SQUV & PCA: reduction tools for THÈMIS

by

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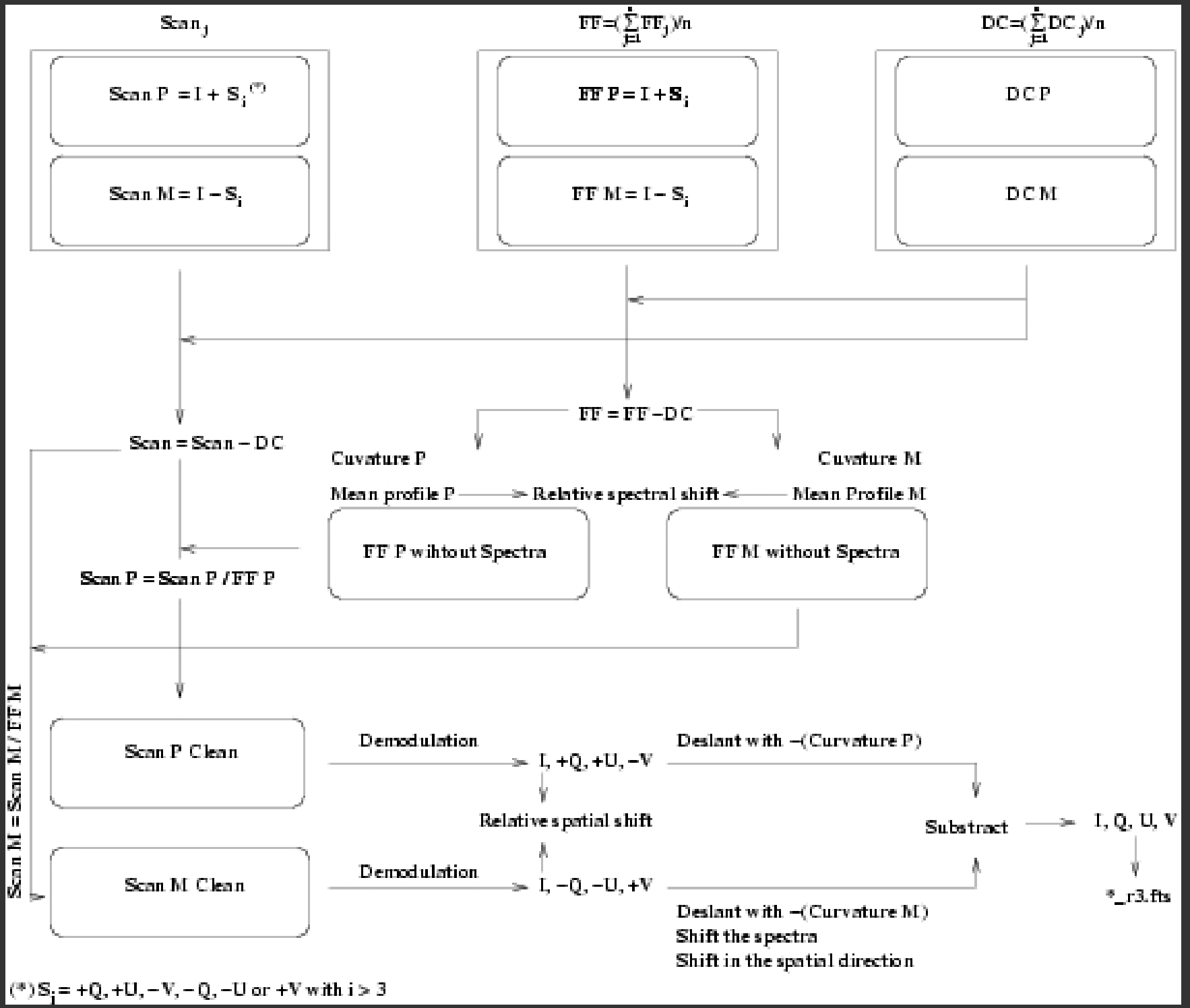
WHAT IS SQUV?

- Stokes Quick Viewer is a tool for the THÈMIS MTR data.
- It is a set of IDL routines and functions with a GUI.
- The input are the THÈMIS data; the output is a standard fits file with the Stokes parameters.
- It is stable, easy and for general porpouse use.
- It is one more code for THÈMIS data, my best reduction code.
- It is not perfect! I try to improve but it will not be perfect!

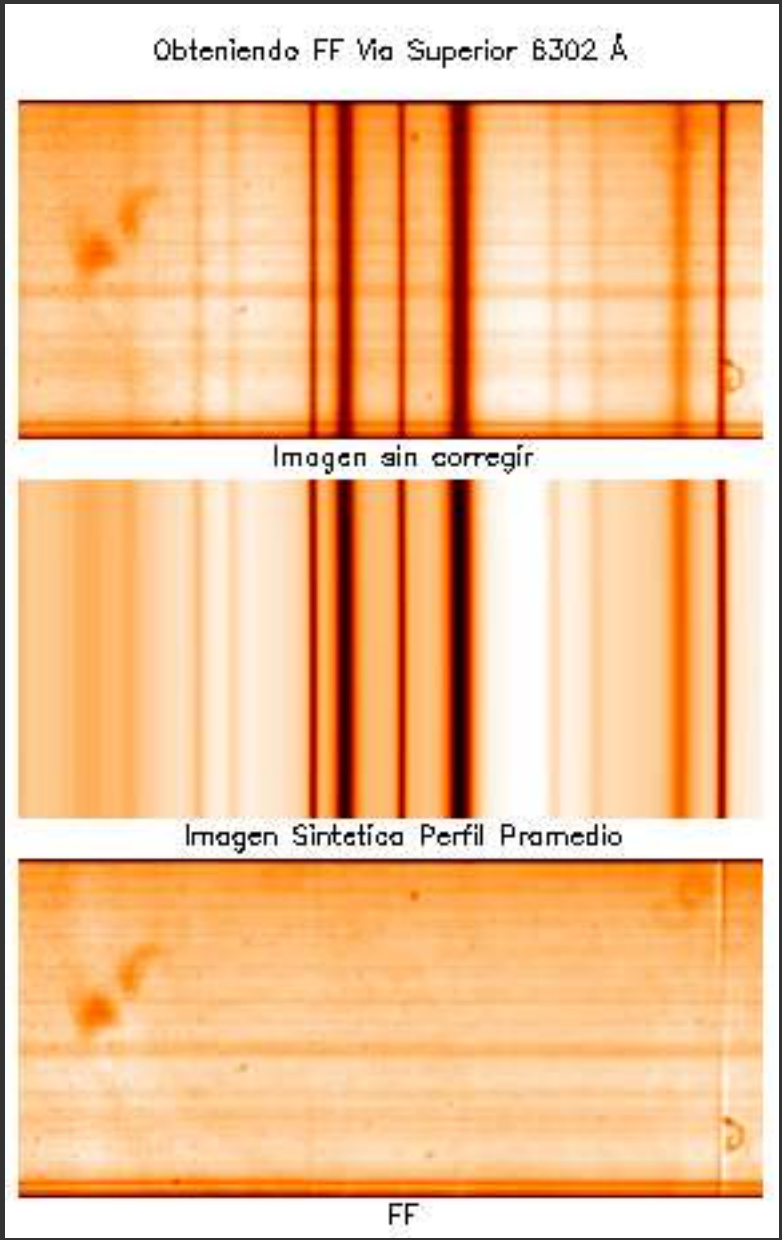
WHAT IS NOT SQUV?

