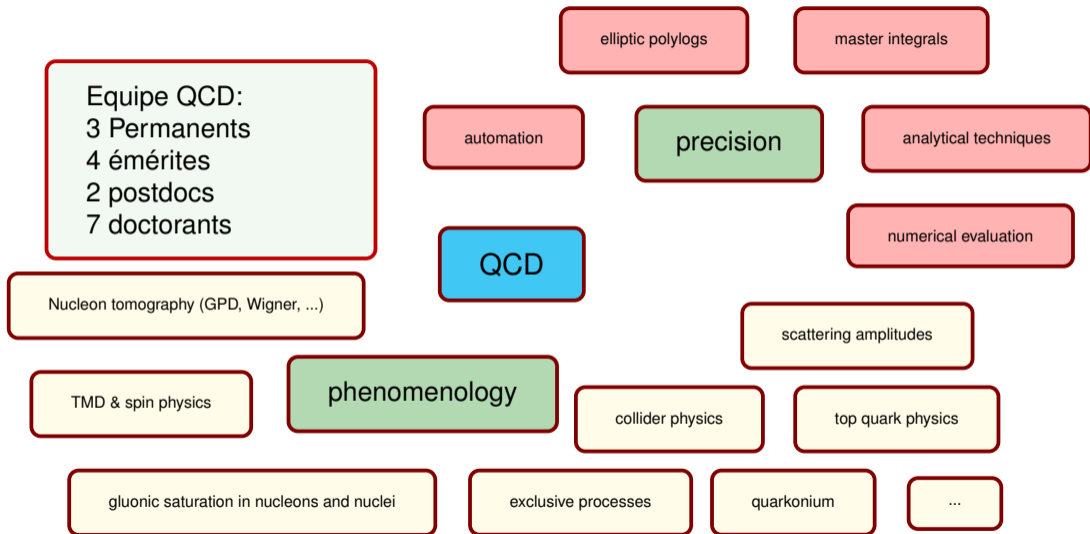


Equipe QCD @ IJCLab



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- Permanents:

- Jean-Philippe Lansberg (DR CNRS)
- Melih Ozcelik (CRCN CNRS) (since 11/22)
- Samuel Wallon (PR Paris-Saclay)
- Véronique Bernard (DR émérite)
- Michel Fontannaz (DR émérite)
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• Postdocs: (grisé si parti cette année)

- Tanjona Rabemananjara (01/26-09/26) (ANR → CEA (DPHn))
- Pieter Taels (01/25-09/26) (ANR)
- Christopher Flett (11/22- 10/25) (ANR → MSCF UCLouvain !)
- Michael Fucilla (10/23-05/25) (ANR, Della Riccia → WAW (NAWA UAm))

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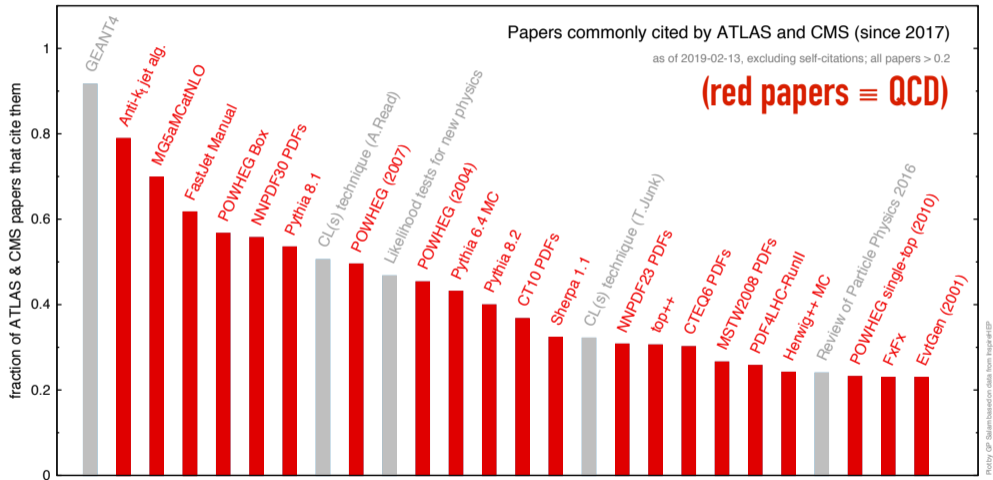
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• Doctorants: (vert si soutenance cette année)

