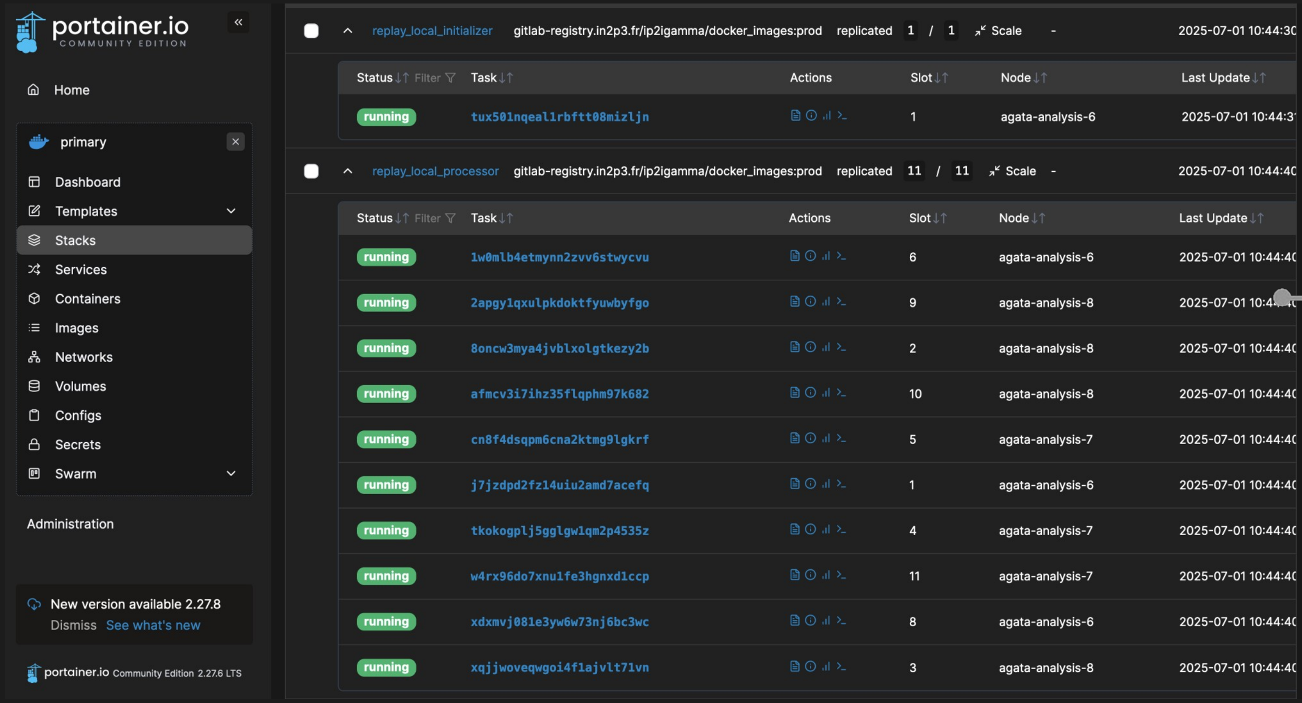
A Distributed Agata Emulator



replay_local_initializer gitlab-registry.in2p3.fr/ip2igamma/docker_images:prod replicated 1 / 1 Scale - 2025-07-01 10:44:30

Status	Task	Actions	Slot	Node	Last Update
running	tux501nqeal1rbftt08mizljn		1	agata-analysis-6	2025-07-01 10:44:3

replay_local_processor gitlab-registry.in2p3.fr/ip2igamma/docker_images:prod replicated 11 / 11 Scale - 2025-07-01 10:44:40

Status	Task	Actions	Slot	Node	Last Update
running	1w0mlb4etmynn2zvv6stwycvu		6	agata-analysis-6	2025-07-01 10:44:40
running	2apgy1qxulpkdoktfyuwbyfgo		9	agata-analysis-8	2025-07-01 10:4
running	8oncw3mya4jvblxolgtkezy2b		2	agata-analysis-8	2025-07-01 10:44:40
running	afmcv3i7ihz35flqphm97k682		10	agata-analysis-8	2025-07-01 10:44:40
running	cn8f4dsqpm6cna2ktmg9lgkrf		5	agata-analysis-7	2025-07-01 10:44:40
running	j7jzdpd2fz14uiu2amd7acefq		1	agata-analysis-6	2025-07-01 10:44:40
running	tkokogplj5gglgw1qm2p4535z		4	agata-analysis-7	2025-07-01 10:44:40
running	w4rx96do7xnu1fe3hgnxd1ccp		11	agata-analysis-7	2025-07-01 10:44:40
running	xdxmvj081e3yw6w73nj6bc3wc		8	agata-analysis-6	2025-07-01 10:44:40
running	xqjjwoveqwgoi4f1ajvlt71vn		3	agata-analysis-8	2025-07-01 10:44:40

DAEMULE

Cluster and Scalability
Local level Processing
Global Level Processing

G. Baulieu

New analysis servers are being set up in Legnaro (P. Le Jeannic)

