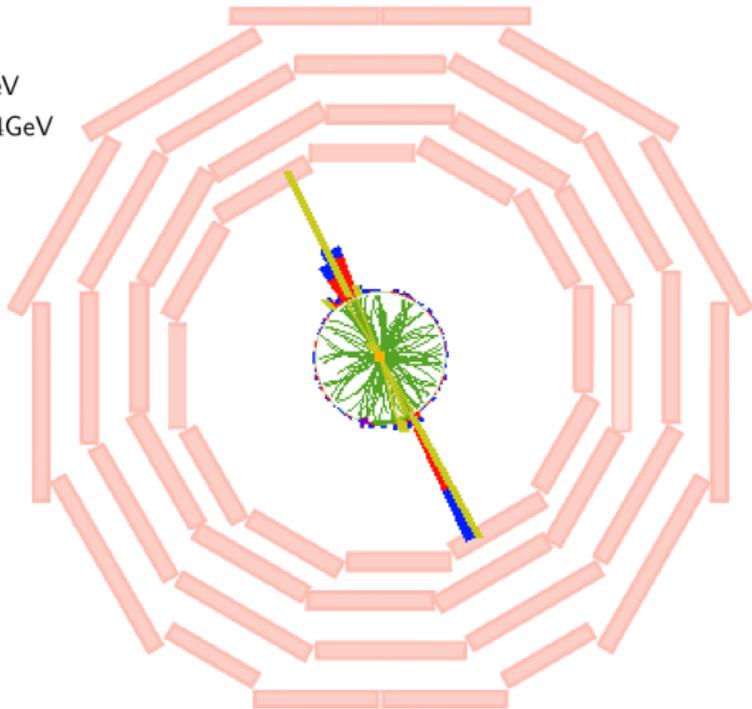
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## Azimuthal correlations in 2-jets events

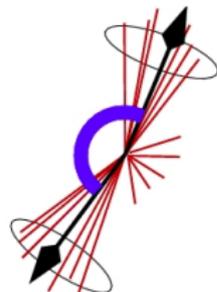
CMS Experiment at LHC, CERN  
Data recorded: Sun Aug 14 13:01:17 2016 CEST  
Run/Event: 278820 / 21368498  
Lumi section: 18

Leading  $p_T = 696\text{GeV}$   
Subleading  $p_T = 694\text{GeV}$   
Leading  $y = 0.23$   
Subleading  $y = 0.57$   
 $\Delta\phi_{1,2} = 178.2^\circ$

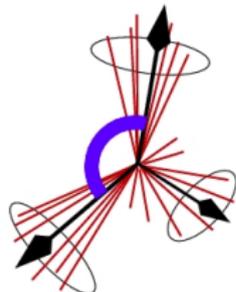


## Azimuthal correlations in 2- and 3-jets events

Inclusive 2-jet



Inclusive 3-jet

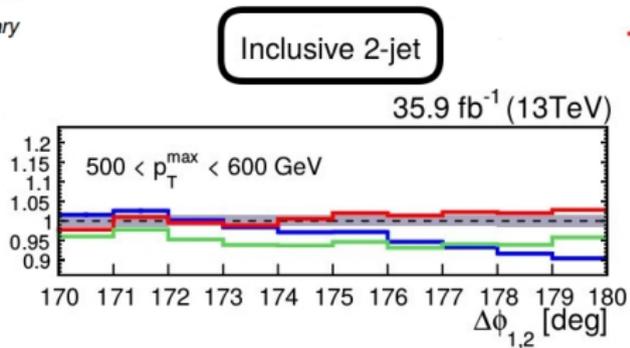


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**CMS**

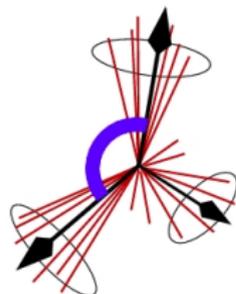
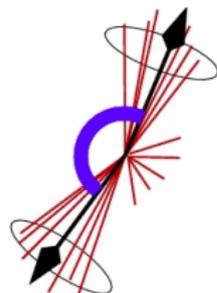
Preliminary

