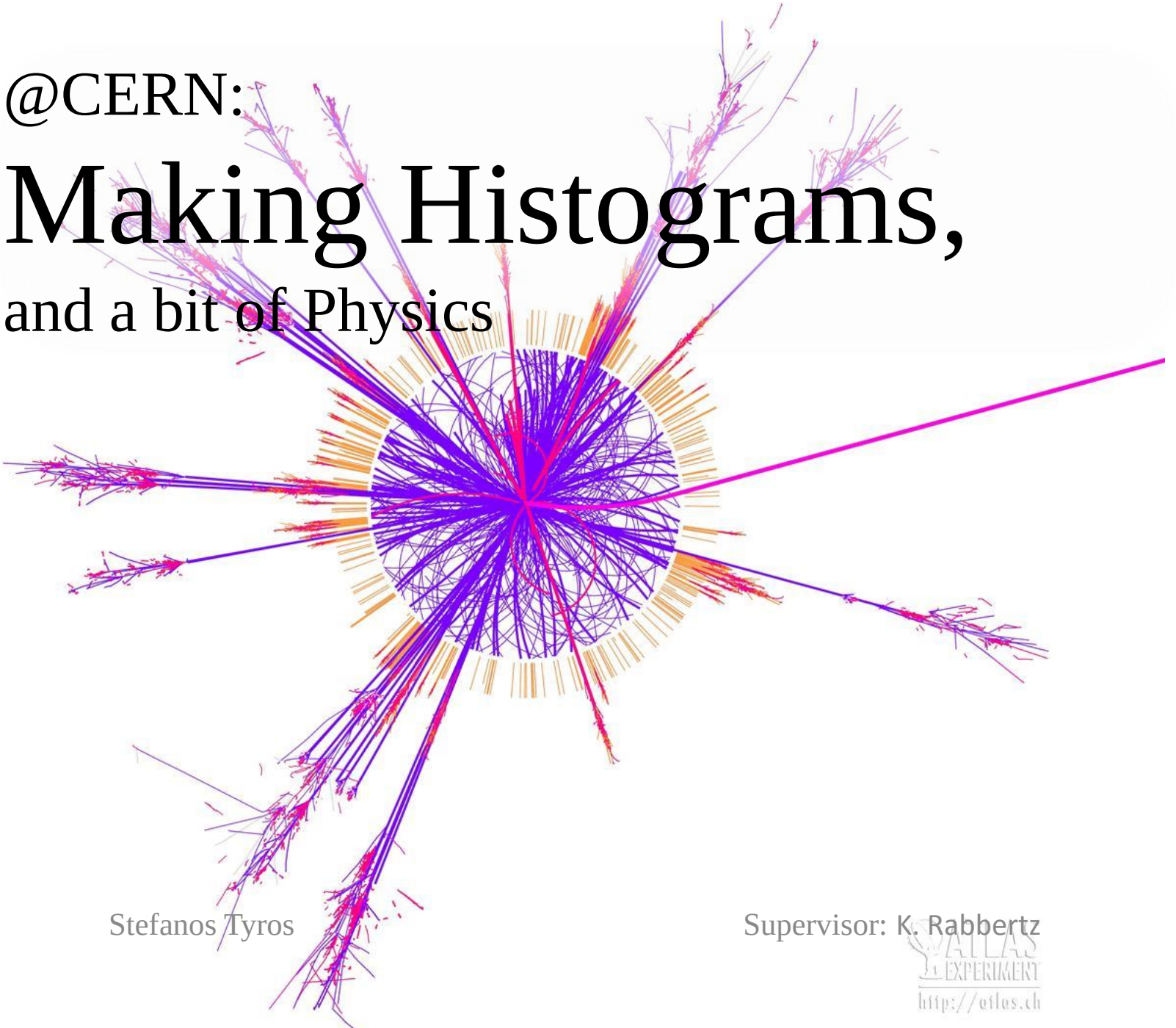
@CERN:

