

# Early CI results from Nanten2 towards Carina



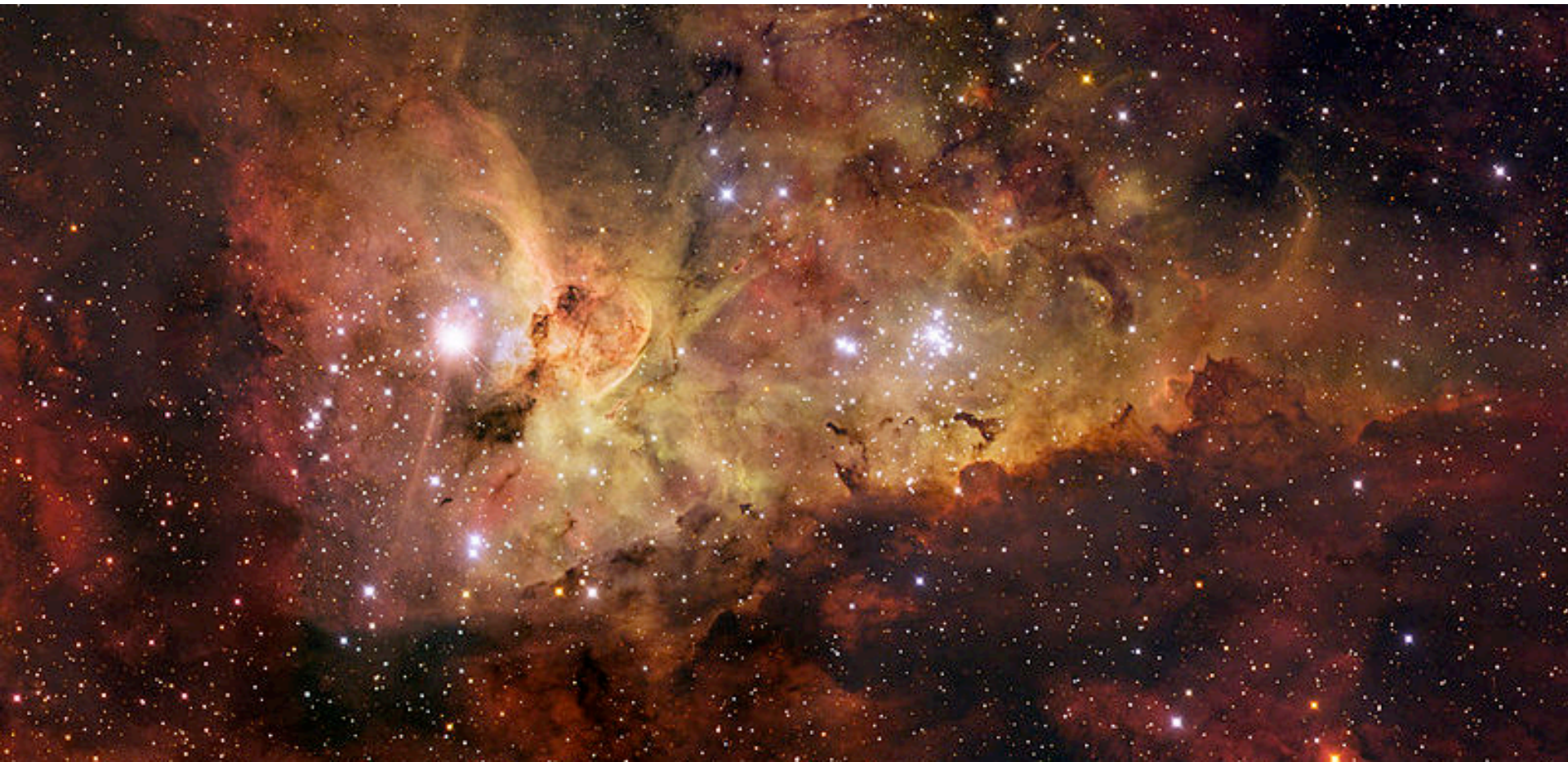
Photo: G. Wong

# Introduction

- Carina
  - What is it?
  - Why are we observing it?
- Observations done towards the region
- Status of the 70m on-the-fly mapping project



# The Carina Nebula



# What is it?

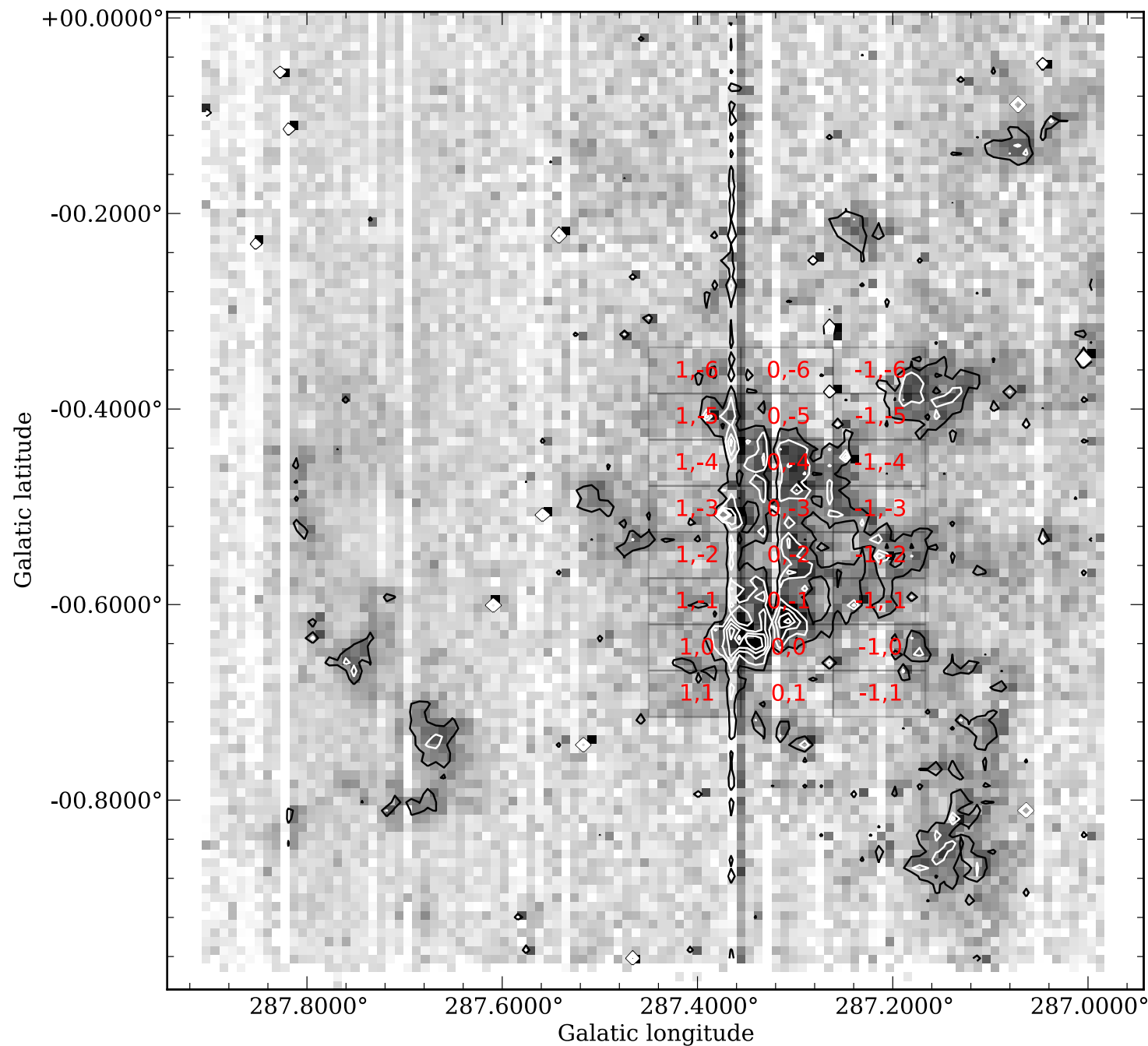
- Also known as the **Great Nebula in Carina**, the **Eta Carina Nebula**, or **NGC 3372**, as well as "**Grand Nebula**"
- Extreme stellar population (distance ~2.3 kpc of the sun).
- Evaporating the gas and dust reservoirs which young stars are trying to accrete.
- Up until recently, mid-1990s, Carina was viewed as an evolved HII region devoid of active star formation.
- Formation occurring on the edges of the nebula.

