

## Scintillation Arcs: Offering New Perspectives on the Ionosphere

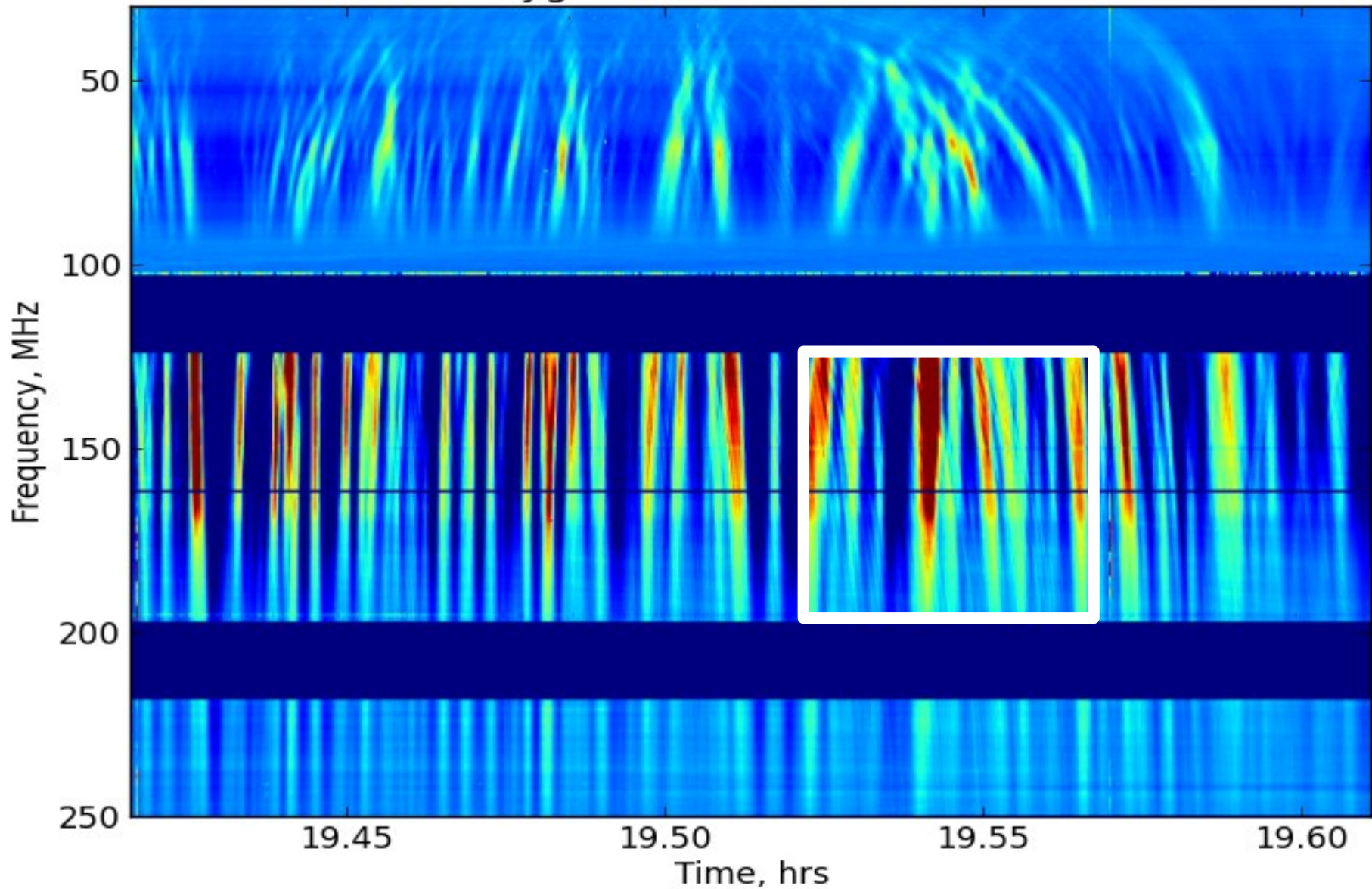
*Richard Fallows*

# KAIRA – The LOFAR Station in the Arctic



# Ionospheric Scintillation – Mode “357”

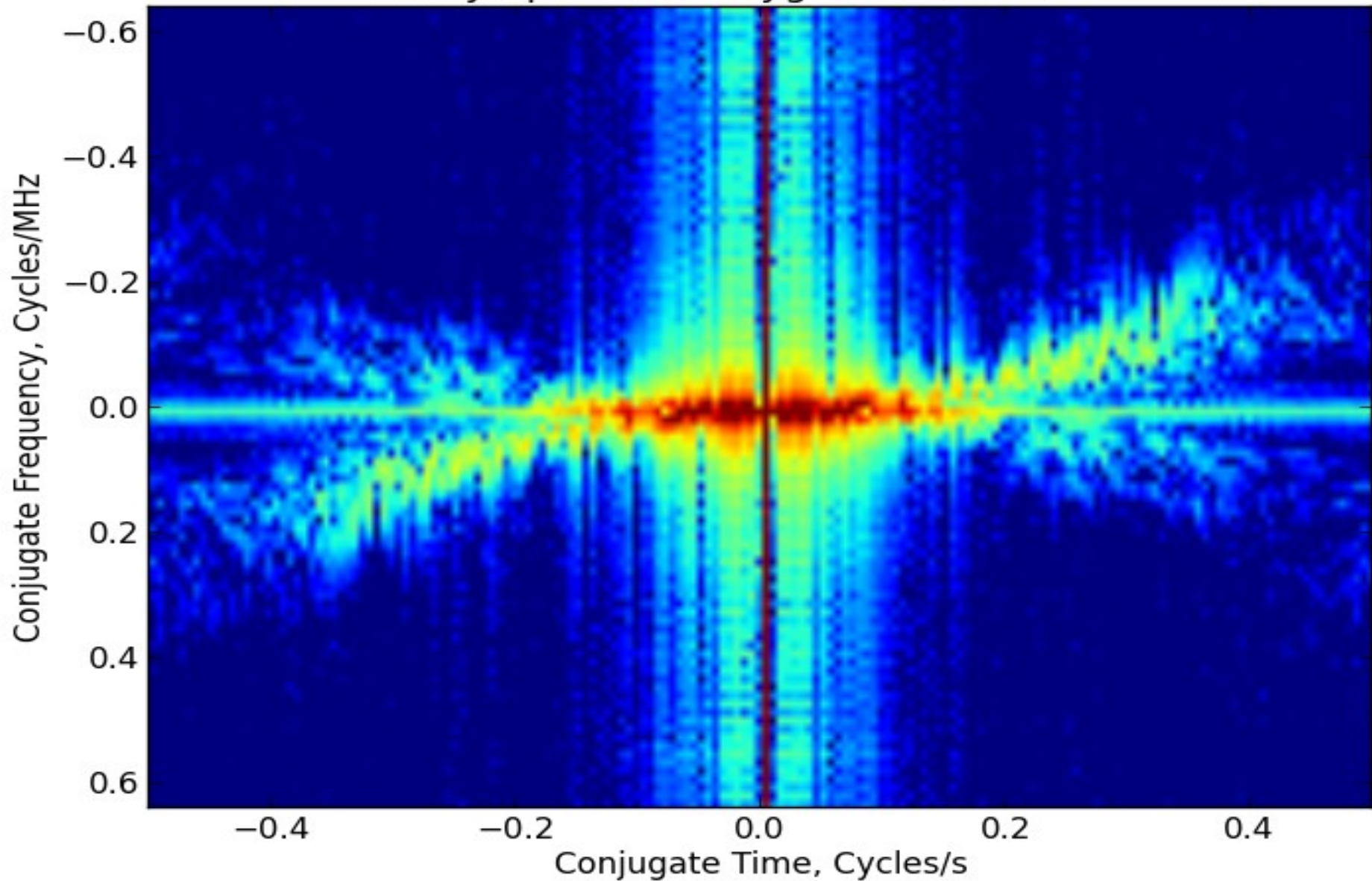
Cyg A - 20120925 - KAIRA



- Following methods of Stinebring et al in analysing Pulsar data to investigate Interstellar Scintillation:
  - Take 2D FFT
  - Obtain square of absolute values of the result
  - A 2D power spectrum
- “Scintillation Arcs” seen in studies of interstellar scintillation
- Not detected yet in interplanetary scintillation
- Just found in ionospheric scintillation:

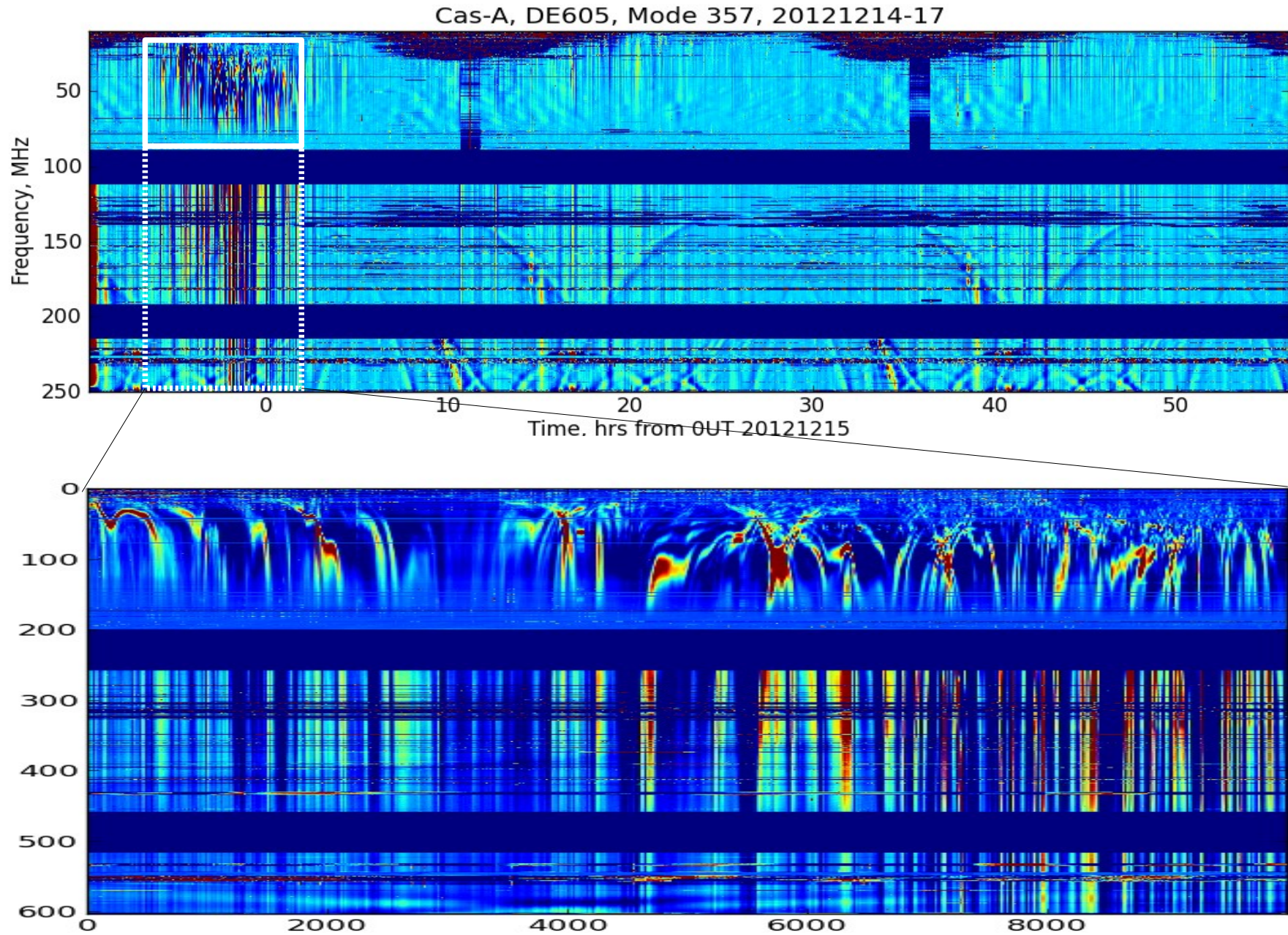
# 2D Power Spectrum

Secondary Spectrum - Cyg A - KAIRA - 20120925

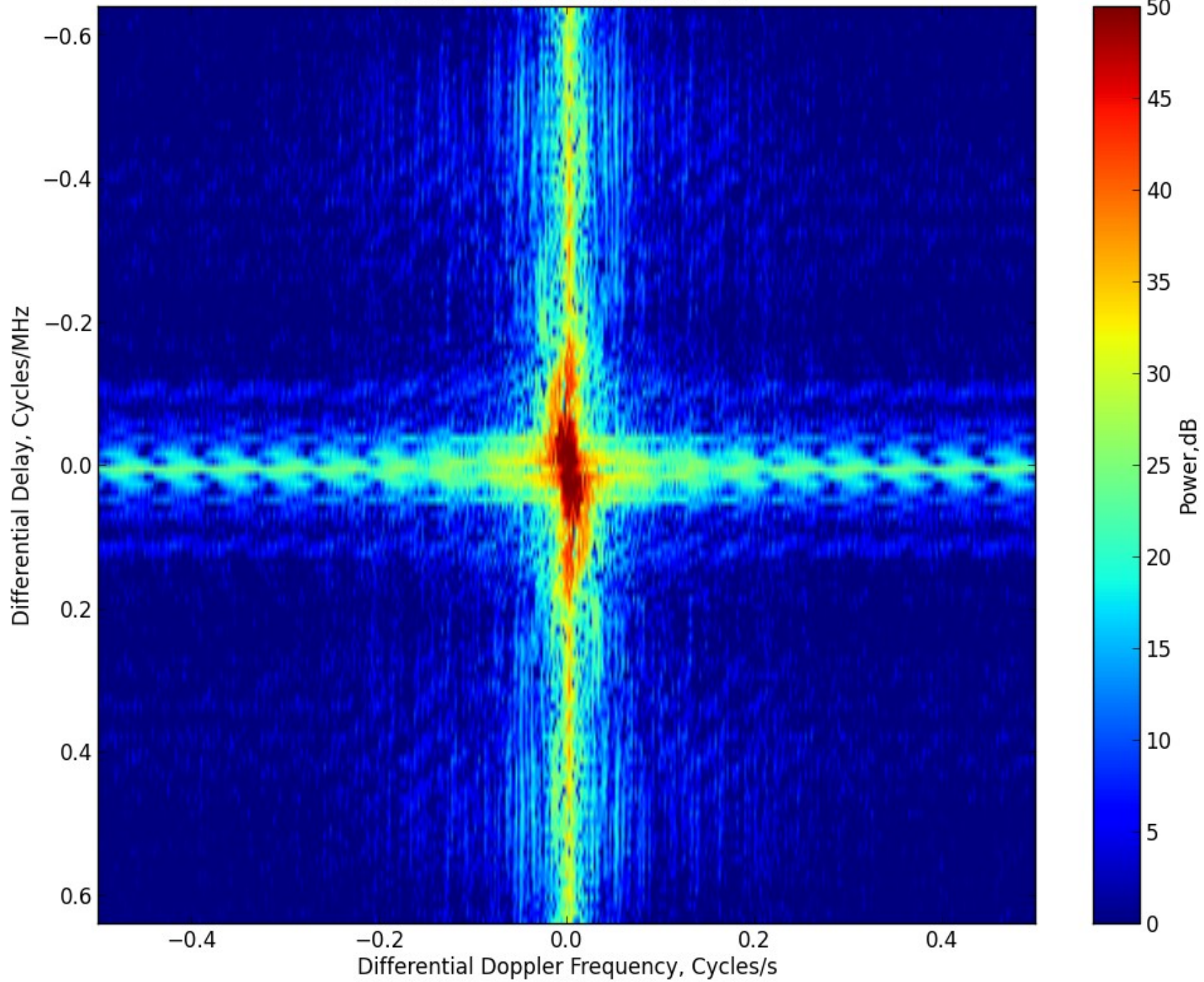


- Ionospheric scintillation also seen in LOFAR station data.
- Have long datasets spread over 10-250MHz in frequency:
  - Can segment to look for variations in time and frequency throughout the observation.
- Strong scintillation seen in long observation of Cas-A taken in December using international stations.
- Focus on LBA section and analyse 480s segments, overlapping by 240s (arbitrary).

