

Report from Nanobeam 2008

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Nonobeam 2008 Workshop

Budker Institute of Nuclear Physics, Novosibirsk, Russia, 26-29 May 2008

**Day 3: Advanced e⁺ source / Crystal channeling and applications
Wednesday 28 May 2008**

**Positron source and liquid target R&D at BINP
Pavel LOGATCHOV (Budker INP, Novosibirsk)**

**Laser Compton based positron source
Tsunehiko OMORI (KEK)**

**Present status of KEKB positron source
Takuya KAMITANI (KEK)**

**New positron source at the KEKB injector linac based on oriented tungsten crystal converter
Igor TROPIN (TPU, Tomsk)**

**Crystal channeling for electron/positron beams
Tohru TAKAHASHI (Hiroshima University)**

**On the use of ERL for gamma production
Nikolay VINOKUROV (Budker INP)**

Photos of Liquid Lead target R&D at BINP

photo: Kamitani-san



photo: Kamitani

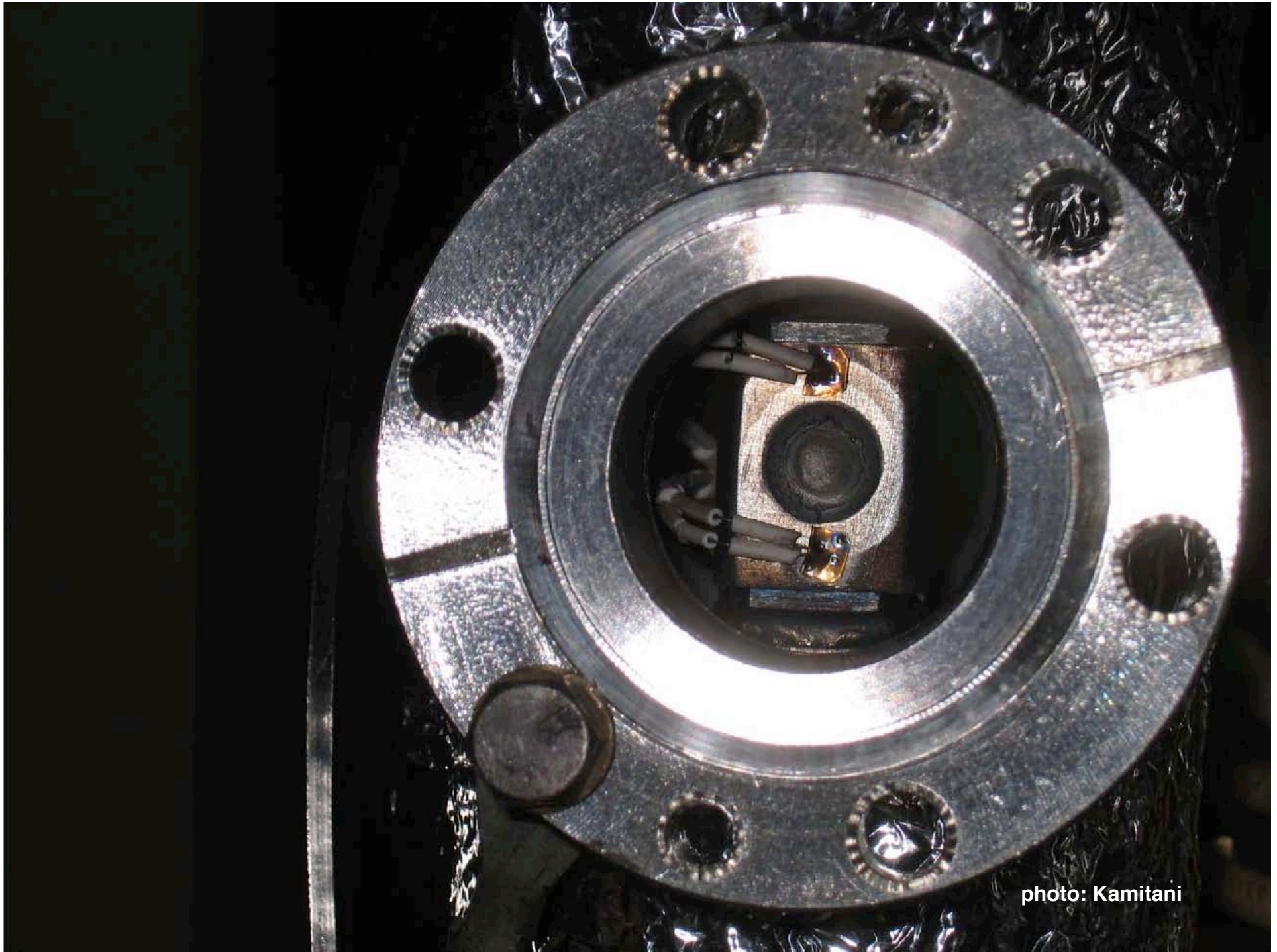


photo: Kamitani



photo: Kamitani



photo: Kamitani





photo: Kamitani

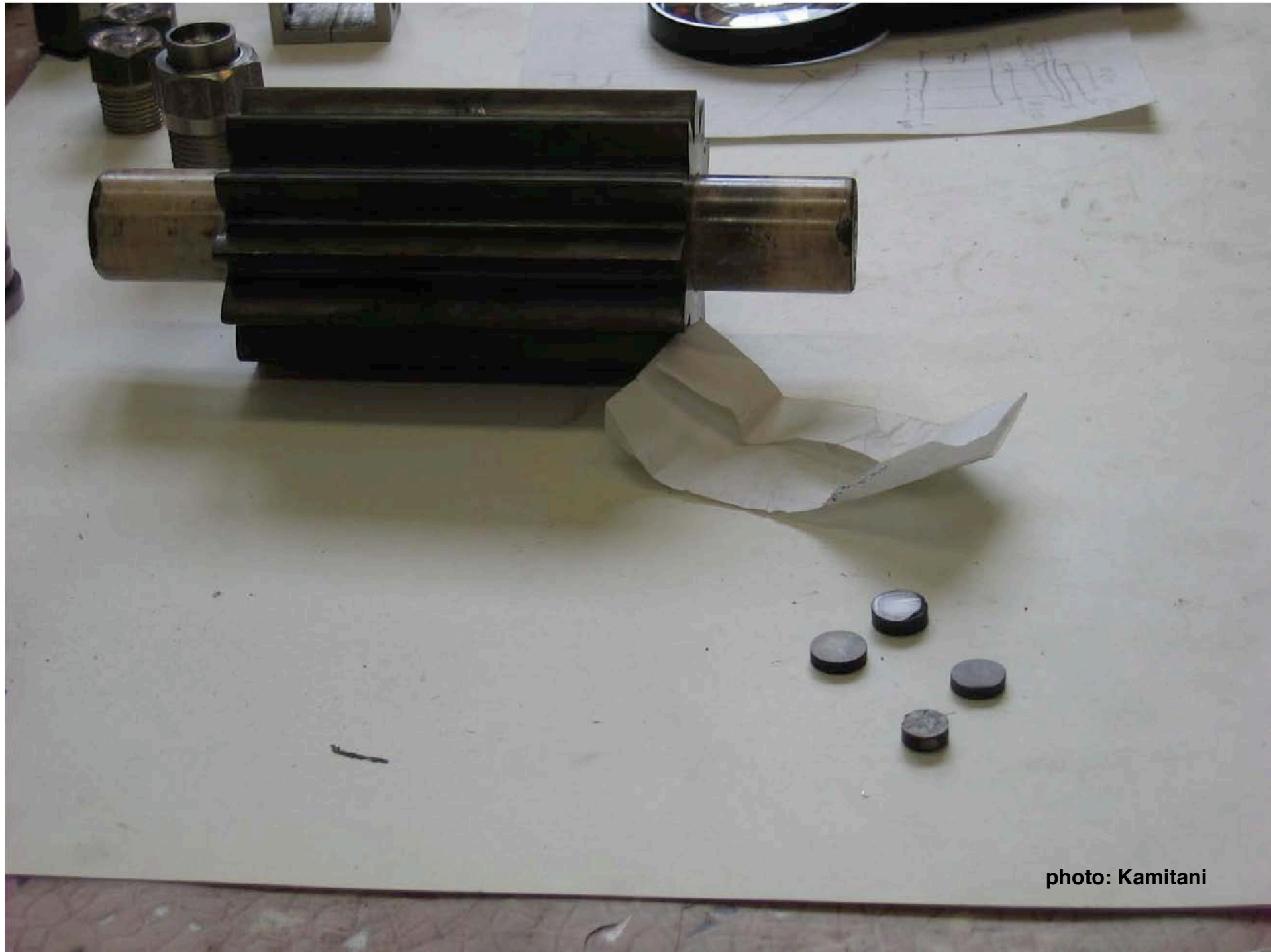


photo: Kamitani

The 600 Hz Conventional e⁺ Source Option with Liquid Lead Target

During the workshop Logatchov-san, Urakawa-san,
Takahashi-san, and Omori made a conceptual design of a
conventional e⁺ source with liquid lead target for ILC

Question:

Can Liquid Lead Target (& BN window) survive the 3000-bunch-creation in 1 m sec?



