Status of EMIR Commissioning at the IRAM 30m telescope

(excerpt from presentation given to the SAC on 27./28.4.09)

Carsten Kramer
IRAM, Granada
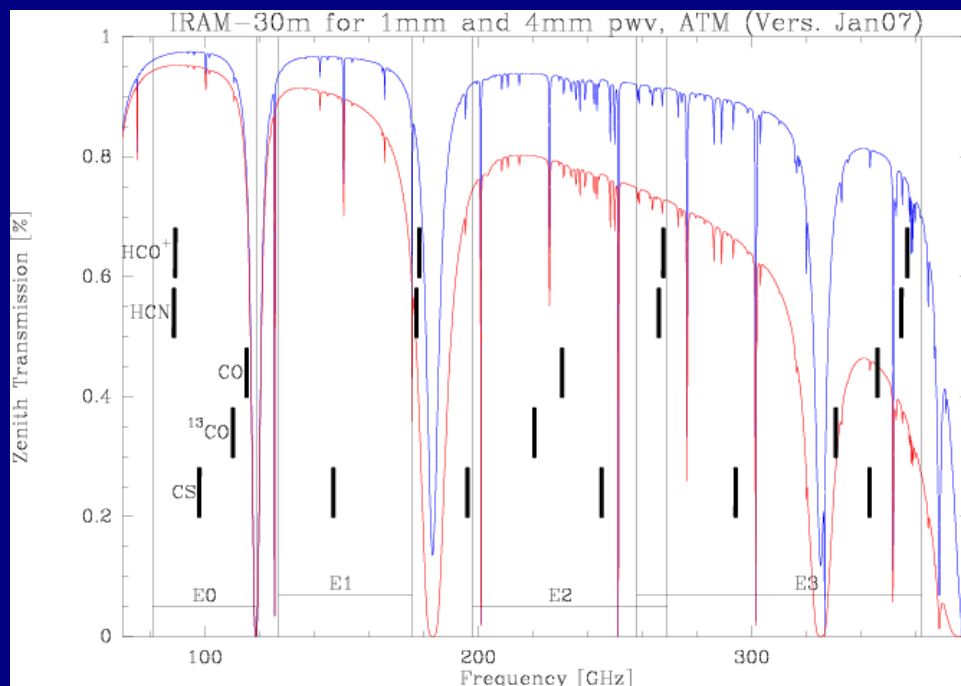
II. The EMIR has arrived

EMIR	Fsky	mixer	polar-	IF width	Trx	Gim	combinations			Trx
band	GHz	type	isation	GHz	K	dB	E0/2	E1/3	E0/1	K
E0	83-117	2SB	H/V	8	50	>10	X		X	65
E1	129-174	SSB	H/V	4	50	>10		X	X	65
E2	200-267	SSB	H/V	4	50	>10	X			65
E3	260-360	2SB	H/V	4	70	>10		X		85

	Type	Channel Width	Bandwidth	Receiver (width mode)
1 MHz	Filterbank	1 MHz	4x256 MHz, 2x512 MHz, or, 1x1GHz	EMIR
4 MHz	Filterbanks	4 MHz	8 or 9 x 1GHz	EMIR, either HERA1 or HERA2 (wide)
WILMA	Autocorrelator	2 MHz	16 or 18 x 930 MHz	EMIR, HERA (wide)
VESPA	Autocorrelator	3.3 kHz-1.25 MHz	10-512 MHz	EMIR, HERA (narrow)

16.3.2009

II. EMIR IF Processing

II. EMIR Commissioning

- Backends:
  4MHz, WILMA, VESPA

- Observing Modes:
  psw, wsw, bsw, fsw
  otf/psw, otf/fsw

- Intensity and Frequency
  calibration
  (IRC+10216, Scep, Polaris, W3OH, DR21, ...)

- Tuning to band edges of E0, E1, E2

- VLBI Test between EMIR E0 & PdB successful (21.4.)

