# StaFF / MONALISA

David Urner
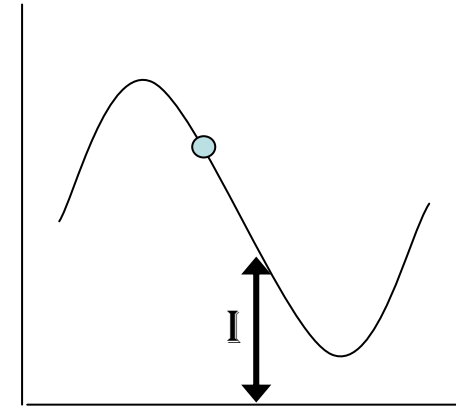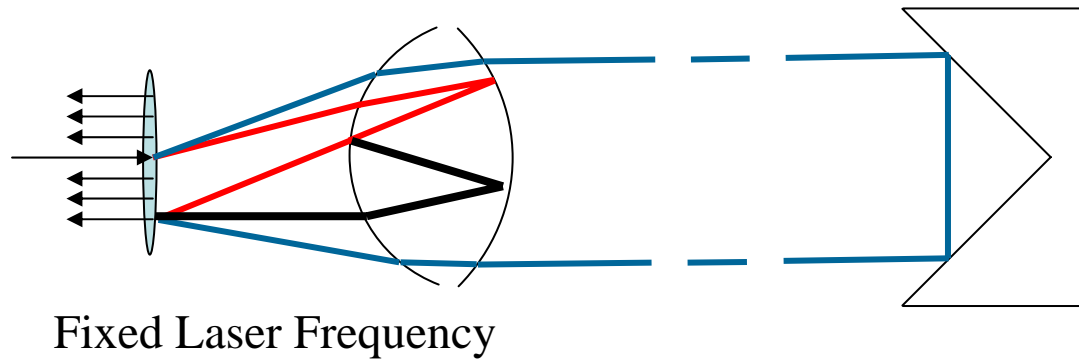Paul Coe
Matthew Warden
Armin Reichold
Oxford University

# The Distance Meter: Michelson mode



Fixed Laser Frequency

- Length motion leads to change in interference pattern
  - Measure intensity I.
- Double Reflections in lens lead to multiple interference patterns
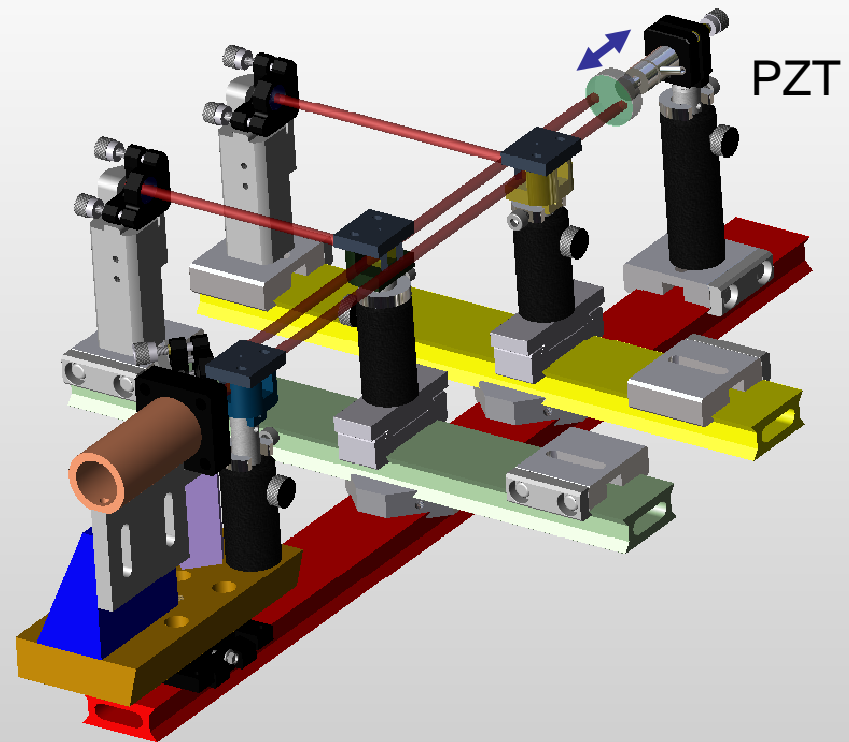  - Does not work!

# STATUS: New Design

- More traditional Michelson setup leads to nice results.

