# Pointing errors and dynamic range

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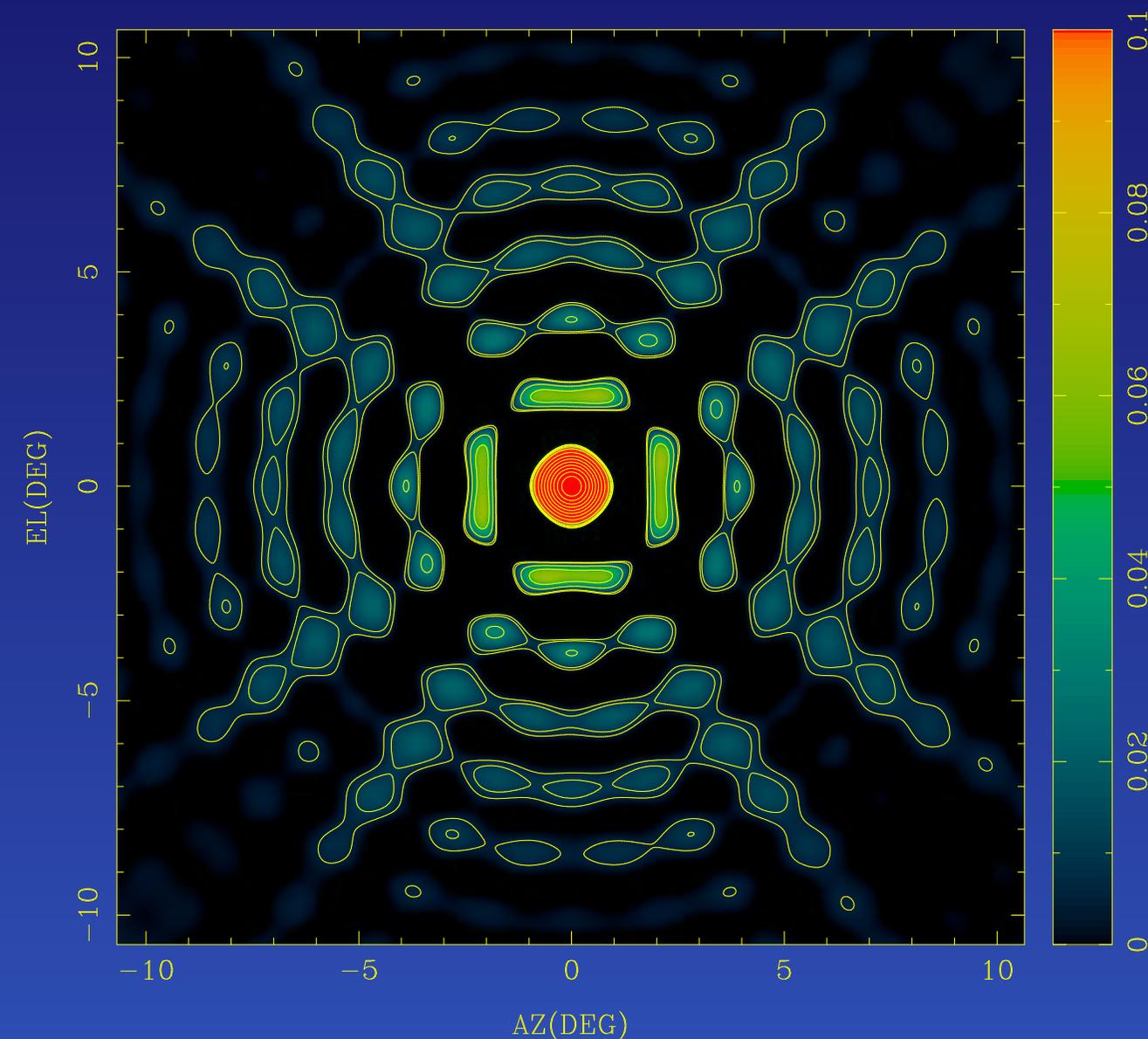
- The signal from the distant bright sources leaks into field of view through sidelobes

- Rotation of the primary beam causes artefacts

- What is the effect of pointing and tracking errors?

