AYSS Alushta-2025

Automation of BM@N Run9 data processing on a DIRAC distributed infrastructure

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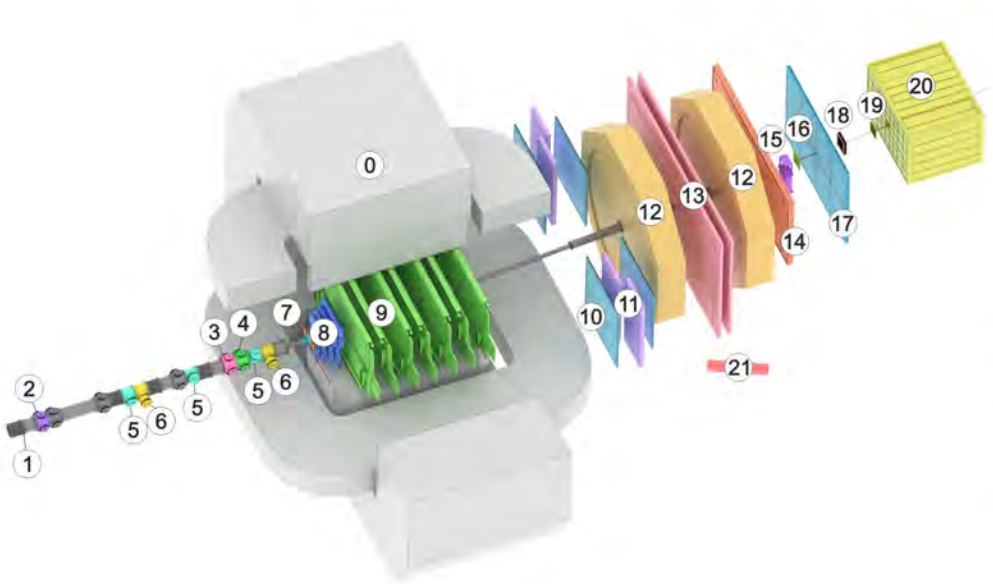
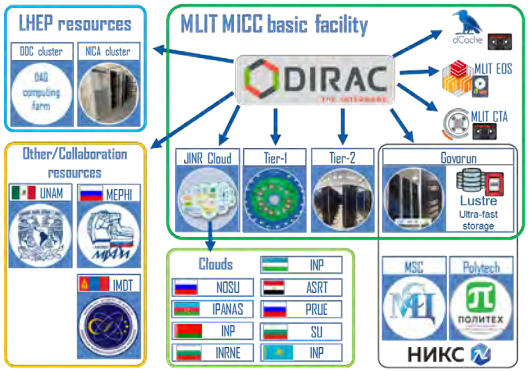


What do we have from BM@N run8



DIRAC distributed infrastructure

Production Manager

1. Form input file list → Input
2. Configure production → Config
3. Form executable → Job.sh
4. Launch jobs

DIRAC
THE INTERWARE

Total values:

Files: 31306
Size: 436 TB

RAW → RawToDigi (Jobs: 31306) → DIGI (Size: ~ 25 TB) → DigiToDst (Jobs: 31306) → DST (Size: ~ 66 TB)

Per file values:

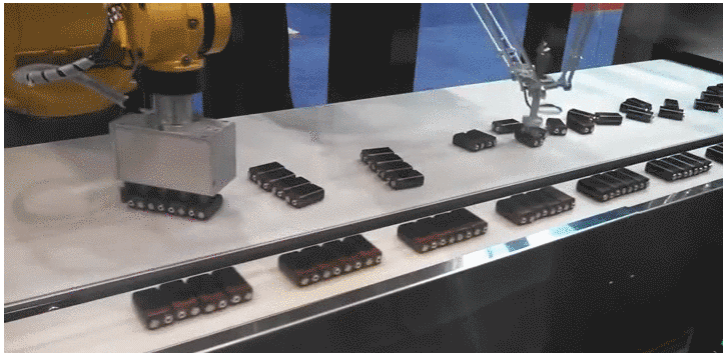
1 file: ~14 GB | 1 job: ~1 hour | 1 file: ~0.8 GB | 1 job: ~12 hour | 1 file: ~2.2 GB