# Why study it?

- Carina Nebular (NGC 3372) ideal location to study:
  - Formation of stars (low and high mass)
    - Stars being formed in molecular clouds about 5-10pc away from massive stars (Eta Carinae and HD 93129A)
  - UV radiation and stellar winds
  - An environment that will change rapidly when massive stars go supernova (1-2Myr) and form a giant superbubble
- Different stages of star formation has been observed in this region.
- Only can be observed in the Southern Hemisphere.
- Ionised hydrogen
- Atomic Carbon

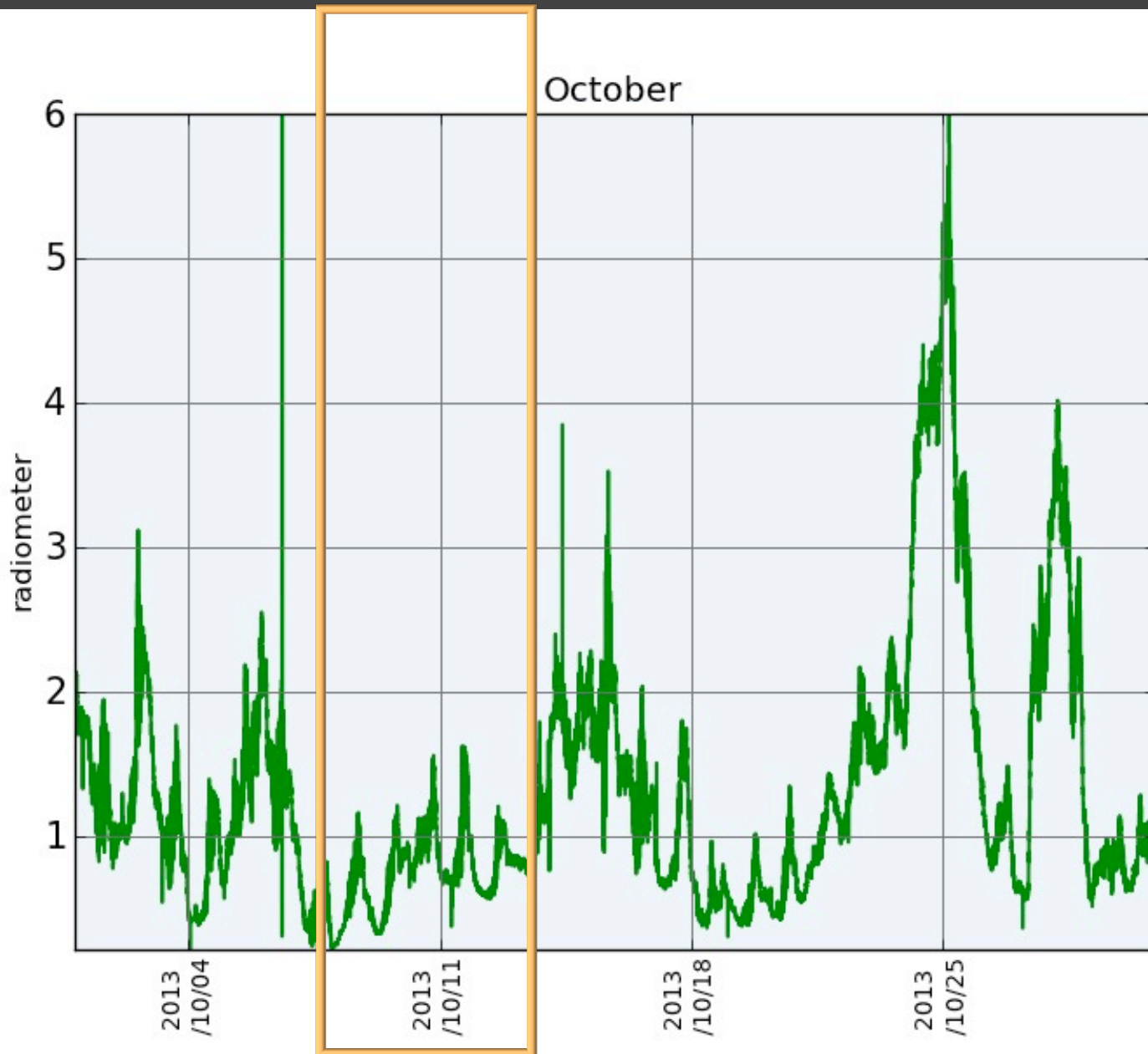
# What lines do we observe?

- |              |         |                       |
|--------------|---------|-----------------------|
| ■ CI 3P1-3P0 | 492 GHz | 37 arcsec = 0.010 deg |
| ■ CI 3P2-3P1 | 809 GHz | 22 arcsec             |
| ■ CO J=4-3   | 460 GHz | 39 arcsec = 0.011 deg |
| ■ CO J=7-6   | 806 GHz | 22 arcsec = 0.006 deg |
- Started observations in CI 3P1-3P0 (492 GHz)
  - For more information:  
<http://www.astro.uni-koeln.de/nanten2/node/173>



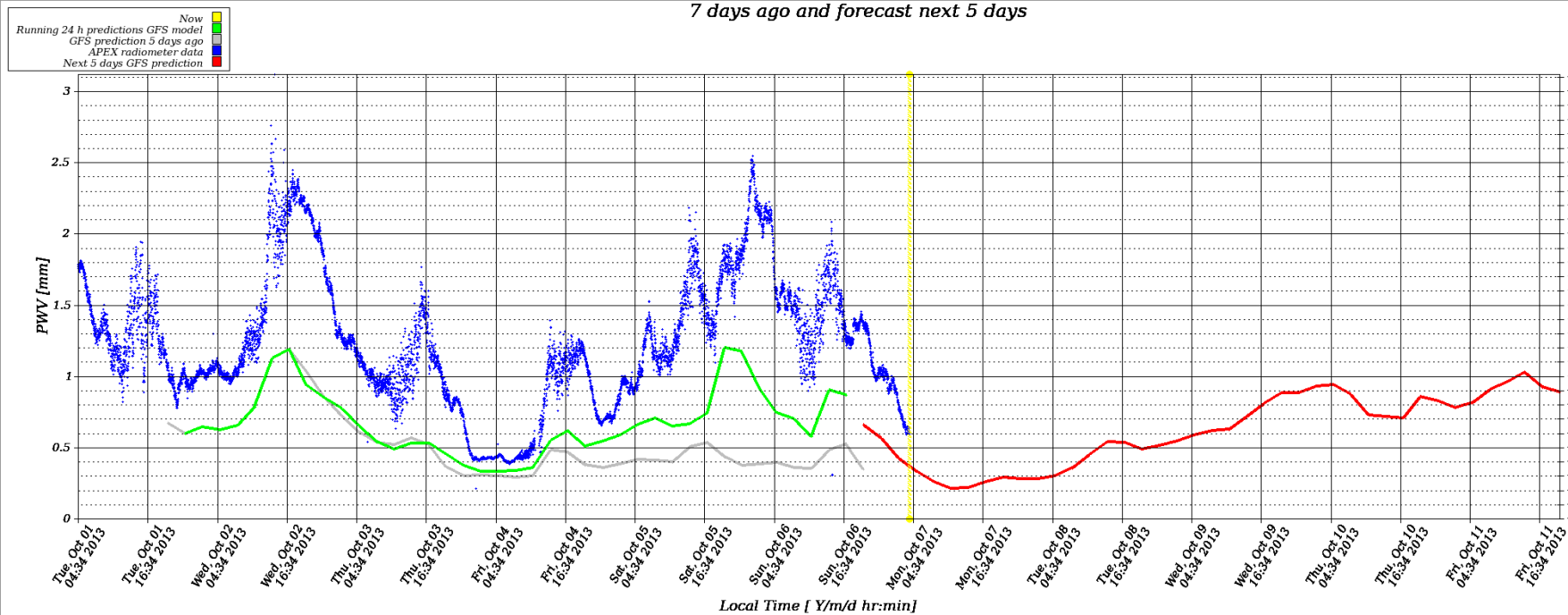
$^{12}\text{CO}$  1-0 image  
taken from  
Mopra.  
Overlaid with  
footprints for  
observations with  
NANTEN2.

