

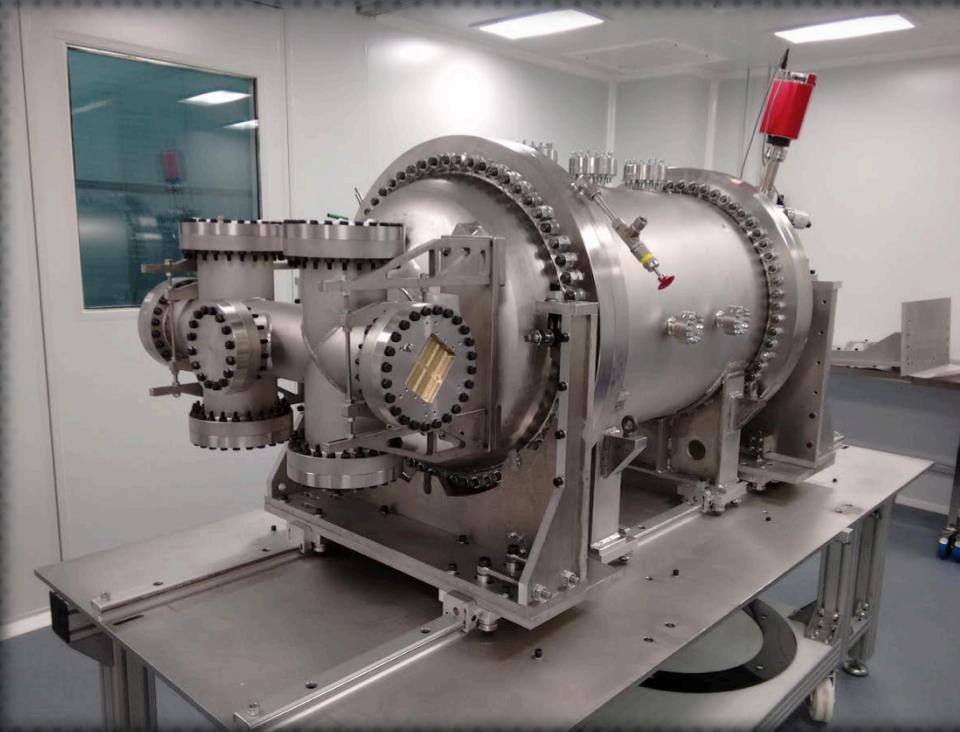
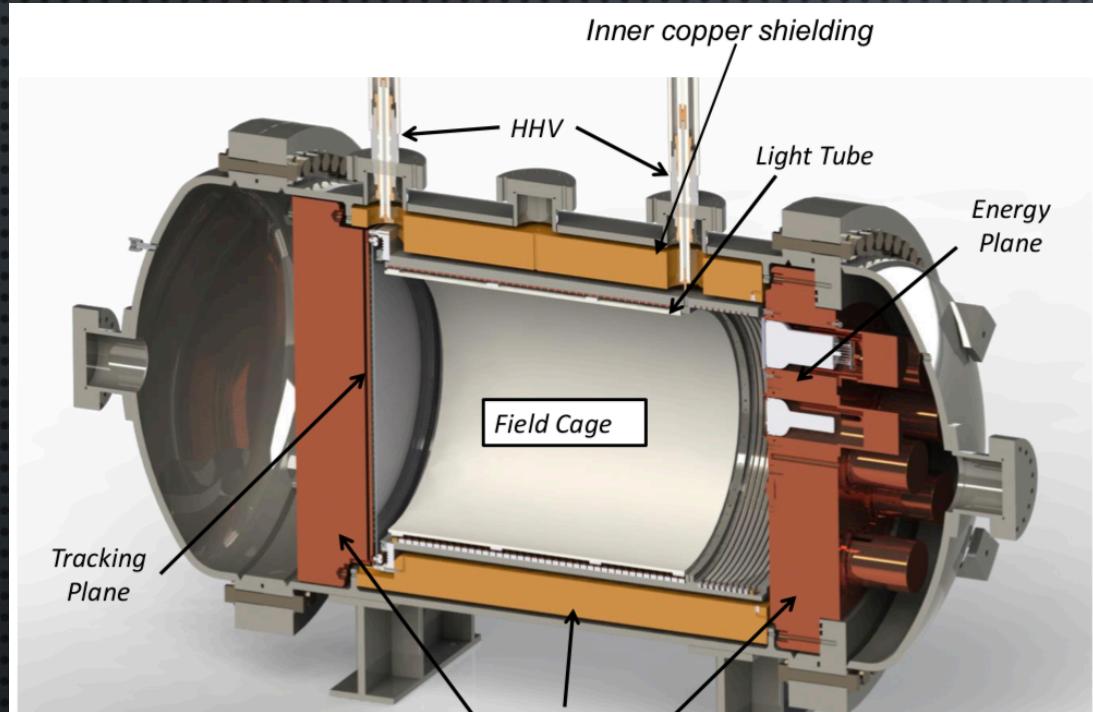
DETECTORES DEMO++, NEW Y NEXT100

ALBERTO MARTÍNEZ, JORDI TORRENT Y SARA CÁRCEL

