High-Energy Cosmic Particles

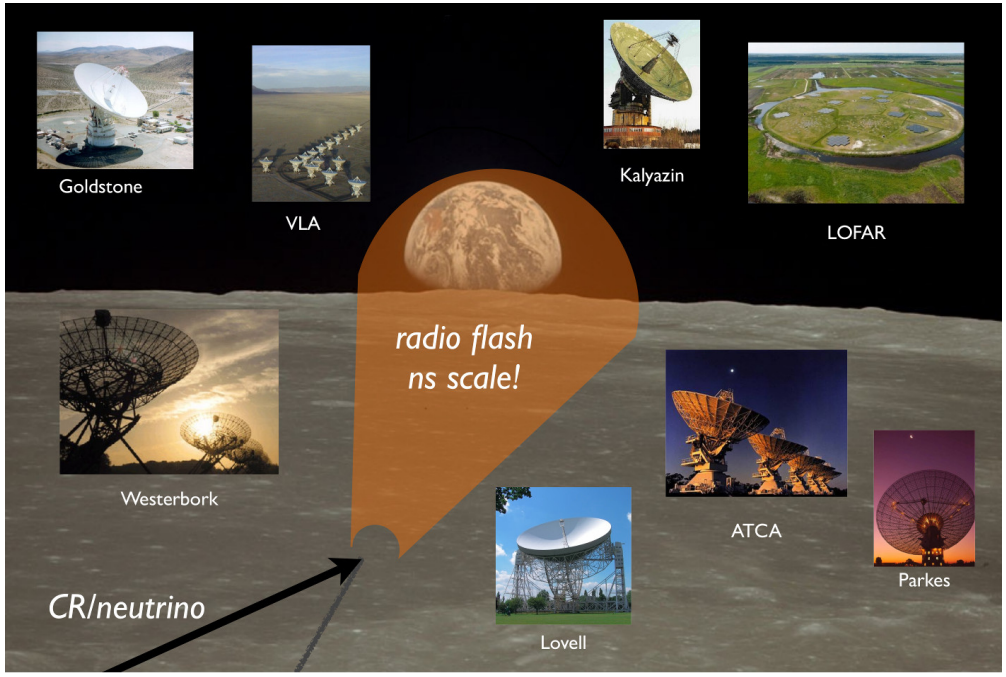
Focus Group Summary

Image: J. Yang / NSF

Atmospheric detection

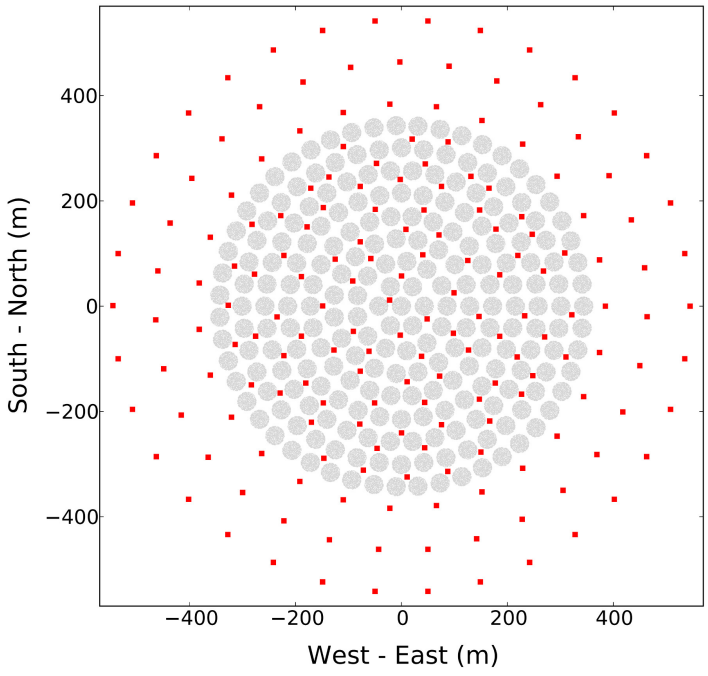
Schellart et al. PRL **114** 165001 (2015)