# Water Vapor

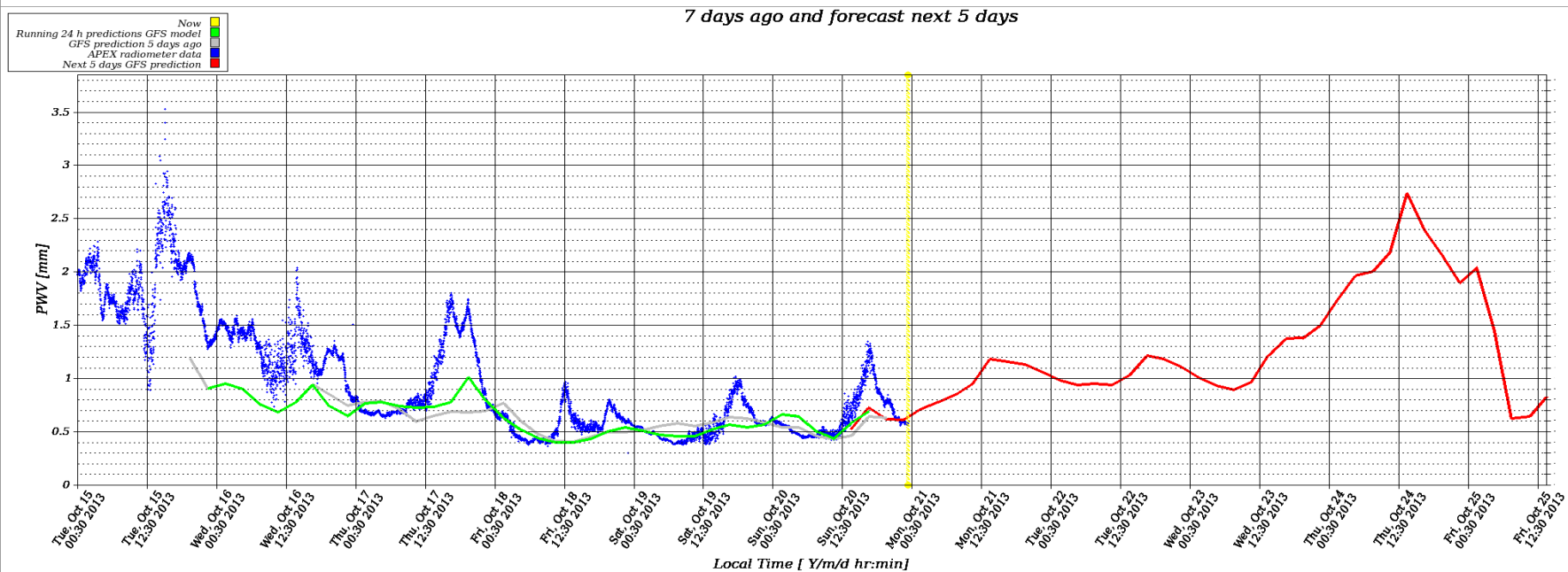




7 days ago and forecast next 5 days

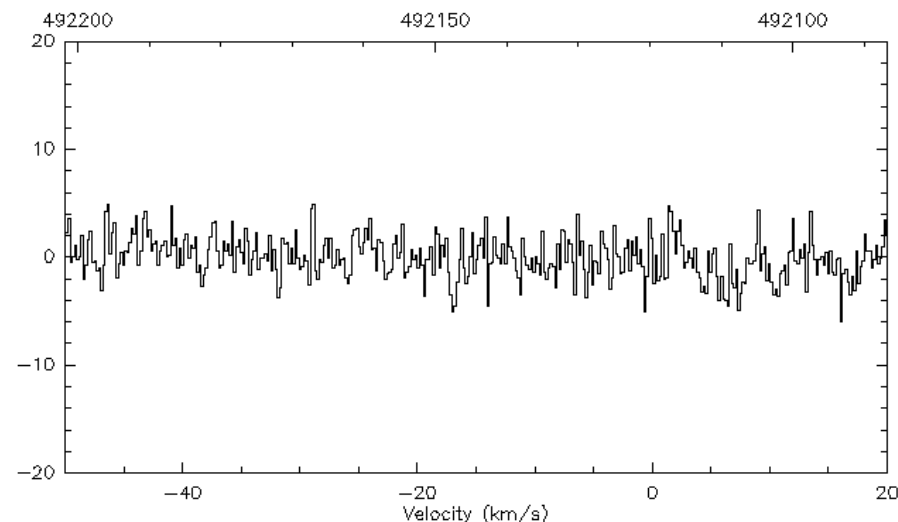
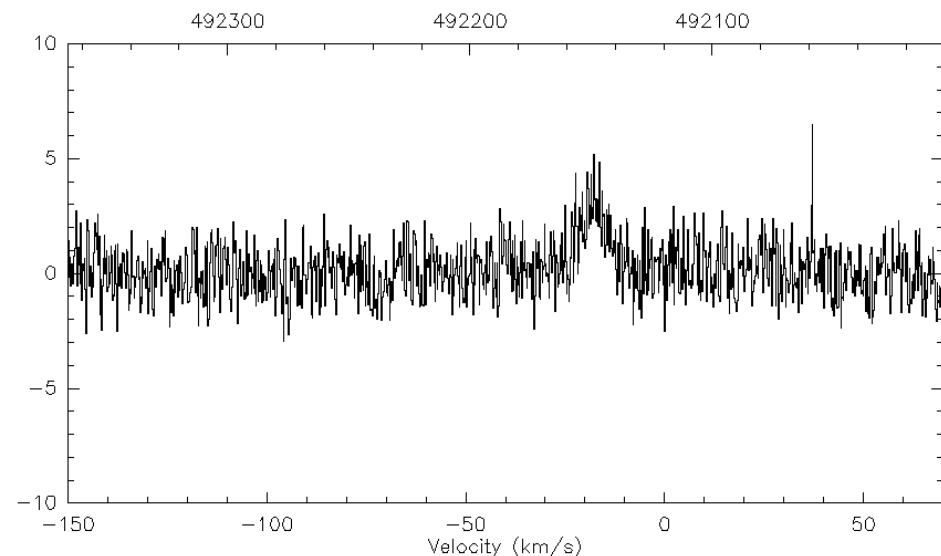


