

# IVS Newsletter

Issue 18, August 2007



## St Petersburg, Russia's Venice, Hosts Next IVS General Meeting

—Andrey Finkelstein, IAA and Dirk Behrend, NVI, Inc./GSFC



The official poster of the 5th IVS General Meeting.

The Institute of Applied Astronomy (IAA) of the Russian Academy of Sciences invites the international VLBI community to attend the 5th IVS General Meeting to be held in St Petersburg, Russia from March 3–6, 2008. The second largest city in Russia, with a population of about five million, is located on the River Neva and the Baltic Sea, and truly deserves the name Venice of the North. While March is not the warmest month of the year (the average daily temperature is slightly below freezing), the city presents itself in a beautiful snow cover. Also lines to the main attractions (e.g., Hermitage, Imperial palaces) are not as long as in summer peak season.

The keynote of the 5th General Meeting will be the vital contribution of VLBI to the future of global observing systems under the theme of “Mea-

asuring the Future”. VLBI is a key technique for realizing the global reference frames and studying global change by monitoring the full set of Earth orientation parameters (polar motion, DUT1, celestial pole). Required accuracy levels and long-term stability can only be guaranteed with a rejuvenated VLBI system.

The content of the meeting will be of interest to the broad spectrum of IVS members as well as to the wider VLBI and Earth science community. All IVS Associate Members and individuals who have interests in the various applications and research fields of VLBI such as geodesy, astrometry, Earth sciences, and related fields are encouraged to attend the meeting.

In addition to the General Meeting, several side meetings are being planned. There will be an IVS Analysis Workshop, a VLBI2010 Working Meeting, a Working Meeting of the IERS/IVS Working Group on the Second Realization of the ICRF, and an IVS Directing Board meeting. Further, it is planned to visit the VLBI station at Svetloe Observatory, which is located about two hours north of St Petersburg.

More information is available at:  
<http://www.ipa.nw.ru/conference/gm2008>  
<http://ivscc.gsfc.nasa.gov/meetings/gm2008>.

## Intensive INT3 to Become Operational in August

—Dirk Behrend, NVI, Inc./GSFC

Plans are under way to make the so-called INT3 Intensive sessions operational by August 27. The INT3 will be an additional 1-hour session run on Monday mornings at 6 UT to fill the 36-hour gap in the data series between the INT1 and INT2 Intensive sessions. Further, this session will take advantage of the electronic transfer capabilities available at the participating stations of Ny-Ålesund, Tsukuba, and Wettzell as well as at the correlator at MPIfR Bonn. The observational data will be e-transferred from the stations to the correlator, where it will be processed in less than 24 hours after the end of observing. Hence, the dUT1 product will be available with very short latency.

Several tests have been performed to optimize the network connection of the involved components. A complete network test was run on June 18 yielding a reasonable performance. A dress rehearsal is sched-

uled to be done on August 13. Given a successful outcome, everything will be in place to go ahead with the operational start on August 27.

The INT3 will be observed for about six months in the described setup. At that point, the performance will be evaluated and a decision will be made if it will be continued in its current form or possibly extended (e.g., more stations). It will also be looked into the possibility to go from e-transfer to actual e-VLBI, i.e., correlating and analyzing the incoming data in near-real time (see also Page 8 about the activities of ultra-rapid intensives using e-VLBI).

The Bonn Correlator has set up Web pages about their e-VLBI activities. These will also include reports about the INT3 sessions: <http://www.mpifr-bonn.mpg.de/div/vlbicor/geodesy/evlbi/index.html>.

# IVS Chair Interview

## Schuh to Lace Up the IVS

*Harald Schuh from Vienna University of Technology, Austria is the new chair of the IVS. He succeeded Wolfgang Schlüter, BKG, Germany, who had served as the IVS Chair for eight years. Newsletter editor Hayo Hase caught up with Harald and conducted an e-mail interview in order to learn more about Harald as a person and to see which way the IVS is headed under his leadership.*

*Harald, how did you get in contact with VLBI?*

I studied geodesy at the University of Bonn in the seventies, when I got in contact with a young Associate Professor named James Campbell. I very much liked his quiet attitude and his special kind of humor, and I decided to choose him as my diploma thesis advisor. My thesis topic was not directly on VLBI, but it was about the analysis of Earth rotation parameters, in particular UT1. James told me about a new space geodetic technique, called VLBI, that employed large radio antennas and had been developed by scientists in the USA and Canada. He had already done some studies in this technique and had analyzed real VLBI data. In 1980, his research proposal 'VLBI data analysis' got approved by the German Research Foundation and he offered me a position as Research Assistant in this project.

