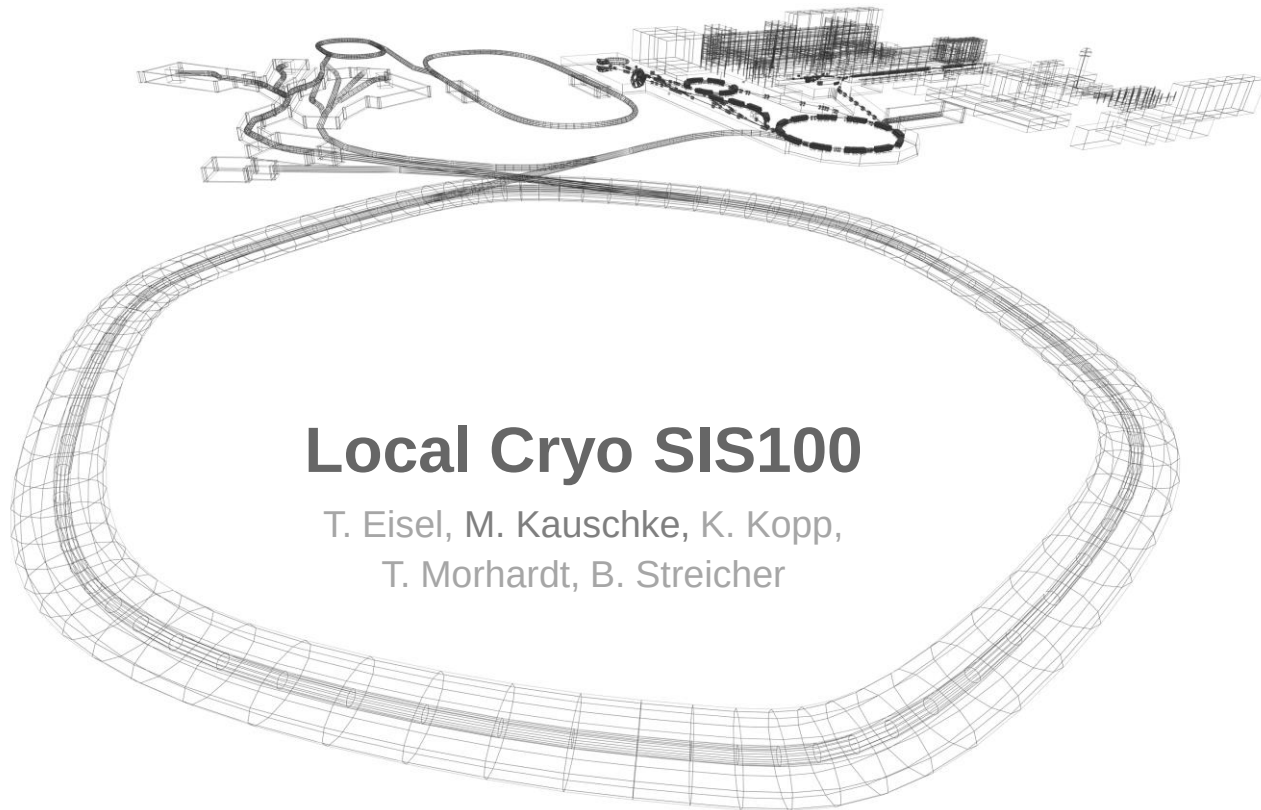




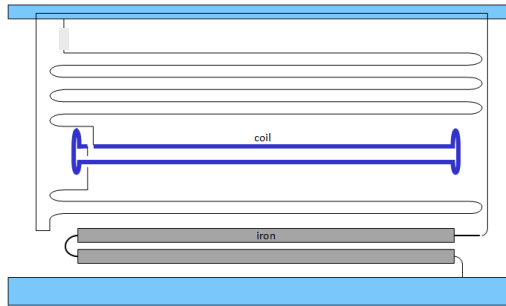
# Local Cryo SIS100

T. Eisel, M. Kauschke, K. Kopp,  
T. Morhardt, B. Streicher

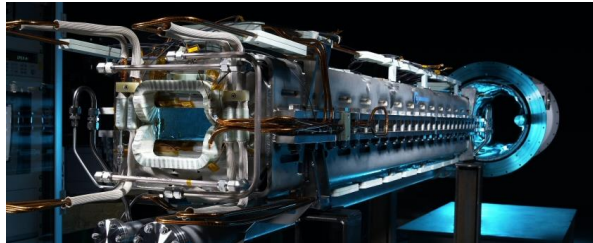
- Overview
- Magnets
  - magnet cooling
    - heat loads
    - parallel hydraulic circuits and its balancing
- Feed Box and Feed In-Line Box
- By-Pass Line
- Current Lead Box

# Magnets

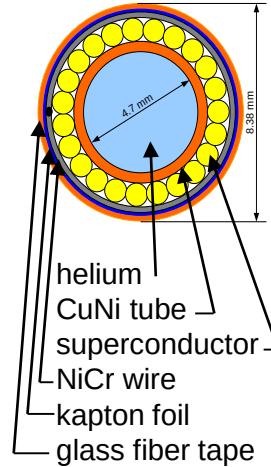
109 Dipole: 1.9 T, 4 T/s @ 1 Hz



