LIÈGE université
Sciences Appliquées

MONDAIC

Updates on the progresses from Mondaic on NN integration

August 26, 2026

H. Michel, F. Nguyen, S. Koley, et al.

Slides modified from the weekly updates from Mondaic.

Einstein Telescope

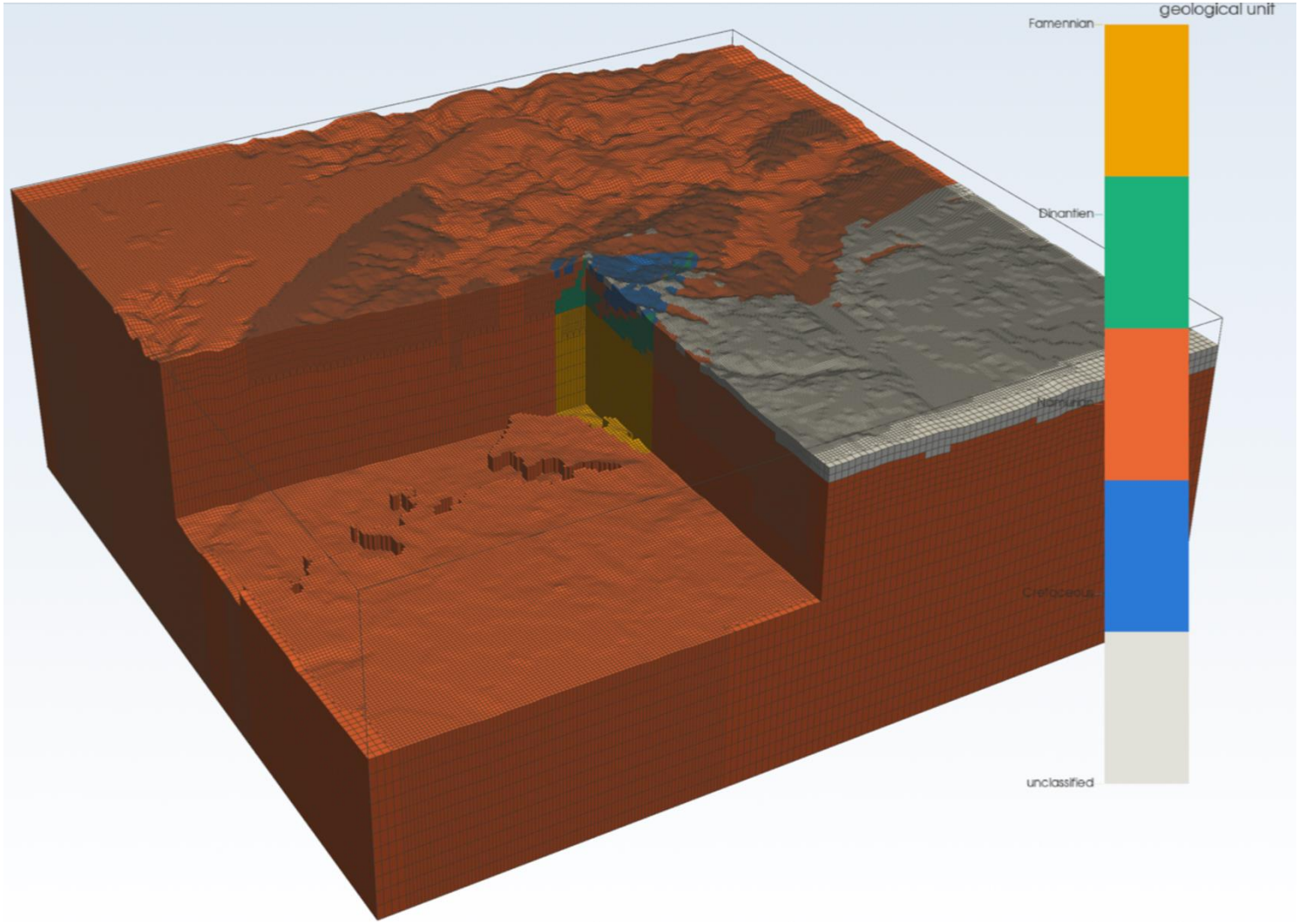
Overview

- Task 1: Meshing
  - Geological meshing → Solved
  - Caverns meshing → Mostly solved (some details lost in the process)
  - Merging → Working, still experimental
  - Optimization → Working
- Task 2: NN integration
