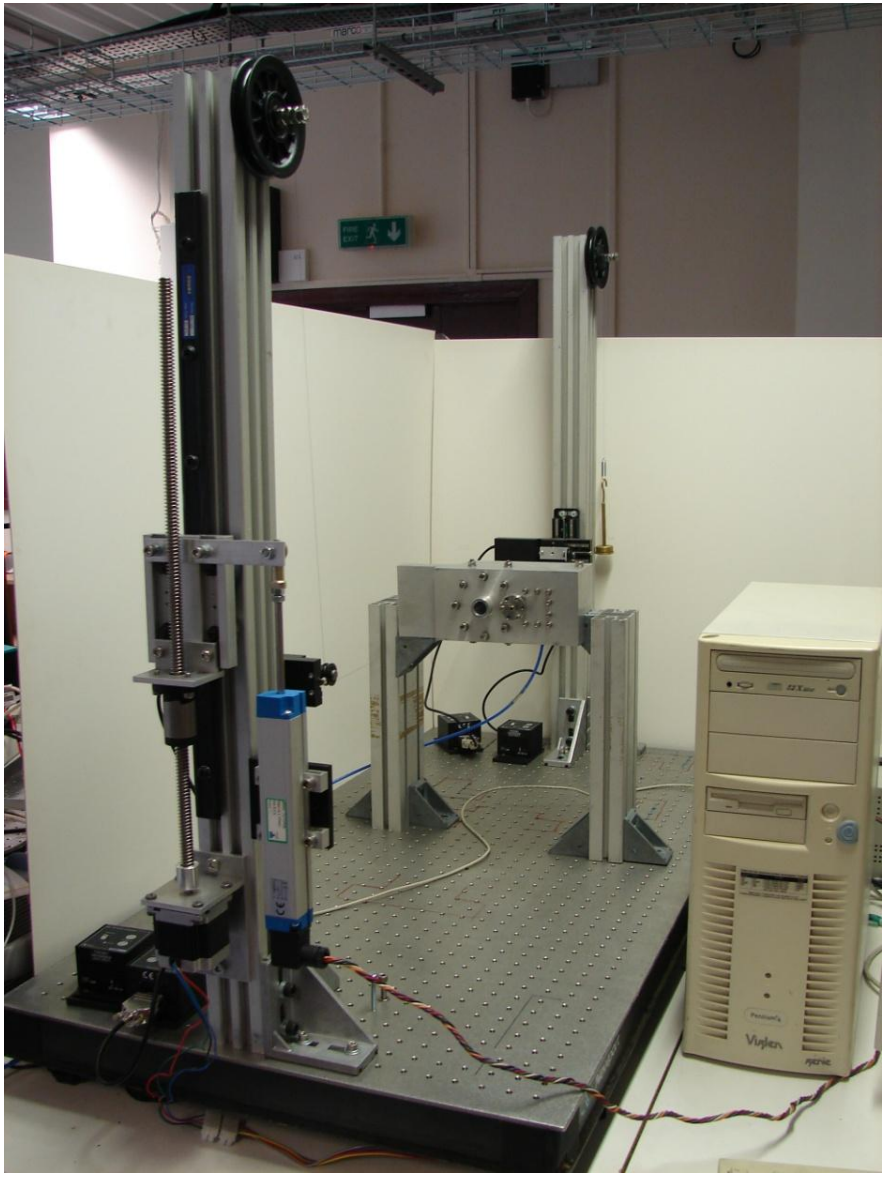


Bead-Pull Measurements of RF Cavities – update of RHUL System

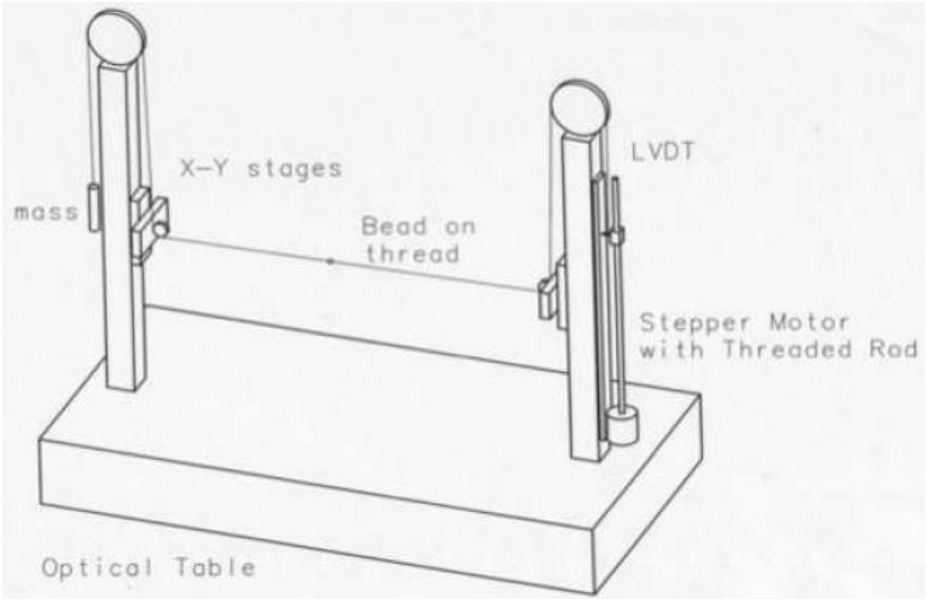
FETS Meeting
27th June, 2012

Gary Boorman, RHUL

Bead-Pull Measurement

The Bead-Pull perturbation technique measures the electric field versus position using a small dielectric or metallic bead moving through a cavity.

