Rosseland Centre for Solar Physics

Detection of Ellerman bombs in SST observations

Rebecca Nguyen

Rosseland Centre for Solar Physics, Institute of Theoretical Astrophysics, University of Oslo

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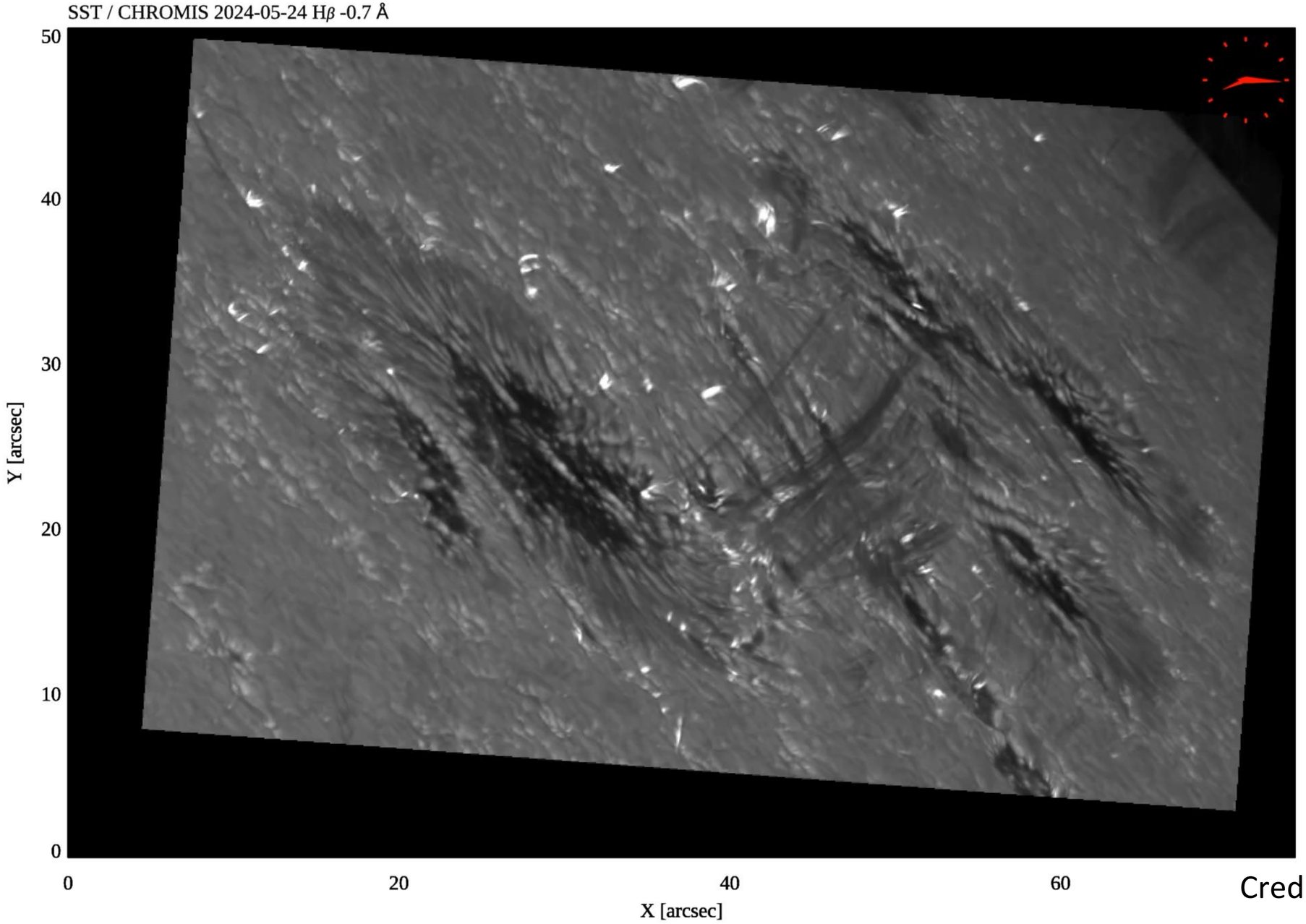
Ellerman bombs (EBs)



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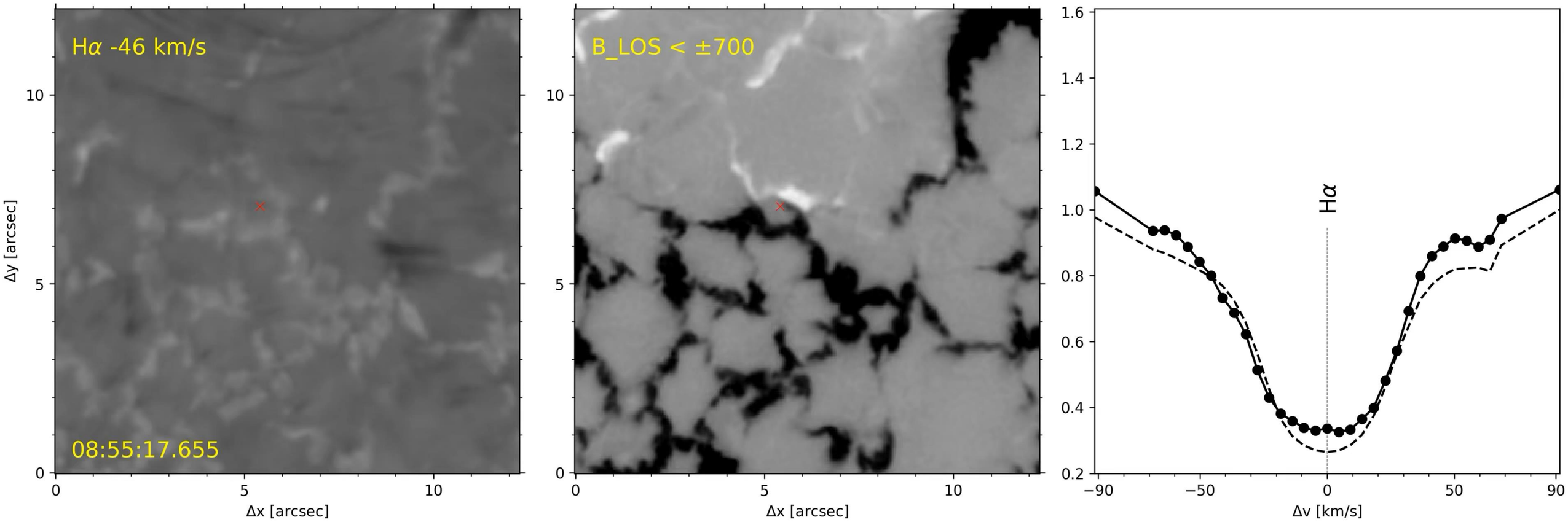
Credit: SST/RoCS/UiO

Ellerman bombs (EBs)



SST/CRISP 21-May-2024 AR 13685 by RoCS

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Courtesy of Ignasi Josep Solar Poquet

