The CTF3 Two-beam Test-stand Installation and Experimental Program

R.J.M.Y. Ruber, V. Ziemann, T. Ekelöf, M. Johnson
Uppsala University, Sweden
H.H. Braun, S. Döbert, G. Geschonke, G. Riddone, J. Sladen, I. Syratchev, W. Wunsch
CERN, Switzerland

UPPSALA UNIVERSITET

THE TWO-BEAM TEST-STAND

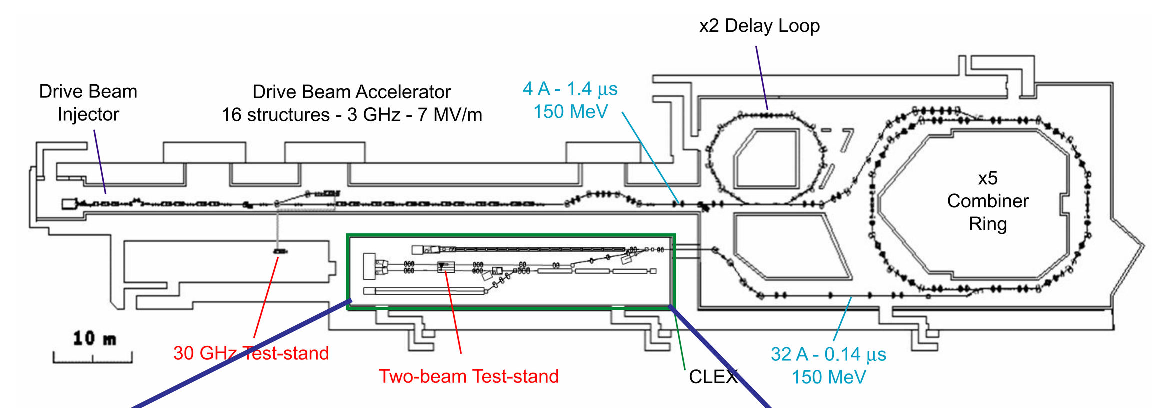
Demonstrate two-beam acceleration
- power production in PETS
- high gradient acceleration with low RF breakdown rate

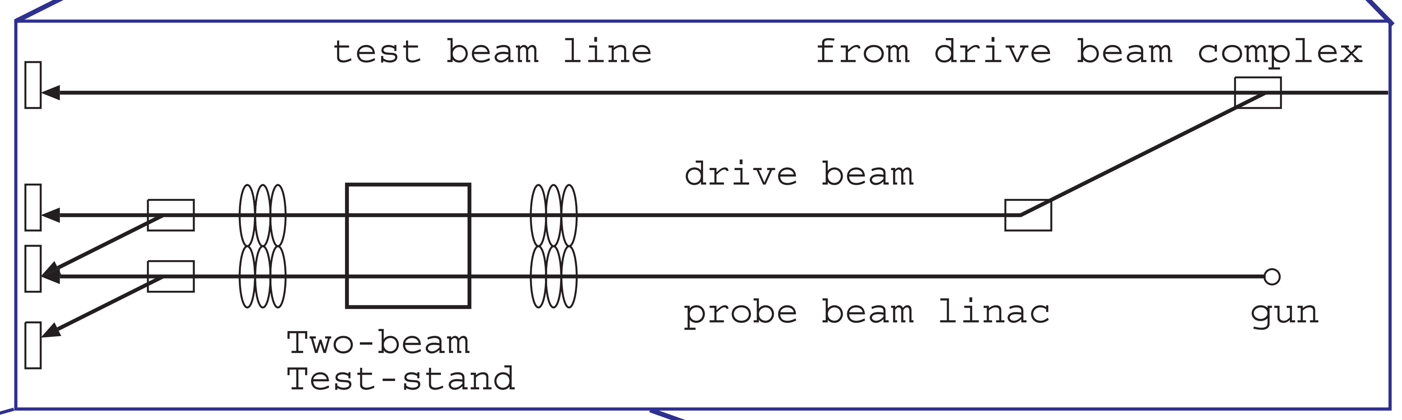
Concentrate on
- beam stability & dynamics limitations from RF breakdown
- physics of RF breakdown

BEAM GENERATION

CTF3 complex creates a high power drive beam used to generate RF power.

