



# Water Plant/Loop Cryo Storage status

LNGS-Gerda meeting  
(05-07/11/2007)

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# Water Plant/Loop of Gerda

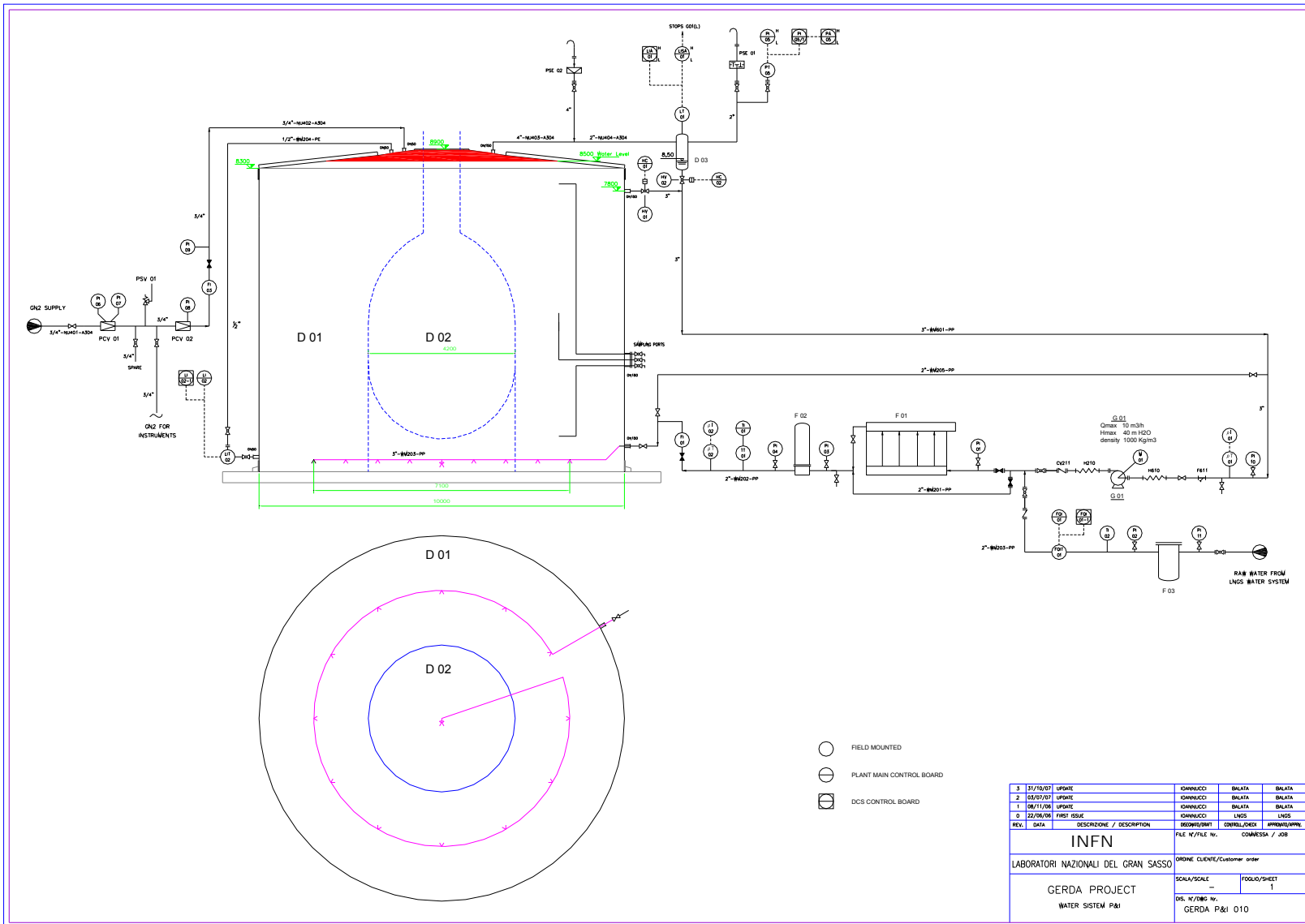
## Main features:

- Purification of raw water during first filling of the tank
- Keeping the Water clean in the tank during the running of the detector

We can use a special ion exchange resin for purifying the LNGS raw water:  $> 15 \text{ M}\Omega \text{ cm}$

Filling flow rate can be higher than  $2 \text{ m}^3/\text{h}$  (Borexino water plant option)

No more Piping from Hall C to Hall A ( $\sim 500\text{m}$ ): we are independent during the Detector operation



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## Some working parameters

- Standard loop rate 4 m<sup>3</sup>/h (~6 cm/h speed inside the tank: ~6 days to replace one tank volume)
- Max loop rate 8 m<sup>3</sup>/h (~ 2 tank volume/week)
- Inlet water quality:
  - resistivity > 15 MΩ cm
  - no particles > 4.5 μm
- Nitrogen gas purging flow rate ~ 500 NI/h (gas phase above water level ~ 4m<sup>3</sup>)

