

The 9th Meeting of Asia for Mushroom Science

October 25(Wed) - 28(Sat), 2017 BAREVE Hotel, Jeju, Korea

•주최: (사)한국버섯학회, 국립원예특작과학원 공동 •주관: 조선대학교, 제주대학교, 경상북도농업기술원 공동 •후원: 농촌진흥청, 한국버섯생산지연합회, 한국종균생산협회, 버섯정보신문, 울간버섯, 에코랜드, 제주컨벤션뷰로

EATING VLBI observations from early time to present

The 3rd EATING VLBI Workshop, Oct/30-Nov/1 2017, Jeju

Kazuhiro Hada (NAOJ), Yoshiaki Hagiwara (Toyo Univ.),
Marcello Giroletti (IRA), Matteo Stagni (IRA), Bong Won Sohn (KASI)
Tomoaki Oyama (NAOJ), Sejin Oh (KASI), Gabriele Giovannini (IRA),
on behalf of EATING experiment folks

Why “EATING”?

- Gabriele (boss) sent a “very serious” email to Marcello, Monica and me
- “Japan-Korea-Italy WS”
- “EATING VLBI”
 - Still remains a “dummy title”
- We are still waiting for final approval from our boss!



workshop 受信トレイ x 1.reply x it x V x

Gabriele Giovannini <ggiovann@ira.inaf.it> July/12/2012
To Kazuhiro, Marcello, Monica

We need to have a draft of the program of the ws to start...here is just to start please send me your suggestions before the end of this week

=====
A Japan-Korea-Italy ws:

The main scope of the mini-ws will be to summarize

Marcello Giroletti <giroletti@ira.inaf.it>
To ggiovann, Kazuhiro, Monica

First dummy idea for a title:

East Asia To Italy: New Generation VLBI → Eating VLBI!

yum yum :)

Kazuhiro Hada <hada@ira.inaf.it>
To ggiovann, Monica

East Asia To Italy: New Generation VLBI → Eating VLBI!

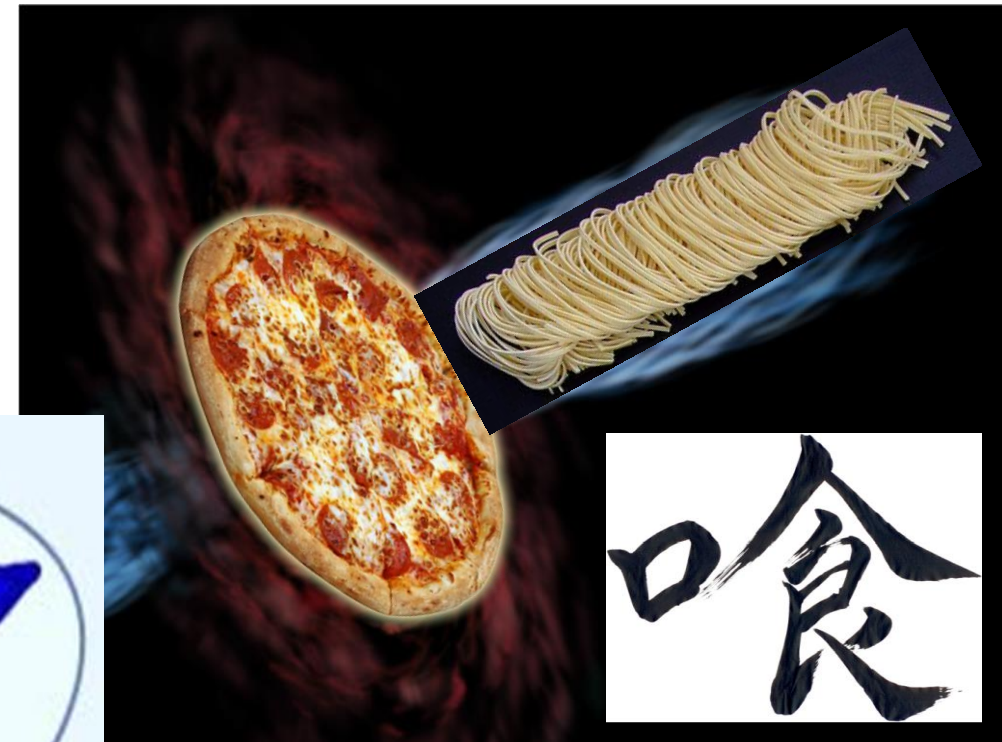
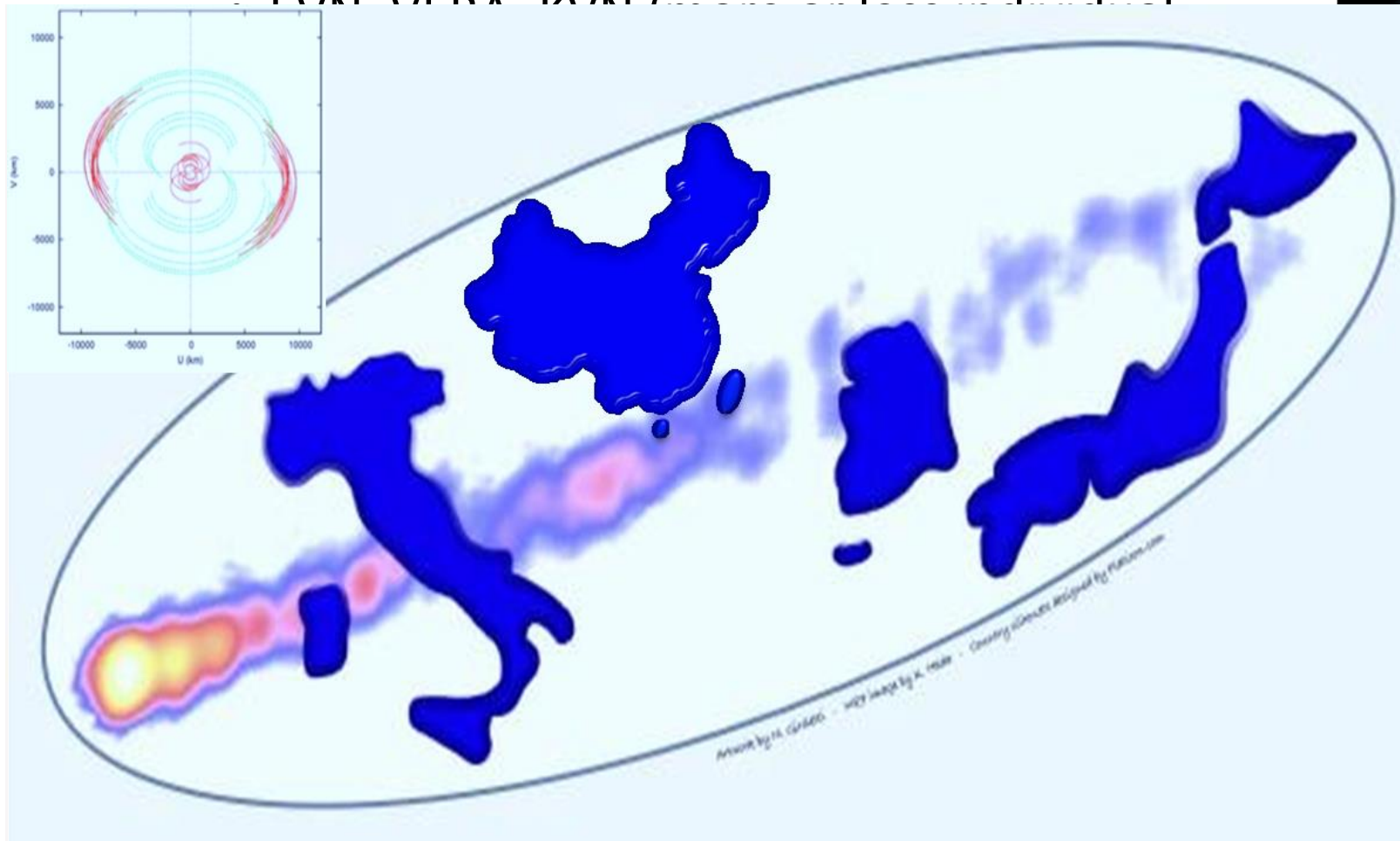
Kazuhiro Hada <hada@ira.inaf.it>
To ggiovann, Kazuhiro

Kazuhiro Hada <hada@ira.inaf.it>
To ggiovann, Monica

...ed the acronym but not the title, here's another solution:

East Asia To Italy: Nearly Global VLBI → Eating VLBI!

- First bite (Oct/2012)
 - Italy, Japan, Korea, Australia
 - ~40 participants, 31 talks
 - To know each other better



Second bite (Oct/2014)

- Italy, Japan, Korea, Australia, Spain, Germany
- 44 participants, 35 talks
- IVN fringes, KaVA activities
- Many papers through collaboration

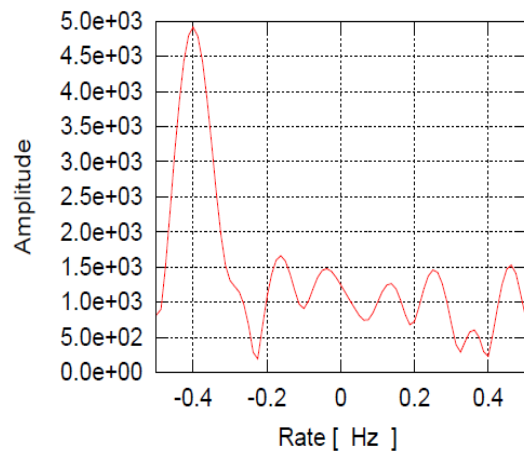
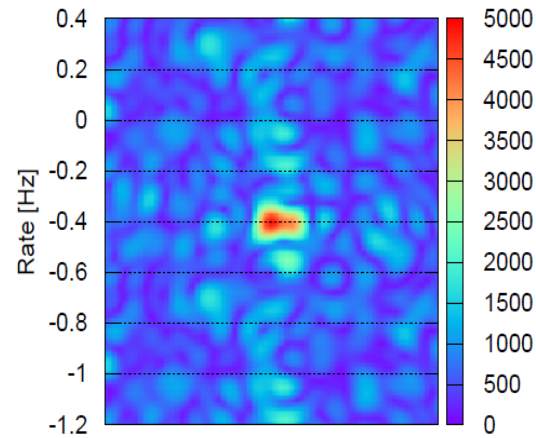
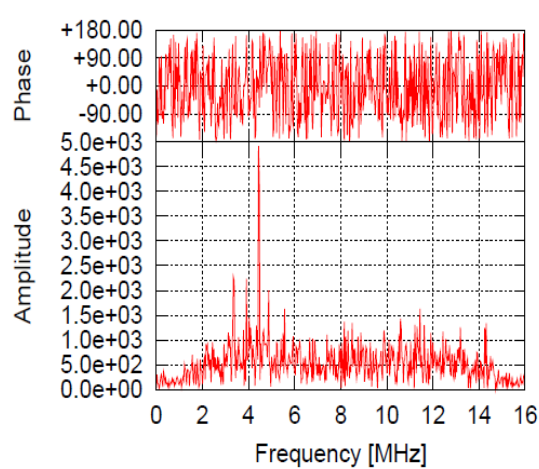
Early EATING experiments: Italy-VERA

- 2013/Feb/19
 - VERA-Noto, 22GHz, 1Gbps, a few hrs
 - => Failed: Noto receiver not cooled
- 2013/Apr/9
 - Noto 22GHz receiver broken => Postponed
- 2013/Apr/22
 - VERA-Noto, 43GHz, 1Gbps
 - Noto recorder trouble => Postponed
- 2013/May/22
 - VERA-Noto, 43GHz, 1Gbps, a few hrs
 - => Fringes not detected
- 2015/Feb/19
 - VERA-McNtSr, 22GHz, 1Gbps, a few hrs
- 2016/Apr/5
 - VERA-McNtSr, 22GHz, 1Gbps, ~10hrs

Feb/2015 test: first Italy-VERA fringes!

