

The Fifth National Workshop on the SKA Project

24 NOVEMBER 2025 – BOLOGNA RESEARCH AREA

Regional Centres network: the Italian plan

ANDREA POSSENTI



SKA1-MID, Karoo, South Africa:

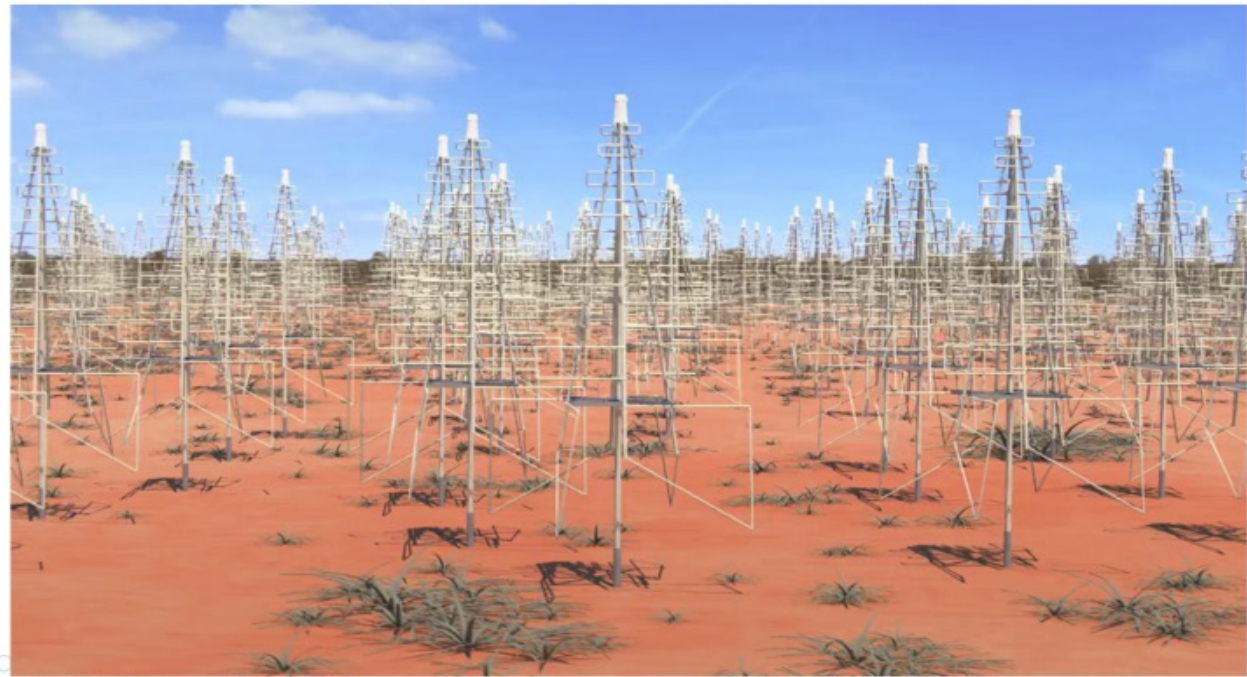
133 SKA1 + 64 MeerKAT dishes. Max baseline ~150km

Bands: **2** (0.95–1.76 GHz), **5** (4.6–14(24) GHz), **1** (0.35–1.1 GHz)



SKA1-LOW, Murchison, Australia:

130,000 dipoles (512 stations x 256 antennas); 50–350 MHz
~80km baselines; large areal concentration in core



[© R. Braun]

... two kinds
of antennae

SKAO:
two sites...

[© R. Braun]

but... Not only antennae...

Computing and data archiving are the key ingredients for extracting the best of the science from antennae, network and receivers

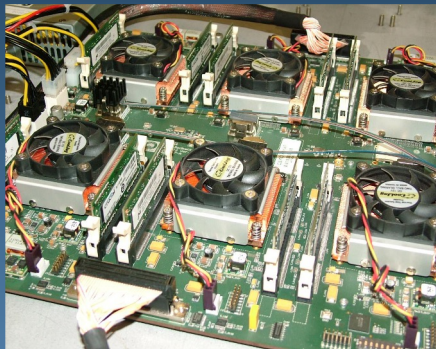
[© SKA organization 2021]



Thus, computing and data archiving are the real «limiting factors» for the capabilities of the new Observatory: SKAO will become more and more efficient with the improvement of those