The probe beam is generated by the CALIFES linac (CEA).





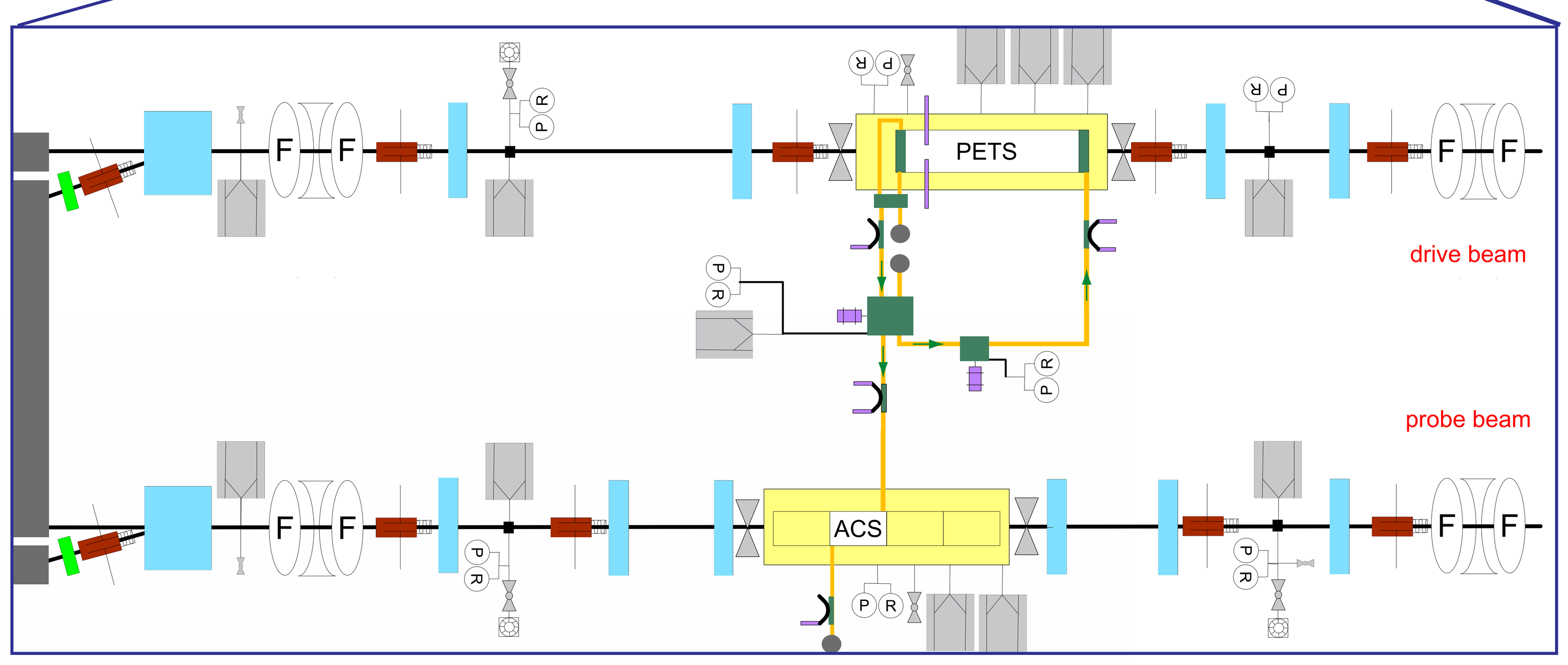
DESIGN

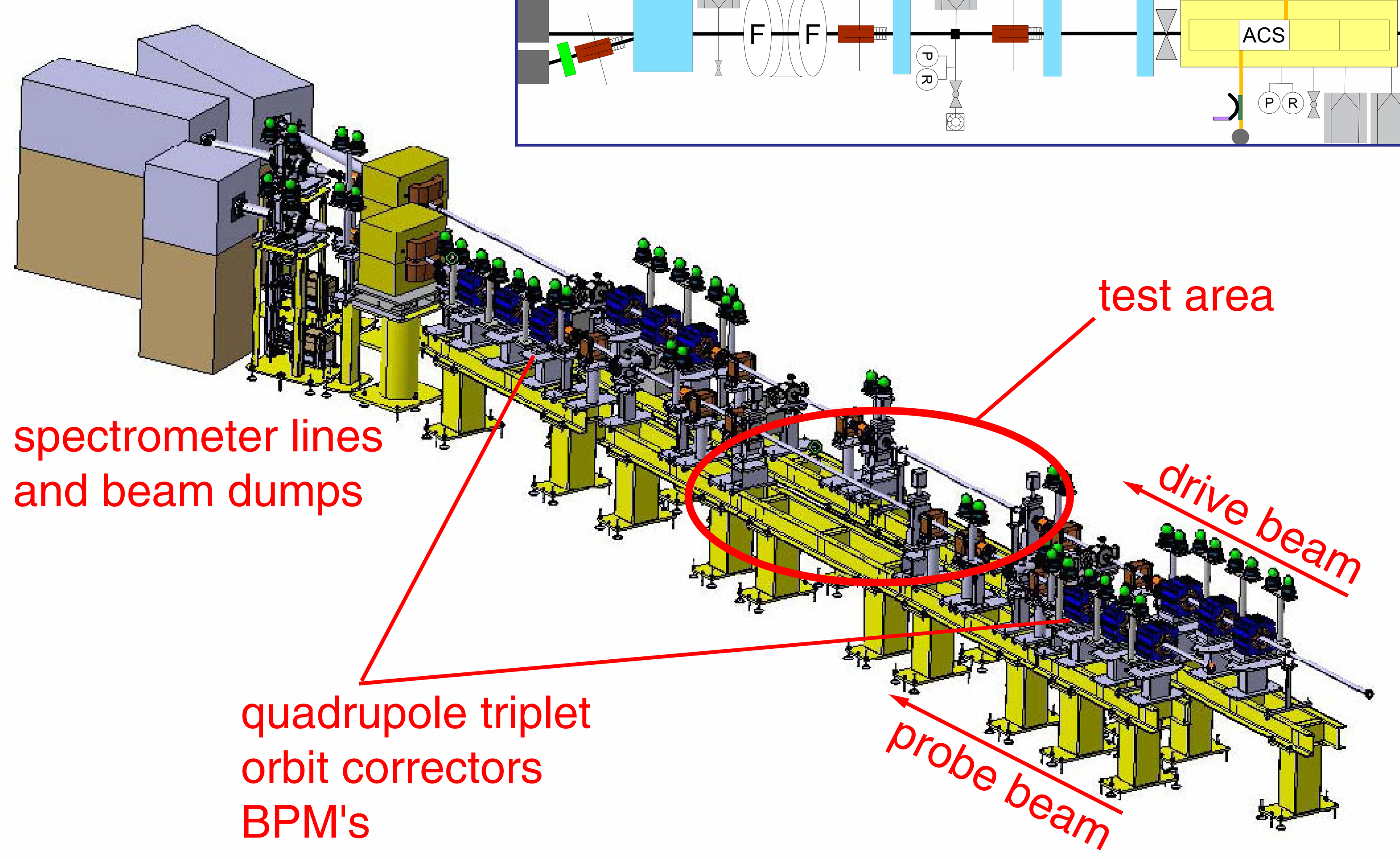
Optics for drive and probe beam lines are similar with differences in drift space.
Test areas next to each other.

Upstream quadrupole triplet to adjust to a small beam size.

Two steerer dipoles and two BPM's located before and after the test area to control and monitor incident angle and beam position.

Downstream quadrupole triplet provides a small beam size for energy measurements in the spectrometer line.





CONSTRUCTION

Each equipment has its individual support which allows alignment with a +/-0.15 mm accuracy with respect to a best-fit polynomial.

- quadrupoles:
  G max. = 11.2 T/m; integrated *G* = 2.53 T
- dipoles:
  B max. = 1.64 T; field integral = 2.53 Tm
- steerer dipoles:
  B max. = 0.017 T; integral 0.0045 Tm

- BPM:
  - 8 electrode inductive pick-up
  - relative position accuracy +/-10 µm
  - signal bandwidth
    - H/V position 0.8 kHz -- 150 MHz
    - intensity 0.3 kHz -- 250 MHz
  - 512 MS/s analogue memory 500 ns buffer
  - 14 bit ADC at 800 kS/s.

