
MONALISA
TILC 09 TSUKUBA JAPAN Mon 20 April 2009

MONALISA

- ILC roles and requirements
- Interferometer measurements
- Recent results
- Highlights 2009/10

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Roles at ILC

- Monitor most position sensitive magnets
  - Final focus quadrupoles
  - Energy chicane magnets
  - Beam delivery system
- Provide independent monitor of position
  - Cross check beam-based measurements
  - Provides measurement when beams absent
  - Help relocation after push-pull

(Random example) ILD Letter of Intent

- QD0 alignment

DETECTOR INTEGRATION

MACHINE DETECTOR INTERFACE

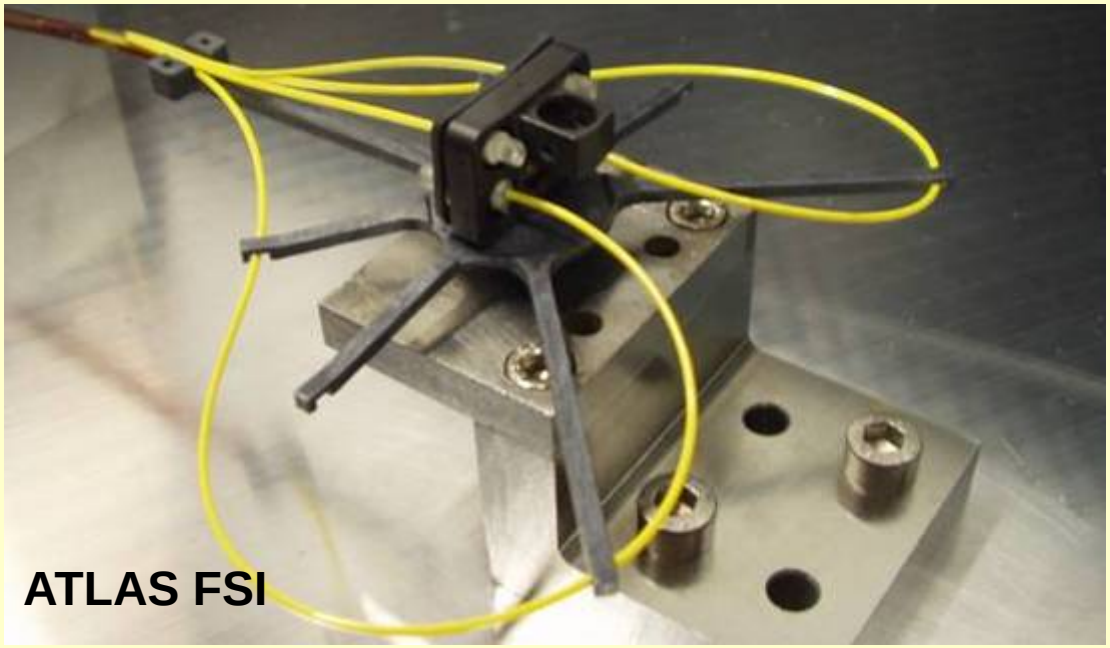
which is suspended from the TPC end flanges. The QD0 magnets reside on actuators in their support structure and are monitored using an interferometric laser alignment system like MONALISA [139]. The service cryostat for the supply of the QD0 magnets on the beam line, in the garage position and during the push-pull operations are located at the bases of the pillars and move with the platform.

The stability of the QD0 support structure has been studied. The vibrations induced by ground motions are at most 2.2 nm at 8.3 Hz which is below the limits of 50 nm defined in the minimum requirements document [137].

