Slender Ca II H fibrils observed by Sunrise/SuFI

R. Gafeira[1], A. Lagg[1], S. K. Solanki[1,2], S.Jafarzadeh [3] M. van Noort [1], and Sunrise team

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2 - School of Space Research, Kyung Hee University, Republic of Korea
3 - University of Oslo, Norway

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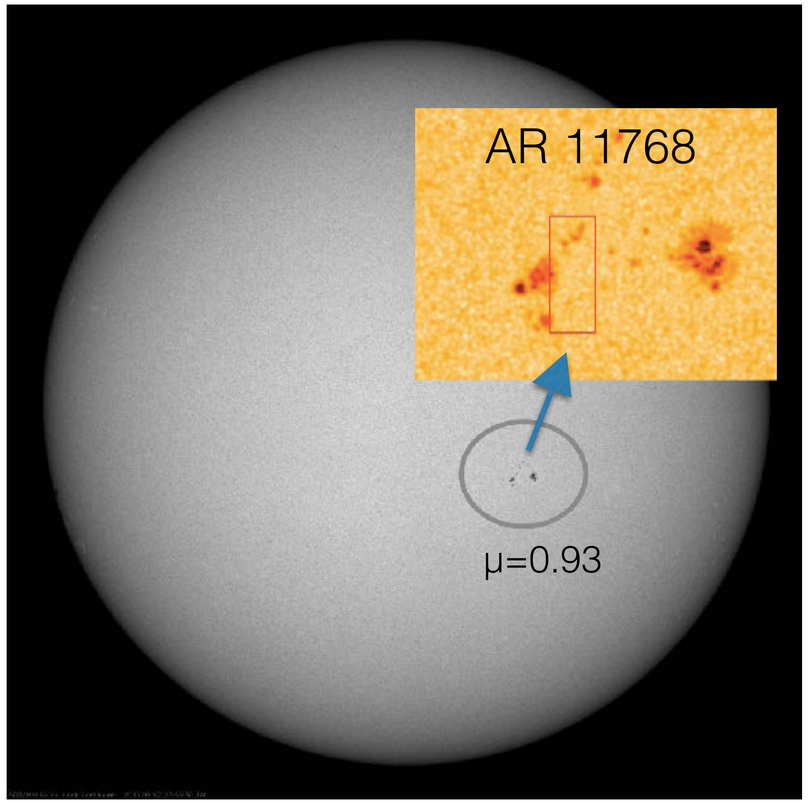
Sunrise Observatory

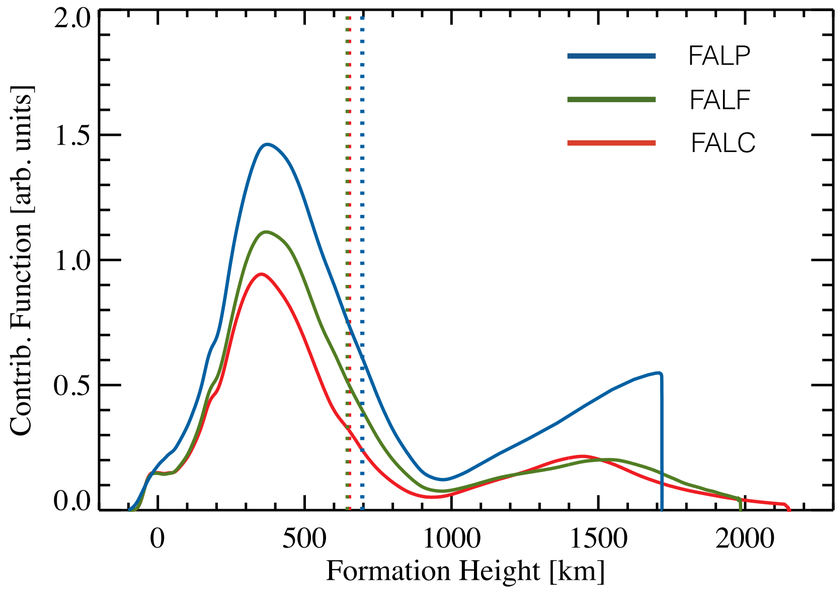
- 1 meter Gregory telescope
- SUFI - UV filtergraph
  - FOV 15x39”
  - Resolution ~0.15”
- Two scientific flights: second flight launched on 12 June 2013 from Sweden and it landed on 17 June 2013 in Canada

Data set

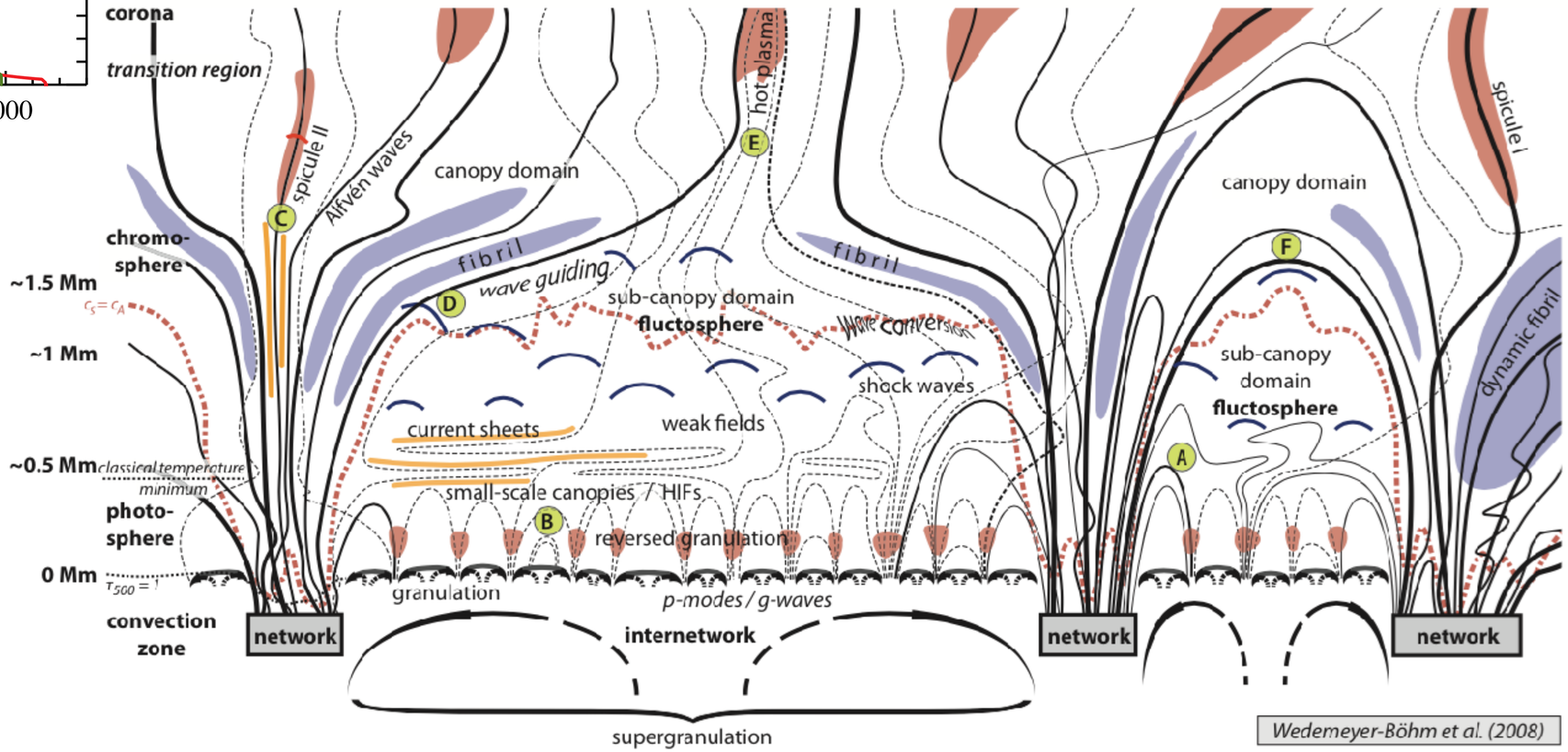
- Ca II H (3968.4 Å) SUFI filtergrams
  - One hour observation - starts at 23:39 12/06/2013
  - Cadence of 7 seconds
  - Bandwidth of 1.1 Å
  - With and without MOMFBD reconstruction



