CORRELATOR OPERATIONS REPORT, JIVE
EVN TOG MEETING, September 2016, St. Petersburg

21 September 2016 (statistics cover 1 Feb - 10 Sep 2016)
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PERSONNEL
Support Scientists
    Minnie Mao departed for U.Manchester in April
    Ross Burns arrived from U.Kagoshima in May
    Jay Blanchard arrived from U.Concepcion (ALMA phasing) in May
Thus back to 3 support scientists (full=4), with all three having
arrived since January.

Operators
    Hans Tenkink will retire on 3 November, and has been on
    a 2.5 day-per-week schedule since February. We plan to go
    forward with only the two remaining operators.

SCIENCE OPERATIONS

   The table below summarizes projects correlated, distributed, and released
from 1 February to 10 September 2016. The table lists the number of
experiments as well as the network hours and correlator hours for both user
and test/NME experiments. Here, correlator hours are the network hours
multiplied by the number of multiple correlation passes required. This
definition carries over to the EVN software correlator at JIVE (SFXC), even
though it may actually run faster or slower than real time.

	User Experiments			Test & Network Monitoring		
	N	Ntwk_hr	Corr_hr	N	Ntwk_hr	Corr_hr
Correlated	64	549.5	688.5	14	50	56
Distributed	68	543	656	15	57	57
Released	72	610	746	15	54	54

The following table summarizes the sessions having some user experiments
to finish or with activity since the previous report
(entries = remaining to do / total).

	N_to.corr		Corr.hrs	N_to.dist	
Jul'15 OoS	-	1/1	22/22	1/1	GA037A
Sess 3/2015 (d)	-	0/18	0/243hr	0/18	
Oct-Nov OoS/RA	-	3/3	37/37hr	3/3	GA037B, EG089A-B
Feb e-EVN	-	0/6	0/29hr	0/6	incl. 3 ToO's
Sess 1/2016 (d)	-	0/19	0/231hr	4/19	
Mar-May e-EVN	-	0/12	0/68hr	0/12	incl. 6 ToO's
Jan-Apr OoS/RA	-	2-6	20-56hr	prognosis (EG089C-D + non-EVN)	
Sess 2/2016 (e)	-	0/5	0/47.5hr	0/5	5 ToO's
Sess 2/2016 (d)	-	14/18	163/231hr	18/18	
Jun e-EVN	-	0/2	0/14hr	0/2	
Sep e-EVN	-	4	24hr	prognosis (incl. 3 ToOs)	
Jul-Sep OoS/RA	-	1	7hr	prognosis (EG094A)	
Sess 3/2016 (d)	-	26	200hr	prognosis	

   Back to 3 support scientists in May for the first time since September,
we have made progress catching up with the backlog that has grown.
Two-three of the sess.1/16 experiments yet to distribute are quite
close to going out the door (the other is the 2nd of two 699 phase-center
EG078 observations within the session).

Some landmarks since the previous TOG report:

Session 1/2016
    another user 2Gbps observation
    5.2 TB of output FITS files

Session 2/2016
    another user 2Gbps observation (first at K-band)
    an EVN+LBA observation
    v105E DBBC firmware used throughout K-band session
        some ACG problems with 4MHz BBC bandwidths
    bug found/fixed in KVN control system for observations with
        8MHz BBC bandwidths (recorded only first half of bitstreams)
    prognosis - 2TB of output FITS files.

e-VLBI:
  lots of target-of-opportunity: 14 observations since mid-Feb; already
      2nd most e-ToO hours in any year -- 41 hrs needed for record (not
      including the likely 17 hours to come in/around the Sep. e-EVN day)
  21-22 June e-EVN day:
      First 2Gbps e-VLBI for user experiments
          stations need a fil10G to do this: Ef,Mc,Nt,O8,Ys,Hh
          others ran at 1Gbps using 32MHz subbands: Jb,Tr,T6/Sh
          Wb omitted (not then yet able to use DBBC v105E firmware)
      First significant e-VLBI from KVAZAR stations during
          the clock-search period: Zc & Bd at 512 Mbps.
      total bit-rate limit: 16 Gbps empirically okay for real-time SFXC
      recording 2 Gbps e-VLBI not tested

NETWORK SUPPORT

   We continued with the new schedule depositing procedure put in place
for session 3/2015. Instead of PIs uploading their sched output directly
to vlbeer and isolating PIs from stations via the .latest/ subdirectory,
PIs now send the key file to us, and we run sched and populate vlbeer.
The motivation for this was a recurrence over the previous couple sessions
of stations downloading wrong versions of schedules; the new procedure
aims to separate PIs further from the stations, and better matches
the procedure that the VLBA has used for quite a while (so hopefully
makes things simpler for the PIs). It also enables us to run beta
versions of sched with features not yet in any distribution version
(also as Socorro can do) -- specifically 2Gbps for the DBBC/DDC personality
and inclusion of pointing-sector control for EVN stations. As an additional
(unplanned) advantage, it also facilitates incorporation of revised patching
information that may be communicated to us after the sched plug-ins have been
distributed to the PIs.

