Progress report of KaVA AGN Science WG

Motoki Kino (Kogakuin Univ), Kazuhiro Hada (NAOJ)
on behalf of KaVA-EAVN AGN Science WG

"VERA Users Meting"
Nov 4-5 2017 at NAOJ Mizusawa

Contents

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From KaVA to EAVN:
the case of KaVA AGN SWG

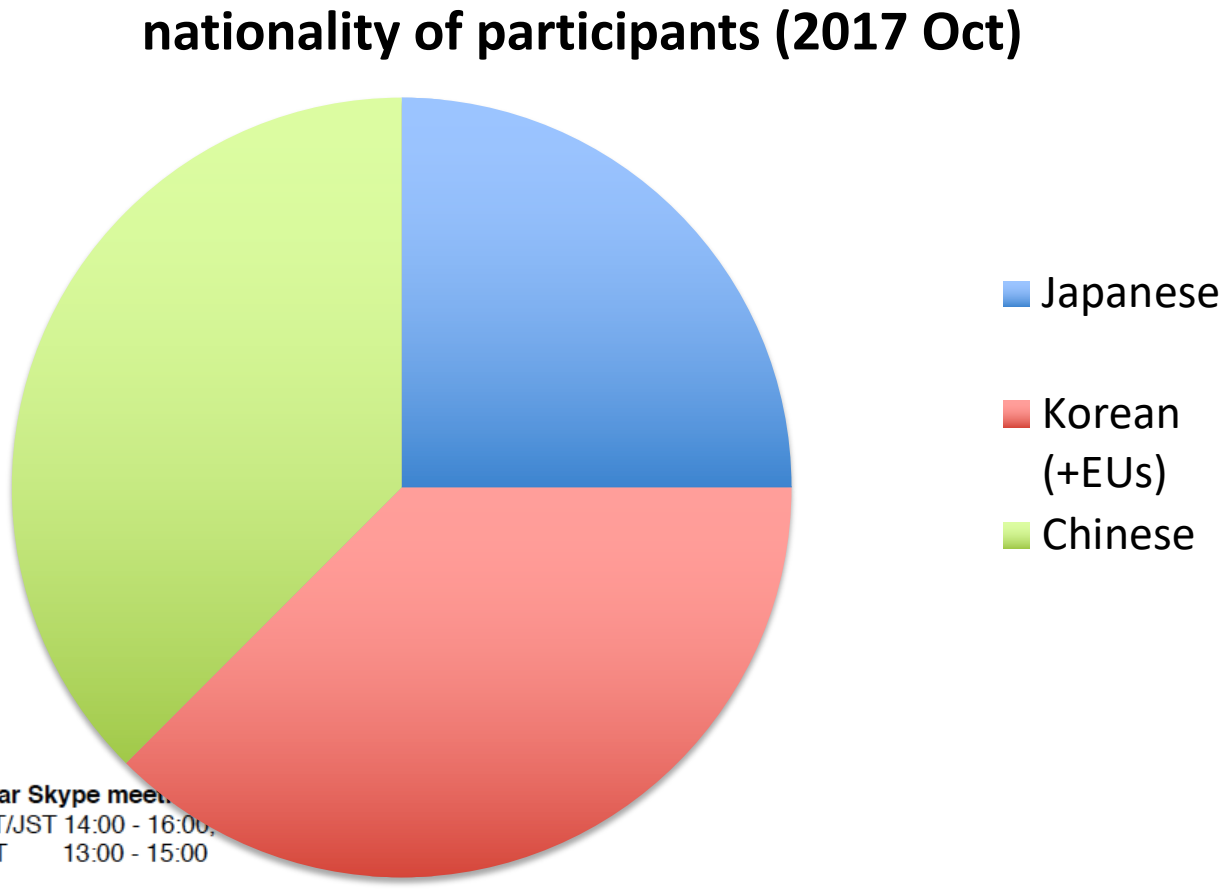
Kick off at Guiyang, China!

