



# **Beam test plans at KEK**

## **( window, liquid lead, hybrid target, undulator )**

### **Present members :**

**KEK:** J.Urakawa, T.Omori, T.Suwada, T.Kamitani,

**BINP**, Novosibirsk :**Pavel Logachev (BINP)**, V.M.Strakhovenko, ---

**Hiroshima:** T.Takahashi, M.Kuriki, ---

**IPNL:** X.Artru, R.Chehab, M.Chevallier, ---

**LAL:** A.Variola, O.Dadoun, ---

**CERN:** L. Rinolfi, A. Vivoli, F. Zimmermann, ---

**Osaka University:** S. Kashiwagi, G. Isoyama, ---



# Window Issues : Broken by acoustic shock wave or thermal effects (temperature rise)

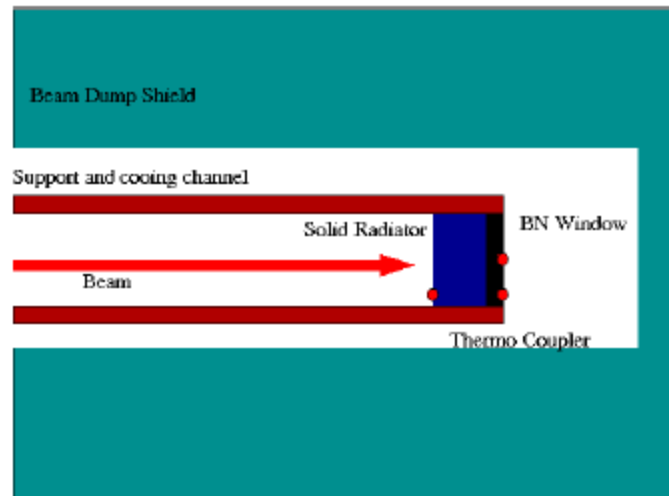
New target system: Liquid Lead Target System

(90% Pb, 10% (mass) Sn alloy, 300°C)

## Window Candidates : BN, BC, Be, ---

- ▶ Space is very limited for KEKB BD.
- ▶ Solid Radiator is placed before BN plate.
- ▶ The sample is fixed with support rod, which also acts as cooling channel.
- ▶ It is difficult to place any equipments other than TC?

### KEKB Beam Dump Setup



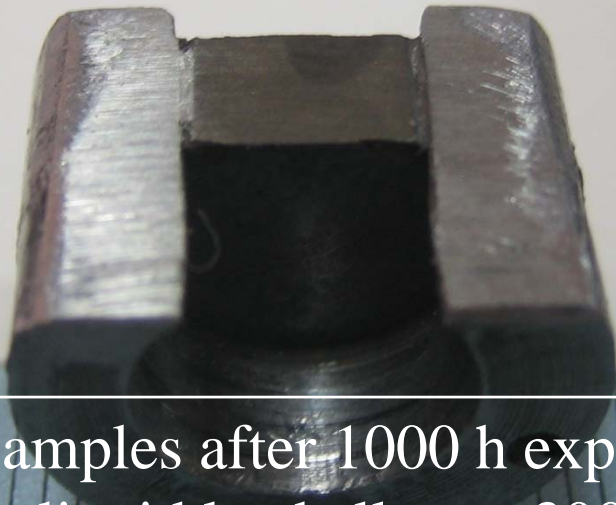
**BINP requested the windows test with KEKB beam. However, we kek decide this test is pending. Maybe, we do not do this.**

**Window thickness 4mm**

**BN disks for windows**



Test samples after 1000 h exposition  
in liquid lead alloy at 300°C  
(no any damage of brazing joint).

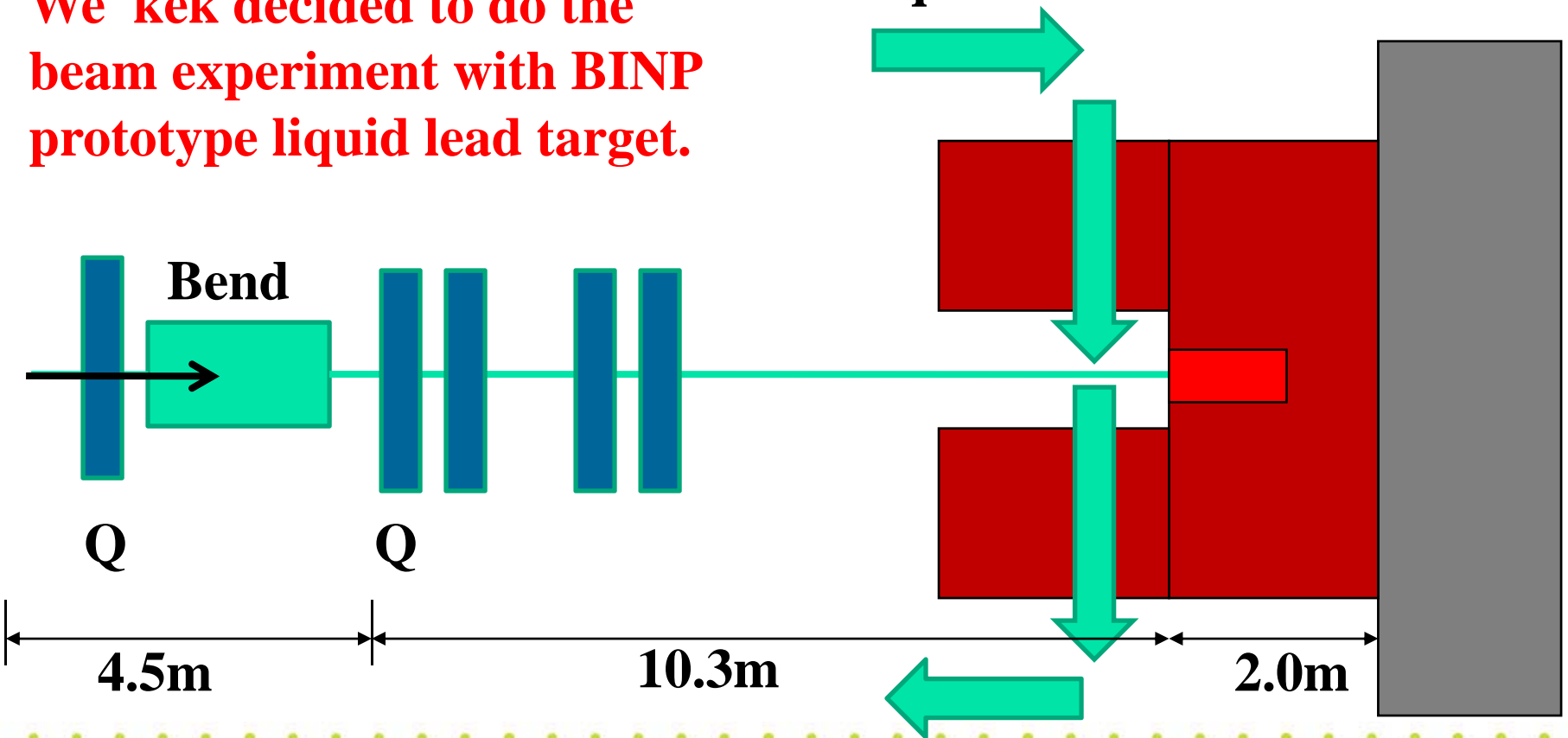


# Liquid lead target test

## At ATF Linac End

We kek decided to do the beam experiment with BINP prototype liquid lead target.

