

TTCmeeting at KEK ; December 2-5, 2014  
WG-4 : Cavity Fabrication and Preparation

# **R&D of advanced production methods for HOM coupler of SRF 9-cell cavity**

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# 【 GOAL 】

R&D and cost-effective mass-production of **HOM coupler** (**HOM cup** and **HOM antenna**) by advanced whole press forming of pure Nb showing hard workability with anisotropy.

## # Current methods applied so far :

**Full machining**

**Backward-extrusion  
+ machining ( + annealing )**

**Multi-processes of press forming  
+ intermediate annealing**

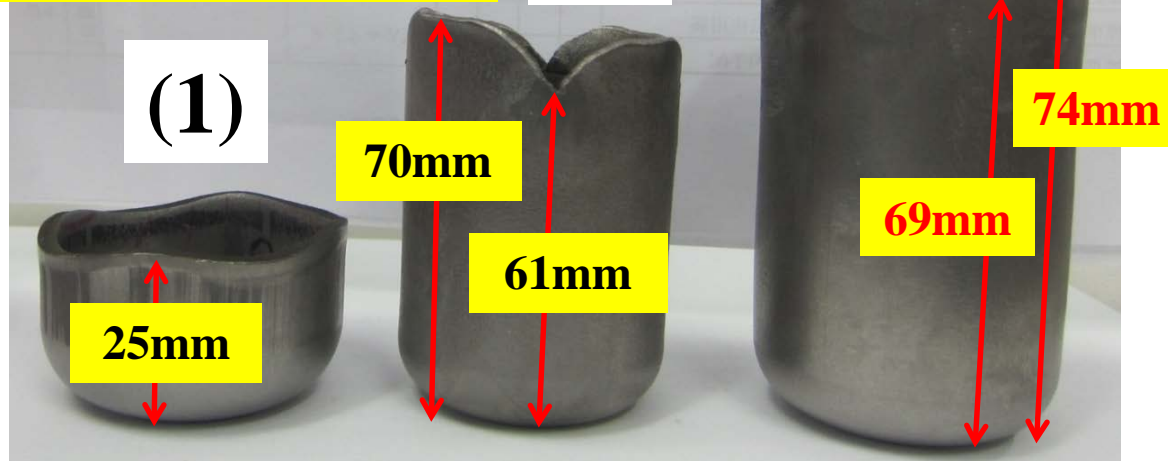
**Others**



**HOM coupler**

# 【 HOM cup 】

Blank thickness : 2.8 mm  
Punch diameter : 40 mm



Blank diameter		
75mm	110mm	120mm (45° from RD)
Thickness after drawing		
2.7mm	2.3mm	2.4mm

(1) : Conventional at RT

(2) : Advanced method  
( circular blank )

(3) : **Advanced method**  
( **non-circular blank** )



