MC Tuning: The Theory Perspective

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Disclaimer.

This is actually a Herwig++ perspective.

Most remarks, however, apply to other generators as well.

Outline.

- Motivation.
- The General Strategy.
- How? Past and Present.
- Examples.
- Conclusions.

Why do MC authors tune at all?

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A generator author's work flow?

- Cook up a new model.
- Implement and debug it.
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- Release code.

Somewhat incomplete.

Why do MC authors tune at all?

A generator author's work flow:

- Cook up a new model.
- Implement and debug it.
- **Tune to data for which improved description expected.**
- **Find limitations, or tension between different observables.**
- **Revise (or even discard) model.**
- **Make sense of parameters obtained.**
- Release code **with well-motivated default parameters.**

Why do MC authors tune at all?

This does not mean that we do, nor want to tune a released code to each and every observable ourselves.

The General Strategy.

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We do want global fits.

Only then we can truly gain insight in the dynamics we claim to model.

Even sophisticated approaches fail for truly all parameters at once.

Factor parameter space (beyond FSR $\times$ ISR)

- Identify which parameters mainly drive what observables.
- Identify which observables should be considered more important.

How? Past and Present.

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Until recently ...

- Analyses coded in-house.
- Brute force tune by throwing points at parameter space.
- Then scan around minimum in χ^2 to check stability.

Reasonable description of a range of data achieved.

Default parameters as in first complete Herwig++ series 2 release.

M.Bähr et al. et al., Eur.Phys.J.C58:639-707,2008

How? Past and Present.

Presently using Rivet + professor.

Extremely useful. Even better parameter point determined.

The only choice when it comes to underlying event and related issues.

See next slides for details.

Examples.

Min Bias.

S. Gieseke, C. Röhr and A. Siodmok

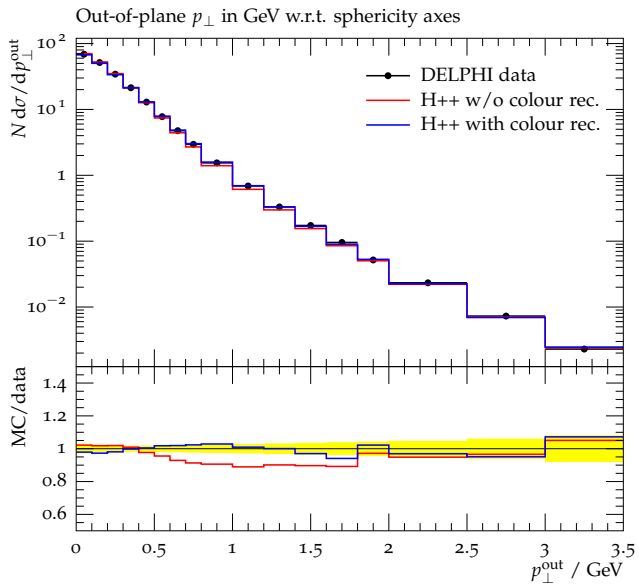
Mismatch observed in ATLAS min bias data.

Hints that colour reconnection will cure this.

Model under development just at the same time.

Step 1: Retune to LEP data.

- Check that no discrepancies arise.
- Determine colour reconnection probability.

