Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

Autosubmit Tutorial 2021

v3.13.0 and Autosubmit GUI

The Autosubmit Team

Autosubmit team

Get involved or contact us:	
Autosubmit GitLab:	https://earth.bsc.es/gitlab/es/autosubmit
Autosubmit Mailing List:	autosubmit@bsc.es

Documentation:	
Autosubmit:	**http://autosubmit.readthedocs.io**
FAQ:	**https://autosubmit.readthedocs.io/en/latest/faq.html**
GUI:	**https://autosubmit.readthedocs.io/en/latest/autosubmit-gui.html**

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Autosubmit Tutorial 2021

Hands-on: How to run experiments using Autosubmit

The Autosubmit Team

Link to the tutorial slides

Hands-on

https://tinyurl.com/AS-Hands-on-2021

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Autosubmit Release 3.13.0 - News

The Autosubmit Team

3.13.0 - News summary

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3.13.0 - Summary - Improvements

Improves ... :

General **workflow speedup** due to major rework of the tool.

The **structure** of the **workflow** is now cached on a database (speed up)

Able to run experiments **without size limitations***.

Jobs limits management system (total jobs, number of inner jobs…).

Improvements to recovery of **job logs** for all types of workflows.

Improvements to **advanced wrappers** and added **Shared-memory (multi-thread) wrappers**.

Failure tolerance.

Safety, validation improvements

- Checks that experiment is well configured before run.
- Experiments are not longer modificable by non-owner user.

Improved **Git management** (backups, only-branch downloads…)

Logging system rework and code errors.

3.13.0 - Summary - New Features

[Automatic] **Recover** from errors generated at platform endpoint.

[HOST = mn1,mn2...] Use **multiple hosts** in the same platform. Activable*

[Threads] Speed up improvement. This can be disabled using **DISABLE_RECOVERY_THREADS** in platforms.conf

[New run flag] **Schedule** an experiment to run at specific **time**.

[New run flag] **Schedule** an experiment to run after another **experiment**.

[New run flag] Do a **run** based on a subset of the experiment **members**.

[New command dbfix] **Fix** Autosubmit **db** via a command line.

[New command inspect] Allows to **generate** autosubmit templates **without submit** them.

[New jobs parameter] Allows to load a custom shebang or **modules/** environment script before run the job

[Srun] **Multi-thread** wrappers.

[Presubmission] Adquire **priority** on not-running yet jobs (up to 5). Activable*

[Improved command] **Migrate** an experiment.

[New expdef parameter] **Prioritize** a list of jobs **over** the rest of workflow.

[New jobs parameter] **Tune** dependencies at lower level by **specifying** them by **chunks**.

[New wrapper parameter] Impose **conditions** for **wrapper** formation.

3.13.0 - Wrappers - Configuration

Wrapper configuration is set in autosubmit.conf. [wrapper]

Parameters

Type: Allows to select an wrapper approach.

JOBS_IN_WRAPPER: Sections that will be included on the wrapper.

MIN_WRAPPED: Minimum wrapper size.

MAX_WRAPPED: Maximum wrapper size.

MACHINEFILES: STANDARD

METHOD: Select between MACHINEFILES or Shared-Memory.

QUEUE: Select the wrapper queue.

POLICY: Select the behaviour of the inner jobs

Strict/Flexible/Mixed

EXPORT: Allows to load env variables before run the wrapper.

Types Guideline

Vertical: Most appropriate when there are many sequential jobs.

Horizontal: Most appropriate when there are multiple ensemble members. Can be used with machines files or shared-memory.

Horizontal-vertical: Most Appropriated to run shared-memory and to run different ensembles sequentially.

Vertical-horizontal: To group subsequents jobs with different wallclock.

3.13.0 - Wrappers - Policies

Flexible

If a wrapper of **MIN_WRAPPED** jobs is not possible, these jobs will be **submitted as individual jobs**.

Strict

If a wrapper of **MIN_WRAPPED** jobs is **not possible**, these jobs will **not be submitted**. Until there are enough ready jobs. **Can cause deadlock.**

Mixed

It **acts like Strict** with the **difference** that the **failed jobs** will be **resubmitted** individually. **Can cause deadlock.**

New Features - Illustrated

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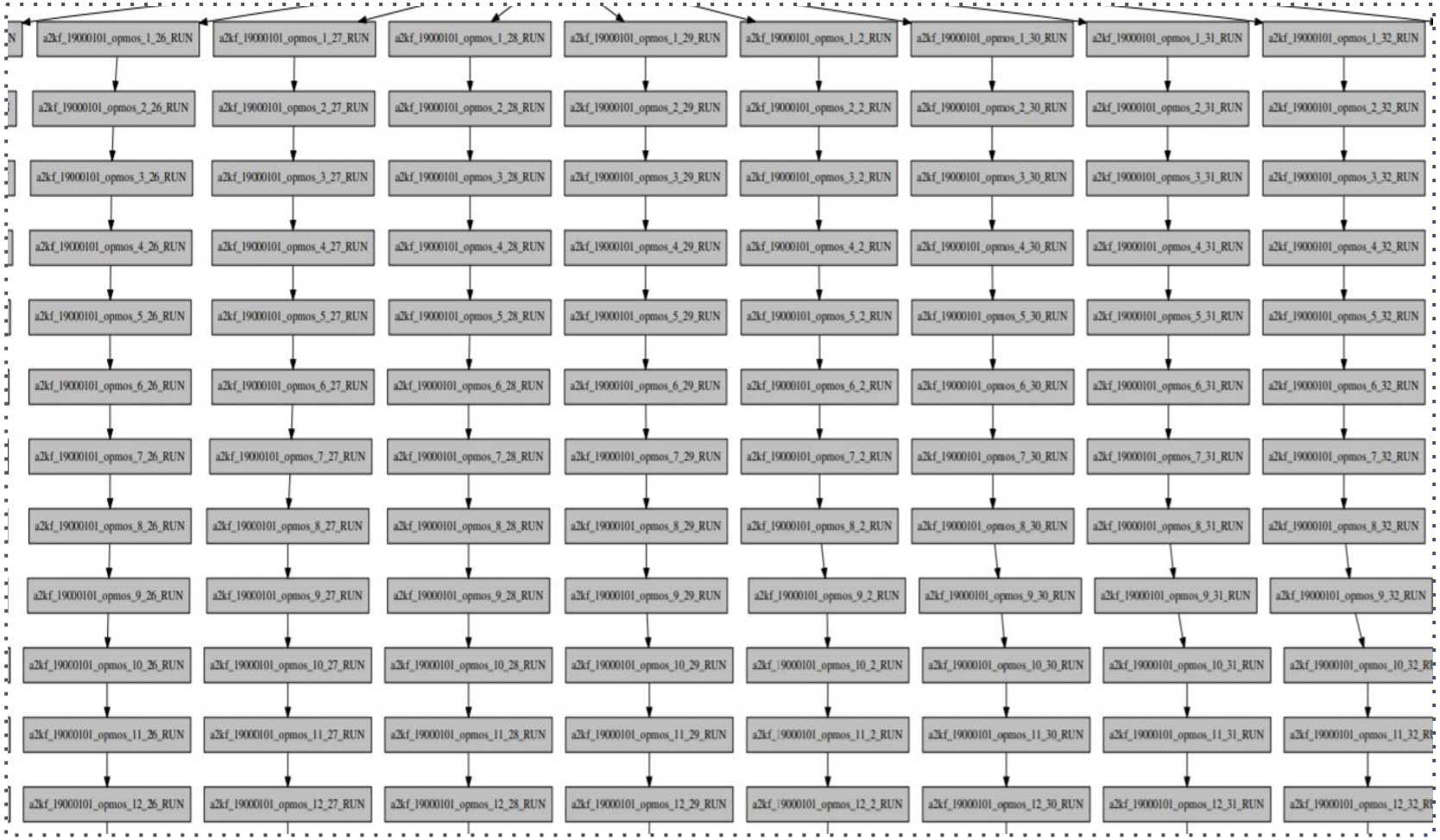
New Features- Srun

```
[RUN]
FILE = run.sh
DEPENDENCIES = INI RUN-1
PLATFORM = power9
RUNNING = chunk
WALLCLOCK = 02:00
PROCESSORS = 1
THREADS = 8
TASKS = 1
SPLITS = 40
QUEUE = debug
```

```
[wrapper]
TYPE = horizontal-vertical
Method = srun
```

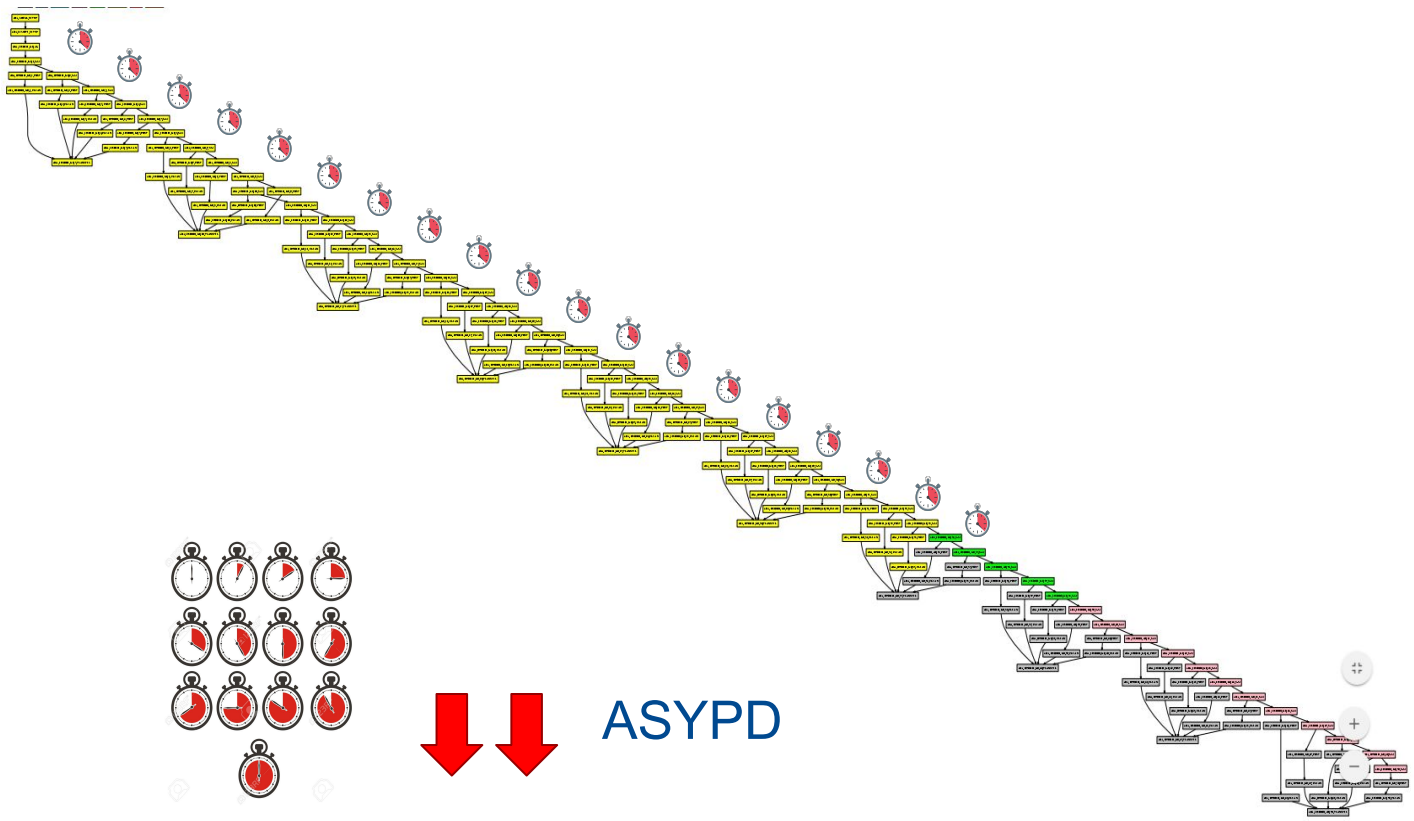
Thread-level parallelism.



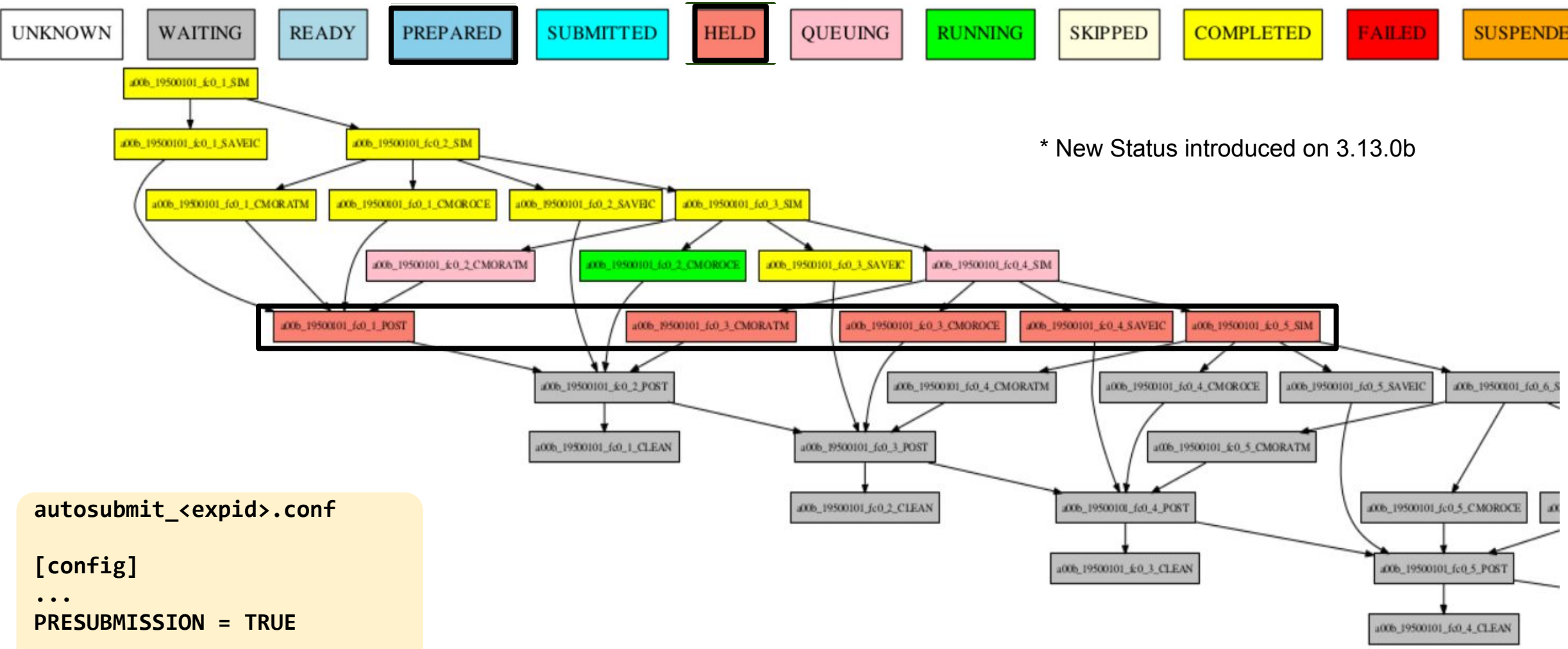
Allows to run serial jobs in different nodes

New Features - Presubmission

- **Minimize queuing** time.
- By **submitting** jobs **before** they are prepared to run.
- They are put on **hold** in the queues gaining **priority**.
- Autosubmit will **activate** them.
- **Presubmission** is set on *autosubmit.conf*



New Features - Presubmission(cont)

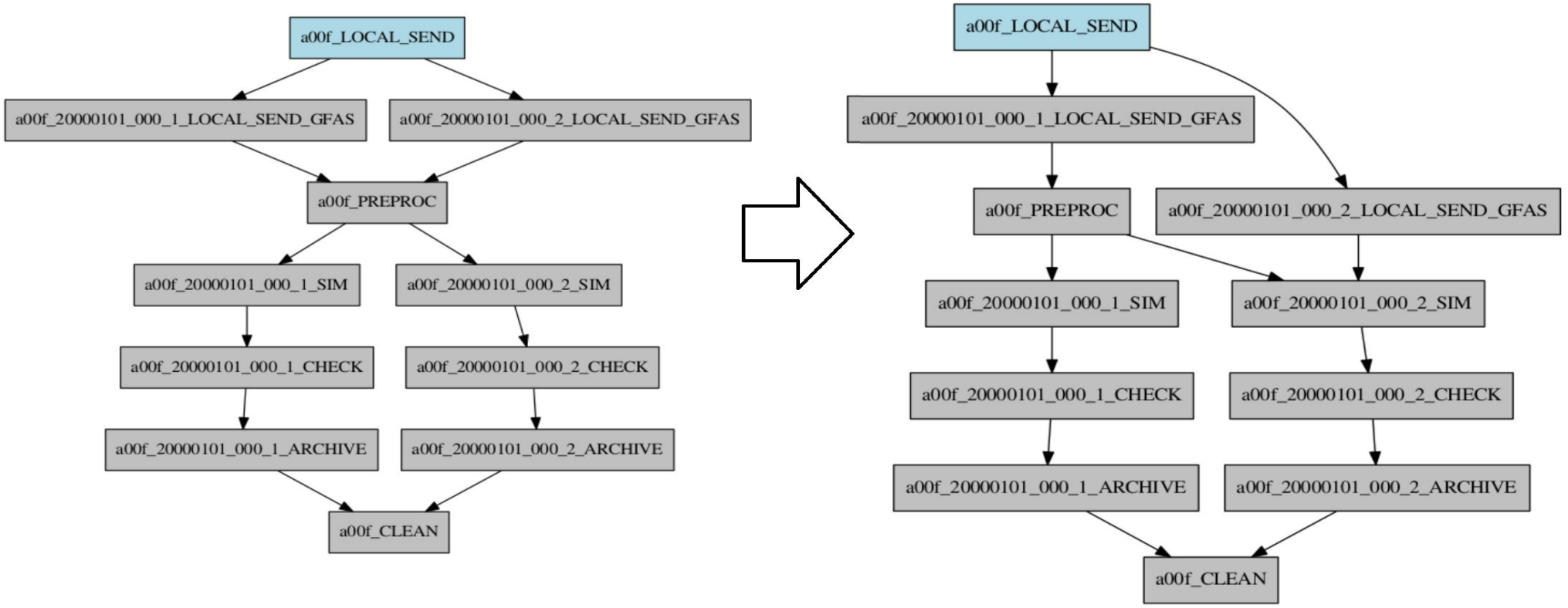


* New Status introduced on 3.13.0b

```
autosubmit_<expid>.conf

[config]
...
PRESUBMISSION = TRUE
...
```

New Features - Select Chunks



Tune dependencies at lower level by **specifying** them by **chunks**.

```
[PREPROC]
FILE = templates/prepoc.sh
DEPENDENCIES = LOCAL_SEND_GFAS
(...)
SELECT_CHUNKS = LOCAL_SEND_GFAS*1
```

New Features - Migrate

Migrate is a feature that allows to transfer data to another user.

