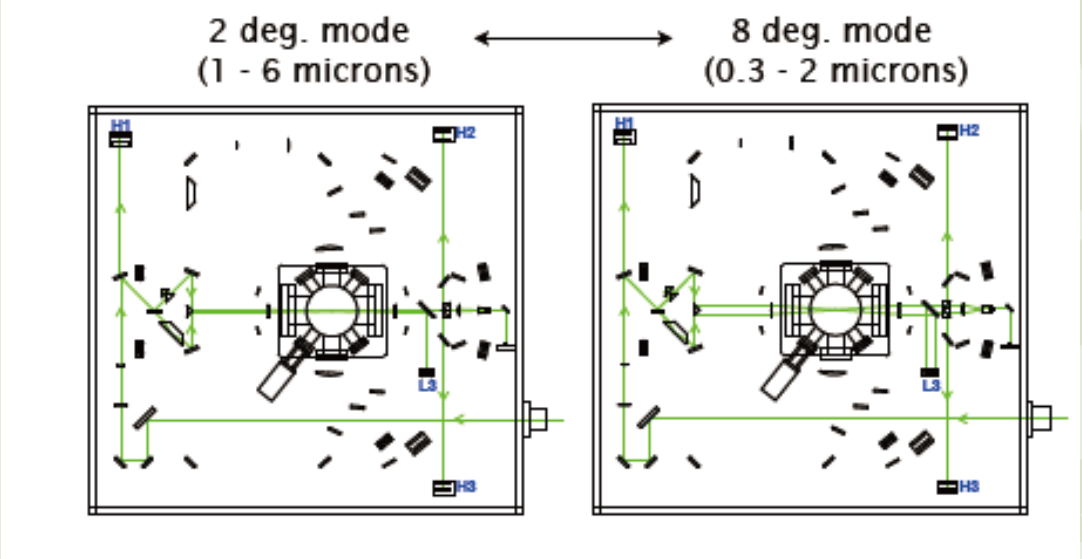
IP-BSM status and plan: beamtime result in 2010 Nov & Dec

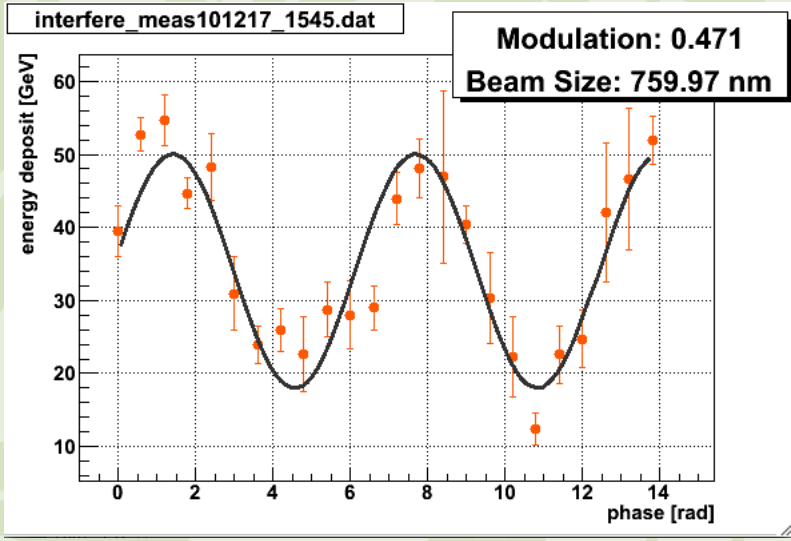
M. Oroku, Y. Yamaguchi, J. Yan, T. Yamanaka, Y. Kamiya, T. Suehara, S. Komamiya（The University of Tokyo）
T. Okugi, T. Terunuma, T. Tauchi, S. Araki, J. Urakawa
(KEK)

outline

- Result of the beamtime in Nov /Dec of 2010
  - 2-8 degree mode
  - 30 degree mode
    - reasons we could not see the modulation
- Status of the laser
  - Laser focusing problem
    - What happened?
    - some possible reasons
  - Laser timing problems
    - Timing system renewal
  - Detector gate timing
- Plan from 2011 Jan~

