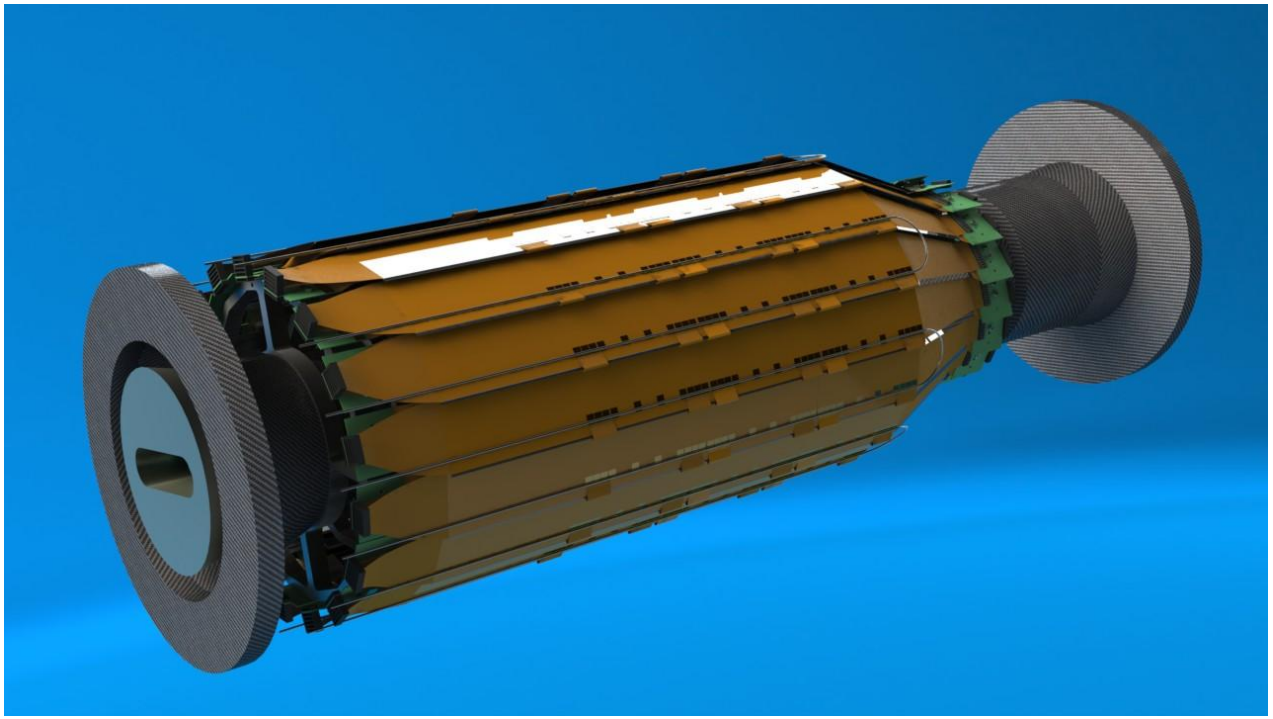


Belle II SVD Mechanics and Cooling Status Report

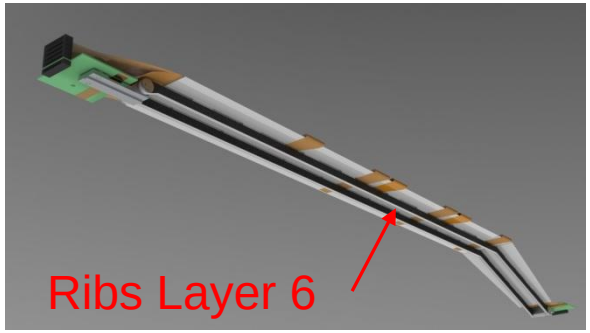
Immanuel Gfall (HEPHY Vienna)

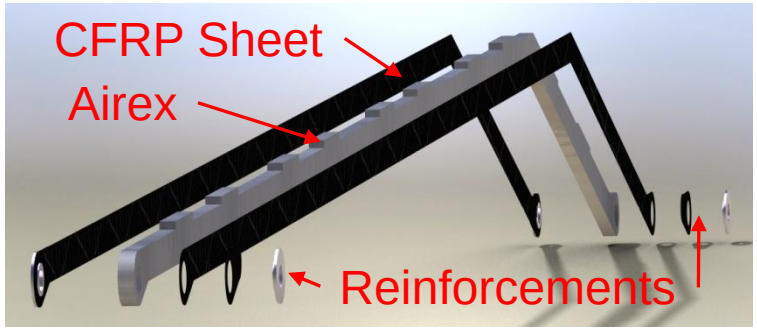
7th International Workshop on
DEPFET Detectors and Applications

