

# Nb/Cu Clad Seamless Cavity R&D in KEK

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# Introduction

- We proposed Nb/Cu clad seamless cavity that has the reliable performance and developing them to the industrialization at the 1<sup>st</sup> ILC Workshop at KEK.
- We have already succeeded in Nb/Cu clad single cavity by Dr.Saito.

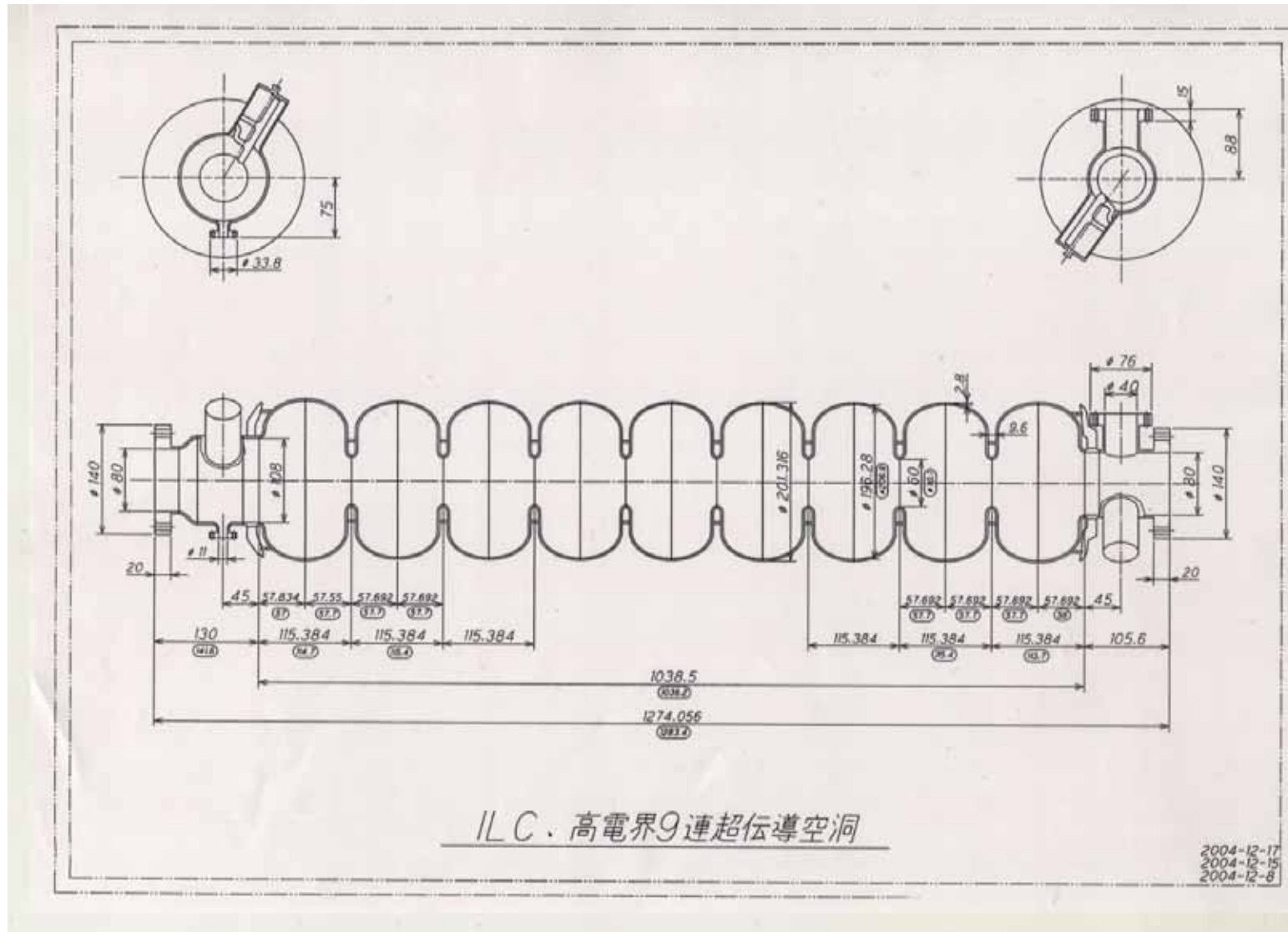
# Outline

- Goal of WG5 ---from MEC point of view
- Responsibility of MEC VS the function of WG5
- Development of the cavity
- The status of New vacuum furnace
- Test equipment :9-cell cavity by hydroforming
- Engineering of EP system in house
- Industrialization of manufacturing for cavity
- Summary

