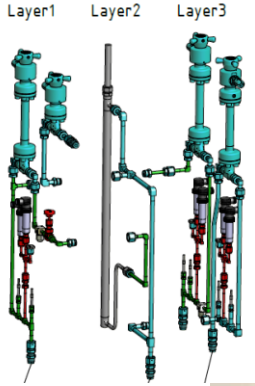
IBBelle Meeting @ MPI
6.-7. 10. 2014

Agenda:

- Overview of Cooling Requirements
- Services for IBBelle
- Container Option
- Acceptance Tests for CO2 Parts
- System Tests
- Parts Lists for IBBelle, Documentation
- MARCO Pumps



Participants

KEK:
Nobuhiro Kimura, Shuji Tanaka, Toru Tsuboyama

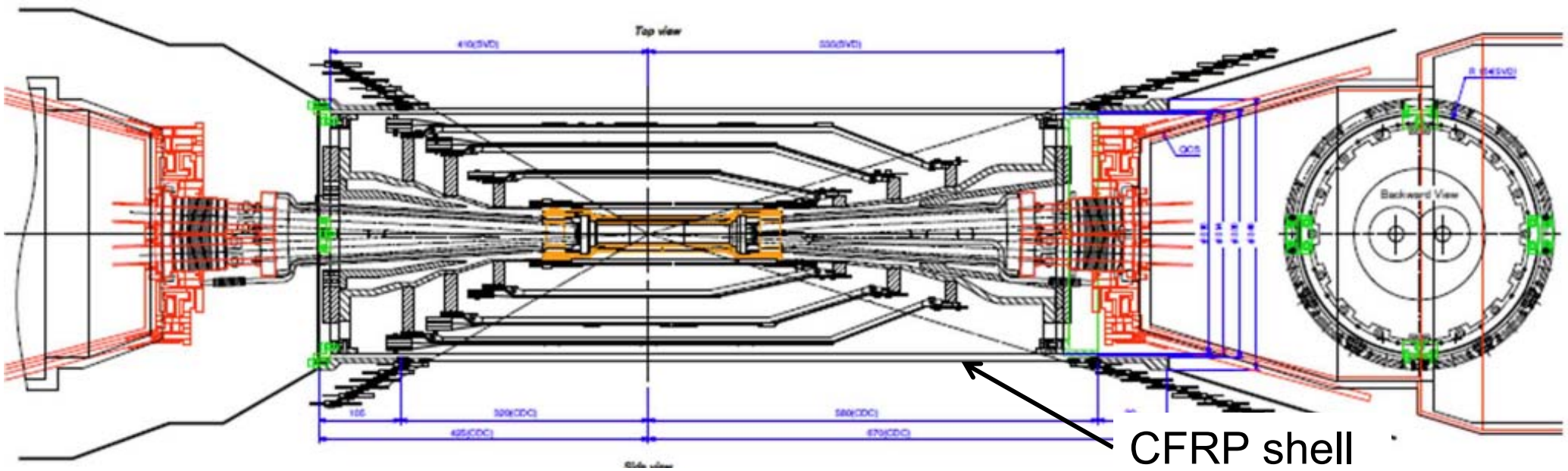
NIKHEF:
Bart Verlaat

CERN:
Lukasz Zwalinski

DESY:
Reimer Stever, Carsten Niebuhr (both via SeeVogh)

MPI:
Hans-Günther Moser (parttime), Sven Vogt, Tscharlie Ackermann, Christian Kiesling

IR Region and Silicon Systems („VXD“)

