SKACH
Data Science & Simulations
Program Overview

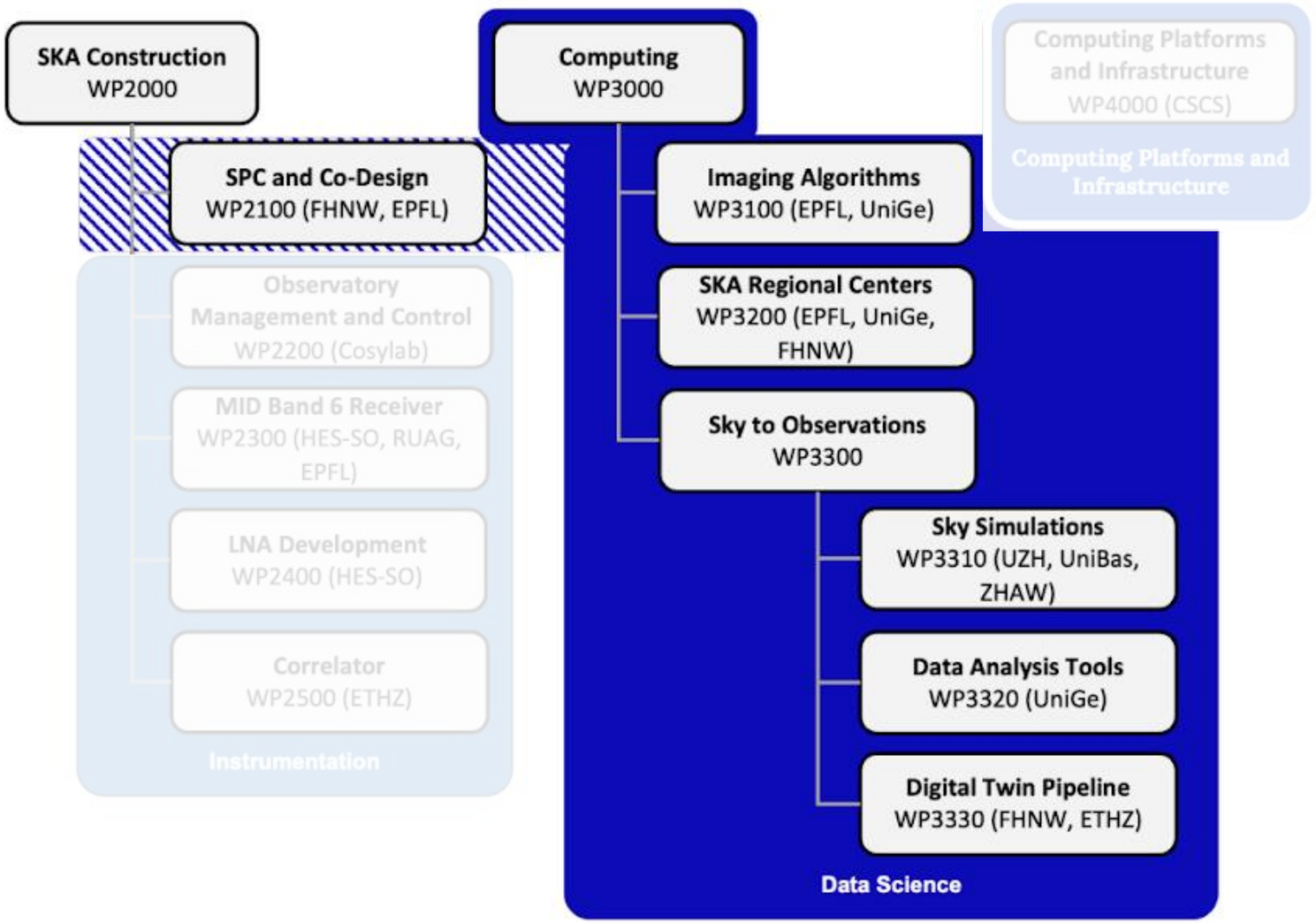
Emma Tolley and Simon Felix

2022-10-03

Symmetry Magazine / Ana Kova

The Data Science & Simulations Program

- Covers SERI work on data science, imaging, visualization, computing, simulation, and services development
- The role of the program: **reporting and communication**
- Chairs will also help with grant writing, create portal with information for newcomers to get involved



Working Groups

WP2100: SPC and Co-design (EPFL, FHNW)

Participation in **SKAO SCOOP** team for co-design and benchmarking activities for the SKA SDP (Stefano C. & Manuel S.)

