Stabilization of Focus at ATF2

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StaFF

Stabilization of theFinal Focus

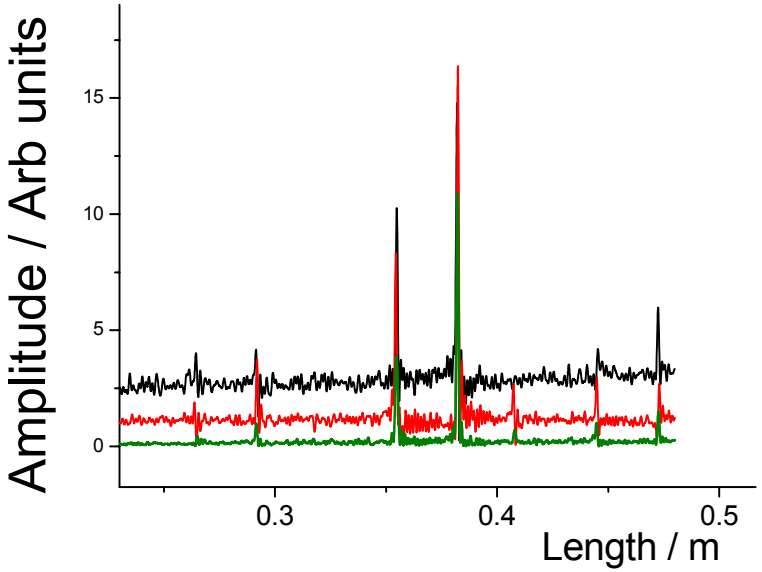
→

MonALiSA

Monitoring of Alignment
and Stabilization with high Accuracy

Interferometric Monitoring

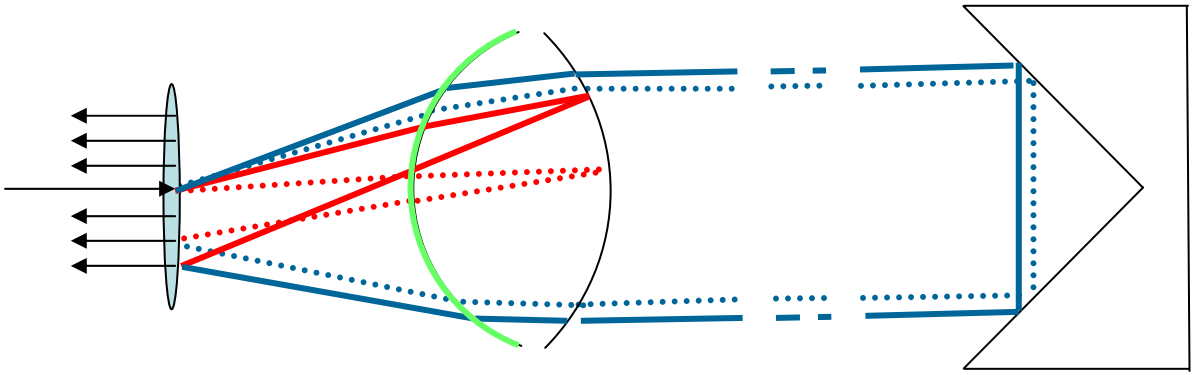
- Develop 2
  - Distance
  - Straightn 10m



over 10m

ution over

Dista



SI mode:

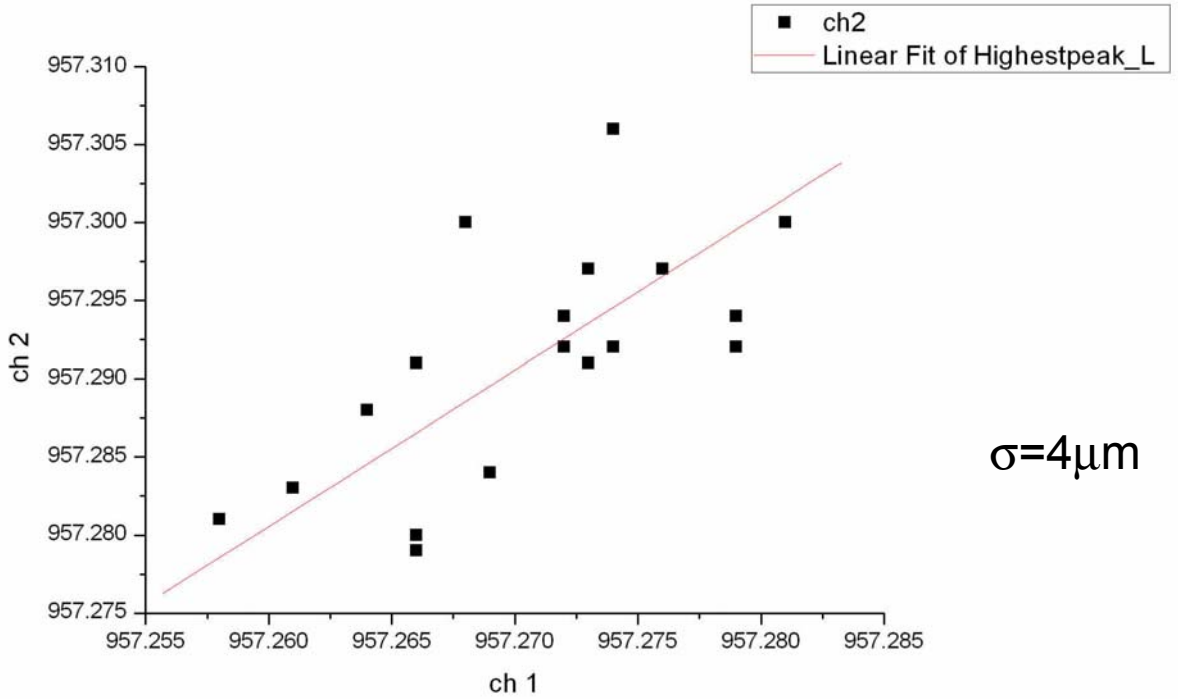
1μm resolution
absolute distances

Michelson mode:

1nm resolution
relative distances

FSI Performance

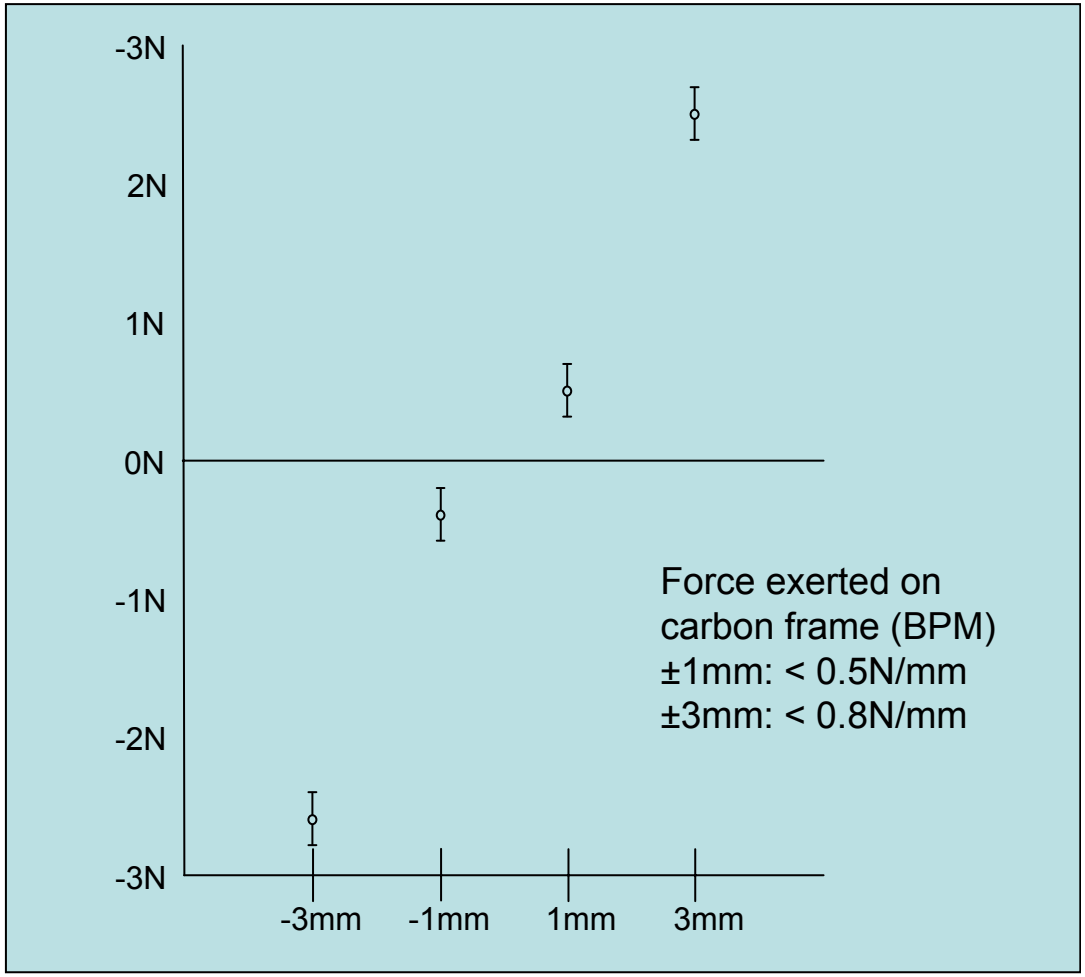
- Using 5m conventional Michelson interferometer in air as reference.
- Running at small tuning speed
- Tuning over small fraction of tuning range



