

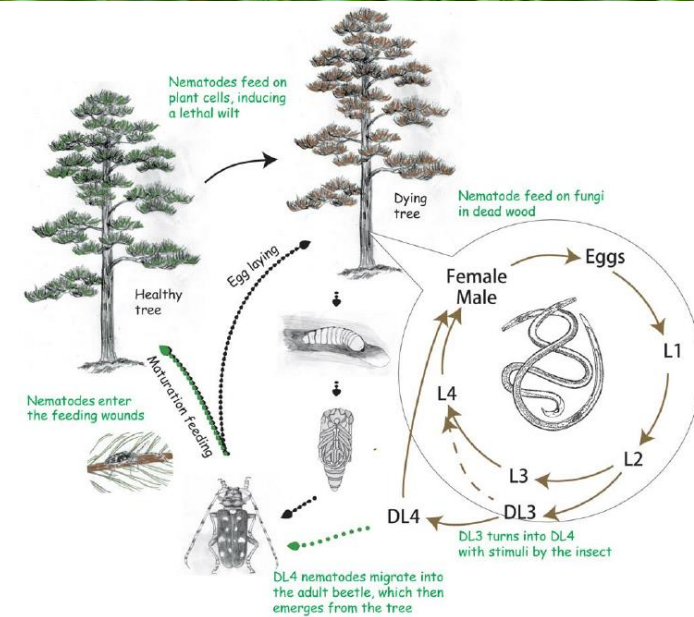
Large-scale aerial photo processing for tree health monitoring with HTCondor

Project CanHeMon (Canopy Health Monitoring)

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The Pine-Wood Nematode



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PINEWOOD NEMATODE OUTBREAK ON MAINLAND PORTUGAL



2001 ■◀

Outbreak mapped at the level of local administrative units,
courtesy of ICNF, Portugal (icnf.pt)

Decision 2012/535/EU:

- Surveys of coniferous trees in a Buffer Zone surrounding the infected area
- Fell and remove trees that are in poor health, or dead
- Contain the spread, especially towards the Spanish border
- Apply restrictions on the movement of plants, wood, and bark susceptible to have PWN



Can we detect trees in poor health over Portugal Buffer zone using a semi-automatic algorithm with airborne multi-spectral images ?

Summer 2012

Study area

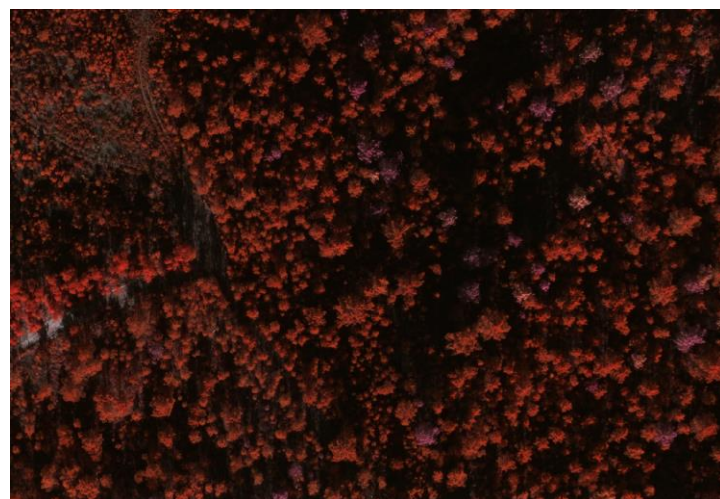
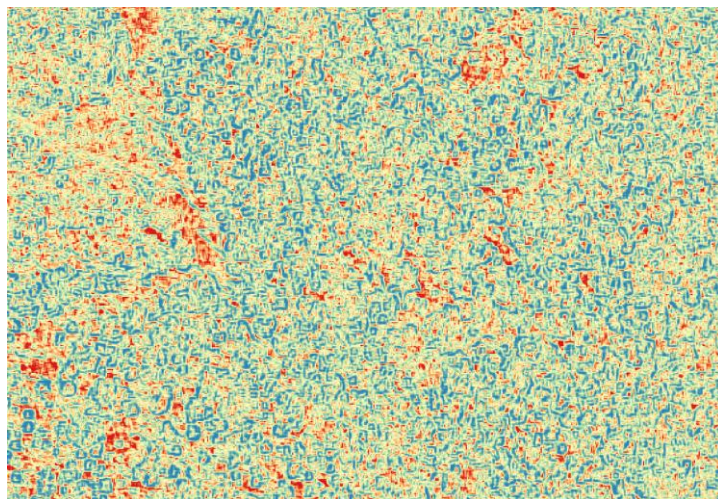


- Area in km²: ~ 27,000
- Images from 2014 to 2016
- Number of 1 km² tiles: 24.904
- 4 bands per raster: RGBNir
- Resolution: 0.30 m per pixel / 0.15 m per pixel
- 10 texture rasters per tile
- Total number of bands: 14
- Size of input data: ~ 63TB
- Vector file with the Land Cover of Portugal (2010)