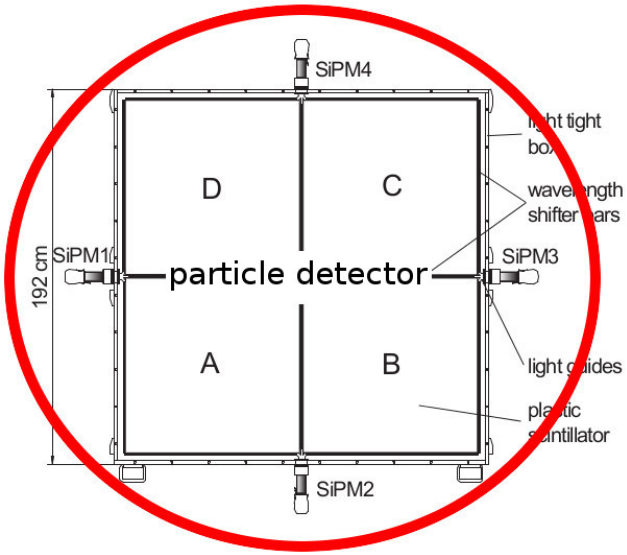
Lunar detection



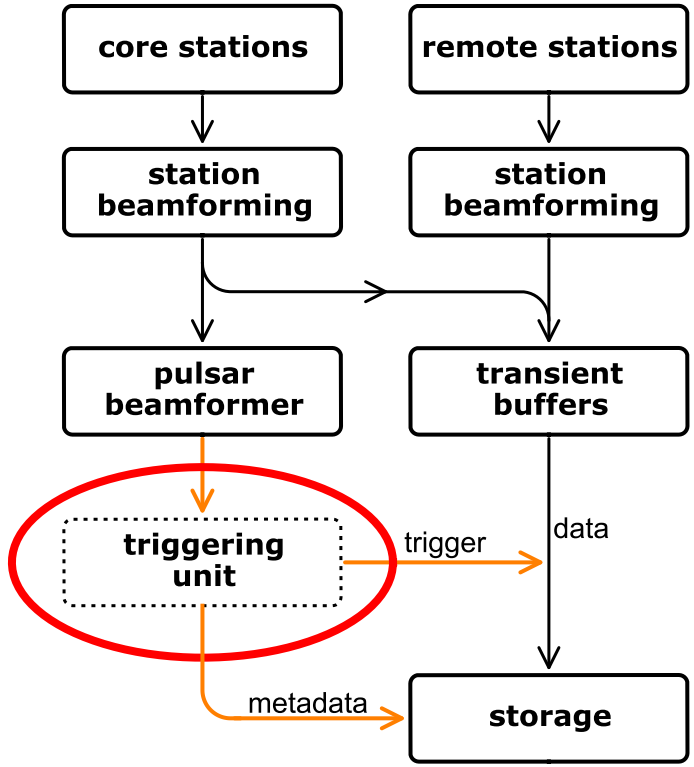
Both SKA-LOW only.