IRA DiFX (3C84)

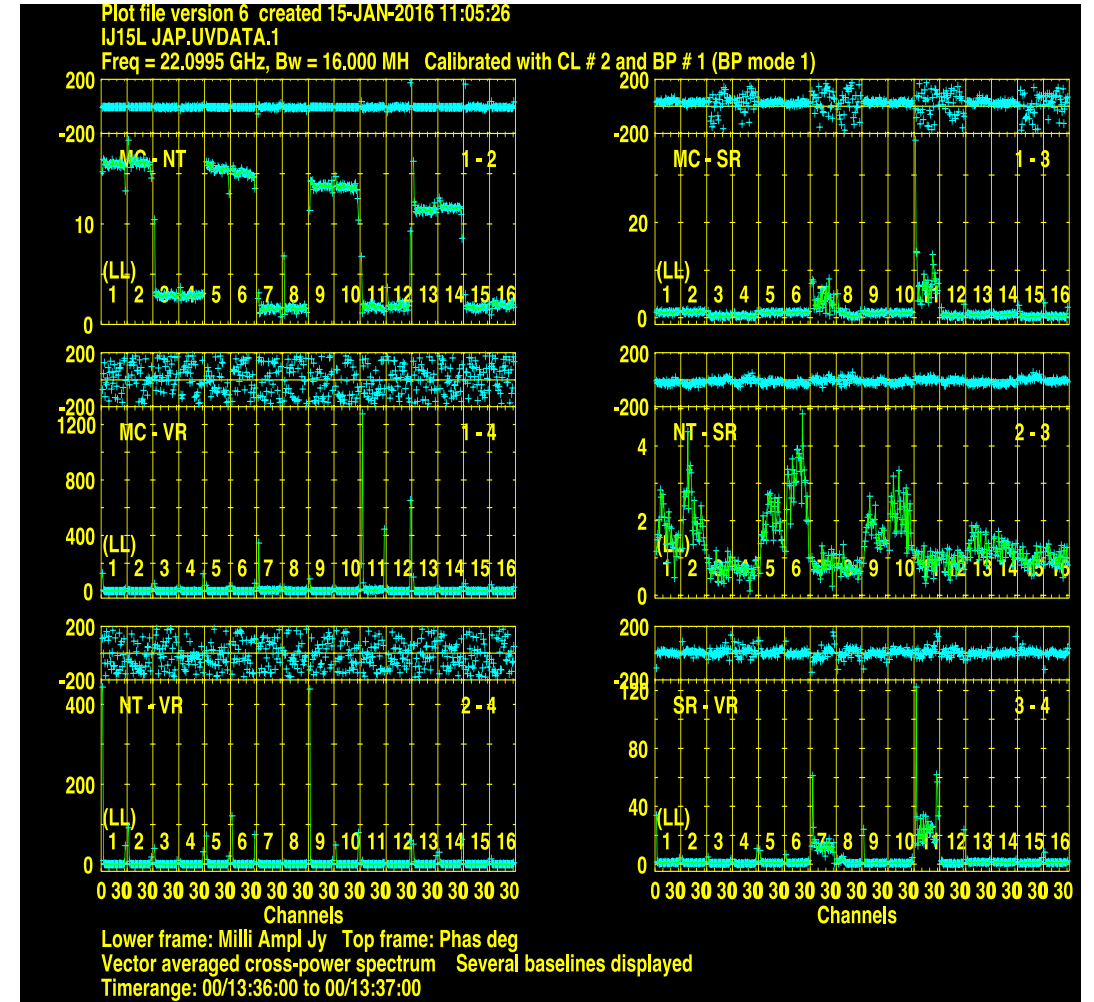
Mizusawa correlator (Orion-KL)



Frequency [MHz]

```

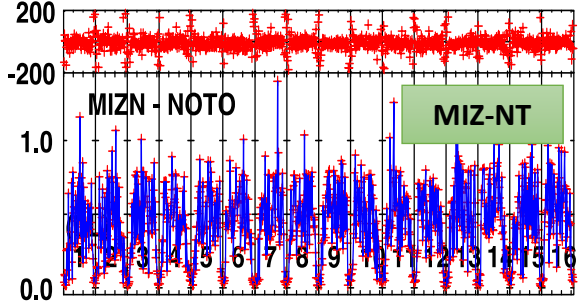
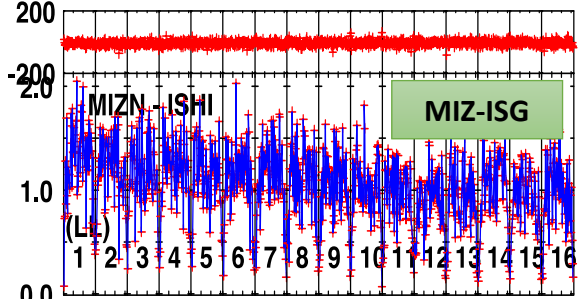
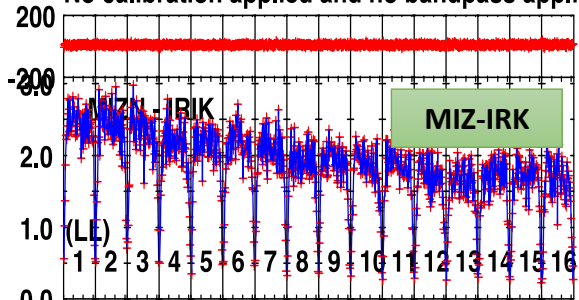
Epoch      : 2015/050 14:38:01
Station-1  : IRIKI
Station-2  : NOTO
Source     : ORION-KL
Length     : 10.000000 [sec]
Sampling   : 32000000 [sps]
Frequency  : +22227.490000 [MHz]
Peak Amp   : 491451.202808 [%]
Peak Phs   : 16.455231 [deg]
Peak Freq  : +4.437960 [MHz]
Rate       : -400.422668 [mHz]
SNR        : 19.432445
    
```



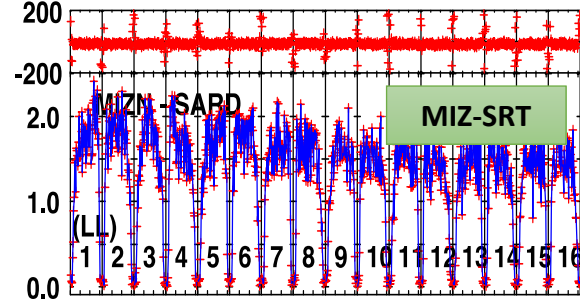
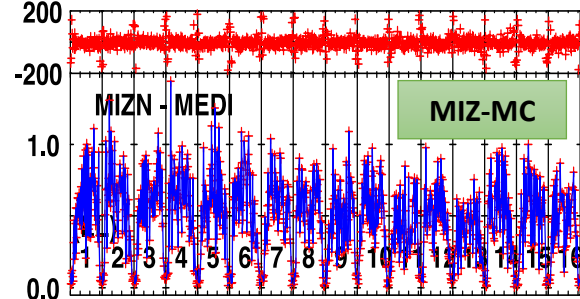
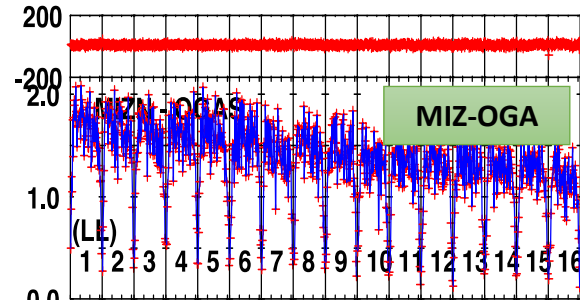
The first fringes were not so clean as we hoped...

Apr/2016 test

Plot file version 1 created 08-DEC-2016 16:03:40
 3C84 ITA-JAP2016.SUB SP.2
 No calibration applied and no bandpass applied



A 10sec scan of 3C84



Lower frame: Ampl Jy Top frame: Phas deg
 Vector averaged cross-power spectrum Several baselines displayed
 Timerange: 00/08:20:45 to 00/08:20:53

- Finally clean fringes over the whole IF!
- Thanks to...



Spring 2017: a big jump



Genuine EATING VLBI has finally come true!

From KaVA to EAVN to EATING campaign

	Date	UT time	Target	Freq.	Stations
1	3/12	18:55 – 00:55 (6hr)	SgrA	43GHz	KaVA7, TM
2	3/18	12:45 – 19:45 (7hr)	M87	22GHz	KaVA7, TM, UR, HT, KS
3	3/19	11:40 – 18:40 (7hr)	M87	43GHz	KaVA7, TM
4	3/27	13:10 – 23:10 (10hr)	M87+SgrA	43GHz	KaVA7, TM
5	4/3	13:20 – 23:20 (10hr)	M87+SgrA	22GHz	KaVA7, TM, UR, HT, KS, MC, NT
6	4/4	12:35 – 22:40 (10hr)	M87+SgrA	43GHz	KaVA7, TM
7	4/9	12:20 – 22:20 (10hr)	M87+SgrA	43GHz	KaVA7, TM, NY
8	4/14	12:00 – 22:00 (10hr)	M87+SgrA	43GHz	KaVA7, TM
9	4/17	11:45 – 18:45 (10hr)	M87	22GHz	KaVA7, TM, UR, HT, KS, SJ, MC, NT
10	4/18	11:40 – 21:45 (10hr)	M87+SgrA	43GHz	KaVA7, TM
11	4/24	09:20 – 16:20 (7hr)	M87	22GHz	KaVA7, TM
12	4/25	09:15 – 16:15 (7hr)	M87	43GHz	KaVA7, TM
13	4/26	15:55 – 21:55 (6hr)	SgrA	43GHz	KaVA7, TM, SJ
14	5/10	08:20 – 17:20 (7hr)	M87	22GHz	KaVA7, TM, MC
15	5/11	08:15 – 17:15 (7hr)	M87	43GHz	KaVA7, TM
16	5/25	14:00 – 20:00 (6hr)	SgrA	43GHz	KaVA7, TM
17	5/26	07:15 – 16:15 (7hr)	M87	43GHz	KaVA7, TM

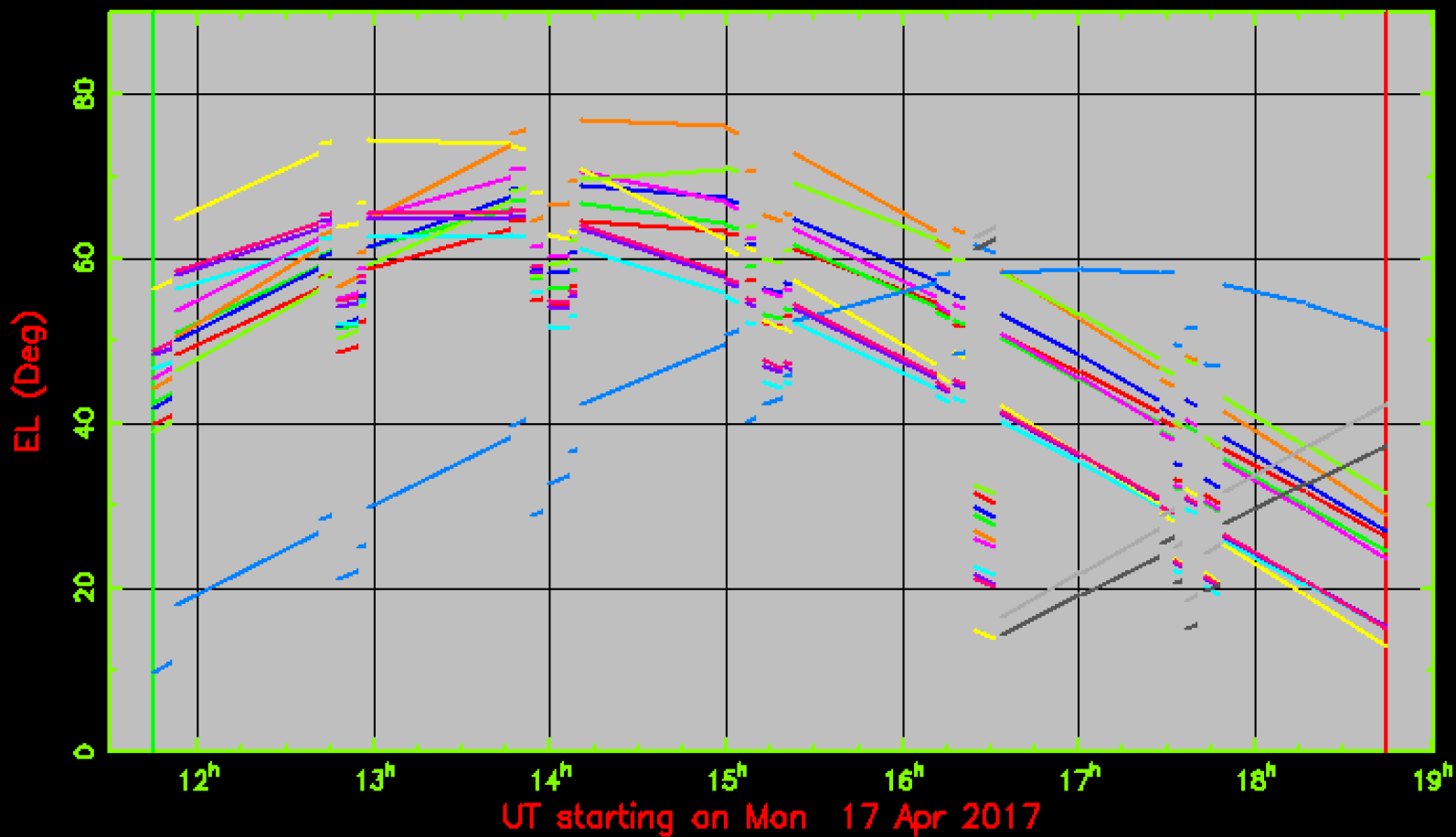
EHT+ALMA

TM: Tianma, UR: Urumqi, SJ: Sejong, HT: Hitachi, KS: Kashima, NY: NRO45, MC: Medicina, NT: Noto

