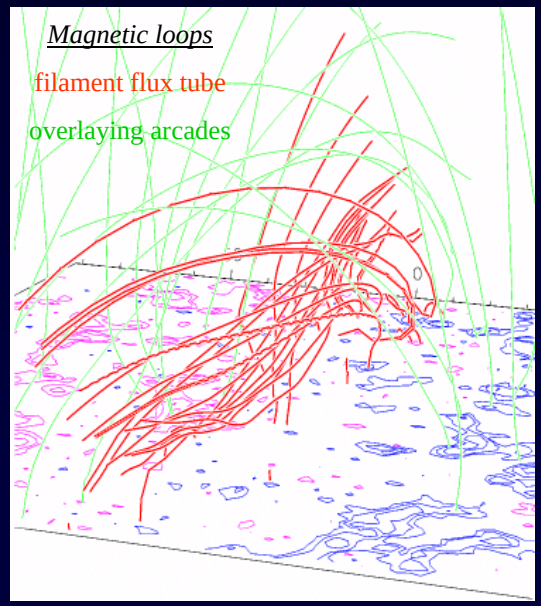
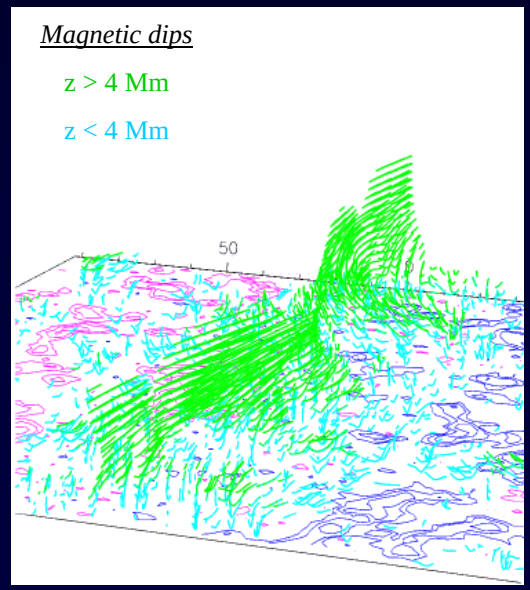
Observational evidence of photospheric magnetic dips in filament channels

B. Schmieder, G. Aulanier, Arturo López Ariste

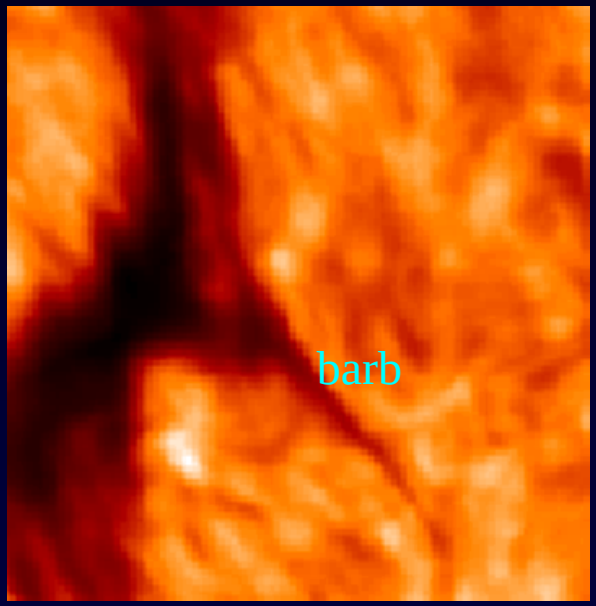




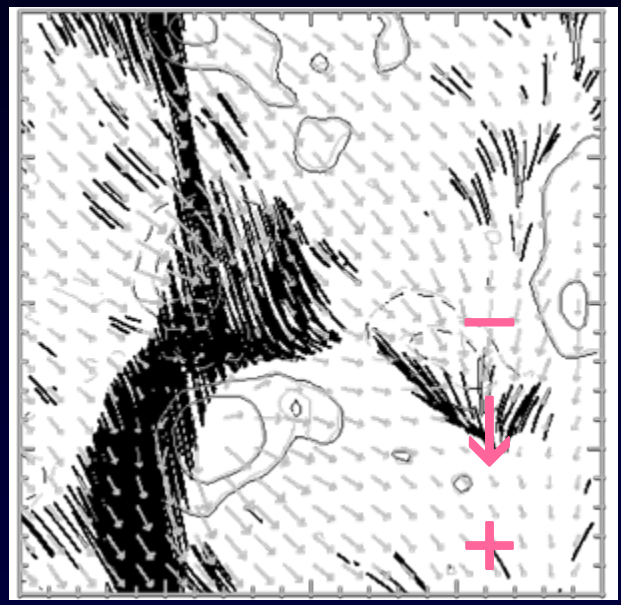
Adapted from Aulanier & Schmieder (2002)

Modeled dips

Adapted from
Aulanier et al. (1999)

