

SOLIS-VSM, 2015-11-19

AN ALTERNATIVE ATTEMPT TO INVERT SOLIS/VSM DATA

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Milne-Eddington:

- solve RTE analytically:

$$S(\tau) = S_0 + S_1\tau$$

- 9 free Parameters:

- Magn. field vector: B, γ, χ

- LOS-velocity: v_{LOS}

- Line-center / continuum opacity: η_0

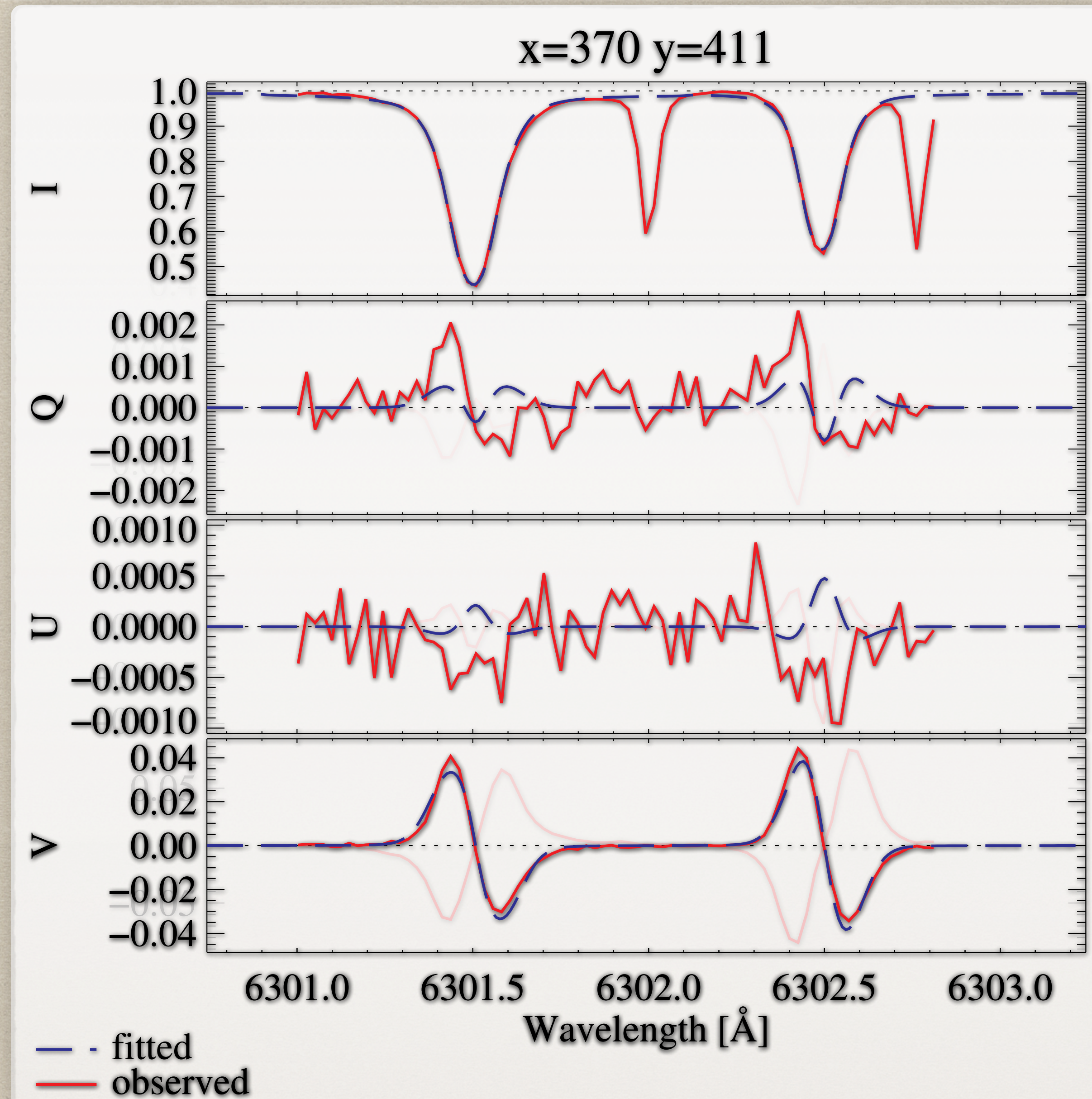
- Line broadening: v_{dop}, a

- Source function: S_0, S_1

- Filling factor α

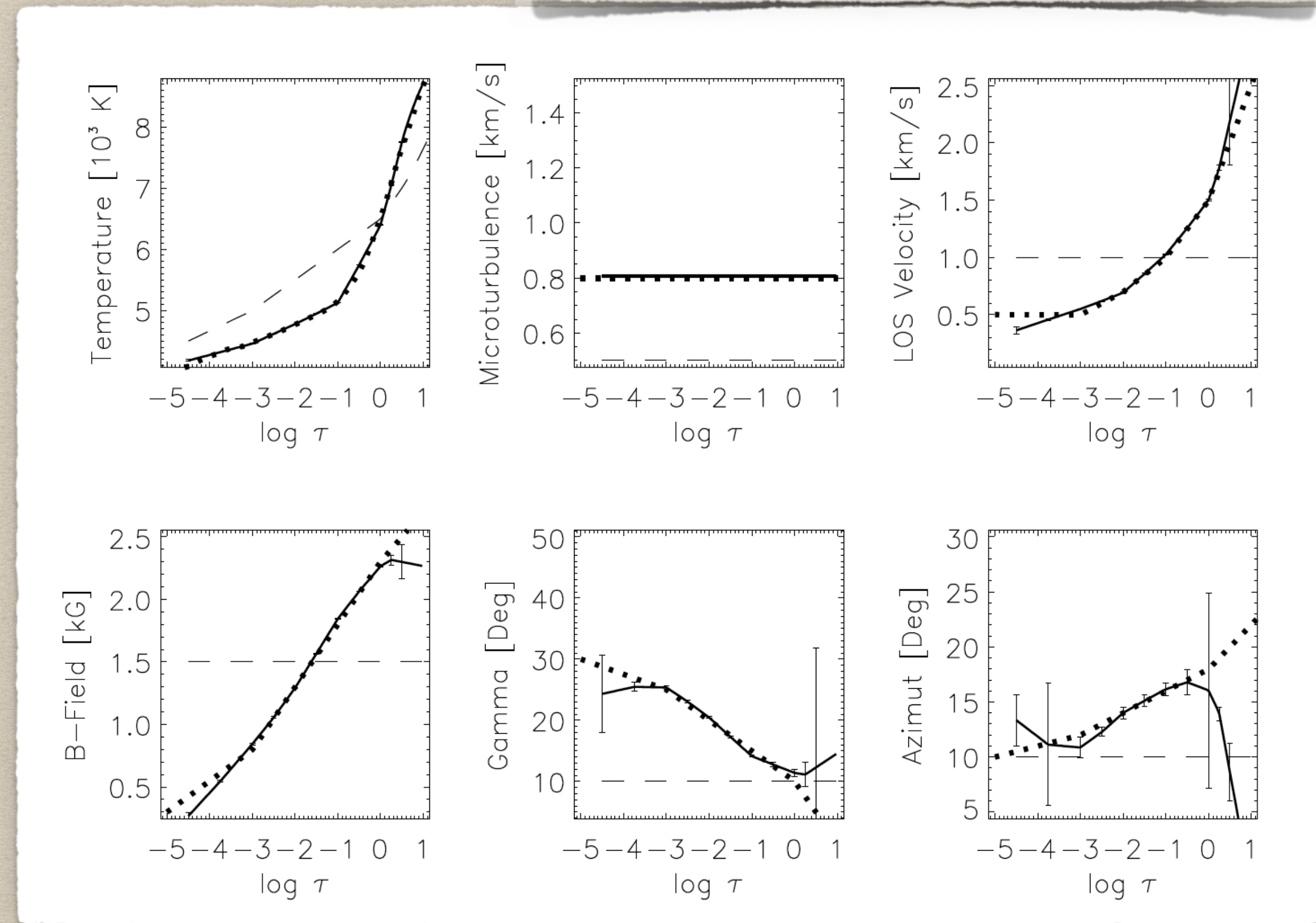
- Only one spectral line, 2nd line only with additional parameter (line strength ratio)

- No gradients with height (only symmetric Stokes profiles)



Frutiger, 2000; van Noort 2012

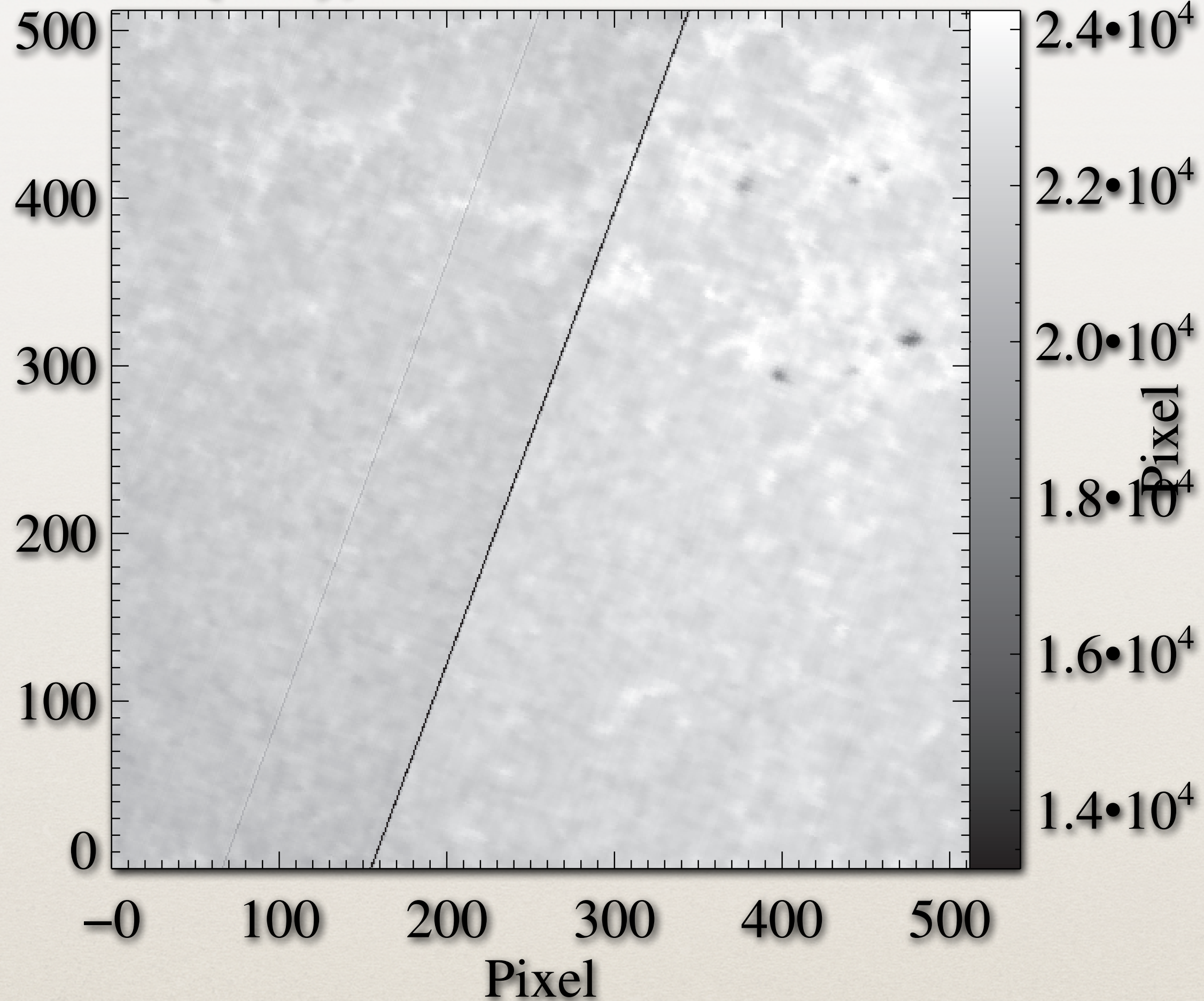
- Atmosphere in local thermodynamic equilibrium, parameters:
 - Magn. field vector: B, γ, χ
 - LOS-velocity: v_{LOS}
 - Realistic temperature stratification
 - Line strength according to Saha-Boltzmann
 - Line broadening with ξ_{mic} and ξ_{mac}
 - All parameters defined at 1 to N nodes
- FF determined uniquely (assumption: lines formed under same conditions, different g_{eff})



