

KVN status report

Current and Future

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Global KASI
Innovative KASI
Science Korea KASI

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EATING VLBI2017

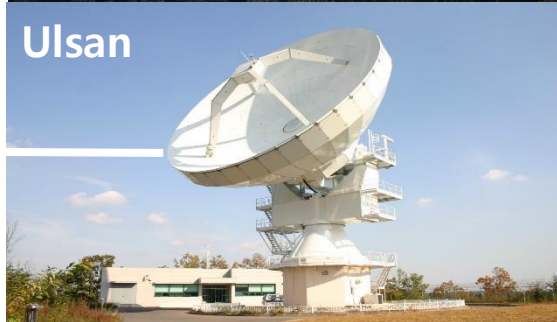
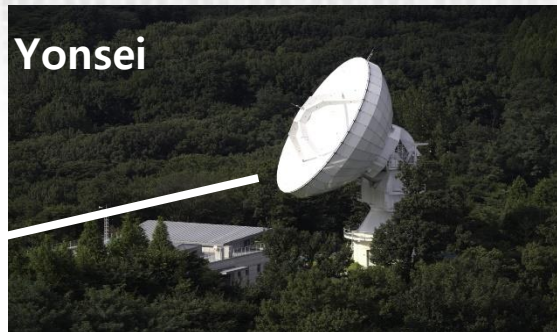
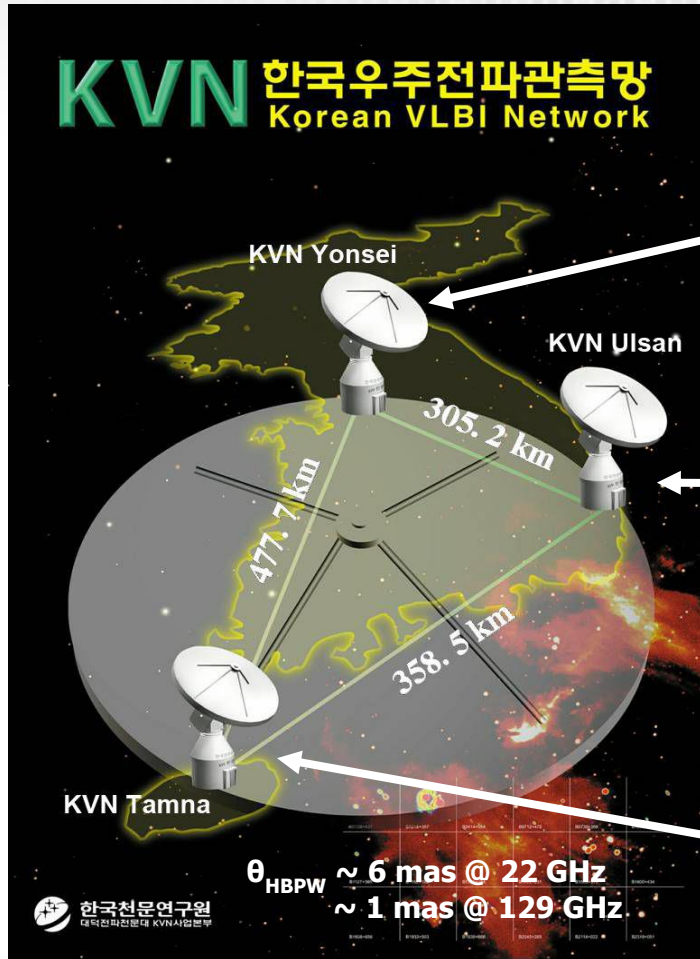
KASI

한국천문연구원
Korea Astronomy & Space Science Institute

Outline

- **Current Status of KVN**
- **Upgrade Activities**
- **Future Plan – the Extended KVN (KVN-E)**

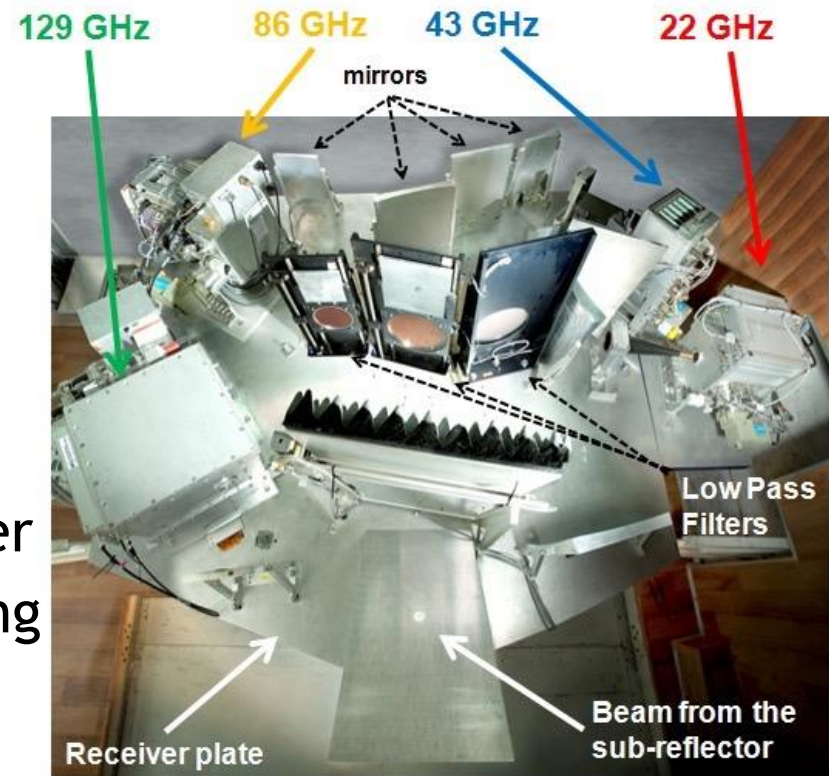
Korean VLBI Network (KVN)



