Possible risk and R&D Plan

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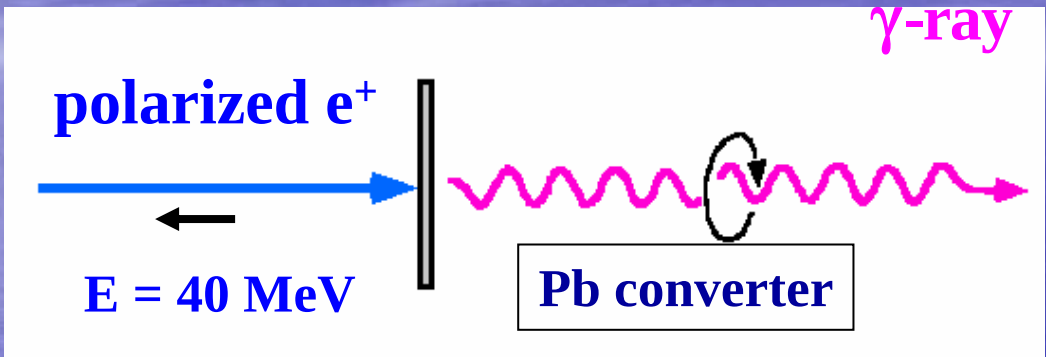
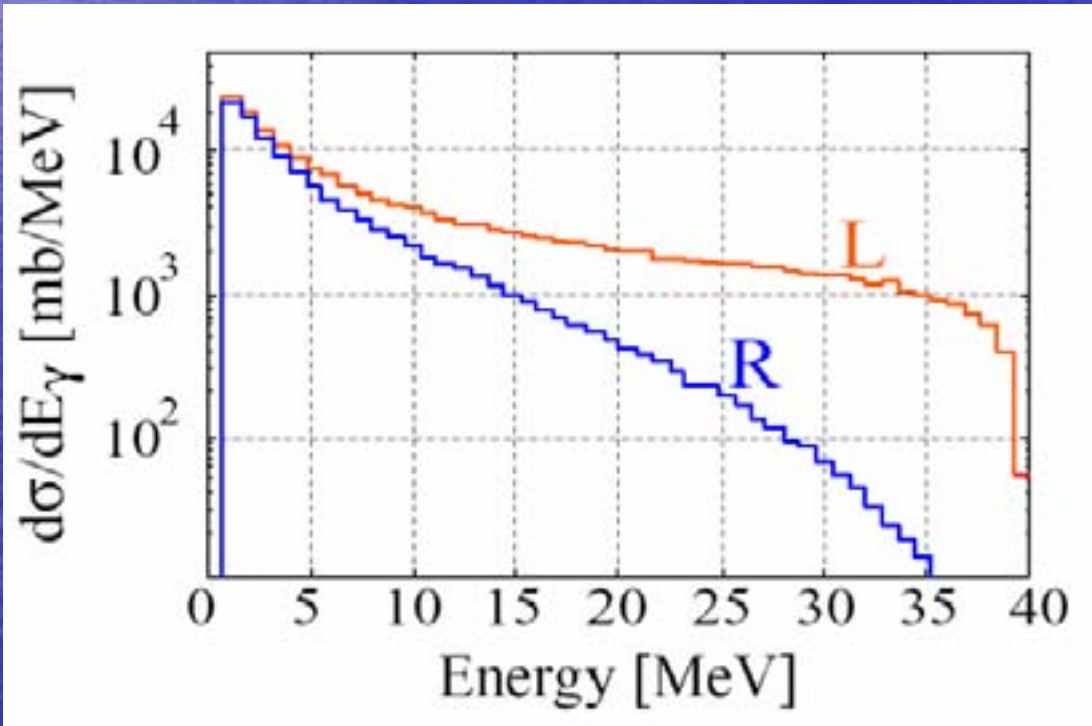
Snowmass, 8/18/2005
Thursday, 10-12,20min.