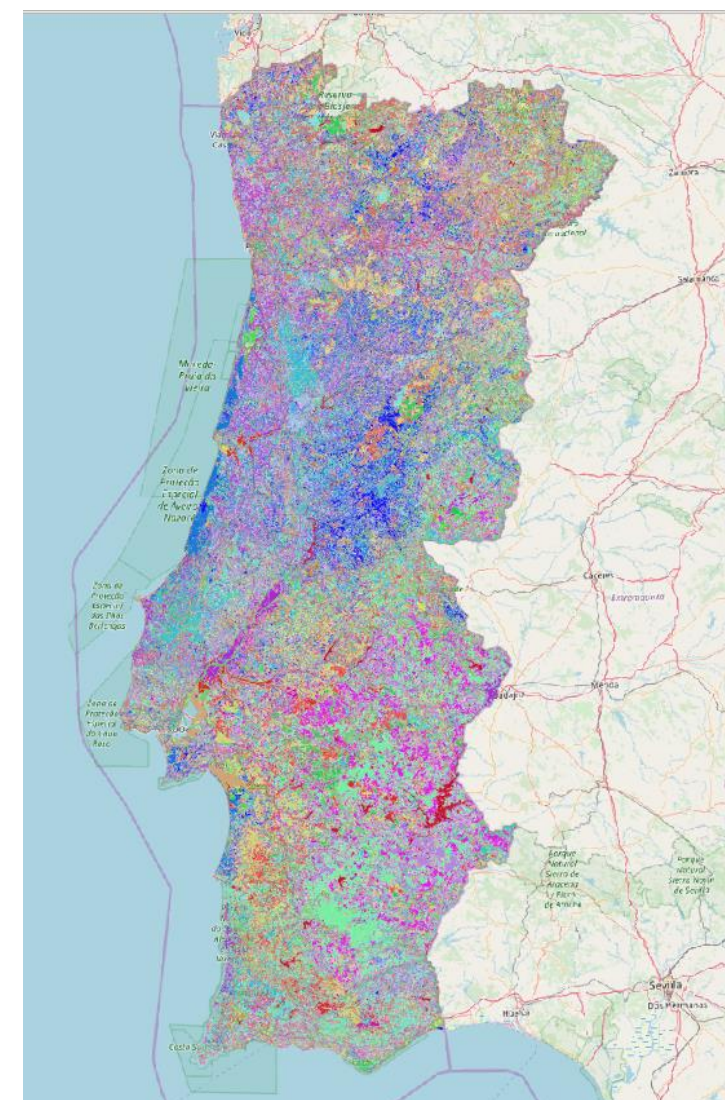
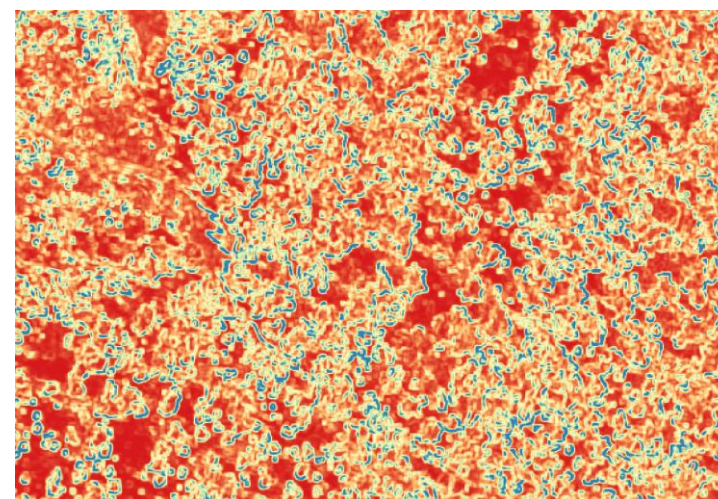
Quick look at the input data



0.30 m resolution



0.15 m resolution



MaxEnt - Maximum entropy model

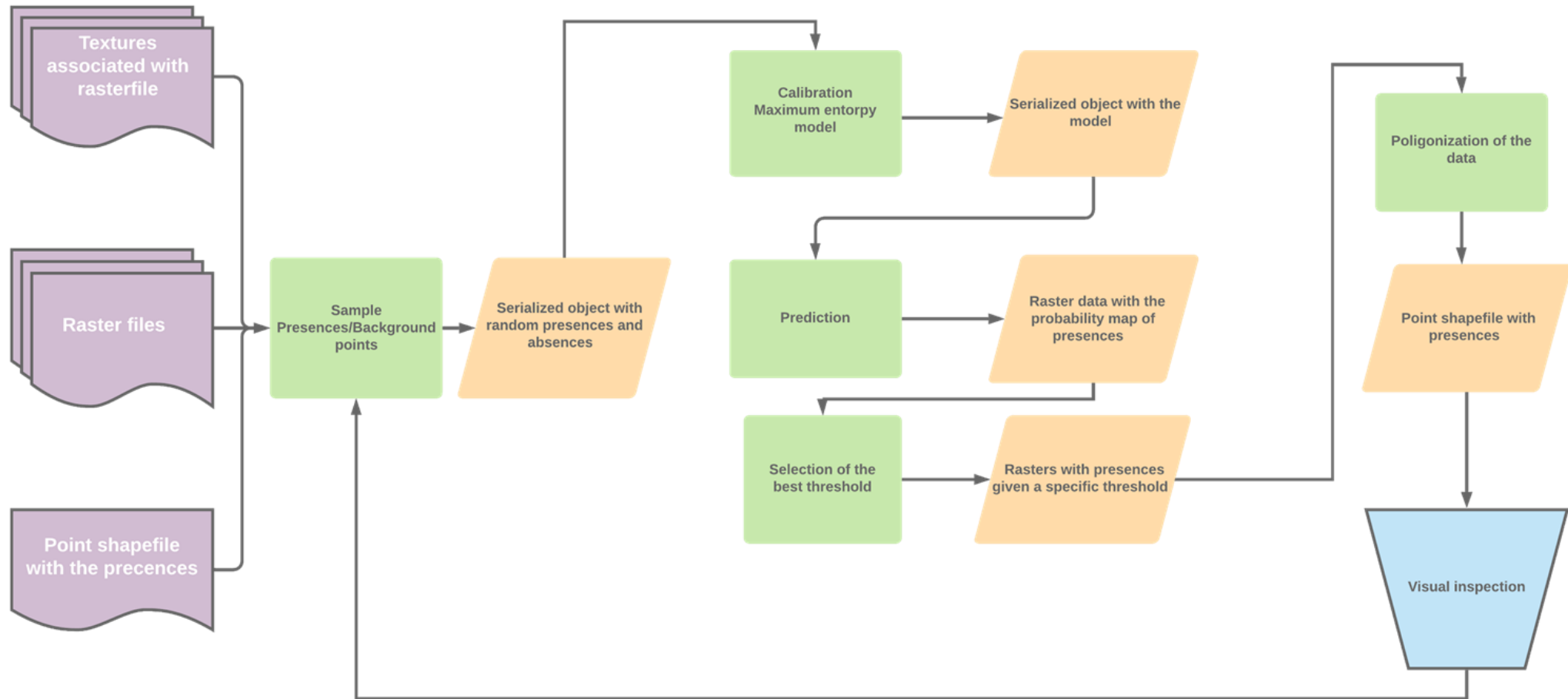
- Creates a probability map of presence for each pixel in the study area
- Based on Shannon entropy more choices less constraint