# The Dataset

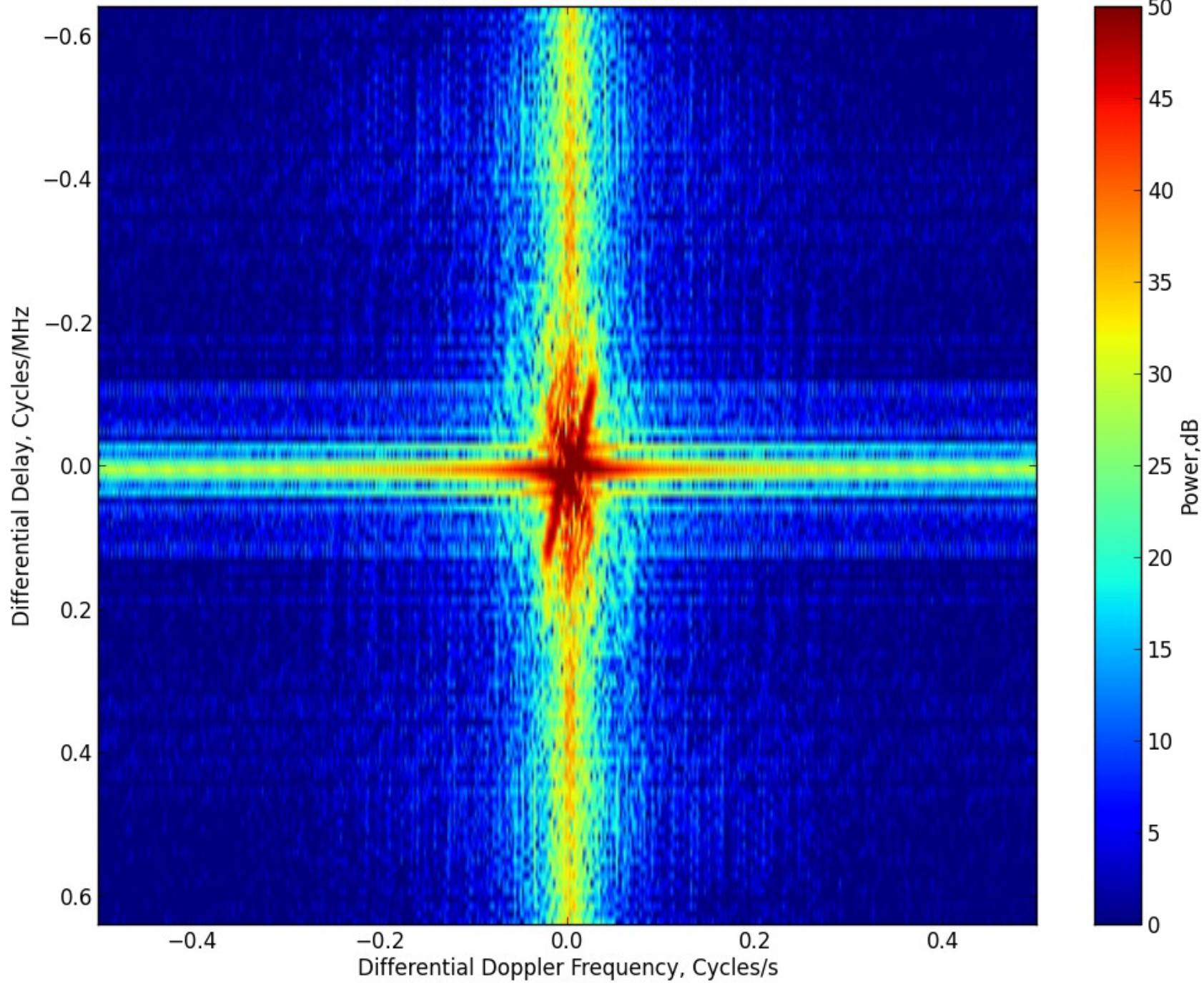


Time Slice: 24960 to 25440

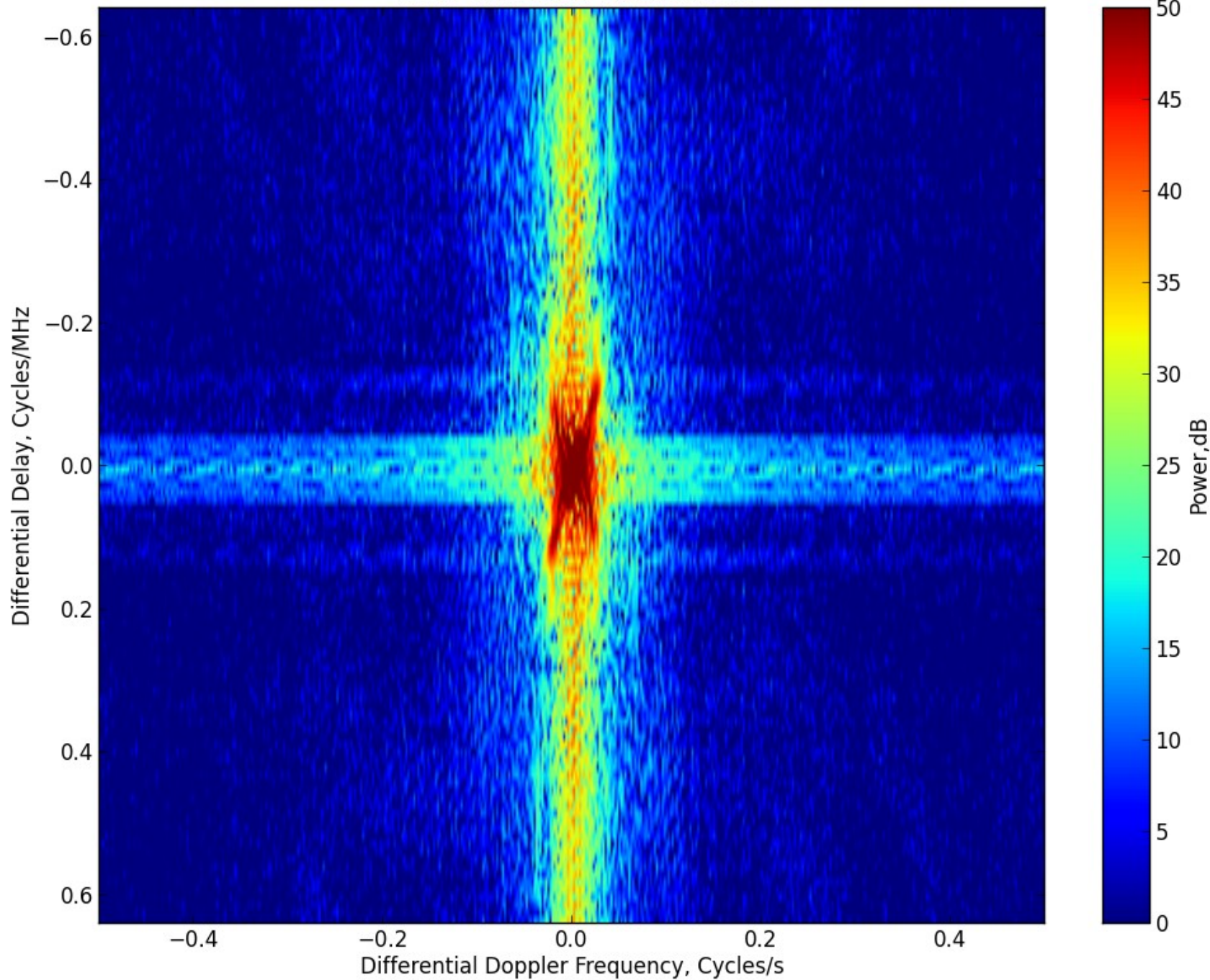




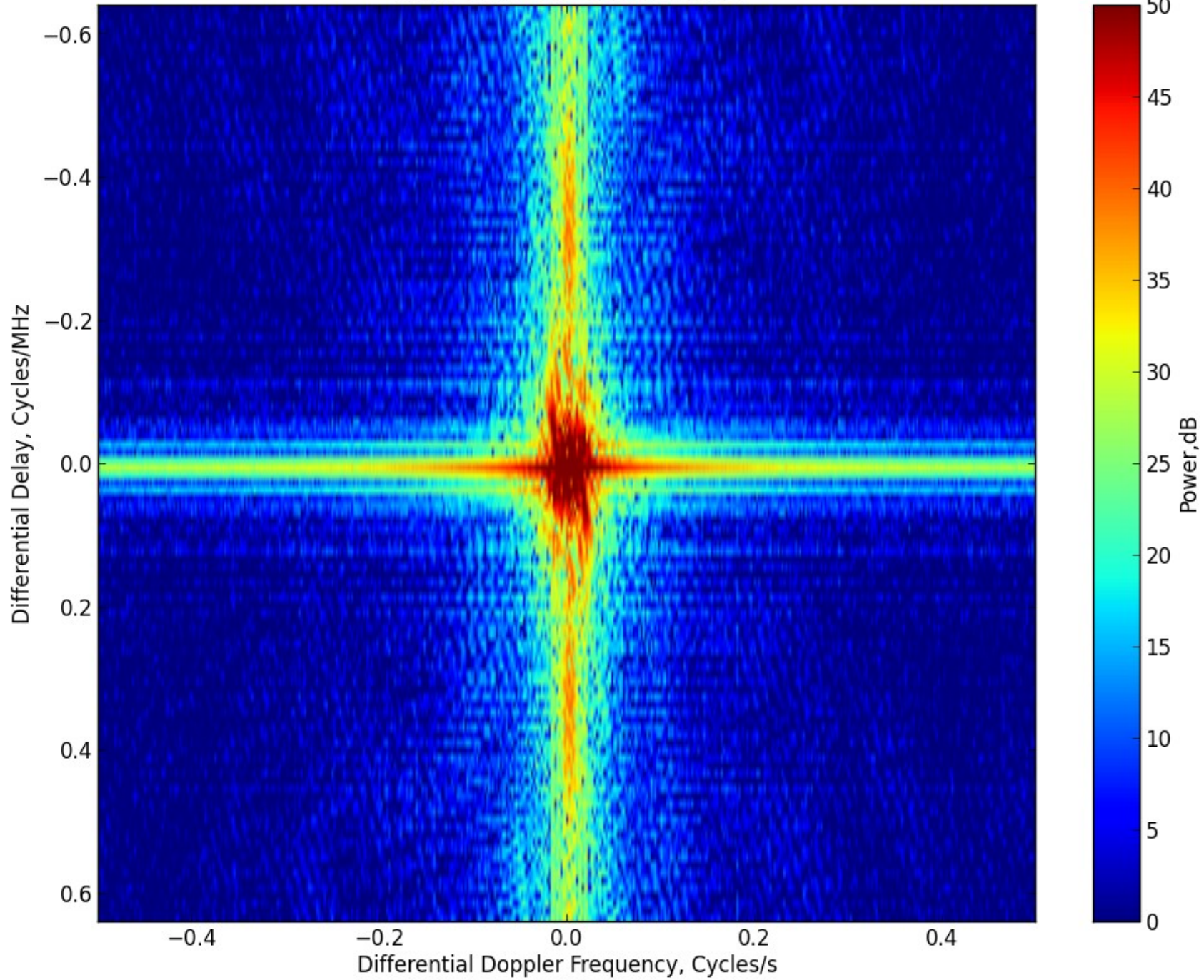
