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FREIA

Horizontal Cryostat Requirements

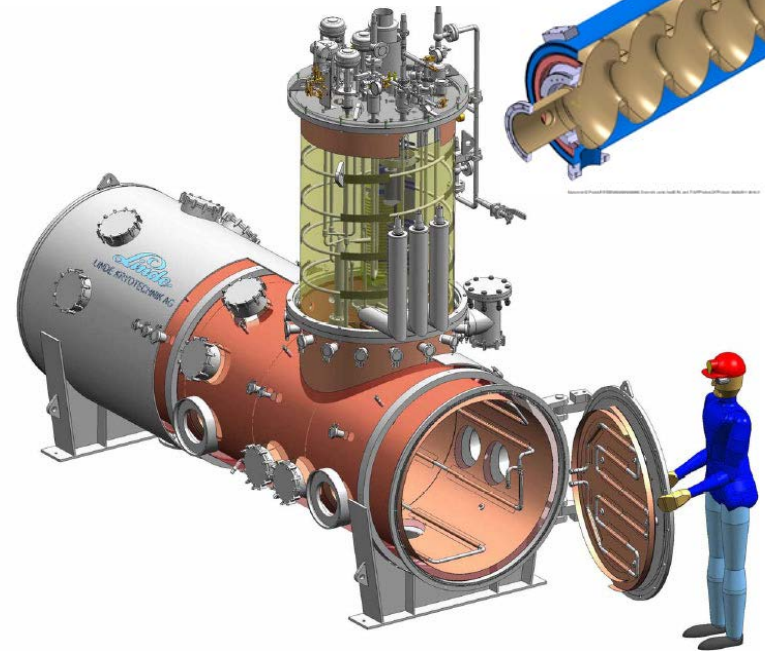
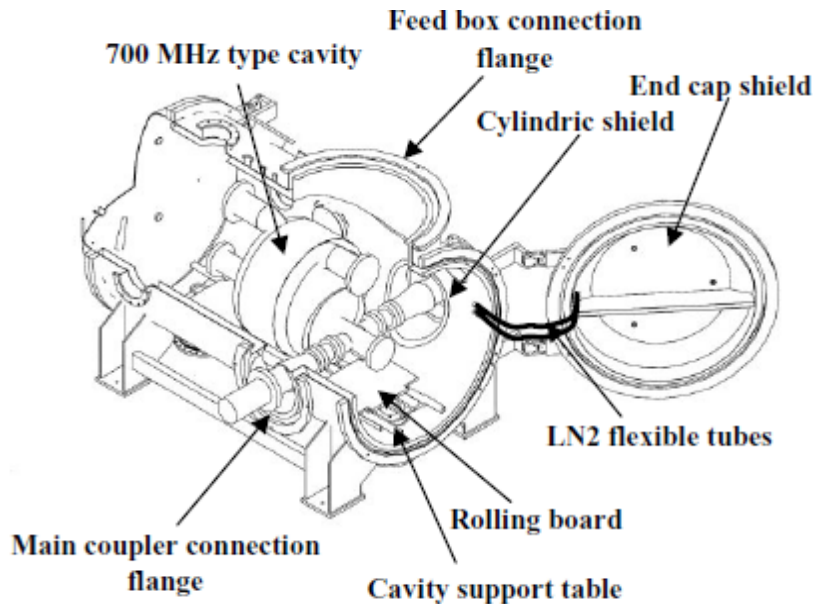
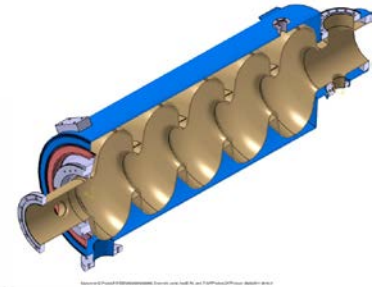
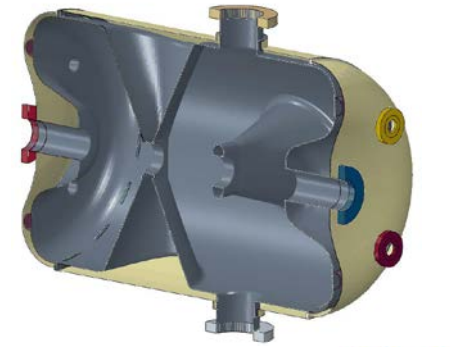
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FREIA Horizontal Test Cryostat



