ATF2-IN2P3-KEK kick-off meeting (Oct. 10, 2006)

Shintake monitor status

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ATF2 Shintake-monitor group

- Students
  - T. Suehara (Univ. of Tokyo, D2),
    - Optics (main table, laser table)
    - Overall design,etc.
  - H. Yoda (Univ. of Tokyo, M1)
    - Gamma detector
- Staffs
  - T. Sanuki (Univ. of Tokyo),
    - Advisor (ATF2, overall)
  - T. Kume (KEK),
    - Optics support (fringe stabilization etc.)
  - Y. Honda (KEK),
    - Support (optics etc.)
  - T. Tauchi (KEK)
    - Advisor (ATF2, overall)

Progress from status reported in 2nd ATF2 project meeting(1/2)

- Phase control/scan of interference fringes (by Suehara)
  - Principle of refection type delay line was confirmed by using PZT stage.
  - Possibility of PLZT is also considered.

- Precise phase monitor (Kume)
  - Phase monitor not affected by light intensity change was designed and prepared for experimental confirmation.

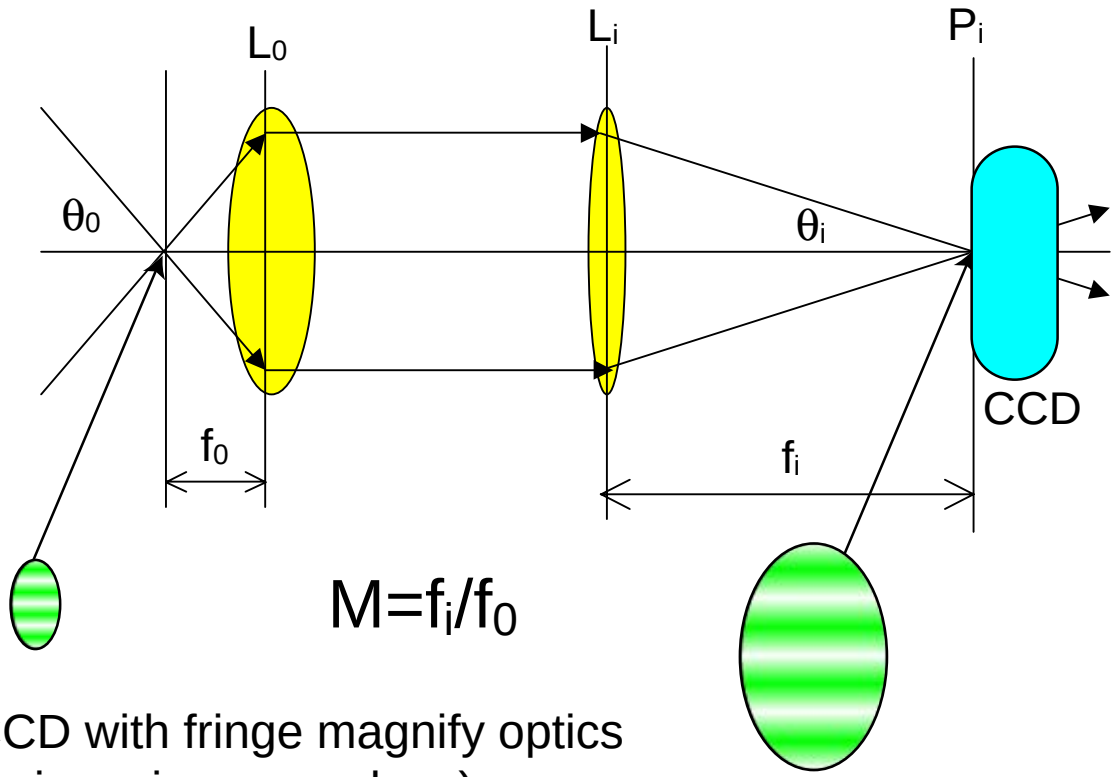
- Off-axis real time phase monitor (Suehara)
  - Fringes during operation are to be monitored by using off-axis monitor.
  - Correlation between two phase monitors (@IP and Off-axis) is prepared for experiment and going to be observed and confirmed by using two sets of monitoring system.