# Goal of WG5—from MEC point of view

- Development of High gradient cavity  
→45MV/m cavity
- Easy tuning of cavity
- Cost reduction of manufacturing
- Easy process for mass production of 21000set cavities

# 9-Cell Cavity



# Responsibility of MEC VS the function of WG5

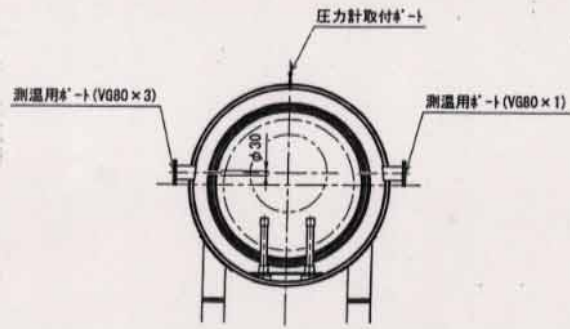
## blue items

- Nb/Cu clad pipe
- Engineering of cavity shape and configuration
- Manufacturing of cavity (Press&EBW and Hydroforming)
- Vacuum furnace (purchase, test run and operation)
- Engineering of EP system for the cavity in house
- Tuning of the cavity
- Assembly of the cavity
- Evaluation of rf performance at vertical style
- Nb/Cu clad seamless cavity
- Manufacturing of cryostat of high gradient
- Development of input coupler for high power
- Evaluation of the performance of  
module/modulator/cryotron
- High pressure rinse

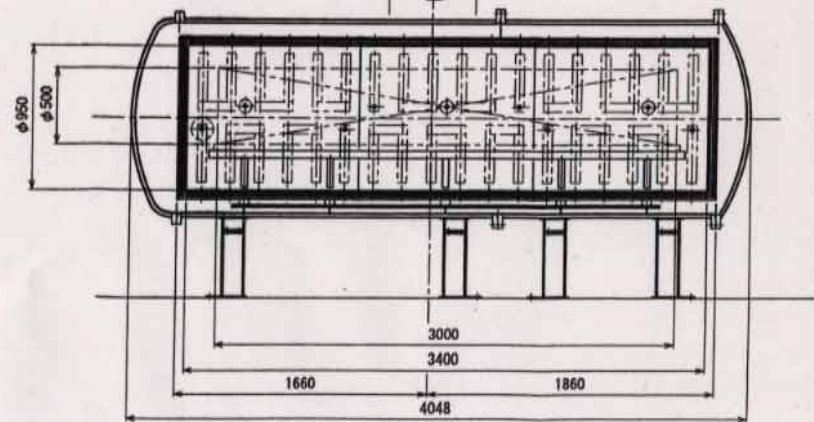
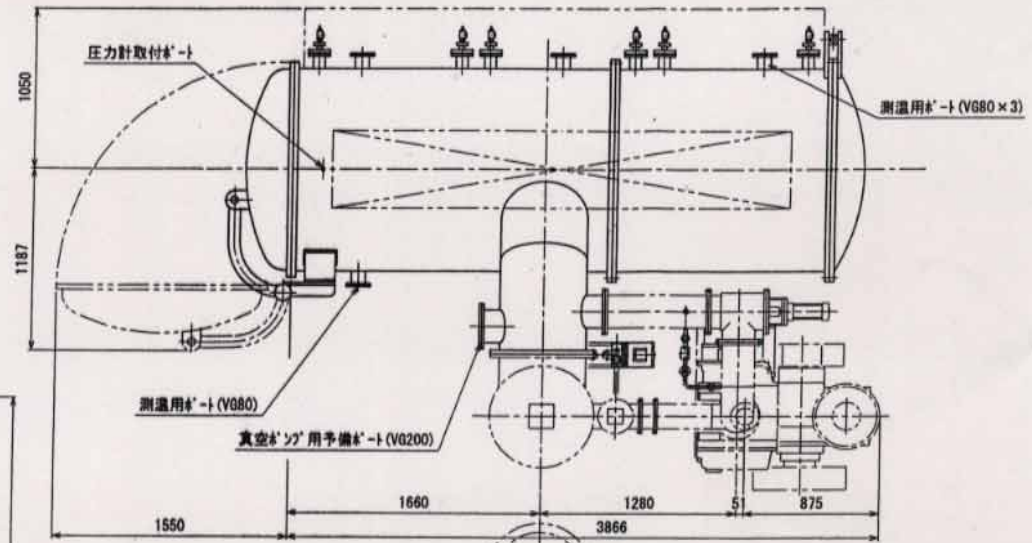
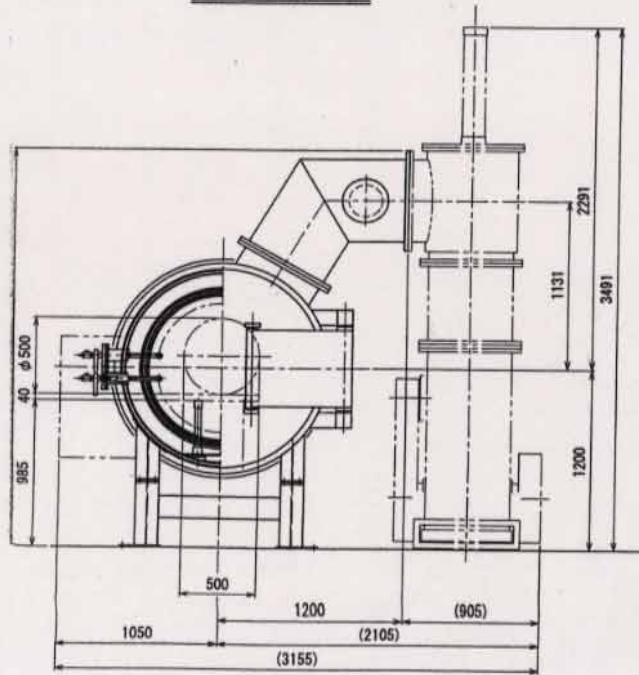
# Development of the cavity : action plan ( 1 )

