

Loss of large scales in SCUBA-2/POL-2: tests on synthetic maps and Fourier transforms

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Driving question

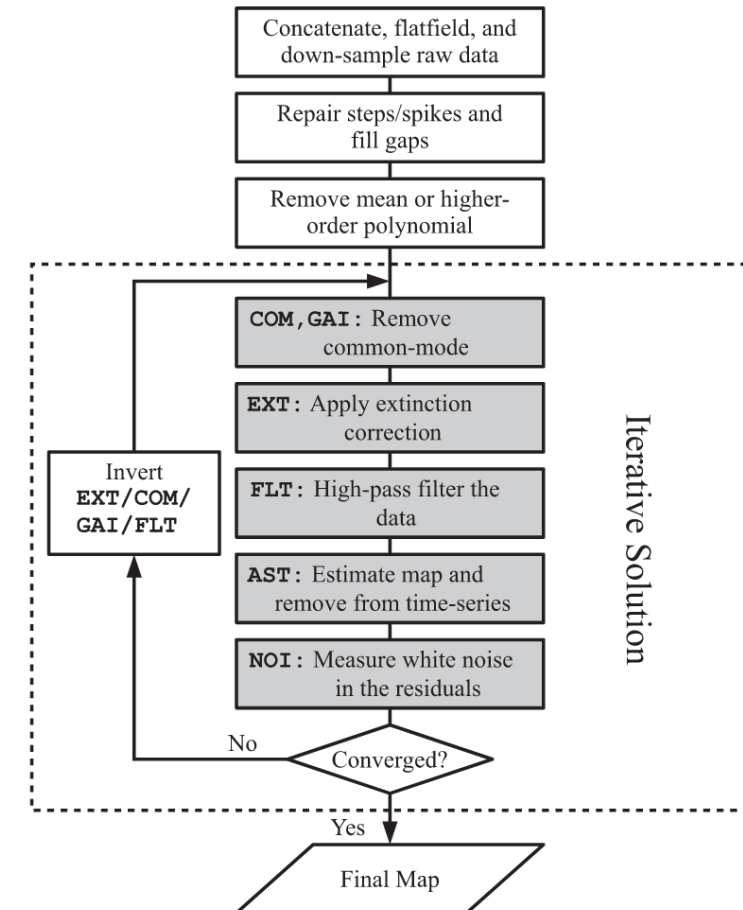
How can we quantify the effect of large-scale filtering in the POL-2 pipeline?

i.e. “Where and how much does flux loss in POL-2 affect the BISTRO/HAWC+ comparison?”

Filter HAWC+ maps using POL-2 pipeline to see where flux is lost on those maps

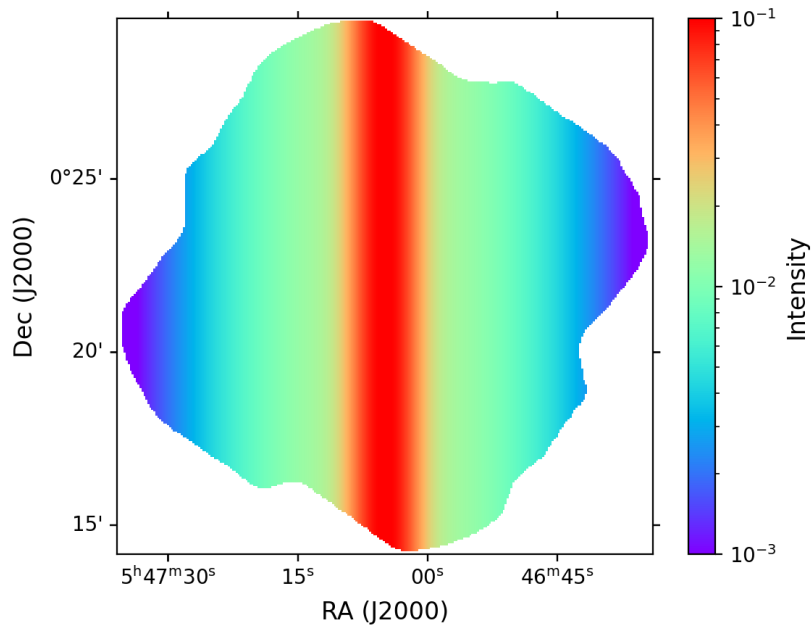
- Add (downscaled) HAWC+ map to POL-2
- Process that through the pipeline
- Separate the two maps again

