

# EVENT DISPLAYS

*Interactive data visualization in HEP*

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ATLAS SW Tutorial

# **PART 1**

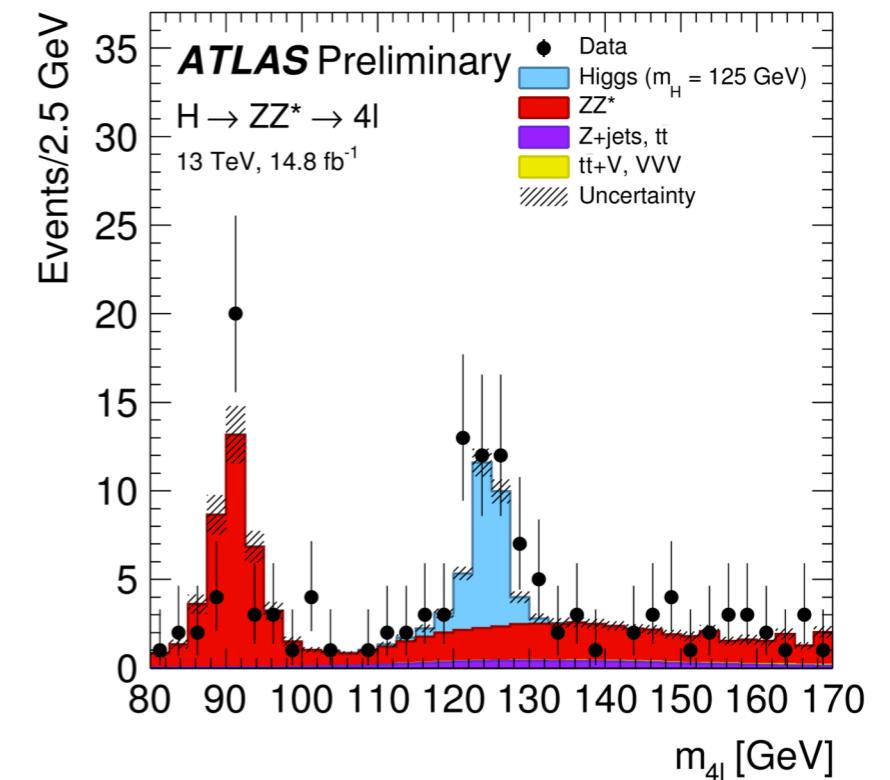
# **EVENT DISPLAYS IN HEP**

# VISUALIZATION IN HEP

So far, in this tutorial, you mainly looked at how to look at event data **statistically**.

You select your data by applying selection criteria, then you look at them globally.

And that is what you need to correctly “extract the physics” from your data.

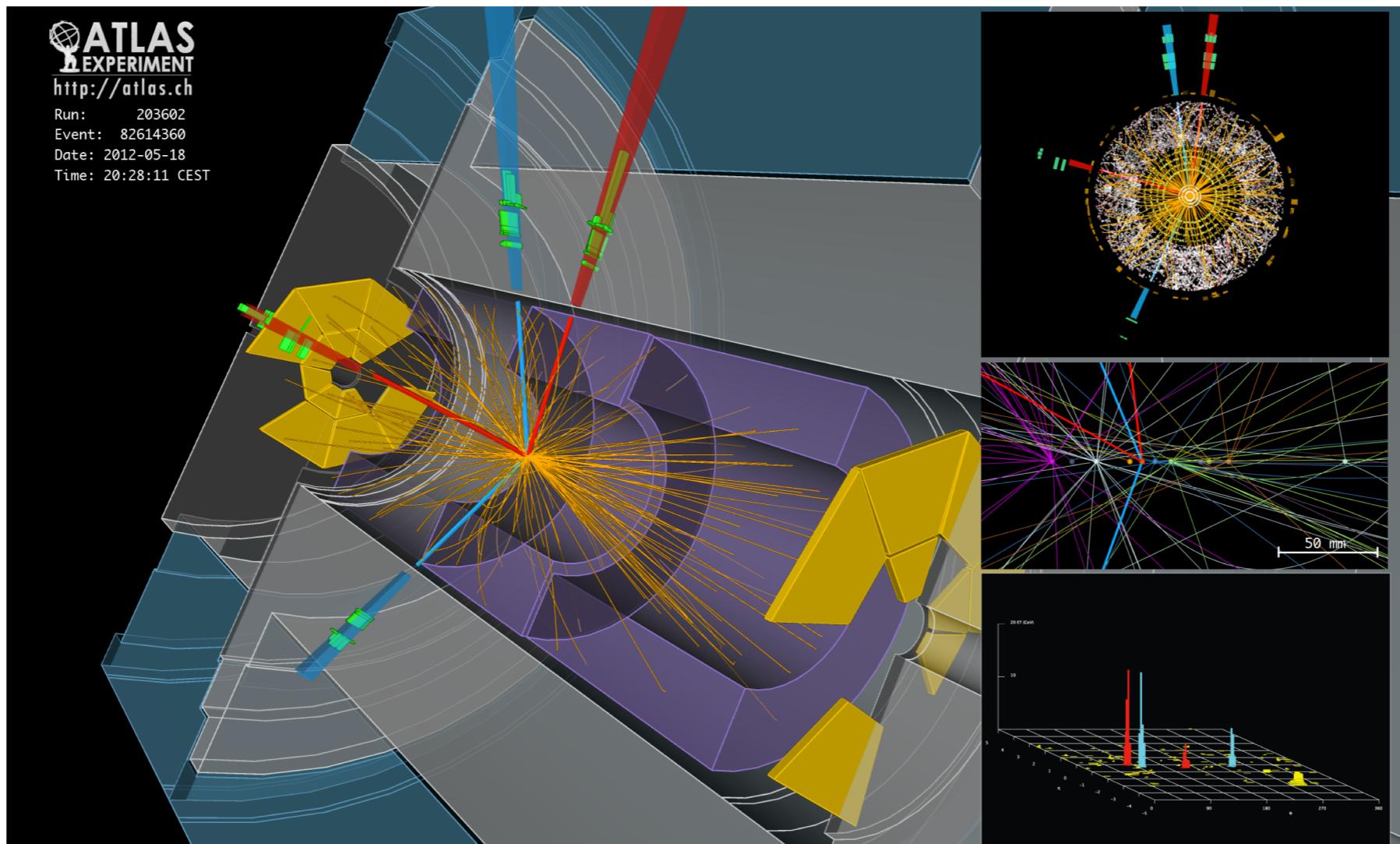


But there are **tasks** for which it is important to **look at single events thoroughly**.

For example...

