CLEANROOM FACILITIES FOR HIGH GRADIANT RESONATOR PREPARATION

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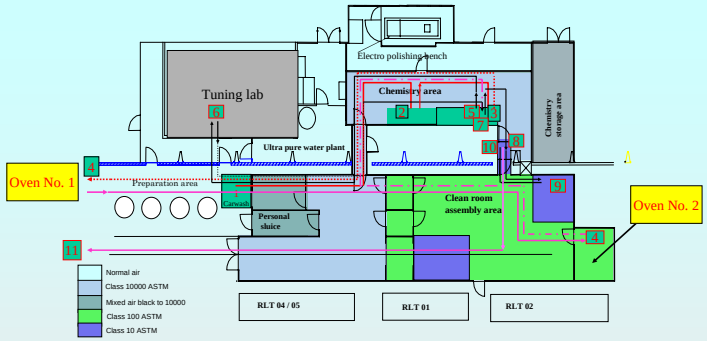
Abstract

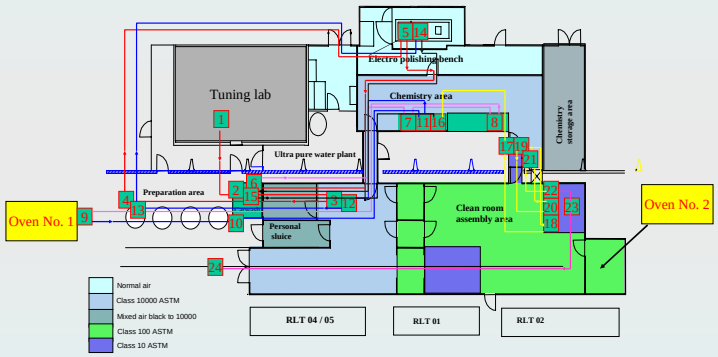
In 1991 a clean room facility to serve for high gradient super conducting cavity treatment- and preparation technique was set up at DESY. Since then several improvements on the infrastructure were made. A total of 88 multi cell TTF / TESLA design resonators with acceleration gradients of up to 39 MV/m have undergone treatments in this facility. We report on reliability experiences of the individual infrastructure components and the flow scheme of cavity preparation. Experiences on infrastructure maintenance procedures and improved quality control of the infrastructure will be presented. Basing on these experiences and the state of art of clean-room technology in 2005 a baseline lay out for an advanced cavity preparation and assembly infrastructure will be discussed.

	annealing and titanisation
1	Car wash
2	Ultrasonic degreasing and rinsing
3	titanium BCP inside 80µm outside 20µm
4	insertion to oven 1+ 800°C annealing
4	insertion to oven 2 + 1400°C titanisation
5	titanium BCP inside 80 µm outside 40µm
6	tuning of field profile
7	niobium BCP inside 20µm
8	1st high pressure rinse
9	assembly of flanges +leak test
10	2nd and 3rd high pressure rinse
11	RF acceptance test for tank welding

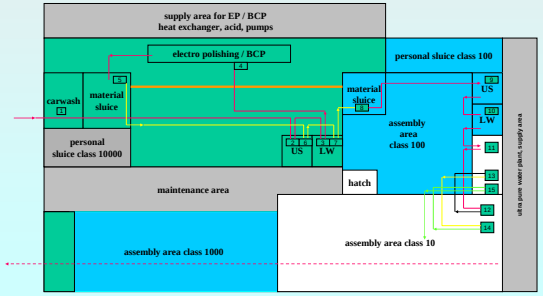


Workflow inside DESY cleanroom for cavity preparation => ANNEALING and TITANIUM POST PURIFICATION

	Electro polishing
1	Mechanical, visuelle inspection, tuning
2	Degreasing, pre-cleaning
3	Assembling flanges HOM,PIC, main coupler
4	Assembling timing belt, rotation disk, electrical connections
5	EP-bench, EP as described
6	Pre-cleaning,
7	US, conducted rinsing
8	BCP Ti pickling
9	800°C heat treatment
10	Pre-cleaning,
11	US, conducted rinsing
12	Assembling flanges
13	Assembling timing belt, rotation disk, electrical connections
14	EP-bench, EP as described
15	Pre-cleaning,
16	US, conducted rinsing
17	High pressure rinsing
18	Drying Class 10, over night
19	3 High pressure rinsing
20	Drying Class 10, over night
21	2 High pressure rinsing
22	Drying Class 10, over night
23	Install antenna, mass spectrum
24	Hand over to insert, vertical cold test



Workflow inside DESY cleanroom for cavity preparation => ELECTRO-POLISHING



Proposal for a cleanroom lay out with minimum cross contamination by cavity work flow