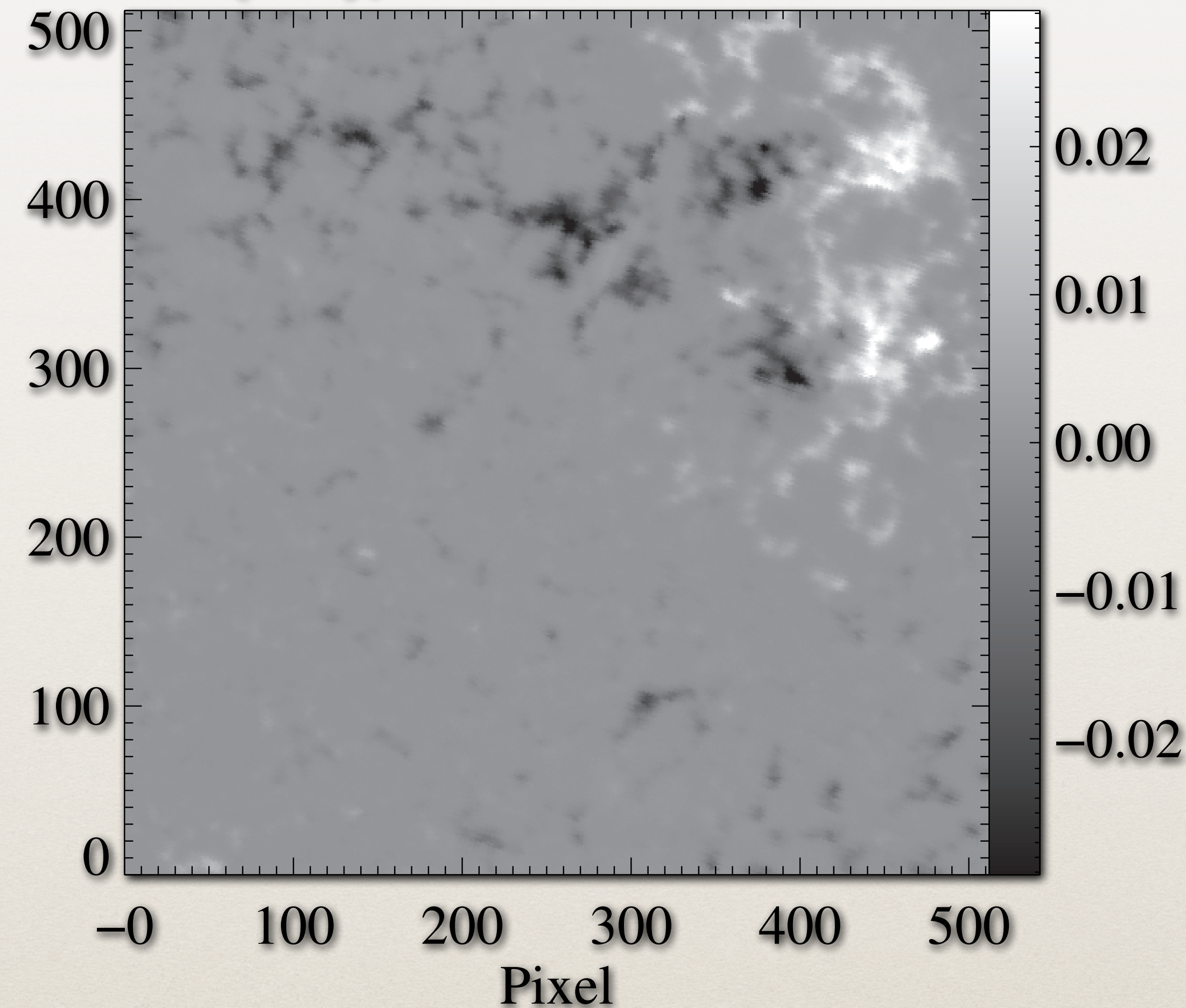
ACHTUNG!

Detailed knowledge about instrument is mandatory!

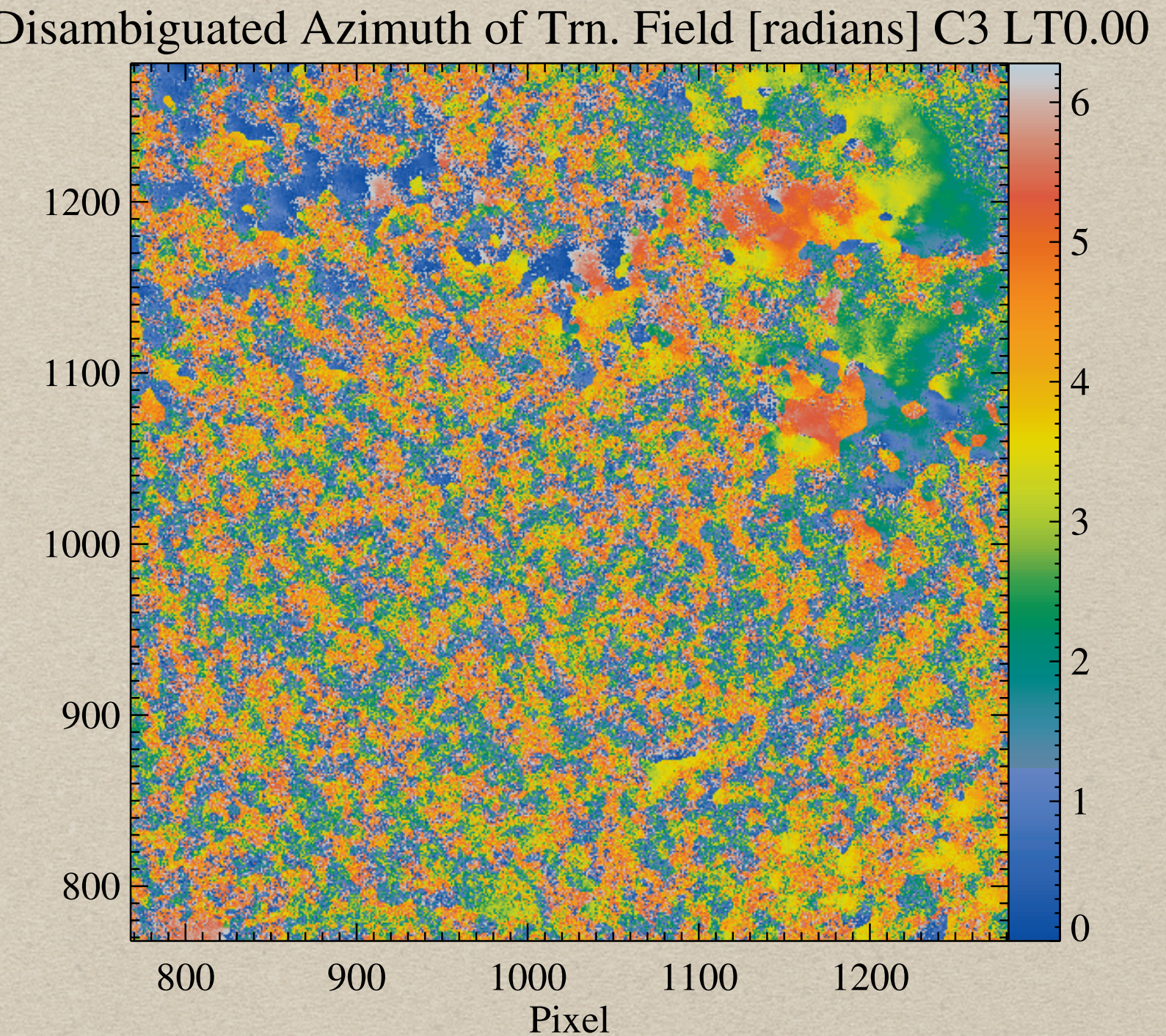
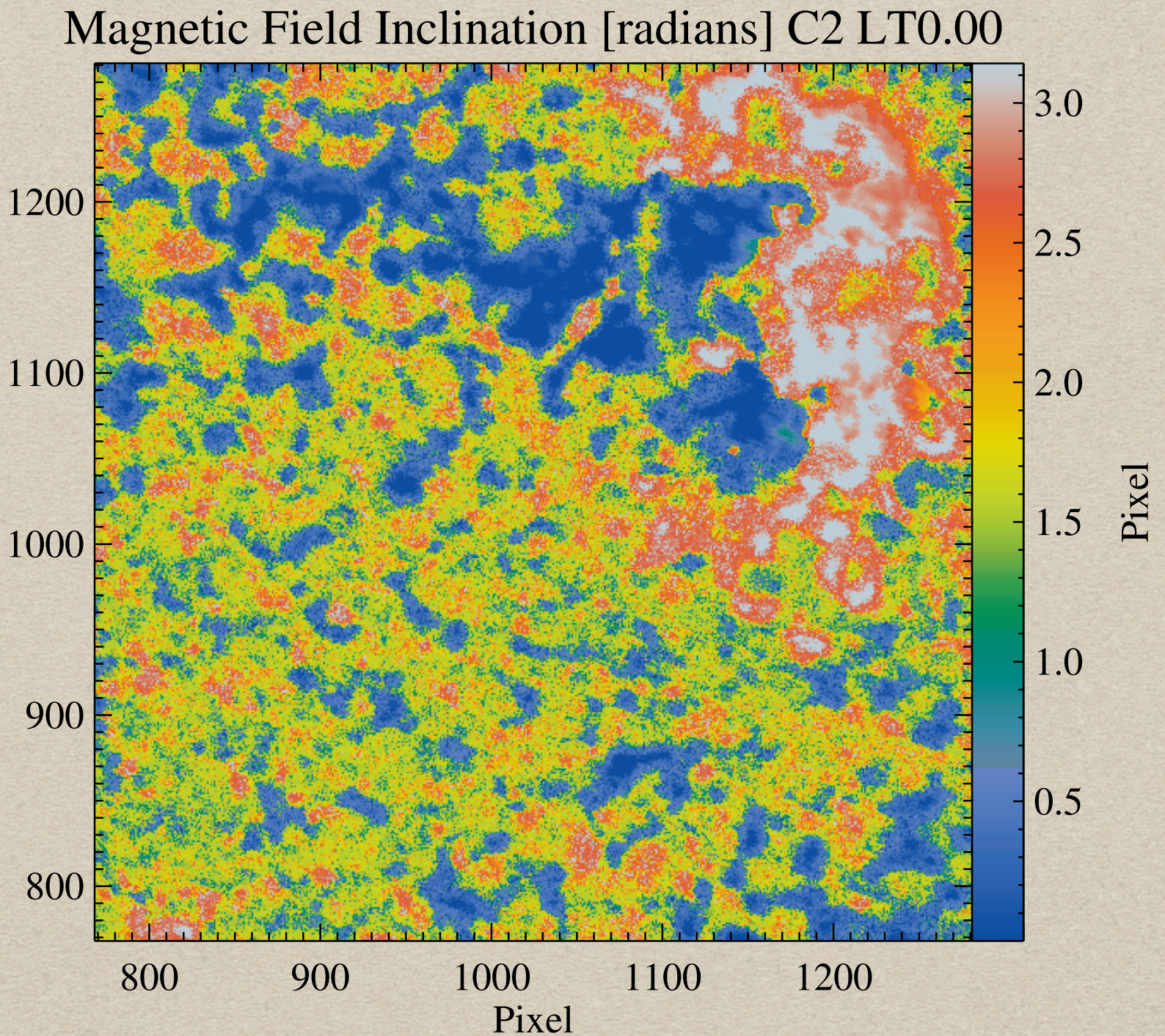
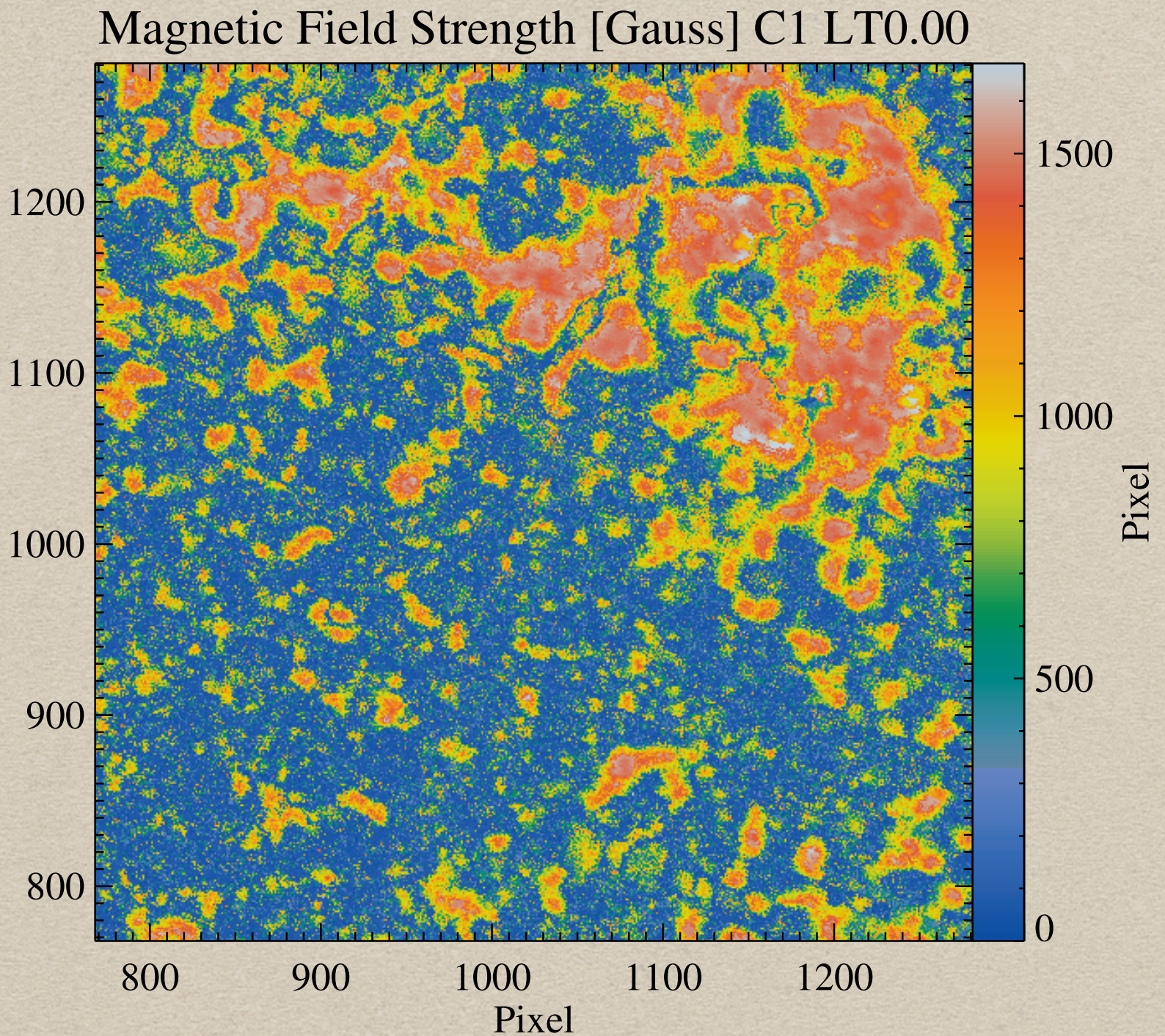
I (obs), 6301.41–6301.58 Å