- Allows to transfer data between from different or same group/project.
- Transfers /esarchive user to another user. #**OPTIONAL**
- Requires an temp_transfer_dir accessible for both users. #**MANDATORY**

Configuration Parameters in **each section of platform.conf** that **contains data**.

USER_TO = <target_user> # Mandatory
TEMP_DIR = <hpc_temporal_directory> # Mandatory
SAME_USER = False/True # OPTIONAL, default false
PROJECT_TO = <project> # OPTIONAL, if the target_user below to another project
HOST_TO = <cluster_ip> # OPTIONAL, Try to use direct ip.

In case of shared filesystem, is advised to only put these parameters **on the one dedicated to transfer data**. (transfer_node in marenostrum4 case.)

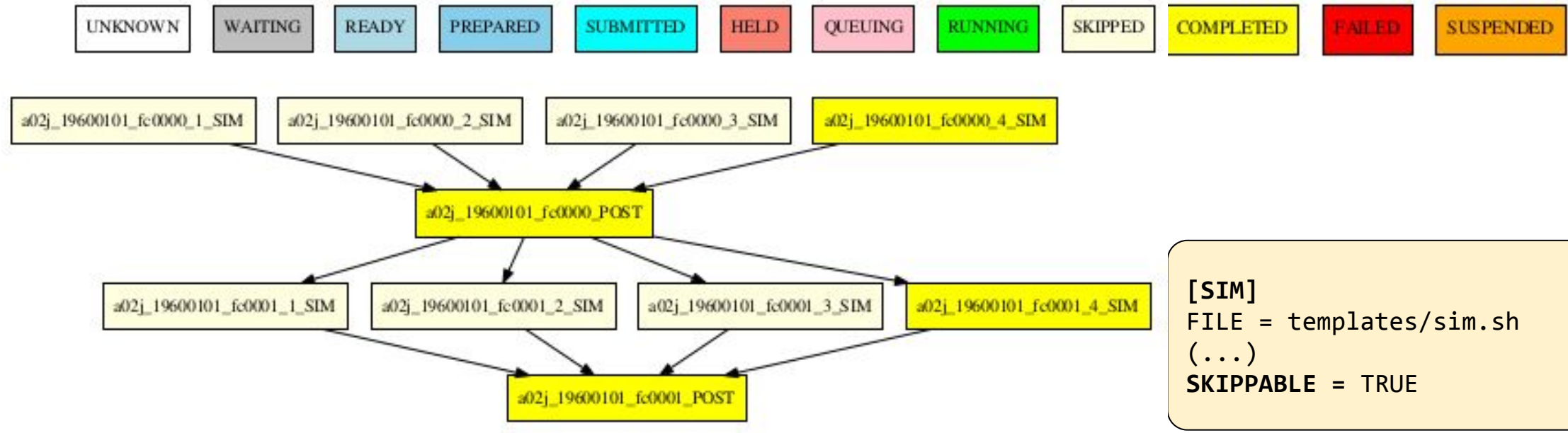
USAGE:

```
autosubmit migrate <expid> <--offer>  [--only_remote]
autosubmit migrate <expid> <--pickup> [--only_remote]
```


https://earth.bsc.es/gitlab/es/autosubmit/-/wikis/migrate-experiments

New Features - Skippable jobs

Allows to skip a job of the same section and run the latest one




```
[SIM]
FILE = templates/sim.sh
(...)
SKIPPABLE = TRUE
```

New Features - Priority jobs (Crossdate-wrappers)

```
[wrapper]
TYPE = horizontal-vertical
MACHINEFILES = STANDARD
JOBS_IN_WRAPPER = SIM&DA
MIN_WRAPPED = 9
POLICY = flexible
CHECK_TIME_WRAPPER = 300
```

```
...
MEMBERS = 00[0-3]
CHUNKSIZEUNIT = day
CHUNKSIZE = 1
NUMCHUNKS = 10
...
```

Configuring a crossdate wrapper.

Copied from **t0kx** experiment.

Configuring priority jobs.

Add TWO_STEP_START parameter into expdef.conf

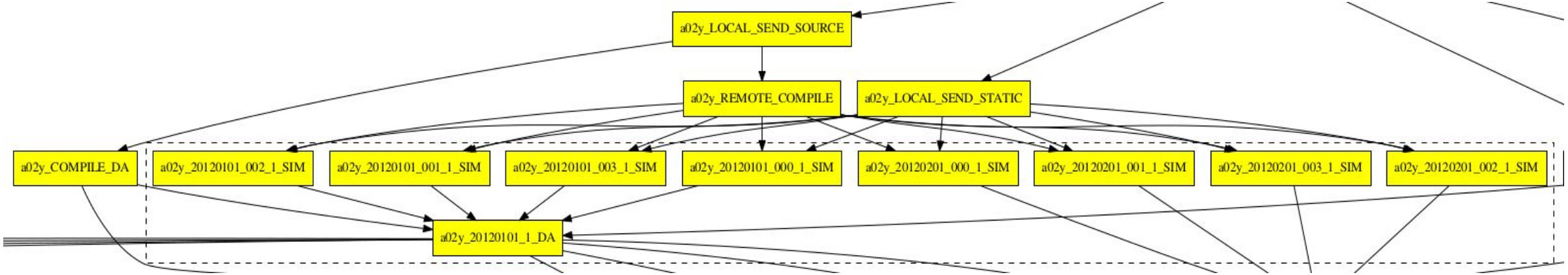
```
TWO_STEP_START =
20120101_1_DA&LOCAL_SETUP,LOCAL_SEND_SOURCE,REMOTE_COMPILE,LOCAL_SEND_STATIC,LOCAL_SEND_INITIAL_DA,COMPILE_DA;SIM[20120101 20120201[C:1]]
```

New Features - Priority jobs (Crossdate-wrappers)

With this set-up

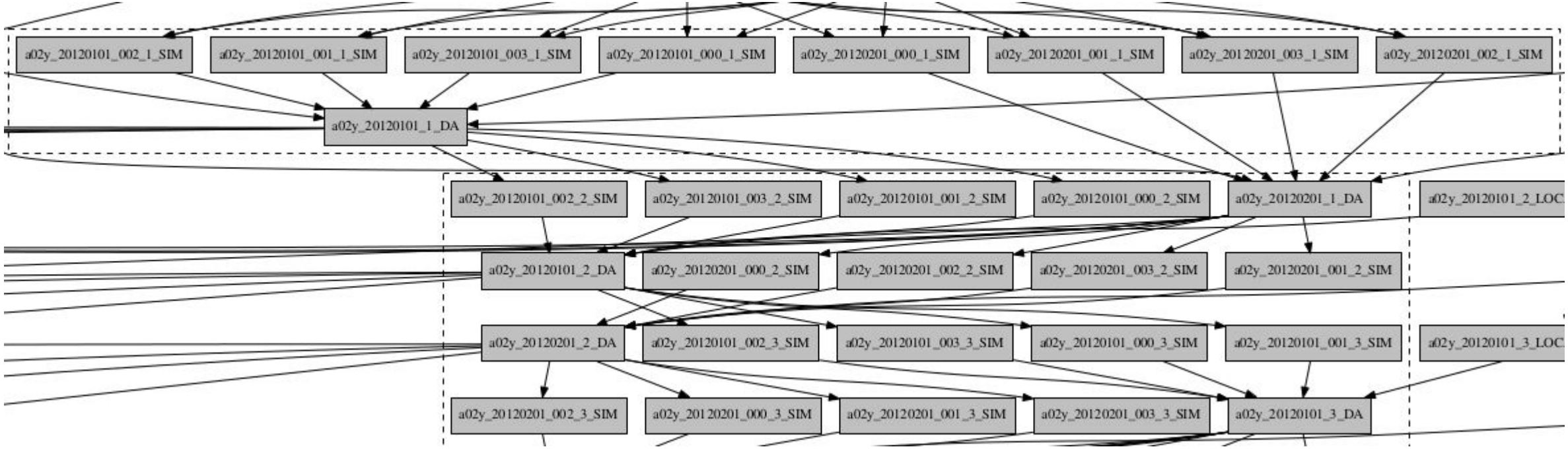
We accomplish that some specific jobs, regardless of if they were wrapped will be completed before the rest of the wrapper.

With the aim of balance the wrapper



New Features - Priority jobs (Crossdate-wrappers)

Run the rest of the workflow inside a bigger wrapper



Autosubmit Graphical User Interface

(The GUI)

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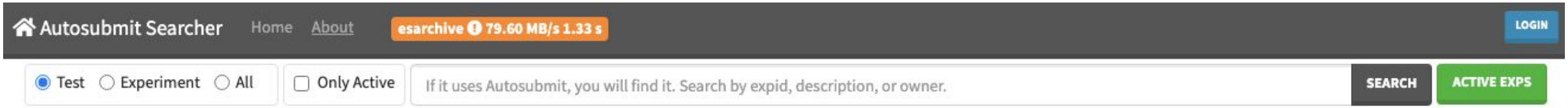
Presentation Structure

- **Autosubmit GUI Main Window**
  - Search
  - Summary data
  - How Autosubmit GUI collects data
- **Experiment Information**
  - Experiment Main Window
  - Experiment Metadata (Header and Footer)
- **Tree Representation**
  - General Description
  - Wrappers Representation
  - Monitoring
  - Filtering
  - Advanced Filter
  - Job Summary
- **Experiment History**
  - Runs of the experiment
  - Job data in Tree View
  - Job Runs

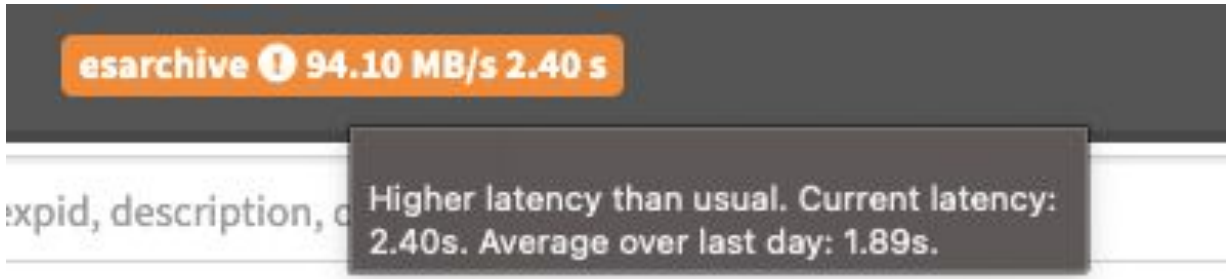
Presentation Structure II

- **Graph Representation**
  - General Description
  - Wrappers Representation
  - Monitoring
  - Job Search
  - Grouped by Date Member
  - Grouped by Status
- **Autosubmit Statistics**
  - General Description
  - Filtering
- **Performance Metrics**
  - Description
- **Quick View**
  - Description
- **FAQ**
- **More Tools**
  - Command generation

Autosubmit GUI Main Window: Search

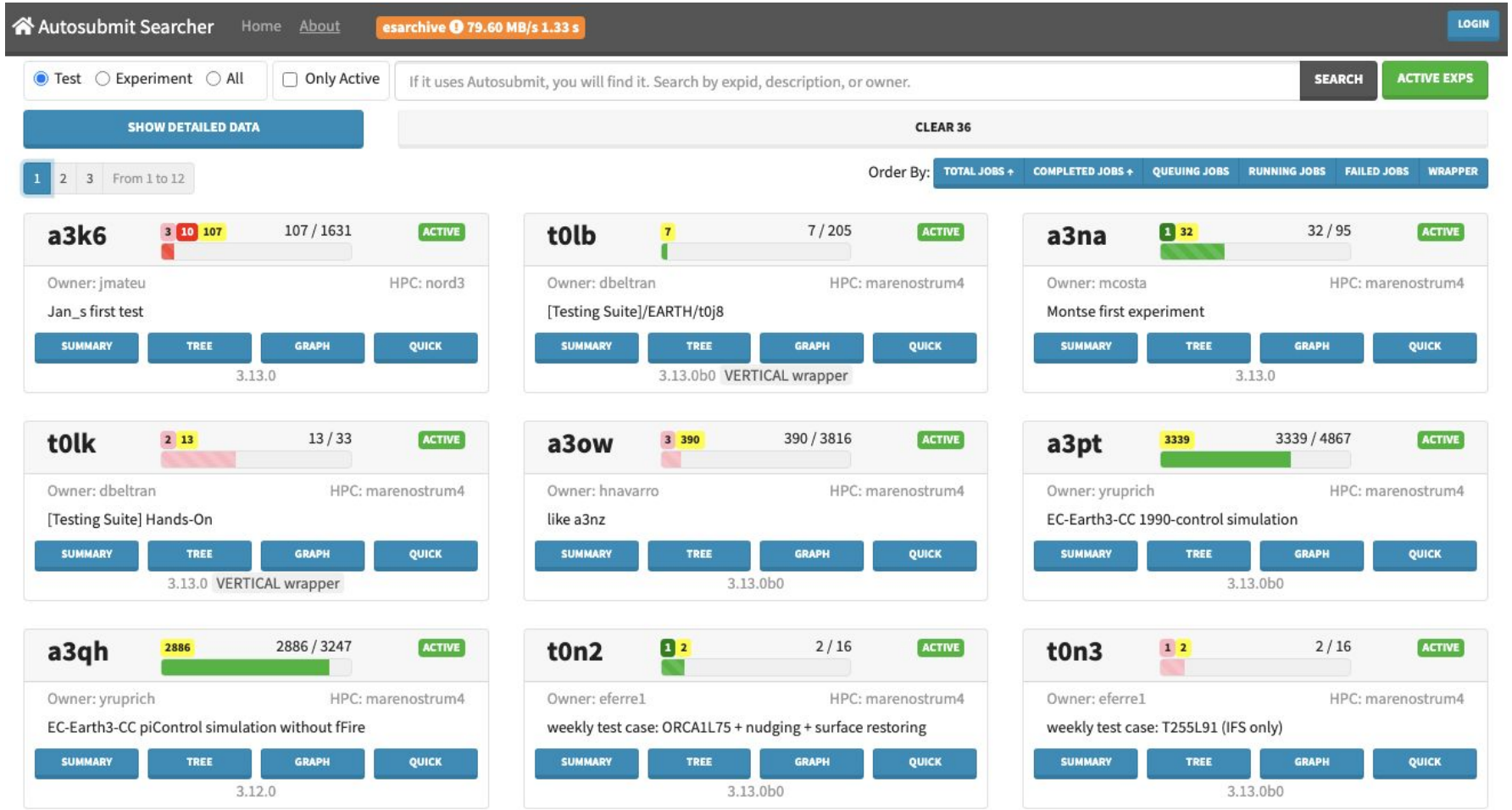


- Search (with filters)
- Active Exps
- “esarchive” Status (yellow on warning)



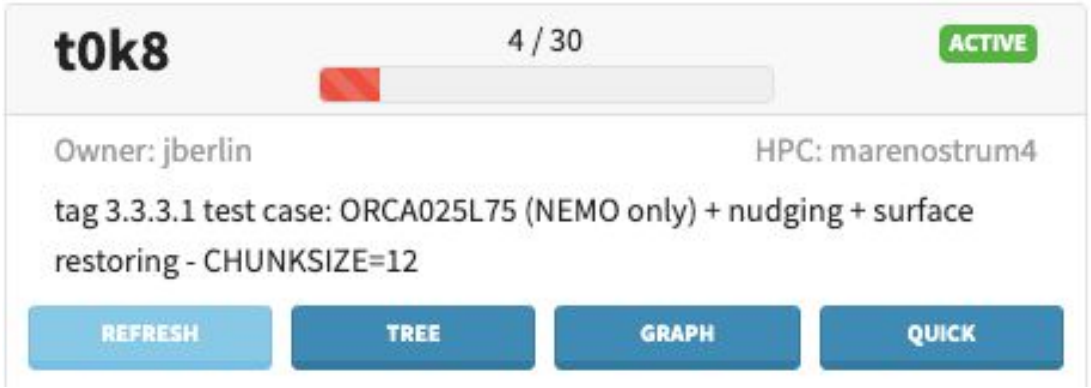
https://earth.bsc.es/autosubmitapp/

Autosubmit GUI Main Window: Search Result



- **“ACTIVE”** experiments listed first.
- Include experiment completion information.
- Quick way to see the status and completion of your experiment.
- Summary information is updated every 3 minutes.
- Experiments using Autosubmit 3.13.0 send update their information instantly.