*Please give us some information about your academic career.*

From 1974 to 1979, I studied at the University of Bonn, where 'Geodesy' was offered as a full study program. In those years, there were plenty of students in this subject: in my class we started off with more than 140 students. After graduation and a short intermezzo at the Institute of Photogrammetry, I took the job offered by James Campbell.

It was an exciting time: we organized our first VLBI experiments; the new 20-m radio telescope at Wettzell observed its first fringes (in 1983); we participated in NASA's Crustal Dynamics Project; and the first geodetic measurements of crustal motion were made. A lot of interesting effects—such as variations of Earth orientation, Earth tides, and even relativity—could be observed by VLBI, which was very fascinating for a young PhD student. My main task was to develop an in-house analysis software, which we called BVSS (Bonn VLBI Software System), the predecessor of the current OC-CAM software. I also liked to travel and enjoyed meeting our international partners in the USA, Sweden, the Netherlands, and Italy—just to name a few of them. Many of my good friends and colleagues are from that time.

After finishing my PhD in 1986, I continued first as Research Assistant and then, from 1988 onward, as Assistant Professor at the Geodetic Institute in Bonn. In 1989, I joined the German Air and Space Agency (DLR) in Cologne, a very huge organization; and in 1995 I moved to Munich, where I got a position as Head of the Earth Rotation Division of DGFI (Deutsches Geodätisches Forschungsinstitut). In Munich I tried, among other things, to get VLBI-related research projects approved and to find good Master and PhD students to work on these projects. Wolfgang Schwegmann, Volker Tesmer, and Robert Heinkelmann are just a few names from that time. And I'm happy that most of them are still in the VLBI business. In 2000 I became a full professor at Vienna University of Technology.

*When you started in Vienna, there were hardly any Austrian contributions to the international VLBI activities. Today, however, Vienna is among the few places in the world, where young students dedicate a lot of time to geodetic VLBI in well received research themes. What is the secret behind this?*

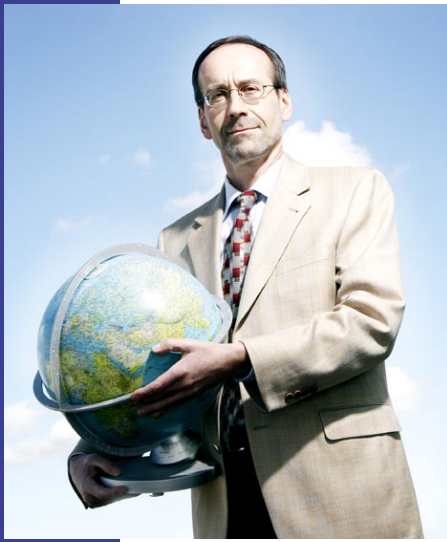
Like in Munich, I tried to establish a VLBI group. I was lucky to get several excellent PhD students—for instance Johannes Böhm and Thomas Hobiger. Further, we offer interesting research topics to the diploma ('master') students for their theses. Thus, we were able to attract a good number of students and we were also successful in getting several new research projects approved, which secured funding for PhD positions. Furthermore, I am very glad that quite a lot of PhD students and guest scientists from abroad came to Vienna to join our team.

*The Directing Board of the IVS elected you as their new chair person. What can we expect under your chairmanship? What do you consider to be very important for the IVS?*

The Global Geodetic Observing System (GGOS), which just recently has been changed from an IAG project to a permanent IAG component, will be the main challenge for the international geodetic community in the next decades. GGOS will play an essential role in helping to solve environmental and societal problems. Many open questions related to global change, sea level rise, or the prevention of natural hazards need precise reference frames and exact geodetic measurements. VLBI will provide a critical contribution to GGOS by its relation to a quasi-inertial celestial reference frame and its unique ability to measure long-term UT1-UTC and precession/nutation. Major goals for the next years will be to strengthen the role of VLBI within GGOS and to raise the awareness of the importance of VLBI in the scientific community as well as in the general public.

