DRAFT Minutes of the CLIC project meeting of 26.04.2016

The program and transparencies can be found here:
http://indico.cern.ch/event/516216/

News:
The minutes of the last meeting were approved.
Steinar presents the news about the CLIC review. He thanks Maurizio Vretenar for his excellent work as chair of the committee. He shows the mandate, the program of the review and the CLIC goals up to 2018-19. The report of the review

- fully supports optimizing 380 GeV and suggest two sets of parameters, nominal and ultimate, with an optimization of power consumption
- supports development for high-efficiency klystrons
- considers developing two-beam CLIC already for the initial-energy stage, and keep klystron based version as alternative
- recommends to demonstrate the absence of showstoppers and to emphasize new designs with cost- and power-reduction
- states that beam delivery and final focus is the most visible concern. This needs more detailed studies, including ATF2, and improvement could come from a more detailed study of background vibrations
- states the attractiveness of X-band testing in collaboration with other institutes to better understand the conditioning, and encourages to work out a conditioning strategy for the accelerator
- comments on the future improvements of the two-beam modules.

According to the MoSCoW (Must-or-Should,Could-or-Won't) classification,
'Must' items are

- parameters and design
- RF structure design, production and testing
- X-band test stands
- High-efficiency klystrons
- Additional experimental verification activities, participation in ATF2

'Should' items are the full klystron version and CLIC module development.
Drive beam front-end (12 MeV), Damping Ring, and technology developments are ranked as '*Could'* items.
The future of CALIFES was discussed separately. The uniqueness of this infrastructure is an asset and the committee recommends studying the funding till 2018 to keep it running at CERN, by reducing the CERN personnel required for operation through involving members of the collaborations.
In follow up, one has to consider how CALIFES can be run 2017-2021, using existing resources at least for 2017-18(19).

The MTP2016 is not expected to deviate from MTP2015, so the present planning remains valid with adjustments suggested by the review. A detailed planning for CALIFES needs to be made.
Future meetings are

- Project Meetings 28.06, 11.10 and 20.12
- ECFA LC workshop Santander (30.5-3.6)
  http://www.ifca.unican.es/congreso/ECFALC2016

- High Gradient workshop 2016 at Argonne (6-8.6): https://indico.hep.anl.gov/indico/conferenceDisplay.py?confId=963
- PACMAN 2nd workshop Debrecen Hungary (13-15.6): https://indico.cern.ch/event/458671/
- XbFEL face to face meeting 21.6: https://indico.cern.ch/event/521539/
- A possible CALIFES workshop in September
- Linac 2016 in September
- LC conference and school in Japan in December.

The CLIC update paper that contains updated general information similar to CDR volume 3 is being sent out for comments "now". We need to revise the CDR signature list and this also needs to be checked.

Erik presents a status update for CALIFES beyond 2016. The project was presented to the review committee, which has reported favorably. The BE director has asked to estimate running costs for 2017-2021.
A workshop for CALIFES users is planned for early fall (September) in order to get a survey of users and to understand the need for modifications.
Once the formal go-ahead is given, CALIFES can be included in funding applications. It should evolve into a user facility with a user committee.
Early actions for CALIFES should be taken in view of XFEL, AWAKE, ESA and the SwissFEL.
As next steps, the resource details will be provides to the management, workshop dates communicated, and the CALIFES study group will discuss how to organize users and beam time.
Thibaut asks what machine configuration will be accepted, and how much funding is available for modifications. The budget estimate is 700kCHF/year, 2 external PJAS, and 2.5/3.5 FTEs. The initial configuration is foreseen without many changes. Improvements can come from outside users in the collaboration.
Steinar explains that the target participants for the workshop are including people from outside the CLIC community, from other similar facilities, in order to find a potential user base and leader base.
Steinar adds that there are no similar facilities at CERN for the accelerators; there are others for the detectors. **Thibaut** comments that HiRadMat is similar.
Igor remarks that the actions cover only the international program. Also impedance measurements should be in the list that the workshop should cover.
Steinar and **Erik** reply that the list will be more complete for the workshop. Here only external partners were listed, as it is easier to deal with internal CERN contacts.

Marcin Parteki gives an 'ATF report'. There is a considerable amount of beam time beginning 2016, not very much later in the year but more again in 2017. 43nm beam size was obtained with sextupoles and at low beam current. The ground-motion feed-forward hardware was updated. A synchronisation problem is being worked on and should reduce the vertical orbit jitter by 20%.
The ultra-low β^* optics with two CERN-built octupole magnets should decrease further the beam size. The octupoles are already assembled at CERN and wait for the magnetic measurements to start in May.