Autosubmit GUI Main Window: Summary Data



The **“More”** button will open the Tree View of the experiment.
The **“Quick”** button will open the Quick View of the experiment, which loads significantly faster.

The summary includes:

- Average Queue Time
- Average Running Time
- Independent metrics for SIM jobs
- List of failed jobs

How do we collect data?

Workers running on short intervals make sure we get **current data most of the time**.

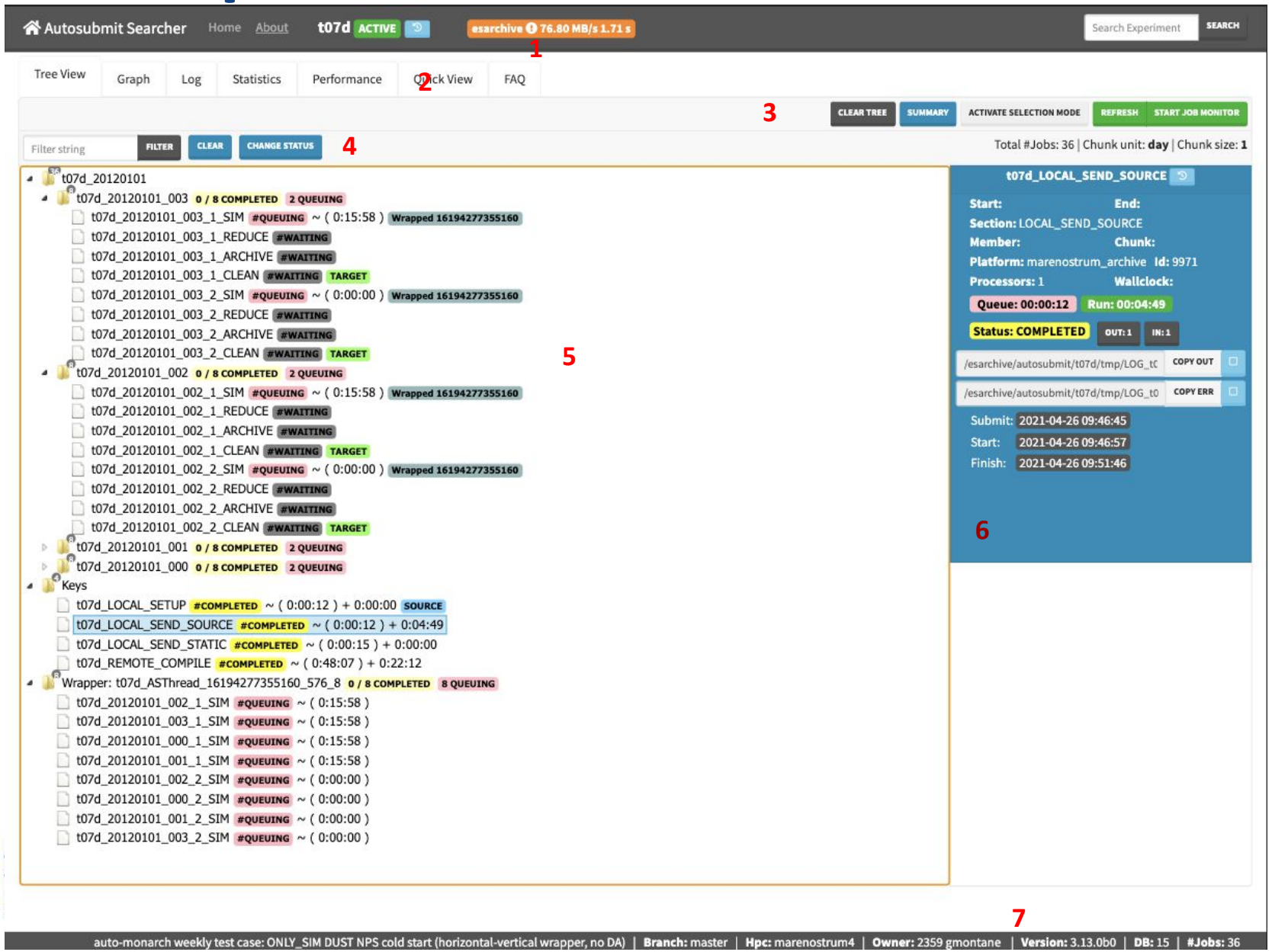
Workers make sure that all information is included. They also make **corrections due to concurrency** conflicts.

Autosubmit v3.13.0 implements **distributed sqlite3 databases** that store the lifecycle of your experiment, while still **preserving the traditional filesystem storage**. We call these distributed databases, the **historical database**.

The historical database keeps records of **all** the runs of your experiment.

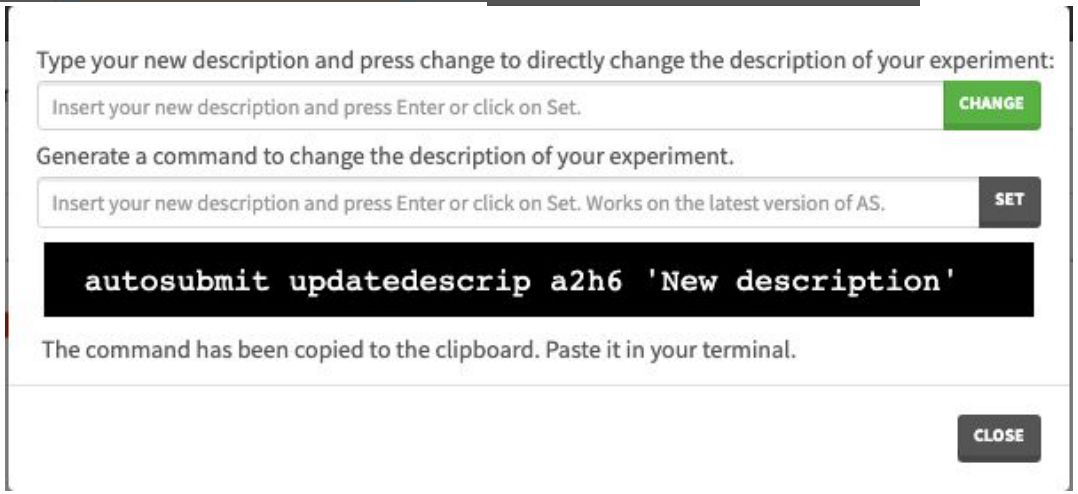
The main source of information for experiments not using the latest Autosubmit version is the **file system**.

Experiment Information: Main Window



1. Header
2. Content Tabs
3. Control Panel
4. Search & Actions Panel
5. Tree View
6. Job Selection Information
7. Footer

Experiment Header



From left to right:

- **Home:** Takes you to the main page.
- **About:** Some information you might need to know.
- **t07r:** Experiment identifier
- **INACTIVE:** Experiment status, **ACTIVE** if running.
- **Button with clock symbol**: Opens experiment history. Only for Autosubmit **v3.13.0** onwards.
- **Change**: Allows you to change the description or generates command.
- **esarchive:** Current status of /esarchive, if it is yellow, it might be bad news.
- **Search Experiments:** Allows you to search for another experiment.

Experiment Footer

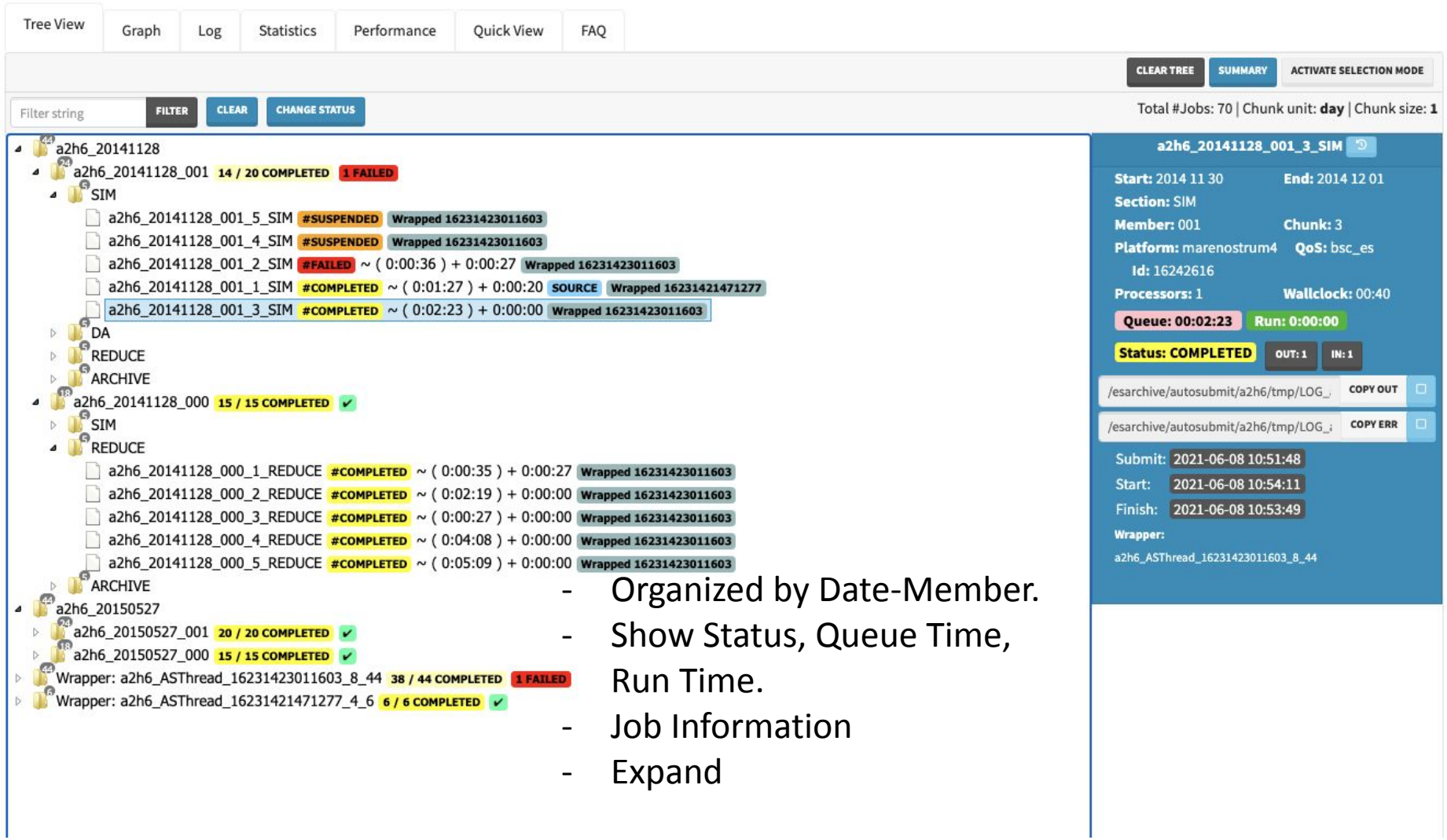
MONARCH - Global Aerosol 1.5 Operational simulation |

| **Branch:** operational | **Hpc:** marenostrum4 | **Owner:** 1747 molid | **Version:** 3.9.0 | **DB:** NA | **#Jobs:** 12

Presents the experiment description plus some other relevant data:

- Branch
- Hpc
- Owner
- Autosubmit Version
- DB Version
- Number of Jobs

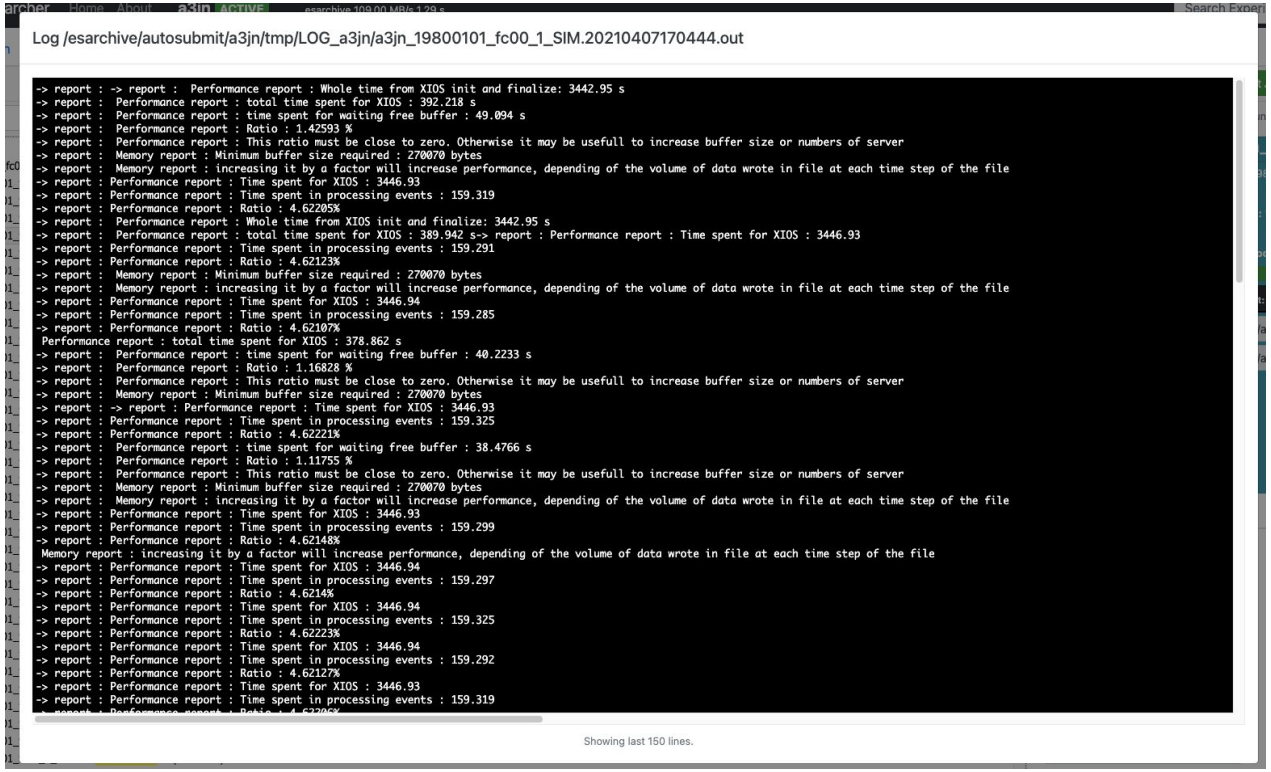
Tree Representation: General Description



- Organized by Date-Member.
- Show Status, Queue Time, Run Time.
- Job Information
- Expand

Job Selection

- **Out**: Next jobs.
- **In**: Previous jobs.
- **Copy out** to clipboard -> Paste
- Visualize **out** (Eye button)
- **Copy err** to clipboard -> Paste
- Visualize **err**



Tree Representation: Wrappers

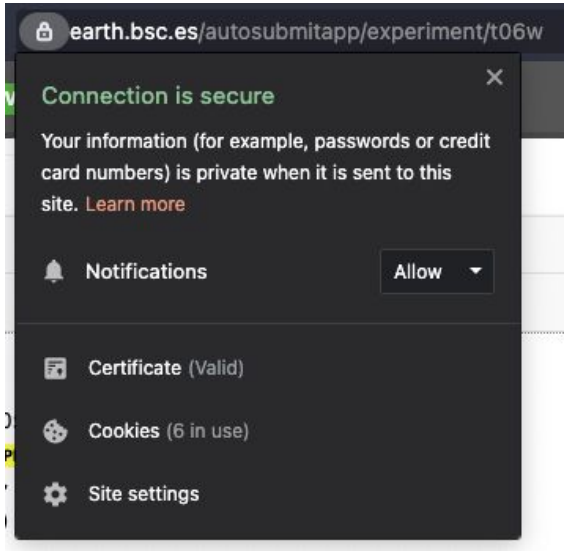
One folder per wrapper.

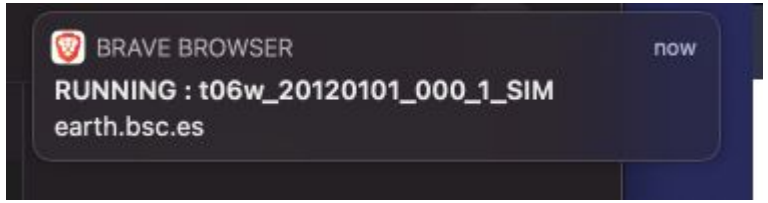
Repeated jobs but same information.

