The (scientific) pathway to SKAO

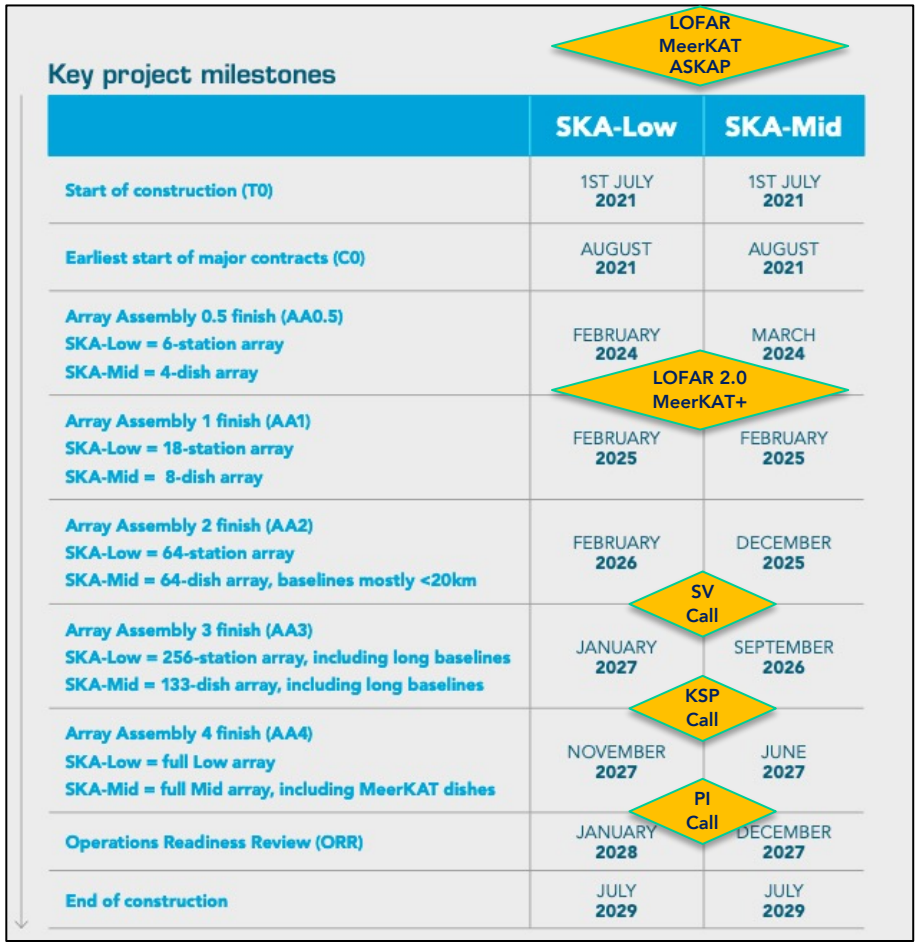
[the chairs' version]

Open Discussion

(08/10/2021)

G. Brunetti, A. Possenti, I. Prandoni, G. Umana

SKA Timeline



	SKA-Low	SKA-Mid
Start of construction (T0)	1ST JULY 2021	1ST JULY 2021
Earliest start of major contracts (C0)	AUGUST 2021	AUGUST 2021
Array Assembly 0.5 finish (AA0.5) SKA-Low = 6-station array SKA-Mid = 4-dish array	FEBRUARY 2024	MARCH 2024
Array Assembly 1 finish (AA1) SKA-Low = 18-station array SKA-Mid = 8-dish array	FEBRUARY 2025	FEBRUARY 2025
Array Assembly 2 finish (AA2) SKA-Low = 64-station array SKA-Mid = 64-dish array, baselines mostly <20km	FEBRUARY 2026	DECEMBER 2025
Array Assembly 3 finish (AA3) SKA-Low = 256-station array, including long baselines SKA-Mid = 133-dish array, including long baselines	JANUARY 2027	SEPTEMBER 2026
Array Assembly 4 finish (AA4) SKA-Low = full Low array SKA-Mid = full Mid array, including MeerKAT dishes	NOVEMBER 2027	JUNE 2027
Operations Readiness Review (ORR)	JANUARY 2028	DECEMBER 2027
End of construction	JULY 2029	JULY 2029

- With establishment of IGO, SKAO construction formally started
- SKA projects and teams will be defined over the next few years, under the impulse of pathfinders/precursors

➢ **Scientific Community Engagement:** Urgent need to organize and coordinate Italian community in view of SKA KSPs

