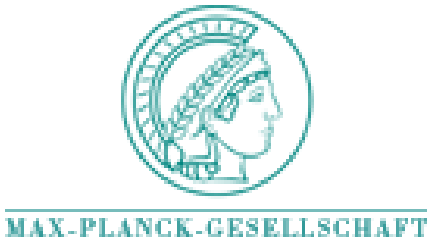

IBBelle (CO_2 Cooling)

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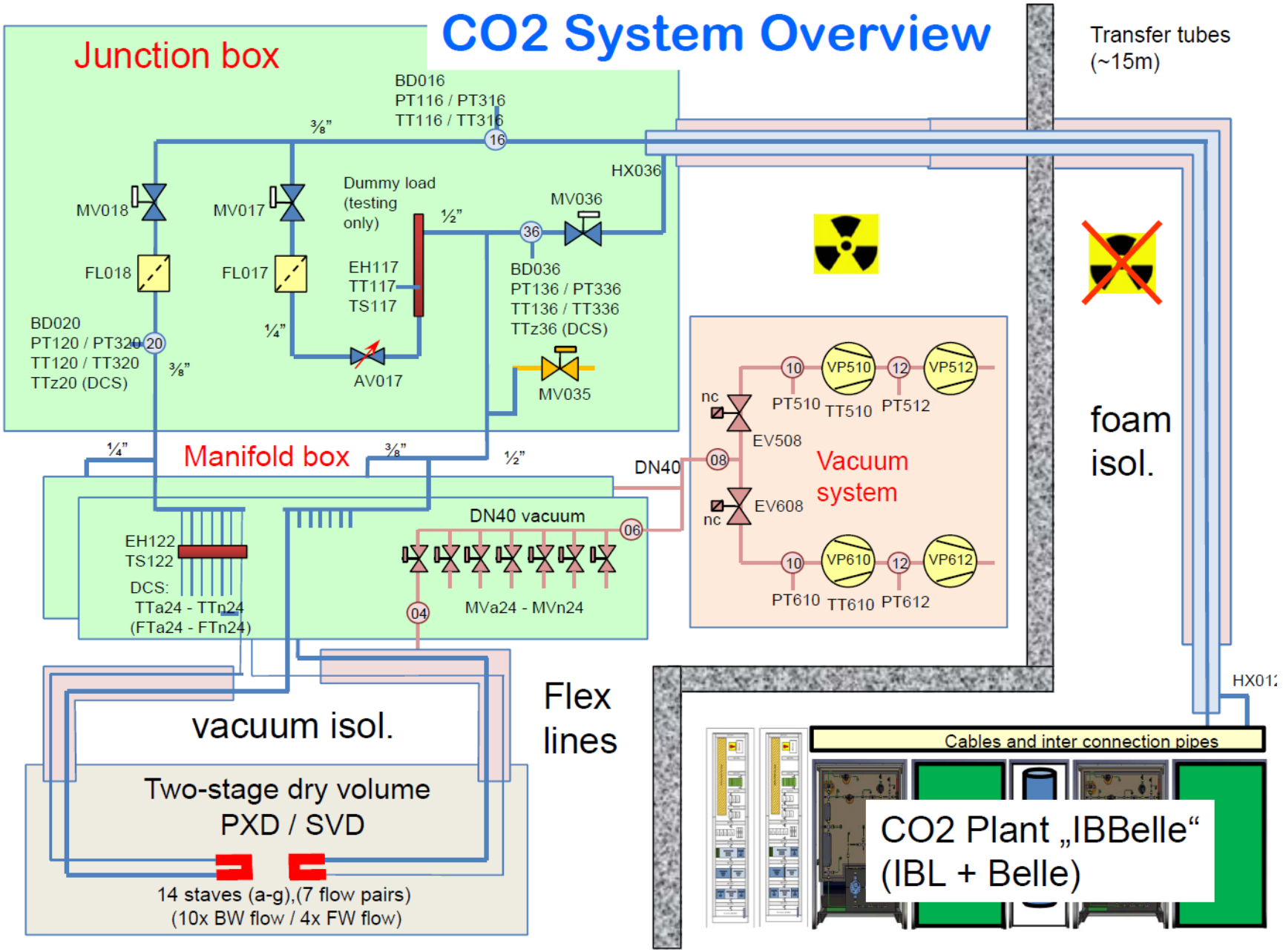
Max-Planck-Institut für Physik, München

