EVN TOG video meeting

November 24th, 2020

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Continuous Calibration

- Irbene joined the list of cont_cal capable stations.
- In total 12 stations (Ef, Ir, Jb, Hh, Mc, Mh, Nt, On, Sr, T6, Tr, and Ys) are using continuous calibration at least in one band, 6 in all EVN bands.
- Many station report about developments, but for some stations/receivers cont_cal cannot be realised.

DBBC2 and Fila10G News

- Running all sessions on V107 beta5 now and recording up to 4 Gbps.
  - cont_cal issue remain (swapped polarity)
  - some stations show higher degrees of zero TPI values
  - Be careful with calibration when reloading firmware
  - 2 and 16 MHz filters have non optimal bandpass shapes.
- Fila10G firmware 4.1 (Nov 22, 2018)
  - A number of the GPS modules have not survived the GPS week roll over in April 2019
  - Sync via NTP still possible.
  - VLBI Lab in Bonn has found new firmware and will provide replacement modules for stations.

DBBC2 V107 versions in use:

ef DDC,107,October 28 2019
hh DDC,107,October 28 2019
ir DDC,107,November 14 2018
jb DDC,107,October 28 2019
mc DDC,107,October 28 2019
o8 DDC,107,Januar 29 2019
t6 DDC,107,October 28 2019
tr DDC,107,October 28 2019
wb DDC,107,October 28 2019
ys DDC,107,June 07 2019

Fial10G versions in use:

ef Compiled on : Nov 22 2018 13:06:37
hh Compiled on : Oct 20 2017 13:04:01
ir Compiled on : Nov 22 2018 13:06:37
jb Compiled on : Nov 22 2018 13:06:37
mc Compiled on : Nov 22 2018 13:06:37
o8 Compiled on : Nov 22 2018 13:06:37
tr Compiled on : Nov 22 2018 13:06:50
wb Compiled on : Mar 2 2017 14:25:35
ys Compiled on : Oct 20 2017 13:04:01

Recorders

- Some station reports mention Flexbuf recording speed problems. Are there any issues?
- Any other news?

