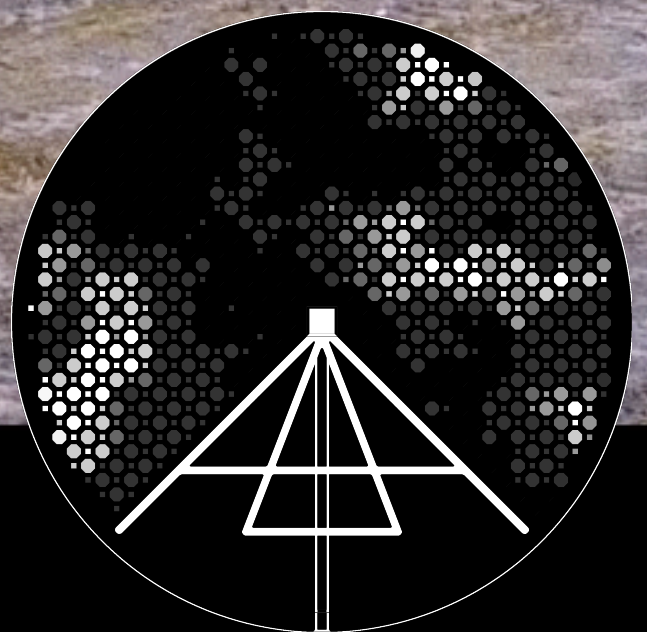


NenuFAR : A French pathfinder of SKA-Low

Philippe Zarka

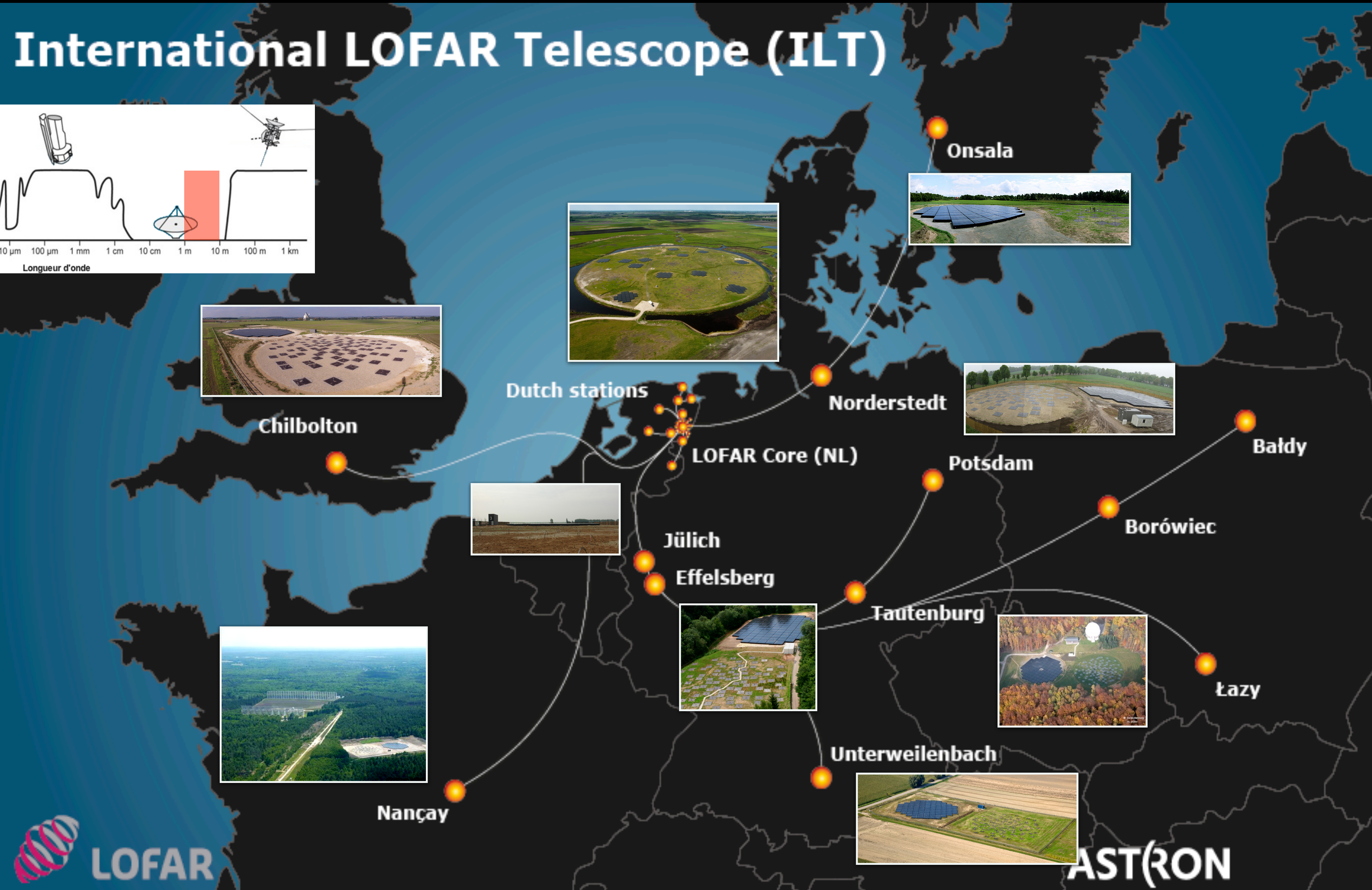
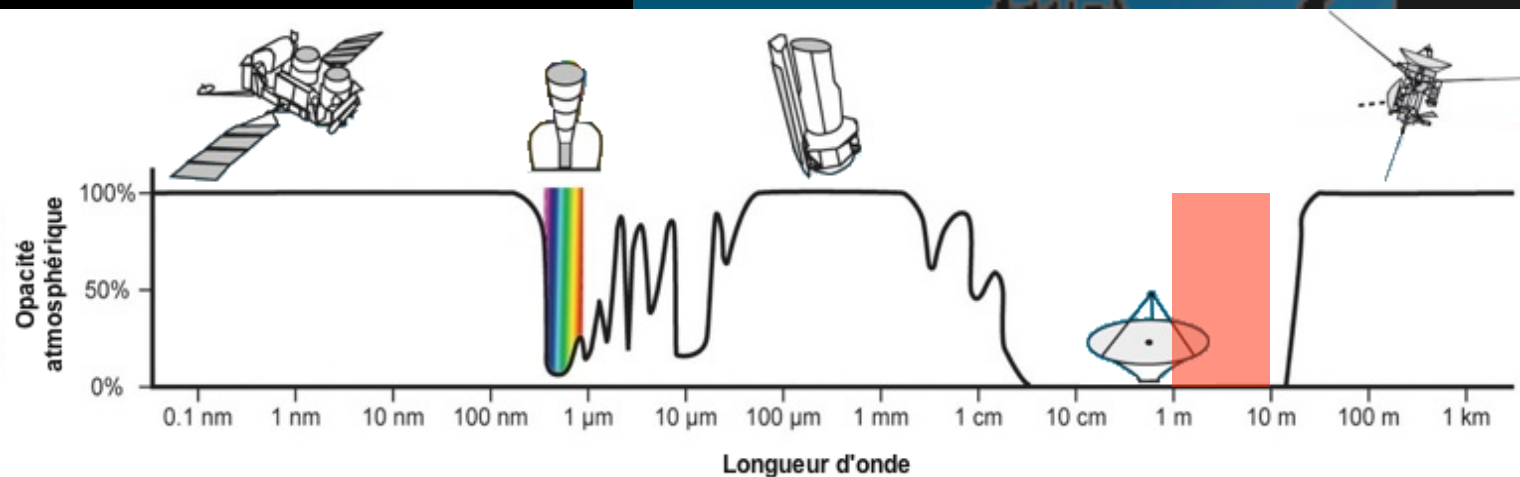
Observatoire de Paris, CNRS, PSL

