Prefactor - The LOFAR pre-facet calibration pipeline

Overview

The official repository of prefactor is now on GitHub: https://github.com/lofar-astron/prefactor

It consists of parsets for the genericpipeline that do the first calibration of LOFAR data. Originally in order to prepare said data for the Factor facet calibration (https://github.com/lofar-astron/factor), but also useful if you don't plan to run Factor.

It includes:

- clock-TEC separation with transfer of clock from the calibrator to the target
- some flagging and averaging of amplitude solutions
- diagnostic plots
- at least some documentation

There are several pipeline parsets in this repository:

- **Pre-Facet-Cal.parset** : The "standard" pre-facet calibration pipeline, works on pre-NDPPP'ed data
- **Pre-Facet-Cal-RawData-Single.parset** : A pre-facet pipeline to work on raw (non NDPPP'ed) data
- **Pre-Facet-Cal-RawData-PreAvg.parset** : A pre-facet pipeline to work on raw (non NDPPP'ed) data that does the subband concatenating in the first NDPPP step. (To reduce the number of files on systems where this is a problem, e.g. JURECA)
- **Initial-Subtract.parset** : A pipeline that generates full FoV images and subtracts the skymodels from the visibilities. (Needed for facet-calibration, this could also be done as the first step of Factor.)

Software requirements

- the full "offline" LOFAR software installation version >= 2.15 (With small modifications the Pre-Facet-Cal pipelines can be run with older versions, but that is not supported by the authors anymore.)
- LoSoTo
- Python-PP (see http://www.parallelpython.com/ or https://pypi.python.org/pypi/pp)
- Python matplotlib
- WSClean (for Initial-Subtract, version >=1.9)

Documentation

There is a preliminary version of a cookbook chapter at:

https://github.com/lofar-astron/prefactor/blob/pdf-doc/docs/cookbook_prefacet.pdf **Please read that first!**

Usage Notes

- Don't edit the original parset files directly. Make a copy with a descriptive name (e.g. Pre-Facet-Cal-calibrator-3c295.parset) and edit that copy.
 - There is also no need to change the runtime_directory and working_directory entries in the pipeline.cfg for different pipeline runs. The pipeline framework will generate sub-directories with the job-name in there.
- calibrator and target data have to match:
 - observed with the same selection of stations (If calibrator and target observations have the same number of stations but different stations, then the pipeline will not fail but produce wrong results.)
 - observed close enough in time that calibration values can be transferred
- For each observation you should process all the calibrator data at once together. (Clock/TEC separation and flagging of bad amplitudes work better with the full bandwidth.)
 - The target data can be processed one time- or frequency- block at a time.



- Yes, updating the LOFAR software can be annoying. But it is worth ist! Trust me.
- Get someone to write a better documentation for the genericpipeline.

FAQ

KeyError 'mapfile' : Your pipeline run fails like that:

That happens when one step didn't generate a mapfile. Usually that means that the pipeline was looking for its input data, but couldn't find any files that match. Please check your *_input_path and *_input_pattern in the parset file! (Note: ls -d *_input_path/*_input_pattern should find your data.)

PipelineStep_* missing : Your pipeline run fails like that:

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(The exact name of the missing module varies.) You are probably missing one of the entries in the recipe_directories setting in your pipeline.cfg, or one of those entries doesn't work. Make sure both entries point to the correct directories, and that the missing module can be found in the plugins subdirectory of one of those two entries.

Missing "h5imp_cal_losoto.h5": Your pipeline run fails with an "executable_args failed" error and in the logfile you can find something like:

```
"/usr/local/lofar/losoto/current/lib/python2.7/site-packages/losoto-1.0.0-
py2.7.egg/losoto/h5parm.py",
line 40, in __init______
raise Exception('Missing file '+h5parmFile+'.')
Exception: Missing file ./h5imp_cal_losoto.h5.
```

That was caused by a bug in an old version of the genericpipeline. Update the software, make sure you use the new version of the software when starting the pipeline, and check the pathes in pipeline.cfg that they use the new version!

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