

***Impulsive coronal heating from  
large-scale magnetic  
rearrangements:  
observations with SDO/AIA***

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# Coronal heating

- Coronal heating long-standing issue
- *Magnetic braiding* one viable mechanism (e.g., Parker 1988)
- Very difficult to observe (small scales)
- Reconnection produces electron beams

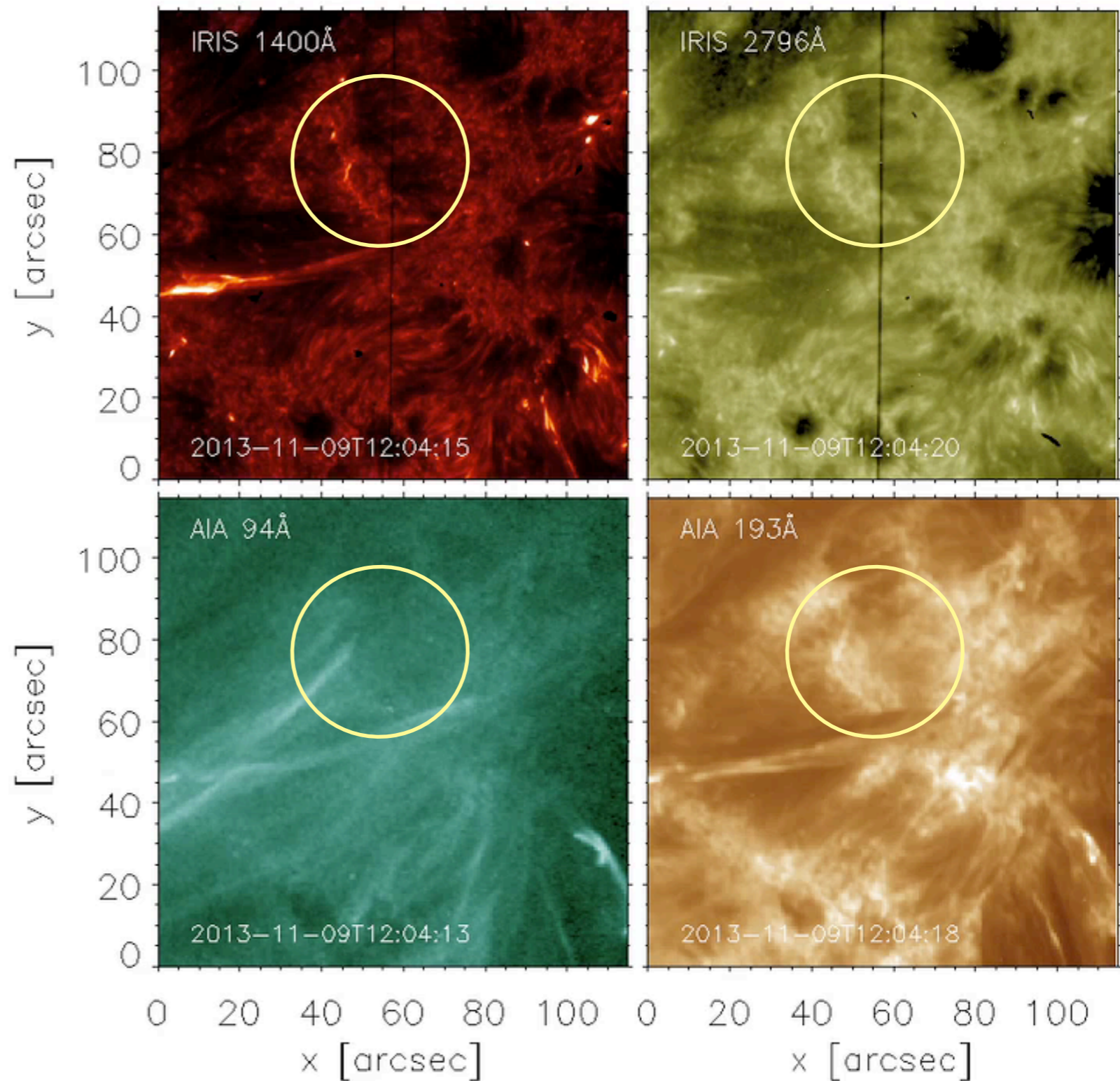




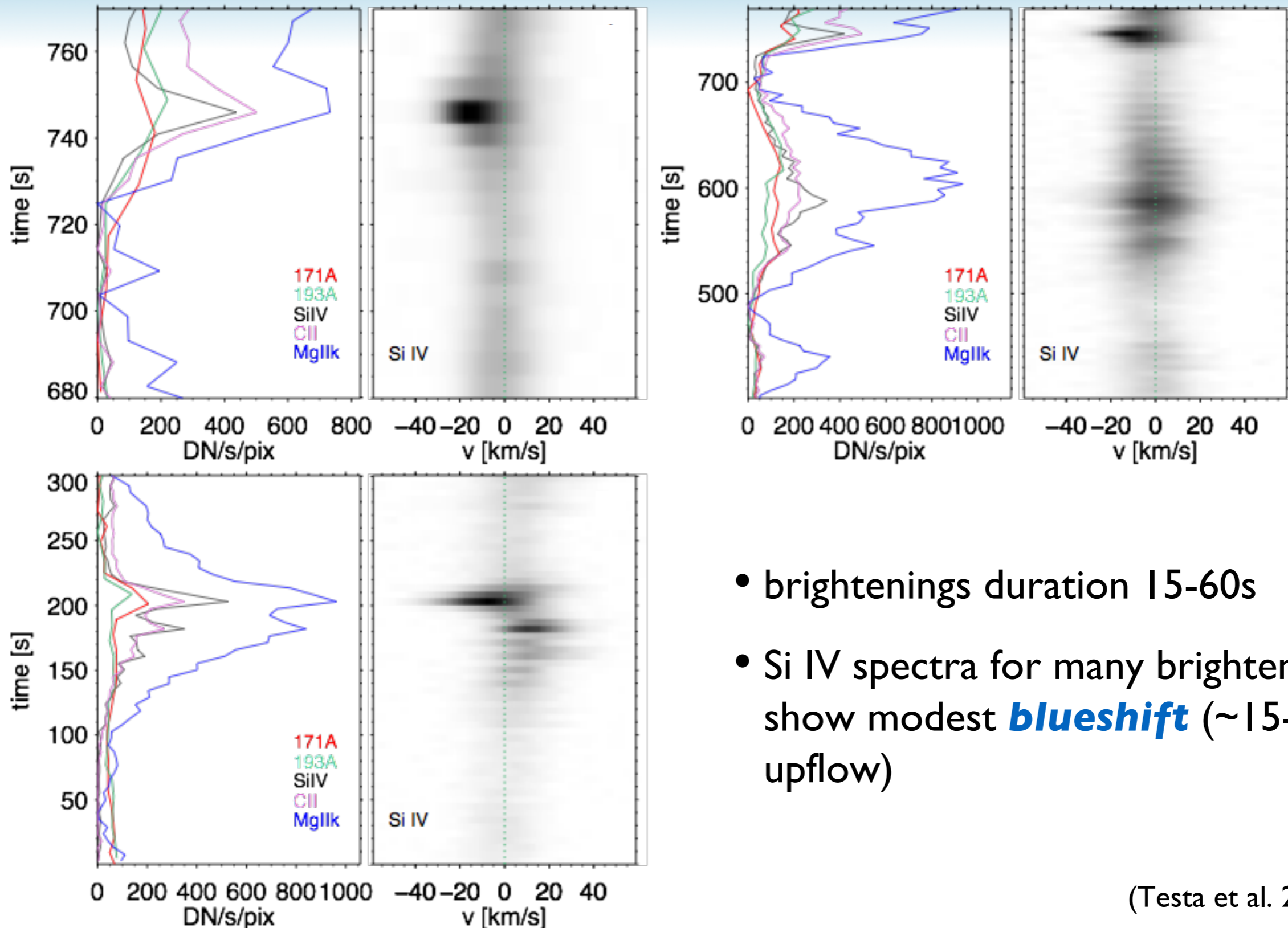
# IRIS brightenings

Interface Region Imaging Spectrograph [IRIS] often observes short-lived brightenings ( $\lesssim 30$ s) at footpoints of coronal loops

(Testa et al. 2014, *Science*)