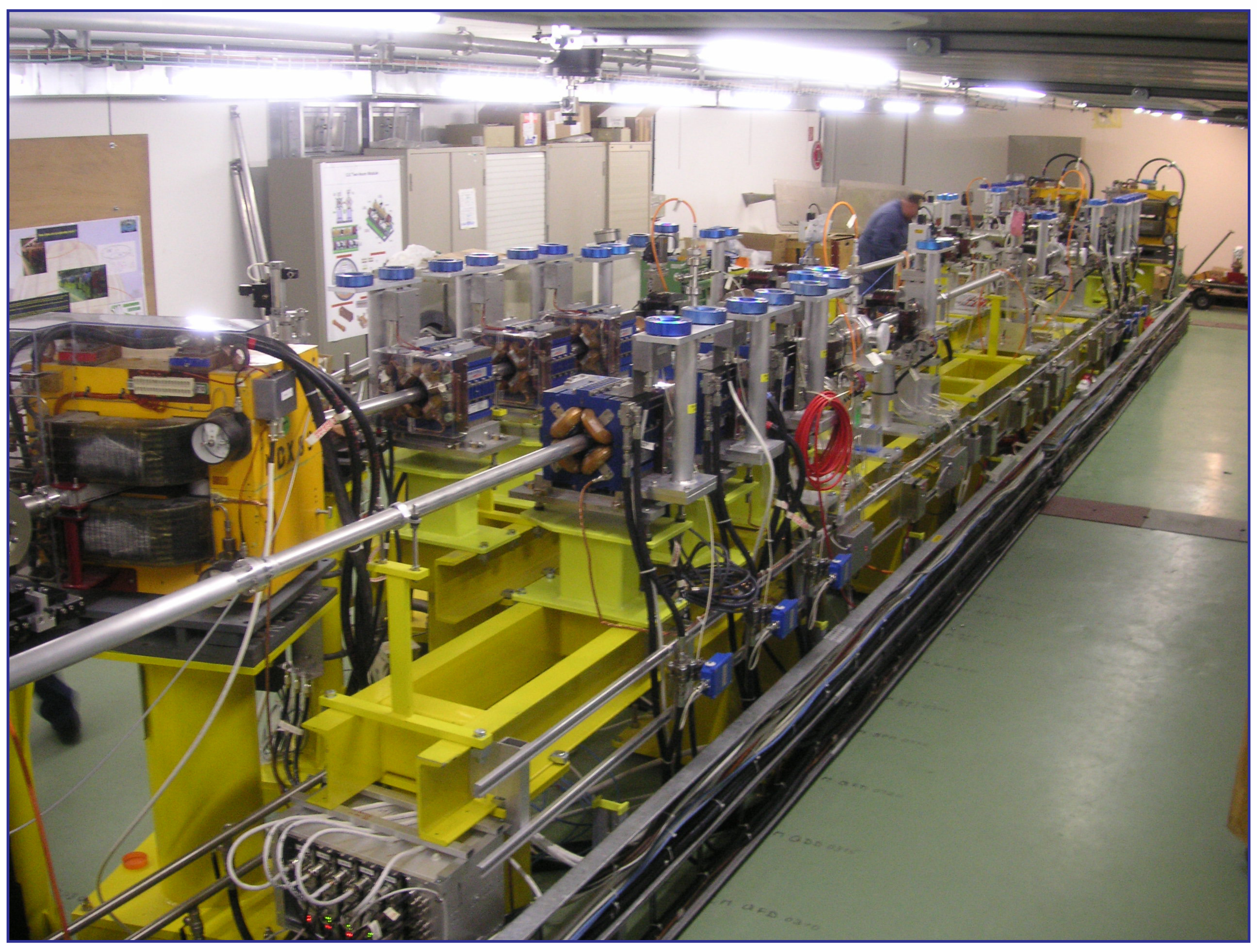
- drive beam screen:
  - parabolic shaped aluminium OTR (to reduce vignetting effect in the optical system)
- probe beam screen
  - fluorescent ceramic (because of lower beam intensity)

- RF signals:
  - detected by diode (amplitude information only), or
  - IQ demodulators (if phase information required)
  - 8 bit ADC at 1 GS/s 250 MHz bandwidth.

