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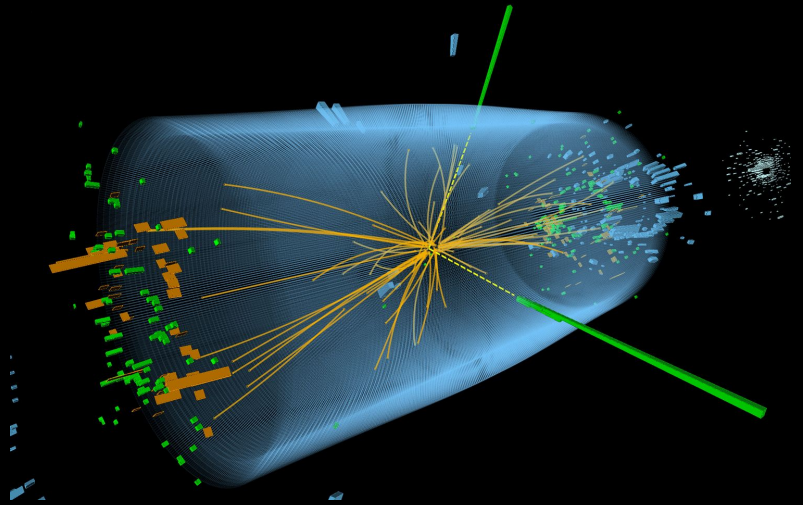
Particle Physics Phenomenology

Lecture IV

Reinterpretation and Tools



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Mini Curso, Universidad de La Serena
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@ CERN, CMS

The need for Reinterpretation

Experiments use resources/manpower/cost/effort in creating a dedicated analysis. Can not cover ALL possibilities

Experimental results $<$ Theoretical models

How can we (theorists/phenomenologist) do an efficient and reliable reinterpretation of an experimental result to different BSM scenarios?

We need extensive information about analysis details !

Including cutflows, publicly available efficiencies. Not always easy

Reinterpretation Challenges

Prompt Searches

Signal Generation
Selection Cuts
Signal Region definition/cuts
Trigger efficiencies
Validation

Standard Tools available for all these (i.e MadGraph, DELPHES, CheckMate). Processes are streamlined.

LLP searches

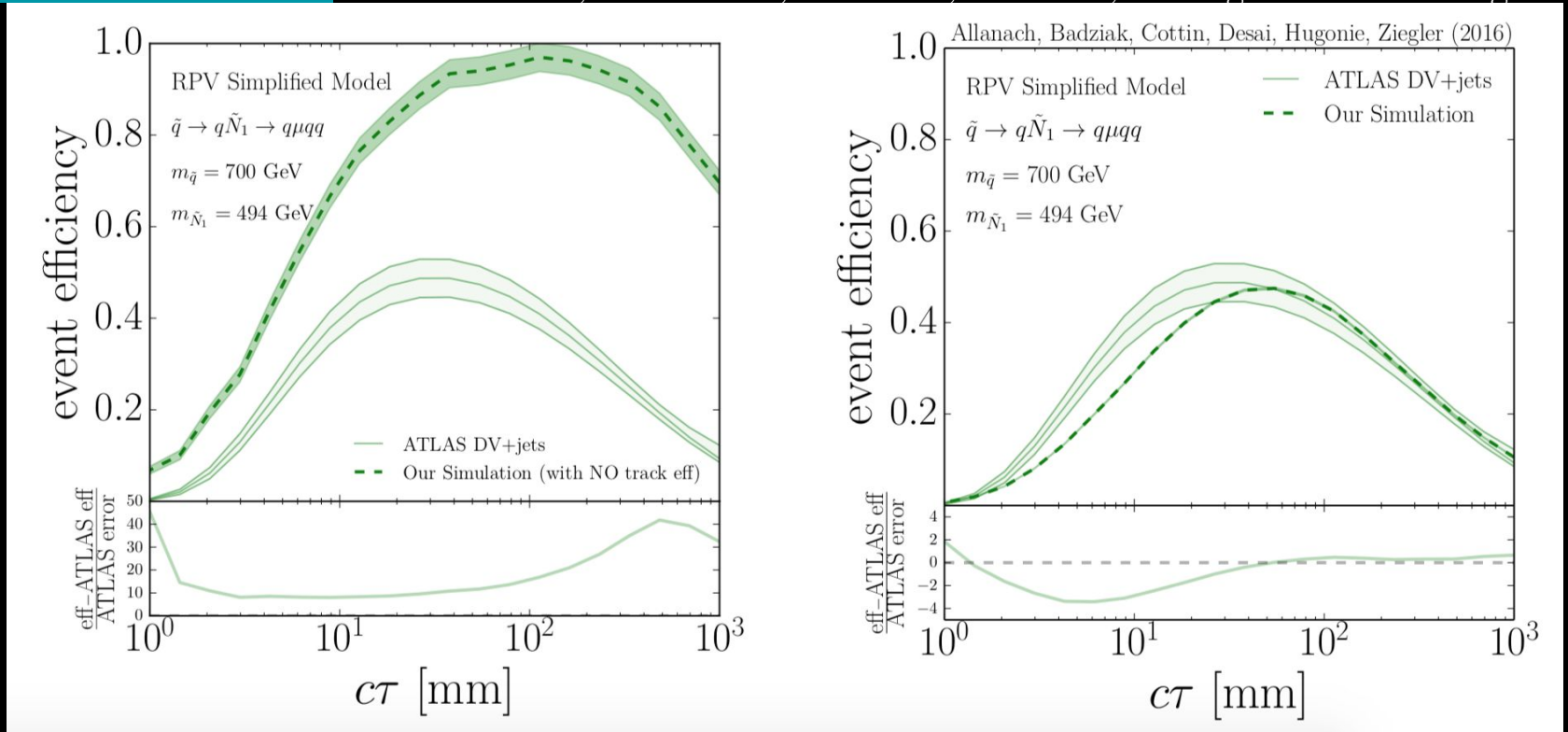
Signal Generation
Selection Cuts
Signal Region definition/cuts
Trigger efficiencies
Validation
Displacement in EG
Tracking and Vertexing efficiencies
Detector effects in displacement/timing

