IP-BSM Status and Plan(2)

13th ATF2 Project Meeting

Jan. 11, 2012
KEK, Tsukuba, Japan

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Outline

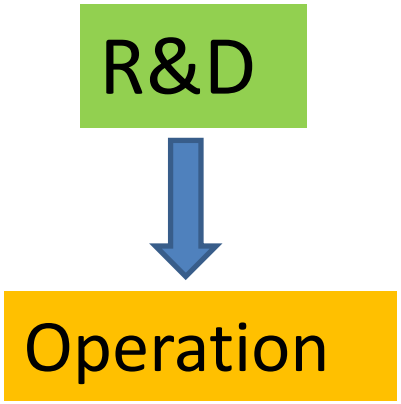
Jackie

- Status of beamsize measurement
  - ➢ Results of beam time
  - ➢ Estimate of systematic errors
  - ➢ Current condition of system

Oroku

- Status of each component
- Plan & remaining problems towards
  - ➢ 30 deg mode
  - ➢ 174 deg mode
  - ➢ 37 nm measurement

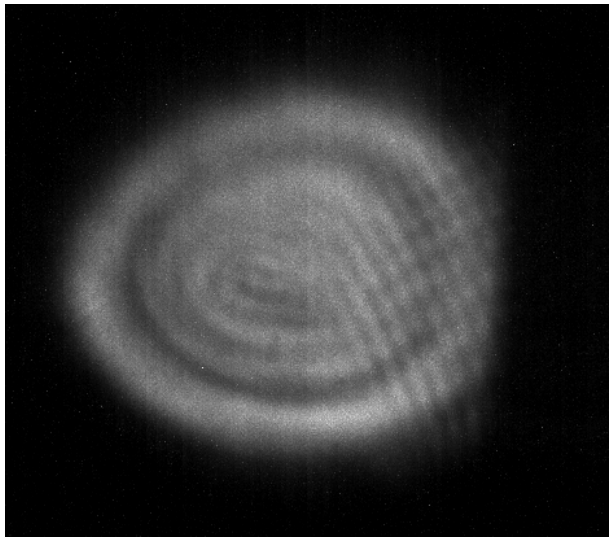
Status of components



Components still needing R&D

- Laser System
- Transport line
- Detector
- Laser path alignment & control
- Phase monitor
- Profile monitor
- 30 degree fringe
- 174 deg mode laserwire & fringe

Laser system



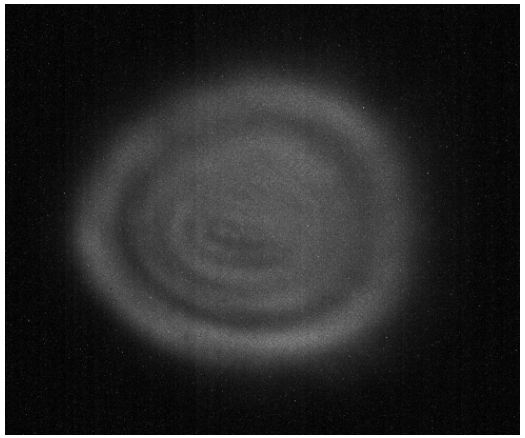
Laser profile

This profile taken at work with Laura

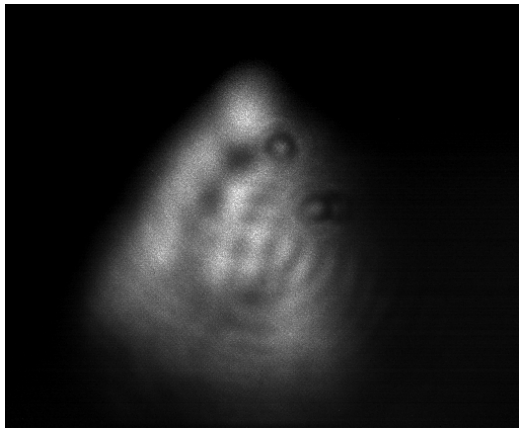
Status & plan

- Power stability: ~ 1% OK
- Timing stability: < 1[ns] OK
- Laser divergence: stable during beam time
- Imbalance of laser profile ⇒ Tuning of cavity
- Temperature of internal cooling water fluctuates ⇒ ??
- Laser pointing jitter & divergence ⇒ Plan to stabilize with beamlock system