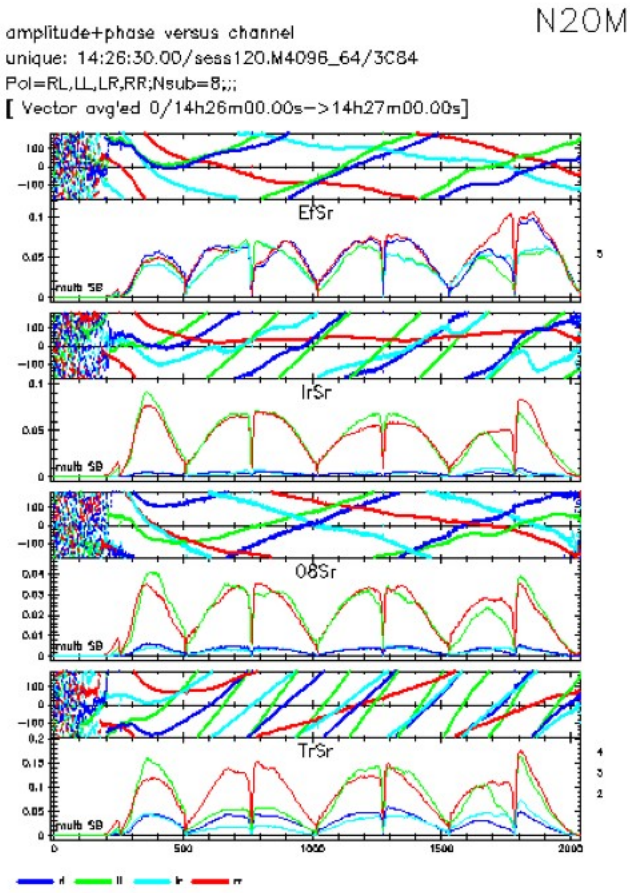
Media requirements

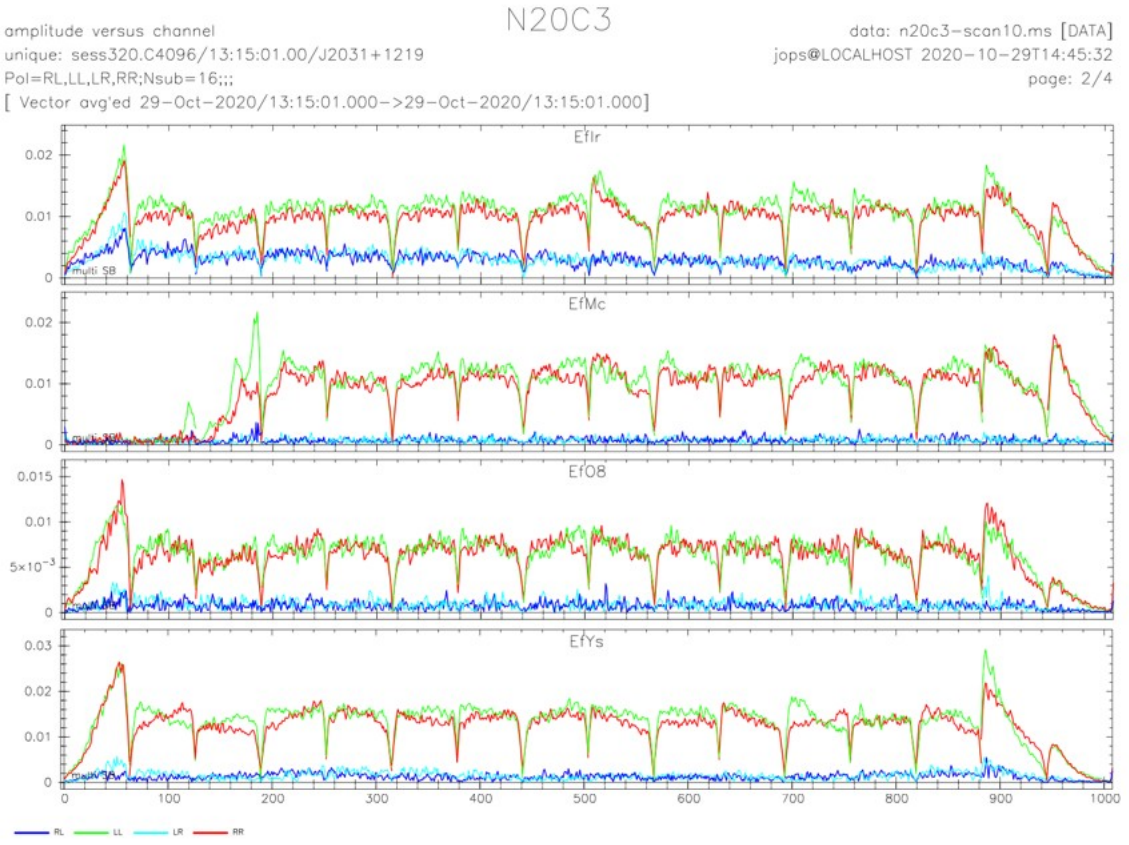
- 2 x 250 TB goal for 2 Gbps recordings
  Roughly achieved by many stations (~460 TB).
- The CBD has decided to double the disk space capacity again by 2021 to allow an increased recording rate of 4 Gbps.
  - 4 Gbps require a Flexbuff or Mark6 at the station. Mark5 recorders can hardly do 4 Gbps.
  - 4 Gbps require 512 MHz of bandwidth at each polarization.

➔ All stations need to buy more disks in 2021!

