# Feedback R&D for Optical Cavity

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SAPPHiRE DAY

# collaborators


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Special thanks for French Team

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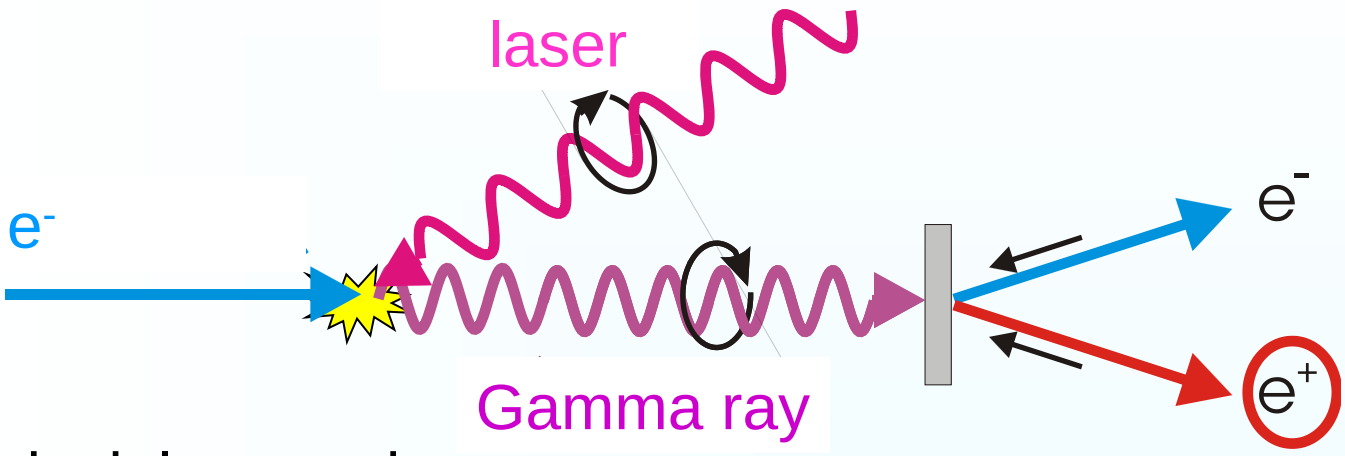
- Positron source using laser Compton
- Cavity control
- Gamma yield
- issue

# Introduction

## Polarized e+ by laser Compton Scheme




<u>proof of principle experiments</u>

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

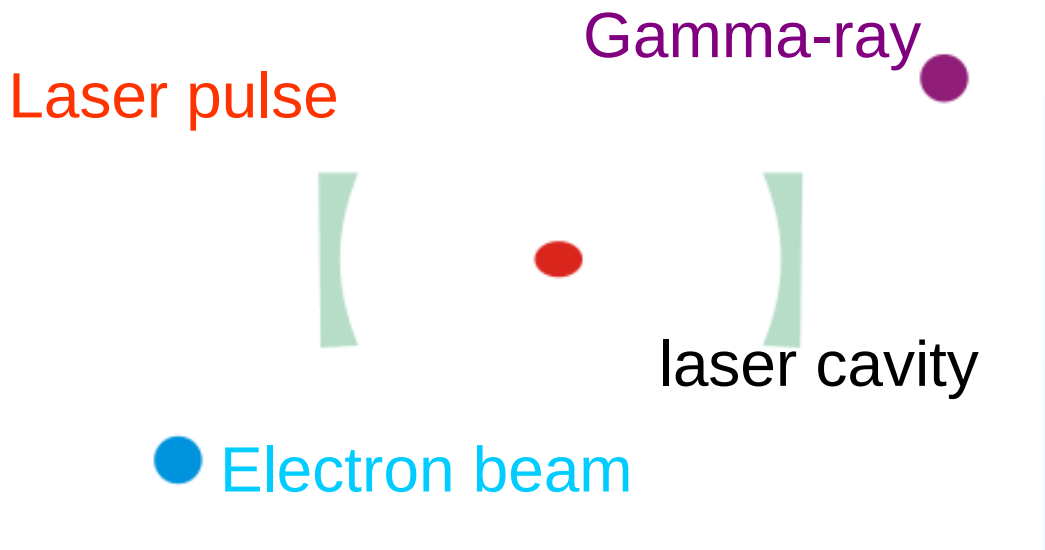
T. Omori et al., Physical Review Letters 96, 114801(2006)