Chinese members in the AGN SWG (2017 Nov)

Zhiqiang Shen (SHAO)
Wu Jiang (SHAO)
Tao An (SHAO)
Lang Cui (XAO)
Yingkang Zhang (SHAO)
Xiaopeng Cheng (SHAO)

Yuzhu Cui (NAOJ)
Guang-Yao Zhao (KASI)

KaVA AGN SWG - making a smooth transition to EAVN AGN SWG

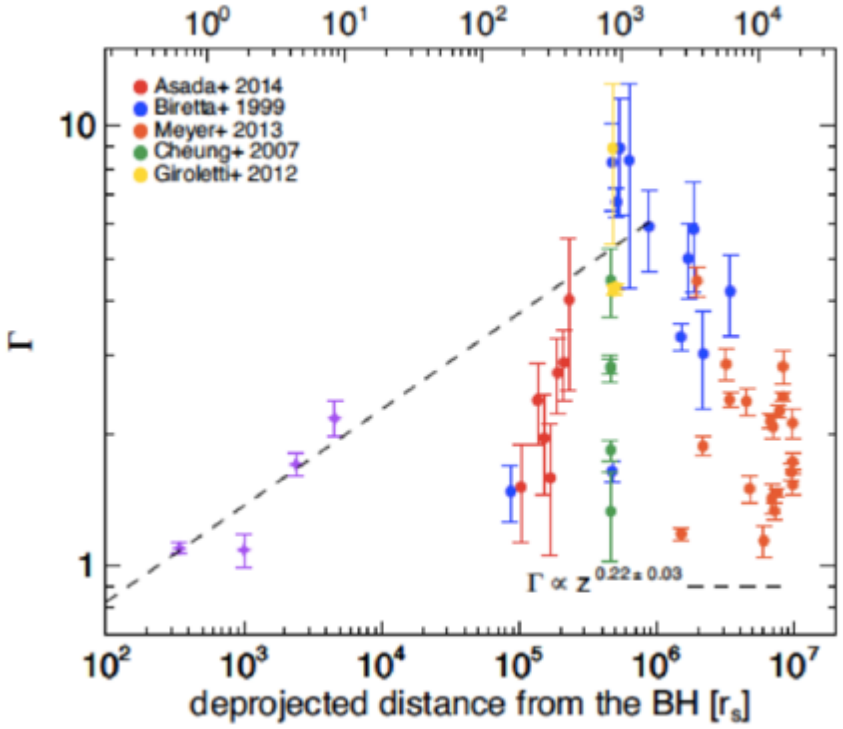


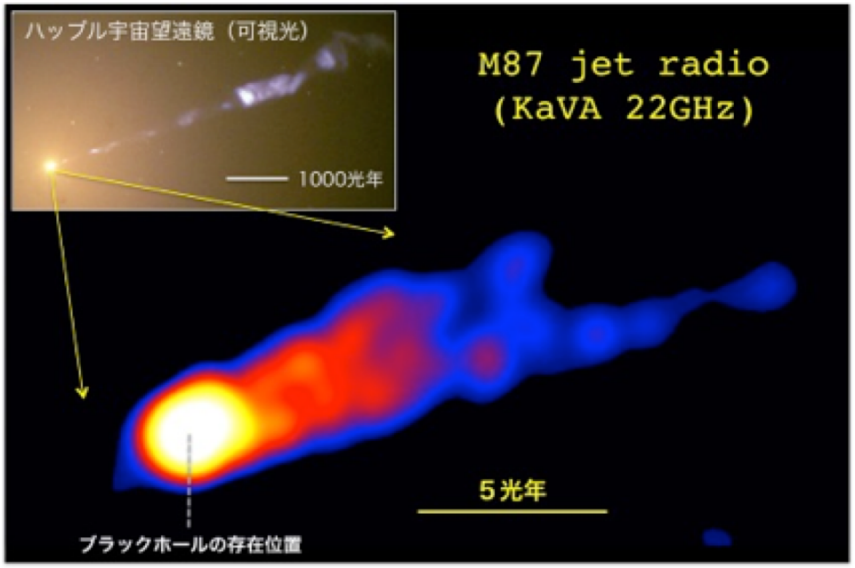
Memo of KaVA/EAVN AGN Regular Skype mee
Date: 2017 October 26th (Thu) KST/JST 14:00 - 16:00,
CST 13:00 - 15:00

