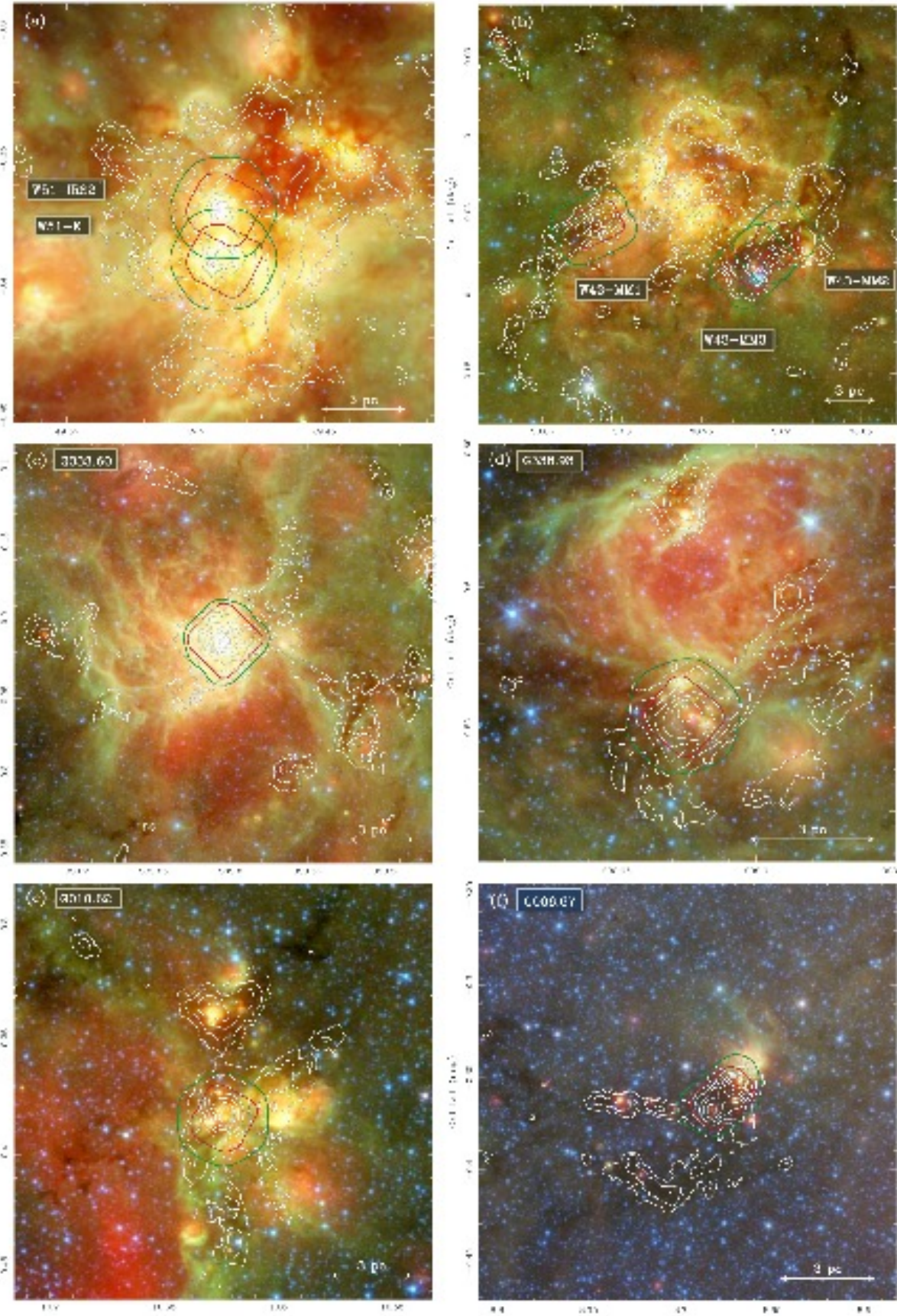


As part of the large program ALMA-IMF, we constrain the scenario of high-mass star formation by searching for massive pre-stellar core (MPSC) candidates in the population of cores extracted from 15 massive protoclusters.