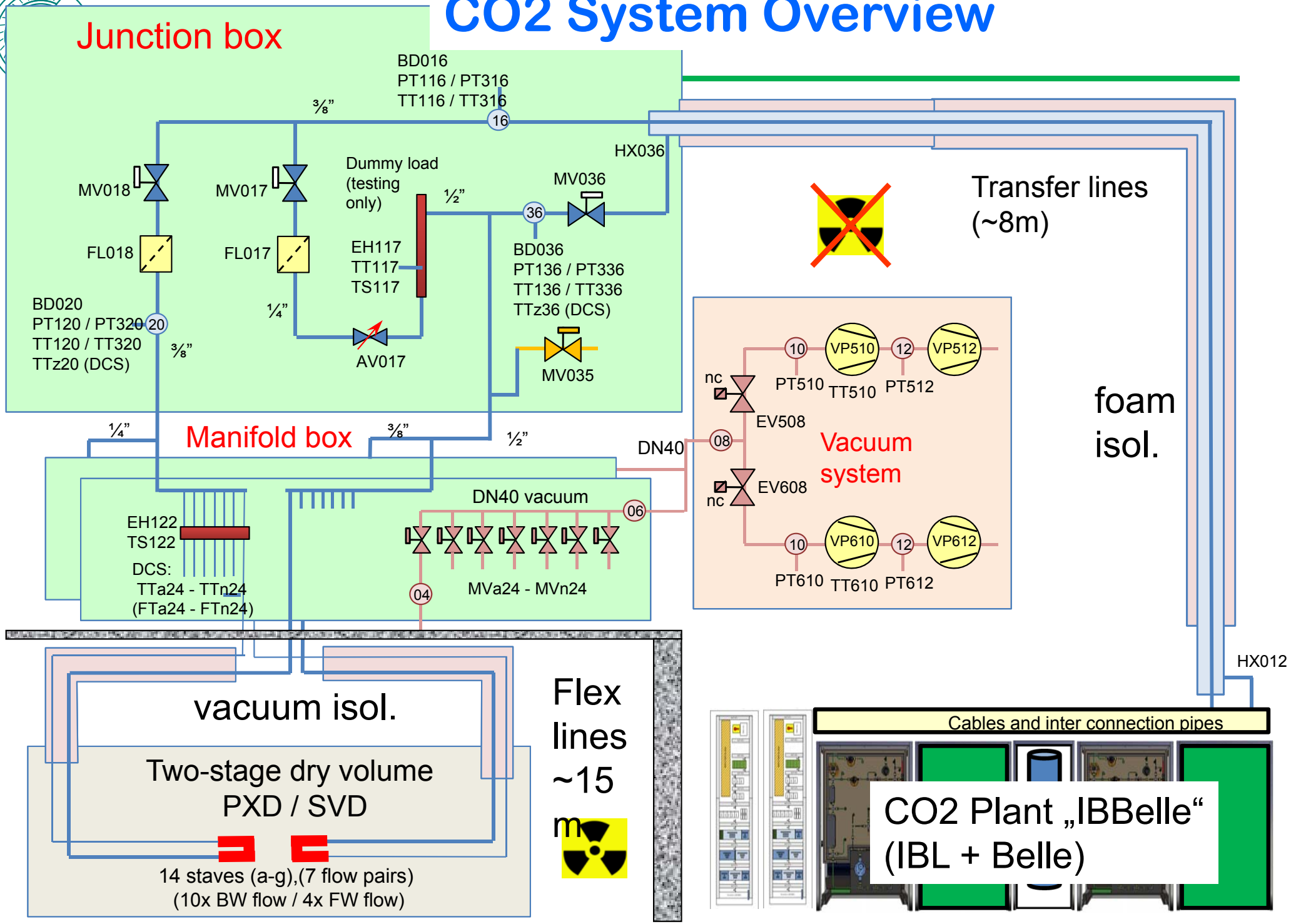


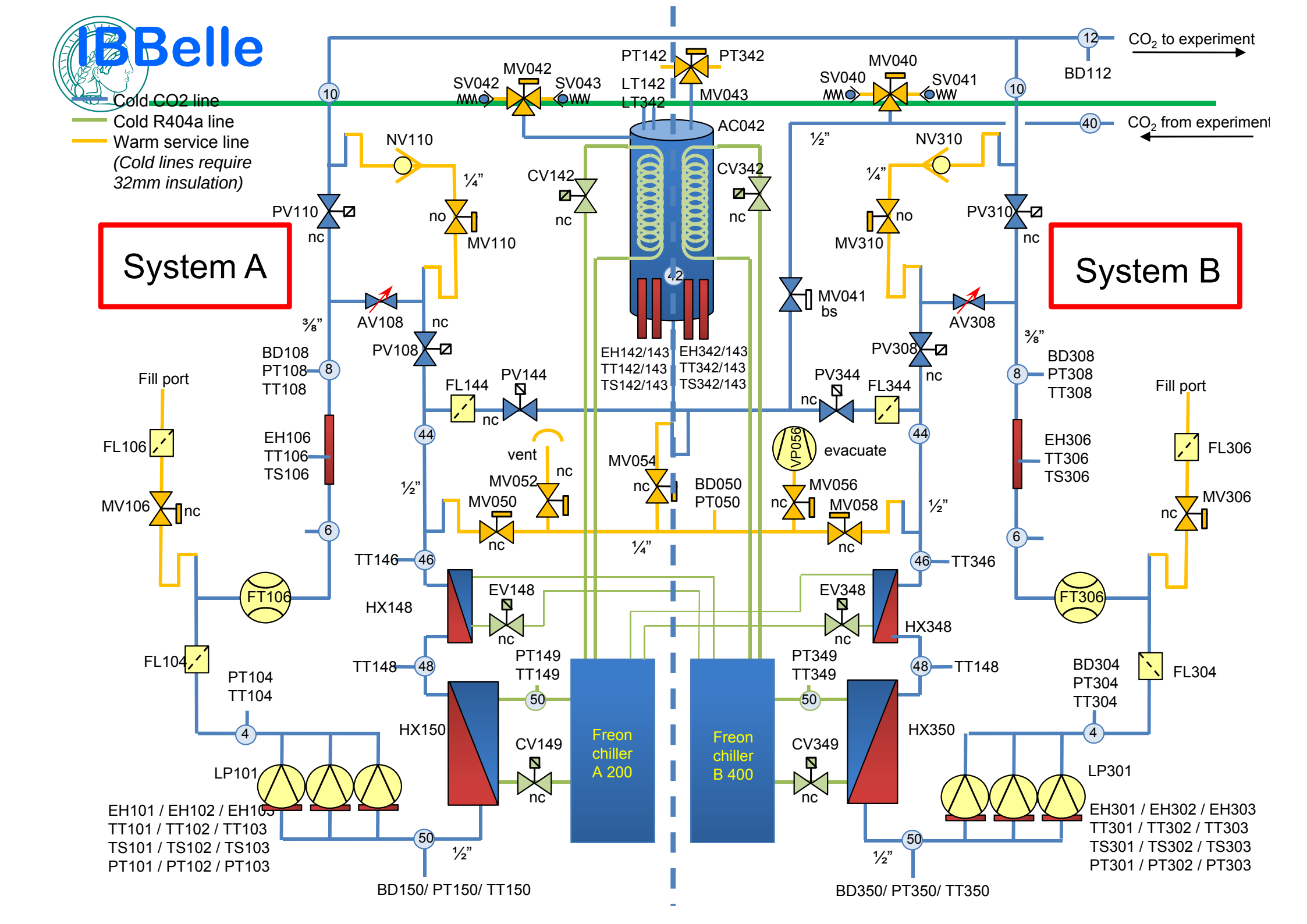
- Cooling of Si systems necessary (Si: shot noise, ASICs: electro-migration)
- The VXD (PXD + SVD) is a mechanical unit, dimensions defined by the cylindrical CFRP shell and the end flanges.
- Installed into Belle II as a unit together with the beampipe (+crotched part)
- needs to be thermally isolated against the CDC (room temp.) and the beampipe (15 °C).

VXD Cooling Requirements & Specs

- Minimize material in acceptance region
- SVD requirements:
  coolant temperature for APV25 @ -20°C for SNR improvement
  total dissipated power ~ 700 W
- PXD requirements:
  sensor temp. < 25°C, ASICs < 50°C : cooling block @ <-20°C
  dissipated power ~ 360 W
- Cooling power ~ 1.6 kW at VXD (incl. ~ 540 W parasitic heat influx)
  have to add heat loss through 15 m of transfer lines → ~ 2-3 kW
- Nitrogen Volume:
  dew point inside VXD volume: ~ -30 °C
- Outside of VXD: room temperature (~ 23°C) at the CDC
  may need a thermal enclosure towards CDC, well insulated