M87

EL-time

Experiment code: a17107a



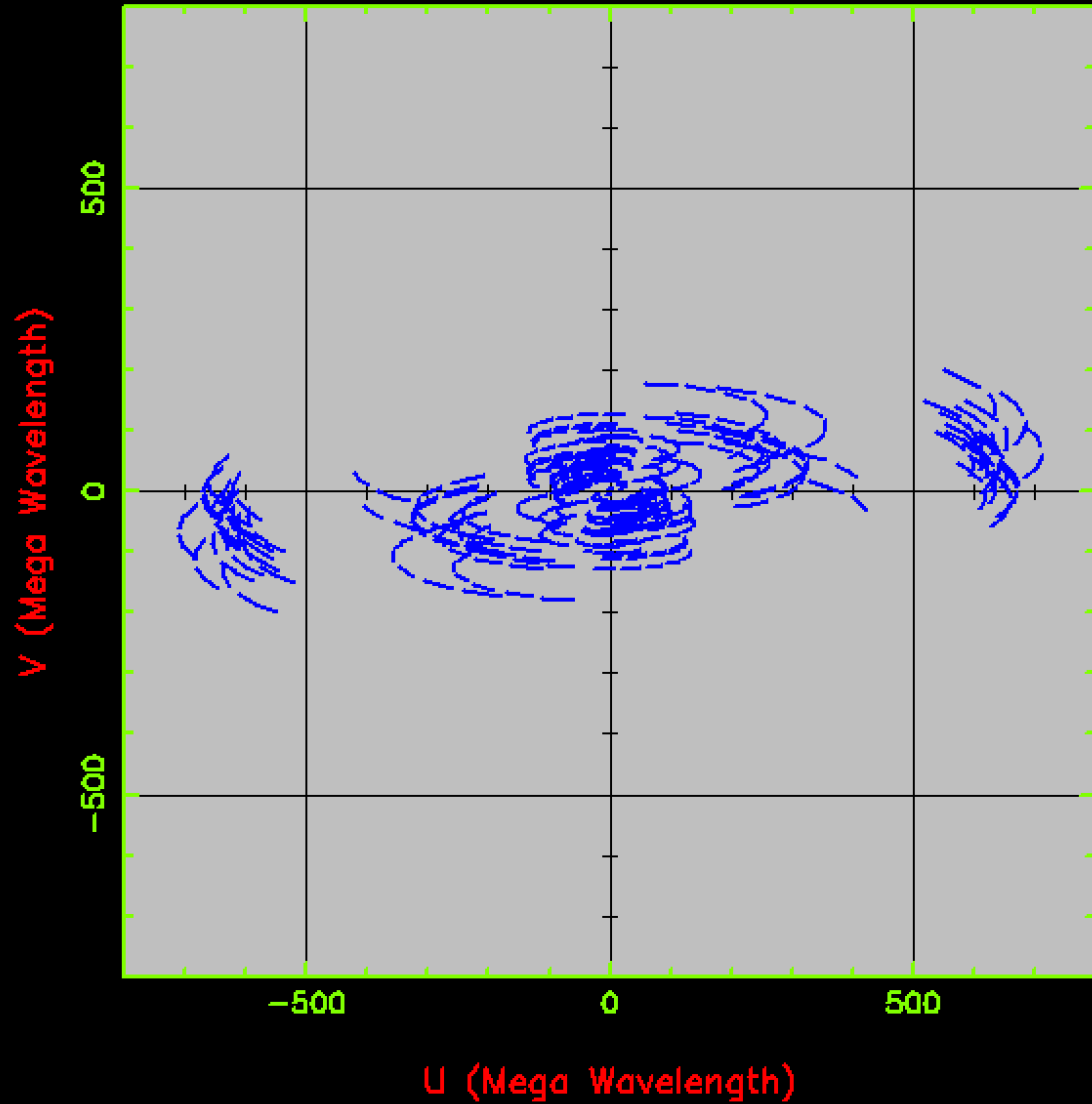
KVNYS	VERAOGSW	KASHIMA	
KVNUS	VERAISGK	MEDICINA	3C273
KVNTN	TIANMA65	NOTO	M87
VERAMZSW	URUMQI		M84
VERAIRIK	HITACHI		More

UV coverage

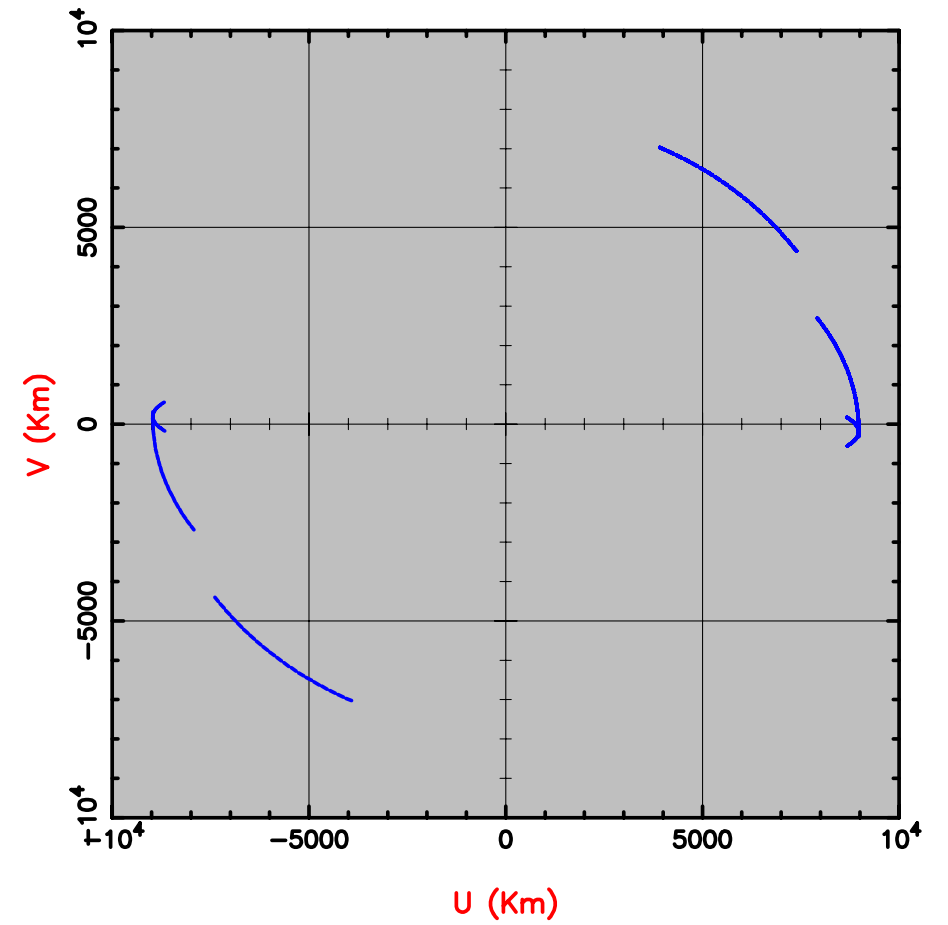
UV Coverage for $\alpha 17107a$

KVNYS
KVNUS
KVNTN
VERAMZSW
VERAIRK
VERAOGSW
VERAISGK
TIANMA6S
URUMQI
HITACHI
KASHIMA
MEDICINA
NOTO

MB7



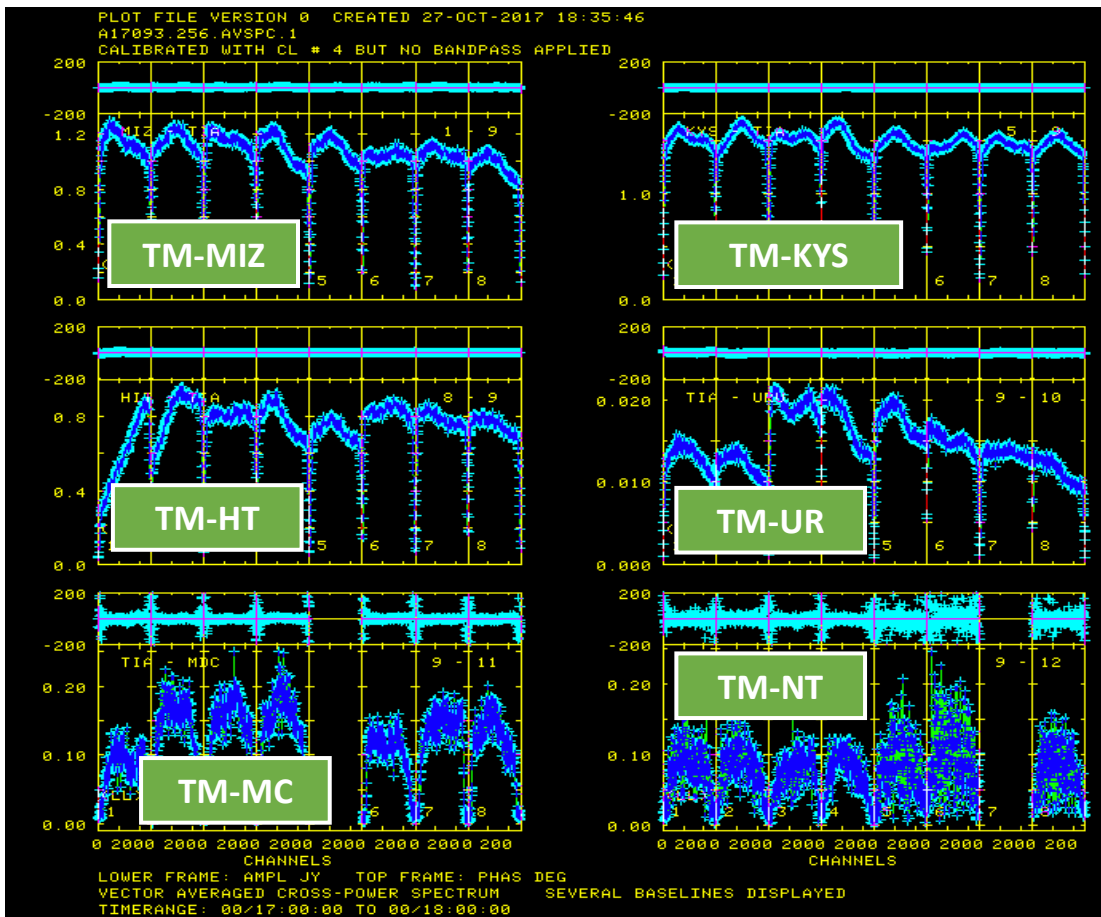
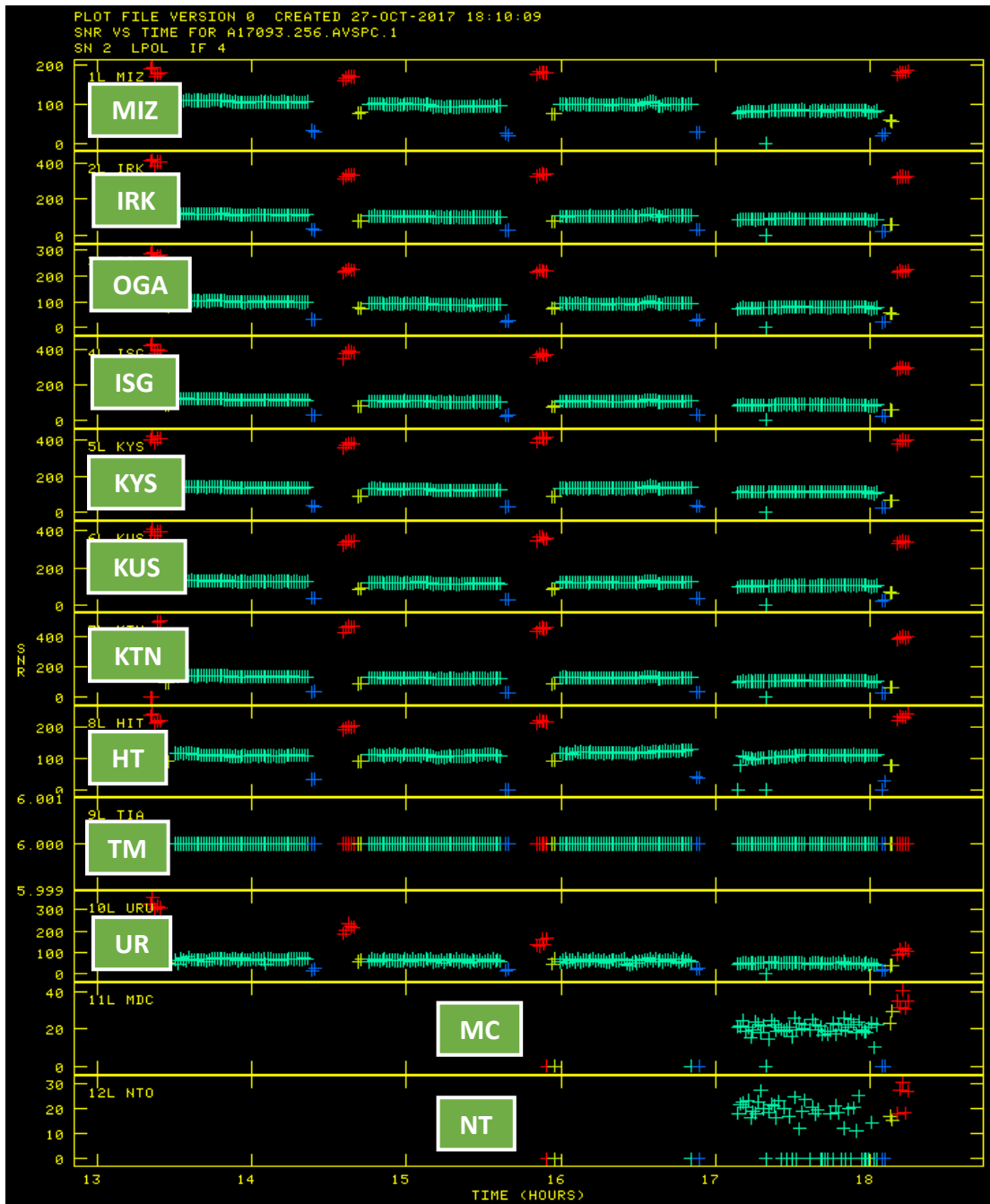
1st Italy-VERA test in 2013/Feb !