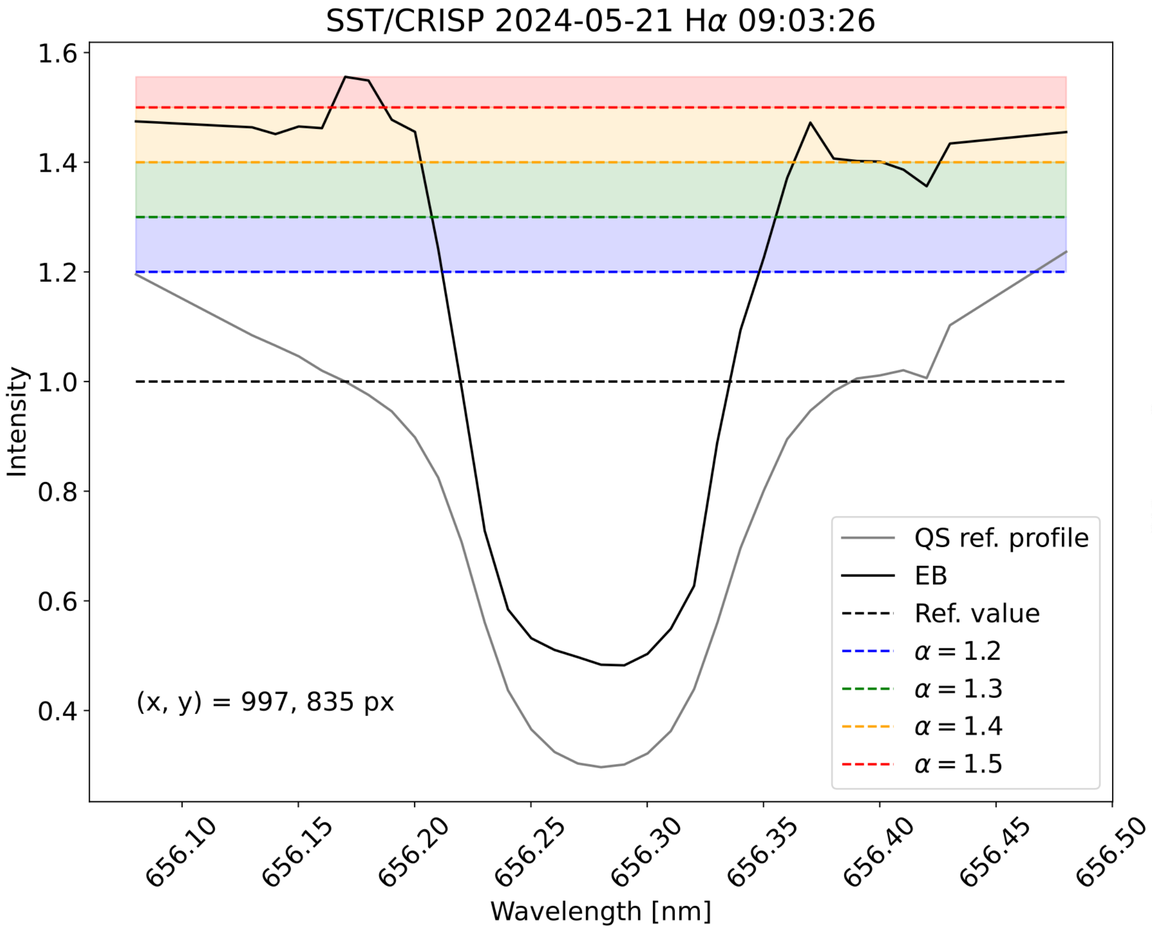
Swedish 1-m Solar Telescope

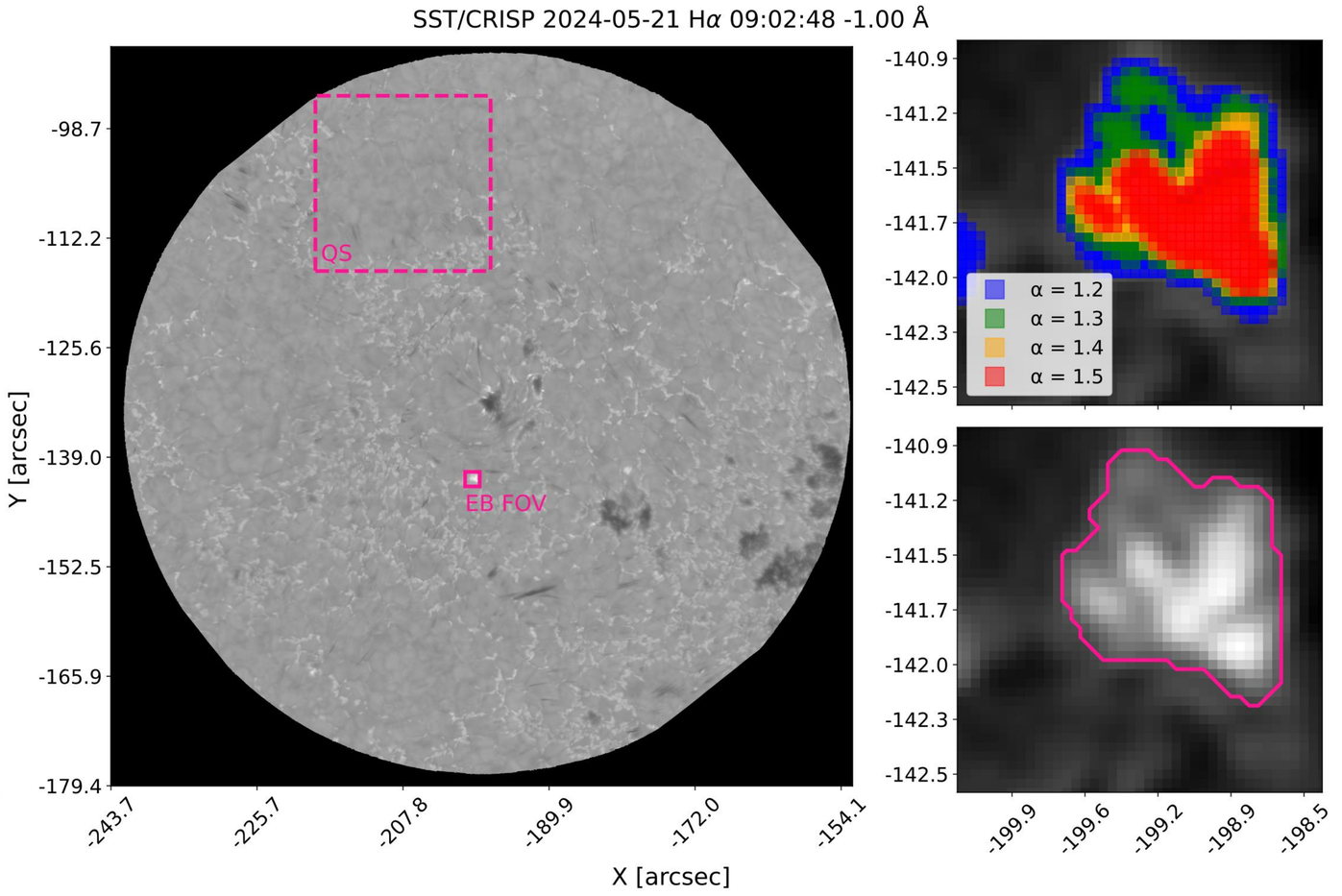
Credit: Tiago Pereira

Motivation

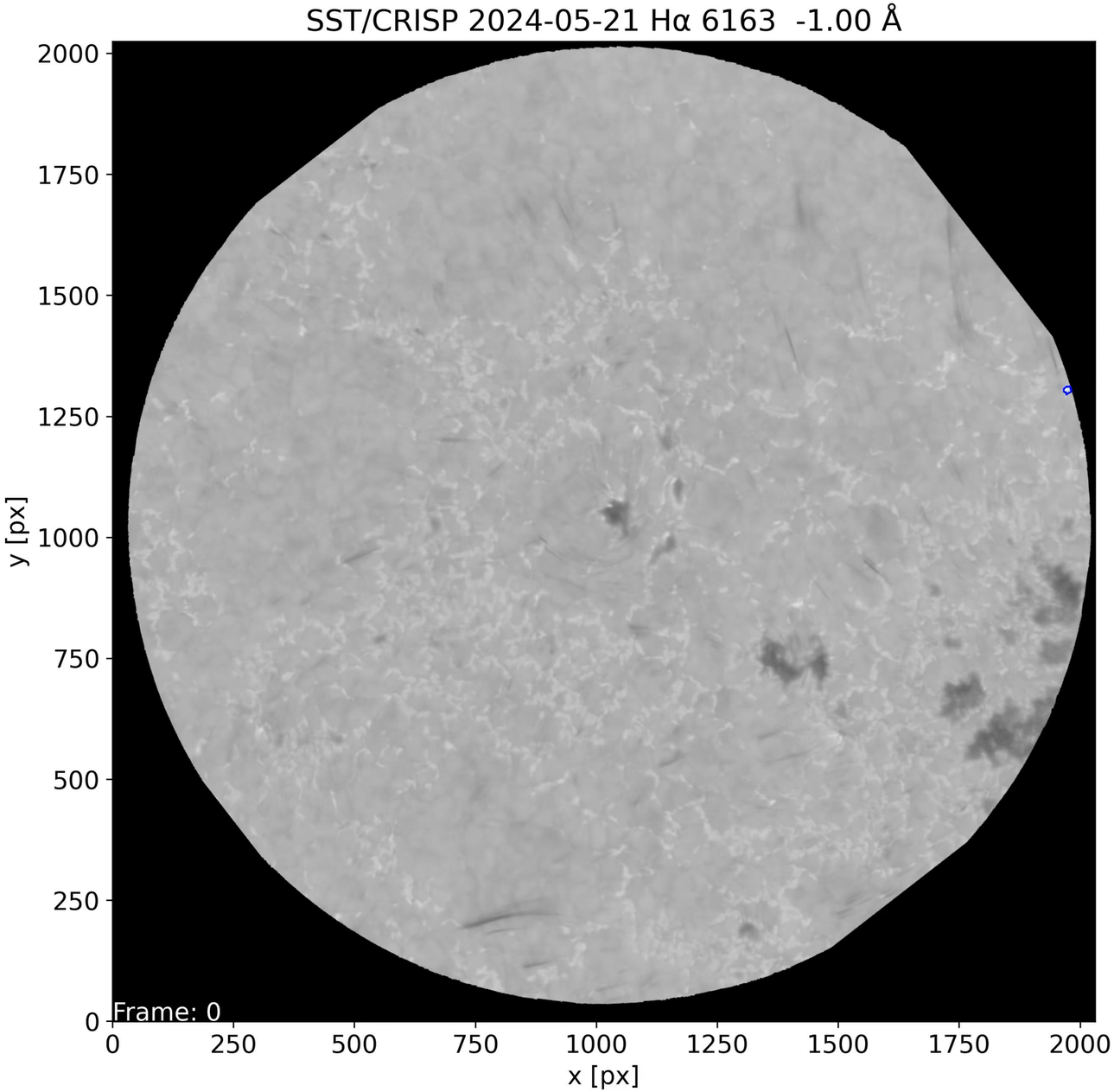
Develop a detection and tracking algorithm for EBs, in order to characterize their