- Alignment, Focus, Efficiencies

EMIR band	Fsky GHz	mixer type	polar-isation	IF width GHz	Trx K	Gim dB	combinations E0/2	E1/3	E0/1	Trx K
E0	83-117	2SB	H/V	8	50	>10	X		X	65
E1	129-174	SSB	H/V	4	50	>10		X	X	65
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Alignment
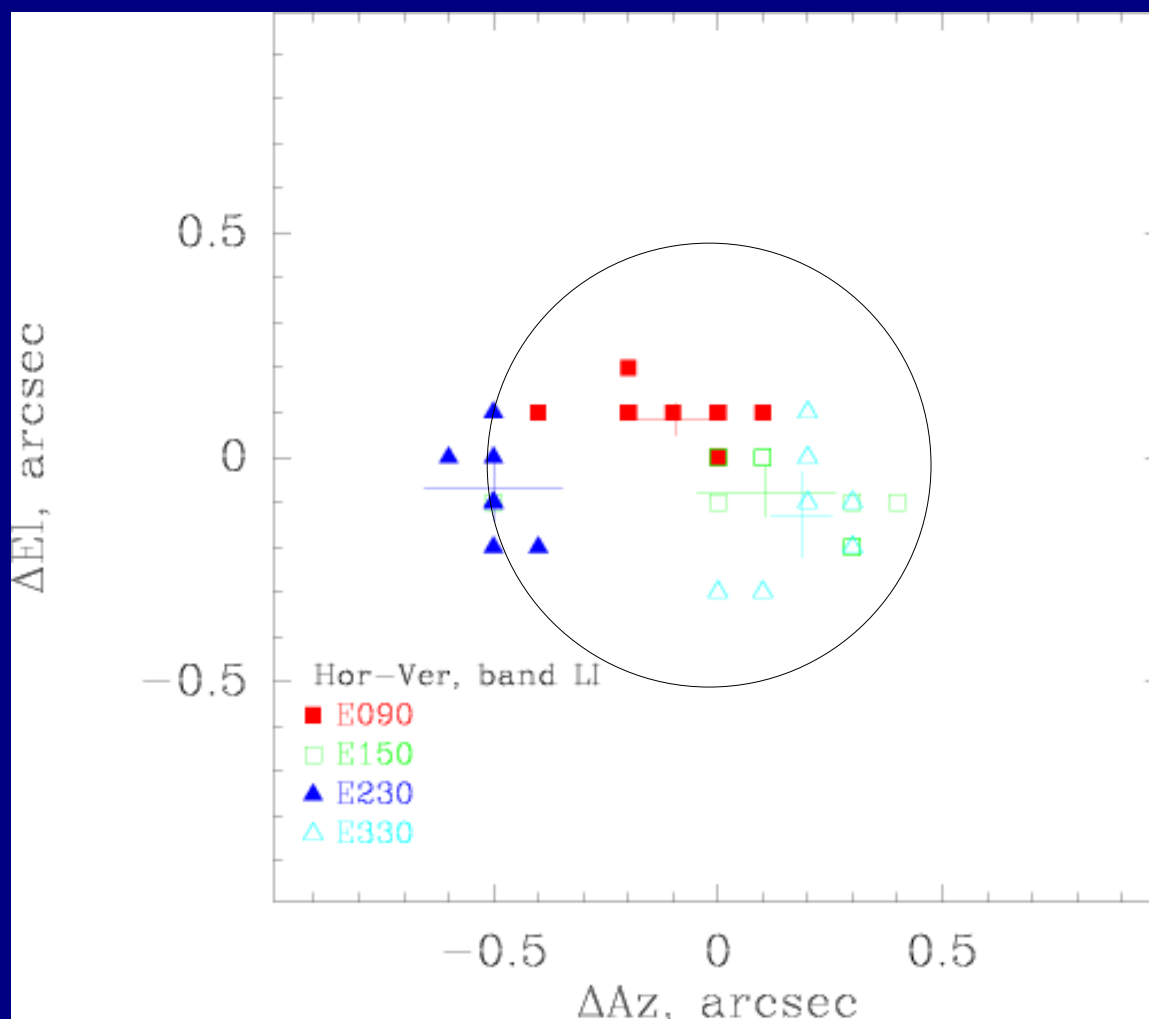
CHECK E1/E3

Nasmyth Offsets

Left Beam: -39.0"/+5.5" (E0, E2, E0/E2, E0/E1)
Right Beam: +51.0"/+5.5" (E1, E3, E1/E3)

