HiPeRTA : into ESCAPE

Pierre Aubert, Sami Caroff, Thomas Vuillaume, Gilles Maurin, Giovanni Lamanna

Context of HiPeRTA

Context of HiPeRTA

Context of HiPeRTA

Context of HiPeRTA

Laboratoire d'Annecy de Physique des Particules

High Performance Computing

Context of HiPeRTA

High Performance Computing

Context of HiPeRTA

High Performance Computing

hipeRTA

Real Time Analysis

Context of HiPeRTA

High Performance Computing

Asterics
Astronomy ESFRI & Research Infrastructure Cluster

hipeRTA

Real Time Analysis

cta
cherenkov telescope array

Large-Sized Telescope : LST

ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures

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cta
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Large-Sized Telescope : LST

Tests

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European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures

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High Performance Computing

hipeRTA

Real Time Analysis

Large-Sized Telescope : LST

Tests

Integration

Array Control and Data Acquisition System : ACADA

Context of HiPeRTA

High Performance Computing

hipeRTA

Real Time Analysis

LAPP contribution :
- Optimize/maintain **High Performant Data Analysis Frameworks**
- **Optimisation** Tools/Technics/Lecture
- **Git** / **Python** / **Jupyter**
- Schools **ASTERICS** / **ESCAPE**

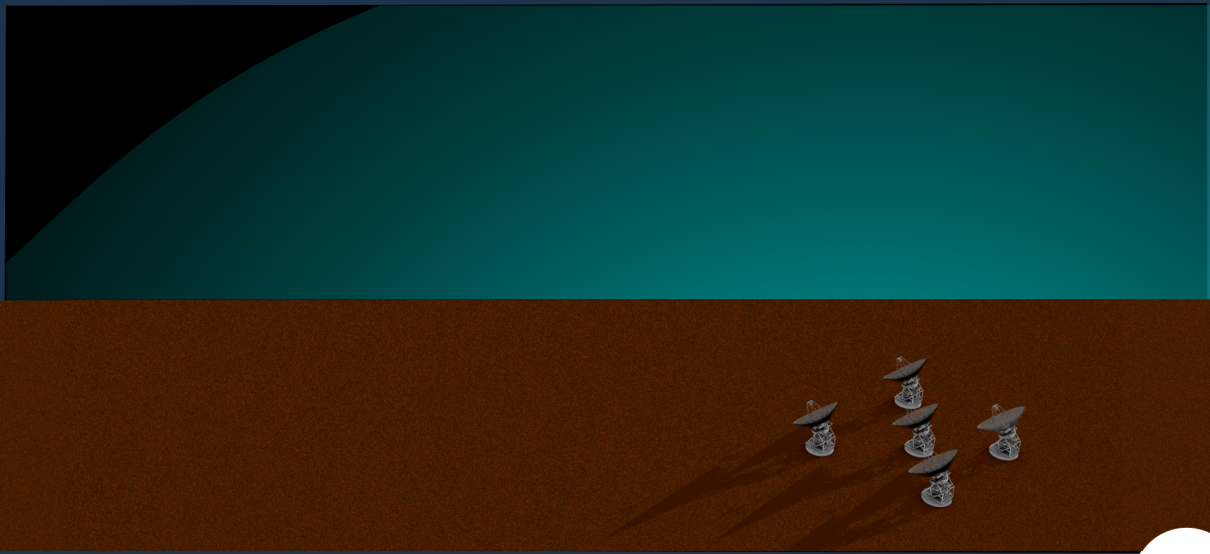
Large-**S**ized **T**elescope :
LST

Tests

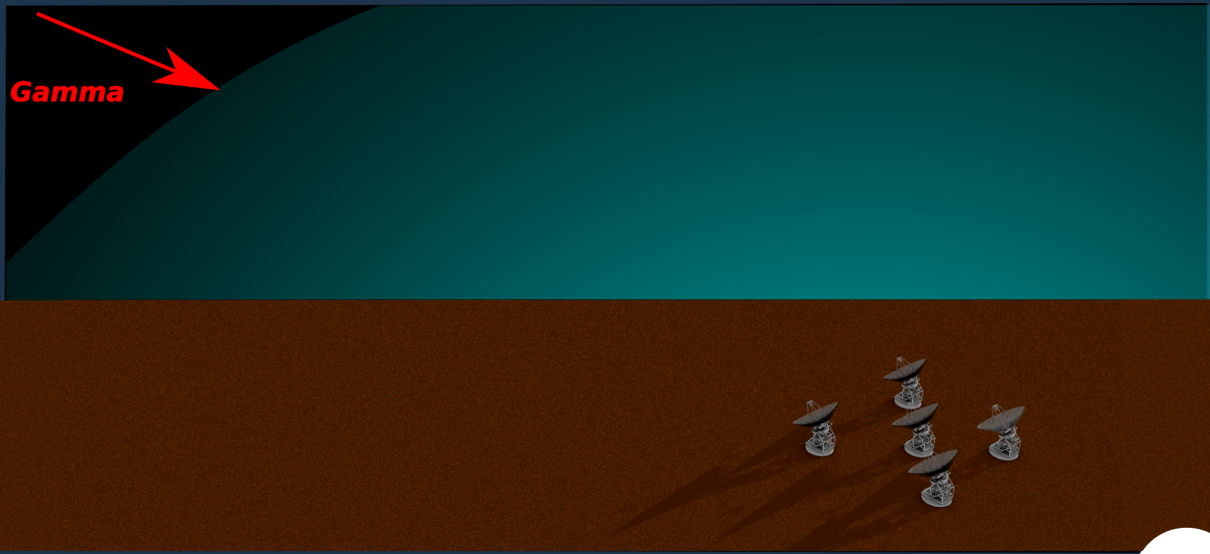
Integration

Array **C**ontrol and **D**ata **A**cquisition **S**ystem :
ACADA

Event reconstruction



Event reconstruction



Event reconstruction

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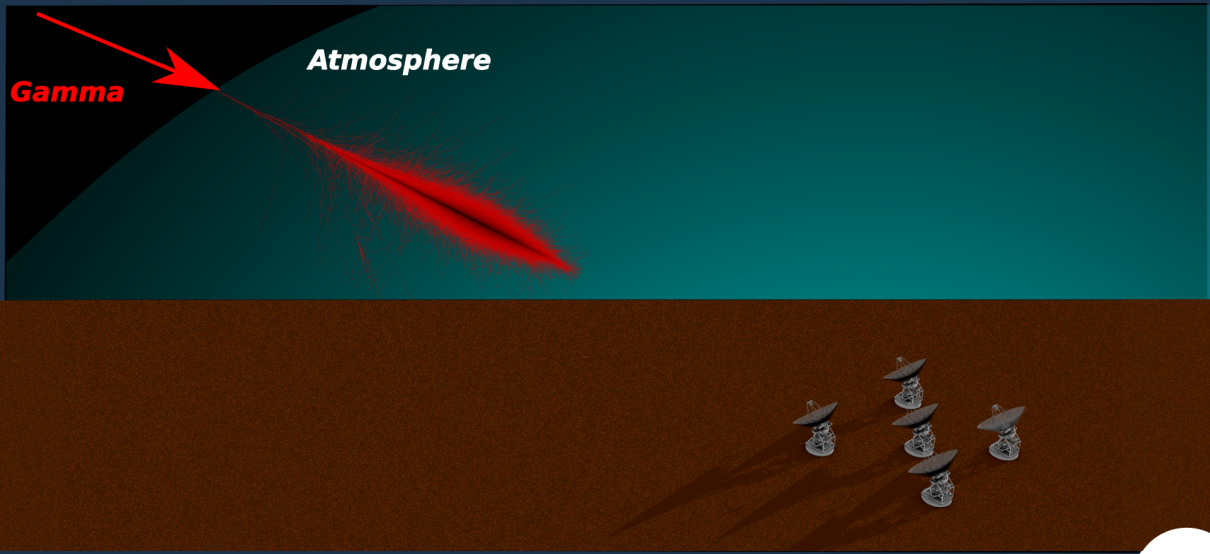