Formation height Ca II H

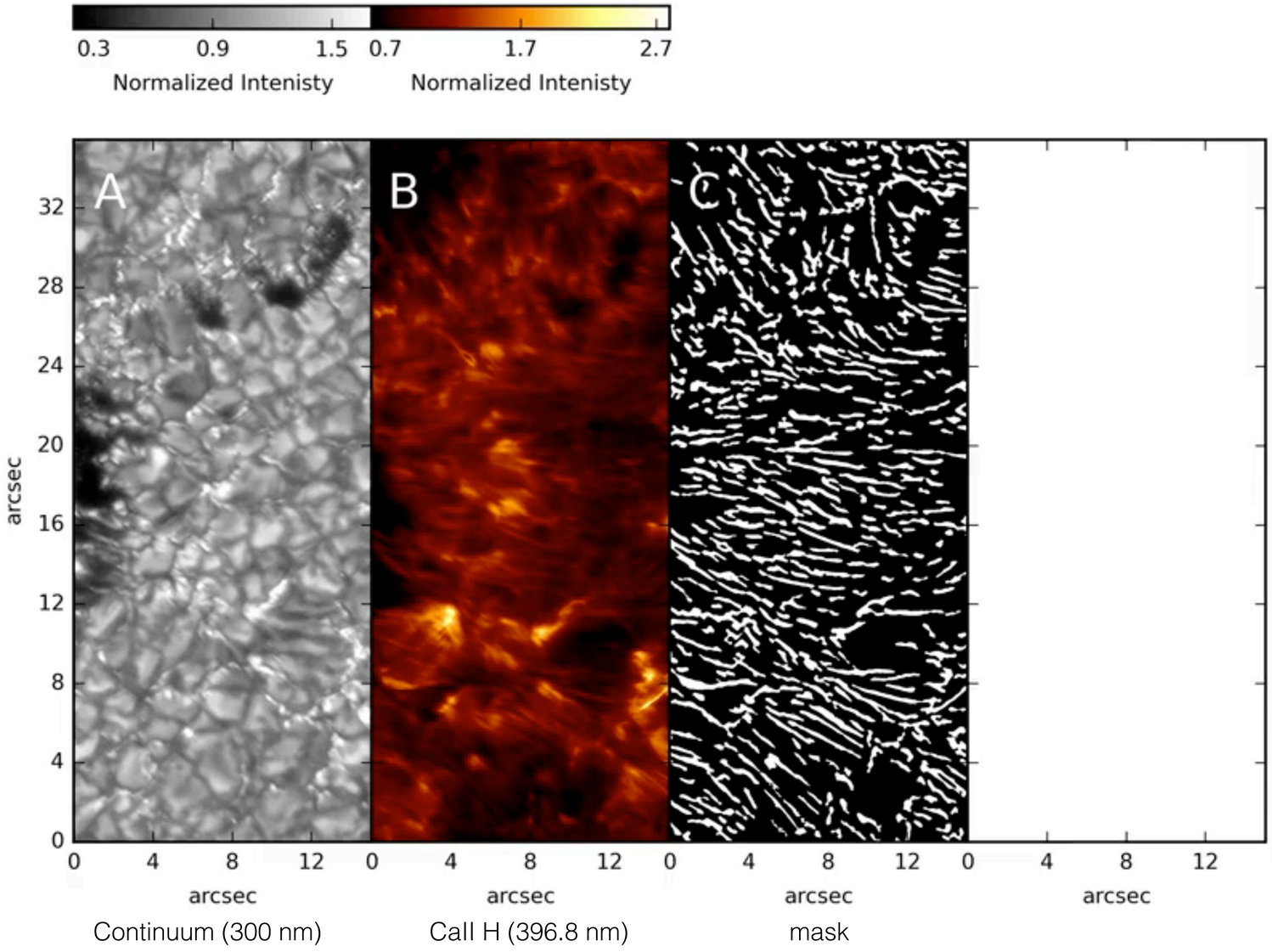


Shahin Jafarzadeh (2016)

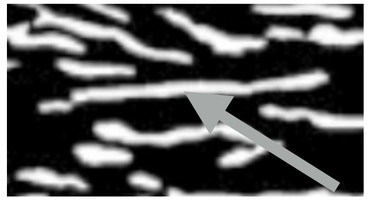


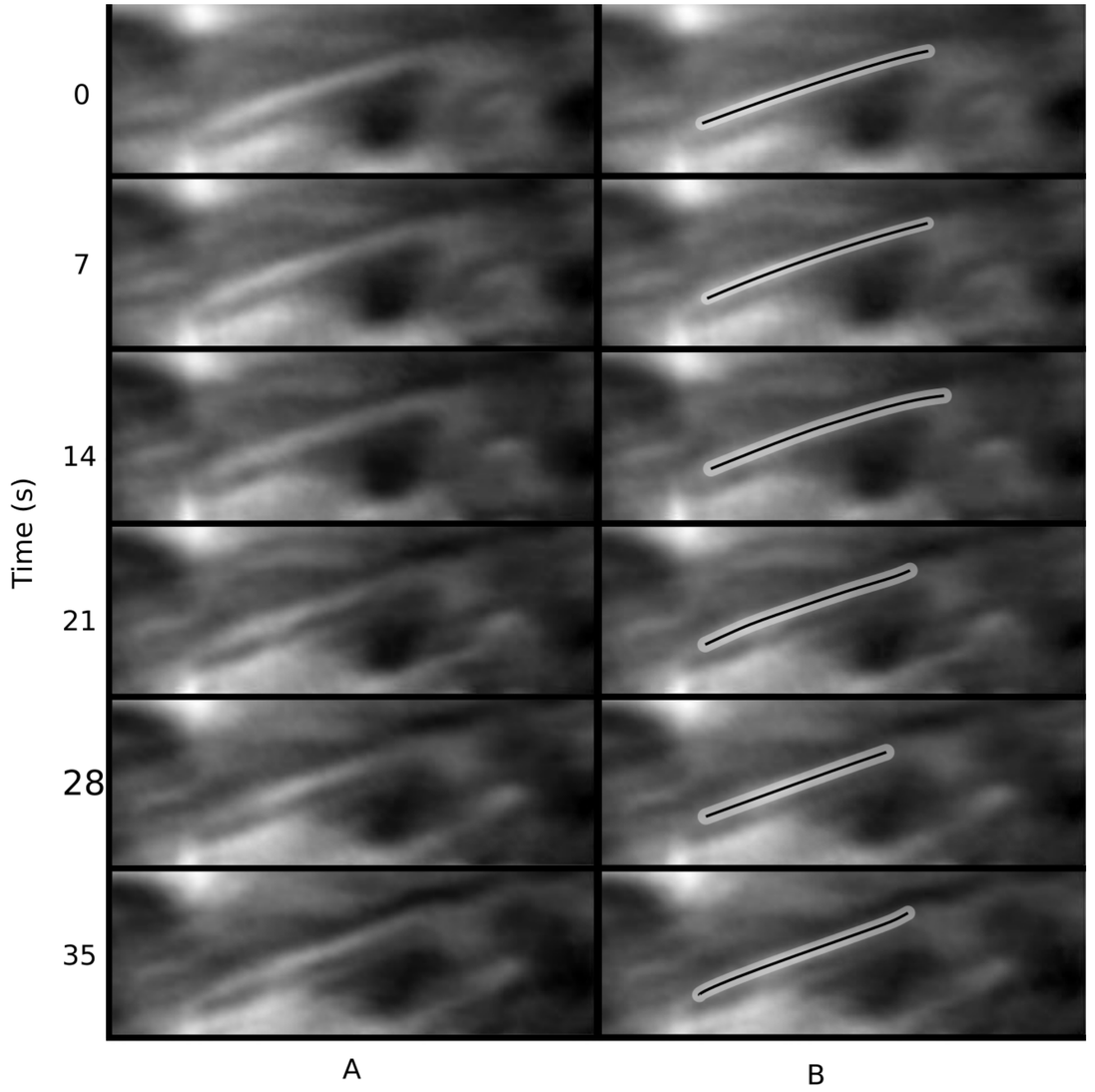
Wedemeyer-Böhm et al. (2008)