Toward the positron sources

-> increase intensity of gamma rays

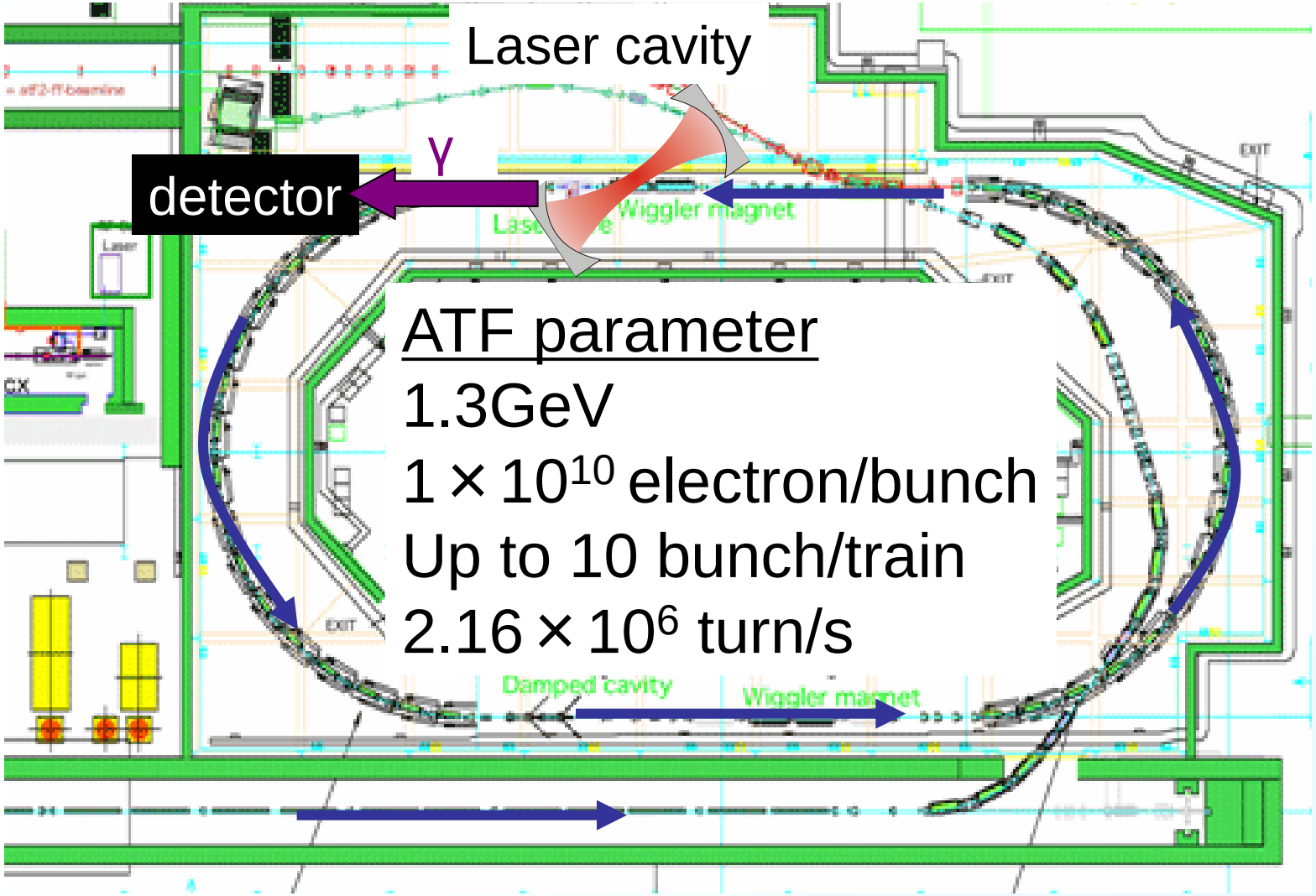
# Increase laser intensity using laser cavity

For increase gamma-ray yield
=Increse Laser intensity at interaction point with electron

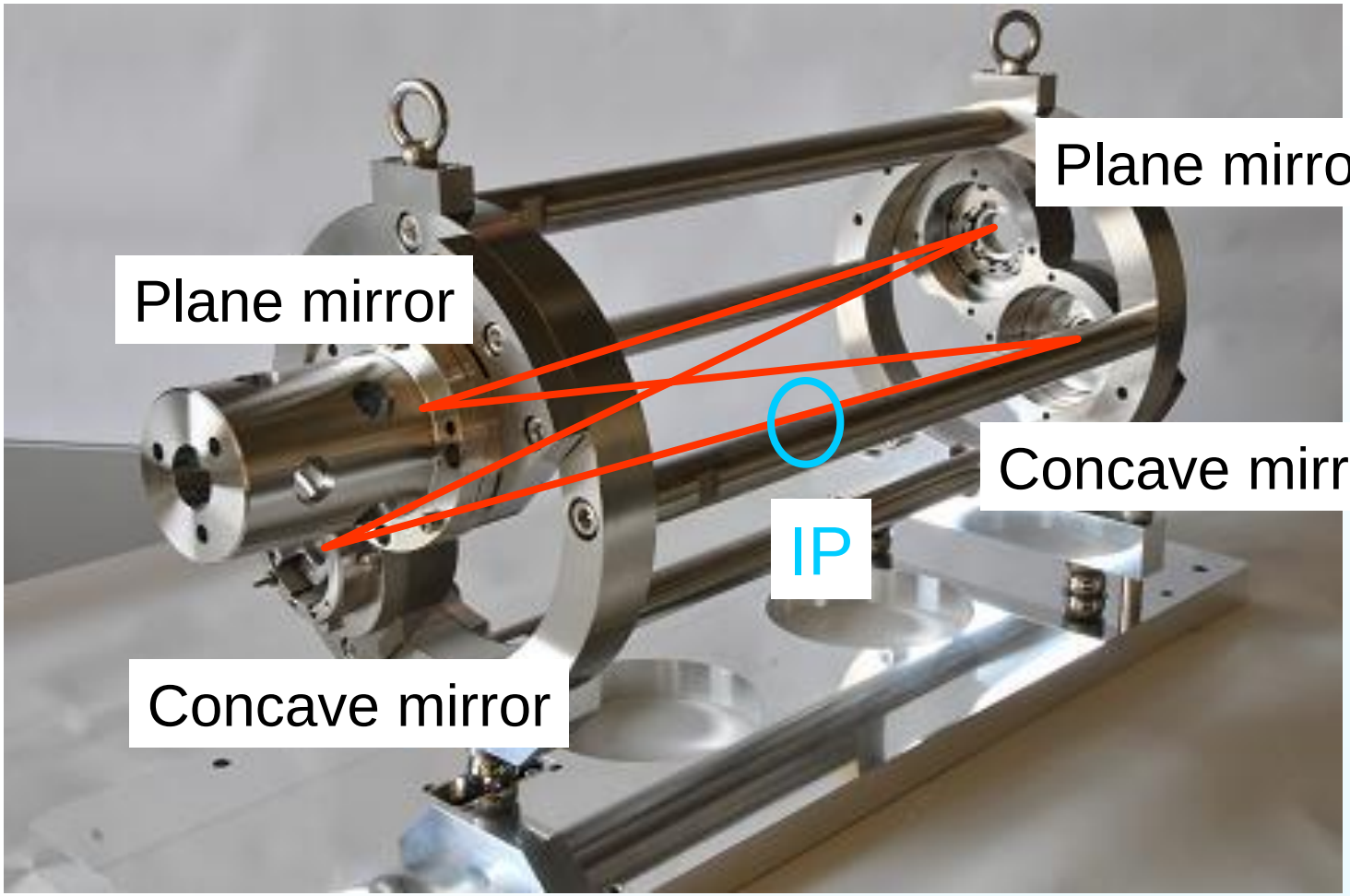



- High efficiency collision by timing synchronization electron and laser pulse
- Increase of laser intensity by resonance of laser cavity
- Condensed laser at IP