ALMA-IMF Dataset

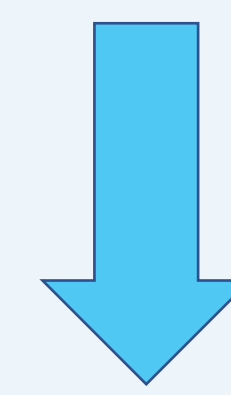


- 15 massive protoclusters
- $D \leq 5.5 \text{ kpc}$
- Same spatial resolution of 2000 AU
- 700 dust cores
- 15 to 20% massive cores
- Young to evolved regions
- 12 PPV cubes per field
- A lot of molecular content available

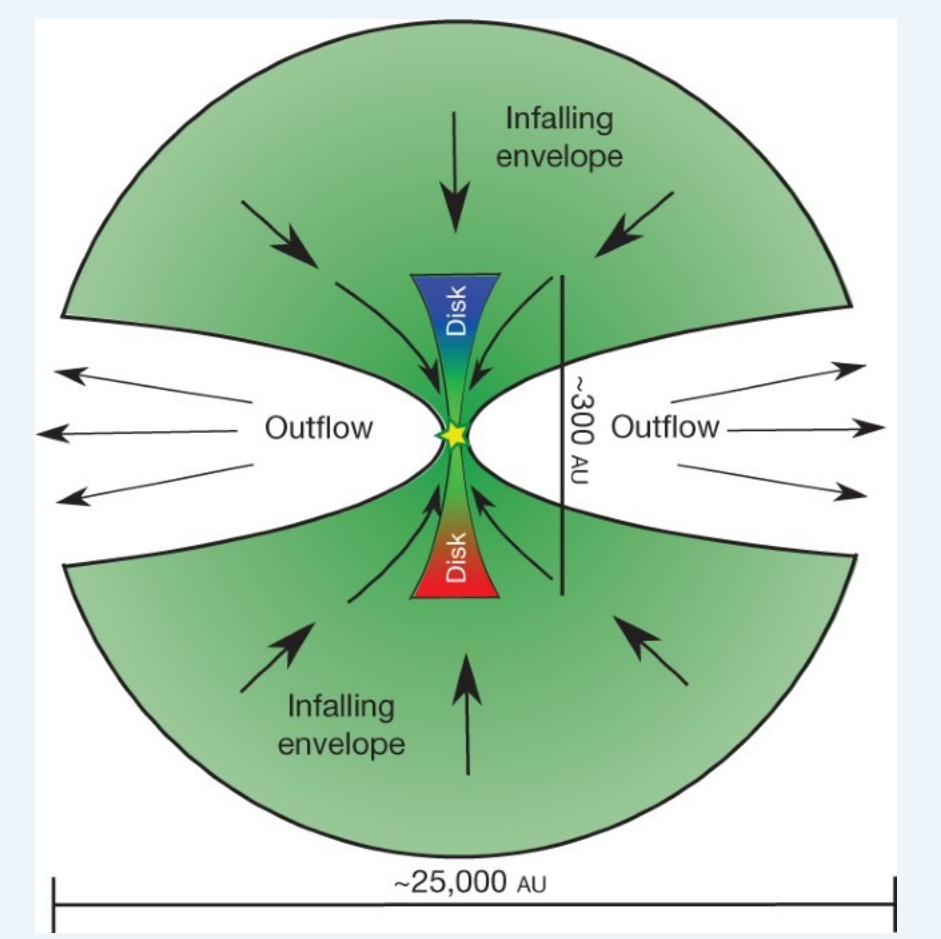
Motte et al, ALMA-IMF I, 2022

Aims

- Use the large ALMA-IMF dataset in order to constrain the scenario of high-mass star formation
- **Discriminate proto-stellar from pre-stellar cores**
- Search for massive pre-stellar core candidates ($M > 8M_{\odot}$) and study their properties