Standard production flow:

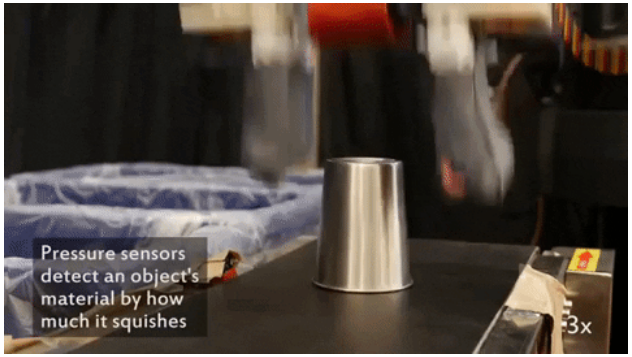
Register data → Test software → Launch distributed processing → Detect issues, Analyze performance

Full run8 data production takes around 8 days!

Why to automate run9 data processing?



Not to save time – data taking happens not so often.

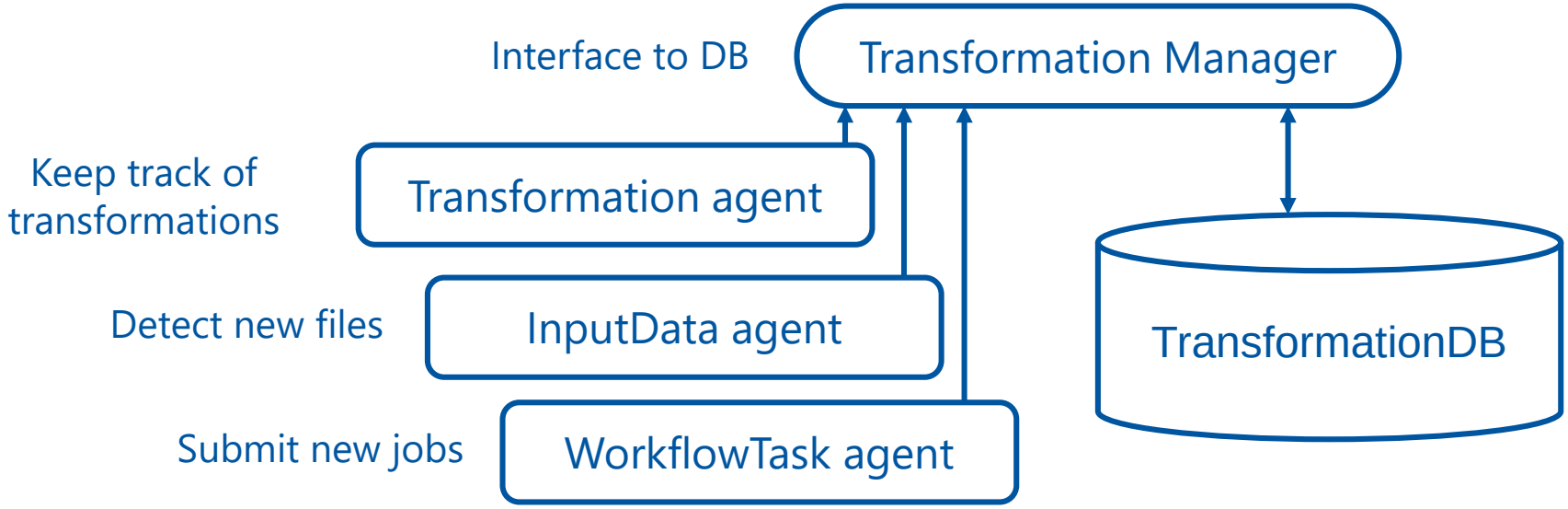


Not to avoid errors – we do not encounter them during jobs submission.