Ratio to data



Inclusive 3-jet

- PYTHIA8
- Herwig++
- MadGraph + PYTHIA8

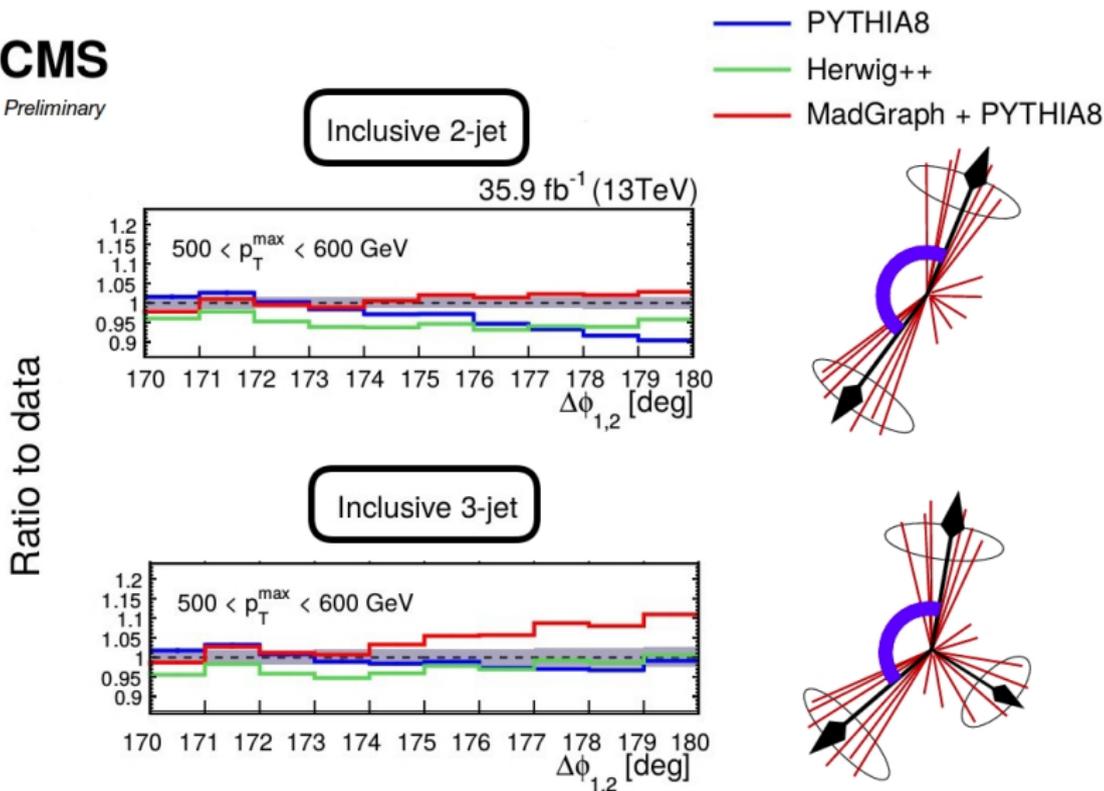


## Azimuthal correlations in 2- and 3-jets events

- Tension between data and predictions  $\sim 12\%$
- Counter intuitive performance
- Non of them is able to describe both simultaneously