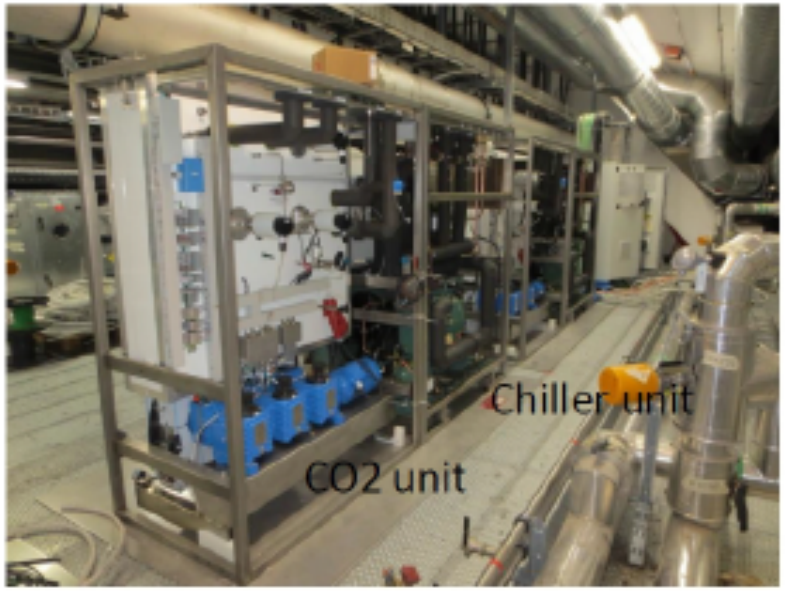
CO2 System Overview




IBBelle
Cold CO2 line
Cold R404a line
Warm service line
(Cold lines require 32mm insulation)
System A
System B
CO_2 to experiment
CO_2 from experiment
BD112
PT142
PT342
LT142
LT342
MV042
MV043
SV042
SV043
MV040
SV040
SV041
AC042
CV142
CV342
NV110
NV310
PV110
PV310
MV110
MV310
MV041
bs
AV108
AV308
PV108
PV308
PV144
PV344
FL144
FL344
EH142/143
TT142/143
TS142/143
EH342/143
TT342/143
TS342/143
BD108
PT108
TT108
BD308
PT308
TT308
Fill port
FL106
MV106
EH106
TT106
TS106
EH306
TT306
TS306
FL306
MV306
vent
MV052
MV050
MV054
BD050
PT050
VP056
evacuate
MV056
MV058
TT146
TT346
EV148
EV348
HX148
HX348
FT106
FT306
FL104
PT104
TT104
PT149
TT149
PT349
TT349
TT148
BD304
PT304
TT304
FL304
HX150
HX350
CV149
CV349
Freon chiller A 200
Freon chiller B 400
LP101
LP301
EH101 / EH102 / EH103
TT101 / TT102 / TT103
TS101 / TS102 / TS103
PT101 / PT102 / PT103
EH301 / EH302 / EH303
TT301 / TT302 / TT303
TS301 / TS302 / TS303
PT301 / PT302 / PT303
BD150/ PT150/ TT150
BD350/ PT350/ TT350

Commissioning of IBBelle at CERN

Installation at CERN (ATLAS Experiment): the “twin” of IBBelle



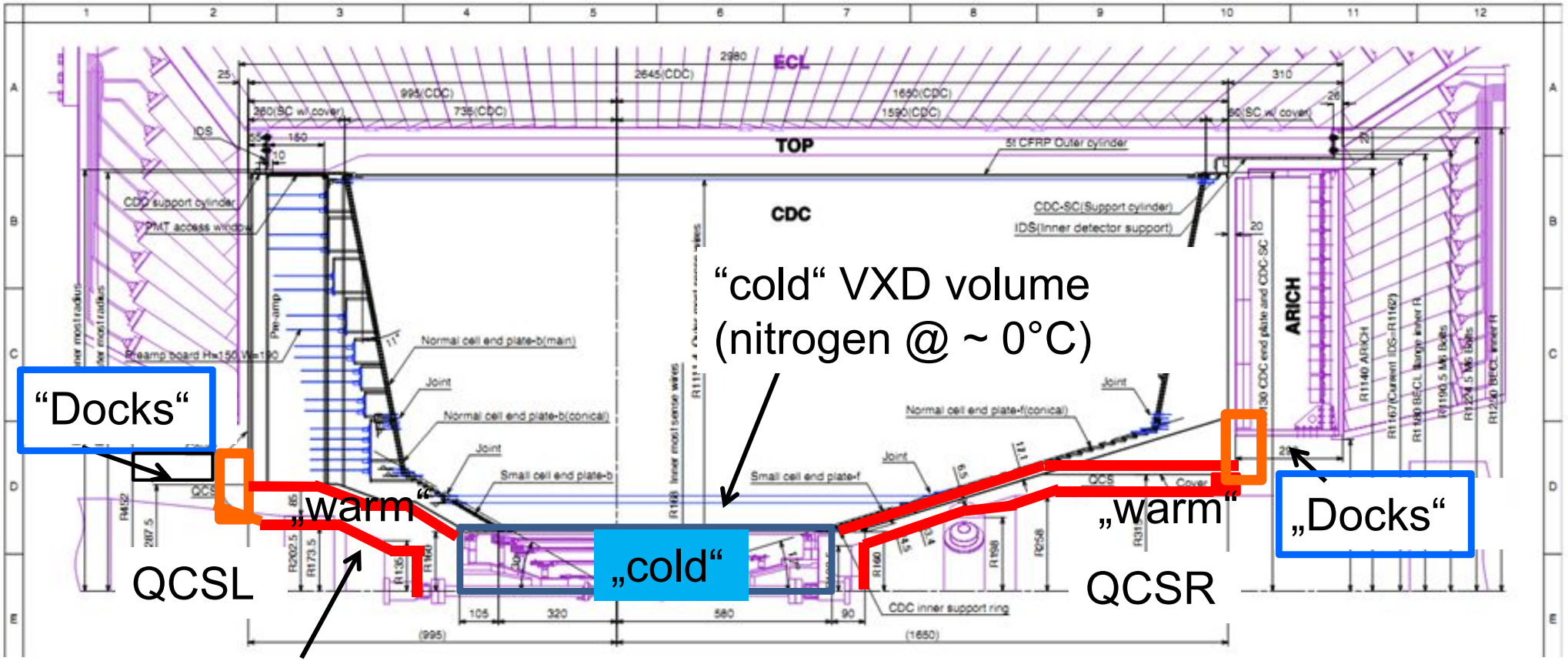
Accum. rack

Construction of IBBelle (ATLAS) is finished

Commissioning with dummy heat load, now connected to IBL

Some problems getting down to -40°C (not important for the Belle version)

Two Dry Volumes: “cold“ and “warm“



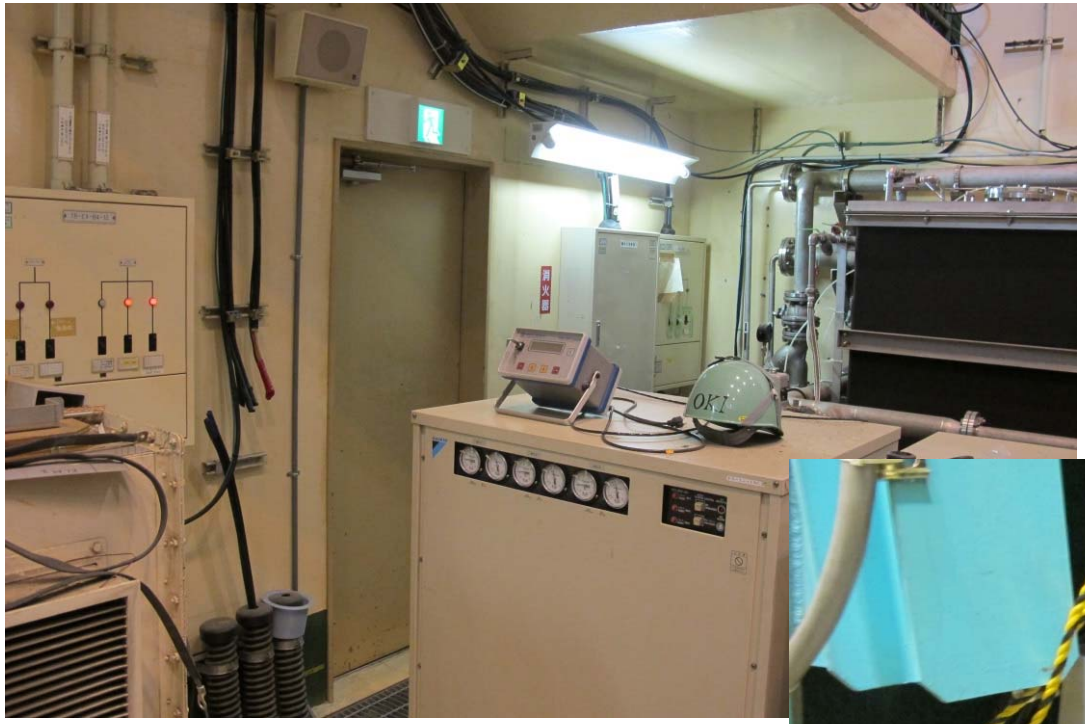
“warm“ volumes between QCS and CDC inner wall, up to CDC end wall, both in FWD and BWD directions.

