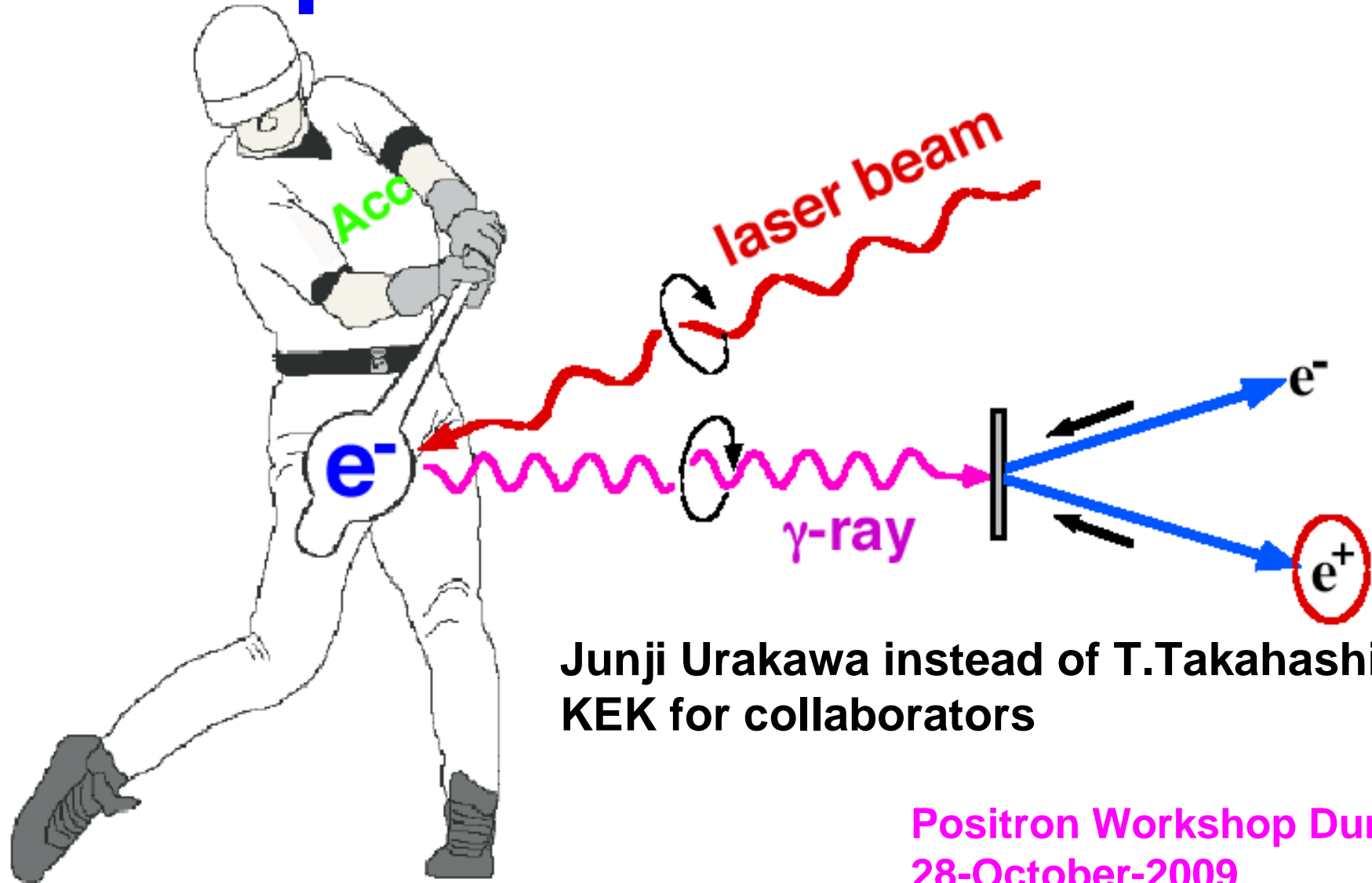


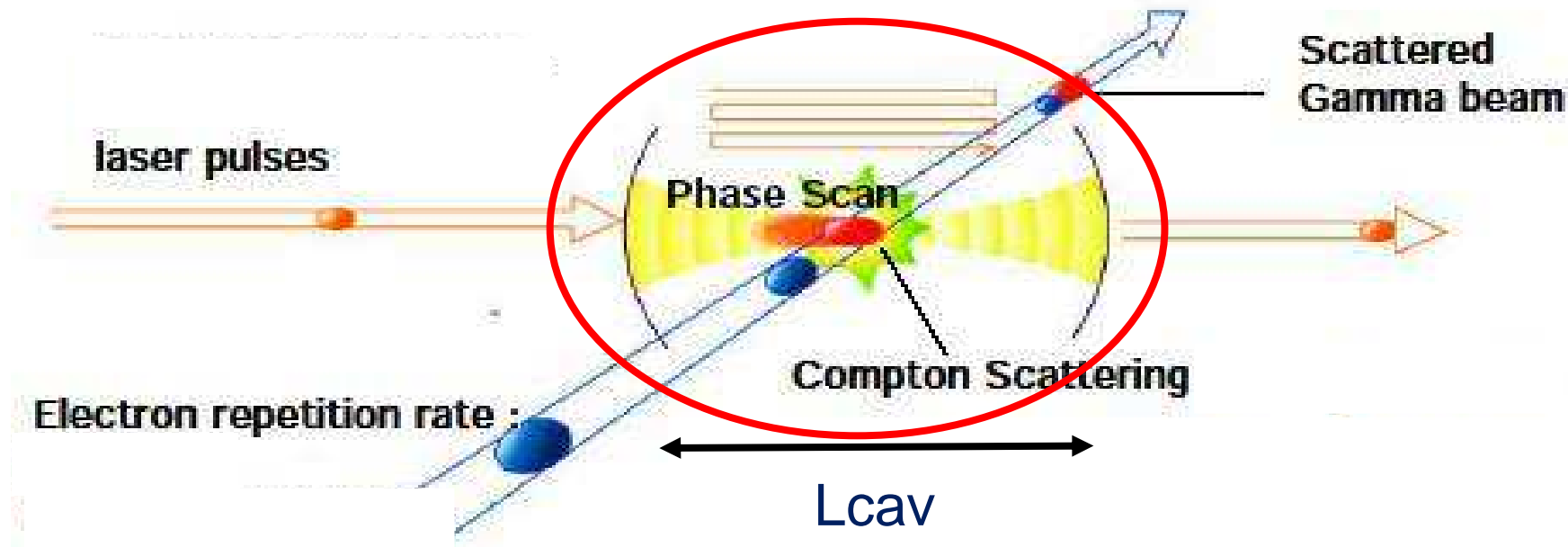
Compton Experiment at the ATF Update since TILC09



Junji Urakawa instead of T.Takahashi
KEK for collaborators

Positron Workshop Durham
28-October-2009

Optical Cavity for Laser-Compton



Higher laser power

$L_{cav} = n \lambda / 2$, $\Delta L < \text{sub-nm}$, position for pulse stacking

->more enhancement, then more precision

Laser should be focused for high power density

Efficient laser-Compton scattering

$\Delta T < \text{sub-ps}$

Accommodate laser cavity in the accelerator

Two Prototype Cavities

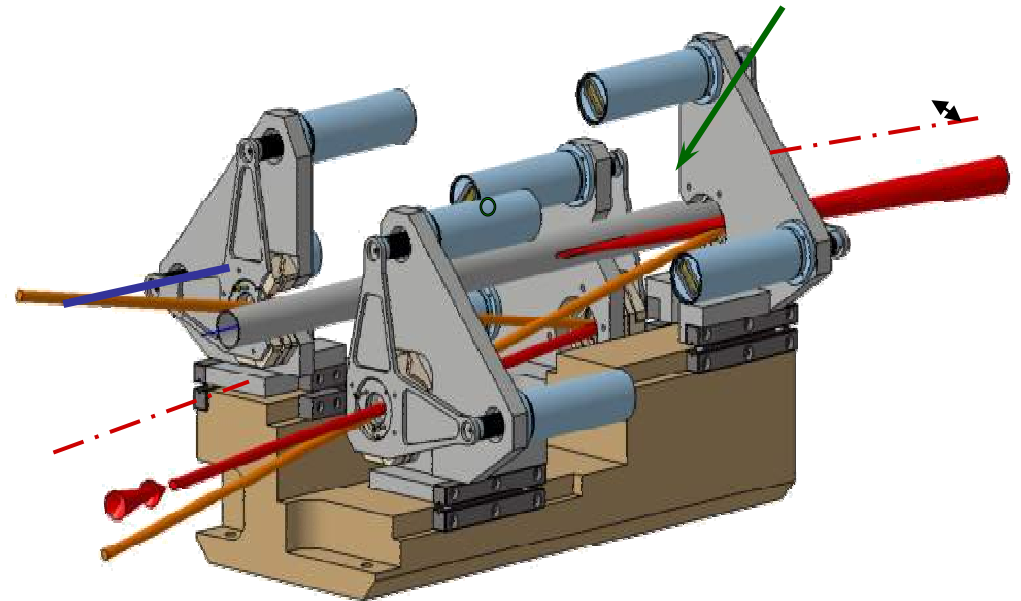
2-mirror cavity (Hiroshima / Weseda /
Kyoto / IHEP / KEK)



moderate enhancement
moderate spot size
simple control

demonstration of γ ray gen.
accum. exp. w/ cavity and acc.