➢ **Science/Data Analysis Support:** Urgent need to establish measures to support future SKA teams

SKA-Italy Board is working at a scientific roadmap

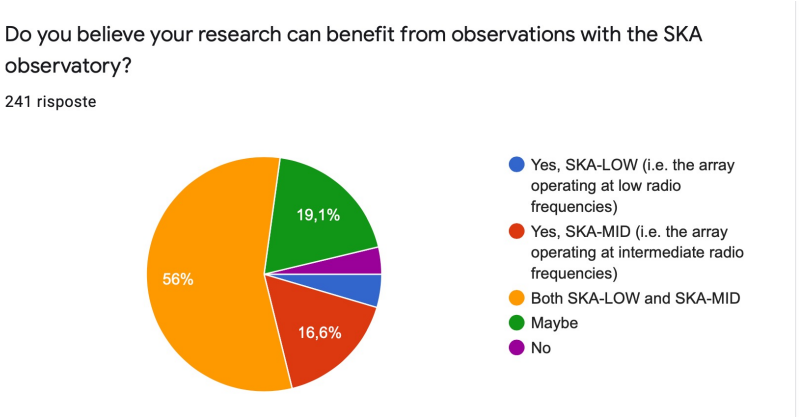
.. also building on SKA Questionnaire outcomes and this Workshop

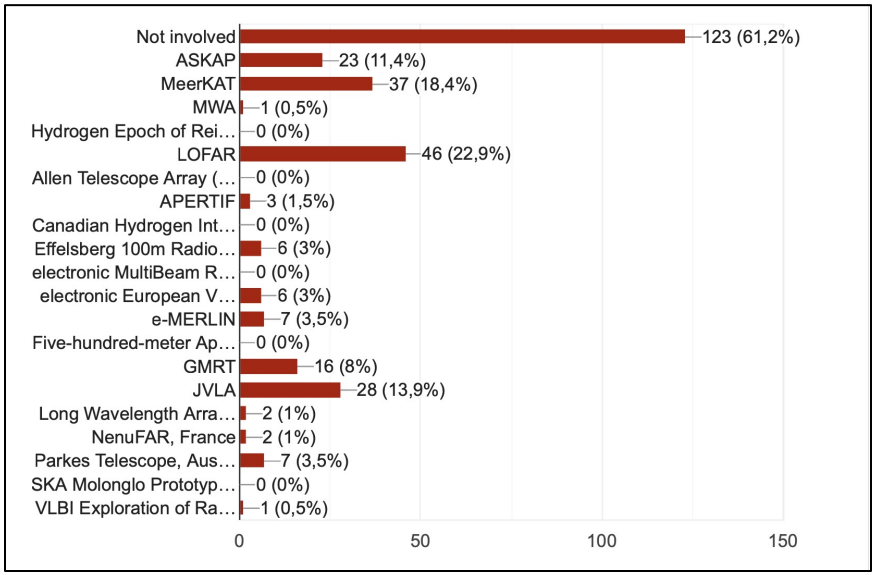
Community Engagement

- Exploit SKA pathfinders/precursors:
  - LOFAR and LOFAR 2.0
  - MeerKAT and MeerKAT+

- SKA:
  - Maintain/increase active participation to SKA International WGs (international visibility & leadership)
  - Organize thematic national workshops and other initiatives (national teams)
  - Exploit synergies with other facilities and/or SKA surveys

- Data analysis:
  - Engage community in SKA Data Challenges
  - Provide capabilities to handle precursor and SKA data





LOFAR & LOFAR 2.0

1. SHORT TERM (2021+):

- enhance computing power and storage: LOFAR is pushing radio analysis into HPC regime (natural precursor for SKA RC)
  - Exploitation of LBA surveys : 2000 hrs of LOFAR LBA data (Pleiadi ?)
  - LOFAR-VLBI & LOFAR-VLBI of deep fields: VLBI =300,000 “core hrs” for single pointing (8 hrs deep)… LOFAR-VLBI of deep fields still TBD
- Young researchers (3x2 post docs DP450)