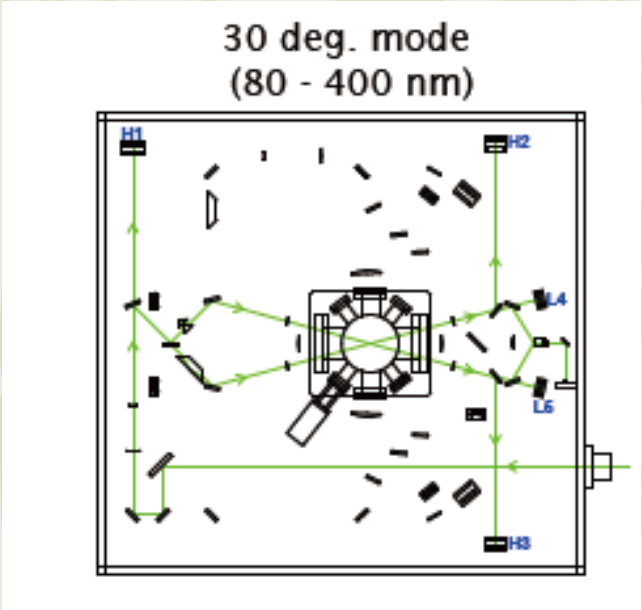
2-8 degree mode

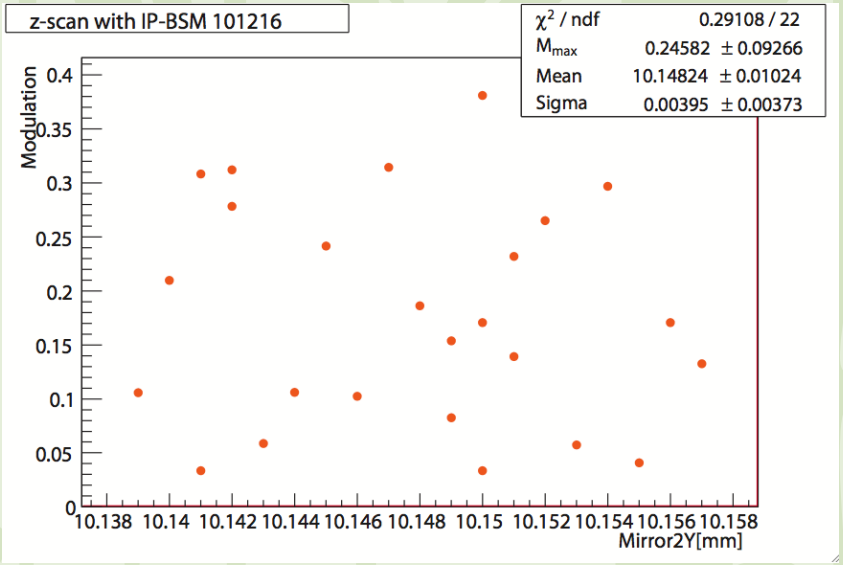




- Modulation measured
- Multi knob scans conducted

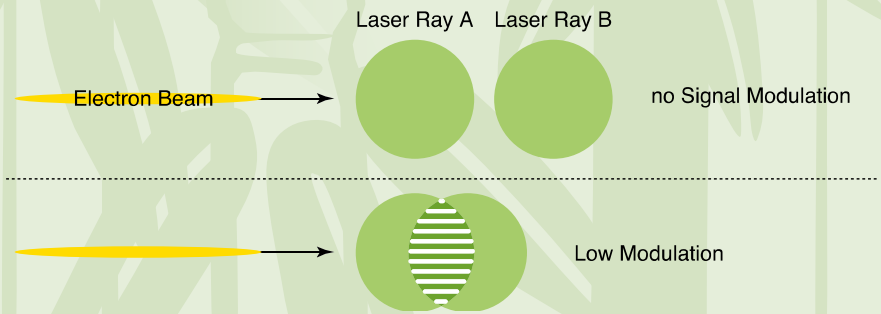
30 degree mode





Z scan result

- Could not see modulation



beam time process

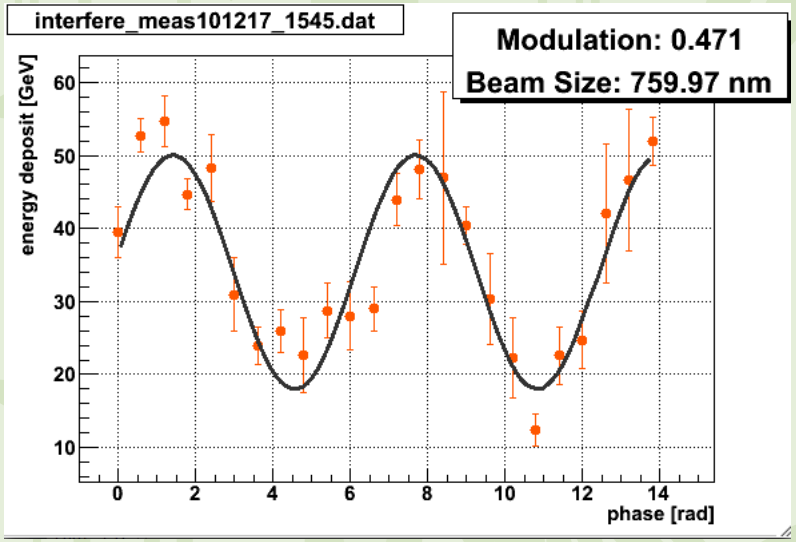
- 12/16
  - 15:30 switch to 30 deg. mode (M > 0.9 with 6 deg. mode, corresponding beam size < 350 nm)
  - 17:00 Laser wire scan, reducer scan, z-scan