4-mirror cavities w/LAL



high enhancement
small spot size
complicated control

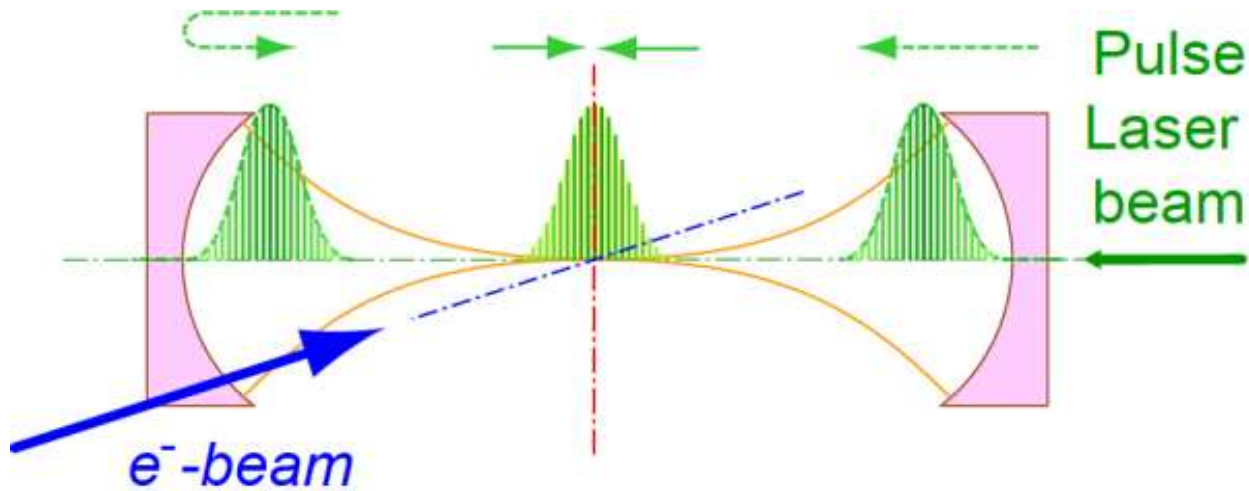


intense γ ray generation

2 MIRROR CAVITY STATUS

Experimental R/D in ATF

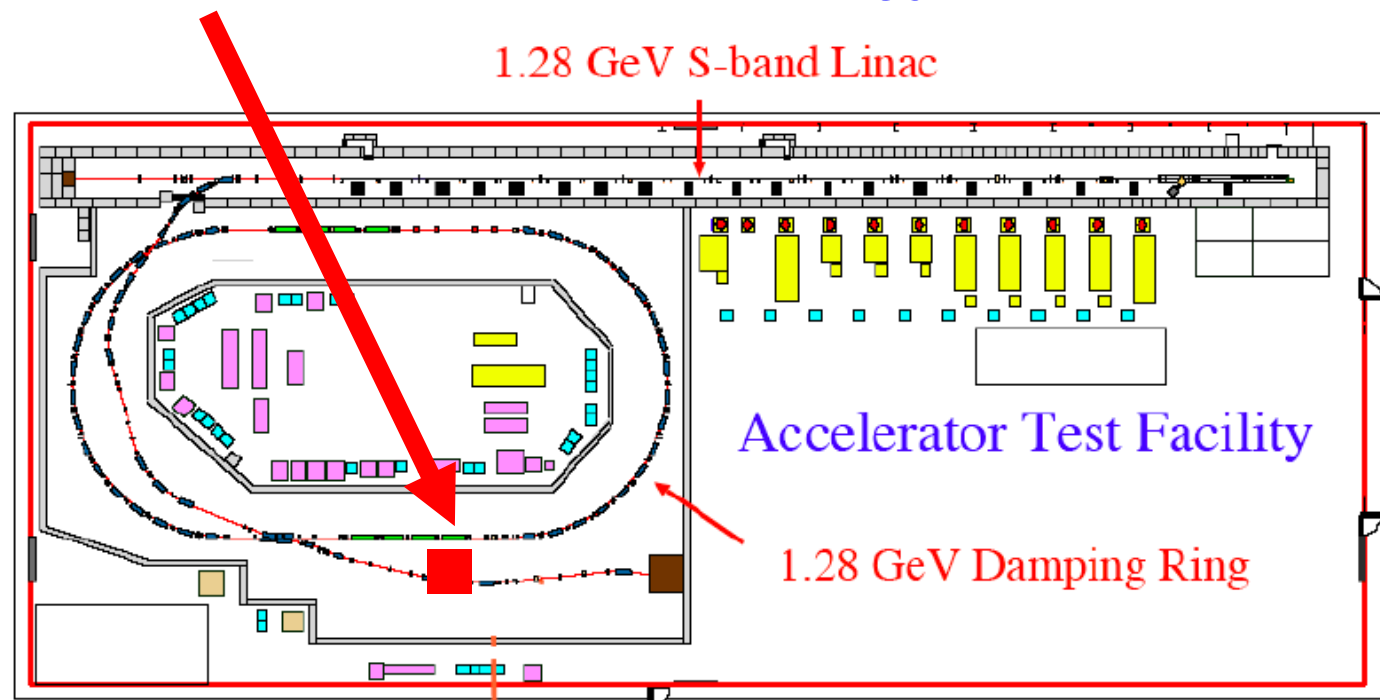
Hiroshima-Waseda-Kyoto-IHEP-KEK



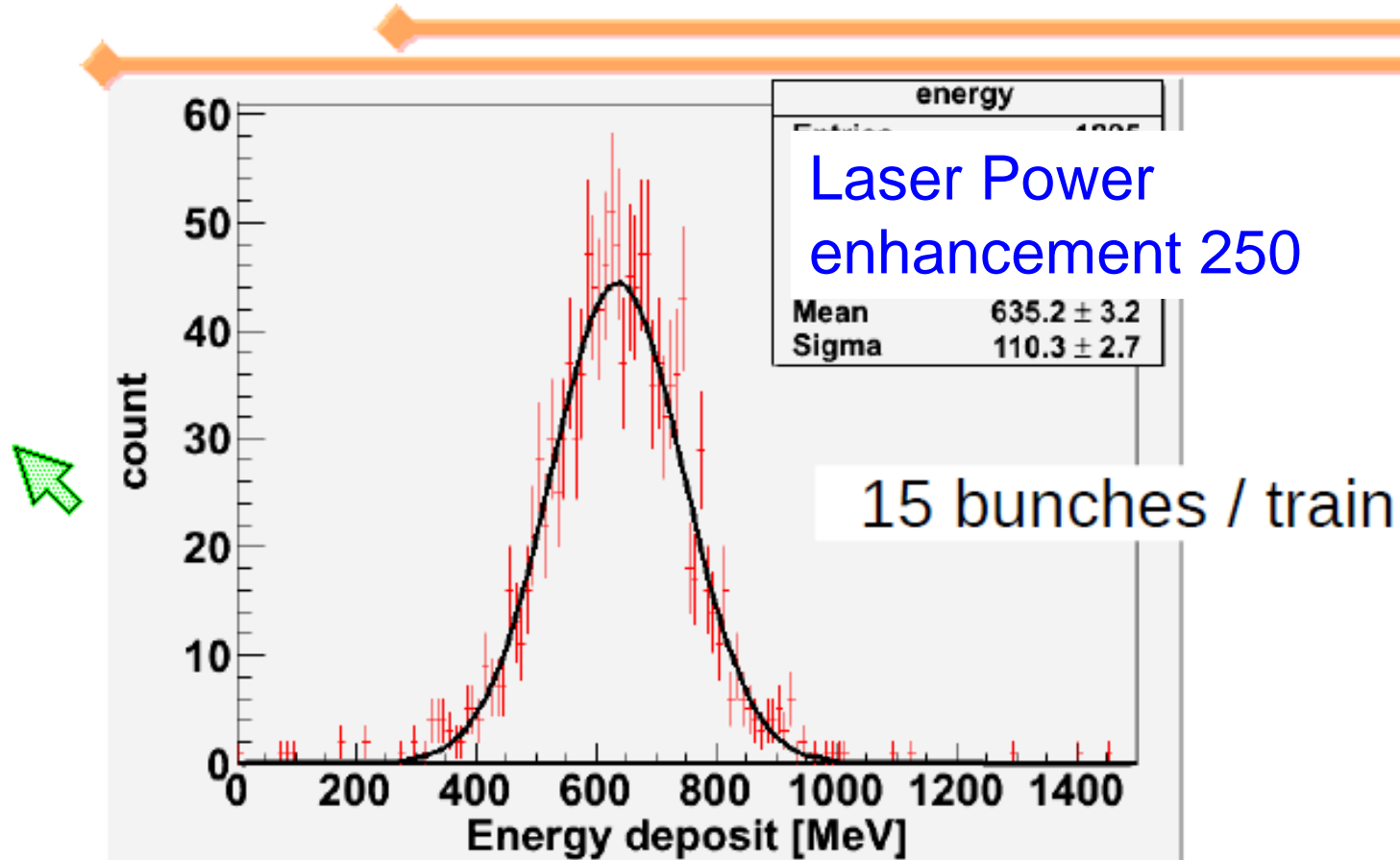
Make a fist
prototype
2-mirror cavity

$$L_{\text{cav}} = 420 \text{ mm}$$

Put it in
ATF ring



Result



We detected 27 gamma-rays / bunch train.
generation 60 gamma-rays / train to all angle.