Use of nitrogen mandatory (potential hazard by oil from dry air supplier)

Cooling Lines for SVD & PXD: Details

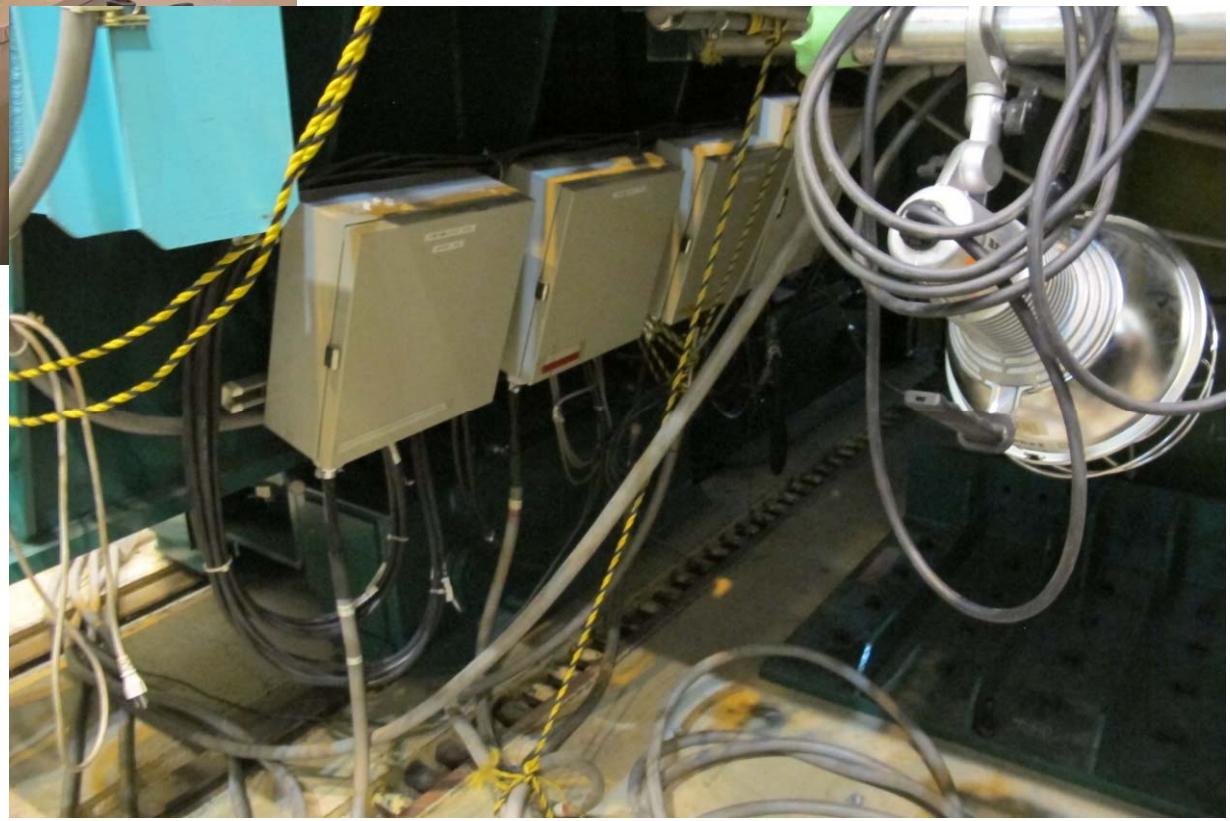
CO_2 Circuit	Detector	Half	Layer	Type	Side	Power [W]
1	PXD	up	1&2	endring	bwd	90
2			1&2	endring	fwd	90
3		down	1&2	endring	bwd	90
4			1&2	endring	fwd	90
					sum PXD	360
5	SVD	left	3-6	endring	bwd	93
6		right	3-6	endring	bwd	93
7		left	3-6	endring	fwd	93
8		right	3-6	endring	fwd	93
9		left	4&5	origami	bwd	68
10		right	4&5	origami	bwd	68
11		left	6	origami	bwd	96
12		right	6	origami	bwd	96
					sum SVD	700
					sum VXD	1060

Services (Power) for IBBelle



AC Power for CO2 System:

400 V 3-phase power line in Tsukuba Hall (2 x 25 kW)
circuit breaker @ 60 A



IBBelle needs also 220 V, should be derived close to the unit

Request European standard (+ zero and ground), will be provided by KEK

Services for IBBelle

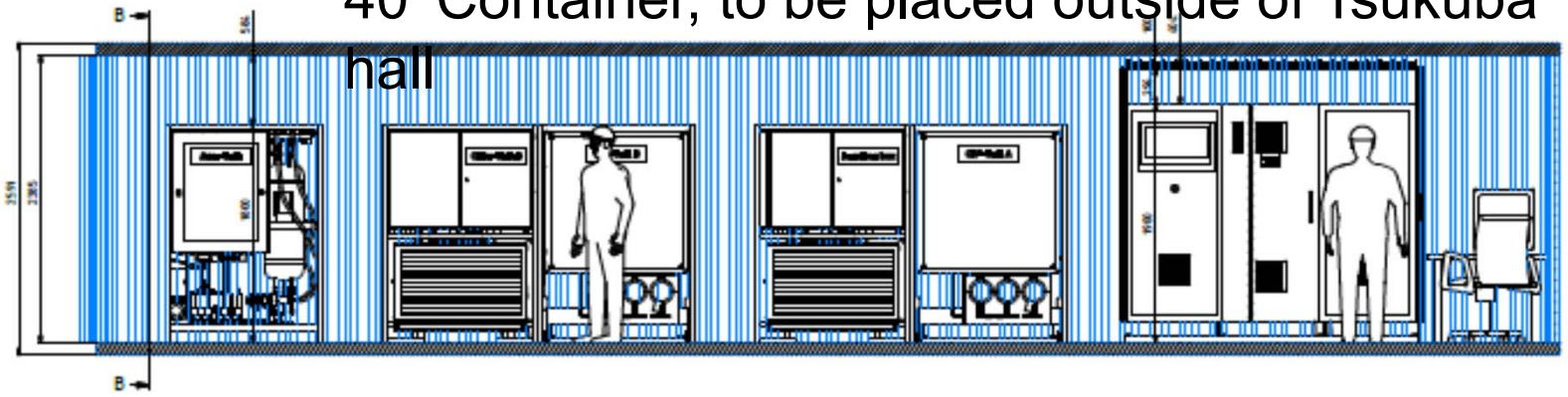
- European standard existed already at KEK, needs to be reactivated
- Requirement: 400 [V] ± 10 %
  (filtering of V spikes required, Shuji will inquire supply specs)
- Water for the chiller cooling: 20 l/min, room temp OK,
  only filter needed, connections to be specified
- N2: 50 l/min room temp OK

