UK/EU Plans for ATF2

G.A. Blair

ATF2-IN2P3-KEK kick-0ff meeting, Annecy,

8th October 2006

- Overview
- EUROTeV
- UK

Funding Programmes

Funded until Dec. 2007

Includes ATF/ATF2:

- CERN BPM,
- Laser-wire
- STAFF (stabilisation)
- FONT, NanoBPM
- BDSIM

Funded until Mar. 2007

Includes ATF/ATF2:

- Laser-wire
- FONT, NanoBPM
- BDSIM

ATF2 EU Overview I

Item	LAL,LAPP (France)	DESY (Germany)	CERN (Europe)	UK
Mechanical stability and vibrations (include Ground Motion) of Qs	EUROTeV	EUROTeV	1 active stabilization table ($2.35 \times 0.8 m^2$ $\times 0.8$(H)m) 100kCHF (8.72 Myen)	yes
GEANT4 modeling of the ATF2 beam line by BDSIM	EUROTeV; 1.5 person·year at post-doc level in 2006–2008 + travel money			yes
Evaluation and implementation of steering and optical tuning algorithms, BBA and IP tuning	1 PhD student in 2006–2009 + money for visits to KEK		7 person·month	yes+ EUROTeV (ILPS)
Participation in commissioning activities with development of the strategy	yes		4 person·month	yes