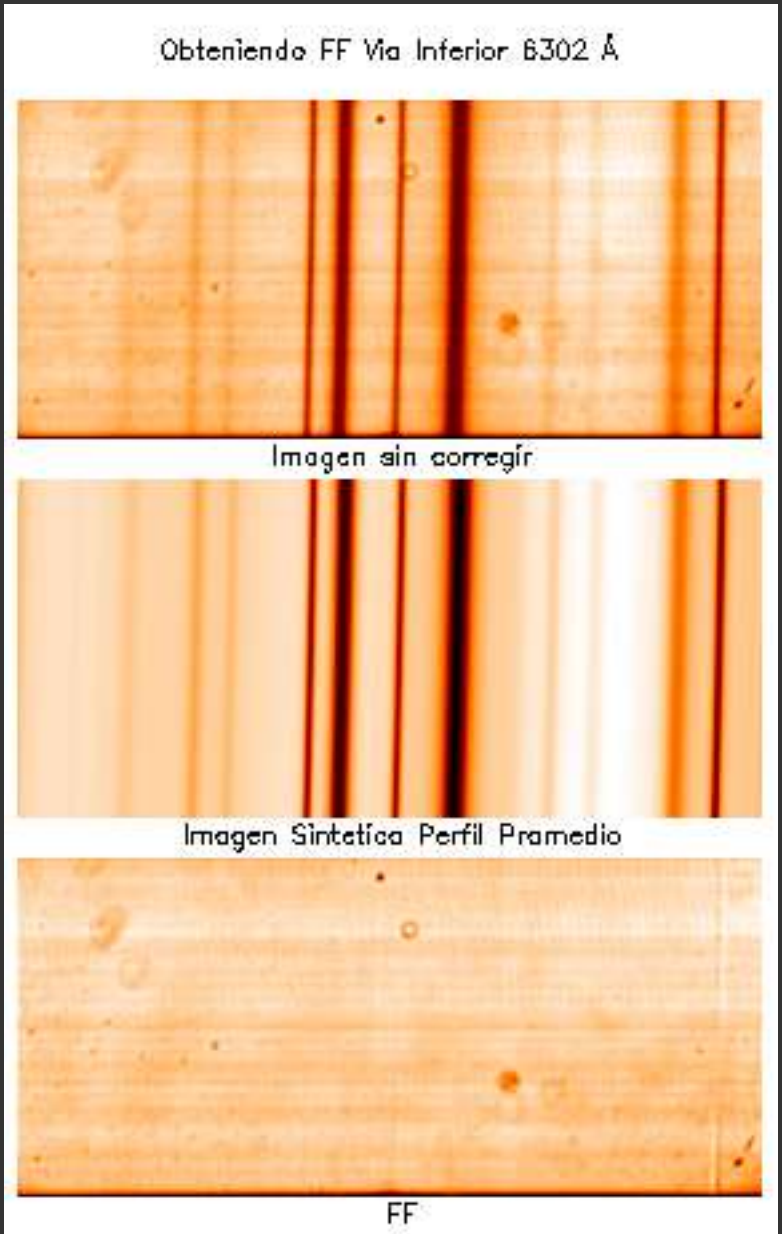
- It is NOT a scientist!! It does NOT Science.
- It is NOT perfect! I try to improve but it will not be perfect!

HOW DOES IT WORK?



THE FFs


Obteniendo FF Via Superior 6302 Å
Imagen sin corregir
Imagen Sintetica Perfil Promedio
FF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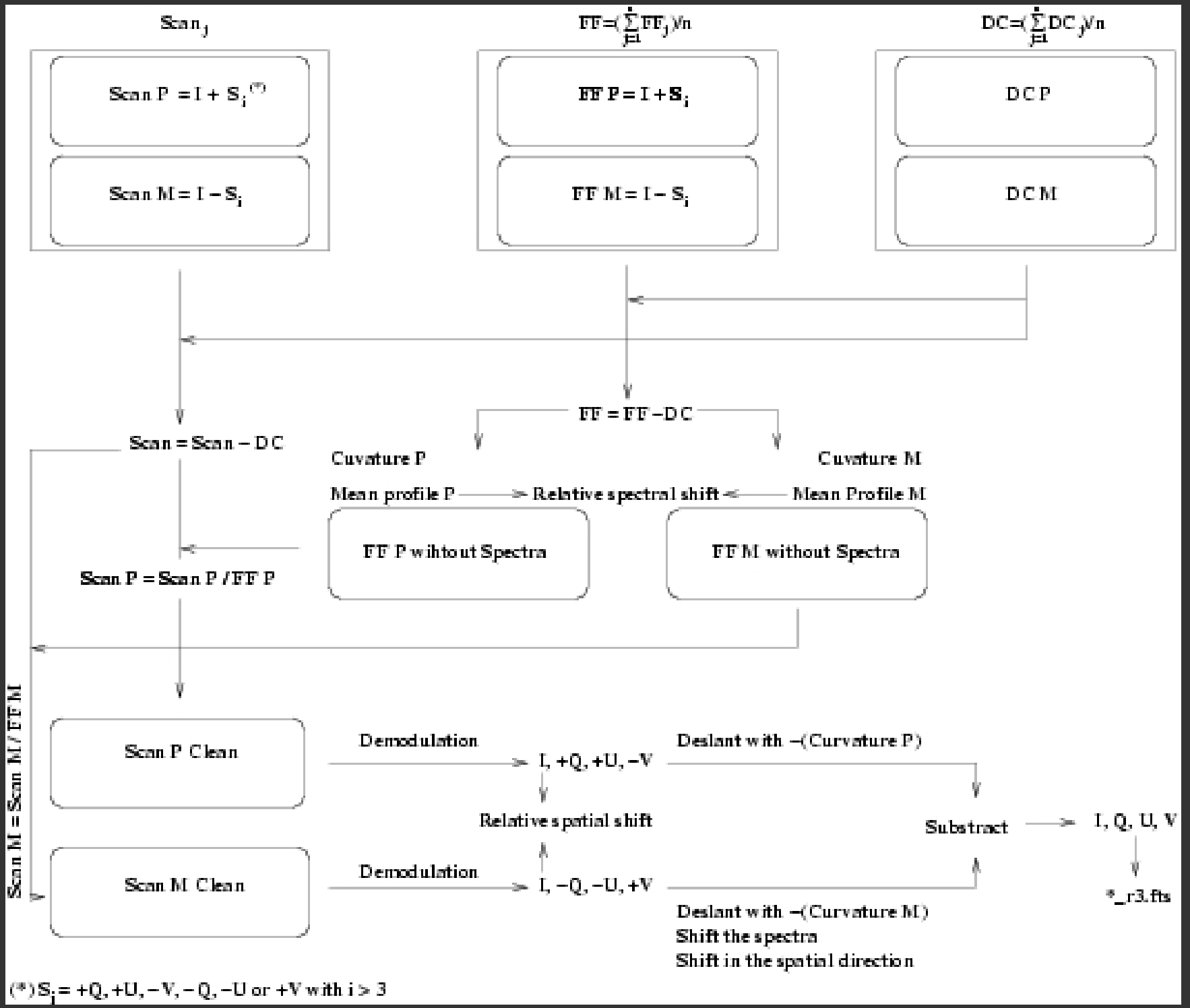


