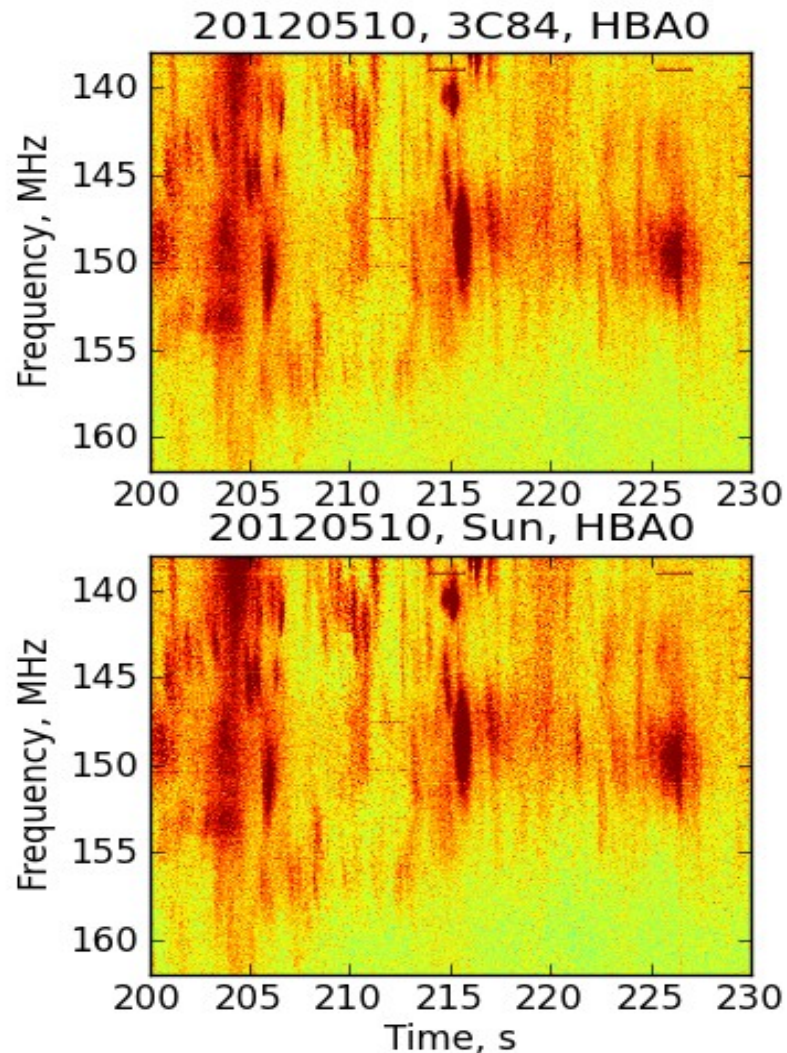


## Musings on Beam Profiles and Scintillation

*Richard Fallows*

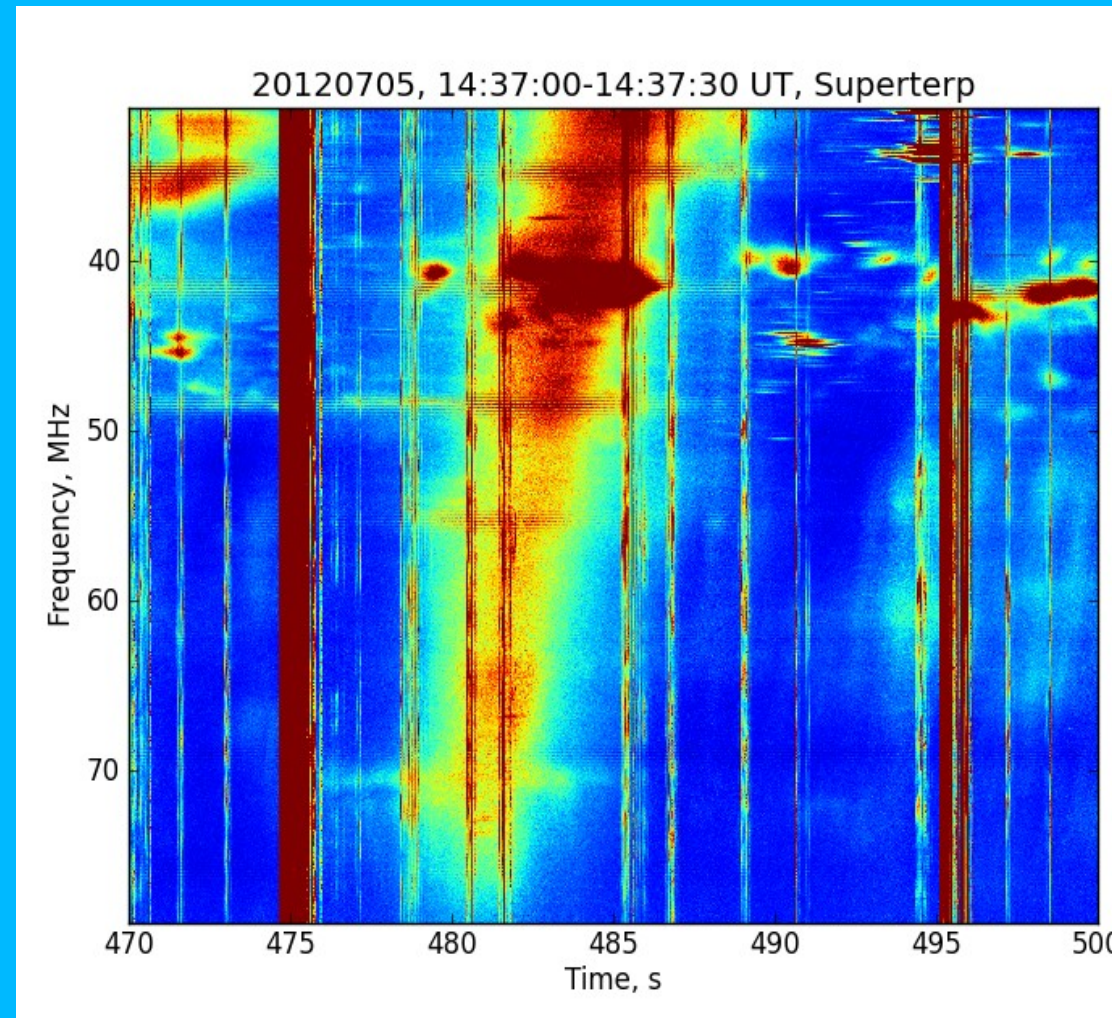
# The General Problem



- I want to observe interplanetary scintillation (IPS)
- This means (usually) observing in daytime
- The Sun is up in daytime
- The Sun dominates the power in beam sidelobes in many observations

# Pretty Pictures But...

- Observing the Sun leads to pretty pictures
  - Right: Type III radio burst seen through a thunderstorm
