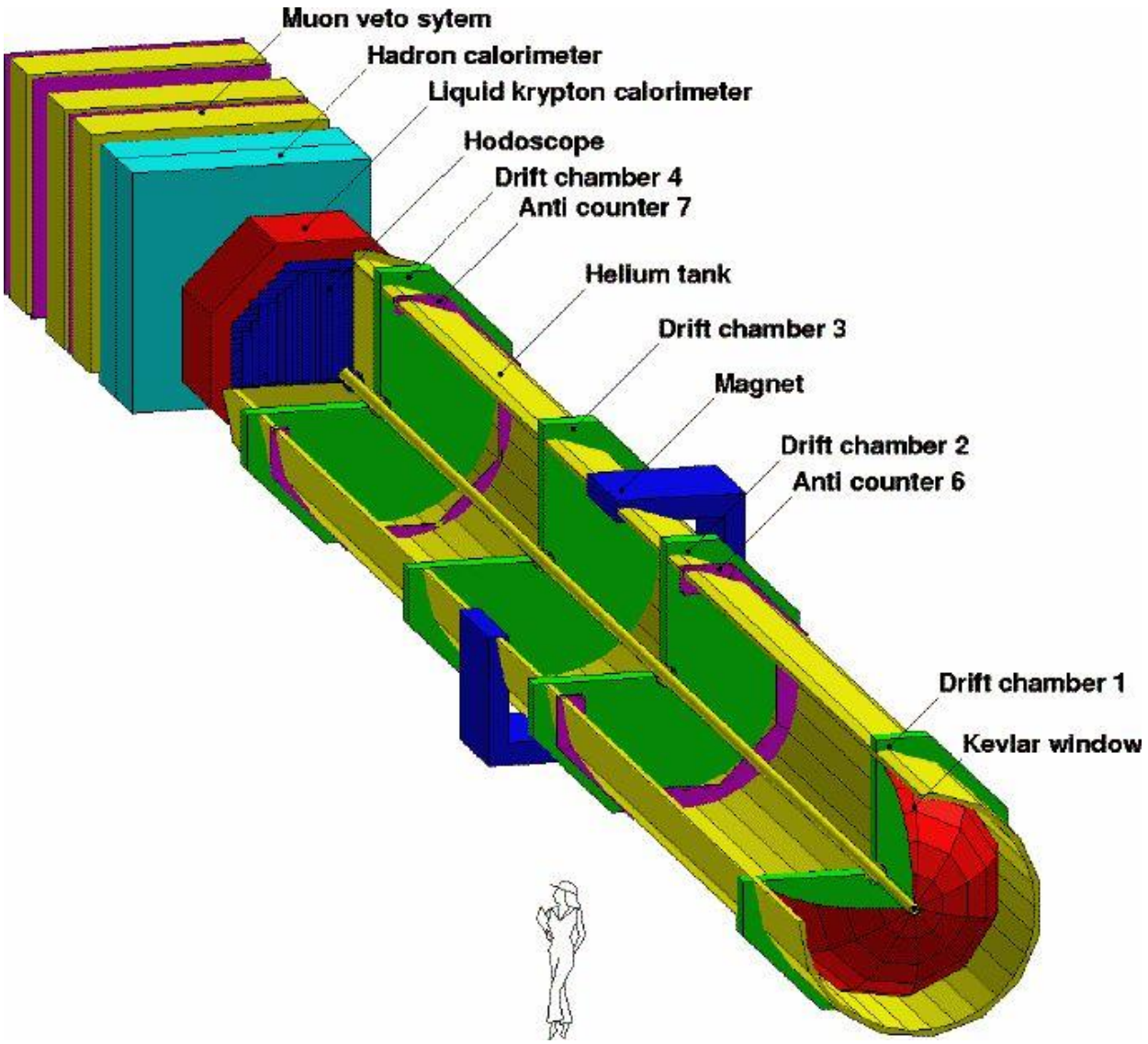