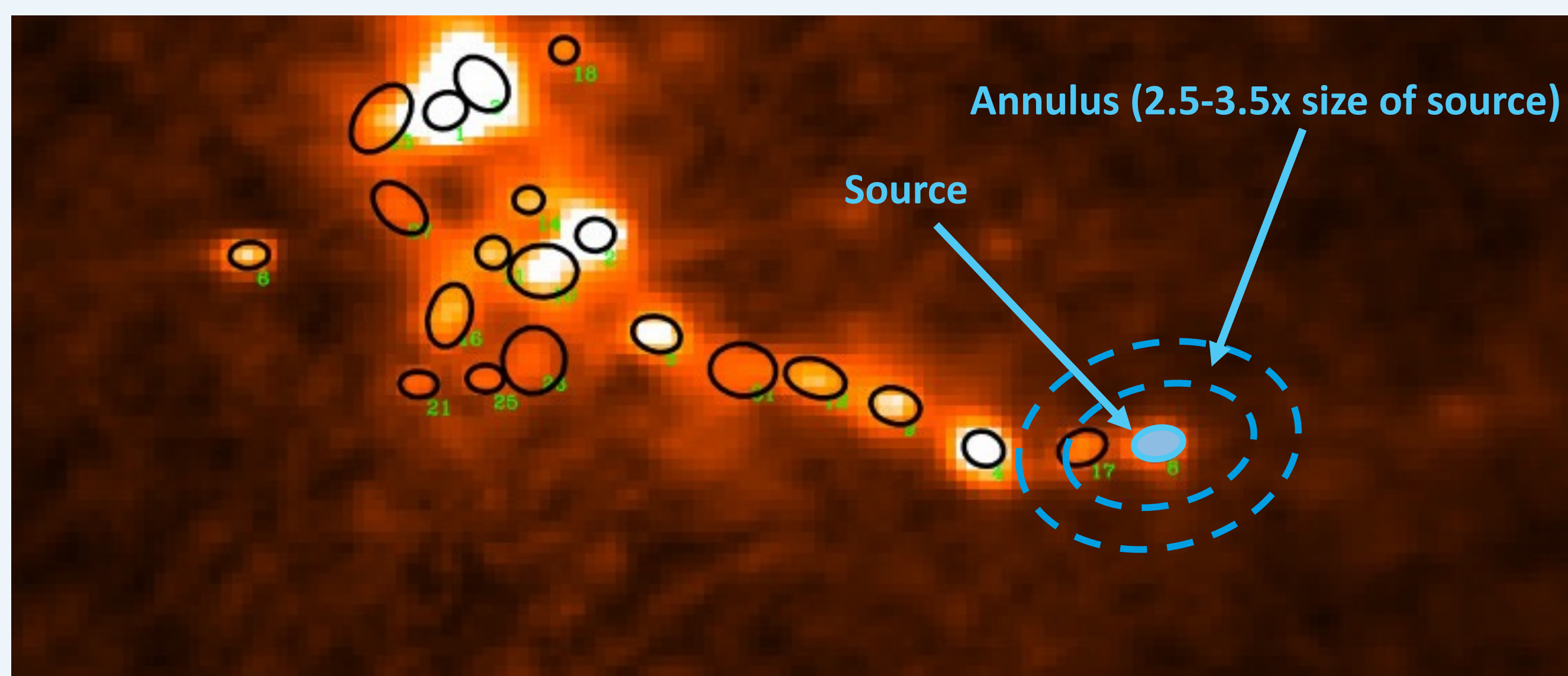


Need to build an automated outflow detection method



Tobin et al, Nature 2012

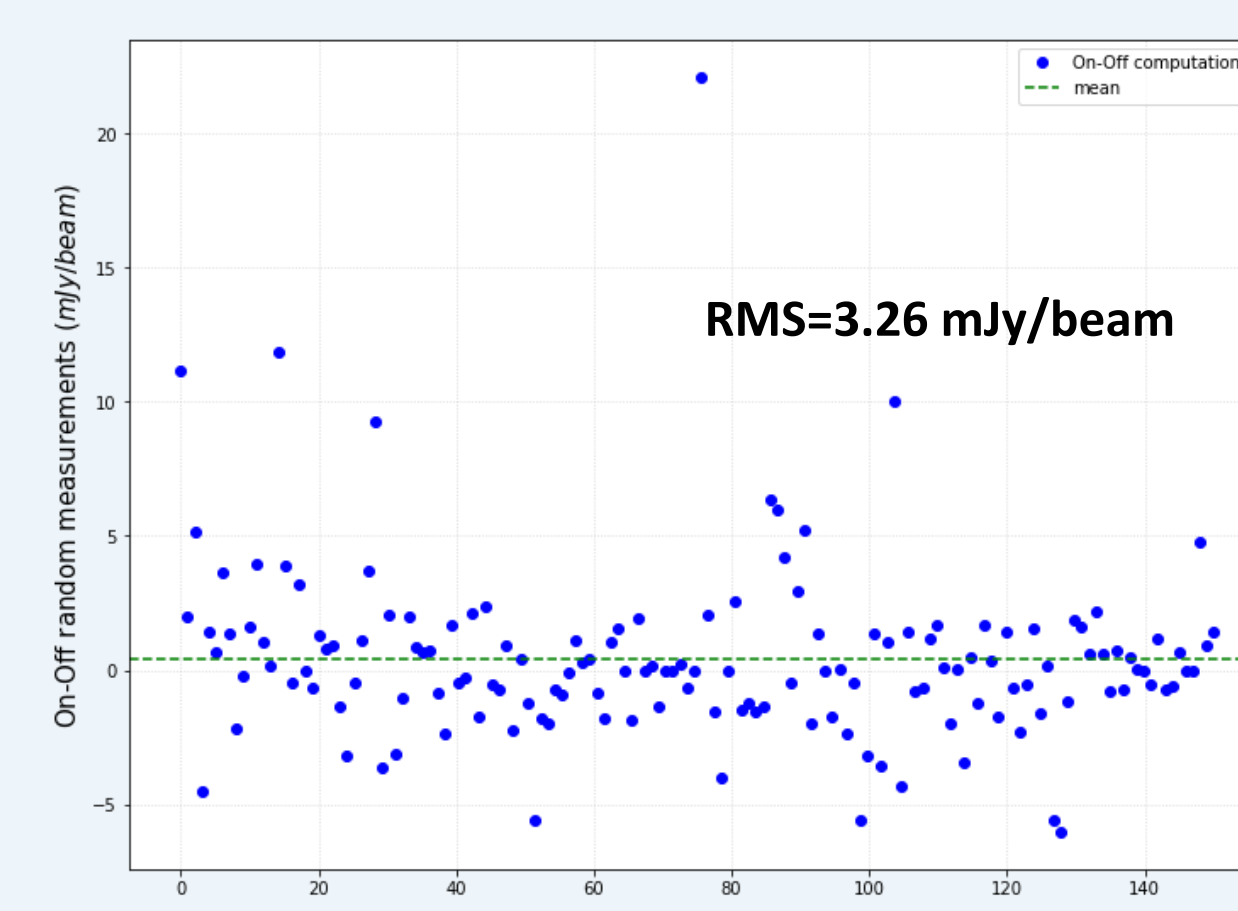
On-Off automatic method