5Th Belle II PXD/SVD Workshop

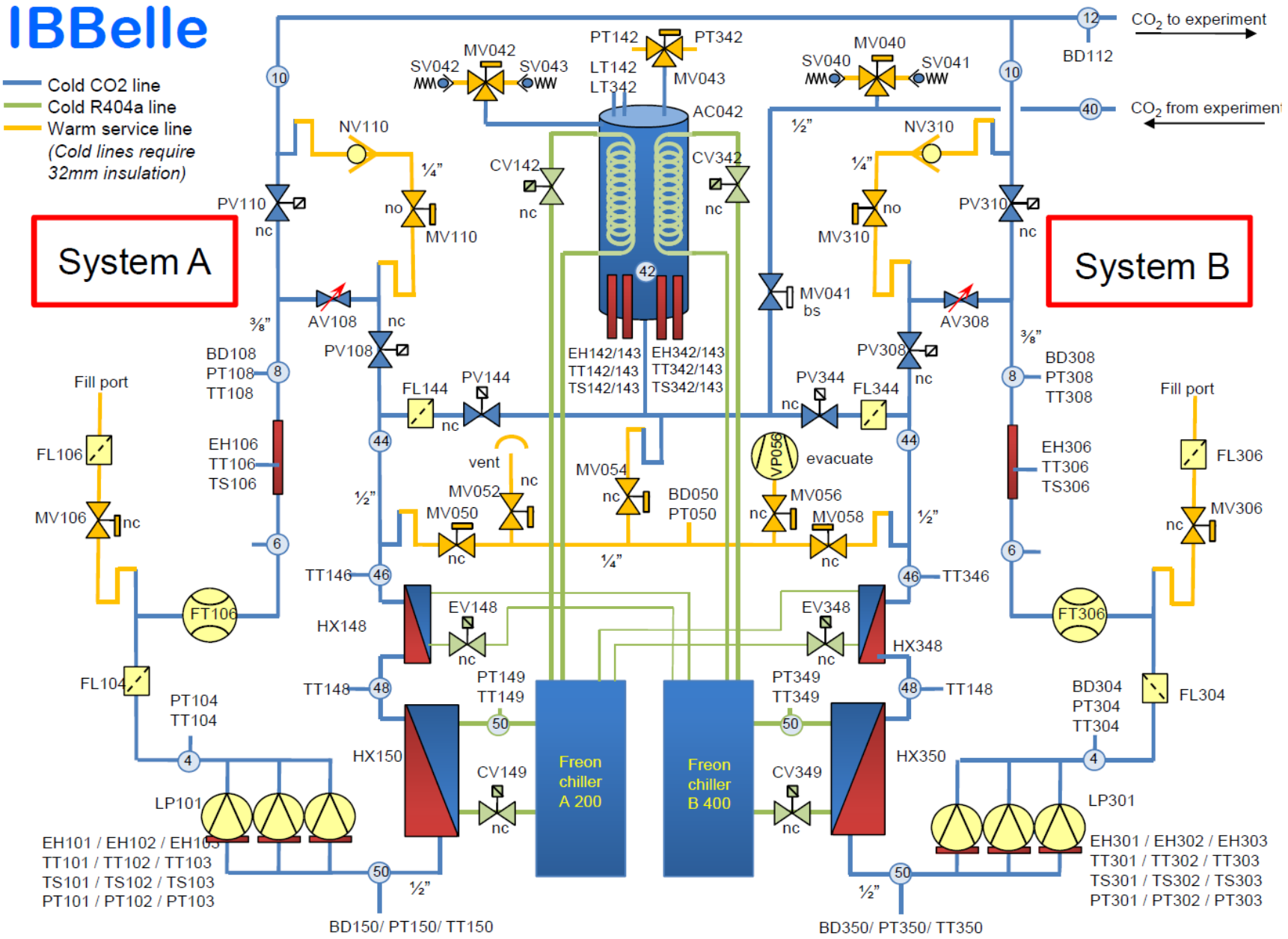
DESY, 23th January 2014

CO2 Cooling


CO2 System Overview
Junction box
BD016
PT116 / PT316
TT116 / TT316
3/8"
16
HX036
MV018
MV017
Dummy load
(testing
only)
1/2"
MV036
36
FL018
FL017
EH117
TT117
TS117
BD036
PT136 / PT336
TT136 / TT336
TTz36 (DCS)
BD020
PT120 / PT320
TT120 / TT320
TTz20 (DCS)
20
3/8"
1/4"
AV017
MV035
Transfer tubes
(~15m)
foam
isol.
1/4"
Manifold box
3/8"
1/2"
DN40
10
VP510
12
VP512
nc
PT510
TT510
PT512
EV508
08
Vacuum
system
EV608
nc
DN40 vacuum
06
EH122
TS122
DCS:
TTa24 - TTn24
(FTa24 - FTn24)
04
MVa24 - MVn24
10
VP610
12
VP612
PT610
TT610
PT612
HX012
Flex
lines
vacuum isol.
Cables and inter connection pipes
Two-stage dry volume
PXD / SVD
14 staves (a-g),(7 flow pairs)
(10x BW flow / 4x FW flow)
CO2 Plant „IBBelle“
(IBL + Belle)

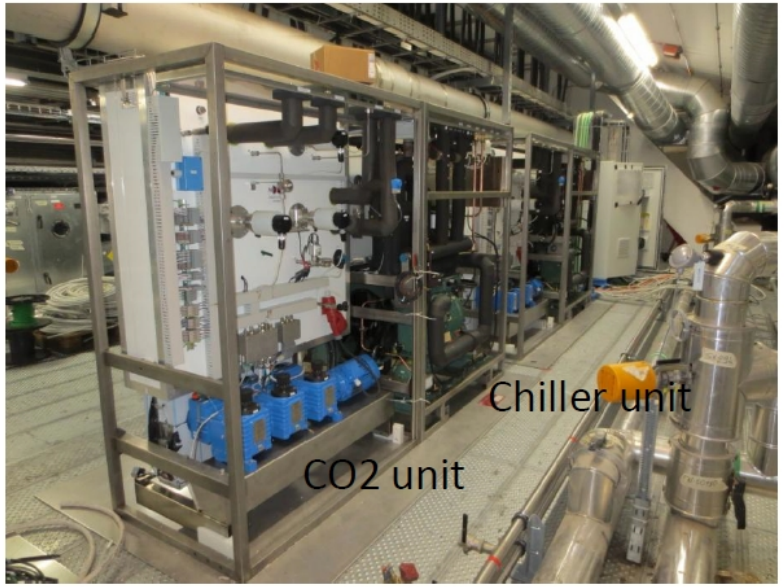
IBBelle

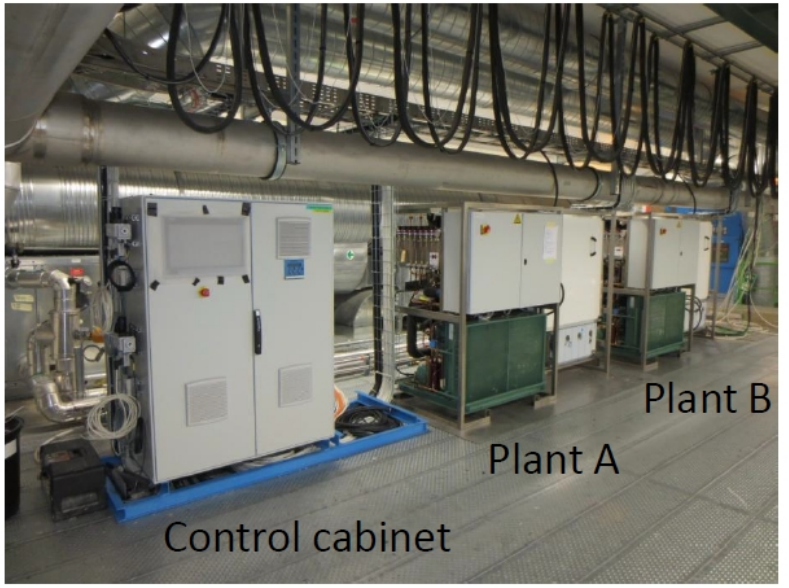
IBBelle is a common project of ATLAS IBL and Belle II VXD crews



