iram
Institut de
Radioastronomie
Millimétrique

x12
NOEMA
project
NOrthern Extended Millimeter Array

Obs. De Paris
September 2014

NOEMA

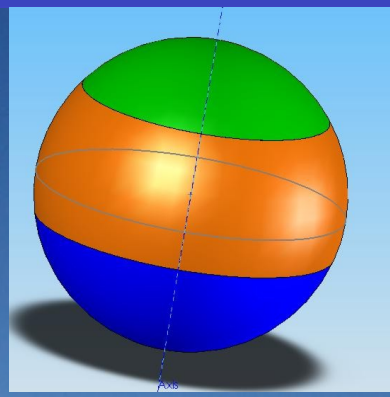
*The **N**orthern **E**xtended **M**illimeter **A**rray*

K.F. Schuster – IRAM
Presented by J.Pety – IRAM & Obs. De Paris

Advanced Millimeter Wave Astronomy calls:

- for an ALMA competitive equivalent on the northern hemisphere
- for an instrument which allows for large surveys.
- for an observatory which allows the IRAM community to efficiently prepare and complement ALMA observations.

IRAM Plateau de Bure



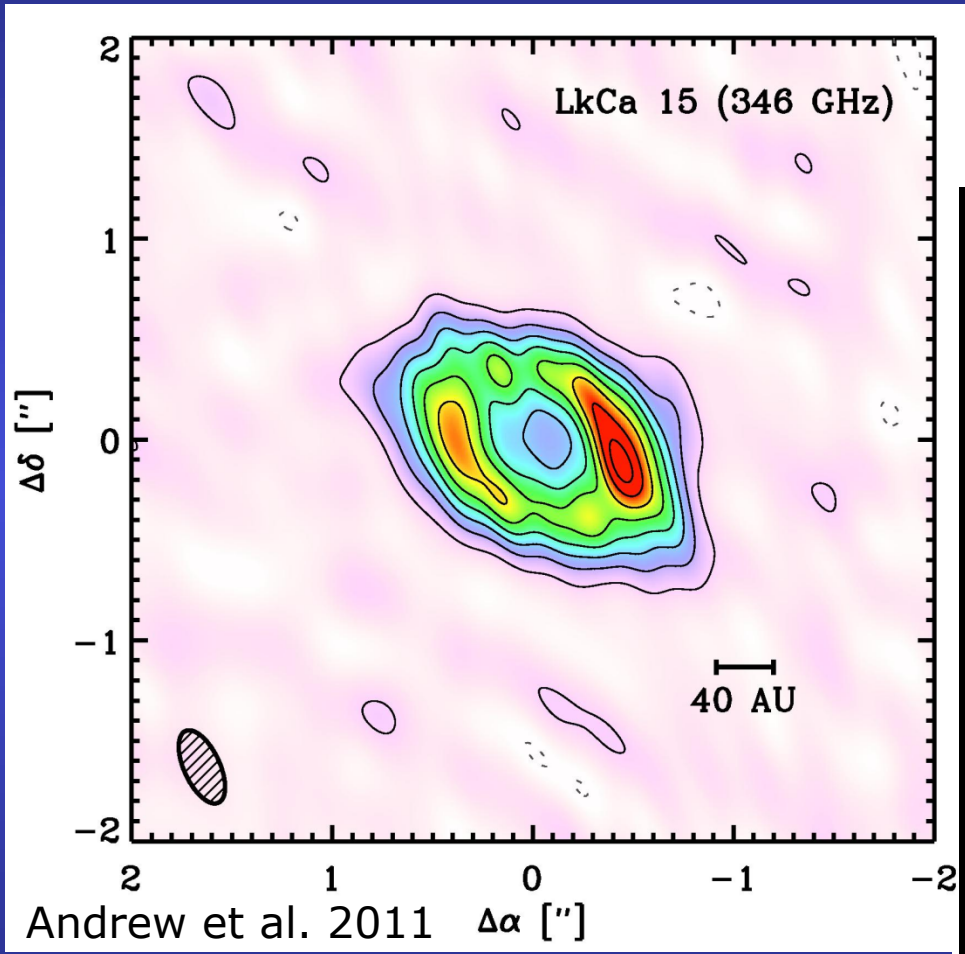
NOEMA
Northern Extended Millimeter Array

- Double the number of 15 m antennas at PdB from 6 to 12
- Extension of the Baselines from 0.8 to 1.6 km
- Increase of IF bandwidth from 8 GHz to 32 GHz

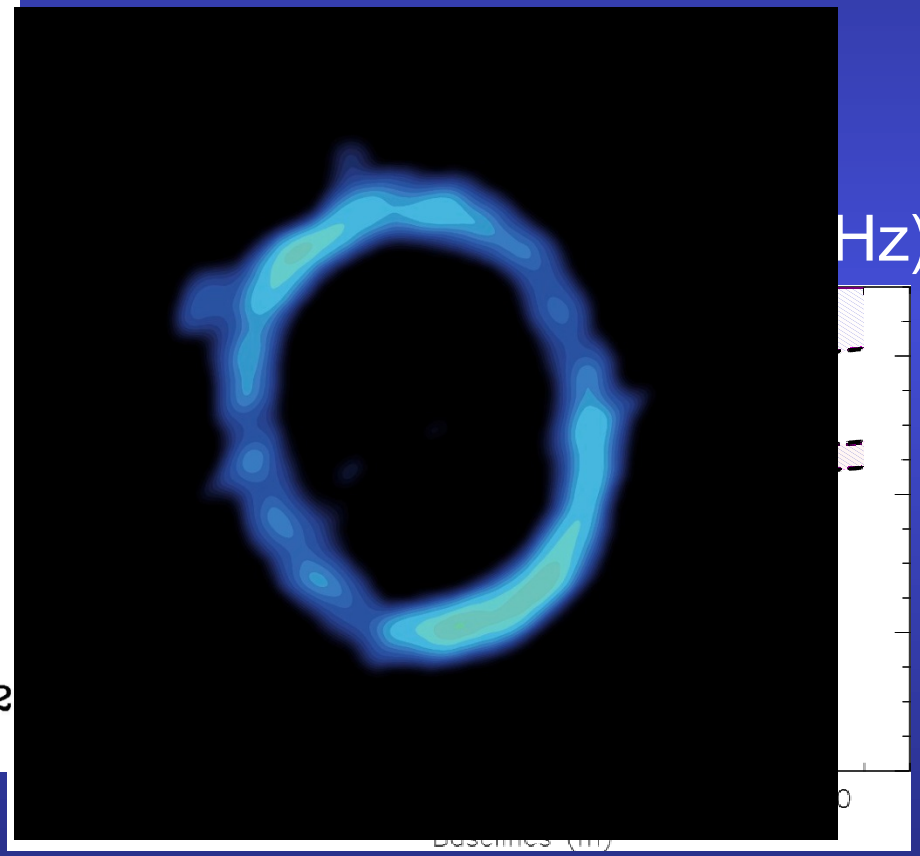
Comparison of Collecting Area		
[m^2]	Interferometry	Total power and short spacing
ALMA	5655	914
NOEMA/30m	2121	707

Sensitivity Goals		
	Continuum or Frequency Survey	Single Line
NOEMA vs ALMA	> 55%	> 35%

