Event generators at the Large Hadron Collider

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Theoretical High Energy Physics

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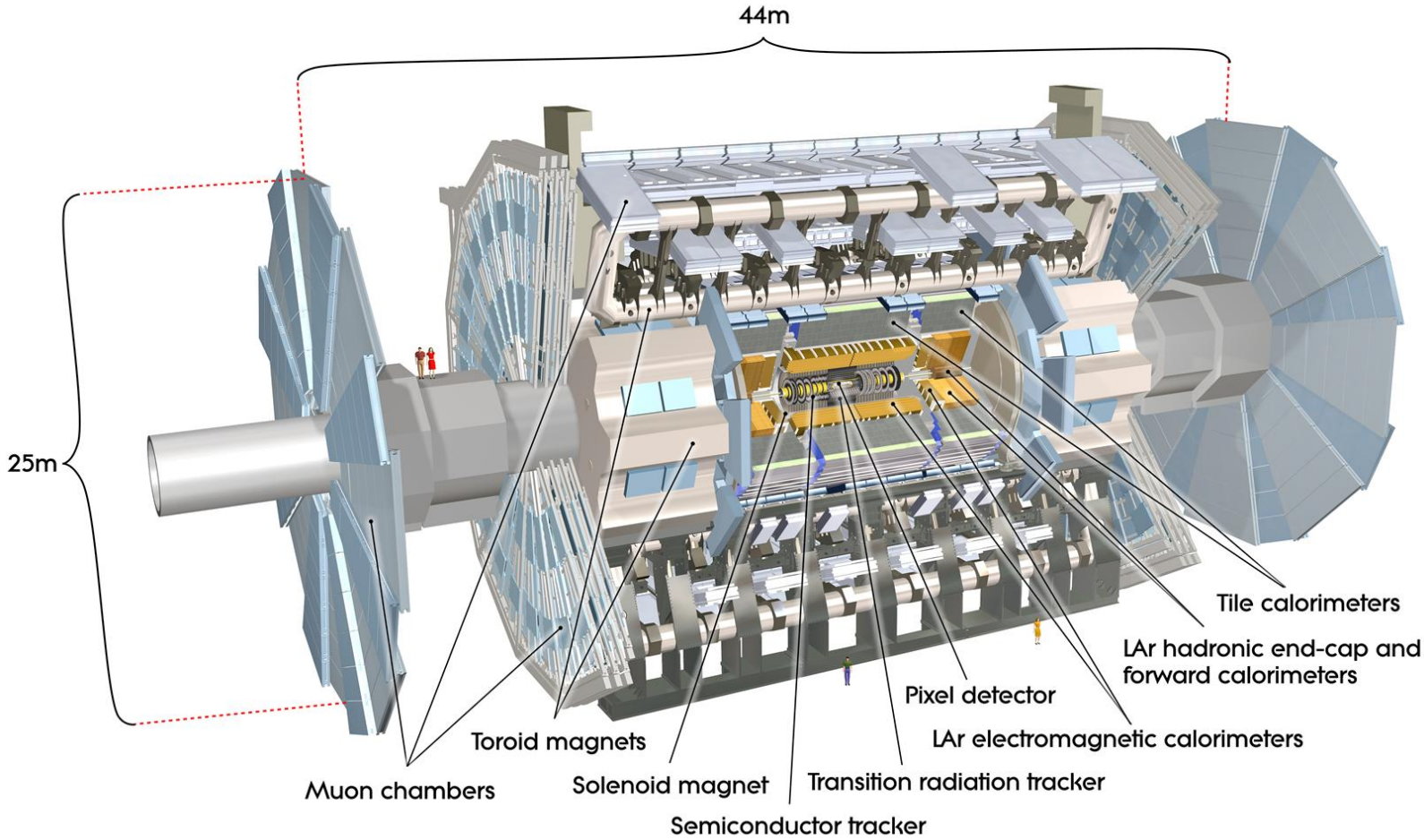
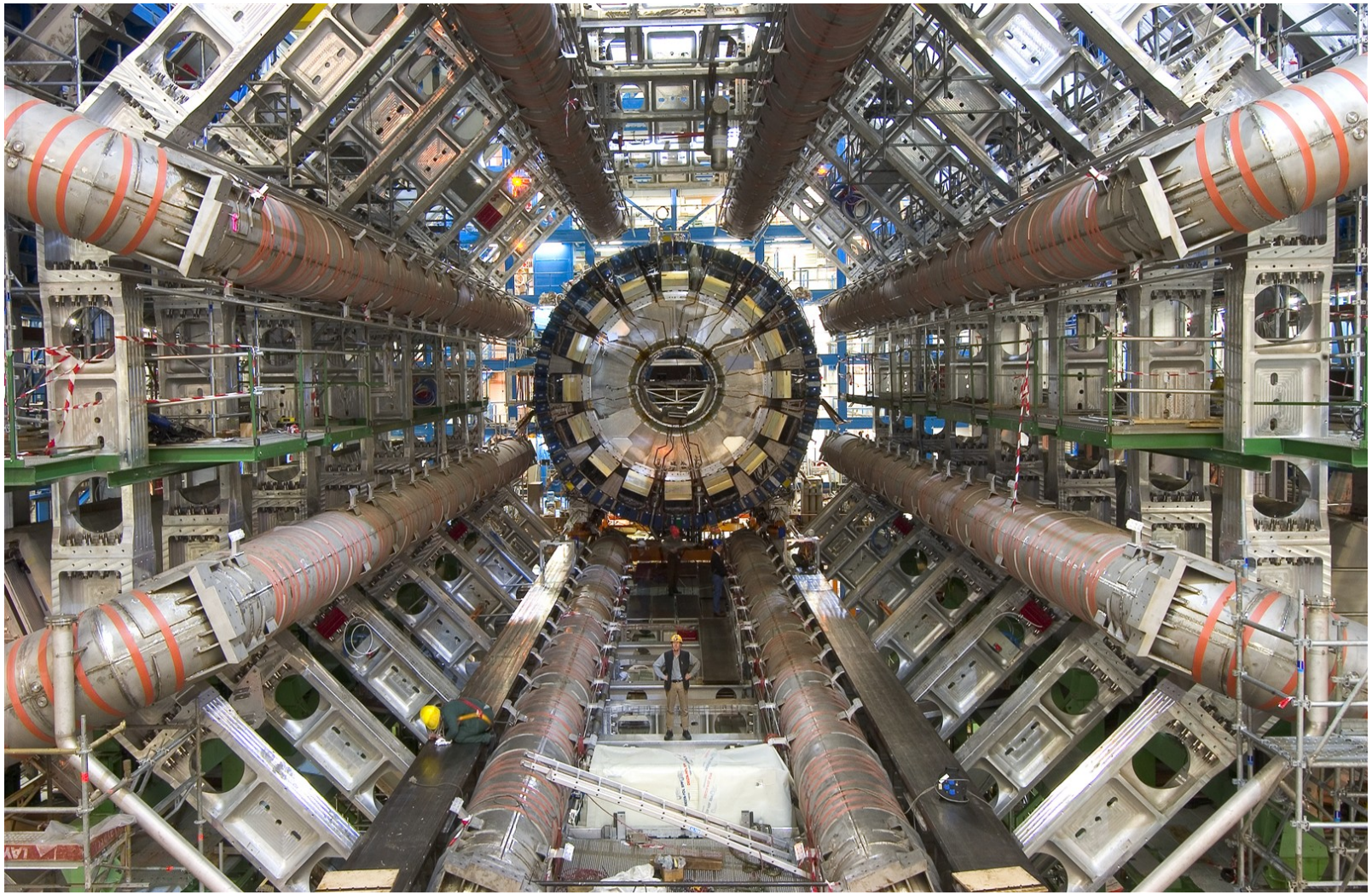
Large Hadron Collider

