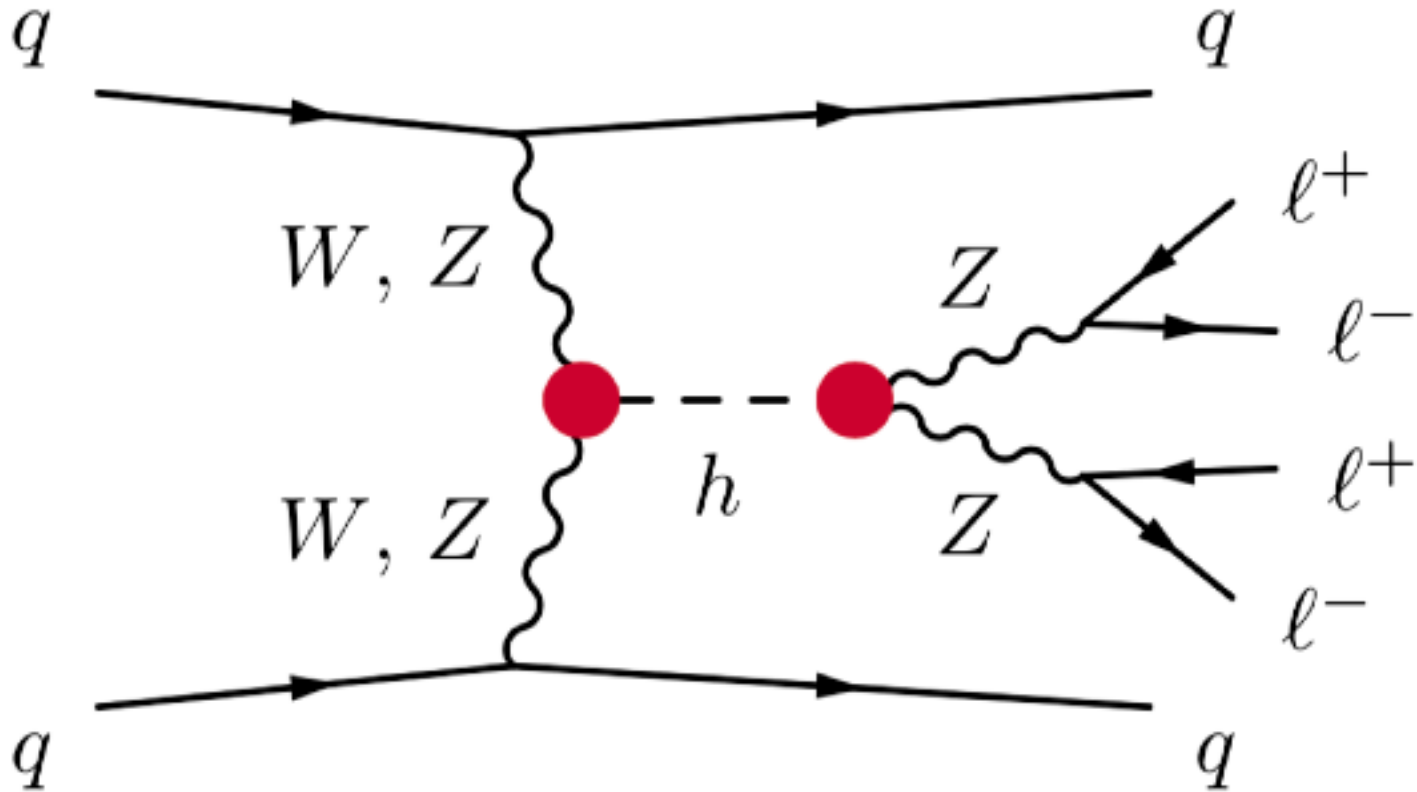