Not much information. No standard tools nor way of doing things.

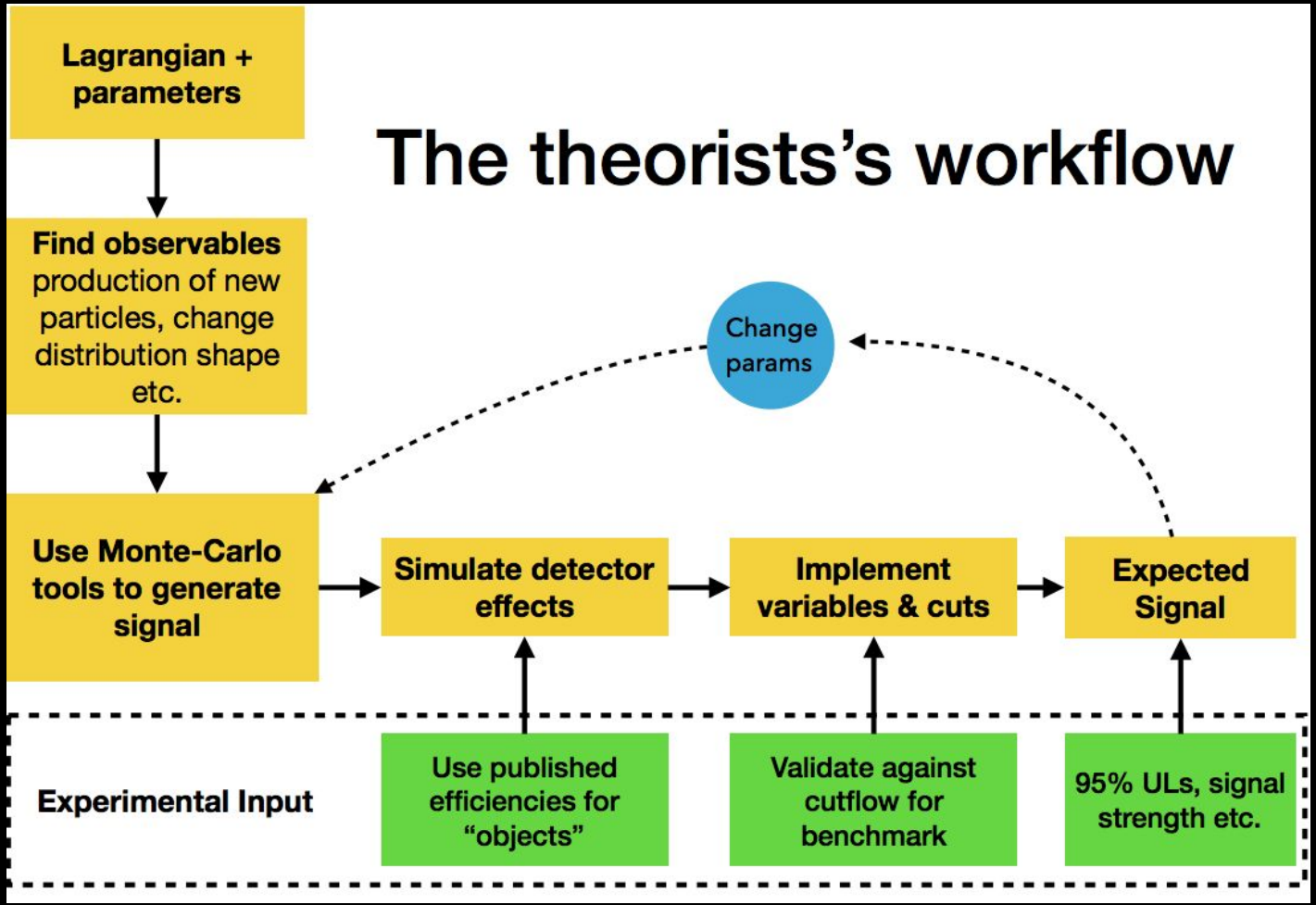
Risk of dangerous extrapolations. Validation is KEY!