  - ‘nn_salvus’: Python package for post-processing of Time-domain snapshots
  - Internal on-the-fly to Salvus
- Task 3: Frequency domain output on GPU
  - On Pause
- Task 4: Full (mostly) automated workflow
  - From geological model, caverns layout and sources distributions to NN
  - Ongoing work

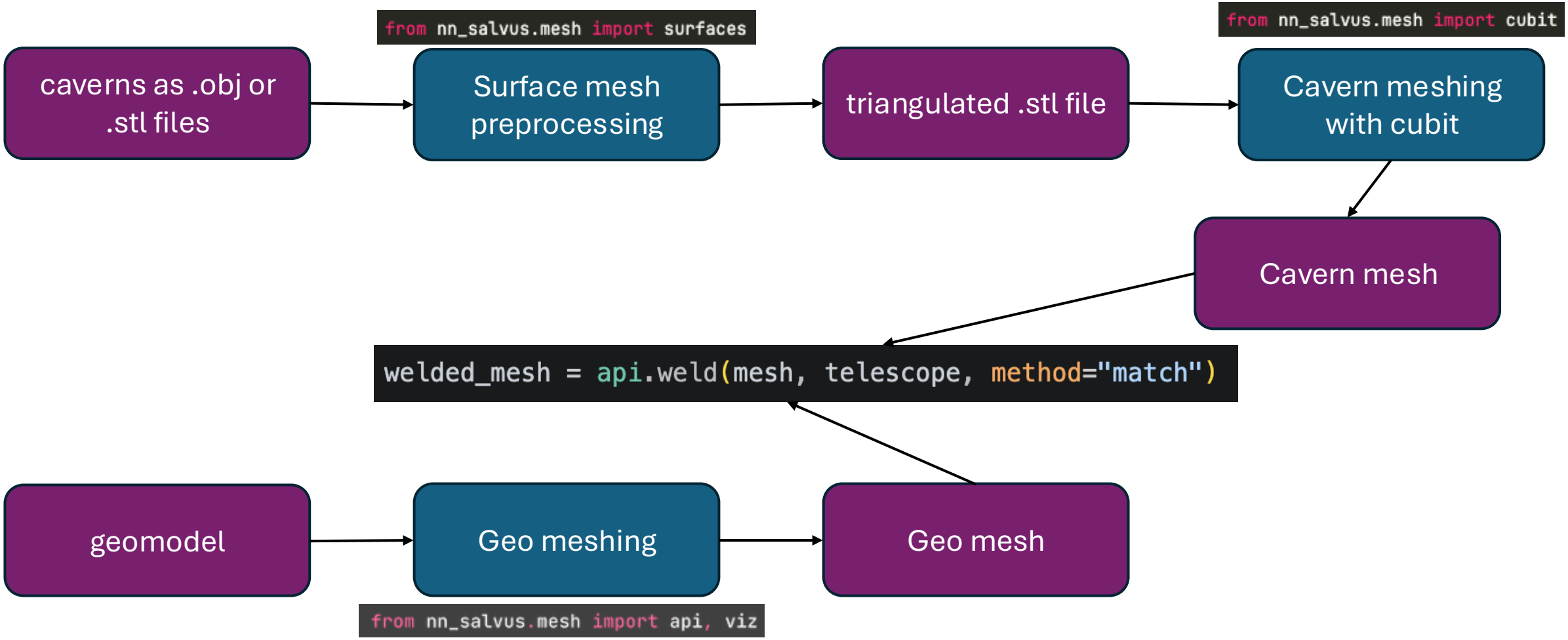
Task 1: Meshing

- Meshing beased on STL from the geological model
  - Easily updatable
- Fully conforming mesh generated
- Including topography