Making Histograms,

and a bit of Physics



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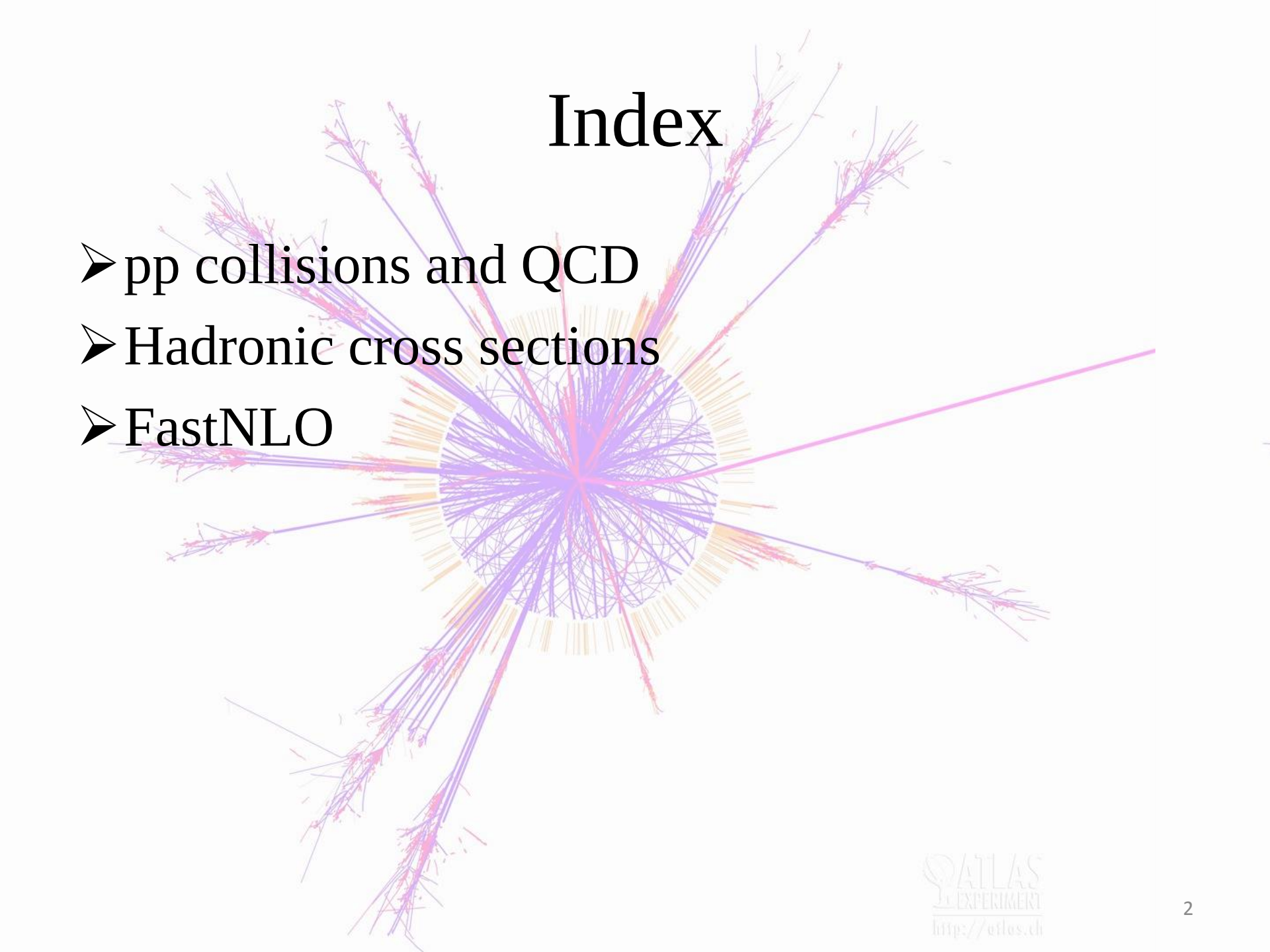