WP3100: Imaging algorithms (EPFL, UniGe)

Scientific visualization (Florian C.)

Development of computational imaging software framework (Matthieu S., Joan Q.)

Deployment of innovative data analysis tools (Erica L.)

WP3200: SKA Regional Centers (EPFL, UniGe, FHNW)

Development of tools and technologies for SRCs, participation in working groups and prototyping teams

WP3310: Sky Simulations (UZH, UniBA, ZHAW)

Hydrodynamical simulation development (Darren R, Lukas S.)

Development of mock data and observations (ZHAW)

WP3320: Data Analysis Tools (UniGe)

Implementation of innovative data analysis tools (Erica L.)

WP3330: Digital Twin Pipeline (FHNW, ETHZ)

Development of digital twin pipeline (contact: Simon F.)

WP2100: SPC and Co-design

Stefano Corda @ EPFL (contact)
Manuel Stutz @ FHNW

- Participation in **SKAO SCOOP** (previously part of PlaNet) team
  - Co-design and benchmarking activities for the SKA SDP
  - See Stefano's talk today for more details

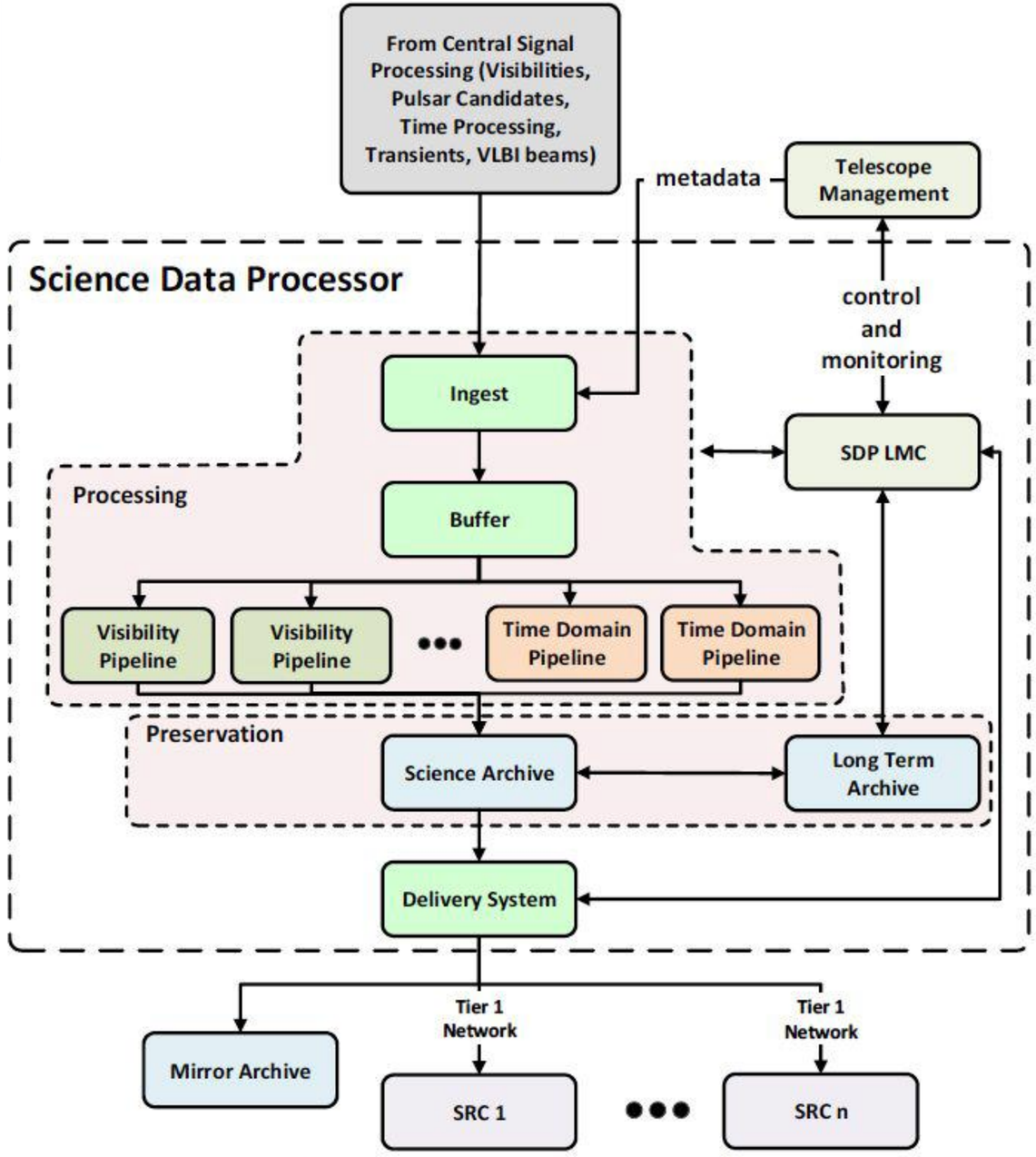


Figure 1-16: SDP data-flow, architecture and functions.

WP3200: SKA Regional Centers

Arpan Das & Pablo Llopis @ EPFL
Rohit Sharma @ FHNW
Marc Audard @ UniGe

- Participation in SRC prototyping teams (Arpan, Pablo, Rohit)
- Development of new tools for proto-SRCs (Arpan)
  - Development of new data formats for easy GPU analysis
- Science user engagement (Marc)

SRC prototyping teams

“Tangerine team” => development of science platform (how users interact with the data)

Orange team => development of visualization services

“Olive team” => testing & developing HPC, cloud computing services for SRCs

Coral team => deployment and benchmarking of tools and services

WP3100: Imaging algorithms

Scientific visualization of cosmological simulations
Florain Cabot @ EPFL, starting Sept 2022

Implementation & deployment of the learnable compressive sensing algorithm and synthetic data generation. Erica L. @ UniGe

Development of computational imaging software framework. Matthieu Simeoni (contact) & Joan R. Queralt @ EPFL

WP3310: Sky Simulations (UZH, UniBA, ZHAW)

WP3320: Data Analysis Tools (UniGe)

WP3100: Imaging algorithms

Development of computational imaging software framework. Matthieu Simeoni (contact) & Joan R. Queralt @ EPFL

- Imaging in radioastronomy is an ill-posed inverse problem
  - Signals recorded by different antennas ‘sample’ the image of the sky
  - Need to invert this sampling function to obtain the sky image from the antenna signals
- For more details see Joan’s talk for the April 7 weekly meeting