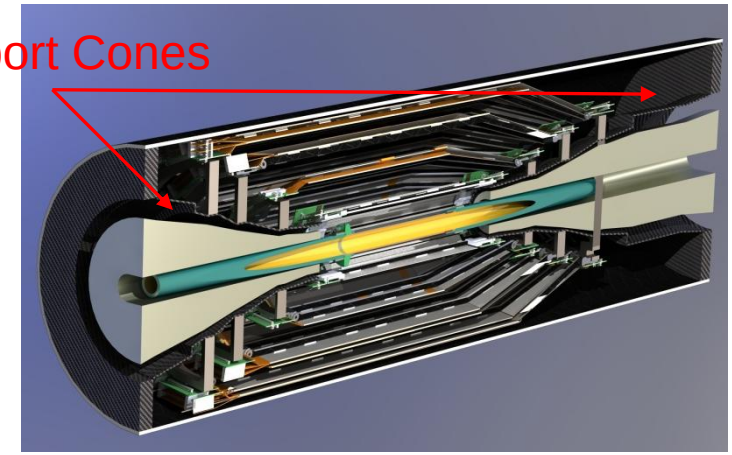
10 May 2011

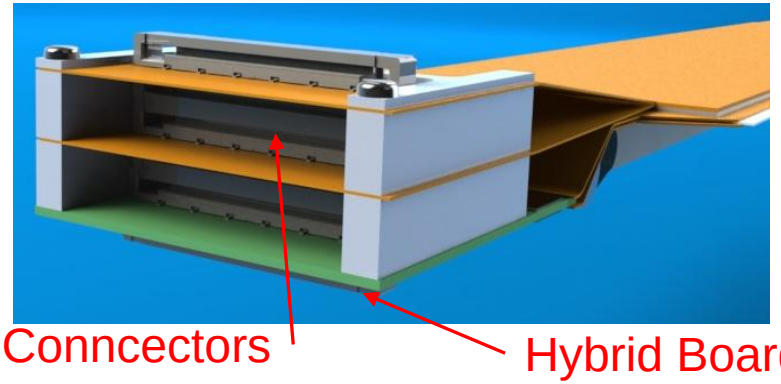
SVD Design Status

- Carbon fiber sandwich ribs
- Layer 4,5,6 designed in Vienna
- Layer 3 designed at KEK
- New connector block using JAE connector