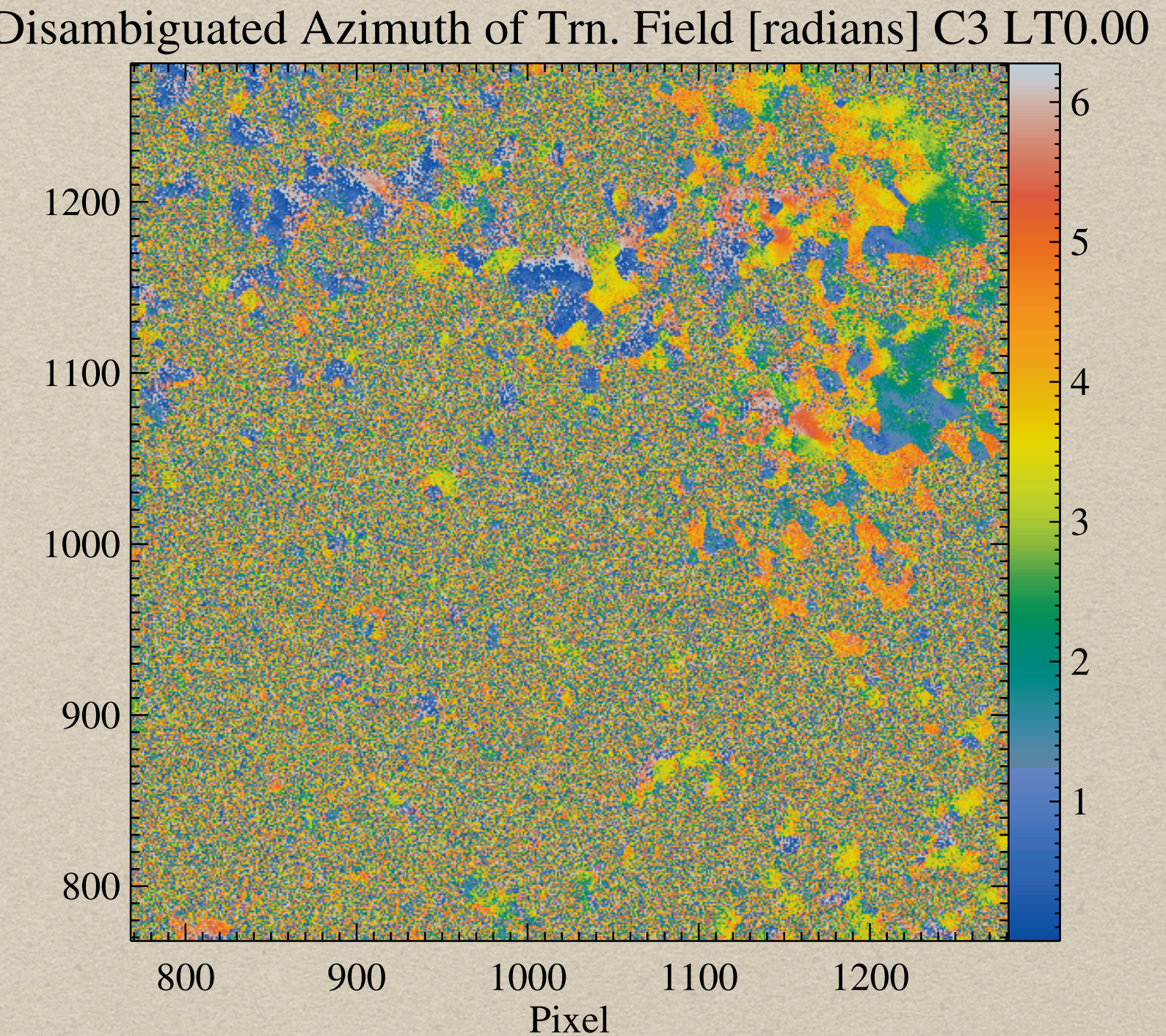
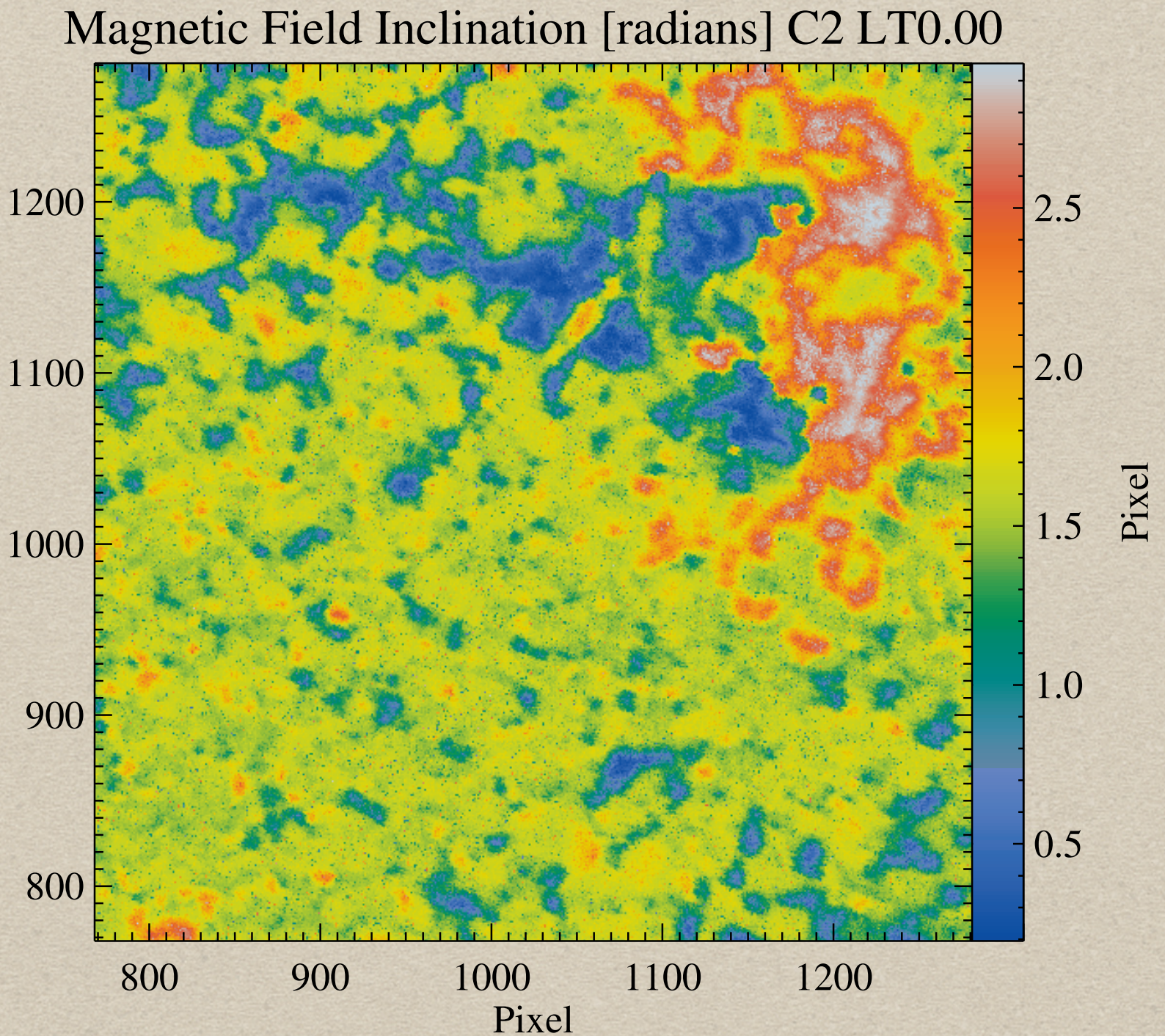
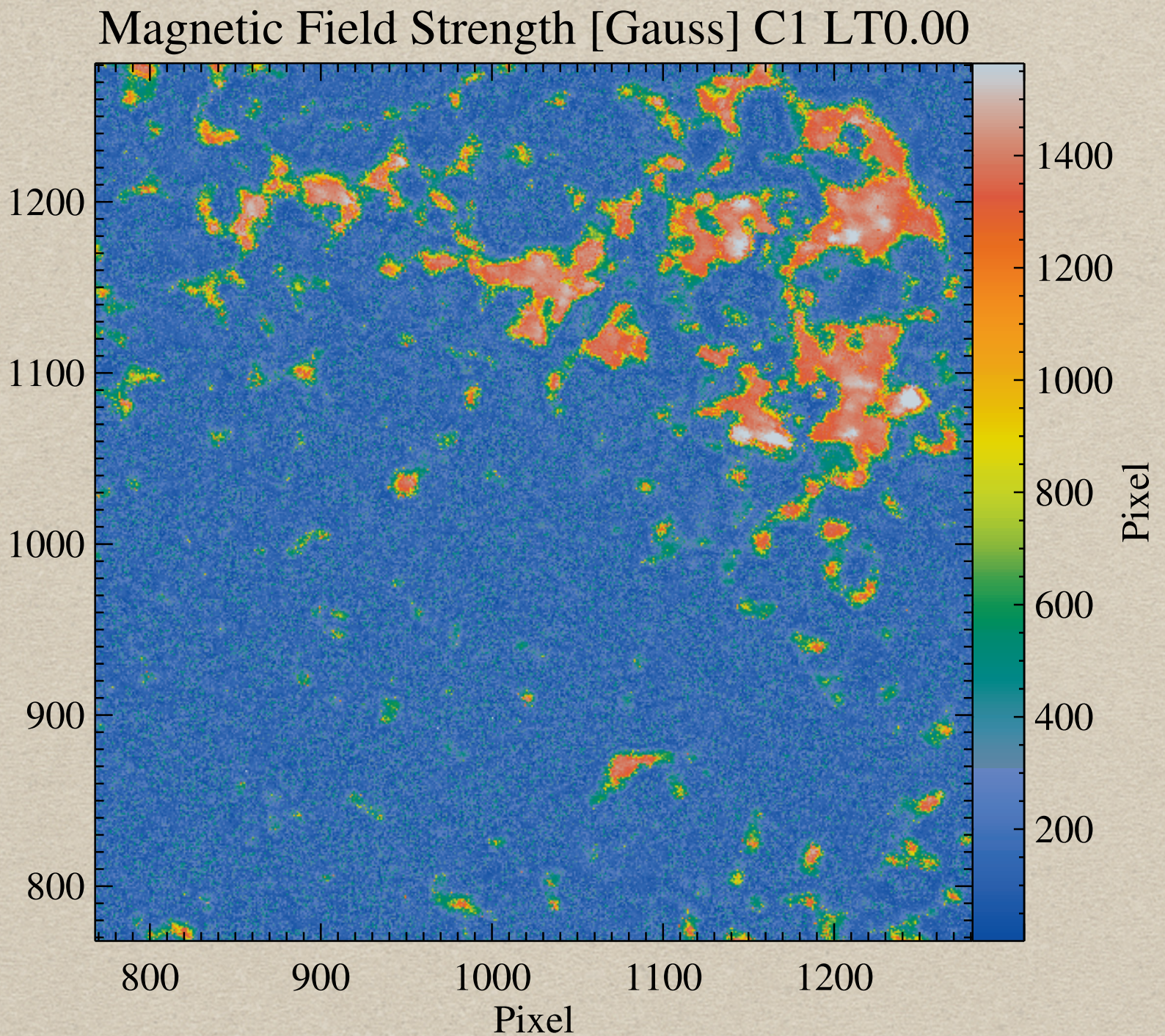
V (obs), 6301.51–6301.73 Å