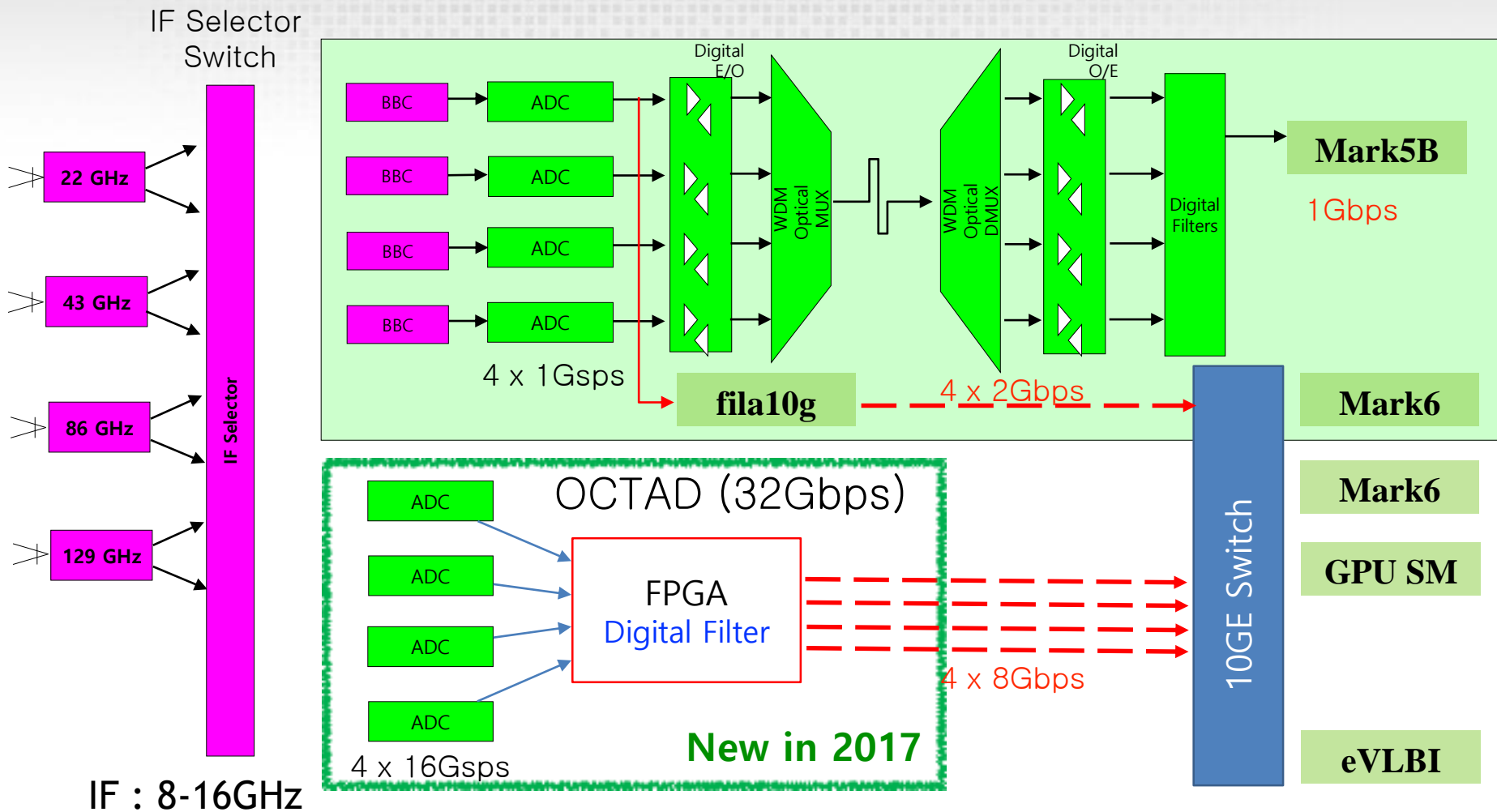
- 3 Telescopes (D = 21m)
- 22/43/86/129GHz
- 300 - 500 km
- $\theta = 1 - 6 \text{ mas}$
- 2001-08 : Construction
- 2009-12 : Commission
Single-Dish Surveys
VLBI Test
- 2013 - : Operation
- Science Targets
AGN/SF/Evolved Star

Multi-Frequency Receiving System

- Simultaneous Multi-frequency Observation
 - @ 22/43/86/129GHz
 - Dual Pol : LCP & RCP
- Multi-Frequency
 - Spectral Index
 - Rotation Measure
- (Source) Frequency Phase Transfer
 - Weak Source Detection/Imaging
 - Chromatic (λ) Astrometry



Digital Backend



4 frequency bands full stokes from 2018

Specification of KVN

Band	Frequency (GHz)	Tsys (K)	Aeff [Gain] (%)	SEFD (Jy)	t_int (sec)	ΔS (5σ) (mJy/beam)
K	21.25-23.25	100	60	1300	120	30
Q	42.11-44.11	150	60	1900	60	50
W	85-95	200	55	3000	30	120
D	125-145	250	35	5300	20	250

w/ 2Gbps (Mark6)

- OCTAD (2017-)
 - 4 x 16Gbps Samplers + Digital Down Converter
 - 32Gbps Data Output (e.g. 4 x 2GHz, 16 x 512MHz)
- Wideband Receiver Project (2017 - 2019)
 - Frequency : 18-26 / 35-50 / 85-115 / 125 - 172 GHz