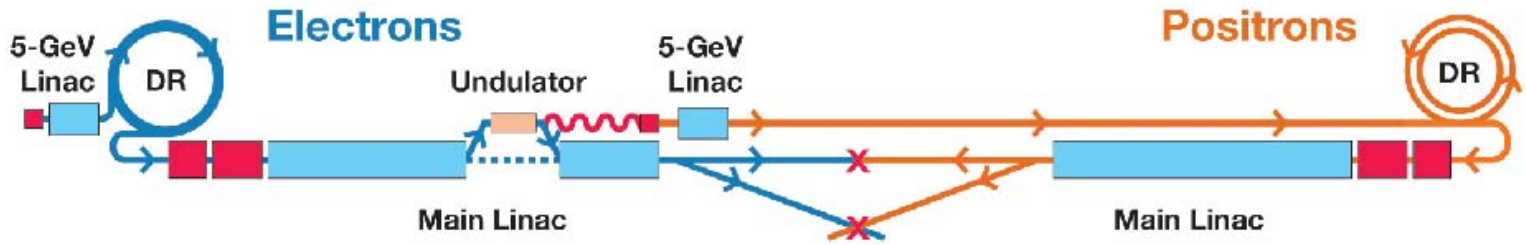
ATF2 EU Overview II

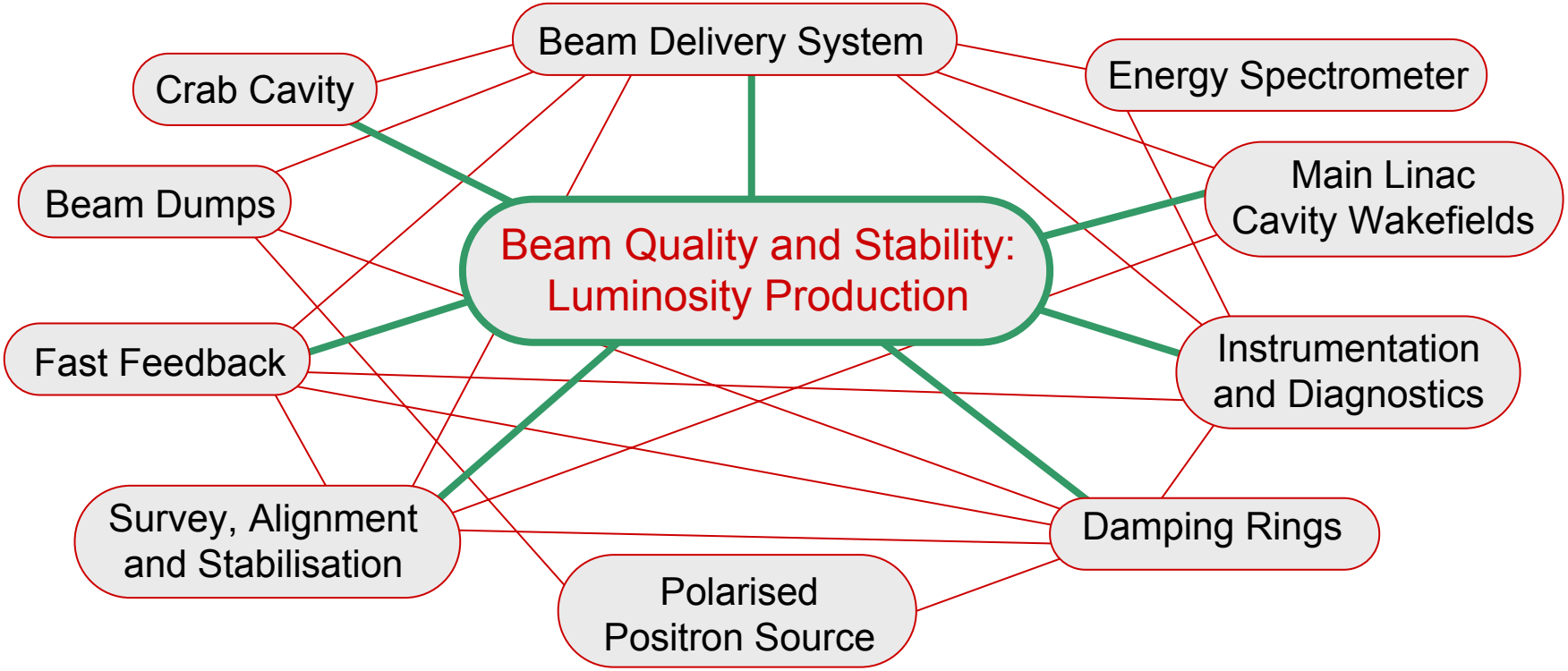
Item	LAL,LAPP (France)	DESY (Germany)	CERN (Europe)	UK
Design of the low-noise electronic readout system, and coherent radiation monitor for beam size measurement	technical contributions + money for visits to KEK			
Fast kicker pulser		XFEL		
Laser wire system		EUROTeV (LBBD)		35 Myen
Remote operations		EUROTeV		
Survey of relevant collective effects in ATF2 and ATF extraction line			1 person·month (wake field)	
Beam feedback / feedforward system				4 person/year, 10 Myen
High-precision transformer BPMs (3); 100nm resolution, 4mm aperture			EUROTeV 160kCHF (13.95 Myen)	

UK LC-ABD Phase 2 bid

- Second phase of the UK programme
  - Builds on existing programme in BDS systems.
  - Extends to some work in DR and Linac HOM studies.
  - Bid is for 3 years starting from April 2007.
- Peer review process currently underway
  - Initial peer-review meeting was on Sept. 5th in London
  - “Visiting Panel” meeting 11/12 October.
  - Should know outcome by the end of 2006.
  - Until then, nothing definite can be said about funding for the following UK/ATF2 projects.