The PdB Site

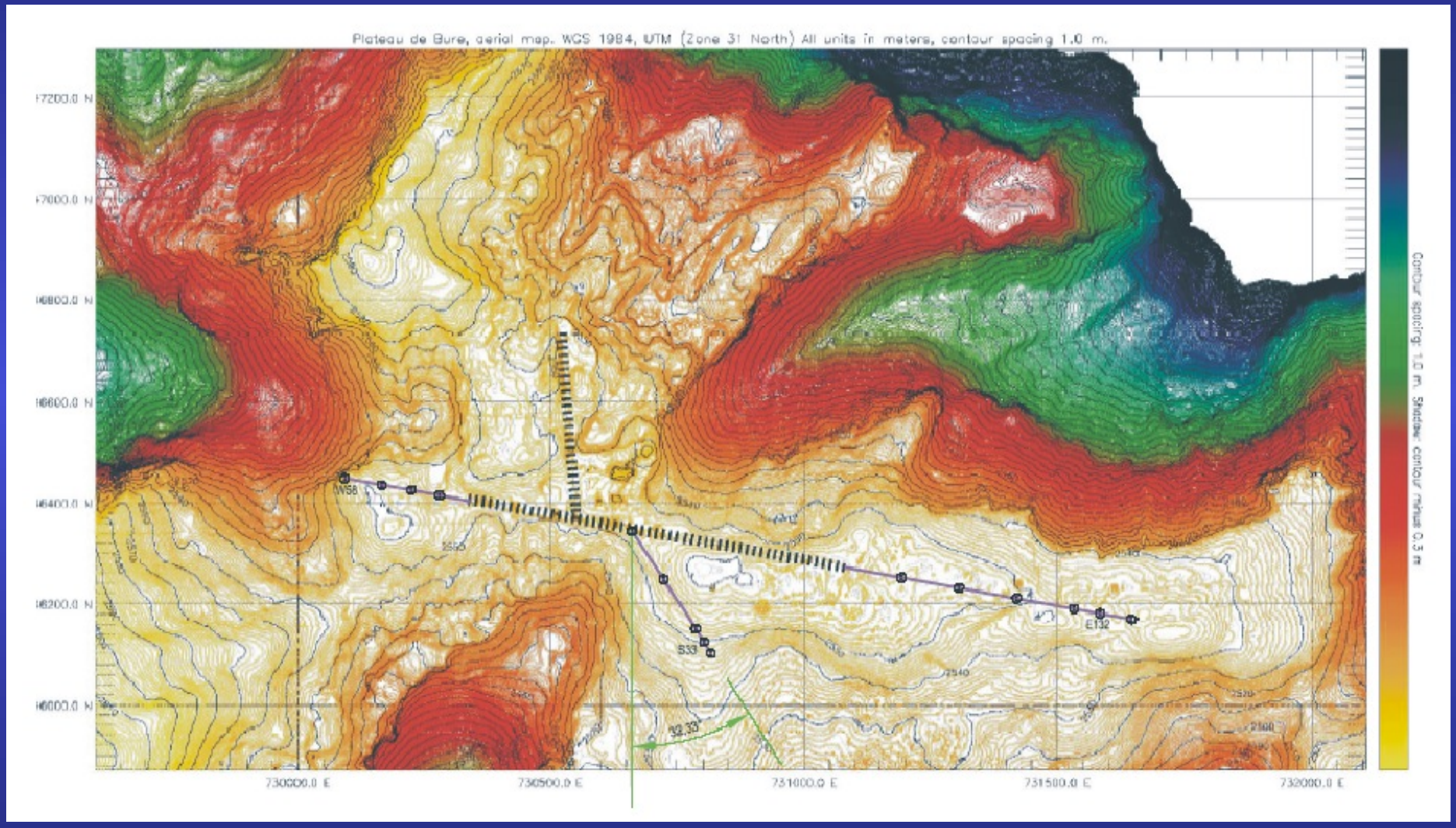


Andrew et al. 2011

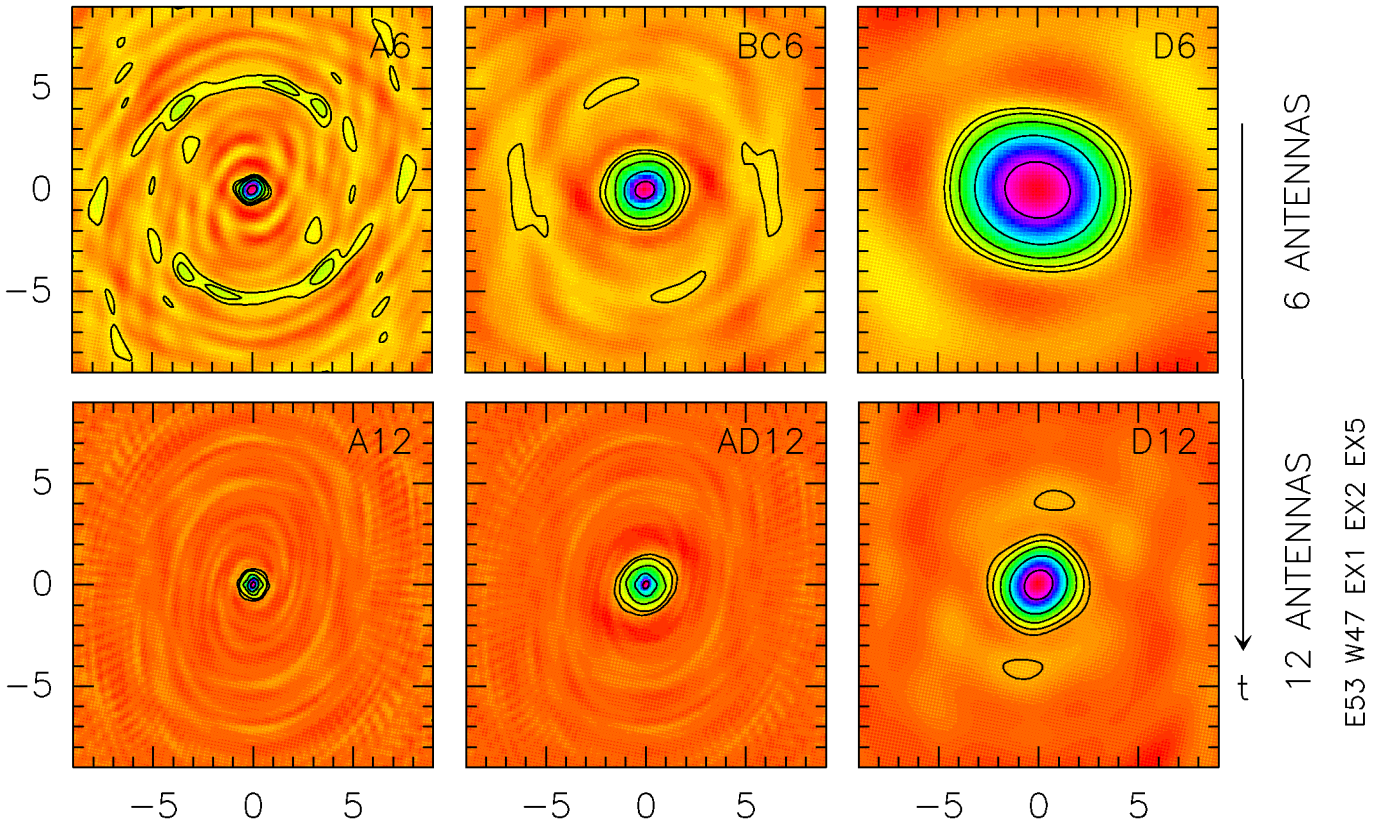


GG Tau in the 350 GHz continuum
Pietu et al. 2012

Baseline Extensions



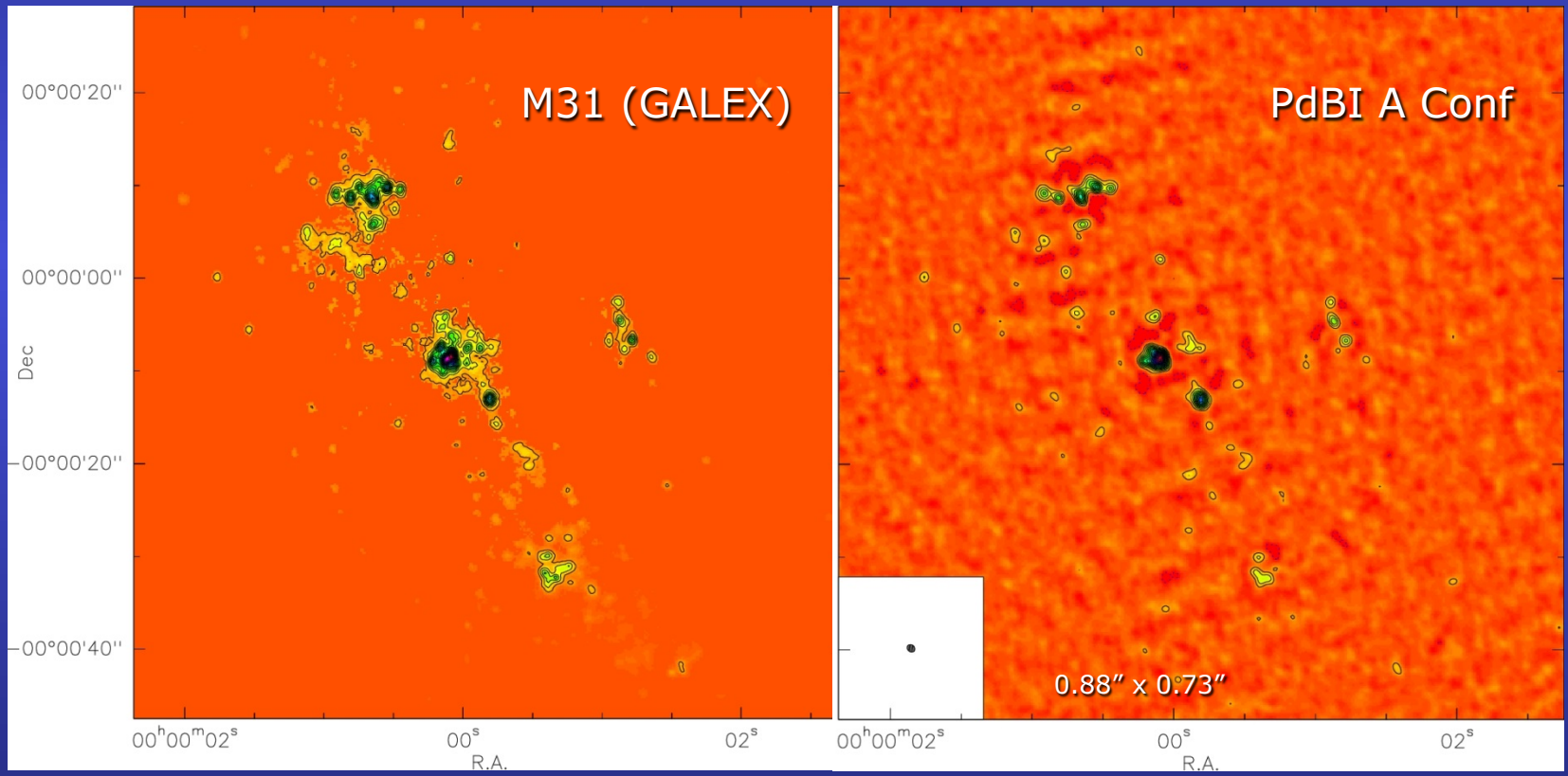
Design considerations: Low sidelobe levels ⇨ high dynamic range



