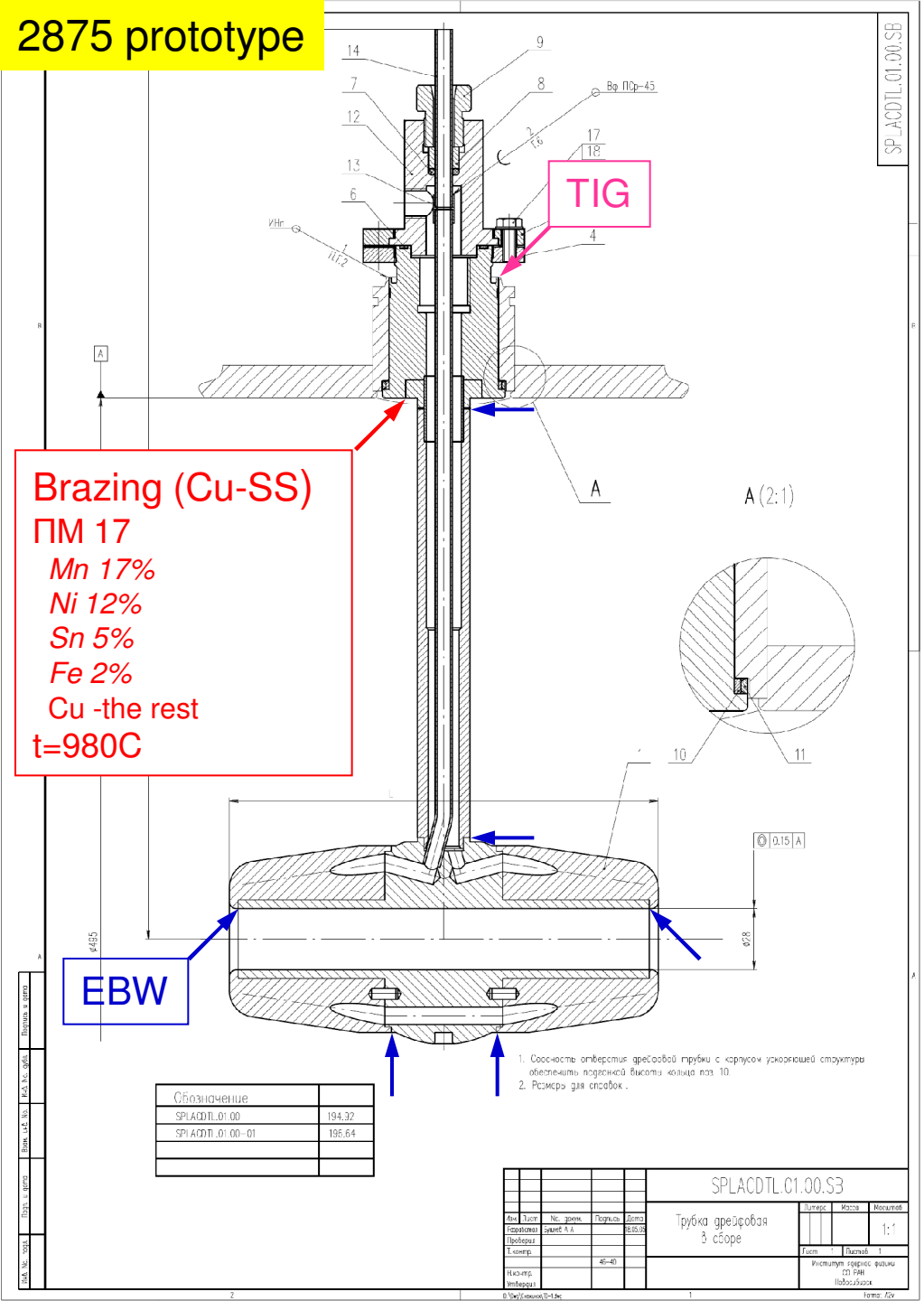
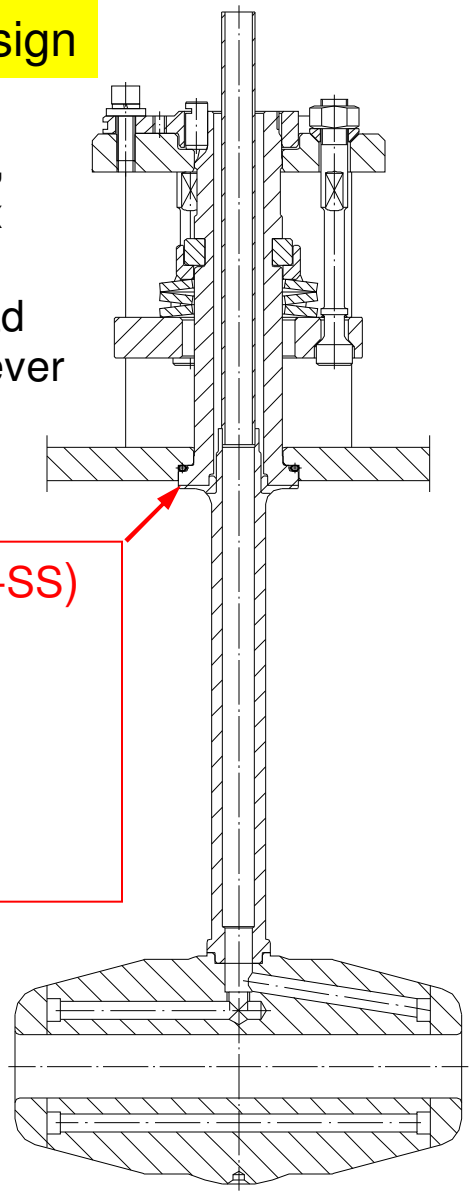
Drift tube mock-ups production