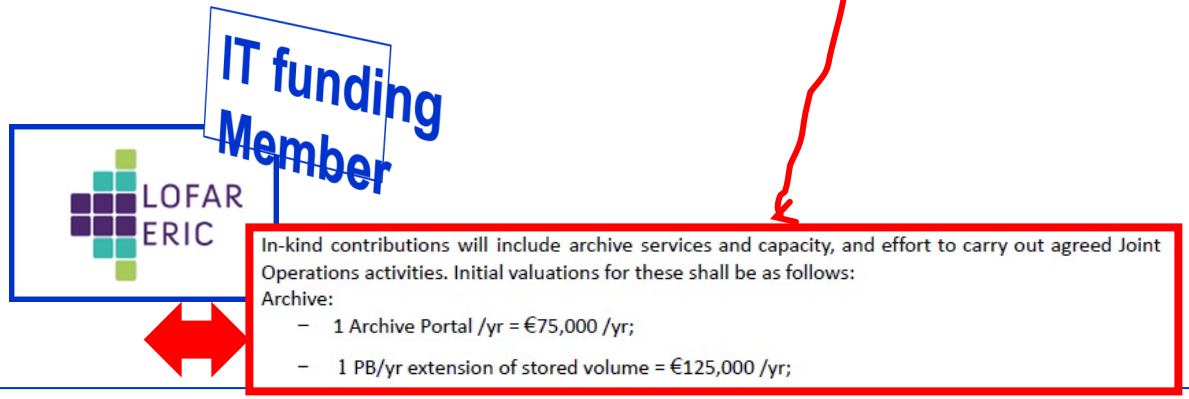
2. LOFAR 2.0 (2021-22):

new KPs will gradually replace current KPs in 2024+.
Expected some networking among groups from old KPs (?) but important opportunity to confirm/improve involvement and leaderships.

- Info Meetings: 7, 12 October 2021
- Call for LoI : week 1 December 2021
- Workshop TBD
- Discussion TBD

3. ERIC LOFAR (2022+):

- Step 1 : September 2021
- Step 2: Q1 2022 ?
- Start : Q4 2022 ?
- Strategy in connection with SKA RC



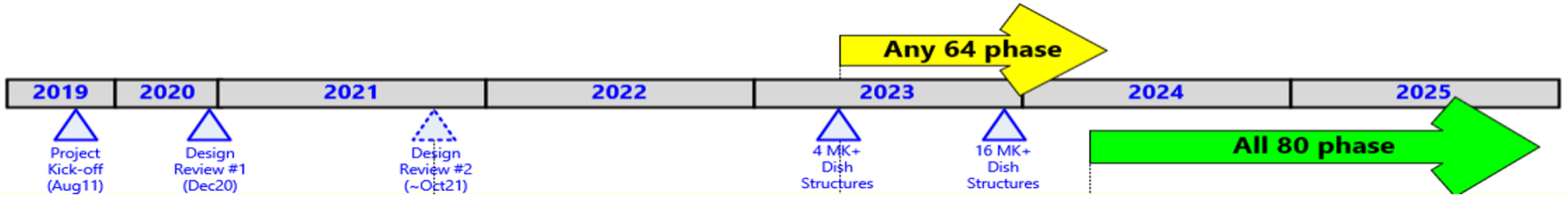
MeerKAT+

A joint project between:

- South African Radio Observatory (SARAO), Max-Planck Gesellschaft (MPG) organisation in Germany and INAF)

Objective:

- to extend the MeerKAT instrument by adding 16 SKA-format dishes to the current 64 element array.
  A significative improvement of the MeerKAT capabilities **in terms of sensitivity and angular resolution.**



Intent of joint collaboration is to select observing project(s) for reserved share that produce **legacy science products** remaining relevant into SKA era (reserved share is ~10% of overall, or ~500 hours/year, until integration into SKA (~2026?)

Planning (proposed) to get the Italian community involved (to be ready for the call for GTO on late 2022)

step 1 Collect all the information for the WP proposed ideas (ongoing) and inform the community (help from CSN)

step 2 Internal call for EoI either

- to collaborate to one of the proposed LSP
- to propose new projects

step 3 – Focused internal workshop(s) to finalise the Italian contribution

step 4 Workshop together with MK+ partner institutions, to constitute project (s) team(s), to focus on optimizing readiness for analysis of future datasets and further developing plans for wider exploitation.