- Integration of many interferometer into one node more difficult –

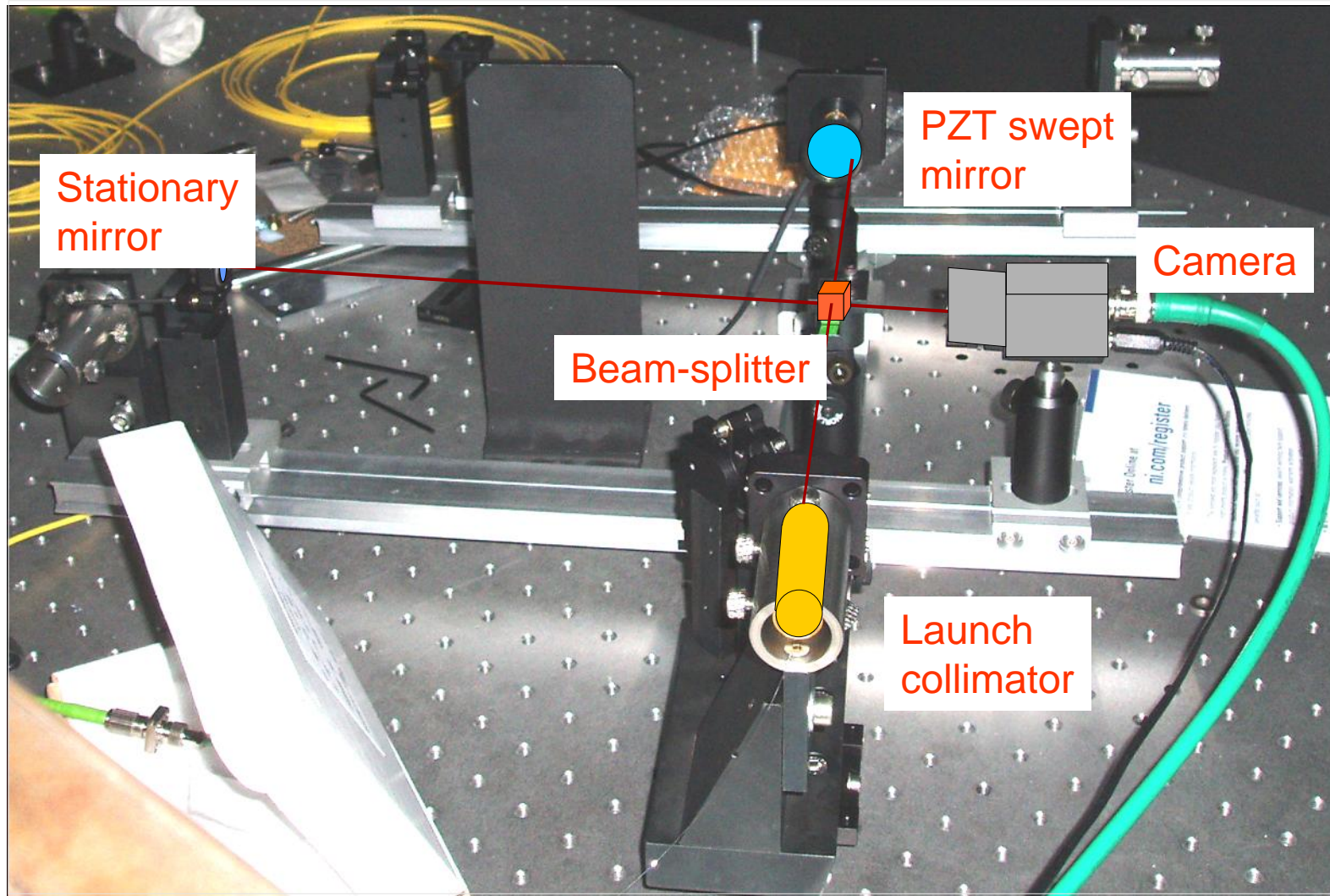- A compact version is ready and shows promise.