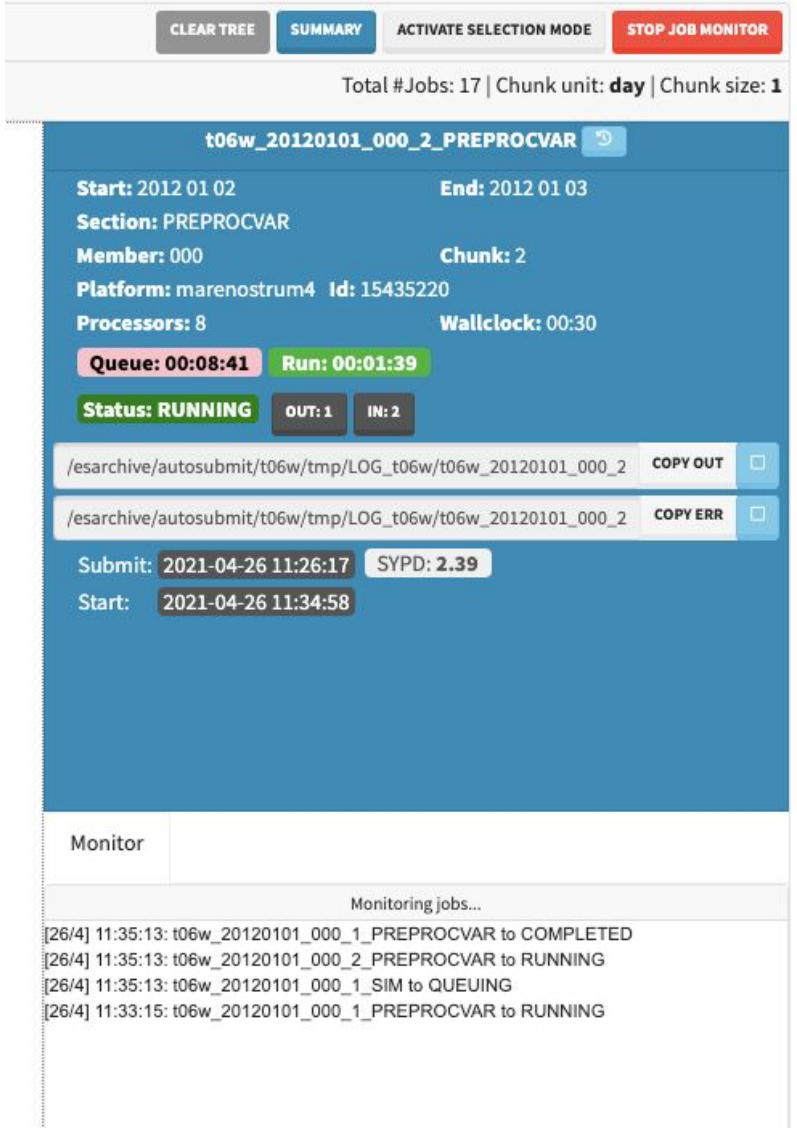
Normalized times.

Tree Representation: Monitoring

- **Refresh:** Once.
- **Start Job Monitor:** Intervals 2 * SAFETYSLEEPTIME
- **Stop Job Monitor:** Stops the worker.
- If allowed, it can send **desktop notifications.**







Tree Representation: Filtering

Filter by string in job name, status, time.

Tree Representation: Advanced Filtering

Filter using wildcard

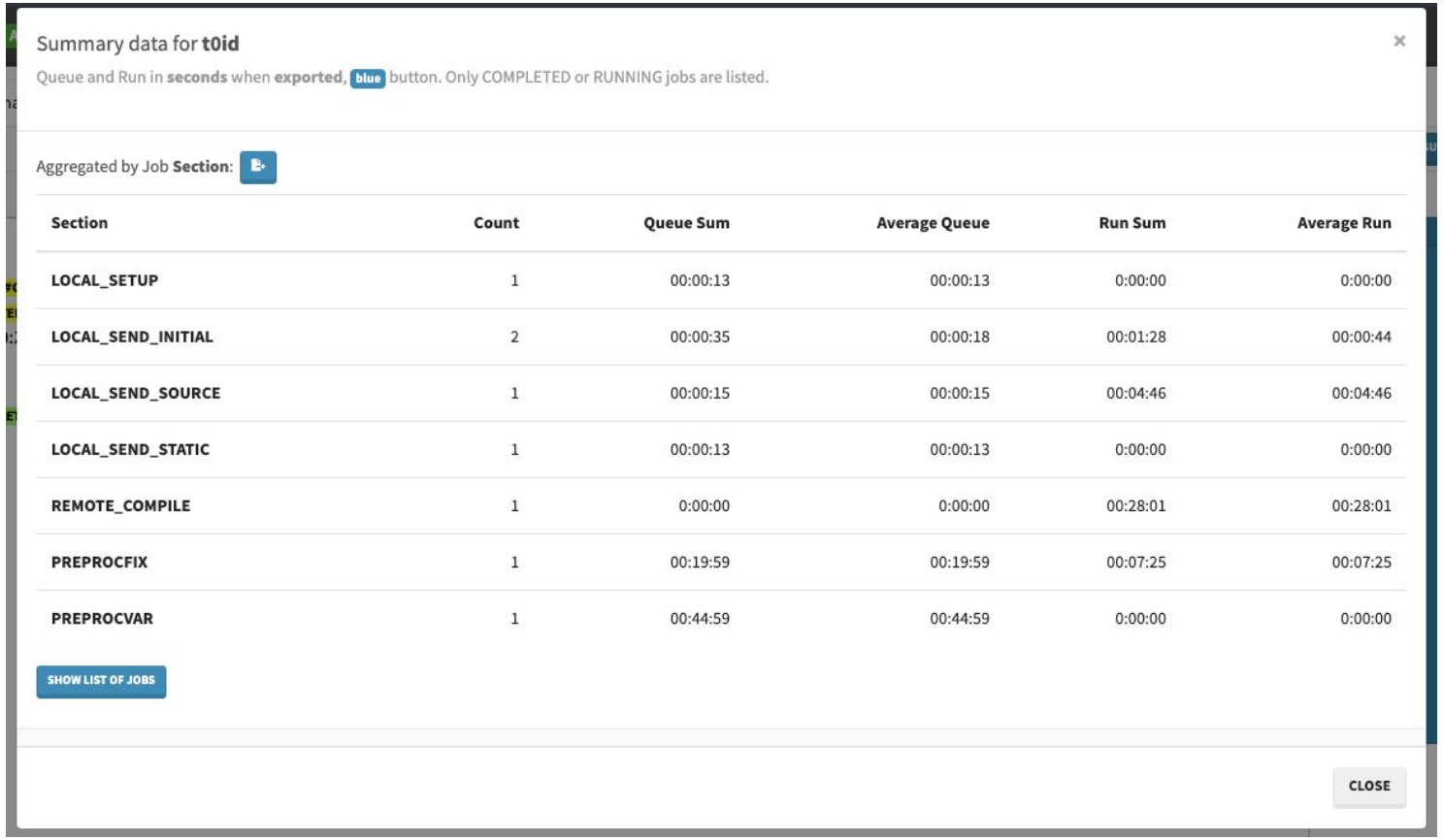
Tree Representation: Negation Filter

The negation “!” filters out those names containing the adjacent string. The wildcard “*” works as an OR when combined with the negation.

Tree Representation: Job Summary

By clicking on the “Summary” button, a window opens (right). On this window:

- Table that shows the **aggregated** data of the current jobs in the tree view grouped by **SECTION** (job type):
  - Section
  - Count
  - Queue Sum
  - Average Queue
  - Run Sum
  - Average Sum
- **Show List of Jobs**: Opens a table containing the list of jobs, fields: Job Name, Queue, Run, Status.



Experiment History: Runs

By clicking on the “History” button:

- Shows table of historical information

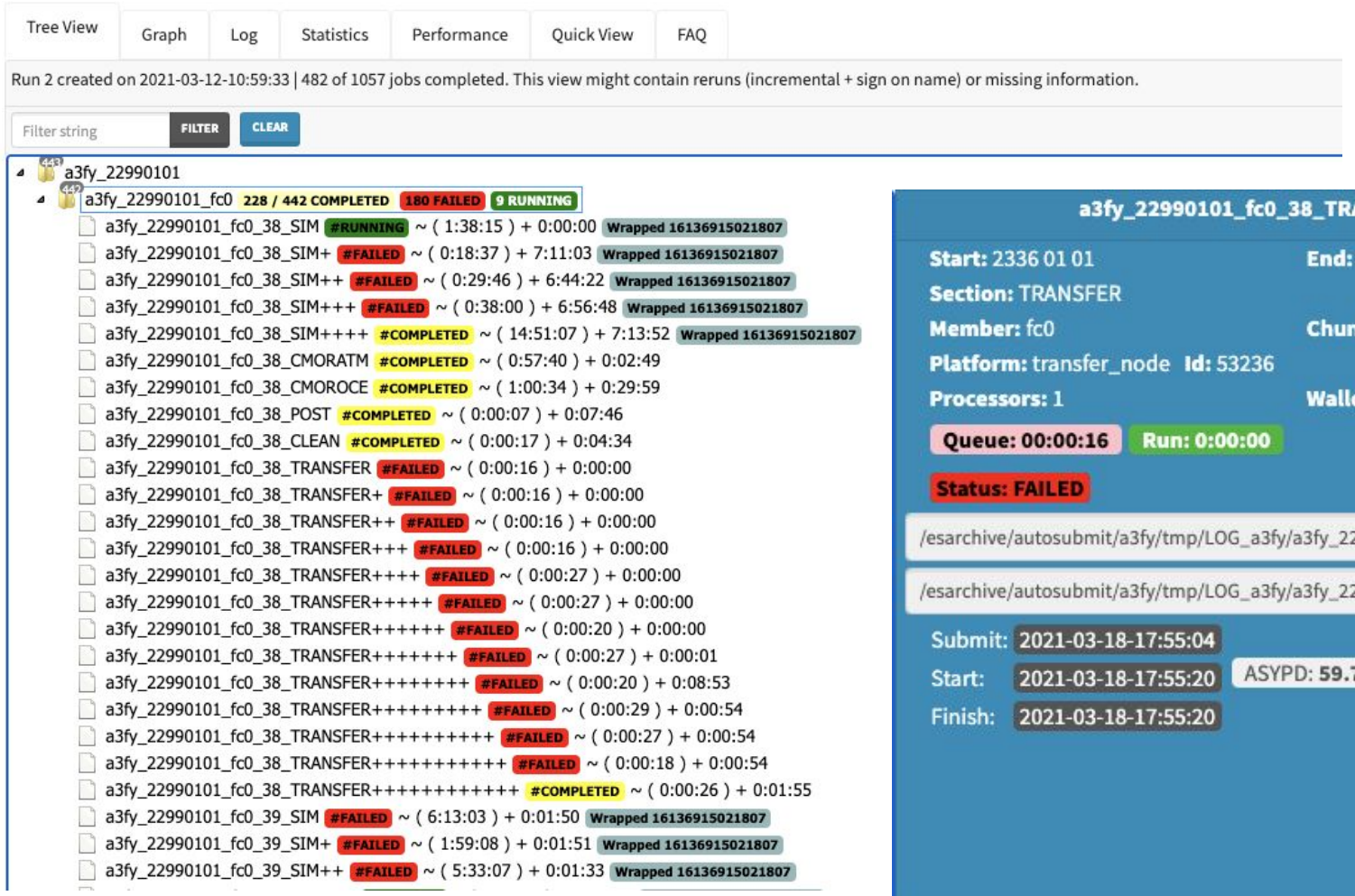
Runs of **t0id** (The first row represents the current run.)

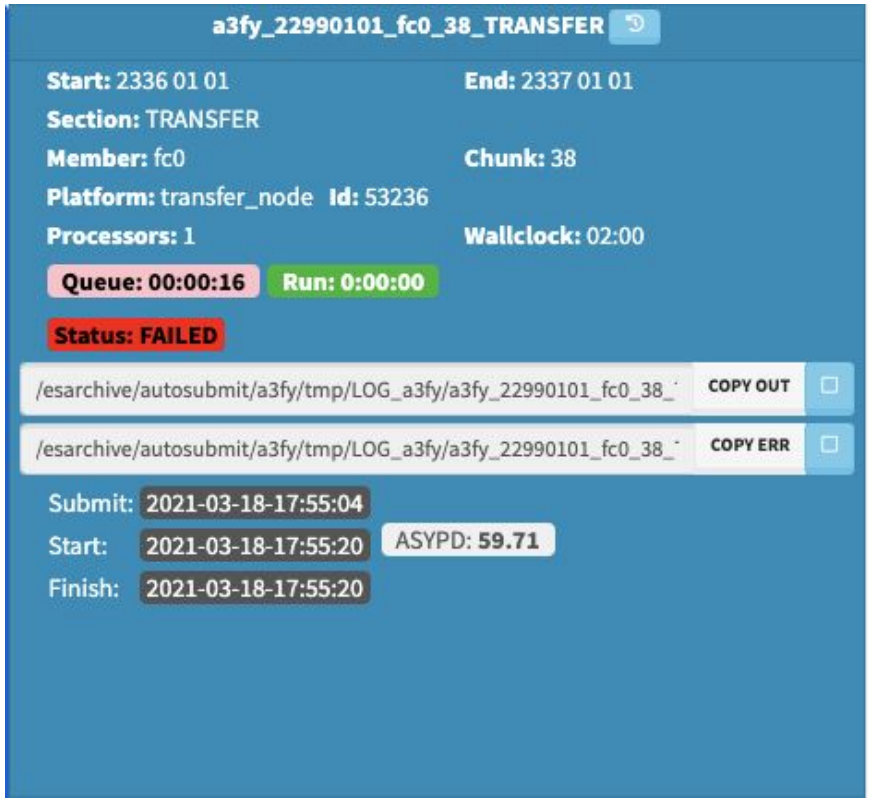
	RunId	Created	Finish	Submitted	Queuing	Running	Failed	Suspended	Completed	Total	SYPD	ASYPD	ChunkUnit	ChunkSize
	107	2021-04-26-09:34:17		0	1	0	0	0	9	**17**			day	1
	106	2021-04-23-22:16:25	2021-04-24-23:21:30	0	0	0	0	0	19	**19**	7.64		day	1
	105	2021-04-16-22:11:19	2021-04-19-11:22:51	0	0	0	0	0	19	**19**	4.55		day	1
	104	2021-04-09-22:10:39	2021-04-12-09:57:18	0	0	0	0	0	19	**19**	7.64		day	1
	103	2021-04-02-22:08:01	2021-04-06-09:40:19	0	0	0	0	0	19	**19**	6.67		day	1
	102	2021-03-26-22:10:33	2021-03-26-23:50:49	0	0	0	0	0	19	**19**	4.98		day	1

Experiment History: Job Data in Tree View

By clicking on the “Eye” button:

- Shows the job data in the Tree View.
- Reruns +





Experiment History: Job Runs

By clicking on the “History” button:

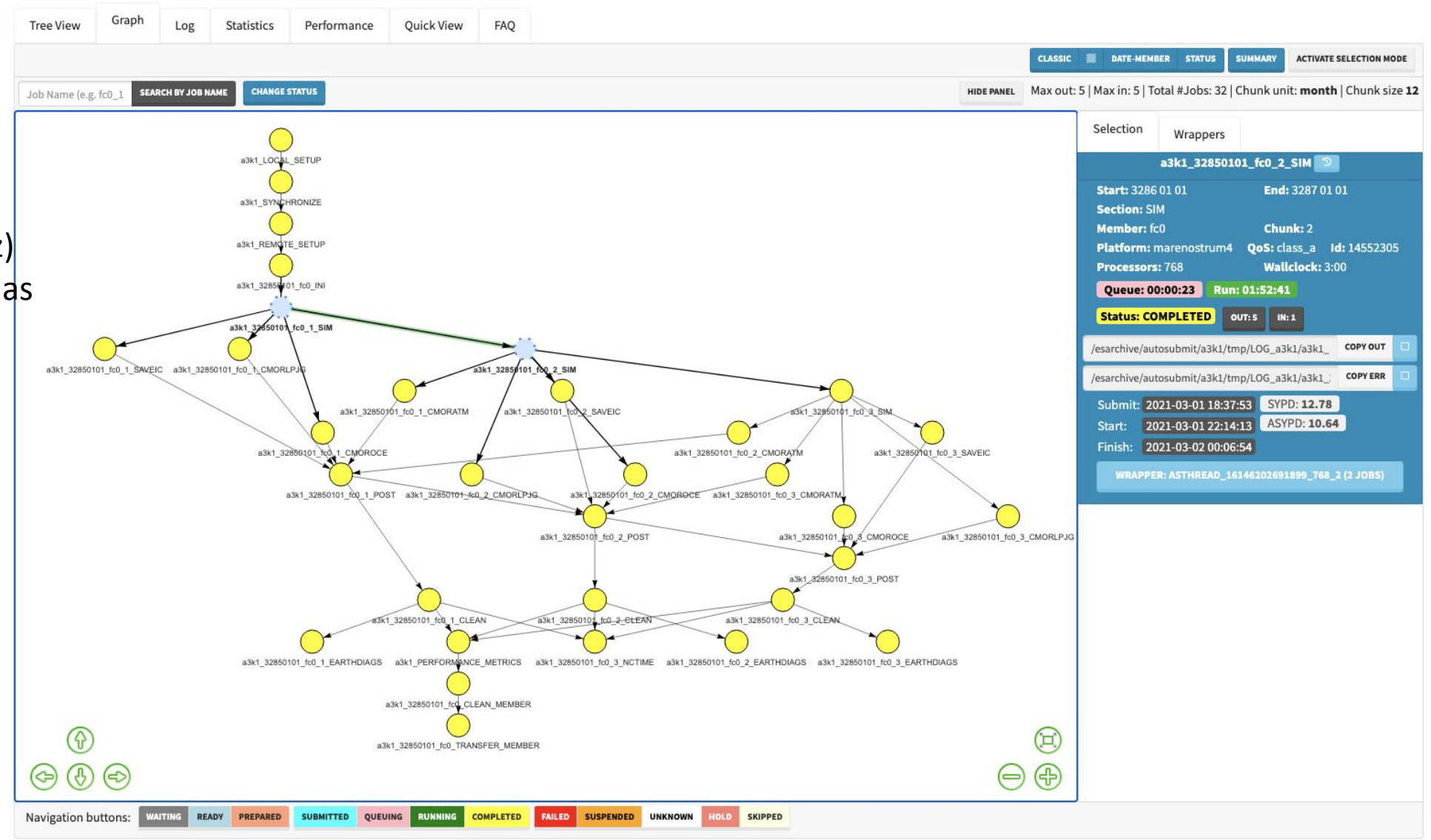
- Shows table of previous runs of the job. Can be exported.