THE DEMODULATION PROBLEM

$$\underbrace{\begin{bmatrix} I \\ Q \\ U \\ V \end{bmatrix}_{in}}_{\mathbf{S}_{in}} = \underbrace{\begin{bmatrix} M_{11,1} & M_{12,1} & M_{13,1} & M_{14,1} \\ M_{11,2} & M_{12,2} & M_{13,2} & M_{14,2} \\ M_{11,3} & M_{12,3} & M_{13,3} & M_{14,3} \\ M_{11,4} & M_{12,4} & M_{13,4} & M_{14,4} \end{bmatrix}^{-1}}_{\mathbf{D}} \underbrace{\begin{bmatrix} \tilde{S}_1 \\ \tilde{S}_3 \\ \tilde{S}_3 \\ \tilde{S}_4 \end{bmatrix}}_{\tilde{\mathbf{S}}_{\mathbf{CCD}}}$$

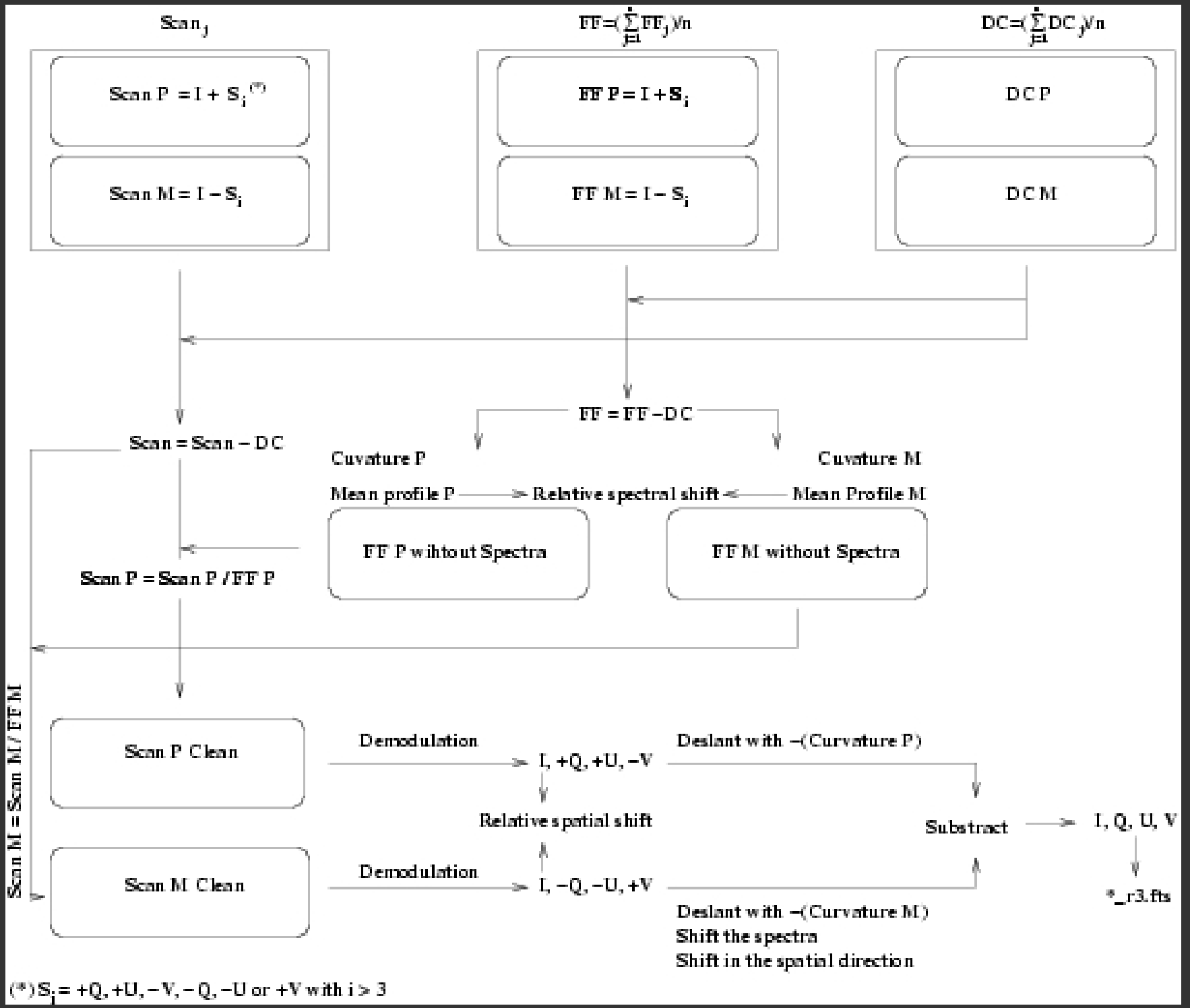
$$\mathbf{S} = \mathbf{D}\tilde{\mathbf{S}}$$