Transport line

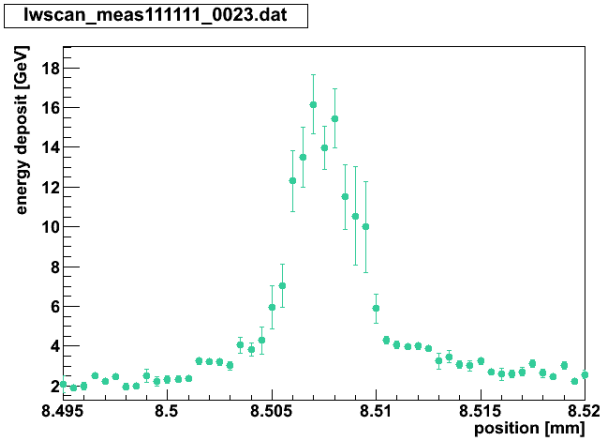


~20 m transport



- Problem with profile transportation?
- Problem with laser itself?

- Effect on operation is not evaluated



Laser wire scan : not too bad profile

Detector

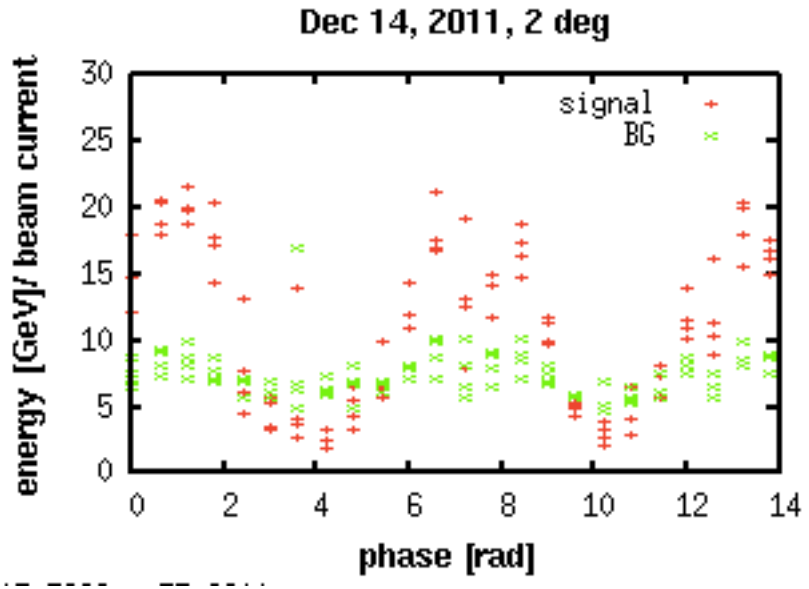


fig from jackie's talk

- S/N separation with multilayer fitting "Shot by shot method" is not going well ⇒ take BG data in handy & reliable way
- Complexity of use HV ⇒New HV power supply(easier to use)

Laser path alignment & control

- Laser drift: <20micron@IP/hour

⇒

- laser wire scan every 2 hours
- Position jitter stabilization system
- Feedback by PSDs (not yet)

- Fringe tilt by misalignment ~ 20 mrad@ 30 degree mode (50 % modulation decrease with σx ~ 20 μm)

⇒

- Construct laser path as precise as possible
- Use alignment laser to make good laser path
- Smaller x size

