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## Infrastructure status for XFEL

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## Infrastructure status for XFEL

### Short Summary

- A. Ettore Zanon s.p.a. Company
- B. Company participation to the R&D phase of the XFEL project
- C. Company actual involvement to the XFEL project
- D. Cavities production lay-out and Infrastructures
- E. Production toolings
- F. Target schedule
- G. Conclusion



The company was founded in 1919  
It is located in the North-east of Italy  
90 KM from Venezia  
Number of personnel 140  
Shop's workers 100  
Machining , forming , welding and testing facilities



Standard production for chemical industry  
(reactors, heat exchangers)

Production of special components  
for research institutes and laboratories  
(UHV , cryogenics , Fusion ,  
Superconductivity )



# Infrastructure status for XFEL (A)

Standard productions

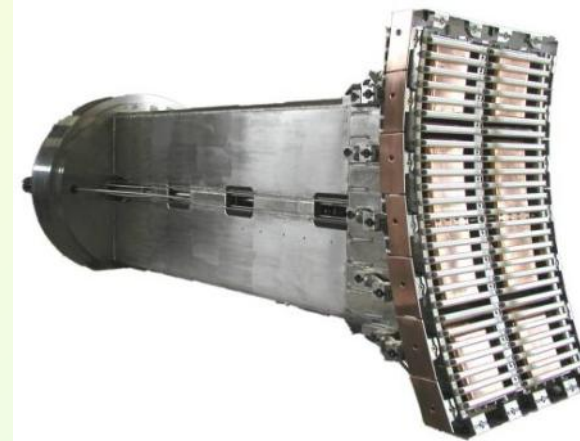


Oxychlorination reactor -Cladded material  
Dimension Dia. 4,1 m X L. 20m , 165 Tons



Orbital welding of heat exchanger tubesheet  
Material S.S. And Zirconium

Special components for research



ITER like ICRH antenna – 8 MW RF antenna (Inconel 625)  
EFDA-JET



Aluminium thermal shield for the ATLAS detector at CERN



## Infrastructure status for XFEL

(B)

Participation to the R&D phase of the XFEL project to develop and manufacture critical components

- Development and manufacture of the cryomodules and assembling tooling ( 10 units supplied )
- Development and manufacture of 1,3GHz superconducting cavities (66 units supplied - performances above 30MW/m))
- Development and manufacture of the 3,9GHz superconducting cavities (3 units)
- Manufacture of the Titanium helium tanks (111 units supplied)
- Manufacture of the titanium blade tuner (16 units , alternative design solution to the standard tuners)



## Actual involvement to the XFEL project

## August 2010

Award of a DESY contract to manufacture and treat 300 units of the 9 cells , 1,3GHz superconducting cavities



## Scope of work includes :

- Manufacture of the 1,3GHz , 9 cells cavities
- Manufacture of their Titanium Helium tanks
- Integration of the cavity into its titanium helium tank
- Treatments and Surface cleaning treatments (BCP , electropolishing , HPR , 800°C vacuum annealing , 120°C backing ecc.ecc) as per DESY specifications
- Components manufacture and certification according to PED (Presssure Equipment Directive)
- Delivery production rate (for serial production) 3 units/week

## Cavities production lay-out and Infrastructures

- To fulfill the contractual requirements decision to separate this production from others Ettore Zanon s.p.a. production and strong effort to study and optimize the production lay-out
- Cavities production into two dedicated buildings , building lot I and building lot IV
- Building lot I  
prefabrication of cells , dumb-bell , subassemblies , end groups  
EB welding , chemistry
- Building lot IV (renewed building)  
Final cavity welding , integration with Helium tank , surface treatments

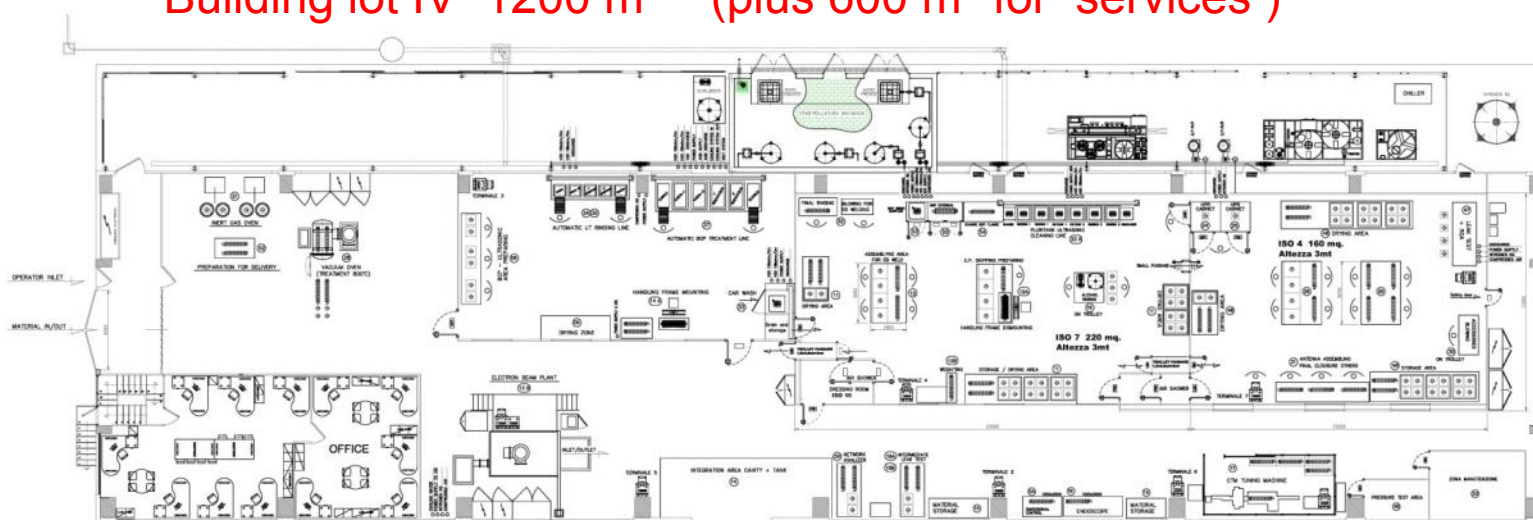
(Prefabrication of the titanium Helium tank in the “standard” shop)