Focus
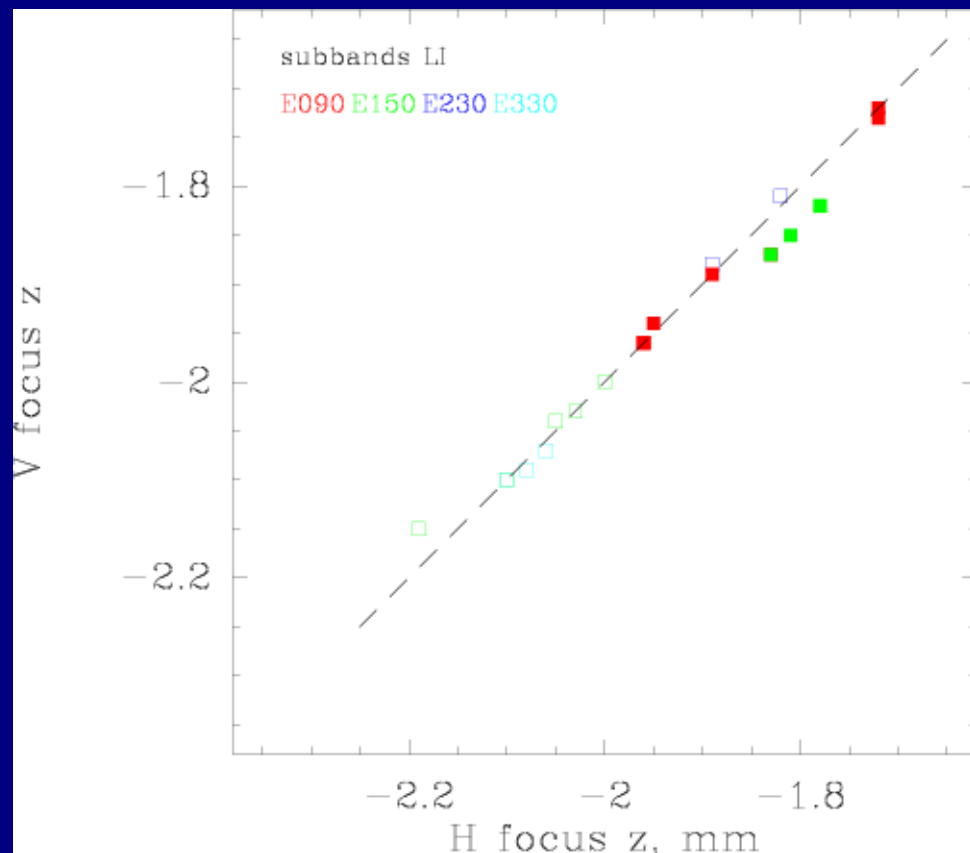
H/V
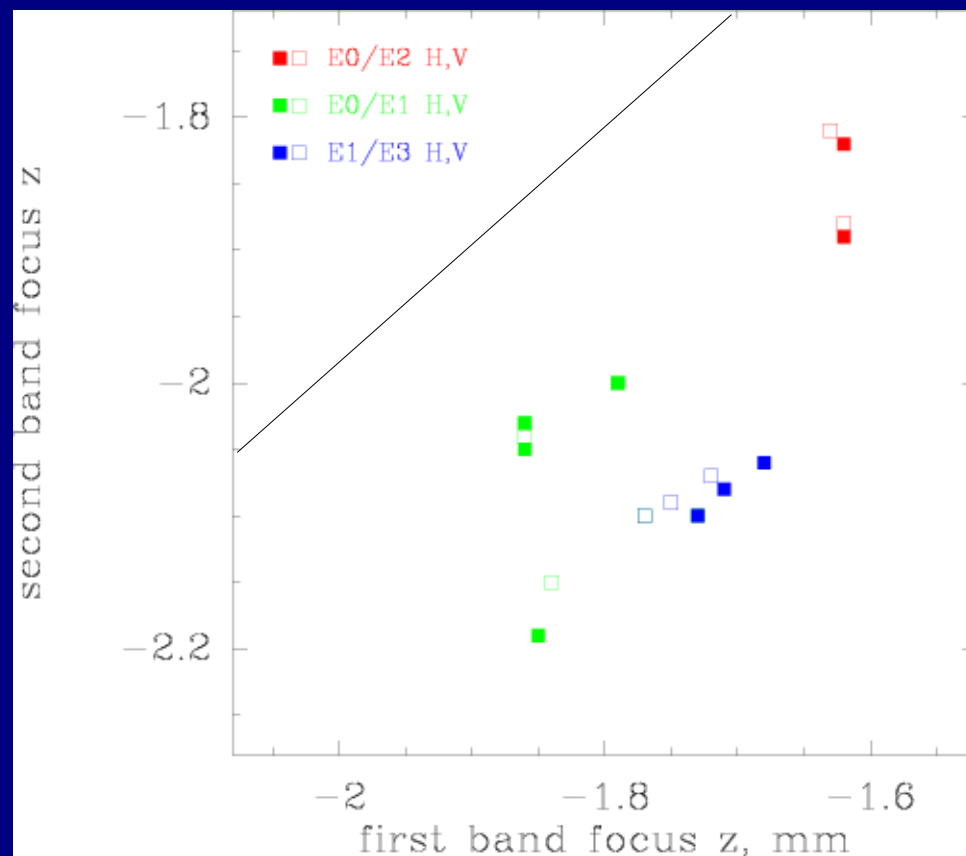