Liquid lead 300°C





# Beam Parameters

$\beta$  function tuning range : 0.1m to 10m

Bunch structure : 1 to 20 bunches/train

Bunch charge : 0.5 to 2.0 x 10<sup>10</sup> electrons/bunch

Beam energy : 1.3GeV

Repetition rate : 0.7 to 6.25Hz

Usual normalized emittance : 10 $\pi$ mmmmrad

Beam size : 0.2 to 2.0mm

Energy density on target

0.006 to 48 x 10<sup>10</sup> GeV/mm<sup>2</sup>

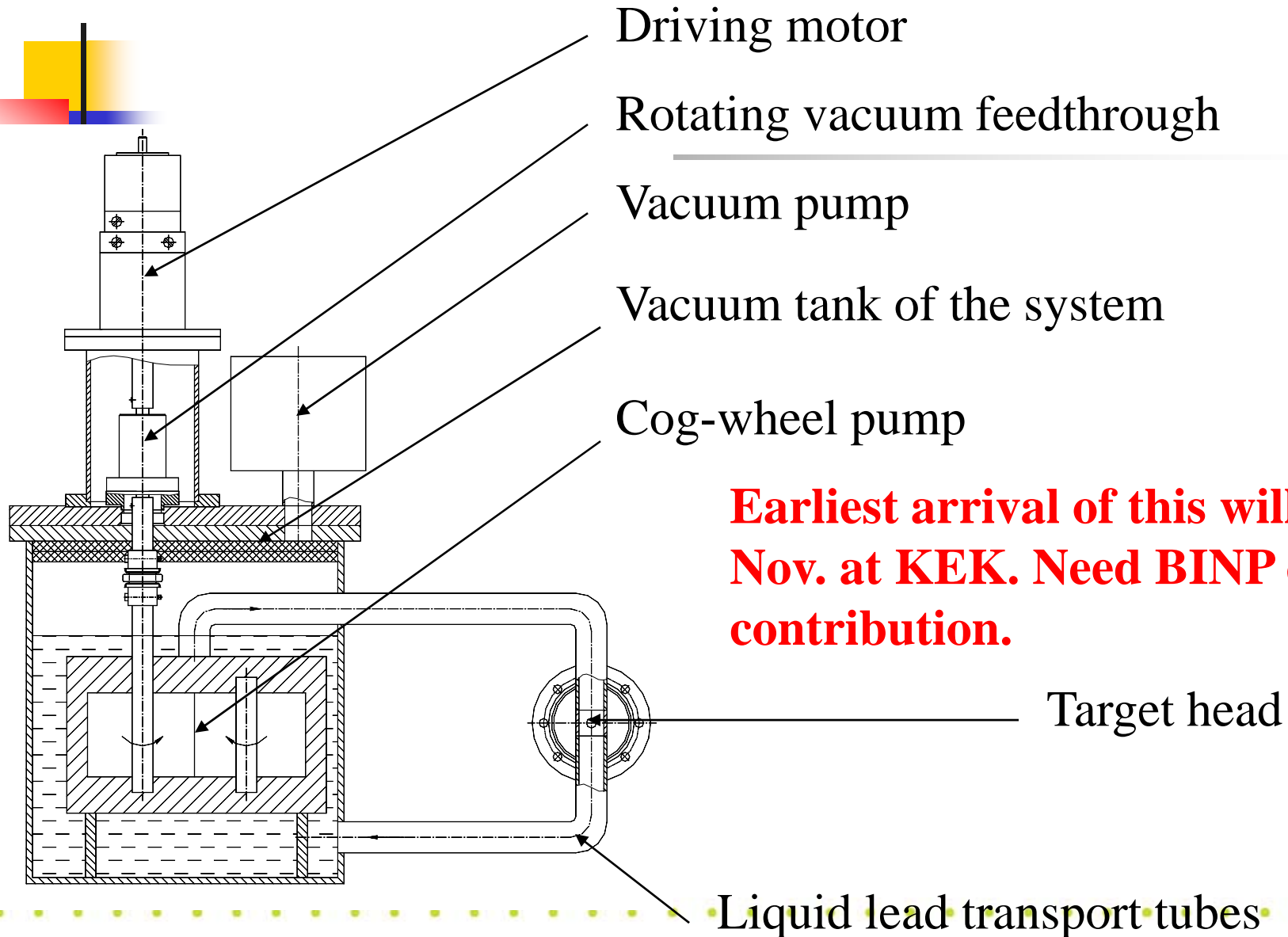
Power deposit on target

0.004 to 300 x 10<sup>10</sup> GeV/mm<sup>2</sup> s

Acceptable beam rep. rate?