## Production lay-out

Building lot I about 600 m<sup>2</sup>

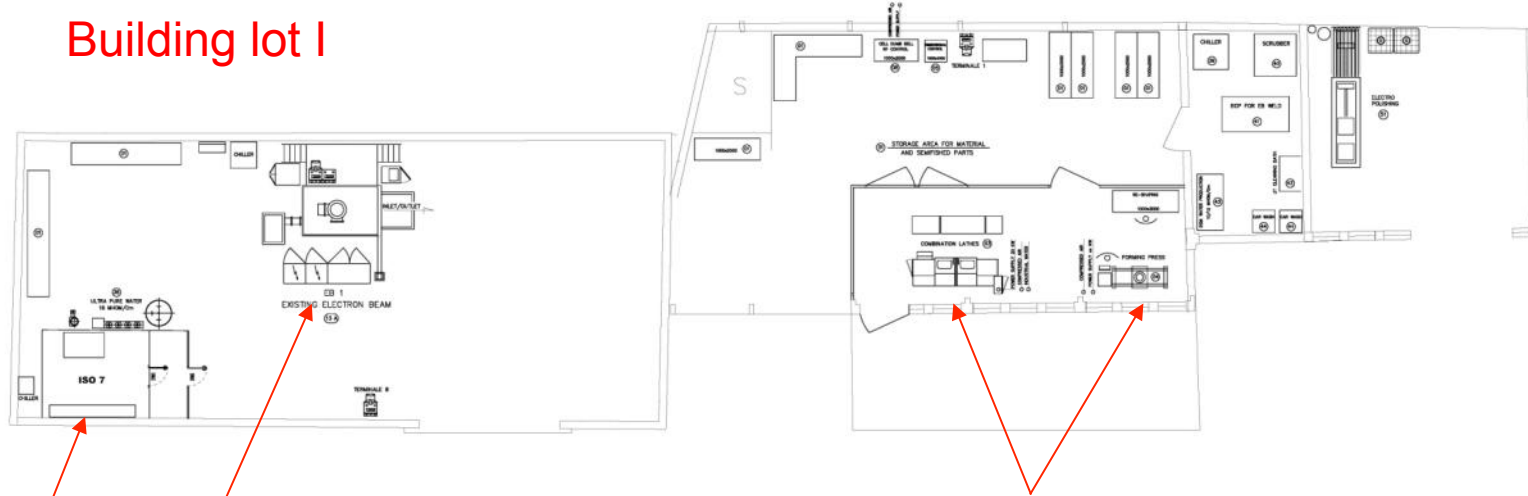


Building lot IV 1200 m<sup>2</sup> (plus 600 m<sup>2</sup> for services )





Building lot I



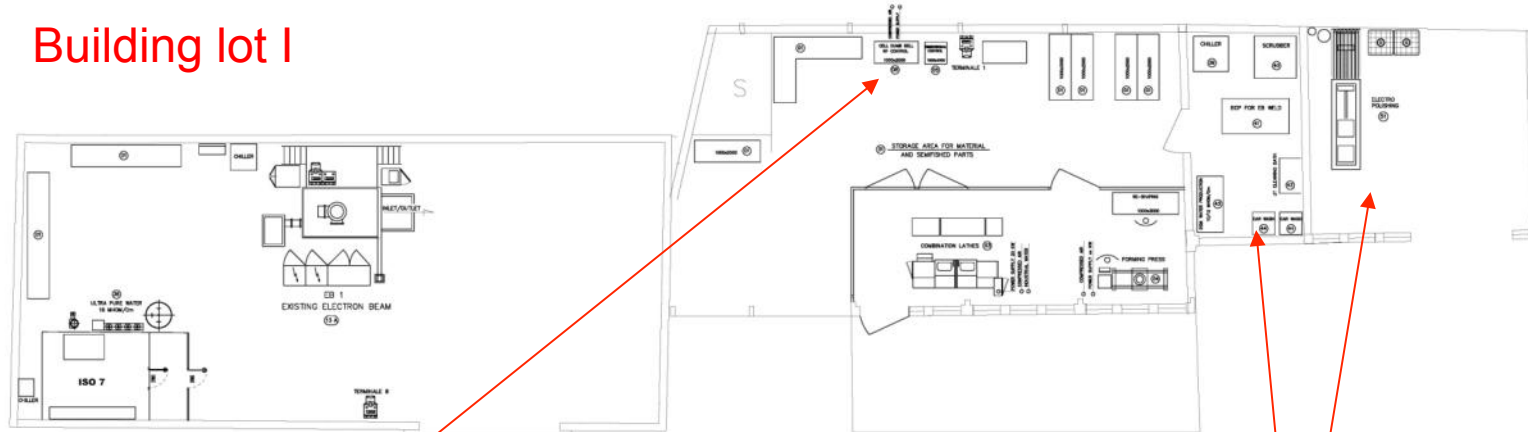
Dedicated 200T forming press (cells , tube's pulling , reshaping )  
 CNC turning machine (cell Dumb-bell machining, others)

Electron beam plant , 150KV-30KW – retrofitting for new pumping units with  
 cryogenic pump

Clean room ISO7  
 UPW production unit (18MΩcm)



## Building lot I



Frequency control of cells / Dumb bells  
(Desy equipment. Hazemema machine)

Chemistry and Electropolishing  
areas



## Building lot IV

The building shall be completely “restored” for this production with installation of central conditioning system too (clean environment)