Example: Recasting ATLAS Displaced Vertex Search [arXiv:1504.05162] Phys. Rev. D 92, 072004 (2015)

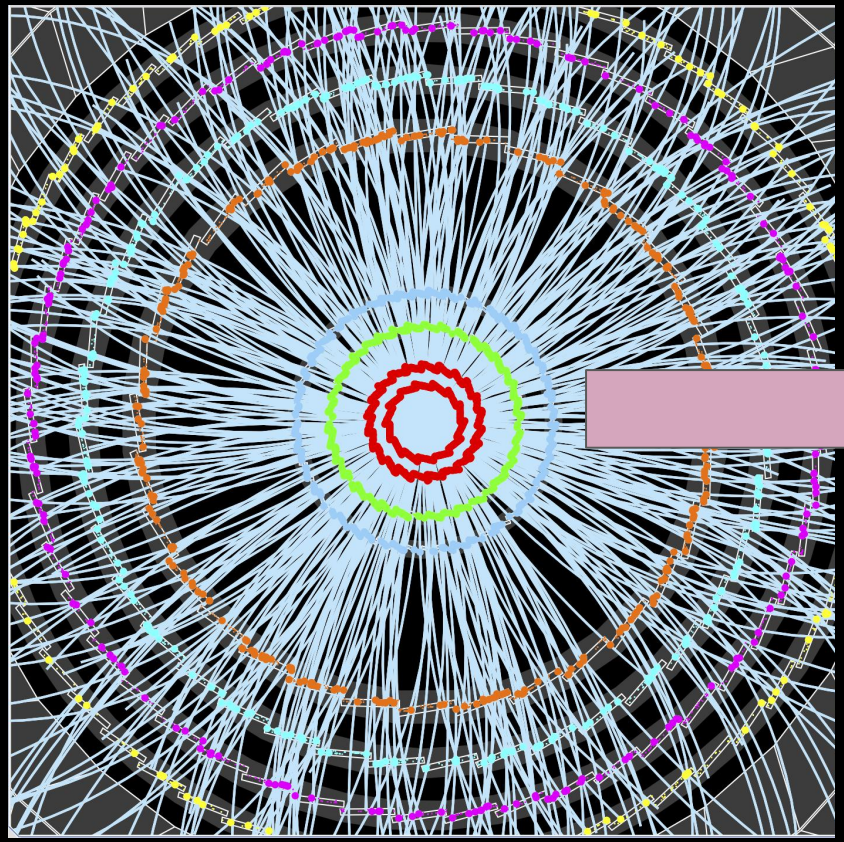
8 TeV Validation : Not much recasting info. Ad hoc track efficiency function defined in [arXiv:1606.03099] Eur.Phys.J. C76 (2016) B. C. Allanach, M. Badziak, G. Cottin, N. Desai, C. Hugonie and R. Ziegler