$$H(\hat{\pi}) = - \sum_{x \in X} \hat{\pi}(x) \ln \hat{\pi}(x)$$

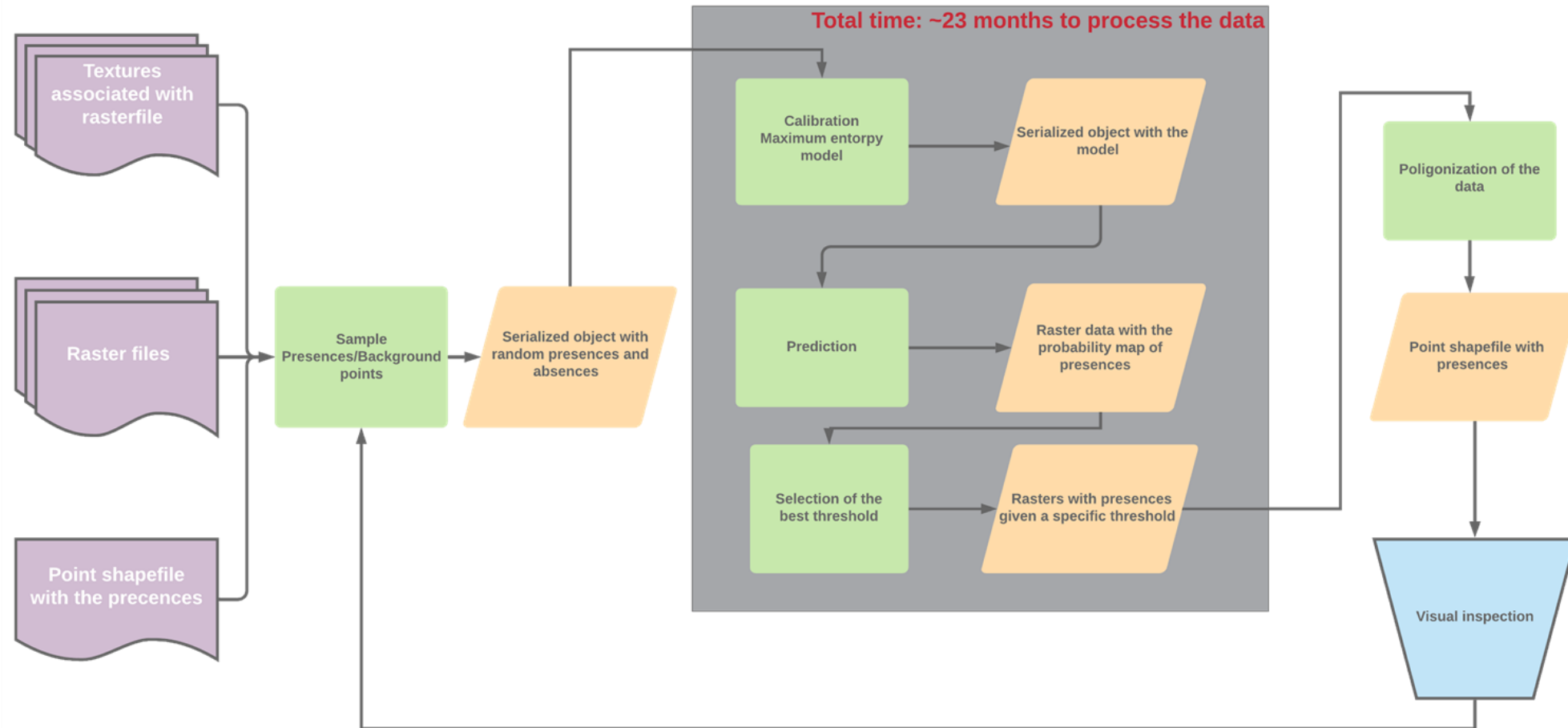
- It gives the least biased probability distribution with constraints assigned
- Suitable for continuous and categorical spatial variables
- Widely used in ecological modelling
- Can train on presence-only data
- Regularization of the data is possible to avoid overfitting