ME RESULTS: OLD INVERSIONS (BRIAN / ILPO)

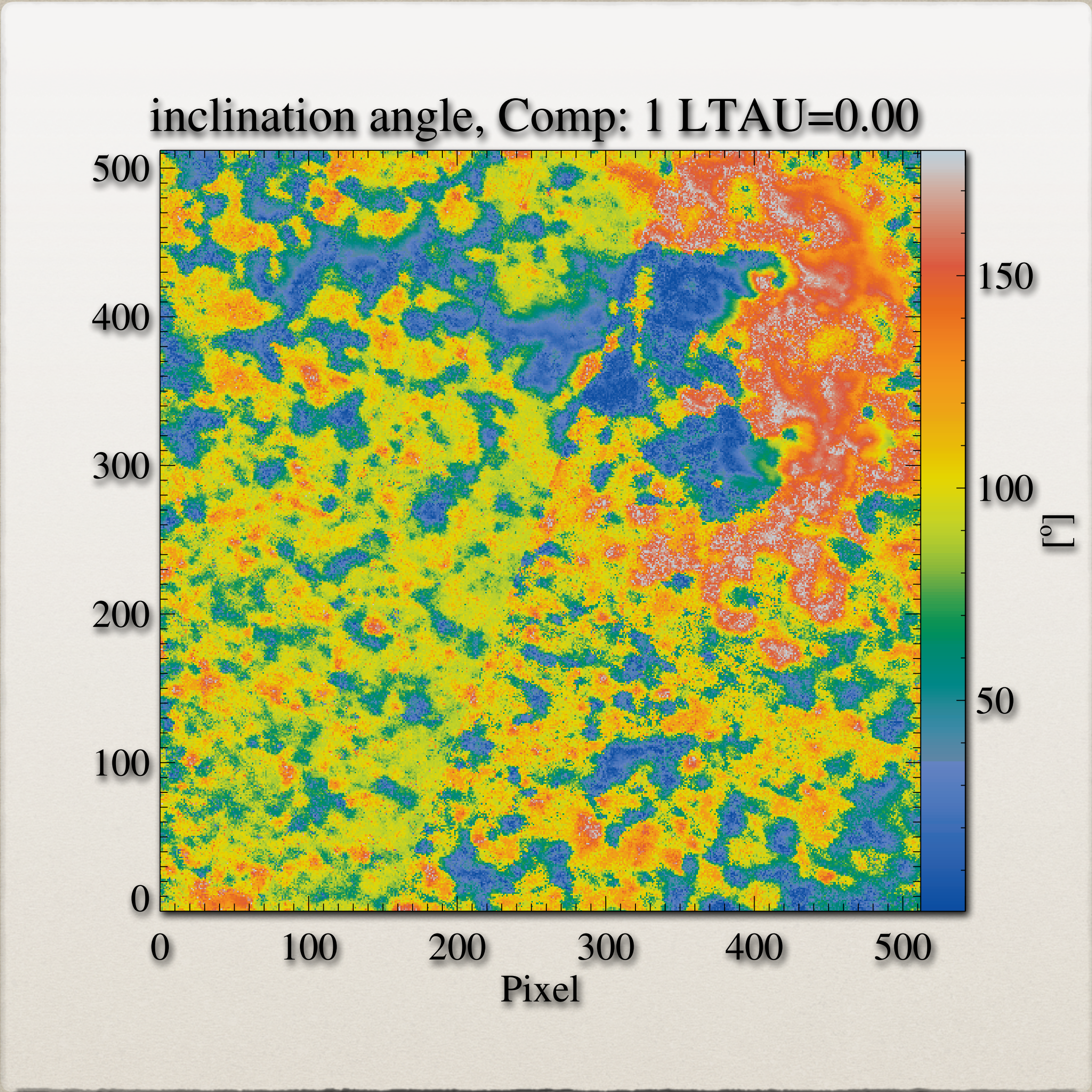


ME RESULTS: NEW INVERSIONS (BRIAN / ILPO)

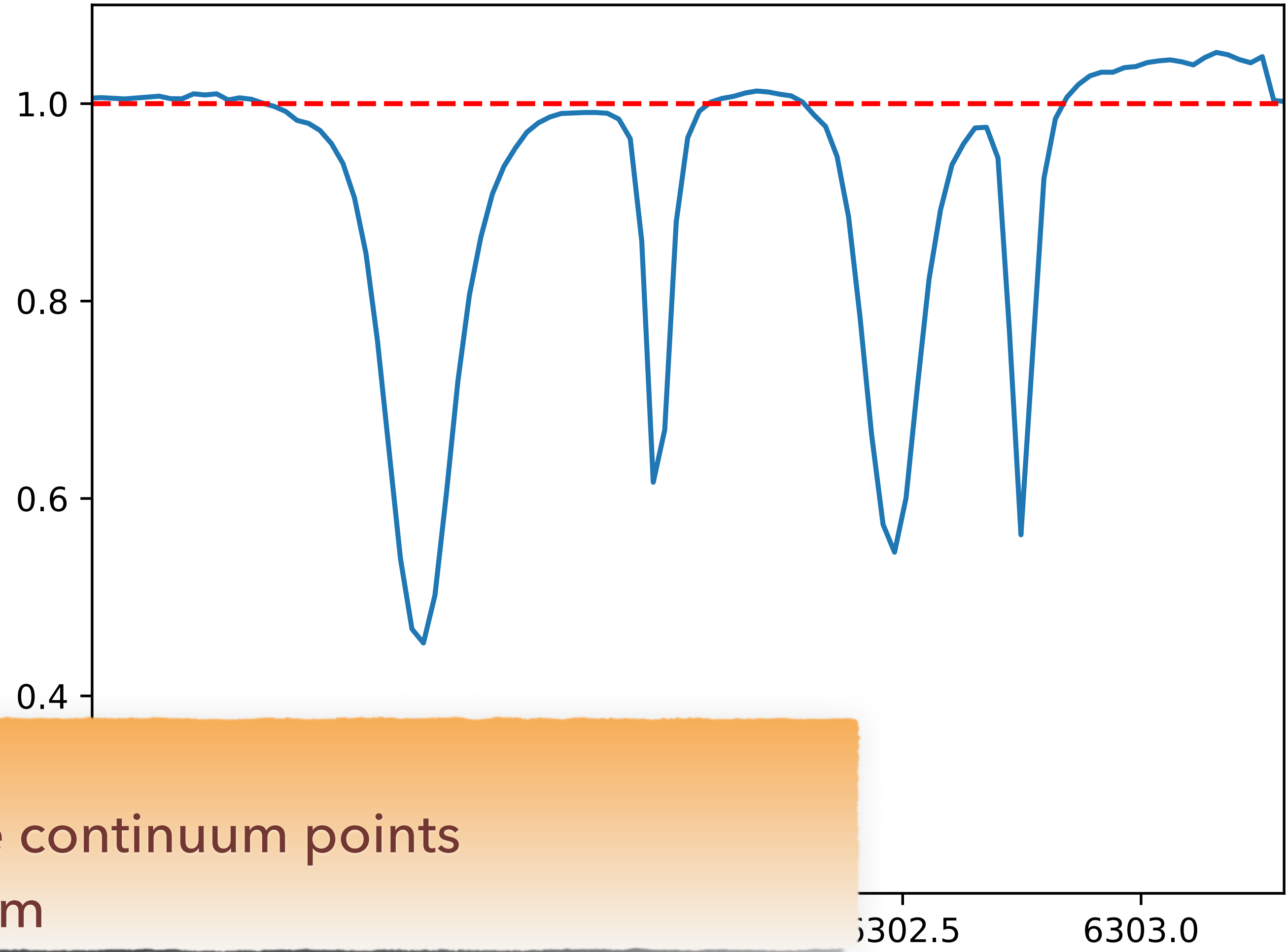


Motivation for my work:
Can inversions be improved by going beyond Milne-Eddington?

SPINOR INVERSION - 1ST ATTEMPT

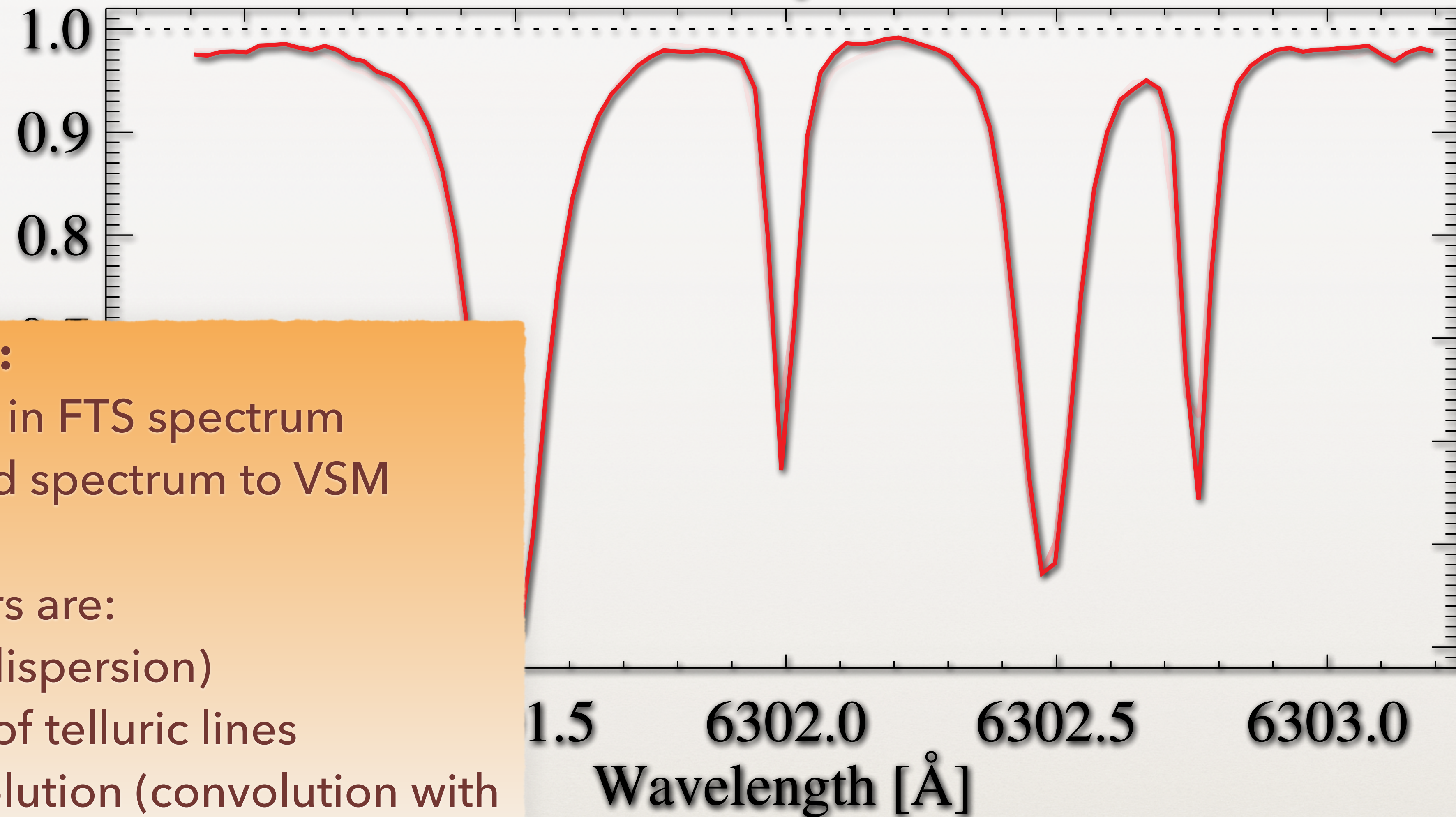


**Clear difference
between left and
right**



Quick & dirty fix:
Fit a polynomial to the continuum points
using the FTS spectrum