→ $60 \times 2.16 \text{ MHz} \sim 1.2 \times 10^8$ [gamma / second]
Revolution

AFTER TILC09

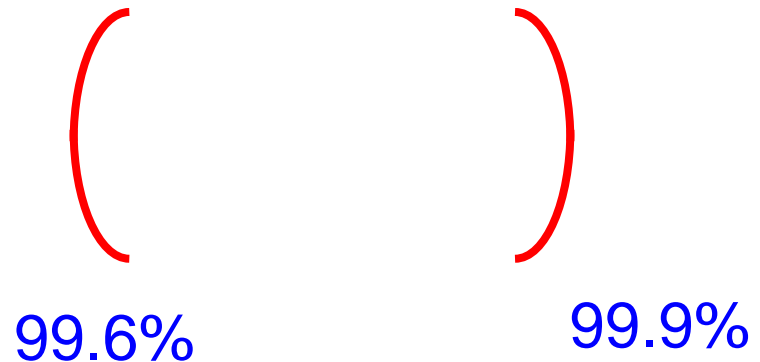
- ▶ One of the Mirror was replaced with the higher reflectivity one

- 99.6% -> 99.9%

- power enhancement

- 250 -> ~750

- more precise controll required (~0.1nm)



- ▶ Status of the cavity w/ new mirror

- Finess ~2000 with feedback on before vacuum on

- now in preparation for beam

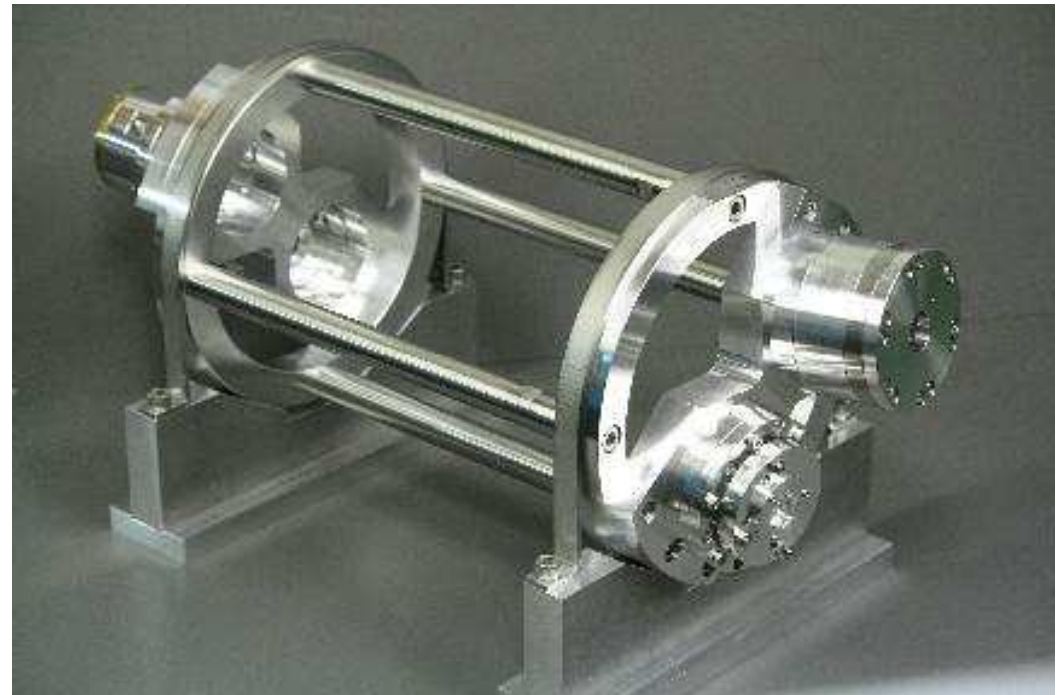
- hope to get 3 times more photons by the end of the year

4 MIRROR CAVITY STATUS

March 2009

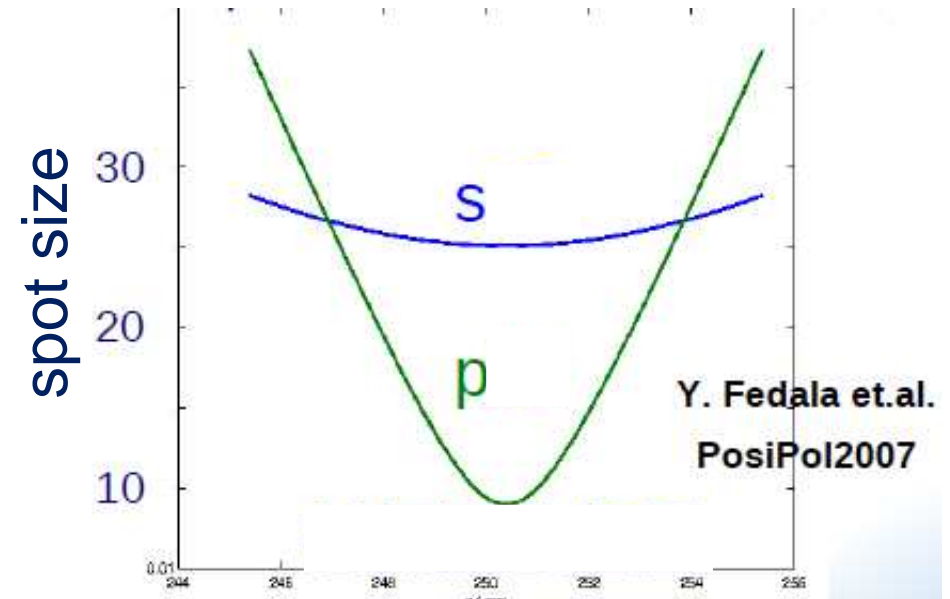


August 2009



2D configuration

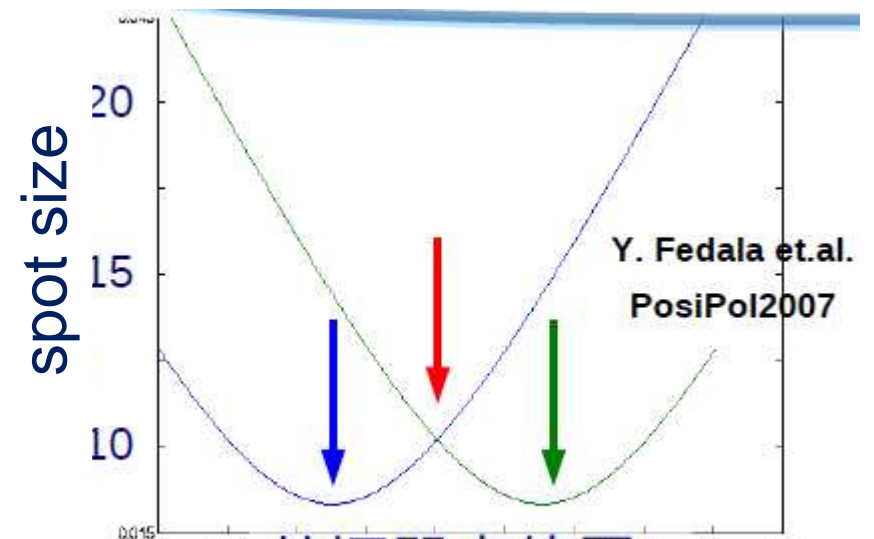
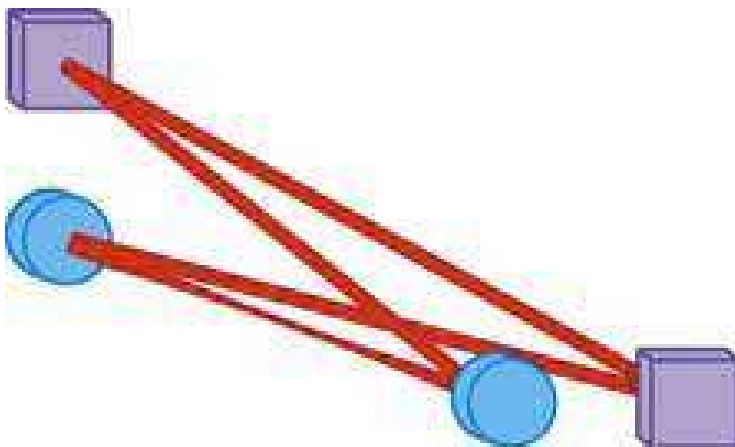
2D 4mirror cavity has astigmatism.



