

# Running DESDM Software on FermiGrid

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for the Fermilab DOCS group and  
OSG User Support

# Project Background

Science verification started in November and is ongoing.

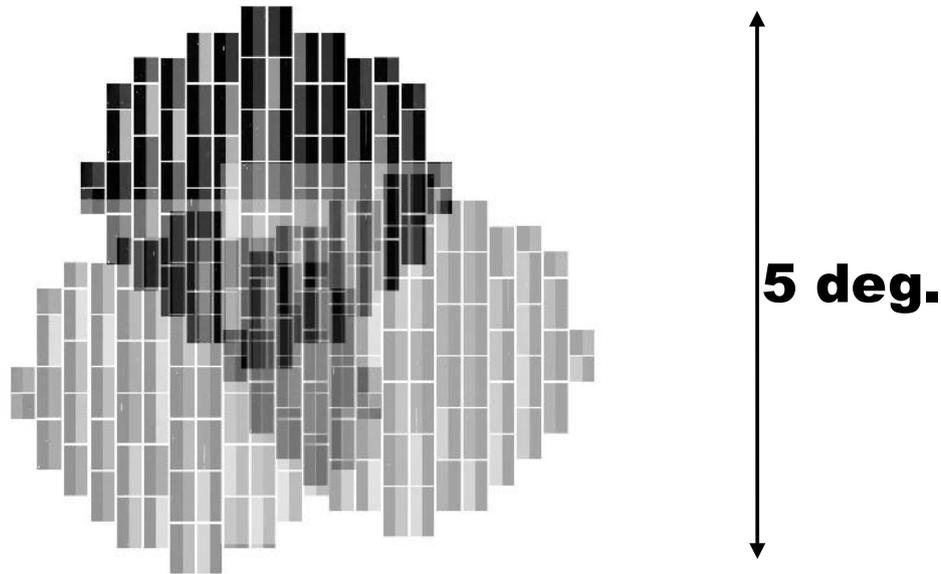
To help with assessing the scientific validity of the data, the DOCS group designed a workflow to run DESDM software on FermiGrid using OSG interfaces. This augments standard DESDM processing.

Later, some parts of this workflow may help with reprocessing.

# Input Exposures

The telescope produced roughly 150 science exposures per night until February 8th. The DES system moved these to NCSA, and from there Fermilab can download them.

The [entire] Dark Energy Survey consists of a dithered pattern of some 200,000 overlapping 90 second exposures (3 shown here) in 5 colors.



--Figure courtesy the DES project.

