

# $^{13}\text{CO}$ filaments in the Taurus Molecular Cloud

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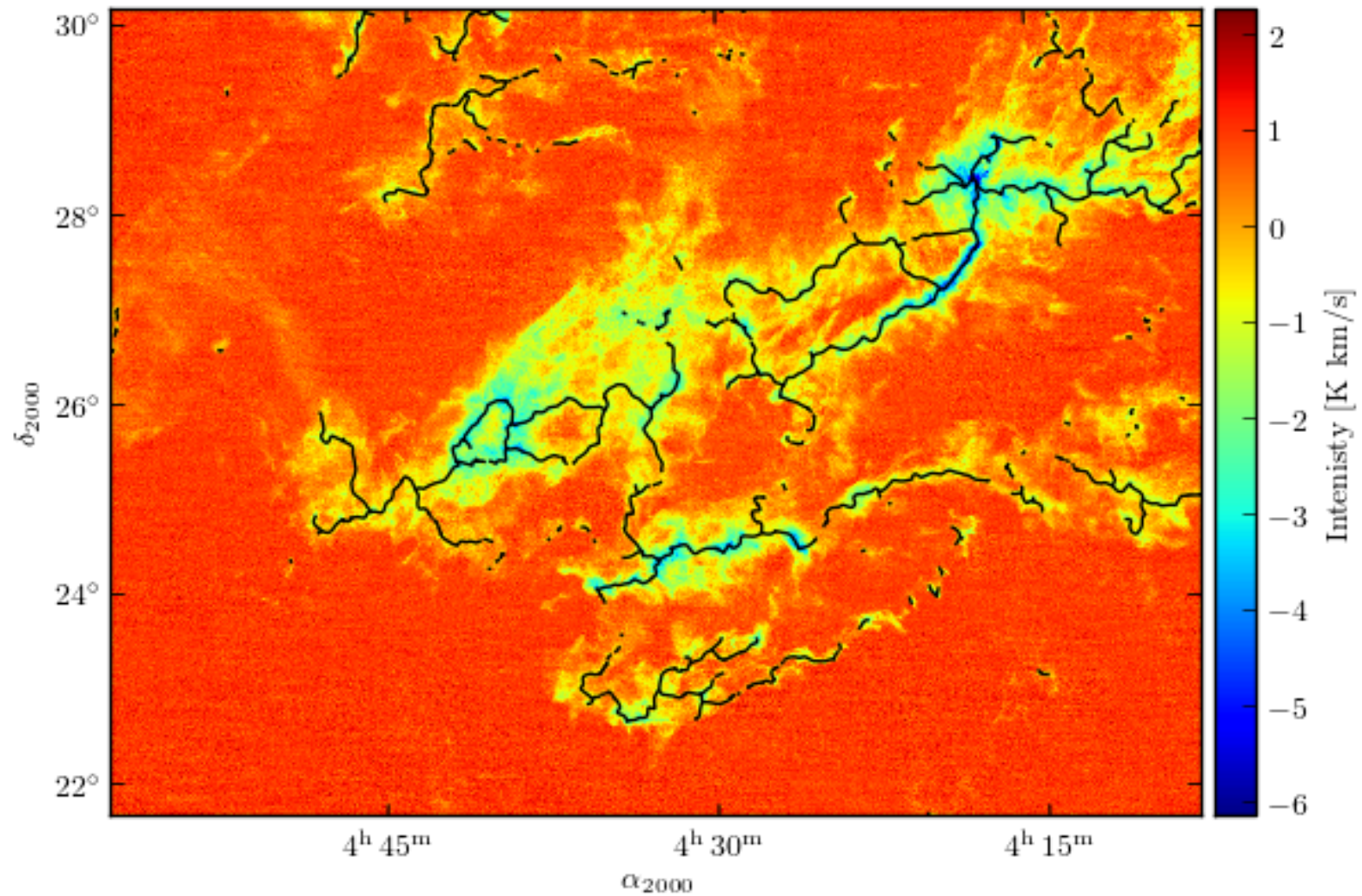
# Taurus Molecular cloud in CO

The image displays the Taurus Molecular Cloud in CO emission. The cloud is characterized by a complex, filamentary structure with bright, glowing regions of orange and yellow, indicating areas of high molecular density and temperature. These bright regions are set against a dark, almost black background, which represents the surrounding interstellar space. The overall appearance is that of a vast, turbulent cloud of gas and dust, with intricate patterns of light and shadow that suggest dynamic processes occurring within the cloud.

Goldsmith et al. 2010  
Narayanan et al. 2010

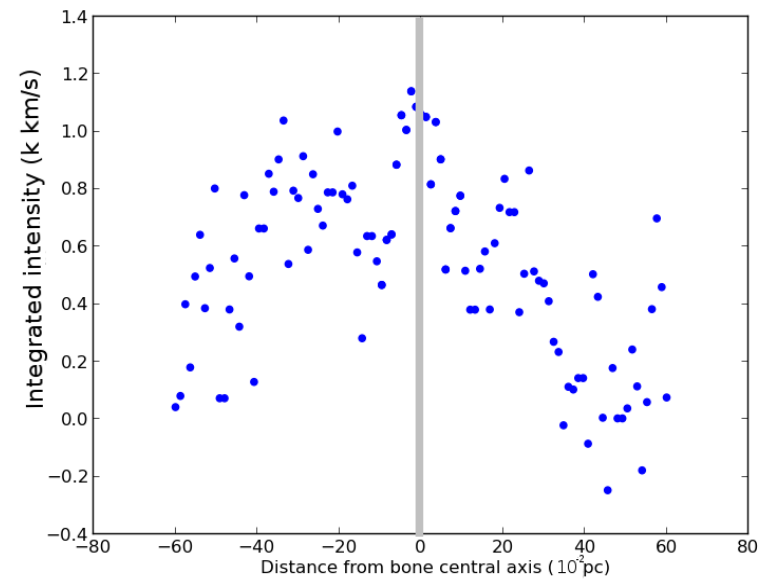
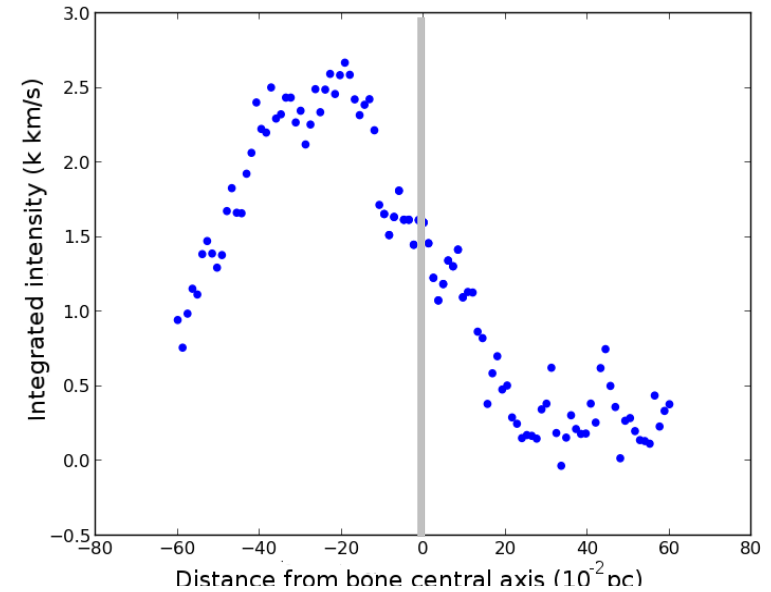
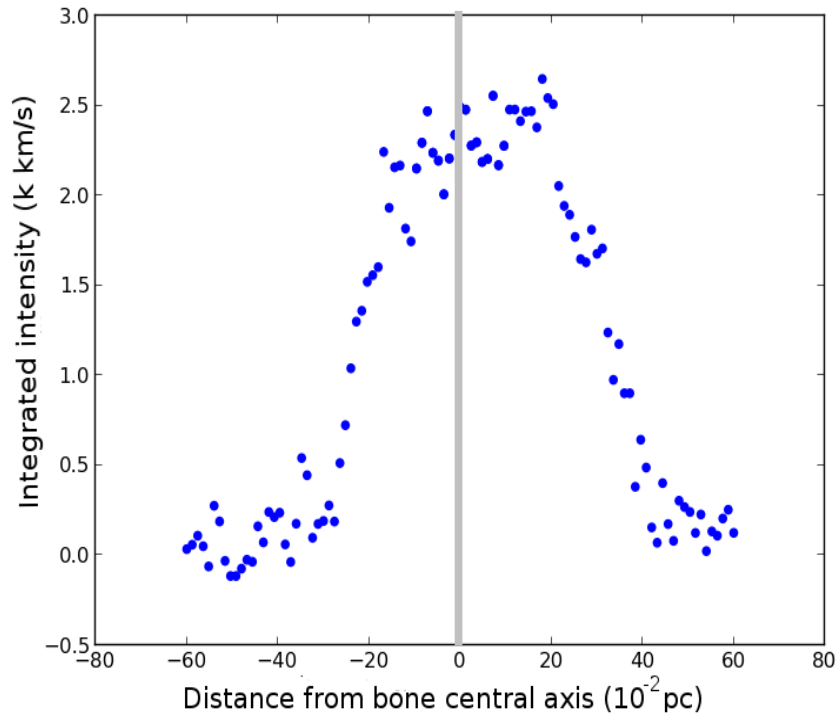


