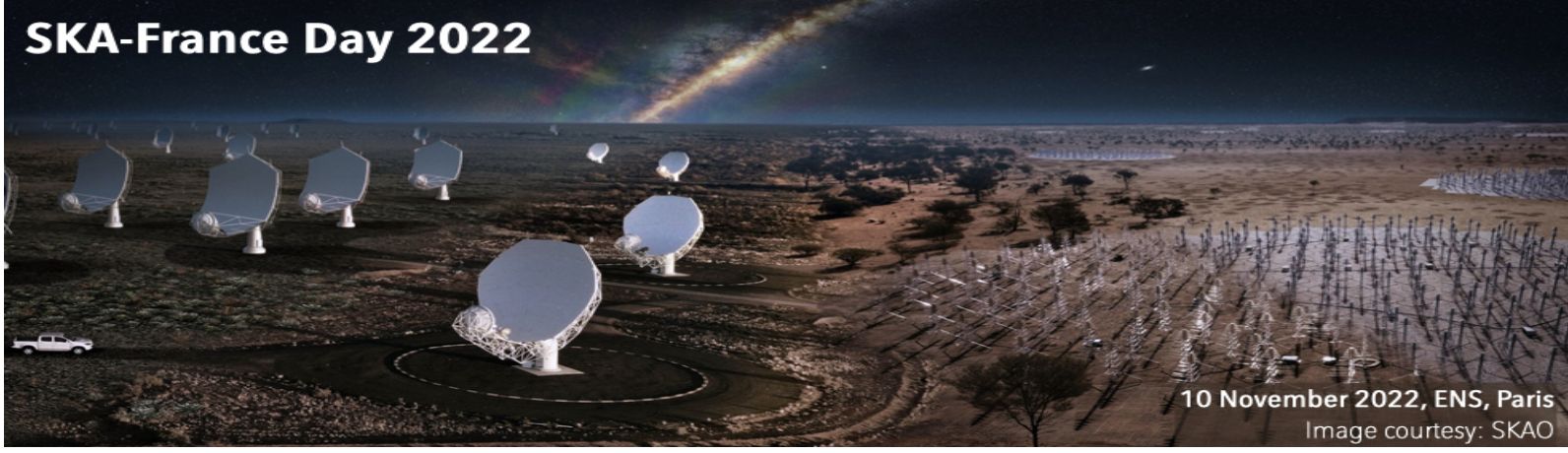

THE SKAO : an opportunity in wide areas for French research

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Outline

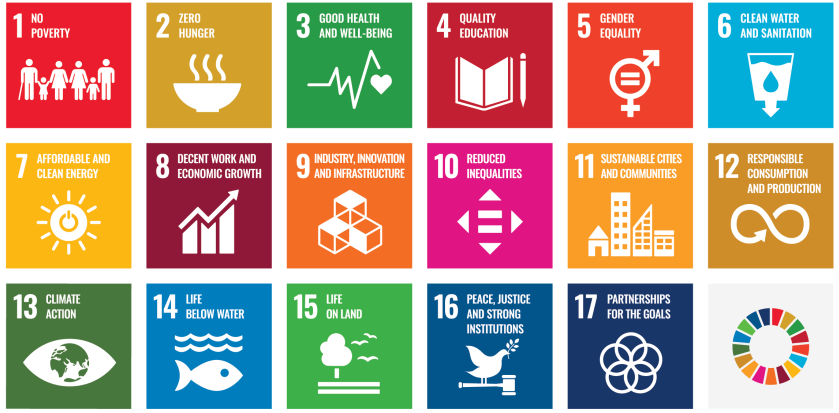
- Impact of Research Infrastructures
- Research from, on and with SKAO
  - Beyond Astronomy and Fundamental Physics
  - SKAO as a research object
  - SKAO as an experimental playground
- Take away messages