LC-ABD programme addresses



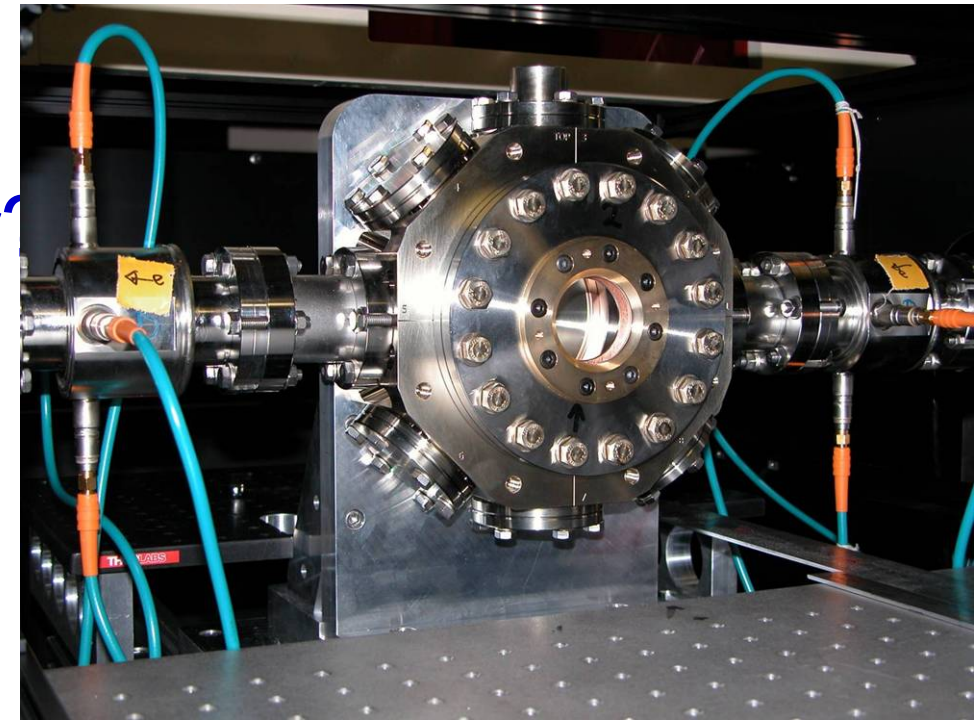


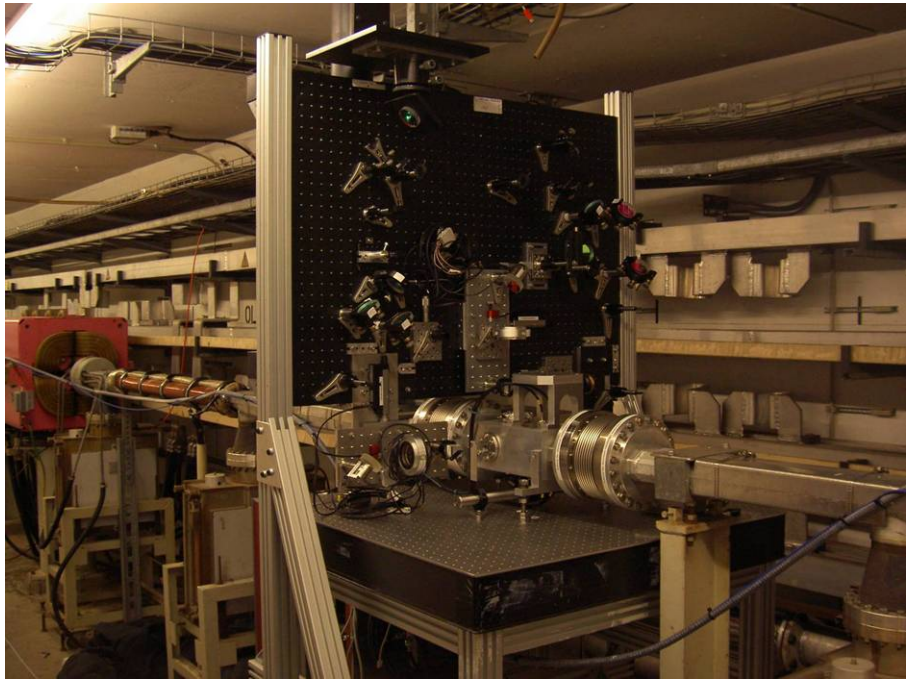
ATF2 Laser-wire I

- Build on experience at ATF extraction line
- Multiple IPs for emittance measurement
- Light transport studies, looking to ILC
- Implementation of fast-scanning mechanisms.
- Understand operational issues and input into ILC technical design.
- Complementary programme at ATF and at DESY to address ILC operational issues.

