Draft of Future ATF proposal beyond 2012 (from April 2013) for 6th ATF ICB meeting

In Feb. 2010, KEK Domestic review committee authorized by KEK directorate recommended the reconsideration of ATF international collaboration for ILC beyond JFY2012 and for new ATF international collaboration which will be started from April 2013. Then, KEK directorate requests us to make a good proposal for the research programs beyond JFY 2012 if we want to keep our facility and activity.

Explanation of KEK research situation (mainly budget situation) within 3 or 4 years from now

Super KEKB construction started from 2010 and the beam power upgrade of J-PARC has to approach to 1MW. The Super KEKB construction will take 4 years to restart the machine operation. The beam commissioning will start in 2014. KEK big R&D groups (ATF, STF and ERL) for future KEK plans are getting financial support from GD and directorates using KEK annual budget and special budget including KEKB and J-PARC operation budget. Since KEK total budget becomes very severe due to economical recession, KEK GD and directorates declared the operation of R&D facilities (ATF, STF and ERL) should be reevaluated in the relation of usefulness and importance of each facility.

Requests of KEK directorates to ATF International Collaboration

They asked us to make a good research programs beyond JFY2012. Judging the proposal, they will decide the support for the operation of each facility. We think we need a tentative proposal to submit to 11th ATF TB and 6th ATF ICB. We can improve it since we will submit it to KEK directorate later (maybe, by May). Anyway, we have to make a global consensus during ATF international collaborators. Since present KEK GD and directorates will be reorganized from April of 2012, present directorates want to make new future plans for next directorates who will manage KEK until JFY 2014 (three years period, usually six years or more). We think present directorates will decide them beyond JFY2012 by the end of 2011.

New proposal for ATF International Collaboration beyond JFY2012

New proposal should include several plans for long term (say, 3 or 6 years) R&D's as an international collaboration program, educational program for young researcher and students. ATF revised MOU which will be executed from April of 2013 is necessary. Of course, we want to keep important R&D's for ILC within the limitation of KEK-ATF ability which means manpower and budget situation of JFY2013 and so on. However, KEK directorate is requesting us more global R&D which includes application of advanced accelerator technologies and basic science research using ATF.

We decide the allocation of ATF machine time for ILC R&D will be 50% beyond

JFY2012.

Present ATF activities are mainly R&D dedicated to assessing and developing critical linear collider techniques. This will continue in 2011-2012. The current arrangement has KEK fully supporting the running of the facility (about 3.5 oku-yen/year in total for salaries of KEK staff (about 1.2), electricity and consumables (about 1.0), maintenance (about 0.3), software & hardware support company (about 1.0)) and, outside collaborators funding essentially their participation and own R&D as in-kind contributions. This is consistent with current ICFA recommendations for the access to accelerator facilities in HEP and with the MoU under which the collaboration operates. (We think some amount of research budget from 2013 will be needed to come from the Japanese government or from foreign institutes/collaborators. How to make research operation money? In the past there had been discussion on in-kind contributions, and also of common funds. However, common funds are delicate and would not be necessary if the proposal is attractive and convincing. Global international collaboration is much desired. The extension of ATF/ATF2 beyond 2012, together with STF, and the new organization for these projects is part of KEK's "pre-ILC plan". This future pass is much desired to keep the ILC/ATF activities at KEK. Also, we have to consider the common funds for the longer operation of ATF if possible.)

After 2012, it is expected that ATF will need to be motivated not only by linear colliders, but also by other science. Moreover, the funding for linear collider R&D at KEK will probably not be enough to fully support ATF operation as now. Given the above, current discussions on ATF's future include the following priorities:

1) Definition of a broader scientific research program at ATF beyond 2012.

2) Changes in the mechanisms for external participation and support to ATF.

3) Improvements to the organizational scheme for collaboration and operation.

For this proposal, we want to concentrate the proposal of new research programs because re-organization issues and collaboration scheme issues had better discuss to change present ATF MoU by the end of JFY2012.

Future research programs: The definition of the future research program at ATF is the most important. High quality scientific proposals can be expected to mitigate future funding problems and influence discussions of other changes. Extensions of current linear collider R&D programs, in particular (1) nano-beam orbit control with FONT, (2) new FD & ultra-low beta optics to reduce the vertical beam size below 20 nm, could then be envisaged through KEK support and international collaboration. The KEK ATF management will then again discuss with its partners to define our overall collaborative research plan.