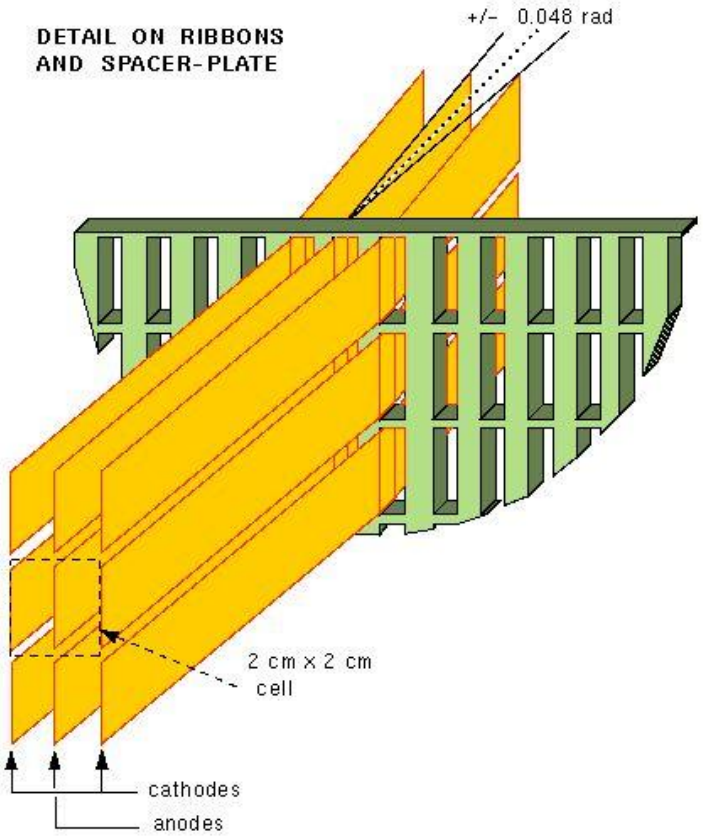
NA48 / NA62

