SOME NEWS CORNCERNING CLIC STUDIES

Over last few months, been considerable discussion about road maps for construction of a new LC facility sometime in the near future – this discussion stimulated by a proposal by the ILCSG that technology choice for 500 GeV LC be made sometime in 2004.

The typical time-scale being discussed is 2008 for the start of construction and completion by about 2014.

The CSC felt that the CLIC study, which has been making feasibility studies to develop the two-beam technology for the last 17 years, should at least be considered in these discussions and we therefore decided to produce some sort of road map or plan to indicate the status of our studies, and to indicate how we intended to demonstrate the crucial CLIC feasibility items.

In particular thought we should produce conceptual design report by end of 2008.

This date was considered to be a timely moment for new plans concerning CERN's future to be put forward given (i) the further time needed for careful technical design and series production studies, (ii) the probable construction time of about seven years, and (iii) the availability of new CERN money in 2010.

First step in this process was publication of CN 561 "CLIC activities and resources for the years 2003-2008". This report indicates what can and cannot be achieved with the present resources and lists the sub-systems that are currently NOT being studied at all, and which could be undertaken by outside laboratories or institutes – a sort of shopping list.

In particular it indicates the resources in manpower and money to complete the following recommended programme of work

(i) to complete CTF3
(ii) to continue R&D on high priority R1 and R2 CLIC components
(iii) to produce a conceptual design report by 2008.

The report showed that if the CLIC study continues to be allocated 90% of the total CERN accelerator R&D resources as foreseen in the present MTP until 2008 then an integrated total of 78 FTE's (an average of 13 FTE's per year) and about 12.6 MCHF extra material money are missing over the period 2003-2008 to complete the above programme.

Second step was to organise a series of "CLIC Road Map Meetings" between the machine builders and the users to try to propose a reasonable way forward.

One of the big stumbling blocks in these discussions was how do we convince the community that the novel CLIC RF power generation scheme would work ?

There was a general consensus that the only way to do this would be to build a short section, and that this could only be justified from a financial point of view if this facility could also produce some interesting low-energy physics, and Giga-Z and Higgs factories were mentioned !!
Such proposals are very ambitious for a relatively small study group.

What was missing at this stage was some guidance from the very top.

Shortly after this second Road-Map Meeting the DG called two meetings to discuss CLIC Studies

At the first meeting the DG asked us to provide a list of crucial CLIC-technology related feasibility issues together with a road map indicating when there issues could be demonstrated assuming the present level of resources – this information was discussed in the second meeting and is summarised below.

CLIC LIST OF CRUCIAL CLIC-TECHNOLOGY-RELATED FEASIBILITY ITEMS

1. Test of damped accelerating structure at design gradient and pulse length (TRC R1)

This test can be done when the CTF3 linac, delay loop and intermediate high gradient test stand after the delay loop become operational. (The delay loop takes the 1.5 GHz bunched beam from the linac and produces a 3 GHz bunched beam with twice the intensity).

2. Validation of drive beam generation scheme (TRC R1)

This will be complete when the characteristics of the nominal CTF3 15 GHz bunched beam have been validated. This requires the CTF3 combiner ring and the bunch compressor to be operational. (The combiner ring takes the 3 GHz bunched beam from the delay loop and produces a 15 GHz bunched beam with five times the intensity).

3. Design and test of damped ON/OFF power extraction structure (TRC R1)

A new design of power extraction structure with an ON/OFF capability is now available but requires about one year of further study before the fabrication of a prototype can start.

The validation testing of this prototype requires the CTF3 combiner ring, bunch compressor and end-of-line high-gradient test stand to be operational. The tests will be made with a CLIC-like structure adapted to the lower available current (35A instead of 150A) but would demonstrate all major feasibility issues.

4. **Validation of stability and losses of drive beam decelerator, and design of machine protection system (TRC R2)**

This will be complete when the CTF3 Experimental Area (CLEX) becomes operational with the nominal 35 A beam. The validation of the stability and beam losses would be done in part by making "bench-mark" verifications of simulations and measurements of the 35A CTF3 beam. The final validation at higher current would rely on simulations.

5. **Test of relevant linac sub-unit with beam (TRC R2)**

This requires the CTF3 Experimental Area (CLEX) to be operational with the nominal 35 A drive beam and a short section of linac to produce the main beam.

This CLIC list covers all of the CLIC-specific TRC Ranking 1 and 2 items except :

- Validation of multibeam klystron performance (TRC R2)
  not considered to be a crucial feasibility issue
- Effects of coherent synchrotron radiation in CLIC bunch compressors (TRC R2)
  not considered to be a CLIC-technology feasibility item
- Design of an extraction line for 3 TeV c.m. (TRC R2)
  not considered to be a CLIC-technology feasibility item

CLIC LIST OF FEASIBILITY ITEMS THAT ARE EITHER NOT CLIC-TECHNOLOGY RELATED OR THAT ARE COMMON TO ANY MULTI-TeV HIGH-LUMINOSITY MACHINE

- **The 4 TRC Damping-ring–related issues (TRC R2)**
  (CLIC emittances are however typically a factor 4-5 smaller than NLC)

- **The 3 TRC Low-emittance- transport-related issues (TRC R2)**
  (CLIC however has smaller emittances, and laser-wire beam-profile monitors and luminosity monitors are more difficult at higher energies)

- **The 2 TRC Reliability-related issues (TRC R2)**

- **Calculations of effects of coherent synchrotron radiation in bunch compressors (TRC R2)**

- **Design of an extraction line for 3 TeV c.m. (TRC R2)**
  (the CLIC spent beams have a 100% energy spread)

The following feasibility item has also been included in this list although not-listed in TRC R1/R2

- **Design and test of FF magnet stabilization system**
  (CLIC requires stability at 0.2 nm level)

With the present resources it would take until 2006 (assuming we can adopt a non-linear spending profile) to pay for the following CTF3 sub-systems :

- injector and linac
- CERN costs of the delay-loop
- high-gradient test stand
- CERN costs of the combiner-ring

Concerning the presently "Non-Funded" CTF3 items, based on an estimate of 2 MCHF per year from a total CLIC budget of 3.4 MCHF for new CTF3 installations, it would take an additional 3 years (starting from 2006) to pay for the combiner ring (estimated cost 5.7 MCHF), and a further 2.5 years to pay for the CLIC experimental area CLEX and the newly proposed drive-beam test-line (estimated cost 5 MCHF).

Conclusion :

- installations needed to test the TRC R1-feasibility items (points 1,2,3 of CLIC list) could be completed by 2009, and tests completed by 2010

- however if extra funding for the combiner ring is found early enough (2004) the installation could be completed by 2006, and the R1-feasibility tests could be completed by 2007

- installations needed for the R2-feasibility items (points 4, 5 of CLIC list) could be completed by 2012, and tests completed by 2013.

- however if extra funding for CLEX is also found early enough (2005), the installations to achieve these R2 milestones would be ready by 2008, and the tests completed by 2009.

SUMMARY

R1: 2010 (no extra funds) or 2007 (5.7 MCHF extra)
R2: 2013 (no extra funds) or 2010 (5.7 MCHF extra)
or 2009 (10.7 MCHF extra).