ISTC Projects #3888, 3889p
for the construction of CCDTL accelerating section of Linac4

	ISTC	International Science and technology Center, Moscow	Official Coordinator
	BINP	Budker Institute of Nuclear Physics of Siberian Branch of Russian Academy of Sciences, Novosibirsk	Leading Institute
	VNIITF	Russian Federal Nuclear Center – Russian Scientific Research Institute of Technical Physics, Snezhinsk	Participant Institute
	CERN	European Organization for Nuclear Research, Geneva, Switzerland	Foreign Collaborator/Partner

BINP and VNIITF involvement in the Linac4 activities started in 2004 within ISTC Project 2875 for the construction of the prototype cavities

Complementary ISTC Projects #3888, 3889p for the construction of CCDTL accelerating section of Linac4

ISTC Project #3889p

Development and manufacture of RF cavities for a unique pilot CCDTL accelerating section in the energy range of 50-100 MeV for the new accelerator Linac4

Total for the project		***1 300 000.00** USD ← 1 300 000.00 by CERN*
	BINP	*100 000.00*
	VNIITF	*1 200 000.00*

ISTC Project #3888

Development, manufacture and experimental investigation of a unique pilot CCDTL accelerating section in the energy range of 50-100 MeV for the new accelerator Linac4

Total for the project		***1 100 883.55** USD ← 185 000.00 by CERN + 915 883.55 by EU*
	BINP	*500 000.00*
	VNIITF	*600 883.55*

Total for the 2 projects		***2 400 883.55** USD ← 1 485 000.00 by CERN + 915 883.55 by EU*
	BINP	*600 000.00*
	VNIITF	*1 800 883.55*

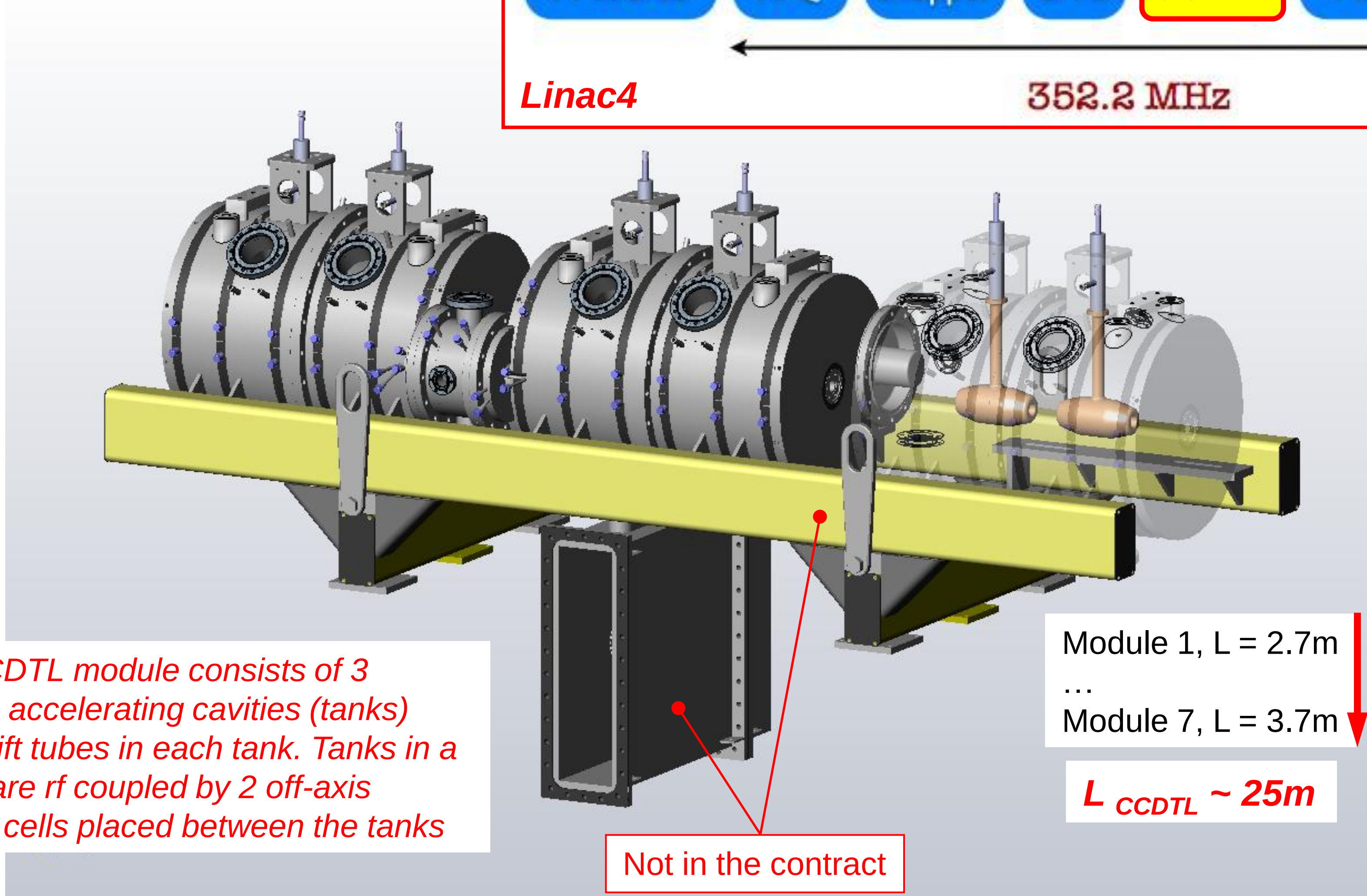
+ CERN in-kind contribution (materials and components) ← already 791 932.90 CHF