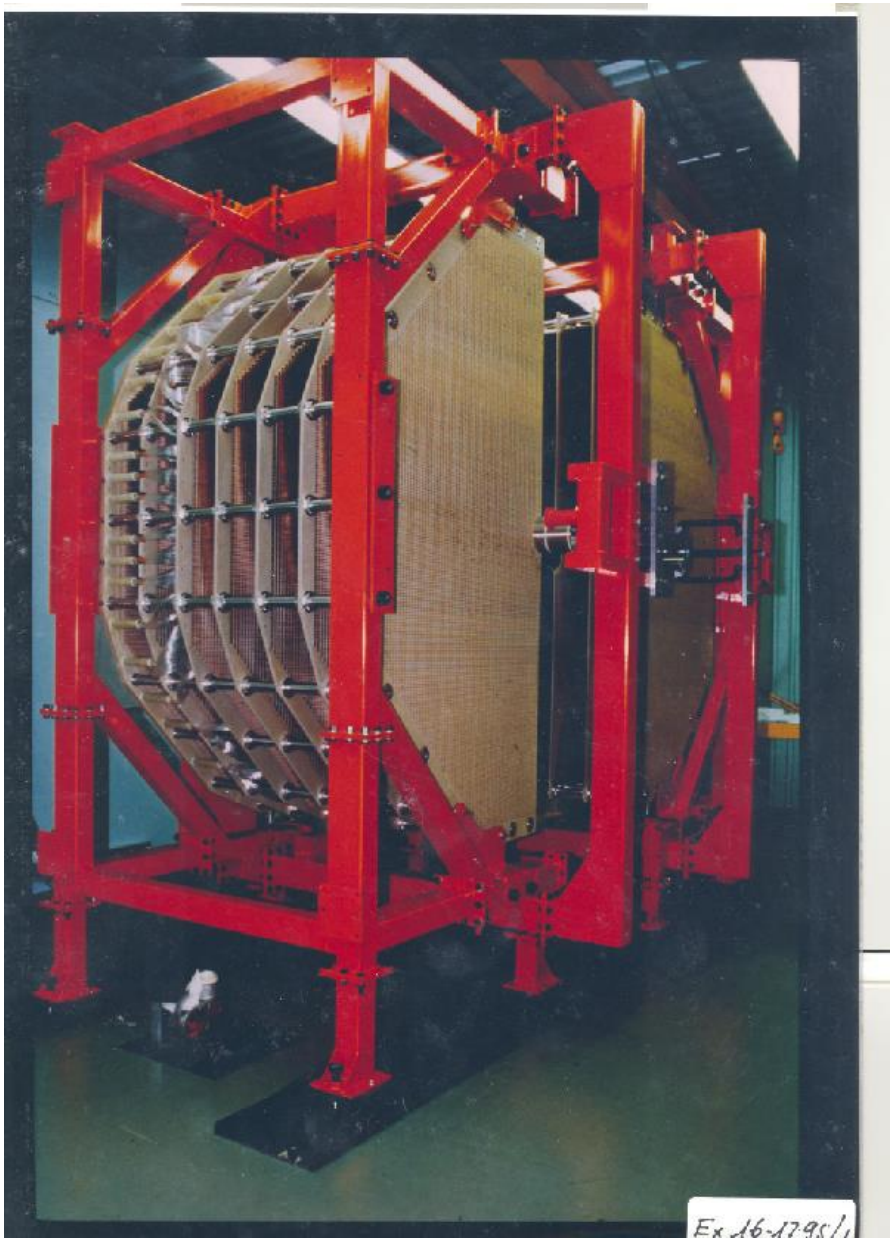

Muon veto sytem
Hadron calorimeter
Liquid krypton calorimeter
Hodoscope
Drift chamber 4
Anti counter 7
Helium tank
Drift chamber 3
Magnet
Drift chamber 2
Anti counter 6