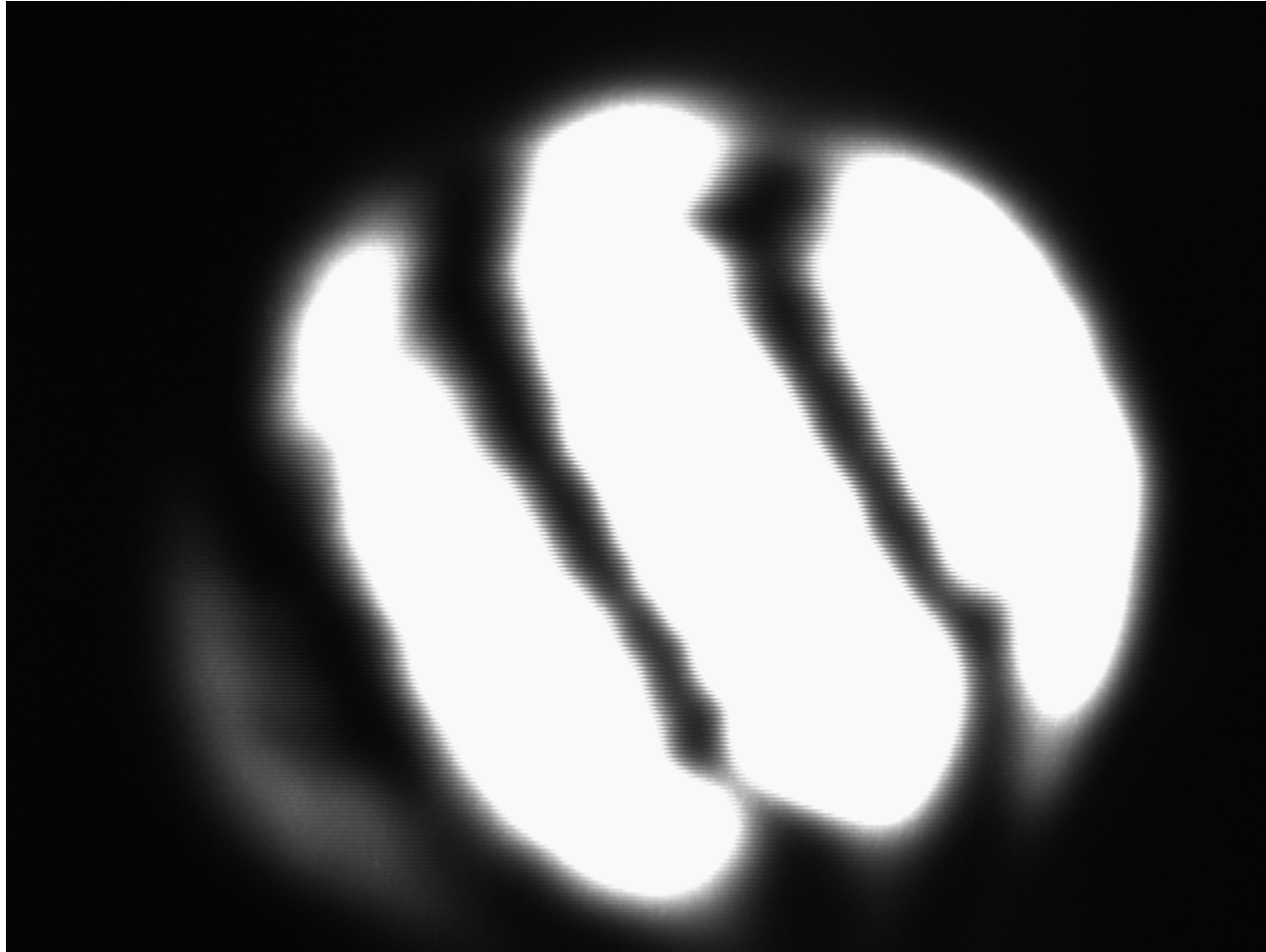# Parallel Michelson



**Original concept**

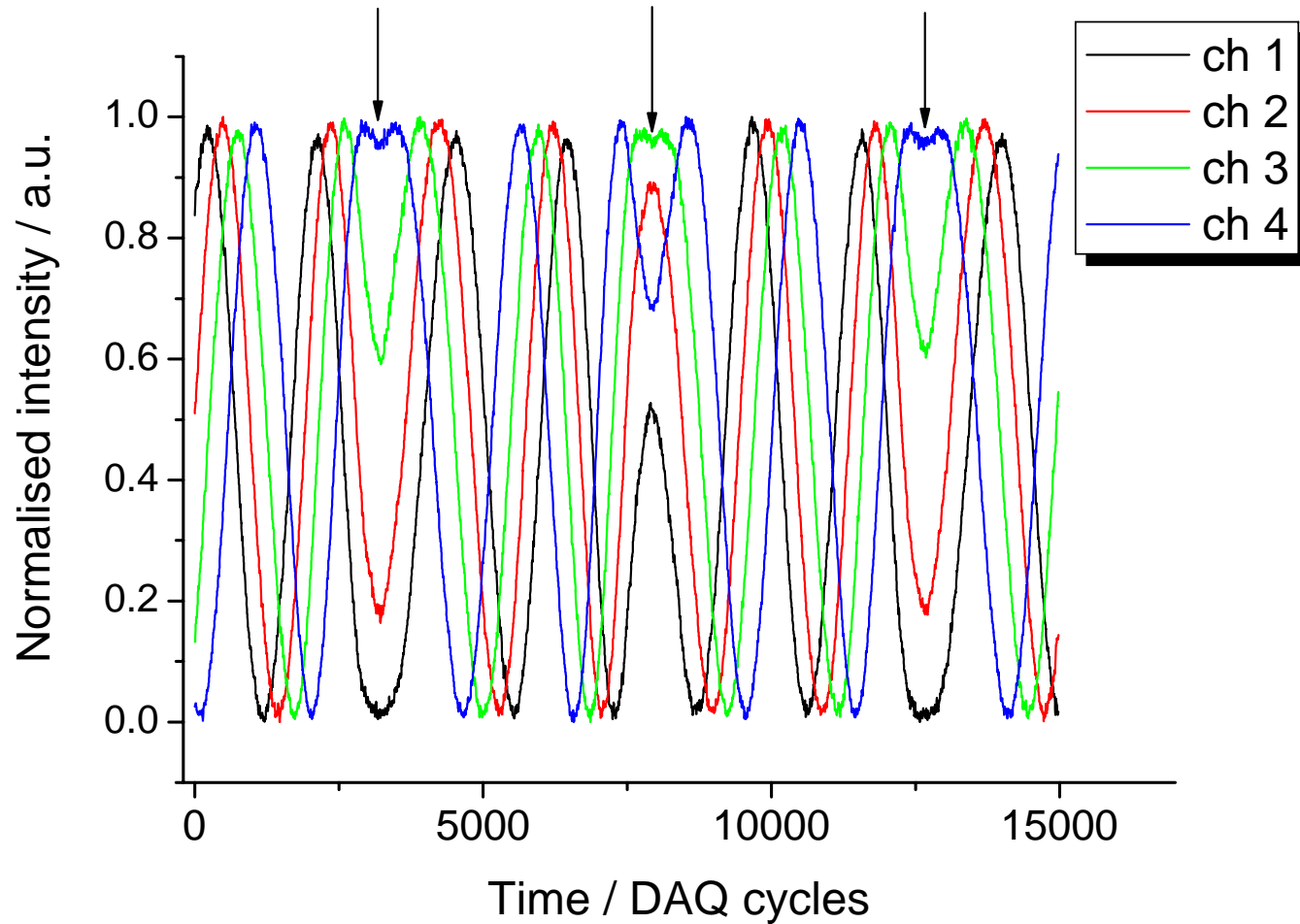**Mechanical design**

PZT

PZT

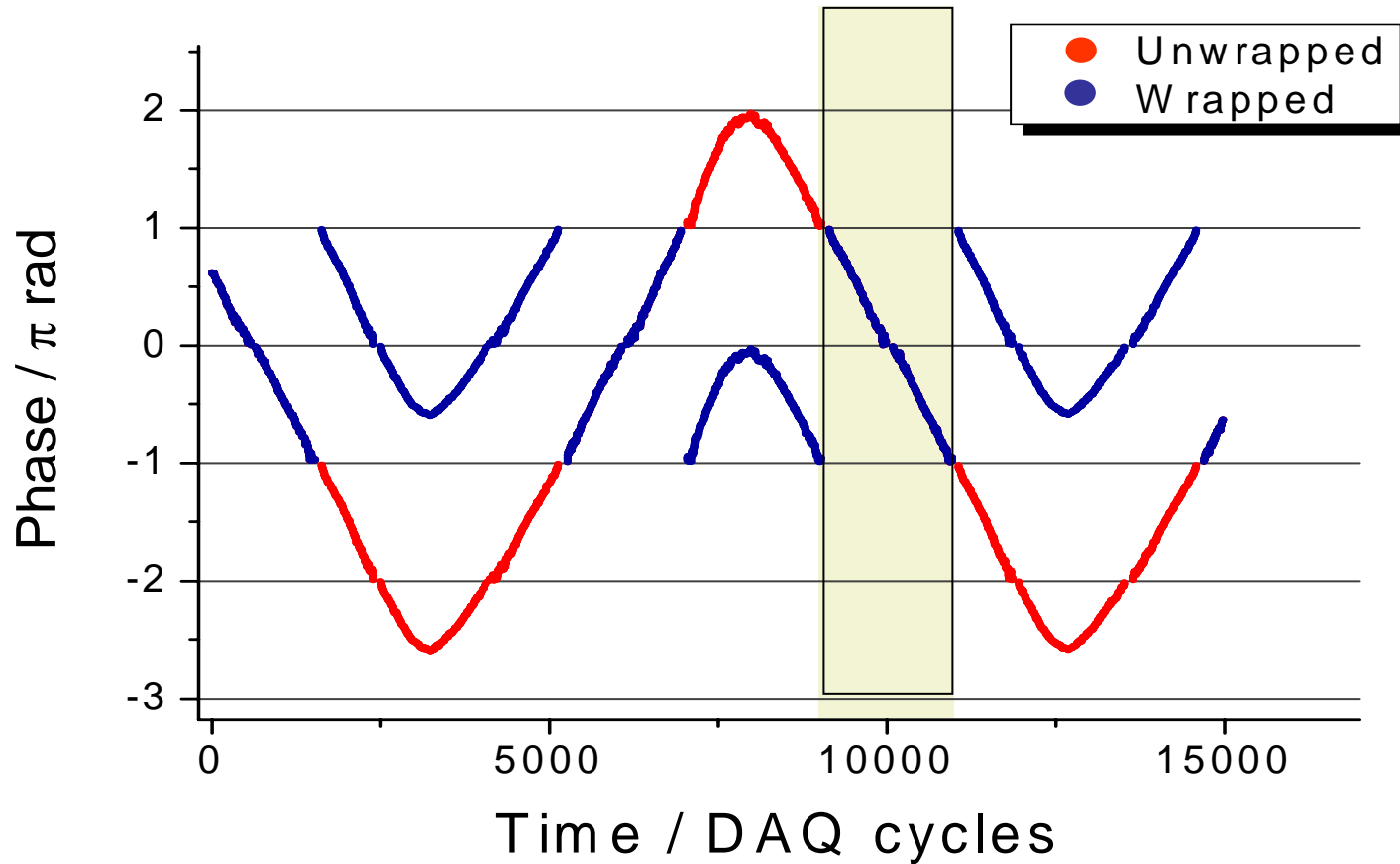Input beam
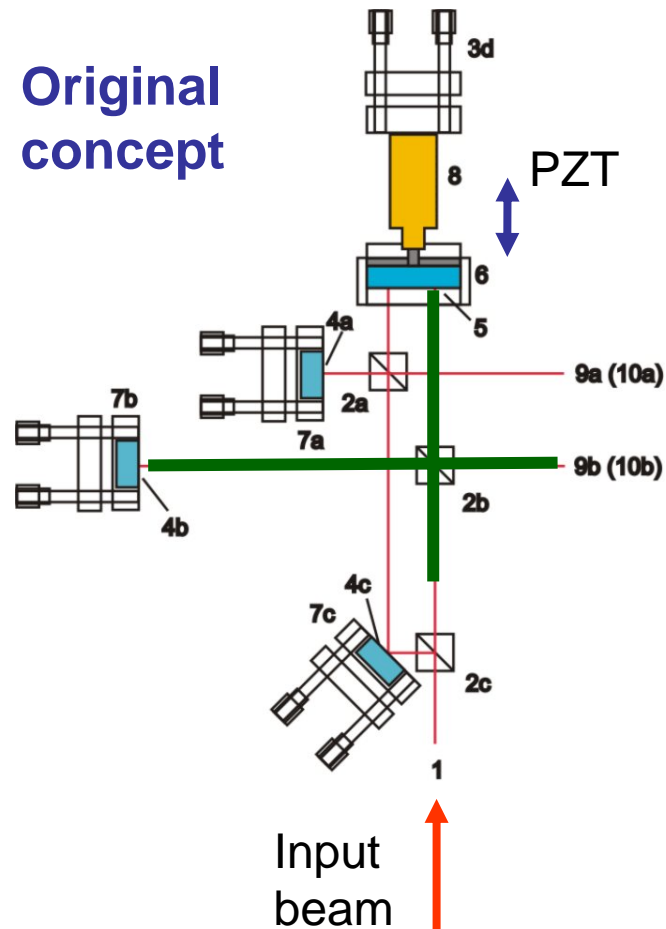