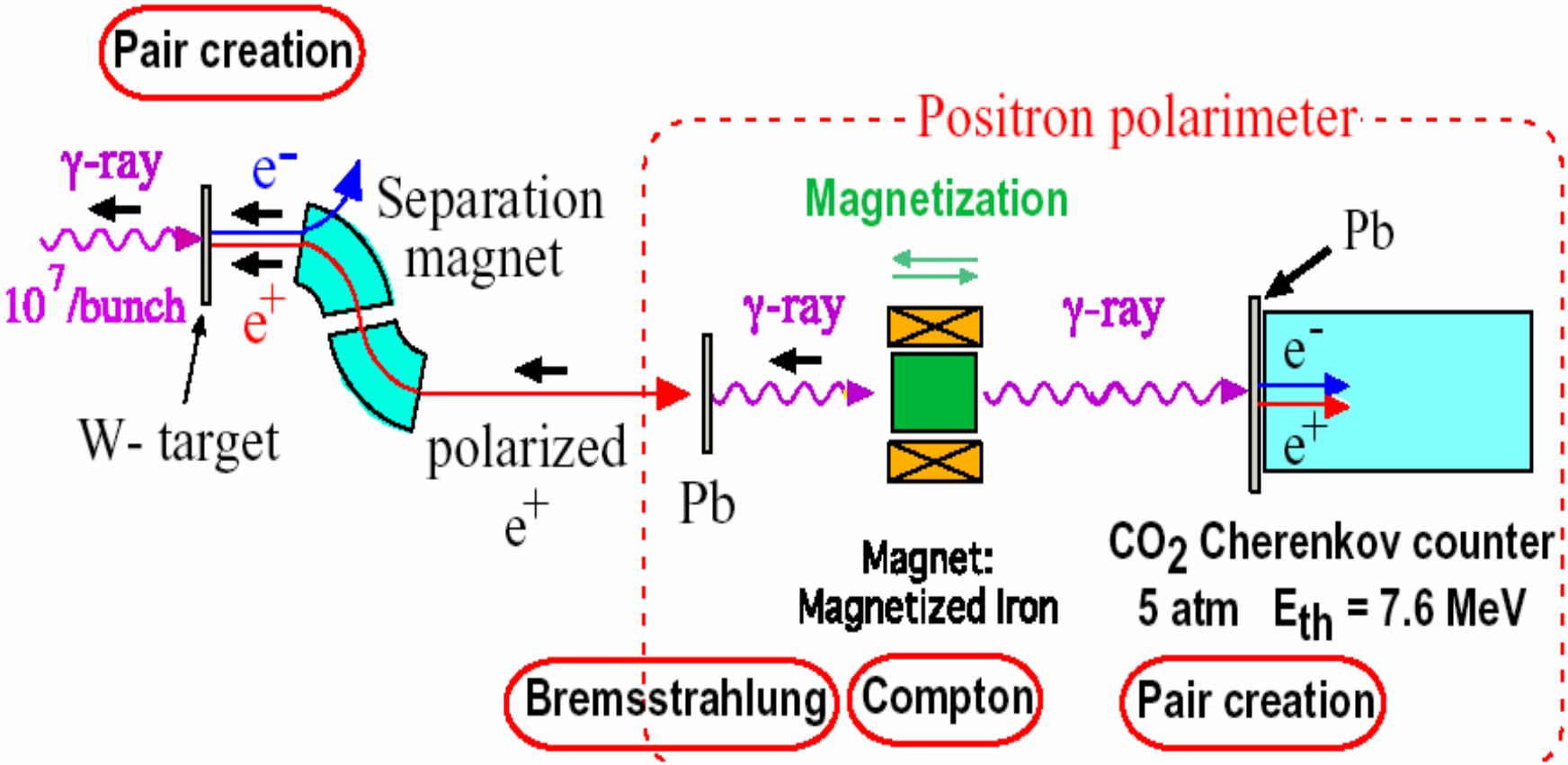
1. *Summary of Compton Scattering Experiment for Pol. Positron generation at ATF*
2. *Possible risk*
3. *R&D Plan*
4. *Conclusion*