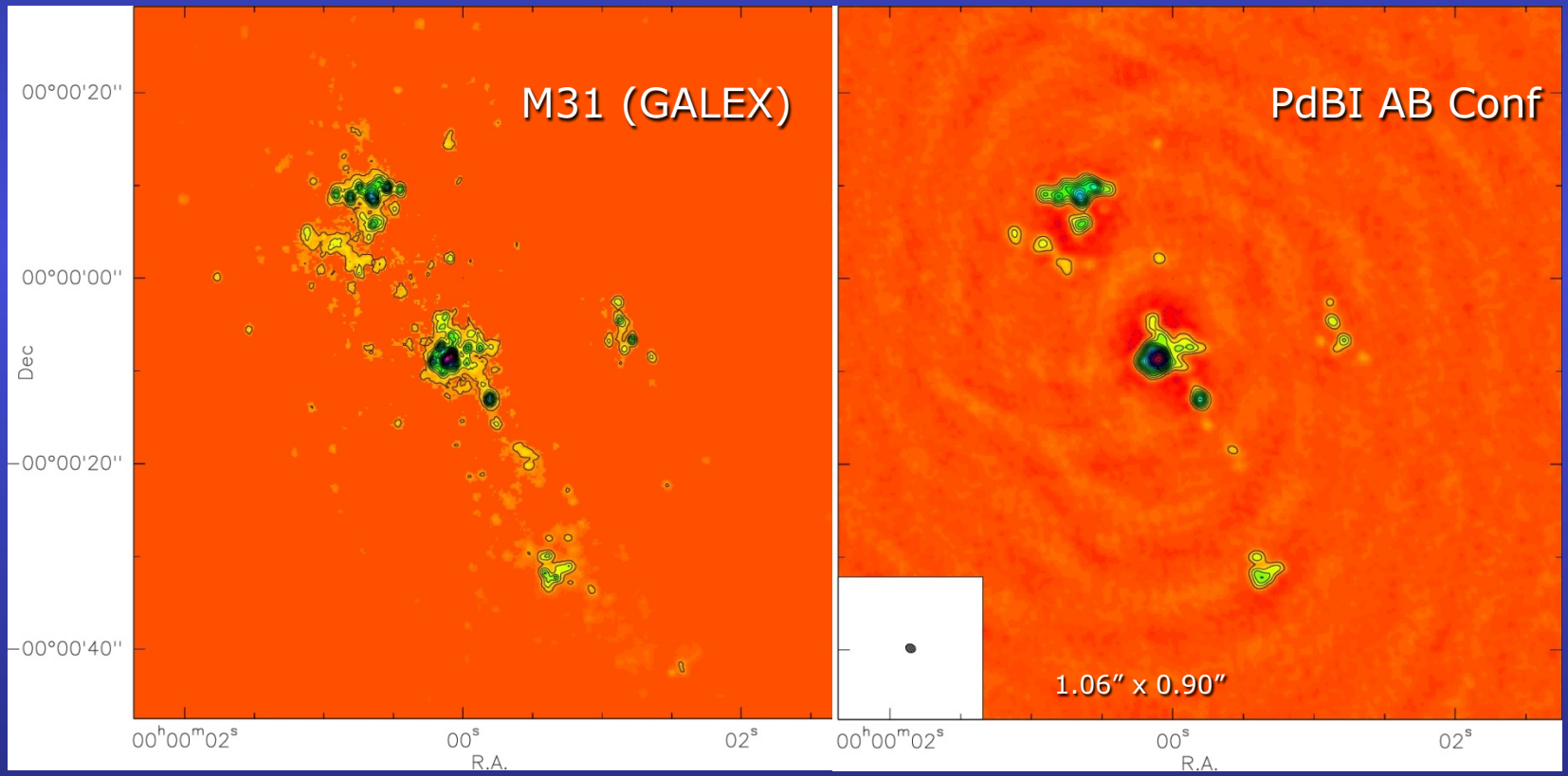
Boissier 2008

Imaging Simulations @ ⇨ 100 GHz

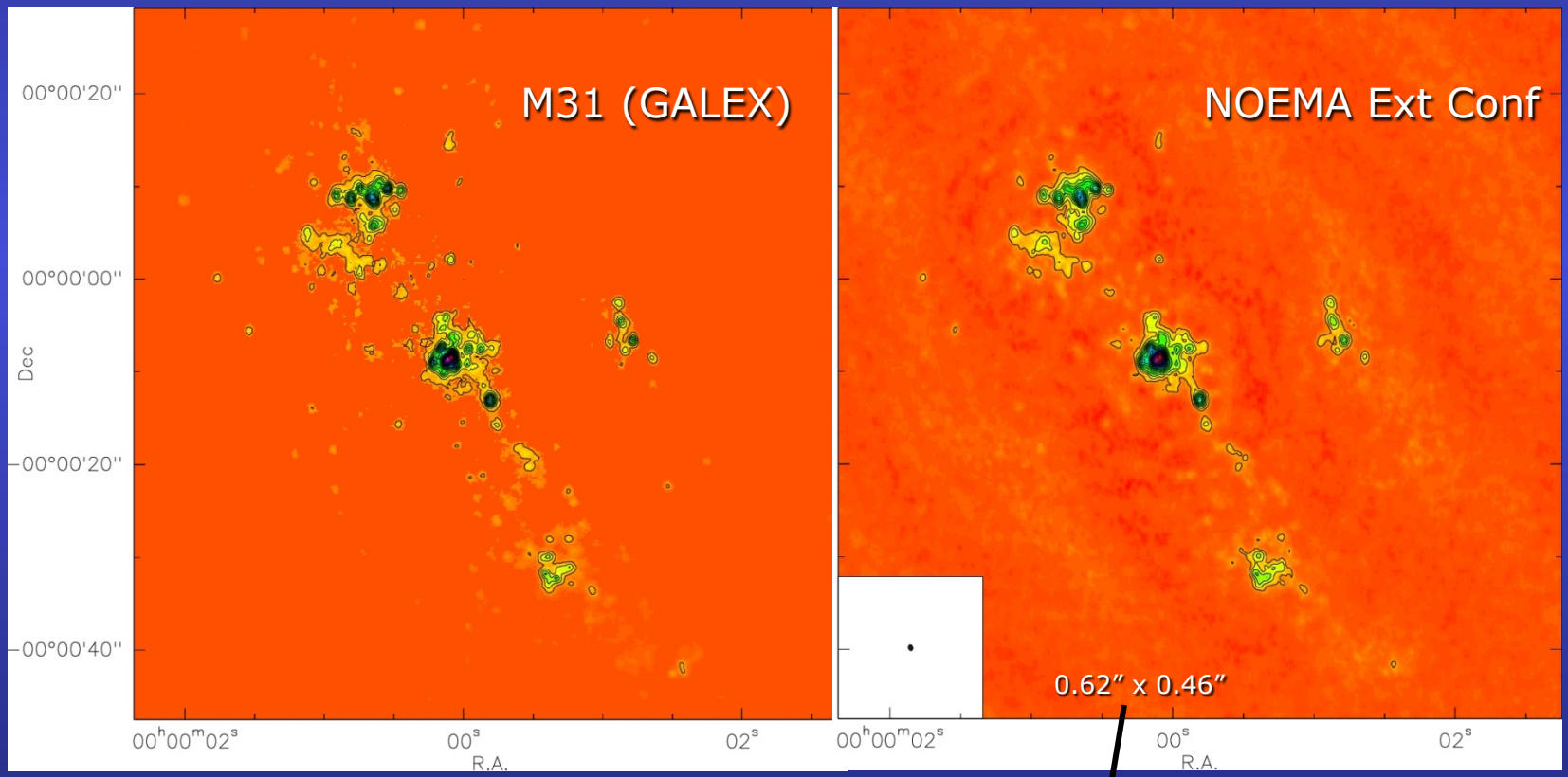
J Boissier 2009



Imaging Simulations @ ⇨ 100 GHz

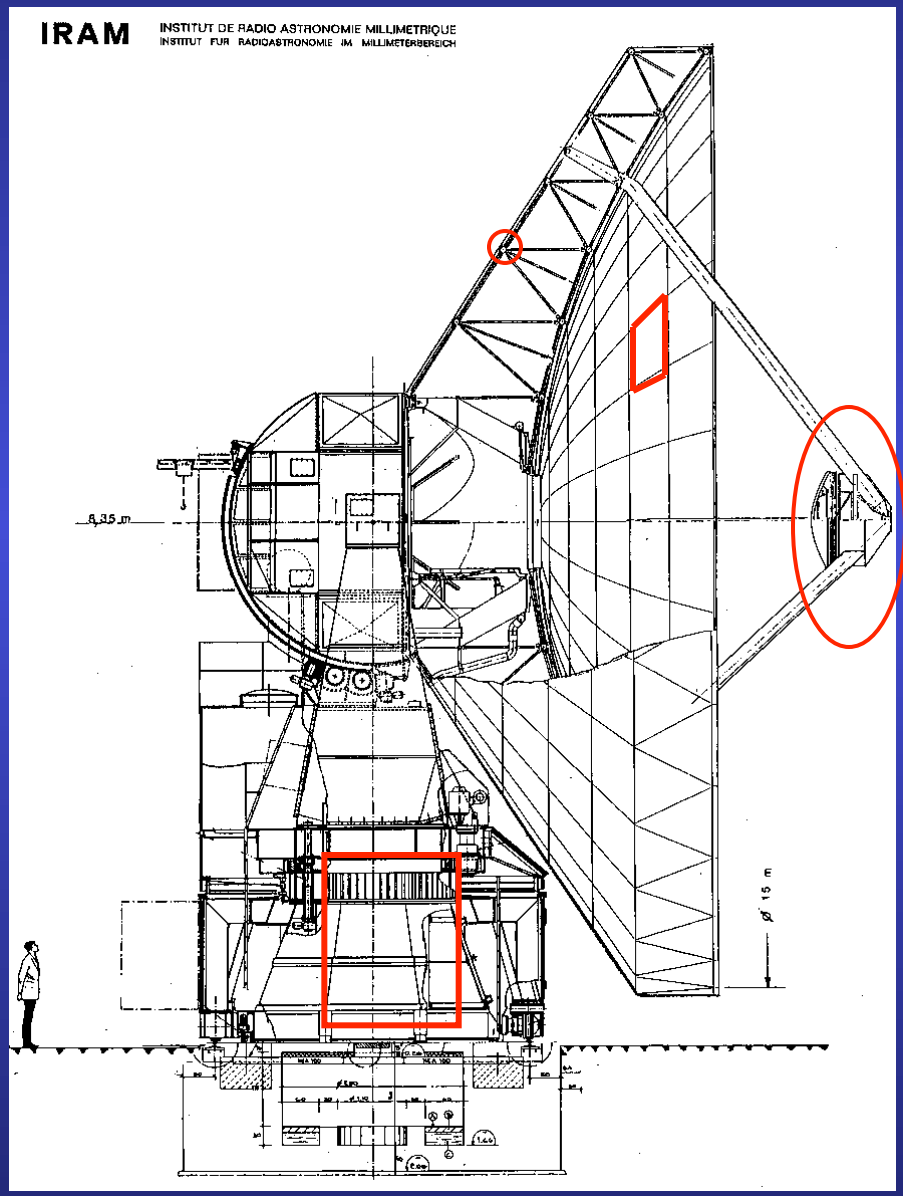


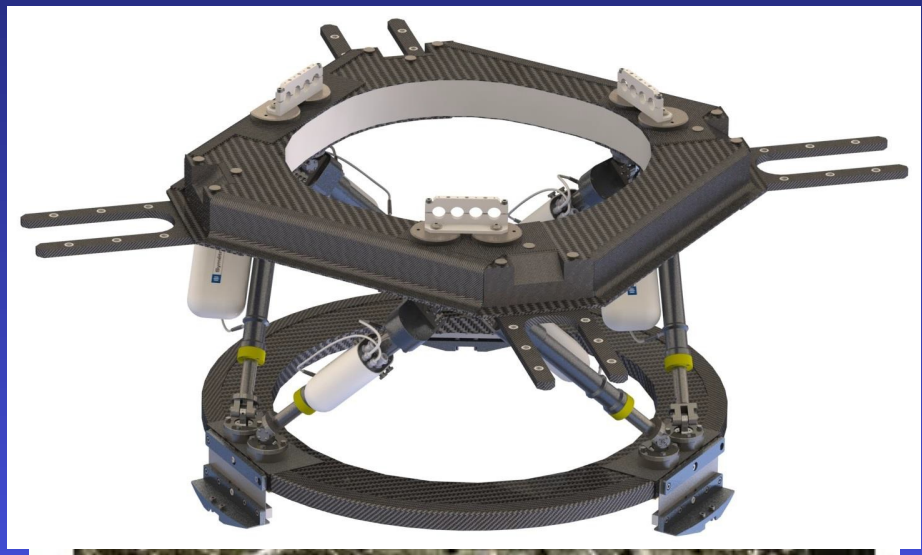