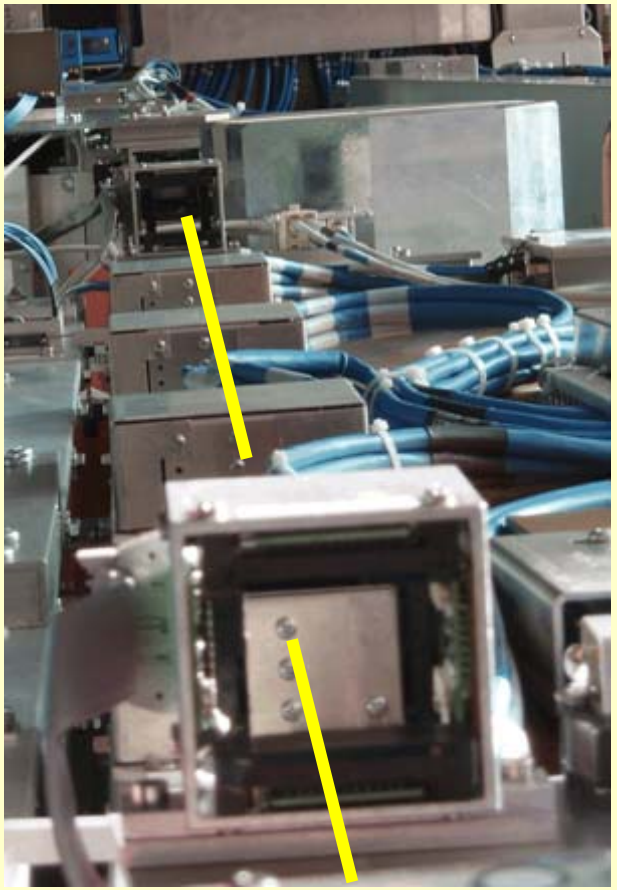
ILC detectors

- All 3 concepts call for interferometer system
  - letters of intent mention the idea
  - 19 Apr push pull ACFA and GDE/BDS session
- Later detailed engineering
  - where and how to arrange lines of sight
  - trade off between different options
    - studies at ATF-2 and CLIC will inform this process
  - other outstanding issues would include:
    - monitoring cold mass non-trivial
    - opening / closing lines of sight not yet mentioned in push-pull plans – probably too early to discuss now

LHC lessons



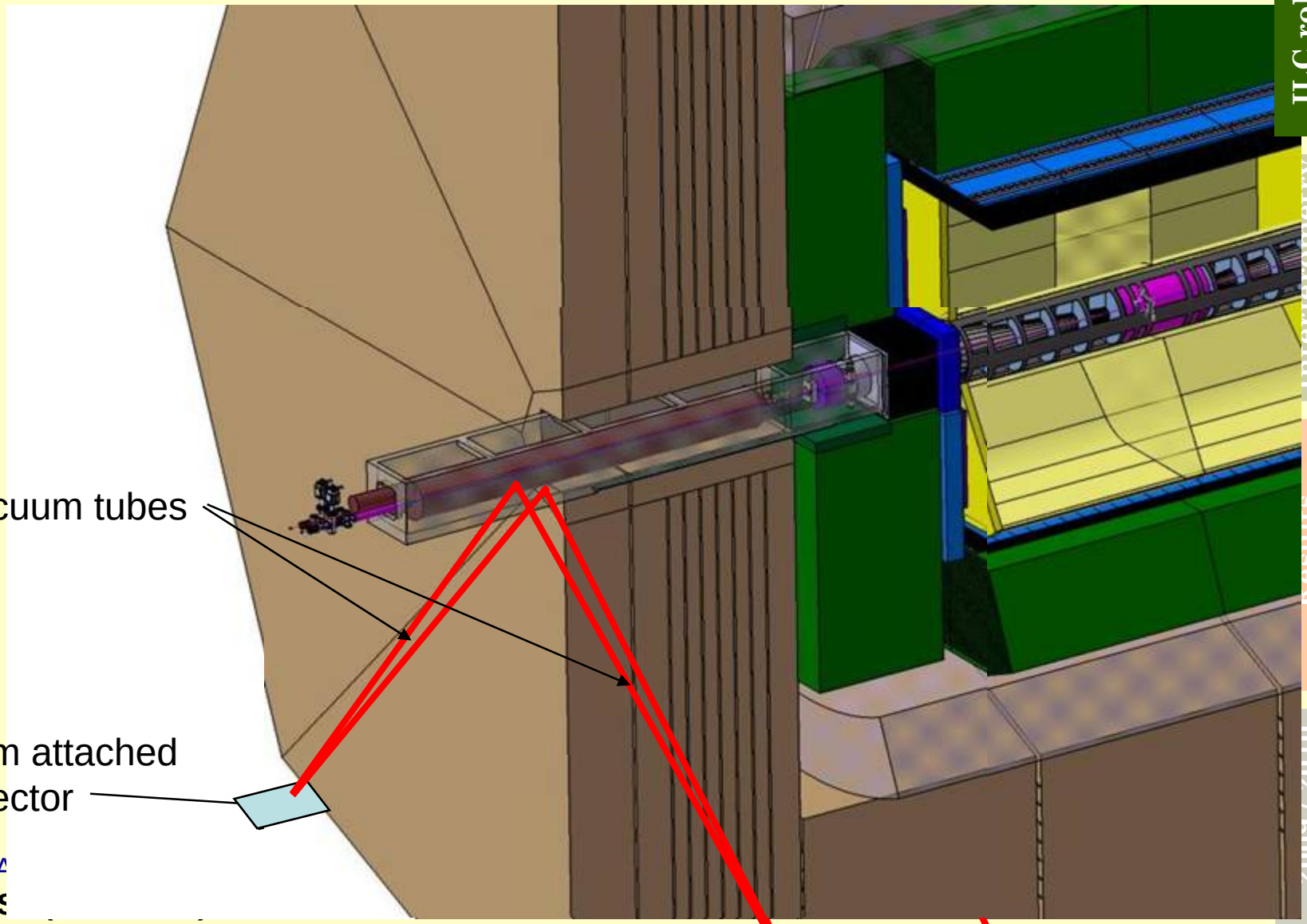
CMS



- Routing fibre –coupled interferometers requires more space than you might think