Into the building

Designed–optimized lay-out for the production sequence

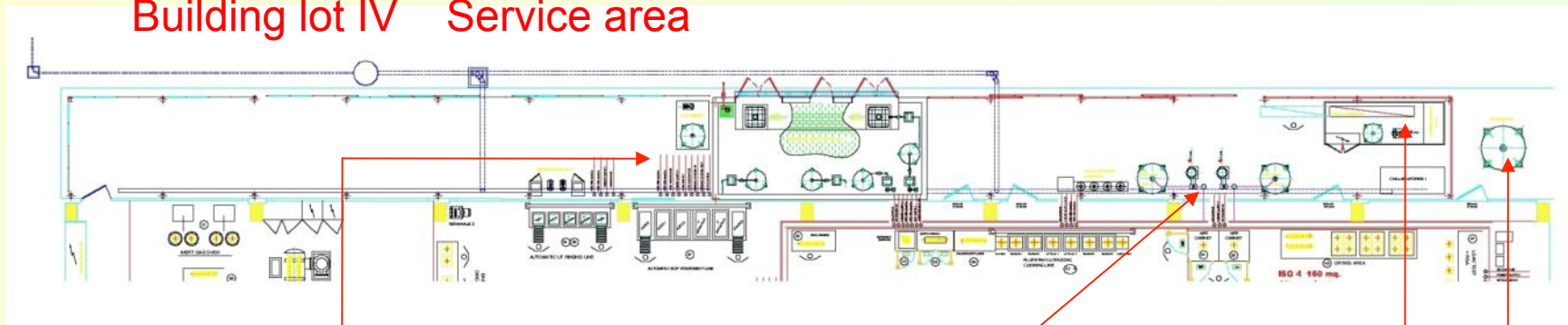
Organization by manufacturing/testing station (MTS) located to suit the production flow

Outside of the building

“Service area” to concentrated all the equipments/services for the MTS

## Infrastructure status for XFEL

### Building lot IV Service area



Chemistry service area : storage of BCP acid , tanks-cooling systems for BCP stations  
Scrubber for acid gasses vent

Pumps (water 18 MΩcm , >100 bar 1,5 m<sup>3</sup>/h ) for High Pressure Rinsing cabinets

Ultra pure Water (UPW ) production plant : production up to 3m<sup>3</sup>/h at 18 MΩcm , 5m<sup>3</sup>/h at >10 MΩcm two distribution loop for 18 MΩcm and 10 MΩcm

Others

Storage tank for LN2 (venting of EBW machine )



## Infrastructure status for XFEL

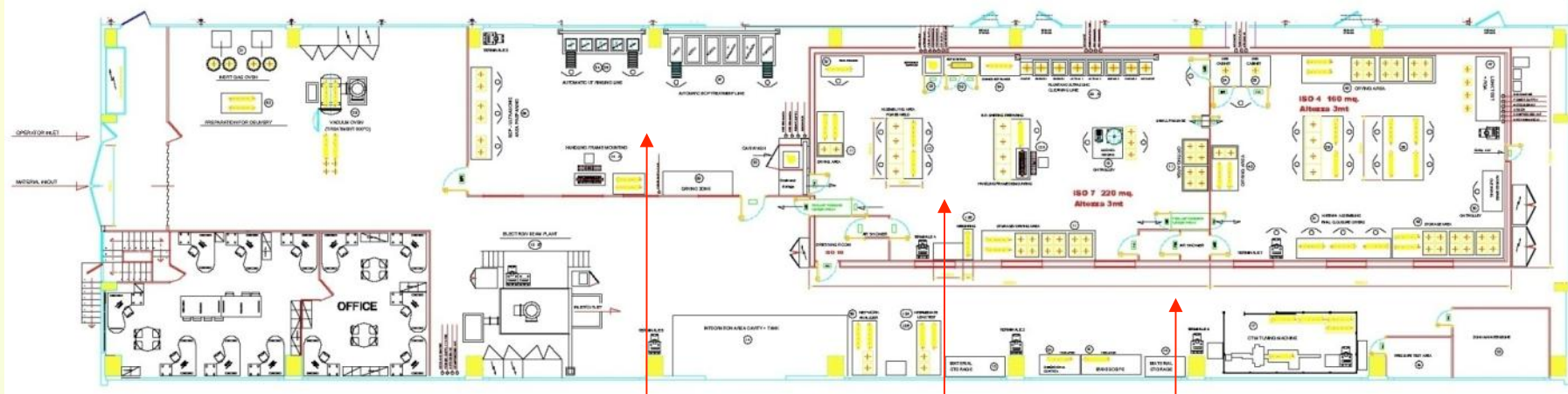
(D)

Building lot IV Service area

Civilian works in progress



## Building lot IV

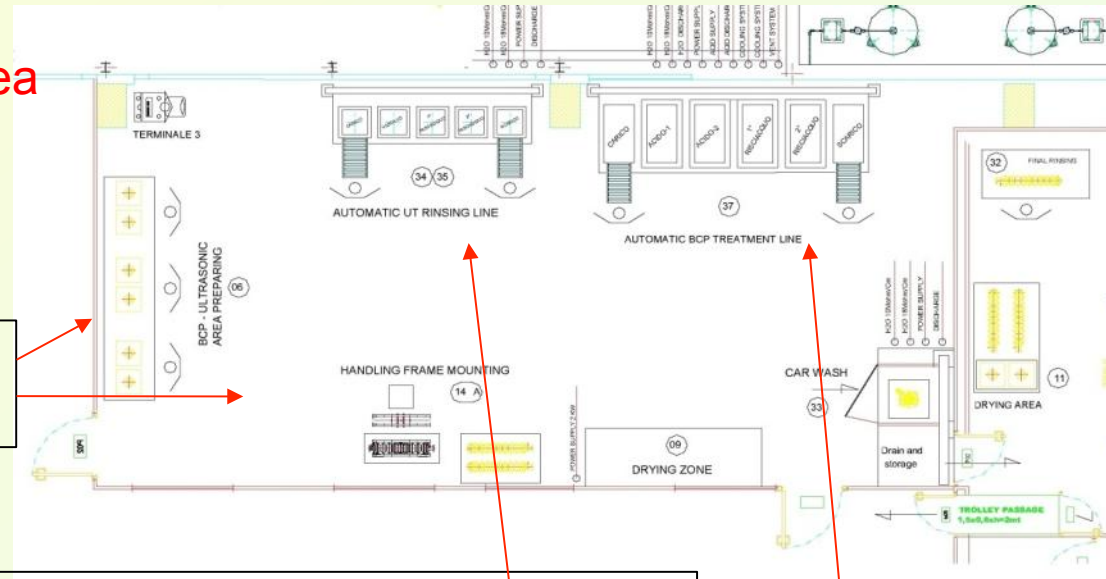


The building is organized in three main areas

- A) Chemical treatment area
- B) Clean room ISO7/ISO4
- C) Control , Integration , 800°C -120°C treatments and testing area