Atmospheric detection



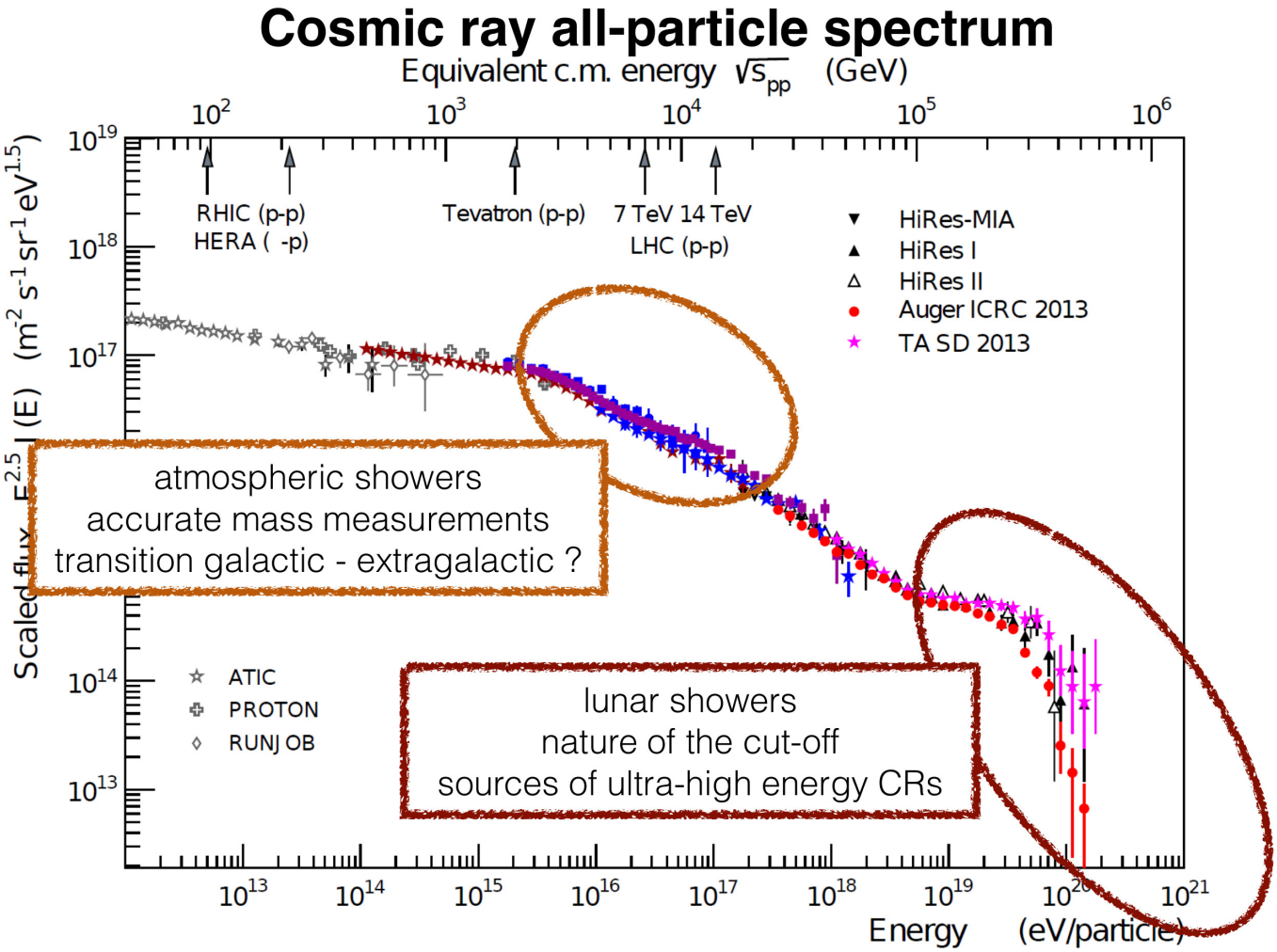


Lunar detection



Specialised hardware to be provided by us.

Engineering change proposals submitted for interfaces.



- large ($\gtrsim 50\%$) overlap in interested members; but
- different hardware and data reduction,
- different science goals,
- distinct KSPs.

commensality, n.

Etymology: *com-* together with + *mensa* table

The habit of eating at the same table

Air-shower detection: *completely* commensal.

- zero dependence on beamforming, imaging
- operate 100% of the time!

