

The thinnest flare loop strands ever observed in the corona by Solar Orbiter/EUI.

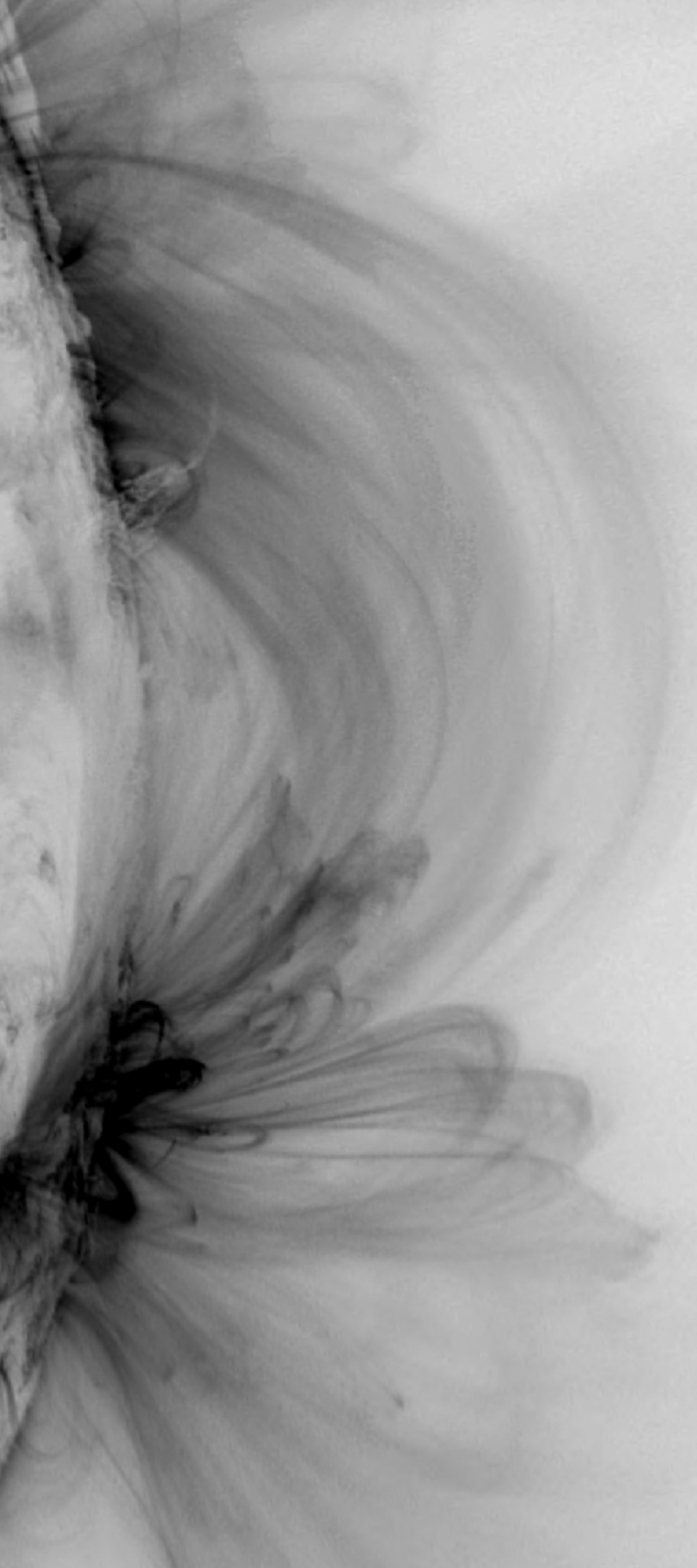
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Royal Observatory of Belgium

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Why are thin loops important?

- The low beta corona is completely filled with magnetic field, yet individual coronal loops stand out as the basic building block of the observable corona.
- Visibility in EUV of certain flux tubes above others is a selection effect of density & temperature, which ultimately is driven by heating
- The cross-sectional scale of the thinnest loops can tell us at what spatial scales coronal heating operates.
- Observation of small spatial scales is limited by telescope resolution, stray-light and spatial noise.
- Determining width of loops is further complicated because they can be
 - resolved or not resolved,
 - can be monolithic or have substructure,
 - can be superposed on a variable background
 - can be isothermal or multithermal.
 - can have constant cross-section or expand with height.

Aschwanden & Peter (2017)

OCCULT-2
loop tracing method

followed by
automated
width measurement
(multi scale)

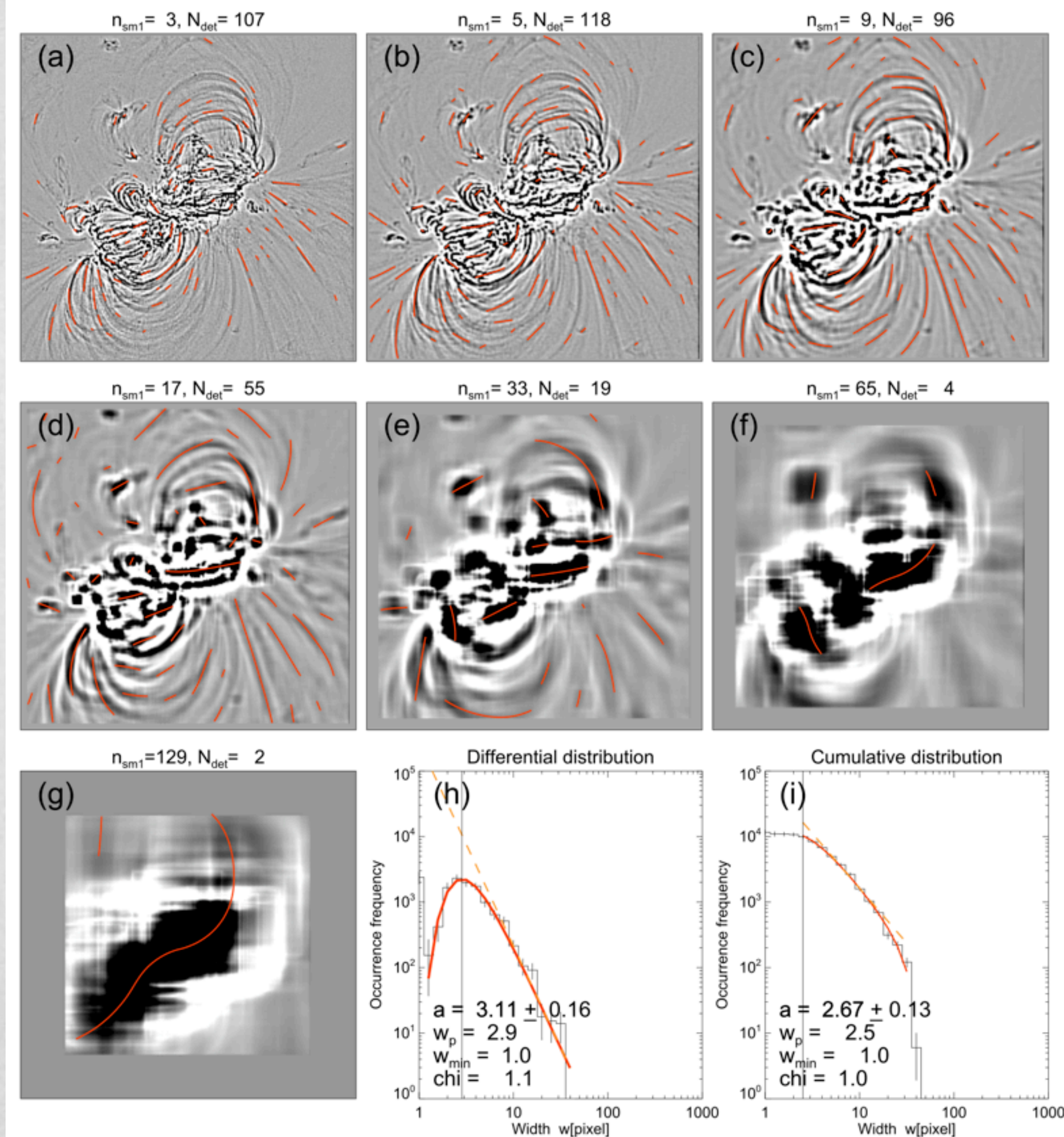
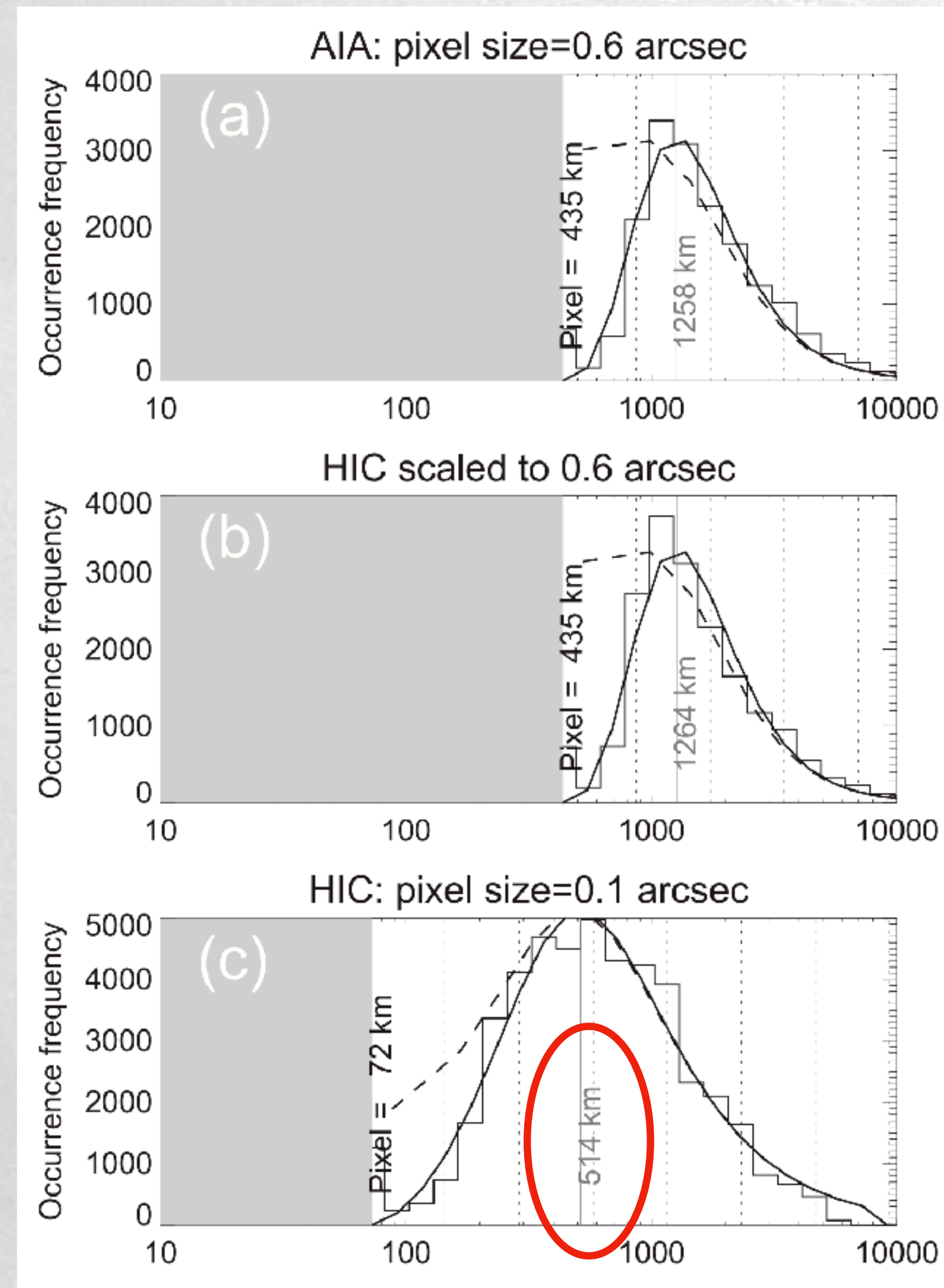