Building lot IV  
Chemical treatment area

Preparation and drying areas



Automatic pluritank station for UT cleaning , rinsing water 10 MΩcm and 18 MΩcm

Automatic BCP treatment line  
 2 cooled acid baths for Niobium and Nb-55-Ti  
 1 bath first rinsing 1 bath final rinsing  
 water 10 MΩcm and 18 MΩcm  
 protection tunnel ,fumes extraction to the scrubber

## Building lot IV Clean room ISO7/ISO4



Dedicated to  
clean assembling , final surface treatments , final assembling for the RFcold test

Total surface of about 400 m<sup>2</sup>

ISO7 area 200m<sup>2</sup> ISO4 area 180m<sup>2</sup>

Operators dressing rooms , 2 air showers

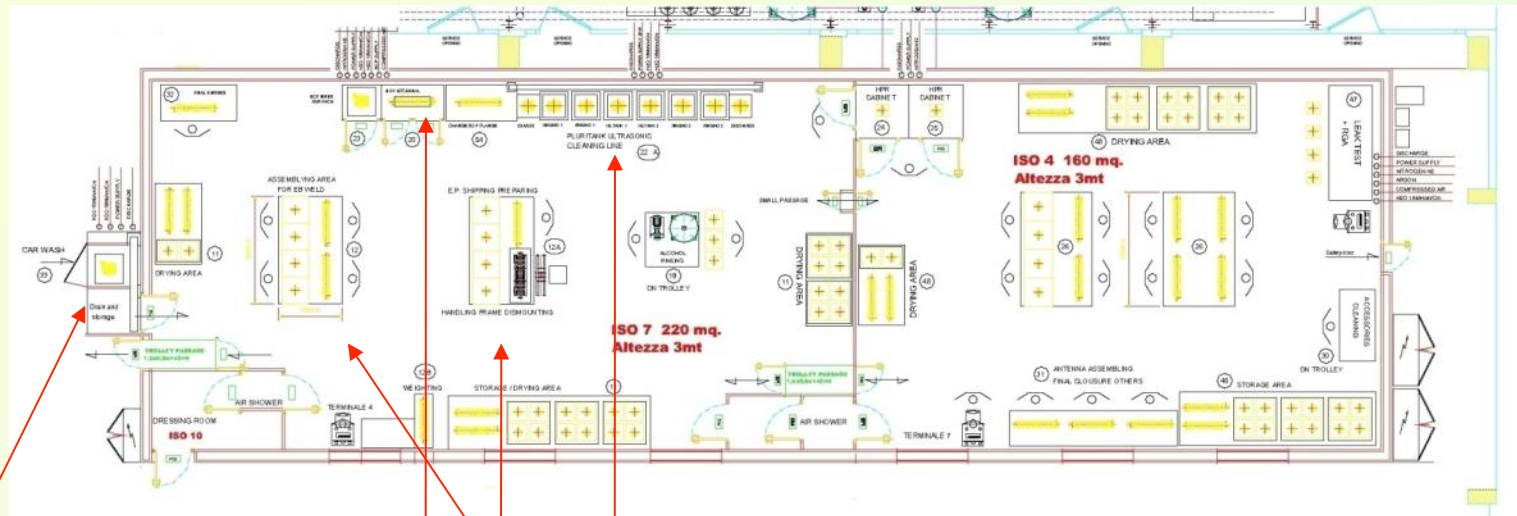
All metallic floating floor

Customized treatment stations



## Building lot IV Clean room ISO7/ISO4

### ISO 7



100 bar UPW cleaning cabinet for ISO7 entrance

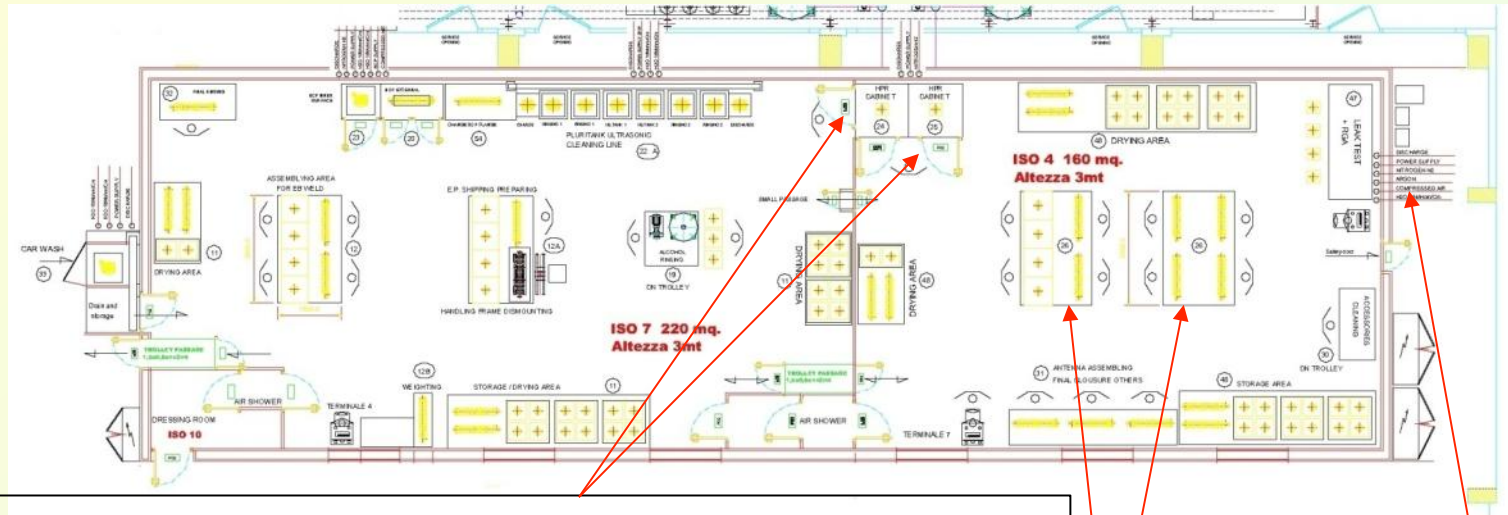
Pre-assembling stations for cavity EBW preparation

