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UK Astronomy Technology Centre

The South African Prototype SRC

IDIA and MeerKAT

Dr. Bradley Frank

Head of Electronic and Software Engineering — UKATC

Formerly SARAO's Associate Director for Astronomy Operations at IDIA

Acknowledging Russ Taylor (Director) and Rob Simmonds (AD Tech)

MeerKAT

- 2006: ~20-dish Karoo Array Telescope


SA Minister of Science and Technology visits proposed astronomy reserve

SQUARE KILOMETRE ARRAY (SKA) SOUTH AFRICA

Update SKA SA & KAT

SKA

#1 / 2006

This issue features:

Minister visits proposed astronomy reserve

Four competing countries to present their SKA

How the KAT is taking shape

KAT funding and astronomy reserve on track

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UK Astronomy Technology Centre

MeerKAT

- 2006: ~20-dish Karoo Array Telescope
- 2008: 80x12m *meer*KAT

#2 / 2007

This issue features:

MeerKAT prototype antenna installed

Feeding the meerKAT prototype

European award for SA astronomy project

SKA champions in South Africa

The meerKAT prototype with all major mechanical components installed. The prototype is at the Hartebeesthoek Radio Astronomy Observatory in South Africa.

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SKA AFRICA
SQUARE KILOMETRE ARRAY

SKA Africa eNews

October 2010

Inside this issue

Innovative new design for SA's MeerKAT

Following an extensive engineering design process, the baseline design concept for the South African MeerKAT precursor telescope has been decided. This design process consisted of an in-depth design study that investigated implementation options and tradeoffs for all key subsystems, and culminated in a Concept Design Review (CoDR) undertaken by an independent panel of international experts. The recommendations of the CoDR panel have informed the baseline concept, and the most visible design decision is that the MeerKAT will consist of 64 Gregorian offset dishes, each with an effective diameter of 13.5 metres.

"This is the most innovative option of the design solutions that we considered, but it will allow the MeerKAT to operate at a sensitivity of over 220 m²/K" explains Anita Loots, Associate Director of the SKA South Africa Project.

With all seven dishes of the MeerKAT precursor array (known as KAT-7) now in place, the construction of MeerKAT itself is the next big step for the SKA Africa team. "We will start by building a qualification (prototype) dish of the new design, on site in the Karoo," Loots adds. This first dish will be located near the KAT-7 array, which will allow extensive testing of the performance of the new design against the existing array.

(CoDR) undertaken by an independent panel of international experts. The recommendations of the CoDR panel have informed the baseline concept, and the most visible design decision is that the MeerKAT will consist of 64 Gregorian offset dishes, each with an effective diameter of 13.5 metres.

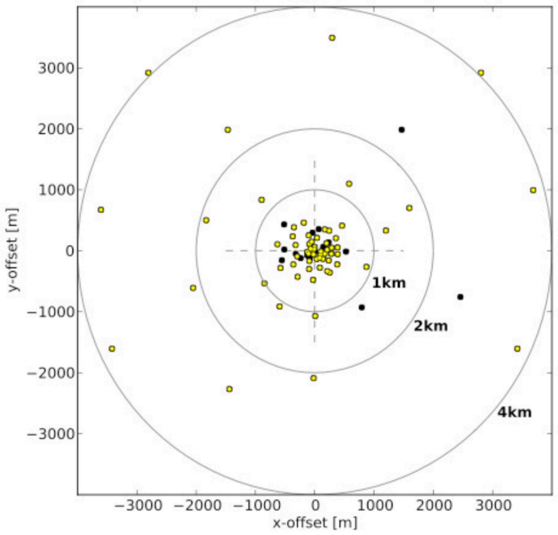

Figure 27: 64-dish Ver. 3.6 (yellow only) full configuration. Yellow and black together form the 80-dish Ver. 3.6

Commercial in Confidence

M0000-0000V1-03 DD
Revision: 1

An iteration of structural design was performed which resulted in the layout presented in Figure 3.

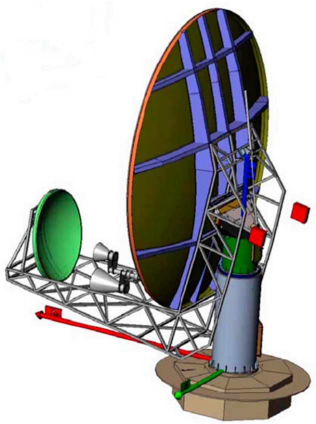

Figure 3: Option 3 – structural layout

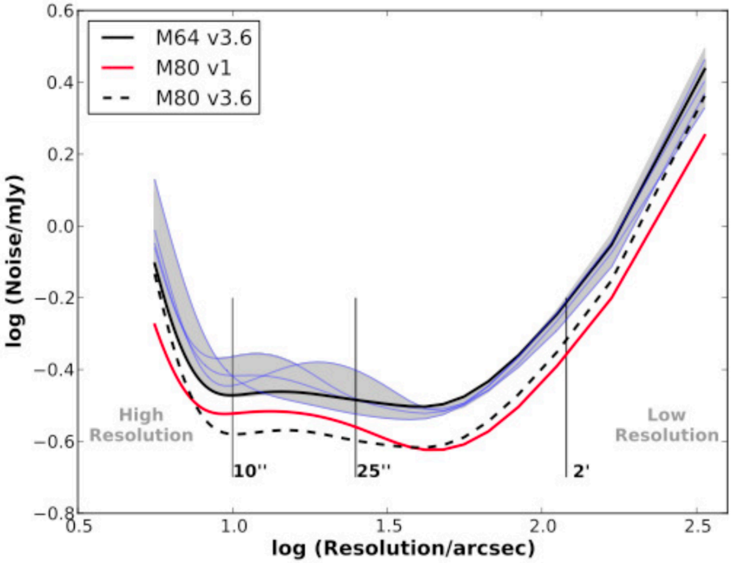

Figure 26: Sensitivity performance versus resolution for array configuratio

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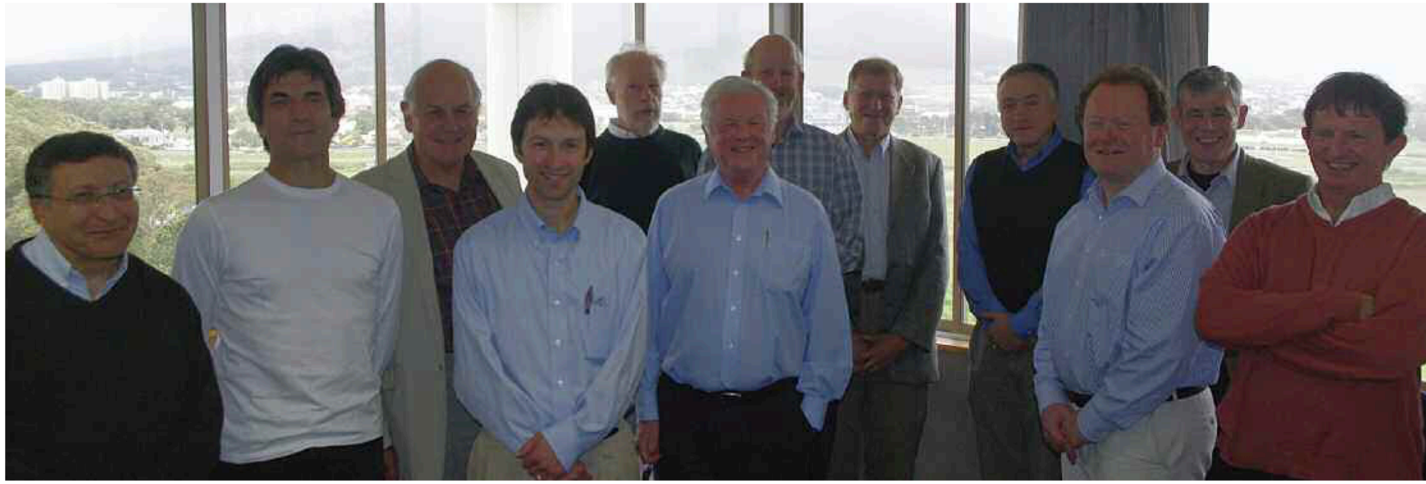
From the MeerKAT Configuration Design Review, 2010

MeerKAT Large Science Projects



An open invitation to the Astronomical Community
to propose Key Project Science with the South African
Square Kilometre Array Precursor

MeerKAT

R.S. Booth
Hartebeesthoek Radio Astronomy Observatory, P.O.Box 443, Krugersdorp 1740, South Africa
email: roy@hartrao.ac.za
W.J.G. de Blok
Department of Astronomy, University of Cape Town, Rondebosch 7700, South Africa.
email: edeblok@ast.uct.ac.za
J.L. Jonas
Rhodes University, Dept. Physics & Electronics, PO Box 94, Grahamstown 6410, South Africa
email: j.jonas@ru.ac.za
B. Fanaroff
SKA South Africa Project Office, 17 Baker St, Rosebank, Johannesburg, South Africa
email: bfanaroff@fanaroff.co.za

Proposal Submission deadline: March 15, 2010

1 Introduction

As possible hosts of the Square Kilometre Array (SKA), South Africa and Australia

Large Survey Projects

A call for large MeerKAT observing proposals by SARAO's predecessor SKA South Africa in 2009 resulted in 10 Large Survey Projects (LSPs, defined to require more than 1000 hours of telescope time over 5 years) being approved in 2010. In 2016, with MeerKAT in an advanced state of construction, SKA South Africa requested revised project plans from eight LSPs:

- LADUMA: Looking at the Distant Universe with the MeerKAT Array
- MALS: The MeerKAT Absorption Line Survey
- MeerKAT Fornax Survey
- MeerTime: The MeerKAT Key Science Project on Pulsar Timing
- MHONGOOSE: MeerKAT HI Observations of Nearby Galactic Objects: Observing Southern Emitters
- MIGHTEE: The MeerKAT International GHz Tiered Extragalactic Exploration Survey
- ThunderKAT: The Hunt for Dynamic and Explosive Radio Transients with MeerKAT
- TRAPUM: Transients and Pulsars with MeerKAT

https://skaafrica.atlassian.net

MIGHTEE

- Wide-band, wide-field survey at L-band.
- Four footprints, overlapping with large multiwavelenght surveys.

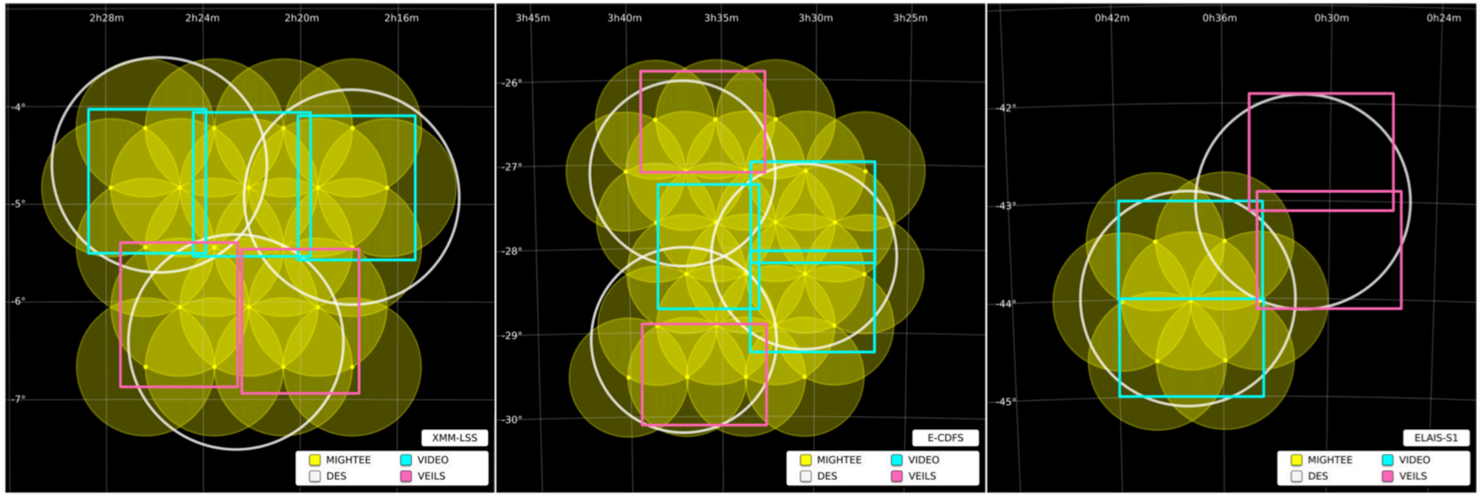


Figure 4: Current plausible pointing strategies for (left-to-right) XMM-LSS (20 pointings, 6.7 deg^2), E-CDFS (24 pointings, 8.3 deg^2) and ELAIS-S1 (7 pointings, 1.6 deg^2). Not shown here is the fourth COSMOS field, which will consist of a single deep pointing. In practice the grid of E-CDFS pointings will be snapped to the LADUMA pointing centre, requiring only 23 additional pointings from MIGHTEE.

MIGHTEE-HI

- Science Goals — Maddox et al. (2020)
    - HI Mass & Velocity Function
    - Kinematics — Spatially resolved HI.
    - Tully-Fisher Relation.
    - HI in Low Mass Galaxies.
    - HI as a function of Environment.
    - HI below the detection limit.
    - Galaxies and the surrounding medium.

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Free Access

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Published online	02 February 2021

A&A 646, A35 (2021)

MIGHTEE-HI: The H I emission project of the MeerKAT MIGHTEE survey*

N. Maddox[1], B. S. Frank[2,3,4], A. A. Ponomareva[5], M. J. Jarvis[5,6], E. A. K. Adams[7,8], R. Davé[9,6,10], T. A. Oosterloo[7,8], M. G. Santos[6,2], S. L. Blyth[4], M. Glowacki[11], R. C. Kraan-Korteweg[4], W. Mulaudzi[4], B. Namumba[12], I. Prandoni[13], S. H. A. Rajohnson[4], K. Spekkens[14], N. J. Adams[5], R. A. A. Bowler[5], J. D. Collier[3,15], I. Heywood[5,12,2], S. Sekhar[3,16] and A. R. Taylor[3,11]

+

Received: 12 October 2020 | **Accepted:** 10 November 2020

Abstract

We present the H I emission project within the MIGHTEE survey, currently being carried out with the newly commissioned MeerKAT radio telescope. This is one of the first deep, blind, medium-wide interferometric surveys for neutral hydrogen (H I) ever undertaken, extending our knowledge of H I emission to $z = 0.6$. The science goals of this medium-deep, medium-wide survey are extensive, including the evolution of the neutral gas content of galaxies over the past 5 billion years. Simulations predict nearly 3000 galaxies over $0 < z < 0.4$ will be detected directly in H I, with statistical detections extending to $z = 0.6$. The survey allows us to explore H I as a

PROCEEDINGS OF SCIENCE

MeerKAT Science: On the Pathway to the SKA

MeerKAT2016

25-27 May, 2016
Stellenbosch, South Africa
published February 01, 2018

Entries on ADS

MeerKAT Science: On the Pathway to the SKA

MeerKAT is a next generation radio telescope under construction on the African SKA central site in the Karoo plateau of South Africa. When completed in 2018 MeerKAT will be a 64-element array of 13.5-m parabolic antennas distributed over an area with a diameter of 8 km. With a combination of wide bandwidth and field of view, with the large number of antennas and total collecting area, MeerKAT will be one of the world's most powerful imaging telescopes operating at GHz frequencies.

MeerKAT is a science and technology precursor of the SKA mid-frequency dish array, and following several years of operation as a South African telescope will be incorporated into the SKA phase-one facility. The MeerKAT science program will consist of a combination of key science, legacy-style, large survey projects, and smaller projects based on proposals for open time. This workshop, which took place in Stellenbosch in the Western Cape, was held to discuss and plan the broad range of scientific investigations that will be undertaken during the pre-SKA phase of MeerKAT. Topics covered included:

- technical development and roll out of the MeerKAT science capabilities,
- details of the large survey projects presented by the project teams,
- science program concepts for open time,
- commensal programs such as the Search for Extraterrestrial Intelligence,
- and the impact of MeerKAT on global Very Long Baseline Interferometry.