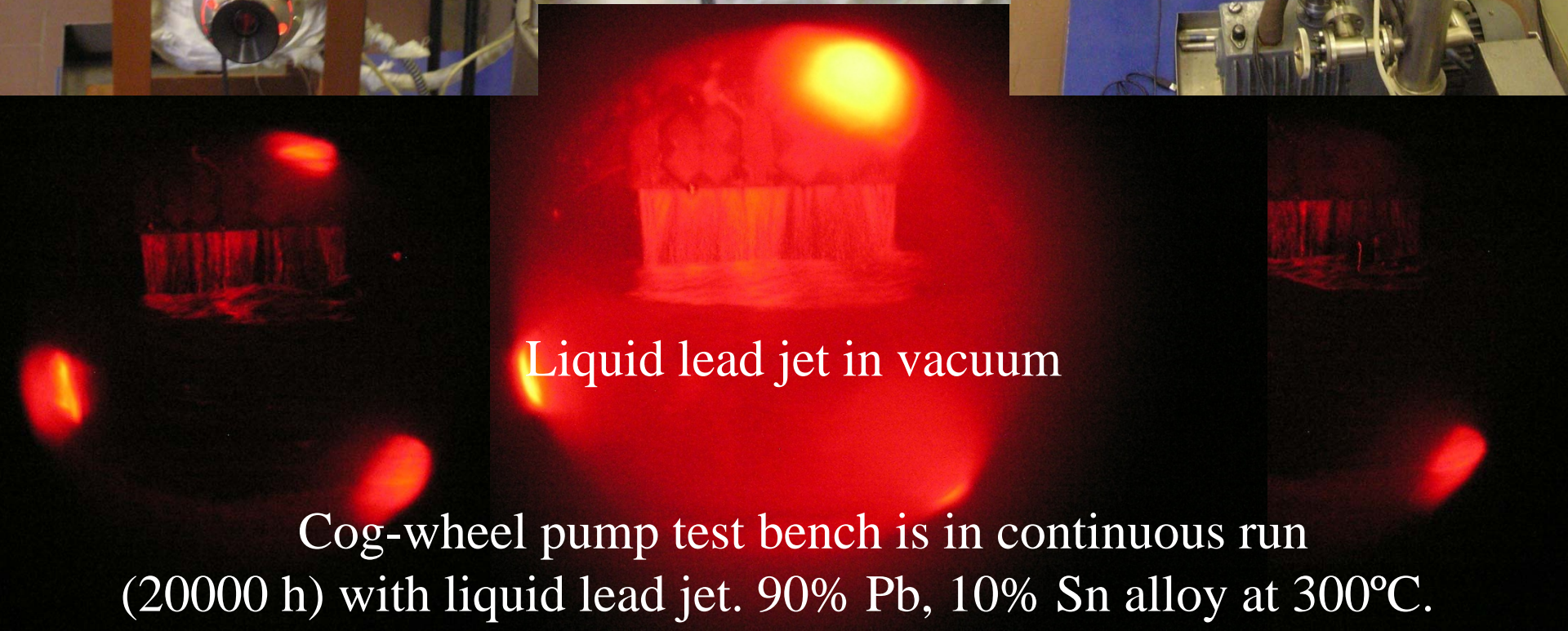
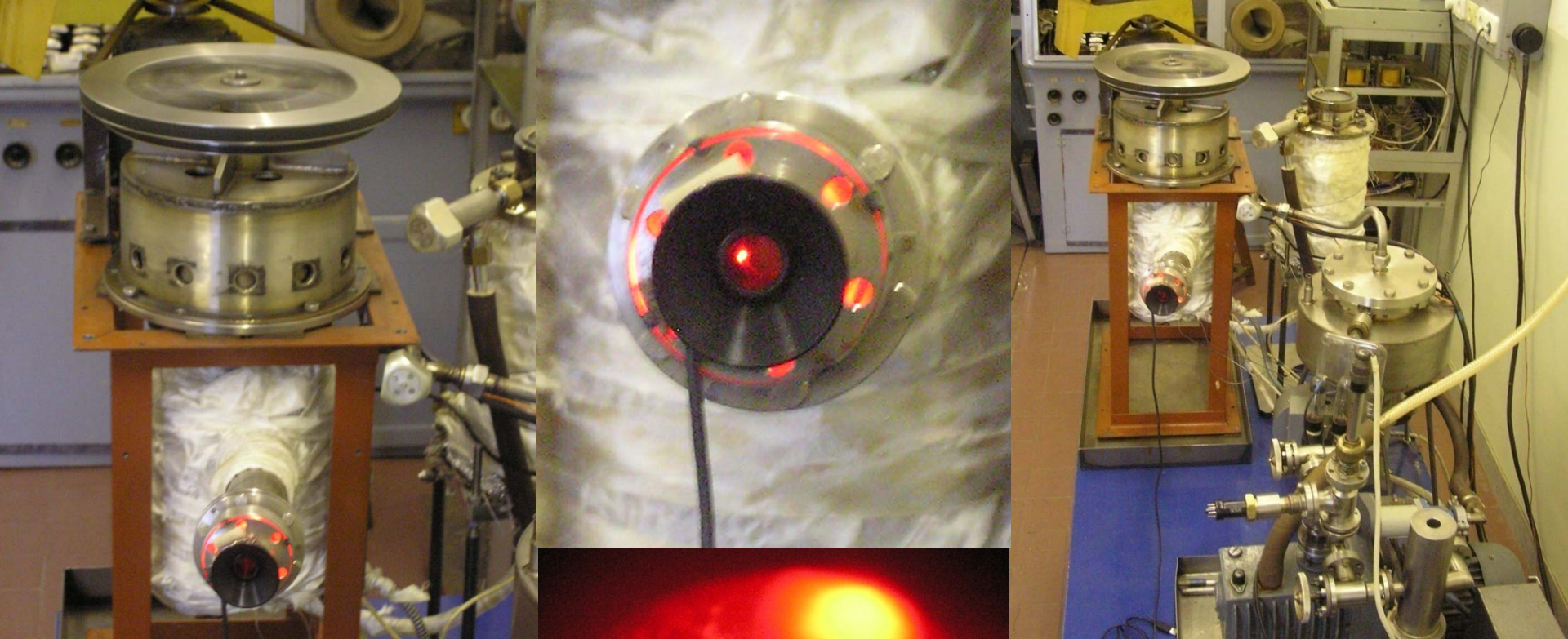
What is meaningful  
beam experiments for  
ILC liquid target?  
This is under discussion.