Time Slice: 25200 to 25680



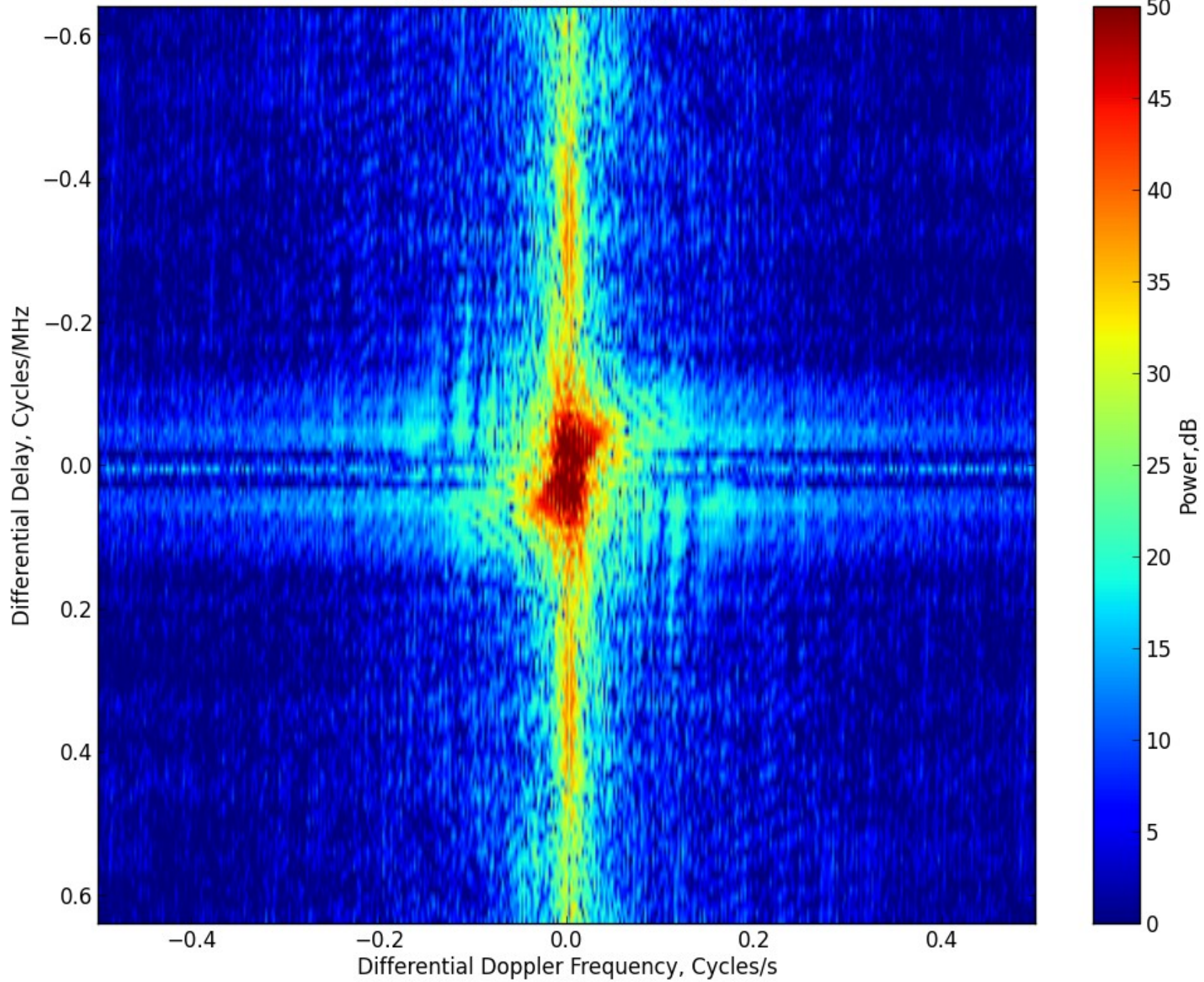
Time Slice: 25440 to 25920



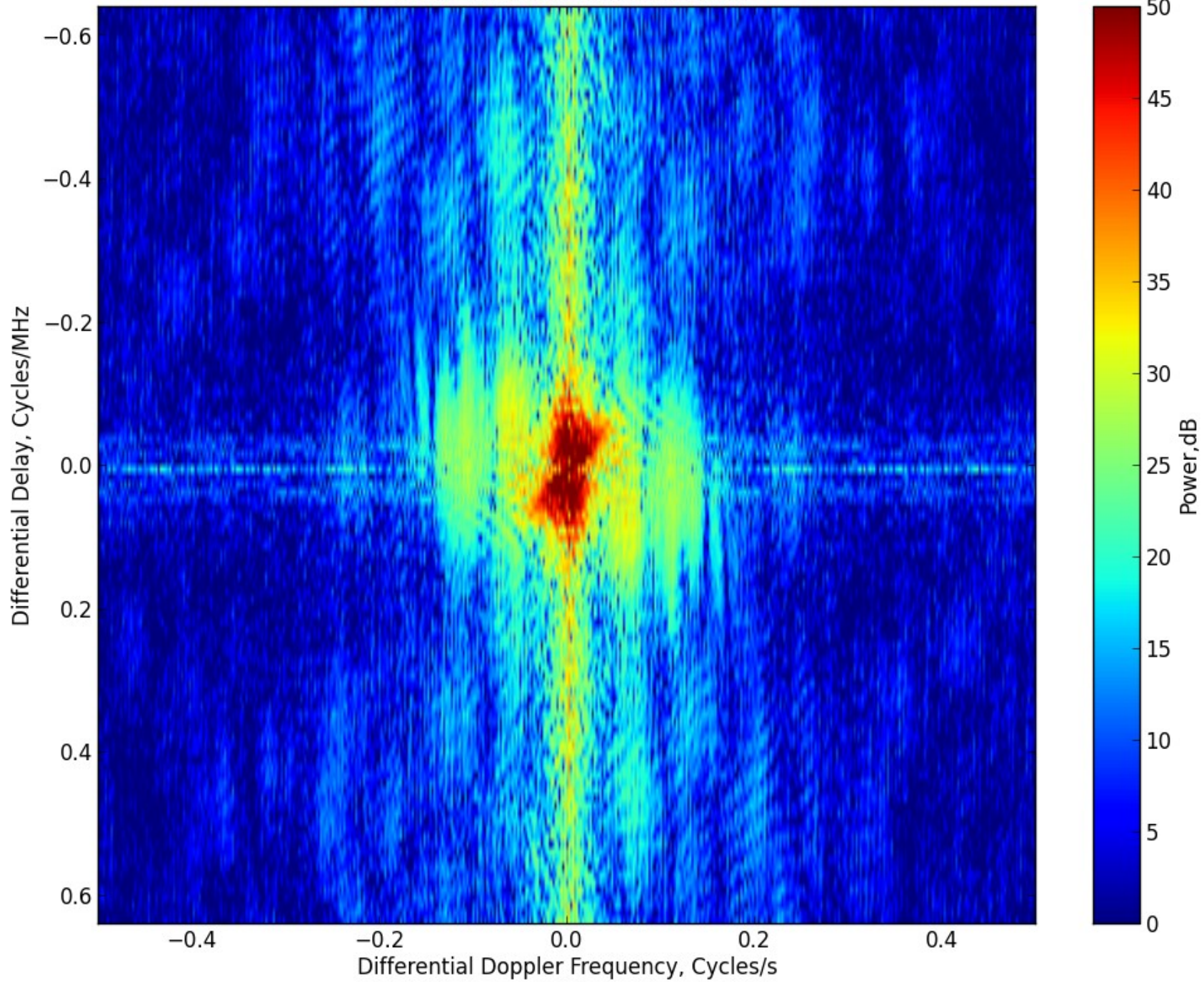
Time Slice: 25680 to 26160