- Bhatnagar et al. (2004), EVLA Memo #84 $\Rightarrow$ solving for pointing errors and some simulations with idealized beams
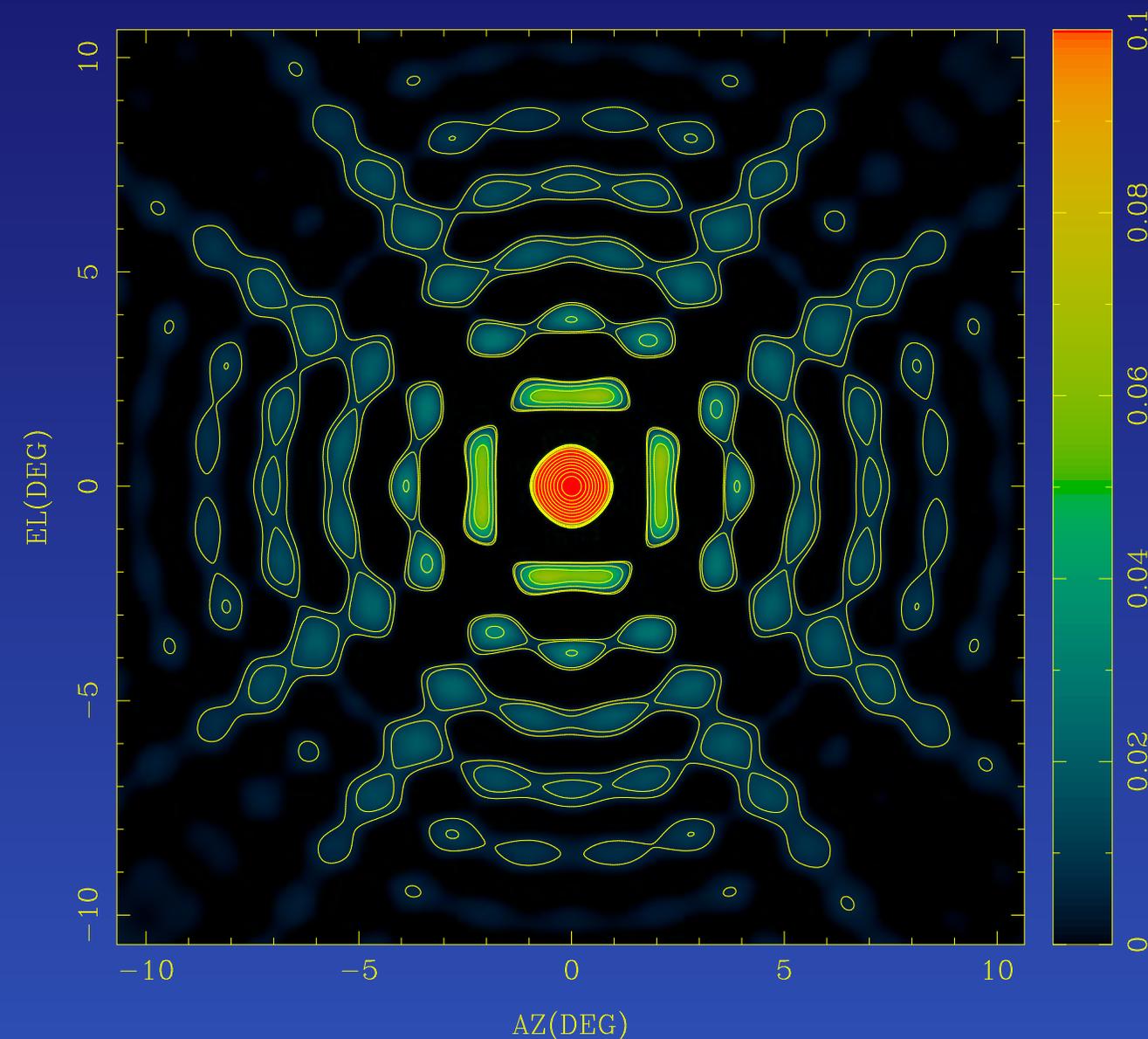
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- What is the effect of pointing and tracking errors?

