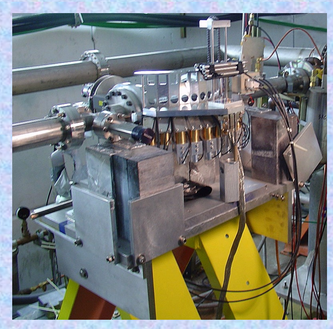
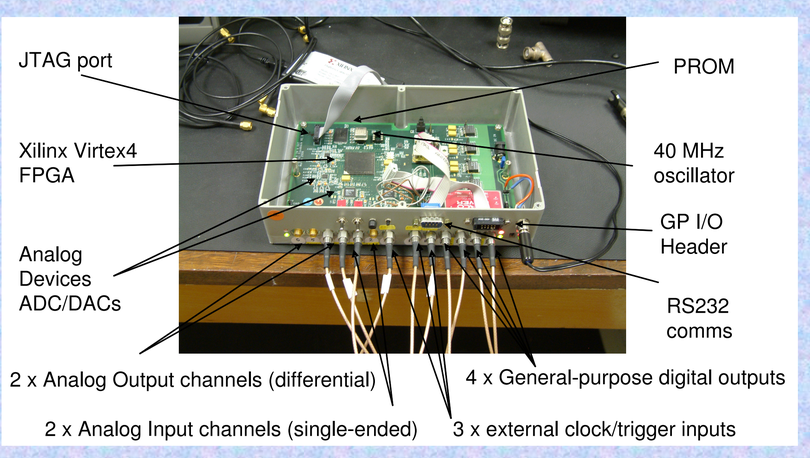
Accelerator and Beam Delivery

The **LC-ABD** (Linear Collider: Accelerator and Beam Delivery) consortium is a group of UK institutes aiming to develop new techniques for the control of intense relativistic particle beams at the nanometre level of precision for the International Linear Collider (ILC). This includes beam measurement, RF system development and work on positron sources. This poster shows a few examples of research activities done as part of LC-ABD.

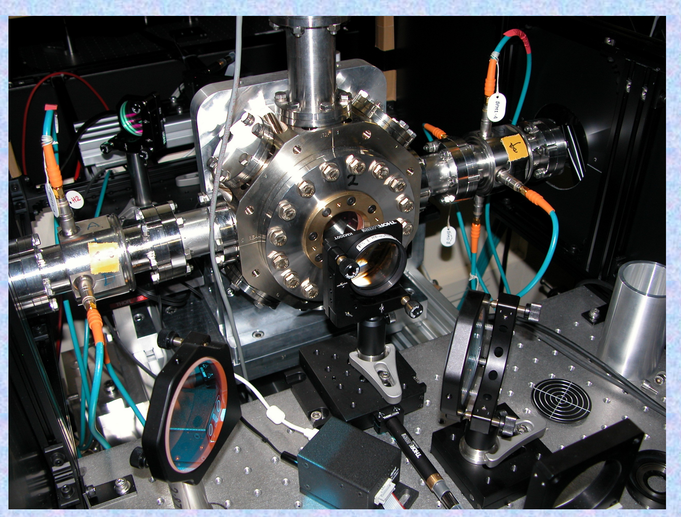
Smith-Purcell: The SP group aims at measuring the longitudinal size of the electron bunches. A SP experiment has recently been carried out at SLAC, which made use of a new mechanism for changing between filters. This resulted in the collection of superior quality data in a shorter period of time. A detailed calibration of the pyroelectric detectors used in the experiment is currently underway.