But to reliably deliver data for physics analysis as soon as we can during data taking!

Transformation system

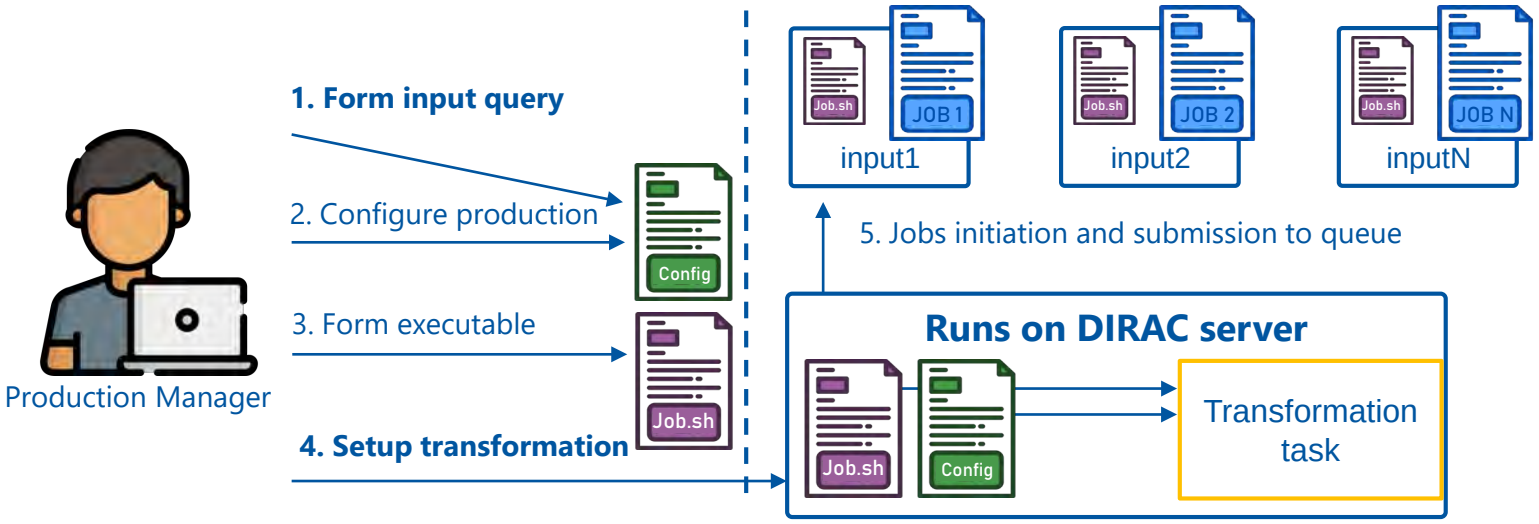
Transformation is a mechanism in DIRAC to start job when new file appear.



All components were installed and tested.

The code of WorkflowTask agent was changed in order to pass input file name as a parameter to the job.

Automated approach



Special transformations were developed to initiate jobs:

- RawToDigi – when RAW file appears this job:
  - Download RAW file.
  - Generate DIGI from RAW file.
  - Upload DIGI to storage system.
  - Upload DIGI to NICA cluster.
- DigiToDST – when DIGI file appears this job:
  - Download DIGI file.
  - Generate DST from DIGI file.
  - Upload DST to storage system.
  - Upload DST to NICA cluster.

Run only on **Tier1.**

Govorun and NICA cluster are also possible as a fallback solution.