Measure e^+ polarization : use Bremsstrahlung γ-ray





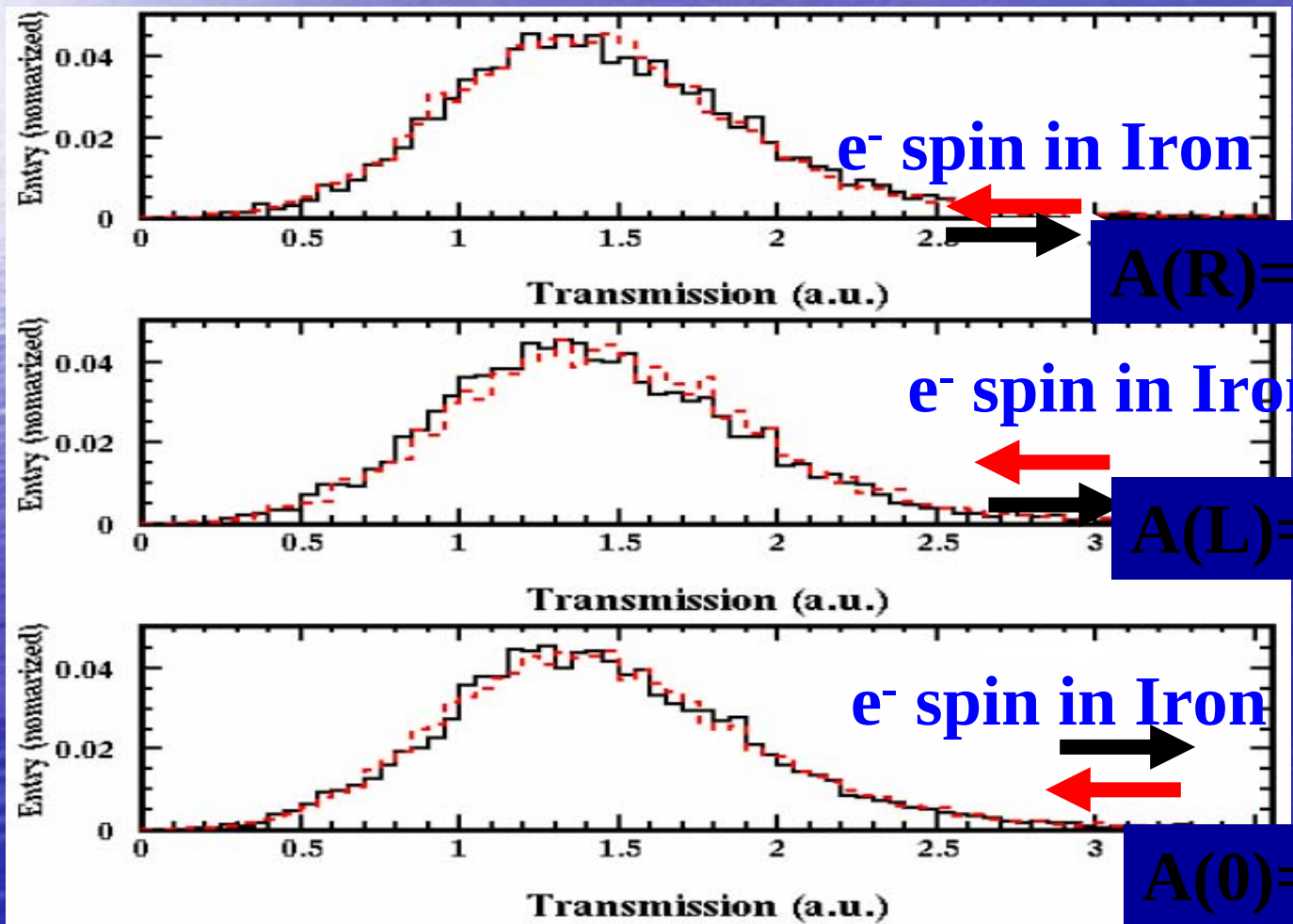
Positron: production, selection, and polarimetry



Experimental Results

- Polarization of positron beam

72+/-21%, predicted cal. value 77+/-10%



2. Possible risk at present

- Very low Momentum Compaction factor of Compton Ring.

Makes Instability Issues.

Need Design Upgrade.

- Laser System

High power laser which has complicated bunch structure is not commercially available.

Need R&D.

- Compton Collision Chamber

Serial connection of 30 optical cavities.

Need the experimental test of a double Compton-chamber system.

3. R&D Plan

- Demonstration of high power laser system which has pulse train structure required.

