On-The-Fly Mapping at AO:
Sensitivity and Baseline Quality

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- Map 3 fields in 4 ways:

  1. DRIFT MODE: 12s/beam
  2. “SLOW” OTF: 6s/beam
  3. “FAST” OTF, RA-Dec: 3s/beam
  4. “FAST” OTF, Dec-RA: 3s/beam

- Setup and preliminary analysis:

  - L-narrow, 1385-1425 MHz coverage (4x12.5 MHz BPs, 12 kHz ch.)
  - 1s integrations across ~5 min strips; Nyquist sampled beam
  - Bandpass correction: divide each record by strip average
Sensitivity Across a Strip – Drift vs. “Slow” OTF

DRIFT

“SLOW” OTF

1s integrations

- 1415 – 1419 MHz
- 1421 – 1425 MHz

1405 – 1415 MHz
1s int. + Hanning
smooth in freq.

1405 – 1415 MHz
1s int. + Hanning
smooth in freq.
Sensitivity Across a Strip – “Fast” OTF

1s integrations
- 1415 – 1419 MHz
- 1421 – 1425 MHz

1405 – 1415 MHz
1s int. + Hanning smooth in freq.

Dec-RA

RA-Dec
Baseline Quality – “Fast” OTF Dec-RA Map

Raw spectrum: 1s integration

3s average: rms/beam

3s average + Hanning smooth
Baseline Quality – Power Spectrum

Raw spectrum:
1s integration

3s average:
rms/beam

3s average +
Hanning smooth

High freq.

Low freq.
Baseline Quality – Average Power

Raw spectrum: 1s integration

3s average: rms/beam

3s average + Hanning smooth
OTF Mapping: Sensitivity and Baseline Quality

For all methods (Drift, “slow” OTF, “fast” OTF):

- **Theoretical sensitivity limit achieved**: no trend in RMS across strip
- **“Flat” baselines**: no harmonics in power spectrum

*Map sensitivity and baseline quality independent of mapping technique*
Baseline Quality – “Fast” OTF RA-Dec Map

Raw spectrum:
1s integration

3s average:
rms/beam

3s average +
Hanning smooth

Intensity (x $T_{sys}$)

channel number
Baseline Quality – Power Spectrum

Raw spectrum: 1s integration

3s average: rms/beam

3s average + Hanning smooth

(period, channels)

High freq.

Low freq.
Baseline Quality – Average Power

Raw spectrum: 1s integration

3s average: rms/beam

3s average + Hanning smooth

High freq.  Low freq.
Baseline Quality – “Slow” OTF Map

Raw spectrum: 1s integration

6s average: rms/beam

6s average + Hanning smooth

Intensity (x T_{sys})
Baseline Quality – Power Spectrum

Raw spectrum:
1s integration

6s average:
rms/beam

6s average + Hanning smooth
Baseline Quality – Average Power

Raw spectrum:
1s integration

6s average:
rms/beam

6s average + Hanning smooth

High freq.

Low freq.
Baseline Quality – Drift Map

Raw spectrum: 1s integration

12s average: rms/beam

12s average + Hanning smooth
Baseline Quality – Power Spectrum

Raw spectrum: 1s integration

12s average: rms/beam

12s average + Hanning smooth

High freq. Low freq.
Baseline Quality – Average Power

Raw spectrum: 1s integration

12s average: rms/beam

12s average + Hanning smooth

High freq.  Low freq.
Baselines, 1s Integrations (Drift Map)