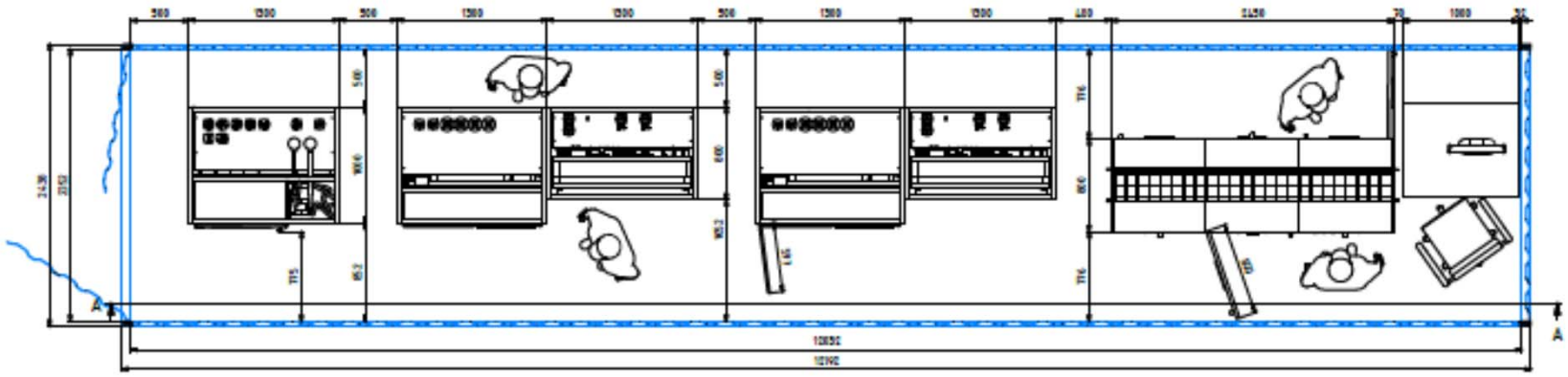
→ List will be established on all required services , together with location of supply units, fixations etc.

Due date: coming B2GM

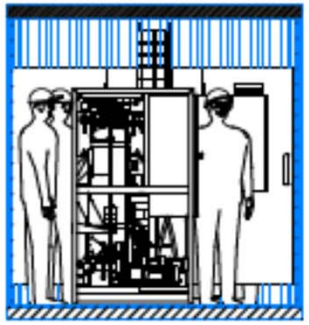
Location: Alternative Arrangement

40’ Container, to be placed outside of Tsukuba hall





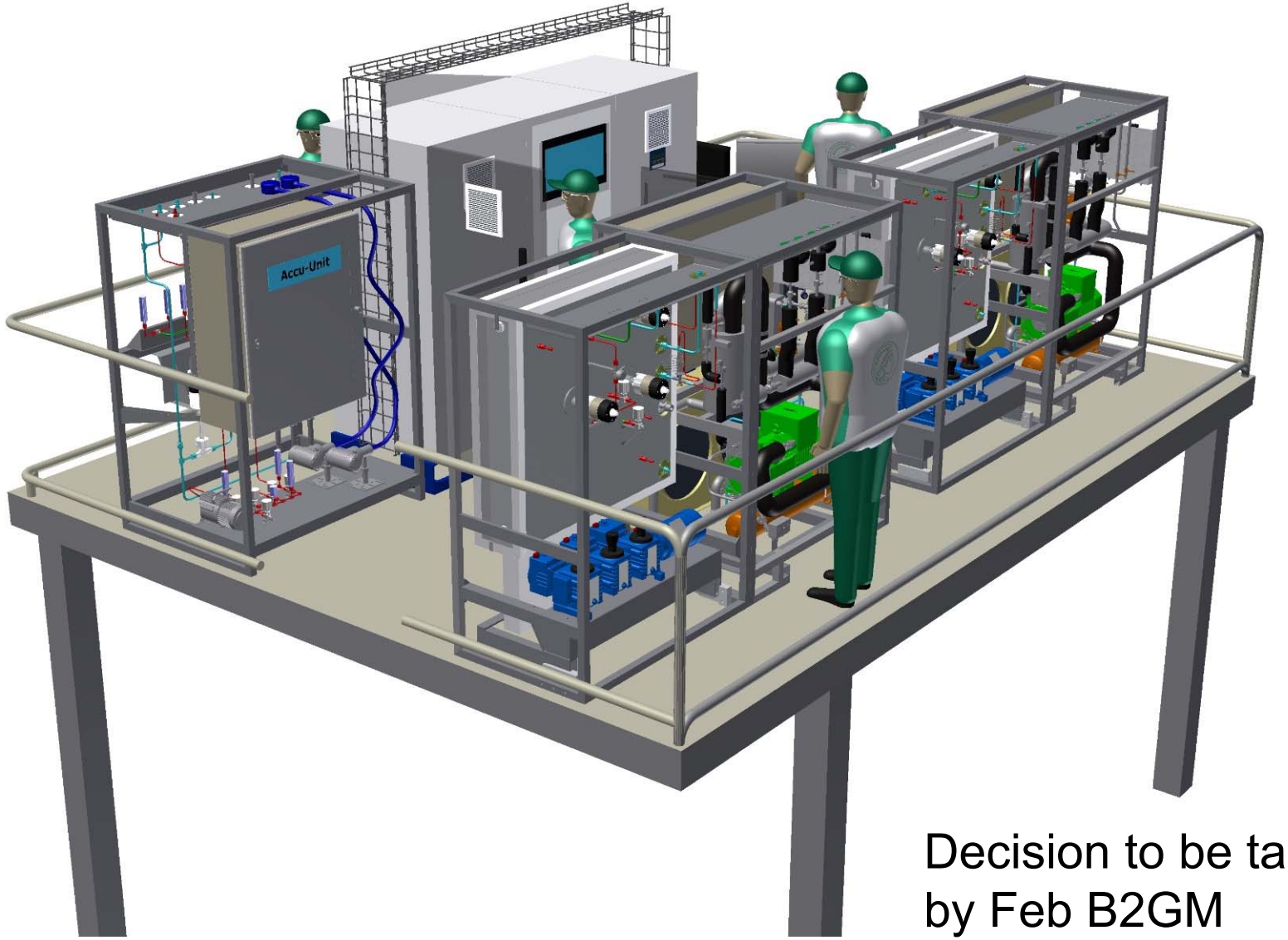
B-B (1 : 20)



Advantage: unit can be assembled at MPI, no need to take it apart for transport, no reassembly

Potential problems:
need water/electricity outside hall
Need to air condition the container