- 27 km accelerator located at Geneva
- Proton-proton collisions at 8 TeV (design 14 TeV)
- Four main experiments with two being general purpose experiments

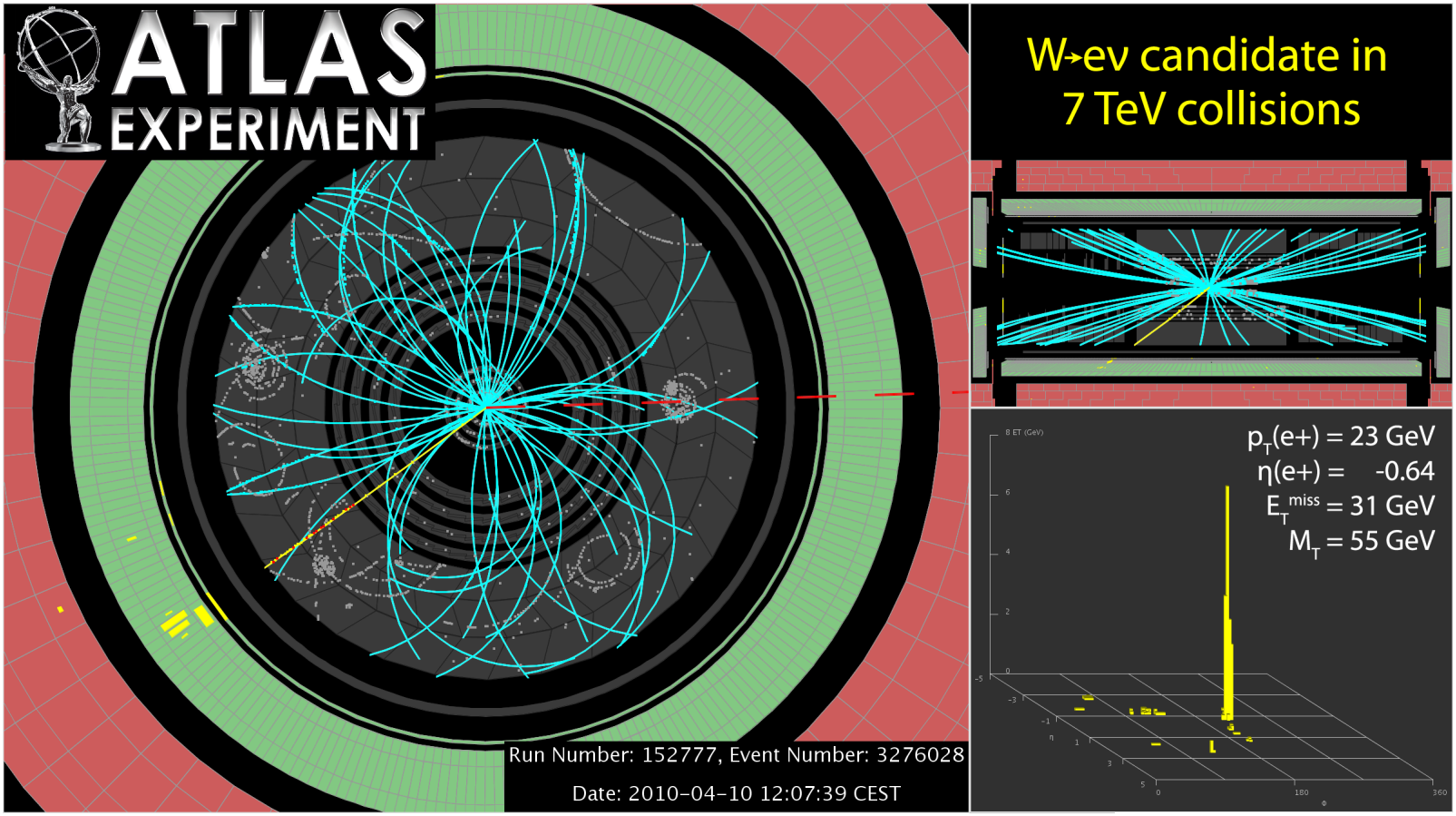
ATLAS experiment



ATLAS experiment



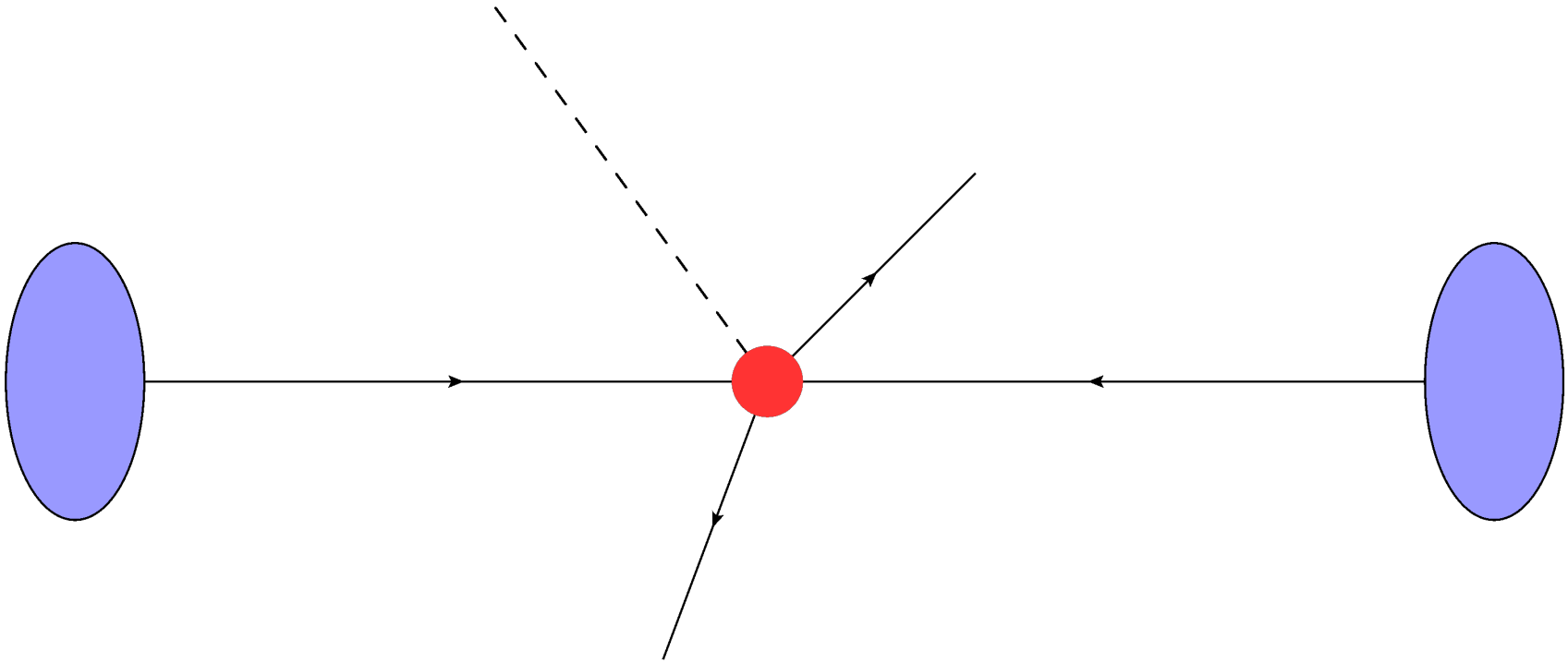
ATLAS experiment