Proposal for optimized clean room lay out

For optimal cavity treatment the clean room should have

- **U-turn ground plane. ➔**
  Supply and maintenance areas are accessible from outside.
- **Air supply by FFU (Filter Fan Unit). ➔**
  minimum interrupts during failure / minimum recovery time
- **Independent air supply for chemistry ➔**
  chemical areas are disconnected ; optimized safety
- **Minimized way's ➔**
  reduced cross contamination / no "backward" transport

Failure rate of components and infrastructure downtime

[total down time in working days]

year	2000 failure	2000 days	2001 failure	2001 days	2002 failure	2002 days	2003 failure	2003 days	2004 failure	2004 days
Cleanroom	3 times	5	5times	14	2times	20	5times	21	5times	35
Chemistry	9times	42	2times	11	2times	25	4times	27	2times	40
Reverse osmosis	2times	2	2times	11	4times	40	5times	34	2times	31
Ultrasonic bath	3times	9	1 time	11	1time	20	4times	28	0	0
HP - rinsing	7times	31	3times	122	2times	37	5times	40	4times	44

Reliability of the ultra pure water system

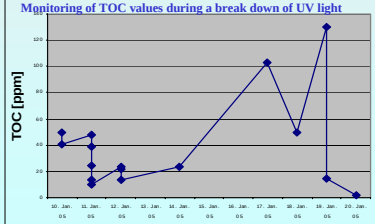
EVENT	EVENT	ORIGIN	RESULT	RECOVERY TIME
HPR Broken diaphragm	1 / 12 years	HP-pump steering	oil in system	16 weeks
HPR Broken filter	6 / 12 years	installation	particle contamination	6 weeks
HPR hardware of HP stand	2 / 12 years	wear out	mechanic blocked	12 weeks
bacteria contamination	1 / 12 years	monitoring	broken UV lamp	8 weeks
plumbing	3 / 12 years	vibrations	Particle contamination	6 weeks
maintenance on Filter	1 / 1 year	live time	particle contamination	2 weeks

Technical data of the DESY cleanroom infrastructure

	Total m³ / h	Class 10 / 100 m³ / h	Class 100 Oven m³ / h	Class 10000 chemistry+ assembly m³ / h	Exchanged air m³ / h	installed electrical power
Clean room circulating air	158 000 for a total of (300 m³)	126 000 for 20 m² (10) 80 m² (100)	13 000 for 9 (m²)	16 000 for 190 (m²)	2 400	100 kW

Utility	Technical data	capacity	Electrical power
Reverse osmosis	1,2 – 2,5 µS / cm	1,4 m³ /h	10 kW
Air condition Chiller I	10 - 6 °C	230 kW	60 kW
Air condition Chiller II	10 - 6 °C	150 kW	35 kW
Chiller chemical treatment (BCP)	15 – 1 °C	40 kW	13 kW 0
High pressure rinsing pump	25-200 bar operating pressure 100 bar	1,2 m³ /h	11 kW

Monitoring of TOC values during a break down of UV light



•During a breakdown in the ultra violet chamber, the TOC level rises to 115 ppb within 7 days.

•After restart the TOC level is normalizes within 24 h.

UP water system installation

Polisher
Inline filter
UV light chamber
Circulating pump

Visualizing laminar flow by N2 air fog for air flow control

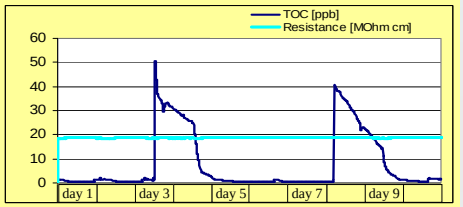
Conditions for clean room class 10
Laminar flow ; air velocity 0,45 m / s

Laminar flow set correctly

Pressure difference set correctly

One van unit cut off and running down
Laminar flow changes to turbulent condition

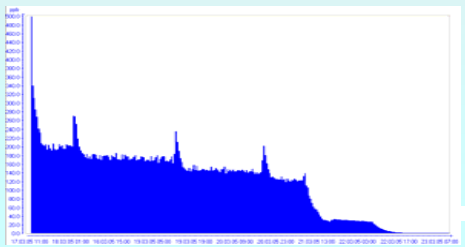
One van unit off and rotates backwards
Laminar flow direction changes to vertical up wards



TOC data for maintenance on polisher ion exchanger

Standard TOC data for maintenance of polisher unit . Recovery time 12h

Quality control of a new supplier for mixed resin 10 times higher TOC data +5 day recovery time



TOC data for qualifying a new supplier for ion exchanger
TOC recovery time 6 days/ Resistance recovery 1h