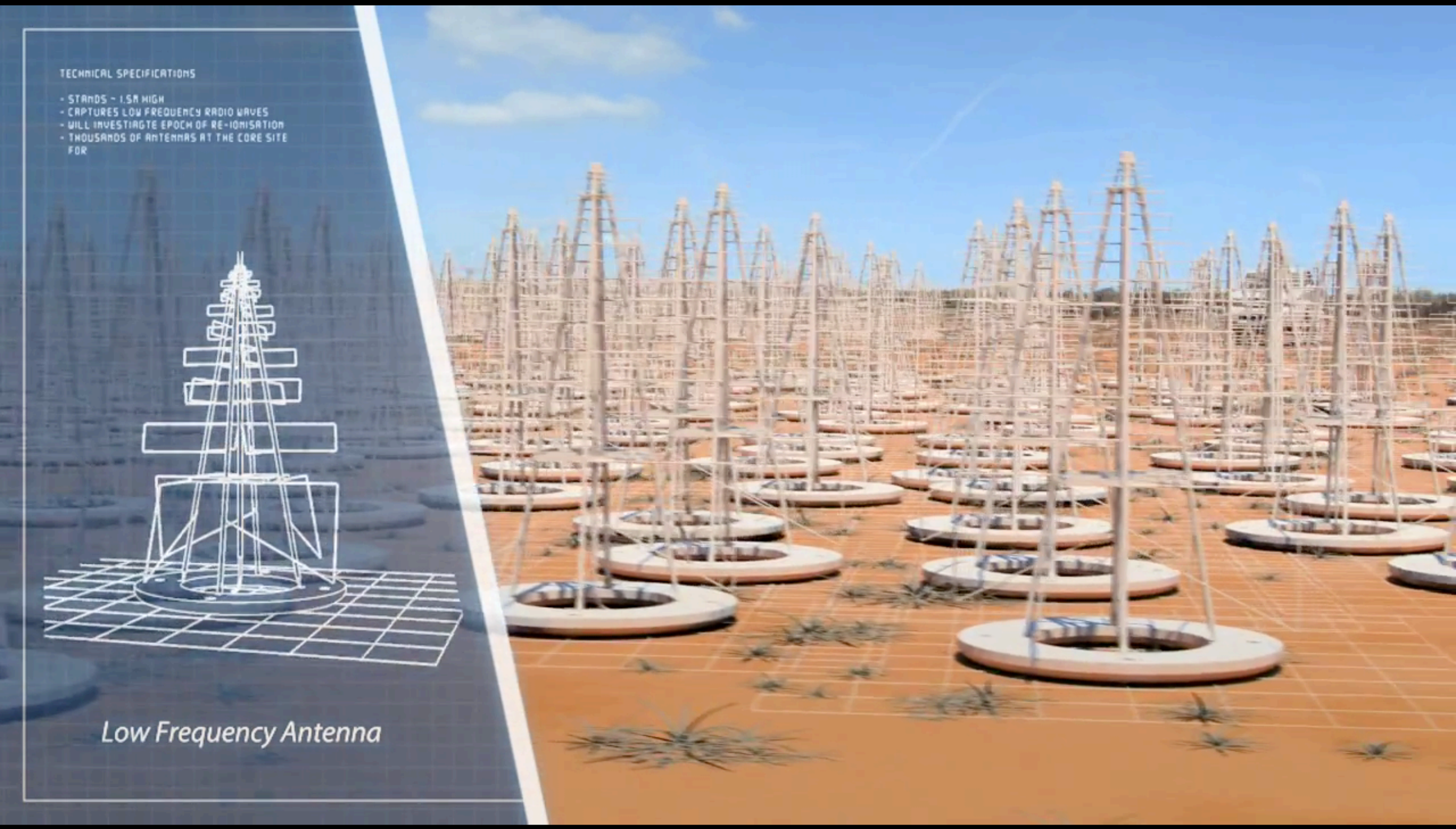
SKA & AENEAS

Anna Scaife
Jodrell Bank Centre for Astrophysics
University of Manchester

ONE OBSERVATORY

TWO TELESCOPES

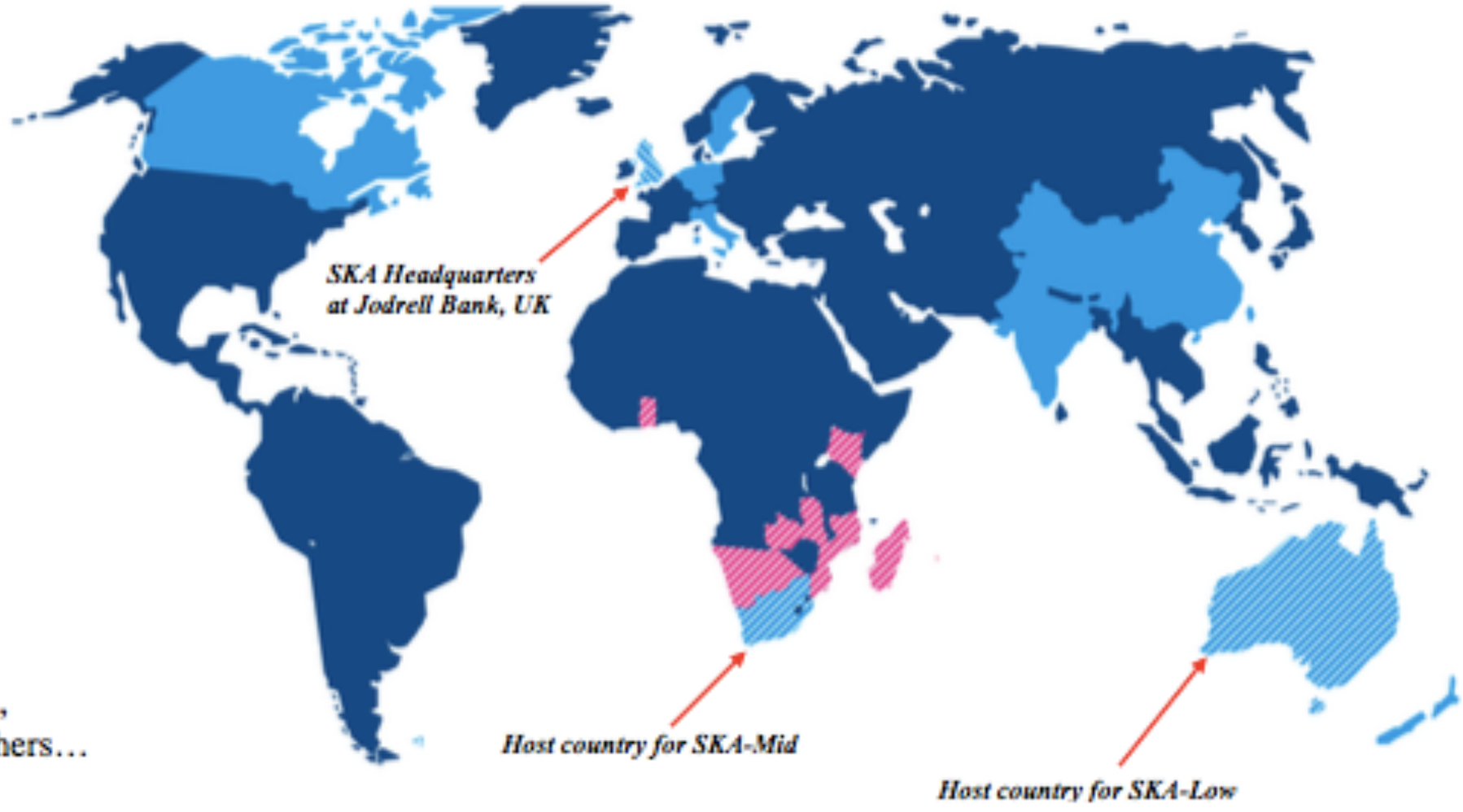
THREE LOCATIONS

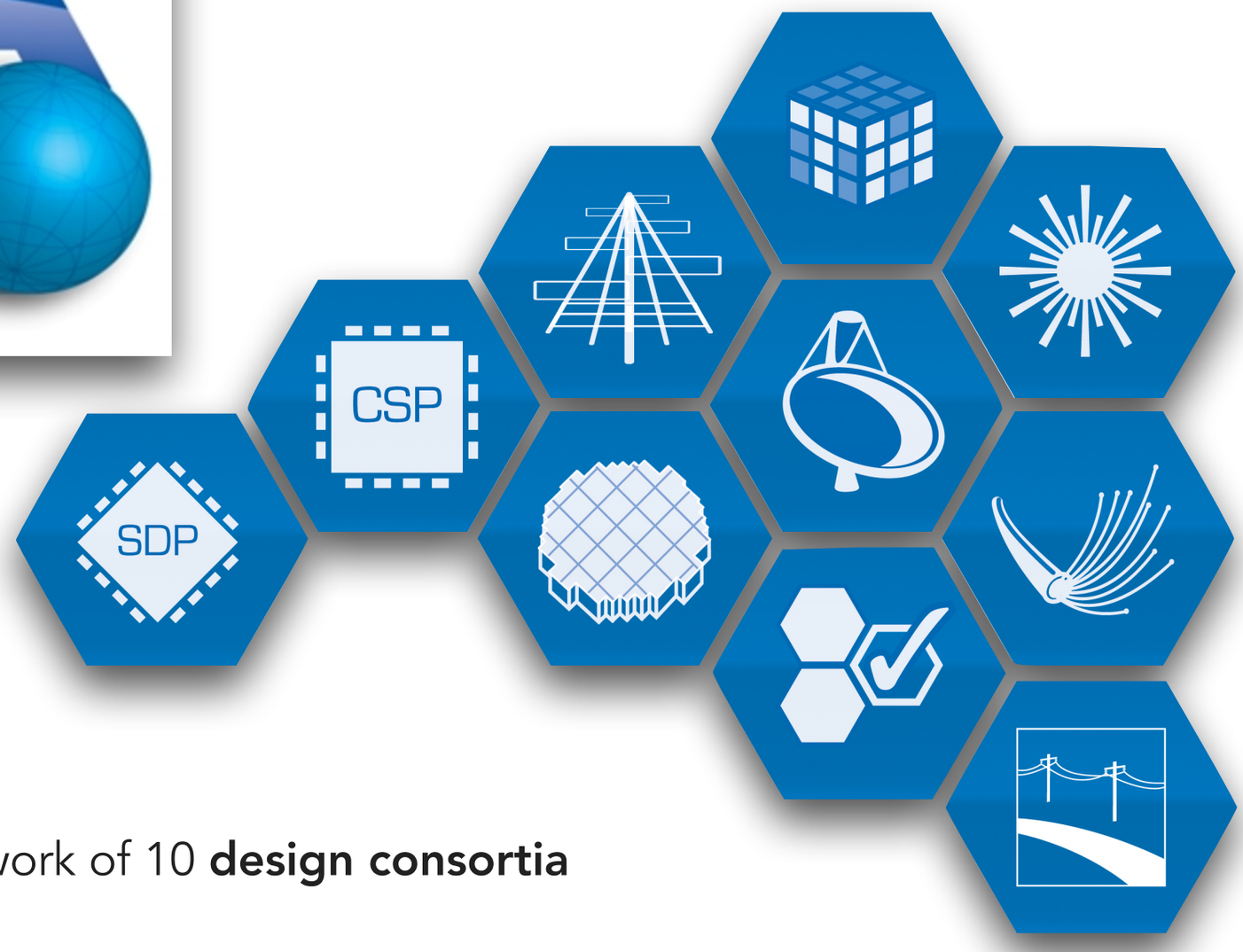

TECHNICAL SPECIFICATIONS
- STANDS ~ 1.5M HIGH
- CAPTURES LOW FREQUENCY RADIO WAVES
- WILL INVESTIGTE EPOCH OF RE-IONISATION
- THOUSANDS OF ANTENNAS AT THE CORE SITE FOR
Low Frequency Antenna

The Square Kilometre Array

- Australia
- Canada
- China
- India
- Italy
- Netherlands
- New Zealand
- South Africa
- Sweden
- UK