Attendees(16)
NAOJ Mtk (1) : M. Kino
KASI (5) : K. Wajima, I. Cho, J.C. Algaba, G.Y. Zhao, B.W. Sohn
SNU (2) : S. Trippe, J.H. Park
Yonsei (1) : H.W. Ro
NAOJ Miz (3) : K. Hada, F. Tazaki, Y-Z Cui
SHAO(4) : W. Jiang, T. An, Y. Zhang, X. Cheng

Progress of
KaVA AGN Large Program

Our pilot KaVA observations revealed superluminal motions in M87





Hada, Park, KaVA AGN SWG et al. (2017), PASJ

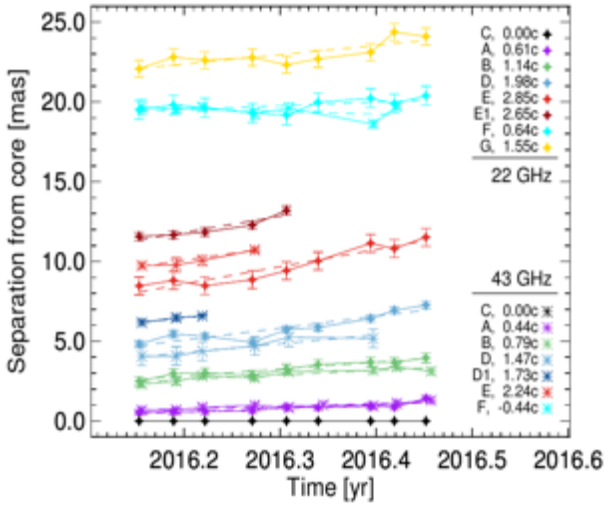
Current status of KaVA AGN LP for M87

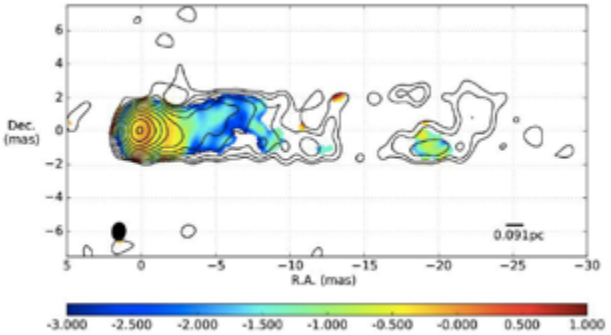
- KaVA AGN LP is the only one VLBI monitoring for M87!

- Bi-weekly monitoring reveals velocity field in great details!

  (Park et al. *in prep*)

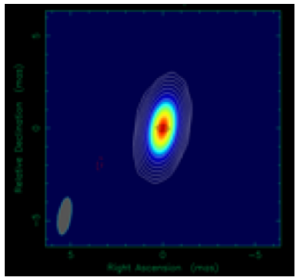
- Quasi simultaneous 22/43Ghz enables us to explore spectral index! (Ro et al. *in prep*)





Current status of KaVA AGN LP for Sgr A*

- Indeed, the KaVA data quality is very good because of rich short baselines!



- The PI, GY Zhao (KASI), is wrapping up Sgr A* data in 2014-2015.

- Michael Johnson (Harvard) joins us and supports closure-only analysis.