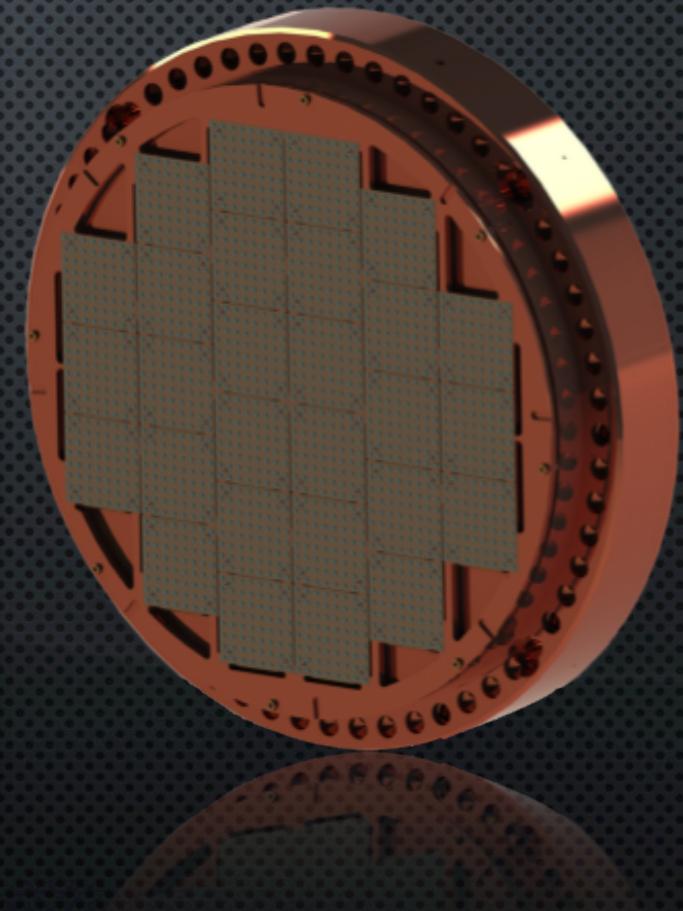
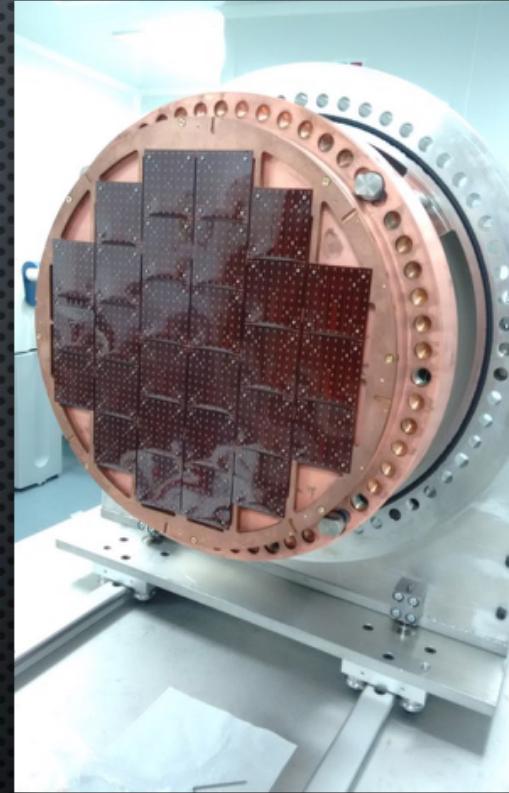
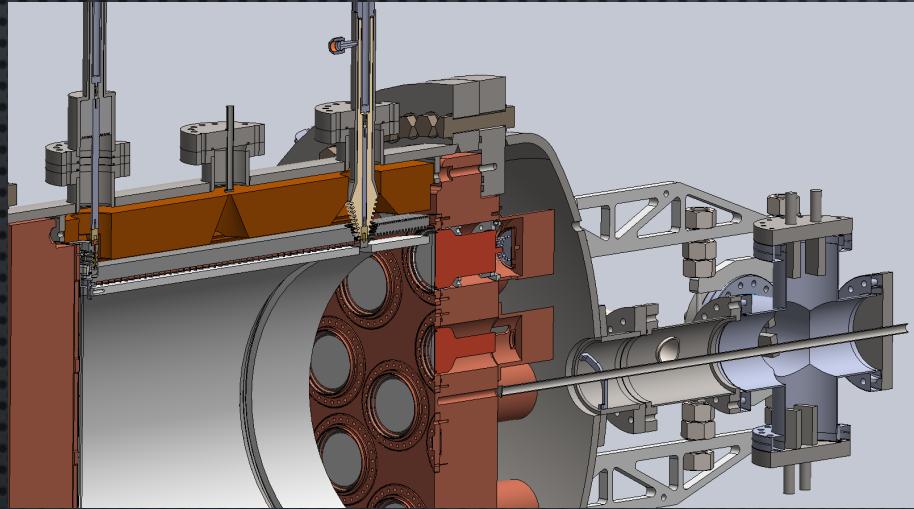
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