position in the cavity

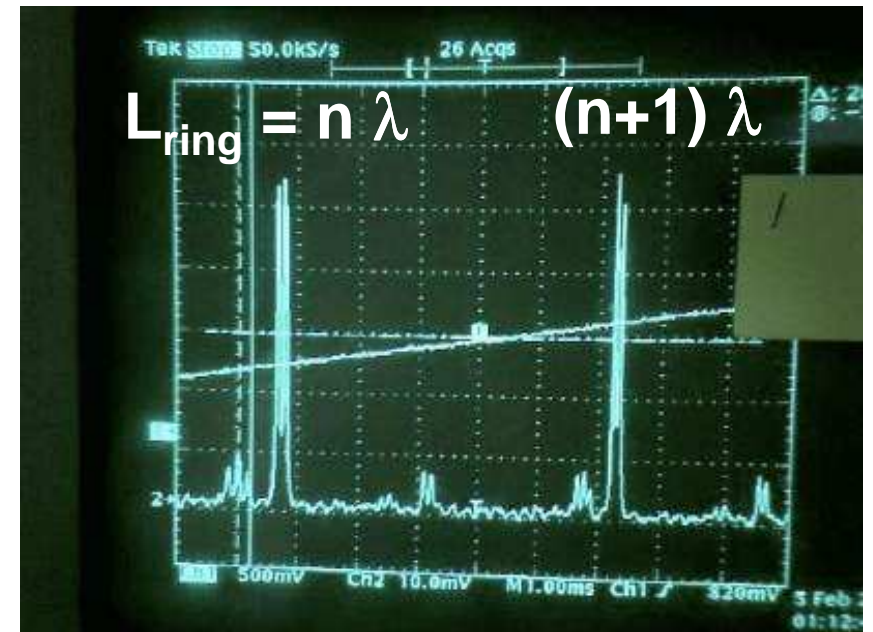
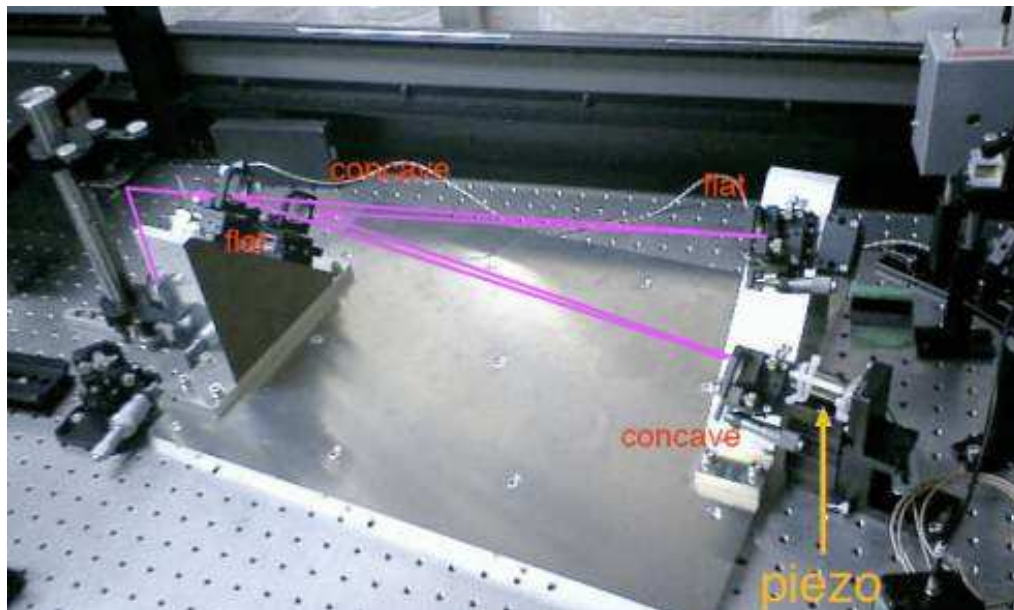
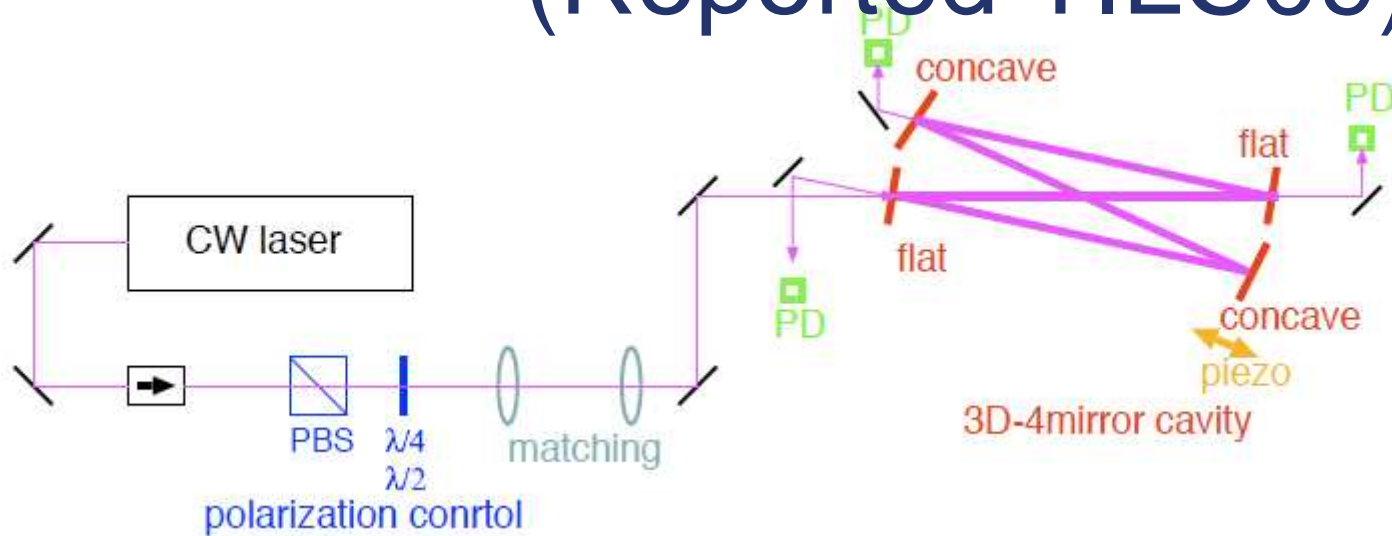
3D configuration