# About DESDM software

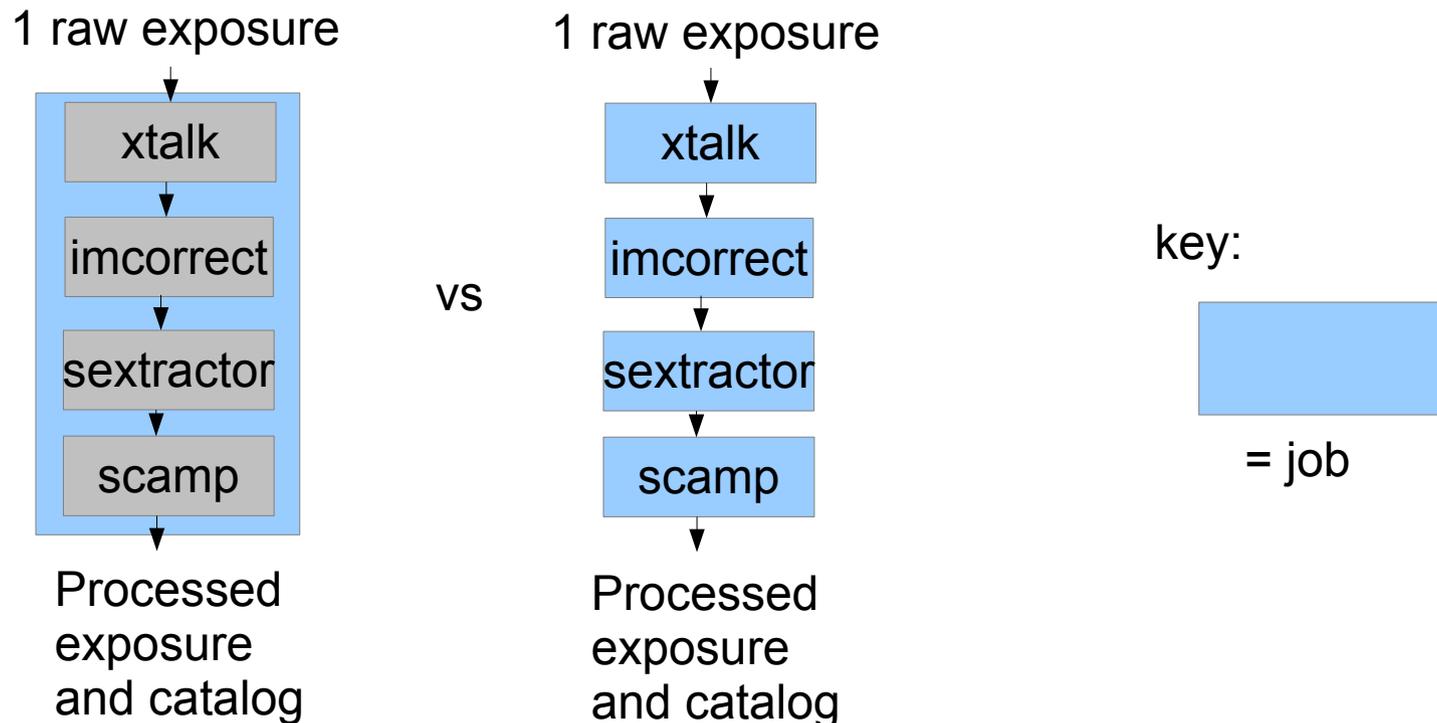
- Large: was ~0.3 GB compressed.
- Complicated: ~10 different processing pipelines each with several programs which are complicated too.
- Originally designed to run on HPC resources (like XSEDE sites) with fast shared disks.
- Uses database to keep track of raw exposures, the many parameters needed for processing, and data provenance.

# Simplifications for this Project

- Focus on just one pipeline to start with.
- Store processing parameters and provenance in files instead of a database. These are hard to search but much simpler to implement. Still serviceable for some important uses.

# Unit of Processing

A job processes a single exposure through all the steps in a pipeline. On the grid, this is simpler and reduces I/O compared to handling each pipeline step as a separate job.



# Challenges in Making Pipeline Grid-ready

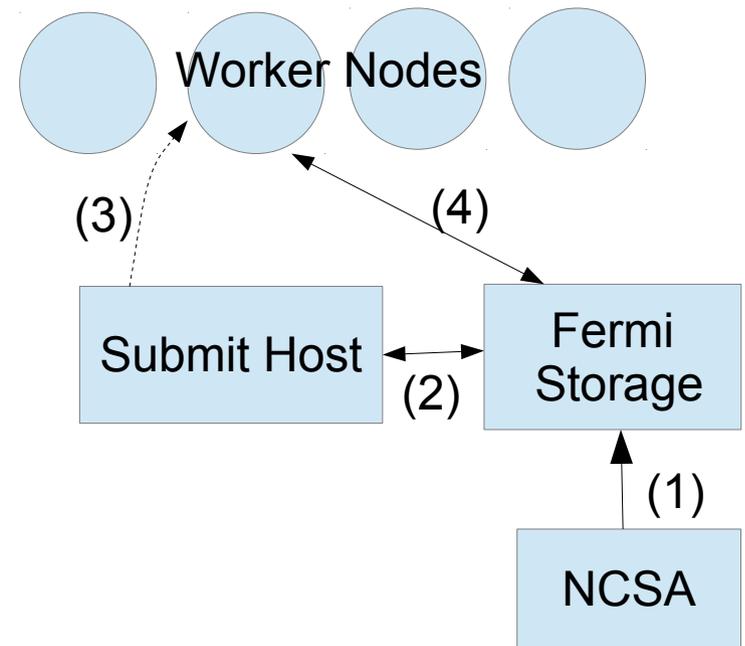
Porting software to run on the grid almost always requires some work. For DESDM this included:

- Getting DESDM software to compile for a standard OSG worker node's architecture (SL5, 64 bit).
- Removing dependencies on database.
- Fixing software to allow processing just **part** of exposure. Faster run time helps testing.
- Changing absolute paths to relative.
- Reducing RAM used.

*Changes were tiny compared to size of software.*

# FermiGrid Workflow

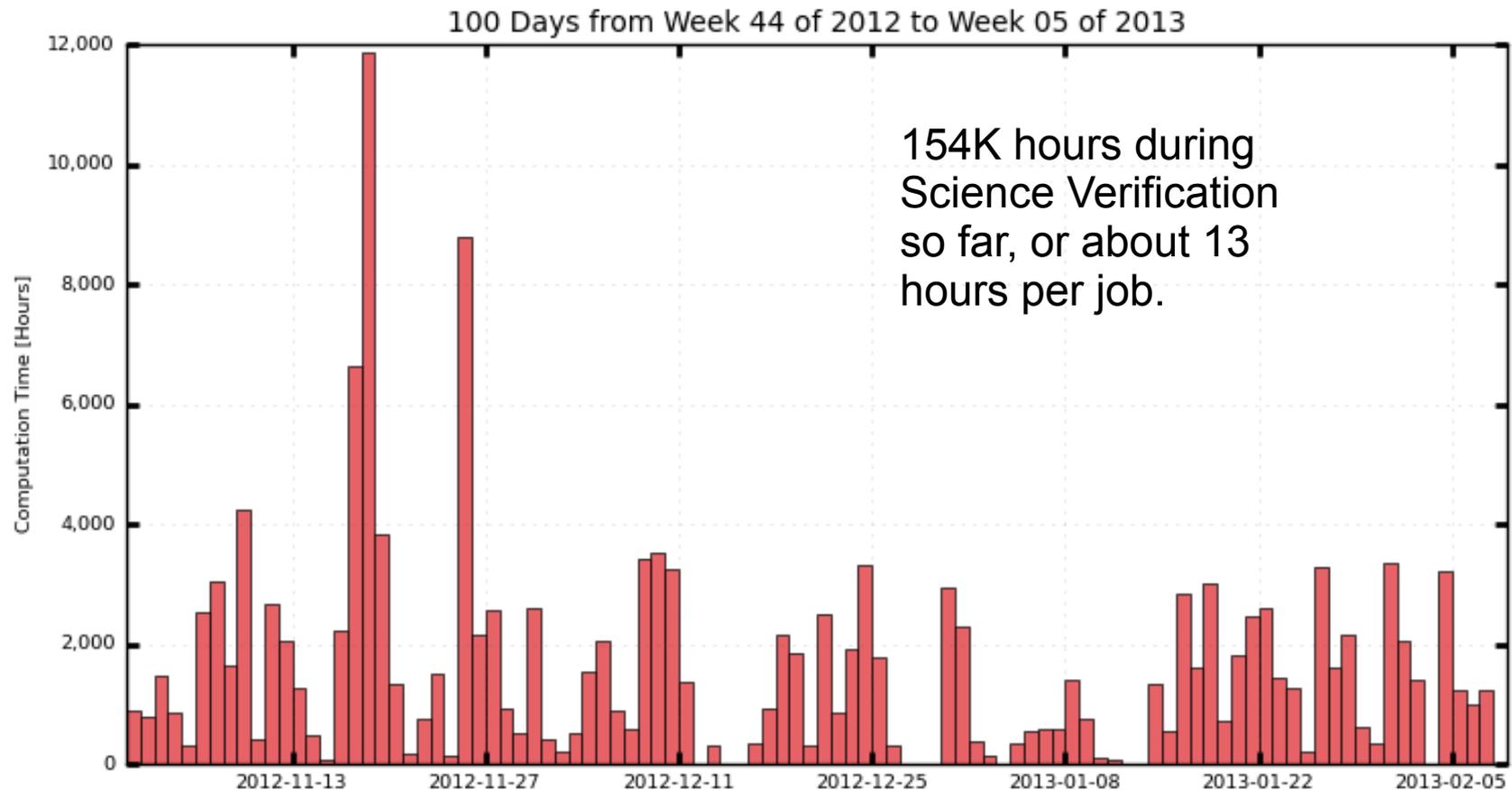
- (1) Download raw exposures to BlueArc or SATABeast.
- (2) Run script to find exposures that need to be processed.
- (3) Start job running.
- (4) Jobs get data from storage, using cpn for throttling.



