

# Recent results of the cavity Compton

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23<sup>rd</sup> Jan 2013

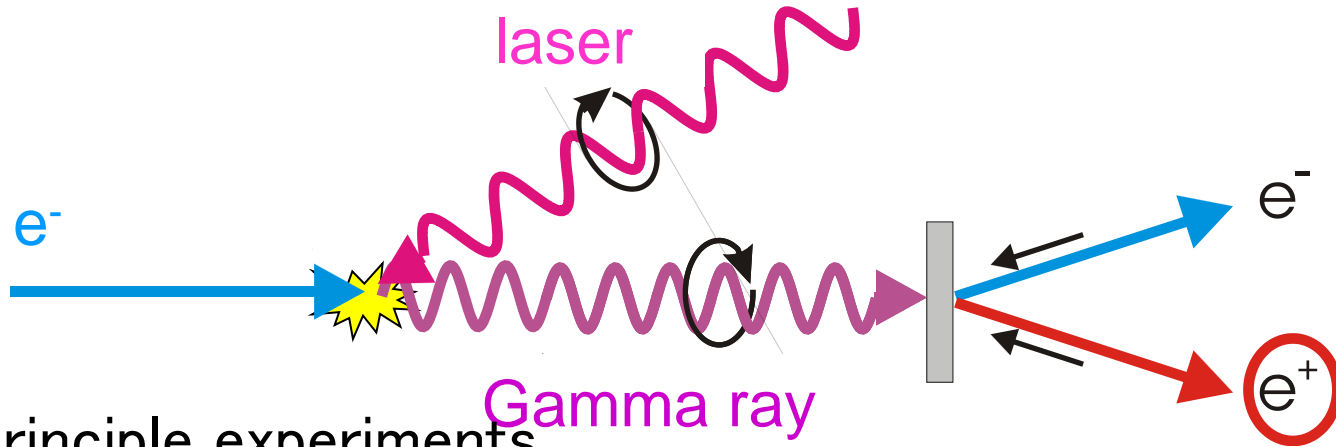
15th ATF2 Project Meeting

# contents

- Status as of previous meeting
- Progress since previous meeting
- Issues and future plan