Cooling units @ CERN

Chillers A and B are connected to their CO2 plant





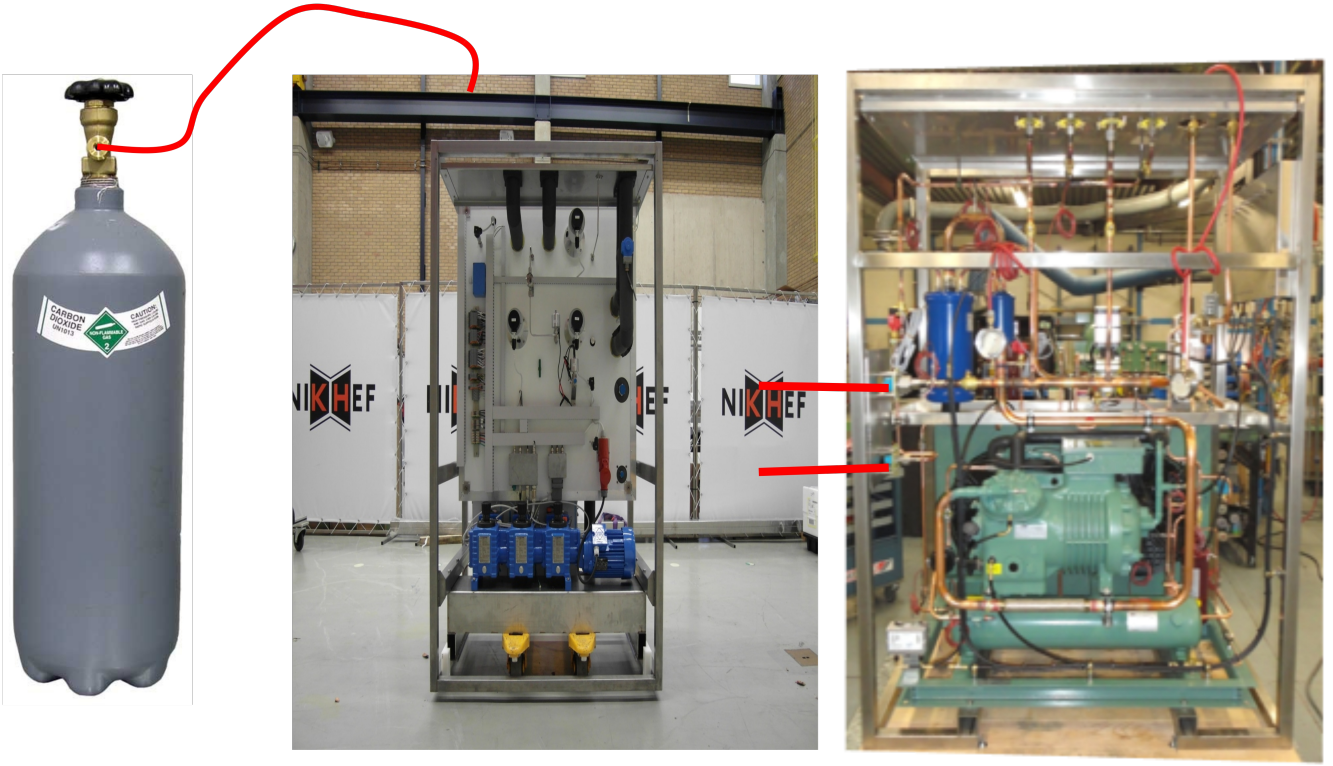
Local mode testing

Due to the absence of the interconnection tubes units are tested in local mode.

- 60 bar bottle instead of controlled accumulator (CO2 liquid system)
- Pre heater in CO2 unit as dummy load for chiller tests

Able to do:

- CO2 pump tests
- CO2 heater tests
- Chiller tuning
- Chiller load tests
- Interlock tests
- Control loop tests



Unit A commissioning status

Testing done from local PC via technical network.

- I/O checks finalized
- Interlock tests almost finalized.
- Pre-tuning of the system for continuous running
  - CO2 system worked without issues
    - Pump, heater, valves, all seem in the proper range.
  - Chiller needed tuning before semi-continuous operation
  - some issues found in chiller, all solved or understood
  - The system is in a shape that running for tests is fine without (too many) interlocks happening

Commissioning plan @ CERN

On local units:

- I/O checks
- Interlock checks
- Rough tuning for continuous operation
- Component mapping to generate reference measurements for future feedback
  - Pump scan
  - Accumulator heat and cool curves
  - Chiller capacity scans
  - Heat balance tests

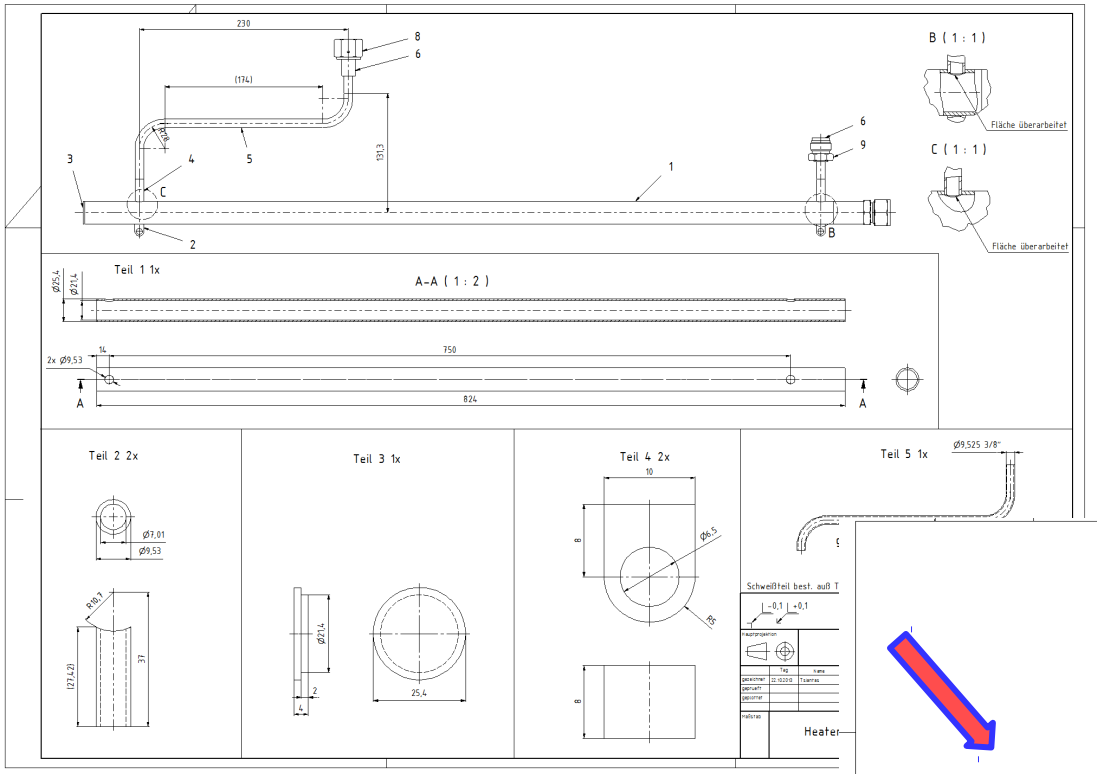
On system over junction box

- Recheck of all interlocks
- Retuning control loops to final system performance
- Automatic procedure testing
- Long term tests under several operational conditions.