Delayed fracture



# 【 HOM cup 】

## Advanced method

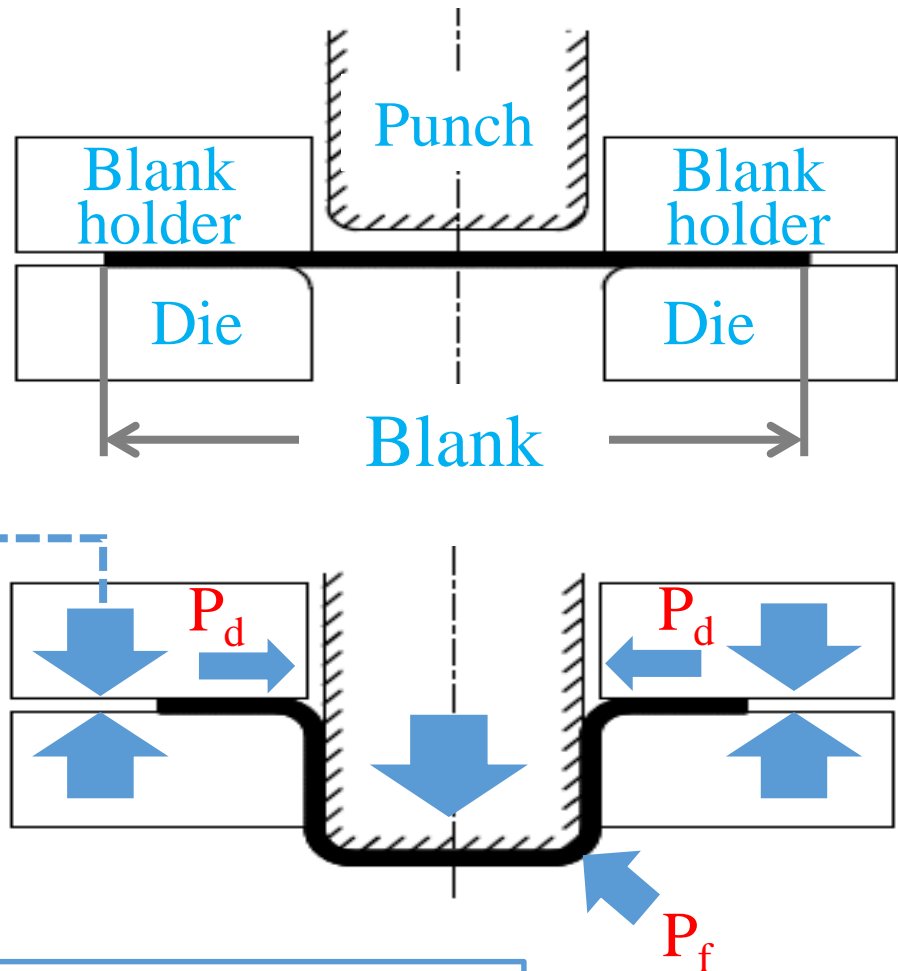
Temp. Control

Velocity Control

Blank

(Circular  $\Rightarrow$   
Non-circular)