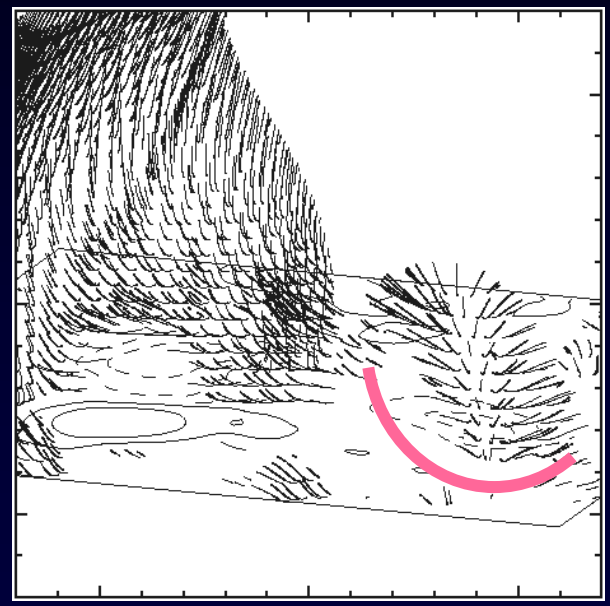


Hα filament



B_z (z=0) & Magnetic dips

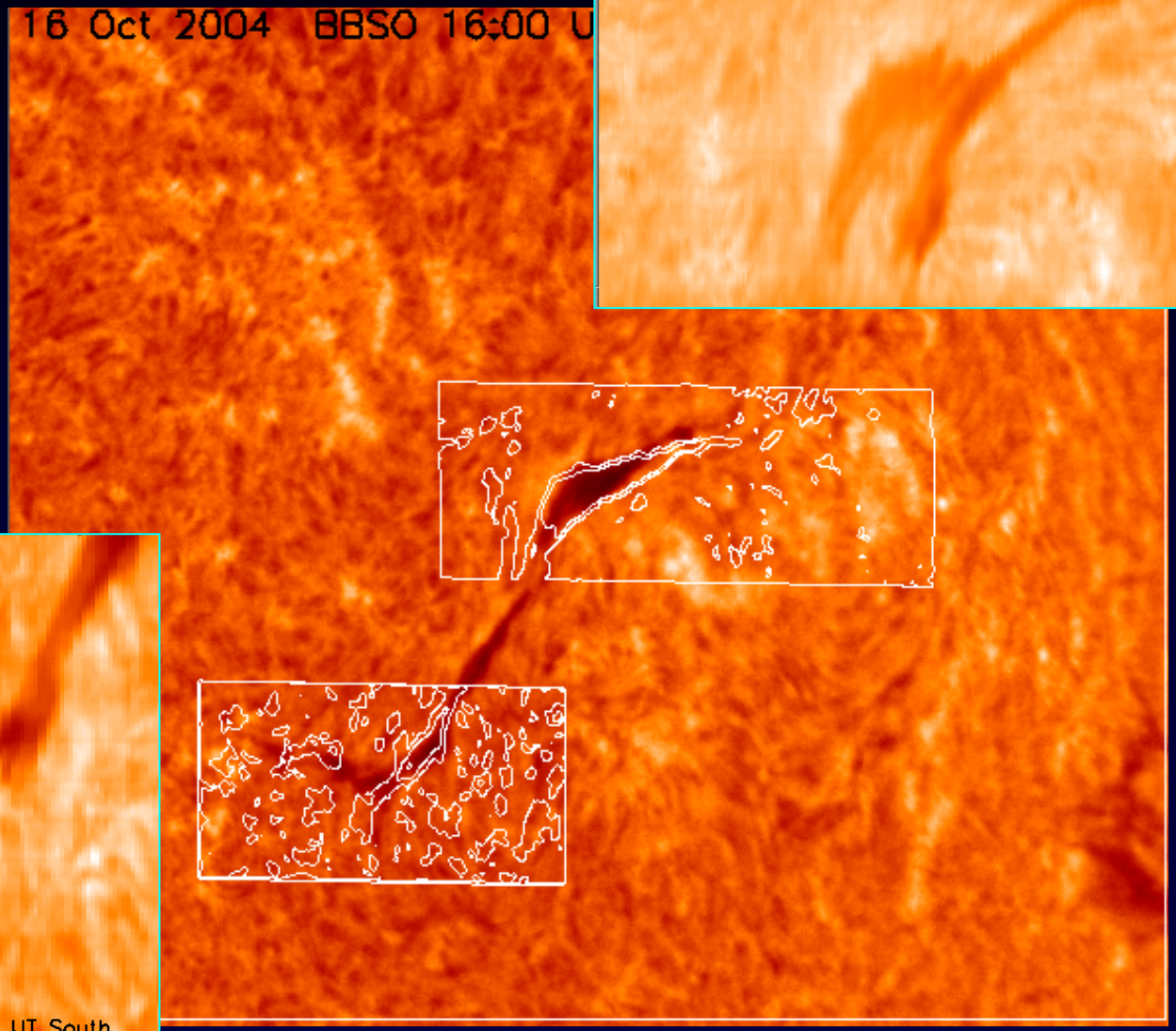
B_t (z=0)

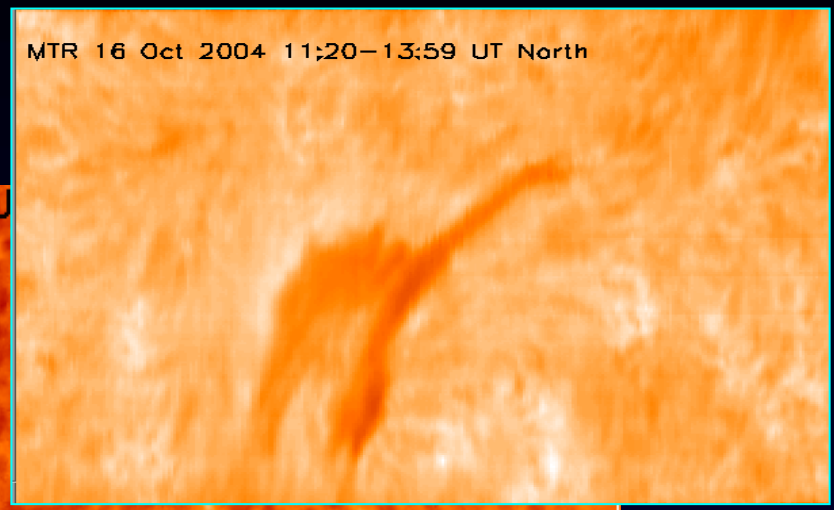


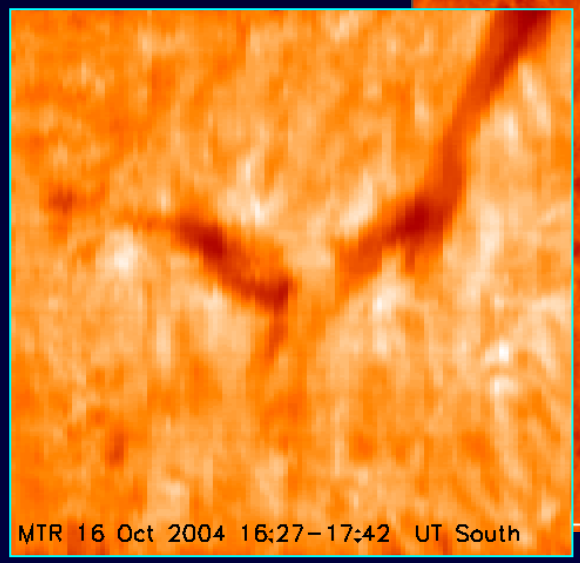
Dips
viewed in 3D

JOP 178 International campaign
16 October 2004

THEMIS







THEMIS Observations in the Multi lines mode

1. Simulaneously observations of the polarized profiles of Fe I doublet 6301-6302 A, Na I, Hα with beam exchange technique
2 . Data processing (flat field, dark current) → SQUV
3. Inversion code for the Fe I doublet with a PCA-based algorithm in a Milne-Eddington atmosphere using a grid of models →
B, Inc., Azi. with error bars in the LOS ref. frame
4. Change of the system of reference to local frame
5. The 180 ° ambiguity is not resolved, two solutions for incl. and azi.