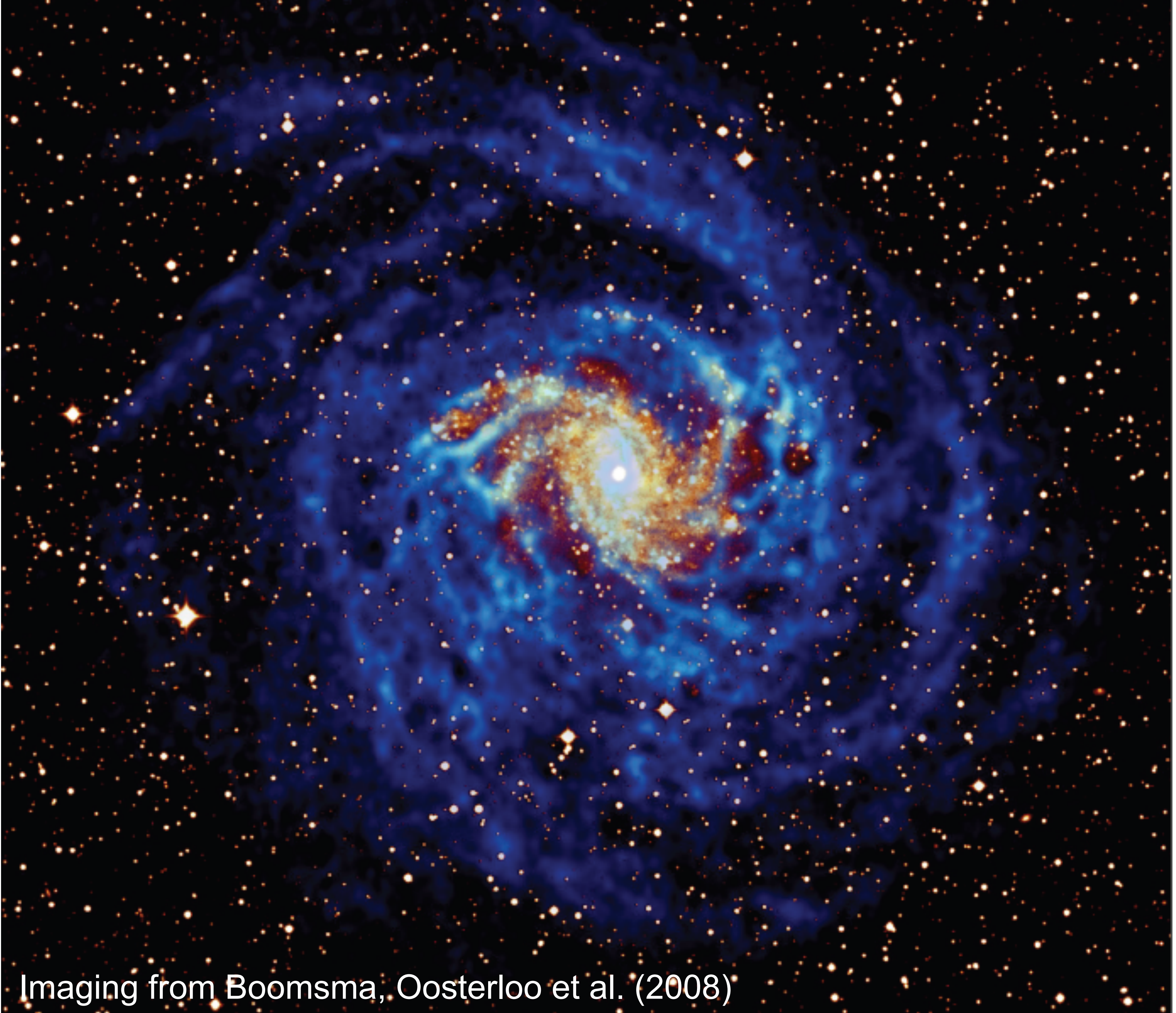
Report of the MeerKAT Large Project Review Panel – 2017

I. Background and Motivation for a Review

In 2009 the Square Kilometre Array (SKA) South Africa (SA) office released an open invitation to the international astronomical community, calling for key science projects to be carried out on the SKA precursor MeerKAT (Booth et al. astro-ph/0910.2935). A committee was formed in 2010 chaired by J. Lazio (JPL) to review these proposals and recommend a large science program for MeerKAT. The committee chose ten Large Survey Projects (LSPs), defined as requiring more than 1000 hours of telescope time over five years, and expected approximately 70% of the observing time to be allocated t LSPs during that span.

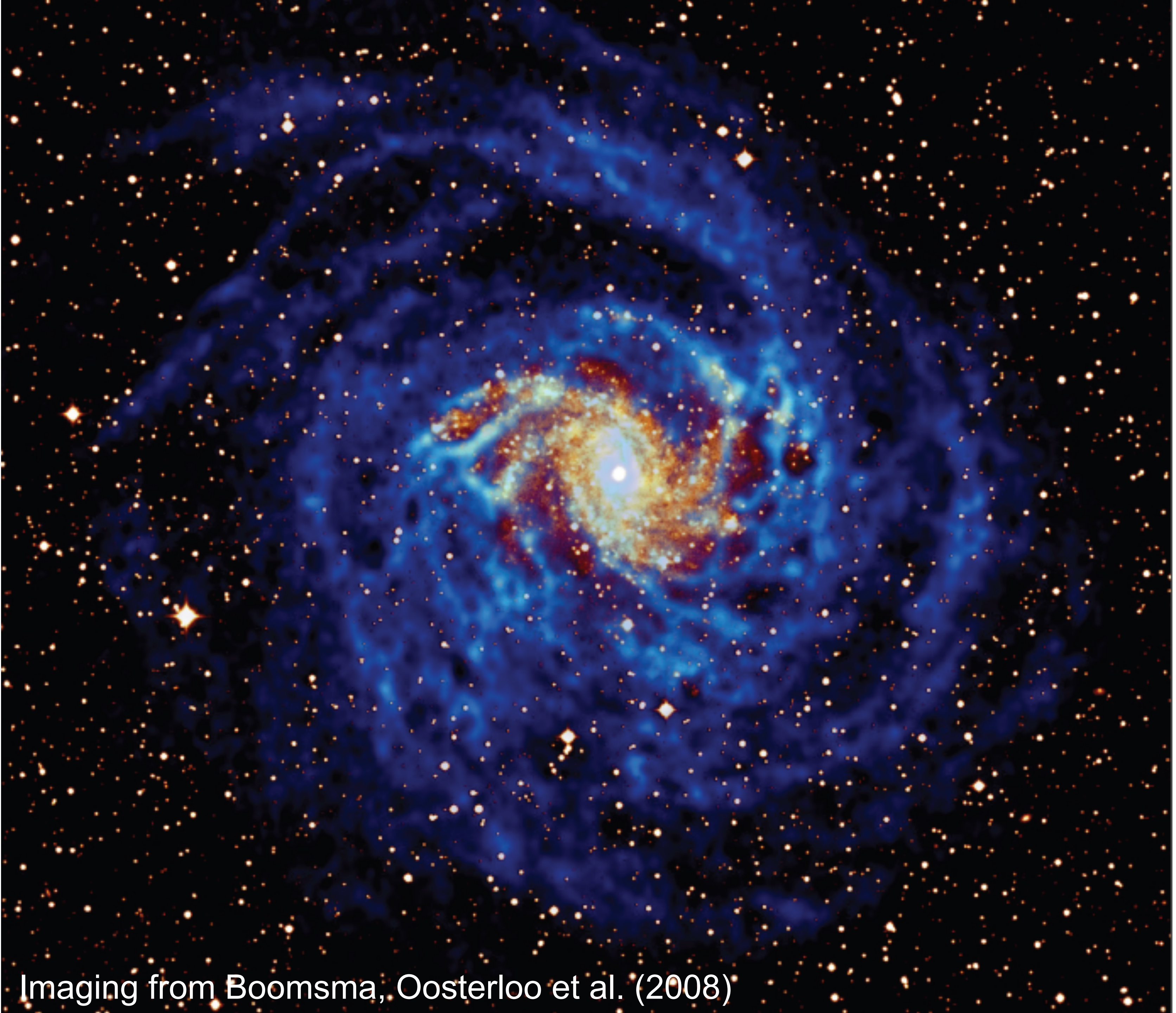
Table 1. Rank-ordered list of the recommended MeerKAT large science program.

Large Survey Project (LSP) Components	*Requested Time (hrs)*	*Readers' Science Score*	*Panel Ranking*
MeerTime (binary)	1440	3.87	A
MHONGOOSE	1650	3.55	A
MeerTime (MSPs)	2160	3.58	A
LADUMA	3424	3.84	A
Fornax	900	3.41	A
TRAPUM (Fermi sources)	338	3.60	A
MeerTime (1000 PTA)	720	3.78	A/B
ThunderKAT (CVs)	250	3.42	B
MIGHTEE (L band)	979	3.23	B
ThunderKAT (GRBs)	330	3.42	B
MeerTime (GCs)	1080	3.38	B
MALS (UHF band)	2320	N/A	B
TRAPUM (nearby galaxies)	226	3.28	B
TRAPUM (GCs)	320	3.22	B
TRAPUM (SNR, PWN, TeV)	92	N/A	B
ThunderKAT (SNe Ia)	200	3.08	B
MIGHTEE (S band)	948	2.77	B/C
MeerTime (magnetars)	100	3.00	C
TRAPUM (Fly's Eye)	720	3.33	C
ThunderKAT (XRBs)	500	3.00	C
MALS (L band)	1073	N/A	C
MeerTime (young PSRs)	400	2.83	C



The benchmark
WSRT Imaging of NGC6946
16x12h with WSRT
0.2 mJy/beam (~4km/s)
66 samples per channel, per polarisation, per integration.

MeerKAT?



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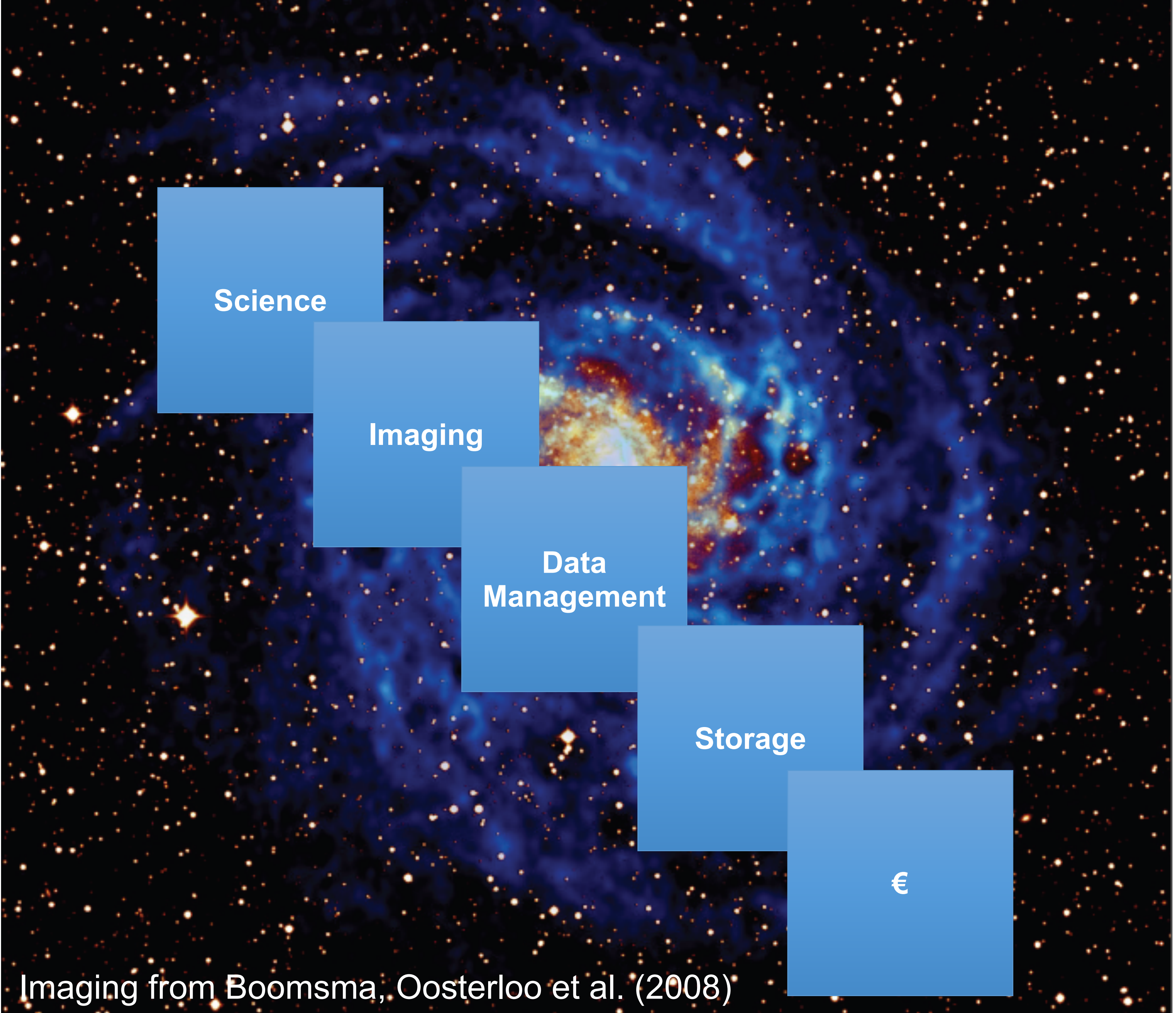
MeerKAT can achieve this in 12h
0.2 mJy/beam (5km/s)
2016 samples per channel, per polarisation, per integration.



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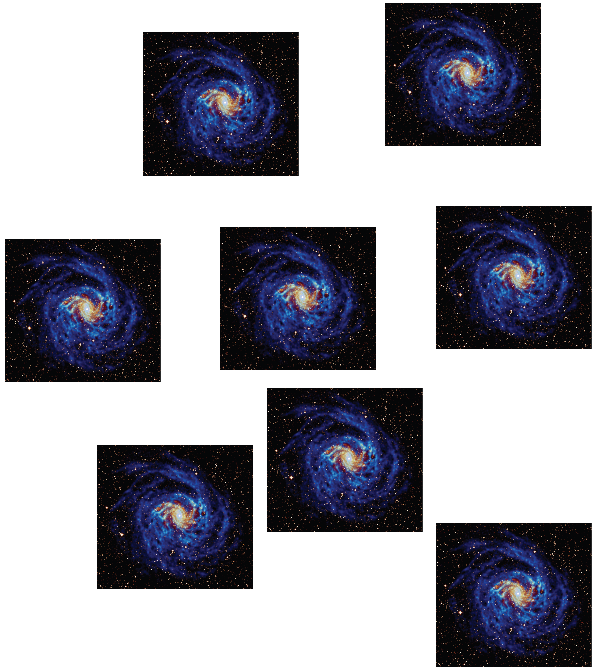

Science!

Bricks and mortar
People
Money

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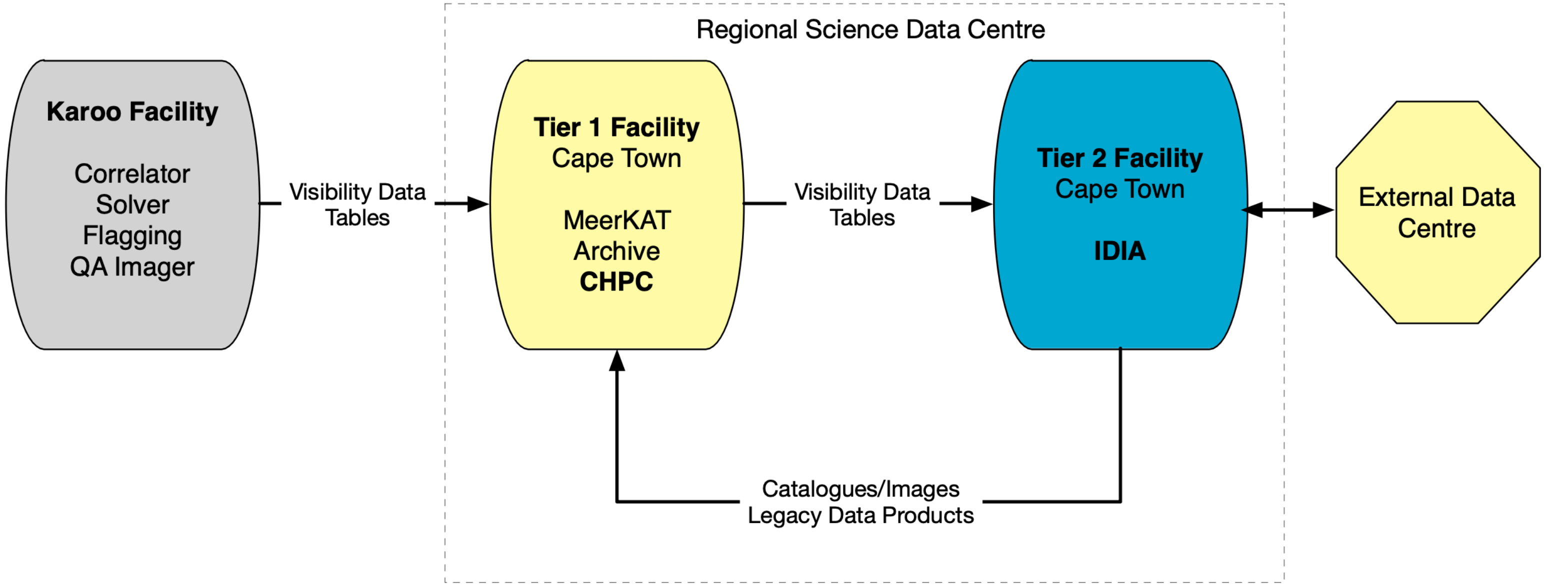
MIGHTEE-HI Data Processing

- Volumes Expected: 1TB/hour
- Science Processing: data transport, management and imaging
- Analysis: Interactive, collaborative, agile, user-focused



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Data Processing for the SKA*

- Not entirely unexpected…

Square Kilometre Array
Software and Computing:

Estimating the Sizes of the Challenges

Duncan Hall
SPDO Software and Computing
2009 Oct 13

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* and SKA pathfinders

Data Processing for the SKA*

Article

International Journal of
HIGH PERFORMANCE
COMPUTING APPLICATIONS

Challenges in exascale radio astronomy: Can the SKA ride the technology wave?

The International Journal of High Performance Computing Applications
2015, Vol. 29(1) 37–50

DOI: 10.1177/1094342014549059
hpc.sagepub.com
SAGE

Erik Vermij[1], Leandro Fiorin[1], Rik Jongerius[1], Christoph Hagleitner[2] and Koen Bertels[3]

Abstract
The Square Kilometre Array (SKA) will be the most sensitive radio telescope in the world. This unprecedented sensitivity will be achieved by combining and analyzing signals from 262,144 antennas and 350 dishes at a raw datarate of petabits per second. The processing pipeline to create useful astronomical data will require hundreds of peta-operations per second, at a very limited power budget. We analyze the compute, memory and bandwidth requirements for the key algorithms used in the SKA. By studying their implementation on existing platforms, we show that most algorithms have properties that map inefficiently on current hardware, such as a low compute–bandwidth ratio and complex arithmetic. In addition, we estimate the power breakdown on CPUs and GPUs, analyze the cache behavior on CPUs, and discuss possible improvements. This work is complemented with an analysis of supercomputer trends, which demonstrates that current efforts to use commercial off-the-shelf accelerators results in a two to three times smaller improvement in compute capabilities and power efficiency than custom built machines. We conclude that waiting for new technology to arrive will not give us the instruments currently planned in 2018: one or two orders of magnitude better power efficiency and compute capabilities are required. Novel hardware and system architectures, to match the needs and features of this unique project, must be developed.