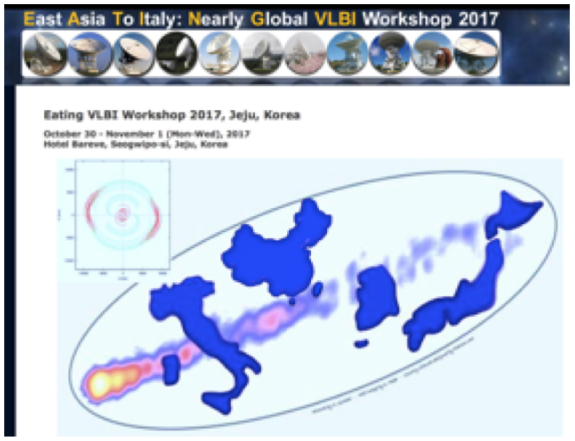
More results to come

See details in presentations in recent workshops

http://www.miz.nao.ac.jp/vera/en/content/cc/cc20170117/c1

http://eavw2016.csp.escience.cn/dct/page/70003

http://agn.kasi.re.kr/eatingvlbi/index.html



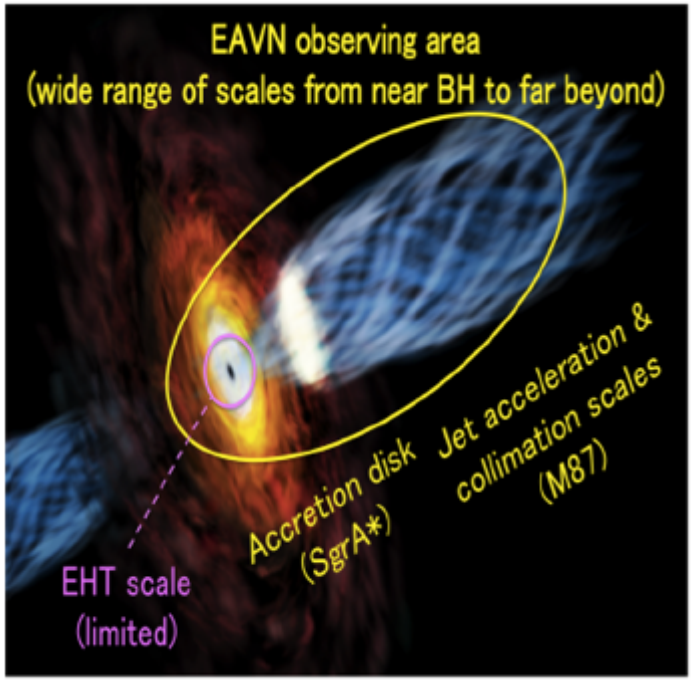
EAVN and EHT campaign in 2017

Demonstrating the Power of EAVN: Coordinated EAVN campaign for M87/SgrA* in 2017 March/April

Hada, K. (NAOJ) on behalf of The EAVN Tiger Team & The EAVN AGN Science Working Group

2 EAVN and EHT joint campaign for M87/SgrA* in April 2017

In the forthcoming April, there will be a special event for the community of black hole physics and high-energy astrophysics: for the first time, ALMA will join the global VLBI network at millimeter wavelengths, so-called the Event Horizon Telescope (EHT). With the EHT plus ALMA, it is expected that images of the shadows of the supermassive black holes in the Galactic Center SgrA* and a nearby radio galaxy M87 are directly obtained, as well as horizon-scale structures of the surrounding accretion disk (SgrA*) and



