First test of BN window

BN window test at KEKB ring abort line

-- Liquid PB target for ILC e^+ source --

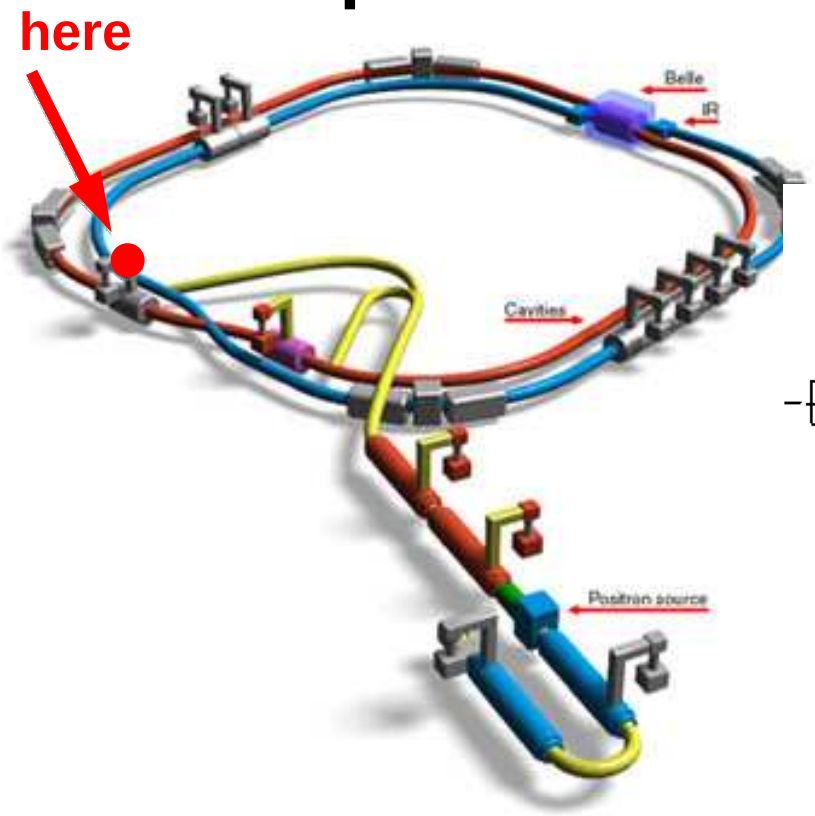
Quick Report on the Oct/22nd experiment

Iida, Kamitani, Mimashi, Urakawa, Nakamura, Kuriki, and Omori

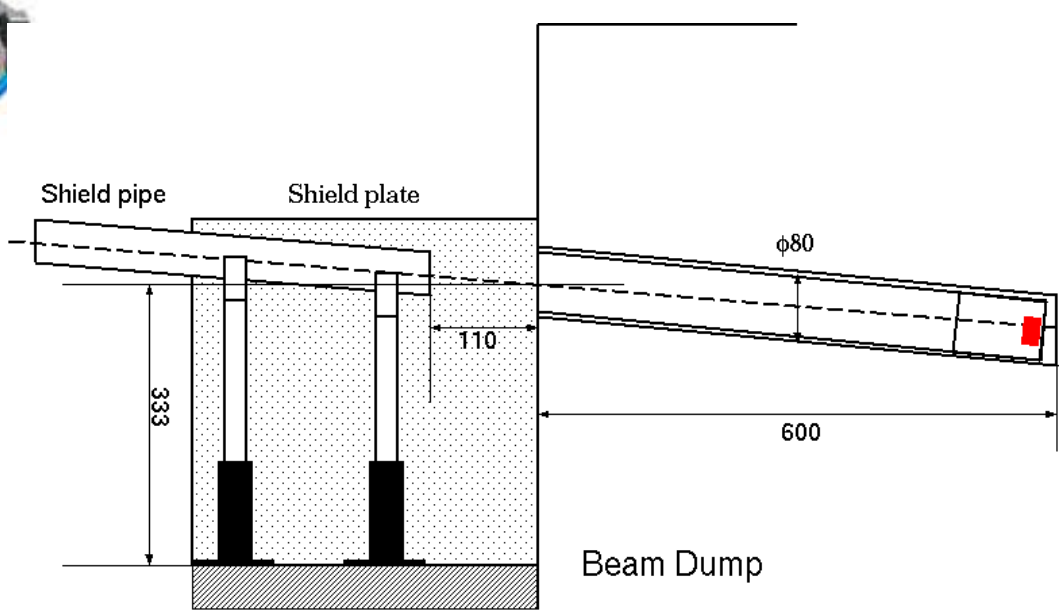
28 Oct 2009 Positron Workshop Durham

Presented by Junji Urakawa instead of Omori.