Imaging Simulations @ ⇨100 GHz



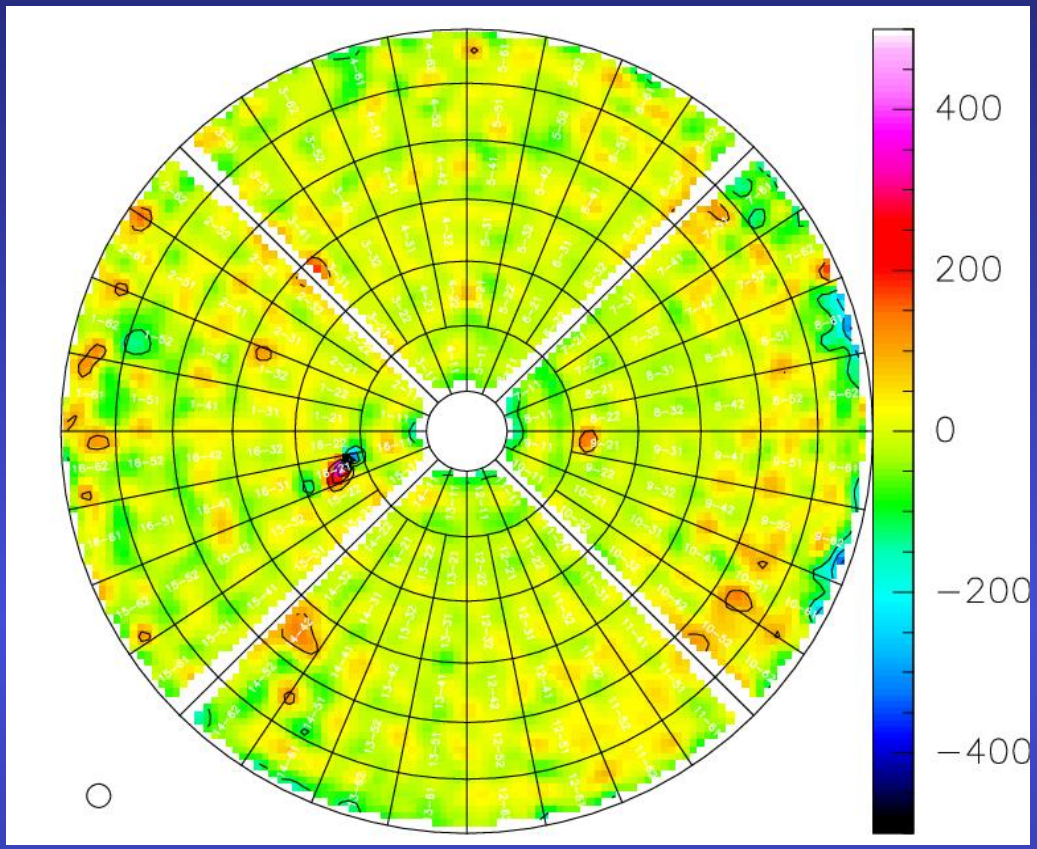
resolve GMCs in Virgo

The Antenna





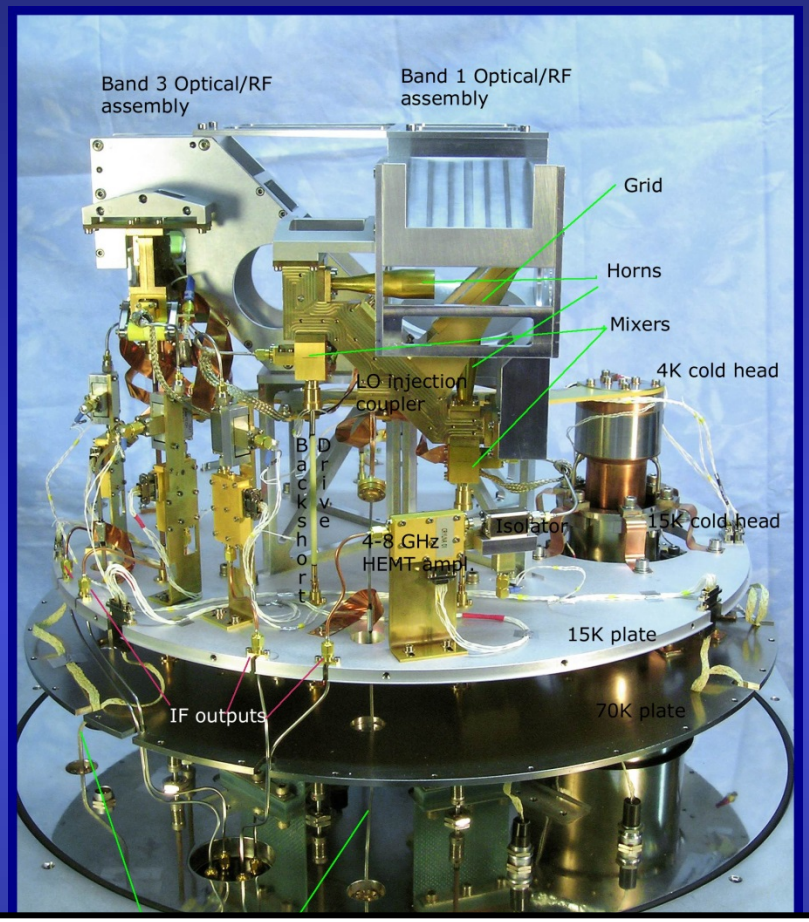
With aluminum panels 2-year cycle for indoor maintenance is envisaged.

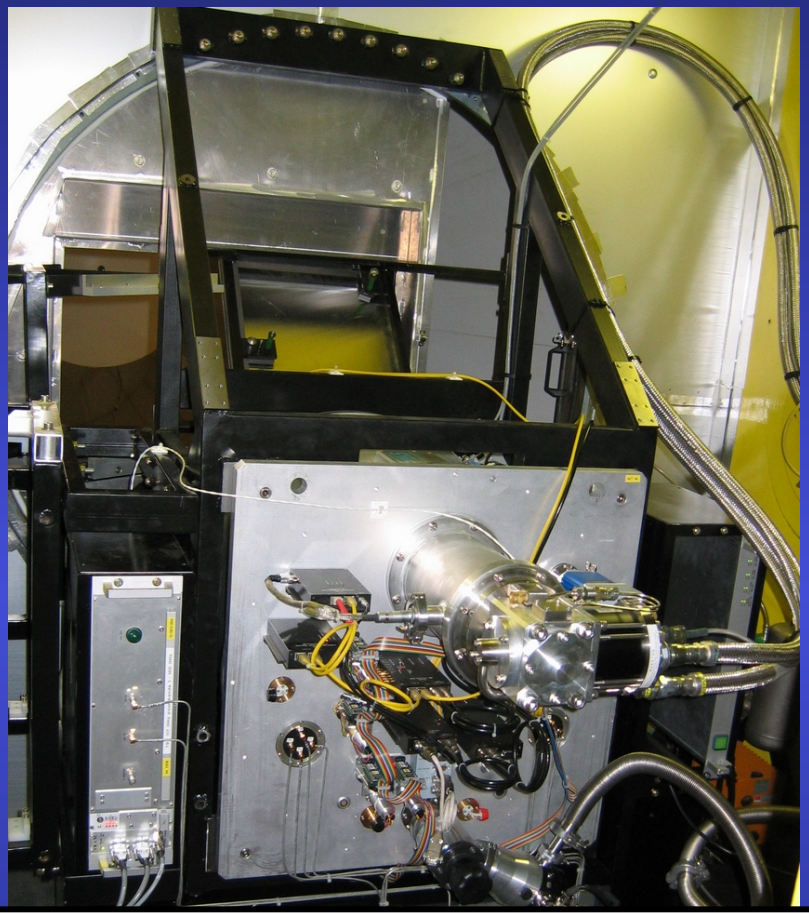


35 μm rms

