

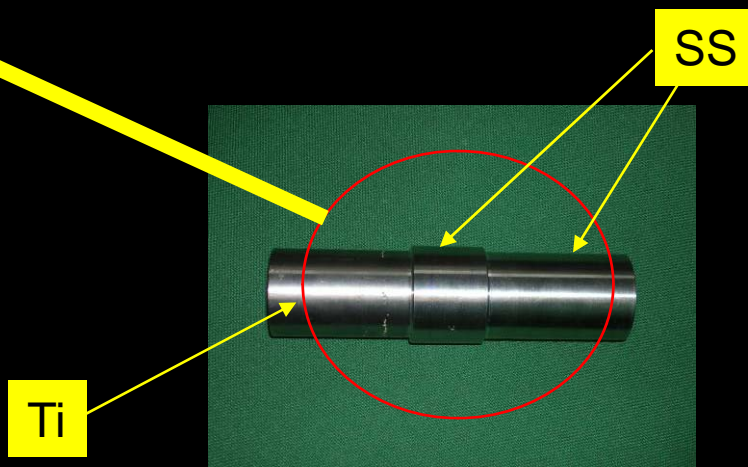
# Results on Ti/SS transitions

- ❖ **Only technologies which apply directly to tubes**
  - Results on small tubes (1 – 2”) - small savings
  - Plans on larger tubes (240 mm) - large savings

## He vessel to 2-phase line



- ❖ Allows making 2-phase line totally SS including all bellows

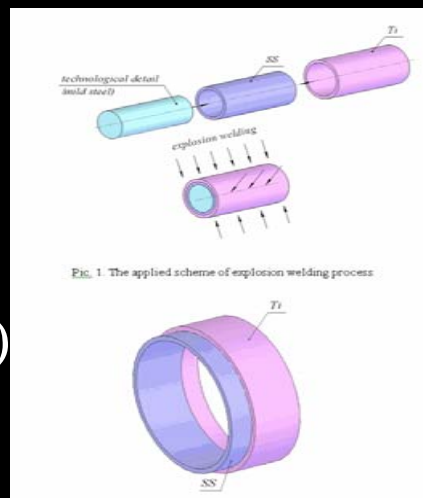


## Technologies explored

- ❖ **Silver loaded brazing in Argon**
  - DG Technology (Italy)
  - 2 samples made
    - Conflicting results being understood



- ❖ **Explosion bonding of tubes**
  - Sarov, Russia (through JINR)
  - Excellent results (see next slides)



## Explosion bonding (1)

### ❖ Leak check results:

- 10 x 1.5" tubes tested
- Temperature cycles:
  - 5 cycles dipping in LN<sub>2</sub> followed by fast heating with heat gun



## Explosion bonding (2)

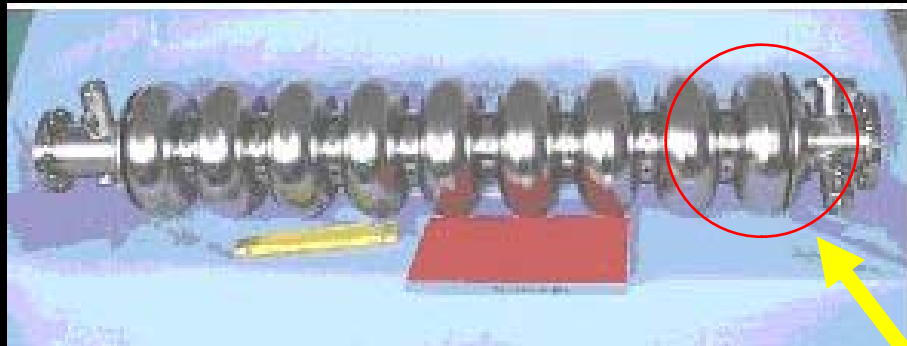
### ❖ Summary table He leak test performance

Sample number	Vacuum level [mbar]	Leak rate background [atm-cc/sec]	He-leak rate after thermal cycles [atm-cc/sec]
1	$< 5 \times 10^{-4}$	$0.4 \times 10^{-10}$	$0.9 \times 10^{-10}$
3	$< 5 \times 10^{-4}$	$0.8-0.9 \times 10^{-10}$	No variation
4	$< 5 \times 10^{-4}$	$2.4-2.5 \times 10^{-10}$	No variation
5	$< 5 \times 10^{-4}$	$3.7 \times 10^{-10}$	No variation
6	$< 5 \times 10^{-4}$	$0.1 \times 10^{-10}$	No variation
7	$< 5 \times 10^{-4}$	$0.1-0.2 \times 10^{-10}$	No variation
8	$< 5 \times 10^{-4}$	$0.8-1.0 \times 10^{-10}$	No variation
9	$< 5 \times 10^{-4}$	$0.3-0.5 \times 10^{-10}$	No variation
10	$< 5 \times 10^{-4}$	$3.1 \times 10^{-10}$	$2.1 \times 10^{-8}$

## Explosion bonding (3)

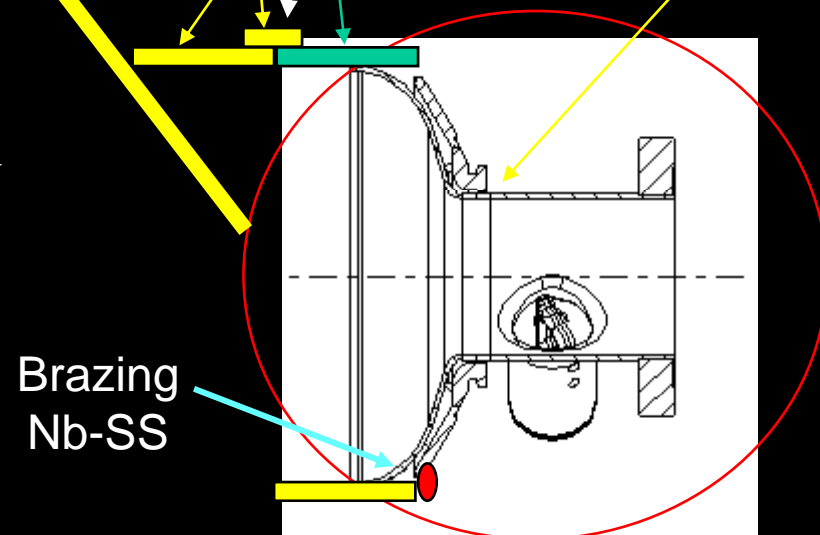
- ❖ Some of these 1.5” samples will be sent to Fermilab this month for testing at 2 K with 3<sup>rd</sup> harmonic cryostat
- ❖ Russian are making ~ 20 x 2” samples to be used in Type 4 ILC cryomodules. Expect first samples soon.

## Larger Ti-SS transitions (1)



Brazing or explosion bonding

SS Ti Nb/Ti



Brazing  
Nb-SS

### ❖ Explore possibility of SS He-vessel

- Made parts for test using both explosion bonding and brazing technologies
- Nb-SS brazing may be another possibility

## Larger SS-TI transitions (2)

### ❖ Study bonding induced magnetization levels

- Hope for KEK design inner magnetic shield
- Measured 1.5” tubes
  - Results still “raw” due to poor setup
  - Indication is that fields  $< 5 \mu\text{T}$  are typical, but observe large variations
    - Improvements possible with different shock absorber materials

