Digital Twin Pipeline

Simon Felix, Rohit Sharma, Christoph Vögele, Lukas Gehrig, Stefan Kögl

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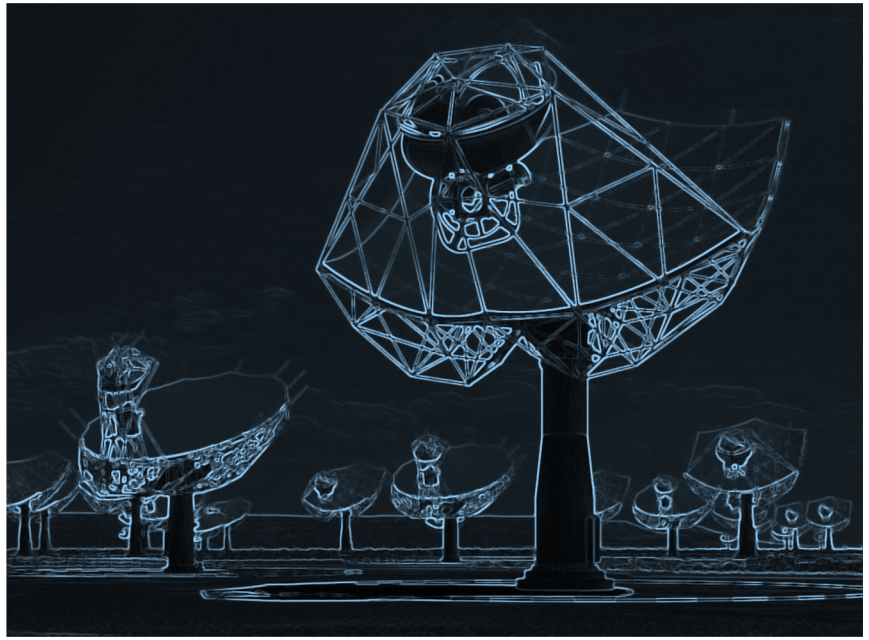
ETH zürich

University of Applied Sciences and Arts Northwestern Switzerland
School of Engineering