- Typical ATCA pointing errors: around 10" without the reference pointing and 2-3" with the reference pointing.

Simulations

- Sky model: a single point source at various offsets near -50 degrees of declination

  - $V_{ij}^o = \left(E_i \star E_j^*\right) \star V_{ij}^{True}$, where E_i is the aperture illumination pattern

  - For a point source it gives a multiplication of each visibility by a complex factor (a product of the values of Fourier transforms of E_i and E_j^* taken at correct offsets).

Simulations

- Sky model: a single point source at various offsets near -50 degrees of declination

- Array configuration: 6A; Frequency: 1.4 GHz

- Correlator configuration: 128 MHz, 10 seconds cycle

- Duration of observations: 13 hours

- Both the single channel case and the multi-frequency synthesis (edge channels are rejected) have been considered.

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- Pointing offsets: Gaussian random variables, independent for each axis and antenna

  - Zero mean, 2" variance
  - Slowly varying offsets (different for each antenna and axis) measured in a real experiment used as a mean of the distribution.

Simulations

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- Pointing offsets: σ=2", zero mean or real offsets.

- The simulations have been performed twice with and without pointing errors. The dynamic range was determined from the rms of the residual image (a difference between two dirty images).
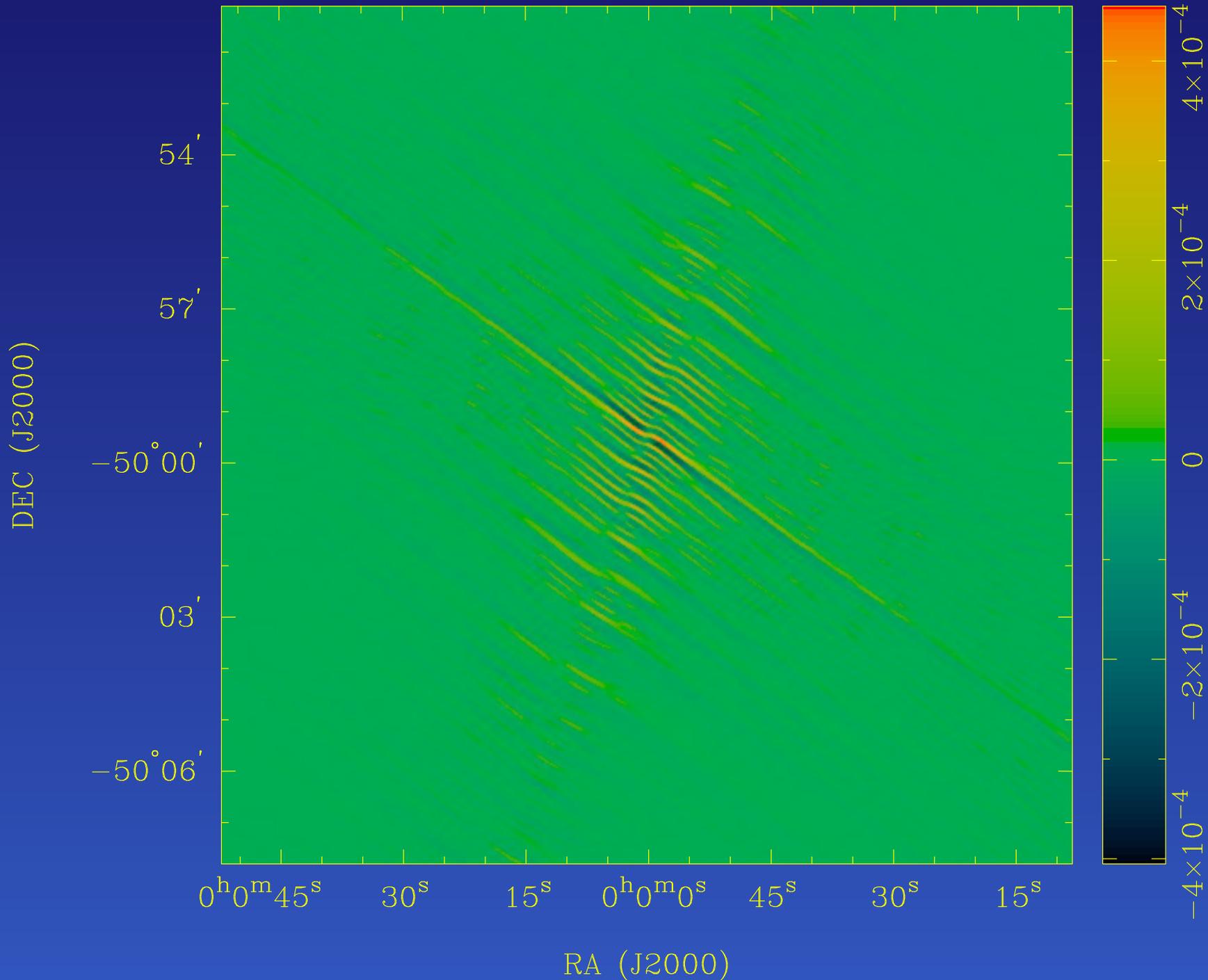
⇑ A fragment of the typical residual image (offset ∼32") ⇑
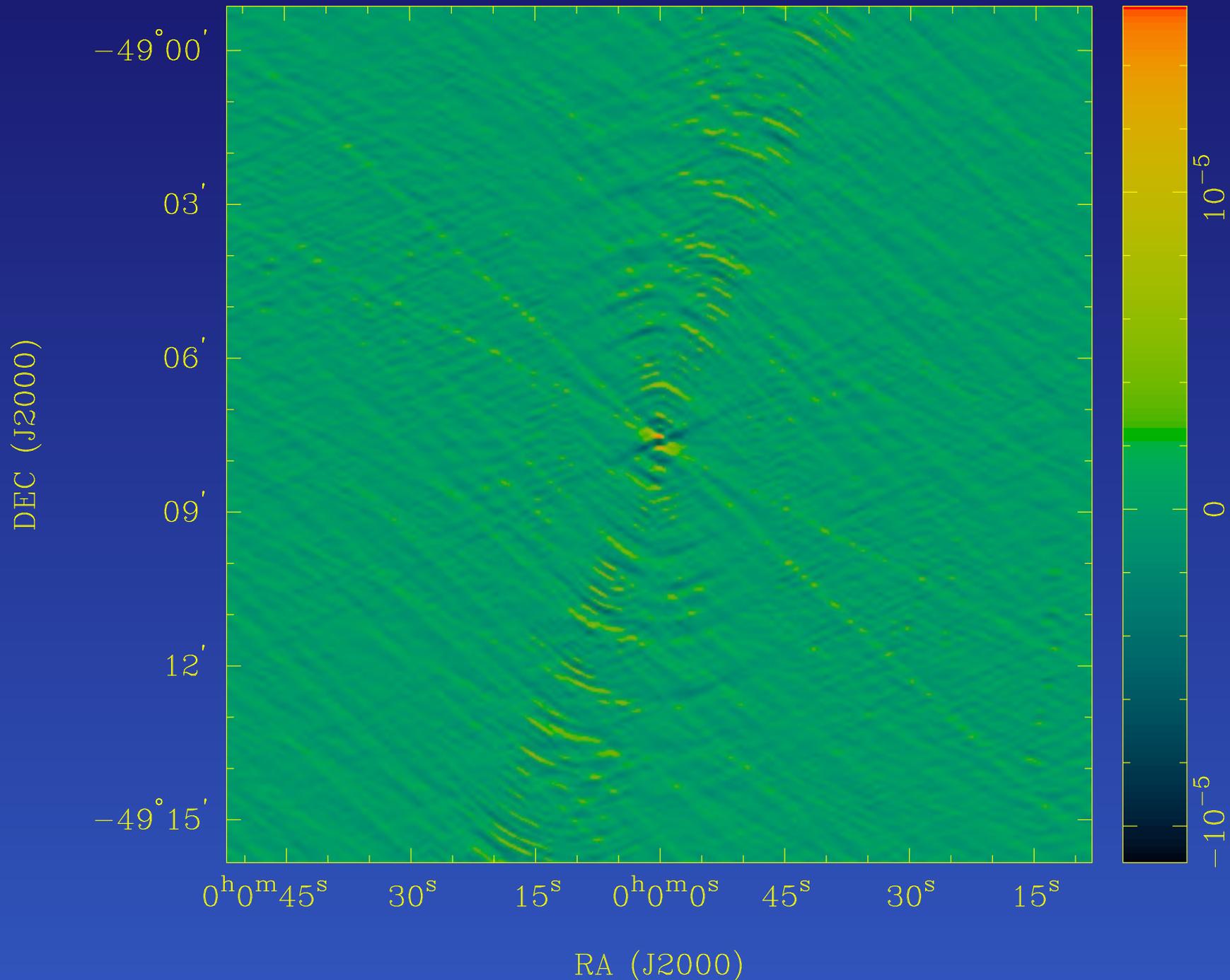
⇑ A fragment of the typical residual image (offset ∼1 deg) ⇑
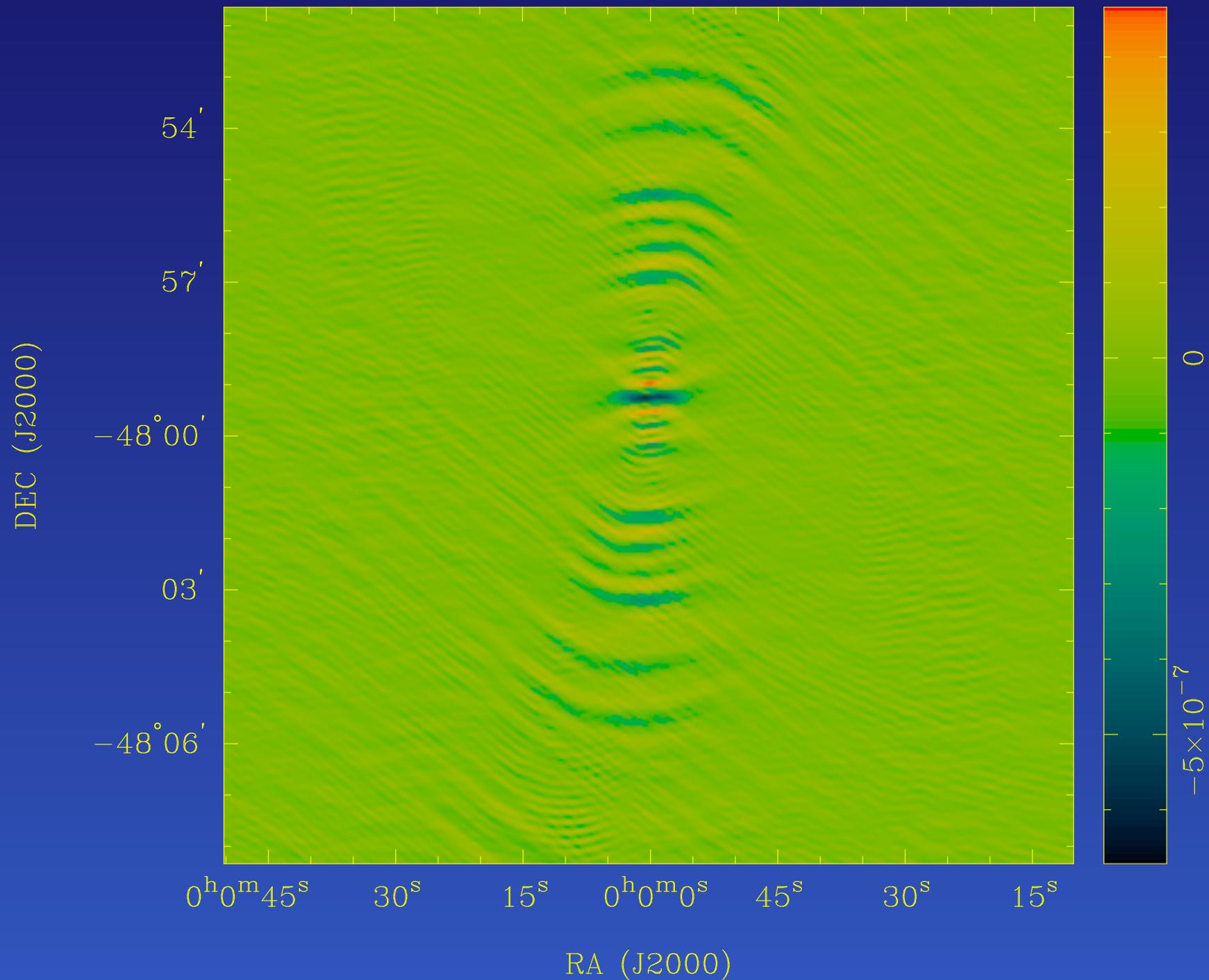
⇑ A fragment of the typical residual image (offset ∼2 deg) ⇑