Cabinets for BCP close circuit of the inner / outer cavity surfaces

Automatic pluritank station for cavity cleaning  
 2 UT cleaning baths , 2+2 rinsing baths  
 water 10 MΩcm and 18 MΩcm

Alcohol rinsing , Others

## Building lot IV Clean room ISO7/ISO4



ISO 4

N° 2 cabinet for final HPR  
 UPW 18 MΩcm water , >100bar , 1.5m<sup>3</sup>/h  
 Cavity's rotation , vertical translation Nitrogen overlay

Assembling stations for  
 FMS installation - RF antennas assembly

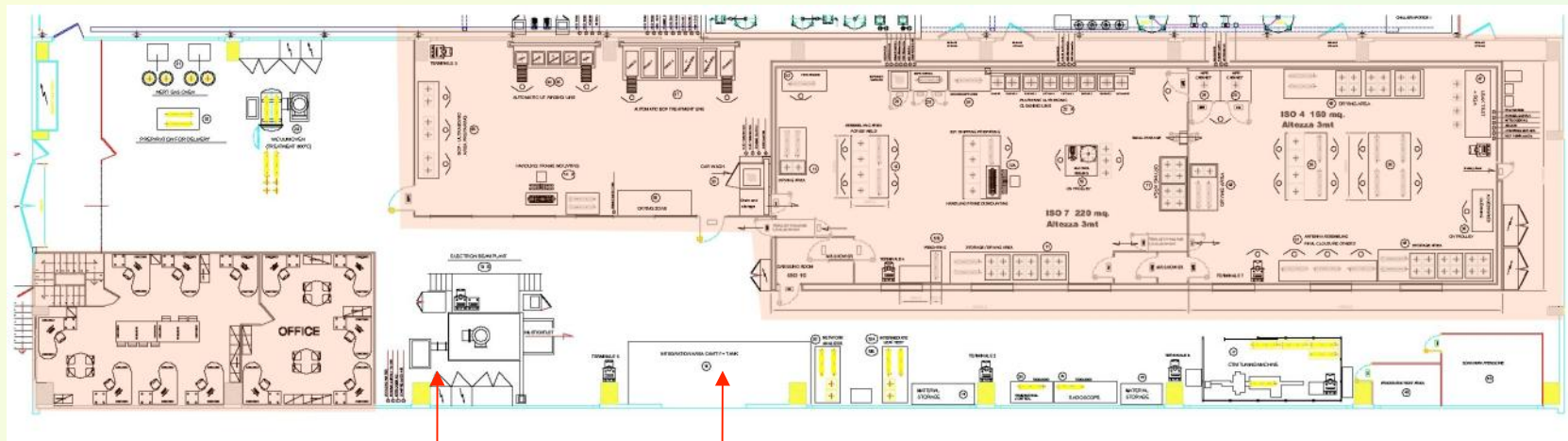
Others

Station for final leak test  
 special equipments for slow-controlled  
 venting of the cavity

## Building lot IV

Control , Integration , 800°C -120°C treatments and testing area

The area is organized to suit part of the production and control operations  
(good clean environment , not classified)

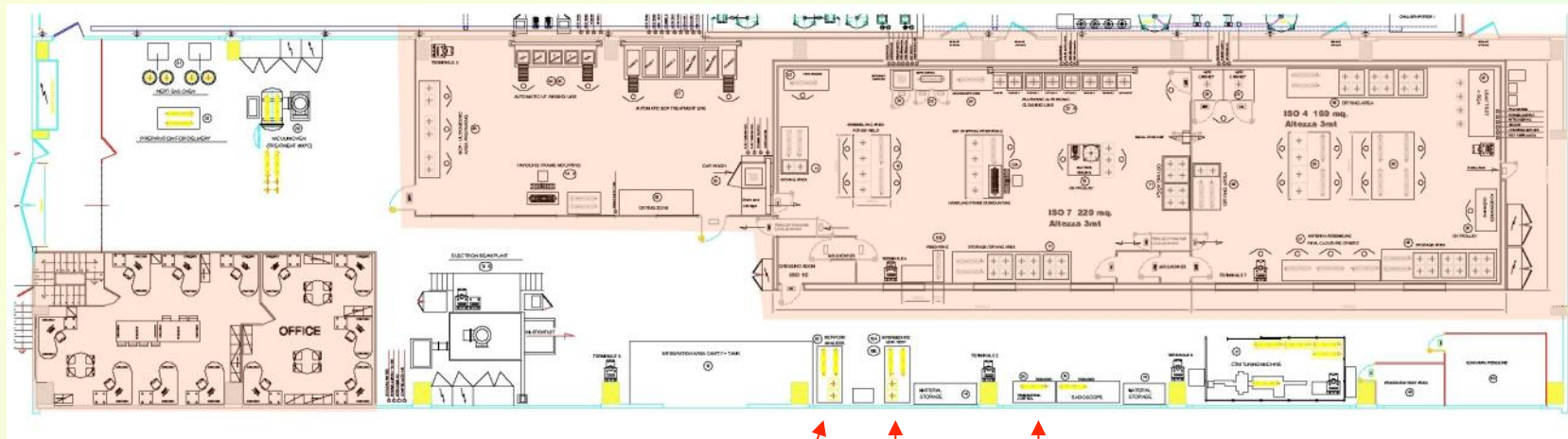


Station with automatic TIG equipment for Cavity-tank final integration

New EB welding plant : S.S. Chamber , size 3,4x2x2 m , oil free pumping group with cryogenic pump ( $3 \times 10^{-5}$  mbar 35 minutes) ,nitrogen venting , RGA