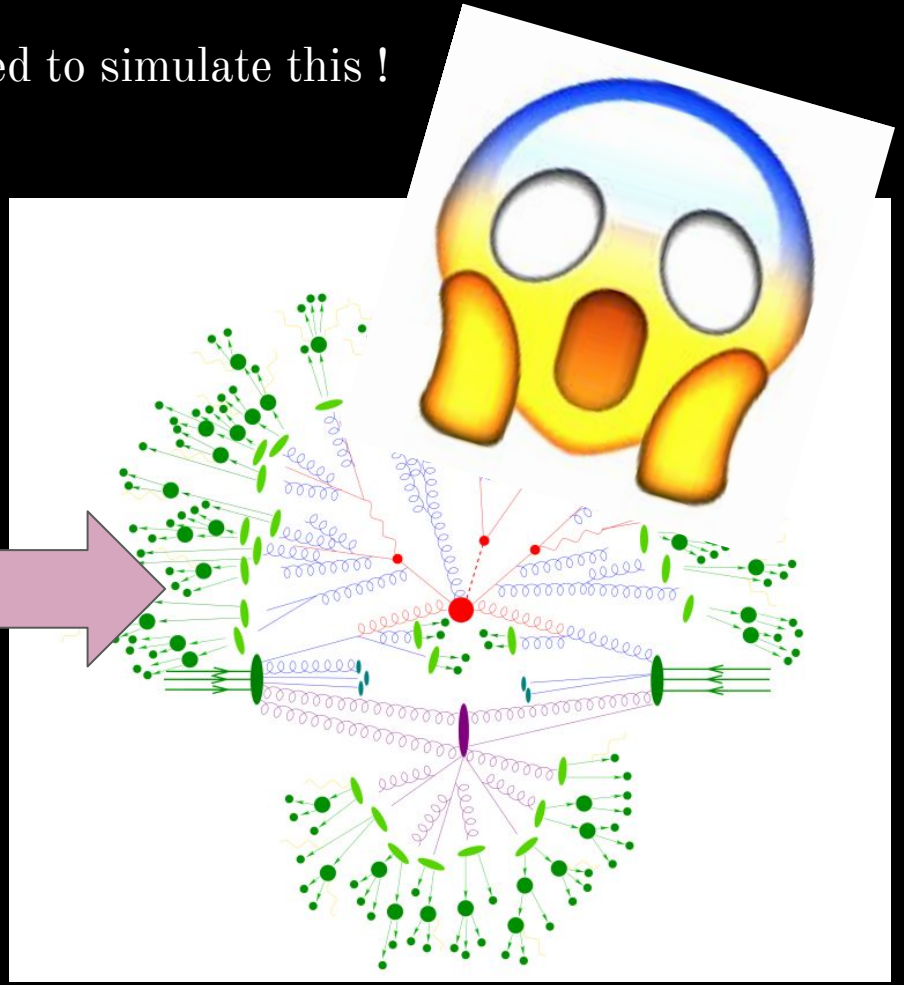


Thanks to Nishita Desai @ LLP Workshop, CERN

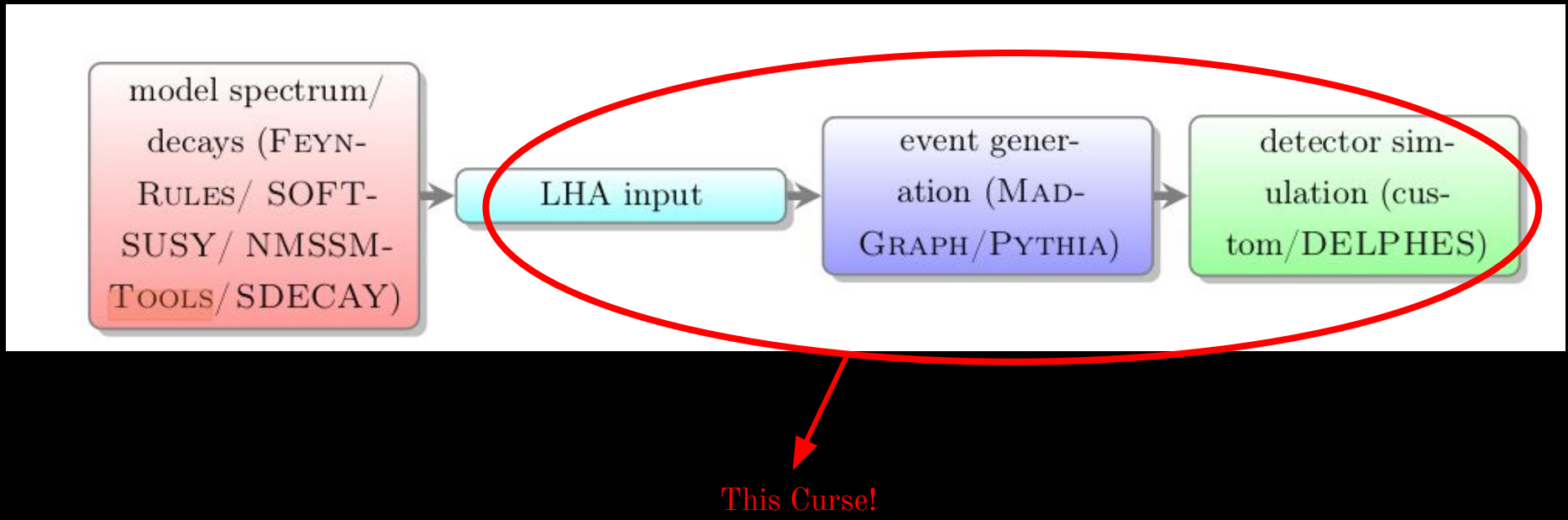


Phenomenologists need to simulate this !





Usual chain of simulation done in phenomenological studies



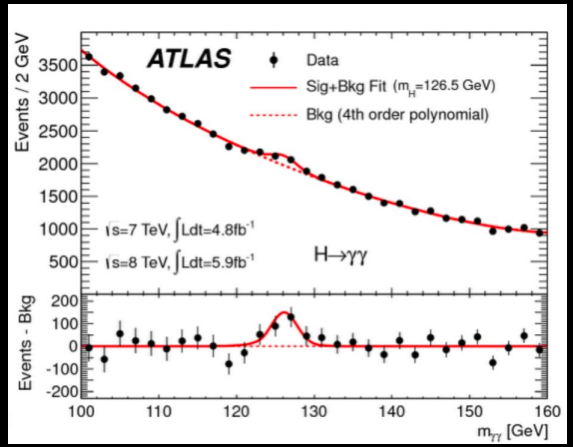
MadGraph/Pythia

http://madgraph.phys.ucl.ac.be/
https://arxiv.org/abs/1405.0301