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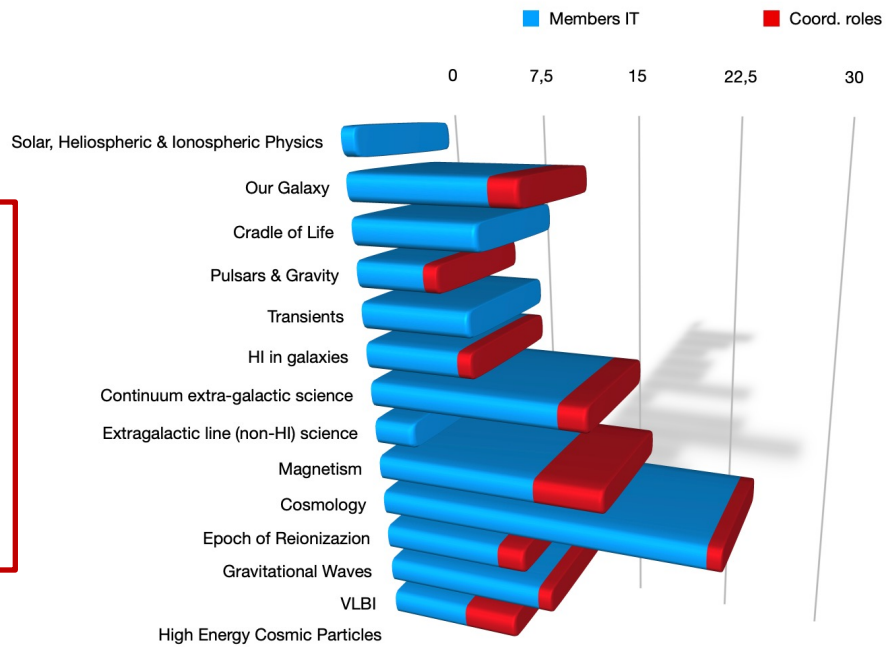

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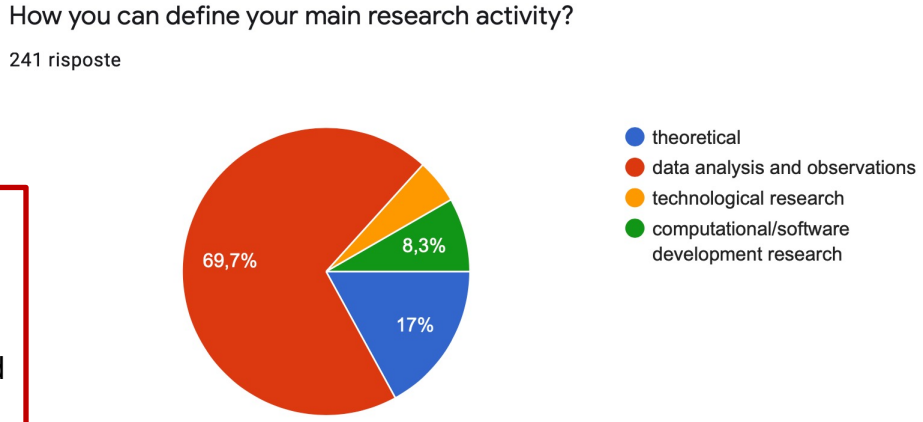


SKA Regional Data Centre

Besides high capabilities in the various scientific fields, **two things will be decisive to guarantee INAF to play a leadership role in the exploitation of the SKAO:**

I. the availability of state-of-the-art and adequate IT resources

The aim is an Italian SKA Regional Centre (SRC) pole, integrated both in the SRC European network and with the new IT infrastructure of INAF

20-30 M€ needed btw 2022-2030 to finally attain a Tier-1 size infrastructure
with capability of ≈ 3+ Pflops and ≈ 70 PBy/yr of storage and
with a running cost at regime of ≈ 3 M€ per year

DM 450 and PNRR resources
Centralized at the Technopolo in synergy with INFN/Cineca/others

II. the ability to attract and train a human capital of excellence that knows how to make the best use of the resources

The aim is to have, possibly in the context of a putative "software division" within INAF,
several IT experts with an astrophysical background

- Required expertise e.g. in: (a) understanding of the operations of the data acquisition systems, (b) management and development of the systems that will oversee the data analysis/curation/archiving, (c) development of scientific software, (d) interaction with the users in the preparation and management of the observing programs
- About 10-12 additional FTE are needed (split among 15-20 additional people)