4 pass amplification using 16mmf YAG rod and

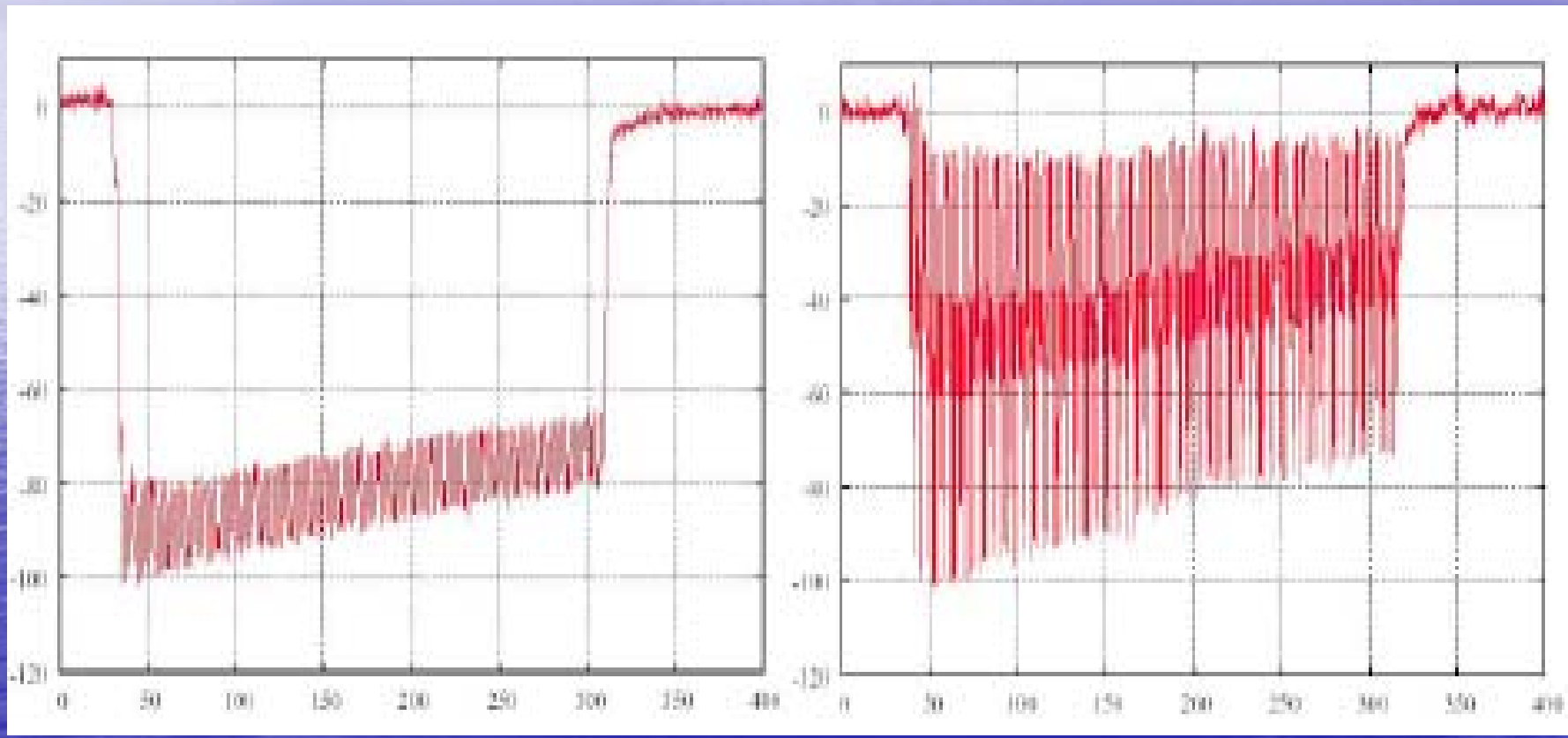
If necessary, solid state amplifier.

- Generation of gamma-ray with fancy Compton chamber at ATF damping ring.

In this year we will make one Compton chamber with fancy optical cavity.

Multi-bunch electron beam generation with 2.8nsec bunch spacing at ATF

280 bunches/train 100Hz operation is possible?



940 μJ/100 pulses with 2.8nsec spacing, UV 266nm, 7psec（FWHM)