Run only on **Tier2.**

Govorun, NICA cluster, Tier1 are possible as fallback solution

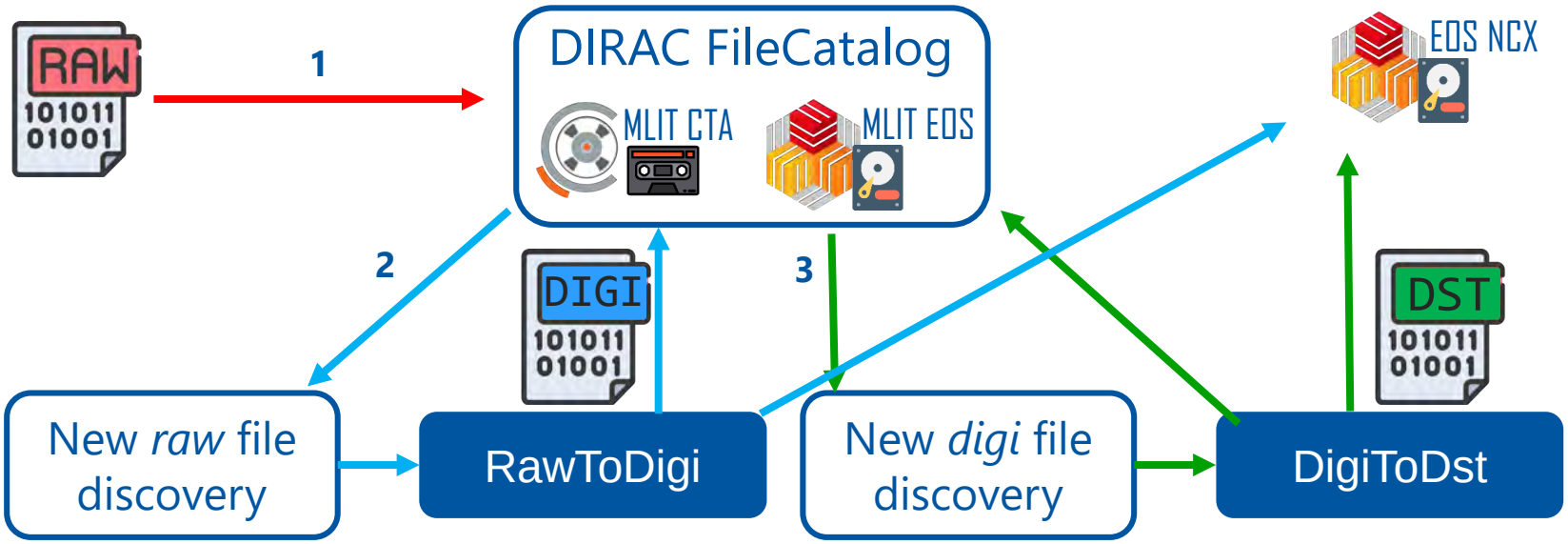
Automation schema

Detection of a new files rely on the files meta data

RawToDigi query: `{type=raw, run_number=9}`

DigiToDst query: `{type=digi, run_number=9}`

For 1 file – 1 job is started



Corner cases

What if jobs profile change from run8?

Do not activate automation until we check RawToDigi and DigiToDst jobs.

What if RAW file size will be enormous, like 100 GB?

Do not submit jobs automatically for files bigger than 16 GB.

What if one of computing resources is not sustaining the load or unavailable for any reason?

Do not restrict job submission to a computing resource, but rather require resource to have a special tag: rawtodigi, digitodst.
With that approach it is possible to change destination of waiting jobs manually.