Liq. Pb Window Test at KEB



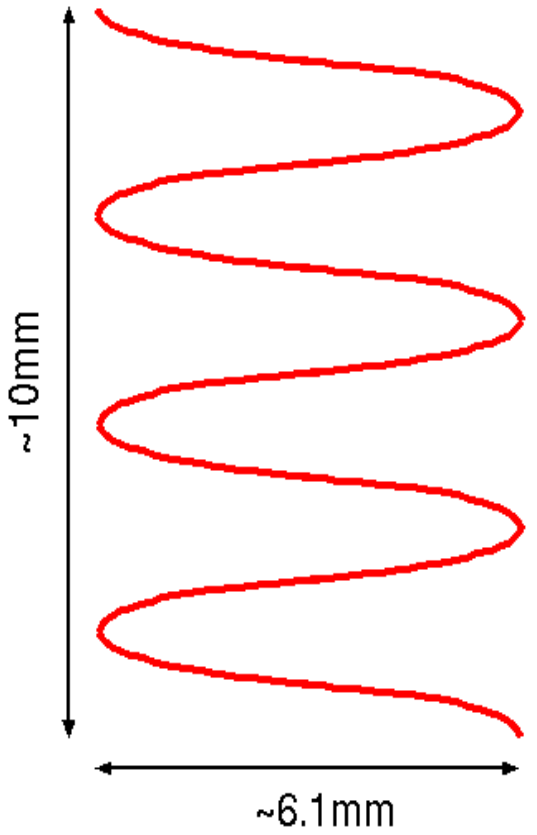
Stored beam and dump



- KEKB-HER: 8GeV, 10nC, 1600 bunches (1600mA)
- The beam is deflected by the abort kicker as shown when it is dumped.
- Because of “Step size” variation, the energy density is varied from 1810 to 13700 J/mm^2

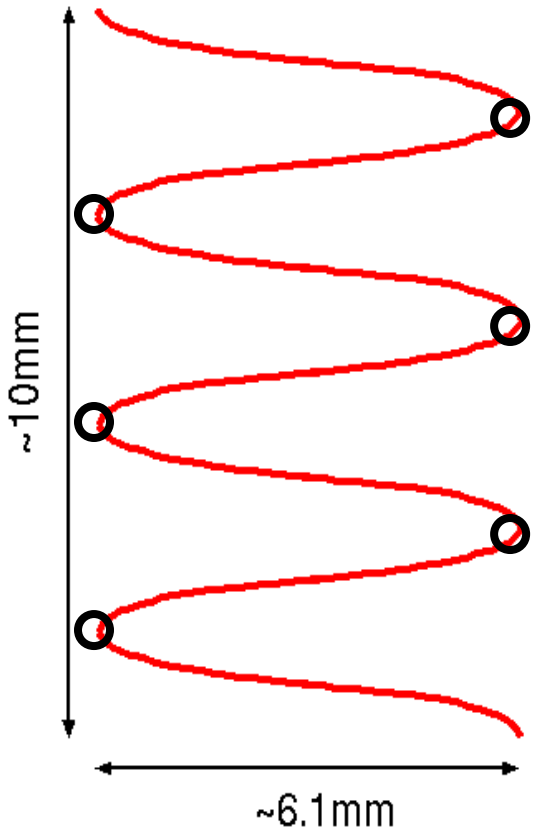
Beam Condition

- 10nC, ~1600 bunches, 10μs
- Bunch-by-bunch impossible
- Unable to change beam size (~1mm rms?)
- Swept by kicker (protect extraction window)
- Moves 7μ ~ 45μ/bunch on target (0.9mm ~ 6mm over 132 bunches)



Beam Condition

- 10nC, ~1600 bunches, 10μs
- Bunch-by-bunch impossible
- Unable to change beam size (~1mm rms?)
- Swept by kicker (protect extraction window)
- Moves 7μ ~ 45μ/bunch on target (0.9mm ~ 6mm over 132 bunches)