on behalf of the NenuFAR-France collaboration

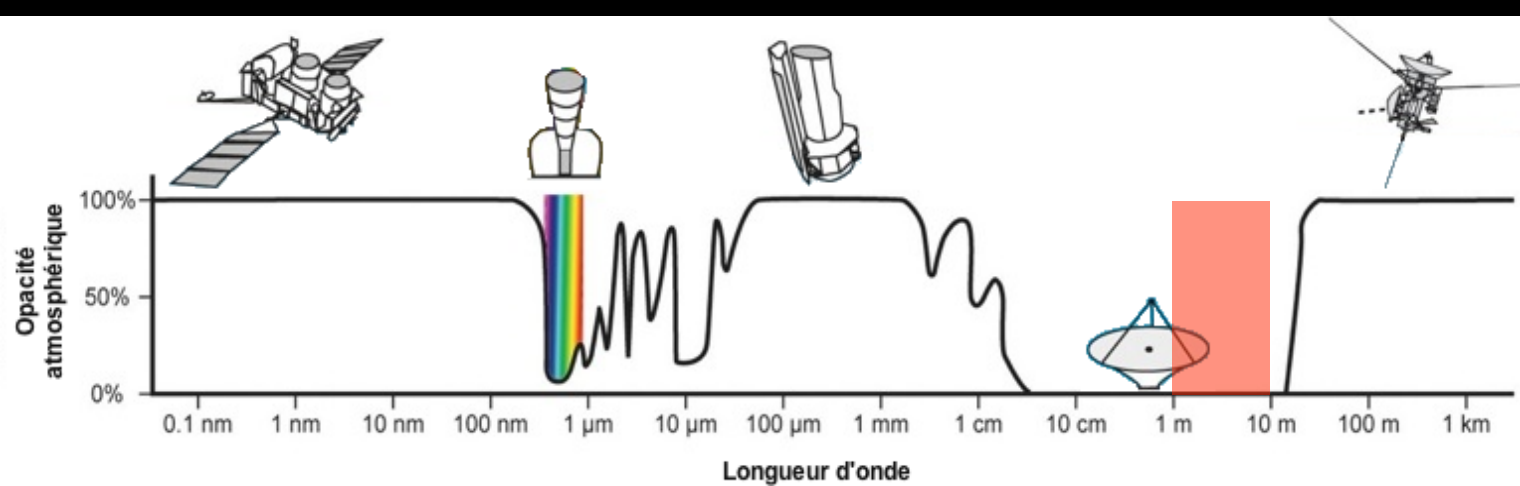
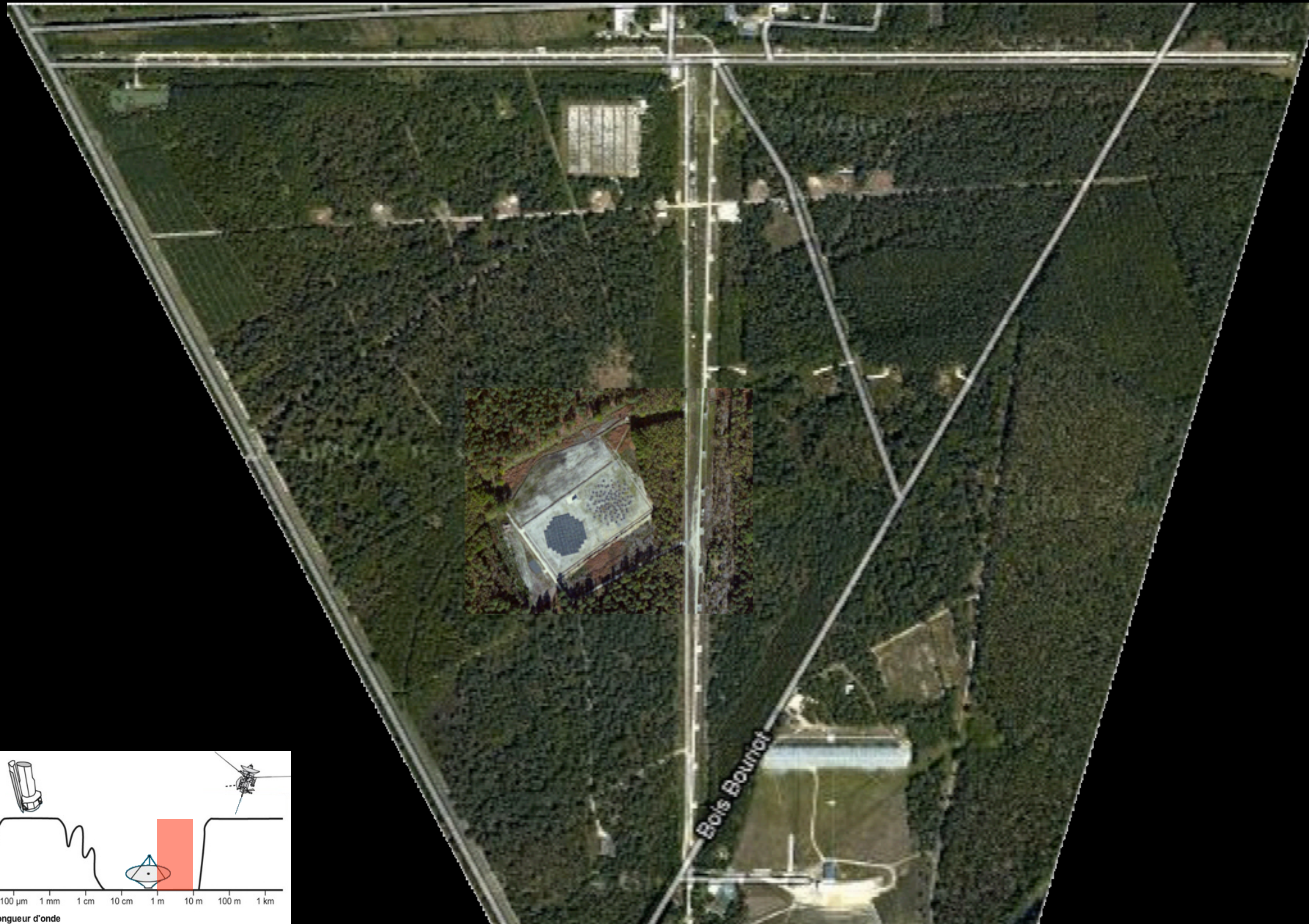


LOFAR : new instrument, science, context, dynamics

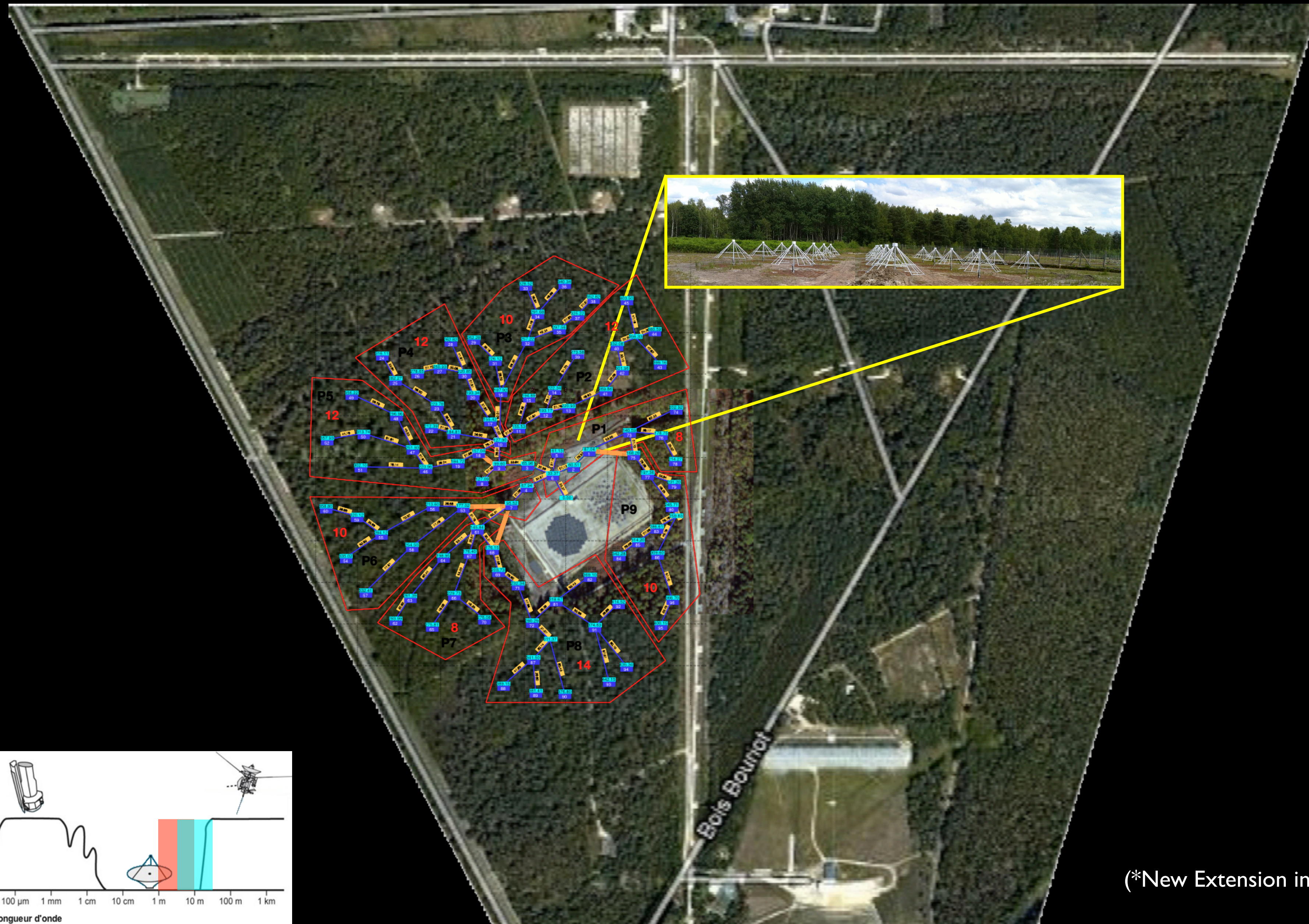
International LOFAR Telescope (ILT)