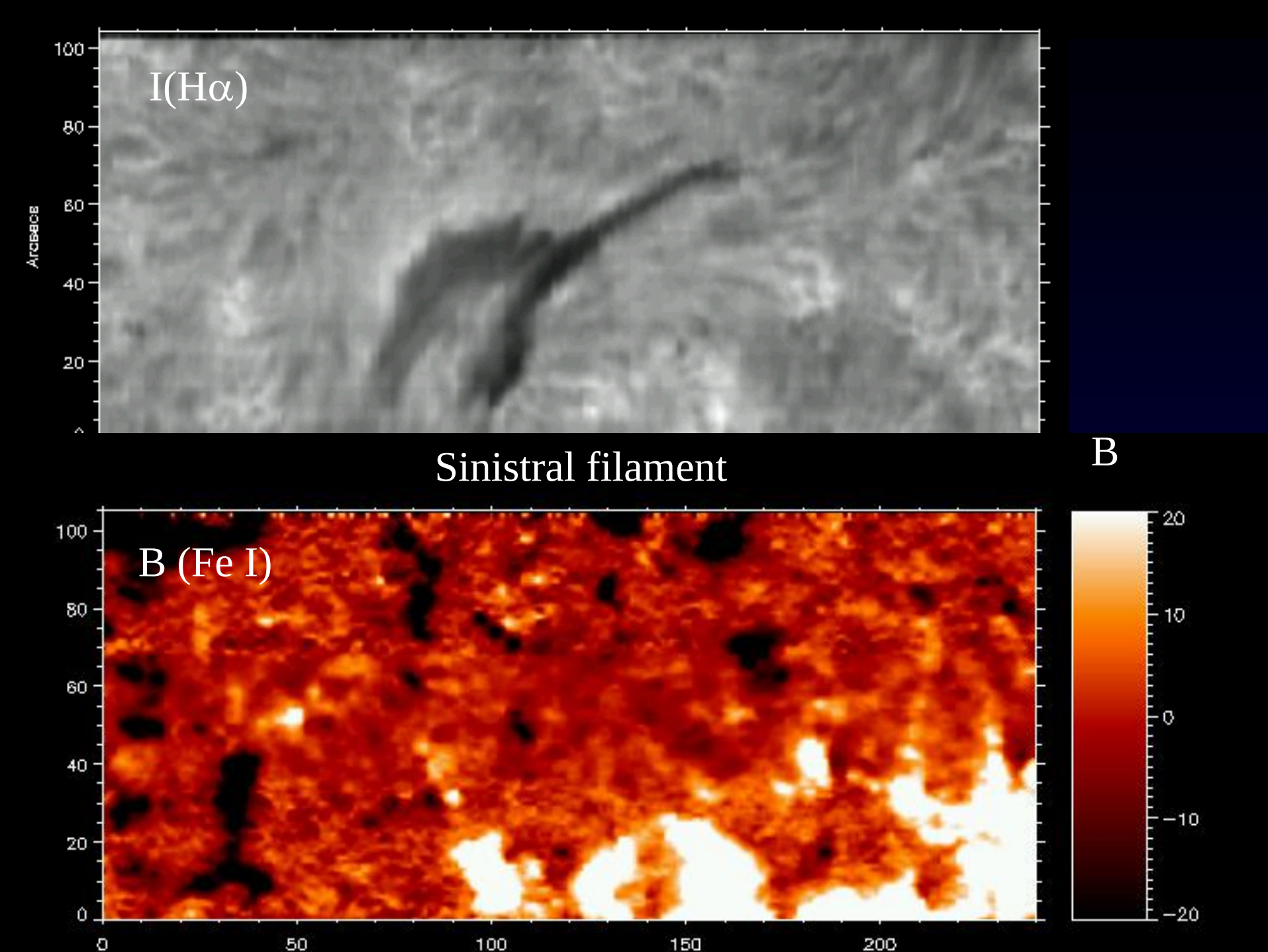
Criterion used for resolving the ambiguity : the chirality rules for filaments

SINISTRAL CASE

DEXTRAL CASE

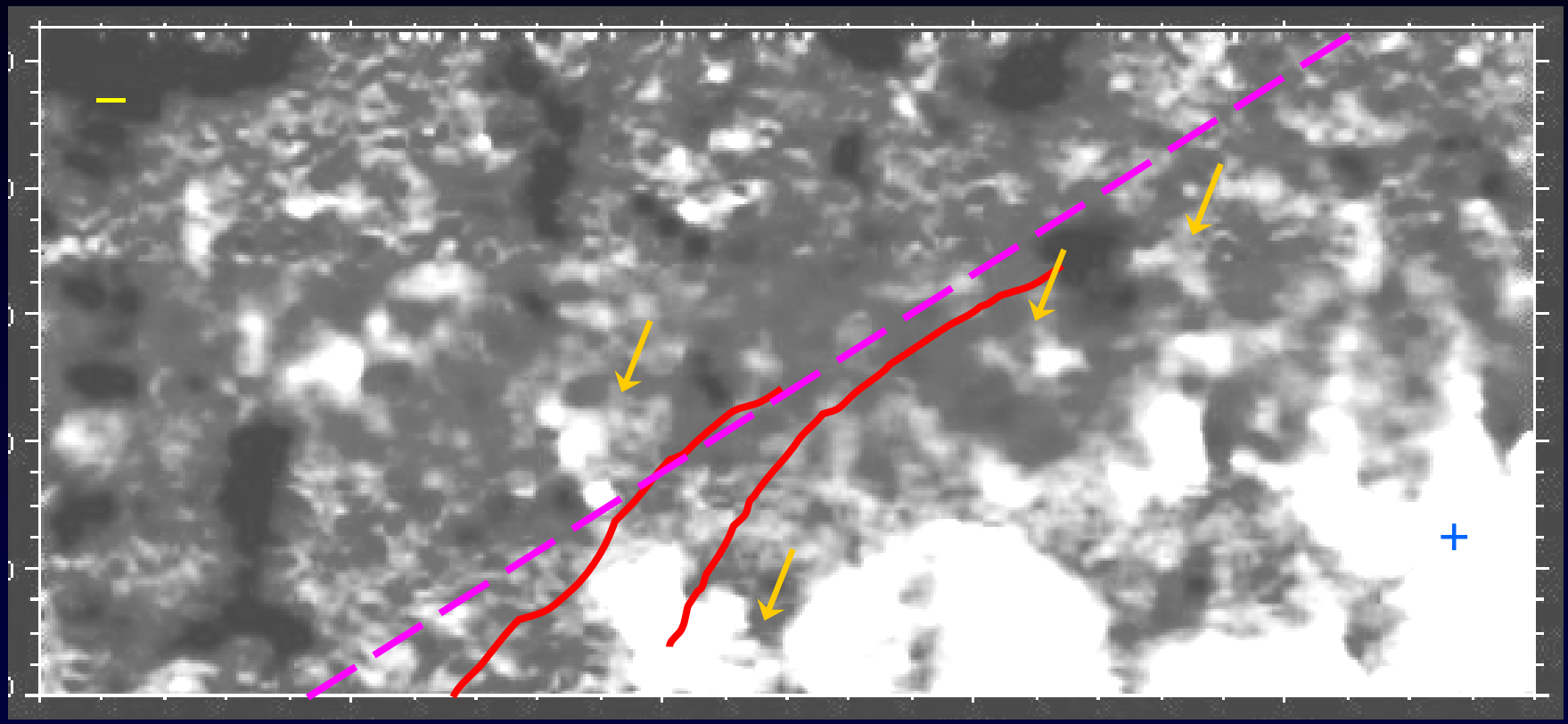
According to the directions of the fine structures and the feet (Halpha)

Filament


I(Hα)
Arcsecs
100
80
60
40
20
B
Sinistral filament
B (Fe I)
100
80
60
40
20
0
0
50
100
150
200
20
10
0
−10
−20