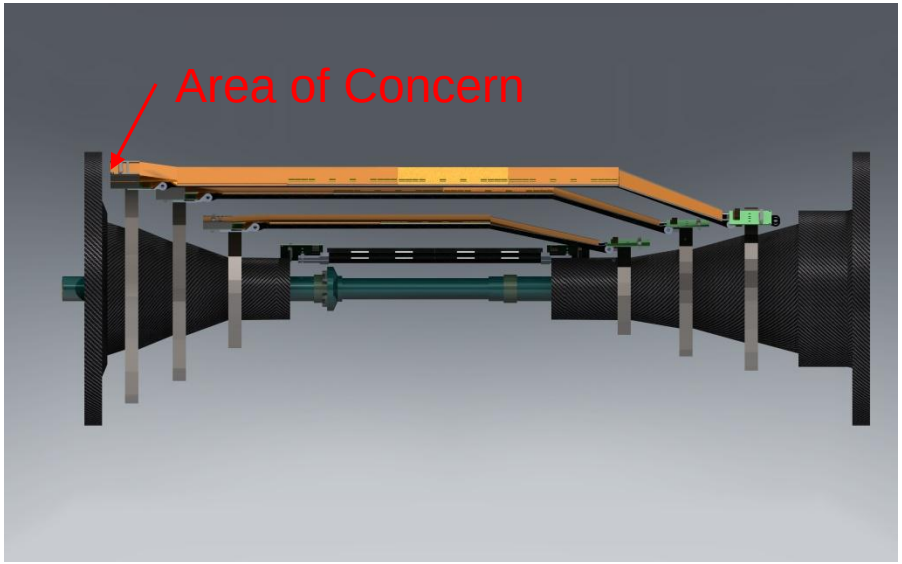


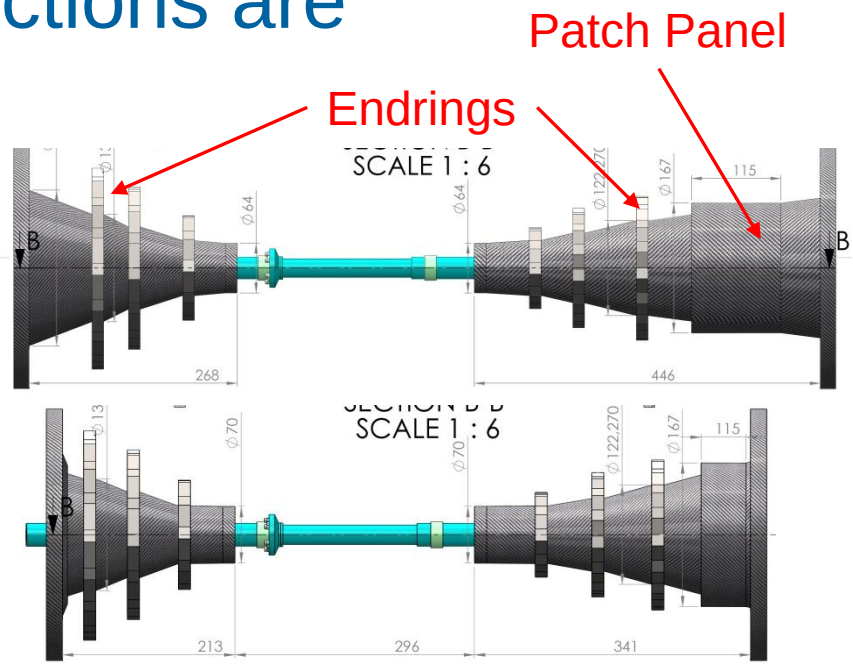




New Space Constraints

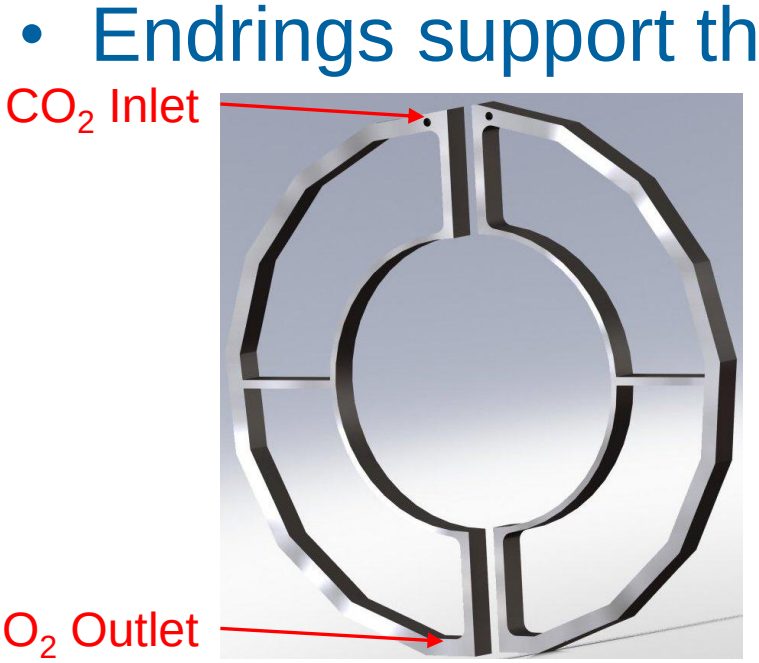
- Unfortunate length change in SVD envelop
- Challenging/impossible service ways
- Especially cooling connections are compromised