Figure 10. Seven bipass-filtered images (grayscale) with filters of $n_{sm1} = 2, 4, 8, 16, 32, 64, 128$ pixels and automated loop tracings (red curves), obtained from the AIA/SDO image at a wavelength of 193 Å as shown in Figure 9. Otherwise, this is a similar representation to Figure 6.

Aschwanden & Peter (2017)

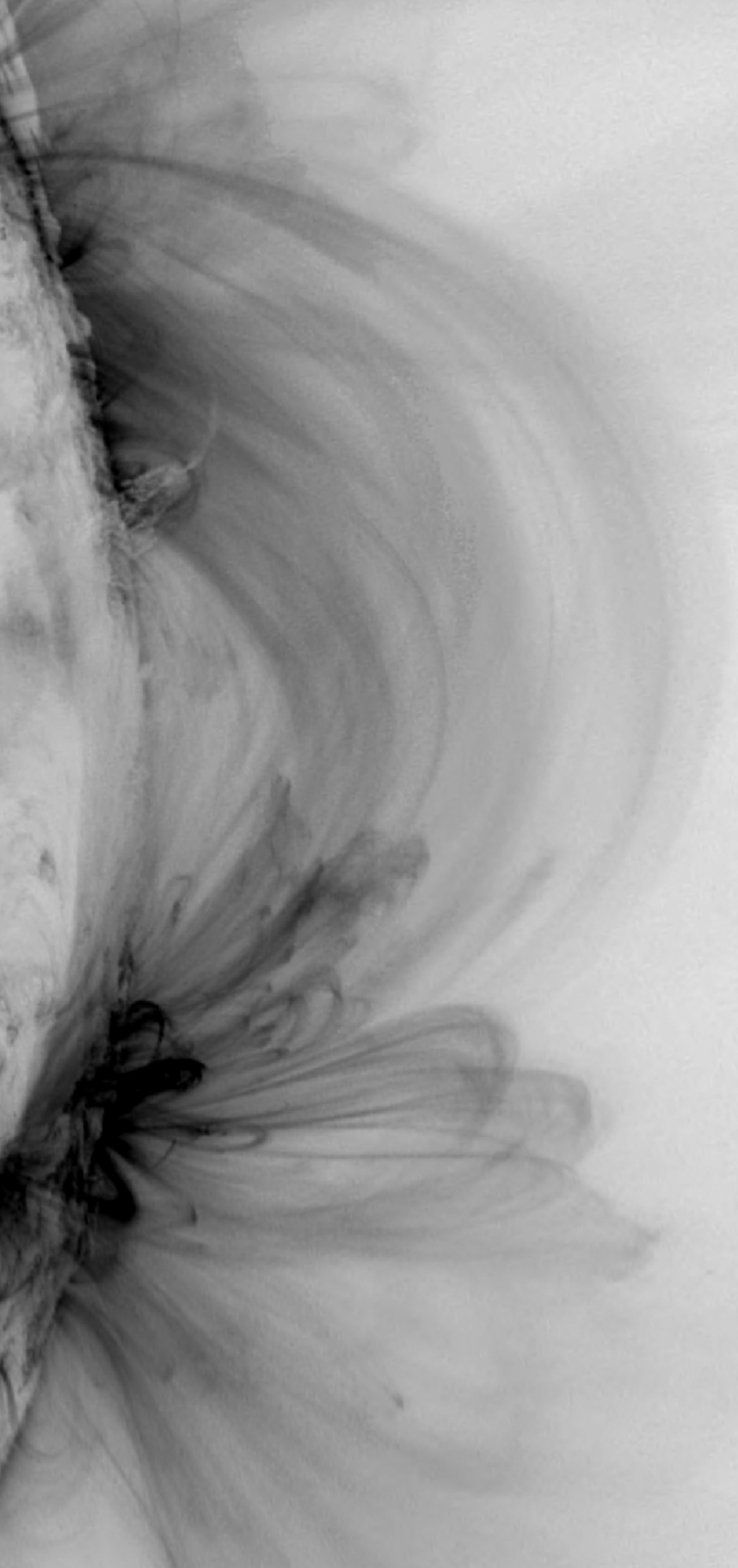


AIA 193 Å

Hi-C 193 Å

Peak width = 514 km
(7 Hi-C pixels)