  Test observations/correlations:
    EG091A clock-search: Tr remote maser & optical-lattice test (15mar)
    TE118: e- 2Gbps test (12 apr)
    FR030, FR031: 2 & 4 Gbps PFB tests (2 May)
      FR032: DDC radiometry tests (stations only; no corr.)
    FR033, FR034: 2 & 4 Gbps PFB tests (12 May)
    RG008B clock-search: KVAZAR (Zc,Bd) e-VLBI at 512 Mbps (21jun)
    FR035, FR036: 2 & 4 Gbps PFB tests (22 Aug)
    FR037: 4 Gbps PFB test (13 Sep)
    FT010: KAT7 test (22 Sep)

Irbene: participation in sess.1/16 NMEs was better than in sess.3/15,
in that both polarizations of the 4.5-8.8 GHz receiver were comparable
in amplitude. We included Ir in user experiments that they could usefully
join (5cm, 6cm non-globals) -- inserting them into the schedules after PIs
provided their key files. In sess.2/16, their L-band receiver width
increased from 20MHz to 100MHz, but owing to late arrival of packs from T6
and a problem with the pack used at Irbene for the L-band NME, we have begun
correlation with the K-band portion of the session, so don't have much more
specific feedback beyond the initial NME runs. We estimated SEFDs from
the observations that we have correlated, and inserted Irbene into the
EVN Status Table and EVN calculator, as the CBD wanted.

Pack issues:

   Below I try to present some pack-load related numbers gathered when
preparing a couple slides for the Spring board meetings (but not shown);
updated for the Oct/Nov session as best as can be done at the moment.

   Bullets [a]-[c] below try to illustrate the observing pack-load growth;
[d]-[e] bring up a couple sources of faster growth that I had not contemplated
in coming up with the guideline for future session-sizes last year.

     a) Session 2/2014 was about twice as big as any previous session,
        largely owing to very little low bit-rate spectral line and
        a good amount of globals -- this needed ~1600 TB of packs in
        total, and stations that observed all experiments needed 122 TB
        (by far a record for a station/session that still stands).

     b) For the 2016 sessions, initial block schedules that didn't consider
        pack-availability as constraint had "raw" loads of:
             1/2016   1871 TB
             2/2016   2090 TB
             3/2016   1567 TB
        Here, "raw load" means the TBs summed over {experiments, stations}
        without consideration for effects of size-quantization of the
        available packs. Out-of-session observations between sessions {i}
        and {i+1} are included in session {i}'s load.

     c) Moving from the "ideal" case above of what could possibly be scheduled
        to what in the end could be observed (all values in [TB]; sess.2/16
        has a more careful accounting with FlexBuff space separated):

	raw load	actual packs	from JIVE	on-hand	FlexBuff
1/2016	1325	1535	1082	453	
2/2016	1730	1878.48	1306.4	452.91	119.17
3/2016	1495	1889.67	904.8	731.2	253.67

            note that session 3/16 includes in the on-hand category
            some packs used in the Sep-Oct out-of-session observations
            that were already counted in sess.2/16 -- without those 256TB,
            the ratio of {actual packs}/{raw load} is about the same for
            sess.3/16 as for the previous one (~1.09).

        The packs for session 2/16 can be divided into those for the in-session
        observations and the out-of-session ones between sessions 2-3:

		from JIVE	on-hand	FlexBuff
2/2016	total	1306.4	452.91	119.17
	in session	641.2	228	117.55
	OoS	665.2	207.31	1.62

        "Raw load" is again a simple sum over {experiments, stations};
        the "actual packs" sum over the packs used to achieve this.
        The bulk of the reduction of session 2/2016 from [b]->[c] stems
        from the introduction of a significant amount of e-VLBI ToO's,
        replacing some disk-based observations. For session 1/2016,
        the reduction arose from lack of packs requiring fewer observations.
        For session 3/2016, one observation was dropped from the initial
        block schedule. If we didn't do the out-of-session/in-session
        pack sharing mentioned above, there would have had to be another
        dropped observation.

d) globals correlating in Europe need to pre-position packs for NRAO
   stations, if there's no balancing flow of packs from European stations
   in globals being correlated in Socorro. There have only been two of
   these since 2012 -- so recently NRAO stations in globals have in essence
   been supported directly from the EVN pool. The actual sum of packs
   pre-positioned to NRAO stations over the 2016 sessions are::
      1/2016: 480 TB   [but 681 TB returned to JIVE/Bonn...]
      2/2016: 496 TB (224 for sess.2/16; 272 for OoS between sess.2-3/16)
      3/2016: 296 TB

e) Some big RadioAstron proposals have wanted Gbps recording on
   ground stations. The below lines show "raw" loads for RadioAstron
   observations in the out-of-session periods between sessions (which
   get distributed along with the pack for the preceding session):

   1-2/2016: 681 TB if Gbps   (Gbps = 4 of 8 obs)
                  could only support 512Mbps --> 320 TB

   2-3/2016: 770 TB if Gbps (can be supported)   (Gbps = 3 of 4 obs)

   3/16 - 1/17: only one 7-hr 256Mbps non-global observation

EVN Archive Growth (user experiments)

10 Sep 2016:   39.58 TB

Growth since last Symposium: 21.11 TB

MkIV

SFXC