SKA Original
First Light ~2027



SKA Digital Twin
Simulation of Sky, Instruments & Analysis

Flexible Building Blocks

SKA

First Light ~2027

Post-It Color Meanings

processes / functions

interfaces between modules

settings / configuration

additional information

Software Bubble Description

RASCIL

OSKAR

MeqTrees

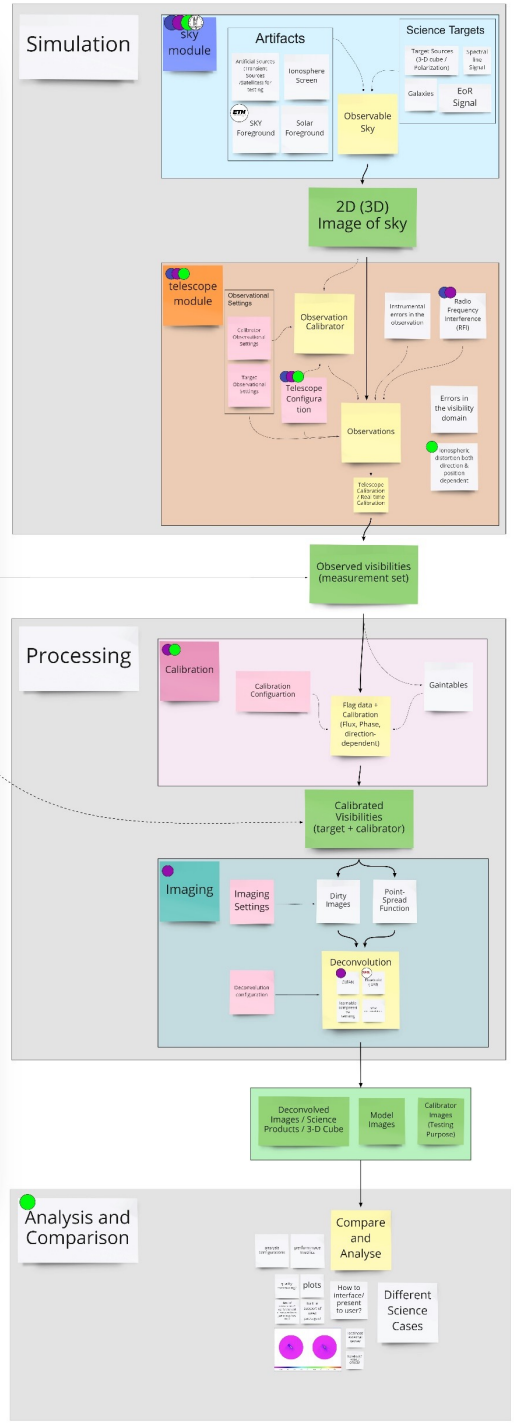
University of Zürich

University of Geneva

University of Applied Sciences of northwestern Switzerland

L'école polytechnique de Lausanne

Swiss Federal Institute of Technology in Zurich



miro

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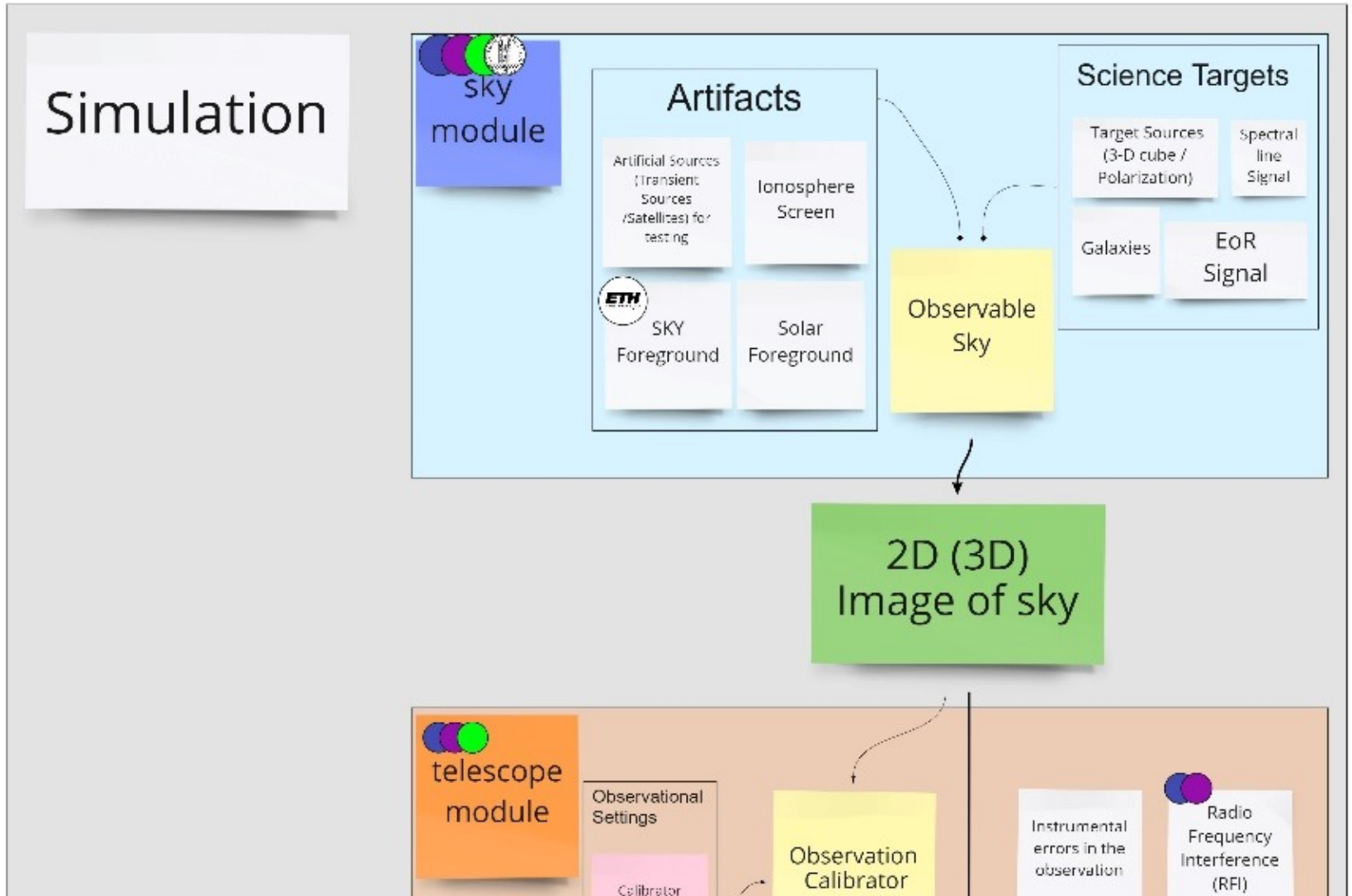