Special thanks to Oh Sejin san

http://www4.nhk.or.jp/cosmic/23/

- NHK TV “Cosmic Front”
- EHT, EAVN and KJCC

AGN WG commits KaVA+Tianma array performance evaluation

	Code	Date	Target	λ	Stations	Person in charge (responsible for writing a report)
1	a17071a	3/12	SgrA	Q	KaVA, (TM)	Zhao/Cho
2	a17077a	3/18	M87	K	KaVA, TM, UR, HT, KS	Hada/TT + persons from UR,HT,KS
3	a17078a	3/19	M87	Q	KaVA, TM	Yuzhu/Xiaopeng/Yingkang
4	a17086a	3/27	M87/SgrA	Q	KaVA, TM	M87: Yuzhu/Xiaopeng/Yingkang
						Sgr: Zhao/Cho/Jiang
5	a17093a	4/3	M87/SgrA	K	KaVA, TM, UR, HT, KS, MC	M87: Hada/TT/Sohn + persons from UR, HT, KS, EATING
						Sgr: Zhao/Cho/Jiang/TT + persons from UR, HT, KS, EATING
6	a17094a	4/4	M87/SgrA	Q	KaVA, TM	M87: Tazaki
						Sgr: Zhao/Cho/Jiang
7	a17099a	4/9	M87/SgrA	Q	KaVA, TM, NY	M87:Hada/TT + persons from NY
						Sgr: Zhao/Cho/Jiang/TT + persons from NY
8	a17104a	4/14	M87/SgrA	Q	KaVA, TM	M87:Tazaki
						Sgr: Zhao/Cho/Jiang
9	a17107a	4/17	M87	K	KaVA, TM, UR, HT, KS, SJ, MC, NT	Hada/TT/Sohn + persons from UR, HT, KS, SJ, EATING
10	a17108a	4/18	M87/SgrA	Q	KaVA, TM	M87: Yuzhu/Xiaopeng/Yingkang
						Sgr: Zhao/Cho/Jiang
11	a17114a	4/24	M87	K	KaVA, TM	Park/Ro
12	a17115a	4/25	M87	Q	KaVA, TM	Tazaki
13	a17116a	4/26	SgrA	Q	KaVA, TM, SJ	Zhao/Cho/Jiang/TT + persons from SJ (Oh?)
14	a17130a	5/10	M87	K	KaVA, TM, MC	Hada/TT/Sohn + EATING
15	a17131a	5/11	M87	Q	KaVA, TM	Park/Ro
16	a17145a	5/25	SgrA	Q	KaVA, TM	Zhao/Cho/Jiang
17	a17146a	5/26	M87	Q	KaVA, TM	Park/Ro

- 日韓中みんなでデータを共有、一緒に解析
- 性能評価については田崎さんポスターも参照

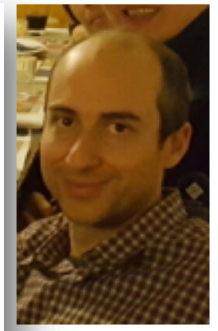
Beyond KaVA-EAVN: EATING VLBI!
(East Asia To Italy: Nearly Global VLBI)

PROPOSAL FOR COORDINATED OBSERVATIONS WITH THE IRA TELESCOPES

ISTITUTO NAZIONALE DI ASTROFISICA

The Director
Via P. Gobetti 101
I-40129 Bologna (Italy)

For ORA use
Registration N°:
Date:



TITLE
Joining the exceptional M87 multi-wavelength campaign in Spring 2017

Principal Investigator:

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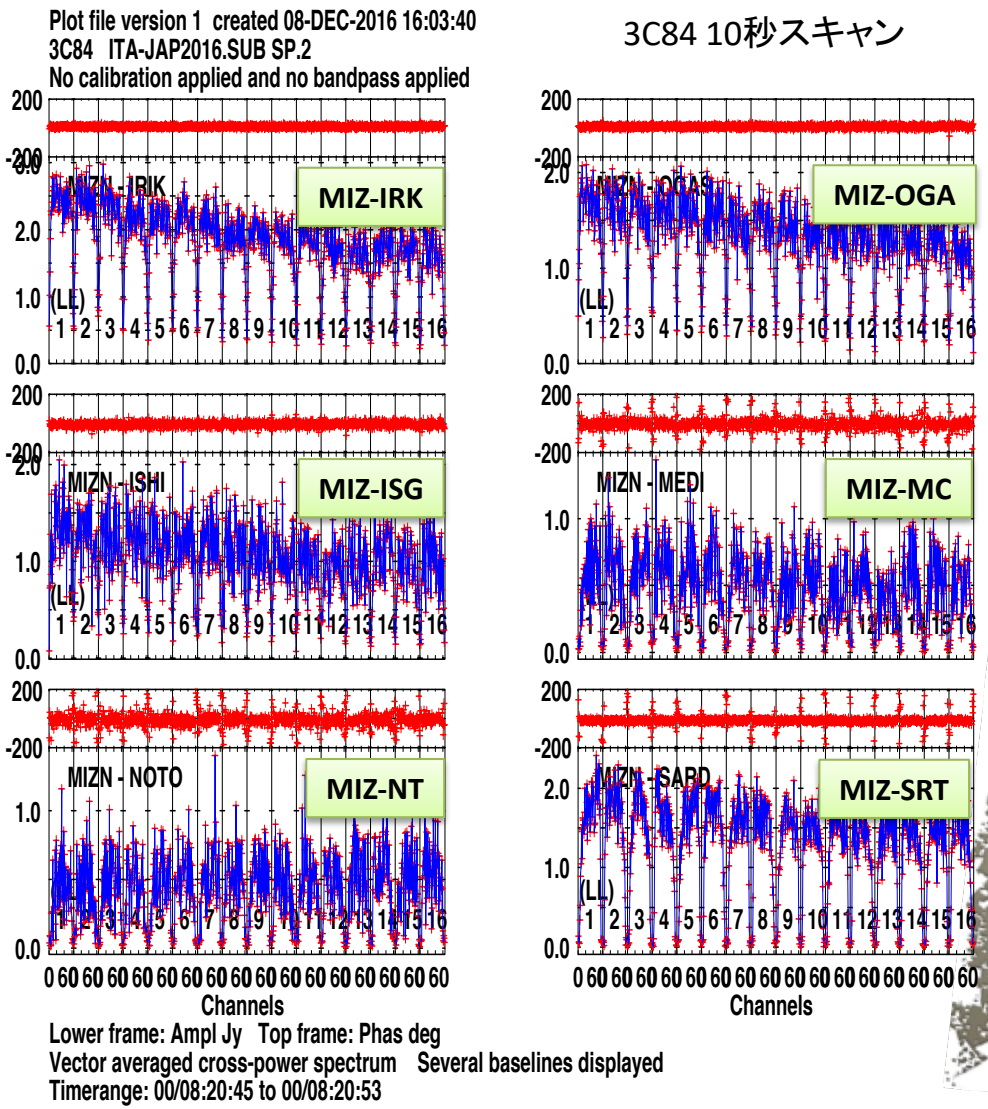
via Gobetti 101
Bologna (ITALY)
Tel: +39 051 639 9394 Fax: +39 051 639 9431
Email: giroletti@ira.inaf.it

Other Investigators (name, institution):

K. Hada, M. Honma. T. Oyama
R. Lico, G. Giovannini, P. Cassar
(IRA-INAF); M. Kino, O. Se-Ji
(SHAO); X. Liu (XAO); D. Mazi

EAVN-2017 also detected trans-continental fringes to Italy!

Italy-VERA experiment in April/2016



3C84 10秒スキャン

- **日伊で初めてちゃんとしたフリンジ検出**
- **開発グループ皆様の多大なるサポート**
- **Oh Sejinさんデータ形式変換サポート**

- EAVN+伊フリンジ検出成功の大きな足がかり

Plan in 2018

Large Program in 2nd term submitted

In-depth study of plasma flows around super-massive black holes: Intensive monitoring of M87 and Sagittarius A*