Event generators

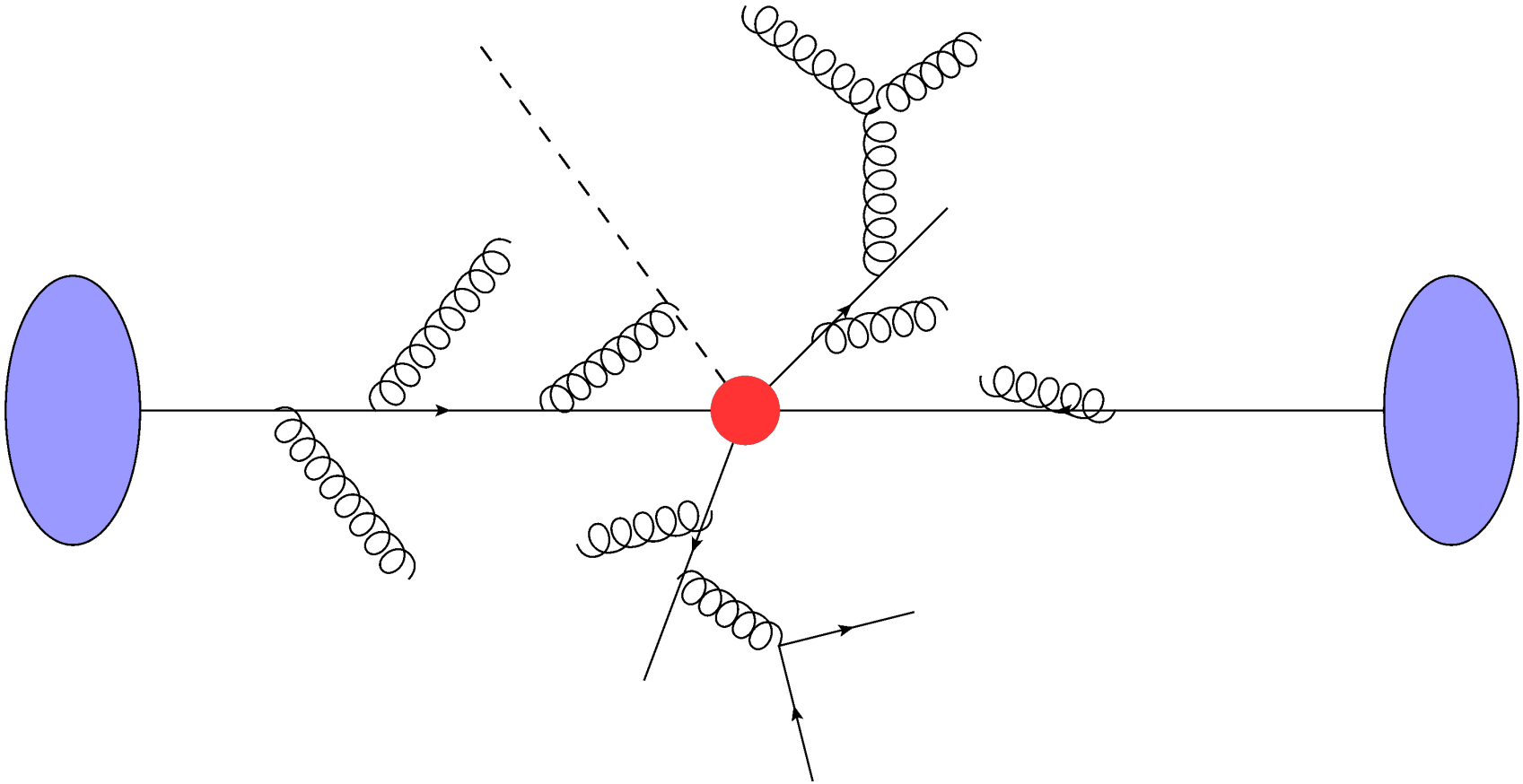
Event generators

Hard process



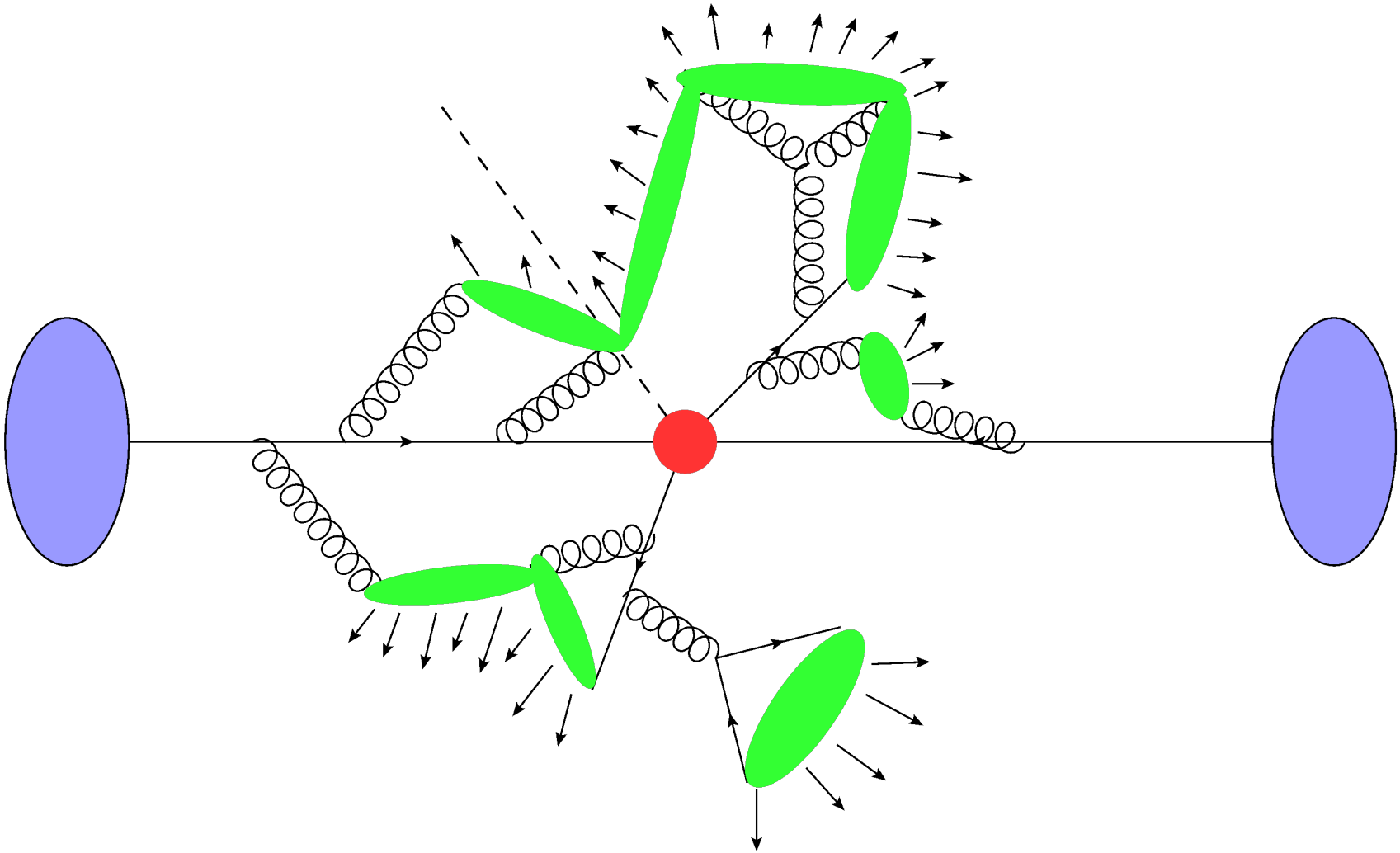
Event generators