KaVA : KVN and VERA Array



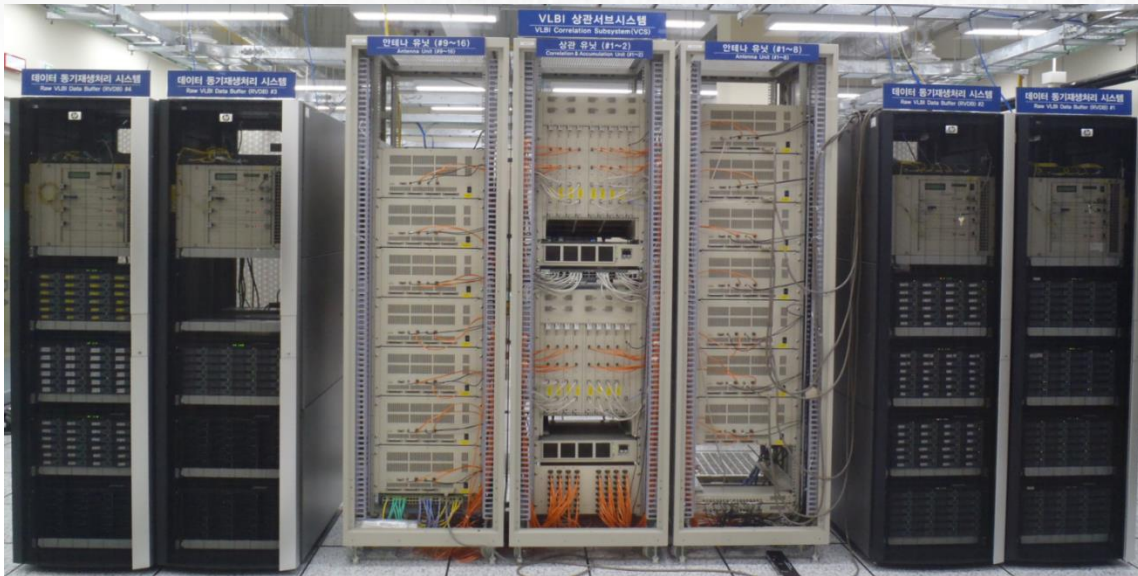
- 7 Telescopes (D ~ 20/21m)
- Baseline : 300 - 2300 km
- Frequency : 22/43(/86/129)GHz
- Beam Size : 1.2/0.6(/1.5/1.0) mas
- ~ 1000 h/yr



Daejeon HW Correlator
@Korea-Japan Correlation Center



Korea-Japan Correlation Center (KJCC)



Daejeon HW Correlator

- Joint Development & Operation by KASI & NAOJ
- Input Data Rate = (4 x) 2Gbps x 16 stations
- KaVA & EAVN observation