# Methodology



- Trace filamentary network (DisPerSe)

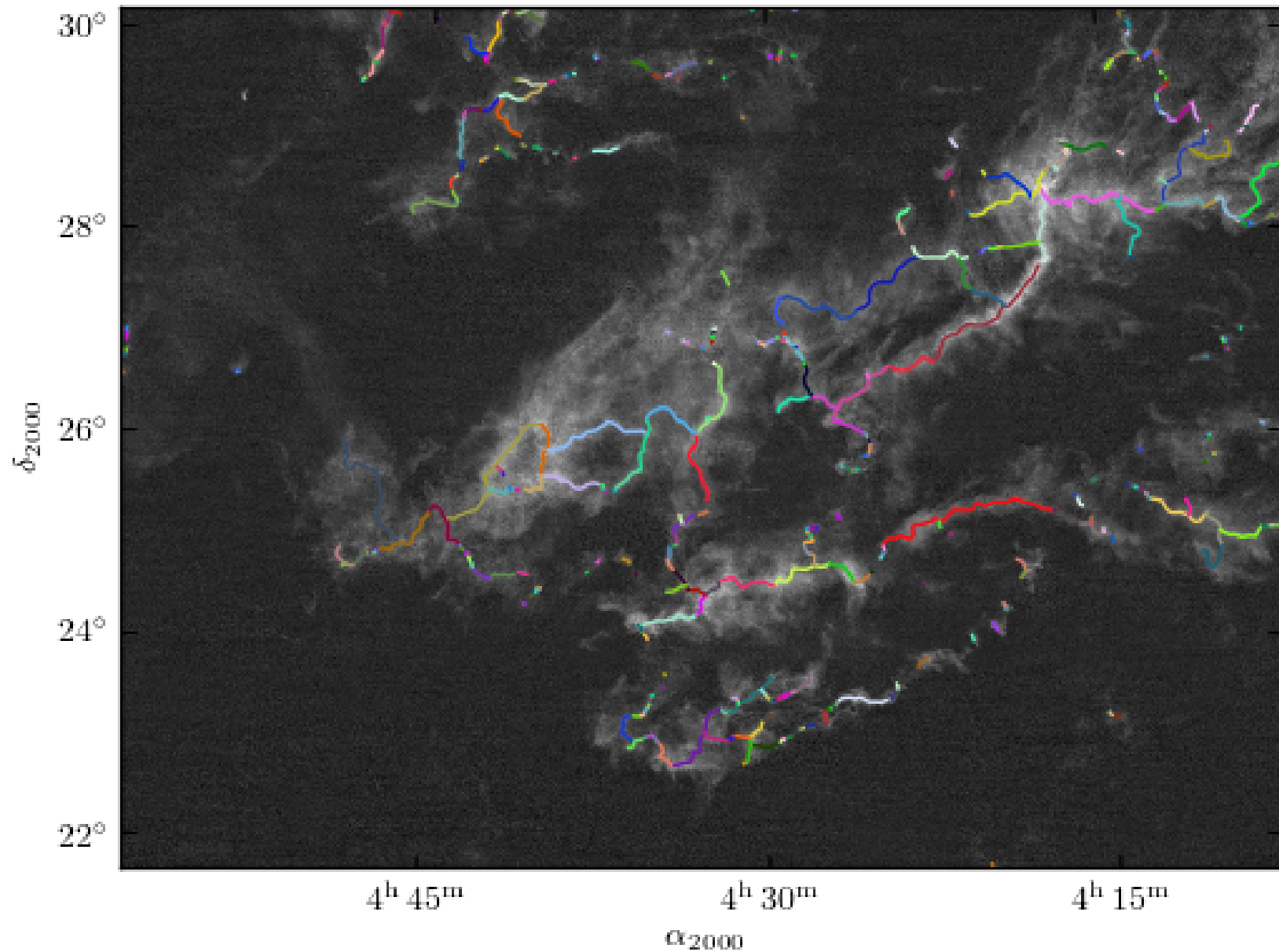
# Methodology



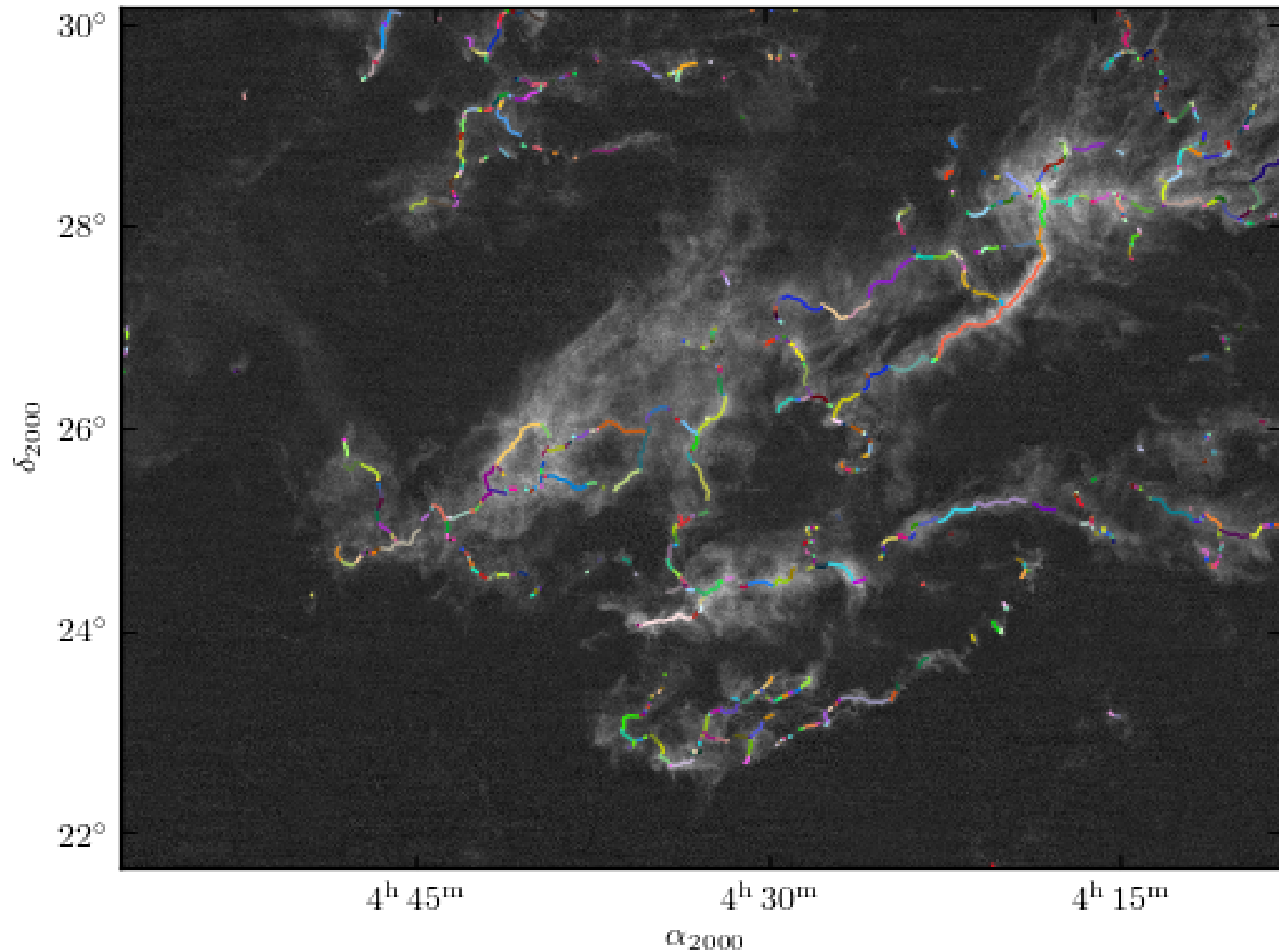
# Methodology

- Automatically **assess** the **shape** of a profile
- Perform **quality** checks
  - existence of peak
  - peak at center
  - Peak intensity above noise level
- **Filter** network of DisPerSe to only include continuous structures with desirable properties