# Introduction

## Polarized $e^+$ by laser Compton Scheme



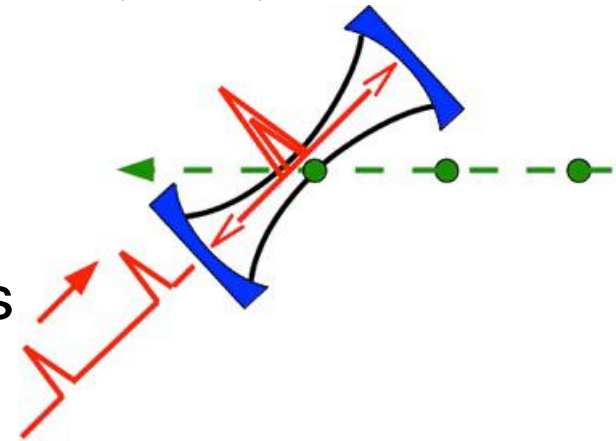
proof of principle experiments

M. Fukuda et al., Physical Review Letters 91, 164801(2003)

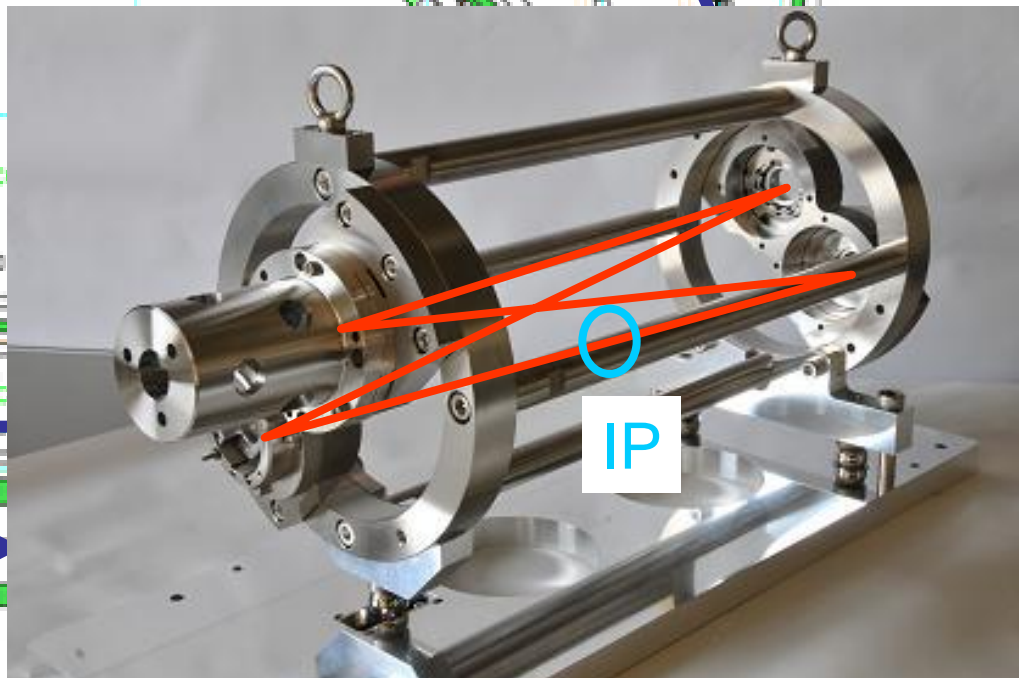
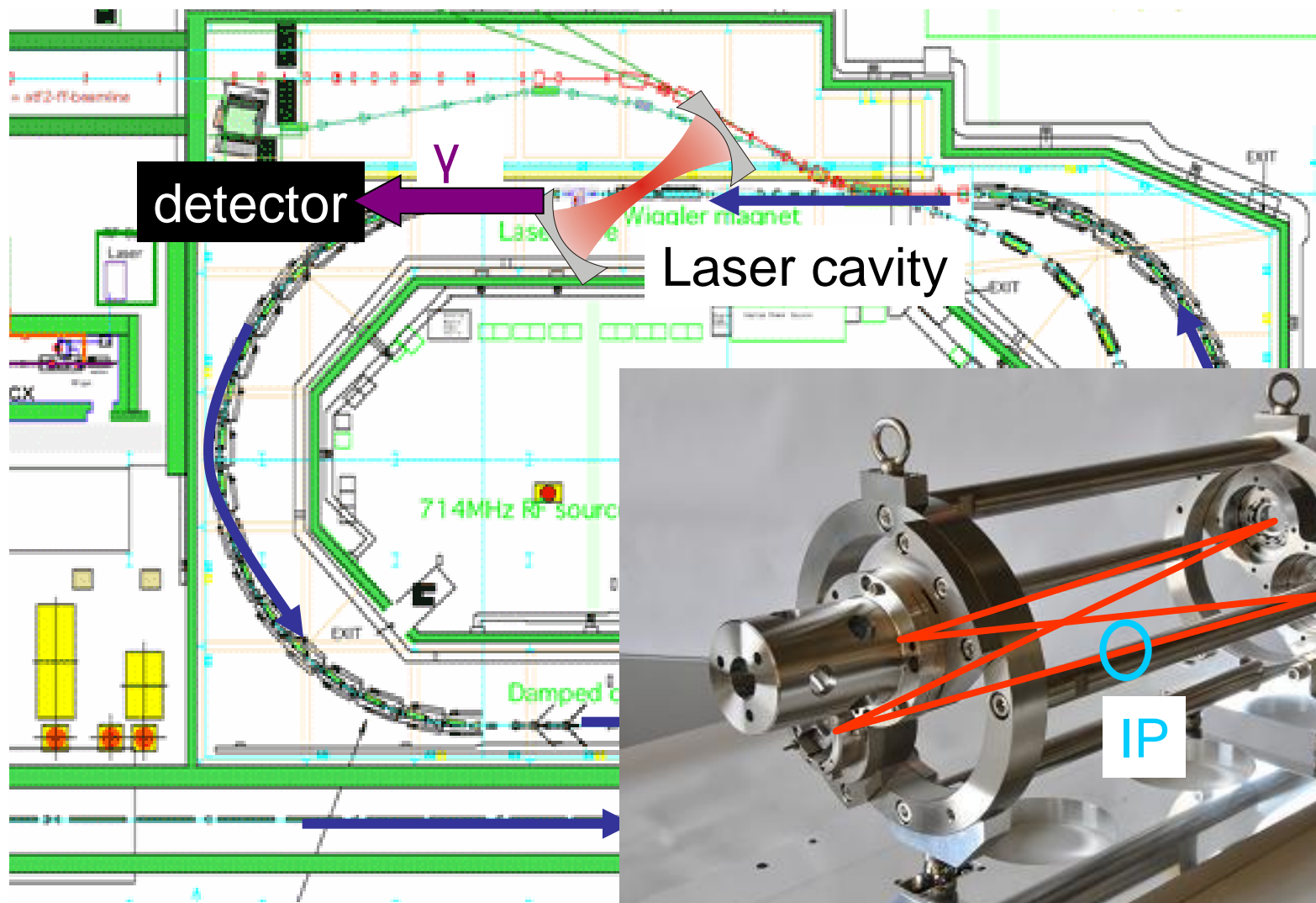
T. Omori et al., Physical Review Letters 96, 114801(2006)