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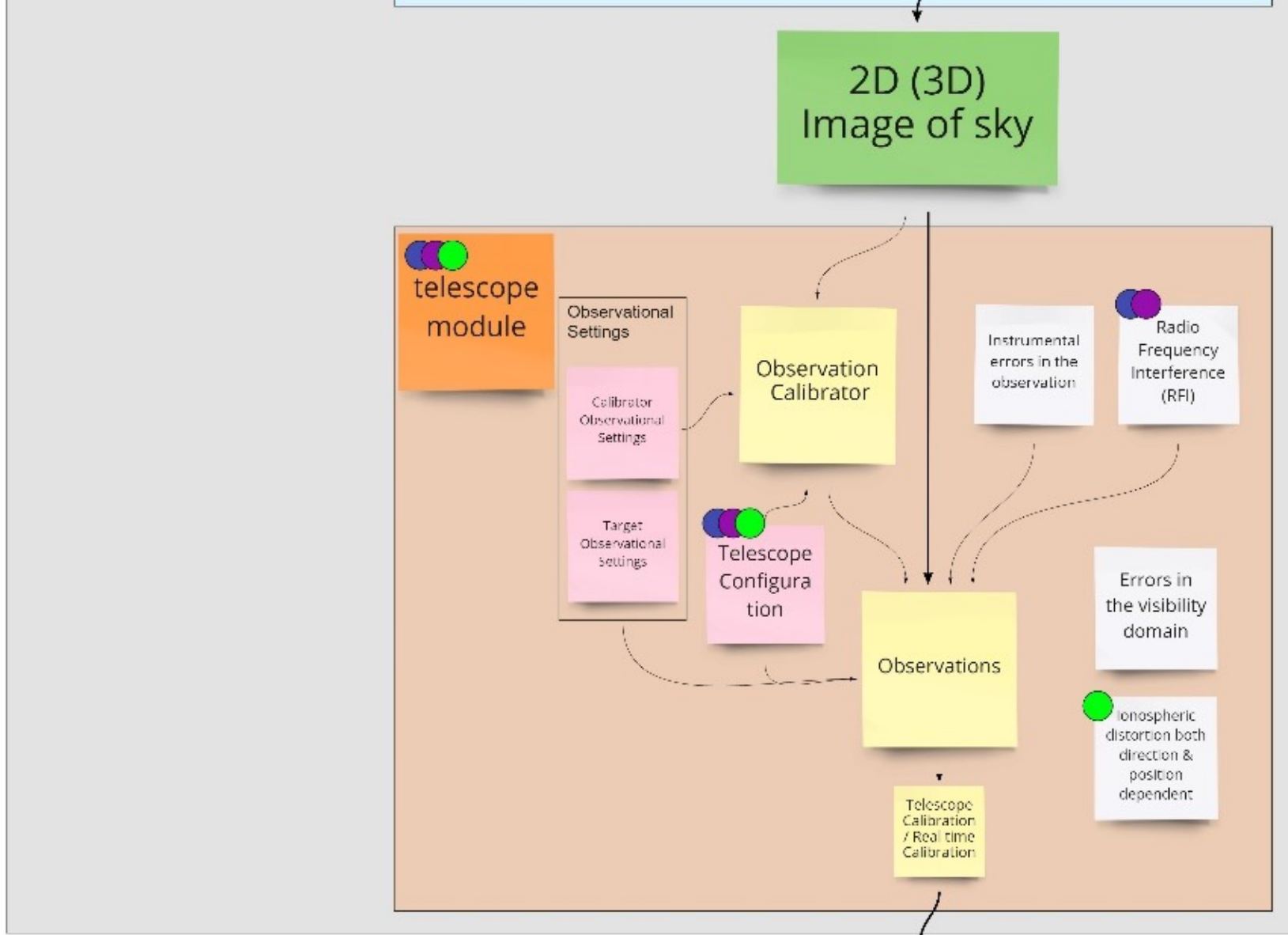
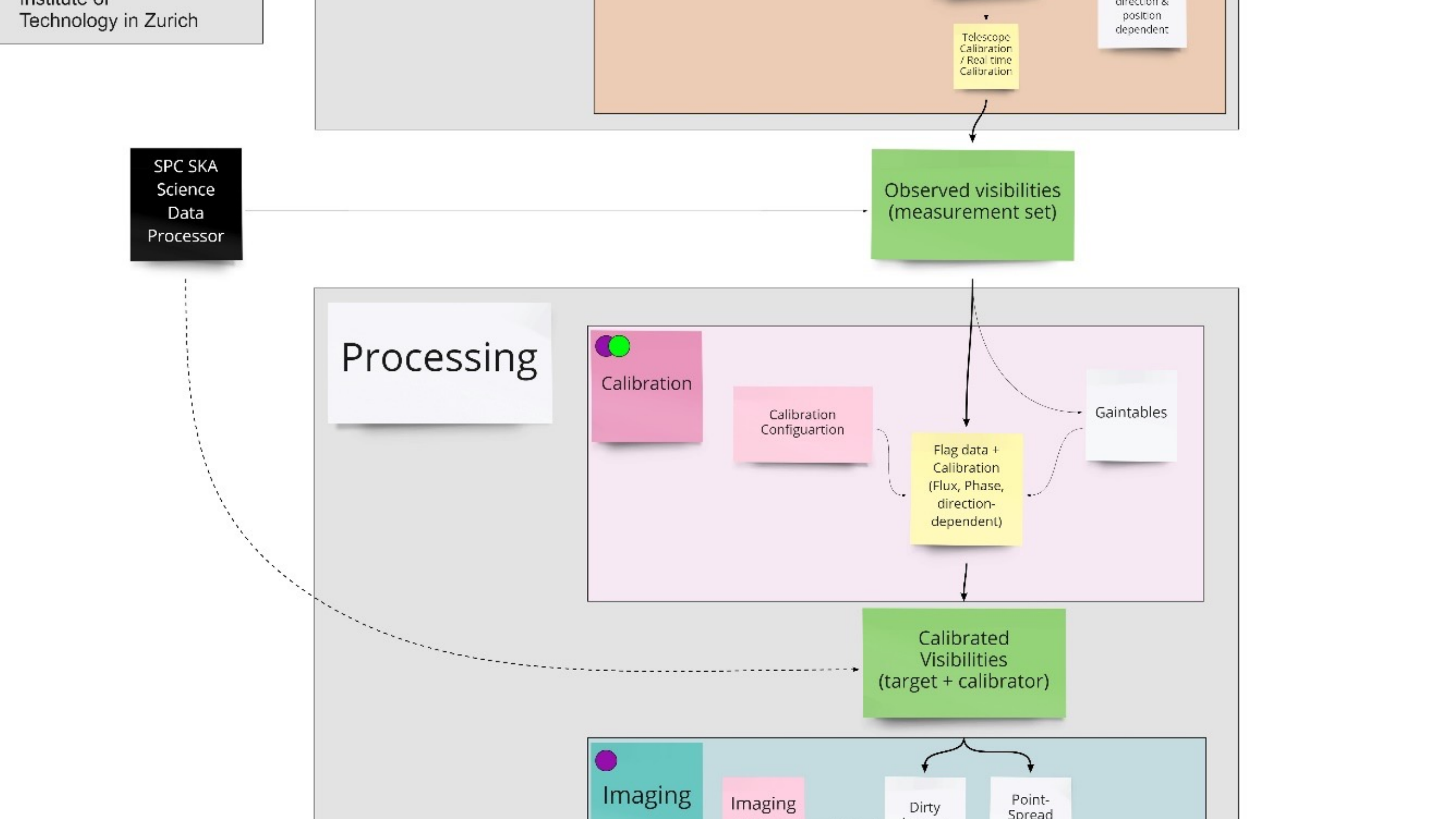