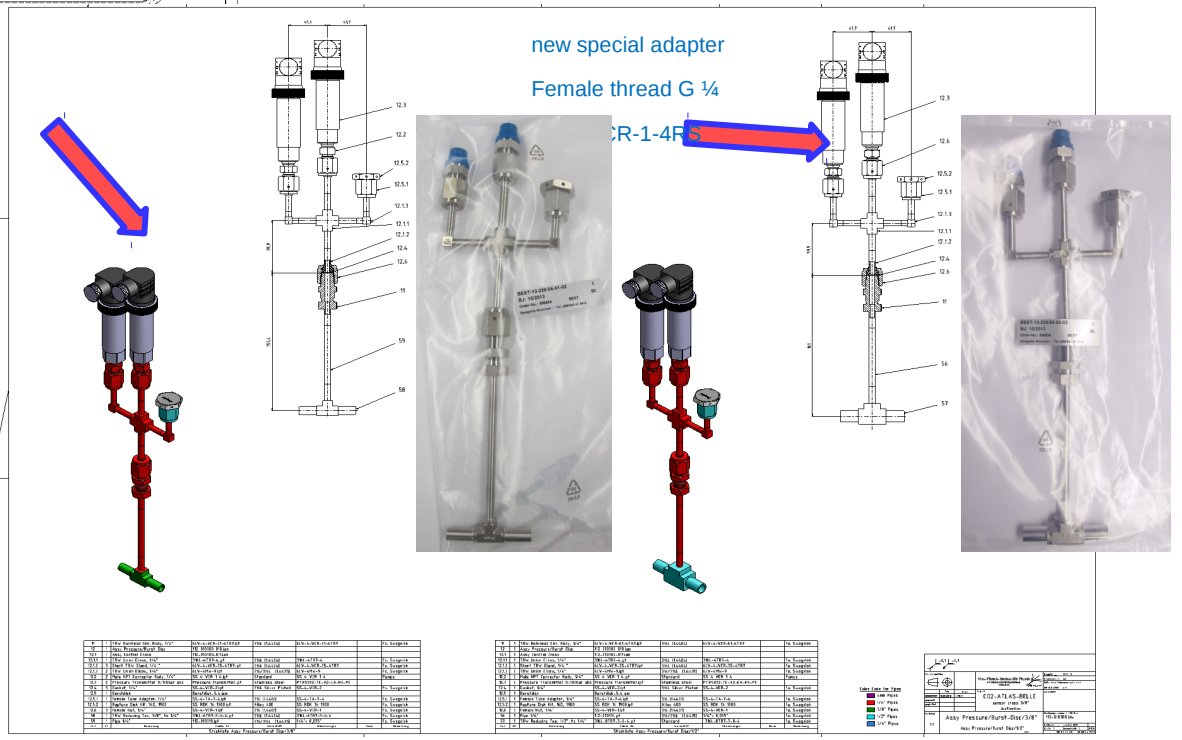
Junction box

- Junction box in finalization stage
- Housing and insulation done. Welding done. Heater done. New pressure sensors

Heater and sensors



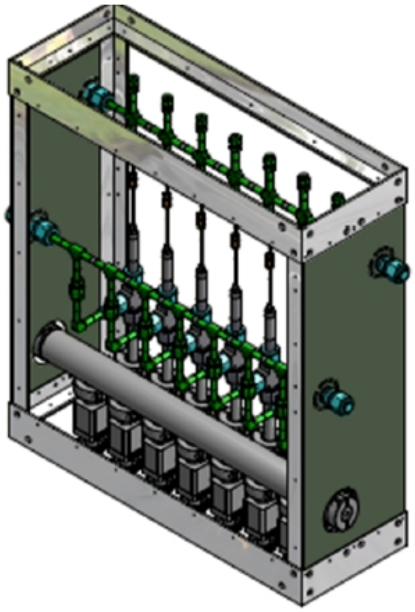
Heater housing



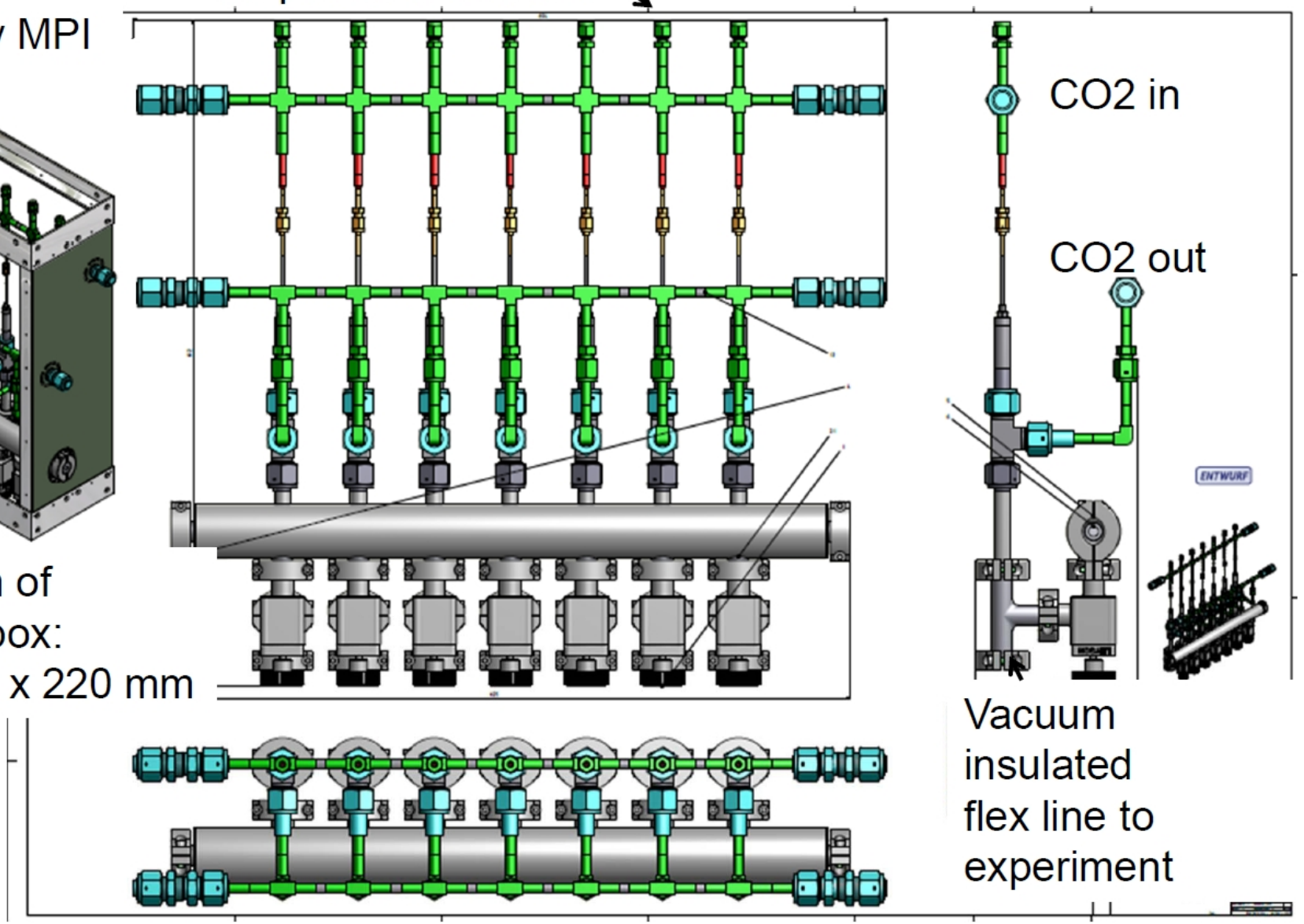
Pressure sensors

Manifold box (I)

design by MPI



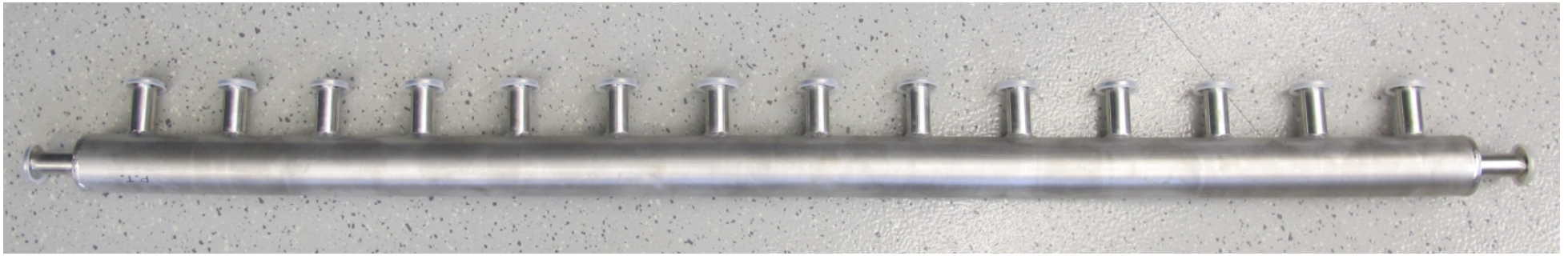
dimension of
manifold box:
600 x 680 x 220 mm