Progress from status reported in 2nd ATF2 project meeting(2/2)

- Optical axis stabilizing system against long laser transfer line is now being prepared for operation. (Suehara)

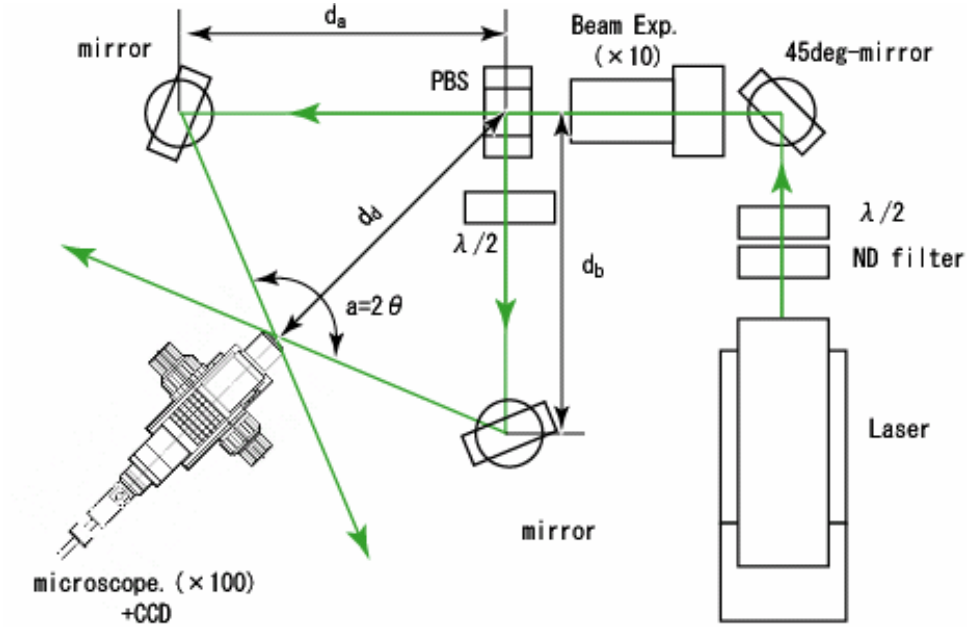
- Gamma detector (Suehara, Yoda)
  - Multi layer inorganic scintillator is estimated to be more promising compared to multi cherenkov detector through simulation.
  - Detecting system adopting scintillator is under designing.

Phase detection using optical microscope



CCD with fringe magnify optics
(using microscope lens)
> 1mm fringe (6° ,30° setup)