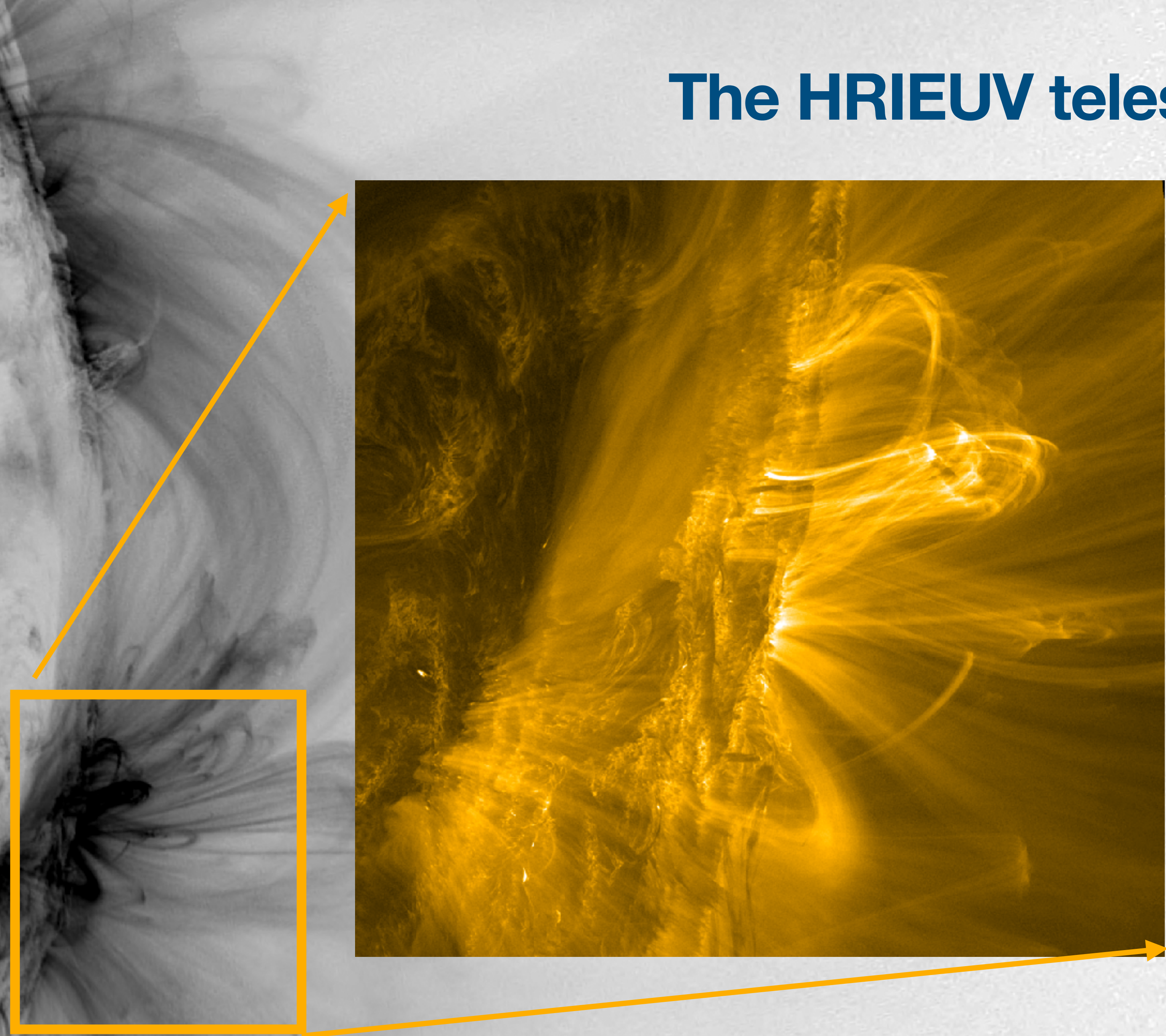
Most loops are resolved.



AIA	Hi-C 1	Hi-C 2.1
Several bandpasses	19.3 nm	17.2 nm
Non-stop operations	Dataset of a few min	Dataset of a few min
0.60"/pix	0.10"/pix	0.13"/pix
1 au	1 au	1 au
438 km/pix	73 km/pix	95 km/pix

**Last row is pixel scale,
not necessarily spatial resolution.**

The HRIEUV telescope of Solar Orbiter/EUI



AIA	Hi-C 1	Hi-C 2.1	HRIEUV
Several bandpasses	19.3 nm	17.2 nm	17.4 nm
Non-stop operations	Dataset of a few min	Dataset of a few min	~700 datasets of typically 1h
0.60"/pix	0.10"/pix	0.13"/pix	0.49"/pix
1 au	1 au	1 au	0.293 au
438 km/pix	73 km/pix	95 km/pix	105 km/pix

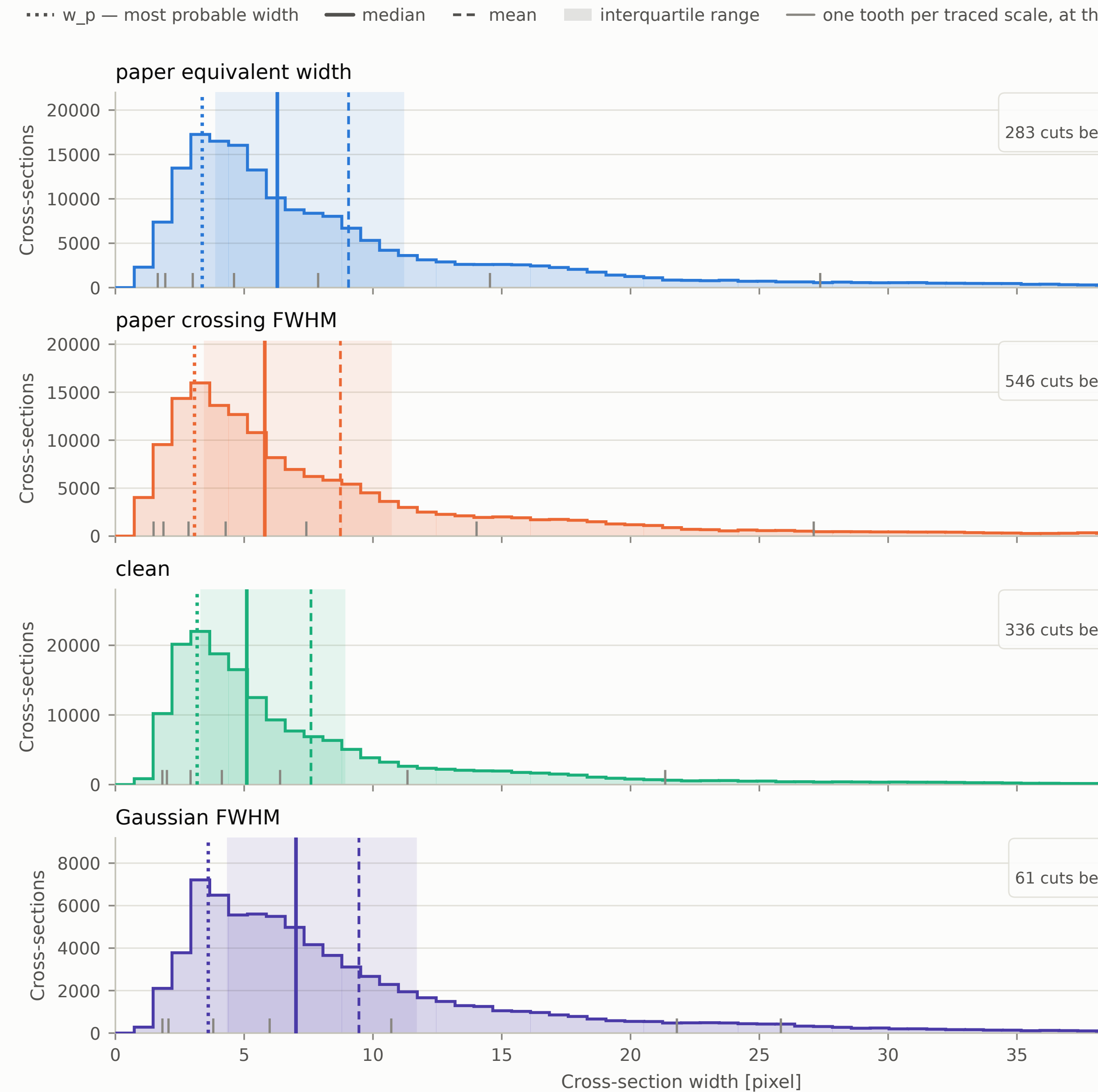
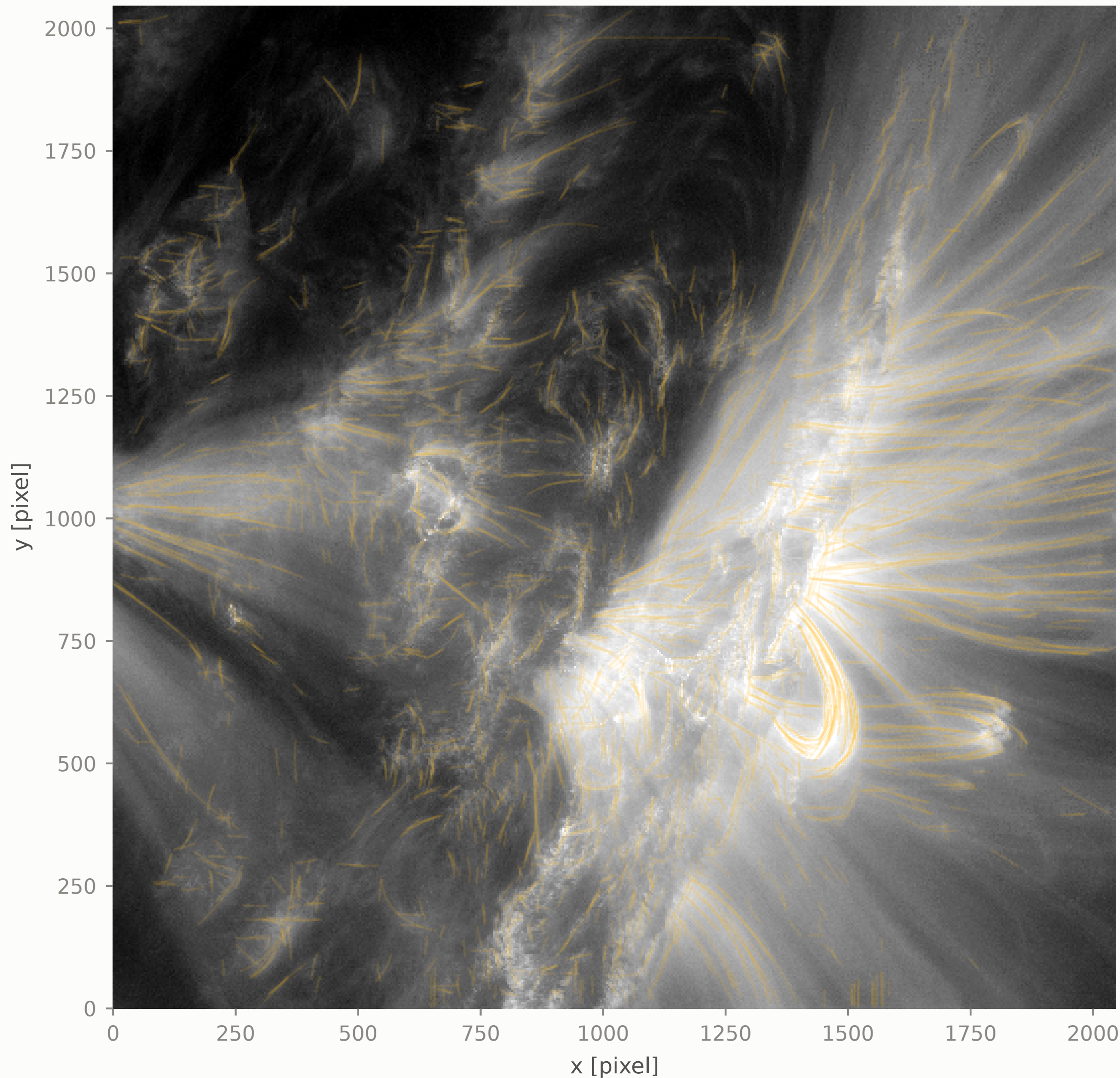
**Last row is pixel scale,
not necessarily spatial resolution.**