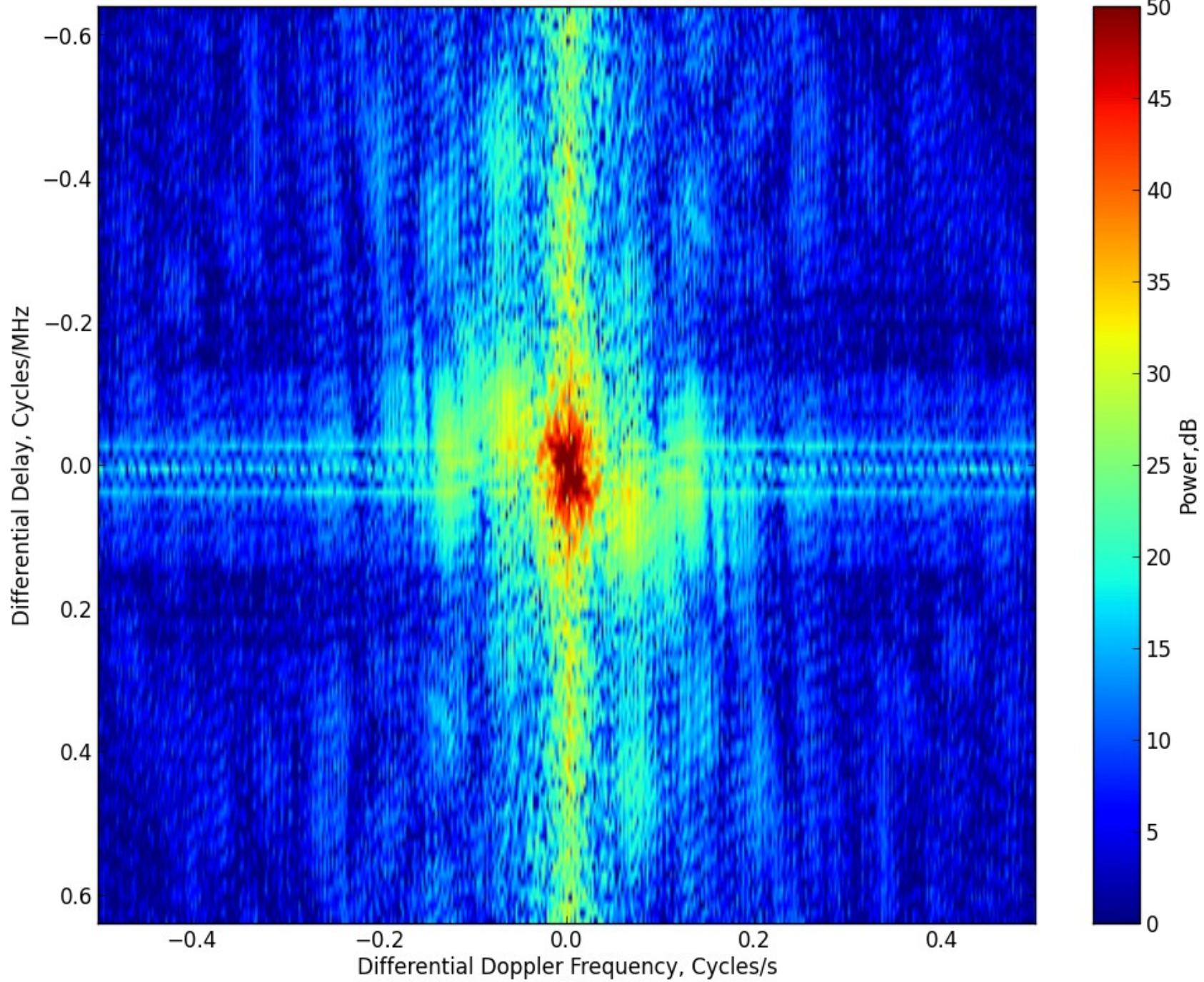
Time Slice: 25920 to 26400



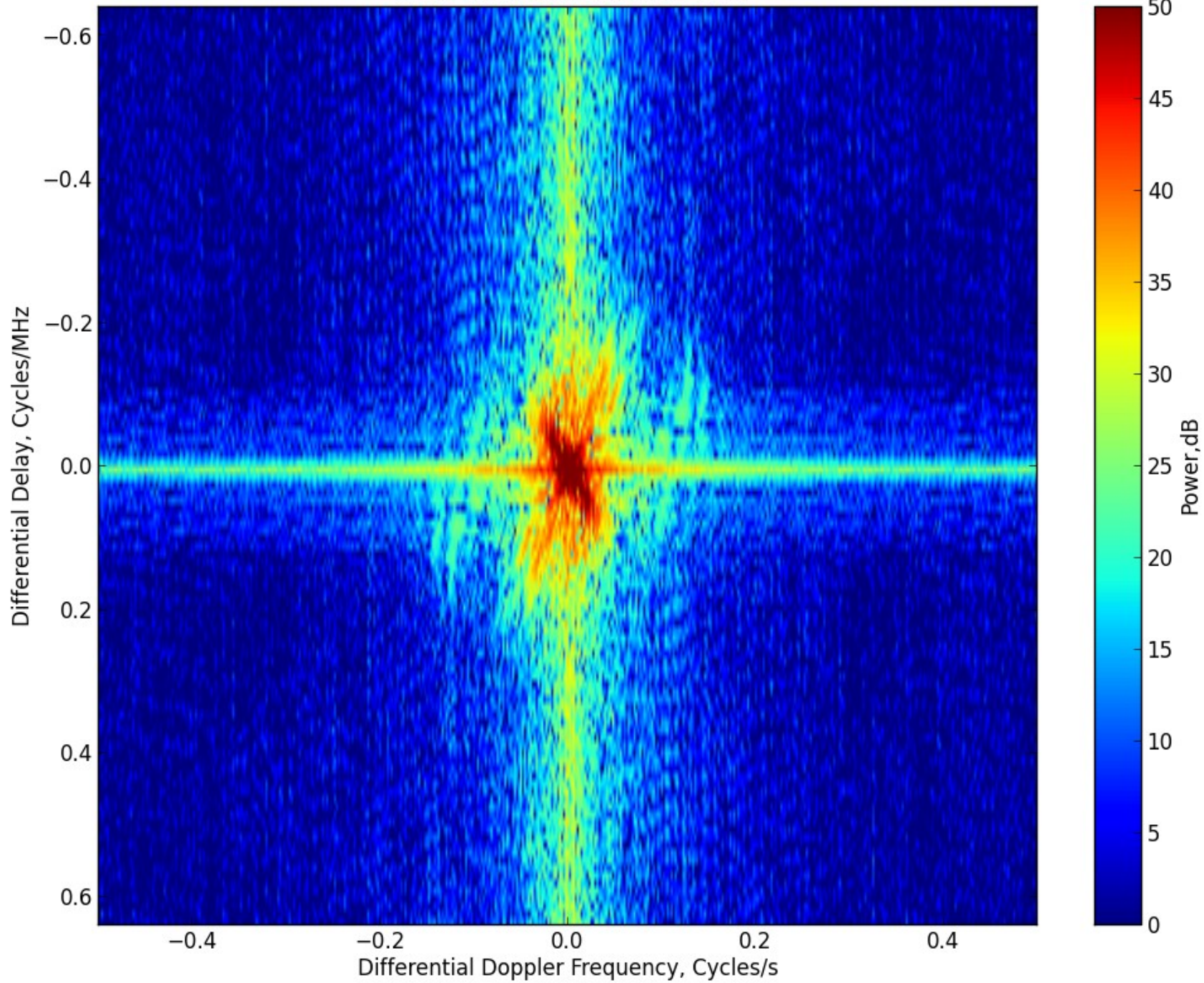
Time Slice: 26160 to 26640



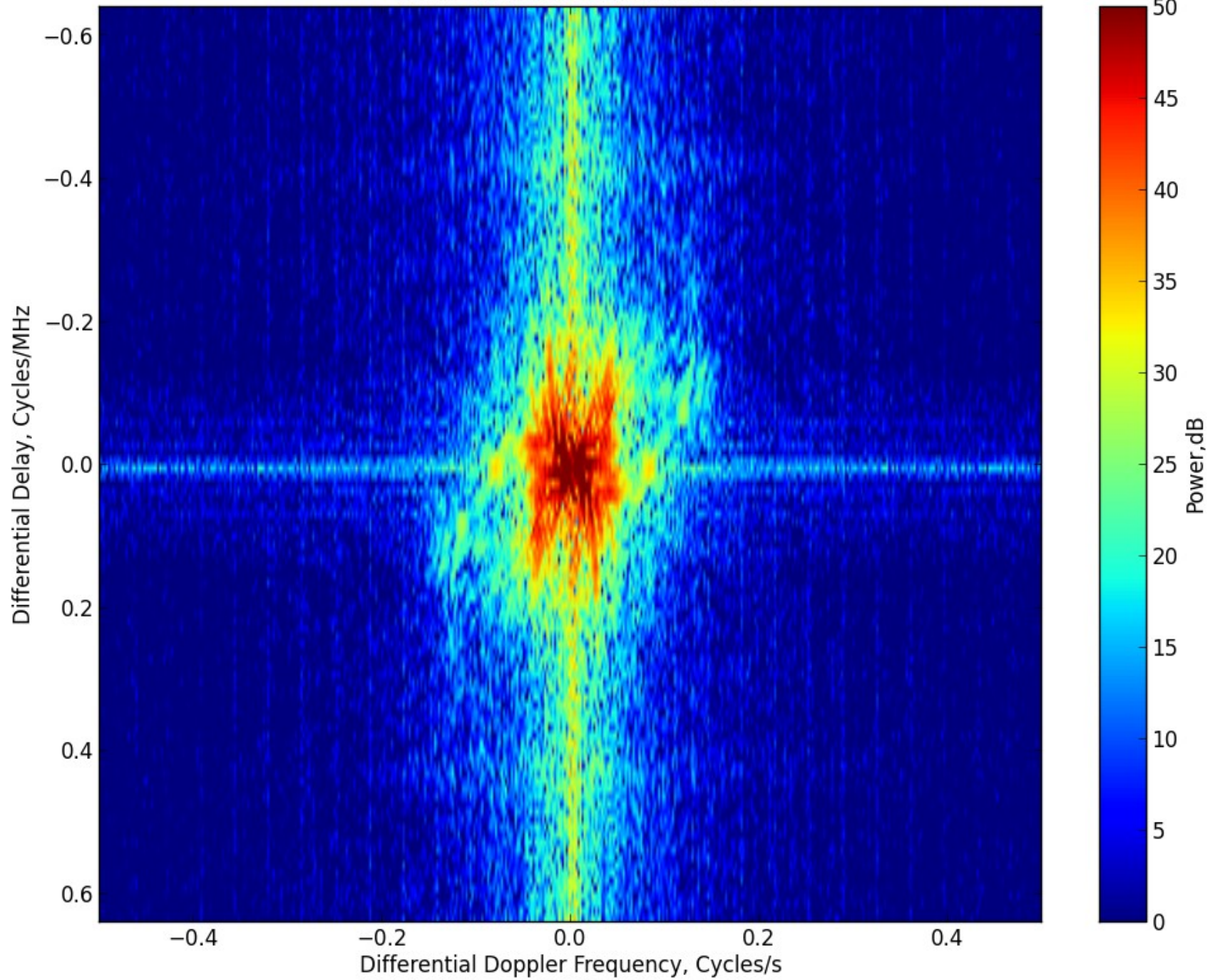