$$\mathbf{D}^{-1}\mathbf{S} = \tilde{\mathbf{S}}$$

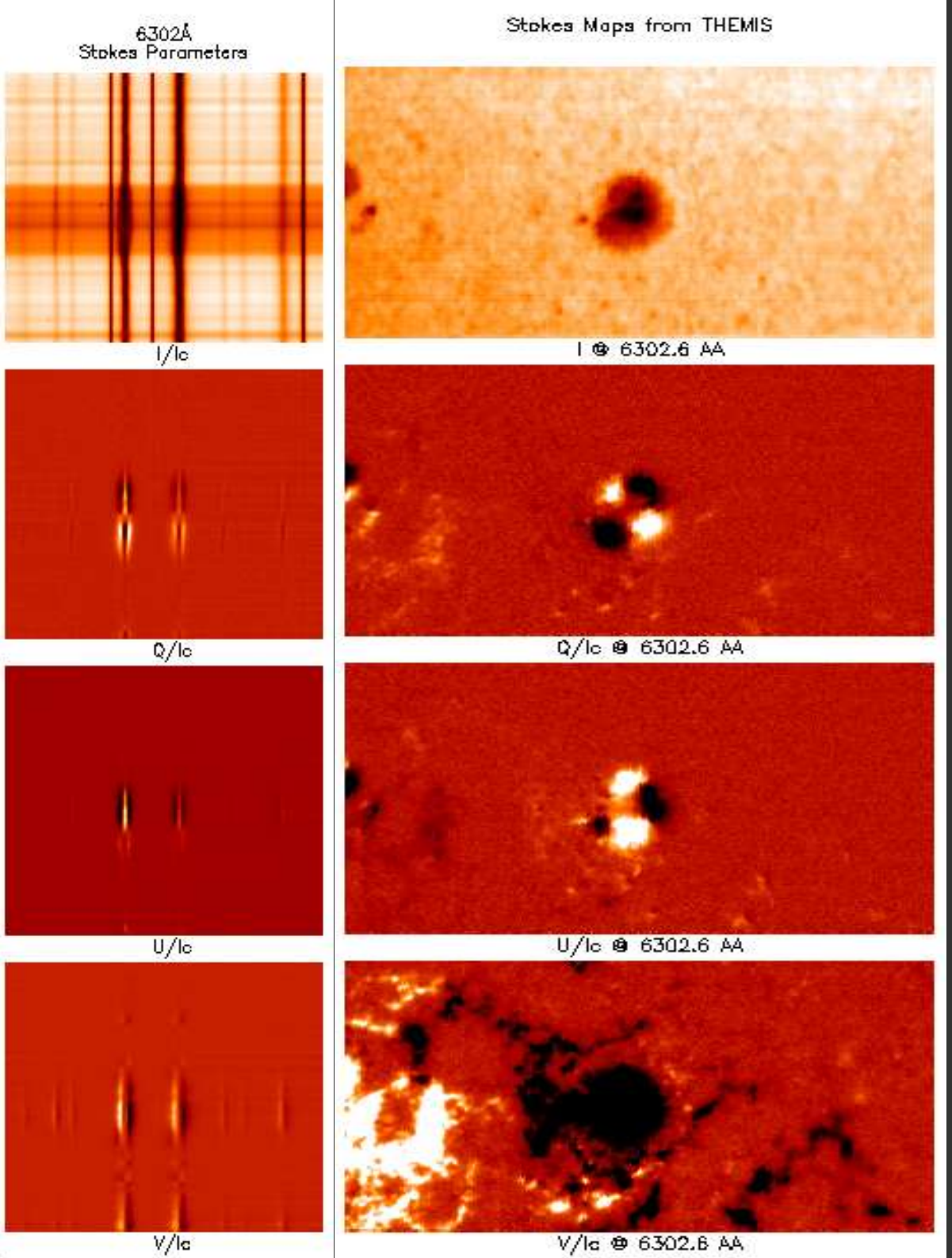
$$\mathbf{A}\mathbf{x} = \mathbf{B}$$

- Linear system determined (n=4) or overdetermined (n>4)
- It is solved by Singular Value Decomposition and 'back-substitution' method.

HOW DOES IT WORK?



THE STOKES PARAMETERS



INVERSION: PCA CODE

- PCA: Fast and stable
(Rees et al, 2001; Socas-Navarro et al, 2002; López Ariste & Casini, 2002, Casini et al, 2003)

- Limited to the Fe I 6301.5 and 6302.5 lines

- Milne-Eddington model atmosphere (linear source function, constant with height otherwise

- Main result: Vector magnetic field with filling factor

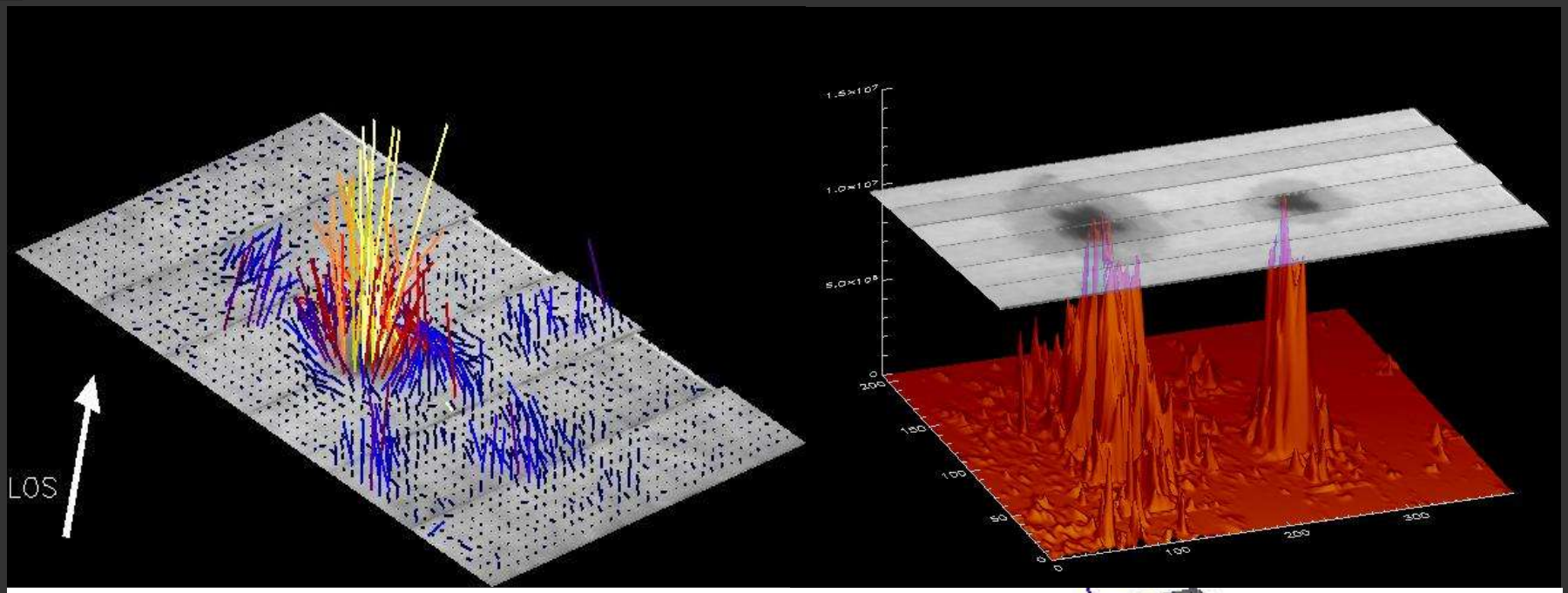
PCA implementation

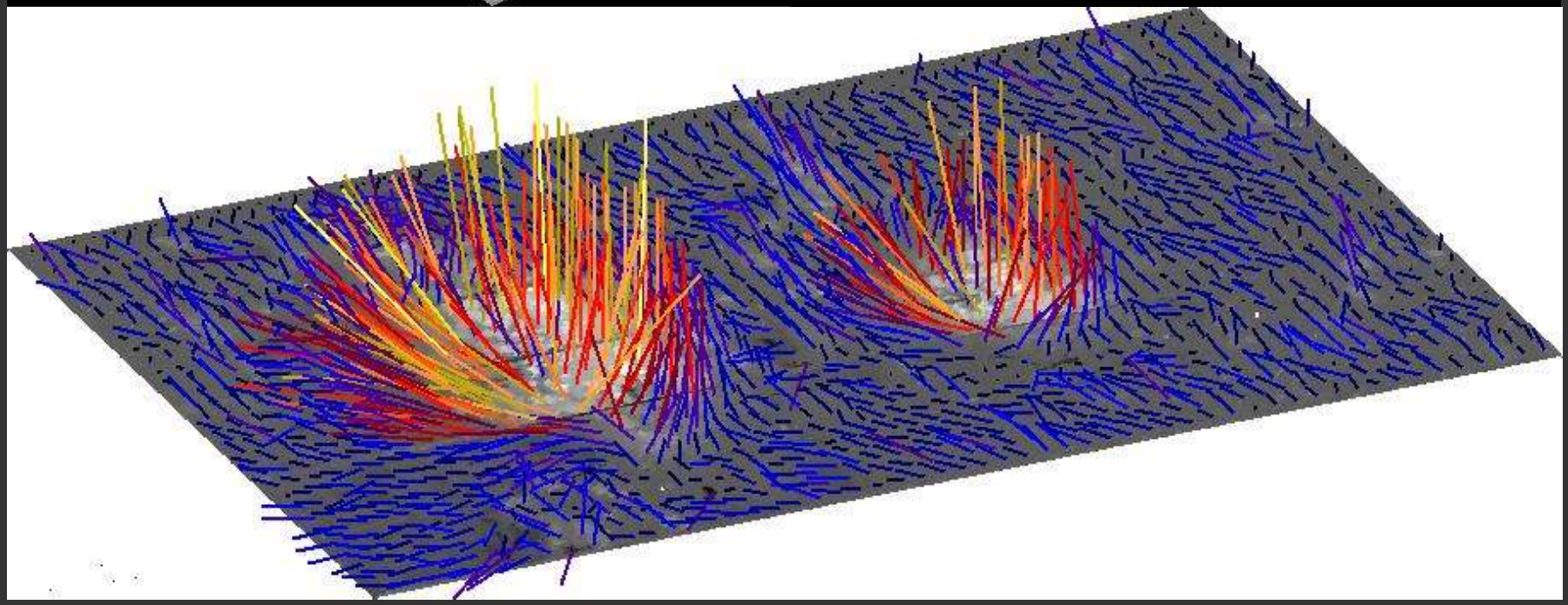
- The code uses as input the *_r3.fts files, output of the SQUV data reduction code.

