

# Energy spectrometry R&D in the UK

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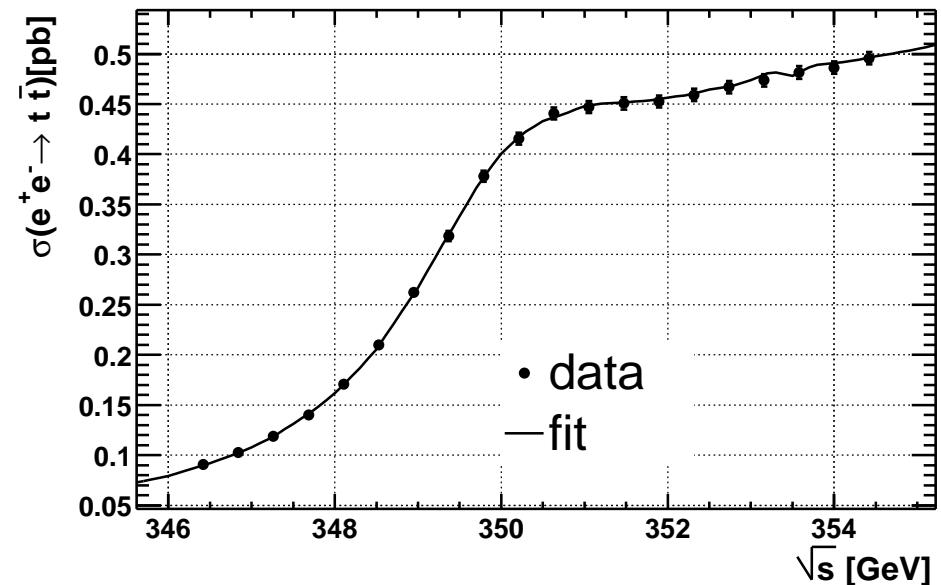
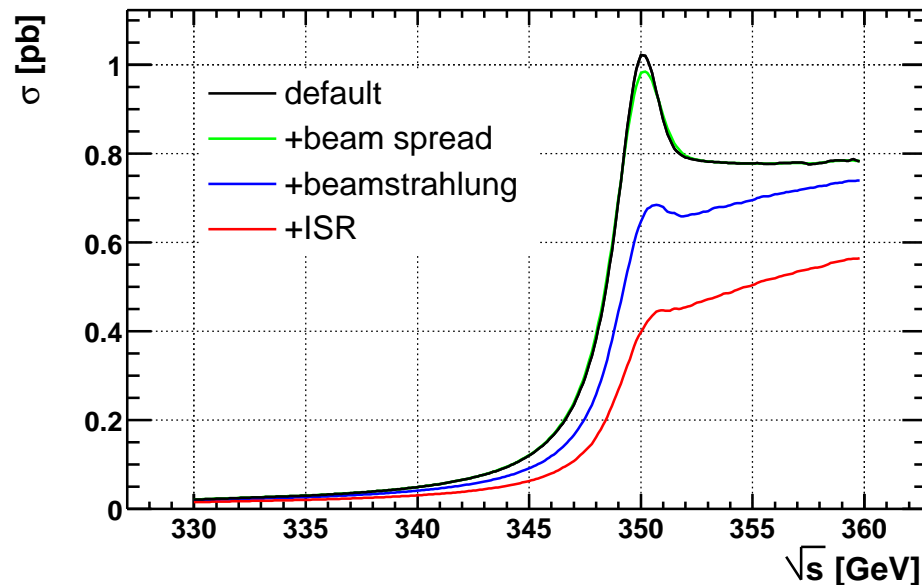
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- Introduction and motivation
- Current work
- Future plans

# Motivation

Development of spectrometer driven by required precision on physics processes to be measured

Want to e.g. measure top quark to  $\sim \mathcal{O}(100)$  GeV



Precise knowledge of the beam parameters is needed

Continuous monitoring and measurement

Other processes - Higgsstrahlung,  $WW$  production, pair-production of exotic particle - also provide input.

# Overview of R&D

Organisationally, the UK groups have funding up to end of 2007 through PPARC, CCLRC and EuroTeV.