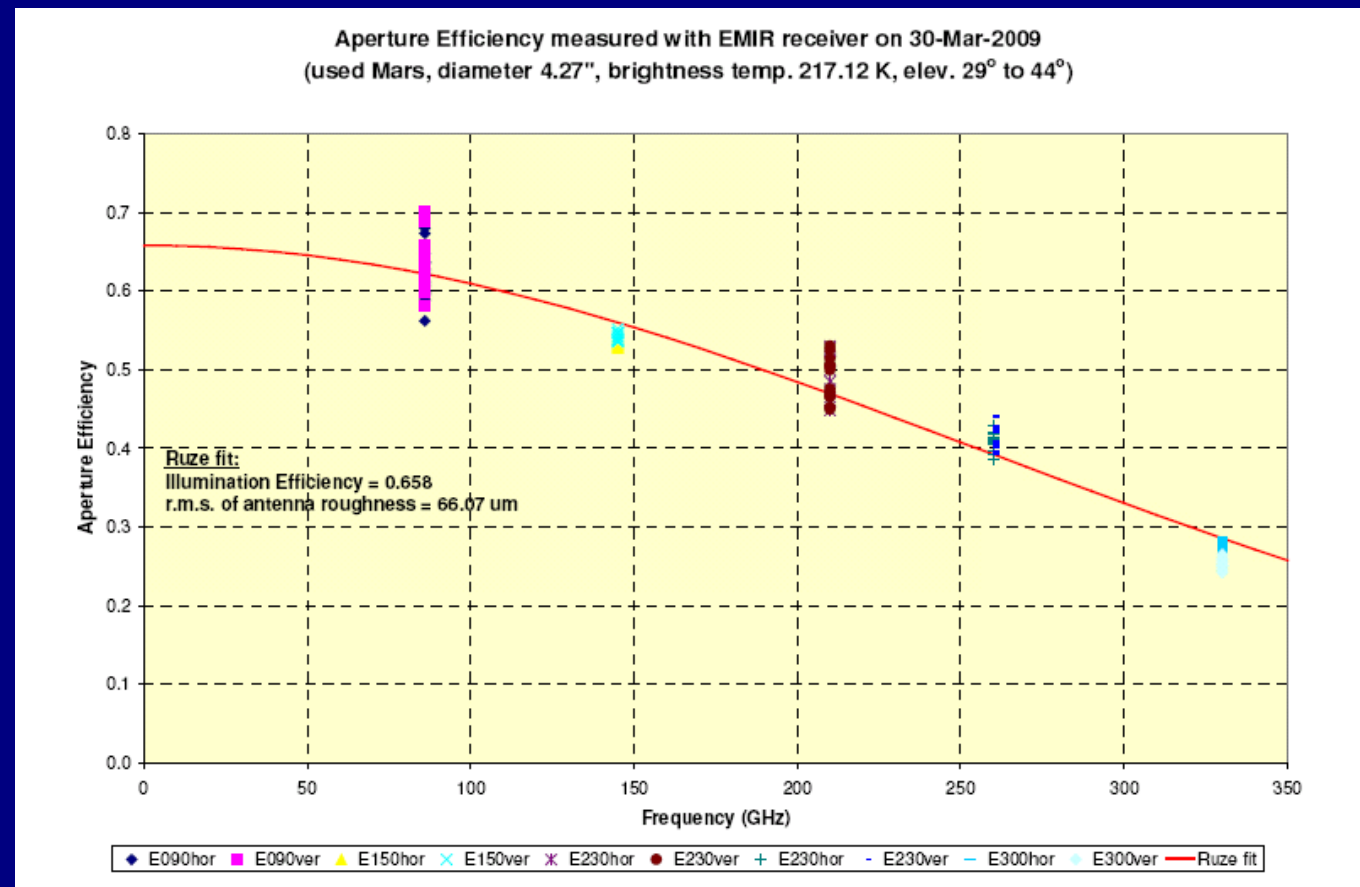Two bands