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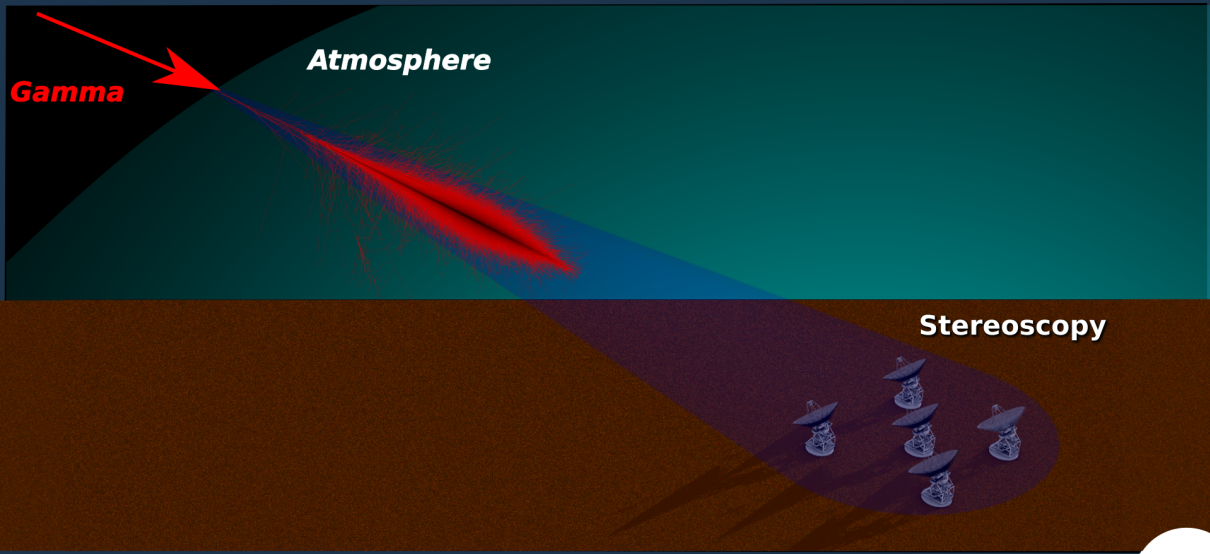

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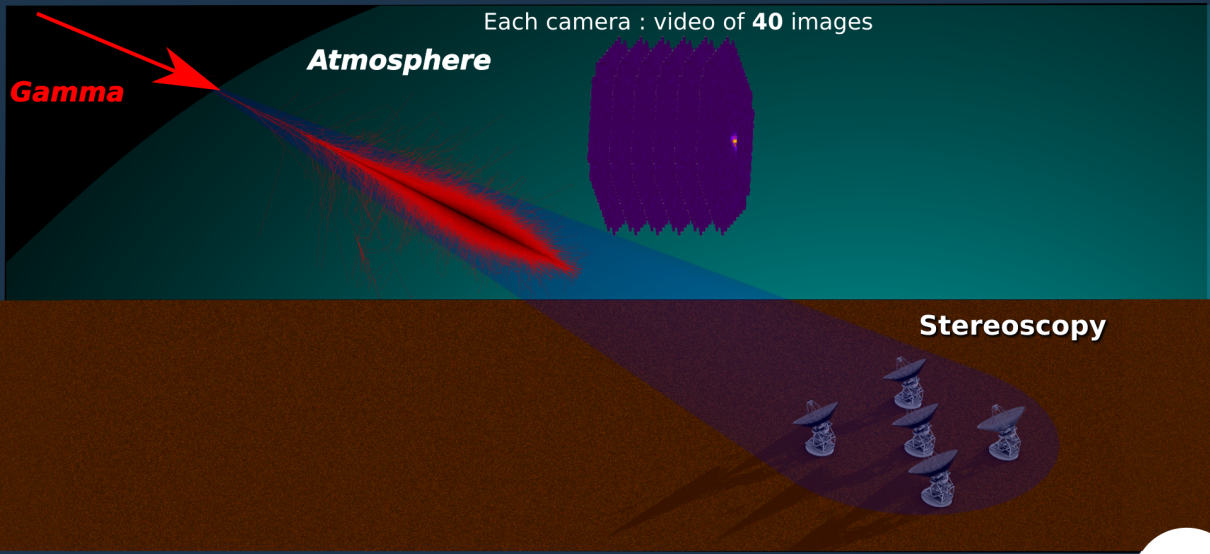

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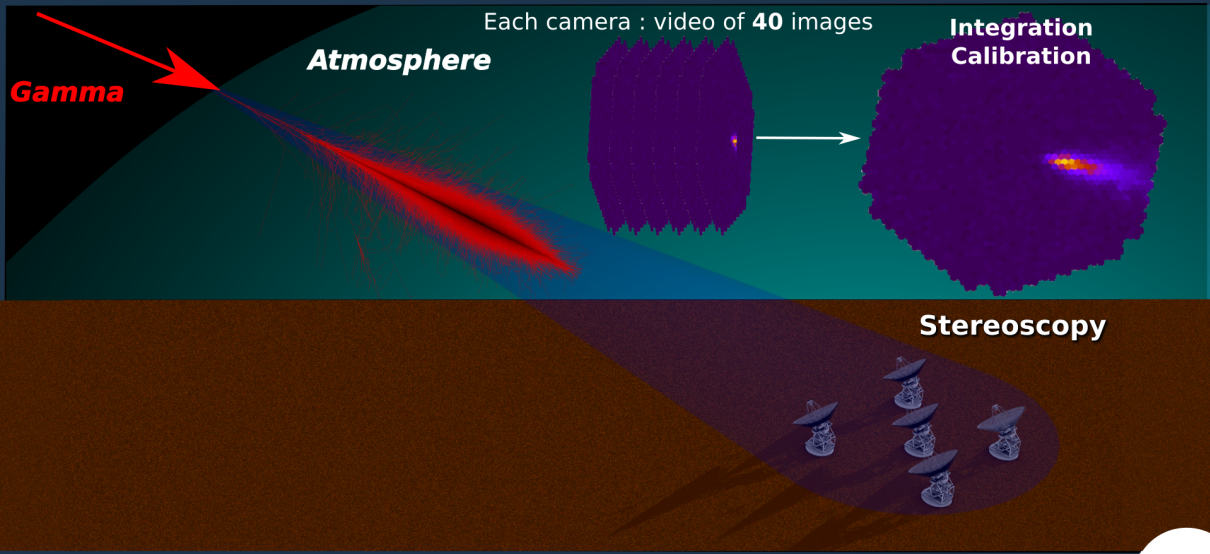

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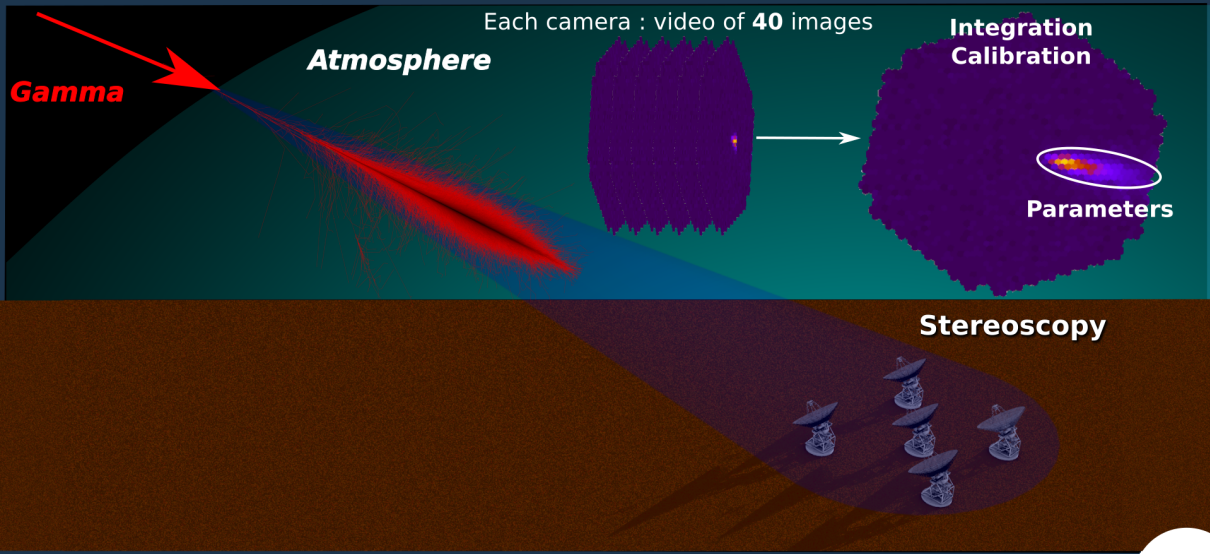