- ~2015
- Current state of the art, and projected trends, are *insufficient for the exascale challenge of the SKA.*

* and SKA pathfinders

Data Processing for the SKA*

International Journal of
HIGH PERFORMANCE
COMPUTING APPLICATIONS

Article

Challenges in exascale radio astronomy: Can the SKA ride the technology wave?

**Erik Vermij[1], Leandro Fiorin[1], Rik Jongerius[1], Christoph Hagle
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…ojected trends, are
*…cient for the
…ale challenge of the*

* and SKA pathfinders

Data Processing for the SKA*

Computing Challenges in the SKA Era

Bruce Elmegreen
IBM T.J. Watson Research Center
Yorktown Heights, NY 10598
bge@us.ibm.com

Rutgers University, March 16-18, 2015

Summary

- Processors: Moore's law for *systems* still on track
  ** $T/year investment: exponential growth continues to the SKA1 era
  ** also assumed by the SKA SDP 2015 report
- Memory: changing to become more energy efficient (non-volatile)
  – also allows extremely fast large memory spaces ("solid state memory")
  – However, new memory technologies are more expensive now
- SKA1 data volumes are not excessive by world standards
- SKA1 raw data rates are large but the technology should handle it.
- Not discussed: software changes, machine learning, neural networks, …

* and SKA pathfinders

Data Processing for the SKA*

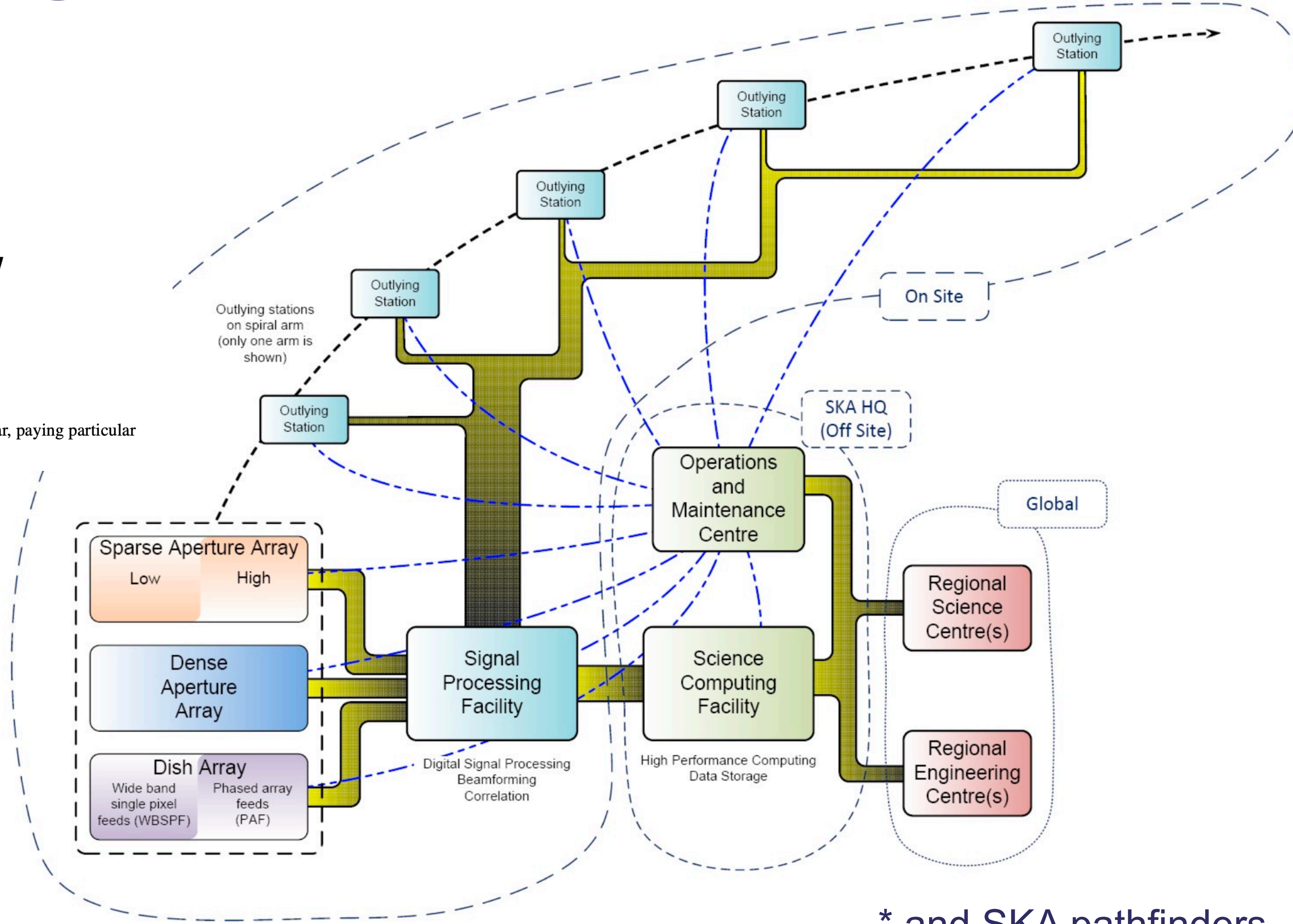
WIDEFIELD SCIENCE AND TECHNOLOGY FOR THE SKA
SKADS CONFERENCE 2009
S.A. Torchinsky, A. van Ardenne, T. van den Brink-Havinga, A.J.J. van Es, A.J. Faulkner (eds.)
4-6 November 2009, Château de Limelette, Belgium

The Square Kilometre Array - an overview

R.T. Schilizzi[1], P.E. Dewdney[1], and T.J.W. Lazio[2]

[1] SKA Program Development Office, University of Manchester, UK
[2] Naval Research Laboratory, Washington DC, USA

Abstract. A brief overview is given of the international SKA project and developments during the past year, paying particular attention to technical highlights, site characterisation, schedule and policy issues.



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* and SKA pathfinders

Data Processing for the SKA*

18 R.T. Schilizzi et al.: The Square Kilometre Array - an overview

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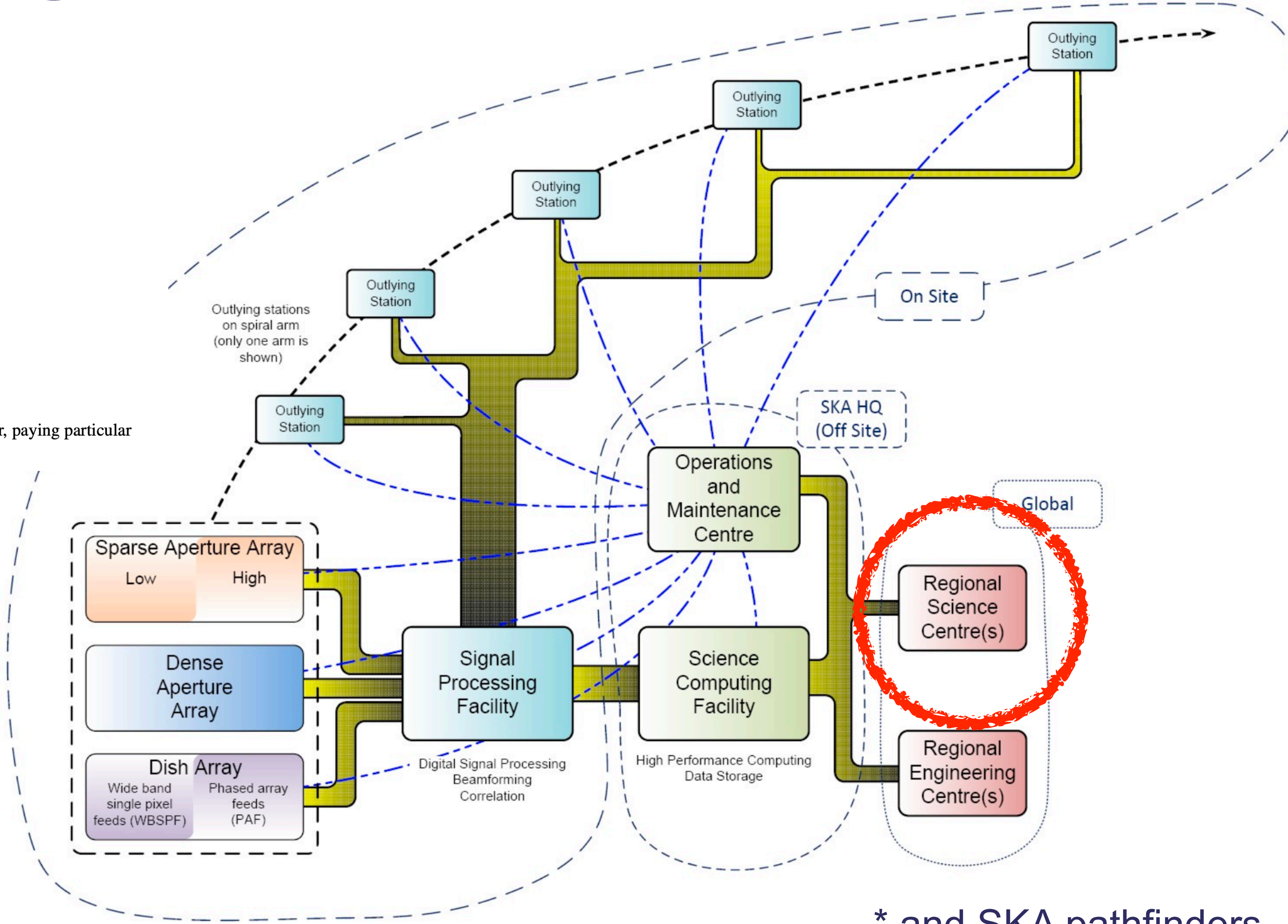

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* and SKA pathfinders

Keyword

Categories
Speeches

Government Level
- Any -

Province
- Any -

Subjects
16 days of activism
20 years of freedom
Africa
African Peer Review Mechanism
Agriculture
Anti-corruption initiatives
Arts and culture
Aviation
Black Economic Empowerment

Start Date
09/09/2024

Minister Naledi Pandor: Launch of Inter-University Institute for Data Intensive Astronomy (IDIA)

03 Sep 2015

Address by Naledi Pandor MP, Minister of Science and Technology, at the launch of the Inter-University Institute for Data Intensive Astronomy (IDIA), South African Astronomical Observatory, Cape Town

Prof Russ Taylor
Prof Tyrone Pretorius, UWC Vice-Chancellor,
Dr Max Price, UCT Vice-Chancellor,
Dr Bernie Fanaroff
Prof Frik van Niekerk, NWU Deputy Vice-Chancellor,
Directors of the SKA project

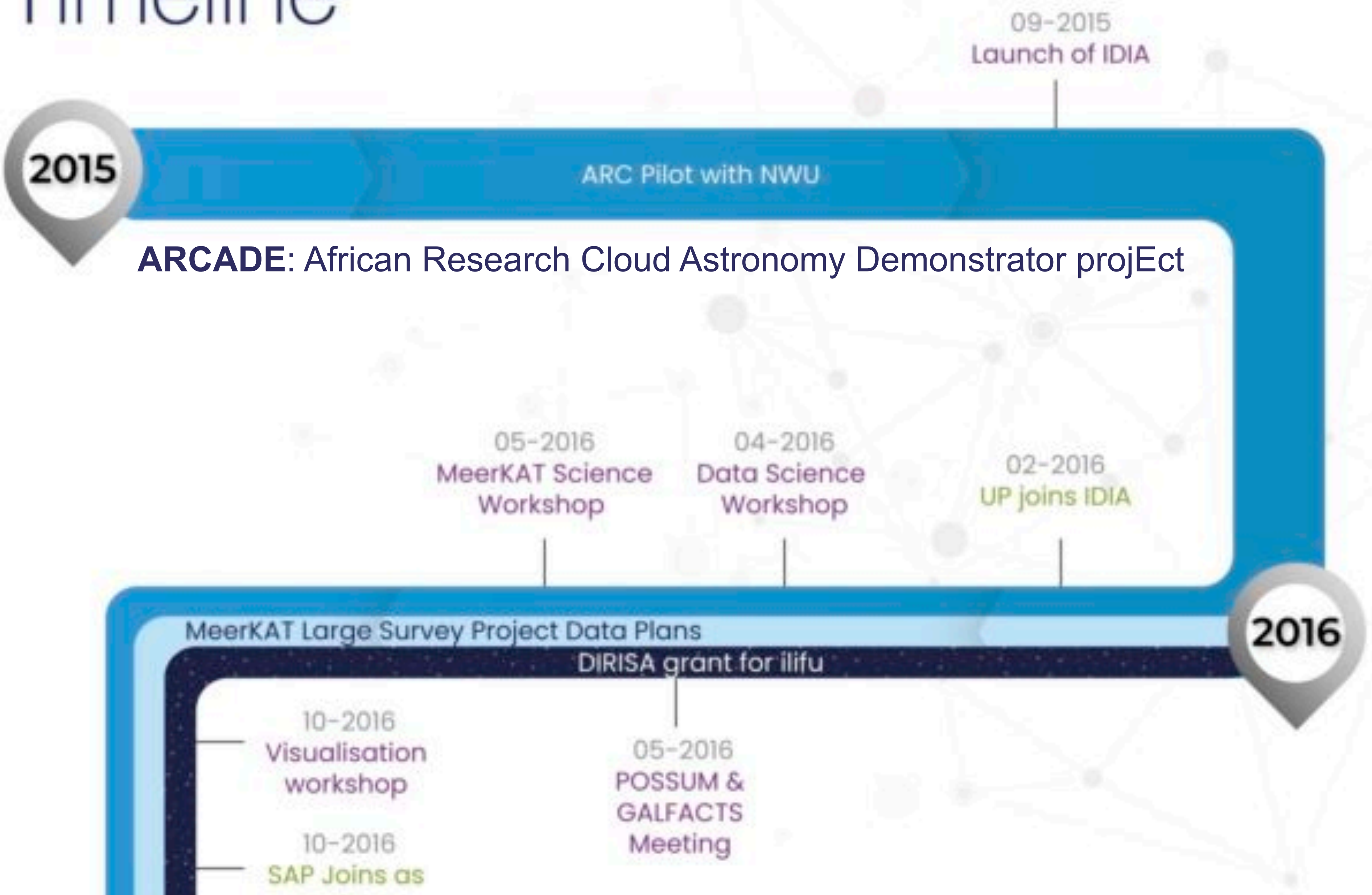
IDIA

- Facility to empower the science users.
- Quid pro quo — scientific community would need to *show up* ($).
- Partnership with observatory, but community driven.
- Political and scientific support, and $ to get started.

IDIA

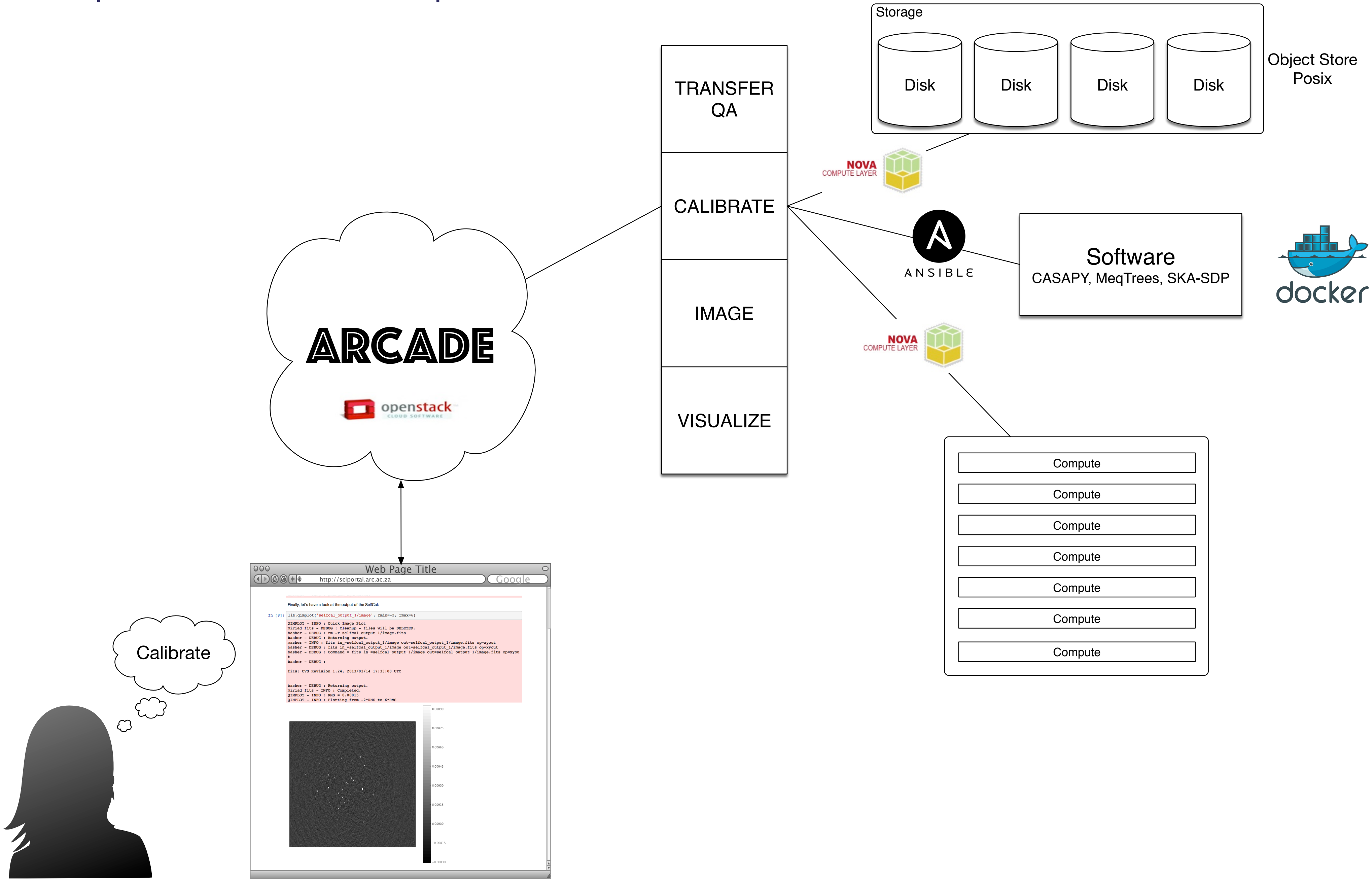
- Facility to empower the science users.
- Quid pro quo — scientific community would need to show up ($).
- Partnership with observatory, but community driven.
- Political and scientific support, and $ to get started.
- But therein lay the problem — how do we get started?