We need a fine level monitor and control

Water level inside tank might change with temperature

Standard water level is 8.50 m (Hall A room temp. ~ 20 °C)

$\Delta T = 10$  °C increment means 6 cm water level increment ( $\Delta V \sim + 1.5 \text{ m}^3$ )

# Water tank pressure control

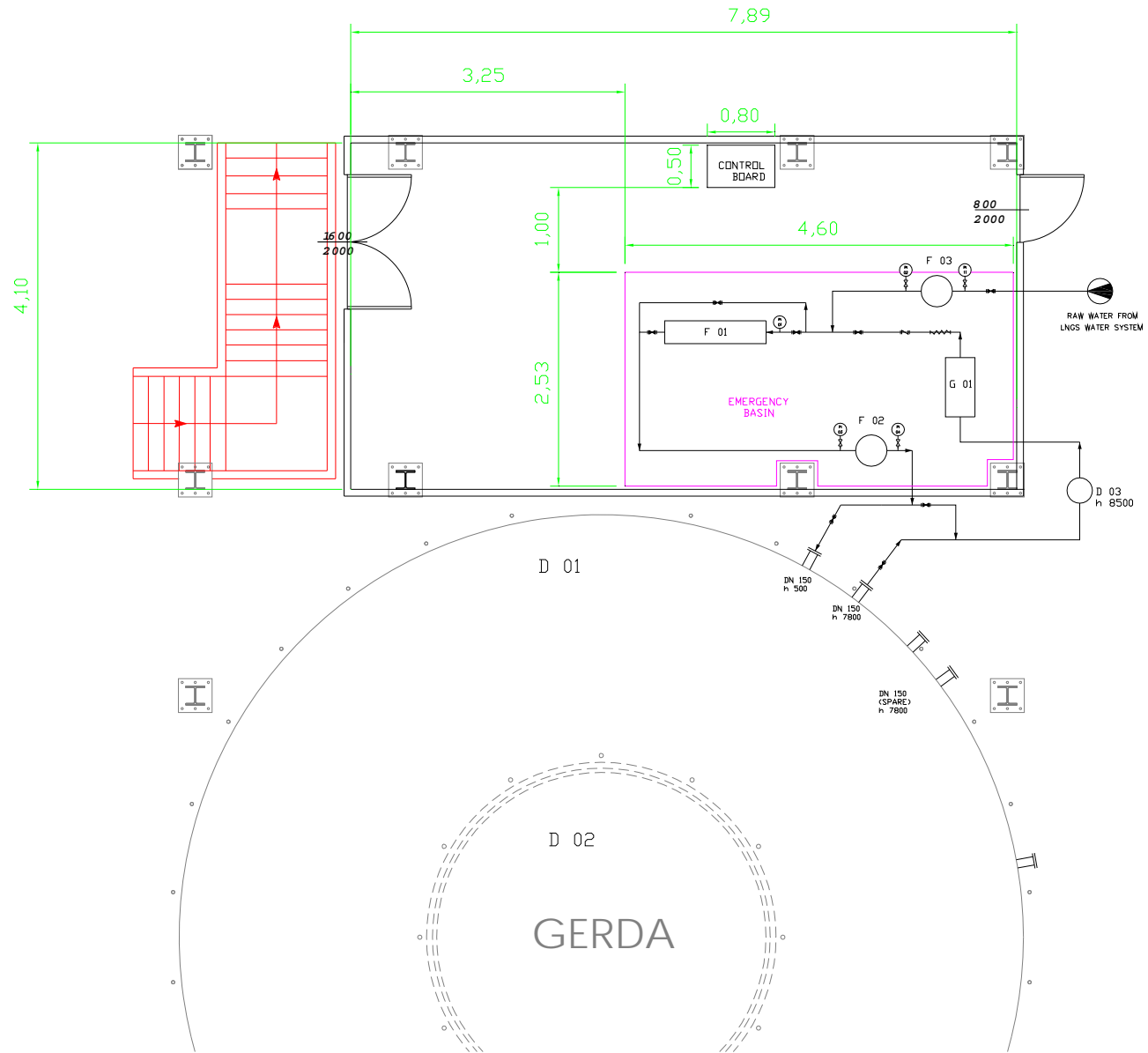
- We use two pressure switch elements
  - Normal operation: tank positive pressure max 40 mbarg; tank negative pressure max 15 mbarg
  - Emergency operation rapid tank draining: air inlet 350 Nm<sup>3</sup>/h (tank negative pressure max 15 mbarg)

