

CO Multi-scale Mosaics Of Nearby (COMMON) Star Formation

Stuartt Corder
NRAO-JAO



Collaborators: Hétor Arce (Yale), Scott Schnee & Anneila Sargent (CIT), Dick Plambeck & Melissa Enoch (Berkeley)

Outline

- Motivation
- Initial regions and status
- Future work: more regions, more lines
- ALMA: Will be great for this project and is moving along

Motivation

- The majority of mass in nearby star-forming regions is in large scale structures, structures that interferometers filter out but the feedback is on much smaller scales.
- The resolution of single dish telescopes allows for at best about 7" resolution (with most being significantly poorer).
- Given the distance to nearby star-forming regions (140-500 pc), the physical resolution achievable with single dish telescopes is typically insufficient to probe many important spatial scales:
 - The outflow-ambient cloud interface
 - The circumstellar envelope
 - The outflow kinematics
- Therefore a combination of interferometric mosaics of these regions and single dish surveys is required

Motivation

- Initial mass function of condensations
- Structure and kinematics of cavities left by previous generations of outflows
- Structure of current outflows and their interaction with the ambient cloud
- Small scale kinematics in the cloud

Motivation

- CO was chosen because it is detectable even in relatively diffuse environments
- The $J=1-0$ transition was selected because it maximizes beam size and limits the importance of phase stability over other CO transitions.
- ^{12}CO , ^{13}CO and C^{18}O were selected to probe different density environments and because they are often observable simultaneously.
- CARMA was the interferometer of choice because of its unparalleled uv-coverage among millimeter interferometers and compact configurations.

Regions Selected

- NGC1333 and B1 in Perseus and Serpens A were selected because single dish $^{12,13}\text{CO}$ data is available through the COMPLETE project (Goodman et al.)
- Continuum maps with BOLOCAM (CSO) are available at 1.1 mm (Enoch et al.)
- These regions are also quite active providing the possibility of truly testing the influence of outflow feedback across many scales
- These regions are somewhat compact so they can be mosaiced in relatively few (<300) pointings with CARMA.

NGC 1333 Status

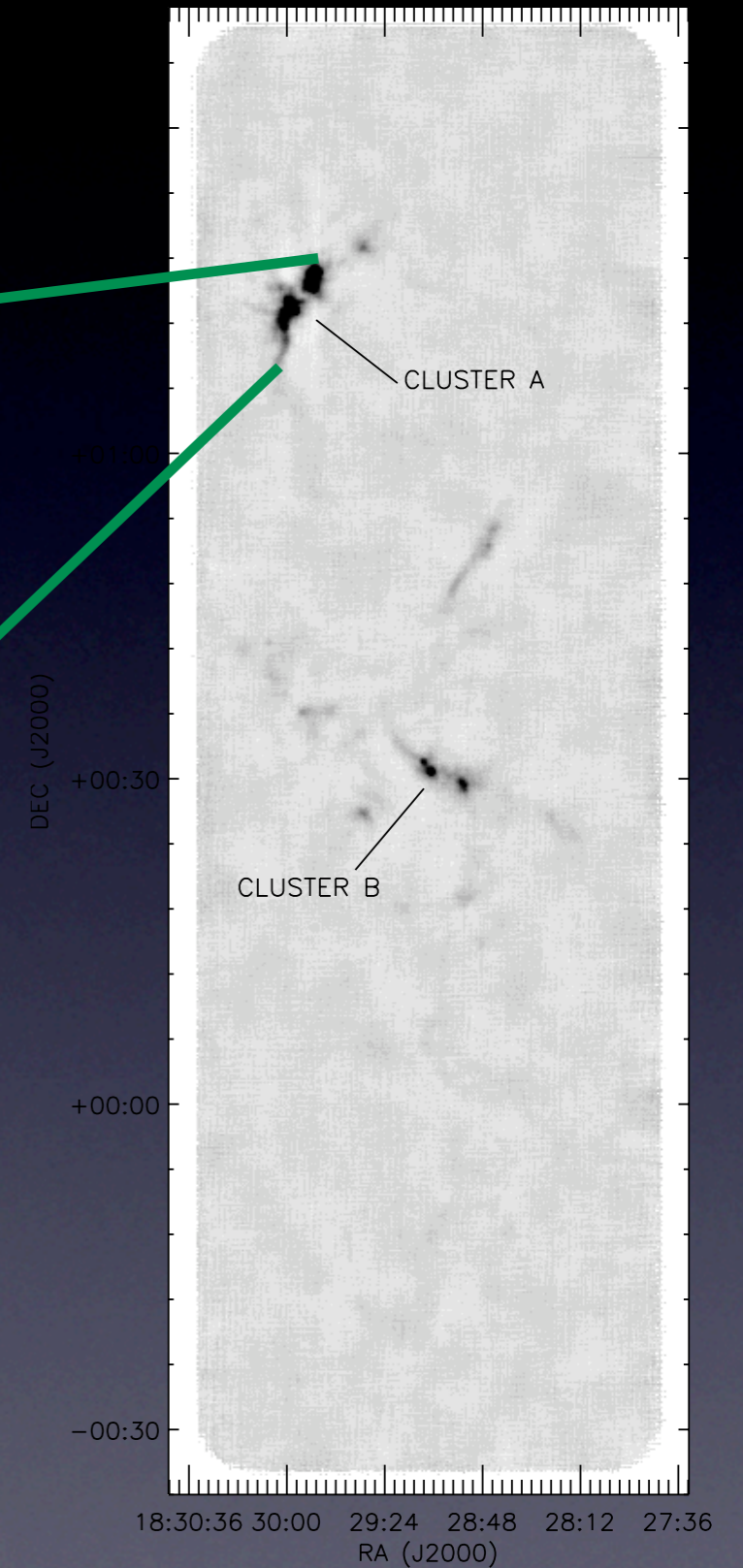
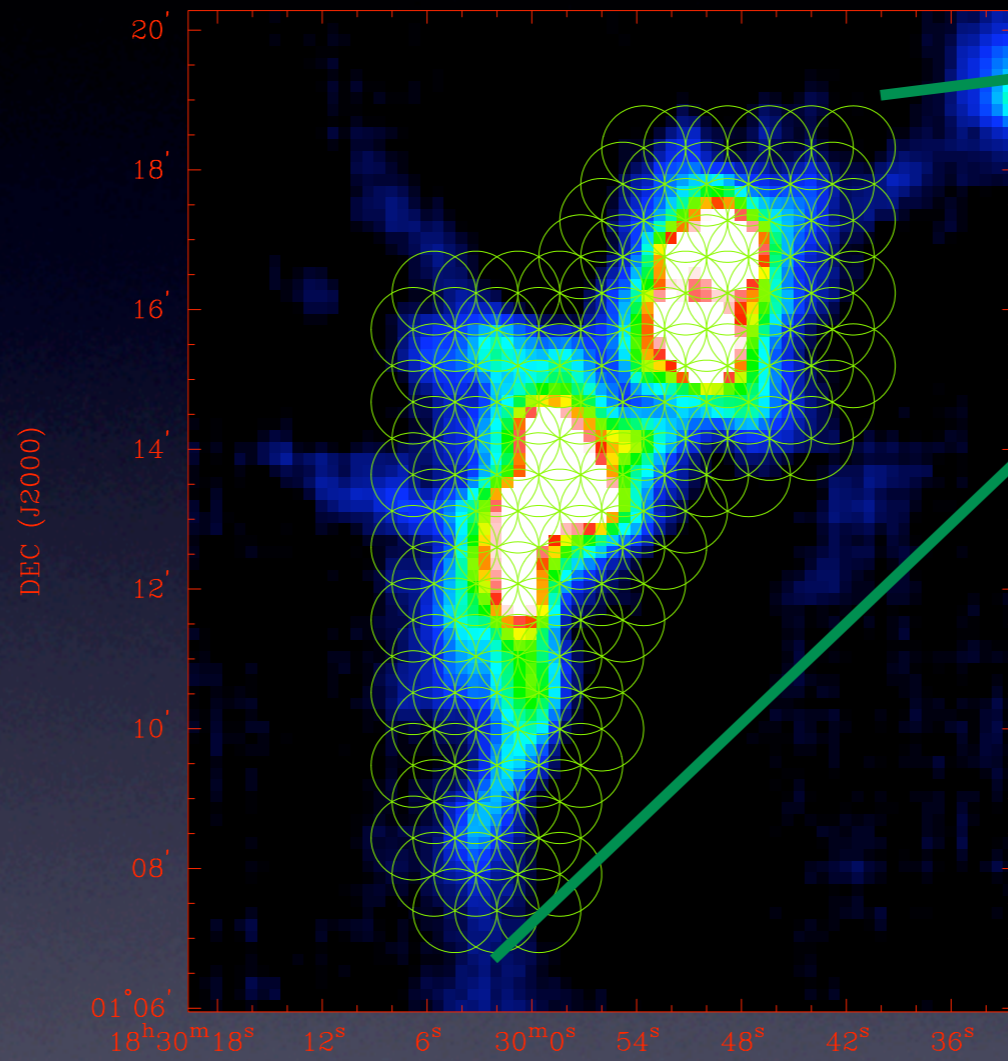
- Data reduced:
 - BIMA ^{12}CO (klam~2.5-27)
 - BIMA HCN (klam~2-23)
 - FCRAO 14-m $^{12,13}\text{CO}$
 - CSO 10-m 1.1 mm continuum
- Data in hand:
 - CARMA $^{12,13}\text{C}^{18}\text{O}$ (klam~3-45)
 - CARMA 3 mm continuum (klam~3-45)
- Data to be take:
 - CARMA compact configuration in at least ^{13}CO , C^{18}O
 - CARMA compact configuration data in continuum

