

# **BN window test at KEKB ring abort line**

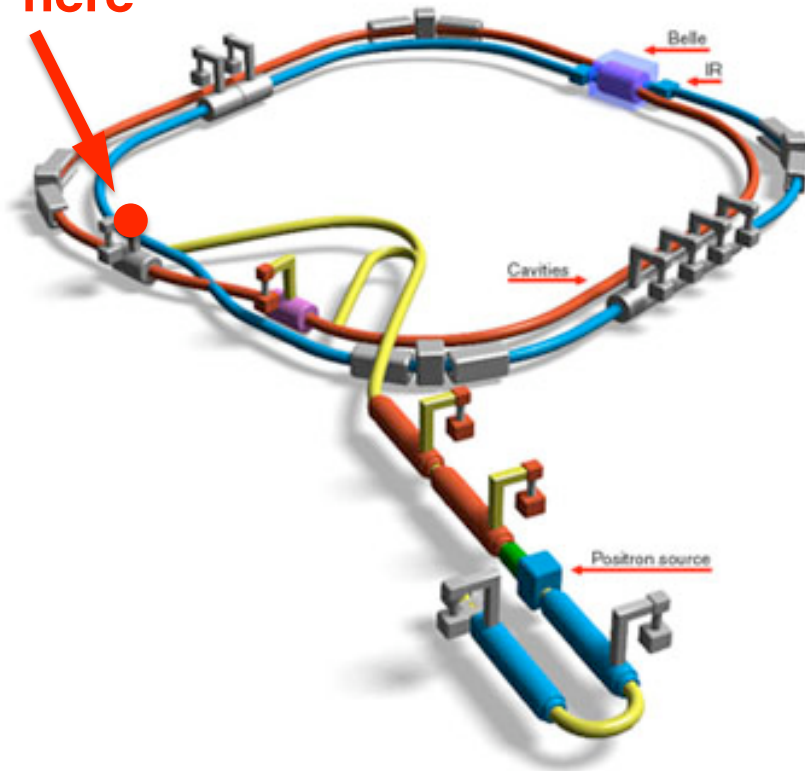
**-- Liquid PB target for ILC  $e^+$  source --**

**Brief Report on the Oct/22<sup>nd</sup> experiment**

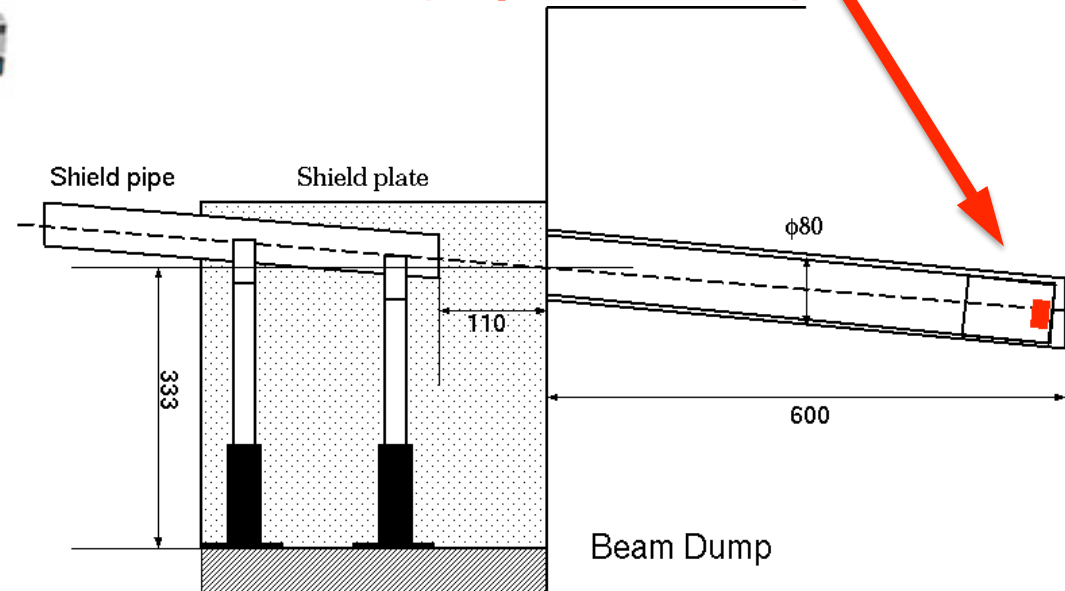
**T. Omori and J. Urakawa  
with KEKB and radiation safety colleagues  
19 Nov 2009 ILC-CLIC  $e^+$  studies**

# Liq. Pb Window Test at KEB

here



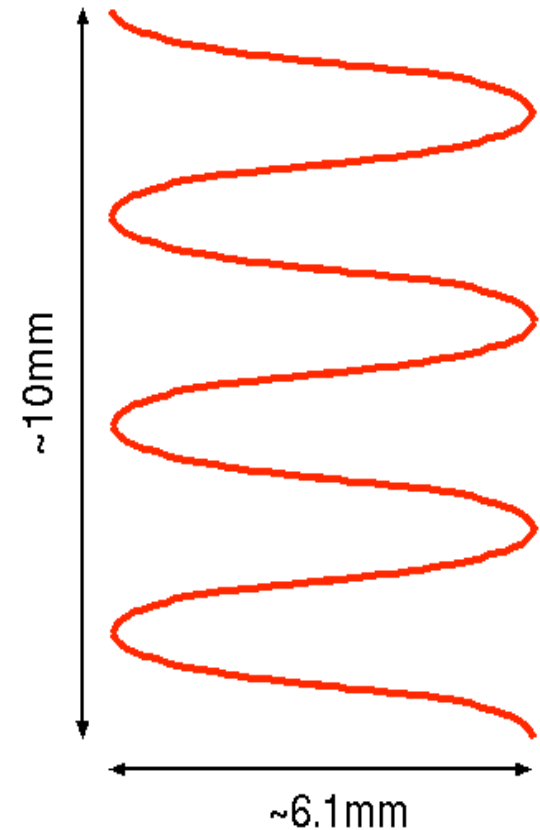
put a target sample in  
hole for beam dump  
(depth 600 mm)



- KEKB-HER: 8GeV, 10nC (Max), 1600 bunches (1600mA)
- The beam is deflected by the abort kicker as shown when it is dumped.