132 bunches in ~ 1mm

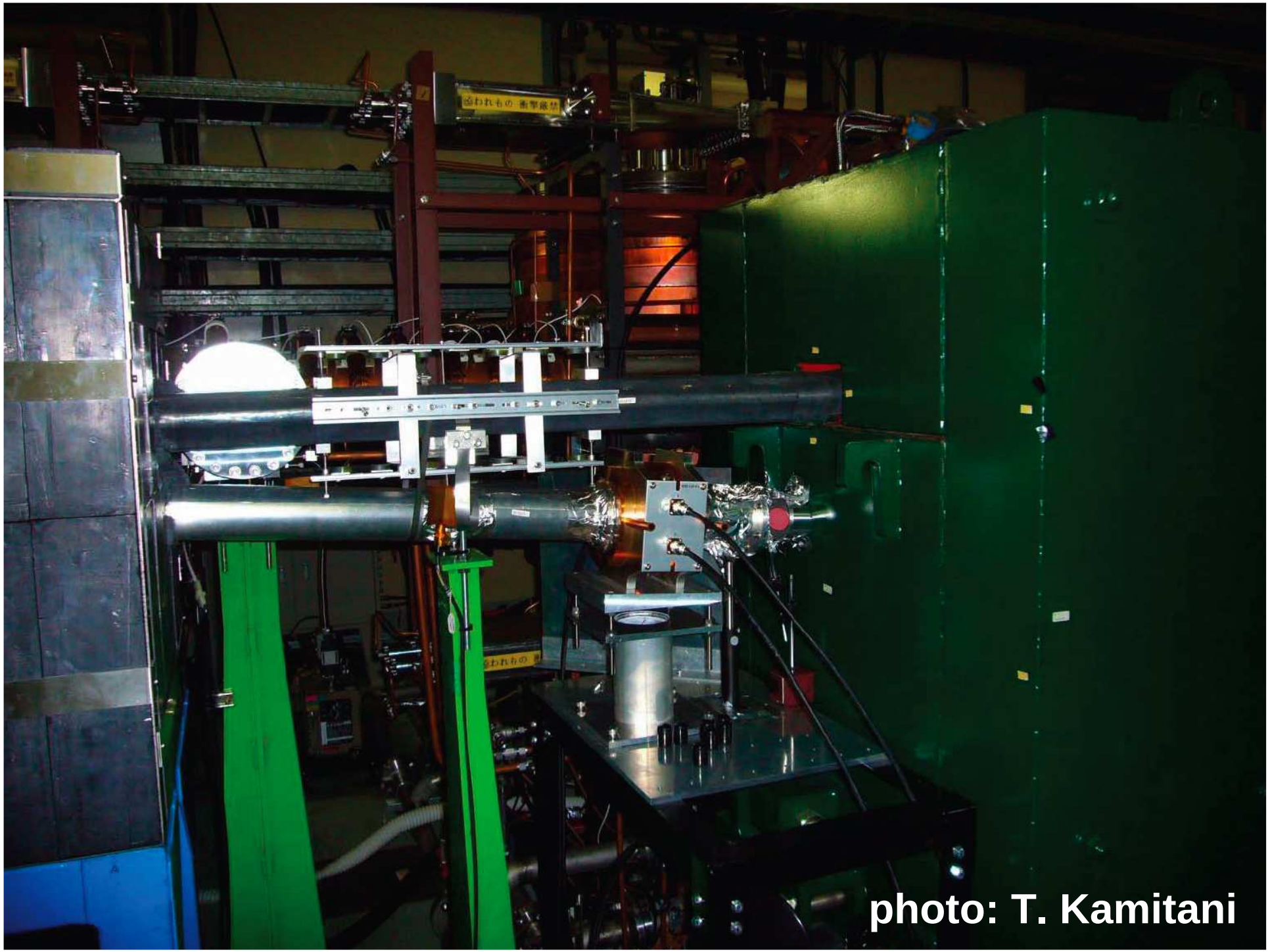


photo: T. Kamitani