x=243 y=208

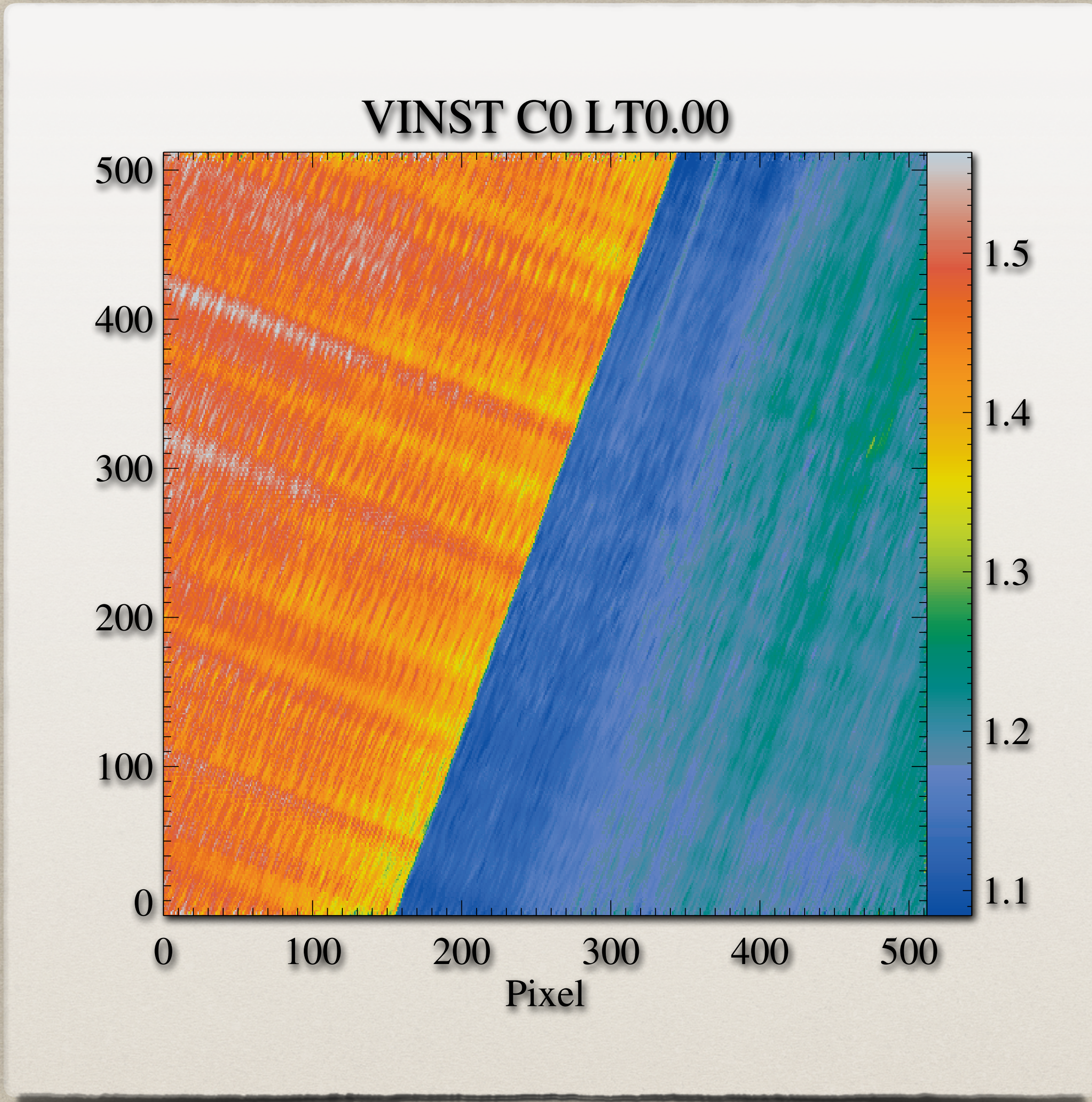


Quick & dirty fix:

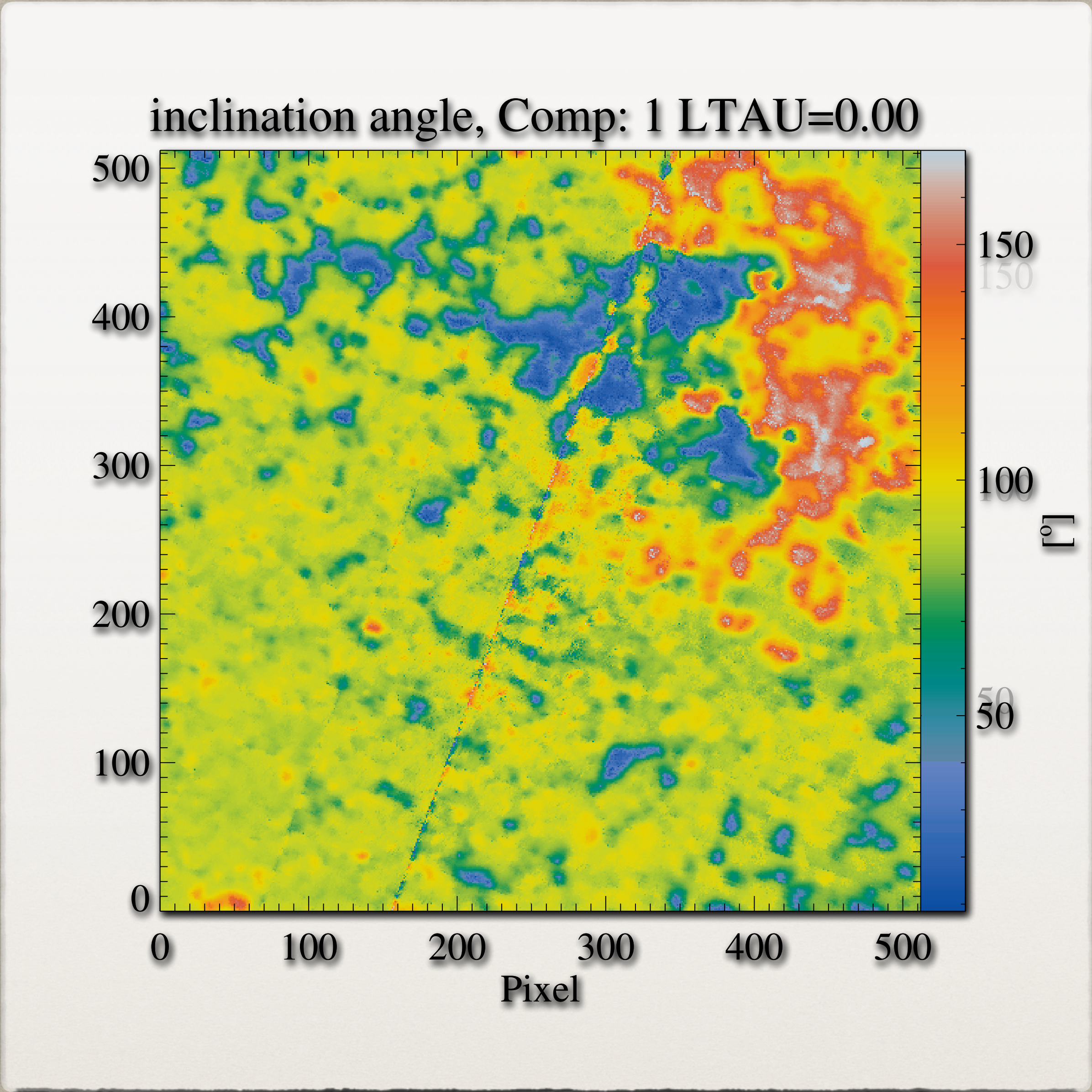
- Fit telluric lines in FTS spectrum
- Adjust the fitted spectrum to VSM spectrum.

Free parameters are:

- WL (offset+dispersion)
- Amplitudes of telluric lines
- spectral resolution (convolution with a Gaussian with a given FWHM)