Automatic detection and tracking

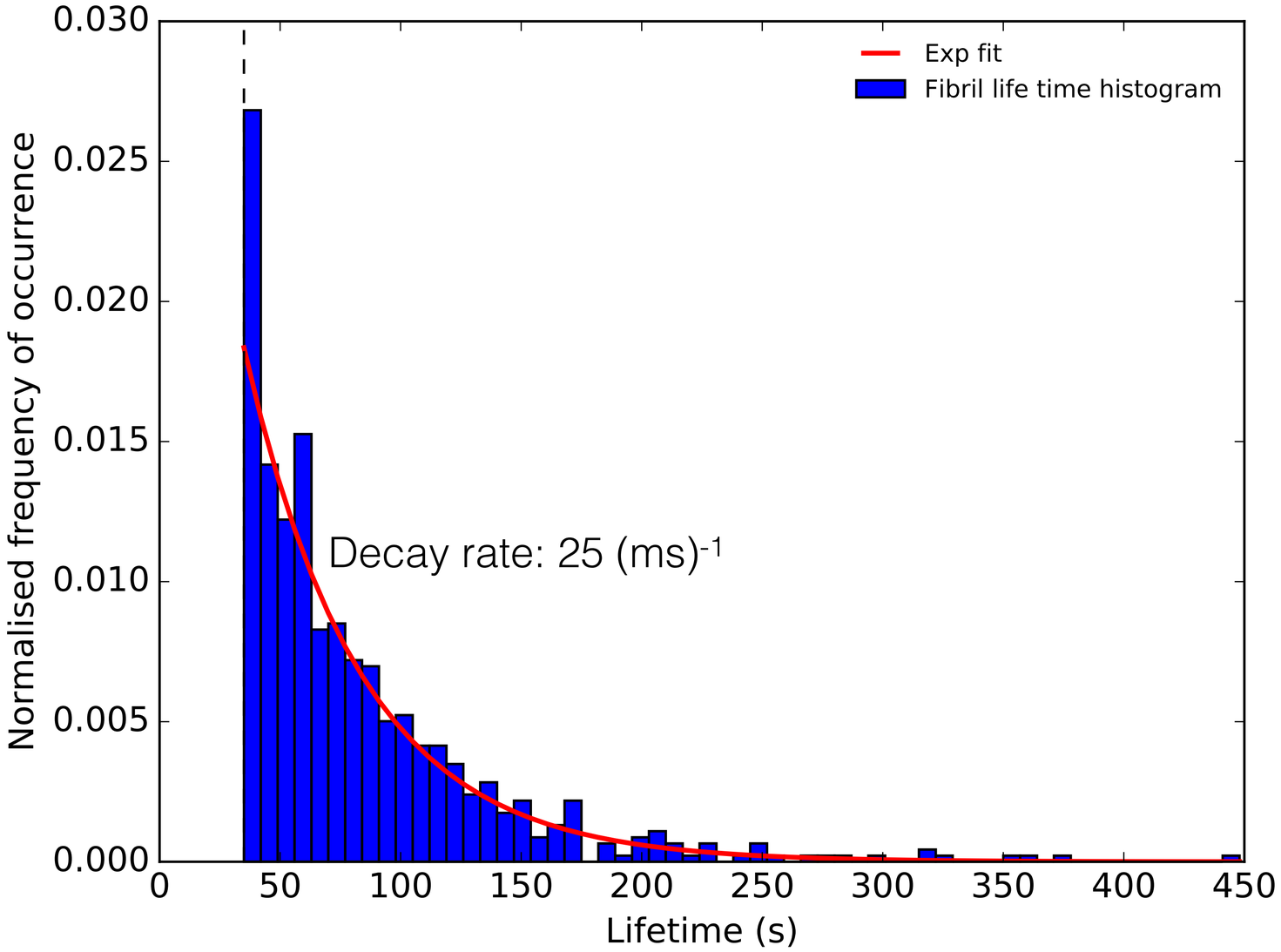


Fibril evolution

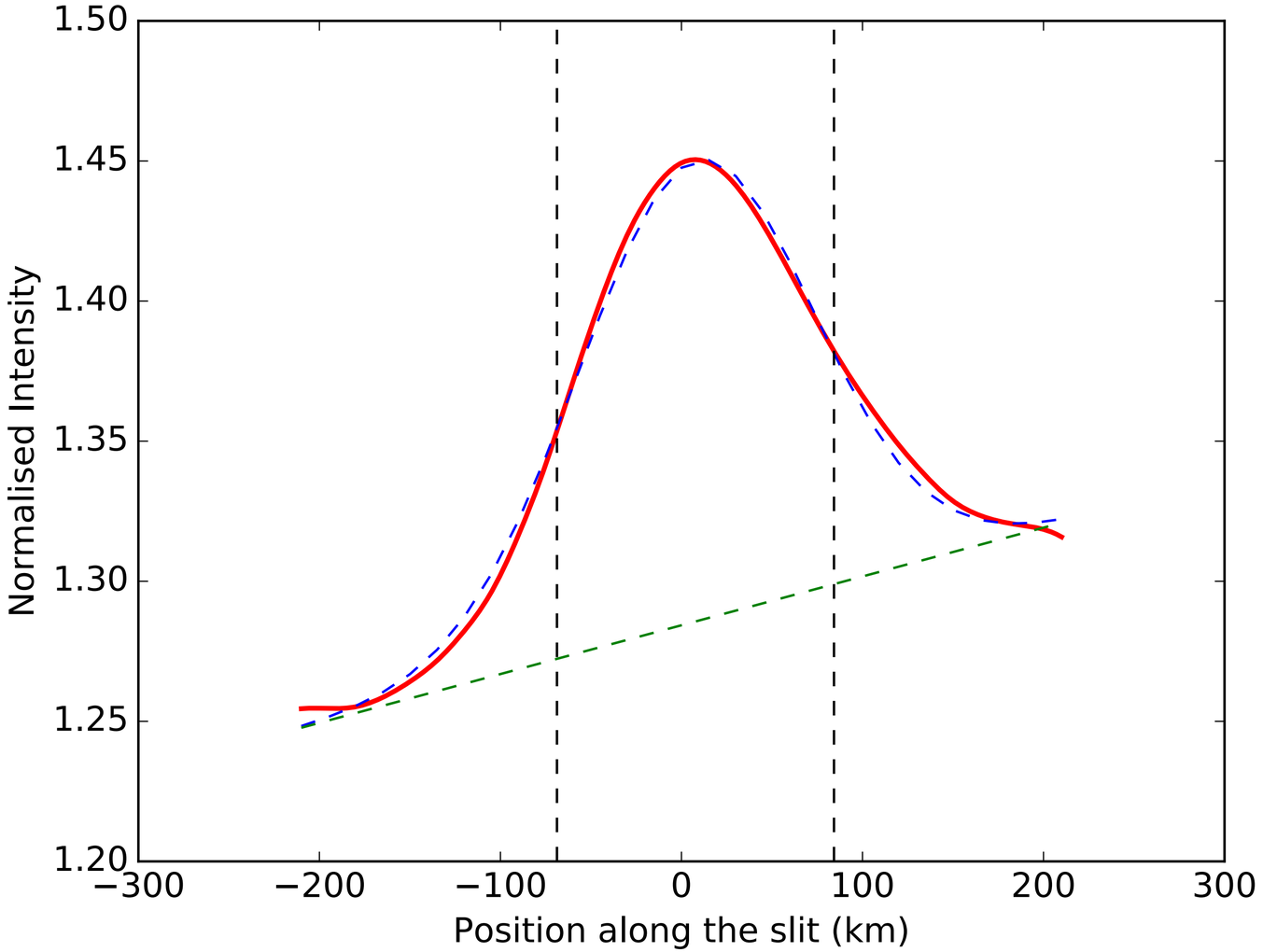




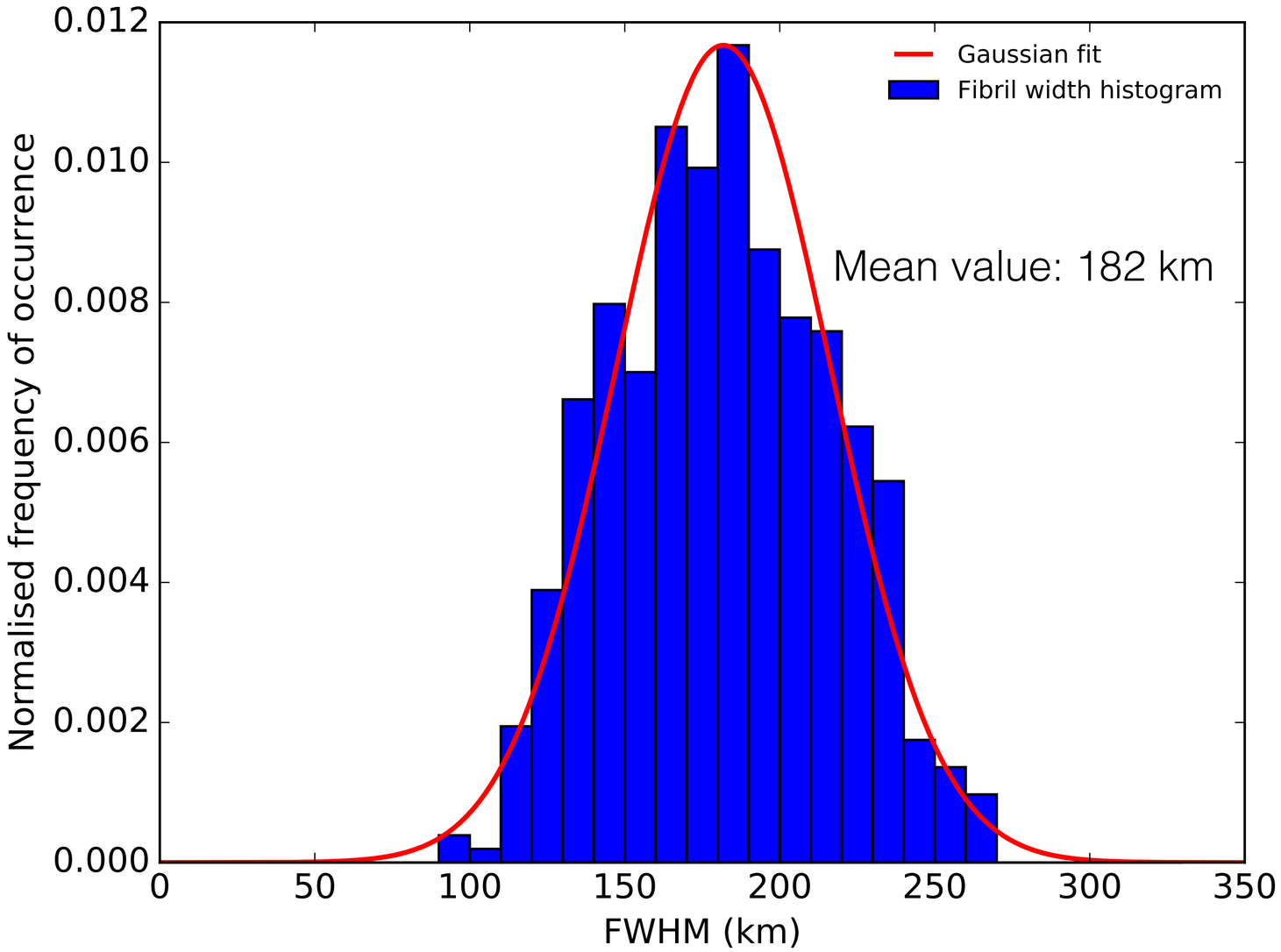
Lifetime


Exp fit
Fibril life time histogram
Decay rate: 25 (ms)-1
Normalised frequency of occurrence
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0
50
100
150
200
250
300
350
400
450
Lifetime (s)