ATF2 Laser-wire II

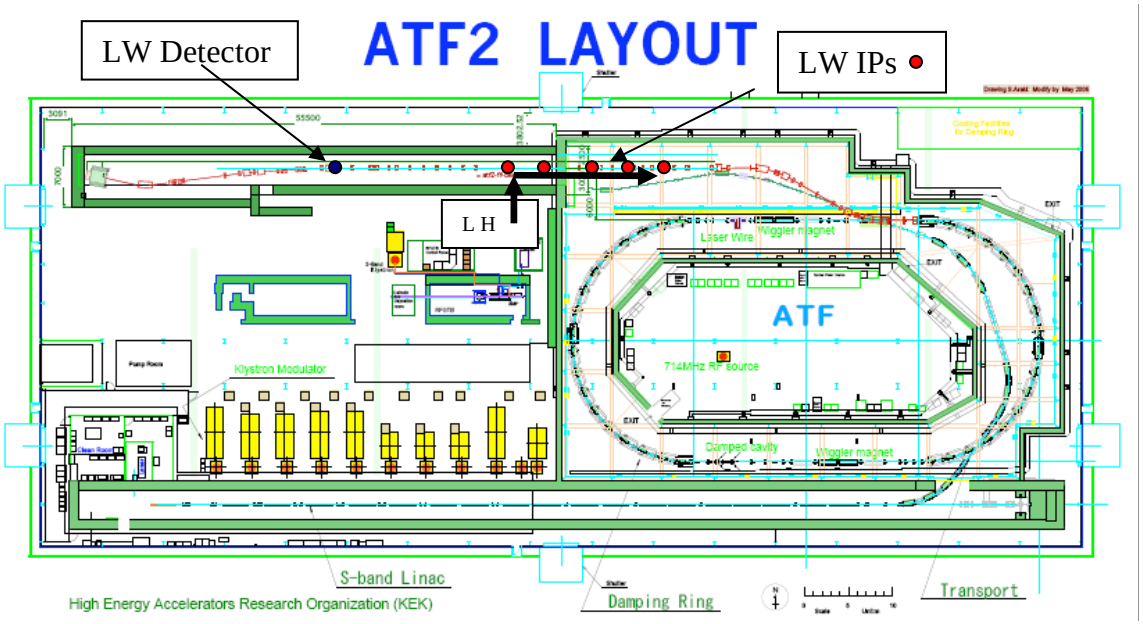
new dedicated IP
Integrated BPM?
Integrated wire scanner?





Multi-dimension scans
Light delivery
Petra system

ATF2 Laser-wire III



- Aim for 4 IPs for emittance measurement
- Staged approach
- light transport
- Detector location