# Experiments at the KEK ATF



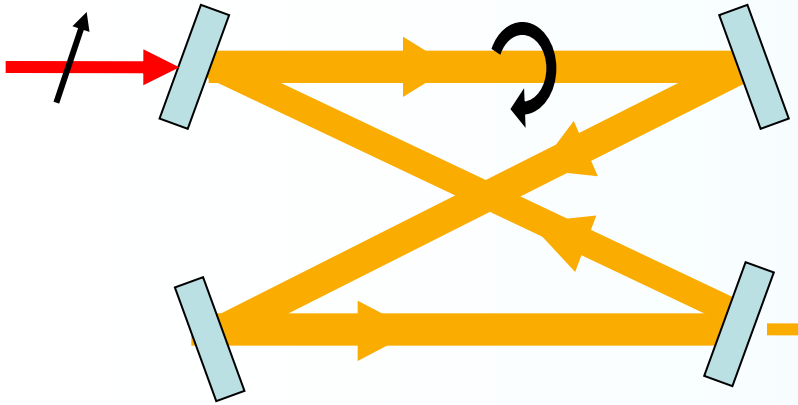
# laser cavity

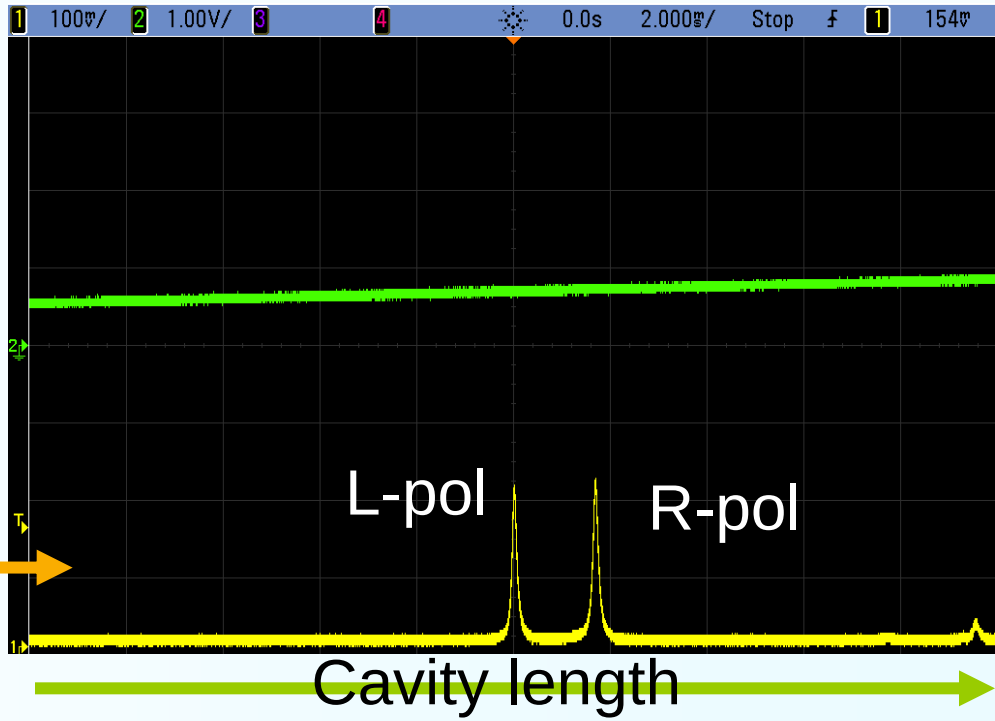


# Polarization property

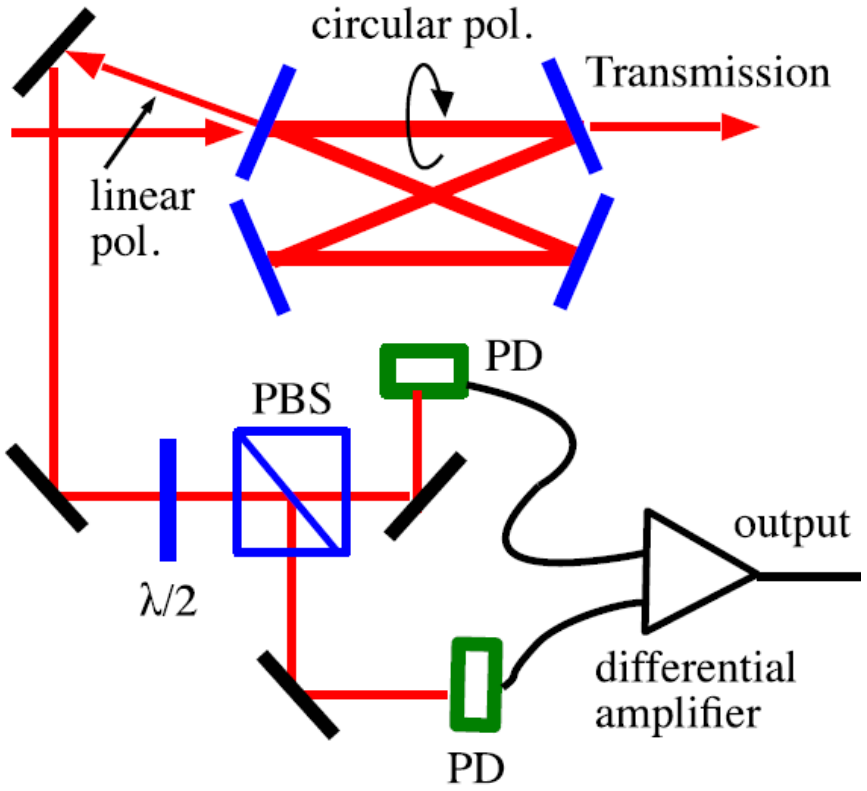
geometric phase due to twisted pass

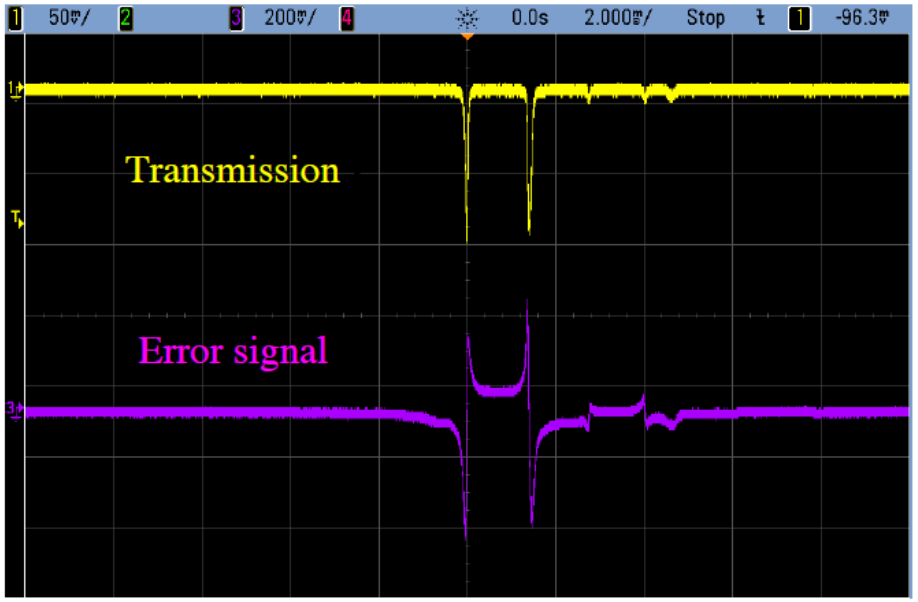