Toward the positron sources

→ increase intensity of gamma rays  
using an optical cavity

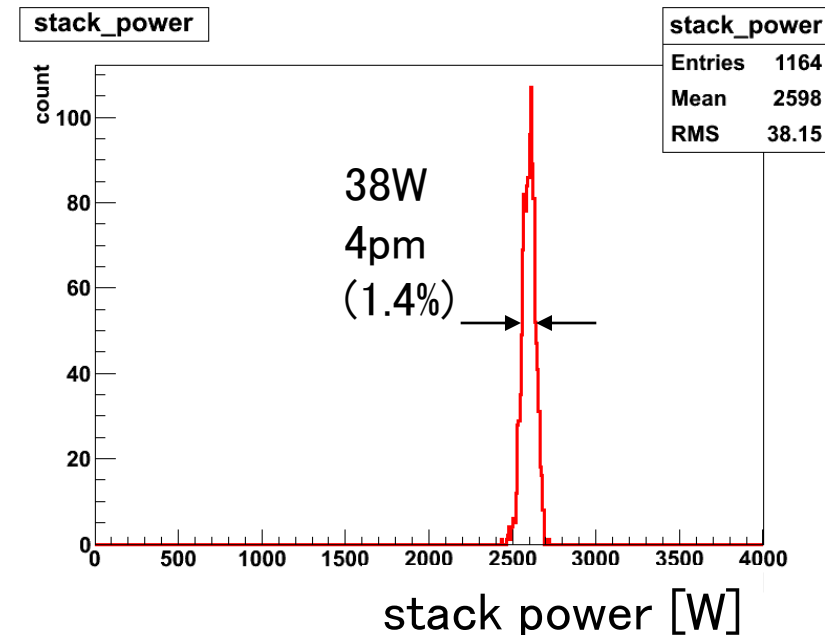
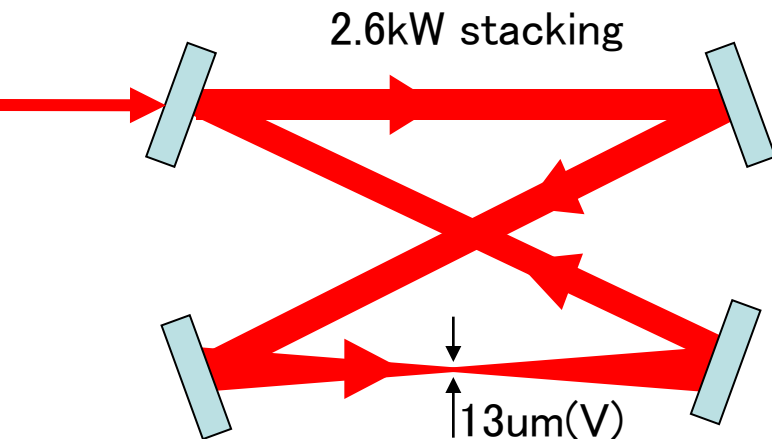


# overview



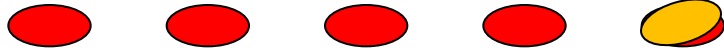
# Last ATF2 Project Meeting report

- Stable resonance with new feedback system
  - 2.6kW average power w/ 1.4% fluctuation
- laser waist size at IP( $\sigma$ )=13 $\mu$ m(vertical scan)



5 bunches/train

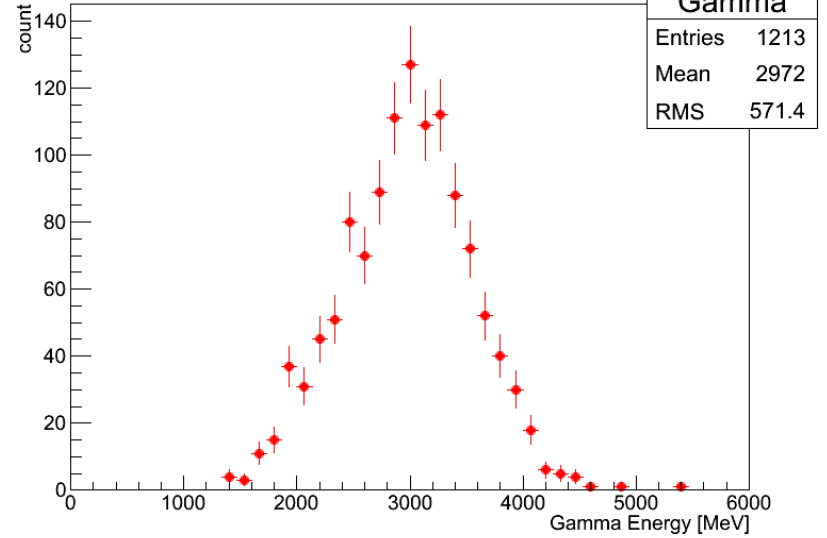
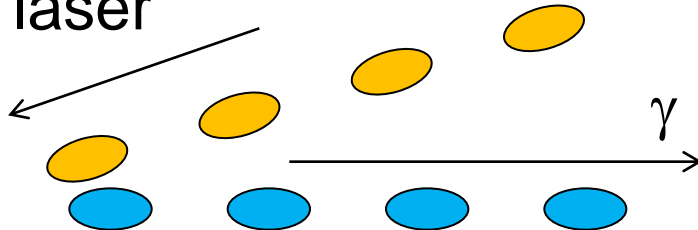
e- →