**CMS**

Preliminary

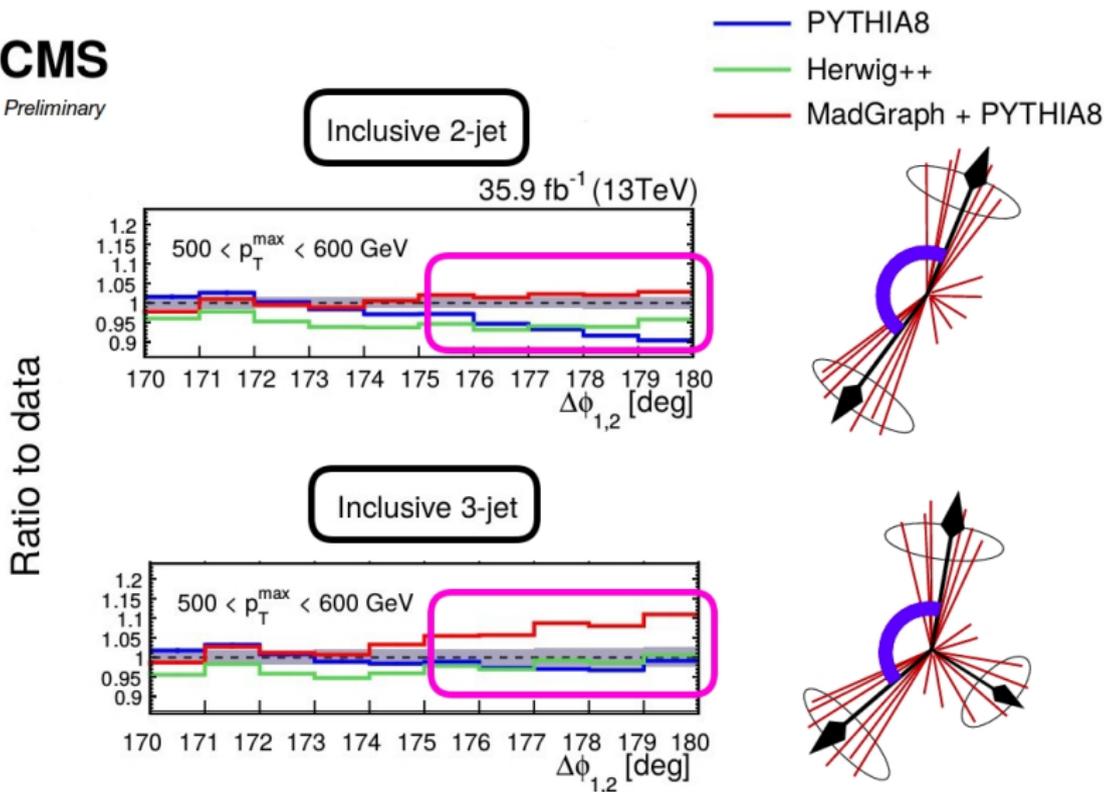


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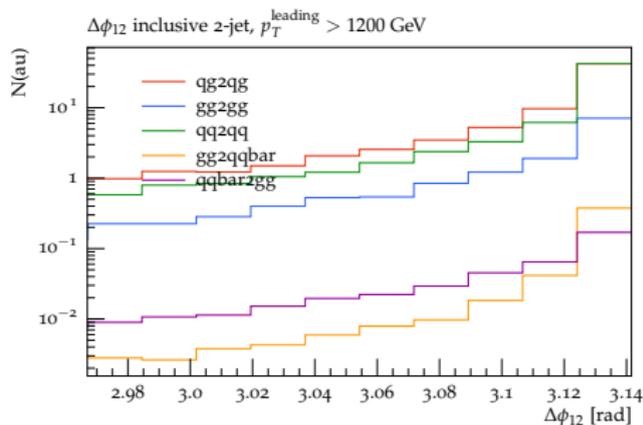
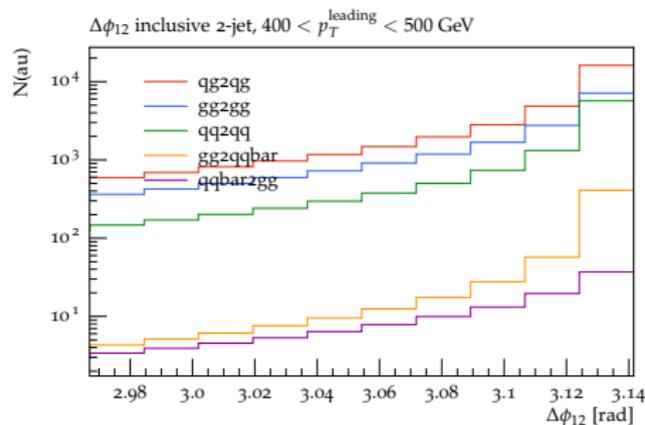
**CMS**