7 days ago and forecast next 5 days



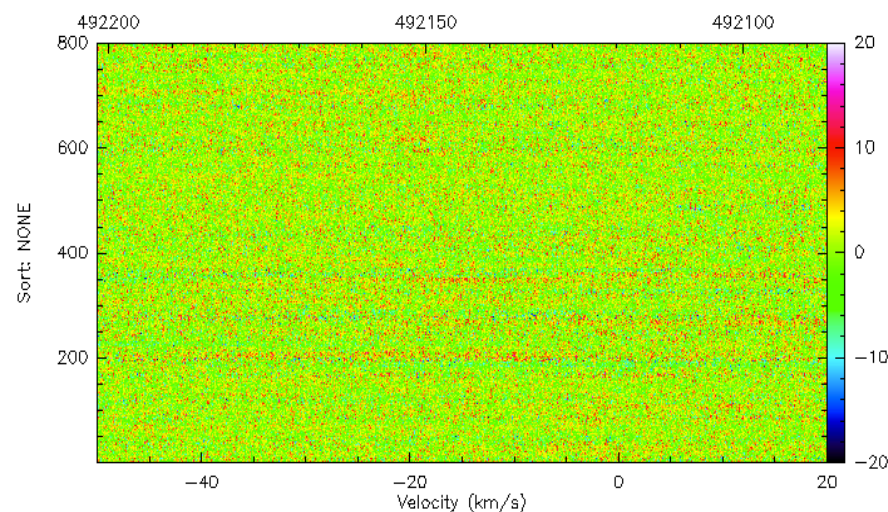
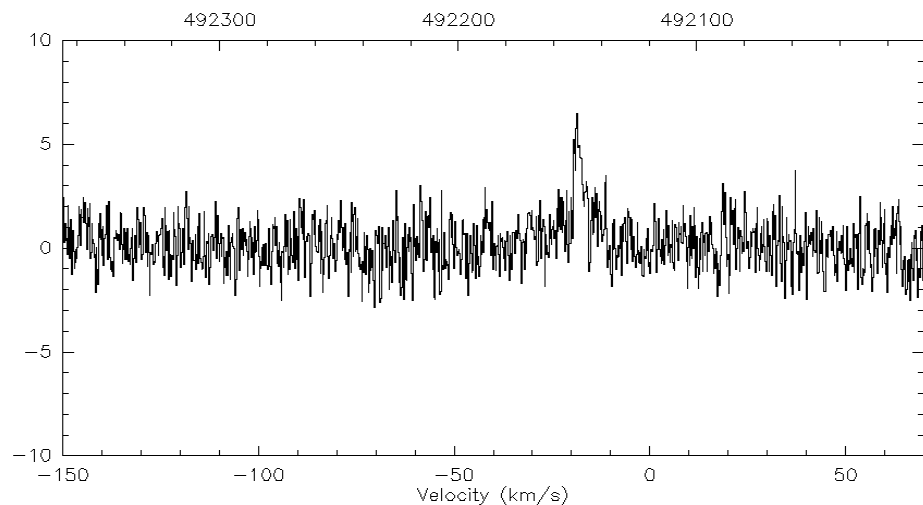
79; 3 CARINA CNTR CI 3P1-3P0 NANTEN2-N07 O:07-OCT-2013 R:30-JAN-2014  
 l: 287.308 b: -0.637 Ga Offs: +153.2 +0.2  
 Fair tau: 0.495 Tsys: 566. Time: 5.00E-02min El: 51.1  
 N: 8191 ID: 6881.25 V0: -25.00 Dv: -0.1859 LSR  
 F0: 492160.700 Df: 0.3052 Fi: 500160.390

1; 3 CARINA CNTR CI 3P1-3P0 NANTEN2-N00 O:12-OCT-2013 R:30-JAN-2014  
 l: 287.308 b: -0.637 Ga Offs: -508.7 -256.9  
 Average tau: 0.686 Tsys: 886. Time: 5.00E-02min El: 49.9  
 N: 8191 ID: 6881.25 V0: -25.00 Dv: -0.1859 LSR  
 F0: 492160.700 Df: 0.3052 Fi: 500160.354



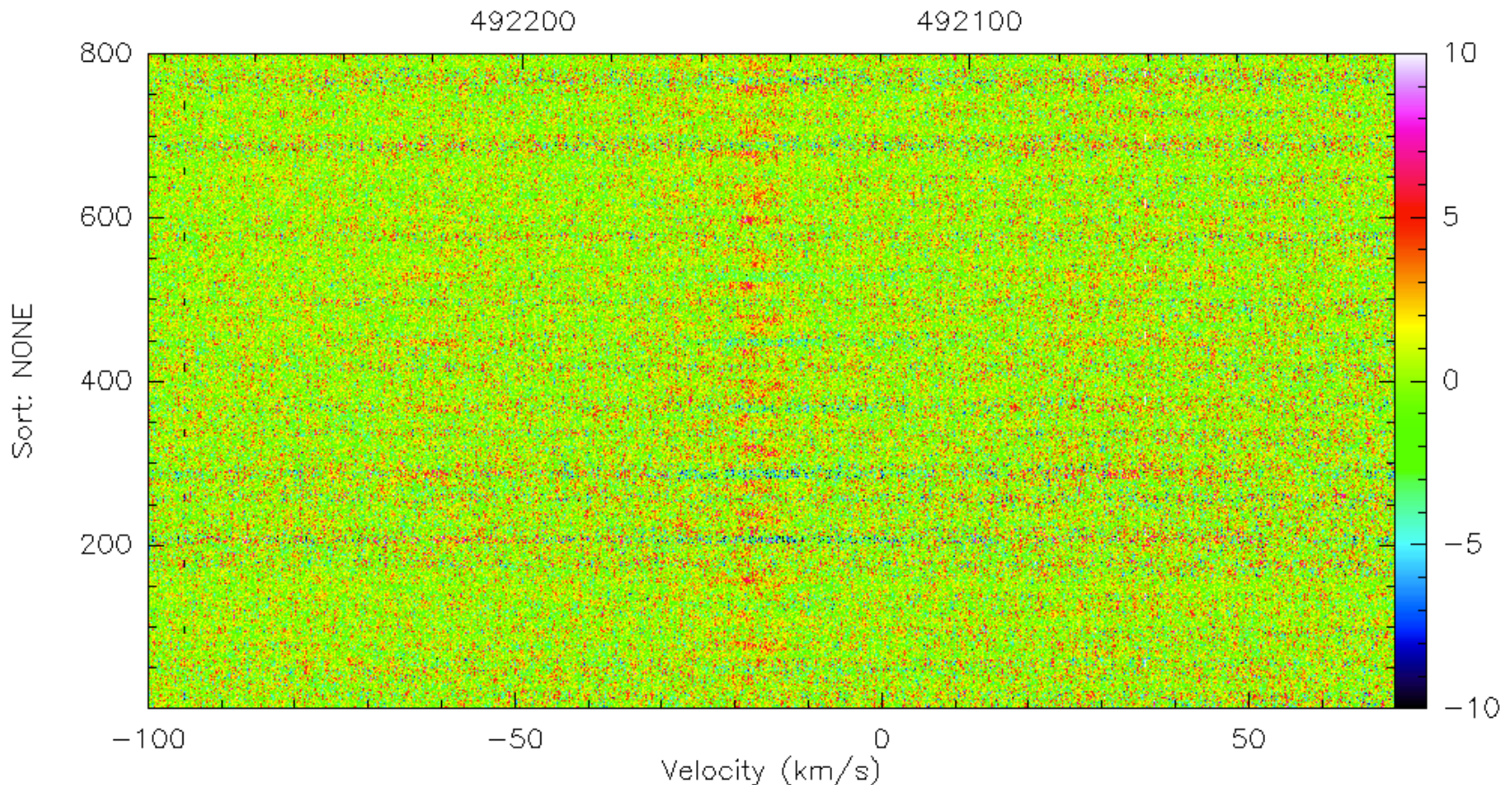
78; 3 CARINA CNTR CI 3P1-3P0 NANTEN2-N07 O:07-OCT-2013 R:30-JAN-2014  
 l: 287.308 b: -0.637 Ga Offs: +144.7 +0.2  
 Fair tau: 0.495 Tsys: 566. Time: 5.00E-02min El: 51.1  
 N: 8191 ID: 6881.25 V0: -25.00 Dv: -0.1859 LSR  
 F0: 492160.700 Df: 0.3052 Fi: 500160.390