cable: ~130m  $d_i=4.7$  mm  
iron: 14m  $d_i=10$  mm



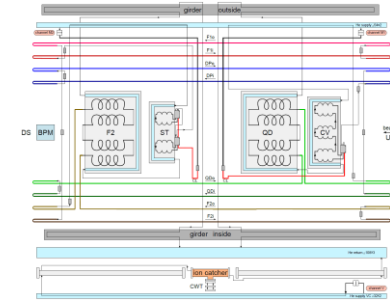
superconducting cable (13 kA)



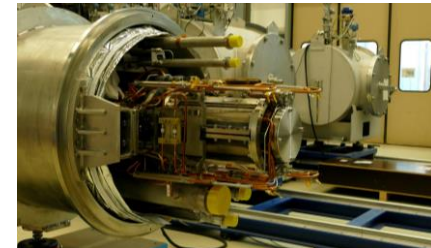
filament size: 2.4-3.4  $\mu\text{m}$



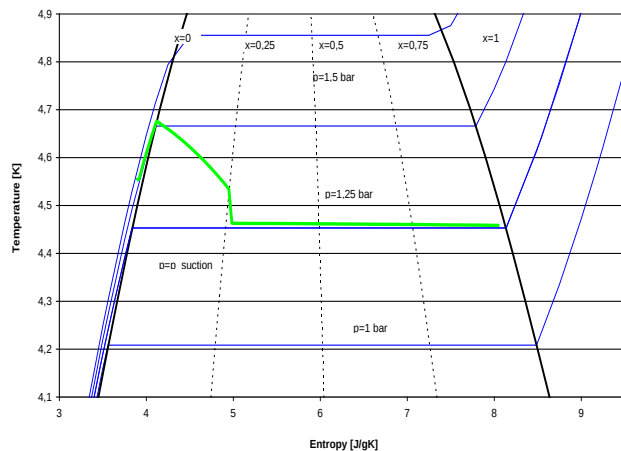
84 Quadrupole modules: 27 T/m



cable: ~100-150m  $d_i=4.7$  mm  
iron/ girder: 10-15m  $d_i=10$  mm



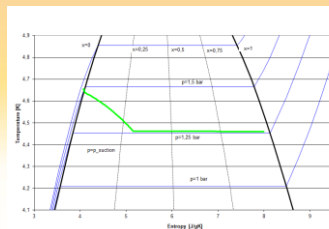
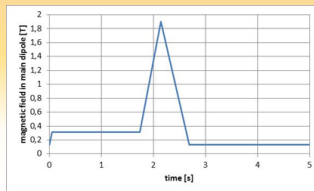
## Exemplary T-s-diagram for dipole