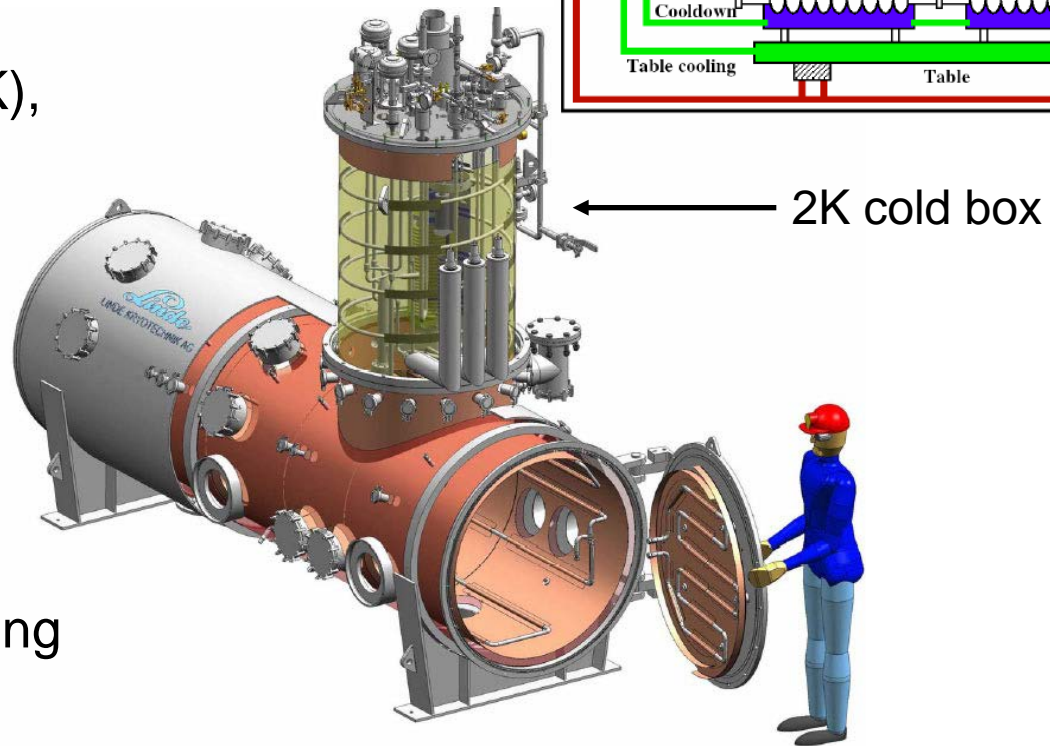
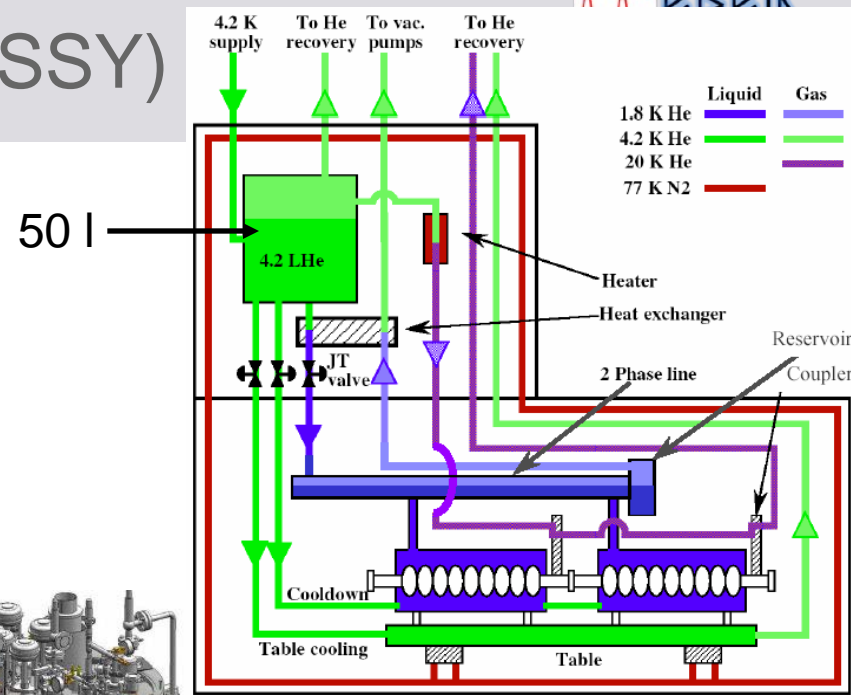
- internal volume (3.5 m x 1.1 m)
 - for 1 or 2 spoke or elliptical cavities
- operation temperature range 1.5 – 4.2 K
- based on existing designs
 - CHECHIA, CryoHoLab, HoBiCat