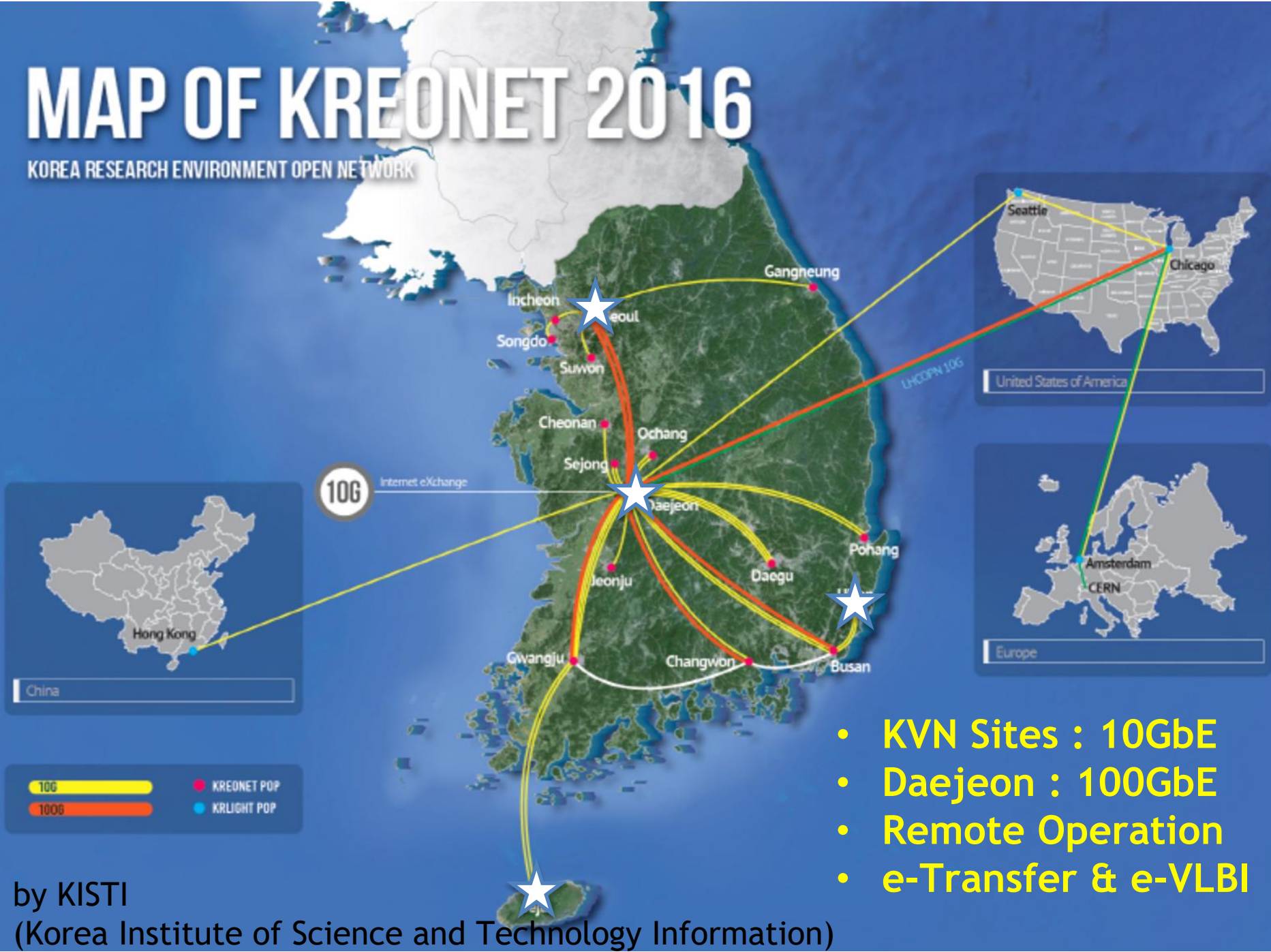


DiFX SW Correlator

- KVN observation

MAP OF KREONET 2016

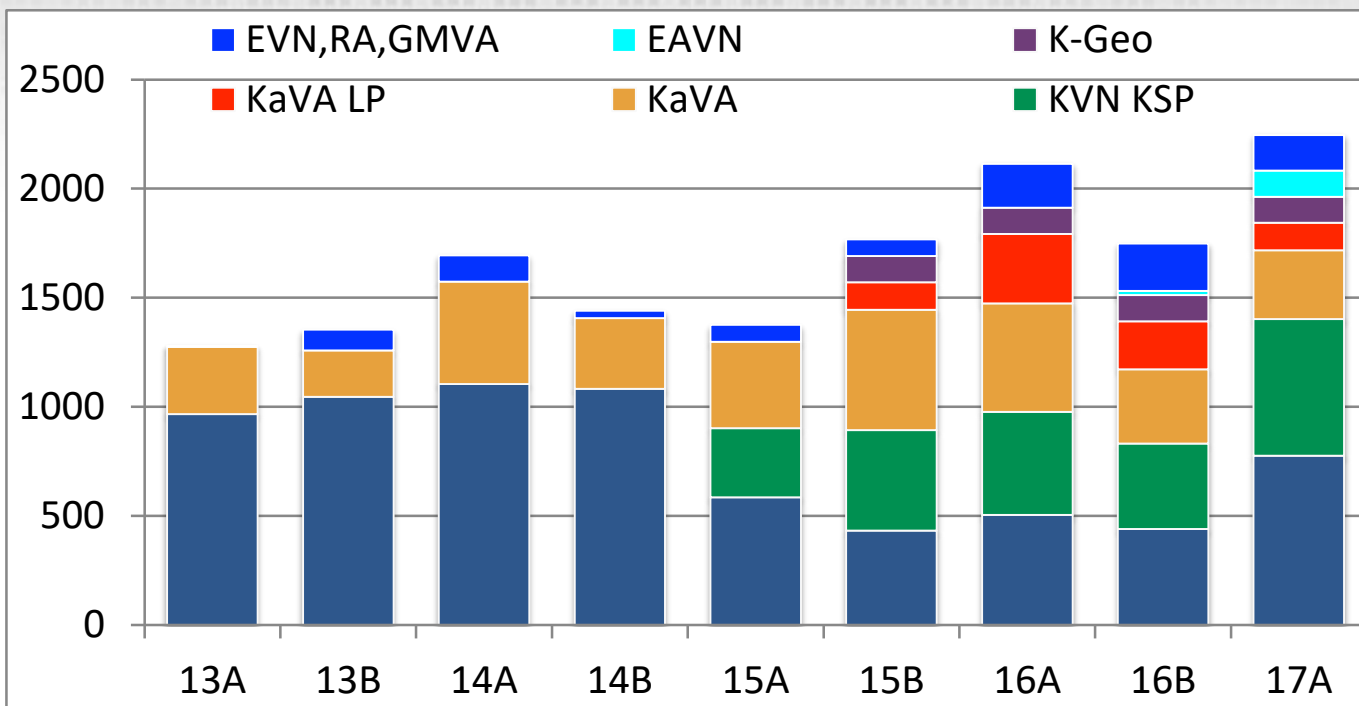
KOREA RESEARCH ENVIRONMENT OPEN NETWORK



- KVN Sites : 10GbE
- Daejeon : 100GbE
- Remote Operation
- e-Transfer & e-VLBI

by KISTI
(Korea Institute of Science and Technology Information)

VLBI Operation Time

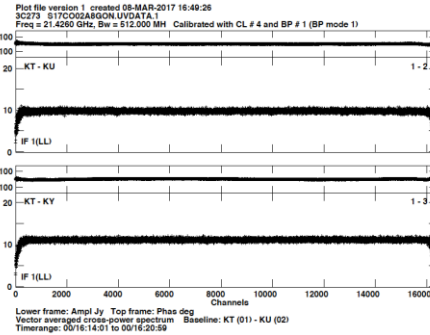
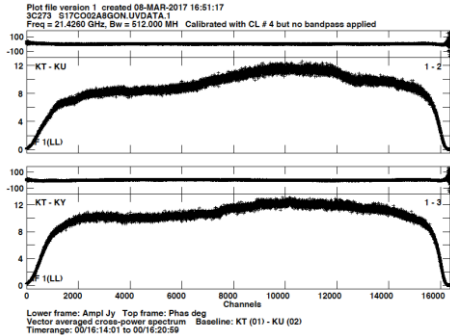


- VLBI ~ 4000h / yr
- KVN Key Science Projects (1000h/yr) from 2015
- KaVA Large Programs (500h/yr) from 2015
- EVN, RA (22/43GHz) + GMVA (86GHz) ~ 300h / yr
- EAVN (East Asian VLBI Network) ~ 200h/yr
- Global Open Use ~ 1000h/yr