SINISTRAL CASE

B horizontal mean direction
if the chirality is sinistral

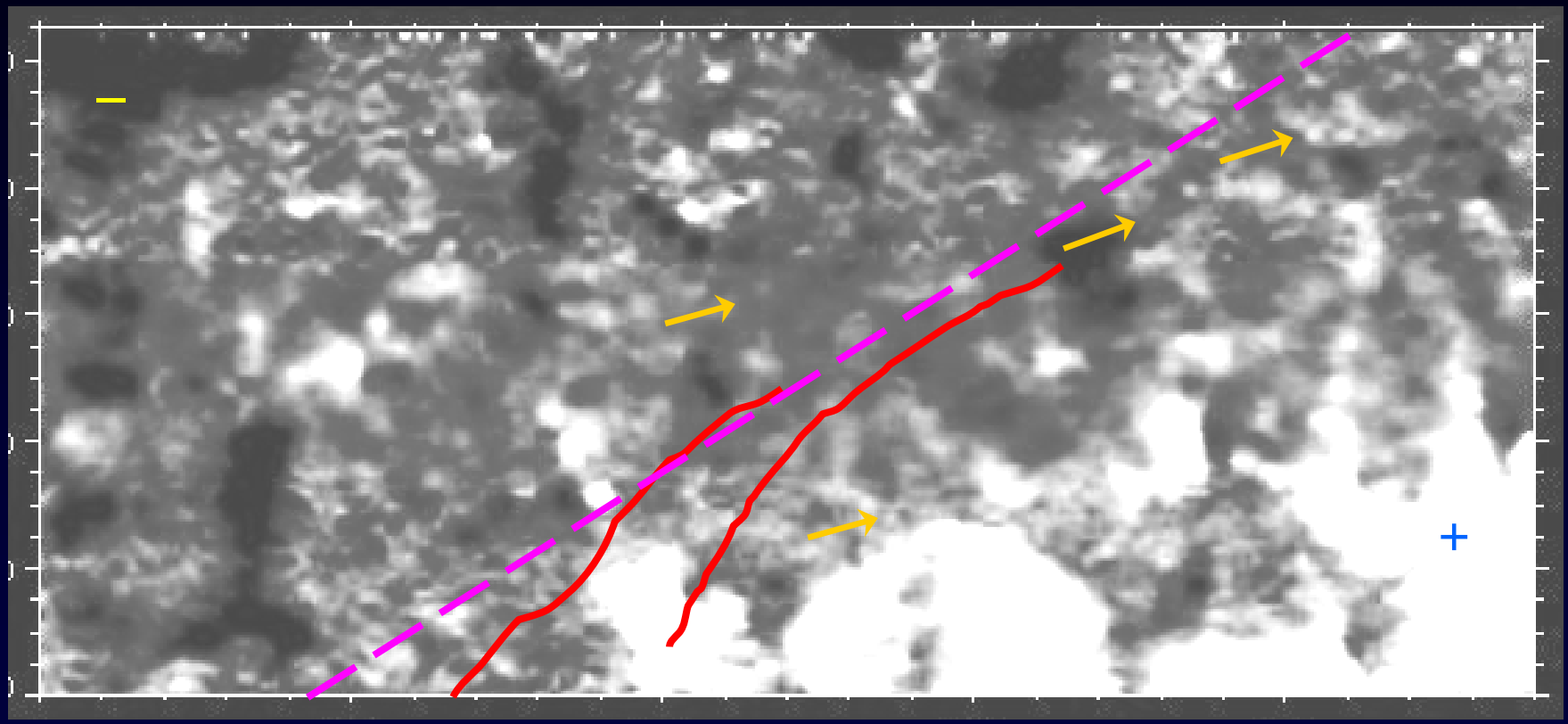


Filament axis

Photospheric inversion line (Bz)