II. Telescope Efficiencies

Frequency [Ghz]	HPBW [arcsec]	Feff [%]	Beff [%]	Aeff [%]
86	29	95	81	63
142	16	93	62	57
330	7	89	32	29

from Mars (4.4.09, 43deg Elevation, CK)
and from skydips

Ellipticity of HPBWs:
>90%

Results from 30.3.09
JP):

Aperture Efficiency measured with EMIR receiver on 30-Mar-2009
(used Mars, diameter 4.27", brightness temp. 217.12 K, elev. 29° to 44°)

Ruze fit:
Illumination Efficiency = 0.658
r.m.s. of antenna roughness = 66.07 um

Telescope Efficiencies

Frequency [Ghz]	HPBW [arcsec]	Feff [%]	Beff [%]	Aeff [%]
86	29	95	81	63
142	16	93	62	57
330	7	89	32	29

from Mars (4.4.09) and from skydips
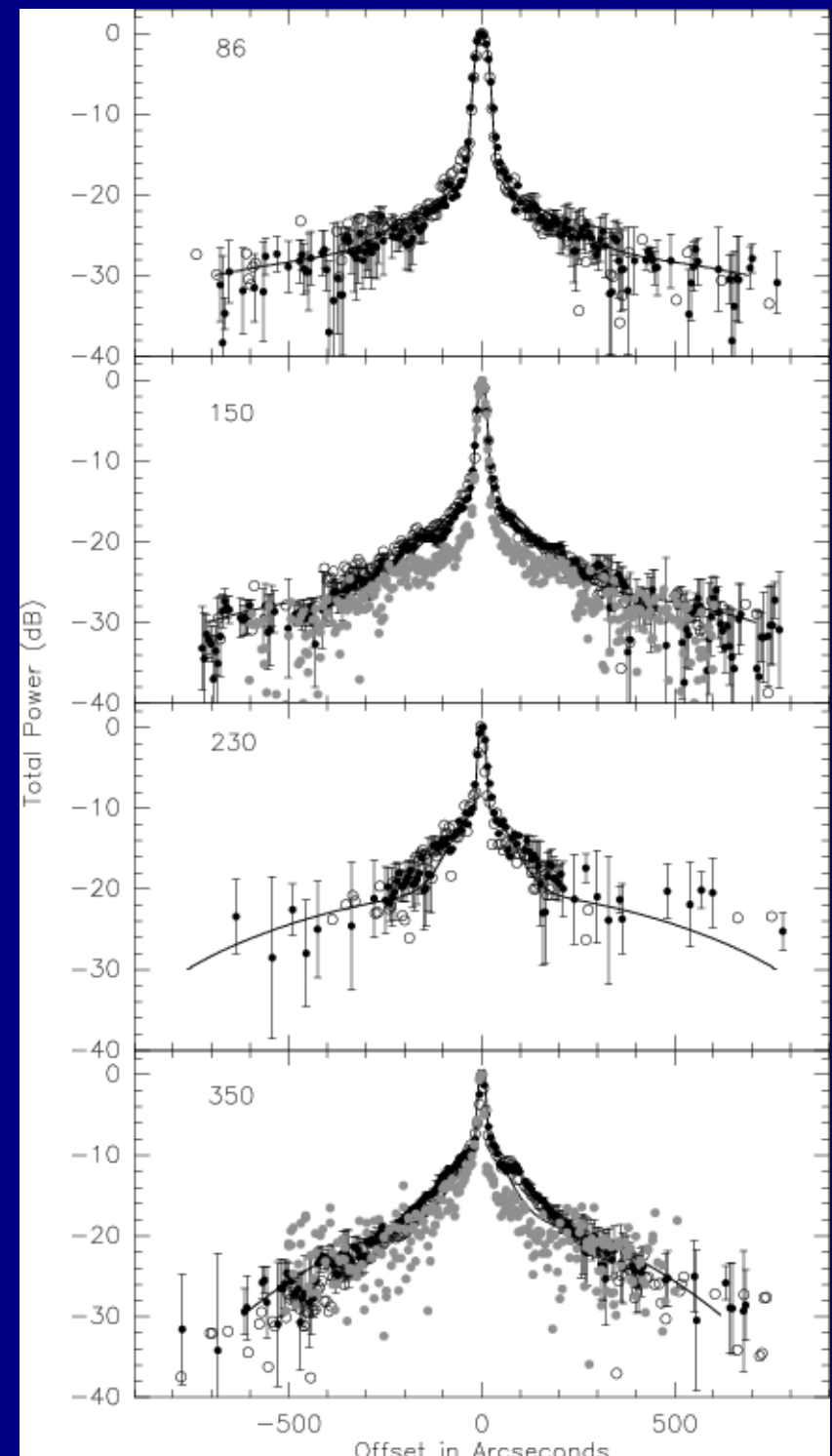
Beam shapes (differentiated moon edge)

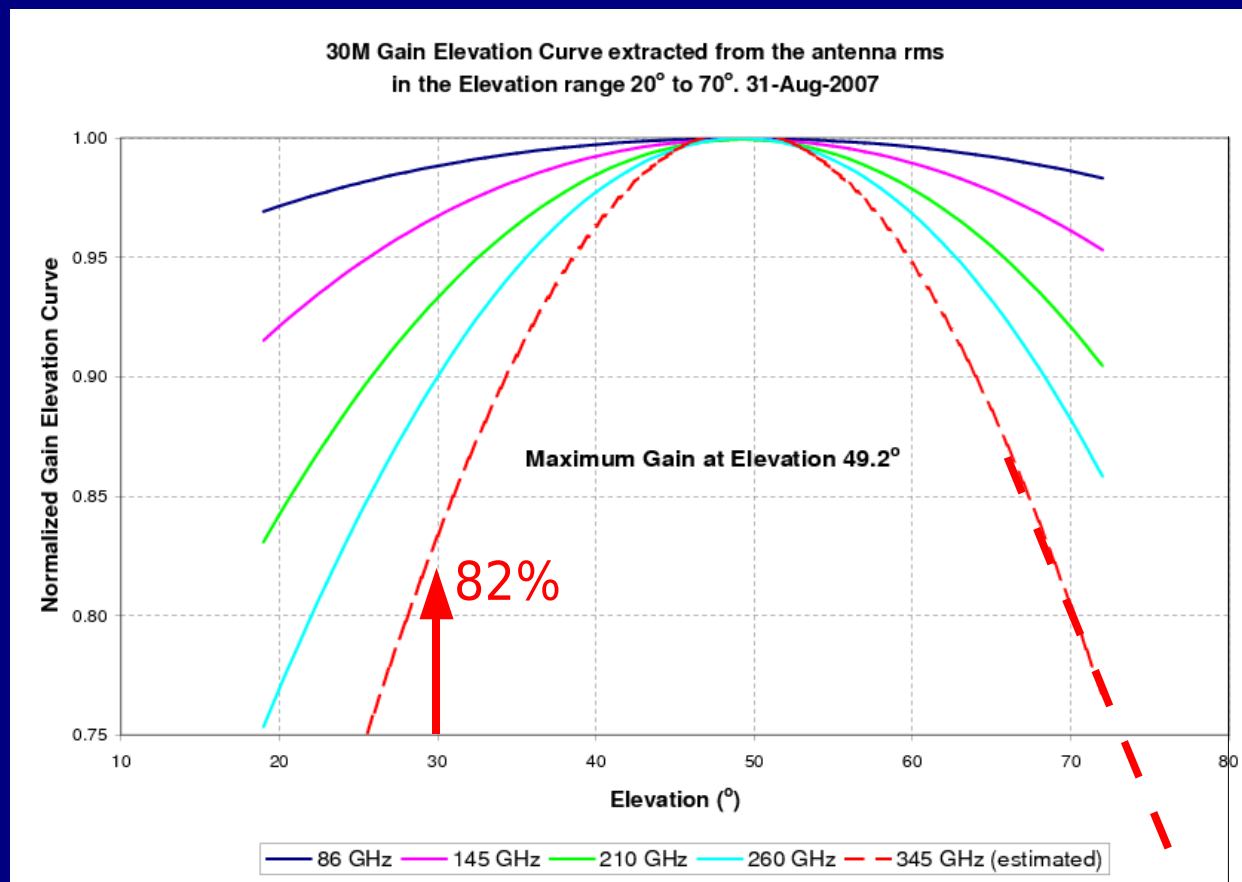**1998** (Greve et al., A&A)
2009
(prel. results from EMIR Commissioning)