In Nançay : From LOFAR FR606

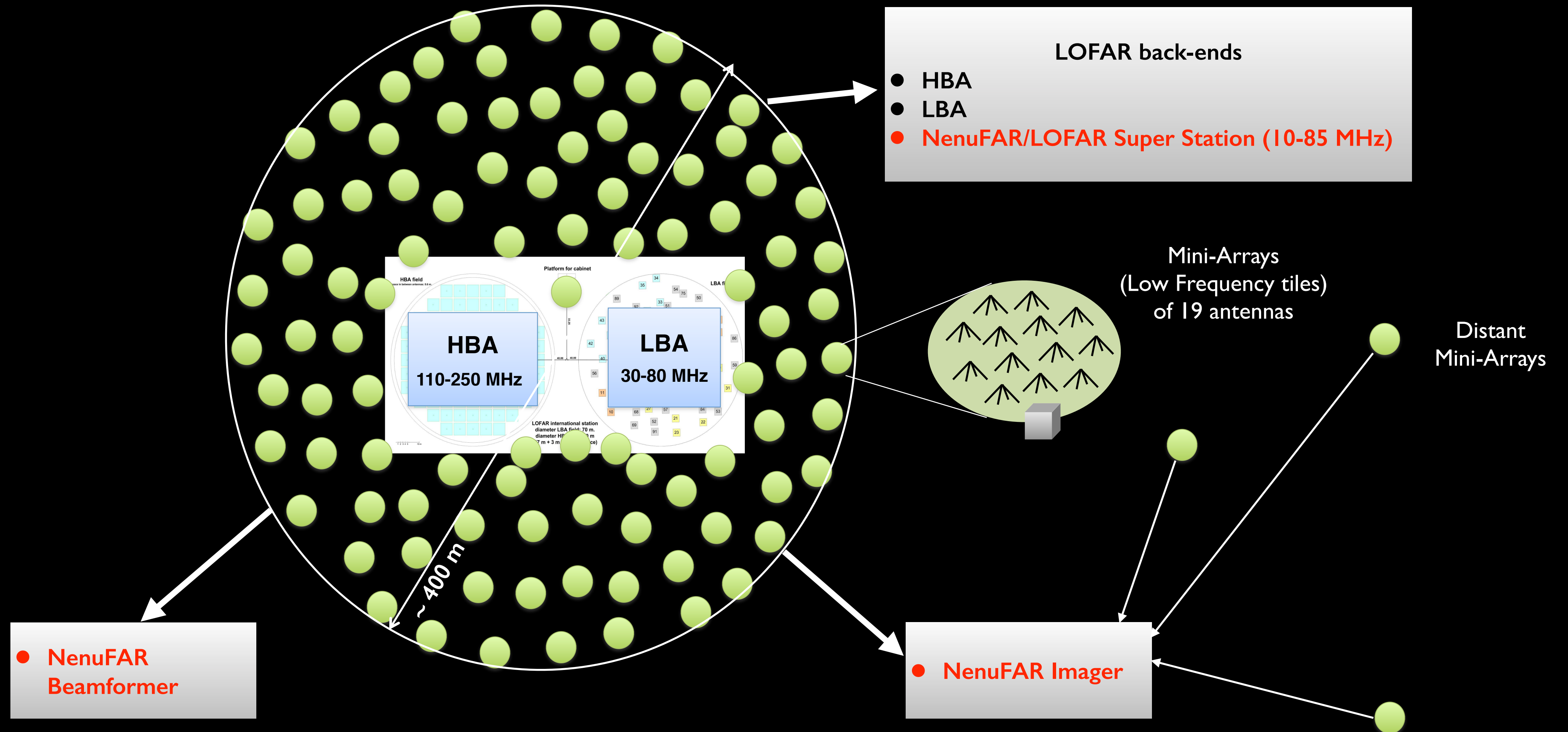


In Nançay : From LOFAR FR606 to NenuFAR*



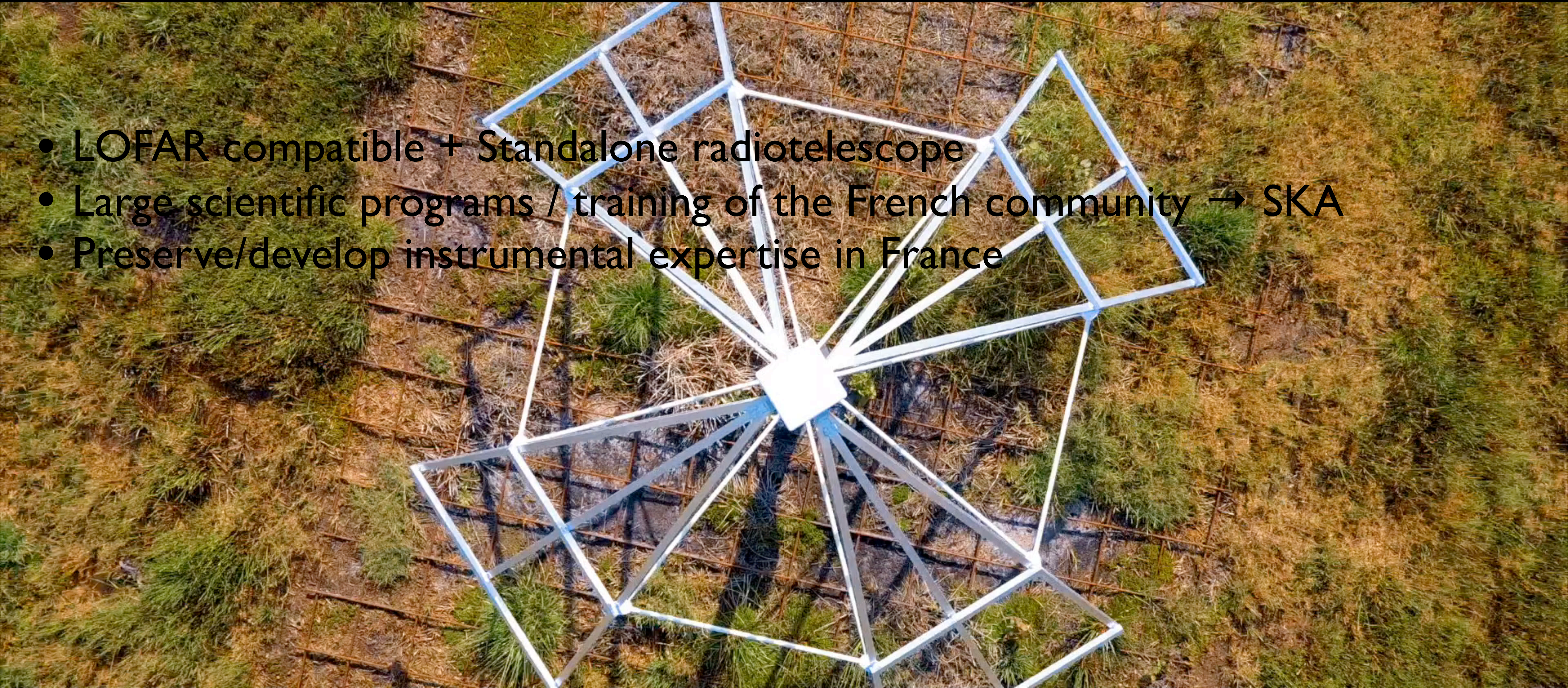
(*New Extension in Nançay Upgrading LOFAR)

The concept of NenuFAR (2007-2008)



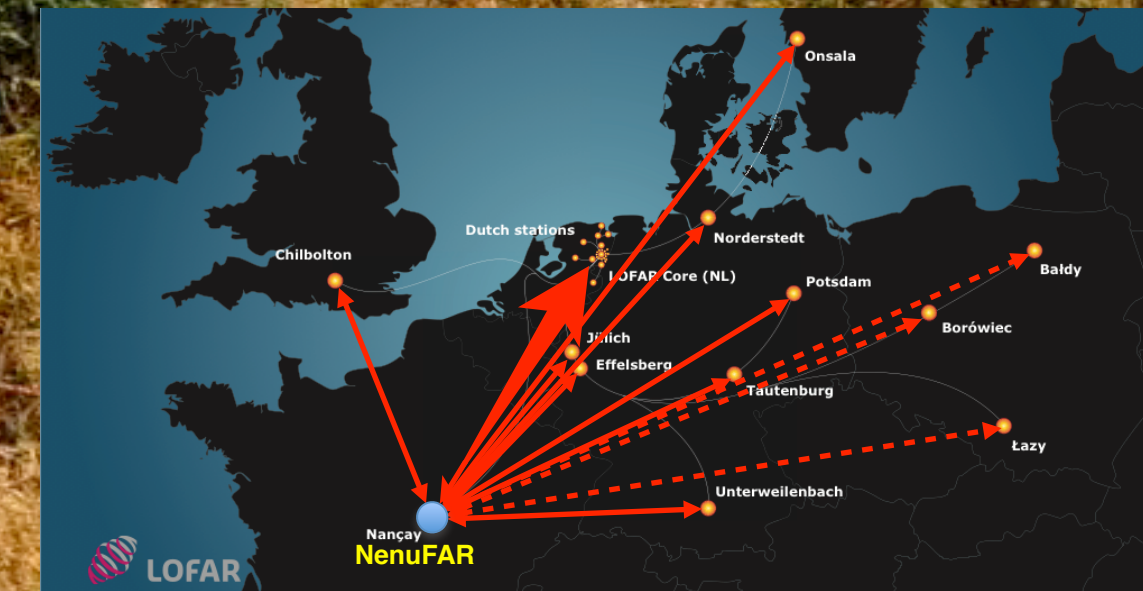
Motivations

- LOFAR compatible + Standalone radiotelescope
- Large scientific programs / training of the French community → SKA
- Preserve/develop instrumental expertise in France



Motivations

- LOFAR compatible + Standalone radiotelescope
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-
- More sensitivity at low frequencies
 - LOFAR super station improves LF imaging (high resolution, diffuse emission)
 - Large compact array / beamformer : pulsars, transients ($\gg$ GW?), exoplanets/stars
 - Large compact array / imager : dark ages/cosmic dawn, exoplanets, transients

