

Main beam beam position monitors

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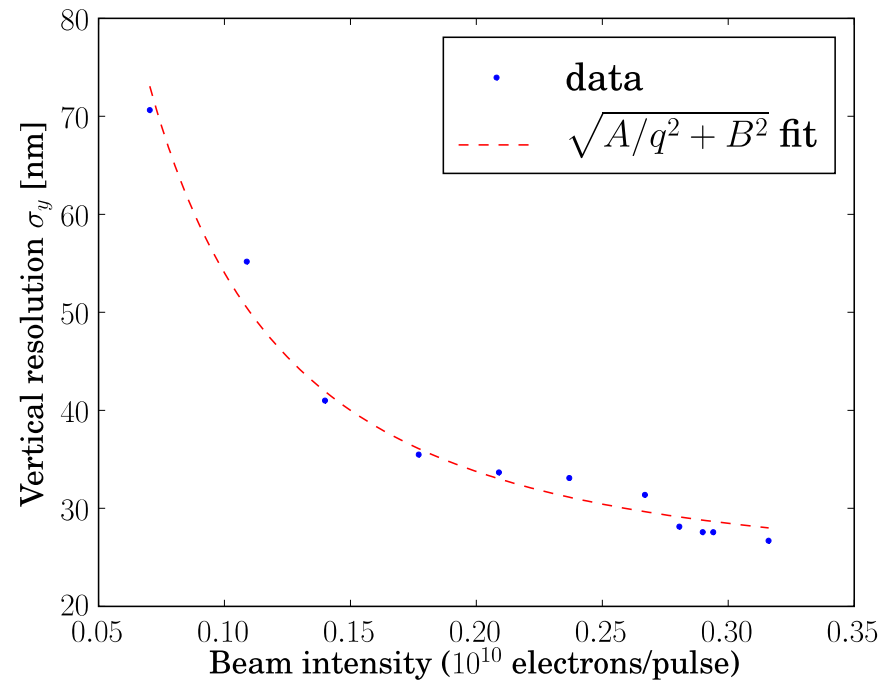
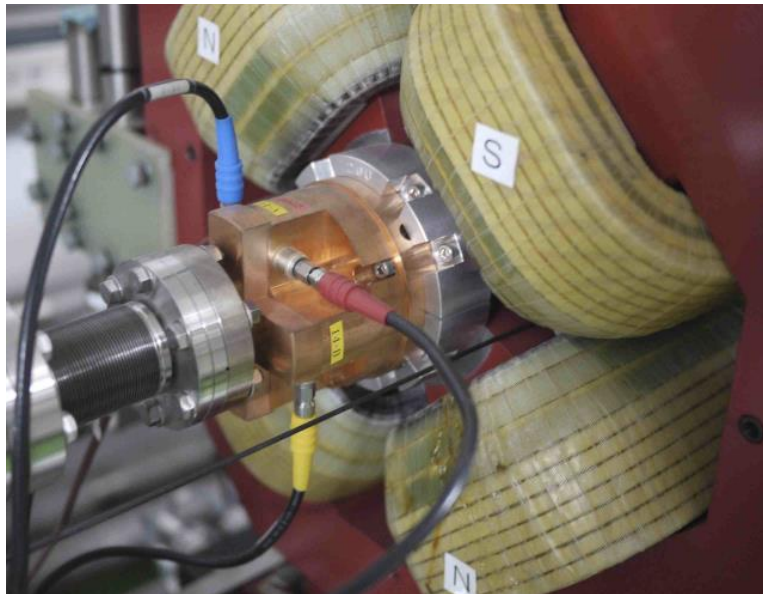
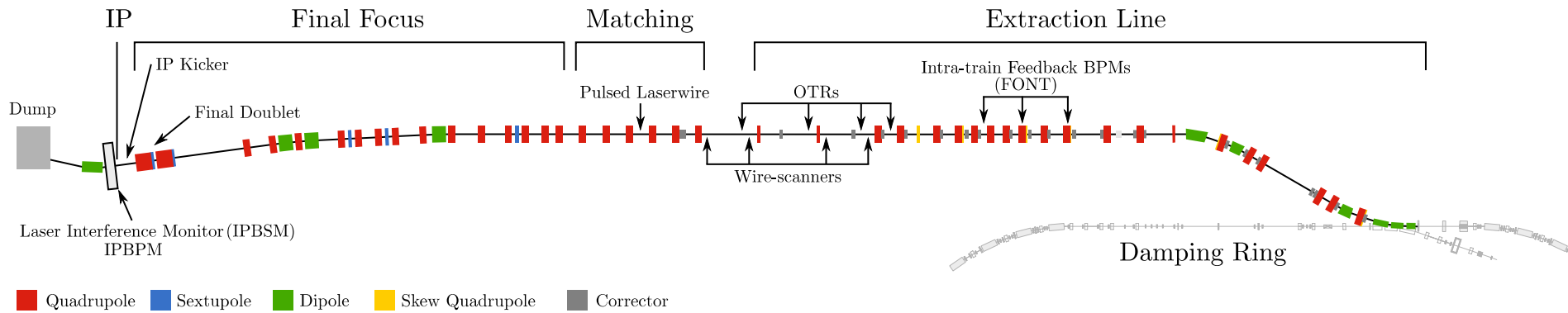
Talk introduction