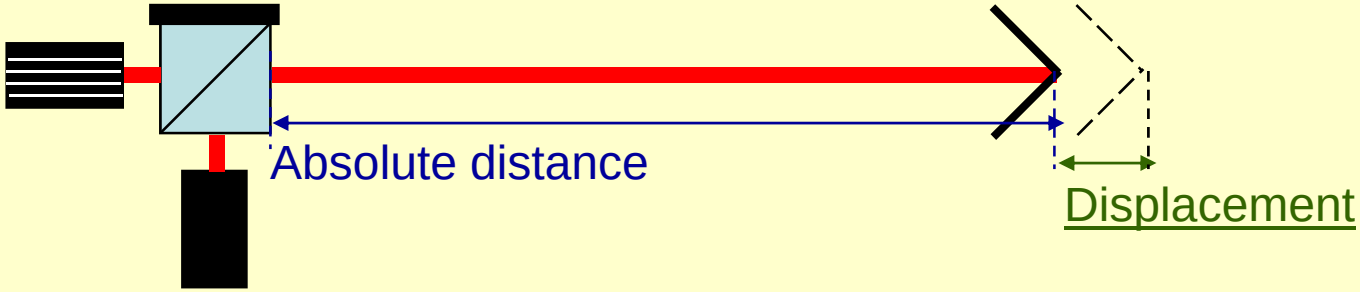
Put lines of sight into the design as early as possible

Narrow lines favoured through detector



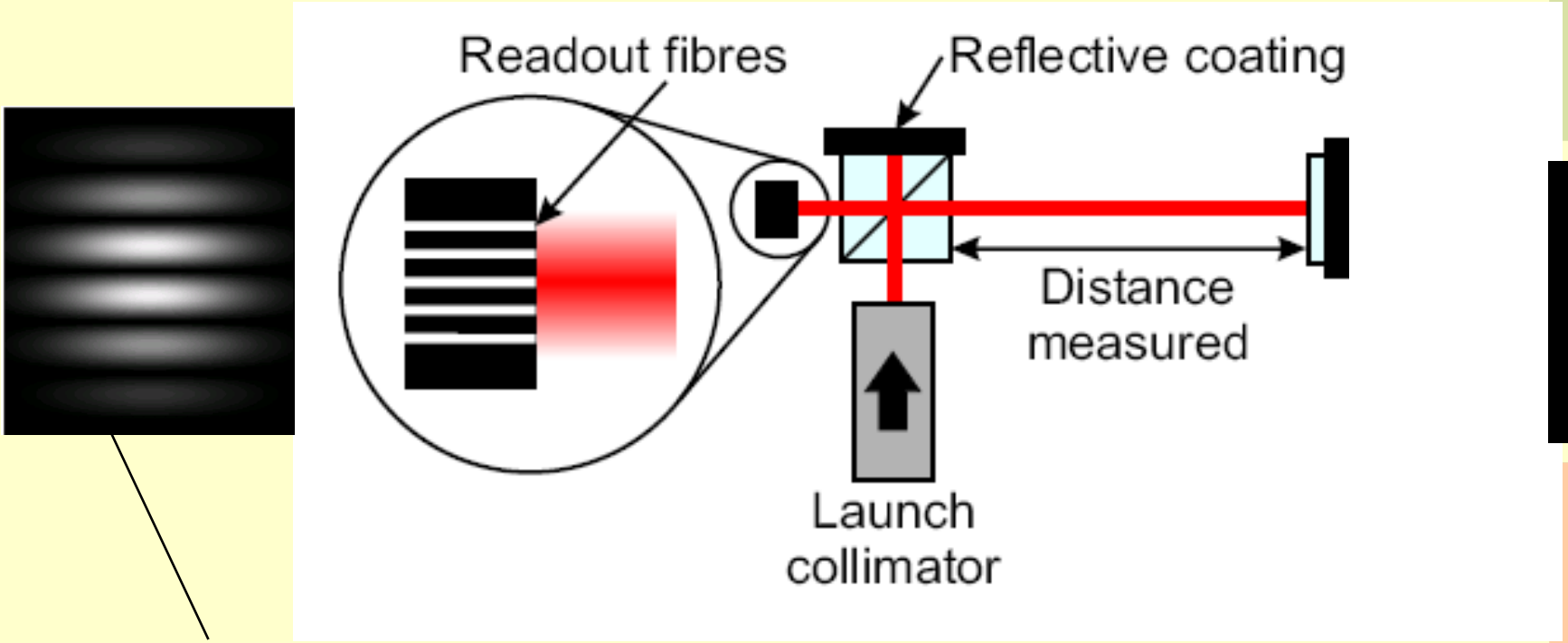
Interferometer: Distance meter

- Operates in two modes
  - Absolute Distance (< μm resolution)
  - Displacement measurement (nm resolution)



- Two modes combined
  - Displacements referred to absolute distance
  - Tolerant to interruption of measurements