- \* **New facility of vacuum furnace**  
3 m class annealing vacuum furnace  
for Nb/Cu clad pipe

On April '05 we will start the 1<sup>st</sup> batch  
and will prepare the jig for pipe  
handling.

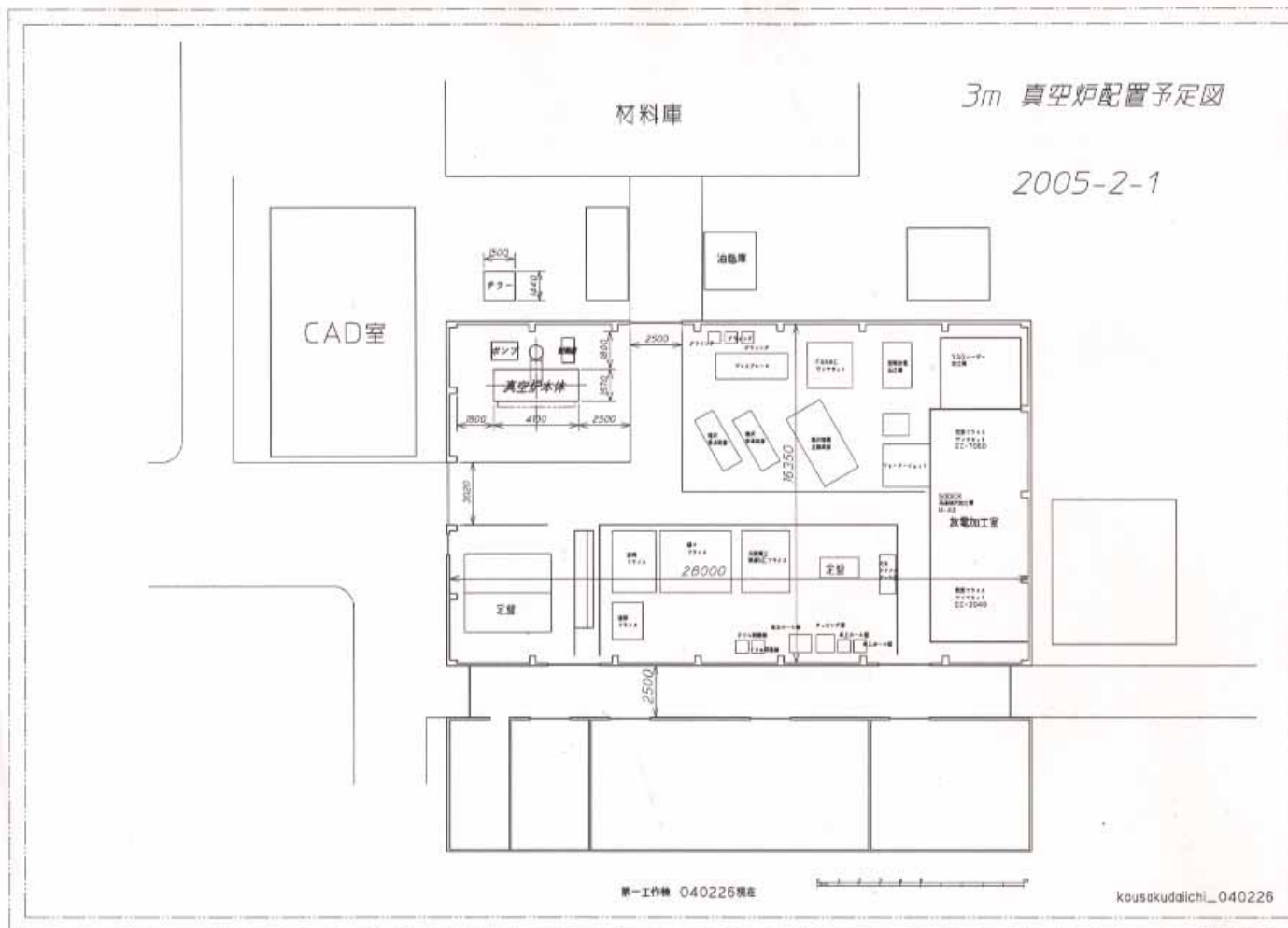


測定用口取付位置





# Layout of New Vacuum Furnace in MEC 1<sup>st</sup> Factory



# Development of the cavity : action plan (2)

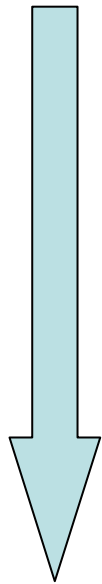