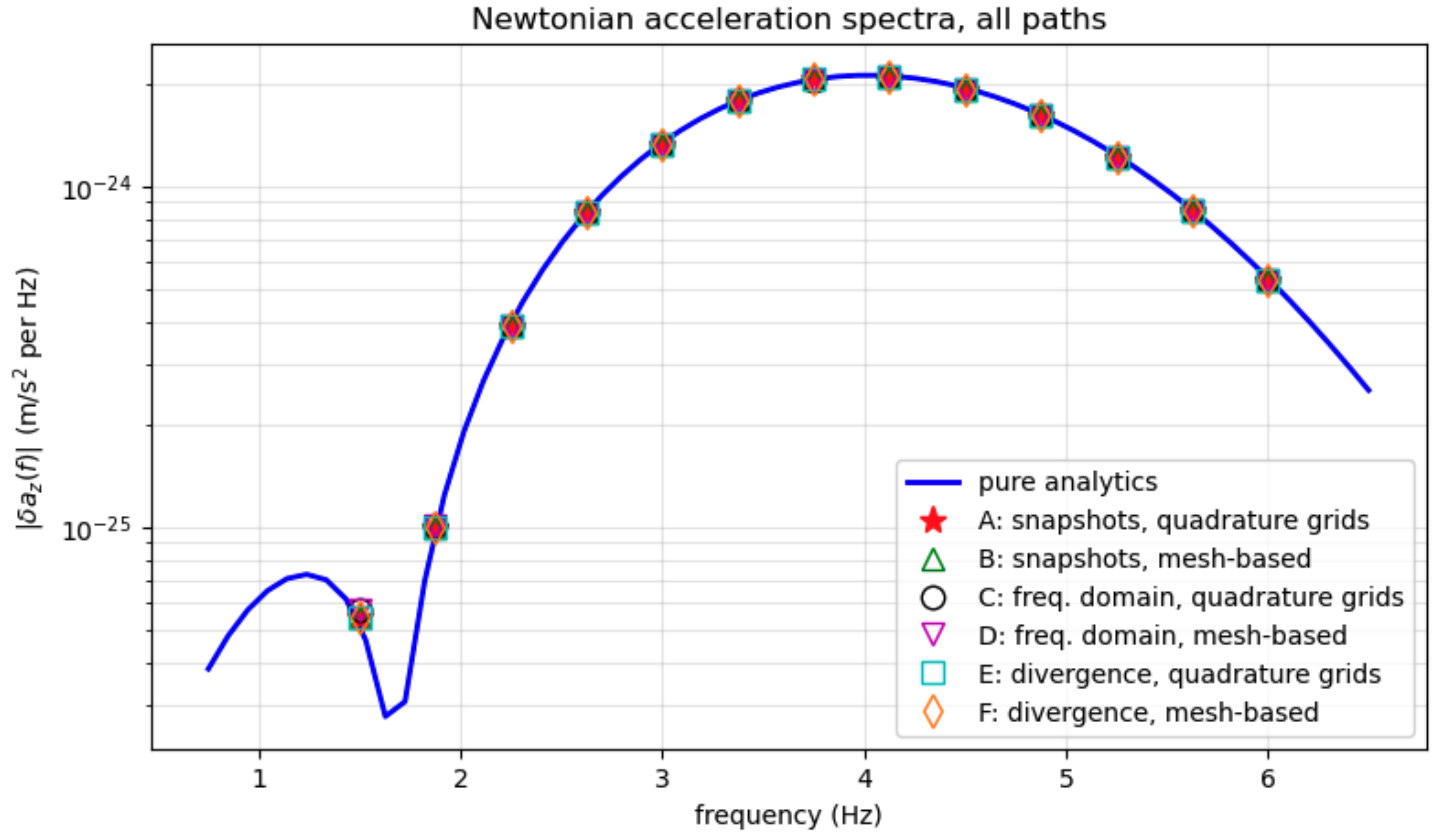
Geological units, vertically exaggerated