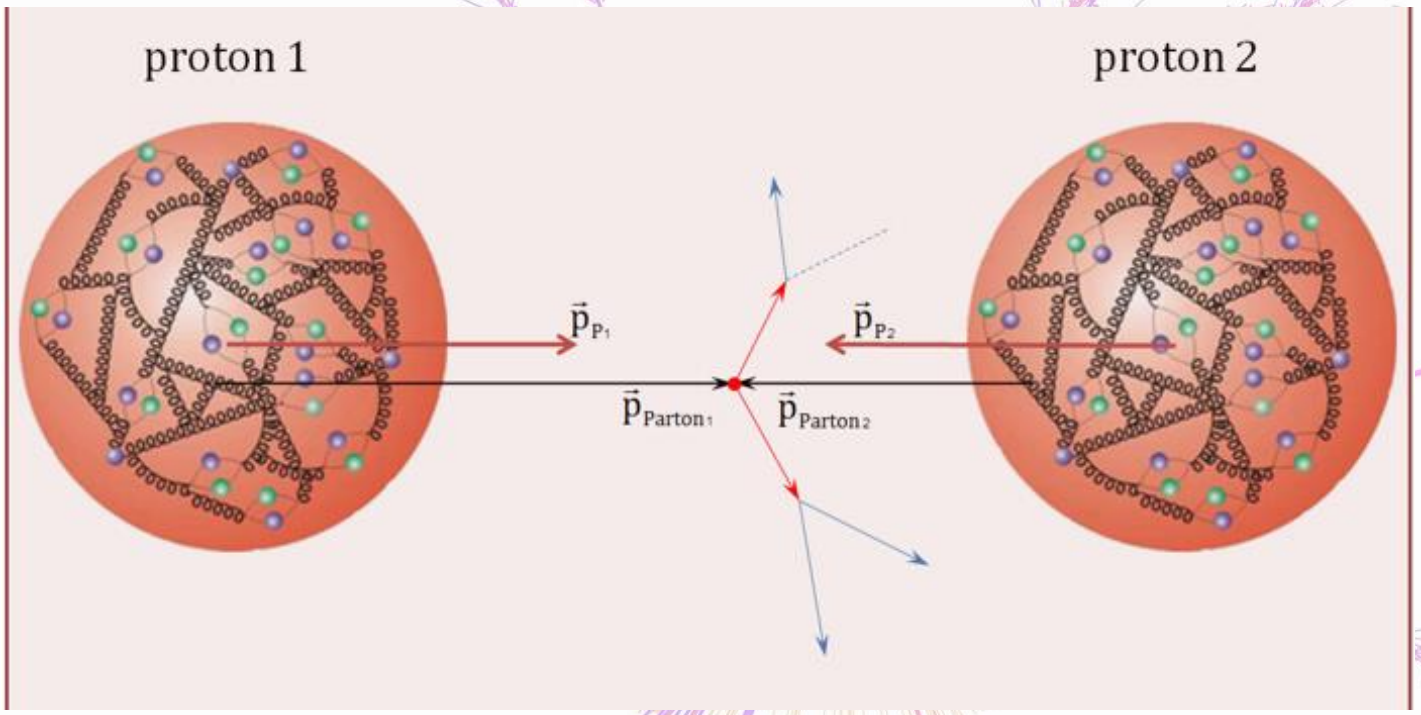
- pp collisions and QCD
- Hadronic cross sections
- FastNLO