# Michelson : realised in the lab

# Michelson :
## Camera view of mirror sweeping

Replaced camera with MT connector
used 4 nearest neighbour fibres to read out

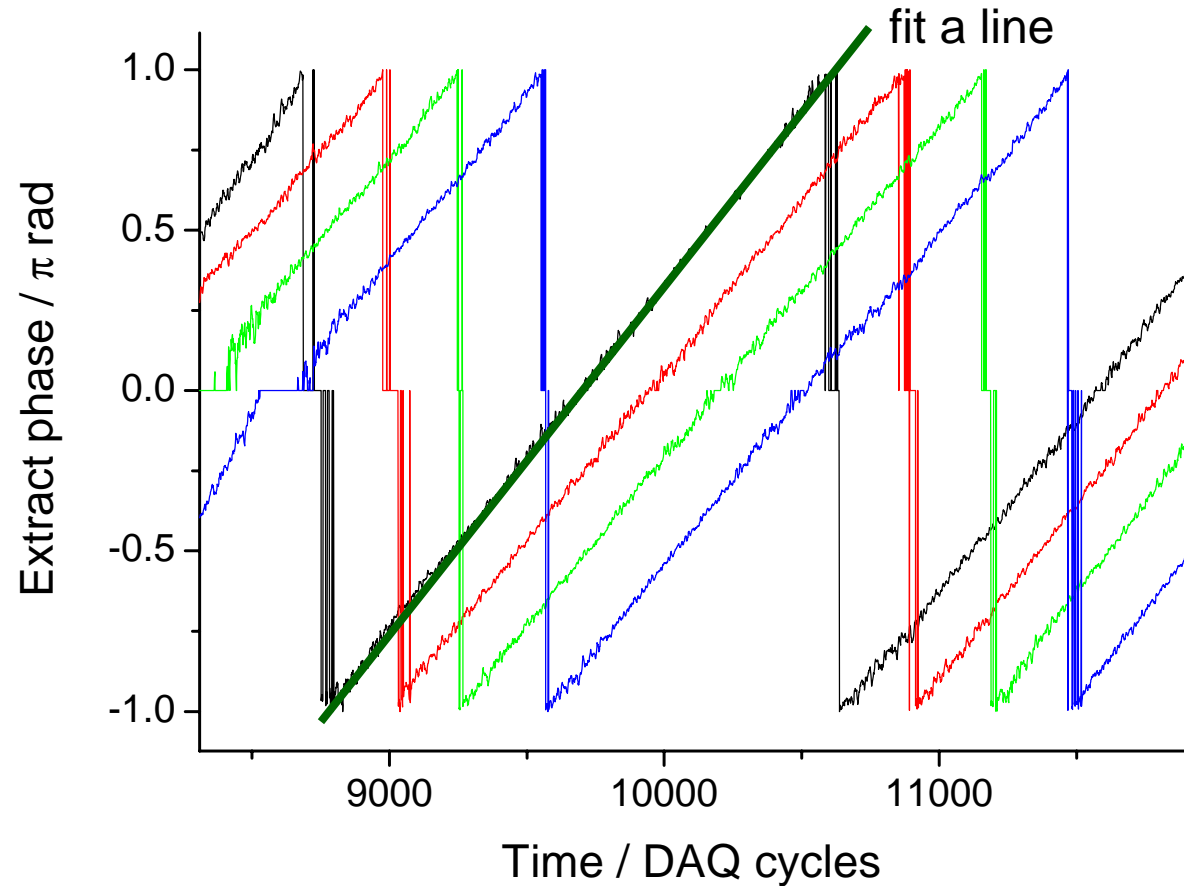# Use modified Carré algorithm to extract 4 channel average wrapped phase