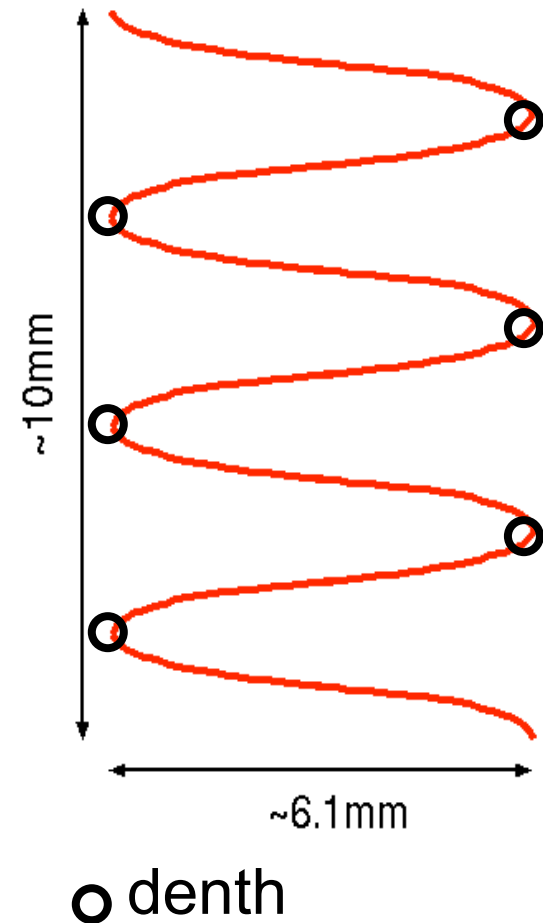
# Beam Condition

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



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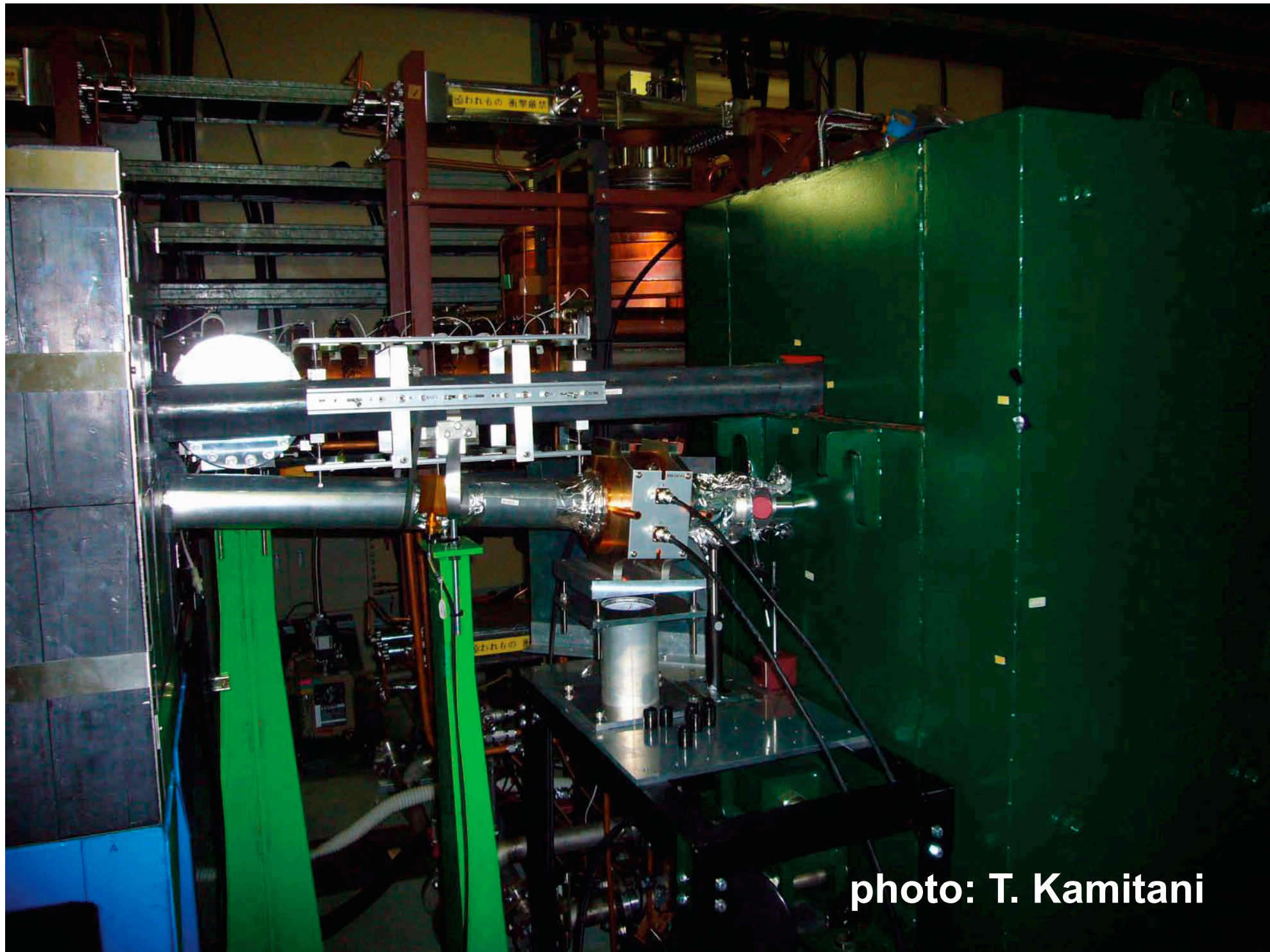