Exact number of IPs will depend on funding
Laser upgrade is also being bid for

BDSIM simulation of ATF/ATF2 beamline

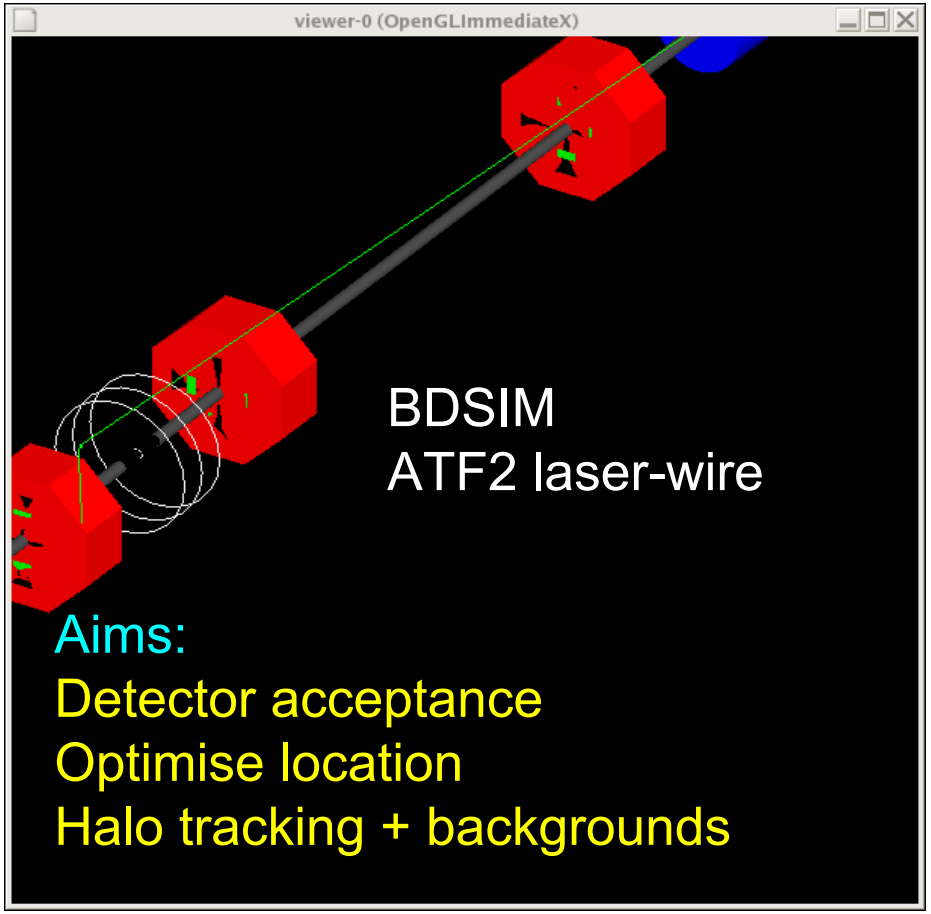
- BDSIM is a Geant4-based beamlne simulation toolkit
- Used for PETRA

  laser-wire (J. Carter)
- In use at ATF (L. Deacon)
- Plans for ATF2

  L. Deacon (RHUL)

  LAL

  EUROTeV
- Important to benchmark for ILC



http://flc.pp.rhul.ac.uk/bdsim.html

ILC/ ATF2 Diagnostics Laser System

Laser oscillator choice:

- A conventional mode-locked Nd:YLF (1047 nm/1053nm)
- or Nd: YAG (1064 nm) laser
- or A mode-locked fiber laser (1047/1053/1064 nm)

Laser Amplifier choice:

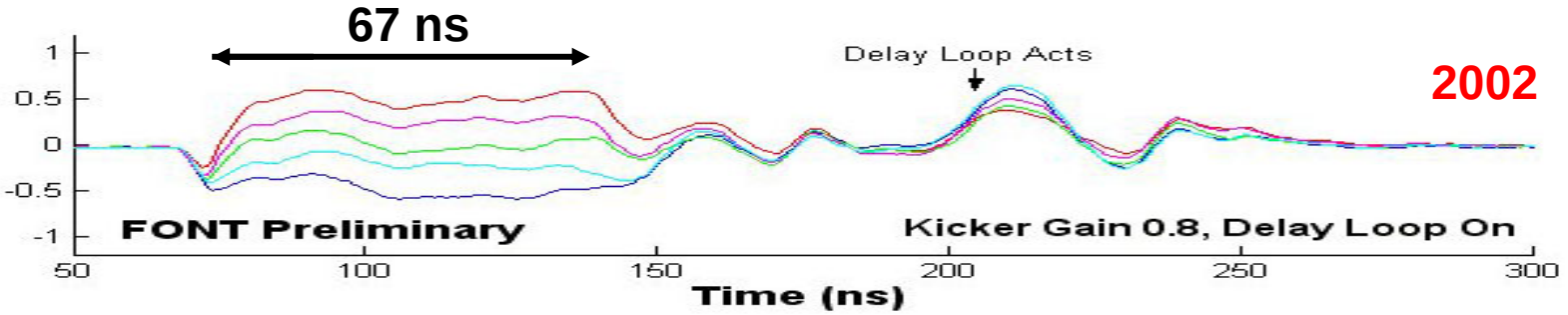
High power diode pumped Nd:YLF or Nd:YAG

Fiber?