- However, this is not IPS...



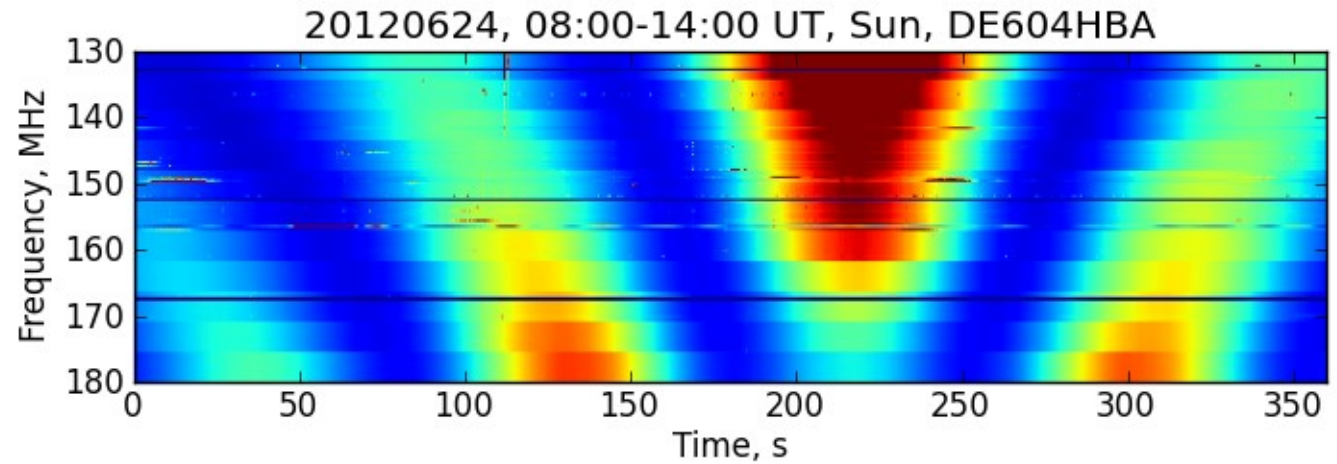
- Observe at night:
  - Restricted “viewing” distance from the Sun
  - Everybody else wants to observe then!
- Try and find observation times when the Sun would not be in a sidelobe:
  - **Mapping wide-field beam patterns of single stations**
  - Main subject of this talk
- Use a second off-source beam:
  - Being investigated, probable final solution (but does restrict bandwidth available)