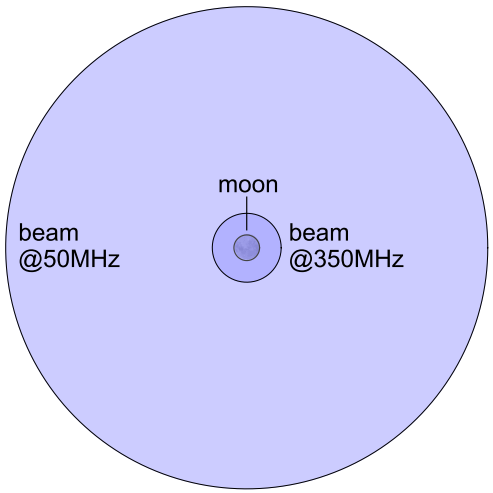
Lunar detection: partially commensal.

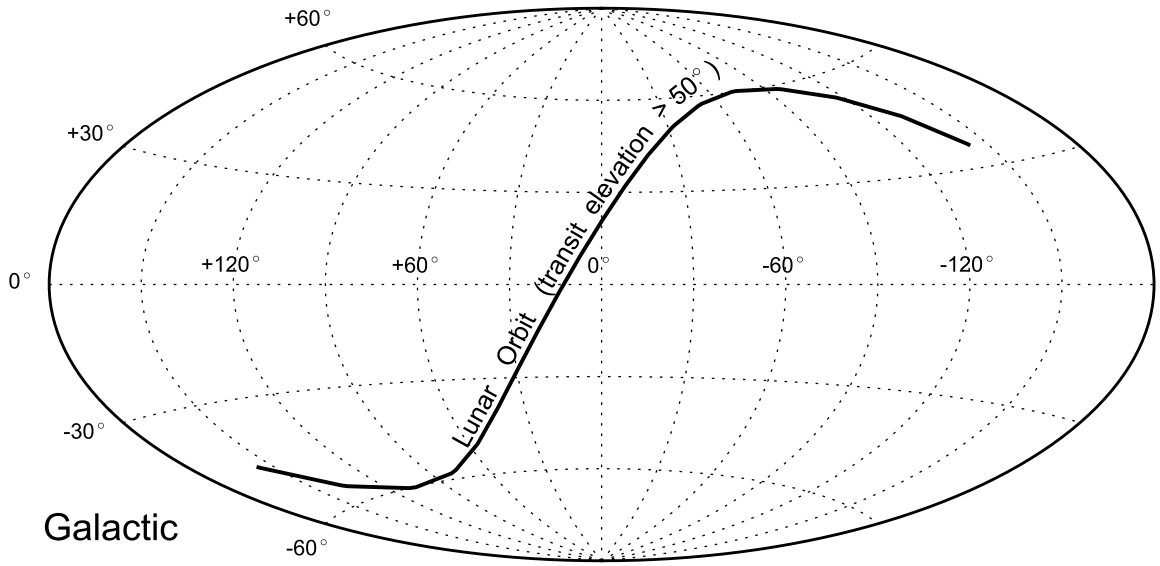
- moon occults 0.3–14% of FWHM beam
- moon drifts at $0.5^\circ/\mathrm{hr}$
- $T_{\mathrm{moon}} \sim T_{\mathrm{sky}}$

So:

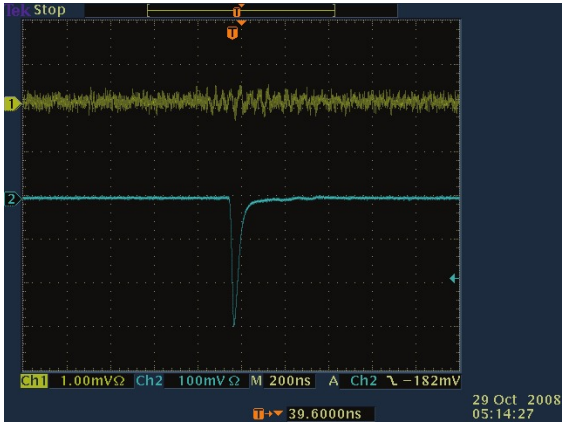
- pulsar & transient search mostly unaffected
- imaging tricky

Possible synergy with EoR, with moon as calibrator.
(Vedantham et al. MNRAS **450** 2291 (2015).)