Grand total above 3.1M$

Both projects officially started on June 01, 2009.

Funding for the project #3888 is available form mid July, 2009.
Funding for the project #3889p is available from August 13, 2009
(1st money transfer to the ISTC from CERN)

Scope of the ISTC projects #3888/89p:



Each CCDTL module consists of 3 separate accelerating cavities (tanks) with 2 drift tubes in each tank. Tanks in a module are rf coupled by 2 off-axis coupling cells placed between the tanks

Not in the contract

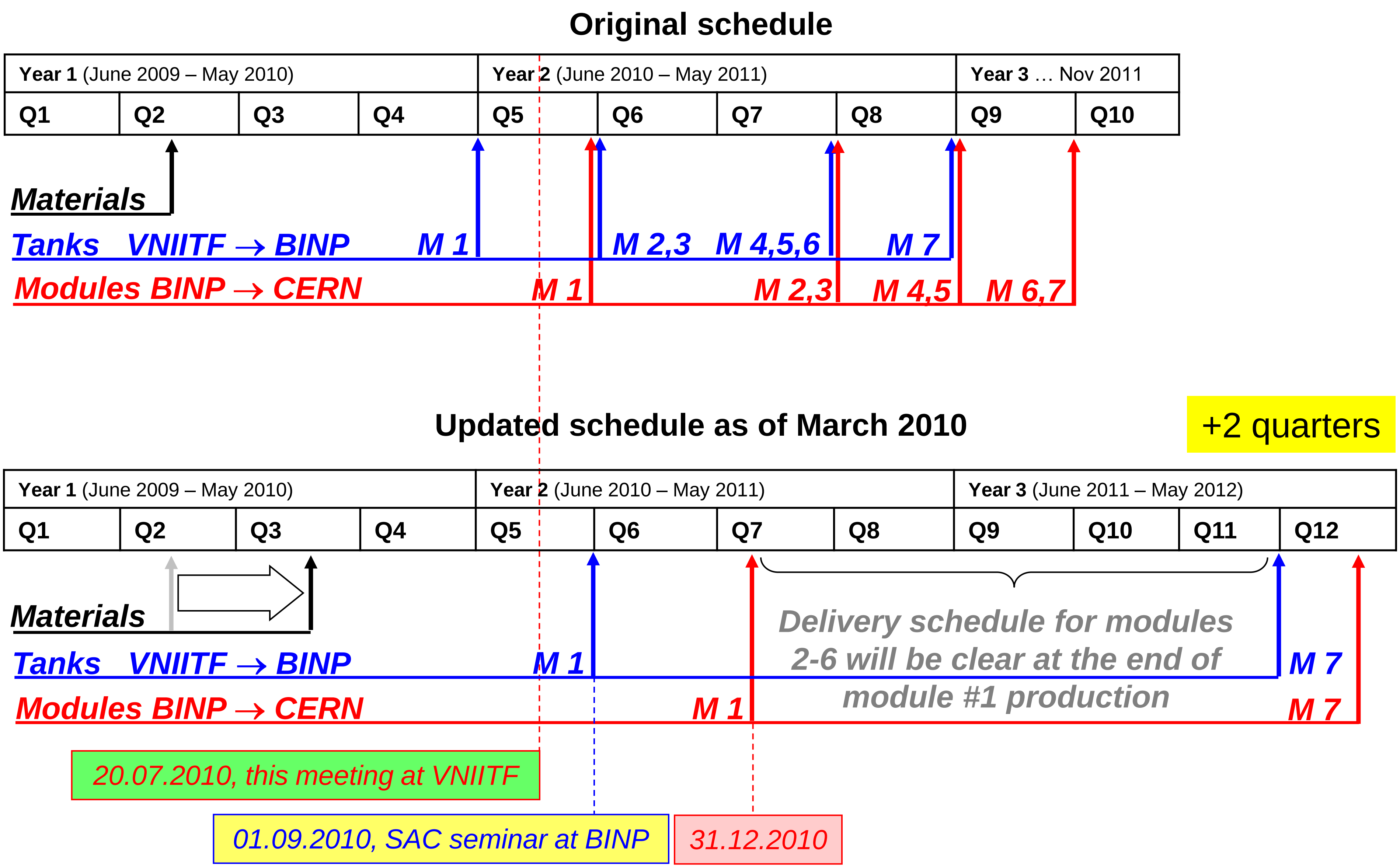