International collaboration with: KEK, SLAC, LBNL, LLNL and Notre Dame

Designing a spectrometer for the linear collider

- ATF NanoBPM collaboration (in KEK)
- SLAC End Station A running
- Spectrometer specific BPM design

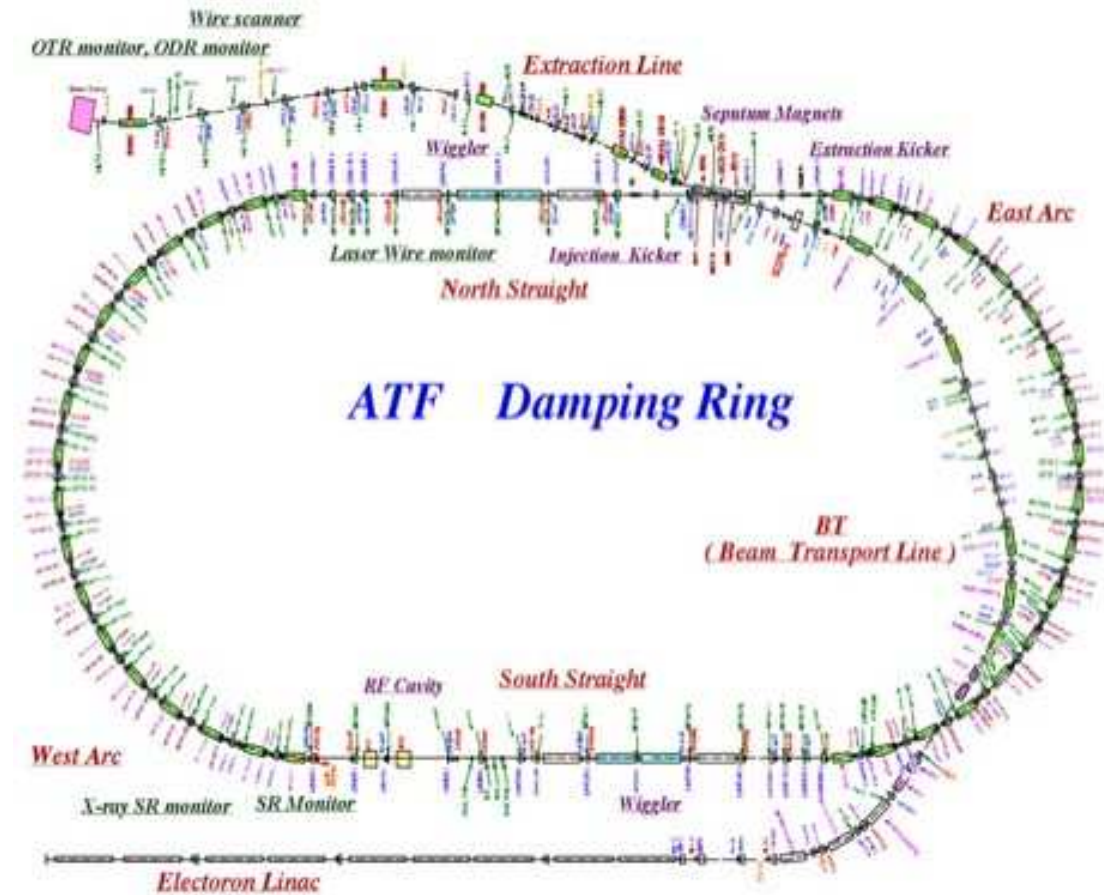
# ATF NanoBPM work I

ATF: damping ring at KEK:

- 0.7-6 Hz repetition frequency
- Energy 1.28 GeV
- Bunch length 10 ps
- 3 bunches at 150 ns spacing

“Learning” laboratory for us - hands-on experience: test-beams, BPMs, etc.

