Status of VLBI in Italy

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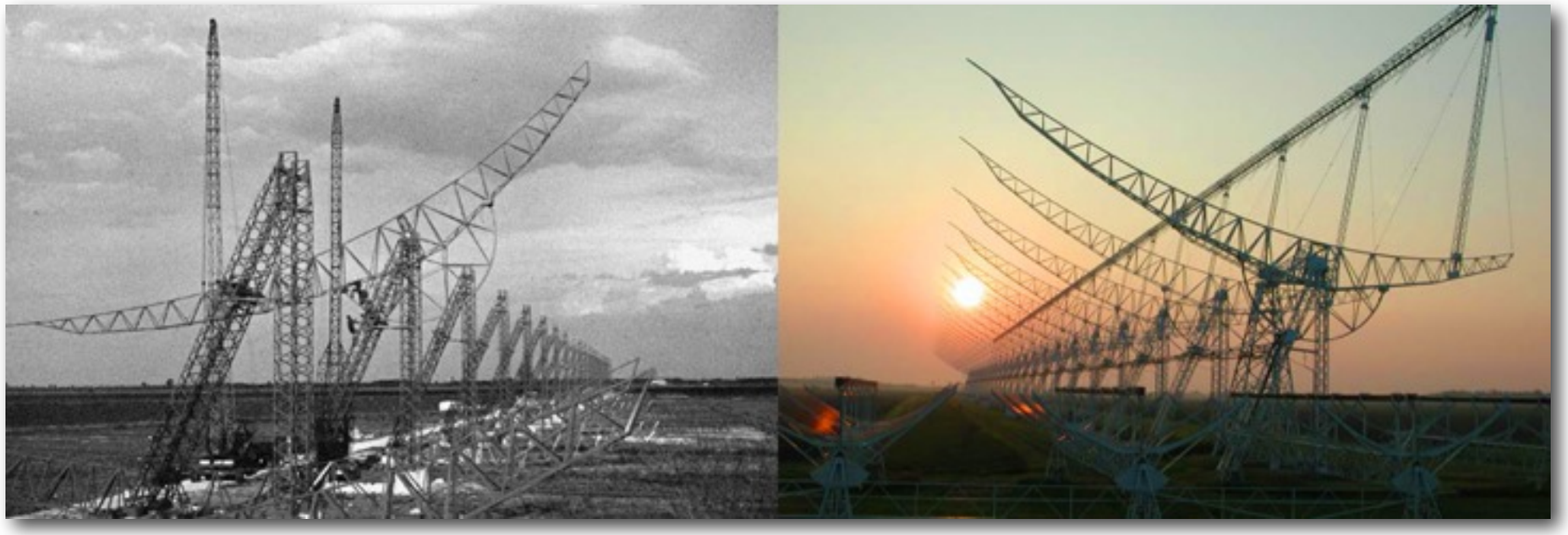
Outline

1. Instruments, from yesterday to now
2. Quick science overview
3. I-VLBI, Eating VLBI, status and perspectives

I. Instruments

History

- Radio astronomy in Italy began exactly 50 years ago with the Northern Cross interferometer, built in Medicina by the University of Bologna



- Interest for VLBI grew in the 1970-80's
  - IRA was a founding member of EVN in 1980
  - accompanied by plans for construction of VLBI dishes for astronomy and geodesy

Milestones

- **1983 opening of 32m in Medicina (Mc)**
- **1988 opening of 32m in Noto (Nt)**
  - 2006 Mc connected with optical fiber
  - 2012 Nt connected with optical fiber
- 2013 Mc-Nt fringes found with DiFX correlator in Bologna
- **2013 opening of 64m in Sardinia (Sr)**
- 2014 Sr-Mc and Sr-Nt fringes found with DiFX correlator in Bologna
- 2014 Sr participates to EVN sessions