  - 21:30 beam stop (bad vacuum), laser interlock (lack of cooling water)
  - beam and laser recovered
  - ~tried to find modulation
- 12/17
  - 3:00 switch to 8 deg. mode
  - 10:50 modulation back, M = 0.68

Reasons we could not see modulation with 30 degree mode

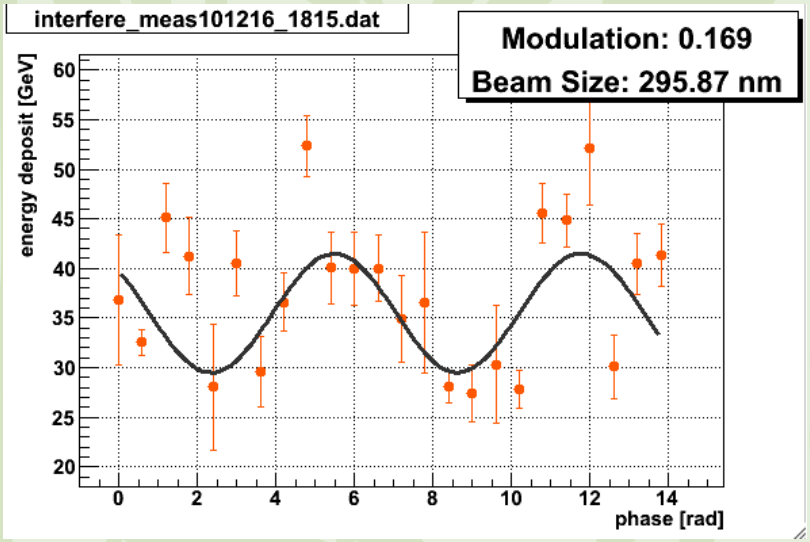
- Bad S/N (~ 1:10)
  - BG level ~ 100 GeV
  - Signal energy ~ 10 GeV (1/10 of May's run)
    - laser focusing problems (details in Jacqueline's slides)