- 4 new machines
  - 2 x Xeon Silver 4310 (48 threads) @ 2.1 GHz
  - 128 GB of RAM
  - 10 Gbs access to data (anodeds5)

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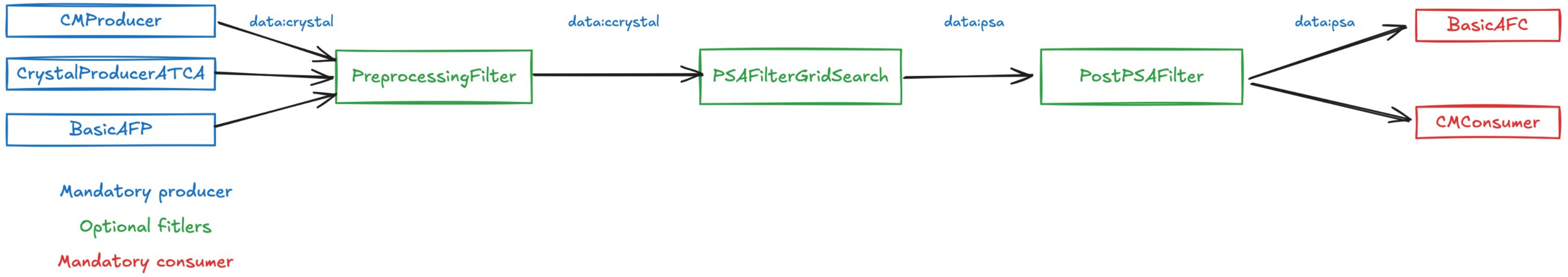
We need to be able to use computing power where it is : dispatched on different servers

Distributed Agata Emulator (DAEmule)

- A new AGAPRO emulator
- Designed to be scalable and able to run on clusters
- Using the same actors and configuration folders (from genconf.py)
- Different instances can communicate through a Central Memory system (REDIS implemented)
- Still under development, first tests performed on the Legnaro new Analysis cluster.

Local level processing

- Subset of actors available



- Each actor runs in its own thread
- Producer : choice between Central Memory, .cdat files or ADF files
- Filters : On/Off on Preprocessing, PSA and PostPSA
- Consumer : choice between ADF file and Central Memory
- 3 run modes :
  - Simple
  - Parallel
  - Batch

Local level processing

- Simple mode :

  A single emulator on a single crystal folder, on a single machine.

- Parallel mode :

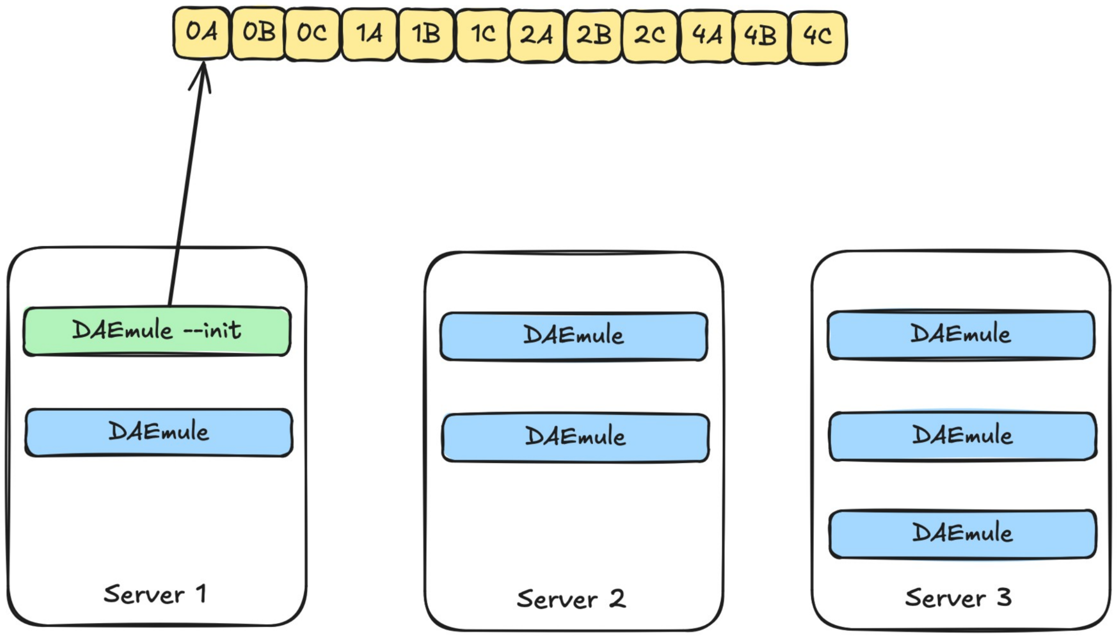
  As many emulators as crystal folders, on a single machine. Define the number of emulators run in parallel. (~FEMUL behaviour)

- Batch mode :

  A single emulator per DAEmule instance but many instances on different servers.
  Each DAEmule instance run on one crystal folder and then ask for a new one.