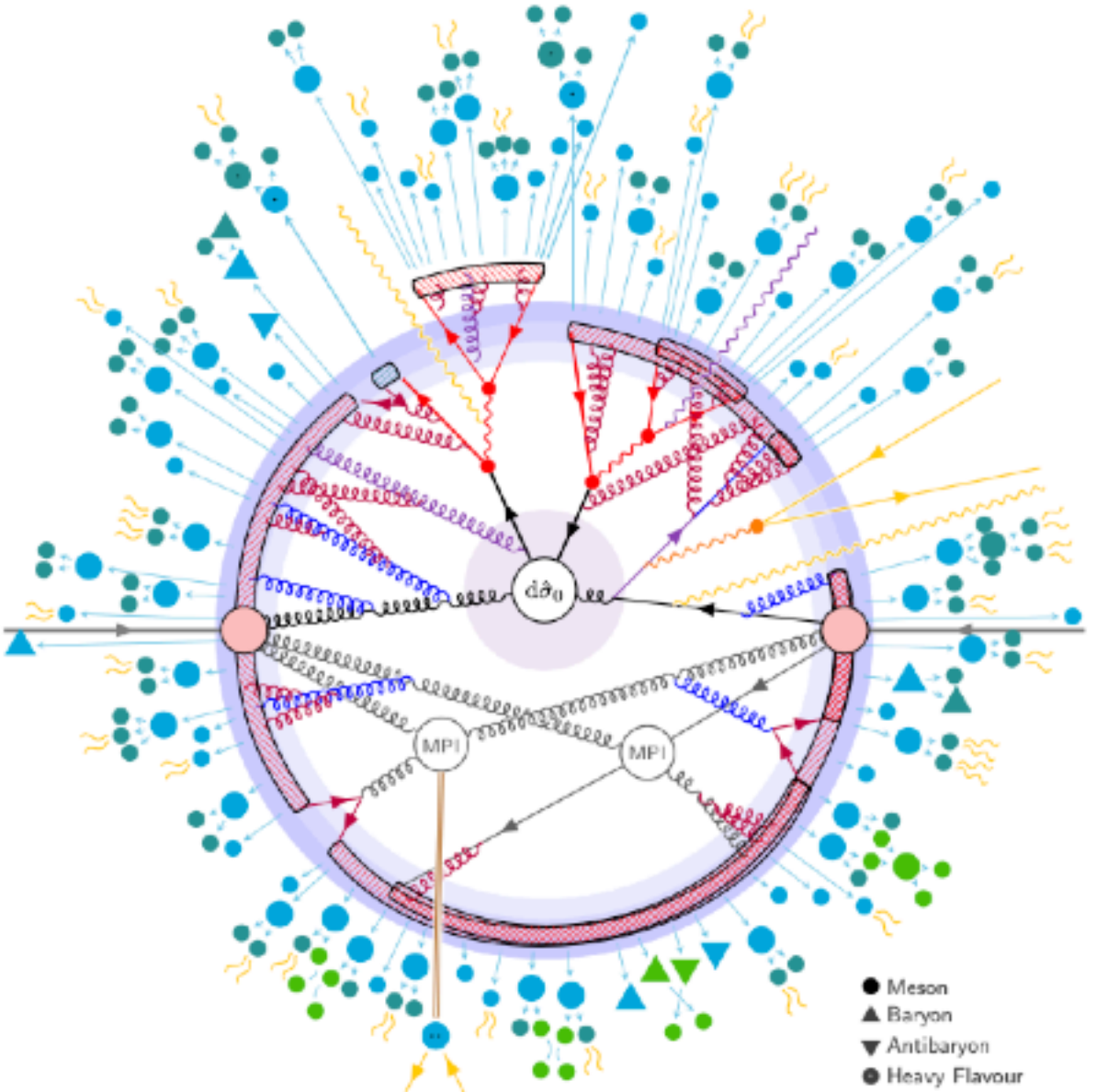
/62

