# Improving LbMCSubmit

## Simplifying simulation production requests and tuning

Simon Thor

simon.thor@cern.ch

Supervisors: Chris Burr and Adam Morris

CERN Summer Student Programme

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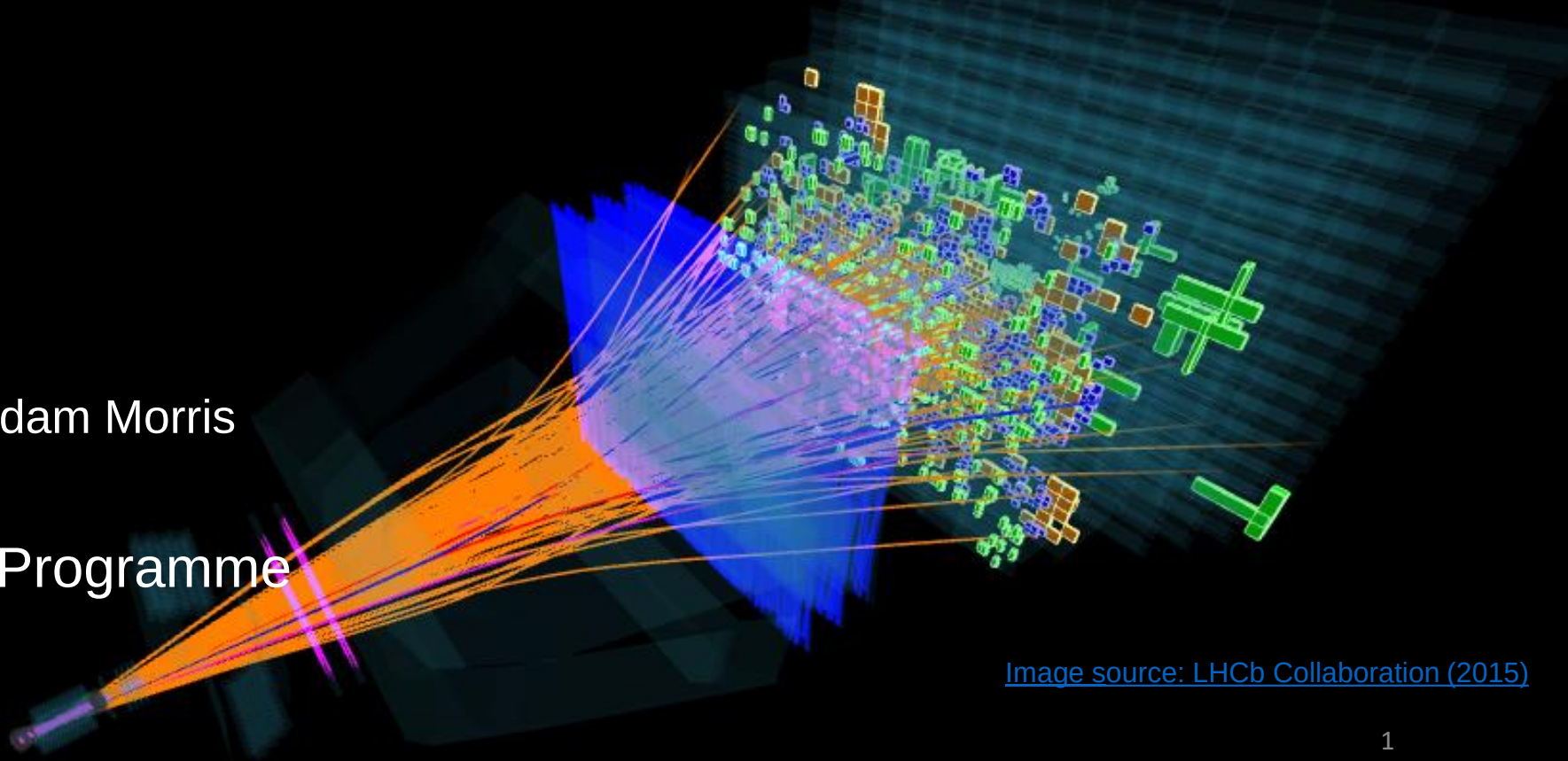