# Transient Doppler shifts

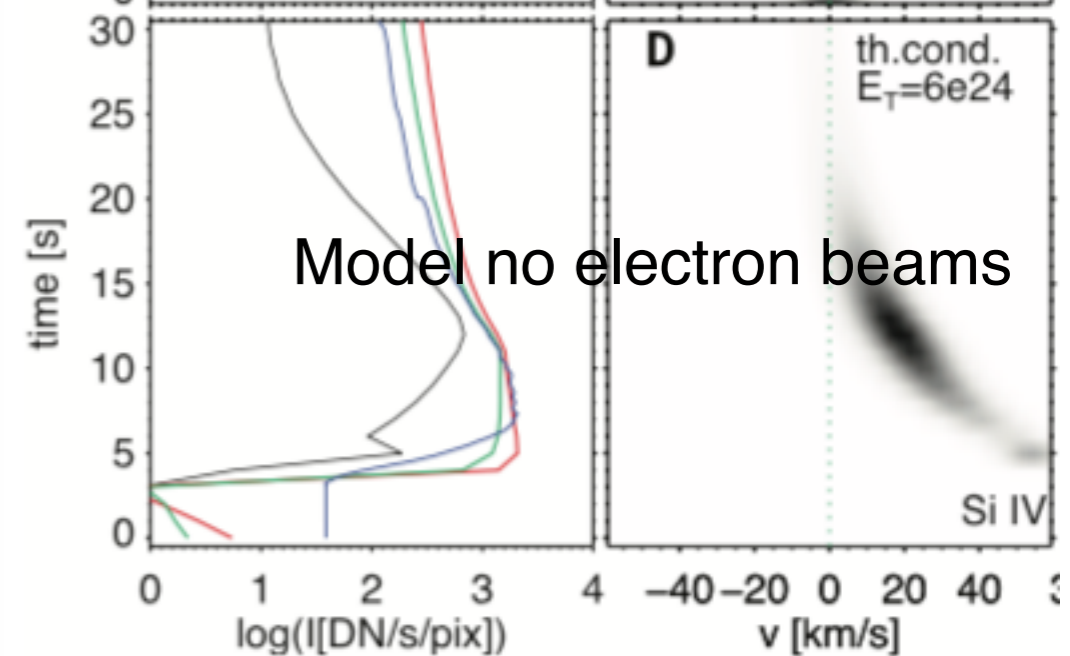
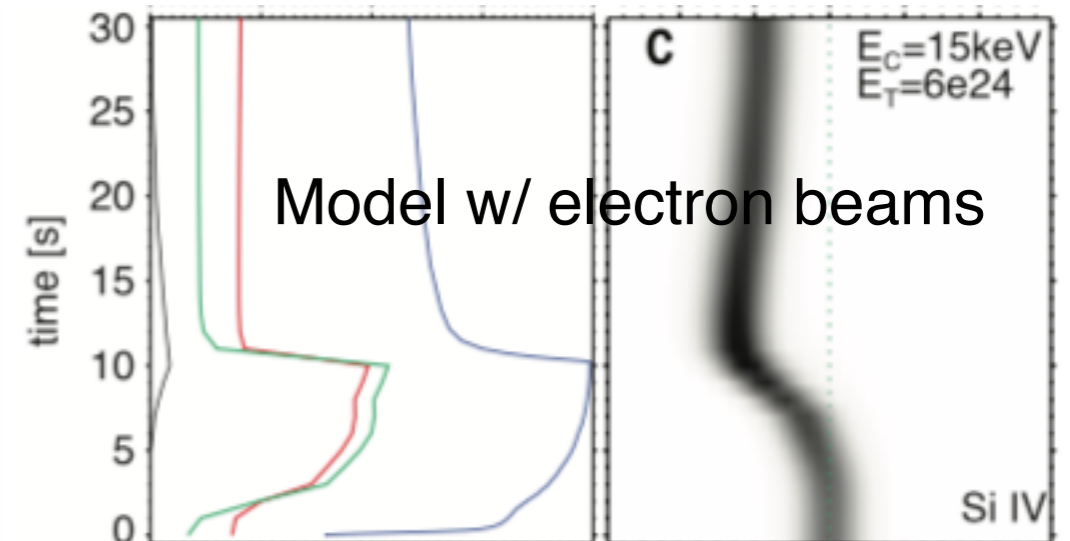
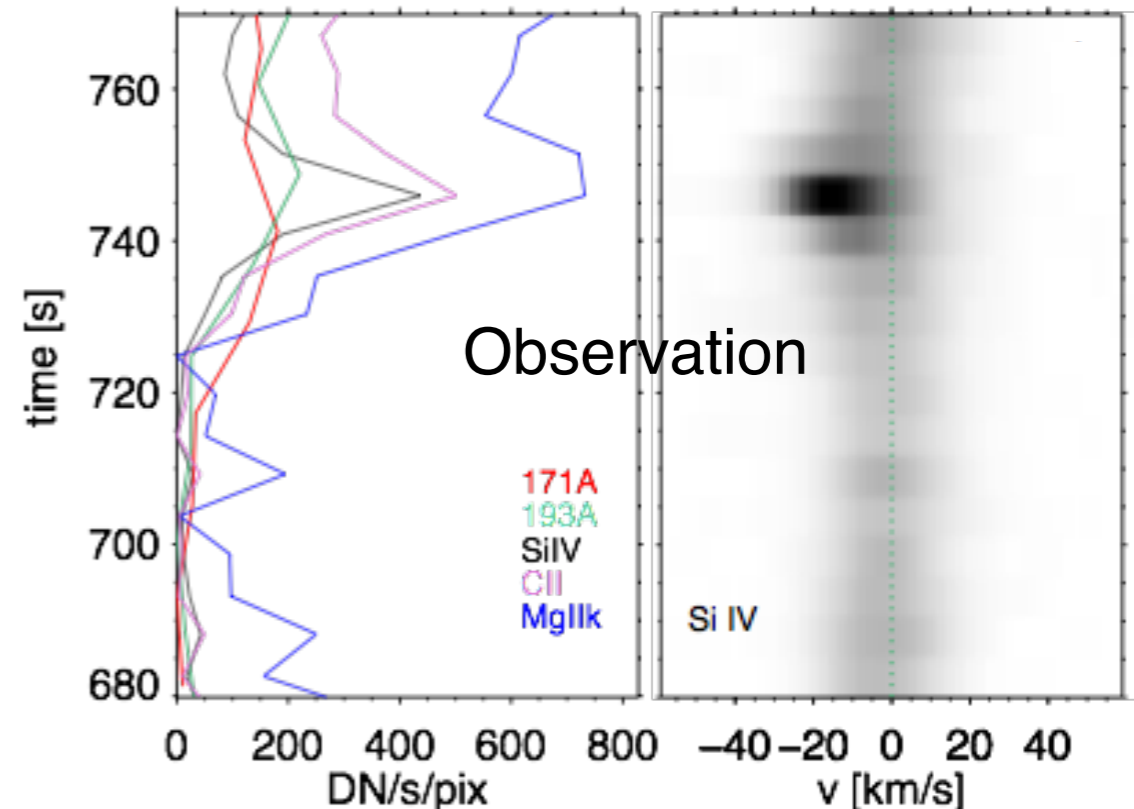


- brightenings duration 15-60s
- Si IV spectra for many brightenings show modest **blueshift** ( $\sim 15\text{-}20$  km/s upflow)



# Signatures of magnetic reconnection

- Hydrodynamic modeling: heating by electron beams explains blueshift [Testa+ 2014, Science]



# Present study

- Framework: *systematic study*
- Coronal counterparts



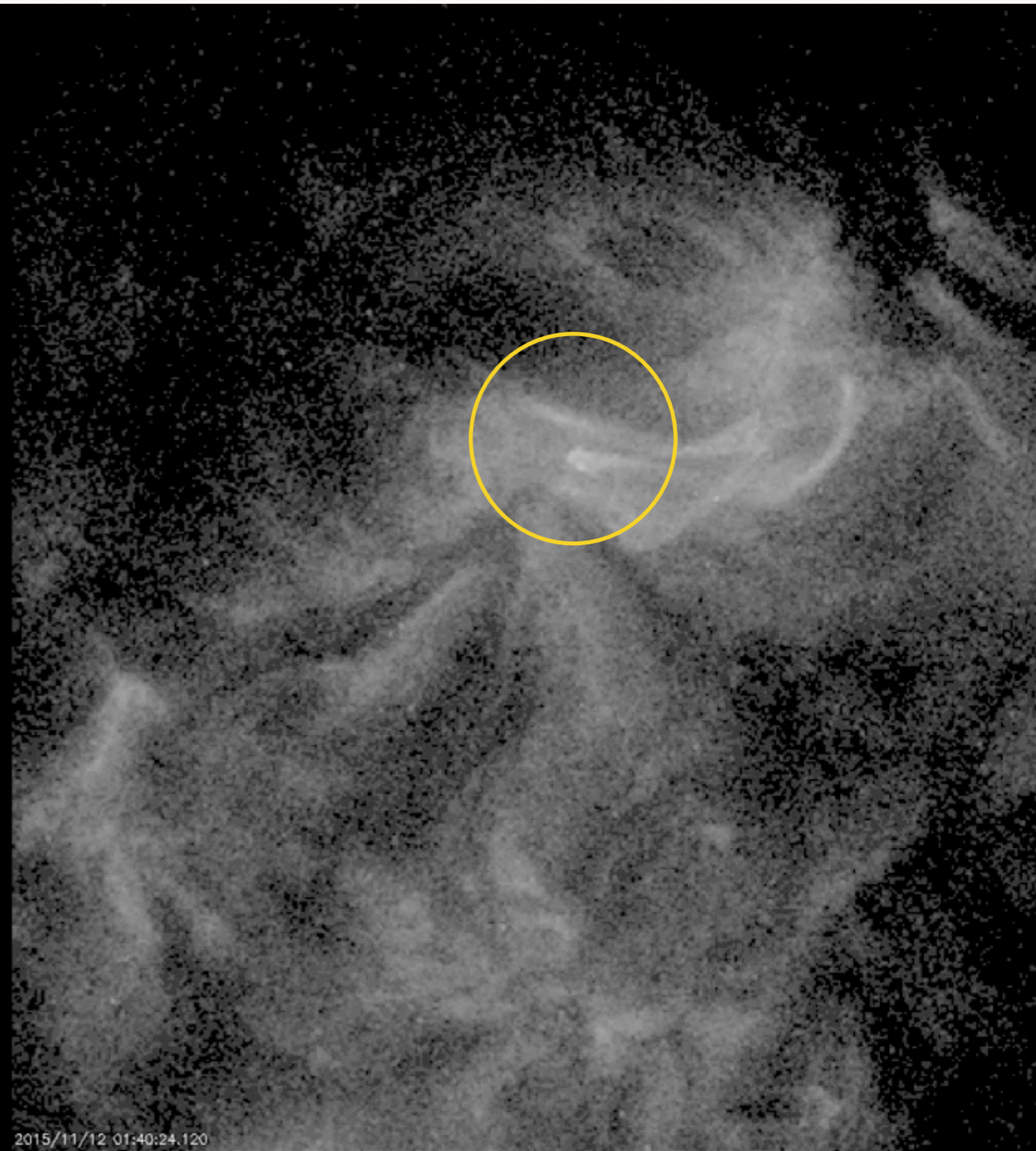
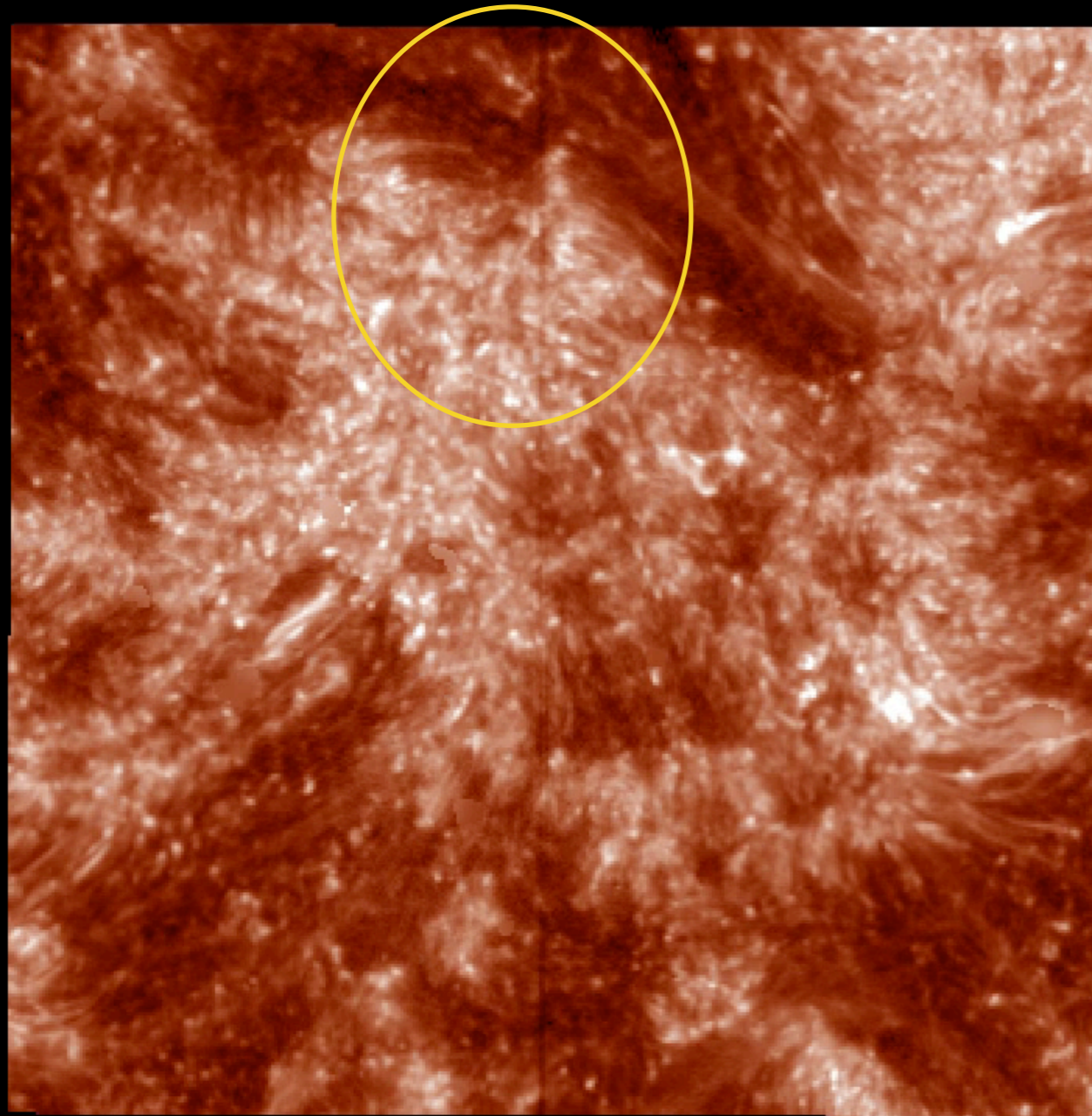
# IRIS bright points:

## Event list

1. 2014/02/04 13:29:17
2. 2014/02/23 12:14:30
3. 2014/02/23 23:13:38
4. 2014/03/19 13:46:55
5. 2014/03/23 14:31:38
6. 2014/04/10 01:49:30
7. 2014/09/17 12:34:52
8. 2014/09/17 15:27:46
9. 2014/09/18 08:02:53
10. 2015/01/29 18:29:18
11. 2015/11/10 23:29:19
12. 2015/11/11 02:29:41
13. 2015/11/12 01:19:50
14. 2015/12/24 15:16:25

# AIA/IRIS sample of transient events in AR loops

2015/11/12



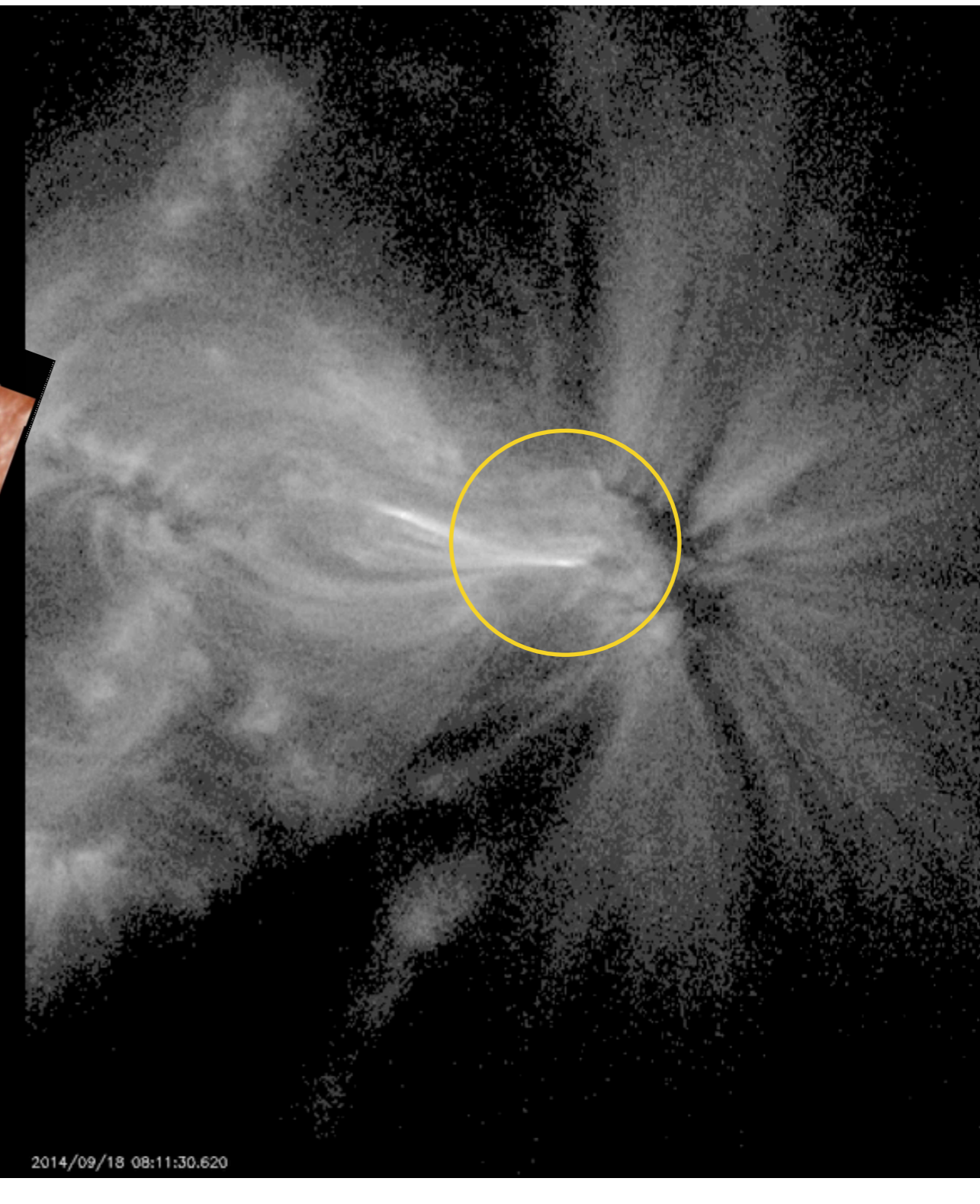
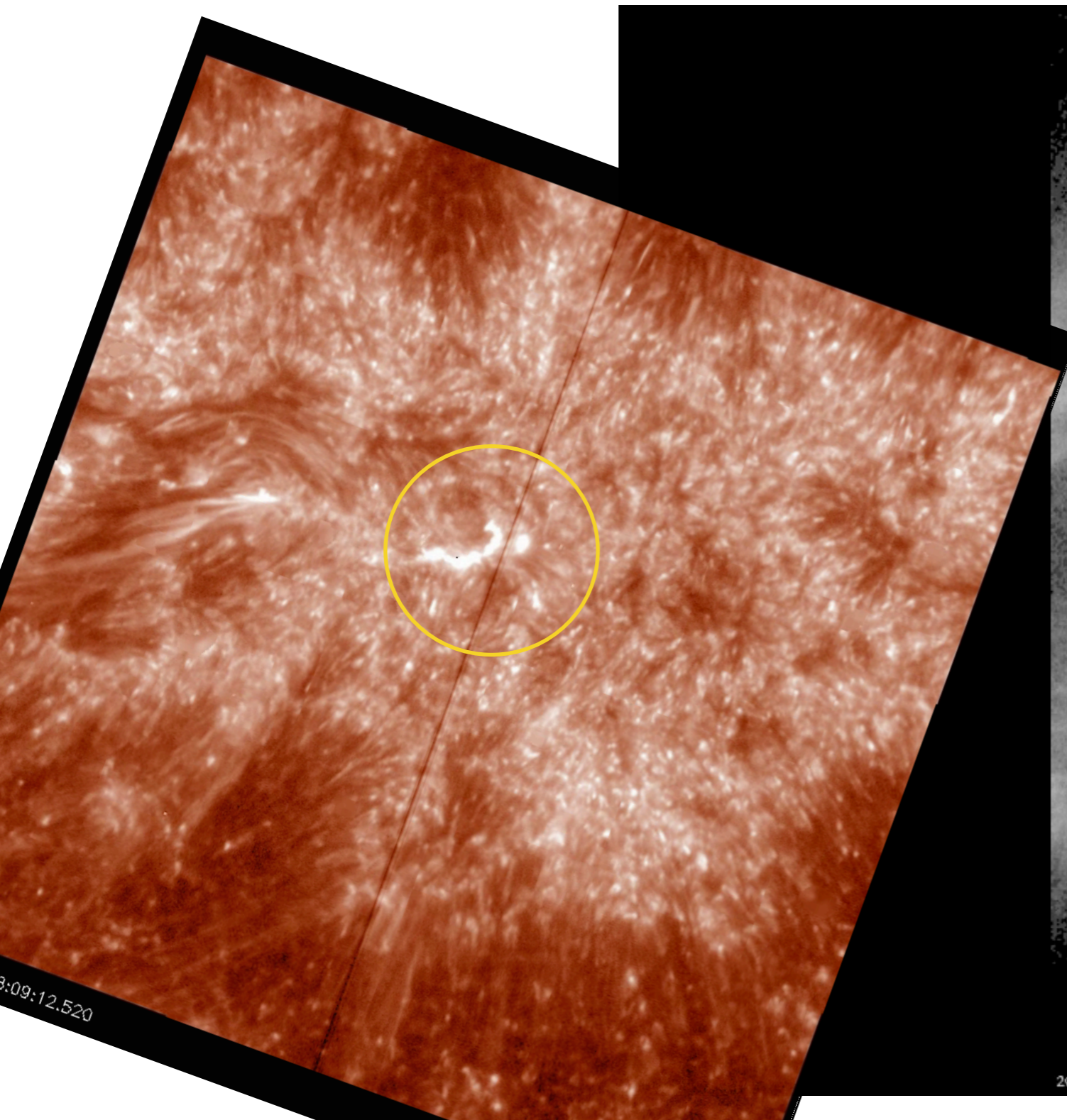
2015/11/12 01:30:25.490

