



CLIC-CTF3 Collaboration Board
Minutes of the 17th meeting
7th February 2014

Participation:

Present:

Australia	M. Boland (ACAS)
CERN	R. Corsini (CERN)
	S. Stapnes (CERN)
	A. Augier (CERN)
Estonia	A. Aabloo (University of Tartu)
	V. Zadin (University of Tartu)
Finland	J. Aysto (HIP)
	K. Osterberg (HIP)
France	O. Napoly (CEA Saclay)
Germany	S. Hillenbrand (KIT)
Greece	E. Gazis (NTUA)
Italy	A. Ghigo (INFN-LNF)
	G. D'Auria (Synchrotrone Trieste)
Norway	E. Adli (University of Oslo)
Serbia	S. Lukic (Vinca Institute for Nuclear Sciences)
Spain	F. Toral (CIEMAT)
Sweden	T. Ekelöf (Uppsala University)
	R. Ruber (Uppsala University)
Switzerland	L. Rivkin (PSI, EPFL) – <i>Chairman</i>
Russia	G. Shirkov (JINR)
UK	P. Burrows (Oxford)
	P. Karataev (RHUL)
USA	W. Gai (ANL)
	S. Tantawi (SLAC)
Turkey	M. Dogan (Ankara University)
	A. Aksoy (Ankara University)

1. Approval of minutes and agenda (11.10.2013)

L. Rivkin welcomes all participants. He reminds that the main point of the agenda is the election of a new spokesperson. He is thus pleased to see such a large audience attending this meeting.

The agenda and corresponding documentation are available on Indico at:

<https://indico.cern.ch/event/271065/>

No modifications are made to the agenda. L. Rivkin informs that due to the lack of time, collaborators were asked to provide a 10 lines summary of activities for their Institute. This input will be added in point 4 (Collaboration issues and status).

Minutes of previous meeting (11.10.2013) are approved without any comment. SS reminds that this previous meeting was quite short and mainly dedicated to the set-up of a committee for the search of the new spokesperson. There were no actions pending from this meeting.



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2. Main issues from the workshop and goals for 2014

S. Stapnes reminds that the Conceptual Design Report (CDR), published in 2012, demonstrated and documented the main feasibility issues for CLIC: two-beam acceleration above 100 MV/m, accelerating gradients at the same level within the required breakdown rates for a 3 TeV machine, and key performance parameters for alignment, stability and beam instrumentation.

In 2013:

- The first klystron-based X-band test facility at CERN became operational and was successfully used for accelerating structure conditioning and operation. Two more facilities are being prepared providing a factor three increase of the overall test capacity.
- The two-beam acceleration principle as well as the most central drive-beam performance and deceleration parameters have been established by the CTF3 measurements
- Increased effort has been directed at development of high-efficiency RF sources, modulators and klystrons, including studies & specification towards procurement of prototypes.
- A re-baselining of the CLIC parameters for cost and power performance gains, also targeting stages as needed for initial Higgs-measurements, is well underway and expected to conclude in 2014.
- A very significant interest in using CLIC technology for compact X-FELs has led to the initiation of specification studies of several such facilities in collaboration with numerous light source laboratories. For CLIC this will increase the overall industrial basis for X-band and high-gradient technology.
- Dedicated high-gradient studies and interactions with key industrial partners have shown the potential of the X-band technology also in medical and industrial accelerator systems.
- Very important demonstrations of beam-based alignment and emittance preserving methods have successfully been implemented at the FACET facility at SLAC and further progress has been made concerning final focus parameters at ATF at KEK.
- The FP7 initial training network PACMAN covering key elements of alignment, stability, magnet and instrumentation developments has been initiated and 10 young researchers/Ph.D students are being/have been hired.
- The first complete mechanical main linac module has been constructed and measured in the laboratory, and more modules – including one for CTF3 – are being prepared.
- The CLIC development programme until 2018 has been redefined as a result of the CERN resource planning made after the European Strategy update in Spring 2013, and optimized towards the goal of providing a Project Plan by that time.
- CLIC performance documentation, based on the CDR of 2012, has been submitted to the US “Snowmass” process.
- Seven new collaboration partners have joined (The Hebrew University Jerusalem, Vinca Belgrade, ALBA/CELLS, Tartu University, NCBJ Warsaw, Shandong University, Ankara University Institute of Accelerator Technologies (IAT)) and numerous updated agreements between CERN and collaboration partners for the CLIC development programme in the next 5 years have been signed.
- The common work with ILC has continued in areas as Civil Engineering studies, SC input couplers, beam delivery systems/ATF, sources and damping rings, and the formal framework for hosting the LCC directorate at CERN has been implemented and is operational. The LCC organisation pursues a possible Higgs factory implementation based on ILC technology in Japan, and in parallel CLIC as a future energy frontier option at CERN after LHC.