Module 1, L = 2.7m
…
Module 7, L = 3.7m

L_{CCDTL} ~ 25m

Distribution of works:

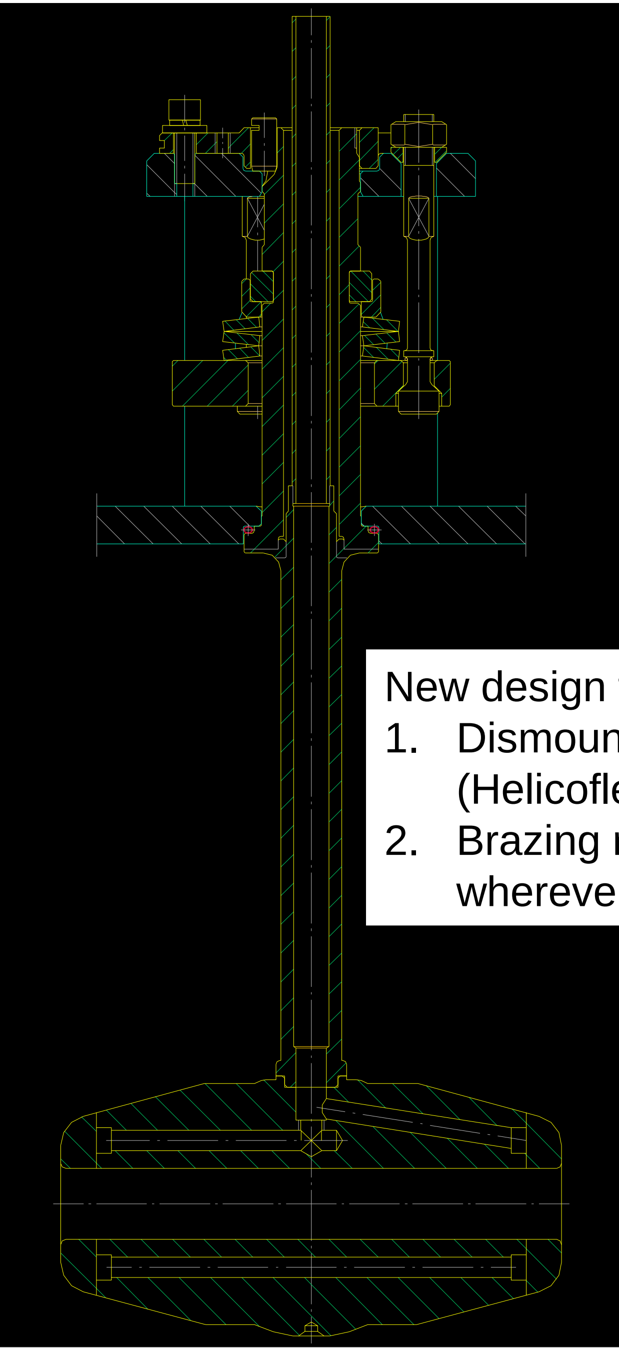
- The design of Linac4 CCDTL accelerating section will be developed jointly by CERN, BINP, VNIITF.
- Tanks will be built at VNIITF. After copper plating and a test assembly the modules will be shipped to BINP.
- BINP will build and install the drift tubes and fixed tuners and take care of the rf tuning and final assembly.
- Rf conditioning and high power tests of all the 7 modules will be done at CERN.