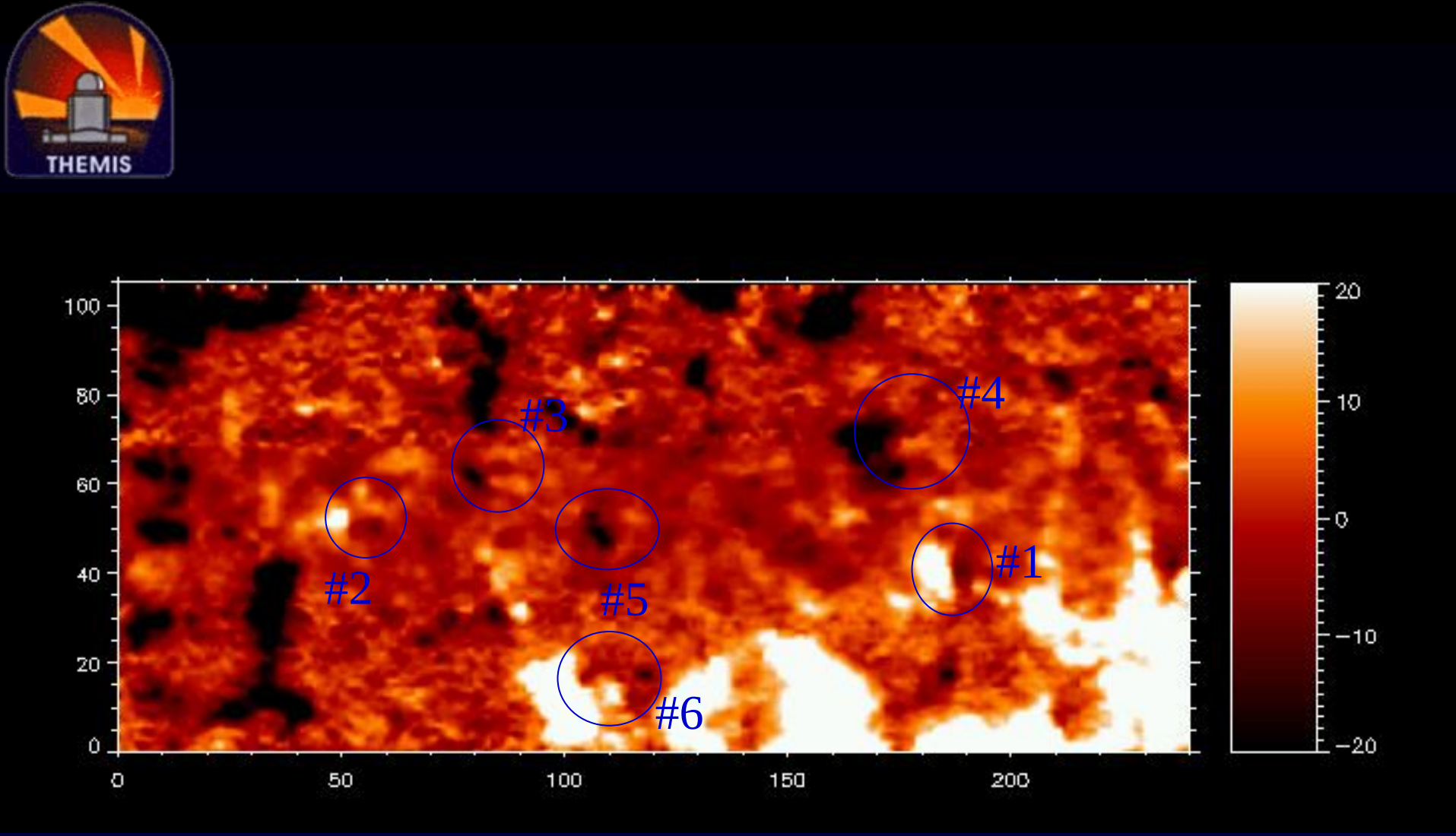
DEXTRAL CASE

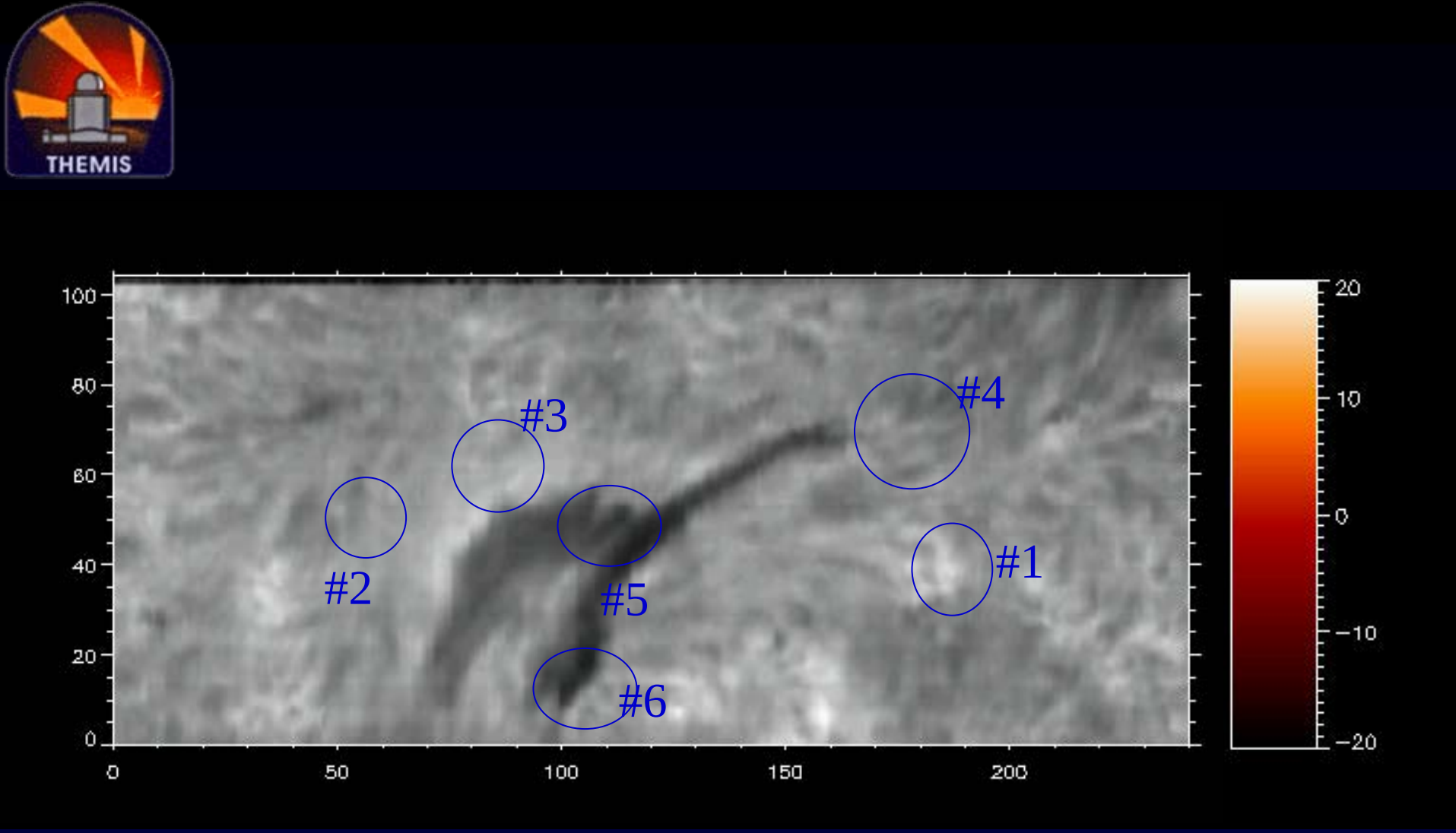
B horizontal mean direction
if the chirality is dextral



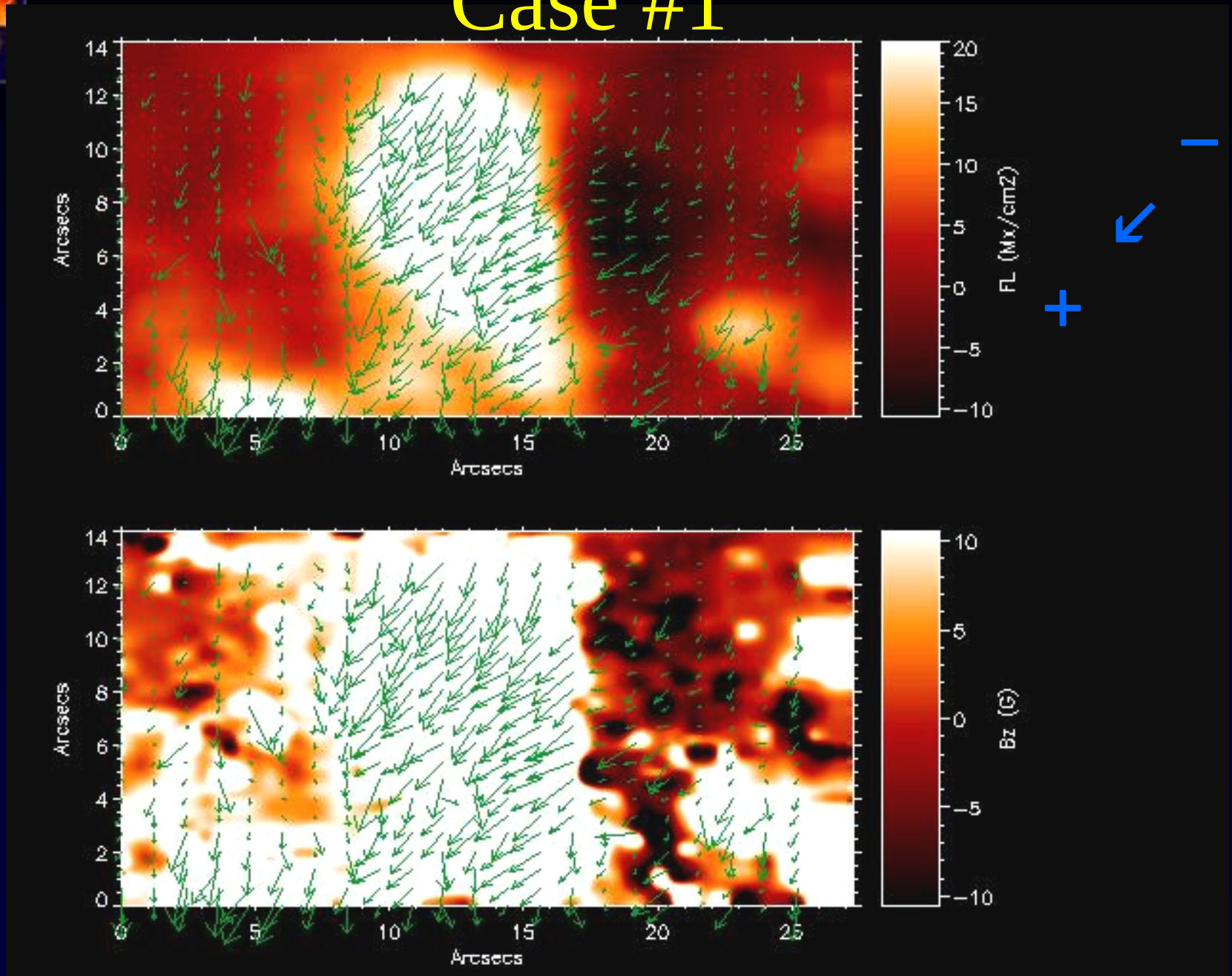
Filament axis

Photospheric inversion line (Bz)