Testing process on synthetic maps

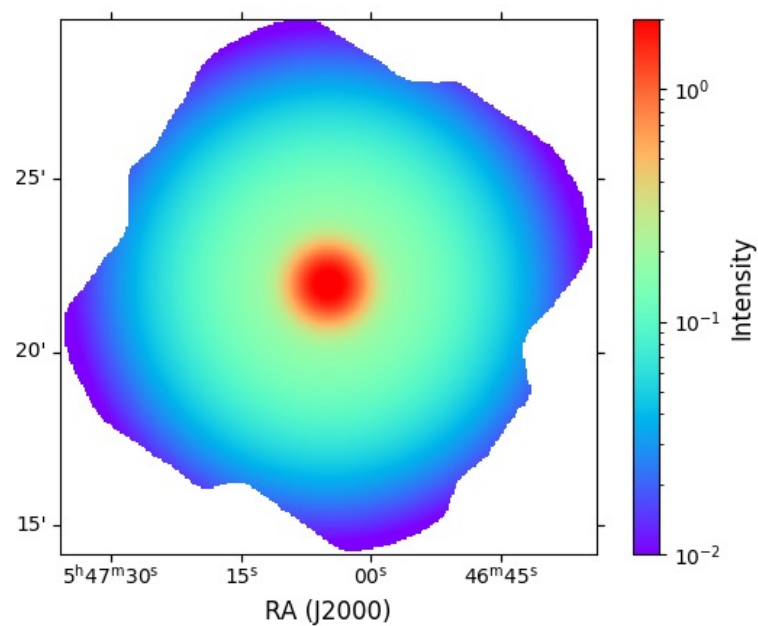


Synthetic maps

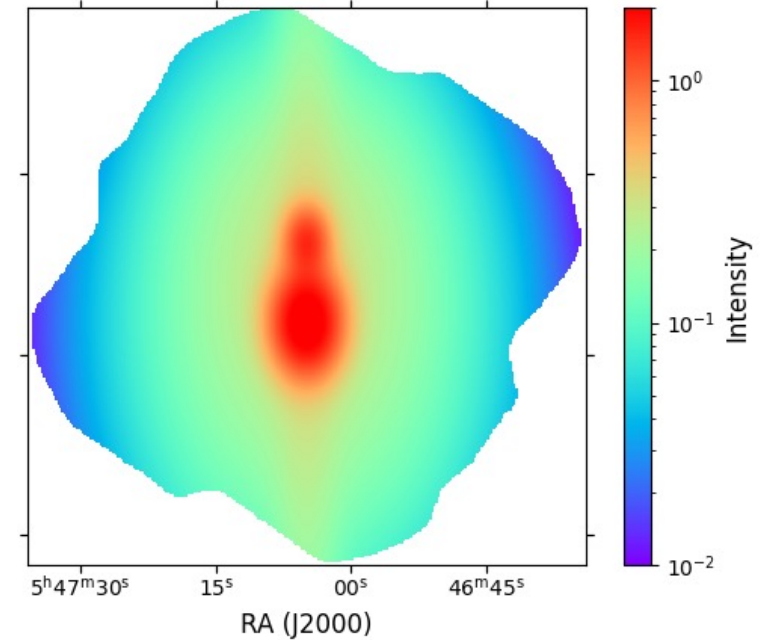
Filament



Core



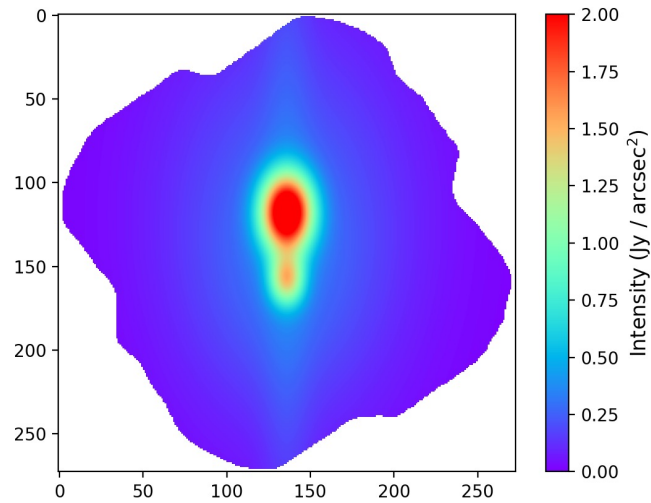
Filament + Cores



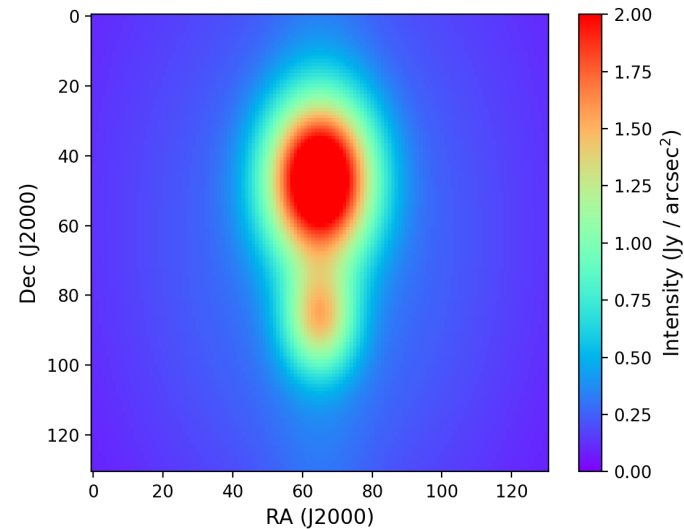
- Peak intensity $\sim 0.1 - 1 \text{ Jy} / \text{arcsec}^2$ (filament/cores at 154 μm)
- I, Q, U maps (shown: I)
- Before/after comparison, Fourier transform

Fourier transform: procedure

Original (273 x 274 pixels)

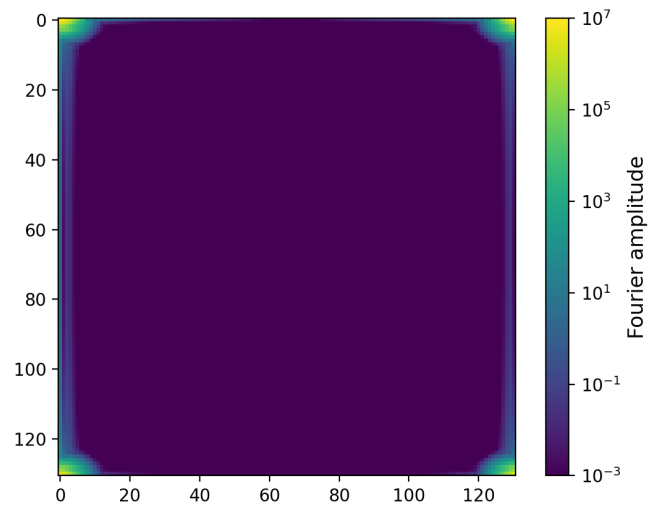


Cropped (131 x 131)

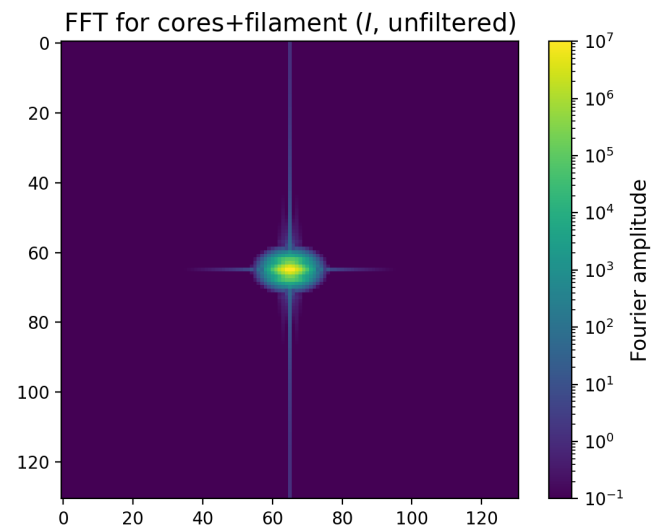


(to avoid issues with
irregular map edge)