# Use modified Carré algorithm to extract wrapped phase <u>for each</u> channel

**Extract independently from each channel using 4 points separated equally in time**

**Here 320 cycles apart**
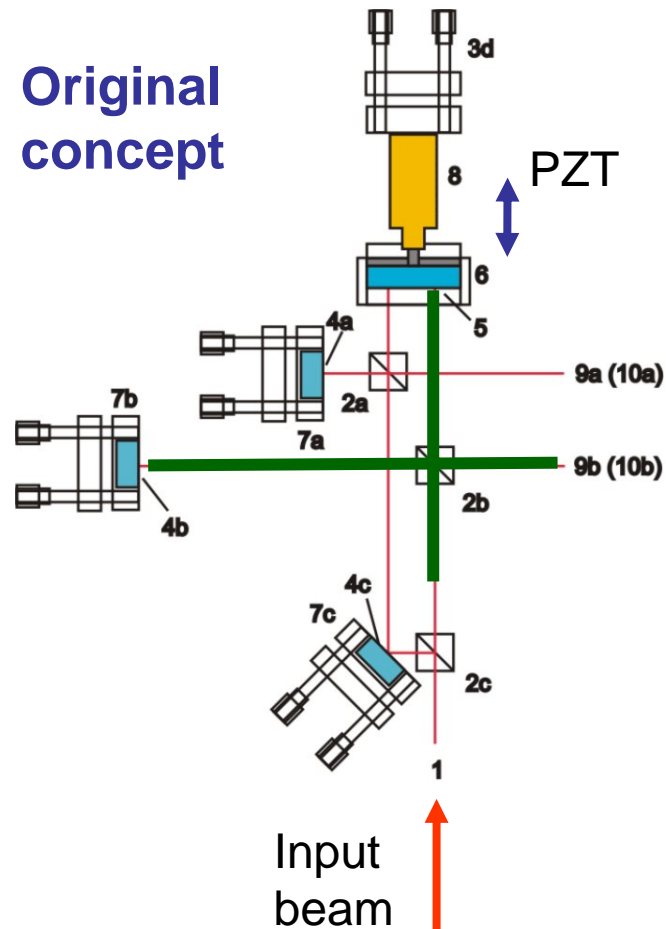
Fit a line to each straight section around cycle 10 000 and extract residuals

**$1\sigma$ ~ 40 mrad equivalent 10 nm**



fit a line

Extract phase / $\pi$ rad

Time / DAQ cycles

# Parallel Michelson

**Original concept**

**Mechanical design**

PZT

PZT

3d

8

6

5

4a

2a

9a (10a)

7b

7a

9b (10b)