- cavity only resonates with circular polarization
- Different resonance point in left and right polarization





# Control method using Polarization property

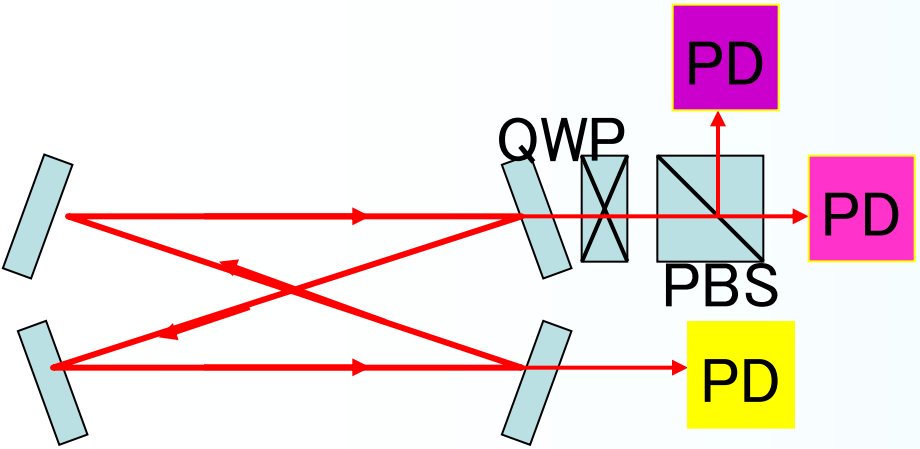


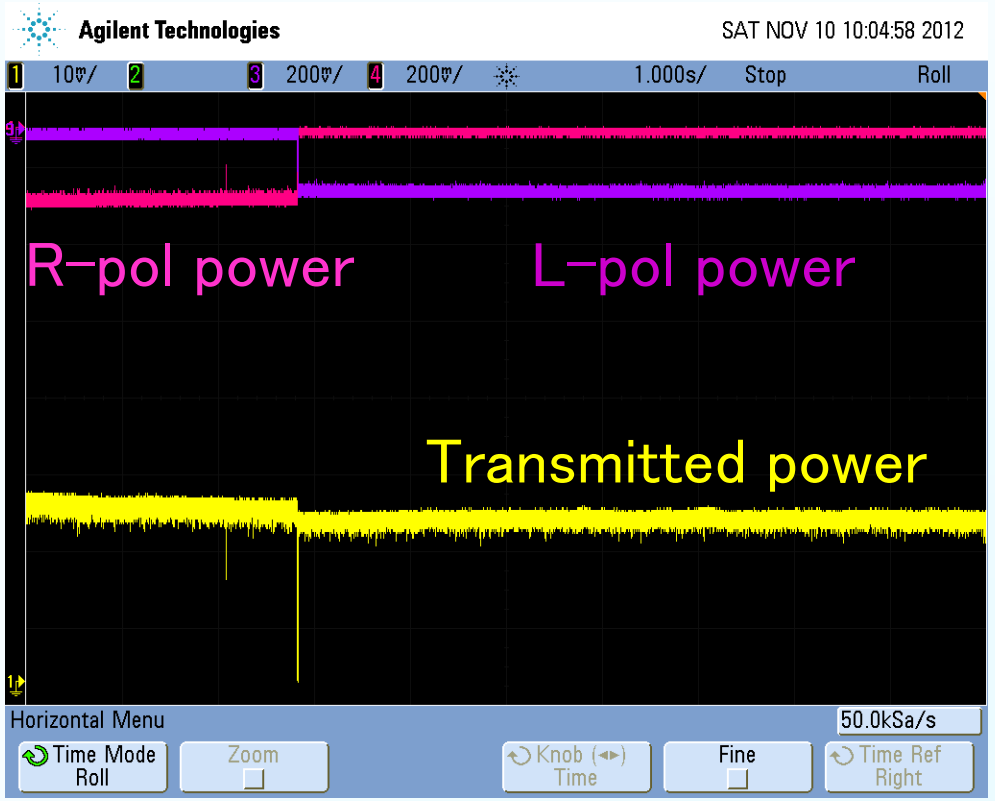




Different slope in left and right pol.