The SKAO data flow

CSP: Central Signal Processor

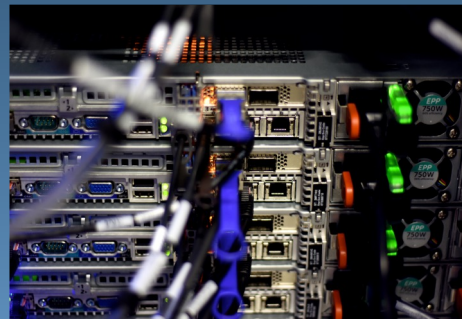


e.g. FPGAs in the ASKAP correlator

5 + 9 Tb/s
data
buffer of
2 minutes



SDP: Science Data Processor

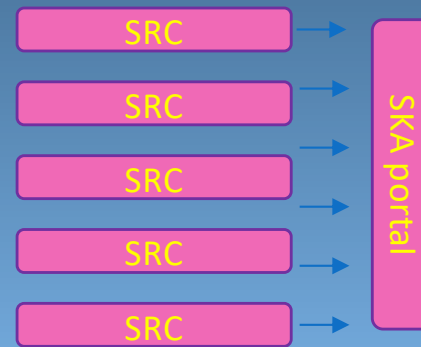


e.g. SDP prototype, Cambridge

5 Tb/s
data buffer of 2 weeks

300 PB/yr
data persistence

SRC: SKA Regional Centre network



Distributed facilities

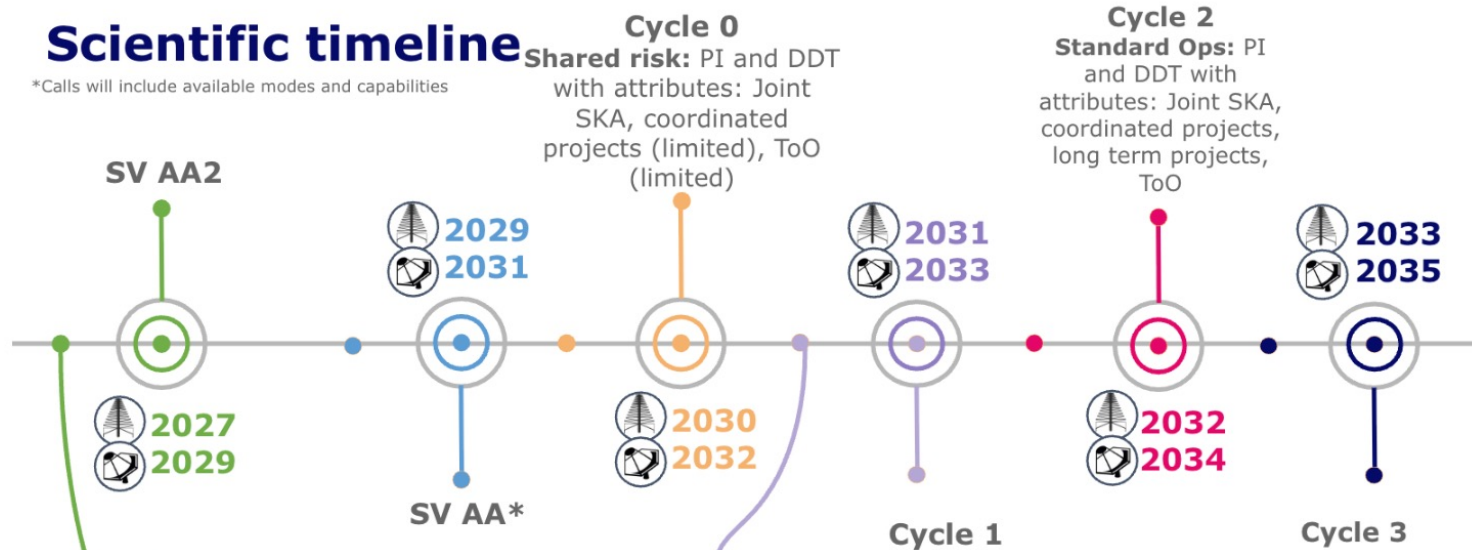


USERS

The re-adjusted SKAO timeline

Scientific timeline

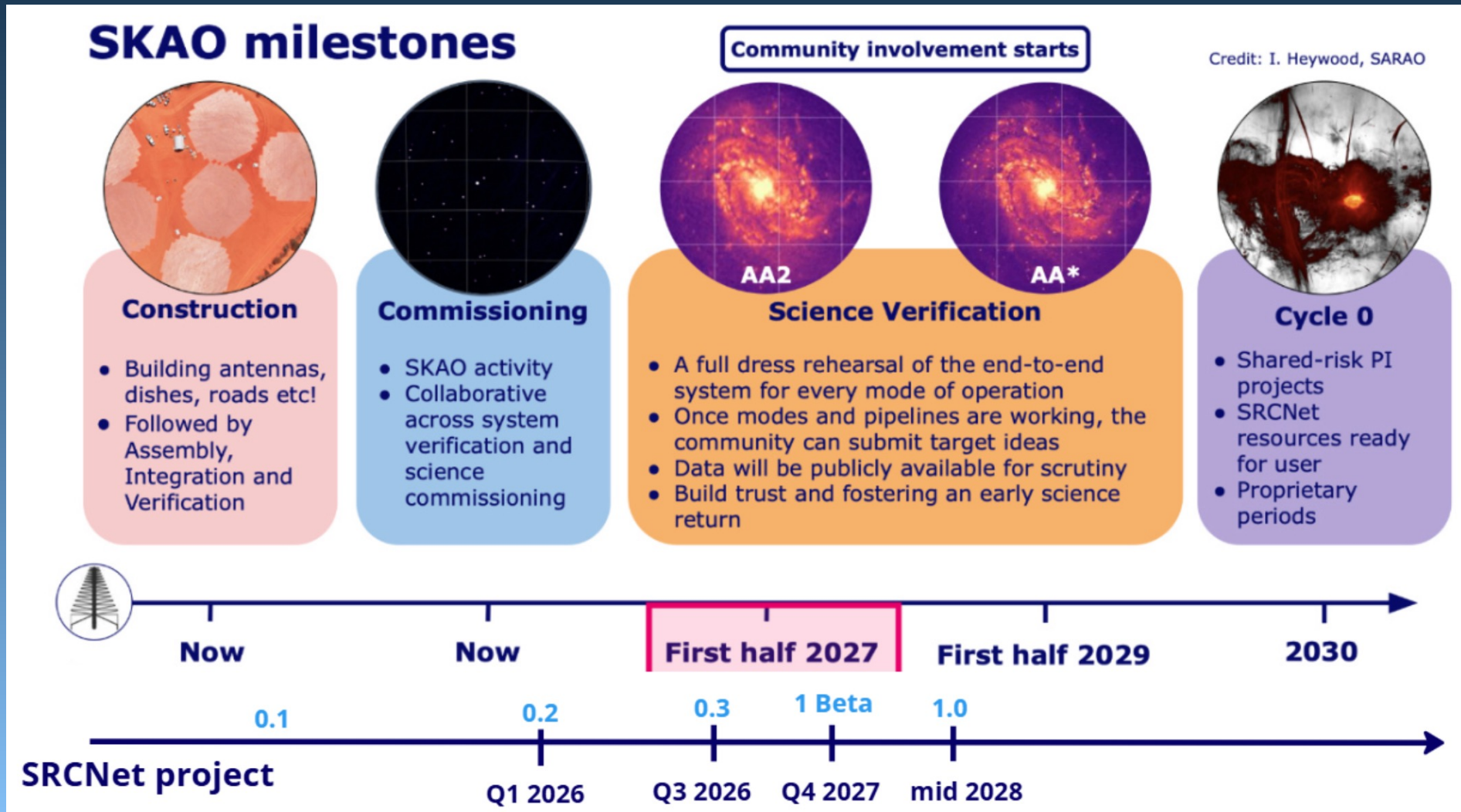
*Calls will include available modes and capabilities



Science Data Volumes Assuming AA*	Annual increase in new science data (PetaBytes)	Cumulative Total (unique) Science Data (Petabytes)	notes - Low	notes - Mid
2026	0.0	0.0	no users	no users
2027	0.5	0.5	AA2 SV LOW	no users
2028	0.5	0.9	AA2 SV LOW	no users
2029	25.6	26.5	AA* SV LOW, increased data rate	AA2 SV MID
2030	65.4	91.9	LOW Cycle 0 starts	AA2 SV MID
2031	88.5	180.4	LOW Cycle 1	AA* SV MID, increased data rate
2032	150.0	330.4	LOW Cycle 2	MID Cycle 0 starts
2033	198.8	529.1	LOW Cycle 3 KSPs start	MID Cycle 1
2034	215.0	744.1		MID Cycle 2
2035	300.0	1044.1		MID Cycle 3 KSPs start

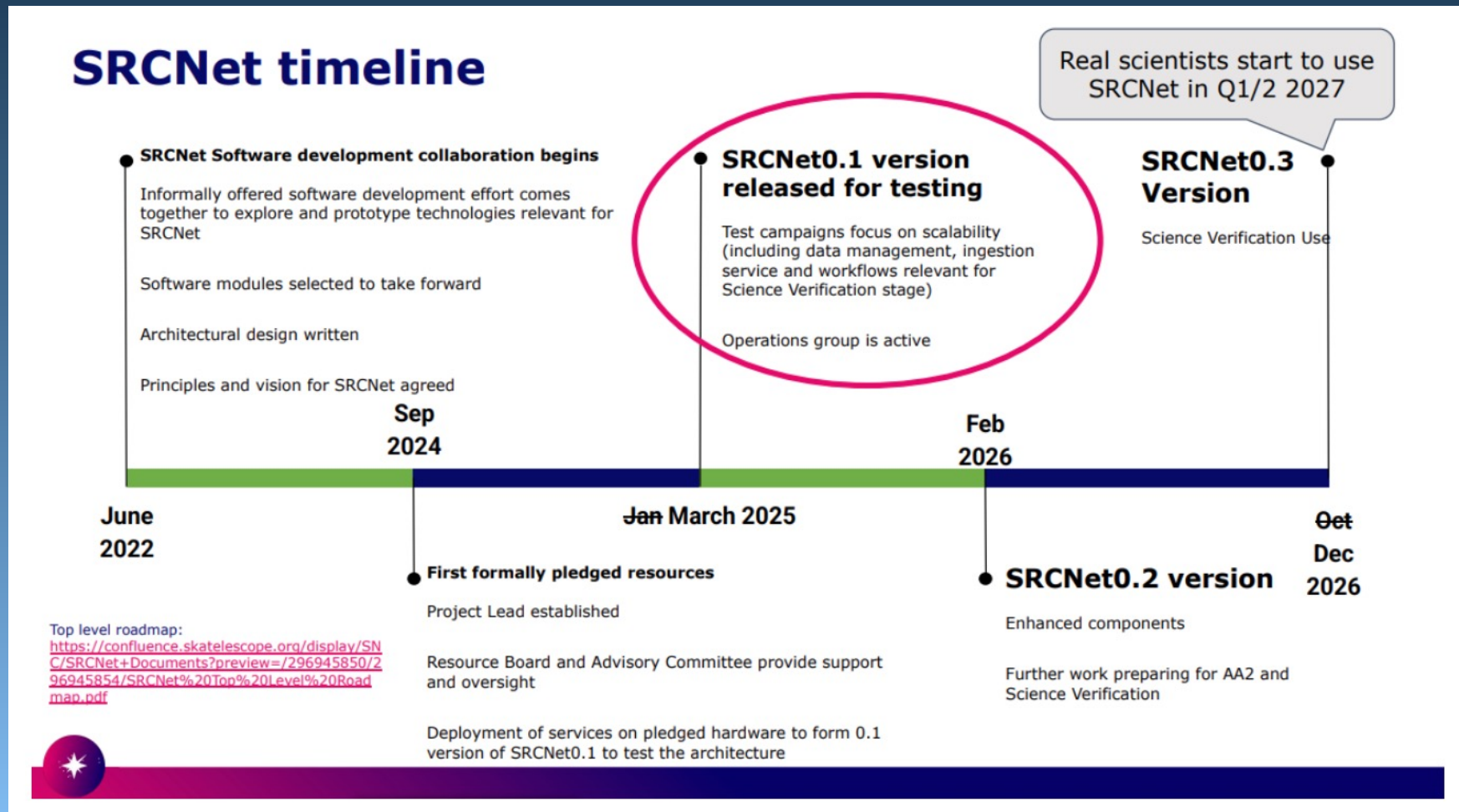
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The global Roadmap of the SRCnet