Today, all 6 PdB antennas have been improved in surface to better than 42 μm rms (50 μm rms initial goal).

The Receivers



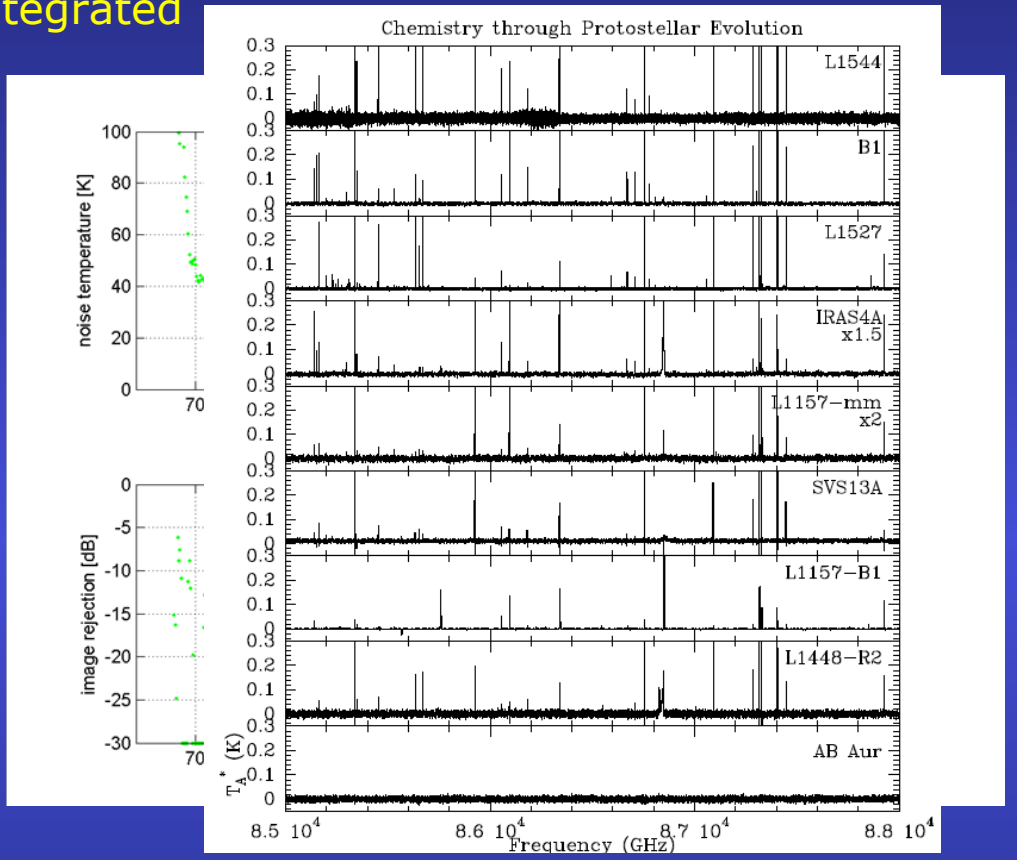


NOEMA RF Band Specifications				
Band	NOEMA-1	NOEMA-2	NOEMA-3	NOEMA-3
RF Frequency (GHz)	**72**-116	127-179	200-276	275-373