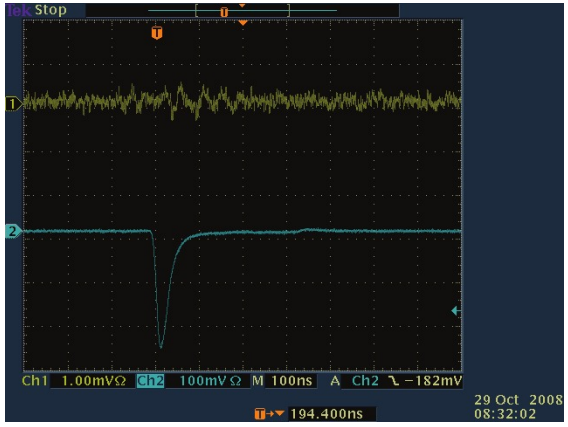

moon
beam
@50MHz
beam
@350MHz


+60°
+30°
0°
-30°
-60°
+120°
+60°
0°
-60°
-120°
Lunar Orbit (transit elevation > 50°)
Galactic

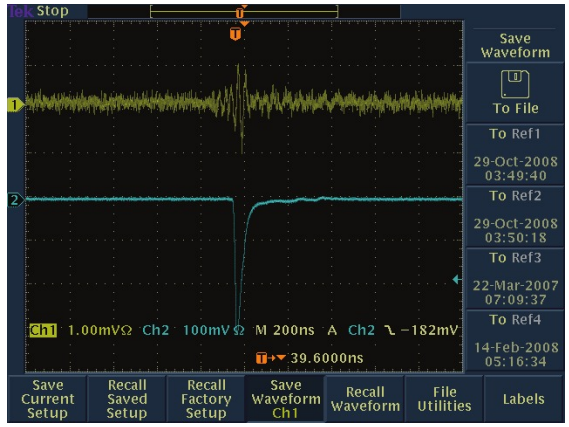
RFI test results from LORA array at LOFAR:



shielded



unshielded



cables in front of antenna

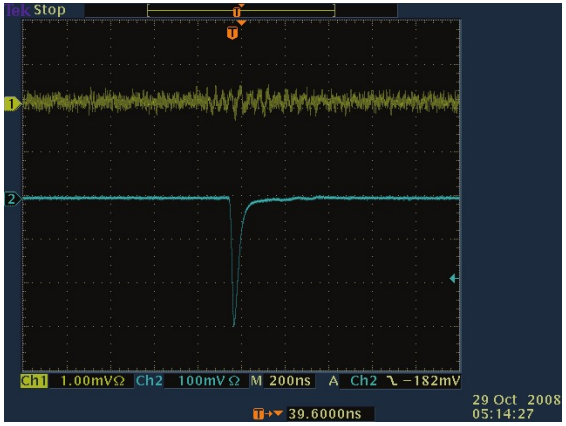
Compared to this, at SKA-LOW:

- SiPMs instead of PMTs
- RF-over-fibre instead of cables
- buried, better shielding?

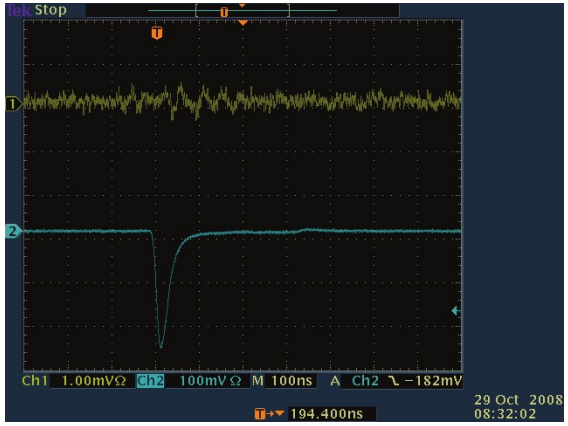
Nanosecond-scale pulse averaged over milliseconds: power $\times 10^{-6}$

Project most affected by nanosecond-scale RFI: us.