# Space needed inside Gerda Main Building

We need space at the ground floor for placing the main parts of the water system (pump, filters, ions exchange resin, control board,...):

approximately area = 2.5m X 4.6m





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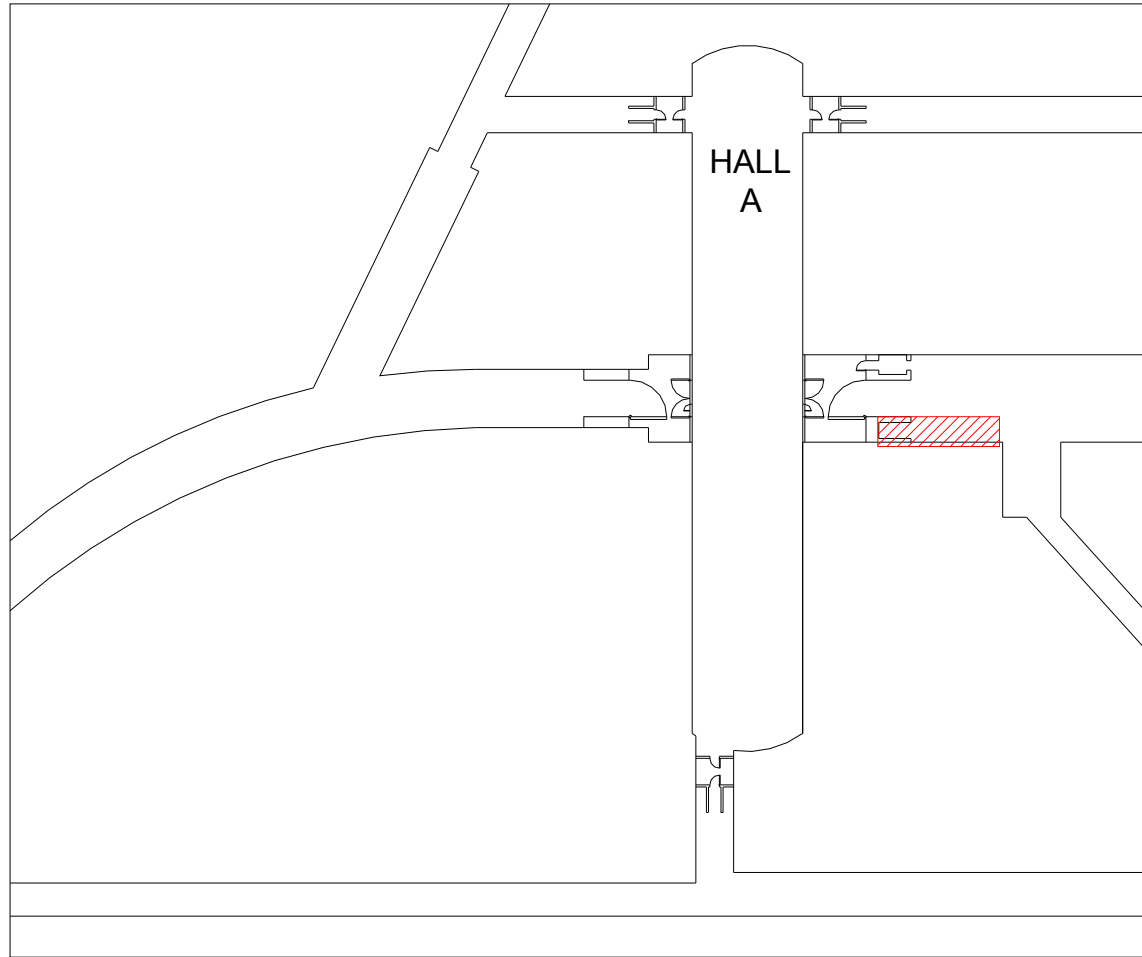
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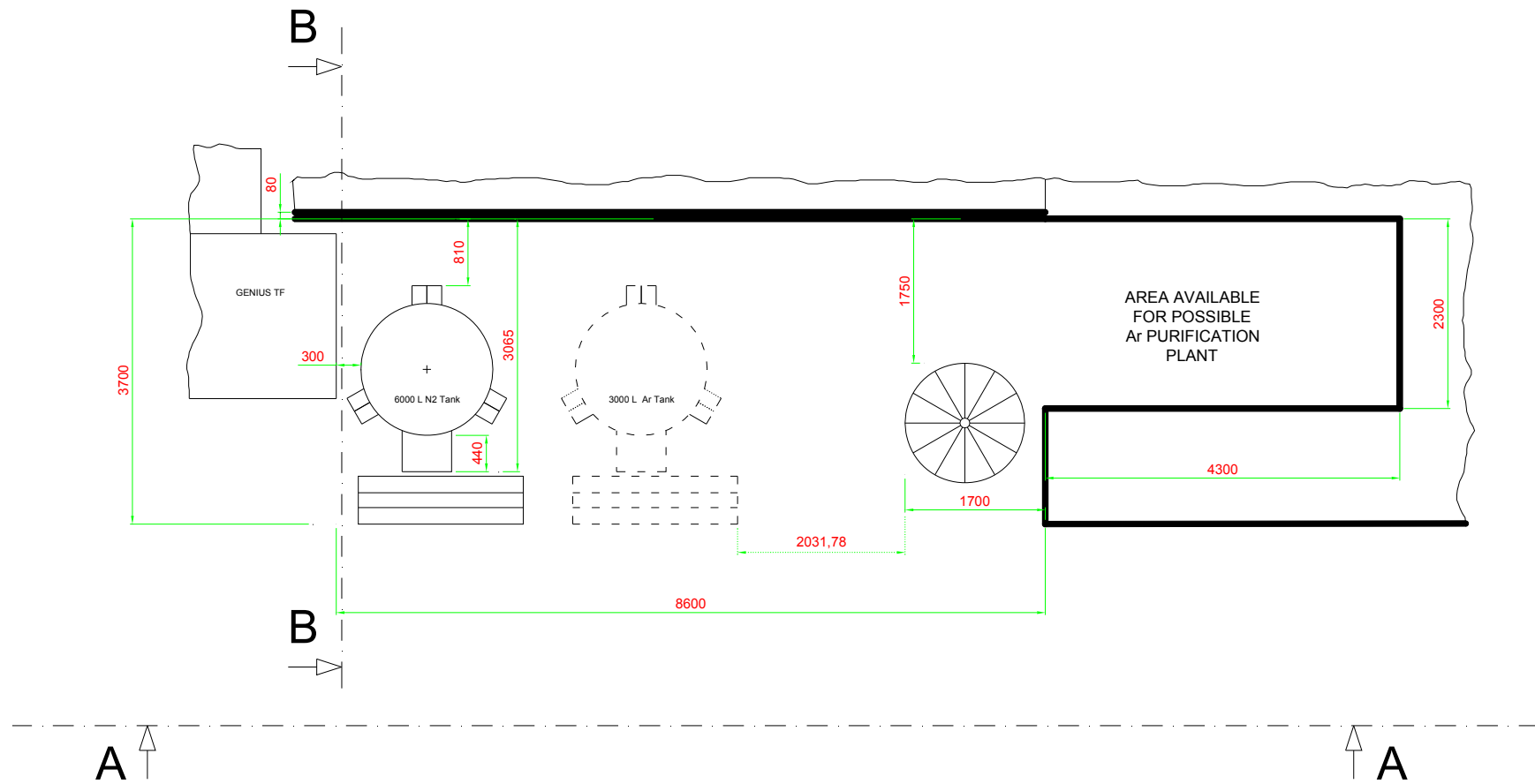
# Cryogenic Containers