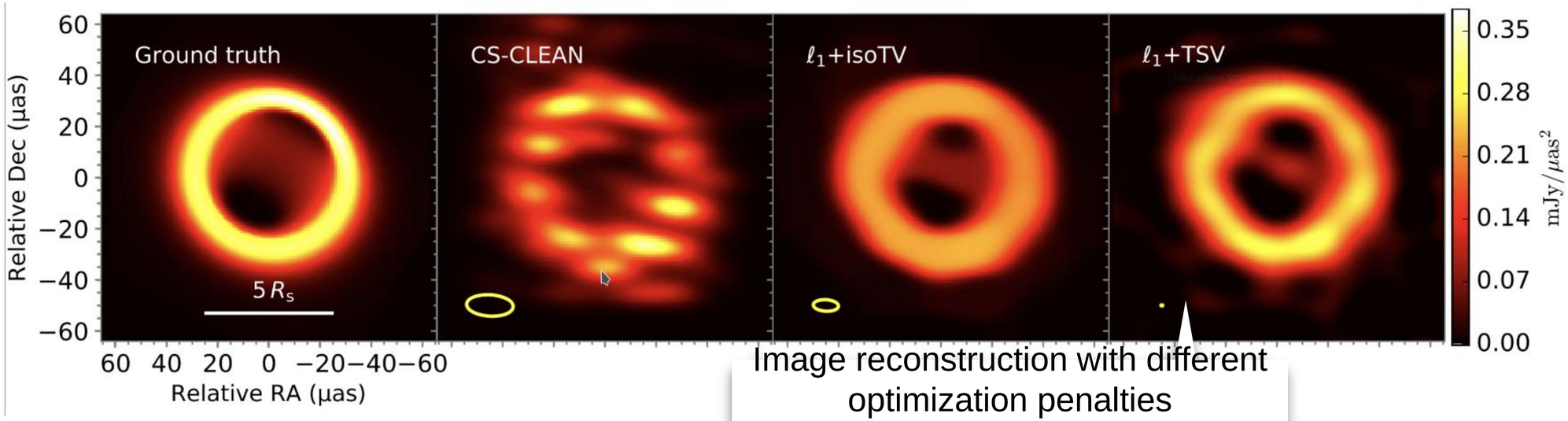


Image reconstruction with different optimization penalties

WP3310: Sky Simulations (UZH, UniBA, ZHAW)

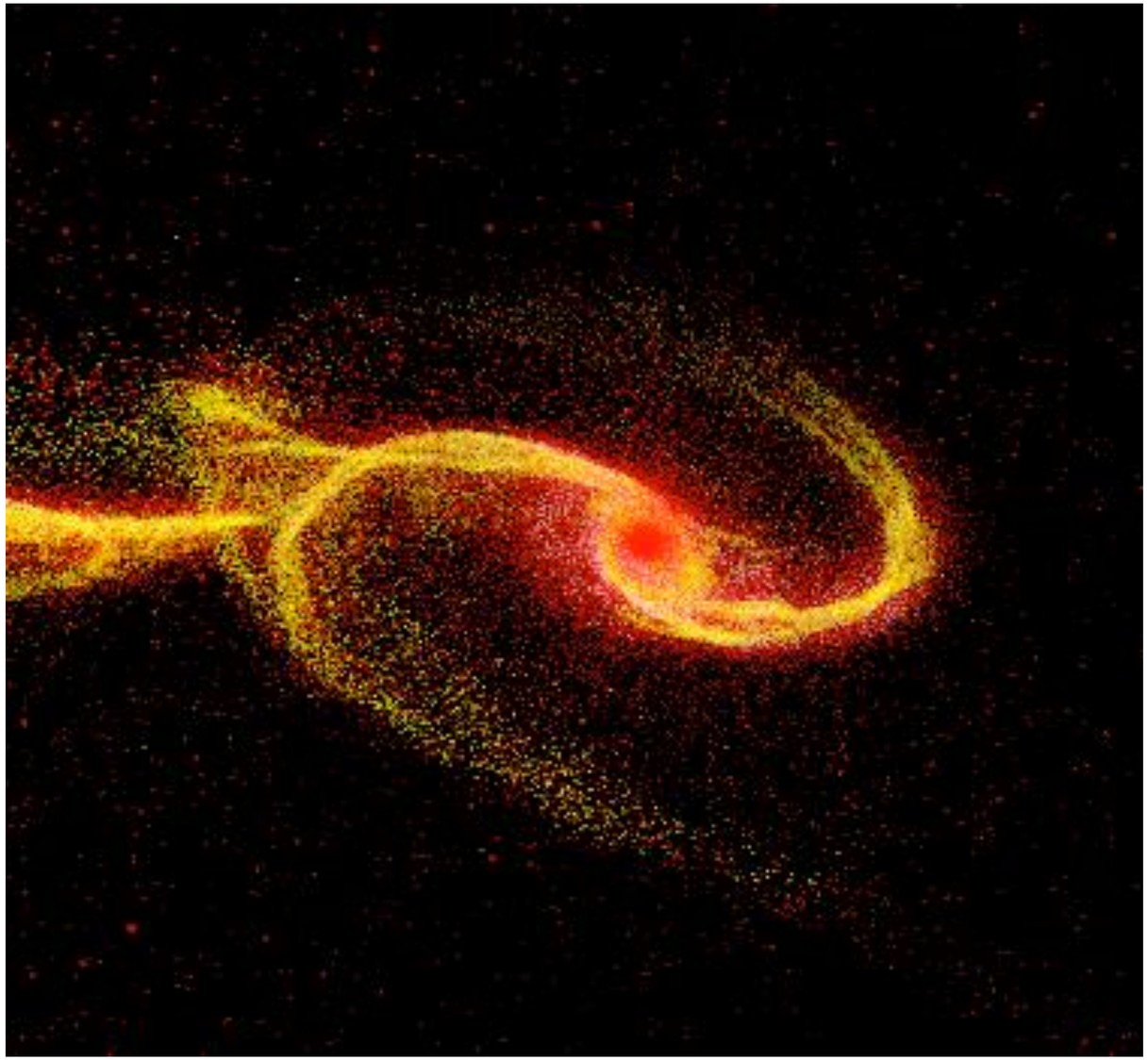
Contact: Darren Reed

Hydrodynamical simulation development
(Darren R, Lukas S.)