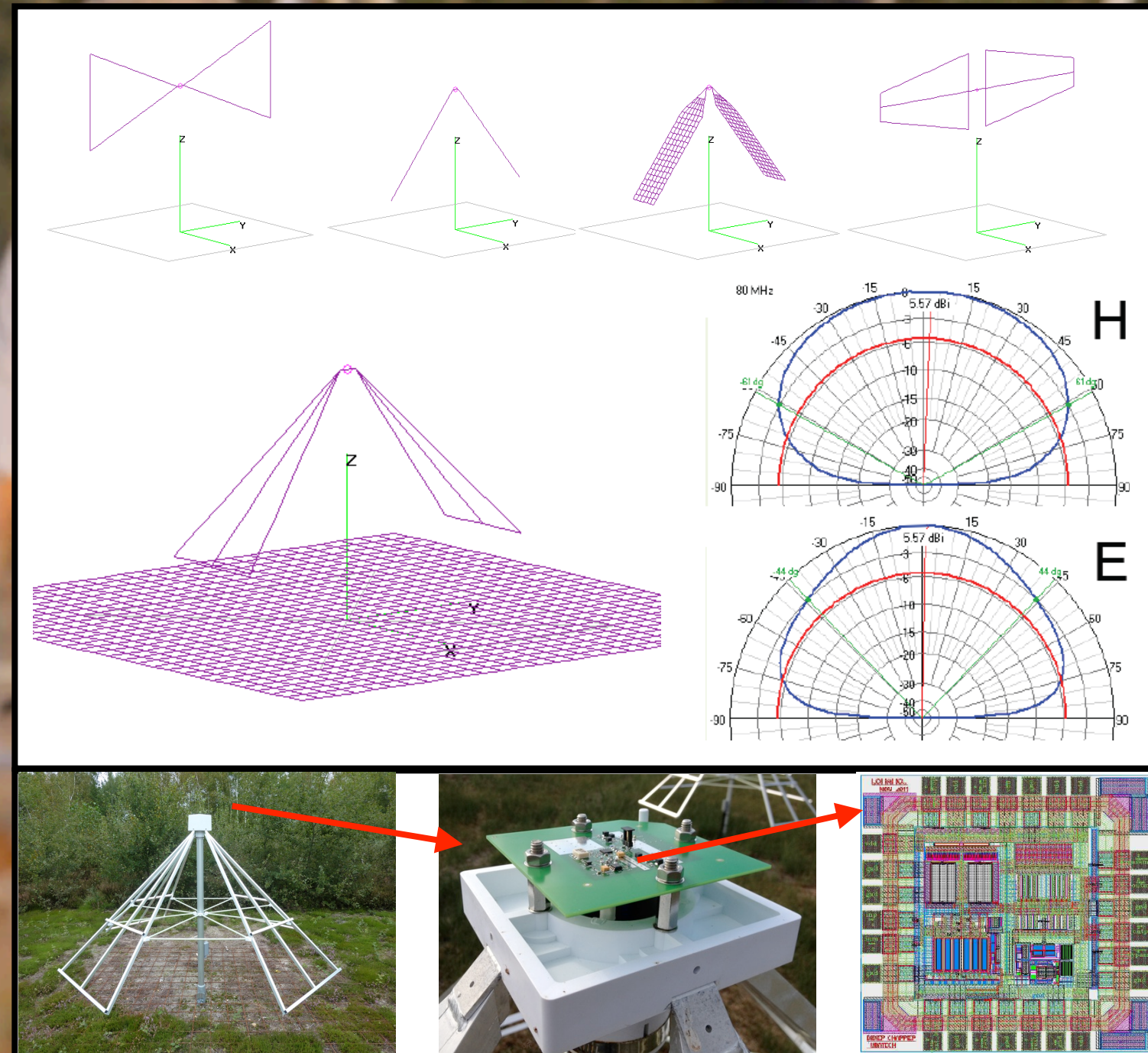


Design study (2009-2013)