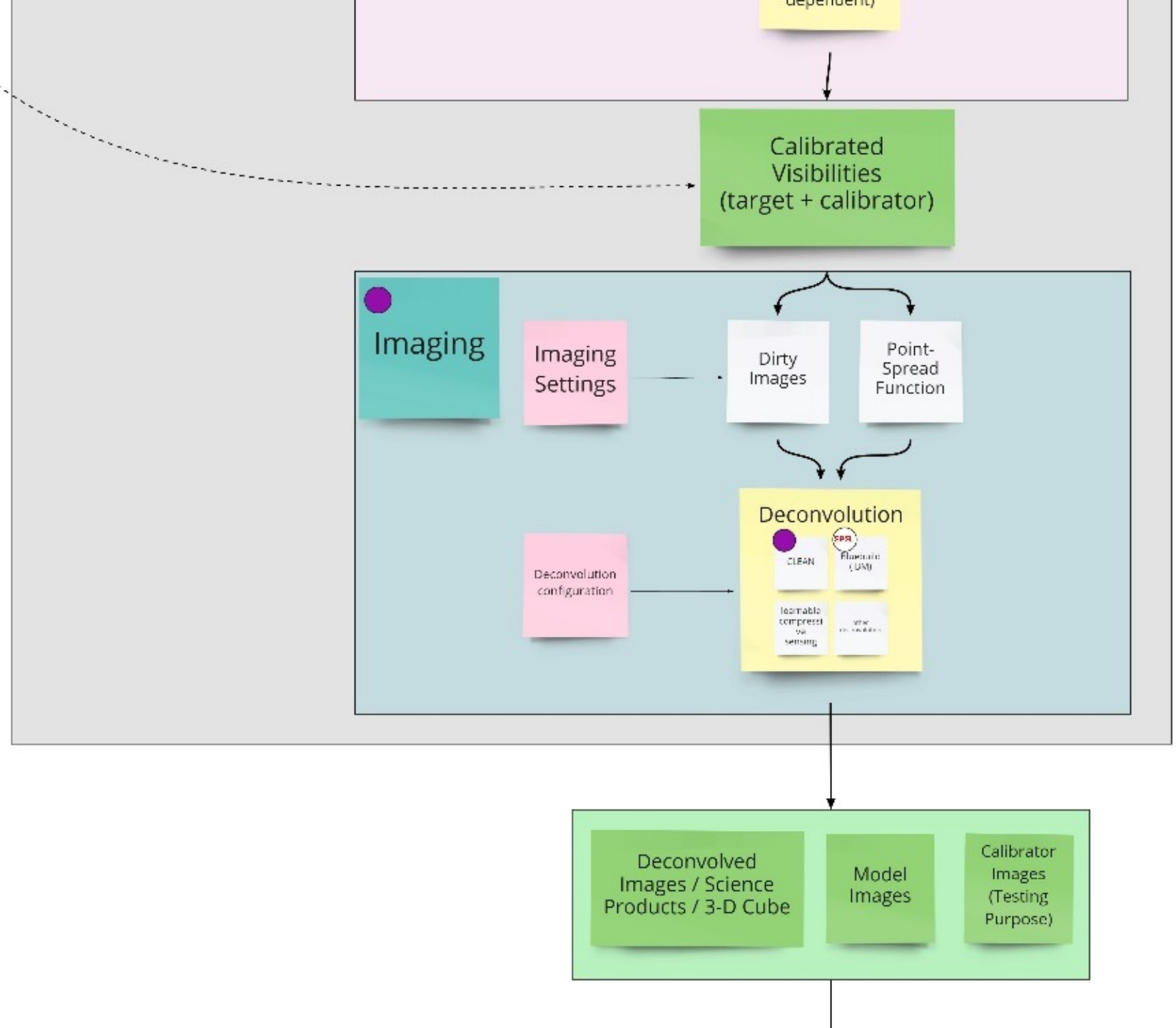