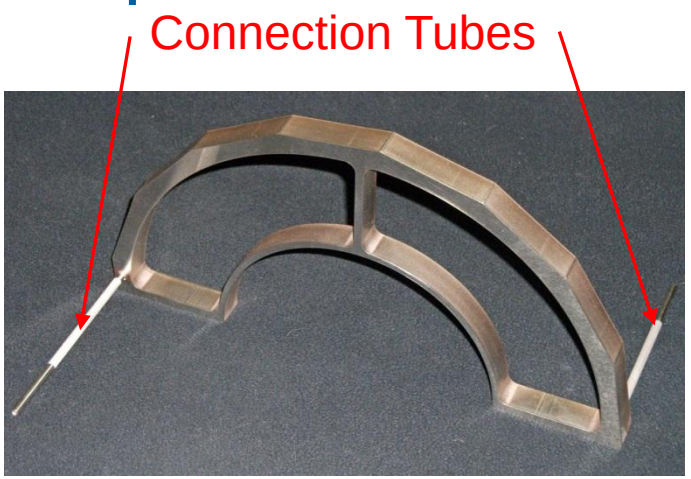
Endring Design

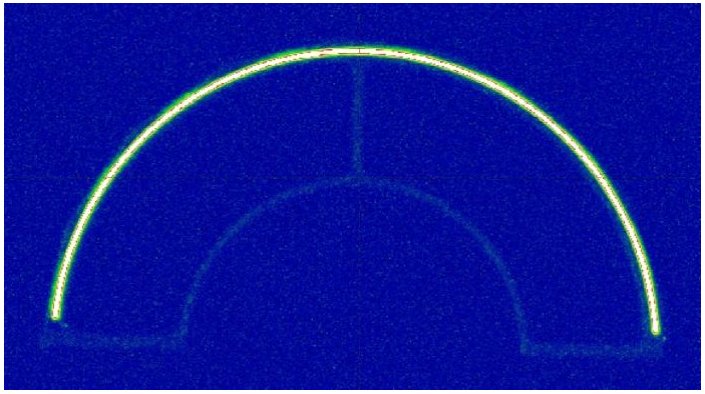
- Separable ring
- Integrated cooling channel
- Four pieces joined to two
- Endrings support the ladders



Manufacturing

- Grooves are cut into the halve pieces
- Diffusion welded
- Ultra sonic leak tested
- Tubes brazed to the ring

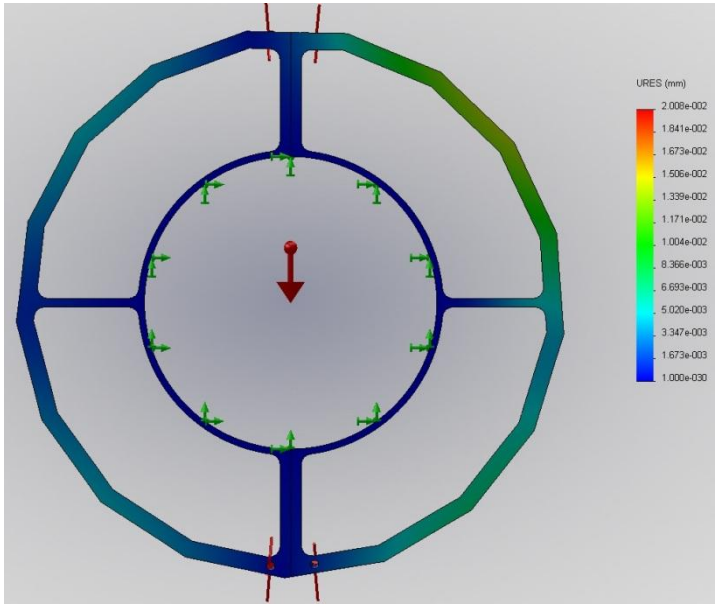




Simulation

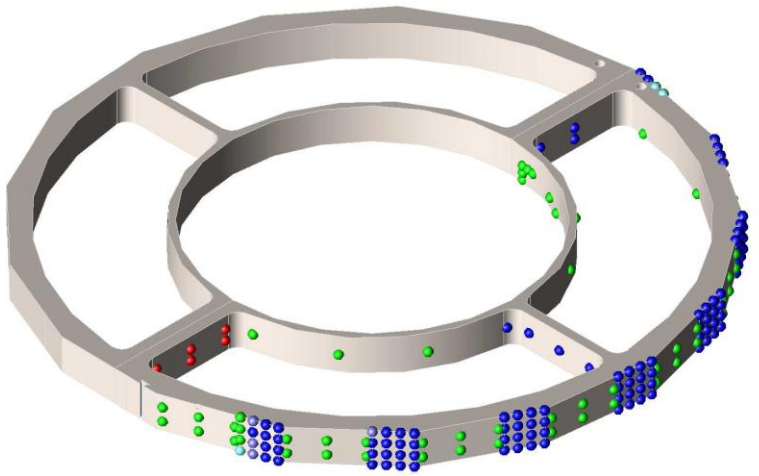
- Endring has been simulated prior to production
- Gravitational load 17 x 60 g
- Sim. pressure (100 bar)
- Deformation: 0.014 mm