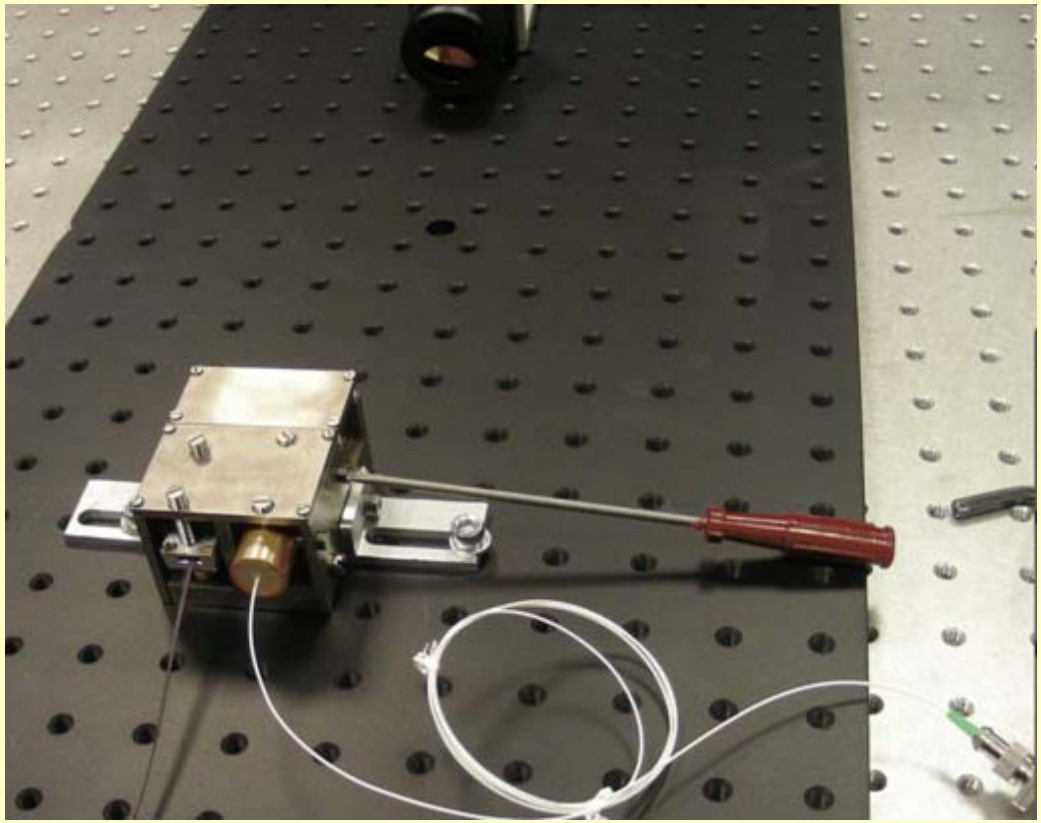
Interferometer: Distance meter

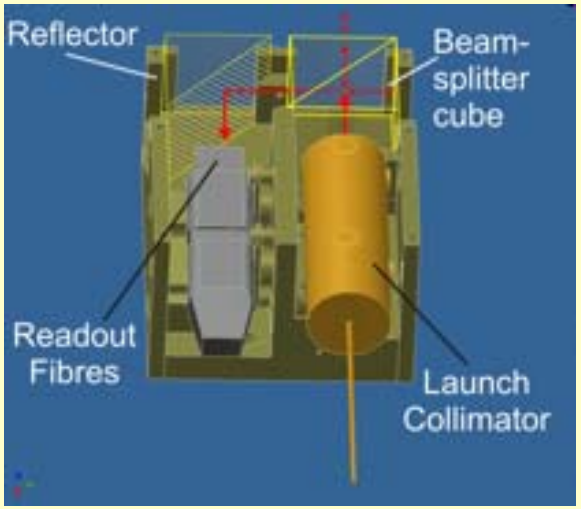


1. **Simulated fringe pattern – read out with parallel fibre array**
2. **Converted to interferometer phase reading**
3. **Measurements all based on phase values**