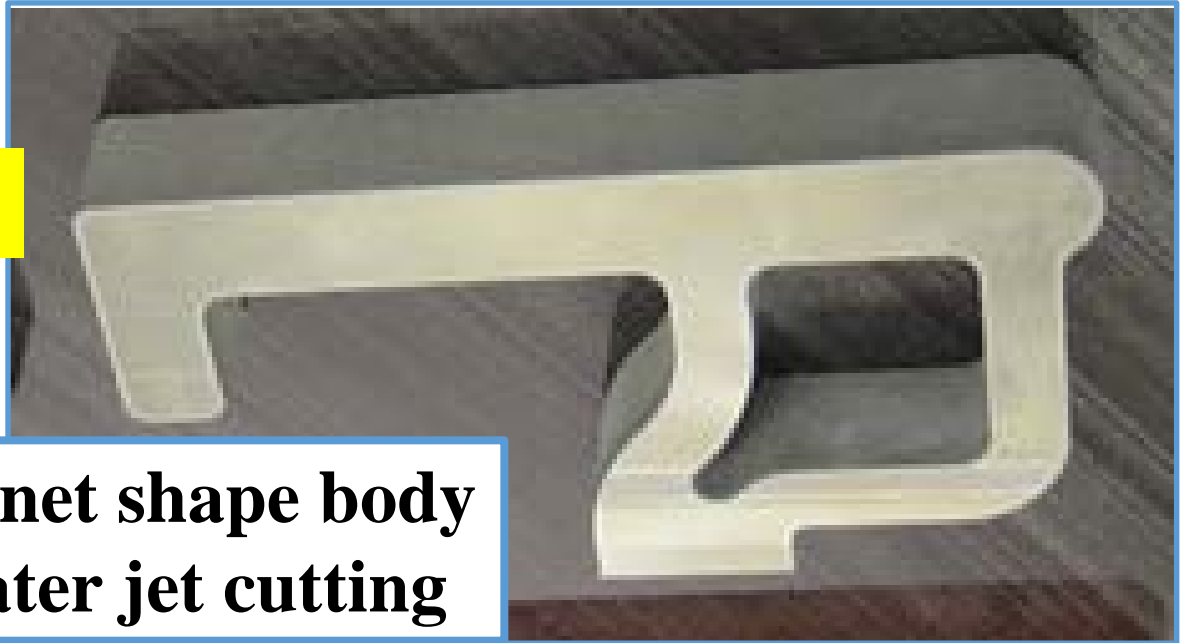
Blank Holding Force



$$\text{Balance : } P_f = P_d \text{ ( LDR )}$$
$$(<)$$

**【 HOM antenna 】**

**Thickness : 9.5 mm**



**Near net shape body  
by water jet cutting**

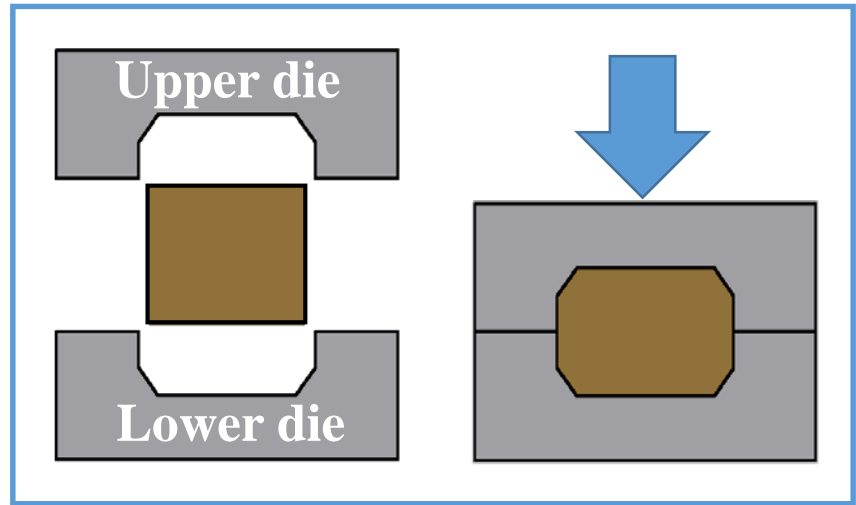


**Thickness : 9.0 mm**



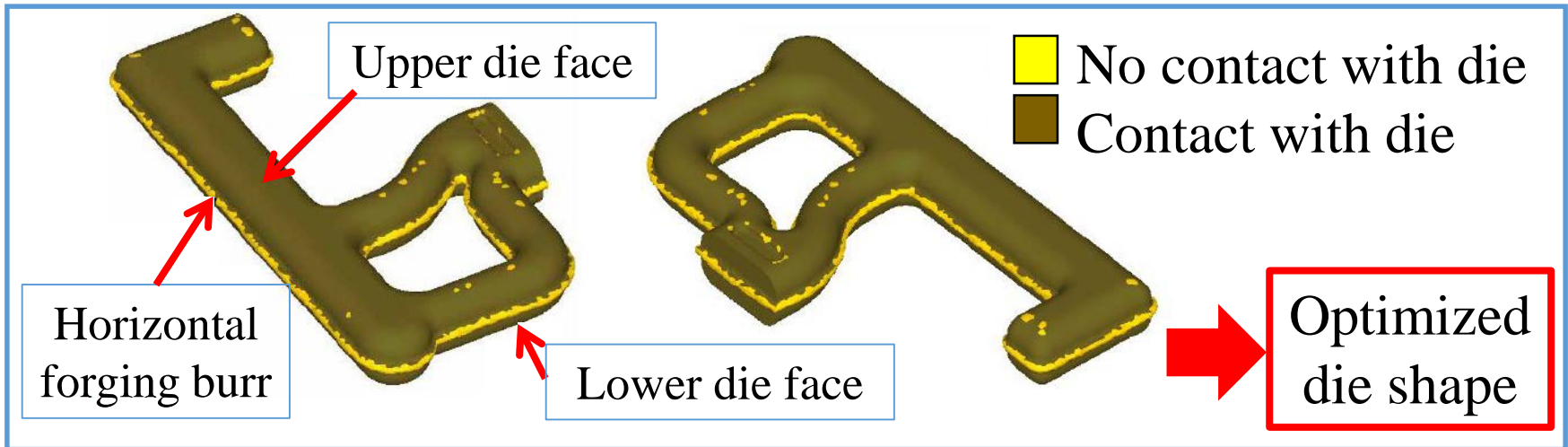