Location of the CO2 Plant at KEK



Decision to be taken by Feb B2GM

The Charm of the Container …

- The container would be located outside of Tsukuba Hall
  Preferred place : Behind Tsukuba hall (but: need access way)
- Transfer line into Belle II is ~ 50 m, i.e. OK, hydrostatic pressure difference will not pose a problem (cit. Bart)
- Japanese earthquake regulations:
- Container MUST be inside a “house” (=garage)
  Advantage: take away walls of the container, excellent accessibility
  “Garage” will be air conditioned (no special isolation for container)
- Gemba meeting during B2GM on IBBelle location, decision in Feb 15

Certification Procedures

- Certification via German TÜV

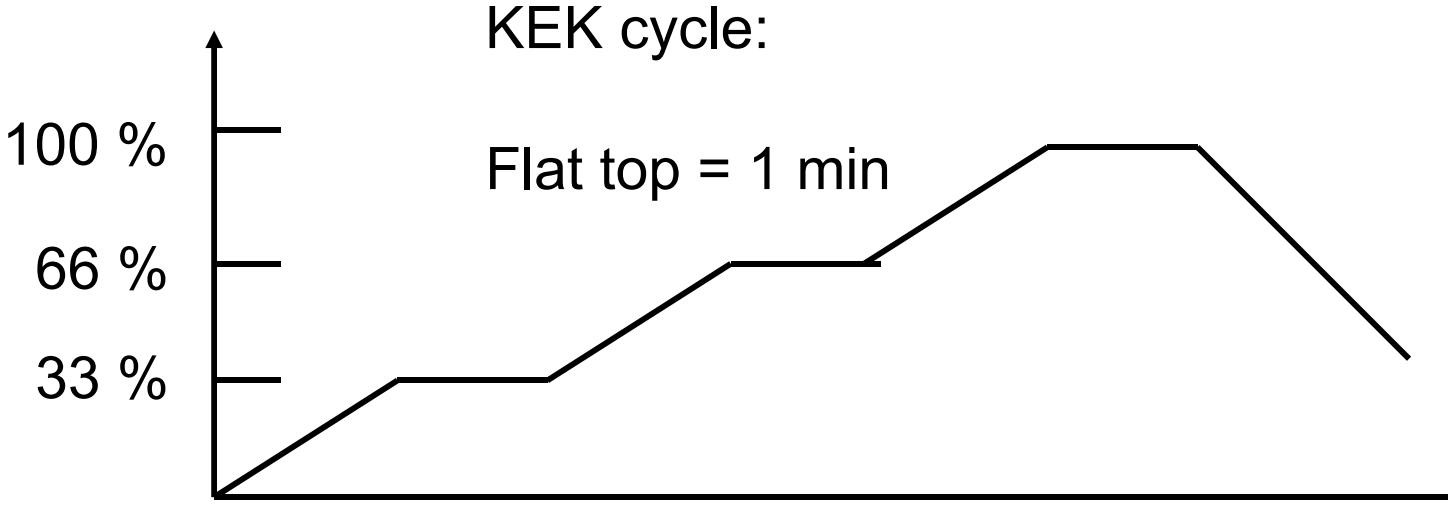
  Parts: mostly CE Standard (valves etc.)

- Pressure test with one sample to 300 bar, leak OK, but no burst

- Standard for tubing: 186 bar for all certified equipment (130 x 1.43)

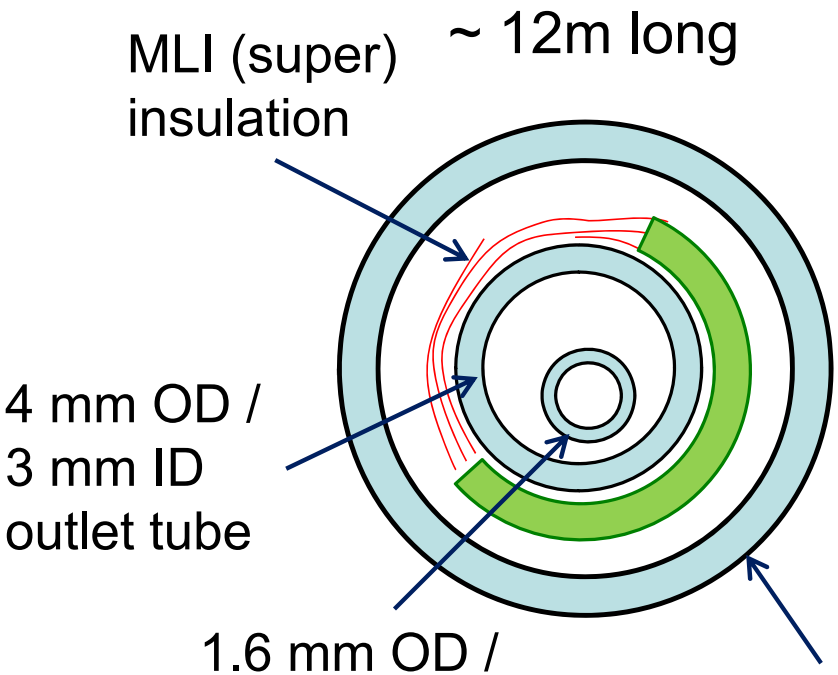
  Safety valve: 110 bar
  Burst disk: 130 bar

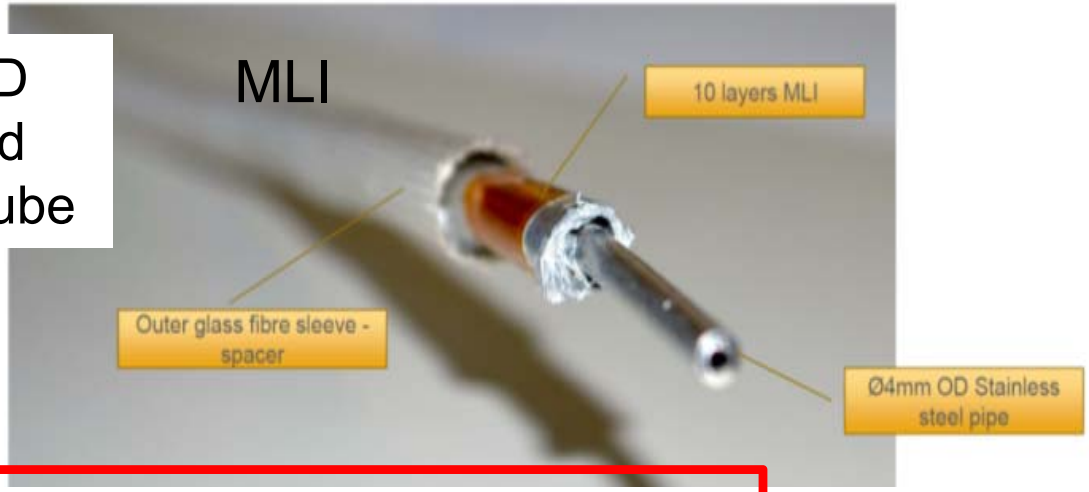
CERN:
100 % for
1 hour



CO2 Vacuum Transfer Lines

Flex line design (by CERN/NIKHEF)