Interferometer head

- Prototype tested at Oxford



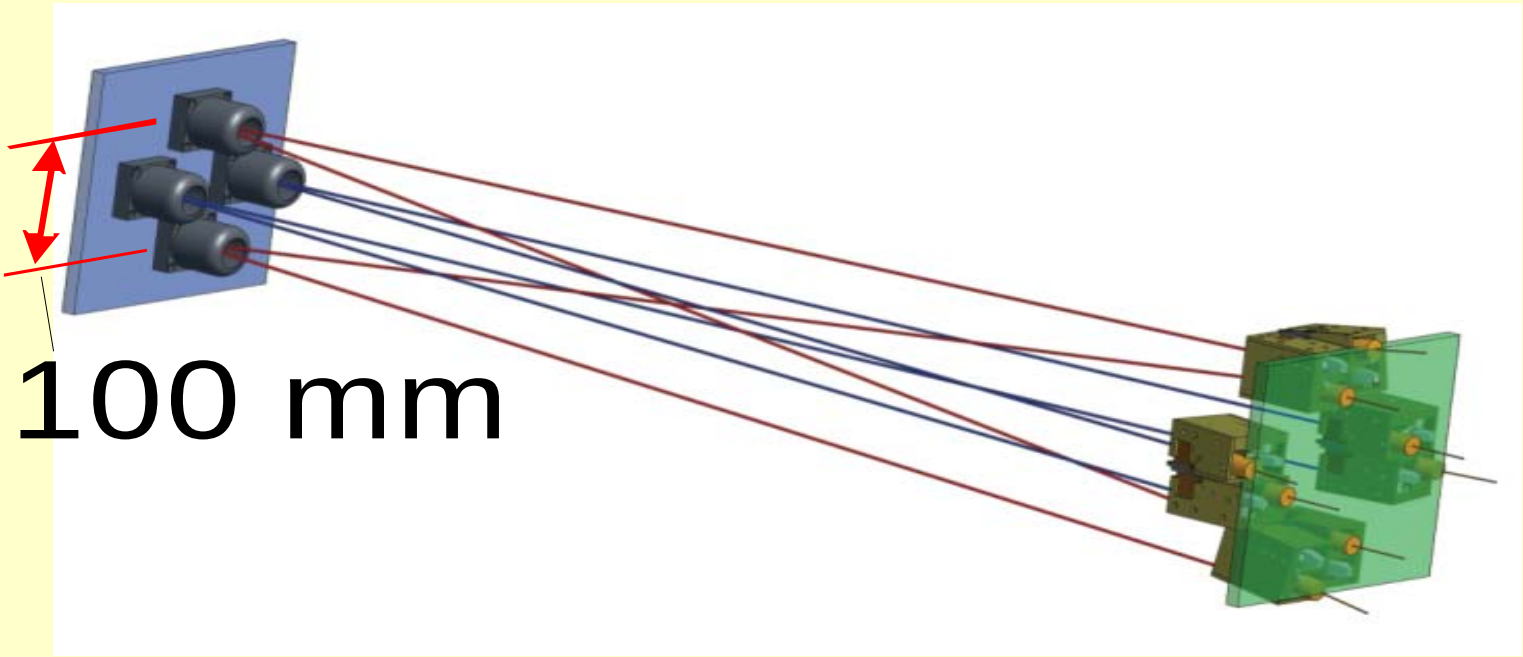


Interferometers: Make relative measurements

- Distance Meters measure point to point
  - Range and displacements (ε changes)
- 2 lasers reduce systematic errors of range
  - We use FSI laser and the FFI laser
- Compact Straightness monitor
  - Combines distance meters to measure object to object
    - 3 translational degrees of freedom
    - 3 rotational degrees of freedom

Instruments: CSM

- Compact Straightness Monitor
- Example from ATF2
  - Measures plane to plane
- Internal displacements and rotations measured
- CSM always blind to 6 external DoF