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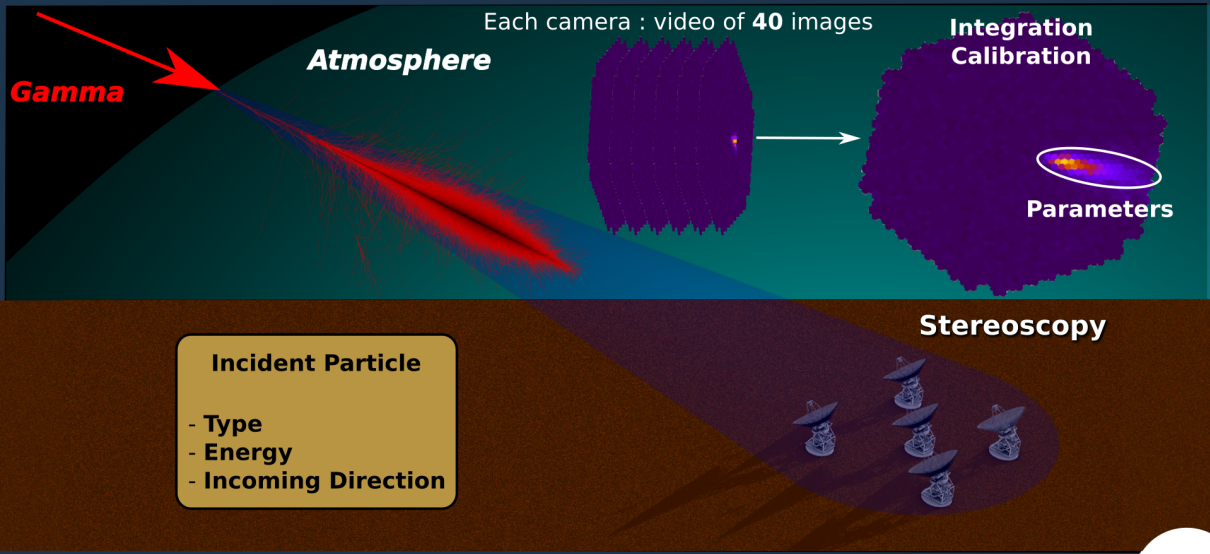
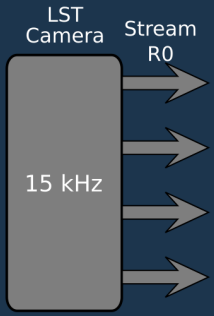


HiPeRTA : R0 -> DL3

LST Camera

HiPeRTA : R0 -> DL3



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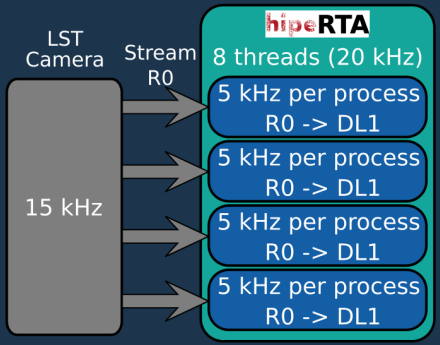

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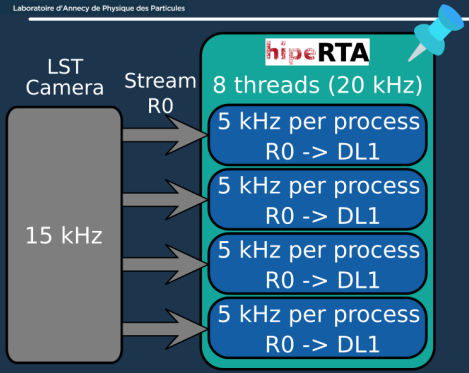
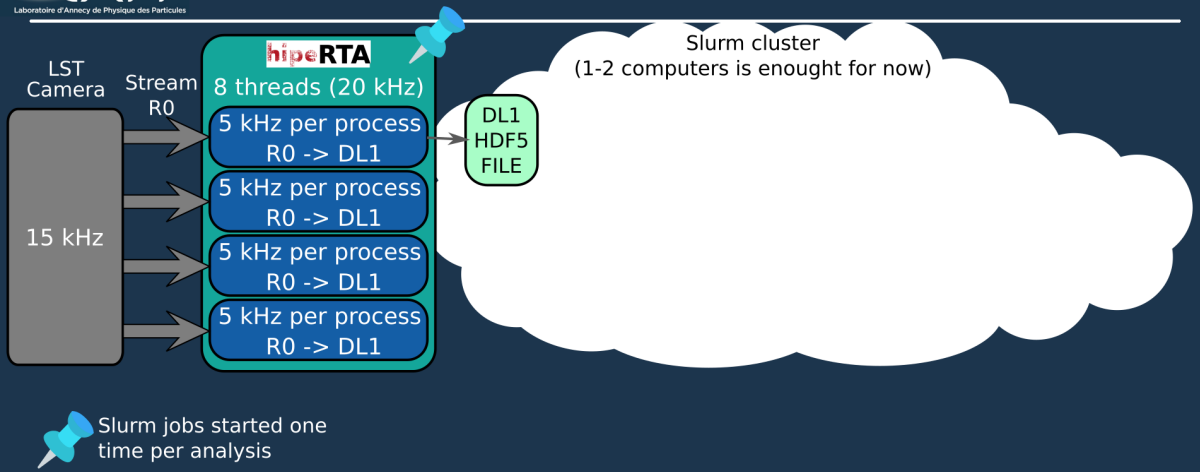


Slurm jobs started one time per analysis

HiPeRTA : R0 -> DL3



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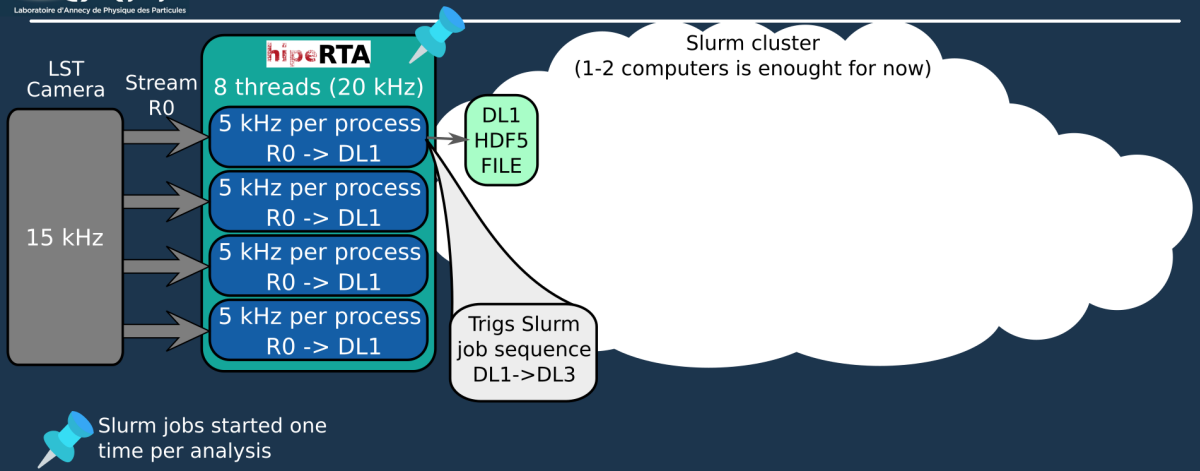

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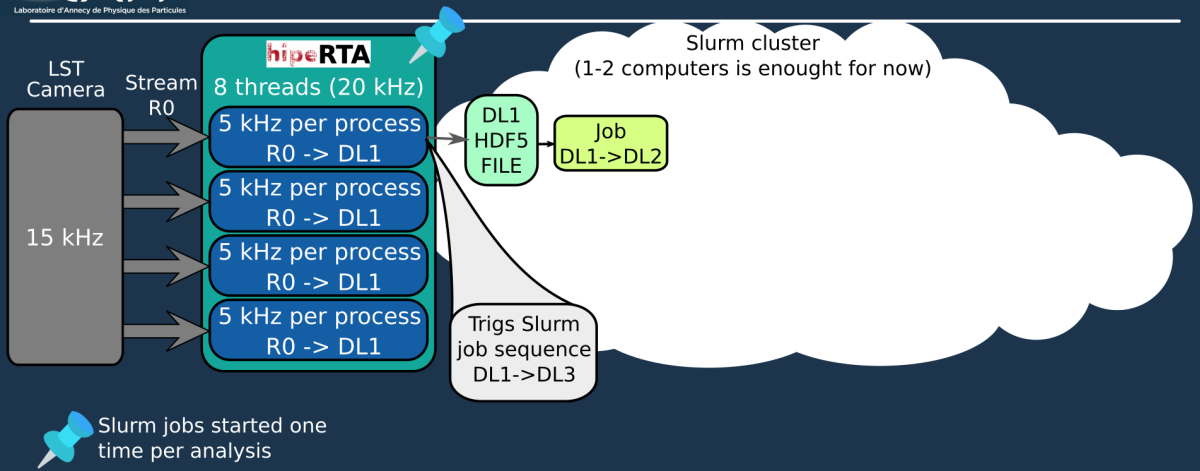