Share
Slovenia
Zagreb
Trieste
Milan
Verona
Venice
Brescia
Padua
Turin
Parma
Asti
Genoa
Bologna
Ravenna
San Marino
Monaco
Cannes
Livorno
Florence
Italy
Grosseto
Pescara
Corte
Viterbo
Terni
L'Aquila
Rome
Ajaccio
Bonifacio
Latina
Olbia
Sassari
Alghero
Nuoro
Sardegna
Tyrrhenian Sea
Oristano
Cagliari
Carbonia
Croatia
Zadar
Bosnia and Herzegovin
Sarajevo
Livno
Šibenik
Split
Mostar
Catanzaro
Palermo
Messina
Siderno
Trapani
Marsala
Catania
Agrigento
Gela
Ragusa
Annaba
Tunis
Kelibia
Beja
Sardinia
Noto
44°N
36°N


Medicina


Sardinia


Noto

Medicina

- available receivers: 1.4, 1.6, 2.3, 5.0, 6.7, 8.4, 22 (dual feed) GHz
- frequency agility (~immediate for same focus receivers, few minutes for transition between different foci)
- 10 Gbps connection to Bologna
- Mark5-C recorder, FILA10G board, DBBC transition completed
  - also Mark5-A+analog backend "legacy" configuration

Noto

- available receivers: 1.4-1.6, 2.3, 5.0, 6.7, 8.4, 22, **43** GHz
- active surface improving efficiency above 22 GHz (up to 86 GHz?)
- frequency agility being implemented these days
- 1 Gbps connection now, 10 Gbps in future
- Mark5-B recorder, FILA10G board, DBBC transition completed

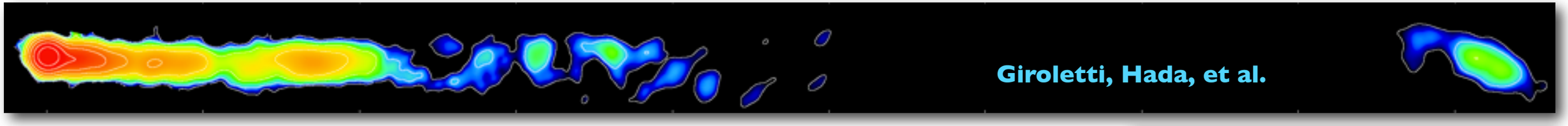
Sardinia

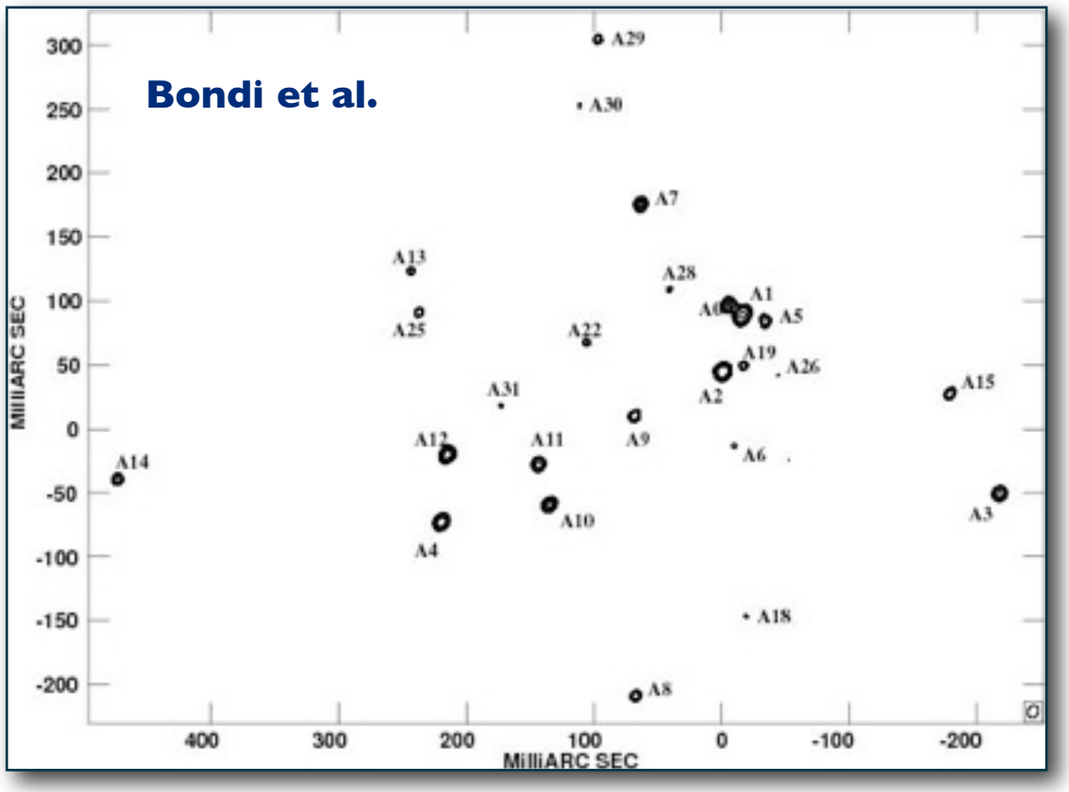
- 64 meter station
- 0.3/1.4, 6.7, 22 GHz (7-beam) receivers available
- 43 GHz receiver planned
- designed for up to 13 total receivers (three focal positions), up to 100 GHz (active surface)
- DBBC backend, FILA10G, Mark5-C recorder
  - Mark5-B recorder being installed
- optical fiber link to be funded by regional government