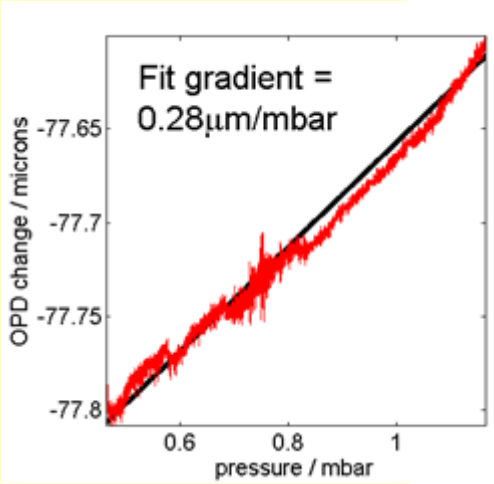


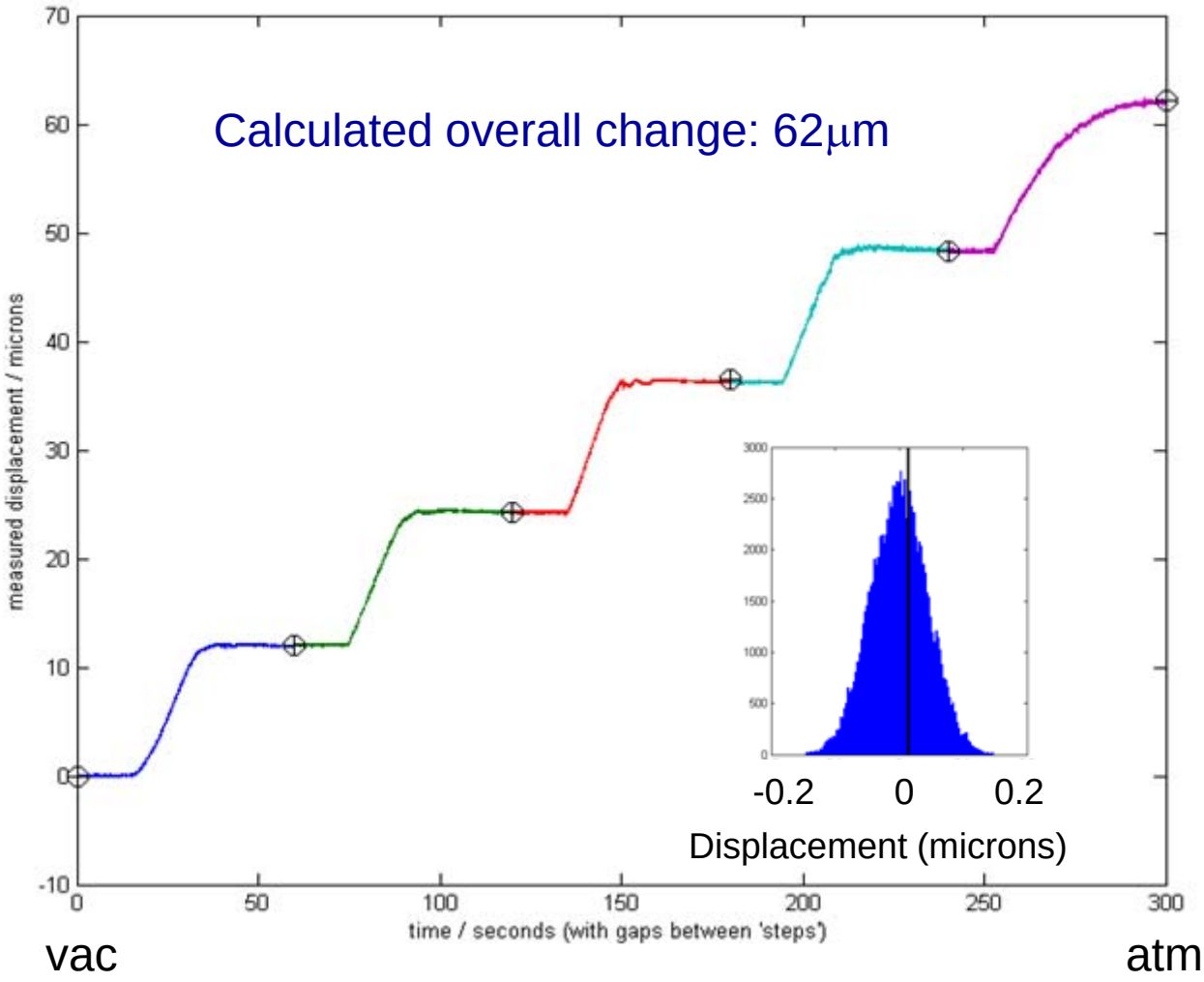
Recent tests

- Verified laser frequency stability
  - EUROTeV-Report-2008-031
    (EPAC08 Paper: TUPC121)
- Demonstrated FFI and FSI agreement inside vacuum vessel
  - see next slide

Changing pressure

- Good agreement between FSI and FFI
- **Strong correlation between pressure and measured OPD**