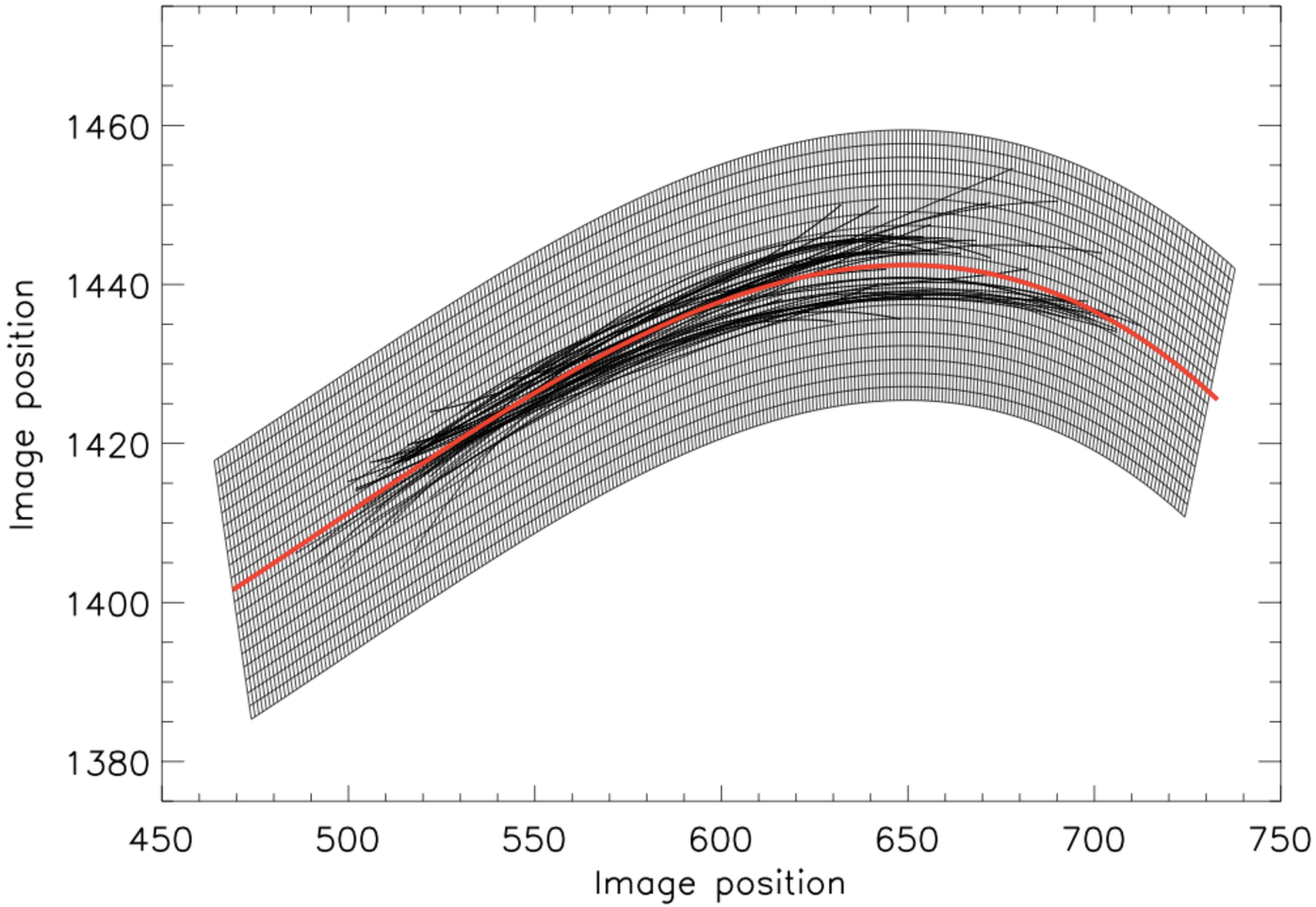
Fibril Width



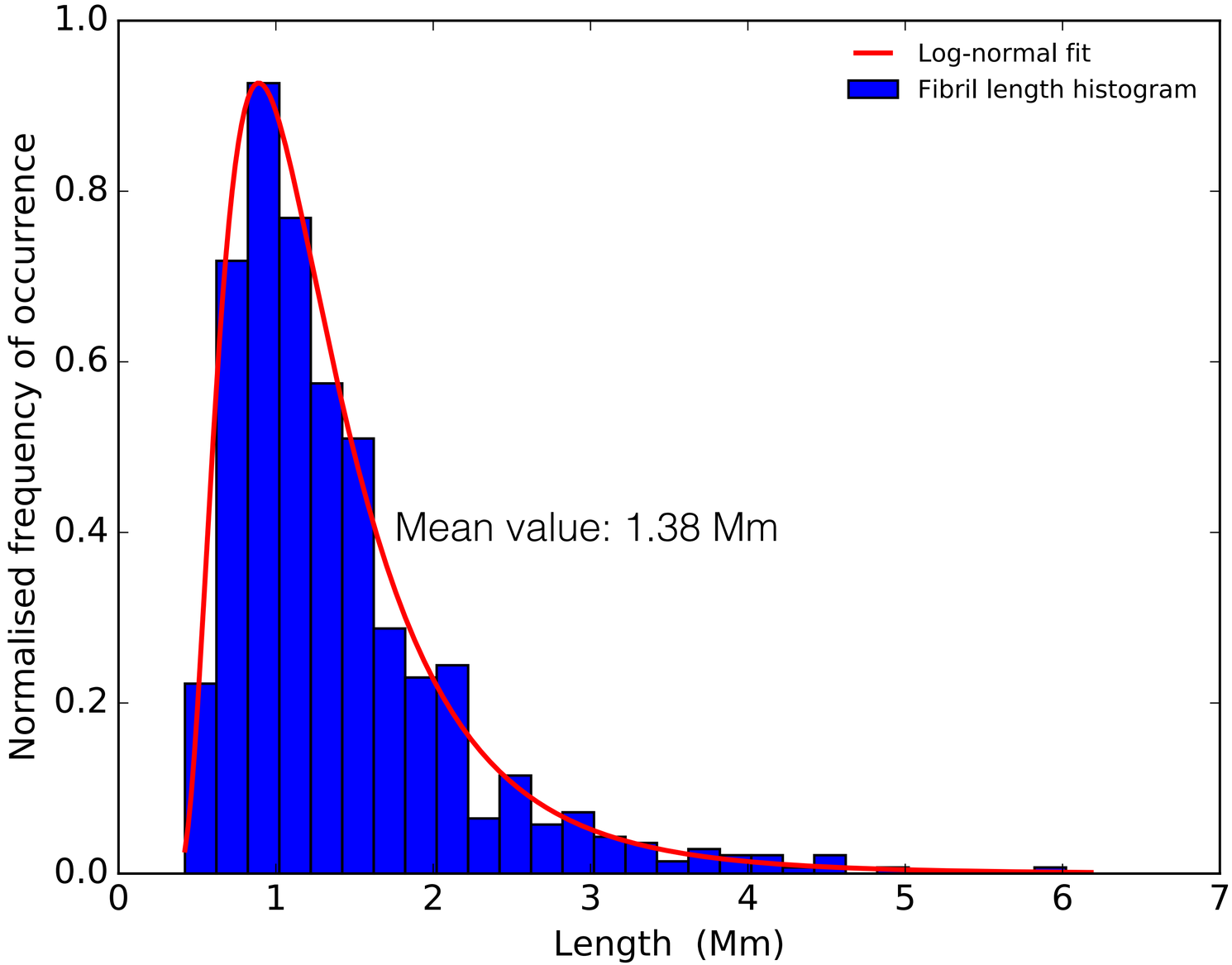
Fibril Width



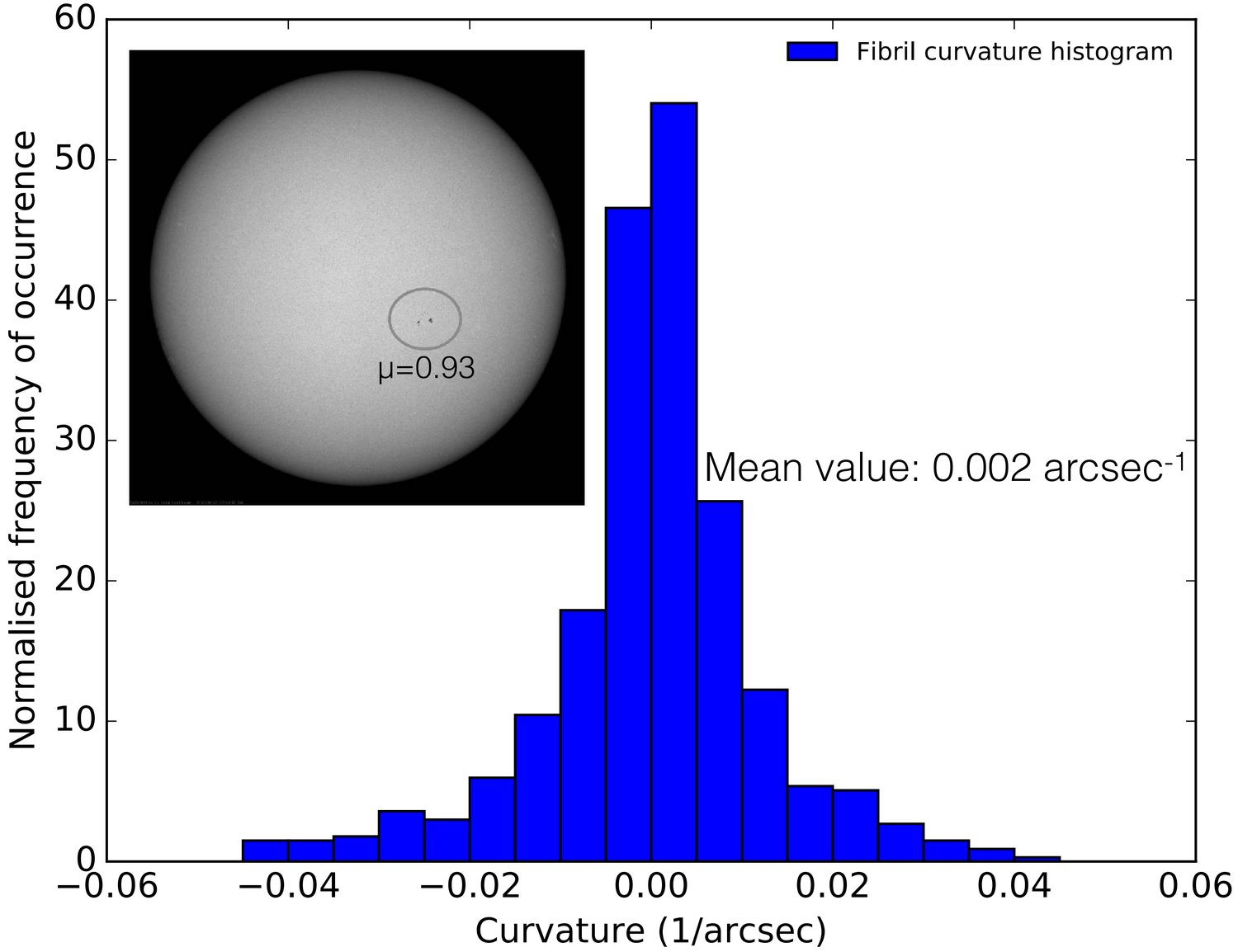
Average skeleton and fibril destretching