2. Science overview

Science - at IRA

- ~10 scientific staff involved in VLBI science, mostly in Bologna
  - plus post-docs, PhD students
- blazars, relativistic jets, connection to high energy emission (*Fermi*)
- search for supermassive binary black holes
- young radio sources, CSS/GPS/HFP
- low luminosity AGN, Seyfert galaxies
- neutral hydrogen
- occasionally, galactic sources (eg novae, supernovae)
- geodesy


Giroletti, Hada, et al.


Bondi et al.
MilliARC SEC
MilliARC SEC
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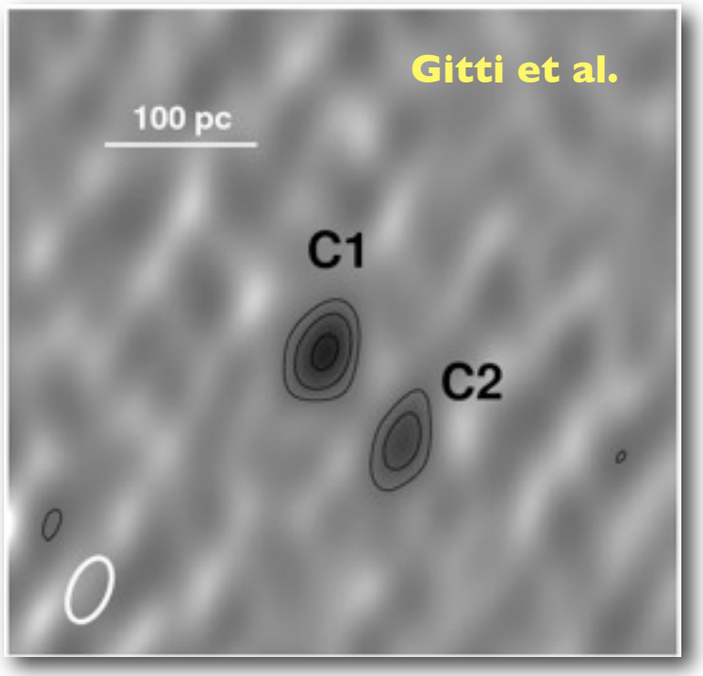
Gitti et al.
100 pc
C1
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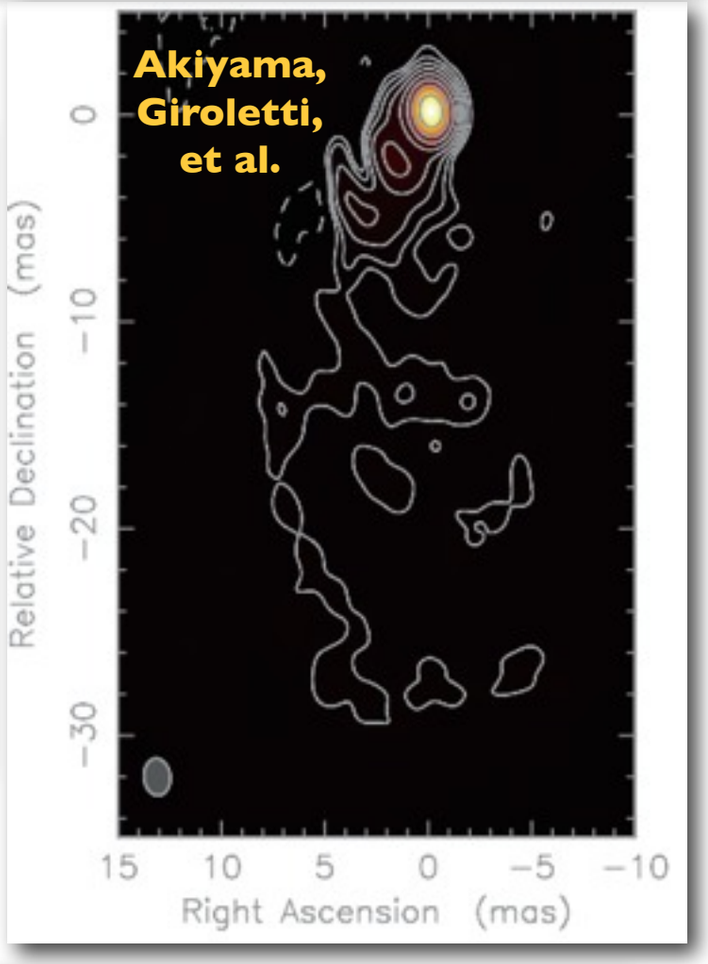
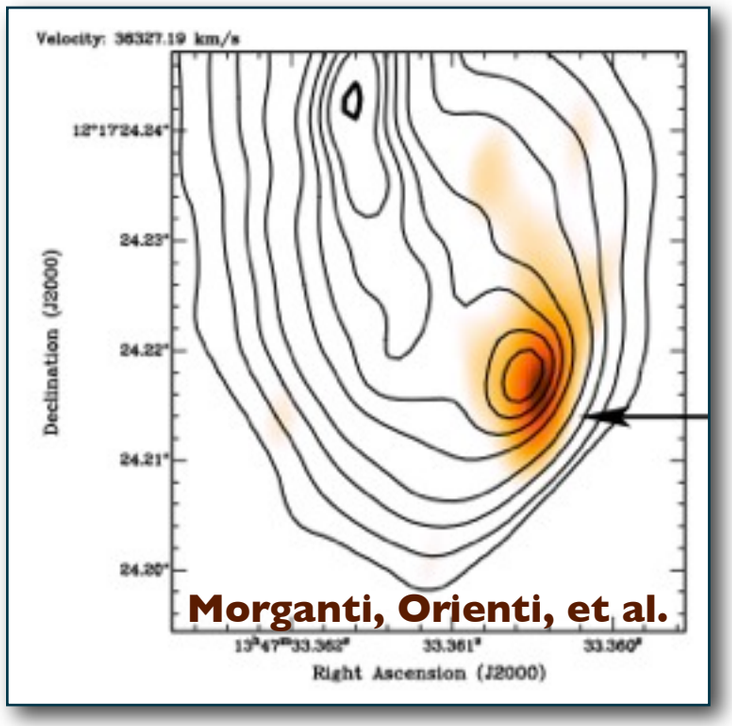
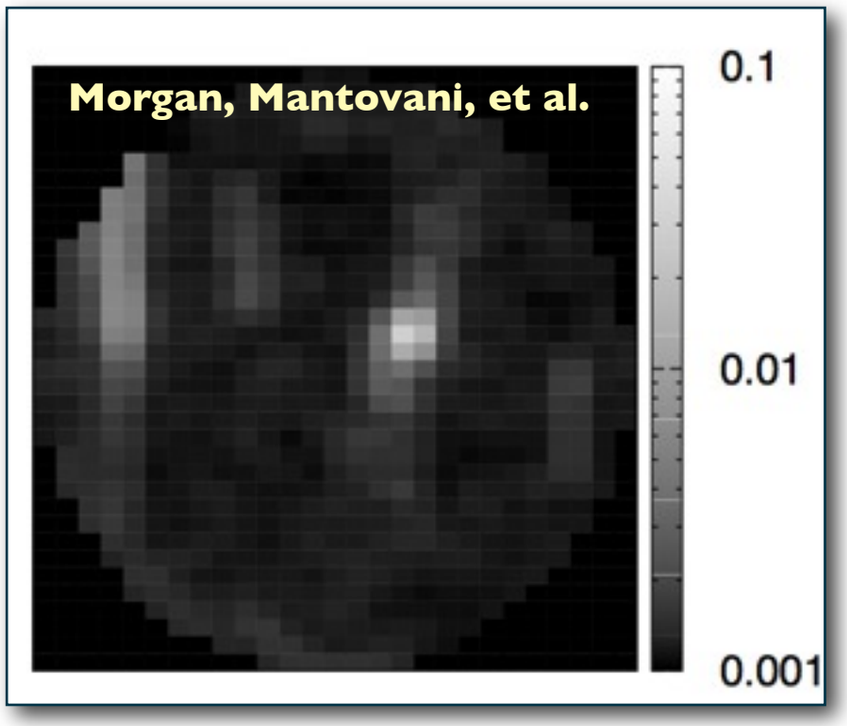