FRINGE SNR with time (3C273, M87)

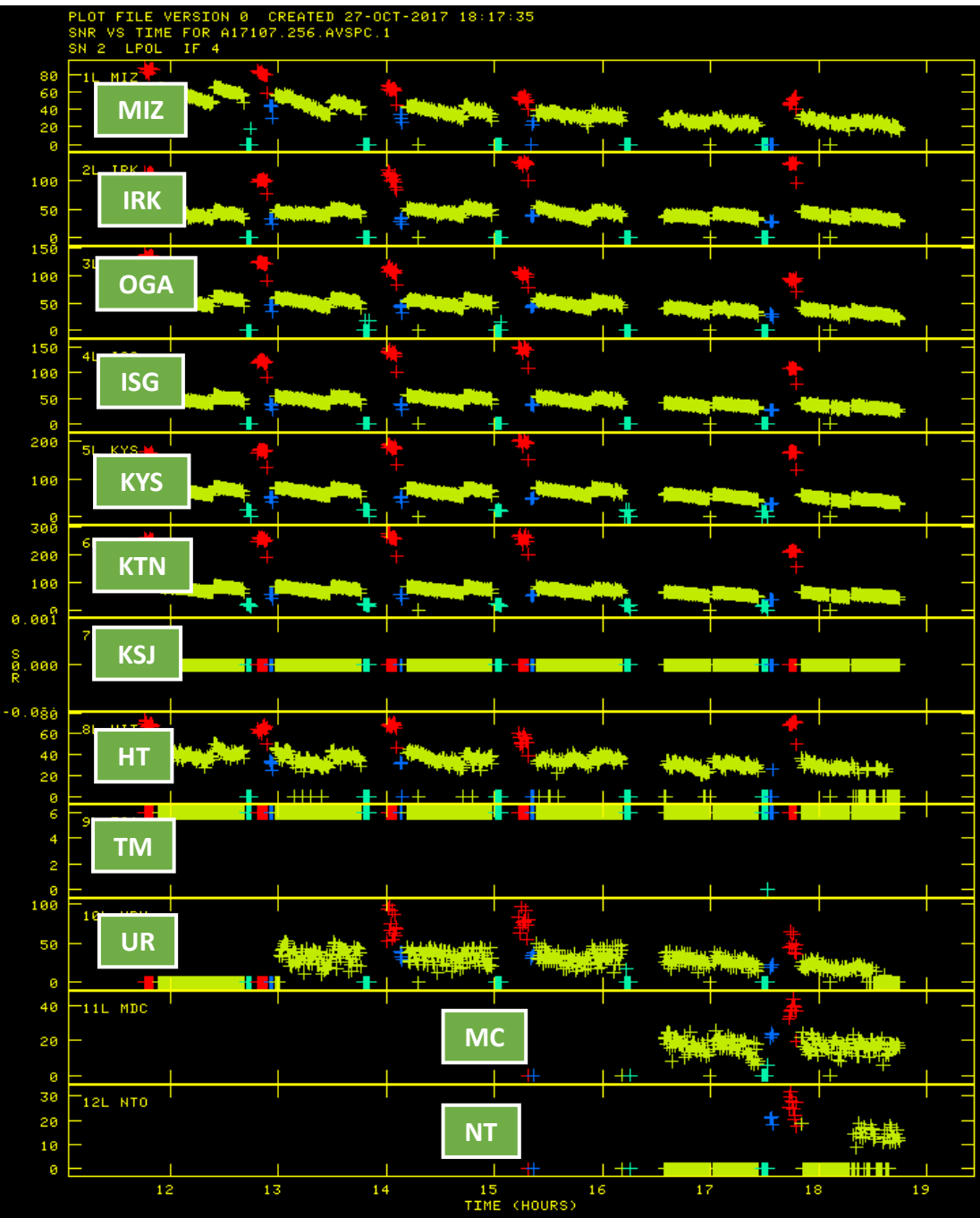
Preliminary results (Apr/3 data)

- EATING fringes detected at very good SNRs over the whole array!
- MC/NT: SNR $\sim 30-40$ (3C273), ~ 20 (M87)
- REFANT= Tianma, IFs not combined yet



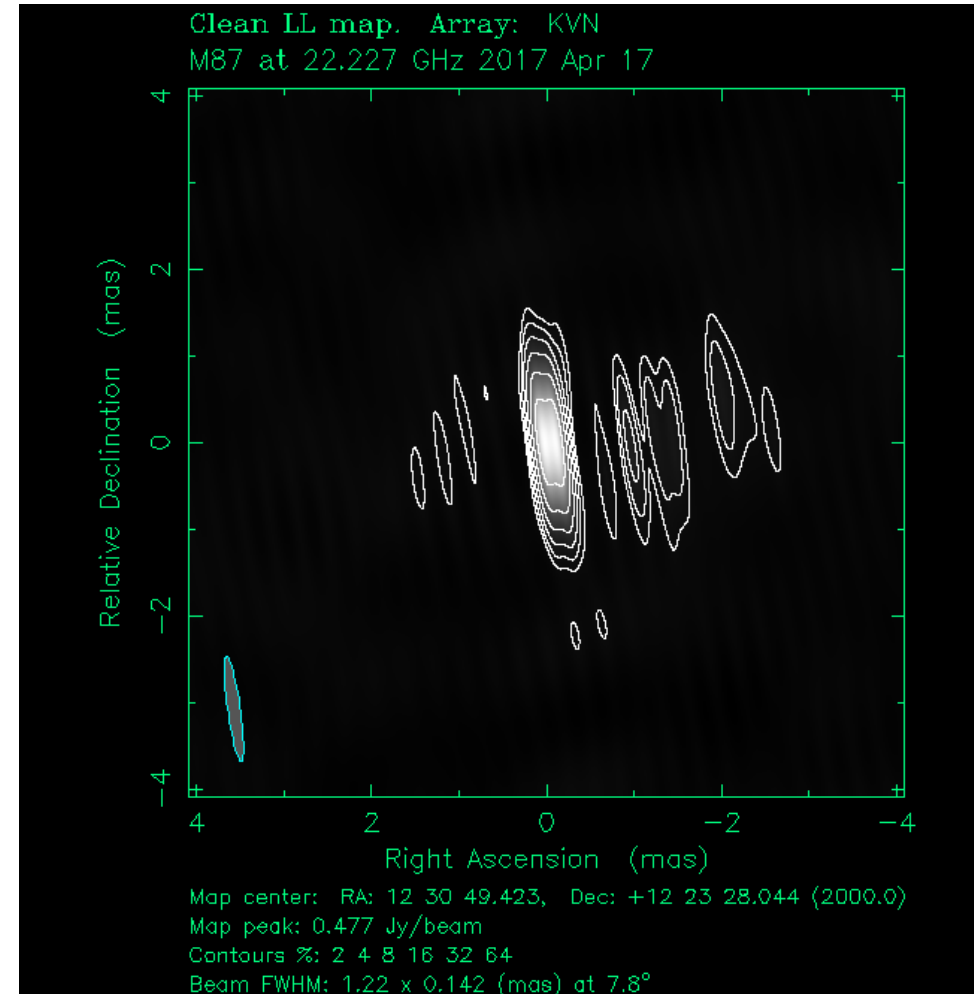
M87 POSSM averaged for the last 1hr

FRING SNR with time (3C273, M87)



Preliminary results (Apr/17 data)

By Won-san's effort!

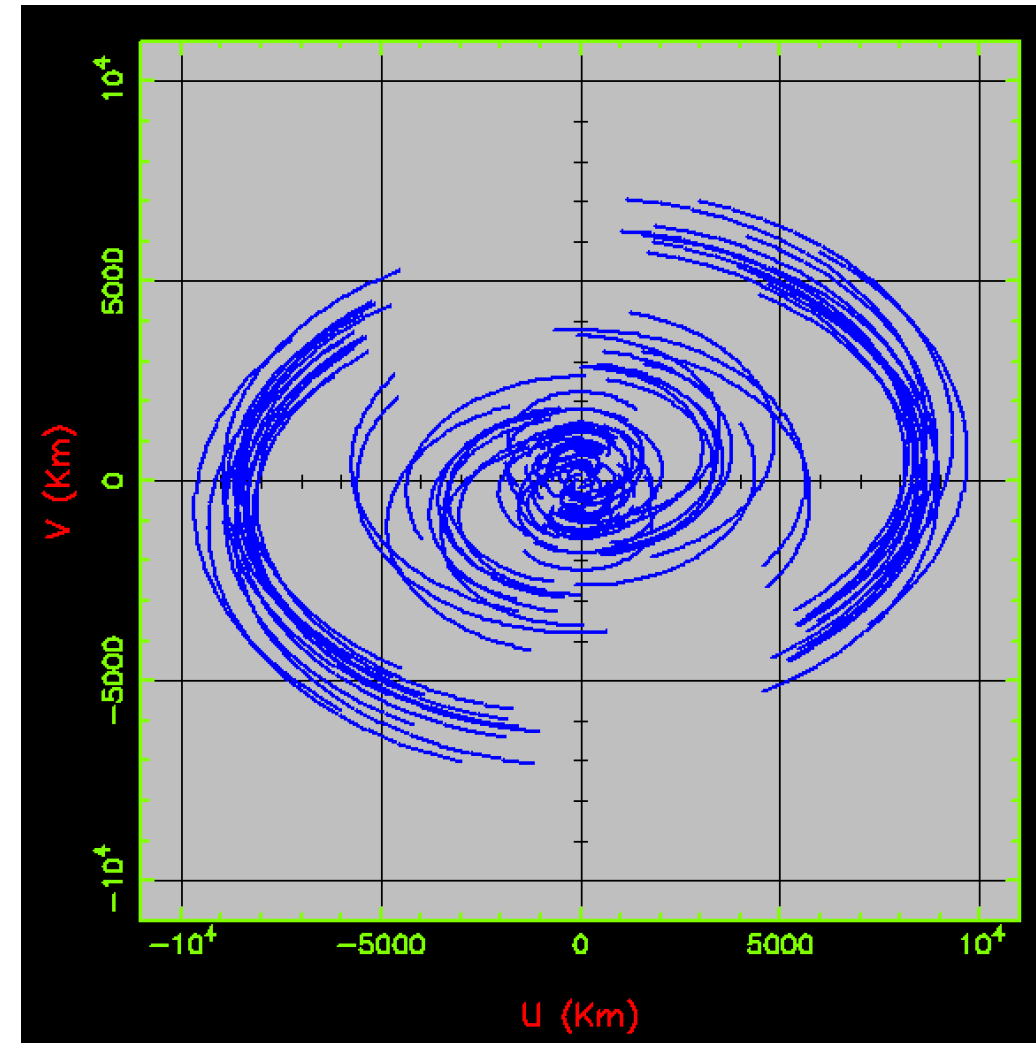


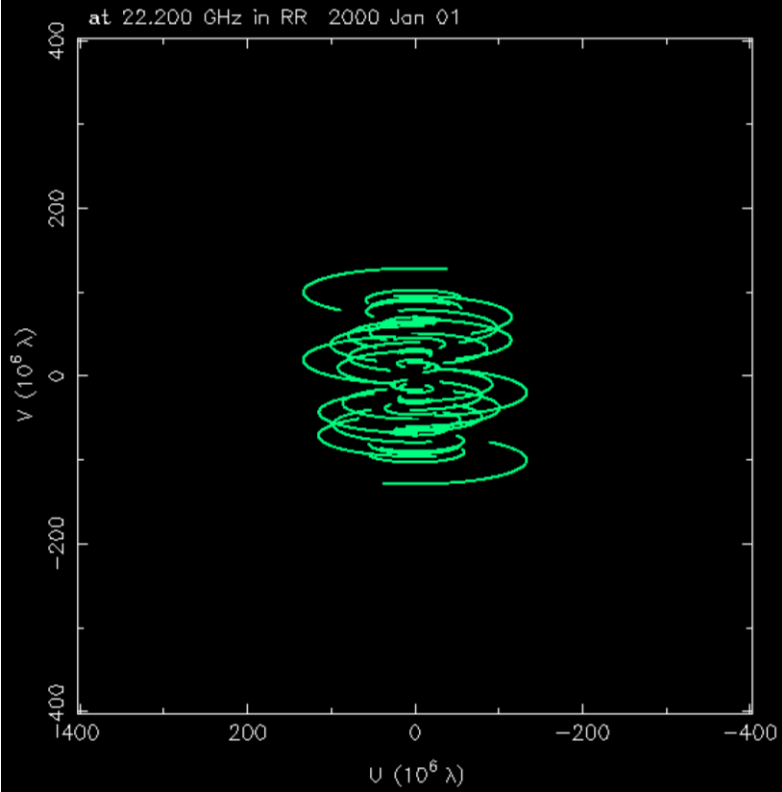
- KaVA+MC+NT at 22GHz
- E-W resolution reaching 0.14mas (19Rs)!