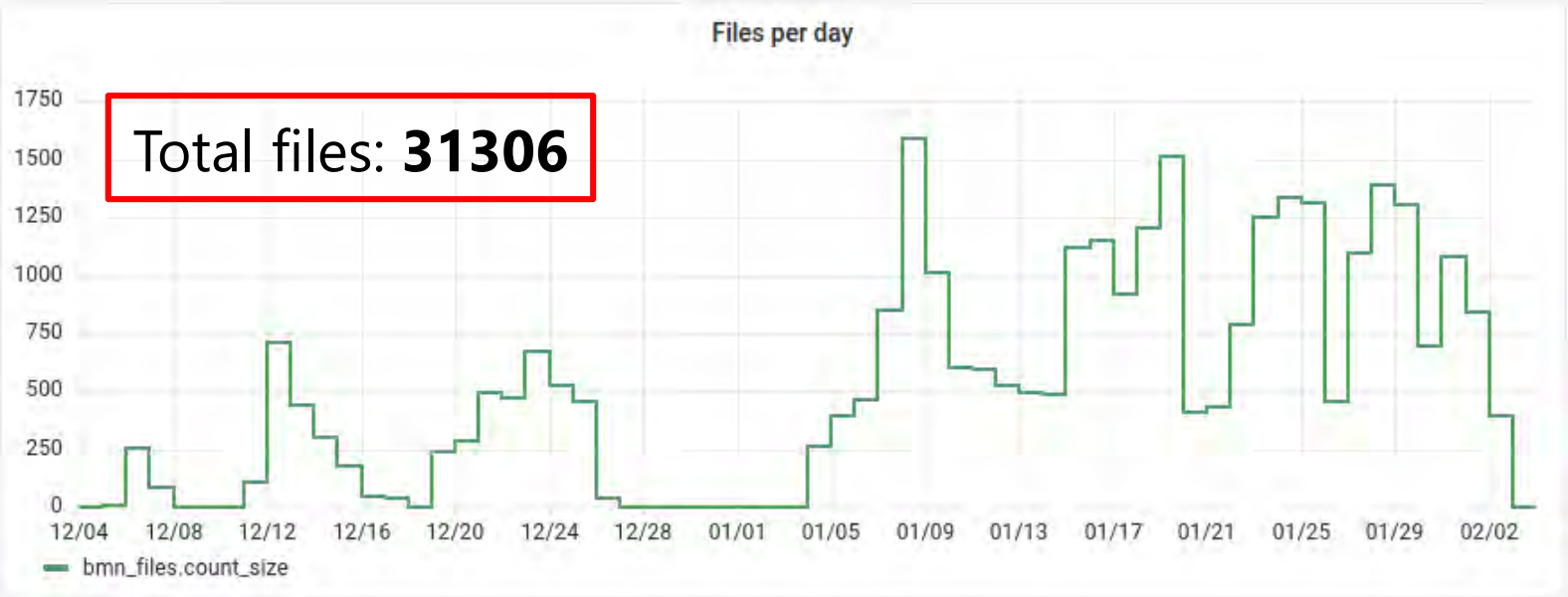
Here should be some plots with jobs submitted by Run9 automation …