Image source: LHCb Collaboration (2015)

# Simon Thor

1. Recently finished my bachelors in engineering physics
2. Rivet  , PhaseSpace, zfit, Decay Language
3. Bachelor thesis: dark sector BSM and emerging jets
   - Manuscript in preparation ATLAS EXPERIMENT
4. Also some space plasma physics research
5. Loves curry bread

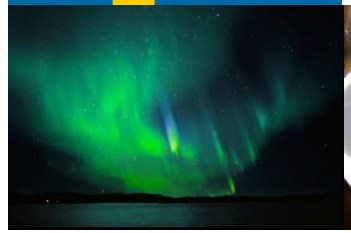



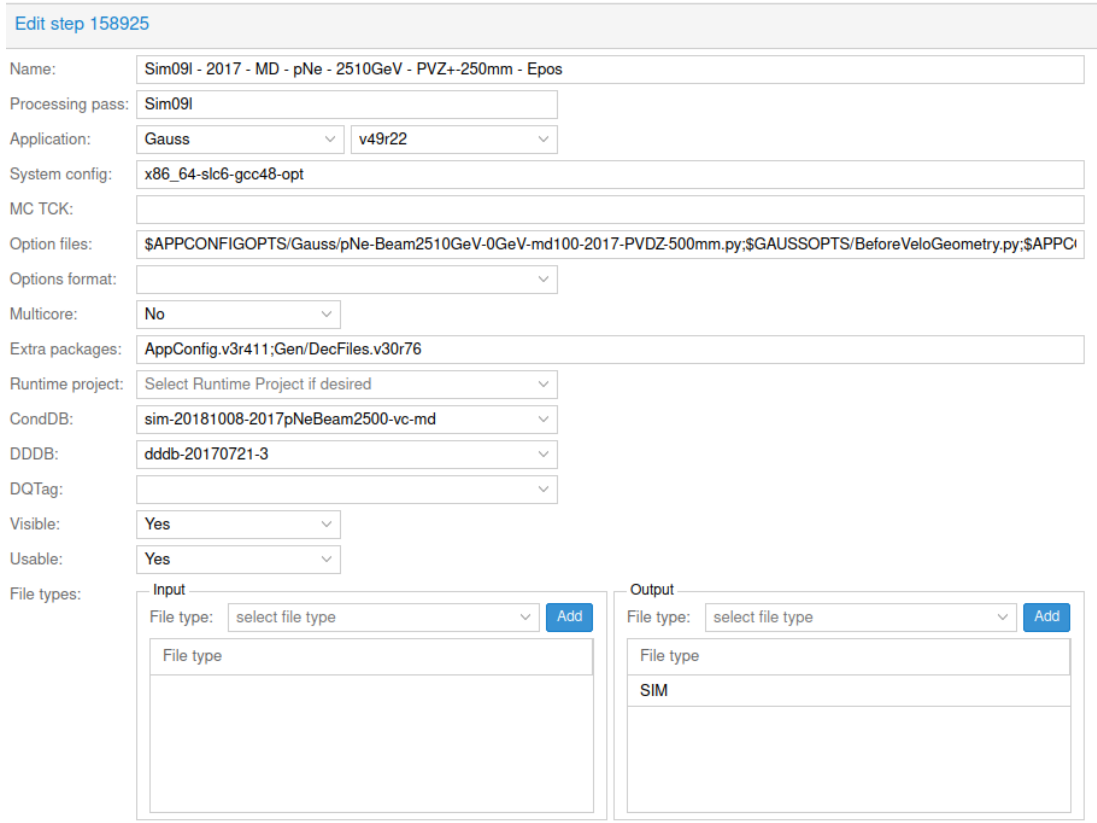
Image sources:
aurora
curry bread

# LHCb simulation productions

- Simulations are done on the grid
- Production requests submitted via web interface