— detected loop axes, every traced scale (NSM1 = 1, 2, 4, 8, 16, 32, 64)

All scales

OCCULT-2 applied on HRIEUV

Full frame, 2048 × 2048 px



Work by Chandrashekhhar Kalugodu (ROB)

OCCULT-2 applied on HRIEUV

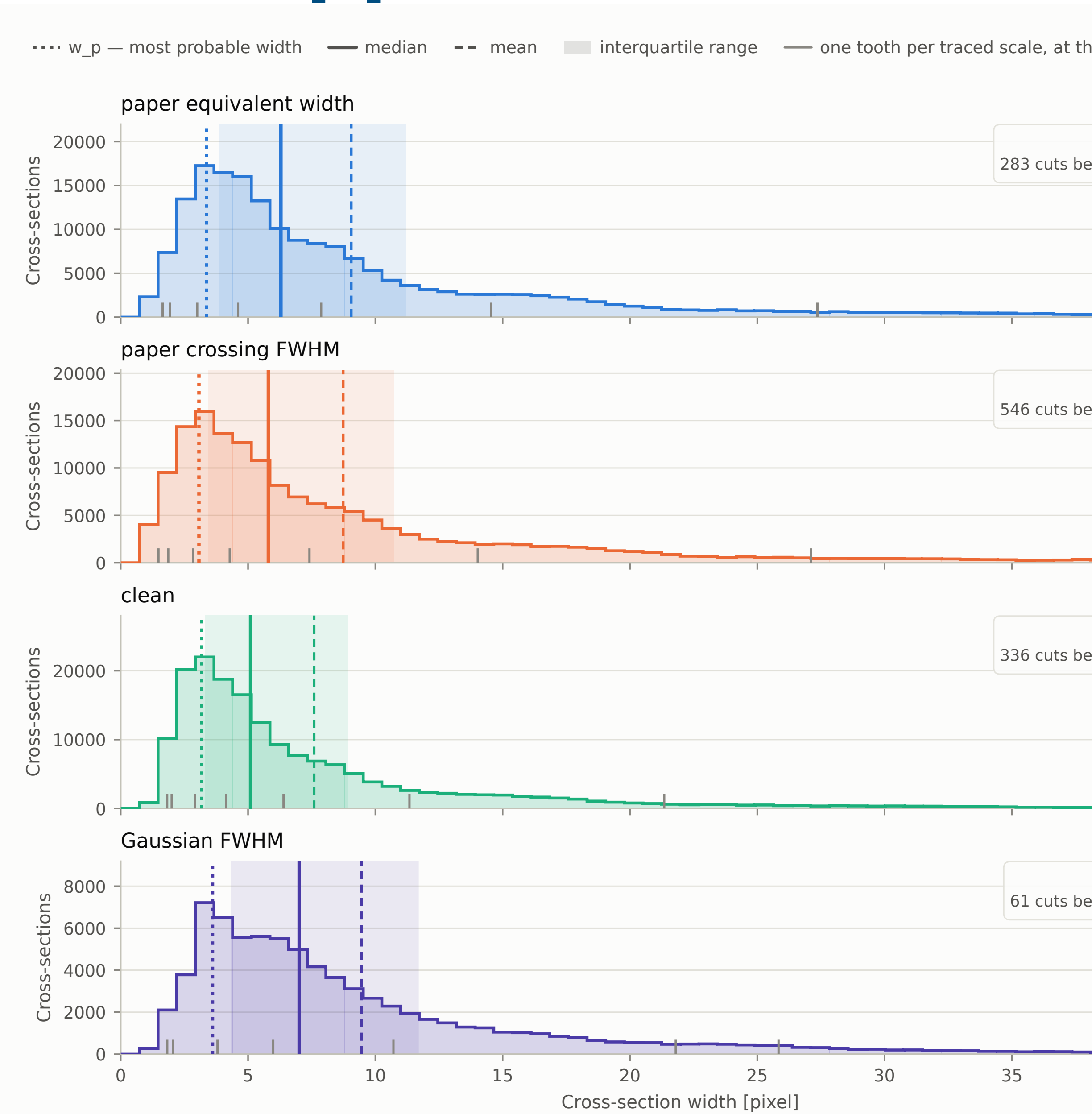
Table 12: Cross-section widths (px) pooled over NSM1 = 1, 2, 4, 8, 16, 32, 64. w_p is the most probable width, read off the population's own smoothed histogram.

Estimator	N_{cut}	N_{loop}	Min	Q_{25}	Median	Mean	Q_{75}	Max	SD	w_p
paper equivalent width	184,881	3,021	1.00	3.92	6.29	9.05	11.17	56.79	7.77	3.37
paper crossing FWHM	160,381	3,002	1.00	3.48	5.80	8.74	10.69	64.75	8.04	3.07
clean	175,862	3,020	1.00	3.34	5.10	7.59	8.88	79.98	6.92	3.17
Gaussian FWHM	78,884	2,938	1.05	4.38	7.01	9.46	11.66	47.04	7.44	3.61