Preliminary



## Outlook for back-to-back dijet events

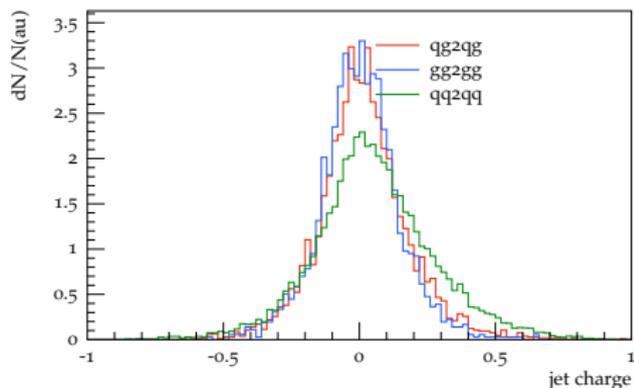
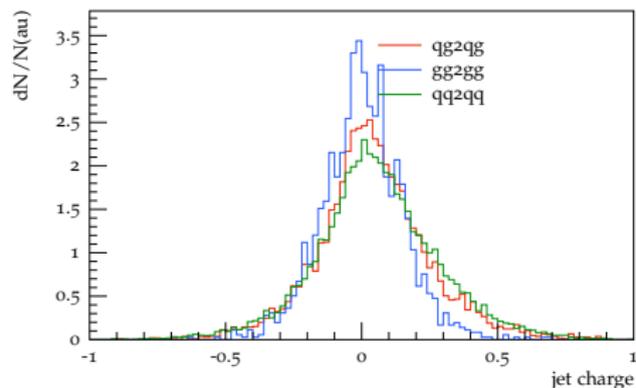
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- Showers in Pythia and Herwig (cut-off scales, recoil strategies, ...)
- Go differential in rapidity



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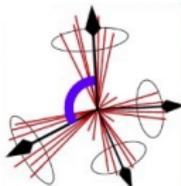
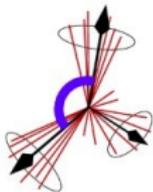
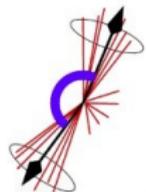
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### Jet charge



# $\Delta\phi_{2j}^{min}$ in 4-jets events

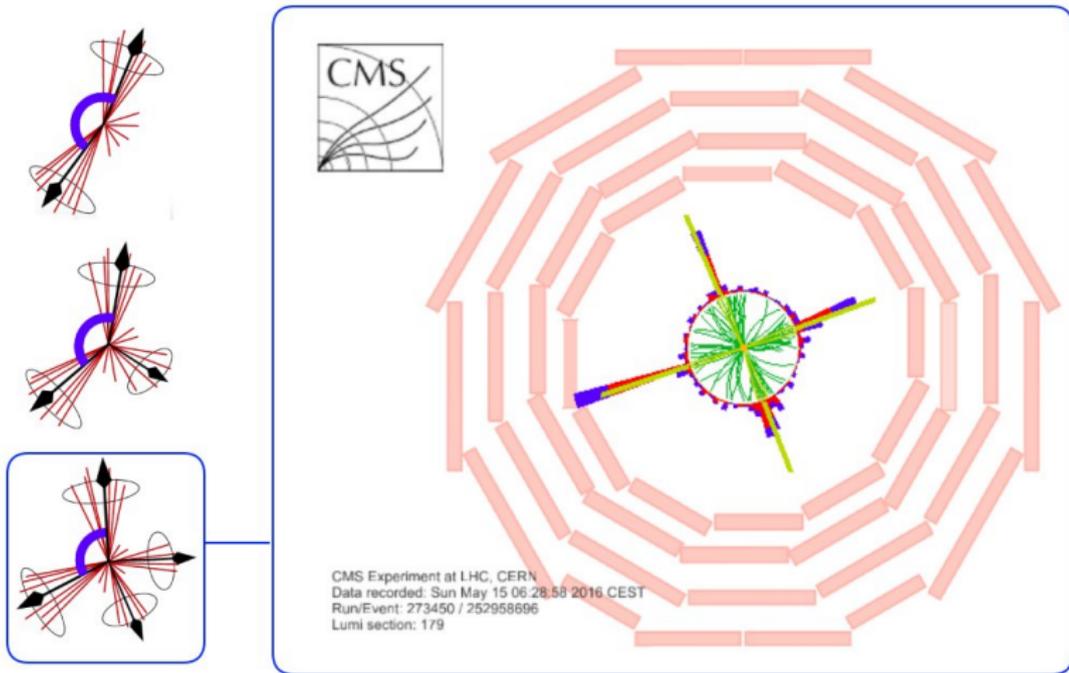
arXiv:1712.05471 [hep-ex]



