

On coherence-sensitive observables

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Outline

Coherence in a nutshell

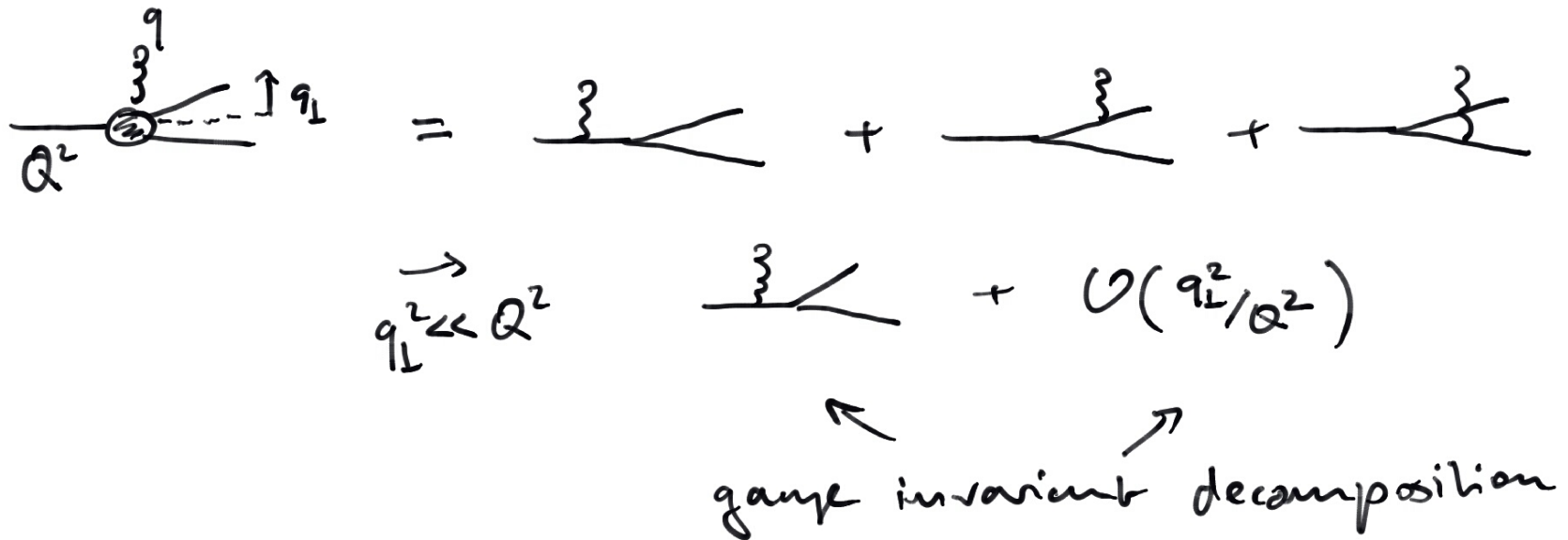
Experimental tests

New observables in e^+e^-

Summary

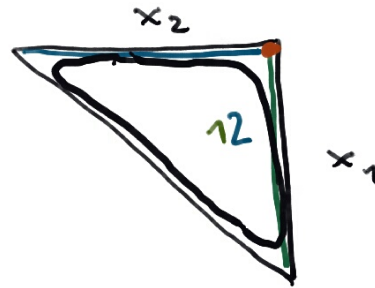
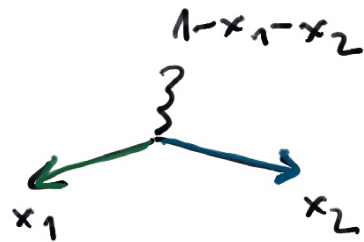
Coherence in a nutshell

Governs soft emissions off collinear systems, manifest at amplitude level.
Multi-emission property.