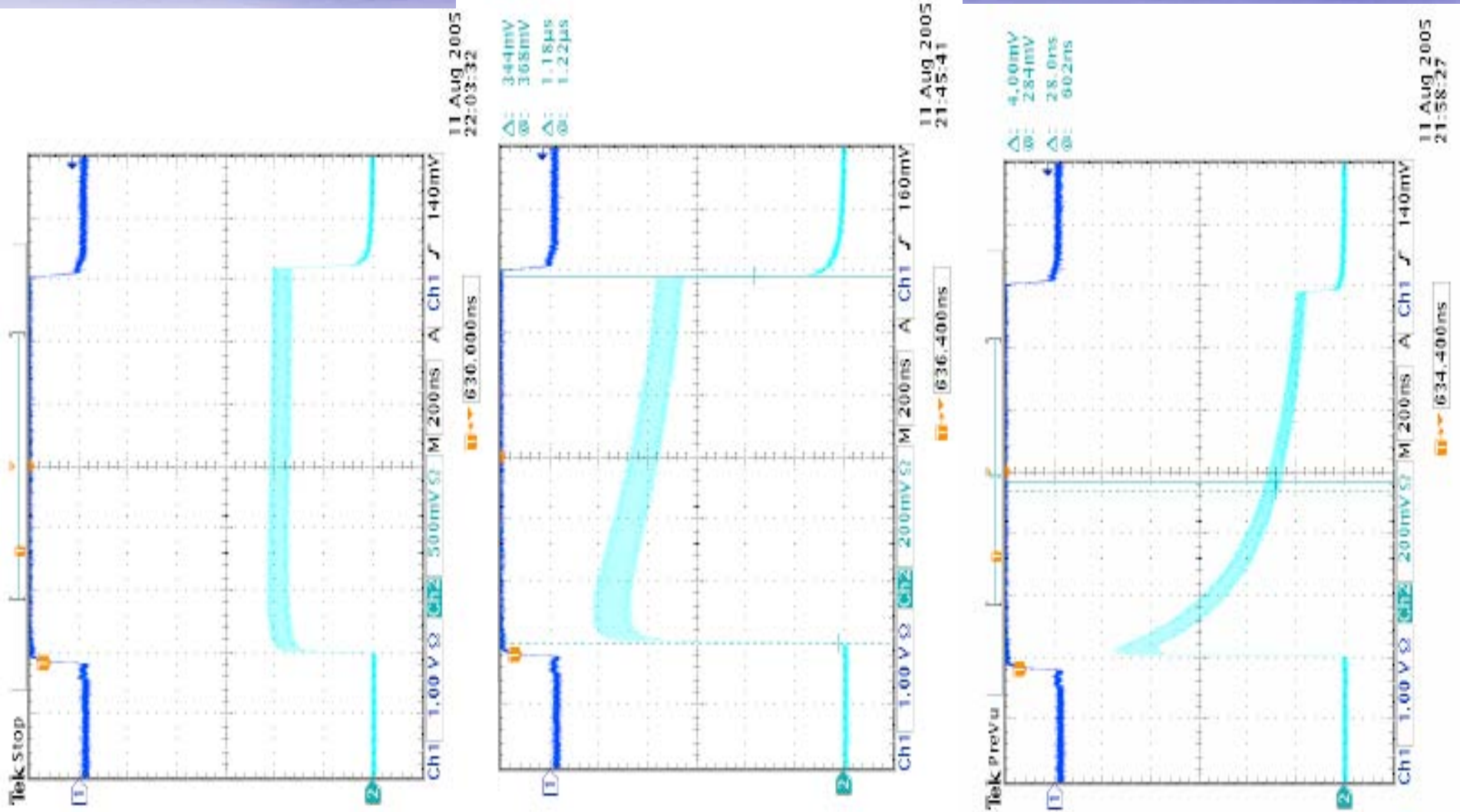
Farady Cup to measure multi-bunch Current, 400nC/100 bunches

Quick test on 443 pulse train with 12.5Hz operation (1.24μsec). Amplification by two pass 9mmϕYAG rod

3.6μJ/pulse

65μJ/pulse

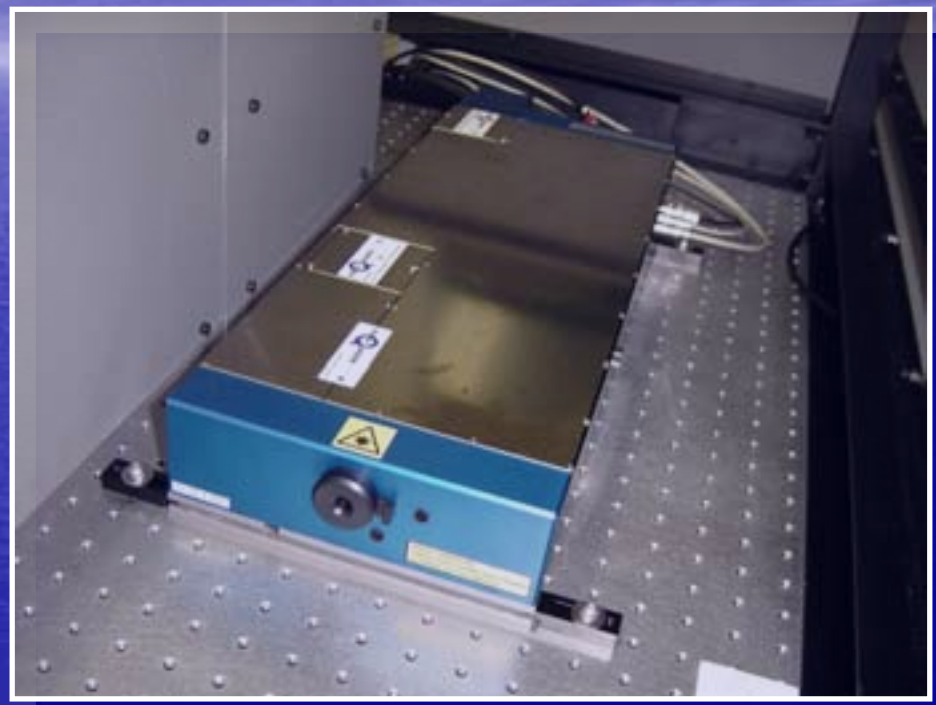
660μJ/pulse



Experimental results (Pulse Laser Storage)

Laser:

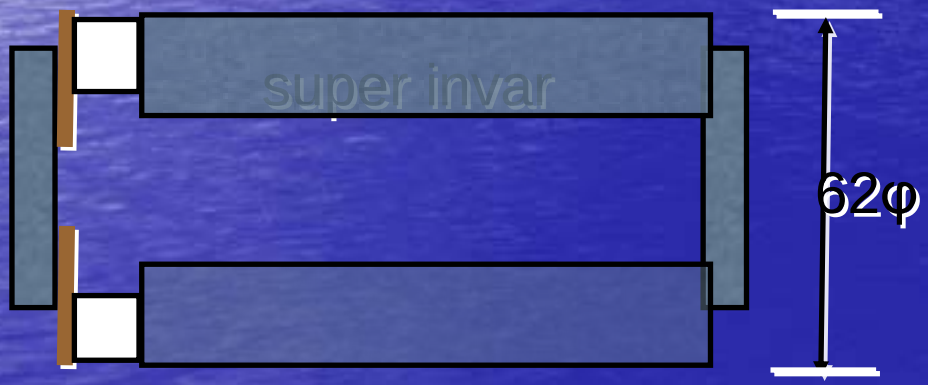
Mode Lock:	Passive SESAM
Frequency:	357MHz
Cavity length:	0.42 m
Pulse width:	7.3 p sec (FWHM)
Wave Length:	1064 nm
Power:	~ 6W

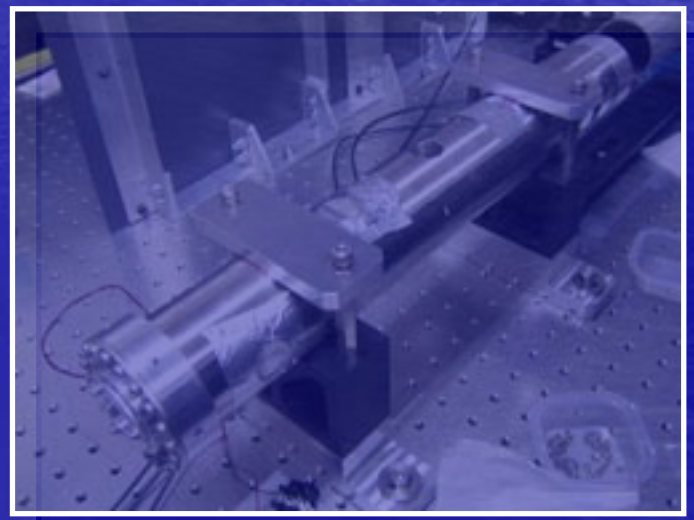


SESAM: SEmi-conductor Saturable Absorber Mirrors

Ext. Cavity:

Cavity:	Super Invar
Cavity length:	0.42 m
Mirrors:	
Reflectivity:	99.7%, 99.9%
Curvature:	250 mm (ω_0 = 180μm)

