

Purification of recovered Helium with low level of impurities: evaluation of two different methods

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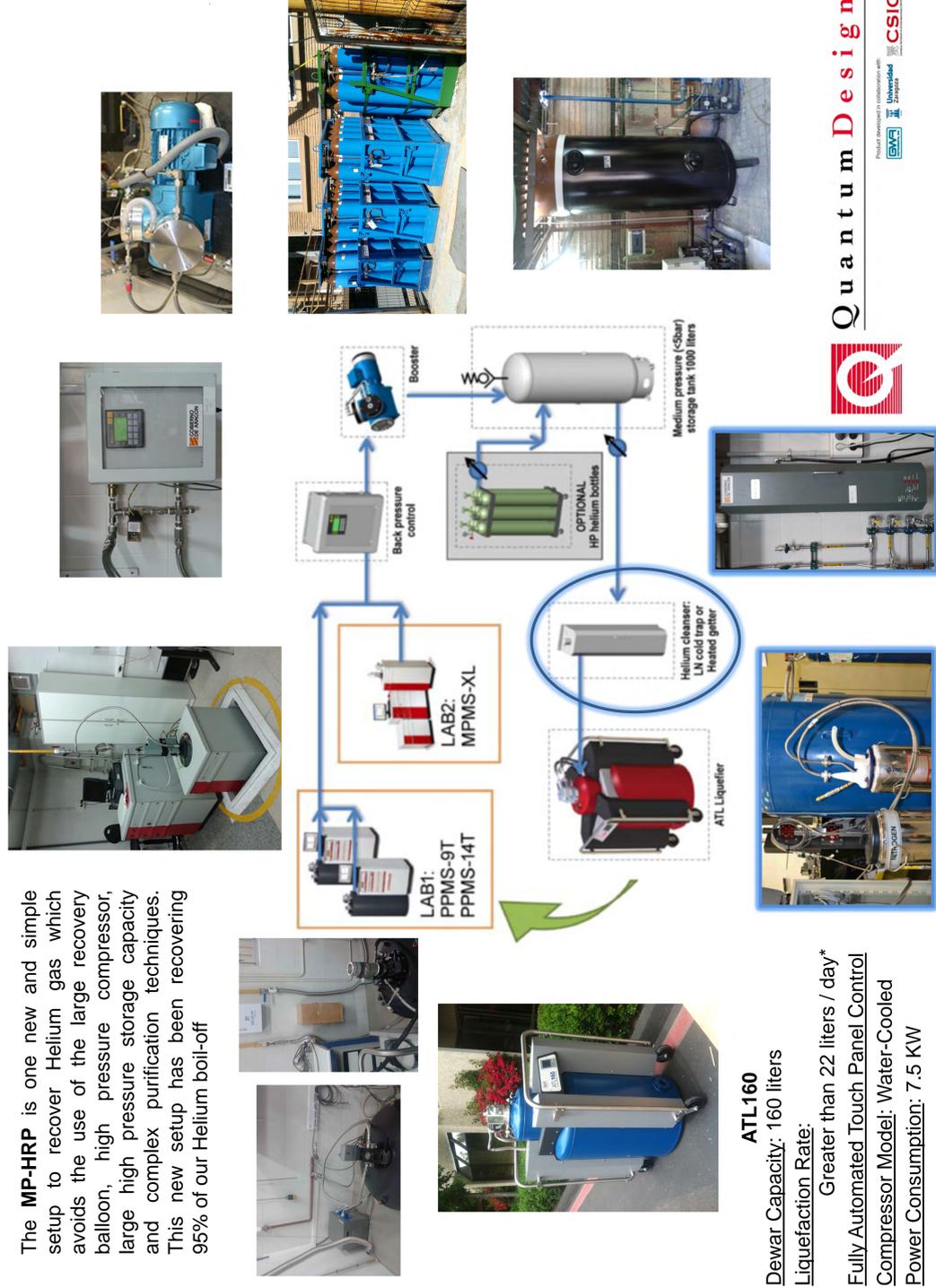
Abstract

Helium gas coming from low temperature experimental systems is recovered to avoid losses of this scarce gas on Earth. Once this Helium gas has been recovered and before its liquefaction, the impurities contained should be removed. It is possible to achieve a low level of impurities by using the proper materials and procedures on the road to Helium recovery.

A comparison of two different methods applied for the purification of recovered Helium with low level of impurities is reported in this paper. One method is the use of liquid nitrogen traps and the other one is the application of a purification system based on getter materials.

The cleaning efficiency has been probed experimentally for both methods through the analysis of the purified He gas. The evaluation covers the life time between regenerations, the everyday care as well as the long term, the energy consumption, the initial investment besides the cost of maintenance of both methods.

The **MP-HRP** is one new and simple setup to recover Helium gas which avoids the use of the large recovery balloon, high pressure compressor, large high pressure storage capacity and complex purification techniques. This new setup has been recovering 95% of our Helium boil-off



ATL160
Dewar Capacity: 160 liters

Liquefaction Rate:

Greater than 22 liters / day*

Fully Automated Touch Panel Control

Compressor Model: Water-Cooled

Power Consumption: 7.5 KW

Medium Pressure Helium Recovery Plant

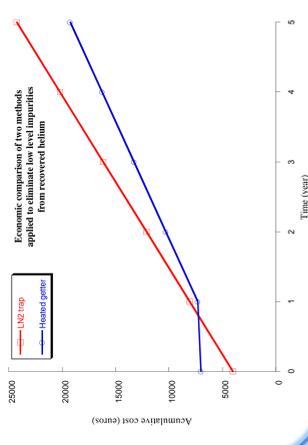
Results

Oxygen traces measured in helium by Servopro MULTIXACT analyzer

Helium gas analyzed	O ₂ (ppm)
He N50	0.75
LN2 cold trap	0.57
Heated Getter	0.02

Both methods achieving
22 L/day (0.92 liters/hr)*
of average liquefaction rate

LN2 cool trap and heated getter over 5 years of operation



Economic evaluation of LN2 traps vs. Gettering depends on:

- Initial investment and cartridge replacement, i.e. trade agreements
- Cost of electric power supply (e.g. 0,124 € per kWh)
- Cost of liquid nitrogen (e.g. 0.60 € per liter of LN2)
- Cost of technician manpower (e.g. 15 € per hour)

Coarse economic cost of each purifying method

Method for gas purifying	Initial investment (€)	LN2/electric power (€/per year)	Manpower (€/per year)	Regeneration (€/per year)
LN2 cold trap	4000	1314	2737	0
Heated Getter	7000	282	8	2700

* Liquefaction rates vary based on input helium quality and pressure.

Conclusions

- A comparison of two different methods applied for the purification of recovered Helium with low level of impurities is reported here. One purification method is the use of liquid nitrogen traps and the other one is the application of a purification system based on getter materials.
- Both methods have been tested in the MP-HRP experimental setup and both of them are effective for achieving the proper average liquefaction rate in the ATL160. However the results obtained on oxygen traces content reveals that the gettering purification system reaches lower oxygen content on purified helium.
- The initial investment to install one of these purification methods is quite comparable; the budget of both of them falling in the same order of magnitude. The final cost depends on trade agreements. The maintenance evaluation depends on values that could fluctuate quite a lot: price of LN2 liters vs. price of power electricity supply and price of technician manpower.

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