photo: T. Kamitani

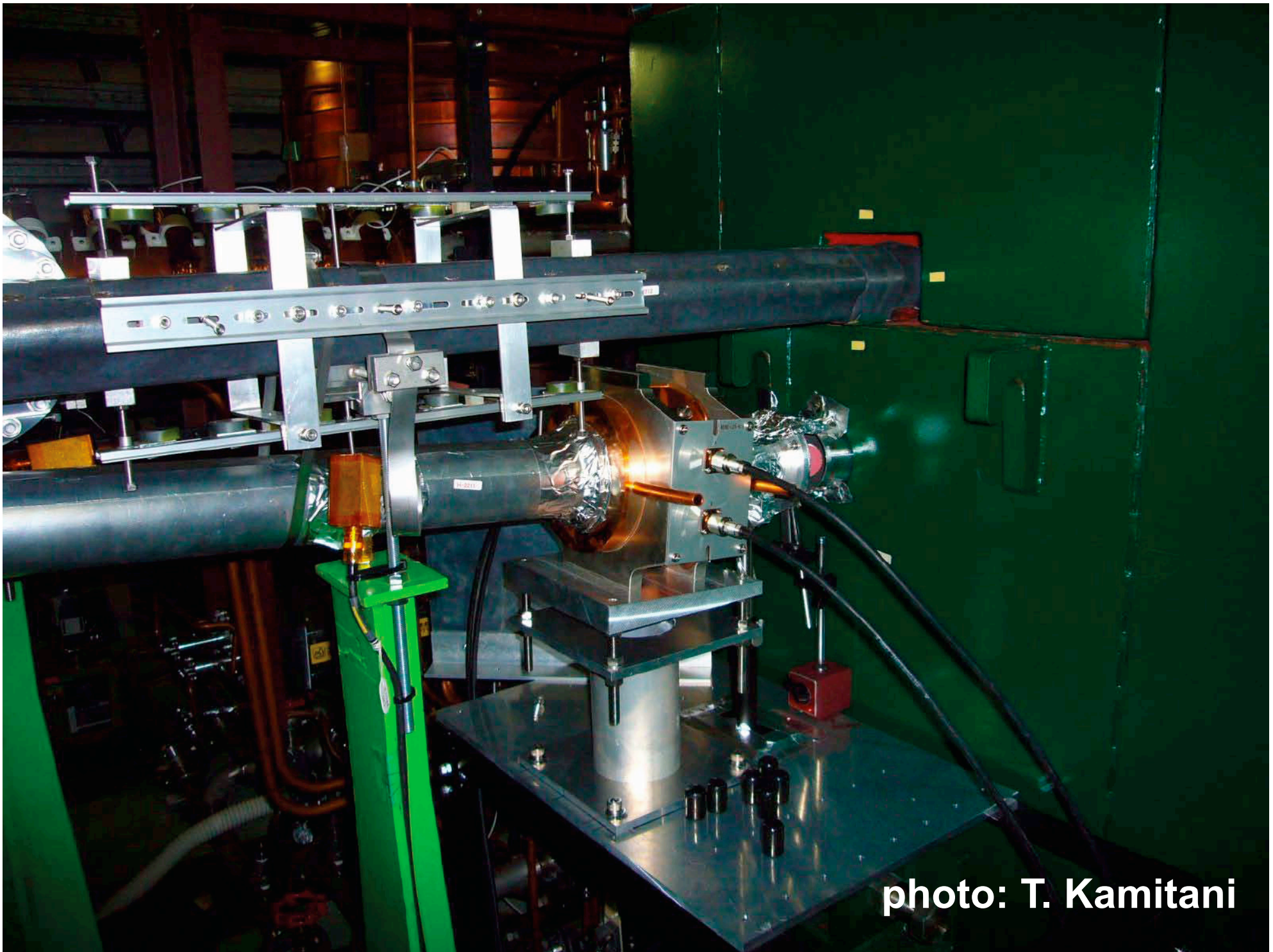


photo: T. Kamitani

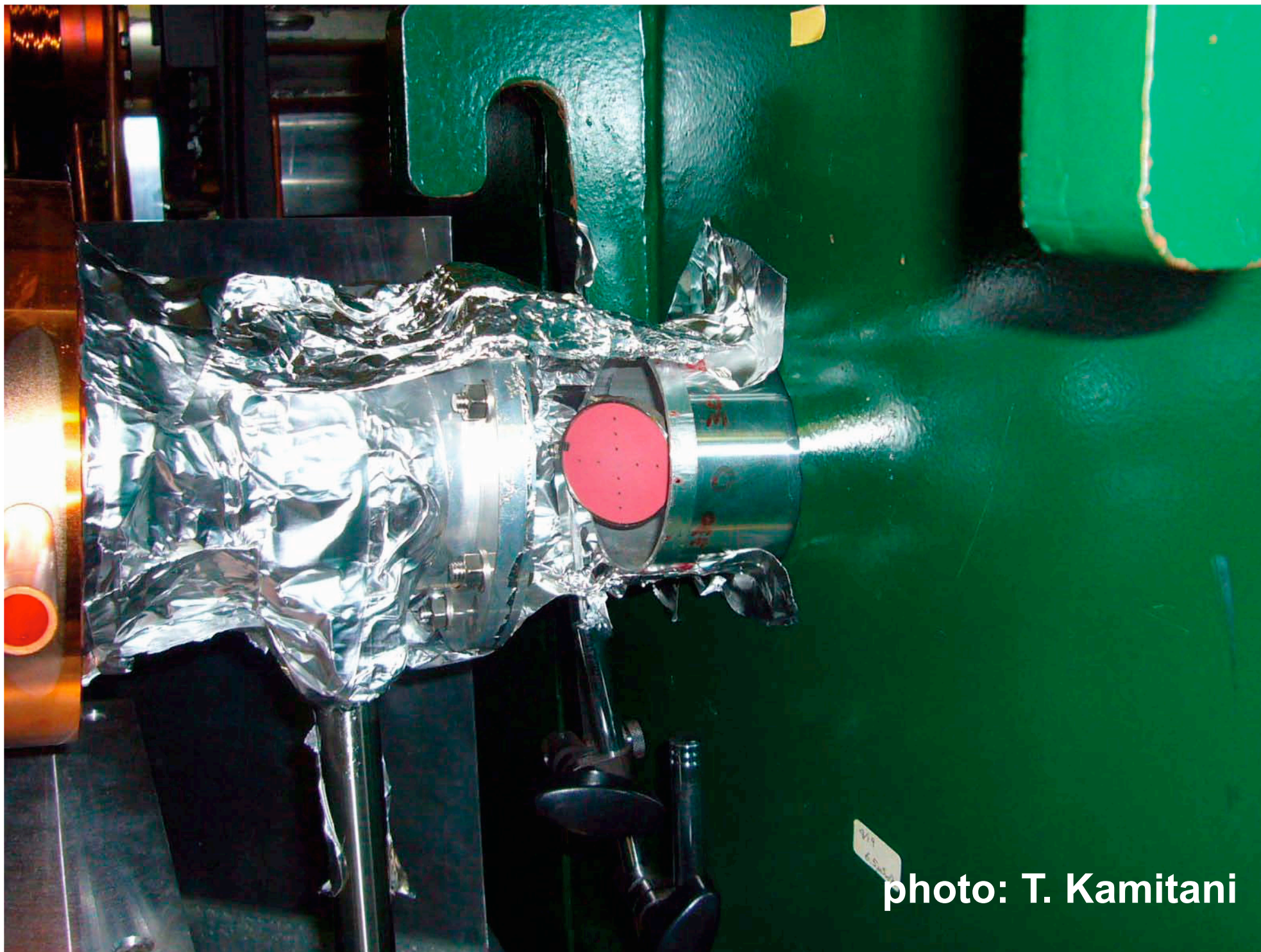


photo: T. Kamitani

# Sample and Holder

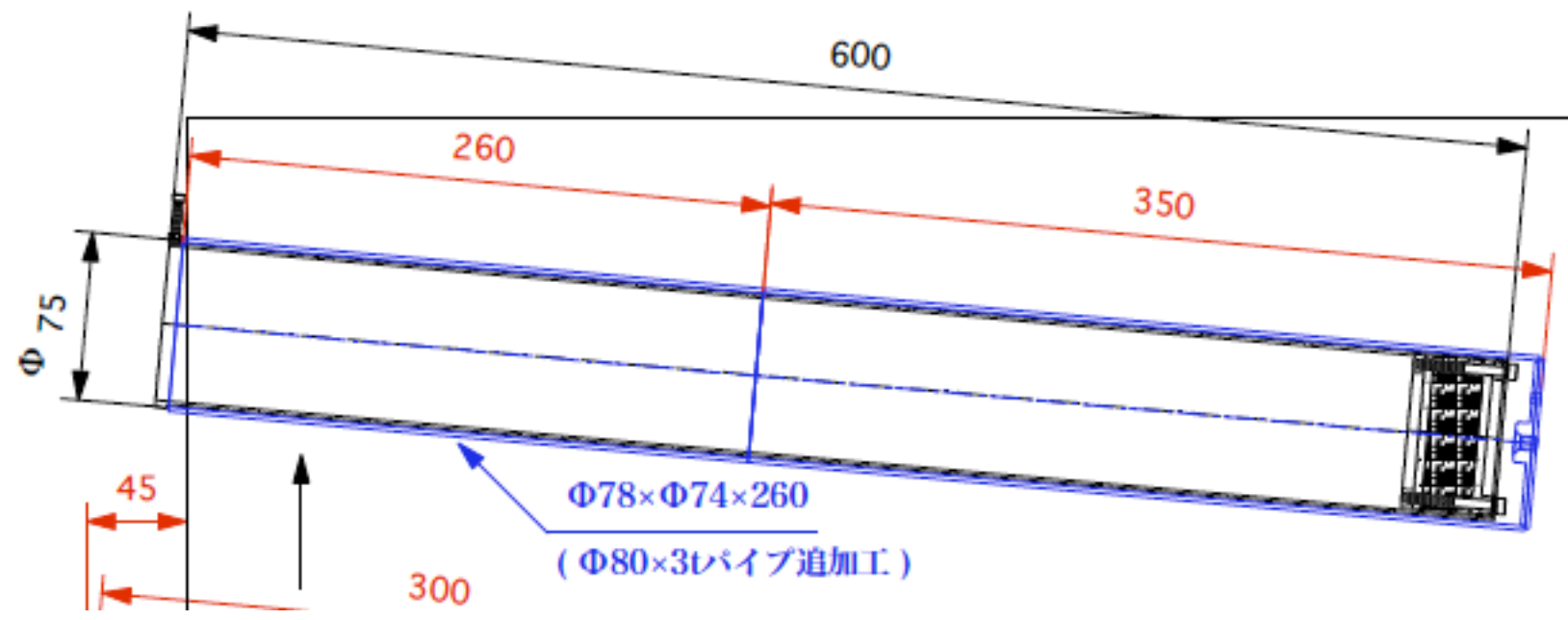
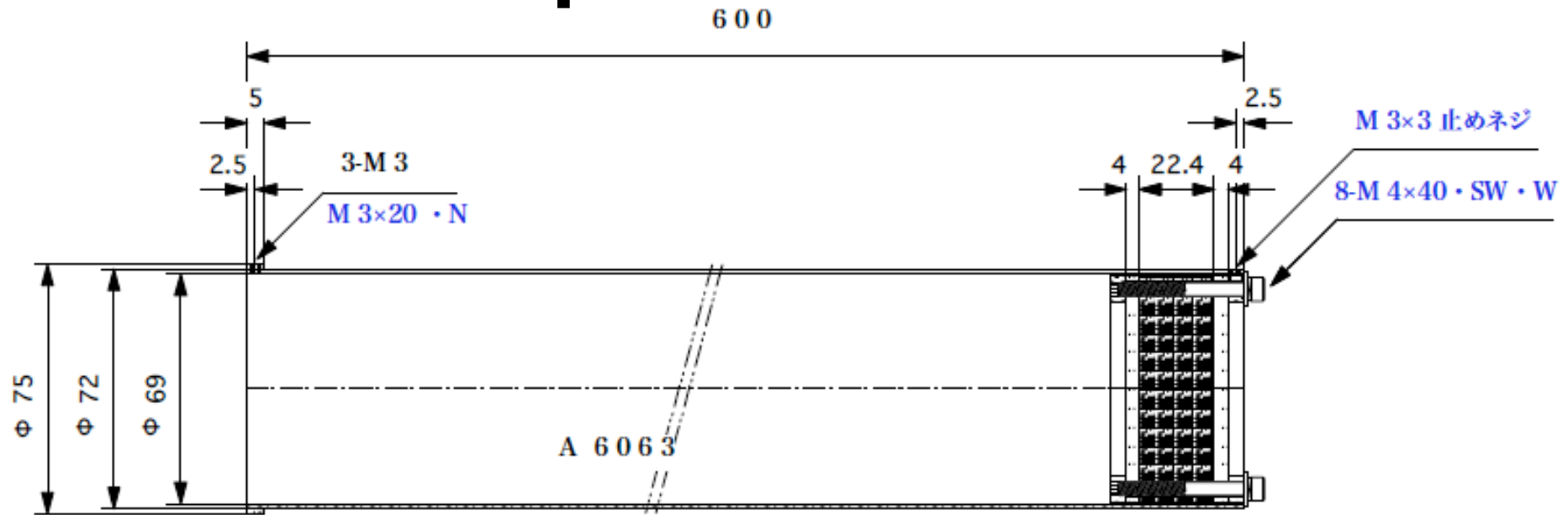




photo: M. Kuriki



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photo: T. Kamitani

# Characteristics of BN shapes

DENKA  
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• Typical value

			Mainly BN			BN-AlN		BN-Si <sub>3</sub> N <sub>4</sub>			BN-others	
Property	Unit	Grade Condition	HC	N-1	NB-1000	BA-3	BA-2000	SBN/70	SBN/50	SBN/30	UA-2	EBN
Maximum products size(outer size)			φ 300×220t	φ 320×220t Each part Max.40t	520×510×55t 500×470×100t 100t:Supply limit	φ 300×120t	410×400×40t	φ 280×180t	φ 270×180t	φ 270×180t	φ 160×200t	φ 280×180t
Density	g/cm <sup>3</sup>		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	<i>280</i>	<i>120</i>	<i>300</i>	<i>270</i>	<i>140</i>	55	160
Thermal conductivity	W/m·K	RT	36	63	60	<i>66</i>	<i>95</i>	44	47	33	8	55
Maximum operation temp.	°C	In atmosphere	950	950	950	950	950	950	950	950	<i>1,100</i>	950