$$Q_{\text{static, 4K}} = 3450 \text{ W}$$

$$Q_{\text{static, 50K}} = 14800 \text{ W}$$

### Cycle A



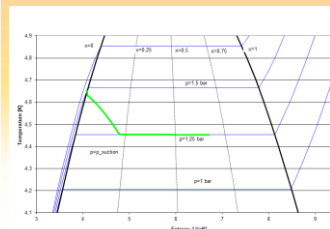
### Proton cycle

Intensity:  $2 \cdot 10^{13}$

Repetition rate: 5s

$$Q_{\text{dyn}} = 3880 \text{ W}$$

### Cycle B



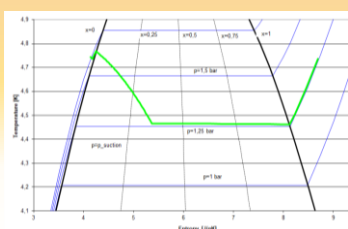
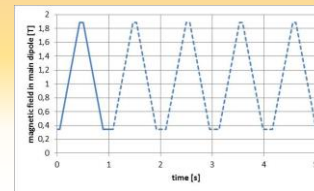
### RIB cycle $U^{28+}$

Intensity:  $5 \cdot 10^{11}$

Repetition rate: 4s

$$Q_{\text{dyn}} = 3060 \text{ W}$$

### Cycle C

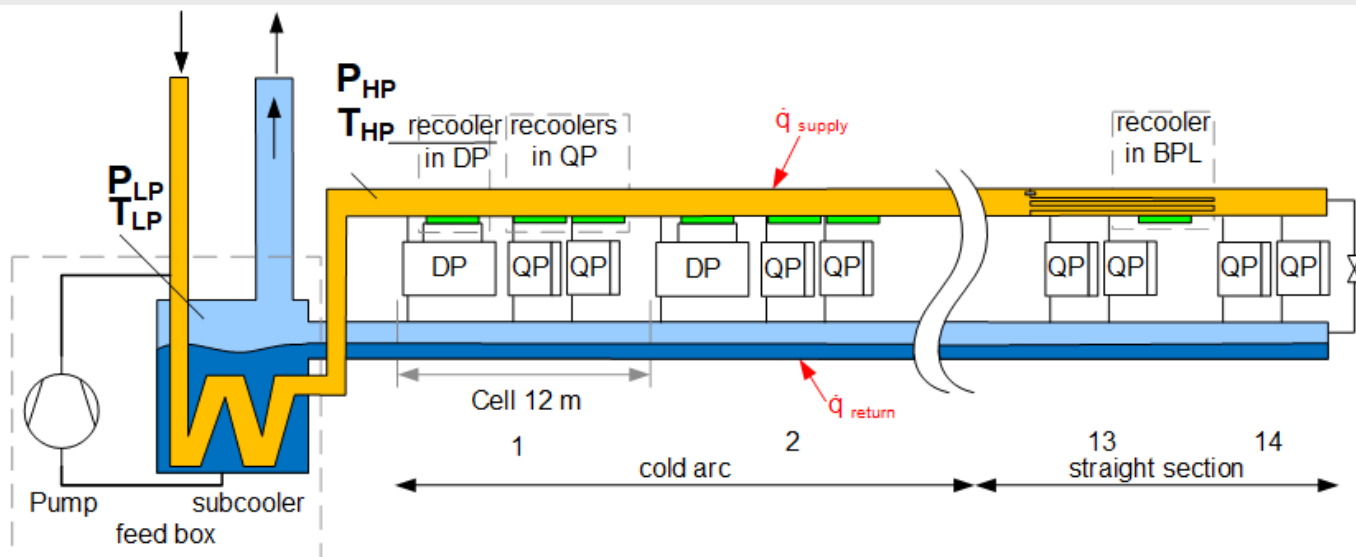


### triangular cycle $U^{28+}$

Intensity:  $1.3 \cdot 10^{11}$

Repetition rate: 0.991 s

$$Q_{\text{dyn}} = 11300 \text{ W}$$



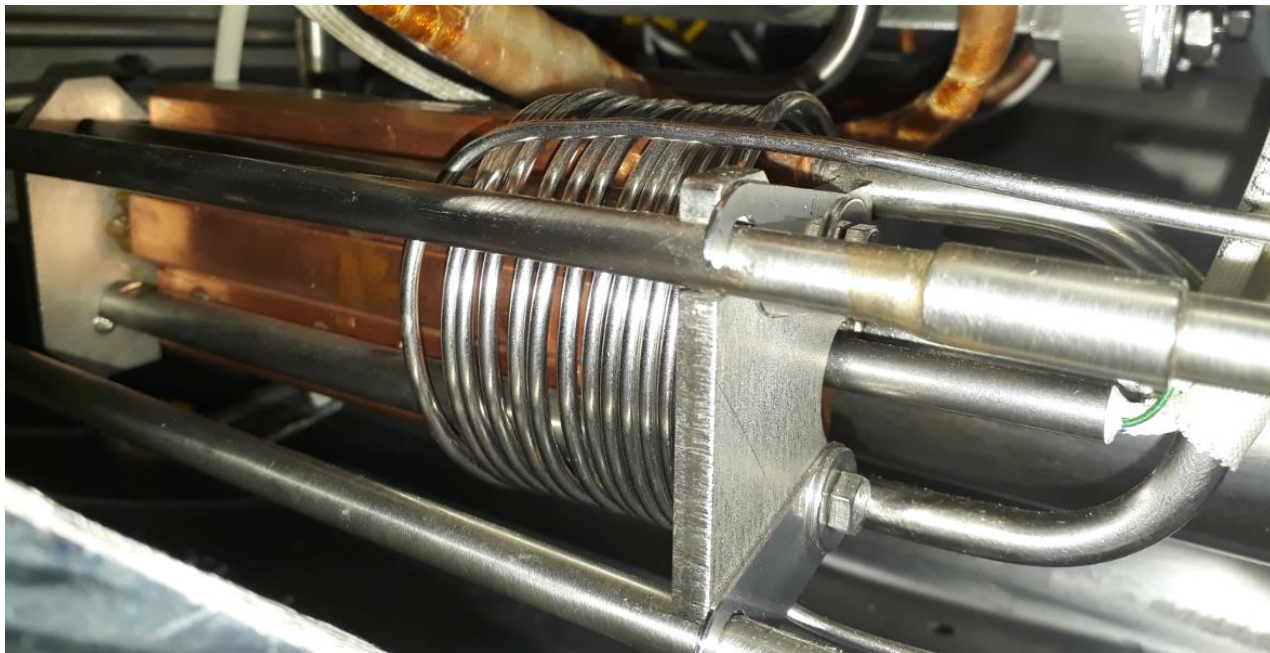
$$\Delta p_{\text{supply}} < 10 \% \Delta p_{\text{FB}}$$