4 Gbps recording rate

- wastro vs. astro mode (32x32 MHz vs. 16x64 MHz)





VLBI Equipment

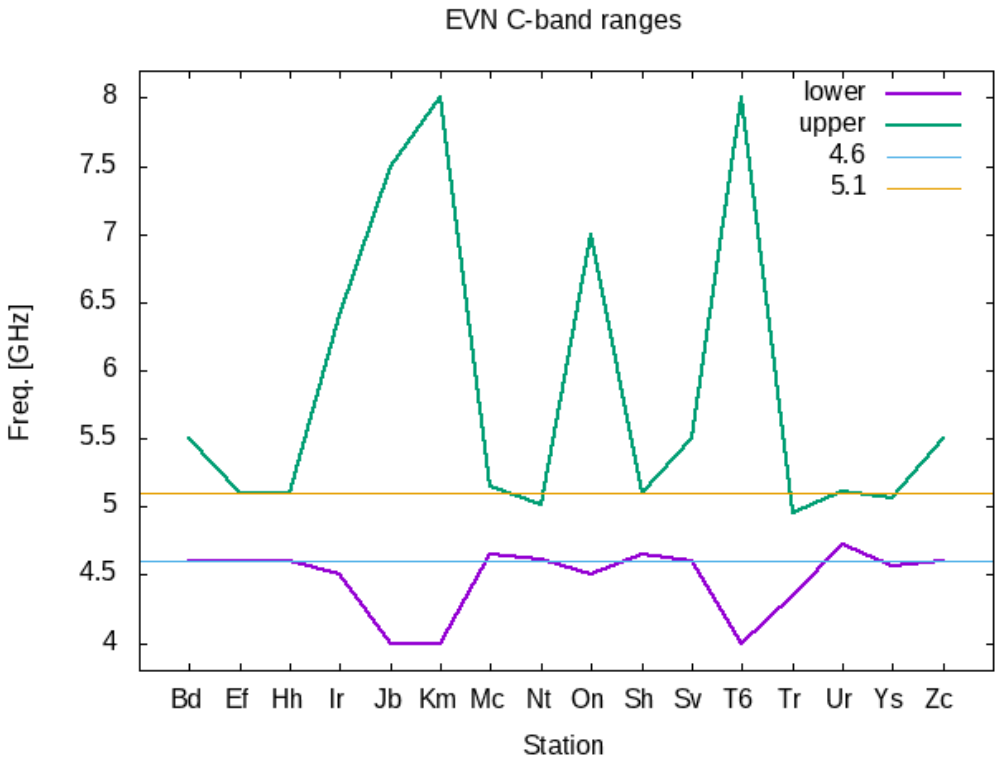
VLBI backend	Recorder	2 Gbps	4 Gbps	Stations
DBBC2	Flexbuff/Mark6	yes	yes	Ef, Ir, Hh, Jb1/2, Mc, Mh, Km, Nt, On, Sr, T6, Ur, Wb, Ys
OCTAD	Mark6	yes	yes	KVN
R1002M	Mark5B+	yes	no	Kvazar
NRAO RDBE	Mark6	yes	yes	Arecibo, VLBA
WIDAR	Flexbuff	(maybe)	no	eMERLIN