IDIA Timeline

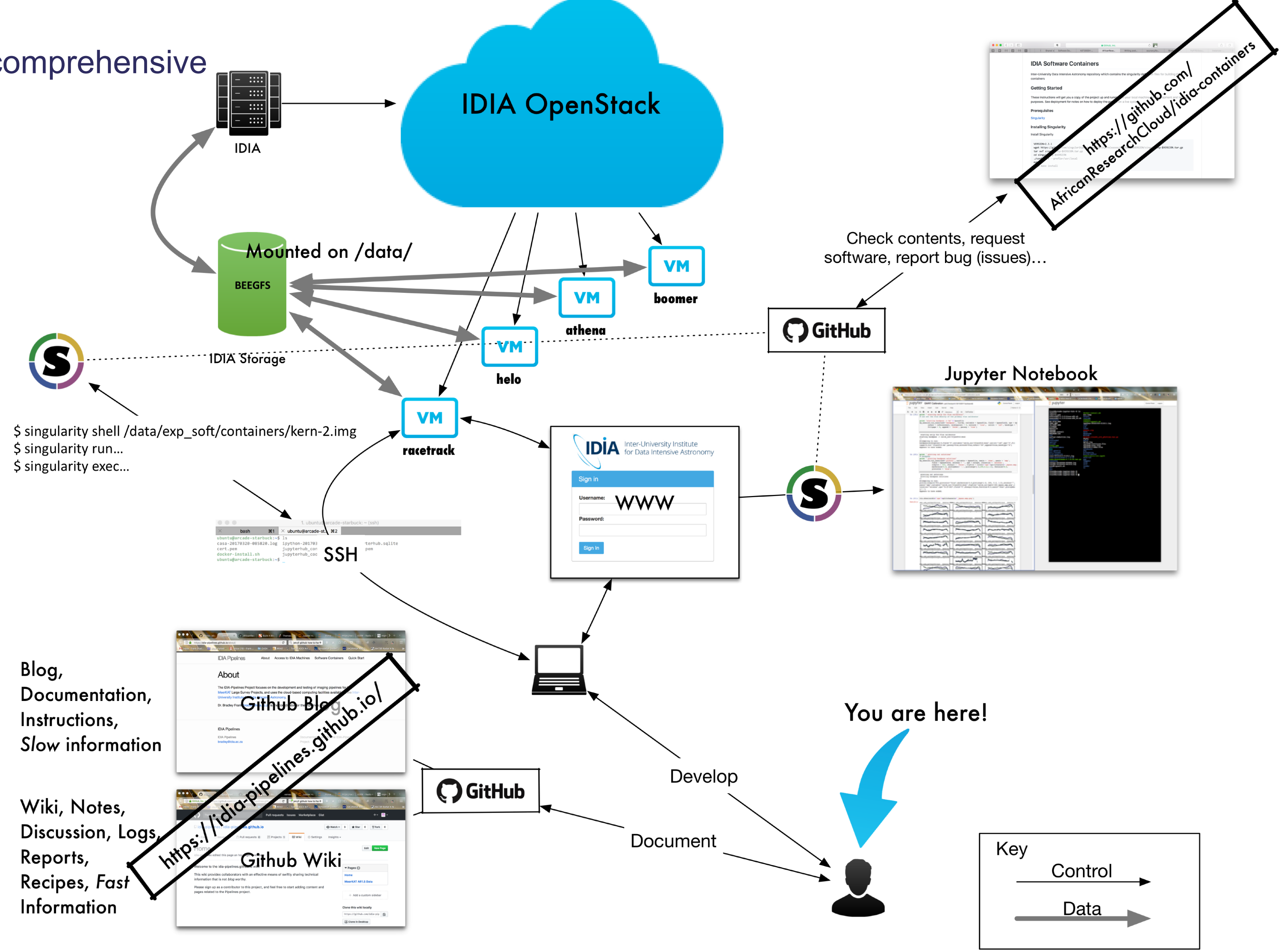


ARCADE: African Research Cloud Astronomy Demonstrator projEct

Basic expression of scientific requirements…



Expanded into a comprehensive architecture…



Further broken down into component design…

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 "language": "python",
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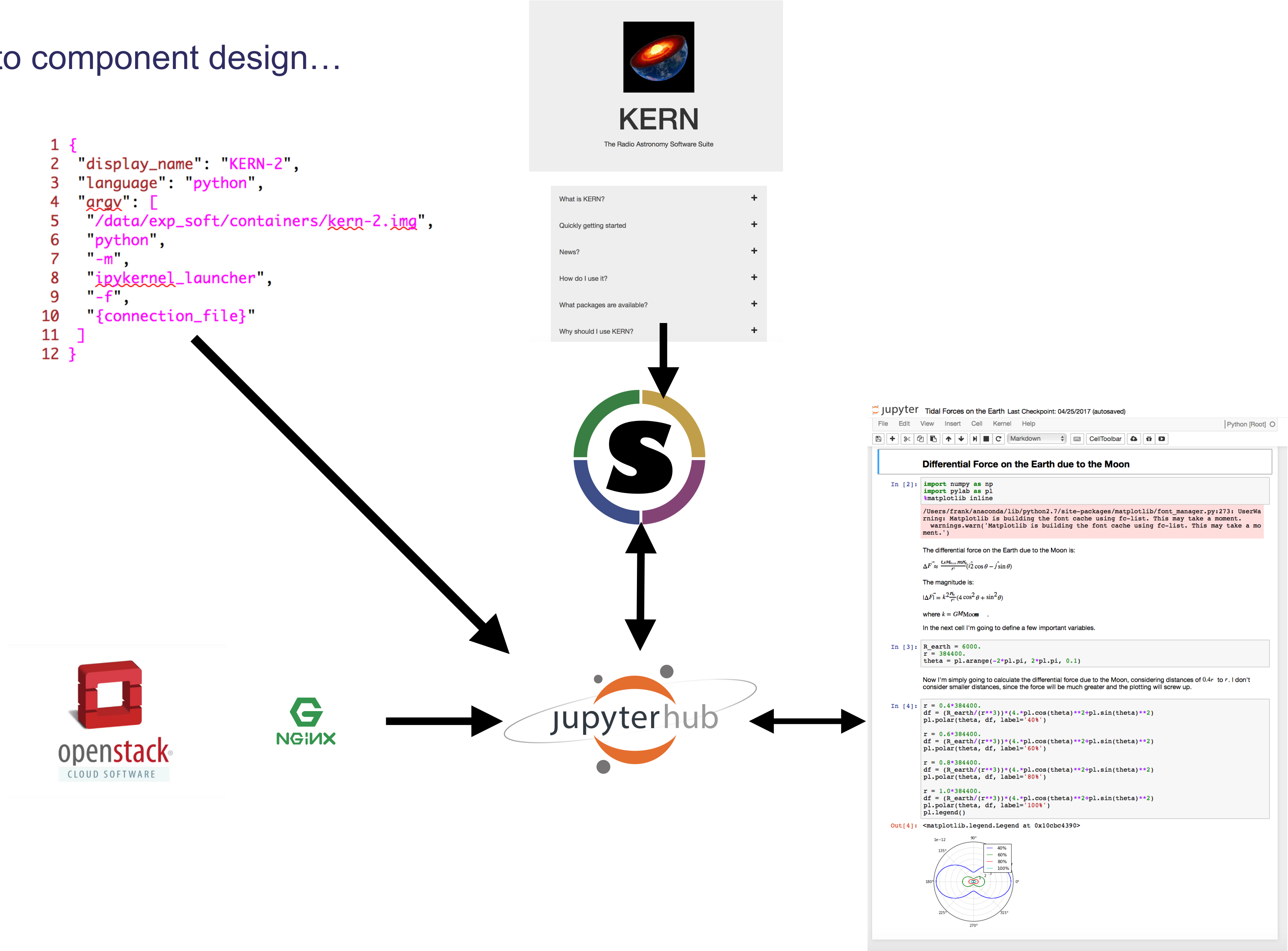
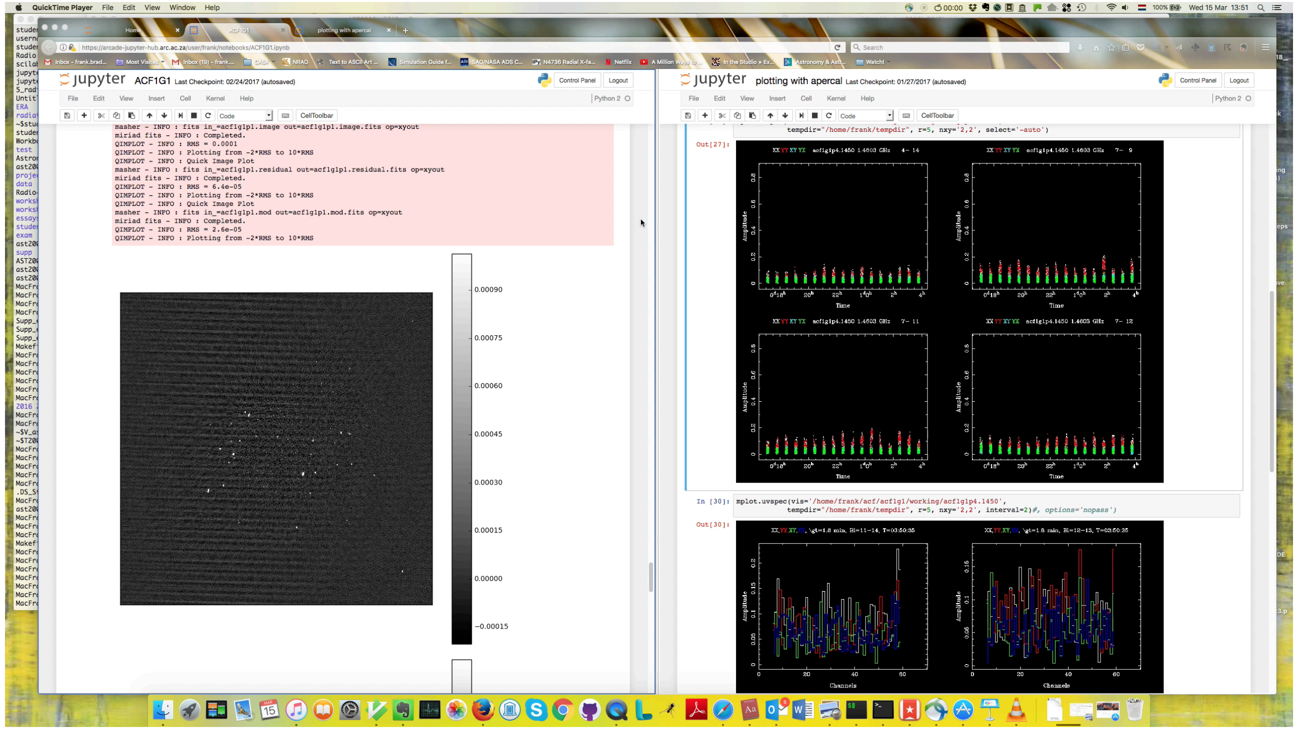
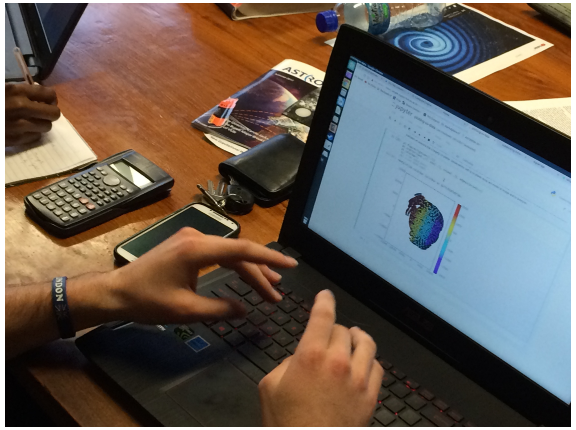
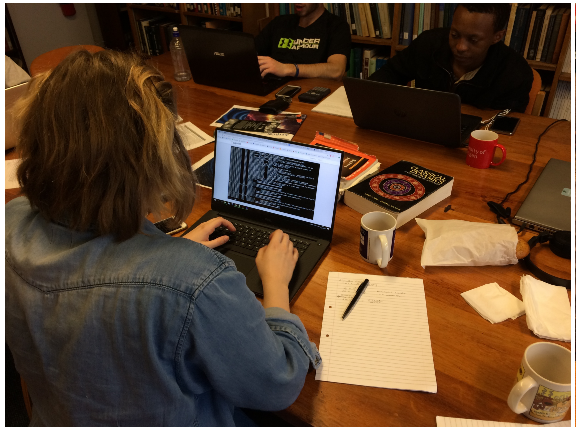
  "python",
  "-m",
  "ipykernel_launcher",
  "-f",
  "{connection_file}"
 ]
}
```

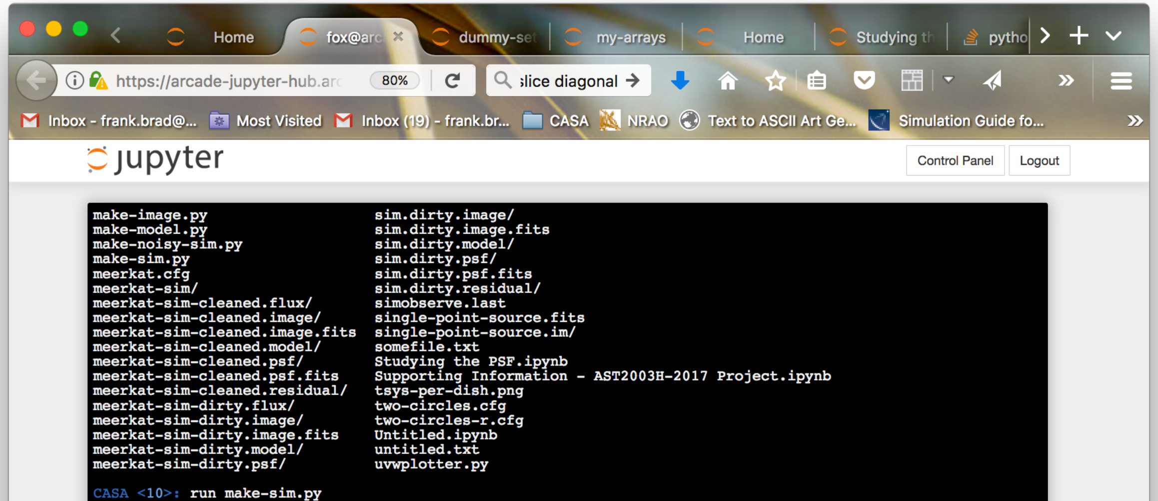


Substantiated by scientific use-cases…

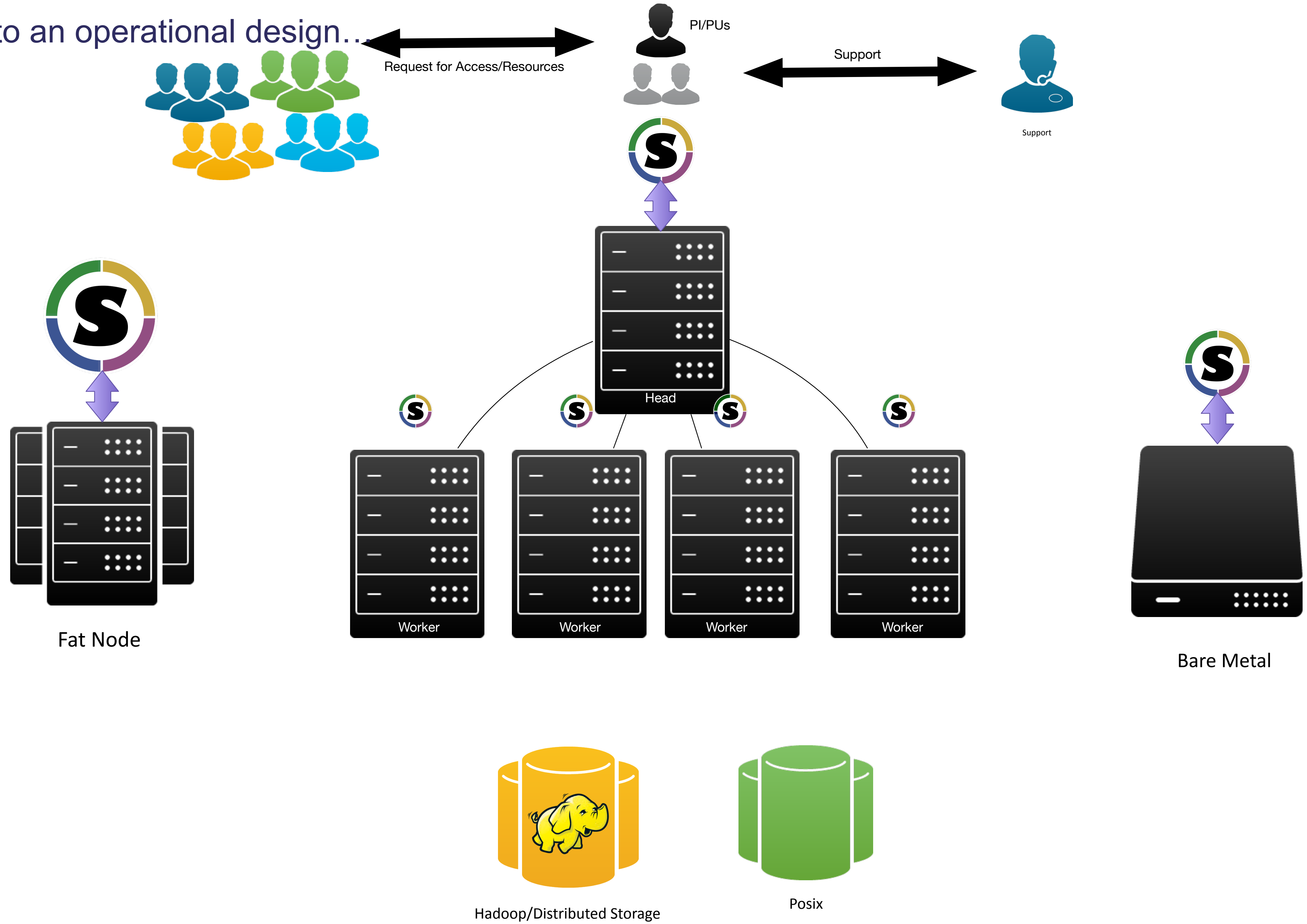








Scaled to an operational design…

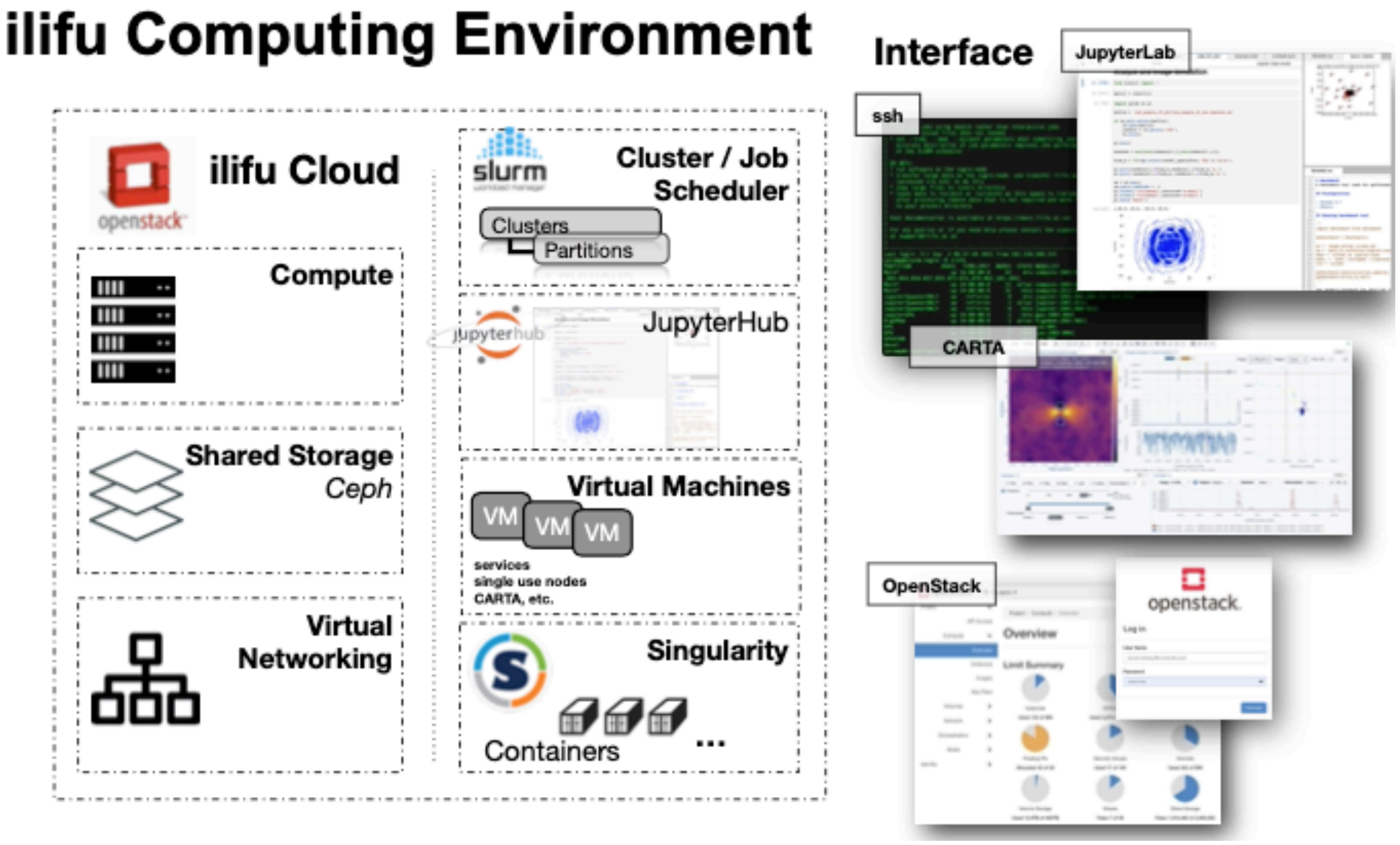


Recap (2015-2017)

- Used the African Research Cloud as a pathfinder for IDIA design.
- Defined the science requirements.
- Data processing use-cases: WSRT data, MeerKAT-16.
- Analysis: large astronomy groups, distributed collaborators…
- Laid the technical and technological groundwork for IDIA development, Ilifu procurement and data centre design.
- **Convinced ourselves that we could build complex systems.**

IDIA and Ilifu (2017+)

- Partnership with Bioinformatics stakeholders.
- Included the observatory (SARAO) as a partner.



Jeremy Smith, IDIA Operations Manager

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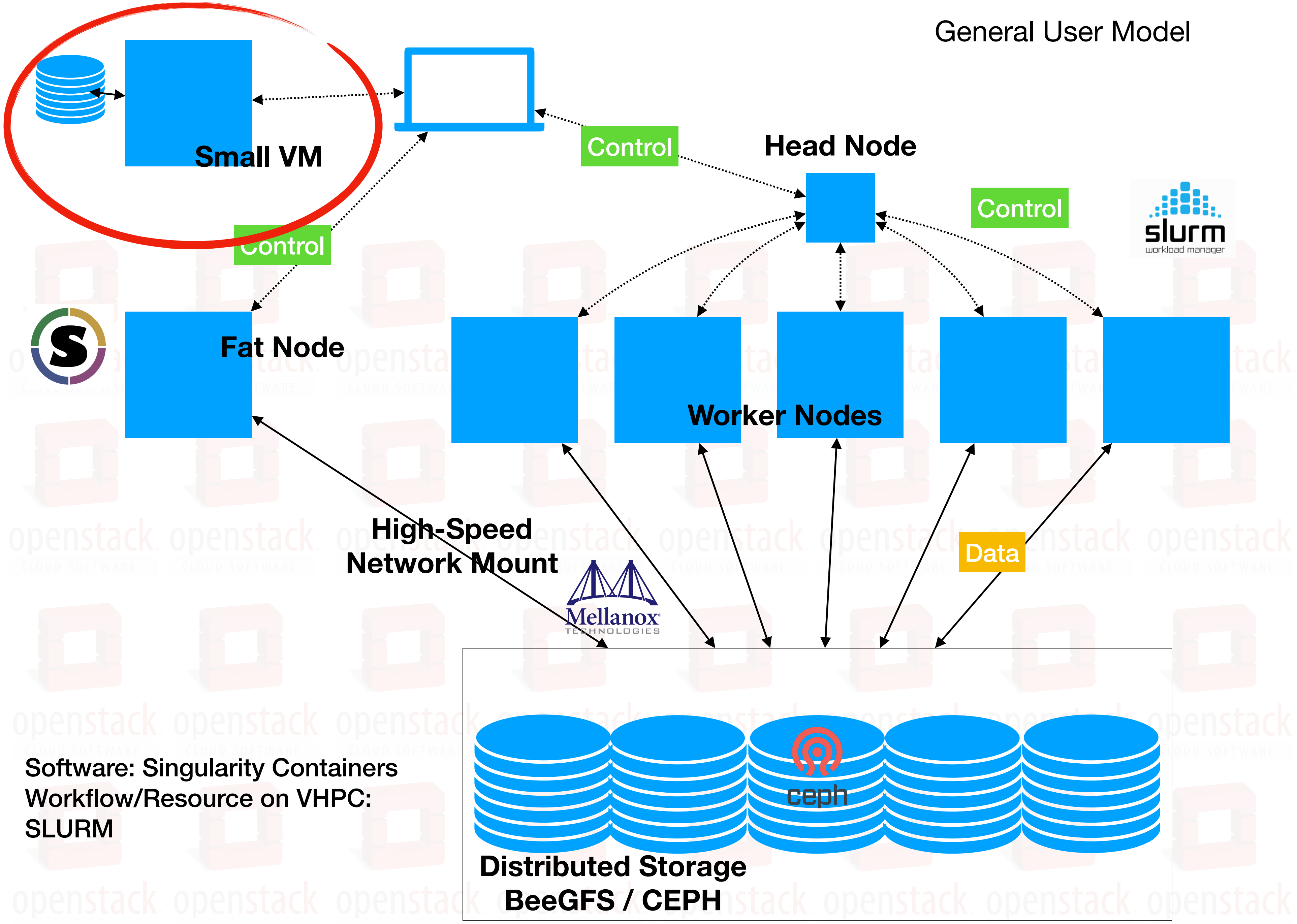
UK Astronomy Technology Centre

General User Model



Software: Singularity Containers
Workflow/Resource on VHPC:
SLURM

32KN

IDIA

Erwin de Blok
SCI-20180516-EB-01

20210308-0066
1647545027

J0408-6545
0408-658
J1130-1449
1127-145
...

J1311-2216
3C283
J1337-28

MHONGOOSE J1337-28 rising 4
1336.499999832362 MHz to 1443.499999832362 MHz
Run at 2022-03-17 19:25:22 UTC

Details

Script Log

Delay Cal Observation

Calibration Report 1 | Calibration Report 2 | Calibration Report 3 | Calibration Report 4

4KW

IDIA

Erwin de Blok
SCI-20180516-EB-01

20210308-0066
1647545021

J0408-6545
0408-658
J1130-1449
1127-145
...

J1311-2216
3C283
J1337-28

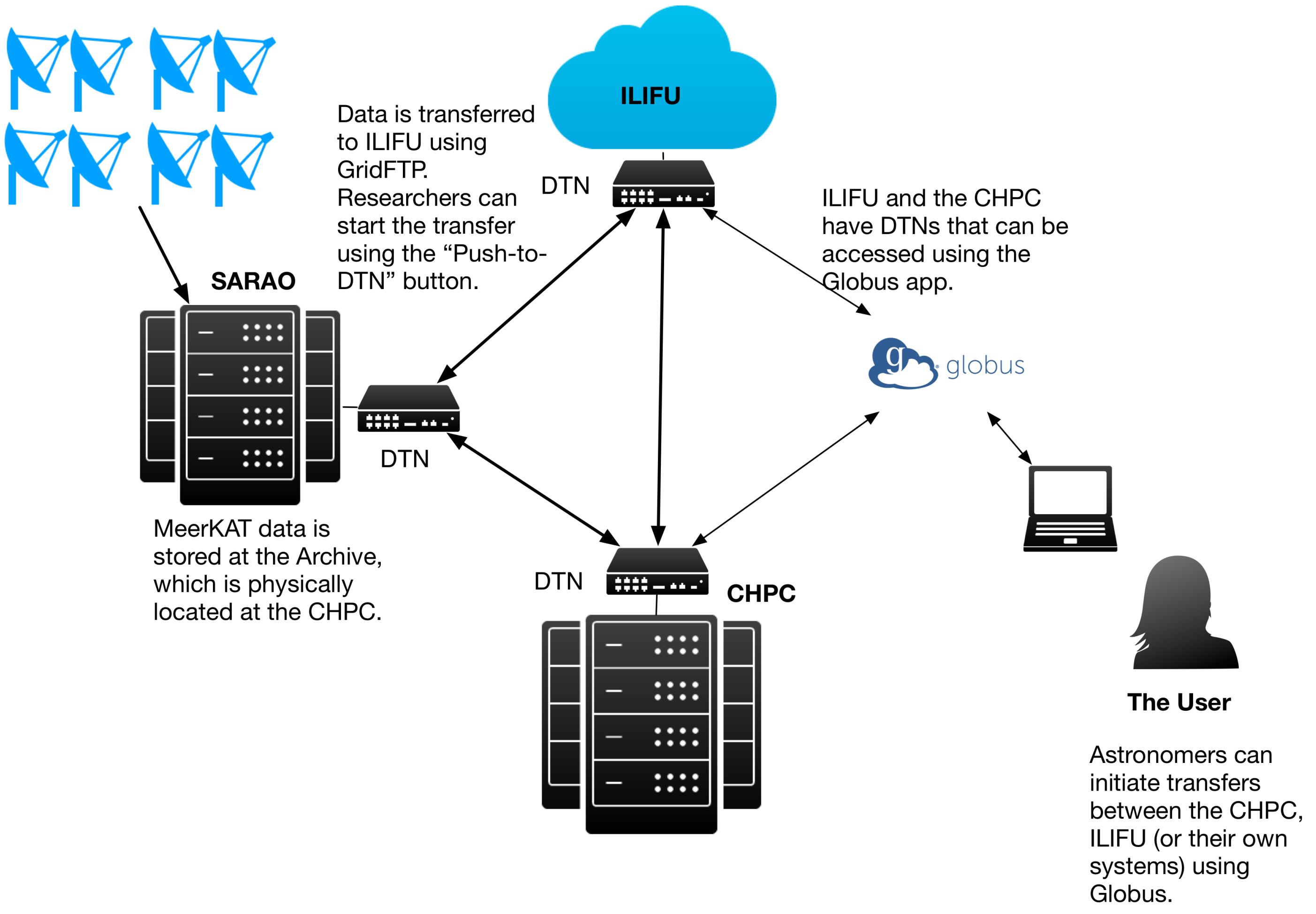
MHONGOOSE J1337-28 rising 4
856 MHz to 1712 MHz
Run at 2022-03-17 19:25:14 UTC

Details

Script Log

Delay Cal Observation

- Design emerged after coordination/ collaboration with SARAO, CHPC and IDIA.
- Hackathons/documents/designs/ negotiation.
- SANReN port + redirection.
- Staging (raw->MS), transfer, authentication and then validation on the IDIA side.