	°C	In inert gas	1,800	<i>2,200</i>	<i>2,200</i>	1,950	1,950	<i>1,700</i>	<i>1,700</i>	<i>1,700</i>	<i>1,500</i>	2,000
	°C	In vacuum	1,600	<i>2,000</i>	<i>2,000</i>	1,800	1,800	<i>1,500</i>	<i>1,500</i>	<i>1,500</i>	<i>1,400</i>	1,700
CTE	×10 <sup>-6</sup> / °C	RT ~1,000°C	-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	×10 <sup>-3</sup>	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 <sup>15</sup>	10 <sup>15</sup>	10 <sup>15</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	<i>250 ~1,000 μΩcm</i>
Chemical structure	BN%		<i>97</i>	<i>&gt;99.5</i>	<i>&gt;99.5</i>	30	20	30	50	70	40	35
Other components			CaO·B <sub>2</sub> O <sub>3</sub>	-	-	AlN	AlN	Si <sub>3</sub> N <sub>4</sub>	Si <sub>3</sub> N <sub>4</sub>	Si <sub>3</sub> N <sub>4</sub>	Al <sub>2</sub> O <sub>3</sub> ·SiO <sub>2</sub>	TiB <sub>2</sub> ·AlN
Typical application	Insulator		○	○	○	○	○					
	Semiconductor equipment		○	○	○	○	○	○	○	○		
	Jig for molding glass		○	○	○	○	○	○	○	○		
	Nozzle and crucible			○	○	○						○
	Paving plate				○	○						
	Bearing and cogwheel					○			○	○		
	Boron source										○	
	Evaporator											