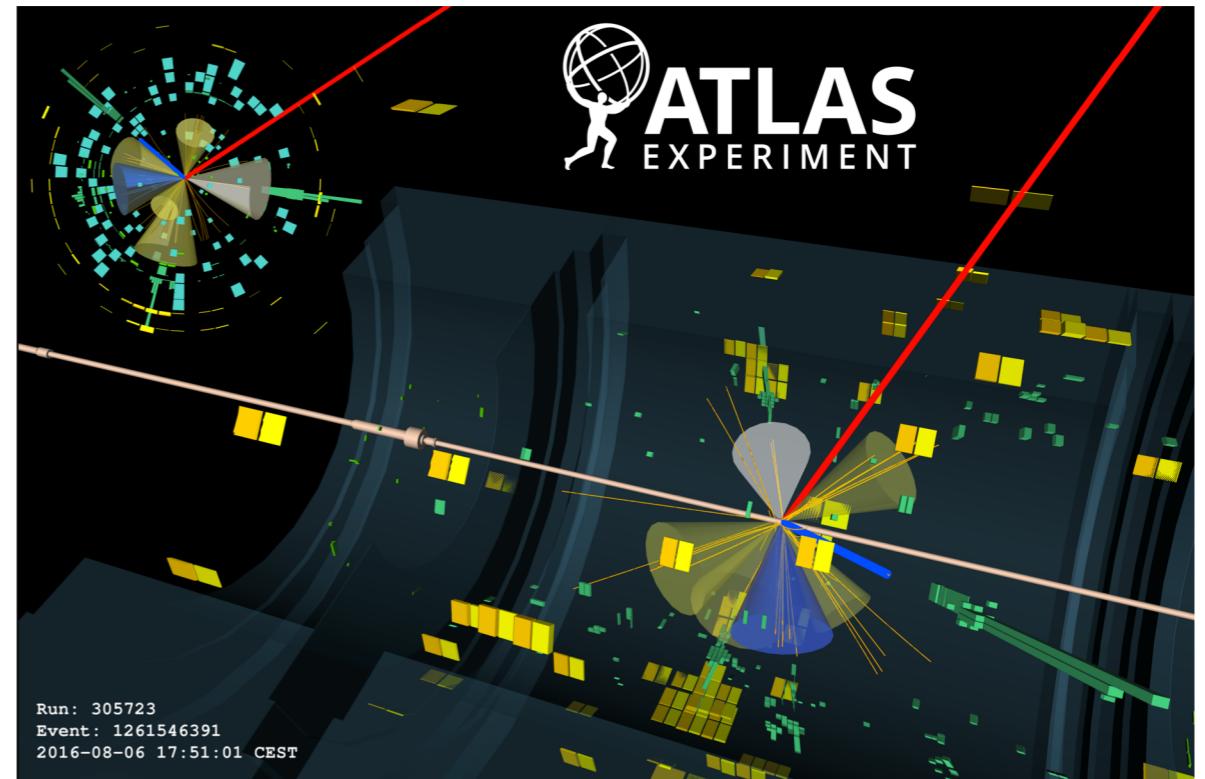
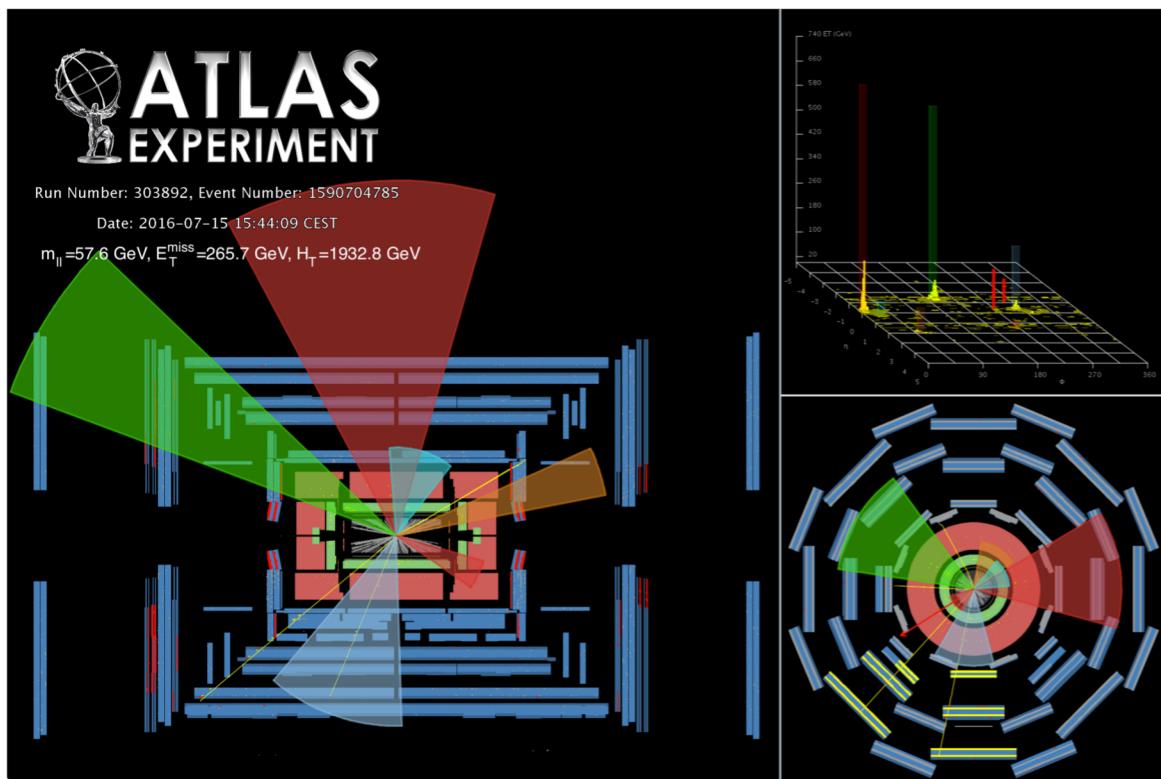
# PHYSICS ANALYSIS

...if you are working on a **physics analysis**, you might want to inspect the physics objects in a bunch of events, to **check your selection algorithms**



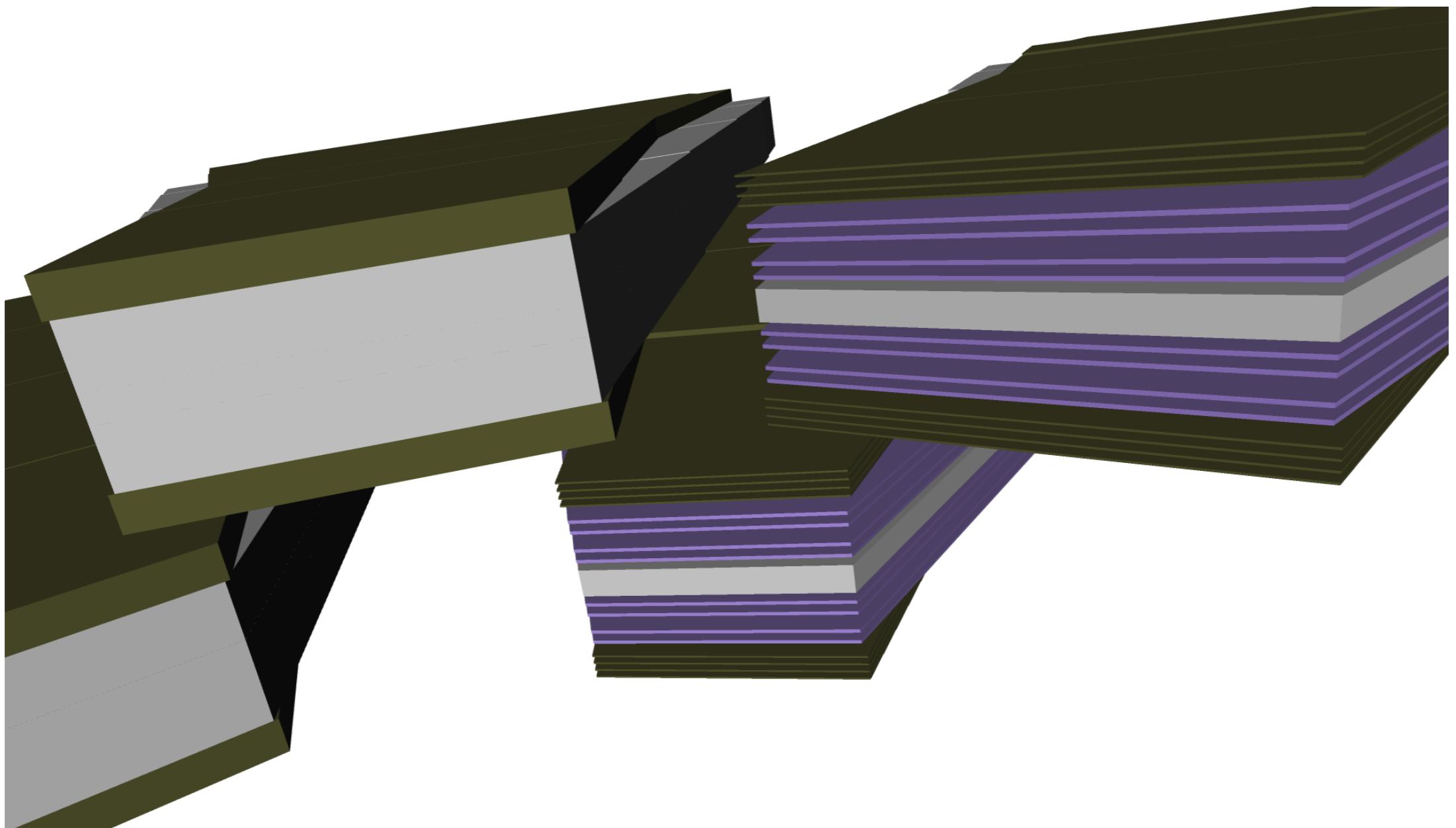
# PHYSICS ANALYSIS

- ...you might also want to **produce a detailed event display** illustrating the topology, to accompany your paper