# Scheme of the prototype of liquid lead positron production target.



**Earliest arrival of this will be Nov. at KEK. Need BINP quick contribution.**



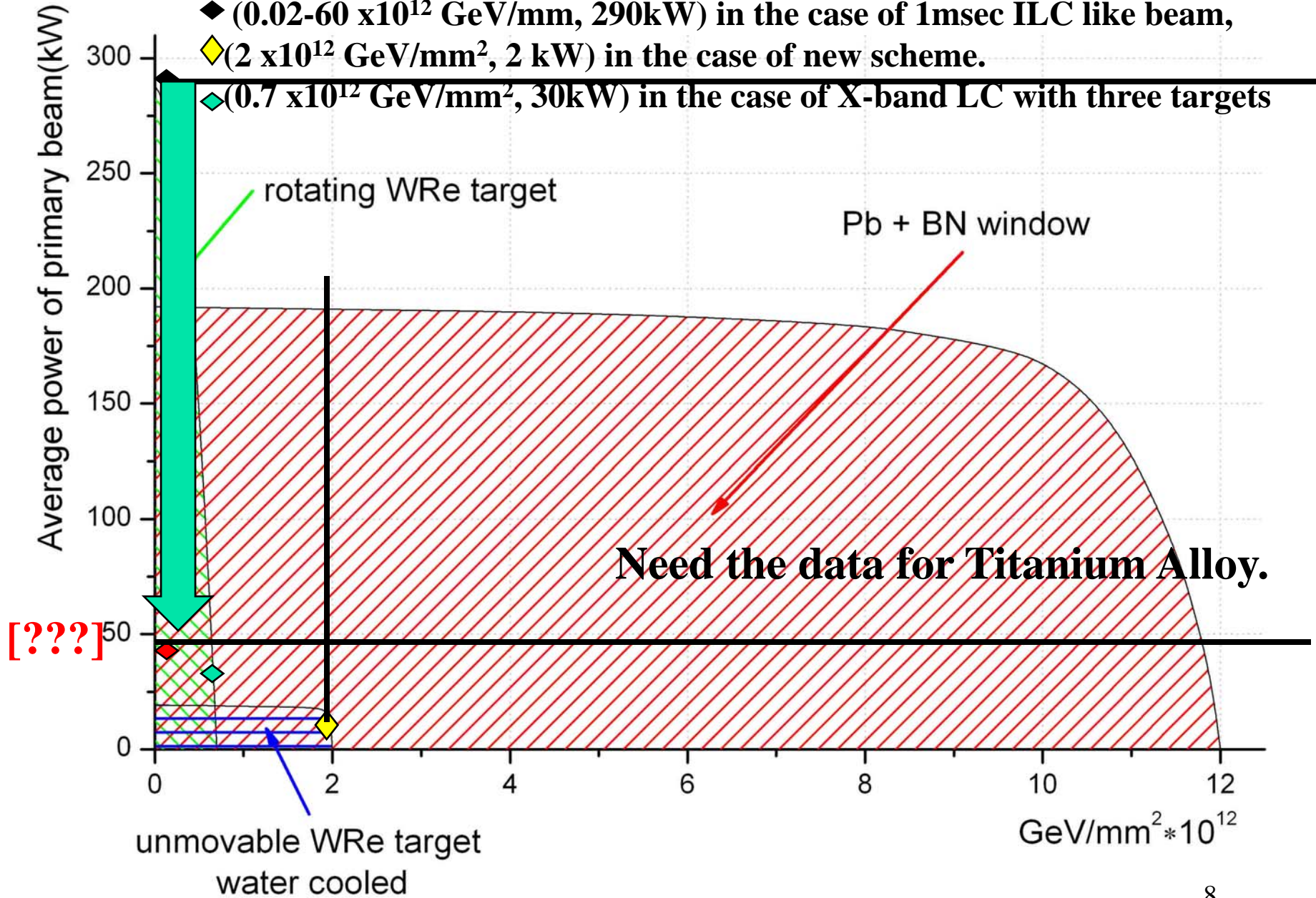


Liquid lead jet in vacuum

Cog-wheel pump test bench is in continuous run  
(20000 h) with liquid lead jet. 90% Pb, 10% Sn alloy at 300°C.



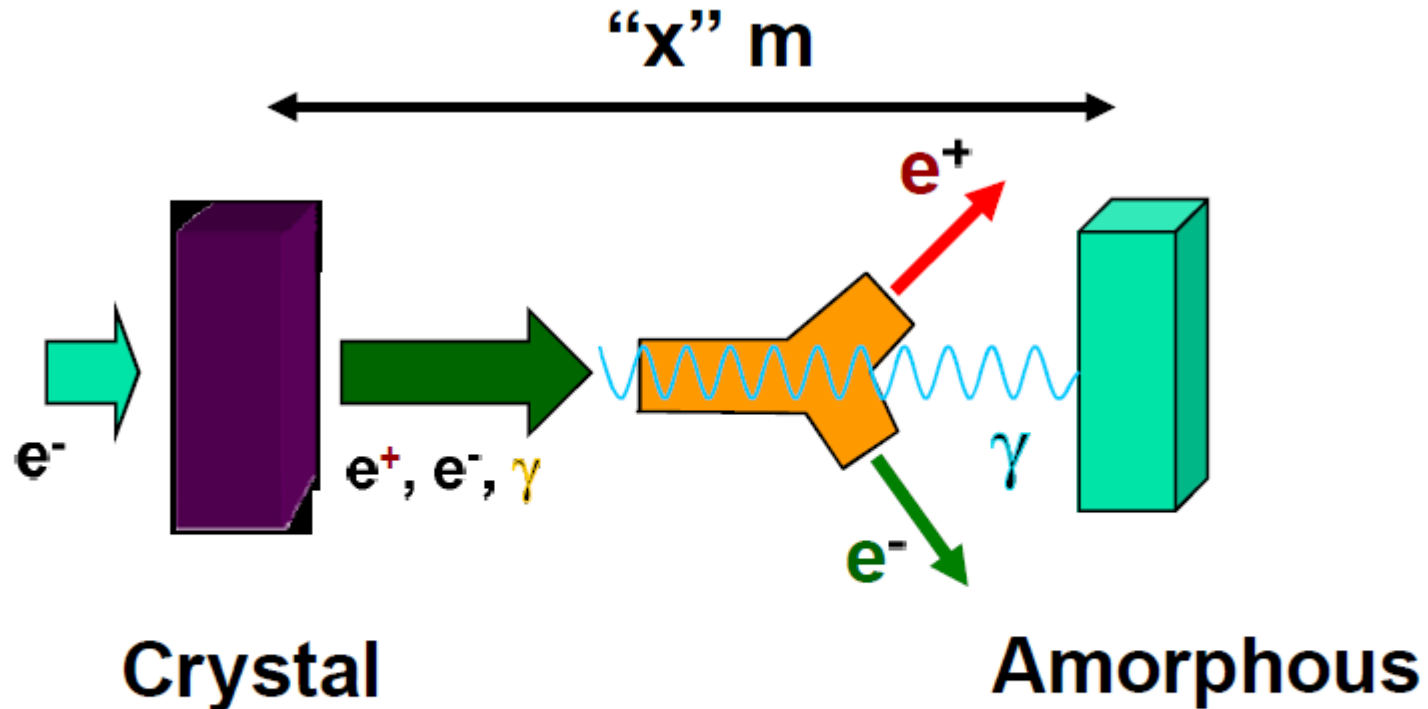
- ◆ (0.017-50  $\times 10^{12}$  GeV/mm, 40kW) in the case of Undulator scheme
- ◆ (0.02-60  $\times 10^{12}$  GeV/mm, 290kW) in the case of 1msec ILC like beam,
- ◆ (2  $\times 10^{12}$  GeV/mm<sup>2</sup>, 2 kW) in the case of new scheme.
- ◆ (0.7  $\times 10^{12}$  GeV/mm<sup>2</sup>, 30kW) in the case of X-band LC with three targets