## \* Hydroforming for 9-cell seamless cavity

How to approach this issue

- Review the technology on single cavity
- To do the essential test and concurrent engineering for hydro forming to save the time
- To develop dedicated machine tool which is useful hydroforming for 9-cell cavity

# Main process of Hydroforming

Clad Pipe



Necking

Annealing

Hydroforming

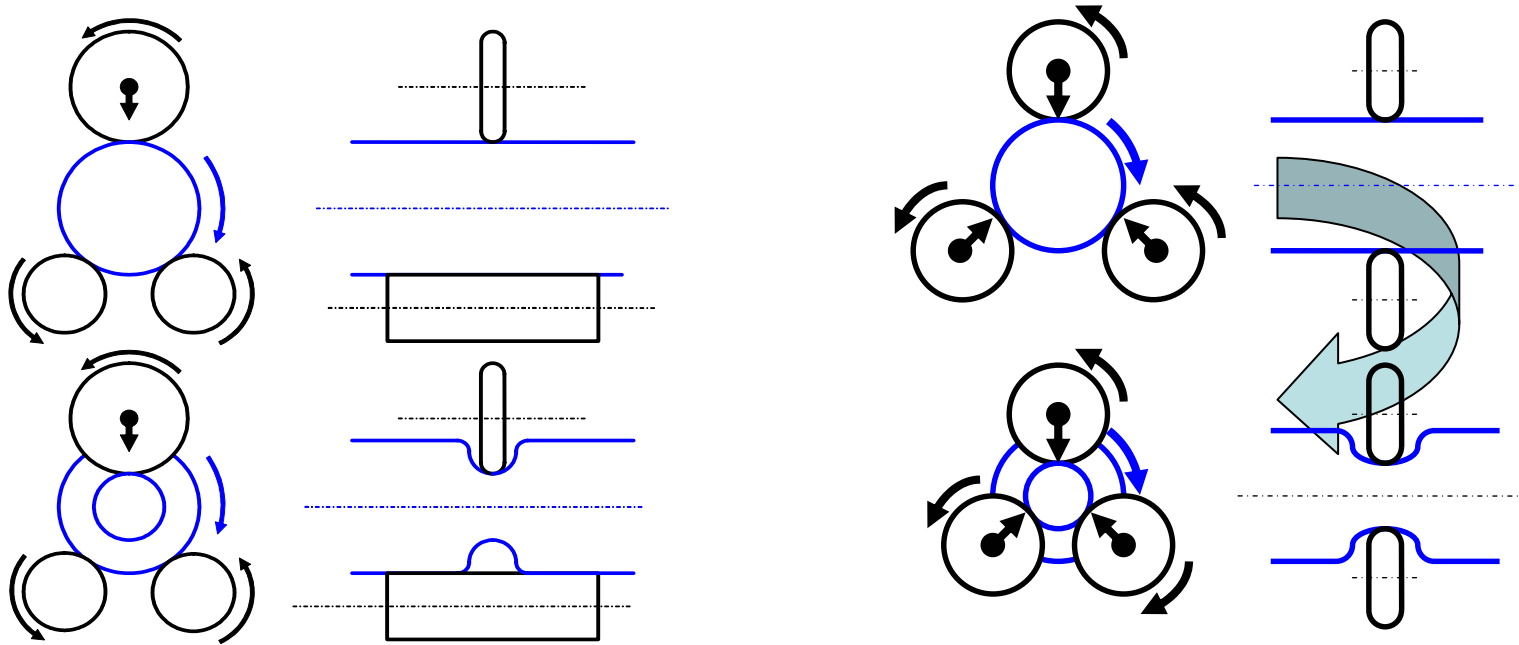
(Intermediate Annealing)