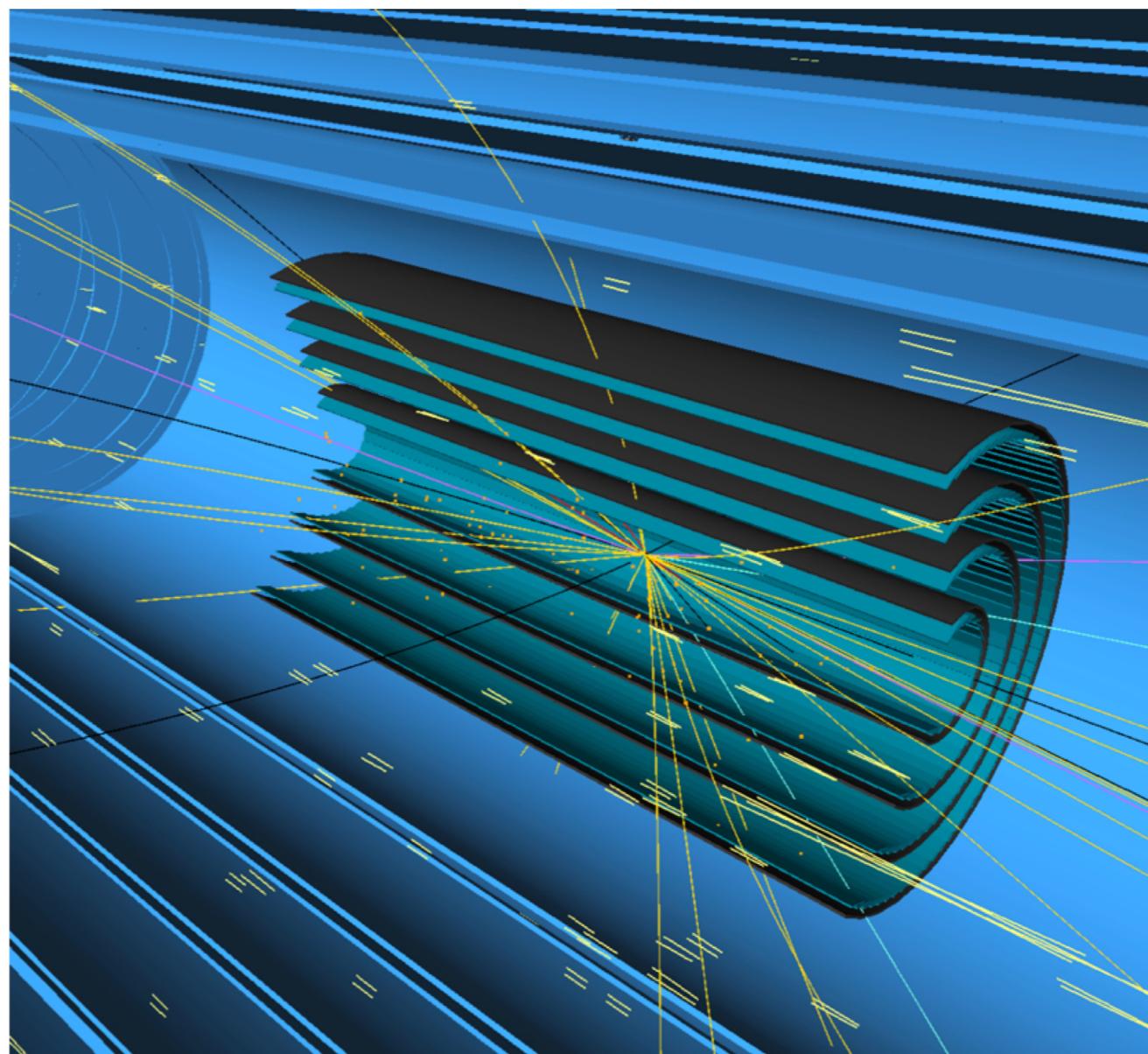
# DETECTOR DEVELOPMENT

- ...if you work on a **sub-detector**, you want to check if the definition of your new **geometry is correct**



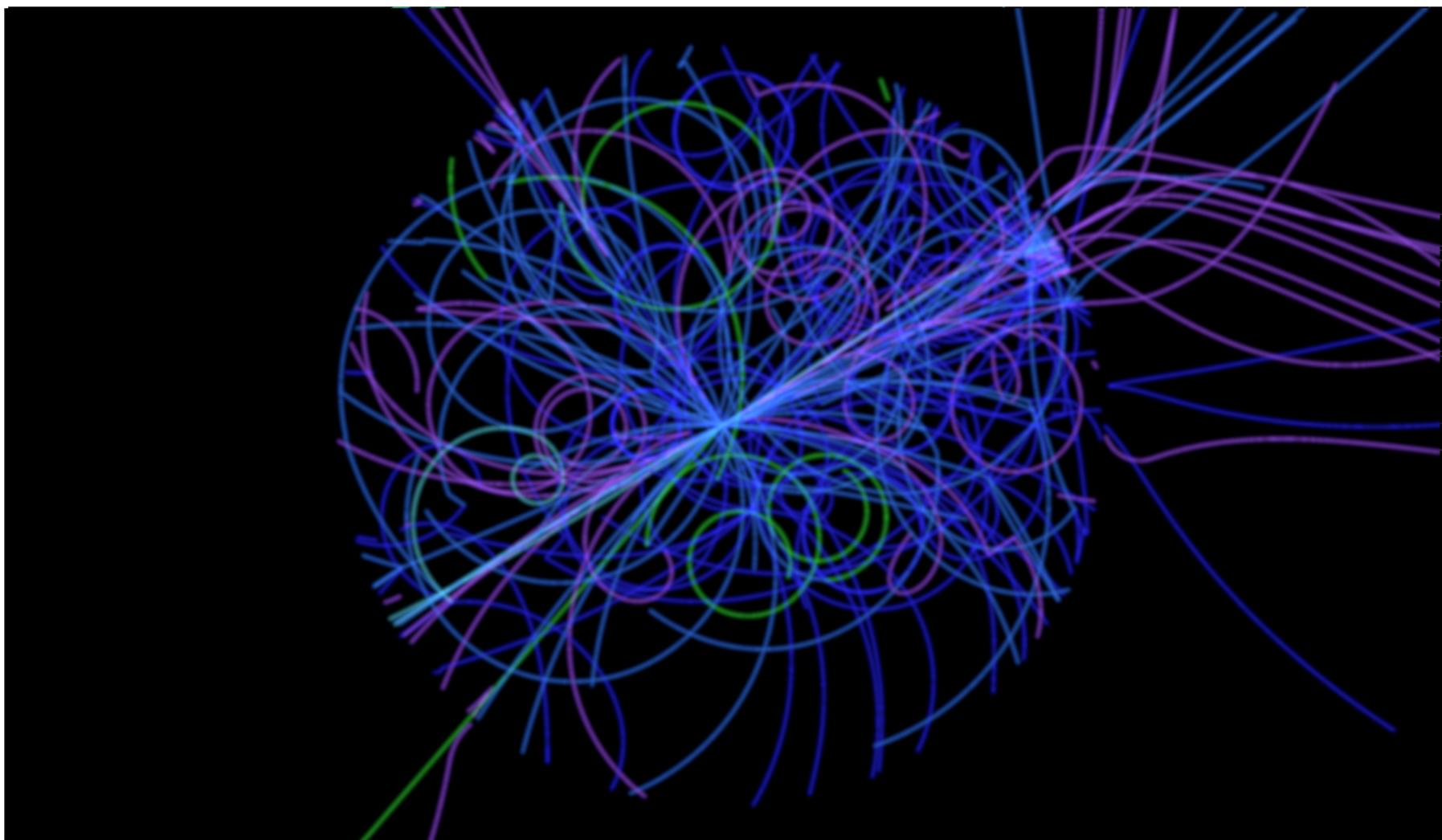
# DETECTOR SIMULATION

- ...if you work in **detector simulation**, you might want to check if your new piece of **code works as expected**



