

# Wide-band Single Pixel Feeds for the SKA



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# Wide Band Single Pixel Feeds (WBSPFs)

Key differences with aperture arrays and phased array feeds:

- larger bandwidth → more sensitivity, higher time resolution, more spectral information
- this extends to higher frequencies → towards more 'thermal' science, higher angular resolution
- smaller fields of view → lower survey FoM than PAFs and AAs (so only used for the narrowest tiers of the wedding cake)

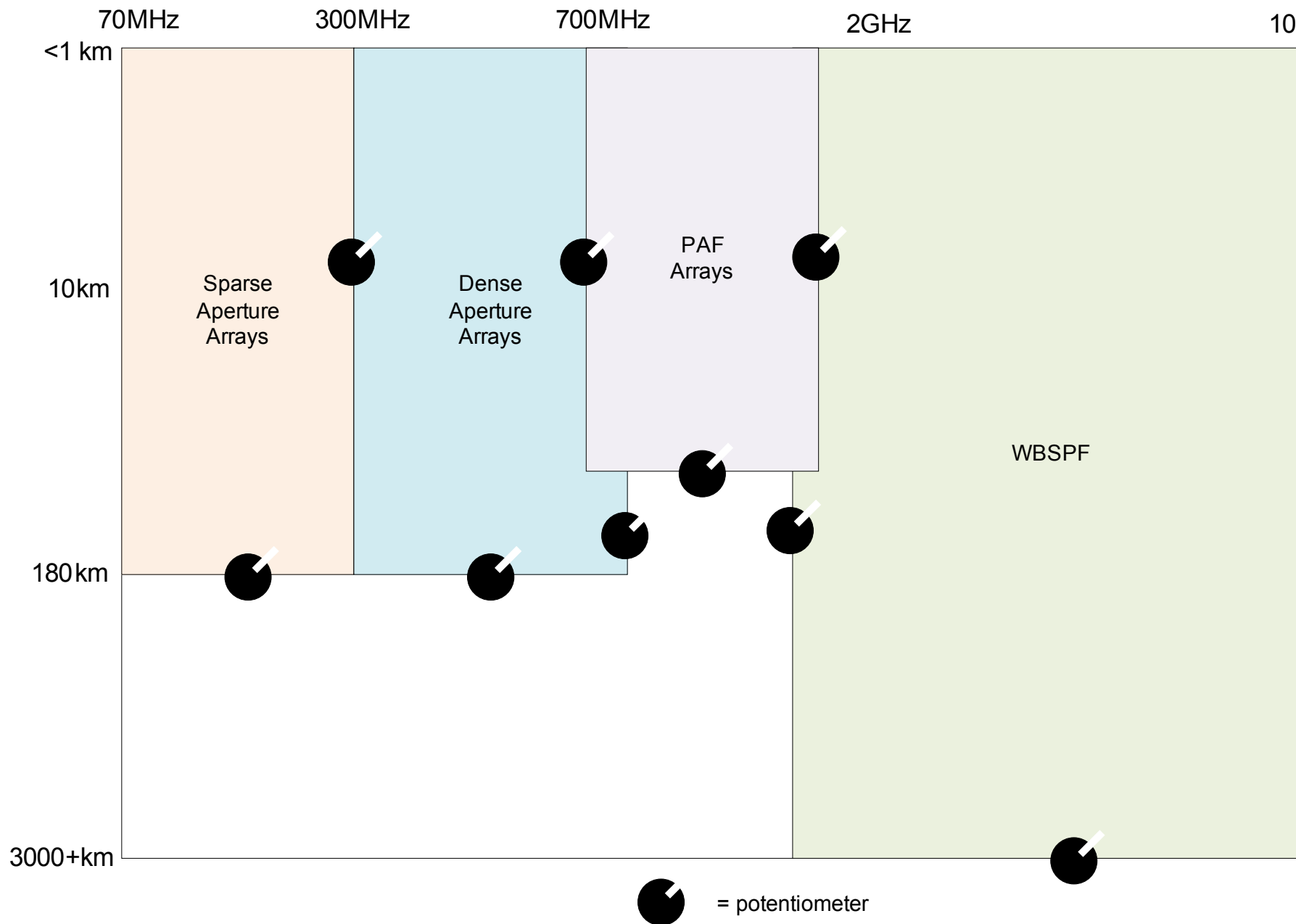
## Ongoing evolution towards WBSPFs

ATCA(-CABB), (e-)MERLIN, (E)VLA all recently upgraded / upgrading to much larger bandwidths