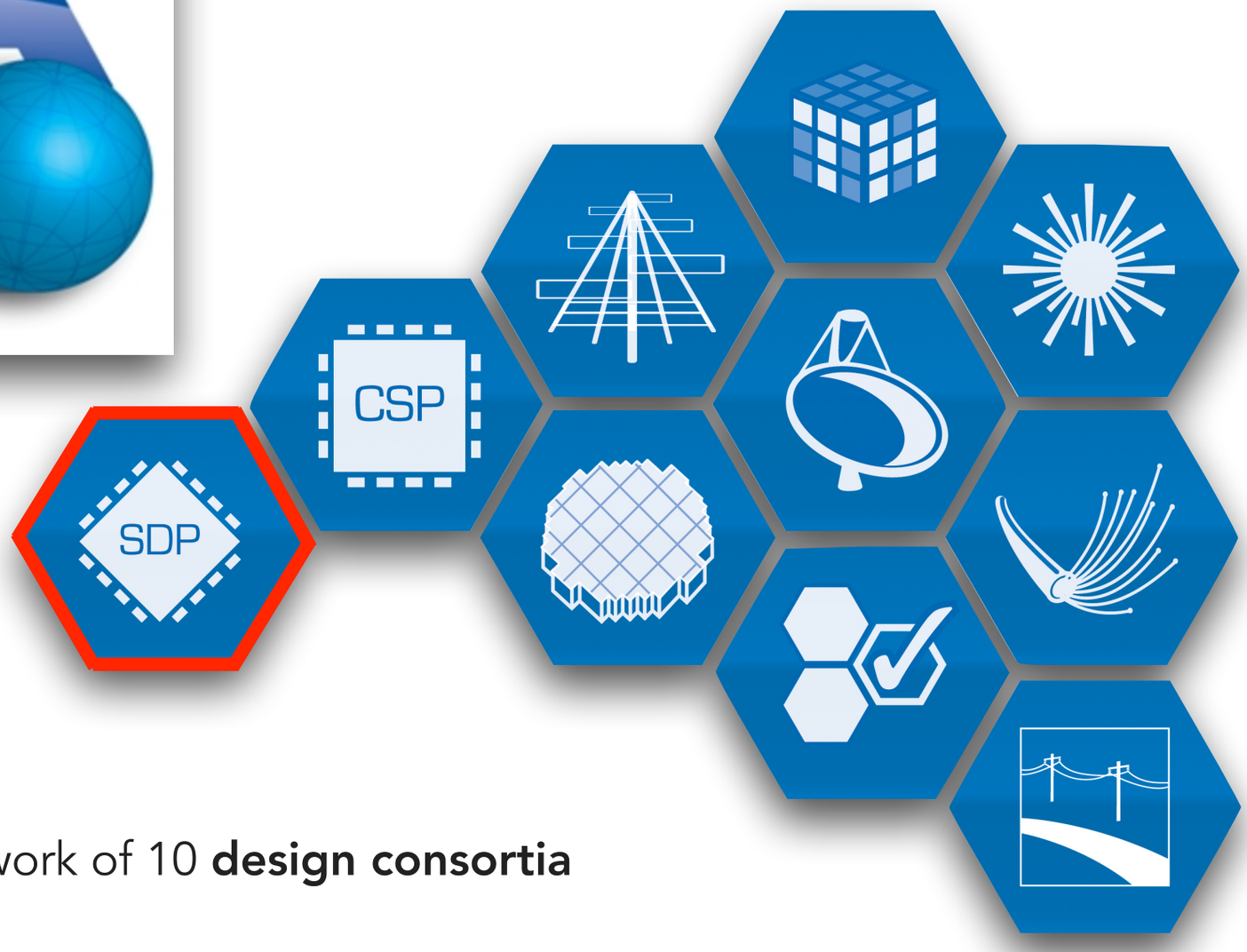
Potential new members: Spain, Portugal, Germany, France, others…





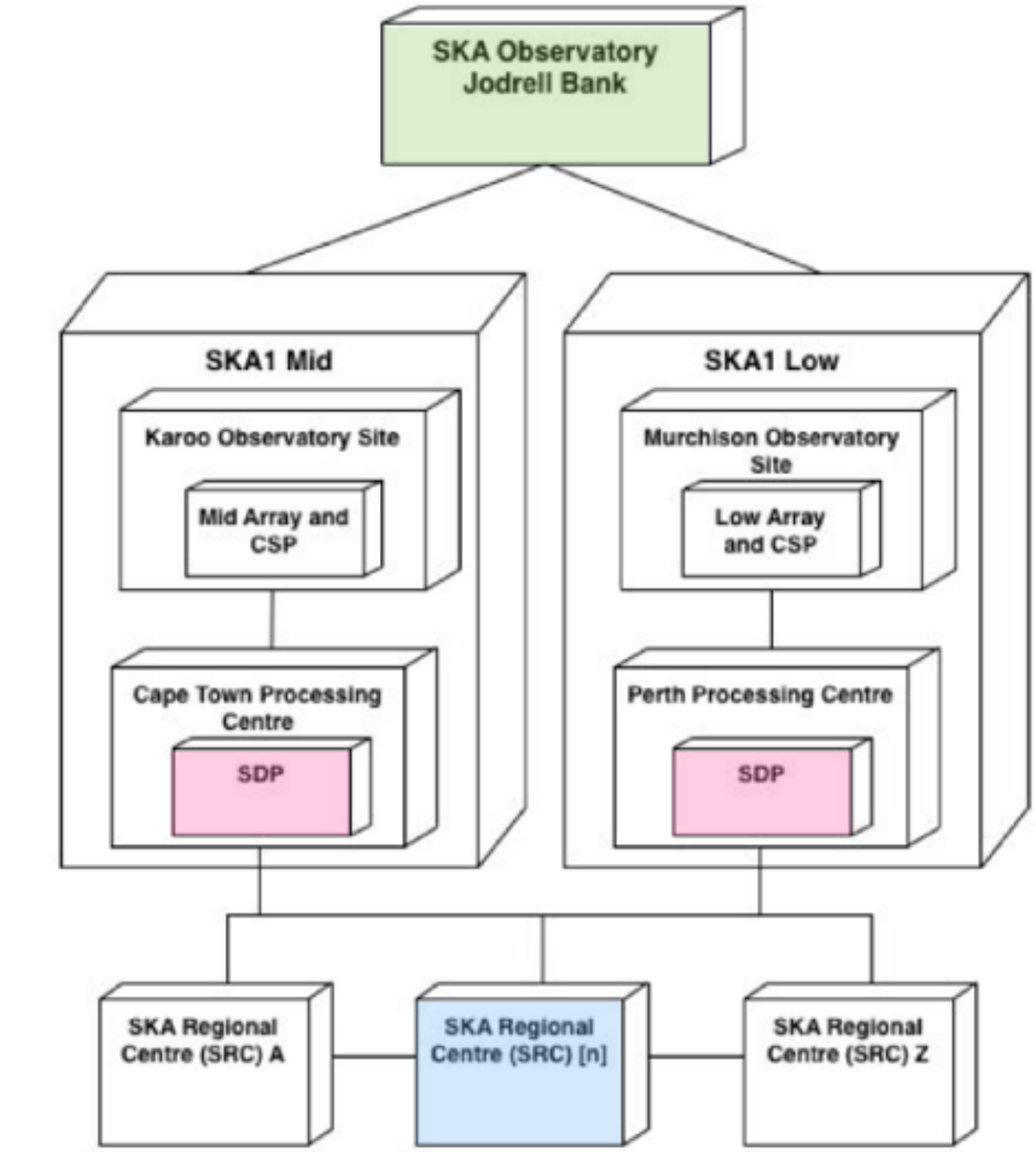
The SKAO oversees the work of 10 **design consortia**