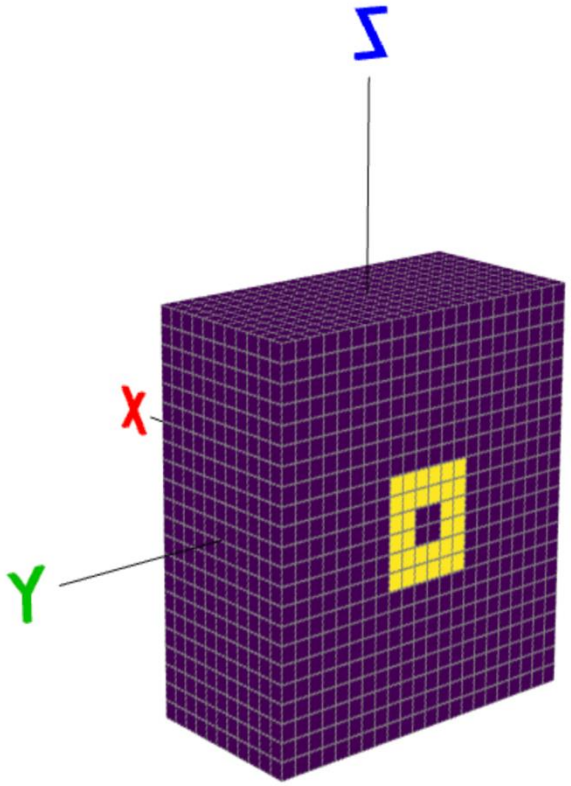


Task 1: Meshing



Task 2: NN integration





Task 2: NN integration

- Currently, 4 implementations in the ‘nn_salvus’ package (+ ANNA)
  - Two integration methods:
    - On pre-defined integration points
    - On the GLL points from the mesh
  - Two formalisms:
    - Split form
    - Divergence
      - Divergence formalizm requiers the definition of every interfaces in the mesh for computation (complicated to automate)
  - Undergoing internal (ULiège) review before release to collaboration
- In solver:
  - Volume integration of the split-form implemented
  - Pending IP → implementation of ANNA directly in Salvus