2015/11/12 01:40:24.120



# AIA/IRIS sample of transient events in AR loops

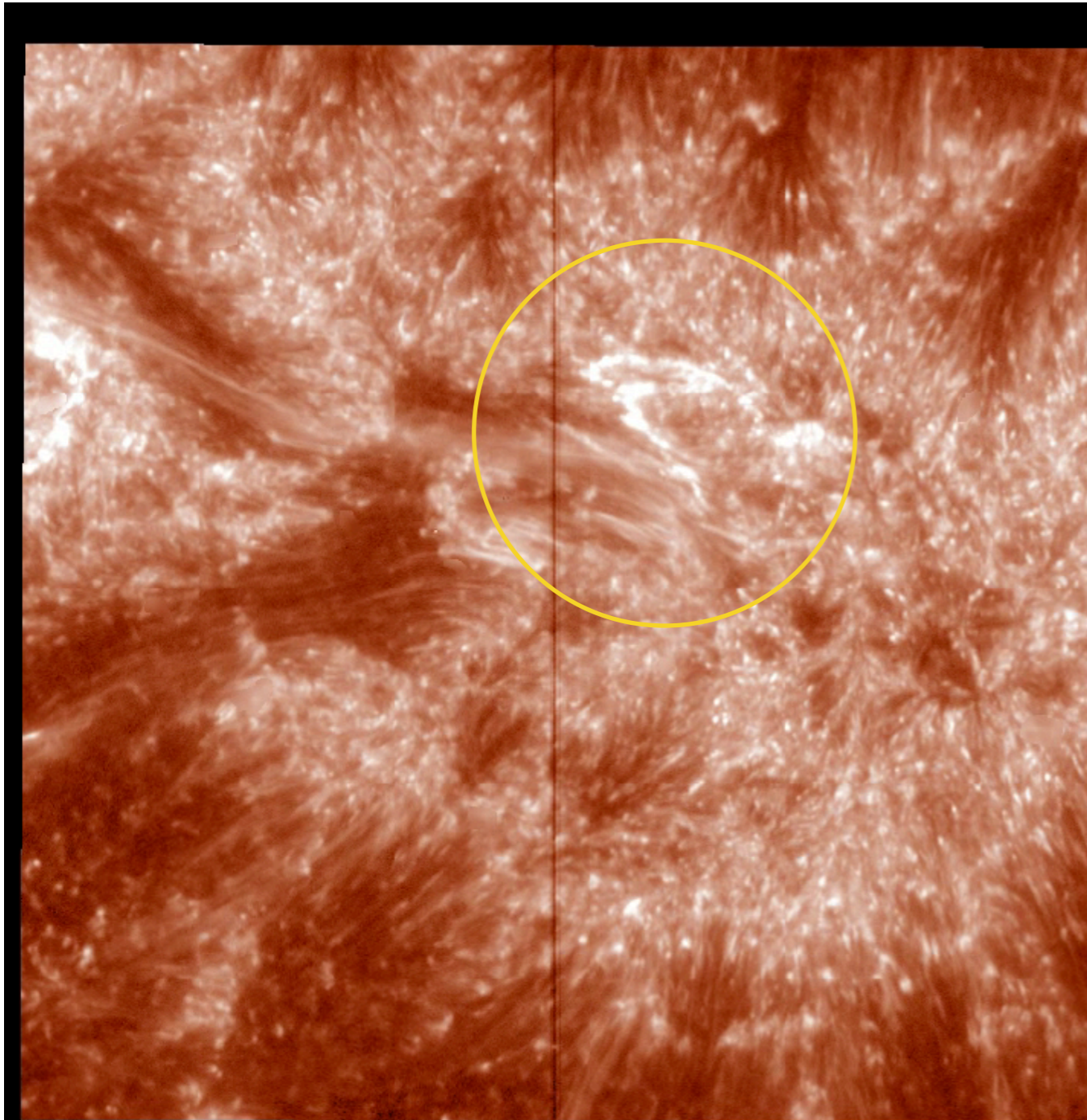
2014/09/18



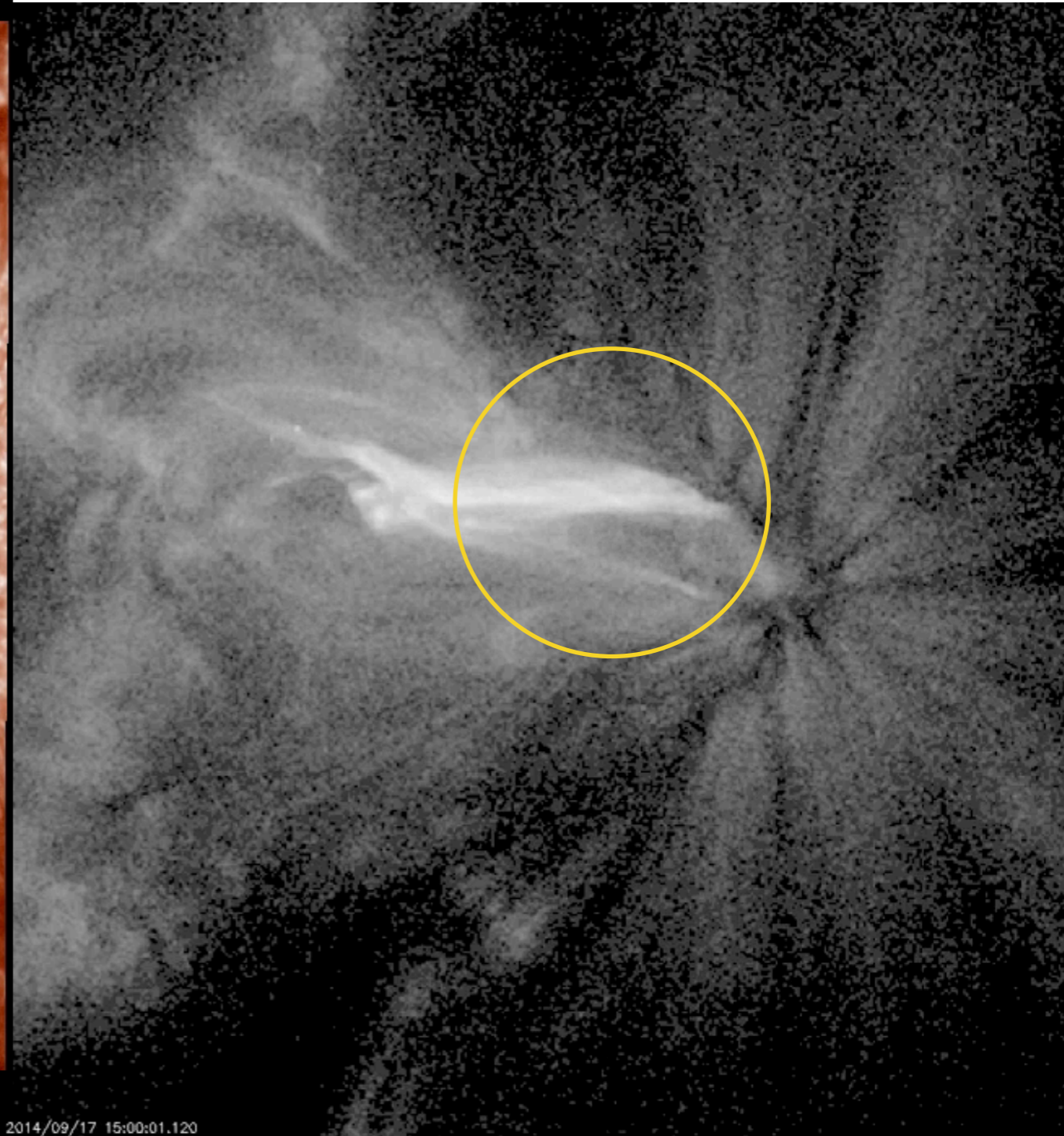


# AIA/IRIS sample of transient events in AR loops

2014/09/17



2014/09/17 14:57:45.250



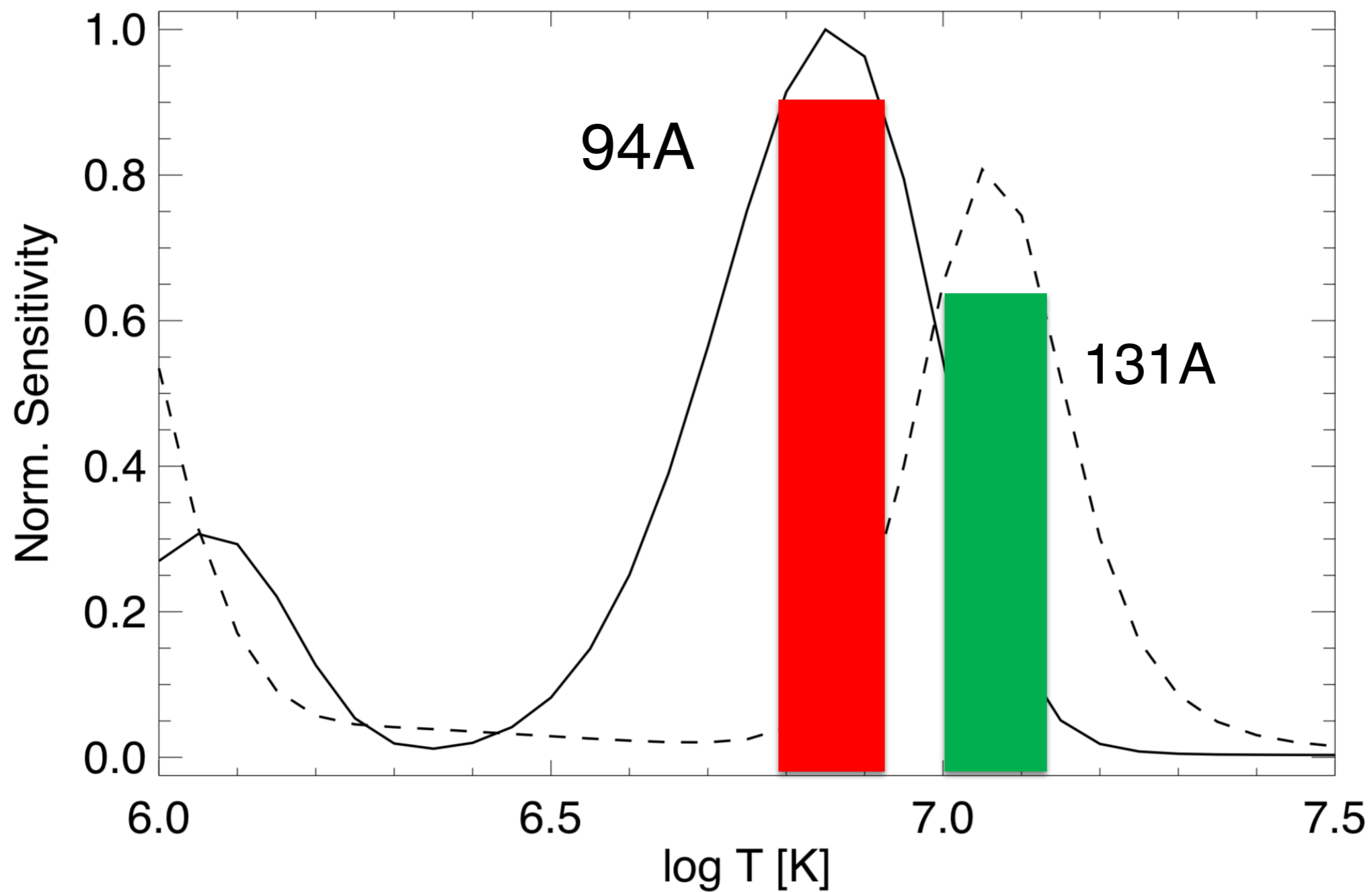
2014/09/17 15:00:01.120



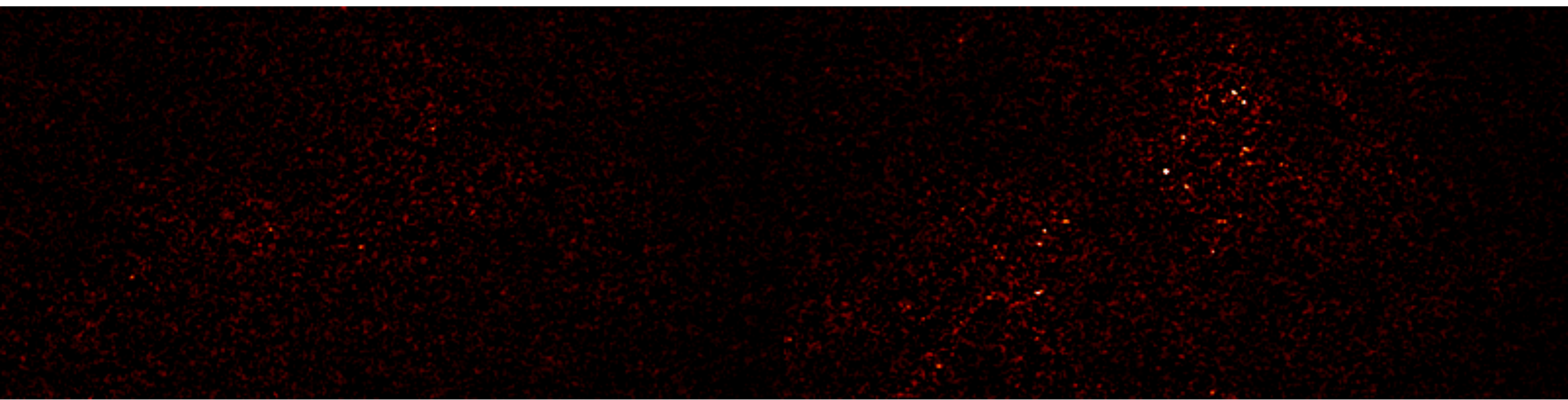