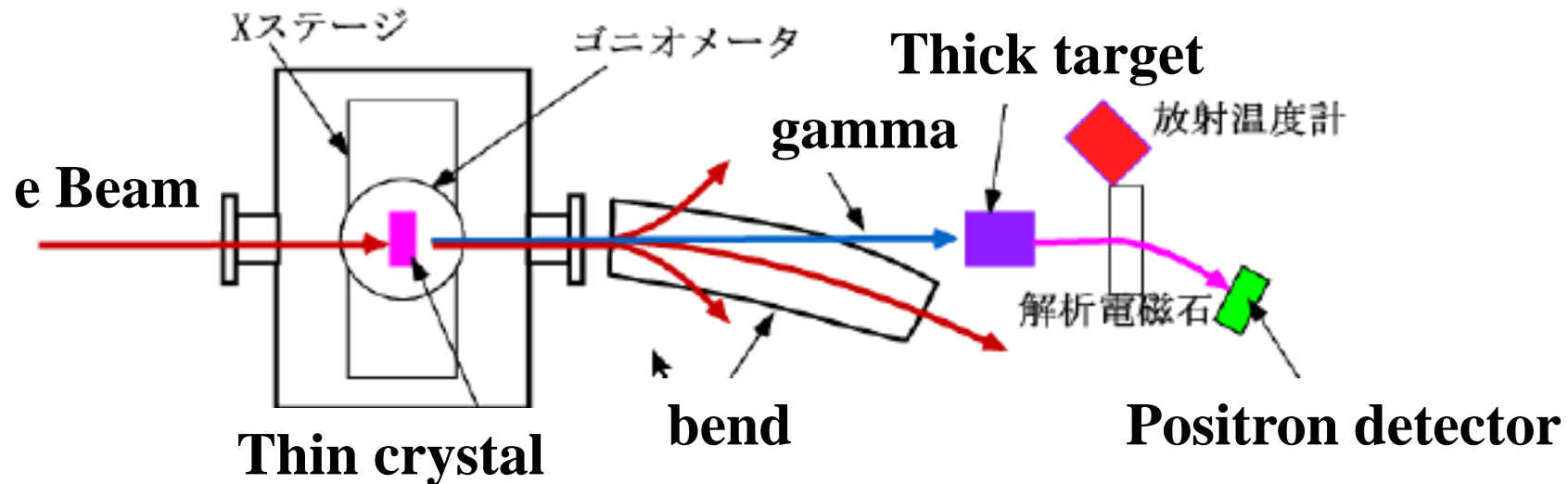
# Hybrid Target Test at KEKB Linac end

## ■ THE HYBRID TARGET



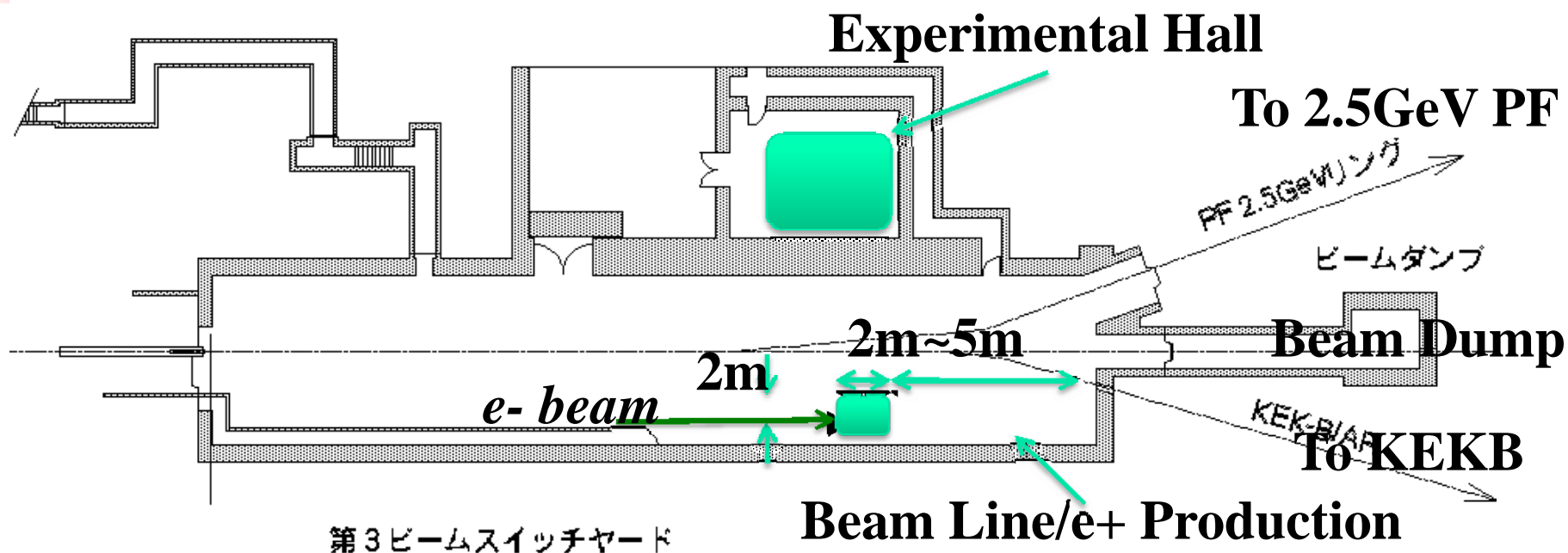
Part or all the charged particles can be swept after the crystal; all the  $\gamma$  are impinging on the amorphous target.