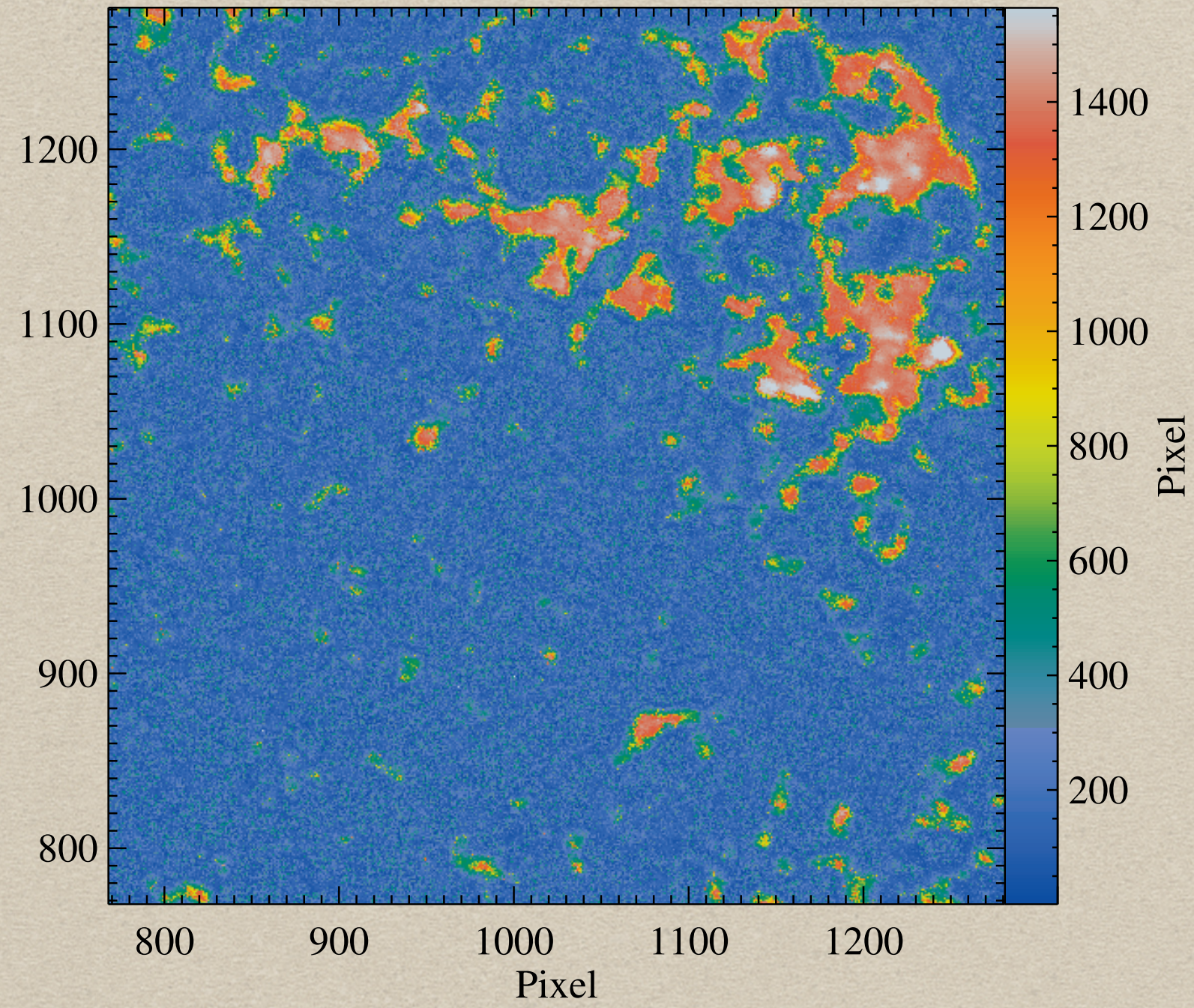
Before corrections



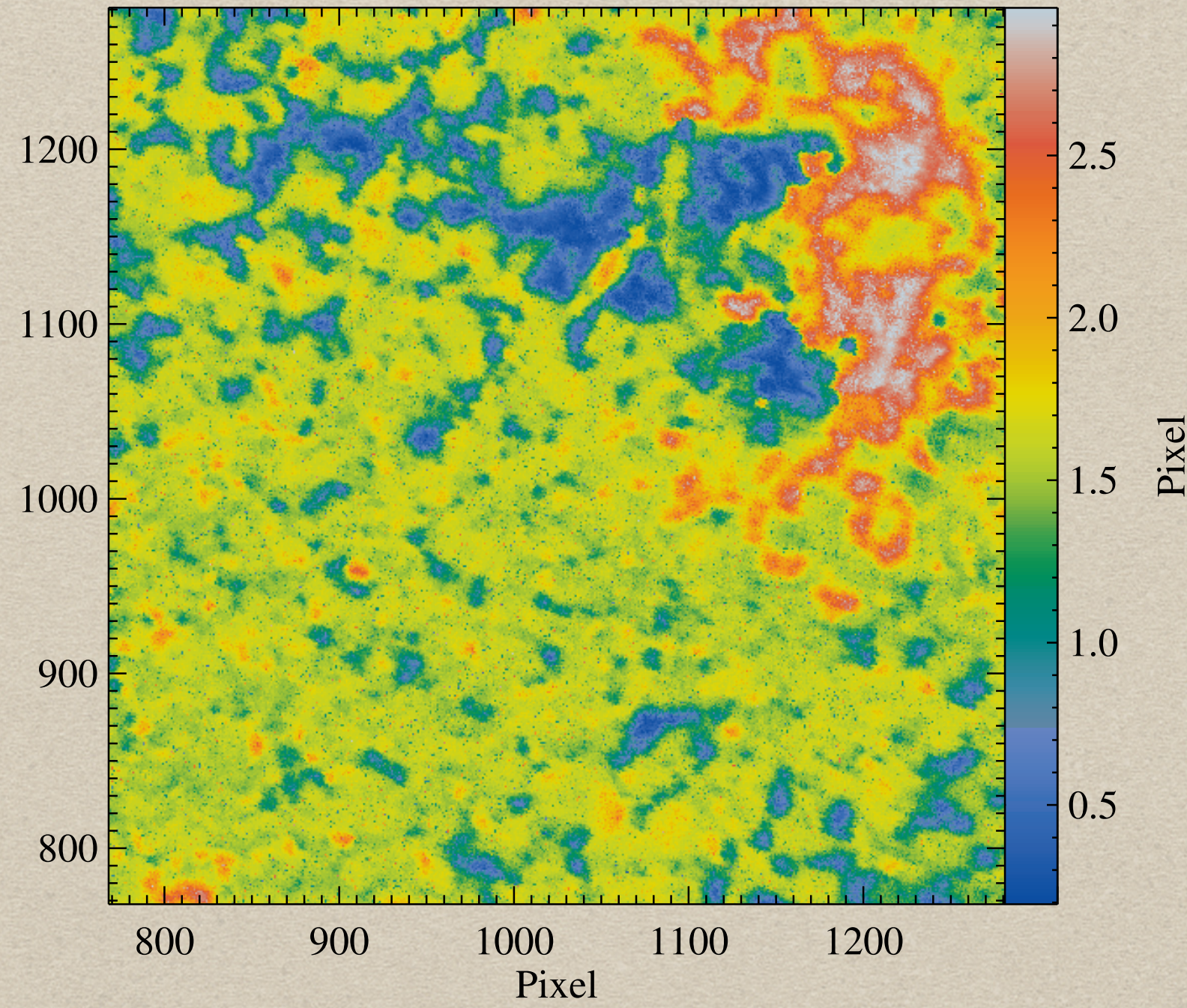
After corrections

ME RESULTS: NEW INVERSIONS

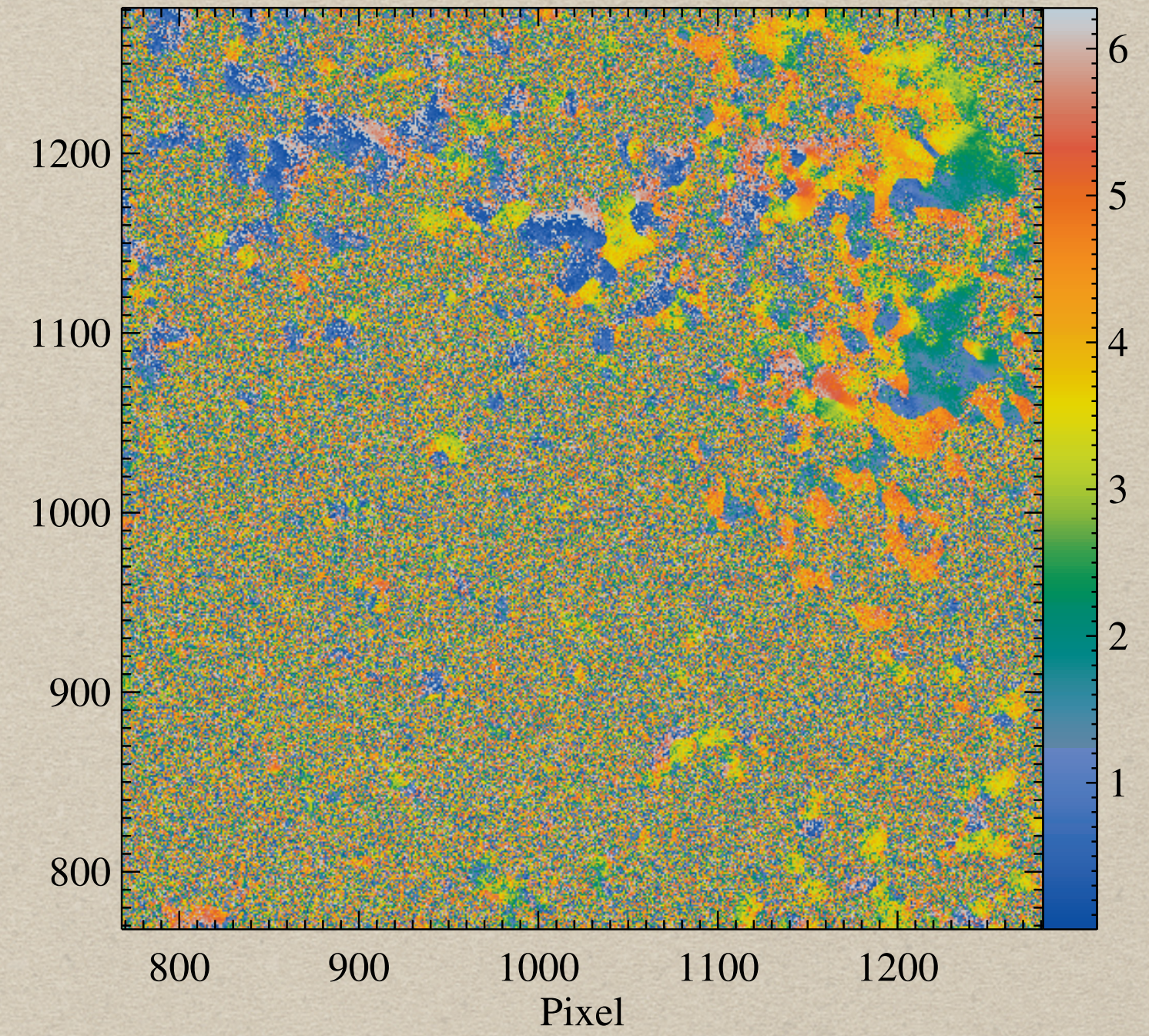
Magnetic Field Strength [Gauss] C1 LT0.00