properties and magnetic field configuration.

Detection of EBs





Tracking of EBs



Minimum area:

0.035 $arcsec^2$

Minimum lifetime:

74 s (2 frames)

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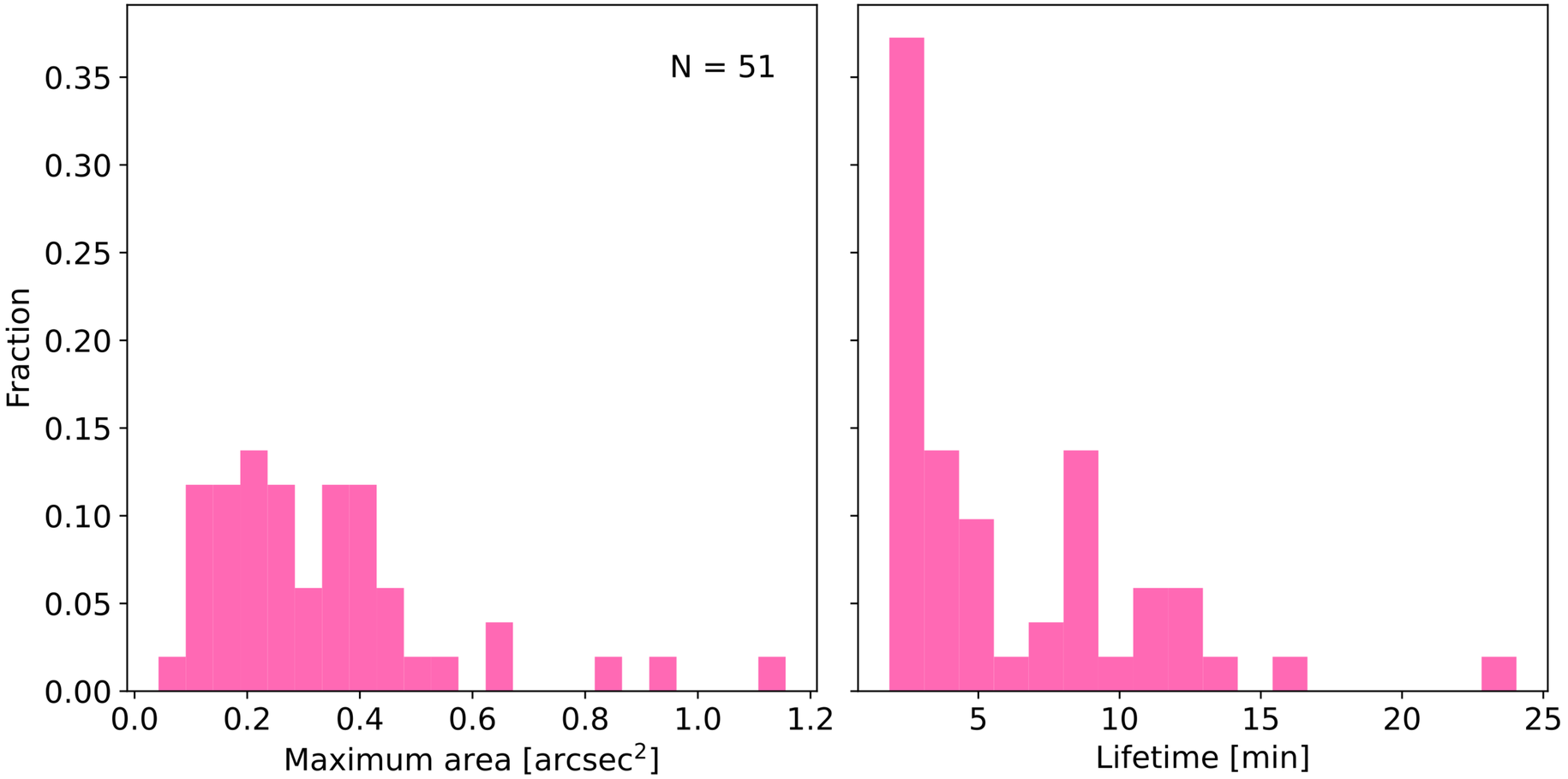
General EB statistics