(Prototype used SRM/dCache for storage.)

# Resource Usage

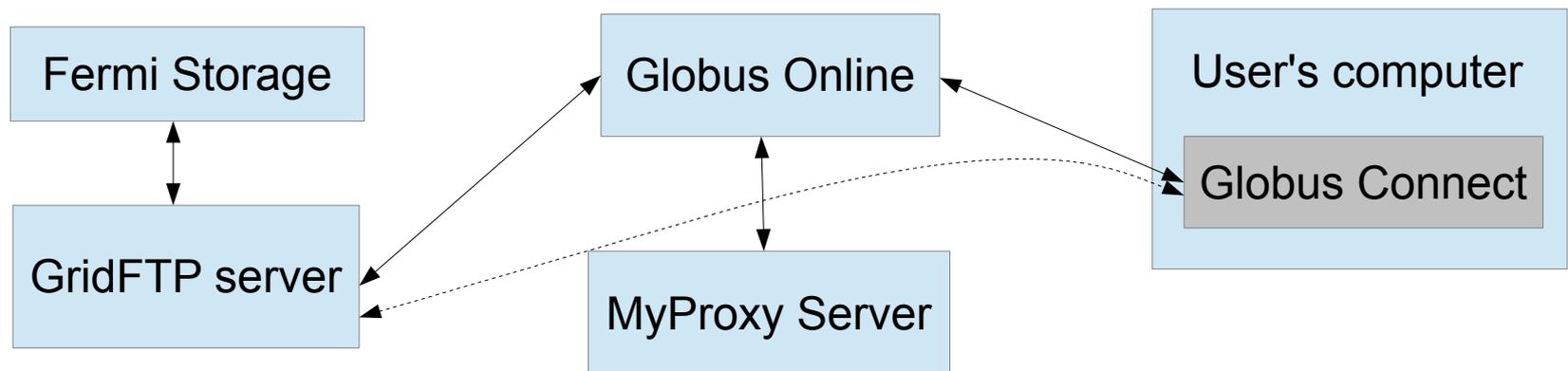
## CPU:



**Data transfer:** Moved roughly 1.1 TB of data per day over the network, or about 9.5GB per job.

# Data Handling Improvements

- Started moving data to Enstore tape when BlueArc got filled up.
- Set up GridFTP-based system that can publish data to collaboration members through Globus Online. Initial solution is intended for a limited amount of data, but have started working to generalize it.



# Side Benefits of Making Software Grid-ready

Useful for scientists and programmers to run DESDM software pipelines on their own PCs (“standalone”).

The experience helped influence some of the work on the refactored system, which will have similar capabilities.

# Lessons Learned

- Moving large amounts of data even by a medium-sized VO is possible by carefully using the resources and support at Fermi.
- Working with a large, unfamiliar codebase is possible with lots of help from the VO.

This experience could be useful for other VOs, especially ones on the cosmic frontier.

# Conclusions

The basic but practical system processed about 14000 DES exposures over the course of the project, generally within a day. This helped with science verification and software improvements.



Image courtesy the DES project.