FFT

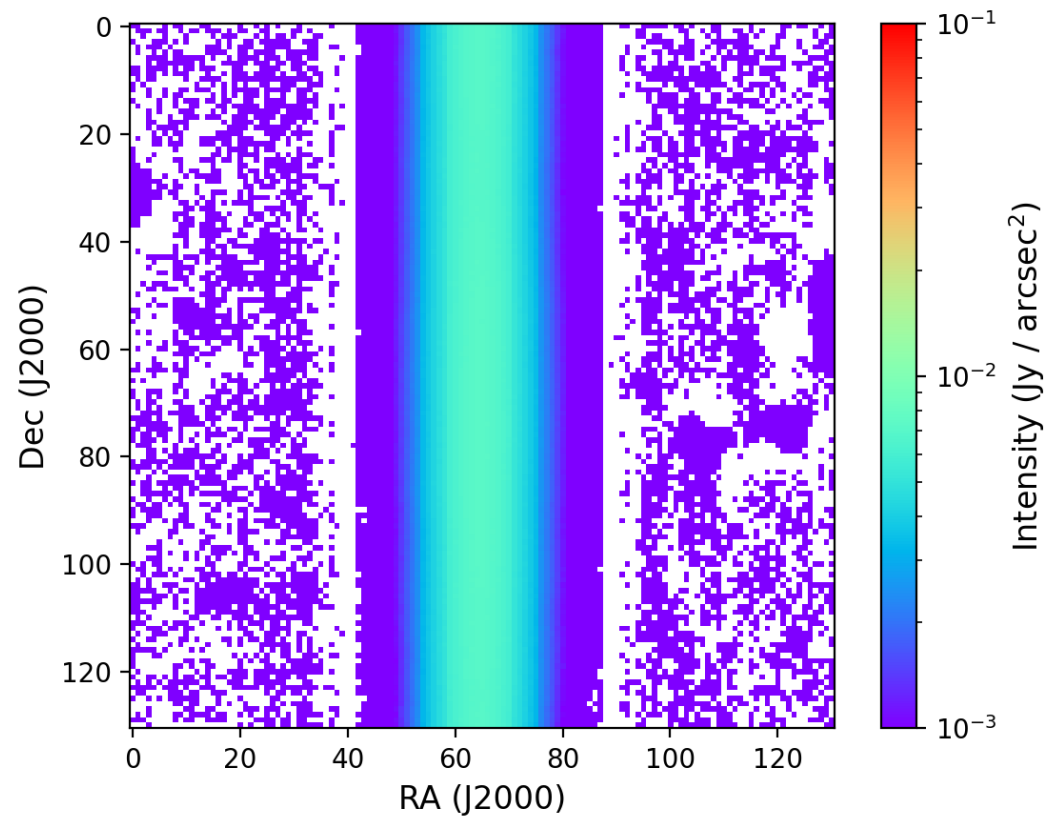
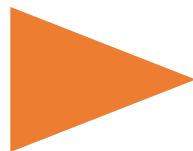
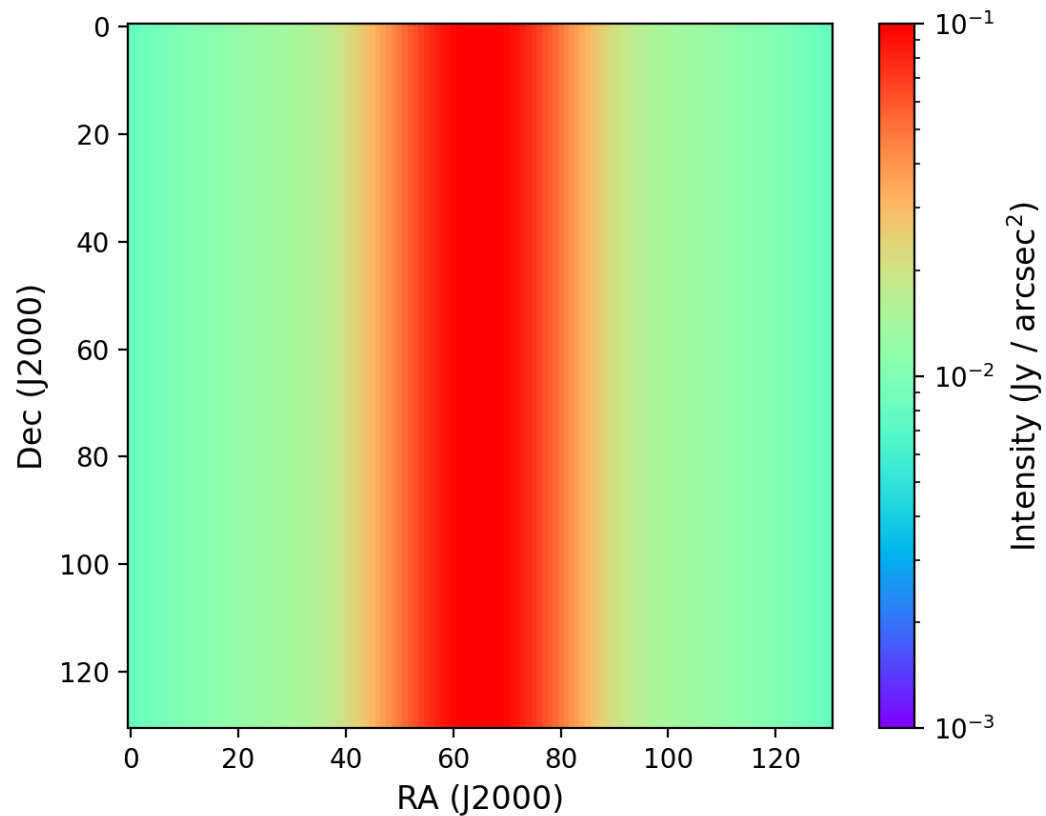