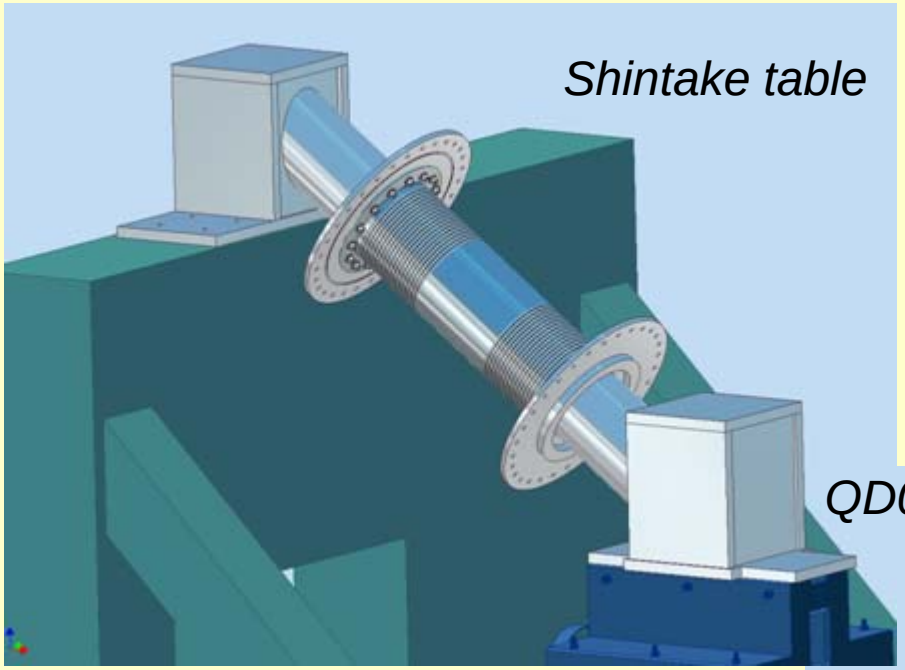




Highlights 2009 / 2010

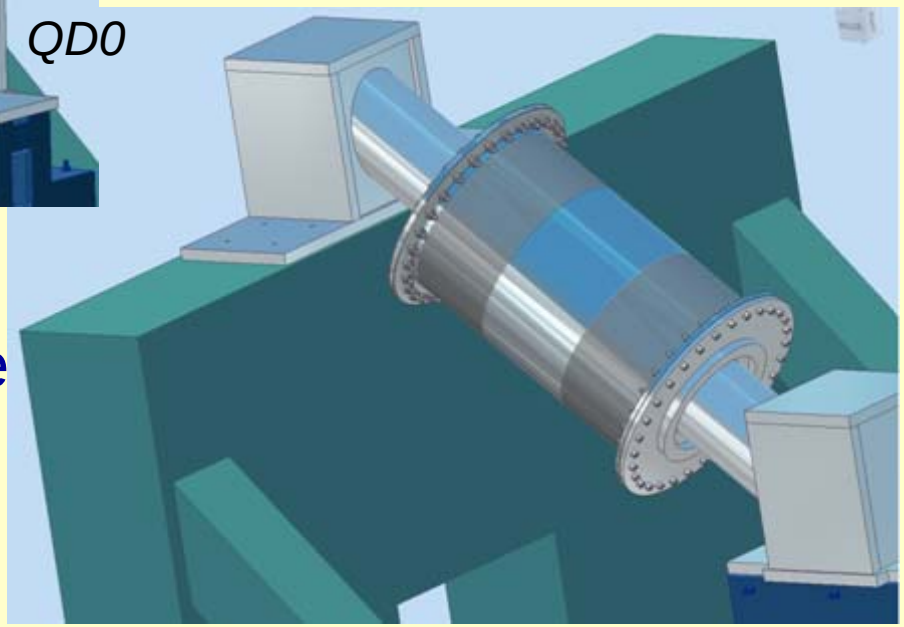
- Installation at ATF-2
  - July 09 install, test vacuum vessel at ATF2
  - Autumn install, test optics at ATF2
  - Commissioned system by Jan/Feb 2010
- Test magnet at CLIC
  - Simple initial interferometers mid 2010
  - Upgrade to CSM tests 2011
- Laser stabilisation system at Oxford
  - to provide Rb frequency reference
  - commissioning in 2009

ATF-2 installation 2009



Double bellow system

- encloses vacuum in centre
- high pressure outer

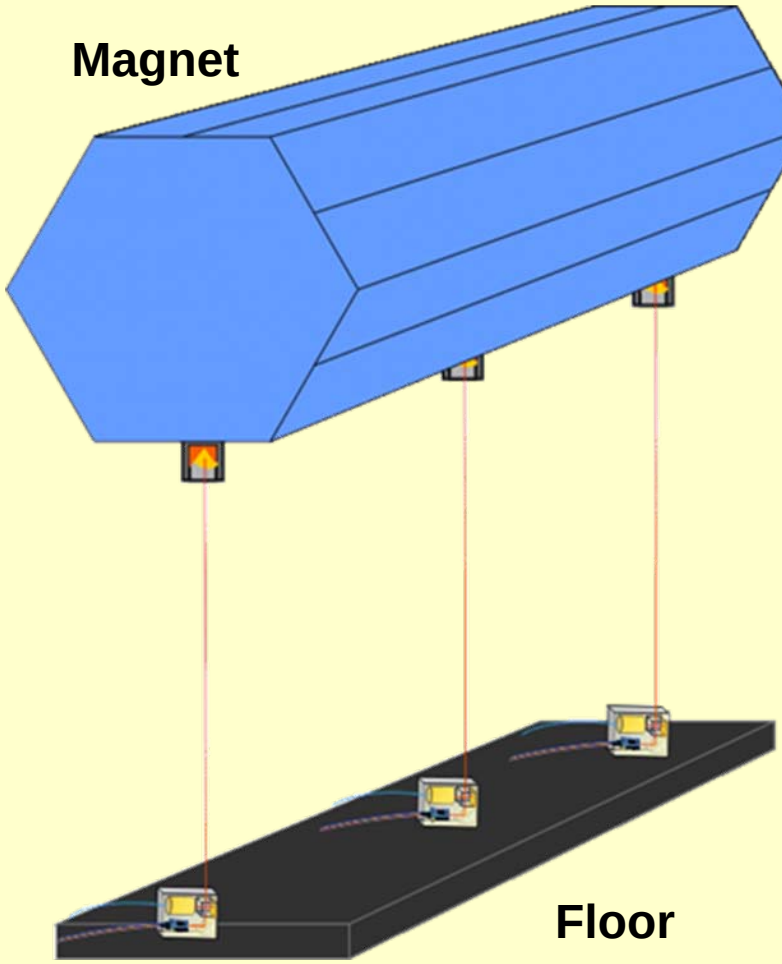


CSM interferometers

- lines of sight along centre
- reflectors on Shintake
- launch heads on QD0

Monitoring CLIC magnet 2010

- Test several points along the magnet
  - at first independent DMs
- Compare readings with accelerometers
  - on the magnet
  - and on the floor