BI Status

- All data obtained.
- Data reduced:
 - FCRAO 14-m $^{12,13}\text{CO}$
 - CSO 10-m 1.1 mm continuum
- Data in hand:
 - CARMA $^{12,13}\text{C}^{18}\text{O}$ (klam~2.5-45)
 - CARMA 3 mm continuum (klam~2.5-45)
- First look shows that the region is fairly empty in continuum.

Serpens

- Age ~ 1 Myr
- Distance ~ 230 pc
- Mass ~ 3500



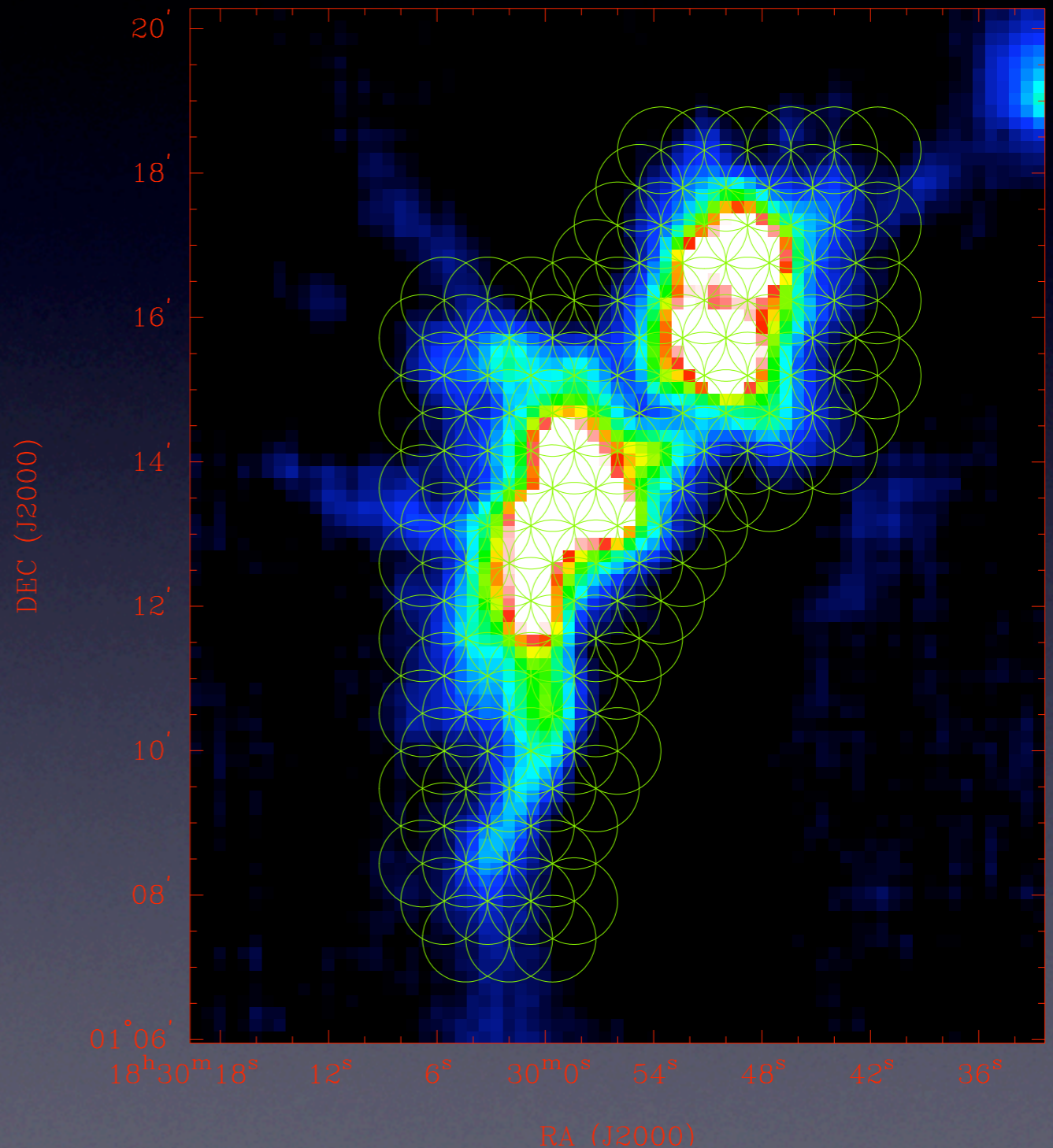
Enoch et al.