2b

4b

4c

7c

2c

1
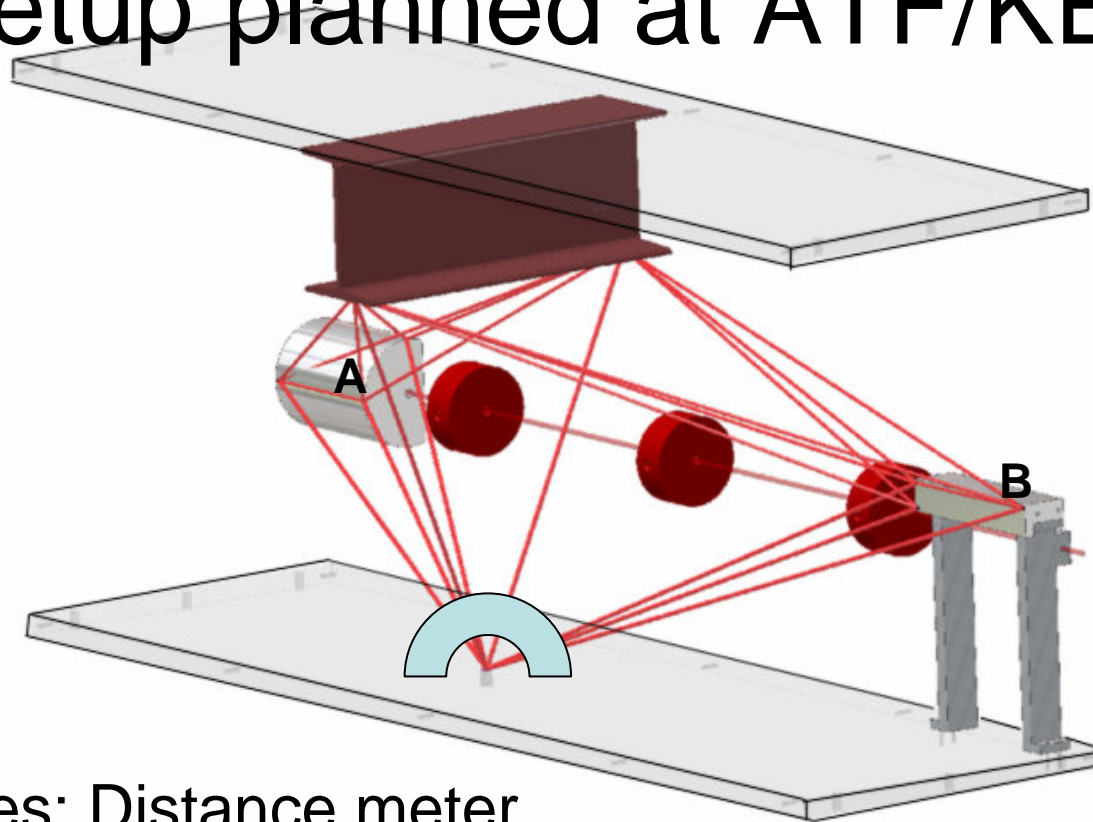
Input beam
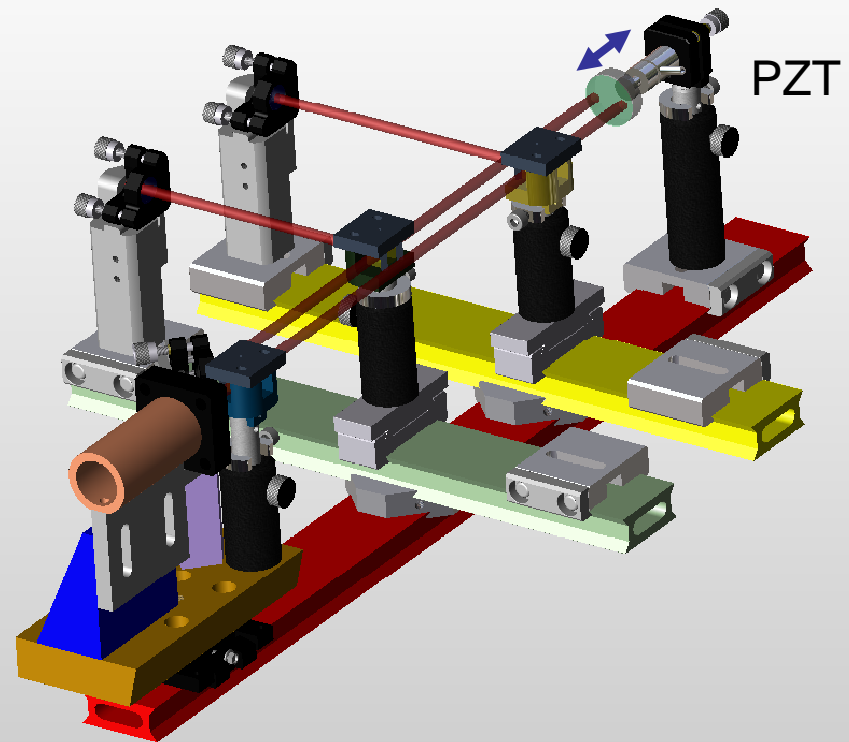
# A Straightness Monitor Made from Distance Meters
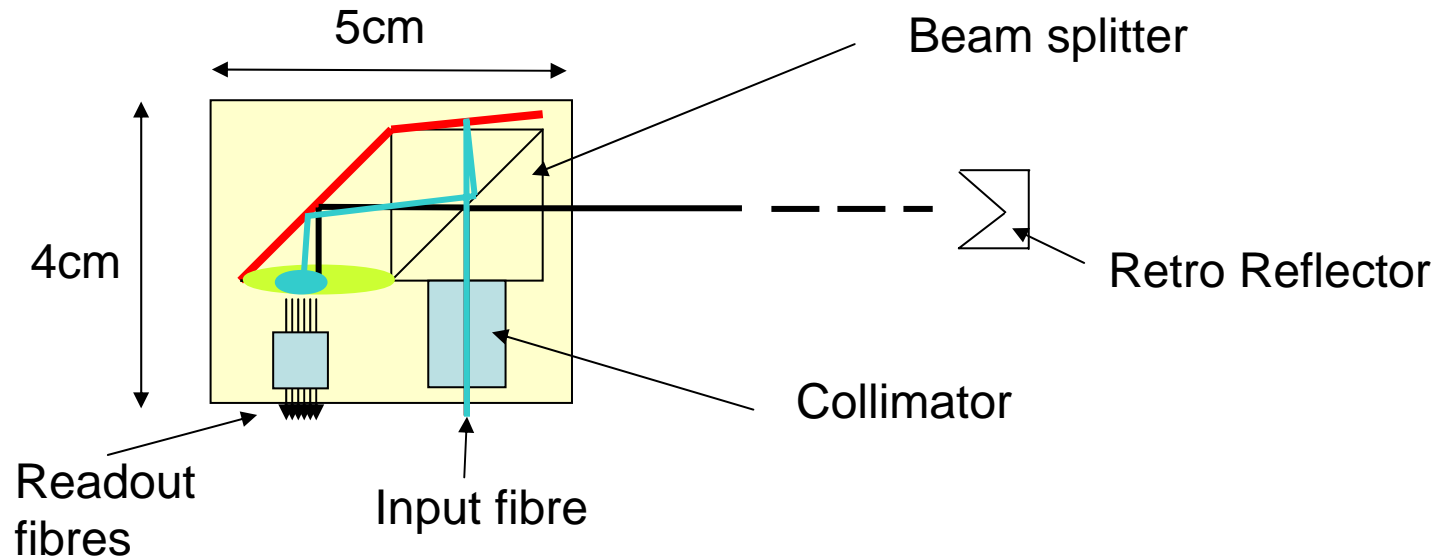# Setup planned at ATF/KEK



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

# STATUS: New Design

- More traditional Michelson setup leads to nice results.

- Integration of many interferometer into one node more difficult –

- A compact version is ready and shows promise.

# Compact Interferometer head



- Shown here using 2cm optics
- 1cm optics likely to work. According to Zemax simulation diffraction should not be a problem. (tests underway)
- Need to solve problem how to produce 0.2 degree angle for mirror on beam splitter cube

# Status of Subsystems

- Electronics ready for mass production (in use by LiCAS, DC mode integrated for us)
- Temperature measurement system ready for mass production (24 channels built and tested)
- Readout software:
  - ADC Readout needs adaptation from LiCAS
  - Binary storage format ready
- FSI data analysis code:
  - Simple version working and used
  - In collaboration with LiCAS group implementing advanced object oriented analysis framework.
- Michelson Mode analysis code:
  - M-Phys student project
- Evaluation of Laser to buy for ATF setup finished by end of January.
  - New laser available by end of February