CARINA CNTR l: 287.308 b: -0.637 Ga  
 Scan: 54974-54976 O: from 12-OCT-2013 to 12-OCT-2013  
 Nspectra: 800 Offset ranges: (-510.3;-176.1) (-256.9;-91.8)  
 N: 32768 ID: 27525.0 V0: -25.0 Dv: -4.648E-02 LSR  
 CI 3P1-3P0 F0: 492160.700 Df: 7.63E-02  
 Bef: 1.00 Fef: 0.93 Fi: 500160.354 Gim: 0.500



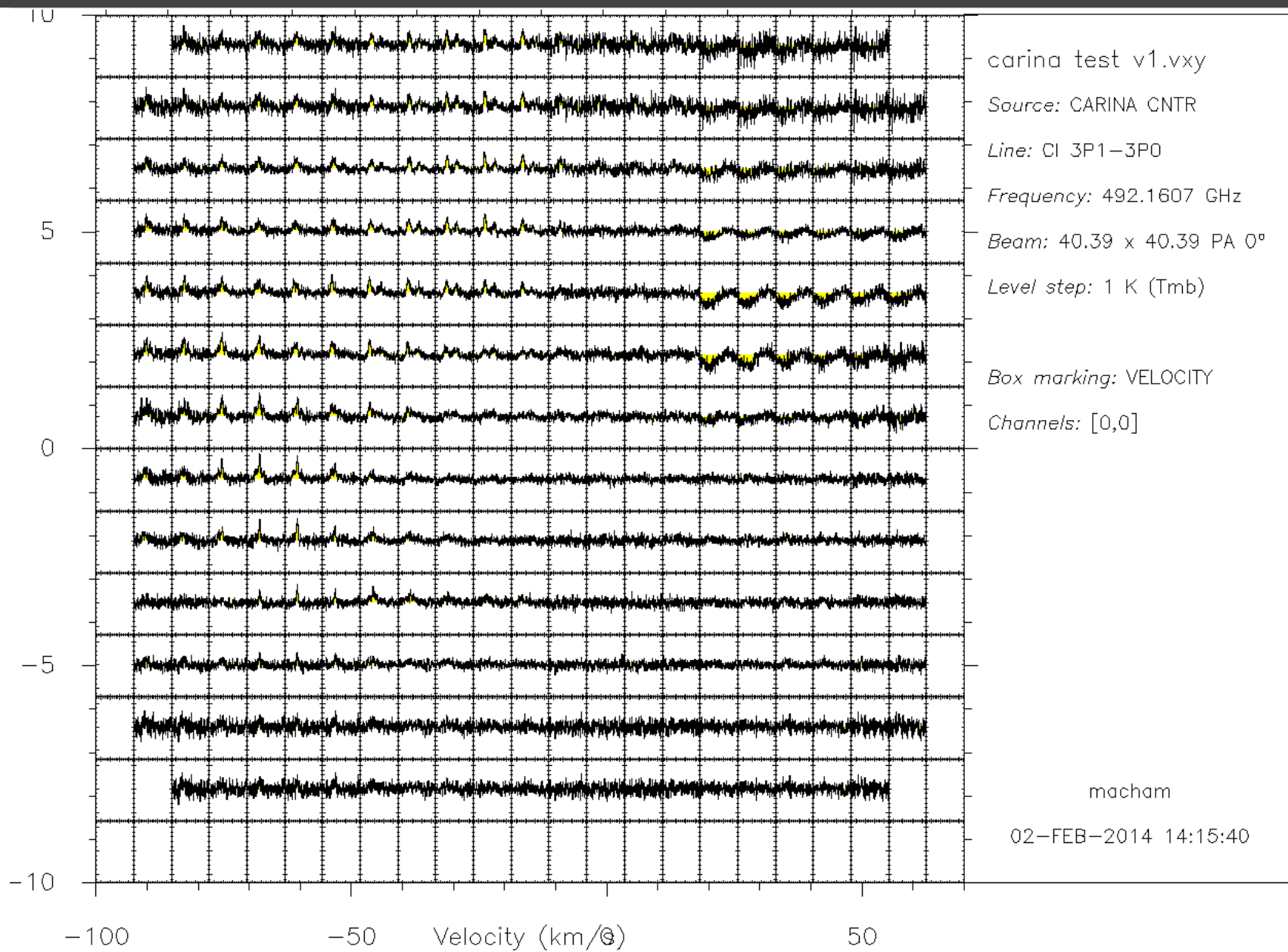
# Sample spectra

CARINA CNTR l: 287.308 b: -0.637 Ga  
Scan: 54375-54377 O: from 07-OCT-2013 to 07-OCT-2013  
Nspectra: 800 Offset ranges: (-170.2:+163.4) (-85.3:+77.1)  
N: 32768 l0: 27525.0 V0: -25.0 Dv: -4.648E-02 LSR  
Cl 3P1-3P0 F0: 492160.700 Df: 7.63E-02  
Bef: 1.00 Fef: 0.93 Fi: 500160.390 Gim: 0.500