- Research highlights
 - ATF2, large scale CBPM system, 35 cavities
 - 27 nm single bunch resolution
 - stable system over 3 weeks
 - CLIC main beam BPM prototype
 - Single bunch sensitivity (dipole and reference cavity)
- Proposed work for CLIC2
 - Three cavity system
 - Meet CLIC requirements (50 nm, 50 ns)
 - Move towards novel designs (Choke mode, cost optimisation)

CLIC1 funding

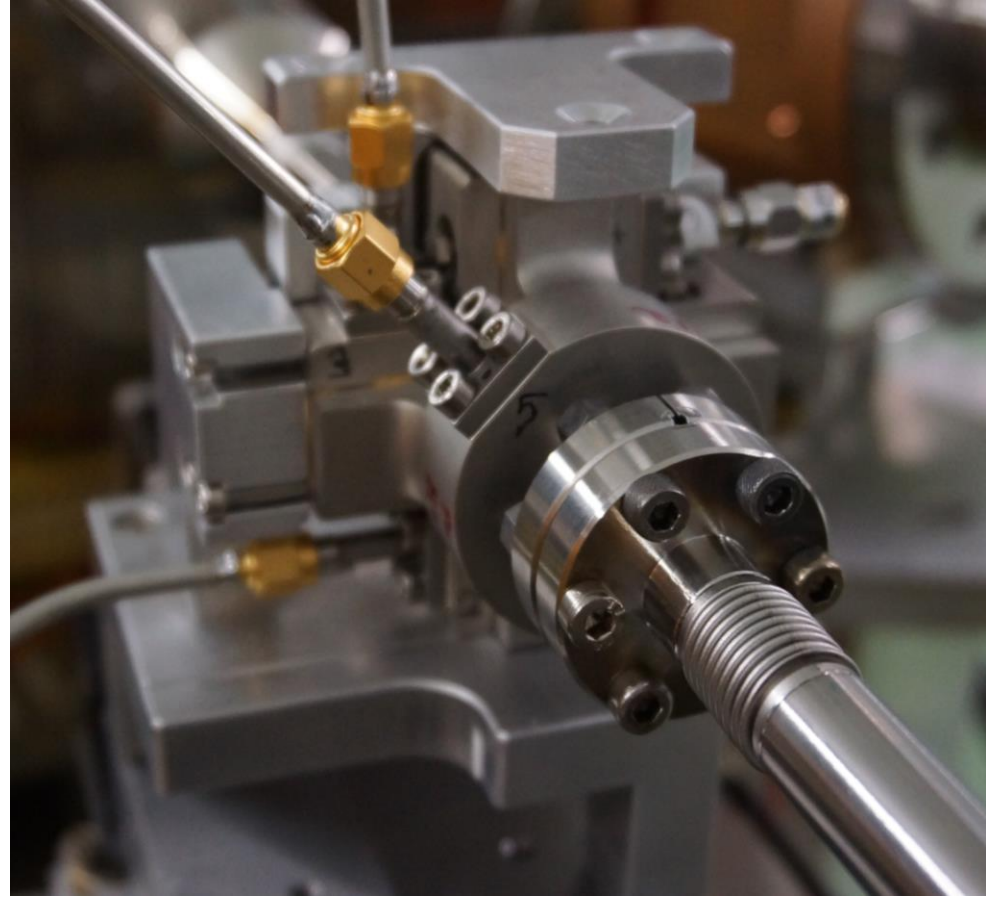
	RHUL	CERN
Academic (Stewart Boogert)	7.2 / 7.2	0 / 0
Electronics Engineer (Gary Boormann)	12 / 18	6 / 0
PDRA (Alexey Lyapin)	18 / 18	12 / 12
Student (Francis Cullinan)	0/36	0/0
PDRA (Robert Ainsworth)	0	0 / 6
TOTAL	37.2 / 73.2	18 / 18
Travel		9 / 11 k£
Material		17 / 17 k£