**Cold forged product**

# 【HOM antenna】



Water-jet cutting machine for R&D

Cold forging



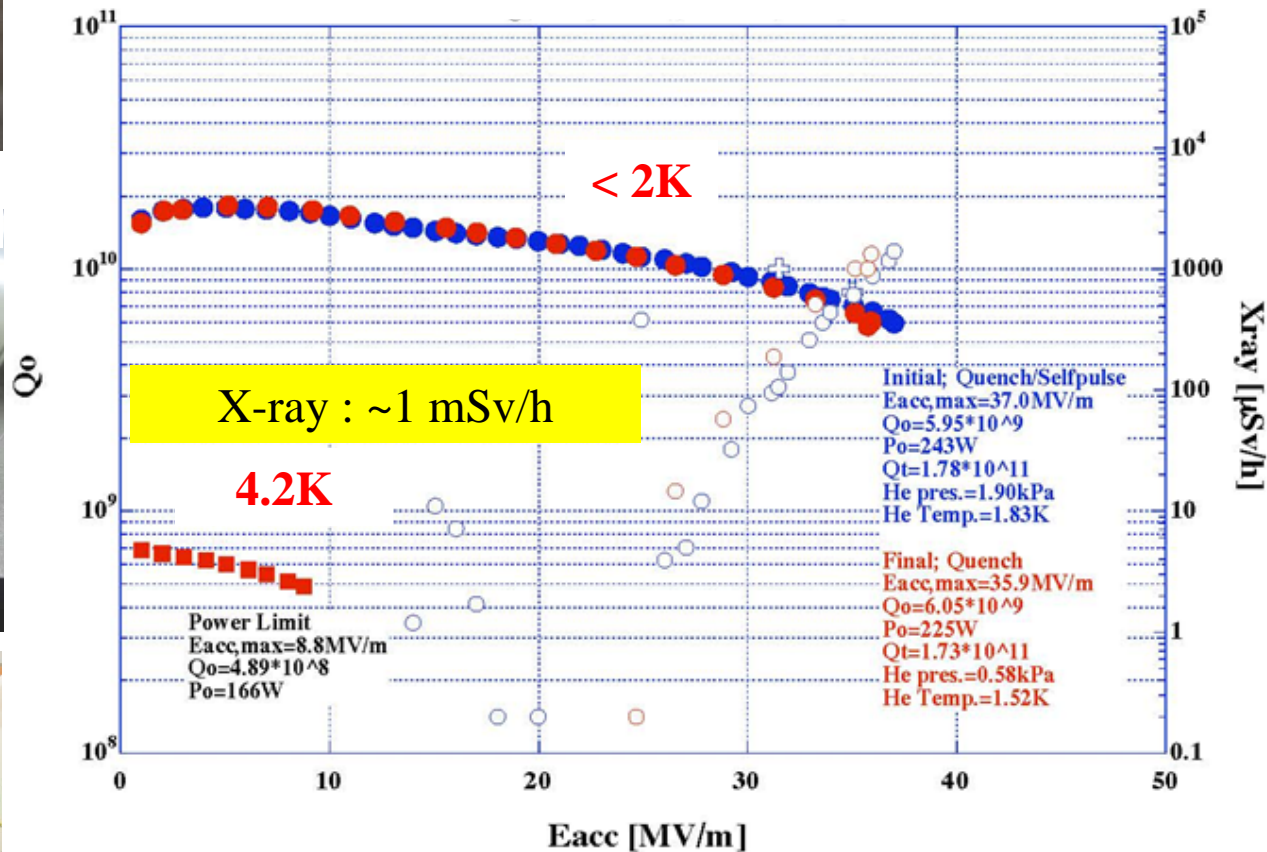
Cold forging simulation analysis

# 【 Assemble and vertical test 】

Initial rise: 37.0 MV/m,  $Q_0 = 6.0 \times 10^9$   
 Final rise: 35.9 MV/m,  $Q_0 = 6.1 \times 10^9$



Assembled by EBW



( Referred from Dr. Saeki, KEK, et al. :  
 IPAC 2014, Dresden, Germany )