Median maximum area:

0.275 $arcsec^2$

Median lifetime:

3.0 min

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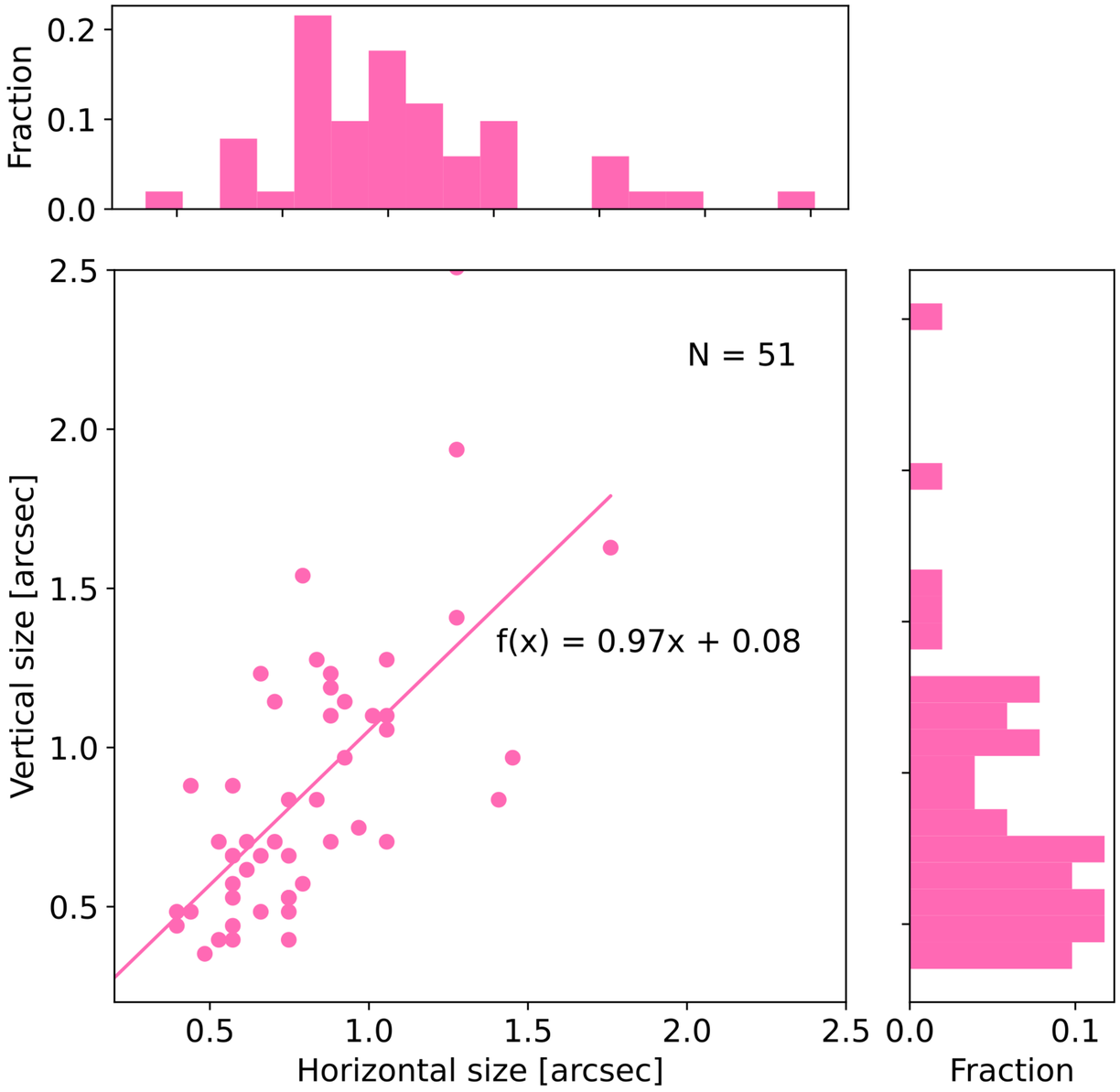
General EB statistics



Median maximum vertical extent:

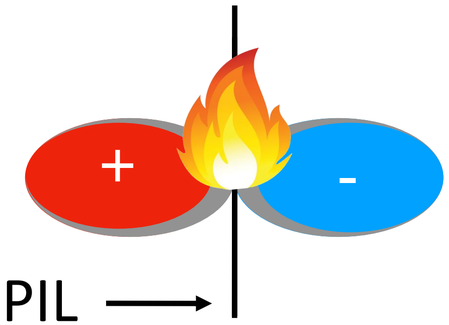
0.704 arcsec

Median maximum horizontal extent:

0.748 arcsec

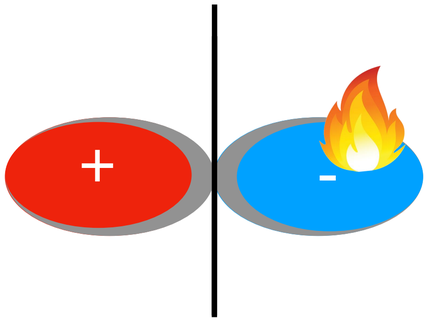
Classification of magnetic field configuration

Group A



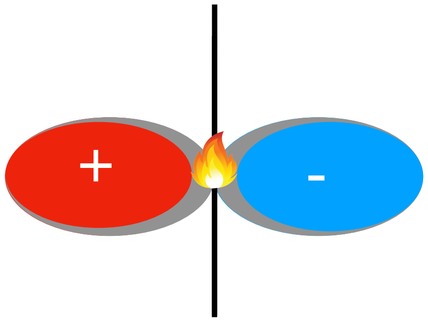
Dipolar EBs

Group B



Unipolar EBs

Group C



Noise level of B_{LOS}: $\sigma = 9.5\,G$

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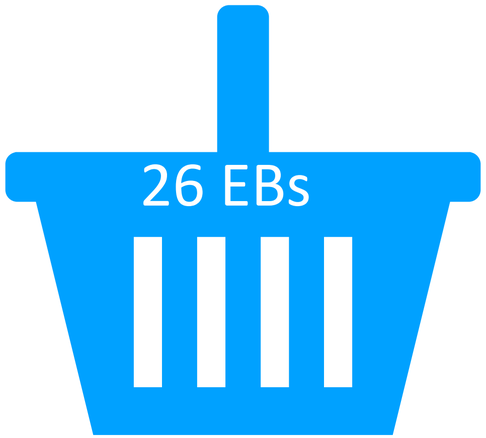
Classification of magnetic field configuration