- Same information must be filled in many times for similar production requests

- No way to do bulk edits
- Hours of manual work to update model production requests when new software version is released
- Less popular models are updated less frequently



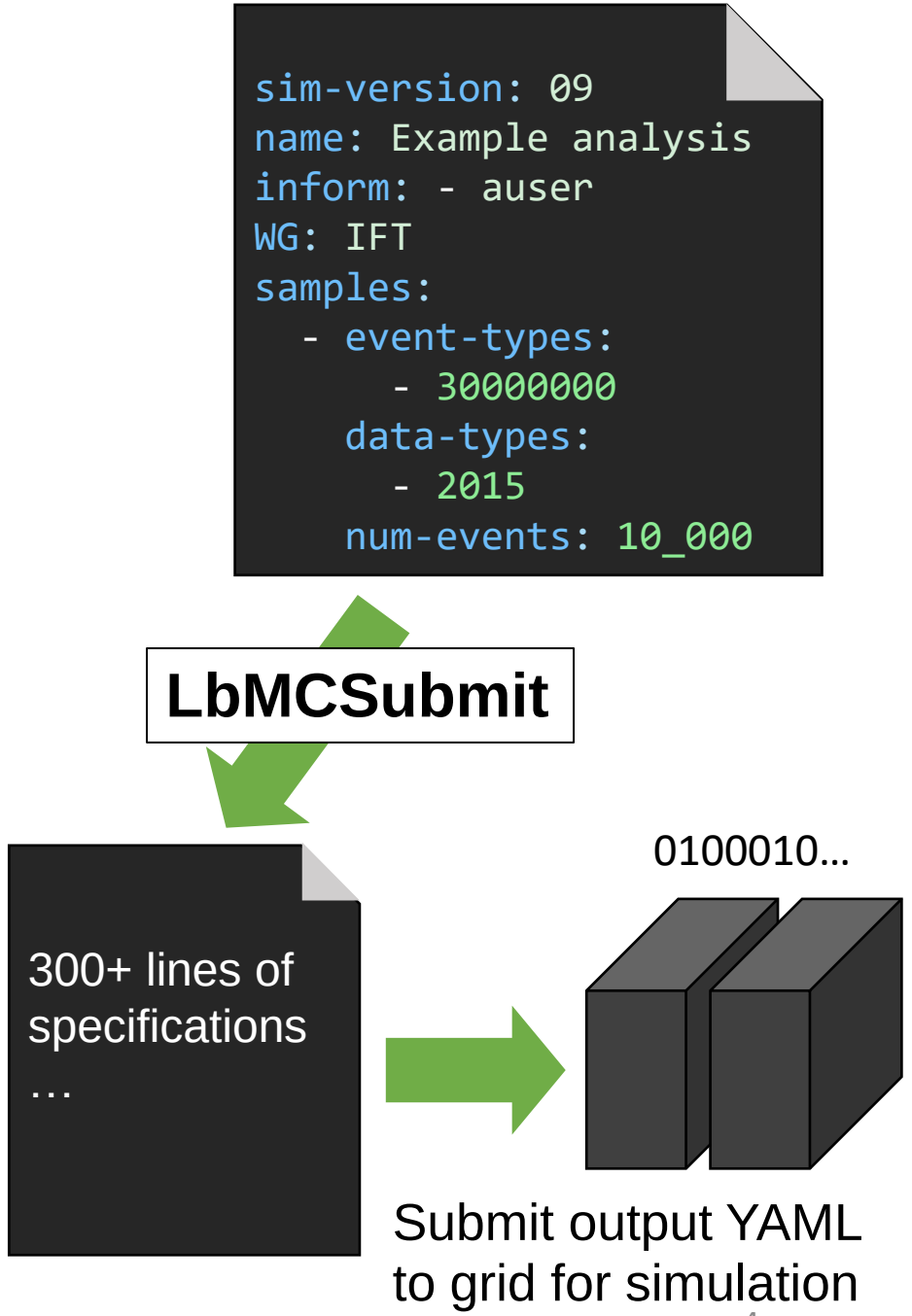

- Error-prone
- Faulty simulation productions lead to wasted computing resources

# Solution: LbMCSubmit

- Write YAML file with minimal information
  - Year, interaction type, …
- LbMCSubmit generates a YAML file containing suitable program version numbers, settings, etc.
- Faster and less error-prone
- Latest version of software as default