Experimental setup for observing interference fringes by using microscope

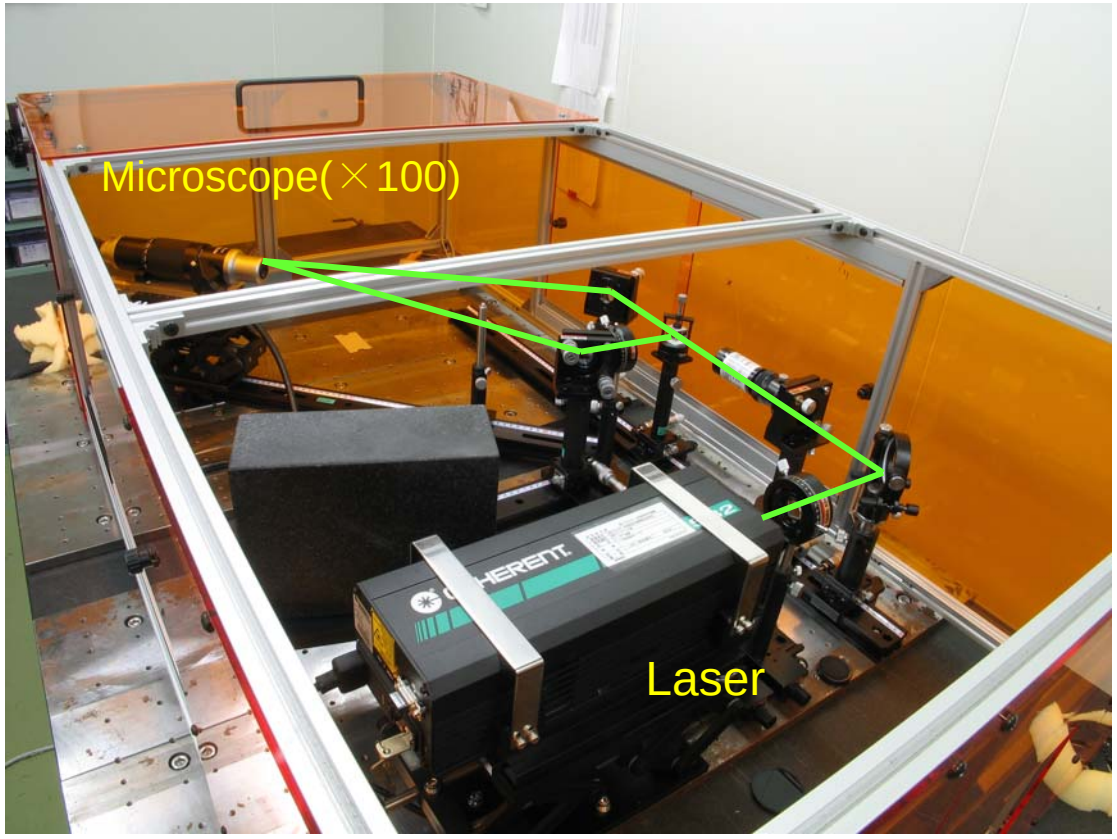


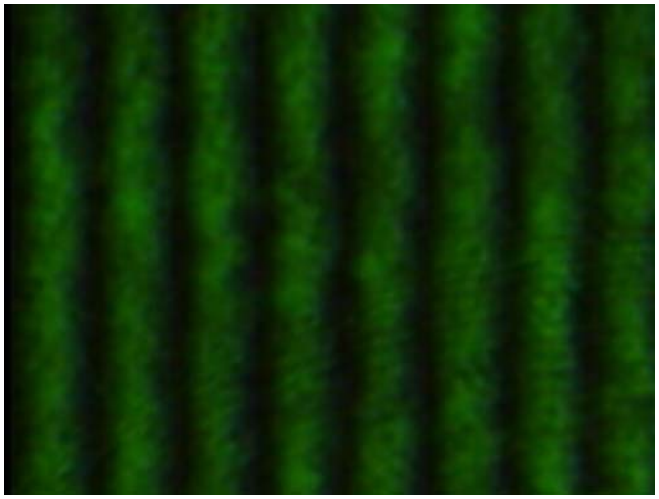
Laser specifications

•wavelength	532 nm
•power	20 mW (CW)
•line width	6 MHz
•beam diameter	0.7 mm
•beam divergence	<1.3 mrad
•stability	±3 % (@8hour)
•mode	TEM00
•M^2	1.2

- Set on the optical table with air suspension made of granite to isolate floor vibration.
- Covered to prevent air flow