Group A

Group B



Group C

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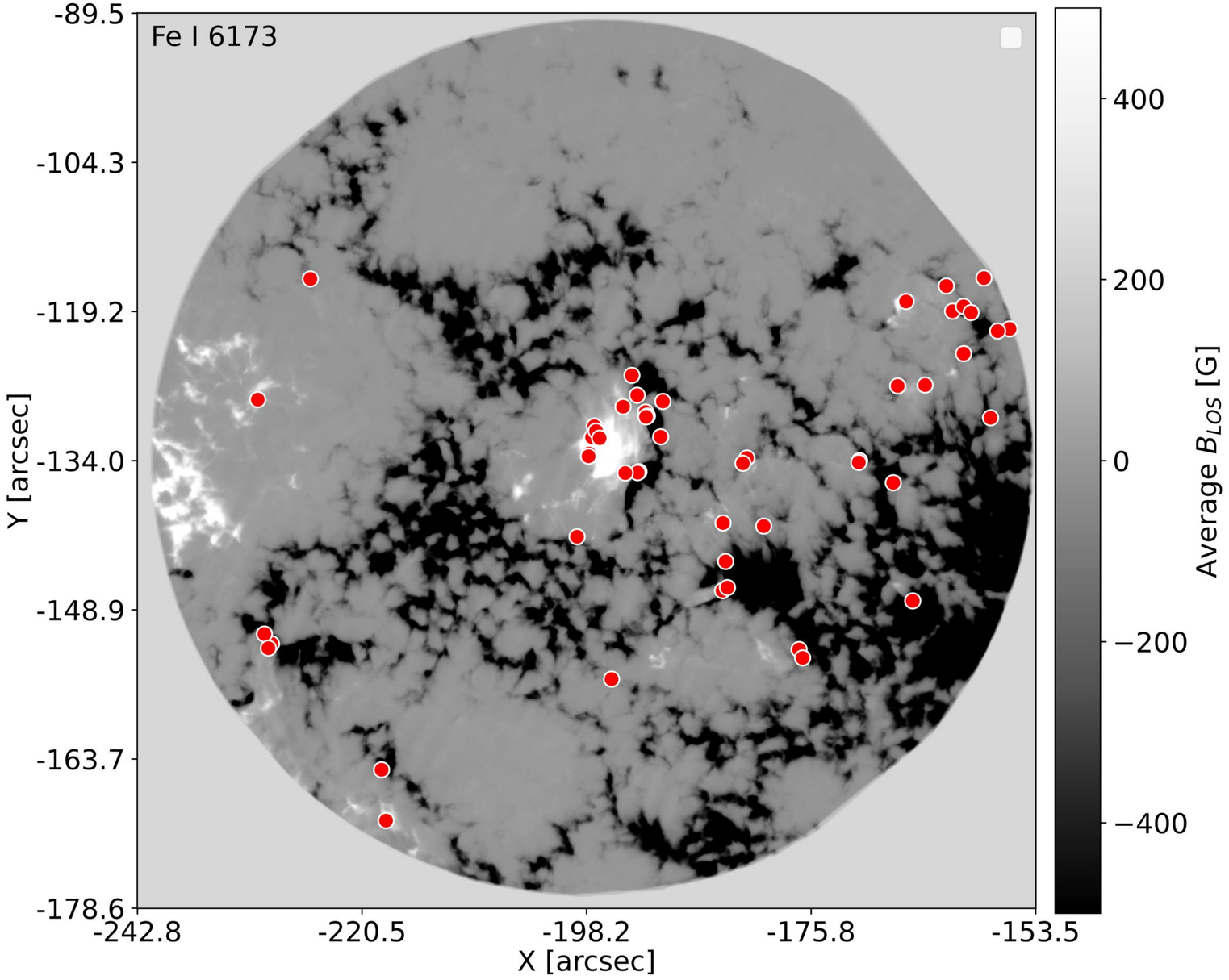
Spatial distribution of EBs