# Network of integrated emission map (DisPerSe)

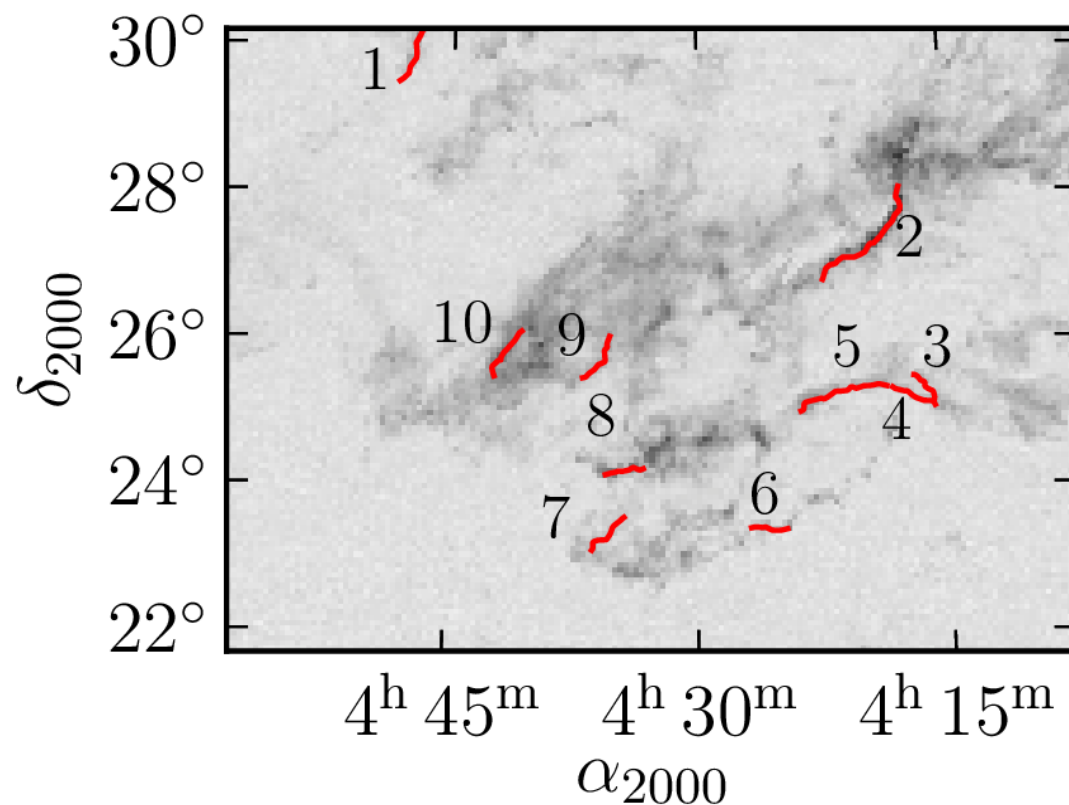
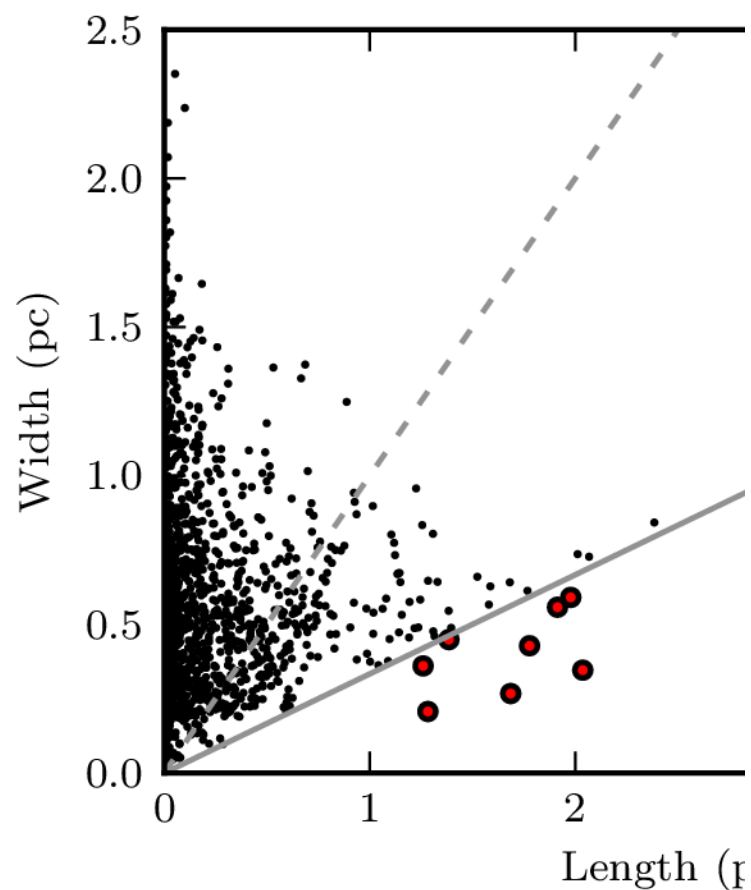


# Network of integrated emission map (filtered)



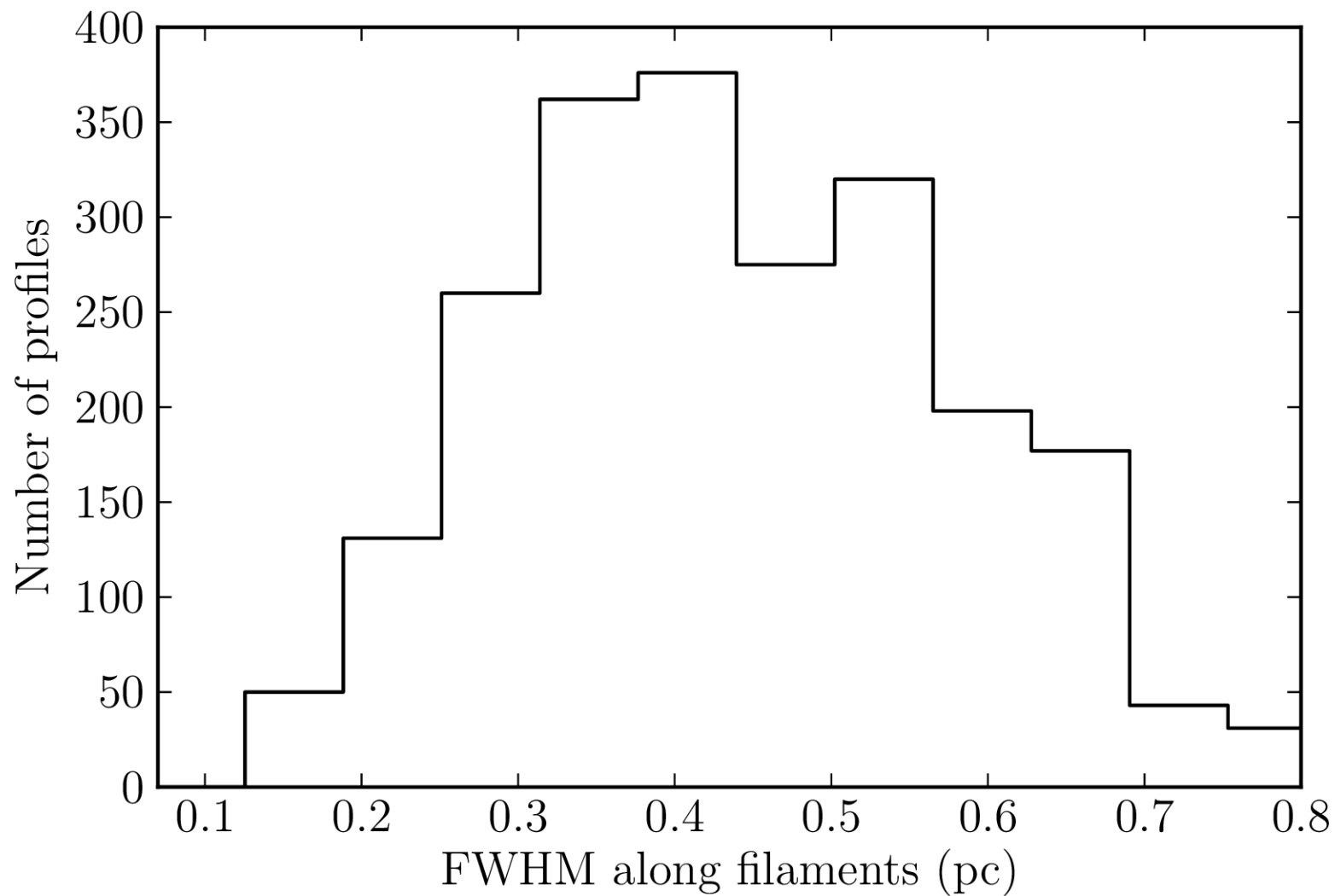
# What makes a filament?