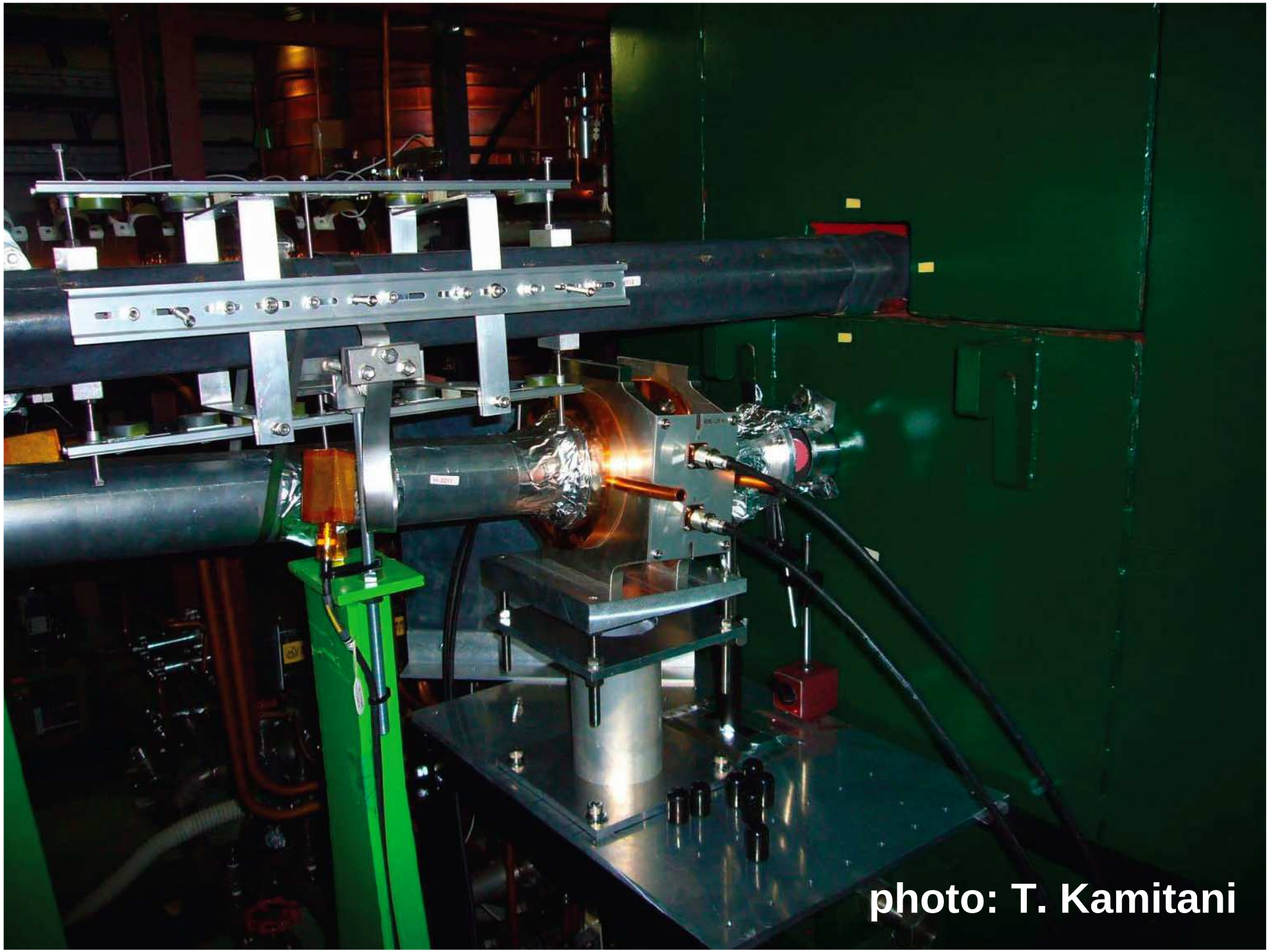


photo: T. Kamitani