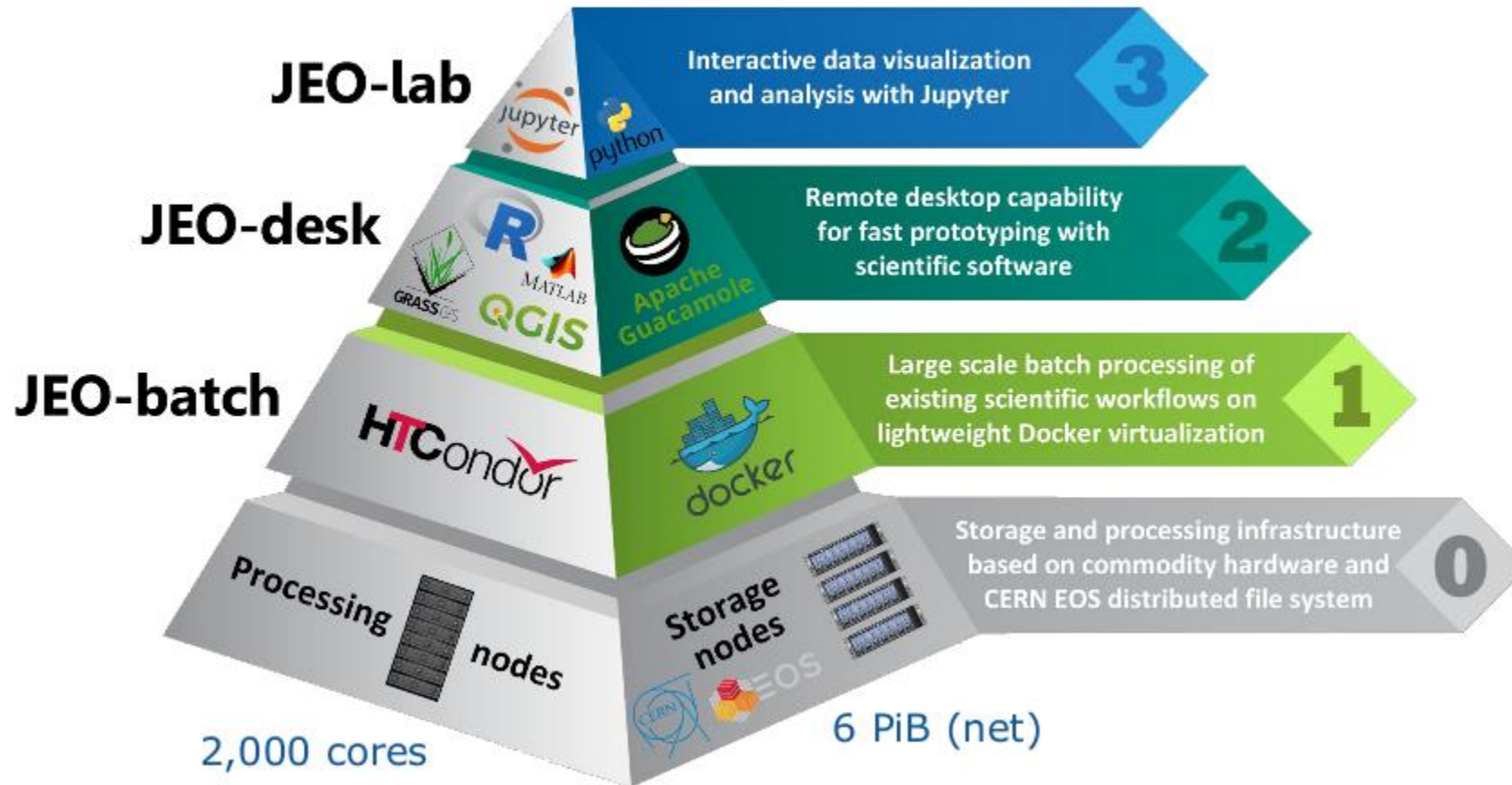
Workflow



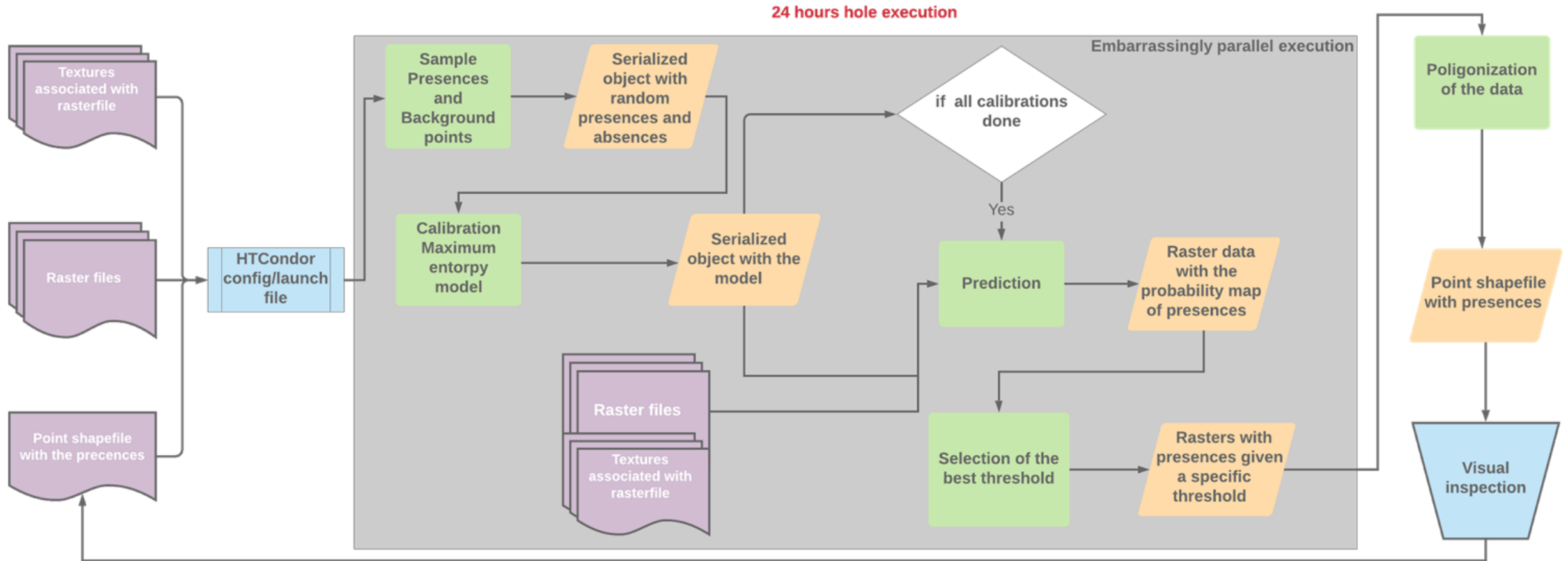
Workflow