next steps:
- confirm Aeff at 345 GHz
- full moon scans under stable conditions

III. Gain elevation curve

30M Gain Elevation Curve extracted from the antenna rms in the Elevation range 20° to 70°. 31-Aug-2007

Maximum Gain at Elevation 49.2°

82%

65%

86 GHz — 145 GHz — 210 GHz — 260 GHz — 345 GHz (estimated)

The aperture efficiency is ~30% at 43deg Elevation, but is predicted to drop by 65% to ~20% at 80deg Elevation. Check with Mars in 7/09.

IRAM–30m Telescope: 32 GHz Spectrum of Orion
Eight MIxer Receiver EMIR (2.4.2009)
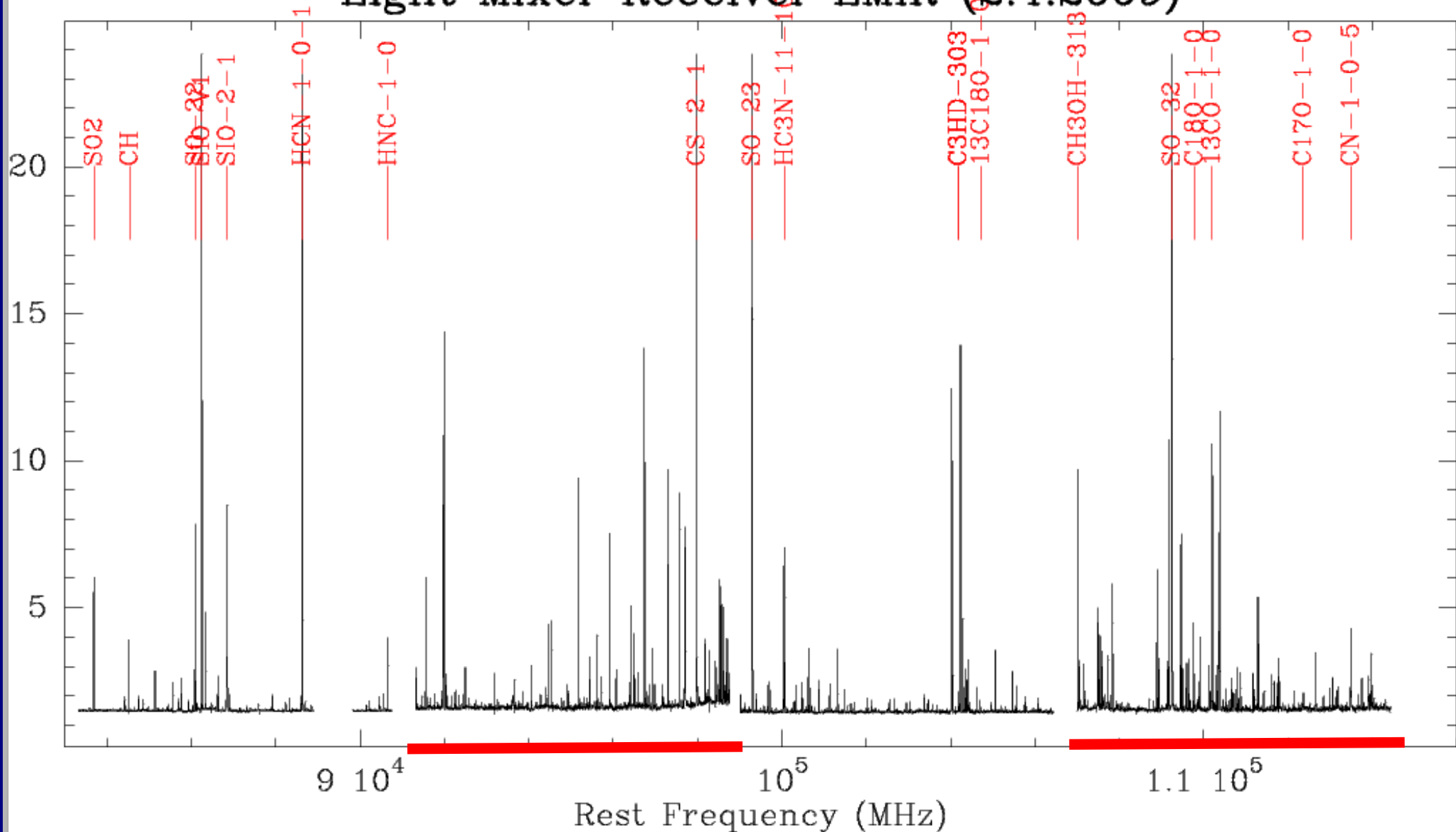
WILMA 2x8GHz LSB & USB simultaneously (one pol. only)