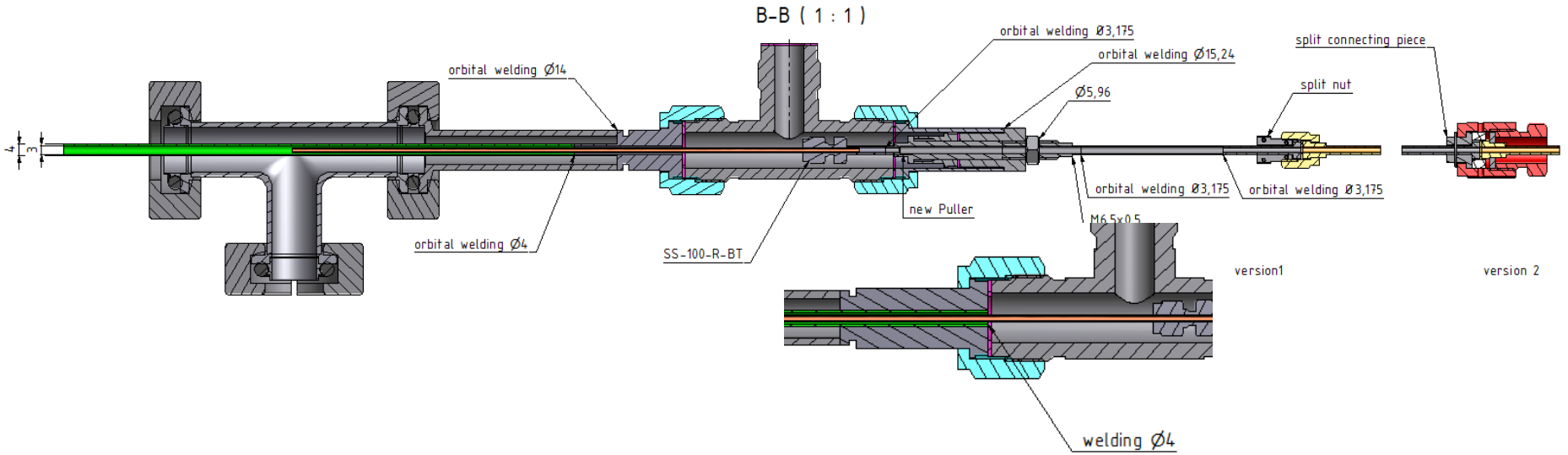
Manifold box (II)

Manifold ready. Helium leak test

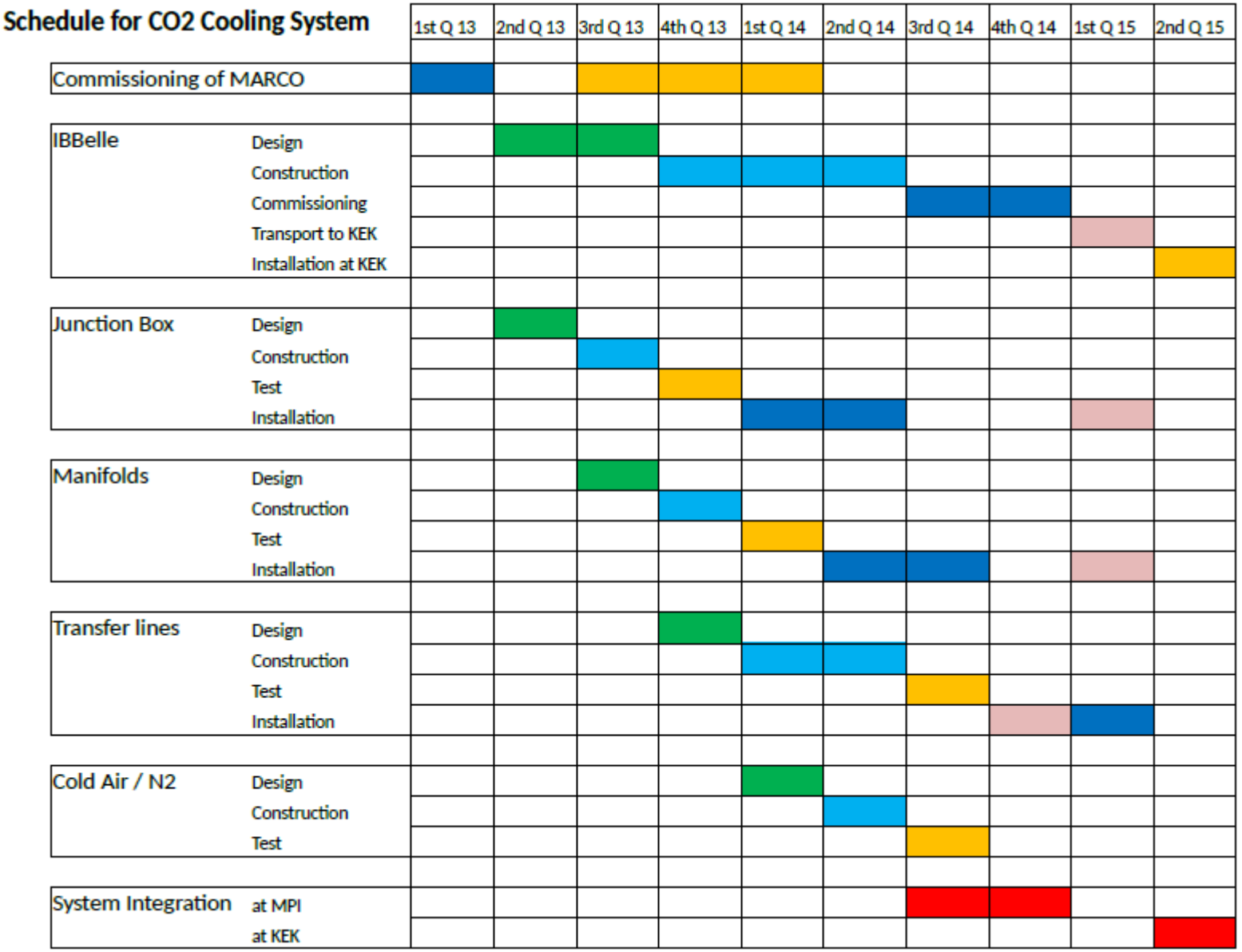
- Leak detector sensitivity 1x10-9 mbar l / sec after a few minutes.
- All valves open during the test.
- Response time test leak about 5sec.