SQUARE KILOMETRE ARRAY



Produces the observatory data products

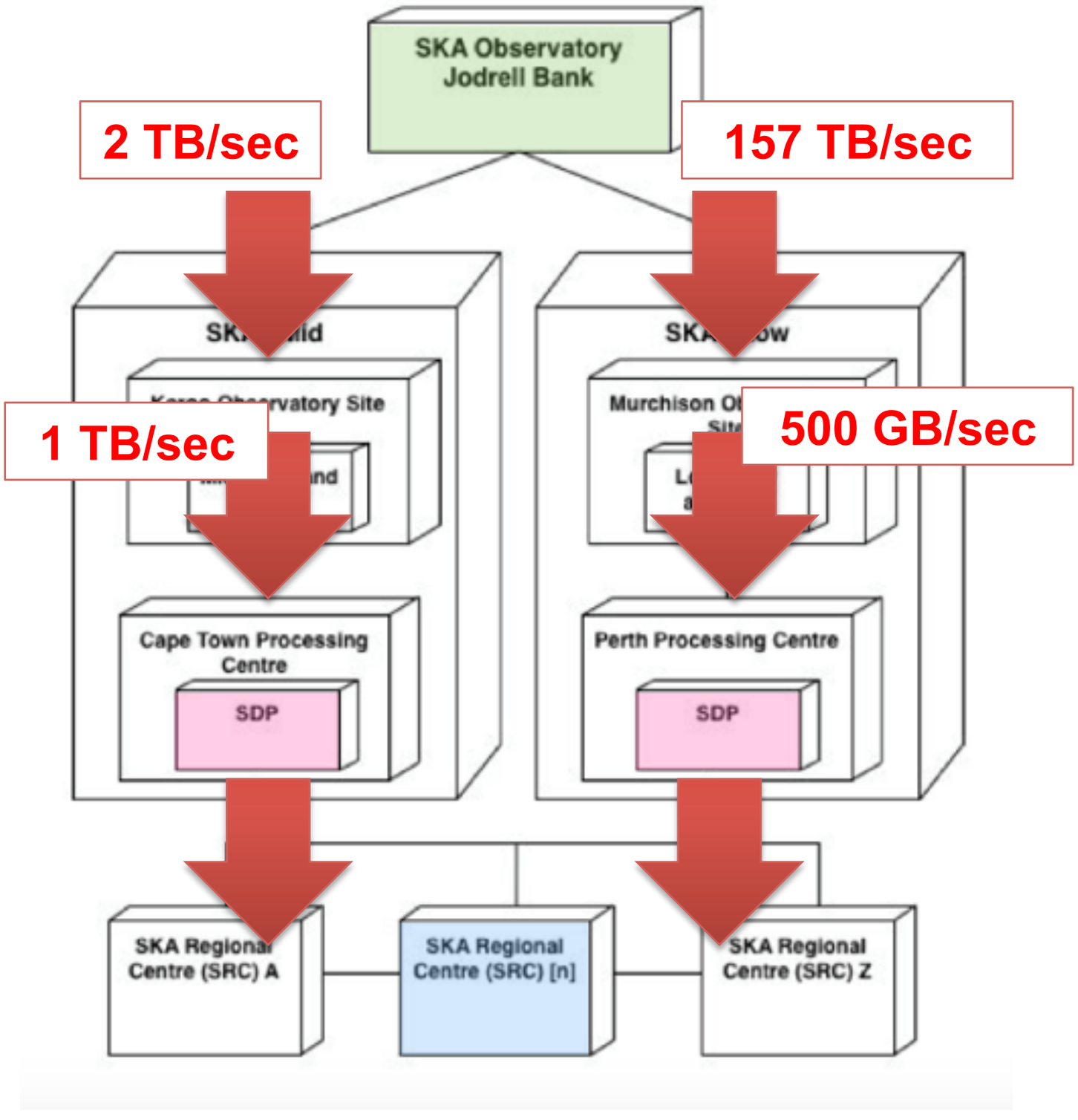
The SKAO oversees the work of 10 **design consortia**



CENTRAL SIGNAL PROCESSING

SCIENCE DATA PROCESSING

REGIONAL DATA CENTRE



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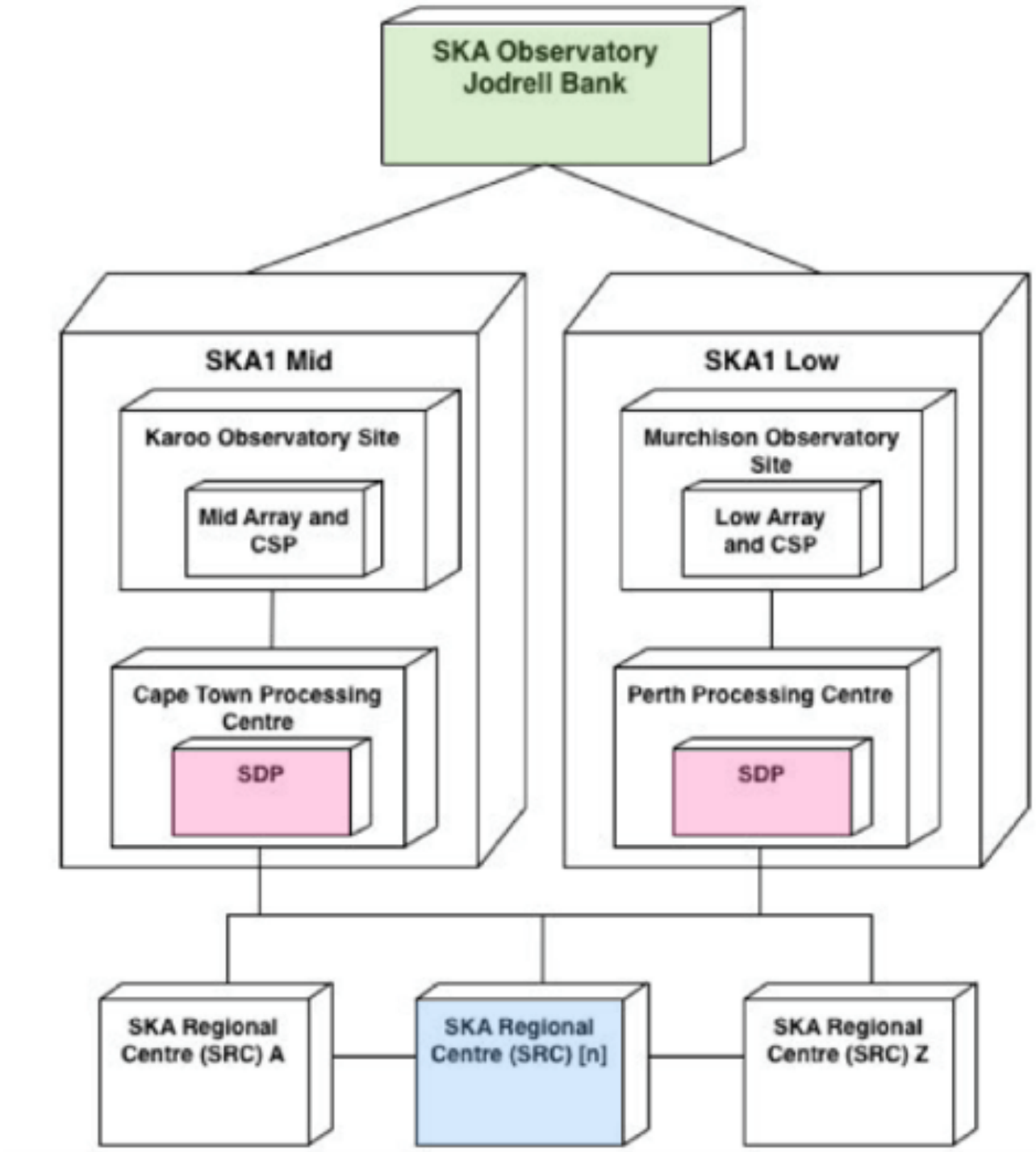