Summary

- Installation at ATF-2 2009 / 2010
- Installation at CLIC test magnet 2010/11
- System testing / development ongoing at Oxford

Valuable information from this programme feeds directly into ILC and CLIC requirements for interferometric monitoring


Thank you for listening
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ございます。
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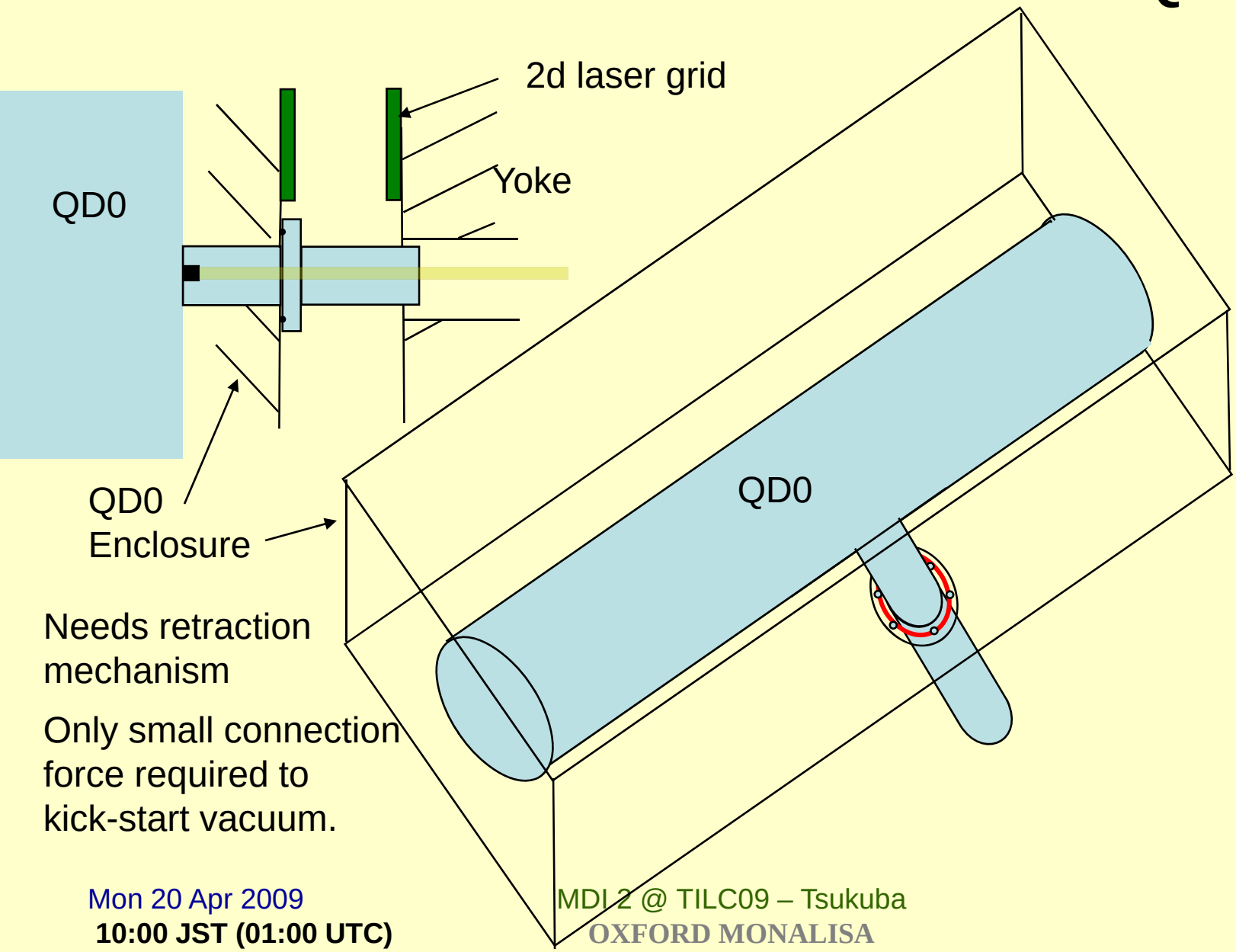
Back up slides – beyond this point

Ideal Case: Direct View of QD0



Needs retraction mechanism

Only small connection force required to kick-start vacuum.

Separation of Tasks: No direct view