Motoki Kino & Bong-Won Sohn
*on behalf of KaVA-EAVN AGN Science Working Group**

Abstract

Exploring the vicinity of super-massive black holes (SMBHs) is one of the frontiers in astrophysics. Because of the largeness of angular-sizes of the central SMBHs, Sagittarius A* (Sgr A*) is the excellent laboratory for studying gas accretion process onto the SMBH and M87 is well known as the best case for investigating plasma outflow ultimately driven by SMBH. To get better understanding of plasma inflow/outflow physics near the SMBHs, we have started this KaVA AGN Large Program (LP). Based on the successful first term of our AGN LP, we propose to continue the same dual frequency (22 and 43 GHz) and high cadence monitoring during the same yearly period as in the 1st term aiming for in-depth studies of our new accomplishments on M87 and Sgr A* obtained in the 1st term. We also emphasize that this AGN LP now plays a leading role for boosting the performance evaluation of the East Asian VLBI Network (EAVN). In order to maximize our scientific accomplishment in the 2nd term, we also enhance a scientific collaboration with Event Horizon Telescope (EHT) Collaboration (EHT-C) via multi-wavelength (MWL) Science Working Group in EHT-C.

Plan of KaVA-EAVN LP w/ EHT (2018)

	total epoch	Interval	when (duration)	1 epoch [hrs]	total [hrs]
M87 @22GHz	12-3 = 9 epochs	2 weeks	2017 Dec – 2018 May (6 months)	7	63
M87 @43GHz	12-3 = 9 epochs	2 weeks	2017 Dec – 2018 May (6 months)	7	63
Sgr A* @43GHz	9 epochs	1 month	all year long	6	54
EHT campaign (M87+SgrA*) @43GHz	3+2 epochs	~ 1 week or even less	2018 Apr (one month)	12	60
EHT campaign (M87+Sgr A*) @22GHz	3 epochs	~ 1-2 weeks	2018 Apr (one month)	12	36

Also plans to request Tianma, Urumqi, JVN, Sejong and Italy

KaVA performance evaluation

- AGN SWG is responsible for
  - C2 mode (1Gbps, 128MHz x 2 IF)
    - 2017: Q-band evaluation completed, open for 2018A
    - 2018: K-band evaluation
  - 2Gbps mode
    - 2017: first test observations at K/Q, various issues found
    - 2018: more analysis (various recorders, correlators)
  - Dual polarization mode
    - 2018: test at K/Q including more VERA stations?

Summary

- KaVA AGN SWG are successfully making a smooth transition to EAVN AGN SWG.
- The 1st paper on early science result on M87 w/ KaVA is published (Hada, AGN SWG+17). More results to come.
- In Spring 2017, the KaVA Large Program successfully coincided with EHT. Also, this LP expanded into the “EAVN campagin”
- AGN SWG are leading KaVA+Tianma array performance evaluation by using the EAVN campaign data. Also contributing to various KaVA performance evaluation items.
- Large Program in 2nd term. More tie-up with EAVN, EHT

Towards EAVN common-use (1/2)

Draft Plan for EAVN Common-Use

(Note that this is a DRAFT plan and details will be discussed at the EAVN meeting in July)

- Start of operation: 2018B semester
  - Shared-risk operation
  - **Launch of KaVA+Tianma is prioritized for EAVN common-use**
- Total observing time: 100 hours/semester (= 40% of KaVA common-use operation)
- Observation frequency: 22, 43 GHz (and 6.7 GHz if performance evaluation is fully done)
- Observation mode: **1 Gbps (C4 (32 MHz x 8 ch) and/or C5 (16 MHz x 16 ch)), single polarization**
- Correlator: Daejeon Hardware Correlator

Blue: approved by KaVA DM
Black: TBD
Underline: related to EAVN TT

4/13

by Wajima-san

Towards EAVN common-use (2/2)