supported by
Wallenberg
foundation



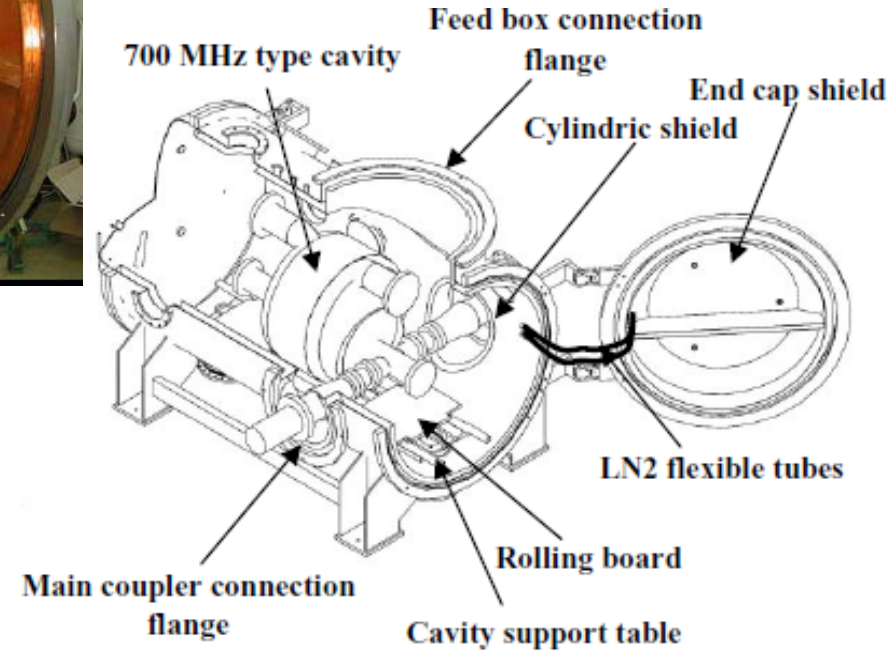
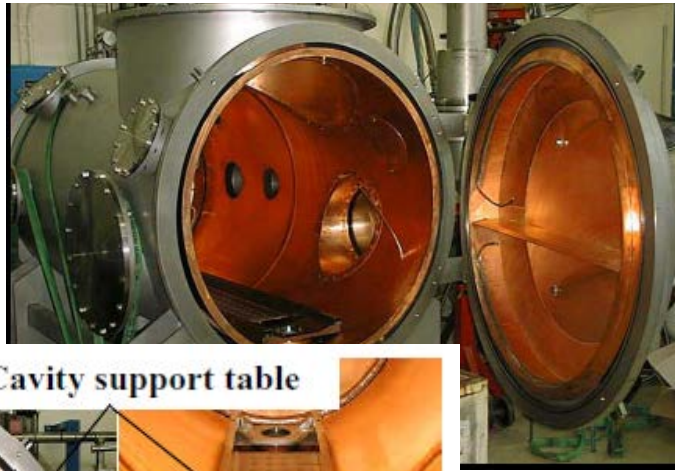
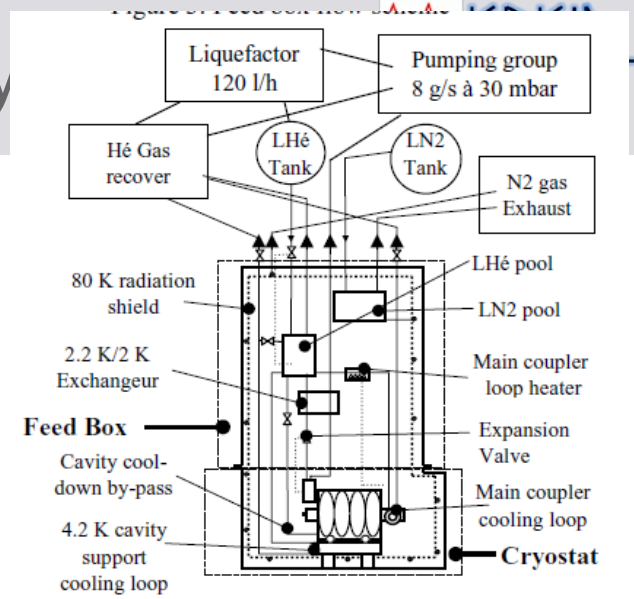
HoBiCaT (HZ Berlin, BESSY)