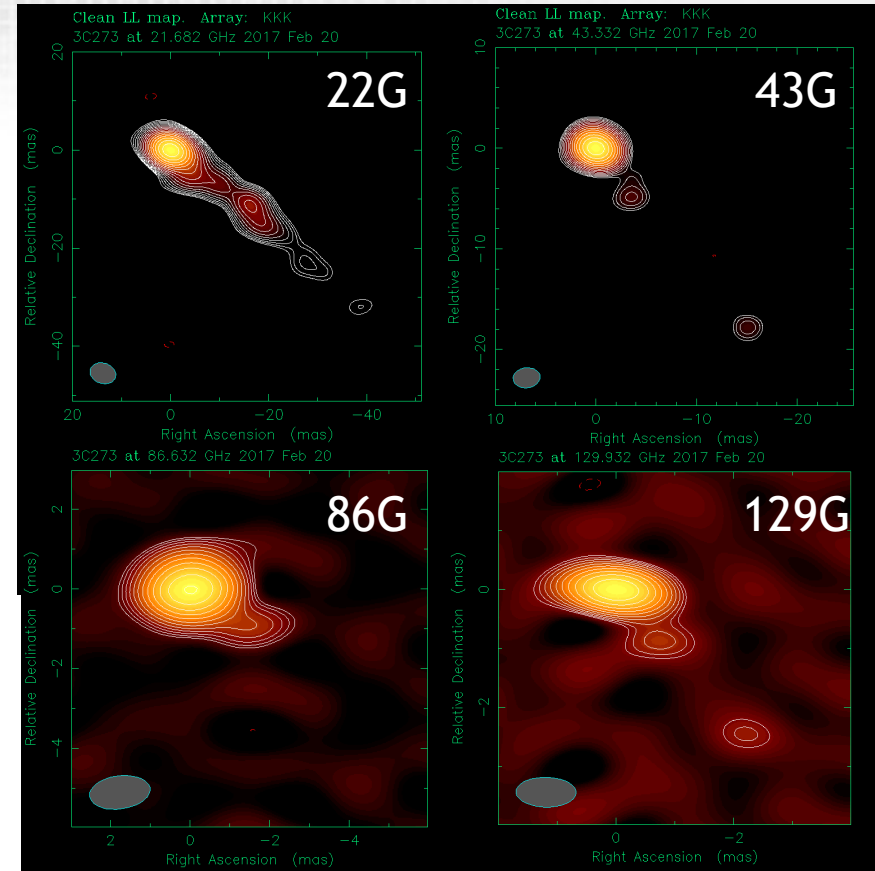
New : 8Gbps Mode

- 8Gbps : 4 x 512MHz BW
- ~3 time higher sensitivity than 1Gbps mode
- ~500h/yr

BPASS Applied



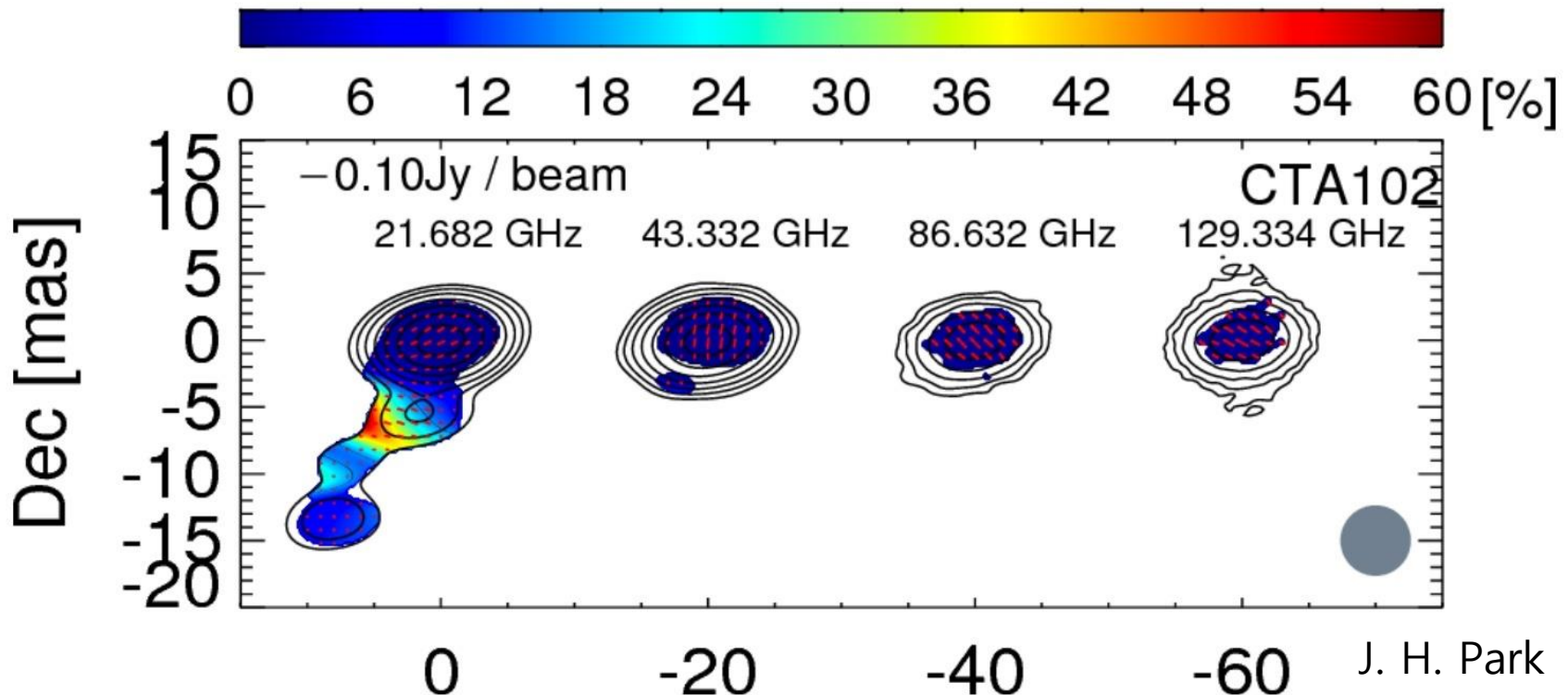
512MHz BW



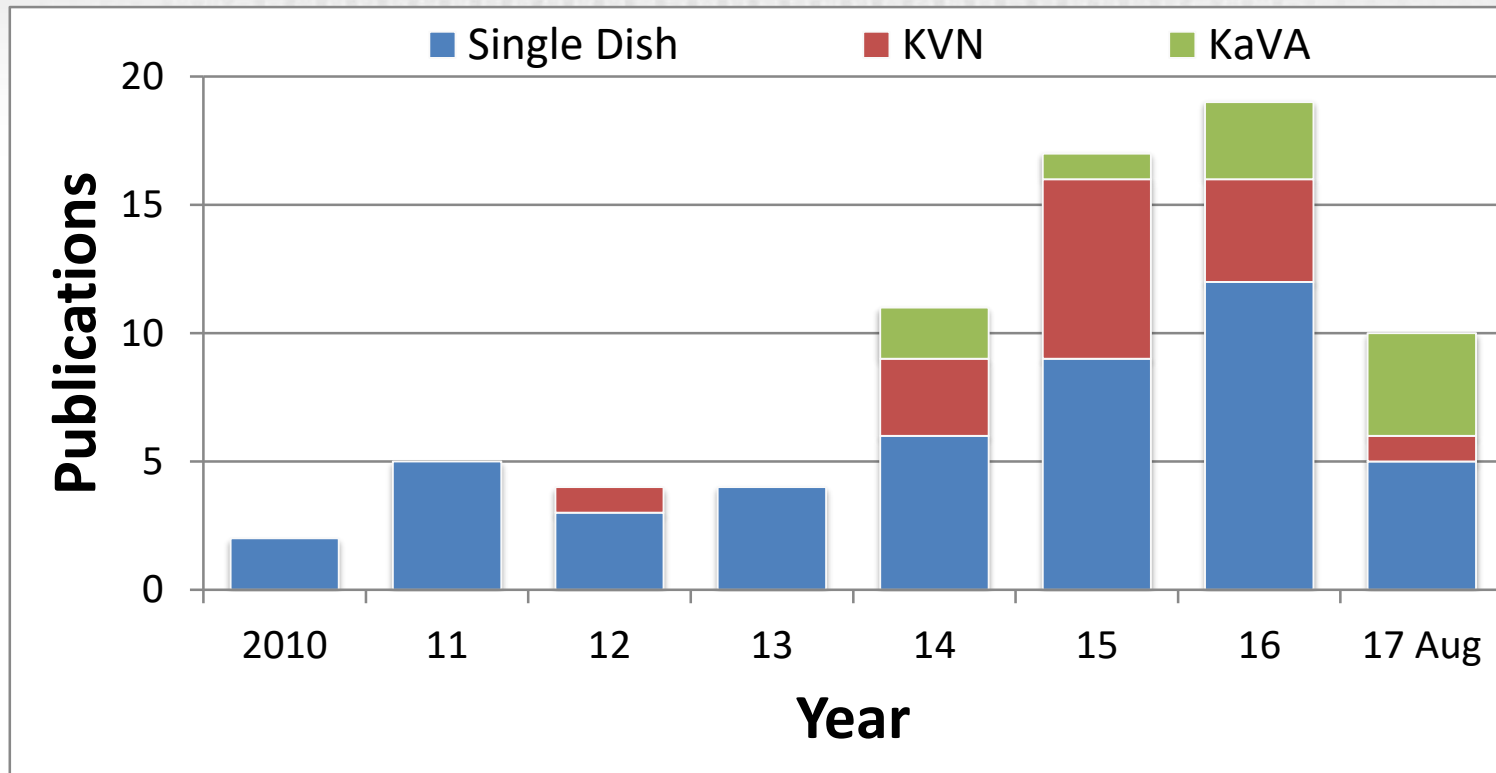
S.-S. Lee

New : 130GHz Polarization

- Polarization Calibration up to 130GHz
 - calibrated absolute polarization angle with KVN single dish polarization result



Publications



- VLBI papers increasing (Mostly AGN)
- S/D papers using 86 & 130GHz and polarizations data

Wideband Receiver Project

- 2017 - 2019
- Upgrade current Rx by replacing narrow band components
 - LNA, Polarizer, Feed Horn
- First wide K-band receiver was installed at Yonsei
 - Trx ~ 15K (~40K including Quasi-optics)
 - Measured aperture efficiencies are almost same over 18-26GHz

	Freq(GHz)	Trx(K)	
K	18-26	< 40	2018
Q	35-50	< 50	2018
W	85-115	< 80	2018
D	125-172	< 60	2019

Plan of the Extended KVN

- New KVN stations
 - + 2 stations (10 baselines)
 - Short Baselines (30 - 500km)
 - Frequency : 18-172GHz
- Pre-study : 2017-18
 - AGN / SF / Evolved Star
 - Pulsar
 - Microquasar, SNe, TDE
- Construction: 2020 - 2022
- Operation : 2023 -