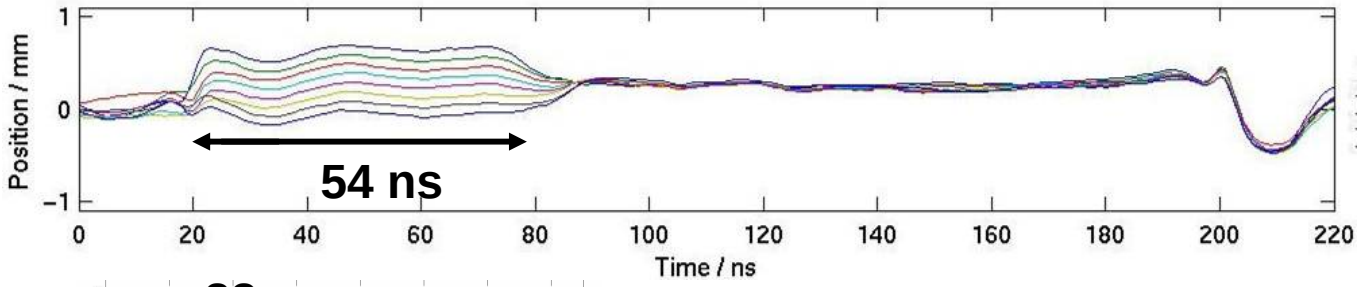
Choice on 2nd harmonic crystal : LBO/BBO (250 nm – 500 nm)

- System being investigated now (fiber laser attractive)
- Will be built this year at Oxford
- High power output will require further second stage

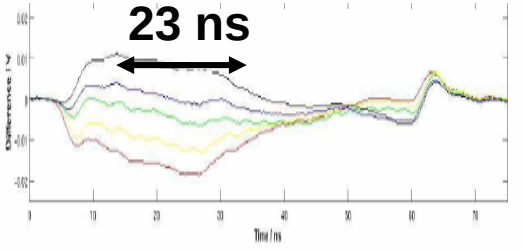
FONT: Intra-train Feedback



2002



2004



2005

FONT4 digital processor board

P. Burrows

Feedforward to Extraction Line

FONT project (UK Institutes)

Planned

Layout of KEK-ATF Extraction Line

nm Fast Feedback

Double kicker
X jitter compensation

µm Feedforward (DR BPM -> EXT Line new strip line kicker)

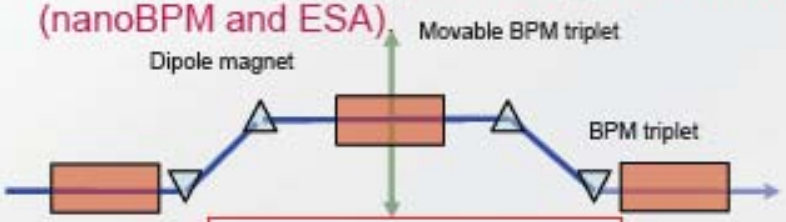
Precise Energy Measurement – Key parameter for the physics

Absolute beam energy measurement absolutely critical for particle physics at linear collider (top quark, Higgs & SUSY mass measurement)

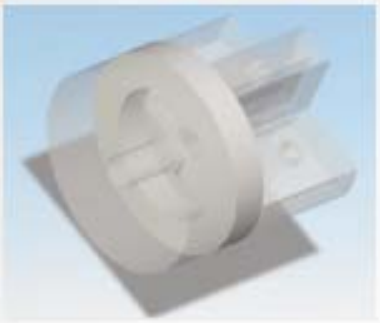
Measure beam deflection in precision magnetic chicane system.