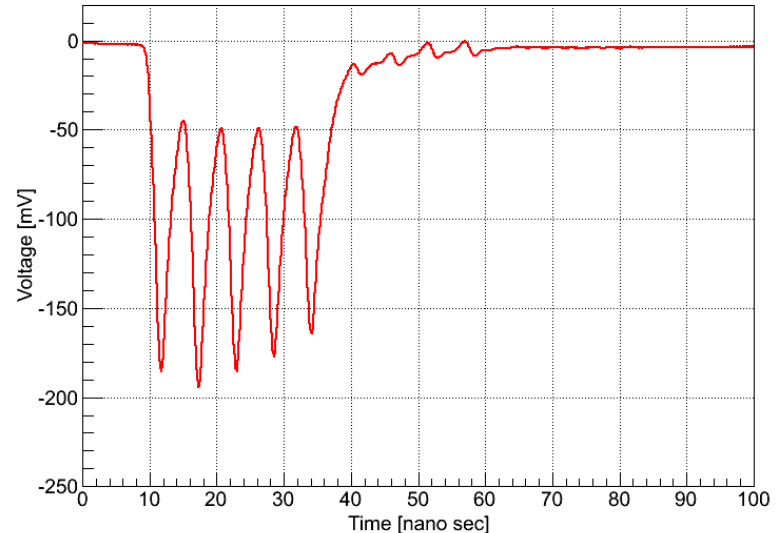
5.6ns

▪ # of  $\gamma$ s = 123.8/train

laser ←



- confirmed stable photons from each bunch

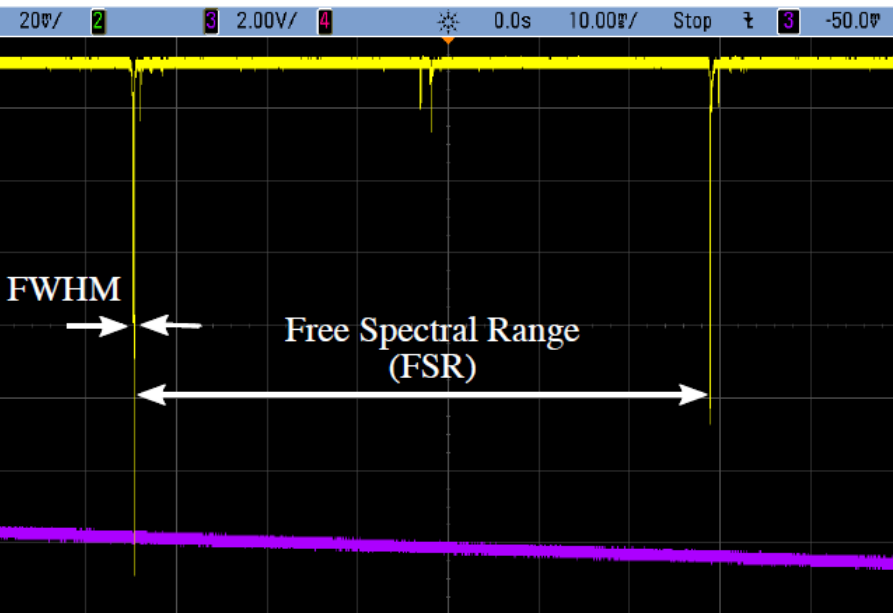


# Status as the last meeting

- What achieved
  - 2.6 kW stored w/ 1.4 % stability
  - 128 photons/train
  - laser waist size 13  $\mu\text{m}$  in vertical direction
- What to be confirmed
  - finesse
  - power balance
  - laser profile at IP