# Mass Production of Interferometer

- Full test of present system in air in next few weeks.
- Test vacuum system for laboratory:
  - Design ready to build vacuum test system
  - Available in February
  - Test present setup in vacuum
- Vacuum fibre feedthrough:
  - Commercial feedthrough too expensive:
    - Build own feedtroughs
    - Jig in production now
    - First workable feedthroughs by February to be used in test vacuum system
- Build Jig to place/glue components (beamsplitter and collimator) precisely onto base.
  - Build first model by March
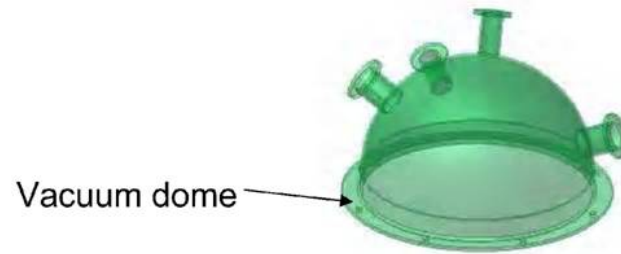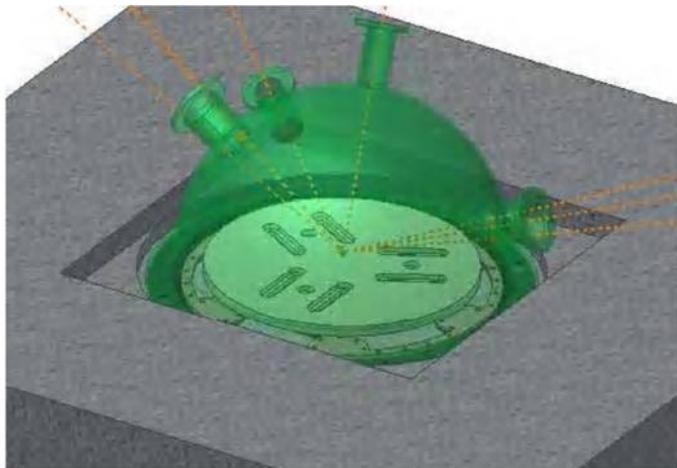
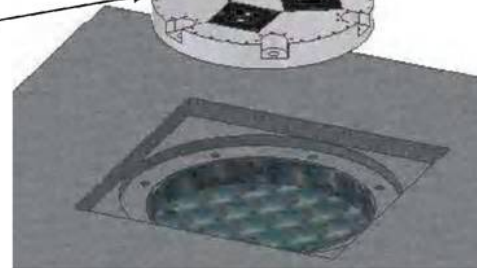Vacuum dome
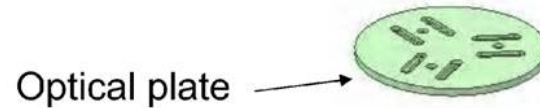
Optical plate