Akiyama, Giroletti, et al.
Relative Declination (mas)
Right Ascension (mas)


Velocity: 36327.19 km/s
Declination (J2000)
Right Ascension (J2000)
Morganti, Orienti, et al.


Morgan, Mantovani, et al.
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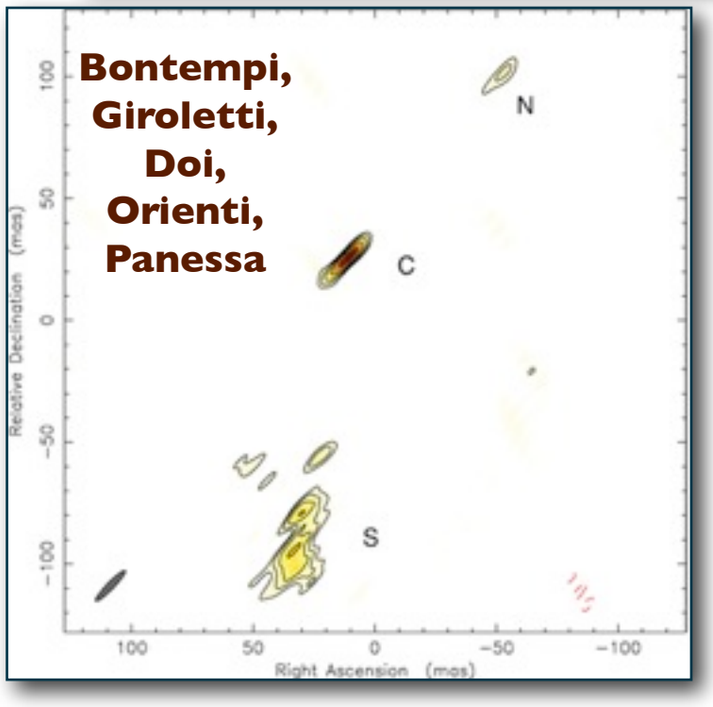
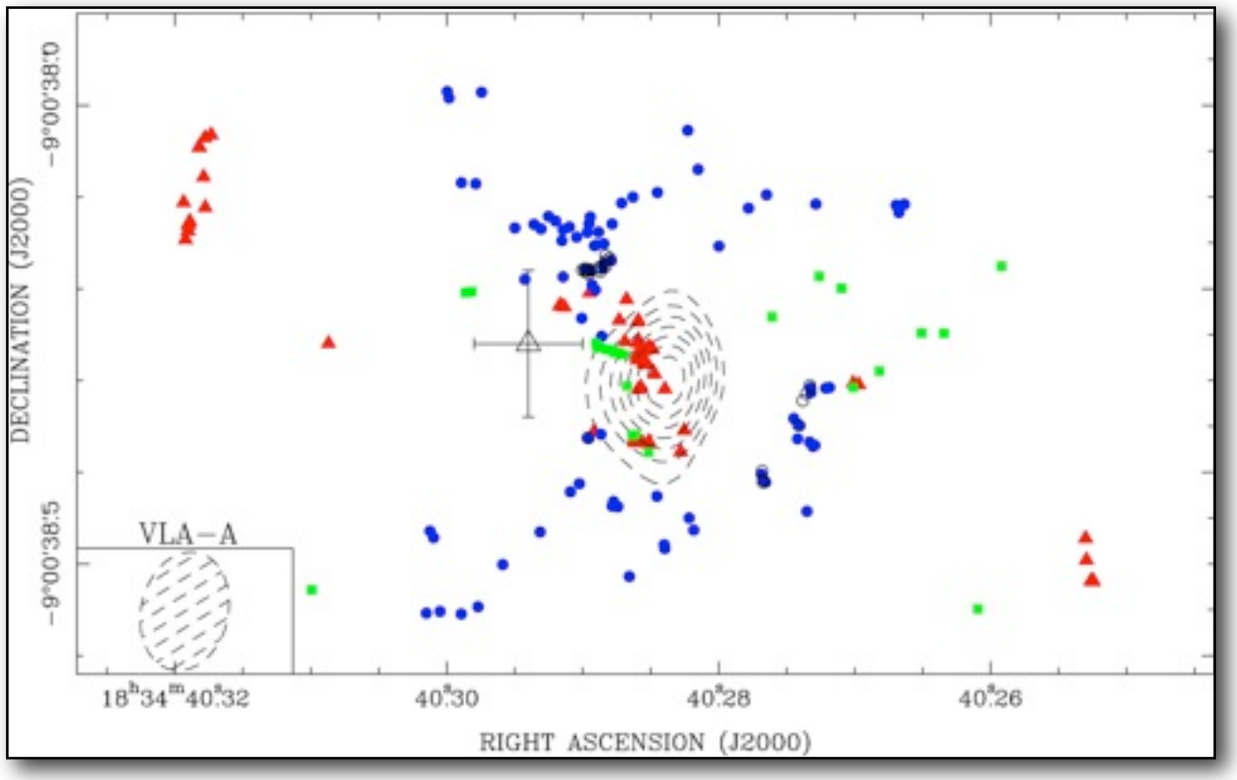