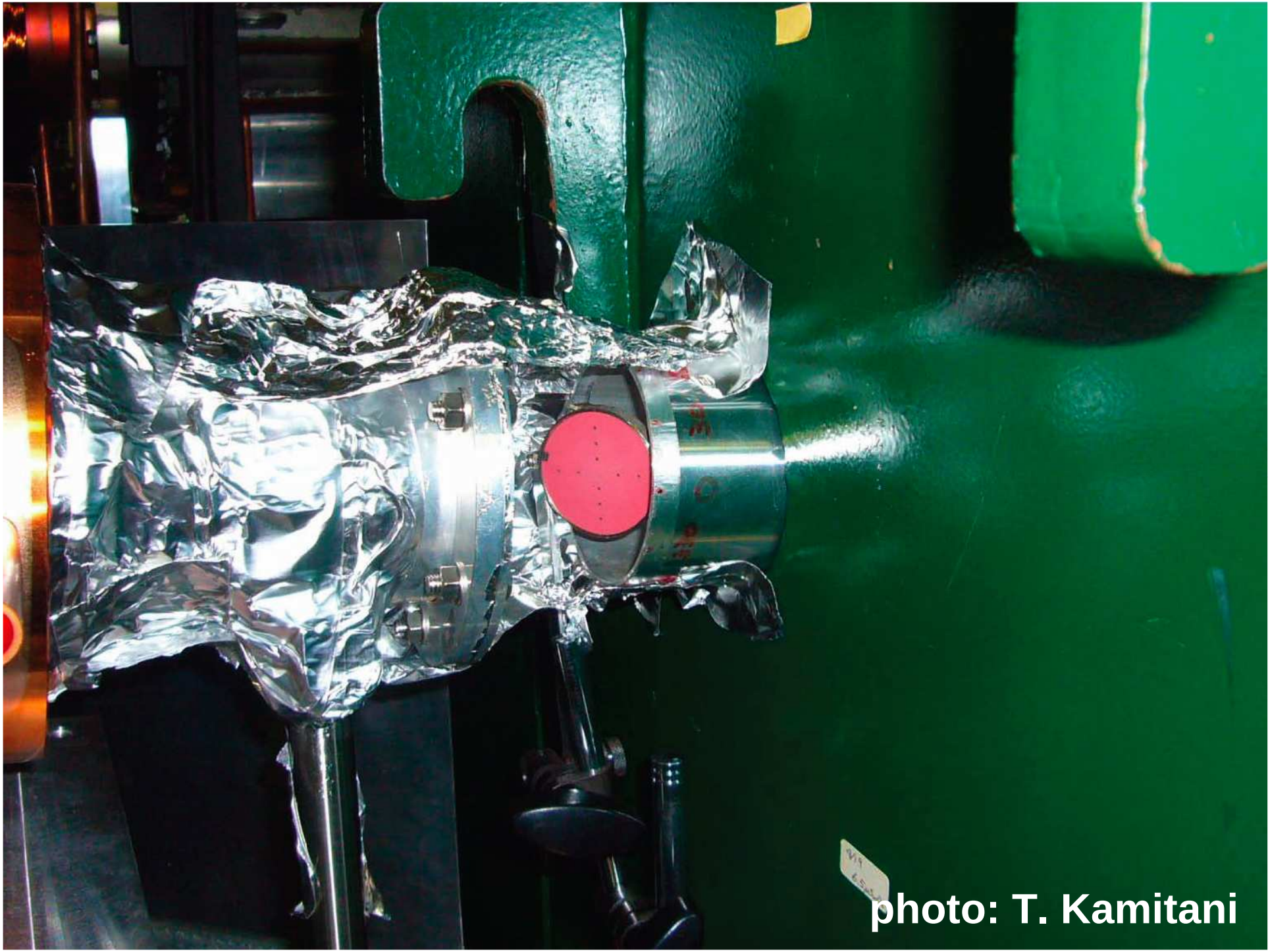
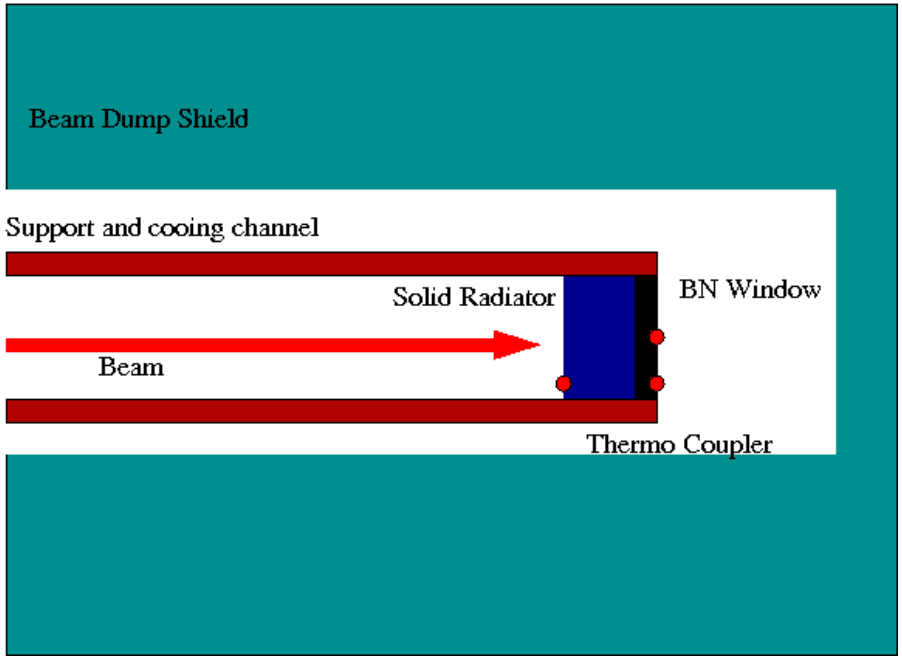