Local level processing

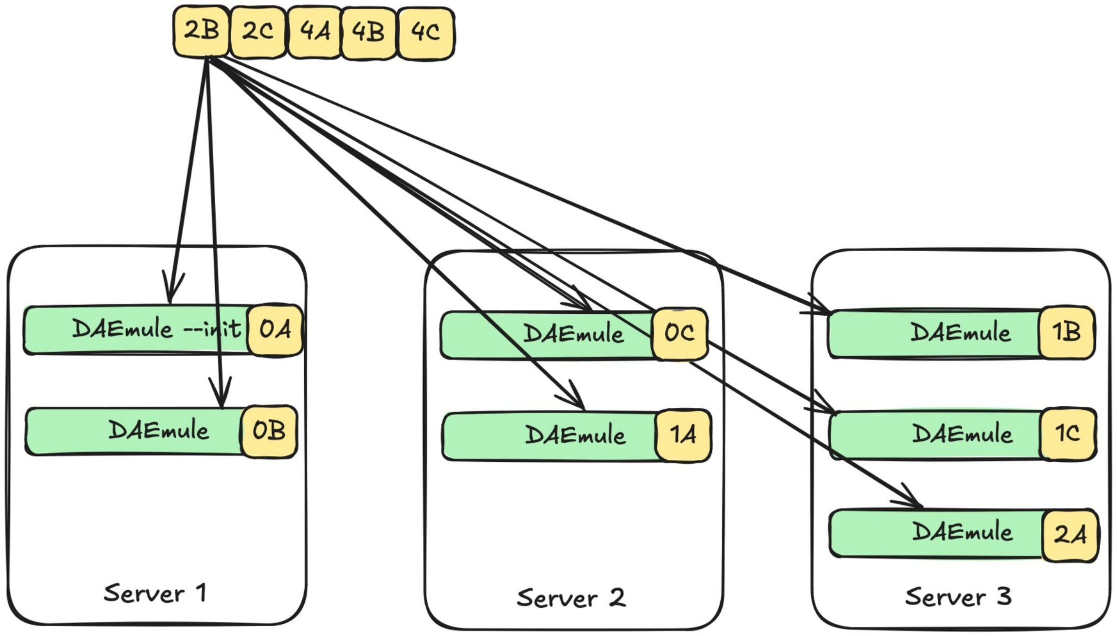
- Batch mode overview :



→ from configuration file to Central Memory list

Local level processing

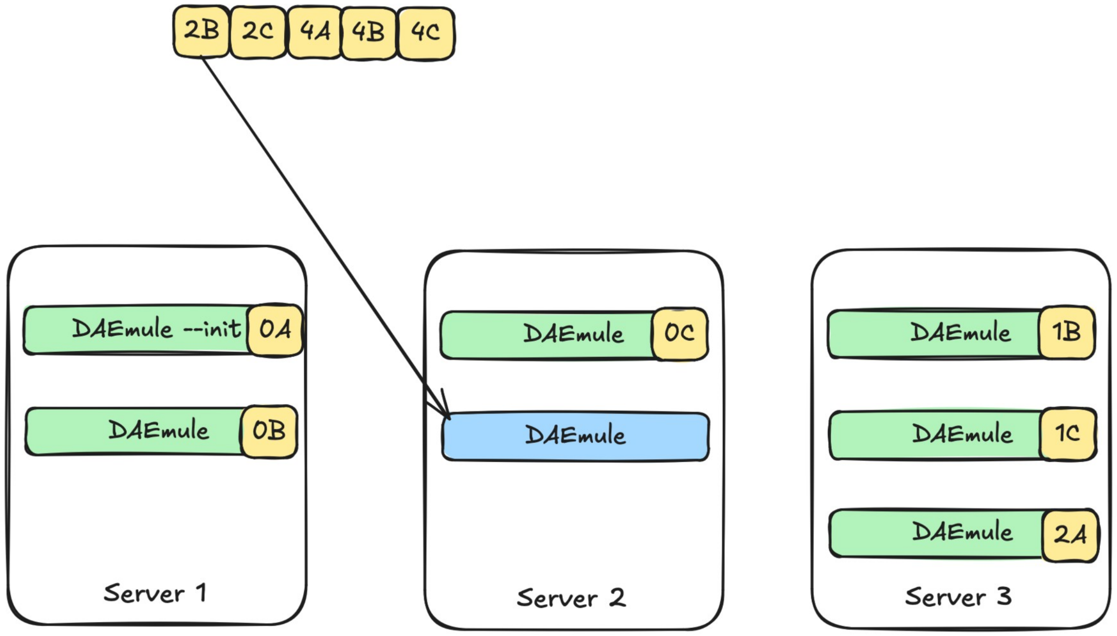
- Batch mode overview :



→ each instance fetches a workload from central memory (atomic)