"Pre-ILC" facility at KEK will comprise ATF/ATF2 and STF. For ATF addition of 200 TW laser facility is proposed, to be installed on ATF roof (6x4 m^2 area; very compact). Energy and intensity frontier are complementary. ATF 1.3 GeV e^- beam together with 200 TW laser will explore the intensity frontier (nonlinear QED, breakdown of vacuum, general relativity, black hole generation, nonlinear vacuum science, quantum theories, Unruh radiation,…) pushing beyond the FFT, BNL and GSI experiments. The ultimate goal would be to reach the 1.3×10^{16} V/cm Schwinger critical field for 1 micron wavelength. The laser plasma interaction regime will be explored at different levels. The effect of the laser field will be amplified by using the 1.3 GeV electron (Lorentz factor).

ATF has a chance to apply several funding supports of the MEXT, JSPS, JST, NEDO and so on, which are government funding agencies by independent research and development proposals using ATF, every year. Usually, the approval of these applications is severely competitive and difficult. If approved, major resources will be provided for new equipment and upgrading of the ATF facility during 2012-2016, including also contributions to continue ATF operation.

Approval process; first submit the draft to 11^{th} TB meeting, second modify it according to TB comments, then submit the modified proposal to 6^{th} ICB in March 2011. After that, we have to submit final proposal to KEK directorates in May 2011. The approval process at KEK will take several months, finally KEK directorates will give us their conclusion to ATF International collaboration team.

Requests to ATF facility's performance by March of 2013 for new research programs; storage electron beam current near 200mA in the damping ring, 2×10^{10} electrons/bunch, enough stable beam operation with less 10% sigma beam orbit stability, 3.125Hz operation possible (if needed, increase 6.25Hz), which means the vacuum condition in the ring should be achieved for the stable operation and beam feedback system to stabilize the beam orbit within 10% sigma will also be established. The ATF will continue to have 20 week operation per year.

Education for PhD students and Master course students should basically managed by supervisor of collaborative institutes with sub-supervisor who is belonging to KEK or ATF operation team. The sub-supervisor has to suggest students the research group to join for ATF beam experiments. Student education is an important part of ATF and should be emphasized. This issue should be discussed and included into new ATF MoU later.

Proposal;

There are several interesting research items which were discussed with international

collaborators. We would like to list as follows;

1. Super-FQ R&D or new normal FQ R&D (advanced FQ R&D) to make smaller beam size (less than ~20nm). In-kind contribution /6 years (2013-2018)

Advanced FQ R&D to make smaller beam size < 20 nm; BNL concentrates on ILC prototype for the moment and will complete SC ATF quadrupole later. The stability of the magnetic center is an important question that can already be explored. Verifying the magnet measurement stability is a first step. The first priority is tuning ATF-2 with the present NC magnets.

2. Nano beam orbit control (Font study extension). in-kind contribution /3 years (2013-2015)

3. Gamma-Gamma laser system R&D. (2013-2017) (**Gamma-gamma collider R&D)**

4. Non linear QED Physics (from high field physics to Vacuum science).

Need 10Hz, 200TW laser at ATF2, **high-field physics at ATF2**

Following CLIC related issues will be included in research item 1.

- **Test of hybrid final-quadrupole solution for CLIC at ATF (small aperture), e.g. close to IP**; interesting if a place can be found and if the spot size could be significantly reduced.
- **Correction of magnet motion with sensor and feedback on the beam** could be tested at ATF; sensors still need to be optimized for frequency range of interest; ATF frequency is not optimum but could be increased to 12.5 or at least 6 Hz. A fast kicker is used for 30 bunch extraction, spaced 150 ns. The ultimate ATF repetition rate limit is 12.5 Hz, which would start to be interesting for CLIC tests. Reaching 12.5 Hz would need modifications of the laser system (6 Hz possible), and perhaps of cooling system, of kickers, etc…. The RF system already runs at 12 Hz. 6 Hz is more easily possible. Geophones exist at CERN which are sensitive at 6 Hz, though this is different from the future CLIC frequency.
- **Double kicker system?** Any need for improvement of double kicker system. Several $1x10^{-4}$ stability of pulsed fast kicker achieved recently. This is comparable to the double kicker which accomplished $3x10^{-4}$ stability. The stable operation of the single fast kicker is present ATF objective.

- Damping ring. Goal to reduce vertical emittance to 1 pm using precise correction of orbit and coupling. Extract vertical emittance beam stably, and reduce emittance growth in extraction line. A **prototype CLIC DR wiggler could be installed in the ATF DR** to lower the emittance.
- CLIC would like (to continue) to work on **ATF and transfer line tuning, including tuning of the damping ring**. There is always the need for tuning the ring in order to maintain a small emittance. Feedback system can help for stabilization, e.g. orbit feedback.

Overall the scope of ATF-2 will be significantly widened with above new research items.