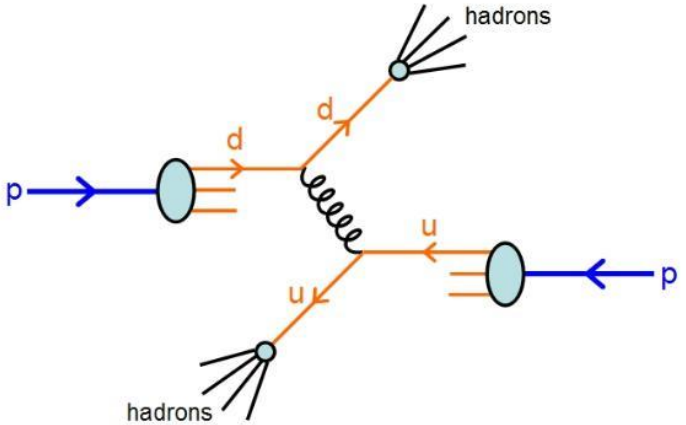
pp collisions



- In LHC pp collisions take part instead of "clean" ee
- Lower energy loss due to acceleration as of higher mass
- Can reach higher energies but with a price to pay

Hadronic Cross Sections

- Asymptotic freedom of QCD allows high energy quark-quark scattering to be calculated
- Hadronic Cross Section are calculated with the use of experimentally deduced Parton Distribution Functions (PDFs)



$$\frac{d^2s}{dp_T dy} = \int dx_1\, dx_2 f_1(x_1) f_2(x_2) \left| M(x_1, x_2) \right|^2$$

- f: proton PDFs
- x: fraction of proton momentum carried by constituent
- M: matrix element for quark process (QCD)

Theory-Experiment interface

PDFs based on assumptions – hence PDF errors are sets of PDFs (few hundreds) from estimating errors on the former

- Monte Carlo generators: use experimental data and theoretical models, they “throw the dice” and give results by running multiple events
- Too slow to run at NLO level, as each calculation need a few millions events and we have hundreds or thousands of PDFs
- Need to find a smarter way

FastNLO

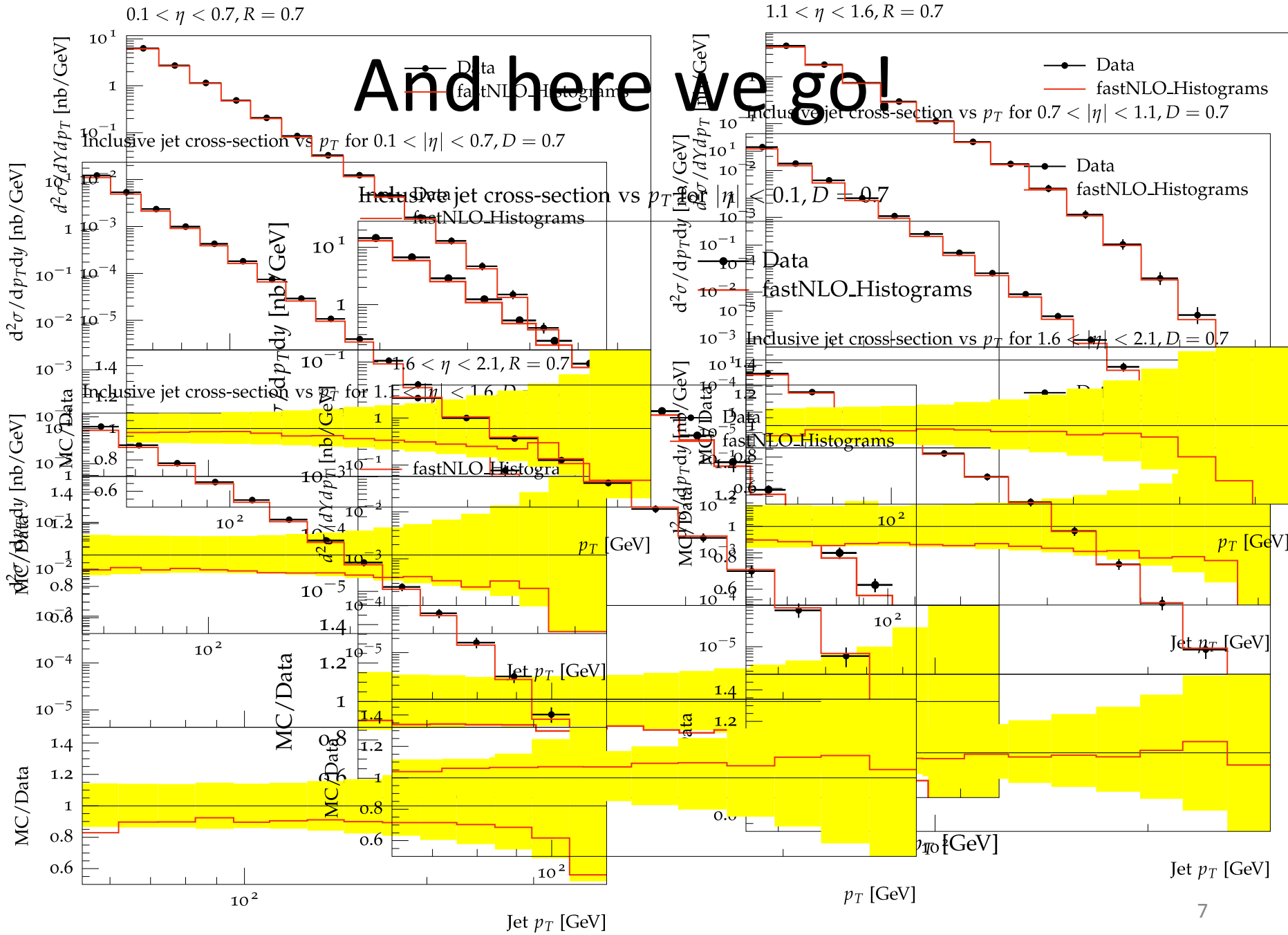
- An approximate method (which works very well) used to exlude the PDF dependence from the integral
- Can then easily calculate cross sections for various PDFs

