

## **Minutes of the 7<sup>th</sup> CTF3 Committee Thursday, 20<sup>th</sup> November 2008**

Participants at CERN:

E.Adli, R.Corsini, K.Elsener, M.Petrarca, I.Syratchev, M.Micheler, O.Mete,  
W.Farabolini, G.Geschonke, S.Doebert, J.P.Delahaye, G.McMonagle, J.Monteiro

Participants via WebEx:

T.Garvey, F.Toral, R.Ruber, T.Ekelöf, V.Ziemann, K.Peach, A.Faus-Golfe,  
G.Montoro, A.Ghigo,

Excused:

R.Roux, L.Rinolfi

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### **Approbation of the Minutes of the Last Meeting and collaboration news**

The minutes of the 6<sup>th</sup> meeting were approved without comments.

### **Update on CTF3 Operations and schedule (Roberto Corsini)**

Apart from Isolde, CTF3 is the only machine still in operation on the CERN site. This leads to a number of difficulties because of power cuts and work on the control system. The schedule foresees to run until 12<sup>th</sup> December. One of the objectives during the remaining time is to start beam operation in Califes. In addition the initially planned commissioning will be continued.

Since the last meeting the new RF deflectors have been installed in the Combiner Ring. This has been a great success: Installation and conditioning went very smoothly and the vertical beam instability has disappeared completely. The beam can now be stored for a long time, an example of 20  $\mu$ s was shown. This allows now precise optics measurements such as closed-orbit corrections, tune measurements (good agreement with model) dispersion-free steering (first encouraging results already), kick measurements e.t.c. All this has led to a bunch train combination by a factor of four, a combined beam current of 12 A has been achieved already. The Delay Loop was not used during these tests.

One of the highlight was the successful first operation with beam of the Two Beam Test Stand, beam has been sent up to the dump at the end. Meanwhile a PETS has been installed in the TBTS and beam has been sent through without losses.

Commissioning and debugging of TL2 and TL2' is ongoing.

The draft planning of the winter shutdown was shown, with the closure and earliest start-up dates with beam of the four parts of CTF3: The linac will be ready for beam on 2. March, the Rings on 30. March, CLEX on 20. April. CTF2 will be ready for 30 GHz testing and PHIN testing from 2. March.

Interest to close CLEX earlier was expressed. The planning will be reviewed accordingly and in the next meeting in December it will be discussed again. The full planning, as known so far, is on Indico:

<http://indico.cern.ch/getFile.py/access?contribId=1&resId=0&materialId=slides&confId=33484>

**Califes (Wilfried Farabolini)**

The modulator problems have been identified to be caused by electromagnetic interference and have been cured with help from the manufacturer. The voltage ripple and drift of the modulator will still have to be corrected by the manufacturer.

Conditioning of the LIL sections has been done up to 62 MW at 1.5  $\mu$ s pulse length. Eventually the aim is to go up to 92 MW at the BOC output, this requires to review the phase programming for RF pulse compression. The RF gun's resonant frequency after bake out appears to be now 450 kHz lower than previously, which will allow to operate at a water temperature of 27 deg.

A few parts of the waveguide RF power distribution system are still missing and the control of components still needs to be implemented, but there is a good chance that a first beam can be produced at the beginning of December. The plan is to produce a photo cathode in-situ on Monday 24<sup>th</sup> and Tuesday 25<sup>th</sup> and to tune the laser on Wednesday to be ready for beam.

### **Laser (Massimo Petrarca)**

Massimo presented recent progress on the laser for the Photo Injector (PHIN) and Califes.

The layout of the first amplifier was improved and it has now achieved a peak power of 3 kW, which is the nominal !

Work on the second amplifier is progressing, presently with 2 passes it produces an output power of 6.3 kW, which is about 50% of the nominal.

The two stages of harmonic generation from IR to green and then to UV are operational with efficiencies of 40% and 22% respectively for the moment.

Synchronisation with the RF has been improved by experts from the manufacturer of the oscillator/preamplifier. A jitter of 634 fs has been measured with a drift of <200fs over a day. This has to be compared to the requirement of <1ps !

He presented a programme of improvements for the near future, which should allow to reach nominal performance eventually.

He and the team were congratulated for this excellent progress, in particular also by Ken Peach.

### **Status of the PHIN photo injector (Konrad Elsener)**

Konrad described the PHIN test setup. The installation was achieved just in time before the end of the EU FP6 programme within CARE, in spite of a notorious lack of manpower. The photocathode is about a year old already, the quantum efficiency is probably not optimum, but it allowed to make a first beam.

### **PHIN Beam Tests, first results (Steffen Doebert)**

Steffen presented the observations with beam. The results are very preliminary, calibrations still have to be confirmed. Strong dark current was observed, about 0.1 nC in a bunch, it seems to come mainly from the end of the pulse. The beam current can be measured with a Faraday cup at the end of the beam line. A current of 0.2 A has been achieved with the nominal pulse length of 1.3  $\mu$ s at 1.5 GHz repetition frequency. Several scans of beam size as a function of solenoid field have been done, the behaviour of the horizontal plane still needs to be understood. Beam energy could be measured with the spectrometer line to be 5.3 MeV with a spread of 0.5%. A very preliminary measurement of beam emittance was also done, giving a result "too good to be true", more work is required. The quantum efficiency was estimated to be about 0.5 %, which is lower than nominal, however, the cathode was produced already one year ago.