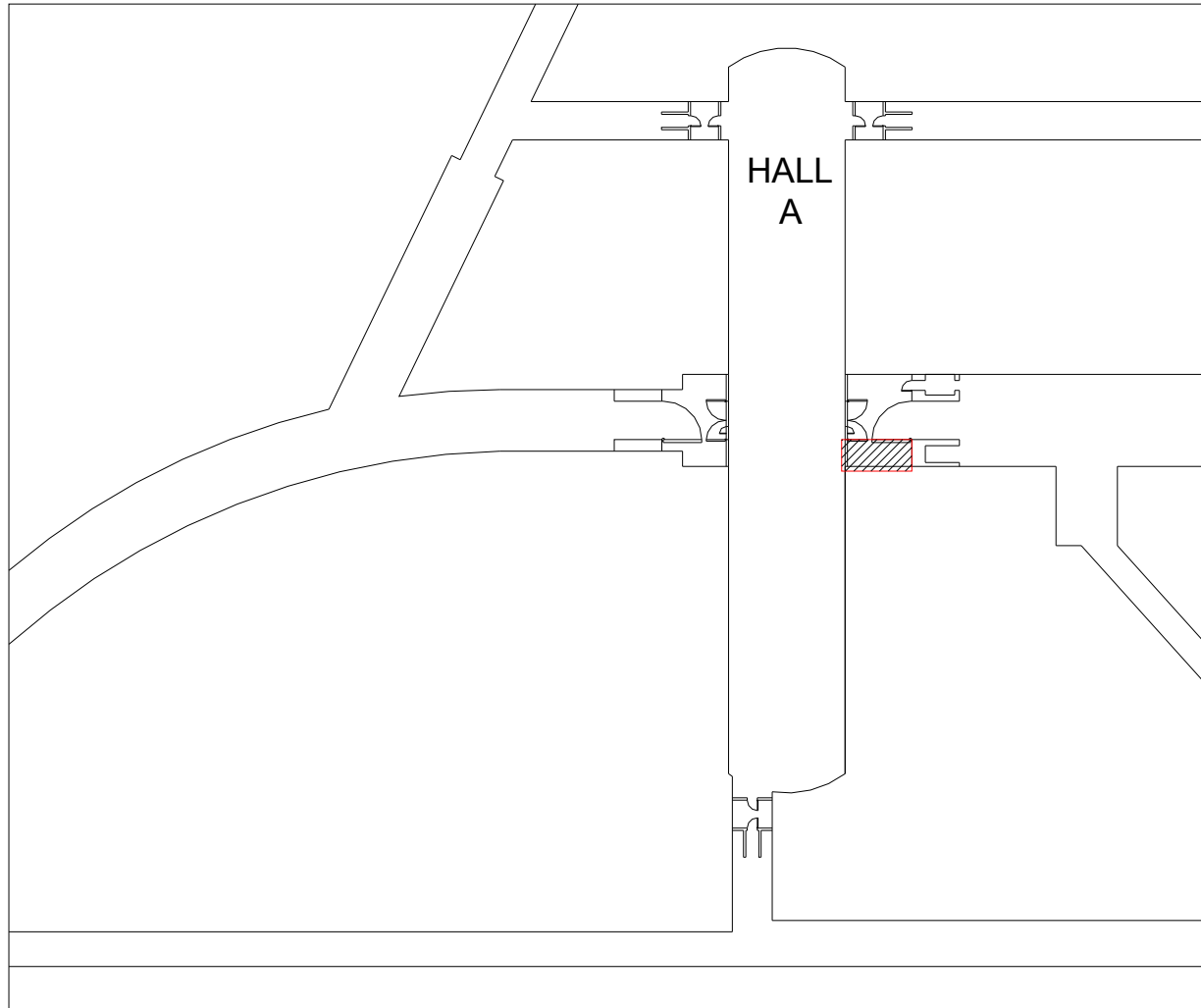
- 6000 L tank for LN<sub>2</sub>
- 3000 L tank for LAr
- 1500 L tank for GDL