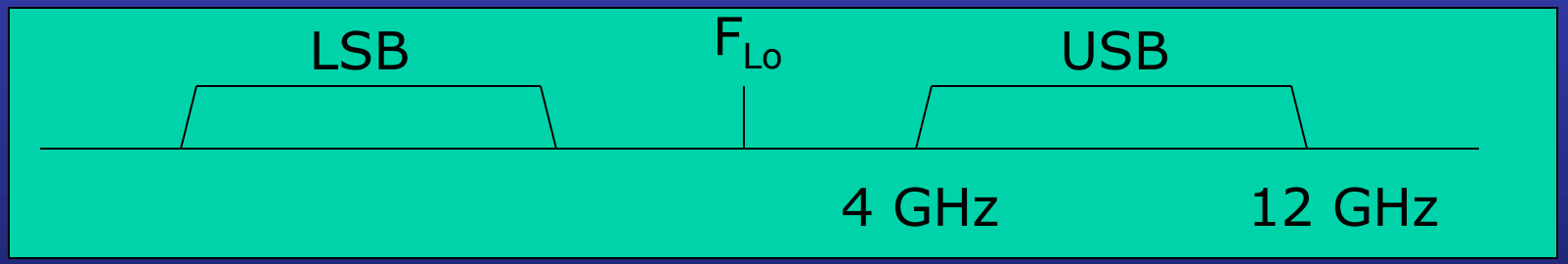
New 8 GHz 2SB Technology

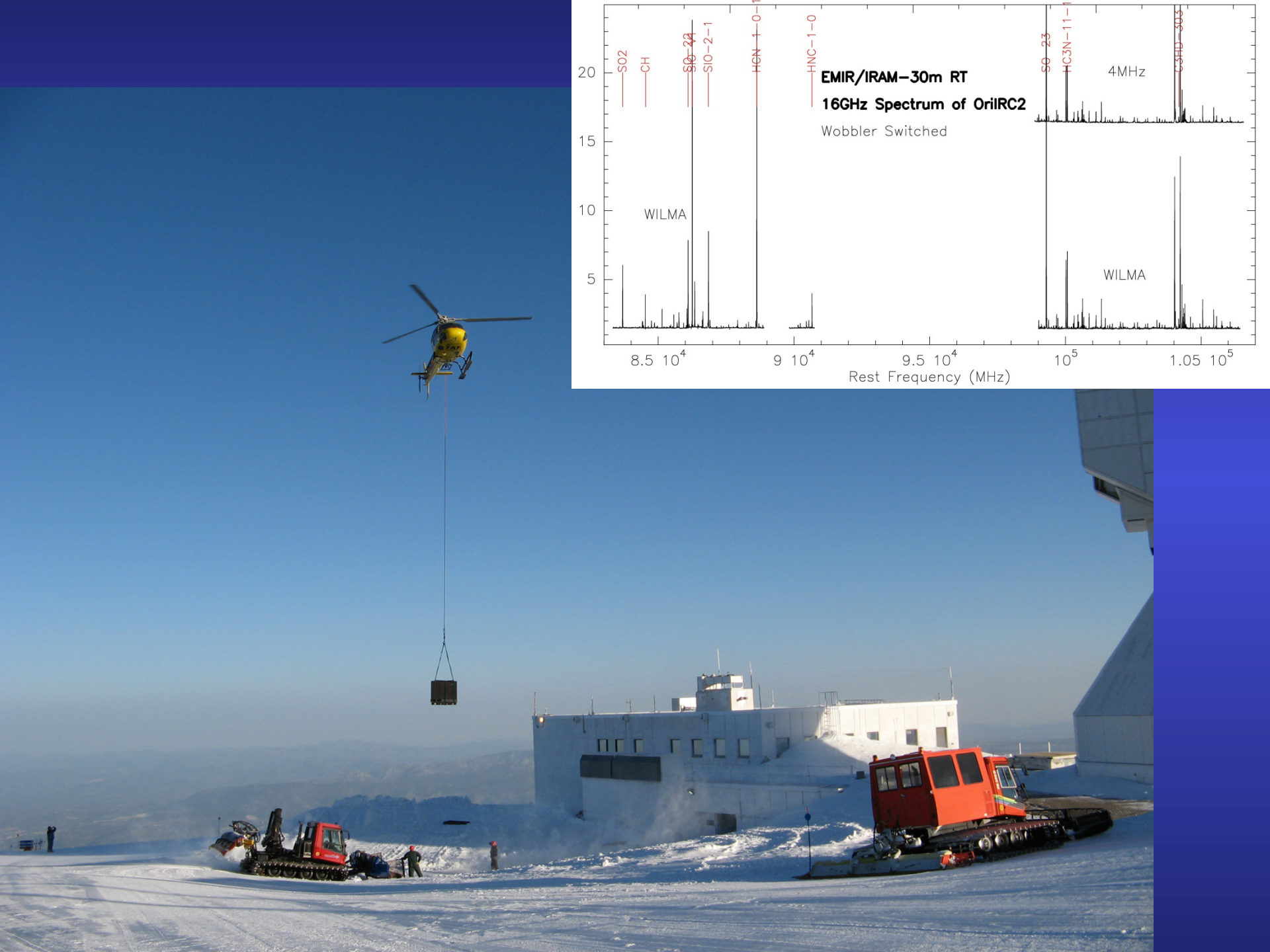
Since summer 2013 commissioned in all 4 bands in EMIR, newest version is fully integrated

Lefloch et al 2013



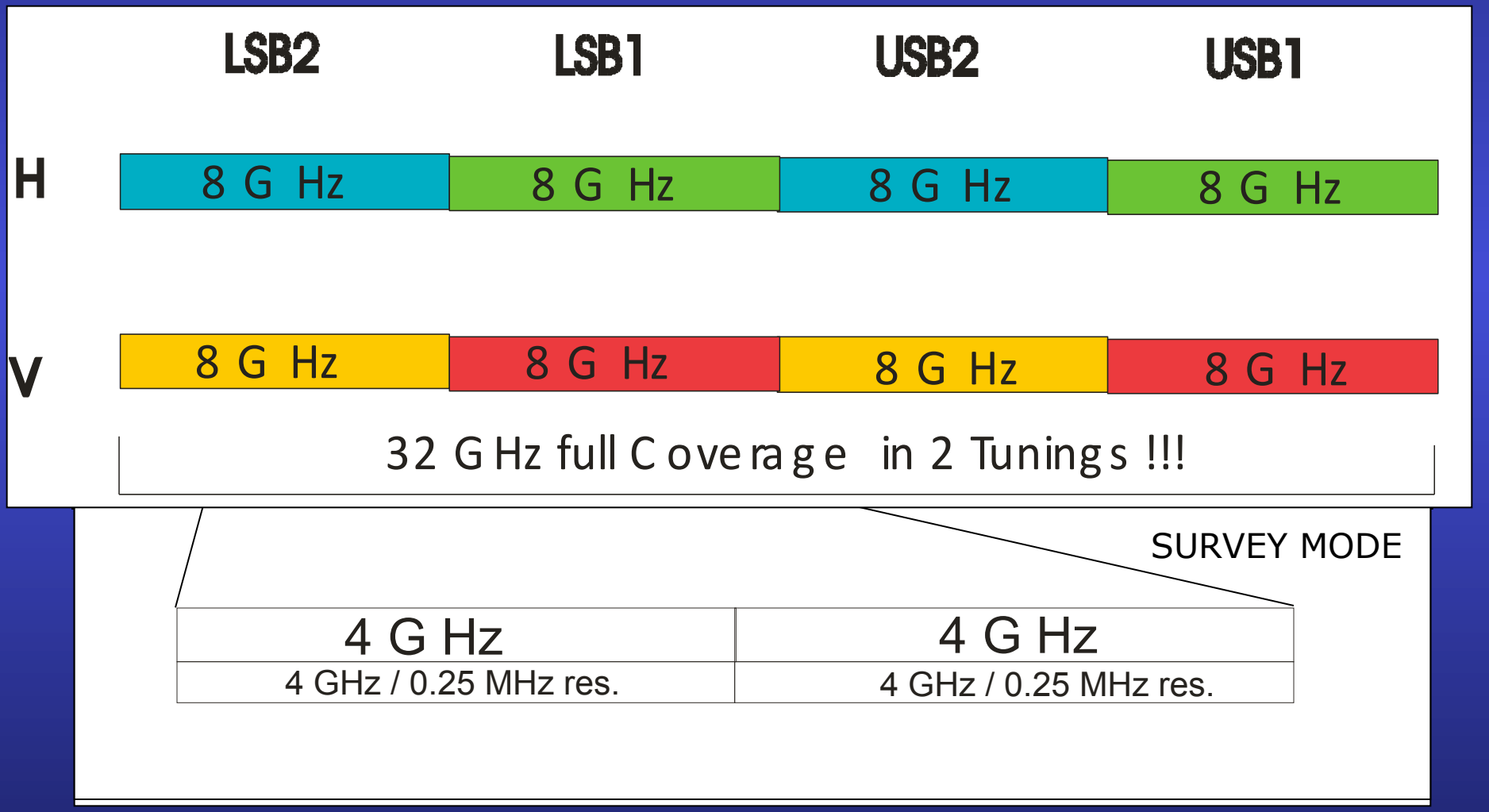
Delivers 16 GHz of IF band per polarization !