Project planning



Drift tubes production

1. Drift tubes for CCDTL prototype (ISTC project 2875) – successful, but …
2. Decided to improve the design and production technology
3. Built 2 drift tube mock ups to verify new ideas
4. Now making 50 drift tubes (42 + 8 spares)

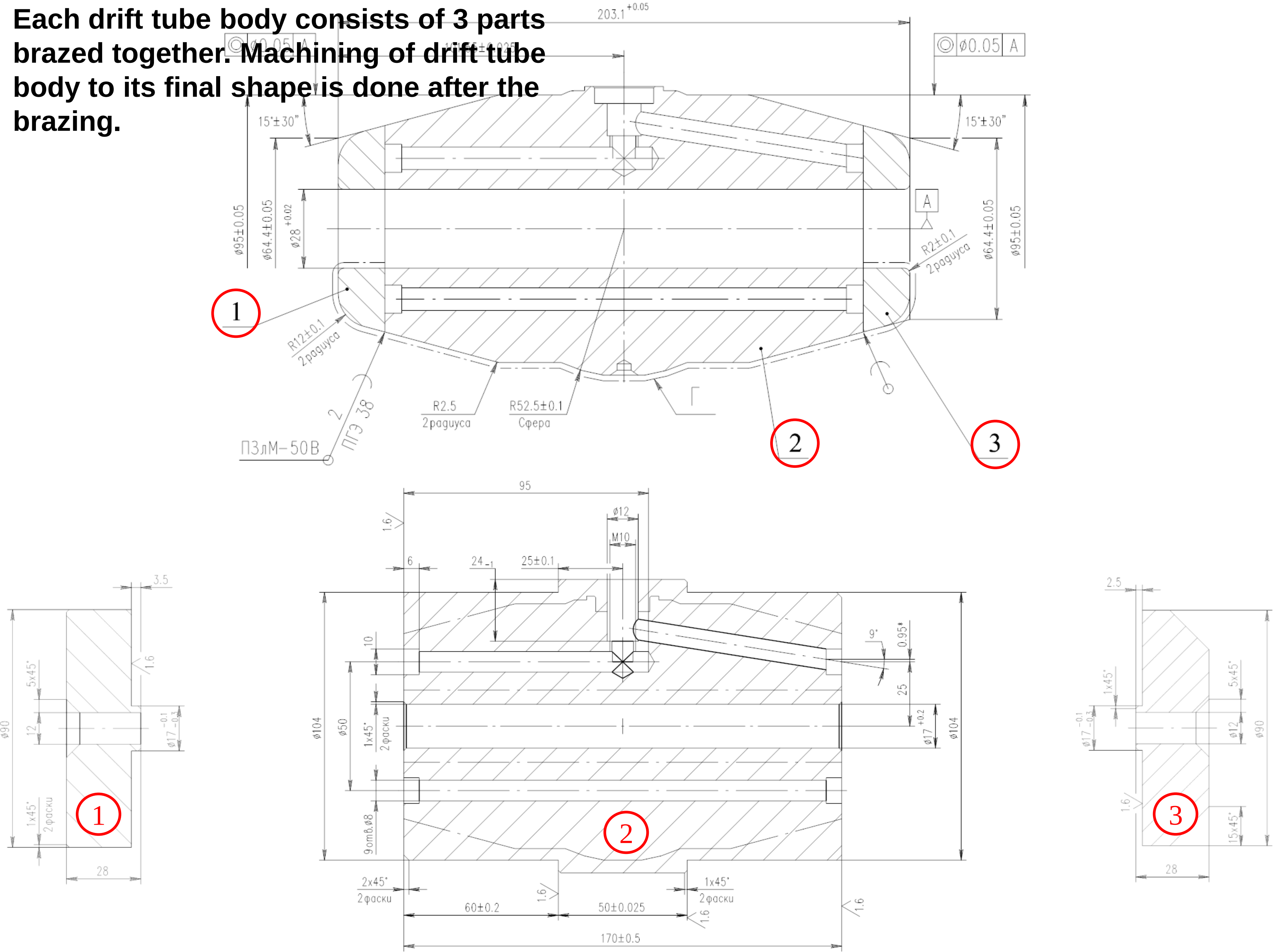


New design features:

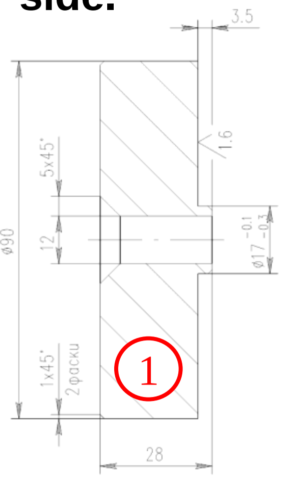