4 EMIR bands: E090 E150 E230 E330
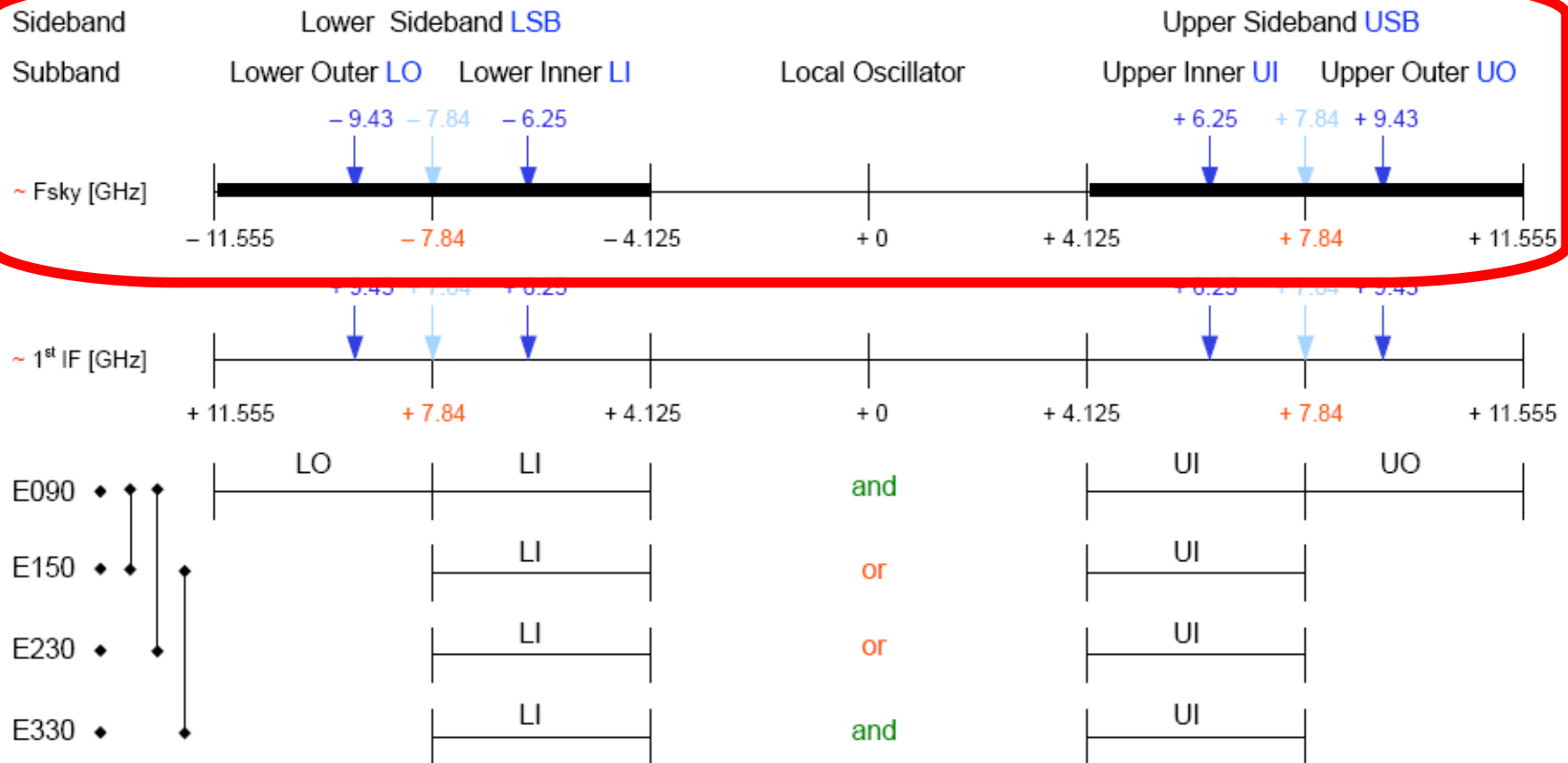For each of the 4 bands, 2 polarizations: Horizontal Vertical (same Local Oscillator → same frequency ranges)

Sideband		Lower Sideband LSB					Upper Sideband USB	
Subband		Lower Outer LO	Lower Inner LI		Local Oscillator		Upper Inner UI	Upper Outer UO

~ Fsky [GHz]

−9.43 −7.84 −6.25   +6.25 +7.84 +9.43

−11.555   −7.84   −4.125   +0   +4.125   +7.84   +11.555

~ 1st IF [GHz]