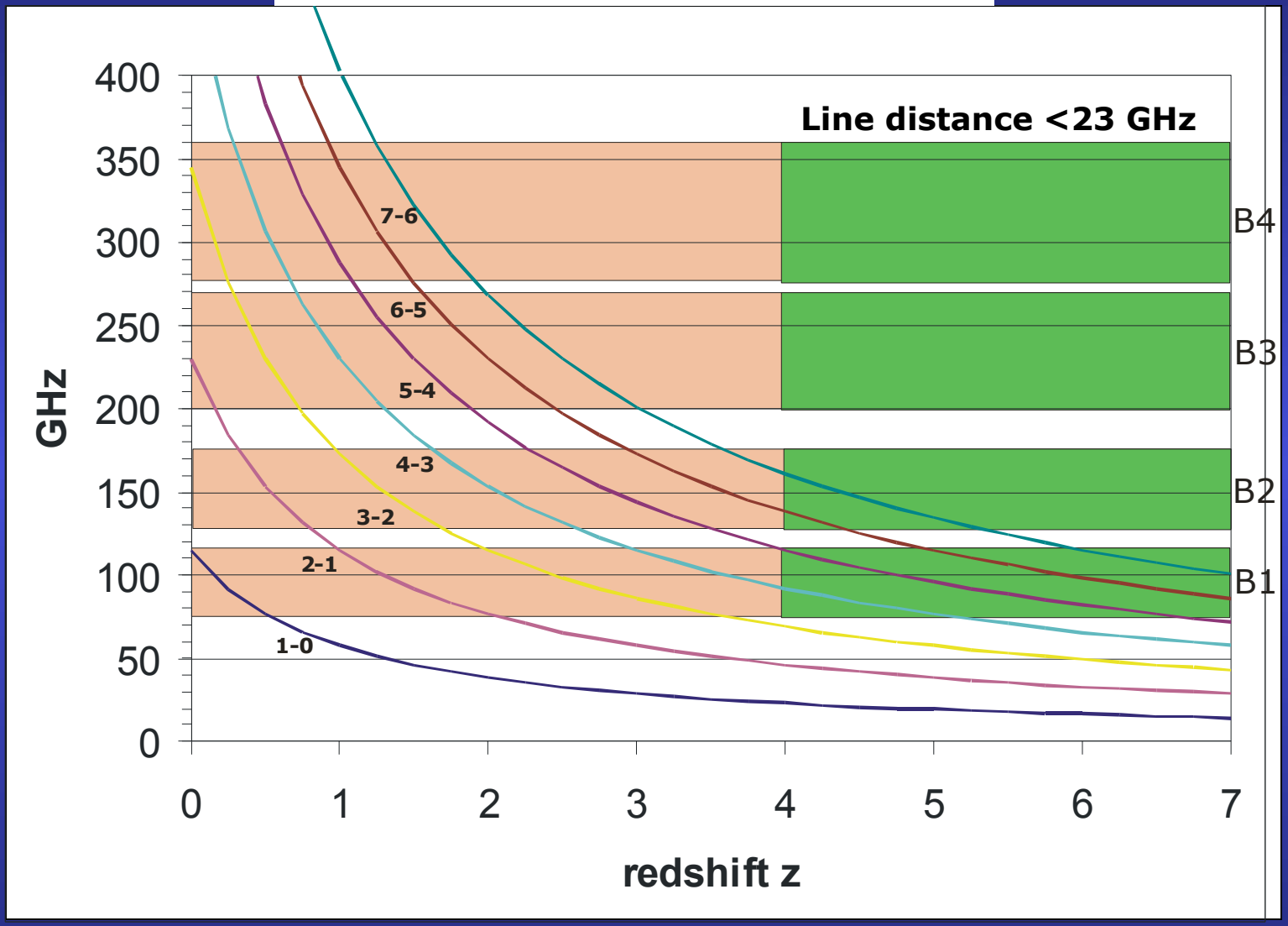

SO2
CH
SO 22
SIO 44
SIO-2-1
HCN-1-0
HNC-1-0
SO 23
HC3N-11-10
C3HD-303
EMIR/IRAM-30m RT
16GHz Spectrum of OrilRC2
Wobbler Switched
4MHz
WILMA
WILMA
20
15
10
5
8.5 10^4
9 10^4
9.5 10^4
10^5
1.05 10^5
Rest Frequency (MHz)

NOEMA Special Features I

Backend POLYFIX



Redshifted CO transitions



NOEMA Special Features II

- NOEMA will allow efficient self calibration for sources as weak as 2 mJy at 3mm and 5 mJy at 1.3 mm.
- NOEMA continuum observations will allow for many sources spectral index measurements and multifrequency synthesis.
- Polarimetry as a hardware prepared to-be-worked-on option.

Future NOEMA Enhancement Options

- Full Phasing for VLBI
- Dichroic Mirrors and second Polyfix backend for full polarization Dual Band Obs.
- Full Stokes Polarimetry
- Multibeam Receivers

Project Status Planning

The Project has been split into two Phases:

Phase I: +4 Antennas + Receivers + Correlator for 12 Antennas

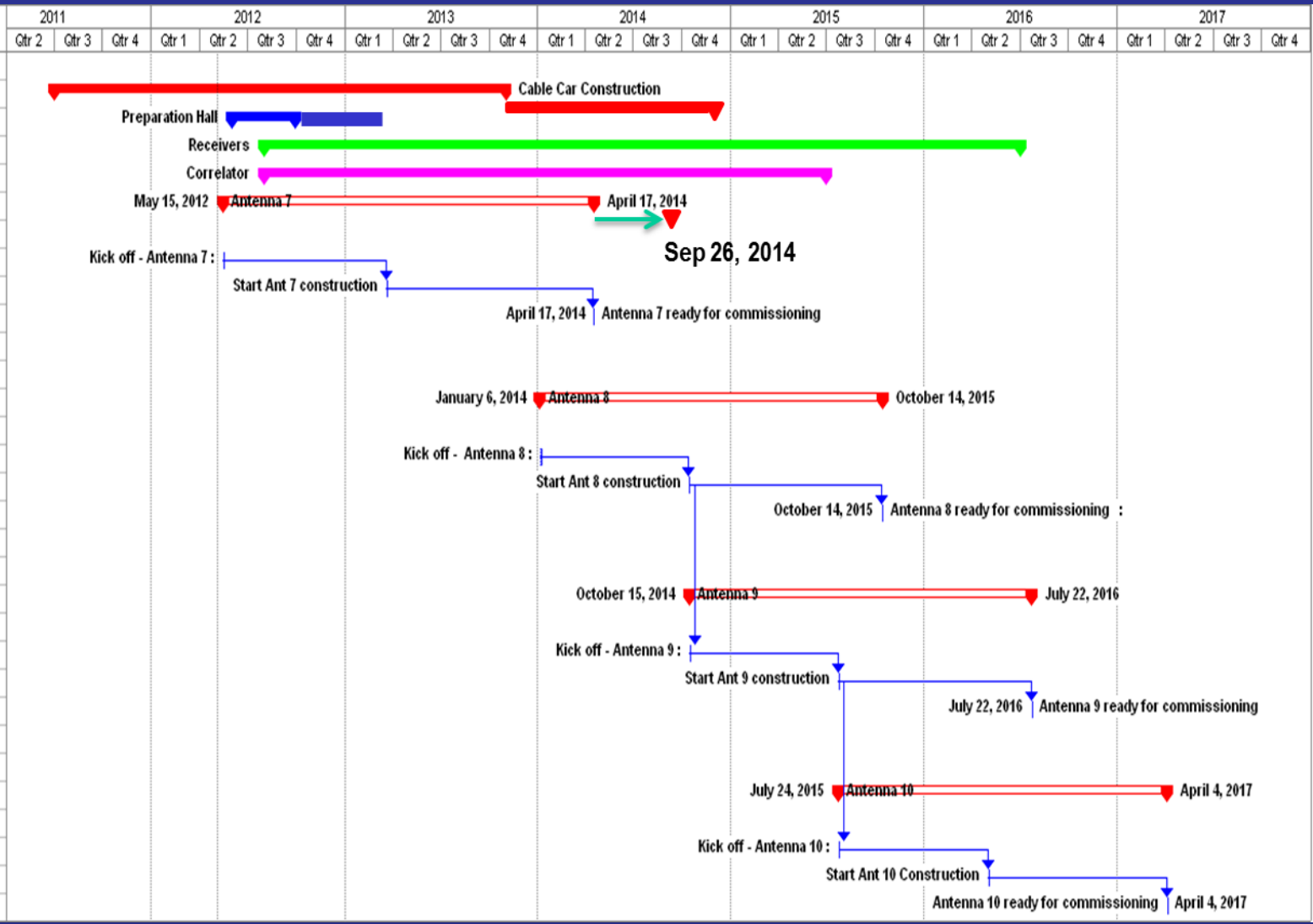
Phase II: + 2 Antennas + Receivers + Baseline Extension

Phase I (34 MEu) is currently underway

Phase II (15 MEu) needs identification of additional resources and ideally is following Phase I without gap.