Serpens

- All data obtained.
- Data reduced:
 - FCRAO 14-m $^{12,13}\text{CO}$
 - CSO 10-m 1.1 mm continuum
 - CARMA $^{12,13}\text{C}^{18}\text{O}$ ($\lambda \sim 2.5\text{-}45$)
 - CARMA 3 mm continuum ($\lambda \sim 2.5\text{-}45$)
 - i.e., everything.

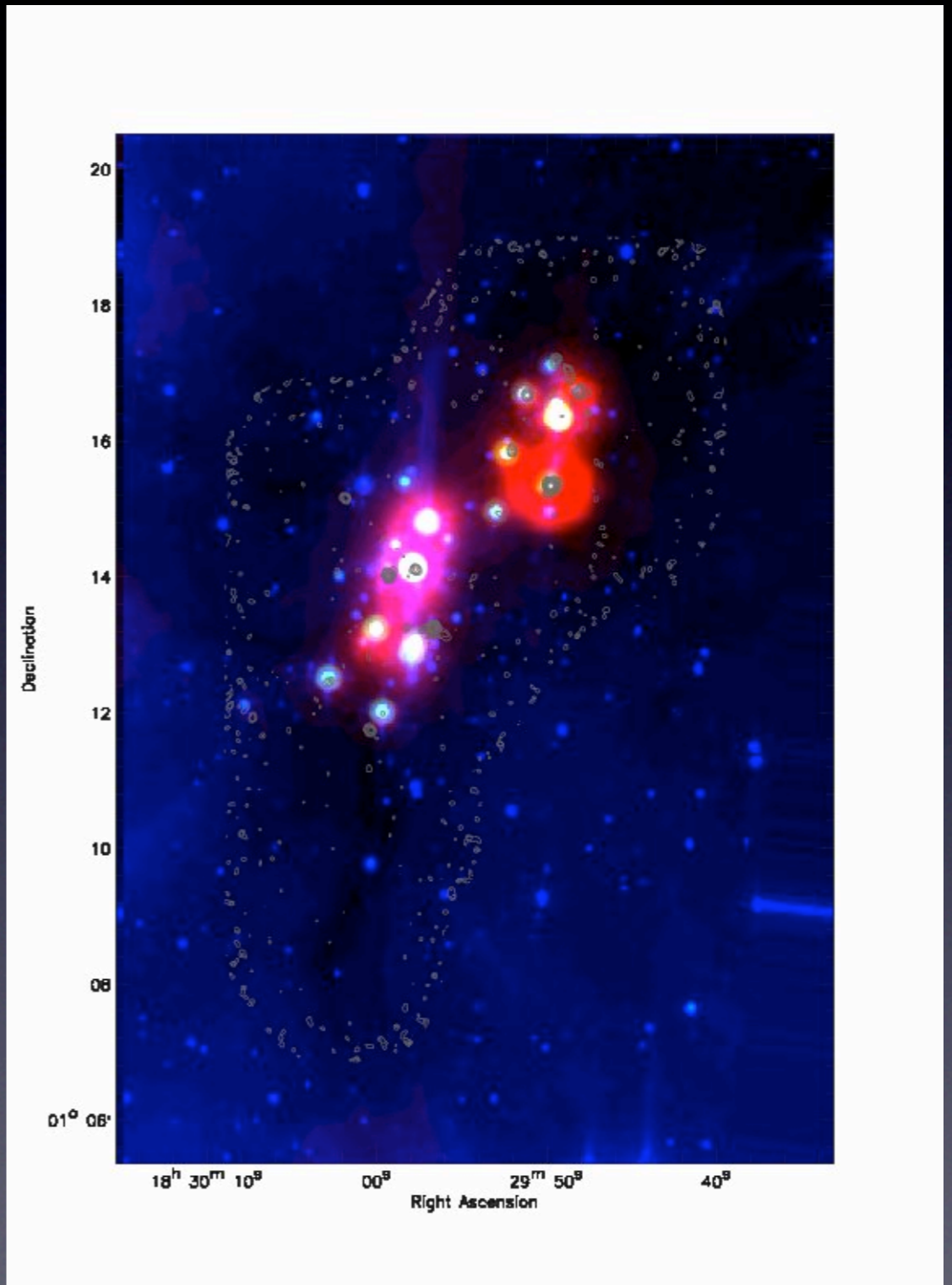
Serpens

- Actual new data!
- Still need to combine single dish
- CO image *must* have single dish but there are “problems”