- Design pressure : 20 bar
- Endring design sufficient



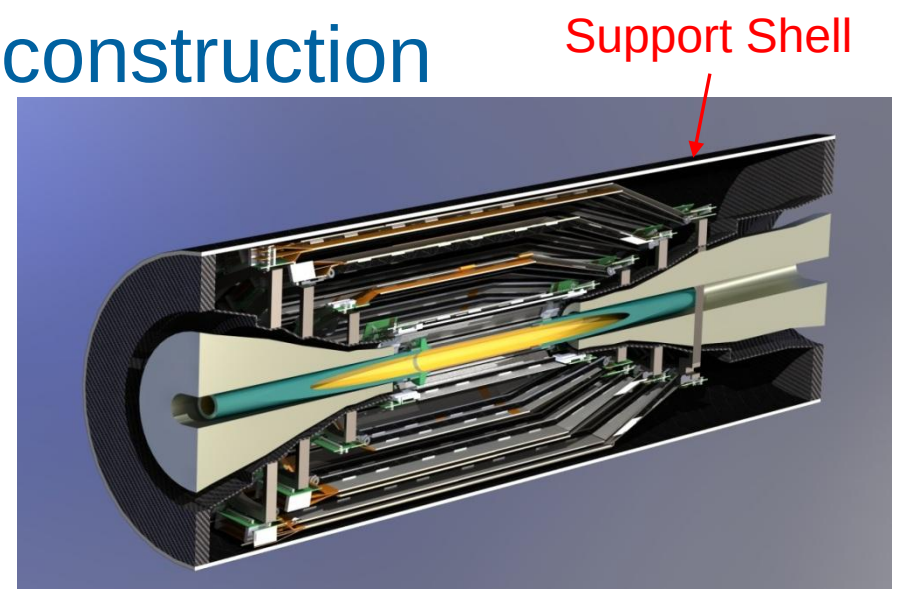
Build Precision Measurment

- Endring is being measured with a coordinate measurement machine
- Mount point flatness was measured first
- Flatness: difference between lowest and highest measured point
- Max Flatness: 0.017 mm
- Average flatness: 0.007 mm
- Flatness and inner radius does not change @200 bar



Support Shell

- Thermal insulation
- Mechanical coupling between heavy metal beam masks
- Limited protection of SVD during installation
- Carbon fiber sandwich construction
- CFRP < 1mm
- Airex foam core with 3-5 mm thickness

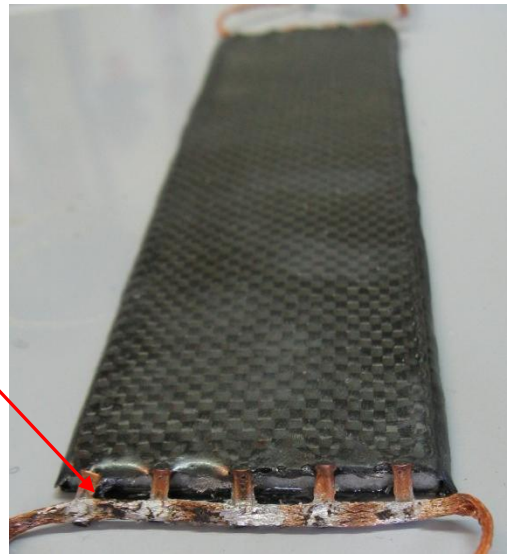


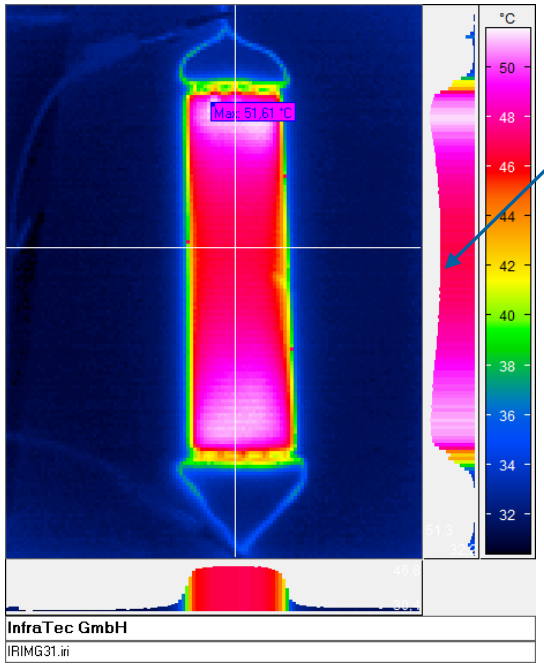
Heater

- SVD volume temperature -10°C
- CDC-SVD interface temperature 23°C
- Thermal insulation is required
- Active heating could be required
- This usually adds material (e.g. copper)
- Could result in unwanted effects
- Better solution should be used!