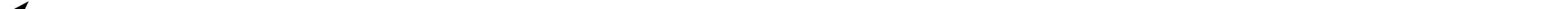
Are simulators all you need?

Sample from

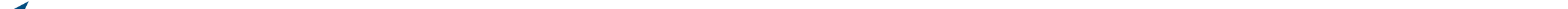

q
q
W, Z
Z
ℓ^+
ℓ^-
h
W, Z
Z
ℓ^+
ℓ^-
q
q



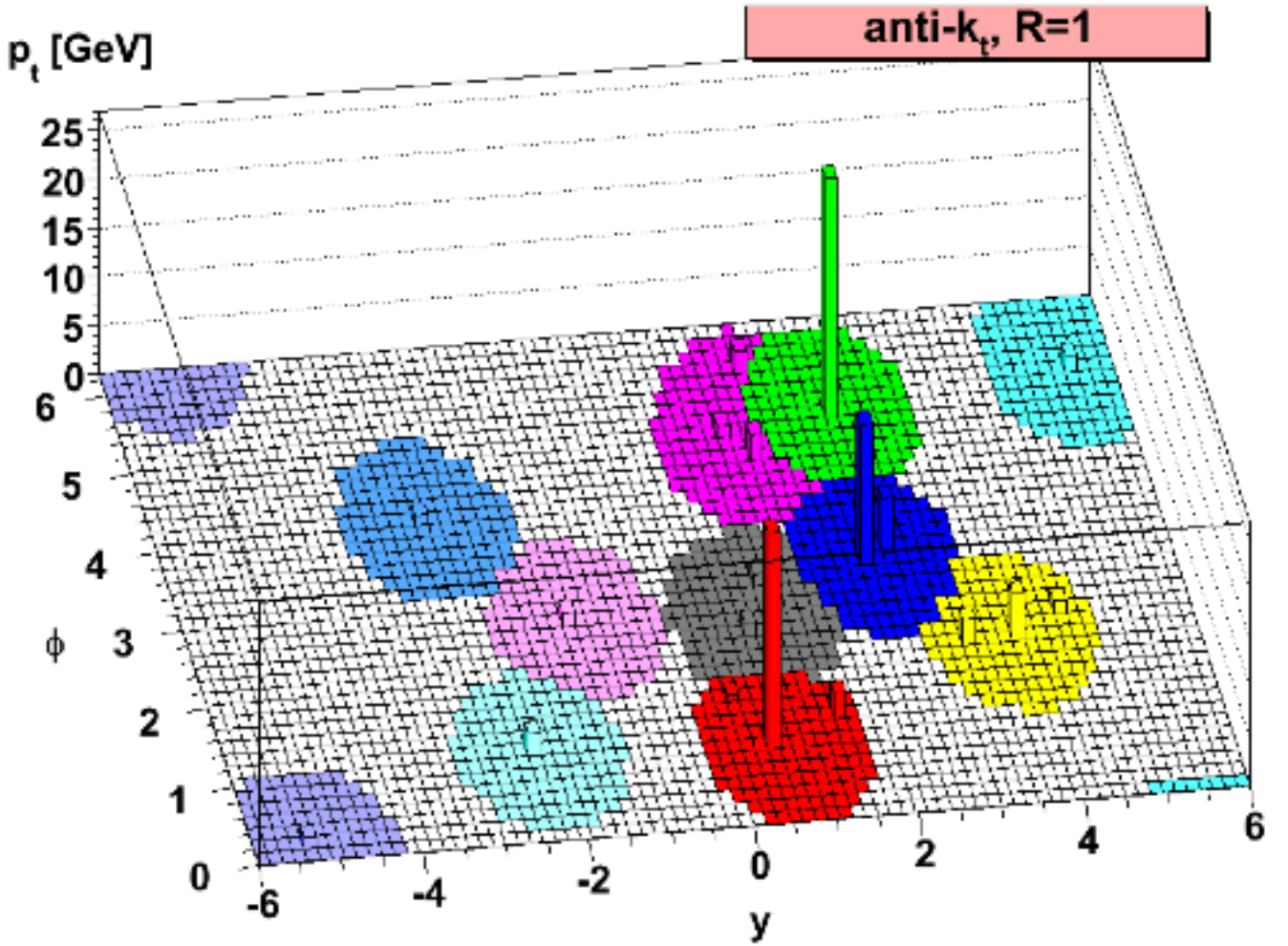
[Pythia]


Evolution

Latent variables


Prediction (simulation)