go to 3D config. to avoid astigmatism

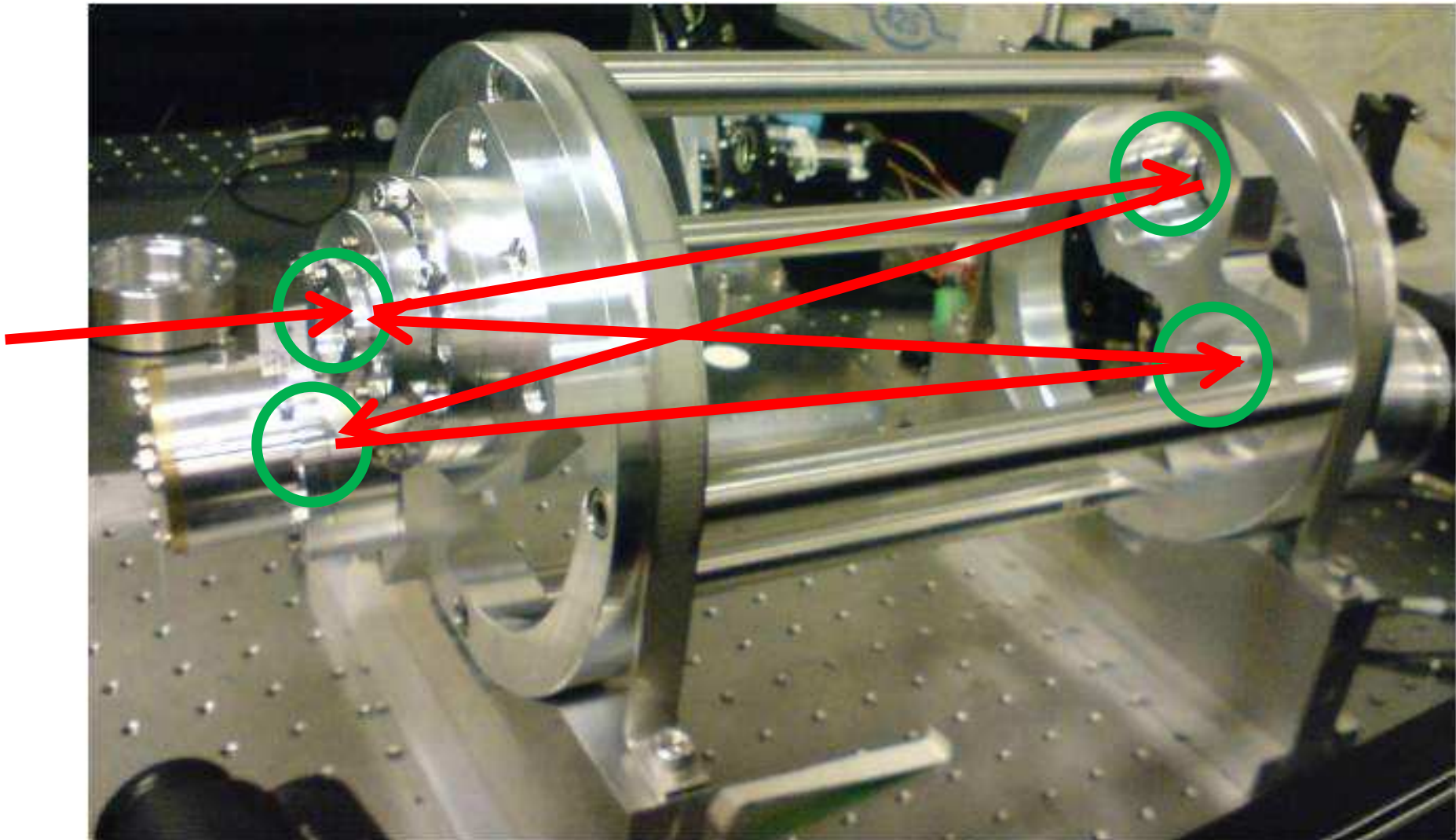


position in the cavity

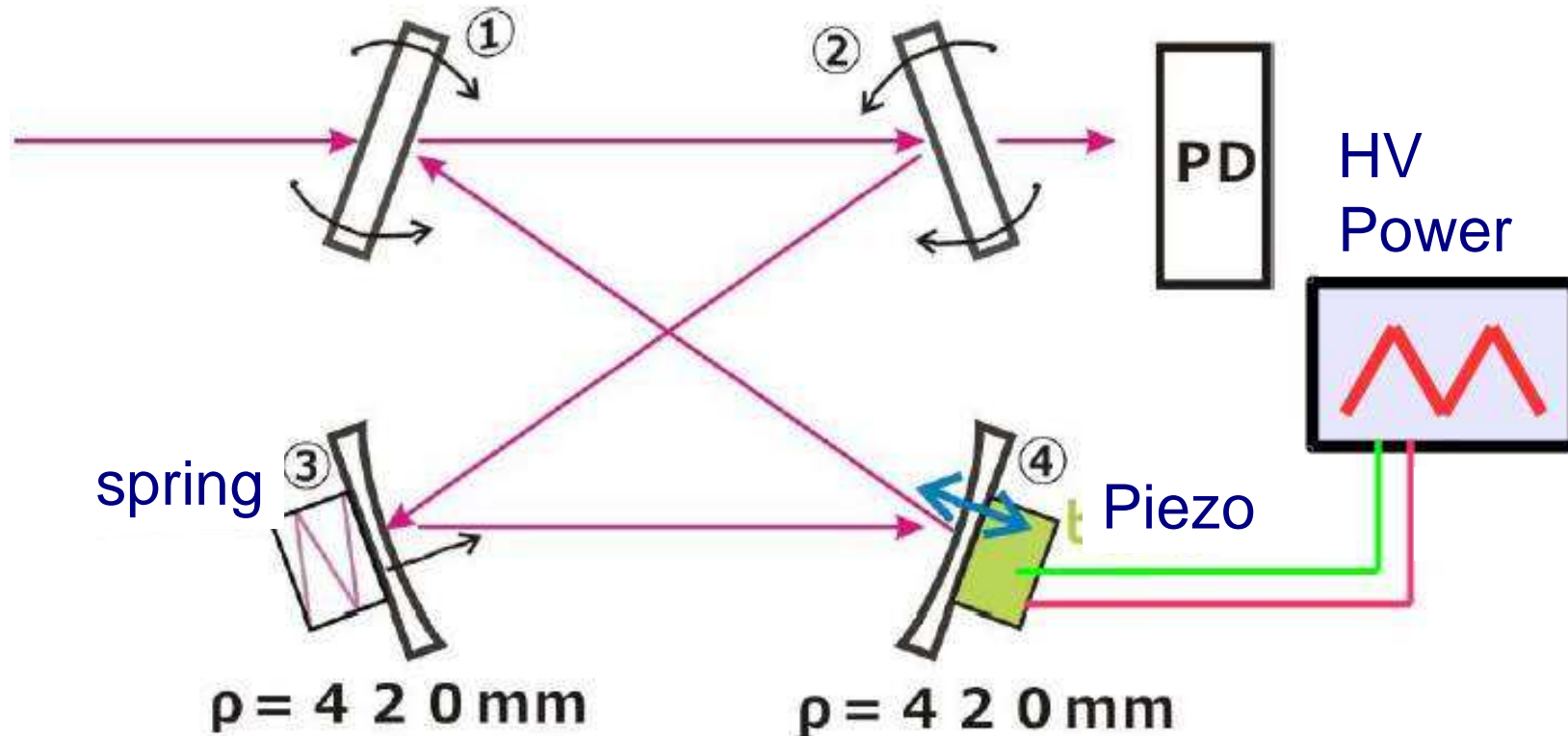
R&D of 4 mirrors cavity started at KEK (Reported TILC09)



prototype 4 mirror cavity Constructed

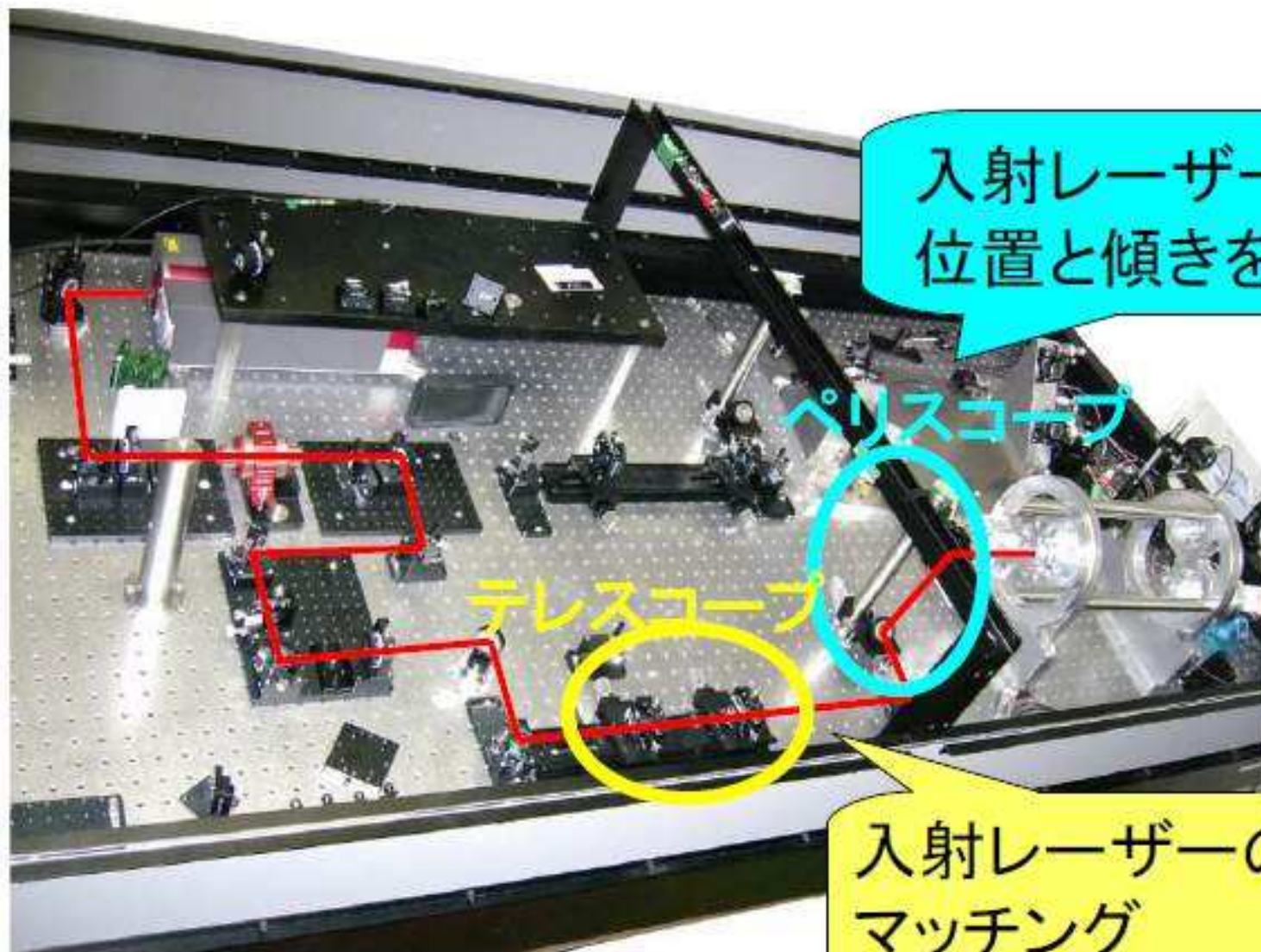


tuning mechanism



Objective: to establish method of:
mirror alignment, control cavity length
→ feed back to the beam compatible cavity