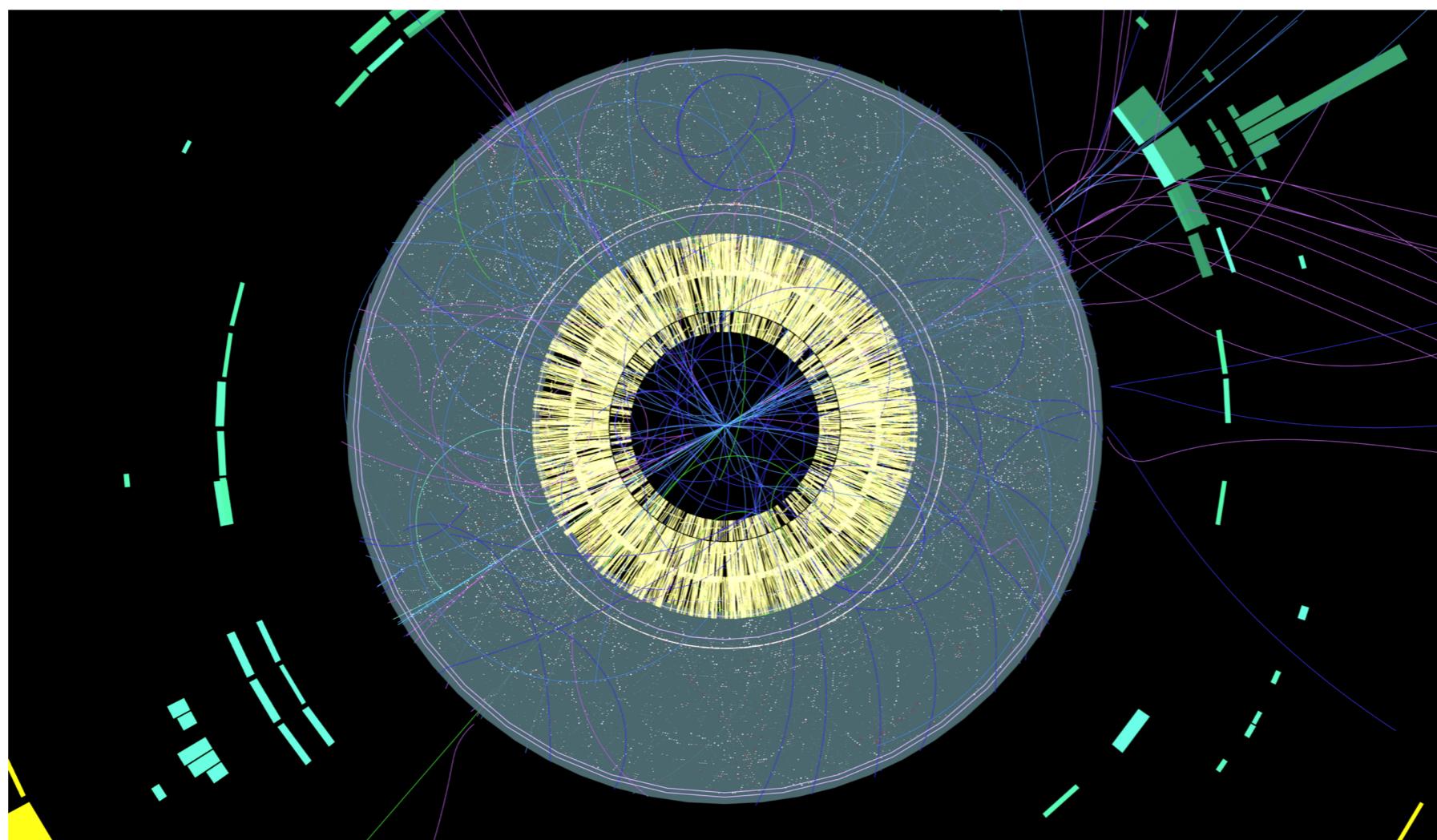
# PHYSICS SIMULATION

- ...if you work with **generators**, you might want to check the Truth events...