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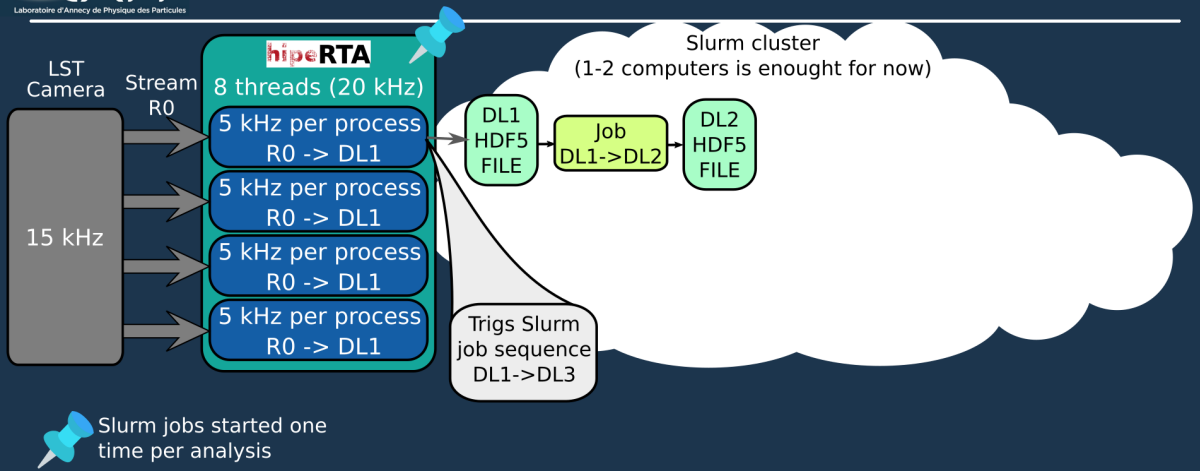

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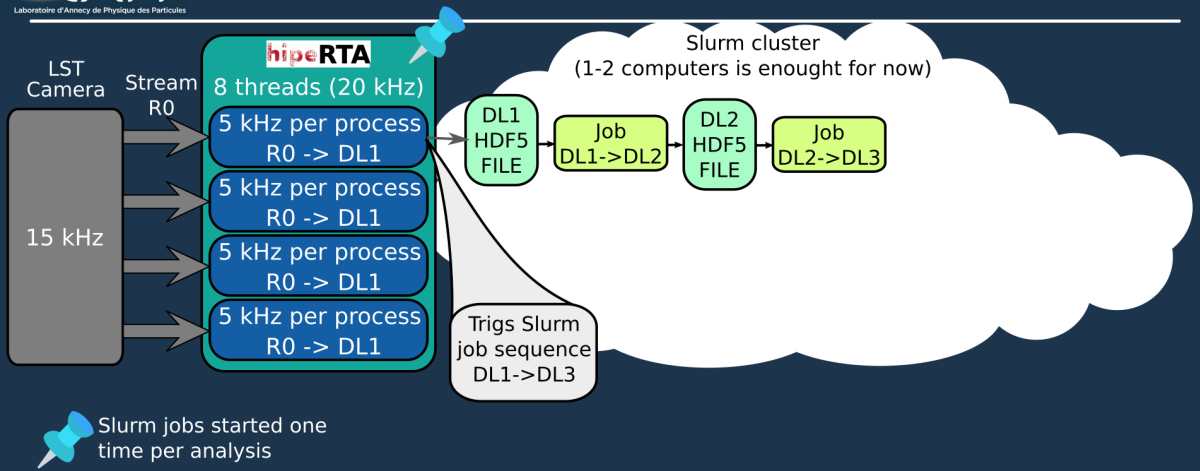

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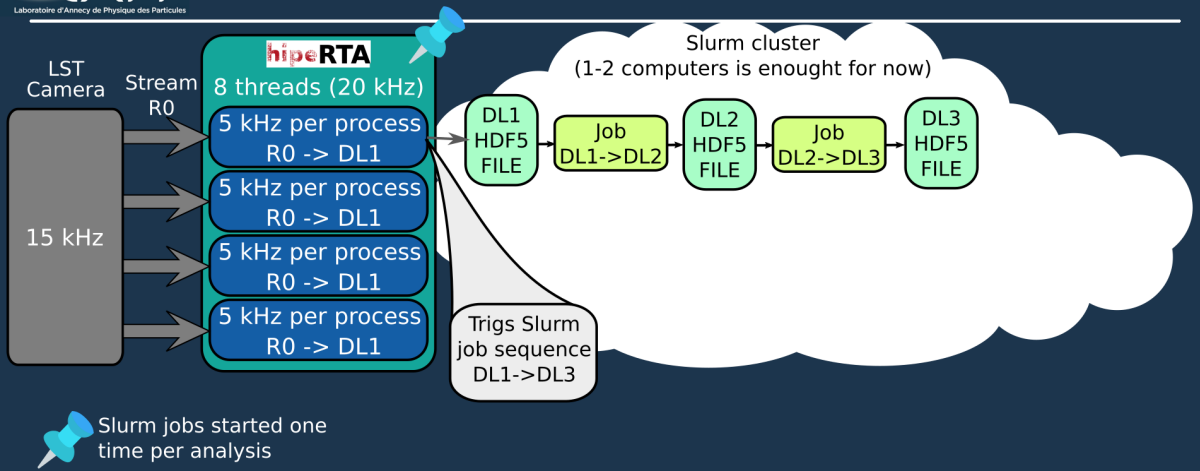

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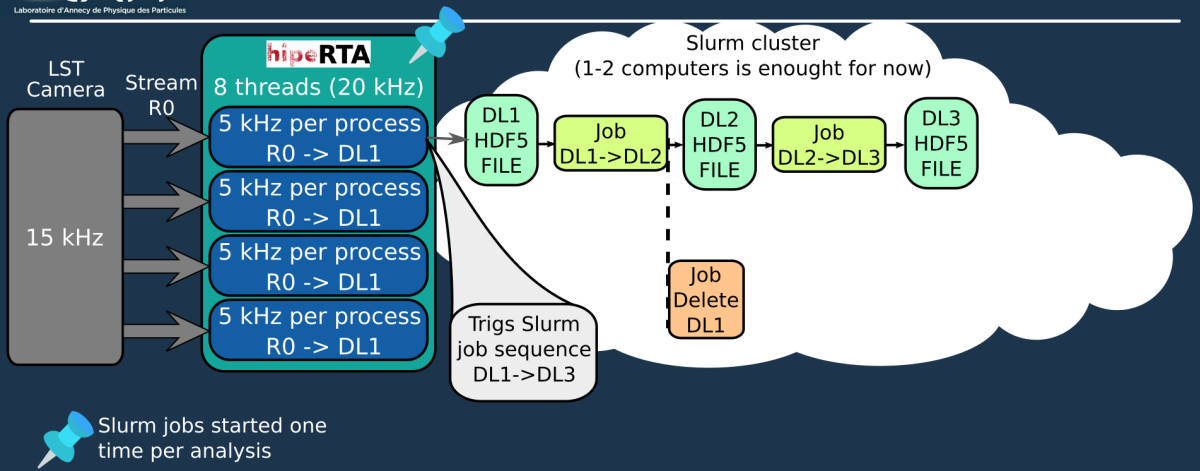