ATF2 beam position monitors

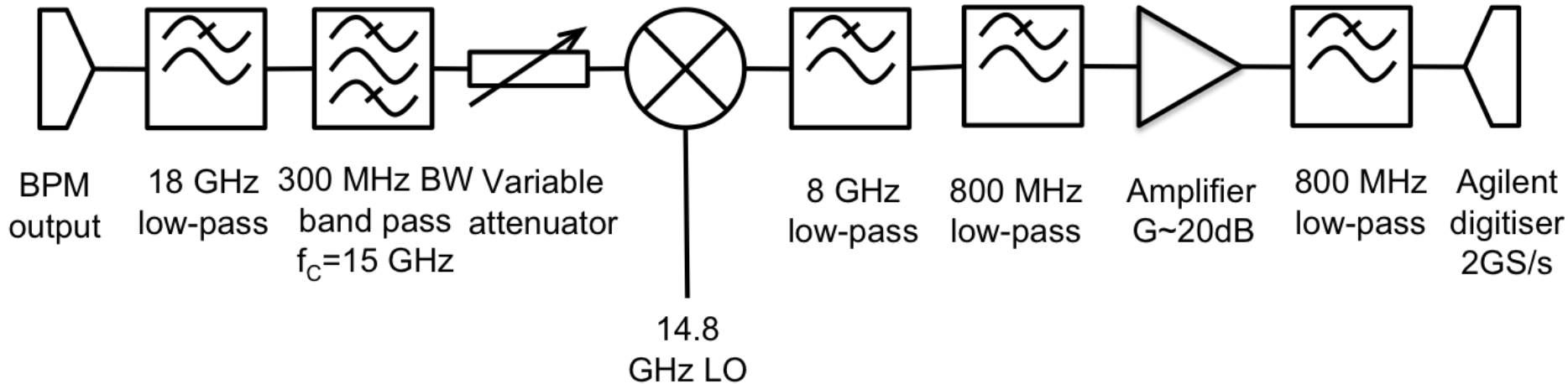


CLIC Main beam BPM

- Low-Q stainless steel cavity
- Simulation in
 - Gdfidl
 - Microwave studio
- Measurement
 - VNA @ RHUL (before) and CERN (after brazing)
 - Beam measurements @ CALIFES
- Dipole cavity
 - $f_{\text{dipole}}=14.993$ GHz
 - $Q_L=274$
 - $Q_0=450$
- Reference cavity
 - $f_{\text{dipole}}=14.960$ GHz
 - $Q_L=150$