Historical data for **a3fy_22990101_fc0_38_TRANSFER**

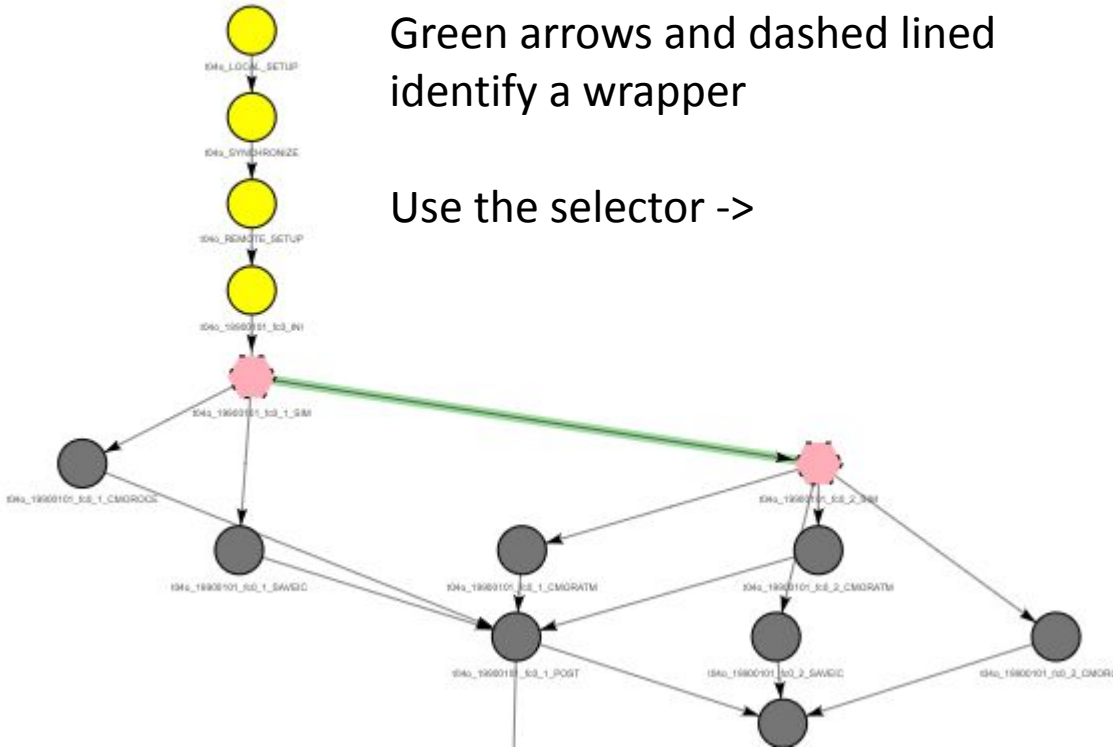
RunId	Counter	JobId	Submit	Start	Finish	Queue	Run	Status	Energy	SYPD	ASYPD	Wallclock	NCpus	NNodes
2	56	40206	2021-03-22-20:14:53	2021-03-22-20:15:19	2021-03-22-20:17:14	0:00:26	0:01:55	COMPLETED	NA	751.3	38.15	02:00	1	0
2	36	38753	2021-03-20-20:23:45	2021-03-20-20:24:03	2021-03-20-20:24:57	0:00:18	0:00:54	FAILED	NA	1600	39.34	02:00	1	0
2	35	29255	2021-03-20-20:22:21	2021-03-20-20:22:48	2021-03-20-20:23:42	0:00:27	0:00:54	FAILED	NA	1600	39.18	02:00	1	0
2	34	21437	2021-03-20-20:20:57	2021-03-20-20:21:26	2021-03-20-20:22:20	0:00:29	0:00:54	FAILED	NA	1600	39.15	02:00	1	0
2	33	36109	2021-03-20-20:11:34	2021-03-20-20:11:54	2021-03-20-20:20:47	0:00:20	0:08:53	FAILED	NA	162.1	32.27	02:00	1	0
2	32	17229	2021-03-20-20:08:01	2021-03-20-20:08:28	2021-03-20-20:08:29	0:00:27	0:00:01	FAILED	NA	86400	40.15	02:00	1	0
2	31	14084	2021-03-20-20:07:31	2021-03-20-20:07:51	2021-03-20-20:07:51	0:00:20	0:00:00	FAILED	NA		40.3	02:00	1	0

Graph Representation: General Description

- Control Panel
- Graph (Heuristics/GraphViz)
- Job Selection (Same as TreeView)
- Navigation Buttons (Bottom)

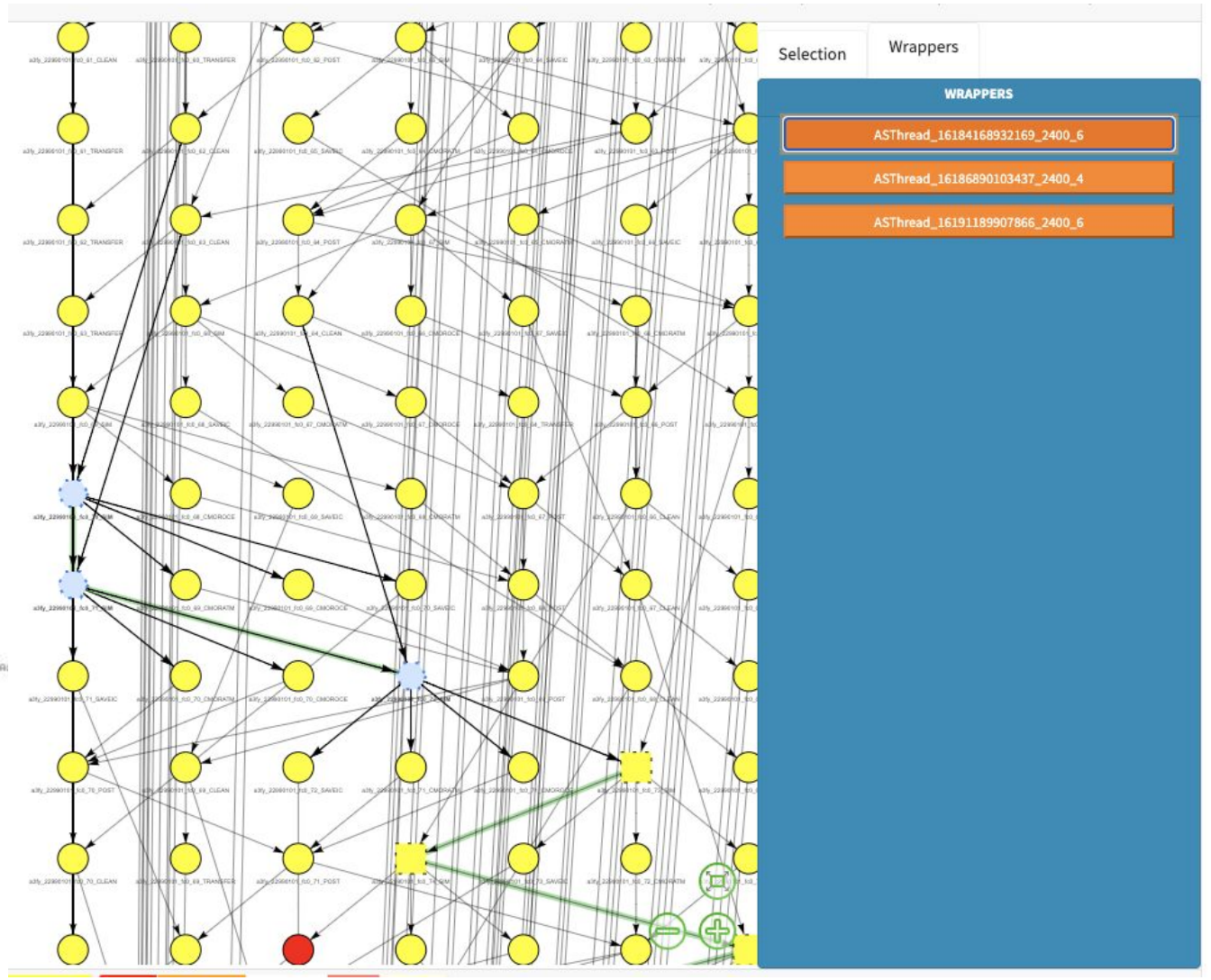


Graph Representation: Wrappers

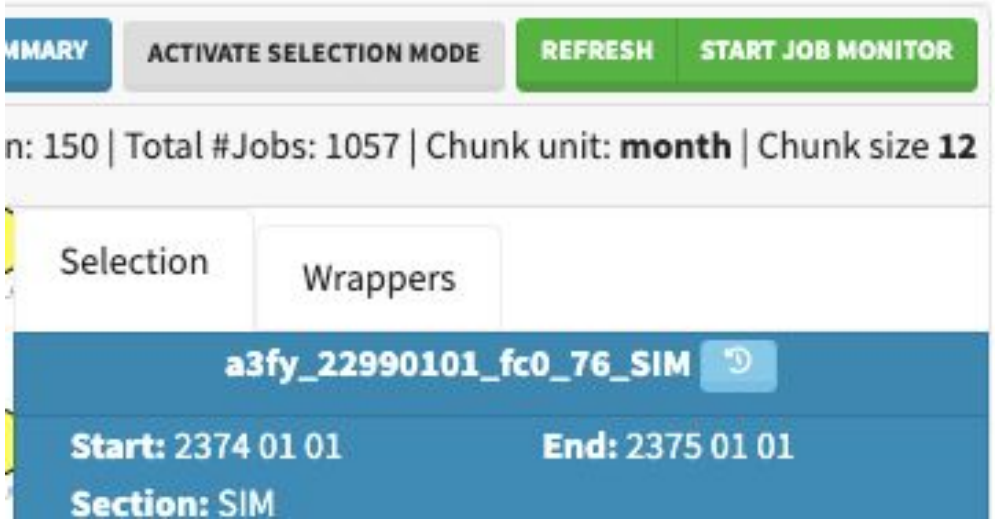


Green arrows and dashed lined identify a wrapper

Use the selector ->



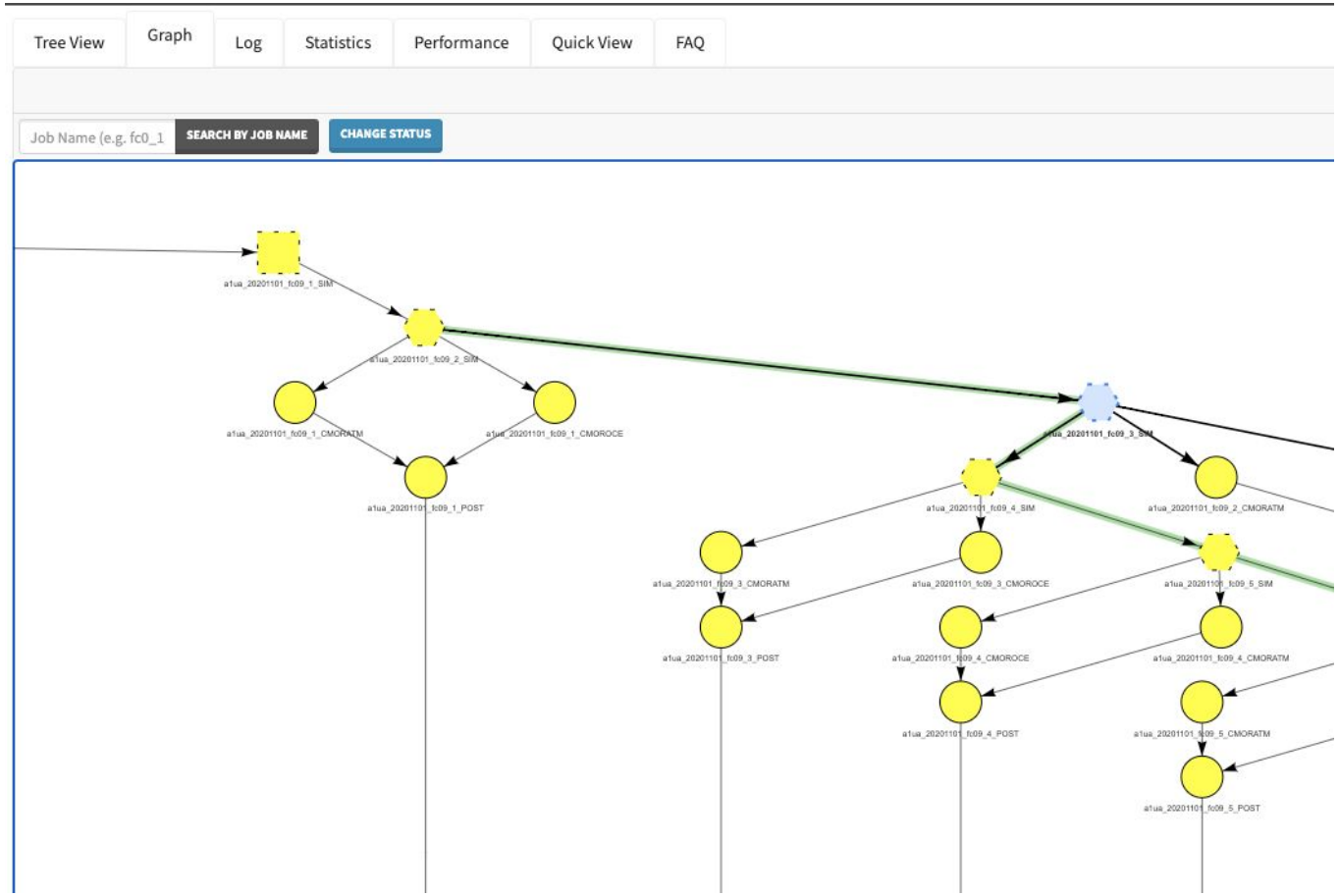
Graph Representation: Monitoring



- **Refresh:** Once.
- **Start Job Monitor:** Intervals 2 * SAFETYSLEEPTIME
- **Stop Job Monitor:** Stops monitoring worker.
- If allowed, it can send desktop notifications.

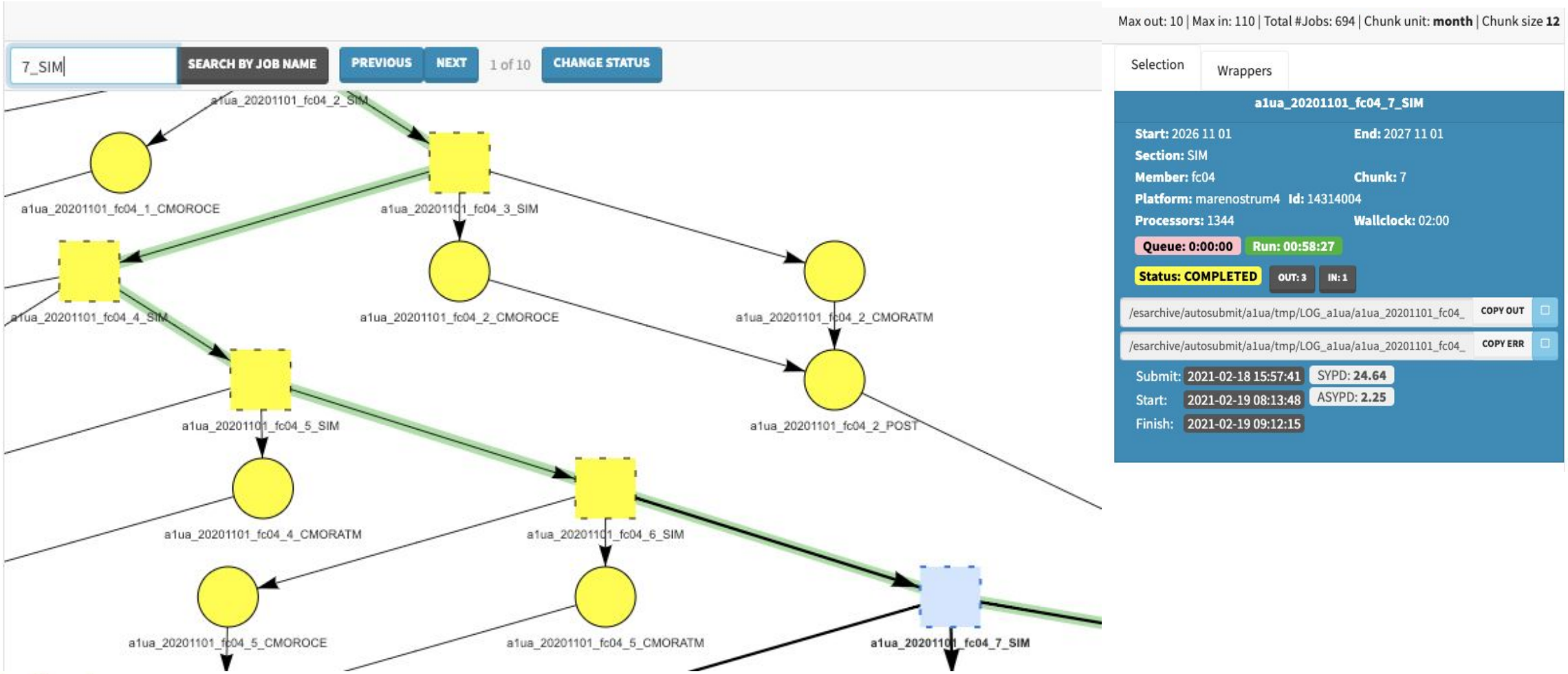
Graph Representation: Job Search I

Search by string in job name -> Generates an internal list of results
Implements wildcards as in the Tree View filter.