2875 prototype



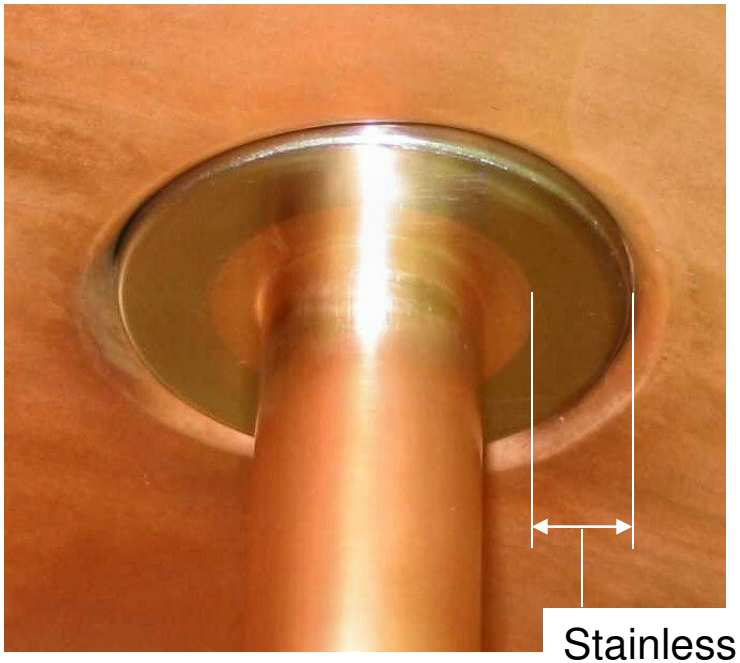
3888/89 DT design

1. Dismountable, with Helicoflex joint
2. Brazing instead of EBW wherever possible

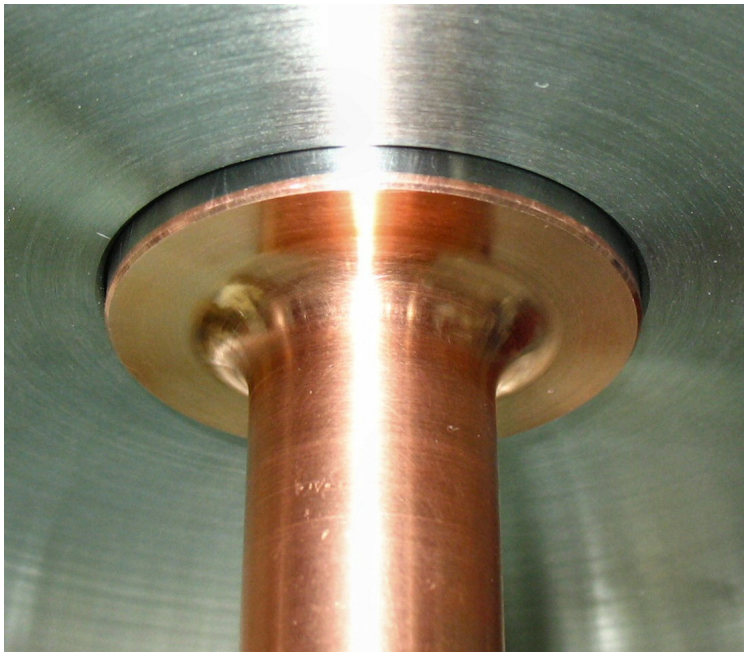


More on the next slide …

2875 prototype



3888/89 DT design

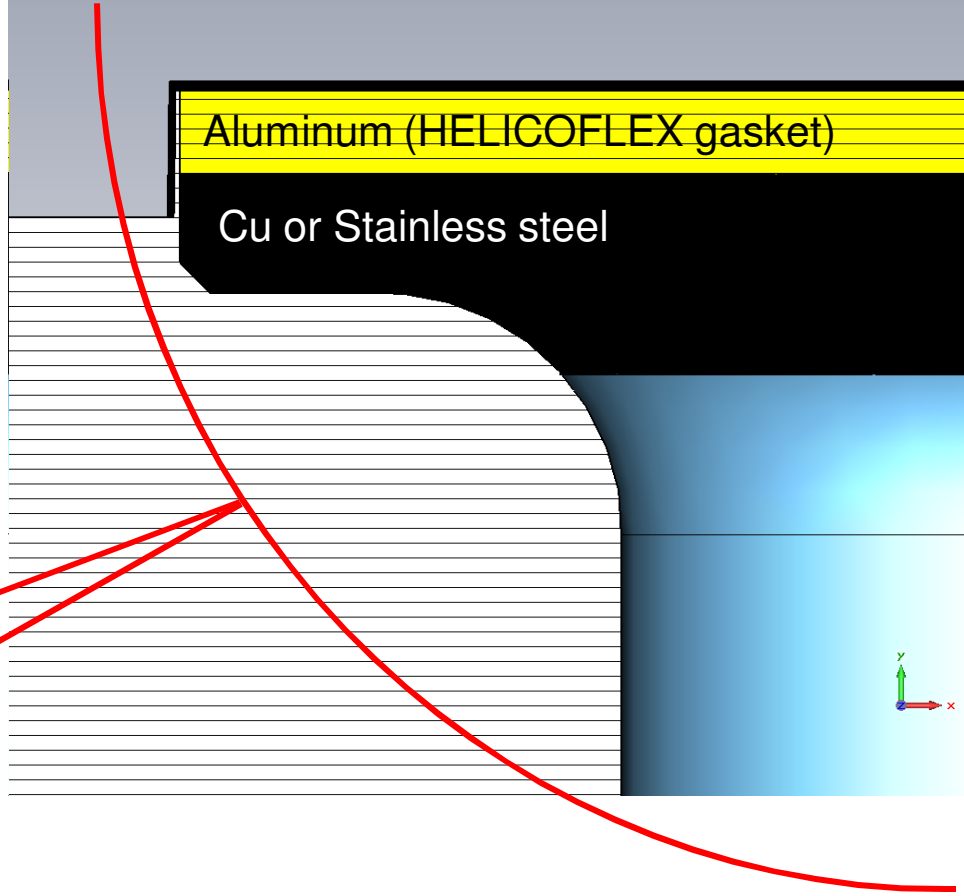


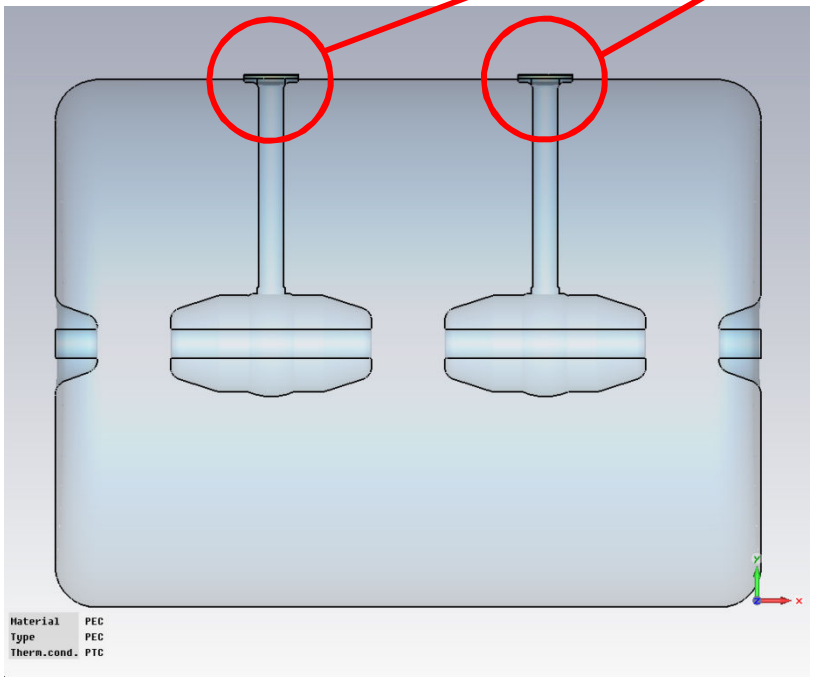
- Thicker stainless steel collar
- Less stainless steel exposed to rf fields

More on the next slide …

Power loss estimation for the Helicoflex connection of stem and tank, where the joint sits on non–copper plated steel surfaces

ER, 10.08.2009





Losses over the region of interest
(% of total losses in the tank)

	Cu	Stainless steel
Tank 1	0.317%	2.03%
Tank 21	0.195%	1.26%

More on the next slide …

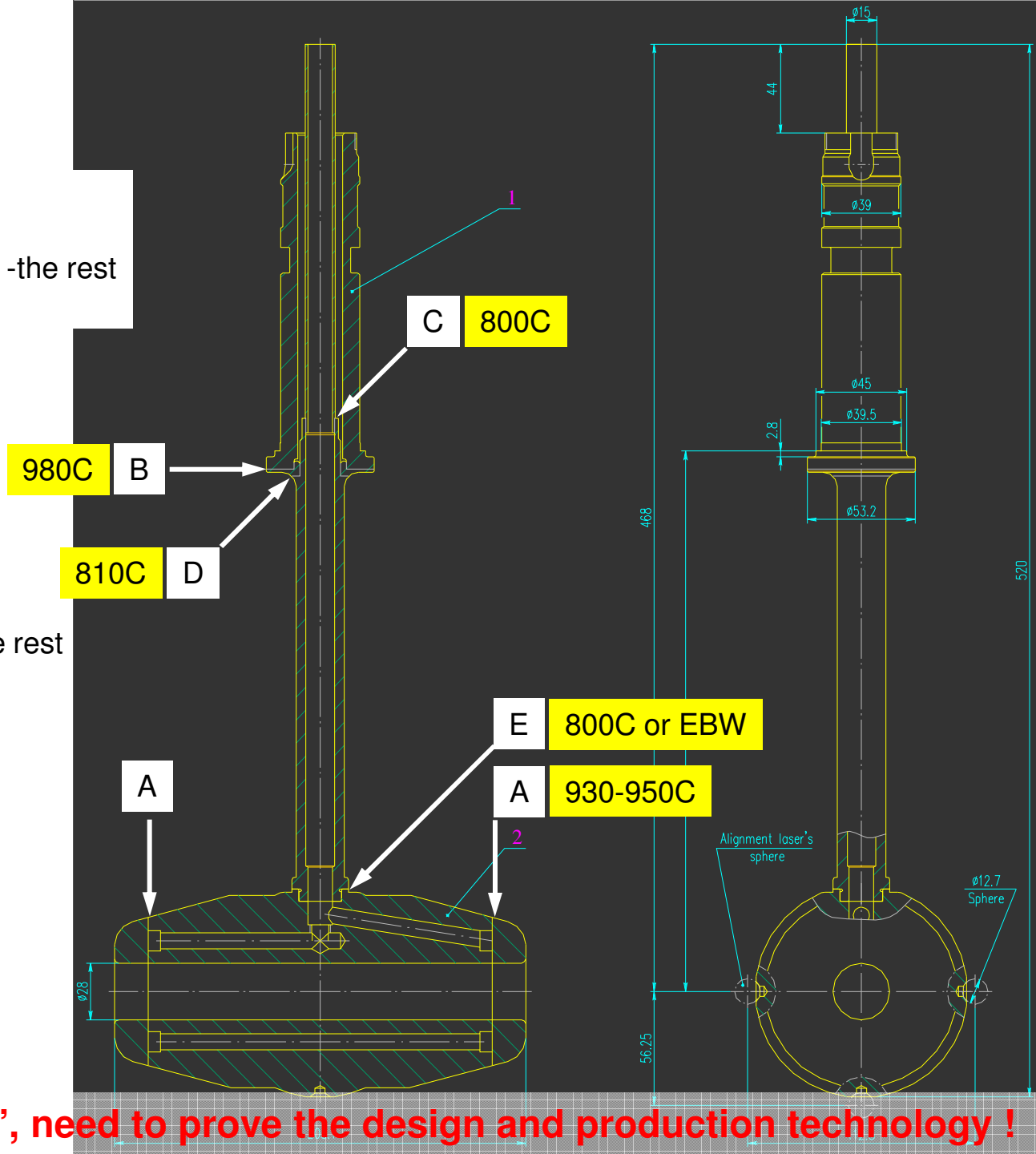
Joint A – Brazing (Cu-Cu)
ПЗлМ 50В
Au 49.6-50.4%, Cu -the rest
t=930-950C

Joint B – Brazing (Cu-SS)
ПМ 17
Mn 17%, Ni 12%, Sn 5%, Fe 2%, Cu -the rest
t=980C

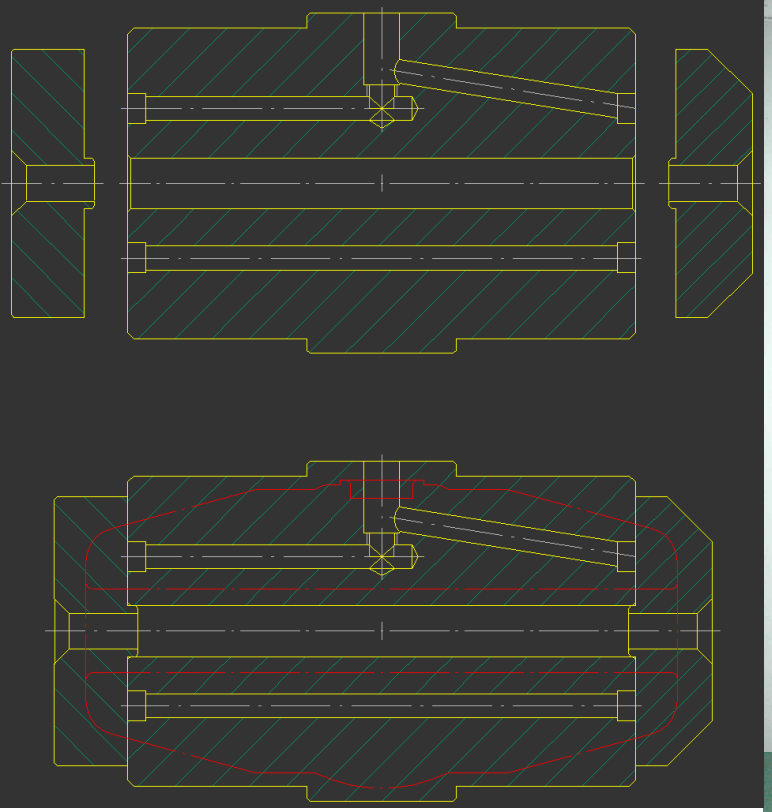
Joint C – Brazing (Cu-Cu)
ПСр 72
Ag 71.2-72.5%, Cu -the rest
t=800C

Joint D – Brazing (Cu-Cu)
ПСрМПд 68-27-5В
Ag 67.5-68.5%, Pd 4.5-5.5%, Cu -the rest
t=810C

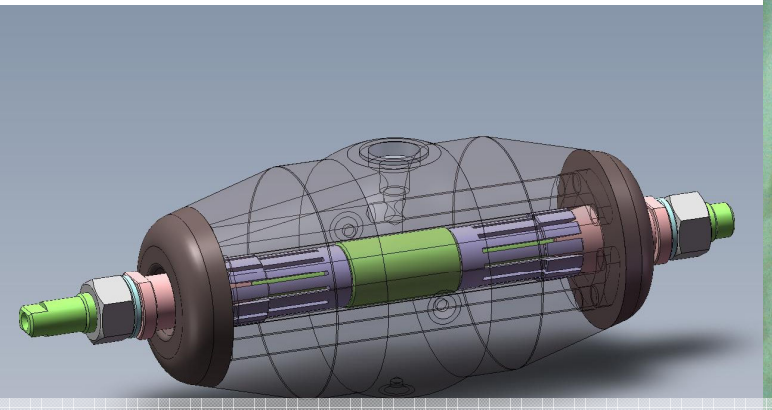
Joint E (the final joint)
– Brazing (Cu-Cu) or EBW
ПСр 72
Ag 71.2-72.5%, Cu -the rest
t=800C

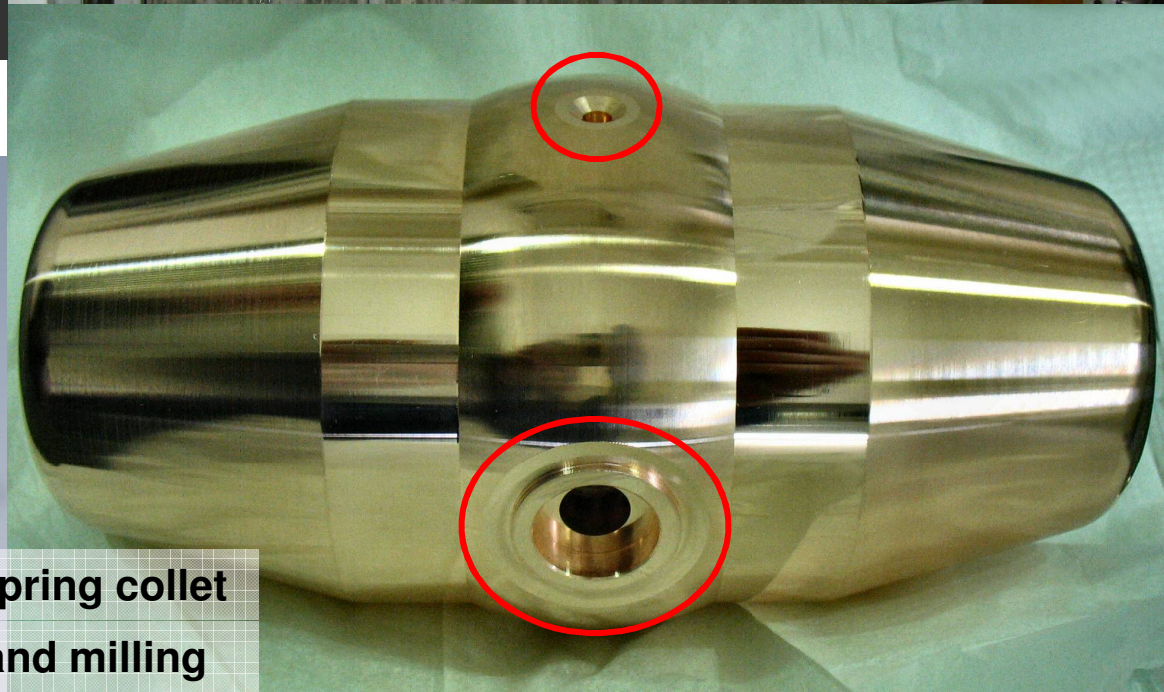


Too many “improvements”, need to prove the design and production technology !