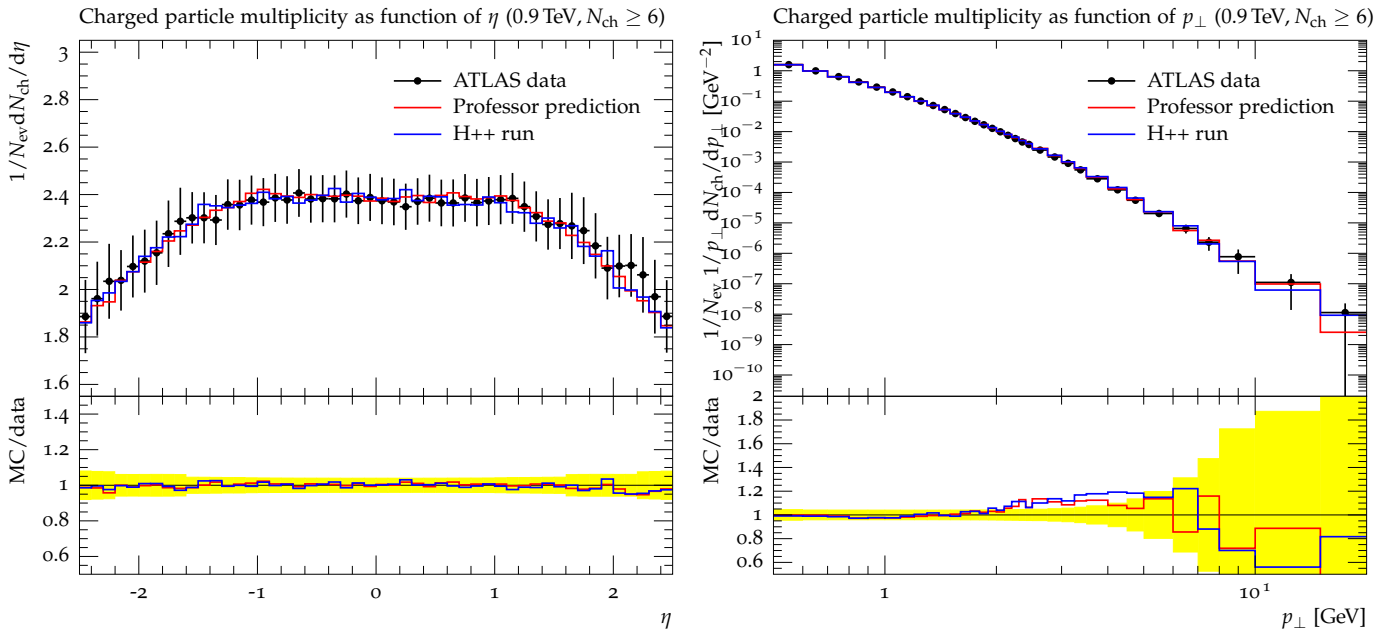


Min Bias.

S. Gieseke, C. Röhr and A. Siodmok

Step 2: Tune to ATLAS data.

- CR probability consistent with preferred value from LEP.



Bottom line: Tuning to verify that model is consistent and works.

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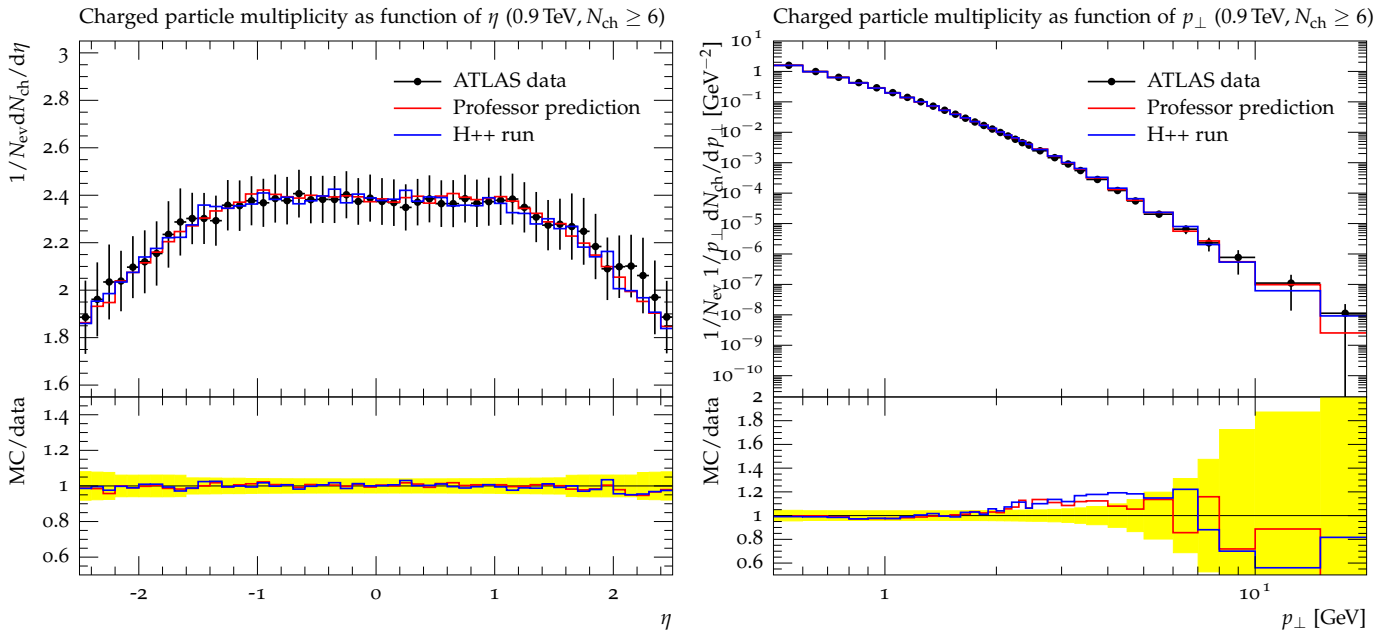