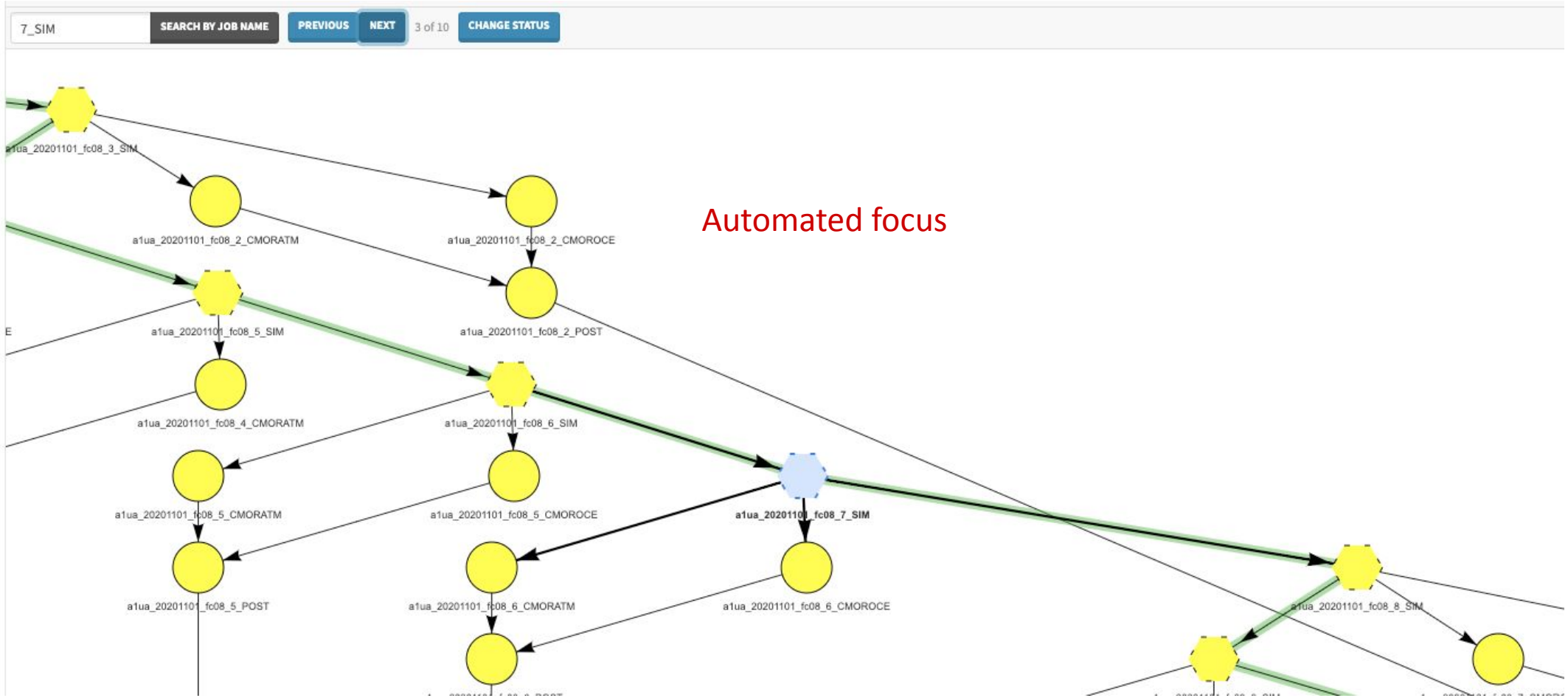


Graph Representation: Job Search II

Navigate through the list of results



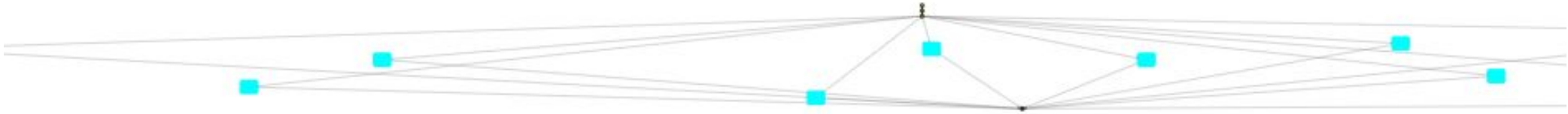
Graph Representation: Job Search III

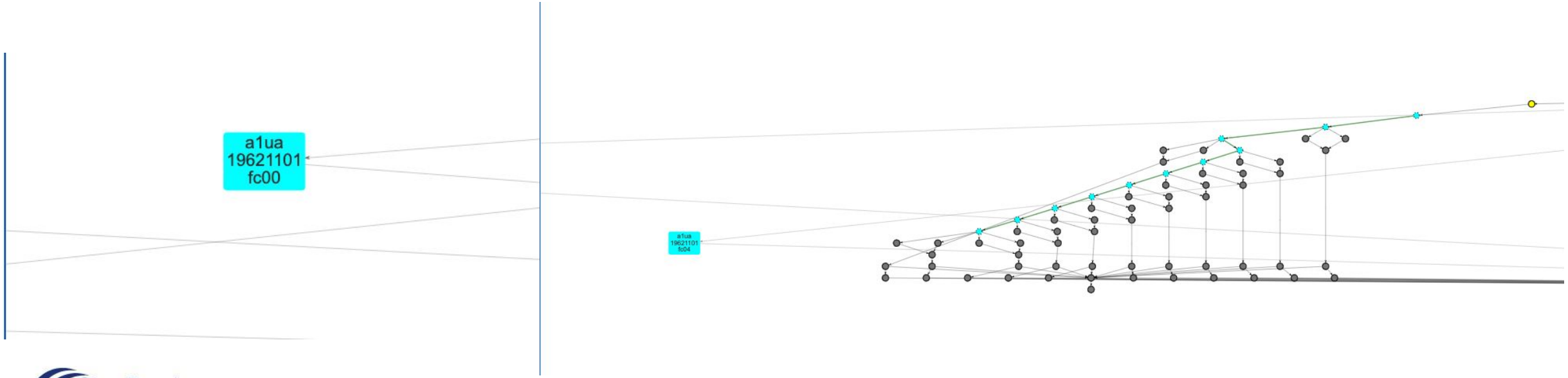


Automated focus

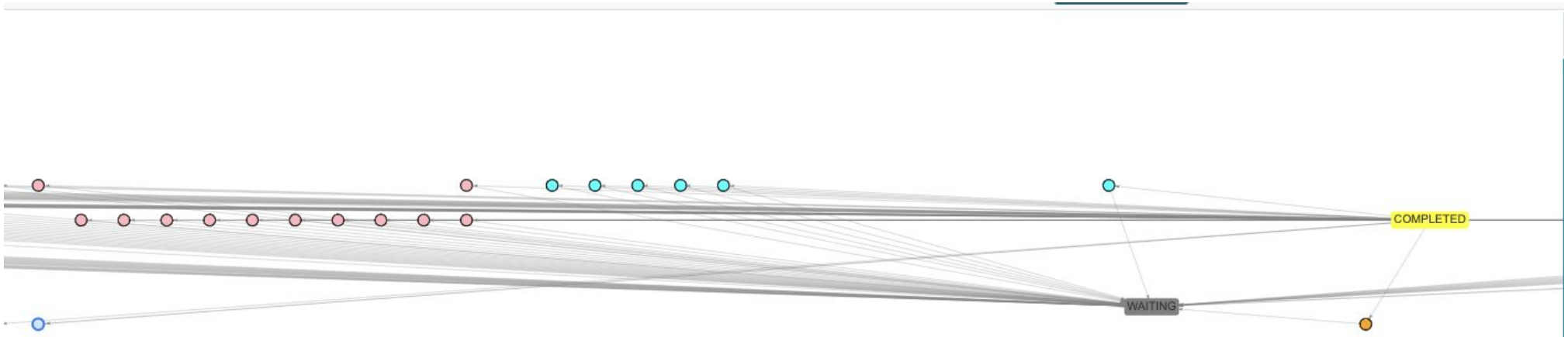
Graph Representation: Grouped by Date-Member

Groups of jobs with same date and member
Relevant color: The color of the most significant status of the jobs inside.
Can be expanded



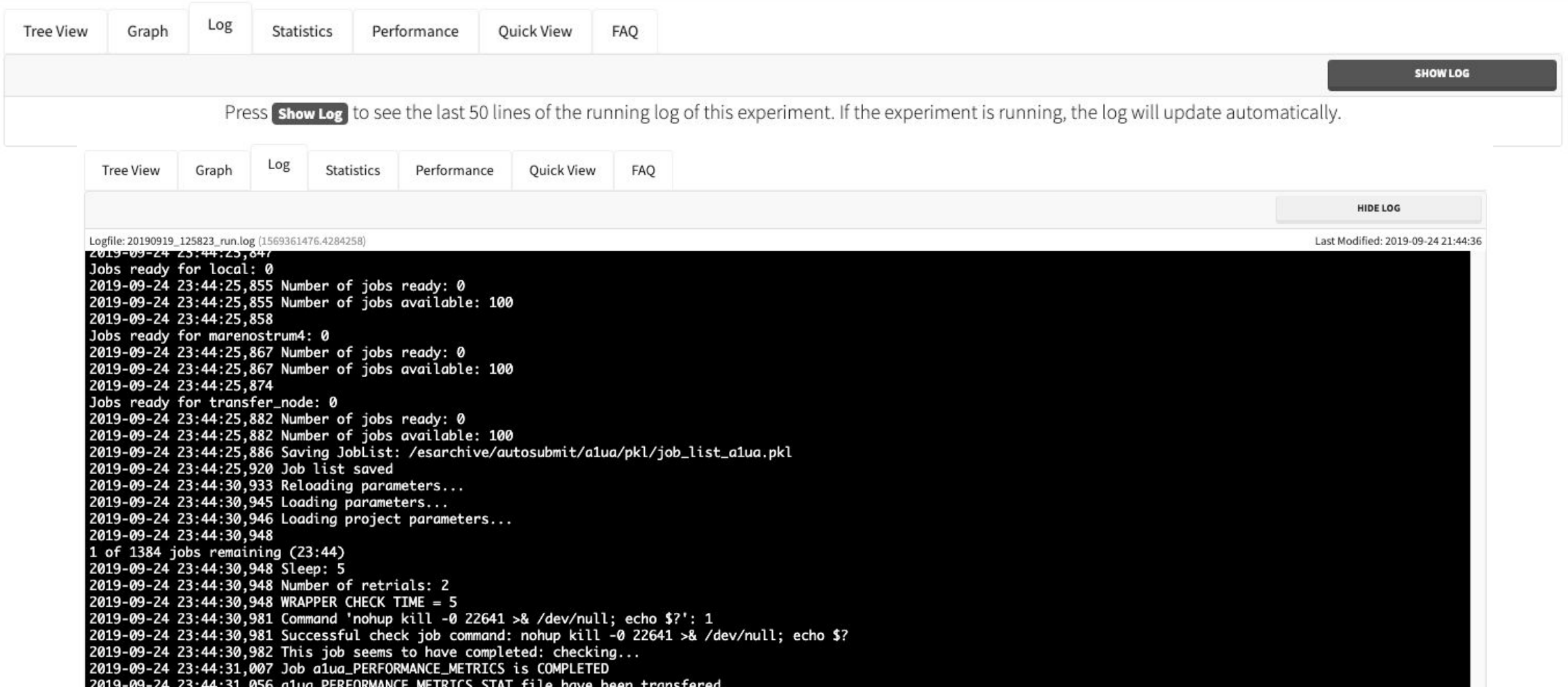


Graph Representation: Grouped by Status

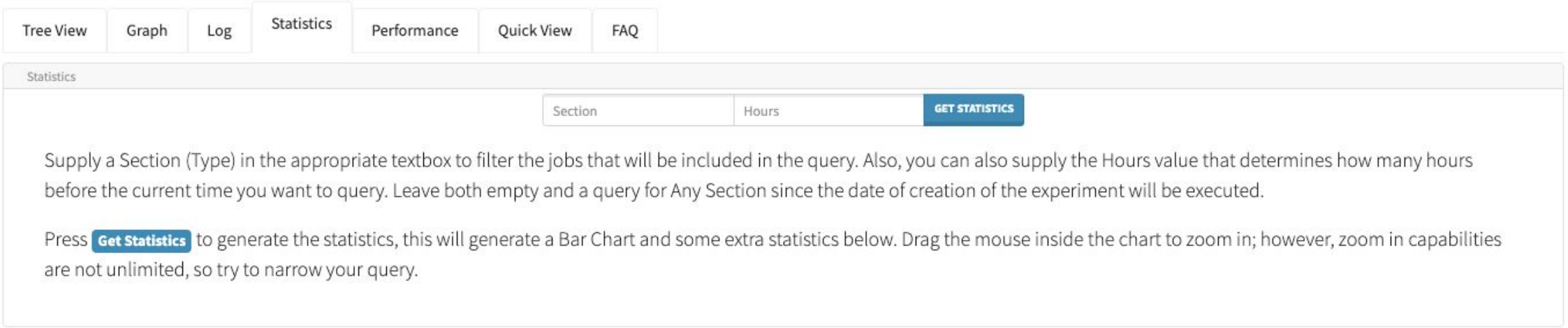


- Groups of jobs with same status, with exceptions.
- Relevant color.
- Can be expanded by double clicking on a group.