High purity

High purity and large size

Large size

# Sample 1 設置作業

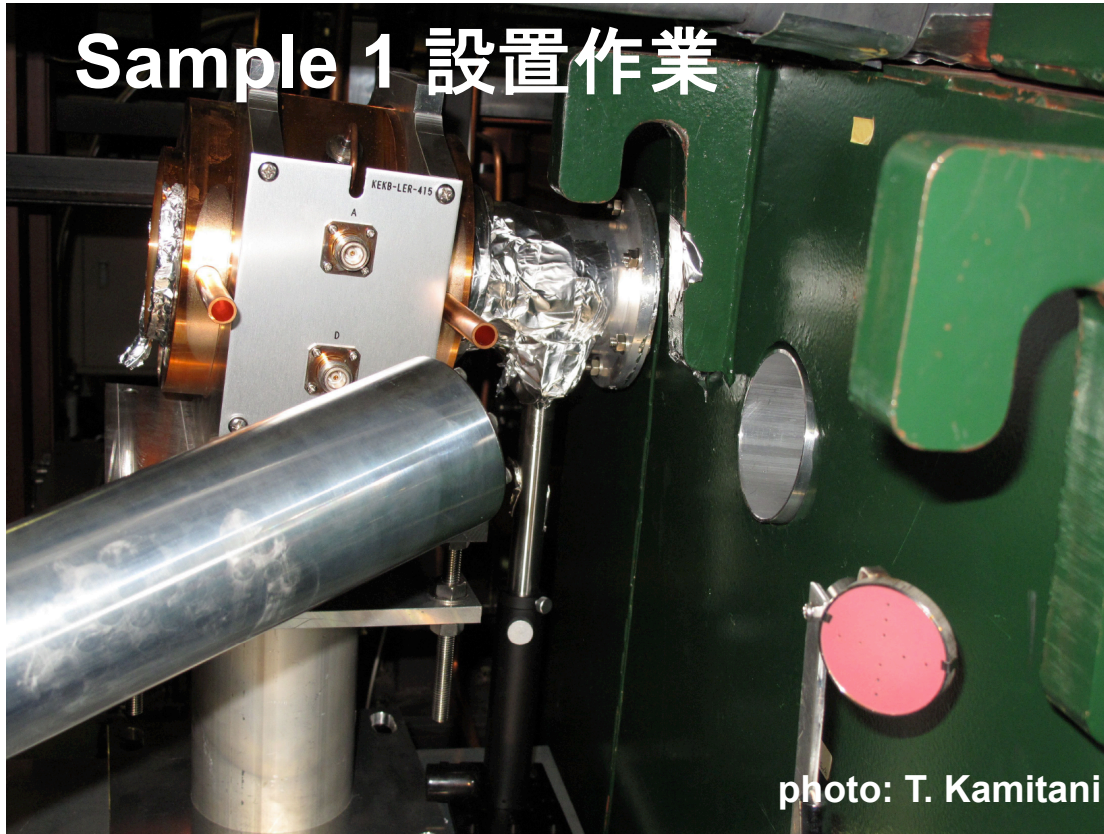


photo: T. Kamitani

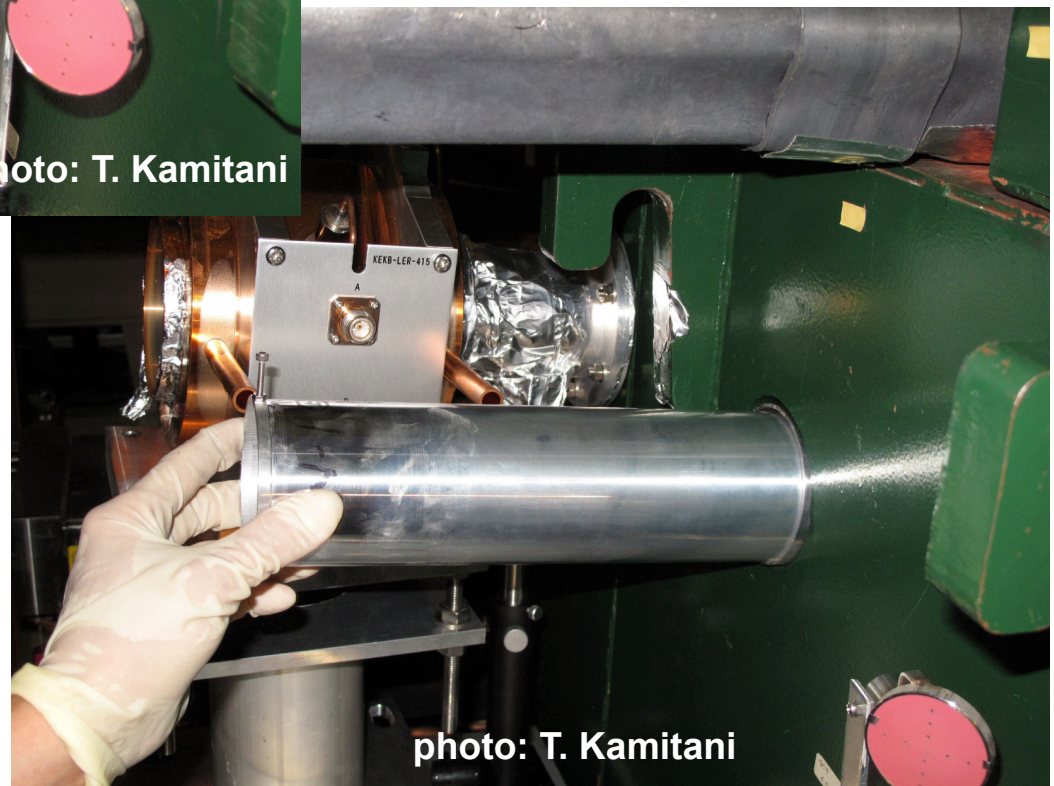
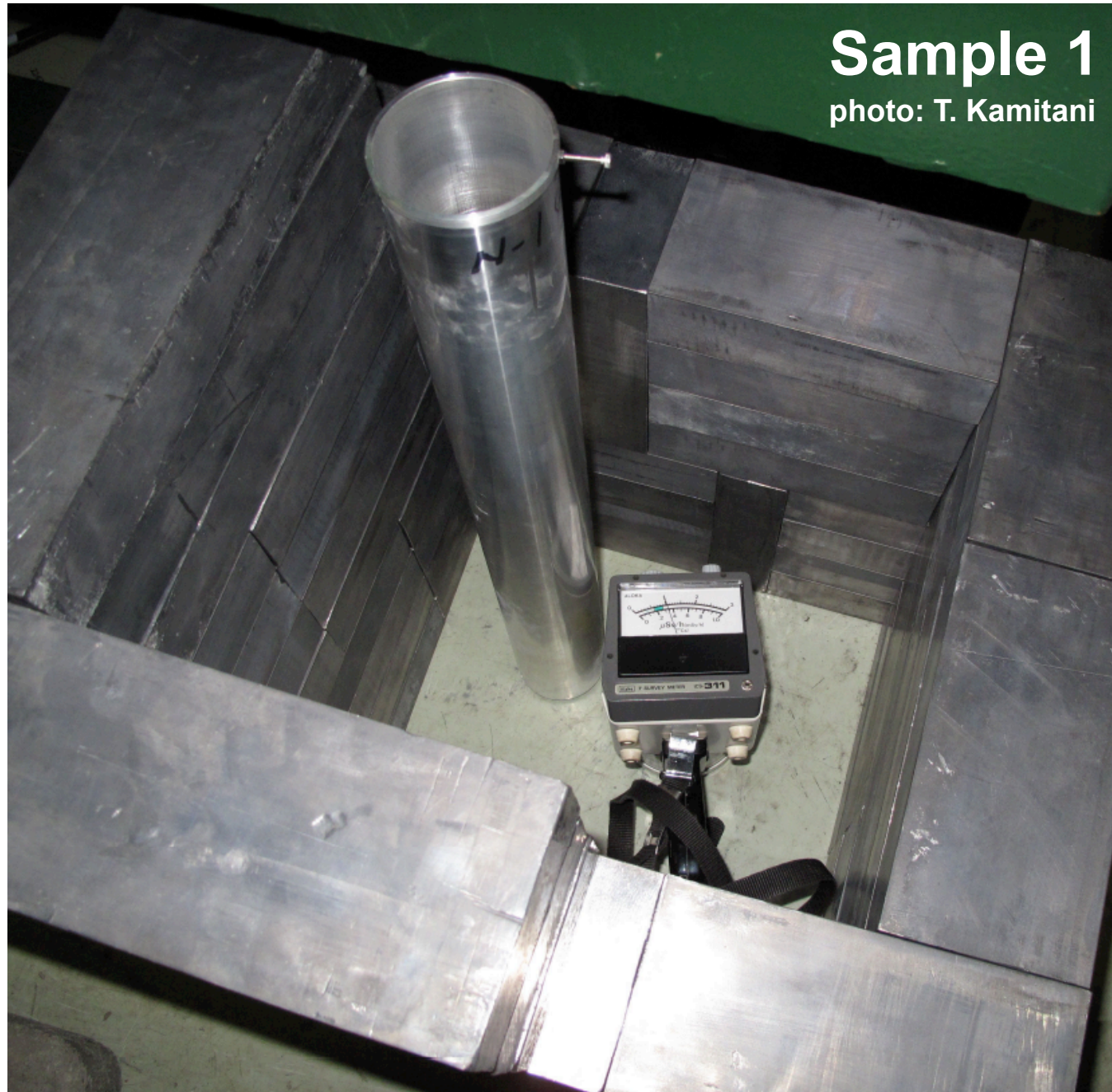