- It produces as output a *_m3.fts file producing all the THEMIS observation keywords and a 2D image for each one of the model parameters plus its error bar.

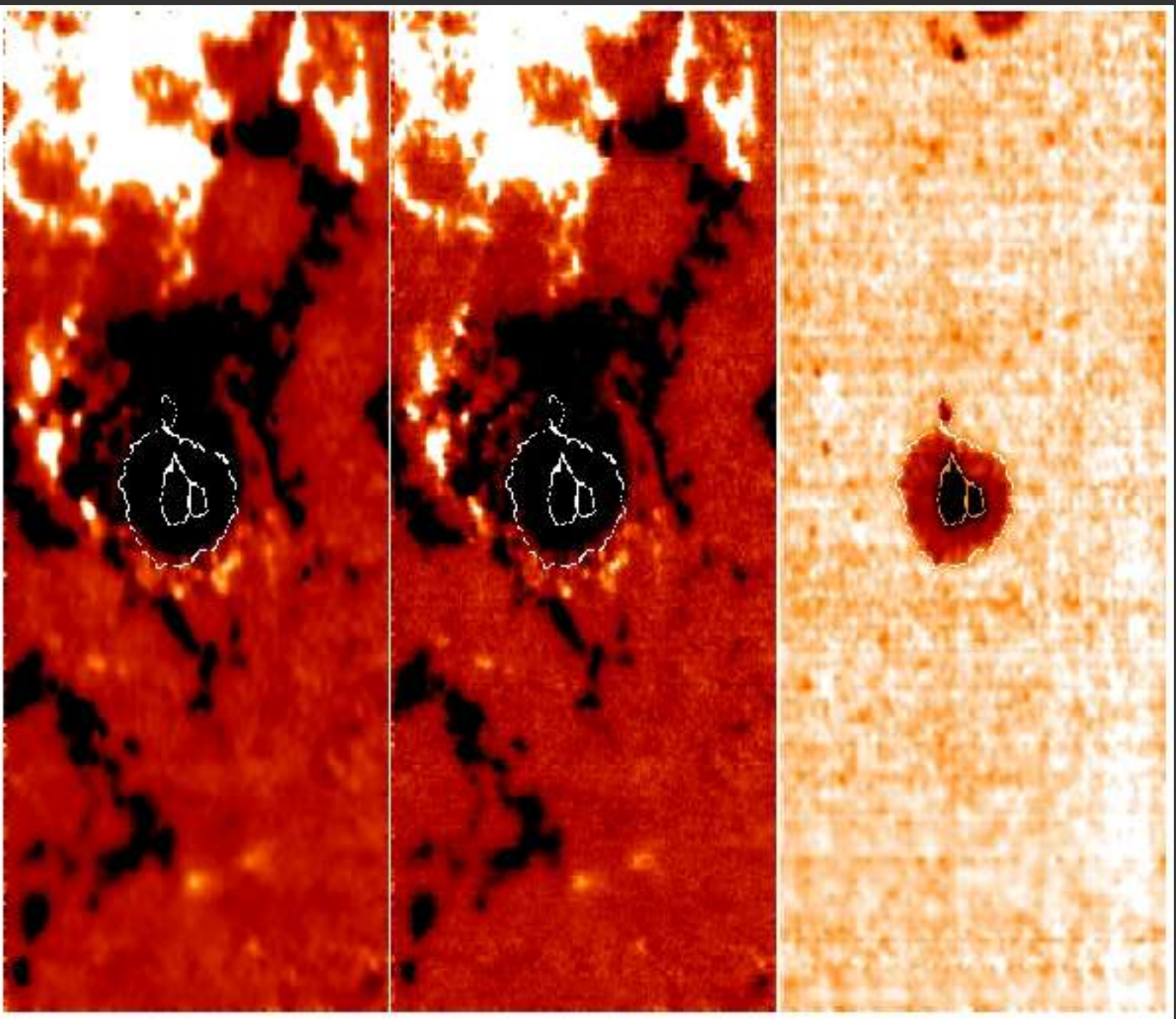
- The PCA database is unique and not open to user modification

EXAMPLES: August 2004 (ASD & ALA)





MORE EXAMPLES: Nov 2003 (VB)



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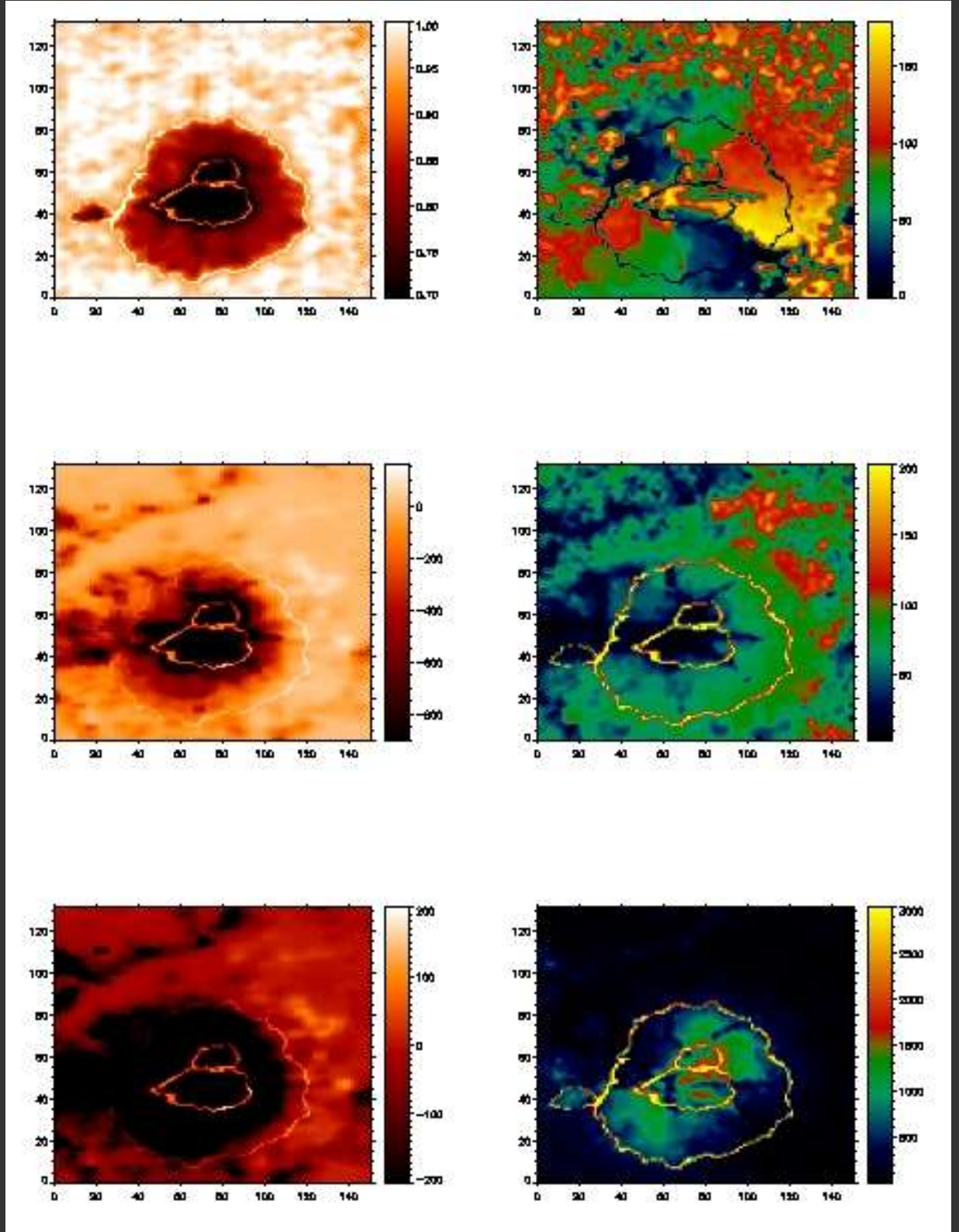