Autosubmit Log: General Description



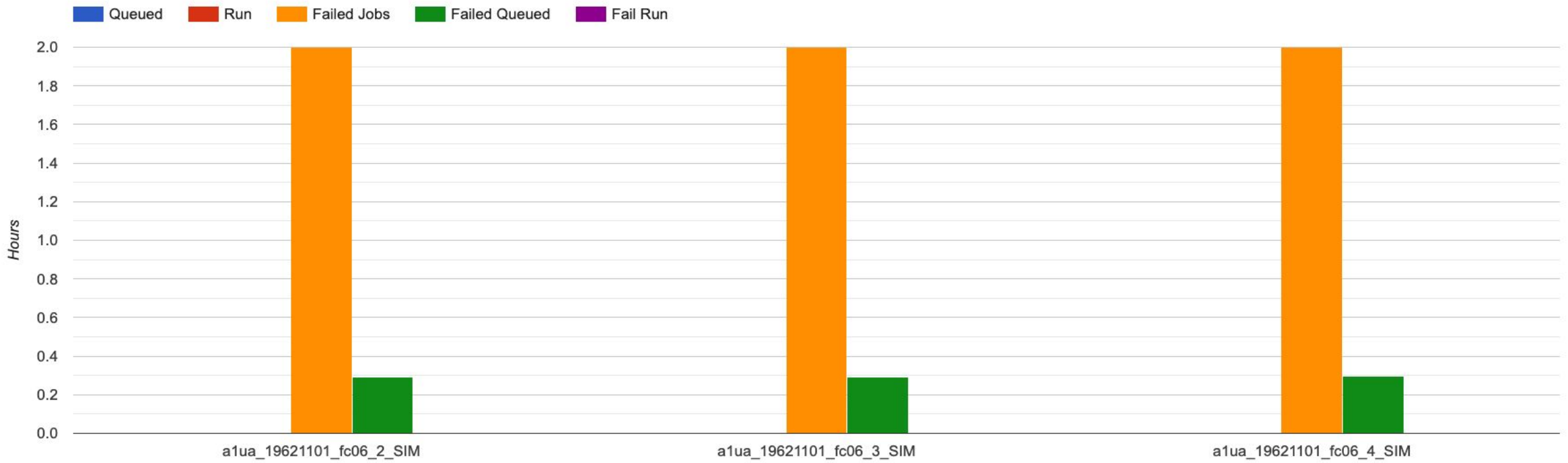
Autosubmit Statistics: Filter Options



Short value for hours

Section = Job type

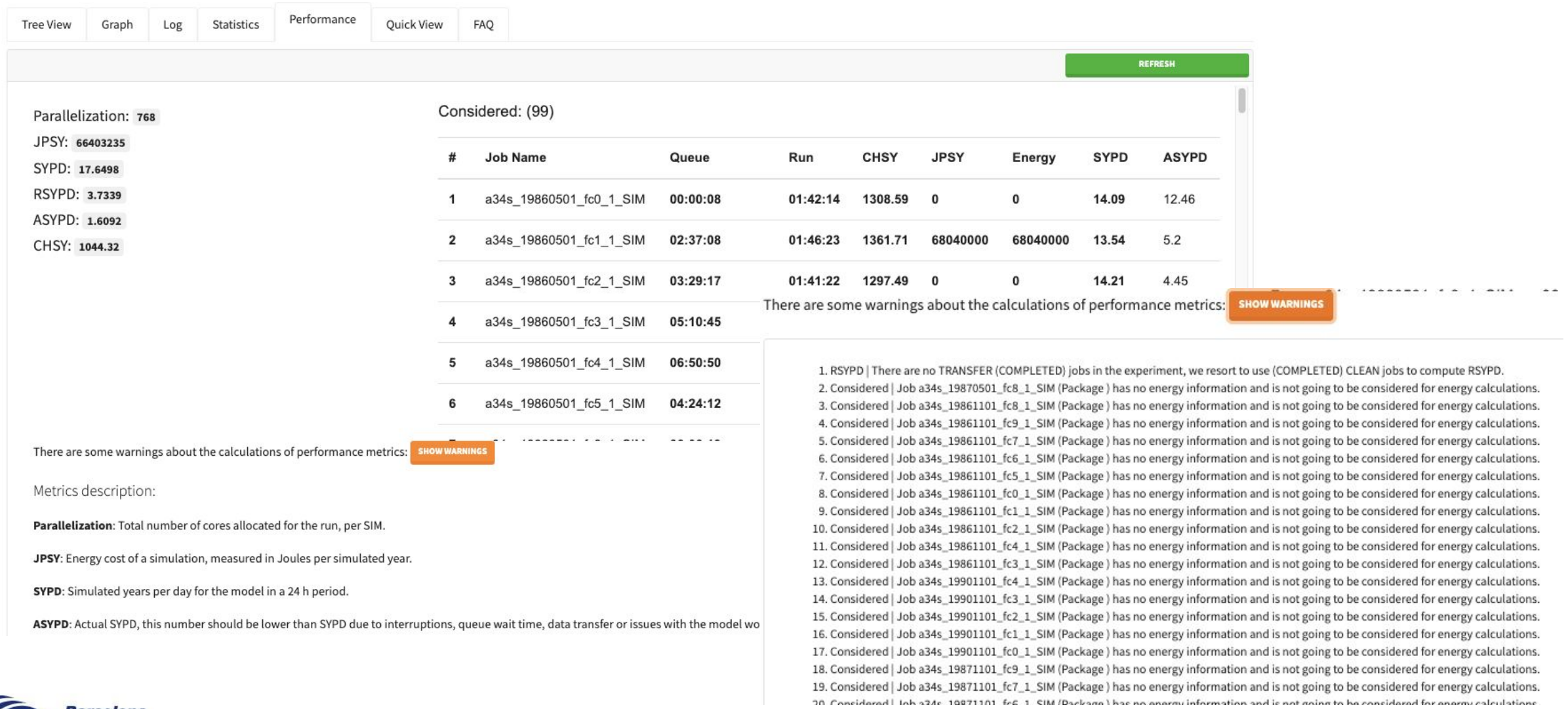
Autosubmit Statistics: Results I



Autosubmit Statistics: Results II

Period: 2020-06-15 13:56:00 ~ 2020-06-16 10:56:00
Submitted (#): 6
Run (#): 6
Failed (#): 6
Completed (#): 0
Queueing time (h): 0.0
Expected consumption real (h): 6.0
Expected consumption CPU time (h): 8064.0
Consumption real (h): 0.0
Consumption CPU time (h): 1.49
Consumption (%): 0.02

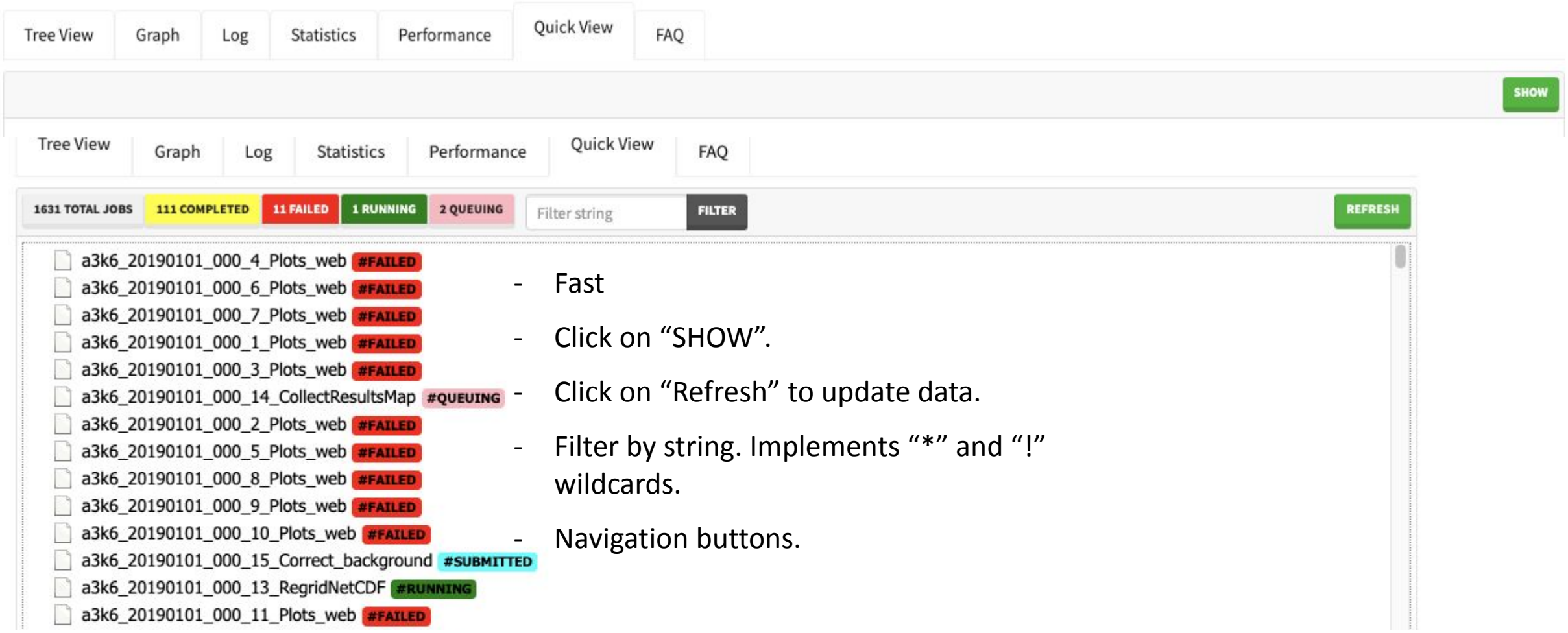
Performance Metrics: Description



Barcelona Supercomputing Center
Centro Nacional de Supercomputación

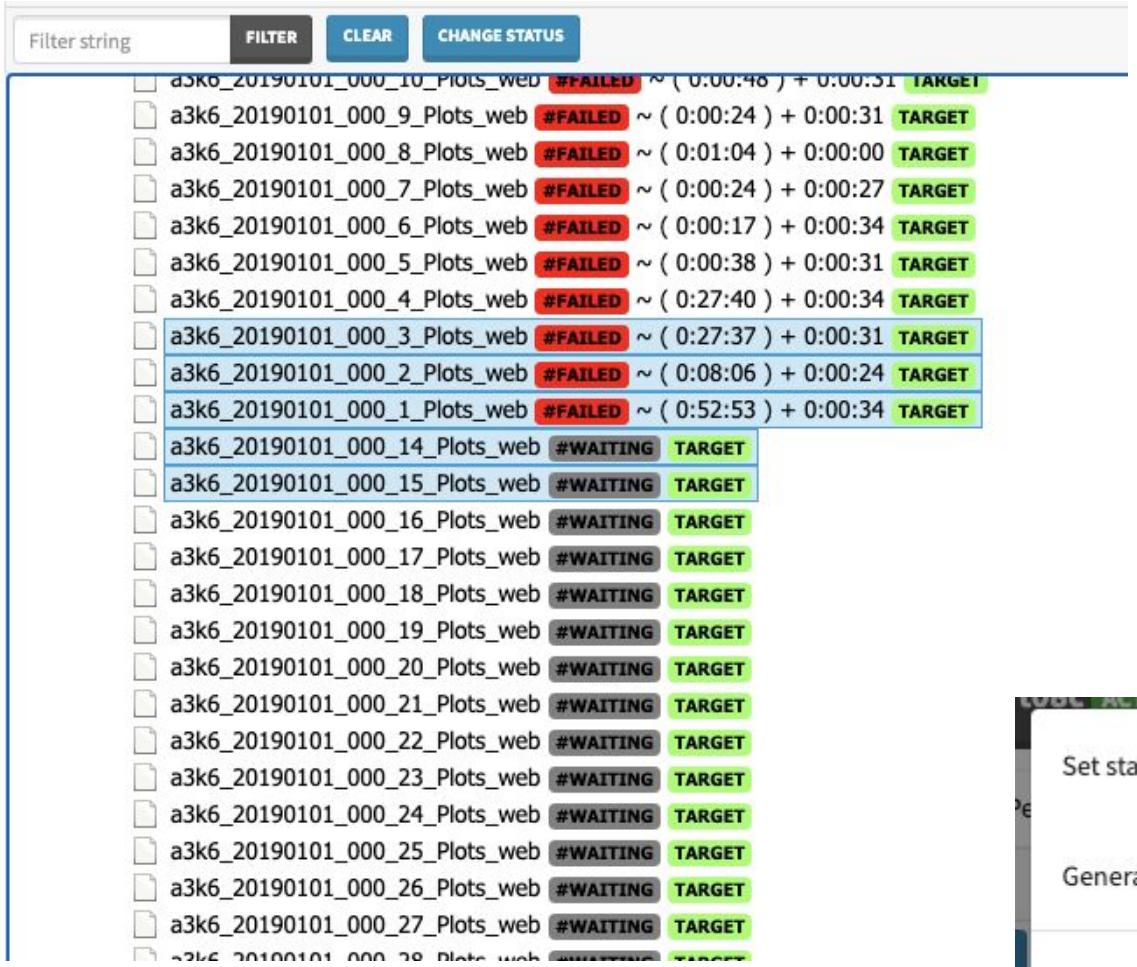
https://www.researchgate.net/publication/312034731_CPMIP_Measurements_of_real_computational_performance_of_Earth_system_models_in_CMIP6

Quick View: Description

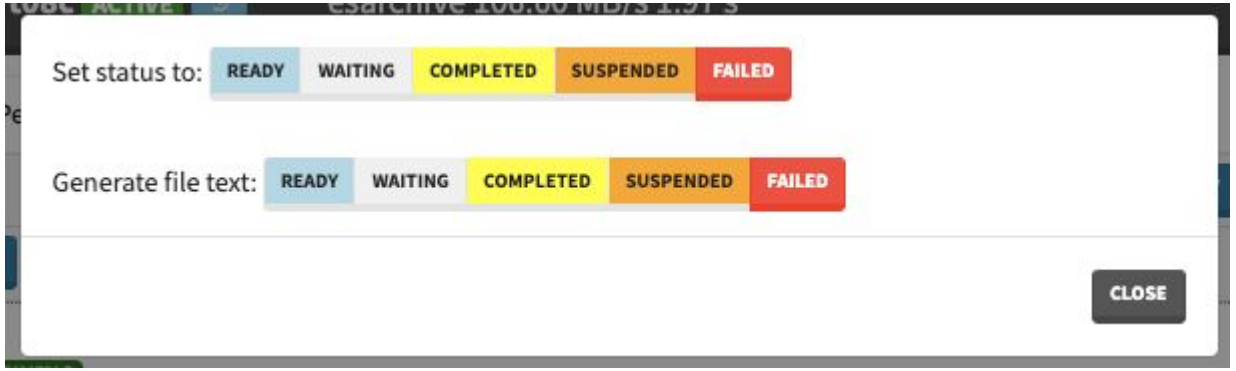


- Fast
- Click on “SHOW”.
- Click on “Refresh” to update data.
- Filter by string. Implements “*” and “!” wildcards.
- Navigation buttons.

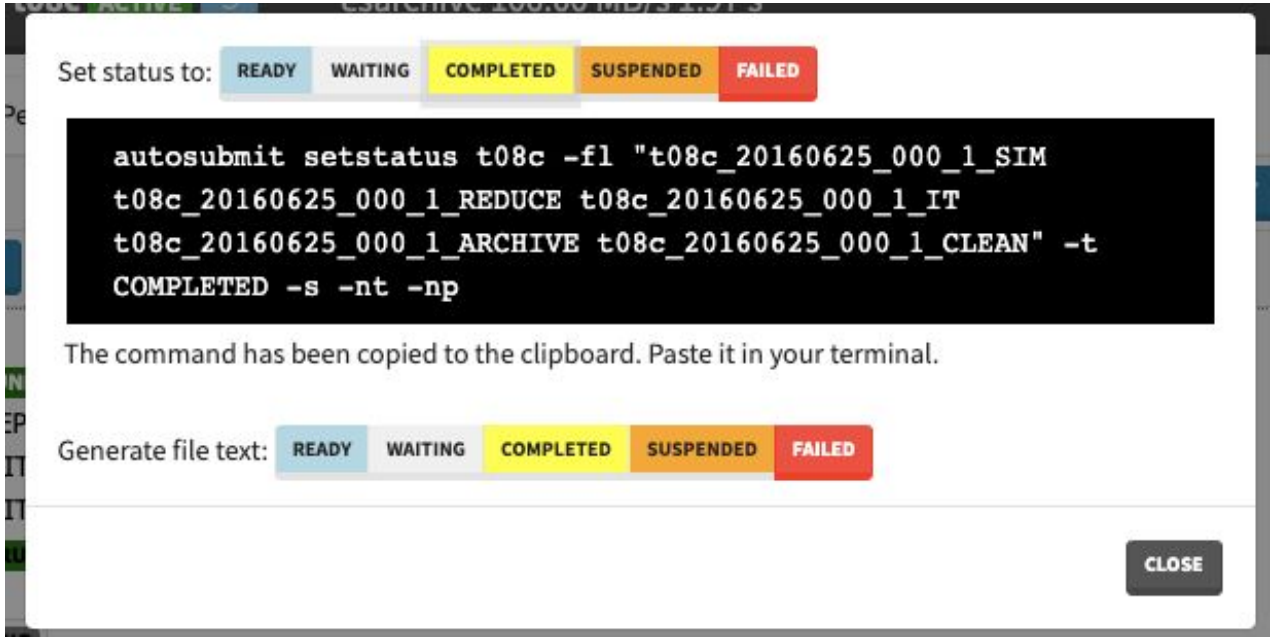
More tools: Command Generation I

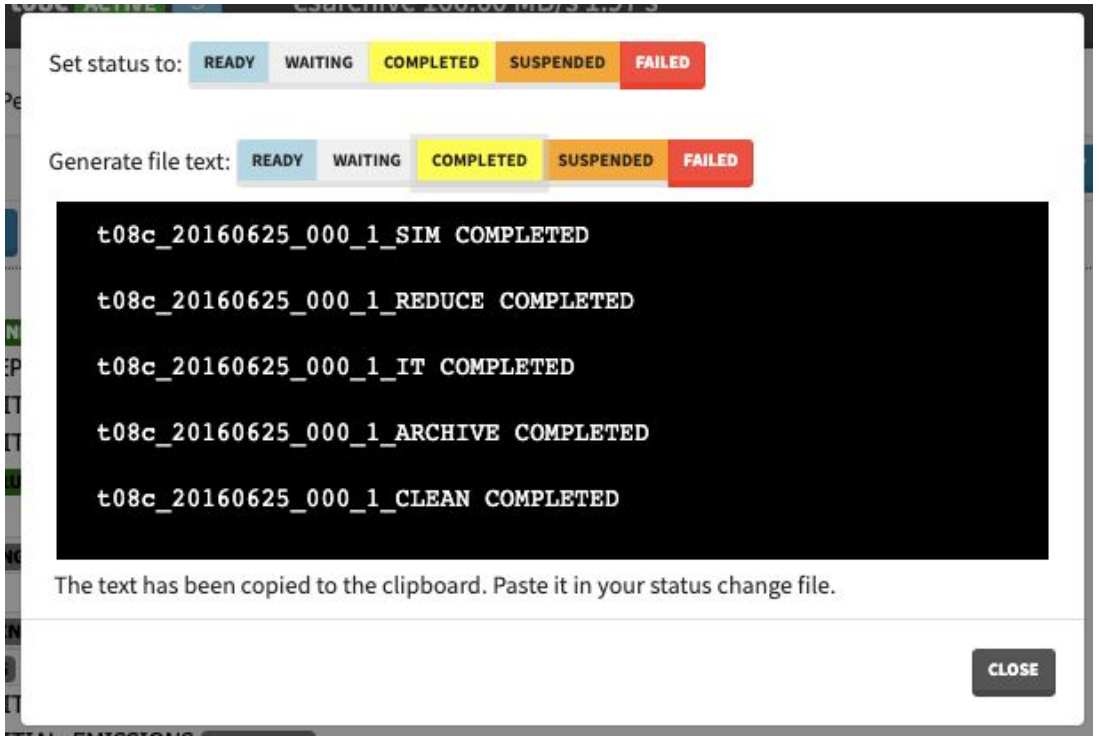


1. Hold **Ctrl (Command on MacOS)** and click on the jobs you want to modify, this creates a multi-selection.
2. Click on **Change Status**, a window will open (see below).
3. Click on the target status.