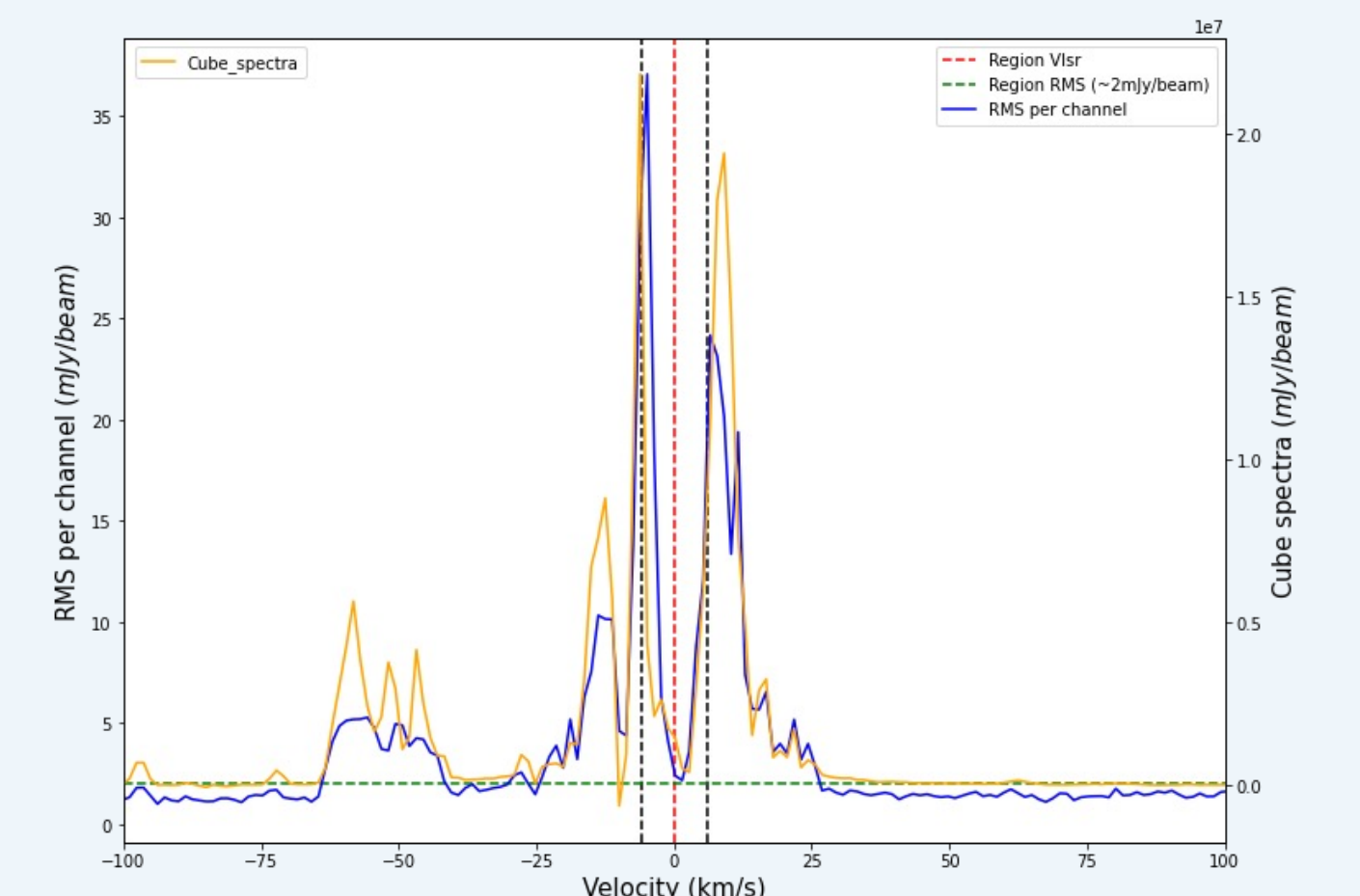
- A simple idea : excess on source compared to background in an annulus (Bontemps et al, 1996)
- CO(2-1) and SiO(5-4) lines used to trace outflows