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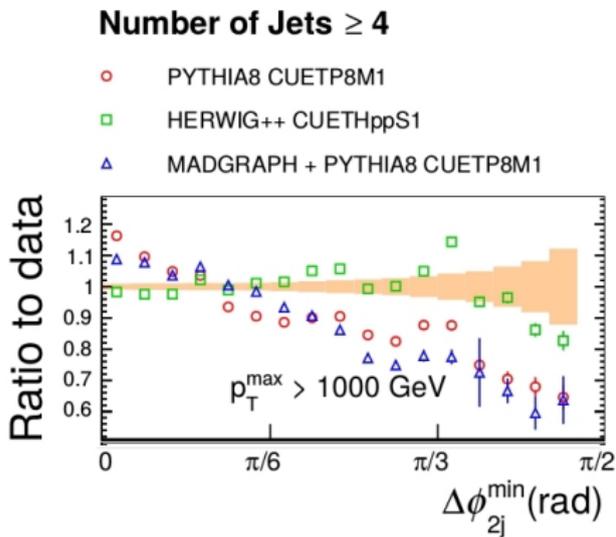
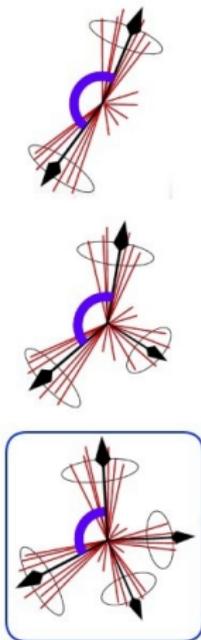
- Require at least a four jets with  $p_T > 100$  GeV
- Minimum  $\Delta\phi$  between all the pairs



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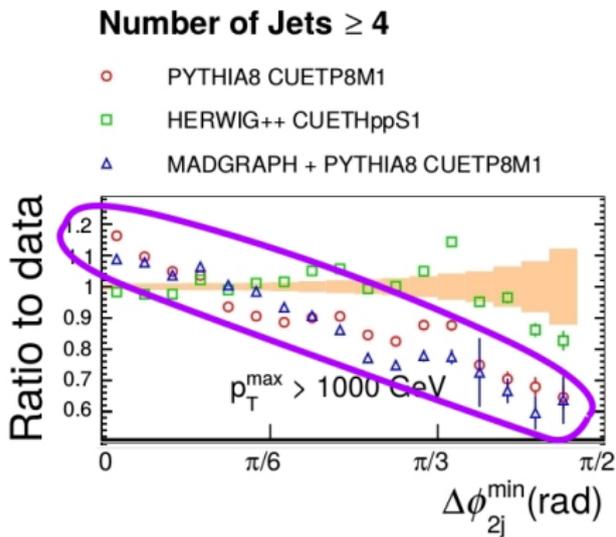
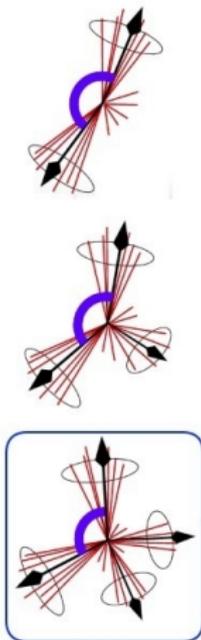
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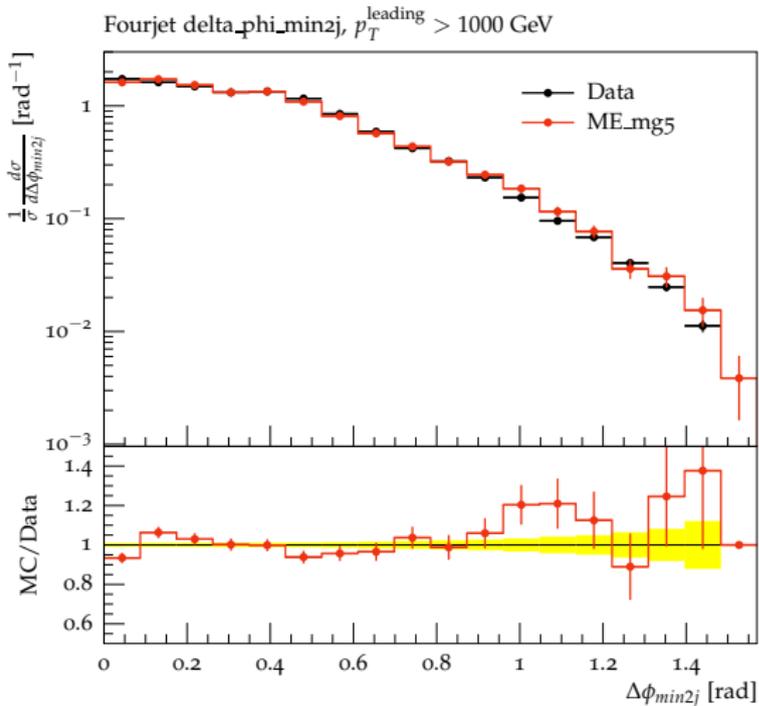
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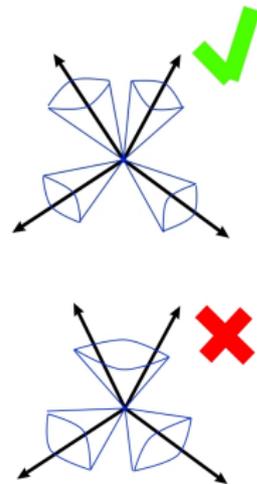
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# $\Delta\phi_{2j}^{min}$ in 4-jets events at the ME level