Zero mean, 2" variance
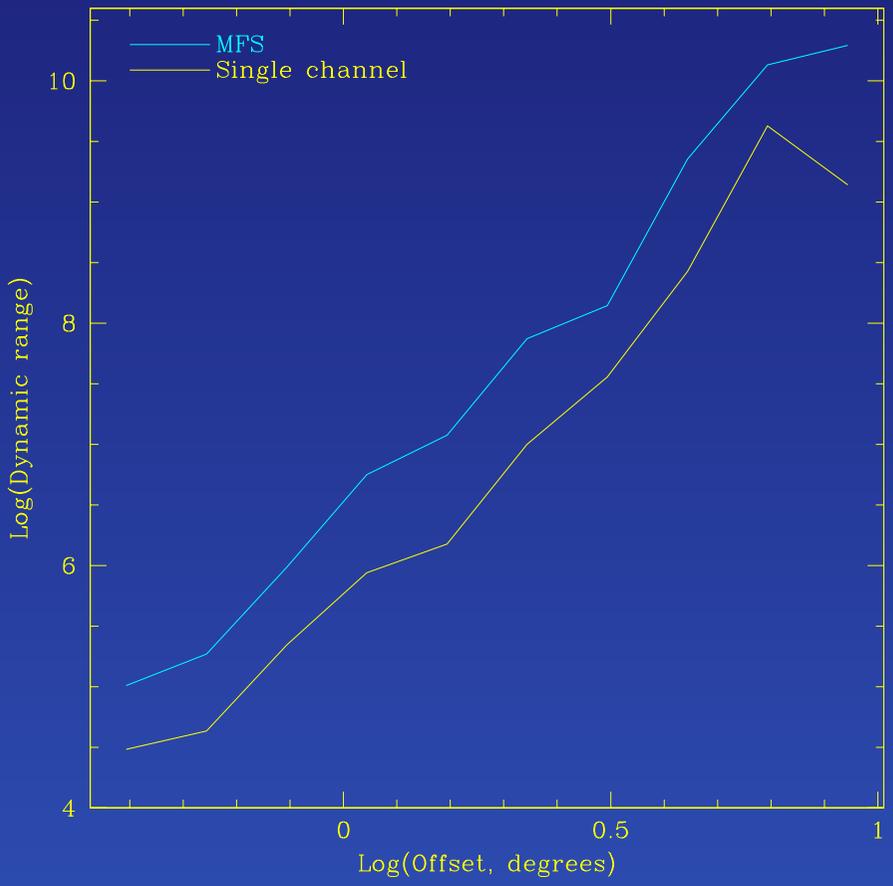
Varying mean, 2" variance
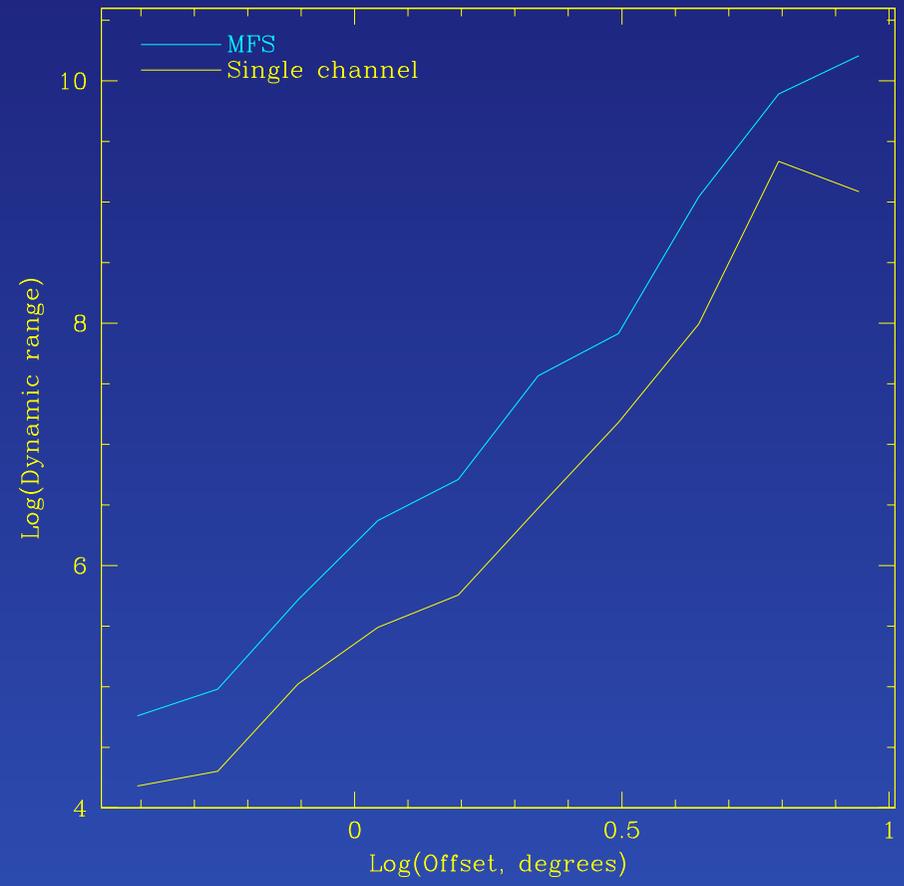