Machining drift tube body





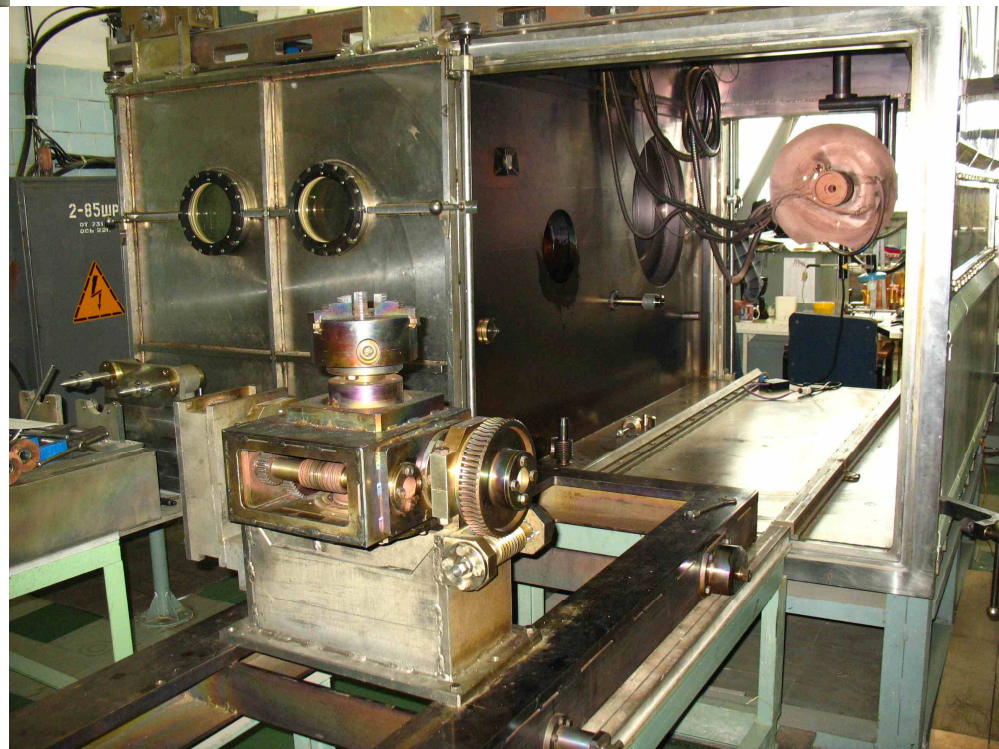
DT is fixed on the shaft with finger spring collet

Same assembly is used for turning and milling

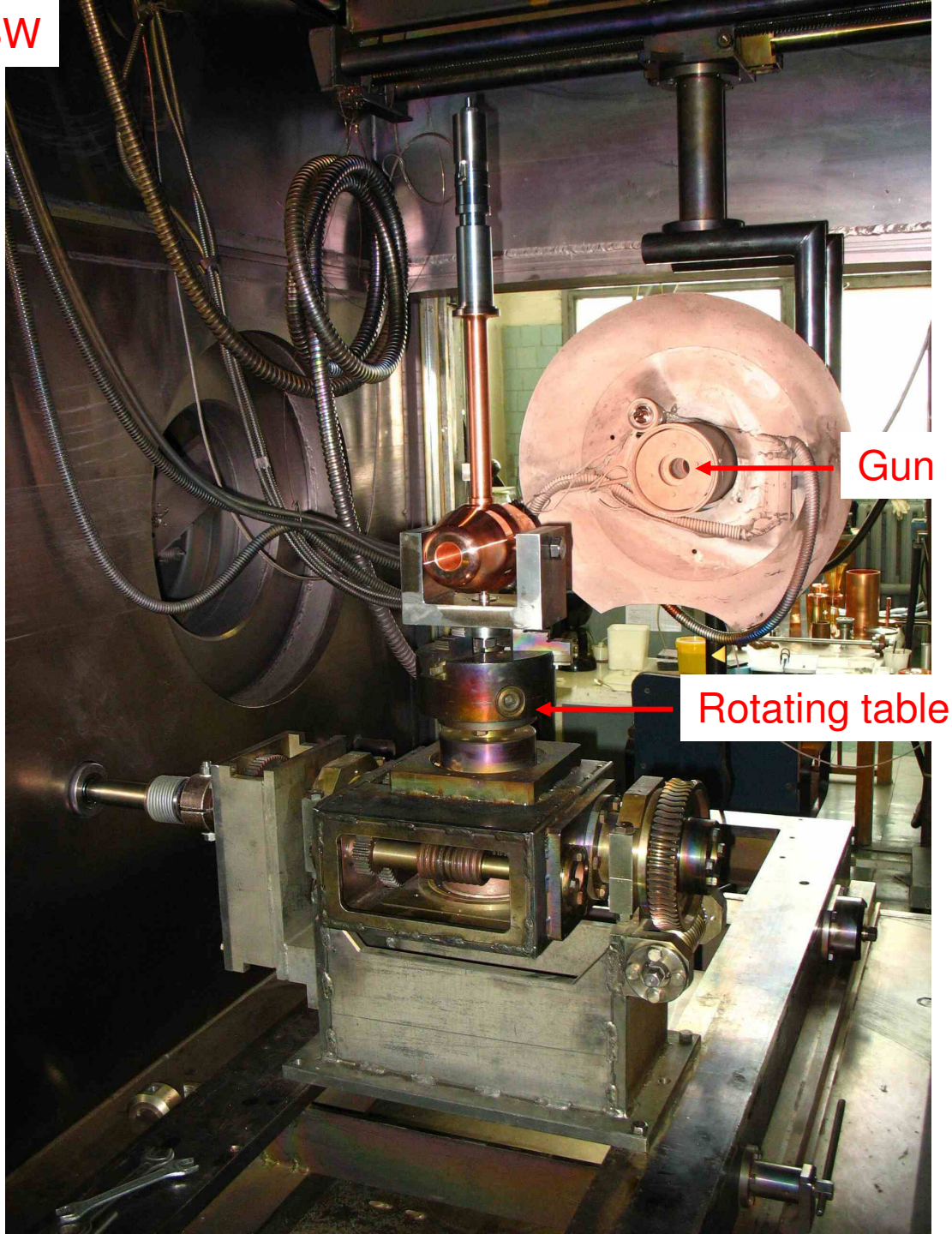
Stem and drift tube body connection
Option 1 - EBW