Not a strong re-adjustment for the SRCnet

The short term Roadmap of the SRCnet



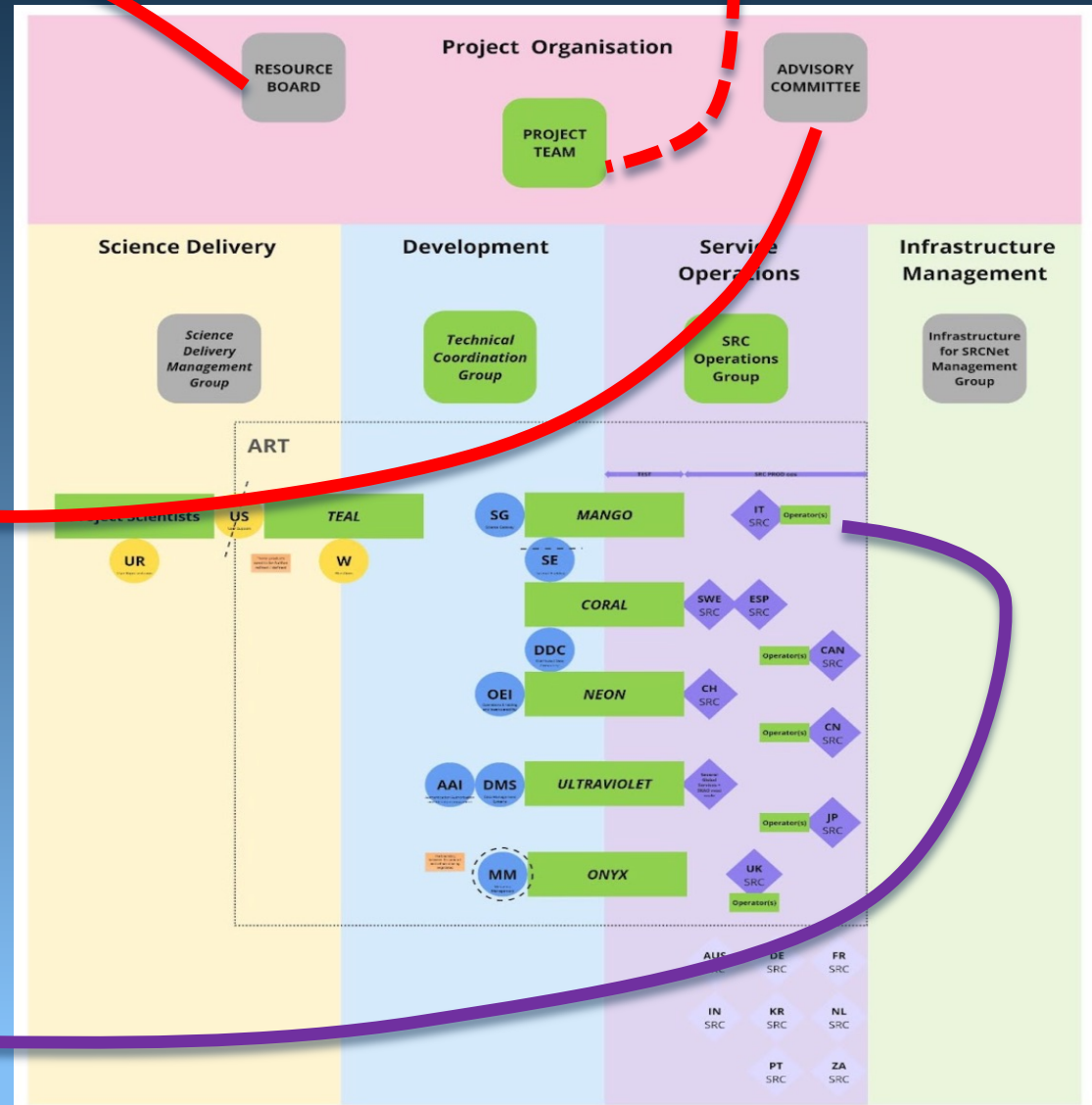
The revised structure of the SRCnet project

Rosie Bolton (Leader)

Andrea Possenti
(Resource Board)

Fabio Pasian
(Advisory Committee)

**NATIONAL
EFFORT:
the IT-SRC node**



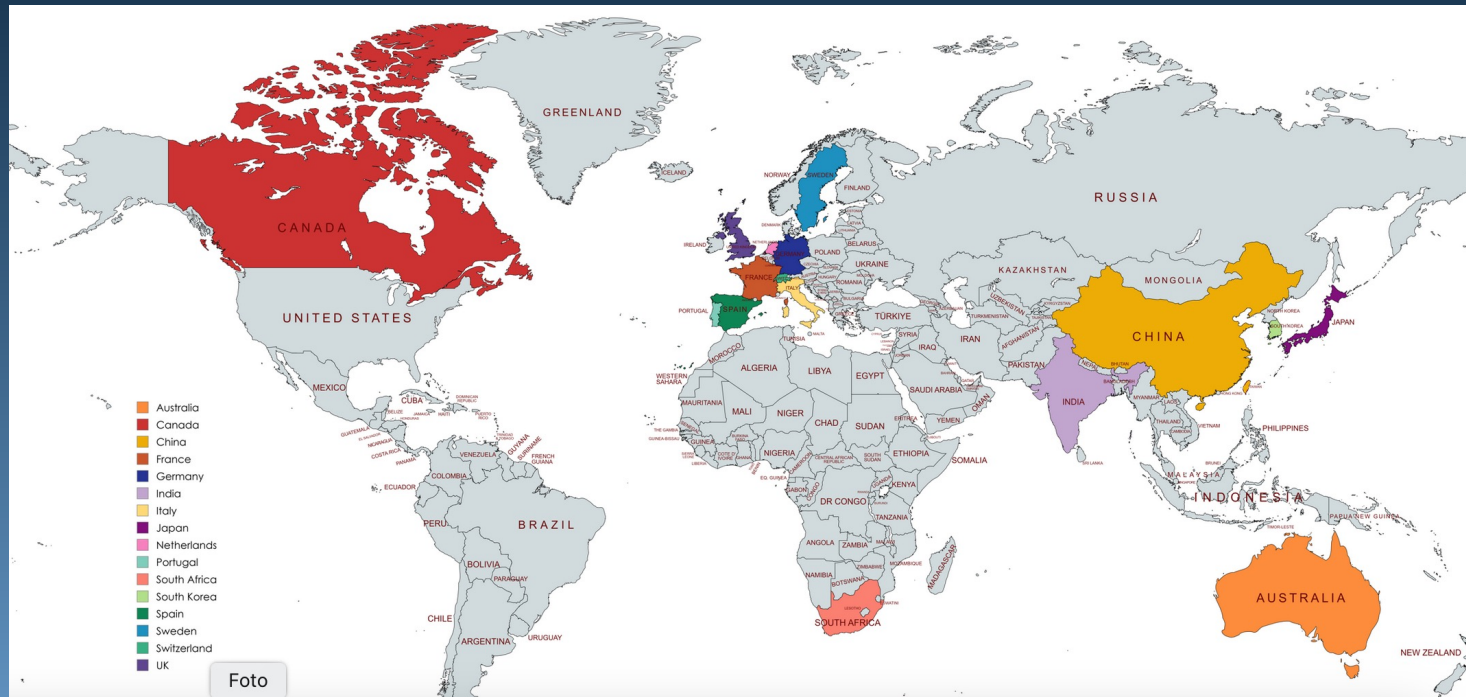
Adapted from Janneke deBoer(SKAO)

Italian expected outcome of the SRC network foundation



- ✓ 1. The identification of a kernel of “modi operandi” in the interactions among the various actors to secure an efficient, persistente, and always developable science-needs driven system
- ✓ 2. The establishment of a SRC network with a significant node located in Italy
- ✓ 3. The recognition of the local investments in both hardware and human expertise, and its conversion into incentives as soon as possible

Now 9 active nodes for the SRCnet



Adapted from Janneke deBoer(SRC)

**The Italian node passed the
validation test on Aug 2025**

The past Italian contribution to the global effort science



**≈ 100 Italian astro-scientists are members
of the SKA Science Working Groups!**

Developed requests and
imagine solutions **to the**
USE CASES **for the SRC**
network

+

Staying at the frontline in
ADAPTING **to the new way**
for doing data reduction
and computation in the
SKA era

+

Exploit experience in
precursors & pathfinders **to**
provide suggestions and
solutions

SKA Science Regional Centres - SCSRC community input

Survey Flow

Standard: Questionnaire Preamble (2 Questions)

Standard: Section 0 - Some general questions (6 Questions)

Standard: Section 1. Data products and scientific requirements (17 Questions)

Standard: Section 1. Data products and scientific requirements Loop (66 Questions)

Standard: Section 2. Archive mining and VO Interface (19 Questions)

Standard: Section 3. Post-processing – Analysis – Visualisation (53 Questions)

Standard: Section 4. User support (11 Questions)