Shift

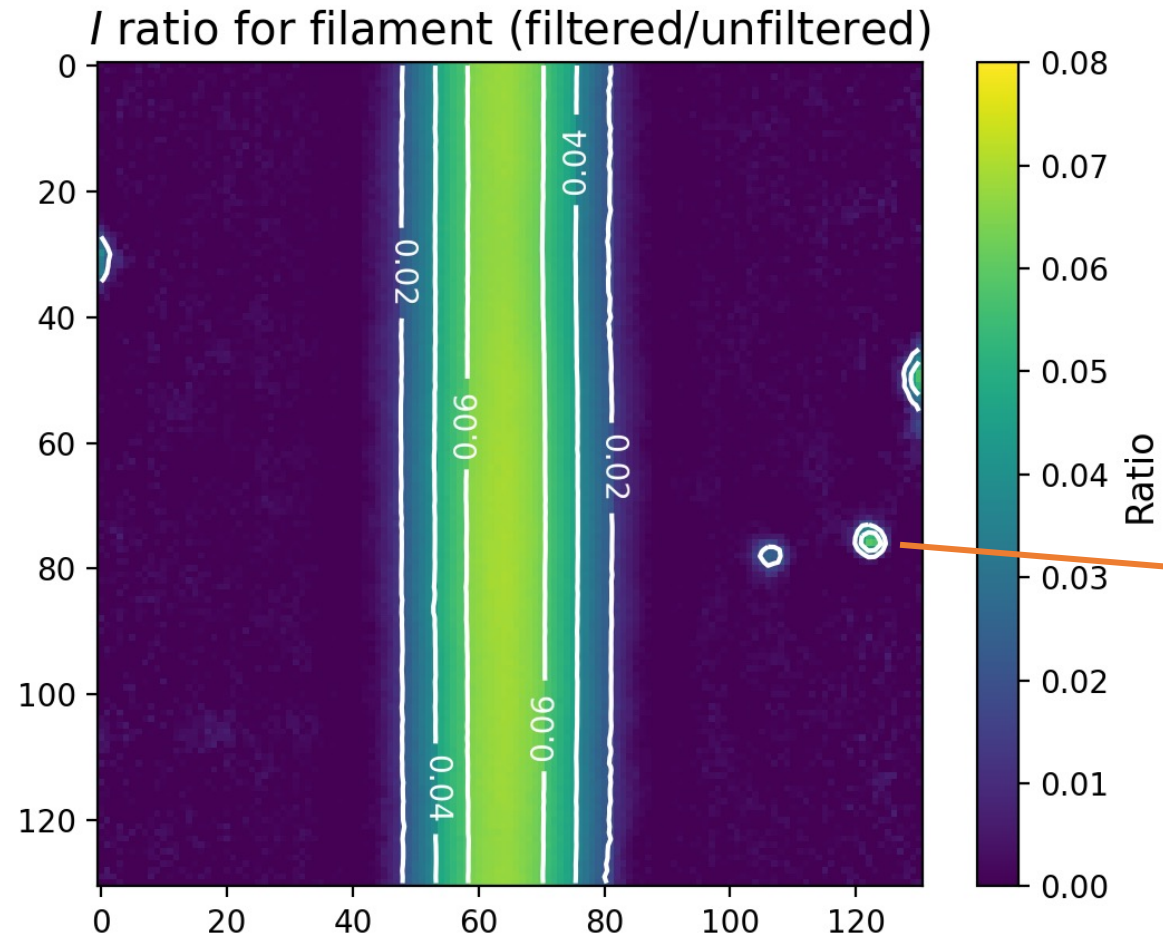


Low spatial frequencies
are now at the center

Filament: filtering (logscale)



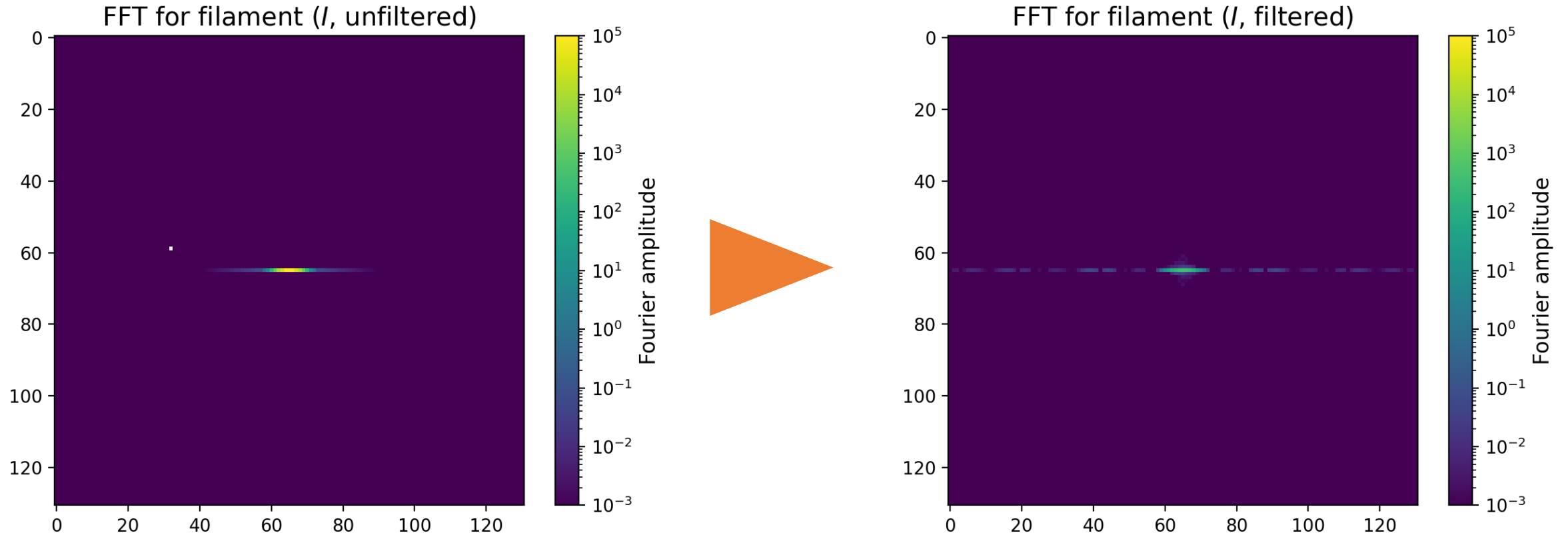
Filament: filtering (ratio)



Flux loss > 90 %

Features: emission in “empty” map?