Require highly stable **B**eam **P**osition **M**onitor systems (resonant cavities, only available technology). Resolution <100nm

Existing group has significant expertise in world leading systems (nanoBPM and ESA).



Aims to address:
- Long term stability
- Calibration systems
- Systematic effects



Design based on exisiting designs (ATF/ATF2) by UK.

World leading cavity BPM expertise in the UK, design for ATF2 cavity BPM.

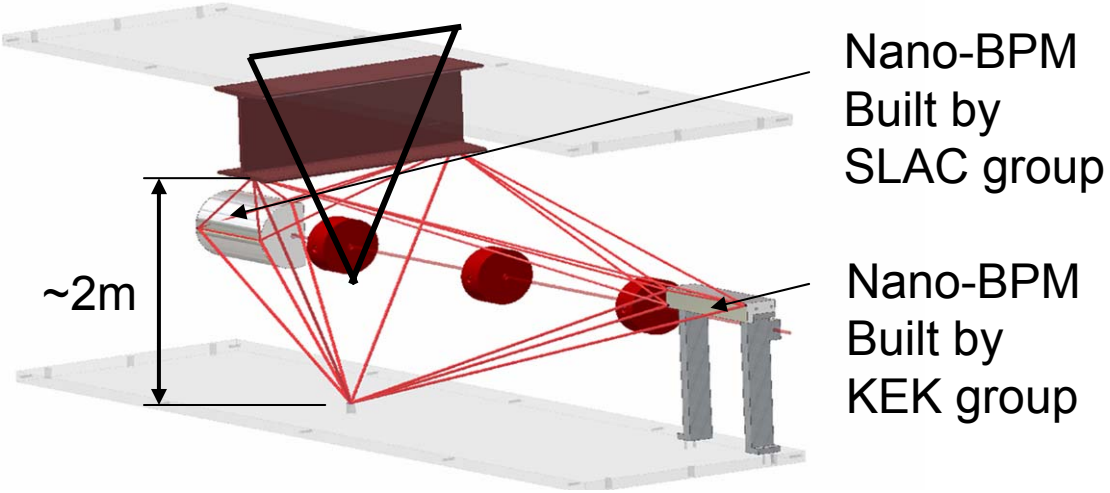
- Optimise overall spectrometer design
- Triplet of cavity BPMs(electronics, and mechanics)

- Sensitivity/position resolution
- Calibration procedures (electronics and cavity)
- Systematic effects, such as gain drifts in the electronics, frequency variation in the cavities.
- Long term performance of the cavities

Oxford

Stabilization of Focal Point

- ATF2 program needs: Stabilization of Shintake monitor of 10nm with respect to final focus quadrupole.
- Require to monitor on timescales of seconds and minutes → Laser interferometric straightness monitor.
- StaFF group in Oxford is developing a straightness monitor for ILC. A setup using >20 distance meters will be tested at ATF during 2006-2007, with 20-30 nm expected resolution.



D. Urner

Oxford

R&D for compact Straightness Monitor

- ATF setup needed to test
  - Test distance meter (under accelerator conditions).
  - Combination of several measurements.
  - Test of Stabilization algorithms (using BPM movers).
- Compact straightness monitor needed for ILC
  - Integration into one device harder – but allows system with much smaller vertical dimensions (few cm).
  - ATF2 ideal test facility.
  - Goal is to provide at least 10nm resolution (as required by ATF2).
  - Time frame 2009 anticipated.

Machine Studies

- UK bid includes
  - DR studies relevant to ATF.
  - Involvement at ATF2 for testing the local chromaticity correction optics, tuning procedures and knobs to achieve and maintain the vertical beam size of 35 nm.
  - Development of the tuning procedures for ATF2 and participation in the experimentally tests

SUMMARY

A very active and fruitful collaboration involving European partners at ATF/ATF2

Plans are advanced for future participation in Both the hardware and the running of ATF2

- BPM
- Tuning studies
- Laser-wire
- Lasers
- Stabilisation
- Feedback
- Simulation/optimisation