SQUARE KILOMETRE ARRAY

CENTRAL SIGNAL PROCESSOR

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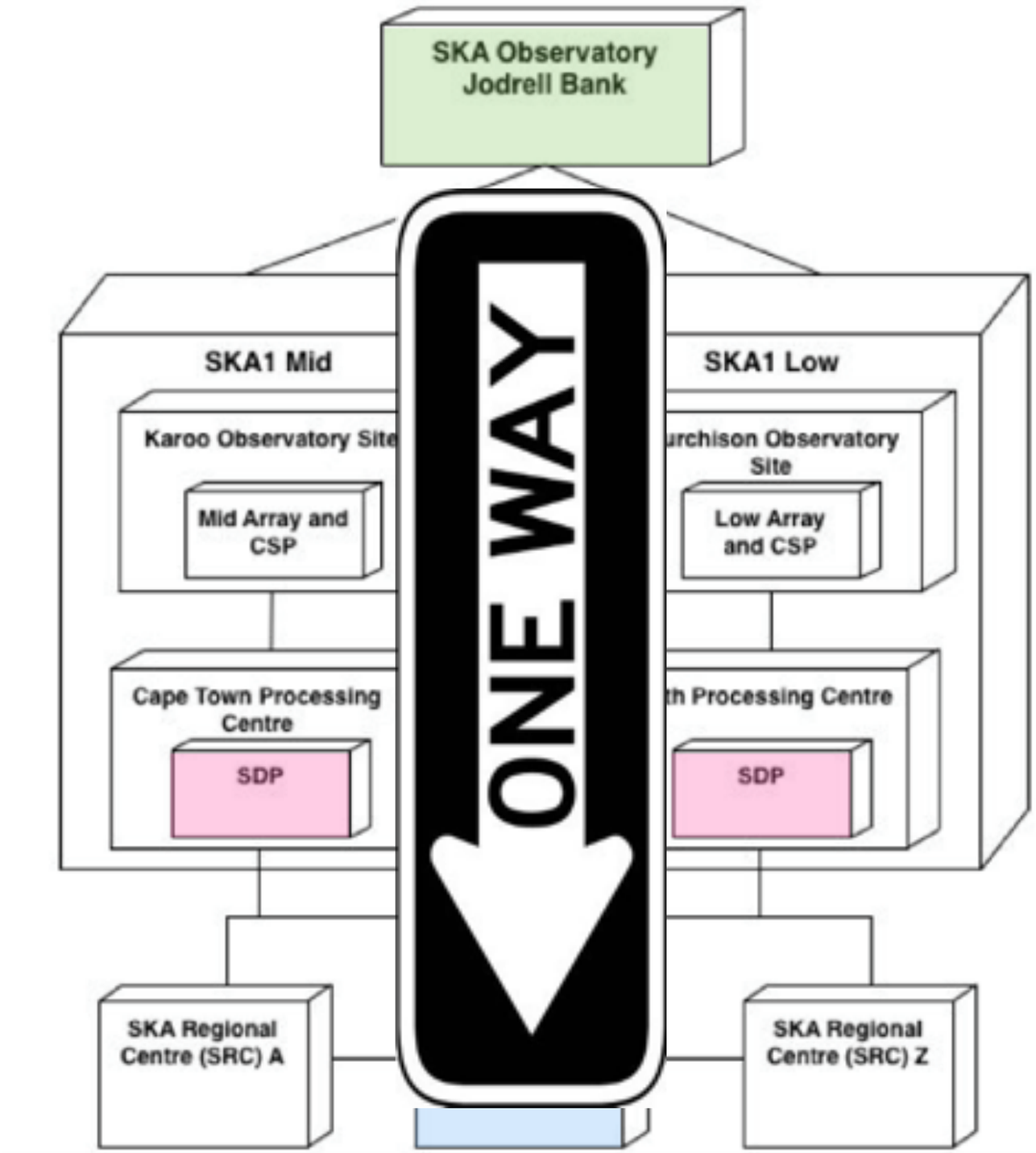


Standardized data products

A standard SKA1-MID image data product has
30k x 30k pixels

SKA1 will have up to **65k frequency channels**
and **4 polarisations**

At 4 Bytes per voxel that equates to
30k x 30k x 65k x 4 x 4
= **936 TeraBytes**

Advanced European Network of E-infrastructures
for Astronomy with the SKA AENEAS - 731016

Future SKA Science Archive

2017
2023

uploads to
facebook
180PB

searches on
Google
98PB

CERN
73PB

LOFAR
Long Term Archive
25PB

YouTube
15PB

SKA
Phase1 Science Archive
300PB

PER YEAR
- 1 Petabyte

Global Network of Centres

Where’s your
latest milestone?


Where’s your
latest milestone?