Development of mock data and observations
(currently hiring @ ZHAW)

Scientific visualization of cosmological simulations.
Florian Cabot @ EPFL, starting Sept 2022

- Goal is to develop scalable smoothed-particle hydrodynamics (SPH) framework for **trillion particle galaxy formation** simulations
  - Needs to operate at exascale
  - Includes SPH, gravity, and radiation
- For more details see various simulation group updates in weekly meeting, at Swiss SKA kickoff, etc

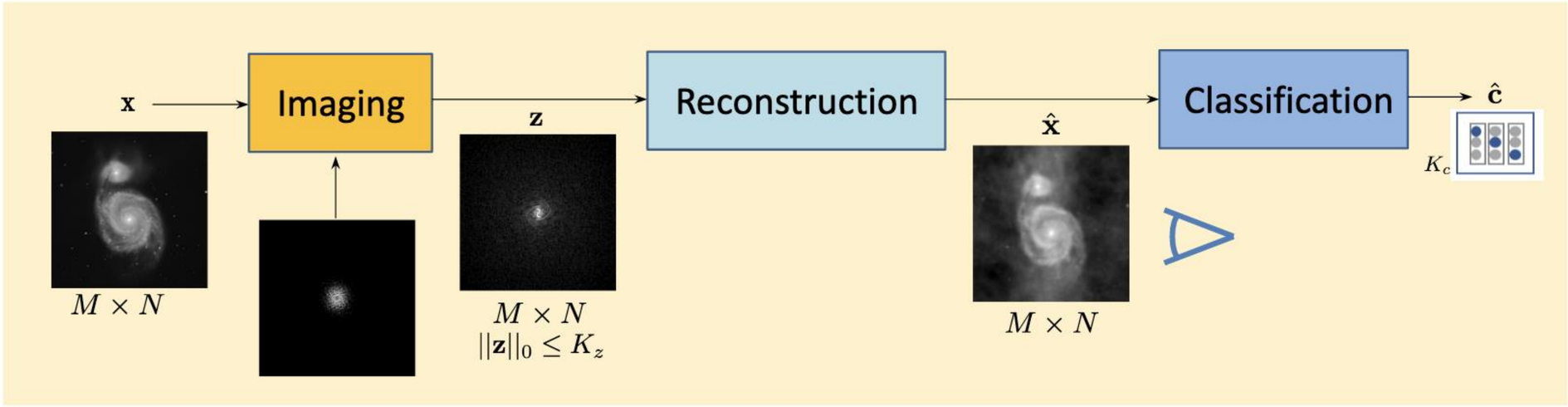


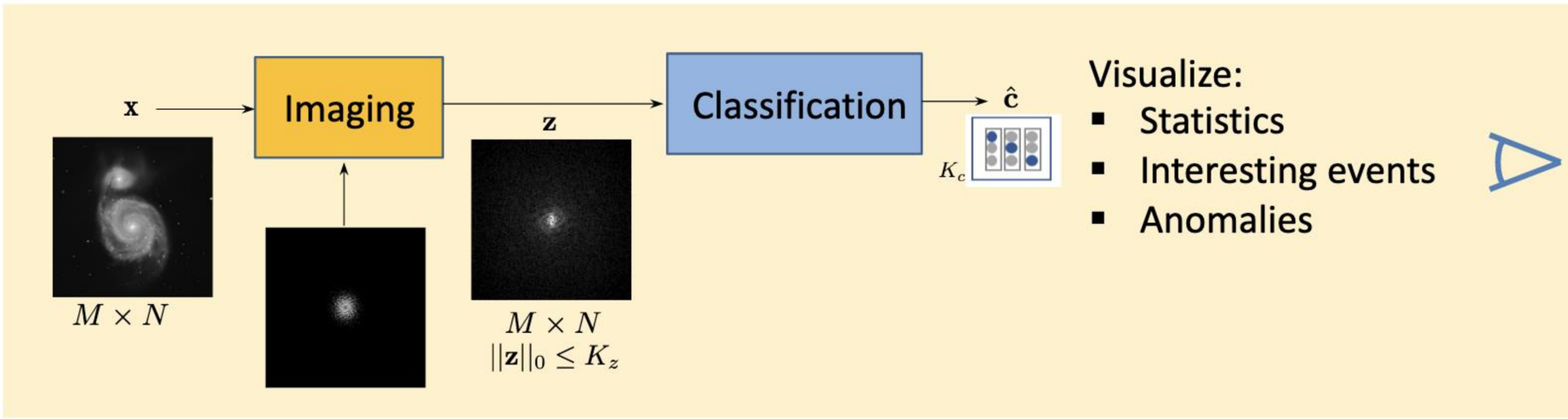
WP3320: Data Analysis Tools

Erica @ UniGe