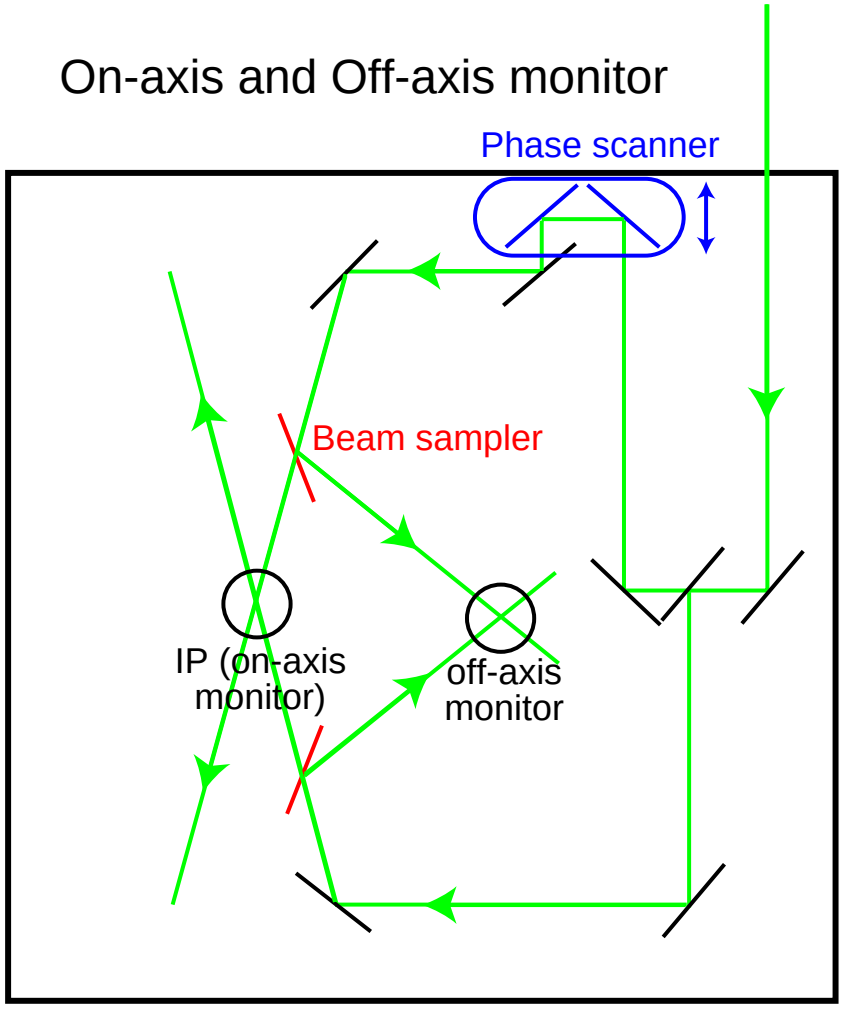
Experimental setup and Observed fringes





- Angle between two beam a=25 deg,
- Wavelength λ=532 nm,
- Fringe pitch Λ=1250 nm

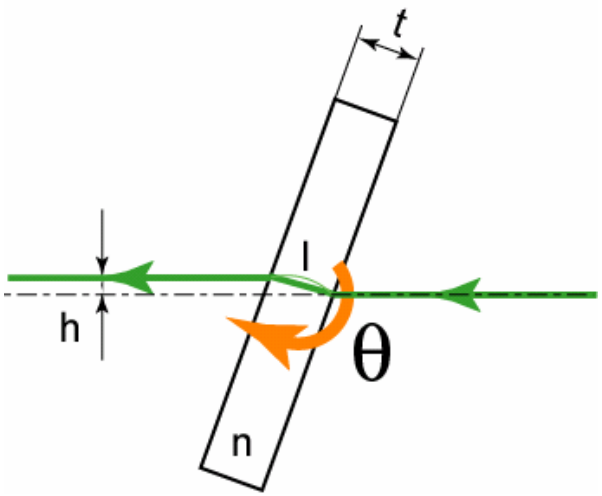
Online phase monitor

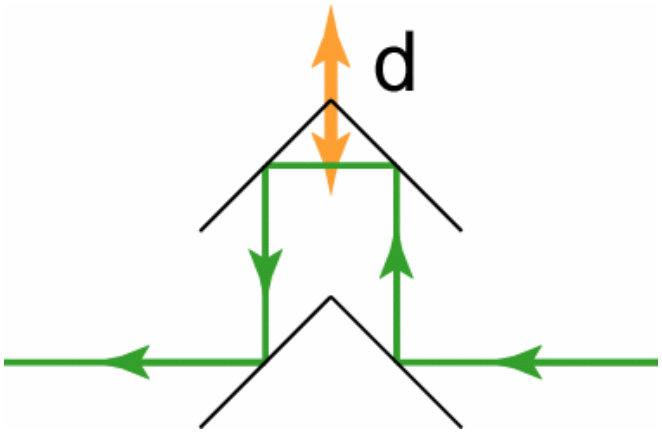


For online monitoring,
we must use off-axis monitor
(we cannot put phase detector
at IP during ATF2 operation !)