1. Dismountable drift tube (Helicoflex joint)
2. Brazing rather than EBW wherever possible

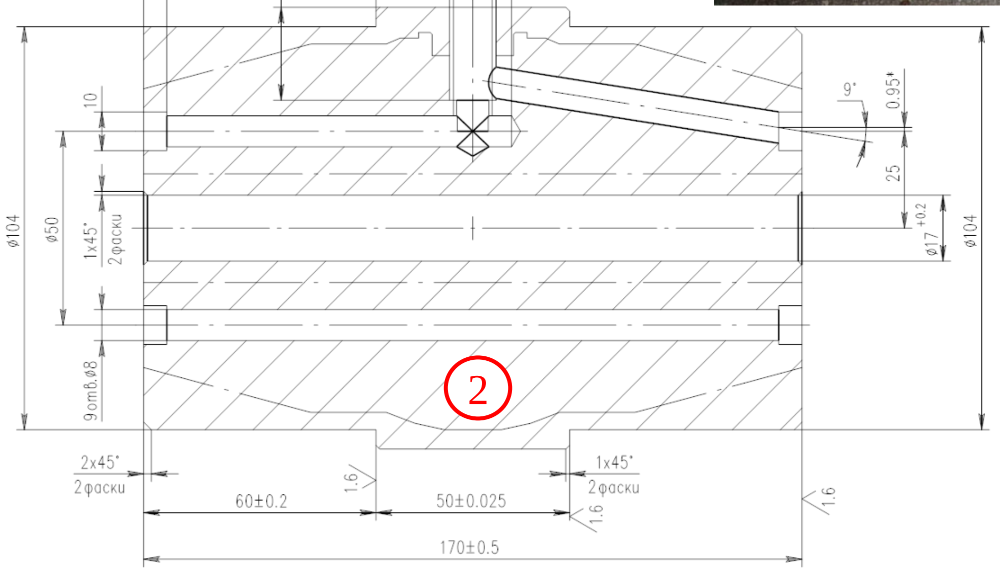
Drift tube mock up on the CMM

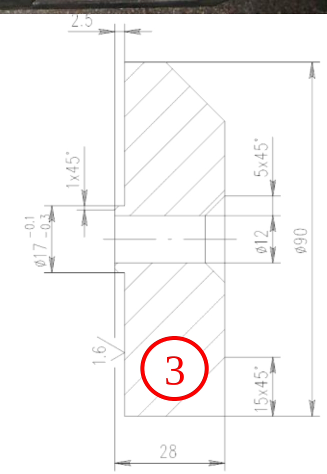
Each drift tube body consists of 3 parts brazed together. Machining of drift tube body to its final shape is done after the brazing.