Implementation & deployment of the learnable compressive sensing algorithm and synthetic data generation

For more details see [Slava's slides from the Swiss SKA Days 2021]





WP3330: Digital Twin Pipeline

Contact: Simon Felix

Development of digital twin pipeline (contact: Simon F.)

Astrosignals: simulation development

Sky Simulations

PASC SPH-EXA

High-resolution simulations

Digital Twin Pipeline

Mock observations

Data Analysis Tools

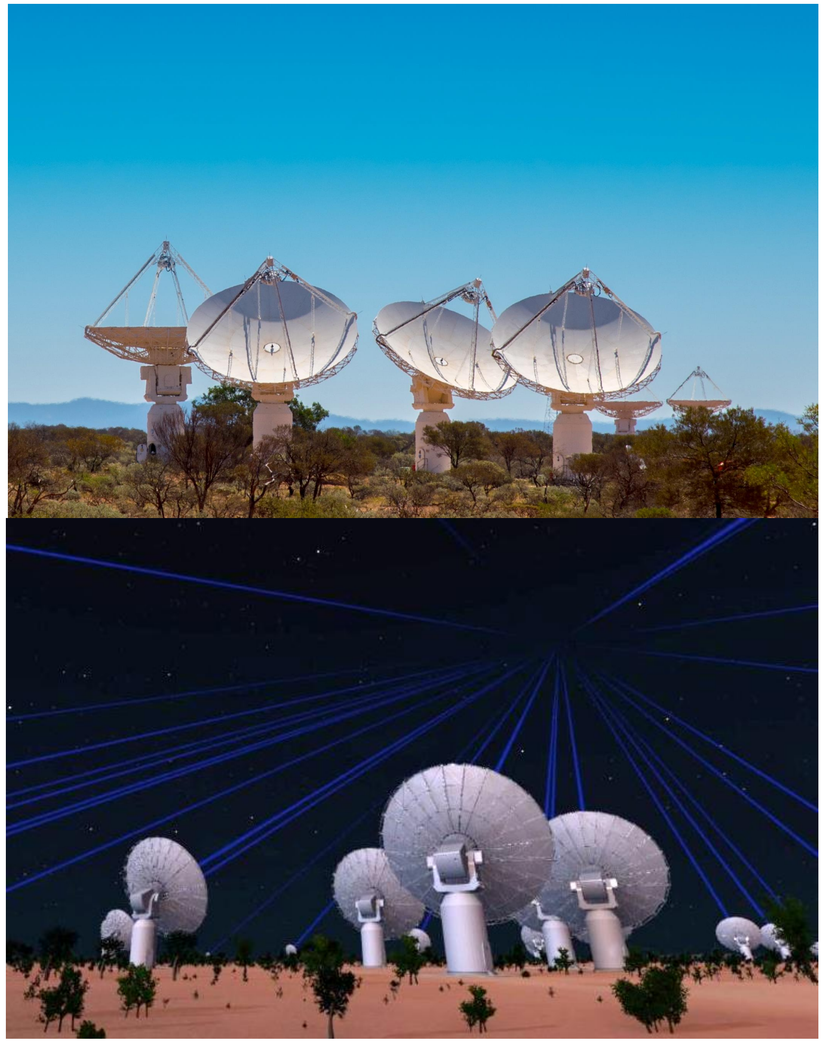
PASC Bluebild

Computational imaging

Use cases

Astrosignals

Scientific analysis



Monthly or biweekly ‘Forum’ meetings

Simulation development

Scientific visualization (Florian C.)