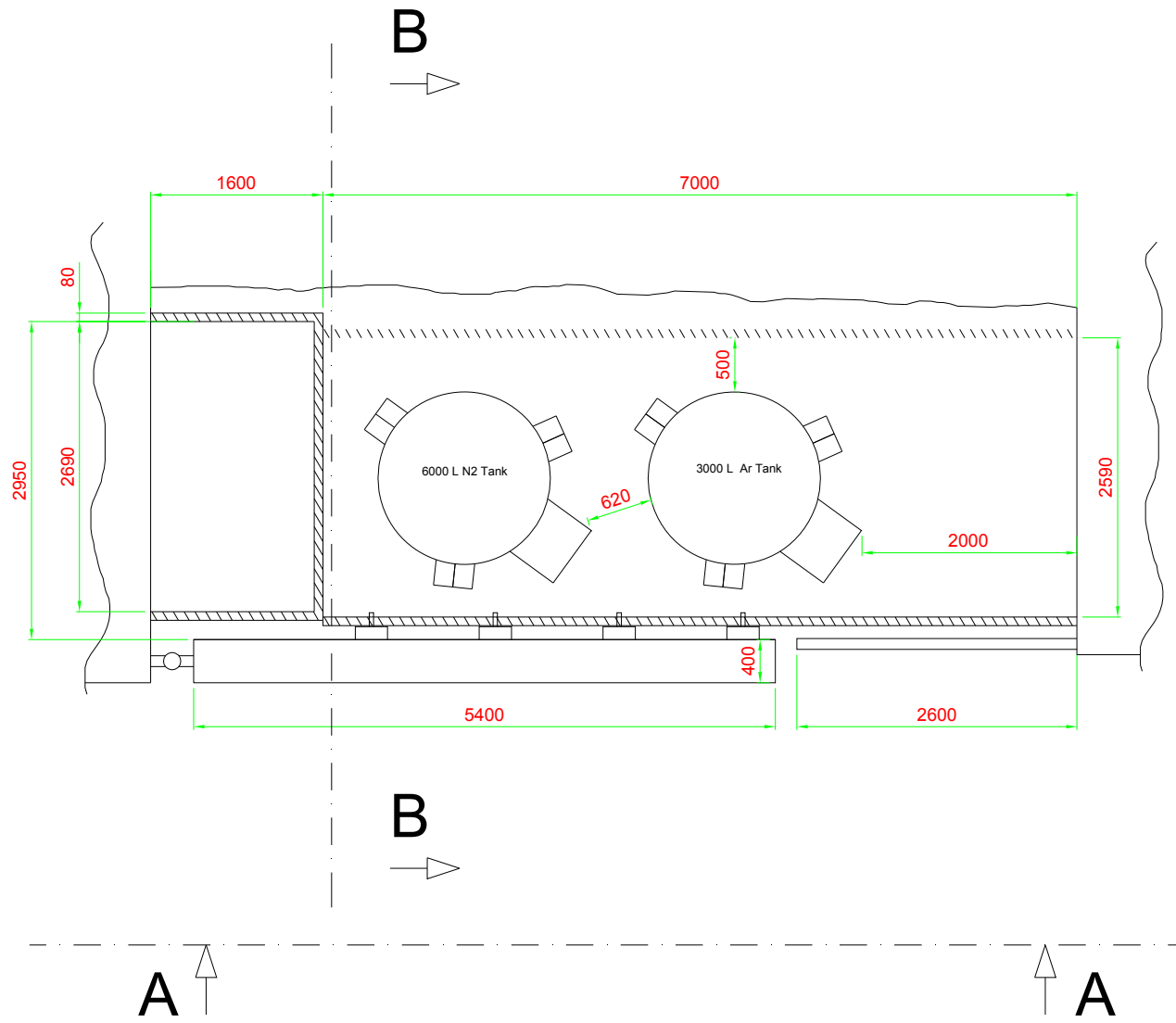
We got a new installing area: LNGS Space Committee and SPP decision