- beam dumps: graphite core with iron or lead/concrete shielding

MAIN PARAMETERS

	Drive beam	Probe beam
Incoming beam		
Energy	150 MeV	170 MeV
Bunch frequency	1.5--15 GHz	1.5 GHz
Pulse length		
- nominal	140 ns	21 ns
- long pulse	1.5 µs	150 ns
Intensity		
- nominal	32 A	0.9 A
- long pulse	5 A	0.09 A
Repitition rate	5 Hz	5 Hz
Test area		
Available length	1.8 m	2.0 m
Beam height to floor	1.35 m	1.36 m
Distance between beams	0.75 m	



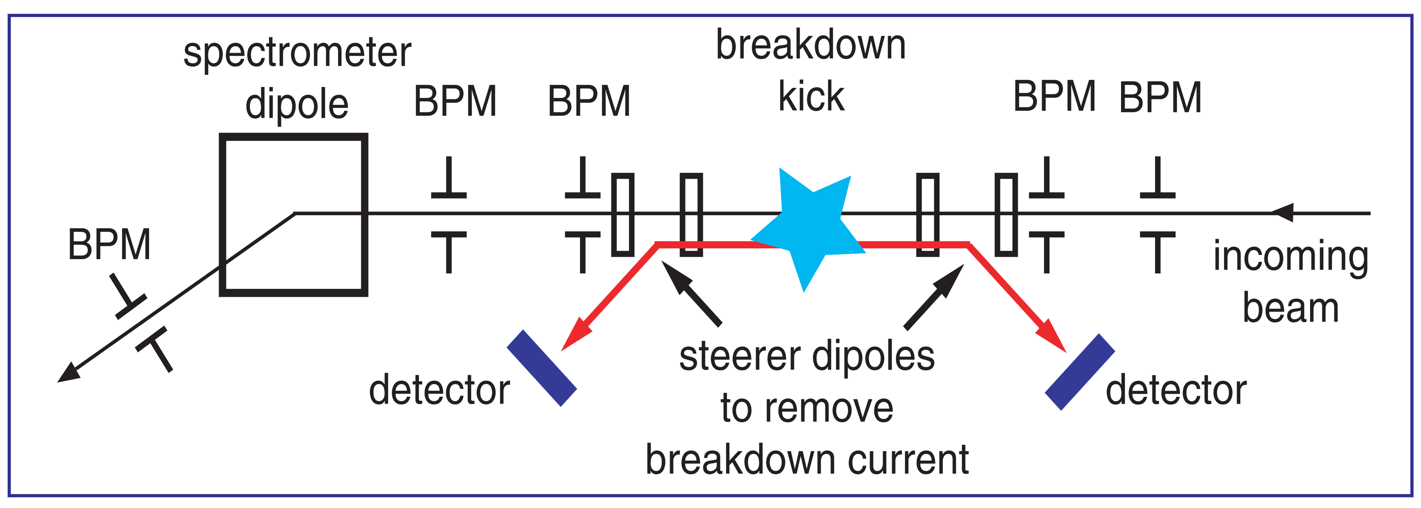
EXPERIMENTAL PROGRAM

Concentrating on
- beam dynamics
- beam kick due to RF breakdown or dipole modes
- beam loading compensation
- RF breakdown rates
- RF breakdown currents.

Phase 0 = beam line commissioning, start end July.

Phase 1 = PETS, start October
conditioning, verify power production,
beam dynamics effects

Phase 2 = PETS + ACS, start March 2009
conditioning, verify accelerating gradient,
study RF breakdown rate,
study beam dynamics effects



CONCLUSIONS

The TBTS is a unique and versatile facility with excellent beam diagnostics and easy access. It is the only available facility to demonstrate two-beam acceleration, to test CLIC structures and study RF breakdown with a beam.

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Roger Ruber, ruber@physics.uu.se, http://cern.ch/ctf3-tbts