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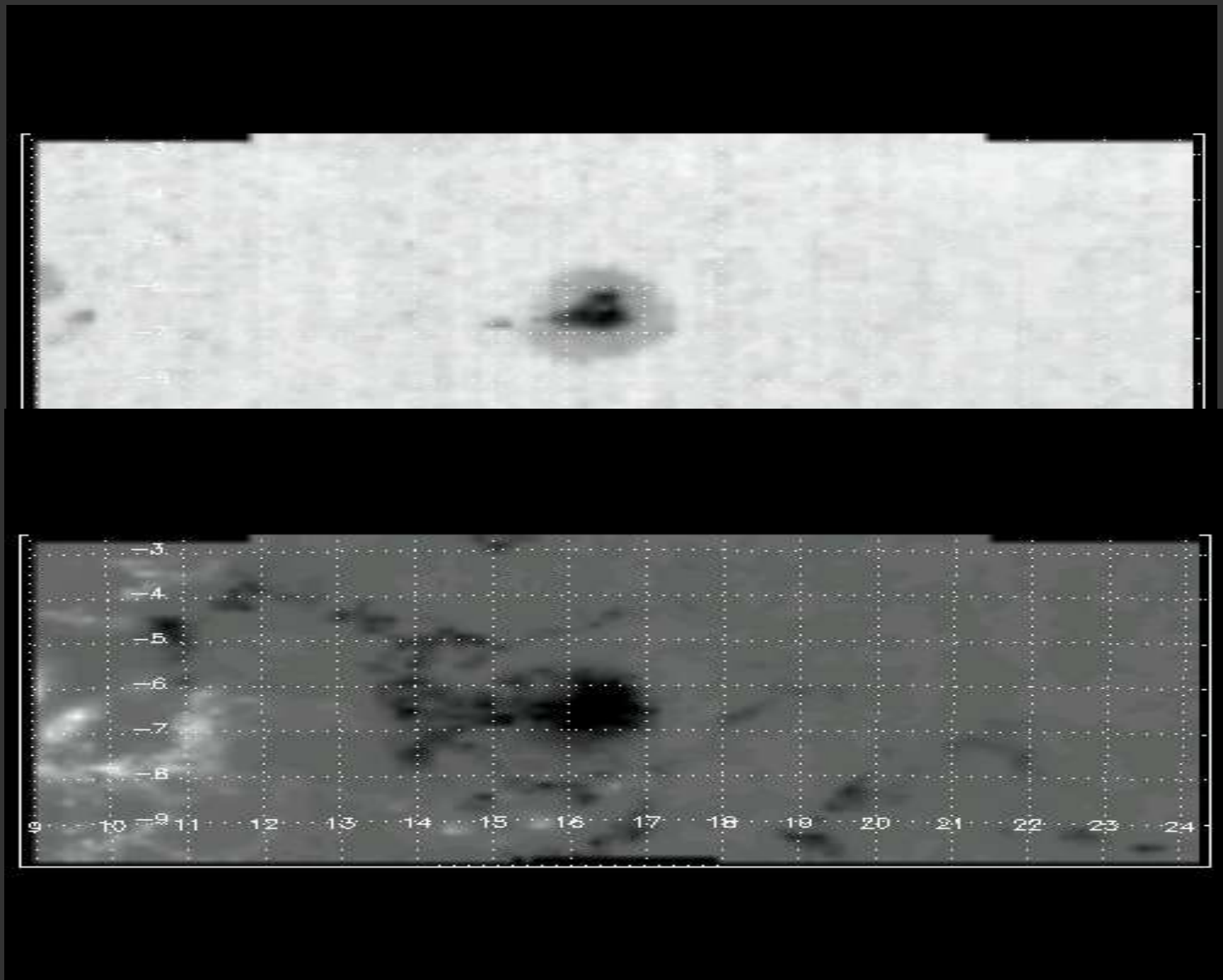

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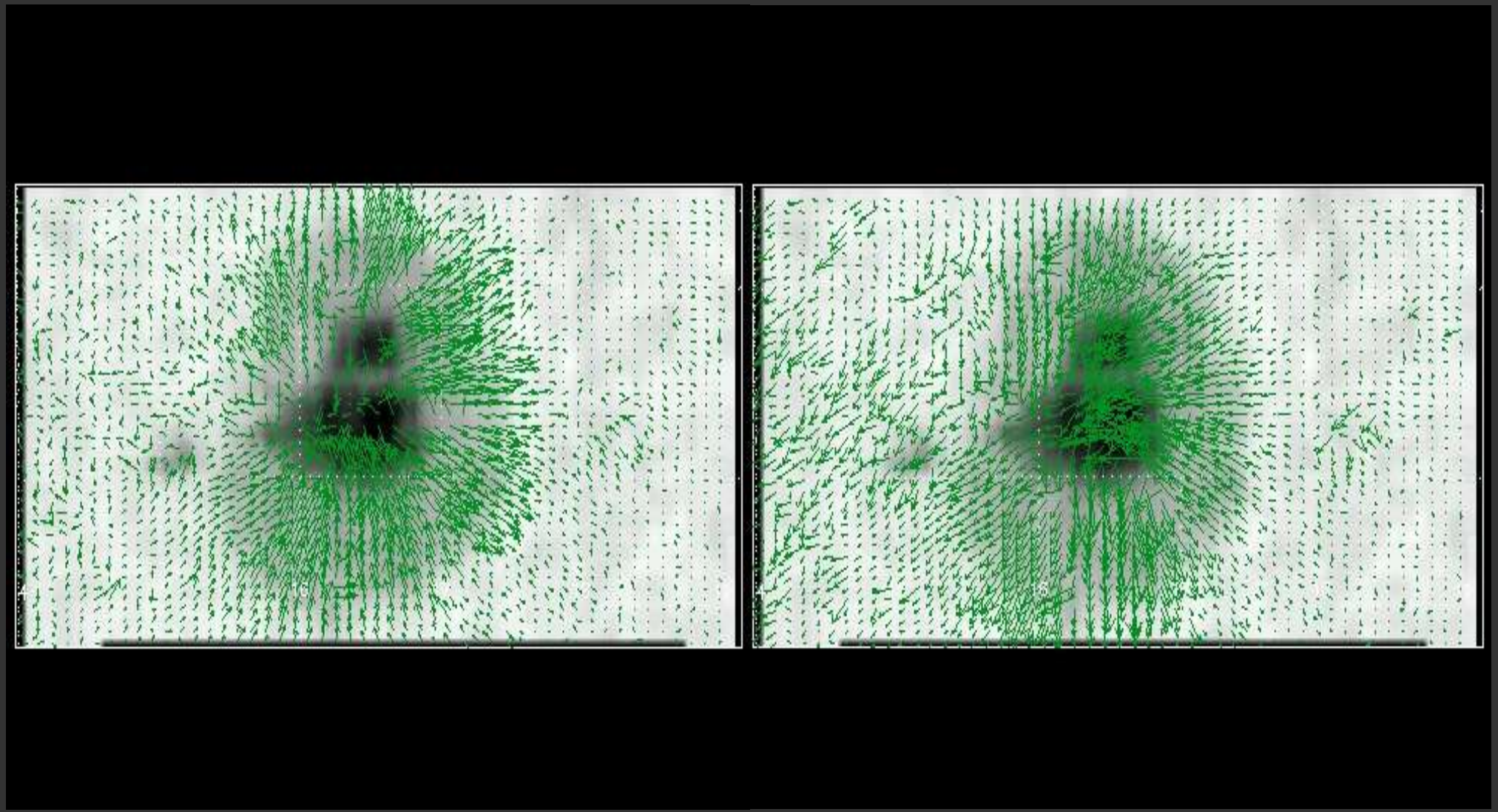