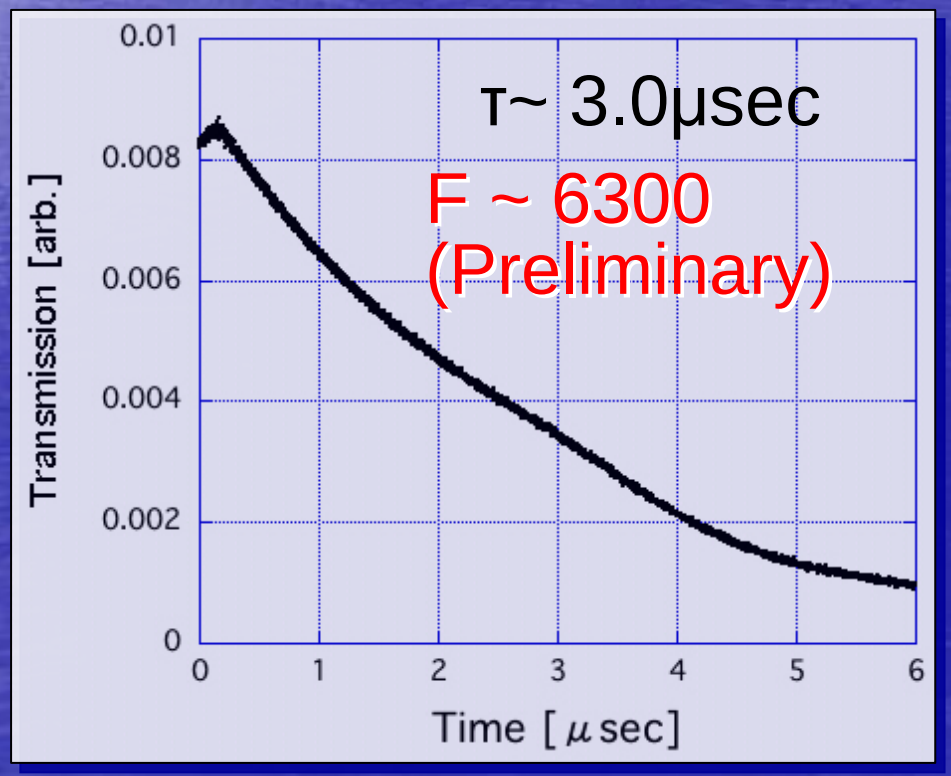




- Finesse: R = 99.9%

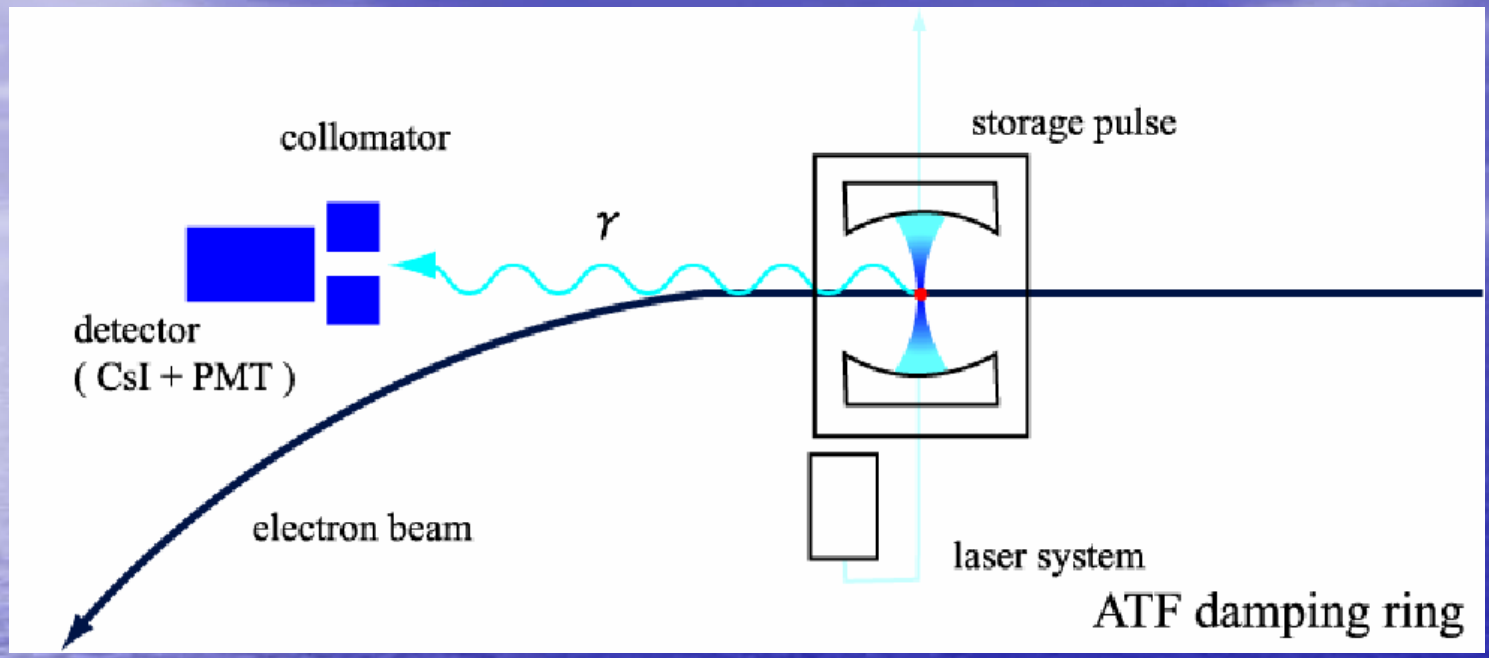
Finesse =πτc/l

τ:decay time
c: light verocity
l: cavity length



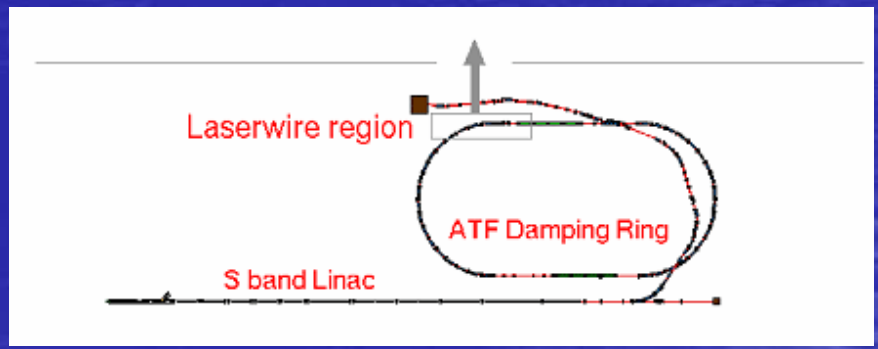
Enhancement factor more than 3000 times.