σ=4μm

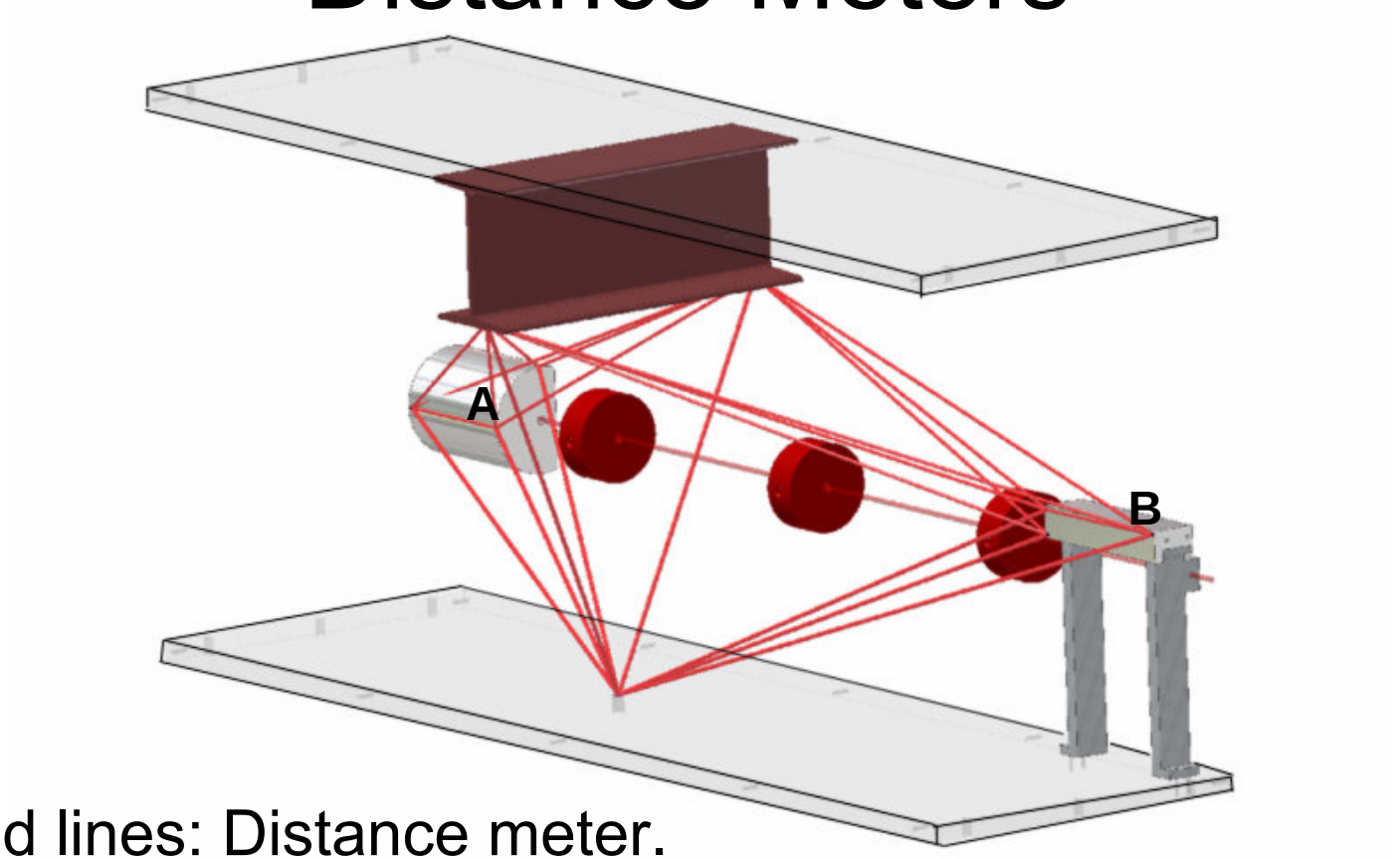
Attaching Vacuum System Force-Free

- Needs bellow to allow motion of BPM
  - Vacuum causes a force order of 100N!
- Develop small force vacuum mount using double bellow system.
- Allows small motion (~1 mm) of BPM-system
- Test stand to measure remaining (perpendicular) force on BPM frame.