Local level processing

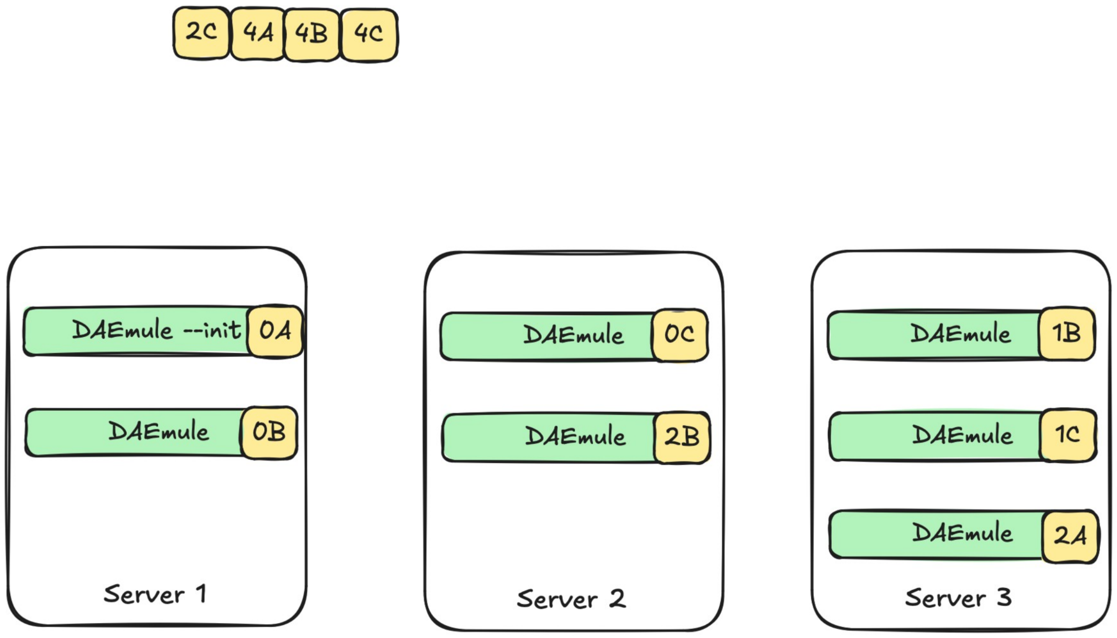
- Batch mode overview :



→ when an instance is done with its workload, it asks for a new one

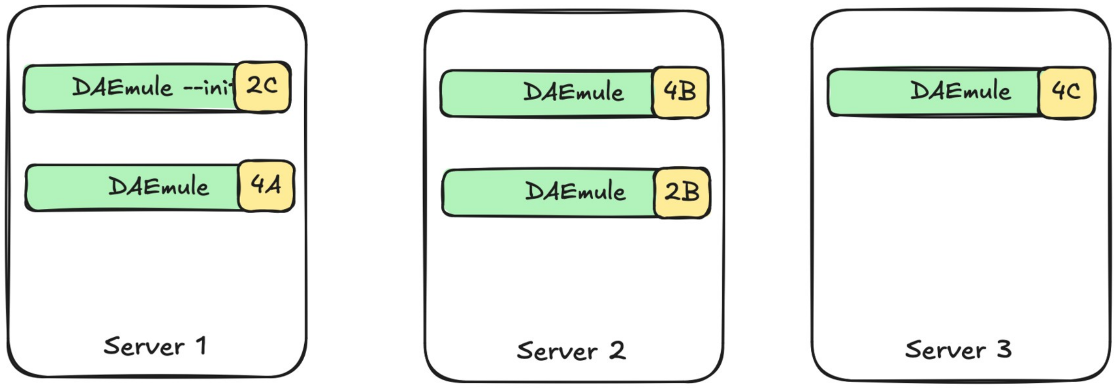
Local level processing

- Batch mode overview :



Local level processing

- Batch mode overview :



→ if the workload list is empty, the instance stops

Handling the cluster

- Launching many instances on different servers is a pain

  → we can automatize this process using **Docker Swarm** and **Portainer**

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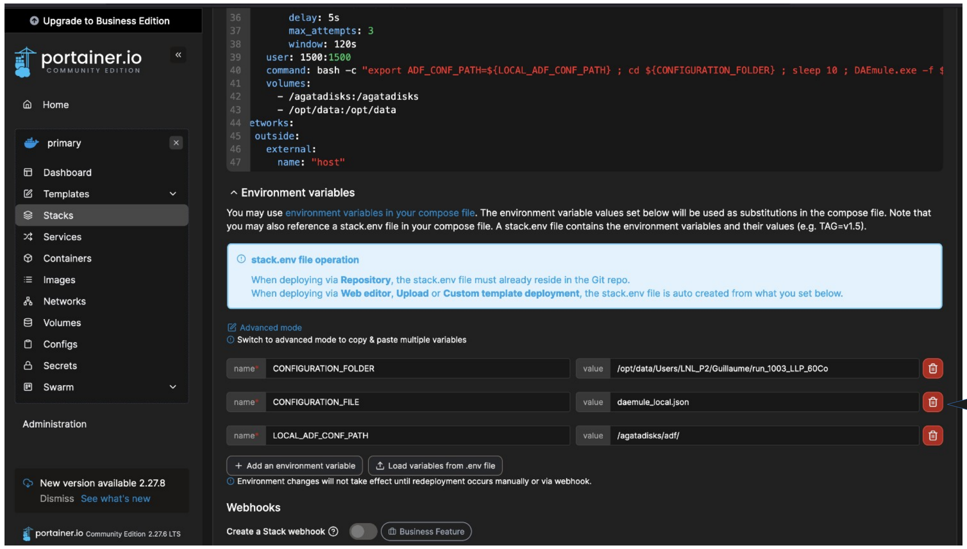

```
        delay: 5s
        max_attempts: 3
        window: 120s
    user: 1500:1500
    command: bash -c "export ADF_CONF_PATH=${LOCAL_ADF_CONF_PATH} ; cd ${CONFIGURATION_FOLDER} ; sleep 10 ; DAEmule.exe -f $
    volumes:
      - /agatadisks:/agatadisks
      - /opt/data:/opt/data
etworks:
 outside:
   external:
     name: "host"
```