Prototype cavity on the optical table



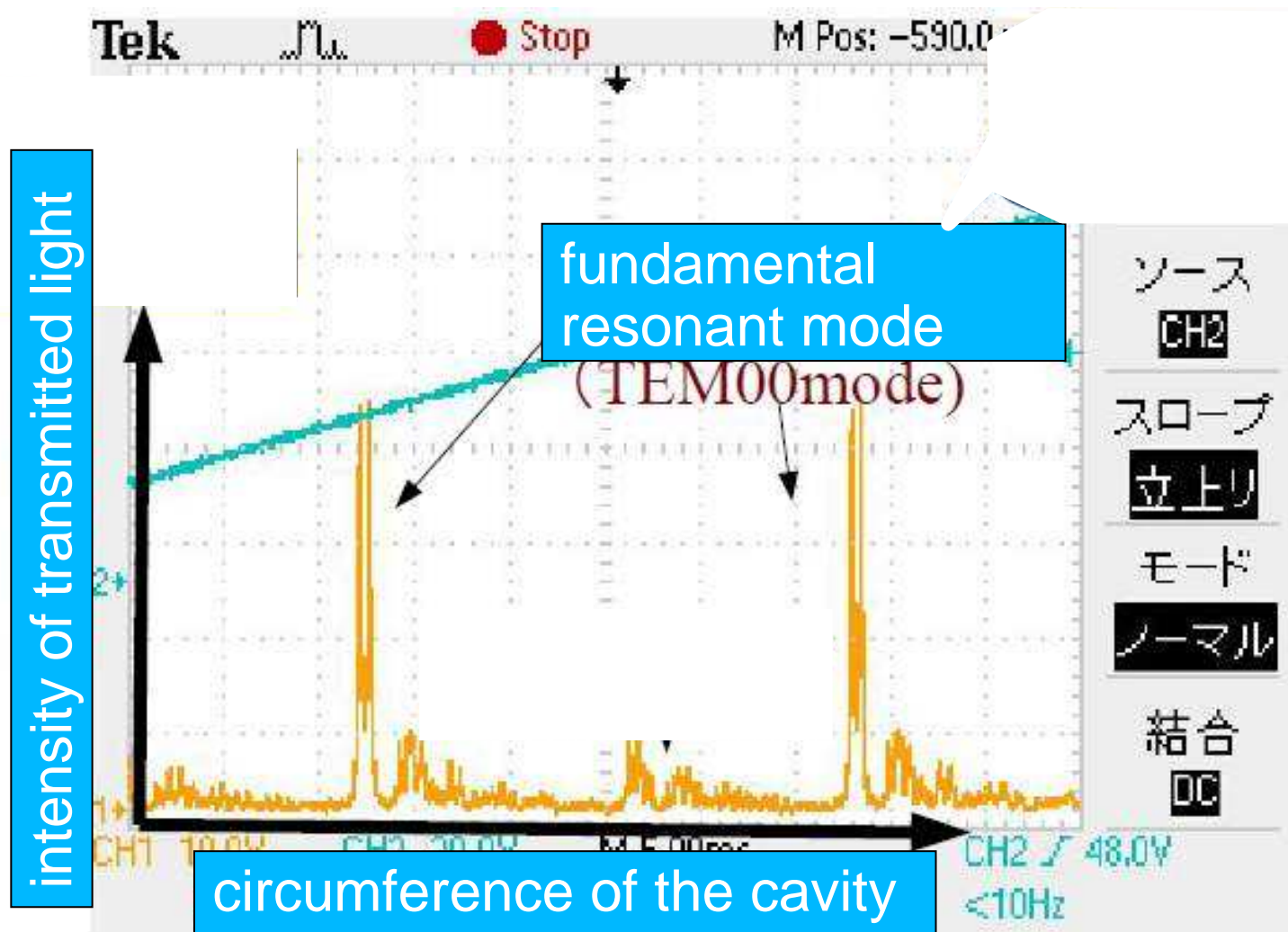
入射レーザー光の
位置と傾きを調整

ペリスコープ

テレスコープ

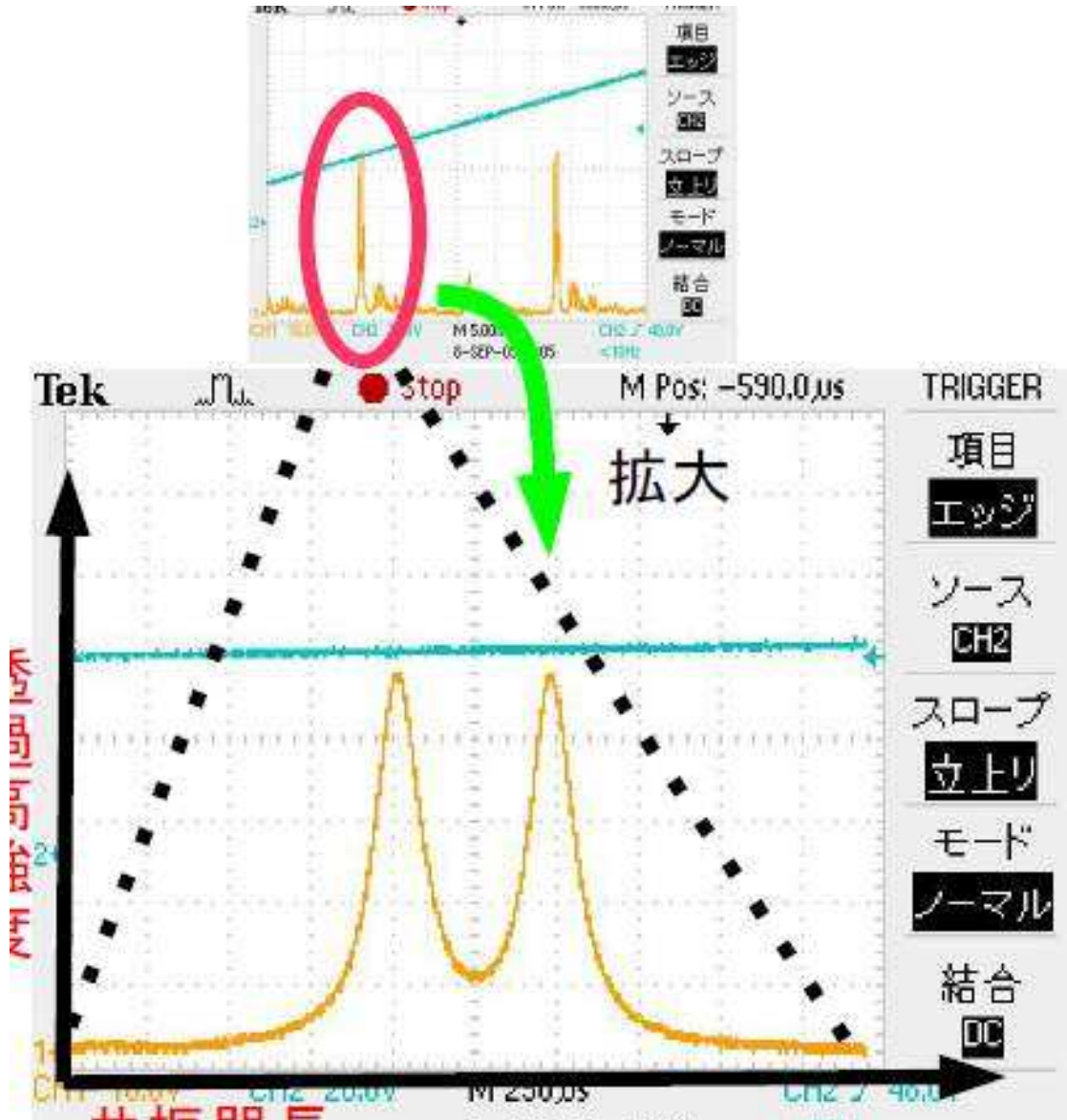
入射レーザーの
マッチング

status of initial tests



resonance of the cavity with injecting laser observed

two peaks



- two separated resonant peaks

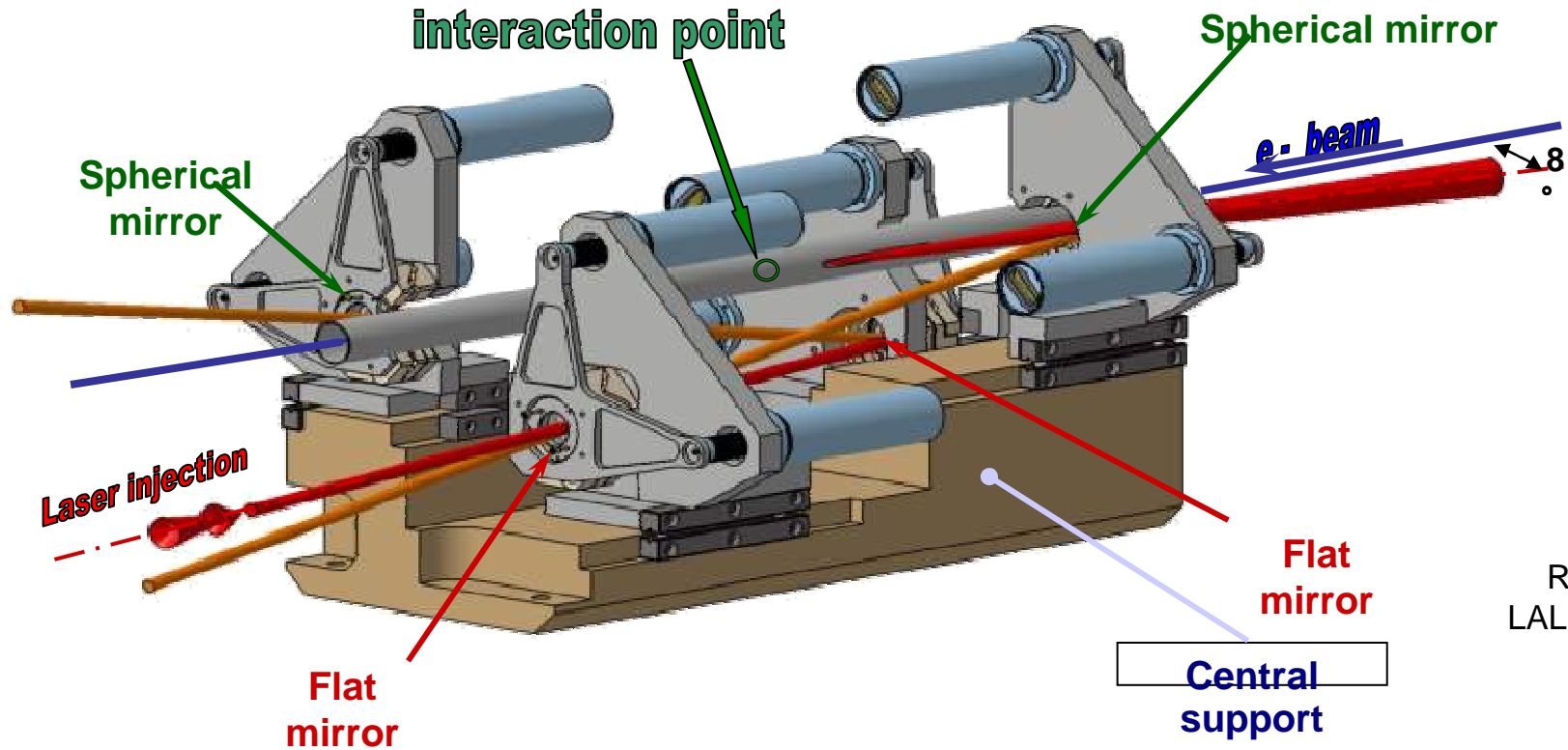
each corresponds to left or right handed polarization

- 3D cavity only resonates with circular polarization due to geometric phase

Useful to:

- generate circularly pol. γ s
- fast switching

Staus of the LAL cavity



R. Cizeron
LAL 30/01/2008

French colleagues visited KEK in July.
discussed detail of the installation procedure
setting up at the ATF beam line



working to install the cavity in summer 2010

Summary

- ▶ 2 mirror cavity to demonstrate photon generation and to accumulate experience w/ beams
 - **At the TILC09**
 - enhancement of 250, 27 gammas / crossing
 - **high reflection mirror (99.6% -> 99.9%)**
 - beam with enhancement ~750 to 1000 this year
- ▶ 4 mirror ring cavity for higher enhancement and small spot size
 - **at the TILC09**
 - basic test on optical table
 - **first prototype at KEK and being tested**
 - **installation of LAL cavity being ready**