The Questionnaire for the SWGs: **174 questions!**

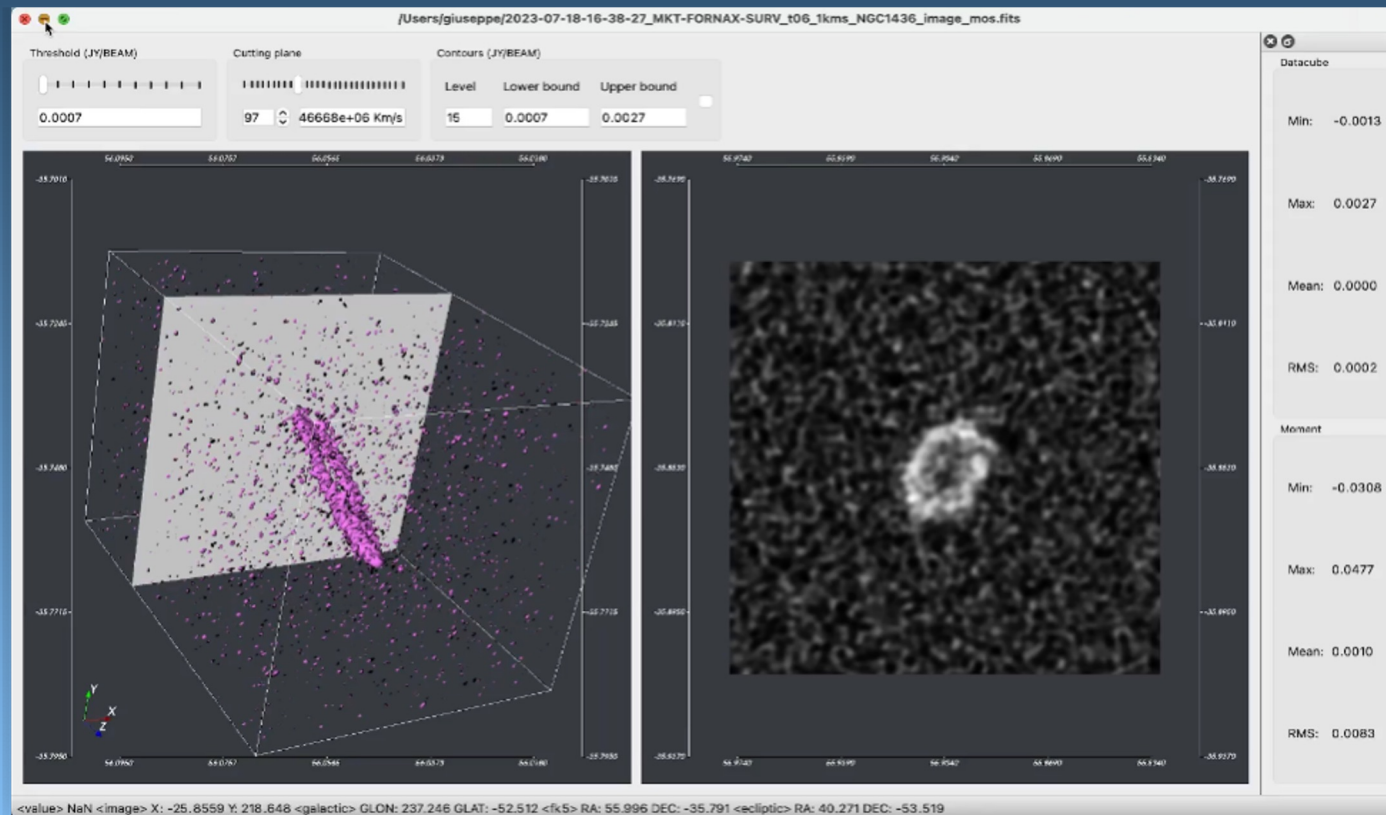
The past Italian contribution to the global effort

Software and Systems' activities in the 2020-2023

Role	First Name	Family Name	Agile Teams
Business Owner	Claudio	Gheller	all
Product Owner	Fabio	Vitello	Orange
Scrum Master	Giuseppe	Tudisco	Orange
member	Eva	Sciacca	Orange
member	Andrea	Lorenzani	Orange
member	Alessandra	Zanichelli	Orange
member	Vincenzo	Galluzzi	Orange
member	Robert	Butora	Orange
member	Marco	Molinaro	Orange
member	Gianluca	Marotta	Orange
member	Gianmarco	Maggio	Olive
member	Sara	Bertocco	Olive
member	Matteo	Di Carlo	Olive
member	Matteo	Canzari	Tangerine
stakeholder	Matteo	Stagni	Cyan (not active)
stakeholder	Cristina	Knapic	Cyan (not active)
member	Giuliano	Taffoni	Architecture Group

INAF strongly involved in the SRCnet international software activities since 2020, with a total integrated effort of **~10 FTEs**

The completed work of the **Orange** Team (INAF led and devoted to Visualization tools) Started with working on Prototype 4: Visualization in Pl15 (since June 2022)



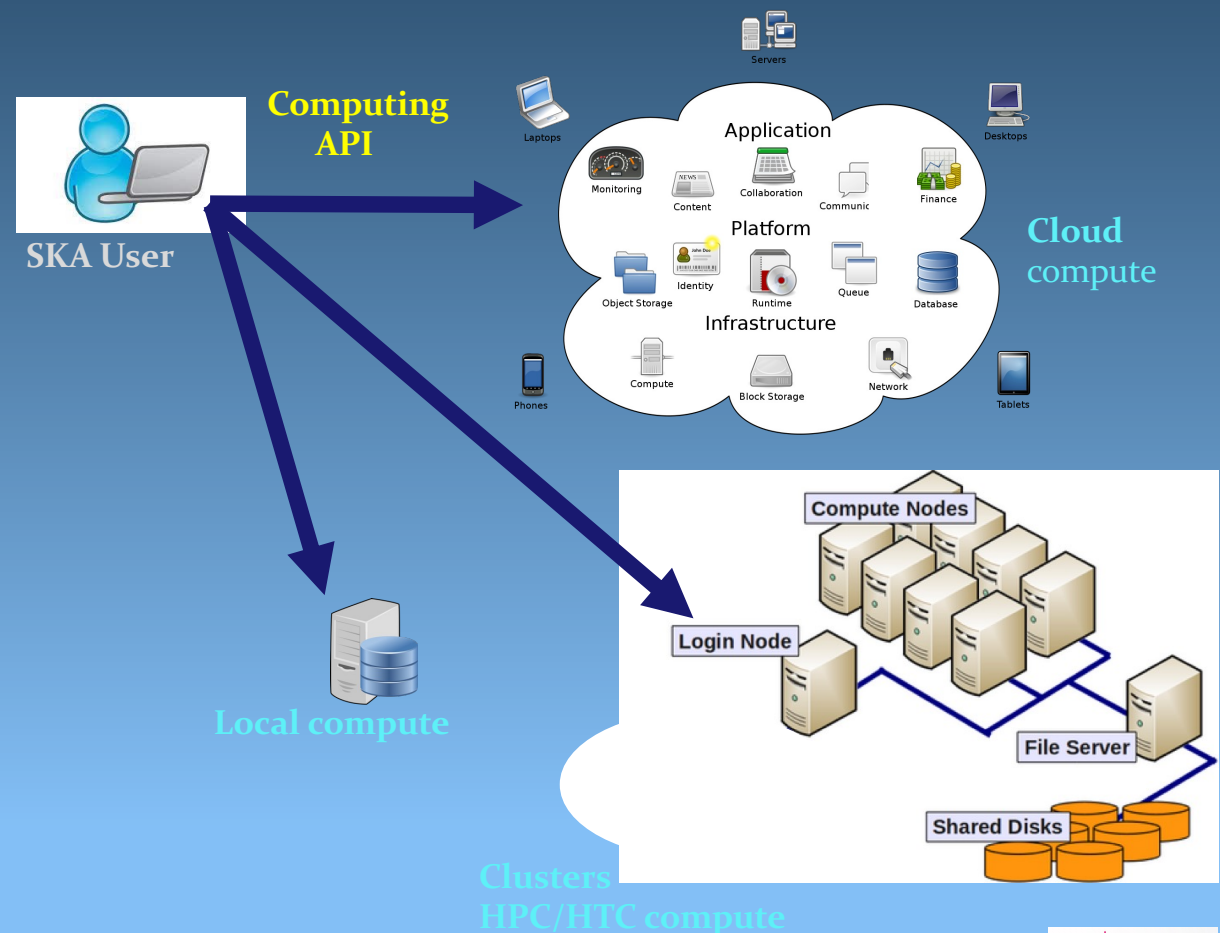
Hope it will be used since the beginning in the SRCnet release

The past work in various Team

Contributions on Computing API (Application Programming Interface)