^ Environment variables

You may use environment variables in your compose file. The environment variable values set below will be used as substitutions in the compose file. Note that you may also reference a stack.env file in your compose file. A stack.env file contains the environment variables and their values (e.g. TAG=v1.5).

stack.env file operation
When deploying via **Repository**, the stack.env file must already reside in the Git repo.
When deploying via **Web editor**, **Upload** or **Custom template deployment**, the stack.env file is auto created from what you set below.

Advanced mode
Switch to advanced mode to copy & paste multiple variables

name	value
CONFIGURATION_FOLDER	/opt/data/Users/LNL_P2/Guillaume/run_1003_LLP_60Co
CONFIGURATION_FILE	daemule_local.json
LOCAL_ADF_CONF_PATH	/agatadisks/adf/

+ Add an environment variable   Load variables from .env file
Environment changes will not take effect until redeployment occurs manually or via webhook.

Webhooks
Create a Stack webhook   Business Feature

Define the configuration file location

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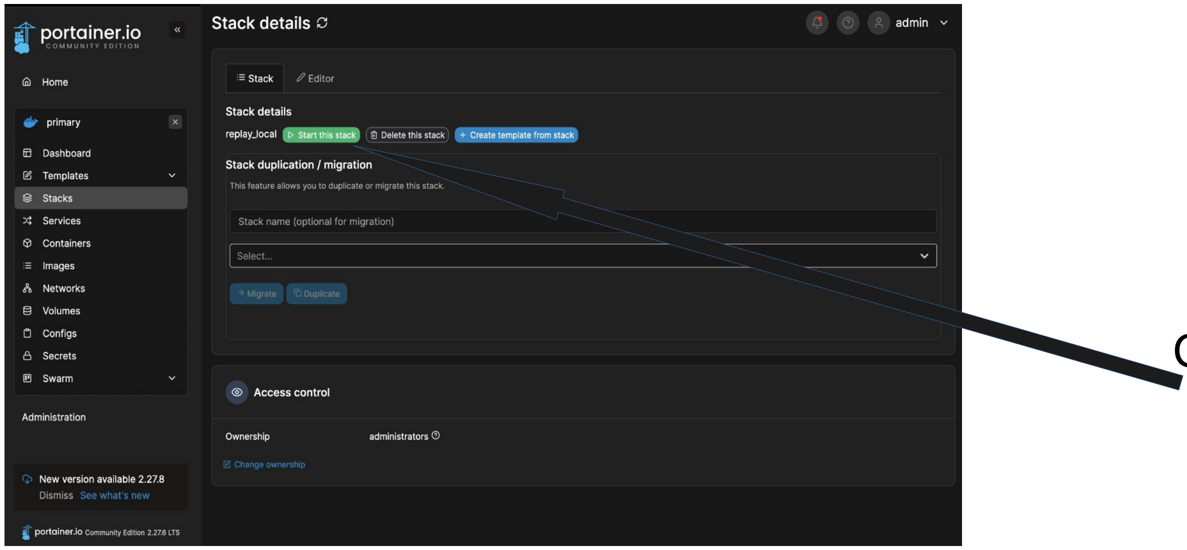

Click on the Start button

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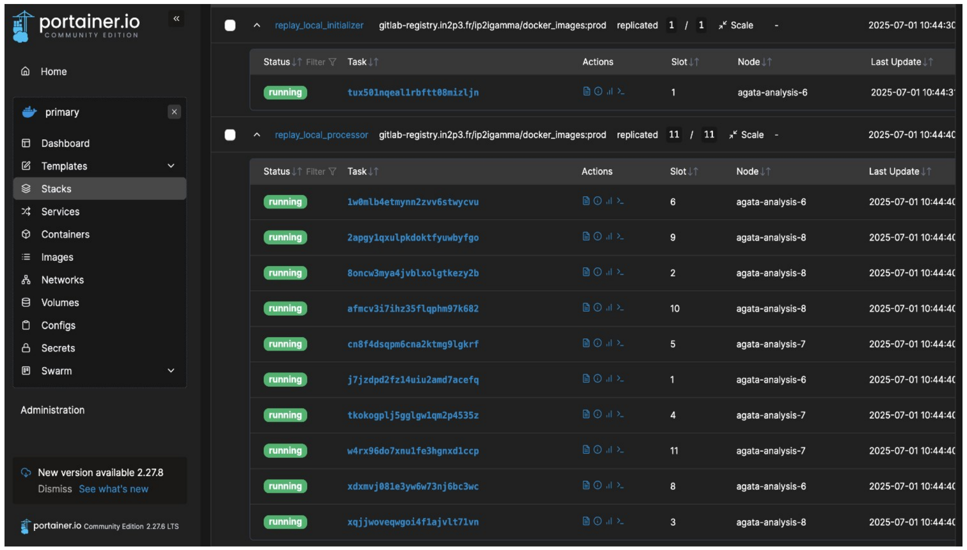