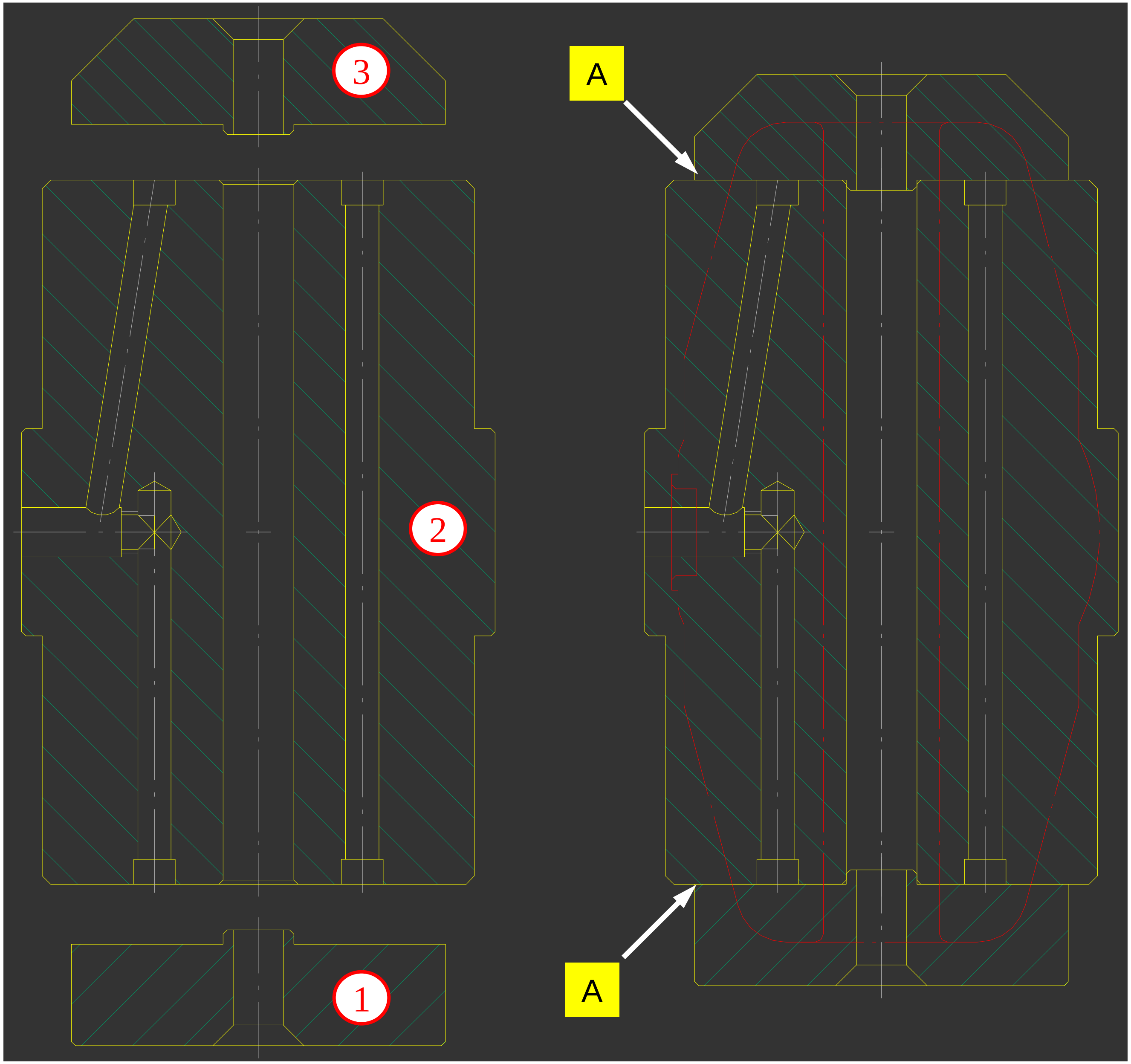
Rough machining of drift tube body parts is done. Cooling channels (in the center parts) are done at one side.