# Analysis

- Background-subtracted evolution
- Morphology/Spatial scales
- Light curves/time scales

# AIA hot channels: 131A, 94A



20151112\_011950



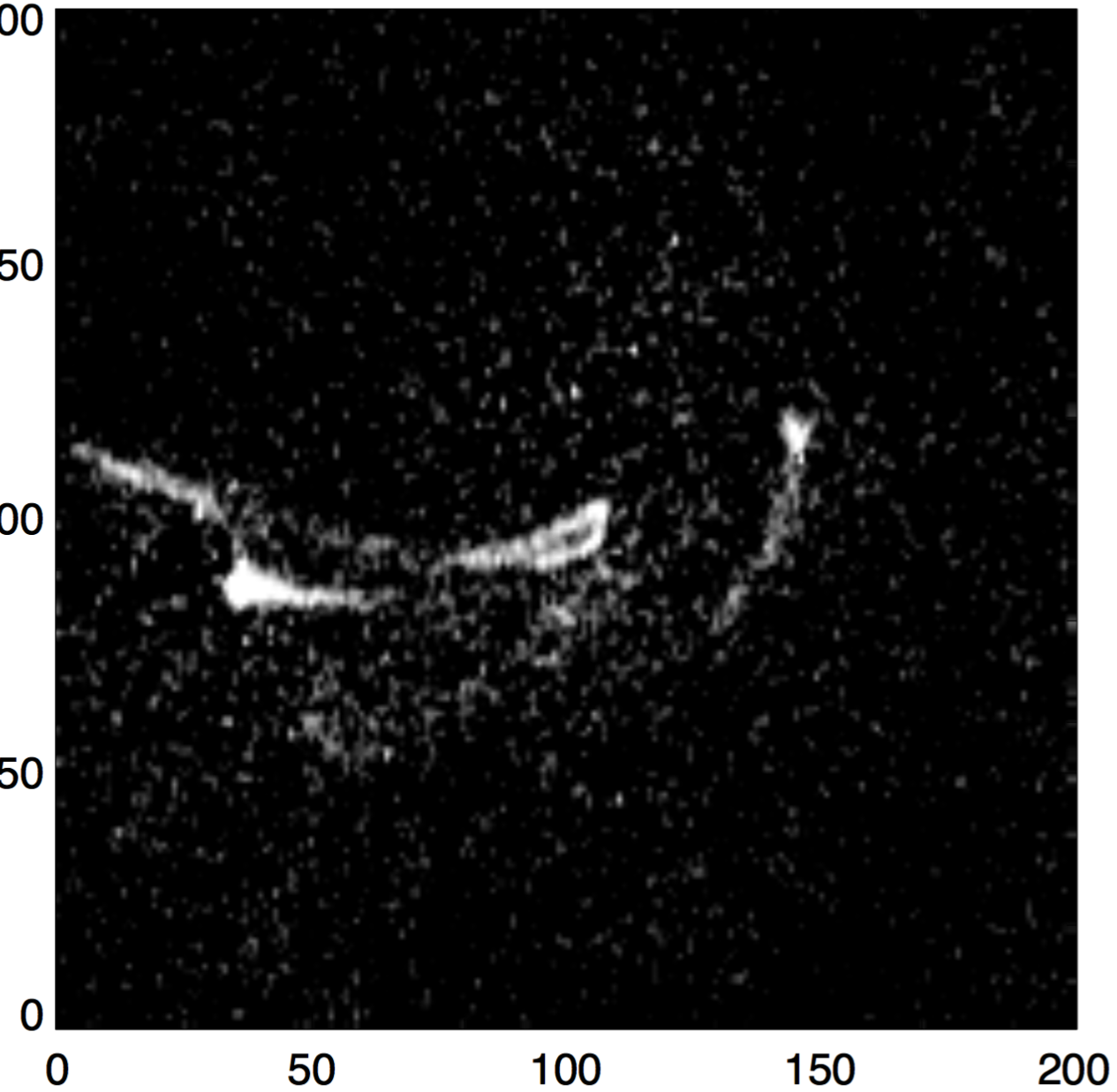
94A

131A

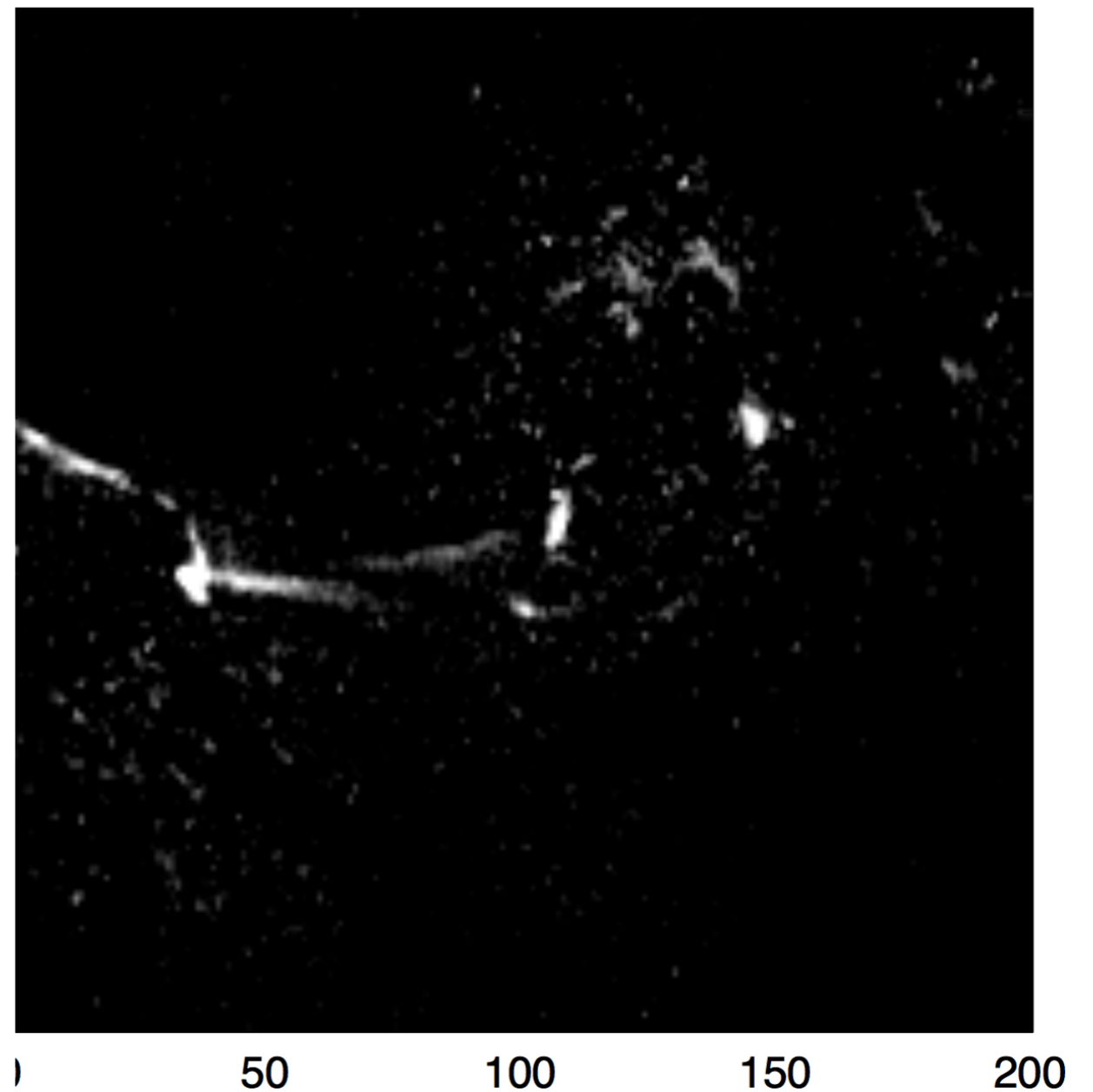


# 20151112-011950

0151112\_011950/94A/frame=22/200:400,300:500 1112\_011950/131A/frame=22/200:400,300:500