Parton shower



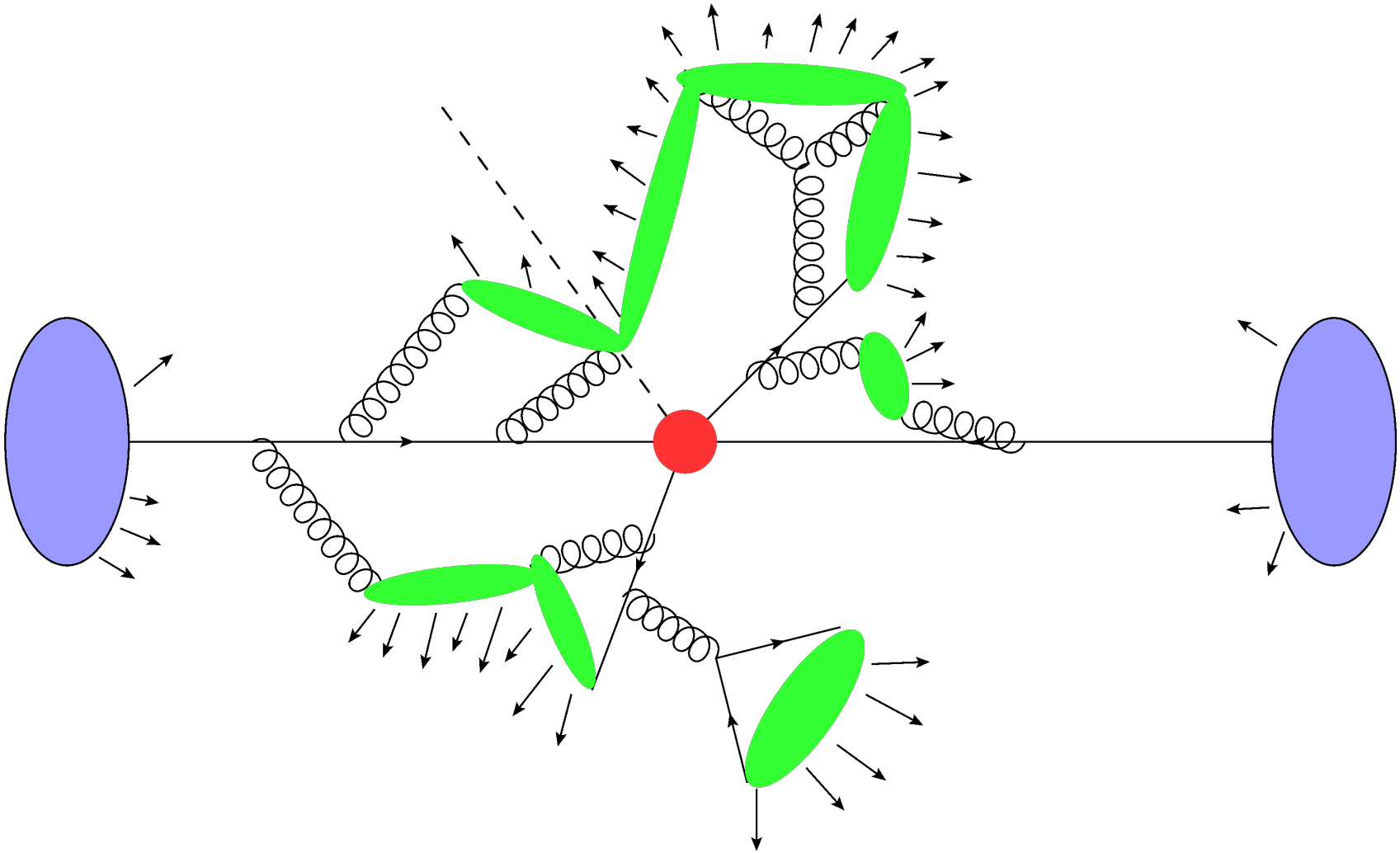
Event generators

Hadronization



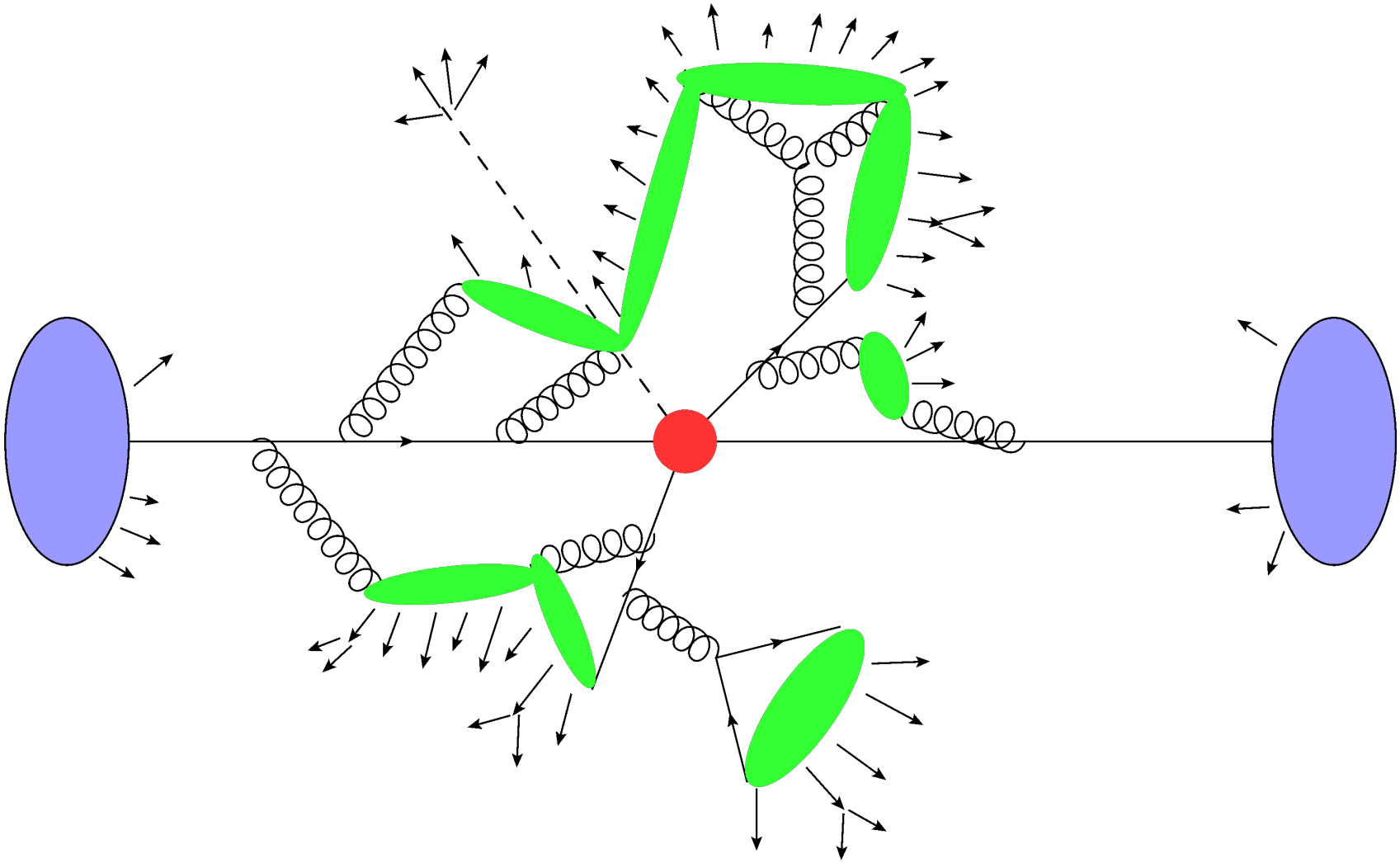
Event generators