Visualization for SRCs (Arpan D)

CSCS Vis Team (Jean F.)

Sky Simulations (UZH, UniBA, ZHAW)

Development of mock data and observations (ZHAW)

Hydrodynamical simulation development (Darren R, Lukas S.)

PASC SPH-EXA

Astrosignals

Simulation development

SKA Regional Centers

Swiss SRCSC Rep (Emma T.)

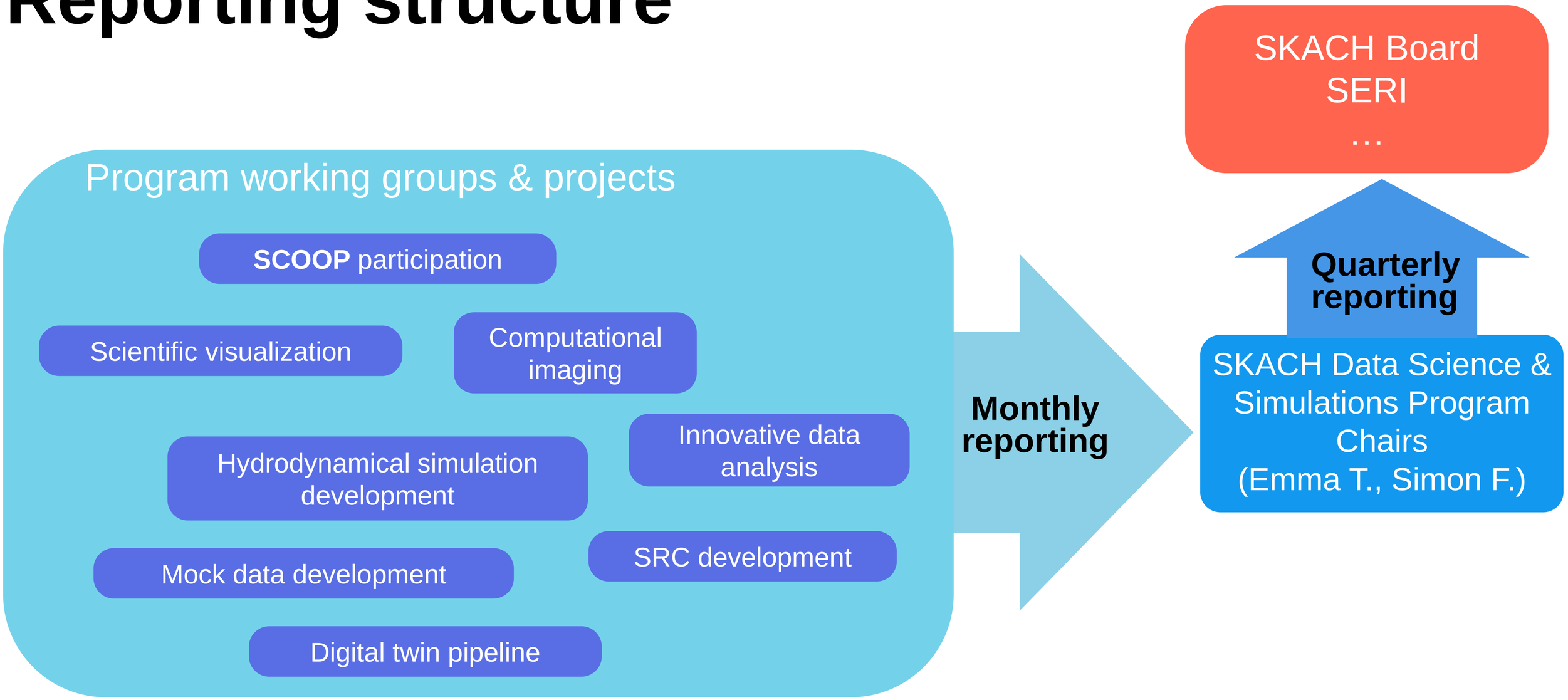
SKA Regional Centers (EPFL, UniGe, FHNW)