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The CLIC workshop held at CERN this week (<http://indico.cern.ch/event/275412/>) was as usual successful with 306 participants registered. Goals for 2014 have been defined and are summarised below:

- Complete re-baselining of a staged implementation taking into account the Higgs energy scale and improved power/cost models
- Some work-areas:
 - Aim to get XBOX 2 operational, place main contracts for DB FE project, Lab and CTF3 modules, CTF3 programme in general incl. feed-forward and beamloading experiments, etc.
 - Relations and planning with industrial suppliers (dedicated work-packages for industrialization and technology transfer)
 - Power/energy reduction programmes (high visibility)
 - Define the future system test plans and opportunities
 - Exploitation of EU programmes (Horizon 2020)
 - Detector and Physics studies towards Energy Frontier physics and common goals with FCC where possible
 - Complete update of WEB, EDMS and outreach material/showroom (The help of the Collaboration might be needed at this stage)
 - Adapt and prepare CLIC presentation for appropriate machine committees (PAC and CMAC)
 - Work-package implementation agreements with existing and new collaborators (annexes, k-contracts)

T. Ekelof wonders about the possible options for the future (FCC, CLIC, etc.)? S. Stapnes reminds that, as far as CLIC is concerned, a plan for future test-facilities is in any case needed by the end of 2014. R. Corsini also recalls that CTF3 will stop in 2016 (there is actually no budget line in CERN MTP for the continuation of this activity). E. Gazis suggests that the CLIC Collaboration Board makes proposals for the next phase to CERN management.

3. Spokesperson mandate and future election

L. Rivkin reminds that R. Corsini's term as spokesperson has now come to an end. He has kindly accepted to extend his mandate and he is warmly thanked for this and all the work accomplished for the CLIC-CTF3 Collaboration. L. Rivkin also reminds that a search Committee (A.Ghigo, P. Burrows and T. Ekelof) was created.

T. Ekelof summarizes the process:

CB members were asked to suggest candidates until 15.01.2014. After this date, 5 nominations were received out of which 3 have accepted to stand as candidate for the election. The two candidates that refused were from CERN.

The 3 candidates are (alphabetical order):

- Erik Adli (Oslo University),
- Phil Burrows (Oxford University)
- Angeles Faus-Golfe (IFIC Valencia)

Having accepted to stand as candidate for the election, Phil Burrows has withdrawn himself from the search committee.

L. Rivkin thanks the Search Committee and suggests proceeding with the election. A. Ghigo received a delegation for ALBA-CELLS.



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21 CB members participate to the new spokesperson election. The results are:

- Erik Adli: 4 votes
- Phil Burrows: 13 votes
- Angeles Faus-Golfe: 4 votes

L. Rivkin warmly congratulates P. Burrows who is therefore nominated as the new CLIC-CTF3 spokesperson for 3 years and expresses once more his thanks to R. Corsini.

4. Collaboration issues and status

S. Stapnes reviews the list of members and observers of the CLIC Collaboration. This list is available on the CLIC website at (http://clic-meeting.web.cern.ch/clic-meeting/CTF3_Coordination_Mtg/Table_MoU.htm) but obviously needs to be updated (contacts people for the institute, legal documentation, etc.)

CB members are asked to check this table and send all comments/modifications to A. Augier. A particular effort will be made in 2014 to have a complete and updated information on the website for collaborators.

Action > CB members and A. Augier

Reports received from Collaborators

Vinca Institute Belgrade (Serbia)

As foreseen in MoU,

- Main activity focused on CLICdp studies with 3.2 FTE per year, 1 CLIC physics related PhD thesis ongoing
- Studies: Higgs physics (3 analyses, 1 completed, publication in leading journal in preparation), forward region studies (machine induced background in luminosity measurement- completed and published in a leading journal, forward electron tagging ongoing).
- Publications in 2013
 - Correction of beam-beam effects in luminosity measurement in the forward region at CLIC, JINST 8 P05008, May 2013 (also as LCDNote-2012-008) by *S. Lukic, I. Bozovic Jelisavcic, M. Pandurovic, I. Smiljanic*
 - Contribution with a Higgs related study to: Physics at the CLIC e+e- Linear Collider -- Input to the Snowmass process 2013, July 2013, arXiv:1307.5288 [hep-ex].
- 5 CLIC related talks at LCWS13 Tokyo, ECFA LC2013 Hamburg, XII International School, The Actual Problems of Microworld Physics in Gomel, Belarus and Instrumentation for Colliding Beam Physics Conference, Novosibirsk (in February 2014)
- Plans for 2014
 - Publication in a leading journal of the H->mumu analysis (beginning 2014)
 - Completion of H->ZZ and H->WW analyses and publication until the end of the year
 - Possible involvement of another PhD student
- AIDA-2 participation
 - Test-beams (in terms of developing expertise i.e for DAQ)
 - Software development for test-beam operations
 - Test-beam data analysis

Concerns: only LHC related activities are recognized and supported by the local funding agency as 'CERN-related'. Advertising of CLIC studies by CERN to participating countries is important.