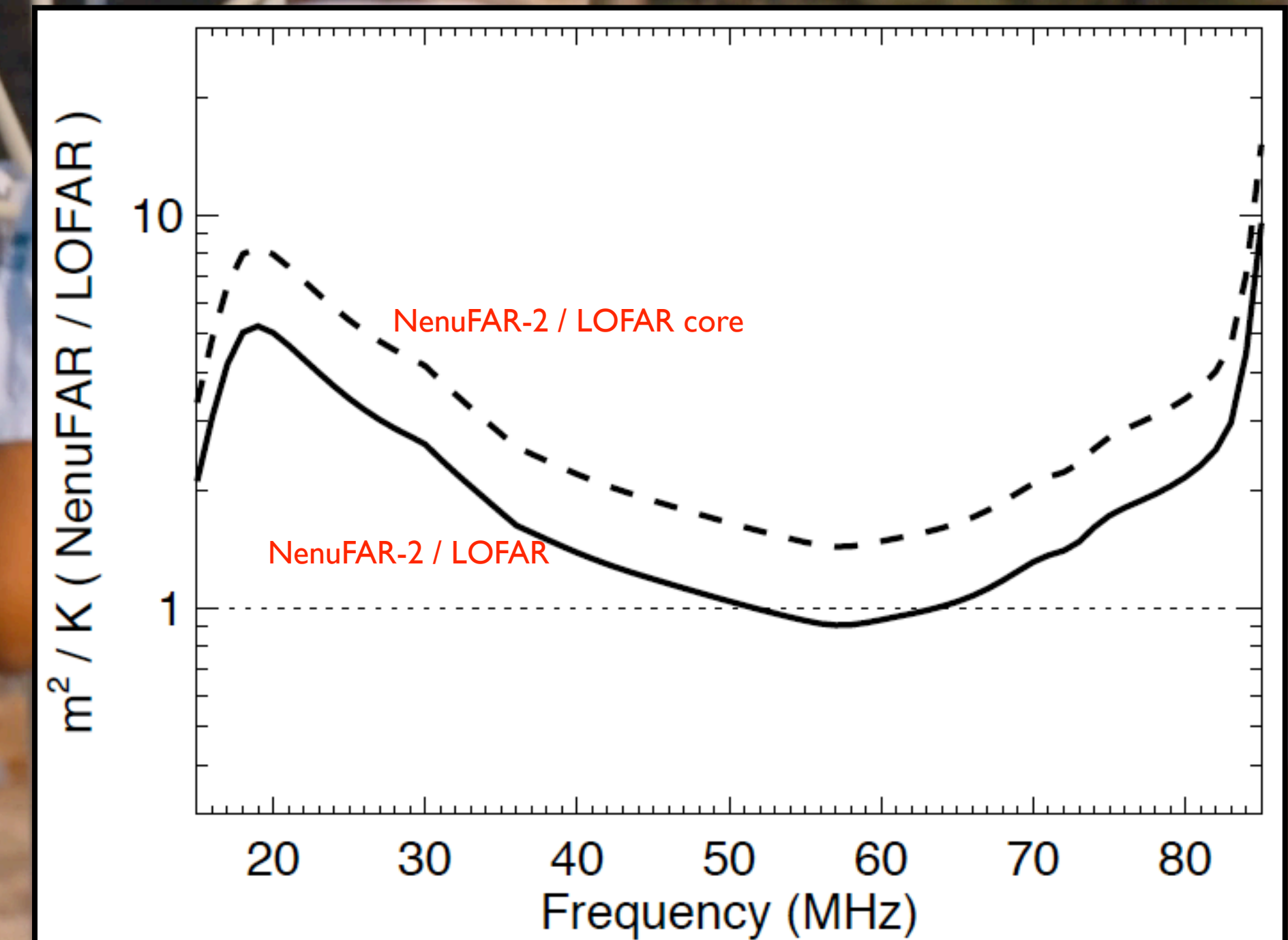
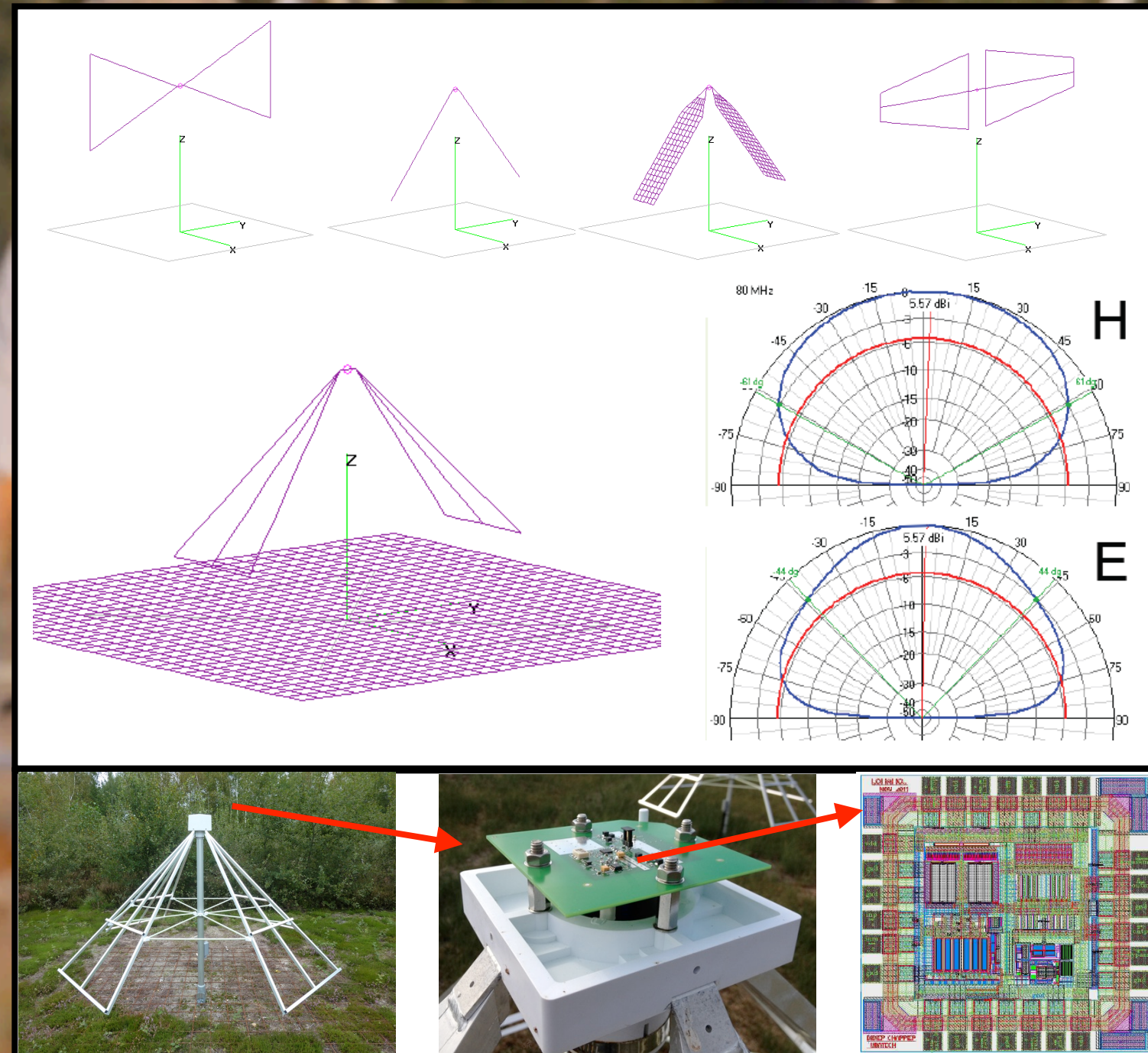
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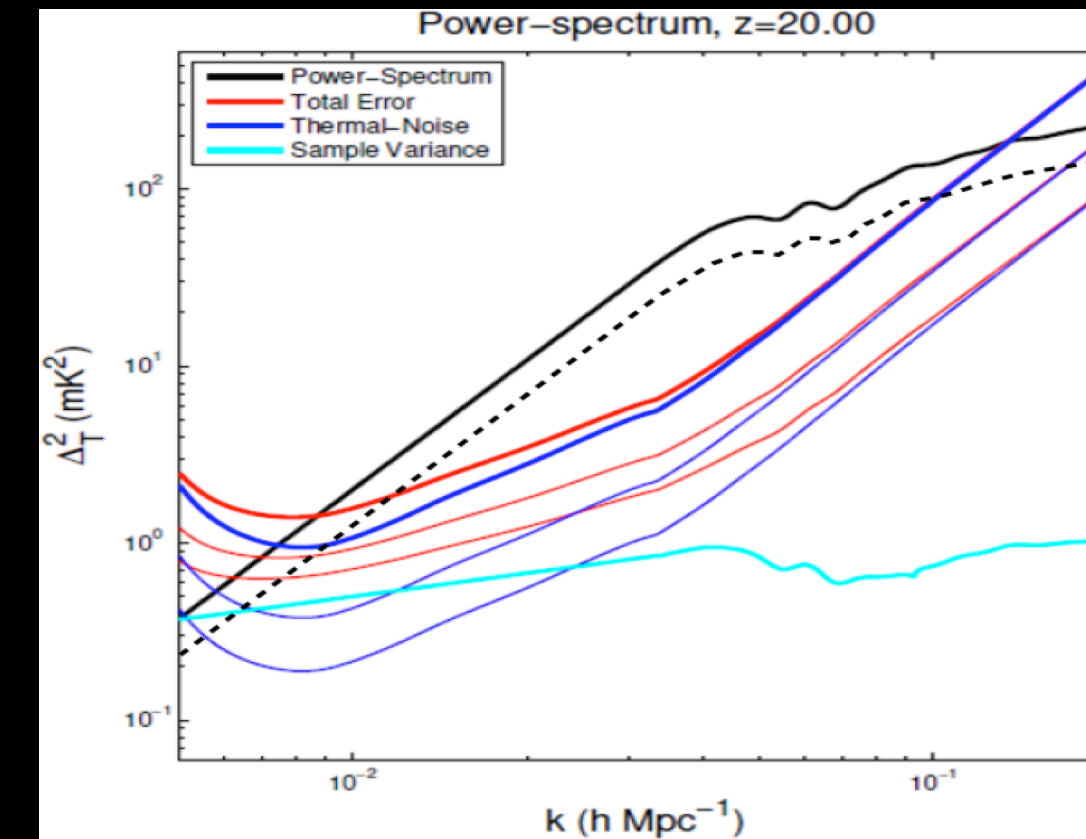
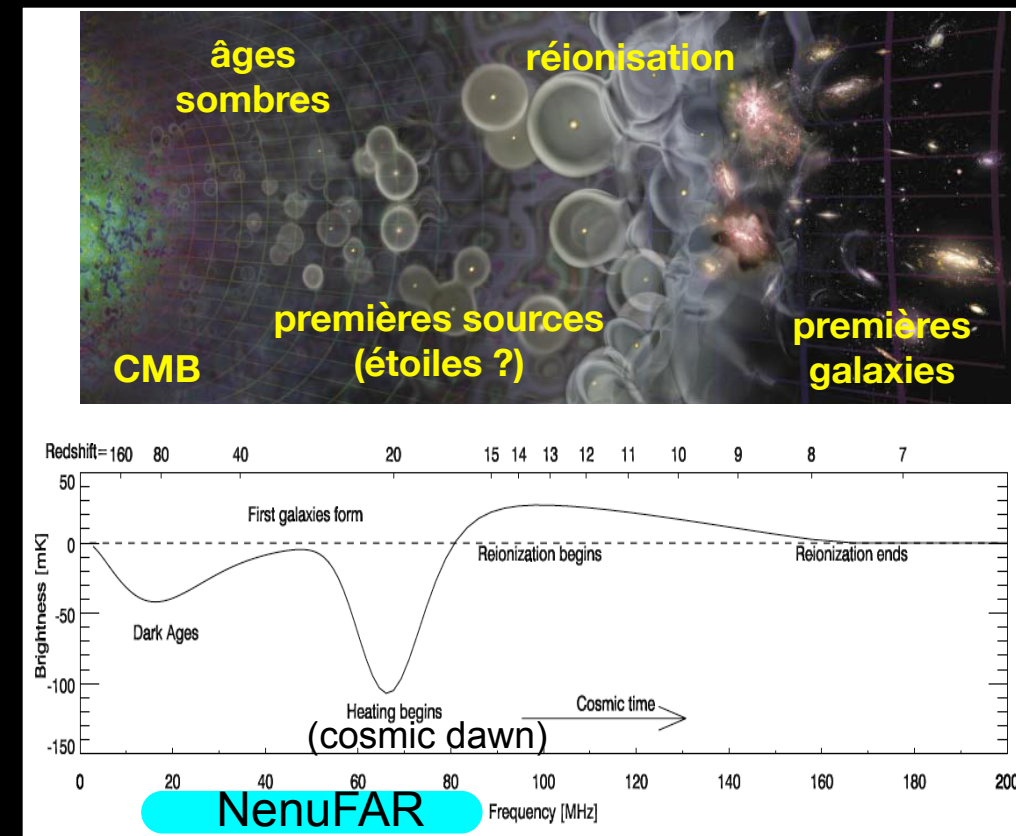
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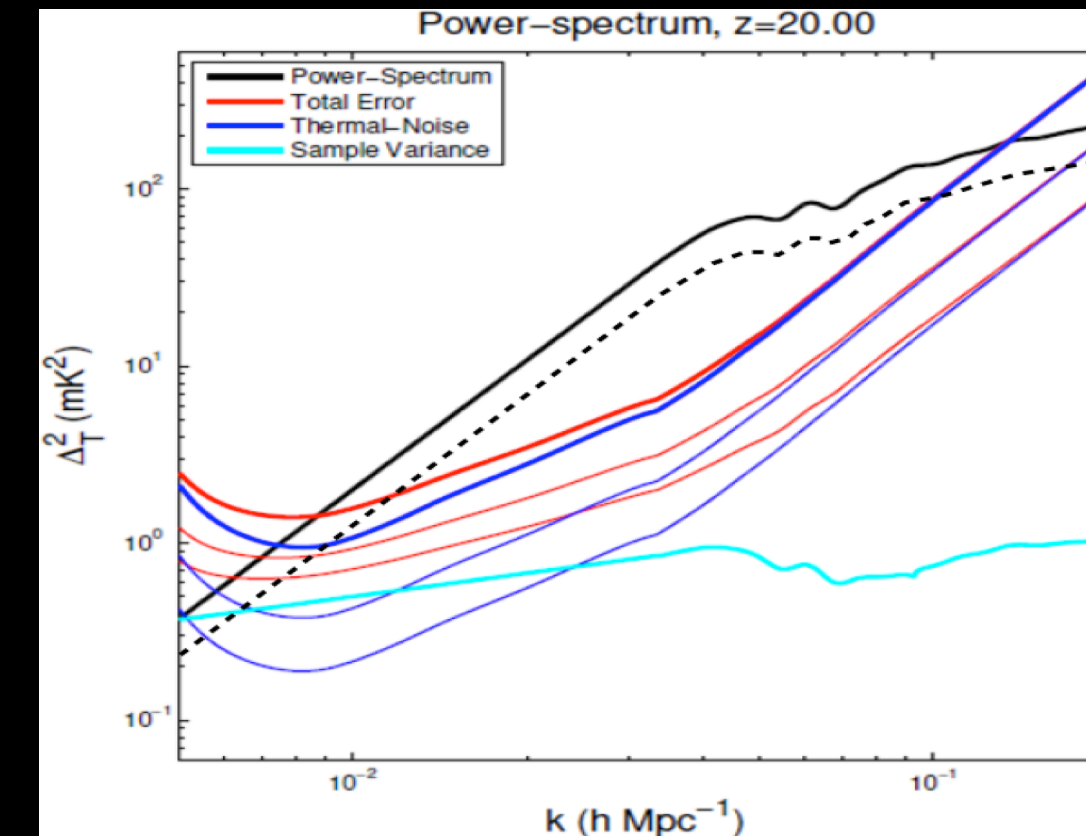
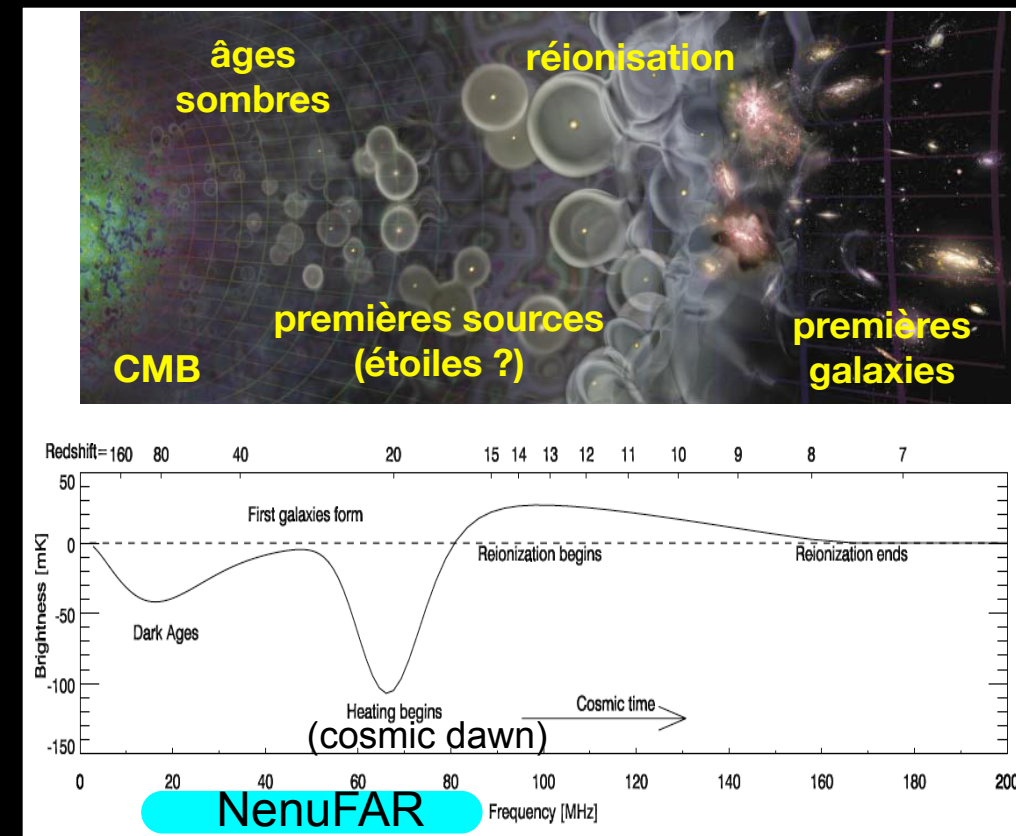
NenuFAR Science