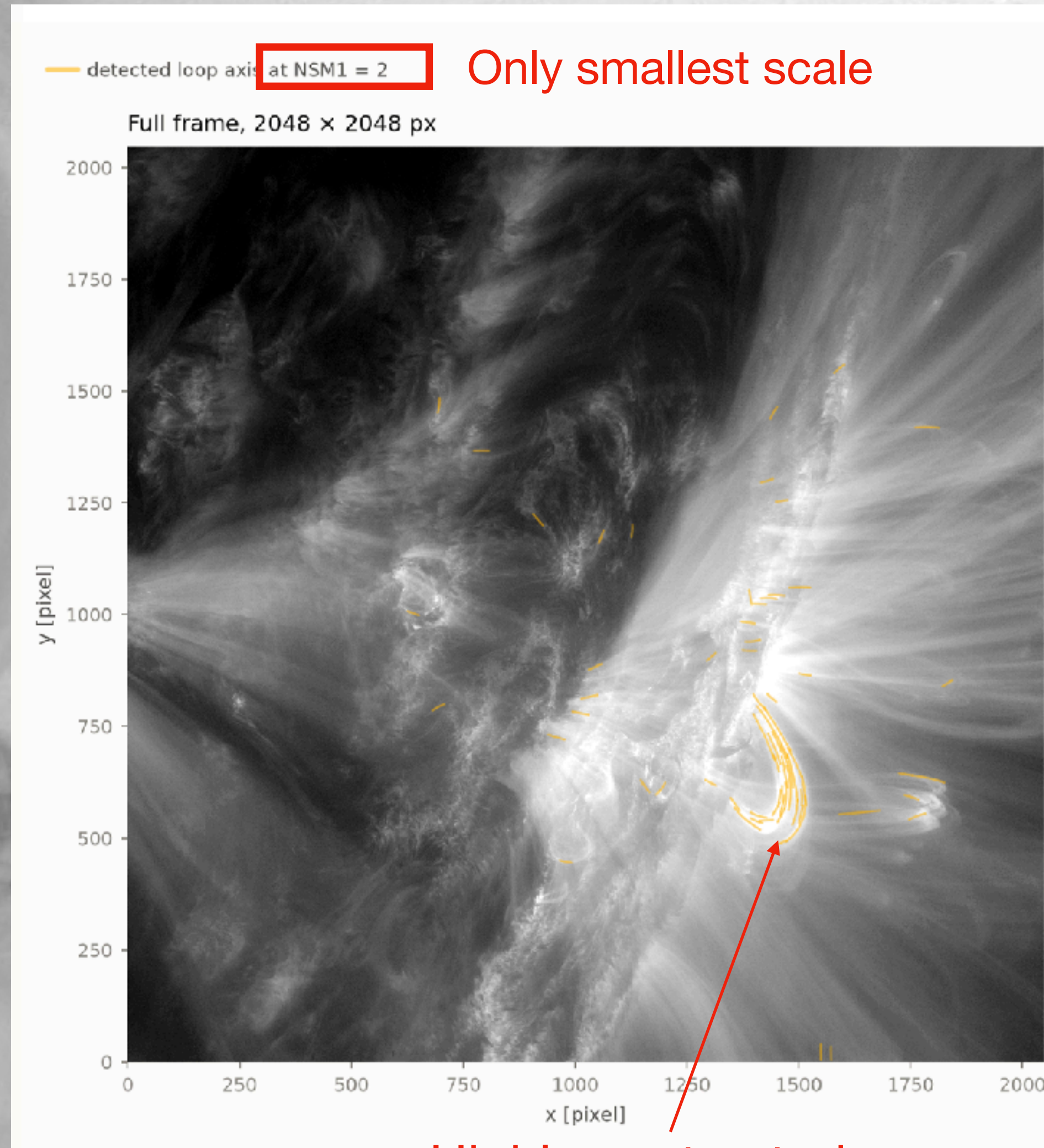
Median width
is about 6 pix or 630km

Measured peak width
is about 3.5 pix or 370km

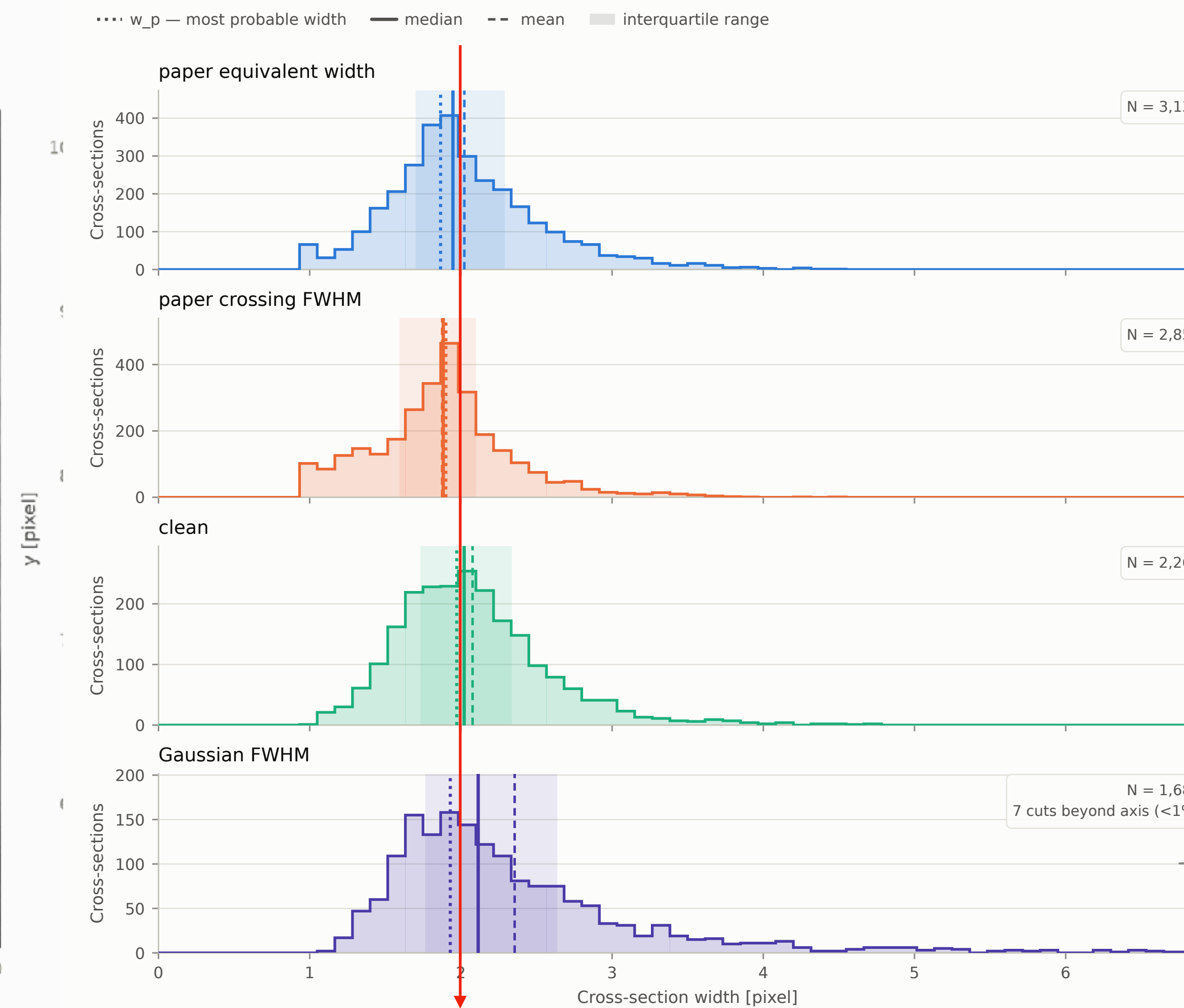
Slightly thinner loops in HRIEUV (370km)
than in Hi-C (514 km) can be caused by
17.4nm instead of 19.3 nm.