Drift chamber 1
Kevlar window

NA48 / NA62

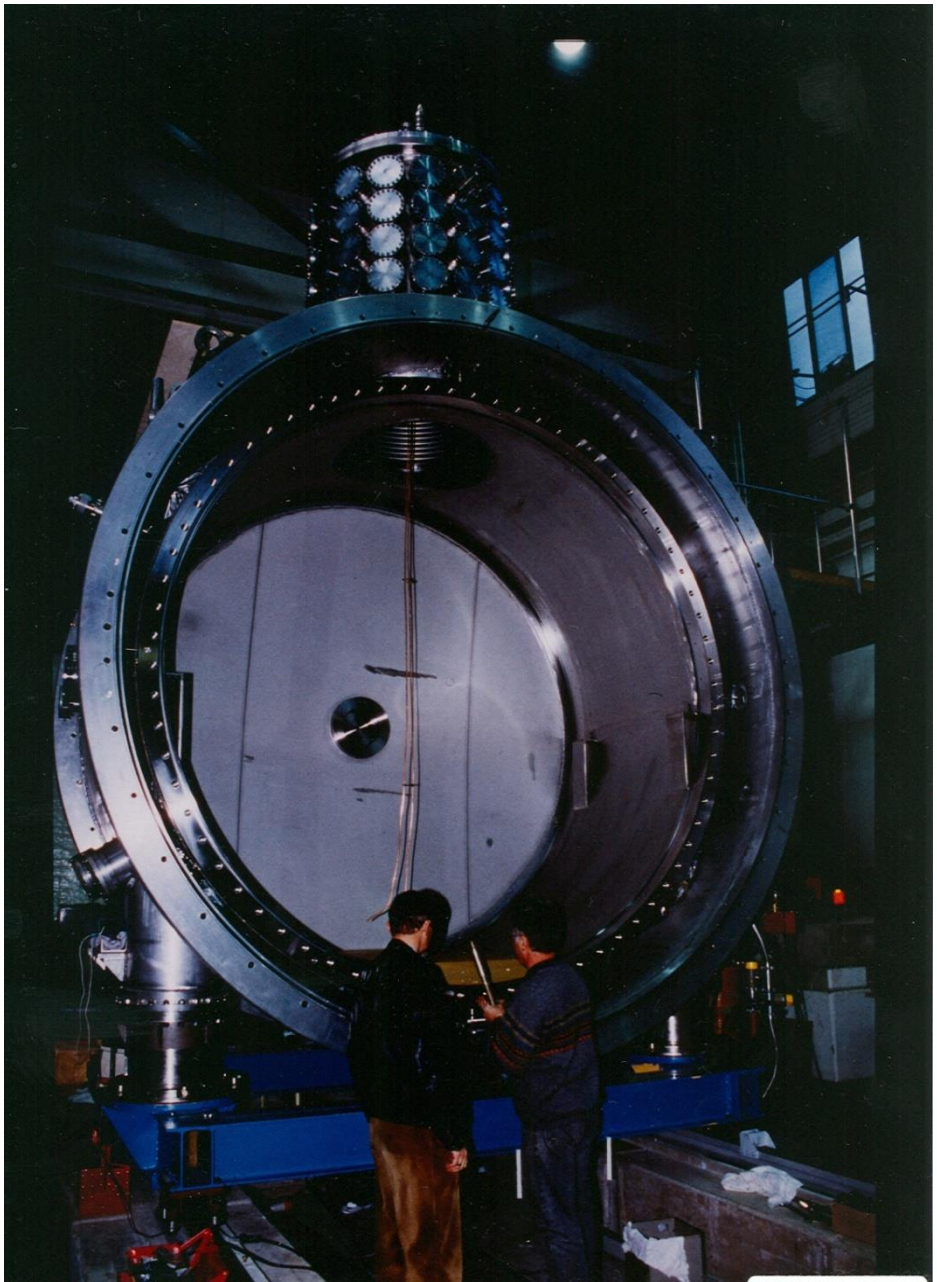
As sensitive and detection medium for the electromagnetic calorimeter the NA48 collaboration has chosen liquid krypton.