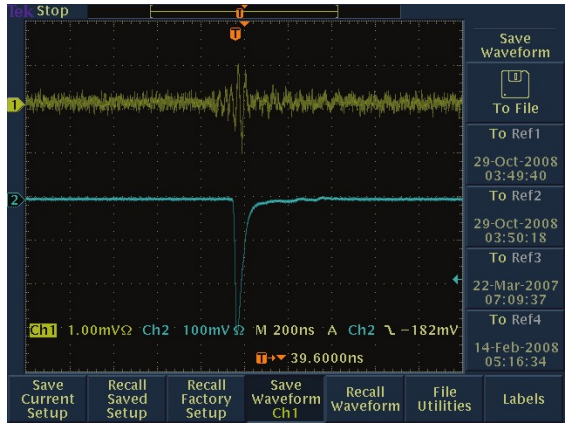
RFI test results from LORA array at LOFAR:



shielded



unshielded

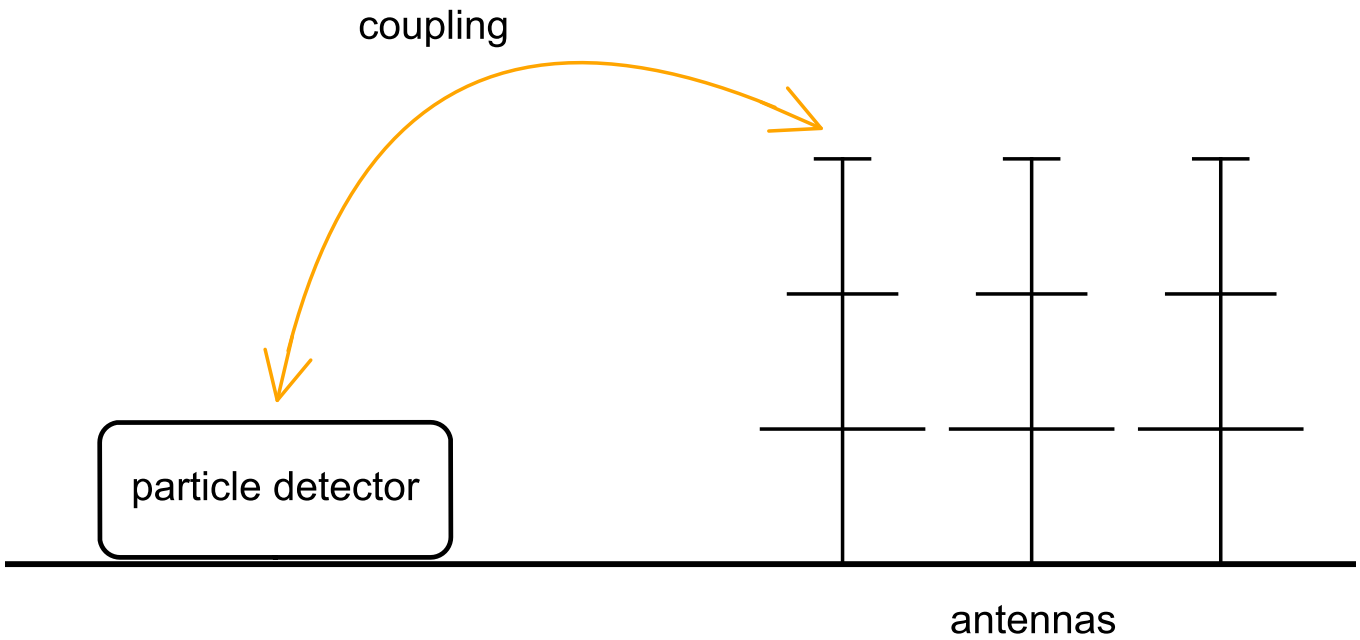


cables in front of antenna

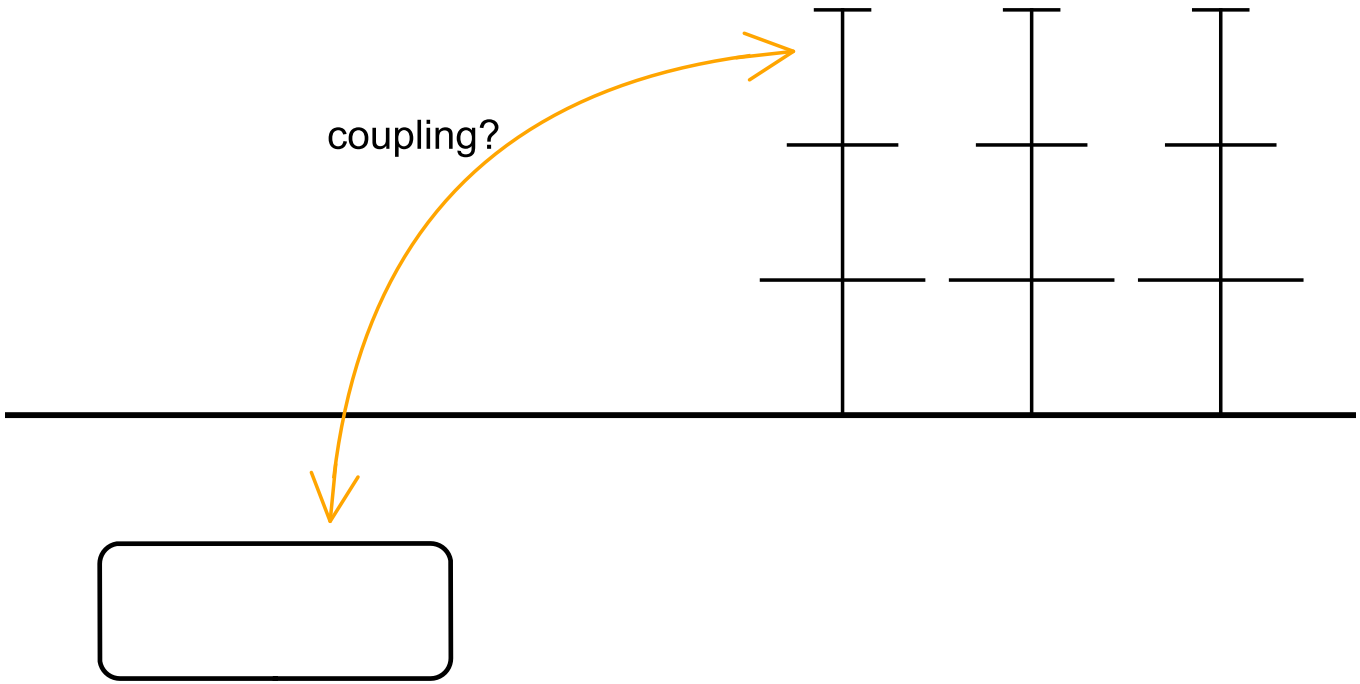
SKA-TEL-SKO-0000202

SKA EMI/EMC STANDARDS AND PROCEDURES

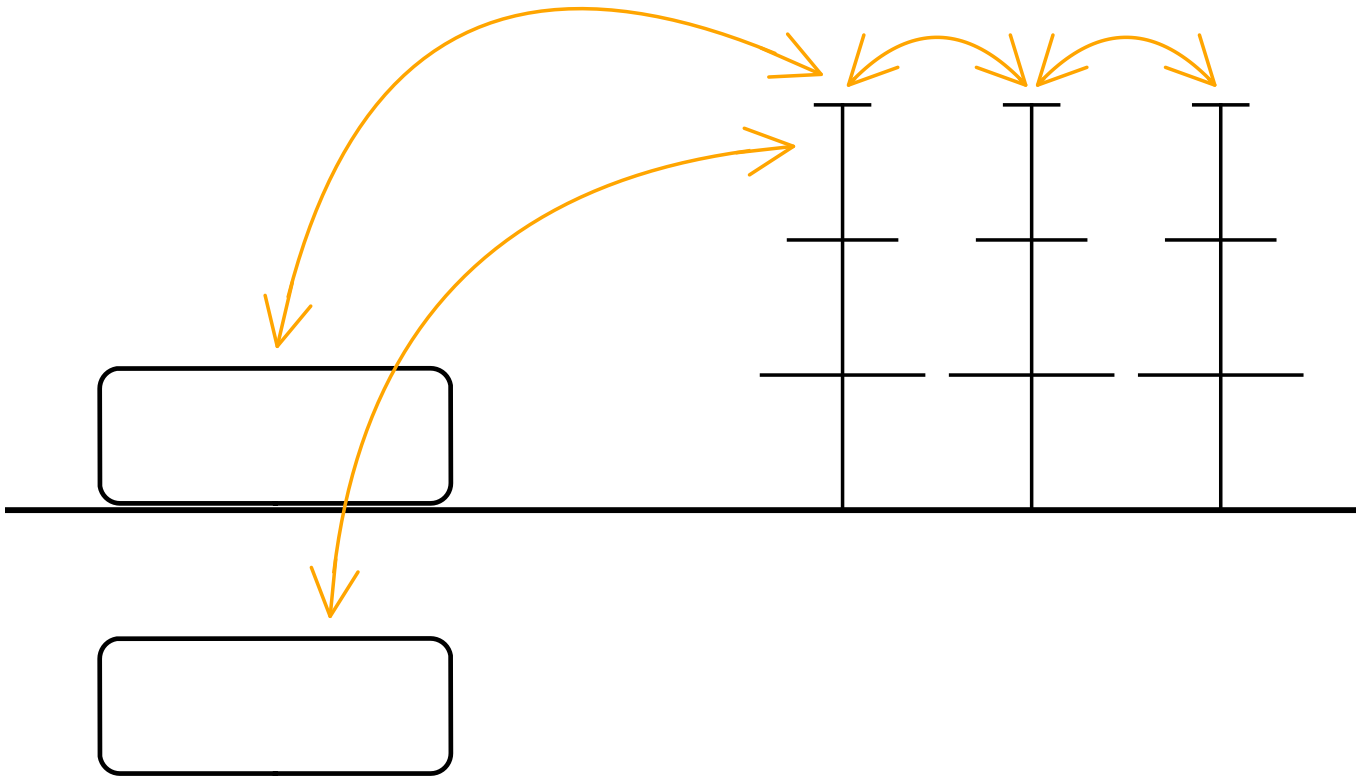
Passive interference



Passive interference



Passive interference



LORA array at LOFAR:

- Control PC: 250 W
- 20 detectors: 250 W
- Total: 500 W

Similar array at SKA-LOW:

- Control PC: 250 W
- 180 detectors: 2,250 W
- Total: 2,500 W

SKA-LOW: $\sim$ megawatts

In commissioning phase:

- Early science possible with first few SKA-LOW stations.
- Side-effect: debugging, localisation of impulsive RFI.

In operational phase:

- Data should go public immediately.
- Most likely, no one will replicate our analyses, except possibly to check significant results.
- Other applications of stored baseband data not expected
  . . . but if they turn up, no ownership of the data is implied.

Summary

Two potential KSPs, each dependent on an engineering change proposal.

Air-shower KSP *completely* commensal.

Lunar KSP partially commensal; still exploring extent.

RFI probably not a problem; will test thoroughly.

No proprietary period for data.