photo: T. Kamitani

# Sample 1

photo: T. Kamitani

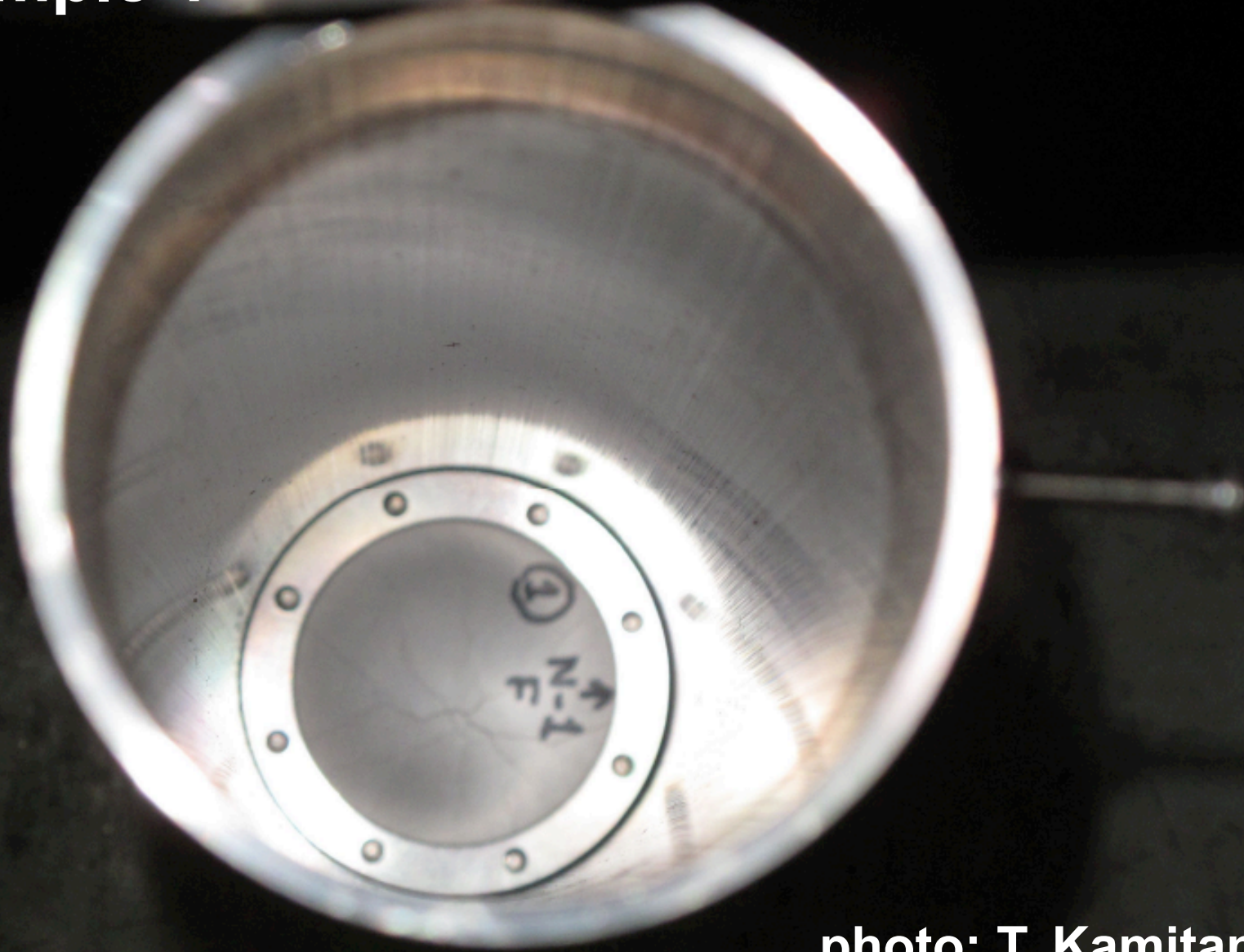


**Sample 2**



**photo: T. Kamitani**

**Sample 1**



**photo: T. Kamitani**

# Sample 1