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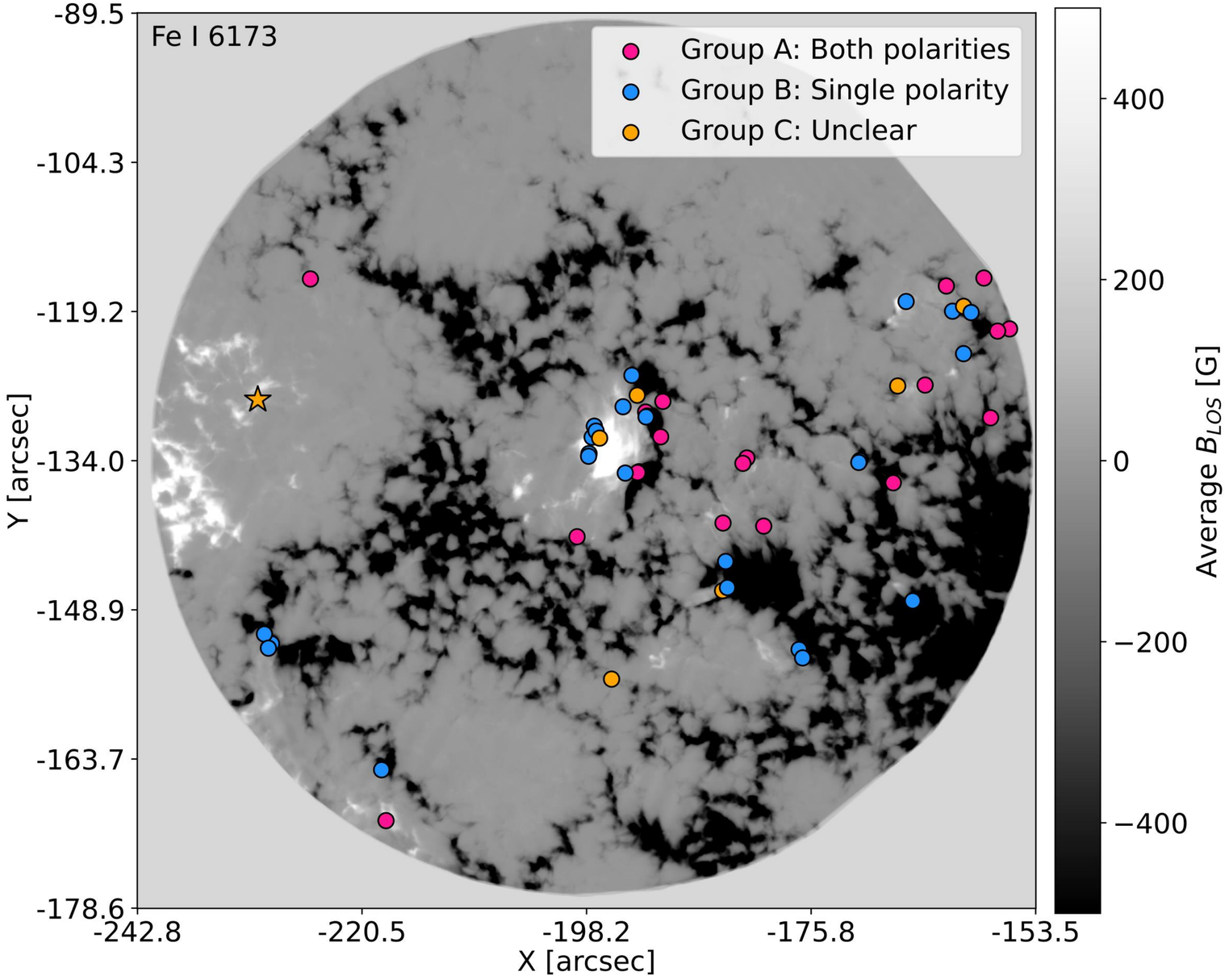
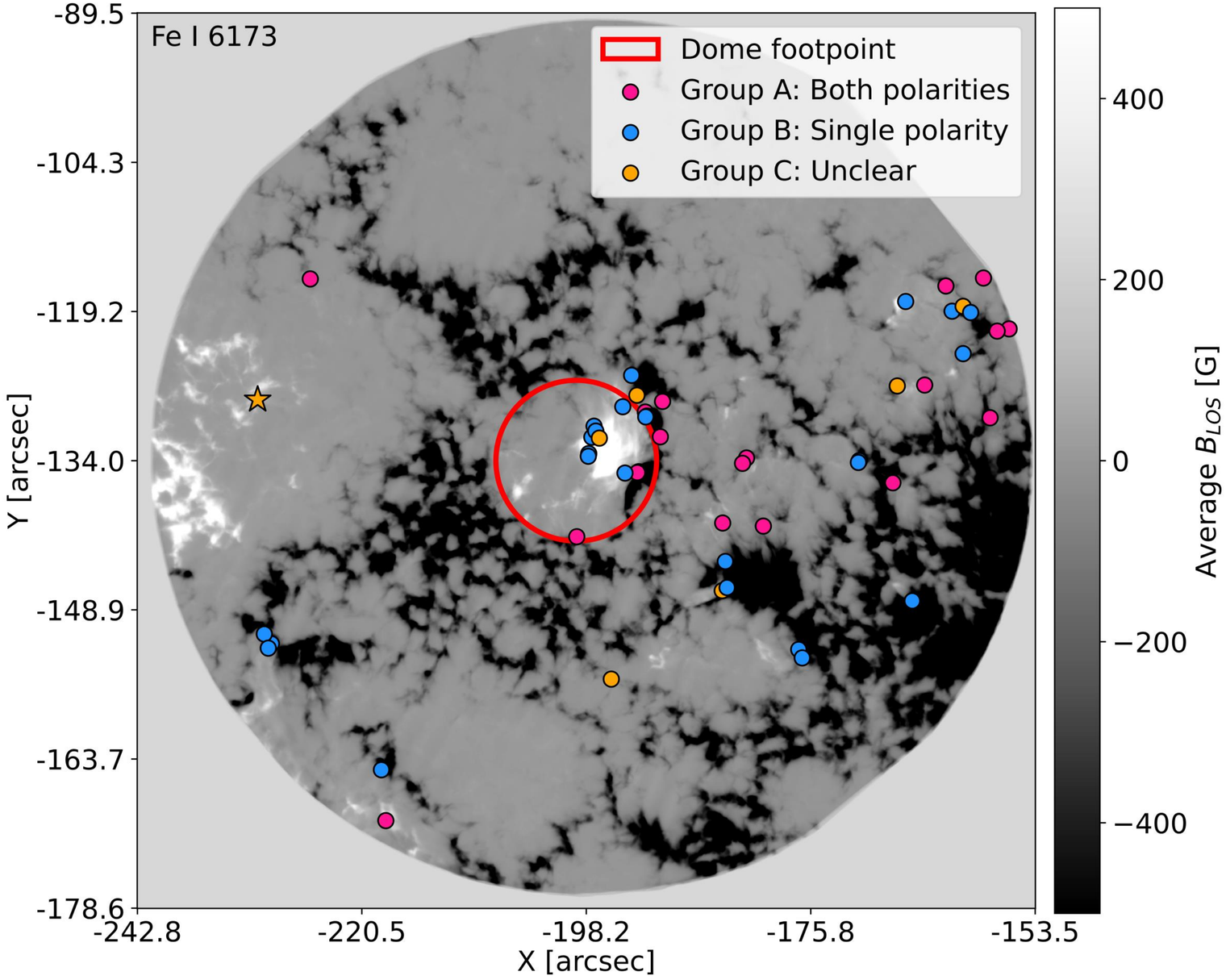
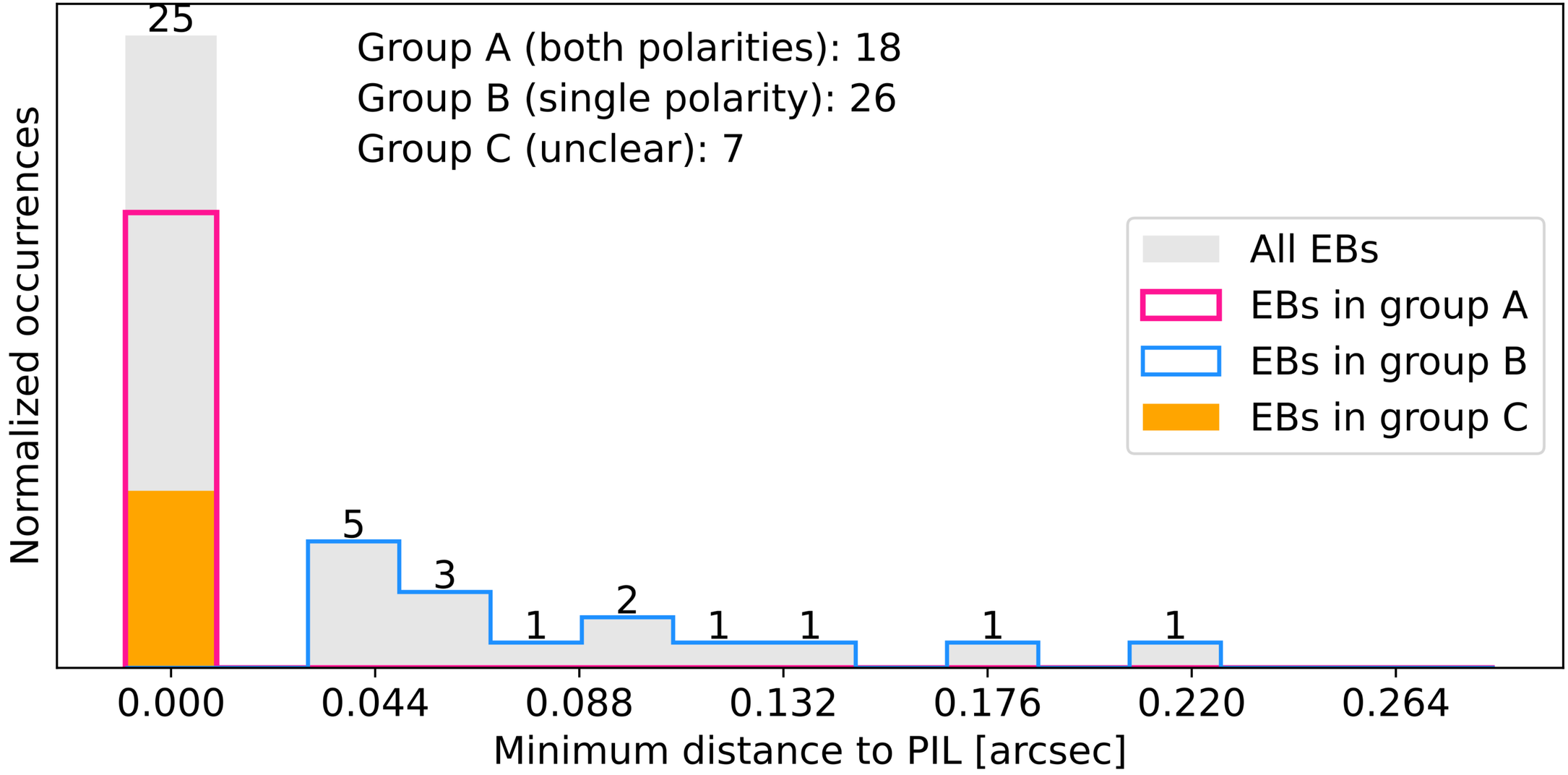
Spatial distribution of EBs