The amount of work done in the very short time available for these tests is impressive. The equipment behaved very well, Steffen remarked in particular on the stability of the laser.

Andrea Ghigo congratulated the whole team for these excellent results. Not only has a beam been produced, but measurements of its properties have already started.

### **TBL update (Steffen Doebert)**

The prototype PETS tank is being manufactured by CIEMAT. IFIC Valencia has already finished two prototypes of beam position monitors (BPS). One of them is installed in TBL together with the read-out electronics, built by UPC Barcelona. The system has recently seen beam for the first time. Experts will meet next week at CERN to investigate a problem with electronic ringing. All quadrupoles are under fabrication in BINP, acceptance testing is foreseen in December. The magnet movers are being built by CIEMAT (see Fernando Toral's presentation). The RF low level 12 GHz acquisition system is available. Prototypes of RF high power components have been ordered, the series for eight PETS will be covered by CEA Saclay.

It is foreseen to install the first PETS during the winter shut-down and test it as soon as possible with beam in 2009. The whole beam line will be installed during 2009, with vacuum chambers replacing the missing PETS, such that PETS can be installed and tested as soon as more become available. The quadrupoles will be installed on provisional supports while the remaining 13 movers are being produced.

The critical item for completing the TBL is the series of 15 PETS. The long fabrication time makes a decision of how to procure them urgent. We can probably not wait for the first tests with beam, which will not be available before spring next year, before deciding on how to proceed. Steffen said "TBL is happening now", however, it is not very likely to have all 16 PETS installed before 2012.

### **Status of CIEMAT contribution (Fernando Toral)**

Work at CIEMAT is going on in three areas:

#### *Kicker for tail clipper*

The kicker tank with the electrodes is complete, shipment to CERN is foreseen next week. Leak testing has been done, the final vacuum conditioning including a "mild" bakeout will be done at CERN. The electrical tests were all positive: the s-parameters have been measured to be correct and the strip lines and feedthroughs were successfully tested up to 3100 V with DC. The rise time is very well within specifications, <5ns has been measured.

#### *Precision magnet movers*

The second prototype will be sent to CERN next week, the 3<sup>rd</sup> one is under evaluation. The series will be ordered in January, all pieces will be available for final installation during the 2009/10 shutdown. Meanwhile provisional supports will be supplied, such that the full TBL line can already be mounted.

#### *PETS prototype*

The 8<sup>th</sup> and final rod will be ready machined next week. Keeping the tolerances during machining has been a challenge, because of internal stresses in the bars. The manufacturer has some problems with brazing the power extractor, several sets of pieces are being produced, one of them will probably be brazed at CERN as backup. Everything else is in fabrication or ready for fabrication. The measuring bench is nearly finished. It is foreseen to finish the PETS by end January for installation in TBL during the winter shut-down.

### **BPS amplifiers for TBL (Gabriel Montoro)**

The first amplifier is installed and connected to a BPS in TBL. It has been tested with beam recently, the results will be evaluated next week at CERN and possible modifications will be discussed. The design of the second version of the amplifier is done, it will be tested in the UPC labs in December. The PCBs for the series are being manufactured. Finally a full system test is planned including the BPS (IFIC), the amplifier and the digitizer(LAPP). The aim is to launch the manufacturing of all 16 amplifiers in January.

### **BPS Status report (Angeles Faus-Golfe)**

The manufacturing of the series of BPS is starting, the contract for the mechanical work has been placed. The ceramic components are already ordered.

The test benches for wire testing as well as for RF testing are being built up in the moment.

Following the tests with beam, the BPS read-out chain will be analyzed at CERN next week.

### **TBTS status (Igor Syrathev)**

Igor reported the status of PETS high power testing. Two tests are being pursued in the moment:

a) high power testing by feeding the PETS with RF power from a klystron. This is being done at SLAC, where up to 300 MW pulse power at 11.4 GHz is available. The nominal pulse length of 260 ns has been reached, at power levels up to 40 MW outgassing was observed, above traces of breakdowns were observed and "real" processing started at about 80 MW. So far 85 MW (1/2 nominal) has been reached. It has to be noted, that part of the RF network is new and has not been processed separately before. For the moment the testing is interrupted, it will be resumed on 8<sup>th</sup> December.

b) RF generation by exciting the PETS with beam in TBTS.

In order to generate up to nominal power levels with the available beam current, the PETS has been equipped with a power recirculation network. For the moment there are some problems with the variable phase shifter and the variable power splitter, but nevertheless operation was possible and RF power at 12 GHz up to 6 MW was produced with a beam of about 1.7 A, which fits the predictions. Also here outgassing was observed. With the low repetition rate of CTF3 slow progress of conditioning is expected.

### **CDR experiment (Max Micheler)**

The system is installed in the CRM line and tests have started. Measurements have been done with synchrotron radiation from the bending magnet of the Combiner Ring in front of the CRM line, as well as with beam. Both measurements show both positive and negative signals, which might point towards problems with the Shottky barrier diode in pulsed mode. The signals seem to be, however, beam-related. Investigation is continuing.

**Next meeting: Thursday, 11<sup>th</sup> December at 14:30**

G.Geschonke