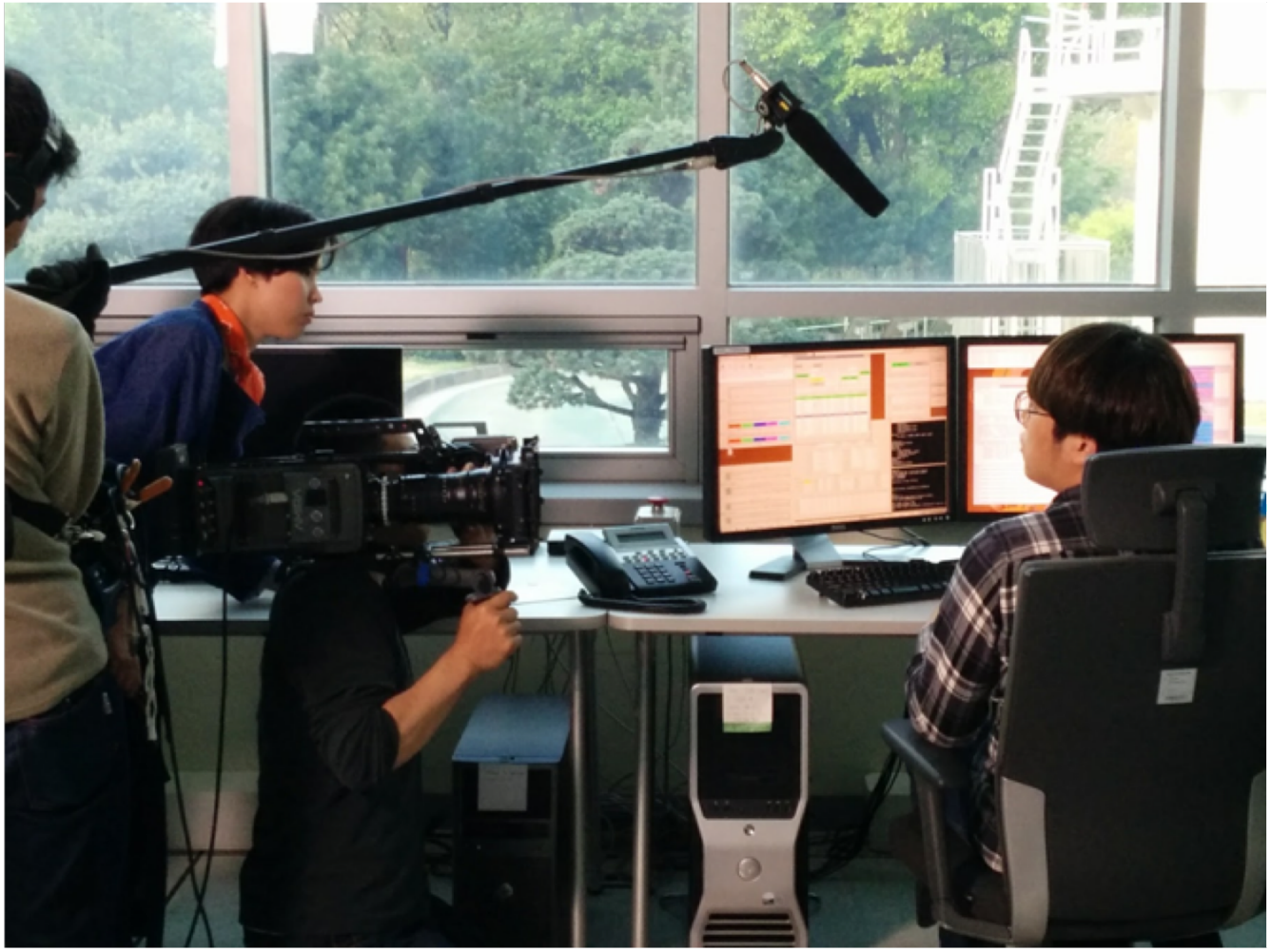
Draft Plan for EAVN Common-Use

(Note that this is a DRAFT plan and details will be discussed at the EAVN meeting in July)

- User support
  - Keeping KaVA's user support structure
  - Inviting new member(s) from China
- Array operation
  - TBD
- Performance evaluation
  - **EAVN TT will lead basic modes for common-use observations**
- Proposal reviewing
  - TBD

Blue: approved by KaVA DM
Black: TBD
Underline: related to EAVN TT

5/13

by Wajima-san

Interview by NHK BS premium
“Cosmic Front” on “EAVN-EHT campaign in 2017”