Release out soon!

NLO Matching.

Recently developed new dipole shower and automated NLO matching.

SP and S. Gieseke, JHEP01(2011)024 and in preparation

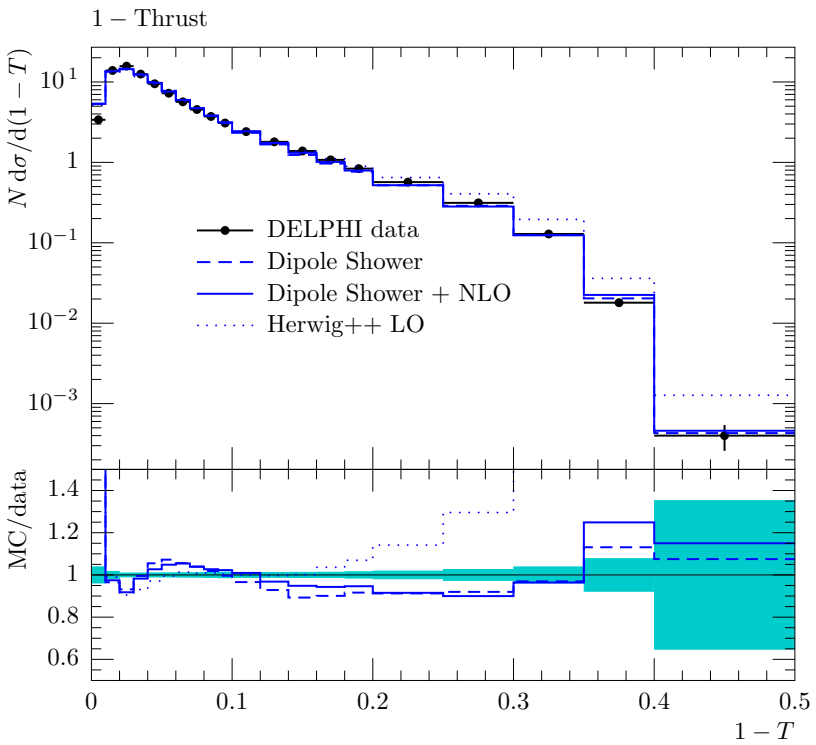
Perform tune to variety of LEP data, H1 energy flows, CDF Drell-Yan.

- Quantify impact of new shower.
- Quantify impact of NLO matching.

NLO Matching.

Perform separate LO and NLO tunes: Comparable results.

SP and S. Gieseke, JHEP01(2011)024 and in preparation



What to learn from?

- Similarity expected for processes of this kind.
- α_s determined more precisely at NLO.
- NLO prefers smaller IR cutoff, i.e. more perturbative dynamics.

Bottom line: Theorist's tuning mandatory here to find expected results.

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Once discrepancies show up, we would be very happy about effective communication and support in retuning new releases.

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