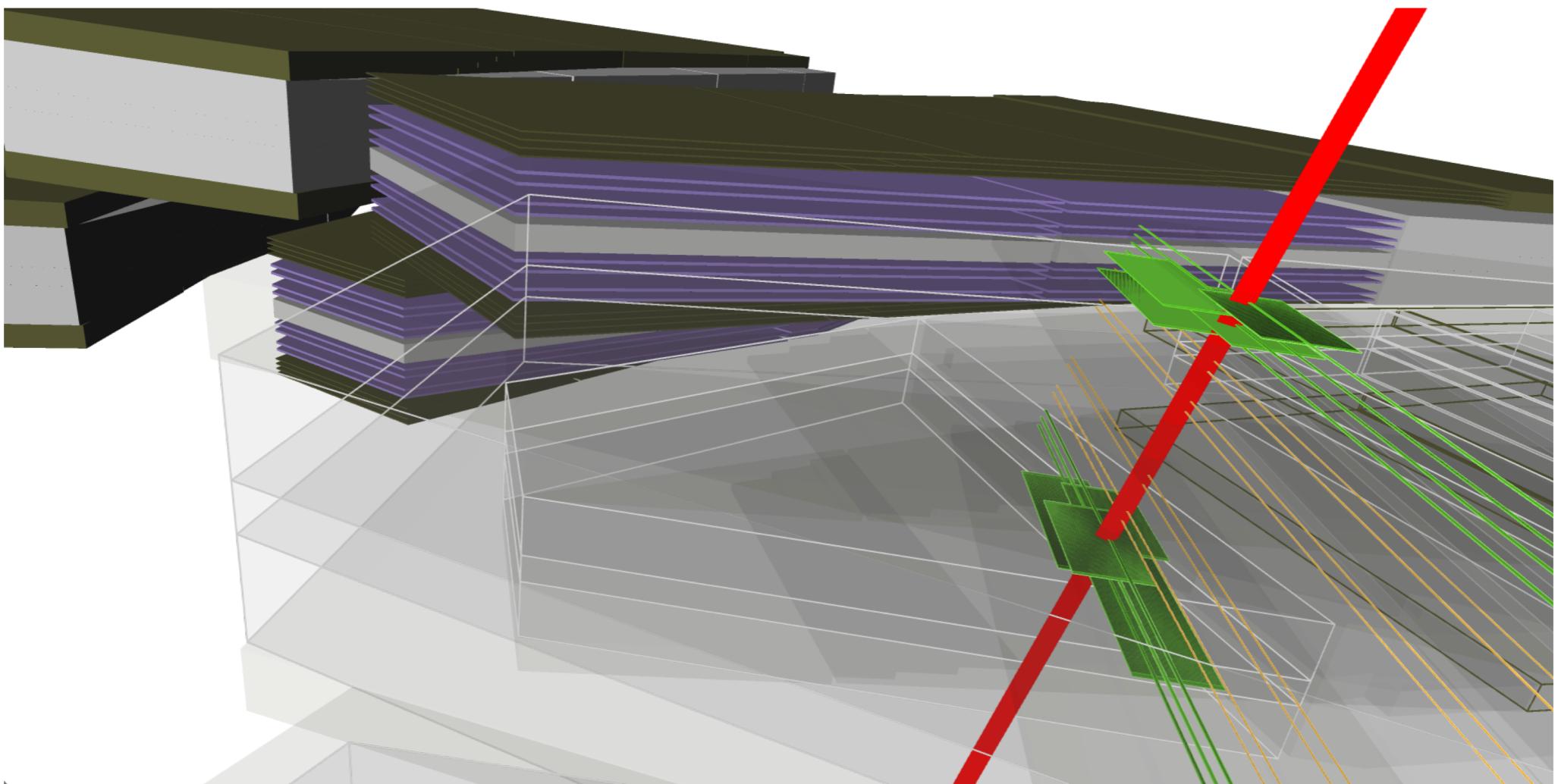
# SIMULATION

- ...and to check the **correspondent detector response**



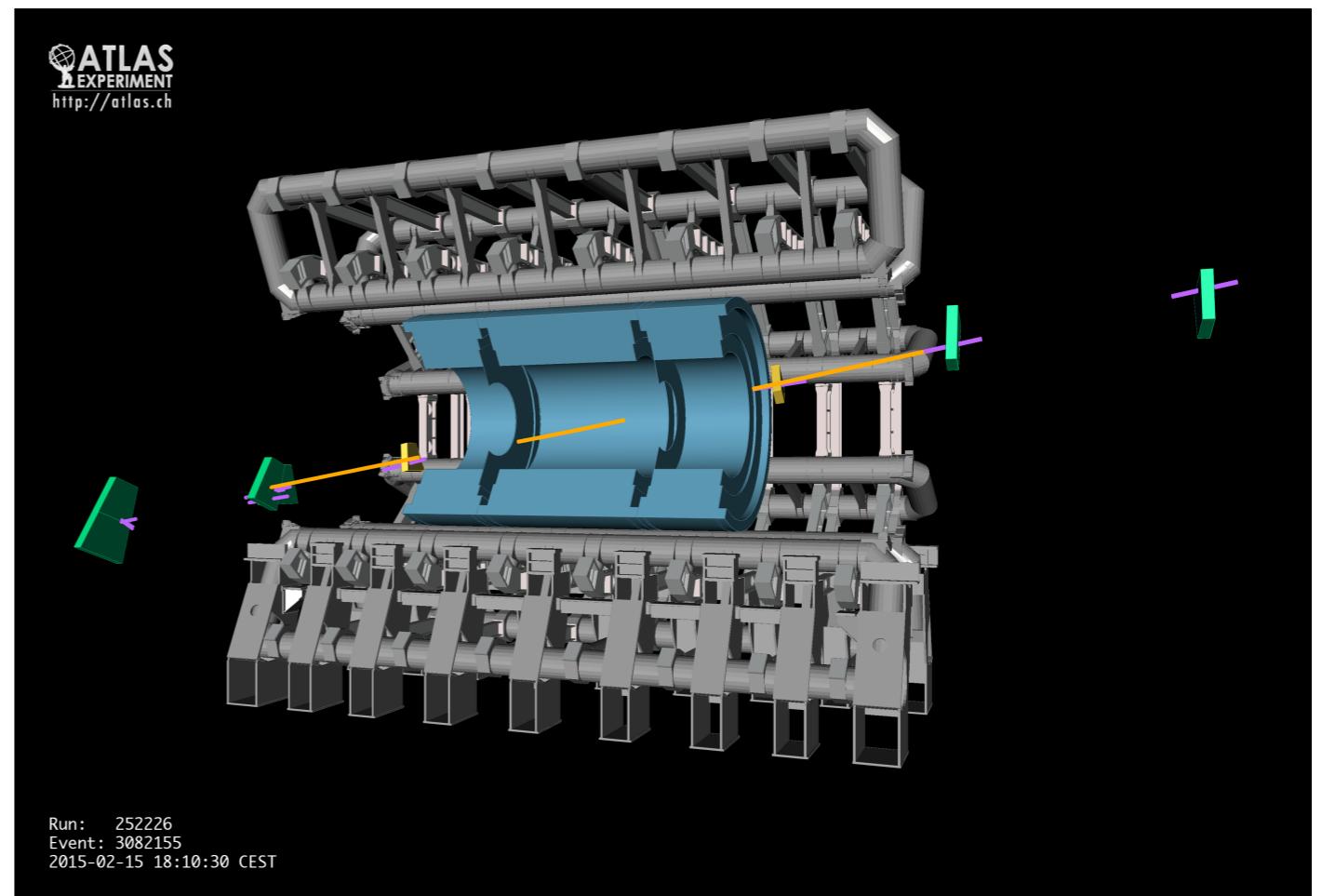
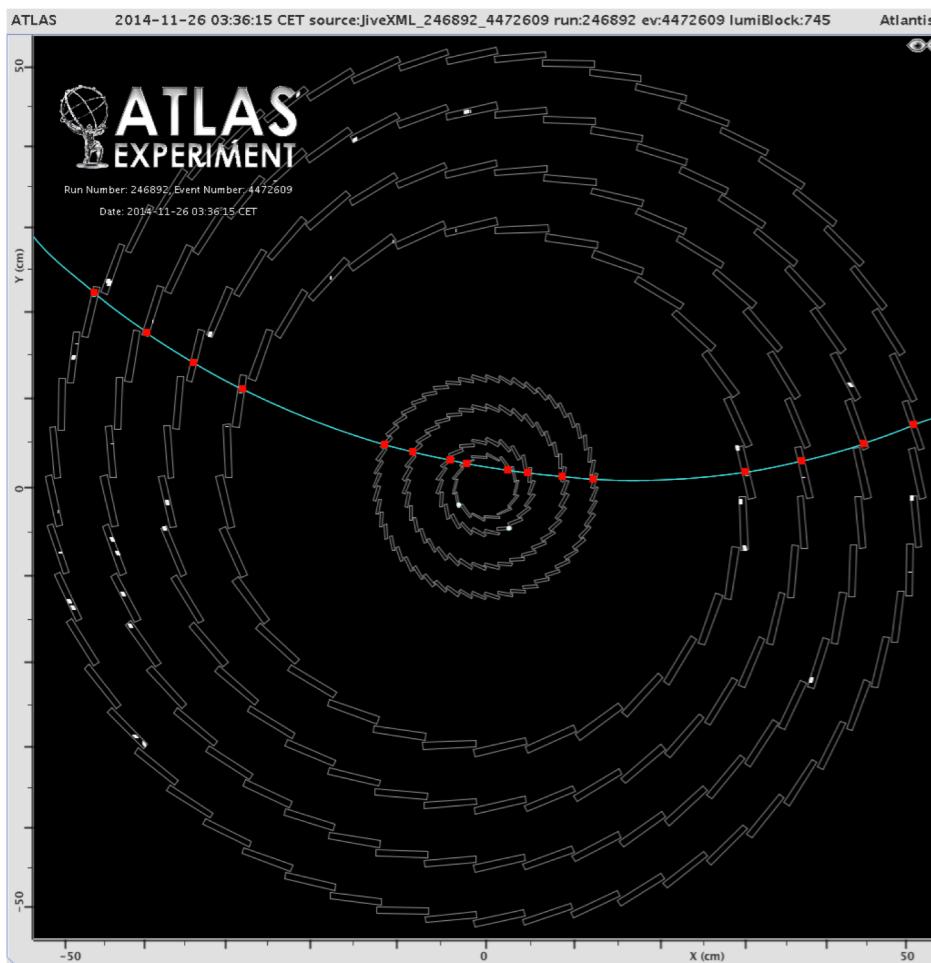
# RECONSTRUCTION

- ...if you work on **reconstruction**, you might want to check that your new **algorithm** correctly reconstructs the track in that new piece of detector



