WP4 200 MeV Probe beam linac

Time schedule: Construction 2006/2007, operational 2008
Resource estimate: 2.0 MCHF and 9 m*y assuming that S-band accelerating structures and power source are provided by CERN from former LEP equipment

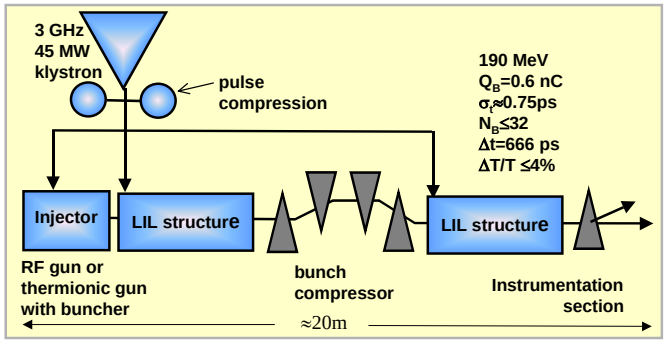
Design, procurement, installation and exploitation of the probe beam linac – including: Electron gun, acceleration system, optics, magnetic and diagnostic elements, vacuum system. The following equipment from the former LEP injector linac (LIL) can be made available: klystron, RF distribution (3 GHz), and 3 GHz accelerating structures.
The probe beam injector linac is a S-band accelerator providing the beam that mimics the CLIC main beam in the CLEX area of CTF3. This beam is essential for a large part of the experiments foreseen in the CLEX area of CTF3, in particular those with the *Two-Beam test stand in CLEX* (WP2.2) and the *Relevant CLIC linac sub unit with beam* (WP5). Examples for this experiments are:

- Test acceleration with CLIC prototype acceleration structures
- Cross check of 30 GHz RF power calibration
- Measure synchronous frequency of accelerating structures prototypes
- Monitor phase advance of 30 GHz accelerating structures during high power processing
- Measure higher order mode frequencies of accelerating structures prototypes
- Test-bed for CLIC main beam instrumentation
- Influence of RF-break downs on beam characteristics
- Measurement of timing stability between drive and probe beam
- Test CLIC beam loading compensation scheme
- Test damping of higher order modes in accelerating structure prototypes
- Test-bed for CLIC main beam instrumentation

A tentative set of parameters for the probe beam is summarised in the table below

Energy	200 MeV
Normalised r.m.s. emittance	20 mm mrad
Energy spread	± 2%
Bunch charge	0.6 nC
Number of bunches	Variable from 1-32
Bunch spacing	0.666 ns
r.m.s. bunchlength	0.75 ps

The beam energy is determined by the need to pass the strong RF focusing fields at the entrance of very high gradient structures without disrupting the beam. The emittance requirement is motivated by the need to pass the beam without losses through the small apertures of 30 GHz accelerating structures. Bunch charge and spacing resemble the CLIC main beam parameters and bunch-length and energy-spread are constraint by the need to measure acceleration in a short wavelength structure with good precision.



A zero[th] order design based on the reuse of LIL structures is shown in the figure above. The front end can be either a thermionic injector or a RF gun photo-injector. Appropriate instrumentation for beam energy, emittance, current and time structure is mandatory.