Building lot IV

Control , Integration , 800°C -120°C treatments and testing area



Several control stations for

Frequency check (Network analyzer)

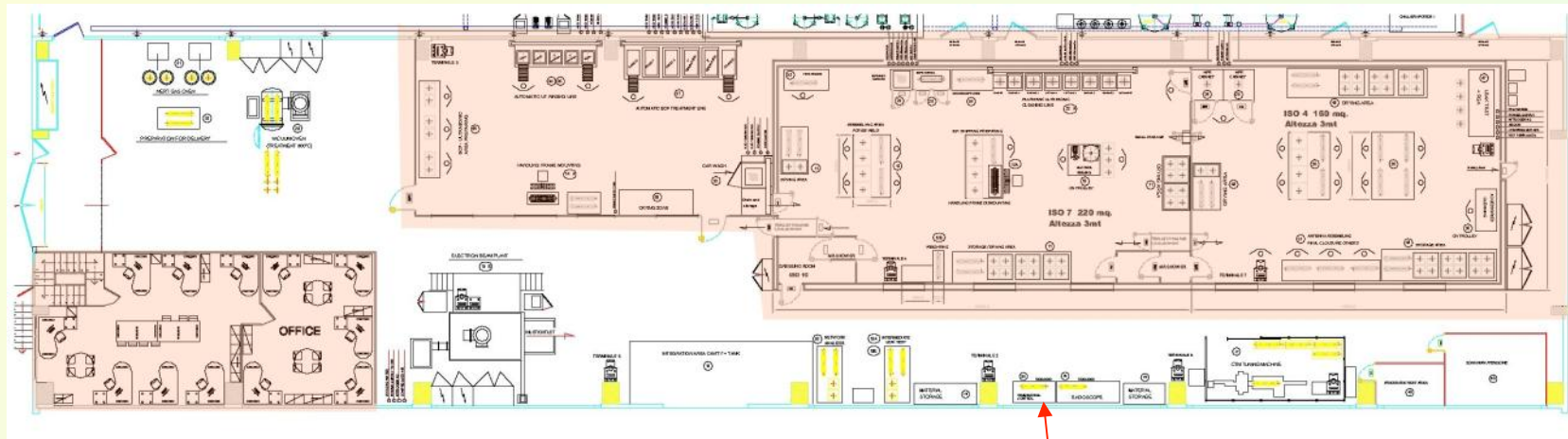
Intermediate leak test (oil free equipments)

CMM , semi-automatic Control Measuring Machine for dimensional survey



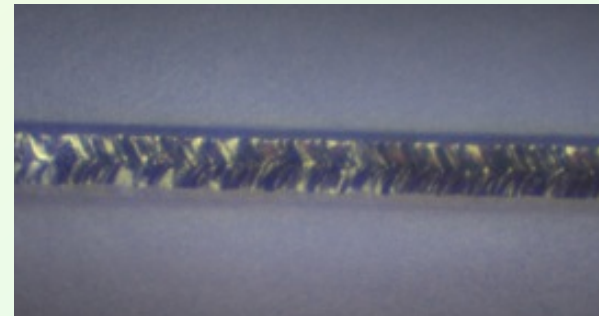
Building lot IV

Control , Integration , 800°C -120°C treatments and testing area

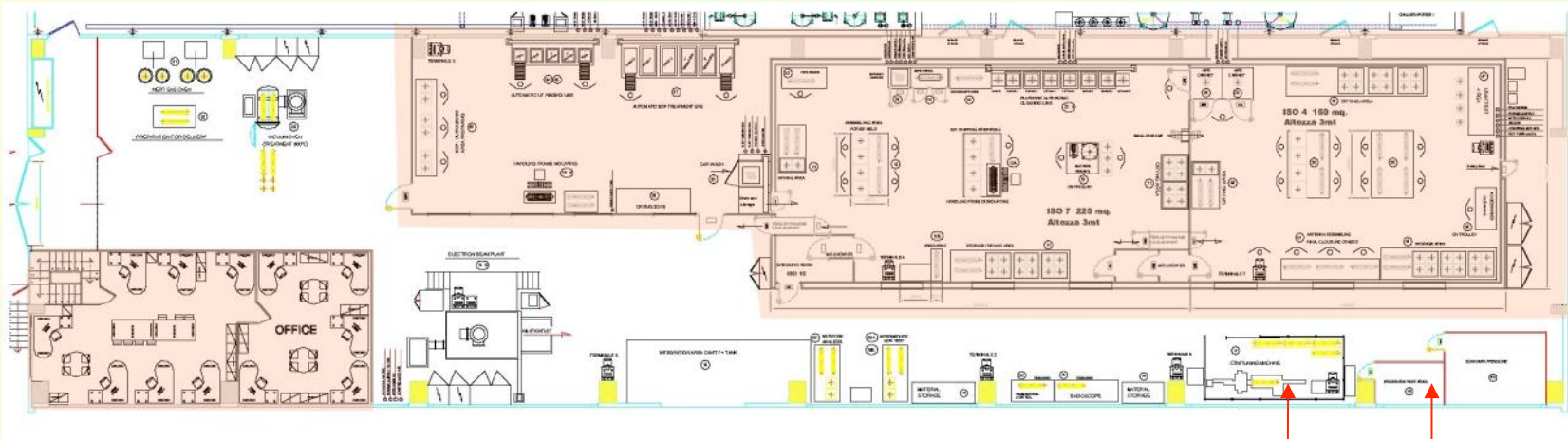


Several control stations for

Visual examination with photo recording of the cavity inner welds and surfaces (endoscope)