**Problems**

- Only proton-proton collisions supported
- Not yet commissioned for wide-spread use



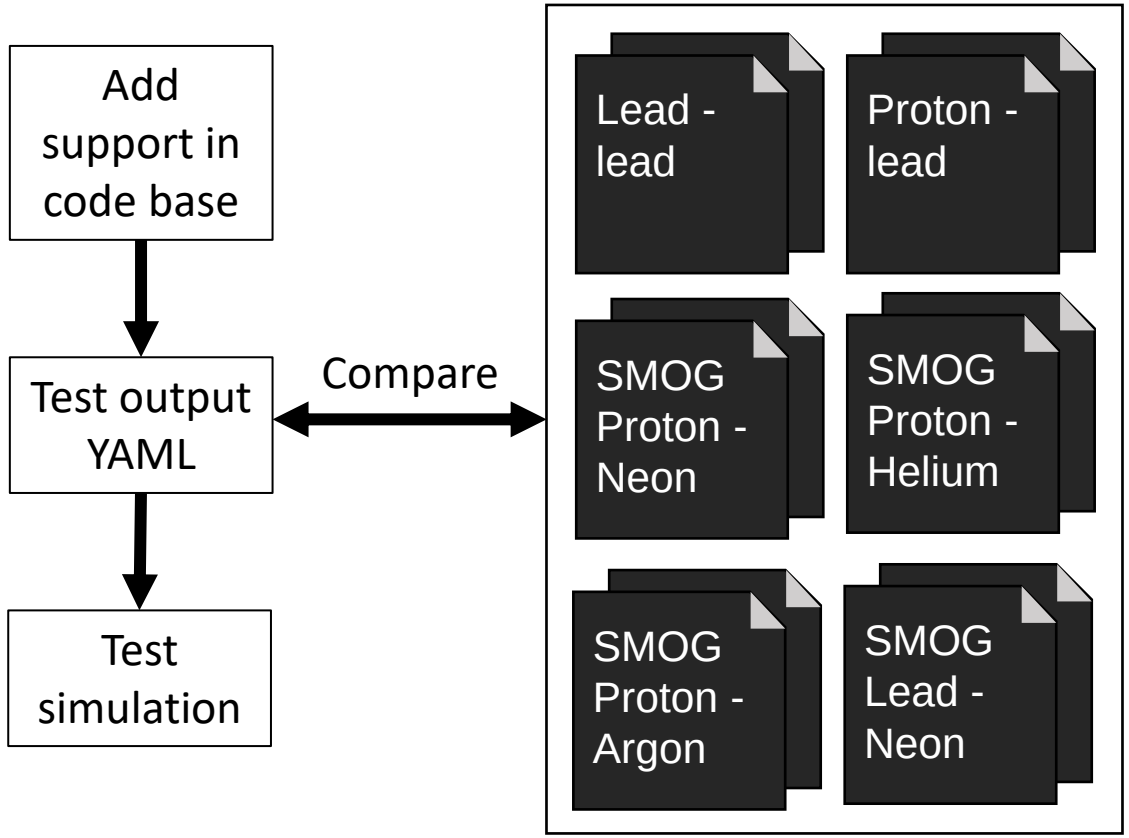
# My work: non-pp collision support

**Workflow**

- Look at previous requests
- Implement collision type in LbMCSubmit
- Run sample simulation to test if it works

**Outcome**

- Added support for all collision types done at LHCb so far
- Identified errors in previous requests
- Submitted production requests for other projects (see presentation by Francis) to stress test LbMCSubmit



# LbMCSubmit + Professor

- Some parameters in event generators must be tuned to match experimental data
- Optimization/tuning done with **Professor**