- **PHOTONS, ELECTRONS AND POSITRONS ON THE AMORPHOUS TARGET : THE LAY OUT**



***At Beam Switchyard at the KEKB  
Injector Linac***

# Beam Switchyard at the KEKB Injector Linac

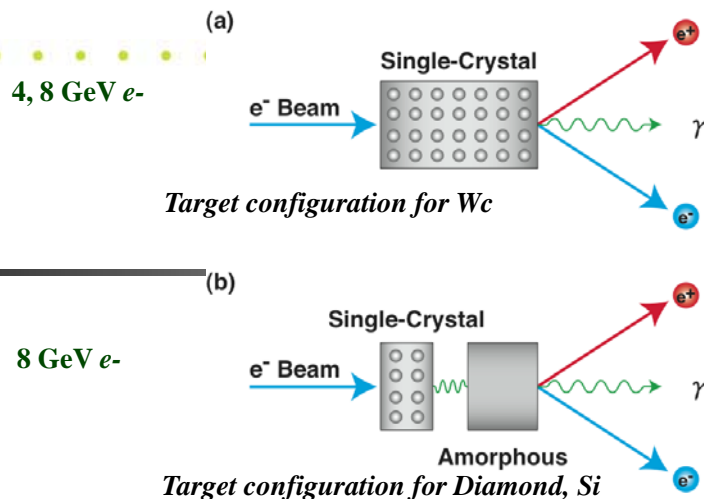


## Linac Beam Switching Yard





# Experimental Studies at KEBB Linac



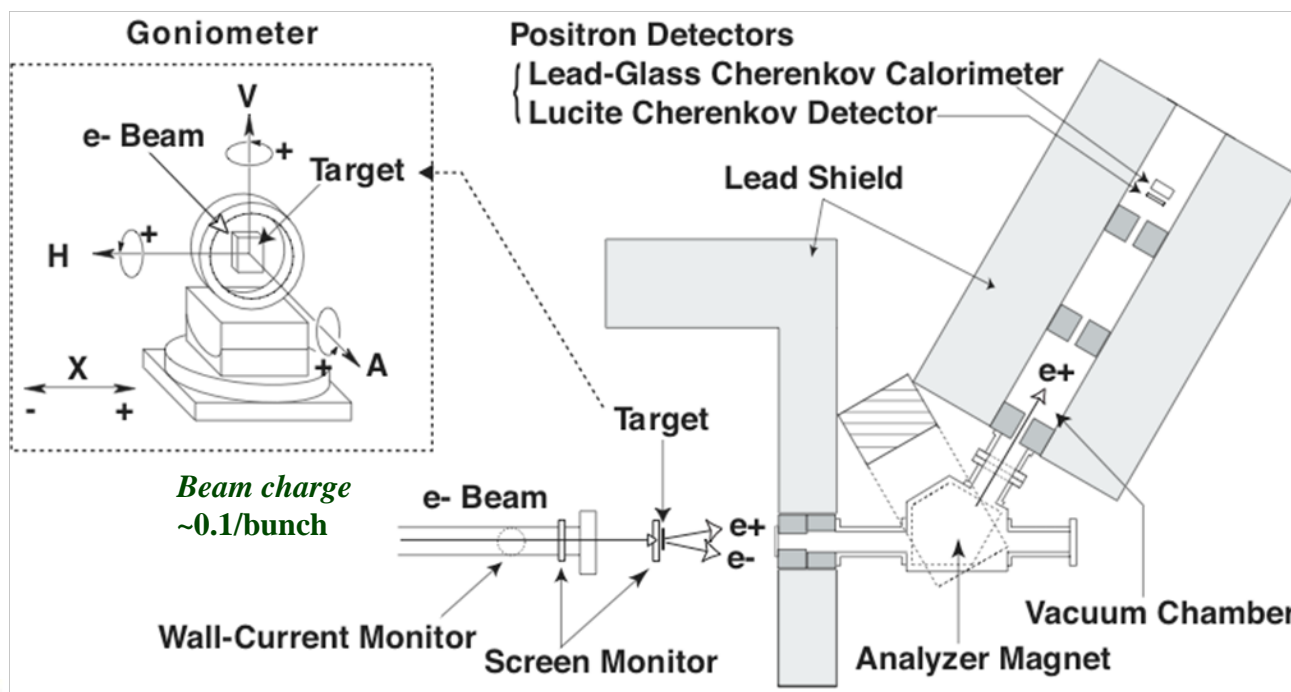
$e^+$  targets tested  
Tungsten crystal (W),  
Diamond, Si, etc.

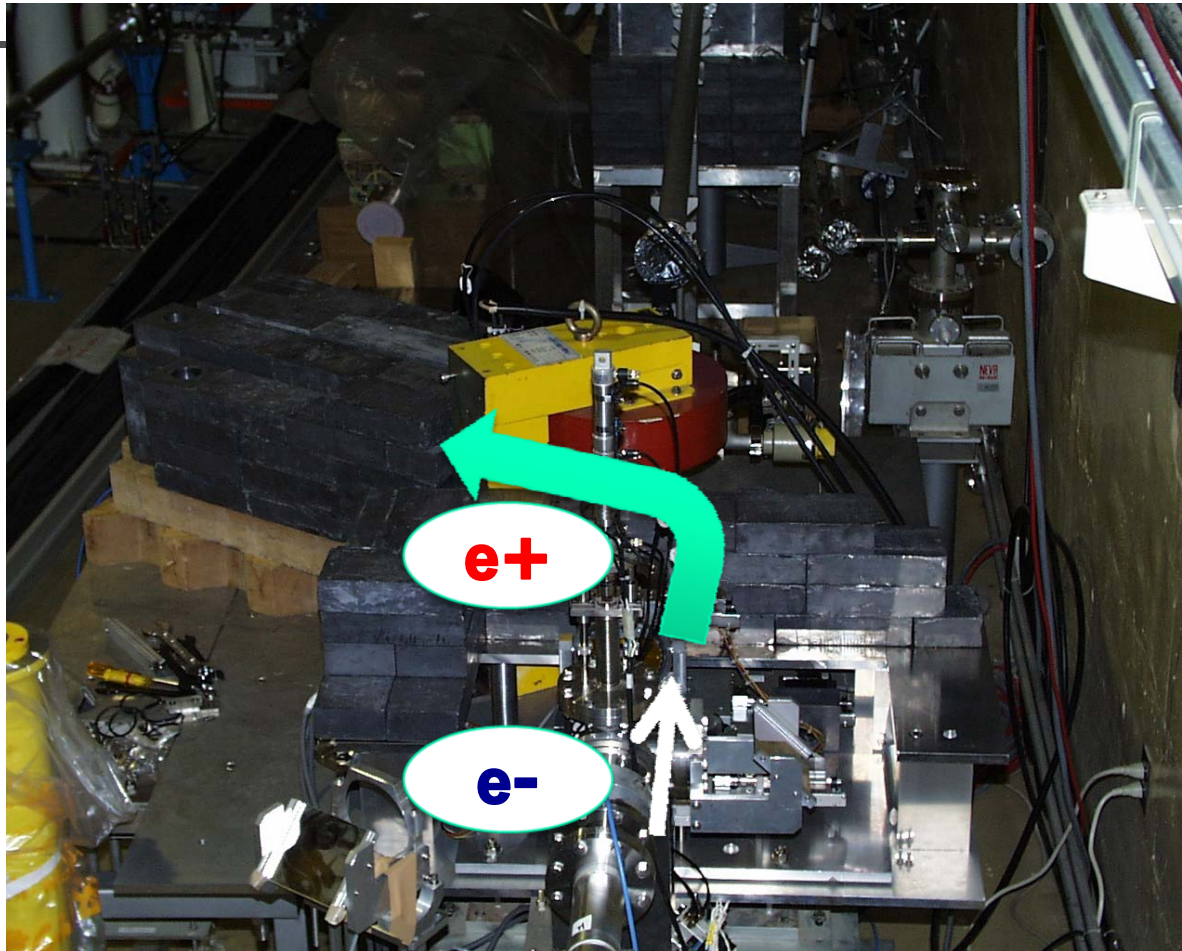
$e^+$  momentum acceptance

$\delta P/P \sim 2.4\%$  (FWHM)

Geometrical acceptance

$\delta\Omega \sim 1 \text{ msr}$  at  $P_{e^+} = 20 \text{ MeV}/c$ .