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Karlsruhe Institute of Technology (Germany)

In November 2012 CERN and KIT have signed a collaboration agreement (k-contract) on the procurement, installation and test of a CLIC damping wiggler prototype at ANKA. The magnet technology (Nb-Ti, horizontal racetrack coil geometry, 51mm period length | the CLIC-DW baseline design) is today's state of the art, the cryogenic design (conduction cooling by forced LHe-ow, beam pipe at relatively high temperature level, 20-80 K) is advanced and requires R&D. The wiggler is currently being manufactured at the Budker Institute, Novosibirsk. The winding of the superconducting coils is completed. A liquid Helium bath test of the magnet assembly will be performed in March, the factory acceptance test of the complete device in May this year. After delivery and site acceptance test at the KIT (June), the wiggler will be installed in the ANKA storage ring in July. The subsequent experimental program will encompass a long-term system test as well as experiments on beam dynamics. In preparation of the latter, beam dynamics studies and test experiments with the existing insertion devices are being carried out at ANKA. The detailed experimental program is under discussion. R&D on a more advanced magnetic design based on Nb₃Sn is continuing at CERN.

CIEMAT and IFIC (Spain)

CIEMAT is finishing the second double length CLIC PETS. It is ready for the final welding. It should be delivered at CERN in March. We are collaborating with IFIC in the development of a stripline kicker for CLIC damping ring. It has been already delivered at CERN. First measurements are ongoing.

We are discussing with CERN to define our next activities. We are interested to continue working on PETS development, but we have not received the final confirmation from CERN yet. Other possibility could be to collaborate with DMP in the development of accelerating structures or the travelling wave buncher.

The current activities for CLIC of the Accelerator Physic Group of IFIC are, besides the stripline kicker, the following:

- Optics Design and Beam Instrumentation studies for the Beam Delivery System, mainly the Ring To Main Linac (RTML) diagnostics sections.
- Beam Position Monitors studies for the Drive Beam of CTF3.
- Cyclinacs for Hadrontherapy applications and High Gradient RF structures studies.

University of Antananarivo (Madagascar)

Physics Department is one of the Departments at the Faculty of Sciences at the University of Antananarivo-Madagascar. Actually, we have about 60 lecturers and Professors.

Our missions are:

-To train the students

-To conduct the research both in fundamental research (Theoretical Physics, High Energy) and applied research (modeling, environmental pollution, energetic, experimental research using nuclear and related techniques, Geophysics...).

For this year, we'll apply the new education system at the University (LMD: License-Masters-Doctorate).

We promote the collaboration with the others public or private institutions, Research Laboratory, Research Center as well as national or international such as CERN, FERMILAB,...

The collaboration is focused on the capacity building, the development of the education at the University particularly in Sciences and technologies and the research development.

Finally, I would like to express my gratitude to all of you to accept the collaboration with Madagascar at CLIC.



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University of Oslo (Norway)

The group has recently been strengthened by a permanent position with main focus on accelerator physics (Assoc. Prof. Erik Adli). We have furthermore been awarded with a prestigious national young-research grant, where the topic is experimental verification of linear collider emittance preservation schemes. The grant is about 1 MCHF over three years, from ~mid-2014. We seek to match part of this money, and in total we hope to employ two researchers/postdocs and one PhD student from ~ mid-2014. The main activities originating from this grant include further development and experimental tests of CLIC wake field monitors in CTF3/TBTS/Califes, further experimental tests of emittance preservation schemes in global test-facilities and contributing to X-band FEL studies. In addition, we have two on-going CLIC PhD students projects, CTF3 Test Beam Line and CLIC rf design optimization, both which should be completed by the end of 2014.

PSI (Switzerland)

- Studies of HOM damping in the CLIC accelerating structure (De Michele thesis, ending this spring).
- Test of wake-field monitors in X-band structures (measurements at Trieste and PSI).
- Construction of RF front end electronics for WFM in X-band structures (EuCARD-2 support).
- Financial contribution to procurement of X-band driver amplifier for Xboxes (FORCE support).
- Studies of low emittance, low vertical coupling, beams in electron storage rings with application to Damping Rings (TIARA support).

University of Tartu (Estonia)

Last year we started with one researcher working with the project. During the year, we obtained extra funding for our research from Estonian Science Foundation and increased team size to three (two additional PhD students). The main aim of the research was to study the effect of nanoscale copper defects as possible cause of the breakdowns. Nanoscale defects act as stress concentrators, when the electric field is applied to the material. This leads to nonuniform stress distribution in the material and can lead to the surface modification, resulting in localized field enhancement. Molecular dynamics simulations of copper with nanoscale iron precipitate showed a void forming either at the top or bottom of the precipitate. Conducted finite element simulations showed modification of surface and formation of protrusion due to a subsurface void. Simulations with surface defects and formation of surface defects were started to investigate possible mechanisms of explaining high field enhancement factor arising from small and possibly dynamic surface defects.