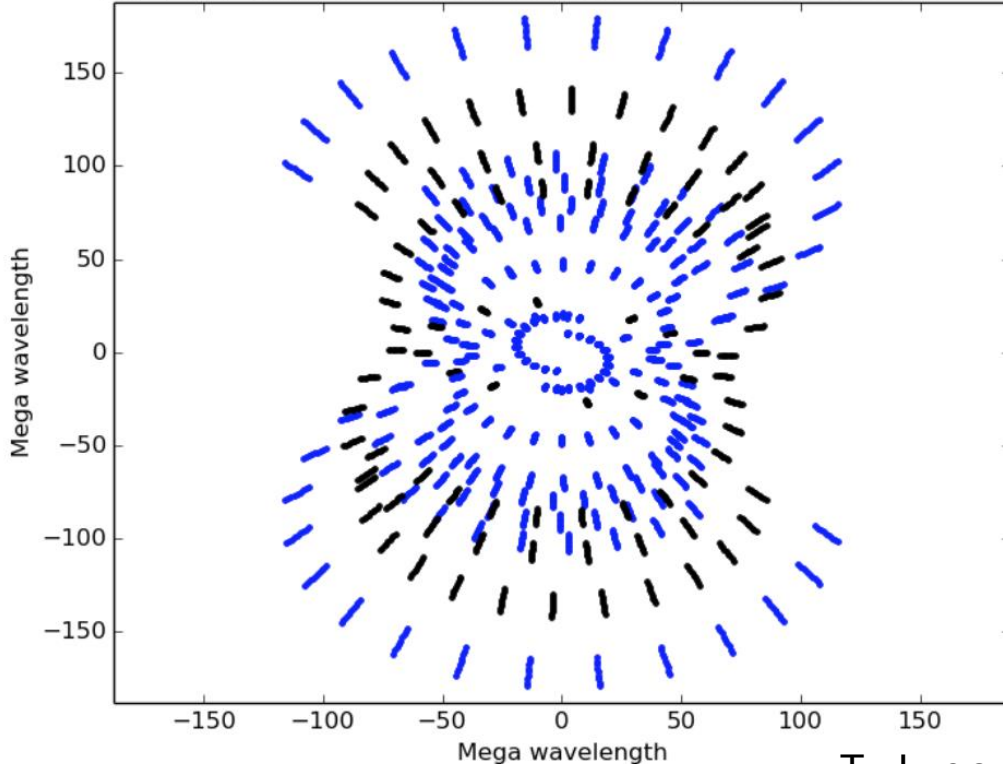


2002 IVS General Meeting

Example: UV - Coverage of KVN-E

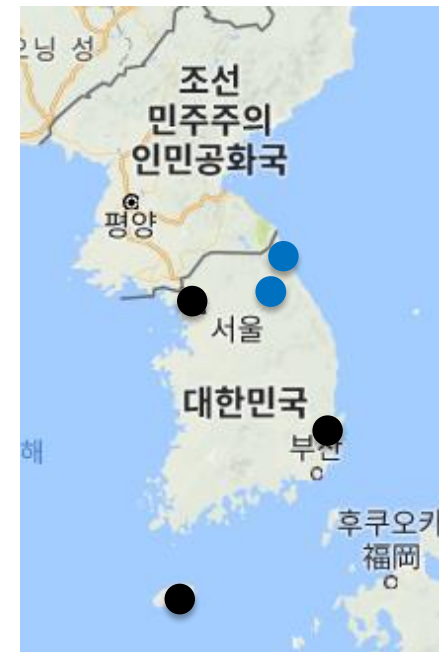
- 3 KVN + 2 New stations (D, S)
- 1hour scan interval at 86 - 94GHz

['Ky', 'Kt', 'Ku', 'Ed', 'Es'] from 86GHz to 94GHz towards dec = 50



T. Jung

- KVN baselines
- New baselines



East Asia To Italy: Nearly Global VLBI Workshop 2017



Important Dates

Registration

Scientific Program

Participants

SOC/LOC Members

Venue & Travel Info

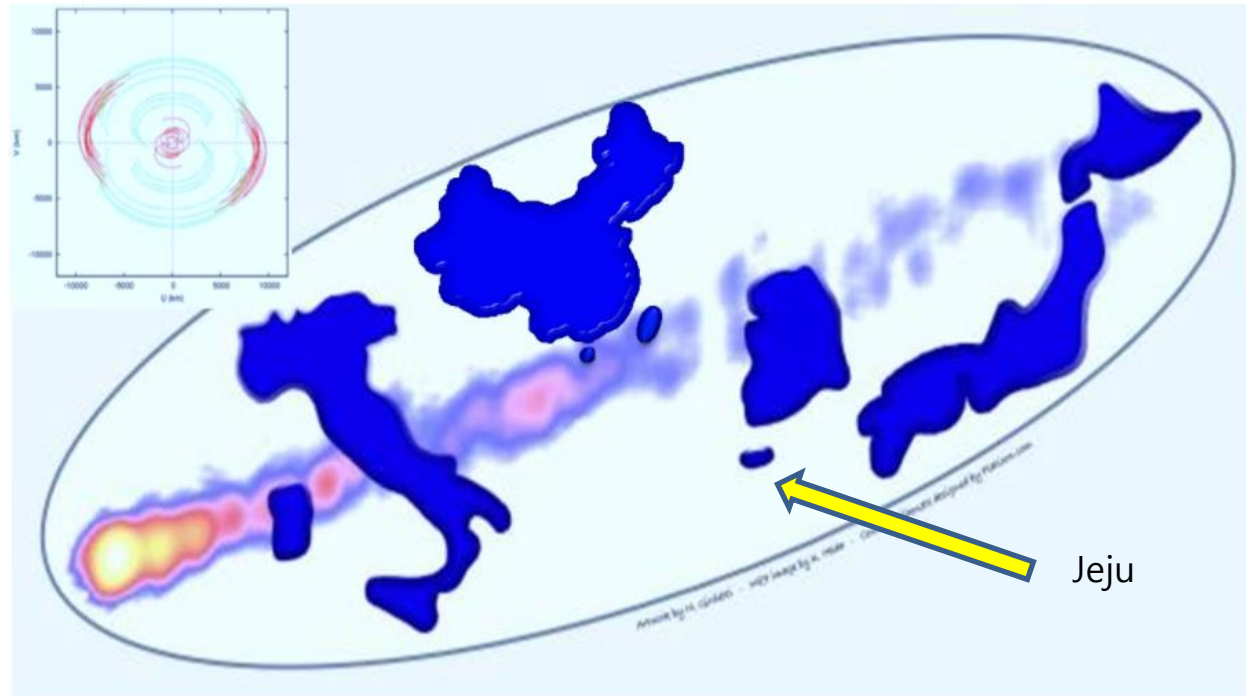
Accommodations

Visit Jeju

Booklets

Eating VLBI Workshop 2017, Jeju, Korea

October 30 - November 1 (Mon-Wed), 2017
XXXX Hotel, Seogwipo-si, Jeju, Korea



- **EATING VLBI - Factor of ~4 of baseline extension w.r.t. KaVA**
 - M87 100 R_{Sch} \rightarrow 25 R_{Sch} @43GHz
 - 3C84 jet width resolved \rightarrow Intensive monitoring (e.g. KaVA M87)
 - Distant Quasar like OVV1633+382 ($z \sim 1.813$) pc scale