- Wrong plan
  - Switching from 6 degree mode to 30 degree mode is unrealistic

Confusion of signal fluctuation with modulation (if bad S/N)



Modulation

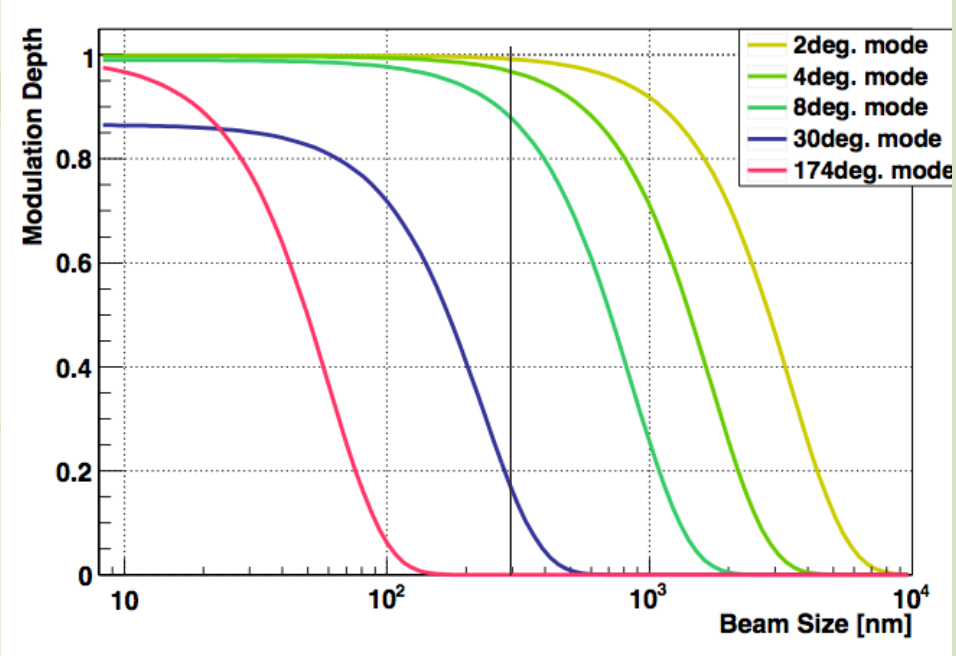


Fluctuation

- Fluctuation ("fake modulation") : Δsig / sig ~ 0.18 (for S/N ~ 1/10)
- If fake M > expected M, it becomes confusing

- Expected M : 0.17 (300 nm)
- Expected M : 0.42 (200 nm)

Mode switching strategies



higher signal fluctuation (lower S/N)
requires smaller beam size for switching mode