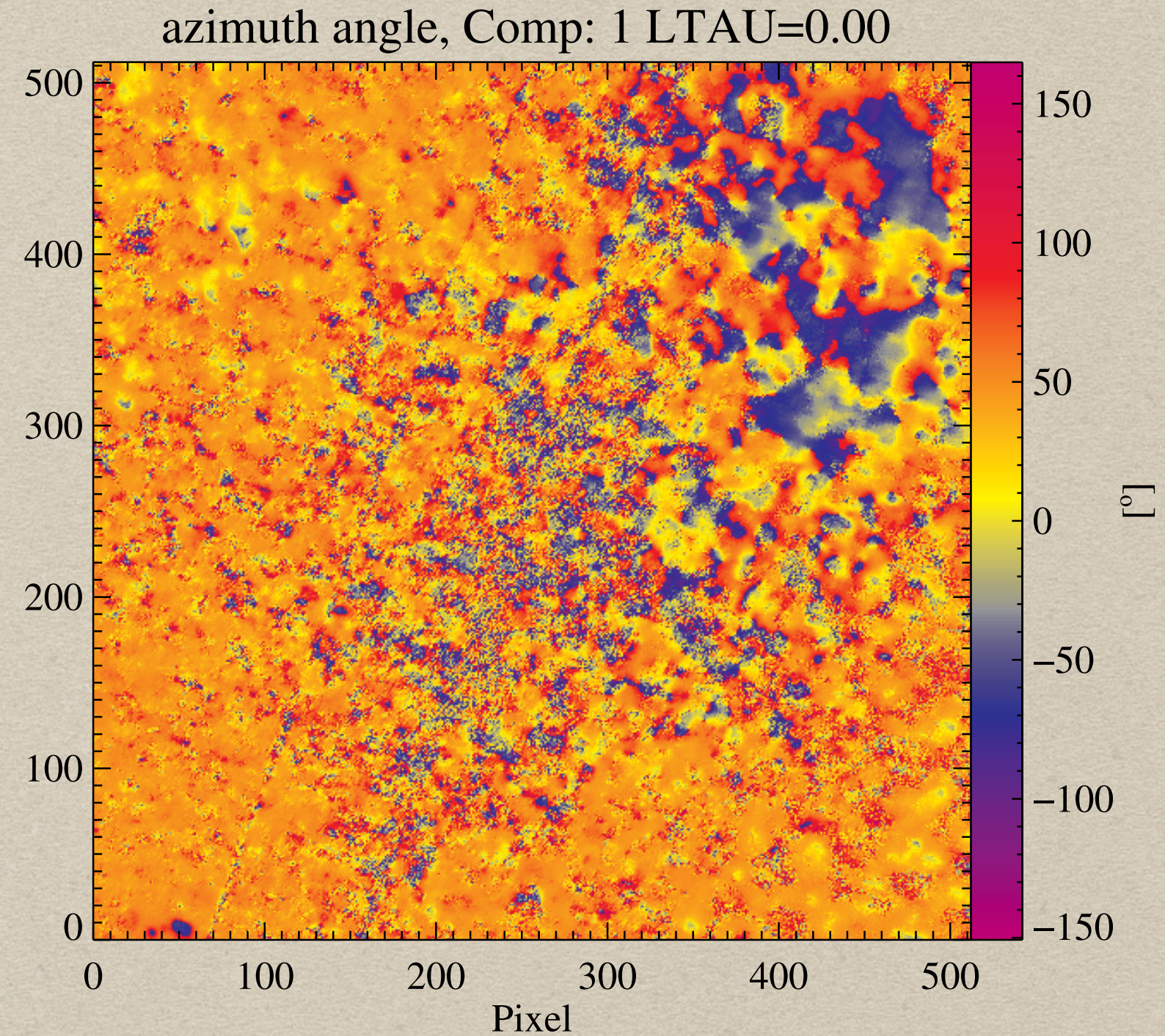
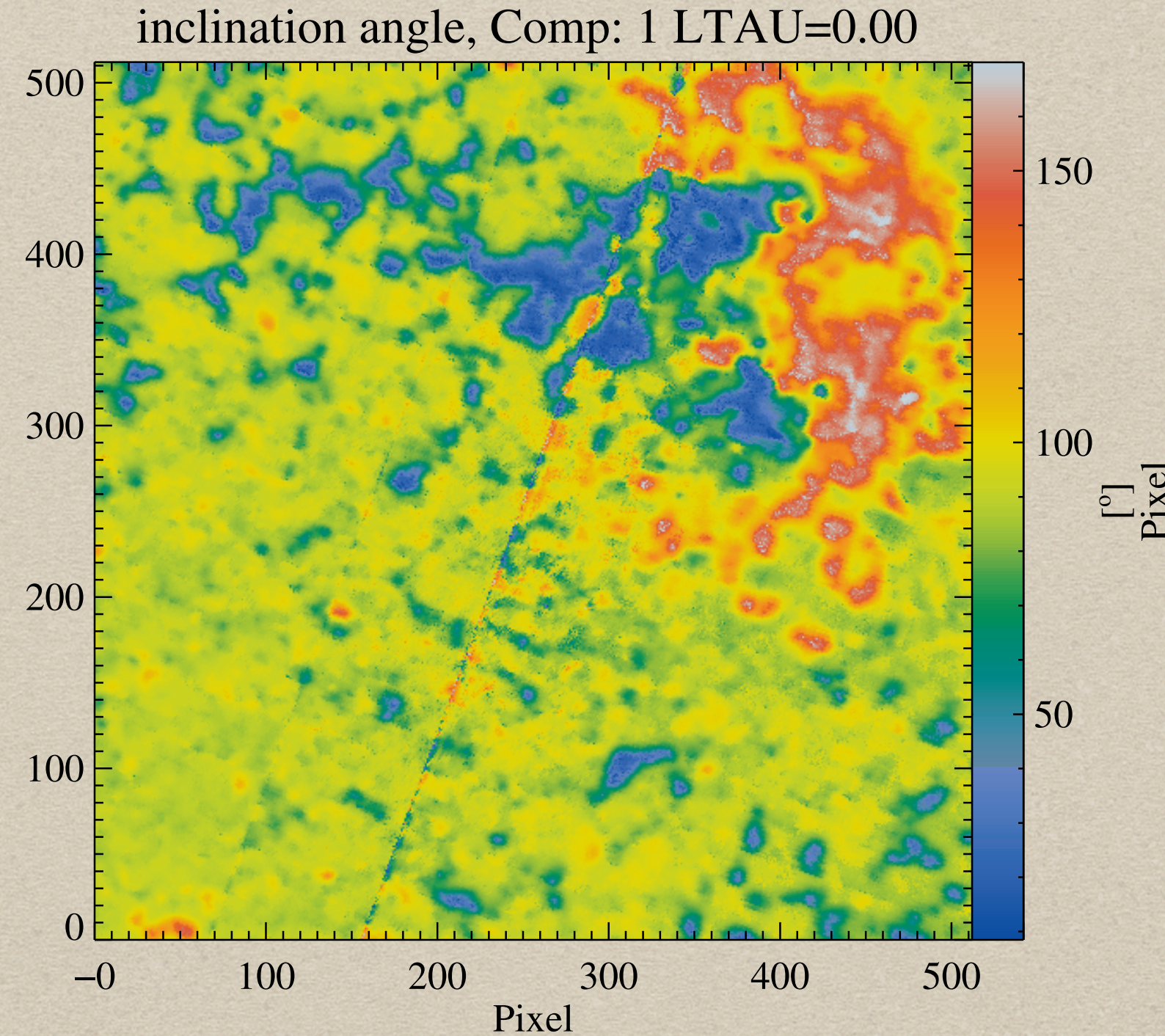
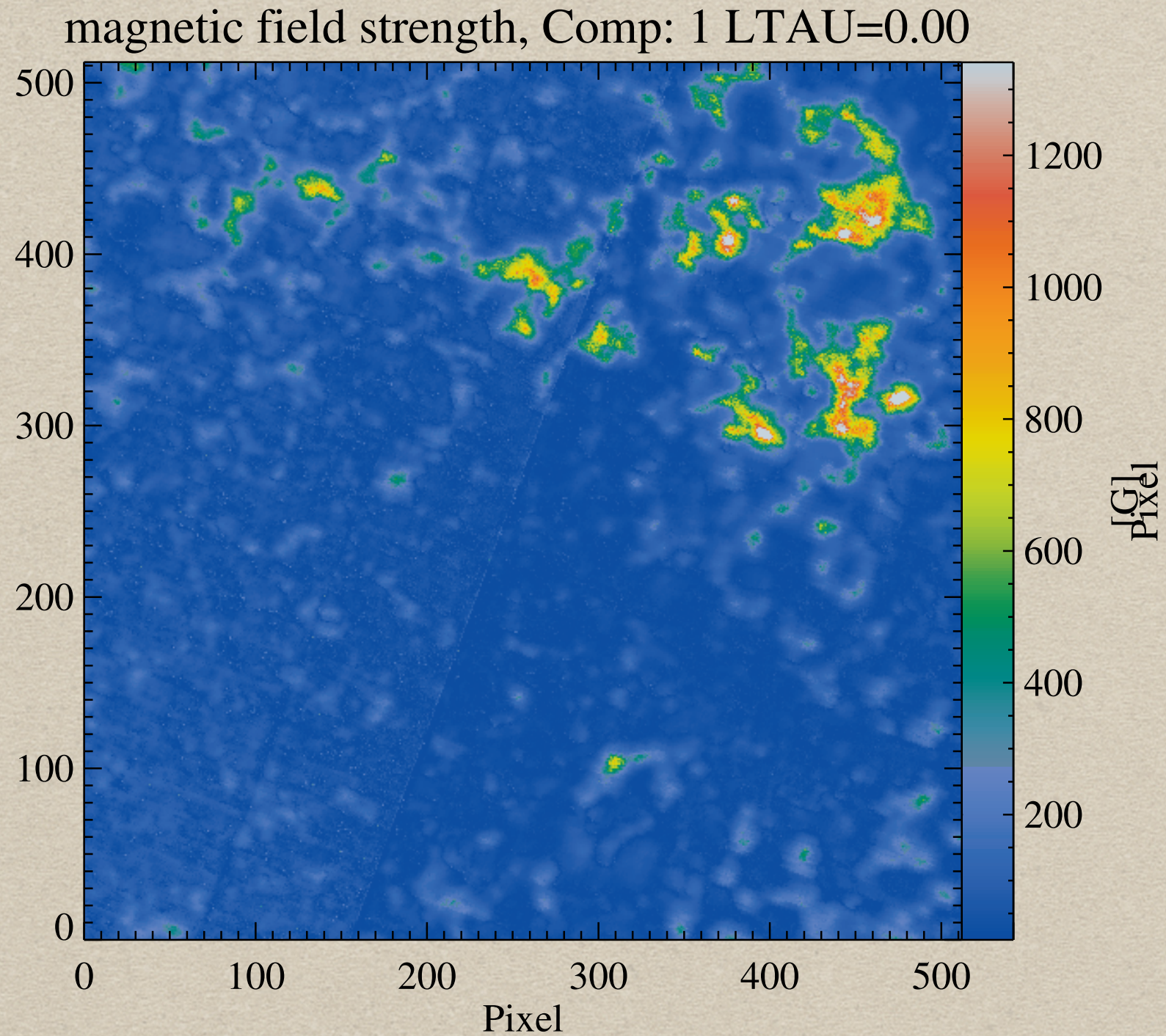
Magnetic Field Inclination [radians] C2 LT0.00

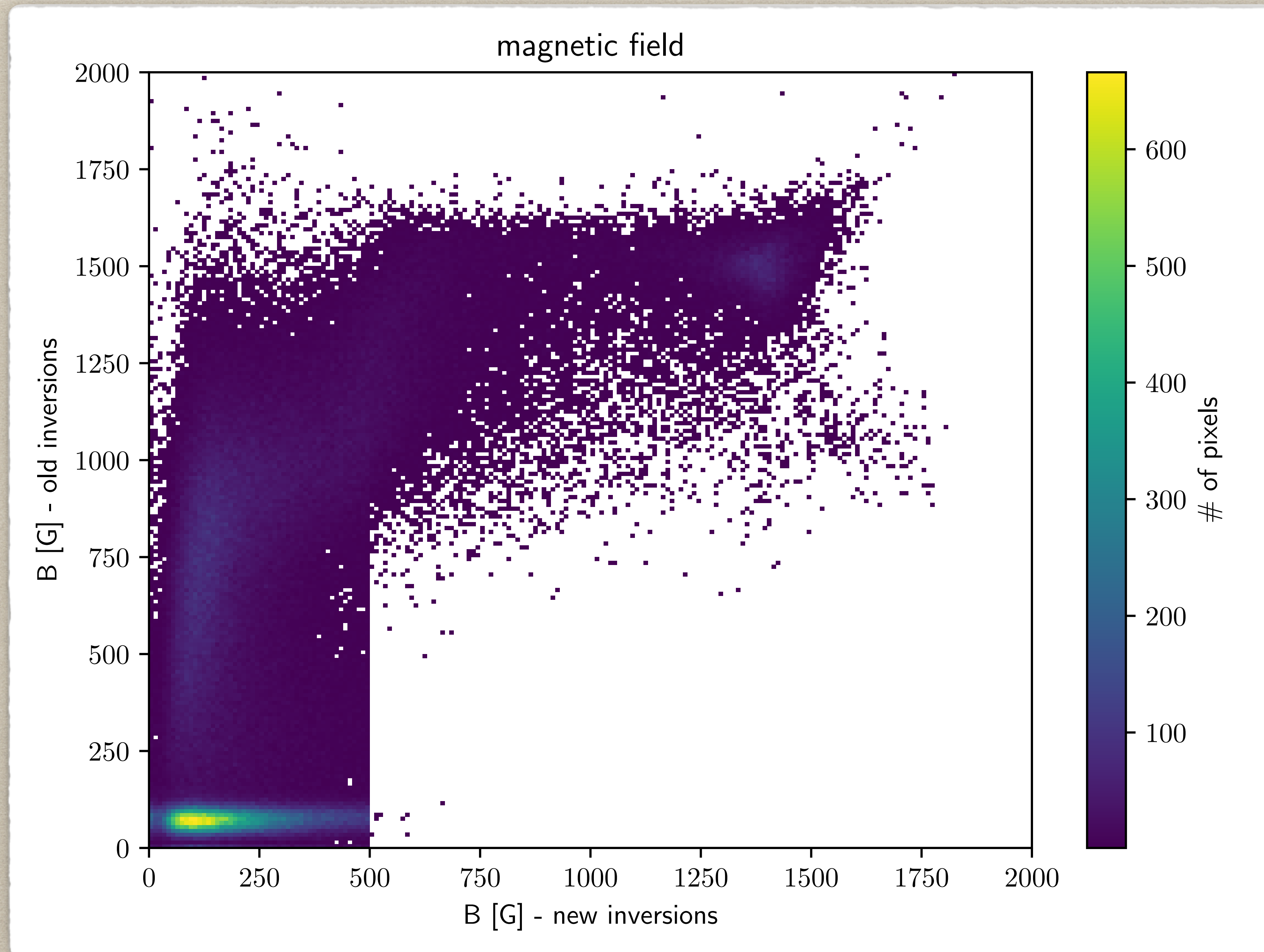


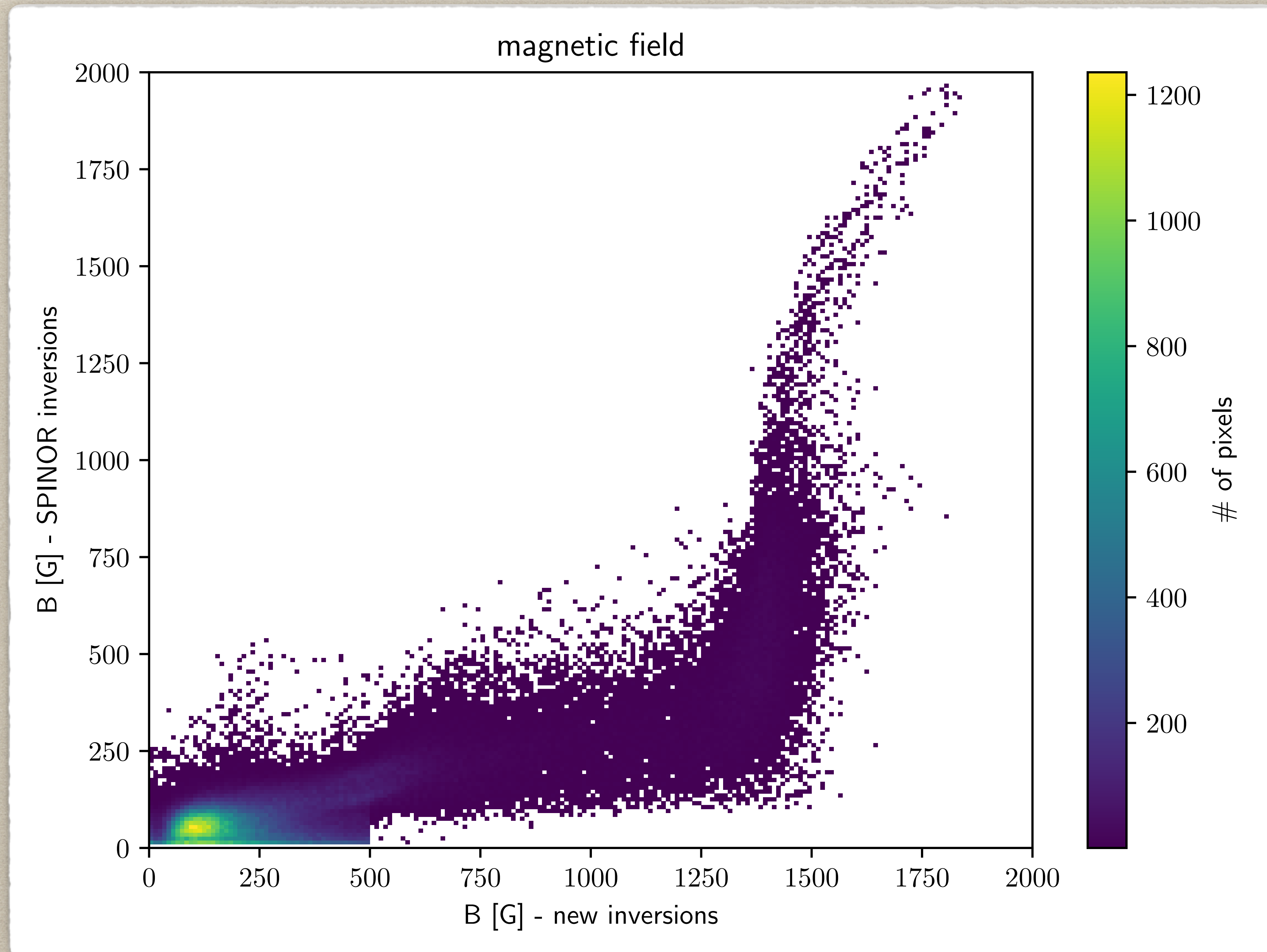
Disambiguated Azimuth of Trn. Field [radians] C3 LT0.00