Modifications in the dis-mountable and rotable concentric joint design



Shedule


Schedule for CO2 Cooling System
1st Q 13
2nd Q 13
3rd Q 13
4th Q 13
1st Q 14
2nd Q 14
3rd Q 14
4th Q 14
1st Q 15
2nd Q 15
Commissioning of MARCO
IBBelle
Design
Construction
Commissioning
Transport to KEK
Installation at KEK
Junction Box
Design
Construction
Test
Installation
Manifolds
Design
Construction
Test
Installation
Transfer lines
Design
Construction
Test
Installation
Cold Air / N2
Design
Construction
Test
System Integration
at MPI
at KEK

Status and outlook

- Cooling units, chillers and accumulator unit installed at CERN.
- Chillers units connected with their cooler units.
- Accumulator Unit still not connected.
- Commissioning started in local mode.

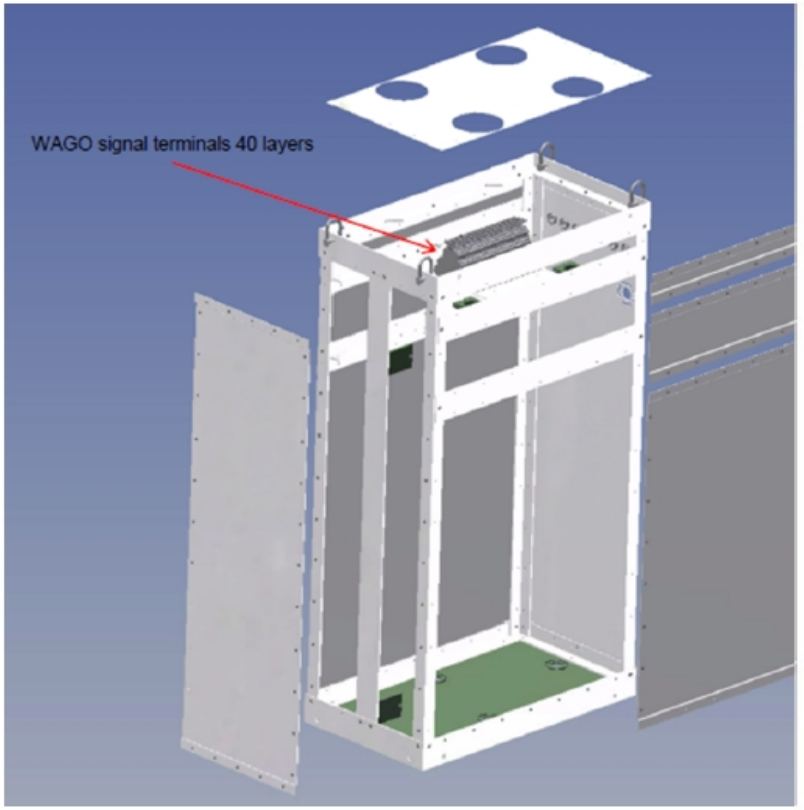
- Junction Box is being finalized.
  - Already tested (160 bar pressure test)
- Manifold Box design completed (at MPI).
  - under construction.
  - Modifications in the design of the dis-mountable and rotable concentric joint.

Outlook

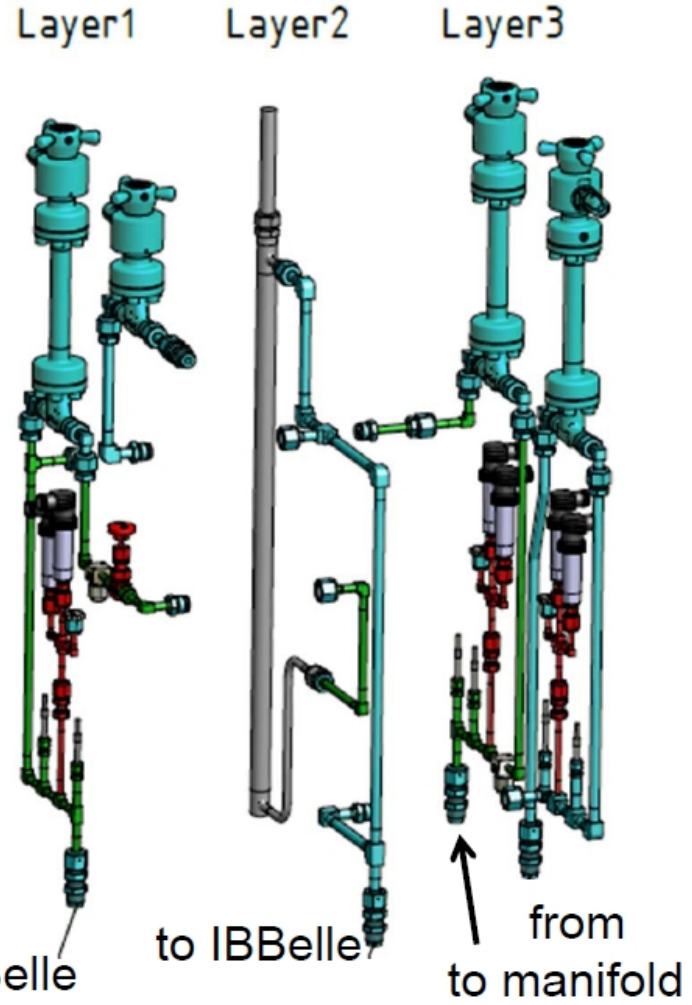
- Commissioning at CERN will continue for the next few months
  - Run system in similar to real conditions over junction box. (February 2014 – May 2014).
- Parts for VXD cooling system already ordered at MPI.
- Start construction of VXD cooling system at MPI: spring 2014.
- construction time about 3 months, commissioning in the fall of 2014.
- Transport to KEK in the spring of 2015.