- An elongated structure with at *least* a 3:1 length to width ratio

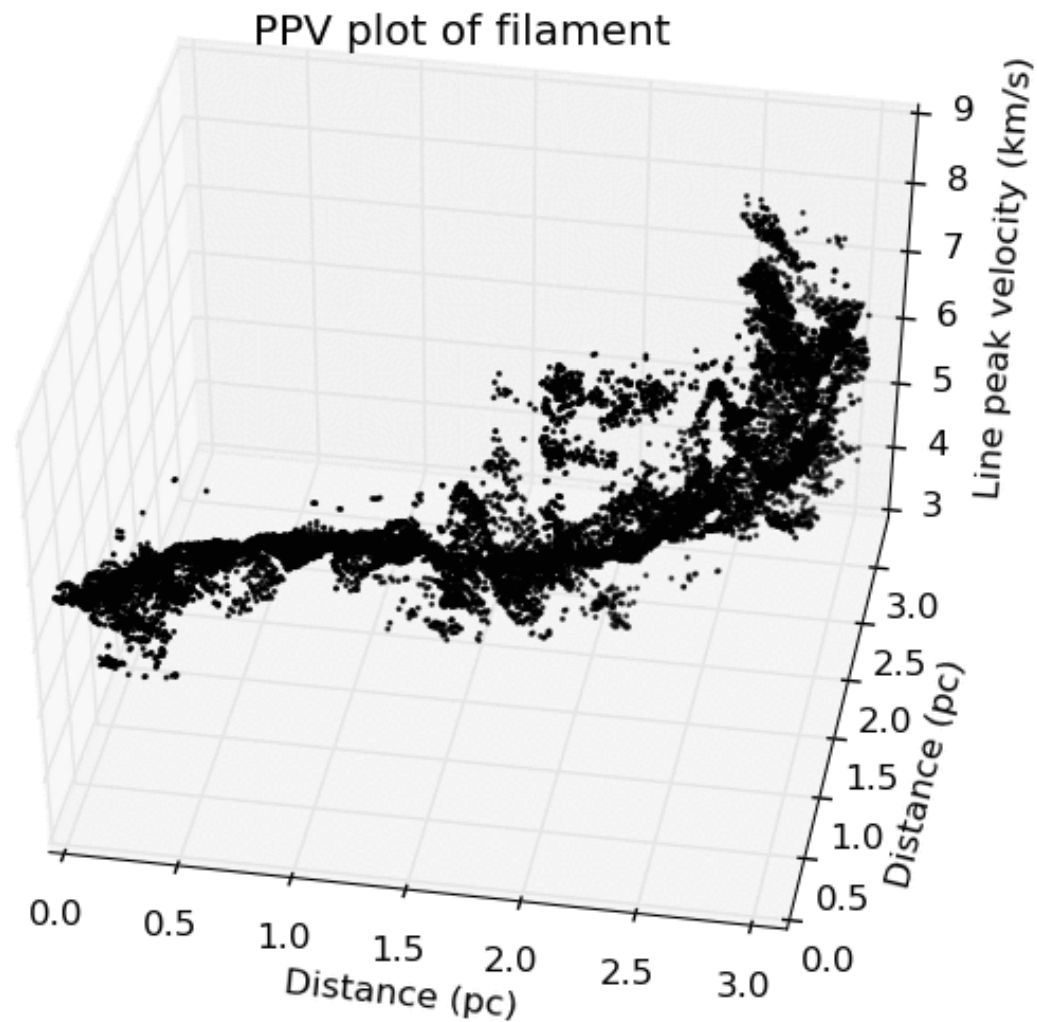




# Width Distribution



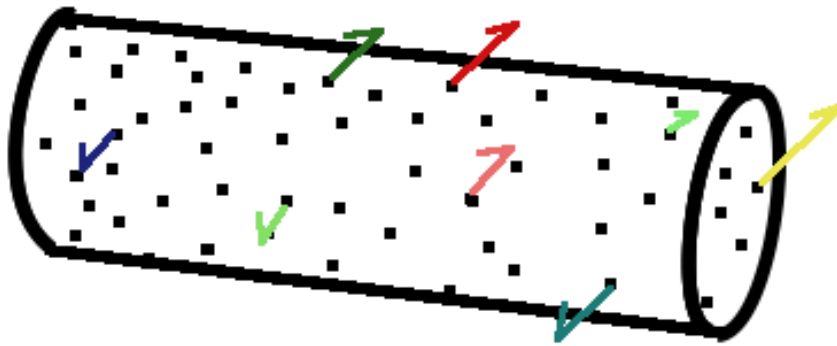
# Filaments in integrated map



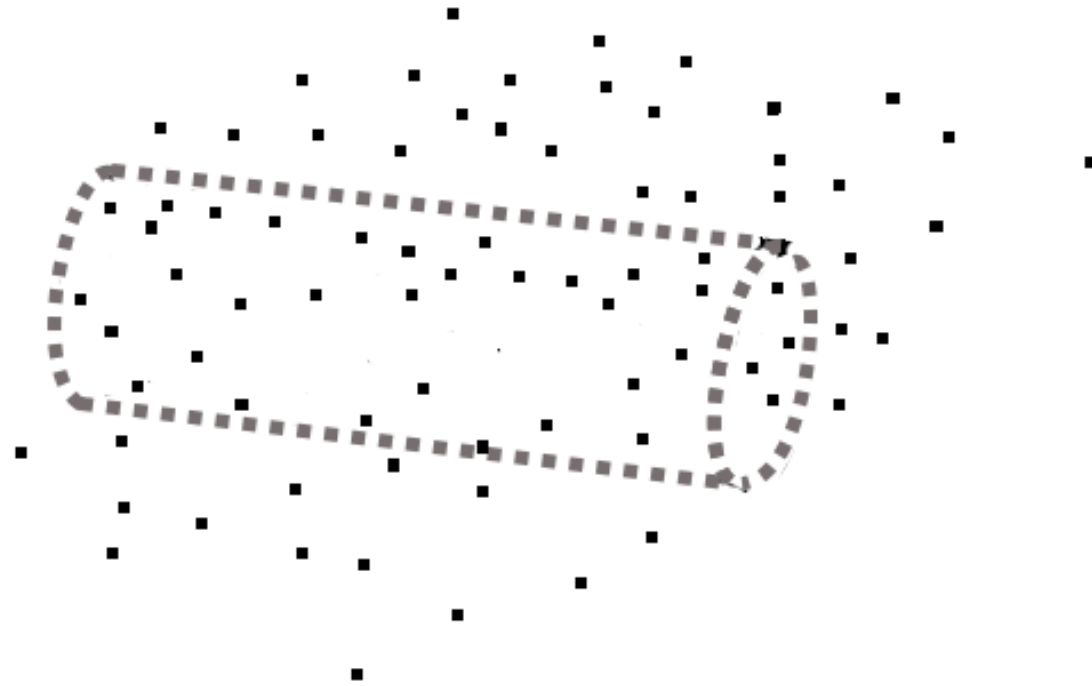
# Filaments in integrated map

Filaments gravitationally **unbound**

Now