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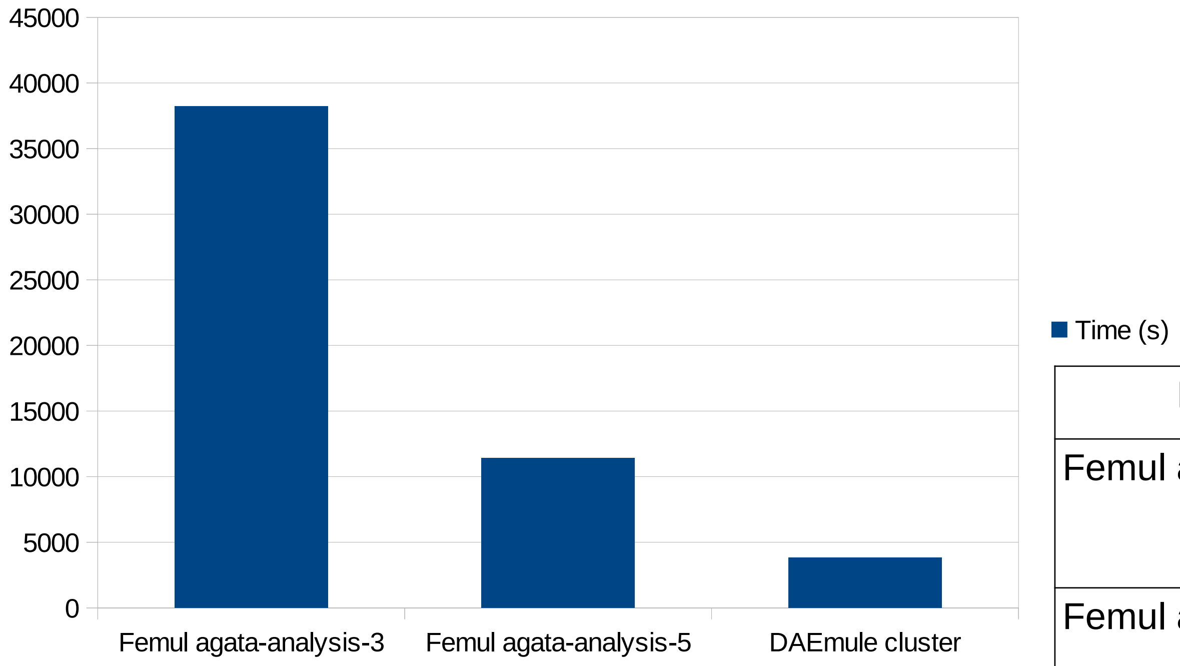
It's running !

First tests on analysis cluster @ Legnaro

- Data from run_1003_LLP_60Co (33 crystals)



Hardware	Time (s)
Femul agata-analysis-3	38209
Femul agata-analysis-5	11405
DAEmule cluster	3828

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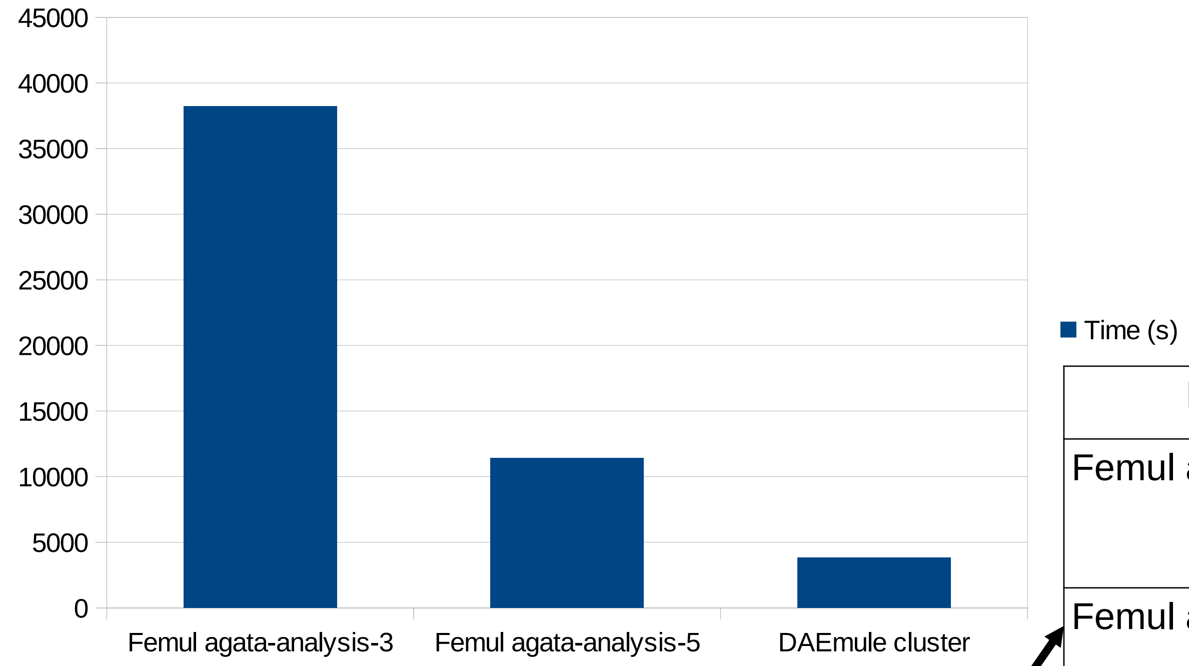