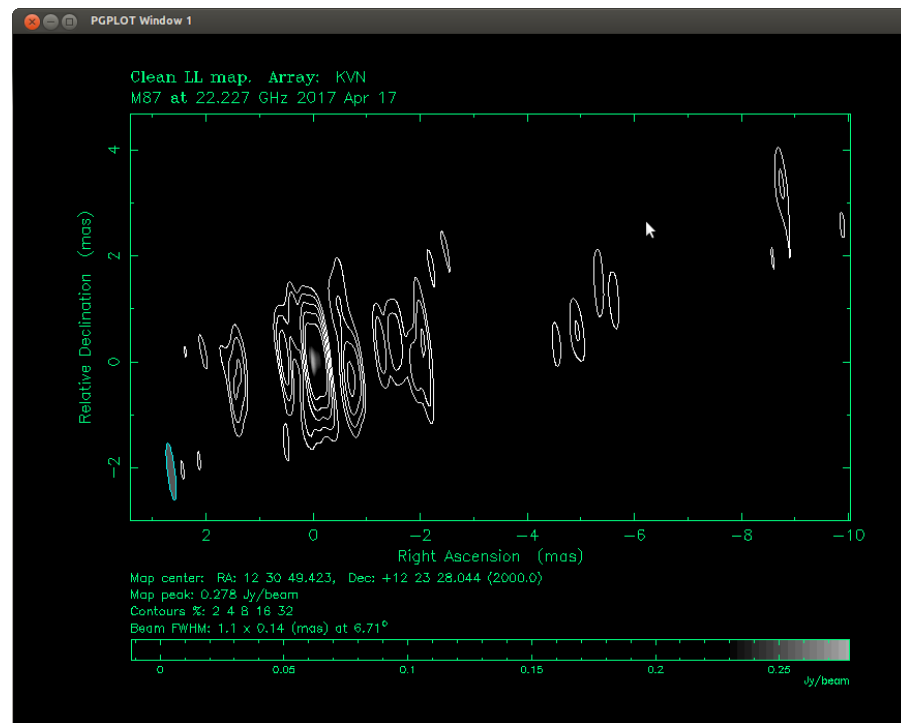
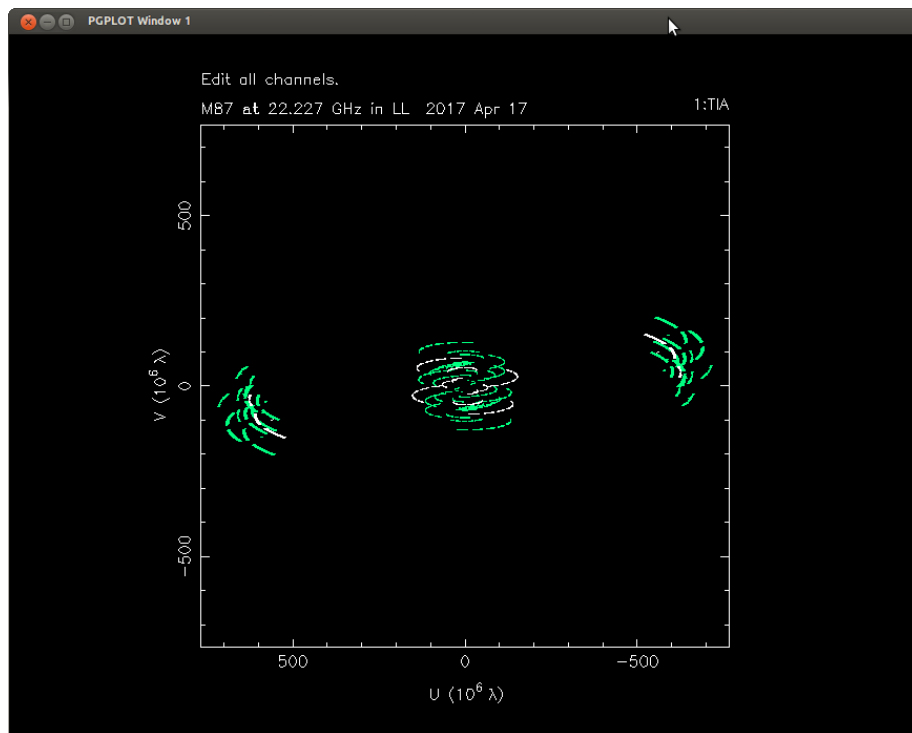
KaVA LP– EHT joint observation with IVN!

Date	UT time	Target	Freq.	Stations
3/12	18:55 – 00:55 (6hr)	SgrA	43GHz	KaVA, TM
3/18	12:45 – 19:45 (7hr)	M87	22GHz	KaVA, TM, UR, TH, HT, KS
3/19	11:40 – 18:40 (7hr)	M87	43GHz	KaVA, TM
3/27	13:10 – 23:10 (10hr)	M87+SgrA	43GHz	KaVA, TM
4/3	13:20 – 23:20 (10hr)	M87+SgrA	22GHz	KaVA, TM, UR, TH, HT, KS MC, NT
4/4	12:40 – 22:40 (10hr)	M87+SgrA	43GHz	KaVA, TM
4/9	12:20 – 22:20 (10hr)	M87+SgrA	43GHz	KaVA, TM, NY
4/14	12:00 – 22:00 (10hr)	M87+SgrA	43GHz	KaVA, TM
4/17	11:50 – 18:50 (10hr)	M87	22GHz	KaVA, TM, UR, TH, HT, KS MC, NT
4/18	11:45 – 21:45 (10hr)	M87+SgrA	43GHz	KaVA, TM
4/24	09:20 – 16:20 (7hr)	M87	22GHz	KaVA, TM
4/25	09:15 – 16:15 (7hr)	M87	43GHz	KaVA, TM
4/26	15:55 – 21:55 (6hr)	SgrA	43GHz	KaVA, TM
5/10	08:20 – 17:20 (7hr)	M87	22GHz	KaVA, TM MC NT
5/11	08:15 – 17:15 (7hr)	M87	43GHz	KaVA, TM NT
5/25	14:00 – 20:00 (6hr)	SgrA	43GHz	KaVA, TM
5/26	07:15 – 16:15 (7hr)	M87	43GHz	KaVA, TM NT

TM=Tianma65, UR=Urumqi, TH=Takahagi, HT=Hitachi, KS=Kashima, NY=Nobeyama45
 MC=Medicina, NT=Noto

EATING VLBI

- M87(17107a) KaVA+VLBIT+**Tianma**

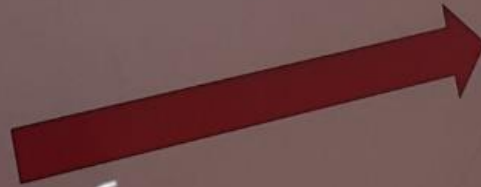


Ur still to come!

Summary

- KVN in stable operation
 - ~4000 h/yr
 - KVN Key Science Project/ KaVA Large Program
- International Collaboration
 - KaVA, East Asian VLBI Network (EAVN)
 - EVN, RA, GMVA, ***EATING (KVN/EAVN-IT)***
- KVN upgrading and KVN-E
 - Upgrade of Receivers and Backends is on going
 - Pre-study of the Extended KVN

VLBI
EATING



Mushroom...?