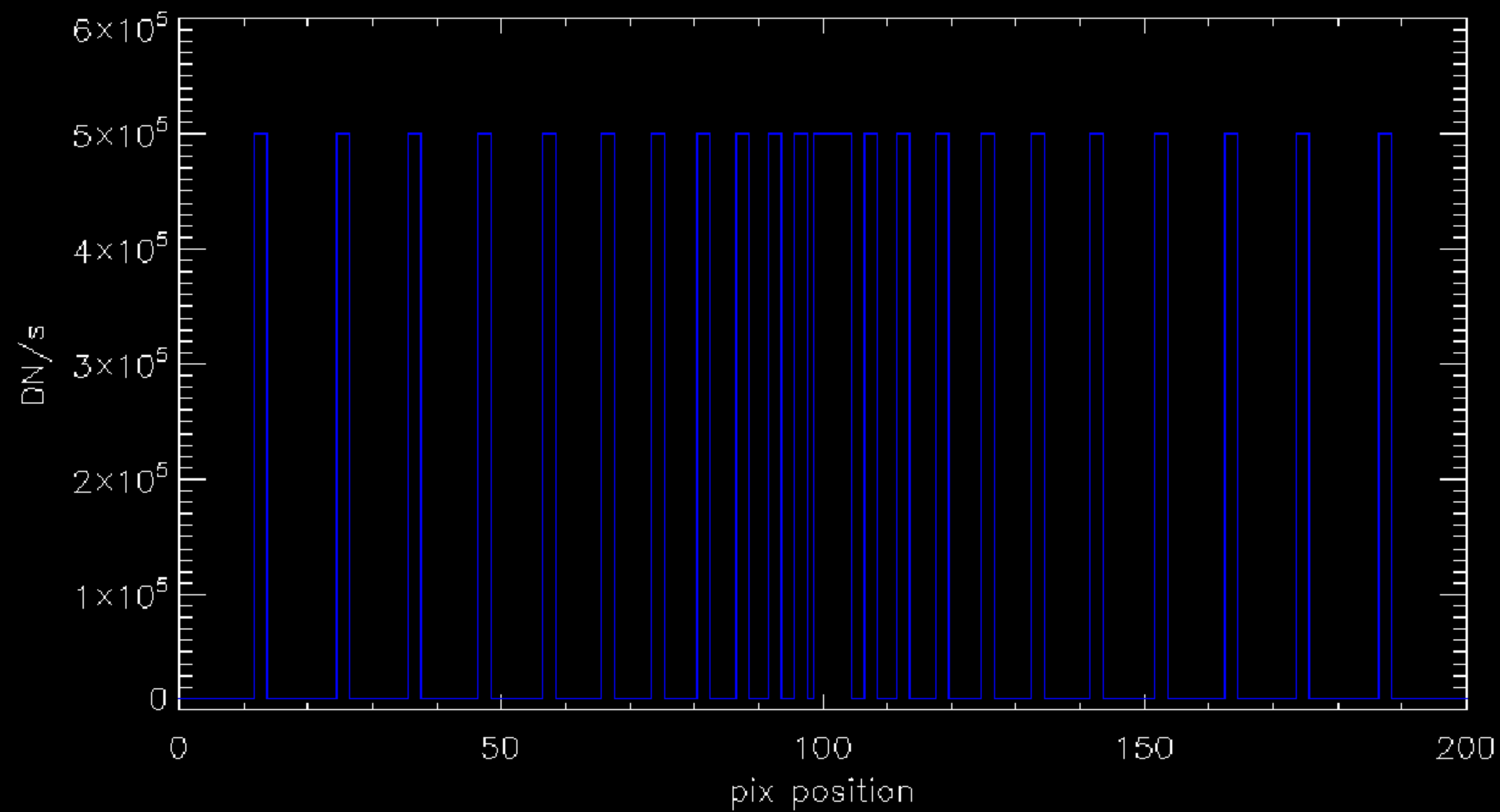
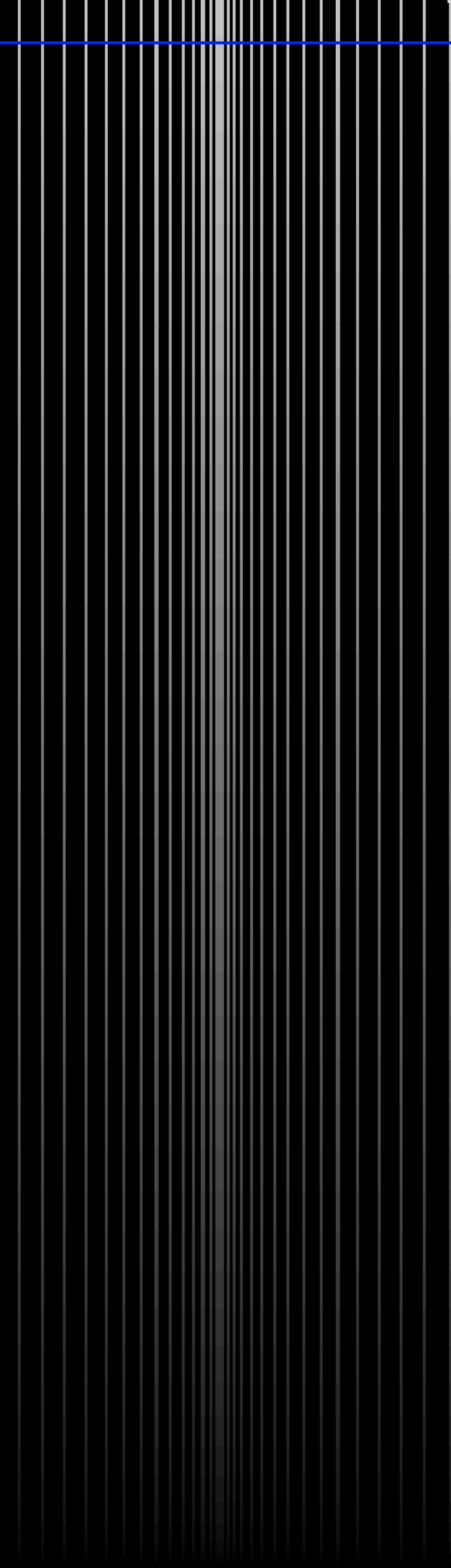