- Correlation between IP and off-axis monitor must be checked.
- Phase will be stabilized by phase scanner (delay line) using off-axis phase monitor data.

Phase delays (shifters) for phase control





•Transmission type

(by rotating angle θ of glass plate)

->Angular resolution of Δθ=~3 min (=8.7*10^{-4} rad) is required for 0.74 nm of resolution

->h=~12 μm for 90 deg of fringe phase change

(in case plate thickness: t=3 mm, refractive index: n=1.5)

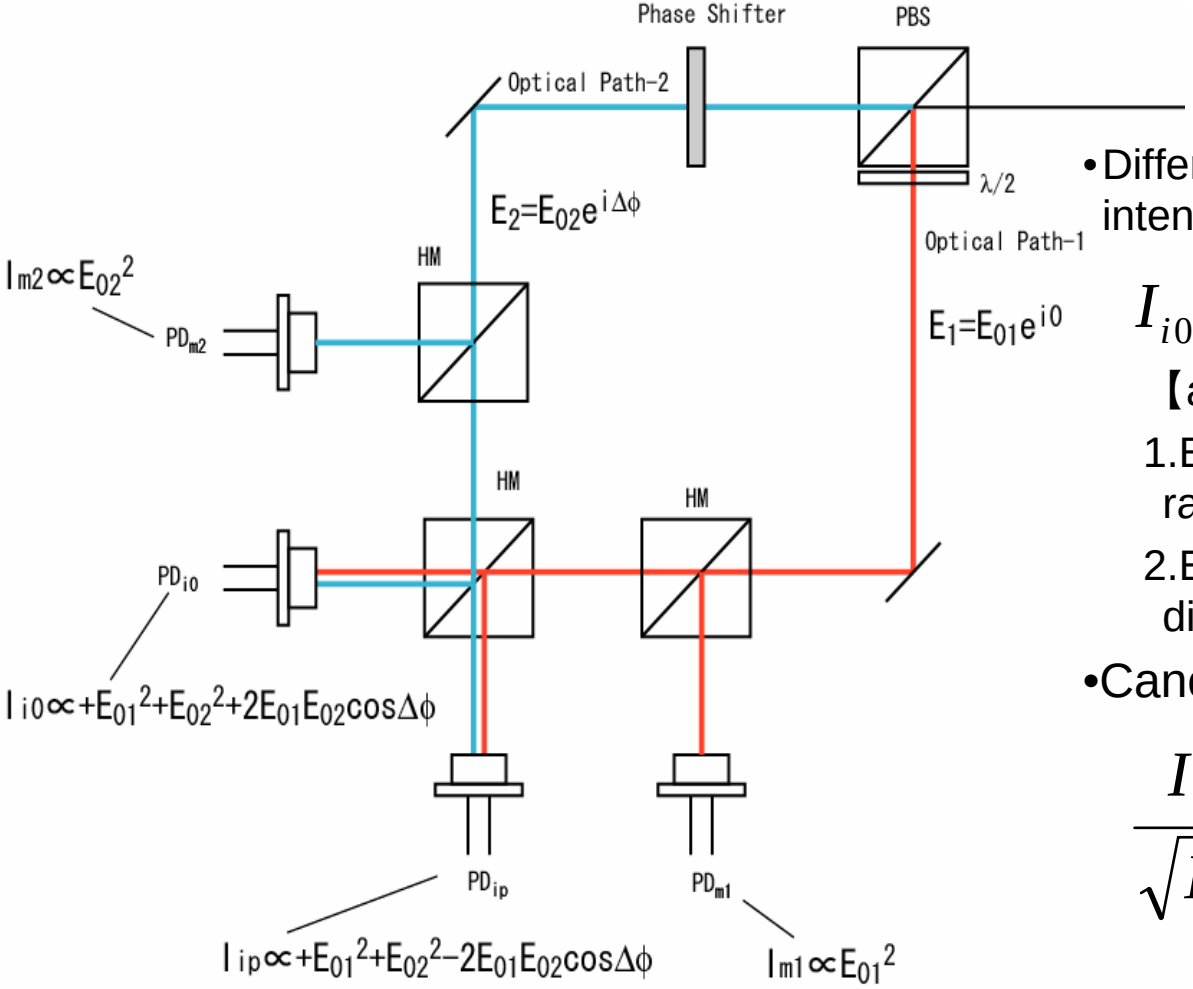
•Reflection type

(by changing relative distance d between the two mirror sets)