How does the Japanese funding agency view the different parts of the research program? The funding agency requests proposals every year. The proposals are reviewed with input from experts. We can submit our new research program items to MEXT and JSPS around this autumn again.

Unfortunately, we had a big earthquake, which is called Pacific-coast of Tohoku earthquake, on 11th March 2011 during ATF machine operation. KEK staffs and ATF collaborators all were safe but the facilities were damaged. We cannot evaluate recovery time for ATF collaborative operation at present. At least we guess about six months are necessary for the recovery of ATF and the re-operation. We think this severe situation requests us more effort to make a excellent proposal for future ATF beyond JFY2012.

We made six meetings which were three meetings in Europe and three in the US, scheduled by the KEK ATF management to discuss and consult with its main international partners about plans and organization for future research programs at ATF beyond 2012. The visit purpose was to make a research guideline of new ATF international collaboration beyond JFY2012. Interesting R&D programs and requests of main collaborative institutes according to future prospect of KEK research situation are appended.

From CERN;

Discussion on ATF Collaboration beyond 2012 – "ATF-3"
CERN 23 September 2010

Participants: R. Assmann (partly), G. Geschonke (partly), D. Schulte (partly), T. Tauchi, N. Terunuma, R. Tomas, J. Urakawa, F. Zimmermann

The **purpose of the visit** by KEK colleagues was to prepare a proposal to the KEK DG and the Japanese Government by the end of the year for a future attractive scientific programme at ATF/ATF2.

KEK might support 1.5 Oku-yen per year for ATF from 2012, which corresponds to about 70% of operating costs. The other 30% then need to come from the Japanese government or from foreign institutes/collaborators. How to make 30% operation money? In the past there had been discussion on in-kind contributions, and also of common funds. However, common funds are delicate and would not be necessary if the proposed is attractive and convincing. Global international collaboration is much desired.

The extension of ATF/ATF2 beyond 2012, together with STF, and the new organization for these projects is part of KEK's "pre-ILC plan".

Junji Urakawa and colleagues proposed the following **research items for "ATF-3"**:

1. **high-field physics at ATF2**
2. **THz microwave beam acceleration**
3. **Gamma-gamma collider R&D**
4. **Super FQ R&D** to make smaller beam size < 20 nm

The future research plan may include a **table-top FEL** at ATF-3, **applications to nuclear waste management** (plutonium detection), **THz-FEL Super-radiation from pre-bunched e- beam**, **SC-FQ** for ATF-2 to get even smaller spot size, and **FONT extension**.

A THz experiment from Munich had been presented at FEL conference. There is now a 50% efficiency from wall plug to laser, and 10-15% laser to beam efficiency. So the total efficiency of a laser-driven accelerator will be a few percent. The difference to Munich is that ATF-3 will employ a ten times more powerful laser (20 TW -> 200 TW).

Gamma-gamma R&D is already ongoing at ATF. An initial 2-mirro optical cavity (1e9 gamma's per second with DR e- beam) was replaced by a LAL 4-mirror cavity (>1e10 gamma /s). Later the laser wavelength will be changed from 1 micron to 10 micron, which will further increase the flux of gamma, but at a different energy (25 MeV -> 2 MeV gamma ray). The MeV energy range is of interest for nuclear waste management

(photo-nucleon resonances).
Overall the scope of ATF-2 will be significantly widened with ATF-3.
Gunther Geschonke reviewed the **CTF-3/CLIC international collaboration**. This collaboration was established 6 years ago. It is organized like a particle-physics experiment. It is based on **MoUs between institutes**, not between countries. The collaboration at present counts 40 member institutes in total. Initially only covering CTF-3 it has been extended to the whole of the CLIC study group. Any institute can join at any moment, sign common MoU, and define in the MoU what and when they want to contribute.
The contributions are very diverse and variable: At the minimum some students are sent. Other institutes send material (e.g. Uppsala built 2-beam test stand, 1 person since 2-3 years paid by Uppsala, INFN Frascati the whole combiner ring with 80-m circumference), work in their institutes is contributed by others. There are no formal requirements, and a proposal/contribution is accepted if it is judged to be useful for the collaboration.
A **collaboration board** includes representatives of the top management of all member institutes. The board meets twice per year, and does not interfere much with daily detailed work. The work is collegial.

Higo san of KEK is a member of the CTF-3/CLIC collaboration. Taka Kondo had drafted the CERN-KEK MoU, one item of which is the ATF/ATF-2 collaboration. CERN is a member of ATF/ATF-2 collaboration.

Junji Urakawa pointed out that the ATF MoU has some problem, since the host institute has to support the full operation of the machine (ICFA guidelines). JAI bring electronics to KEK, and use existing equipment. The work on the coherent diffraction radiation is similar.