Currently, one manuscript is ready for publication a two manuscripts are prepared. The studies were conducted in close collaboration with Helsinki University (prof. Kai Nordlunds and Flyura Djurabekovas group).

Shandong University (China)

Shandong University joined CLIC collaboration this year. Currently we are focusing on the study of RTML: one student (Ruobin Shao) is being based at CERN to study the beam simulation in RTML, and optimize the design of RTML to fulfill the requirement for RTML for beam transportation. Lianliang Ma is advising R. Shao, and also plan to work on this project soon.

University of Helsinki (Finland)

- continues the development of the multi-scale model of electrical breakdown. In parallel: surface charging and ns time evolution under high electric fields, plasma simulations and surface damage.
- continues to study properties of Cu surfaces: plastic response to tensile stress due to interaction of charged surface with field itself, dynamics of tip growth due to self-reinforcing field enhancement.
- initiates the development of two models: one for modeling electro migration and one kinetic Monte Carlo model for investigations of surface evolution in the extreme conditions of high electric fields.
- continues to contribute to the R&D and industrialization of the high precision machining and assembly for the CLIC RF structures involving several Finnish academic and industrial partners.



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- continues the development of a photon absorption based method to measure dynamically outgassing in RF-loaded accelerating structures (AS) with the aim to make measurements at one of the Xboxes.
- continues the development of a non-contact method based on Fourier Domain Short Coherence Interferometry to measure with micrometer precision the internal shape of the AS disk stack.
- contributes in total with approximately 6 FTE/year to the CLIC study.

IAP Nasu (Ukraine)

The research works performed by Institute of Applied Physics are as follows:

- Optical spectra analysis of the breakdown plasma on the DC-spark set-up. Hydrogen detection in an optical spectrum.
- Hydrogen detection by the destructive RBS, ERDA techniques, and non-destructive chromatographic procedures in copper samples that are supposed to be applied for accelerating CLIC structures.

Research works planned for 2014-2018 are:

- Design and construction of a high vacuum set-up for studying the resistance to high voltage breakdown under high vacuum conditions.
- Plasma and beam treatment of the sample surface to study the resistance to high voltage breakdown under high vacuum.
- Joint analysis of the modified sample surface by the electron microscopy or scanning nuclear microprobe and other techniques in IAP NASU and CERN.
- Study and analysis of optical spectra of the breakdown plasma on the DC-spark set-up in CERN.
- Study of external magnetic field influence on the probability of the originating breakdown under high vacuum condition.

CEA (France)

Main objectives for CEA/Irfu/SACM are to:

- continue the two-beam experiments in CTF3 and pursue the high gradient R&D on the 12 GHz accelerating structures.
- propose innovative solutions for future X band RF power sources and components.

The objective includes affordable and reliable solutions for future testing capabilities for the CLIC accelerating structures. The task includes the design and the fabrication of prototype RF devices to demonstrate the feasibility of the new concepts proposed.

The first objective will be pursued mainly with the participation of one CEA staff to the CTF3 experimental program at CERN. The second objective will be pursued within the EuCARD2 R&D program (WP12).

RRCAT (India)

From India side the contributions towards the software development for the machine controls is in continuation.

Additional contributions for short versions CLIC PETS and L Band waveguide components has been discussed and finalised.

Collaboration activities on high power pulsed solid state amplifier systems for the Wide band 500 MHz power source for sub-harmonic bunching have been discussed and preliminary works started.



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5. Next meetings

- S. Stapnes reminds that CLIC Project Meetings are organised on a regular basis. CLIC collaborators are more than welcome to attend these meetings (videoconferencing tools are provided).

Next meetings are foreseen on Friday AM:

- 11 April,
- 13 June,
- 26 September,

and on Tuesday AM 16 December (this last meeting is usually followed by a CLIC Christmas drink).

These meetings should be put to the LCC agenda. **Action> A. Augier**

Mark Bolland (ACAS) mentions that the time for CLIC PM is not ideal for Australian participants and wonders if the day and time could be changed in the future. **Action> S. Stapnes and A. Augier**

- LCWS14 workshop: S. Stapnes confirms that the International Workshop on Linear Collider will be held in Belgrade (Serbia) on 6-10 October. A better CLIC representation should be envisaged.
- CLIC workshop 2015: it is suggested to have the next annual meeting early next year (i.e. last week of January or 1st week of February 2015). CLIC Collaborators will be informed as soon as a date has been fixed. **Action> S. Stapnes and A. Augier**