EVN Out of Session Observing

Richard Porcas March 2013

INTRODUCTION

At the last EVN CBD meeting I was asked to investigate the possibilities for "Out of Session Observing" (OoS) with the EVN, and how this might be implemented. I sent a questionnaire to all full−member EVN observatories (I excluded Wettzell and Arecibo) and got responses from all but one. Five questions dealt with:

1) How much total time per year (to be taken from current allocation) ?
2) How long/short could an OoS block of observing be ?
3) What lead time for scheduling would be necessary ?
4) Other considerations
5) Additional EVN time for "EVN−lite" ?

The answers from the questionnaire are attached as an Appendix. On the basis of the answers to questions 1−4 I present a suggestion of how EVN could proceed. I do not address "EVN−lite" here.

HOW MUCH TIME ?

The answers to question 1 suggest that 10% is about right, although 10% "of what" is a little vague. The CBD memorandum mentions "at least 45 days" per year for all EVN observing. In practice we have 3 x 21−day sessions (63 days) + 10 e−VLBI runs (total 73 days), but not all EVN observatories take part in all of this because they lack some frequencies or an e−VLBI connection. I think 5 − 6 days seems to be acceptable to more−or−less everyone, so I suggest EVN adopts the formalism of "up to 6 days per year".

Note that this implies a corresponding use of 10% of the EVN disk pool and 10% of correlator time.

SIZE OF AN OoS BLOCK

The issue here is how many blocks (N) per year can be supported by the EVN, and thus how long or short can they be. Answers to question 2 (which was perhaps poorly formulated) were varied, including a suggestion of N=10, and suggestions for possible block sizes ranging from 1h to 30h.

OoS observing could be proposed for many possible scenarios, e.g. monitoring 2h every 2nd day for 4 weeks (28h) or a single 12h observation on 27 August (say). We need to set some boundaries reflecting the increased effort, and time lost for set up at some observatories. To provide a focus, something like 10 blocks each of 14h, or 12 blocks each of 12h, spread throughout the year, might be feasible and useful. We should probably set a maximum value for N, a maximum length for a block, and a minimum block length (in the sense that a short 1h observations is "charged" as, say, 6h or 12h for accounting purposes).

It is also suggested that there should be a minimum time between OoS observing blocks.

WHERE DO WE REMOVE TIME FROM THE NORMAL SESSIONS ?

Current sessions run for 3 weeks starting on a Thursday. If 6 days per year are used for OoS then each session must be 2 days shorter. An obvious way is to stop the session early (e.g. on Tuesday). However, since the KVAZAR network cannot join EVN observing at weekends (Friday midday to Sunday midday) it would make more sense, in general, to remove the 2 days at weekends, to maximize the availability of the KVAZAR telescopes for the reduced session length.

LEAD TIME FOR SCHEDULING

I assume that OoS observing will be scheduled "ad hoc" in the sense that a block is scheduled for a specific project. (This is not to be confused with the rapid adhoc scheduling necessary for ToOs.) Proposals for OoS observing will be submitted at normal proposal deadlines, reviewed by the EVNPC amd scheduled if approved. There would be several months (some observatories would like 6 months) between EVNPC approval and the actual observation (see below); it may not be possible to include every requested telescope in the observation.

HOW WILL IT WORK ?

These are some suggestions.

a) Proposals for OoS observations will be submitted at the usual deadlines.

I would suggest they be required to have a special section in the text giving cogent reasons why OoS observing is necessary, what dates and times can be considered, and what is the minimum requirement in terms of numbers of telescopes and any particular telescopes.