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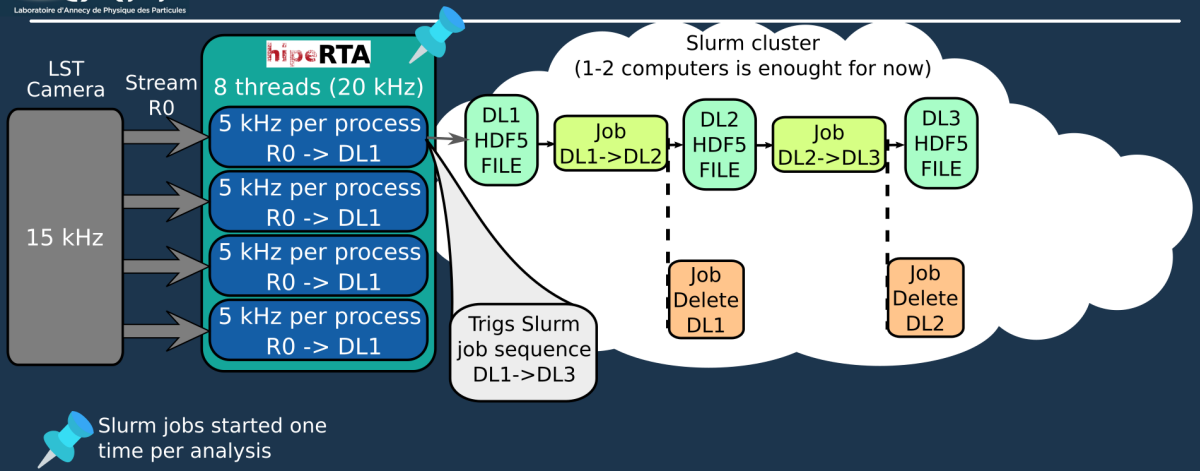

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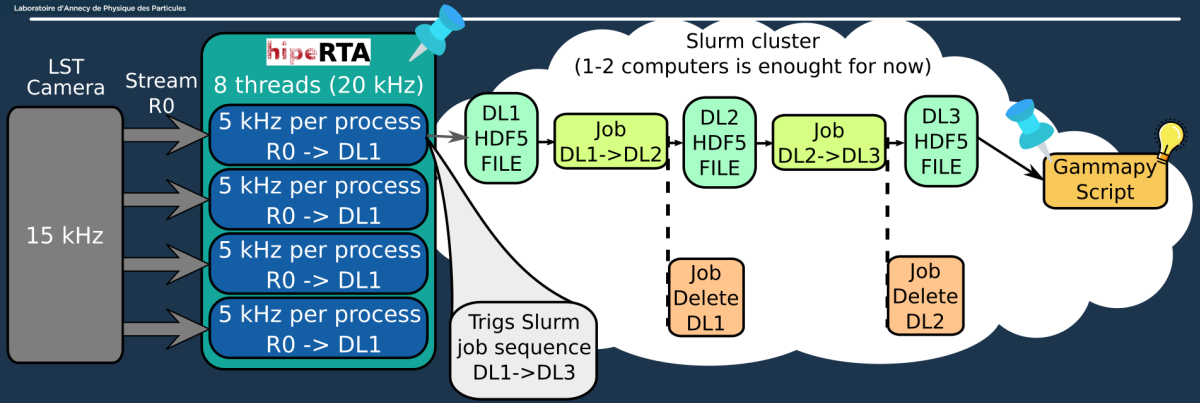
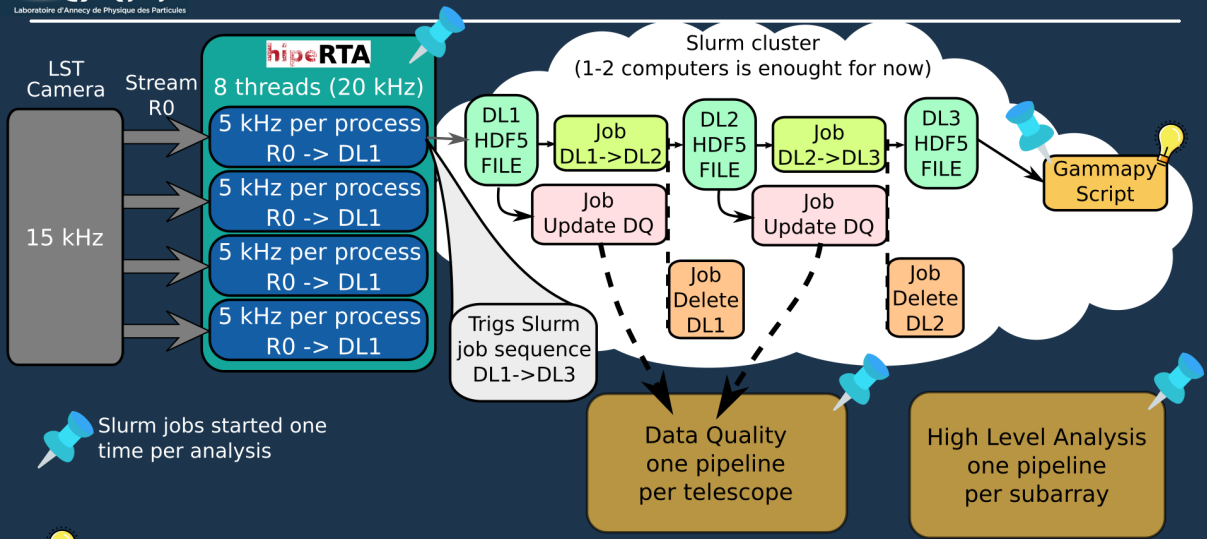


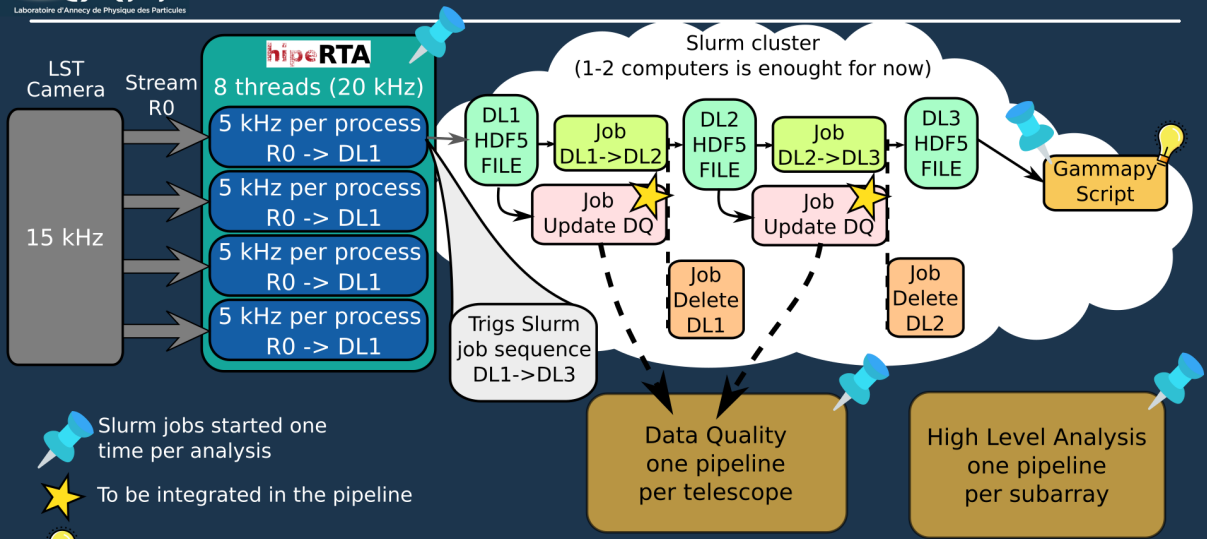
Slurm jobs started one time per analysis