Inference



[M. Cacciari, G. Salam, G. Soyez 0802.1189]

Detector interactions

Shower splittings

z_s

Parton-level momenta

z_p

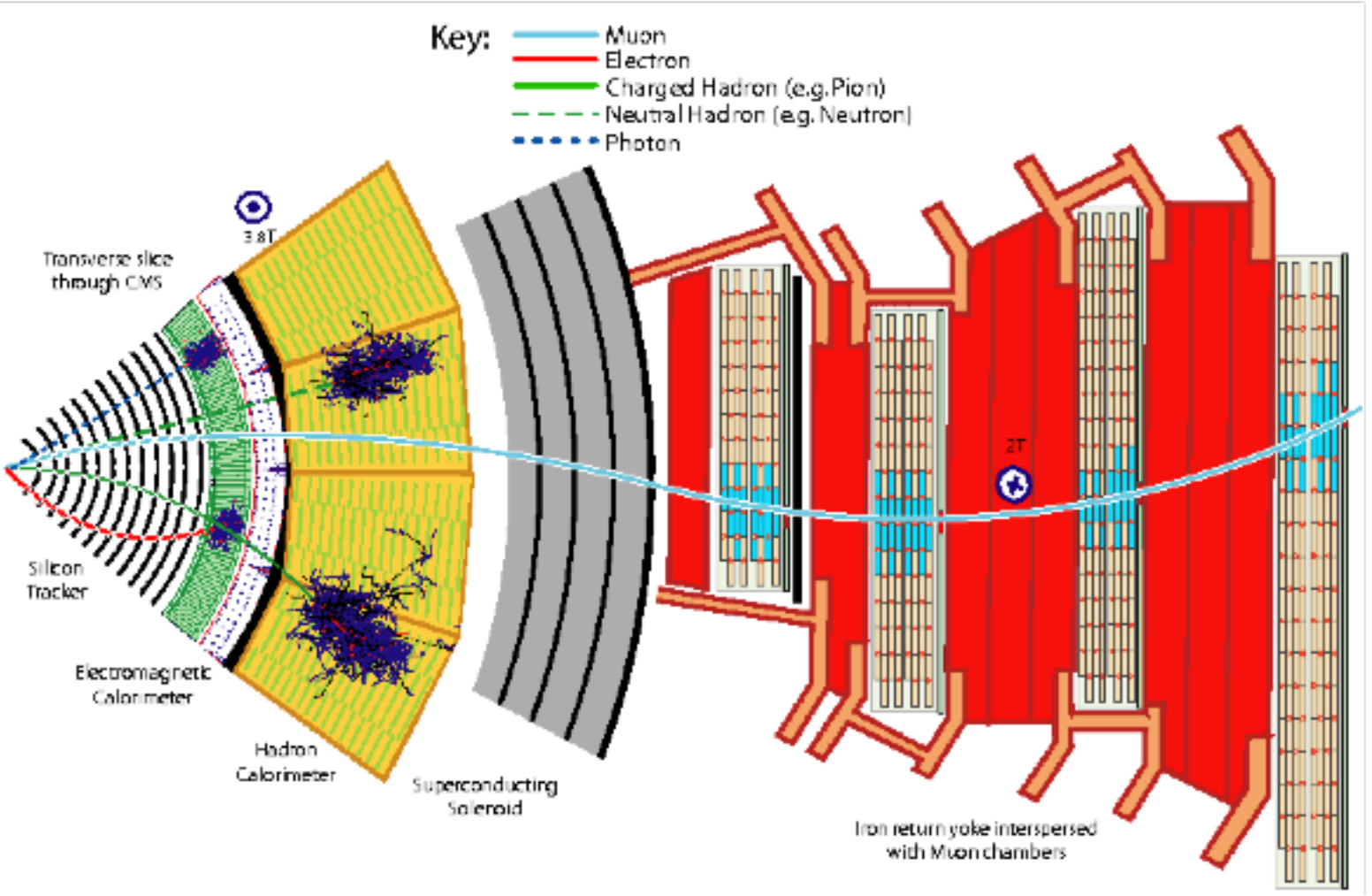
Theory parameters

θ

Observables

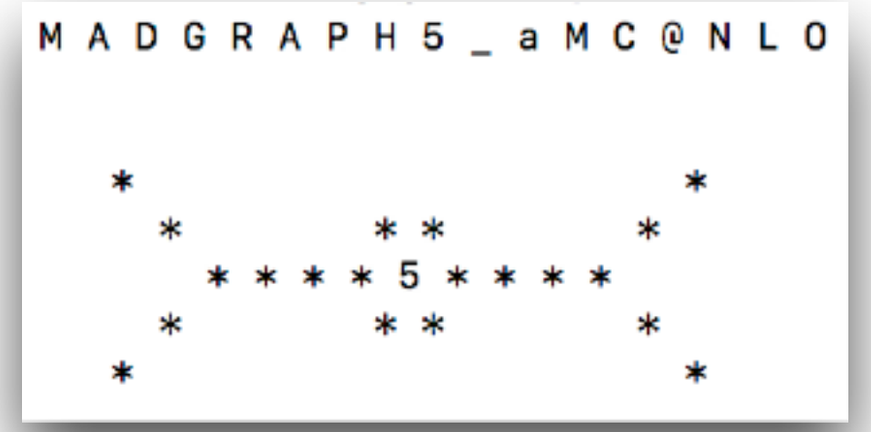
$p(x|z_d)$ $p(z_d|z_s)$ $p(z_s|z_p)$ $p(z_p|\theta)$

$$p(x|\theta) = \int \mathrm{d}z_d \int \mathrm{d}z_s \int \mathrm{d}z_p$$


Key:
Muon
Electron
Charged Hadron (e.g. Pion)
Neutral Hadron (e.g. Neutron)
Photon
Transverse slice through CMS
3.8T
2T
Silicon Tracker