**Problems**

- Many MC simulations with different parameter values needed → time consuming
- Lacking documentation, many steps and inputs makes Professor hard to use

**Goal**

- Increase simulation speed by simulating on the grid using LbMCSubmit
- Add easy-to-understand interface

# Professor workflow

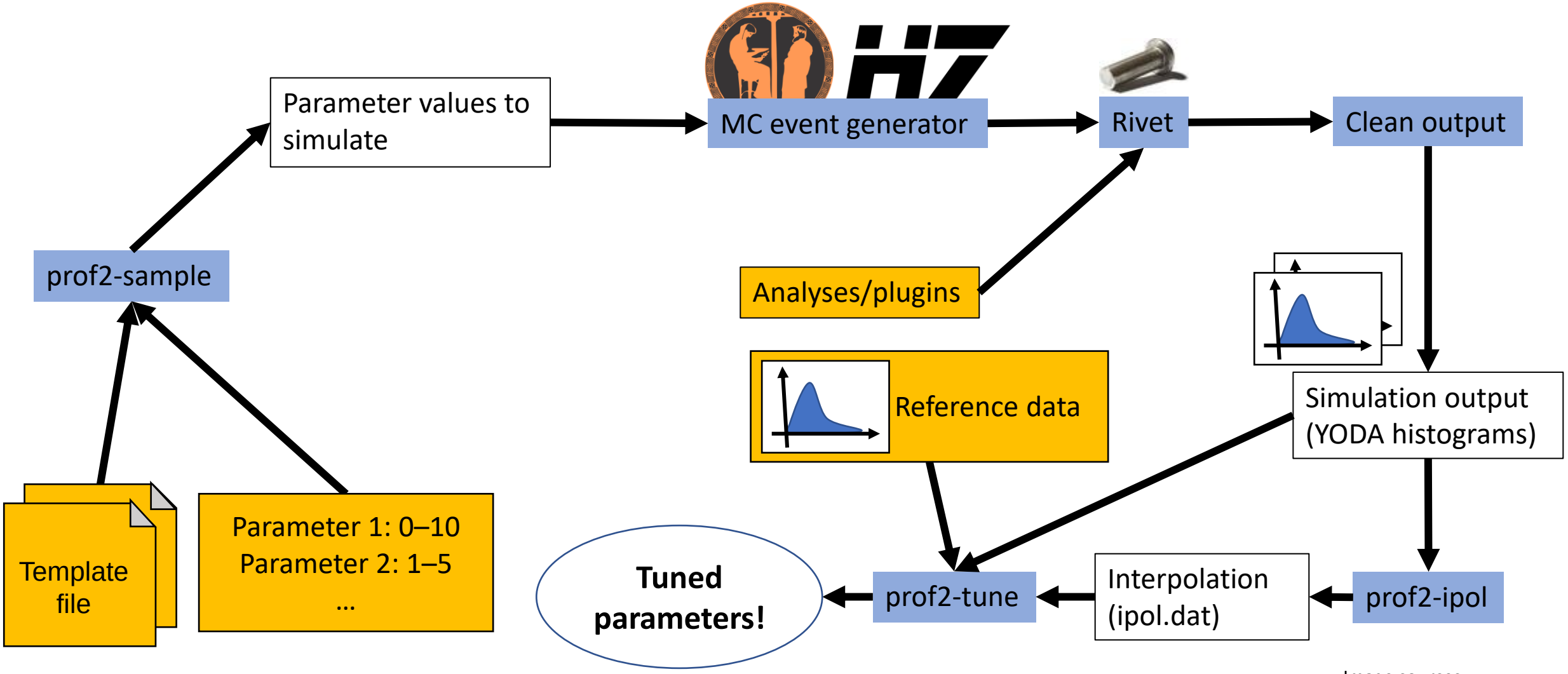



Image sources:
Pythia (2022)
Herwig (2022)
Rivet (2022)