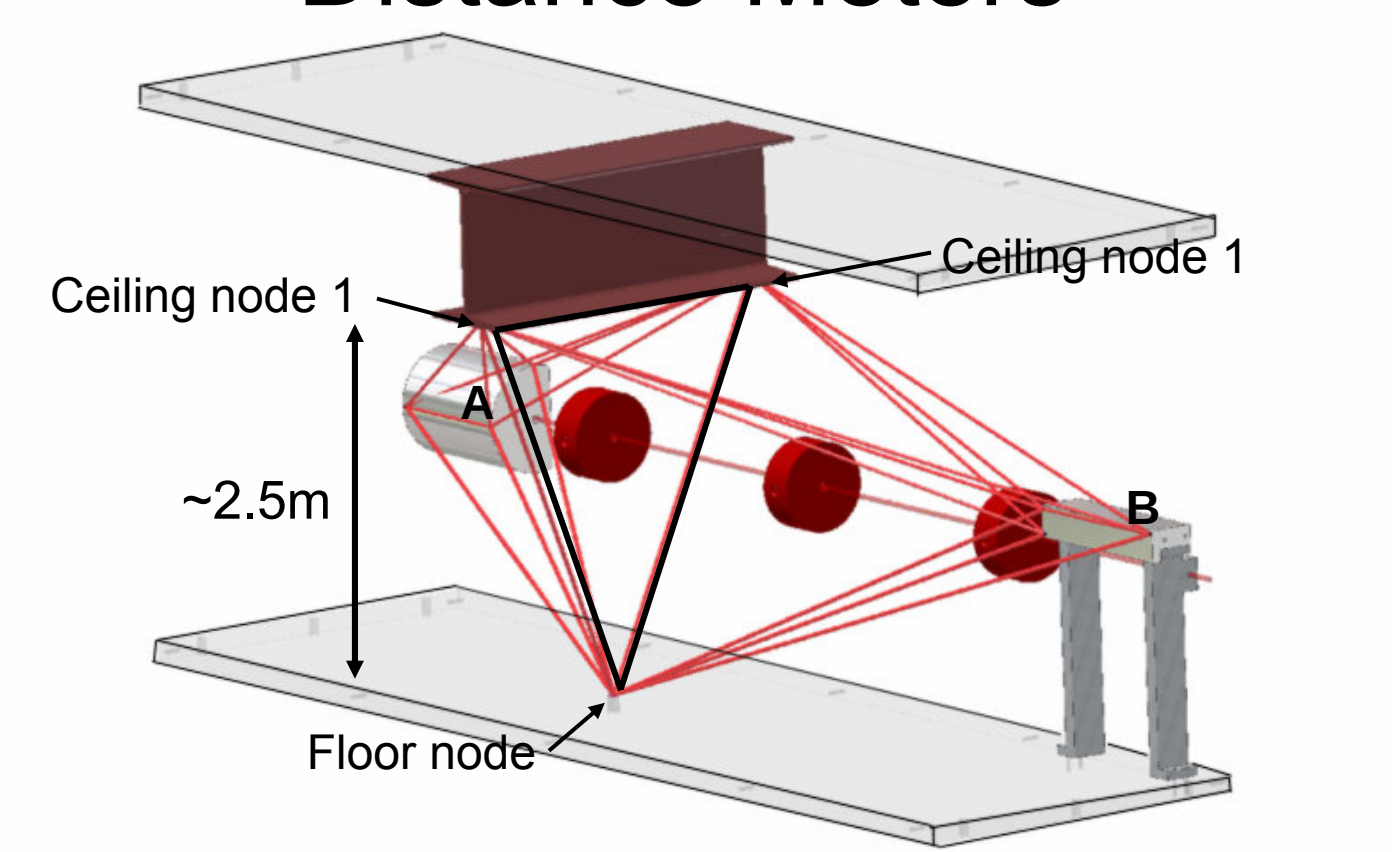
Force exerted by perpendicular motion

A Straightness Monitor Made from Distance Meters



- Red lines: Distance meter.
- Multilateration measure 6D coord. of A with respect to B.