Cavity BPMs from BINP/SLAC and KEK



# **ATF NanoBPM work II**

**Involved in general test-beam running and maintenance**

**We have developed analysis and simulation tools**

**Achieved resolution of 20 nm with a stability of 60 nm**

**Cavities are not optimised (e.g. radius) for spectrometer application**

**For details of results, see Alexei's talk**

**Test-beam at SLAC...**

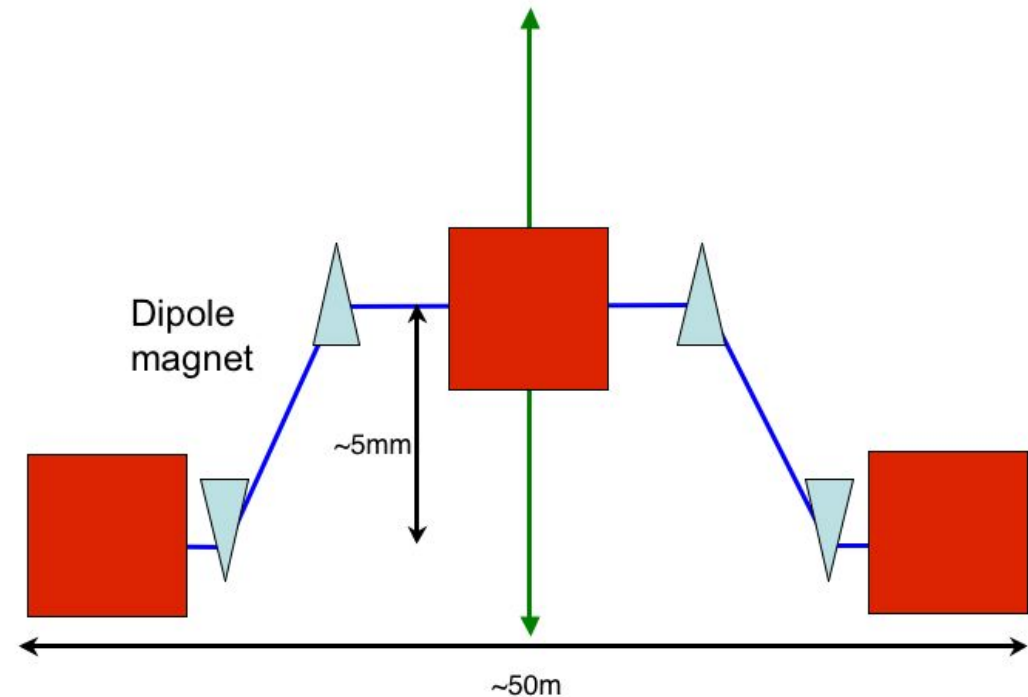
# Energy Spectrometer

UK/US groups developing 4 magnet system:

- Total length 50 m
- Beam deflection 5 mm
- 100 nm BPM resolution  $\Rightarrow 2 \times 10^{-5}$  energy resolution

Vary dipole strength

Move central BPM to track beam movement



# End Station A

**Full energy spectrometry study with:**

- **Electron beam of 28.5 GeV**
- **Similar bunch length and size expected for the ILC**

**Test design and operation**

**Using SLAC cavities with  $\mathcal{O}(100)$  nm(?)**

**Schedule:**

- **Initial set-up in early January 2006**
- **Stage 1 in February 2006: install BPM, readout, calibrate and measure resolution**
- **Stage 2 in summer 2006: add magnets and operate with different fields**

# **UK contribution**

**General test-beam support and shifters**

**Electronics (digitisers, two 8-channel, 125 MHz, 14 bit VME cards)**

**Analysis (similar to ATF work)**

**Movers and design for Stage 2**

**Defining spectrometer BPM design: we can prototype these!**



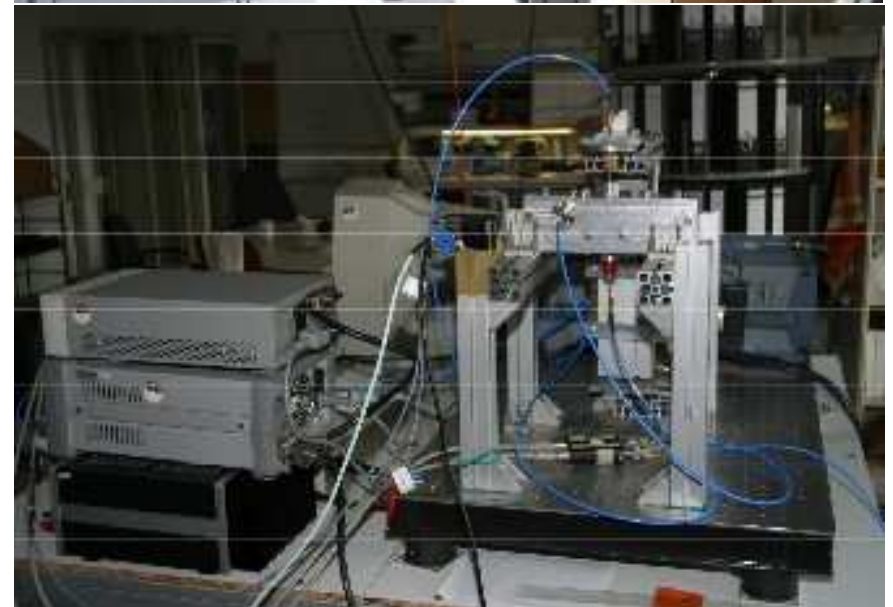
# Cavity test-stand

**Excellent opportunity for development using Alexey's expertise and equipment generously provided by Heinz-Juergen.**

**Cavity test system with antenna on 2d translation stage**

**System delivered and some work started. A new lab is currently being refurbished**

**Simulation started for prototype spectrometer BPMs which are expected in early 2006**



# Future programme

**(Will have) done groundwork study on energy spectrometer**

**⇒ develop full-scale prototype:**

- **Final cavities**
- **Electronics and readout**
- **Magnets and magnet characterisation**
- **Operation in high-energy beam**
- **(Will need a lot of money)**

**Other supplementary projects: energy spread, ...?**

# Summary

**Basic research on BPMs at the ATF has progressed well with a resolution of 20 nm**

**ESA tests are starting soon in which we will validate the design and understand the mode of operation**

**Have built up an in-house test lab to develop BPMs for the spectrometer**

**Also starting to think about our future**