$$f(x) = \sum w_i g_i(x)$$

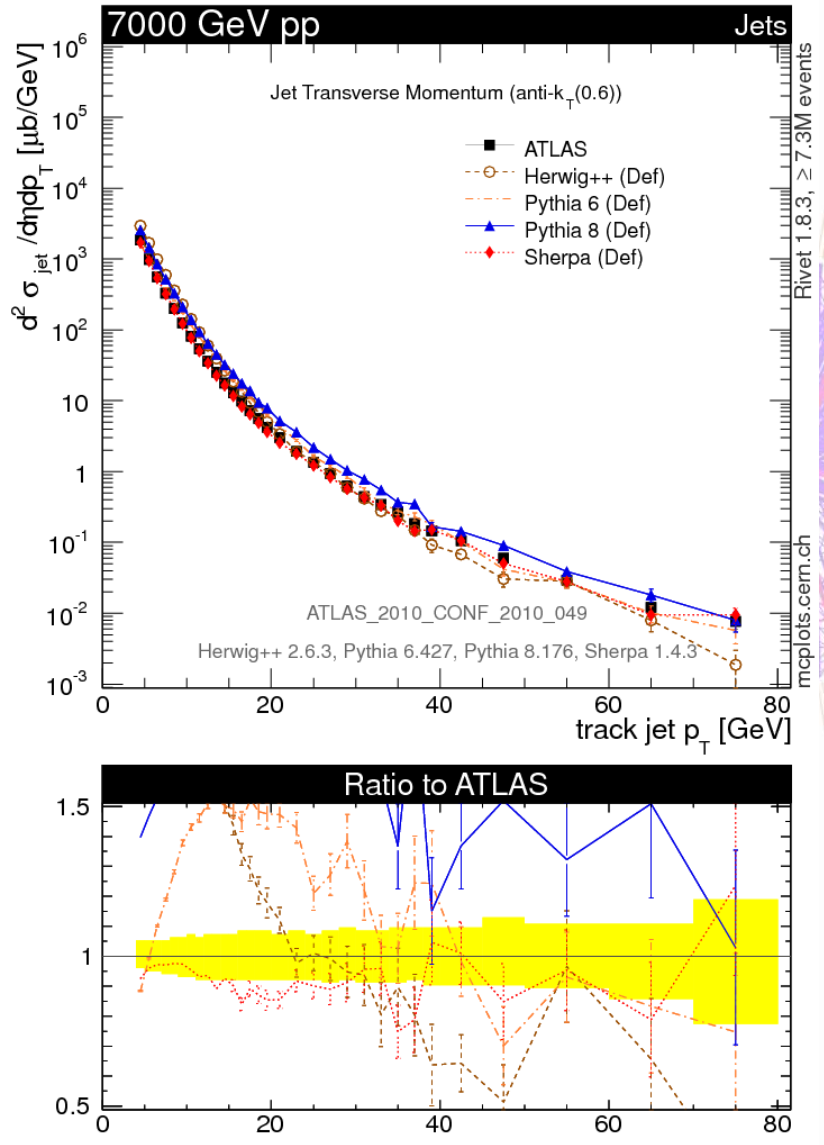
PDFs are interpolated by some eigenfunction