*To specify the VLBI2010 design parameters is certainly the most challenging task for the IVS. Once the VLBI2010 specifications are determined and realized, what will be the strengths and weaknesses of the IVS?*

It is the task of the VLBI2010 Committee (V2C) to determine the specifications for the next generation VLBI system. With respect to future antennas, the idea is that any



*VLBI globetrotter and IVS chair Harald Schuh*





"There is always room for desert."

other radio telescope will still be able to take part in geodetic VLBI sessions. Thus, antennas that are bigger and/or slower than the envisaged VLBI2010 antennas can still be important contributors to the IVS observing program. The V2C, which is chaired by Bill Petrachenko from Natural Resources Canada, is doing an excellent job and already has provided extremely useful results. I'm looking forward to a V2C report that will summarize

the existent findings of the committee and give recommendations for the new system. These specifications can be used as a benchmark for new VLBI systems. Currently several countries are planning to develop or purchase new VLBI systems. The sooner the specifications are available, the better.

*How can the IVS reach the goal of having a uniform and global coverage with observatories? What models will be suitable to overcome the currently existing gaps in the global distribution of antennas?*

With new antennas coming up in countries like Australia, New Zealand, Russia, and South Korea the global coverage is getting better, but it is still far from being optimal. Thus, ideas and proposals for new stations are more than welcome. However, it seems that VLBI will always be at the top end—both for the quality of the results and for the hardware costs.

*In 2003, the European Commission awarded the Descartes Research Prize to an international team of researchers for a new nutation model that was based on VLBI observations; you were part of that team. What are the open issues in modeling and analyzing VLBI data?*

There is still space for improving the models. As our common goal is to get an accuracy below the 1-mm threshold, each individual model should be clearly better than a fraction of 1 mm. Major improvements are still needed (and possible) for models of the troposphere—which seems to be the limiting factor of the overall accuracy of geodetic VLBI—but also other models such as oceanic, atmospheric, and hydrological loading as well as antenna deformation can be improved.

The combination of the various space geodetic techniques is becoming more and more important. Precise surveying of the local ties (e.g., between the reference points of VLBI and SLR) is required to be clearly below the 1-mm level. Thus, classical high-precision surveying is needed, but

completely new ideas are also welcome.

*We know that you like to run in the morning, to eat cake after lunch, and to have fun with colleagues at night. What else do you like—other than VLBI?*

I also like biking, hiking, and cross-country skiing. When I lived in Bonn, I used to play the violoncello. Unfortunately, I haven't found the time yet to do this in Vienna. And, as you have mentioned, I think that after a hard working day you should also take some time to sit back, relax, and have fun with your friends.

*Do you have any wishes or dreams for the future?*

One of my wishes concerning VLBI is to inaugurate one (or more) VLBI2010 antennas in the next years and to have a smooth transition to the VLBI2010-type observing. The extension of VLBI to space with antennas and/or radio emitters on satellites, on the Moon, and on planets is also a very exciting idea.

My dream for the future is a global VLBI network that continuously observes and provides sub-mm results in near real-time with at least three radiotelescopes on each major tectonic plate.



Hayo Hase (right) hands over a souvenir to the Vienna group (clockwise from left: J. Wresnik, J. Böhm, R. Heinkelmann, H. Schuh) following their singing performance at the GM2006 in Concepcion.

#### Upcoming Meetings...

ERIS2007 Bonn, Germany September 10-15, 2007	Journées 2007, Meudon, France September 17-19, 2007
6th International e-VLBI Workshop Bonn, Germany September 17-18, 2007	AGU Fall Meeting SanFrancisco, USA December 10-14, 2007
5th IVS General Meeting St. Petersburg, Russia March 3-6, 2008	

<http://ivscc.gsfc.nasa.gov/meetings>

## My First TOW: A Personal View of the TOW2007

– *Lingling Wang, Shanghai Astronomical Observatory*

*The fourth IVS Technical Operations Workshop (TOW) was held April 30 through May 3, 2007 at Haystack Observatory in Westford, MA, USA. The TOW is intended to provide hands-on training and problem resolution in VLBI operations for the technical staff of the stations. Lingling Wang from Shanghai Astronomical Observatory was a first time participant and summarized her impressions of the workshop for the Newsletter.*



*Participants at the fourth TOW.*

It was the first time that I attended an IVS Technical Operations Workshop, which is held every two years at Haystack Observatory. About 60 people came together this time for four full days from April 30 to May 3. It was undoubtedly very exciting and substantial.

I always hope to have a comprehensive understanding of VLBI, including theory, history, recent developments, and so on. The approach of face-to-face teaching is much more effective than studying by yourself, especially if you already have some understanding of the material.

Therefore, I chose my curriculum to have not only Mark 5, FS, and e-VLBI, which are topics that I usually work on, but also antenna calibration, phase calibration, antenna pointing, the timing system, and even the correlator theory. Actually, I would have liked to take all classes, if that had been possible.