What's next

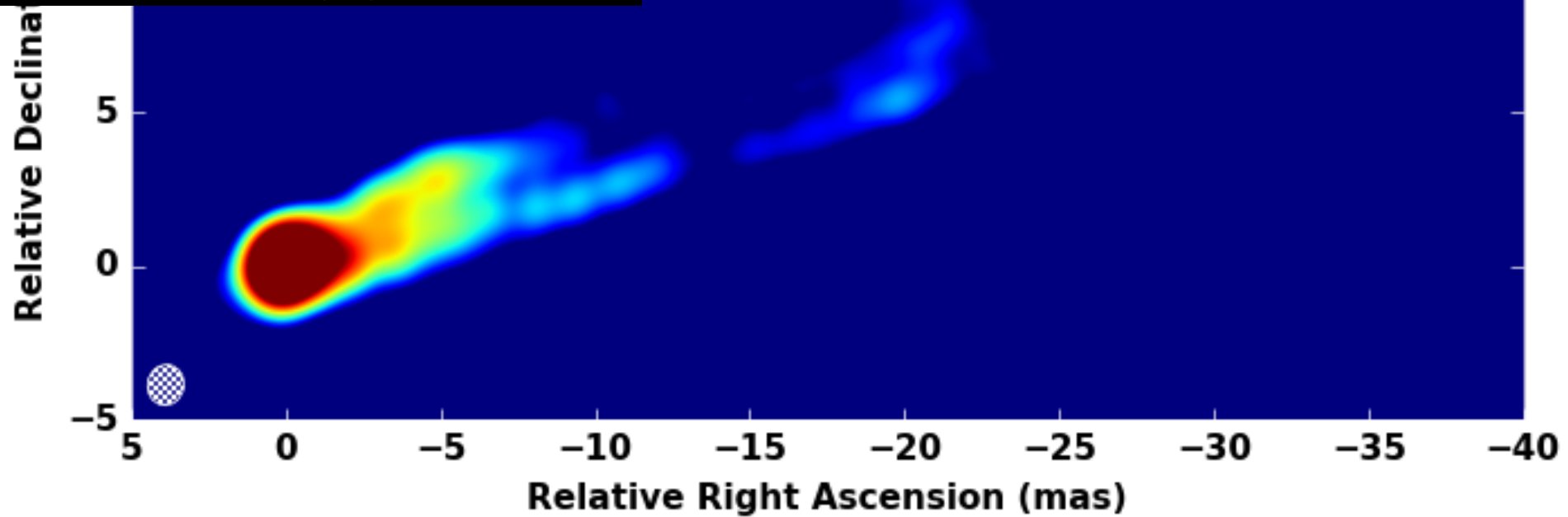
- Short term (next ~1-2yr)
 - EAVN/EATING/EHT campaign in 2018
 - M87 is important, but short common sky
 - Explore more sources suited for EATING array (eg, DEC $> \sim 20\text{-}30\text{deg}$, EHT targets)
 - Q-band session ($\sim 70\text{uas}$! And hope UR joining soon!)
- Long term
 - Regular monitoring possible?
 - K/Q simultaneous capability?
 - More stations or 86GHz??

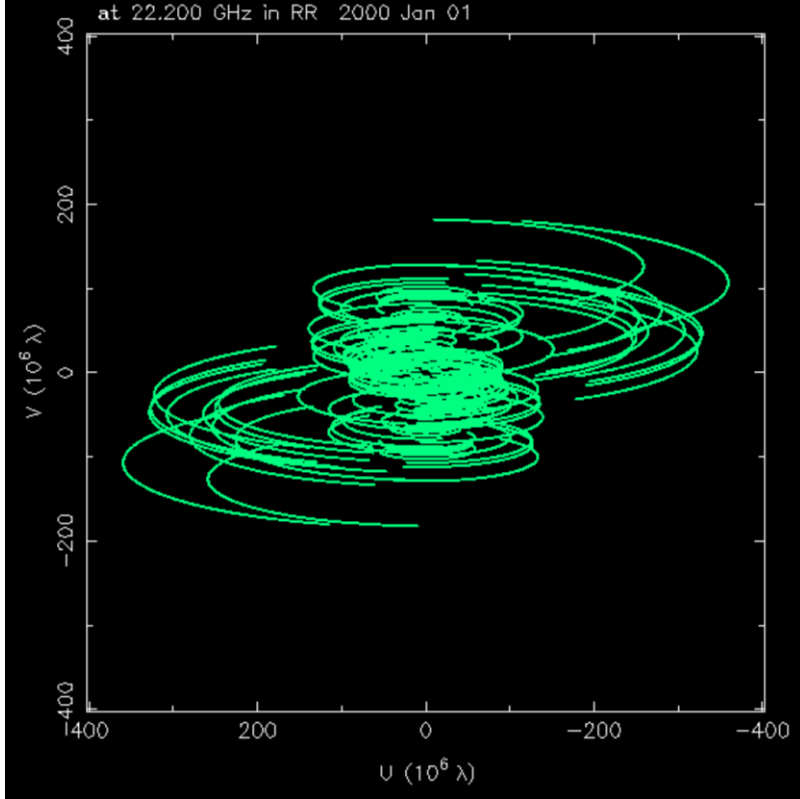
3C84, Mrk501, Mrk421,
BLLac, OJ287, CygA,
1H0323+342, Cyg X-3



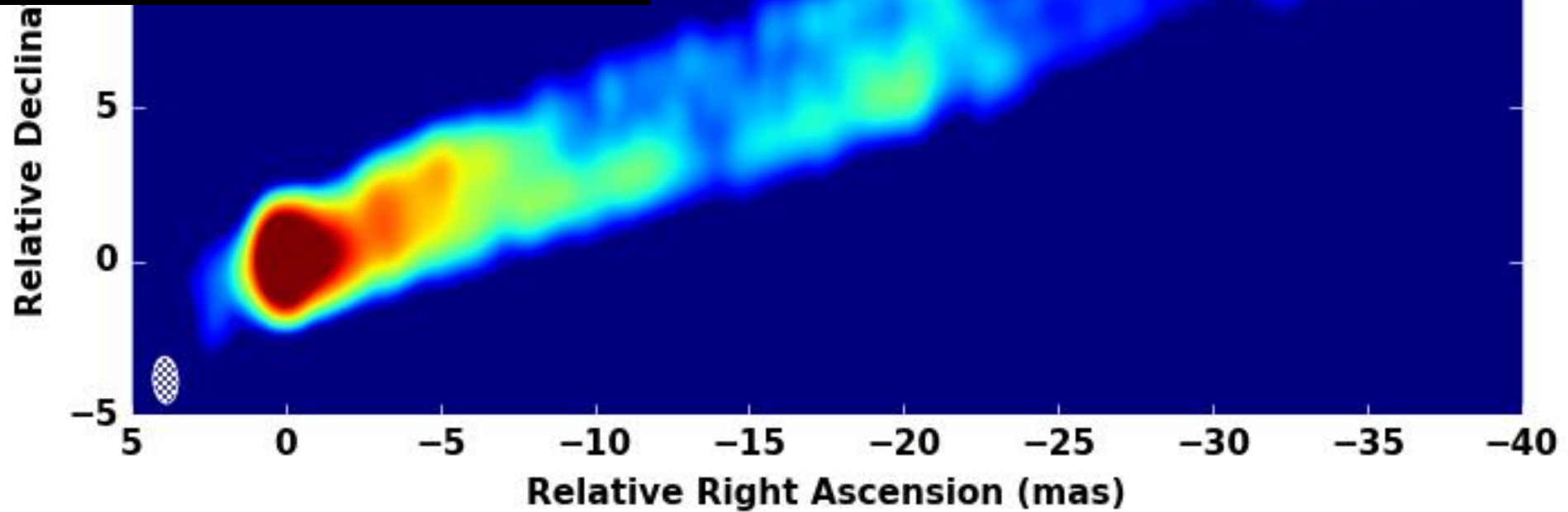


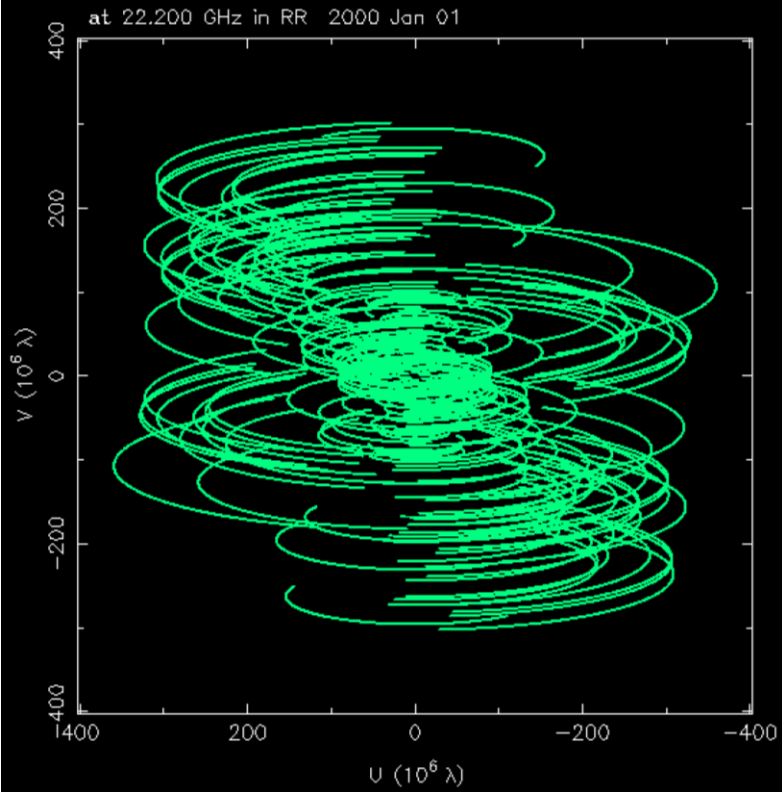
M87 22GHz
KaVA
(we are here now)



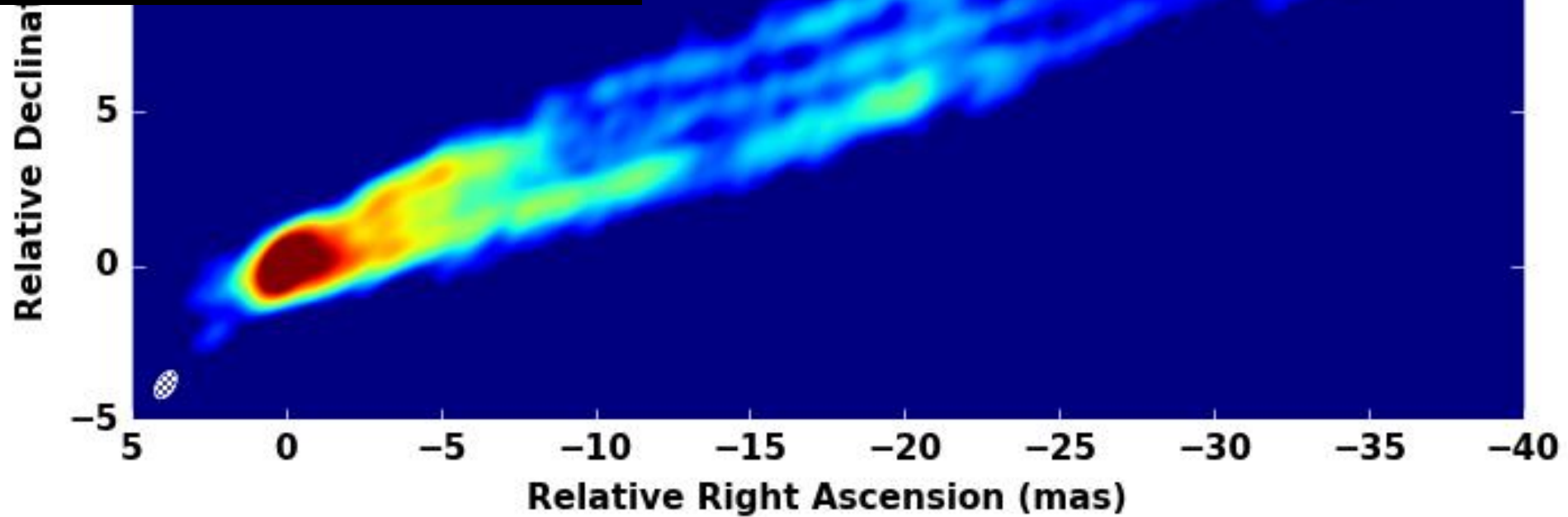


M87 22GHz
EAVN13(KaVA+TM+Ur+Sj+
Tk+Ks+Gf)