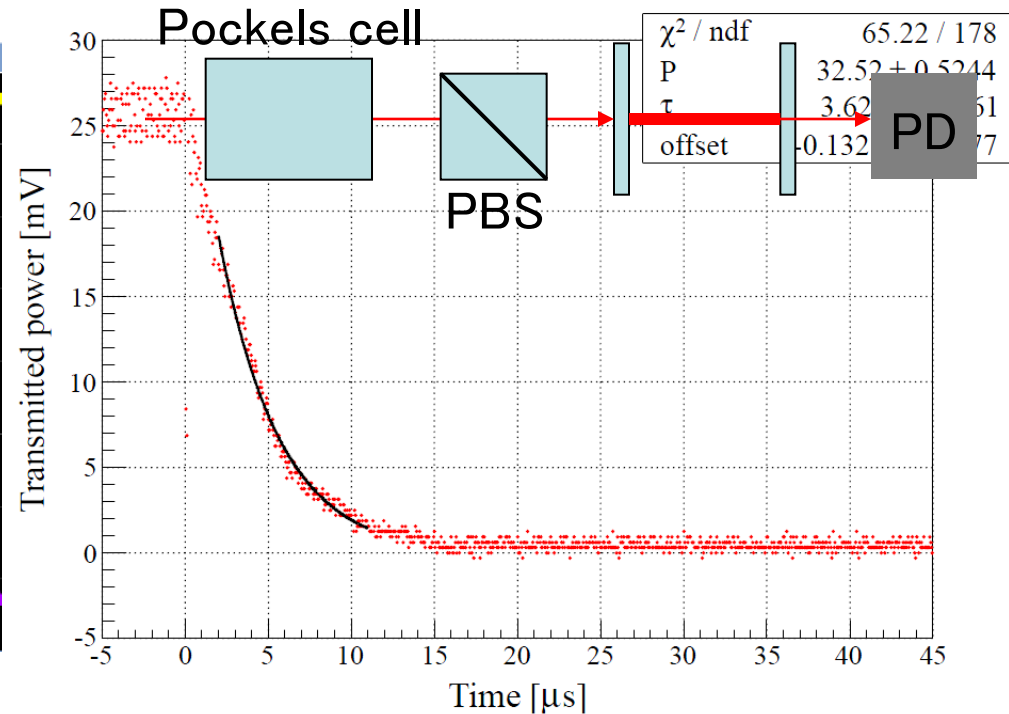
# Finesse measurement

## Airy Function



Finesse:  $4040 \pm 420$

## Decay time measurement

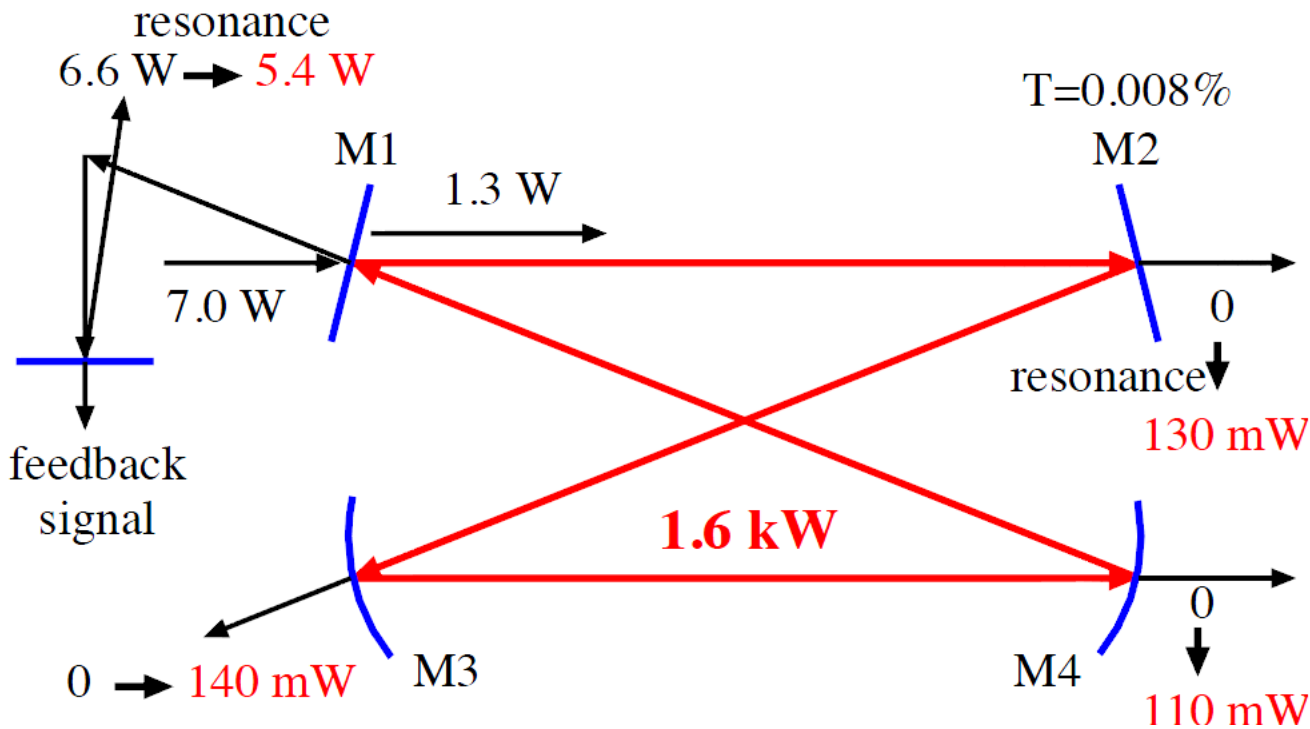


$4040 \pm 110$

Both Consistent but smaller than expected, 4850, from mirror reflectivity



# Power balance



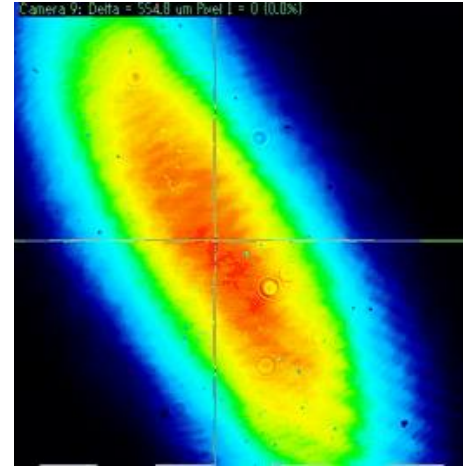
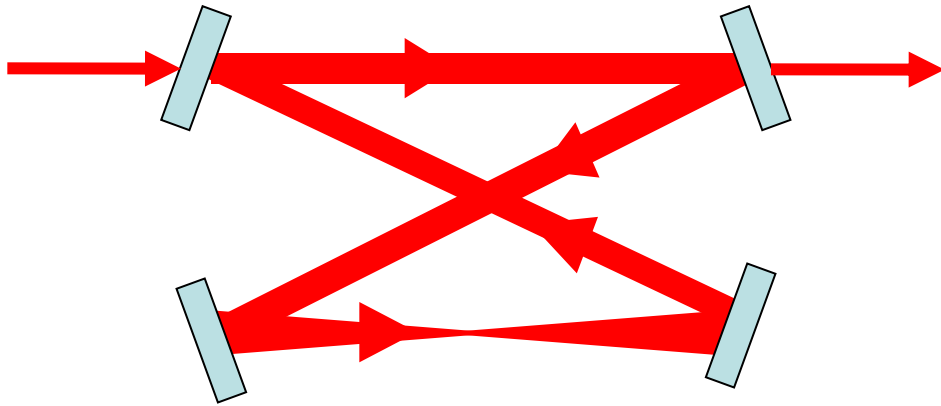
## Stack power