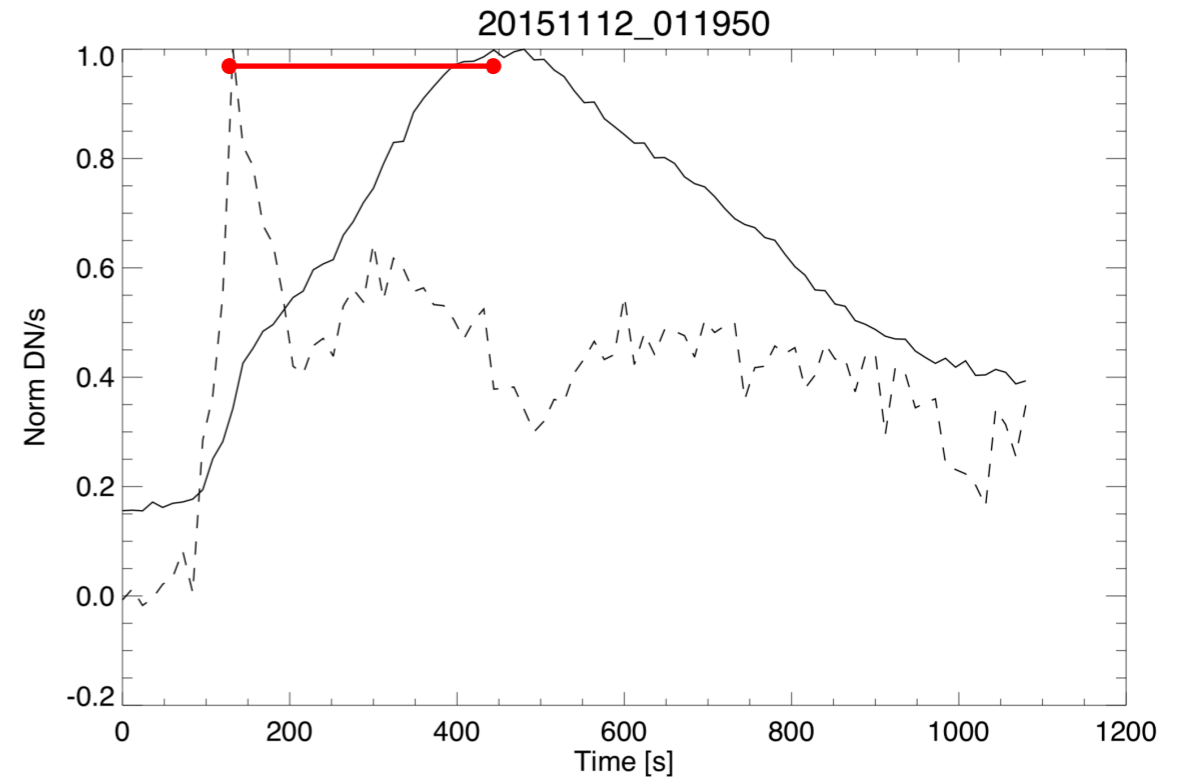
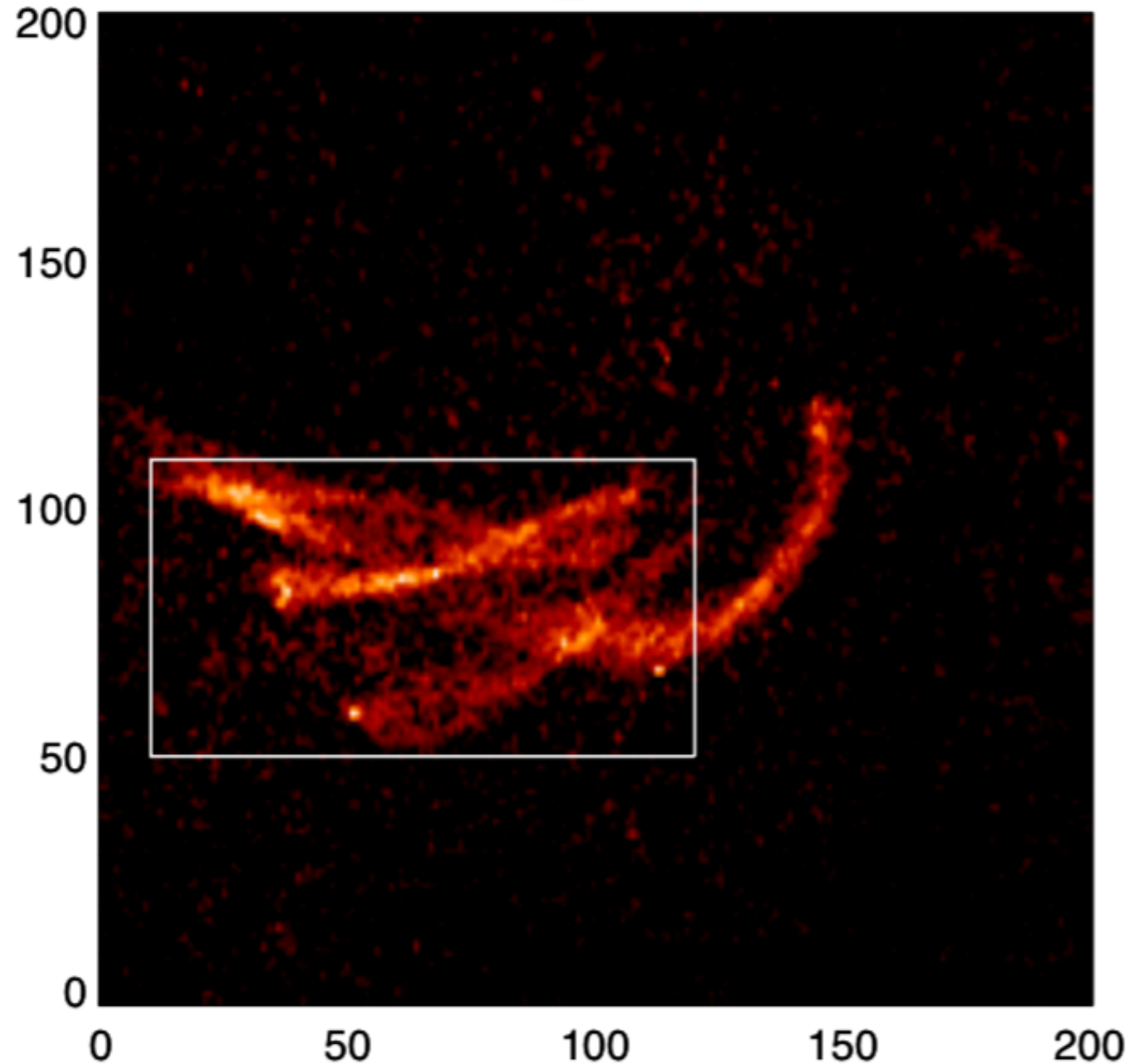
94A



131A

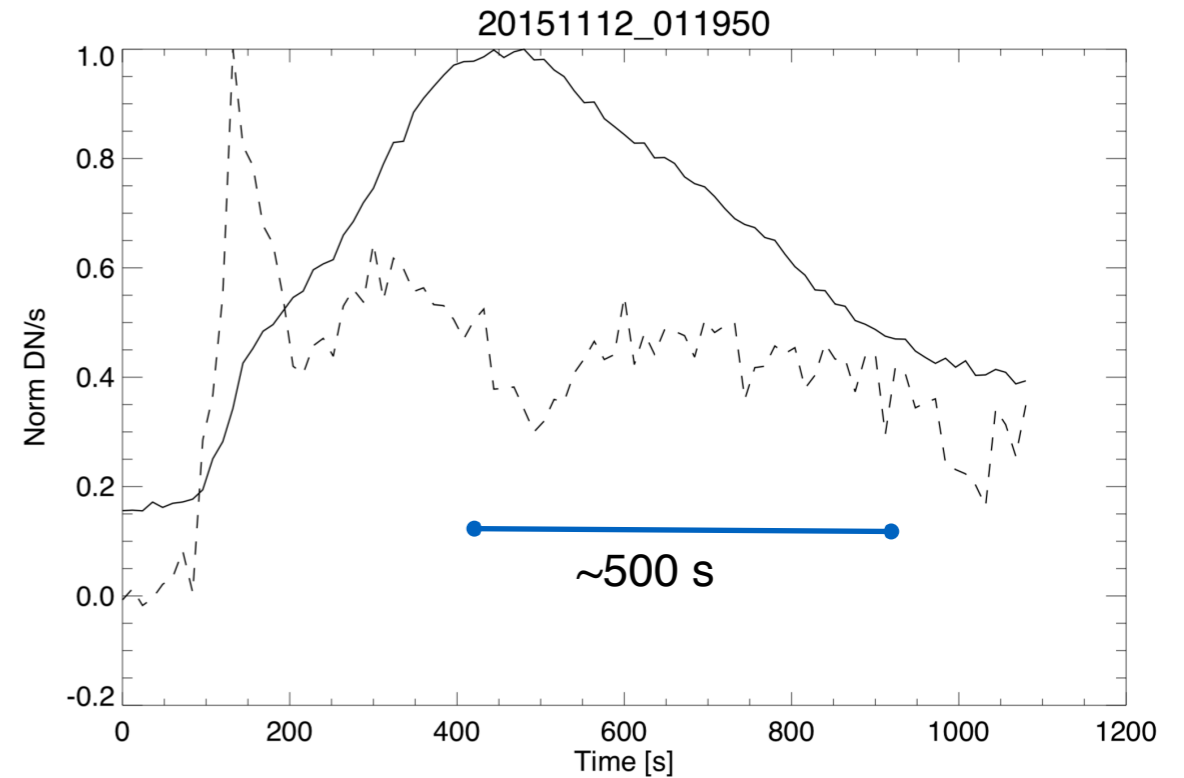
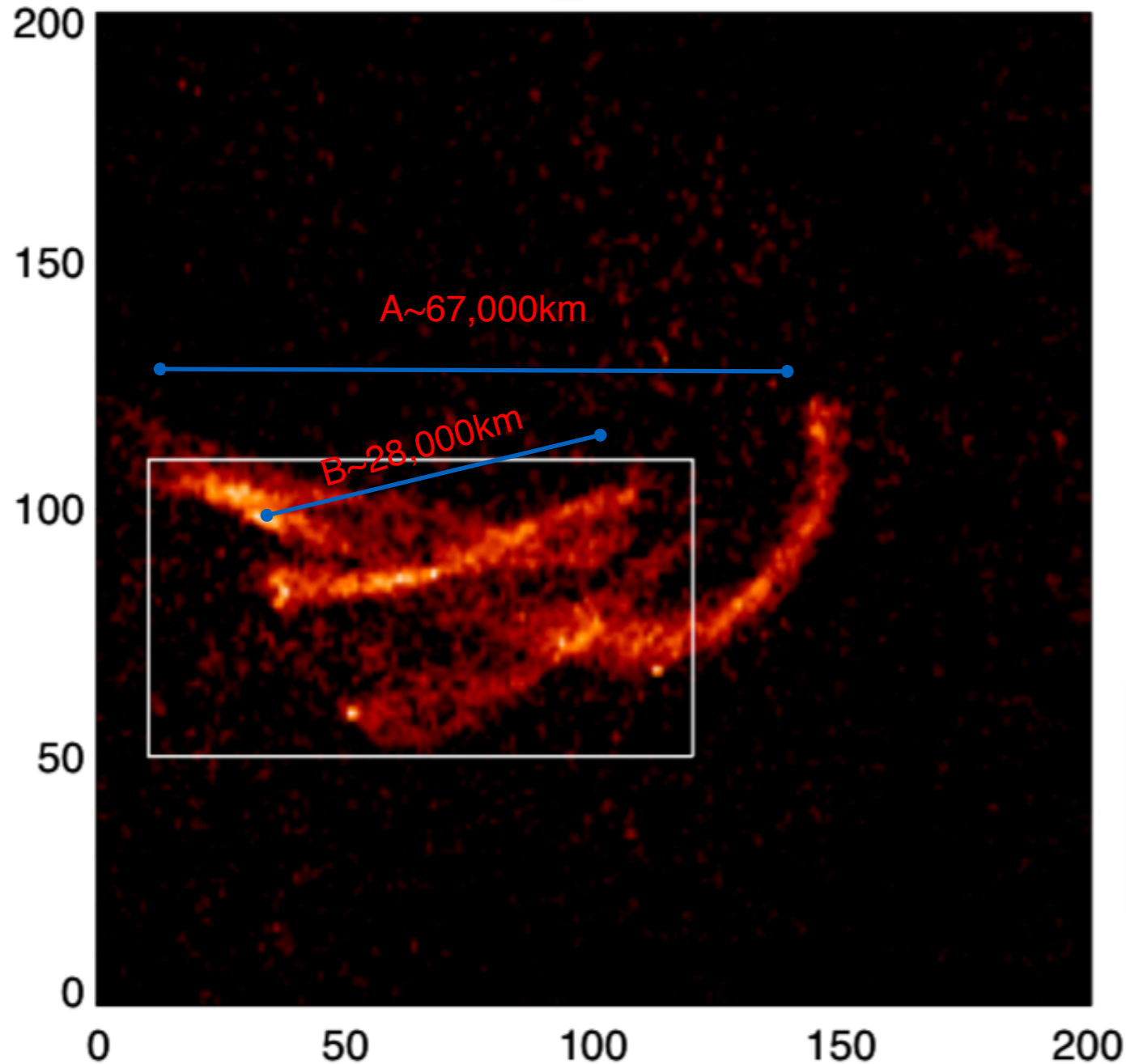
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20151112\_011950/94A



