BLM crosstalk studies at the CLIC Two-Beam Module

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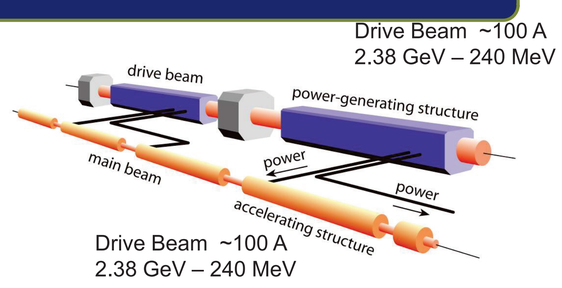
Abstract The Compact Linear Collider (CLIC) is a proposal for a future linear e^+- e^- accelerator that can reach 3 TeV center of mass energy. It is based on a two-beam acceleration scheme, with two accelerators operating in parallel. A main element of CLIC is a 2 m long two-beam module where power from a high intensity, low energy drive beam is extracted through Power Extraction and Transfer Structures (PETS) and transferred as RF power for the acceleration of the low intensity, high energy main beam. One of the main potential limitations for a Beam Loss Monitoring (BLM) system in a two-beam accelerator is the so-called "crosstalk", i.e. signals generated by losses in one beam, but detected by a monitor protecting the other. This contribution presents results from comprehensive studies into crosstalk that have been performed at a two-beam module in the CLIC Test Facility (CTF3) at CERN. Finally, the capability of estimating the origin of losses in different scenarios is discussed.

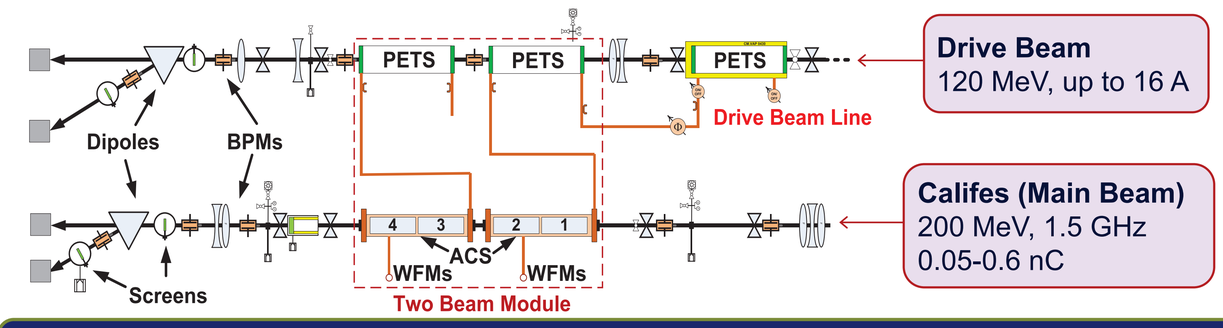
Introduction

- CLIC is a Multi -TeV linac based on a two-beam acceleration scheme
- Challenging design for BLMs: losses from one beam side could be detected from the detectors protecting the other one

→ „**crosstalk**"



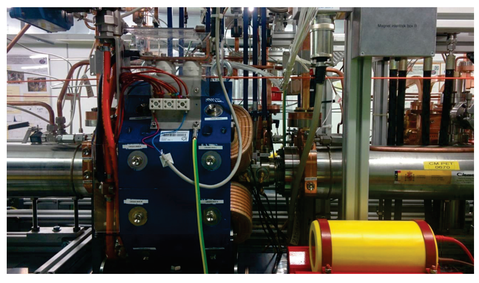
- **CLIC Two – Beam Module**: principal constituent of CLIC. A nominal prototype has been installed at CTF3, CERN

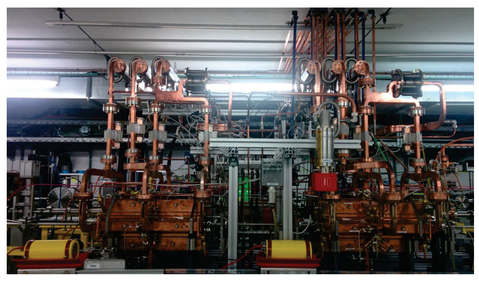


Experimental Setup

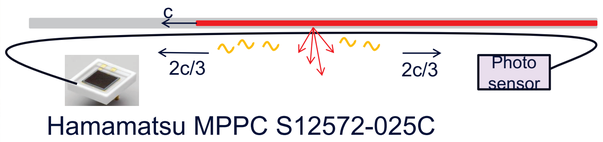
Little Ionisation Chambers (LICs) and **Optical Fibre BLMs** (OBLMs) were installed at TBM in CTF3

Drive Beam	2 LICs 10 cm downstream of quads
	5 m long Ø 200 μm SiO_2 optical fibre 1.5 m upstream the TBM
Main Beam	2 LICs 5 cm downstream of the accelerating structures
	7 m long Ø 365μm SiO_2 optical fibre 4 m upstream the TBM





DAQ of all detectors:
12bit, 100 MS
SIS-330x ADC



Hamamatsu MPPC S12572-025C

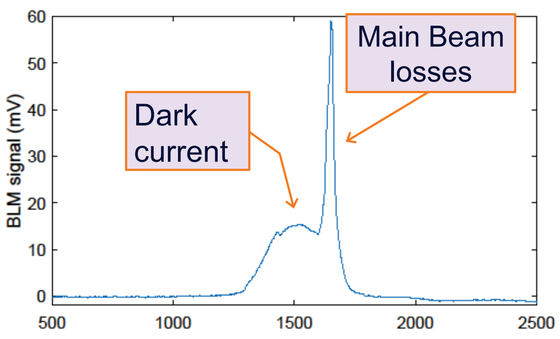
Main Beam (Califes)