What impressed me most was that the teachers were all professional and kind; and the students were all active and harmonious: people shared and discussed their experiences, and talked friendly to each other.

The class about Mark 5B came in handy, as the related knowledge had already been used in a test of our new Mark 5B system. One unexpected, pleasant surprise was that Pablo de Vicente, who is from Yebes Observatory in Spain, generously gave us an article that describes in detail how they had updated their Mark 5A to Mark 5B. He was so kind and translated the original, Spanish version into English—only for us. The article will be very helpful in the near future, when we will start to do the update at Shanghai.

Ed Himwich's classes about the FS were what I had expected, since I was planning some work with the FS. Ed gave me many constructive suggestions and took great patience in his explanations, which impressed me very much.

The feedback discussion is very important: the observation stations, the correlator centers, basically any person could 'complain' about anything that they did not feel comfortable with in their work. This kind of exchange between the station and the correlator personnel is extremely important. Unfortunately, I did not prepare for this beforehand, so I only could say 'no comment yet' when it was my turn. Next time, I hope to be able to give some meaningful opinions.

The workshop was very successful and helpful. But I still have some suggestions here. I will be very gratified, if they are useful for the next meeting.

1. I noticed that time was not enough and I missed some of the classes. How about video recording them? Then, also other people, who did not attend the class, would be able to follow.

2. The notebook is very helpful. But it would be even more helpful, if the students could get it before the workshop and preview it.

My idea is that if it were possible to provide the articles (in draft form, not necessarily in the final version) on the Web site for download prior to the meeting, then people would be able to preview them right before coming to the workshop. After all, having done a long great-circle-flight



*Chet Ruszczyk (standing left) explains the new OS for the Mark 5 system. Pablo de Vicente (standing right) volunteers to perform the upgrade demonstration during the class.*

over the Earth and coping with the tough time difference, to receive so much information in such a short time is really not easy to handle. Previewing means higher efficiency.

Finally, I should say many thanks to Dirk and Heidi for all what they do for us. I also appreciated it very much that Giuseppe Colucci was so kind to take us from the hotel to Haystack Observatory every day. I hope to see you again soon.



# NEWS...



*Top left: The correlator groups from Washington, Bonn, and Haystack discuss common issues. Center left: Wenjun Yang, Zhengwen Sun, Giuseppe Colucci, and Lingling Wang at lunch time. Lower left: Tom Clark, Jonathan Quick, Roger Hammargren, Martin Leenwinga, and Hans Tenkink go hands on. Top Center: Ed Himwich during one of his presentations. Lower Center: Kerry Kingham vividly describes the correlator theory. Top right: Chenyu Chen, Wenjun Yang, Bo Xia, and Zhengwen Sun pose at the MIT sign. Lower right: Brian Corey enjoys a relaxed moment during the ice breaker.*

## Adieu and Farewell

The geographic proximity made it possible. Three members of the former Canadian VLBI group privately undertook the seven hour journey from Ottawa, Canada to Haystack Observatory to say farewell to old friends and colleagues. We had the pleasure of welcoming Mario Bérubé, Jacques Lafrance, and Stephen Farley at the icebreaker party and the first day of the TOW.

It was a real delight to once again see them, to be able to bid them farewell in person, and to wish them all the best in their new endeavors. I hope that with the advent of the next generation VLBI system and the Global Geodetic Observing



System (GGOS) it will be possible for them to re-join the VLBI community. Until then, Mario, Jacques, Stephen, and all the others from up north: we will miss you.



*Mario Bérubé during a break.*

Dirk Behrend

*Mario Bérubé, Matt Harms, Stephen Farley, Heidi Johnson, and Jacques Lafrance after the TOW dinner.*

## A Synopsis of the Viennese VLBI Meetings

– Vincenza Tornatore, Politecnico di Milano



Vienna is world-renowned for its fine arts activities: music, theater, opera, and painting have a long tradition in the Austrian capital. But last April, the city on the Danube had the opportunity to also show off its vocation to science. A total of four international science meetings devoted to the study of the Earth were held in the period April 12–20, 2007. Three of these meetings were dedicated to VLBI—18th European VLBI for Geodesy and Astrometry (EVGA) Working Meeting, 8th IVS Analysis Workshop, and 2nd VLBI2010 Working Meeting—and will be reviewed in this article. All three meetings were locally organized by the Vienna VLBI group, which has to be acknowledged for an excellent job. The fourth event was the 2007 General Assembly of the EGU (European Geosciences Union, <http://meetings.copernicus.org/egu2007>), which covered all disciplines of the Earth, Planetary and Space Sciences, and had a few VLBI-related talks, but will not be covered here.