A new, upgraded version of the original RHUL Bead-Pull system has been constructed at RHUL as proposed last year. [1]



[1] R.Ainsworth, et al, “Bead-Pull Test Bench for Studying Accelerating Structures at RHUL”, MOPC049, IPAC2011

BeadPull Measurement

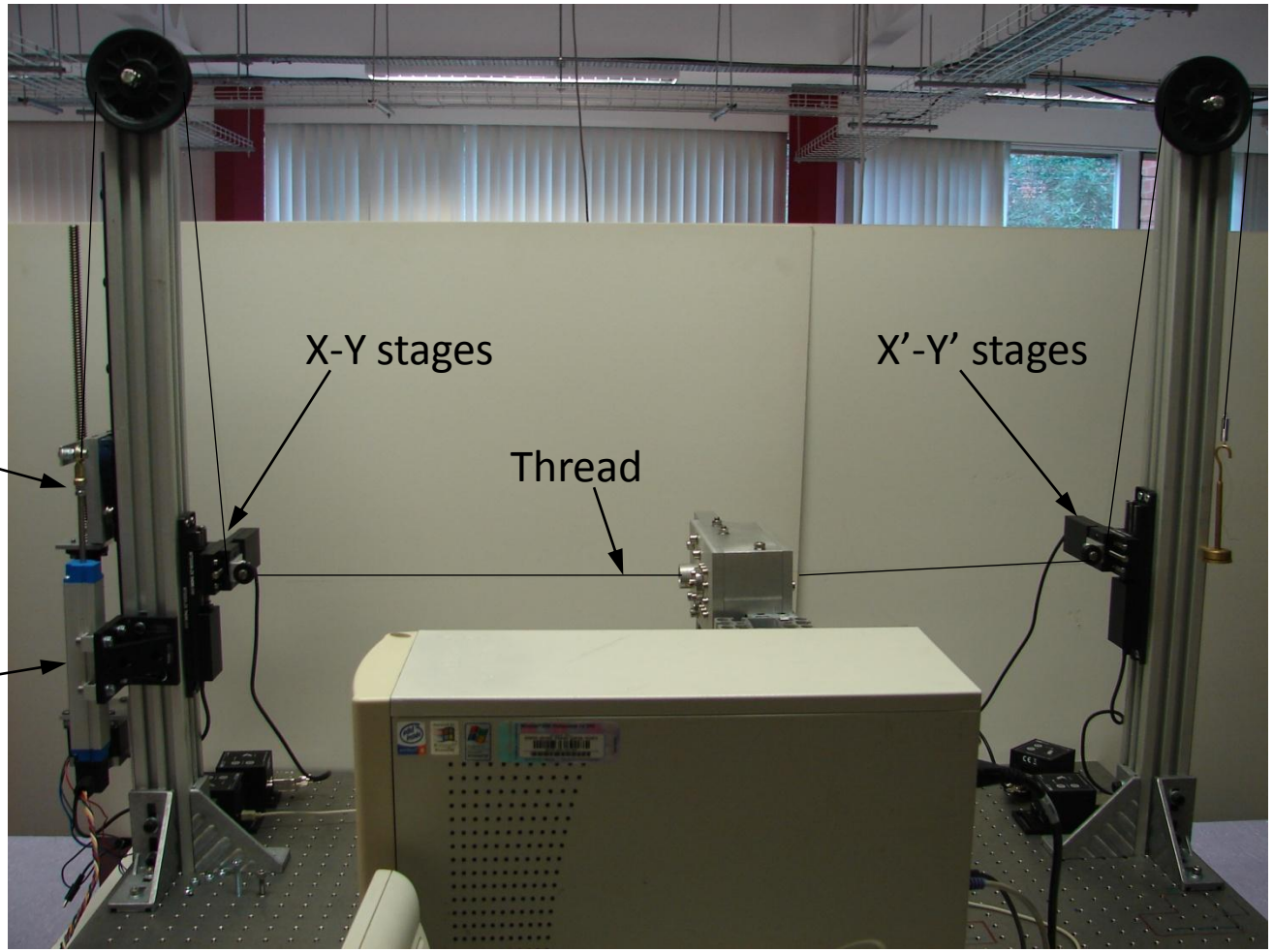
The X,Y and X',Y' axes consist of four ThorLabs MTS50/M-Z8 stages (50mm travel) and four ThorLabs TDC001 controllers with a USB interface.