photo: T. Kamitani

KEKB Beam Dump setup

- It is a test for isolation window material for liquid Pb target system.
- Space is very limited for KEKB BD.
- Solid Radiator (Solid Pb) is placed before BN plate, as a test material.
- The sample is fixed with support rod, which also acts as cooling channel.
- Thermo-coupler, acoustic sensor for monitor.
- Final investigation for damage is made by optical and laser microscopy.



Drawing of the Sample and Holder

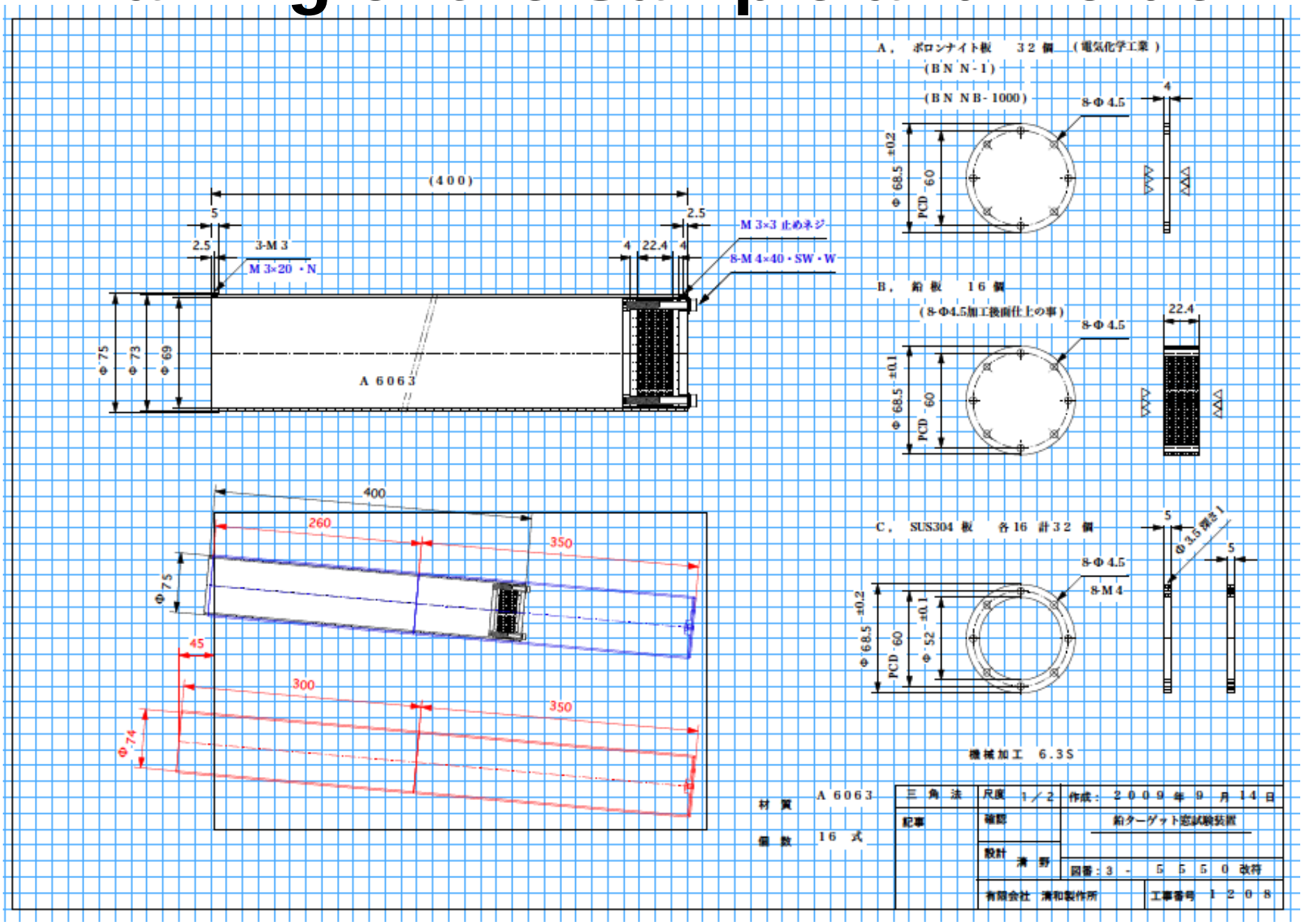



photo: M. Kuriki


photo: M. Kuriki


photo: M. Kuriki


photo: T. Kamitani

Characteristics of BN shapes

DENKA CONFIDENTIAL

・Typical value

Property	Unit	Grade / Condition	Mainly BN: HC	Mainly BN: N-1	Mainly BN: NB-1000	BN-AlN: BA-3	BN-AlN: BA-2000	BN-Si_3N_4: SBN/70	BN-Si_3N_4: SBN/50	BN-Si_3N_4: SBN/30	BN-others: UA-2	BN-others: EBN
Maximum products size(outer size)			φ300×220t	φ320×220t Each part Max.40t	520×510×55t 500×470×100t 100t:Supply limit	φ300×120t	410×400×40t	φ280×180t	φ270×180t	φ270×180t	φ160×200t	φ280×180t
Density	g/cm^3		2.0	1.8	1.6	2.8	2.6	2.7	2.5	2.2	2.2	3.1
Hardness	-	Shore	20	12	11	76	40	75	69	48	45	60
Flexural strength	MPa	RT	35	30	28	*280*	*120*	*300*	*270*	*140*	55	160
Thermal conductivity	W/m・K	RT	36	63	60	*66*	*95*	44	47	33	8	55
Maximum operation temp.	℃	In atmosphere	950	950	950	950	950	950	950	950	*1,100*	950
	℃	In inert gas	1,800	*2,200*	*2,200*	1,950	1,950	*1,700*	*1,700*	*1,700*	*1,500*	2,000
	℃	In vacuum	1,600	*2,000*	*2,000*	1,800	1,800	*1,500*	*1,500*	*1,500*	*1,400*	1,700
CTE	$\times 10^{-6}$/℃	RT ～1,000℃	-0.25	-1.4	-0.6	4.3	5.4	3.0	2.6	2.0	6.0	7.0
Dielectric constant	-	RT、1MHz	4.0	4.5	4.9	6.7	7.0	4.9	6.3	4.9	3.0	-
Dielectric loss	$\times 10^{-3}$	tan δ RT、1MHz	0.8	0.9	1.0	1.8	3.9	2.4	5.3	18.0	1.3	-
Volume resistance	Ω・cm	RT	10^{15}	10^{15}	10^{15}	10^{14}	10^{14}	10^{14}	10^{14}	10^{14}	10^{14}	*250 ～1,000 μΩcm*
Chemical structure	BN%		*97*	*>99.5*	*>99.5*	30	20	30	50	70	40	35
Other components			$CaO \cdot B_2O_3$	-	-	AlN	AlN	Si_3N_4	Si_3N_4	Si_3N_4	$Al_2O_3 \cdot SiO_2$	TiB_2・AlN
Typical application	Insulator		○	○	○	○	○					
	Semiconductor equipment		○	○	○	○	○	○	○	○		
	Jig for molding glass		○	○	○	○	○	○	○	○		
	Nozzle and crucible			○	○							○
	Paving plate				○							
	Bearing and cogwheel			High purity	High purity and large size	○	○	○	○	○		
	Boron source						Large size				○	
	Evaporator											