Time Slice: 26400 to 26880



Time Slice: 26640 to 27120

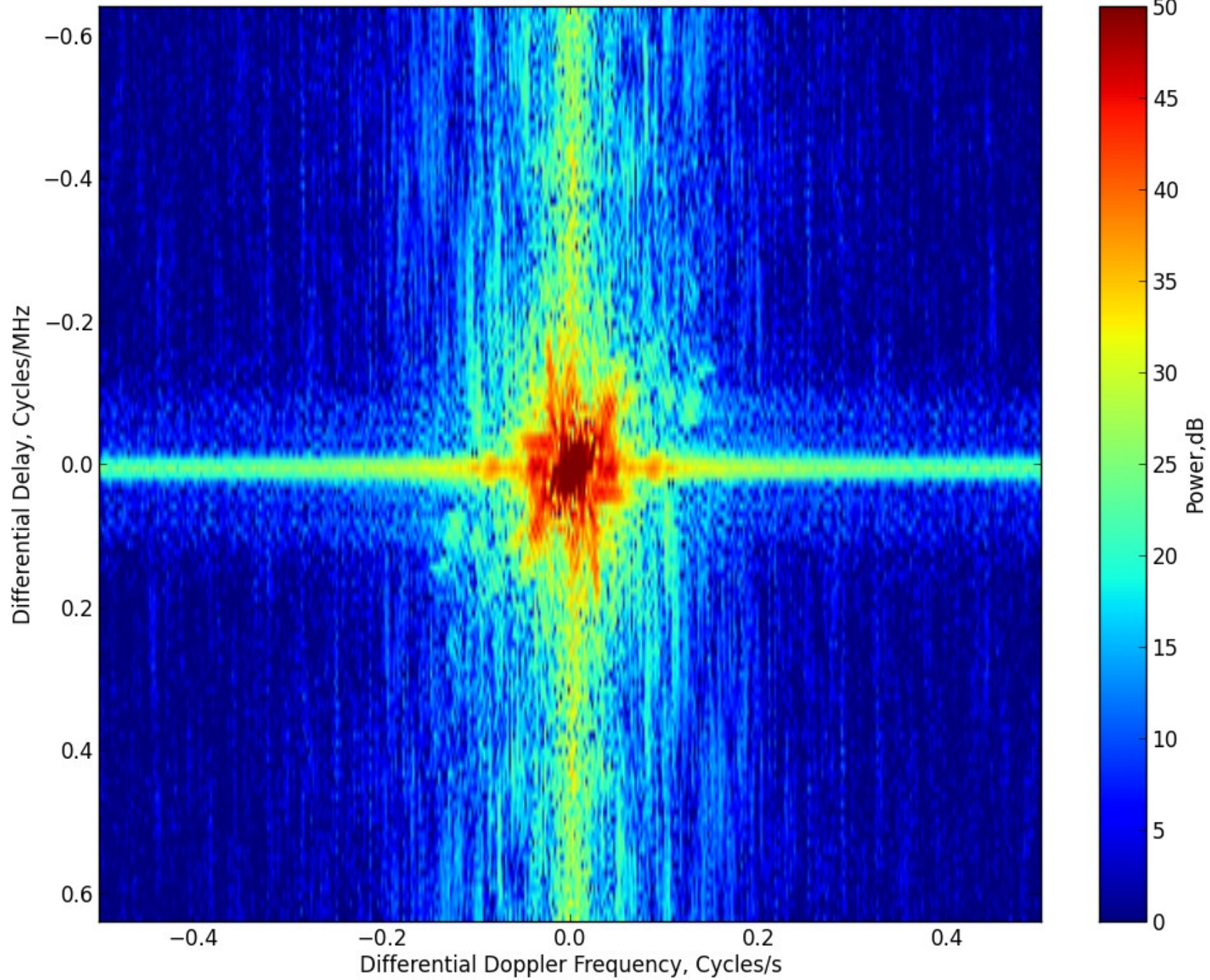


Time Slice: 26880 to 27360

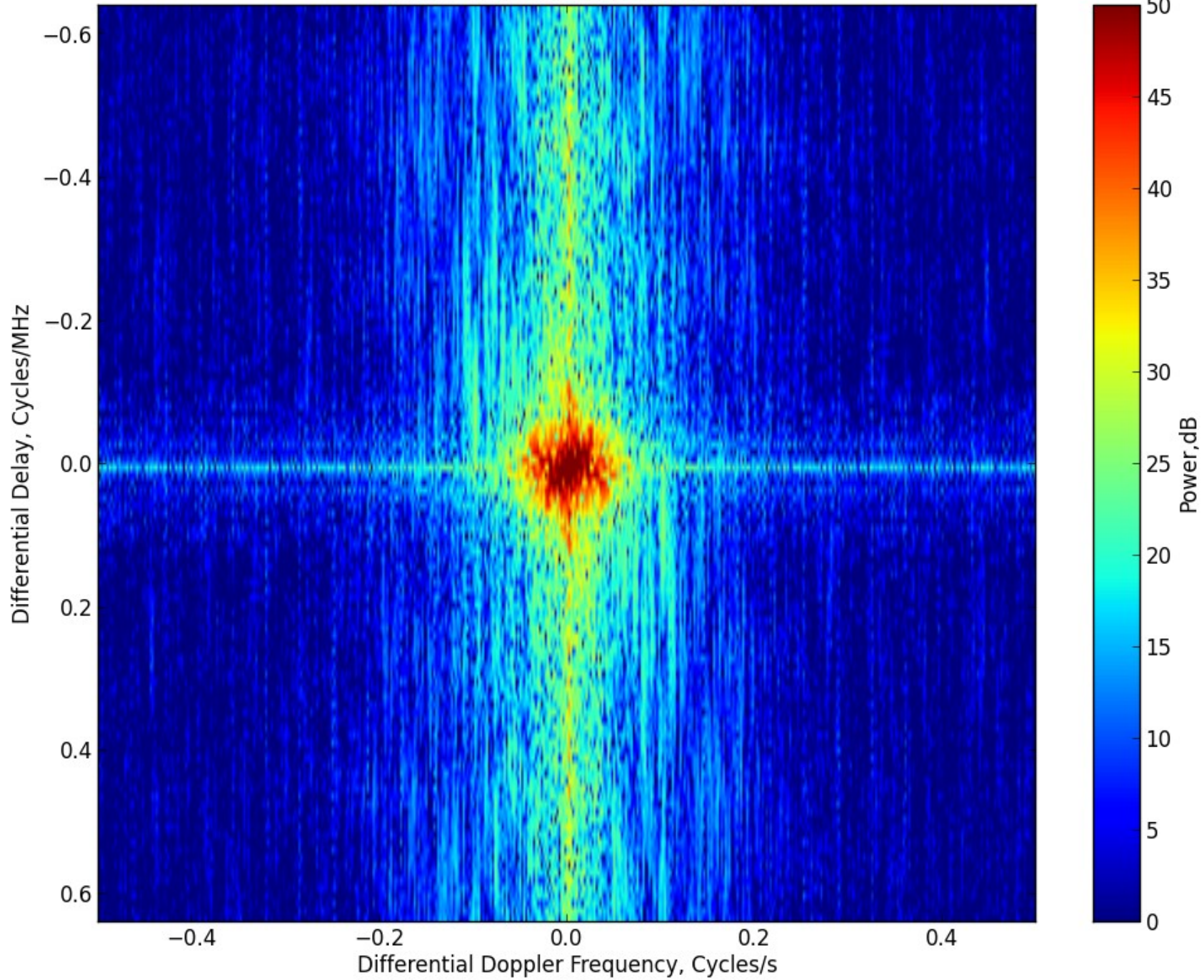




Time Slice: 27120 to 27600



Time Slice: 27360 to 27840



- Scintillation arcs seen in observations of ionospheric scintillation for the first time.
- Enable a deeper study of the scattering medium:
  - Calculation of distance to the medium
  - Velocity of the medium transverse to line of sight
  - With time, can also “see” structures moving across the line of sight.