Spatial distribution of EBs



Minimum distance to PIL



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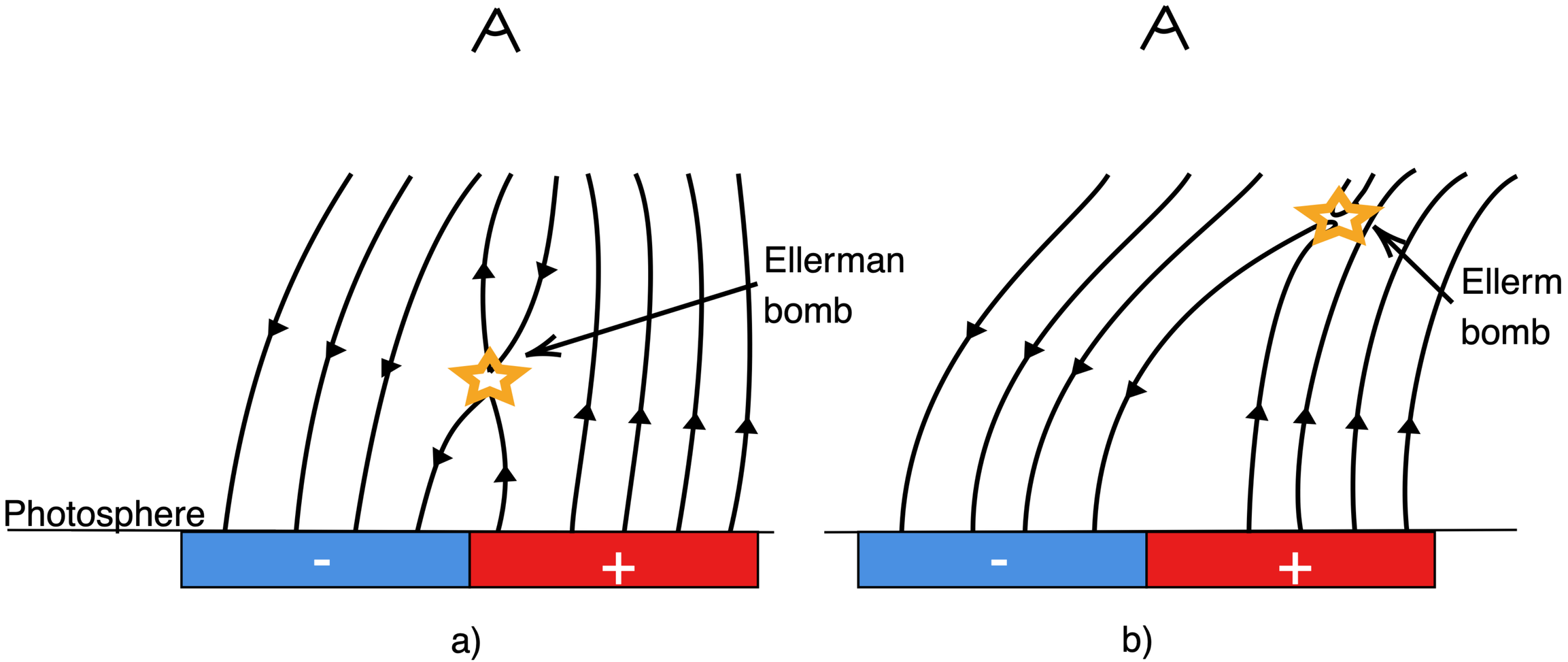
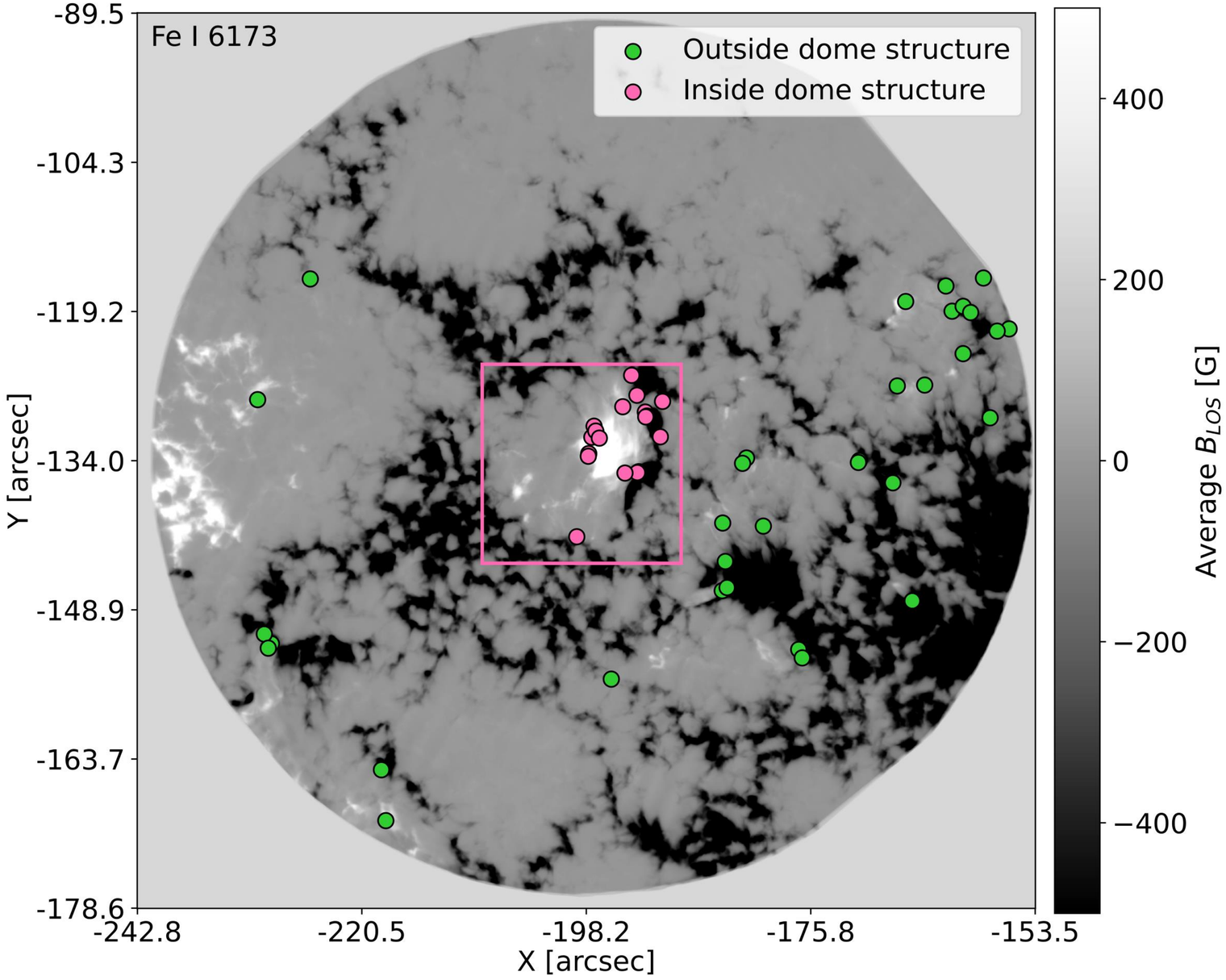
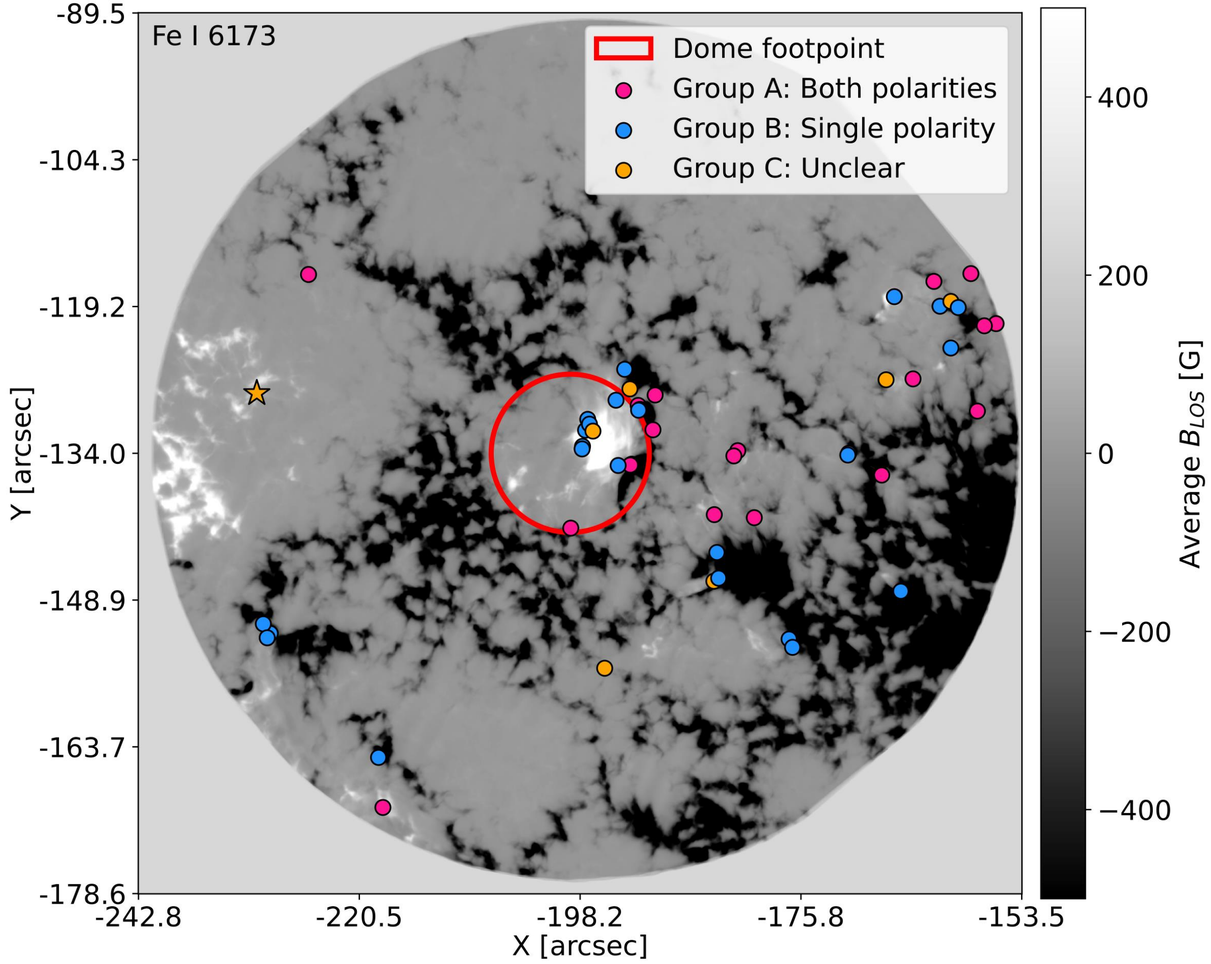
Possible magnetic topologies