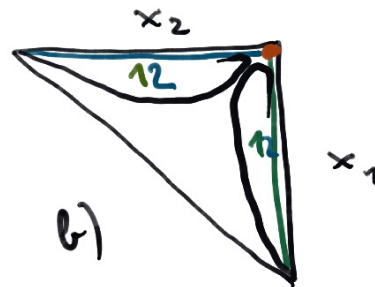
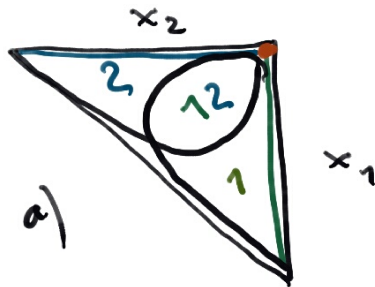
Emission appears as if the soft gluon came from the branching parent:
“Wave-length too long to resolve individual colour charges.”

Avoiding soft double counting & implementing coherence



ANTENNAE

full phase space,
full Eikonal



PARTITIONED

- a) overlapping phase space, "half" Eikonal
- b) disjoint phase space, full Eikonal

Angular ordering either explicitly or through dipole-type setup.

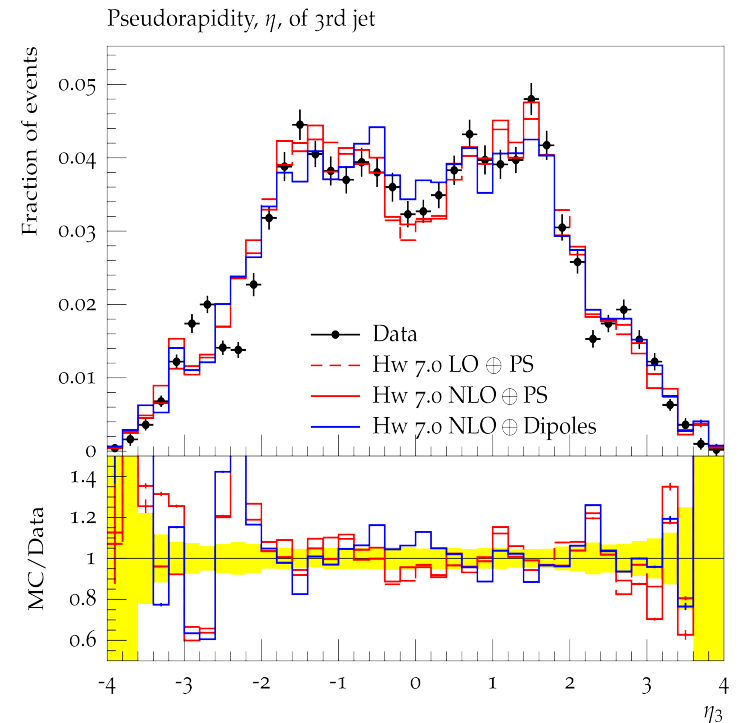
Experimental manifestation

[Herwig 7 release on Tevatron jet data]

First manifest observation and test at the Tevatron.

Virtuality ordering will show a pronounced discrepancy.

Always problematic: Mixture of a number of different colour flows, no clean probe of coherent evolution.

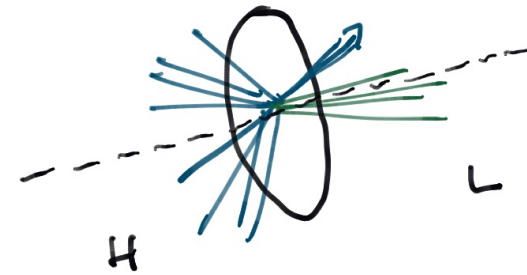
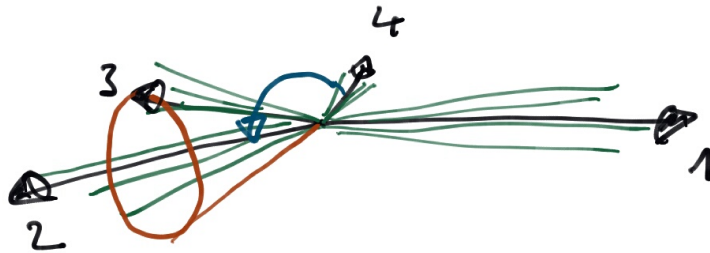


Hard to tell if there is anything systematic unless we have cleaner probes. We can't really make up a “bad” shower, but we can design observables sensitive to coherent effects to systematically judge the predictions.

New observables?