Temporary solution

HiPeRTA : R0 -> DL3



HiPeRTA : R0 -> DL3



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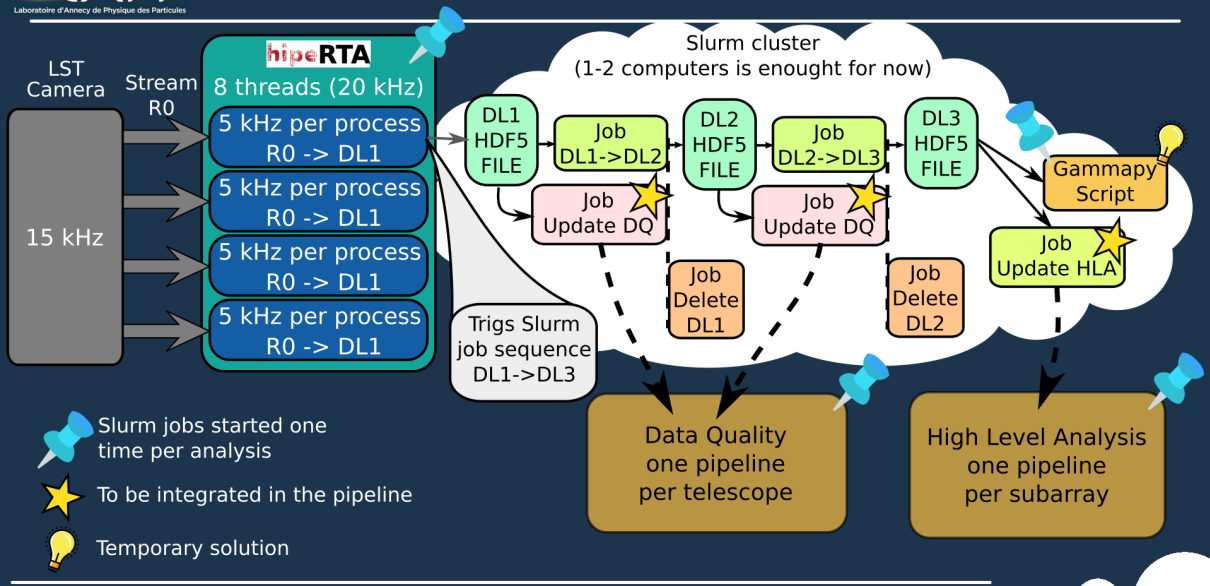


Projects Dependencies

Projects Dependencies

HiPeRTA

Highly **Performant**
R0/R1 -> **DL1**
Analysis

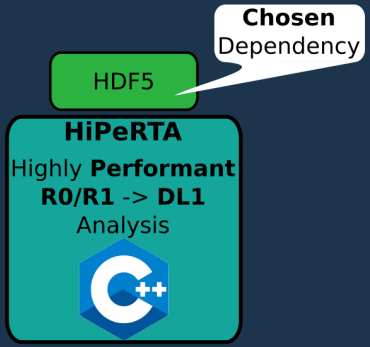
Projects Dependencies

HDF5

HiPeRTA

Highly **Performant**
R0/R1 -> **DL1**
Analysis

Projects Dependencies



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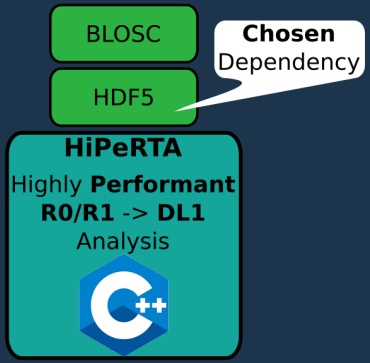

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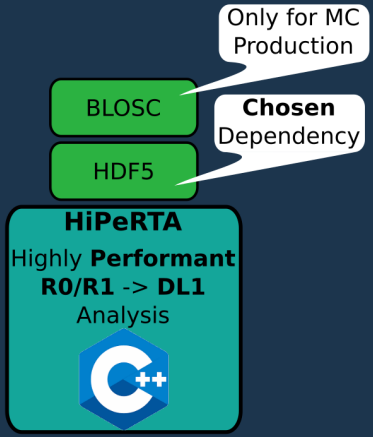

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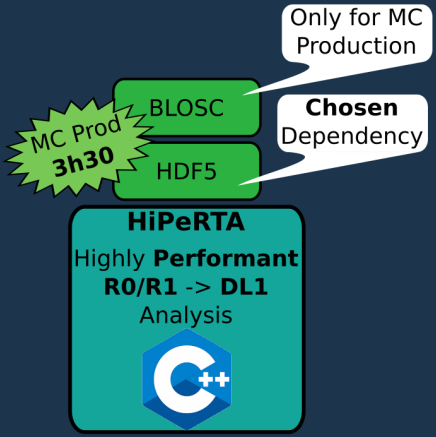

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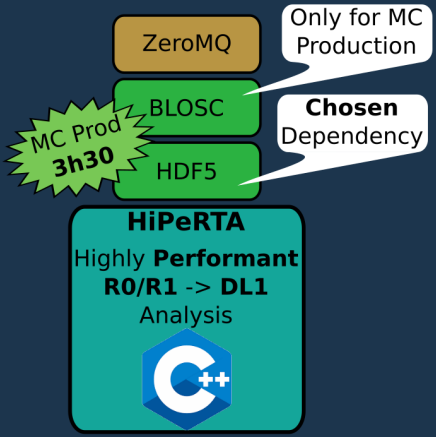

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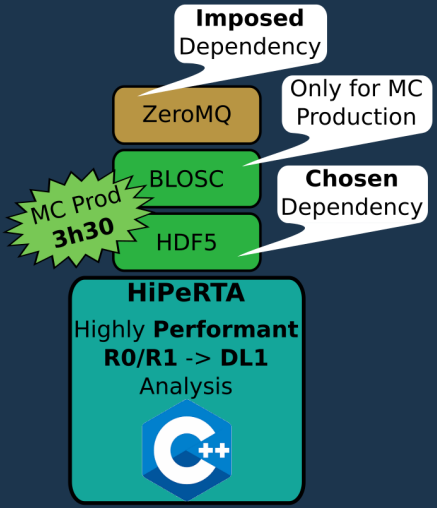

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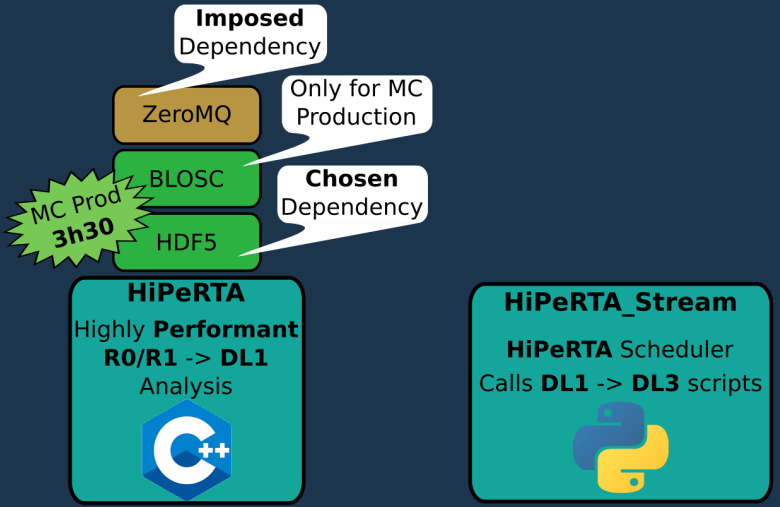

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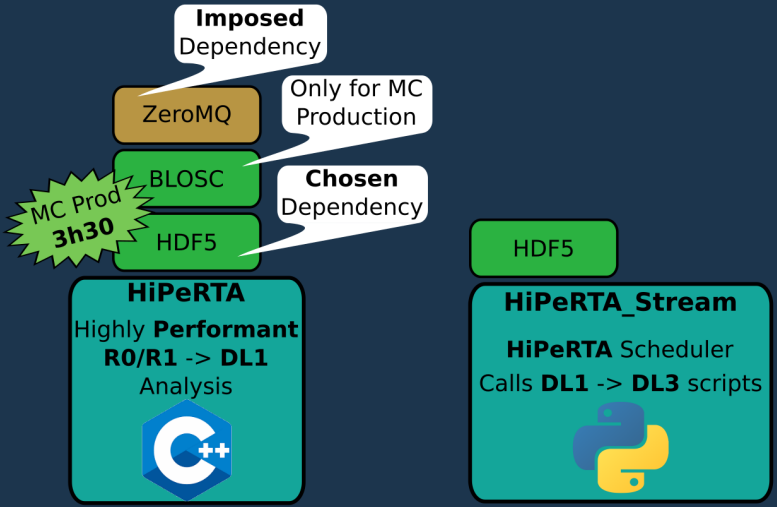

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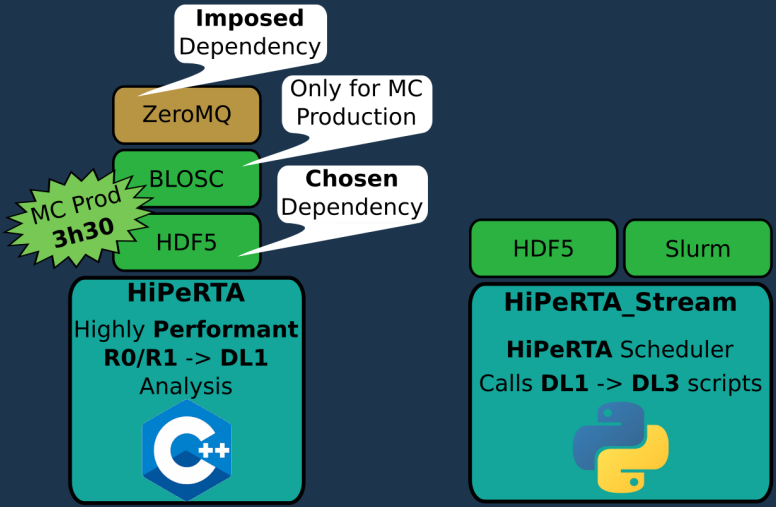