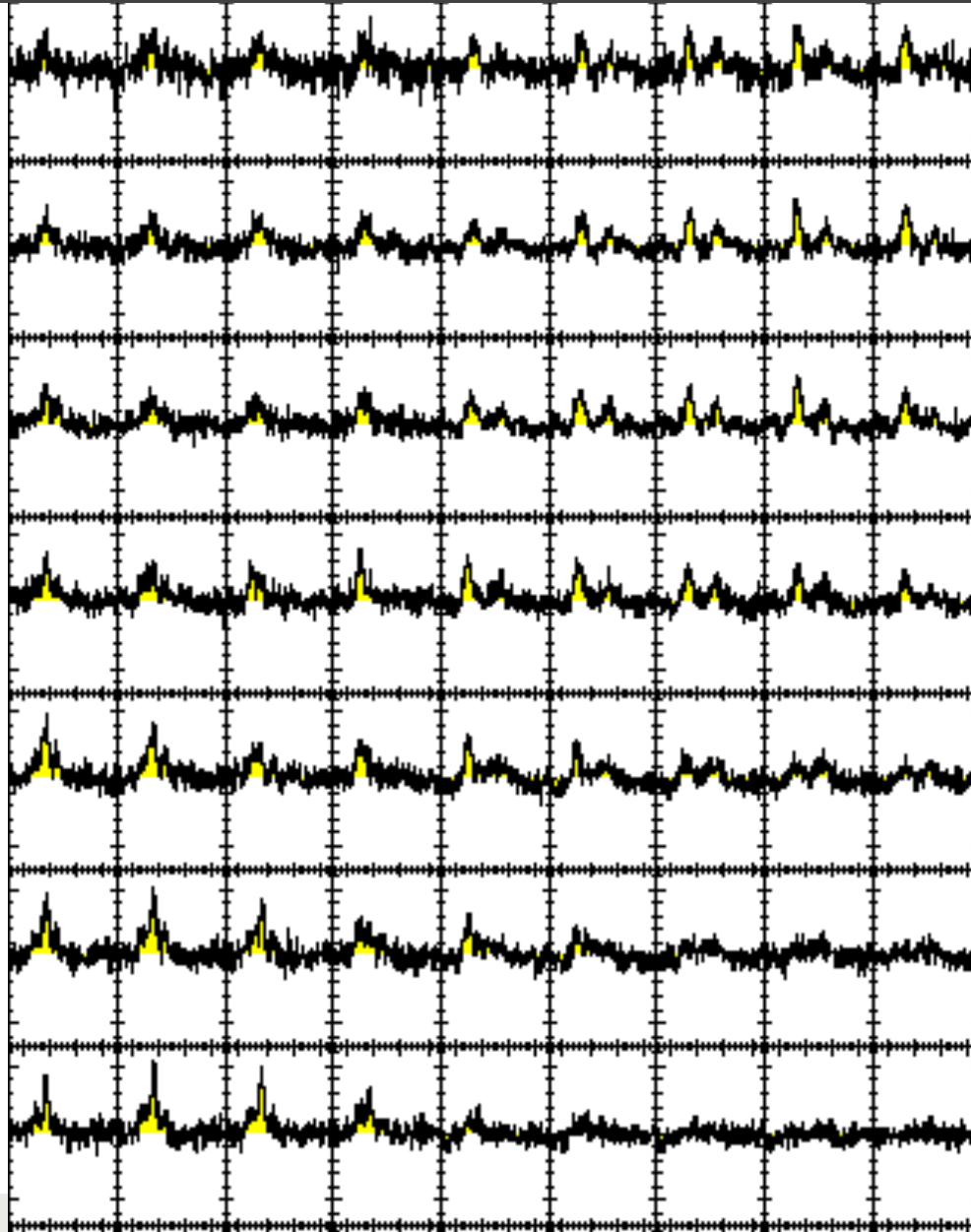




# Hot off the press

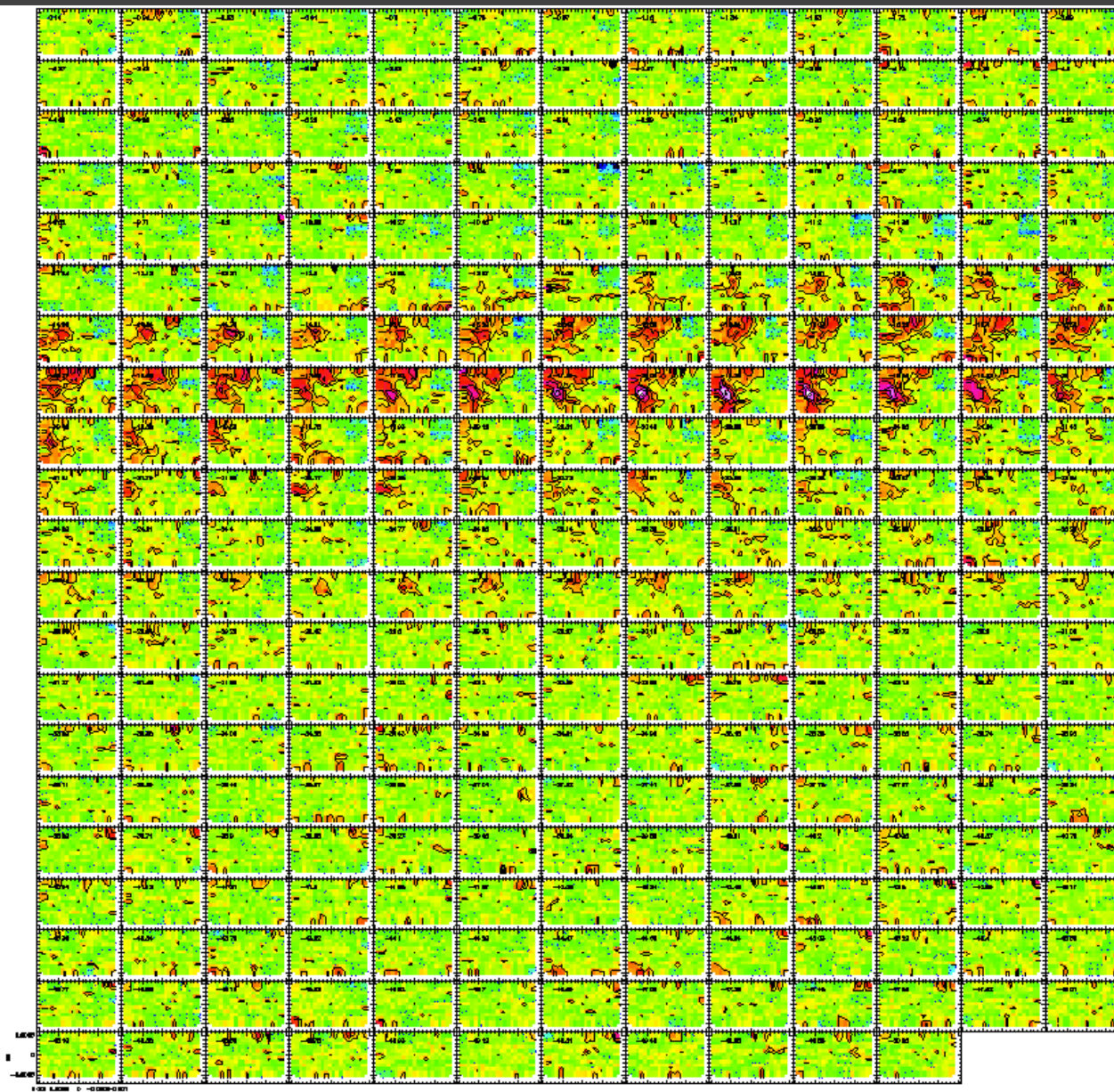


# Hot off the press





# Hot off the press



carina test v1.lmv

Source: CARINA CNTR

Line: CI 3P1-3P0

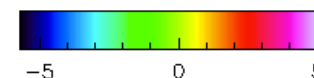
Frequency: 492.1607 GHz

Beam: 40.39 x 40.39 PA 0°

Level step: 1 K (Tmb)