It should be made clear that no OoS observation will be scheduled until after the normal session following the EVNPC meeting.

b) The EVNPC will review the proposal and assign a grade, giving a specific recommendation to the EVN Scheduler on whether to schedule or not. (The EVNPC may consider introducing a threshold grade for this purpose.)

c) Following successful EVNPC review the EVN Scheduler arranges a suitable date for scheduling in consultation with the observatories.

d) The date for scheduling will never be before the next normal session following PC review (e.g. a proposal submitted at the 1 June deadline will not be scheduled before the end of the Oct/Nov session). Thus the lead time will always be many months.

e) To keep EVN observing time and disk resources balanced, disk space and observing time will be subtracted from the normal session immediately prior to the OoS observation. Disk packs for an OoS observation will be distributed to the observatories at the same time as those for the normal session immediately preceding the OoS observation. (However, separate disk packs must be assigned for OoS observing at each observatory, so that no delay is caused in sending disks packs to the correlators after the normal session.)

WHEN COULD WE START ?

I would strongly urge against a general announcement of EVN OoS observing opportunities in the immediate future. EVN has already announced that it will try to support RadioAstron OoS observing for AO1 KSP projects at some level, as this represents a unique observing opportunity. I would recommend that we use these observations as an intial test of EVN OoS procedures, before proceeding to the more general case. Around 16 EVN+RadioAstron perigee imaging observations were approved by the EVNPC following the 1 February 2013 proposal deadline, and most of these will require OoS observations. The first of these would probably be in September this year.

Results from Questionnaire regarding EVN Out-of-Session Observing
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Replies from:

Hh	Jonathan Quick
Mh	Ari Mujunen
Tr	Kazimierz Borkowski
Ys	Pablo de Vicente
On	Michael Lindqvist
Mc+Nt	Carlo Stanghellini
Sh	Hong Xiaoyu
Kvasar	Mikhail Kharinov
Eb	Alex Kraus
JIVE	Bob Campbell
Wb	Rene Vermeulen
Ur	Ming Zhang

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* Q 1: Would your observatory be able to support some amount of *
* Out-of-Session observing and, if yes, what percentage X would *
* be practical ? (A reference value of 10% was mentioned at the *
* CBD Meeting.) *
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HH
Yes, Hartebeesthoek would be quite willing to support OoS observations at any supported wavelength since all receivers are simultaneously mounted/available on-the-fly under computer control. The fraction of time scheduled this way could be relatively high, but see the constraints below (Q 3).

MH
Yes, in principle. A percentage out of the already-allocated EVN time (at the level of 3x3weeks+10xe-VLBI-day) is not a very meaningful number for Metsähovi---the number of additional times we would have to manually switch receivers at the telescope and the duration of resulting observation runs is much more relevant. Increasing the number of receiver swaps significantly from the current is not a realistic option.

TR
Yes, 10 to 20% would be acceptable.

YS
If 10% refers to the already commited time to the EVN (45 days per year) we agree. We can support up to 4.5 more days for the time being.

ON
Yes. 10 − 20 % would be OK for Onsala.

MC+NT
Yes, 10%

SH
Yes, 10% would be acceptable.

KVAZAR
KVAZAR could support ~10% but only under preliminary agreement one month before the experiments.

EB
Yes, that will be possible. I would consider one to two days as practical. Perhaps a combination with eVLBI slots would be useful.

JIVE
Yes. For us at the correlator, the distinction between in- and out-of session isn't a strong one.

WB
The WSRT Tied Array for the period between 01 January 2013 through 31 May 2014 will now commit to accept up to 10 EVN-scheduled out-of-session blocks, each with a maximum duration of 30 hrs, subject to the following conditions:
- The blocks are filled by the EVN scheduler only with EVN-PC approved projects, taking account of ranking and suitability for scheduling as usual.
- Any block is reserved/fixed at least 3 months in advance, even if its detailed filling is not yet known.
- There is no more than 1 block per 2 weeks.
- At least half of the total time reserved (regardless of actual filling and use) for the combined blocks is deducted from the habitual VLBI session lengths and/or the habitual eVLBI runs over the same time frame (i.e., compensation must occur at the latest by abbreviating EVN session 2014-2 May-June).