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Limited by computing power on a single server

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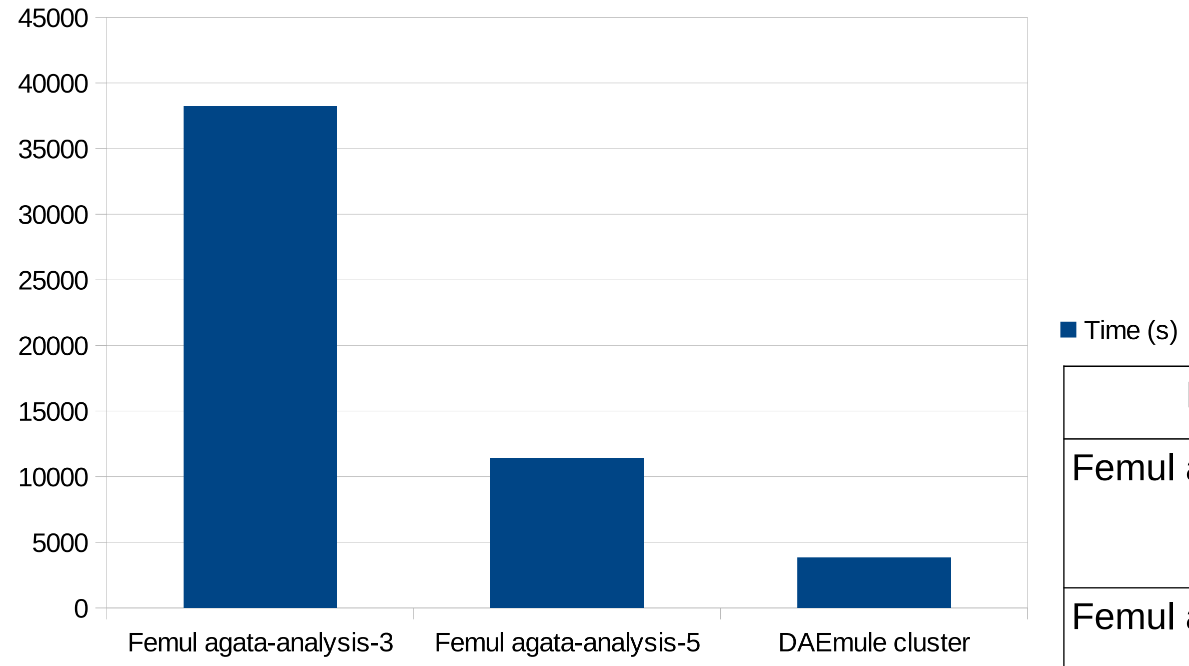

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Limited by data access bandwidth $\rightarrow$

Global level processing

- New actors added to Agapro to manage global level :
  - *Multi-Channels Agata Time Sorter* (MCats) : N entries from Central Memory → One sorted output
  - *AgataEventBuilder* : from data:psa to event:data:psa
  - *AgataEventMerger* : from data:psa + event:ranc to event:data

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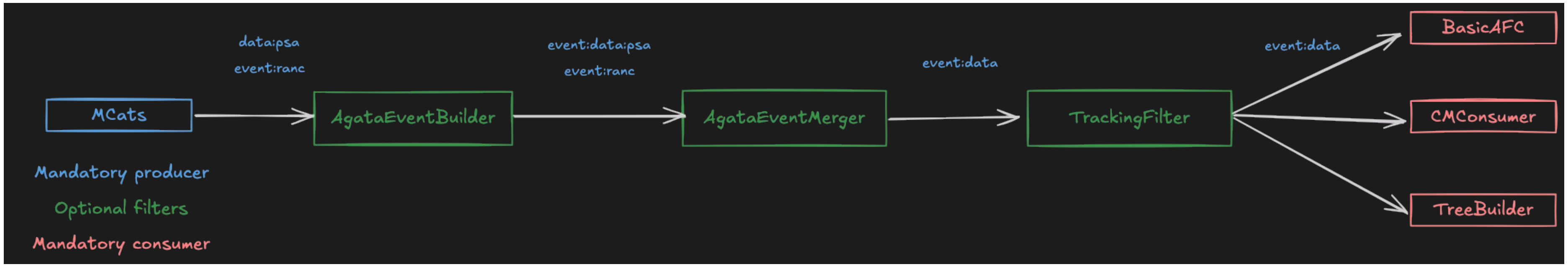