- Cosmology

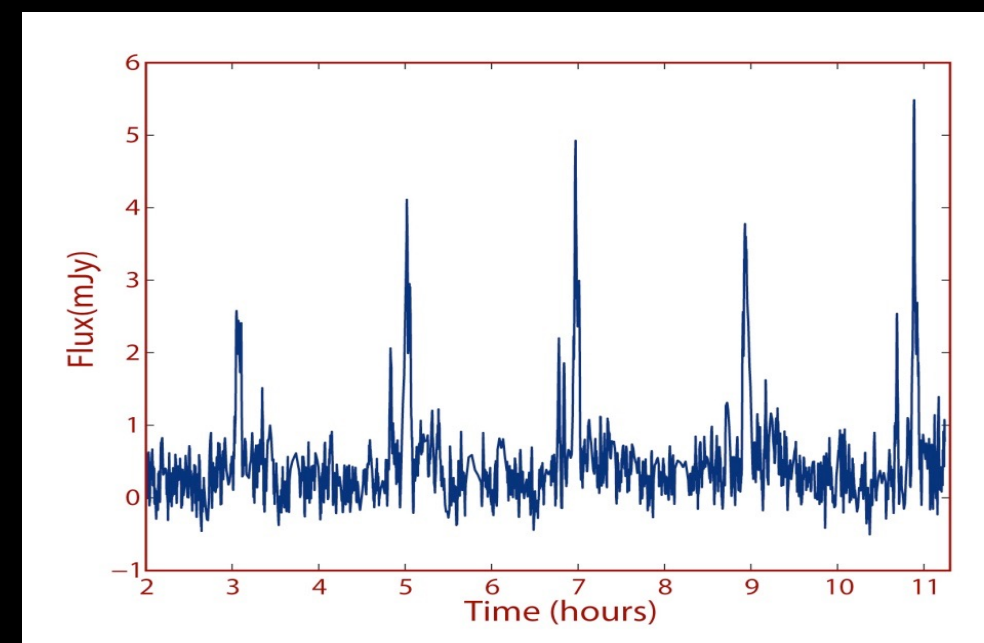


NenuFAR Science

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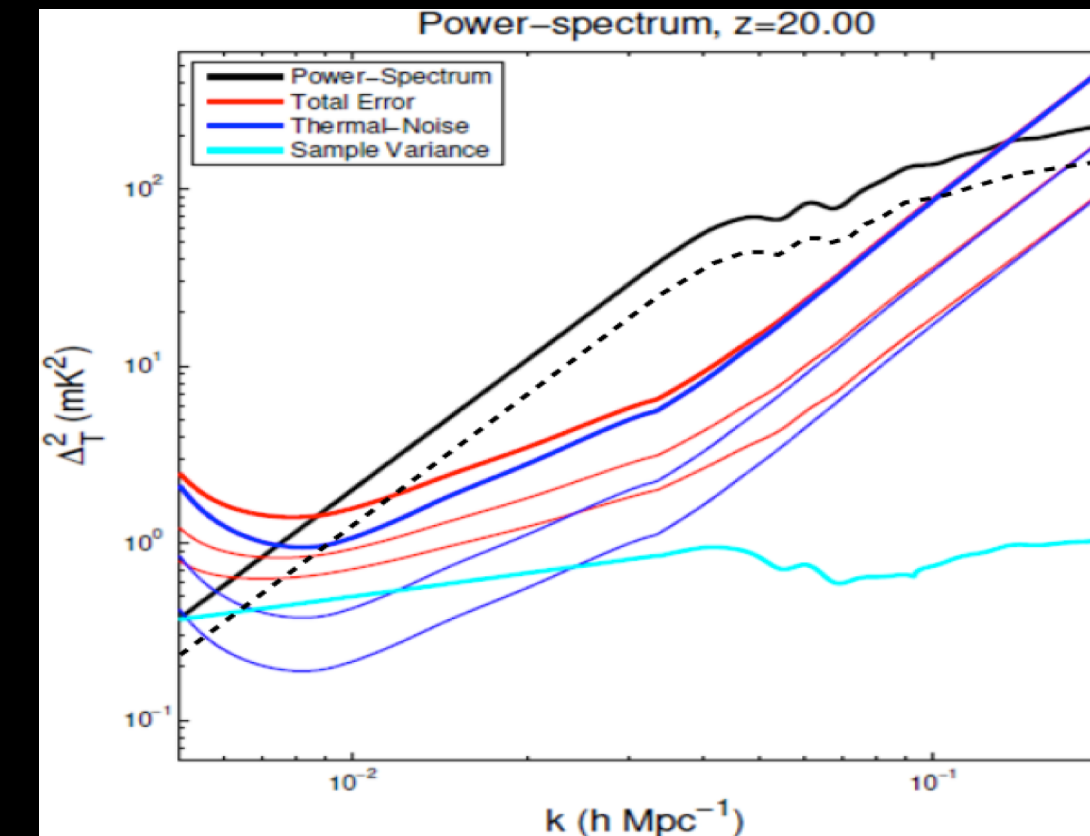
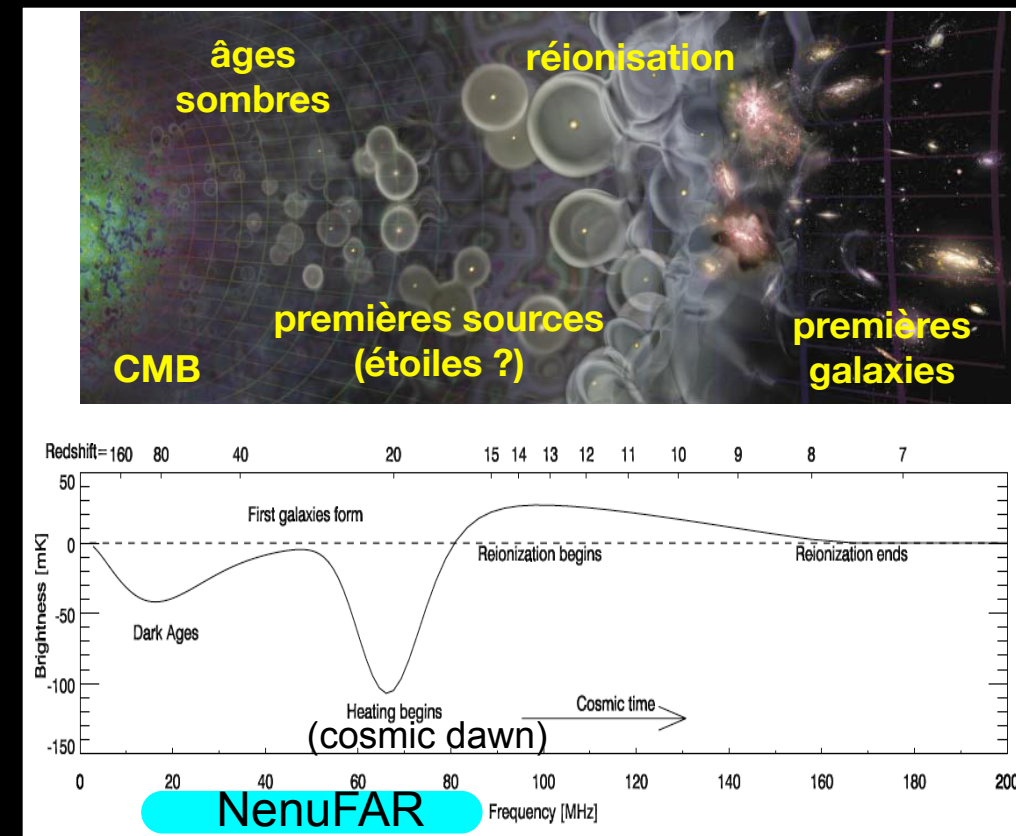