injection power  $\times$  enhancement = 1.6kW

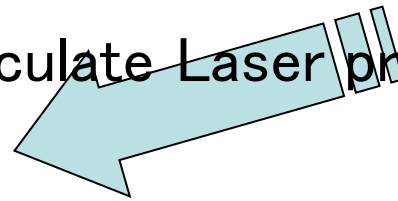
transmitted power / transmission factor = 1.6kW

$\Rightarrow$  both estimations are consistent

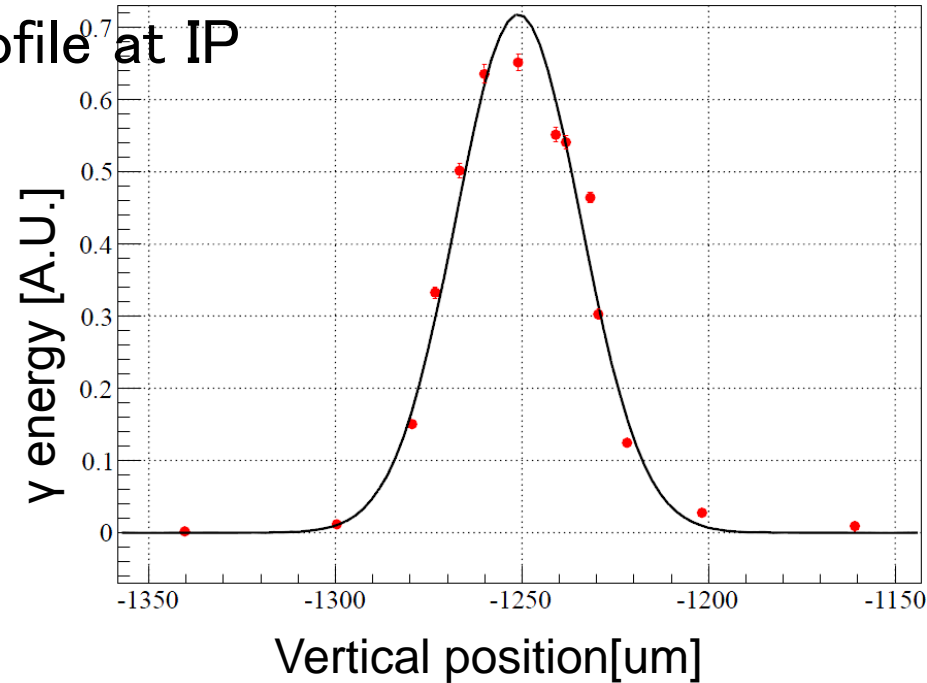
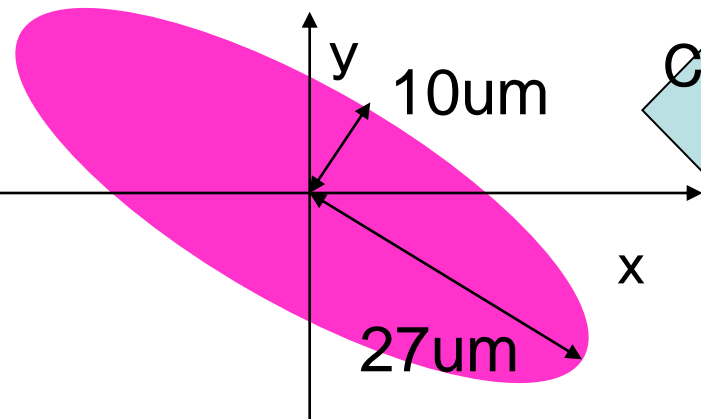
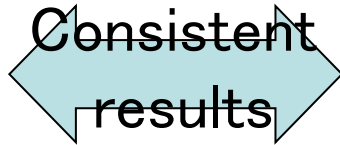
# Laser profile at IP