Discussion

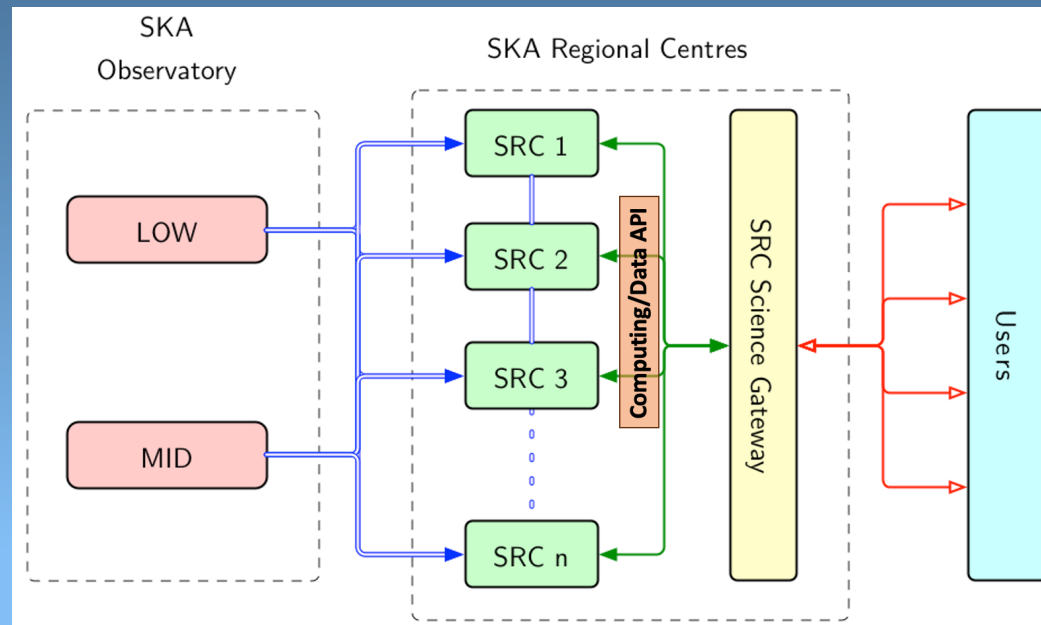
- Use cases
- Requirements
- Authentication and Authorization
- Solutions
- ExecutionPlanner ?
- Dirac ?
- Others ?



The past work in various Team

Aim: **design & implement an Application Programming Interface (API)** to

1. **Discover computing services**, answering the question "what computing services are available and suitable to run my task?"
2. **Access computing services**, answering the question "how can I run my task on the selected computing service (and when)?"



THE FOCUS WAS NOT ON THE TECHNOLOGY, BUT TO PROVIDE AN ABSTRACTION ABOVE TECHNOLOGY

The current Italian contribution to the global effort

Person	Team	Role	Value Stream	PI 28 (sept 25-nov 25)
Maggio	SRC Ops	Operator	Service Ops	0.00 (Ita-node)
Gandolfi	SRC Ops	Operator	Service Ops	0.00 (Ita-node)
Stagni	SOG + SRC Ops	SOG Operator	Service Ops Service Ops	0.25 0.10
Tudisco	SG DevOps + SCRUM	Operator Scrum Master	Service Ops Development	0.10 0.60
Vitello	SG DevOps	Developer	Development	0.40
Butora	SG DevOps	Developer	Development	0.50
Lacopo	SG DevOps	Developer	Development	0.70
Zanichelli	SciDev	Support Scientist	Science Deliv	0.35
Galluzzi	SciDev	Support Scientist	Science Deliv	0.35
Bracco	Project Science	Project Scientist	Science Deliv	0.50
Belli	Project Science	Support Pr Scient	Science Deliv	0.50

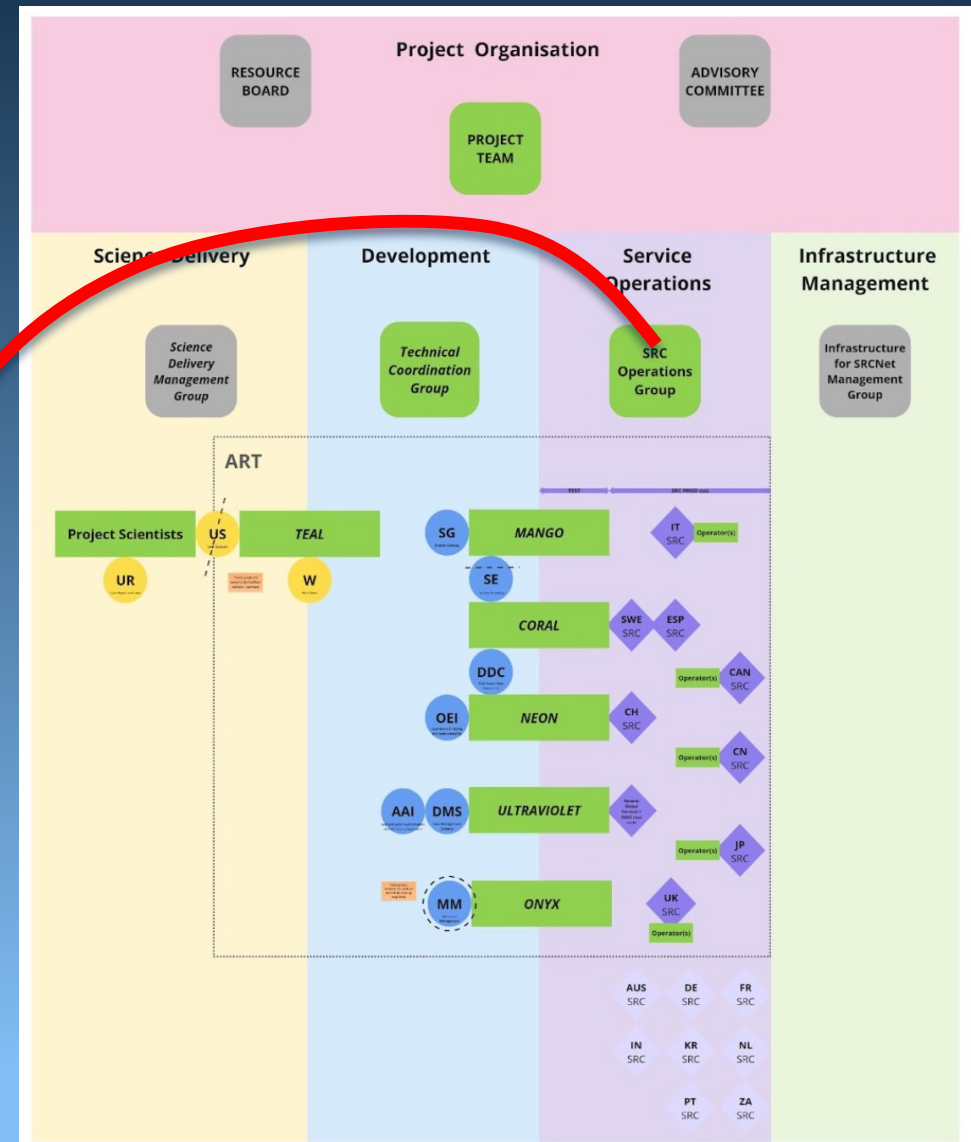
Average involvement : **0.4 FTE**

(Sci-)Dev-Ops team

SRCNet is adopting a (Sci-)Dev-Ops team methodology. Agile teams shall be responsible for all operations activities managed via SP Jira features (including all local SRC deployments).

Matteo Stagni [35%] - SOG Operator.
Matteo Gandolfi – Operator
Gianmarco Maggio. – Operator