- Star-Exoplanet Interactions

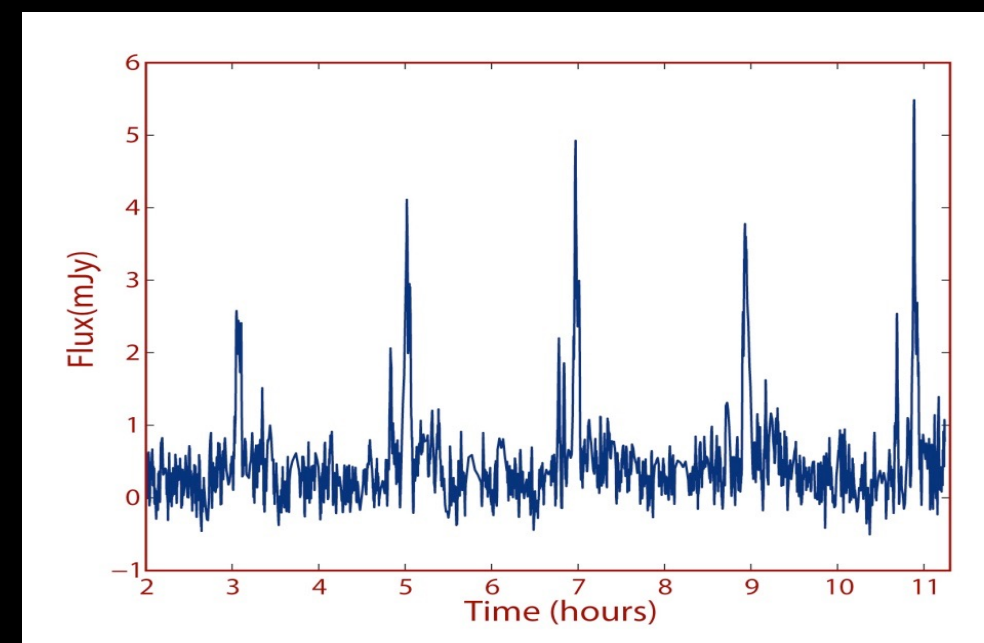


NenuFAR Science

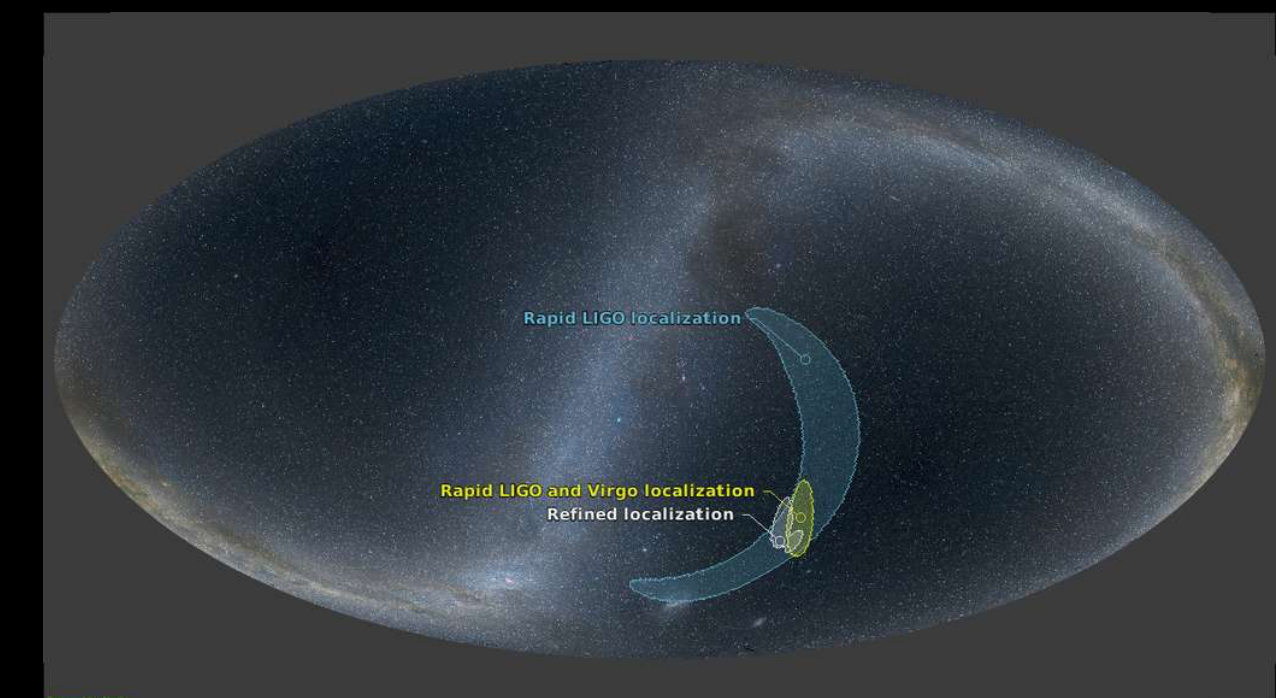
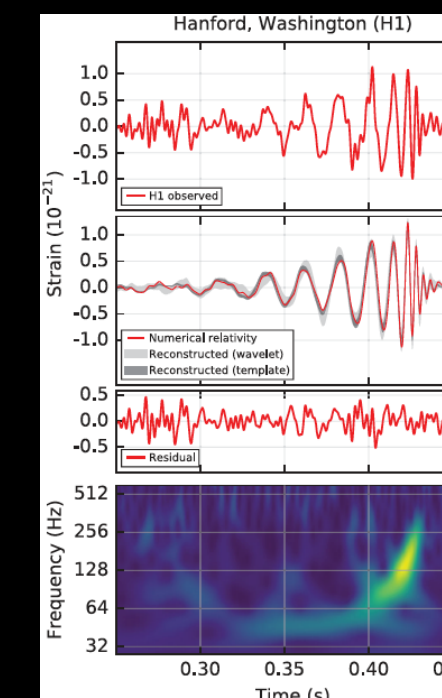
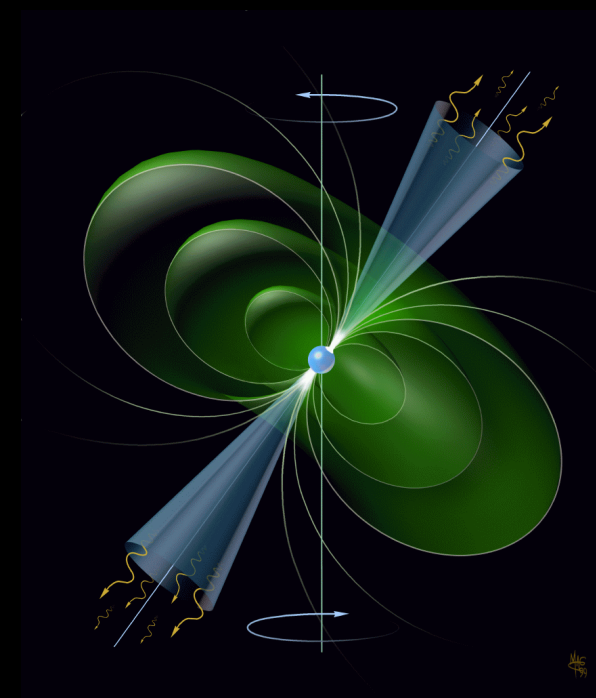
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- Star-Exoplanet Interactions



- Pulsars, Transients ...