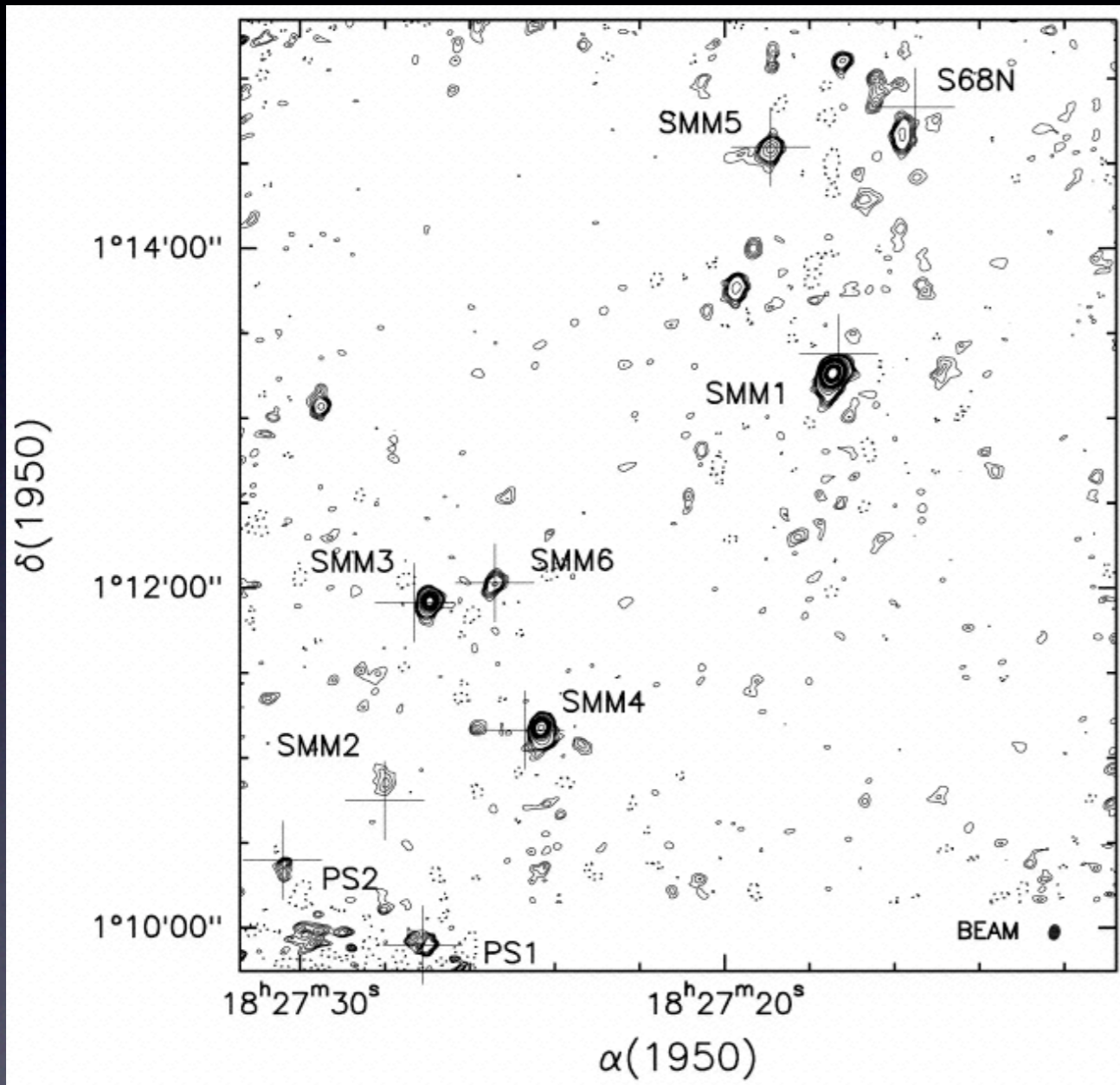


Serpens

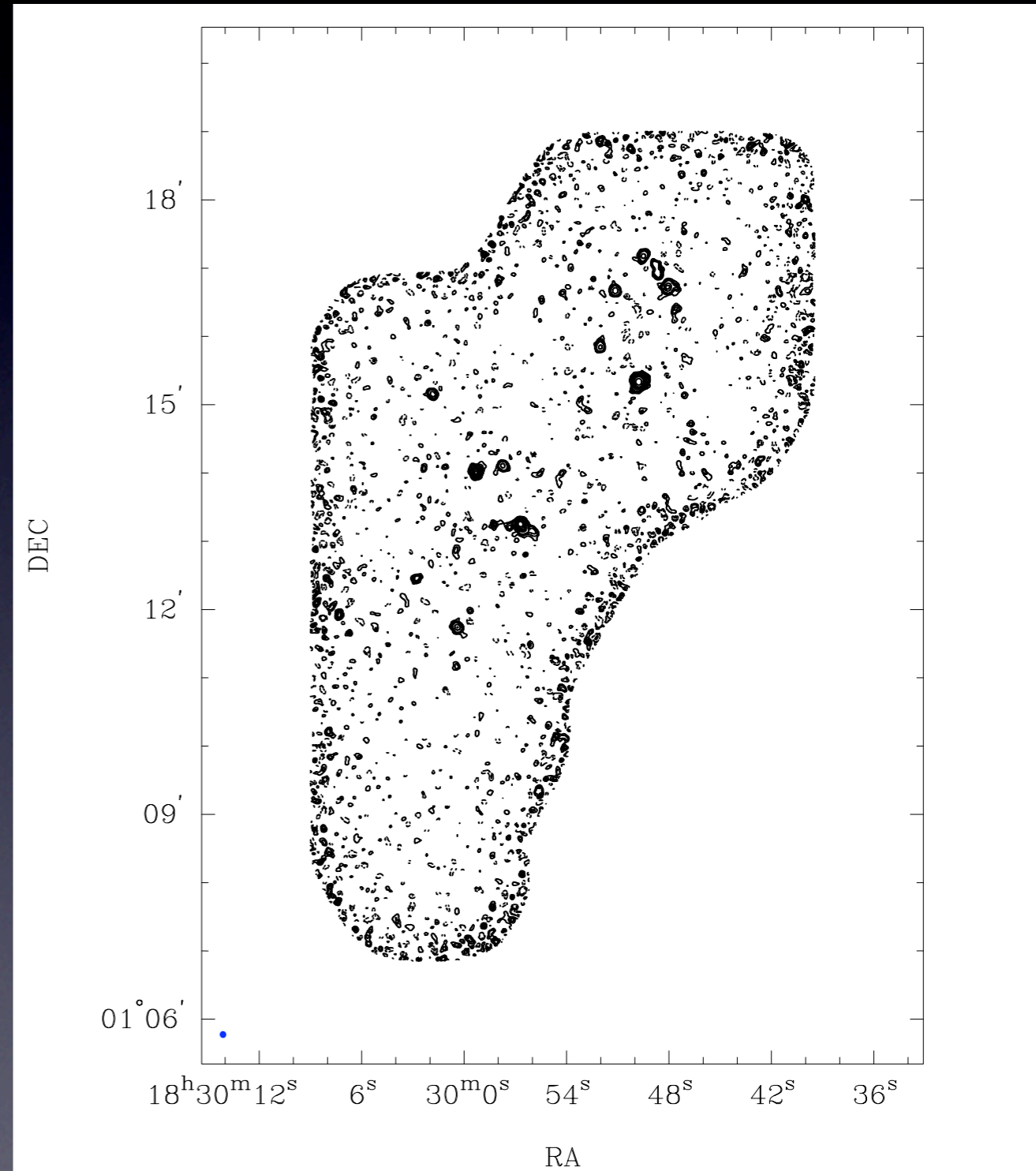
- Actual new data!
- Still need to combine single dish
- CO image *must* have single dish but there are “problems”