Development of tools and technologies for SRCs, participation in working groups and prototyping teams

WP4000: Computing Platforms & infrastructure (CSCS)

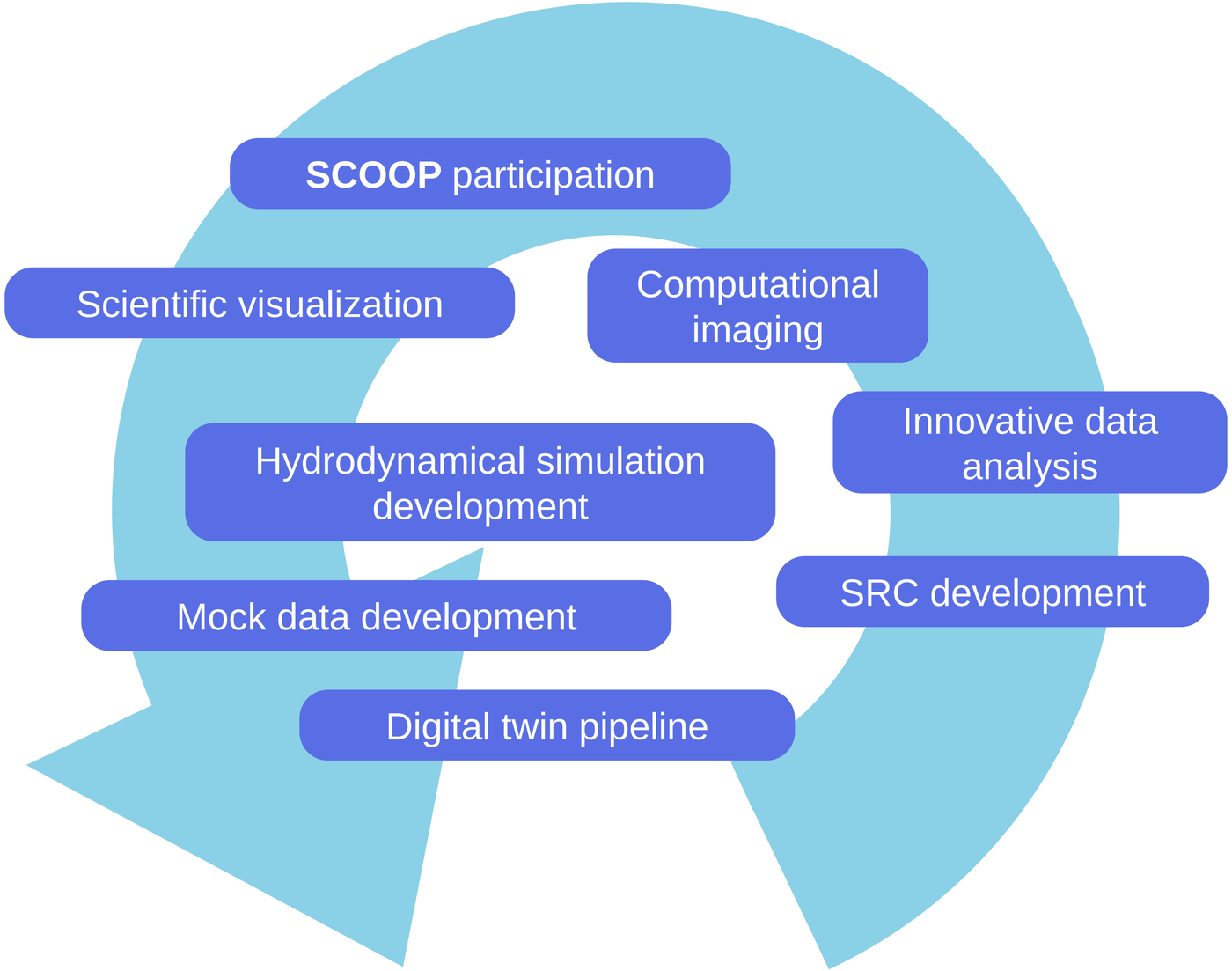
Development of Swiss proto-SRC and participation in SRC prototyping teams

Reporting structure



Biweekly Program meetings

- Dedicated updates from different projects (similar to Friday meetings)



Questions or comments?