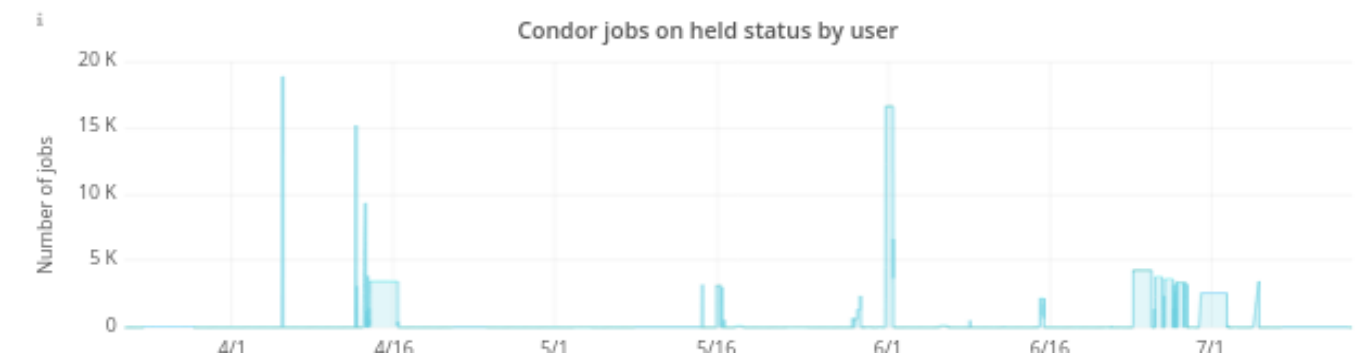
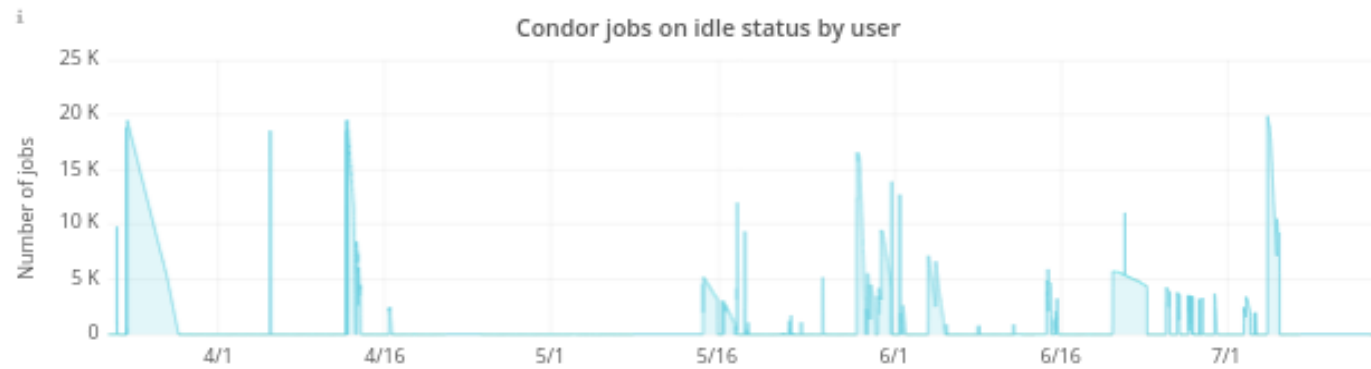
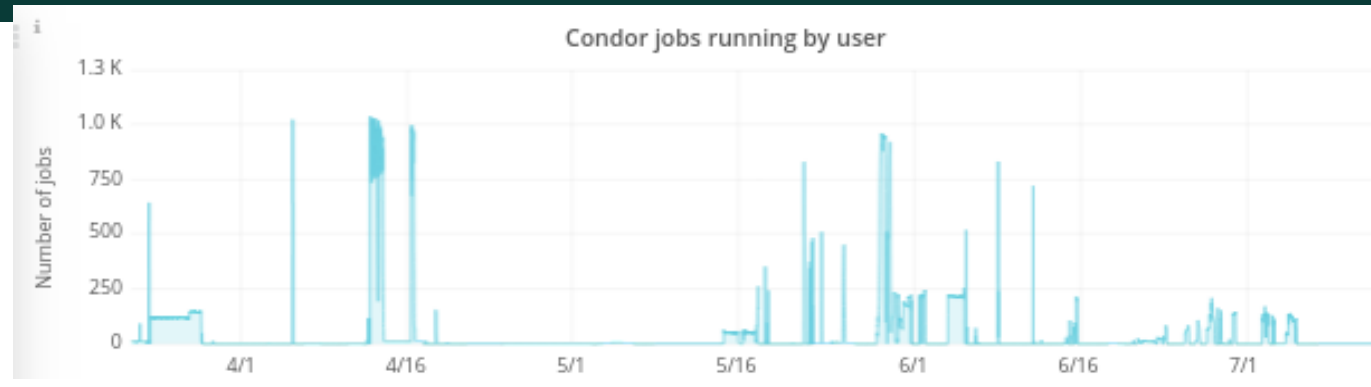
JEODPP