Serpens



Testi & Sargent



Additional Regions

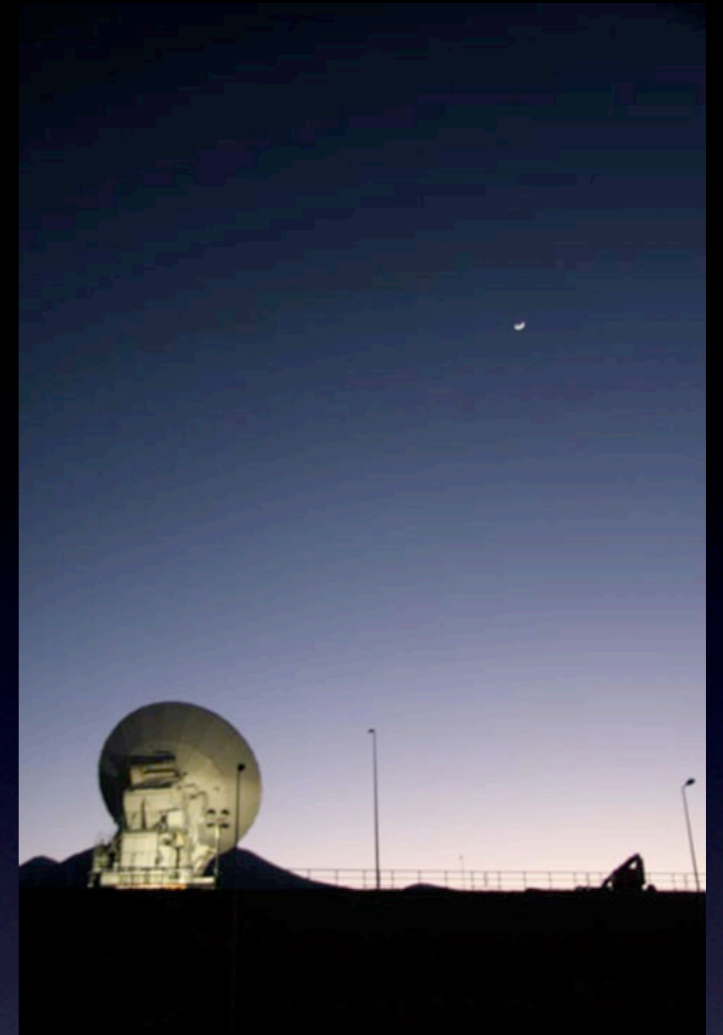
- Orion (high priority but where to start?)
- Taurus (too diffuse?)
- Southern regions (good ALMA targets):
 - ρ Oph
 - Chamaelon
 - Lupus
 - Corona Australis

The Future

- Near future:
 - NH_3 with GBT and EVLA: Same regions but dense tracer.
 - ALMA+ACA observations in 2-1 transitions to get temperature information
 - Integrate optical/ir studies
- Far future: Do this much better if we get focal plane arrays on ALMA someday....

The future is near...

- Antenna Tally:
 - Conditionally Accepted: 2/1/0
 - Additional On-site: 7/3/parts of 2



The future is near...

- Front end tally:
 - 3 engineering models accepted (also conditional)
 - Bands 3 (3 mm), 6 (1 mm), 7 (850 μm) and 9 (450 μm) present

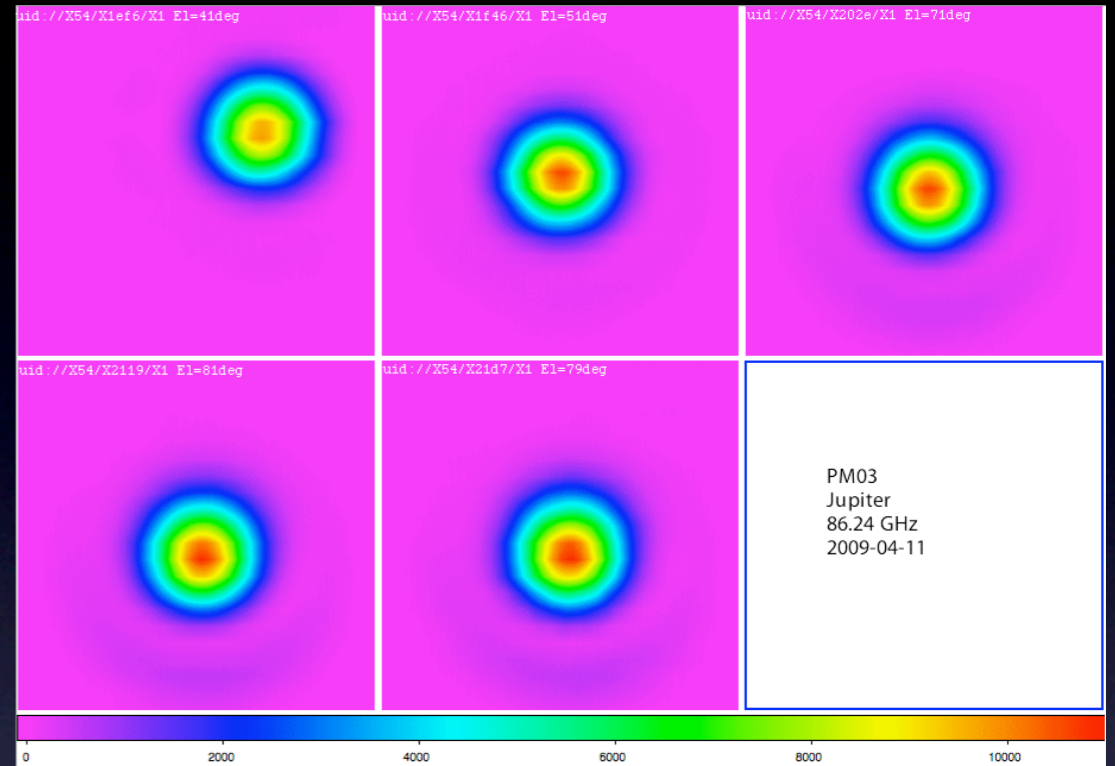
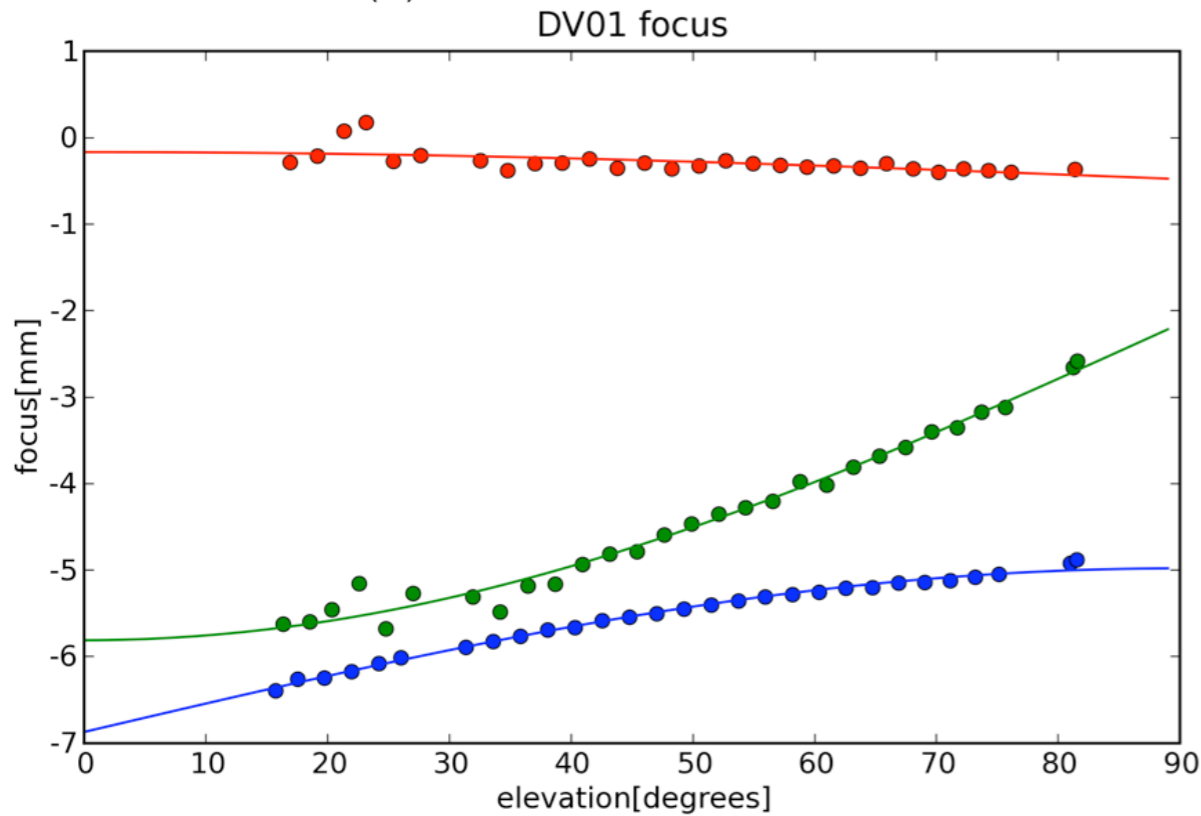