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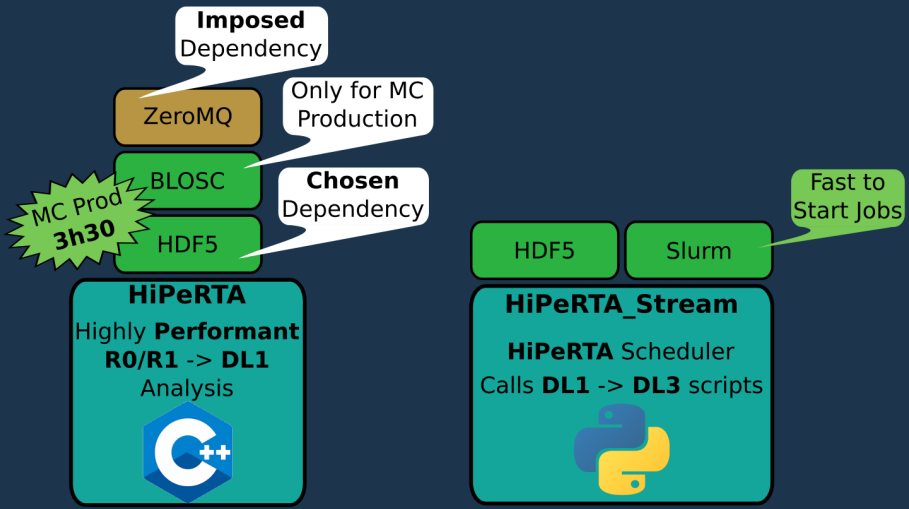

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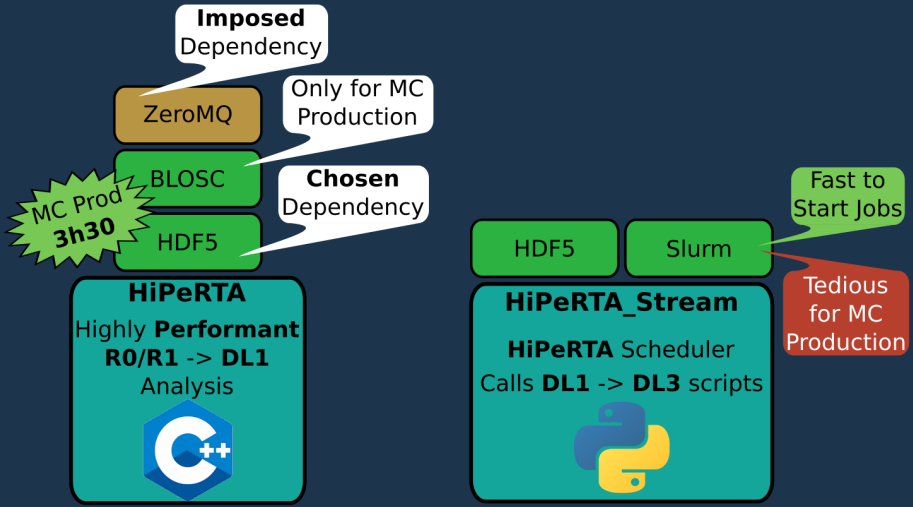

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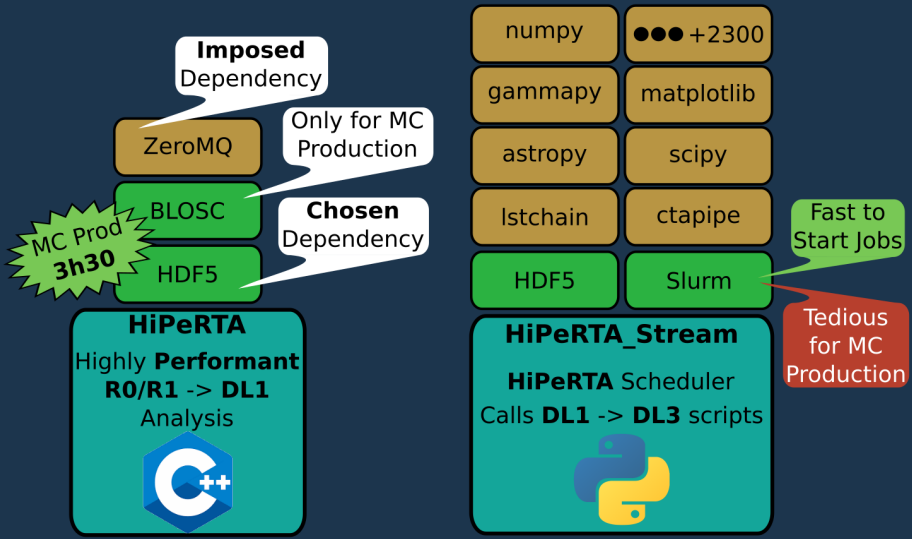

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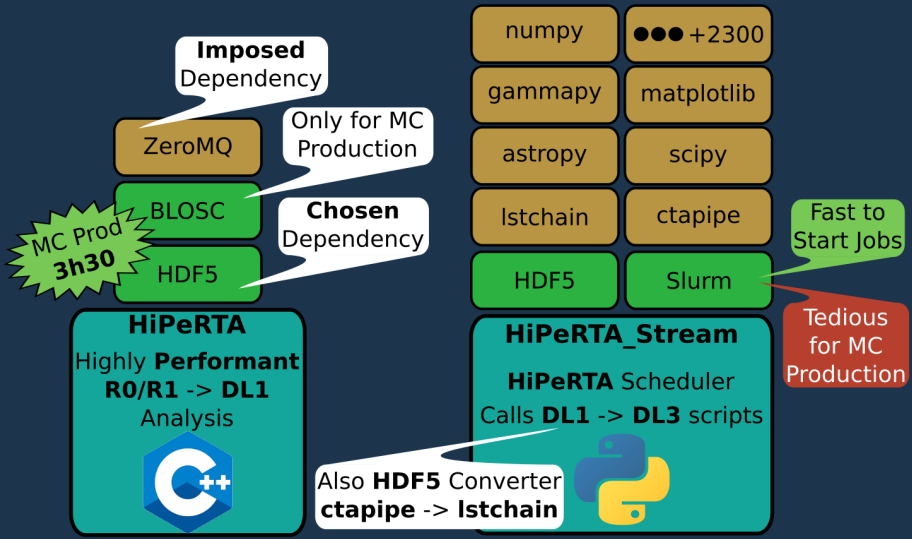

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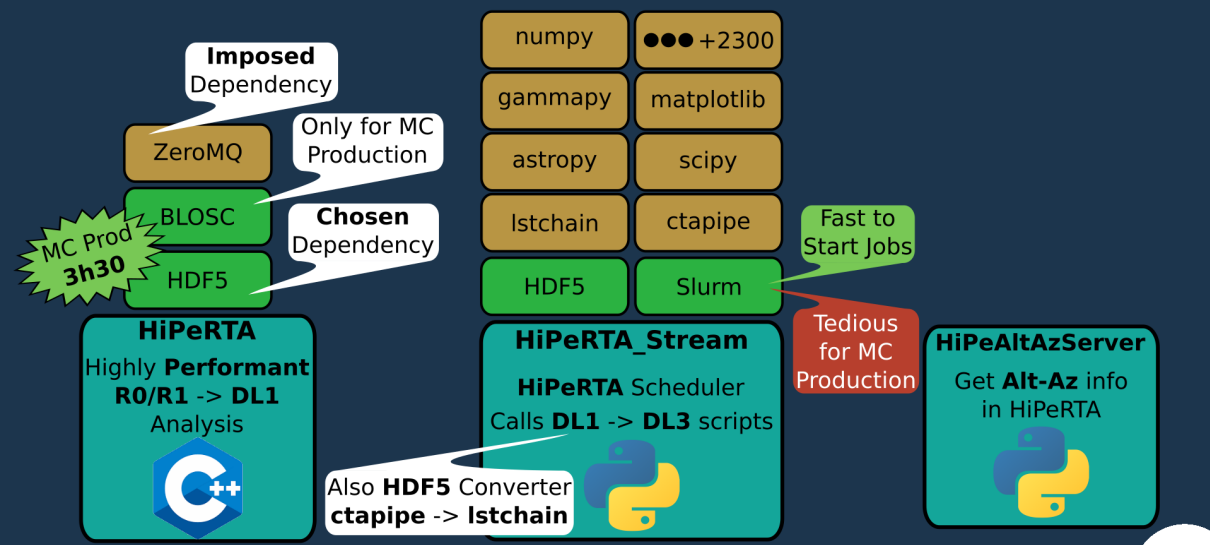