Focus on the thinnest loops

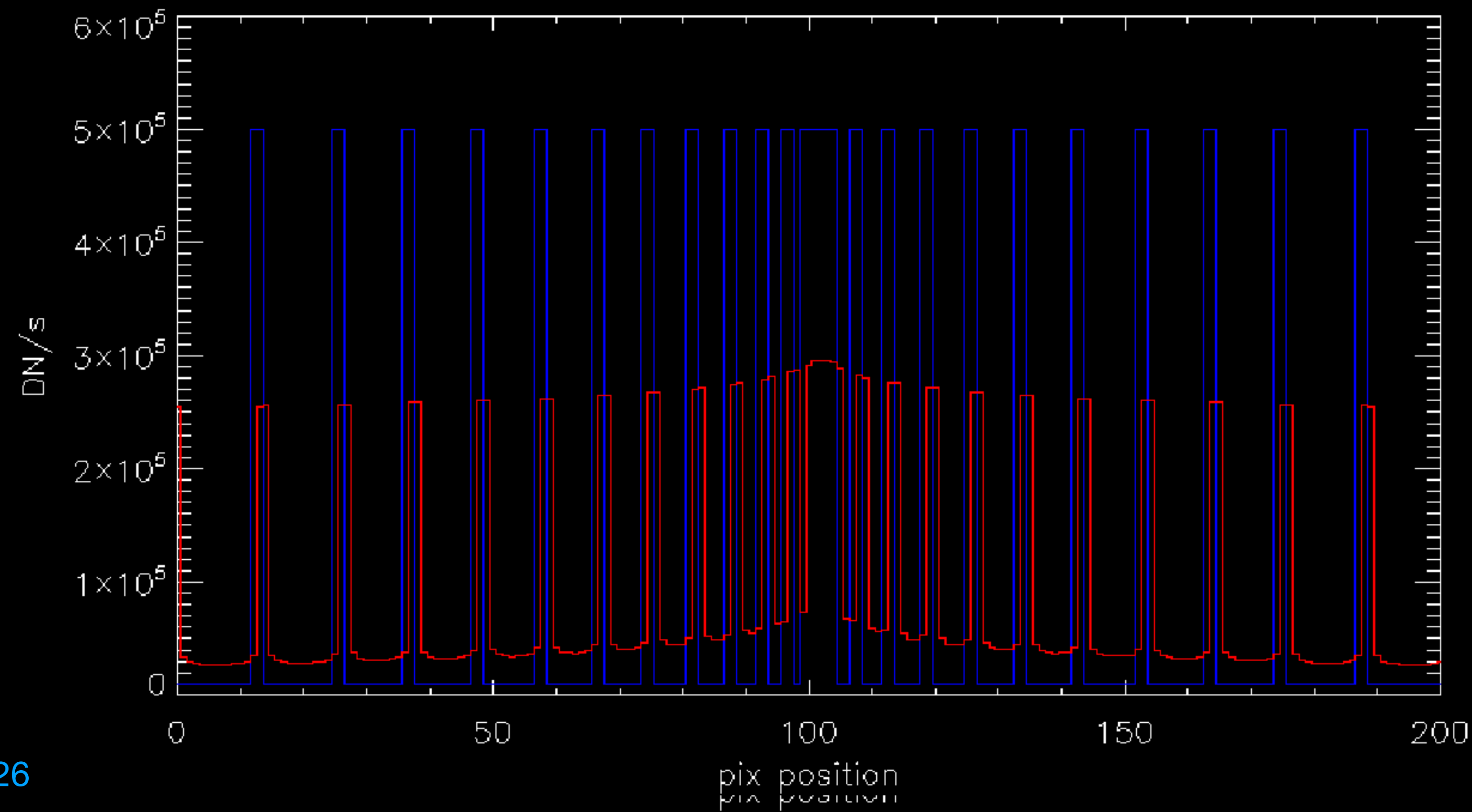


Only smallest scale

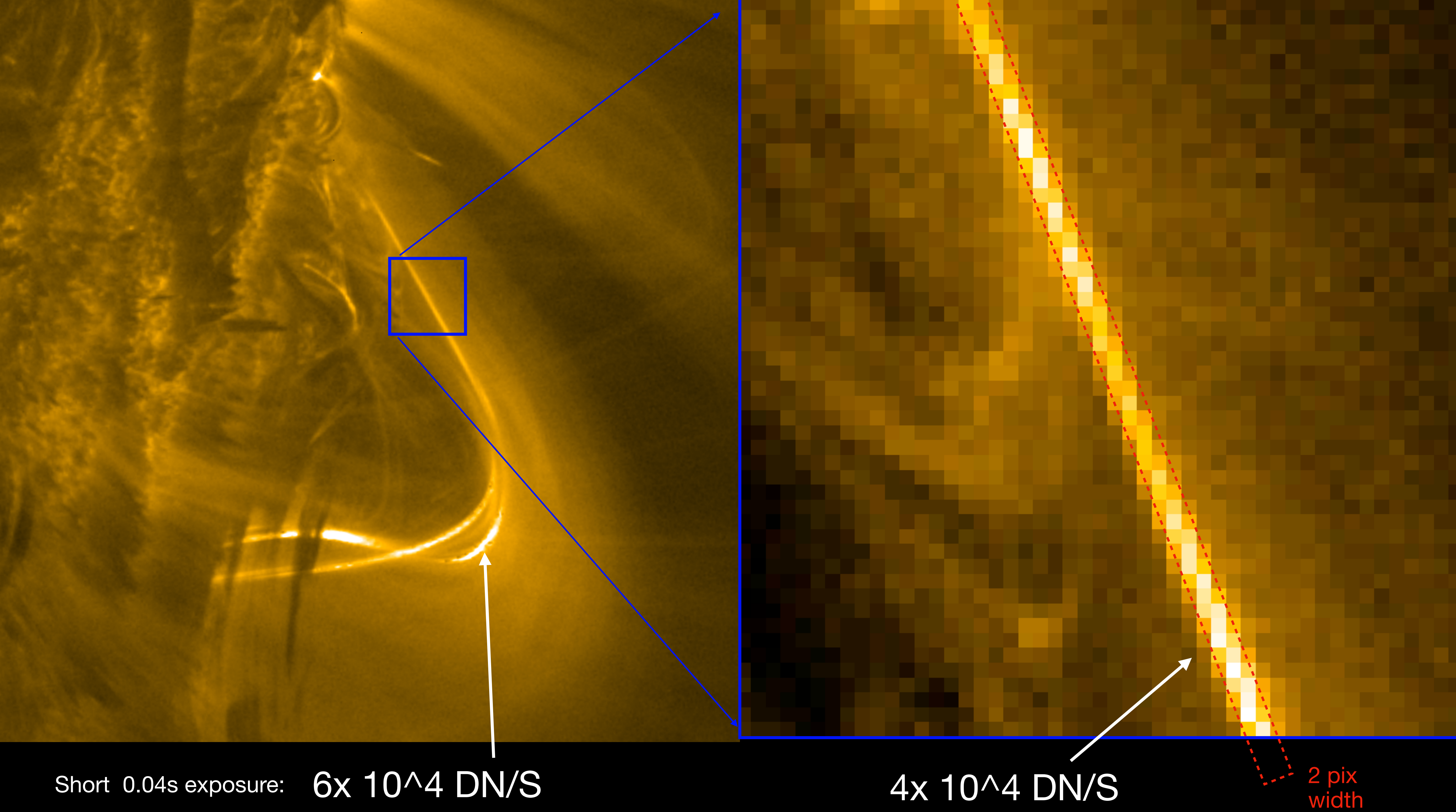




Applying HRIEUV PSF reduces loop contrast.