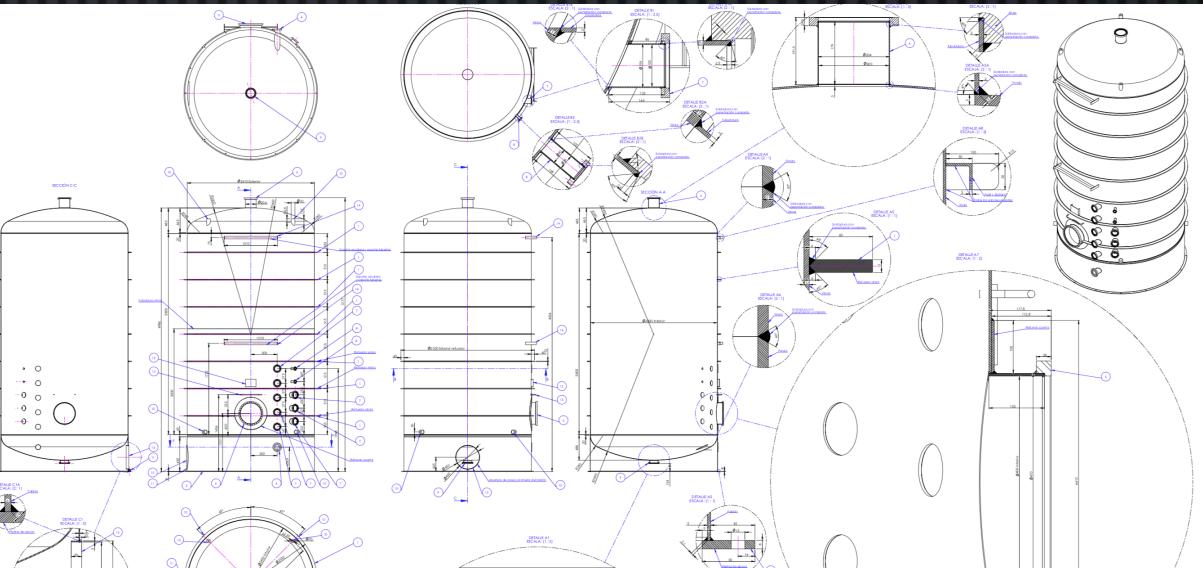
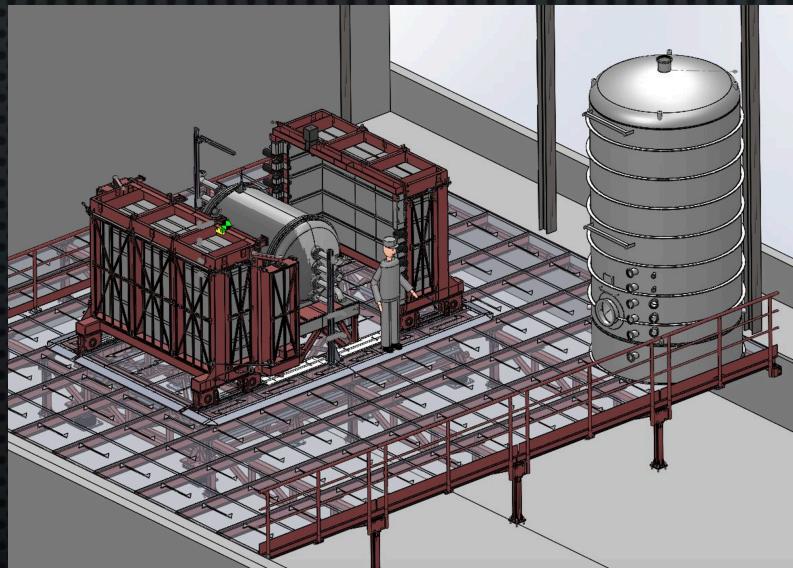
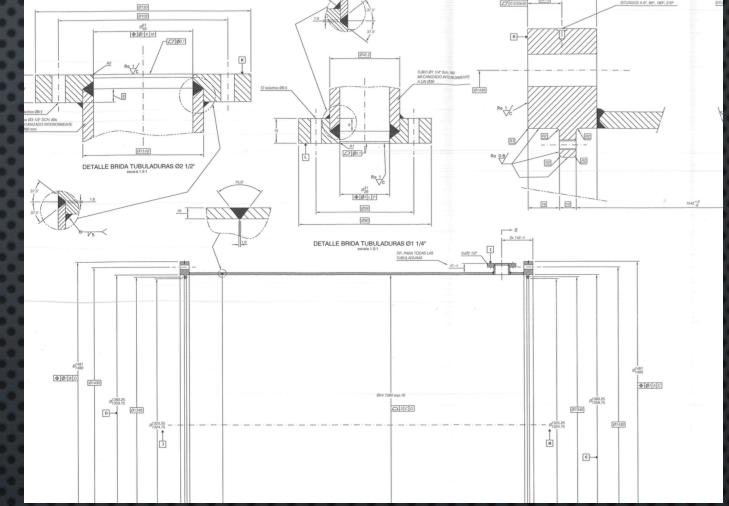
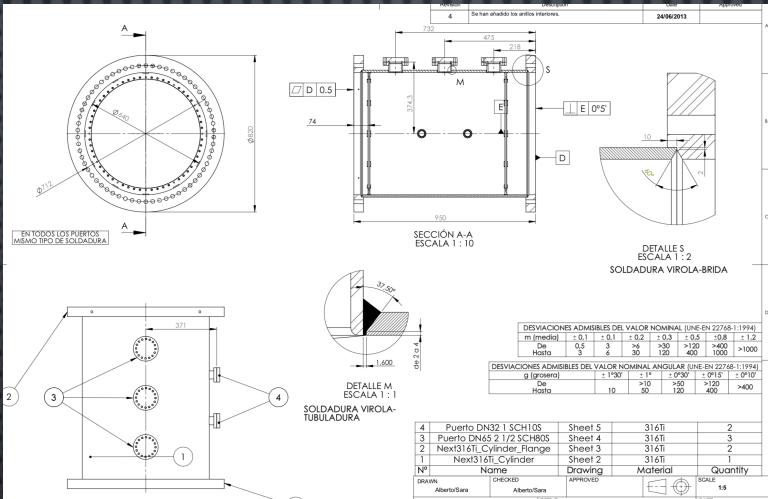