- Dimitrios Daskalas (10/24-10/27) (co-tut. IFJ Krakow (new action), ADI)
- Allen Cris John Rubesh Rajan (10/23-10/27) (co-tut. Dublin)
- **Kate Lynch** (10/21-09/26) (co-tut. Dublin)
- Nicolas Crépet (09/25-09/28) (co-tut. Dublin)
- David Perez (09/24-09/27)
- **Joseph Yarwick** (09/23-09/26)
- Shubendu Mandal (09/25-09/28)
- + A. Safronov, L. Manna, A Copani Serri (3 co-encad. Warsaw)

QCD theory is workhorse of LHC experiments



Need for precision @ HL-LHC

- ▶ illustrated in the case of Higgs physics
- ▶ theory uncertainty (PDF + strong coupling + missing higher orders) dominates in 7/9 channels
- ▶ this is **with the assumption of reduction by x2 in today's theory uncertainties**
- ▶ depending on channel, it can be the uncertainties for the signal or the background that dominates.

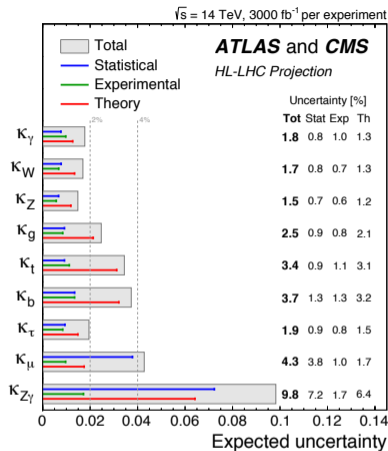


Figure 1. Projected uncertainties on κ_i , combining ATLAS and CMS: total (grey box), statistical (blue), experimental (green) and theory (red). From Ref. [2].

Accurately precise or precisely accurate ?

Accurately precise or precisely accurate ?

Perturbation in a nutshell

Leading order (LO):



Next-to-Leading order (NLO):



NNLO:



All-orders?



...

adapted from M. Wiesemann

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NNLO:

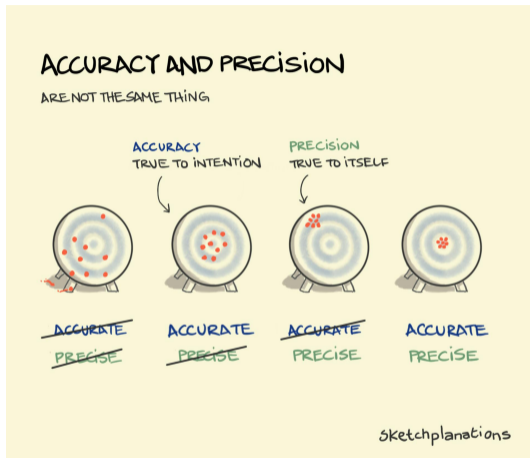


All-orders?



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adapted from M. Wiesemann



Both are important: get the right picture with small uncertainties
Need for Fixed-Order computations (NNLO ?) +
Resummation + Parton Showers + Higher Twists + etc.