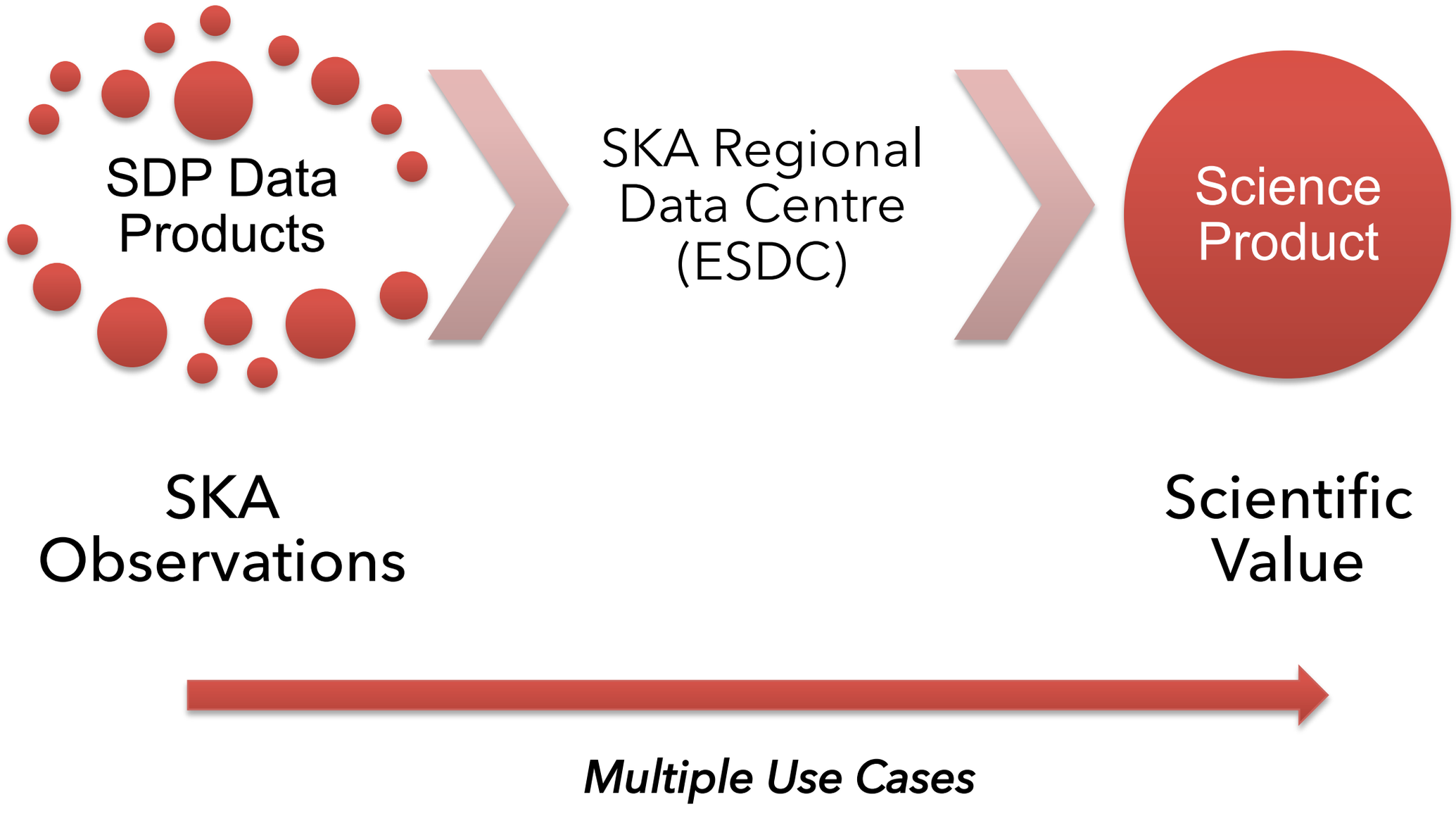
OBJECTIVES

- Develop a set of **design recommendations** for the ESDC pertinent to (1) data handling strategy, (2) scientific functionality and (3) software environment.

- Produce a **high level architectural design** for the ESDC with a **sizing** and **costing** estimate.

- Provide **supporting verification work**, including both theoretical analyses and direct prototyping of critical elements.

- Identify **gaps**, highlight **risks** and make recommendations with respect to **mitigation**.


SDP Data Products
SKA Regional Data Centre (ESDC)
Science Product
SKA Observations
Scientific Value
Multiple Use Cases

The SKA Project has:

11 Science Working Groups

Extragalactic Spectral Line
Our Galaxy
Solar, Heliospheric & Ionospheric Physics
Epoch of Reionization
Cosmology
Extragalactic Continuum (galaxies/AGN, galaxy clusters)
Cradle of Life
HI galaxy science
Magnetism
Pulsars
Transients

2 Science Focus Groups

High Energy Cosmic Particles
VLBI

Scientific Use Case —> Pilot Compute Models

- Implementing example use cases on existing infrastructure
- Mostly using WLCG resources
- Identifying potential bottlenecks in e-infrastructure designed for other fields

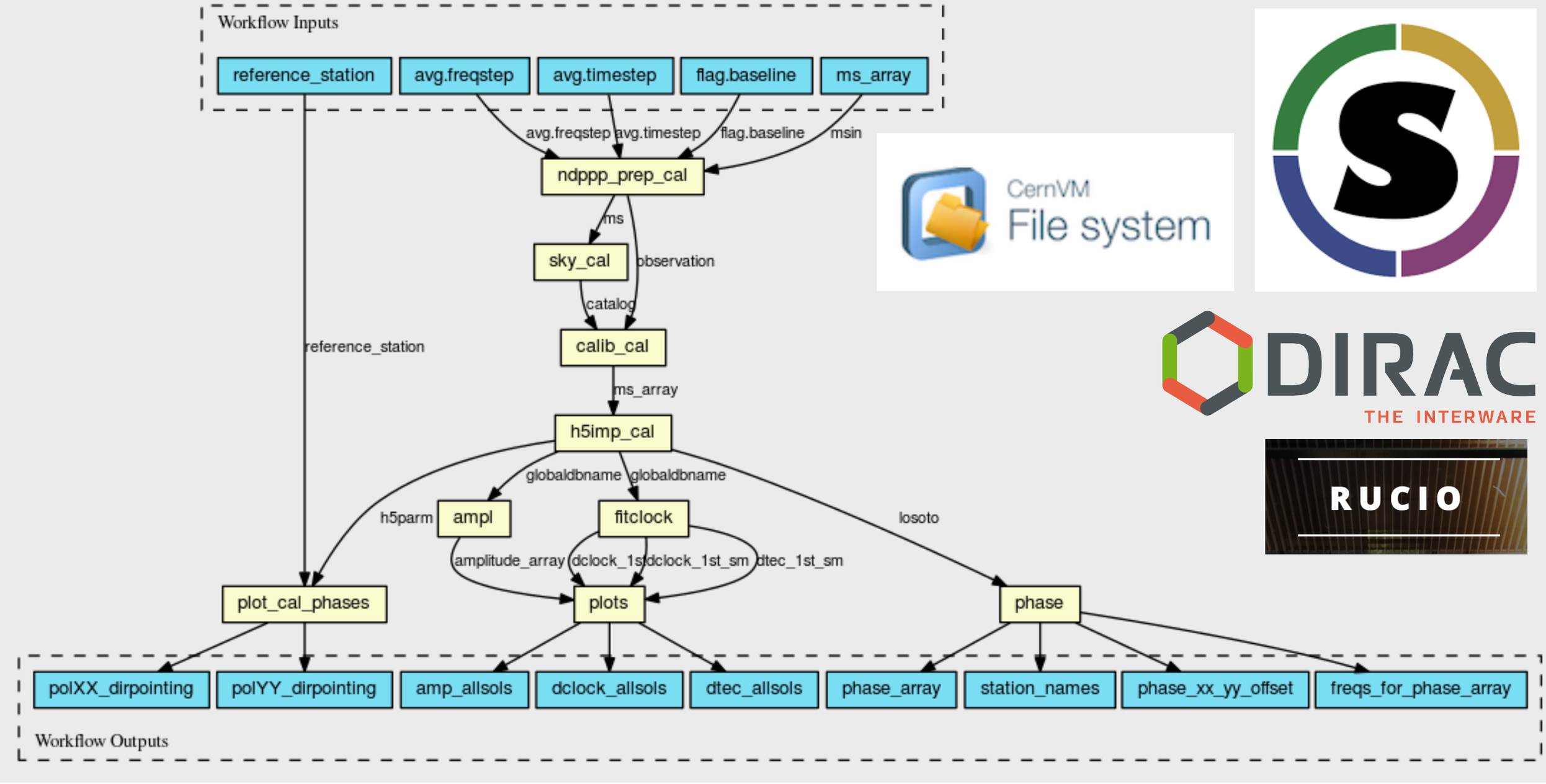
Current Compute Model Use Cases:

- Calibration & Imaging Use Case
- Image-based Object Detection & Classification Use Case
- Catalogue-based Cross Matching incorporating External Archives Use Case