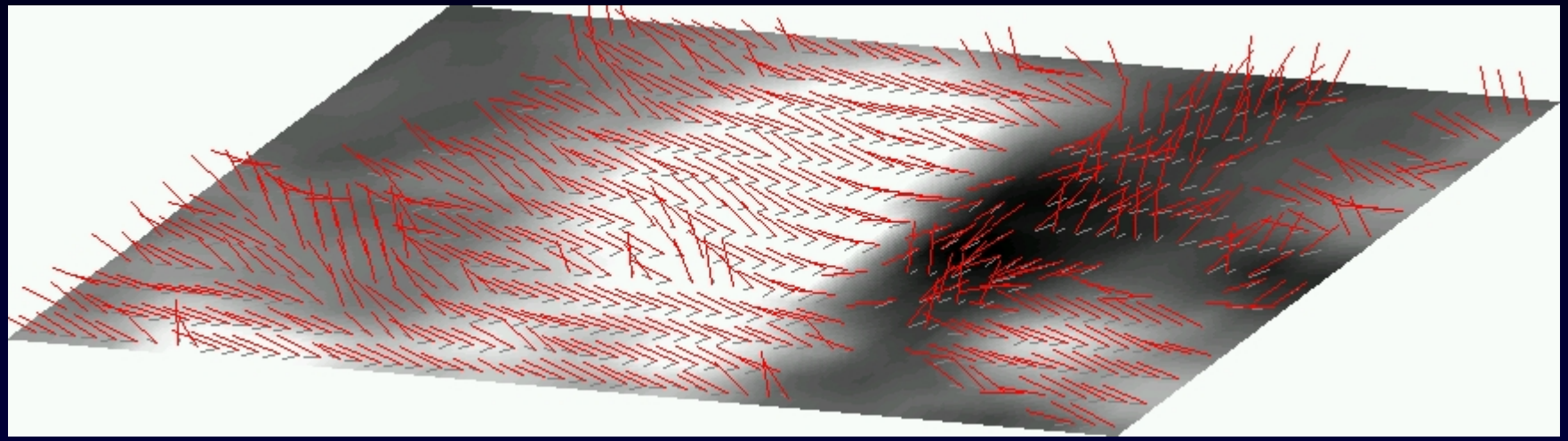

THEMIS
#1
#2
#3
#4
#5
#6
100
80
60
40
20
0
0
50
100
150
200
20
10
0
−10
−20


THEMIS
100
80
60
40
20
0
0
50
100
150
200
20
10
0
−10
−20
#1
#2
#3
#4
#5
#6

Case #1

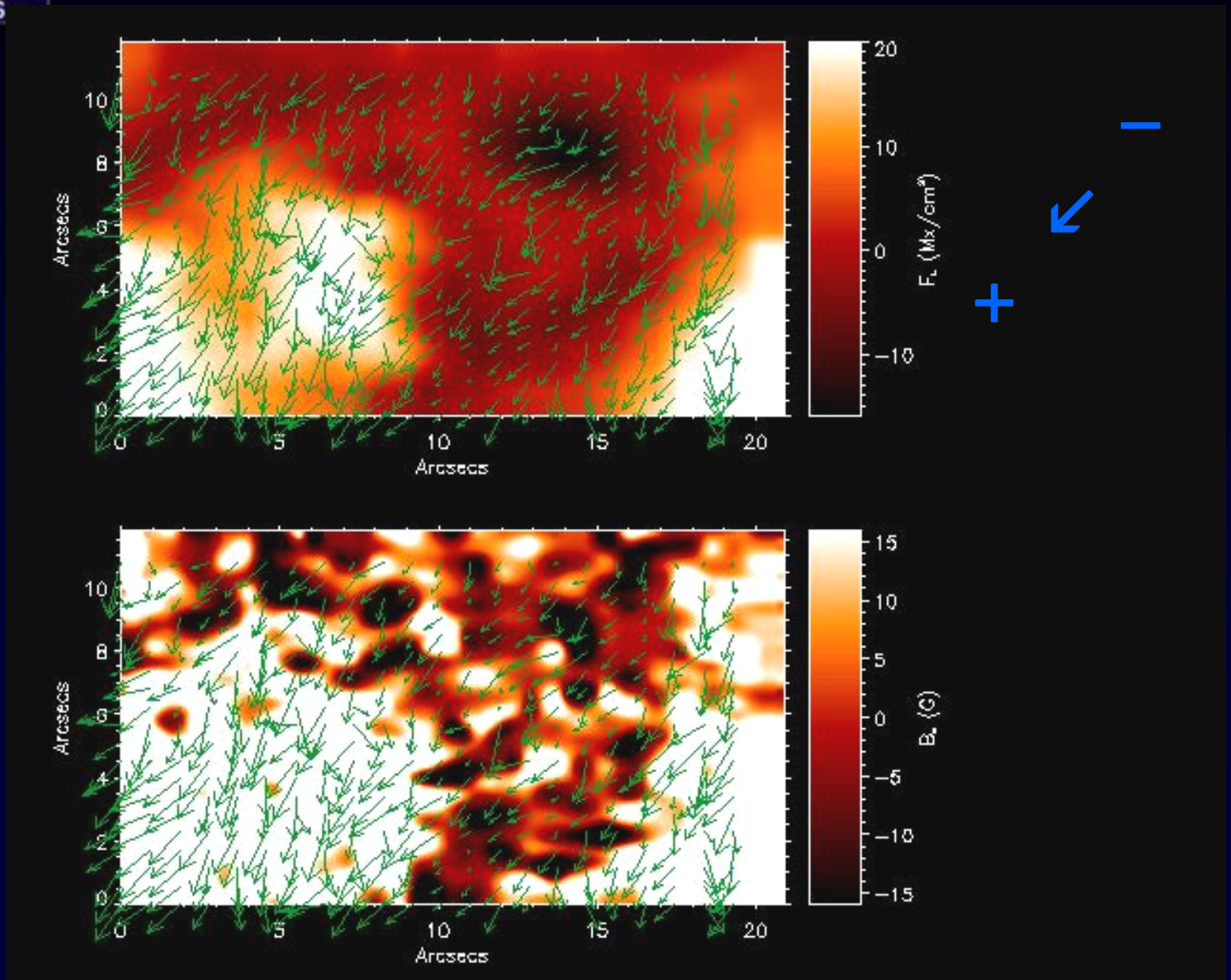


Case #1 3D view

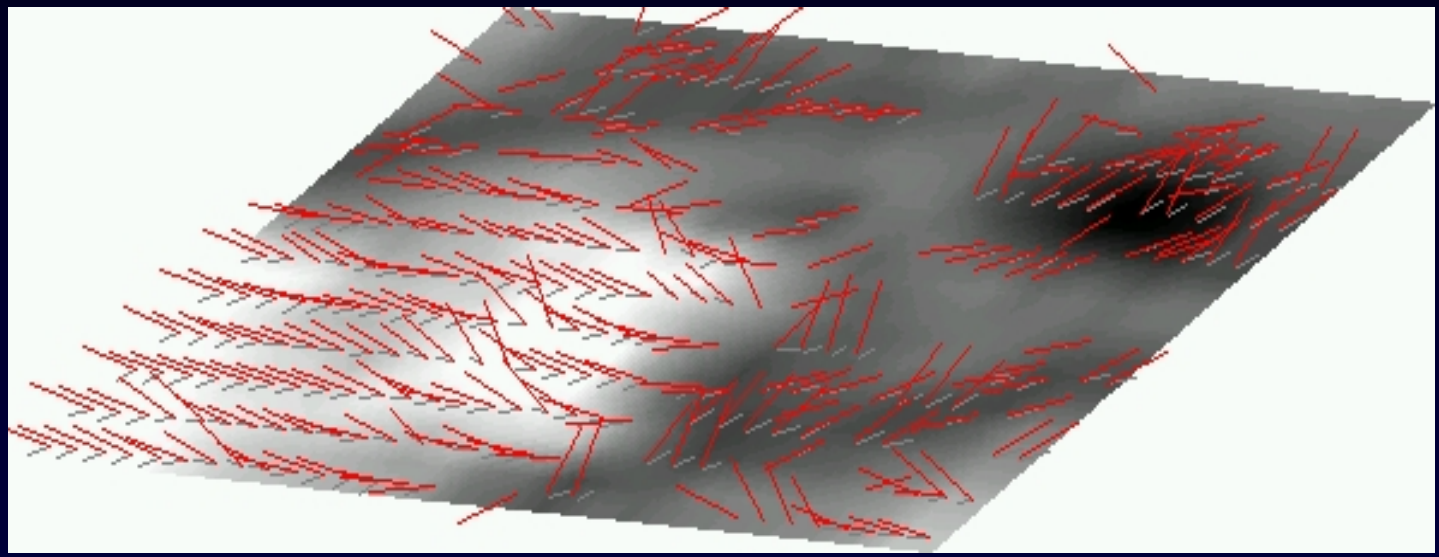


In the filament channel : horizontal dip

Case # 6


Arcsecs
Arcsecs