Box marking: VELOCITY

Channels: [0,0]



macham

02-FEB-2014 14:14:24

# DSS43 – Scientific Capabilities



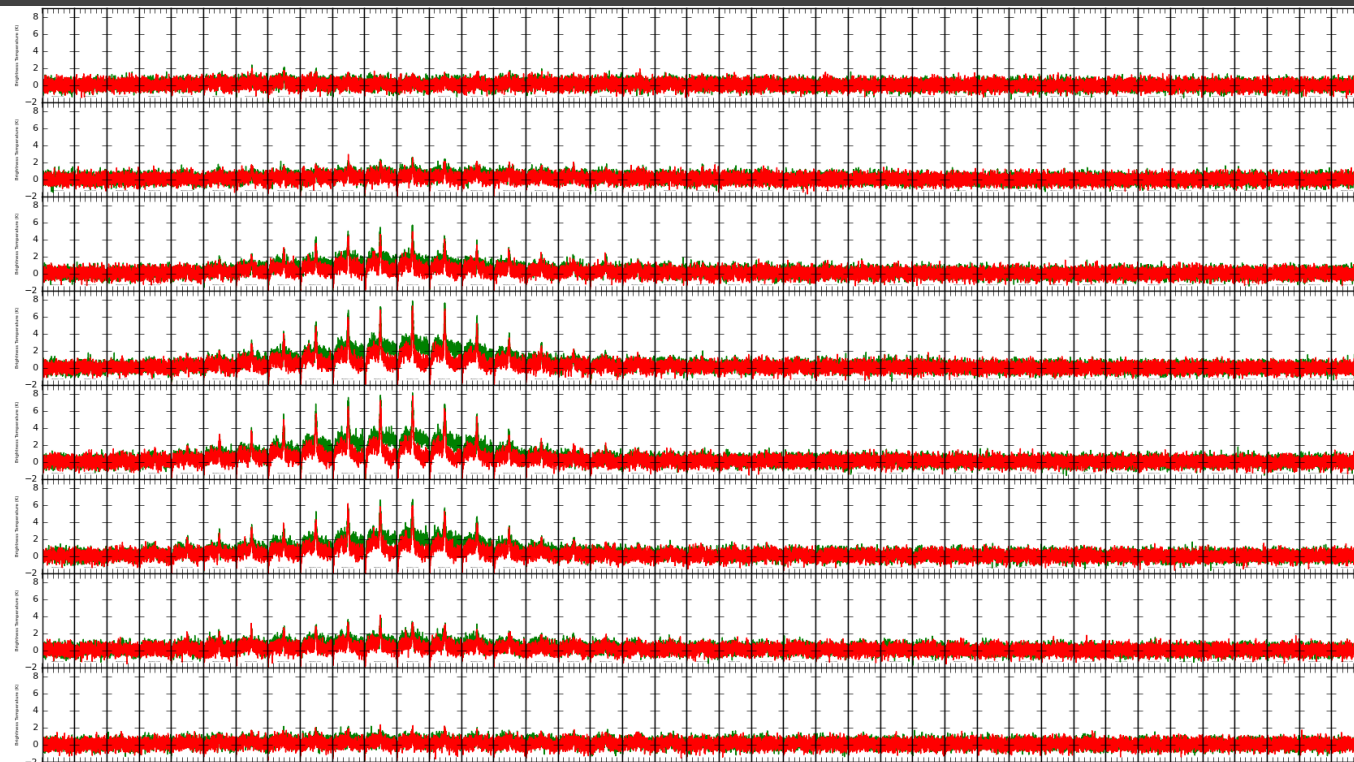
Photo: DSS43  
(G. Wong)

- Spectroscopy in a service observing mode and other single-dish observation

Frequency Range (GHz)	Band (cm)	Receiver	Beam FWHM (arcmin)	Tsys (K)
1.610 - 1.705	18	L-band	8	25
2.270 - 2.300	13	S-band maser	6.4	16
2.200 - 2.300	13	S-band hempt	6.4	25
8.183 - 8.633	3	X-band	1.8	25
18.0 – 26.5	1	K-band	0.8	40