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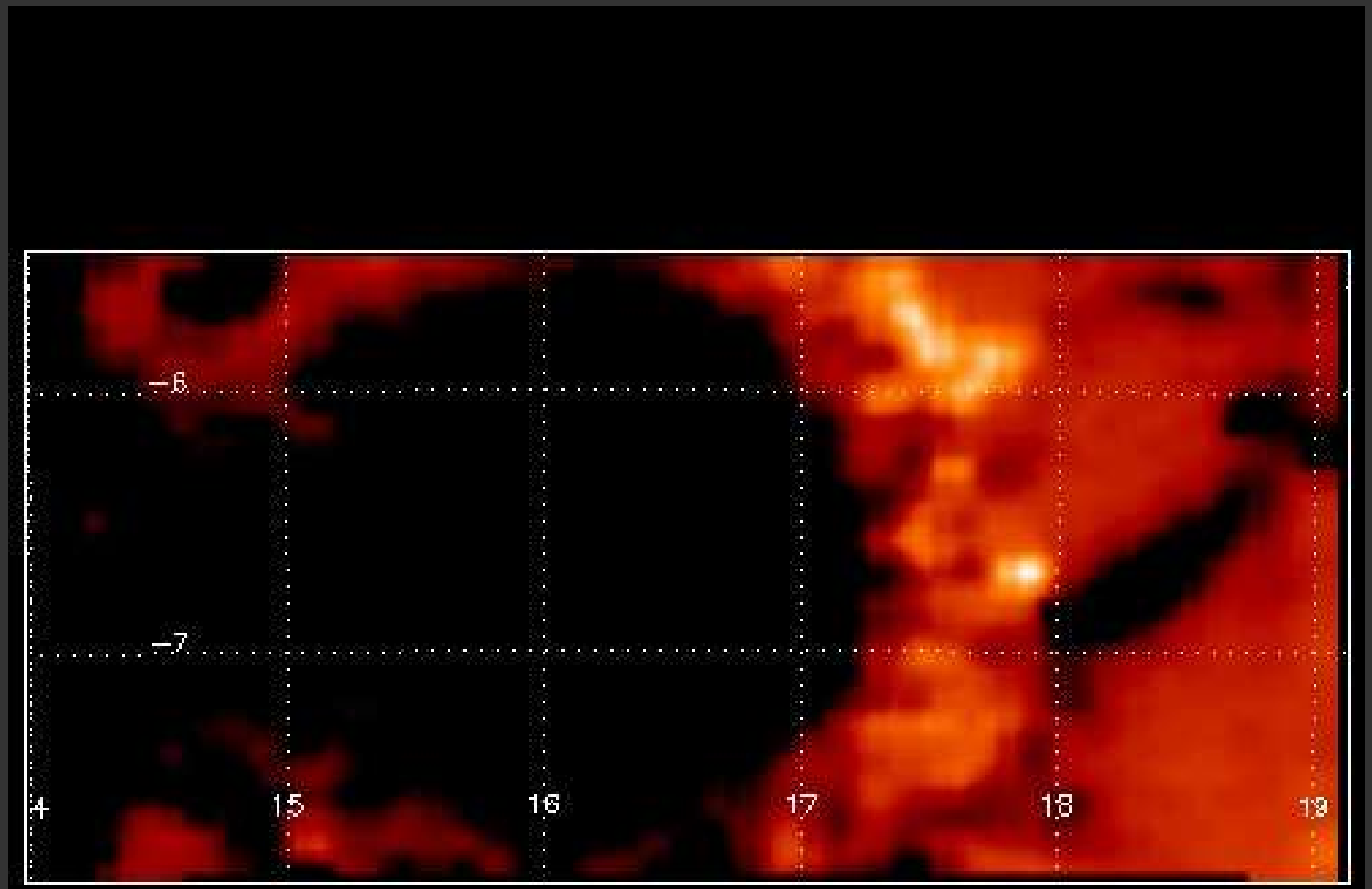