I believe that since the current practice is to have 3 4-week sessions + 10 days eVLBI per year, then if 10 blocks of 30 hrs are used between 01 June 2013 and 31 May 2014, then X=13%. Note also that only >=50% compensation in reduction of regular sessions is requested.

UR
Yes, we agree to share 10% of our committed time to EVN for OoS observations.

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* Q 2: If your observatory can support some Out-of-Session observing, *
*   what is the smallest "unit" of observing time which is   *
*   practical from a scheduling logistical point of view ?   *
*   (e.g. 2h; or 12h; or 1 day...?)   *
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HH
We would prefer that observation sessions be a minimum of 4 hours in duration so as to maintain a reasonable ratio of observing to overhead. However we would only be willing to support sessions of less than 24 hours if some form of electronic data shipment was employed (due to our remote location).

MH
As our receiver swaps are manual, they in pratice incur a 2-day "penalty" to allow for manual work and receiver cooling. This in its turn means that runs shorter than 24h seem not worth the trouble and expense at all, and runs of several days, two at the minimum, would be preferred.

TR
Even 2h would be practical.

YS
12 hours is better than 2 h (technically possible, but we would accept it only in exceptional cases). 12 hours allows to absorb the absence of operators at the telescope, mainly when frequency changes are requested, to fit better several observations in the calendar and use more efficiently the telescope.

ON
A "session" of 2 hours is OK.

MC+NT
2h (for Noto only if it does not require a receiver change)

SH
I think the smallest "unit" of 12 hours is better than 2 h.

KVAZAR
2h would be practical enough.

EB
That would be one hour.

JIVE
If it’s e-VLBI, then the canonical ~4hr network-test/clock-search preceding the science would still be useful. I don’t think the 09-13 UT slot is necessarily required. Other than that, no real minimum-time limitations for the science part.

WB
The total number of blocks (10 until 2014-05-31) and their cadence (no more than one per two weeks) are our strongest limitations, not the block length, which could be as small as 2 hrs if needed, but is more optimally closer to 24 hrs; we set an upper limit of 30 hrs for any block.

UR
The prefered time unit here is 1 day.

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* Q 3:  Most EVN observatories make other, non-EVN, commitments of time *
*       well in advance of observations (IVS, GMVA, "internal", etc..)  *
*       such that ad hoc scheduling of Out-of-Session observations may  *
*       require a long lead time. Please give some idea of the likely   *
*       lead time at your observatory, and give a few examples of the   *
*       most probable scheduling conflicts which might arise.           *
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HH
The required lead time at Hartebeesthoek would mainly be due to practical considerations in terms of reaction times, allocation of personnel/disk resources etc. A lead time of 48 hours (including at least one working day of the week i.e. Monday to Friday) should be sufficient, though even shorter response times would be possible in exceptional circumstances.

The main scheduling conflicts likely to arise would be our periodic 24 hour long IVS experiment commitments and the regular week-long Australian LBA sessions. Certain types of local observing also have some time criticality but these should be able to be worked around for shorter OoS observations.

MH
The internal scheduling priority at Mh goes roughly like this:
1) IVS (joint observing with FGI & compensation involved)
2) GMVA
3) EVN pre-scheduled
4) Preventing excessively long breaks in internal GIX AGN monitoring program, i.e. avoiding longer interruptions than a couple of weeks.

The lead time at Mh varies a lot. Under special circumstances and with exceptionally lucrative science/paper potential just a couple of days might be sufficient, barring any practical impossibilities---or the request might be rejected, equally likely.
The typical reasonable minimum lead time is a couple of weeks, and the chances to be scheduled of course increase exponentially when we are talking about months.

> and give a few examples of the
> most probable scheduling conflicts which might arise.

In the list above, IVS & GMVA would certainly "win" over EVN out-of-session. Lack of RX swap resources, national holidays, vacations might also be a problem. Excessive amount of receiver changes in a short time (IVS, GMVA, EVN, internal GIX combined) together with a long break in GIX continuous data and wasted RX days (due to swaps or idling because the RX would be needed again in a couple of days) all contribute to possible rejection of a scheduling request.