Need to find them and understand how to enrol them

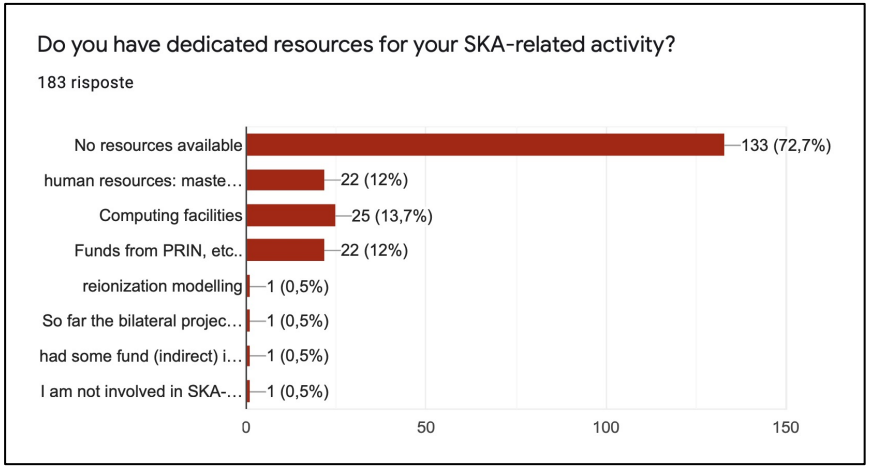
Science Support Summary

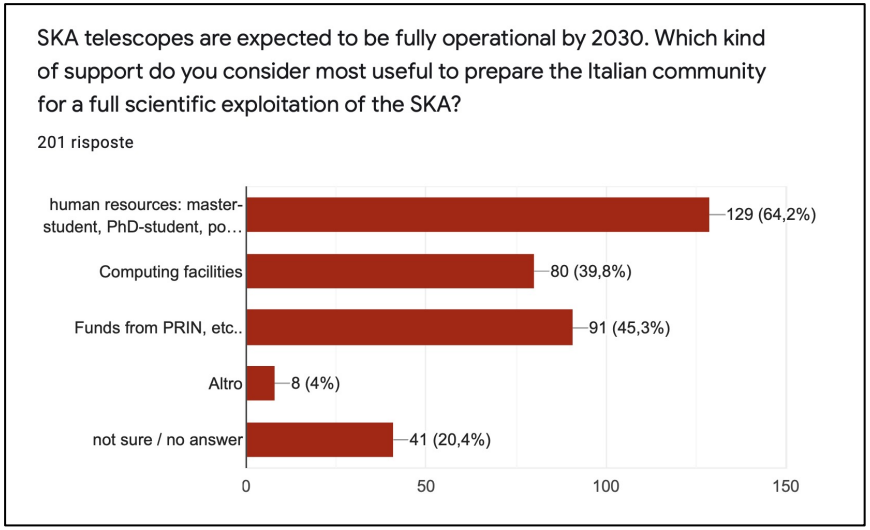
- Man power:
  - National postdocs
  - Full path to TI: PhD – Postdoc – TD - TI
  - Project-dedicated TI positions ?
  - value mixed expertise (science/SW)
  - Also important mixed technology/science and SW telescope expertise
- Project funding:
  - Purely science driven?
  - Valuing/supporting Italian leaderships in international projects/surveys (e.g. GO)
  - Supporting team data analysis needs
- Computing facilities:
  - Dedicated data center
  - Need to attract IT man-power

Science: 10-15 % of Italian investment in SKA (120 Meu) over 2021- 2030

SRC: Additional 20-30 M€ needed over 2022-2030

Resources: DM 450 (SKA/CTA) and PNRR





A possible pathway to SKA KSPs

- **International context:** no decision yet about the KSP policy

- **Coordination of the KSP**: not obvious at the moment: single coordinator/PI for each KSP ? many co-coordinators/coPIs ? a rotation among the coordinators/Pis?

➢ **Important that Italy actively participates to the establishment of KSP/science return policies** (**Scientific Roadmap** can serve to this purpose)

- **Timeline:** SKA fully operational in ~10 years from now and scientific results in some areas may require many years of observations and the contribution of researchers from many countries

➢ **Fertilization an support of the Italian community at large**

  – Need to **identify and give long term support** to an adequate range of scientific themes where the Italian community can compete at the frontline of the research within the future KSPs
  – Need to **define a strategy with short / medium / long term science goals** for each theme and resources associated to them
  – Help to **grow a SKA generation**
  – Help to **grow** a significant number of **potential Italian coordinators/PIs** and CoIs

What's next?

- Any idea/input?
  - Write on conference slack workspace:
    https://join.slack.com/t/theinaf/shared_invite/zt-wicje74x-G3kL~2Ad0f2B2D69cjXugw
    [channel dedicated to final discussion]
- all presentations will be made available on line, incl. minutes of this discussion