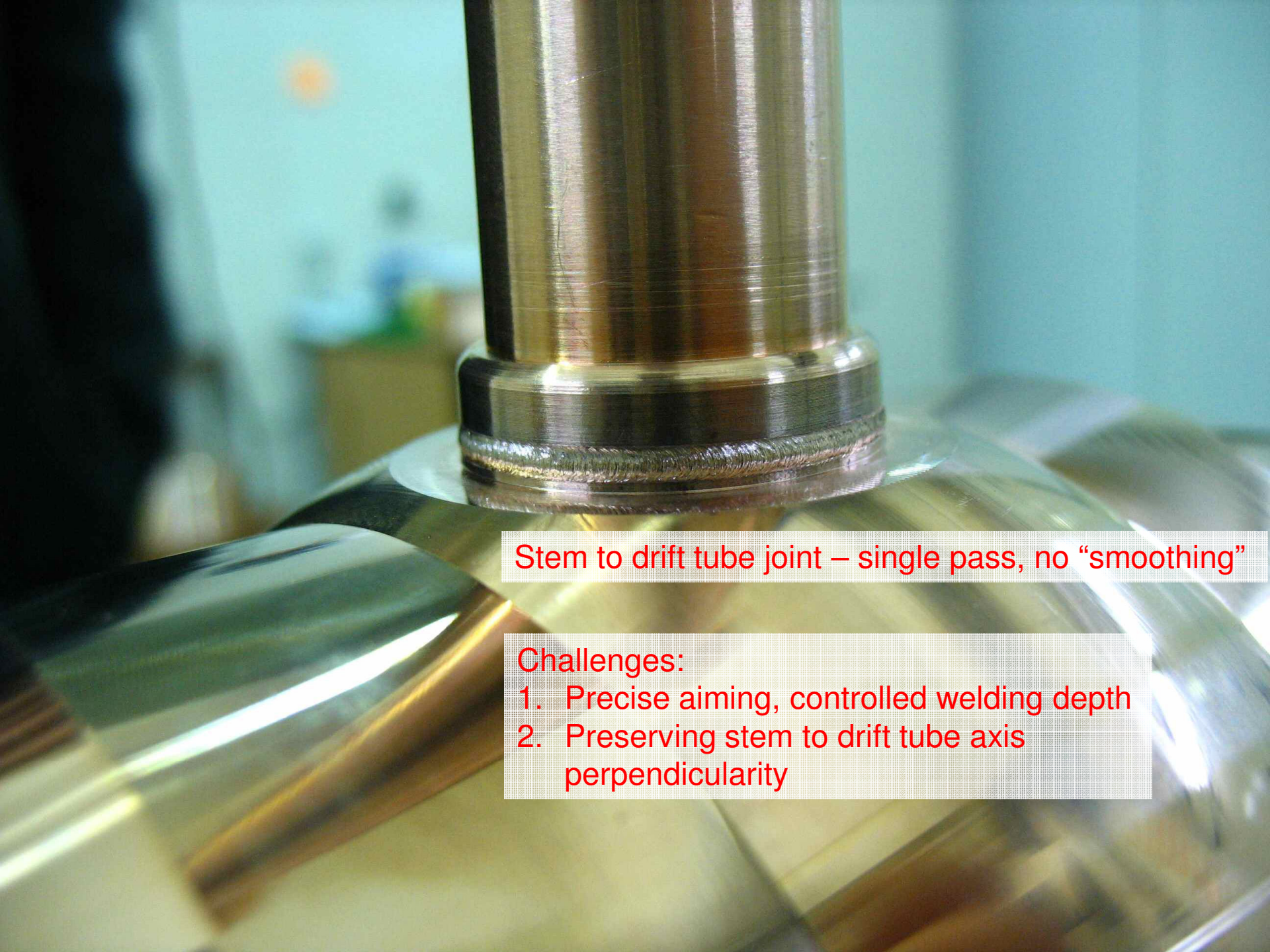
EBW machine at BINP

Chamber: 1.2 x 1.2 x 2m
Vacuum: 10^{-3}Pa
Gun: 60kV DC, 150mA max

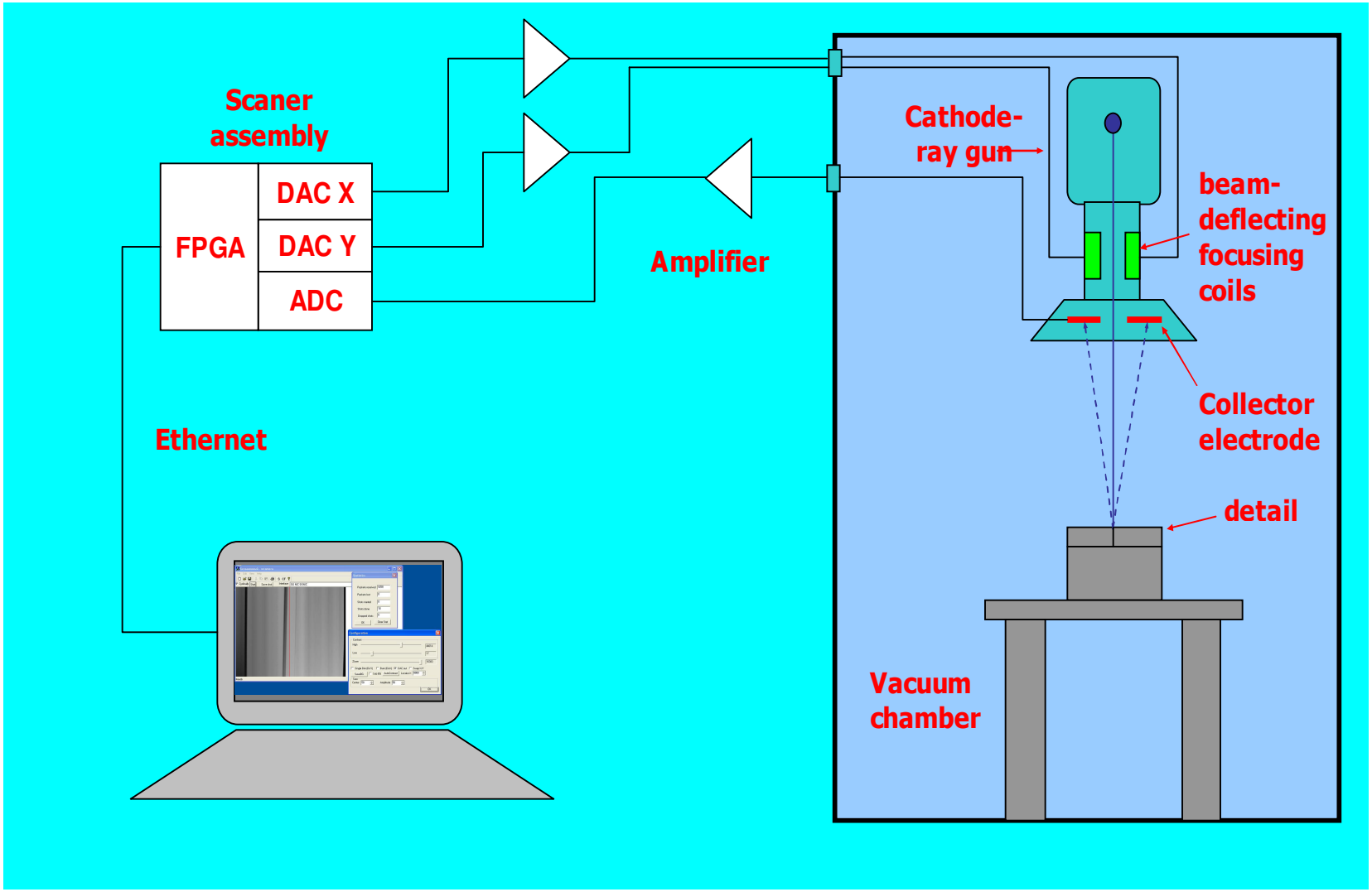


Drift tube at the EBW

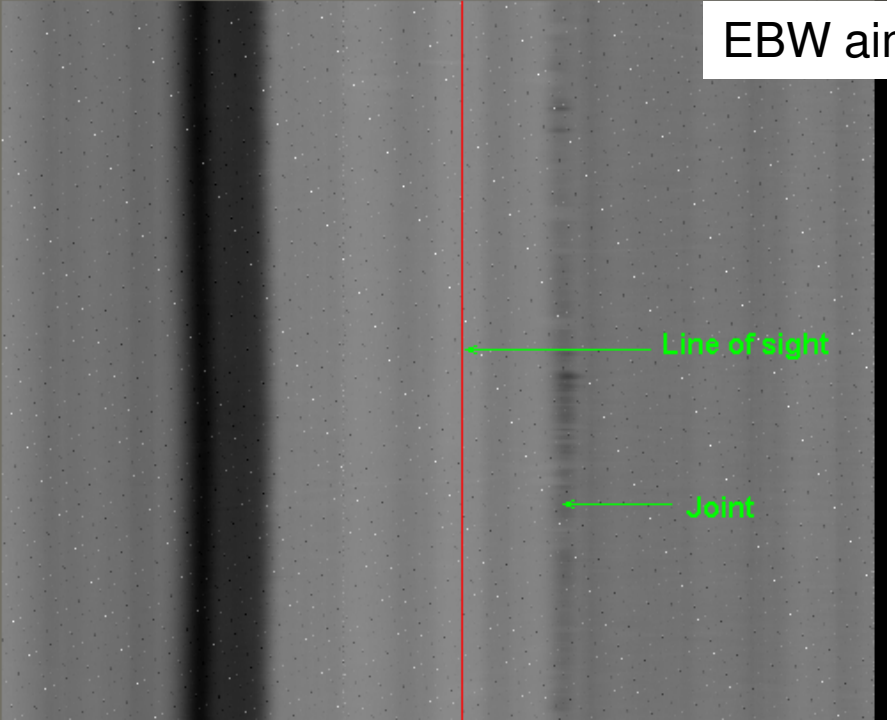



Stem to drift tube joint – single pass, no “smoothing”
Challenges:
1. Precise aiming, controlled welding depth
2. Preserving stem to drift tube axis perpendicularity