Plused Laser and Electron Beam Collision to measure bunch length

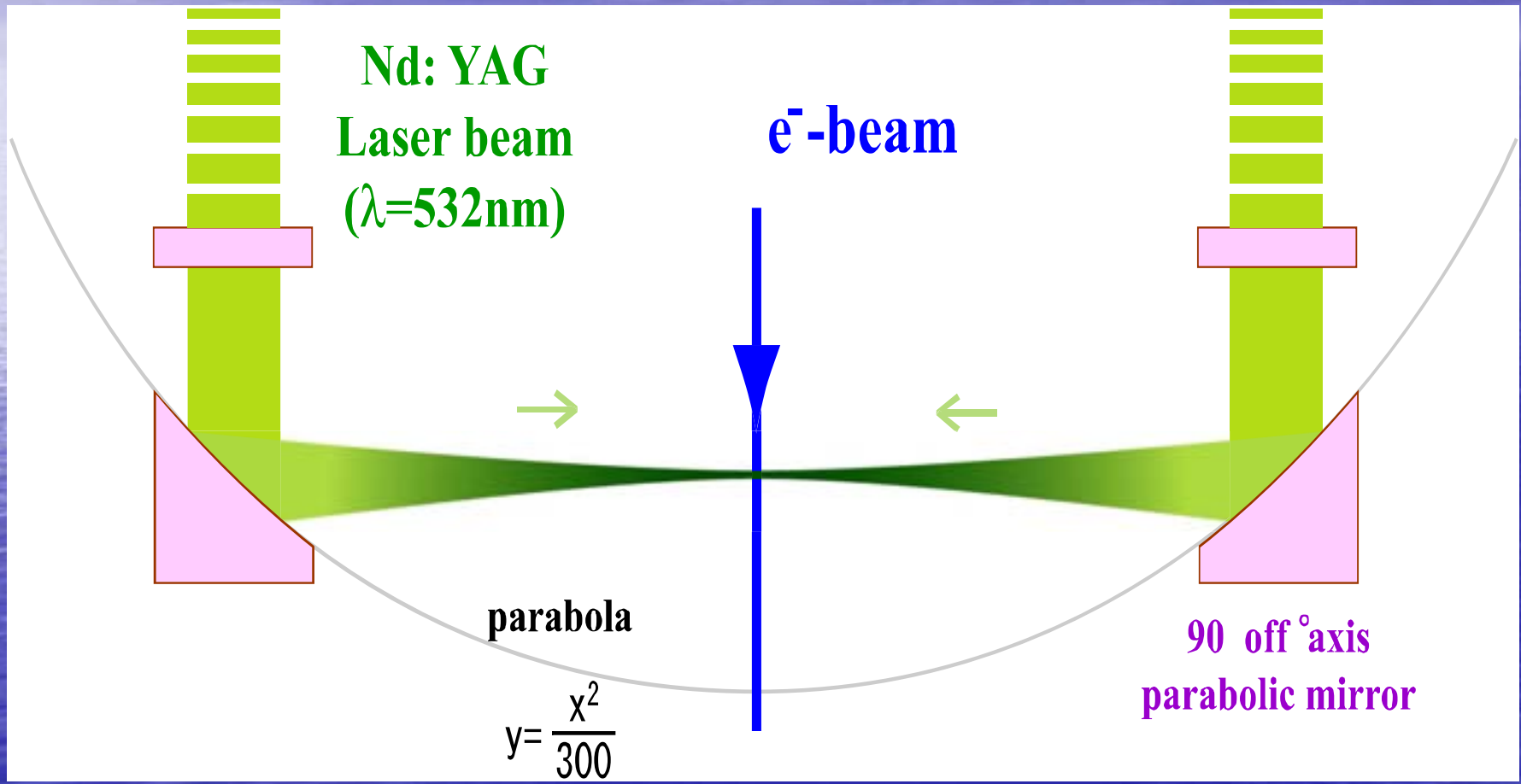


Pulse Laser Wire

(Storage laser pulses in optical cavity):



New Project by JSPS from 2005 to 2009



To make 1μm(rms) focusing at IP with small crossing angle.

4. Conclusion

1. **The polarized-positron generation scheme which we propose is very flexible, and of moderate size. It provides a fully independent system which means that we can perform the ILC beam commissioning at full beam power without the need of a 150GeV electron beam. The design of the Compton ring, the Compton collision chamber, and the laser system will be optimized with respect to tolerances.**
2. **Except for beam stacking into damping ring, we can do test of almost full system at KEK-ATF.**

Thank you.