NA48 / NA62



NA48 / NA62



NA48 / NA62

Demands for cryogenic system:

- Small temperature gradients in sensitive volume (0.8% / K)
- Very high krypton purity
- No loss of Krypton (price 1993: 920 $ / liter, total volume of 10000 liter)
- Continuous operation (initially for three years now continuous running for 12 years)

The cooling principle

$T_{Kr\ triple} = 115.9$ K

$T_{Kr\ boiling} = 120$ K

How to create cooling power at 120K:

- vaporize saturated nitrogen at about 25 bar
- vaporize saturated argon at about 10 bar

Second option has been chosen: condense the Krypton on a surface cooled by a saturated argon bath at about 10 bar and re-condense the argon on a surface cooled by liquid nitrogen.

The argon pressure should not get below 9.6 bar to stay above the Krypton triple point temperature.

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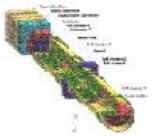
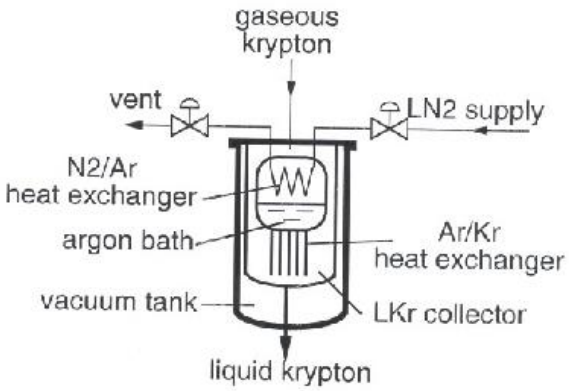
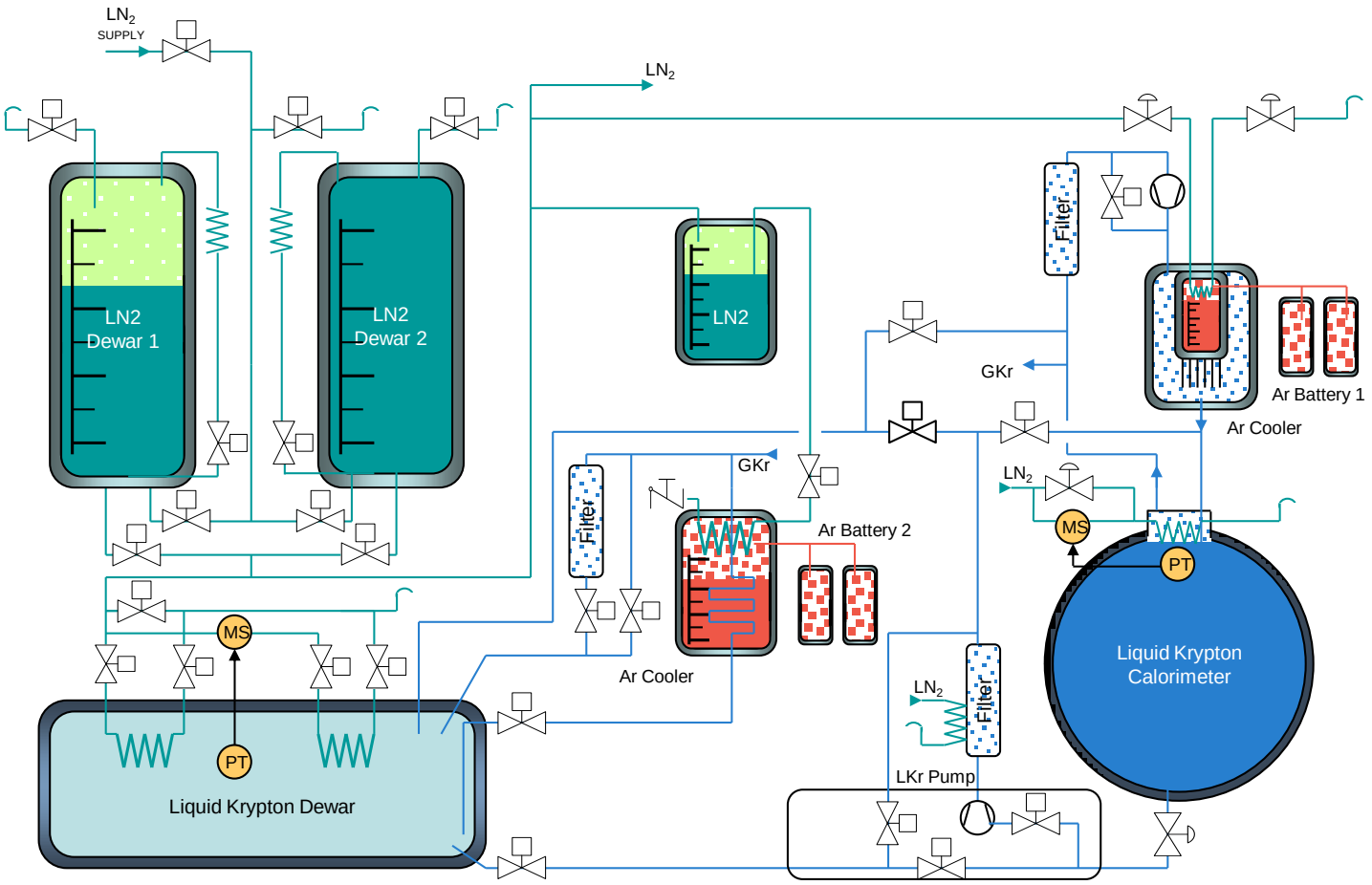