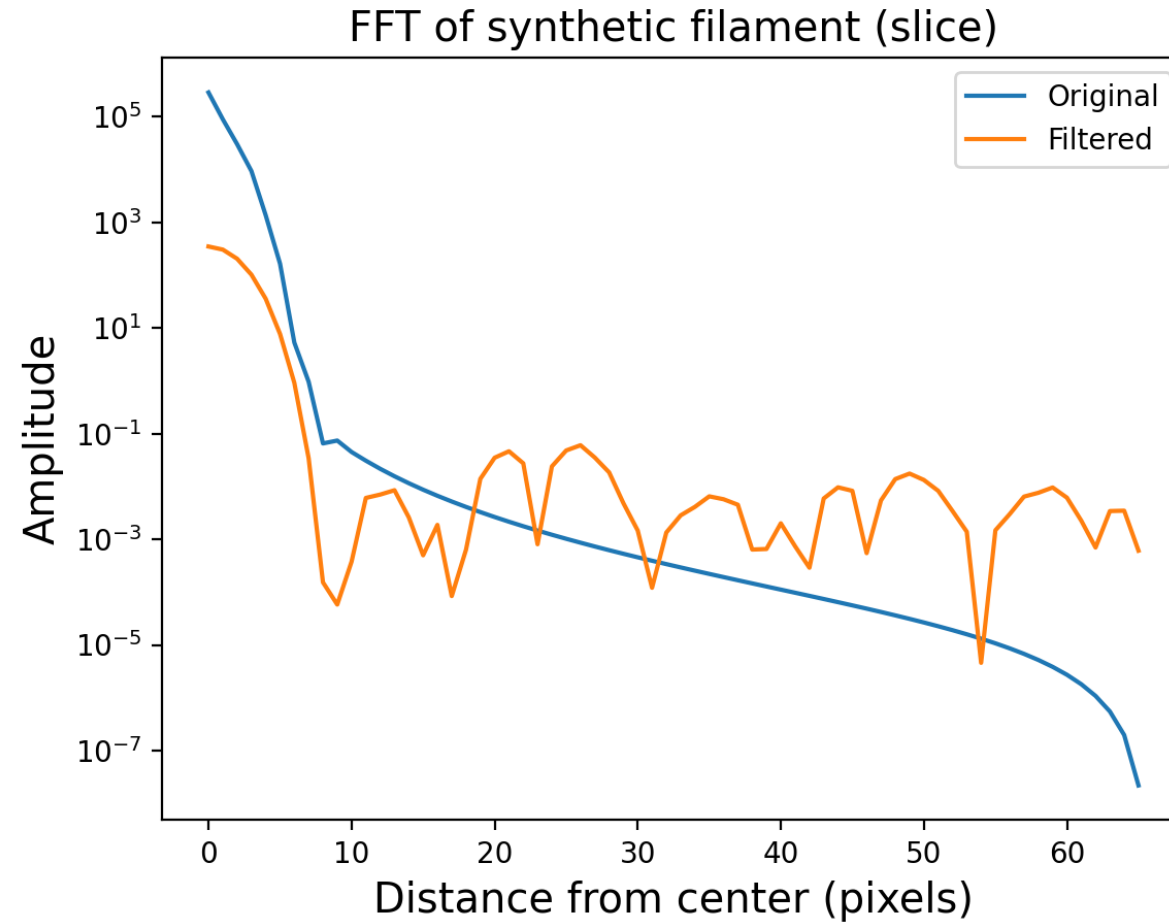
Filament: Fourier transform



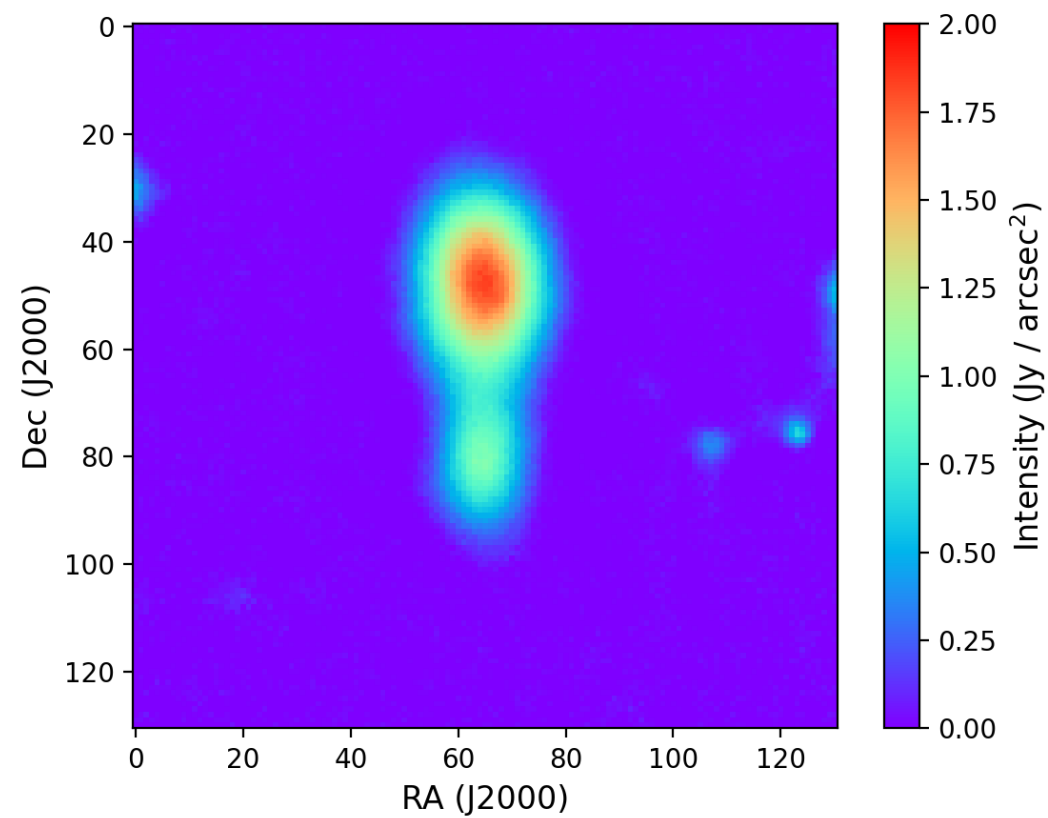
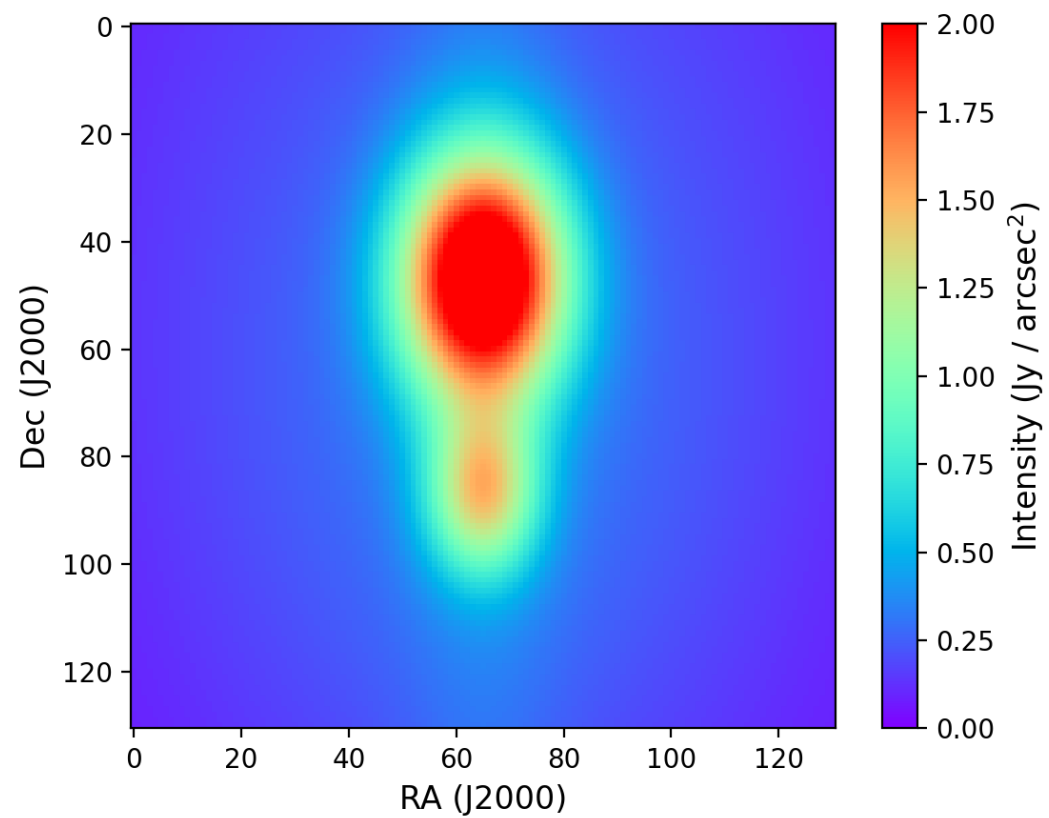
Vertical structure in real space \rightarrow horizontal structure in FFT