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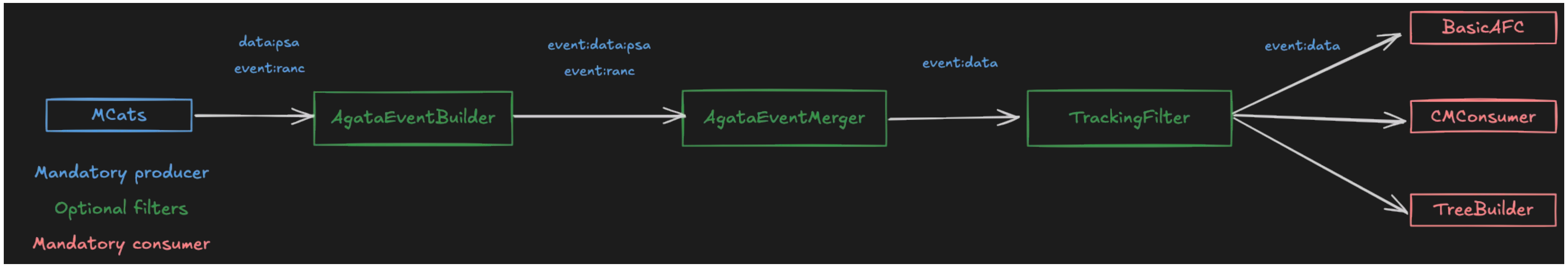
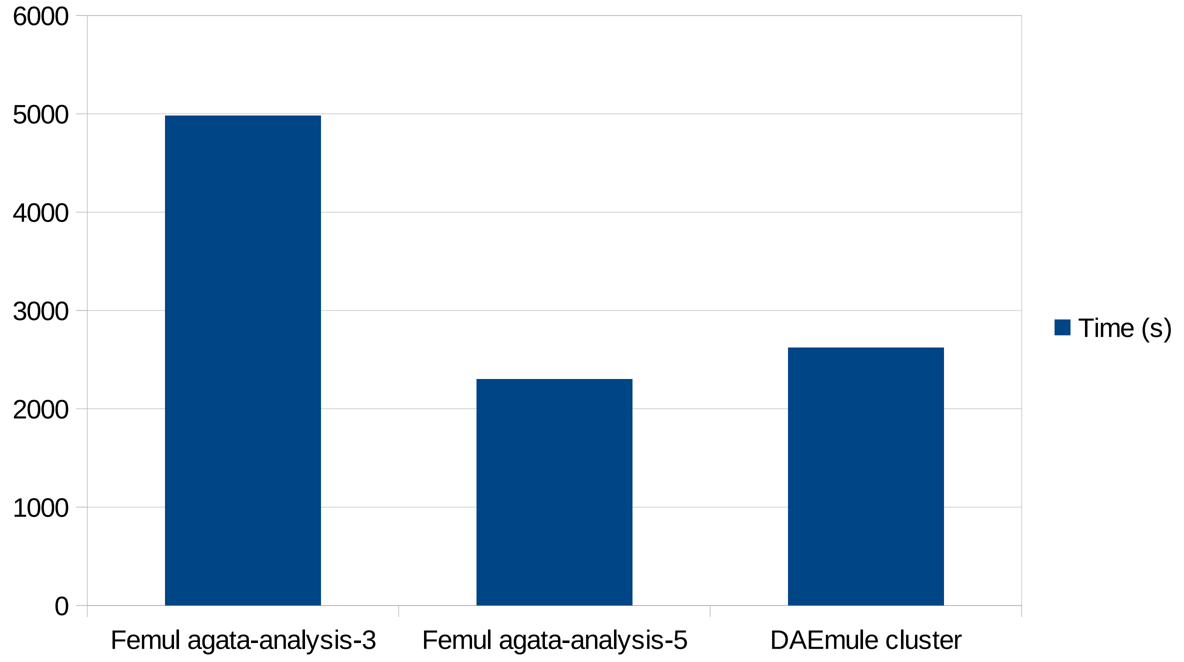


...should be able to run online

First tests on analysis cluster @Legnaro

- Data from ancillary_exp_046_run_50 (31 crystals + ancillaries)



Hardware	Time (s)
Femul agata-analysis-3	4982
Femul agata-analysis-5	2301
DAEmule cluster	2621

DAEmule slower mainly because of timeouts handling
Still under test, coherent results :

```
####################################
 Number of events sent to tracking     42833573
 Number of hits   sent to tracking     175884340
 Number of gammas out  of tracking     61902124
 Number of events with tracked gammas  38867883
 ####################################
```

```
####################################
 Number of events sent to tracking     42833572
 Number of hits   sent to tracking     175884337
 Number of gammas out  of tracking     61902218
 Number of events with tracked gammas  38868166
####################################
```

Conclusion

- First version of an Agapro emulator able to run on clusters under test at Legnaro
- Local level processing running fine
- Global level processing under test – first results ok
- Need to improve integration with Docker Swarm and Portainer.io to ease usage
- Some documentation at https://gbaulieu.pages.in2p3.fr/handbook-dev/binaries/DAEmule/