# The Wide-Field HBA Beam: A First Look

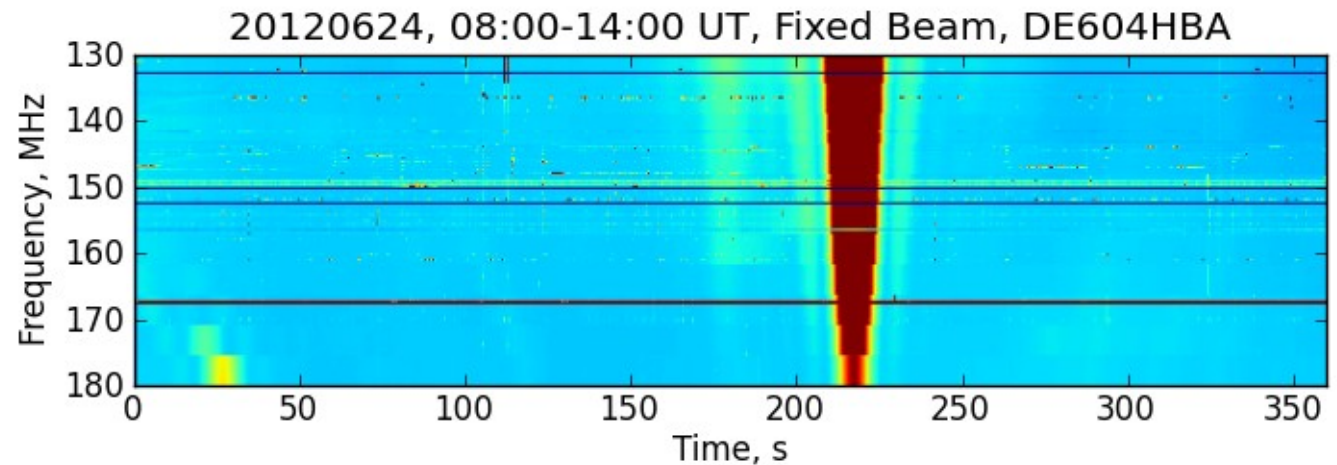
- A 6-hour beam-formed HBA observation, centred around midday, was taken on 24 June 2012:
  - Two beams:
    - First SAP: “Fixed” beam pointing due south to the elevation of the Sun at midday;
    - Second SAP: Tracking beam on the Sun.
    - Reminder: First SAP determines (analogue) tile beam pointing
  - Low time resolution ( $\sim 0.17$ s).
  - 10 sub-bands at  $\sim 5$ MHz spacings used with 16 channels per sub-band. Spreads bandwidth to  $\sim 50$ MHz.
  - International stations, “flys-eye” mode.