CAVITY SHAPED

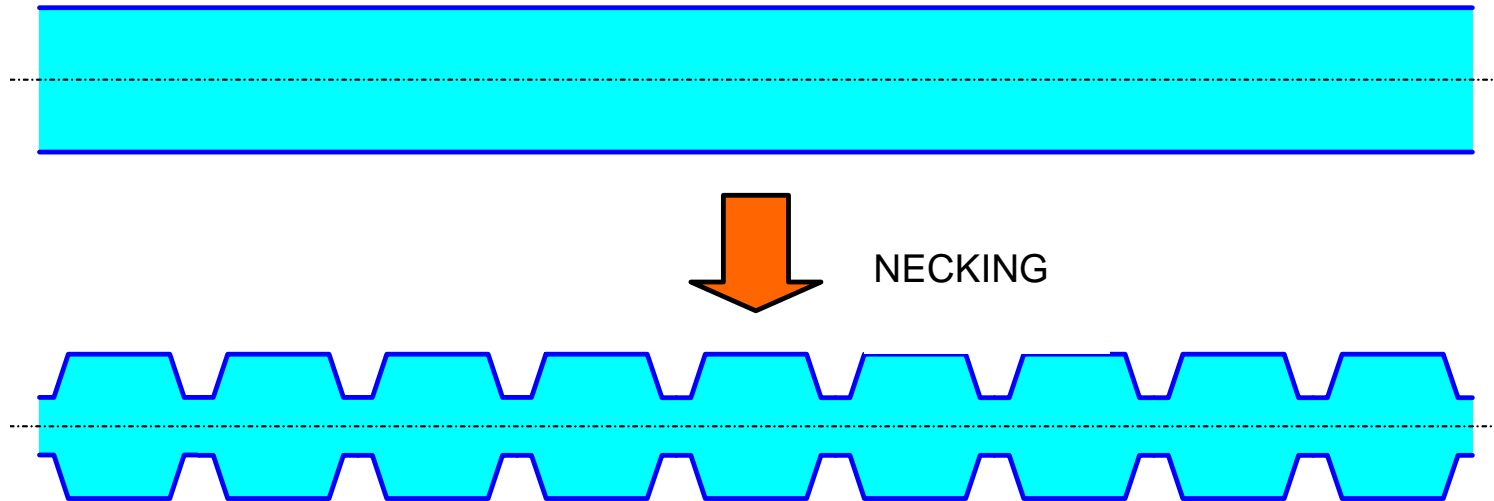
# Hydroforming for Nb/Cu Clad pipe ---Single Cell---