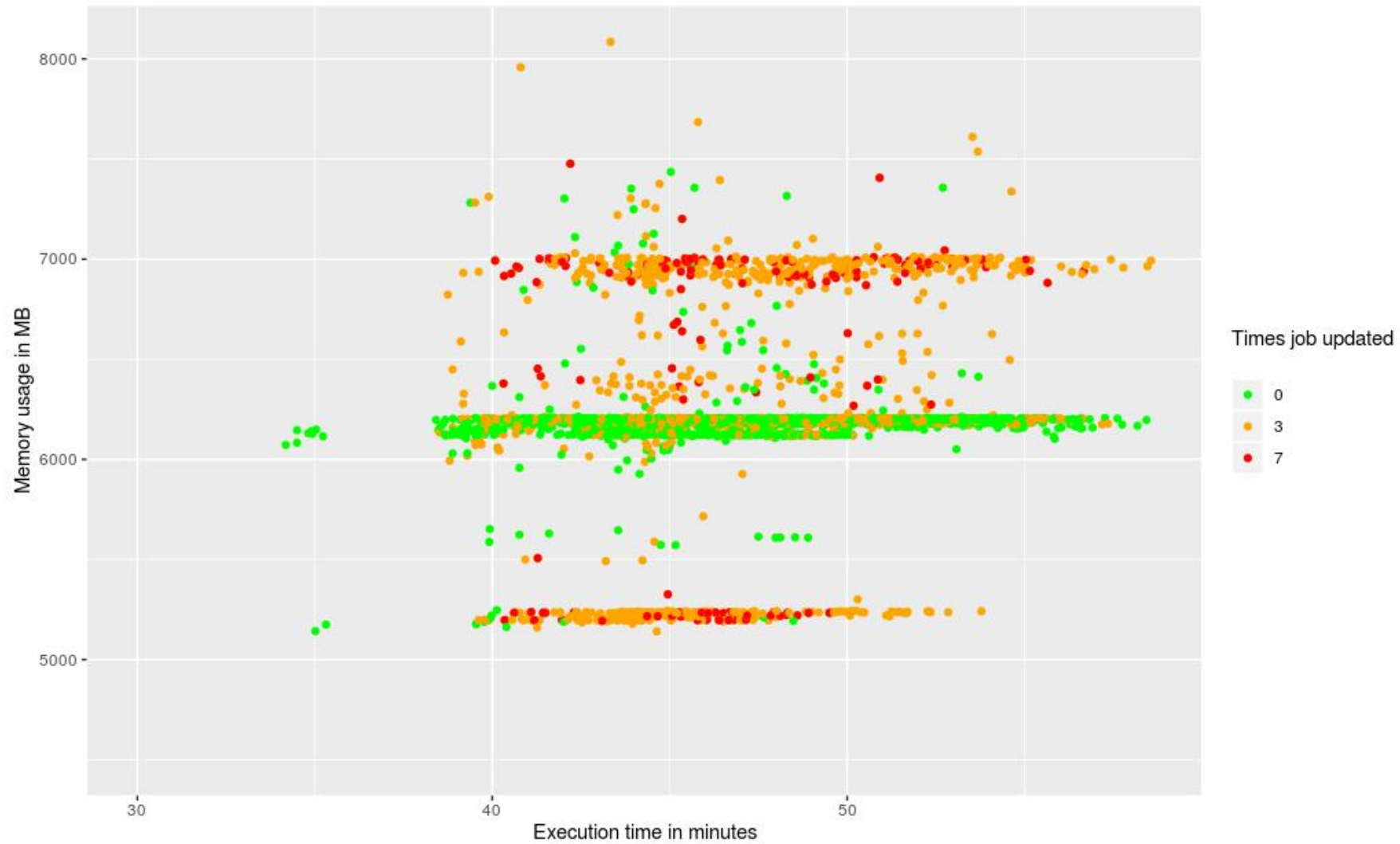
Workflow - HTCondor - Batch processing



HTCondor - Jobs status



Memory usage vs Time



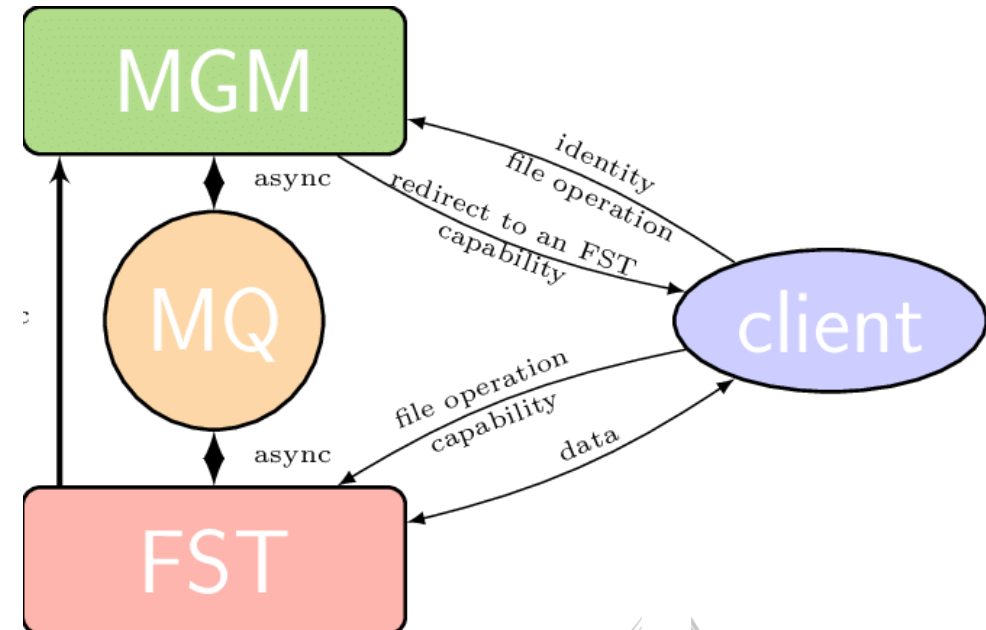
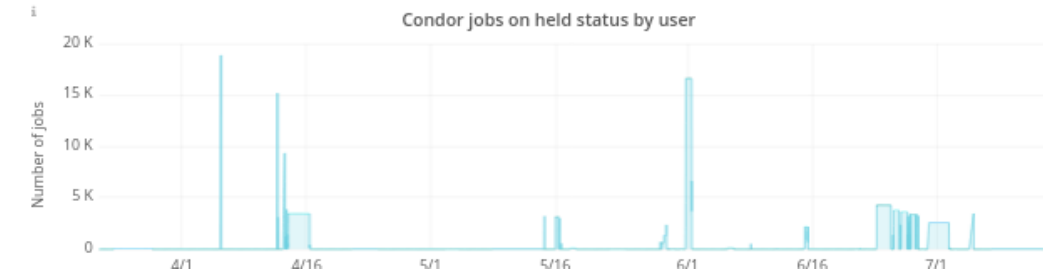
Troubleshooting

Problem: Jobs got on hold

Cause: Overload of the MGM

JEODPP team solution:

- Avoid having too many files in the same folder.
- Disable the ability of some libraries to list files (ex: gdal)
- Avoid the use of extensive listing commands (find, ls stat, ect.)



Troubleshooting