HRIEUV PSF:
Hofmeister et al 2026



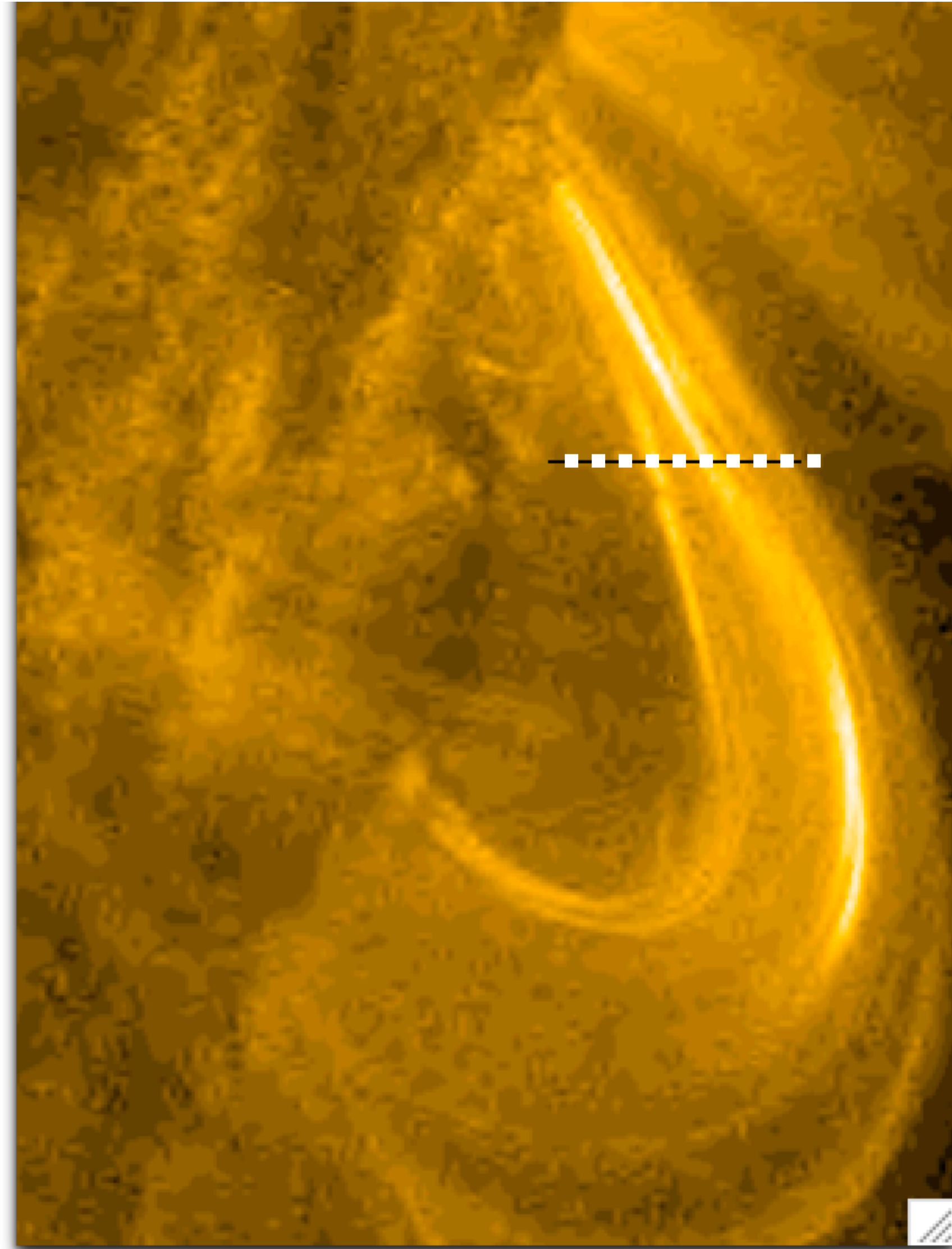


TRACE Cinderella loop

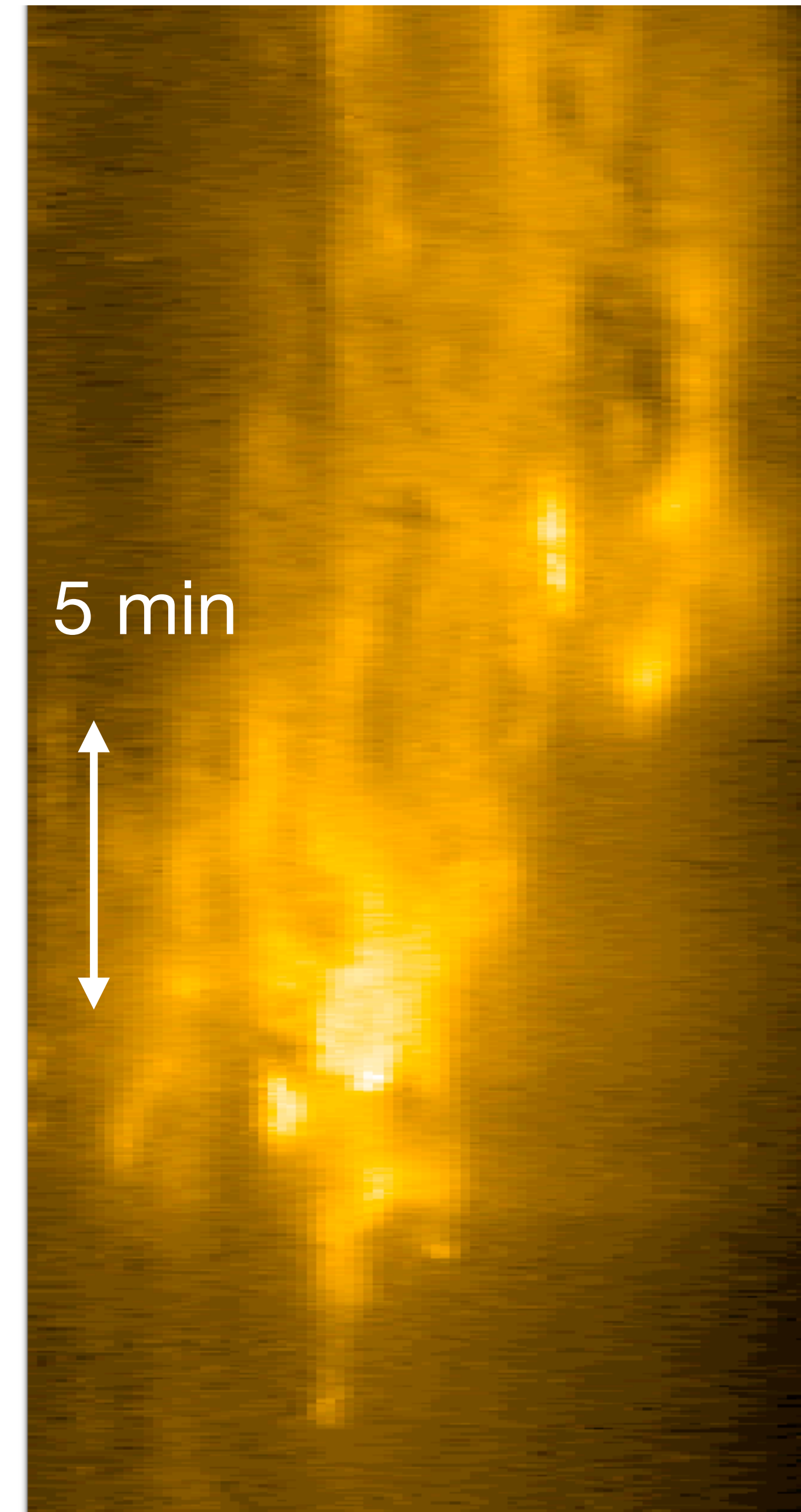


EUI Solanki loop

Thin flare loop strands live for minutes

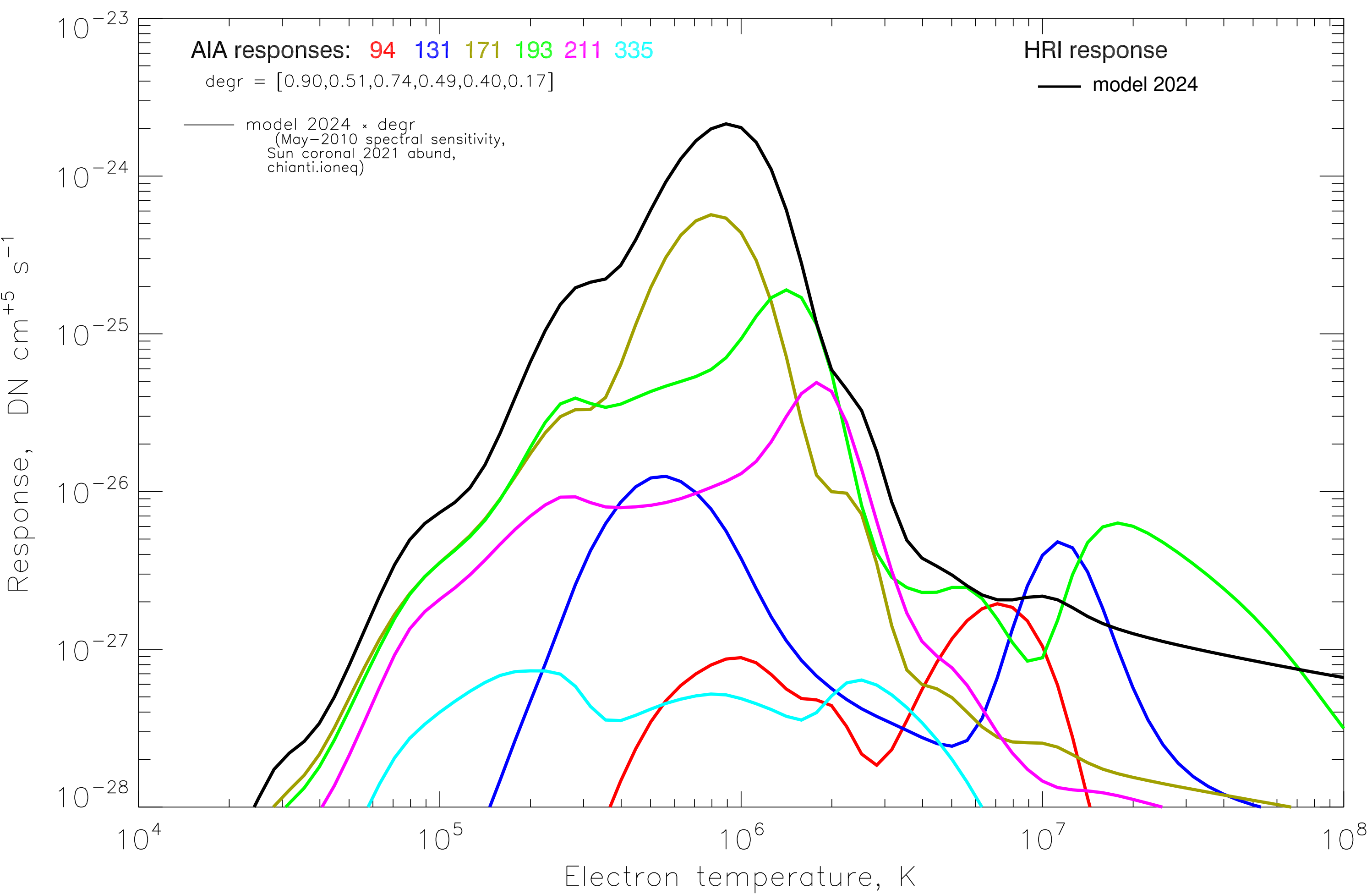


0.04s
short
exposures



Time
26 min
0 min

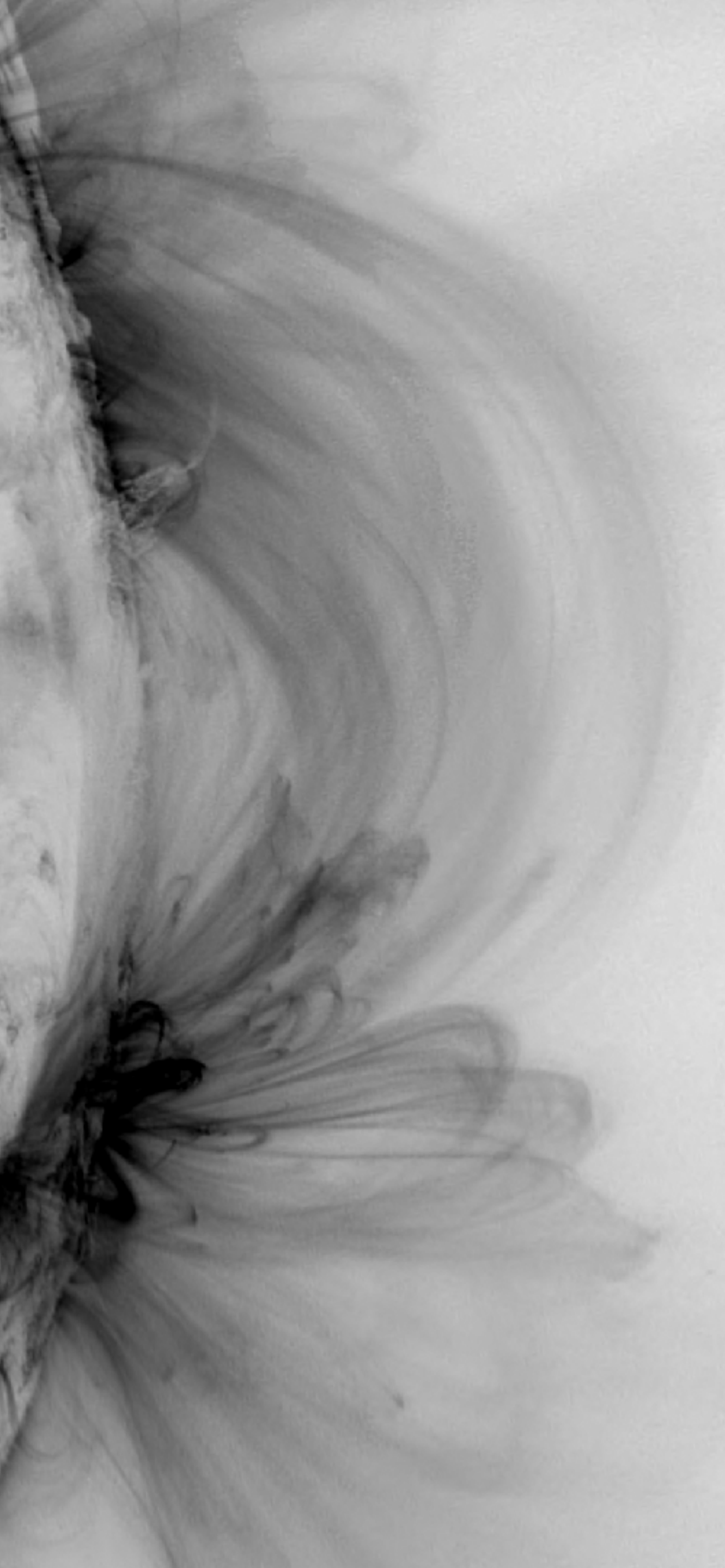
Assuming 6×10^4 DN/s is emitted at the peak of the response function



Loop width	200km	50km
Ne /cm3	3.1x10 ¹⁰	1.2x10 ¹¹
Conduction timescale	1.7h	7h
Radiative timescale	97s	24s

Conclusions

1. HRIEUV sees thinner loops ($<400\text{km}$) than Hi-C, perhaps due to different bandpass (17.4 versus 19.3 nm).
2. Highly contrasted flare loops with 2-pix width
3. A population of unresolved low contrast loops thinner than 200km?
4. The enormous brightness of thin flare strands implies very high densities.
5. Fade times of thin strands of several minutes suggests continuous heating



Thanks!

Sami
present

EUI team at the launch site



David not
present