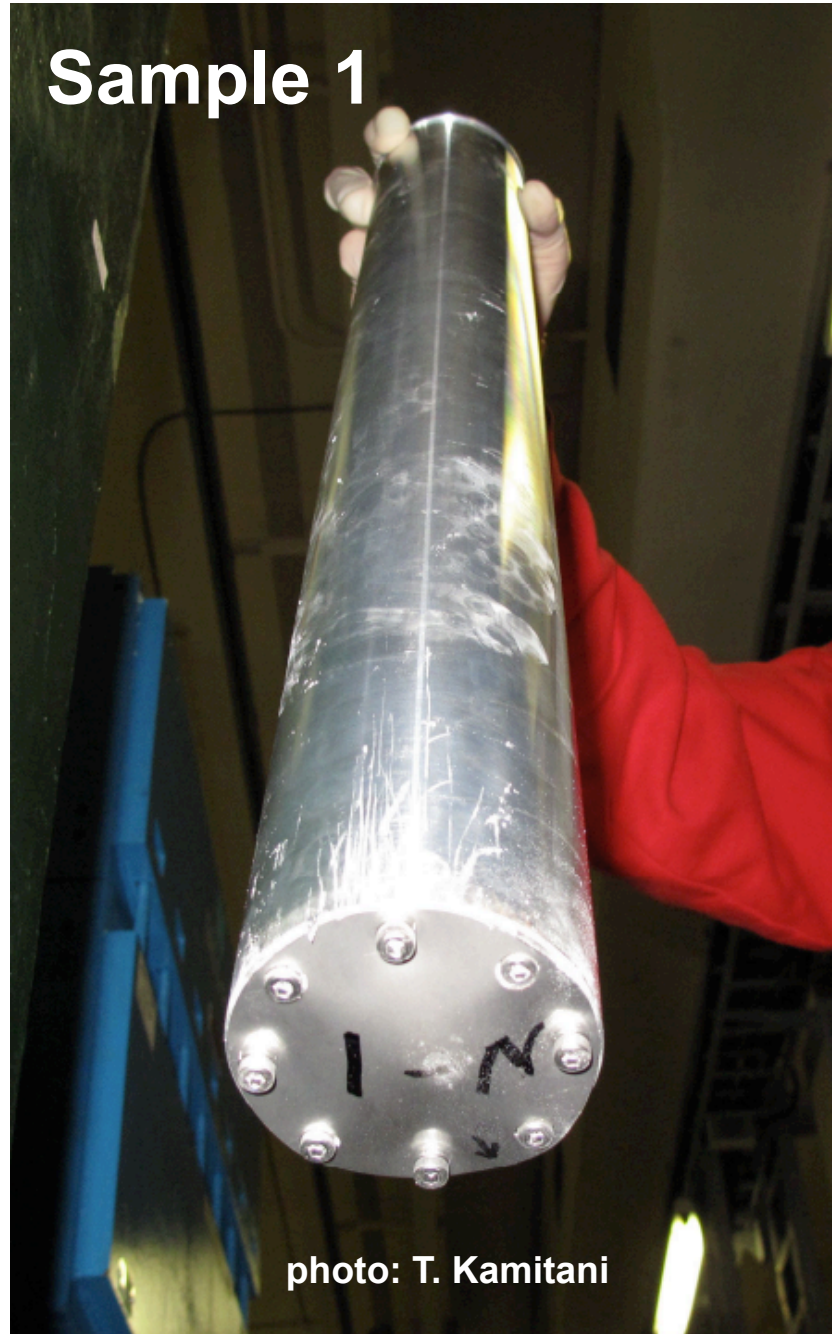
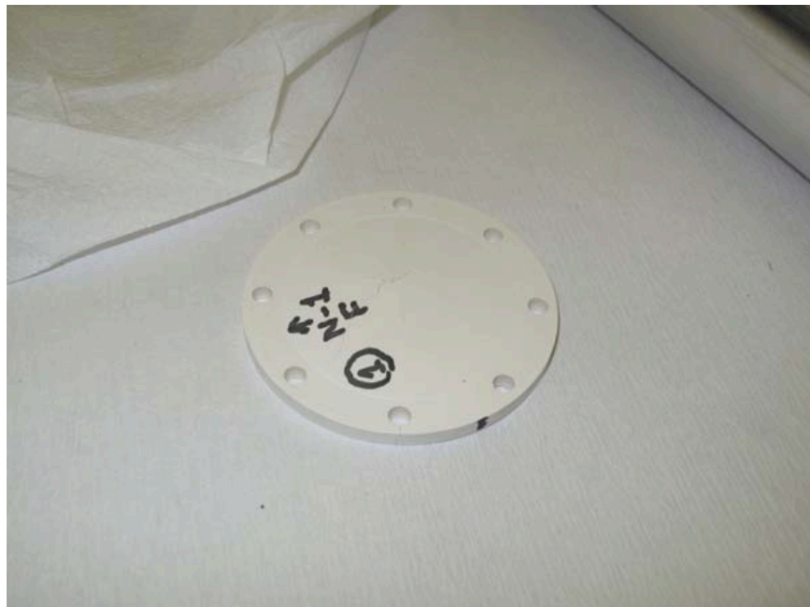
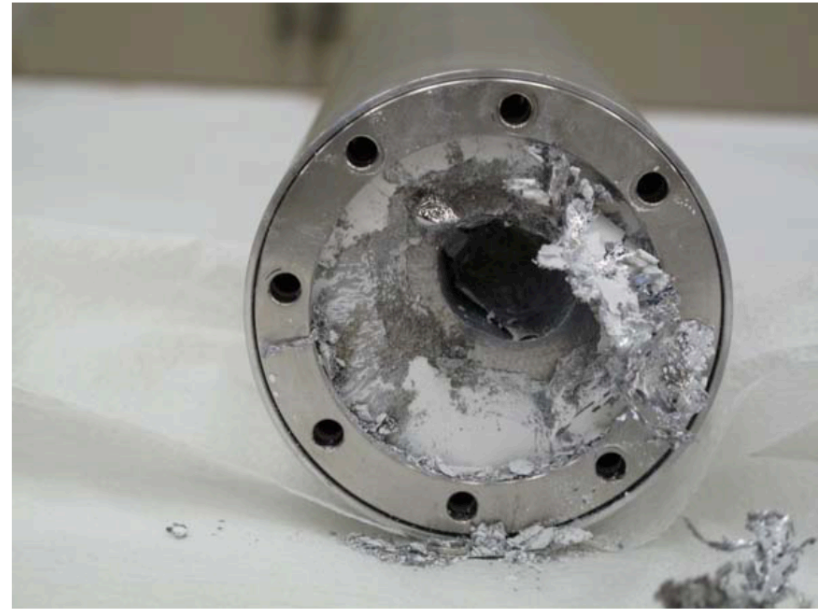
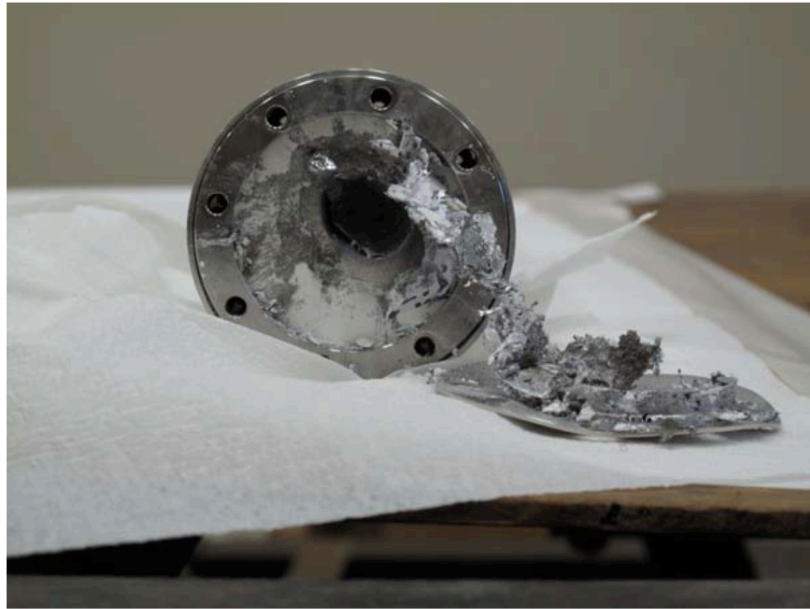
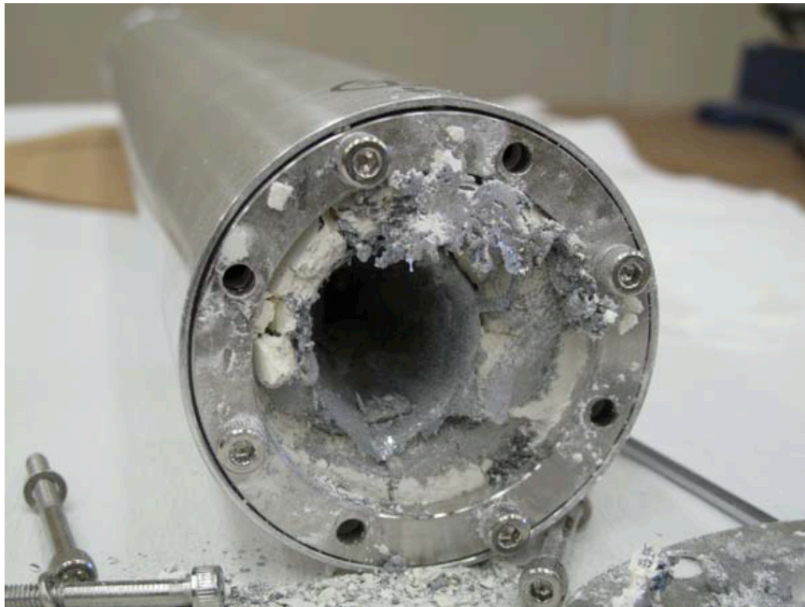