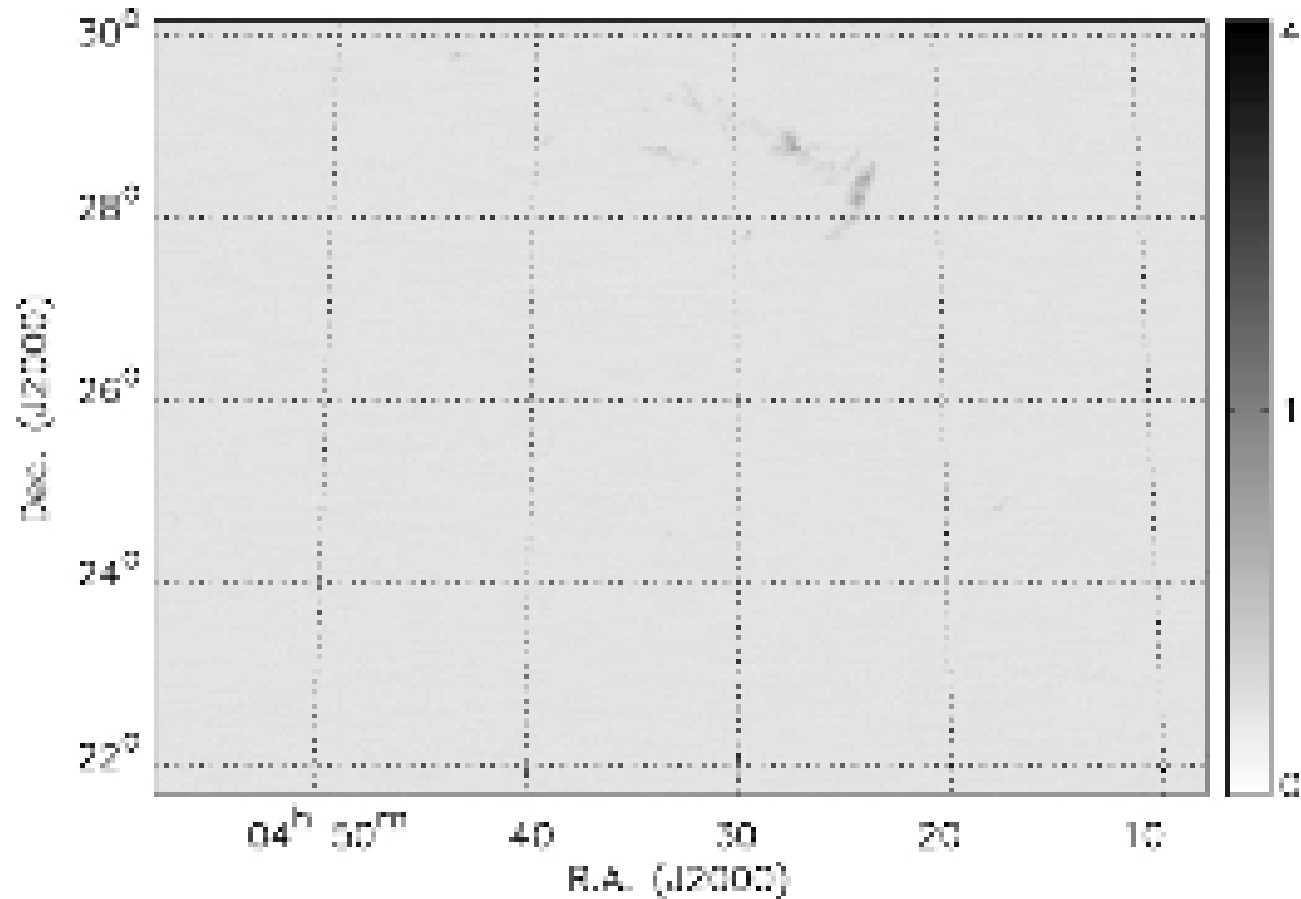


After 1Myr



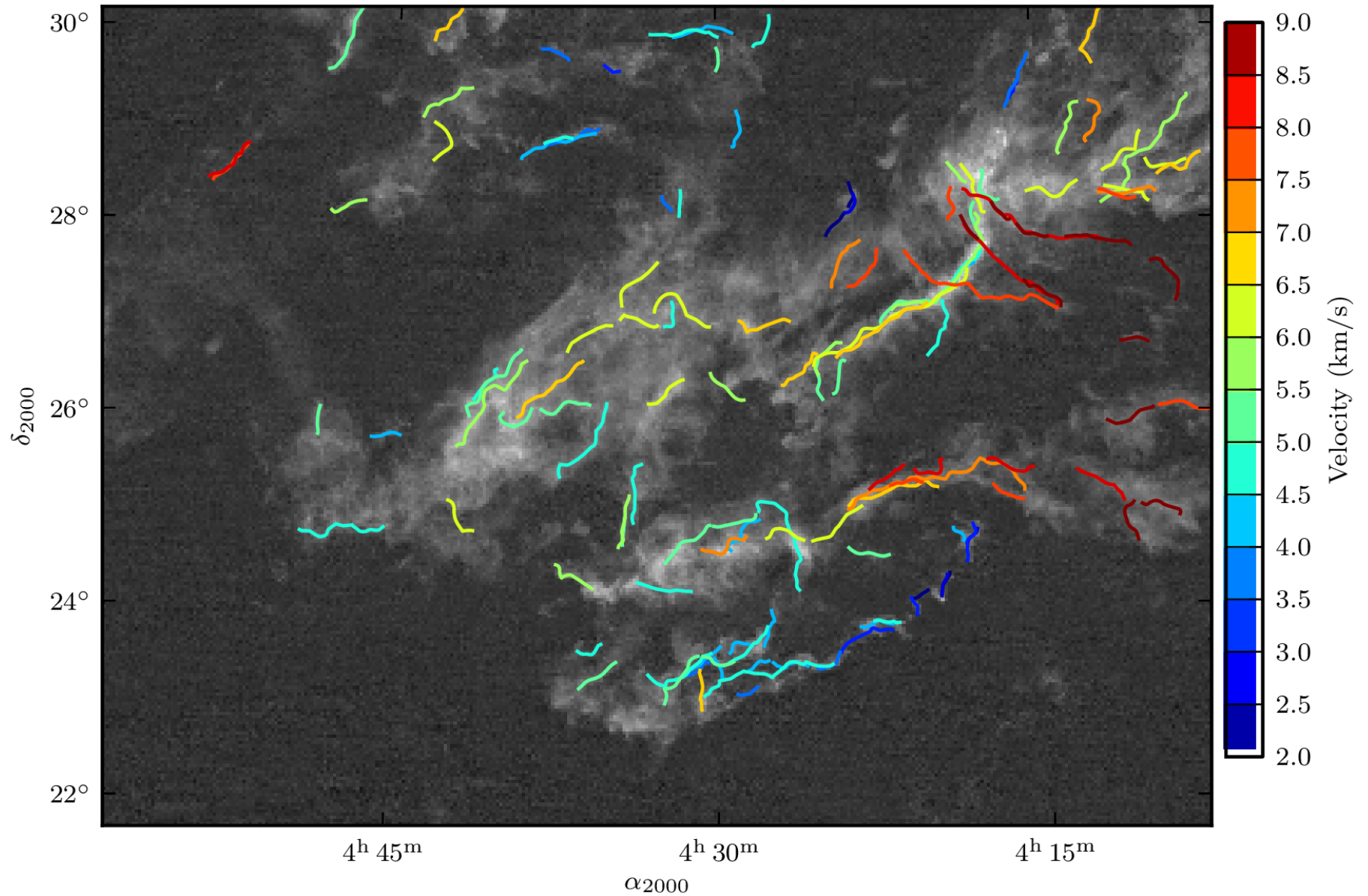
Even if cylinders now, they would **disperse** in a **Myr**

# Filaments in velocity channels



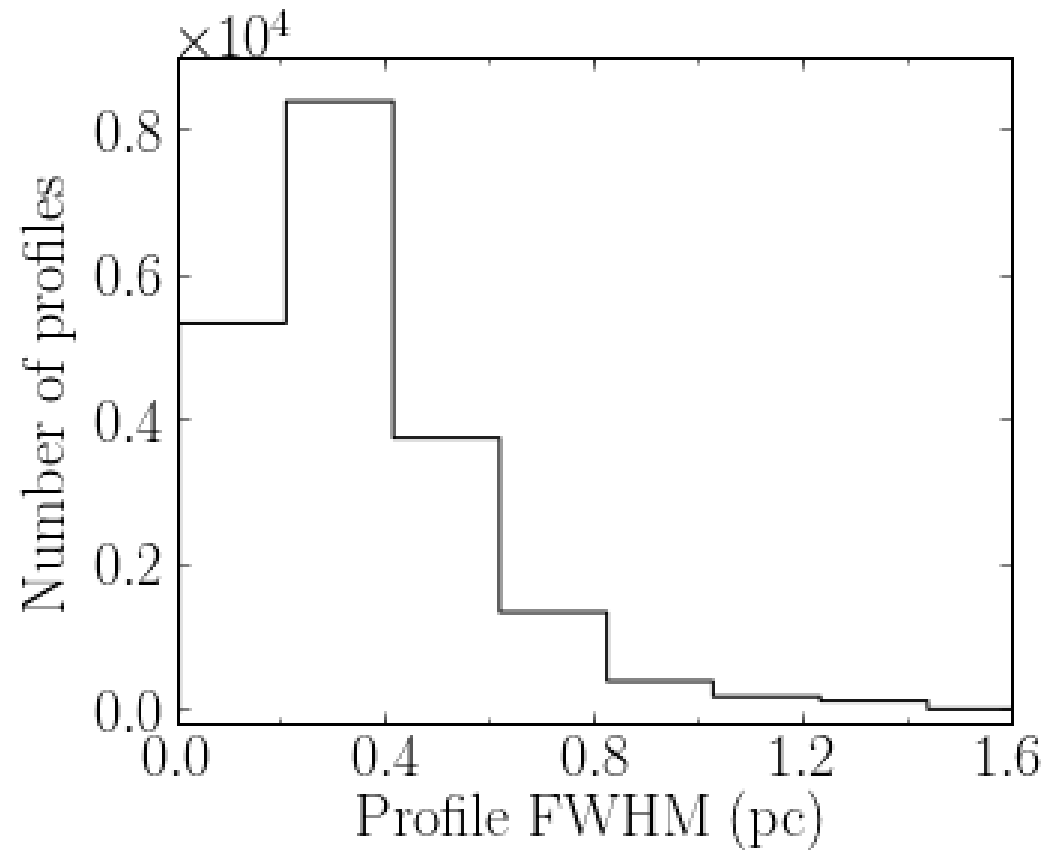
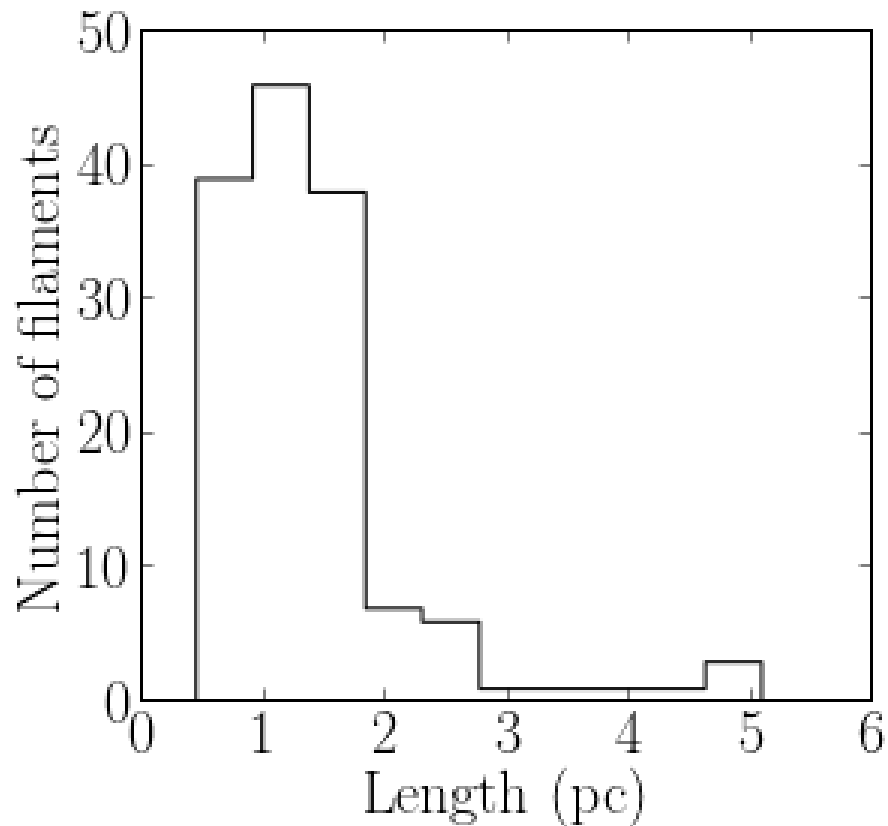
- 14 channel maps, 0.5 km/s width
- Same analysis reveals **143** filaments