admissible bending radius:
~ 50 mm

Will contact CERN, if they are willing to build them for us

IBBelle Prototype: „MARCO“

MARCO ran successfully during the DESY Beam Test in Jan. 2014

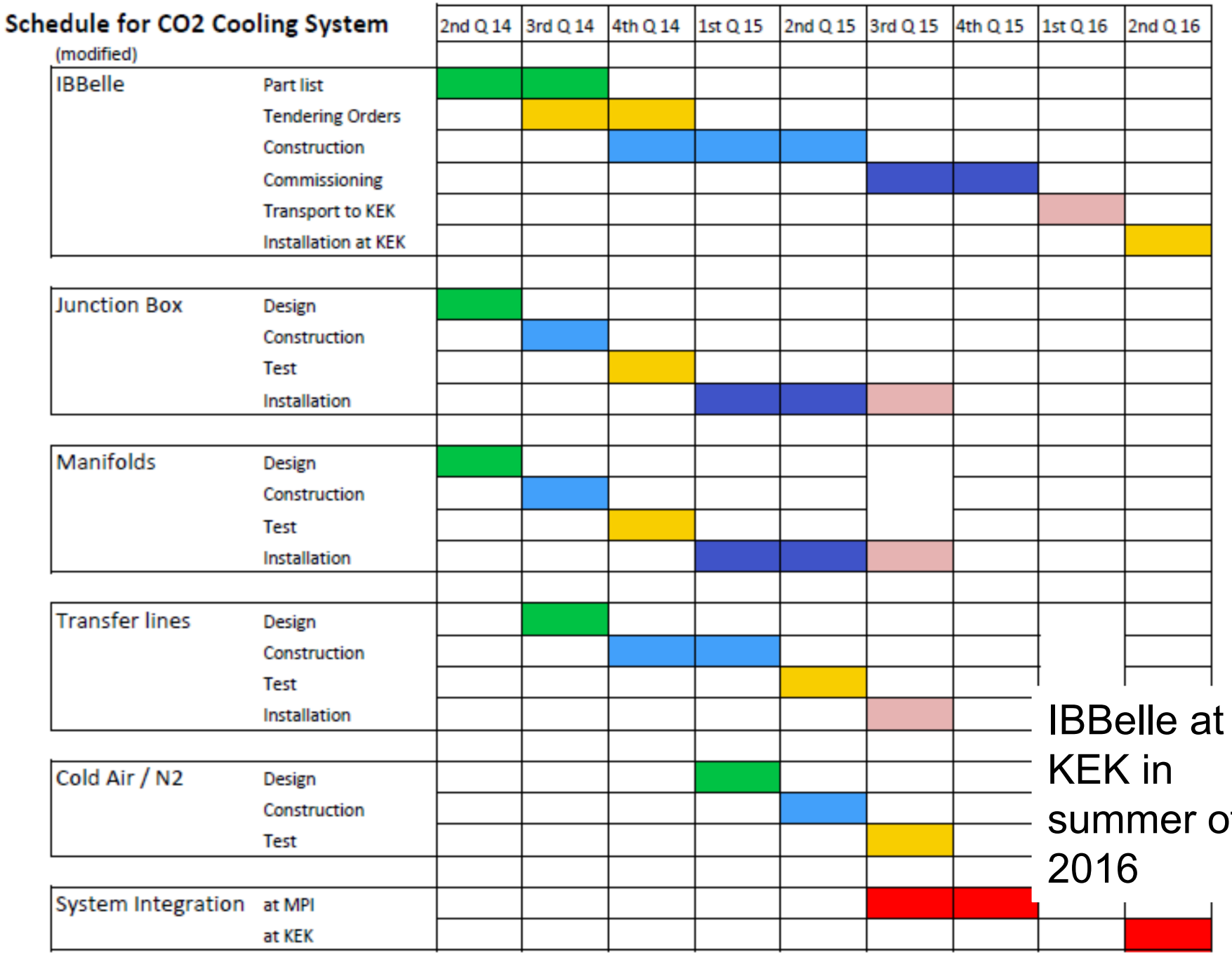
Will be heavily used in the thermal mockup

Problems with the gear pump, but spare parts (pump heads) are existing.

Still worry about long-term testing: Need a different pump (membrane)

Candidate: HNC pump (15 kEur), software change needed, help by CERN indicated

Schedule for the CO2 Plant



IBBelle at KEK in summer of 2016

Status of Parts Ordering

Conclusion on electrical parts: all questions answered
(session between Lukasz and Reinhard)

Conclusion on mechanical parts: questions solved
(session between Bart and Sven)

We can order via CERN (legal issues checked)

So far ordered:

26.0 kEur electronic parts
86.5 kEur pumps, Swagelok parts

Financial contributions from SVD colleagues are coming in
(still to be solved: agreement with KEK)