- J. Knobloch et al.,
HoBiCaT – A test facility for
superconducting RF systems,
Proc. SRF'03.
- internal volume 3.5 m x 1.1 m
- range 1.5 – 2.2 K, 4.2 K
- stability ± 0.1 mbar (1.8K),
1mbar (4.2K)
- integrated 2K cold box
- supply: 180 l/h at 4.2 K
(Linde TCF50)
- pumps for
80W at 1.8K
- LN2 thermal shield cooling

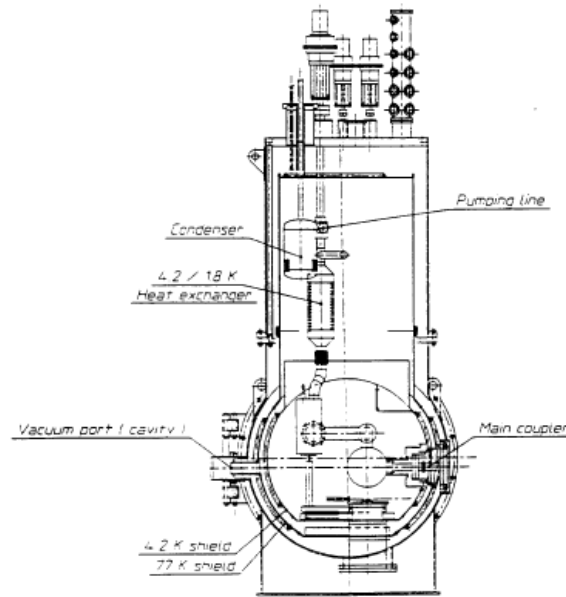
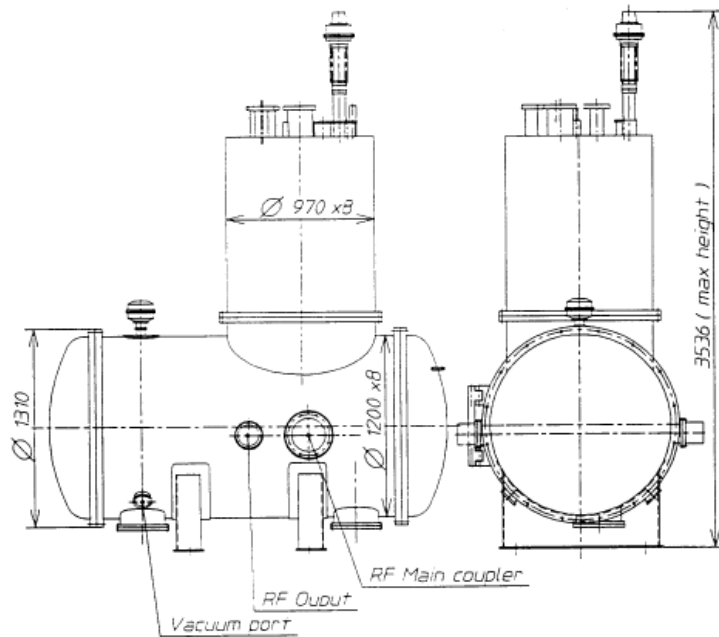