# Filaments in velocity channels

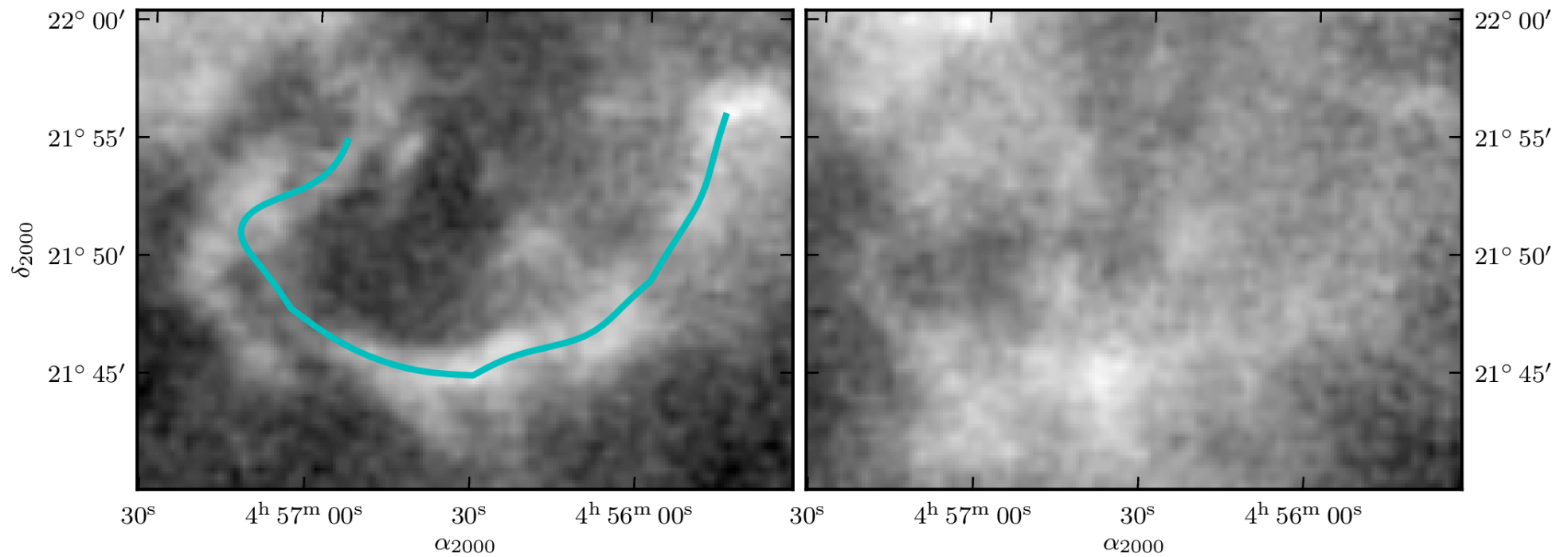




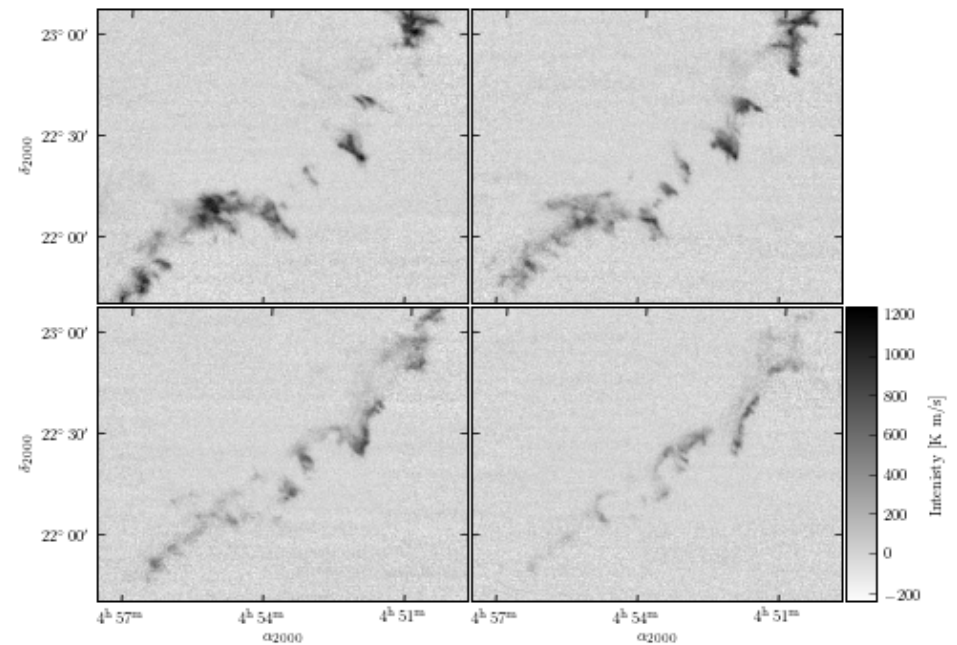
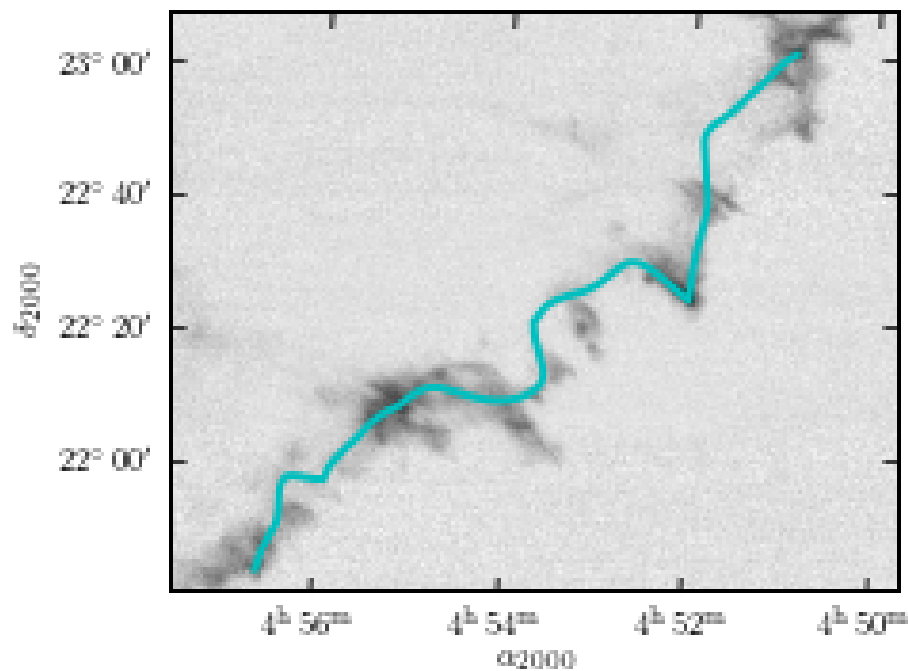
# Filaments in velocity channels