[Plätzer, Gieseke 2009] [Gieseke, Fischer, Plätzer, Skands 2014],

Natural to look back at e^+e^- and explicitly check angular ordering properties. Jet masses probe more complex radiator systems.



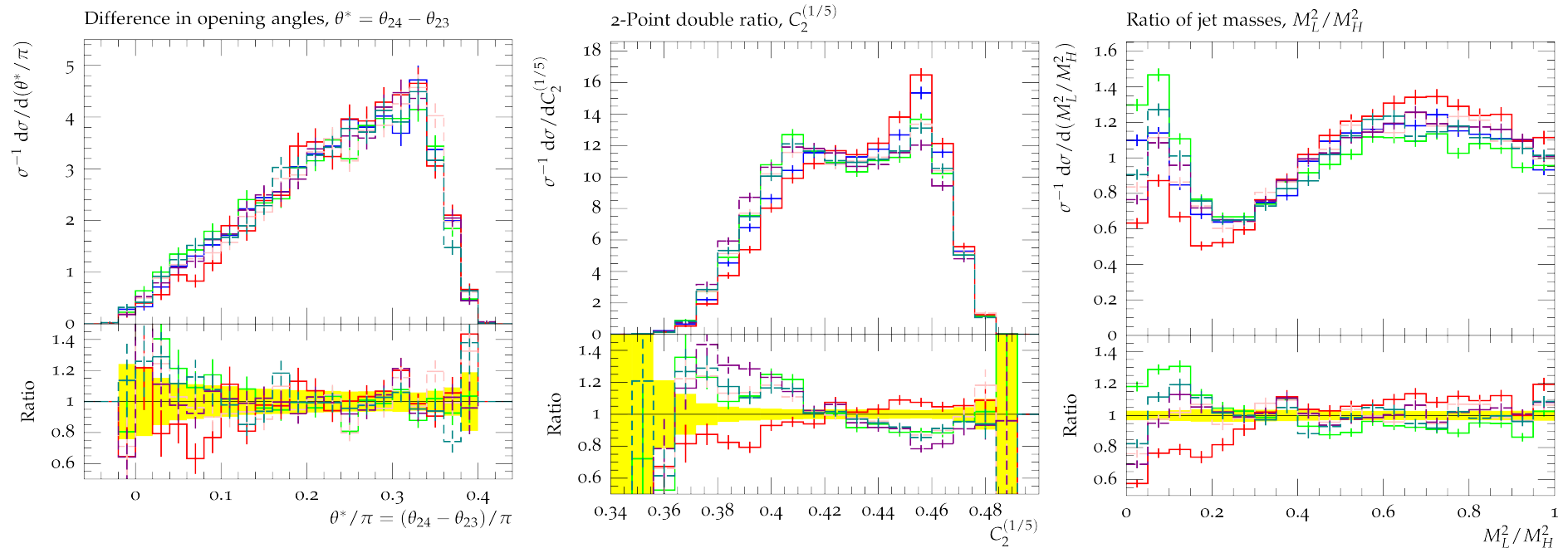
Energy-energy correlation functions should probe similar effects, but might also be sensitive to differences in recoil schemes.

Jet opening angles showed significant differences at parton level for different ordering in dipole-type showers.

New observables?