The Z axis consists of a stepper-motor with a 3mm pitch leadscrew and carriage with an LVDT to ADC channel to provide position information for the carriage.

The position resolution of the MTS50M/TDC001 pairing is around 7µm.

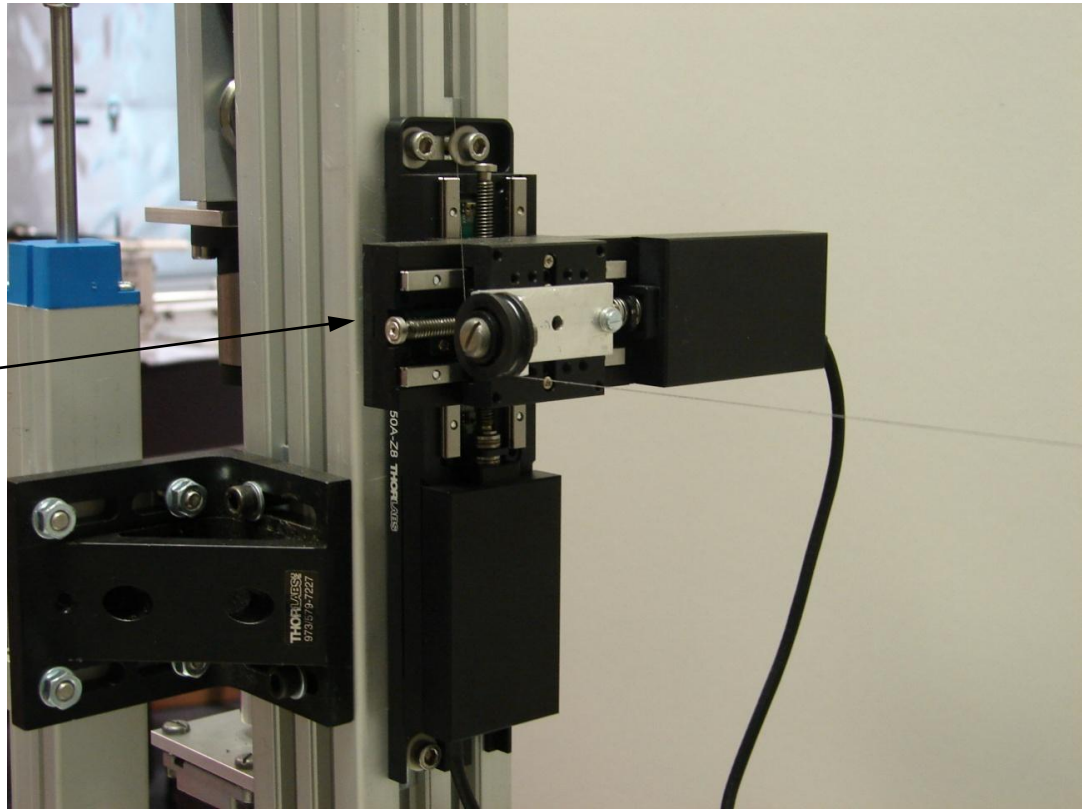
The stepper-motor/lead-screw combination has a step size of 7.5µm. The LVDT resolution depends on the ADC used: a 12bit ADC, a 500mm LVDT with 5V applied gives a readout accuracy of about 0.5mm. This can be improved by using a higher resolution and less noisy ADC.