Projects Dependencies

Imposed Dependency

ZeroMQ

Only for MC Production

BLOSC

Chosen Dependency

MC Prod **3h30**

HDF5

HiPeRTA

Highly **Performant** **R0/R1** -> **DL1** Analysis

numpy

●●● +2300

gammapy

matplotlib

astropy

scipy

lstchain

ctapipe

HDF5

Slurm

Fast to Start Jobs

Tedious for MC Production

HiPeRTA_Stream

HiPeRTA Scheduler Calls **DL1** -> **DL3** scripts

Also **HDF5** Converter **ctapipe** -> **lstchain**

Simplify DL1 -> DL3 Pipeline

HiPeAltAzServer

Get **Alt-Az** info in HiPeRTA

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Unit Tests / Quality Tests / Archive

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HiPeRTA

Unit Tests / Quality Tests / Archive

Phoenix

Toolbox for developers :
- **Constellation** of projects
- High Performant **Data Formats**
- **Code generators**
- Config / Argument **Parsing**
- **Unit Tests** helper
- **Micro Benchmark** / **Profiler**
- **Release** helper

HiPeRTA

Unit Tests / Quality Tests / Archive

Generate :
- **Code**, **Tests**, **Doc**
- **Coverage**
- **Gitlab CI**

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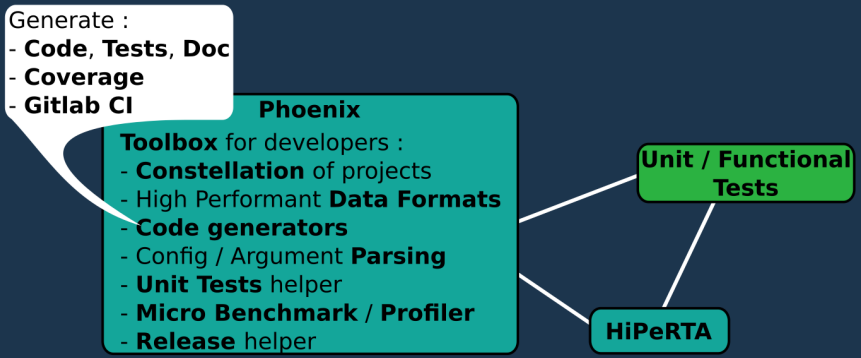

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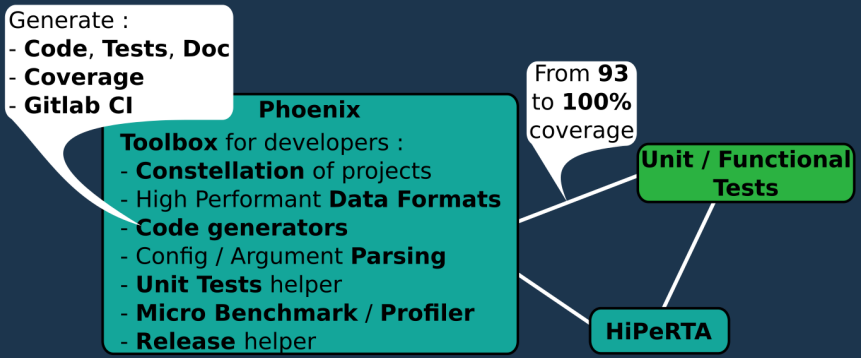

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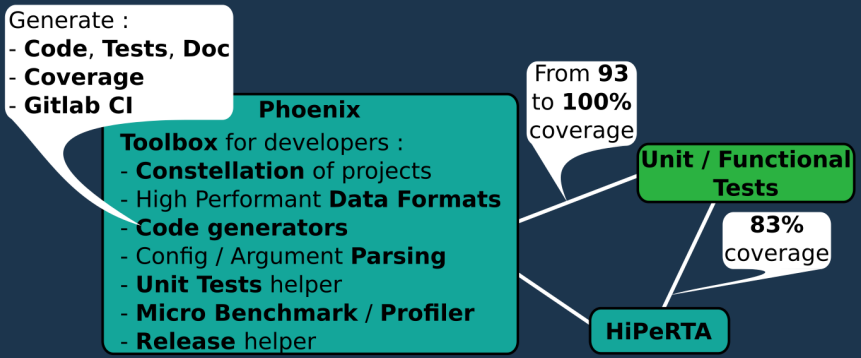

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From **93** to **100%** coverage

Unit / Functional Tests

83% coverage

HiPeRTA

Performance Tests

Static Binary Analyser

MAQAO

Dynamic Binary Analyser

Self **Profiling**

Unit Tests / Quality Tests / Archive

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HiPeRTA

Physics Tests

lst-ci
Comparison with **ctapipe**

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Physics Tests

lst-ci
Comparison with **ctapipe**

HiPeRTA

LST-1 Proto
- Protocol Buffer
- Matrix transposition
- IB Datagram / Connected
- FEFS

Performance Tests

Static Binary Analyser
MAQAO

Dynamic Binary Analyser
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Self **Profiling**

Unit Tests / Quality Tests / Archive

Laboratoire d'Annecy de Physique des Particules

Generate :
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ESCAPE

From **93** to **100%** coverage

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83% coverage

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Generate :
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ESCAPE

Push → zenodo

From **93** to **100%** coverage

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ESCAPE

Push

zenodo

Licence : **CeCILL-C**

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Performance Tests

Static Binary Analyser
MAQAO

Dynamic Binary Analyser
Valgrind

Self **Profiling**

General Guidelines

Development

- **Functionnalities** as **reusable** as possible
- Strong **interfaces** :
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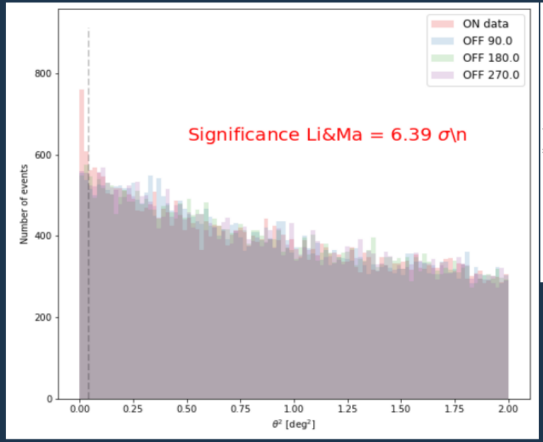
Hardwares :
- **Intel** / **AMD**
- From **SSE2** to **AVX512**
- Will to investigate **ARM**
- Will to offer **GPU**s support

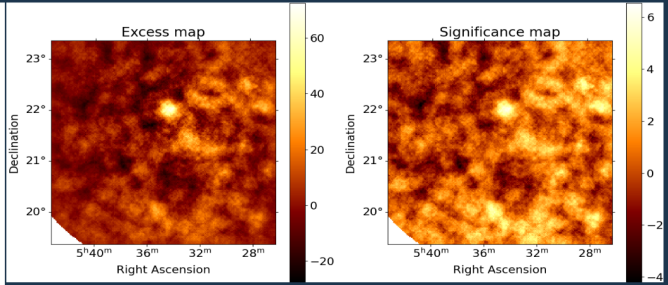
Results

On **Crab Nebula**

4 runs



1 run



OSSR Integration

What is **Available** :

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Software usages :

- **HPC** data analysis of **IACT**s (mainly **CTA**)
- **Inspire** HPC optimisations for physics purpose
- Example of efficient **HDF5** usage
- Showcase of **Phoenix** libraries (Configuration, Option Parsing, Code Generator, etc)

Links

- **HiPeRTA** Source Code
- **HiPeRTA** Releases
- **HiPeRTA** Containers
- **Phoenix** (showcase)