On-Off RMS estimation

1 channel



Full cube

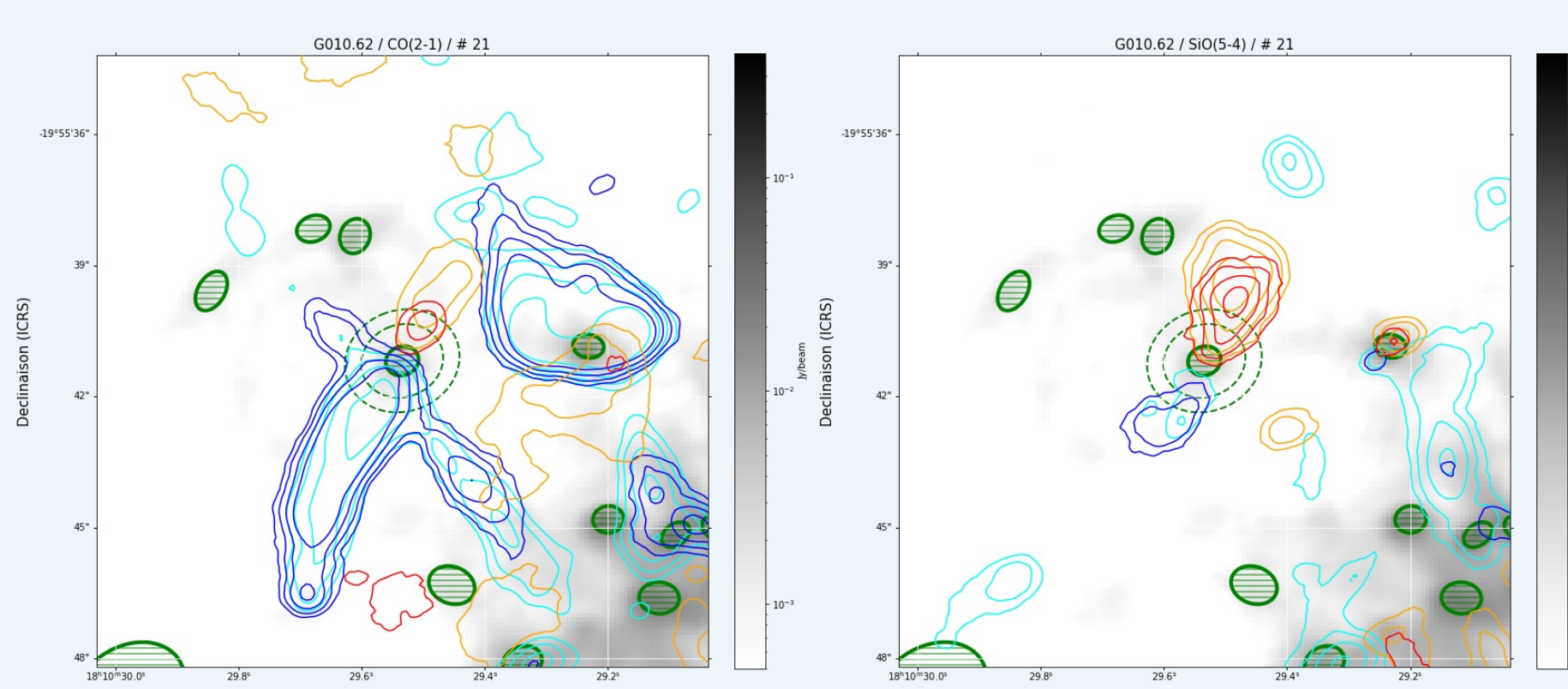
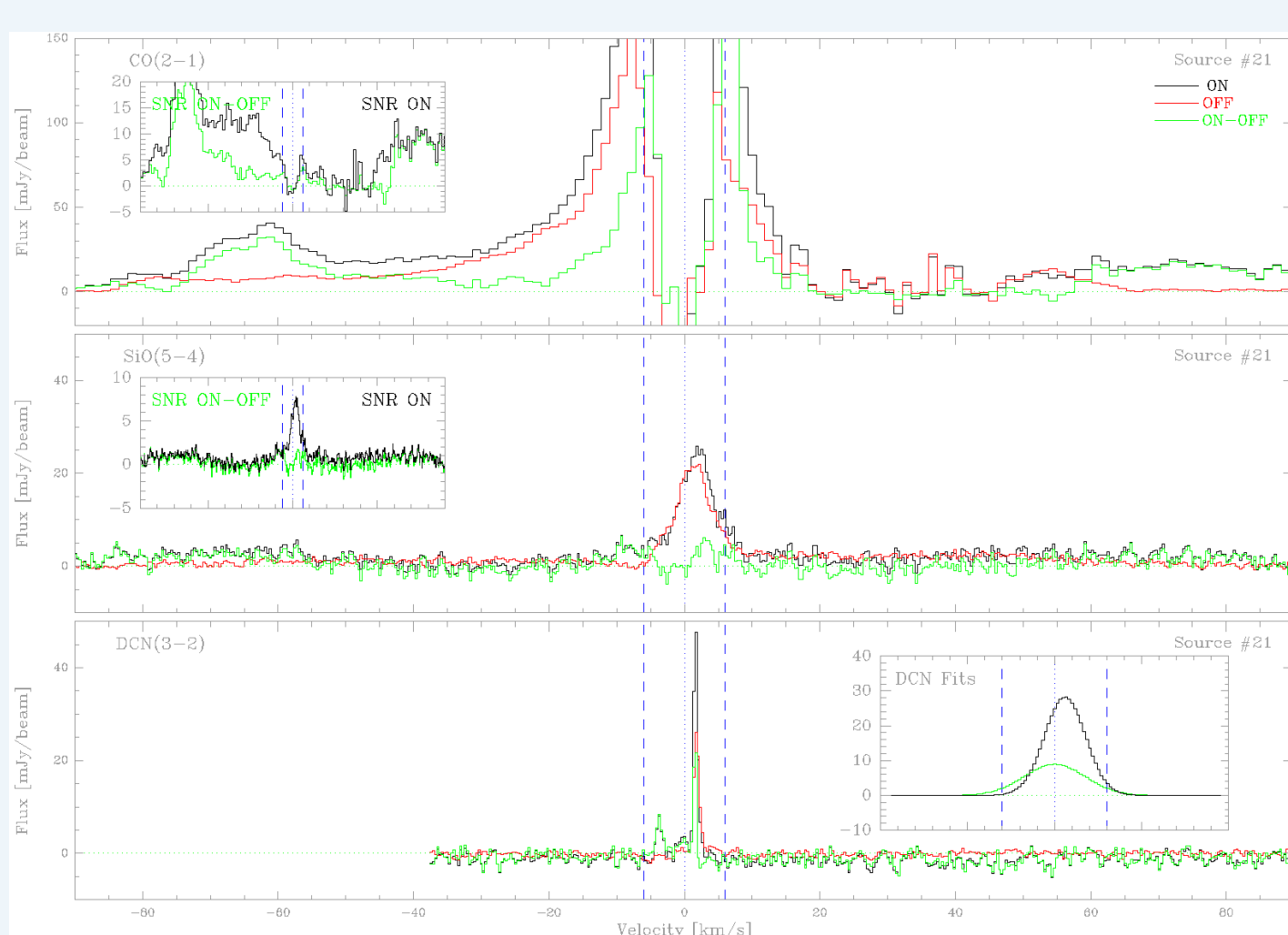