TR
24h should suffice, for example to cool down a system and check it.

A conflict might arise with possible outside of EVN observing in the RadioAstron project.

YS
This is an important issue. We would like to know at least with ~2 months in advance an approximate scheduling. I find very convenient to know well in advance the EVN, eVLBI, GMVA and IVS schedules. Radioastron has a typical lead time of 1 month at most which allows us to program these observations after we have already set EVN, eVLBI, GMVA and IVS observations, which according to our policy, have priority. If the lead time were shorter than 1 month we would surely find conflicts. In any case we can accept, in excepcional cases, lead times below 2 months.

ON
The 25 m telescope is used exclusive for EVN observations. Thus, it can be used at any time (except for some national holidays such as midsummer, vacation period in July, see also NOTE below). We have 2 recording systems and we aim to be able to record with the 20 m and 25 m telescope simultaneously. In order to find operators we would need a lead time of about 2 weeks. We don't have any staff operators and always use "extra operators" for VLBI-observations (EVN+IVS). The main 25 m service is done in August.

The 20 m telescope is used for EVN, IVS, GMVA and single-dish. Most of the single-dish observations takes place in December-June. The single-dish schedule is typical made 4-6 months in advance. Most of the 20 m service (as well as testing new receivers etc) is done in August-November

Lead time for 20 m telescope:

Observing in September-November, we would need 1 month. X-band observations may need shorter time. 22 GHz may need 1 month.
Observing in December-June, we would need 6 months. We would need the dates before we make the single-dish schedule.
Observing in July, vacation period, we could possibly do ToO (this is true also for the 25 m)
Observing in August, partly vacation period, we would need 2 months in order to make sure that we have the receiver in place (in case of 22 GHz). The S/X-band receiver is always available.

NOTE: There is a plan to use the Onsala telescopes as outriggers for eMERLIN. Not clear how much time that will require.

MC+NT
Lead time 1 month.

Scheduling conflicts may arise with experiments already scheduled (geo, sigle-dish, radioastron) and lack of frequency agility (Noto)

SH
two weeks in advance is easy for schedule.

KVAZAR
Lead time in 1 month as minimum - in case the observatories will be provided with enough amount of disk-packs. Otherwise, we need 2 month to provide the observatories with packs for sure.
(We still have some problems with shipment from Dwingeloo due to unsuitable logistics used there)

EB
It would be good, if the dates could be fixed about 6 months in advance. Possible conflicts exist with other VLBI observations (EB+VLBA, HSA, IVS) or other regular (mostly monthly) observations.

JIVE
Just as for ToOs, if it's disk observing, then we'd need time to get packs distributed. An operationally more flexible scheme would be for stations to keep a stash of packs identified for out-of-session, to be back-filled with the next session's shipment -- but of course that has the effect of reducing the available packs for pre-session distribution unless more packs are bought overall. If it's e-VLBI a requires a 00-08 local-time shift, we'd ideally need to know by the end of the day shift a day-and-a-half beforehand (i.e., Monday ~1600 for an observation during Wednesday 00-08) to arrange that graveyard-shift manning.

WB
We would prefer to know the EVN proposed sessions in early March for the period June-November, and in early September for the period December-May. We estimate a 10% probability that blocks requested later than that by the EVN could not be accommodated due to existing technical or scientific commitments.

UR
We have lunar project which is unpredictable usually. It will be likely to conflict with some observations unforseen. In 2014, our 25m telescope will be reconstructured, so there will be very little observational time then.

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* Q 4:  Please identify any other issues not covered above which might *
*       be important considerations for implementing OoS.                *
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HH
It may be worthwhile for ease of scheduling to look at specifying a day of the week when such OoS sessions would typically occur, though I suspect that RadioAstron support wouldn't mesh well with that. Some sort of predictable cadence would be easier though.