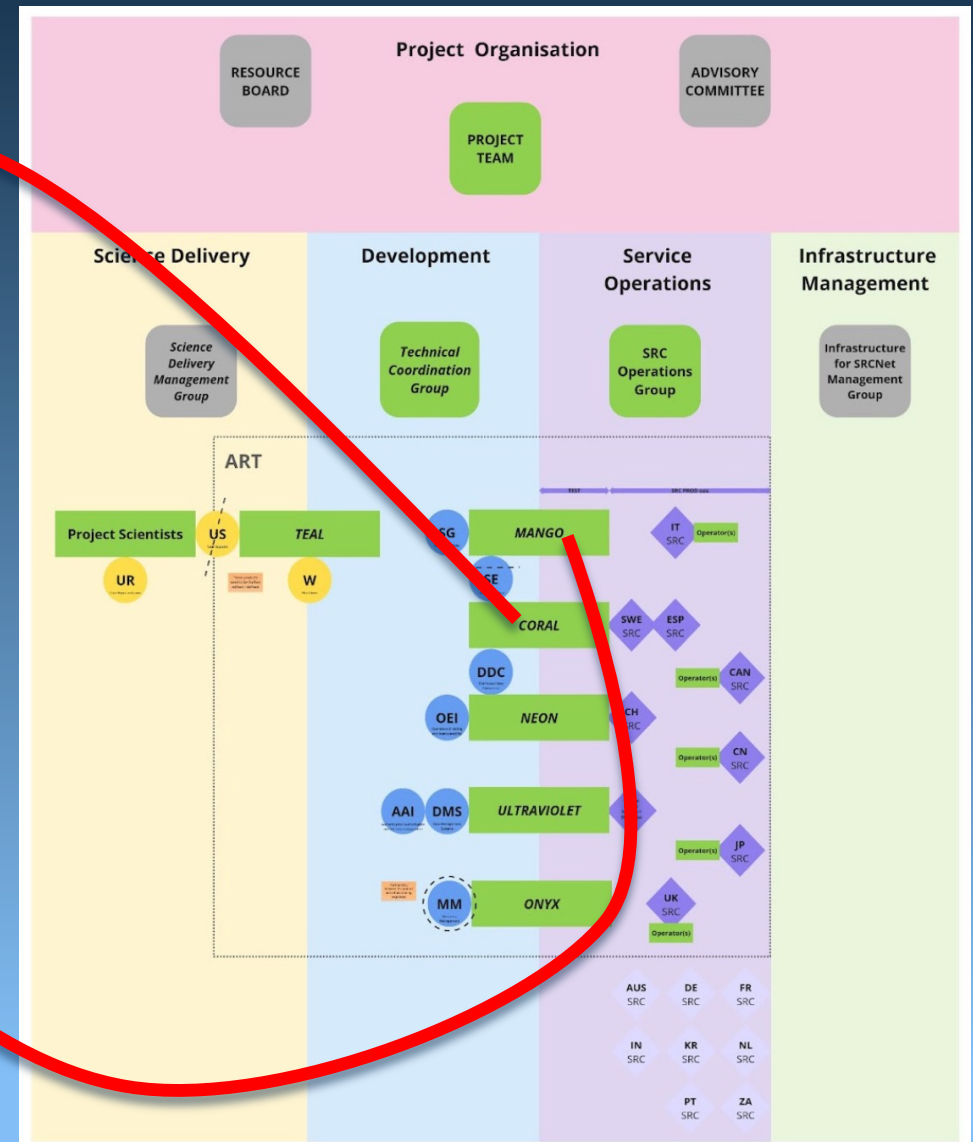
Giuliano Taffoni – Security Contact
(in collaboration with CINECA)



Development

Giovanni Lacopo [50%] -
Developer Coral Team (He is
working on realization and
testing of containers and their
use on various architectures in
order to ensure portability)

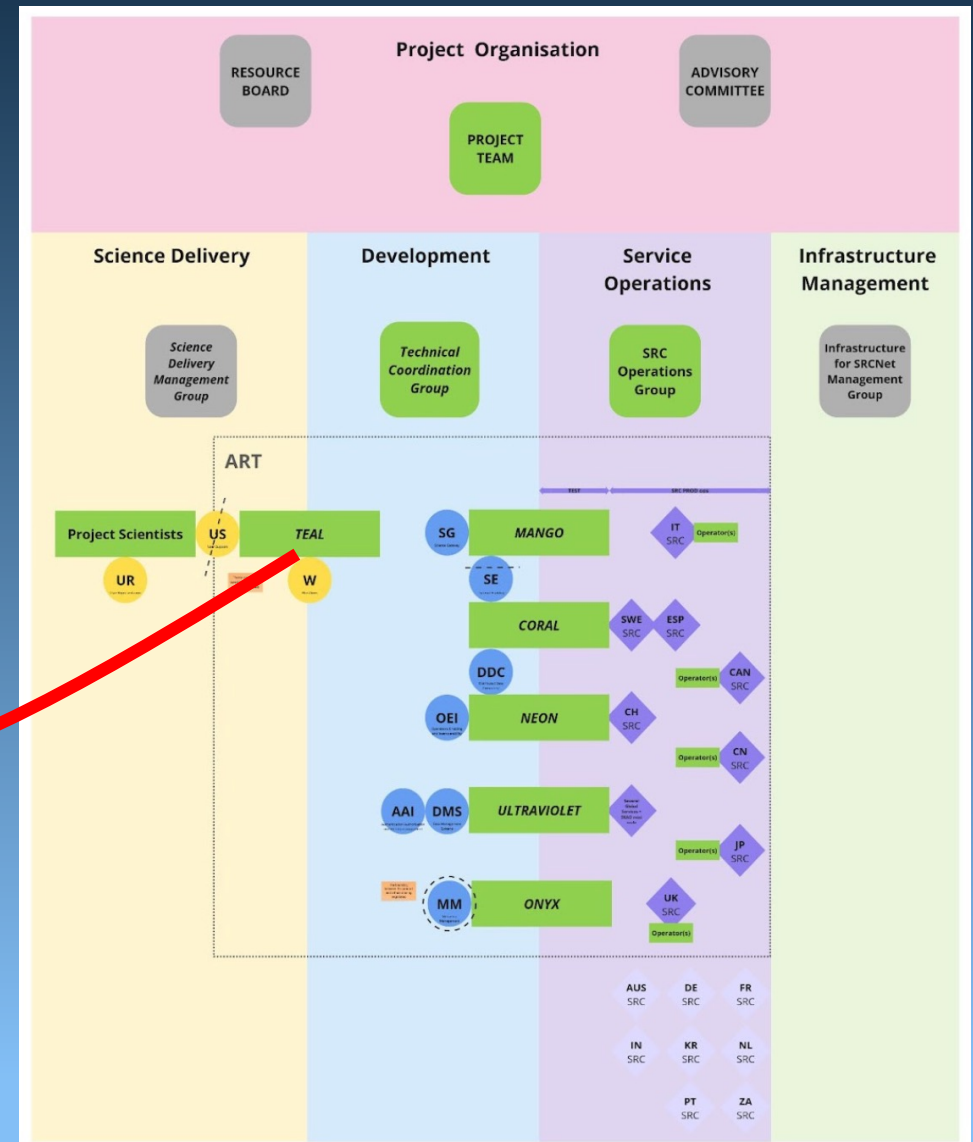
Giuseppe Tudisco [70%] -
Developer Mango Team
(Science Gateway)
Fabio Vitello [40%] -
Developer Mango Team
Robert Butora [50%] -
Developer Mango Team



Science Delivery

Vincenzo Galluzzi [35%] Teal Team
Alessandra Zanichelli [35%] Teal Team

Teal Agile team exists to support the use of science platforms to carry out scientific work and sits at the interface between the delivery of data products and observatory infrastructure.