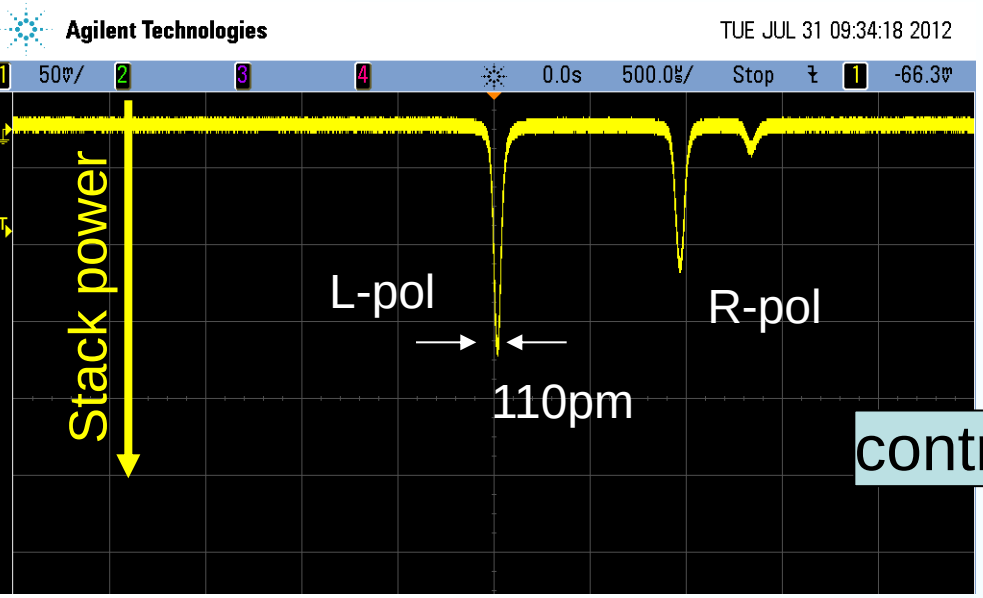
# Advantage in the control method

exchange polarity feedback loop is exchange stack laser pol.
->e+ pol. can be controlled by the polarity control loop