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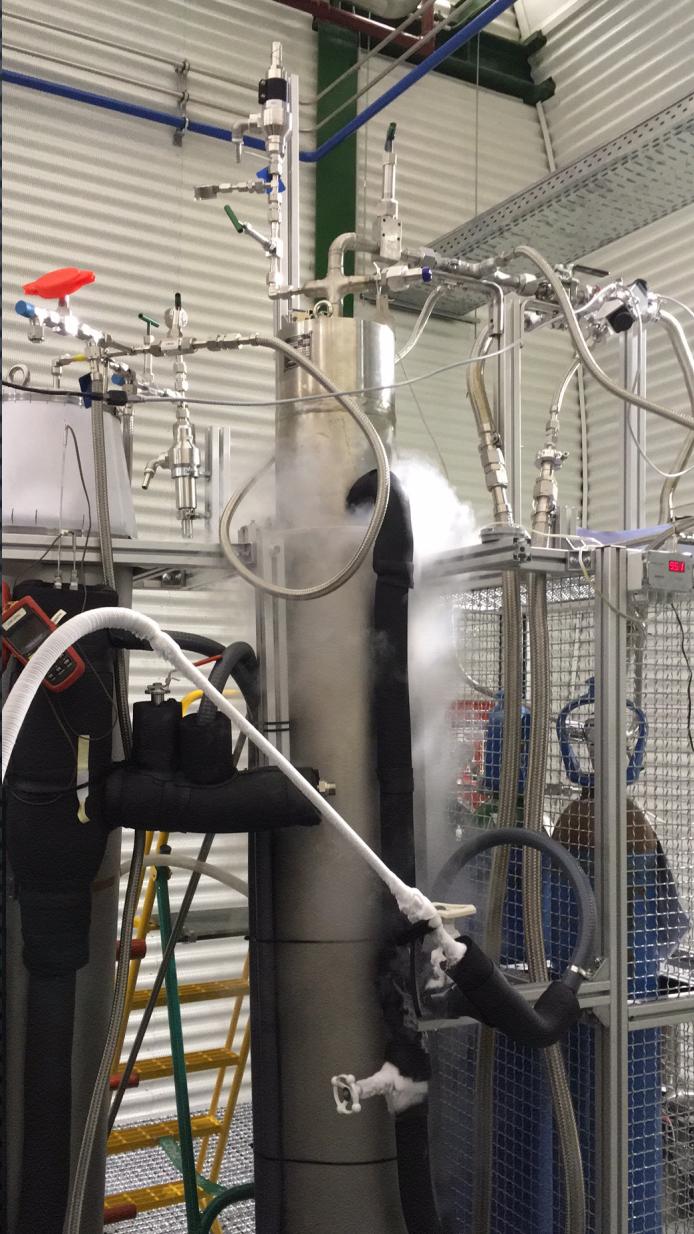
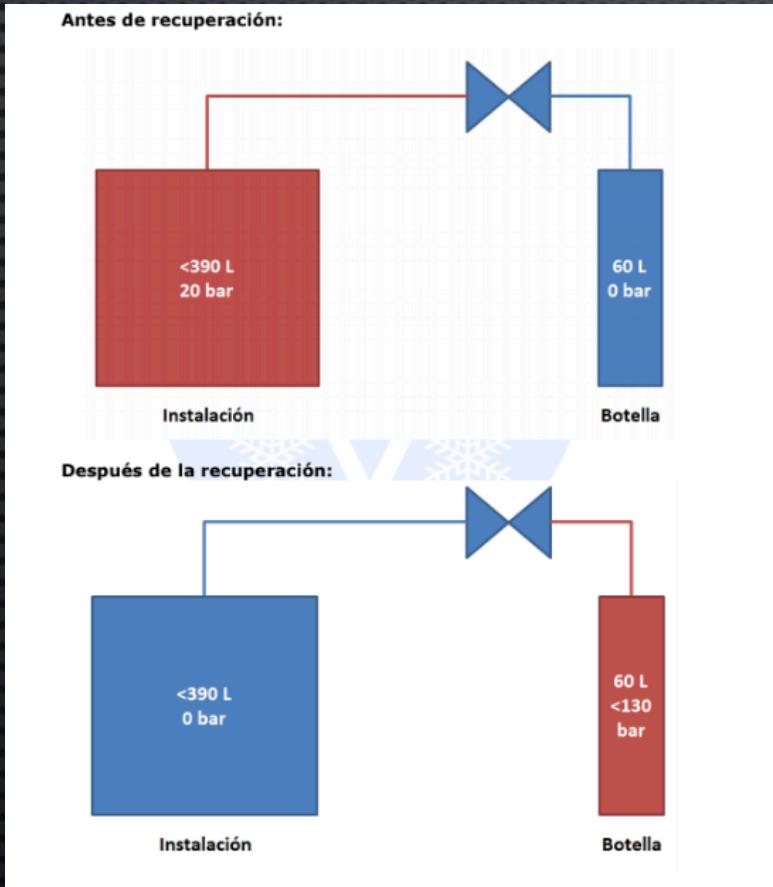
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