Gunther Geschonke clarified that CTF-3/CLIC has no common funds. The member institutes have their own money and students.

The main topic of today's discussion is gathering input and comments on a future ATF research plan in international collaboration.

The long-term plan for CTF-3 is defined. At the end of 2011/2012 the CERN Council will lead a discussion on how to proceed with LC R&D. CTF-3 has the green light to run

through 2013. It will change its role for CLIC development. The long term program is closely tied to the CLIC study.

BNL concentrates on ILC prototype for the moment and will complete SC ATF quadrupole later. The stability of the magnetic center is an important question that can already be explored. Verifying the magnet measurement stability is a first step. A permanent magnet from Kyoto will also be installed at ATF2 (upstream). This is a permanent mechanically tunable magnet. The first priority is tuning ATF-2 with the present NC magnets.

There are many future research plans – does KEK/ATF want to do all of them? The purpose of the proposals and discussion is related to funding request for the government. Foreign collaboration will strengthen proposal to government.

What are the role and possible contributions of CERN?

CERN fellow Yves Renier will continue working for ATF. CERN hardware contributions: perhaps. Manpower for achieving small spot size will be contributed.

Proposals:

- Test of hybrid final-quadrupole solution for CLIC at ATF (small aperture), e.g. close to IP; interesting if a place can be found and if the spot size could be significantly reduced.
- Correction of magnet motion with sensor and feedback on the beam could be tested at ATF; sensors still need to be optimized for frequency range of interest; ATF frequency is not optimum but could be increased to 12.5 or at least 6 Hz. A fast kicker is used for 30 bunch extraction, spaced 150 ns. The ultimate ATF repetition rate limit is 12.5 Hz, which would start to be interesting for CLIC tests. Reaching 12.5 Hz would need modifications of the laser system (6 Hz possible), and perhaps of cooling system, of kickers, etc…. The RF system already runs at 12 Hz. 6 Hz is more easily possible. Geophones exist at CERN which are sensitive at 6 Hz, though this is different from the future CLIC frequency.
- Double kicker system? Any need for improvement of double kicker system. Several 1e-4 stability of pulsed fast kicker achieved recently. This is comparable

to the double kicker which accomplished 3e-4 stability. The stable operation of the single fast kicker is present ATF objective.

- Damping ring. Goal to reduce vertical emittance to 1 pm using precise correction of orbit and coupling. Extract vertical emittance beam stably, and reduce emittance growth in extraction line. A **prototype CLIC DR wiggler could be installed in the ATF DR** to lower the emittance.
- CLIC would like (to continue) to work on **ATF and transfer line tuning, including tuning of the damping ring**. There is always the need for tuning the ring in order to maintain a small emittance. Feedback system can help for stabilization, e.g. orbit feedback.
- Could a **bunch compressor** be installed in the extraction line?

ACTION: KEK/ATF team will provide a list of items where improvements and contributions could be useful (instrumentation, horizontal emittance, etc.), tuning …

One problem at ATF is poor manpower.

How does the Japanese funding agency view the different parts of the programme? The funding agency requests proposals every year. The proposals are reviewed with input from experts.

The ATF will continue to have 20 week operation per year.

A **draft of the "ATF-3" proposal should be composed by the end of this year**. In January, the ATF TB will judge the technical proposal.

The **ATF SGC&TB together with the ATF2 Project meeting will be held at SLAC in January just before the GDE "ILC baseline" meeting**.

ACTION: Daniel Schulte will try to attend the ATF SGC&TB and ATF-2 Project meetings at SLAC

ACTION: CERN side will make a list of things it wants to do, with an indication of time scale and resources

Student education is an important part of ATF and should be emphasized. A general statement of interest from CERN signed by DG could be provided

ACTION: Frank Zimmermann will write a summary of this meeting

ACTION: One page of comments from CERN should be composed as input for the draft proposal

ACTION: General statement of interest from CERN (signed by CERN DG)

ACTION: Junji Urakawa will send history of email communication from July to now to Daniel Schulte

Presentation by Toshiaki Tauchi on the **physics of high intensity field**s including the upcoming PIF workshop in November at KEK.
"Pre-ILC" facility at KEK will comprise ATF/ATF2 and STF. For ATF addition of 200 TW laser facility is proposed, to be installed on ATF roof (6x4 m^2 area; very compact). Energy and intensity frontier are complementary. ATF 1.3 GeV e- beam together with 200 TW laser will explore the intensity frontier (nonlinear QED, breakdown of vacuum, general relativity, black hole generation, nonlinear vacuum science, quantum theories, Unruh radiation,…) pushing beyond the FFT, BNL and GSI experiments. The ultimate goal would be to reach the 1.3e16 V/cm Schwinger critical field (for 1 micron wavelength. The laser plasma interaction regime will be explored at different levels. The effect of the laser field will be amplified by using the 1.3 GeV electron (Lorentz factor). Plasma wake field generation and acceleration experiments are also planned using the 200-TW laser..