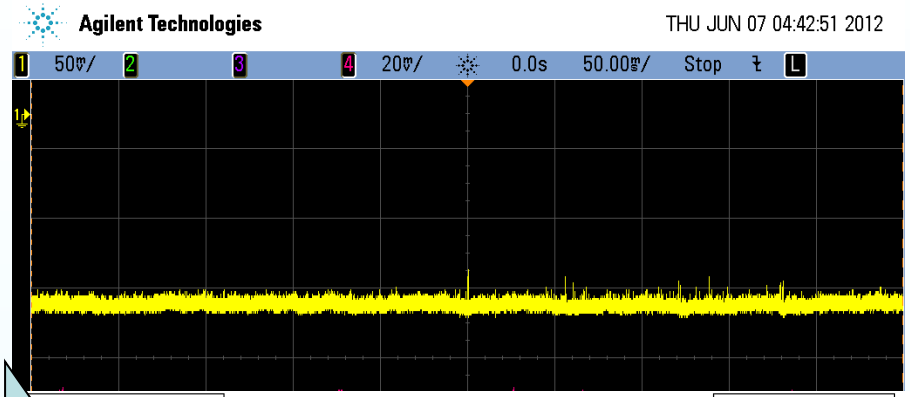


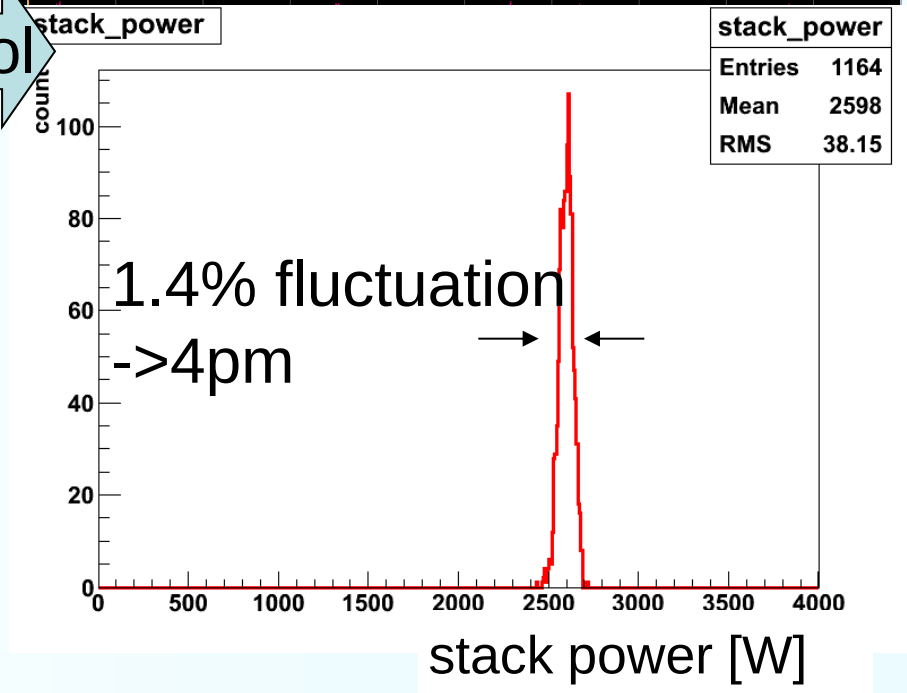



# Cavity control



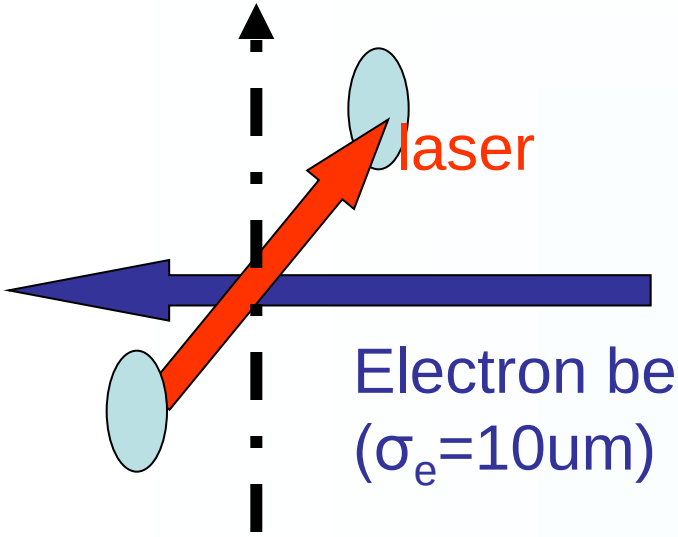

control

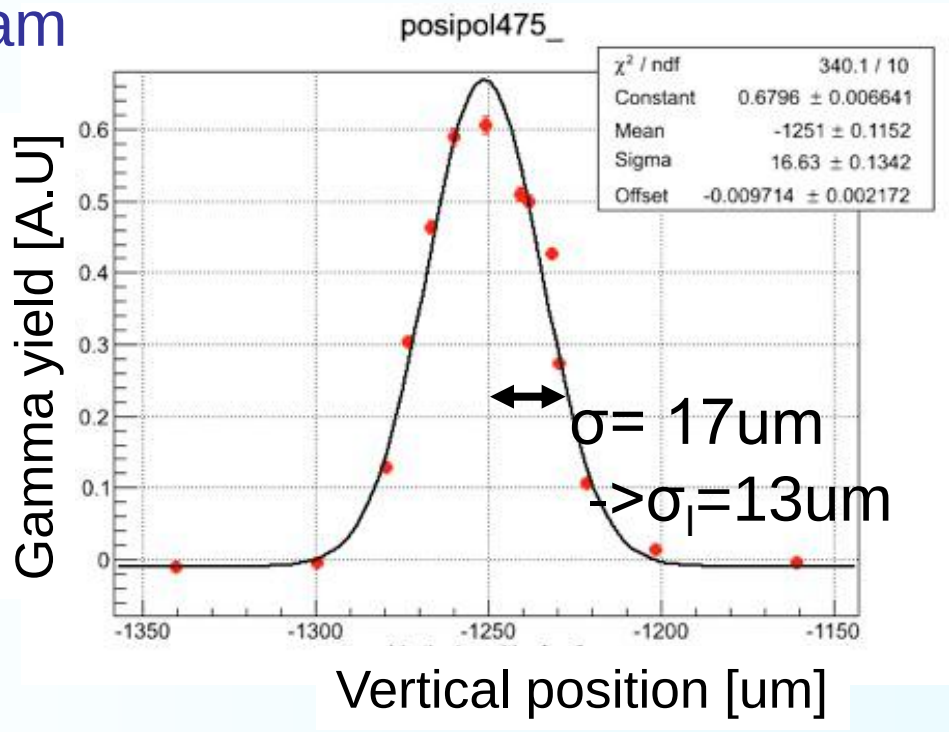



Laser power = 2.6kW
Timing jitter = 8ps