- Security — authenticate on the SARAO side to *request* a push, validated identity, submitted to queue and then transferred back using certificates.



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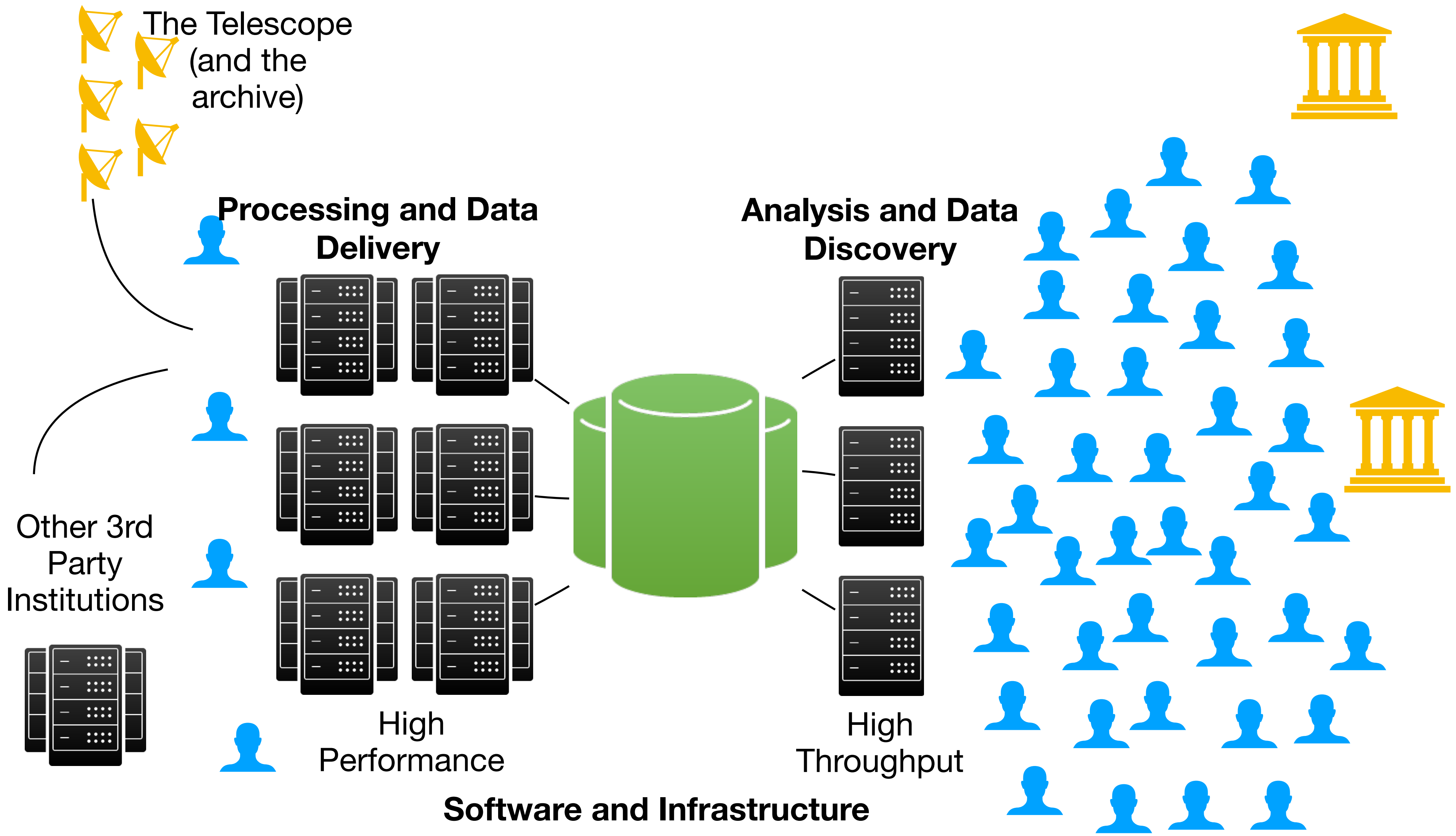
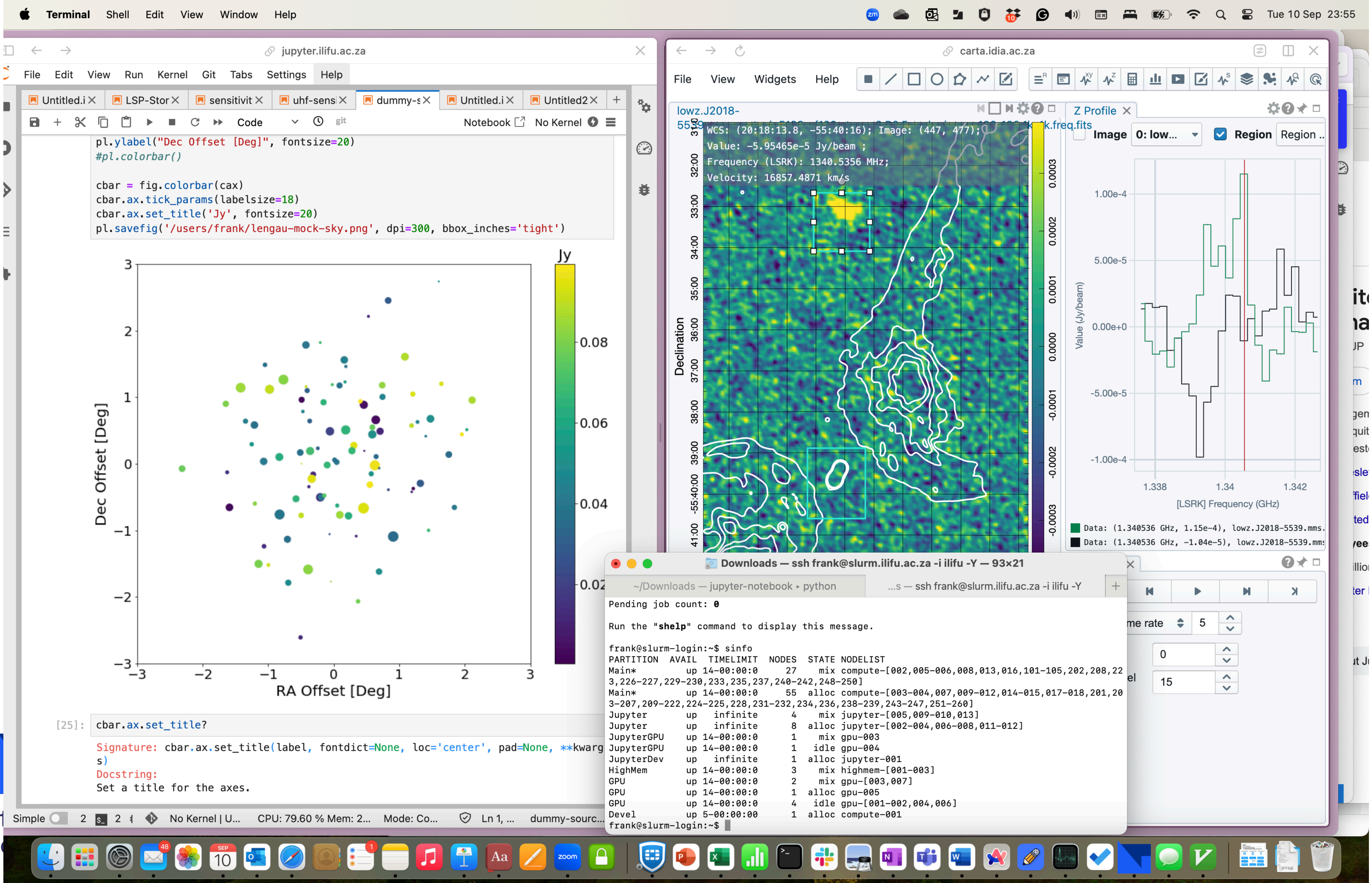


- A few users, long compute times, large data volumes.
- Changes slowly.
- Changes are big. Affect both software *and* infrastructure.

- Many users, highly interactive. Smaller data volumes.
- Changes often, but changes are small.



Terminal Shell Edit View Window Help
Tue 10 Sep 23:55
jupyter.ilifu.ac.za
File Edit View Run Kernel Git Tabs Settings Help
Untitled.i LSP-Stor sensitivit uhf-sens dummy-s Untitled.i Untitled2
Code
Notebook No Kernel
pl.ylabel("Dec Offset [Deg]", fontsize=20)
#pl.colorbar()
cbar = fig.colorbar(cax)
cbar.ax.tick_params(labelsize=18)
cbar.ax.set_title('Jy', fontsize=20)
pl.savefig('/users/frank/lengau-mock-sky.png', dpi=300, bbox_inches='tight')
Jy
Dec Offset [Deg]
RA Offset [Deg]
[25]: cbar.ax.set_title?
Signature: cbar.ax.set_title(label, fontdict=None, loc='center', pad=None, **kwargs)
Docstring:
Set a title for the axes.
Simple 2 2 No Kernel | U... CPU: 79.60 % Mem: 2... Mode: Co... Ln 1, ... dummy-sourc...
carta.idia.ac.za
File View Widgets Help
lowz.J2018-5539
WCS: (20:18:13.8, -55:40:16); Image: (447, 477);
Value: -5.95465e-5 Jy/beam ;
Frequency (LSRK): 1340.5356 MHz;
Velocity: 16857.4871 km/s
Declination
Z Profile
Image 0: low... Region Region
Value (Jy/beam)
[LSRK] Frequency (GHz)
Data: (1.340536 GHz, 1.15e-4), lowz.J2018-5539.mms.
Data: (1.340536 GHz, -1.04e-5), lowz.J2018-5539.mms
Downloads — ssh frank@slurm.ilifu.ac.za -i ilifu -Y — 93×21
~/Downloads — jupyter-notebook ▸ python
...s — ssh frank@slurm.ilifu.ac.za -i ilifu -Y
Pending job count: 0
Run the "shelp" command to display this message.
frank@slurm-login:~$ sinfo
PARTITION AVAIL TIMELIMIT NODES STATE NODELIST
Main* up 14-00:00:0 27 mix compute-[002,005-006,008,013,016,101-105,202,208,223,226-227,229-230,233,235,237,240-242,248-250]
Main* up 14-00:00:0 55 alloc compute-[003-004,007,009-012,014-015,017-018,201,203-207,209-222,224-225,228,231-232,234,236,238-239,243-247,251-260]
Jupyter up infinite 4 mix jupyter-[005,009-010,013]
Jupyter up infinite 8 alloc jupyter-[002-004,006-008,011-012]
JupyterGPU up 14-00:00:0 1 mix gpu-003
JupyterGPU up 14-00:00:0 1 idle gpu-004
JupyterDev up infinite 1 alloc jupyter-001
HighMem up 14-00:00:0 3 mix highmem-[001-003]
GPU up 14-00:00:0 2 mix gpu-[003,007]
GPU up 14-00:00:0 1 alloc gpu-005
GPU up 14-00:00:0 4 idle gpu-[001-002,004,006]
Devel up 5-00:00:00 1 alloc compute-001
frank@slurm-login:~$

UK Ast
Techn

Science Successes

1 2022MNRAS.512.2697R 2022/05