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Perturbation in a nutshell

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Next-to-Leading order (NLO):



NNLO:

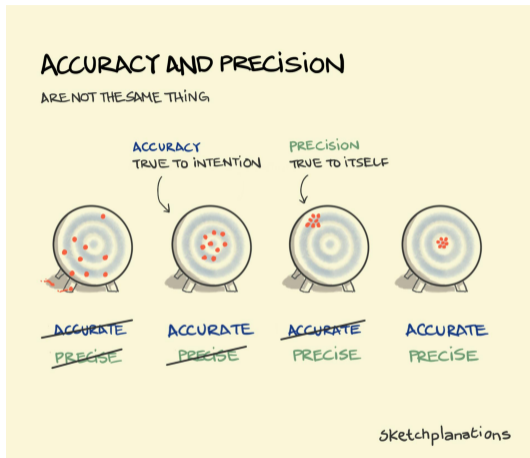


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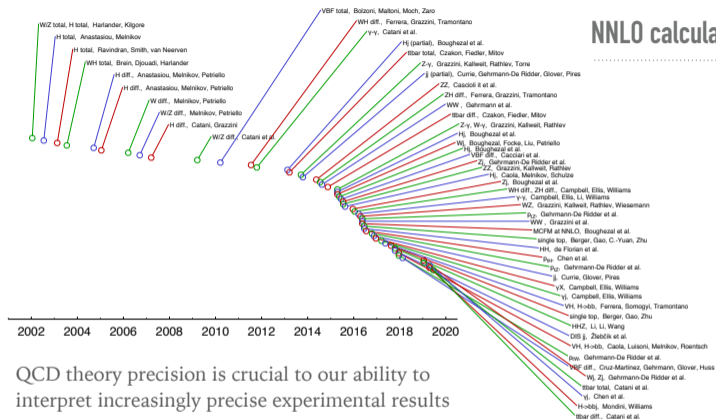
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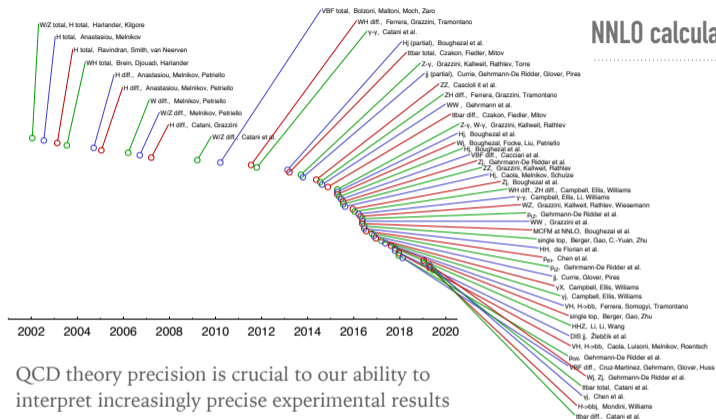
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pQCD and the NNLO boom



NNLO calculations

pQCD and the NNLO boom



QCD theory precision is crucial to our ability to interpret increasingly precise experimental results

G.P. Salam

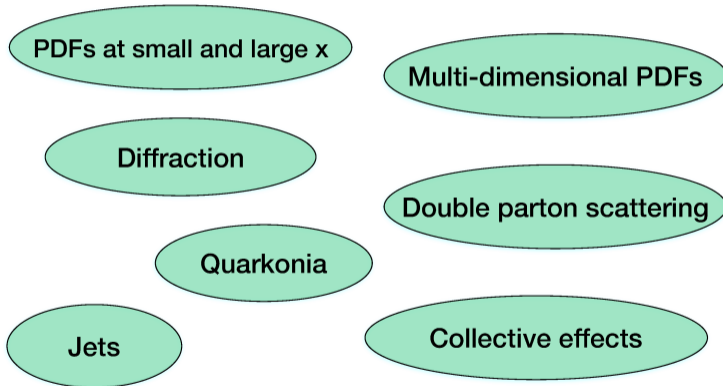
LHCb week, Oxford, 2019-09

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This boom was made possible by advances in elliptic integrals and multiple polylogarithms

Where will we stand with QCD around 2035-2040?

It is to be expected that much of the investigations of the strong interactions at high-energy colliders in the future will focus on:



D.Boer, Granada 2019