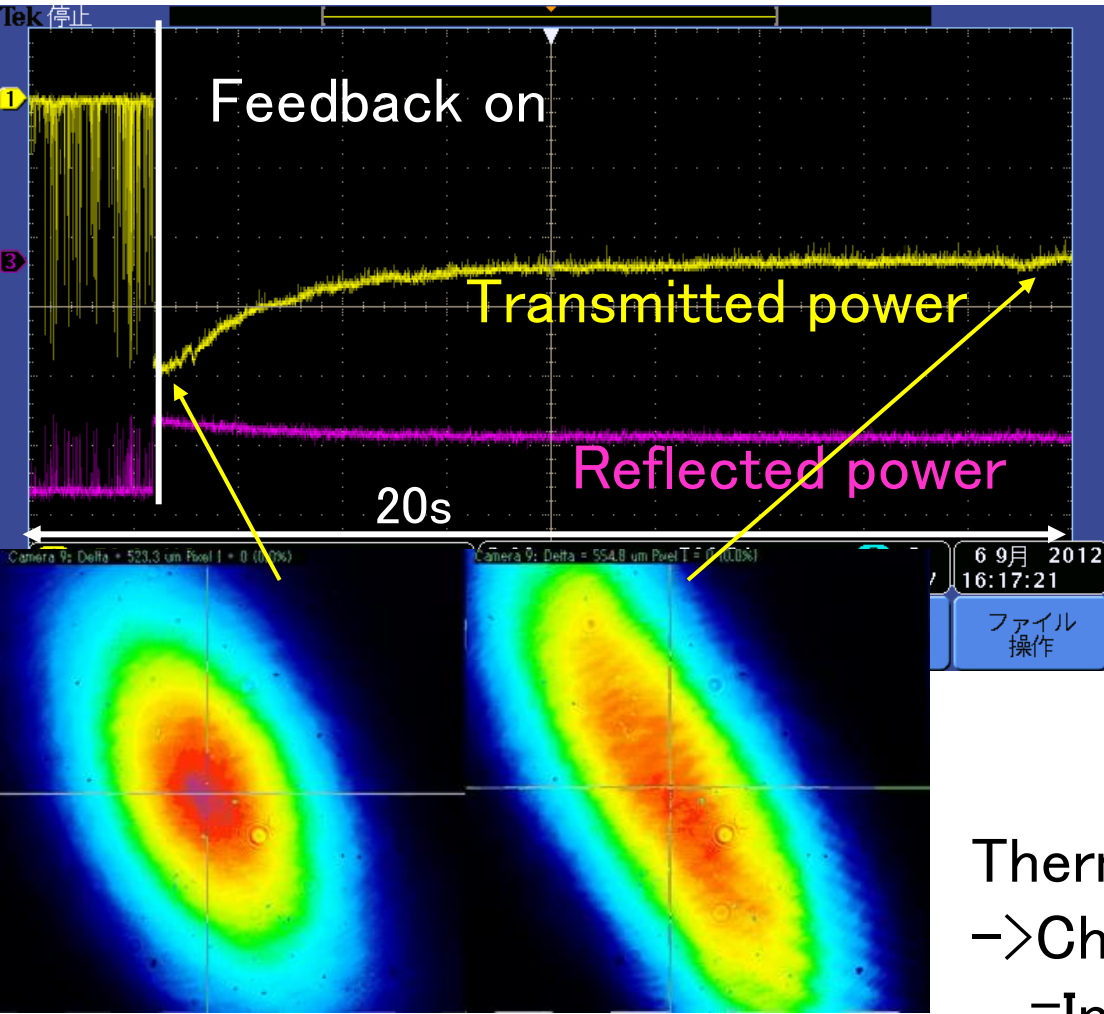
Calculate Laser profile at IP



Consistent results



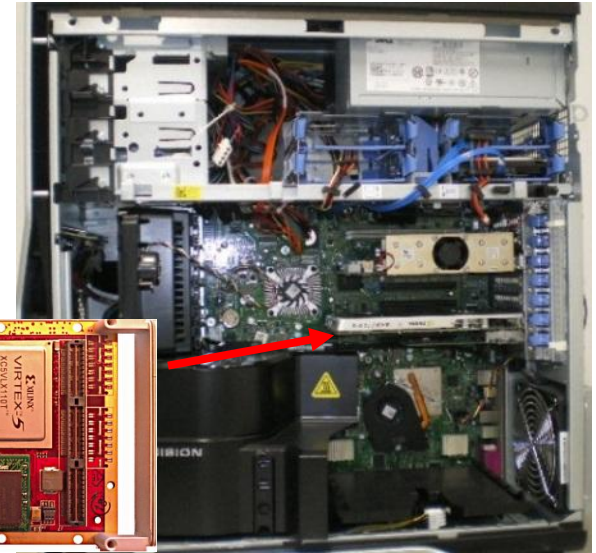
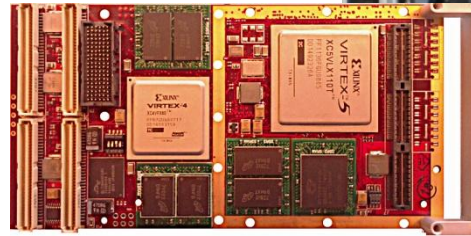
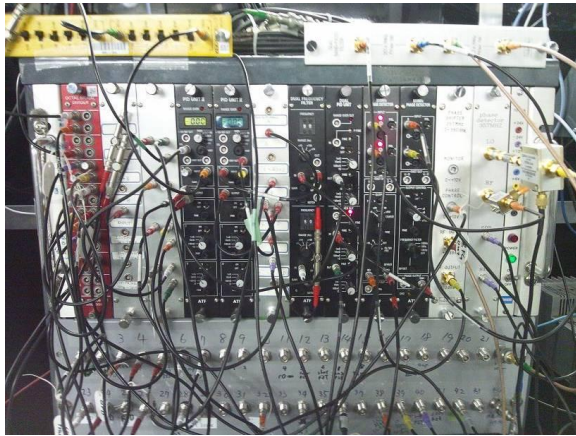
# Decrease in stack power