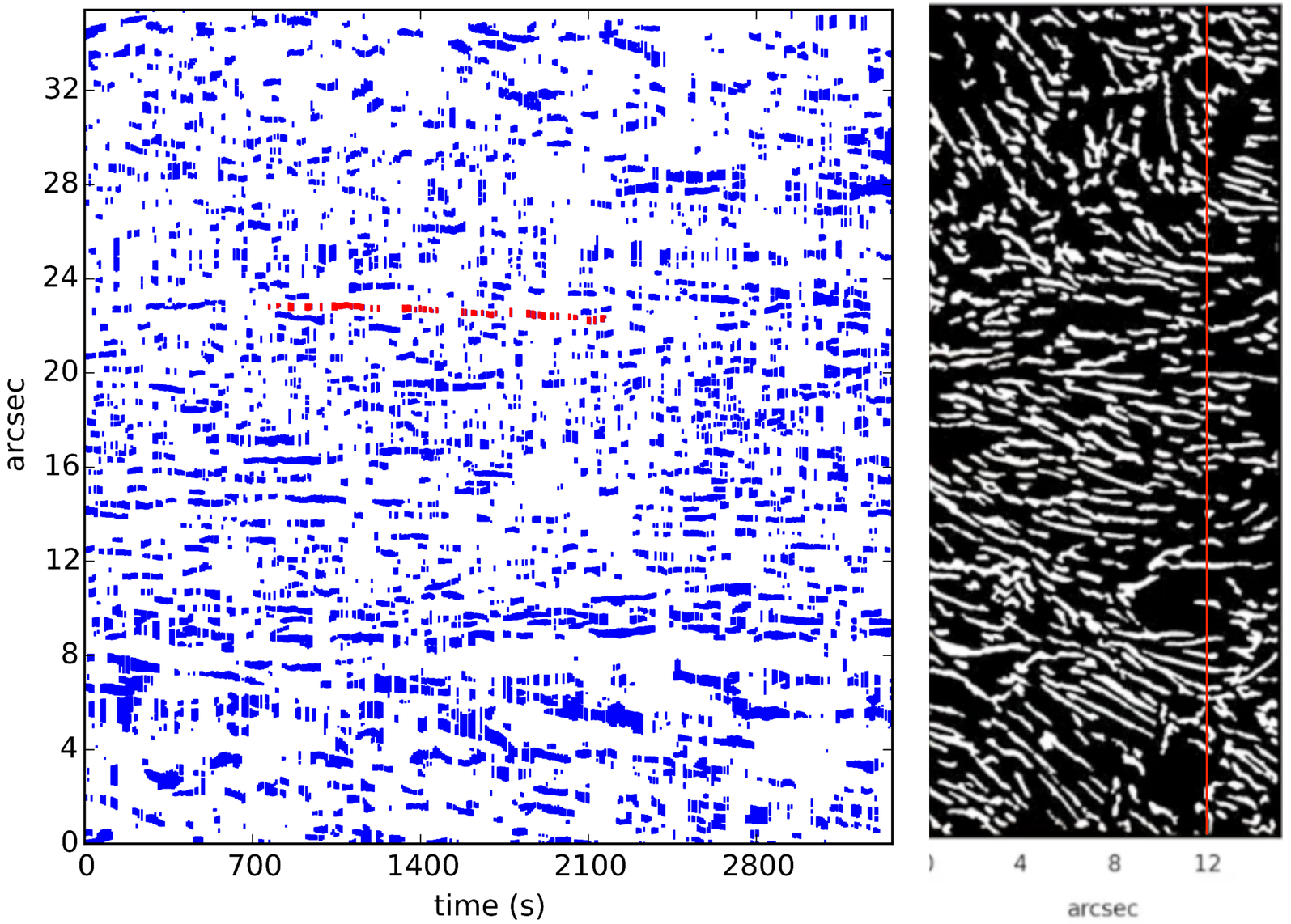
Length


Log-normal fit
Fibril length histogram
Mean value: 1.38 Mm
Normalised frequency of occurrence
Length (Mm)
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
7