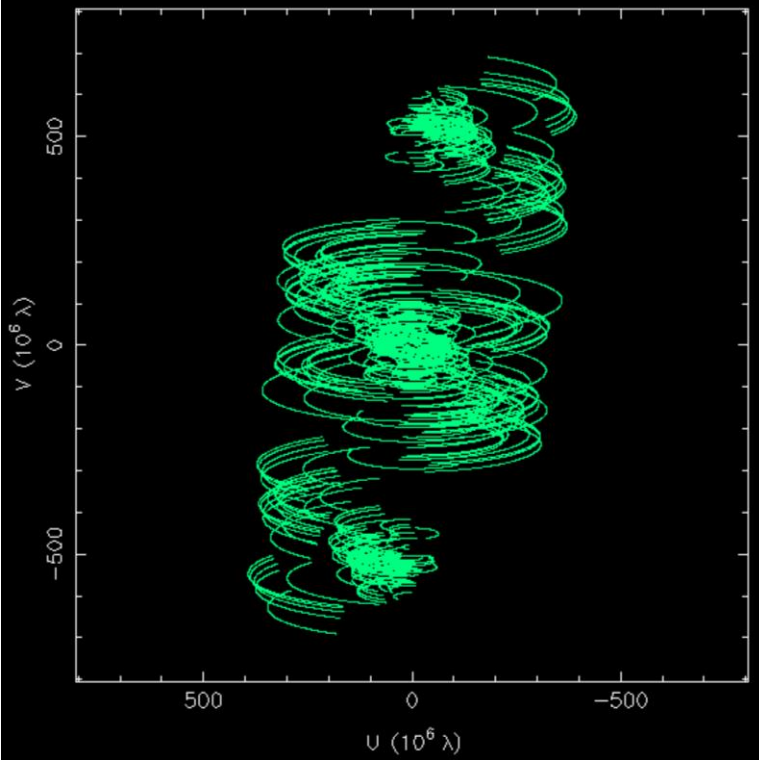




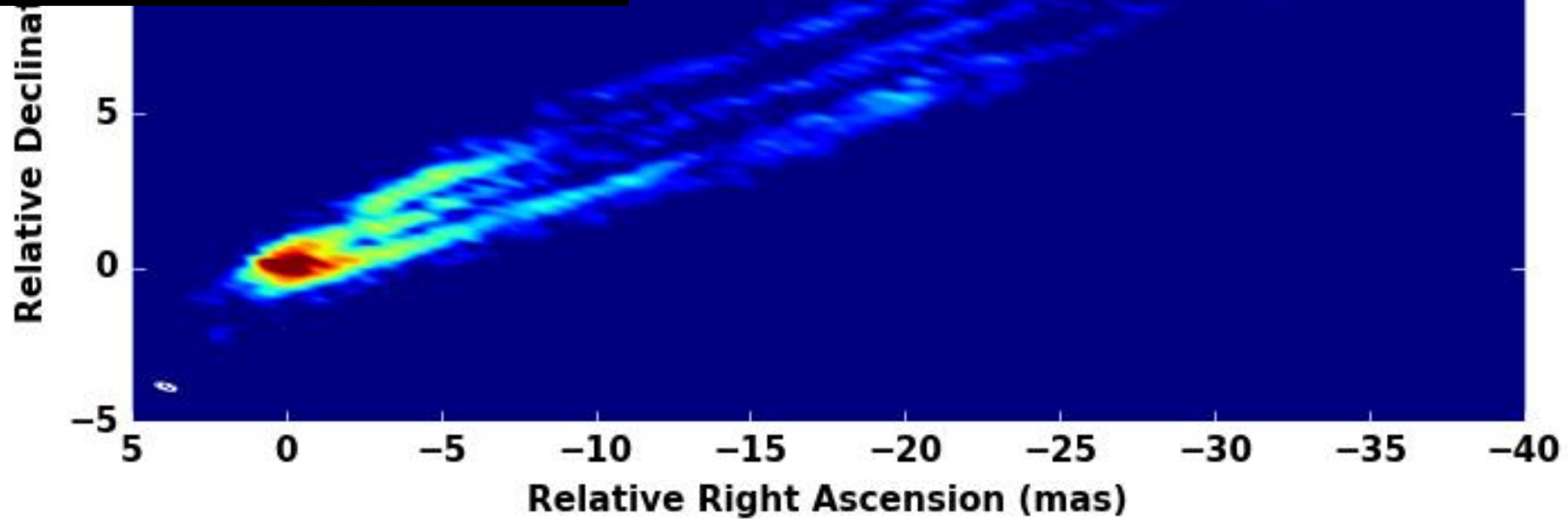
M87 22GHz
EAVN13 + TVN3



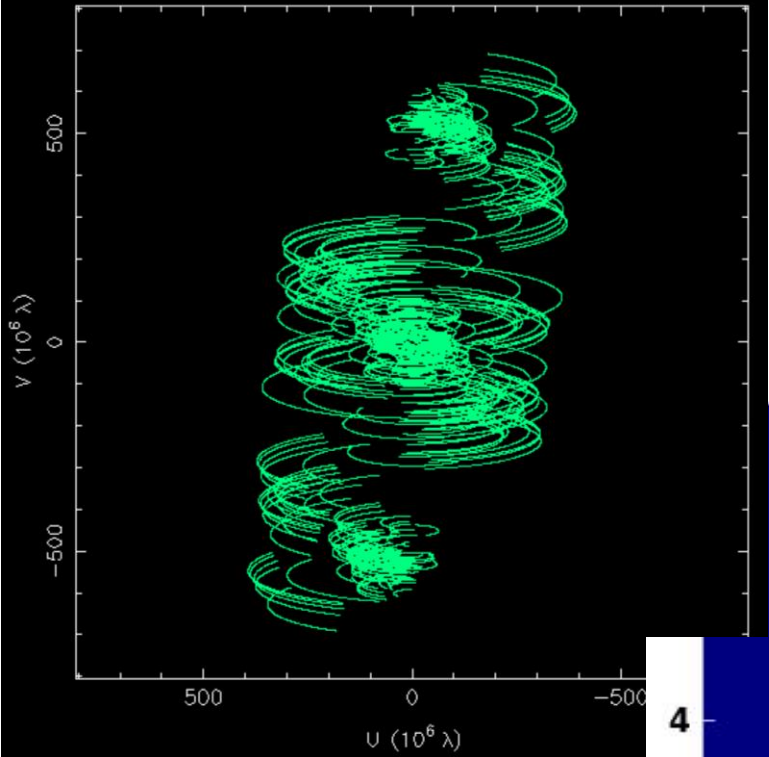
at 22.200 GHz in RR 2000 Jan 01



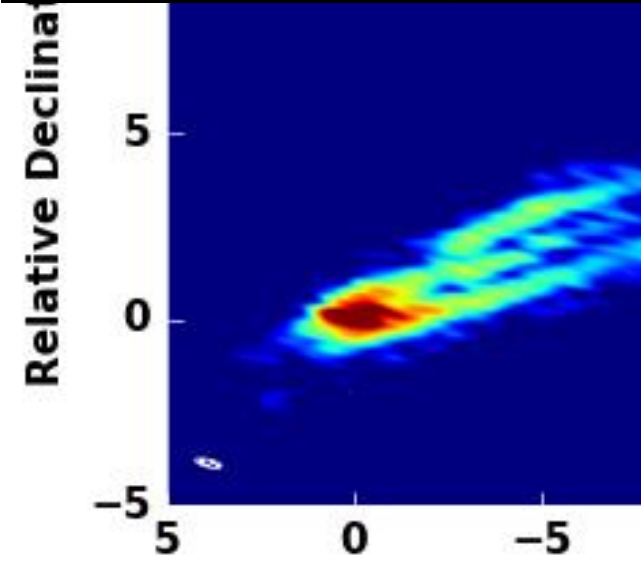
M87 22GHz
EAVN13+TVN3+AU



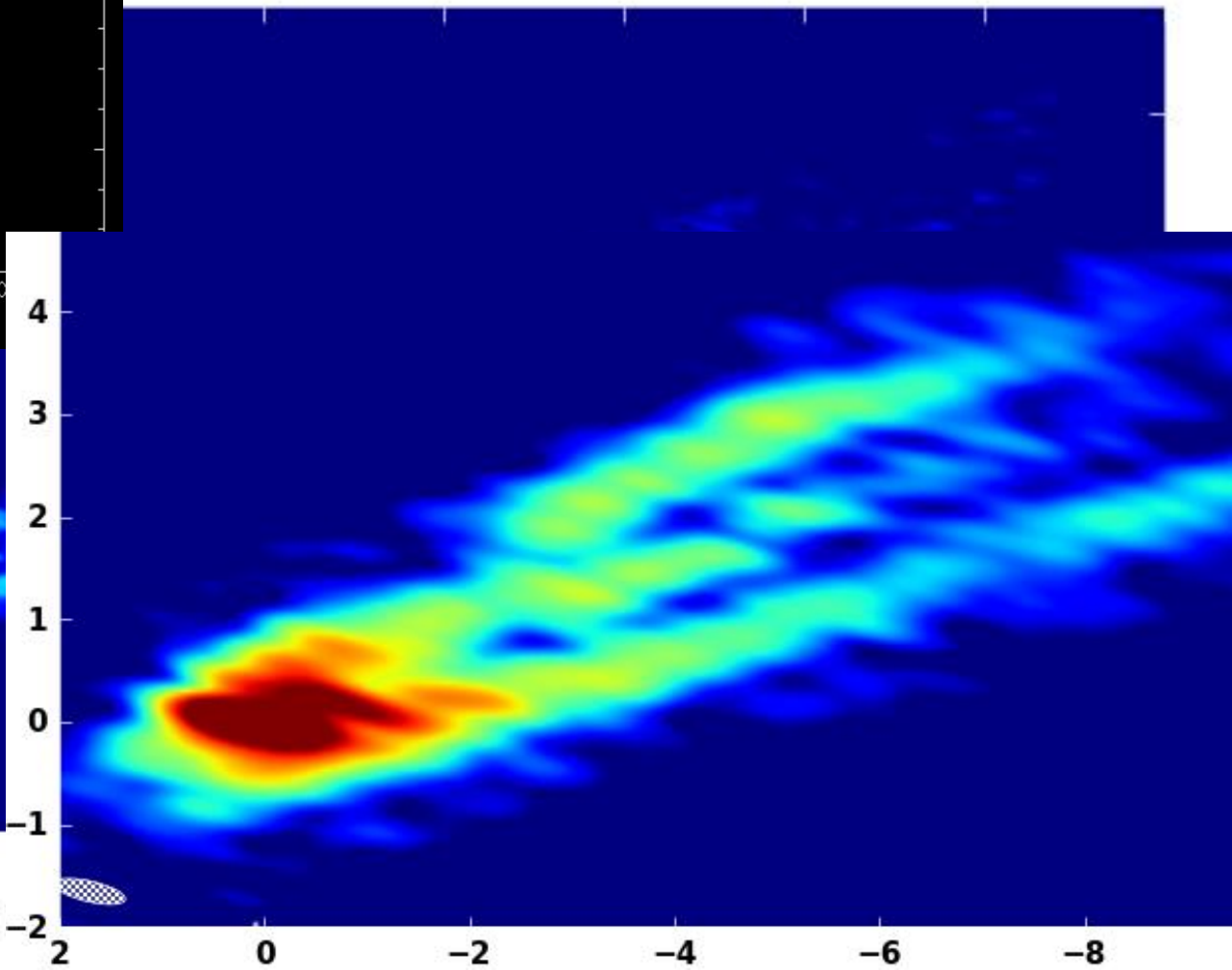
at 22.200 GHz in RR 2000 Jan 01



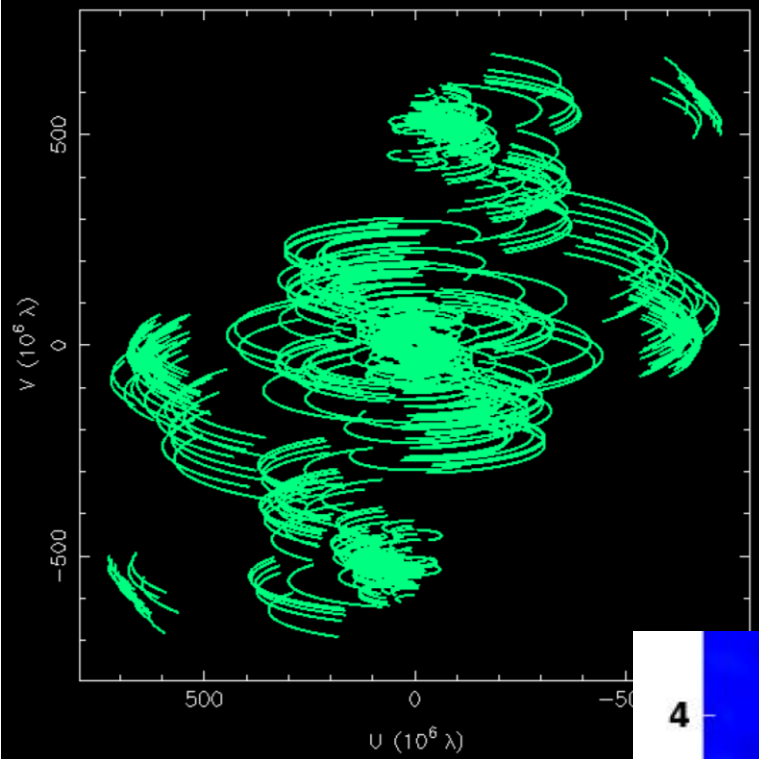