Bontempi, Giroletti, Doi, Orienti, Panessa
N
C
S
Relative Declination (mas)
Right Ascension (mas)

Science - at INAF

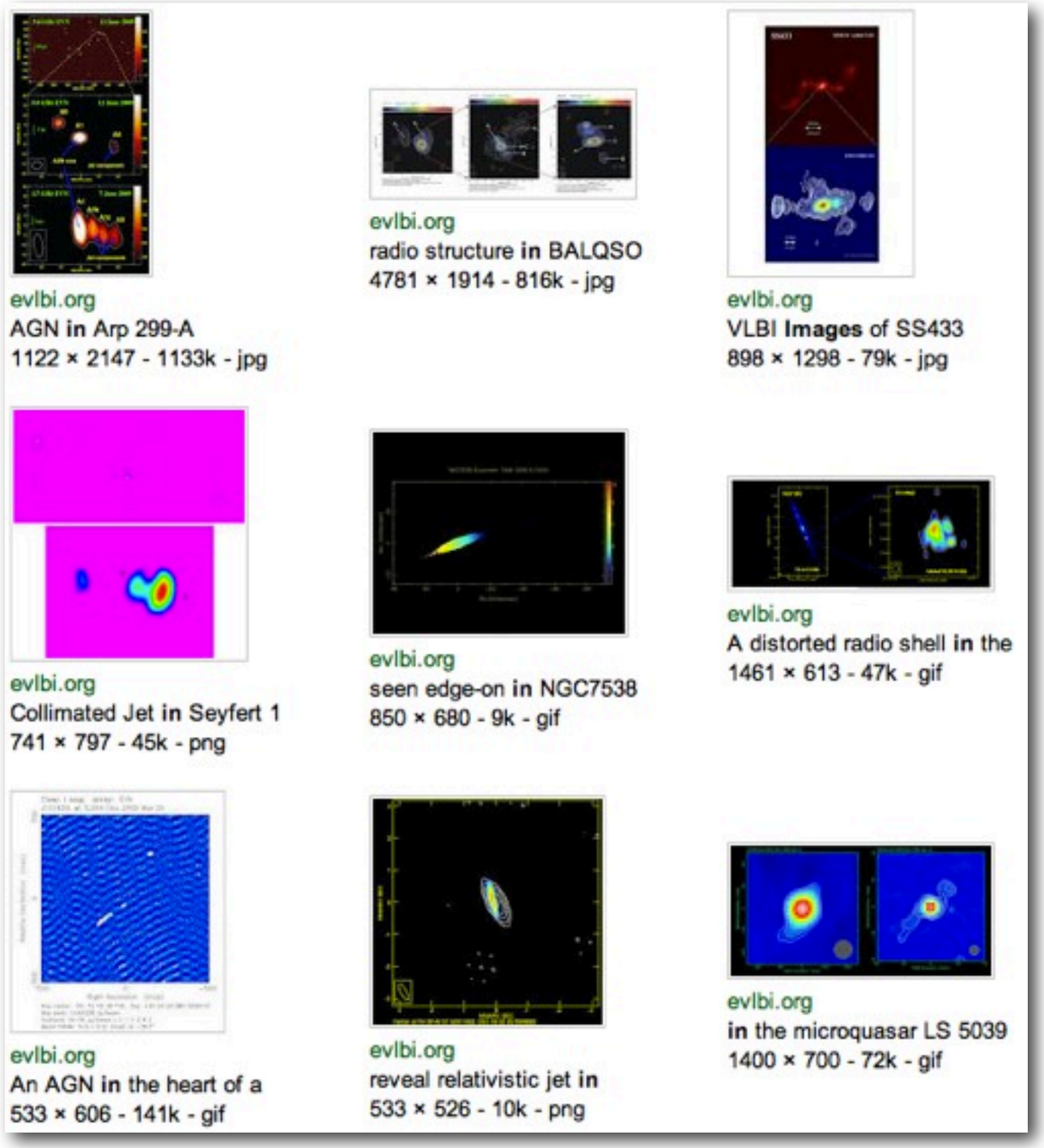
- Arcetri, Cagliari groups
  - Stellar maser sources, giant star formation