Joint A (Cu-Cu): Vacuum brazing with alloy ПЗлМ 50В (Au 49.6-50.4%, Cu -the rest) at t=930-950C



Brazing will start in August

Drift tube suspension stems parts are being machined. Brazing (B, C, D) will start in August

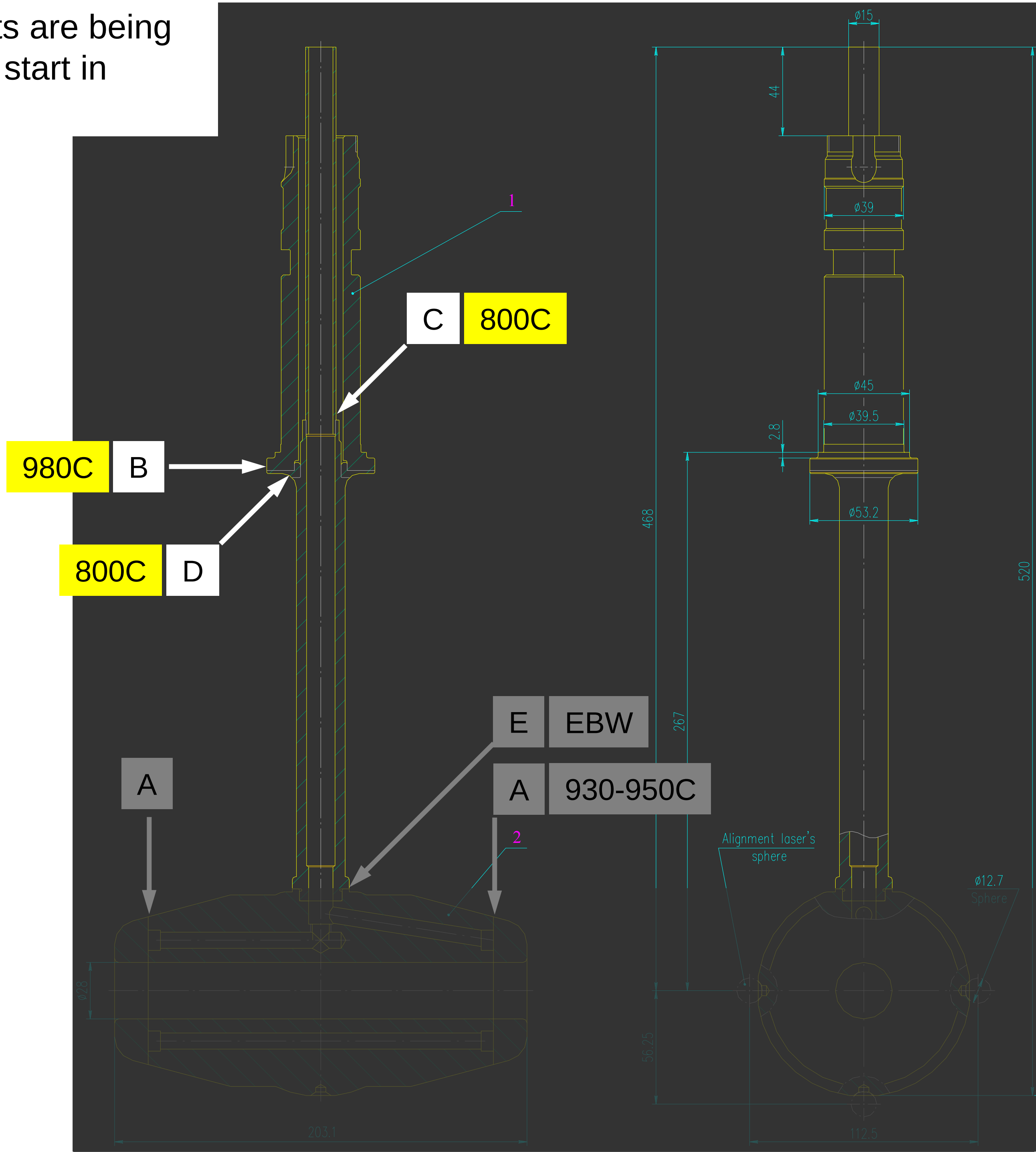
Joint A – Brazing (Cu-Cu)
ПЗлМ 50В
Au 49.6-50.4%, Cu -the rest
t=930-950C