Loss of low spatial frequencies, gain in high spatial frequencies

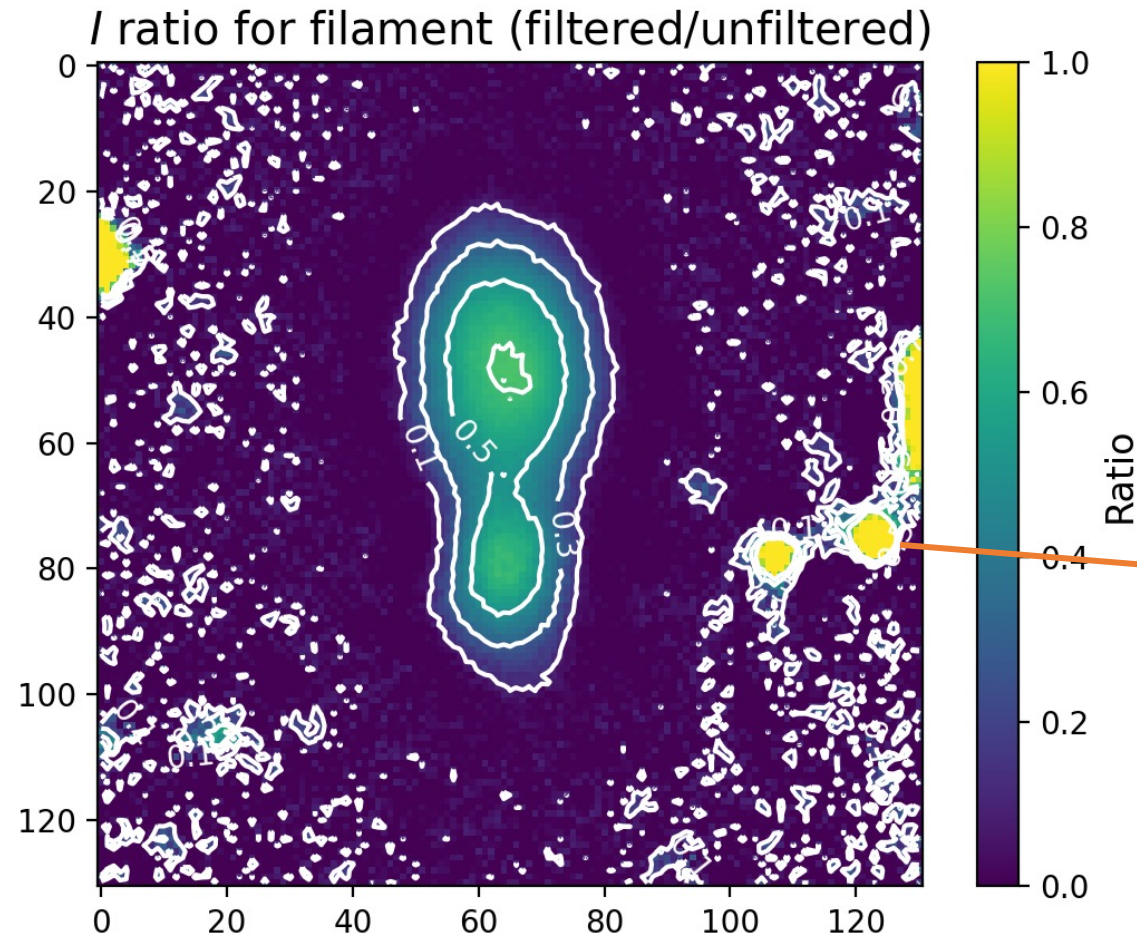
Filament: Fourier transform (1 D)



Filament + Cores: filtering



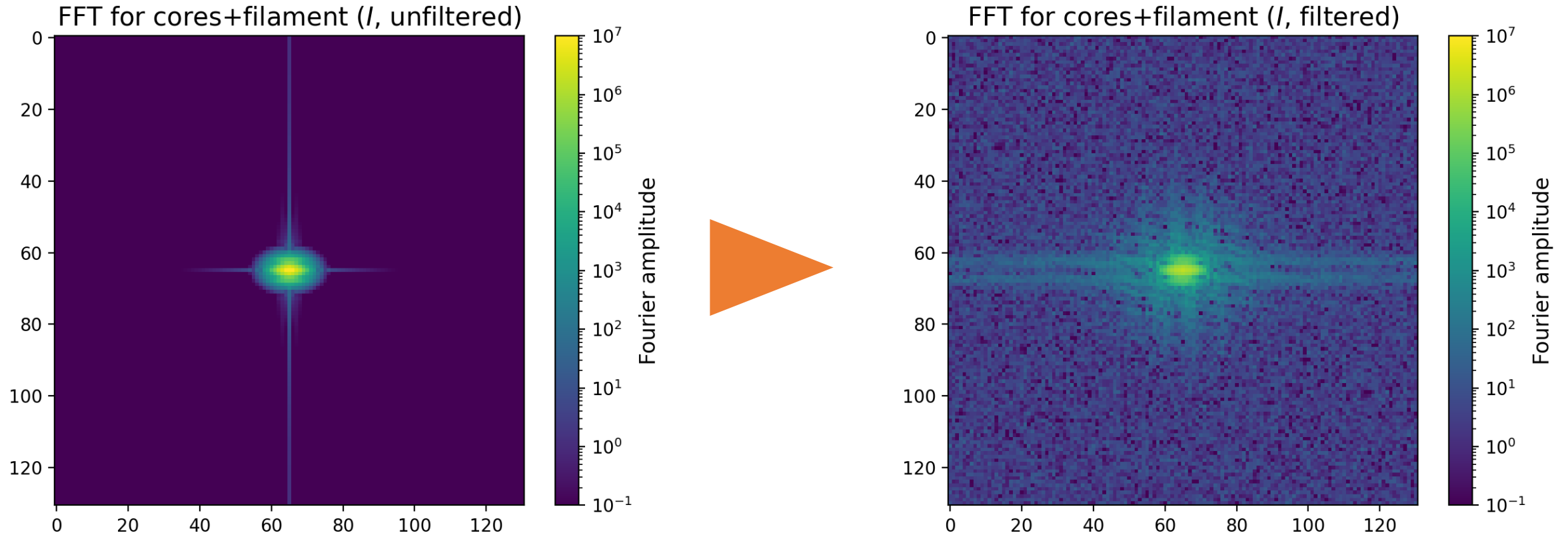
Filament + Cores: filtering (ratio)