- Image Mosaicking Use Case
- Image Cube Stacking Use Case
- Time-domain Re-folding Use Case

skatelescope.eu VO

Use Case : Calibration & Imaging

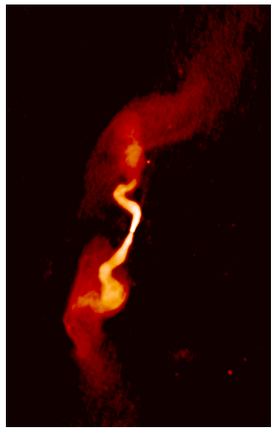


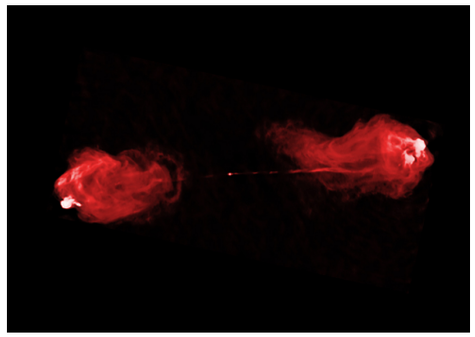
CernVM File system

DIRAC THE INTERWARE

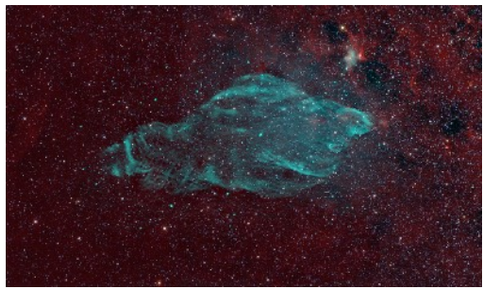
RUCIO

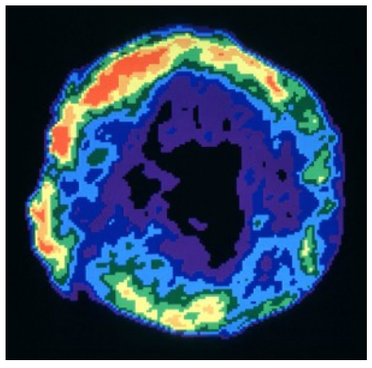
Radio Galaxies





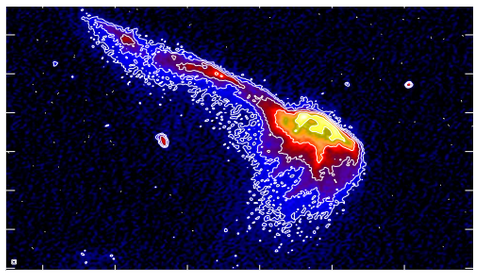
Supernova Remnants

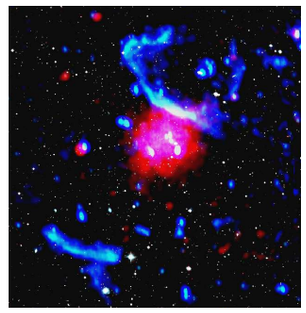




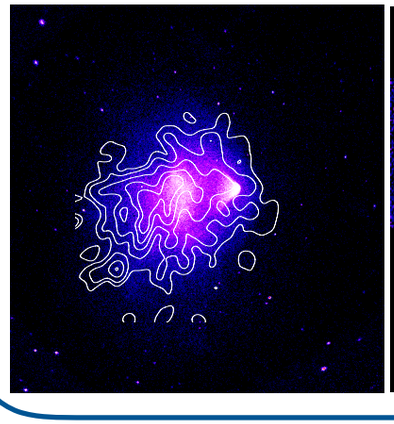
Many Source Classes

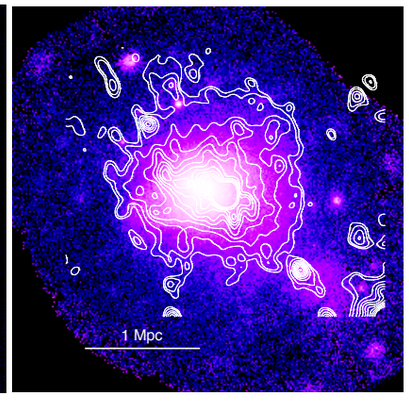
Radio Relics



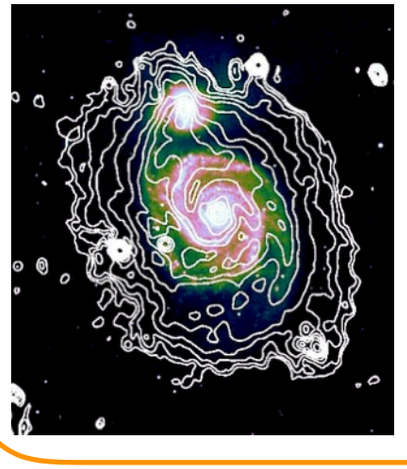


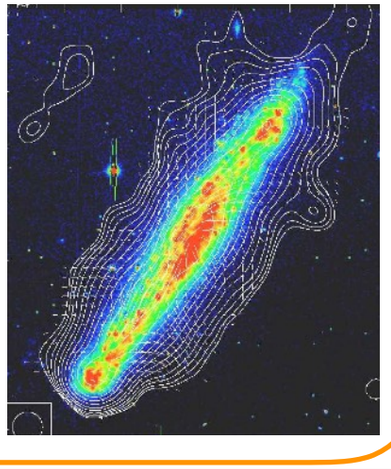
Radio Halos

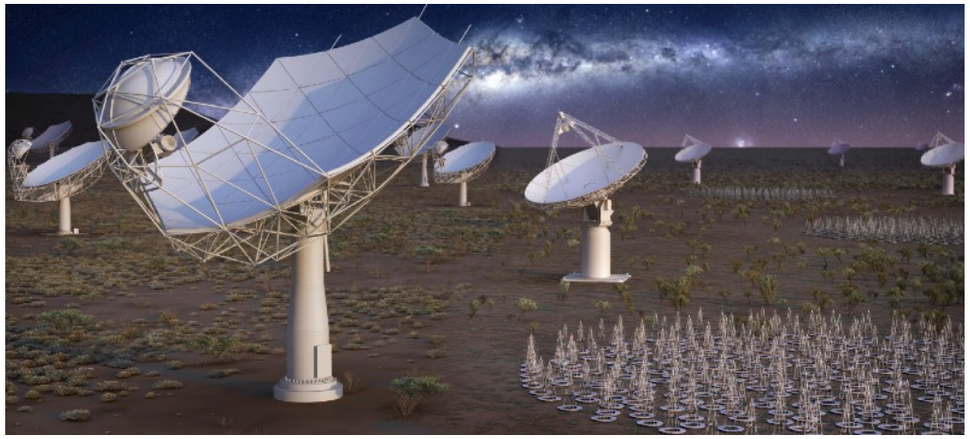




Galaxies



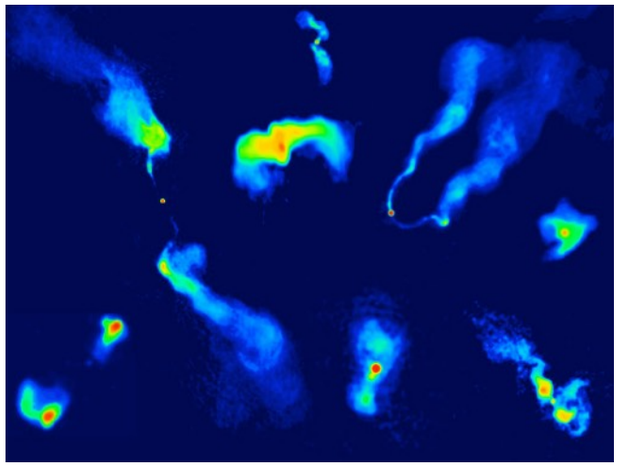


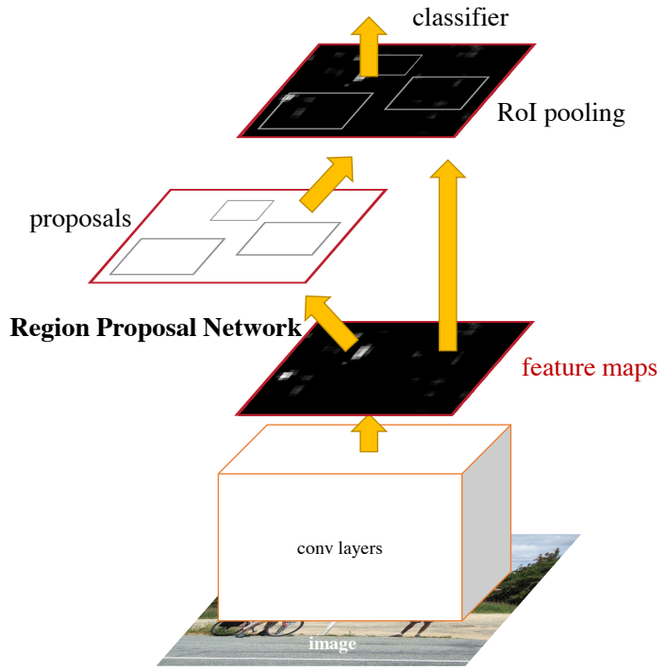


- **Radio galaxy zoo: It took 1 year for ~7000 people to classify 53 229 images**