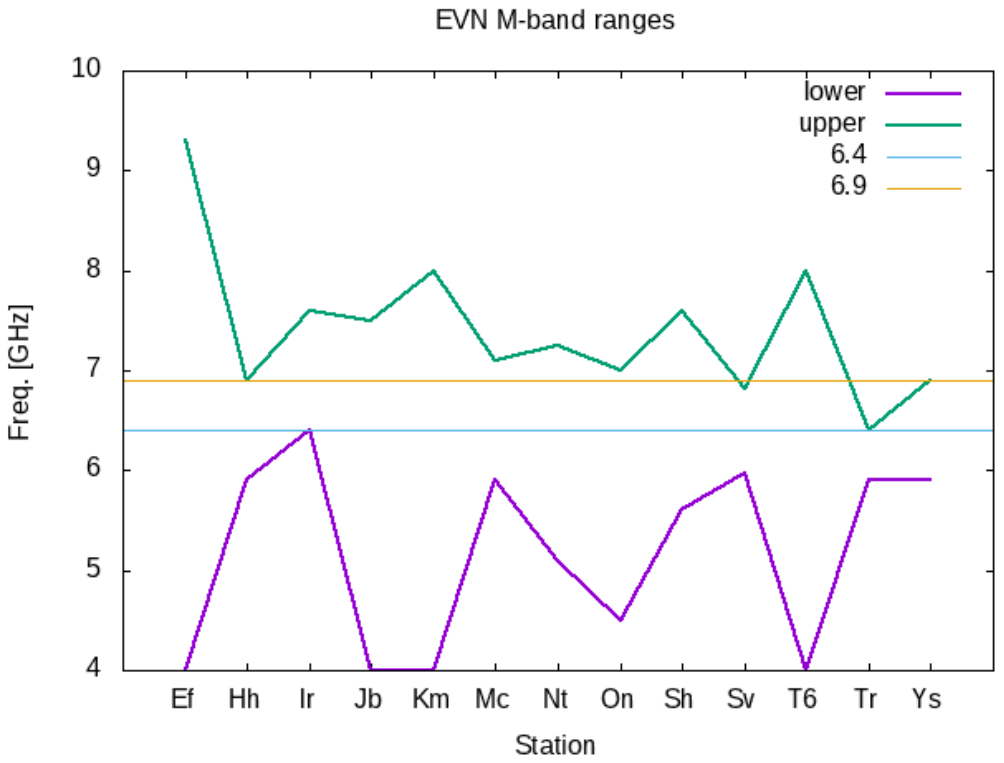
How to configure the DBBC for 4 Gbps

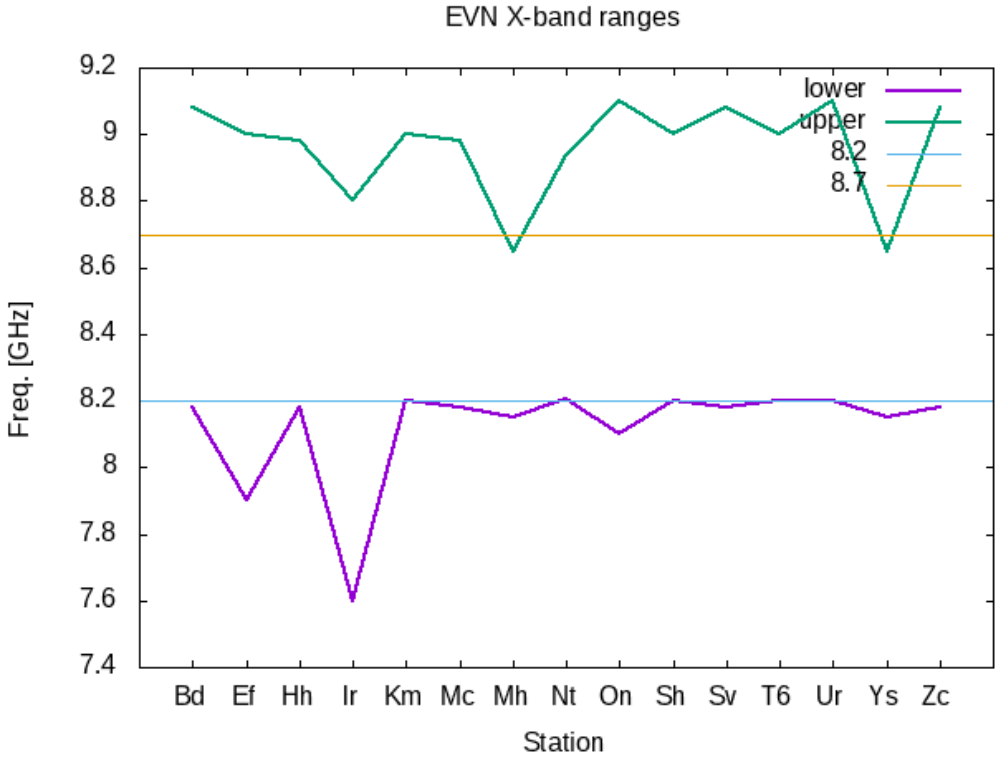
- In astro mode 8x64 MHz at each polarization:
  - VSI sample rate at 128 MHz: clock rate in equip.ctl
  - Is using VSI1 only
- In wastro mode 16x32 MHz at each pol.:
  - VSI sample rate at least 64 MHz: clock rate in equip.ctl
  - Requires both VSI ports: set Fila10G input select in equip.ctl to ‘vsi1-2’
    And connect both cables between DBBC2 and Fila10G!