The future is near...

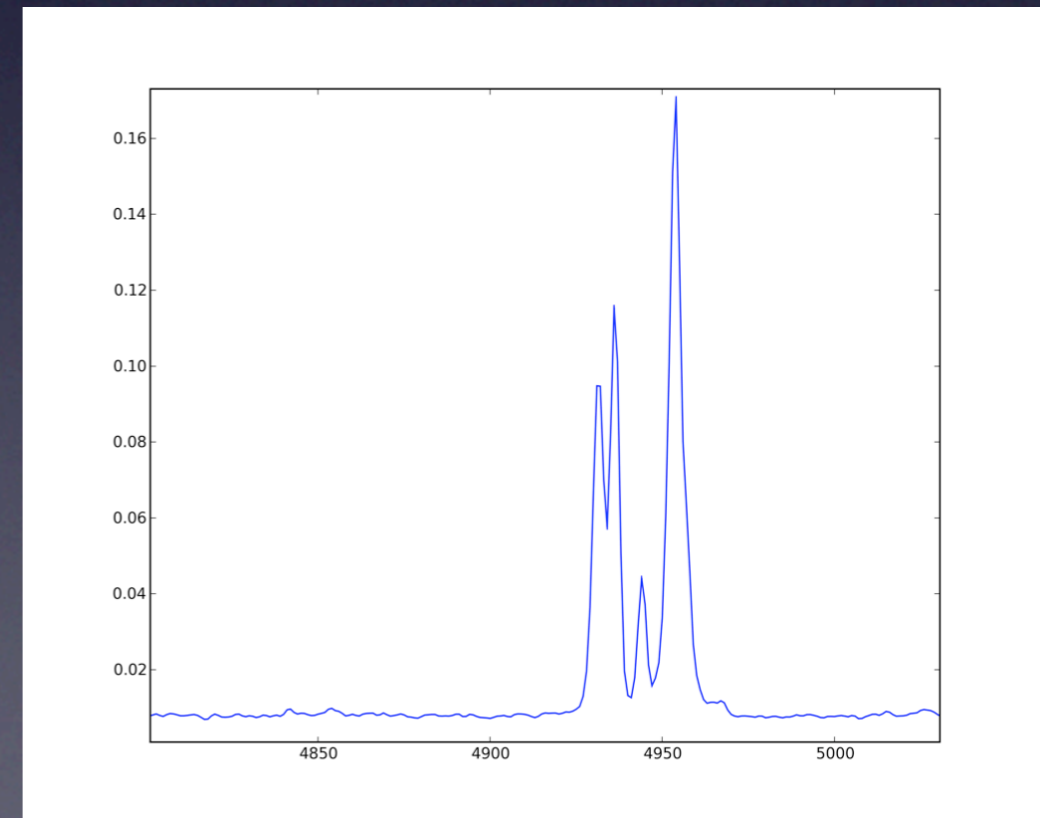
- “The schedule”: AIVC
 - Fringes at the OSF: (late) June
 - Fringes at the high site: December 2009 (this year)
 - Call for early science: late 2010
 - Start early science: second half 2011
- “The team”:
 - AIV
 - CSV
 - SciOps
 - System Engineering, Computing, and many others
 - And you?

The future is near...