$$\frac{d^2\sigma}{dp_T dy} = \sum_i \sum_j w_i w_j \int dx_1\, dx_2 g_i(x_1) g_j(x_2) \left| M(x_1, x_2) \right|^2$$

Integral (heavy work) done once, only interpolation for various PDFs

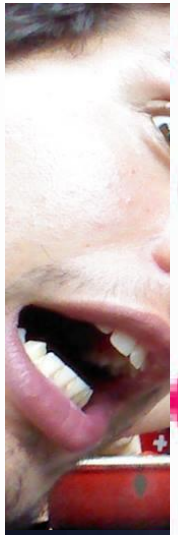

And here we go!
$0.1 < \eta < 0.7, R = 0.7$
$1.1 < \eta < 1.6, R = 0.7$
Inclusive jet cross-section vs p_T for $0.1 < |\eta| < 0.7, D = 0.7$
Inclusive jet cross-section vs p_T for $0.7 < |\eta| < 1.1, D = 0.7$
Inclusive jet cross-section vs p_T for $1.6 < |\eta| < 2.1, D = 0.7$
Data
fastNLO_Histograms
$d^2\sigma/dYdp_T$ [nb/GeV]
$d^2\sigma/d p_T dy$ [nb/GeV]
MC/Data
p_T [GeV]
Jet p_T [GeV]

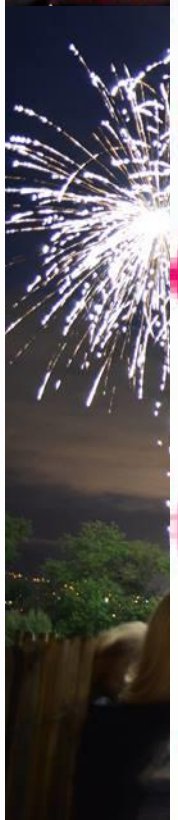
Coming Next

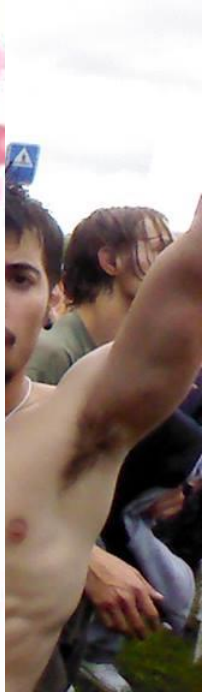


- MCplots: a project for Monte Carlo comparison with data and between them
- FastNLO is to be integrated into MCplots the next 4 weeks

summarising….







Cheers!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