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

Joint E – EBW



Status of works at BINP – auxiliary components

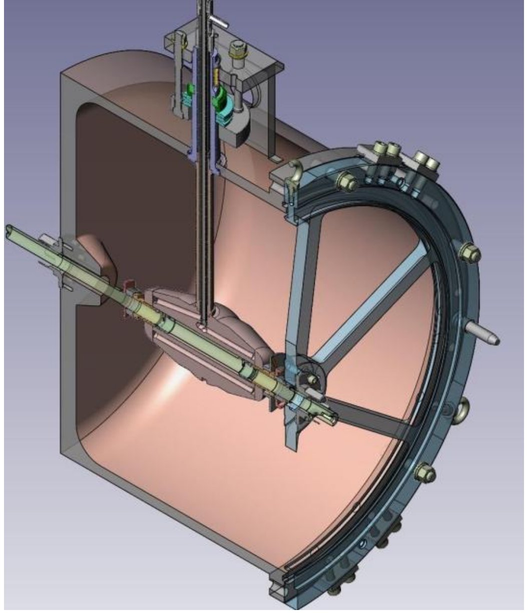
The strategy of frequency tuning

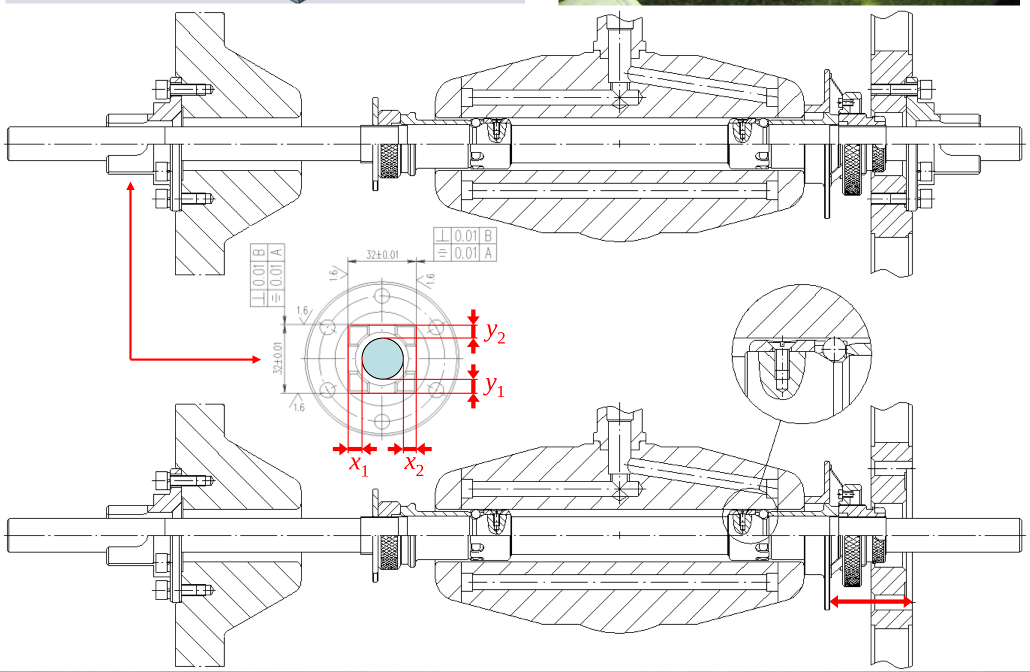
Upon arrival of the cavities from VNIITF to BINP, using a few sets of aluminum dummy drift tubes, resonant frequencies of the cavities are measured. Interpolation of the measurement results allows to correct the real drift tube shape as to compensate limited precision of 3D-calculations and manufacturing accuracy.

Individual final machining of the drift tubes to the dimensions calculated from frequency measurements of actual cavities with aluminum dummy drift tubes is foreseen to bring the resonant frequency to the design value.

The tuners are machined to their final dimensions found from frequency measurements of the cavities with drift tubes installed.

Aluminum drift tubes are ready.
Drift tube installation and alignment tools are ready.
Assembly table is ready.
Waveguide parts (for rf measurements) are being machined.





In order to be able to check the drift tube alignment at CERN, 3 pads for laser tracker target holders are made on each drift tube.

During module assembly and testing at BINP it is more convenient to do the drift tube alignment without a laser tracker.

Special tools were developed and built for the alignment of a drift tube in a half-tank.

Self centering precise shaft is fixed in the drift tube beam hole.

Alignment flange is mounted to the half-tank flange.

Drift tube axis (= shaft axis) position is found by measuring the distances from the reference surfaces to the shaft.

Longitudinal position of the drift tube is defined by the distance from the flange to the drift tube tip.

Status of works at BINP

We are ready to receive high quality products from VNIITF!