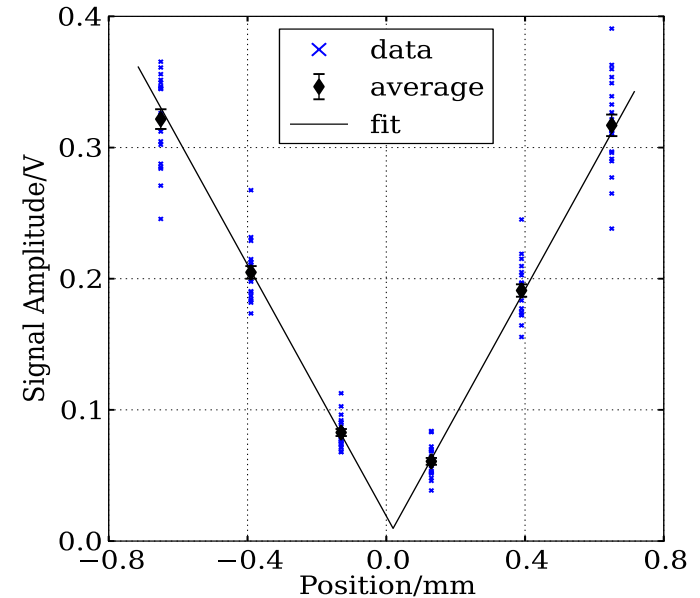
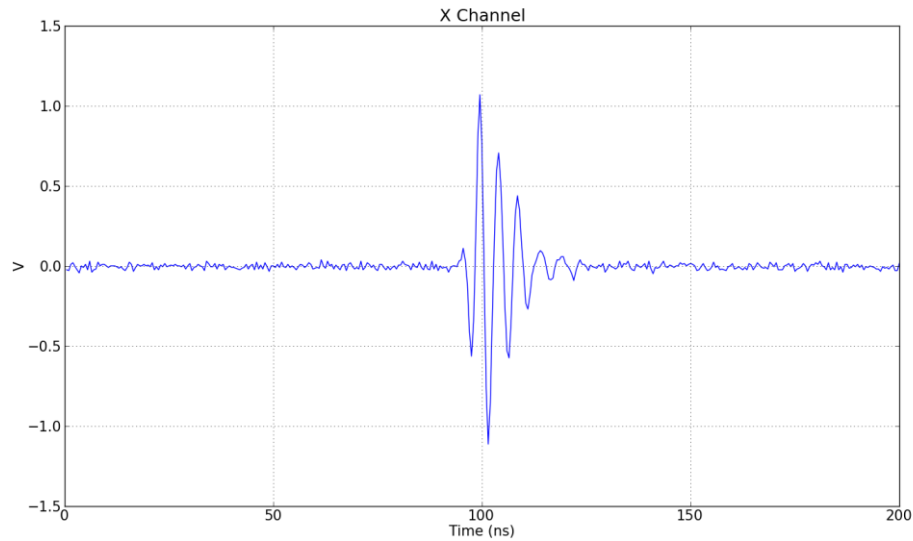


Electronics



- Downconverters designed by RHUL
- Constructed at CERN (CERN tech + F Cullinan)
- $f_{IF} = 200$ MHz
- High speed digitisation

First results



- Coupling agrees reasonably with simulation and VNA tests
 - Tested using CALIFEs beam
 - Thesis of F. Cullinan, demonstration of single cavity performance and signal processing

JAI rf diagnostics capabilities

- Simulation
 - Frequency and time domain
 - Gdfidl (A. Lyapin) ACE3P (R. Ainsworth)
- Bench test
 - SA, VNA, Sources
 - Down-converter systems
 - Bead-pull
 - Antenna scanner
- Testing of rf diagnostics
 - Drive beam BPM (Oxford)
 - Main beam BPM

Future program

- Optimisation of the system and cavity design parameters to meet the CLIC requirements to the main beam BPM (including some cost considerations)
- Improvements to the electromagnetic and mechanical design of the proposed 2- cavity pick-up assembly
- Specification of the analog processing electronics, digital processing, digitiser and control systems
- Beam tests of a 3-BPM system, demonstration of the resolution performance
- Beam tests with the beam position modulated along the beam for simultaneous
- demonstration of spatial and time resolution required for CLIC operation
- Investigations of wakefields and their effects
- Design of a single reduced wakefield prototype pick-up and beam tests

Deliverables

- **2014** Optimised set of design parameters
- **2014** Improved cavity design
- **2014** Specification for the signal processing and control systems
- **2014** 3 v2 design prototypes
- **2015** Beam tests with a 3-BPM system
- **2015** Wakefield simulations
- **2016** Setup of a position modulated train and measurements

BPM new funding request

	RHUL	CERN	Total
Academic (Stewart Boogert)	6 pm	0	6 pm
Electronics Engineer (Gary Boormann)	6 pm	0	3 pm
PDRA (Alexey Lyapin)	18 pm	18 pm	36 pm
Travel	3 k£	15 k£	18 k£
Material	3 k£	15 k£	18 k£