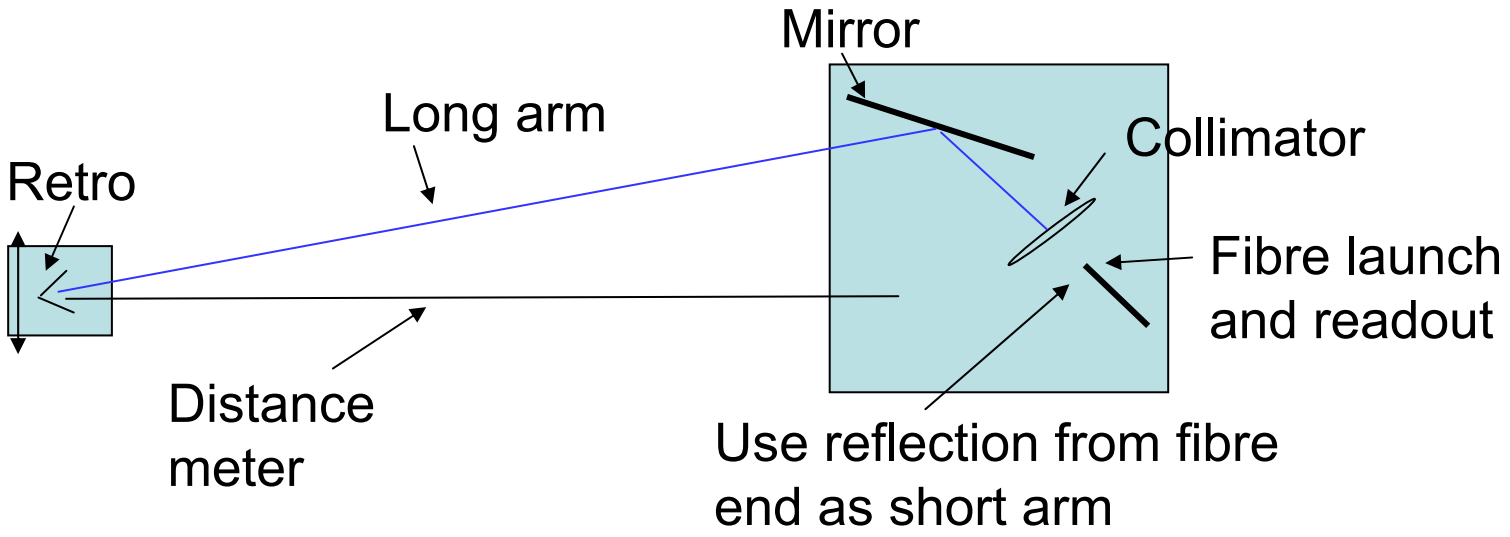
A Straightness Monitor Made from Distance Meters



- Information related via central triangle

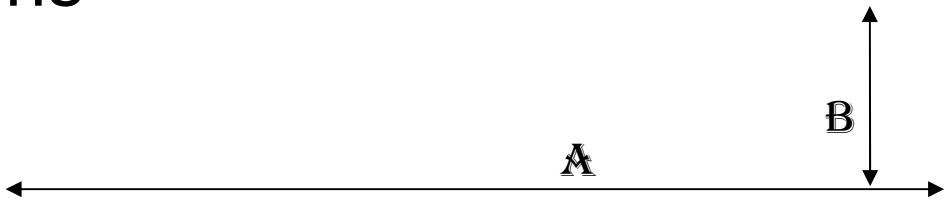
Compact Straightness Monitor

- Too big in perpendicular direction!
- Develop compact version
  - Need 2 devices to separate rotation from vertical translation. + length measurement
  - Next step: Test different ideas



Compact Straightness Monitor

- Too big in perpendicular direction!
- Develop compact version
  - Test different ideas
- Aspect ratio A/B is relevant
- A 5m: B somewhere at 20cm – 50cm for 1nm resolutions



ATF2: Stabilization

- General strategy:
  - Use one active feedback system only, which can combine inputs from several measurements
    - Difficult if active feedback system compete!
  - Test of a system with several input measurements using StaFF setup that will be installed at ATF.
  - Big question is where to locate the actuators to get best response
- Should consider a system moving beam with kicker rather than move Shintake monitor.
  - This is a feed forward system, which is easier to control than an active feedback system.
  - Additional cost?
  - Do we introduce jitter by such a kicker, and how much?

Placement of MonALiSA monitoring system at ATF2

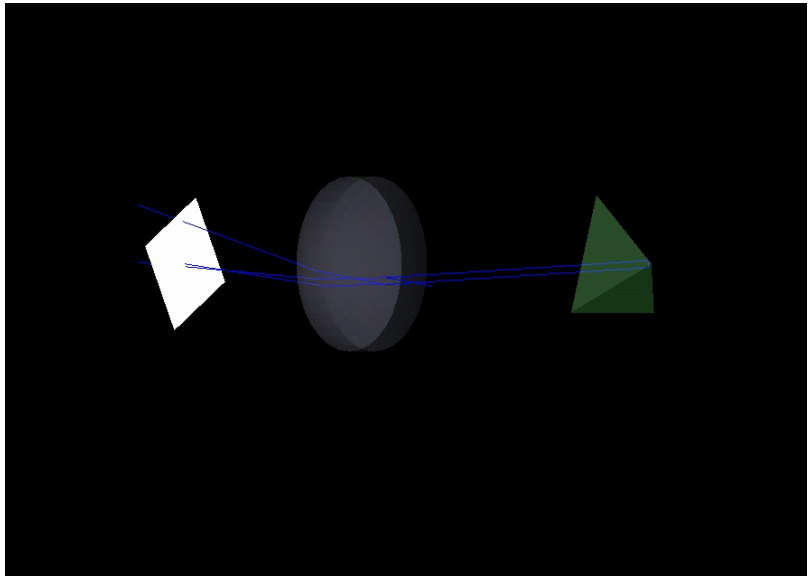
- Easiest if we have direct line of sight between FF quadrupole and Shintake monitor.
  - Which is the crucial element of Shintake monitor do we have to monitor.
    - Are there several parts to monitor
    - Can we get optical access to the crucial element(s)
- We need room (30-50cm) above either the Shintake monitor or above the FF magnet
  - Probably easier to get above magnet.