Phase monitor

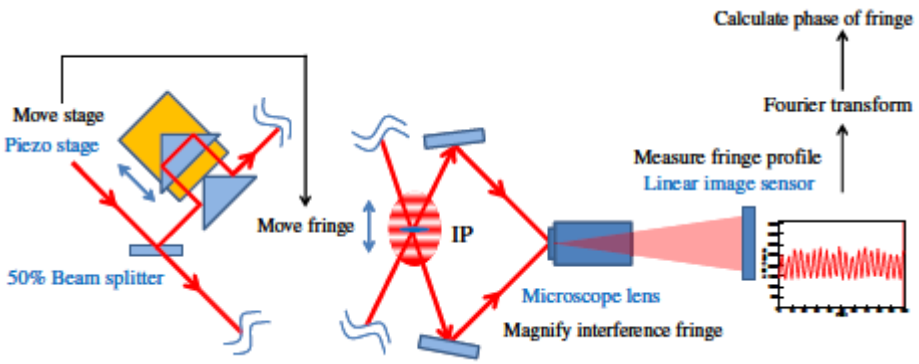


fig from
yamanaka's Mthesis (2009)

- Functioned 1.5 years ago
- Not in operation recently
- Necesary for Phase feedback

Plan & remaining problems

- When switching to 30 degree mode
- Commisioning of 174 degree mode
- 37 nm measurement

When switching to 30 degree mode

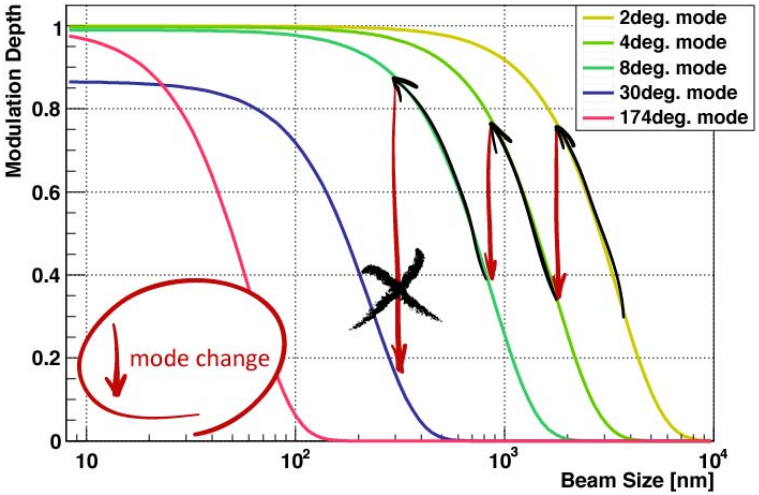


fig from
yamaguchi's talk@
TIPP 2011

- Modulation never detected
- (However) IPBSM is considered to be ready

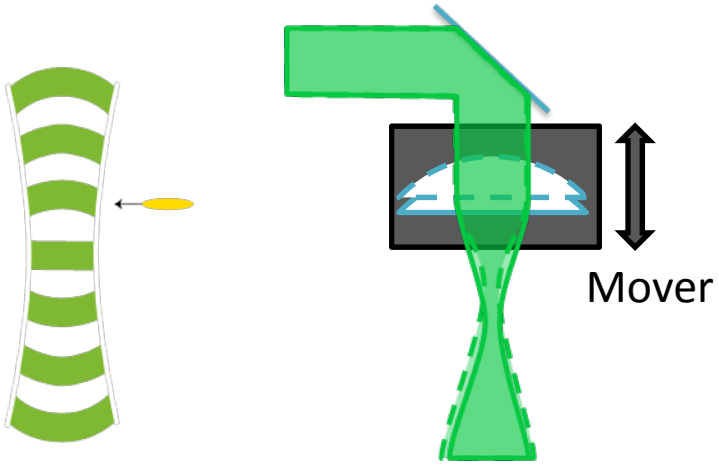
- Problems
  - ➢ Bias due to fringe tilt (depending on x beam size)
  - ➢ Difficulty of modulation detection

- Beam Requirement
  - ➢ σ_y ~ 300 nm
  - ➢ Small bg fluctuation
  - ➢ Small x-y coupling
  - ➢ σ_x < 10 micron