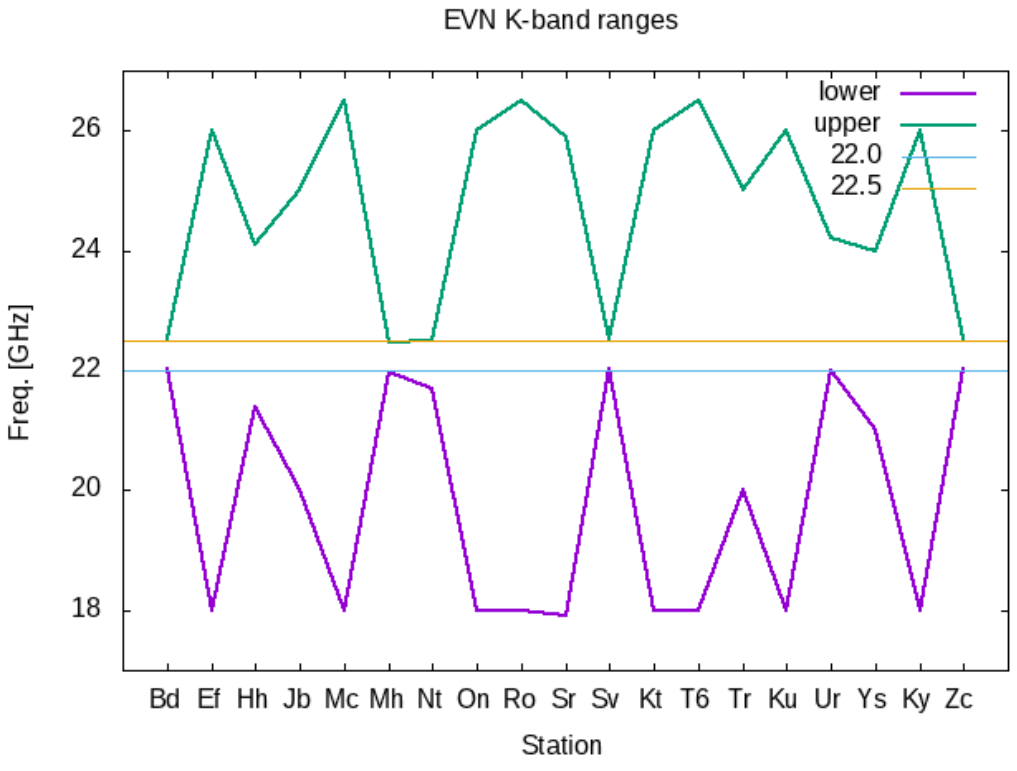
Possible 4 Gbps observing bands

Station	C-band	M-band	X-band	K-band	Q-band
Ar	(yes)	(yes)	(yes)	-	-
Ef, Ir, Mc, Nt, On, T6, Ys	**yes**	**yes**	**yes**	**yes**	**(yes)**
Mc, Nt*	**yes** (400)	**yes** (*400)	**yes**	**yes**	-
Jb2, Tr	**yes**	**yes**	-	**yes**	-
eMERLIN	no (backend)	no (backend)	-	no (backend)	
Hh	**yes**	no (150)	**yes**	**yes**	-
Km	**yes**	**yes**	**yes**	-	-
Mh	-	-	**yes**	**yes**	**yes**
Ro	-	-	**yes**	no (70)	no (70)
Sr	-	**yes**	-	**yes**	-
KVN	-	-	-	**yes**	**yes**
Kvazar	no (backend)	-	no (backend)	no (backend)	-
Ur	**yes** (390)	-	**yes**	**yes**	-
Wb	no (160)	no (160)	no (160)	-	-


EVN C-band ranges
lower
upper
4.6
5.1
Freq. [GHz]
Station
Bd Ef Hh Ir Jb Km Mc Nt On Sh Sv T6 Tr Ur Ys Zc


EVN M-band ranges
lower
upper
6.4
6.9
Freq. [GHz]
Station
Ef Hh Ir Jb Km Mc Nt On Sh Sv T6 Tr Ys