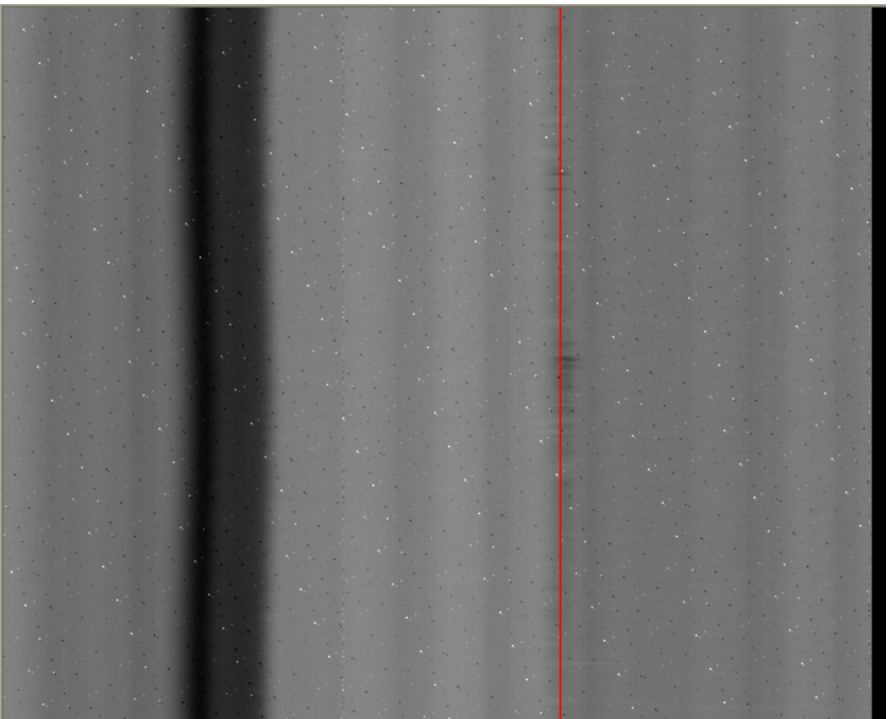
EBW aiming system



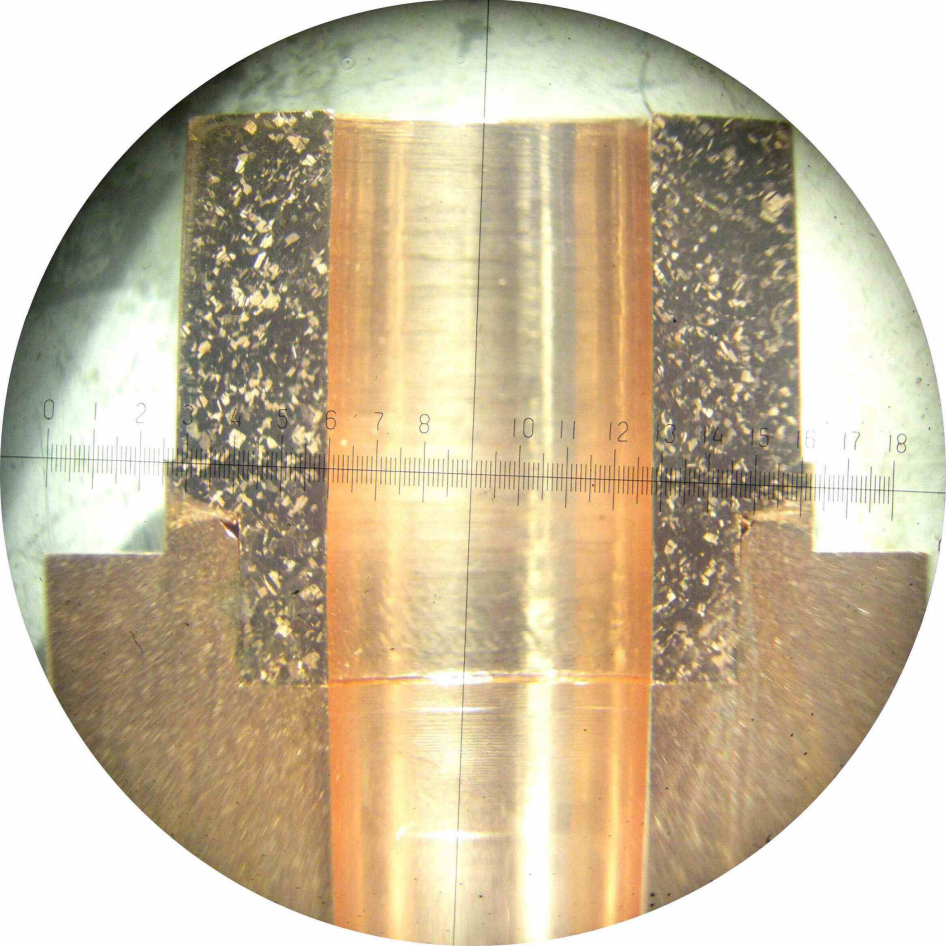
EBW aiming system

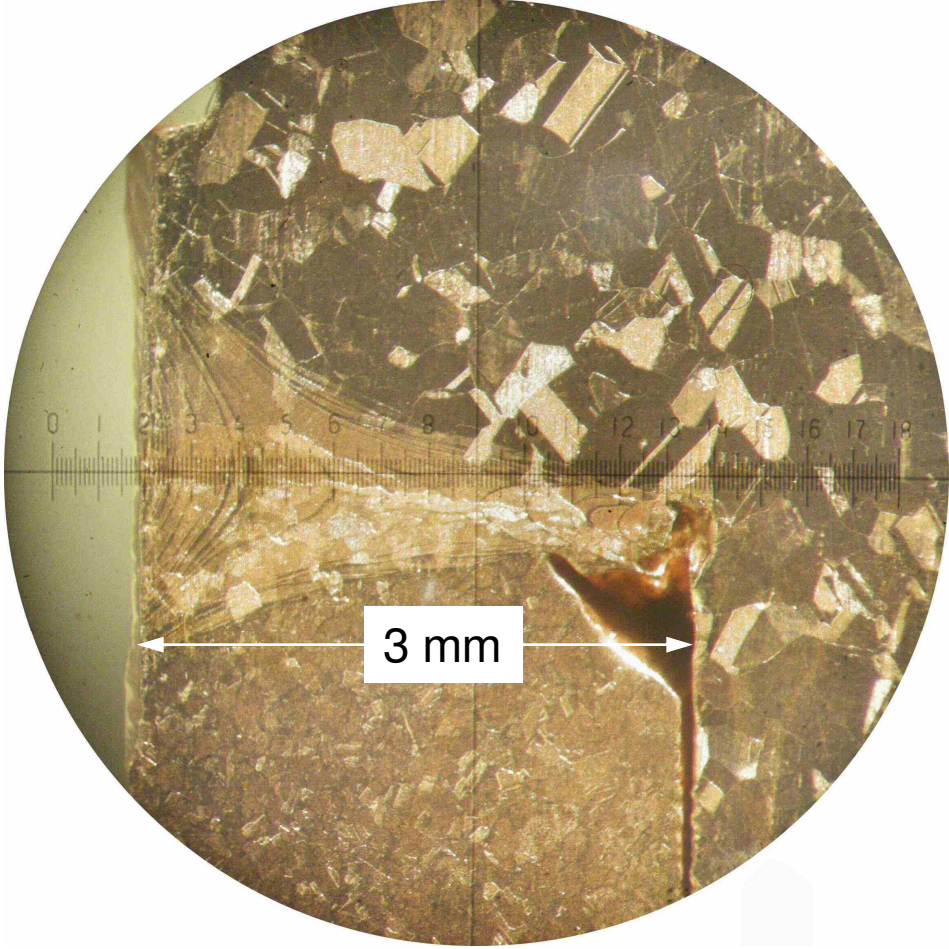


Low beam current one-dimensional scanning (across the joint) while rotating the parts

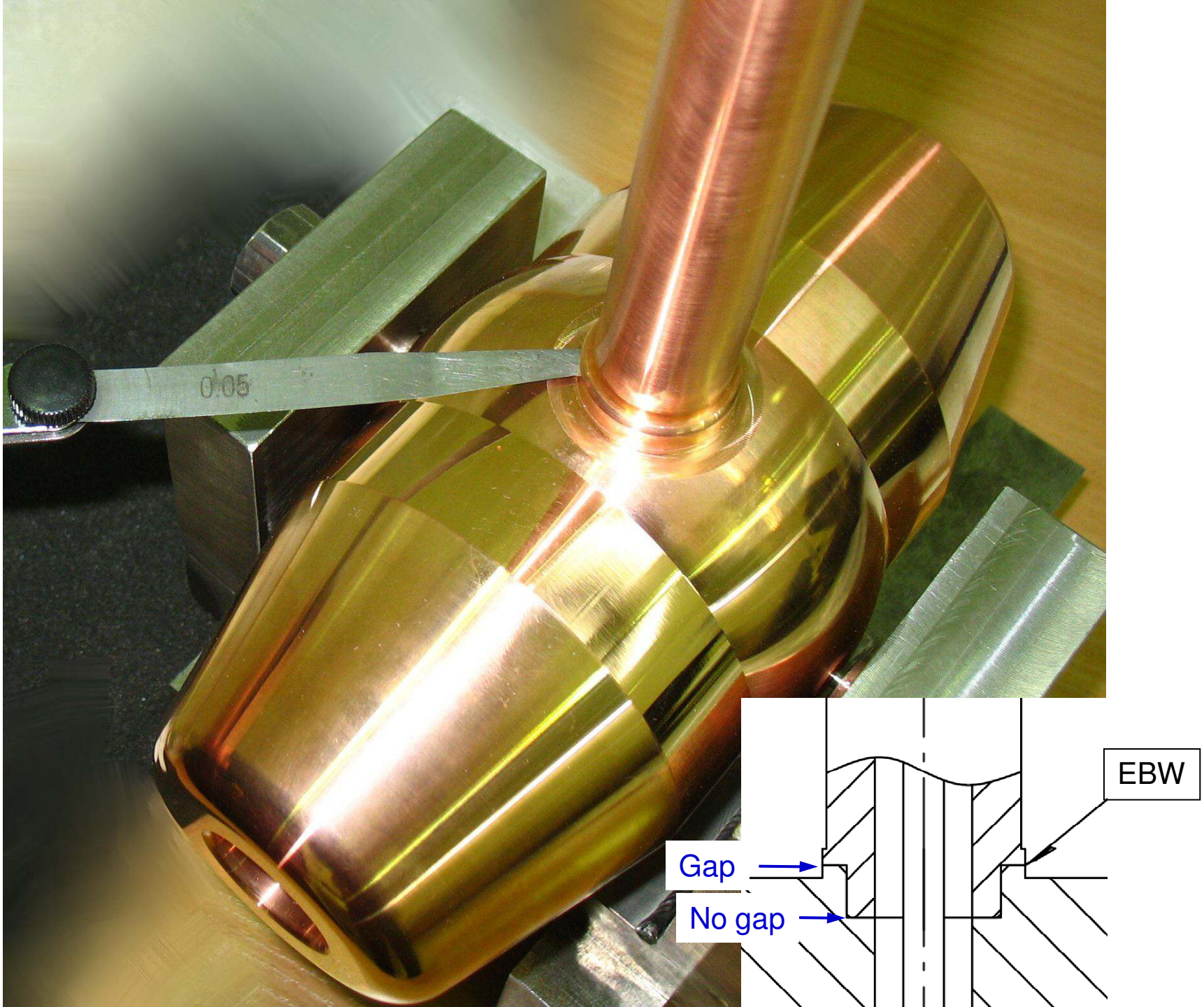


Aiming precision checked on samples is better than 0.2 mm

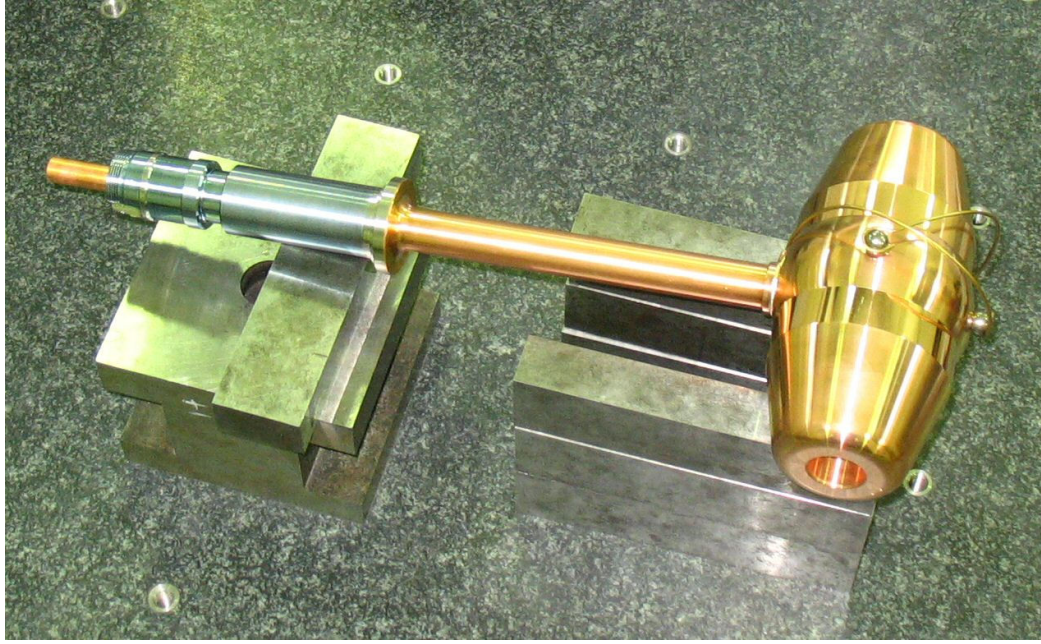




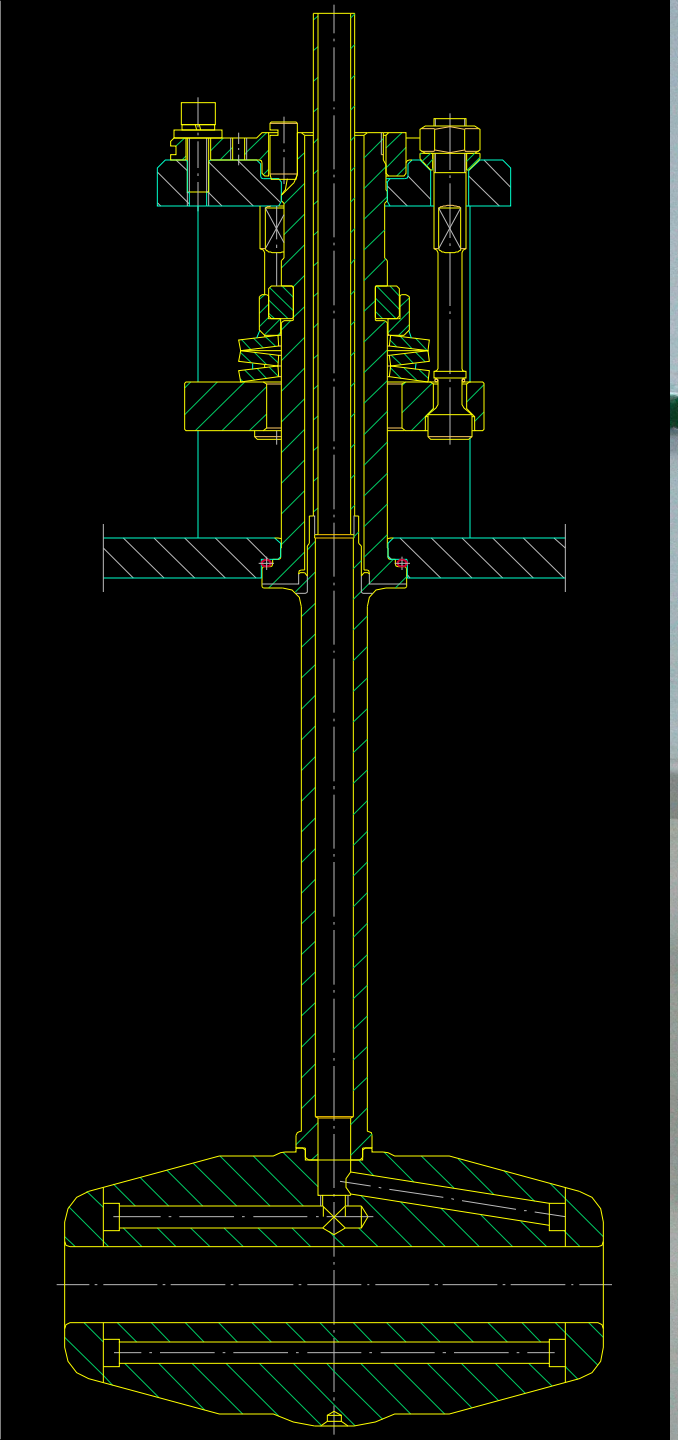
Stem to drift tube joint witness sample
(same welding regimes)