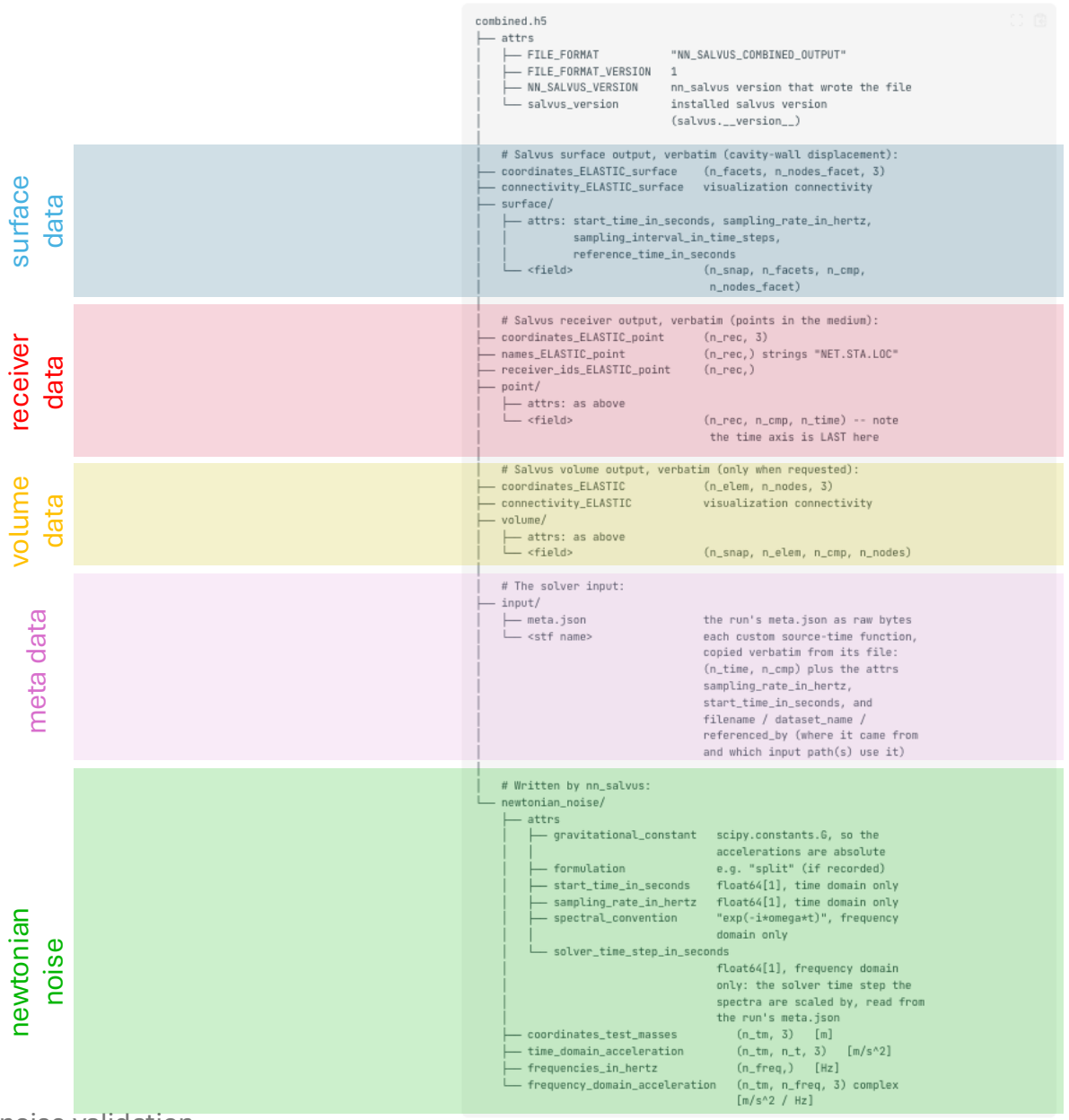
Task 2: NN integration Output formatting

- Exercised by the basic shared cavity example notebook and the more “realistic” examples.

```
combined_path = export.write_combined_output(
    filename=output_directory / "combined.h5",
    test_masses=test_masses,
    times=times_td,
    accelerations=acc_td,
    frequencies=FREQS,
    spectra=spec_fd,
    surface_file=surface_path,
    point_file=receiver_path,
    meta_file=output_directory / "meta.json",
    simulation=w,
    formulation="split",
    overwrite=True,
)
```

- Now includes the full input file of the solver including time series of source time functions.

```
# Reading the file manually.
with h5py.File("./output_box/combined.h5", mode="r") as f:
    # Full input file to the solver.
    solver_input = json.loads(bytes(f["input"]["meta.json"]))[
        "forward_run_input"
    ]
```



Task 3: Frequency output in GPU

- On pause (lower priority)
  - Not urgently needed for the current work
  - Can always be done as post-processing (smaller output to save)

Task 4: Full workflow

- Work ongoing
  - Meshing mostly solved
  - NN integration still under validation

Current work and timeline

- Implementation of the ET collaboration validation cases
- Full meshing pipeline automation (smoothing of the cavity mesh)
- Addition of the surface term of the internally computed split form (should be small if boundaries are far away sufficiently)
- Validation of the tools by ULiège

All expected to be done by mid-September.

Papers

- To be discussed in details next time
  1. NN simulations: from wavefields to NN integration in an integrated framework
  2. NN estimation for the EMR (first for a single cavity: e.g. Beusdael)
  3. Full size estimation of NN at the scale of the triangle
     - First full analysis of NN and the potential of the null stream at scale for the traingle within a complex geology (likely more decorrelation of the wavefield)
  4. Others…

- Contributions are welcome! ☺