CFRP Heater Solution

- Uses conductive properties of CF
- UD Fibers + 1 additional basket weave layer
- Resistance: ~15 Ohm/m
- Average temperatures of 47 °C in the center area at 4.5 A are possible
- dT = 1 °C

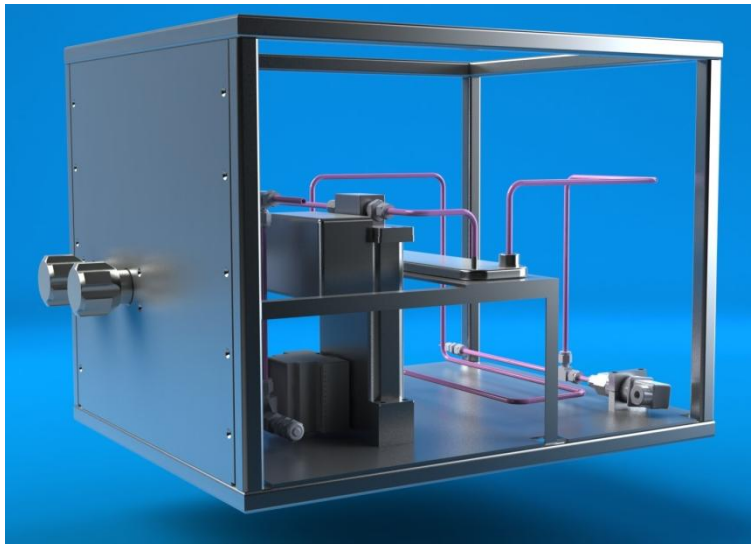




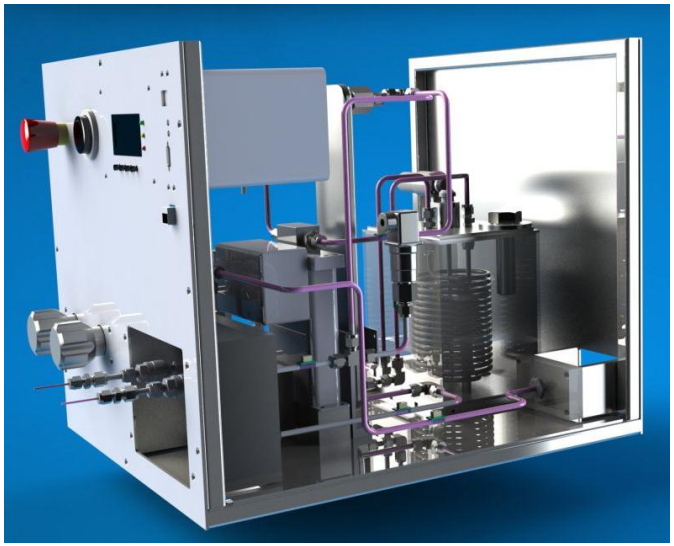
Cooling Status

- Vienna builds an open test system
- First design was completely overhauled
- Water bath heater now replaces electrical heater
- Control/safety system is installed