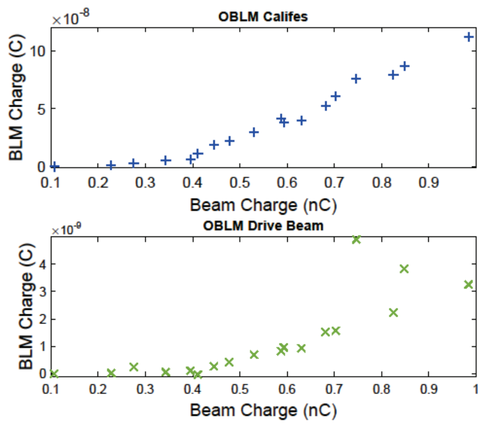
Nominal Operation

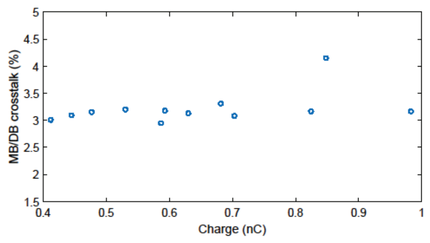
→ No signals on Ionisation Chambers

✓ Losses detected by optical fibre BLMs

✓ Dark current from the thermionic electron gun





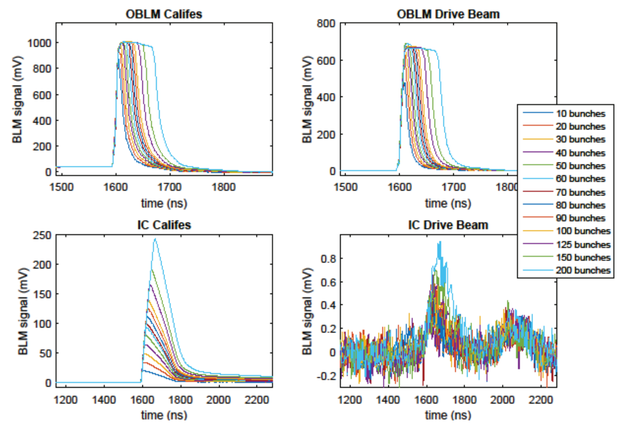


Main Beam → Drive Beam crosstalk estimated at 3.4%

Screen insertion

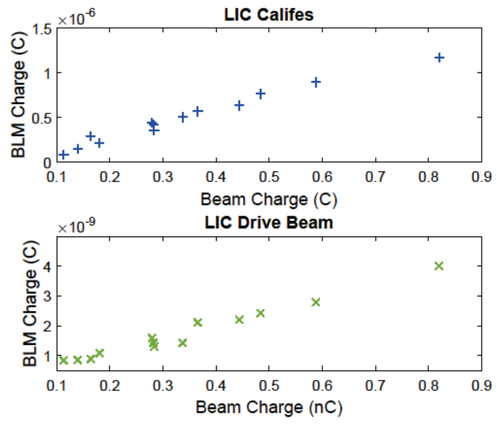
Induction of losses by OTR screen insertion (0.5mm Al), ~4 m upstream the TBM Main Beam

✓ Losses detected by all BLMs

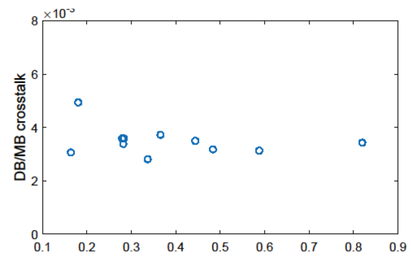


→Saturation of OBLM photosensor

→ Estimation of crosstalk from LICs



Main Beam → Drive Beam crosstalk smaller than 1%



Drive Beam

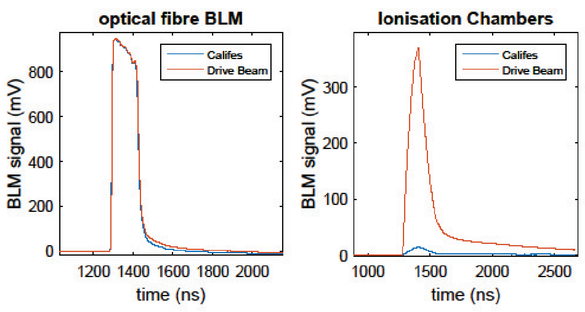
→ Low current Drive Beam (Peak beam current 1.12 A)

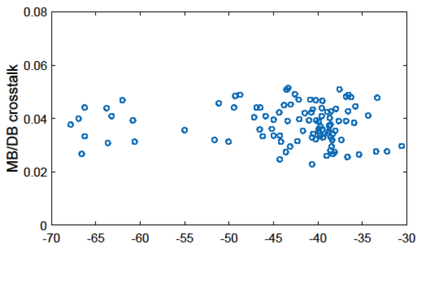
→ Crosstalk signal detected by all Main Beam BLMs

→ Saturation of OBLM photosensors

→Crosstalk estimation from LICs

Main Beam → Drive Beam crosstalk estimated at 3.5%





Conclusions

Low statistics BLM crosstalk measurements at a nominal CLIC TBM prototype show a value of 1 – 5%. Extrapolations to nominal CLIC energy and intensity are required.

Acknowledgements

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