… but date of the data taking was postponed.

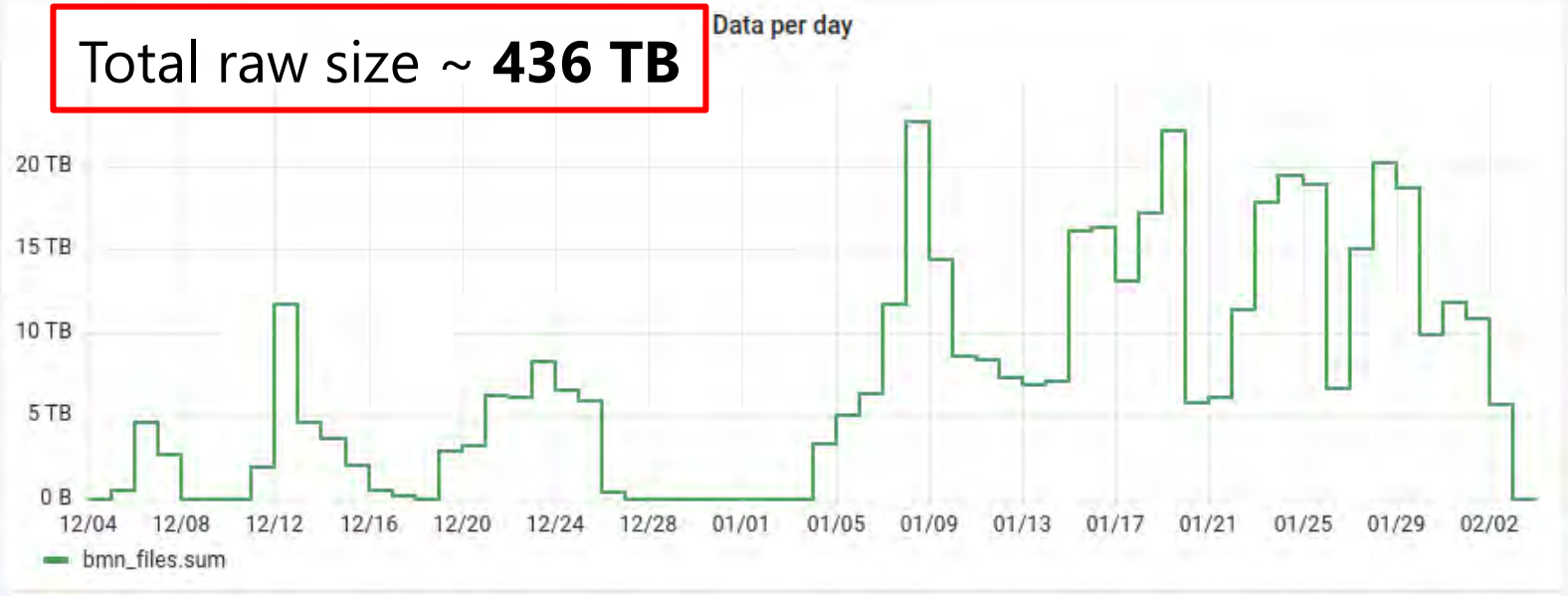
But, we know from physicist what to do in that cases…