Flux loss 30- 70 %

Features: emission in “empty” map?
More prominent than in filament
→ effect of normalization?

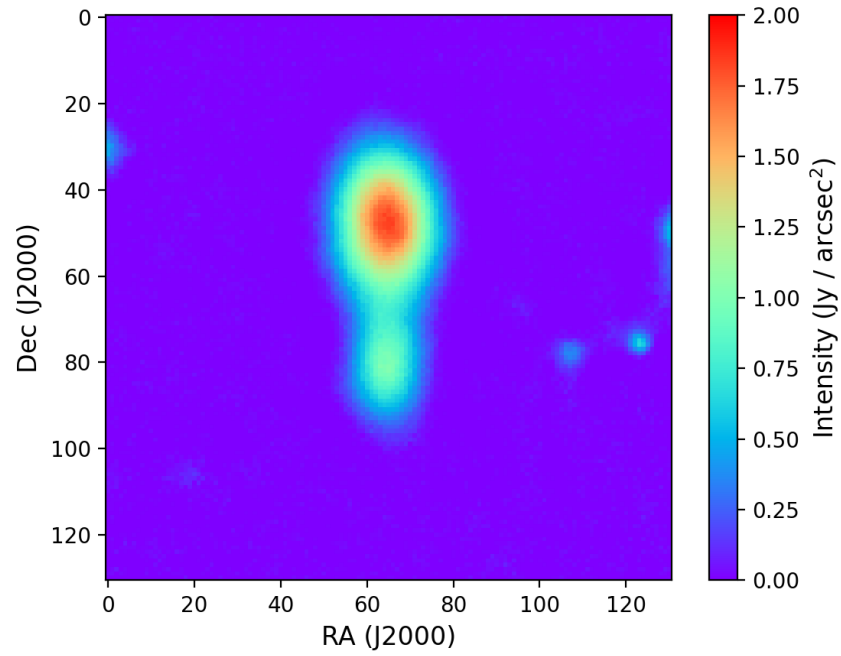
Filament + Cores: Fourier transform



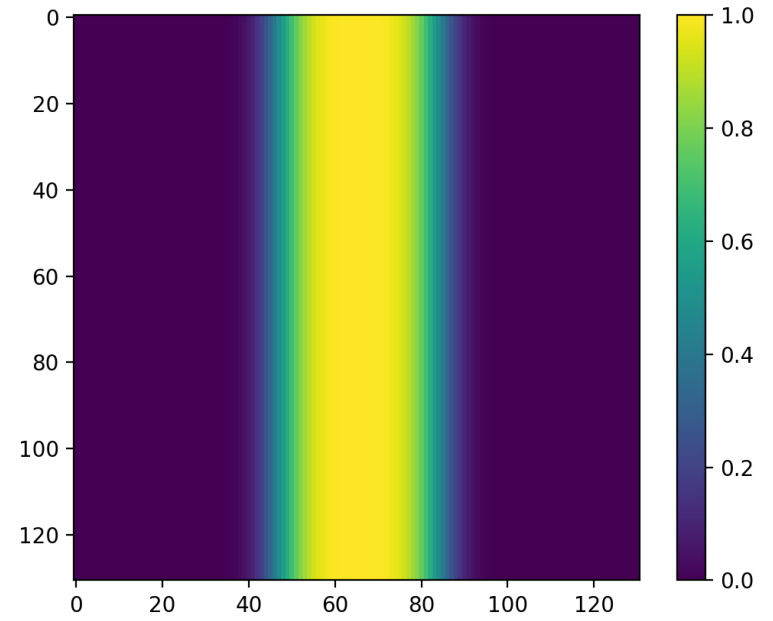
Loss of low spatial frequencies, gain in high spatial frequencies

How much of it is from extraneous features?

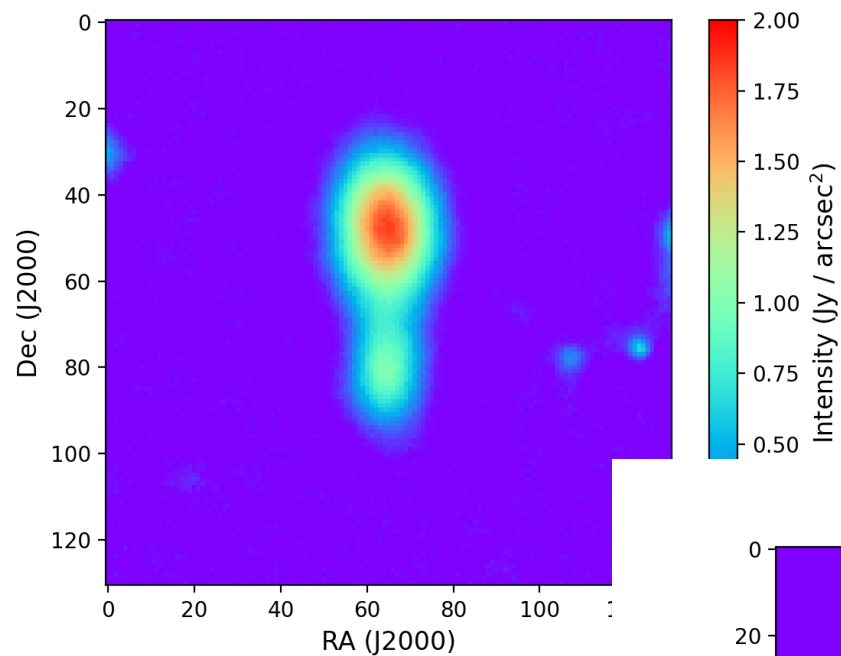
“Edge cleaning”