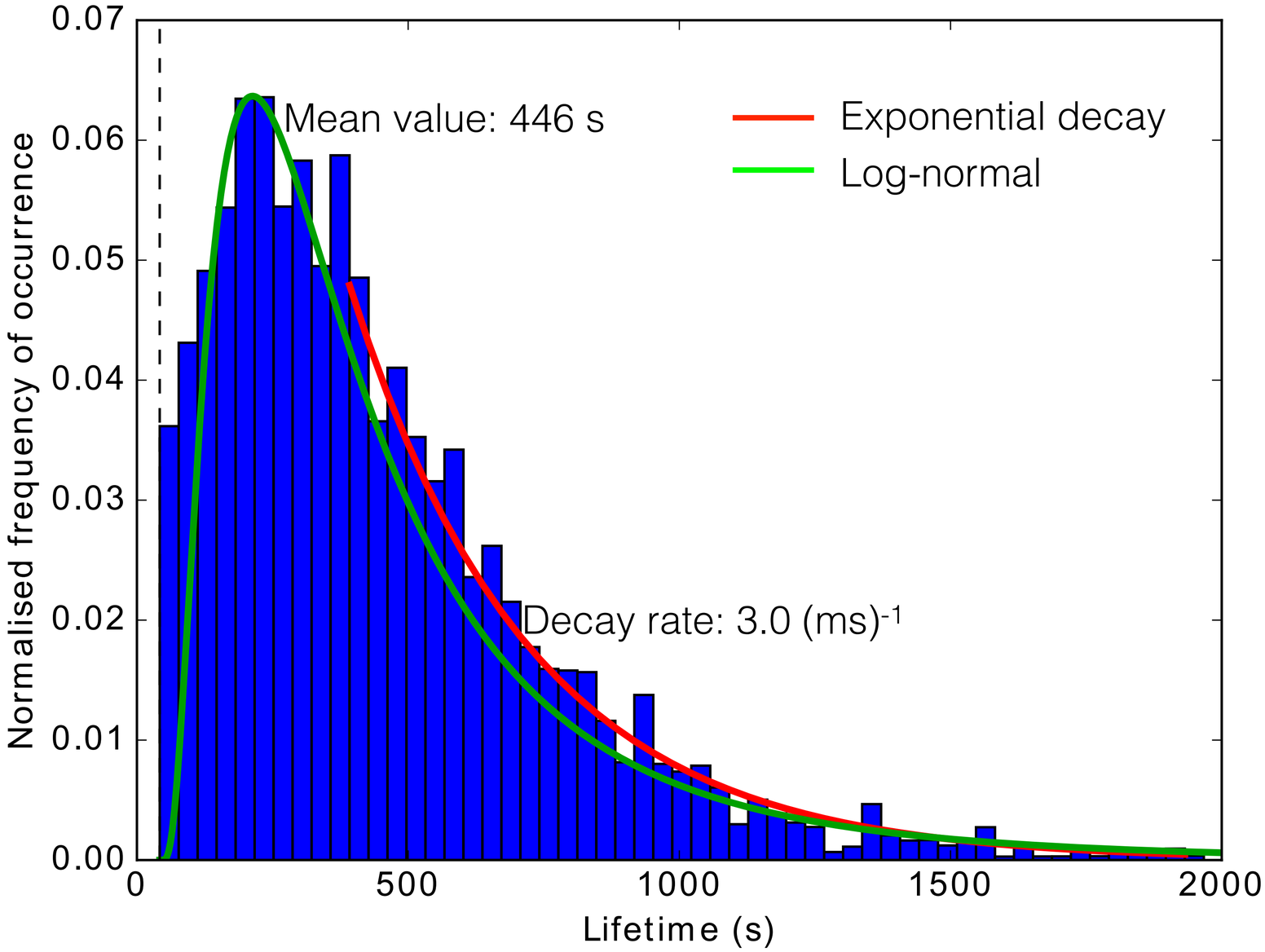
Curvature


Fibril curvature histogram
μ=0.93
Mean value: 0.002 arcsec-1
Normalised frequency of occurrence
Curvature (1/arcsec)
60
50
40
30
20
10
0
−0.06
−0.04
−0.02
0.00
0.02
0.04
0.06