# Projection effects - I

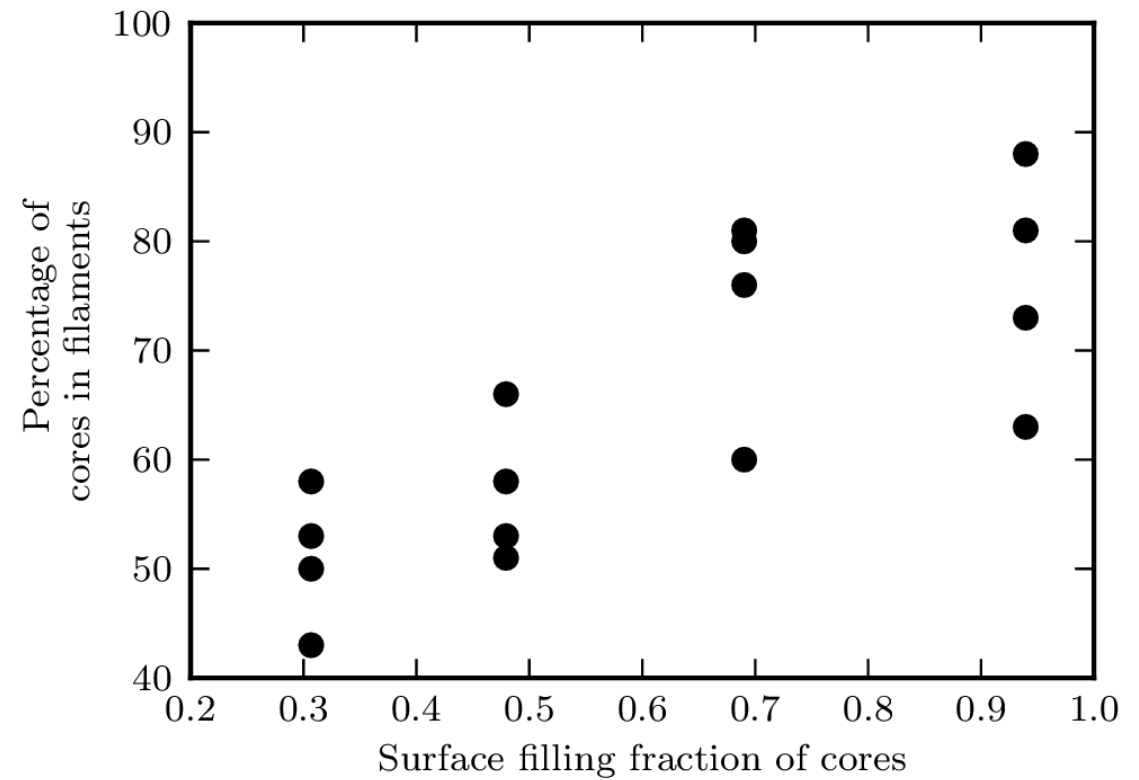
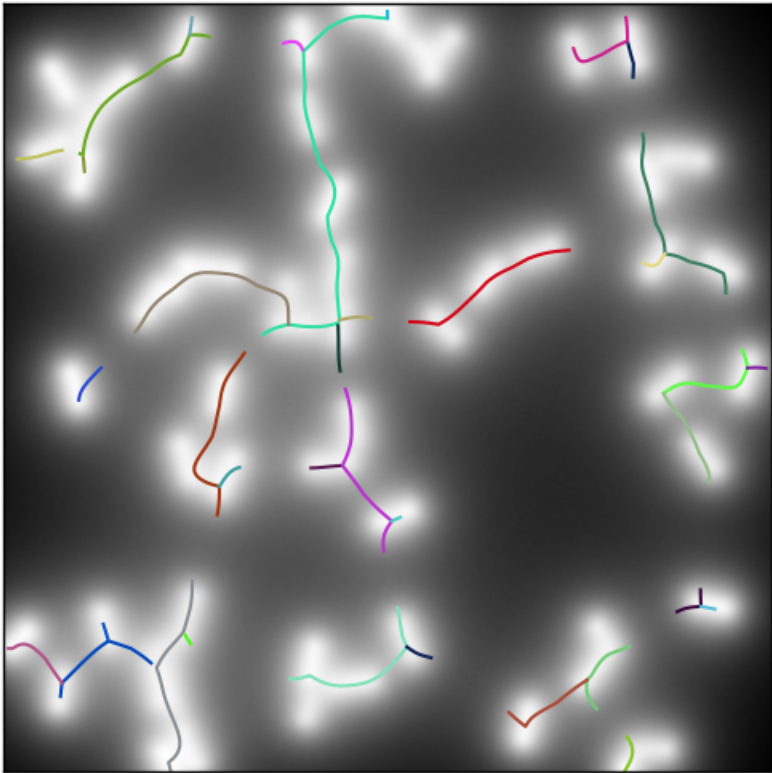


# Projection effects - II

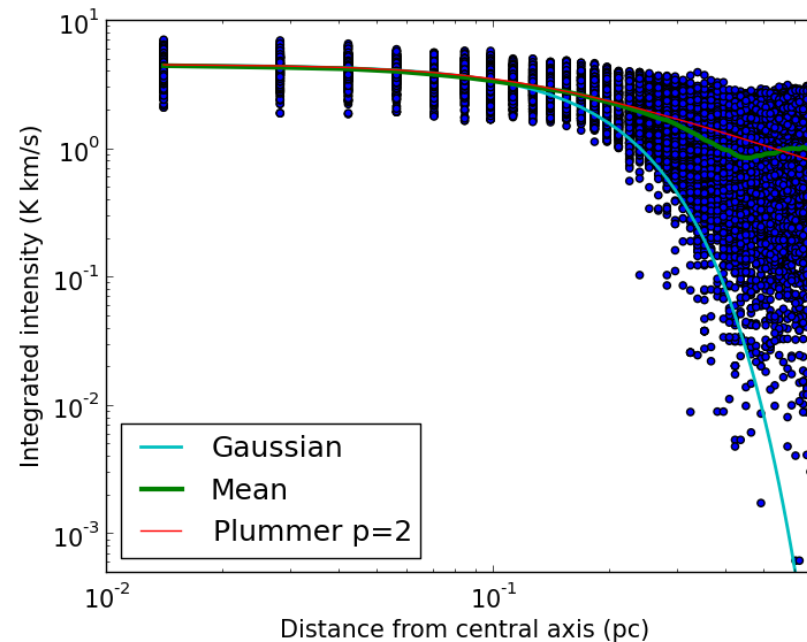
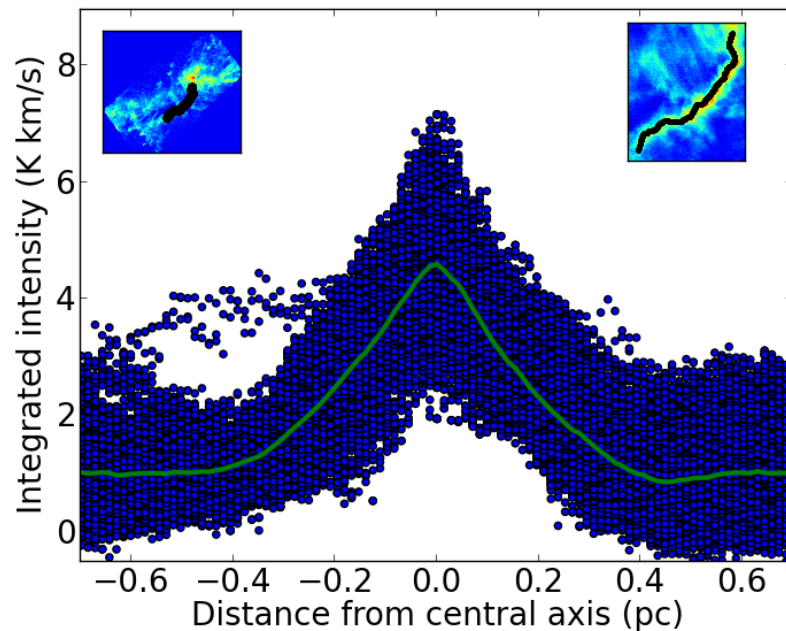
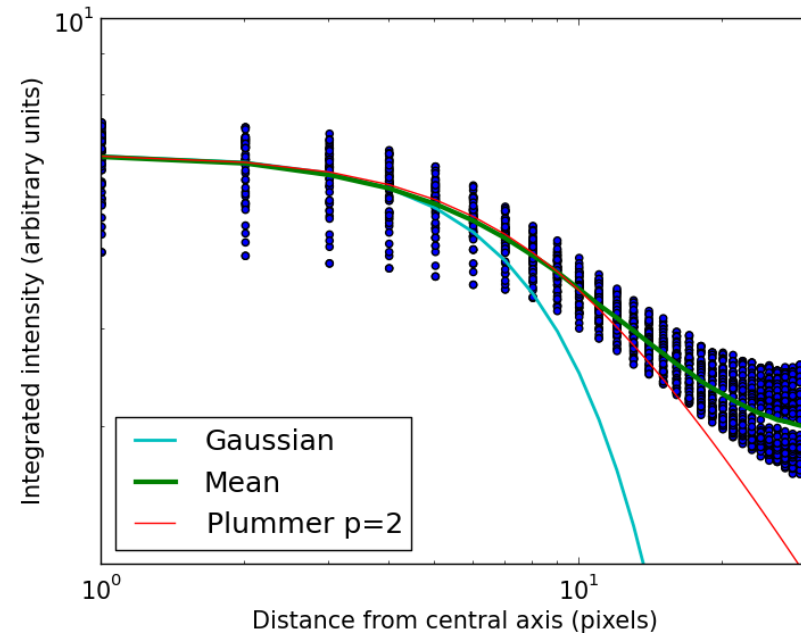
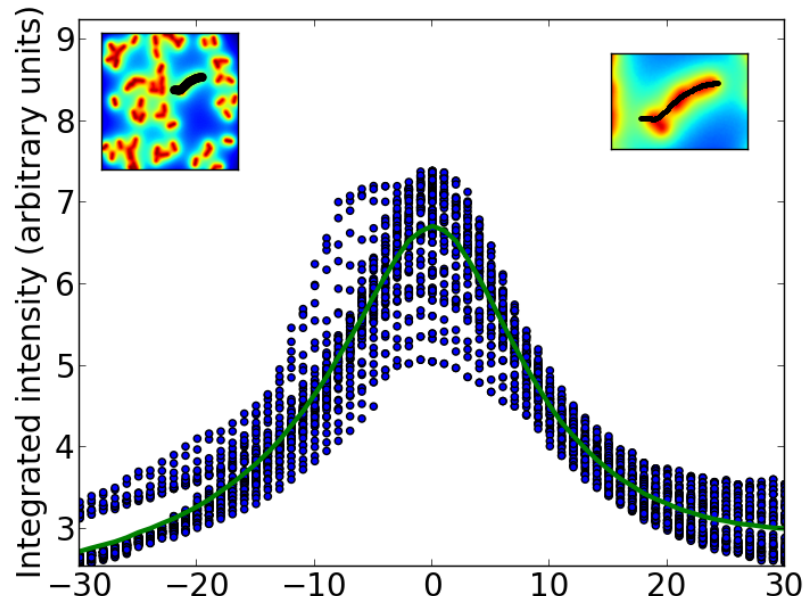