More tools: Command Generation II

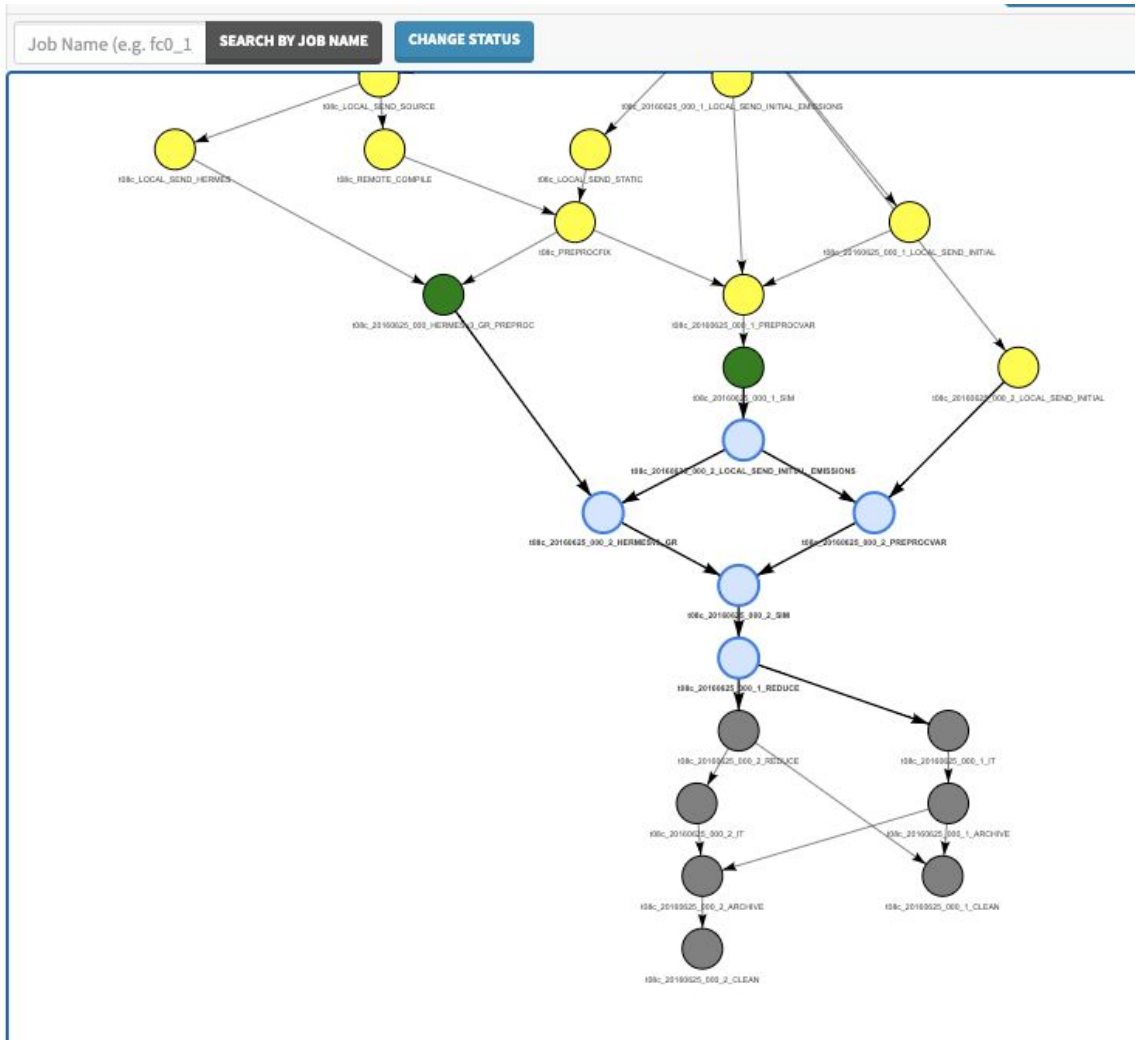




"Set status to" generates a command to execute on autosubmit, it is automatically copied to your clipboard.

"Generate file text" generates a string that can be used to change the status while Autosubmit is running. It is automatically copied to your clipboard.

More tools: Command Generation III



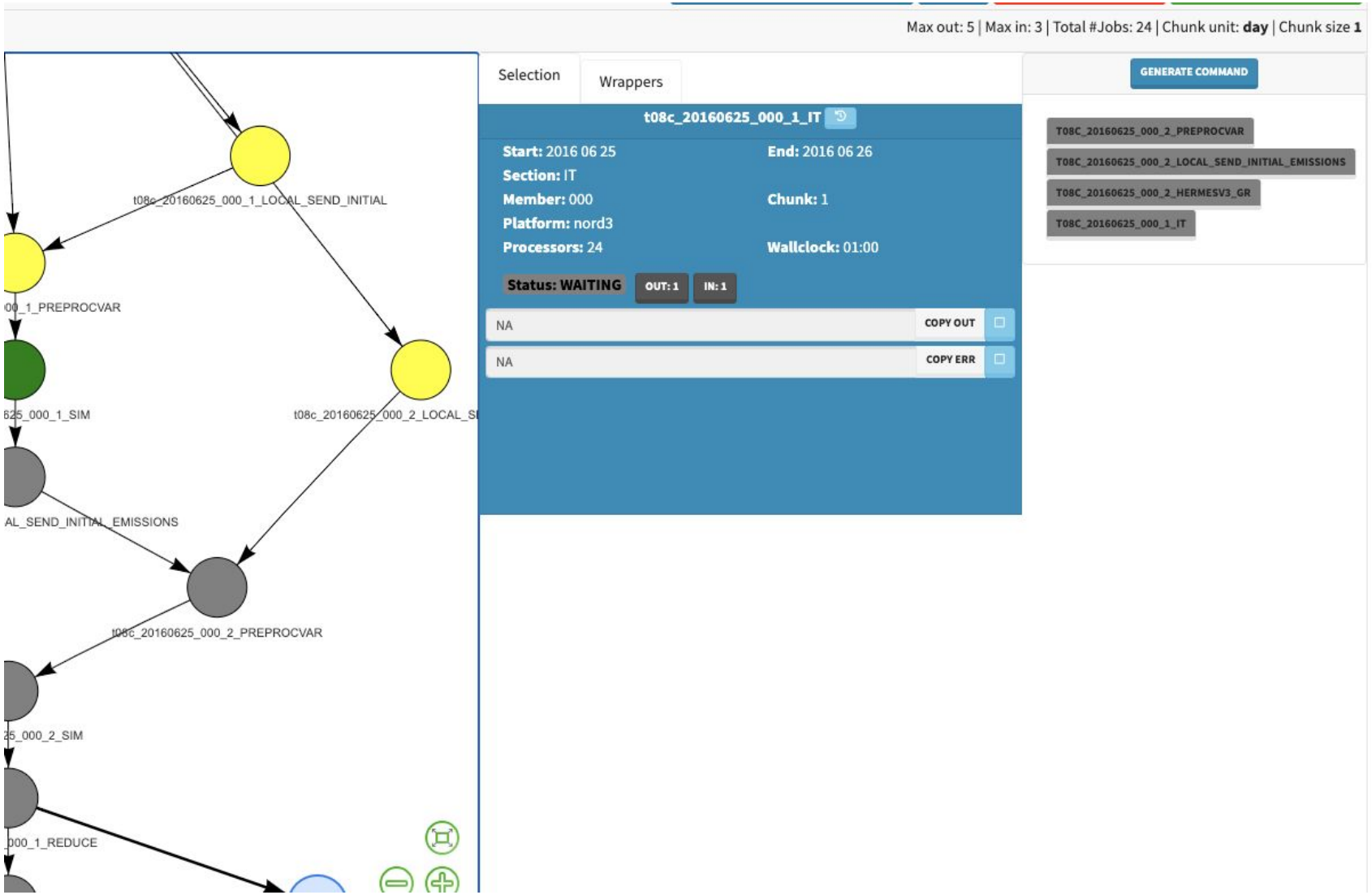
It is also possible to perform a multi-selection in the **Graph** view by holding **CTRL** (**Command** on MacOS) and clicking on the nodes. Then, follow the steps as previously described.

More tools: Command Generation IV

The Graph and the Tree View also implement the **“Selection Mode”** functionality.

Click on **Activate Selection Model** and then click on the jobs or nodes to add them to your selection.

Then, click on **Generate Command** and proceed as previously described.



URL Automation

URL Automation:

https://earth.bsc.es/autosubmitapp/experiment/a0yh/graph

Loads and focus on Graph Representation. Tree View is not loaded.

https://earth.bsc.es/autosubmitapp/experiment/a29z/light

Loads and focus on Quick Representation. Tree View is not loaded.

Suggestions

Suggestions

Get involved or contact us:	
Autosubmit GitLab:	https://earth.bsc.es/gitlab/es/autosubmit
Autosubmit Mailing List:	autosubmit@bsc.es

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

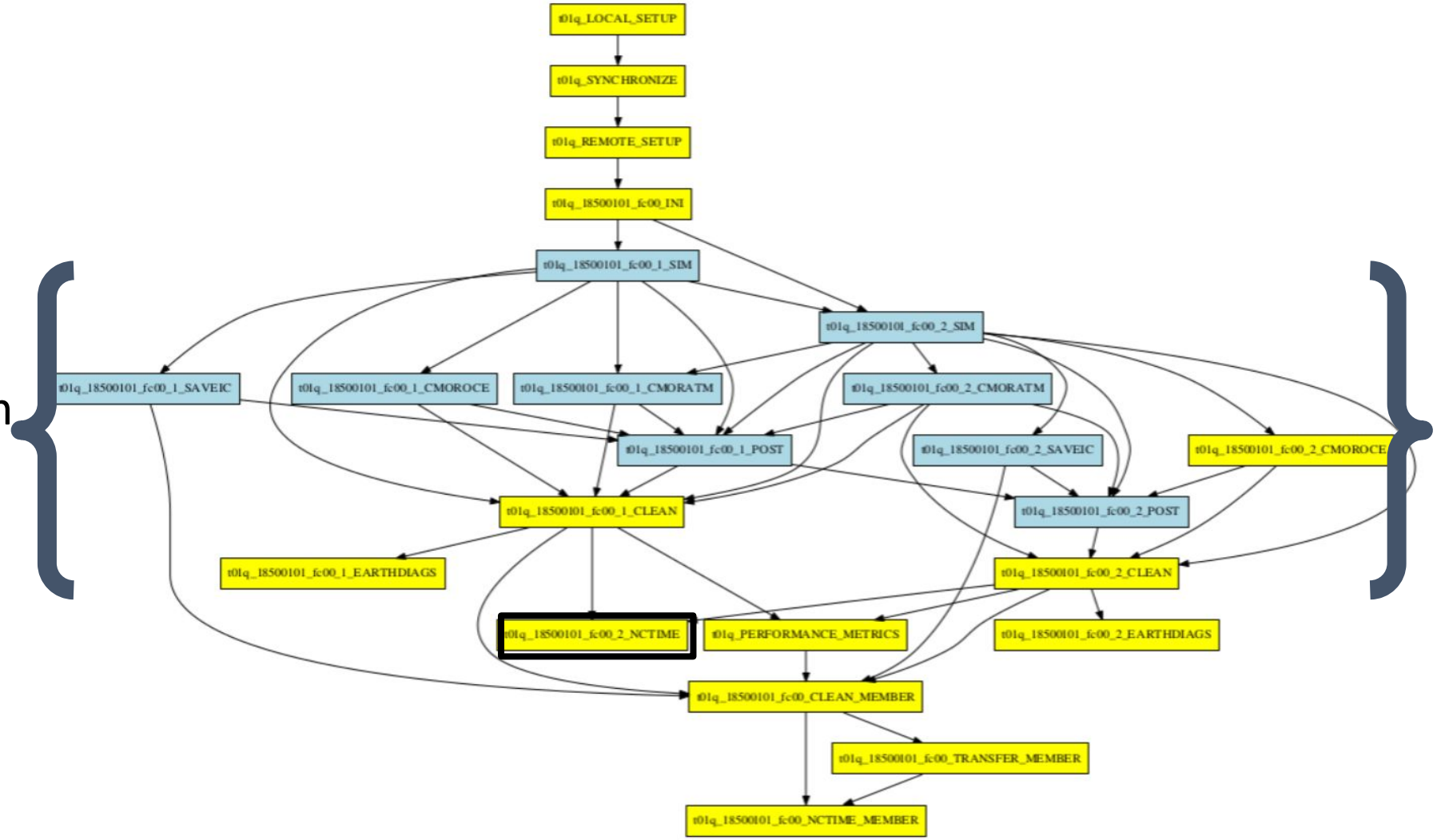
EXCELENCIA SEVERO OCHOA

Thank you for your time

daniel.beltran@bsc.es, miguel.castrillo@bsc.es, wilmer.uruchi@bsc.es

Workflow - Model - Auto-EC-Earth

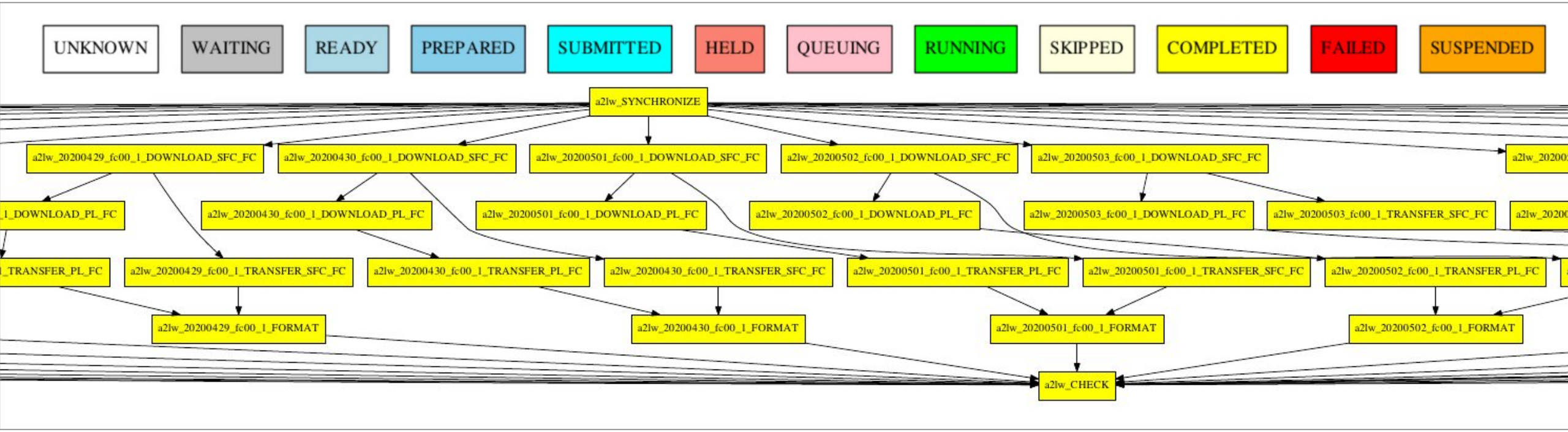
Rerun mechanism



Retrial mechanism

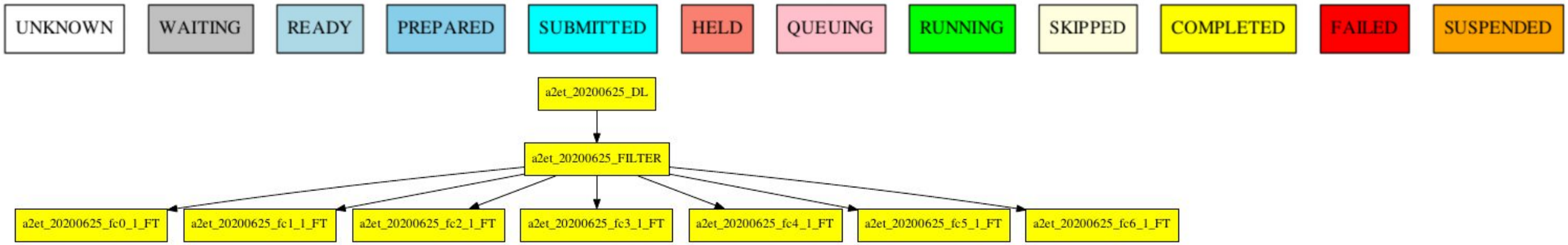
Workflow - Model - Mars

ECMWF MARS data downloader



Workflow - Model - S2S4E

S2S4E operational workflow (data download, formatting, post-processing and visualization)



Workflow - Model - Caliope