σ_x [micron]	Tilt [mrad]	σ'_y [nm]
5	20	316
10	20	361
20	10	361

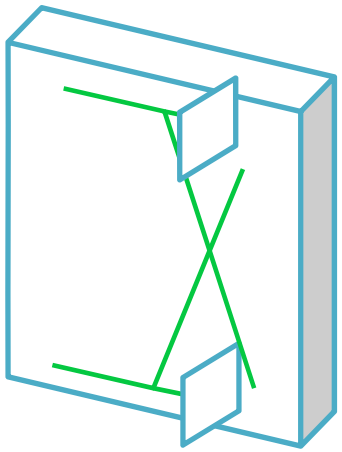
Effect on measuremnt of σ_y (300nm)

Commisioning of 174 degree mode



Spherical wavefront

- Modulation never detected
- Switch is considered to be easier than to 30 degree mode



fringe tilt monitor system

- Difficulty of 174 degree mode
  - ➢ BG become larger
  - ➢ Longitudinal fringe tilt
  - ➢ Spherical wavefront effect

For 37 nm measurement

- Phase measurement & feedback ⇒ Phase monitor
- Position feedback
- Tilt monitor

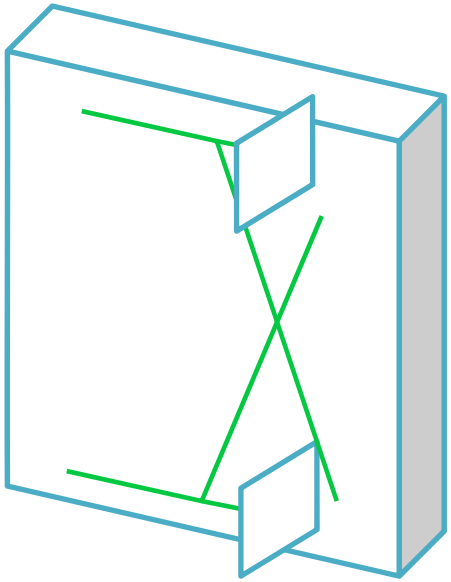
Summary

- Switching to 30 deg mode is considered possible
- Still some components needs commisioning for 174 degree mode & 37 nm

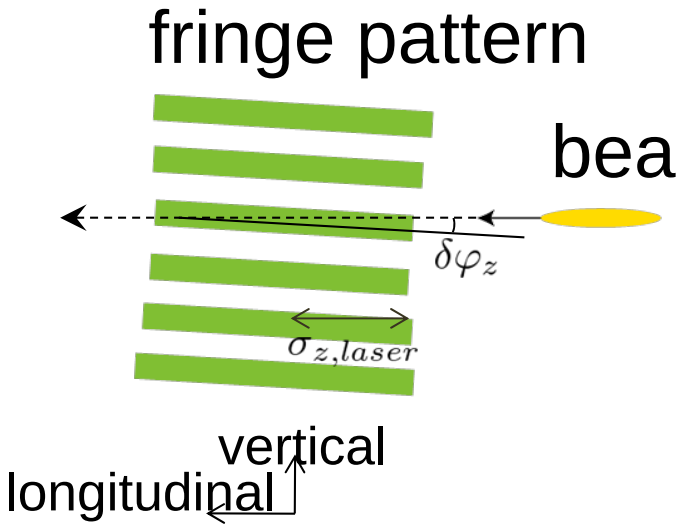
Backup

Tilt monitor

干渉縞の傾きによる影響
→傾きをモニター出来る機構を追加



$$\sigma^2_{\mathrm{y,meas.}} = \sigma^2_{\mathrm{y,ideal}} + \delta\varphi_z^2 \sigma^2_{\mathrm{z,laser}}$$



- ビームに対して干渉縞が傾いていると系統誤差になる
- 2つのPSDを使って干渉縞の傾きをモニターする