F_L (Mx/cm^2)
20
10
0
−10
B_z (G)
15
10
5
0
−5
−10
−15
0
2
4
6
8
10
0
5
10
15
20
−
+

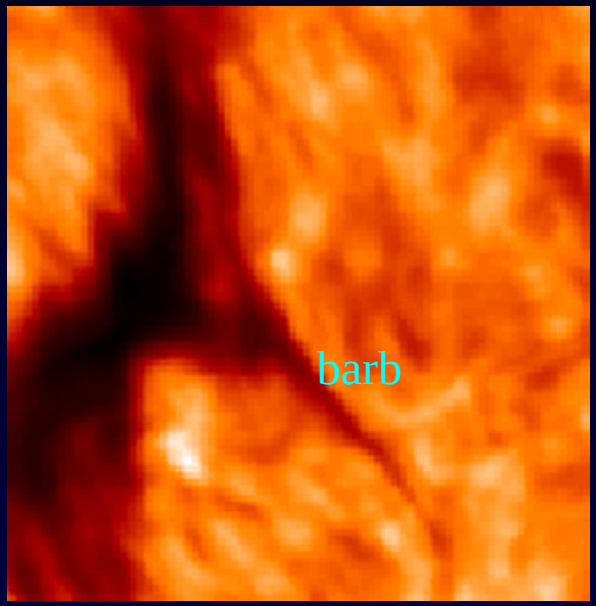
Case #6 3D view



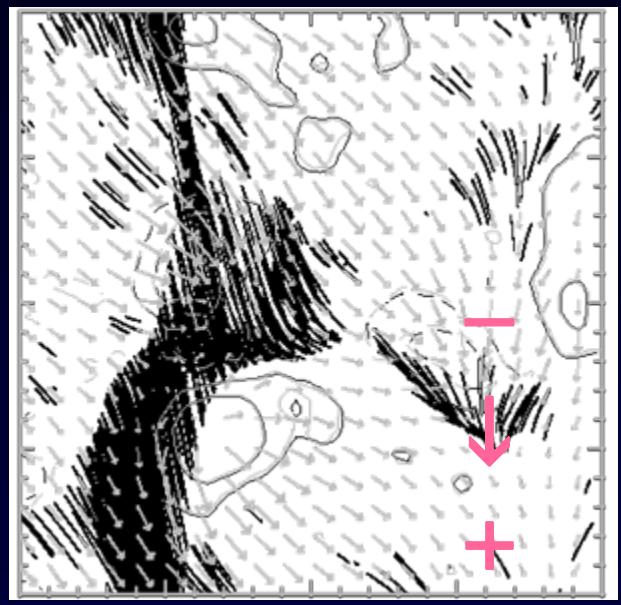
In the filament barb : horizontal dip

Modeled dips ...

Adapted from
Aulanier et al. (1999)

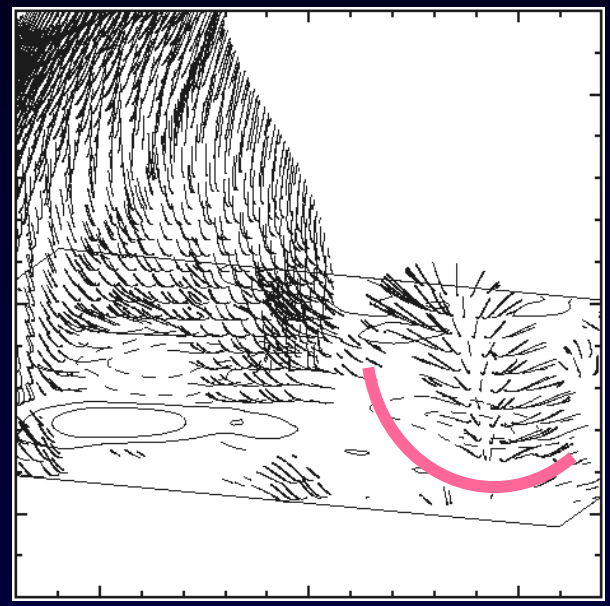


Hα filament



B_z (z=0) & Magnetic dips

B_t (z=0)