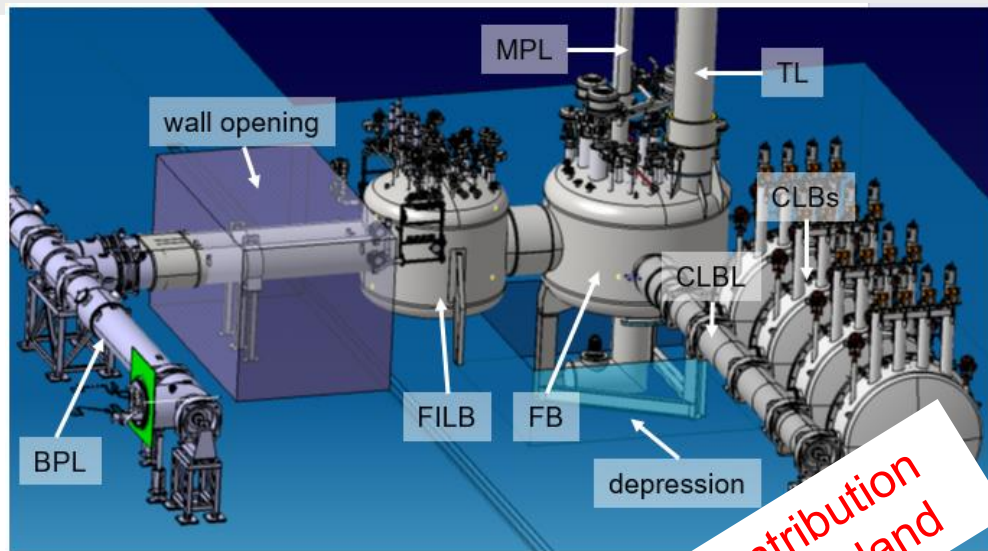
$$\Delta p_{\text{return}} < 10 \% \Delta p_{\text{FB}}$$

adaptation of individual pressure drop of magnets to reference cycle

- by capillary tube at the magnet inlet (adopted to each magnet type)
- by heater attached to the capillary tube