Of the SKA precursors MeerKAT will use WBSPFs

# Receptor Framework

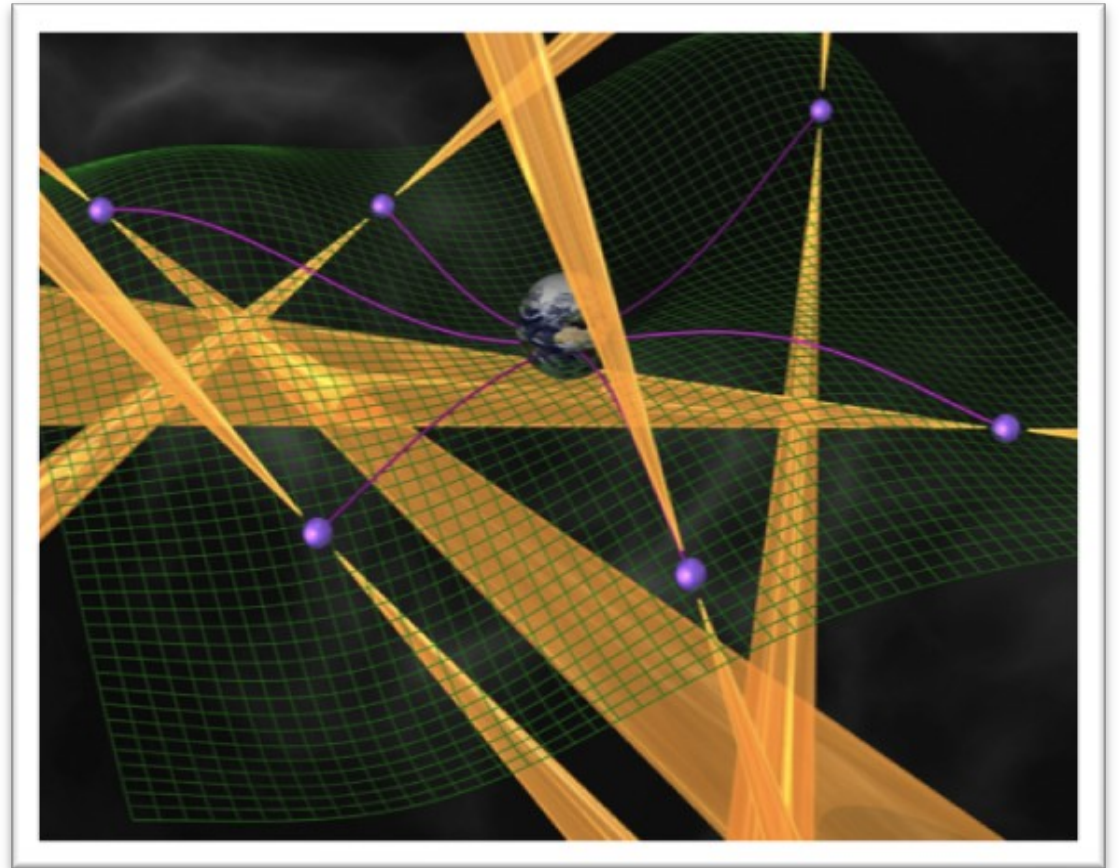
SPDO



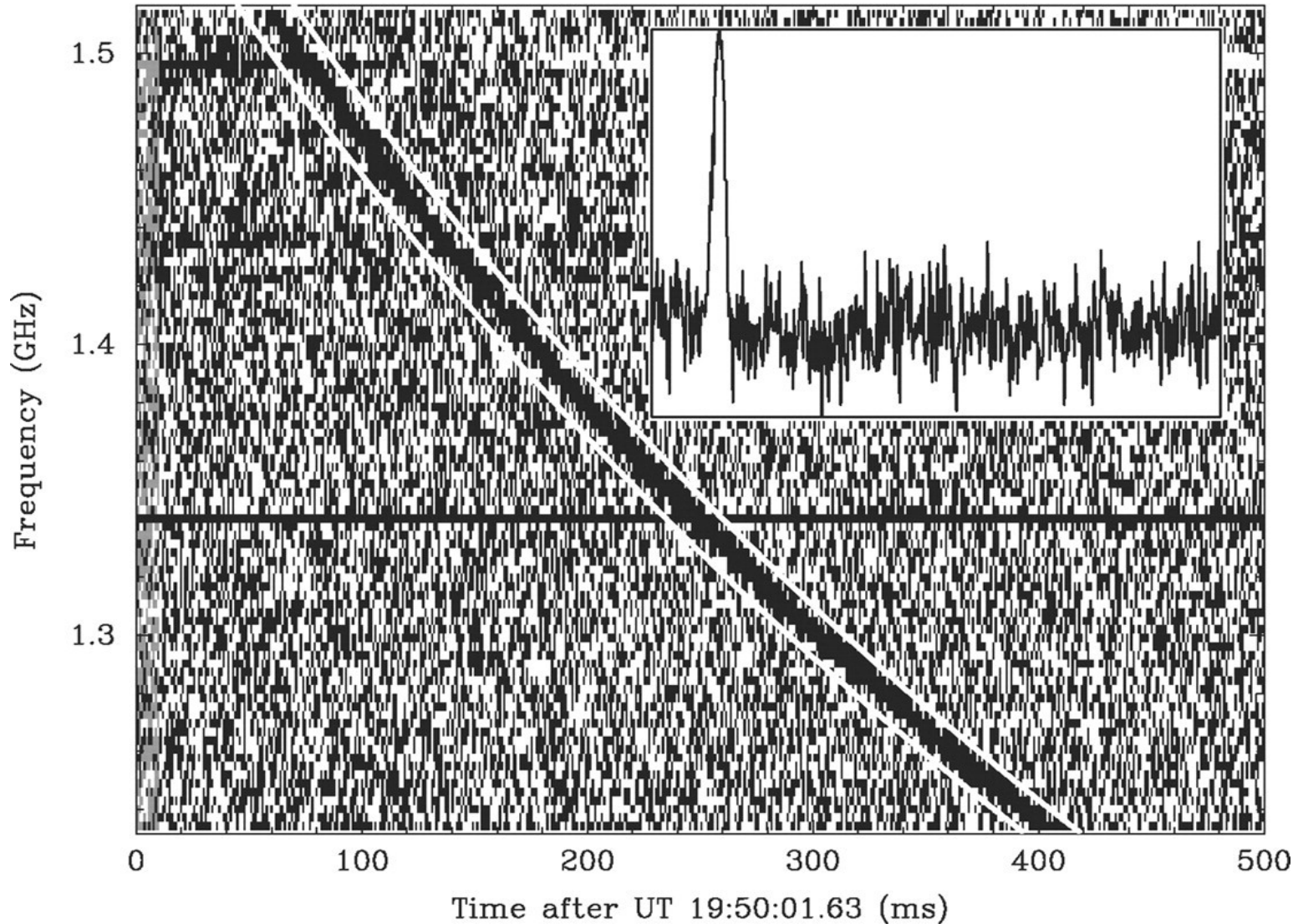
# Science with WBSPFs

## Pulsars / coherent transients

The precision timing for the pulsar timing array will use the WBSPFs (has to be on-axis so no advantage to PAFs - although they will be used to find the interesting pulsars).



