

CLIC issue: Two-beam acceleration

1. Short technical description and corresponding category(ies) of issues :

Feasibility	Performance	Cost
X	X	

2. CLIC nominal parameter issues and comparison with state of the art (in text and/or table):

In addition to achieving the specified individual performances of accelerating structures and PETS (described in the relevant sections) the same performances must be achieved *together* with the structures connected by a relevant rf network and in the presence of the drive and main beams. The effect of high-power rf phenomenon, like dark current and breakdown, on the beams, and vice-versa, and between structures in such a configuration must be determined. System recovery - vacuum, power ramping - from breakdown must be demonstrated. A pulse shape accuracy of 0.1% for beam-loading compensation must be demonstrated.

State of the art (achieved performance):

Two-beam acceleration was demonstrated in CTF2, however with 30 GHz structures operating at 16 ns pulse length. The resulting energy gain was 50 MeV (must look this up).

3. R&D program presently set-up:

The accelerating structures and PETS are being studied extensively (described in the relevant sections). High-power rf components are being developed and used extensively in the high-power test areas (klystron, TBTS, TBL). The TBTS has been constructed to allow all the relevant two-beam tests to be made. Time-domain coupled-structure calculations are being initiated.

4. What performances will realistically be achieved (Target Performances):

➤ **by end 2010**

One PETS will feeding one accelerating structure will operated in the TBTS with a 28 A drive beam and 0.5 A main beam. The target performances are

- 132 MW generated power
- 140 ns total pulse length
- Accelerating gradient of 100 MV/m
- A measured system breakdown rate in the range of 10^{-4} or lower
- Operation of a few hundred hours at 5 Hz
- Breakdown kick measured

- System recovery demonstrated
- **by end 2012 (including FP7)**

PETS and accelerating structures will be changed to the test-module configuration, and a second PETS/accelerating structure pair will be installed. This will allow the previous program to be repeated and refined and the running time extended.

5. Comments on validation of CLIC parameters issues by comparison with Target Performances:

Two-beam acceleration will be demonstrated experimentally. Higher precision estimates of coupled wakefields and beam loading will be made through simulation.

6. Optional: What additional R&D could be set-up to eventually reach the validation of nominal CLIC parameters (estimation of resources and schedule?)