Quantum Beam Project supported by JST

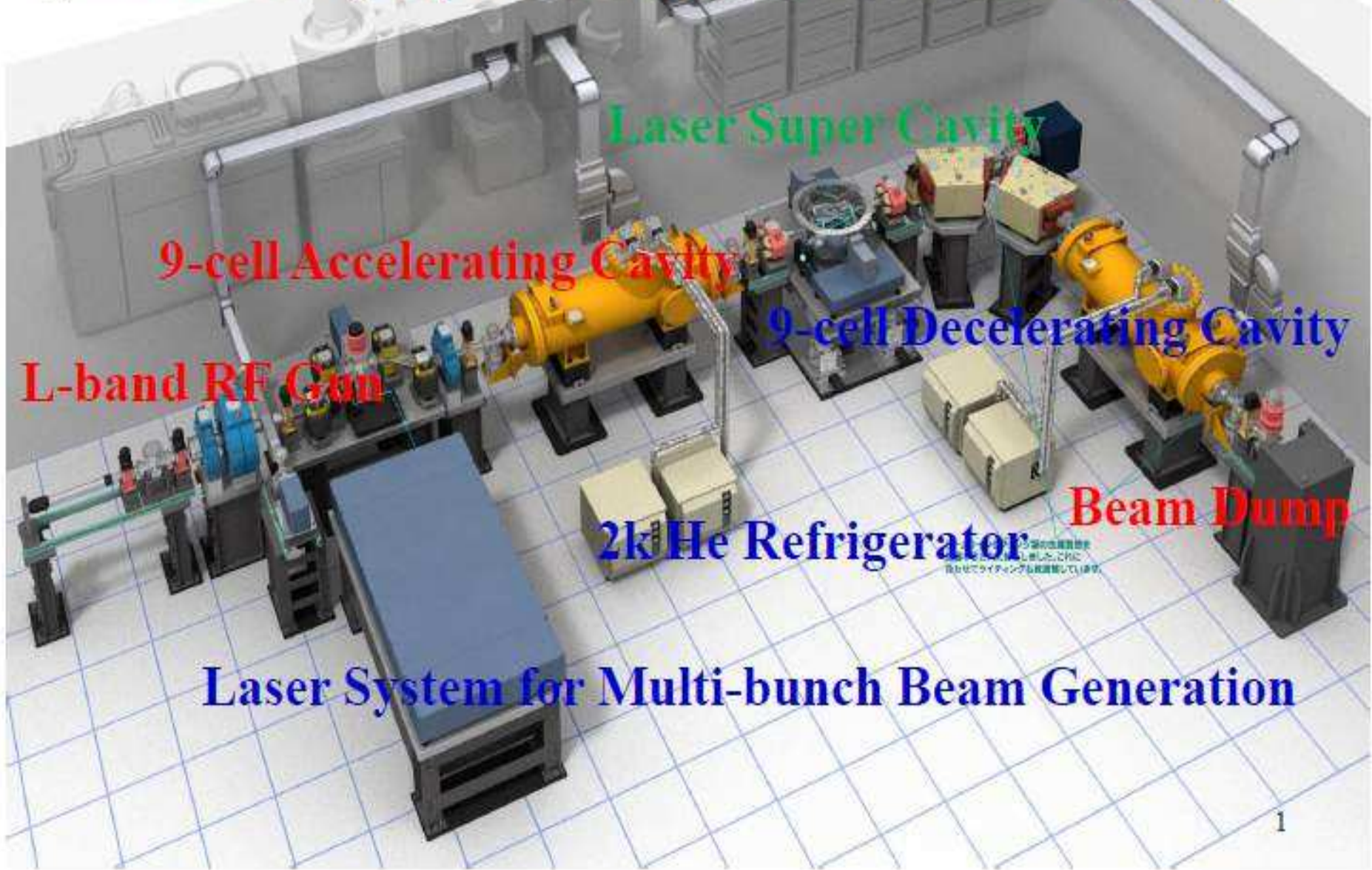
光子ビームプロジェクト「イラステ」最終レポート(2009.03.22)

修正の進捗も反映しました。修正箇所をチェックお願いします。カラーリングはチェック後となります。

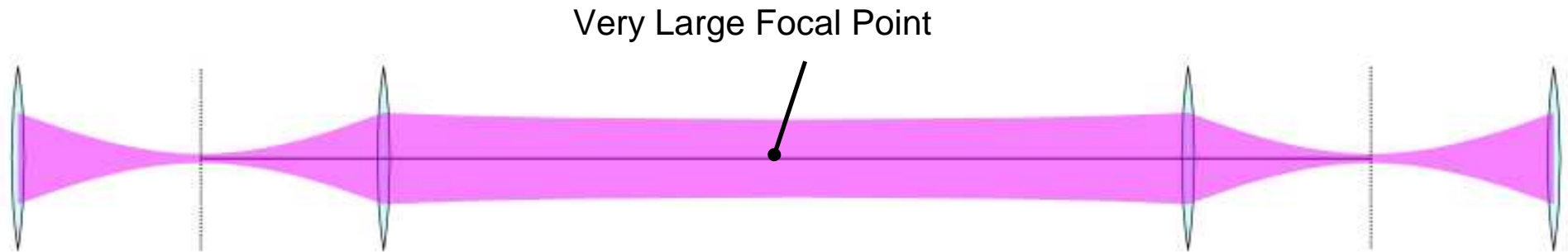
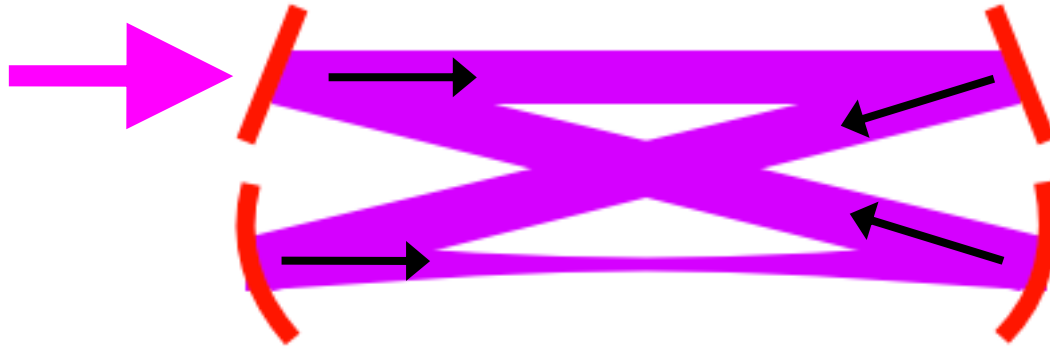
横図6

Development for Next Generation Compact High Brightness X-ray Source using Super Conducting RF Acceleration Technique

最終の資料をいれる前にいくつかの修正を
この資料のチェックは最終版でのチェックで済ませました。
10月14日(木)にこの資料を2009年11月10日(水)の最終レポート
に盛り込み、最終版として提出いたします。



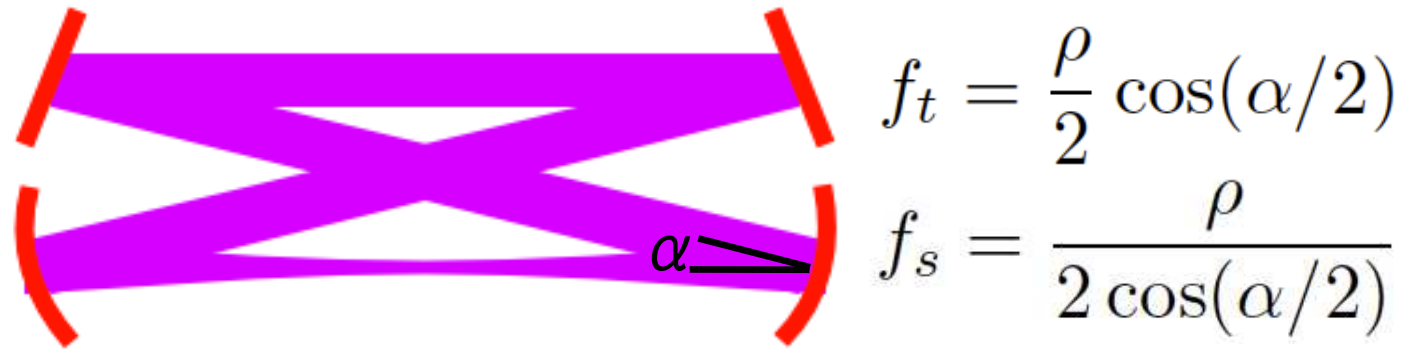
4-mirror ring cavity



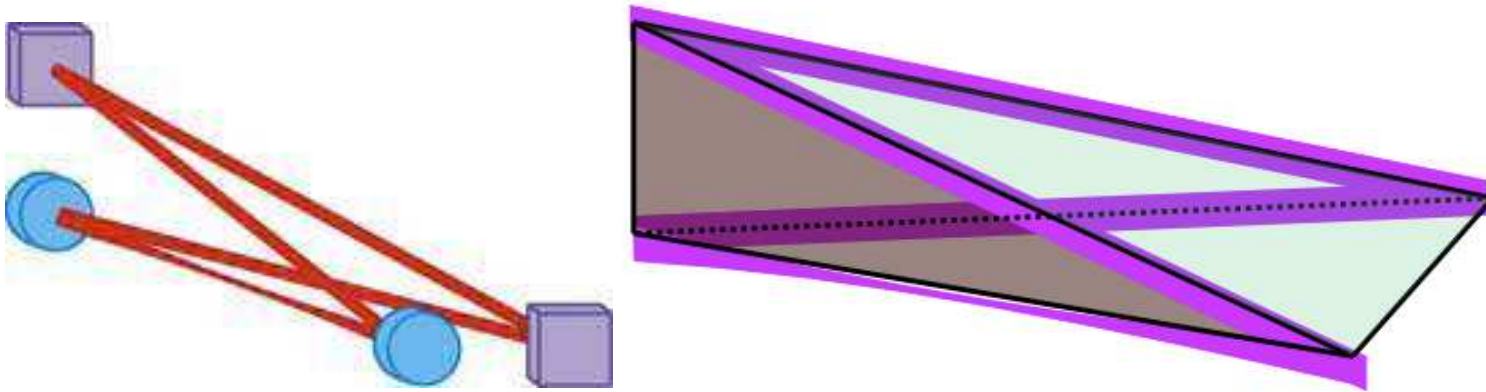
Equivalent Optics of the 4-mirror Cavity