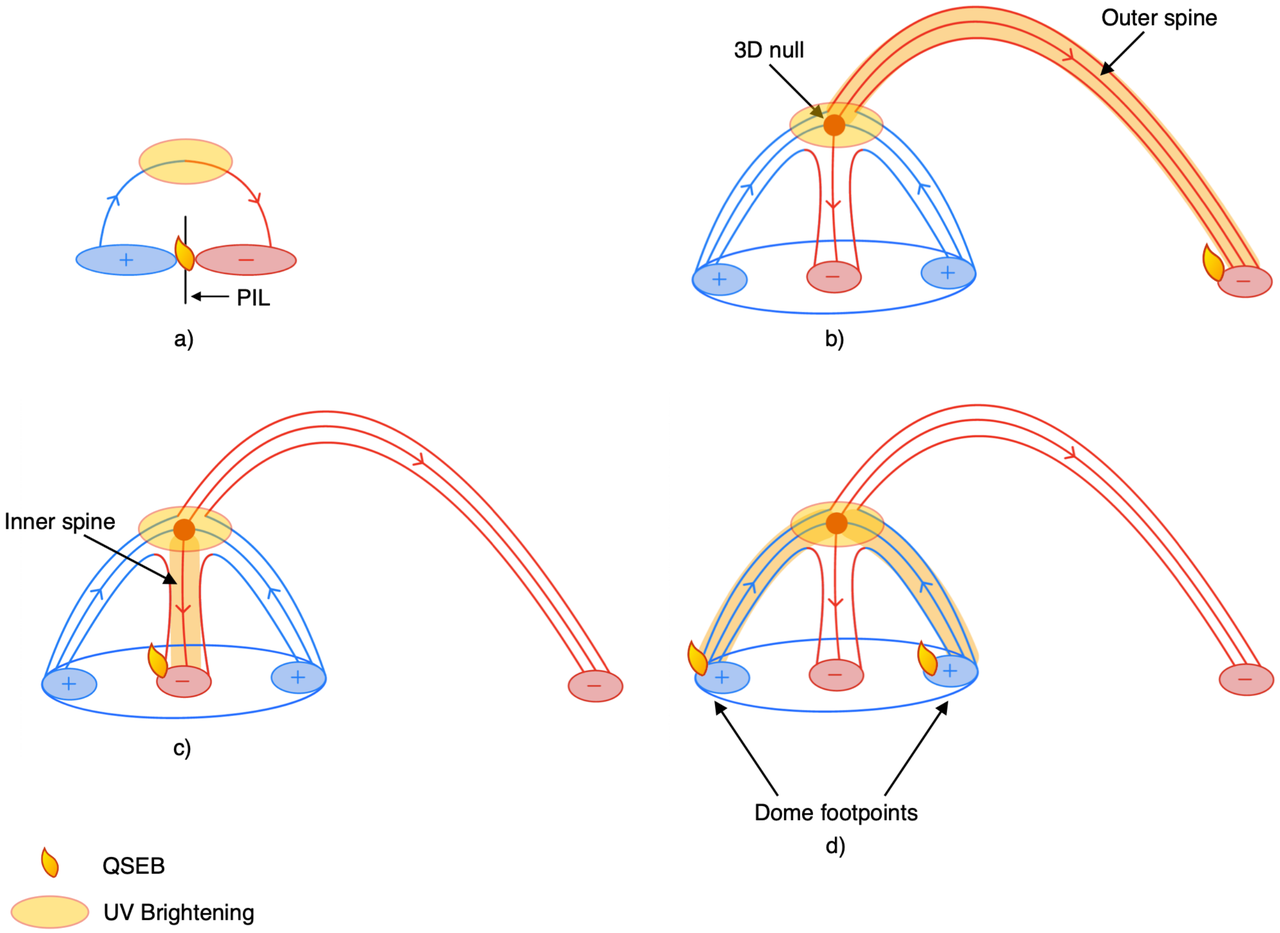


Separate EBs inside and outside dome



Fan-Spine Topology





Bhatnagar et al. 2025

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Conclusions

- We apply a 4-level intensity threshold to $H\alpha$ wings to detect EBs.
- We find median maximum area of 0.275 $arcsec^2$ and median lifetime of 3 min.
- 18 dipolar EBs, 26 unipolar EBs, 7 EBs are unclear.
- Unipolar EBs are most likely due to a reconnection site located higher in the atmosphere.