# SPARC4 Pipeline Workshop Guidelines

*XLVII Reunião Anual da SAB,  Águas de Lindóia, 23 a 26 de setembro de 2024*

This document offers basic guidelines for the hands-on activities in the SPARC4 Pipeline workshop. It is especially relevant for those interested in bringing a laptop to replicate the reduction steps and activities presented during the workshop.

---

**Checklist:**
- ☐ Laptop running Linux or OSX
- ☐ Install dependencies
- ☐ Check sparc4-pipeline documentation
- ☐ Install sparc4-pipeline
- ☐ Download the minidata
- ☐ Place data into a SPARC4 directory structure
- ☐ Create your own parameter file and edit it
- ☐ Try to run the pipeline on your own
- ☐ Check products

---

## 1. Recommended system configuration

Operational system:  Unix based, i.e., Linux or MacOSX
Disk space: > 30 Gb
Memory: > 8 Gb

## 2. Dependencies

Install the dependencies listed below to ensure that the sparc4-pipeline runs smoothly:

➔ Anaconda3 (recommended, but not required, as it includes most of the necessary dependencies in one package).

➔ AstroPoP 0.9.X

➜ [astropy](#), [astroquery](#), [photutils](#), [aafitrans](#), [twirl](#), [yaml](#), [regions](#), [uncertainties](#), [signals](#), [glob](#), [functools](#). Note that some of these packages are already included in Anaconda.

## 3. SPARC4 Pipeline documentation

[https://github.com/edermartioli/sparc4-pipeline](https://github.com/edermartioli/sparc4-pipeline)
[SPARC4 Quick Tutorial](#)
[AstroPoP](#)

## 4. Install the `sparc4-pipeline`

The example below assumes that the pipeline will be installed on your machine within the directory: `"/Users/eder/sparc4-pipeline/"`

You may follow exactly the same example by replacing the home directory `"/Users/eder/"` with your own home directory.

Open a terminal and type the following commands to install the pipeline [skip this step if you have already installed it]:

```
cd /Users/eder/
git clone https://github.com/edermartioli/sparc4-pipeline.git
cd /Users/eder/sparc4-pipeline/
pip install -U .
```

## 5. Download the minidata

Download the minidata in [this link](#).
Download the time series minidata [in this link](#).

## 6. Organize data in the SPARC4 directory structure

Unpack the minidata:

```
cd /Users/eder/Downloads
unzip minidata.zip
```

Place the raw data you downloaded into the sparc4 directory structure, as in the example below:

```
mkdir /Users/eder/data/
mv sparc4acs? /Users/eder/data/
```

You should end up with the following data directories:

```
/Users/eder/data/sparc4acs1/20230604
/Users/eder/data/sparc4acs2/20230604
/Users/eder/data/sparc4acs3/20230604
/Users/eder/data/sparc4acs4/20230604
--------------------------------------
/Users/eder/data/sparc4acs1/20230605
/Users/eder/data/sparc4acs2/20230605
/Users/eder/data/sparc4acs3/20230605
/Users/eder/data/sparc4acs4/20230605
--------------------------------------
/Users/eder/data/sparc4acs1/20230606
/Users/eder/data/sparc4acs2/20230606
/Users/eder/data/sparc4acs3/20230606
/Users/eder/data/sparc4acs4/20230606
```

## 7. Create your parameters file

The easiest way to create a parameters file is to make a copy of the example parameter file, `my_params.yaml`, that comes with the pipeline, as follows:

```
cp /Users/eder/sparc4-pipeline/user_files/my_params.yaml
/Users/eder/data/minidata_params.yaml
```

Then you can open this file with a text editor and edit the following parameters:

```
ROOTDATADIR: "/Users/eder/data/"
ROOTREDUCEDIR: "/Users/eder/data/reduced"
```

```
CALIBDB_DIR: "/Users/eder/sparc4-pipeline/calibdb"
```

Each parameter in the file includes an explanation of its meaning. Be careful to maintain the same formatting, as misformatted values may lead to crashes. Additionally, your new parameter file doesn't need to include all parameters; for example, if you include only the three parameters above, it will overwrite their default values while keeping the defaults for all other parameters.

## 8. Run the pipeline

To run the pipeline for data reduction on the nights of 2023-06-04, 2023-06-05, and 2023-06-06 in the minidata, execute the following commands in the terminal:

```
python -W ignore /Users/eder/sparc4-pipeline/scripts/sparc4_mini_pipeline.py
--params=/Users/eder/data/minidata_params.yaml --nightdir=20230604

python -W ignore /Users/eder/sparc4-pipeline/scripts/sparc4_mini_pipeline.py
--params=/Users/eder/data/minidata_params.yaml --nightdir=20230605

python -W ignore /Users/eder/sparc4-pipeline/scripts/sparc4_mini_pipeline.py
--params=/Users/eder/data/minidata_params.yaml --nightdir=20230606
```

## 9. Check products

If the reduction runs well, you should find the reduction products in the following tree of reduced directories:

```
/Users/eder/data/reduced/20230604/sparc4acs1/
/Users/eder/data/reduced/20230604/sparc4acs2/
/Users/eder/data/reduced/20230604/sparc4acs3/
/Users/eder/data/reduced/20230604/sparc4acs4/
------------------------------------
/Users/eder/data/reduced/20230605/sparc4acs1/
/Users/eder/data/reduced/20230605/sparc4acs2/
/Users/eder/data/reduced/20230605/sparc4acs3/
/Users/eder/data/reduced/20230605/sparc4acs4/
------------------------------------
/Users/eder/data/reduced/20230606/sparc4acs1/
/Users/eder/data/reduced/20230606/sparc4acs2/
/Users/eder/data/reduced/20230606/sparc4acs3/
```

`/Users/eder/data/reduced/20230606/sparc4acs4/`

Note that, by default, the reduced directory tree places the reduced data in `'sparc4acs?'` directories within a night directory. If you want to use the same structure for the raw data or apply the raw data's structure to the reduced data, this can be configured in the parameter file.

The following products are relevant for science:

---

→ `*_proc.fits` : calibrated images with catalogs of point-like sources.
→ `*_stack.fits` : calibrated stack images with a master catalog of point-like sources.
→ `*_polar.fits` : files containing polarimetric quantities for all sources in the catalog.
→ `*_lc.fits` : files containing time series photometric quantities for all sources in the catalog.
→ `*_ts.fits` : files containing time series photometric and polarimetric quantities for all sources in the catalog.

---

The following products are also produced by the reduction :

---

→ `*.log` : log messages issued during the reduction
→ `*db.csv` : a database table with information of images in the raw directory, although not all in this table are selected for reduction.
→ `*._night_report.txt` : night report
→ `*.MasterDomeFlat.fits` : master flat field files
→ `*.MasterZero.fits` : master zero "bias" files

---

**NEW** A set of Jupyter notebooks with examples to familiarize yourself with SPARC4 data products obtained from the reduction of the minidata is available in the link below :

Jupyter notebooks to access SPARC4 Pipeline products