SPC SKA Science Data Processor

Observed visibilities (measurement set)


Institute of
Technology in Zurich
Telescope
Calibration
/ Real time
Calibration
direction &
position
dependent
SPC SKA
Science
Data
Processor
Observed visibilities
(measurement set)
Processing
Calibration
Calibration
Configuartion
Flag data +
Calibration
(Flux, Phase,
direction-
dependent)
Gaintables
Calibrated
Visibilities
(target + calibrator)
Imaging
Imaging
Dirty
Point-
Spread


Calibrated Visibilities (target + calibrator)
Imaging
Imaging Settings
Dirty Images
Point-Spread Function
Deconvolution
Deconvolution configuration
CLEAN
Deconvolved Images / Science Products / 3-D Cube
Model Images
Calibrator Images (Testing Purpose)

Deconvolved Images / Science Products / 3-D Cube

Model Images

Calibrator Images (Testing Purpose)

Analysis and Comparison

Compare and Analyse

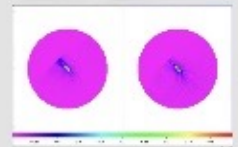
analysis configurations

performance metrics

plots

How to interface/ present to user?

Different Science Cases



We provide pre-defined workflows

Anyone can replace individual parts

Goals of the SKA Digital Twin Pipeline

- Simulation of the sky, instrument, processing and analysis
- To be used by other teams
  - Ease of use
  - Fast ramp up
  - Common benchmarks
- Flexible Building Blocks which can be connected, used stand-alone or replaced

Runtime Environments

Locally
Jupyter Notebooks
…

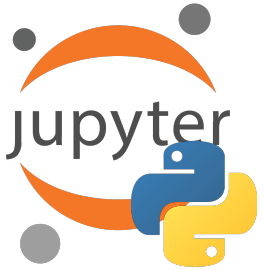
Containers

HPC Environments

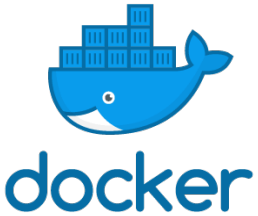
Current State

Embryonic Pipeline built with standard software.

- OxfordSKA/OSKAR - A GPU-Accelerated simulator for the SKA
- RASCIL – Radio Astronomy Simulation, Calibration and Imaging Library



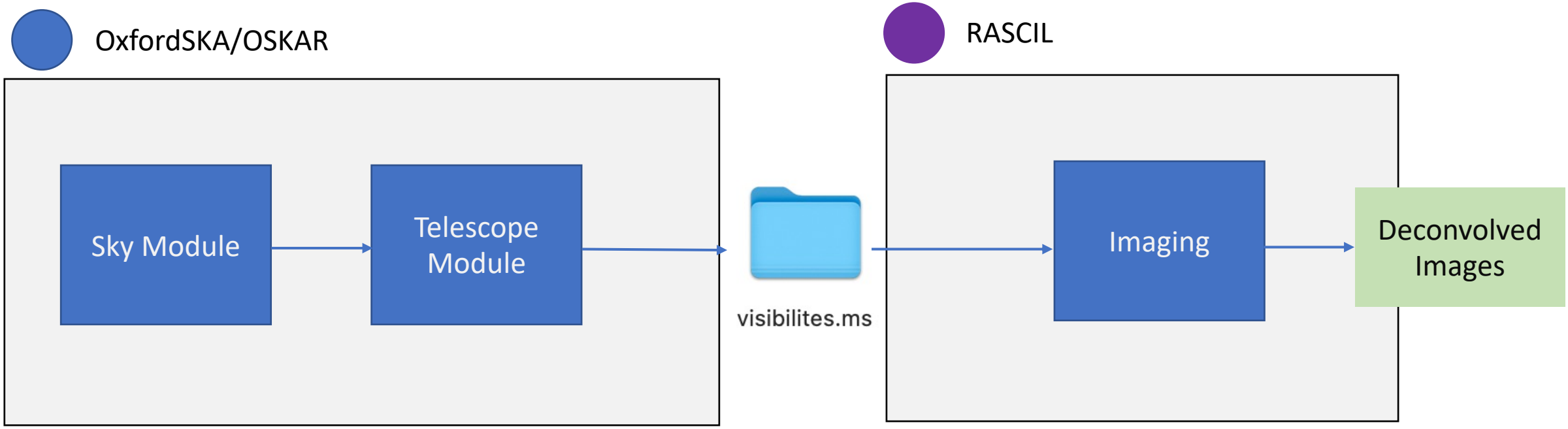
Jupyter notebook as Python interface for user interaction