# Coherent transients: Large frequency range allows you to accurately de-disperse (in real time)

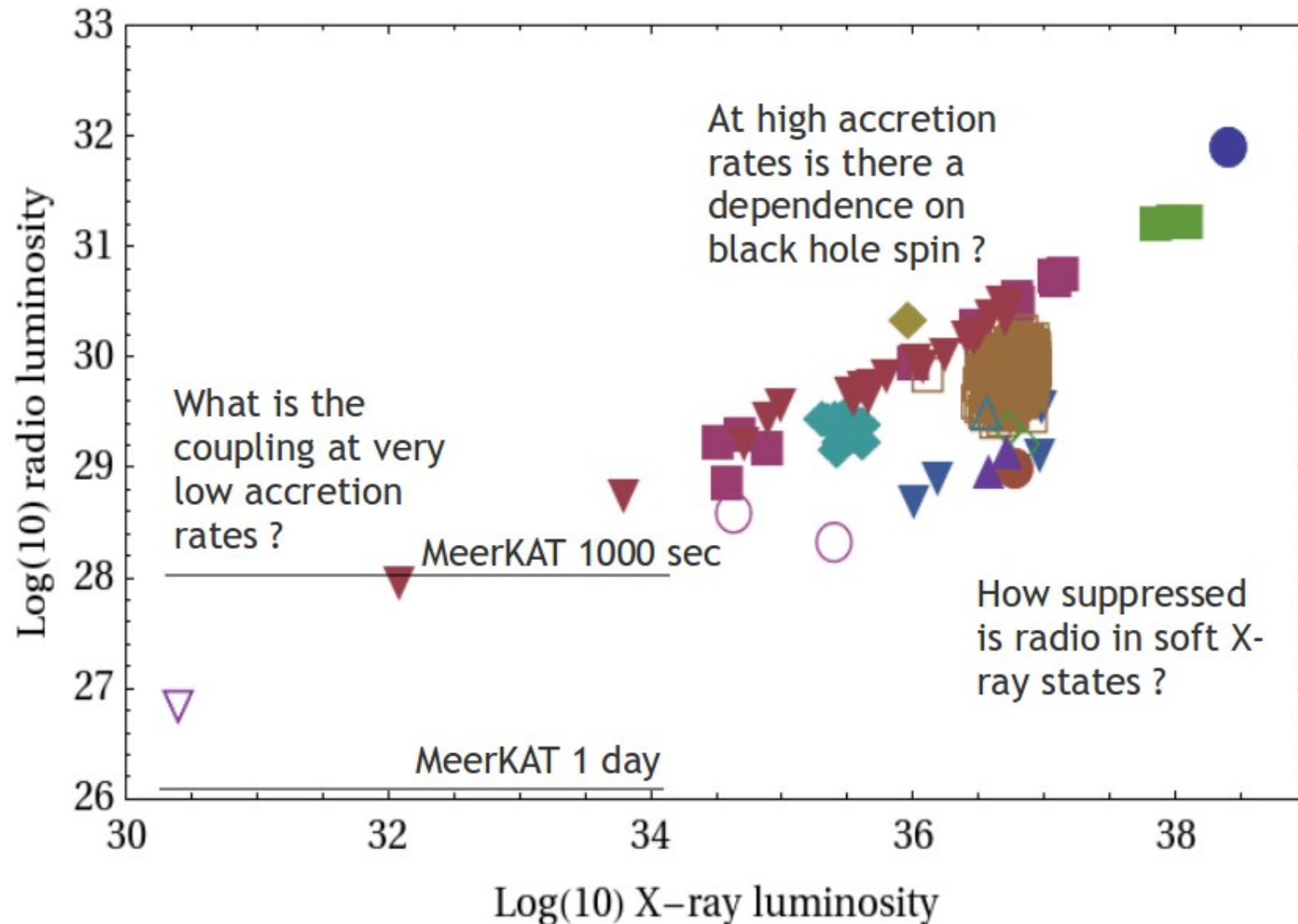


Extragalactic transients at large distance identified within seconds → trigger major multi-messenger observing campaign...

→ probe structure in the intergalactic medium etc etc.

# Detailed study of individual objects

Black hole accretion (individual objects, sensitive regular monitoring of variable objects ... )



And ..

The deepest, narrowest surveys

Spectroscopy

The magnetic universe

Highest frequencies →  
planetary discs, HII regions, young stellar objects ..

VLBI

(apologies to those not mentioned ... )

# Wim van Capellen

## Establish costed scenarios

- Including mechanical and infrastructural costs
- For example:
  1. Reflector 1.2 – 10+ GHz  
(2x WBSPF)
  2. Reflector 0.3 – 10+ GHz  
(3x WBSPF)
  3. Reflector 0.3 – 10+ GHz  
(PAF 0.8 – 2 GHz, WBSPF 2 – 10 GHz, 0.3 – 0.8 GHz WBSPF)
- Once dish costs and performance are known, a system-level trade-off can be made.



# Dish design

- Offset Gregorian: ATA or GBT-like structure
- Impact on performance (Tsys a.o.), dish design, costs, maintenance?

# Phased Array Feeds

- Below 2-3 GHz, PAF's are the best feed design, also single beam
  - <10K room temperature LNA's
  - Optimized beam pattern
- Bandwidth is limited (at most ~2.5:1)