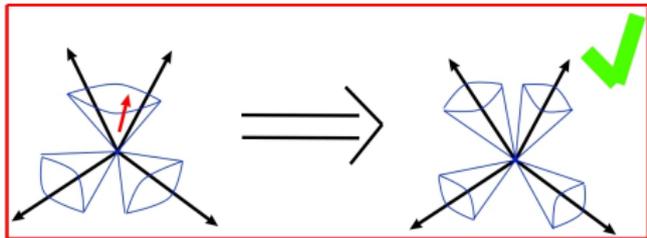
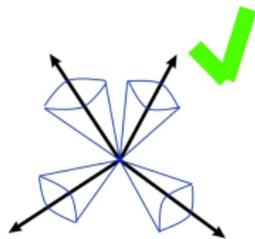
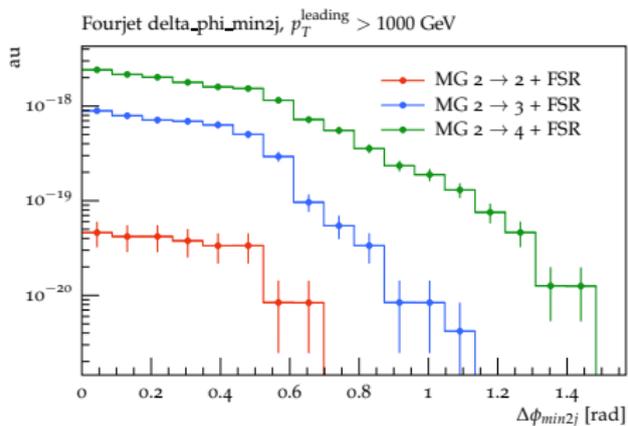


- Four hard jets should be described by  $2 \rightarrow 4$  matrix elements



## $\Delta\phi_{2j}^{min}$ in 4-jets events after PS

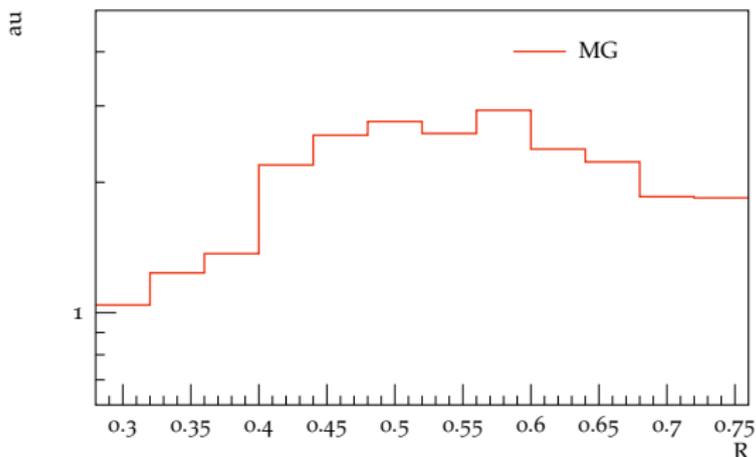
- Merging different multiplicities



## Outlook for 4-jet events

- playing with the generation cuts (kt or cone merging)
- Study other matching schemes (CKKW, CKKW-L)
- Study the effect in other observables
- Investigate in detail the 3-parton events resolved as 4-parton ones by the PS.

### Resolving 4-jets, R scan



Thank you.