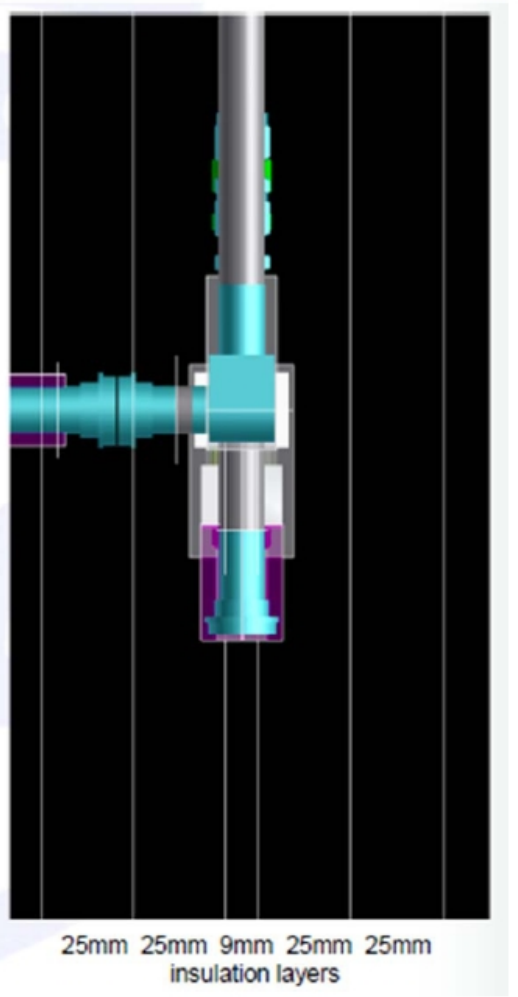
Backup slides

Junction box



housing





dimensions of junct. box:
1060 x 625 x 345 mm

„2-D“ arrangement
In 3 layers

foam insulation
betweeen layers

design by MPI

Slow control

Electronic cabinets: Schneider PLC, being programmed by CERN crew

- CERN uses UNICOS + PVSS
- EPICS will be used for the Belle version

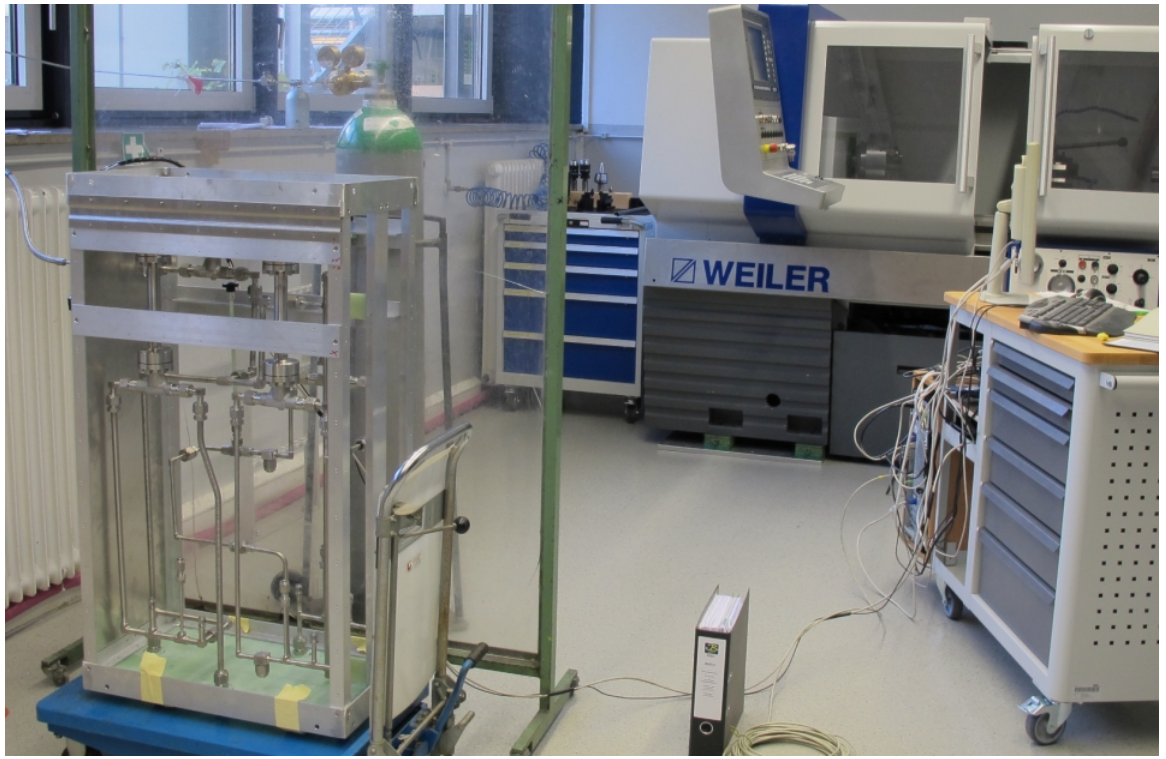
Operation and control:

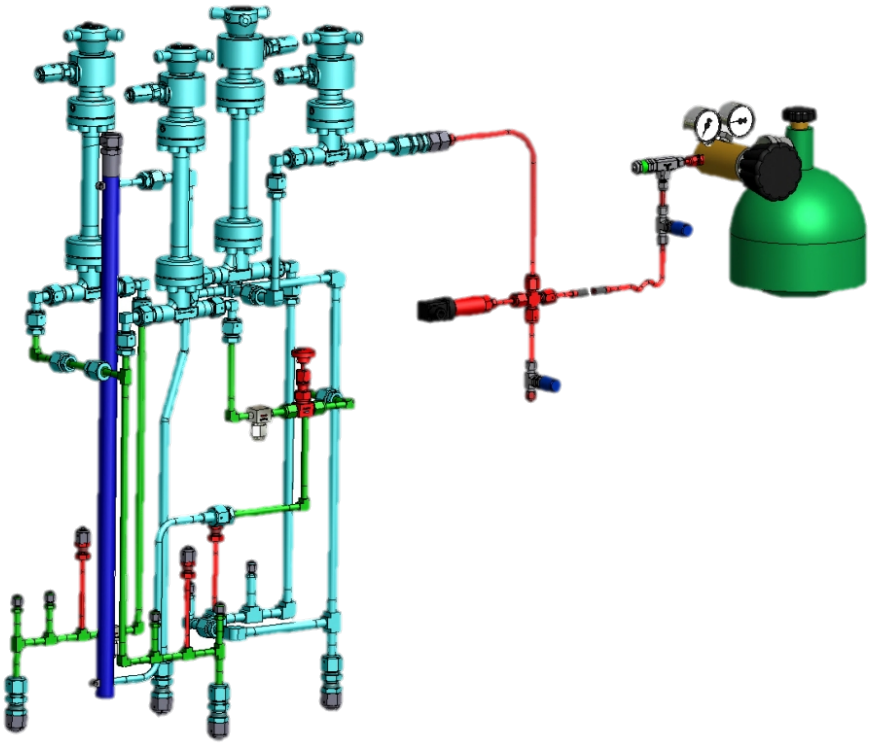
- Operation mode
  - Normal operation state
  - Automatic start procedure
- Stand-by mode
  - It occurs when the other unit is in operation mode
  - Full liquid circulation
- Bake-out mode
  - Only if beam-pipe back-out is present
  - CO2 overflow (units A+B)
- Maintenance mode
  - The system is completely stopped.
  - Components can be switched on only manually by experts.
- Operation
  - The cooling system can only be started and stopped by trained people being part of the engineering team or the services team.
  - Limited control actions allowed from DCS: change of accumulator temperature set-point and demand a swap to the standby system in case of warnings.

Pressure test (I)

Helium leak test

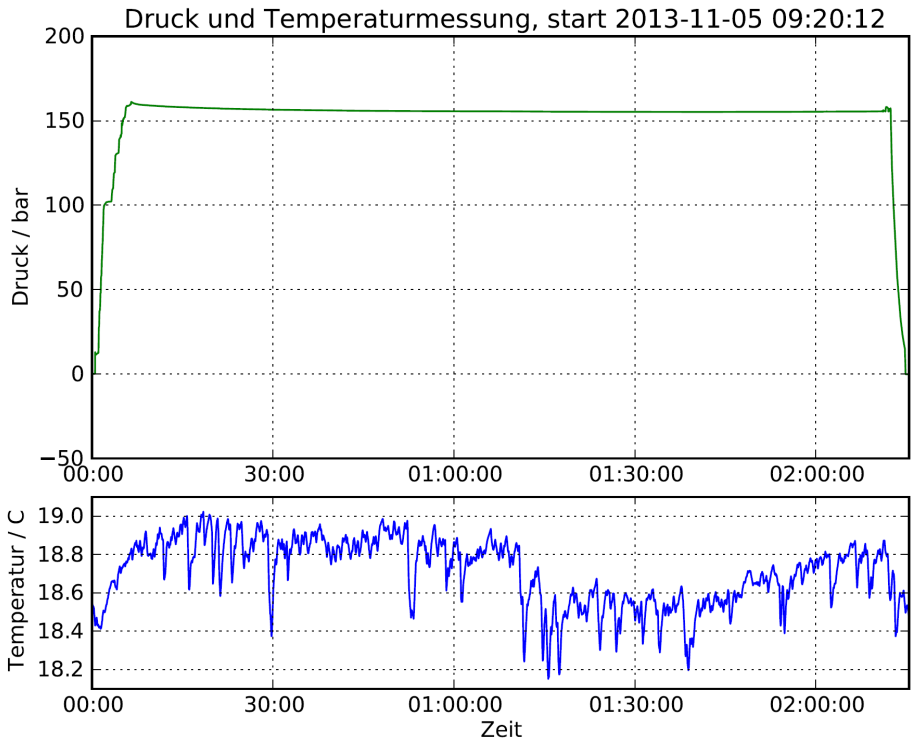
- Connection leak detector at ½ "VCR fitting below the cable outlets.
- Leak detector sensitivity 1x10^{-9} mbar l / sec after a few minutes.
- All valves open during the test.
- Response time test leak about 5 sec