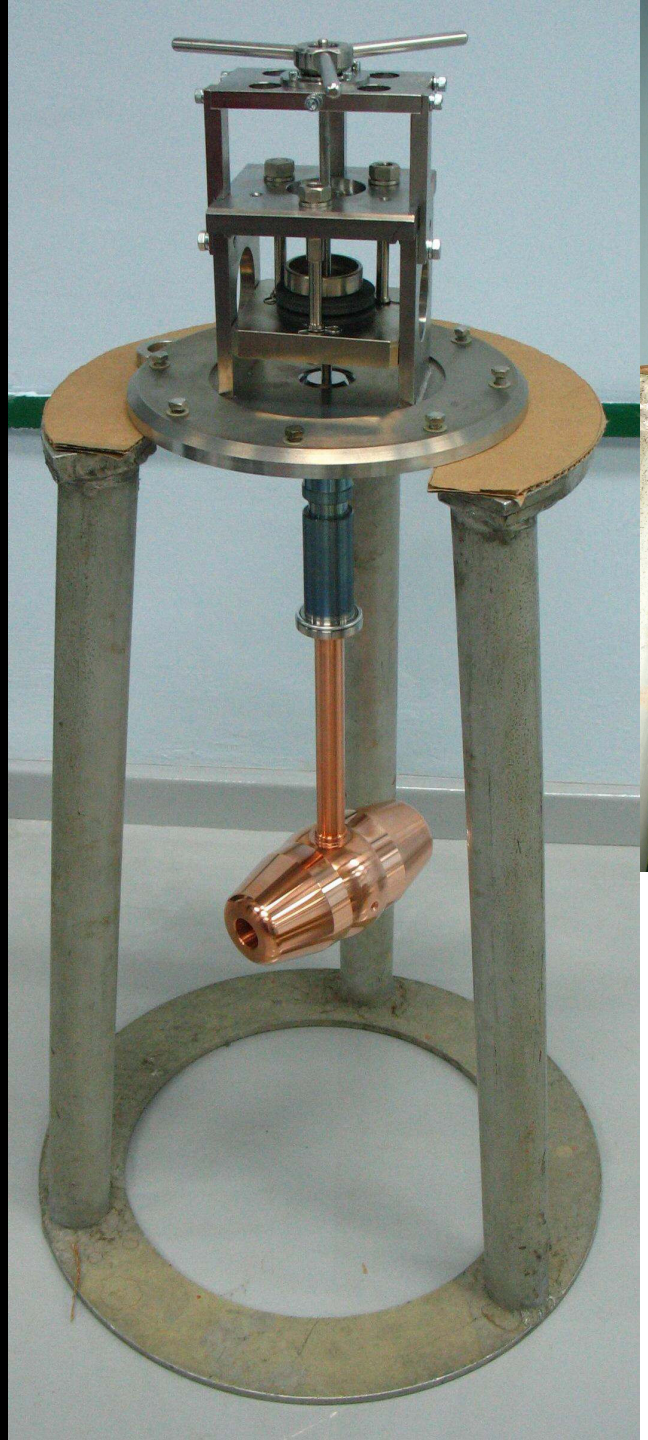

0.05
EBW
Gap
No gap

Inclination due to EBW is 4’

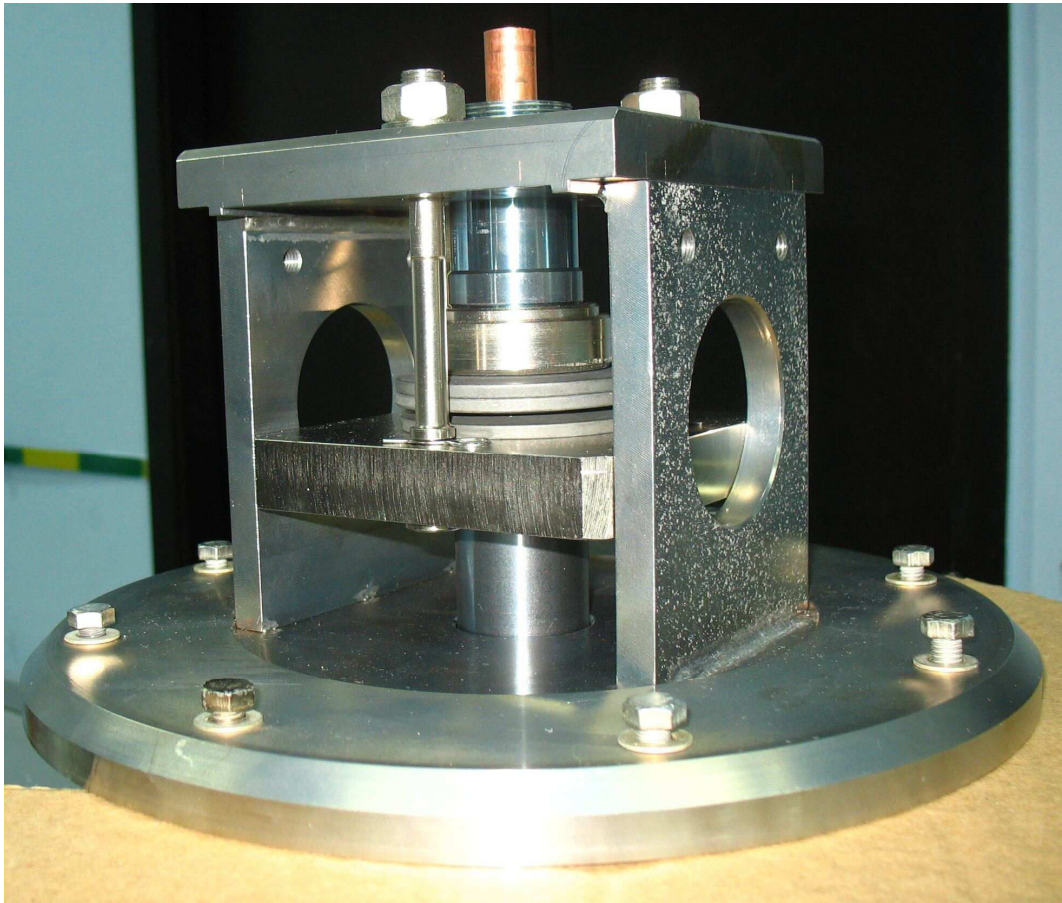


Balls from a ball-bearing instead laser tracker targets





DT test assembly

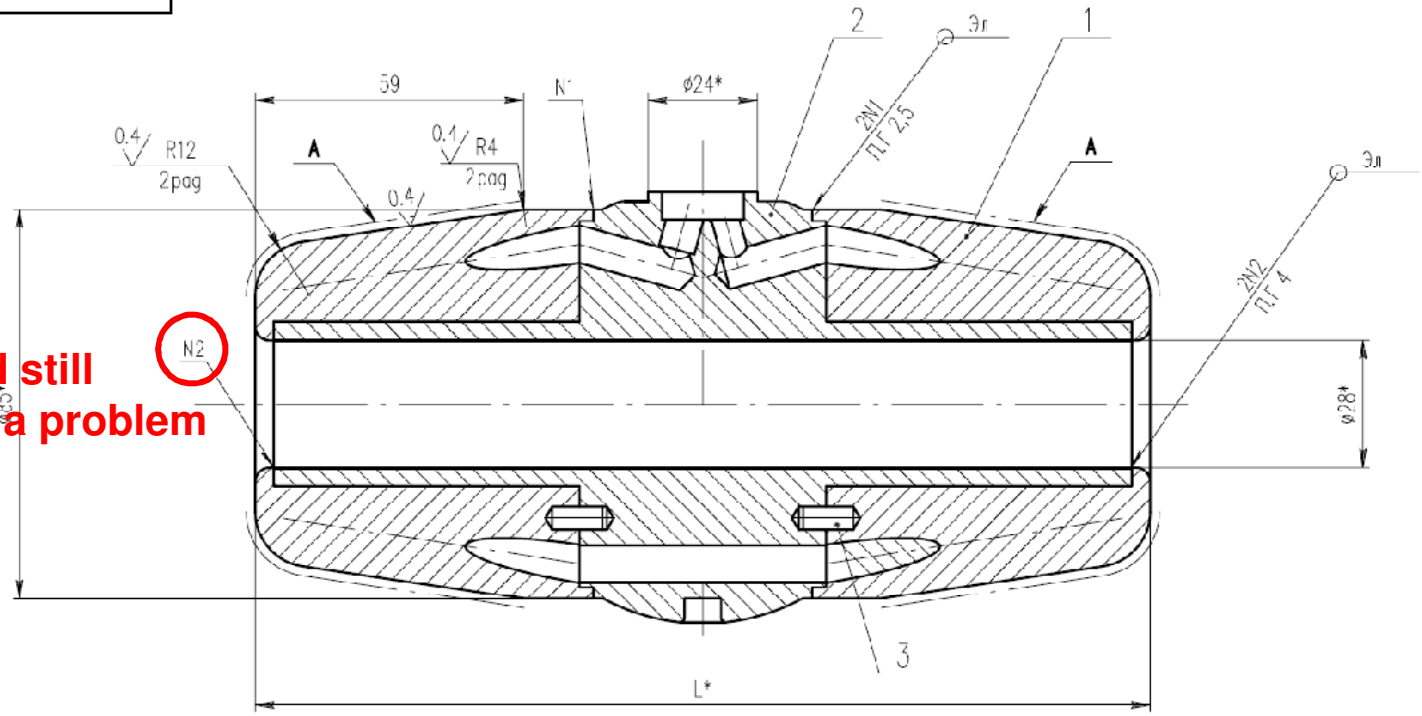


DT test assembly

Summary

We started seeking an alternative to EBW mainly because at the time of 2875 prototype production EBW machine and technology at BINP did not look reliable enough for DT welding. But we started an upgrade of EBW and now definitely are much more advanced in EBW than we used to be. So EBW in principle seems to be appropriate for every joint, may be except of one (see next slide).

SPLACDTL.01.01.02.SB



This weld still might be a problem

Обозначение	L
SPLACDTL.01.01.02.SB	194.92
SPLACDTL.01.01.02-01.SB	196.64

1. Швы сварных соединений по СТП.020-87.
2. *Размеры для справок.
3. Поверхность "А" окончательно обработать после определения конусности на макете.