- **SKA surveys expected to detect >10^7 AGN**
- **Classifying sources by eye takes too much time!**

Banfield et al 2015

Use Case : Object Detection & Classification

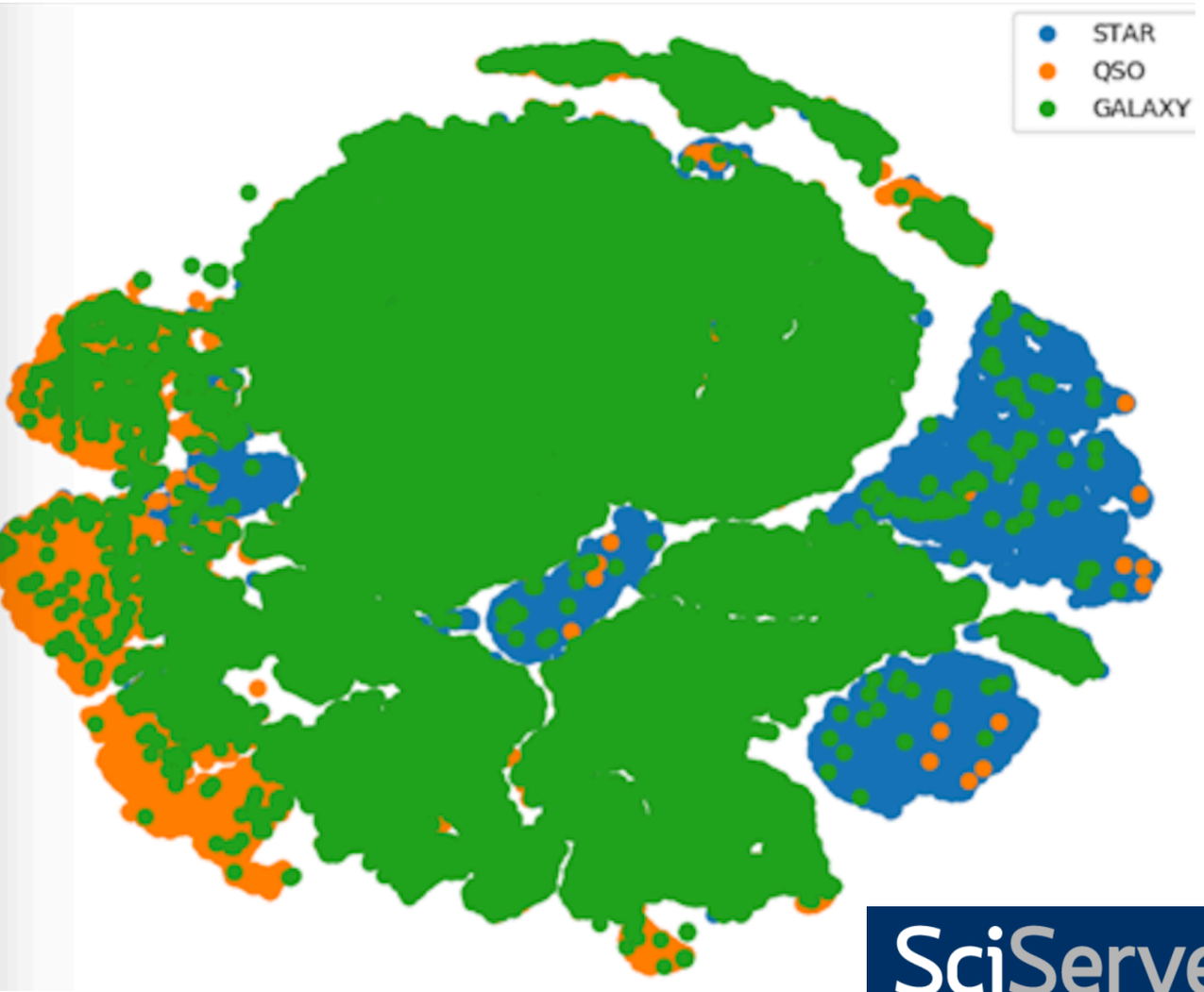




Automatically generate source catalog including source classification


WHAT IS
THIS?

Use Case : Classification using External Archives



- **2.5 million sources**
- **Provide photometry data (optical/IR/radio)**
- **Similar sources cluster, learning source types**
- **Afterwards colour-coding the plot by type shows galaxies/stars/quasars**
- **97 % accuracy on classifying stars/galaxies/QSO**

SciServer

SkyServer

SkyServer provides browser-based public access to all Sloan Digital Sky Survey data for everyone from teachers to professional astronomers.

If you would like the name of the AENEAS contact for prototyping work in your country please let me know!