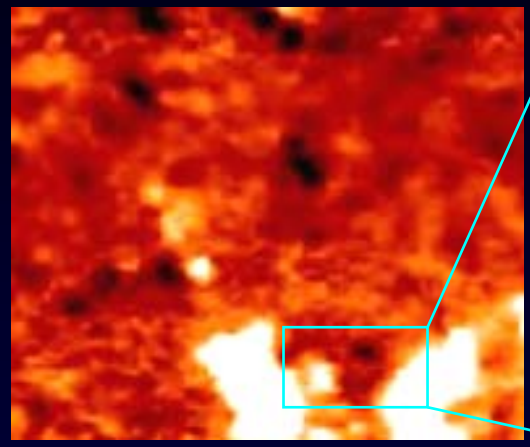


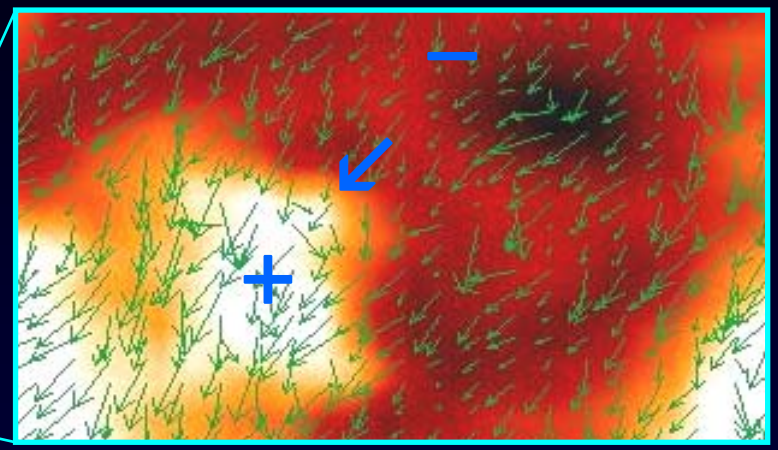
Dips
viewed in 3D

... and THEMIS dips

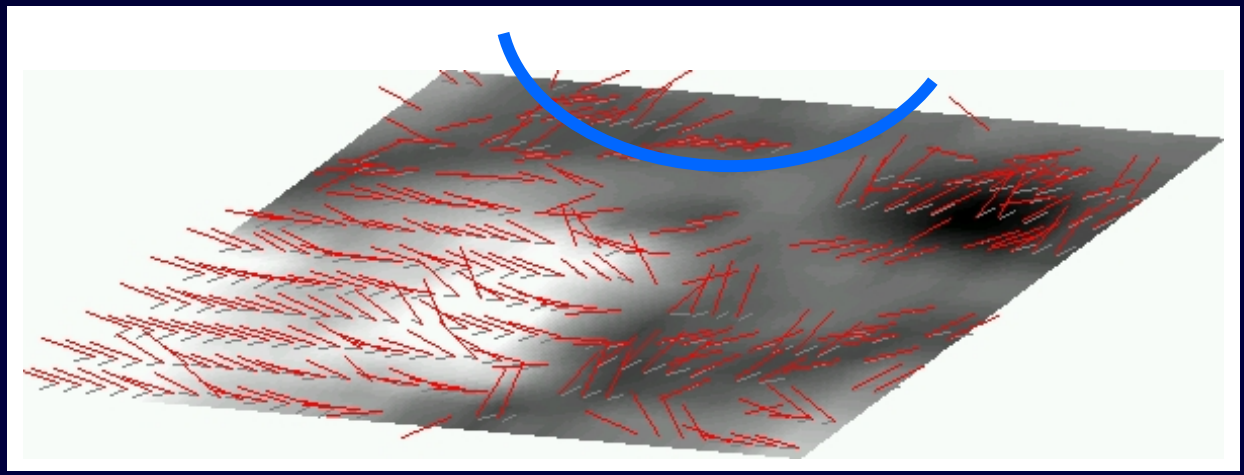
Lopez Ariste et al. (in preparation)

Hα filament





B_z & B_t (z=0)



Dip
viewed in 3D

Conclusion

THEMIS/MTR observes simultaneously in multi lines:
Hα, Fe 6302 and 6301, Na D1

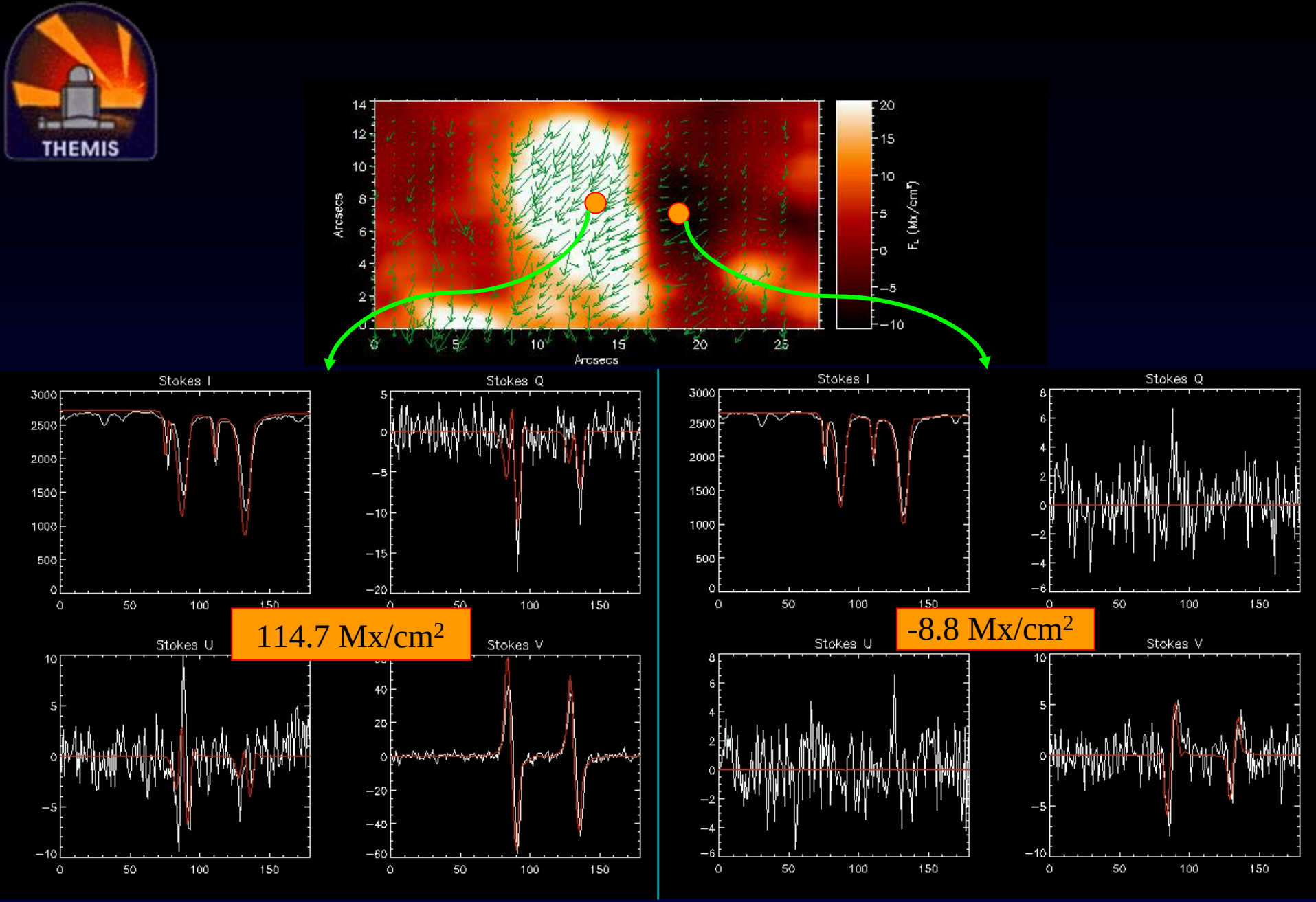
High sensitivity of the magnetic flux: ~10 Mx/cm^2

Magnetic field vector tangential to the photosphere

Photospheric dips = « bald patches » observed

in filament channels

consistent with model of Aulanier & Démoulin (1998)


THEMIS
Arcsecs
Arcsecs
FL (Mx/cm²)
Stokes I
Stokes Q
Stokes U
Stokes V
114.7 Mx/cm²
Stokes I
Stokes Q
Stokes U
Stokes V
-8.8 Mx/cm²

Inversion errors (case #1)