Funding and Timeline

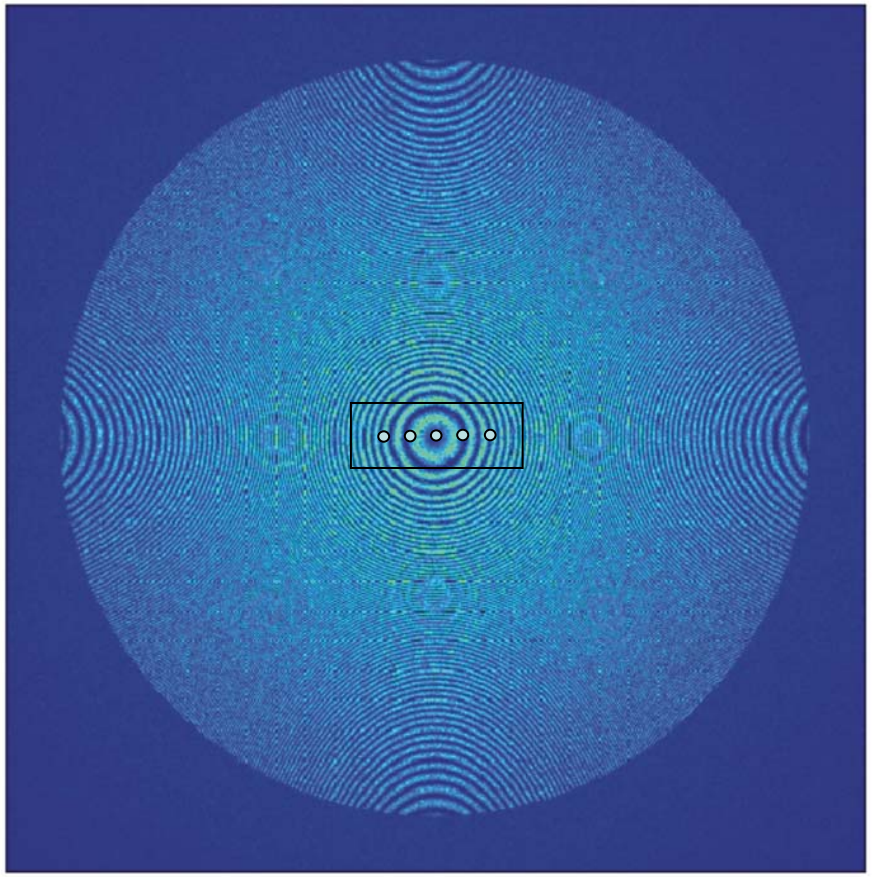
- We are currently preparing bids to get funding in the framework of LC-ABD
  - 1 postdoc 2007-2010
  - ½ DAQ expert
  - Resources in electronics engineering and construction, mechanical design and workshop
  - Funds to develop prototype and final system for ATF2
- We expect to have a first system ready early 2009.
  - Any reason why we urgently should be ready earlier?