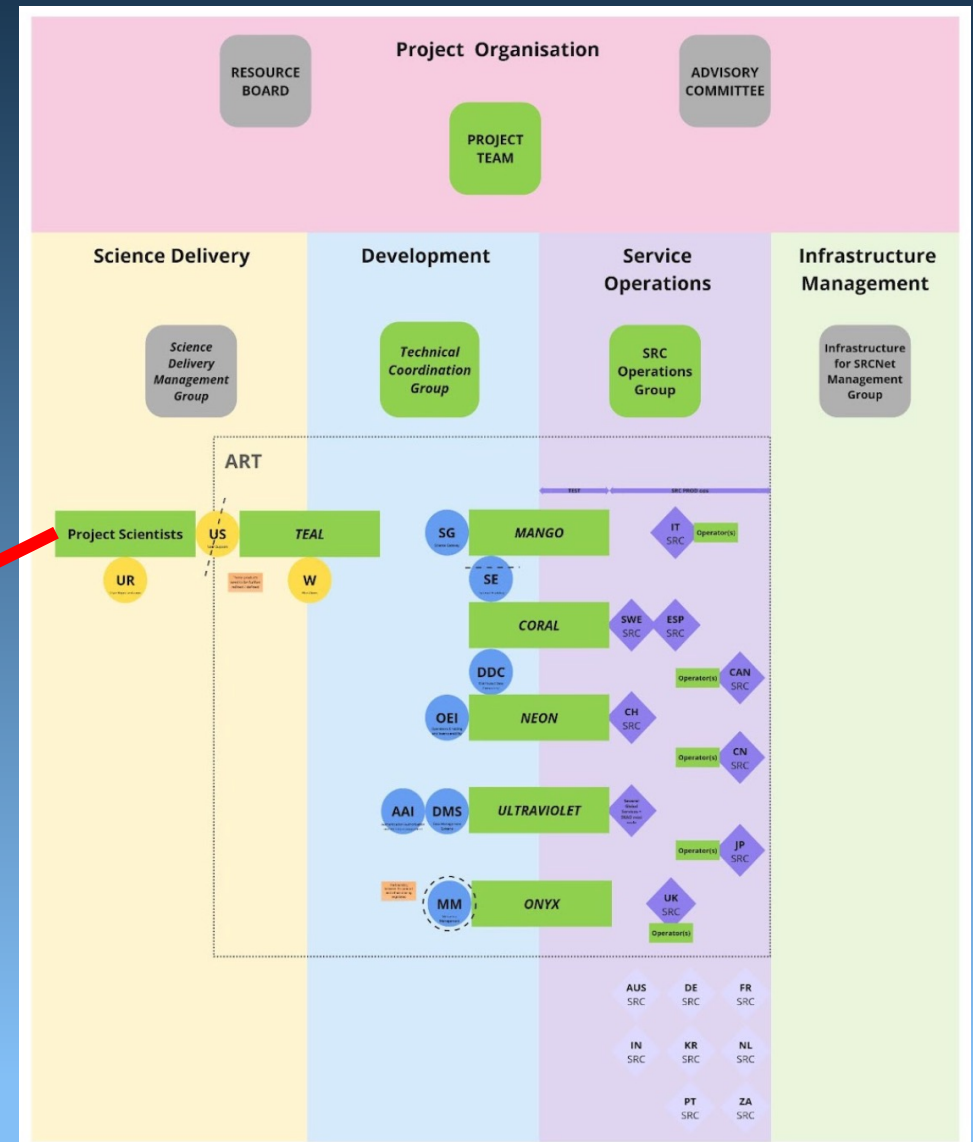


Project Scientists

Mostly involved in (re)defining the scientific requirements

Andrea Bracco [50%] (for Galaxy science)

Carolina Belli [50%] (supporting the team)



Short term roadmap of the INAF node

Immediate Objective: create a prototype of Italian SKA Regional Center integrated in SRCnet v 0.2



Technopolo - Bologna

The INAF node: the global+national HW effort

Computing: INAF capital investment of 2.2 Meuro

CPU

Rack: 4

Nodes: 228 (21 exclusive nodes + 55 nodes)

Model: Lenovo ThinkSystem SD665 V3

Processor: AMD EPYC 9745 (Turin-Zen5c)

Core x node: 128

Total number of cores: 29184

Frequency: 2.3 GHz

Power: 400W

Memory x node 1: 768 GB RAM DDR5 (3GB per core)

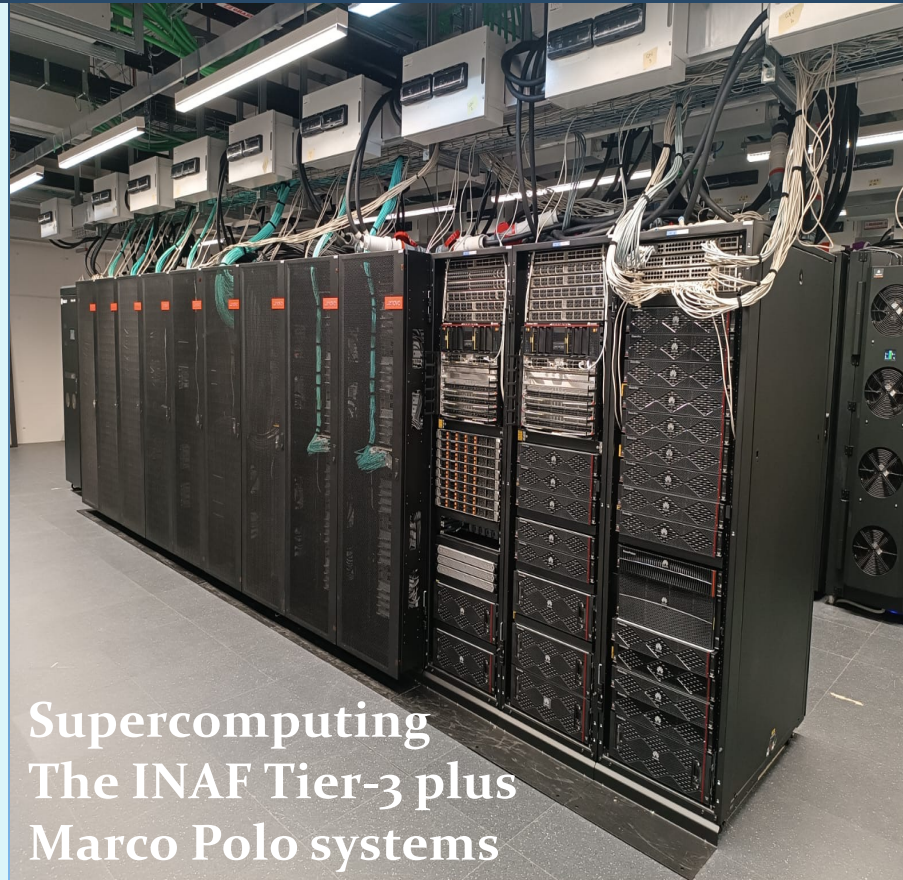
Memory x node 2: 26 nodes with 1.152 TB DDR5.

Interlink

- 2 × ConnectX-7 NDR200 dual-port x node
- 2 × 100 Gb Ethernet per node

HPL: 3,9 PFLOPS

Consumption: 256 kW (including switch IB core)



Supercomputing
The INAF Tier-3 plus
Marco Polo systems

GPU

Rack: 5

Nodes: 90 (4 exclusive nodes + 30 nodes)

Model : Lenovo ThinkSystem SD650-N V3

Processor : Intel Emerald Rapids 8592+

Cores x node: 64 x 2 sockets

Total number of cores: 218

Frequency: 1.9 GHz

Accelerator: Nvidia H100 SXM5

- 4 GPU per node
- Memoria HBM3 per GPU: 80GB
- NVLink 4.0
- Consumption GPU:
 - HPL: 700W
 - Normal operations: 600W

Memory x node: 512GB DDR5 5200 MHz

Interlink:

- 4 × NDR200, each directly linked to GPU
- 2 × 25GbE + 1 × RJ45 GbE x node

Local Storage: 960GB NVMe x node (scratch)

HPL: 15,24 PFLOPS

Consumption: 421 kW (GPU at 700W), 3.317W x node

Certified on 21 Nov 2025

Installation about to be completed by Cineca
Expected availability to INAF Feb-Mar 2026

The INAF node: the global+national HW effort

Archiving: INAF capital investment of 0.3 Meuro

ON LINE AREA

Lable: **OceanStore Pacific**

Space: **5 Pbyte**

Type: HDD



LONG TERM AREA

Lable: **OceanStore Artic**

Space: **11 Pbyte**

Type: MED

Expected deployment on Summer 2026

Installation to be done by Cineca

Expected availability to INAF Autumn 2026

Longer term HW requirements for the INAF node

SRCNet Node Resource Estimation – 2030

<u>Category</u>	1%	2%	4%	8%, no tape	20% node with Tape	Total (All Nodes)
Compute	0.1 <u>PFLOPS</u>	0.2 <u>PFLOPS</u>	0.4 <u>PFLOPS</u>	0.8 <u>PFLOPS</u>	2.0 <u>PFLOPS</u>	10.0 <u>PFLOPS</u>
Number of Cores	500	1000	2,000 cores	4,000 cores	10,000 cores	50,000 cores
Online Storage	2.7 <u>PB</u>	5.4 <u>PB</u>	10.8 <u>PB</u>	21.6 <u>PB</u>	54 <u>PB</u>	270 <u>PB</u>
Scratch/Cache	75 TB (<u>TBC</u>)	250 TB (<u>TBC</u>)	180 TB (<u>TBC</u>)	500 – 600 TB	750 TB	~4.75 – 5.3 <u>PB</u>
Tape Storage				–	33 <u>PB</u>	100 <u>PB</u>
Network	100 Gbps External ≥100 Gbps Internal	100 Gbps External ≥100 Gbps Internal	100 Gbps External ≥100 Gbps Internal	100 Gbps External ≥100 Gbps Internal	100 Gbps External ≥100 Gbps Internal	100 Gbps External ≥100 Gbps Internal Same across all nodes

Longer term development plan of the INAF node

hardware



hardware: already funded assets and made available to SKAnet v. 0.1

Item	End of 2025	End 2026	Longer term
<i>CPU power</i>	0.1 PF/s (mostly CPU from the Pleiadi system)	1 PF/s (Tier 3 – dedicated, + MarcoPolo - shared CPU+GPU)	3+ PF/s (Tier 1 – CPU+GPU)
<i>Storage</i>	0.1 PB on-line disk (S3), from Pleiadi system	1 PB on-line disk (S3), 1.2 PB Tape	22 PB Flash/ year) (LUSTRE, shared)
<i>Network</i>	10 Gb/s (LAN + WAN)	100 Gb/s (LAN) 100 Gb/s (WAN)	400 Gb/s (LAN) 100 Gb/s (WAN)