Electromagnetic Calorimeter
Hadron Calorimeter
Superconducting Solenoid
Iron return yoke interspersed with Muon chambers

[CMS]

GEANT4
A SIMULATION TOOLKIT


MADGRAPH5_aMC@NLO
5

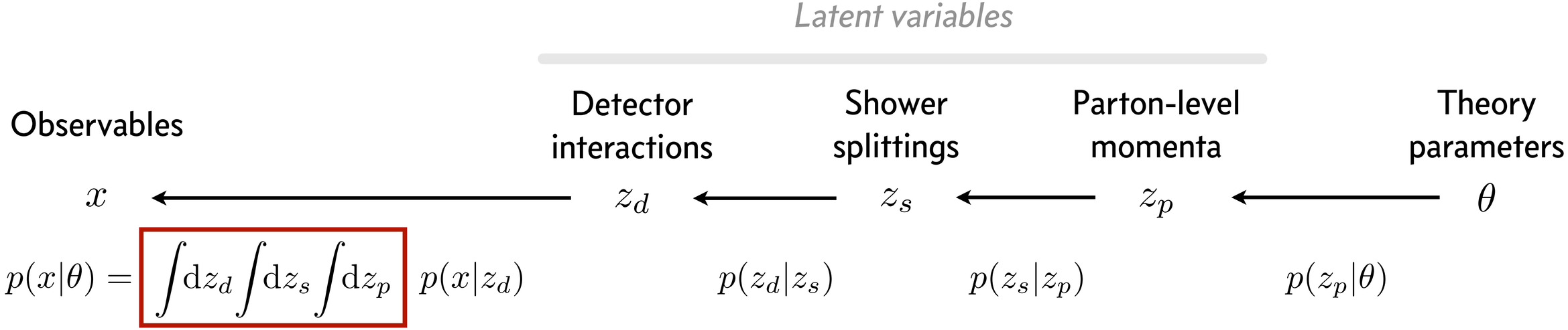
It's infeasible to calculate the integral over this enormous space!

$$p(z|x,\theta)$$

Slide: Johann Brehmer

Slide: Johann Brehmer

Are simulators all you need?



It's infeasible to calculate the integral over this enormous space!

$p(z|x,\theta)$

Inference

What could we do with $p(x)$?