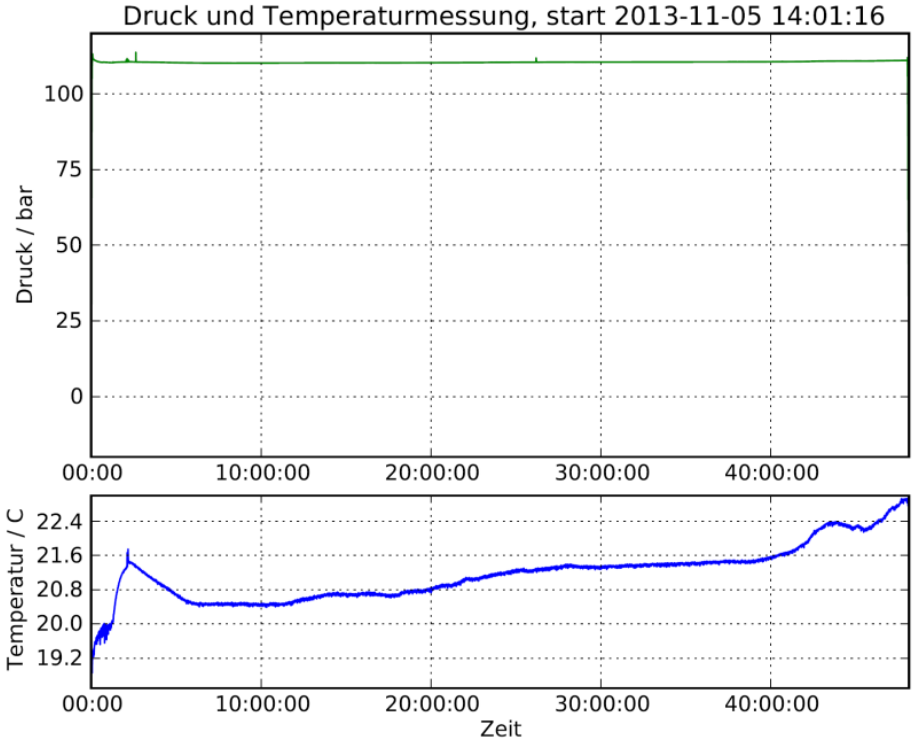


Pressure test (II)

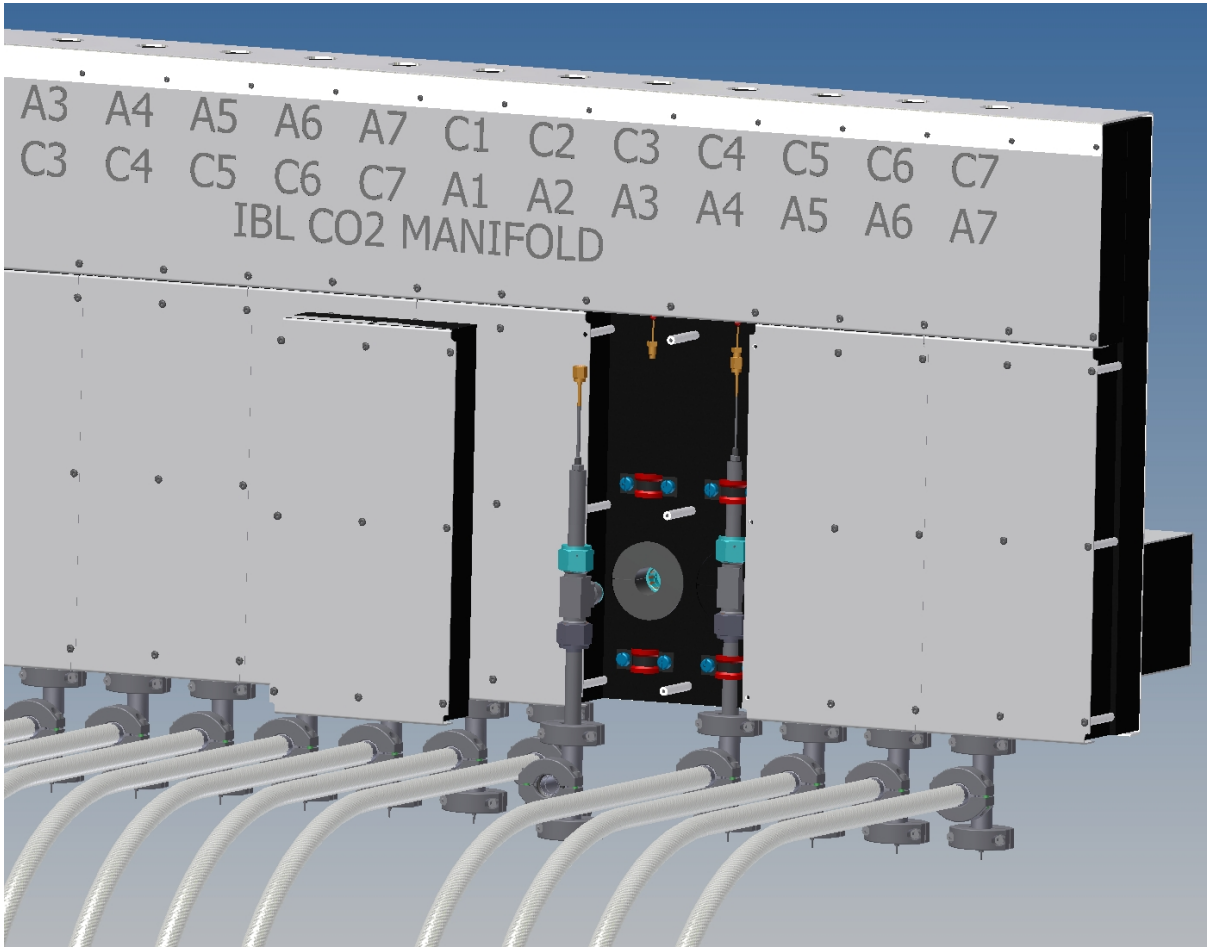
Pressure 160 bar - 2 hours



Pressure 110 bar - 48 hours



Manifold box



Manifold box