Modulation

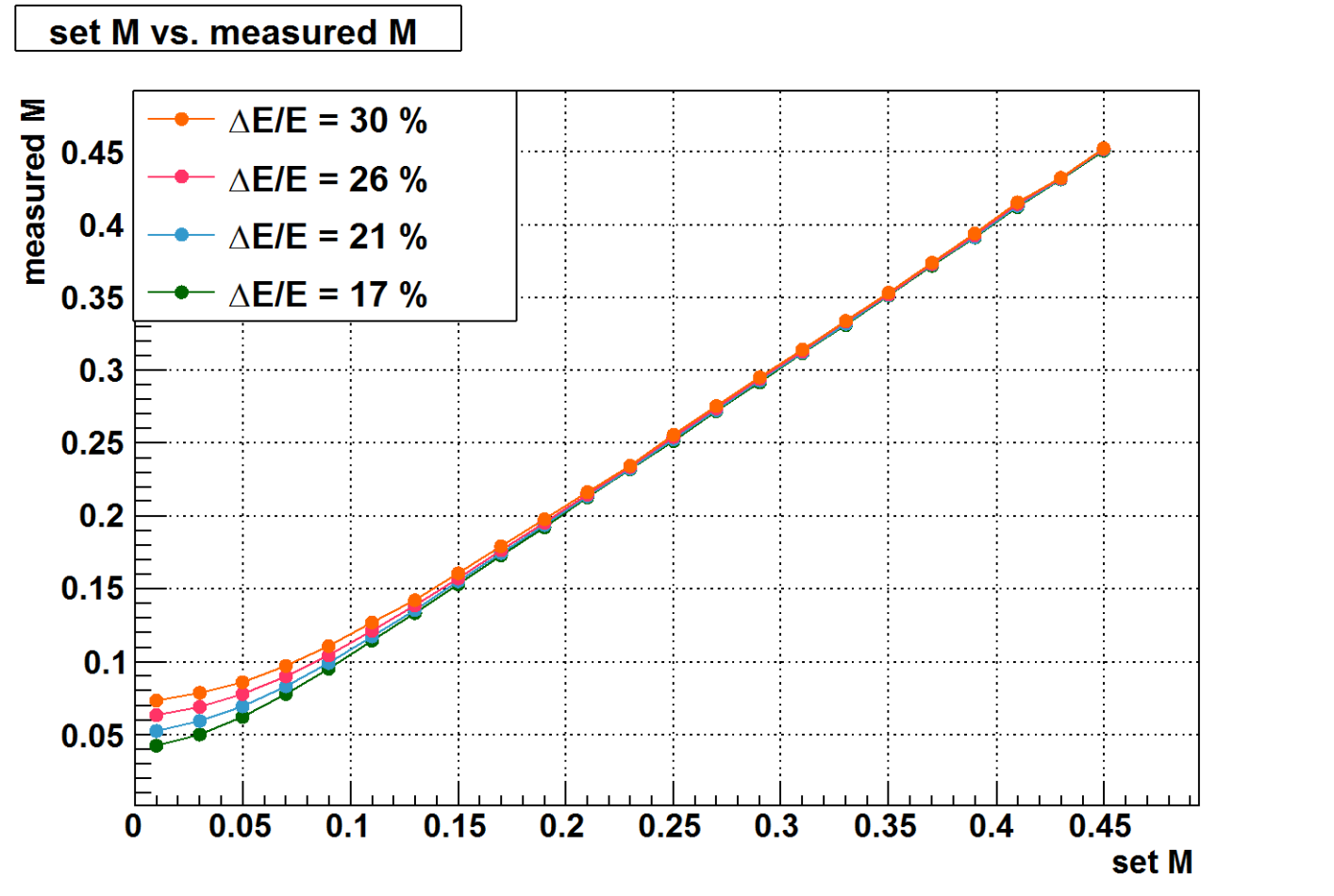
size[nm]	6[deg]	8[deg]	30[deg]
300	0.92	0.88	0.17
250	0.95	0.91	0.27
200	0.96	0.94	0.42