Can cores adjacent in projection produce similar observables?

# Projection effects - II



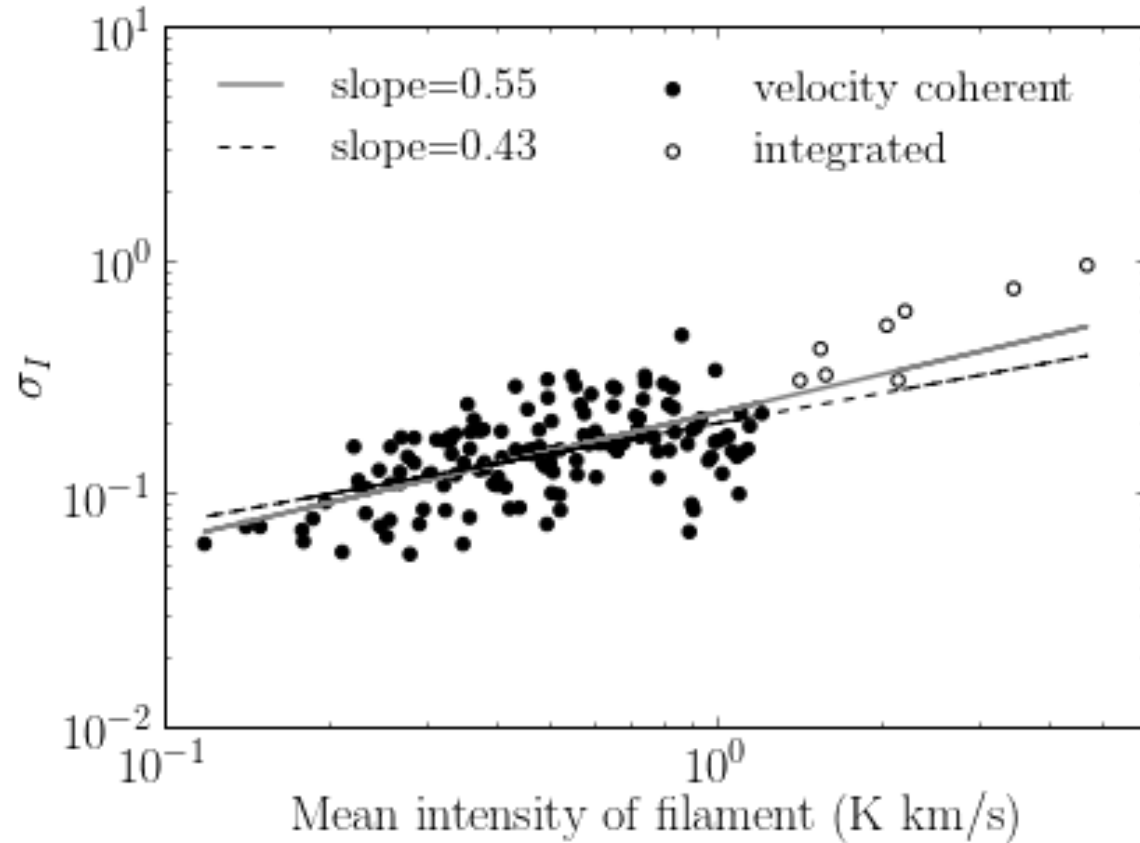
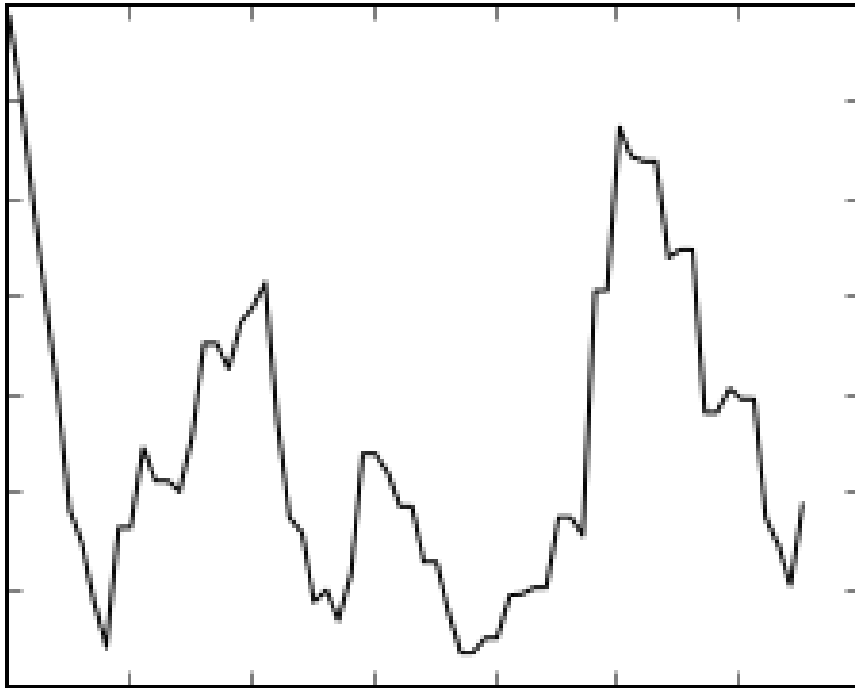
# Projection effects - II





# Hint of stochastic origin?

Intensity along the ridge



$$\sigma_I \propto I^{1/2}$$

# Conclusions

- Integrated emission filaments have widths that peak at **0.4 pc** with a large **spread** (0.18 pc)
- Velocity structure of integrated intensity filaments implies they can **not remain** a **cylinder** for **1 Myr**
- **Filaments** in **velocity channels** have profile widths that peak at **0.25 pc** with a large spread
- Two **projection** effects