Изм.	Лист	№ докум.	Подпись	Дата
Разработал		Зудуев А.А.		19.05.05
Проверил				
Т.контр.				
			43-40	
Н.контр.				
Утвердил				

SPLACDTL.01.01.02.SB

Корпус

Литера	Масса	Масштаб
		1:1

Лист 1 Листов 1

Институт ядерной физики СО РАН Новосибирск

Инв. № подл. | Подп. и дата | Взам. инв. № | Инв. № дубл. | Подпись и дата

D:\Dwg\Юнежиков\TD-1.dwg

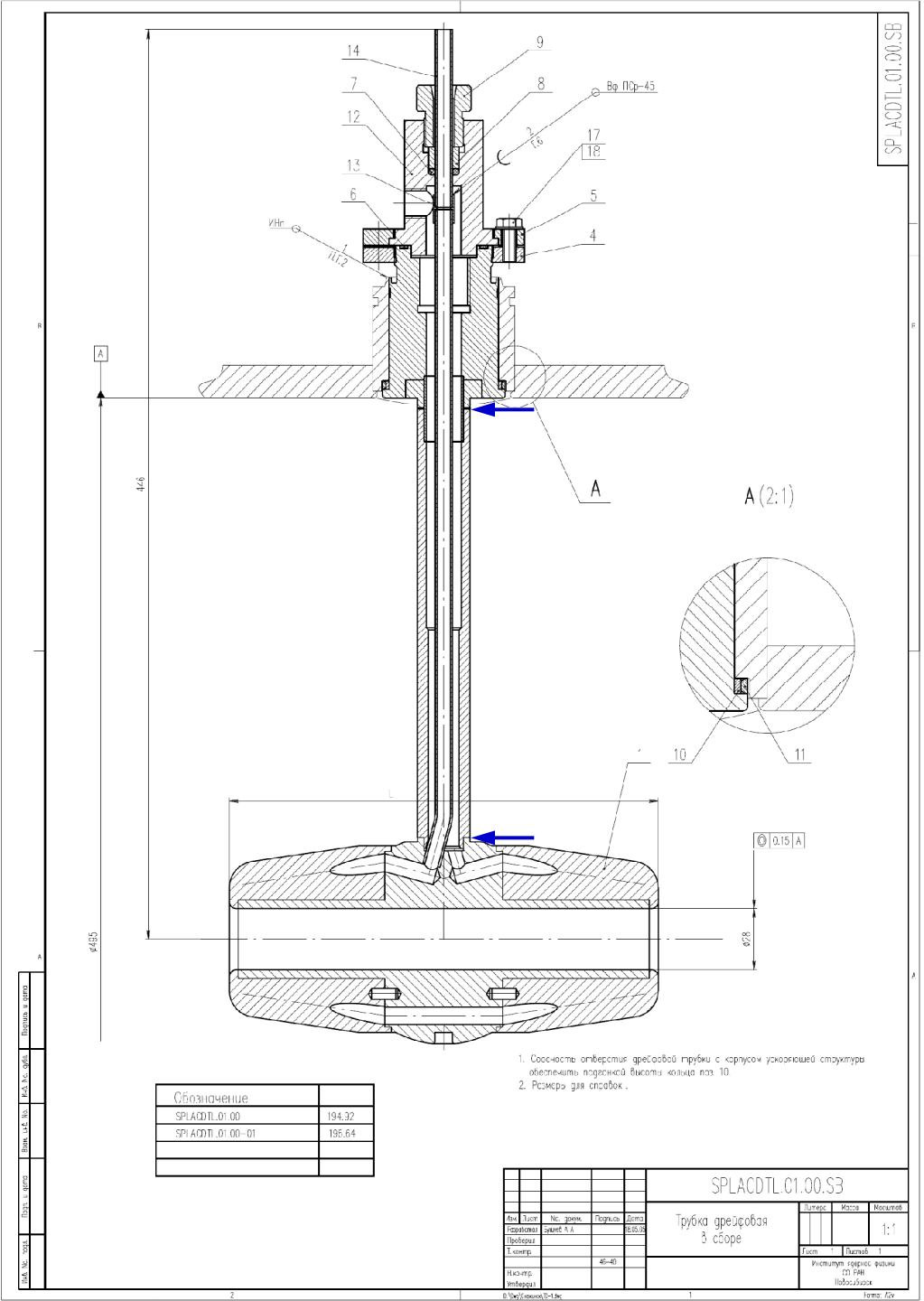
Format A3

Summary

We started seeking an alternative to EBW mainly because at the time of 2875 prototype production EBW machine and technology at BINP did not look reliable enough for DT welding. But we started an upgrade of EBW and now definitely are much more advanced in EBW than we used to be. So EBW in principle seems to be appropriate for every joint, may be except of one (see previous slide).

But we also accepted that DT are to be machined after joining the parts in order to get into the "tunable" frequency range. This calls for brazing (rather than EB-welding) the DT bodies.

For the stem EBW looks more appropriate than brazing from "technological" point of view. But… (see next slide)



But if we used EBW for the upper joint an inclination due to EBW (~4') would bring the bottom end of the stem by 0.3 mm off the beam axis. So we tend to brazing the upper joint with subsequent machining to make sure the stem is straight. Unless we foresee bending the stem afterwards.

Although for the lower joint the situation is less critical.

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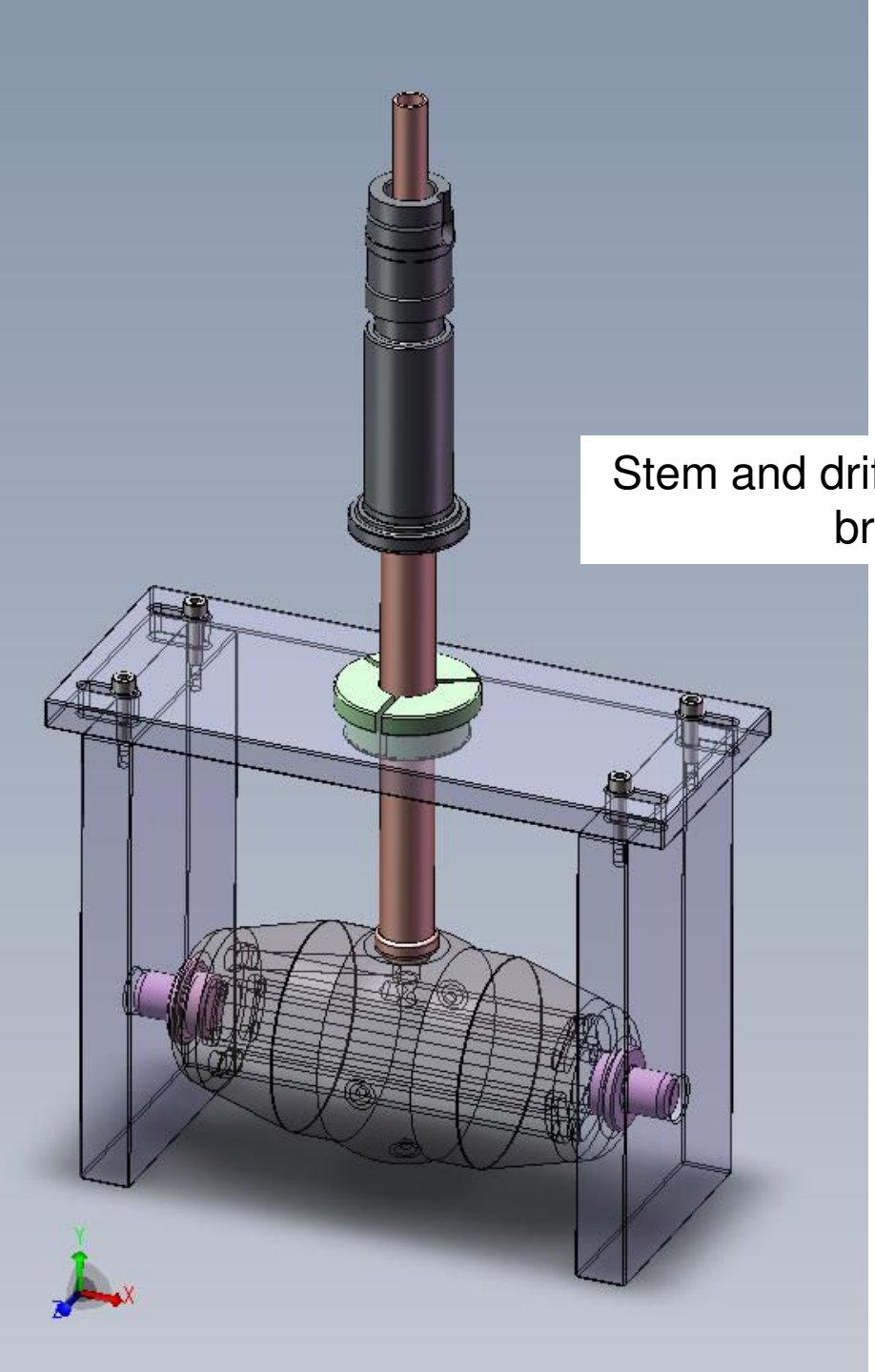
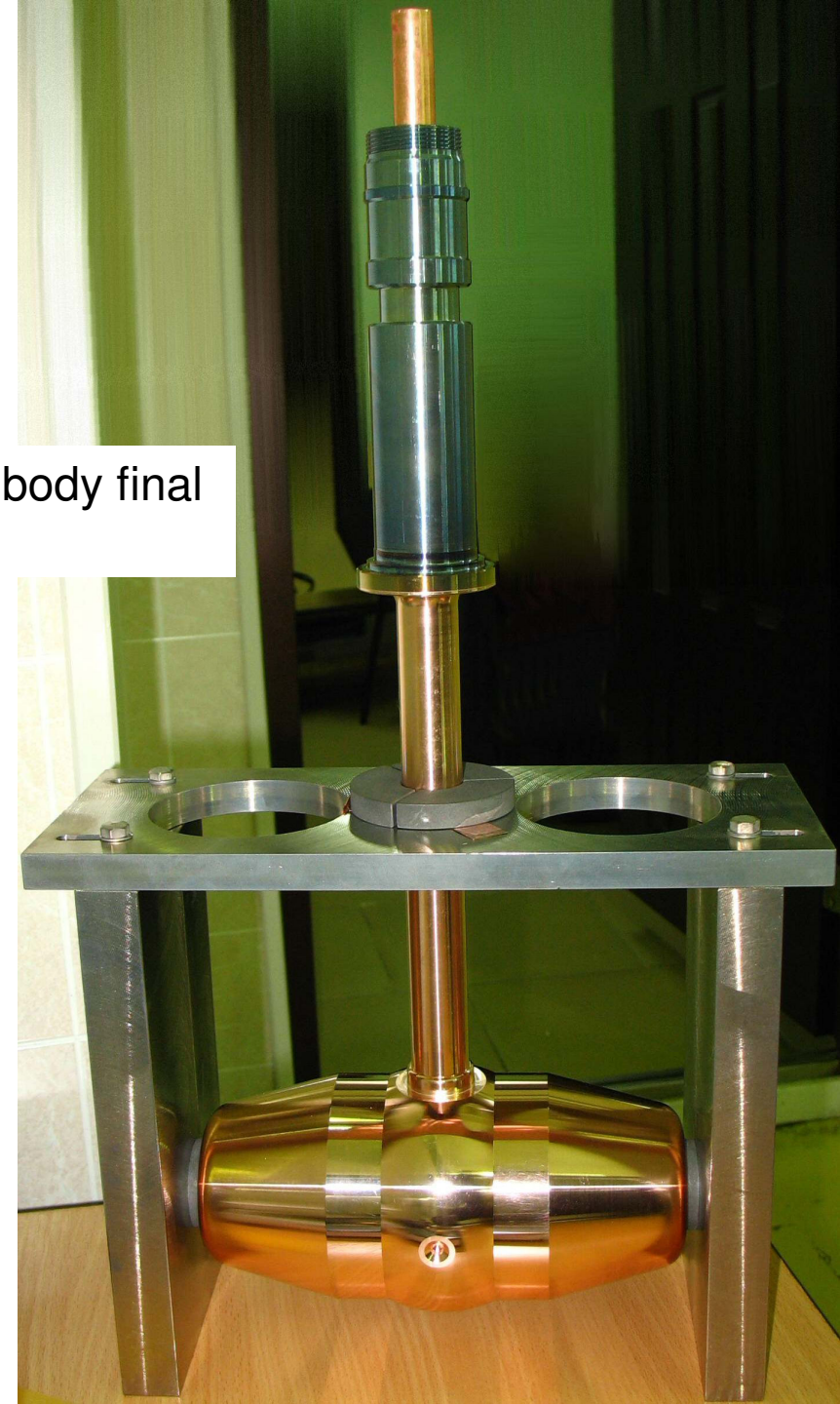
Conclusions