- Collaboration with local people on blazar, LLAGNs: Rome, Milan, Bologna observatory, ...

Science - International

- As part of the European VLBI Network, broad range of science topics
  - AGNs
  - stellar and mega masers
  - astrometry
  - stellar evolution
  - compact objects
- Geodesy, through IVS



Activities

- **EVN:** three 3-weeks sessions, plus up to 140 hours of out-of-session observations
- **e-VLBI:** ten 24-hrs sessions per year
- **Space VLBI:** support to Radioastron KSP and GO ...not forgetting VSOP!
- **IVS**
- **single dish**
- **Italian VLBI:** so far mostly for tests - see Matteo Stagni's talk tomorrow
- **coming soon: Eating VLBI!**

Access

- EVN: three calls for proposals (Feb, Jun, Oct 1st each year)
- single dish, Italian VLBI: two calls for proposals (Apr, Oct 1st each year)
  - need to provide own disks - or transfer electronically
- targets of opportunity: any time

3. I-VLBI

Italian VLBI status table

		Mc	Nt	Sr
RXs	1.4-1.6	✓	✓	✓
	5	✓	✓	✗
	6.7	✓	✓	✓
	8	✓	✓	✗
	22	✓	✓	✓
	43	✗	✓	✗
backend		DBBC	DBBC	DBBC
recorder		Mark5-C	Mark5-B	Mark5-B&C
e-VLBI		10 Gbps	1 Gbps	✗

Italian VLBI - more facts

- Baseline lenghts
  - Nt-Sr 562 km
  - Sr-Mc 580 km
  - Mc-Nt 878 km
    - max angular resolution @22 GHz: 3.0 mas
- Correlator status
  - software correlator (DiFX) installed and operated in Bologna

I-VLBI status

- Two station fringes ~routinely obtained with DiFX correlator installed in Bologna
- Three station fringes not possible yet - only one failed attempt
  - limited team size and experience
  - SRT commissioning and validation
  - analog-digital transition
  - technical failures
- many of the above points shall be cleared in the future
  - more about this in Matteo Stagni's talk tomorrow

I-VLBI plans (a personal view)

- In the short term (end of 2014)
  - obtain first three-station fringes
- mid-term (6-9 months)
  - reliably carry out three-station observations
- long-term (end of 2015?)
  - operate I-VLBI as national facility

EatIng VLBI

Eat/ng VLBI

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3. 43 GHz Noto+VERA(+KVN) could be attempted
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4. real time VLBI is possible for Mc, Nt, VERA
5. maybe lower frequency observations could also be of interest?