[Gieseke, Fischer, Plätzer, Skands 2014],

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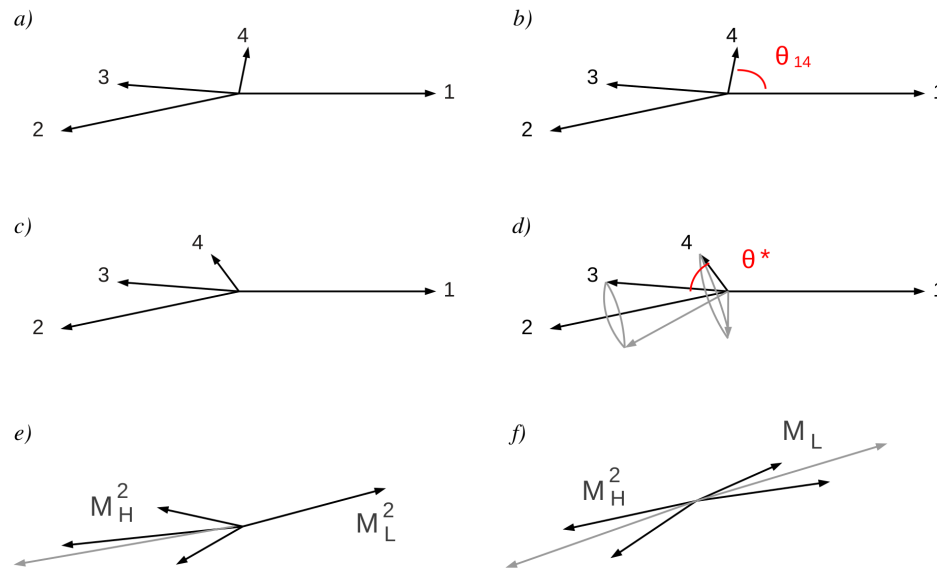


Cumulants/asymmetries of spectra more sensitive.

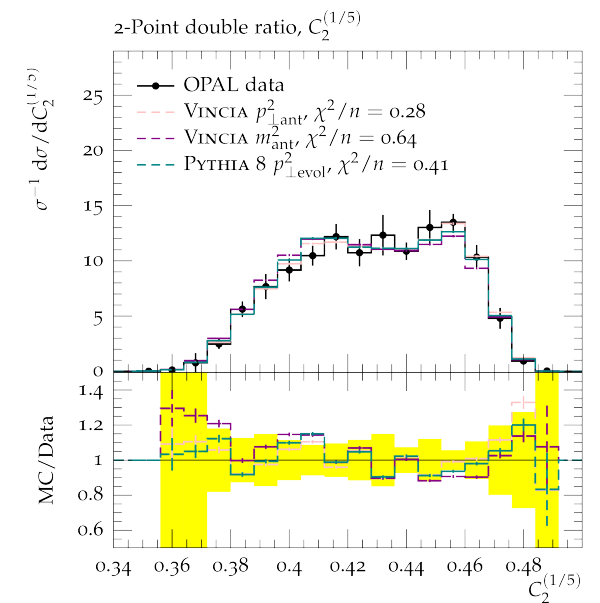
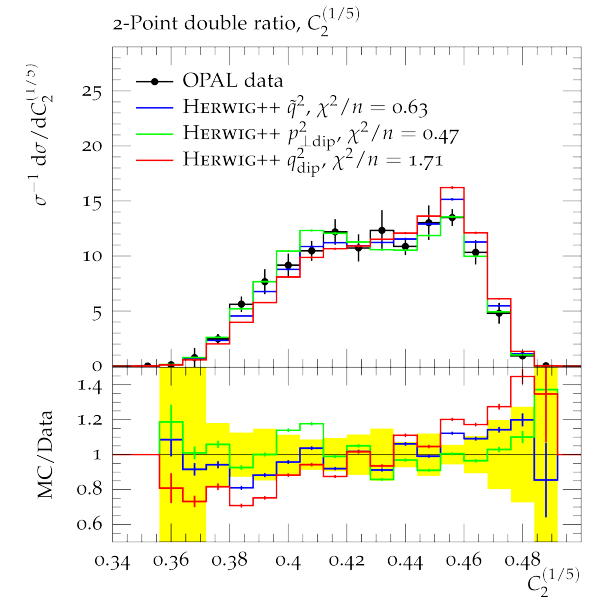
New measurements from old data

[Gieseke, Fischer, Plätzer, Skands + OPAL 2015],

Proposed observables have been extracted from OPAL data.



Similar overall description, the “bad guy” did the worst, but no striking conclusion.



Summary

Coherence is about multiple emissions, non-trivial property of parton showers.

Most of the showers nowadays do contain coherent evolution, it's hard to provide a “bad guy”. Also unclear if coherence per se is tested or washed out by hadronization.

Need to devise clean observables in e^+e^- which test multi-jet radiation patterns in the relevant hierarchies (soft off collinear) to pin down coherence effects.

Excellent opportunities for FCC ee with vital input to parton shower development.

Thank you!