Underlying event



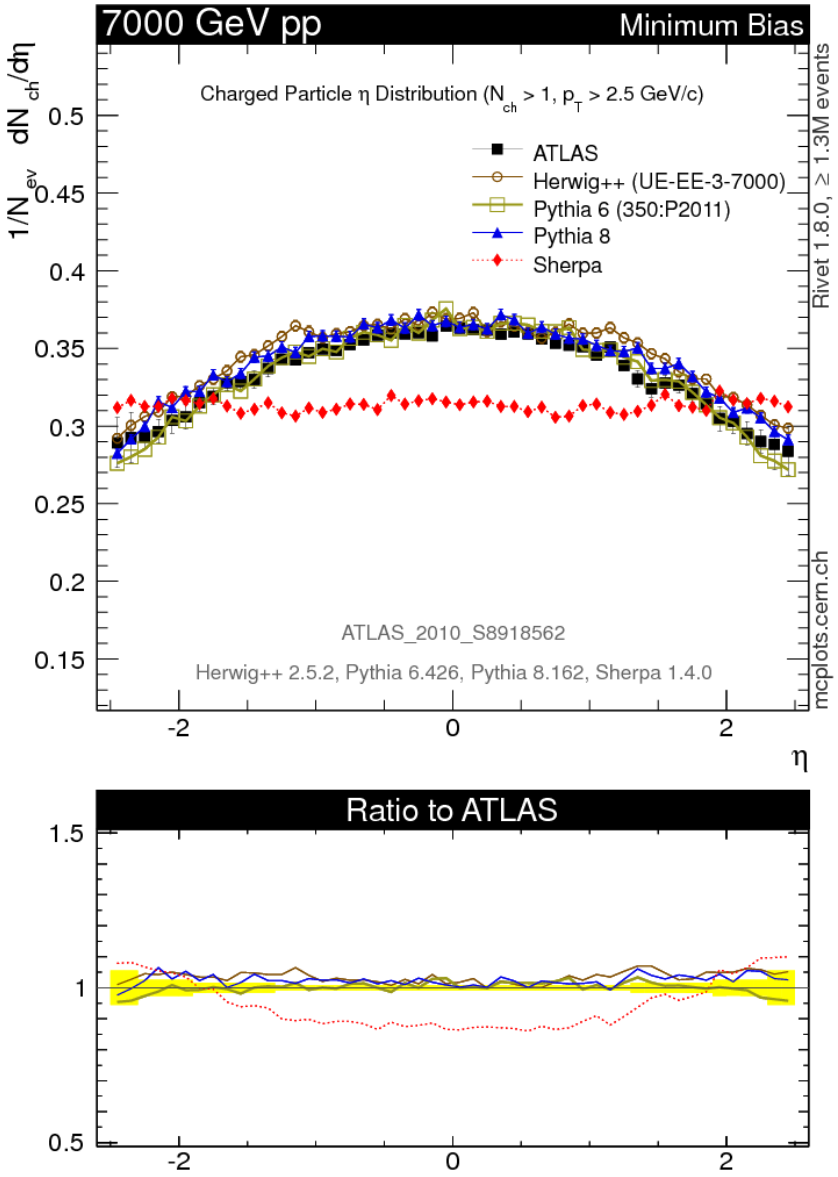
Event generators

Decaying particles

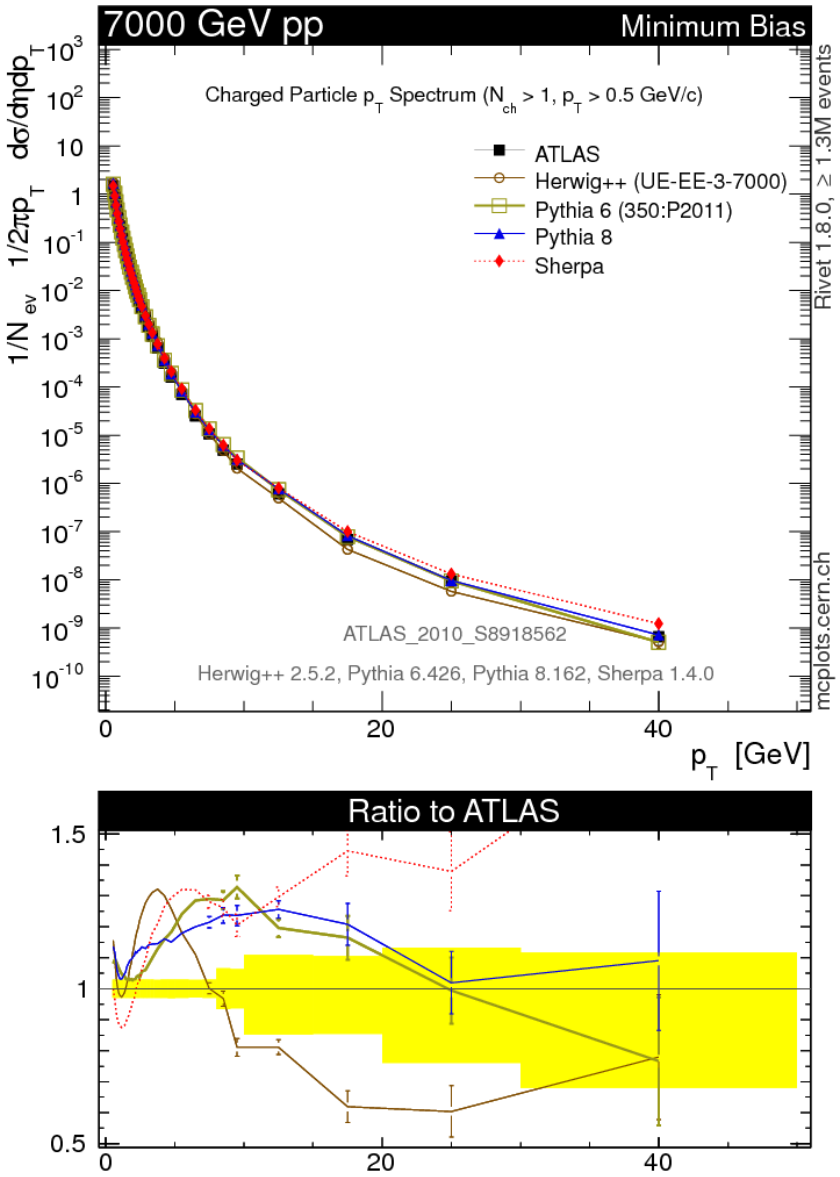


Does it work?