CryHoLab (Orsay, CEA Saclay)

- H. Sagnac et al.,
“CryHoLab”, a new horizontal test cryostat for
SCRF cavities,
Proc. SRF’99, Santa Fe, New Mexico, USA



- P. Clay et al.,
 Cryogenic and electrical test cryostat for instrumented superconductive RF cavities (CHECHIA)
 Proc. CEC/ICMC'95, Columbus, Ohio, USA (TESTLA-95-21)
- one horizontal positioned TTF cavity





Base Requirements



- one or two superconducting accelerating cavities
 - all required ancillaries: helium tank, tuner, input power coupler, monitor/pick-up probe and, if reasonably possible, HOM coupler(s).
 - can be contained in the same insulation vacuum,
- NO independent cool down of the cavities
 - to a temperature adjustable in between 1.8 and 4.2 K,
 - thus includes cold feeder box
- full RF power test of the cavities,
- simple access to and replacement of the cavities,
- for possible future use with magnets or magnetic devices,
 - avoid magnetic materials and eddy currents



Additional Requirements



- cavity insertion table
- possibility to install "warm" bore tube
 - requires alignment possibilities, check thermal shrinking
- close off valves helium, nitrogen, vacuum (external)
- cooling channel power couplers

- cold gas heater
- 2K sub-atmospheric pumping system (requirement IPNO-UU)
- liquid helium transfer line (liquefier to cryostat)

- functionality
 - cool down, cold holding, warm up



Specs Table



Internal free volume (for cavities)	e 4'000 mm length e 1'200 mm diameter	
External dimensions	d 5'500 mm height d 3'000 mm width	horizontal cryostat plus cold feeder box
Liquid helium input	4.5 K, 1.3 bar	
Operation temperature	1.8 – 4.2 K	
Helium leak rate	d 10-5 mbar l/s	
LHe storage pot	e 20 l	is this reasonable ?
Static heat loss	d 10 W	at 4 K
Empty feedthroughs (1)	e 20 x DN40KF	for cavity instrumentation
Empty feedthroughs (2)	e 2 x DN100KF or larger size	vacuum pumping and other use



Boundary Conditions



- bunker
 - 9.6 m long, 4 m wide, 5.5 m height
- liquefier
 - 70 – 100 l/h, 2'000 l buffer tank
 - approx. 40 m transfer line
 - LN2 available (for shield cooling)
- safety and operation
 - vacuum, cryogenics, power failure
 - unattended continuous operation (w/o RF power)
 - system isolation and cleaning/purging (for cavity installation)



Cavity Dimensions



	Cavity			Power coupler		
	length [mm]	diameter [mm]	weight	length	diameter	weight
ESS spoke 352 MHz	900	480				
ESS elliptical 704 MHz						
TESLA elliptical 1.3 GHz						

add to cavity dimensions

- power coupler
- cold tuning system
- vacuum valves

• Multiple users

- transport dewar filling station
- horizontal test cryostat or ESS cryomodule
- vertical test cryostat (future extension)

• Helium liquefier

- ~100 l/h peak load at 4 K
- ~2000 l storage dewar
- ~8 g/s, 80 W peak load at 2 K