… simulate!

BM@N Run8 data taking



Total files: **31306**

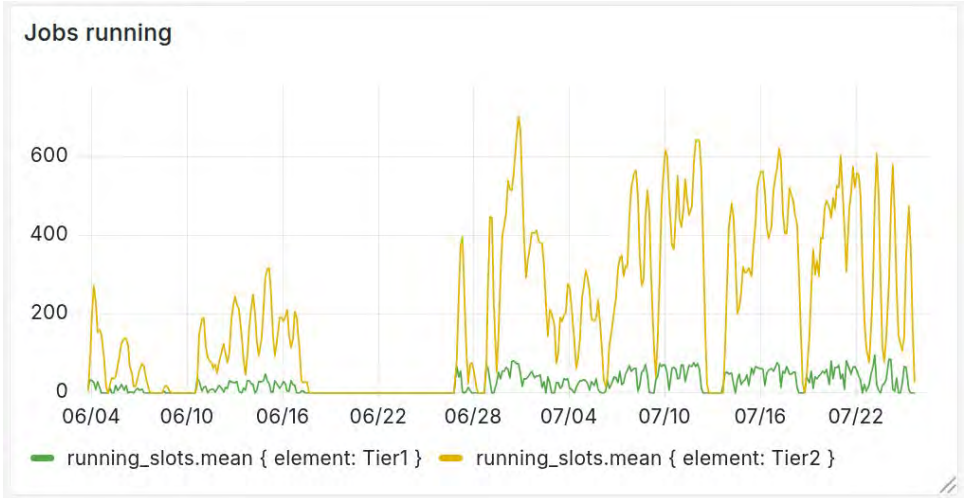


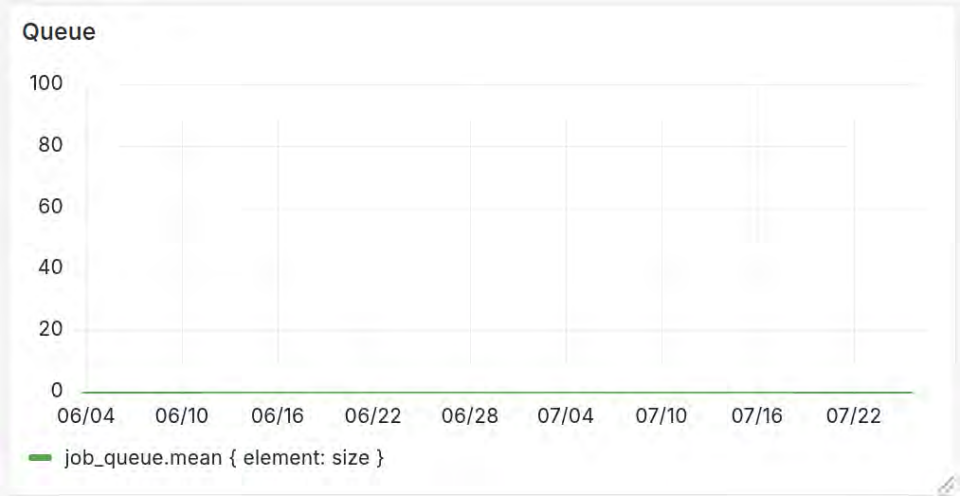
Total raw size ~ **436 TB**

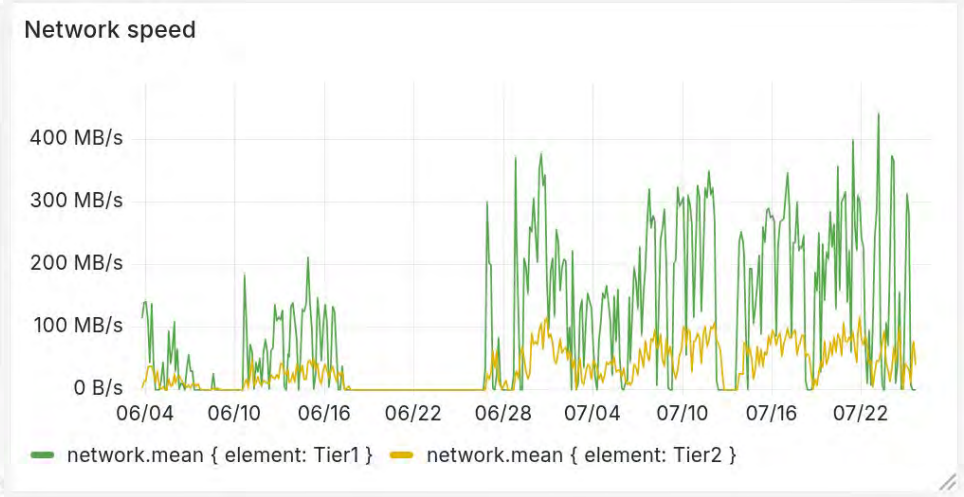
Simulation plots

What if previous data taking was automated?

Data rate from Run8 was taken analyzed and used to simulate the same data flow to the system.