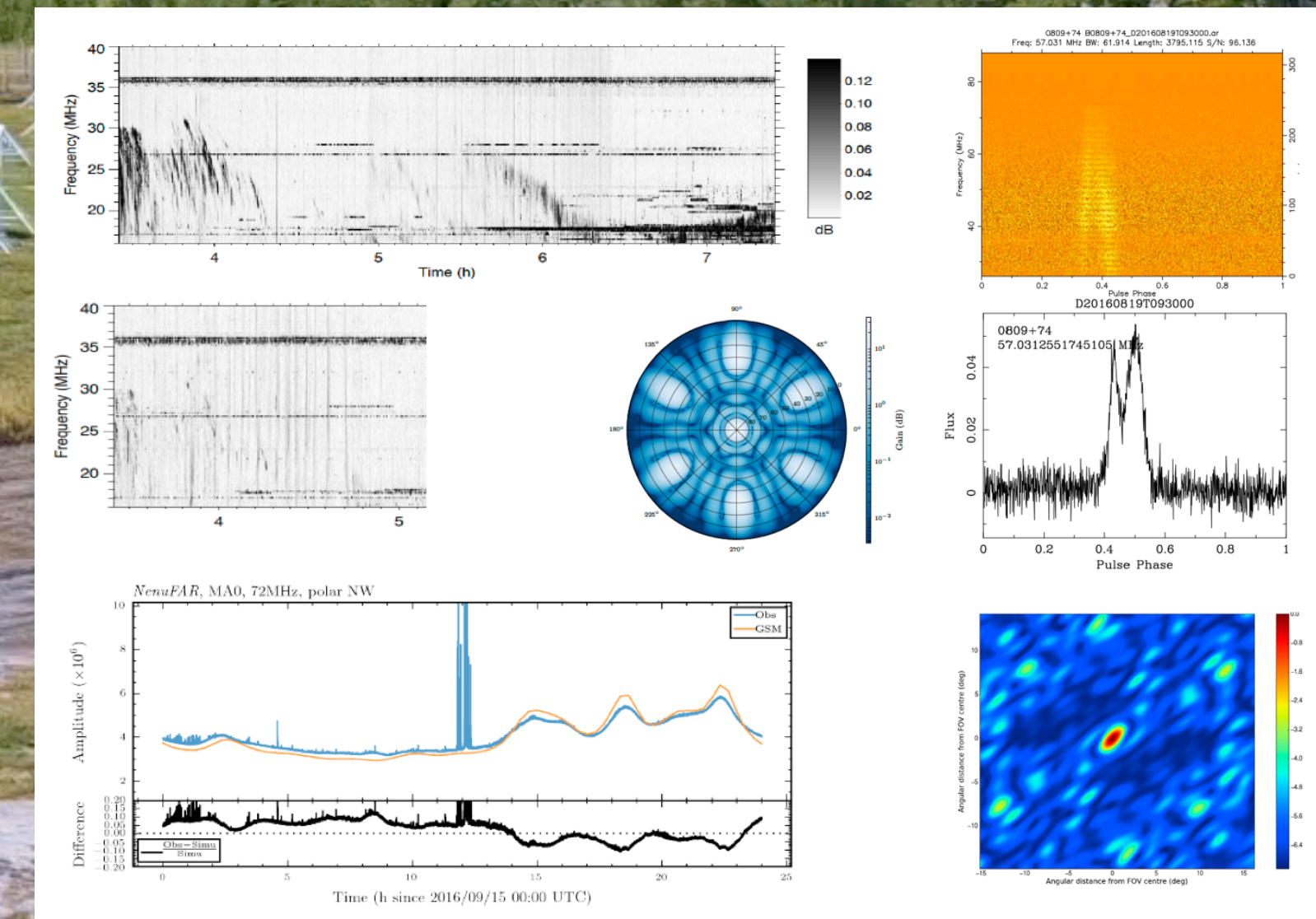


The project NenuFAR

- ~ 5 + 5 M€ (70% funded : Regions, ANR)
- Nançay : site, infrastructure, manpower (~15)
- Scientific community : ~60 (France) + ~25 (Foreign coll.)
- MoU with LOFAR, LIGO-Virgo, SETI
- SKA pathfinder since 2014
- Research Infrastructure MESR with LOFAR
- Will be largely open to the International community
- Ongoing construction & commissioning

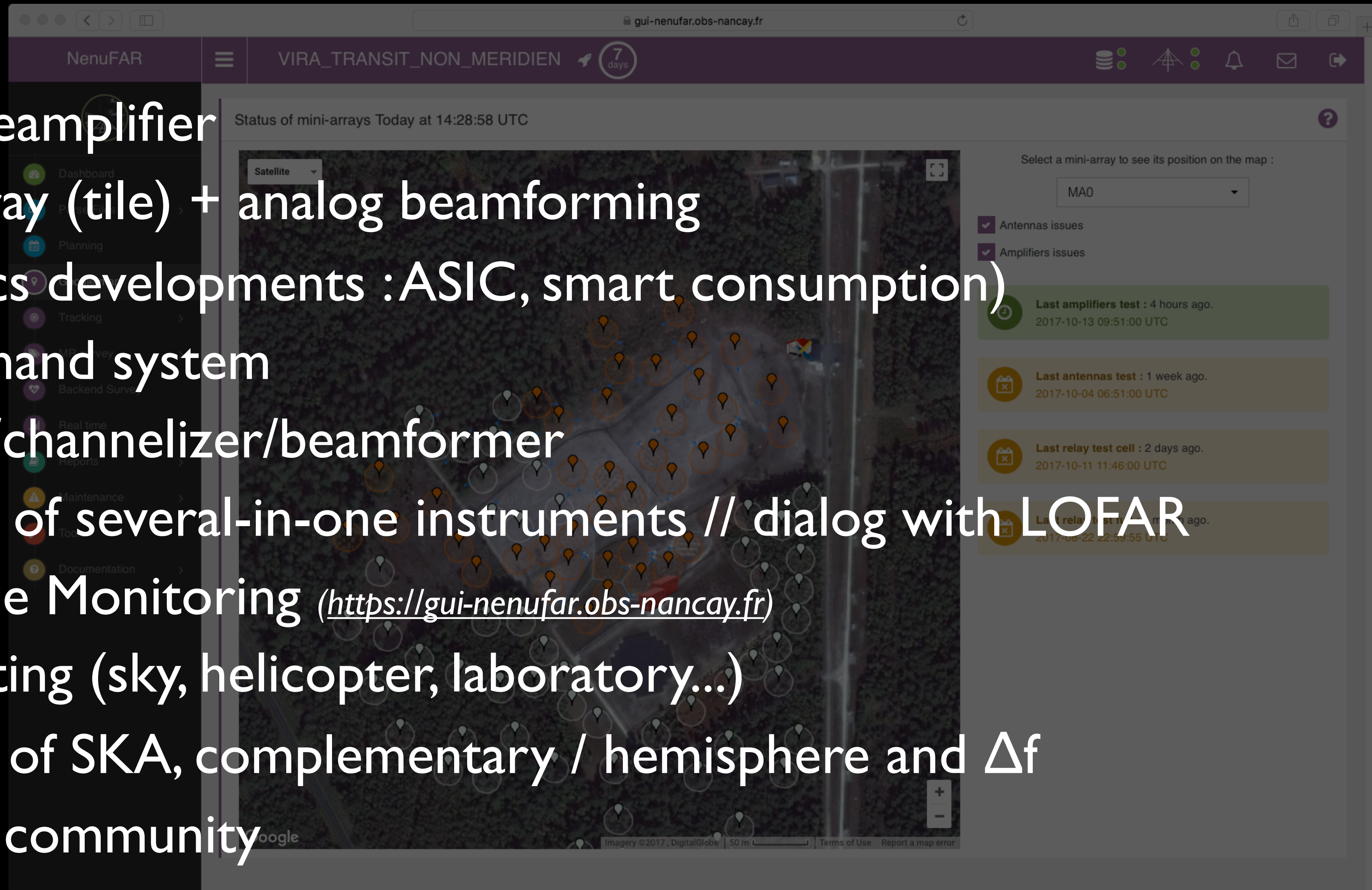
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Possible Lessons for SKA-Low

- LF antenna ASIC preamplifier
- Optimized Mini-Array (tile) + analog beamforming
(→ cf. μ -electronics developments : ASIC, smart consumption)
- Silent control/command system
- LaNewBa : digitizer/channelizer/beamformer
- Complex operation of several-in-one instruments // dialog with LOFAR
- GUI/Online Realtime Monitoring (<https://gui-nenufar.obs-nancay.fr>)
- Commissioning/Testing (sky, helicopter, laboratory...)
- Scientific precursor of SKA, complementary / hemisphere and Δf
- Training the French community



From LOFAR to NenuFAR to SKA



From LOFAR to NenuFAR to SKA

- Coherent (re)construction of a strong French 'LF' radio community



From LOFAR to NenuFAR to SKA



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 - an intrinsic scientific interest
 - + fits in the big picture where SKA is at the 'end' of the path

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Thank you.