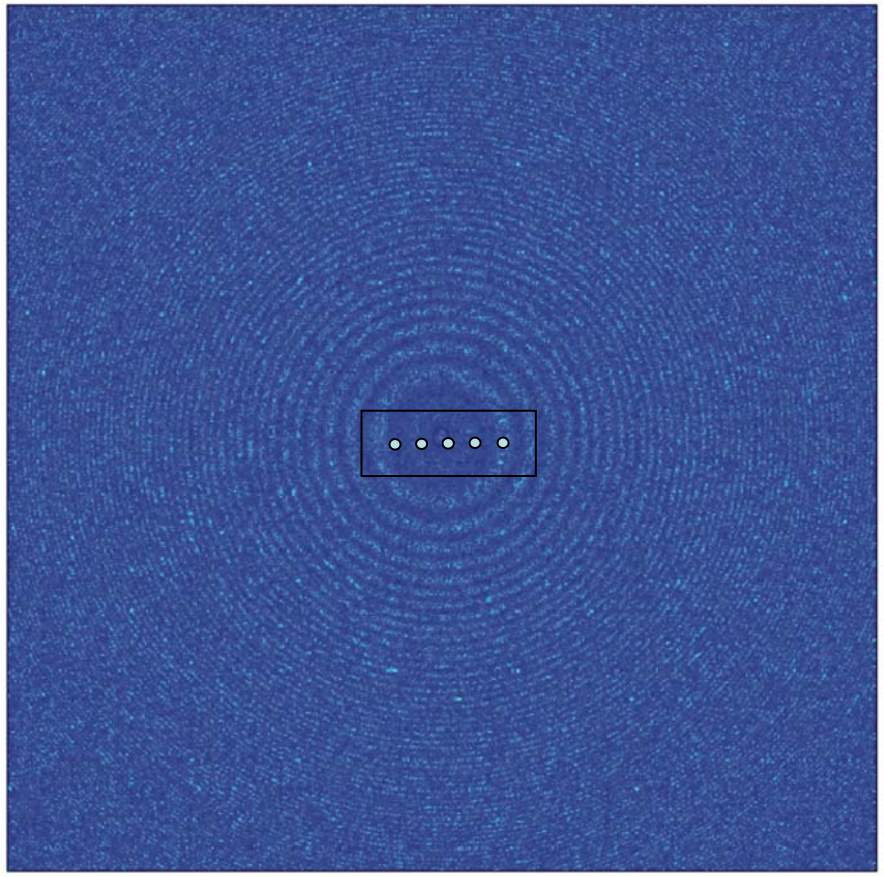
Distance meter simulation

- Simulation done with Zemax
- Use non-sequential mode
  - Take into account polarisation → correct interference pattern
  - Allows stray light analysis
- Allow analysis of chromatic aberrations