# 20151112\_011950

20151112\_011950/94A



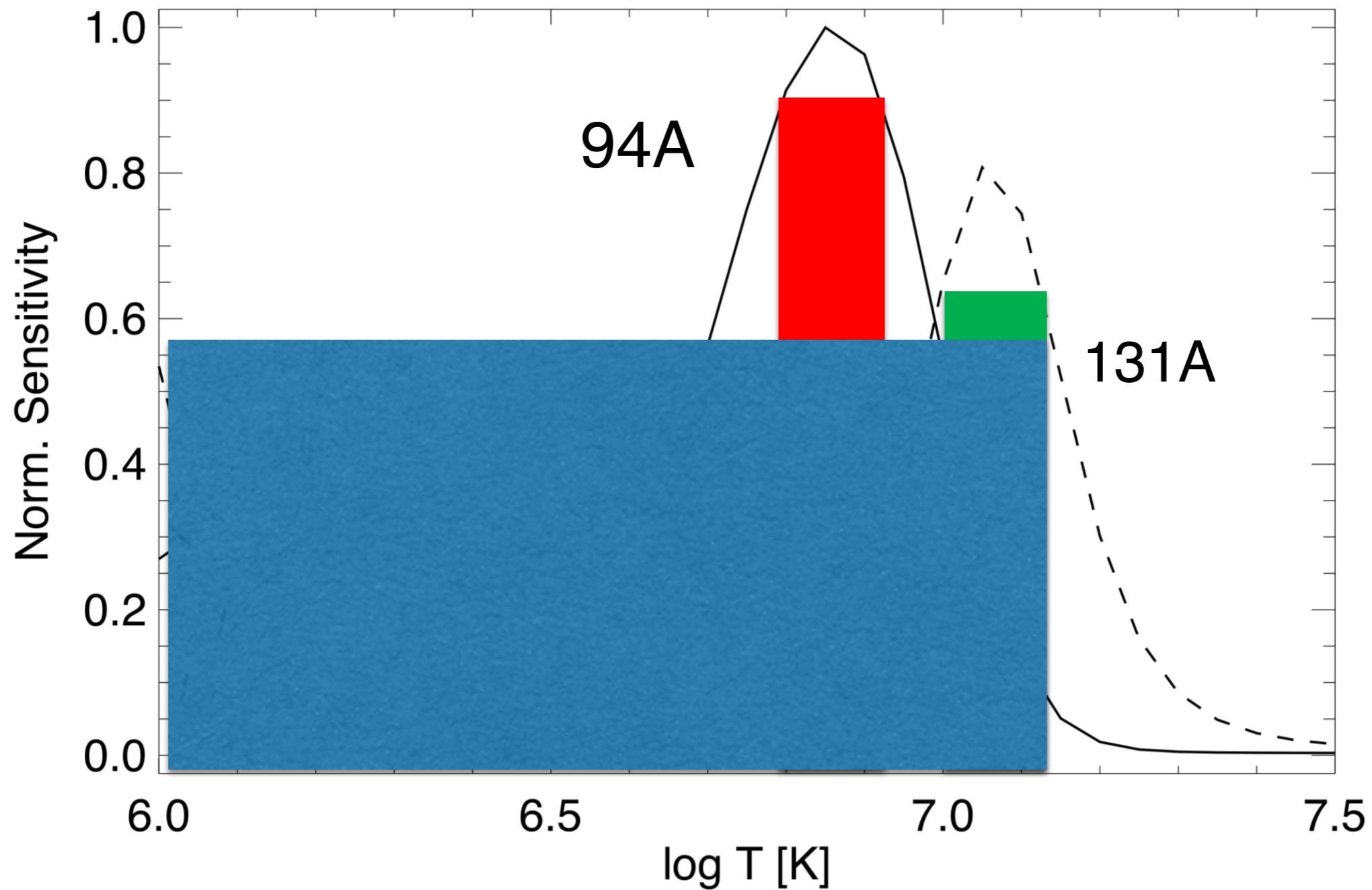
Cooling scaling laws (Serio et al. 1991)

$$\tau_s = 4.8 \times 10^{-4} \frac{L}{\sqrt{T_0}} = 500 \frac{L_9}{\sqrt{T_{0,6}}}$$