An optics with lower vertical β* has been calculated and implemented. Quadrupole scans show a model mismatch in the horizontal plane, the vertical beta seems correct if one relies on the measured emittance. A new method for precise emittance evaluation showed that the mOTR was overestimating the emittance. The optics was applied and verified but a further tuning did not converge well. For a relaxed optics the tuning was converging more quickly. The measured beam size is larger than expected, possibly due to stronger non-linearities. A simulation with multipole fields larger by a factor 5 agrees with the measurements. The octupoles might be needed even for the nominal optics.
Piotr comments that there is high dispersion slope at the FF and asks how one deals with the dispersion during the scan. The dispersion is measured for every point in the scan. **Davide** asks how it is measured. The DR frequency is changed.
Hermann wonders if any sorts of multipoles were increased 5 times. The magnets were measured; these measurements were scaled by a factor 5. **Hermann** comments that a factor 5 is unlikely to be measurement errors, and the discrepancies can come from other sources.
Steinar notes that the emittance measurements were done for the lowest intensity, and asks if they can be redone for higher intensity. This was done already.
Thibaut comments that the mOTR CERN team looks at a high resolution beam size monitor. It is not ready for operational use yet but being worked on.

Lyn reports on the Japanese committee structure about hosting ILC. He was invited the previous week to a meeting to understand how the LHC was built. No decision will be taken until mid 2018 whether to proceed or not, which is positive for CLIC.

Roberto gives a 'CTF3 report', presenting the experimental program for 2016. The run strategy consists of 3 phases: recover last year's performance, complete optimization of the machine, and the exploitation phase. The startup was very fast. Within one day each, factor 4 and 8 combinations were reestablished. Some initial beam studies were performed, two weeks were dedicated for the beam-loading experiment, and the full optimization has started. Roberto shows some highlights for the stability of the machine, the recovery of good beam conditions by feedbacks, and an improved Delay Loop optics. The injector optimization is ongoing. The beam-loading experiment has been running successfully, with beam repetition rate up to 50Hz, where the RF pulse compressor limits the operation. The peak gradient has a correlation with the breakdown rate, while the average gradient is not relevant. The design of the CLIC structure can be optimized to have a lower breakdown probability in the presence of the beam.
The irradiation test stand – VESPER – is starting final calibration and hardware tests and is determining a test program for the 2nd half of the year. He suggests that CALIFES deserves a dedicated talk.
A few technical issues:

- one TWT tube broke, a second shows signs of decreasing power
- the gun works fine (after the problems of last year)
- an RF window for MKS12 broke and a second one broke, as well.

Despite limited resources and some hardware failures, the program is on track.

Roger wonders how the CALIFES running will be impacted by aging equipment. CALIFES has the best modulator, and in general newer equipment. But the maintenance might be limited by manpower.

Nuria reports on 'Xboxes and structures'. The RF network for Xbox3 is installed and under vacuum, so far without the pulse compressor. The LLRF components are ready and under installation. A very good stability was measured. 6mm lead doors were installed on the central part of the roof, reducing the radiation level by 20%. 60 cm concrete slabs are under construction.
Tests for comparing BD with and without pulse compressor have no conclusive result yet. Beam loss measurements show a very good correlation with radiation measurements.
Xbox1 beam loading results show that performance of the structure is limited by the peak gradient rather than the average.
Nuria summarizes the structures ready to be tested and under manufacturing. The TD26_CC_3 is tuned and ready for tests. TD24_R05_SiC_2 is bonded and the metrological control done. The T24_4/5 are for inspection at the company, where 2 disks were rejected due to defaults. TD26_R1_CC disks and mechanical design have been reviewed.
Nuria shows the test schedule for the various tests stands. Xbox1 will not be available after 2016 unless the CTF3 cooling system is maintained.
Steinar asks if we will get an entire structure from one company. It will be possible for a consortium of companies but not for a single company.
Concerning a structure with flat loaded field, **Alexey** states that it needs to be discussed how it is implemented. **Igor** comments that best results were obtained with a T18 with strong tapering. **Daniel** adds that the conditioning strategy needs to be discussed.

Igor presents the 'First commercial (VDBT Moscow) prototype of the high-efficiency klystron' with 40 beams and permanent magnets. The expected efficiency depends on the simulation code but is at least 65% compared to 42% for the initial tube. An efficiency of 66% was measured at nominal power of 6MW. The HEKbox location is in the Xboxes test area.
With the new klystron parameters, using a pulse compressor to ease the parameters of the modulator, the klystron efficiency for a klystron-based CLIC'k can be increased to 70%. Igor shows the CERN/SLAC initiative towards high efficiency X-band klystron development, a proposal for a HT SC klystron solenoid and the 2016 update of the CLIC'k RF unit layout with a new compact 'inline' RF waveguide distribution network.

Igor shows the work of **Ping Wang** for a 'Pulse compressor with correction cavities'. He shows different pulse compressor types and the one with correction cavities. The pulse compressor with correction cavities will make the RF system very compact. Igor shows layouts of the compression and correction cavities, and the performance of the compressor. Finally, he also shows a two stage compressor.

Roberto asks what gain you can expect from the storage cavities for phase and amplitude modulation. This gains 20% back and additional flexibility.

Piotr wonders about the sensitivity to temperature. The phase to amplitude modulation should make it a factor 20 less sensitive.
Lower current density results in a much longer klystron lifetime.

A.O.B.:

Frank Tecker, April 2016