->Position resolution of Δd=0.37 nm is required for 0.74 nm of resolution

Durable and precise phase detection

(Not to affected by intensity change of LASER light source)



- Difference of the 2 interfered light intensities s: I_{i0}-I_{ip}

$$I_{i0} - I_{ip} \propto 2E_{01}E_{02}\cos\Delta\phi$$

【assamptions】

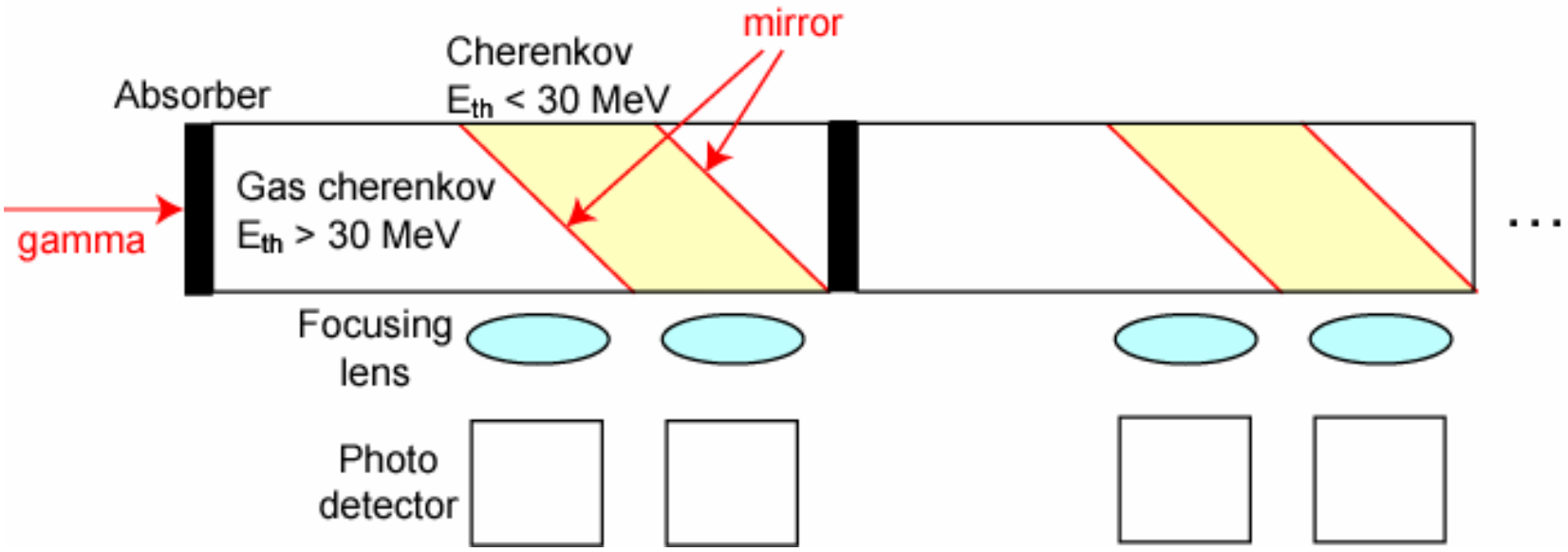
1. Equal transmission/reflection ratio of half mirror :HM,
2. Equal sensitivity of photo diodes:PD_{i0} and PD_{ip}

- Canceling E_{01} and E_{02}

$$\frac{I_{i0} - I_{ip}}{\sqrt{I_{m1}\cdot I_{m2}}} \propto 2\cos\Delta\phi$$

Gamma detector (1)

- Multi material cherenkov detector



High energy subtraction by forward Cherenkov detector

○Insensitive to background shower statistics

×Number of emission photons is low.

Gamma detector (2)

- Multi layer inorganic scintillator