A decorative graphic on the left side of the slide, featuring a black crosshair overlaid on a yellow square, a red square, and a blue square.

## 1. BINP Flux Concentrator magnet (FC)

This is ongoing with the collaboration of KEKB and BINP. However, this FC can accept  $1\mu\text{sec}$  beam pulse, not  $1\text{msec}$ .

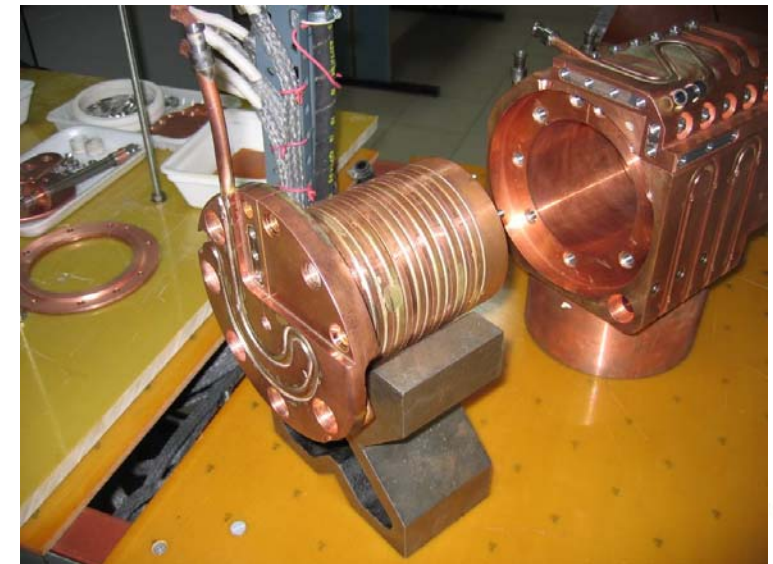
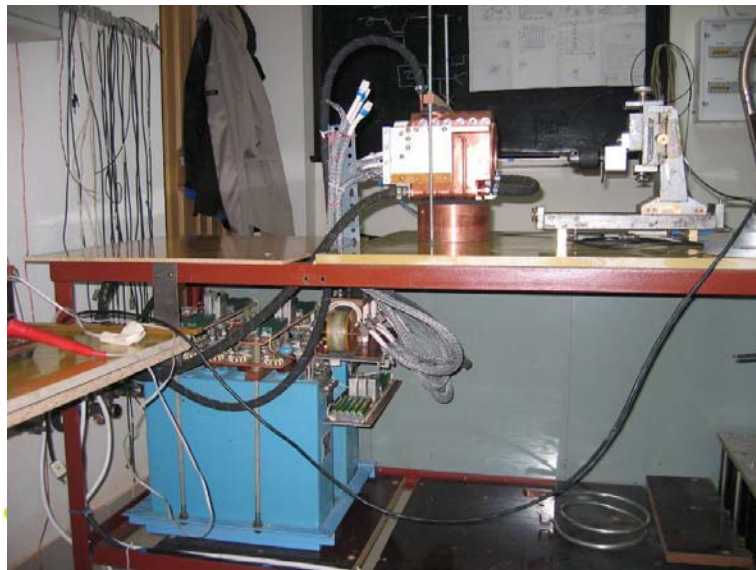
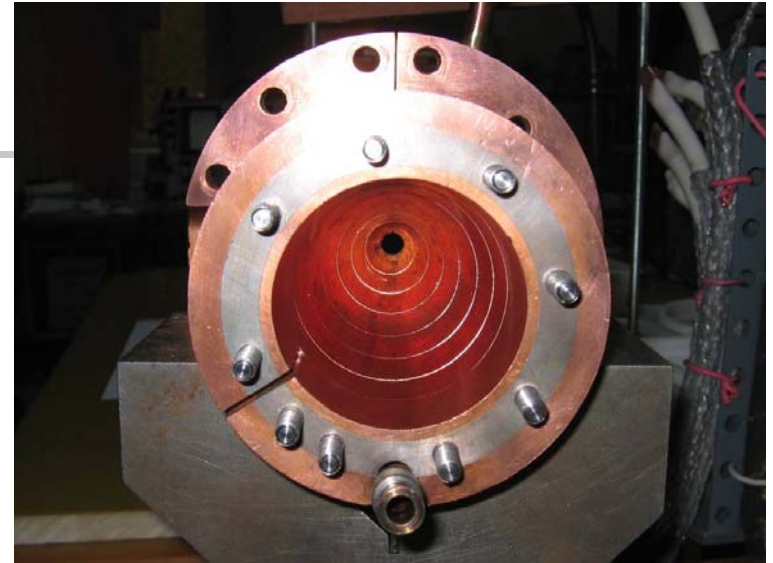
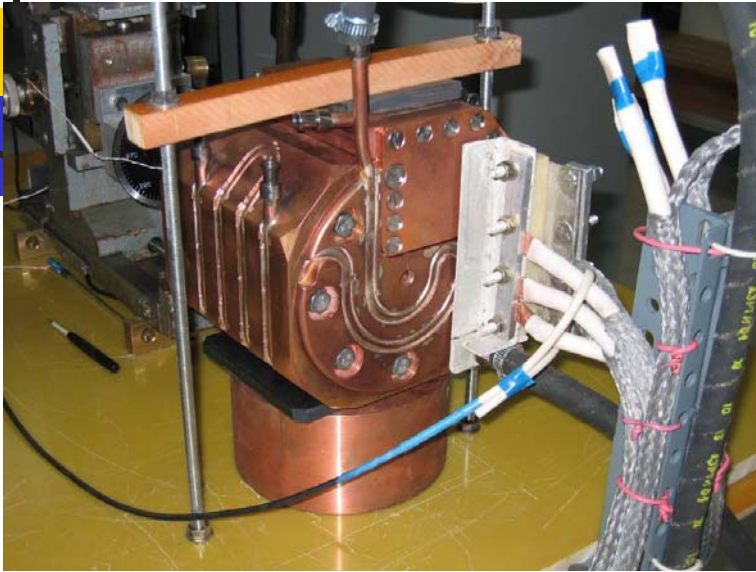
Peak field  $\sim 7\text{T}$

## 2. BINP Liquid Lithium Lens

Need a design work for ILC positron beam by BINP. Just need the design, Hardware R&D is impossible at present.