# Laser size at IP



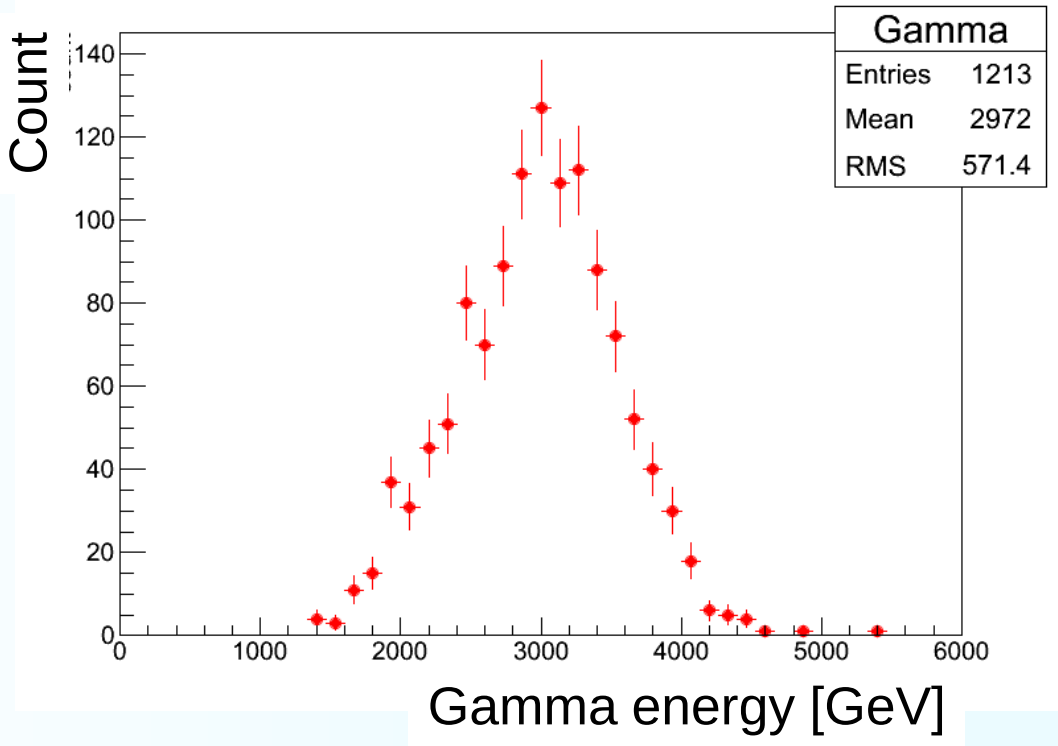
# Gamma-ray yield

2970±20 MeV

⇒ ~120γs/train

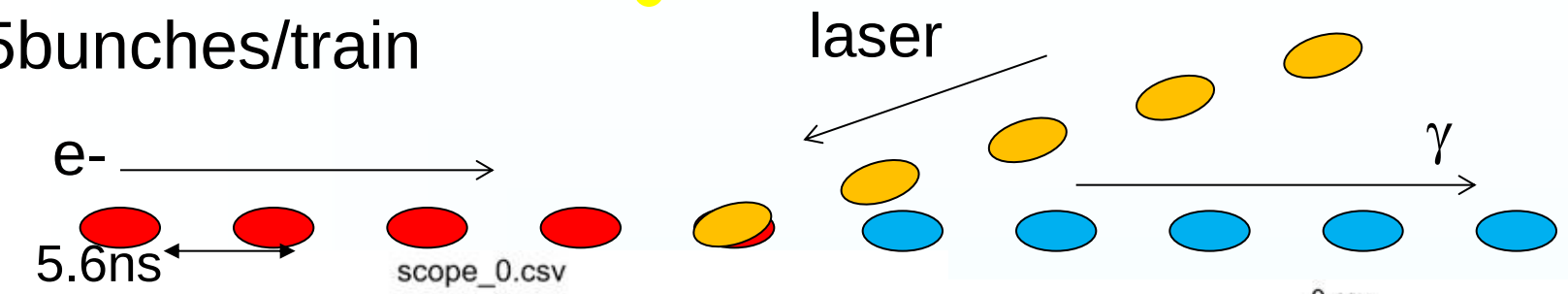
~$2.6 \times 10^8$/sec

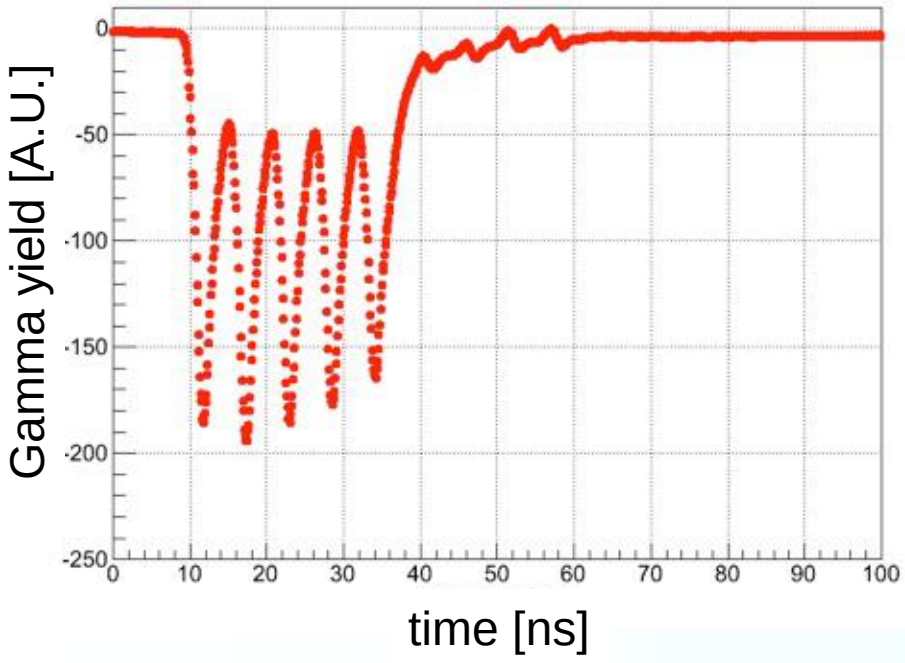
5bunch/train(7.7mA)