Sample 1 設置作業

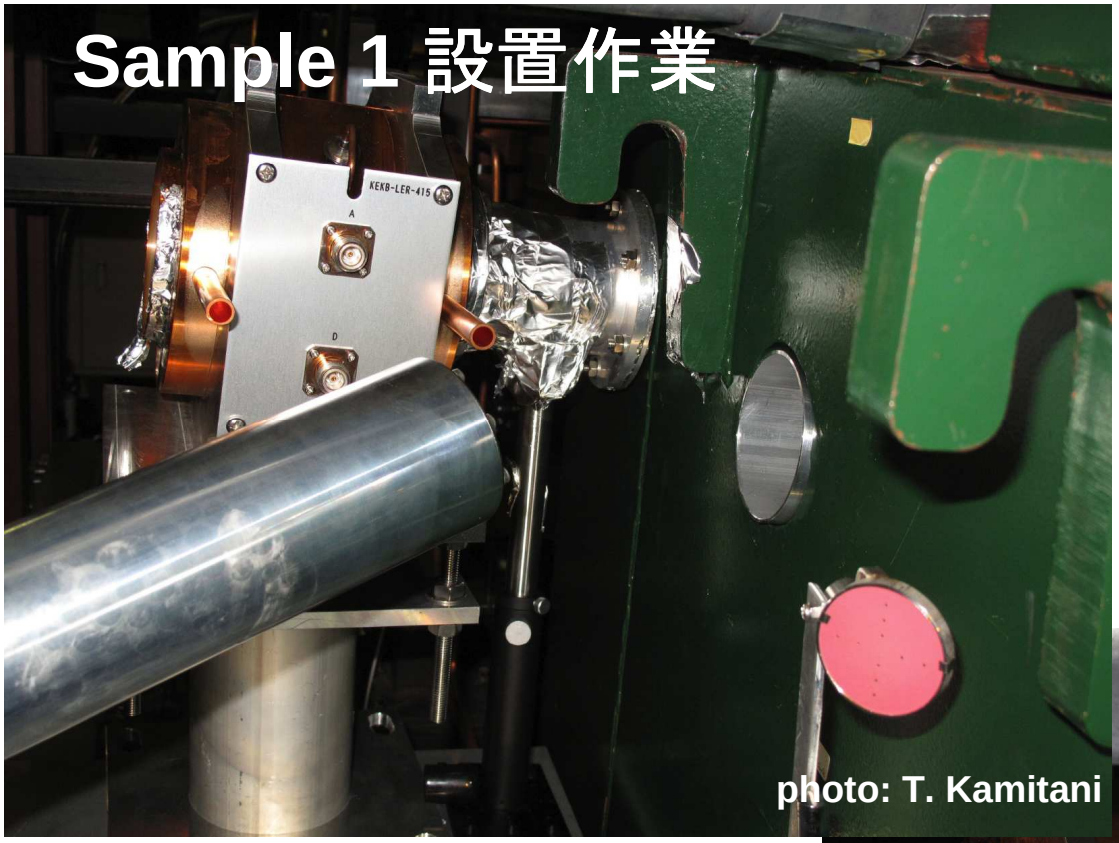


photo: T. Kamitani

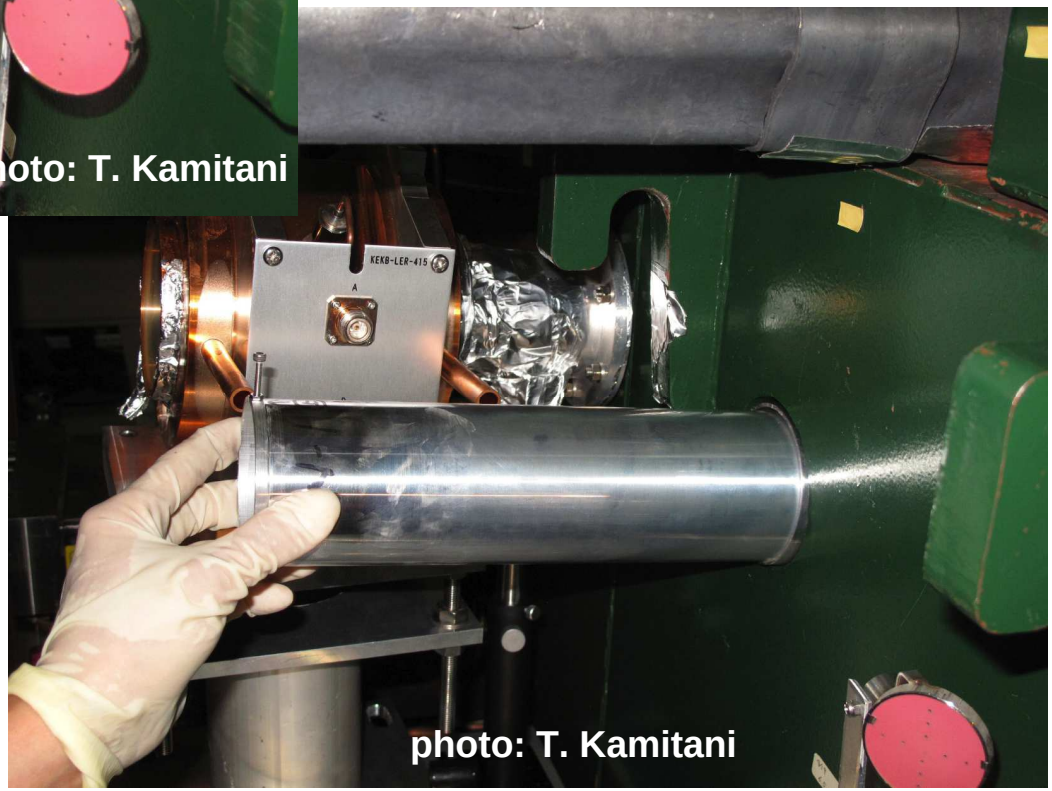
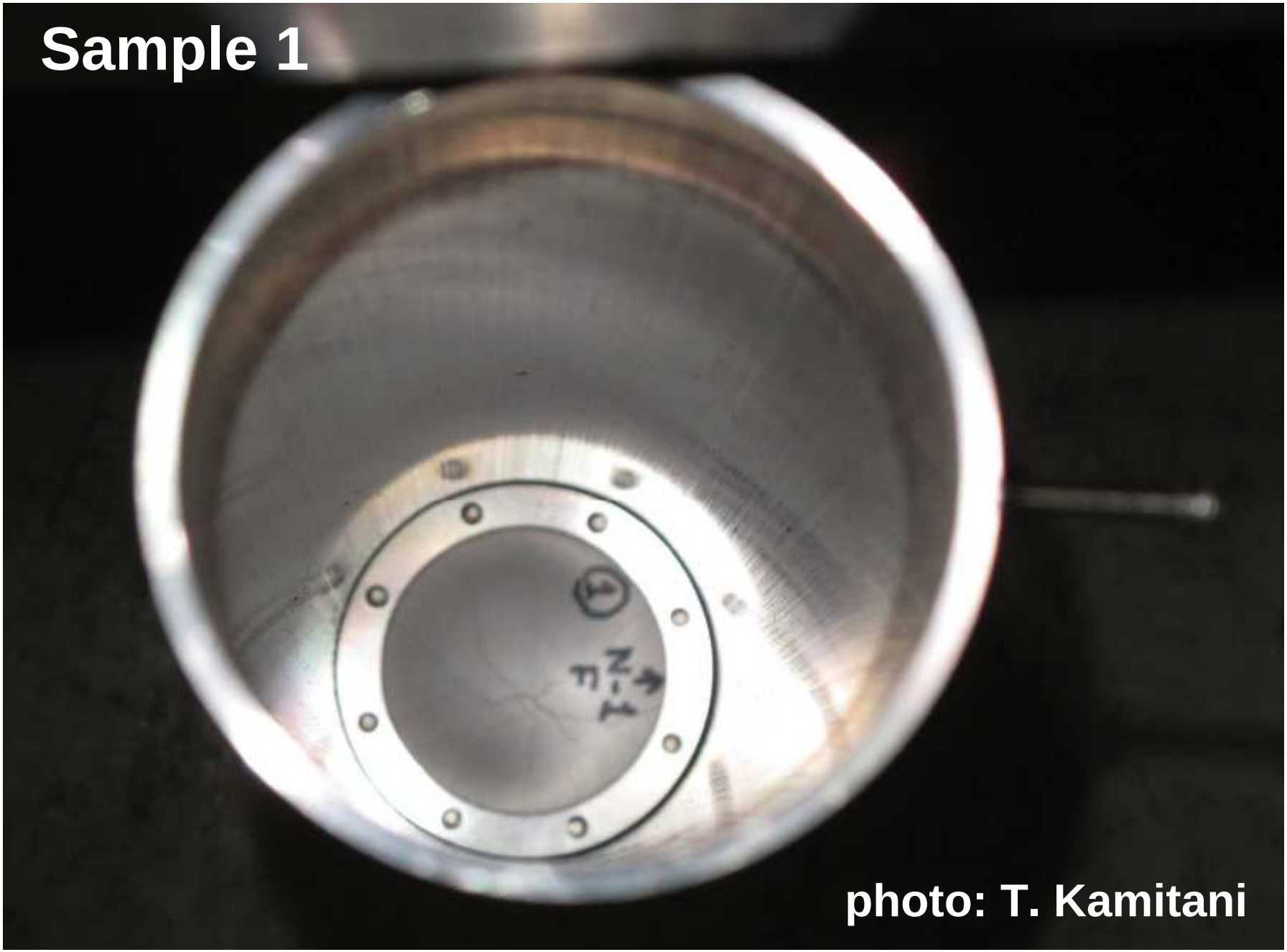


photo: T. Kamitani


Sample 1
photo: T. Kamitani


Sample 2
photo: T. Kamitani


Sample 1
photo: T. Kamitani


Sample 1
photo: T. Kamitani