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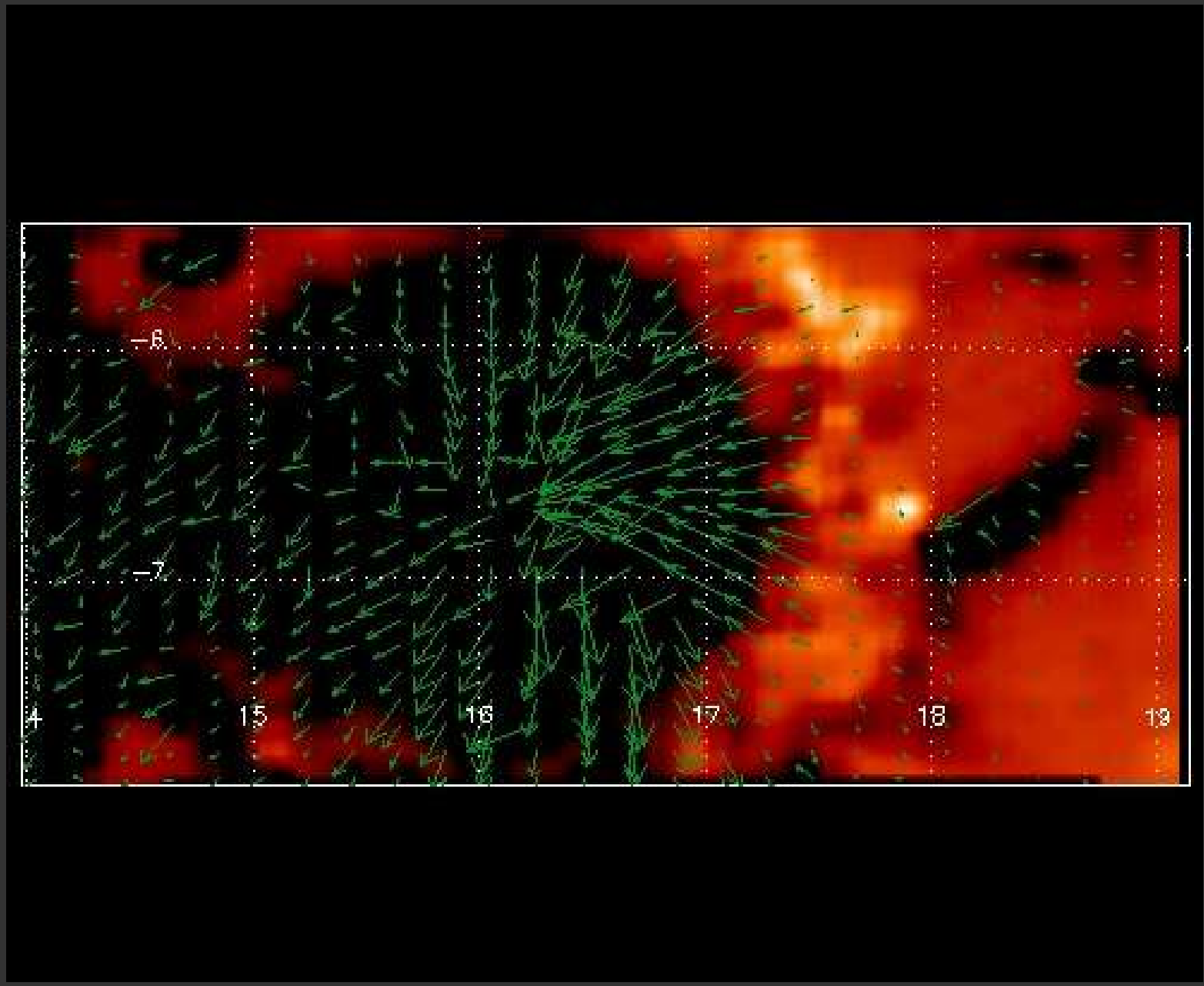
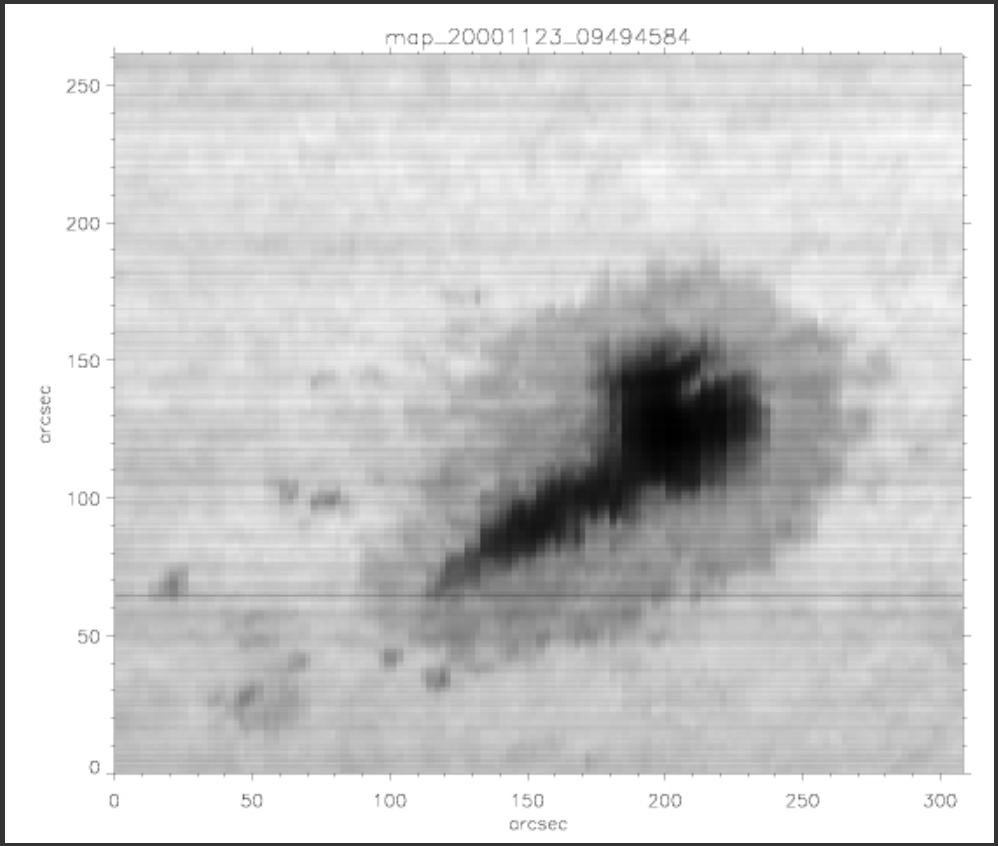
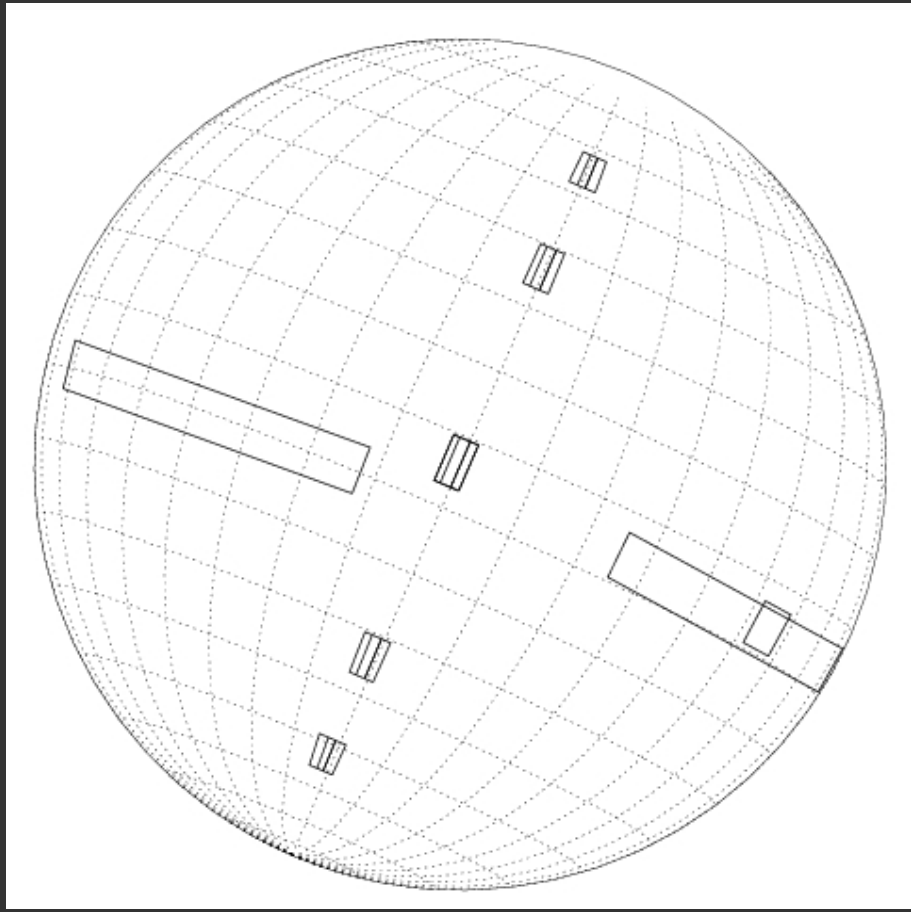


FUTURE...IS NOW

- Automatic reduction: select the files, click-on 'Start SQUV'...et voilà!!!
- SQUV & PCA are in THÈMIS acquisition chain.
- Don't worry! Be happy! THÈMIS works for you: SQUV target in IO. PCA for Fe I 6301.5 and 6302.5 Å.
- Maps of scans in several formats: .eps, .jpg, .fits & .sav.
- Maps of scans on the observation logs.

FUTURE...IS NOW

- How does the scan look? Nice!!!
- Where has the scan been done?...on the Sun, of course!