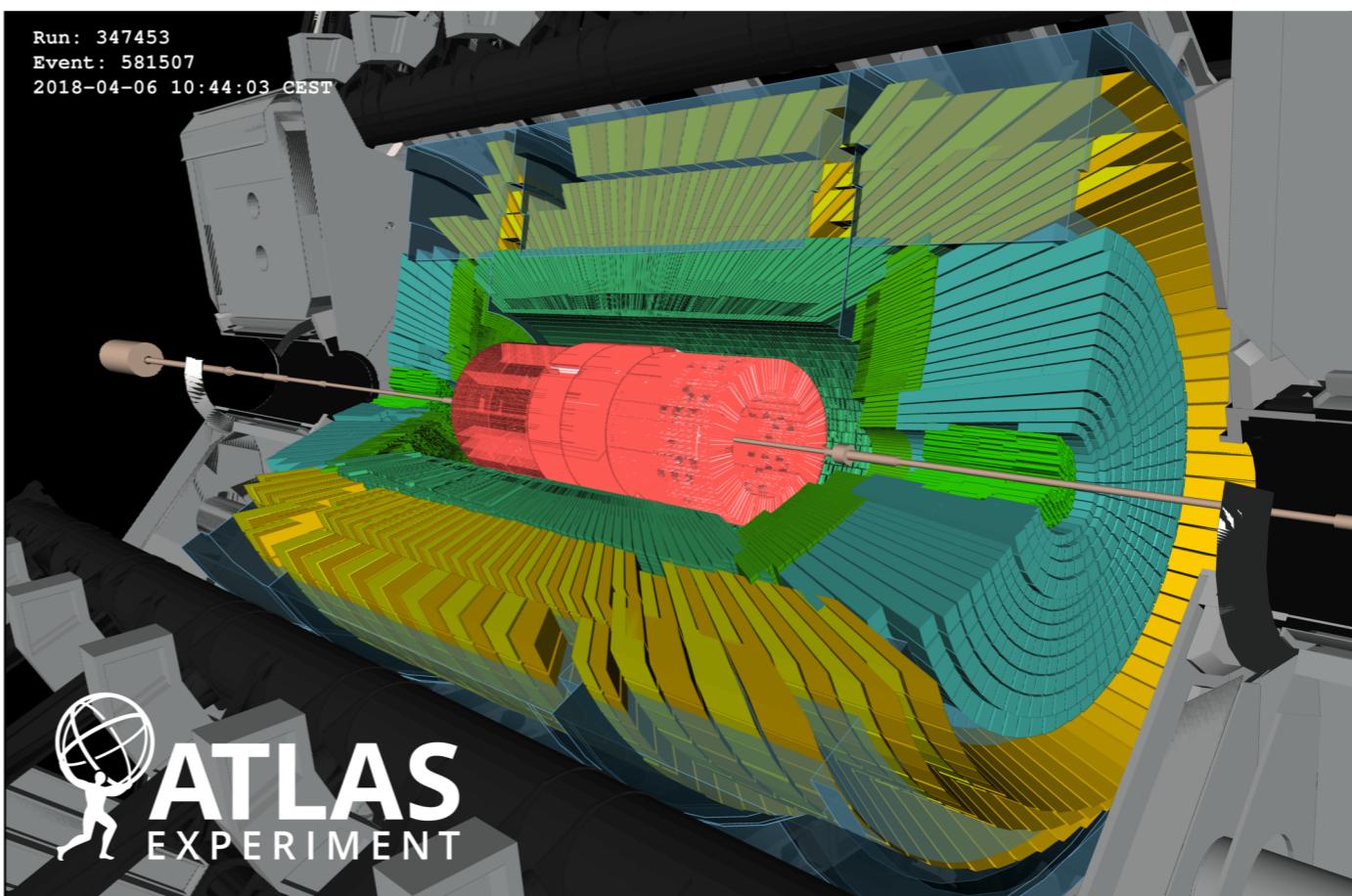
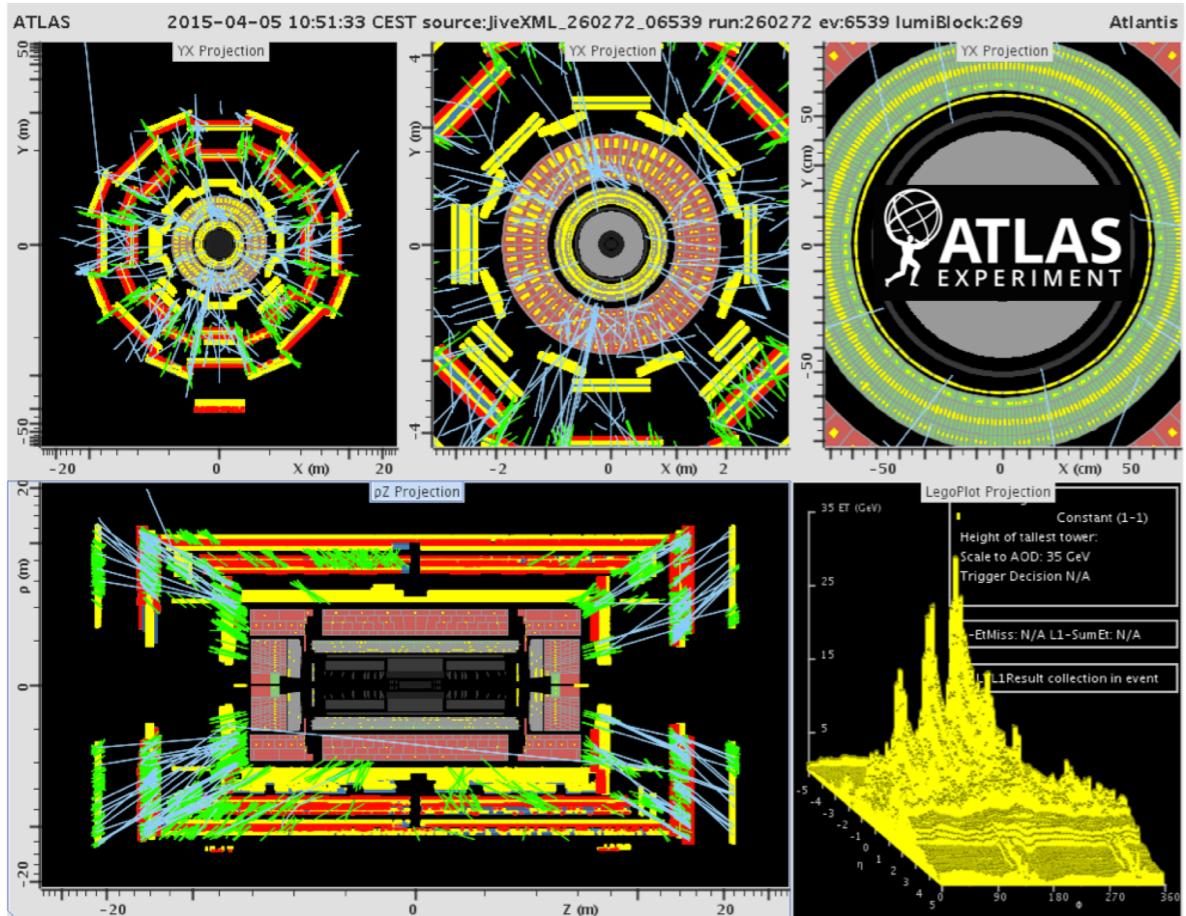
# CALIBRATION

- ...if you work on **calibration**, you might want to inspect a cosmic-ray event to be sure your algorithm correctly reject a cosmic-muon