MIGHTEE-H I: the H I size-mass relation over the last billion years
Rajohnson, Sambatriniaina H. A.; Frank, Bradley S.; Ponomareva, Anastasia A. and 15 more

2 2022MNRAS.tmp..971T 2022/04
MIGHTEE-H I: The relation between the H I gas in galaxies and the cosmic web
Tudorache, Madalina N.; Jarvis, M. J.; Heywood, I. and 11 more

3 2022MNRAS.509.2150H 2022/01 cited: 5
MIGHTEE: total intensity radio continuum imaging and the COSMOS/XMM-LSS Early Science fields
Heywood, I.; Jarvis, M. J.; Hale, C. L. and 23 more

4 2021MNRAS.508.1897P 2021/12 cited: 1
Measuring the baryonic Tully-Fisher relation below the detection threshold
Pan, Hengxing; Jarvis, Matt J.; Ponomareva, Anastasia A. and 4 more

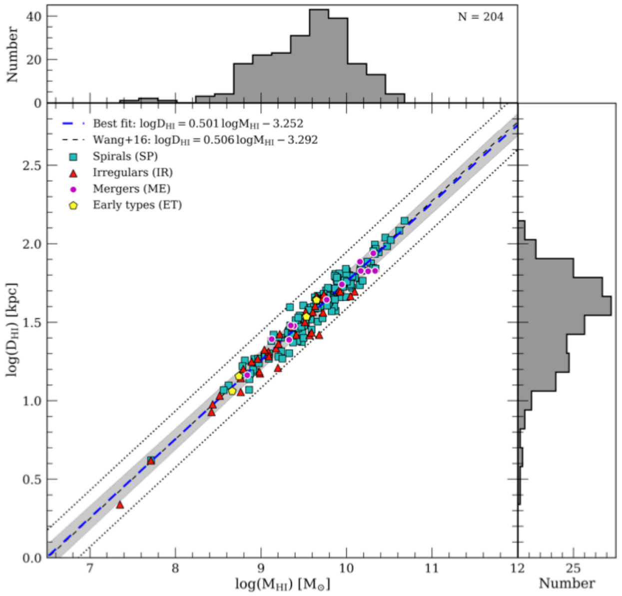
5 2021MNRAS.508.1195P 2021/11 cited: 4
MIGHTEE-H I: the baryonic Tully-Fisher relation over the last billion years
Ponomareva, Anastasia A.; Mulaudzi, Wanga; Maddox, Natasha and 17 more

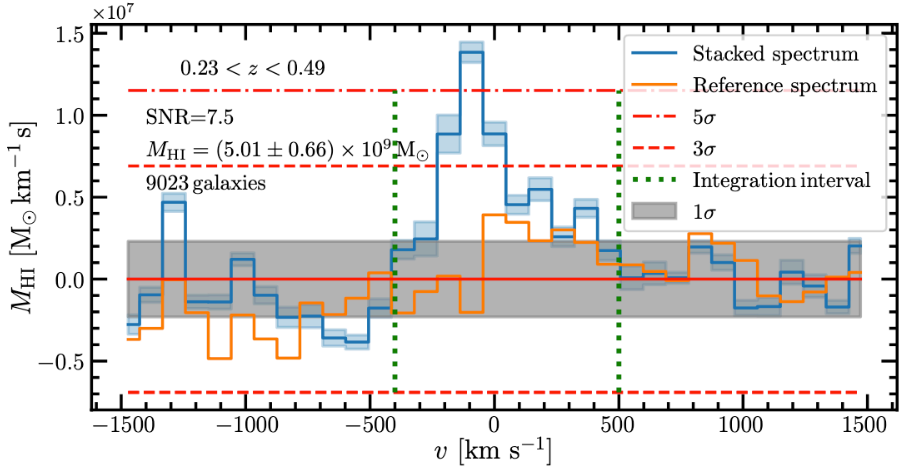
6 2021MNRAS.506.2753R 2021/09 cited: 2
MIGHTEE-HI: discovery of an H I-rich galaxy group at z = 0.044 with MeerKAT
Ranchod, Shilpa; Deane, Roger P.; Ponomareva, Anastasia A. and 13 more

7 2021MNRAS.505.2039P 2021/08 cited: 3
H I intensity mapping with the MIGHTEE survey: power spectrum estimates
Paul, Sourabh; Santos, Mario G.; Townsend, Junaid and 5 more

8 2021A&A...646A..35M 2021/02 cited: 18
MIGHTEE-HI: The H I emission project of the MeerKAT MIGHTEE survey
Maddox, N.; Frank, B. S.; Ponomareva, A. A. and 19 more

9 2020MNRAS.491.1227P 2020/01 cited: 4
Measuring the HI mass function below the detection threshold
Pan, Hengxing; Jarvis, Matt J.; Allison, James R. and 5 more





8 *A. A. Ponomareva et al.*

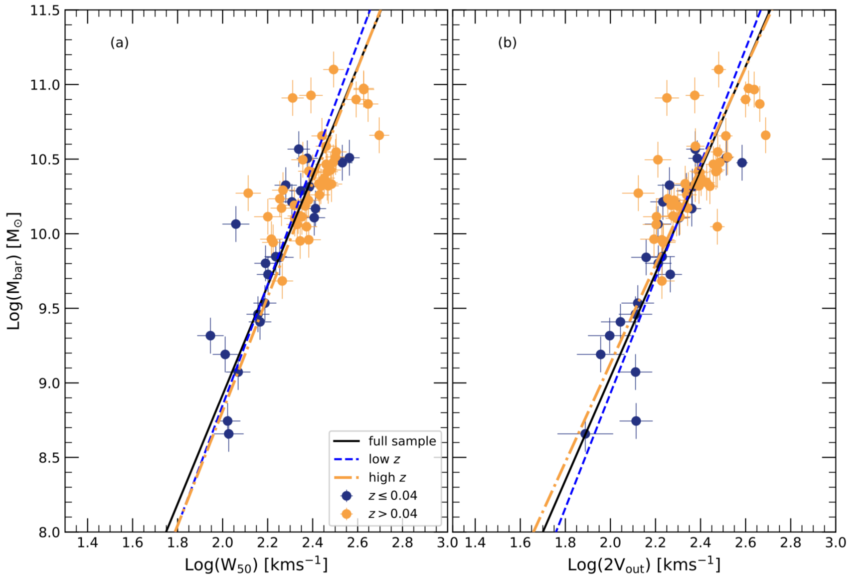


Figure 6. The bTFr based on corrected W_{50}, panel (a) and V_{out}, panel (b). The high-redshift galaxies ($z > 0.04$) are shown with orange symbols, while the low-redshift galaxies ($z \leq 0.04$) are shown with blue symbols. The best-fit for the full sample is shown with the straight black line, while the fits for low- and high-z samples are shown with blue dashed and orange dashed-dotted lines respectively.

Wanga Mulaudzi

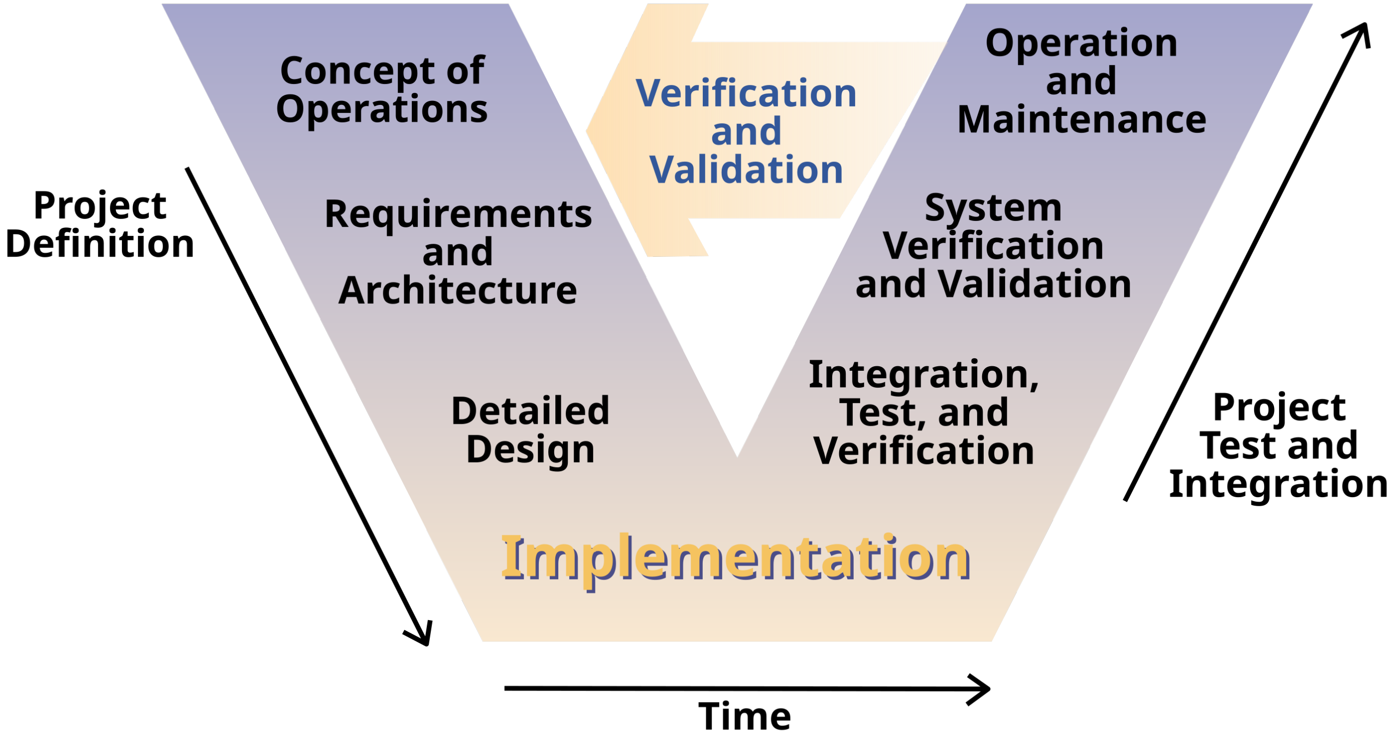
Supervisor: Dr Bradley Frank
Co-Supervisor: Prof. Renée Kraan-Korteweg

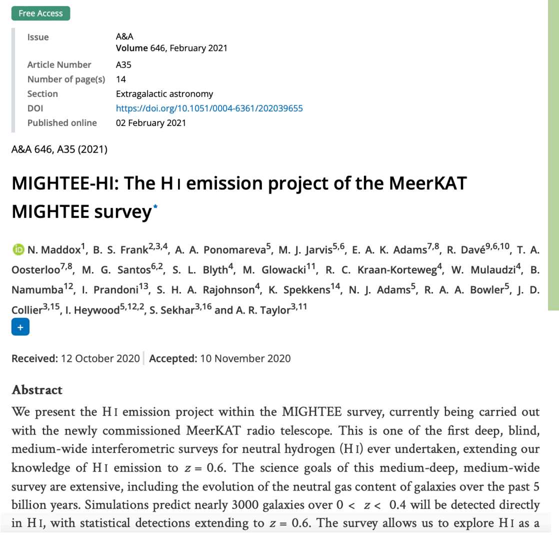
Thesis presented for the degree of Master of Science

Department of Astronomy
University of Cape Town
South Africa
November 2021

Science and Technology Facilities Council
UK Astronomy Technology Centre

Systems Engineering “V” Diagram




Free Access

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Published online	02 February 2021