inter-technique result combination, and future perspectives and developments of VLBI. The proceedings of the meeting are already available and can be accessed online at the URL <http://mars.hg.tuwien.ac.at/~evga/proceedings/>. The meeting was gladdened by a welcome dinner in a delightful, typical Austrian wine tavern (“Heurigen”) on April 12. Most of the attendees diligently continued to work over the weekend to participate in the analysis workshop on April 14 and the VLBI2010 meeting on April 15. Both full-day events took place at the Vienna University of Technology.

The 8th IVS Analysis Workshop, led by IVS Analysis Coordinator Axel Nothnagel, was meant as a platform for intensive discussions, rather than a forum for extended presentations of results. Several workshop attendees gave short introductory presentations to the discussions that focussed on all aspects that can help to improve the precision, accuracy, and reliability of the VLBI results. In this context, the importance of the work of different analysis centers was emphasized. Contributions from a higher number of analysis centers and combination centers were encouraged. It was also stressed that combinations need a proper weighting of the single solutions. More investigations of models, analysis strategies, and instrumental calibrations are required to improve the current performance of the VLBI technique and to overcome inconsistencies still present in some results.

The discussions of the 2nd IVS VLBI2010 Working Meeting were moderated by Bill Petrachenko (Natural Resources Canada) and were based on requirements set out for the next generation VLBI system:

- 1 mm measurement accuracy on global baselines;
- continuous measurements for time series of station positions and Earth orientation parameters;
- turnaround time to initial geodetic results of less than 24 hours.

The status and future plans were presented for coping with the three main error sources (atmosphere, instrumentation, and source structure) that stand in the way of achieving these goals. The main strategies considered to try to minimize the effect of these error sources concern, on the one hand, a manifold increase in the number of observations per 24-hour session and, on the other hand, a manifold increase in the precision of each delay measurement.

Monte-Carlo-simulators have recently been developed (and are being improved) to study the impact of these strategies on IVS products, with particular interest in achieving the 1-mm target. As part of this effort, new scheduling and analytic approaches are being considered to reduce the effect of the atmosphere. Progress is being made toward the 1-mm target with many new approaches still remaining to be tried. Based on the improved UV-coverage of the VLBI2010



Participants at the Viennese VLBI meetings.

The 18th EVGA Working Meeting was held at the premises of the Bundesamt für Eich- und Vermessungswesen on April 12–13. The purpose of this meeting was to exchange results of the latest geodetic and astrometric VLBI research, information on VLBI stations, and discussion of future projects. About 70 scientists, from all over the world and working in all fields of geodetic and astrometric VLBI, attended the meeting and reported their activities. They presented and carefully discussed about 50 contributions in oral or poster form. Major topics concerned station and correlator activities, technical developments of the Mark 5 system, e-VLBI, and digital receiver and back-end system. Other talks discussed geodetic and astrometric VLBI analyses, new modeling techniques and results, new software developments, intra-technique and



# VLBI How To...

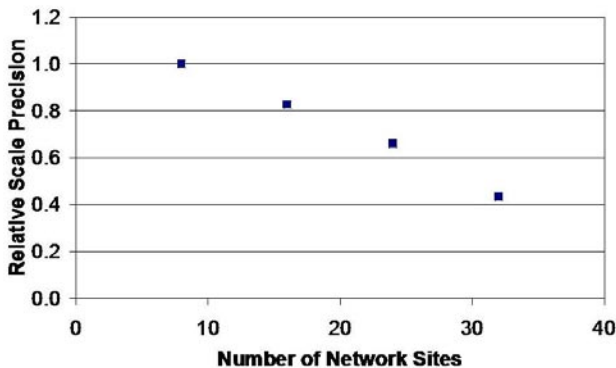
schedules, studies have been undertaken to review the potential of applying source structure corrections directly from the VLBI data. Preliminary results are promising.



Meeting participants enjoying the welcoming dinner at the "Heurigen."

NASA is funding a proof-of-concept development program to study the broadband delay technique in which a number of widely spaced bands are used to resolve phase ambiguities and hence dramatically improve the precision of delay measurements. One of the major parameters that has yet to be specified for the VLBI2010 system is the antenna slew rate. Plans for studies to define this parameter were discussed.