http://home.thep.lu.se/Pythia/
https://arxiv.org/abs/1410.3012

Son códigos que computan cross-sections y genera eventos (i.e archivos con información de momentum) para procesos en colisionadores

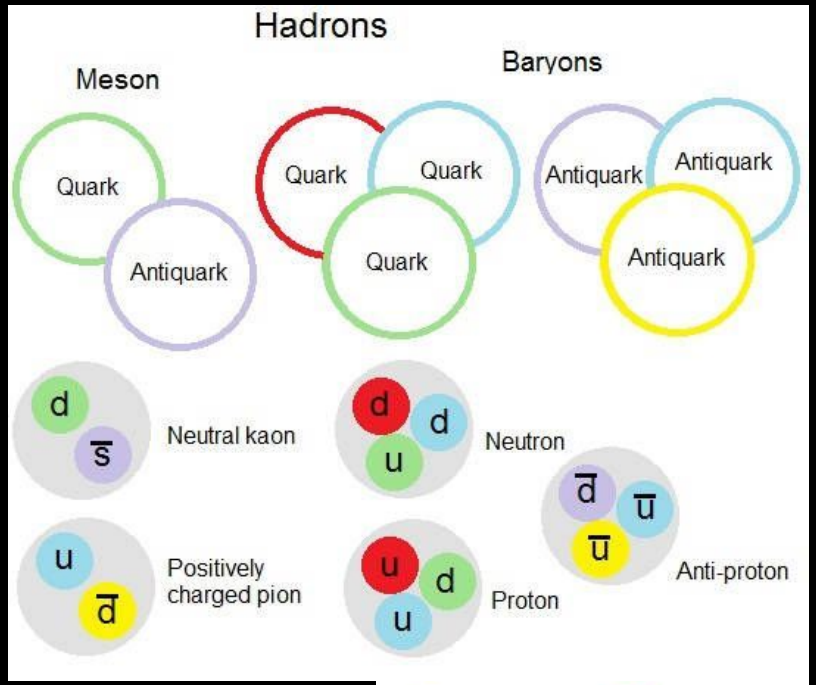
Generamos eventos con Monte Carlo, recordemos que en quantum mechanics las amplitudes son realmente probabilidades!