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2009-04-20T07:01:51.848500000 - 2009-04-20T12:16:04.177500000
X in red: $-0.479 + 0.313 \cos(\text{el})$
Y in green: $-2.151 + -3.659 \cos(\text{el})$
X in blue: $-6.871 + 1.892 \sin(\text{el})$

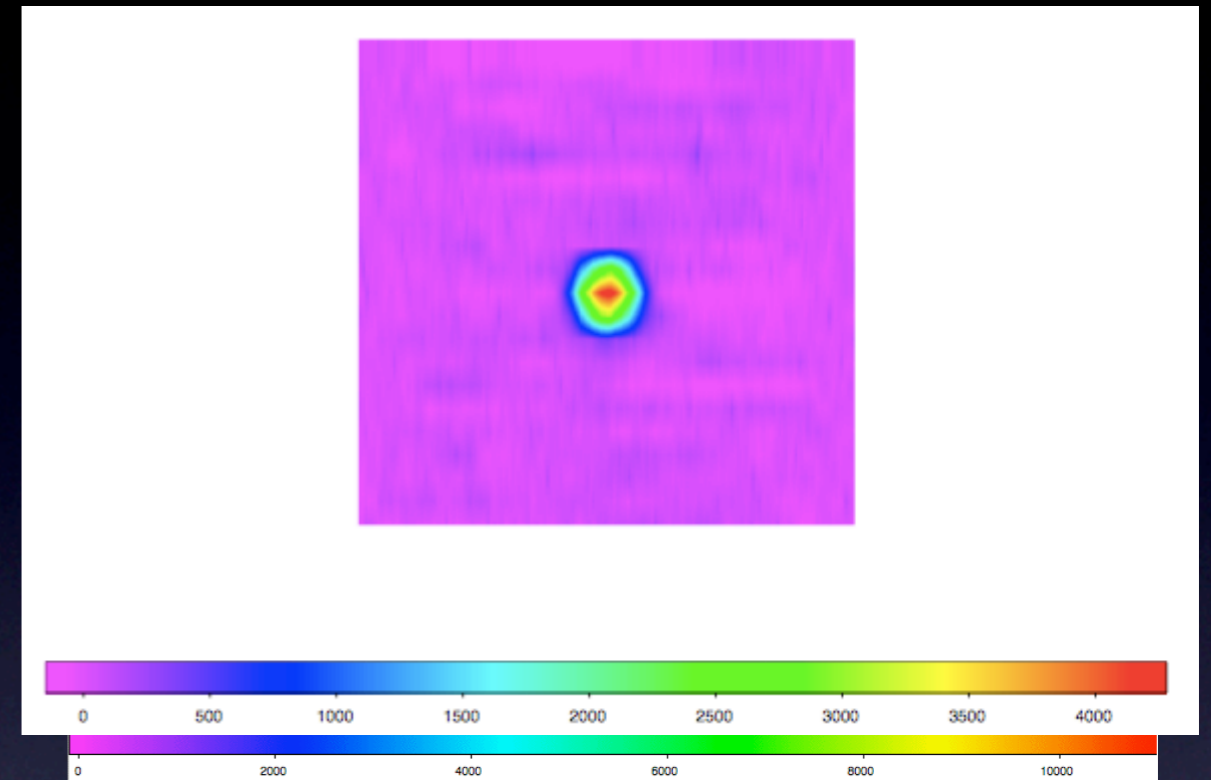
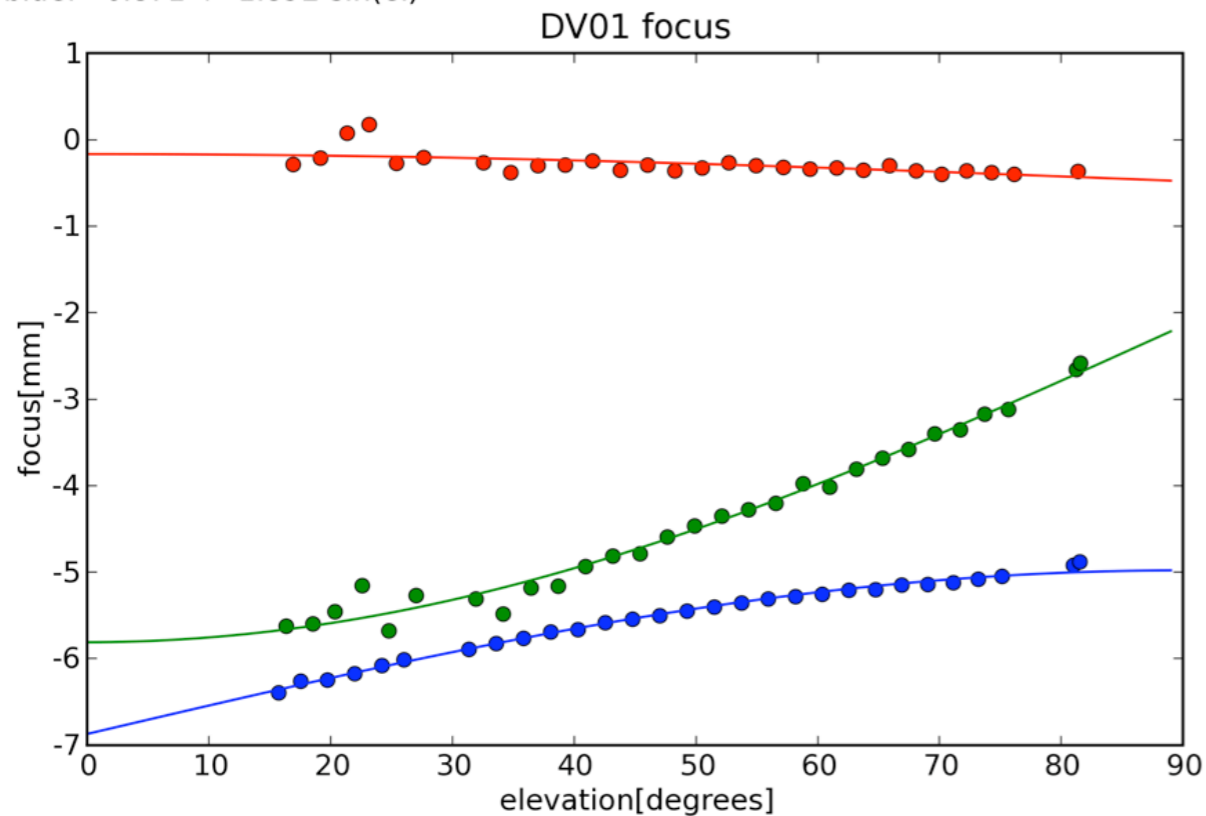


Also: Optical Pointing,
Radio pointing, T_{rx}
characterization (first round
holography done)