<http://mars.hg.tuwien.ac.at/~evga/>



Improvement of the precision of the reference frame scale parameter as derived from Monte-Carlo simulations for globally distributed networks. Precision is expressed relative to the precision of an 8-station network.



*All truths are easy to understand once they are discovered; the point is to discover them.*

*- Galileo Galilei*

## Got Spares?

*- Mike Poirier, MIT Haystack Observatory*

Most of us work at remote facilities that require us to keep many spare parts on hand in case of failure. Many of these parts are at the component level which can support the repair of in-house built equipment. With the influx of the commercial off-the-shelf (COTS) philosophy we open up the possibility of equipment that cannot be repaired or replaced as quickly as in-house built items.

Late last year, we at Westford experienced an extraordinary failure, which caused a significant loss of data due to system down time. Within our antenna control system we encountered a string of multiple failures. This was compounded by the inability to replace quickly the COTS equipment. Upon contacting our suppliers, it was discovered that replacements were not in stock but had to be built by the manufacturer, which would take 4–6 weeks.

As luck would have it, we were preparing for an upgrade of our drive controls in the early spring and had received the new controllers the same week of the failure. This allowed us to re-engineer and expedite the upgrade, and we were able to attempt operations within six days, only to discover that another part of the system had failed. We special-ordered a direct replacement from the manufacturer and received it within four days, only to discover that firmware and CPU upgrades within the board were not backward compatible to our system. The manufacturer had changed the firmware, which enabled new options that were not available on our old system. This required a major rewrite of our servo control software.

The lesson learned is that we, at field sites, must keep spare replacements on hand for equipment that has an extended functional life of more than a few years. After that time the manufacturer may not be able to replace or even support this equipment. We must be aware of any updates from the manufacturer in software and firmware. These changes may not be compatible to our systems; hence, we need to adapt prior to a system failure that would cause significant data loss.

The IVS Newsletter is published three times annually, in April, August, and December. Contributed articles, pictures, cartoons, and feedback are welcome at any time.

Please send contributions to [ivs-news@ivscc.gsfc.nasa.gov](mailto:ivs-news@ivscc.gsfc.nasa.gov).

The editors reserve the right to edit contributions. The deadline for contributions is one month before the publication date.

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## Ultra-rapid e-Intensives between Europe and Japan

– Dirk Behrend, NVI, Inc./GSFC

The four network stations at Kashima, Metsähovi, Onsala, and Tsukuba will commence a study on ultra-rapid Intensives using e-VLBI. In the time frame (initially) from August 2007 to March 2008, Intensive-type sessions of 1-hour length will be observed on two almost parallel baselines between Europe and Japan (Onsala–Tsukuba and Metsähovi–Kashima, see figure) prior to regularly scheduled IVS sessions as well as on specific R&D days of 24 successive Intensive-type sessions. All sessions will be processed in near real-time by making use of the high-speed optical fiber connections of the four stations and the software correlators at Kashima (NICT) and Tsukuba (GSI).

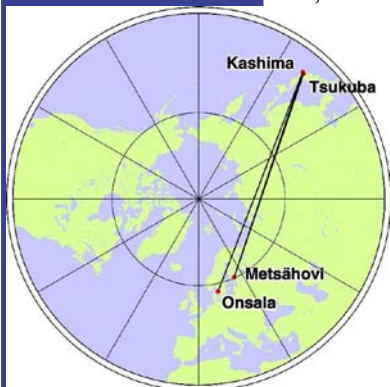
relation at Kashima. Correlation and product generation still involves some manual interaction. Still, it is planned to completely automate the procedure.

The study will allow investigating

- systematic errors in dUT1 estimation of Intensive-type sessions by inter-comparing the results from the parallel baselines as well as by comparison with other IVS routine sessions,
- the consistency of ultra-rapid results with standard results, and
- the impact of different data rates and scheduling options on the results.

These benefits are in addition to the demonstration of obtaining geodetic results in almost real-time.

The study group hopes to be able to present first results at the General Meeting in St Petersburg. Once the procedure (from observation to final product) has been proven to be robust and reliable, it can be employed to improve the IVS observing program, e.g., by reducing the timeliness of the INT2 sessions.



Network for the ultra-rapid dUT1 e-VLBI experiments on “almost parallel” baselines between Europe and Japan.

The databases will be analyzed to estimate dUT1 and be made available for analysts by placing the database files on the IVS Data Center at Kashima. A successful test was done on the baseline Kashima–Onsala with cor-

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