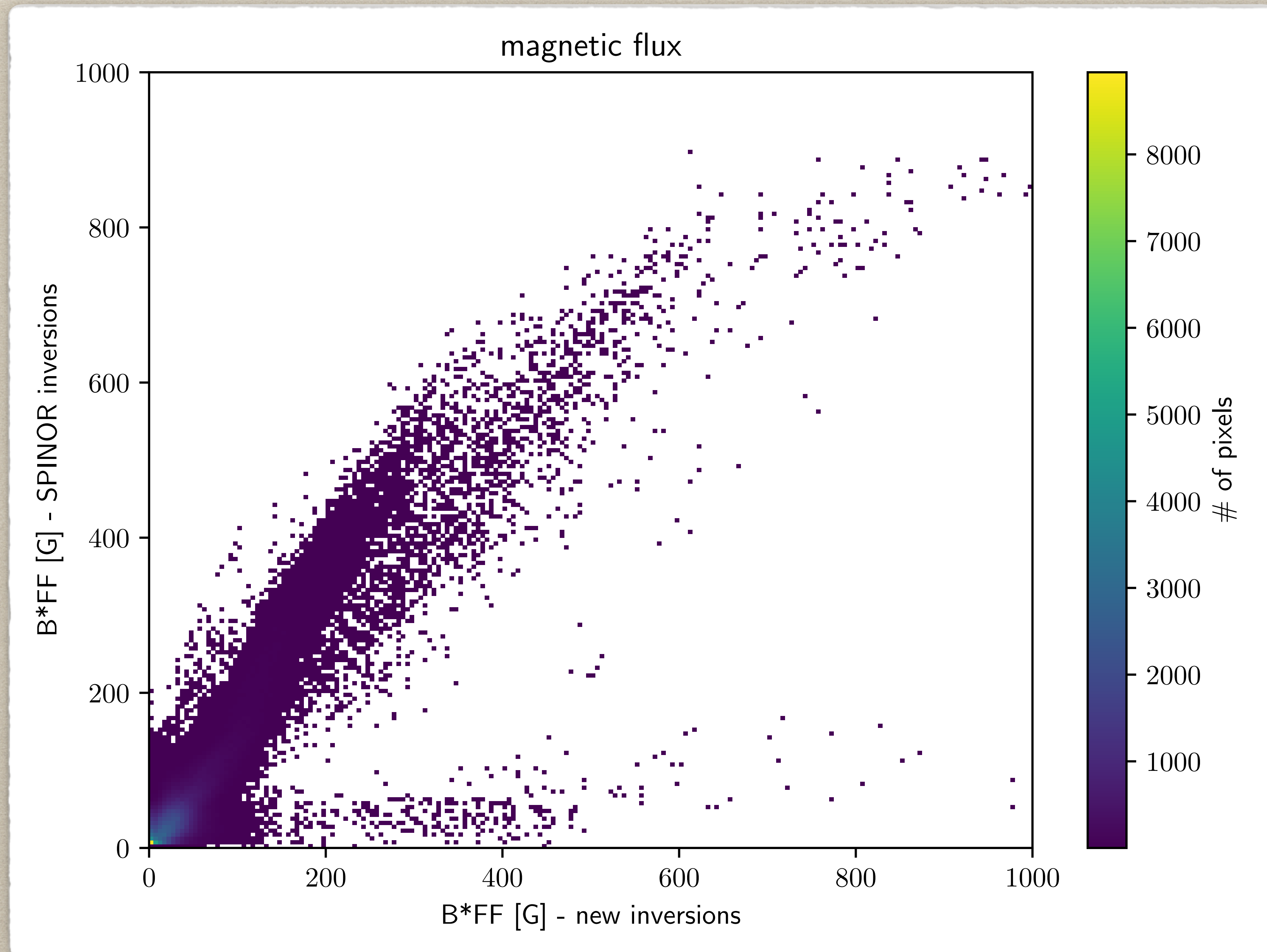


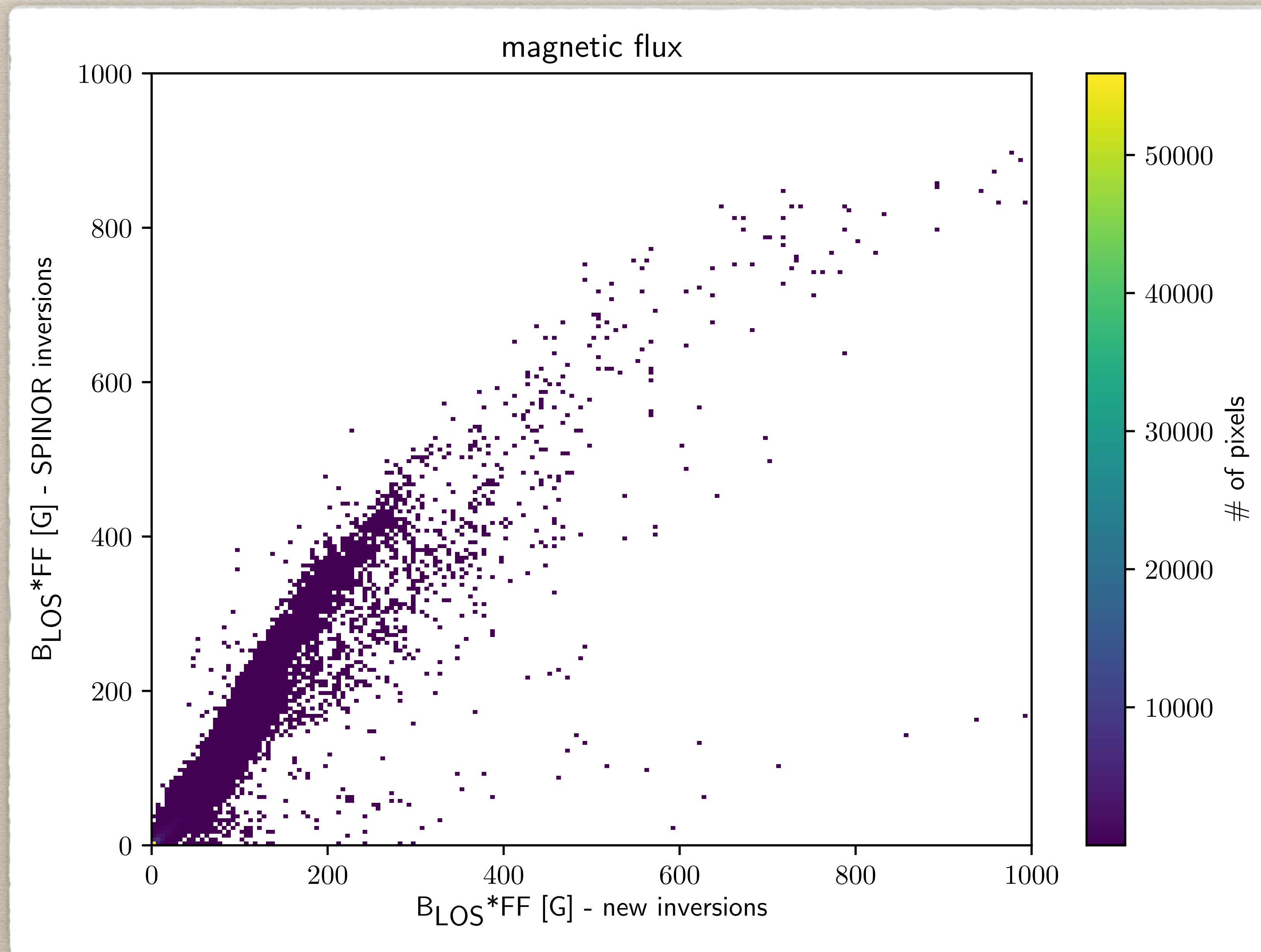
SPINOR INVERSIONS



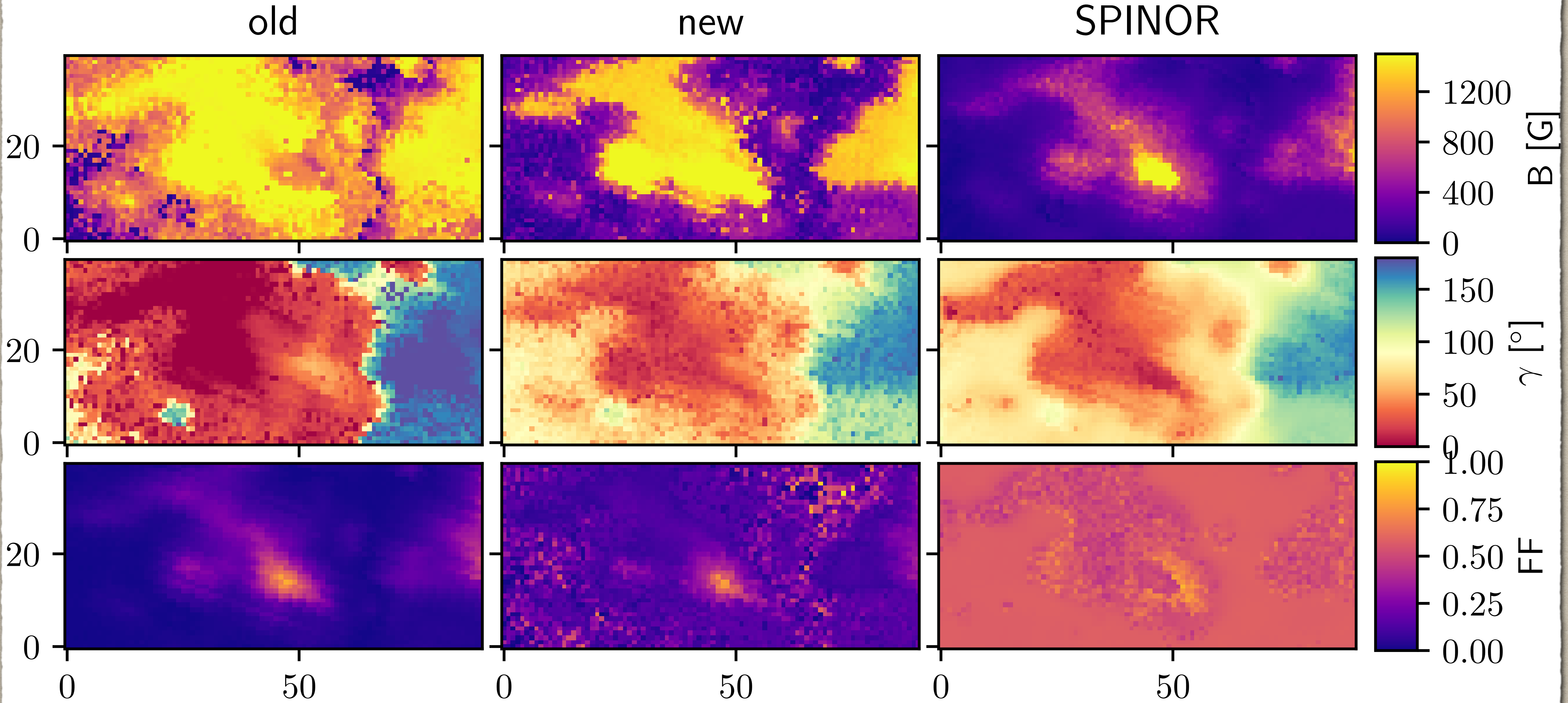








INVERSION COMPARISON ON A STRONG FIELD PATCH



Summary

- Poor agreement between different inversion techniques (even for pixels $>3\sigma$)
- Possible reasons:
 - ME vs LTE treatment?
 - Instrumental effects not treated properly ?
 - Gradients in the atmosphere?

How to continue?

- Try to better understand the source of the disagreement
- Estimate the consequences to derived data products:
 - Disambiguation
 - Synoptic map generation
 - Helicity maps