One other issue relates to network reliability/calibration for OoS observations in terms of the overheads required for NMEs and RXG file measurements. In particular the e-VLBI sessions have a 4 hour pre-session testing phase which performs the role of the NME, but the calibration is held over from the most recent full EVN session. How this is handled for OoS would need due consideration.

MH
If OoS means super-short lead time from request to observations, super-many of those OoSes with hour-scale durations, then it is out of Mh interests and capabilities.

TR
We do not see any issue at the station itself, but OoS will require stations to have some spare disk-packs continuously on the site.

YS
An important issue is observing without sending disk packs to correlators. We think we should go, either to e-VLBI observations or/and recording in disks and later data transfer to the correlators. If this latter mode of observing (sort of buffer observing) gets more frequent, we will have to carefully schedule data transfers and think on a buffer system (flexbus?, aditional Mark5 unit?).

ON
Should we have a calibration session prior to on OoS or should we use the last available calibration-data as we do for e-VLBI sessions? Disk usage could (will) be an issue. Some stations could do e-transfer after the session (i.e., as we do for IVS).

MC+NT
additional cost for disks/shipment may be a problem; highly preferable data transfer to the correlator via the net.

SH
no special issue.

KVAZAR
Support observatories with spare disk-packs for OoS will be helpful.

EB
Note, that EB usually has extended maintenance periods between July and mid-September. During this period, the time 0800-1900 (local time) on Monday-Friday will not be available for observations.

JIVE
The hard questions are of course related to the open-ended nature of what OoS observing will really look like. 20-consecutive-day e-VLBI runs becoming the norm (cf Q.5) would clearly need to involve some revision of how we deploy our 3 operators, perhaps not having physical manning at all times, but only someone on-call on the graveyard shift (i.e., the way Wb has manned EVN sessions for a long time now). There are probably other practical hicchups that might be revealed by observations outside of "normal parameter space" that may have to be discovered en route (e.g., a known example from Patrick/ Geraldine's GB073 too-many-scans for the field-system). If e-VLBI out-of-session obs take up enough correlator resources that we can't process other experiments at the same time, then of course that sets some implicit prioritization that may not match the PC grades.

It would be good if there were e-VLBI- or ToO-like documentation of out-of-sessions obs from the scheduler so I have something official to point to when getting audited (RadioNet) about the number of EVN hours.

WB
General considerations:

The WSRT operations model requires that most of the VLBI observations are planned well in advance, and that they are mostly consolidated into a modest number of fairly long sessions. There are two main planning reasons for a long lead-time:

First, even at the time of a WSRT proposal review and allocation panel meeting, a backbone of the upcoming semester schedule must already be settled, in order to take proper account of variations in oversubscription by day-night and LST ranges, in view of restrictions due to the WSRT HA limits. Most WSRT projects require full 12-hr coverage, with attendant scheduling limitations. VLBI observing slots that are inserted late thus tend to be quite disruptive.

Second, WSRT operations are mostly conducted off-site, with the WSRT even running mostly unattended outside office hours, but for VLBI observing the WSRT aims to have on-site operator attendance; for disk changes, this is a hard requirement. Operator shifts thus have to be planned well in advance.

For the same reasons, consolidation into a limited number of longish VLBI sessions is desirable. Consolidation also helps to minimize overheads associated with (pre-session) antenna phase calibration for the Tied Array.

Note that this questionnaire is interpreted to be not at all about extra flexibility or extra time for unpredictable observing, and that the flexibility is intended to enable predictable observing needs (including for RadioAstron, which has predictable source access constraints). But observations planned in reserved/fixed slots may be overridden by highly rated (by EVN-PC) triggered or true ToO projects.

UR
We usually have lunar mission VLBI observation once a month but the dates are uncertain as far as I know, usually in the middle of the month. It could be related to the spacecraft orbital positions with my guess. Generally we insert the schedule when we get the order from above. When we have the reconstruction work on 25m in 2014, the lunar mission observation will not take place then.
Dates are not specified yet but due to the weather condition here in Urumqi, we could only have outdoor construction work in warm days, usually from Spring to Autumn.