Ralph Assmann expressed the interest at CERN in the experiments on plasma-wakefield acceleration including high-power lasers, and might contribute items to the proposal.

ACTION: Ralph Assmann will formulate CERN interest in items related to (laser) plasma-wakefield acceleration for ATF-3 proposal.

Reported by Frank Zimmermann

A number of potential contributions to ATF2 and ATF3 are currently considered and being explored at CERN:

Ultra low beta functions

The CLIC final focus system will have to compensate the very high chromaticity of the final doublet to an unprecedented level. In order to test the basis of this design, CERN has proposed to decrease the ATF2 IP beta functions to 0.02mm. With the existing beam line, the IP beta-function cannot be reduced below 0.04-0.05mm; the main limitation is the field quality of QF1. Depending on the beam halo, the apertures of QF1 and QD0 could also pose problems in the IP beam size measurement due to an enlarged background in the Shintake monitor. A first improved scenario consists in replacing QF1 with a superconducting quadrupole (Brett Parker et al.) with larger aperture and better field quality. This would allow to explore beta function down to 0.02-0.025mm. Funding of this scenario appears uncertain. The second scenario consists in replacing QF1 with a better normal conducting quadrupole. CERN will explore this option and provide such a magnet, if feasible.

FFS Tuning

The tuning of the FFS is a critical ingredient in the demonstration of the feasibility of any FFS. FFS Tuning is also one of the largest challenges still faced by the CLIC project. Therefore CERN will support ATF2 FFS tuning R&D and operation with manpower.

Direct feed-forward on ground motion

The CLIC main linac and beam delivery system will be very sensitive to perturbations by ground motion. A significant program is carried out to develop mitigation techniques. The most complex and cost effective method is to measure the motion of the quadrupoles until a moment before the beam arrives. The anticipated impact of the quadrupole positions can then be corrected in a feed forward fashion by orbit kickers. This scheme could be validated in ATF2/3 in a staged approach. First, sensors would be installed in selected ATF2 quadrupoles and the correlation will be measured between the orbit evolution and the quadrupole displacements. If good correlation is observed, this experiment will allow the calibration of the ground motion sensors with beam. In a second step, the required software and hardware will then be installed for an orbit feed forward. This would also improve the ATF3 performance.

Preliminary simulations show that the current 1 Hz operation is too slow for this study since the ground motion at this frequency has a correlation length comparable to the beam line. Operating ATF with a frequency of 6 Hz would suffice to significantly reduce the correlation

length and still observe displacements above the BPM noise in some sections of the ATF2 beam-line (sub-micron in the high resolution BPMs of the matching section and above the micron in the FD).

Quadrupole stabilization

The quadrupoles in the CLIC beam lines will need to be stabilized with an active system against ground motion. ATF offers the unique opportunity to verify the performance of these mechanical systems with the beam. One or more stabilized quadrupoles would be introduced in the extraction beam line, and the beam motion downstream be observed.

Damping ring emittance tuning

With the installation of the new ATF DR turn-by-turn high-resolution BPM system by Fermilab it is possible to perform fast and accurate low emittance tuning. This will allow to explore the possibility to reach an emittancs close to the CLIC target of ~1pm, based either on classical response matrix analysis techniques (as in synchrotron light sources) or by using frequency analysis of the turn-by-turn data. CERN commits to collaborate with the Fermilab colleagues to install and commission the required analysis and correction software.

Intra-beam scattering

The CLIC damping ring design is driven by considerations of the intra-beam scattering effects. Experimental verification of the theoretical predictions and simulation codes would be most desirable to validate the design. ATF is a well suited place to perform the relevant experiments, if the small beam emittance can be reached.

Coherent synchrotron radiation

It was recently found that different theories of coherent synchrotron radiation do not agree with respect to the instability threshold. This could have severe consequences for the CLIC damping ring design. ATF is an ideal test bed to identify the correct theory and benchmark existing codes. An exploratory measurement program has been already proposed for running the ATF at low energy (1GeV) for triggering the instability for bunches of higher than 10^{10} particles. To obtain high quality measurements, some investment may be needed for accurate bunch length and energy spread diagnostics, as well as micro-wave radiation detection.