Impact of Research Infrastructures

- The Society is entitled to question the usefulness of large research infrastructures (RI's) and their overall positive / negative impacts.
- This is very legitimate, and is addressed by SKAO and partners, with emphasis on the 17 UN Sustaible Development Goals in all areas of human activities.
- But this is not what I'll address here, restricting my scope to Research only, beyond the original objectives of the giant radiotelescopes.
- I will then address successivey :
  - SKAO as a RI beyond Astronomy and Physics
  - SKAO as a research subject
  - SKAO as an experimental playground for innovation

« As early as 2010, a few years before the start of the design phase for the SKA, the European Cooperation in Science & Technology (COST) held a strategic workshop on the "Benefits of Research Infrastructures beyond Science – the example of the Square Kilometre Array (SKA)" in Rome, with sessions addressing Information and Communication Technologies (ICT), green energy, global science-industry-government linkages and human capital. »

[SKA Construction Proposal Section 3 – The Broad Impacts of SKA]



Research from, on and with SKAO

- SKAO as an instrument for research beyond Astronomy and Fundamental Physics
  - Physics of the ionosphere
  - Instrumentation of the site for environmental studies
  - Surveillance of near-Earth objects
- SKAO as a research object
  - Sociology : cooperation and diplomacy, management of a global project, many parameters optimisation of construction and operation
  - Anthropology : facilities deployed by foreigners in traditionally owned areas
  - Education and culture
- Playground for innovation
  - Technical challenges (ICT)
  - Ecology : how to minimise impacts ?

Beyond Astronomy and Fundamental Physics

- Physics of the ionosphere
  - The LOW telescope is a giant array constantly capturing signals crossing the atmosphere, yielding an invaluable collection of data on ionospheric turbulence : this ought to be exploited
- Instrumentation of the exceptionally preserved SKAO sites for advanced environmental studies
  - Use of the communication infrastructure for collecting data from various ancillary sensors at the many stations
  - Could be developed beyond the needs of the telescope operations
  - Example of LOFAR
- Surveillance of near-Earth objects
  - The MID telescope is capable to detect small objects around the Earth
  - Potential conflict with national security concerns
- SETI ?

SKAO as a research object

- Sociology studies of a large global technical endeavour
  - Cooperation and diplomacy, including in circumstances when some of our fundamental values are challenged
  - Management of a global project as a many parameters / many constraints optimisation problem, from design to operations
    - Complexity, need for dynamical optimisation
    - Account of impacts, Costs, Timeline, Performances, Economic return, Risks …
    - for the E2E global system including instruments / supercomputers / SRC network
    - Added difficulties (commensality of programs, size of datasets)
- Anthropology
  - Handling of cultural diversity without compromising efficiency
  - Facilities deployed by strangers in traditionally owned areas / civilisation issues and beyond
- Education and culture
  - Research as a trigger and as an instrument for education and training : new generations worlwide : the RI as a trigger of large endeavours …
  - A peaceful arena for cultural exchanges : on the role of the RI in its global context regarding motivations, methods, approaches

SKAO as an experimental playground

- Exceptional instruments raising major technical challenges that can be viewed as large scale playgrounds in the real world, with limited / controled risks.
  - Innovation issues addressed in previous talk, especially :
    - Distributed management and exploitation of hundreds of PB of data generated every year
    - Optimal control of an extremely complex operational system
- Ecology : how to minimise impacts ?
  - Will SKAO stand as number one « green RI » ?
    - CO_2-neutral energy provision ?
    - Connections with the local development of PV powerstations ? Di-hydrogen mediated electricity storage and transportation fuel ?
    - Pilot datacenters in terms of frugality ?

Take away messages

- A global project opening global opportunities for ambitious research projects in much diverse areas
- A large public investment which must and can be shared through active invitations to use it in other ways : beyond Astronomy, as an research object and as a safe experimentation field
- And especially a large project which challenges technology while offering a secure playground for innovation
  - Quoting the same chapter of the Construction Plan again :

    the SKA is expected to deliver significant benefits for Member States' research landscape, economy, society, sustainability and culture

The end