Answer:

No

BN window is OK against shock wave.

BN window is broken by heat.

Lead evaporate.



Solution:

e+ Creation in 100 m sec --> 50 bunches/train x 600 Hz

BN window is OK for 50 bunches.

Lead dose not evaporate with 50 bunches.

Lead move 16 mm in 1.7 msec, then heat is removed.

(speed of lead = 10 m/sec, 600 Hz <--> $T_{t_to_t} = 1.7$ m sec

e+ creation

50 bunches/train x 600 Hz

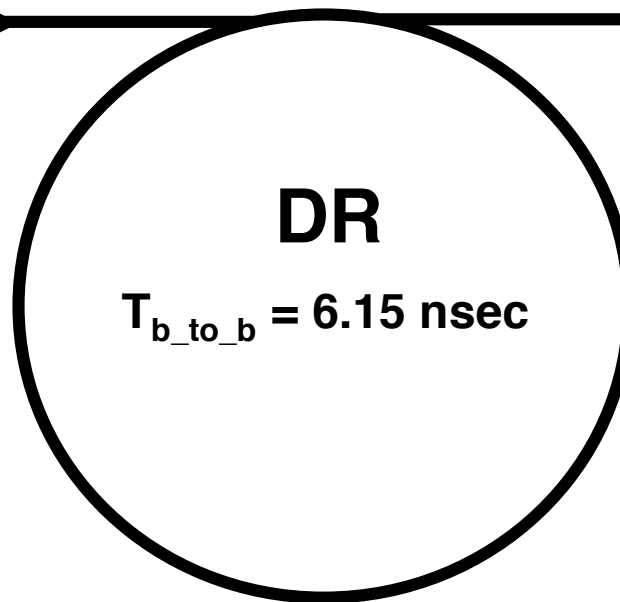
$$T_{b_to_b} = 6.15 \text{ nsec}$$

go to main linac

3000 bunches/train x 5 Hz

$$T_{b_to_b} = 300 \text{ nsec}$$

We create 3000 bunches
in 100 m sec



Time remain for damping = 100 m sec

Table : The 600 Hz Conventional e+ Source Option with Liquid Lead Target

bunches/train :	50
repetition rate:	600 Hz
(We can create 3000 bunches in 100 m sec.)	
drive beam energy:	6 GeV
bunch-to-bunch separation:	6.15 n sec
Ne/bunch (drive beam)	2×10^{10}
pulse length	300 n sec (6.15x50)

total energy of the drive beam bunch:

$$6 \times 10^9 \times 50 \times 2 \times 10^{10} \times 1.6 \times 10^{-19} \text{ J} = 1000 \text{ J}$$

Assume 20 % of 1000J is deposited in the target.

every deposit in the target: 200J

Assume 5 mm diameter of the beam on the target.

Weight of the target : 2 g = 0.002 Kg

$$(2.5 \times 2.5 \times 3.14 \times 10 \times 11 \text{ g} \times 10^{-3}) = 2 \text{ g}$$

delta T:

$$\text{delta T} = 200 \text{ J} / (140 \text{ J/K*Kg}) / 0.002 \text{ Kg} = 700 \text{ K}$$

Summary of consideration of Liquid target for ILC

The conventional e+ source with the liquid lead target seems OK for ILC.
condition: We need 600 Hz operation of the drive beam and the injector.

---> This will be presented in Dubna GDE meeting by Logachev-san/Urakawa-san.
We need beam test at KEKB.

Is the conventional e+ source with rotational solid target OK,
if we employ 600 Hz operation?

--> We need to check.

Dose the liquid lead target help Compton e+ source?

--> to Linac scheme: Maybe it helps.

to Ring/ERL scheme: liquid target is Not necessary.

--> We need to check.

Dose the liquid lead target help undulator e+ source?

--> We need to check.