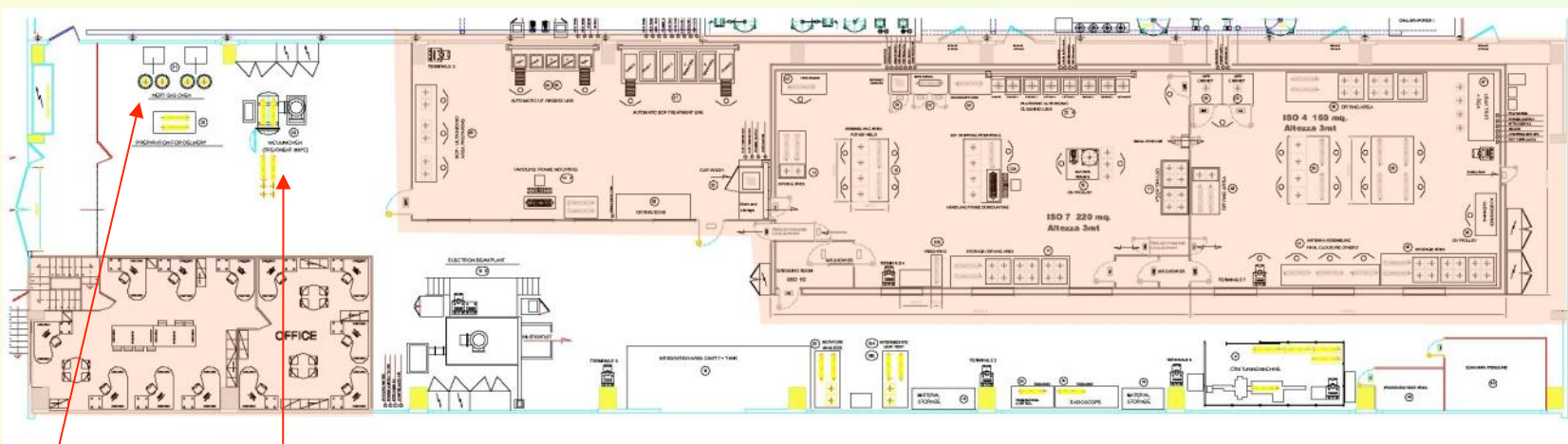
Building lot IV  
Control , Integration , 800°C -120°C treatments and testing area



Dedicated Desy equipment for cavity tuning and frequency controls

Shielded pressure test area (final PED certification)

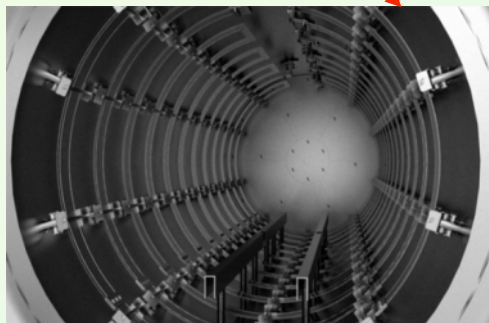
Building lot IV  
Control , Integration , 800°C -120°C treatments and testing area



## Vacuum and inert gas ovens

Vacuum oven for 800°C annealing  
Molibdenum Hot-chamber 0,6x0,6x1,5m  
(4 units per batch) cryogenic pumps , RGA

Inert gas oven for final treatment  
(120°C , 1x10<sup>-5</sup> mbar , 52 Hours)



## Production toolings

Optimization of the production lay-out useless without optimization of the production toolings and manufacturing methods