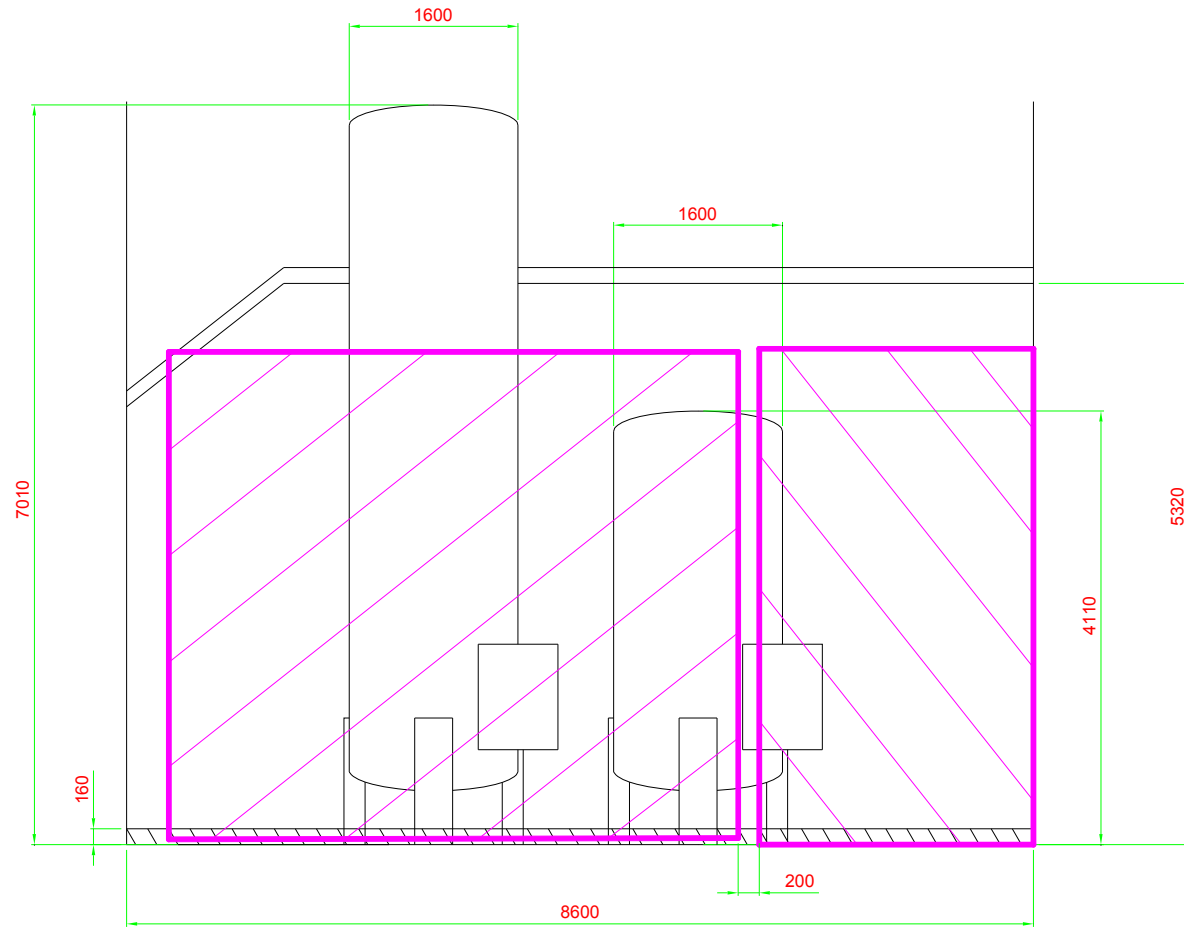
Unfortunately this area is not as good as the one we would like to use: possible trouble for arranging a Rn purification unit for LAr