For more information: <http://www.atnf.csiro.au/observerstidbinbilla/>

# 70m Tidbinbilla On-the-fly mapping

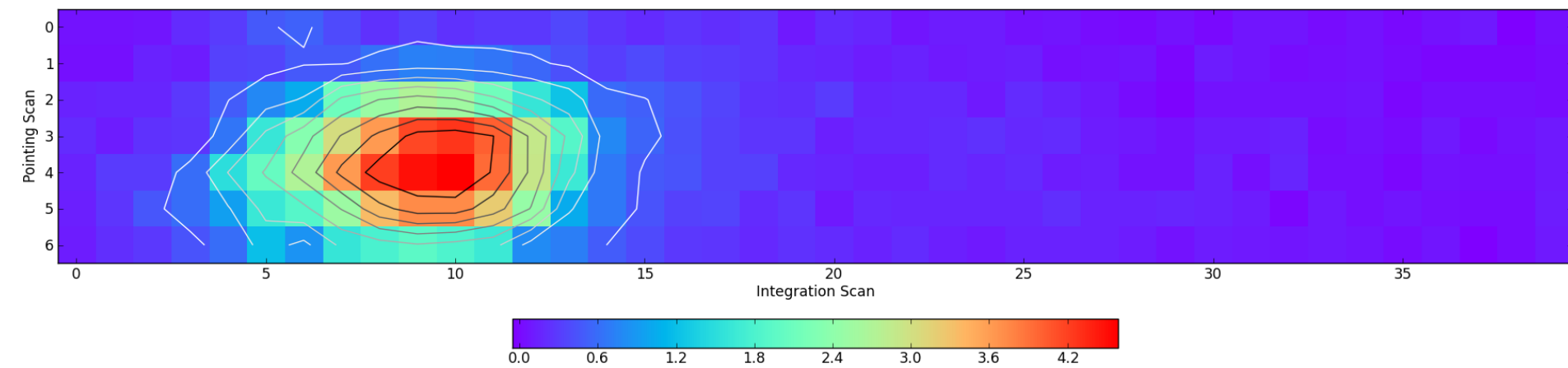


First OTF observation -  
Orion A 2013-07-24  
H92  $\alpha$  at 8309.37MHz



← Tiled Spectra

↓ Integrated emission map

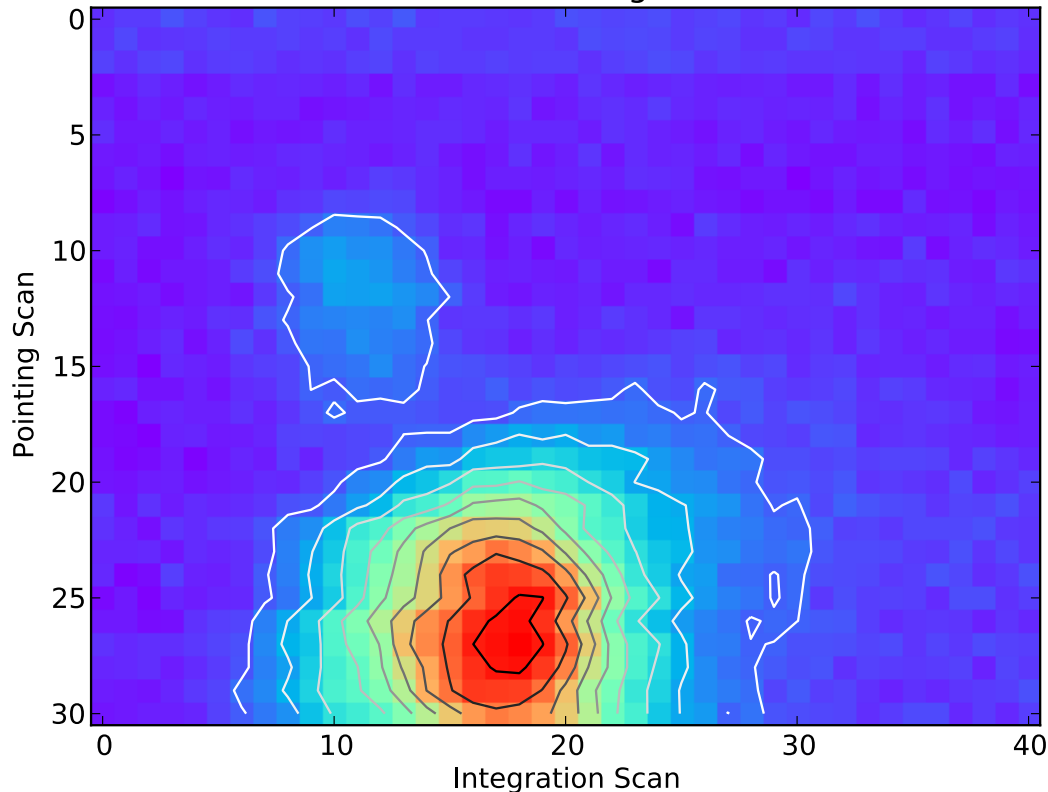


# Observing Orion (Round 2)

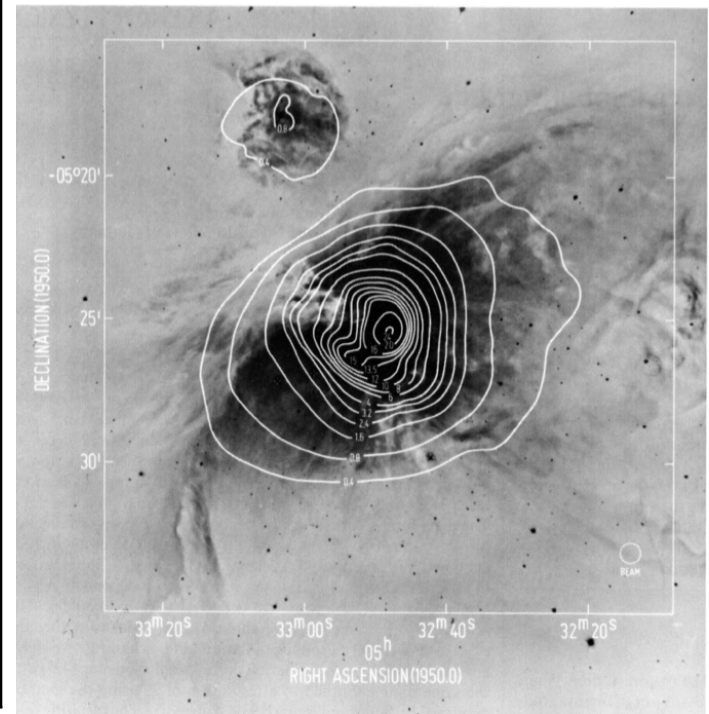
Mapping grid optimisation for 1.8' beam (2013-07-30)

H92  $\alpha$  at 8309.37 MHz

Orion Image



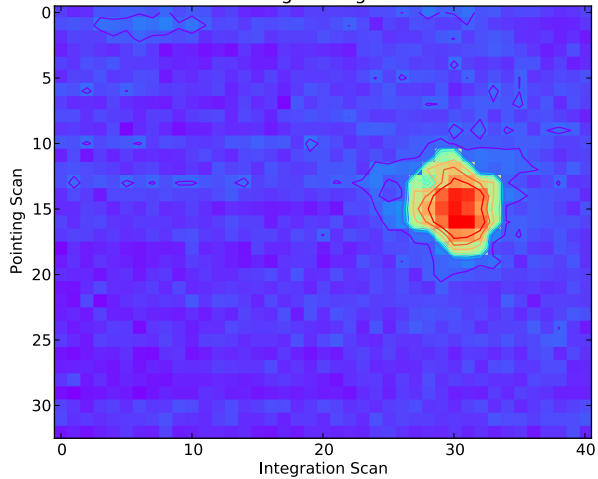
Recent O<sub>3</sub>F observations of Orion A  
hydrogen recombination line



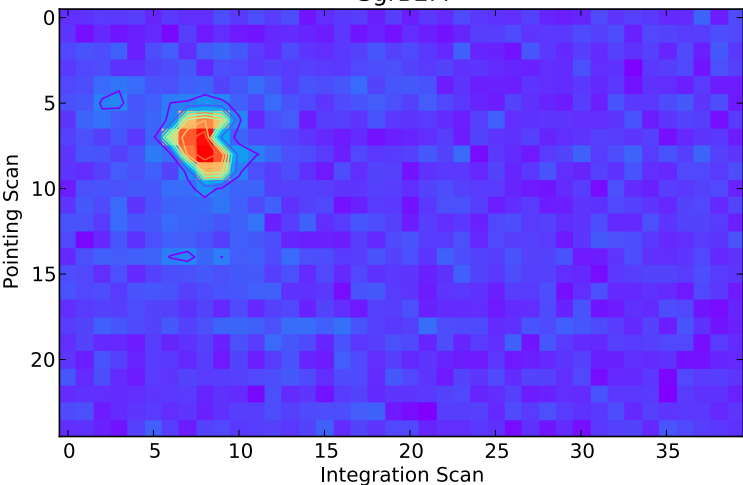
Optical and radio image from  
Wilson and Pauls (1984)

# Other regions: SgrA, SgrB2M & NGC6334

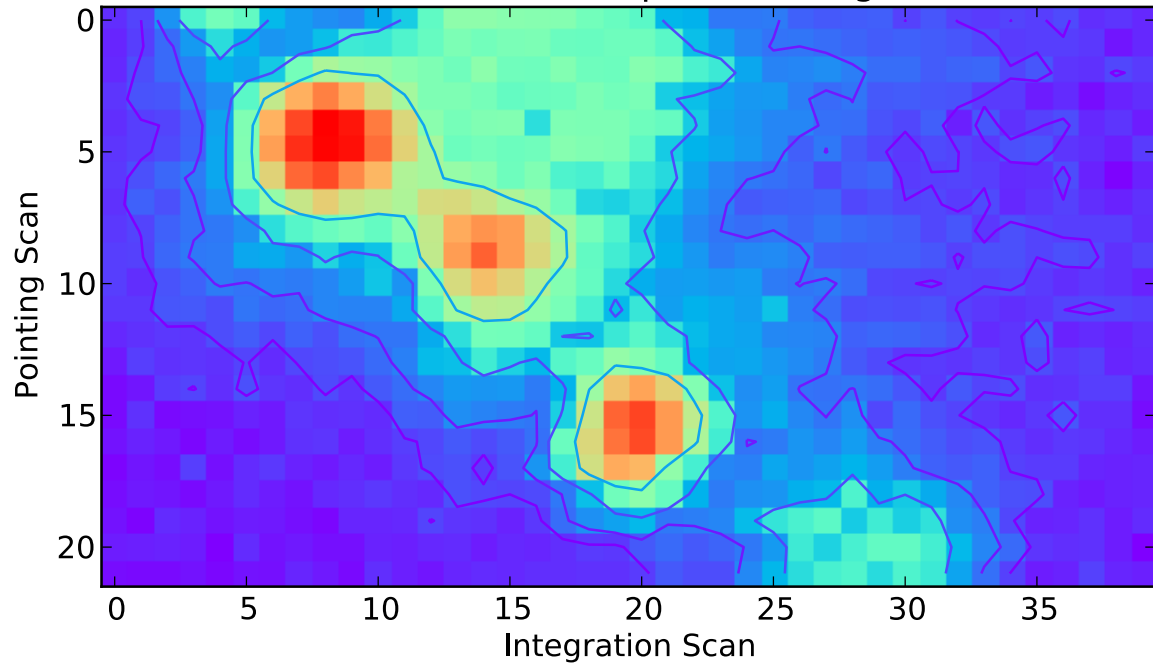
SgrA Image



SgrB2M



NGC6334 06Sept2013 Image





# Data Processing

- Using the ASAP component within CASA for data reduction
- Images created via ASCII then Python's Matplotlib package
- CASA for imaging (Thanks Kana-San!)

# Imaging with CASA

