Thoughts on: the interface of theory calculations with experimental methods

Collider Data Analysis Strategies
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LHC Run3 and beyond

- The next runs of the LHC won't give us any substantial increase in energy. But we will have more and more data.

- The main-stream theoretical focus is on making our tools better and better:

  - we have to make NNLO calculations our standard (loop-results for at least 2→3 topologies; more flexible subtraction schemes; interface with parton showers and/or resummation)

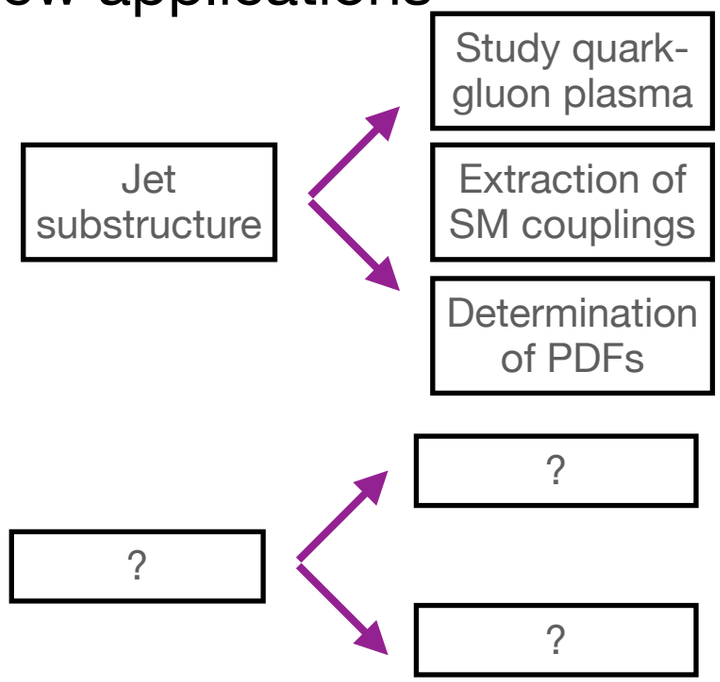
  - we need to upgrade parton-shower simulations to the precision club (log accuracy, colour, higher-order splitting functions)

  - we should have state-of-the art predictions for standard candles (e.g. N^3LO; N^3LL resummation; effects on parton densities)

From exploring less beaten paths…

- We all agree that the challenge ahead is to find new and more efficient ways to interrogate the data

Cross-pollination: bring field-specific developments to the broader pheno community to find new applications



Confront new tools: ML algorithms are reshaping the way we think analyses and searches

What is the role of expert-knowledge in designing ML algorithms?

Can we understand what the algorithms is exploiting?

Is this reachable within our standard approach (pQFT)?

What about unfolded measurements?

…to trailblazing ideas

> In ATLAS we don't care about IRC safety
> (unnamed ATLAS speaker @BOOST 2017

- IRC safety is the basic requirement that us theorists demand about observables
- However, IRC unsafe observables are sometimes incredibly useful (tracks, multiplicities, etc)
- Furthermore, for such a basic requirement, its definition is not that precise (from Sterman/Weinberg, to rIRC safety, to event geometry)
- What do theorists want? It might be different things in different contexts

fixed-order calculability

all-order calculability

power-suppression of non-perturbative contributions

simple non-perturbative corrections

…to trailblazing ideas

we explore both IRC safe and unsafe observables

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THANKS FOR LISTENING!

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