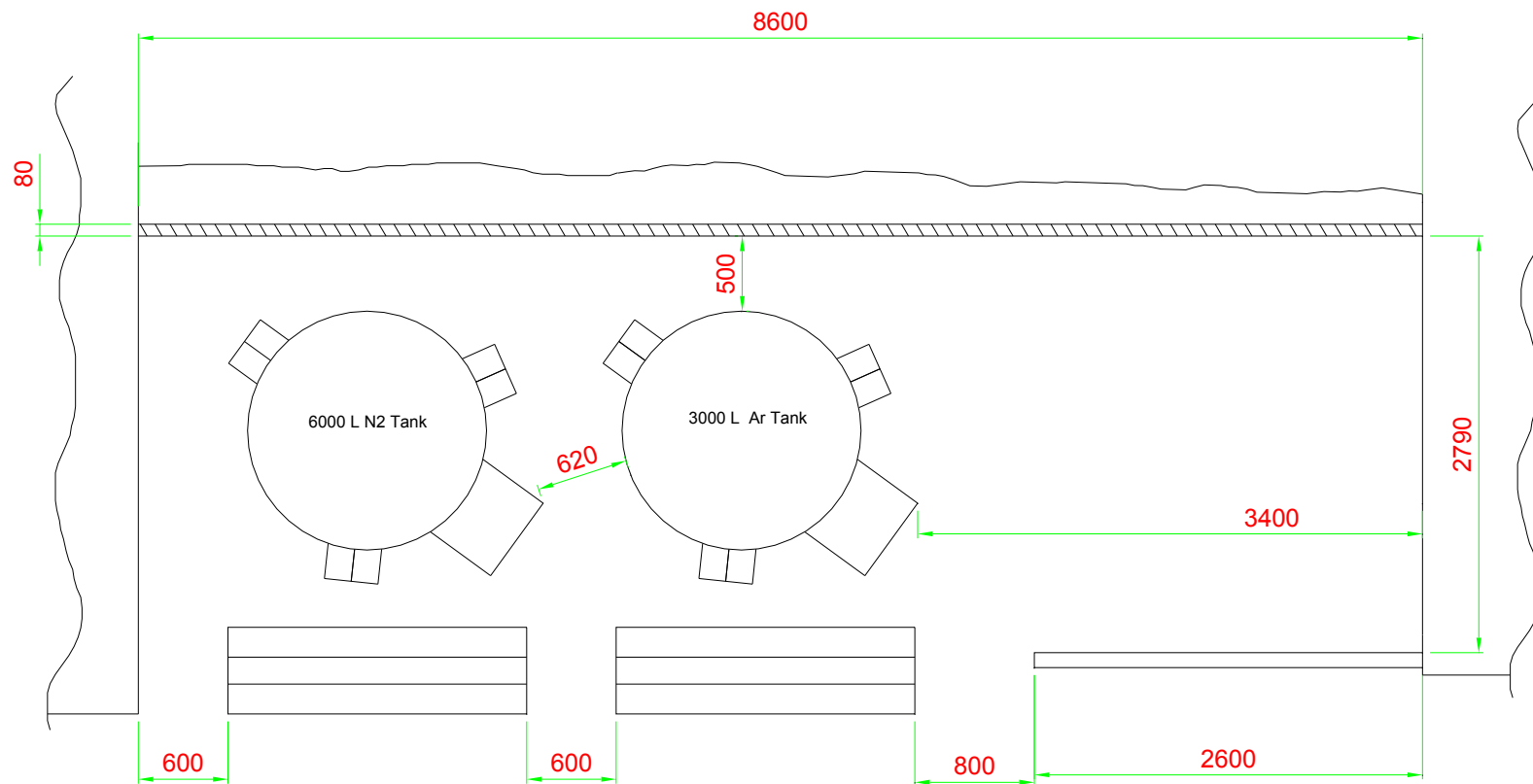




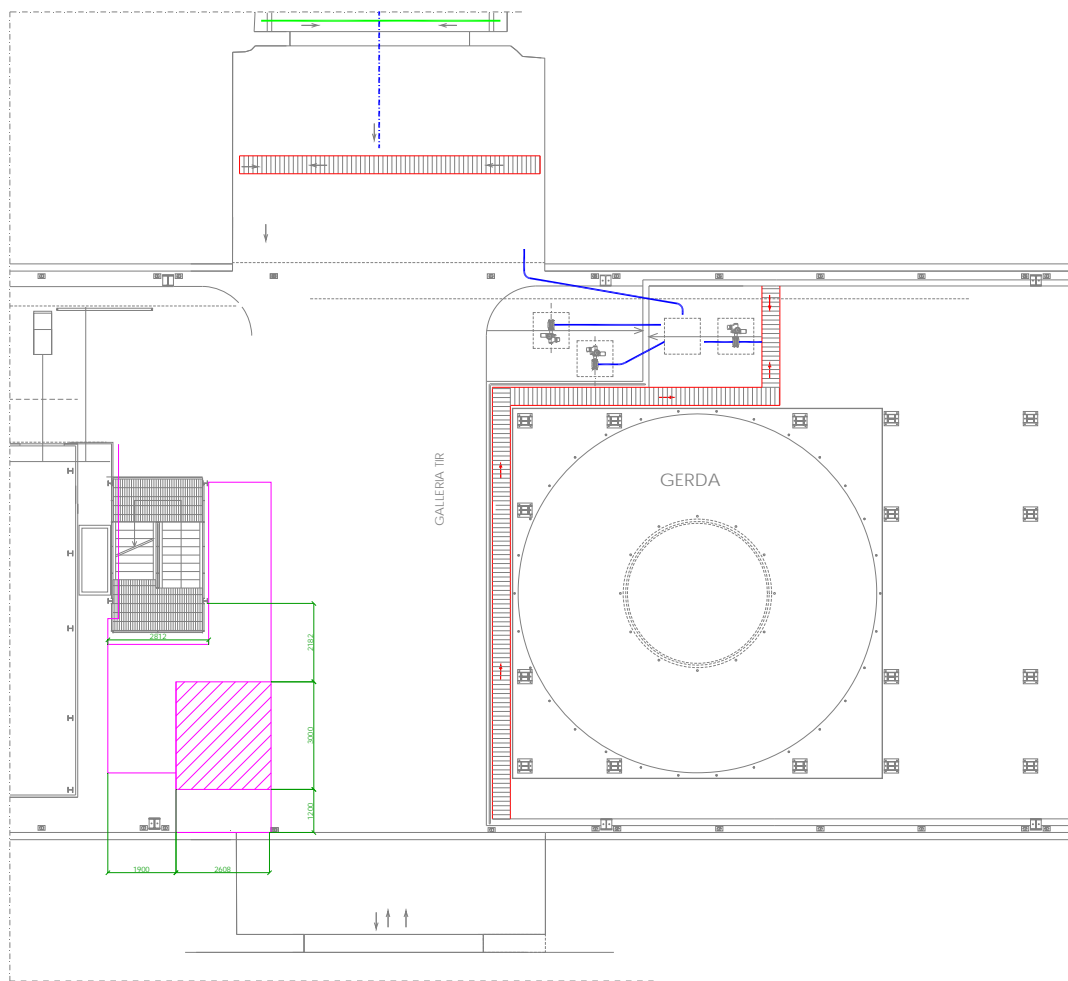




VIEW A-A







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## We need also

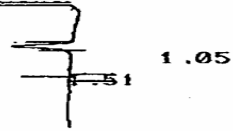
- Vacuum insulated line for LN<sub>2</sub> (~ 40 m from the new storage area)
- Vacuum insulated line (electro polished) for LAr (~ 40 m from the new storage area)
- Vacuum insulated line for GDL needs (~ 4 m from the storage tank)
- Standard line for gas nitrogen distribution (purging the water tank gas phase, pneumatic valves operating, other possible uses): length depends on the number of the points of use.

# First filling of the Cryostat

- Use of LAr 6.0 for better Rn content (?)
- Linde info for LAr 6.0 produced on purpose for GERDA (Trieste and Bologna sites):
  - 1.6 €/L of liquid (LAr 5.0: 0.936 €/L) + VAT (20%)
  - Total cost : 134 400 € (LAr 5.0: 78 624€) vat included
  - Tank truck (volume 16000 L): 100 €/h + 20 % vat (from the 3<sup>rd</sup> hour on of truck stop): Argon purity certificate for each delivery (~5 deliveries for filling the criostat)

CHANNEL A

INJECT 10/25/07 08:54:40



ARGON 10/25/07 08:54:40 CH= "A" PS= 1.  
FILE 1. METHOD 5. RUN 821 INDEX 81  
SAMPLE 1 Fondo Tank

NAME	ppm	RT	AREA BC	RF
H2	<= 0.1	0.63		12740.404
O2 *	0.869	1.05	3801 13.	6679.612
N2	<= 0.5	1.66		2798.553
CH4	<= 0.1	2.44		26396.
TOTALS	0.869		3801	



## First filling of the Cryostat

- If we fill at  $1\text{m}^3/\text{h}$  rate: we need 14 h for each delivery (for safety we do not empty completely the tank truck), in one week the complete the filling:
  - Cost: 1320 € vat included per delivery (total 6600 €)

Advantage: we might not need to purify the LAr before filling (Borexino LTA: 150 L/h of liquid  $\text{N}_2$  max rate)