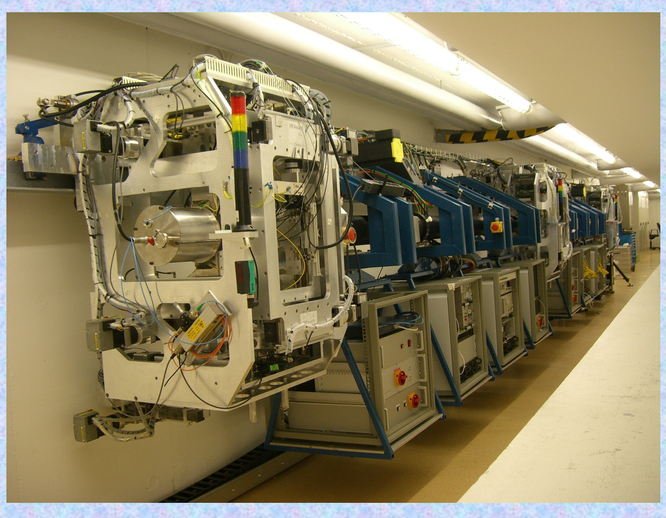




FONT: The F.O.N.T. (Feedback On Nano-second Timescales) project was set up to research, design and test an intra-train beam-based feedback system to achieve and maintain beam collisions, and therefore high luminosity, at a future electron-positron Linear Collider. It is one of the projects of the LC-ABD group which is part of the LCUK collaboration. We also participate through the TESLA Accelerator Physics and Design group. The picture shown to the left shows the May 2007 results of the FONT4 digital feedback prototype.

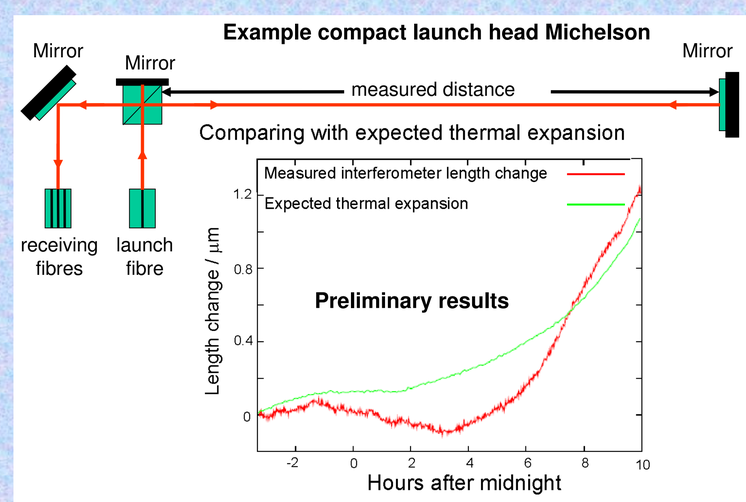
Laser-wire: The ILC will require a very precise measurement of the size of its beam to achieve the expected luminosity. As this is not possible with conventional methods, we are developing a new technique called “laser-wire” in which a laser beam is swept across the electron's path. The profile of the beam is obtained by looking at the profile of the Compton photons produced. We have successfully installed and operated a prototype laser-wire in Japan. Our work includes the design, simulation and measurement of low f# optics, the design and construction of the mechanical system and the development of a new high power high repetition rate laser based on photonic crystal fibres.





LiCAS: The Linear Collider Alignment and Survey collaboration (JAI Oxford & DESY geodesy group) has developed a prototype Rapid Tunnel Reference Surveyor (RTRS). Its purpose is to survey the reference network in the ILC tunnel, quickly and accurately enough for high luminosity orbits to be found via beam based alignment. The RTRS utilises Frequency Scanning Interferometers, Laser Straightness monitors and gravity referenced tilt sensors. Its predicted accuracy is 120 (50) microns vertically (horizonally) over 600m at a speed of 3km per day. Such performance is beyond current open air optical metrology. The prototype will operate in a 70m tunnel at DESY until mid 2008. The next generation RTRS will be tested in the XFEL tunnel in early 2010 to evaluate the long distance performance.

MonAliSA: Interferometers have played a key role in unlocking our understanding of fundamental physics ever since Young in the early 1800s and later Michelson and Morley; who demonstrated the importance of high precision. The MonAliSA group develops novel, accurate, nanometre resolution, interferometric systems; continuing with this pioneering spirit into the demanding world of modern accelerator physics. In the final km “beam-delivery” section of the International Linear Collider (ILC) there are numerous diagnostic tools and magnets which require stabilisation monitoring, most crucially of all, the final focus quadrupole magnets. Solutions we produce will aid these and numerous other applications, where nanometre level measurements of motion between components can *only* be provided by interferometers.



LC-ABD website:

http://www.hep.man.ac.uk/lc-abd/

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