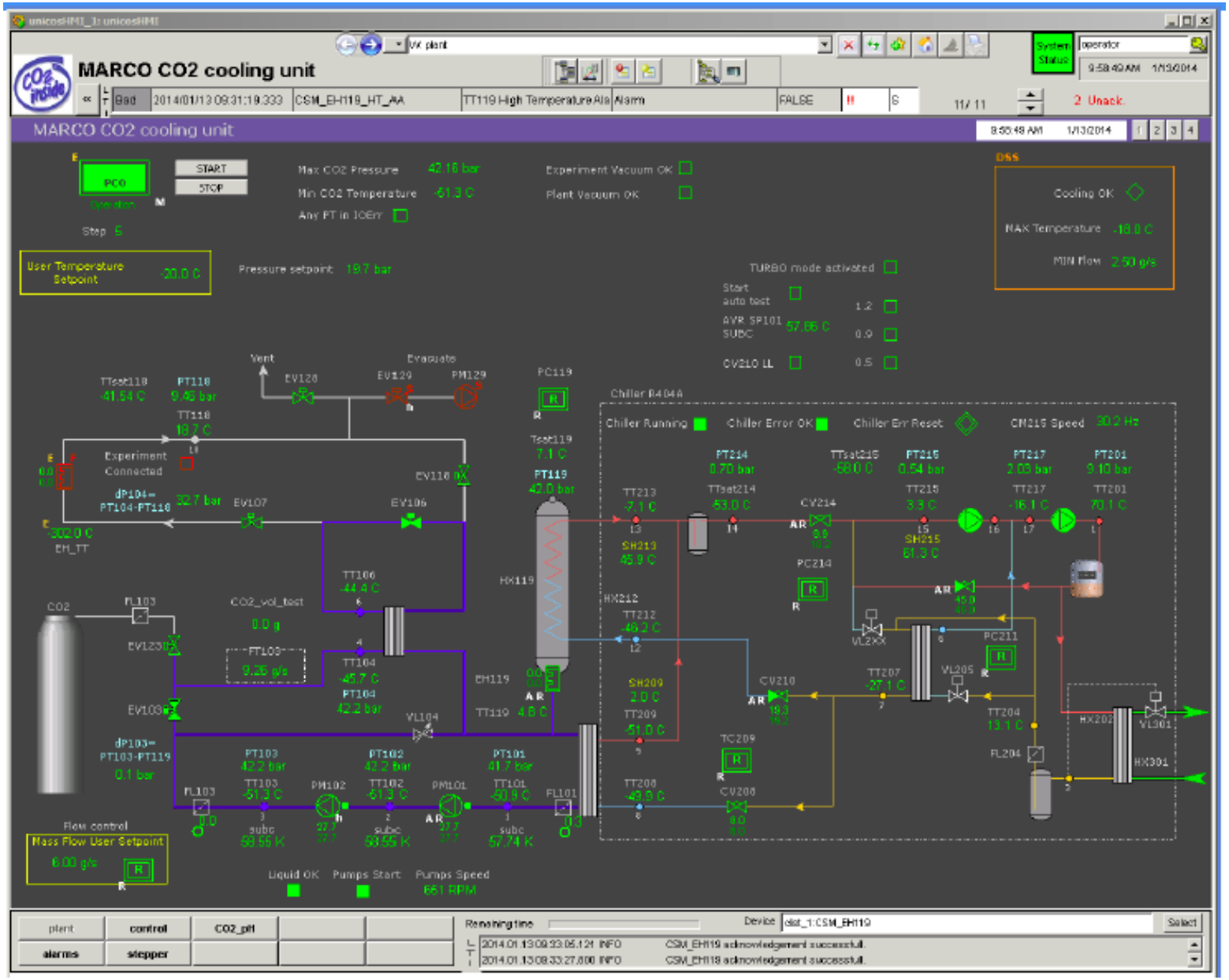
Need to investigate container solution

Certification & Commissioning

- Training envisaged with the ATLAS instance of IBBelle at CERN (look for crew: MPI / DESY / KEK
- Translation from PVSS to EPICS (should not be a problem, according to the experts)
- Commissioning with the help of Jan Godlewski et al joined by Japanese engineers from KEK cryo group
- In case of Container Solution:
  No disassembly, “easy” start of operation at KEK
- Important: prepare Wiki Page with documentation
  To be done on MPI server, with link in KEK Wiki page

  Goal: First version for November B2GM

PVSS GUI for IBBelle



PVSS sets operation points (T, CO2 flux) and monitors the operation

Supervising layer (+GUI) will be re-written in EPICS / CSS (man power ear-marked)

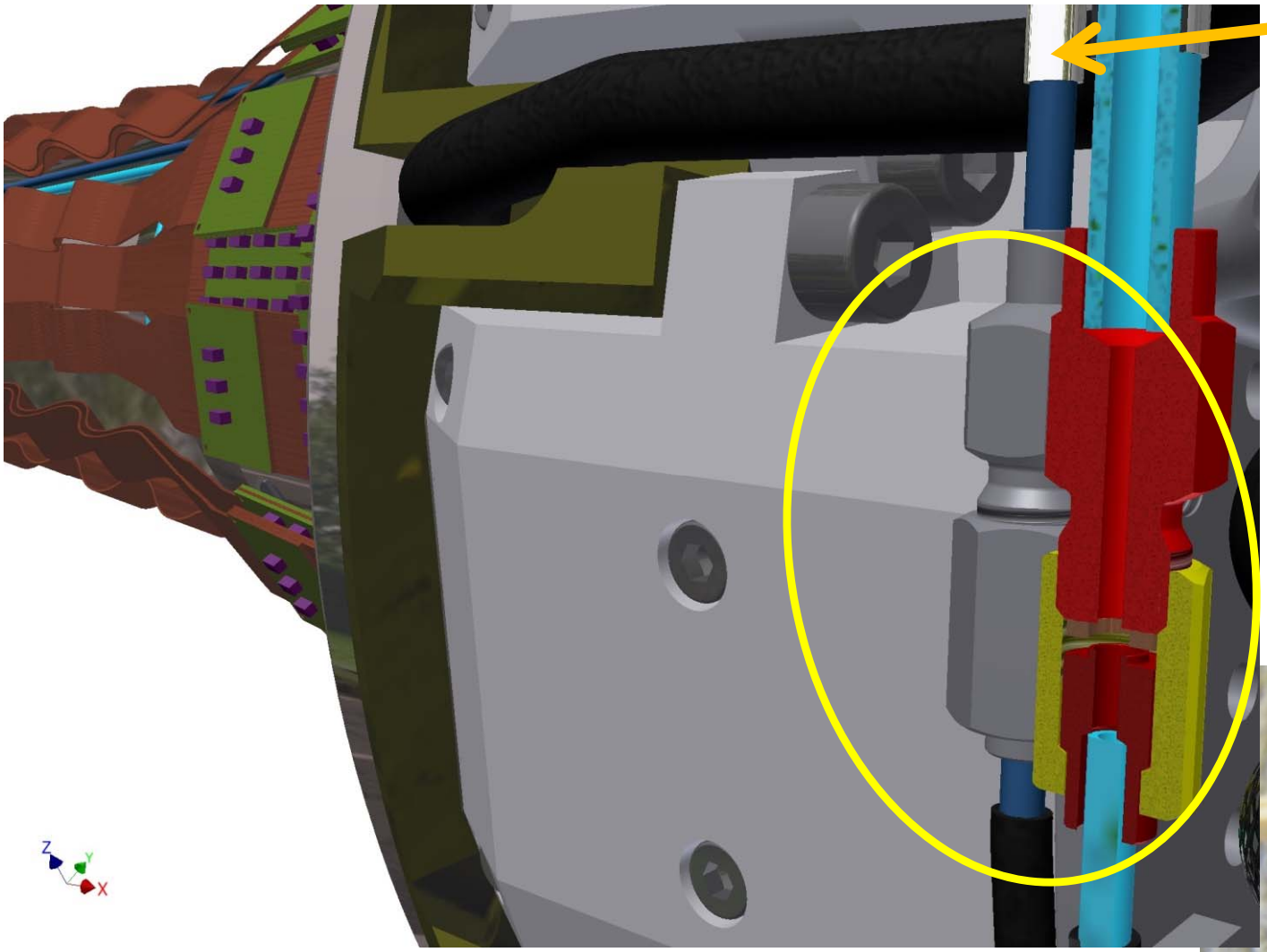
All critical control / operation functions are formulated in PLC and will not be touched

Responsibilities, Operation at KEK

- Lead institute (main responsibility): MPI Munich
  Collaborating institutes: DESY + SVD (Vienna?)
- Installation at KEK: MPI, DESY, SVD (= “VXD”) + KEK
- Commissioning: VXD + KEK
- Agreement with KEK (Nov. 13 B2GM meeting):
  - KEK will operate and monitor IBBelle
    standard service tasks executed by KEK
    (e.g. filter cleaning, replacement of spare parts)
  - major failures will require action by VXD crew

Backup

CO2 Micro Connections after the VXD Flange



Super-insulated CO2 lines

Custom-made micro connector : 5mm

pipe and connector required to stand 300 bar (KEK safety)

CO2 pipes super-insulated outside the VXD flange and the volume between QCS and CDC

Schematics of Piping Layout