beam time summary

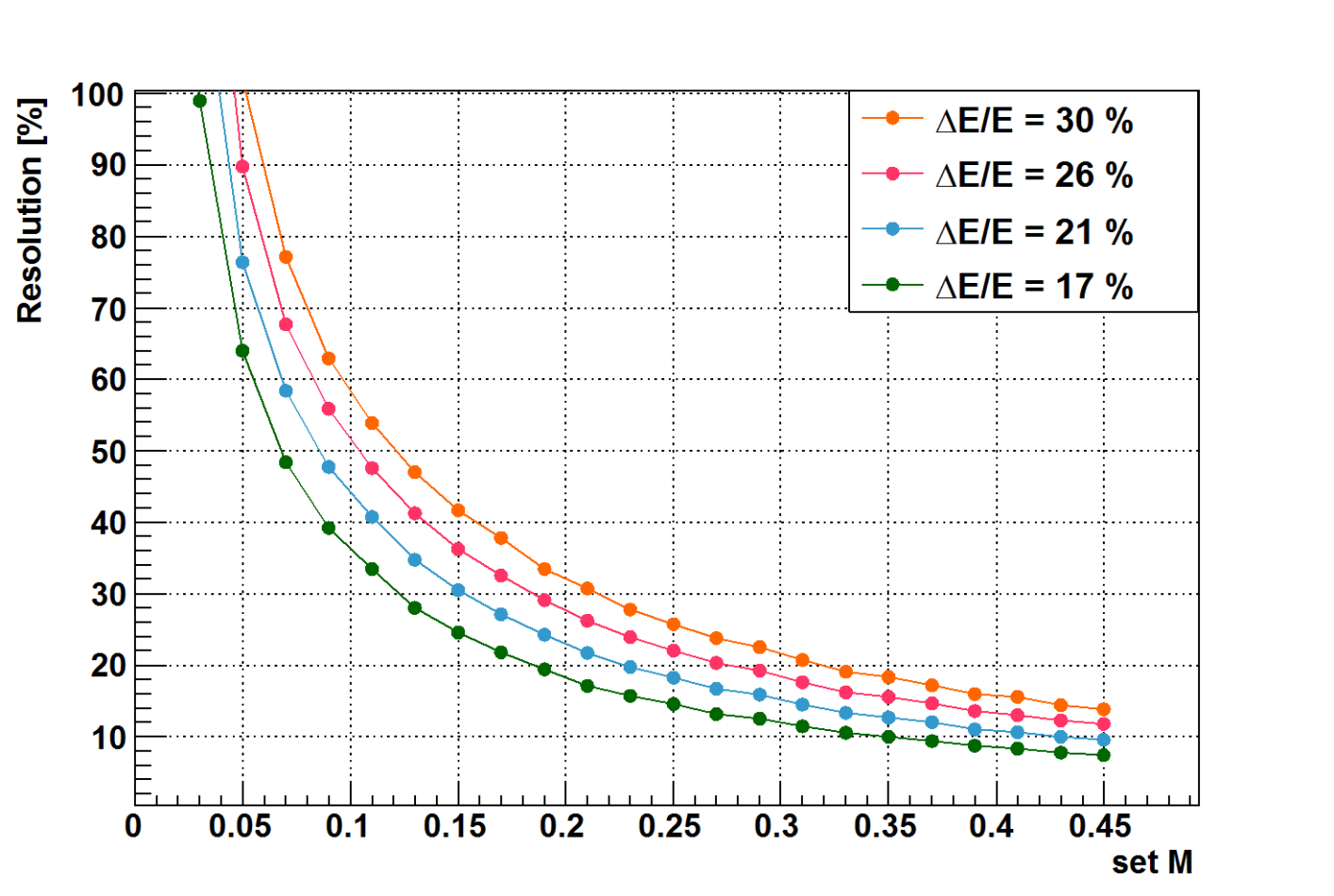
- We could see modulation and conducted multi knob scan with 2-8 degree mode
- We could not see the modulation with 30 degree mode
- Reasons we could not find modulation were bad S/N and wrong strategy

backup

結果 1


set M vs. measured M
ΔE/E = 30 %
ΔE/E = 26 %
ΔE/E = 21 %
ΔE/E = 17 %
measured M
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
set M