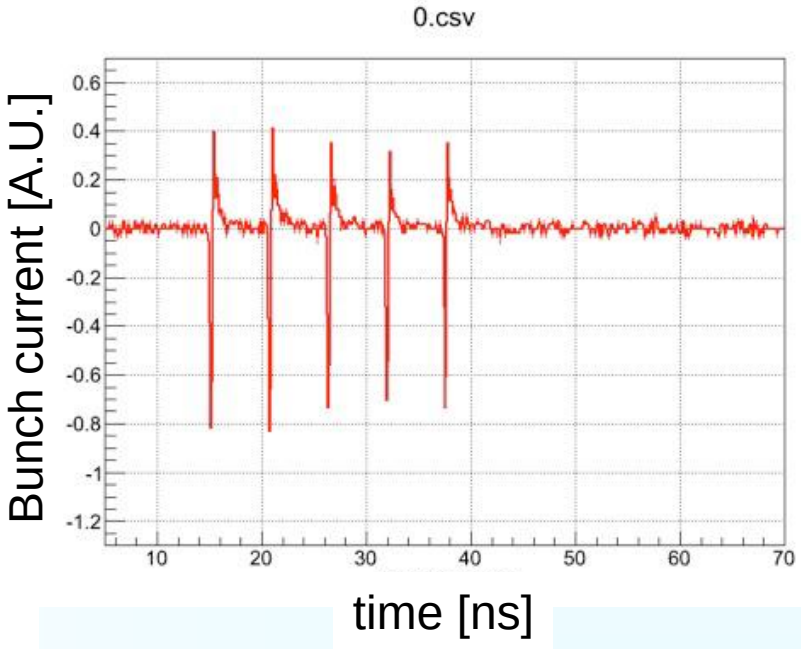


# Gamma-ray yield each bunch

5bunches/train



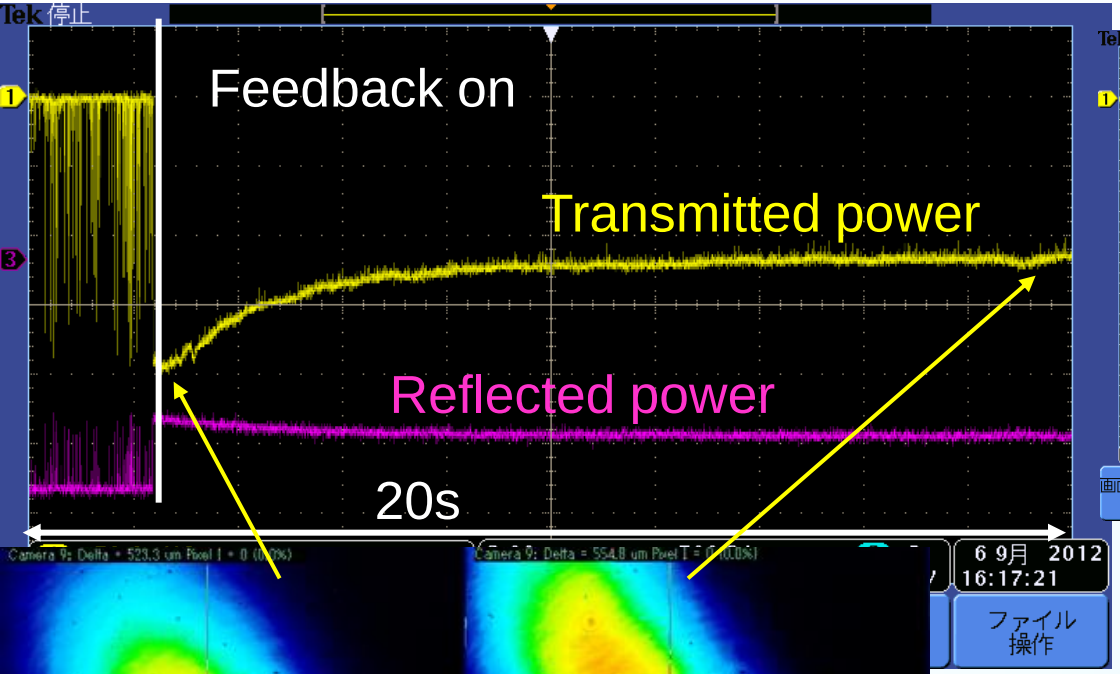



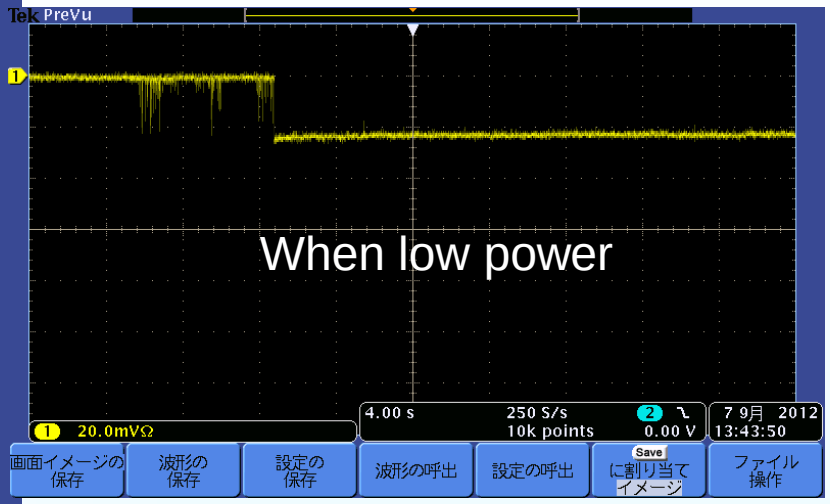



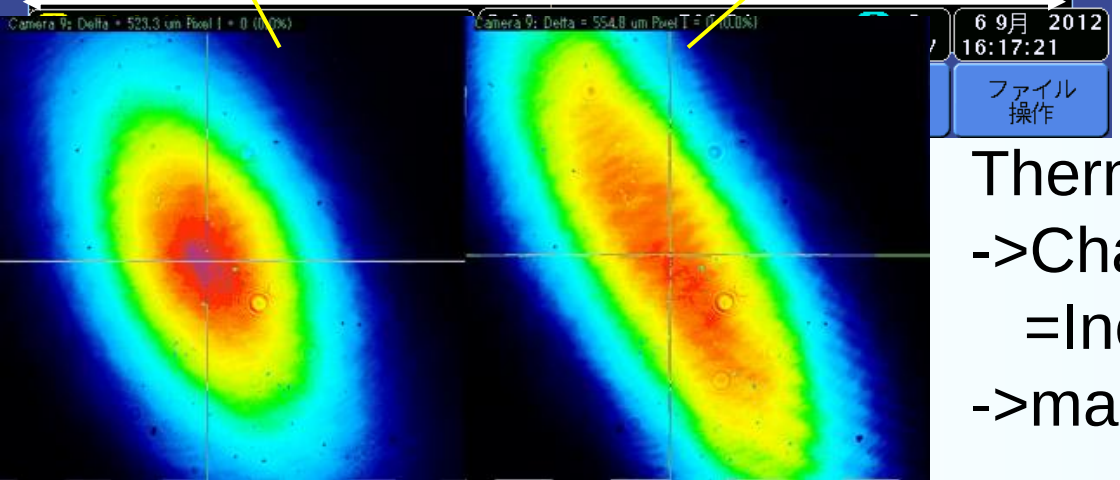

no bunch dependence ( yield is proportional to e- current)

# Thermal effect

Target: more intensity stacking




Thermal deformation of the mirror
->Change of transmitted profile
=Incident efficiency is reduced
->make stacking power limit

# summary

◇R&D e+ source using laser Compton

◇gamma-ray yield = $2.6 \times 10^8$/sec

◇cavity have stack power limit by thermal effect