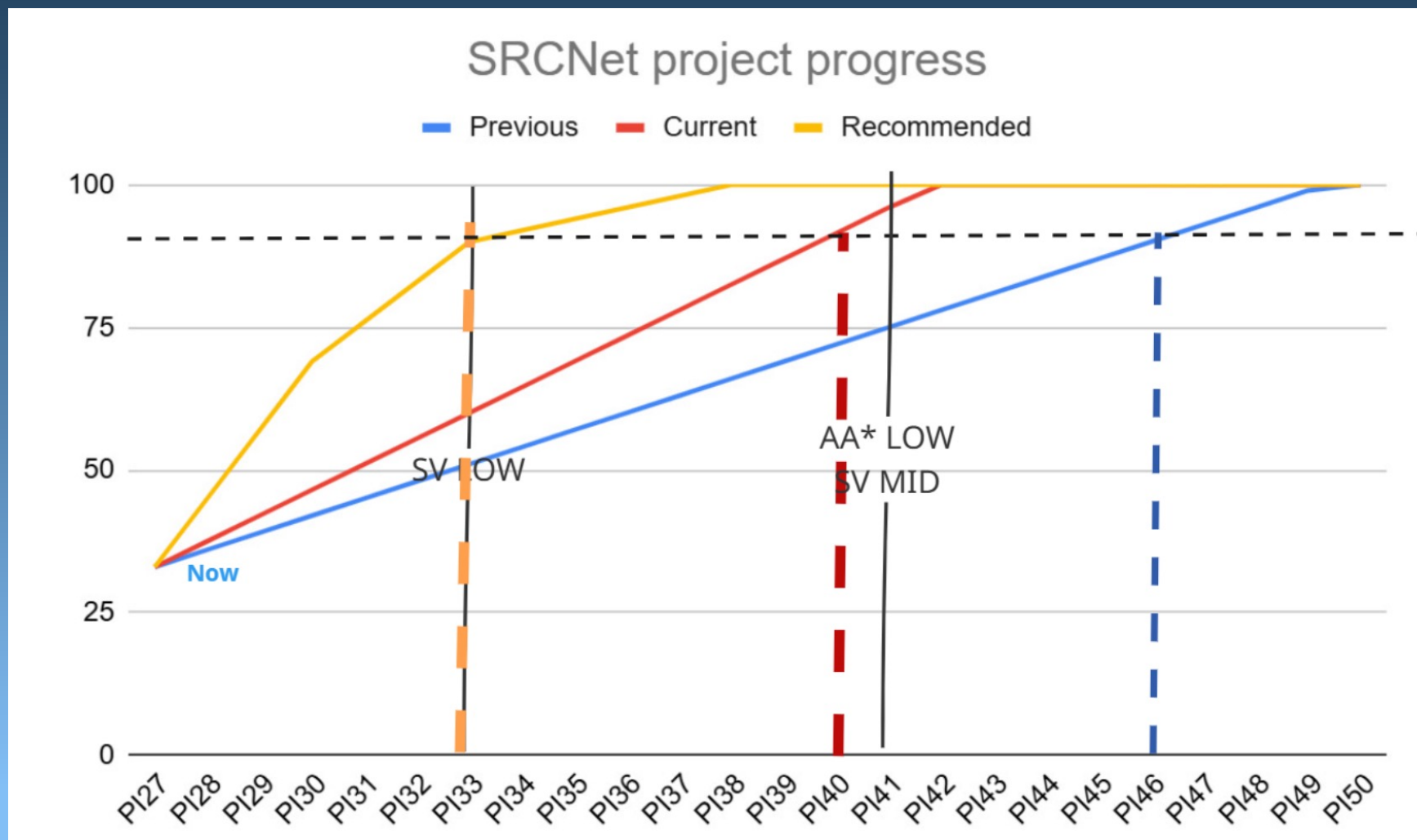
The INAF node: the national human effort

Giuliano Taffoni coordinator since summer 2025

Italian Node Team

Person	LEVEL	Role
Taffoni	(Dev/DevOps)	Coordinator
Vitello	(Dev/DevOps)	Integrator
Tudisco	(Dev/DevOps)	Operator/Developer
Lacopo	(Dev/DevOps)	Developer
Maggio	(Service Ops / SRE)	Operator/Integrator
Gandolfi	(Service Ops / SRE)	Operator
Stagni	(Service Ops / SRE) + (Dev/DevOps)	Operator/Integrator
Galluzzi	SciDev	Support Scientist
Zanichelli	SciDev	Support Scientist
Knapic+IA2	(Dev/DevOps) +(Service Ops / SRE)	Operator/Developer
Sciacca	(Dev/DevOps)	Developer
Russo	(Dev/DevOps)	Developer
Bertocco	(Dev/DevOps)	Developer
Scavo	(Dev/DevOps)	Developer
Butora	(Dev/DevOps)	Developer
Molinaro	(Dev/DevOps)	Developer
Lorenzani	(Dev/DevOps)	Developer
Marotta	(Dev/DevOps)	Developer
Riggi	SciDev	Support Scientist
Massardi	SciDev	User interface

The needed human resources growth



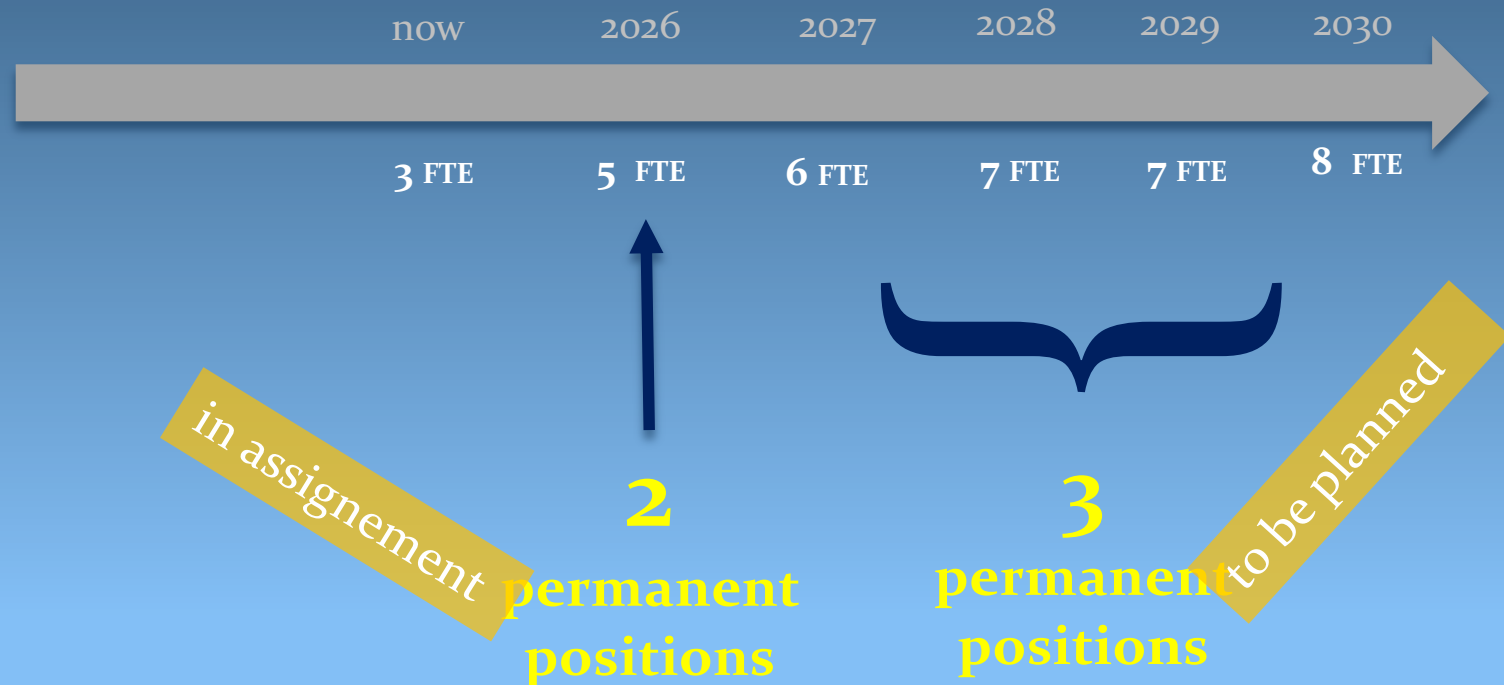
Adapted from Janneke deBoer(SRCnet)

Longer term development plan of the INAF node

human capital

personnel: **FTE for International Effort (2026) = 2.5 FTE**

Anticipated FTE for the National Effort (2026/) \approx 2.5 FTE



Thank you !

The Fifth National Workshop on the SKA Project



Thank you !