# The Wide-Field HBA Beam: A First Look

Effectively  
mapping tile  
beam

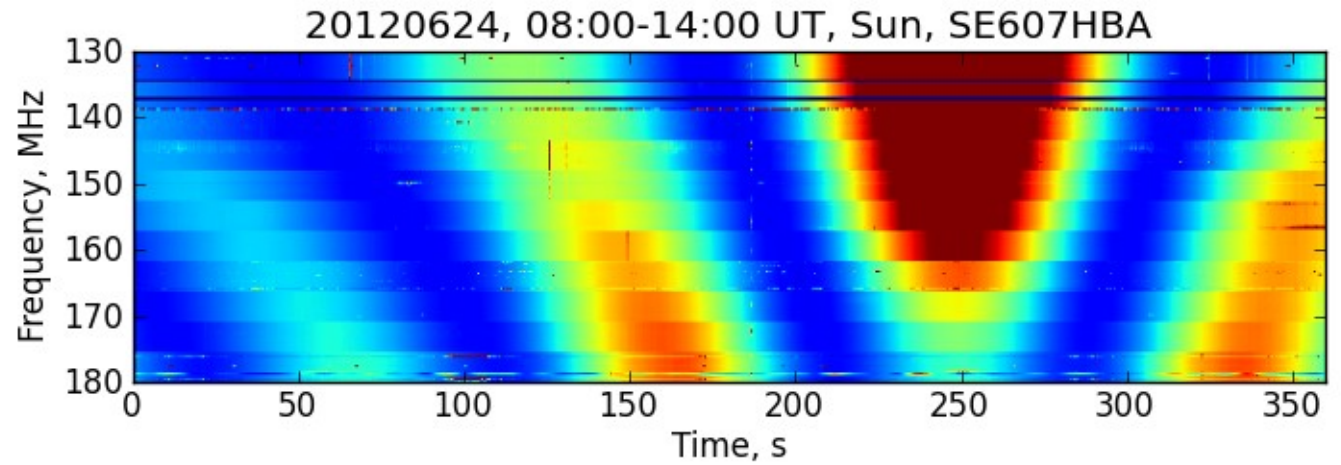


Effectively  
mapping  
station beam