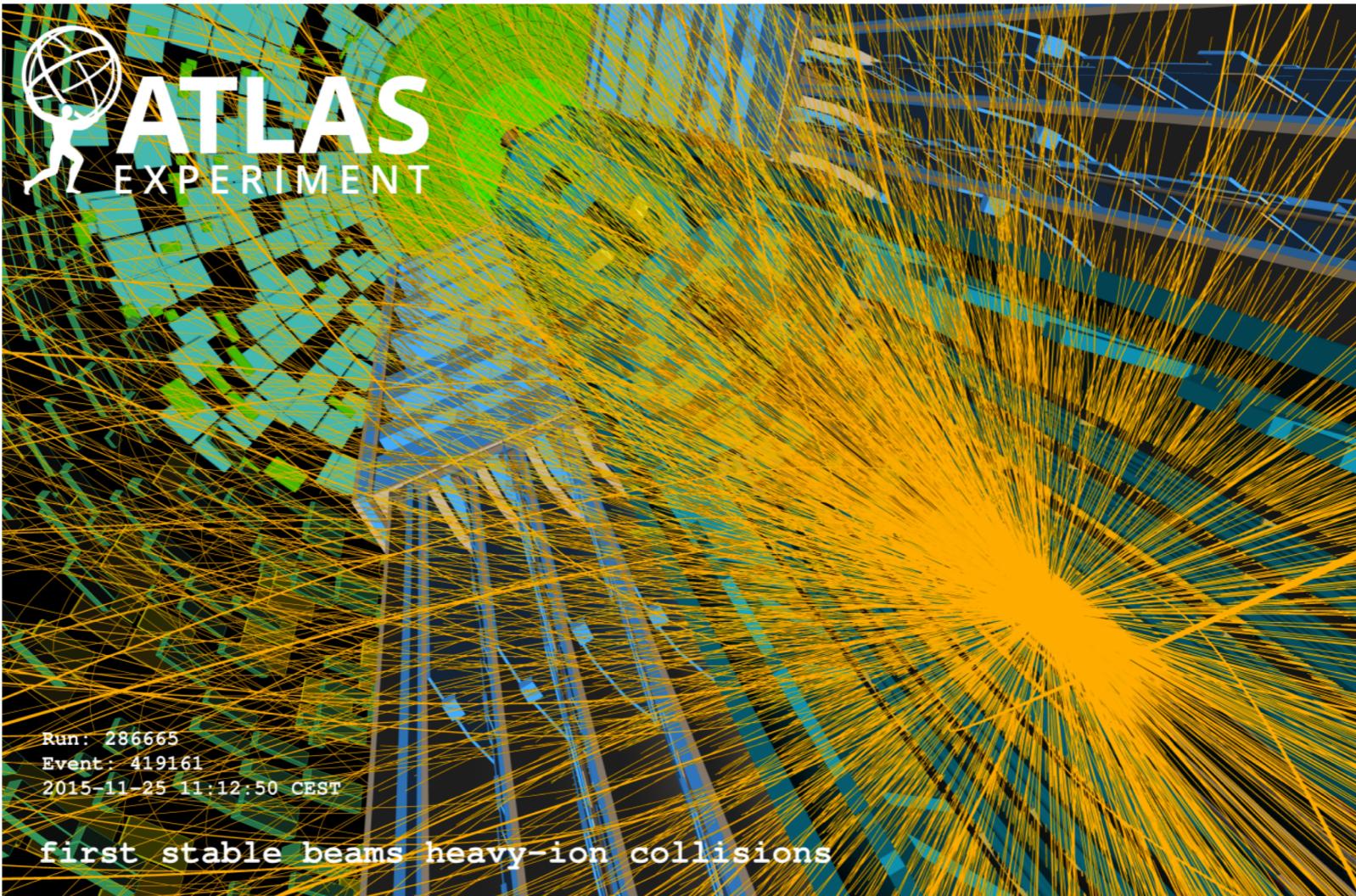
# DATA TAKING

- ...if you work on **data taking** or **data preparation**, you can use an event display to quickly check if **all the parts of the detector** are **correctly taking data**



# OUTREACH

- ...also, if you work on **outreach**, you might want to **create engaging pictures** to accompany your **press releases**



# VISUALIZATION IN HEP

So, **interactive visualization** is a **key ingredient**, at all steps in the **data chain**, for **many tasks**:

- Detector development
- Simulation
- Reconstruction
- Calibration
- Data taking
- Physics Analysis
- Outreach & Education

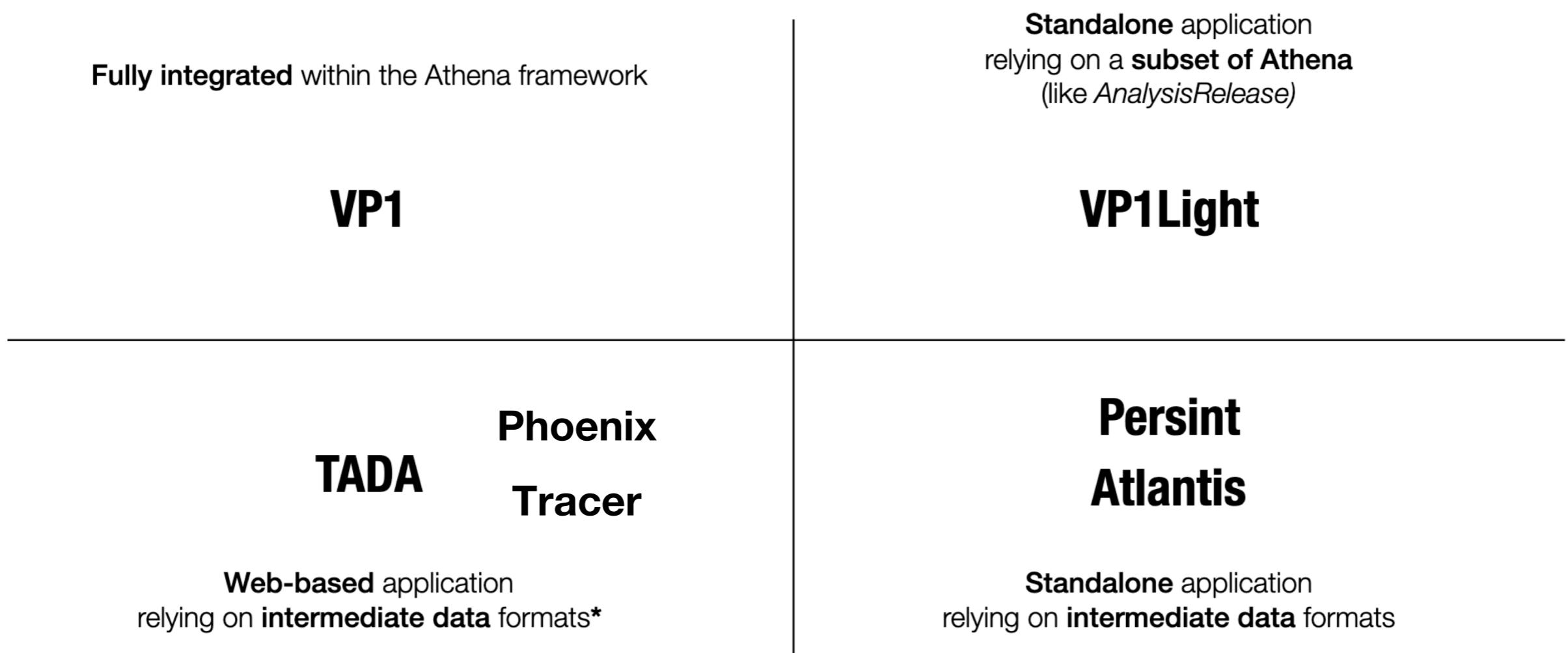
In the following, we will briefly take a look\* at the available **event displays\*\*** in ATLAS

\* See also:

- <https://indico.cern.ch/event/505613/contributions/2228333/>
- <https://indico.cern.ch/event/646947/contributions/3234602/>

\*\* Note: the term “event display” is often used both for the outcome image and the application which produces it

# Event displays in atlas



# Data access

Fully integrated within the Athena framework

**VP1**

**FULL, DIRECT ACCESS TO ALL ATLAS DATA  
THROUGH ATHENA**

**Standalone** application  
relying on a **subset of Athena**  
(like *AnalysisRelease*)

**VP1Light**

**DIRECT ACCESS TO XAOD FILES  
THROUGH ROOTCORE/ANALYSISRELEASE**

**INTERMEDIATE, FILTERED DATA FILES EXTRACTED FROM ATLAS DATA  
DIFFERENT FORMATS: JSON (TADA), XML (ATLANTIS), ASCII (PERSINT)**