Zero mean, 2" variance
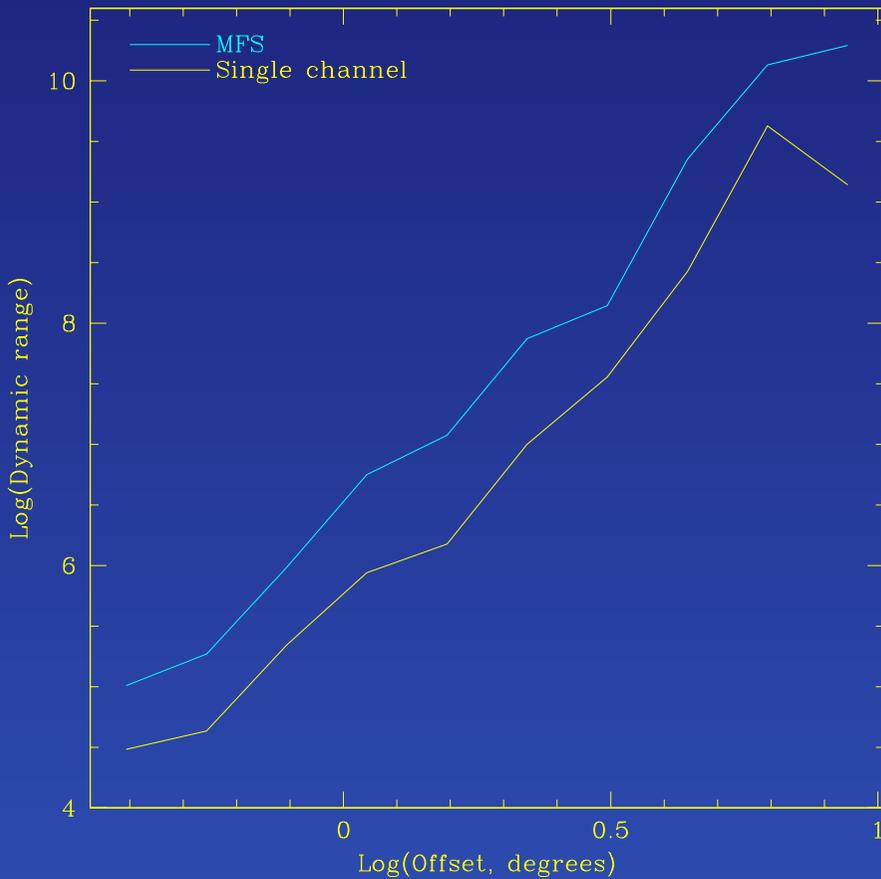
Varying mean, 2" variance
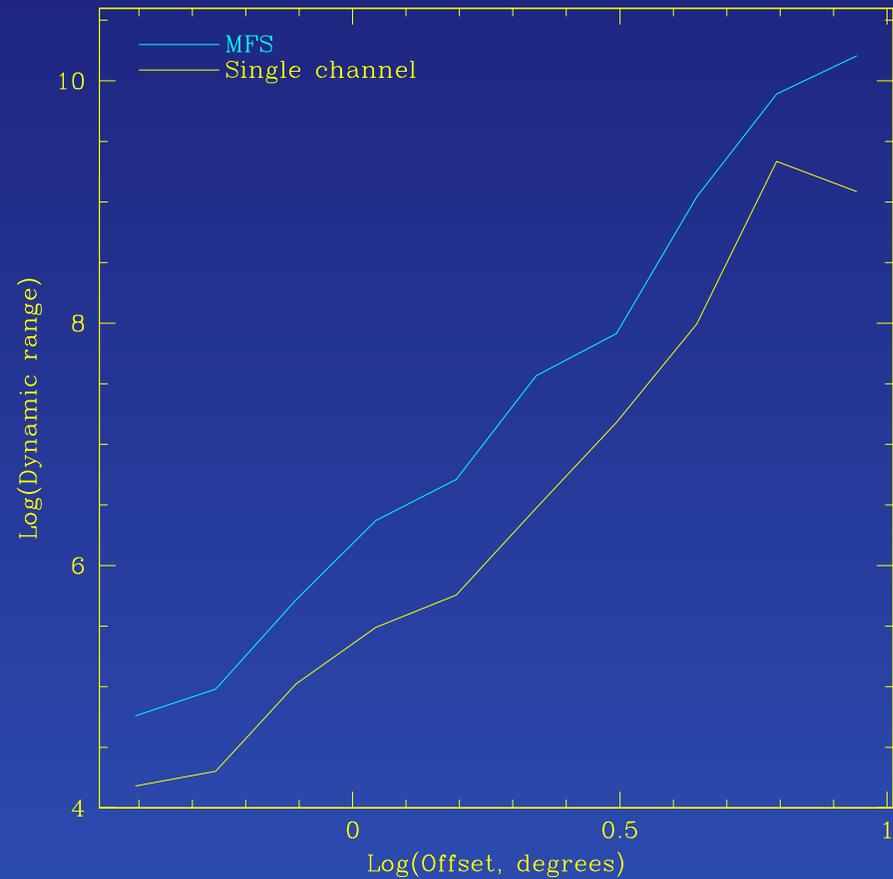
Summary

- The pointing errors should not be a problem if a dynamic range less than $5 \times 10^4 - 10^5$ is required.