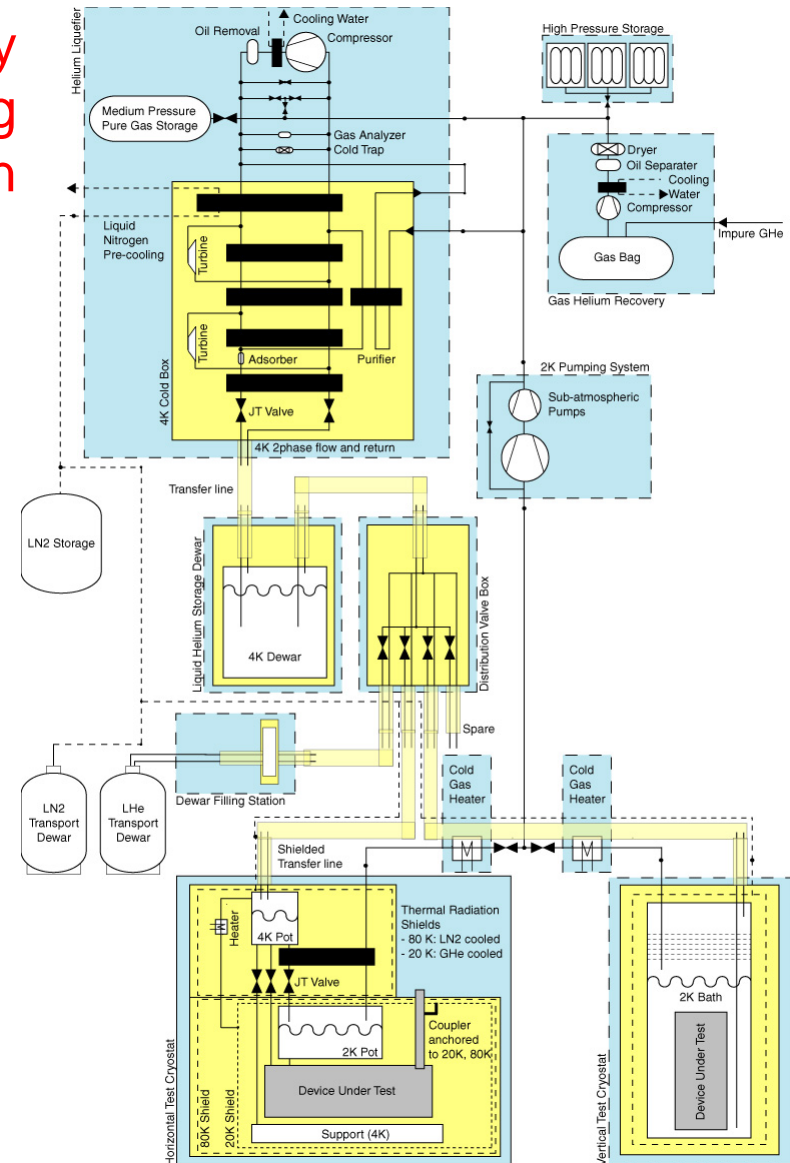
• Helium recovery system

- 30 m³/h average
- 50 m³/h peak load (minutes)