+9.43 +7.84 +6.25   +6.25 +7.84 +9.43

+11.555   +7.84   +4.125   +0   +4.125   +7.84   +11.555

		LO	LI				UI	UO
E090	◆ ◆ ◆	LO	LI		and		UI	UO
E150	◆ ◆ ◆		LI		or		UI	
E230	◆ ◆		LI		or		UI	
E330	◆ ◆		LI		and		UI	

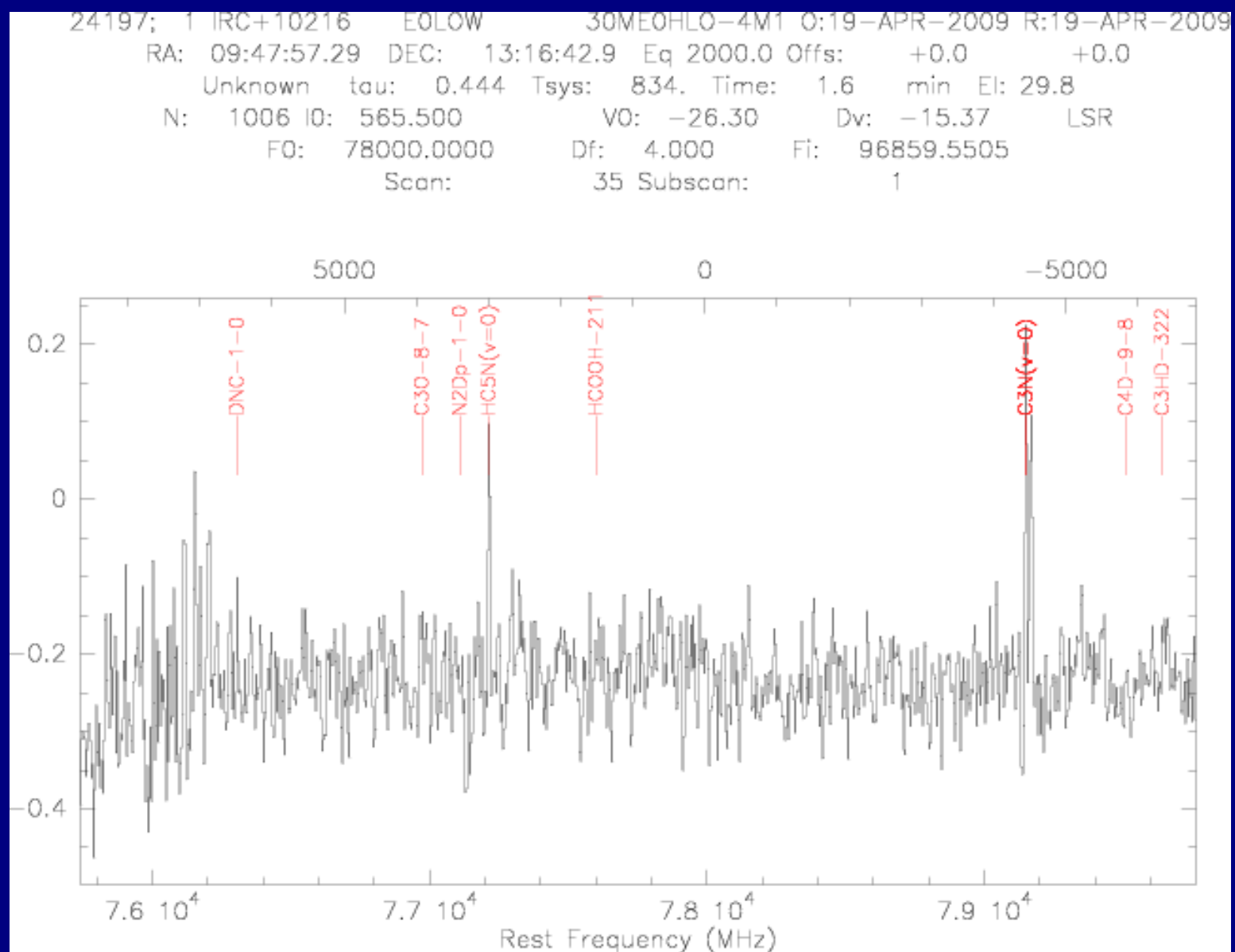Possible Band combinations: E090 E150 E230 E330 E090&E150 E090&E230 E150&E330
Counting everything: at most 4 sub bands of 4 GHz width. Allowed combinations: see SN's IF switch box
WILMA: the I and O sub bands overlap by 0.1 GHz: I from 4.125 to 7.845; O from 7.835 to 11.555 GHz

Hans Ungerechts   3/11/09

Lower Edge of 3mm Band

Call for Proposals: 81GHz
Commissioning & Lab tests: ~76GHz

Next steps and Timeline

- WILMA switches, HERA(!), 1MHz, NCS(start scan)
  reduce measurements of stability & ripples

- Start of regular observations Tuesday, 28.4.

- During the Summer Semester 2009:
  - **E3** Commissioning (LO, ...)
  - **Polarimetry** Commissioning
    (VESPA parallel mode, external calibration)
  - Receiver **Gain ratios** across the bands
  - **Atmospheric calibration** across the bands

Friends of the project

Granada Astronomers (this semester)

Template observing scripts