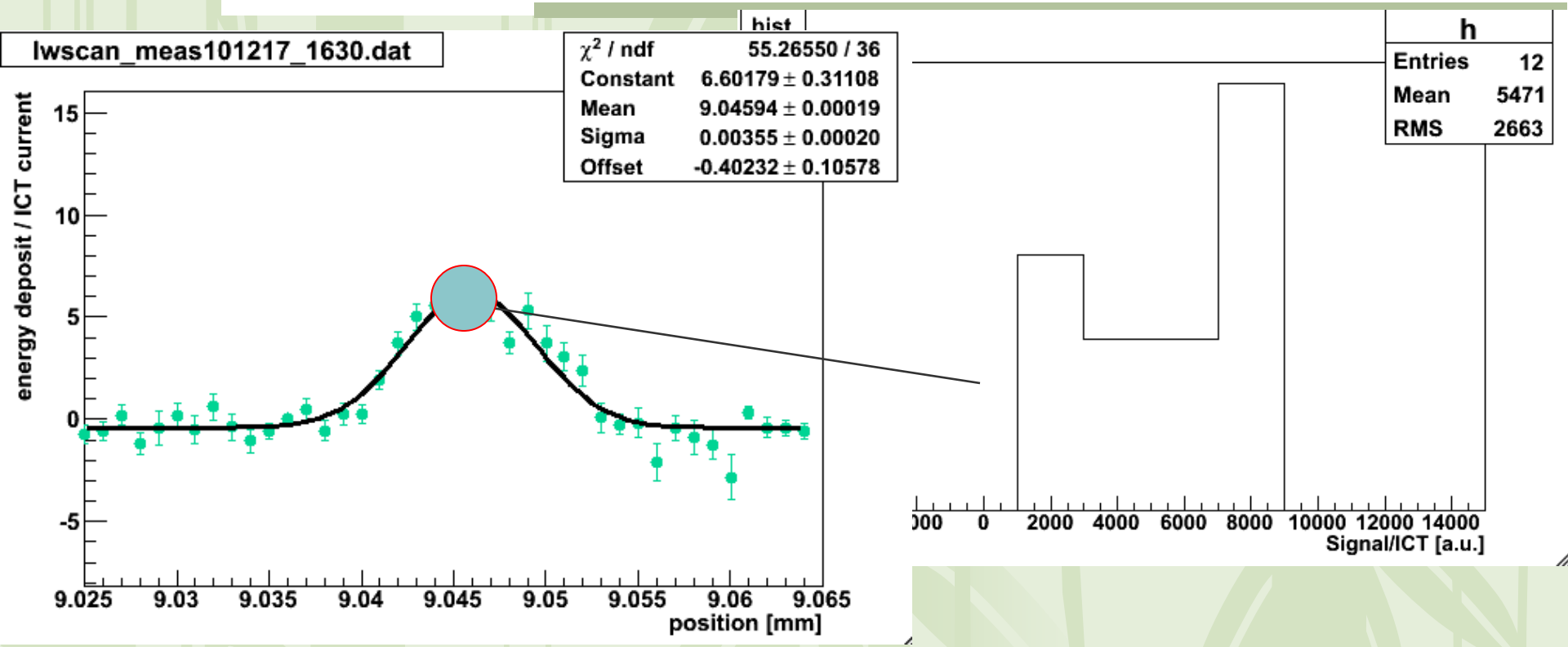
結果 2


Resolution [%]
100
90
80
70
60
50
40
30
20
10
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
set M
ΔE/E = 30 %
ΔE/E = 26 %
ΔE/E = 21 %
ΔE/E = 17 %