**TADA**

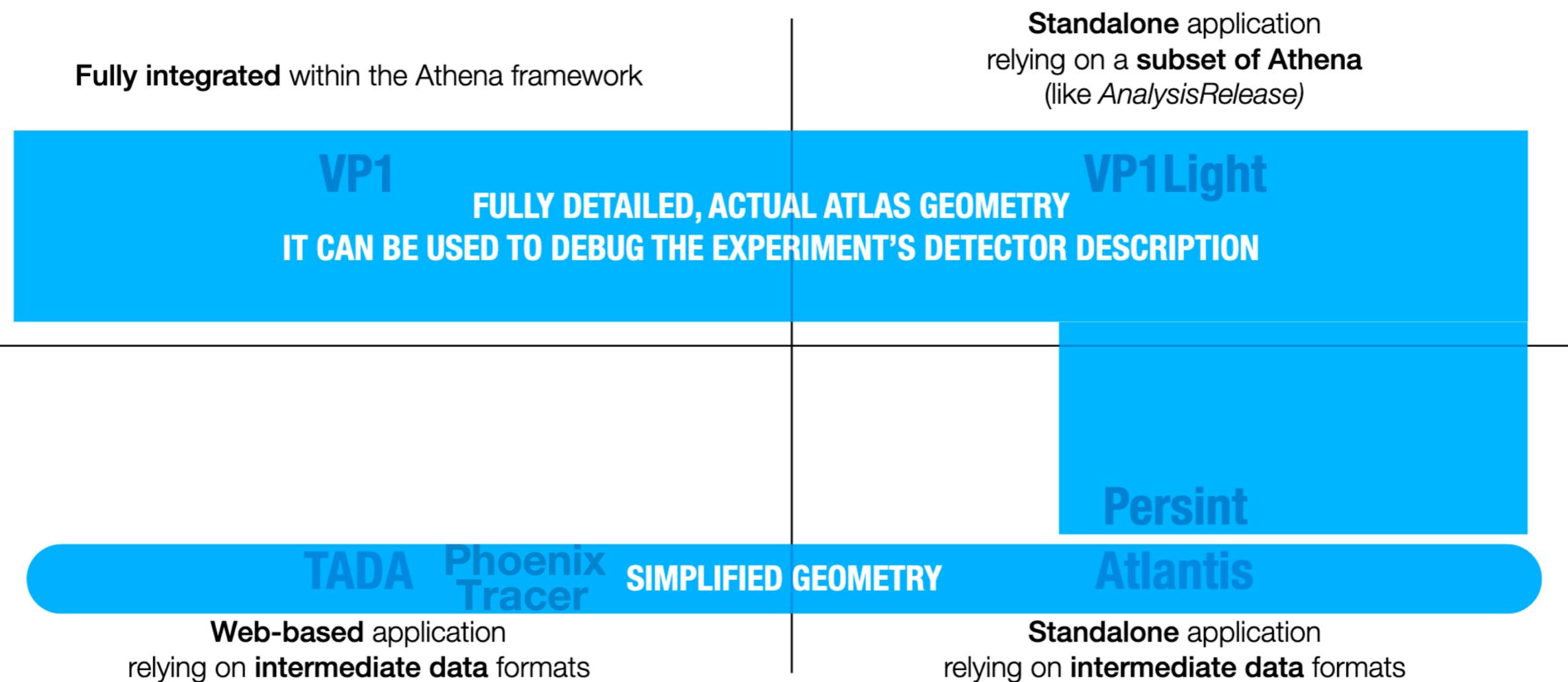
**Web-based** application  
relying on **intermediate data** formats

**Phoenix  
Tracer**

**Persist  
Atlantis**

**Standalone** application  
relying on **intermediate data** formats

# Detector geometry



# Target

Fully integrated within the Athena framework

**VP1**

EXPERTS OR PEOPLE NEEDING TO ACCESS  
DETAILED ATHENA DATA AND FULL GEOMETRY

PHYSICS-BASED INTERACTIVE VISUALIZATION  
ON WEB SITES

**TADA    Phoenix**

Web-based application  
relying on **intermediate data** formats

OUTREACH  
Tracer

**Standalone** application  
relying on a **subset of Athena**  
(like *AnalysisRelease*)

**VP1Light**

PEOPLE WILLING TO  
VISUALIZE  
AND DEBUG FULL  
GEOMETRY

PHYSICS-ANALYSIS USERS

Persistent  
Atlantis

**Standalone** application  
relying on **intermediate data** formats

# Technology

**Fully integrated** within the Athena framework

**VP1**

C++ / QT

JAVASCRIPT / THREE.JS / WEBGL

**TADA**

Web-based application  
relying on **intermediate data** formats

**Phoenix**  
**Tracer**

**Standalone** application  
relying on a **subset of Athena**  
(like *AnalysisRelease*)

**VP1Light**

C++ / QT

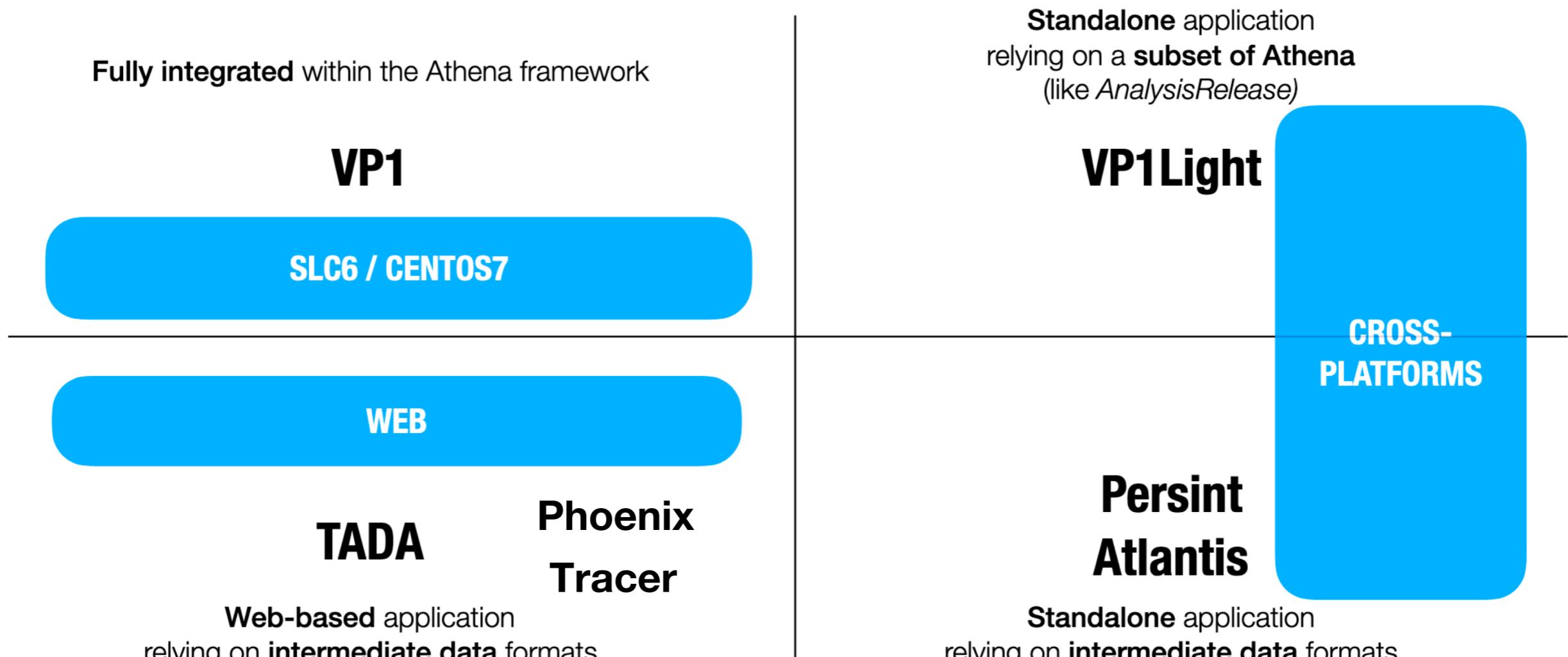
**Persist**  
**Atlantis**

FORTRAN + C++/QT (GUI)

JAVA

**Standalone** application  
relying on **intermediate data** formats

# Platforms



# REFERENCES & BACKUP

# PUBLIC ATLAS EVENT DISPLAYS

- Most of the event displays shown in these slides are taken from the “**Public event displays**” page:  
<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/EventDisplayPublicResults>
- All the event displays listed in the above page are **approved for public use**: you can insert them in your **Thesis** and you can use them in your **talks** and **presentations**.  
You only need to insert the ATLAS copyright statement:  
<http://atlas.cern/copyright>