Plant V1

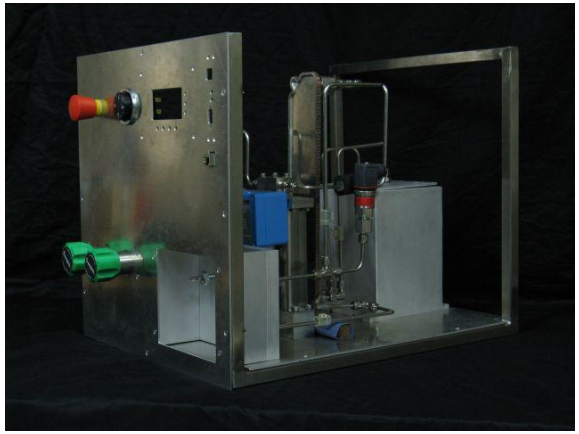


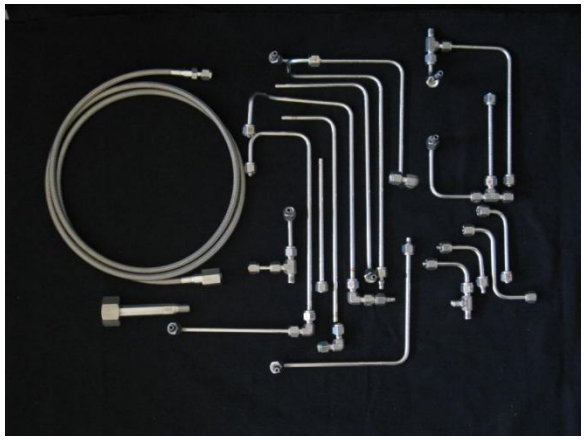
Plant V2 “Evolution”

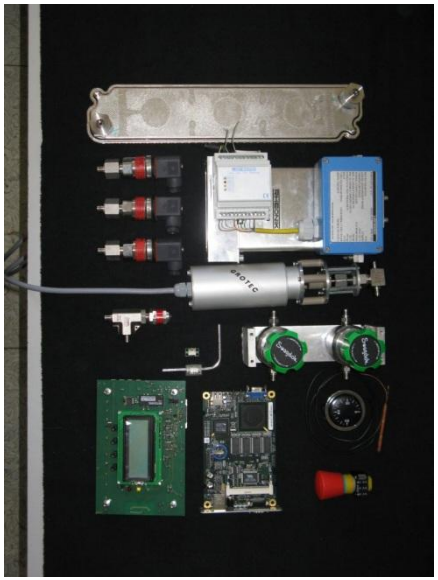


Plant V2

- All components are in Vienna
- Assembly is almost finished
- One orbital weld and the anodizing of some parts is still required
- Control software is currently written







Cooling Tube Pressure Test

- Tube was closed on one end (trapped air)
- Tube was vertical and unsupported
- Length = 310 mm
- 3 measurement points
- Pressure up to 235 bar over a period of 20 hours
- Deformation of diameter: 1.4 -> 1.36 mm @ 235 bar
- No measurable deformation @100 bar

Outlook

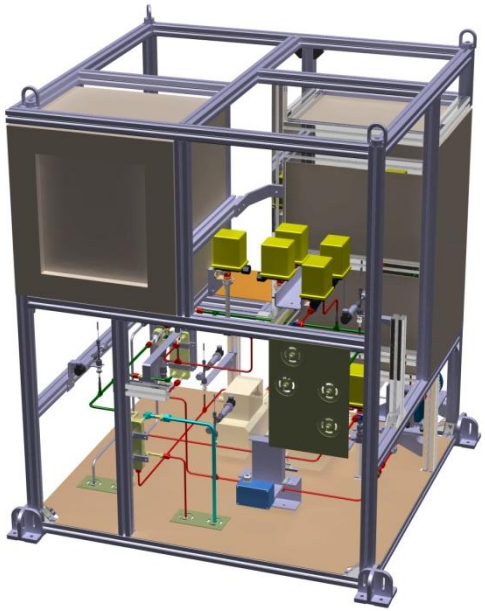
- Finish endring measurements (no surprises expected)
- Elaborate the CFRP heater concept
- Finish the cooling plant control software
- Starting the CFRP support cone design
- Building a closed system together with MPI/CERN/NIKHEF

Closed System

- PXD and SVD rely on CO_2 cooling
- This requires a closed cooling system
- NIKHEF (Bart Verlaat) has the experience
- MPI has the engineering/ building manpower
- Design is done by NIKHEF and HEPHY
- Project name: IBBelLe
- First stage: construction of MARCo, an experimental closed system

MARCo

- MARCo is the “apprentice plant”
- Designed by NIKHEF
- Construction is done by MPI
- Commissioning done at CERN
- Finished by November 2011
- Construction and practical experience will flow into the design of IBBelLe



MARCo Plant by NIKHEF

IBBelLe

- That is the plant design as it will be used by the Belle II experiment
- Two machines will be constructed for parallel service at KEK
- Start of design: July 2011
- Start of construction: March 2012
- Finished system: July 2012
- Long term tests can be done with MARCo before IBBelLe is finished