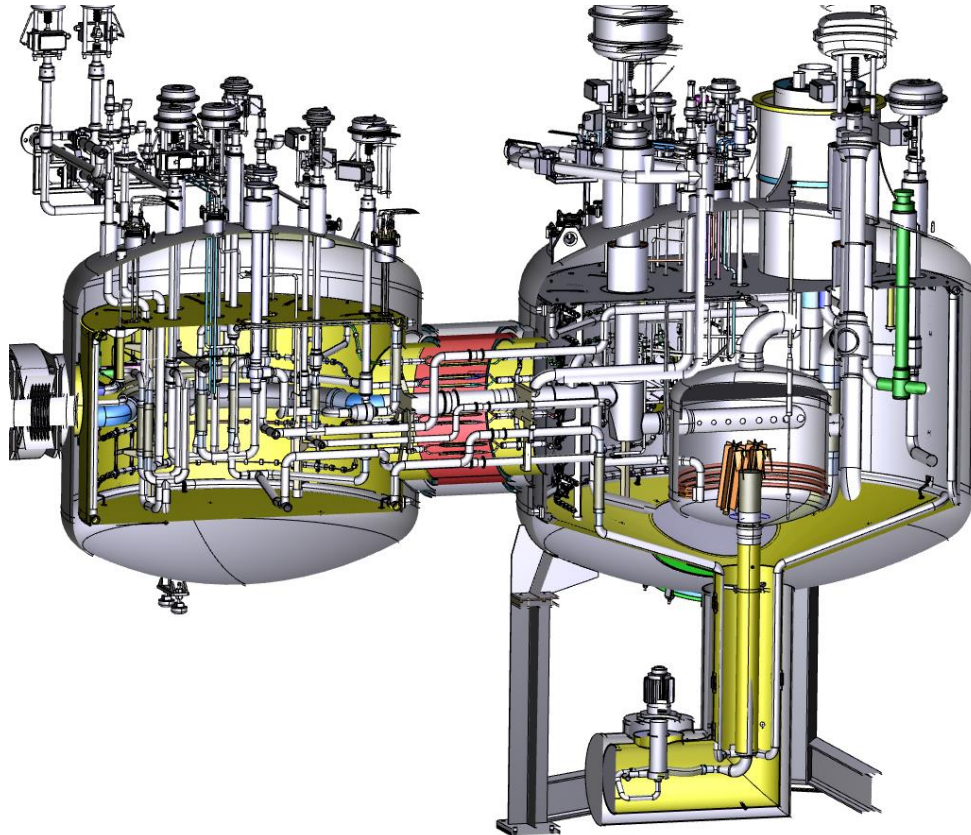
## magnet cooling





- depression
- Polish In-Kind contribution  
WUST in Wroclaw/Poland

## Feed Box & Feed In-line Box

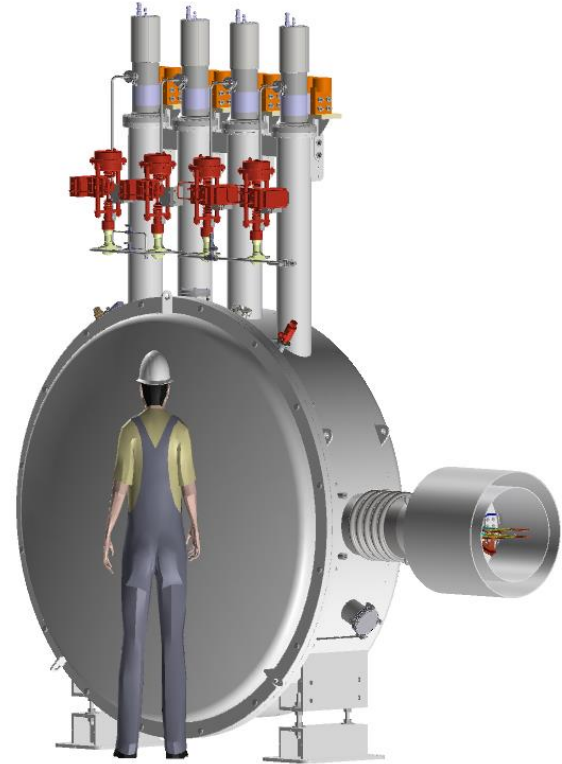
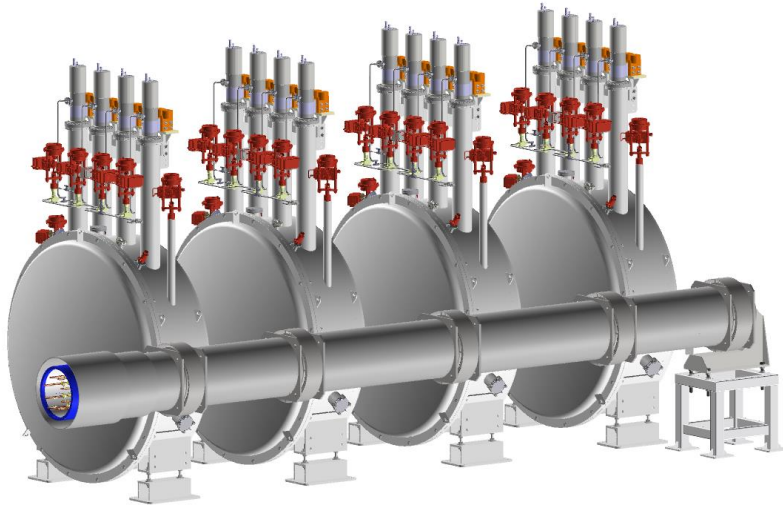


- both supplied sextants can be cooled/warmed independently
  - helium for vacuum chamber cooling have to be conditioned independently
  - cool-down of distribution system
  - recycling of returning liquid (up to 120 g/s)
  - 4x 1kW heater for fast-control (during quench)
  - safety valves for the process lines
  - valves (>100) & instrumentation (>60, e.g. T, m, level)
  - bus bar system integrated
- testing at helium temperatures at STF
- > first Feed Box will be tendered summer this year