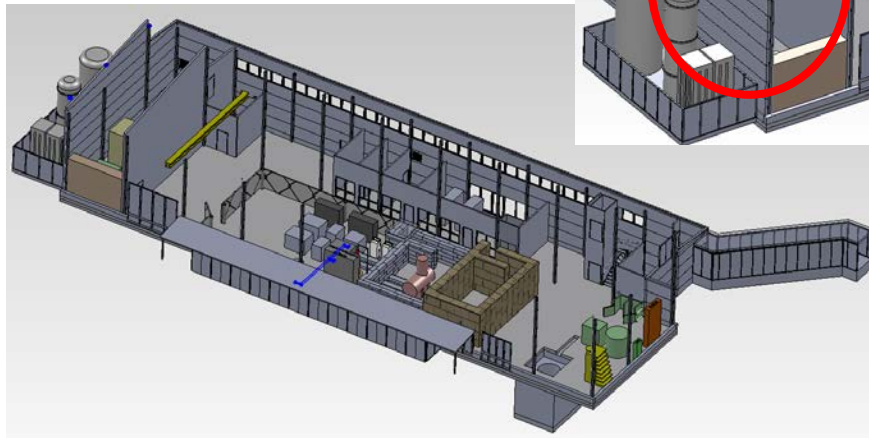
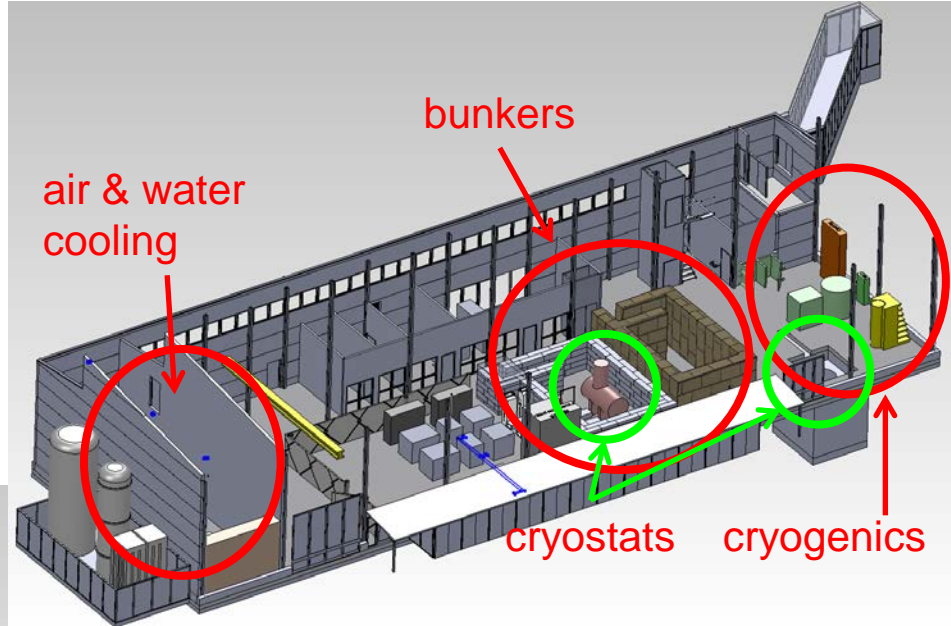
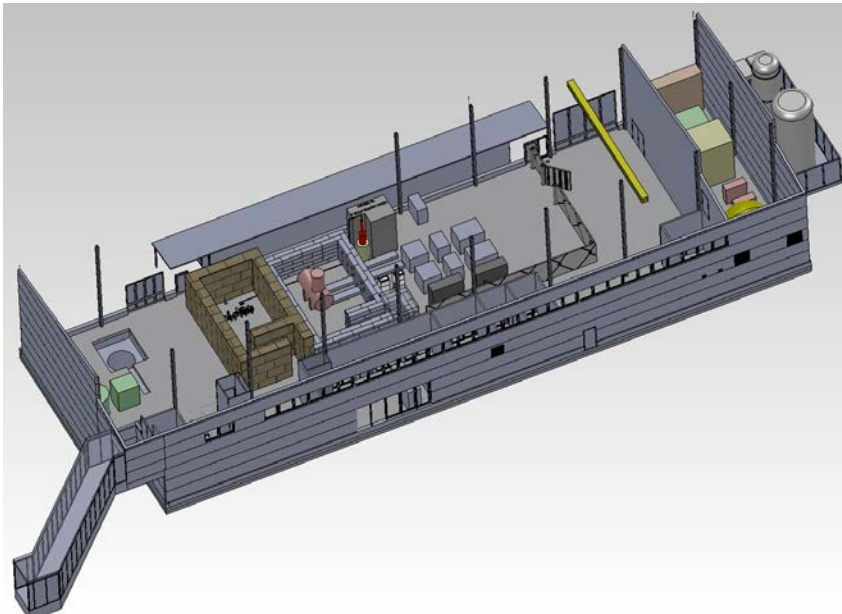
• Liquid nitrogen

- helium liquefier pre-cooling
- cryostat thermal radiation shield cooling
- distribution to external users

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FREIA ... how it will look like



CAI
CENTER FOR
ACCELERATOR
AND INSTRUMENT
DEVELOPMENT



Positive reply from legal department to avoid public tender:

"om detta rör sig om en forsknings och utvecklingstjänst och om resultatet inte enbart tillfaller myndigheten och om projektet inte enbart finansieras av myndigheten så kan undantaget för forskning och utveckling vara tillämpligt. Det ser således ut, utifrån den information som du skickat att detta skulle kunna omfattas av undantaget. Detta under förutsättning att myndigheten inte med avsikt delat upp processen för att slippa upphandling"



- should define
 - contact persons
 - ACS
 - IPNO
 - UU: Rocio SANTIAGO KERN
 - some intermediate "delivery" dates
 - regular telephone conference and/or meeting
- how to imply a smooth and early start of fabrication?
 - early tendering, during Fall?
 - early inclusion manufacturer in design and transfer 3D model to start production drawings