# Professor workflow with new interface

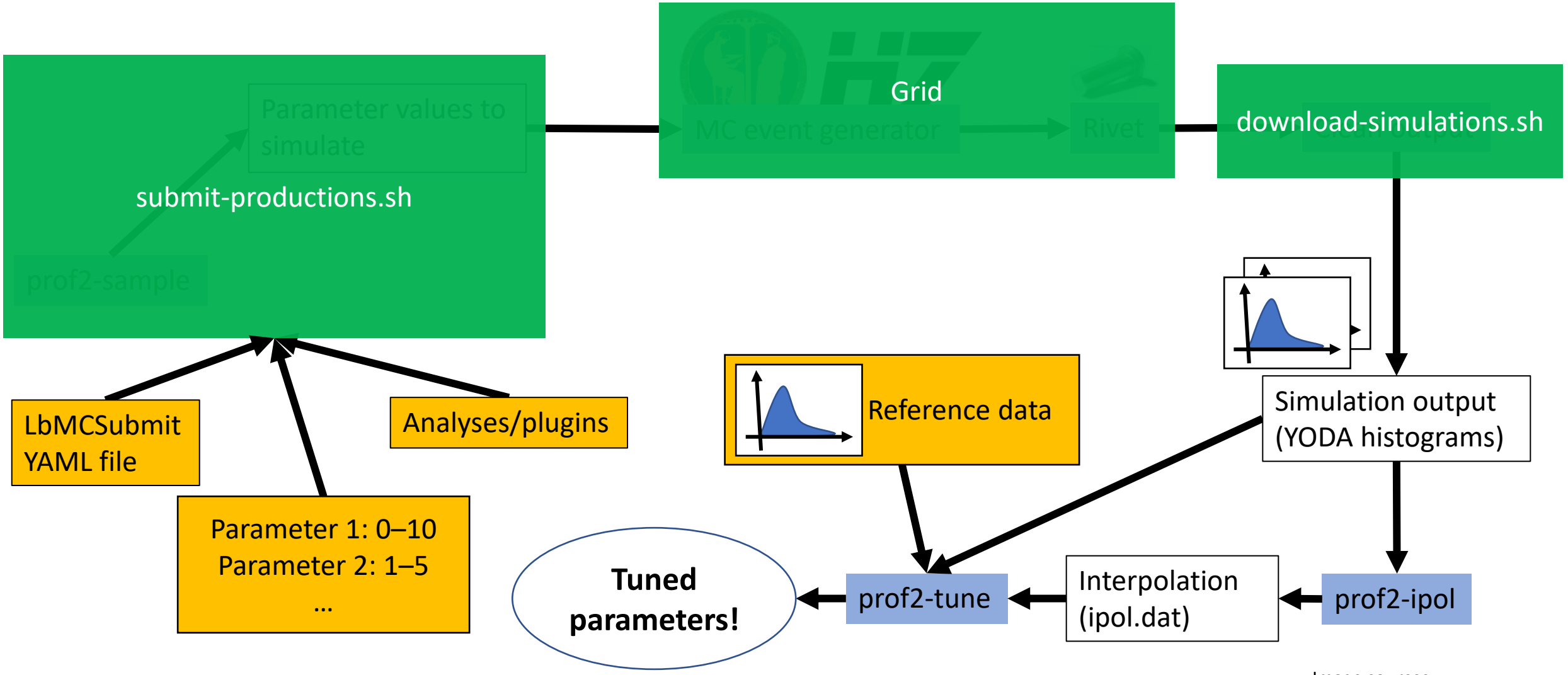



Image sources:
Pythia (2022)
Herwig (2022)
Rivet (2022)

# Summary

**Background**

- LbMCSubmit makes it easier to submit simulation production requests at LHCb
- Professor is a program used for tuning MC event generator parameters

**My contributions**

- Made it possible to simulate **non-pp collisions** using LbMCSubmit
- Tested how well LbMCSubmit works for real-life use cases
- Created an interface to run, download and clean Pythia + Rivet simulations on the grid using LbMCSubmit
- This makes it **easier to use Professor** and **simulations run faster**

**Future work**

- Tune parameters for Sim10
- Possibly add support for tuning of other MC event generators (long-term goal)