M87 22GHz
EAVN13+TVN3+AU



Relative Declination

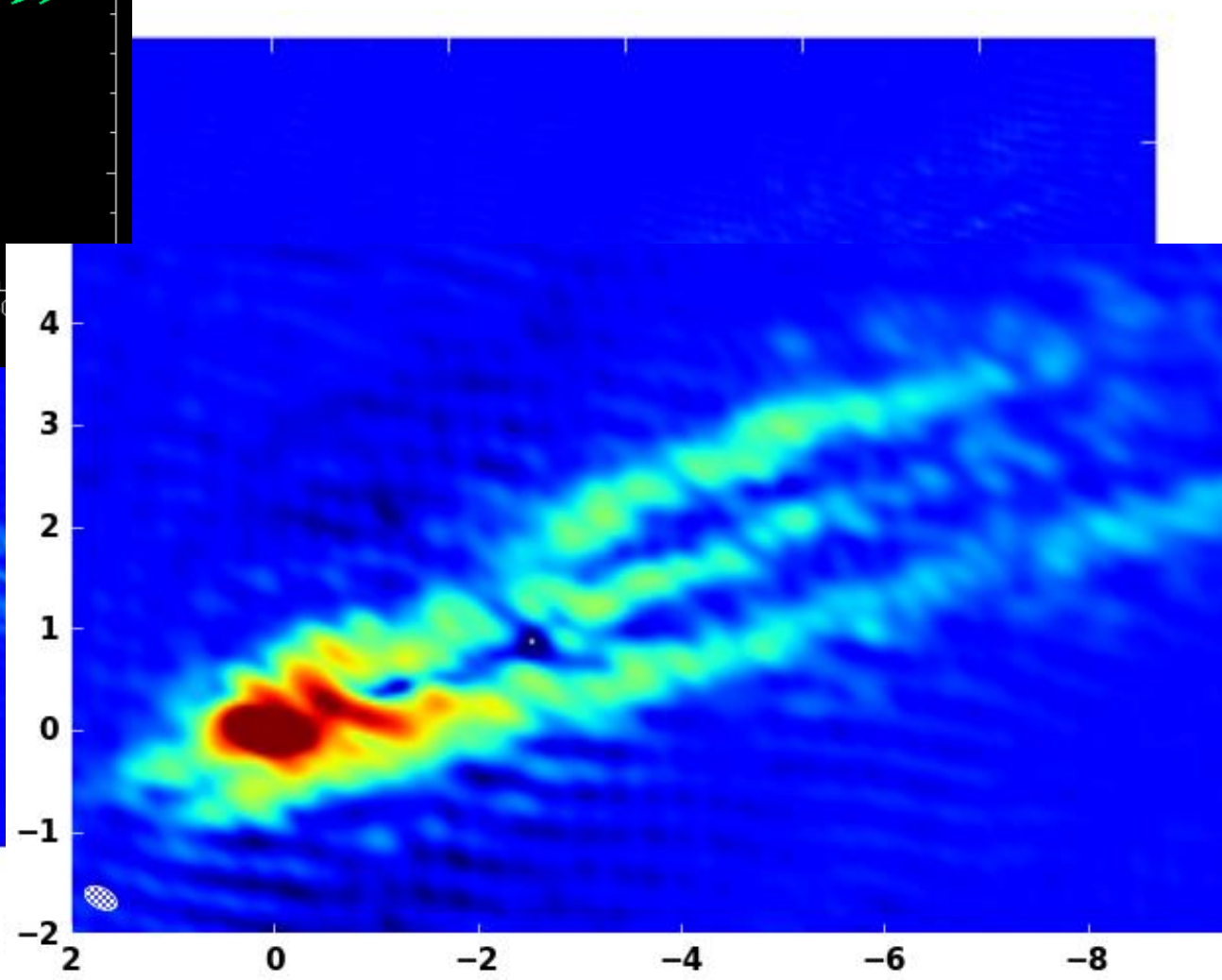
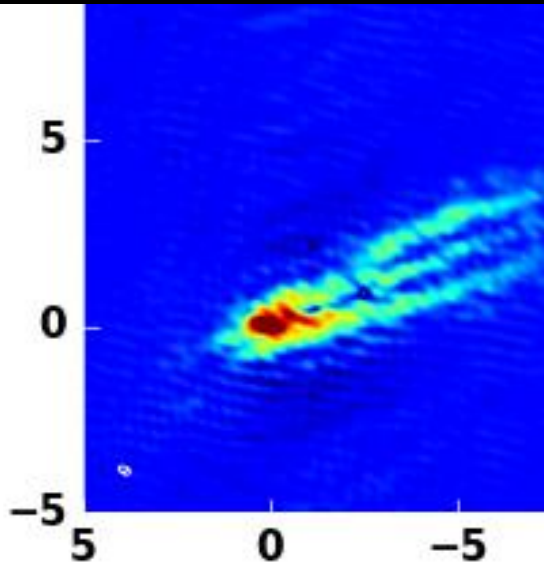


at 22.200 GHz in RR 2000 Jan 01

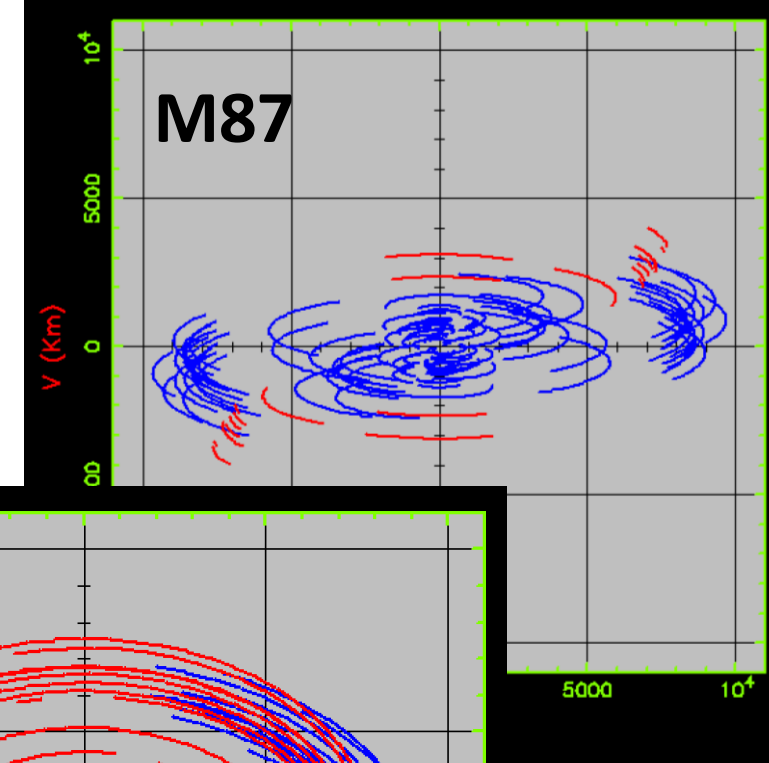
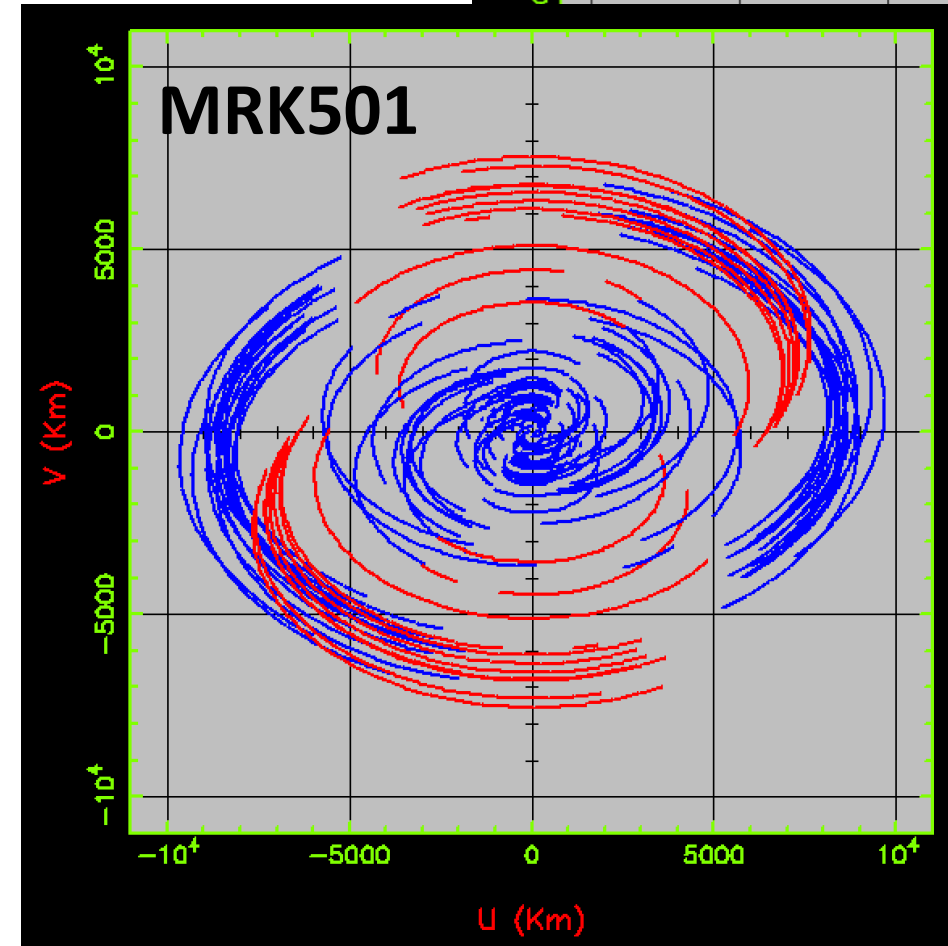
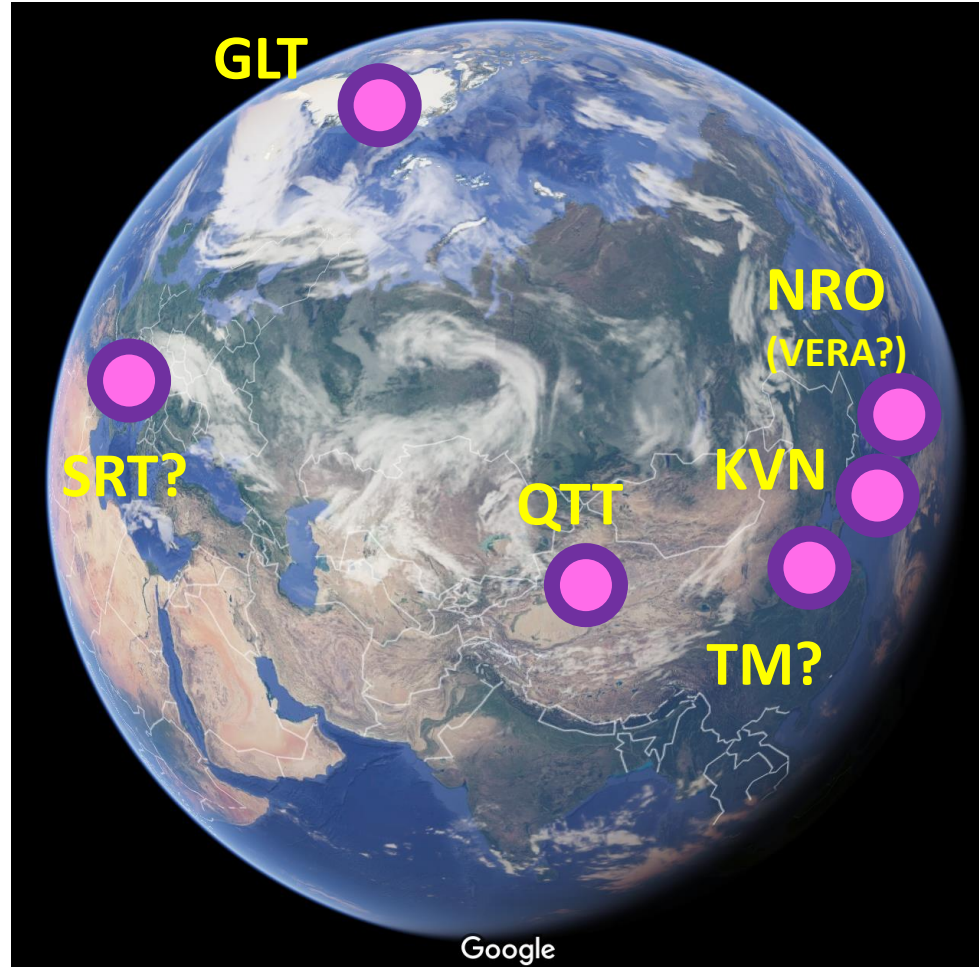


M87 22GHz
EAVN13+TVN3+AU+IVN3

Relative Declinat



EATING VLBI at 86GHz?