Kicker systems

The ATF pioneered the experimental evaluation of a double kicker system for reducing the beam jitter when extracted from the damping ring. This was done for single bunches and ultra-short pulses, following the ILC parameters. The CLIC damping ring kickers have similar jitter tolerances as ILC (~10^{-4}) but for longer pulses and more relaxed rise times. To explore the potential of reducing the jitter tolerances to this level, a strip-line kicker system is developed by Spanish industry and an active adder system to pulse it at CERN. In late 2013 or in 2014, beam tests at the ATF extraction appear ideal to verify the kicker stability with beam. This double kicker system with longer pulses would also be of interest to the X-ray storage ring community, where top-up operation requires very stable kicker systems for closing very tightly the injection bump, and minimize the source spot jitter from the stored beam in the IDs.

Super-conducting damping wigglers

The CLIC damping rings necessitate the inclusion of very demanding superconducting wigglers to reach the small horizontal emittance target and the very fast damping time. A program exists to develop different wiggler prototypes and test them with beam. In particular, a collaboration exists between CERN and the Karlsruhe Institute of technology to develop a wiggler prototype in BINP, based on NbTi technology, and install it in ANKA storage ring. Development of a further prototype, based on Nb_3Sn, is foreseen at CERN. First estimations show that installation of such a 2m-long prototype can reduce the ATF horizontal emittance by 15%, for a design with 2.5T and 50mm period. The emittance could be further reduced by raising the field or including more wigglers. CERN would commit to build the wiggler, the corresponding cryostat and a cryo-cooler for beam tests in 2014.

Beam position monitors

ATF2/ATF3 is the ideal machine to test ultra-high precision, single-shot beam position monitors. CERN would like to test in 2012 at ATF2 a set of three beam position monitors, which have been developed by FNAL for the CLIC main linac. Further beam position monitor development is foreseen for CLIC, to meet the requirements of the beam delivery system. ATF3 would be the ideal test bed for them.

By D. Schulte

From LAL;

Summary of LAL meeting on 24-09-2010 to discuss ATF future

Participants: Toshiaki Tauchi, Nobuhiro Terunuma, Junji Urakawa (KEK), Philip Bambade, Alessandro Variola, Fabian Zomer (LAL)

Material: Slides shown by Junji Urakawa and Toshiaki Tauchi.

File with e-mail correspondence of past months on the future of ATF.

Context: The meeting was one in a series of three meetings in Europe and three in the US, scheduled by the KEK ATF management to discuss and consult with its main international partners about plans and organization for future research programs at ATF beyond 2012. Present ATF activities are mainly R&D dedicated to assessing and developing critical linear collider techniques. This will continue in 2011-2012. The current arrangement has KEK fully supporting the running of the facility (about 3.5 oku-yen/year in total for salaries of KEK staff, electricity and consumables, maintenance, software & hardware support company) and outside collaborators funding essentially their participation and own R&D as users. This is consistent with current ICFA recommendations for the access to accelerator facilities in HEP and with the MoU under which the collaboration operates. After 2012, it is expected that ATF will need to be motivated not only by linear colliders, but also by other science. Moreover, the funding for linear collider R&D at KEK will probably not be enough to fully support ATF operation as now. Finally, a strategic repositioning of accelerator-based activities as global projects is discussed more generally in the community, in which ATF could serve as test ground. Given the above, current discussions on ATF's future include the following priorities:

1) Definition of a broader scientific research program at ATF beyond 2012.

2) Changes in the mechanisms for external participation and support to ATF.

3) Improvements to the organizational scheme for collaboration and operation.

Future research programs (J. Urakawa, T. Tauchi): The definition of the future research program at ATF is the most important. High quality scientific proposals can be expected to

mitigate future funding problems and influence discussions of other changes. Two large funding contracts are now being applied for by KEK, to the MEXT (Non-linear QED physics, with Toshiaki as PI) and to the JSPS (THz microwave beam acceleration, high brightness gamma-ray generation for nuclear waste management, THz table-top FEL, with Junji as PI). If approved, major resources will be provided for new equipment and upgrading of the ATF facility during 2011-2015, including also contributions to continue ATF operation. Extensions of current linear collider R&D programs, in particular (1) new FD & ultra-low beta optics to reduce the vertical beam size below 20 nm, (2) nano-beam orbit control with FONT, could then be envisaged through KEK support and international collaboration. The deadline for the applications is in about a month, and decisions are expected early next Japanese fiscal year (June 2011). The KEK ATF management will then again discuss with its partners to define our overall collaborative research plan. At present, it would be useful to know the interest of international colleagues in the future research, since a mention can be made in the proposals to MEXT and JSPS. In parallel, continued discussions of changes to the ATF collaborative structure and MoU are needed in preparation for the next TB in January 2011. A proposal should be submitted to the ICB next March, ideally in terms of guidelines, to retain flexibility as the situation at KEK and partner institutions evolves in the next few years.