# Thank you for listening!

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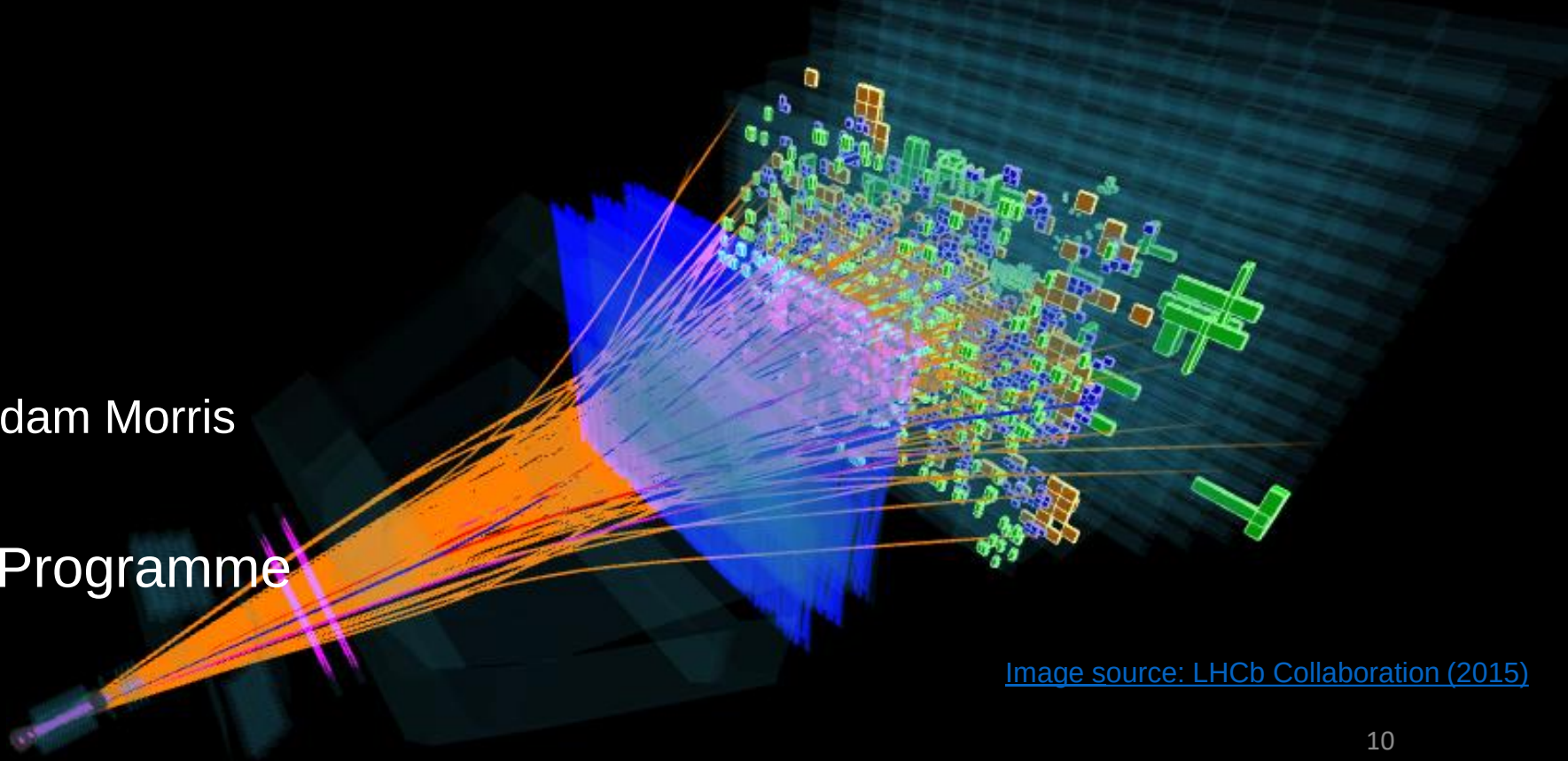

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