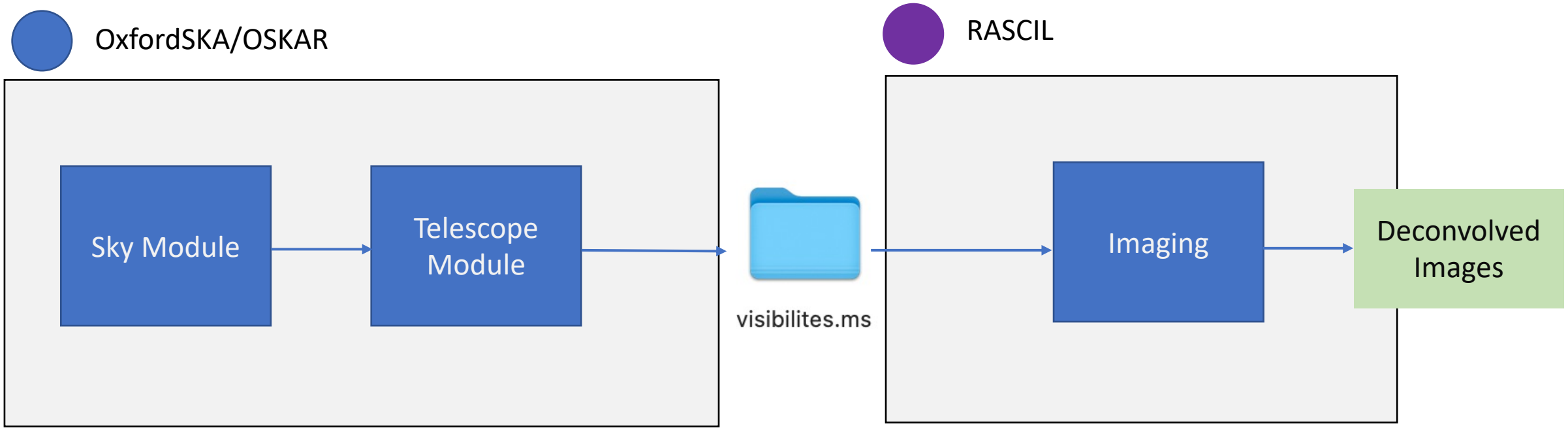
Ready-built docker images with jupyter environments and pipeline to get started fast.

Current State

Embryonic Pipeline built with standard software.



Current State



- Synthetic point sources
- Telescope array configuration
- Configurable observational settings
- GPU accelaration

- Distributed MM CLEAN
- Distributed Processing with Dask

Roadmap

2021

Easy and reliable Deployment

Workload: End-to-end Source Extraction

2022 onwards

Improved Scalability

More Workloads

- Imaging Algorithms (“Bluebild”, “Innovative Imaging Algorithms”, ...)
- Intensity Mapping
- Your workload?

https://fhnw.zoom.us/j/8419498036
Every Friday
SKA: 13:00-14:00
Digital Twin: 14:15-15:00

http://github.com/i4ds/ska
Code

https://swissska.slack.com/
Chat in #digital-twin

https://swiss-ska.fhnw.ch/index.php/s/bJWAfTYyoJg3AGx
Files & Documentation

Report Issues

Request Features

Get Support

Contribute Code