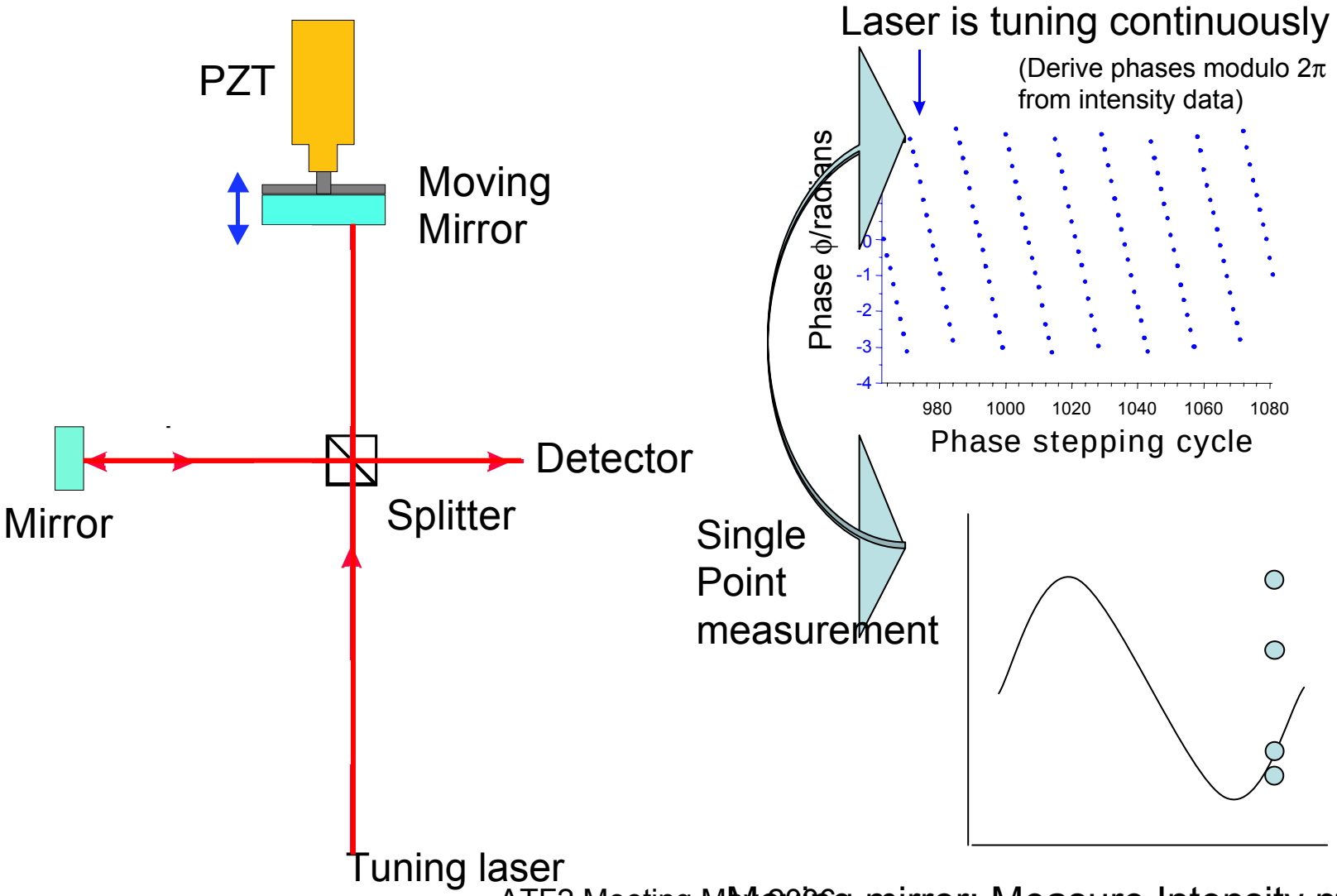


Simulated Interference Patters



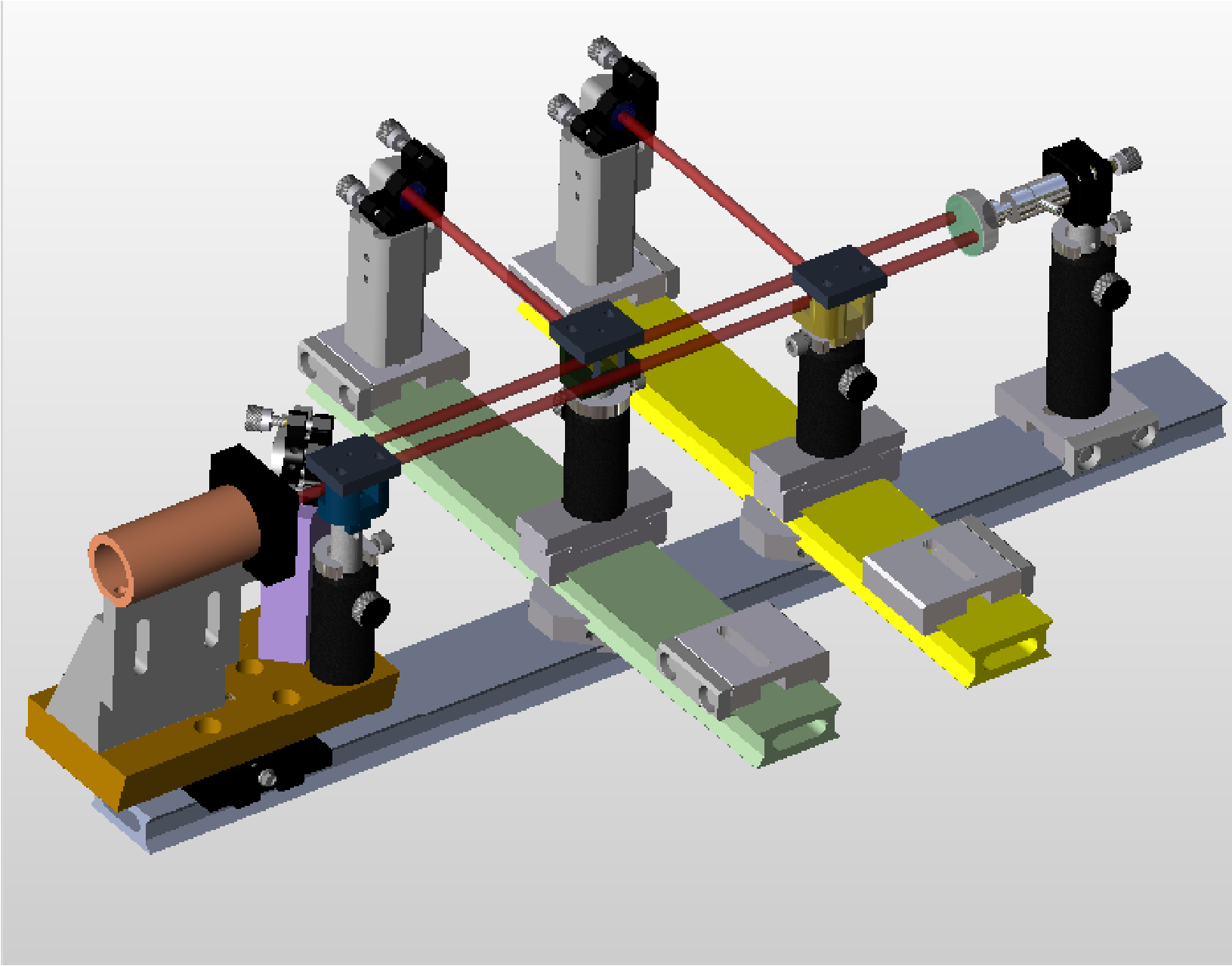


Piezzo Driven Monitor



Moving mirror: Measure Intensity pattern

3–D mechanical model, detector side removed for clarity



First Temperature Measurements