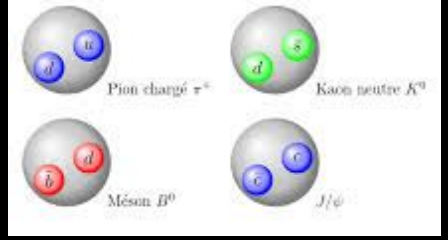
Los generadores de eventos Monte Carlo son importantes para simular el background de procesos conocidos, como tambien para que los fenomenolog@s hagamos estudios y recomendaciones de estrategias de búsqueda para los experimentos!

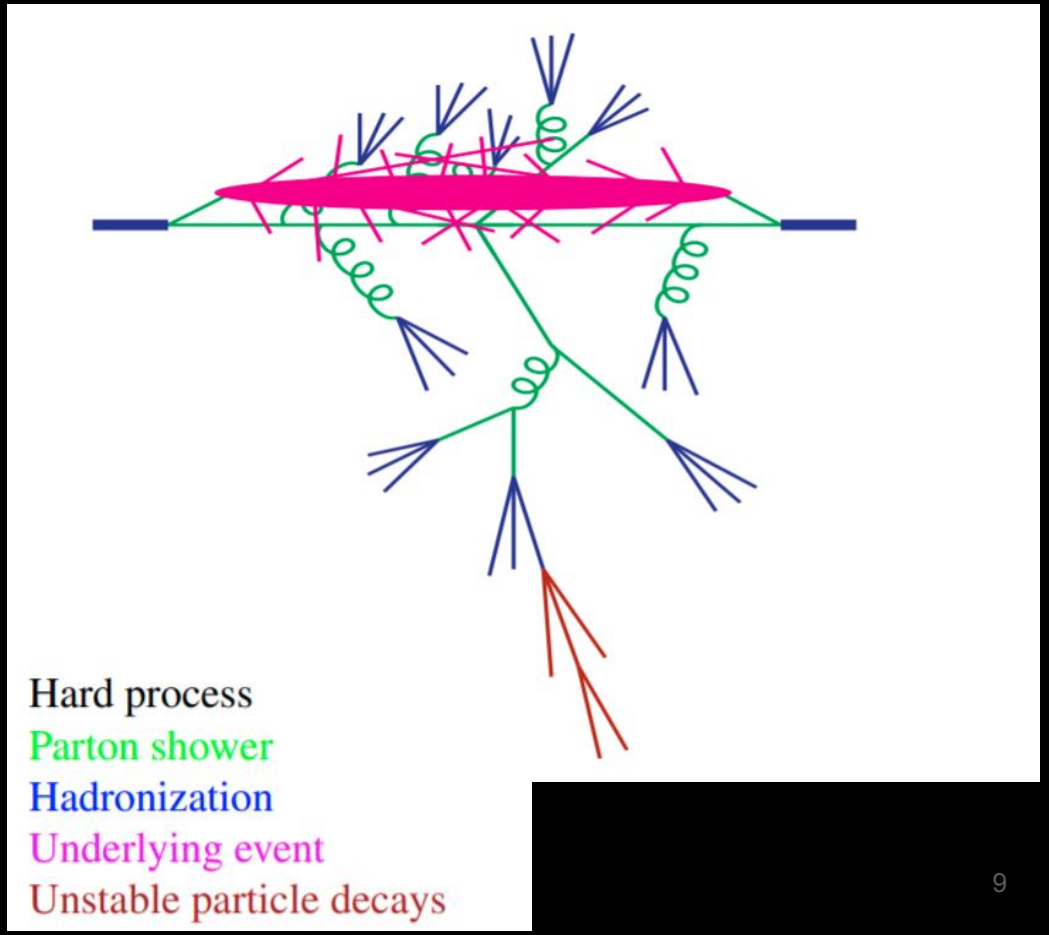


Estos son a grandes rasgos los pasos que se están simulando !

https://arxiv.org/pdf/1304.6677.pdf







Hands-On Session !

>> git clone https://github.com/gfcottin/CursoParticlePhenomenology.git