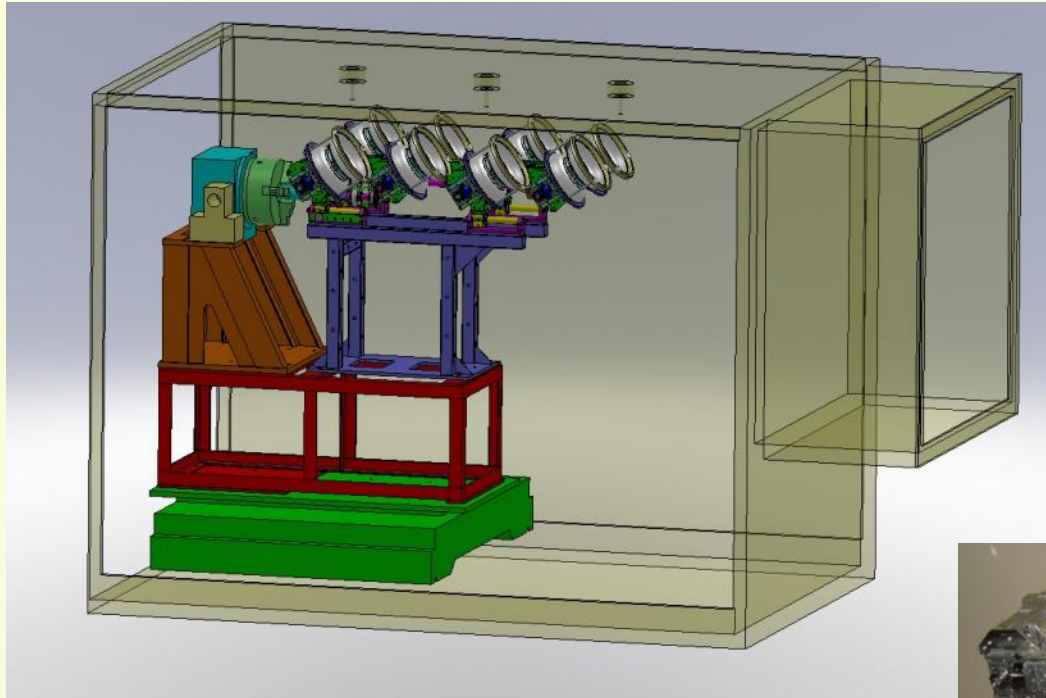
Parallel technical effort to

- improve efficiency of the existing toolings

- Study and test of new sequences

- Design and manufacture new toolings



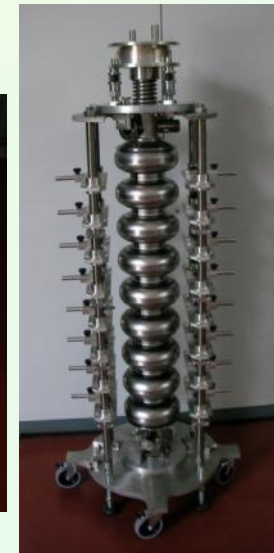


## Electron Beam Welding machines

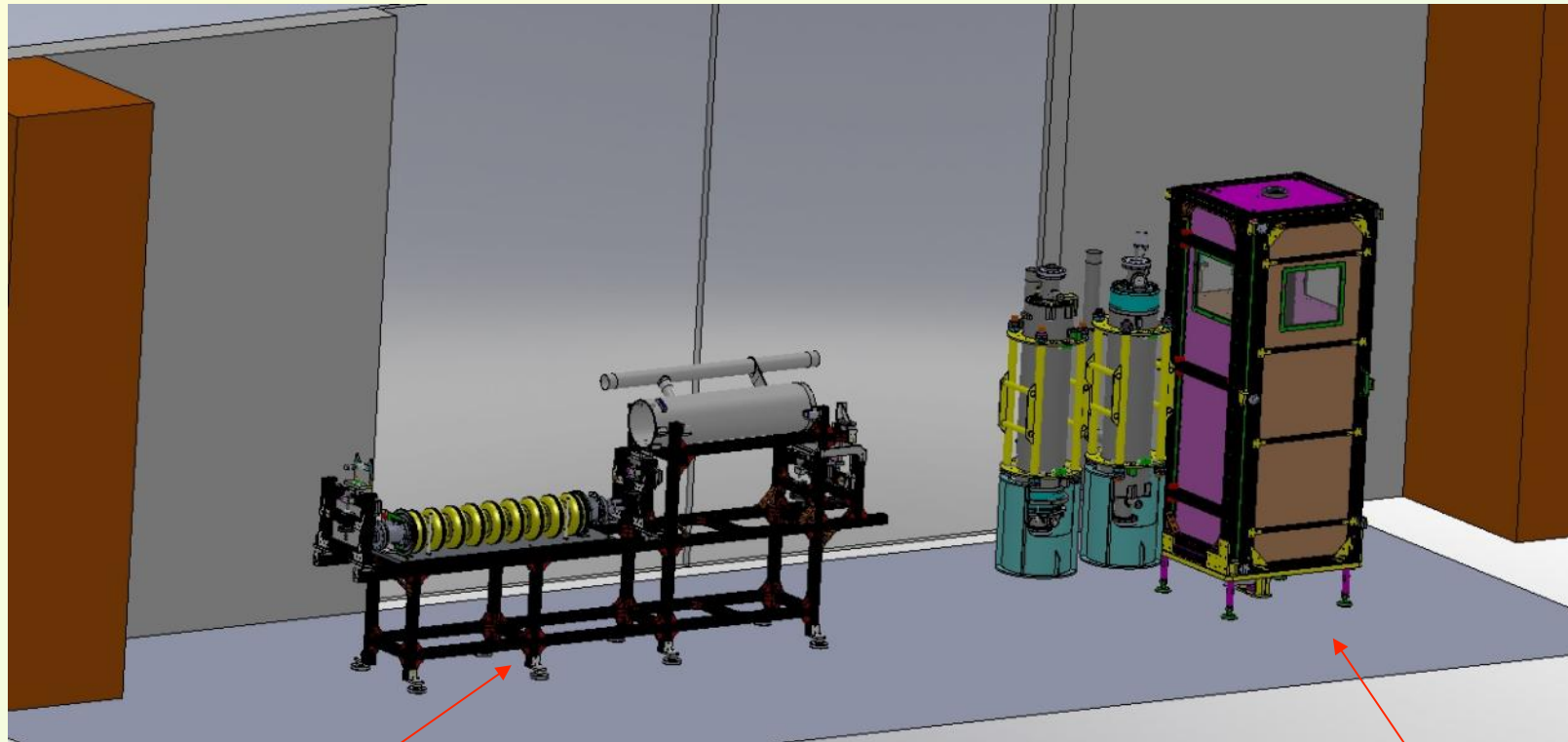
New tooling for multiple loading for the welding operations

Target :

- .Faster items positioning on the device
- .optimization of the machine work-load
- reduction of the pumping dead time per single piece



## Cavity –helium tank integration area / Workstation 14



Alignment-insertion bench

Glove box –automatic TIG welding station

Fast and easy preparation , repeteability of the procedure and quality of the results



## Infrastructure status for XFEL

(F)

### Target schedule

Our effort to prepare the infrastructures necessary for the serial production can be synthesized with the following milestones

- Civilian works (buildings re-conditioning ) ; started –completion by June 2011
- Completion of main equipments contract awards : expected by end March 2011
- Supply of main equipments : partly in progress
- Equipments Installation and commissioning ; expected from June to November 2011 (longest delivery item ; new EB welding machine )
- Production tooling design and manufacture ; expected end October 2011

**Readiness of infrastructure for serial production start  
January-February 2012**

## Conclusion

Ettore Zanon s.p.a. is doing a big effort and investments to organize a dedicated lay-out and optimize production cycles for the production of the 1.3GHz SC cavities

### Company targets

To fulfill requirements of this XFEL contract

To gain and acquire new competitiveness for future similar tasks

## Infrastructure status for XFEL

# END

Thank for the attention