LAL participation (P. Bambade, A. Variola, F. Zomer): LAL contributes to ATF2 and to the Compton photon R&D with the newly installed four-mirror cavity in ATF. Certainly, the presence of LAL in the current work and collaboration can be mentioned in the funding applications. Interest was also expressed for several of the proposed future studies beyond 2012. Although LAL participation would require approval by the scientific council, as well as new funding, interest in for instance linear collider R&D (Philip) and non-linear QED physics (Philip, Fabian) can surely be mentioned at the individual level, including availability to help further define and evaluate these subjects. LAL scientists are very keen on ATF and look forward to discussing the future programs and organization.

By Philip Bambade

From JAI;

Participants: Grahame Blaire, Phil Burrows, Andrei Seryi for JAI; Toshiaki Tauchi, Nobuhiro Terunuma, Junji Urakawa for KEK

The purpose of the visit by KEK colleagues was to prepare a proposal to the KEK DG and the Japanese Government by the end of the year for a future attractive scientific programme at ATF/ATF2 beyond April 2013. As described by KEK colleagues, KEK might support 1.5 Oku- yen per year for ATF from 2013 (which is electric power expense and cost of water facility.), which corresponds to about 70% of the operating costs. In the past there had been discussion on in- kind contributions, and also of common funds. However, common funds would be difficult to arrange, in particular in the present financial situation in UK, and moreover, they would not be necessary if the new scientific proposal is very convincing and will attract wide and global international collaboration. In this case it is likely that the other 30% can also come from the Japanese government.

The following tentative proposals have been presented by KEK colleagues at the meeting in JAI as new topics for ATF/ATF2 beyond 2012: a) Non-linear QED physics at ATF2; b) laser-driven plasma acceleration of 10fs bunches and study high field acceleration of 10fsec beam by THz microwave with optical cavity and THz microwave generation by table-top FEL; c) high brightness gamma-ray generation for nuclear waste management with 10.6um CO_2 laser to generate MeV gamma-ray; d) super Final Quad to make smaller beam size < 20 nm; e) THz-FEL super-radiation from pre-bunched electron beam, generation more than 10MW peak power with multi-bunch beam by 1m long table-top FEL; f) Nano-beam orbit control (FONT study extension). It has also been described that ATF/ATF2 may become a part of the KEK “pre- ILC plan” as discussed by KEK management and GDE.

The John Adams Institute will continue be actively participating in ATF/ATF2 research and be active participant of the ATF international collaboration. The particular topics where JAI is presently involved (FONT, nano-BPM project, Laser Wire, various beam diagnostics and beam tuning) will evolve coherently with the evolution of the ATF/ATF2 programme and with the strategic directions of JAI, which include a) Next generation light sources and compact laser-plasma acceleration FEL and novel laser plasma accelerators technologies; b) Advanced accelerator instrumentation,

diagnostics and devices; and c) Enabling accelerator techniques for scientific, medical and energy applications. The JAI is also interested in further development of ATF/ATF2 as a training facility in accelerator science, as well as a facility where new principles of collaboration and training can be developed.
The JAI will also be interested in development of the collaboration with KEK in particular in the areas of development of the compact light sources (both of their design and applications) that may become a near-term industrial product, for applications in energy, biology, industry and various science applications. An appropriate bi-lateral collaboration agreement will be developed between KEK and JAI in this respect.

By Andrei Seryi

From SLAC;

To: Tor Raubenheimer
From: Nan Phinney
Present: Junji Urakawa, Toshiaki Tauchi, Nobuhiro Terunuma, Ewan Paterson, Chris Adolphsen, Yunhai Cai, Dao Xiang

SLAC has from the beginning been a strong collaborator on ATF and ATF2, and has invested about $10M in hardware and manpower into ATF2. SLAC would like to see strong support from KEK for the successful completion of the ATF2 program. We expect to have ILC funding for the ATF2 program through US FY12, but it is unclear what ILC funds will be available beyond that. SLAC has an interest in pursuing the smaller beam size and nano-beam orbit control beyond 2012 but cannot commit until the funding situation is clarified.

In addition to the ATF2 program, KEK is considering the purchase of a high power laser system for a variety of experiments on non-linear QED physics, Unruh radiation, gamma-gamma linear colliders and even gamma-ray generation for nuclear waste management.