Thermal deformation of the mirror  
→ Change of transmitted profile  
= Incident efficiency is reduced.

# Installation digital feedback

Feedback circuit : analog  $\rightarrow$  digital

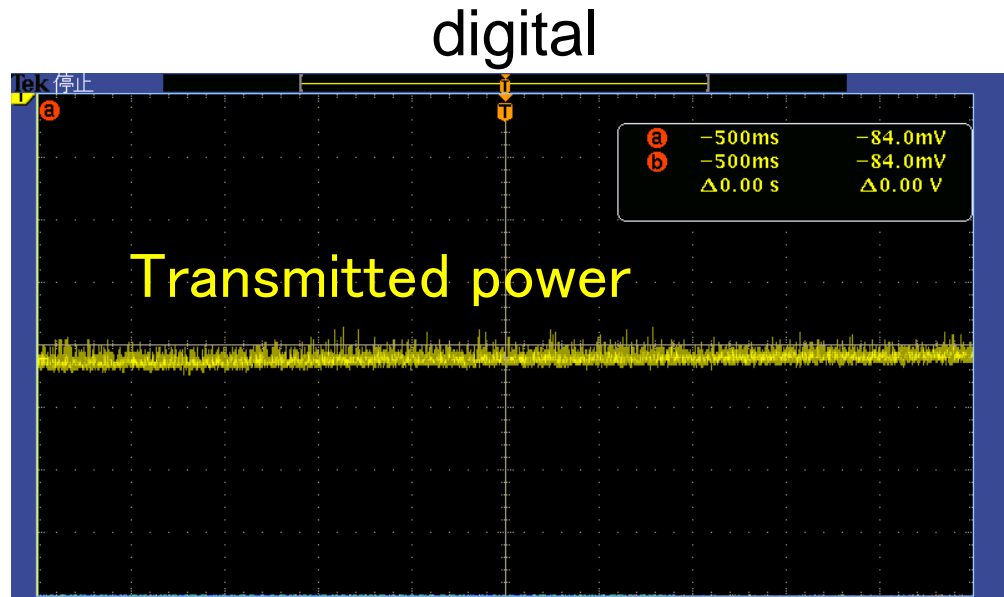
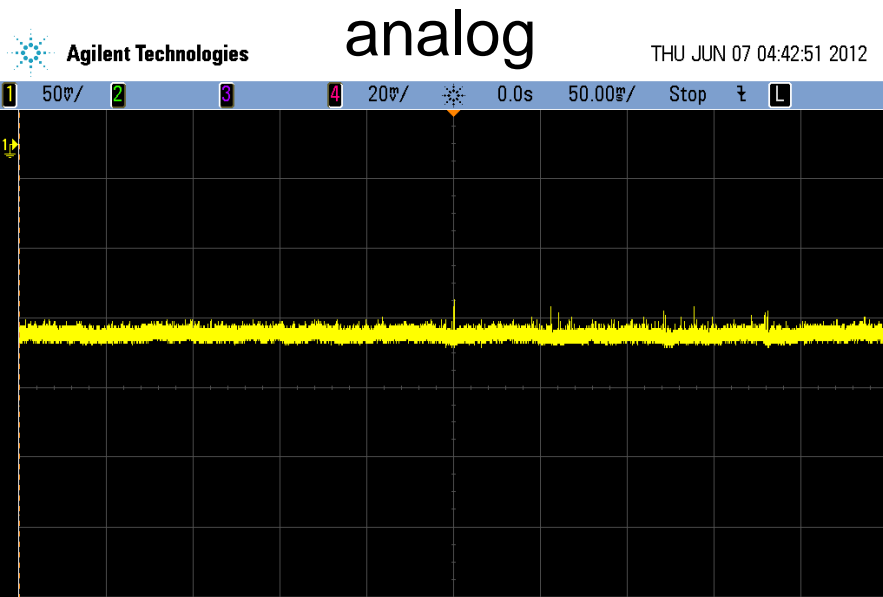


## Advantage

- high expandability
- Auto control

# Digital feedback control

- keep resonance
- stability: analog  $\doteq$  digital
- timing synchronization with ATF
- now development....



# conclusion

- ◇ Good quantitative understanding of the cavity
- ◇ Thermal effect: possibly due to (unexpected) high power loss on mirrors
- ◇ Digital feedback system under developed

Omori-san will report about  
french team and future plan tomorrow.