BeadPull Measurement

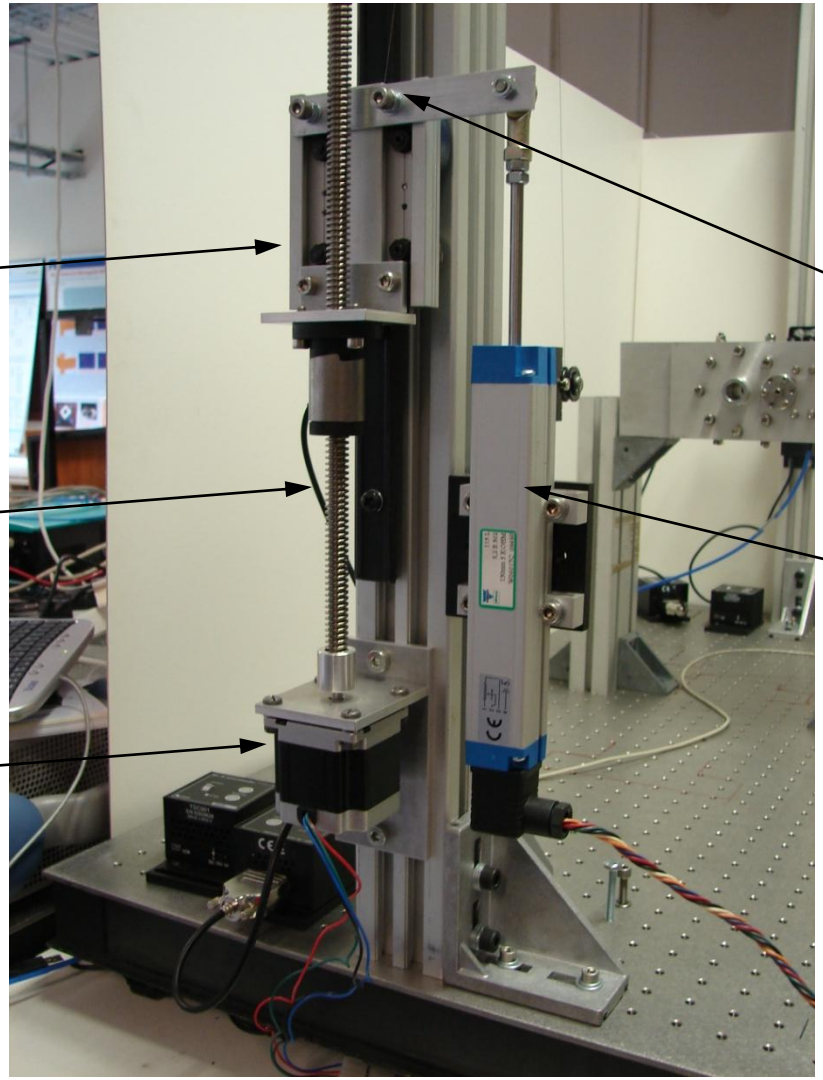


BeadPull Measurement

X-Y stage with pulley for thread



BeadPull Measurement



BeadPull Measurement

A new version of the software is currently being written, using LabVIEW 2010.

LabVIEW drivers for the TDC001 Controllers already exist, as do the drivers for the LVDT and stepper controller.

The VNA used (Rohde & Schwarz ZVB-20) also has drivers ready-written.

The new software uses OO techniques and is based on an event-driven Producer-Consumer template.

Different scan-types (eg linear, circular, compound) are selected and a table of stage and stepper-motor values are created for each bead position required. The control software moves the bead to a position and records the $\Delta\omega$ or $\emptyset$ from VNA. This is repeated until the scan is completed. Analysis can then be performed on the data to characterise the cavity under test.

BeadPull Measurement

In Conclusion…

The upgraded Bead-Pull hardware is extremely portable.

It can accommodate any size cavity (using ‘multiplier’ pulley block).

The software can be used with any commercial or proprietary stages/movers and VNA.

The hardware is very rigid and reduces vibrations to a very low level.