- We estimate the RMS by taking into account the detection method
- 150 On-Off random selections in the field
- Compute one RMS for every channel
- Significant emission can now be detected

Accurate Noise estimation is essential in an automated detection method !

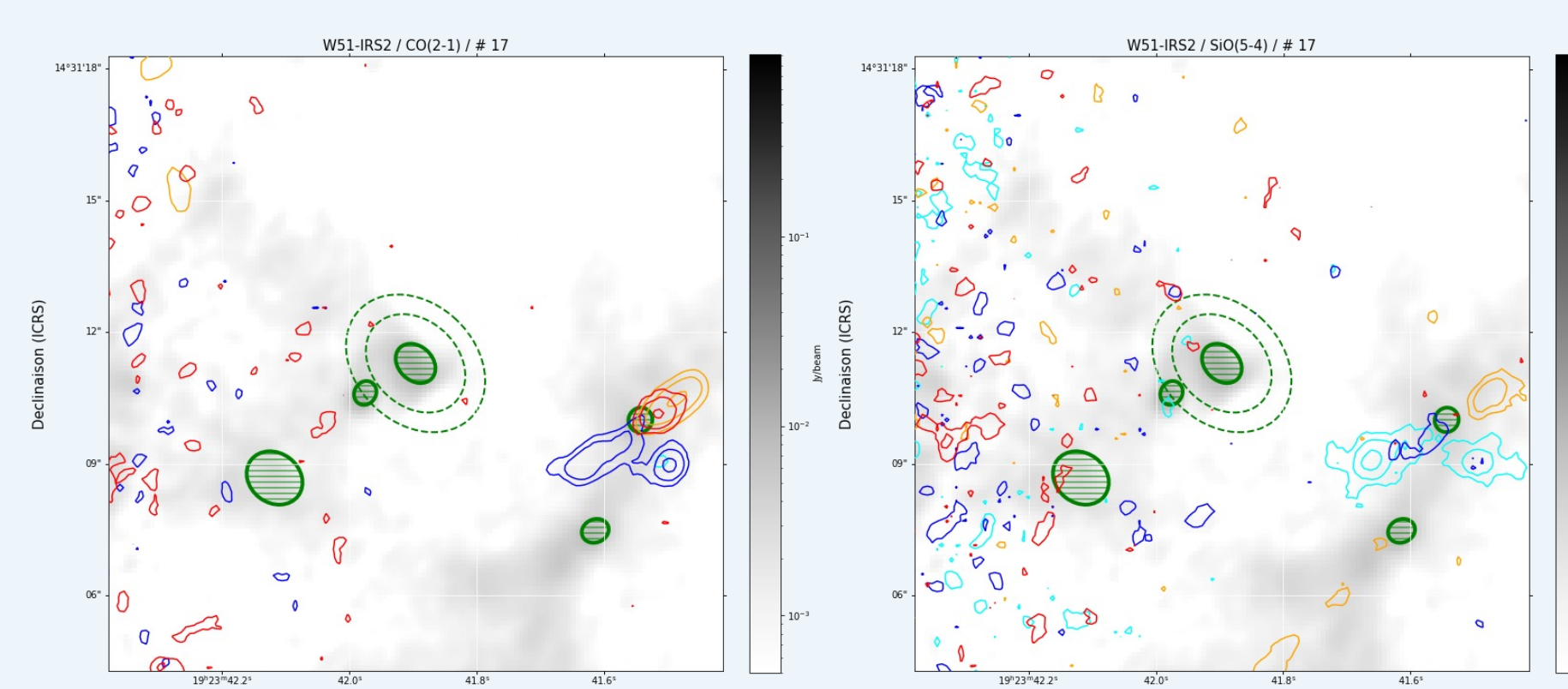
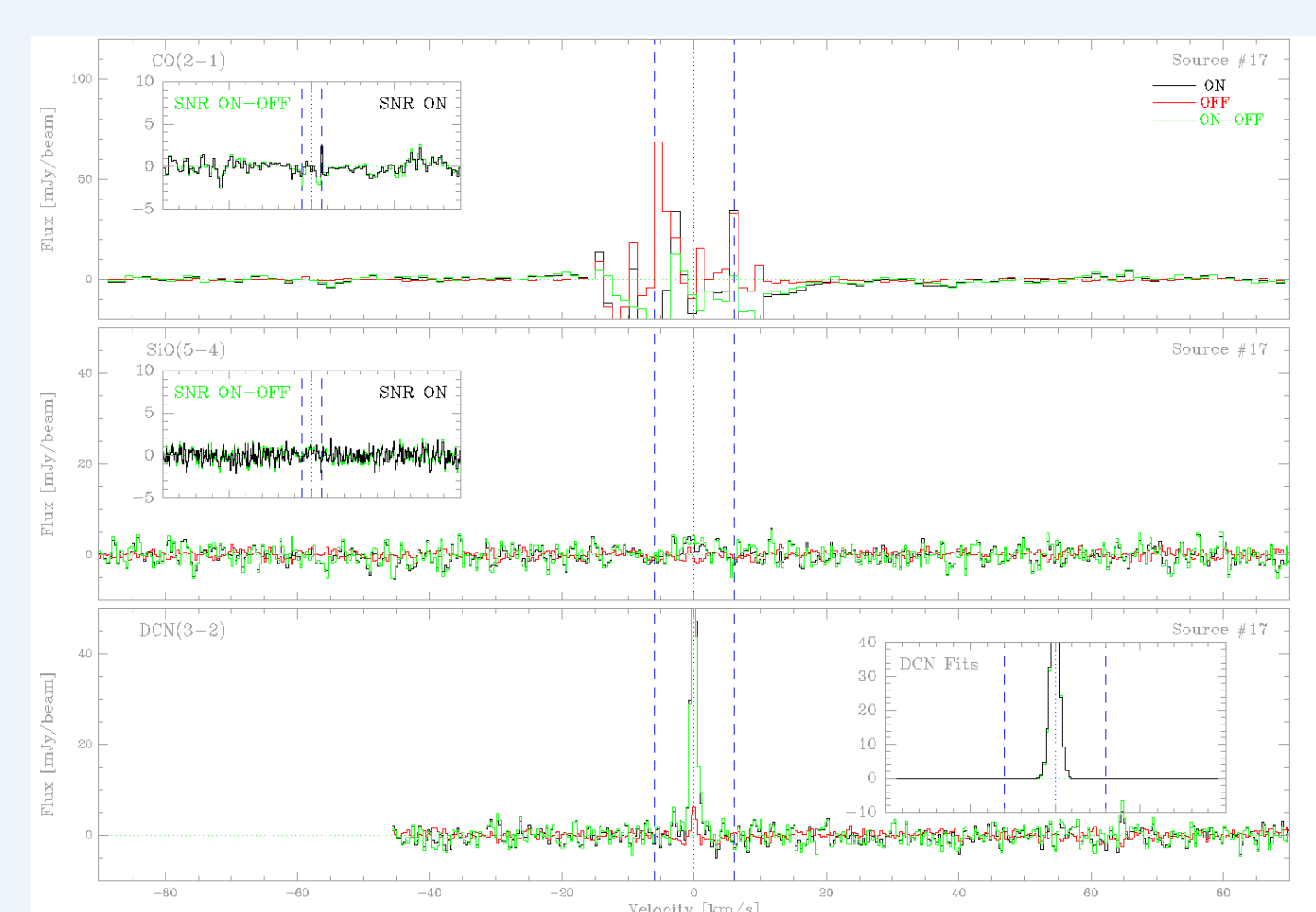
Sources detection

Proto-stellar core



- Automatic detection of CO outflow in the ON-OFF spectrum
- Clear CO line wings in the spectrum
- CO and SiO contours show bipolar outflow pointing on source

Pre-stellar core



- No automatic detection
- Spectra don't show any outflow emission
- No contour pointing on source

Preliminary results and perspectives

- Around 20 MPSC candidates are found in the dataset so far.
- Most massive candidates tend to form in the denser regions where analysis is a lot more difficult due to crowding of cores.
- It is crucial to use both detection on spectra and contours to improve determination of the status of cores.
- After the validation of MPSC candidates, a chemical study will be needed in order to complete the work on their evolution status

TO BE CONTINUED ...