Plan to do next

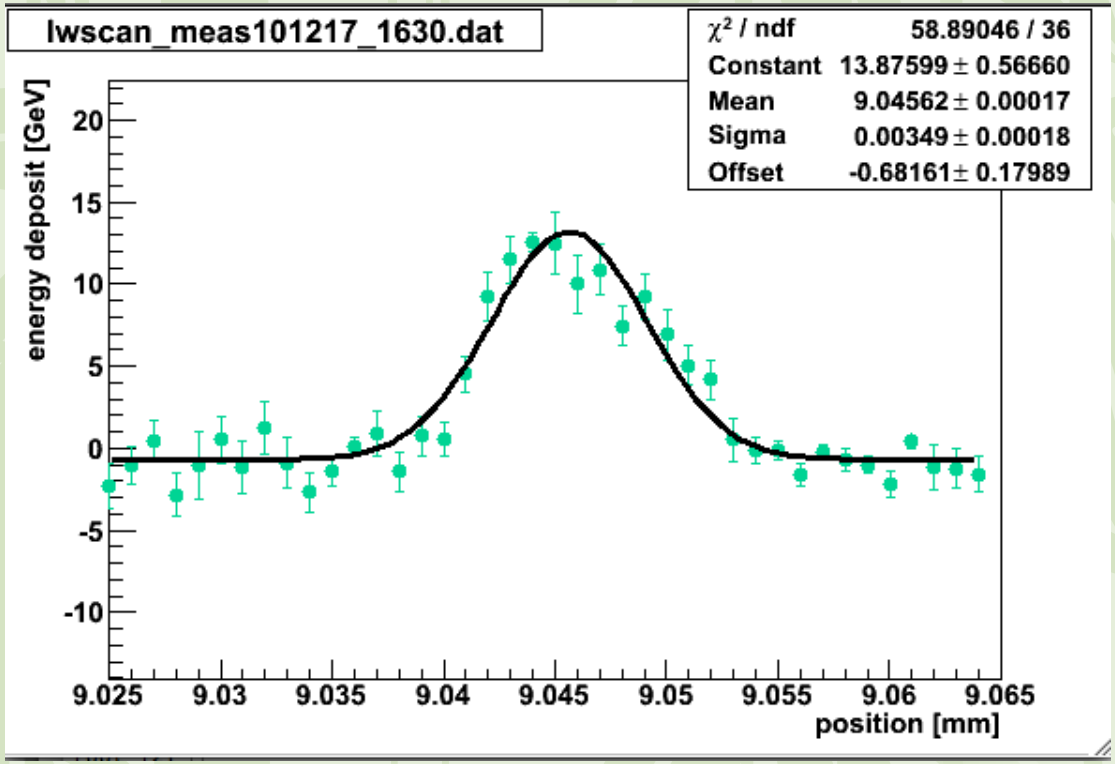
- In IP-BSM shift, we need to verify
  - Laser timing is no more jittering
  - Each laser can be focused at IP with 30 , 174 degree
- In continuous run,
  - Try 30 degree mode from 8 degree mode

Signal stability



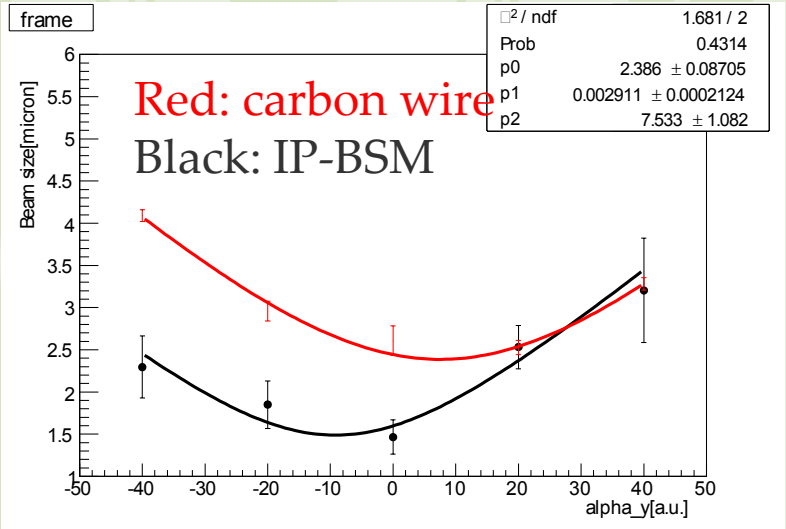
- Laser wire scan(8 degree mode) with 12 average at each point
- With the same condition, Δsig / sig at fringe scan will be ~ 0.18

Signal stability with laser wire



12 average at each point

Comparison with Carbon wire (beam time at Dec 10th)



- Multi knob scan(using α_y)
- 2.42 degree mode
- Nominal optics
- BG ~ 40 GeV

- Reasonable result

Focusing problem まとめ

- 下パスのレンズ調整（+2.5 mm）
- 下パスレーザー径増大
- 上パススキャン中、誤った値を入力して一時的に真空悪化→ビームストップ
- ビーム復旧直後、上パススキャン中、冷却水インターロックでストップ
- 下パスのレンズ調整（-4.1 mm）
- レーザー復旧後、上パスがでかくなった
- 上パスは絞れるようになったが、下パスは絞れないままだった
- 下パスは結局一回も絞れなかった