EVN X-band ranges
lower
upper
8.2
8.7
Freq. [GHz]
Station
Bd Ef Hh Ir Km Mc Mh Nt On Sh Sv T6 Ur Ys Zc


EVN K-band ranges
lower
upper
22.0
22.5
Freq. [GHz]
Station
Bd Ef Hh Jb Mc Mh Nt On Ro Sr Sv Kt T6 Tr Ku Ur Ys Ky Zc

EVN Technological roadmap

Ranking of technological developments

Technological developments	Mentioned in science cases	Ranking (as far as known)
Higher bandwidth, increased	All	essential, except
frequency coverage/flexibility		*Stars and stellar masers in the Milky Way* : nice to have
More antennas	All except *Cosmology*	essential
Higher cadence, more observing time	All except *Galaxy formation and evolution*	essential, except
		Innermost regions of AGN : useful
Wide field	Cosmology	
	Galaxy formation and evolution	essential
	Explosive phenomena, transients	nice to have
Phased array feeds	Cosmology	
	Stars and stellar masers in the Milky Way	nice to have
Short baselines	Explosive phenomena, transients	essential
(both central EVN + eMerlin and at outliers)	Stars and stellar masers in the Milky Way	essential/useful
Polarisation improvements	Innermost regions of AGN	essential
Large FoV archive, raw data storage	Explosive phenomena, transients	nice to have