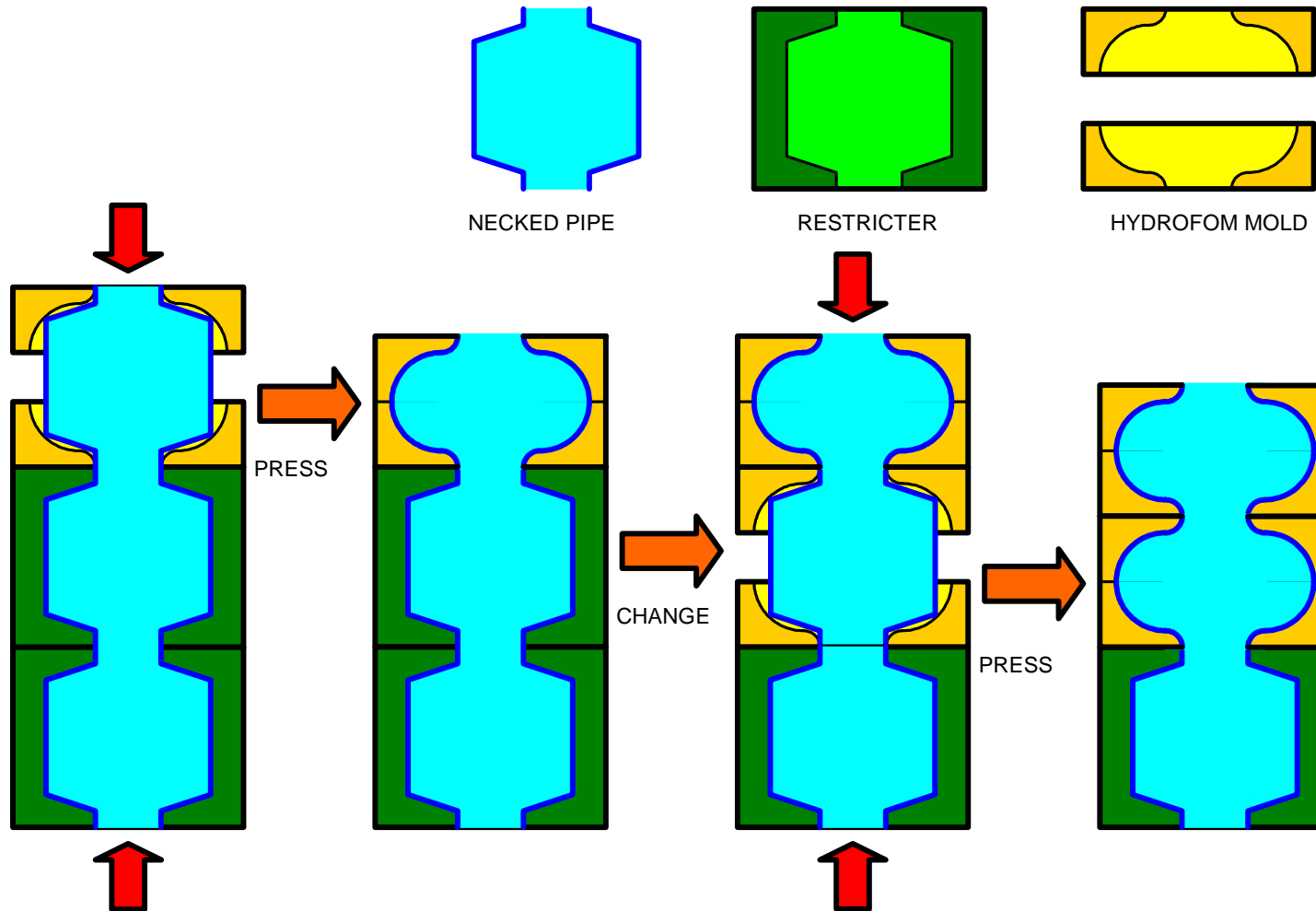
# Necking Method



# Necking Process



# Hydroforming Process

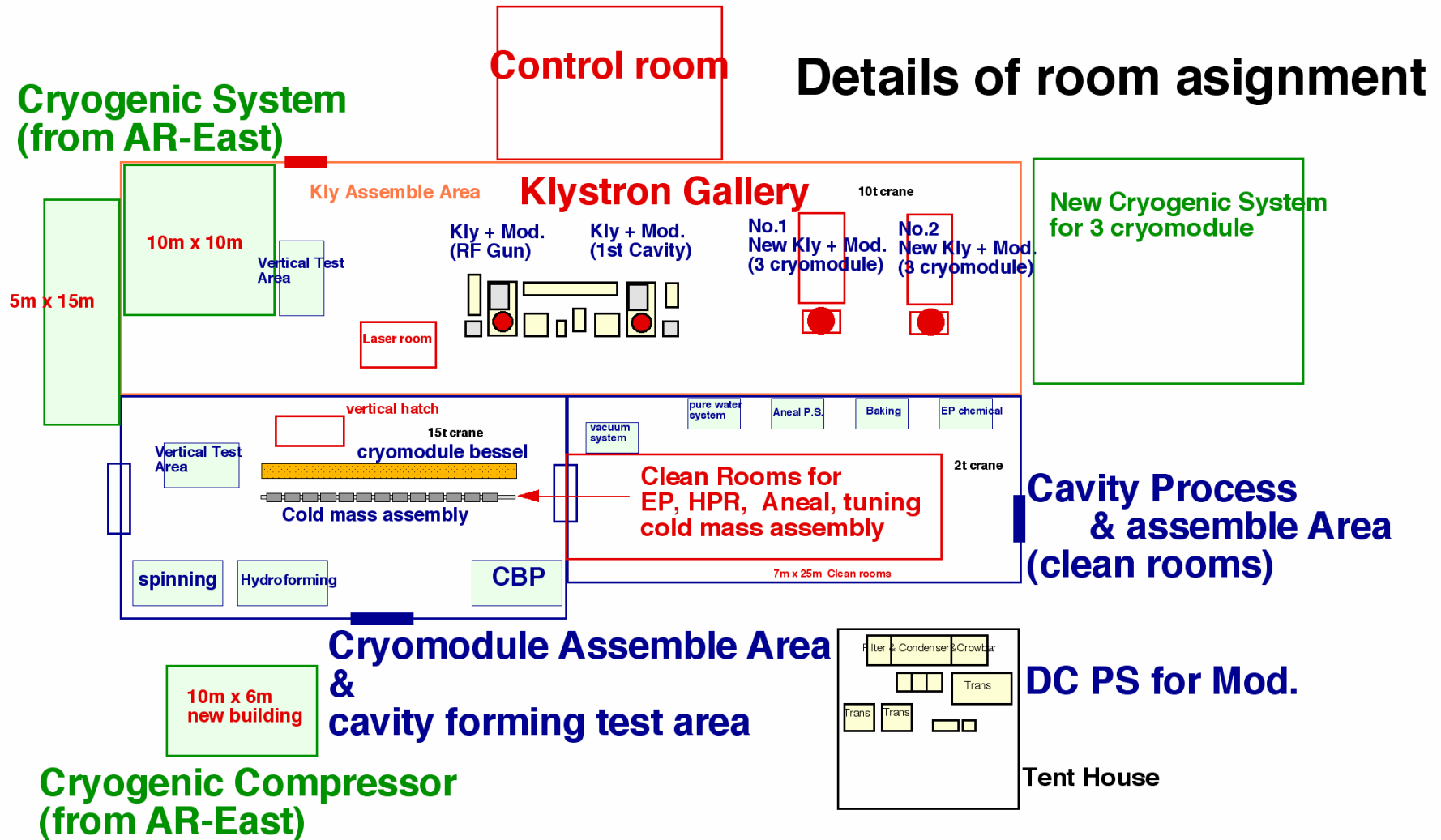


# EP System for Cavity

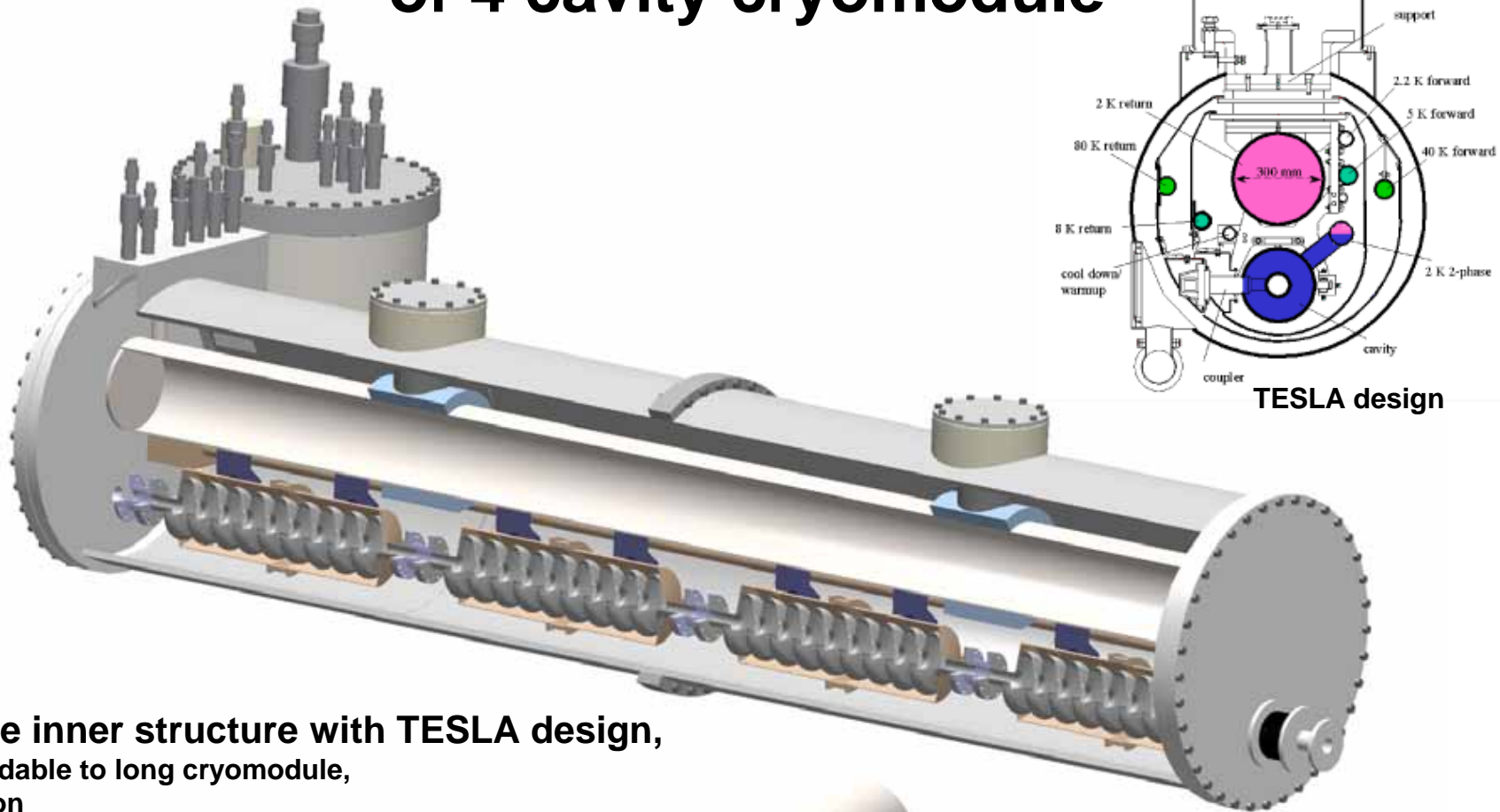
- Concept of EP system
  - Safety
  - Reliable process
  - Clean atmosphere
- Build up model room



# Plan of Superconducting RF Test Facility(STF)

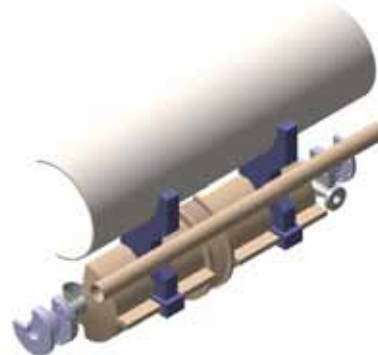


# Conceptual design of 4 cavity cryomodule



**Same inner structure with TESLA design,  
Extendable to long cryomodule,  
R&D on**

**Input coupler improvement,  
Cavity rigidity improvement,  
Tuner mechanism improvement,  
Alignment accuracy improvement,  
Maintainability improvement,  
Cost reduction,  
Industrialization .....**



# Strong point of Nb/Cu clad cavity

- **Higher Gradient**

- \* Better heat transfer

- \* Keep bulk properties,

To demonstrate these strong points ,we will build the EP system and test facility at KEK.

- **Cost Reduction**

- \* Less niobium material

- \* Elimination of major EBW

1/3 cost of Nb & EBW method by our estimation

# Industrialization

- Making sure the all process
- Engineering for cavity itself and machine tool
- Collaboration with expert venders to communicate on new technology of cavity
- Training of the young personel
- Estimating the cost of the cavity and consideration of cost down on the cavity

# Summary

- KEK has successfully developed Nb/Cu clad single cavity.
- To apply our technology to the 9-cell cavity, MEC is engineering the 3m length furnace which will be useful for annealing of the clad pipe.
- We are planning on EP system in 2005.
- And we are developing hydroforming for 9-cell seamless cavity.