The Liquid Krypton Calorimeter
Cryogenics for the NA48 Experiment

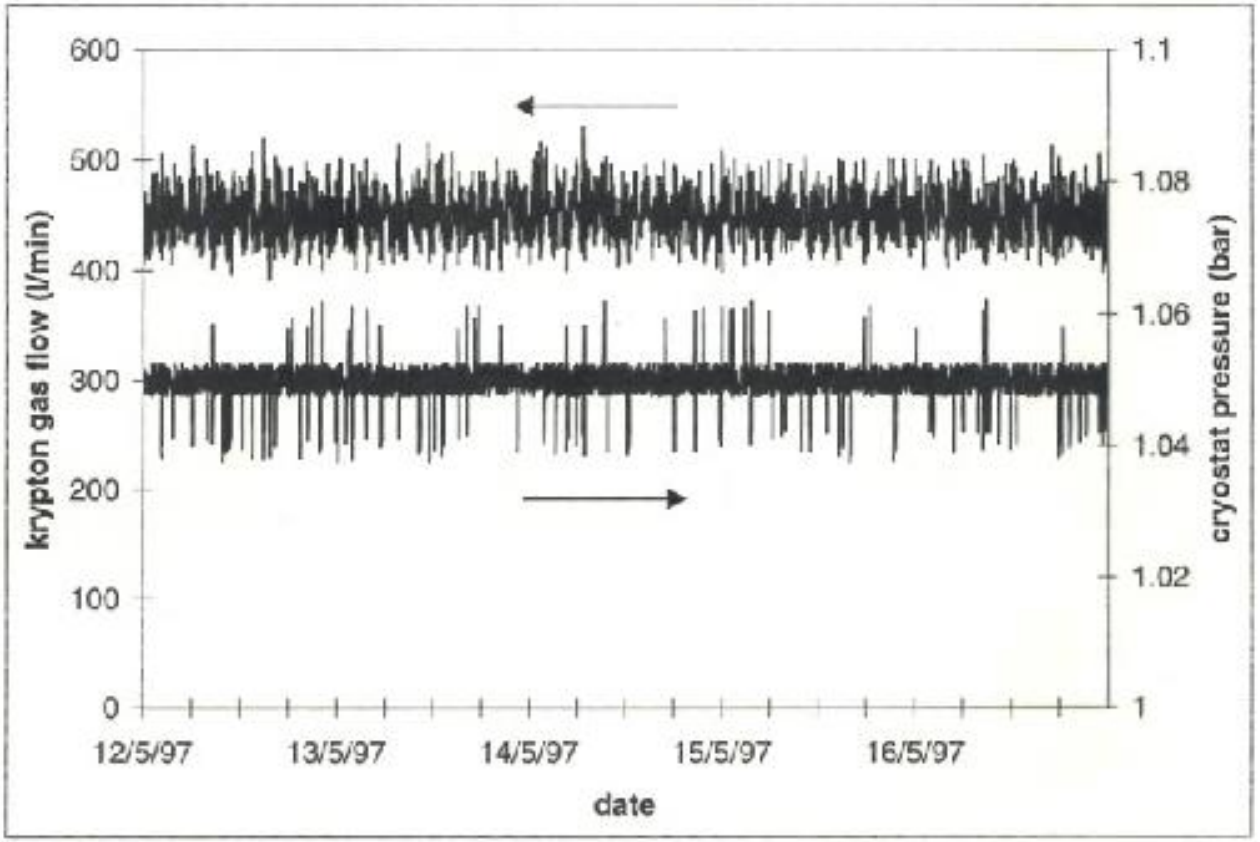


NA48 / NA62

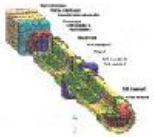
NA48 / NA62


LN2
SUPPLY
LN2
LN2
Dewar 1
LN2
Dewar 2
LN2
Filter
GKr
Ar Battery 1
Ar Cooler
GKr
Filter
Ar Battery 2
LN2
MS
PT
Liquid Krypton
Calorimeter
Ar Cooler
LN2
Filter
MS
PT
Liquid Krypton Dewar
LKr Pump

NA48 / NA62


600
500
400
300
200
100
0
krypton gas flow (l/min)
1.1
1.08
1.06
1.04
1.02
1
cryostat pressure (bar)
12/5/97
13/5/97
14/5/97
15/5/97
16/5/97
date

NA48 / NA62



The Liquid Krypton Calorimeter
Cryogenics for the NA48 Experiment

Results:

After 19 months of operational experience the results can be resumed as follows:

- Cool-down and warm-up can be controlled such that the internal temperature gradients remain within tolerable limits;
- The system allows for uninterrupted operation over periods of many months, with no supervision;
- Krypton impurity levels stays within 10 to 100 ppb O_2 equivalent;
- During data taking , the pressure in the calorimeter remains within ± 10 mbar over periods of months;
- No beam time has been lost due to problems with the cryogenic system;

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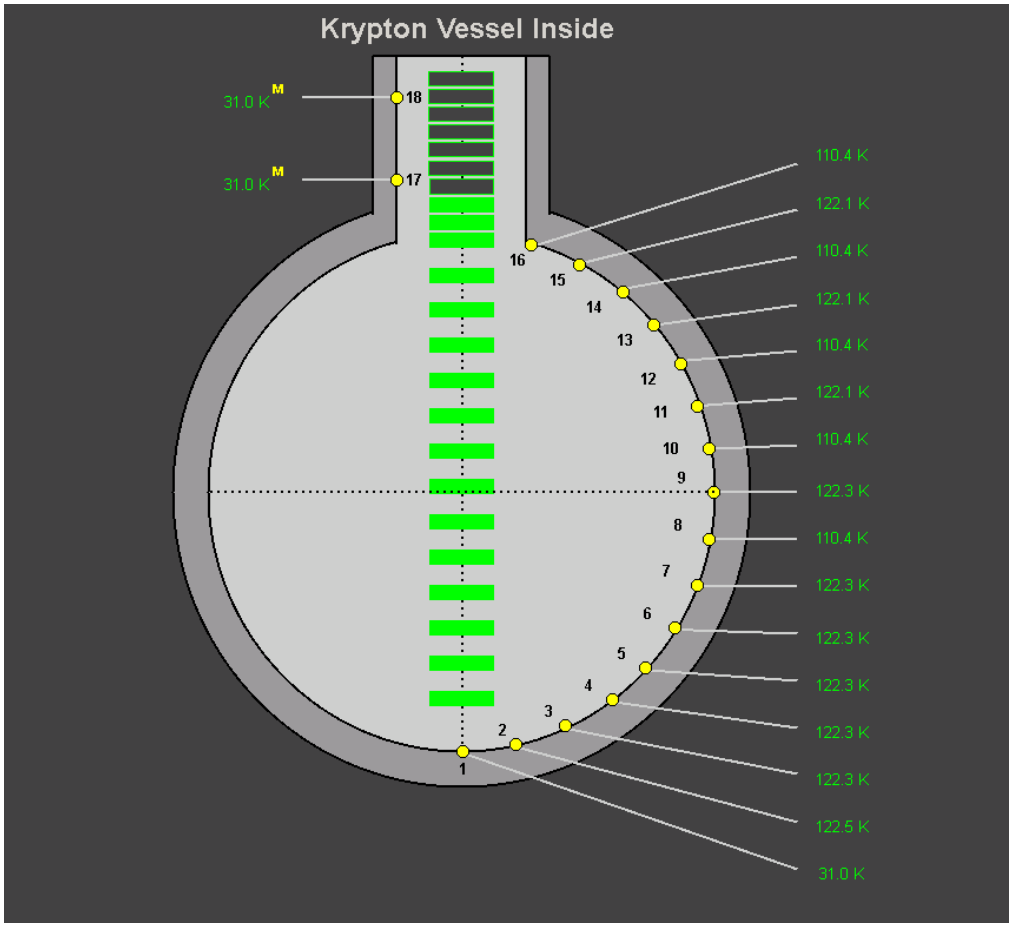
Krypton Vessel Inside
31.0 K M
31.0 K M
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
110.4 K
122.1 K
110.4 K
122.1 K
110.4 K
122.1 K
110.4 K
122.3 K
110.4 K
122.3 K
122.3 K
122.3 K
122.3 K
122.3 K
122.5 K
31.0 K