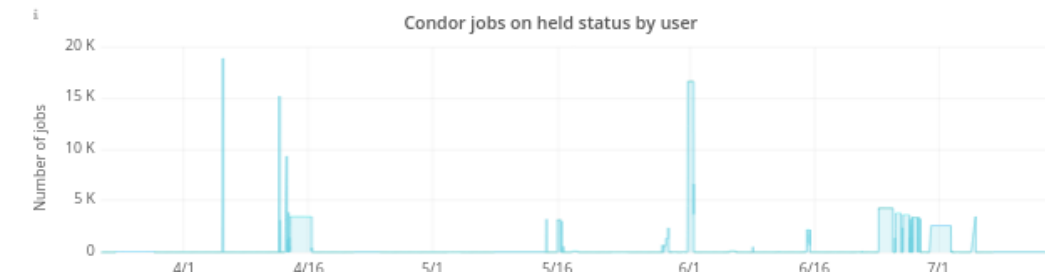
Problem: Black Holes

Cause: Long-term job fails in an specific machine The machine goes in idle, accepting more jobs that it won't finish.

JEODPP team solution:

- Change machines when sending jobs

```
job_machine_attrs = Machine
job_machine_attrs_history_length = 5
requirements = target.machine !=
MachineAttrMachine1 && target.machine !=
MachineAttrMachine2
```



Troubleshooting

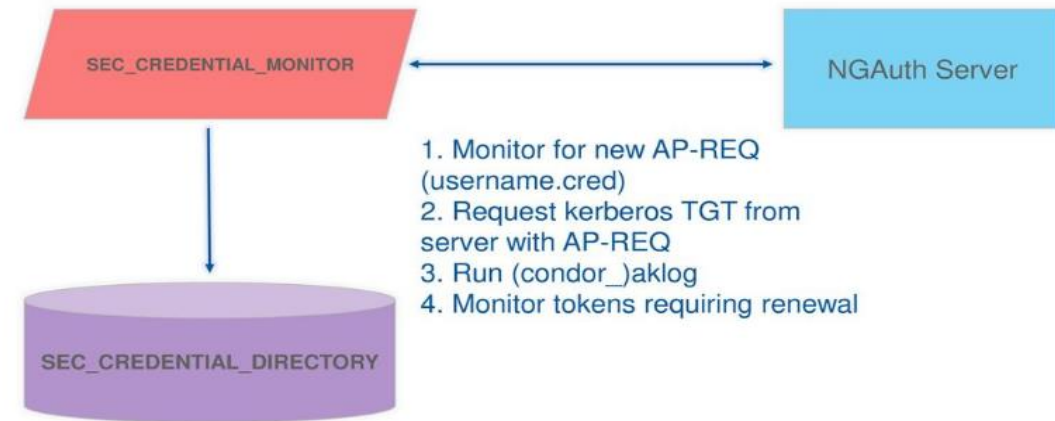
Problem: Failed to initialize log/err/out