A&A 646, A35 (2021)

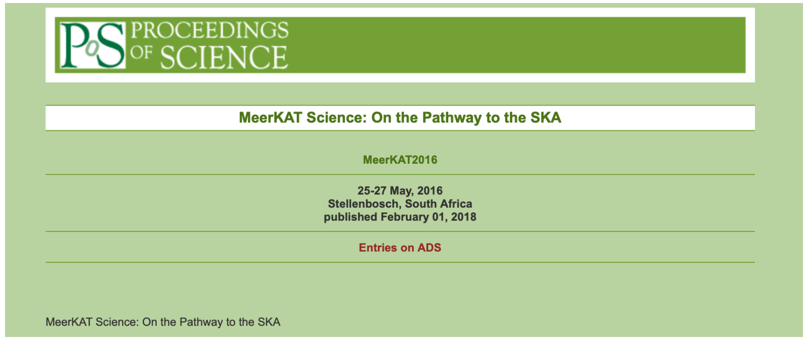
MIGHTEE-HI: The H I emission project of the MeerKAT MIGHTEE survey*

N. Maddox[1], B. S. Frank[2,3,4], A. A. Ponomareva[5], M. J. Jarvis[5,6], E. A. K. Adams[7,8], R. Davé[9,6,10], T. A. Oosterloo[7,8], M. G. Santos[6,2], S. L. Blyth[4], M. Glowacki[11], R. C. Kraan-Korteweg[4], W. Mulaudzi[4], B. Namumba[12], I. Prandoni[13], S. H. A. Rajohnson[4], K. Spekkens[14], N. J. Adams[5], R. A. A. Bowler[5], J. D. Collier[3,15], I. Heywood[5,12,2], S. Sekhar[3,16] and A. R. Taylor[3,11]

Received: 12 October 2020 | Accepted: 10 November 2020

Abstract

We present the H I emission project within the MIGHTEE survey, currently being carried out with the newly commissioned MeerKAT radio telescope. This is one of the first deep, blind, medium-wide interferometric surveys for neutral hydrogen (H I) ever undertaken, extending our knowledge of H I emission to $z = 0.6$. The science goals of this medium-deep, medium-wide survey are extensive, including the evolution of the neutral gas content of galaxies over the past 5 billion years. Simulations predict nearly 3000 galaxies over $0 < z < 0.4$ will be detected directly in H I, with statistical detections extending to $z = 0.6$. The survey allows us to explore H I as a


PROCEEDINGS OF SCIENCE

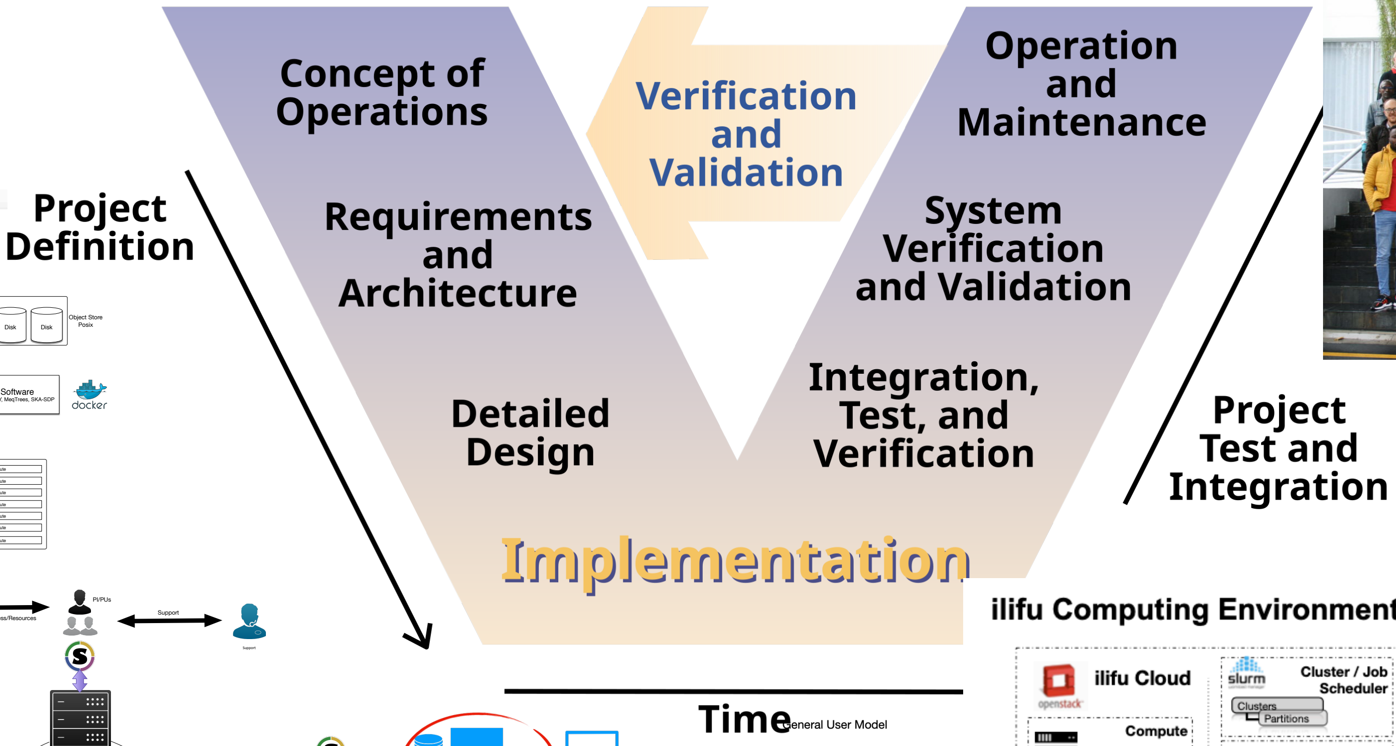
MeerKAT Science: On the Pathway to the SKA

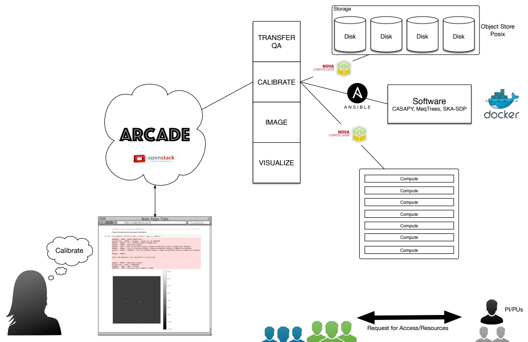
MeerKAT2016

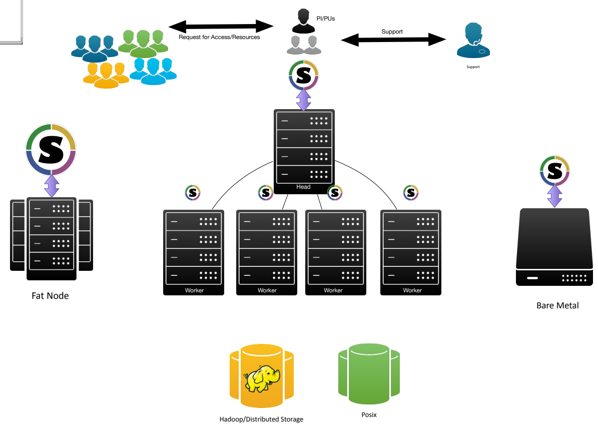
25-27 May, 2016
Stellenbosch, South Africa
published February 01, 2018

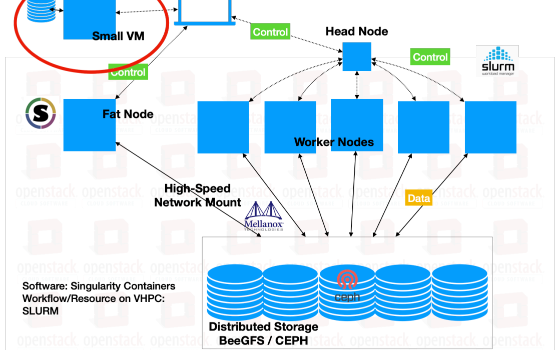
Entries on ADS

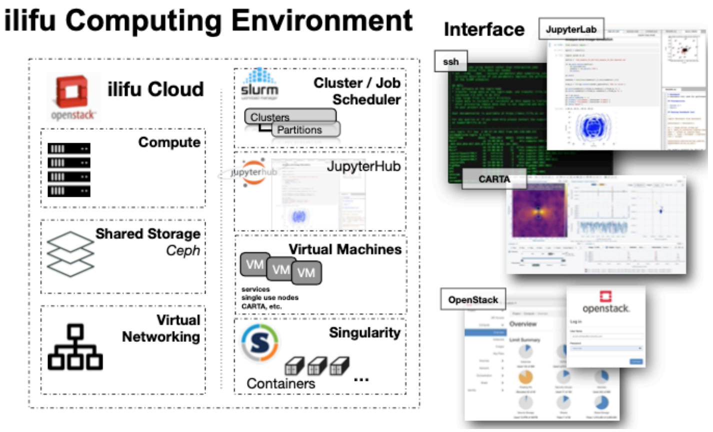
MeerKAT Science: On the Pathway to the SKA



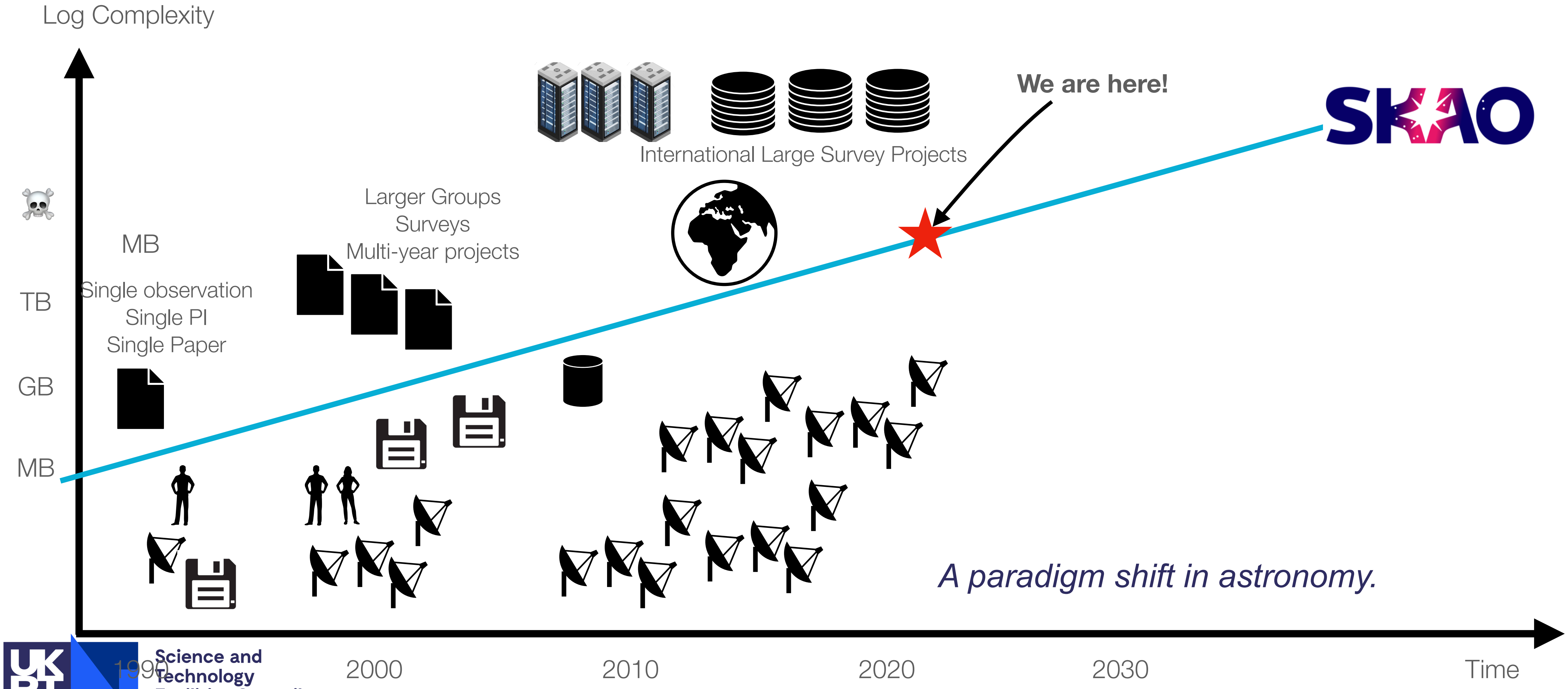








MeerKAT/IDIA in Context



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Time to Science

Model of the data work flow

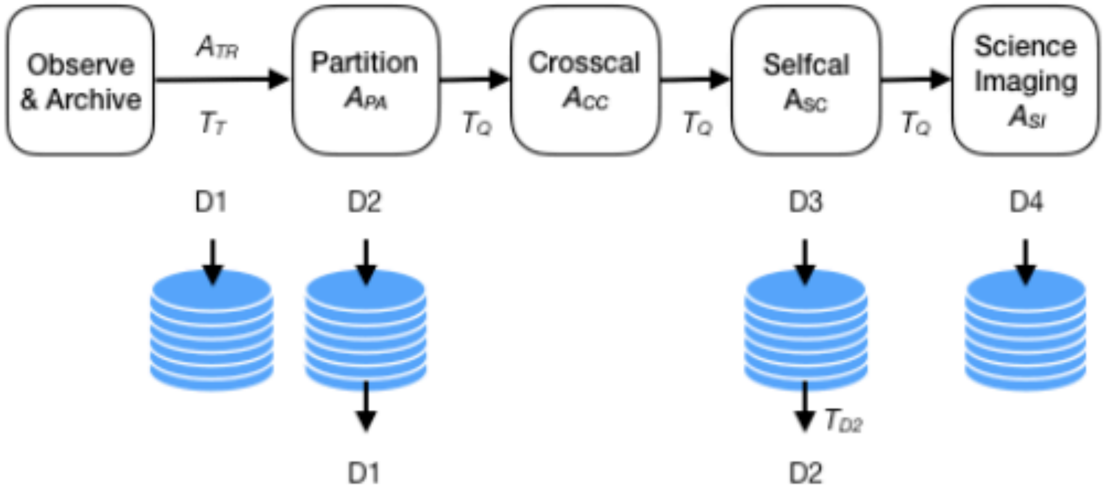
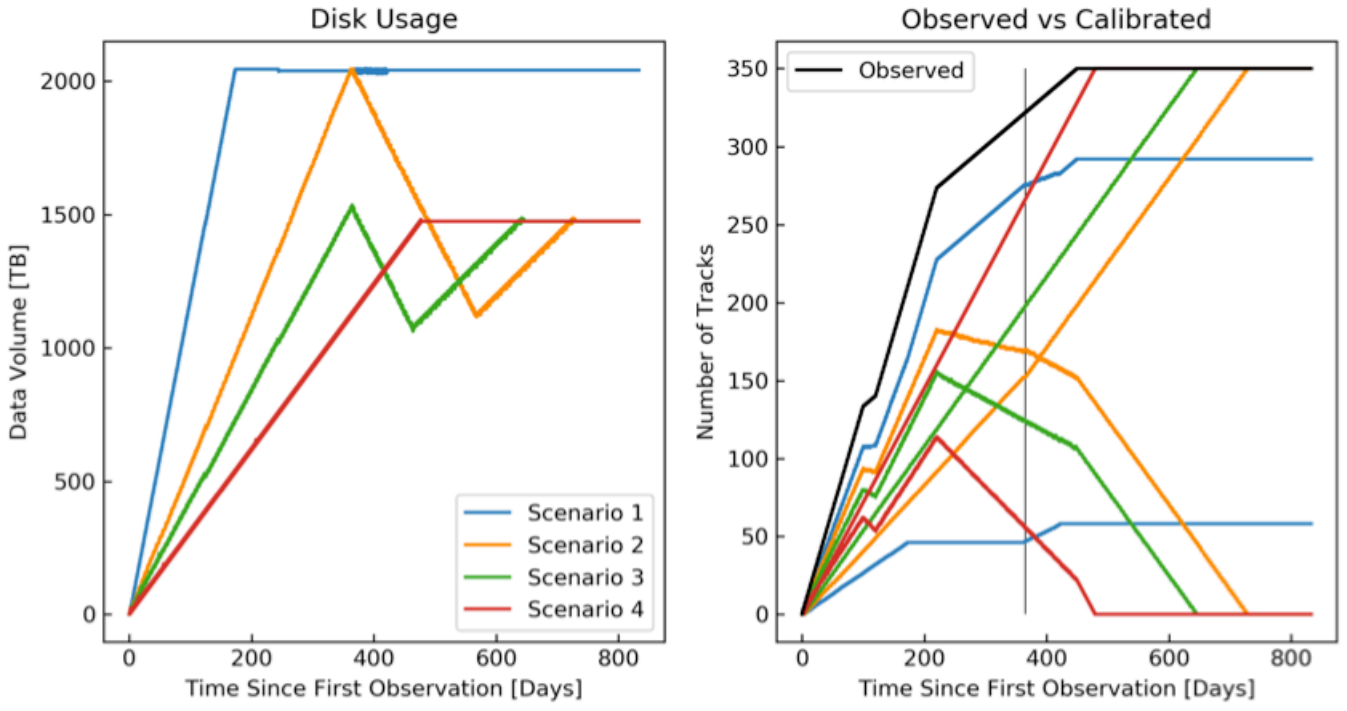


Figure 3: Overview of the LSP operational model at IDIA. Each block illustrates a processing step, and has an associated coefficient. The model includes the corresponding data write or removal operation, and various wait or staging times.

$$T_{proc} = (A_{TR} + A_{PA} + A_{CC} + A_{SC} + A_{SI}) \cdot T_{obs}$$

From Ilifu Processing and Storage
for MeerKAT Large Imaging Surveys (Memo)



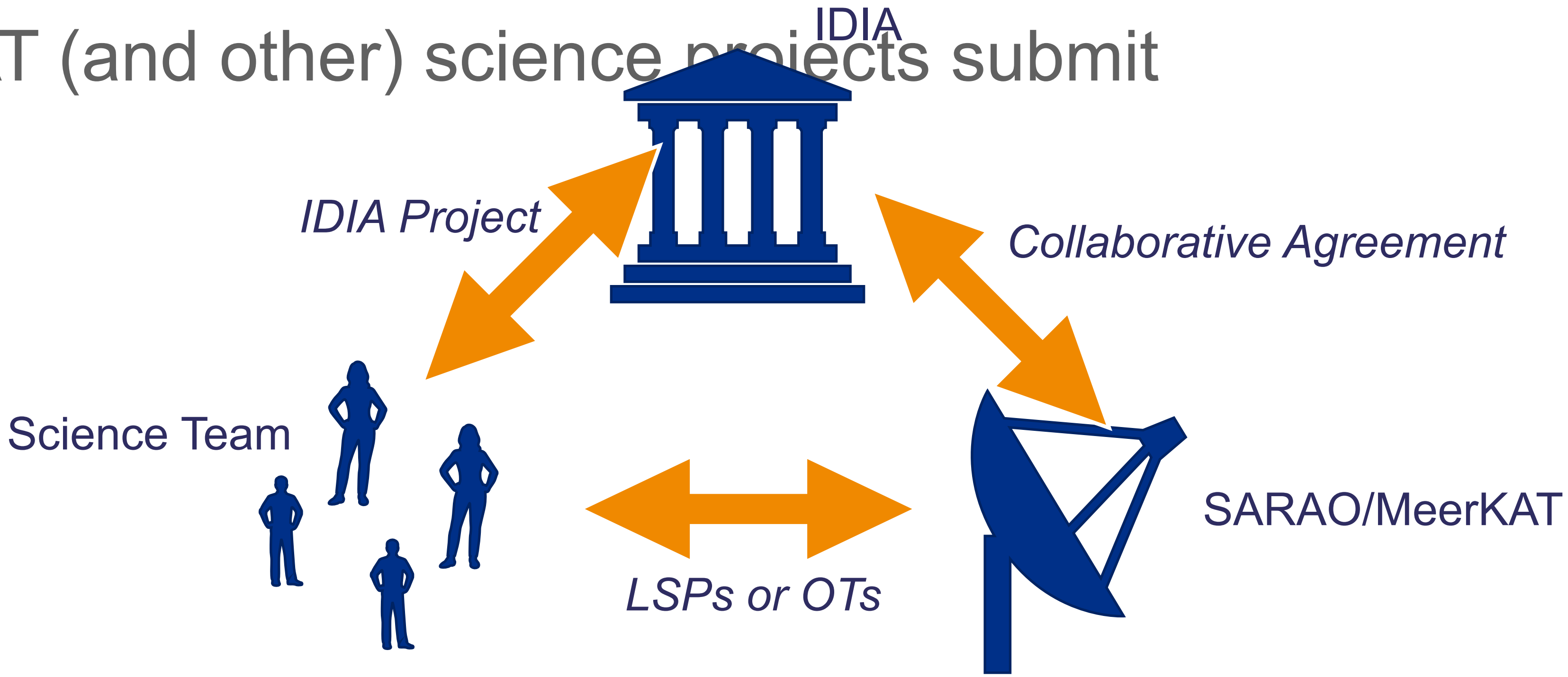
Each scenario explores the impact of:

- Serial vs parallelised processing
- Data production QA
- QA storage overhead (hoarding data)
- Science imaging strategies.

Implemented using SIMPY

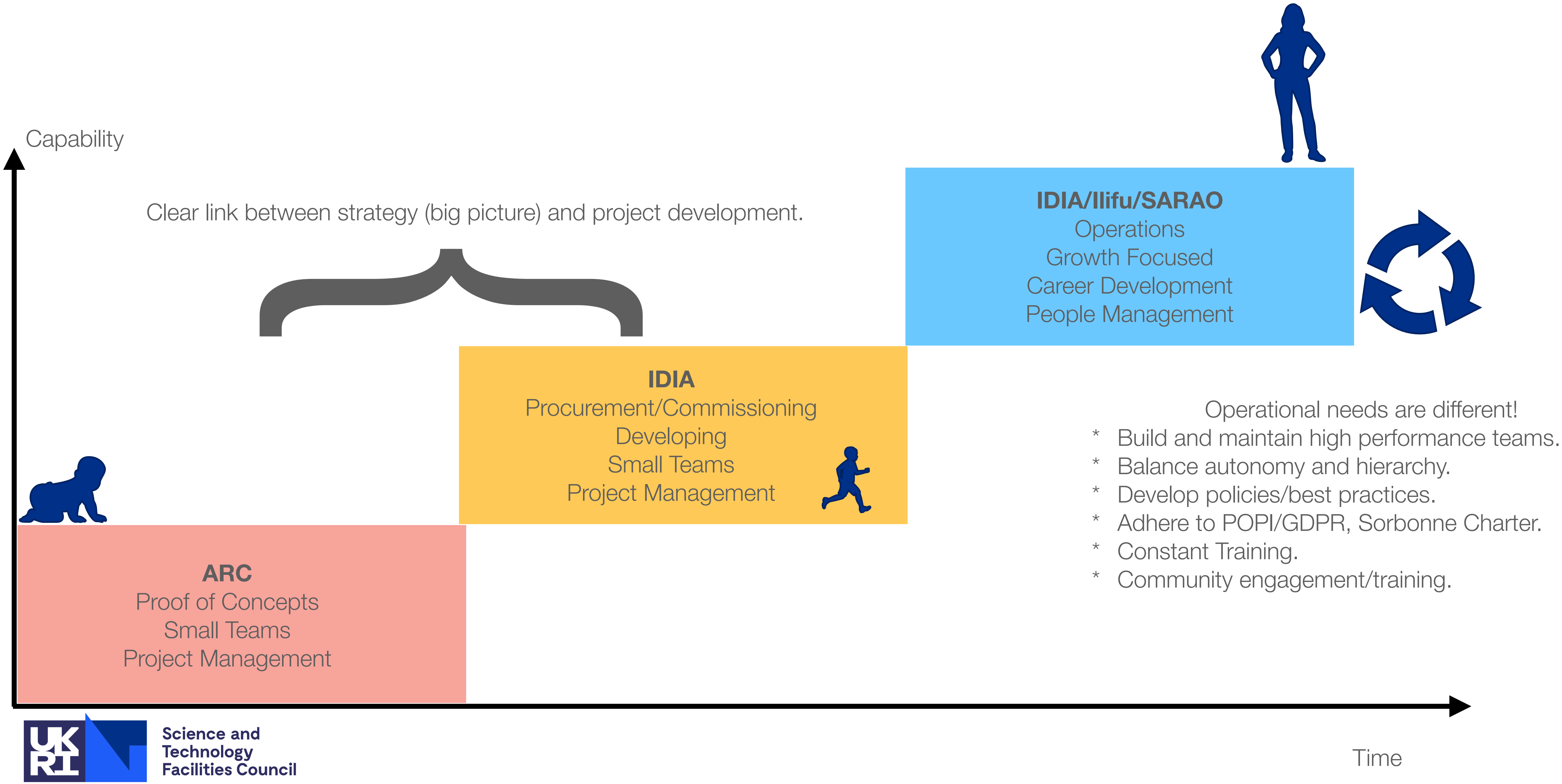