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* Q 5:  In addition to present commitments, would your observatory be   *
*       able and willing to support an increased amount of EVN time, to *
*       be used for "EVN-lite" proposals approved by the EVN Program    *
*       Committee ?  If so, please indicate how much time would be      *
*       possible.                                                       *
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HH
We are currently commissioning the new 15m geodetic telescope to take over some of the IVS experiments going forward, in particular the IVS-R1 experiment series which comprises about 50% of our current annual IVS commitment on the 26m telescope. Any new time allotment for "EVN-lite" would be contingent on this re-allocation of the R1's going ahead, but should it do so, we would probably be able to support an additional 20% (on our current main EVN allocation). However this would also be contingent on there being suitable e-transport of the VLBI data in some form, especially with recent escalations in air-shipment costs.

MH
Instead of talking about "increased amount", Mh would be happy to observe approximately up to the current full allocation (3x3weeks, some subset of 10x24h-e-VLBI) with 22GHz and 43GHz (and 86GHz). That is, if there were more high-frequency observing (even "over allocation" by standards of EVN observatories with full frequency coverage), Mh could probably increase its EVN allocation approximately up to the "3x3weeks, some subset of 10x24h-e-VLBI" level.

When talking about S/X band observing, it needs to be remembered that the receiver for that is owned by FGI, it is only a standard (not wideband) geodetic S/X receiver with only RCP polarization available both in S and X, so it is not fully interoperable with many EVN X band LCP/RCP wideband and tunable receivers. It needs the special (manually swapped) subreflector which is so large that it reduces effective collecting area of Mh small 14m disk significantly. Thus albeit possible in some cases, extending Mh to do EVN (in/out-of-session) S/X is not a super-lucrative option.

TR
Yes, we would welcome some 10% or more extra VLBI observing time (the percentage is relative to present disk session time).

YS
While the telescope is not ready for single dish observations at 7 and 3 mm, we can accept an increase of up to a total of 30 days taking into account both the EVN-Lite and OoS observations. Once these two frequencies (45 and 87 GHz) are fully operational at the 40 m, we will revise this number.

ON
Yes, Onsala is open to "EVN-lite"

25 m telescope: Conditions, see Q3: 10 days
20 m telescope: Conditions, see Q3: 5 days (we would prefer September-November)

MC+NT
Yes, ~20% should not cause serious trouble

SH
About 10-15% for sheshan25 should be ok.

KVAZAR
It will be depend of the cost of Internet traffic within our country.

EB
That's currently not possible.

JIVE
The correlator usually idles, having run out of things to correlate, at some point bewteen sessions (more precisely, waiting for packs to come in from the next session) [This Oct/Nov'12 session will likely prove an exception, with so many short obs and so many stations trying new frequencies/back-ends]. So averaged over long timescales there should be room for expansion.

WB
Requests for predictable flexible observing that cannot be accommodated by the EVN scheduler in the above commitment will have to compete for regular WSRT time through the WSRT-PC at the regular semester deadlines. After 31 May 2014, during the ongoing conversion to Apertif it is likely that the WSRT can make available a larger amount of time to the EVN, but with a dwindling array, or with only a single dish. Decisions will be taken closer to the date.

Note that only >=50% compensation of the regular session lengths is requested, meaning that the WSRT could in principle be spending up to 150 hrs extra on VLBI in the period until 31 May 2014. This is done in anticipation of high temporary demand in connection with RadioAstron, but allocation to specific projects, not restricted to RadioAstron, that can make use of flexible slots, is left up to the EVN-PC and scheduler.

UR
The connection from Nanshan to Shanghai is still about 100Mb/s now, not yet capable for e-VLBI observation, so we will not join EVN-lite observations.