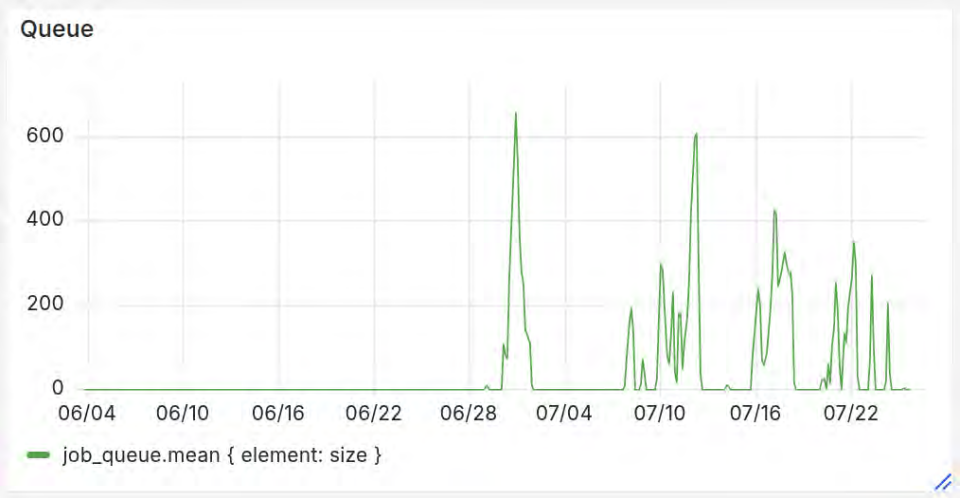


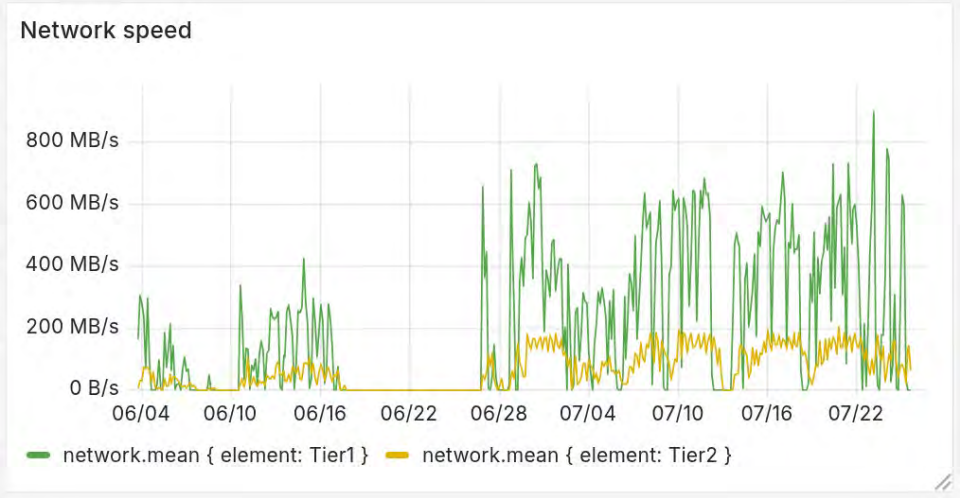


Simulation plots

What if the intensity doubled?

Occasional queues during most intense data taking periods.
Solution: allow Tier1 to process part of DigiToDst jobs

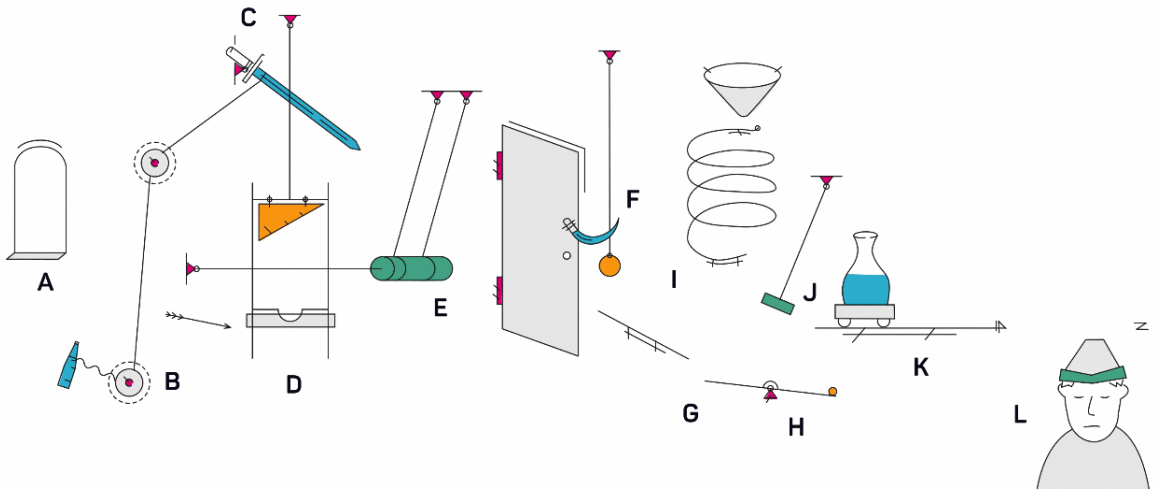




Conclusion

1. Meaningful metadata information was introduced.
2. Automation schema was developed and tested.
3. Basic simulation was performed.
4. Now waiting for data taking.

Thank you for attention!

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