Data comparisons



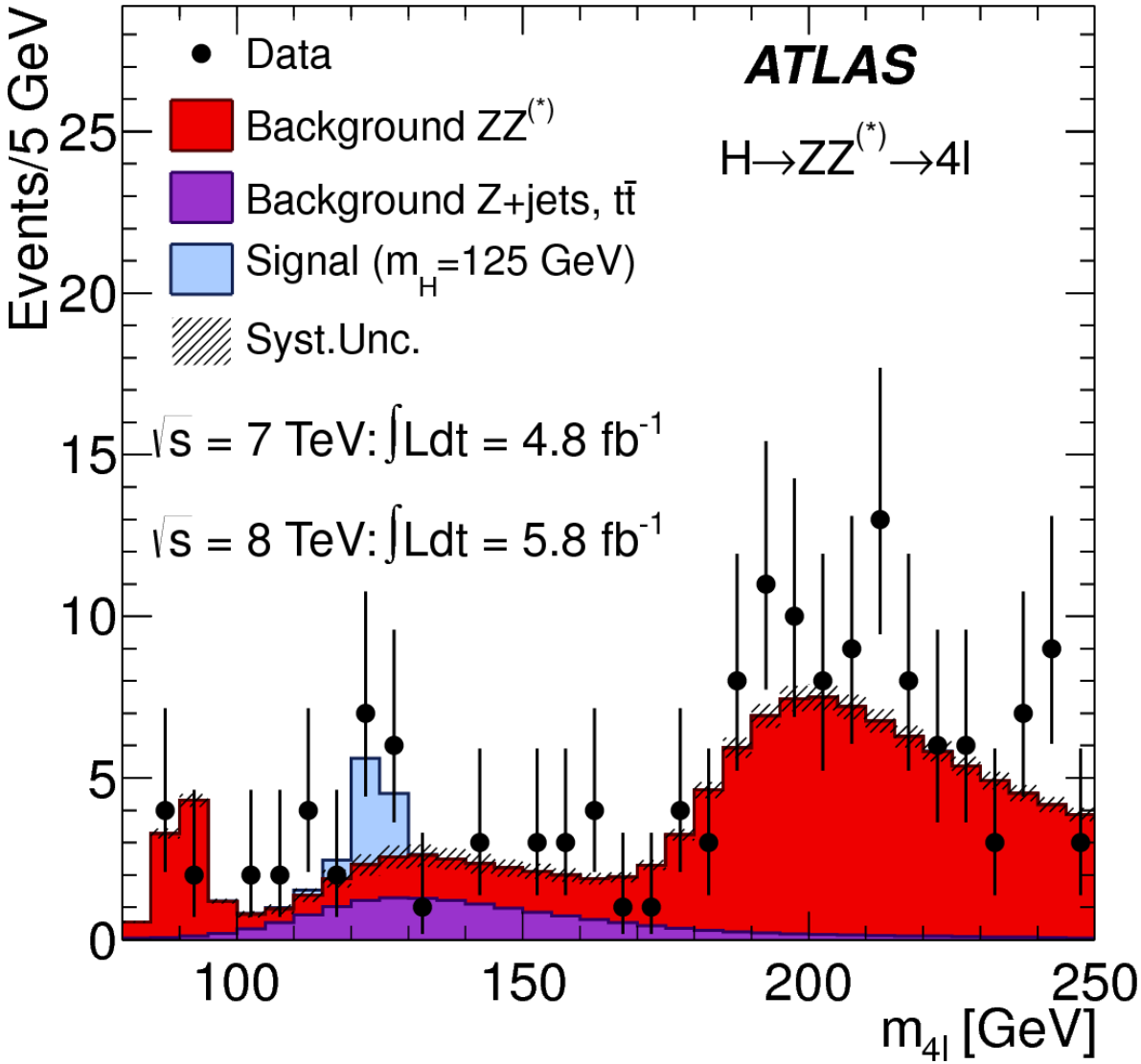
Data comparisons



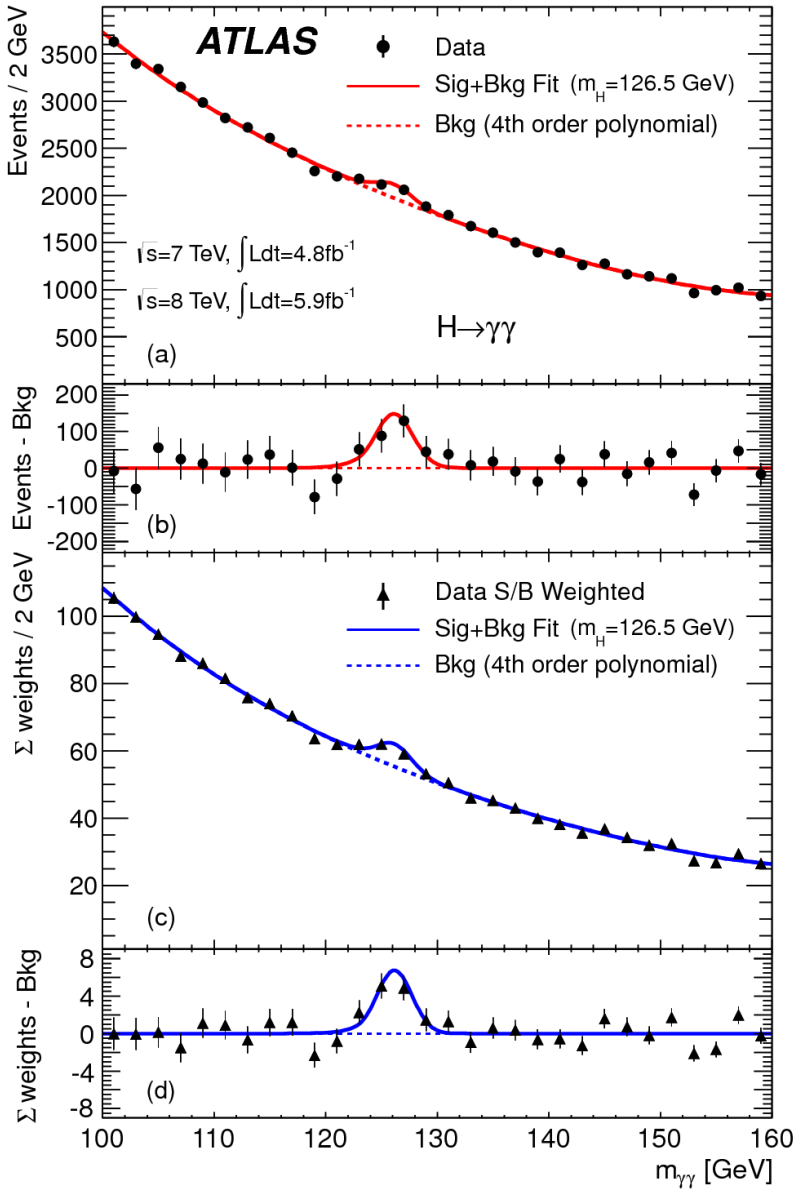
How to improve an event generator

- The "simple":
  - Tune the parameters of the model
- The slightly more complicated
  - Add known physics to the model
    - ★ example: Add W/Z-bosons to parton shower
- The very complicated
  - Make new model for part (or whole) event generator

Higgs discovery



Back-up


ATLAS
Data
Sig+Bkg Fit (m_H=126.5 GeV)
Bkg (4th order polynomial)
√s=7 TeV, ∫Ldt=4.8fb^-1
√s=8 TeV, ∫Ldt=5.9fb^-1
H→γγ
(a)
Events / 2 GeV
Events - Bkg
(b)
Data S/B Weighted
Sig+Bkg Fit (m_H=126.5 GeV)
Bkg (4th order polynomial)
(c)
Σ weights / 2 GeV
Σ weights - Bkg
(d)
m_γγ [GeV]