KB75/M top parts

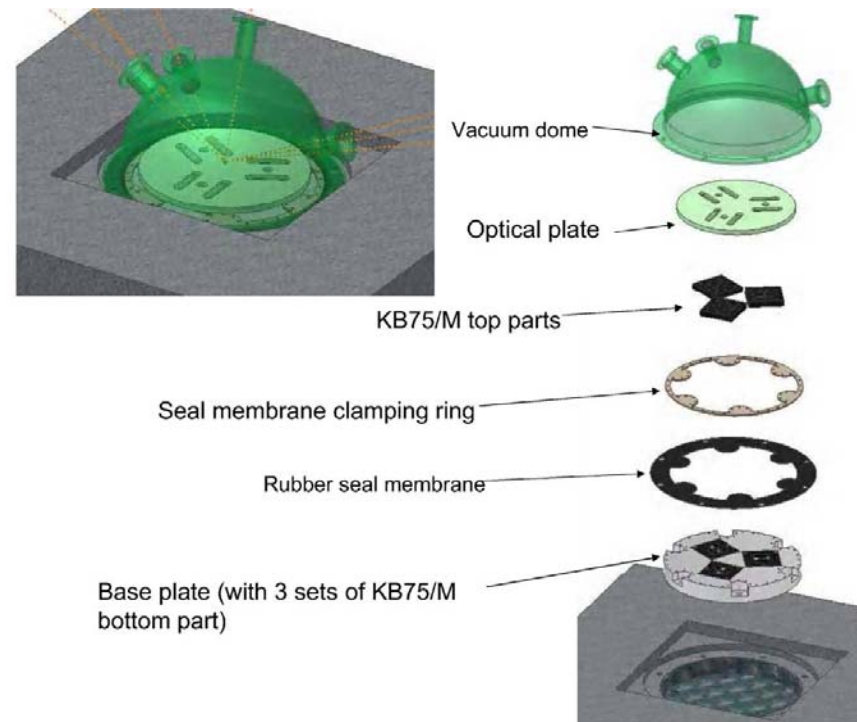Seal membrane clamping ring

Rubber seal membrane

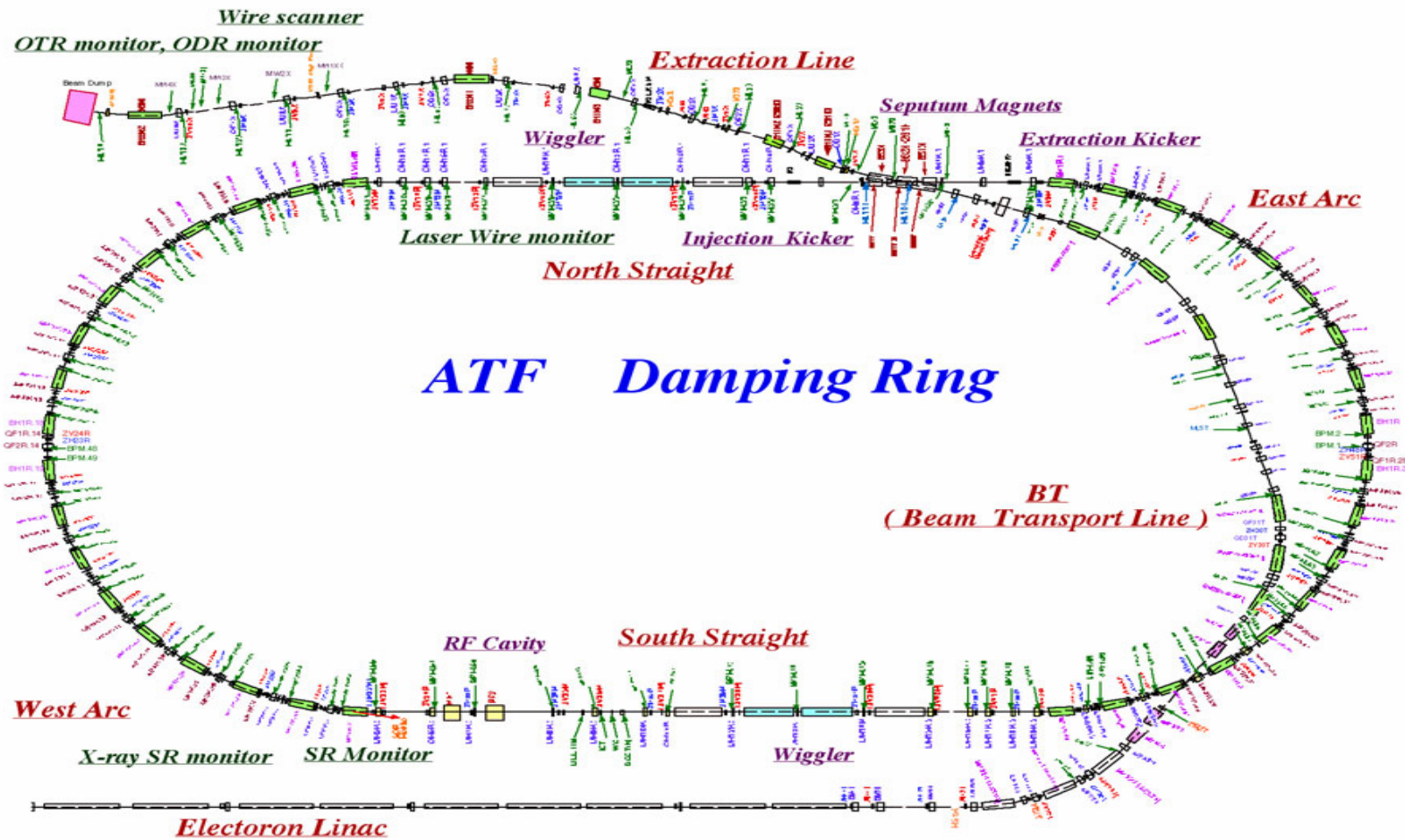Base plate (with 3 sets of KB75/M bottom part)
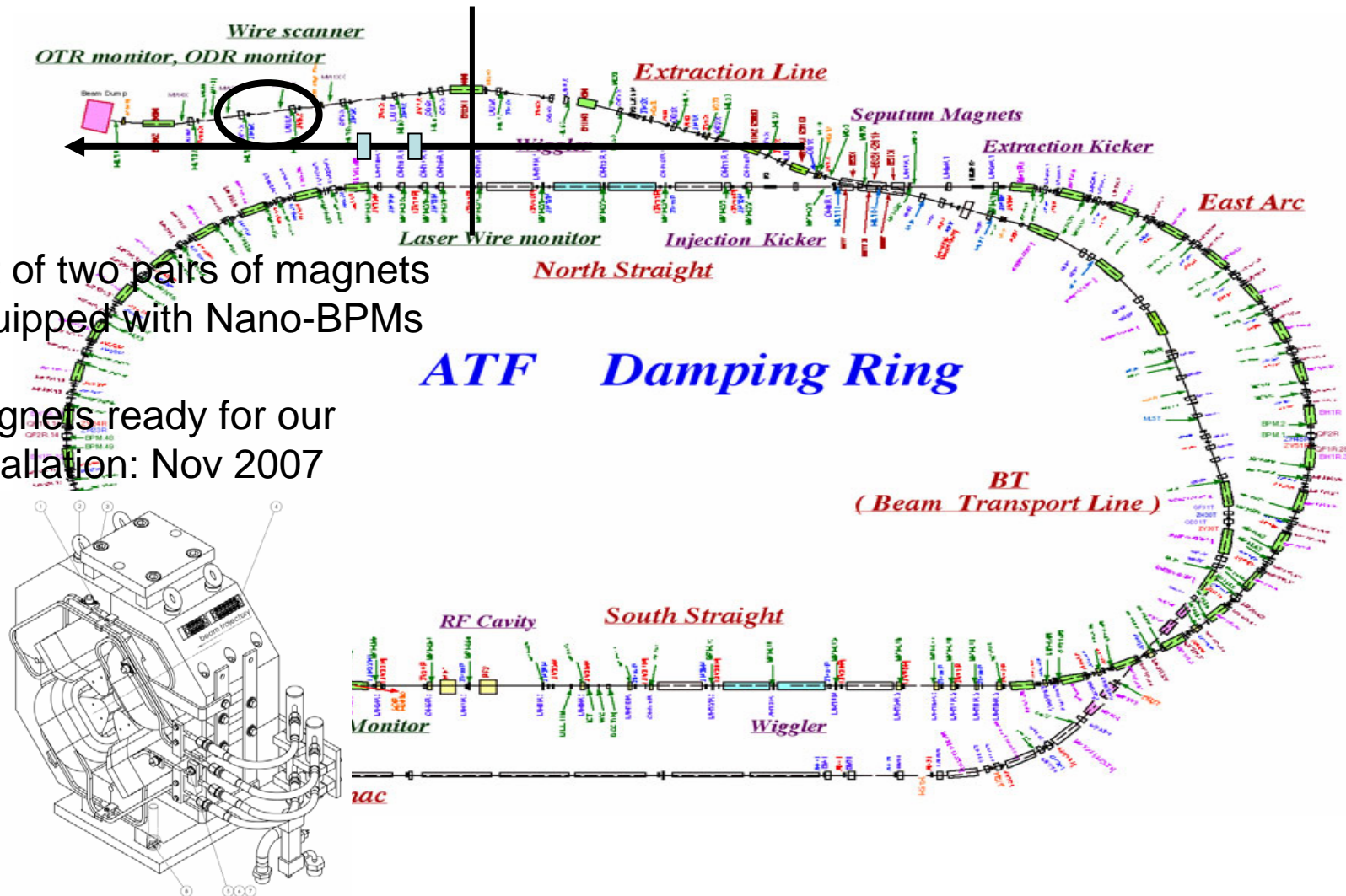
# Vacuum system at ATF



- **Triangle Nodes Concept**
  - Drawings ready for base plate
  - Construction of base plateby March
  - Construction of instrument platform and dome by May

# Move to ATF2

# Move to ATF2



- Set of two pairs of magnets
- Equipped with Nano-BPMs

- Magnets ready for our installation: Nov 2007

# Conclusions

- New interferometer design looks promising.
- Flexible binary format ready for use.
- Analysis software for FSI and Michelson in development.
- Move to ATF2:
  - Setup can be kept beyond Summer 2008.
  - Our setup does not interfere with ATF2 construction.
- Electronics and vacuum system on track to be ready by Nov.