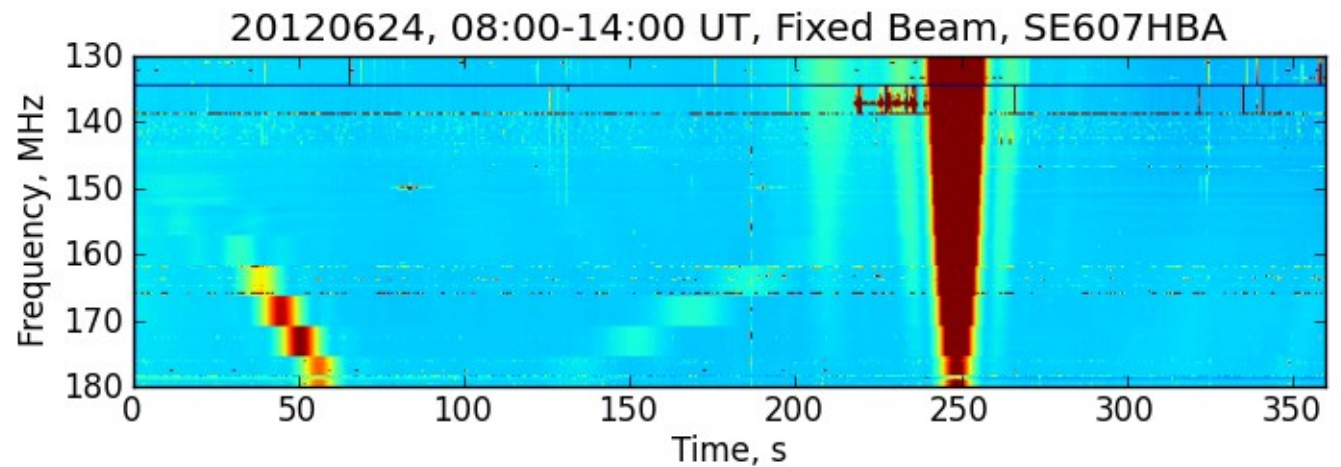


# The Wide-Field HBA Beam: A First Look

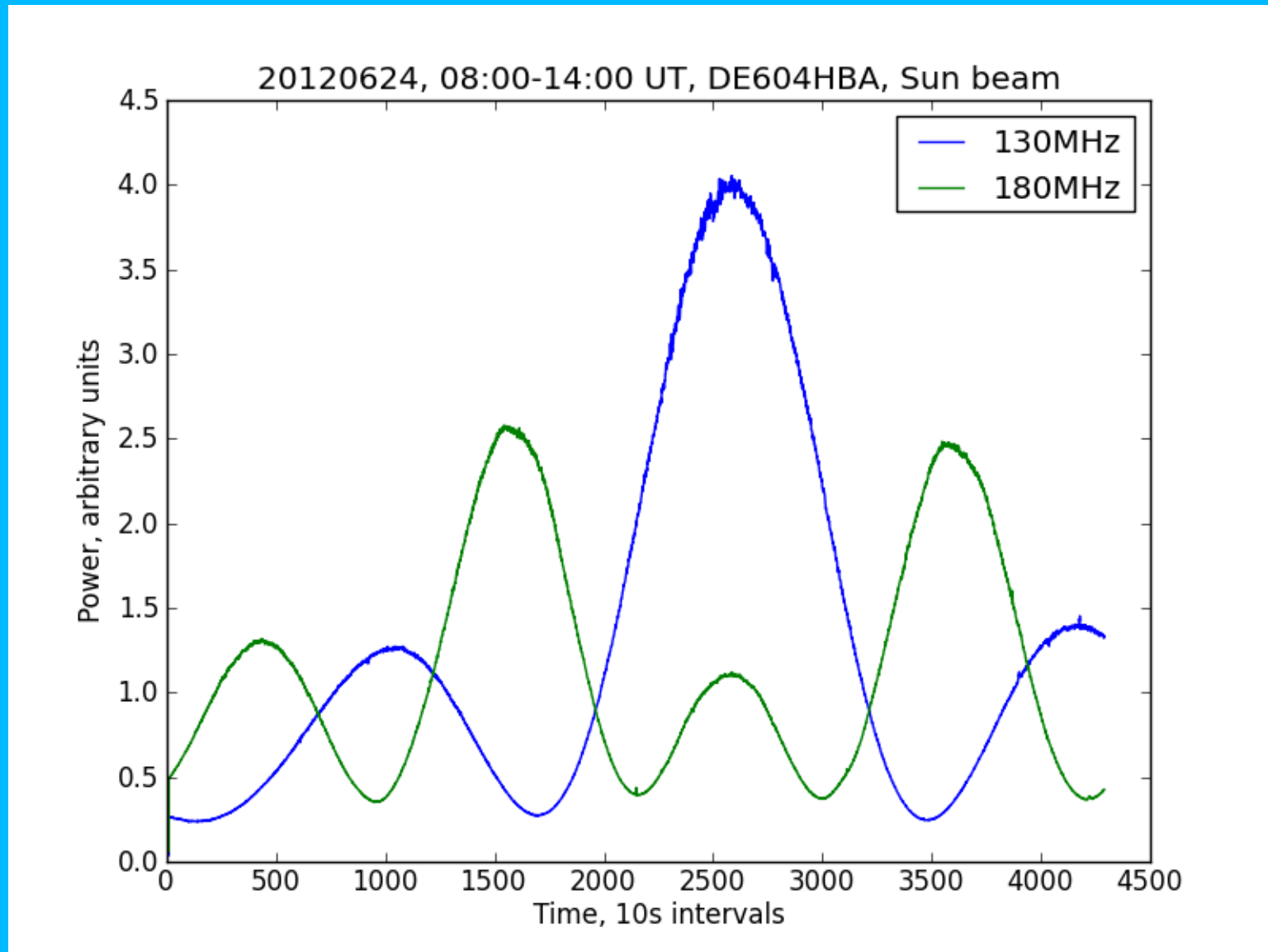
Effectively  
mapping tile  
beam?