For  $T \sim 9 \text{ MK}$ , length  $\sim 60,000 \text{ km}$



# AIA hot channels: 131A, 94A



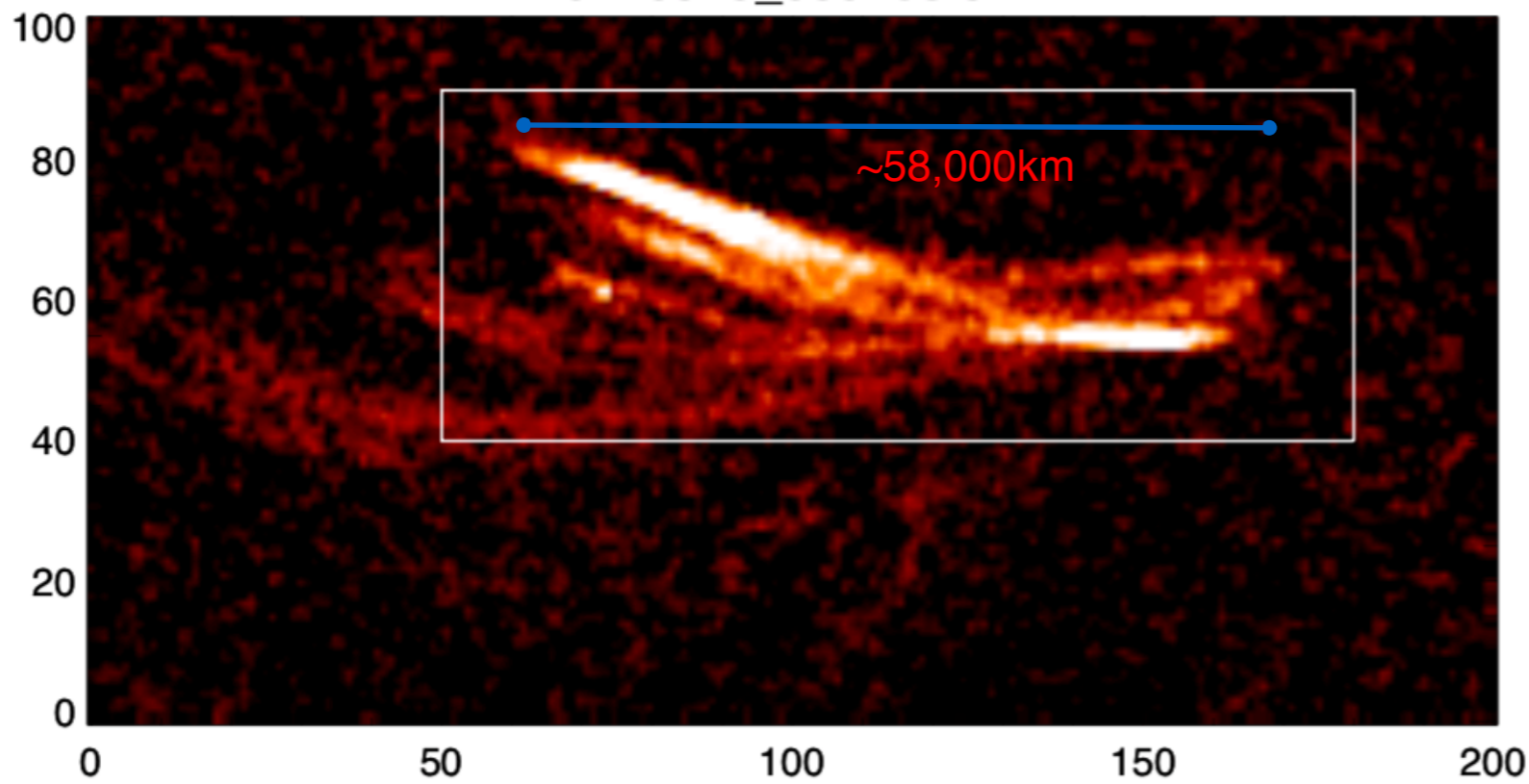
20140918\_080253

94A

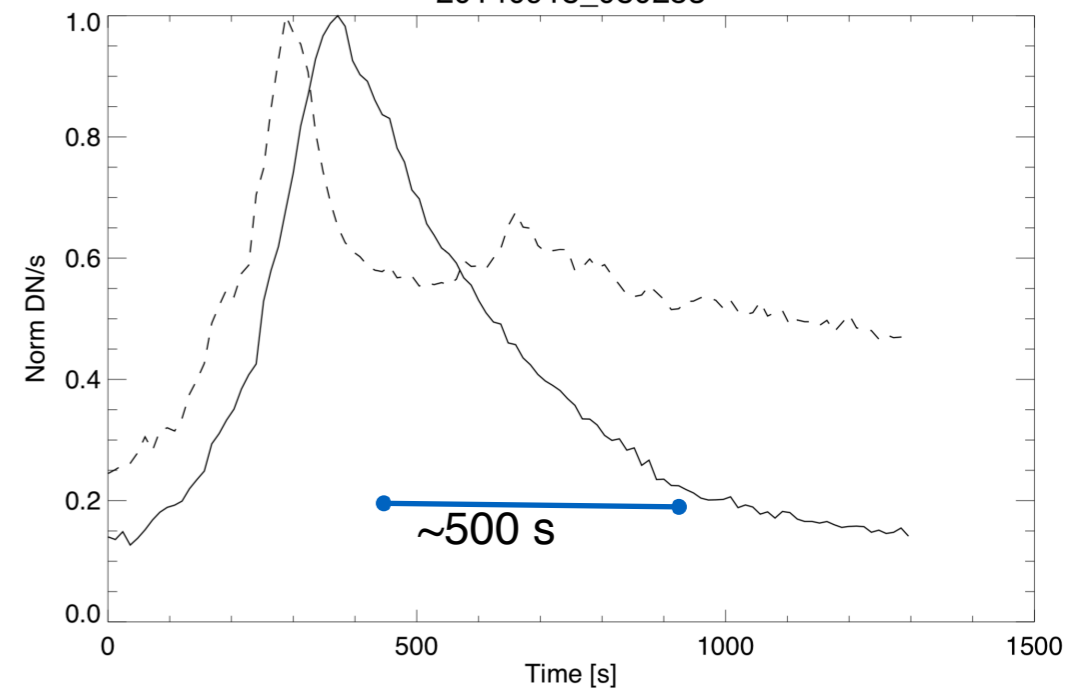
131A

# 20140918\_080253

20140918\_080253/94A



20140918\_080253



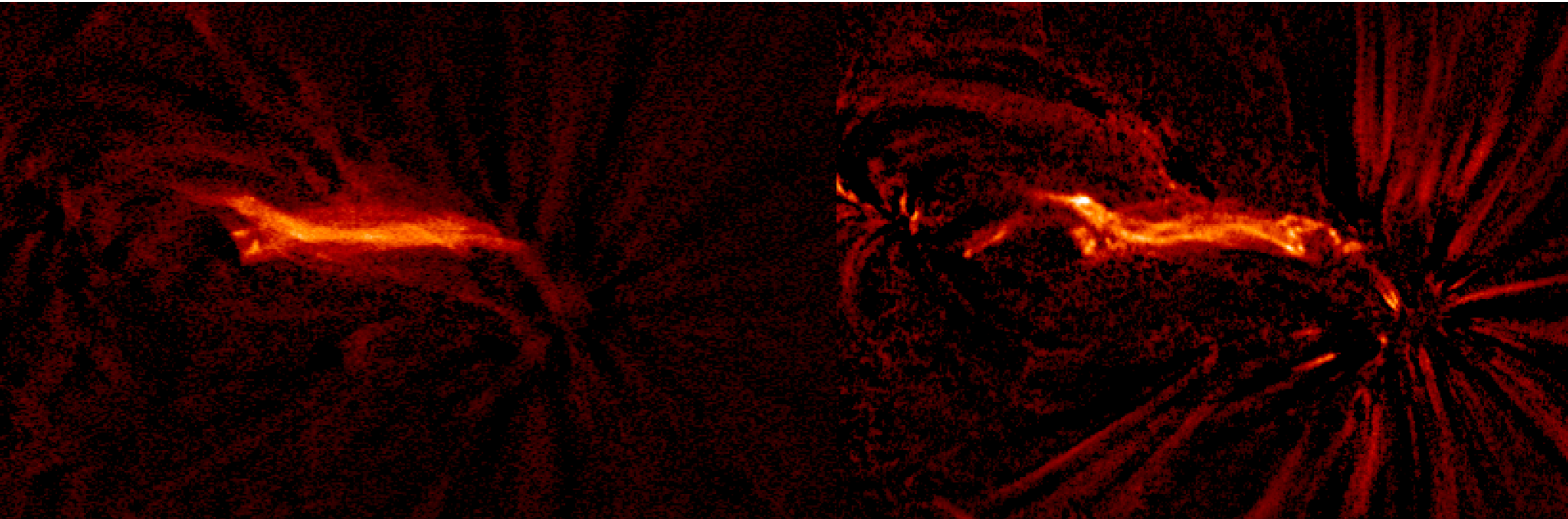


20140917 123452

94A

131A

20140917\_123452

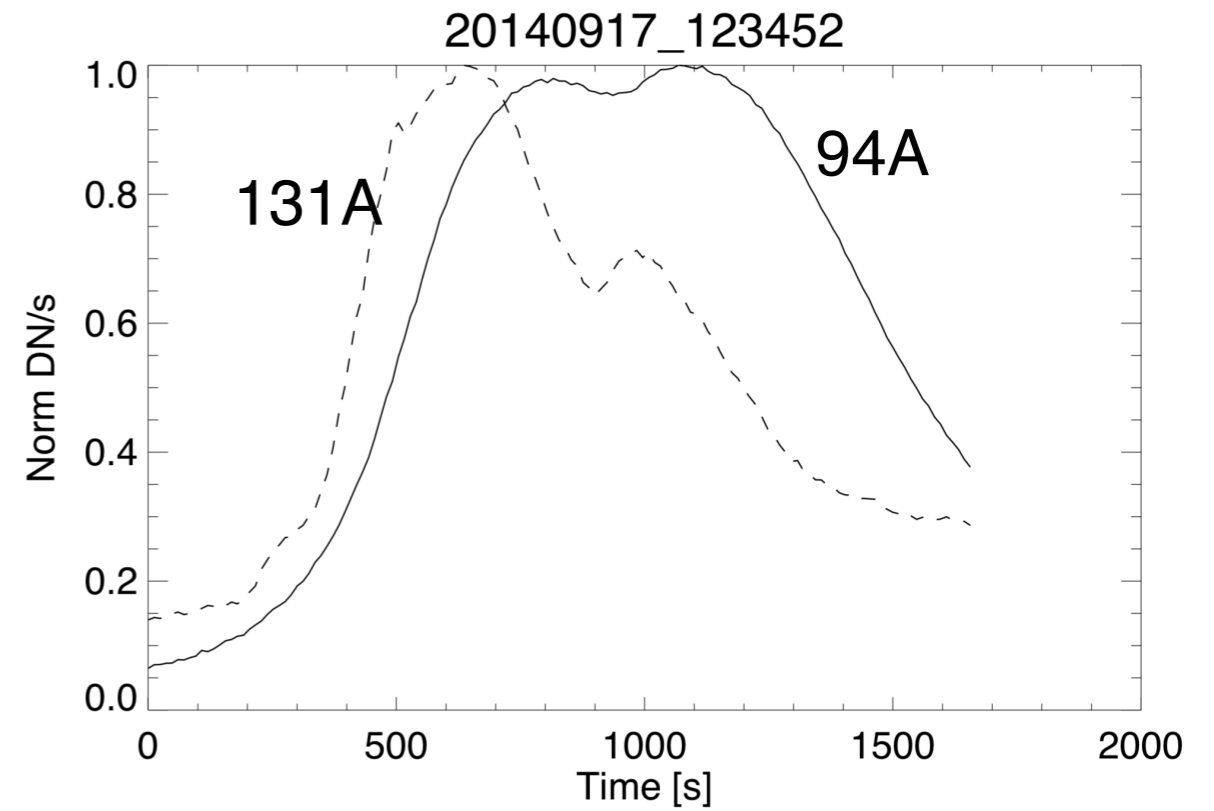
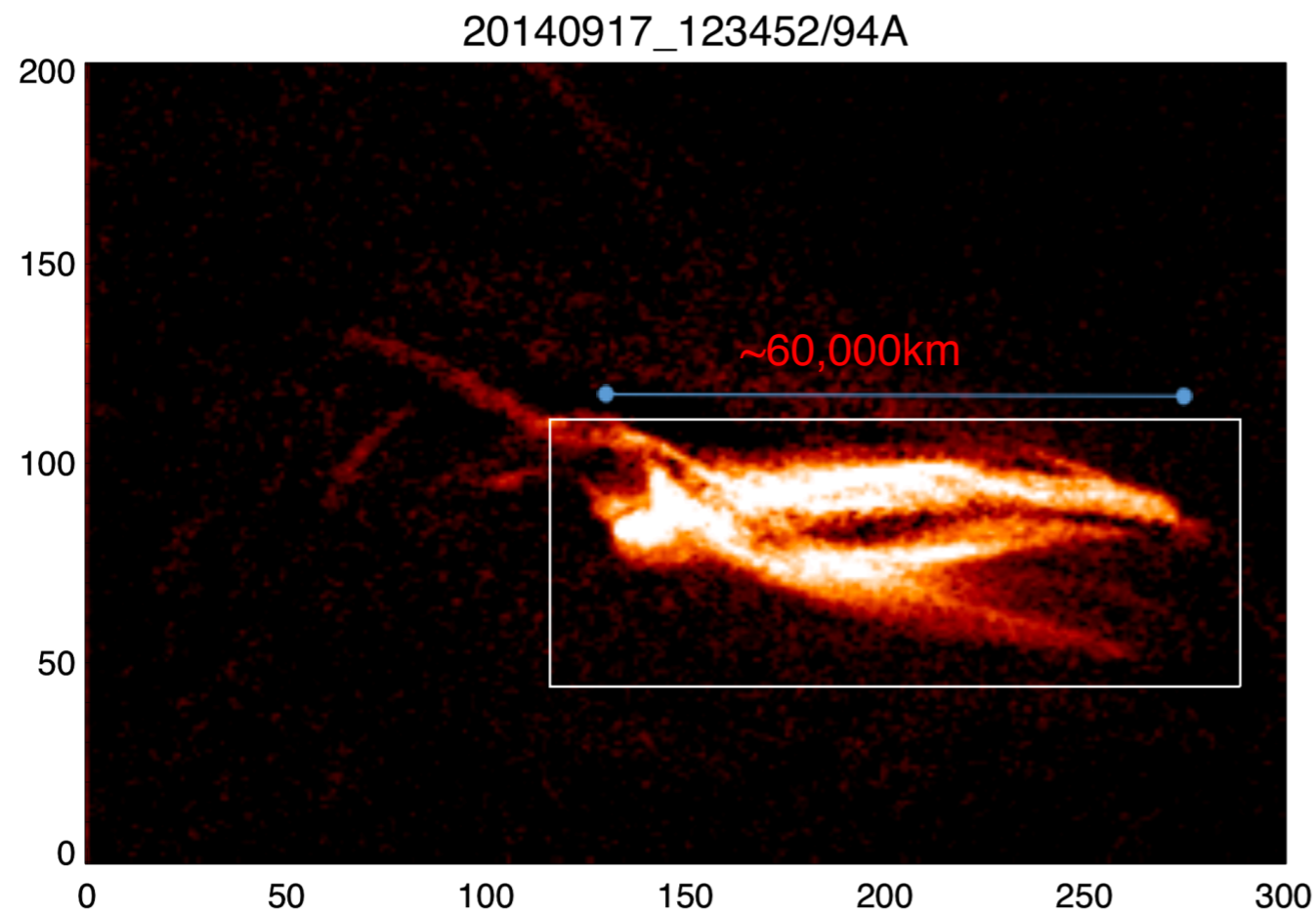


94A

131A



# 20140917\_123452



# Conclusions

- Example of the importance of coupling the low atmosphere to the corona
- Events connected to significant large-scale field rearrangements (tangling?)
  - Hot
  - Impulsive
  - Conglomeration of events?
- Is large-scale loop tangling able to explain what we observe? MHD modeling -> A. Petralia's talk