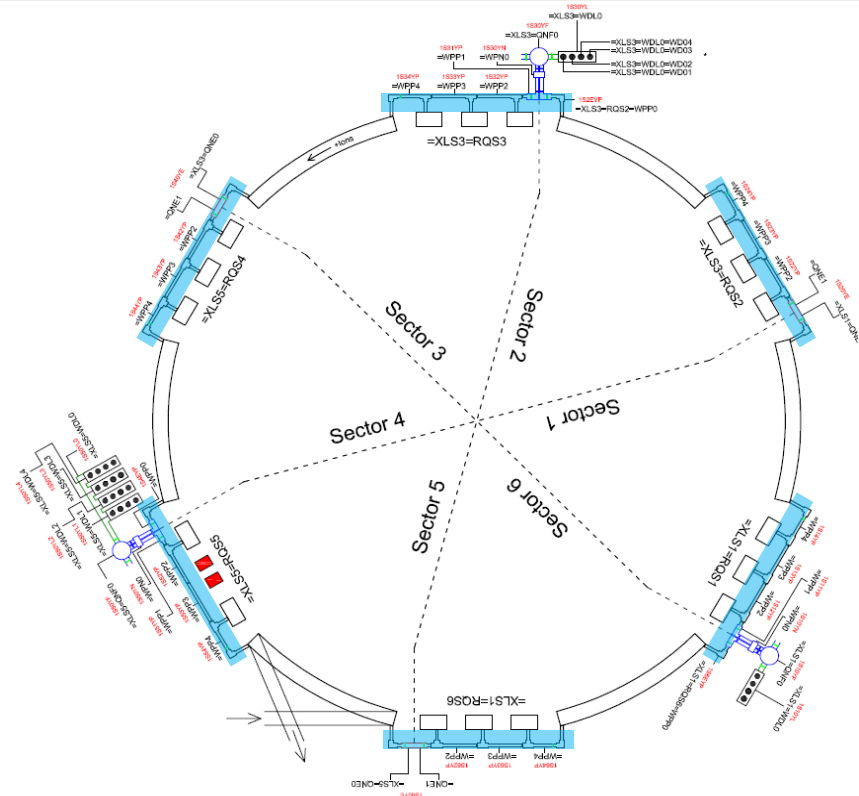
## Current Lead Box

- tendering can be found at WUST platform  
<https://ezamowienia.gov.pl/mp-client/search/list/ocds-148610-2fb9b6ef-bf37-11ed-b311-9aae6ad31be8>



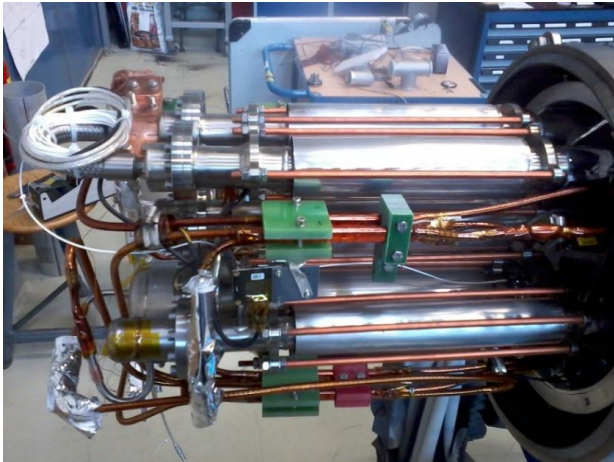
# By-Pass Line

- BPL circumvents 6 straight warm SIS 100 sections
- Supply QDMs with
  - Cold helium (4.5 K)
  - Electrical current
- Interfaces
  - Feed Boxes (3)  
(Interface to He and electrical Distribution System)
  - Magnets
- Key figures
  - 27 modules
  - 16 different types
  - 6 x 50 m = 300 m
  - max. current: 14 kA
  - max. ramp rate: 28 kA/s
  - incl. 3 End Boxes each 12 cold CVs



# By-Pass Line

- manufactured by KrioSystem, Wroclaw
- all delivered except EBs (first next month)
- cold tests at STF
  - performed for FOS, 42, 6E, 32
  - EB/2 is planned
  - many lessons learned, especially regarding the electrical system (and shrinkage)



Thank you for your attention