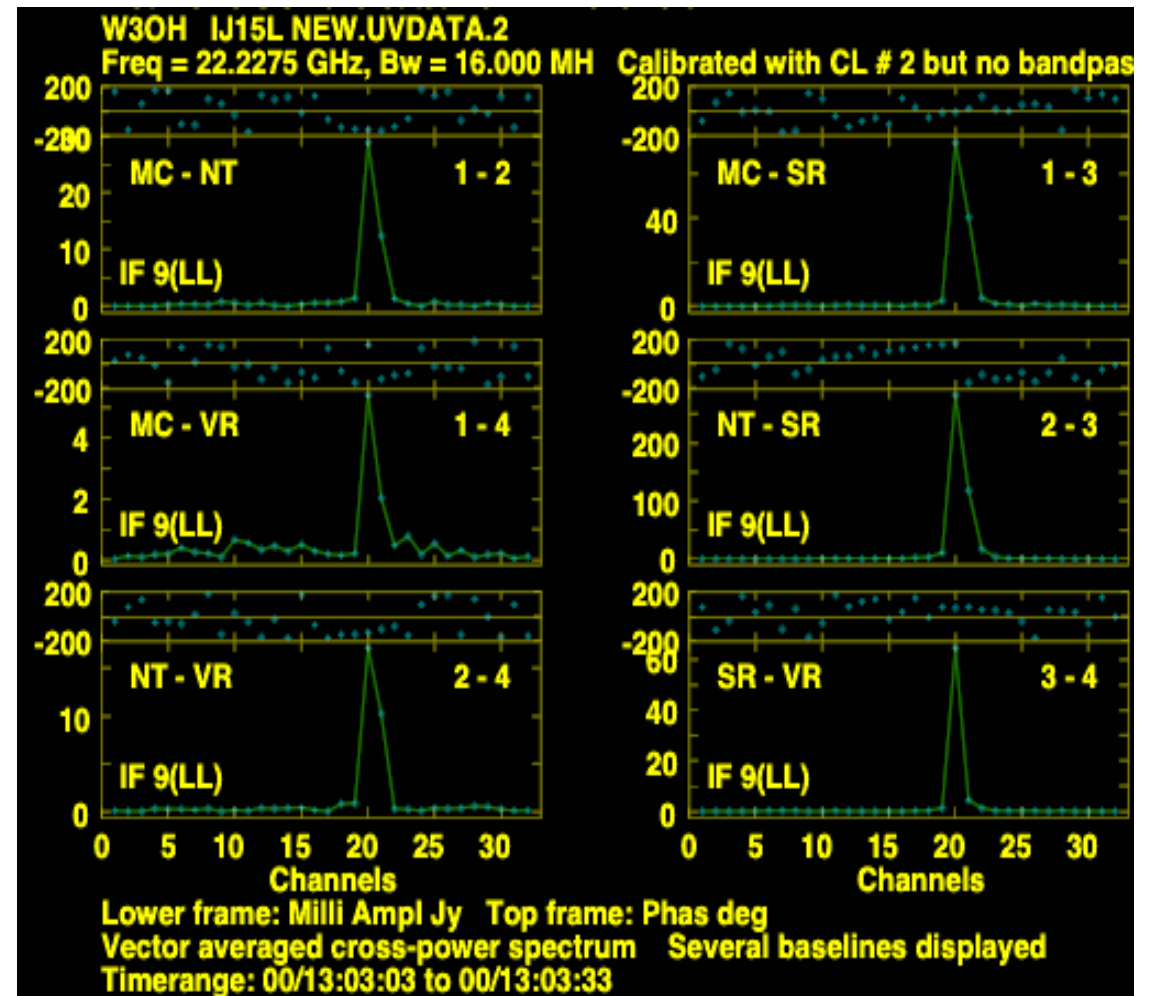
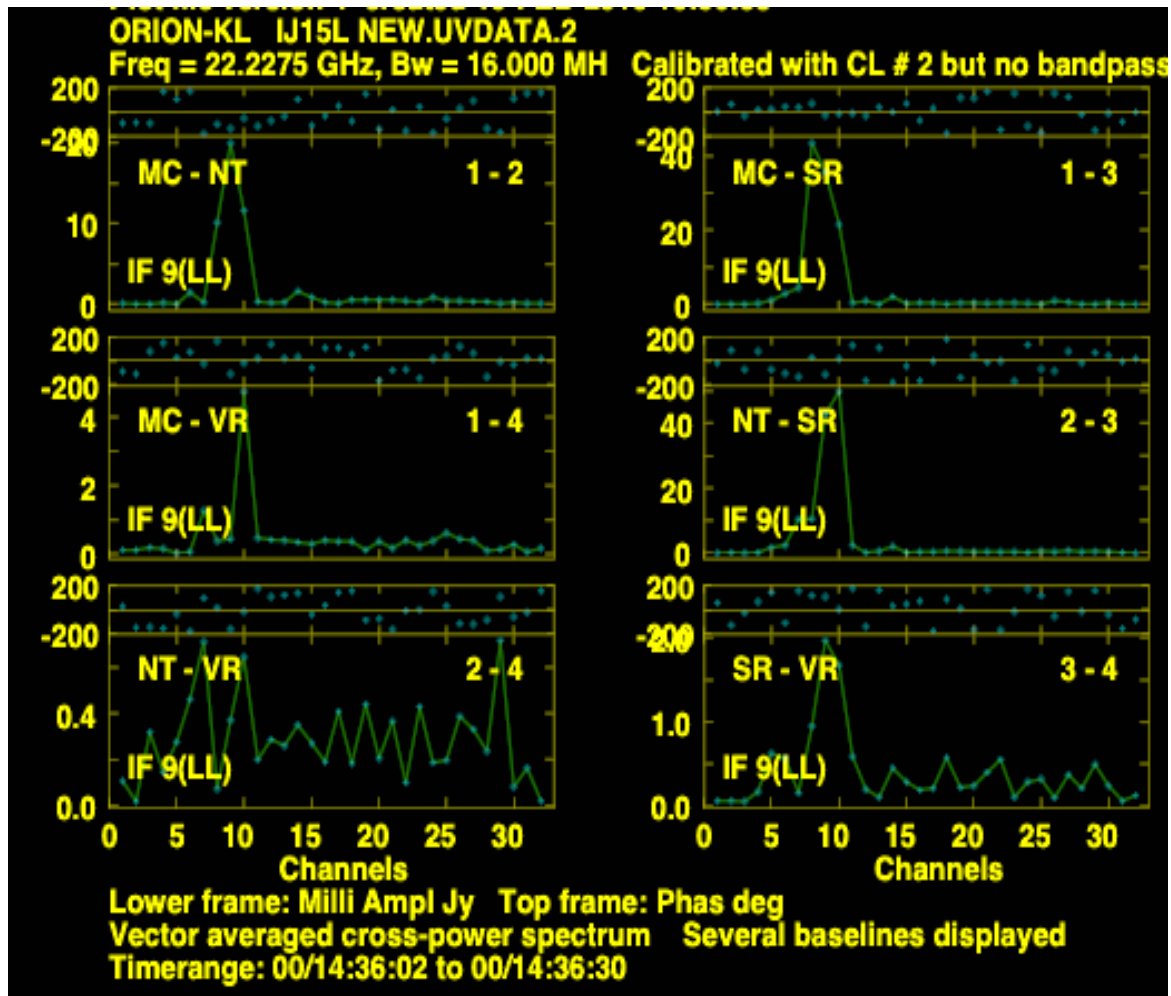


Summary

- The EATING collaboration keeps going very well and accelerating/expanding after $>\sim 5$ years of its launch
- Thanks to the hard effort and joint work by many people (scheduling, operation, correlation) from Italy, VERA and KJCC, at last we got the first Italy-VERA fringes
- This year: a genuine EATING VLBI observation has come true with an excellent science case, starting to produce a first EATING image
- Now it's a real start of whole EATING collaboration! Wish to obtain a first science result with the EATING array!

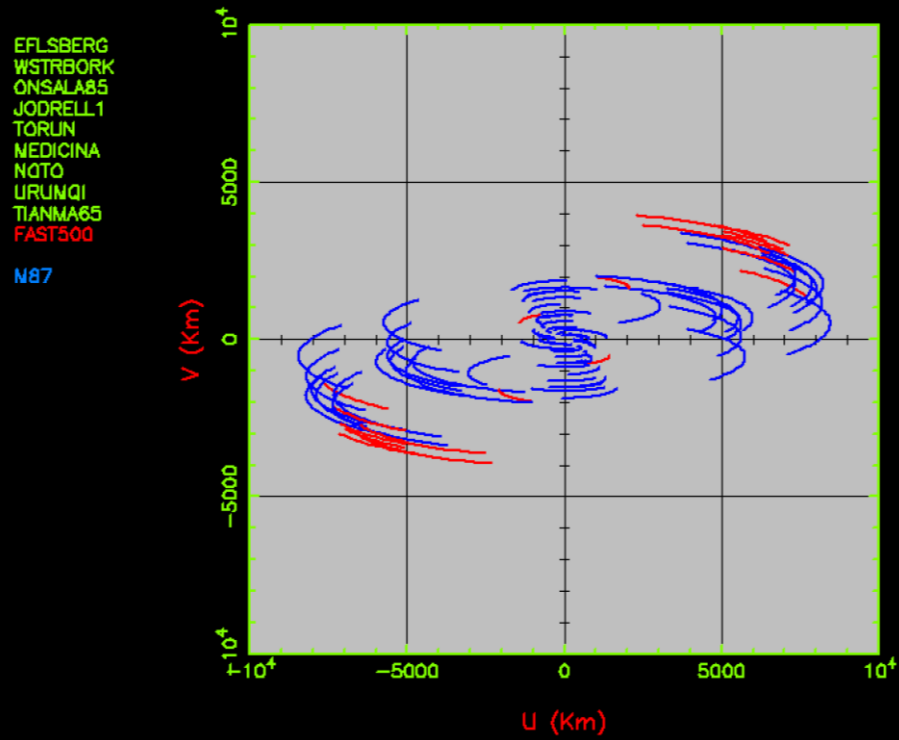
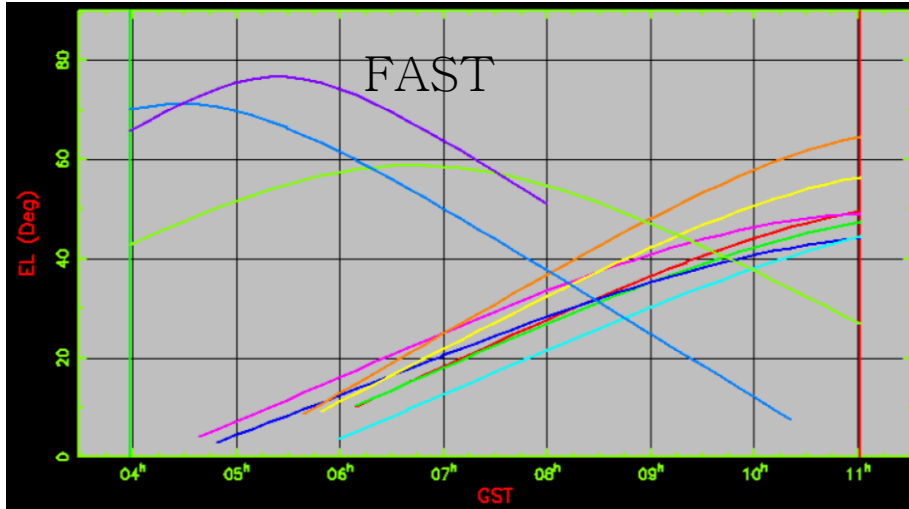
Appendix

2015 Italy-VERA test, masers



VLBI with FAST (S-band, M87)

EVN



EAVN