# Prototype of FC





# Undulator test with beam at ATF Linac end

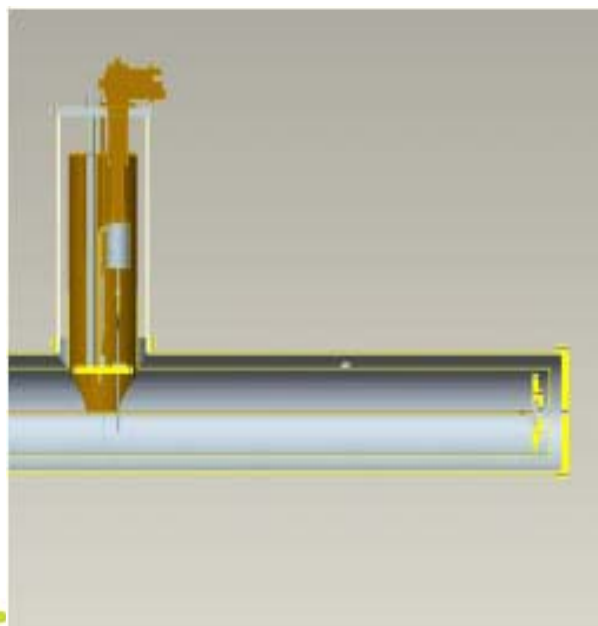
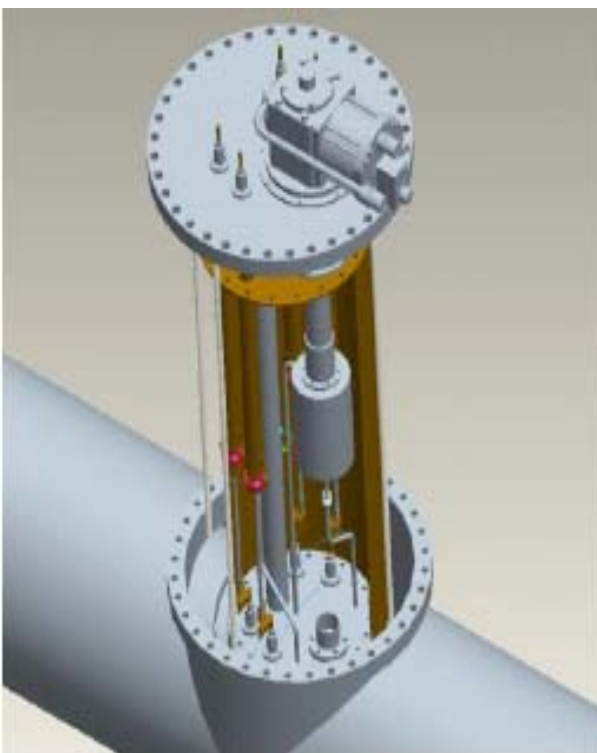
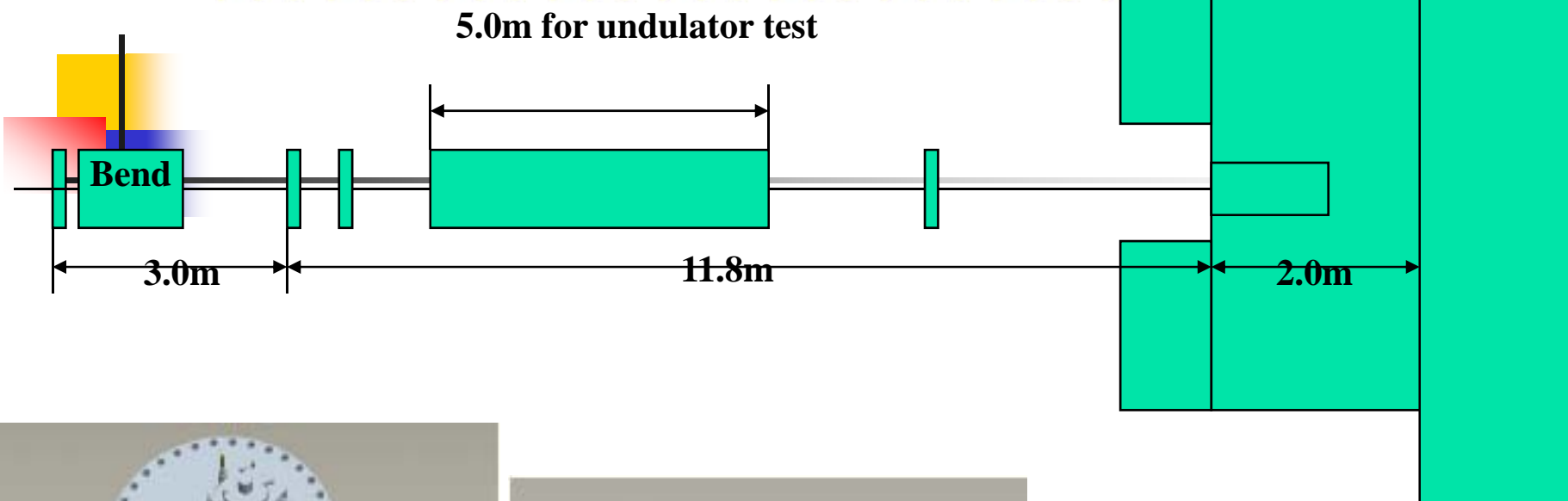


Table 1: ILC Undulator Parameters

Electron Drive Beam Energy	150 GeV
Photon Energy (1 <sup>st</sup> harmonic cutoff)	10.06 MeV
Photon Beam Power	131 kW
Undulator Type	helical
Undulator Period	11.5 mm
Undulator Strength	0.92
Field on Axis	0.86 T
Beam Aperture	5.85 mm
Undulator Length	147 m

## R&D Schedule not yet decided.

1. BINP starts the manufacturing of windows (BN, BC and Be) for test at KEKB ring in 2009. **However, this plan is pending.**
2. Systematic experimental studies on Liquid 90%Pb+10%Sn target system with BN window and the hybrid target system will **start from late 2009**. We are still discussing what kind of measurements are necessary for ILC target system and detail schedule.
3. Beam test with UK 4m long undulator at ATF Linac end **This is under discussion**. We need careful beam quality measurement at the end of ATF Linac.