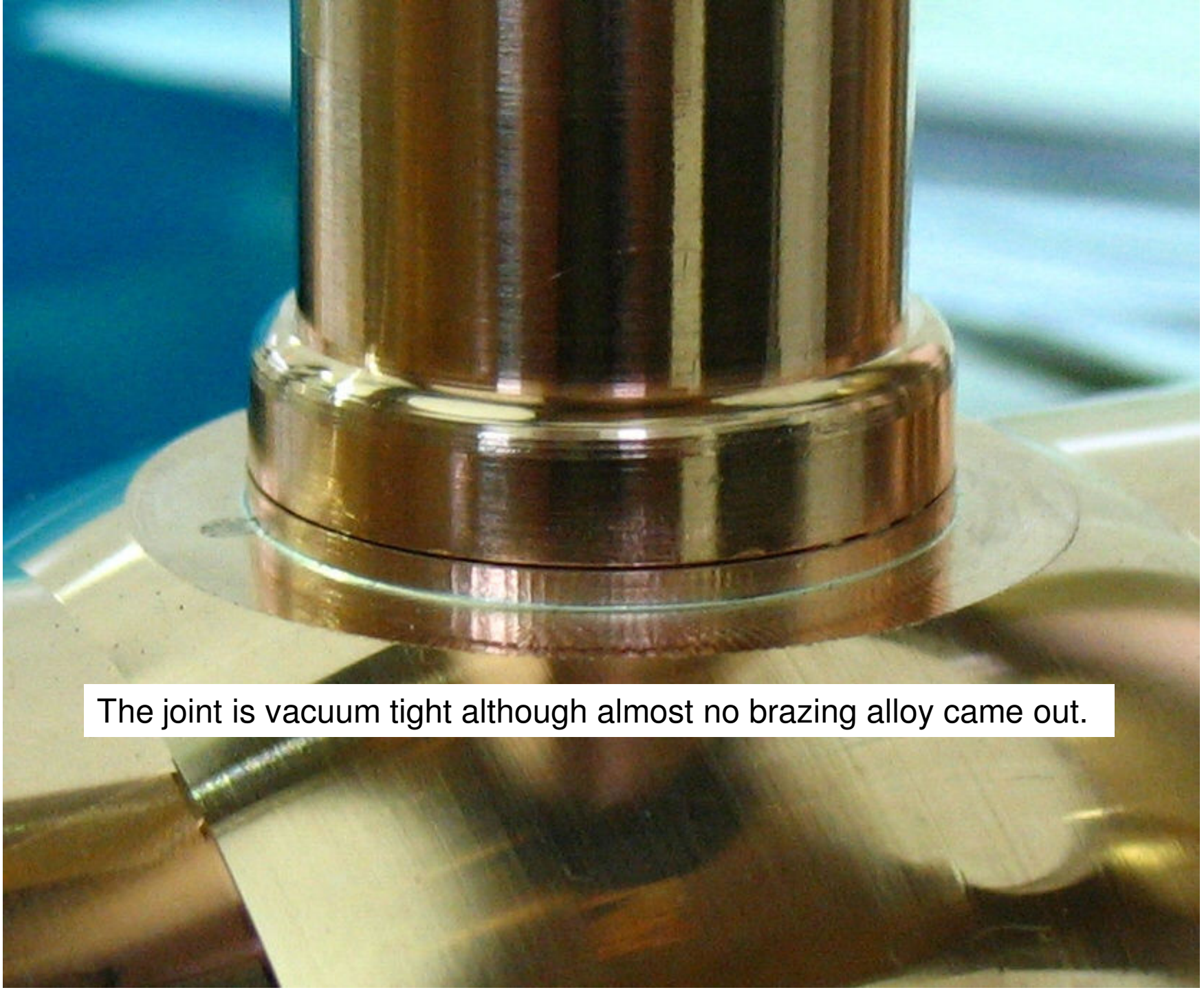
We are in favour of brazing the DT body (with golden alloy).
We tend to brazing the stem upper joint (with silver alloy).
We are quite confident about EB-welding of the stem to DT joint.

Stem and drift tube body connection
Option 2 - Brazing



Stem and drift tube body final brazing



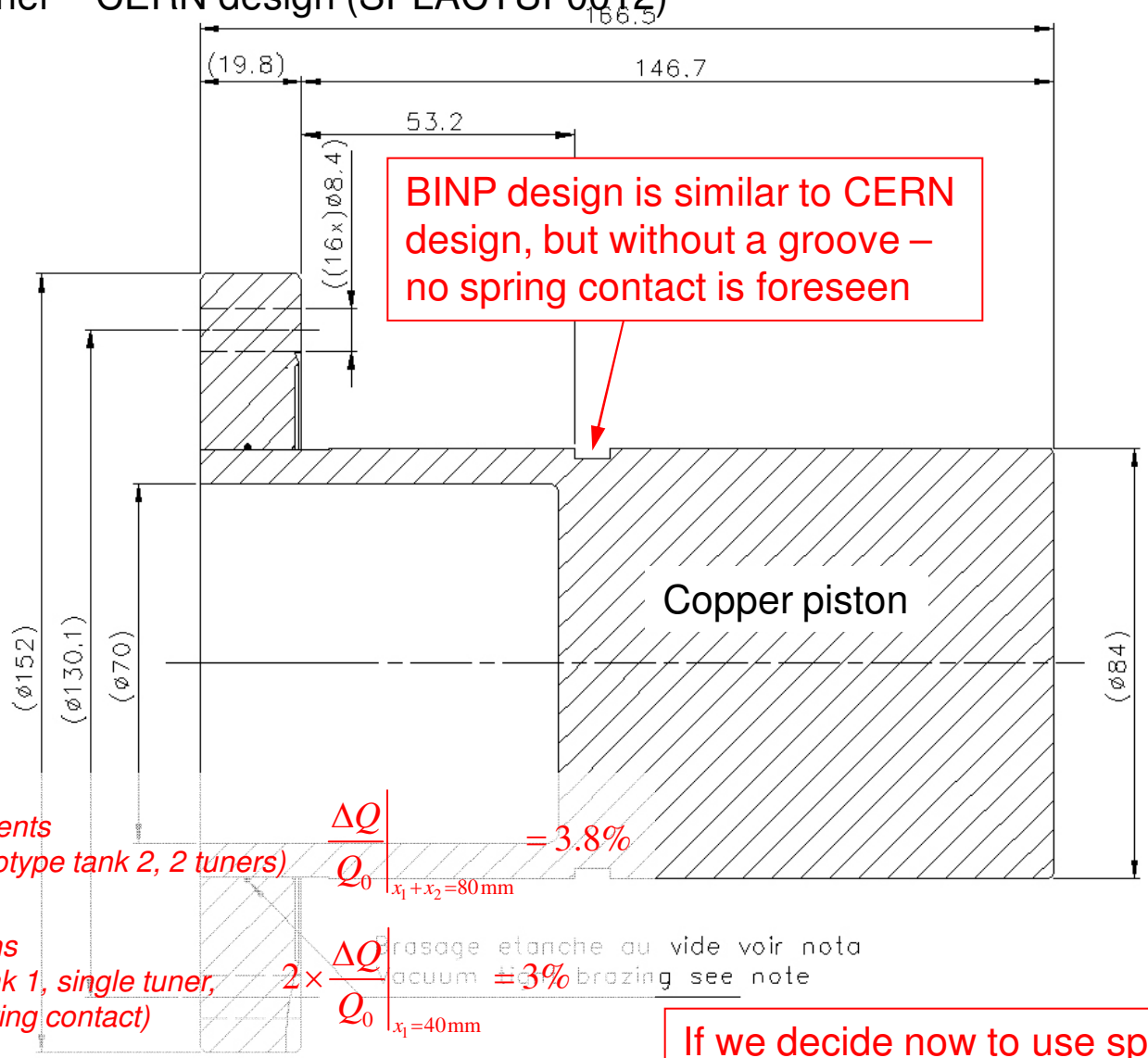


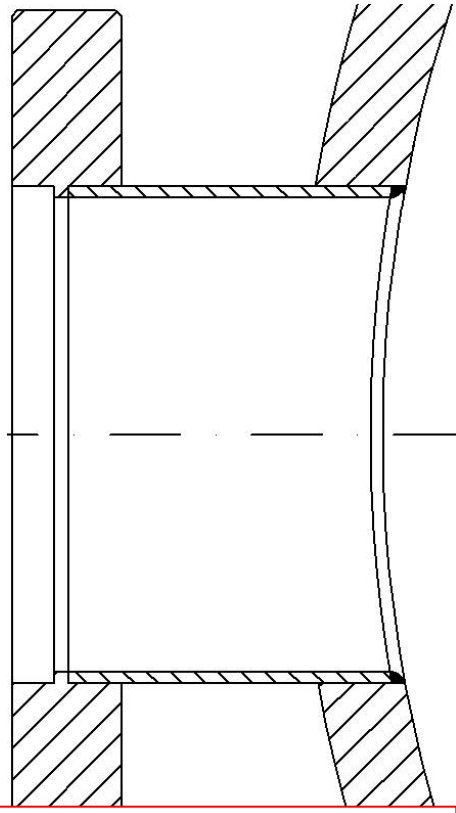
The joint is vacuum tight although almost no brazing alloy came out.

More design issues

Ports / Tuner

Fixed tuner – CERN design (SPLACTUF0012)





Measurements
(ISTC prototype tank 2, 2 tuners)

$$\left.\frac{\Delta Q}{Q_0}\right|_{x_1+x_2=80\,\mathrm{mm}} = 3.8\%$$

Calculations
(Linac4 tank 1, single tuner, without spring contact)

$$2\times\left.\frac{\Delta Q}{Q_0}\right|_{x_1=40\,\mathrm{mm}} = 3\%$$

Calculations
(Linac4 tank 1, single tuner, with spring contact)

$$2\times\left.\frac{\Delta Q}{Q_0}\right|_{x_1=40\,\mathrm{mm}} = 1.5\%$$

If we decide now to use spring contacts or reserve the possibility to take the decision later on, we need to specify precisely the groove dimensions and the port inner diameter.