Planning Phase I

ID	Task Name
1	
2	Cable Car Construction
3	Preparation Hall
4	Receivers
5	Correlator
6	**Antenna 7**
7	
8	Kick off - Antenna 7 :
9	Start Ant 7 construction
10	Antenna 7 ready for commissioning
11	
12	
13	**Antenna 8**
14	
15	Kick off - Antenna 8 :
16	Start Ant 8 construction
17	Antenna 8 ready for commissioning :
18	
19	
20	**Antenna 9**
21	
22	Kick off - Antenna 9 :
23	Start Ant 9 construction
24	Antenna 9 ready for commissioning
25	
26	
27	**Antenna 10**
28	
29	Kick off - Antenna 10 :
30	Start Ant 10 Construction
31	Antenna 10 ready for commissioning

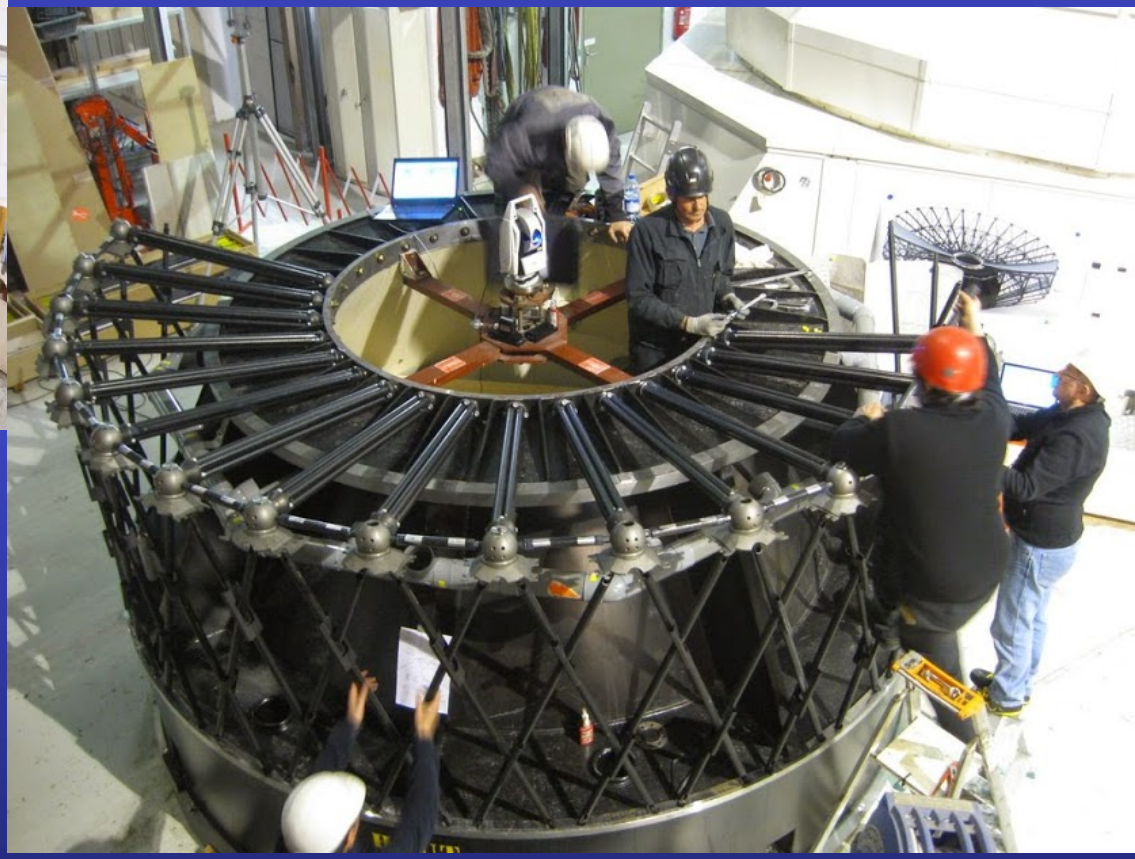


Assembling of first NOEMA antenna

Commissioning will start Nov 14,

next antennas follow every 10-12 months

Start of Ant 7 Reflector Assembling



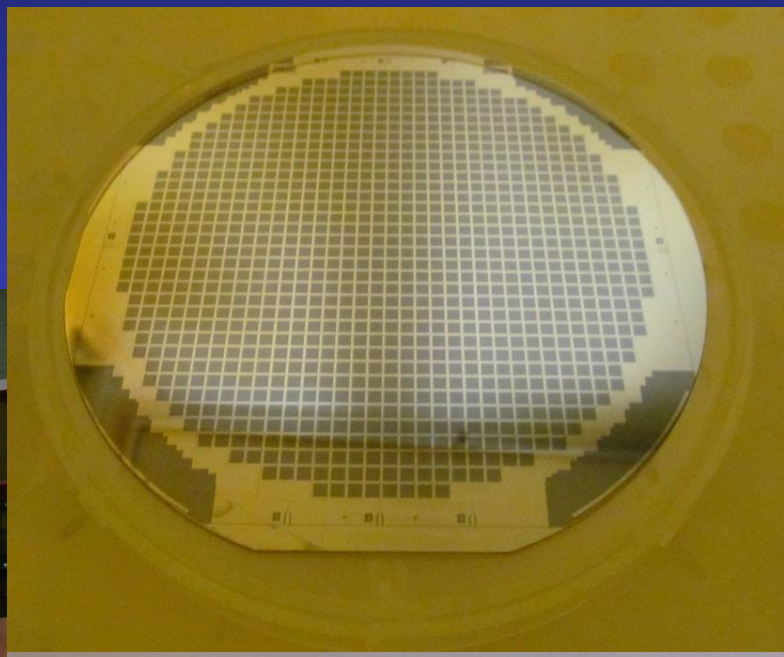
First Pieces of Antenna 8 as of January 2014

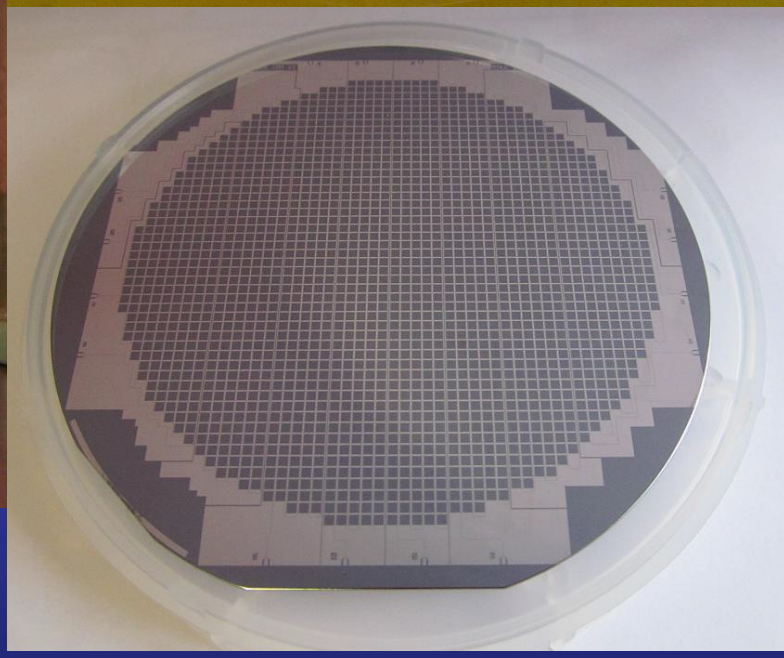
Delivery foreseen for October 2014

The Future Evolution of the IRAM 30m Telescope

- EMIR with high resolution backends for up to 64 GHz total bandwidth
- NIKA II, a dual band continuum imager with 6 arcmin FOV and polarization option.
- The 50 pixel 3mm Heterodyne array
- SHERA the 98 Pixel successor of HERA at 1.3 mm.

NIKA 2 Construction





Summary / Conclusions

- After developing the post ALMA technology, IRAM has started NOEMA construction employing this technology.

- NOEMA will provide an invaluable and unique tool for French astronomers.

- NOEMA first light will be in 2014 (Ant 7) with the following big step in 2015 when the 8th Antenna and the correlator POLYFIX will be commissioned.

- The synergy between NOEMA, the upgraded 30m and ALMA will be very high.

- The flexible character and performance of NOEMA and the 30m telescope will guarantee unique discovery space and at the same time enable groundbreaking survey programs.

- Political efforts concentrate now on organizing Phase 2

- In the next days IRAM will issue an Astronomer Fact Sheet which will allow you to make detailed decisions on your projects (Hows and and Whens).

NOEMA
(*Northern Extended Millimeter Array*)

Thank You for Your Attention