tolerance : 4-mirror = 100 x 2-mirror

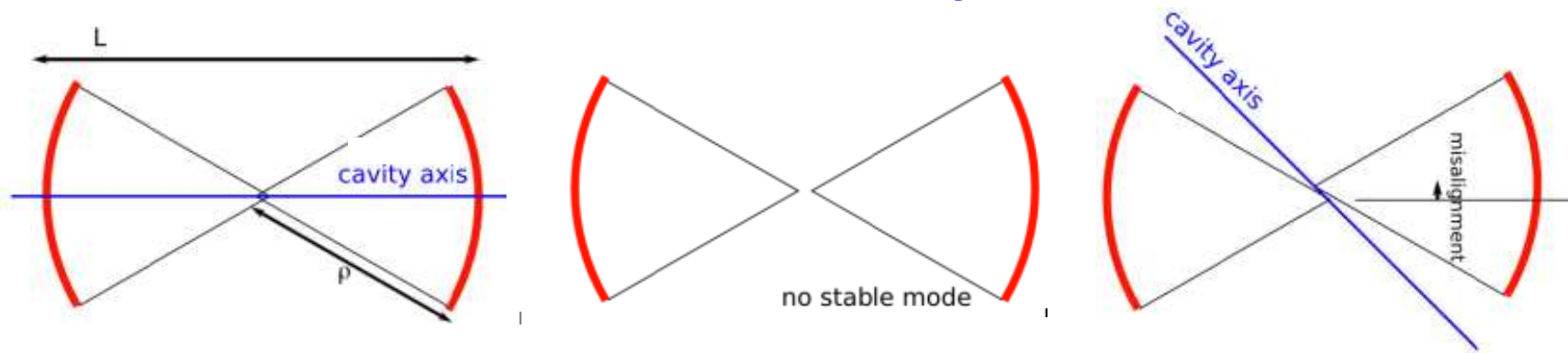
2D configuration



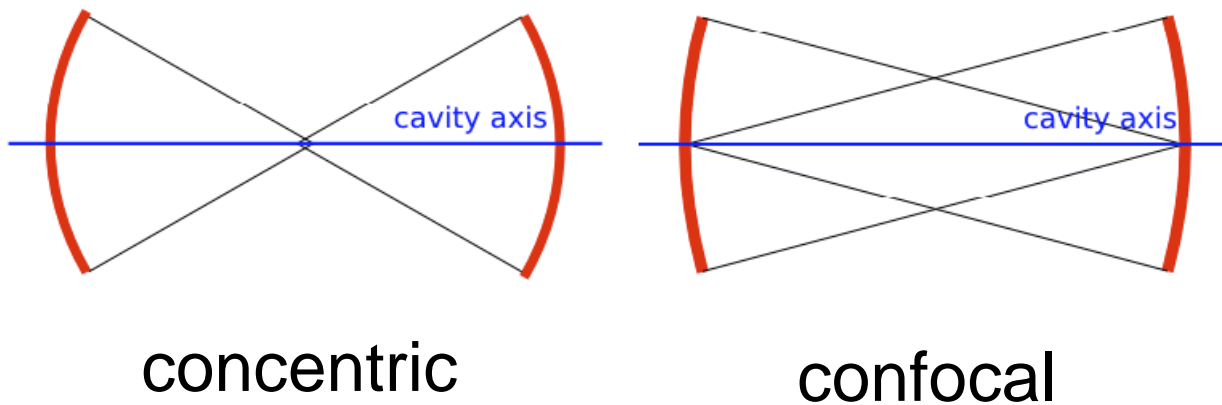
3D configuration



Tolerance of 2-mirror cavity

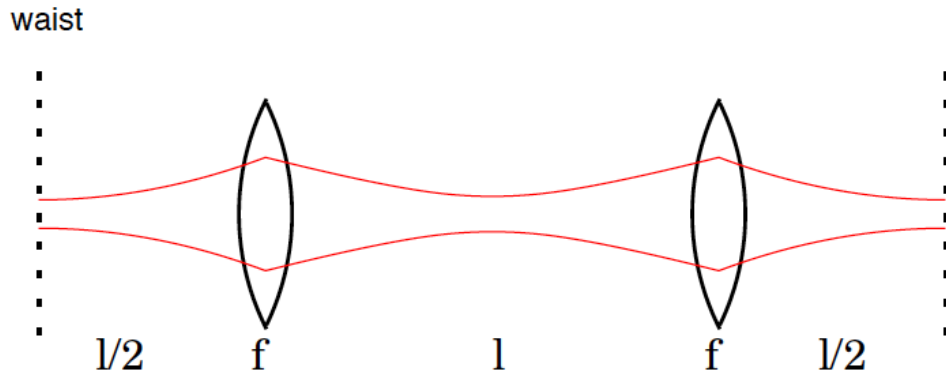
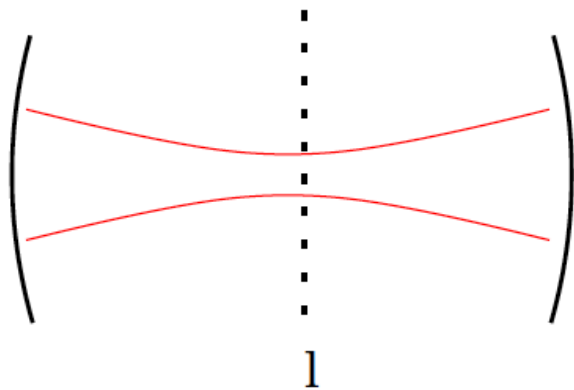
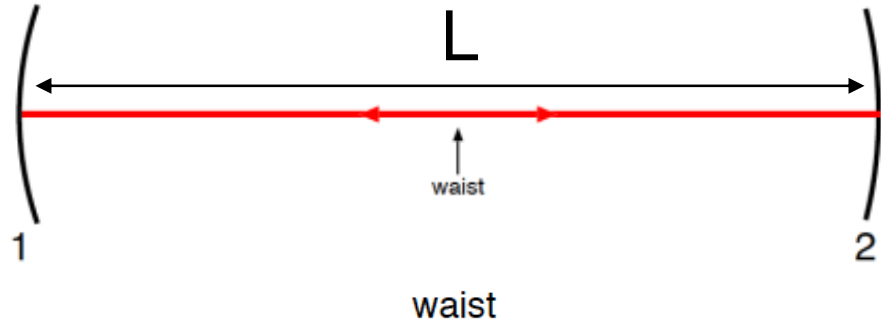


Concentric Configuration and Confocal Configuration



2-mirror cavity

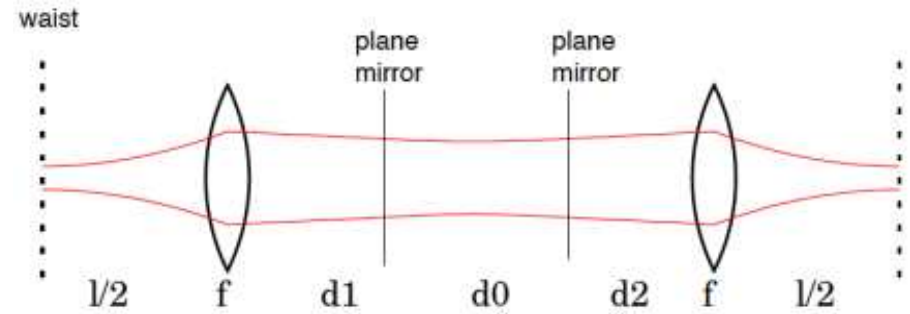
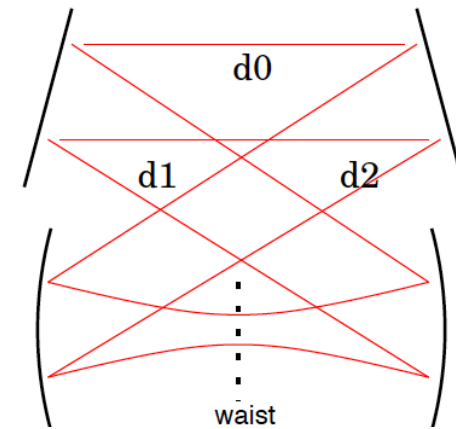
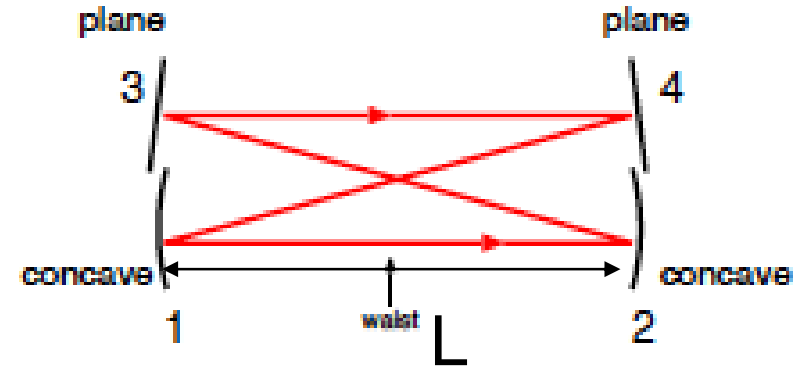
$$R1=R2=L/2$$



concentric

4-mirror cavity

$$R1=R2=L$$



confocal

data summary

bunch /train	current [mA]	Stacked Laser power[W]	γ s/train	expectation	normarized γ s/A/W
1	2.2	437 ± 2	5.4 ± 0.3	4.9 ± 0.3	5.6 ± 0.3
5	4.7	432 ± 2	10.6 ± 0.1	10.5 ± 0.5	5.3 ± 0.1
10	8.5	470 ± 2	19.0 ± 0.1	21 ± 1	4.8 ± 0.1
15	11	498 ± 2	26.9 ± 0.1	29 ± 1	4.8 ± 0.1

Normalized γ yield seems to decrease as # bunches/train goes up

 Bunch (size, timing) fluctuation in the ATF suspected