Effectively  
mapping  
station beam

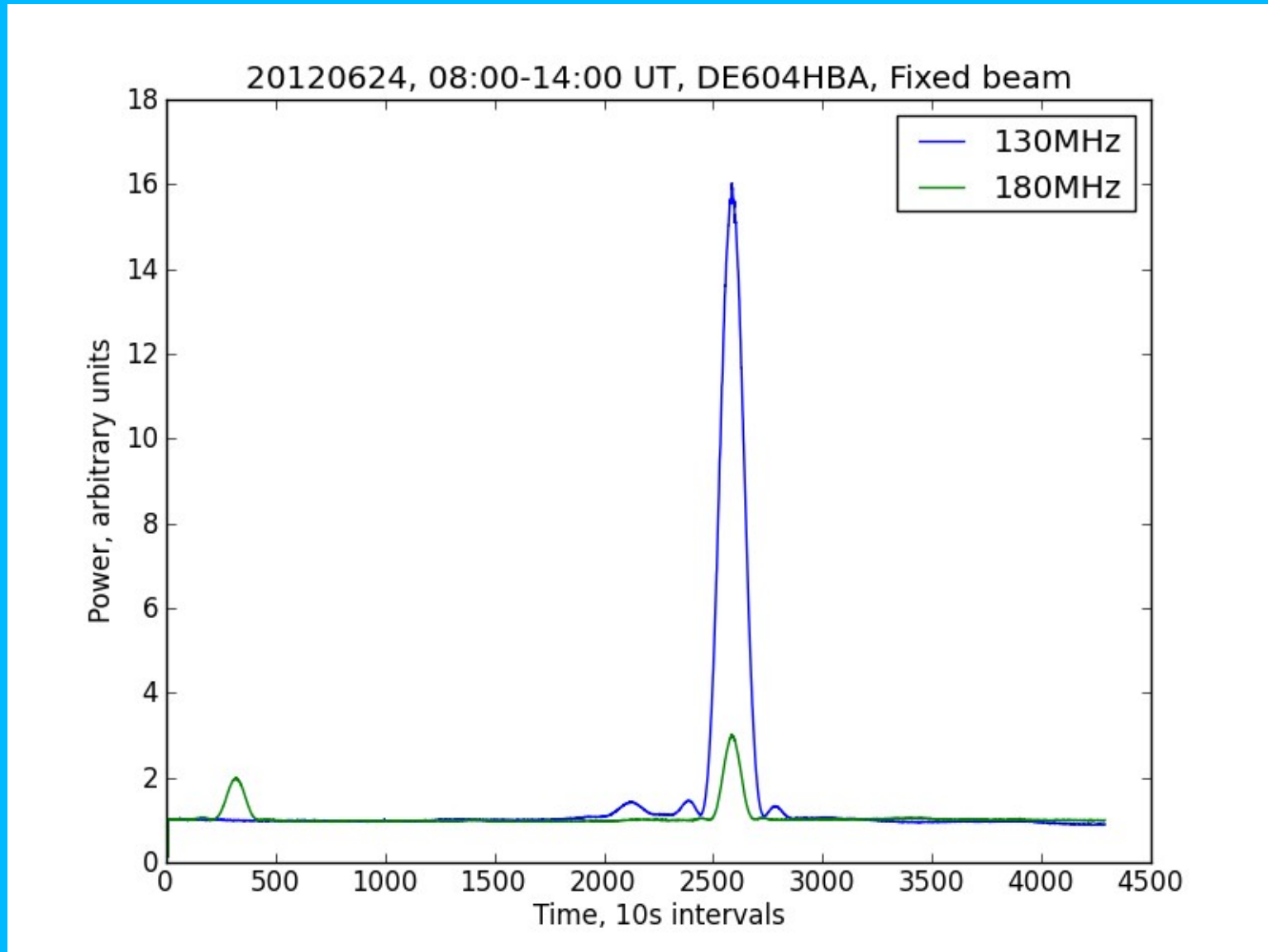


# HBA Tile Beam – Profiles at Different Frequencies



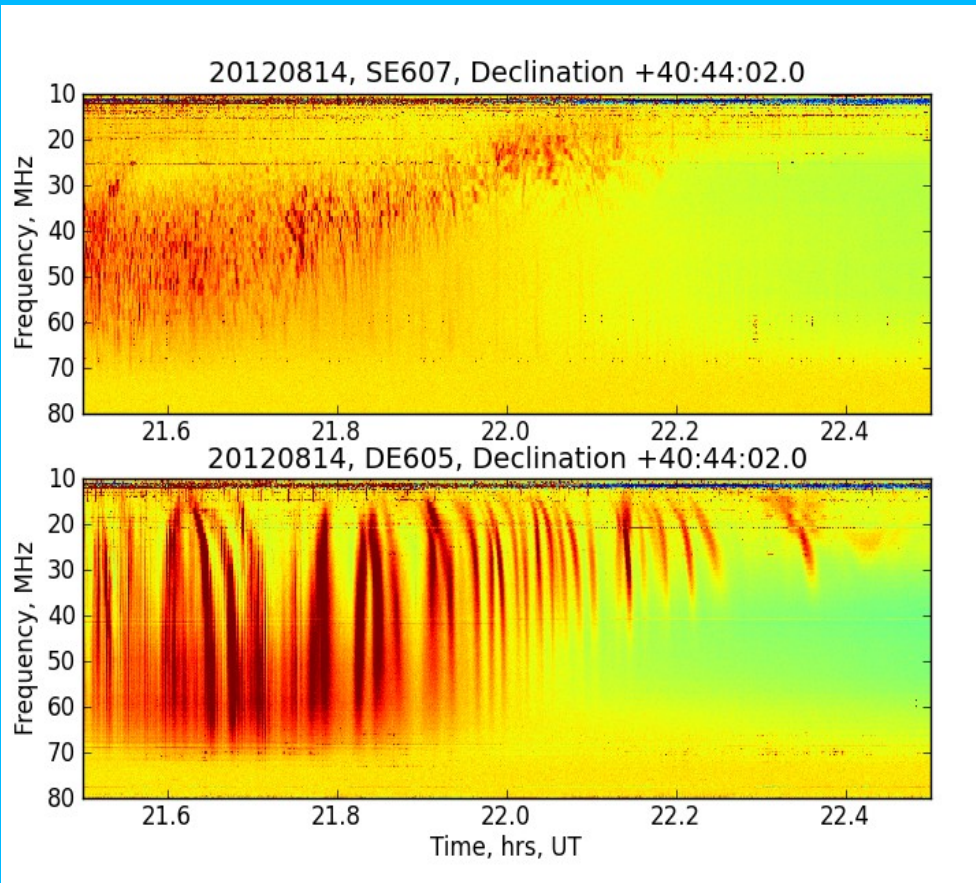


# HBA Low Station Beam – Example Profiles for DE604



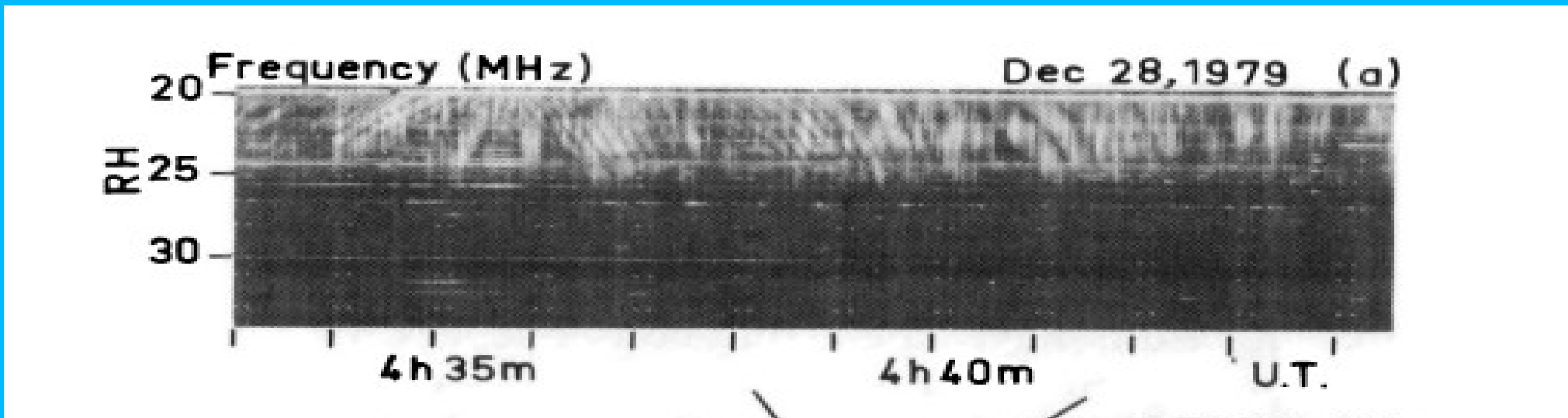
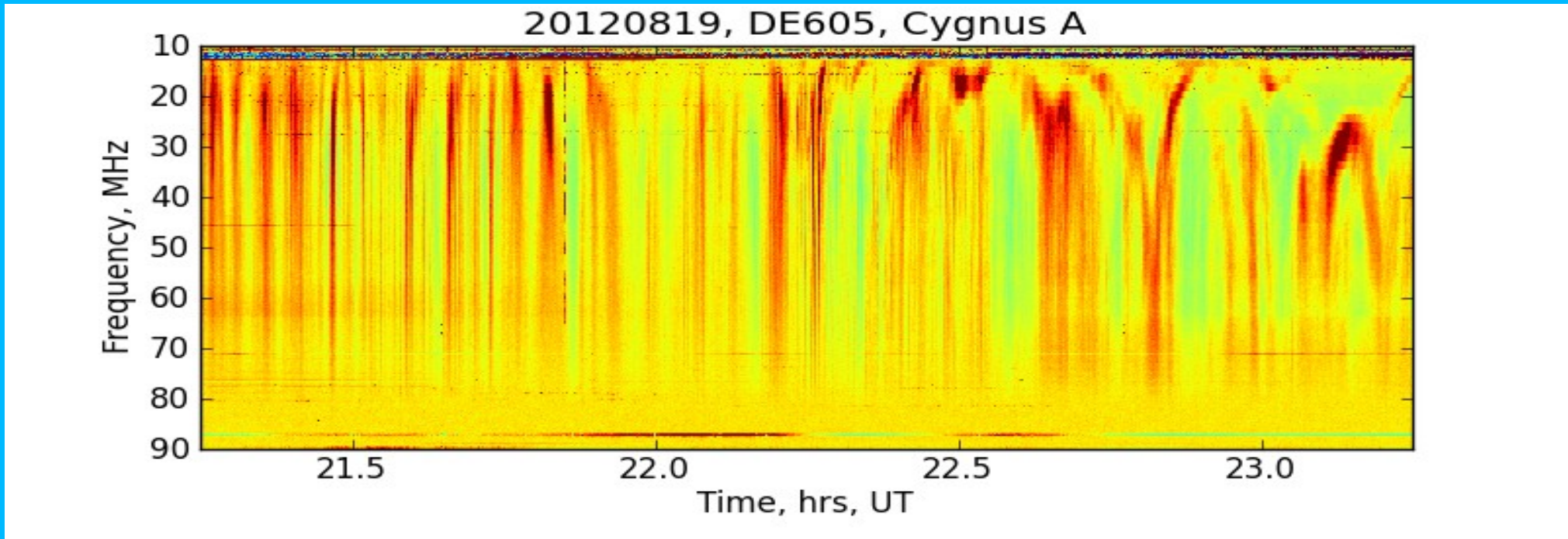
- These have been attempted, using similar observations of the Sun with fixed and tracking beams
- So far, the Sun has proved to be variable and beam profiles less clear-cut
- Attempt similar observations with Cygnus A:
  - First, 1-hour observation
  - Second, 2-hour observation

# LBA Beam Mapping – Fixed Beam on Cygnus A



- 1-hour observation, international stations
- fixed beam pointing to Cygnus A at transit
- Source drifts off beam half-way through
- Scintillation-type structures seen: likely to be ionospheric.

# Ionospheric Scintillation



- Beam-mapping of HBA tile and international station SAP beams attempted.
- Similar LBA attempts less successful
- Ionospheric scintillation seen in observations of Cygnus A