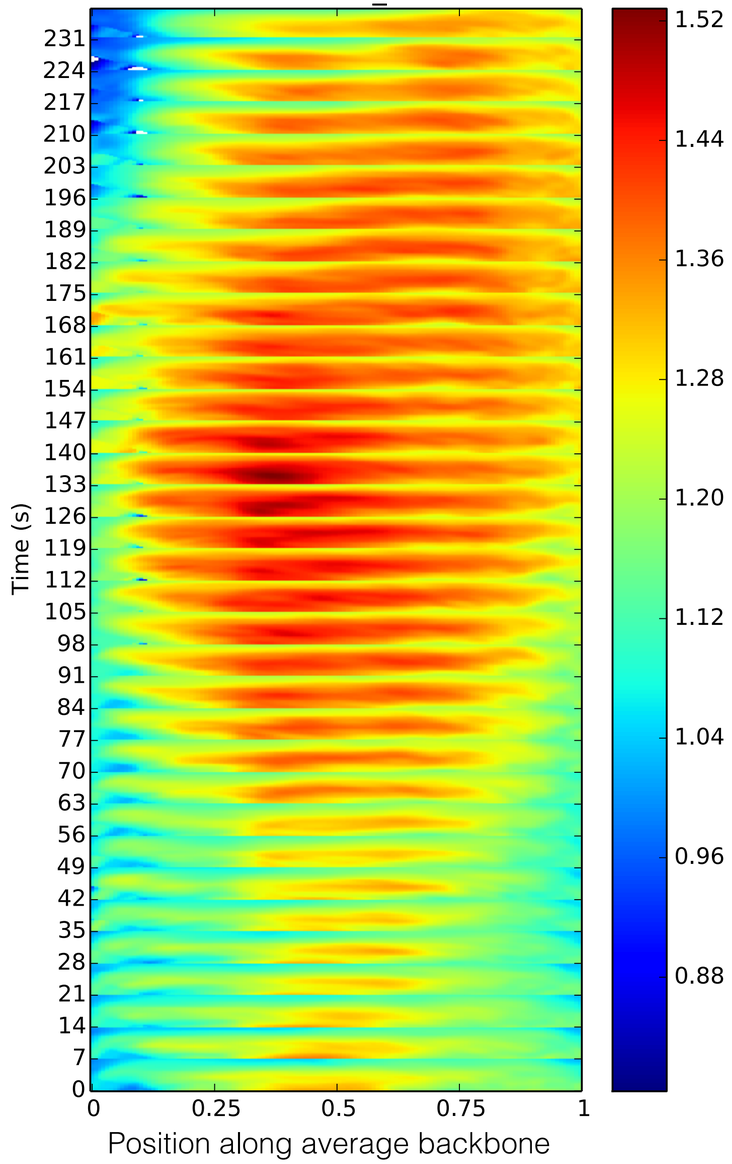
Space-time plot / Detected fibrils

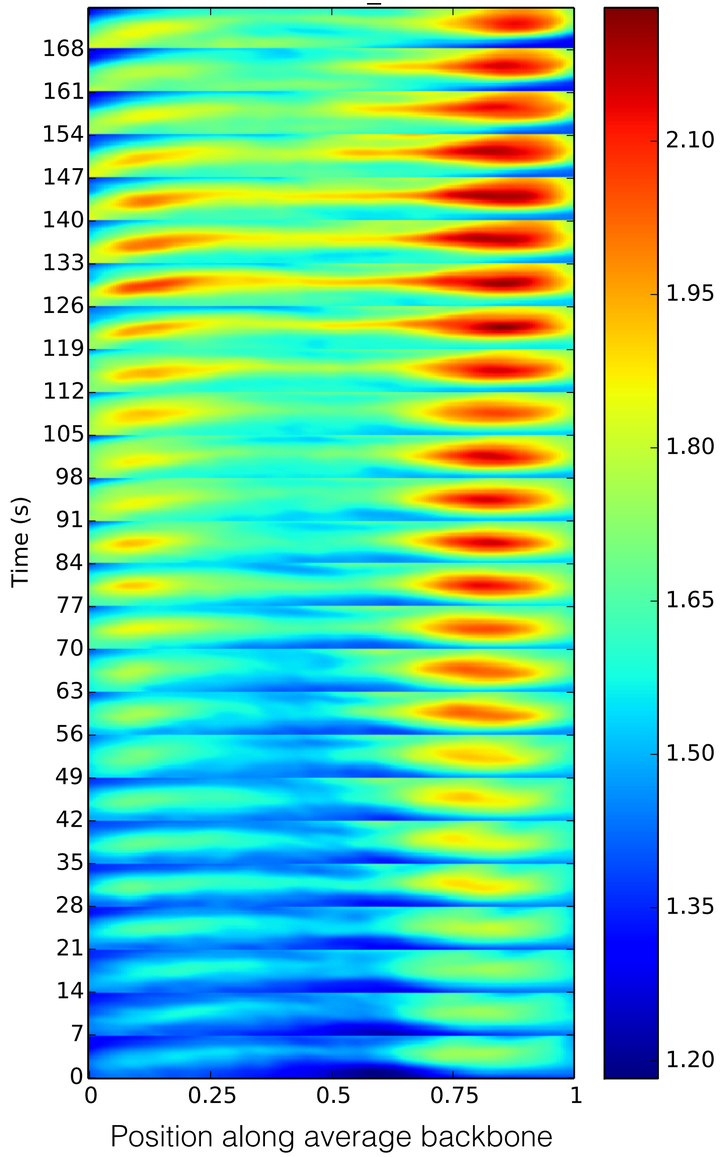


Lifetime extended tracking

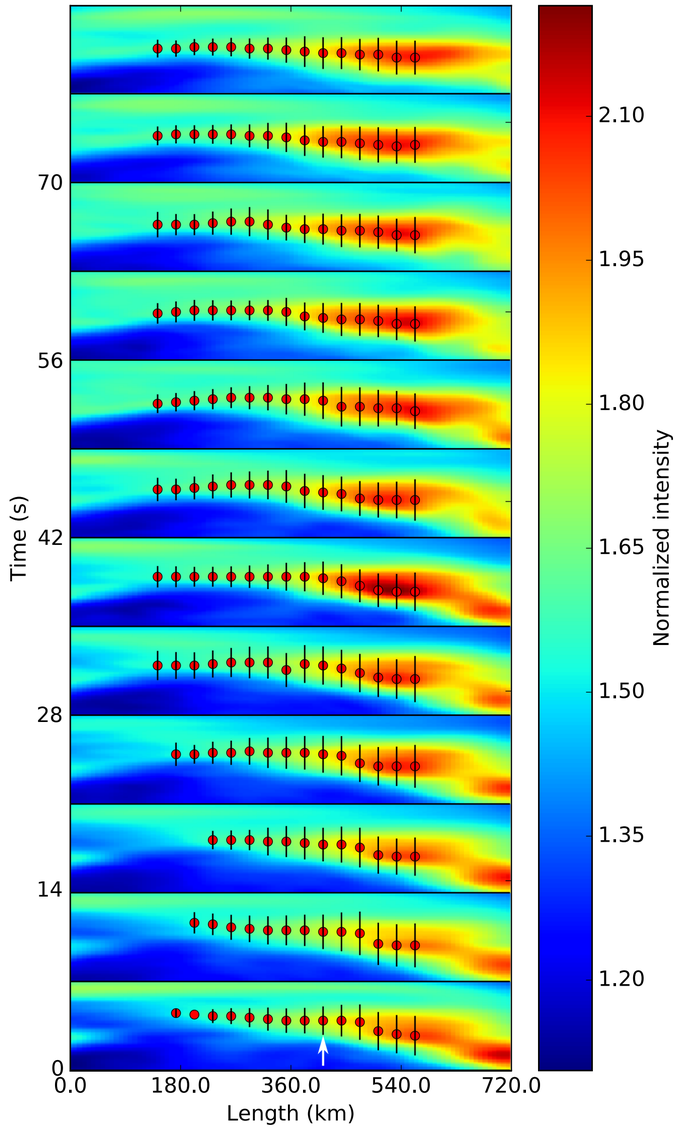


Brightness variations

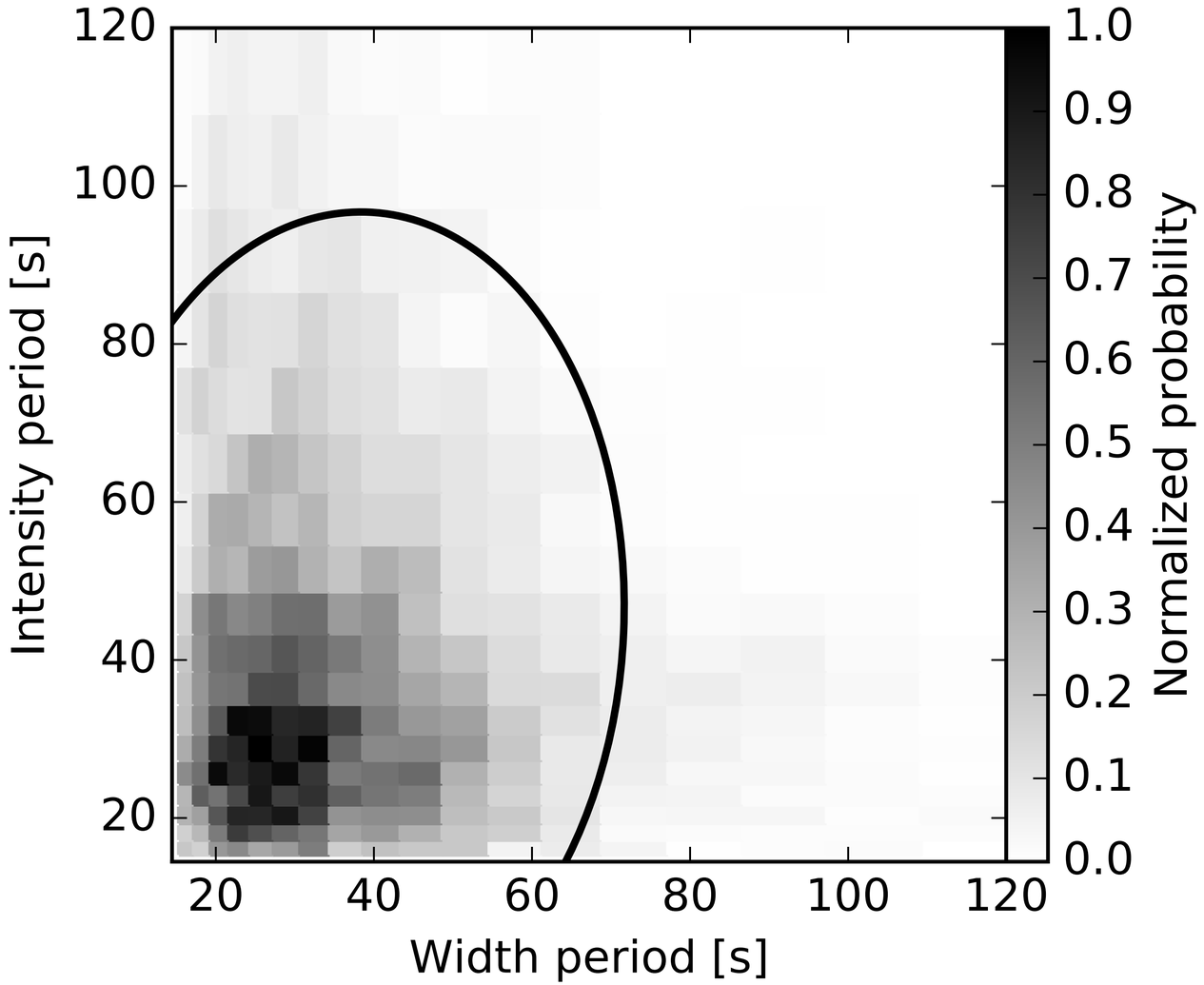




Intensity and Width variations

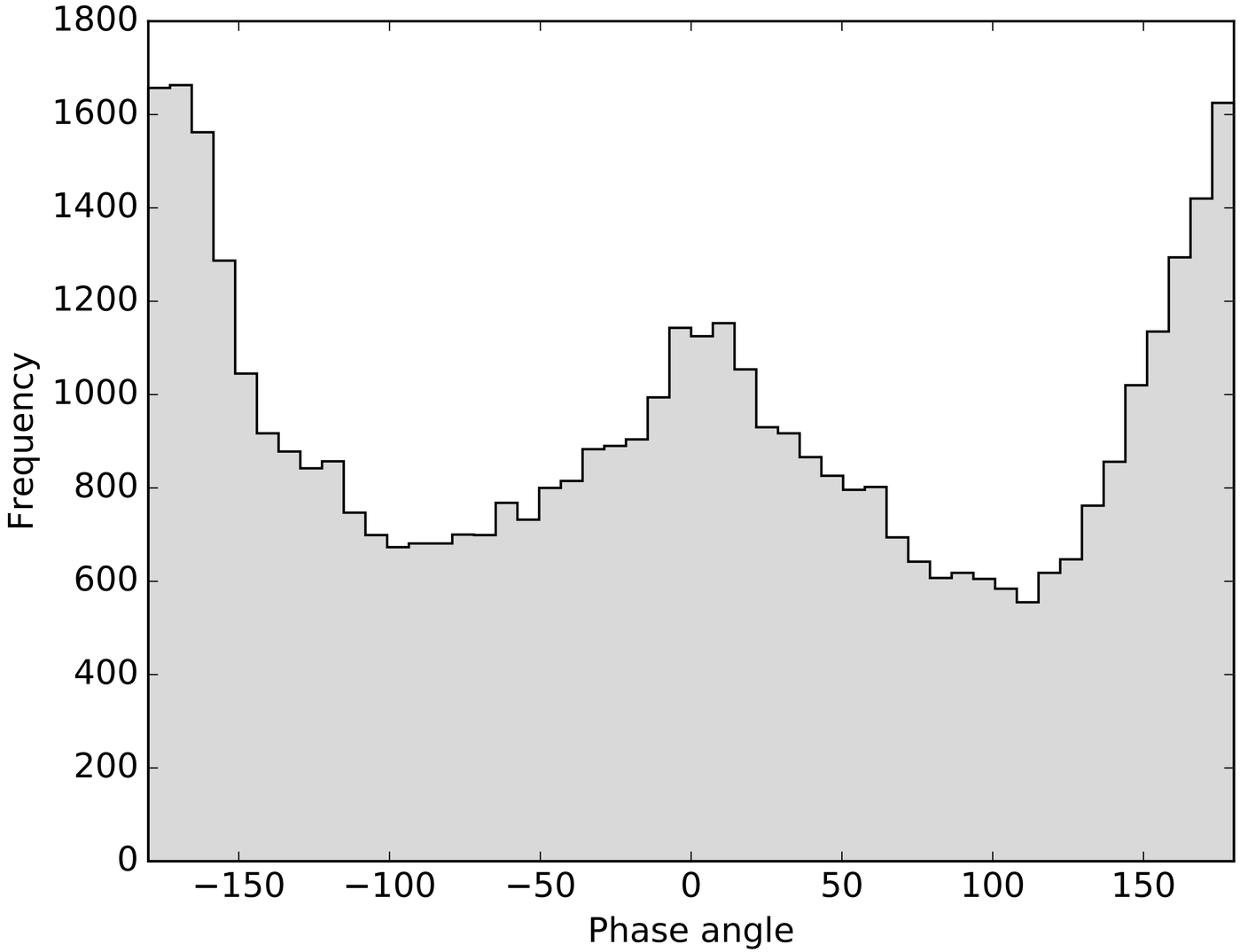


Periods and phase speed of width and intensity oscillations

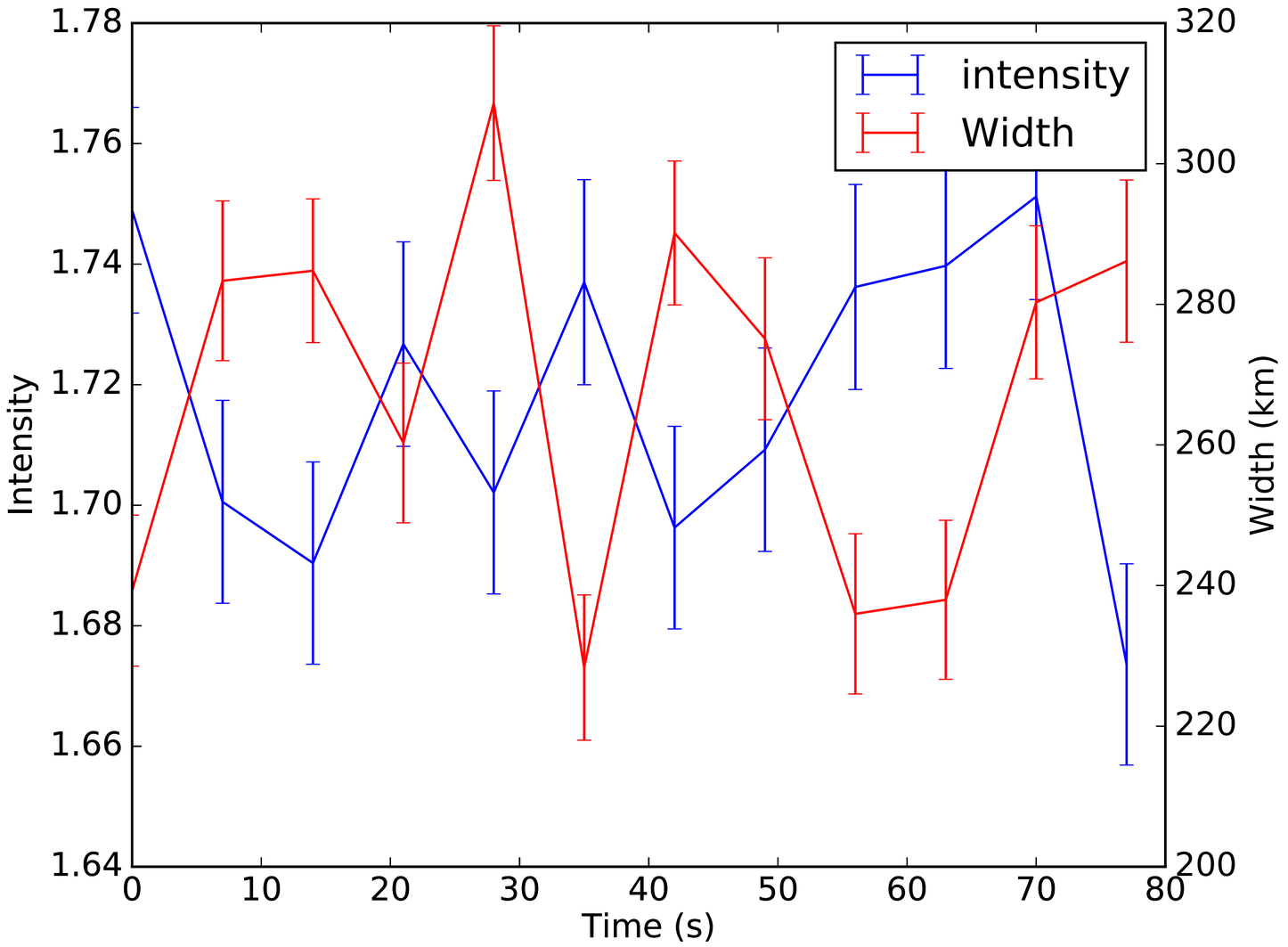


	Phase speed
Width	11^{+49}_{-11} km/s
Intensity	15^{+34}_{-15} km/s

Distribution of phase differences between width and intensity at a given cut across each fibril.



Intensity / Width



Summary

parameter	lifetime (excl. gaps)	lifetime (incl. gaps)	length	width	curvature
functional form	exponential	log-normal	log-normal	gaussian	symmetric
range	35–450 s	35–2000 s	500–4500 km	100–270 km	-0.04–0.04 $arcsec^{-1}$
mean value	n/a	446 s	1380 km	182 km	0.002 $arcsec^{-1}$
standard deviation	n/a	310.27	760 km	34 km	0.019
skewness	n/a	3.70	2.51	n/a	2.26
kurtosis	n/a	31.60	3.24	n/a	17.83
exp. decay rate	25 $(ms)^{-1}$	3.0 $(ms)^{-1}$	n/a	n/a	n/a

(Gafeira et al. 2017a, ApJS, in press)

	Width	Intensity
Periods	32 ±17 s	36 ± 25 s
Phase Speed	11^{+49}_{-11} km/s	15^{+34}_{-15} km/s

Anti-phase

Fast Sausage mode

(Gafeira et al. 2017b, ApJS, in press)