<u>Work Package 1:</u> **Combiner Ring (CR), Transfer Line (TL1) to CR and Transfer Line (TL2) with bunch compressor to CLIC EXperimental Area (CLEX)**

Schedule : Up to and including the CR : ready for installation end 2005, TL2 2006.

<u>1.1 Optics layout</u>
TL1 must be achromatic and isochronous. Some tuning capability in R56 is also included in the design. The combiner ring lattice is also isochronous, with three sextupole families to control chromatic effects and second order dependence of path length from energy. TL2 must provide bunch compression, and its global R56 must be tunable from 0 to 0.3 m. Some sextupoles could also be needed in TL1 and TL2 to control the second order dependence of path length from energy
A reference optics layout exists from INFN-LNF. The combiner ring optical design is very well advanced. Small changes could be needed depending on the final choice of quadrupoles. Some further optimisation would be needed for TL1 and TL2.

Resources : 1 man.year

<u>1.2 Magnets</u>
A total of about 22 bending magnets, 78 quadrupoles and 24 sextupoles will be needed with the present design. Two path-length tuning wigglers are foreseen in the CR. Injection and extraction septa and about 32 corrector magnets are also required. A number of magnets (12 bends and 46 quadrupoles) are available. A detailed design exists for wigglers, sextupoles and correctors, and a preliminary design of quadrupoles is also available.

Resources : 1.85 MCHF and 4 man.years

<u>1.3 Vacuum system</u>
The main requirement for the vacuum chamber is the minimisation of the impedance contribution. The vacuum chamber must be made of aluminium alloy; RF-shielded pumping ports and bellows will be used. The cross section must be as uniform as possible, with gradual tapers, and any joint must have its own RF contact. Typical cross sections are about 100 mm x 40 mm (h x v) in dispersive sections and 40 mm x 40 mm in non-dispersive ones. A vacuum level ~ 10-8 mbar is required in the CR.
A large part of the design of equipment made by INFN for the Delay Loop can be used. Detailed design work is required.

Resources : 0.7 MCHF and 2 man.years

<u>1.4 Beam diagnostic equipment</u>
About 32 beam position monitors and several vacuum ports for synchrotron light are foreseen. The BPMs have already been developed for the CTF3 Delay Loop. This design could be used without modification.

Resources : 0.53 MCHF and 1 man.year

<u>1.5 Power converters for all magnets</u>
The power converter for the CR dipoles is available. Most of the dipoles in TL1 and TL2 will also be powered in series. Individual power supplies are foreseen for most of the quadrupoles in TL1 and TL2. The optimum number of quadrupole families in the CR is 15. Some power supplies are available from LPI.

Resources : 1.16 MCHF and 1.8 man.years

<u>1.6 Technical services and installation</u>
Cabling, water-cooling, alignment, air conditioning.

Resources : 1.05 MCHF and 2 man.years

1.7 Control system for combiner ring and related software

The system has to be compatible with the existing controls infrastructure.

Resources : 0.1 MCHF and 1 man.year

1.8 Fast kicker with High Voltage pulser

The fast extraction kicker system (kicker and high voltage pulser) for the CR must have a rise time below 100 ns, and a flat top of about 150 ns. The required max repetition rate is 50 Hz. The required kick angle is about 5 mrad (maximum beam momentum of 300 MeV/c). Special attention has to be given to the impedance seen by the beam.

Resources : 0.24 MCHF and 1 man.year

1.9 RF distribution system for RF deflector

A complete waveguide system is needed to transport the 3 GHz RF power (10 MW range) from the klystron to both RF deflectors of the CR. The klystron is located in a gallery at ~ 30 m from the deflectors, which are ~ 10 m apart. The waveguide system must include power splitters, attenuators and phase shifters.

Resources : 0.1 MCHF and 0.2 man.year