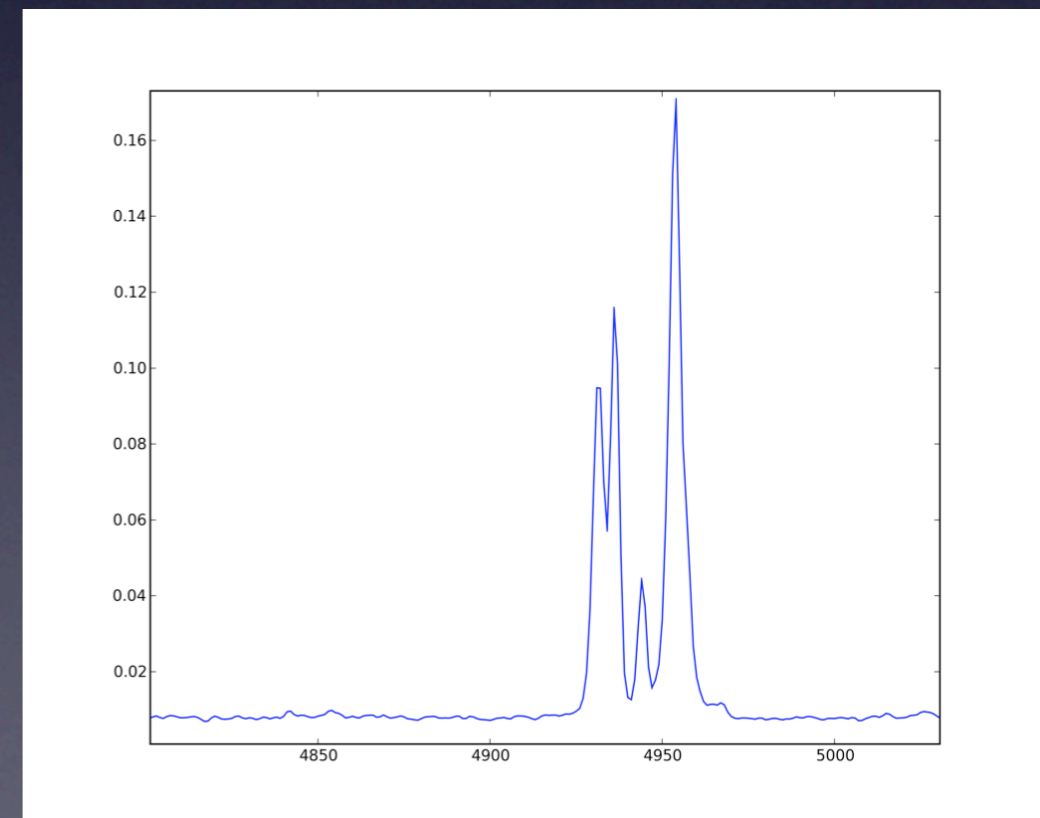


The future is near...

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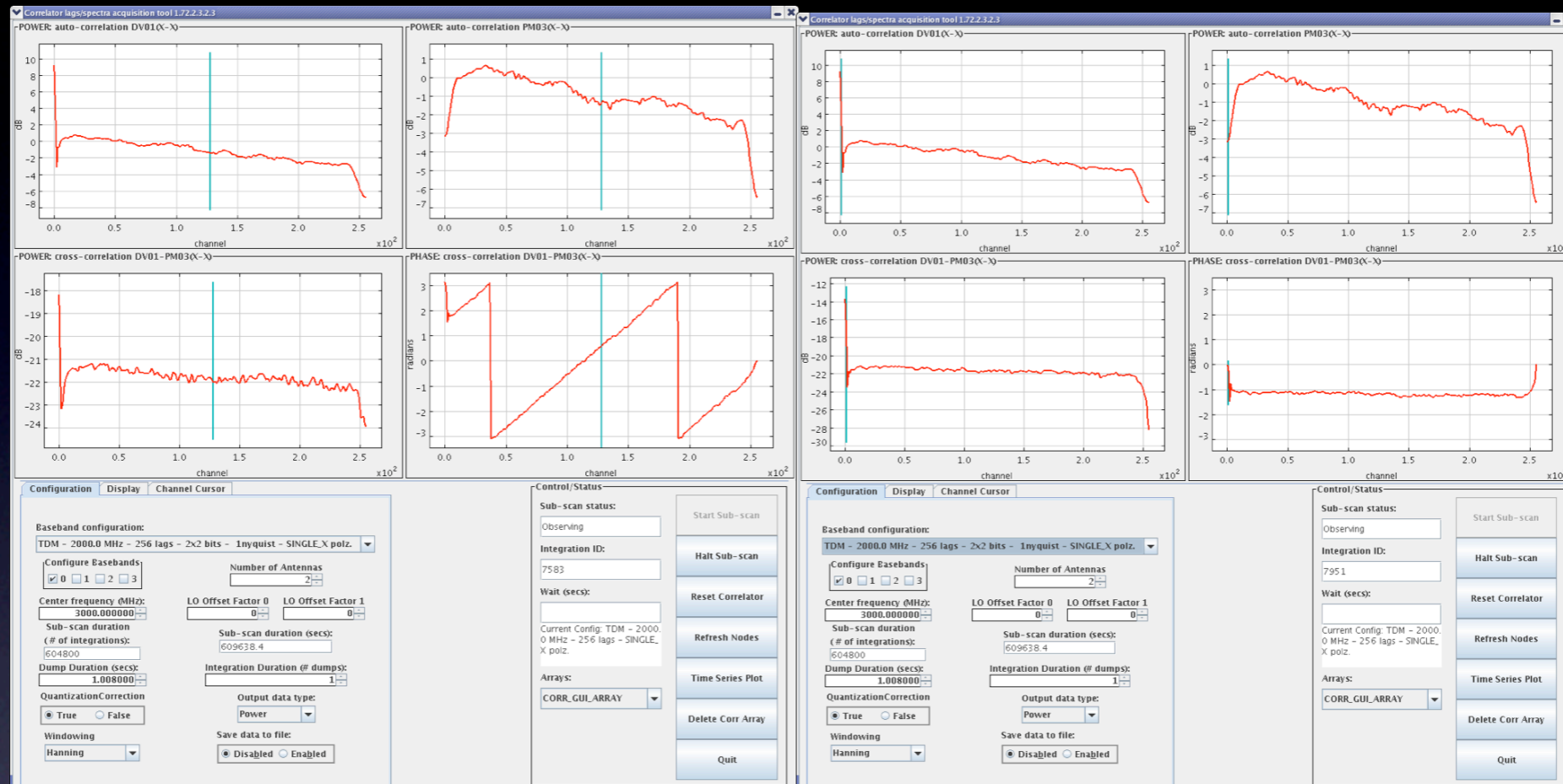
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Radio pointing, T_{rx}
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The future is near...



The future is near...



The future is near...

- Amplitude Calibration
 - Measure T_{sys} and T_{rx} on the telescope
 - Jy/K
 - Aperture and Main Beam efficiency
- Interferometry.....
- NEXT!

The end is here...

- Summary:
 - The COMMON Star Formation project is well underway
 - There is plenty of room for expansion and collaboration
 - ALMA will provide a great leap forward
 - Come and help if you are interested! (3 month minimum stay in Chile)