Possible cause: NGAuth service is overloaded and no TGT is produced

JEODPP team solution:

- Re-launch the process

Schedd



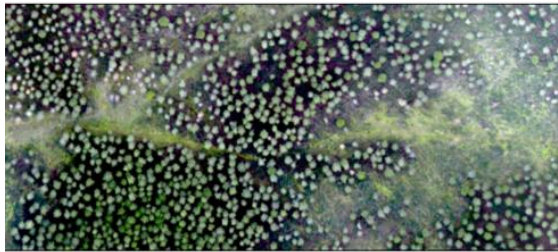
Results



Results



JRC TECHNICAL REPORT



The feasibility of detecting trees affected by the Pine Wood Nematode using remote sensing



JRC TECHNICAL REPORTS

The Canopy Health Monitoring (CanHeMon) project

Pieter S. A. Beck, Laura Martínez Sanchez, Margherita di Leo, Yann Chemin, Giovanni Caudullo, Begoña de la Fuente, Pablo J. Zarco-Tejada

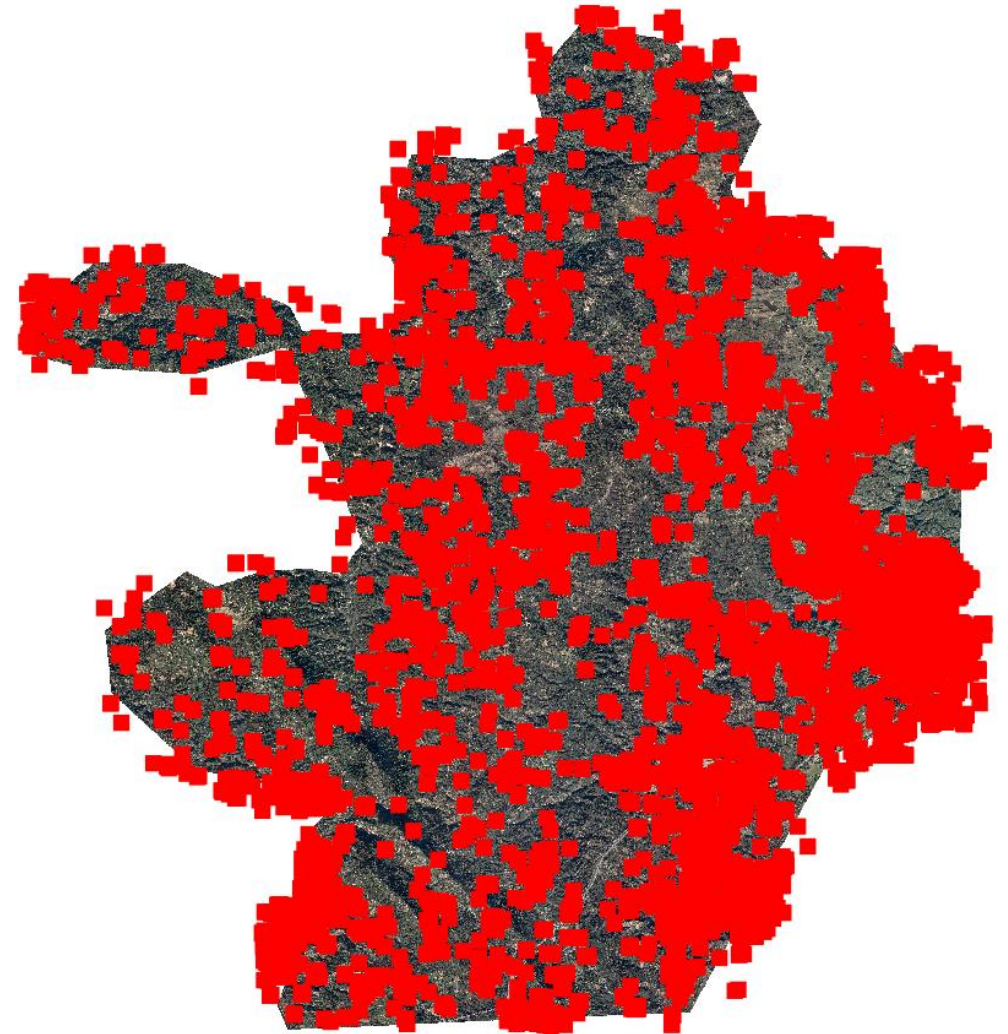


JRC SCIENCE FOR POLICY REPORT

Remote Sensing in support of Plant Health Measures - Findings from the Canopy Health Monitoring (CanHeMon) project

Pieter S. A. Beck, Laura Martínez Sanchez, Margherita di Leo, Yann Chemin, Giovanni Caudullo, Begoña de la Fuente Martín, Pablo J. Zarco Tejada

2019





Any questions?

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