Two possible SLAC research proposals were suggested:

Yunhai Cai proposed an experimental demonstration of high harmonic generation (up to 20^{th}) in a storage ring. The wavelength of the radiation will be at THz. A meter-long x-band accelerating structure is necessary to provide the longitudinal modulation. The theoretical work was published in Phys. Rev. Lett. by Alex Chao and his student.

Dao Xiang proposed to use a TEM01 mode laser to modulate the vertical angular distribution of the beam. The angular modulation will be converted into density modulation with a special chicane with non-zero transfer matrix element R54. The density modulated beam can be used to generate ultrashort coherent radiation at a high harmonic frequency of the laser. The technique makes full use of the extremely small vertical emittance of the beam in a storage ring and has the potential to generate coherent soft x-rays directly from an 800 nm laser. For more information please see "D. Xiang and W. Wan, Phys. Rev. Lett, 104, 084803 (2010)".

By Nan Phinney

From FNAL;

Summary of the meeting on the future (beyond 2012) of the KEK Accelerator Test Facility (ATF), held at Fermilab on November 3, 2010.

Participants: T. Tauchi, N. Terunuma, J. Urakawa (KEK);
C. Briegel, N. Eddy, S. Henderson, D. Johnson, R. Kephart, P. Prieto, M. Ross, V. Scarpine, N. Solyak, D. Voy, M. Wendt (Fermilab)

Fermilab is a collaborator on the KEK-ATF project. In frame of ILC R&D and US-Japan research activities the Fermilab beam instrumentation team helped on development, installation and commissioning of an ATF damping ring BPM read-out system with improved performance. The first, informal part of our discussion was focused on the short-term future (until 2012) of this collaboration, including some technical details.

For the official part on the future of ATF beyond 2012, Junji gave a short introduction, and Toshiaki presented a talk, titled: "Physics in Intense Fields at ATF2".
I can only congratulate Toshiaki and the ATF team for this very impressive, ambiguous, challenging, and more, extremely interesting and satisfying plan! Evidently, continuing high energy physics along the energy frontier path with particle colliders is becoming more and more difficult, as the frontier machines are becoming too large and expensive to be handles by a single laboratory or country (LHC, ILC, CLIC, MC, VLHC,…). Probing the nature from a different perspective, and with new ideas, in this case by the interaction of accelerated particles in an intense EM field, generated by high power laser systems, will certainly give new insights and knowledge.

While it is difficult for me - and I guess also to some of my accelerator physics colleagues - to judge the physics case and related potential of this ATF2 proposal, I can certainly state our greatest interest in collaboration and partnership with respect to accelerator physics and technology. The presented ATF2 proposal shows common interests in several areas, e.g. beam dynamics and optics (e.g. ILC, final focus optics for a MC, RF acceleration in a B-field, etc.), beam instrumentation, diagnostics and manipulation (e.g. high power technologies for H^- laser stripping, beam diagnostics and chopping based on photo-detachment, high resolution beam monitors, electro-optical sampling and other longitudinal beam profile measurement methods, etc.). Particular in the field of high power laser technologies we foresee mutual interests between ATF2 and Project X, and would like to express our greatest interest for continuing our fruitful collaboration with the KEK-ATF team beyond 2012.

Sincerely,

Manfred Wendt
Head of AD-Instrumentation Department / Fermilab

From BNL

Summary of KEK visit to BNL Nov. 5, 2010
By P. Wanderer

Toshiaki Tauchi, Junji Urakawa, and Nobuhiro Terunuma visited SLAC, Fermilab, and BNL the week of Nov. 1-5 to discuss work at ATF2 that might occur after JFY2012 and options for international collaboration at ATF2. These topics were discussed at a meeting that included Parker, Wanderer, Fischer, Weng, and Morse.

BNL's ILC work was discussed. Parker noted that funding after FY2012 was expected to decrease significantly. If funding could be found (U.S. Japan collaboration?), the method of measuring the centers of the ILC quads (vibrating wire) would also be of interest to the SuperB at KEK.

Tauchi said that Kazunori Itakura at KEK was interesting in exploring whether his work on non-linear QED could also be used in studies of QCD. Wanderer suggested that Itakura contact N. Samios, head of RBRC.

Tauchi was interested in speaking with V. Yakimenko to discuss how the BNL ATF selected proposals from the international community. Vitaly was not available. Tauchi will check the ATF web site, and contact Vitaly later if he has questions.

The visit included a tour of the Magnet Davison Direct Wind facility.

Calendar:
ATF Technical Board Meeting Jan. 14 – Tauchi said that Parker should present the status of vibration measurements of the quad.
Due date for ATF2 proposal to KEK directorate: June 2011
Decision date for ATF2 program: end CY2011.