"Governance"

- Independent, with an oversight committee comprising DVCs and SARAO Chief Scientist.
- Funding — tapped from universities and national funding agency (NRF).
- MeerKAT (and other) science projects submit



IDIA and MeerKAT

- SARAO: call for proposals, or large project review, which includes a data processing/management plan or report.
- Simultaneously, IDIA issues a call for expressions of interest, or support, for data management.
- Letter of support, or *data/report*, is provided for potential projects, which is included in proposal, or report.
- For successful projects, IDIA+SARAO sets-up semi-automatic data transfer for observations, and IDIA projects (fairshare rated).
- IDIA reviews projects annually, based on data usage.



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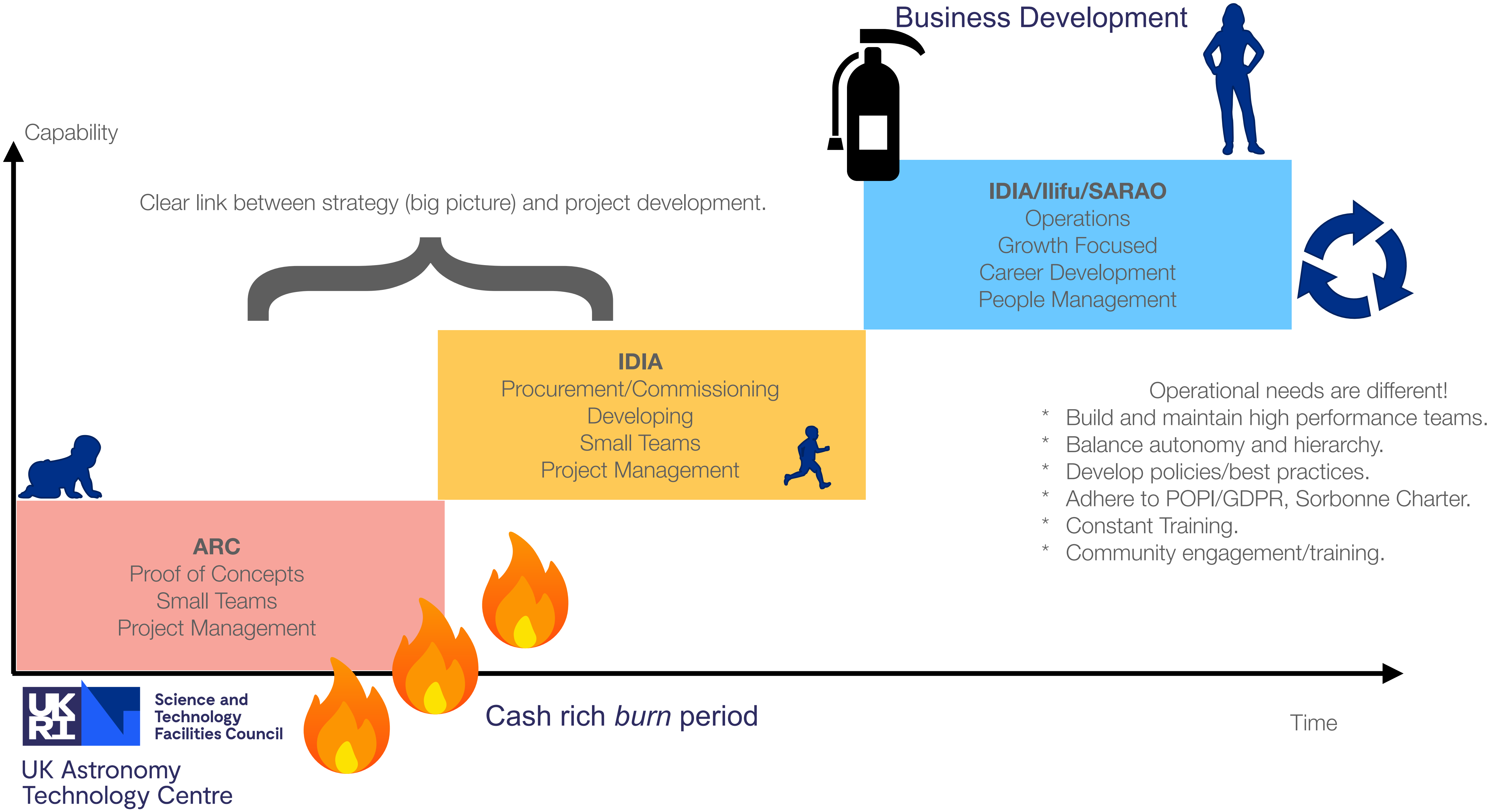
Business Development
Capability
Clear link between strategy (big picture) and project development.
IDIA/Ilifu/SARAO
Operations
Growth Focused
Career Development
People Management
IDIA
Procurement/Commissioning
Developing
Small Teams
Project Management
Operational needs are different!
* Build and maintain high performance teams.
* Balance autonomy and hierarchy.
* Develop policies/best practices.
* Adhere to POPI/GDPR, Sorbonne Charter.
* Constant Training.
* Community engagement/training.
ARC
Proof of Concepts
Small Teams
Project Management
Science and Technology Facilities Council
Cash rich *burn* period
Time
UK Astronomy Technology Centre

Challenges

- Astronomers are not computers scientists!
- Policy development — flexible enough for innovative science, but strong enough to ensure compliance and fairness.
  - Also affects your technology, e.g., Slurm fairshare!
- Service at a *constant* level: $€_{total} = 2 \times €_{OpEx} \times T_{ops}$
  - Depends on Inflation, Operational Model, Staff, etc…
  - For IDIA, $€_{OpEx}$ ~ €0.5M, so $€_{total}$ = €5M for 5 years
- Sustainable management model — scaling from a *project* to an institution.

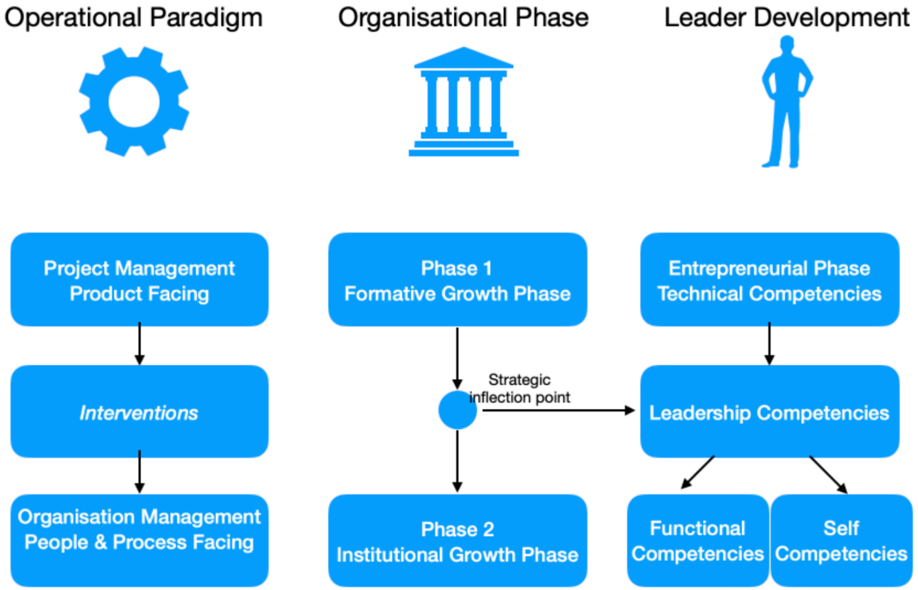

Table V
Self competencies

A. Exercise intellectual integrity	
	1. Understand personal strengths and weaknesses
	2. Hire people to complement weaknesses
	3. Self educate where needed
B. Move from "me" to "we"	
	1. Sell the company instead of self
	2. Become a coach
C. Speak to the oracle	
	1. Maximize external advisors
	2. Participate in networking groups
	3. Anticipate organizational changes
D. Create a sustainable organization	
	1. Become a strategic thinker
	2. Begin to make long-term decisions
	3. Identify unique contribution to the organization

Swiercz & London, 2002