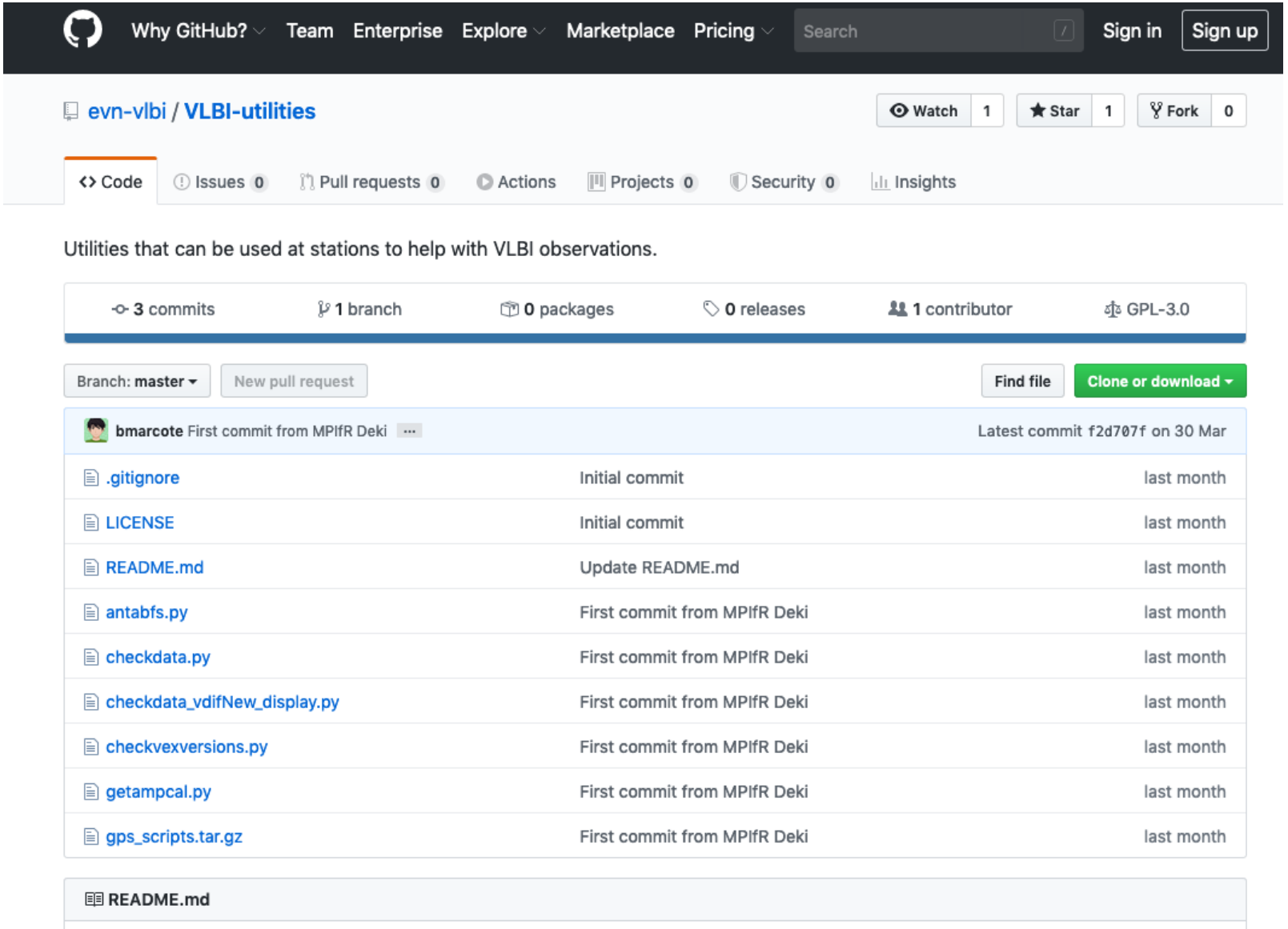
RECOMMENDATIONS

In order to move towards a practical implementation of the goals of the VLBI20-30 Scientific Roadmap, we propose the following actions (in no particular order):

1. All EVN stations to purchase DBBC3-2L2H units (~ 50 keuro) as soon as possible, or backends with similar capabilities.
2. All EVN stations to purchase more storage. The ambition to increase the EVN storage pool to enable full 4 Gbps operations by the end of 2021 should be considered just a step towards 8 Gbps.
3. Call an EVN-wide meeting to discuss the possibility to roll out broadband C – X receivers (~ 240 - 350 keuro), as a short-term alternative to waiting for BRAND.
4. All stations capable of high-frequency observations to purchase or develop KASI-style multi-frequency systems (~ 1.1 Meuro), as well as DBBC3-6L6H units (112 keuro).
5. Actively support the various aspiring new stations, with advice and, if possible, equipment. Intensify collaborations with MeerKAT and newly built telescopes coming online. In particular, offer help to turn Nkutunse into an operational VLBI element. Support the development of the Westerbork Innovation Center.
6. Continue a close collaboration with the SKA office into the construction phase.
7. Formally endorse the concept of EVN-light, find out how much time would actually be available per station, and investigate the scheduling possibilities.
8. Investigate the potential of GPU and cloud correlation before the next major upgrade of the SFXC cluster. Stations should have at least 10 GE connections to the correlator in order to make 8 Gbps real-time operations possible, but preferably 20 GE. JIVE should look at increasing the current 100 Gbps to 200 Gbps, by the next upgrade of SFXC.
9. Decide on criteria to retain the raw data of a few experiments, and make media available for its storage.
10. All EVN stations to agree on an RFI monitoring scheme.
11. Every country with an EVN station in Region 1 should have a member in the CRAF expert committee.
12. Set up an EVN-wide technical meeting to decide on RFI mitigation measures and their implementation.

EVN Software Repository

- https://github.com/evn-vlbi



Field System working group

- Volunteers (so far): Jonathan Quick (Hart), Eskil Varenius (Onsala), Artūrs Orbidāns (VIRAC), Harro Verkouter (JIVE), Javier Gonzales Garcia (Yebes), Christian Plötz (Wettzell)
  - Some email exchange
  - possible topics to contribute: opacity calculation from weather data using the ATM model or a standardized version of the checkdata.py as a regular FS procedure.
  - Next: meet with current FS developers to discuss how this could be organized.
  - ...

EVN Wiki page updates

Receiver frequency ranges:

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Frequency_ranges_for_2%2F%2F4_Gbps

Disk inventory:

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Disk_Inventory

Recorder/Flexbuff status (2 pages):

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Mark6%2F%2FFlexbuff_status

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Recorders_EVN_status

2 Gbps and 4 Gbps status:

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/2Gbps

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/4Gbps

eVLBI status:

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/e-VLBI_Status

EVN Spare parts

https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/EVN_spare_parts

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