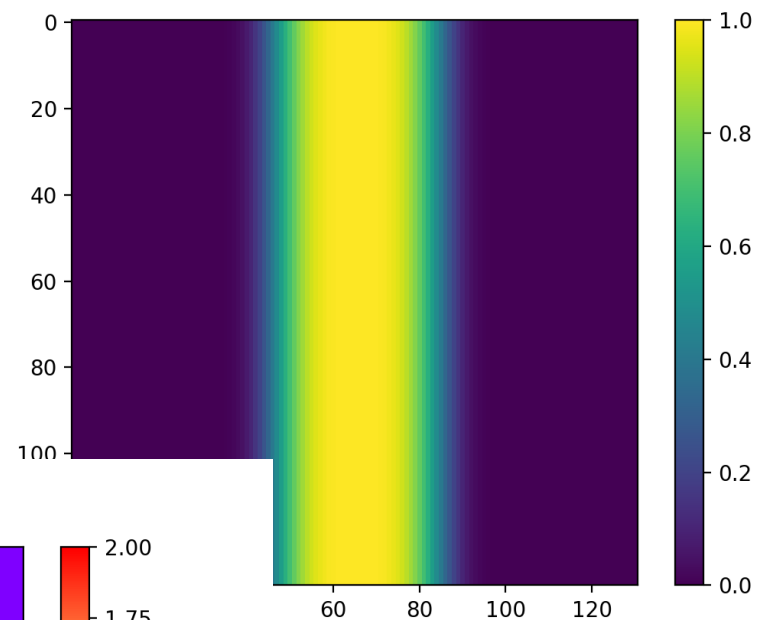
X



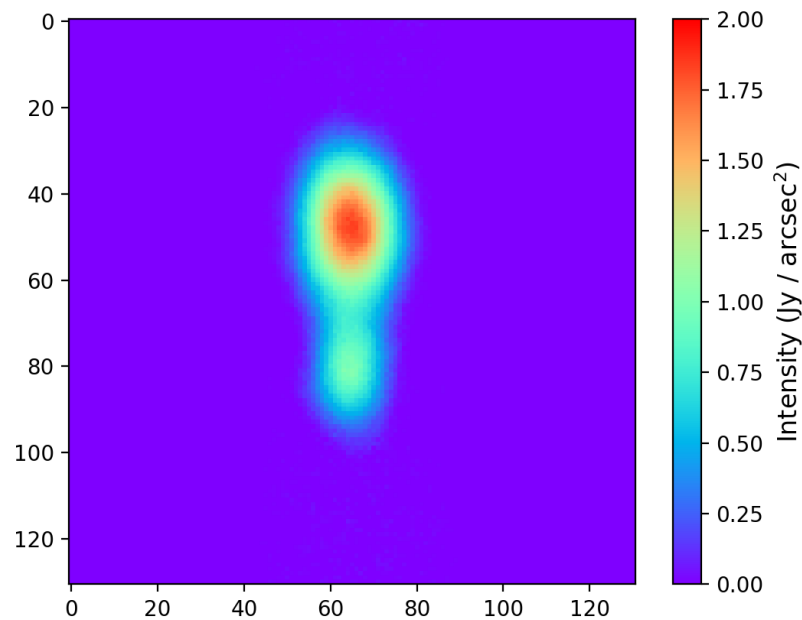
“Edge cleaning”



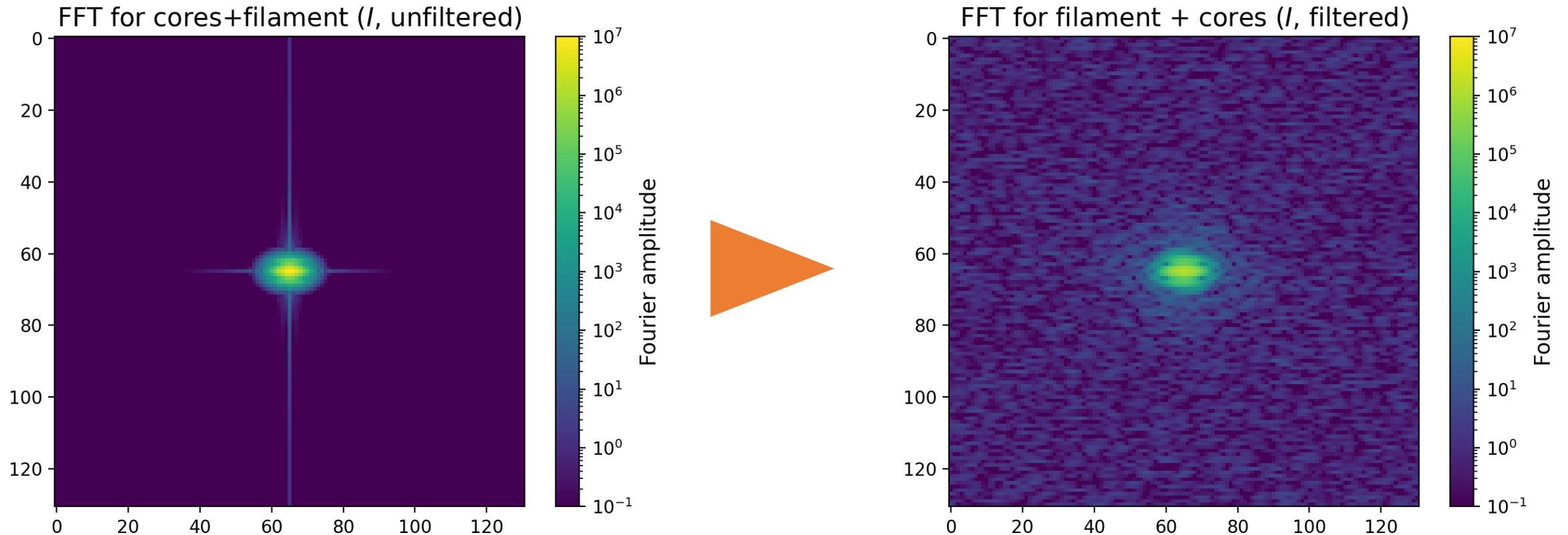
X



=



Filament + Cores: Fourier transform (edge-cleaned)



Loss of low spatial frequencies, gain in high spatial frequencies

How much of it is from extraneous features?

Conclusions and future directions

- Flux loss is significant and strongly dependent on the structure examined, as expected
 - Filament + cores: significant flux loss even in compact region
 - How significant / worrying is this?
 - Effect of extended flux?
- Fourier transform of unfiltered vs. filtered maps:
 - Not simple loss of small spatial frequencies, but “spread” of power spectrum
 - Important to take contamination from “empty” field into account!
 - Significance may depend on scaling factor used