photo: T. Kamitani

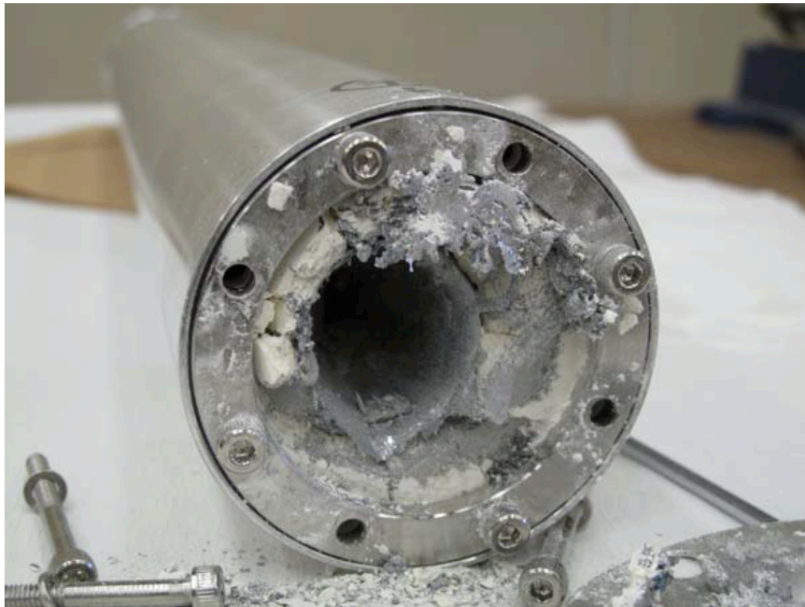
# Sample 1 (460mA + 800mA)



## Sample 2 (800mA)



## Sample 2 (800mA)

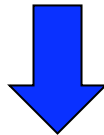


## **Total Energy of the Beam**

**8 GeV, 5 nC/bunch (= 800 mA), 1600 bunches --> 64 kJ**

**Energy deposit of the target (~12 % of Energy of the beam)**

**~ 7.7 kJ**



## **Target Destruction**

**In the experiment on Oct/22<sup>nd</sup>, we did not test the BN strength against shock wave.**

**We are considering the next step.**