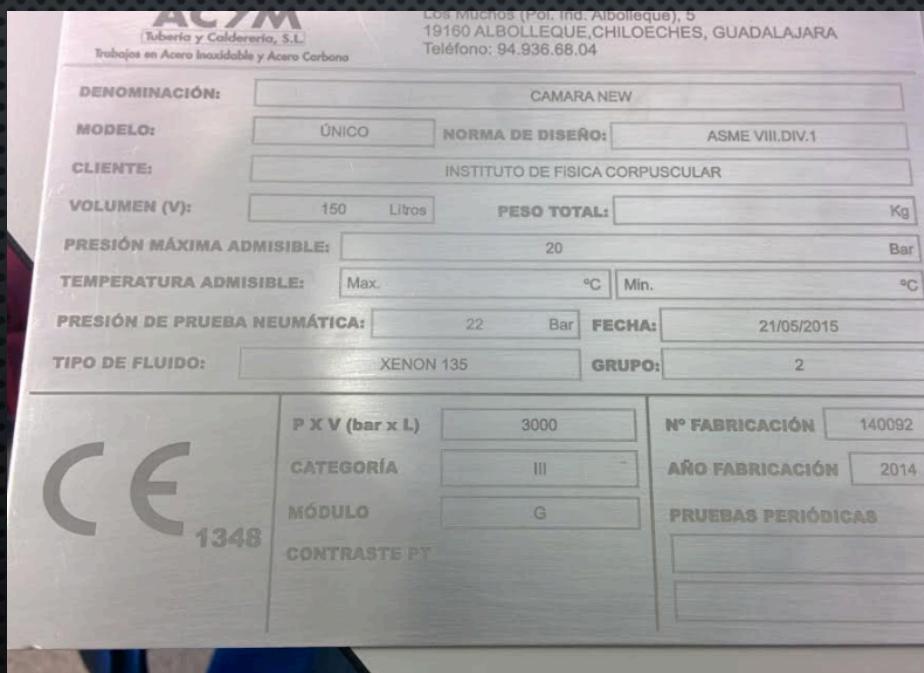


2-RECUPERACIÓN POR CRIOGENIA



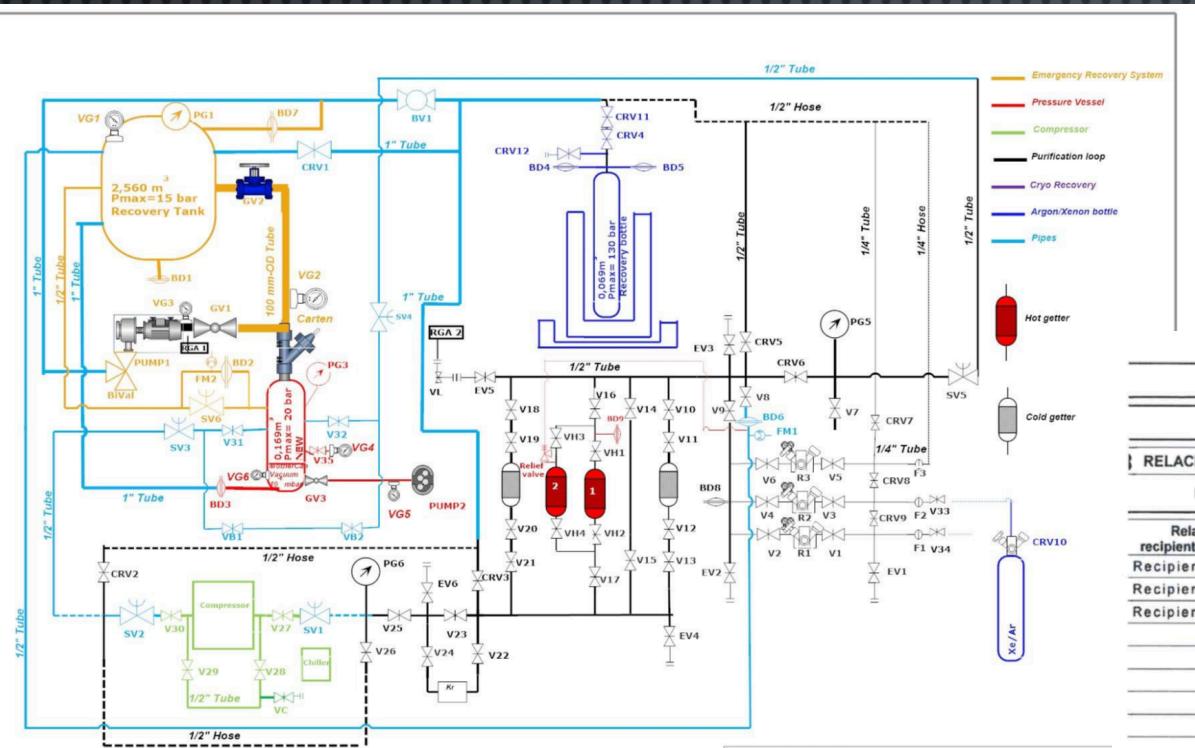
3-MARCADO CE DE EQUIPOS A PRESIÓN

	NEW	NEXT100- TANQUE DE RECUPERACIÓN ACTUAL	TANQUE DE RECUPERACIÓN	BOTELLA DE RECUPERACIÓN
PRESIÓN	20 bar	15 bars	2 bar	130 bar
VACÍO	10^{-6} mbar	10^{-6} mbar	10^{-6} mbar	10^{-6} mbar
VOLUMEN	150 litros	3.000 litros	20.000 litros	60 litros



- Según ASME VIII-División 1
- Según la UNE EN 13445-3

4-INSTALACIÓN Y PUESTA EN MARCHA DEL SISTEMA DE GAS



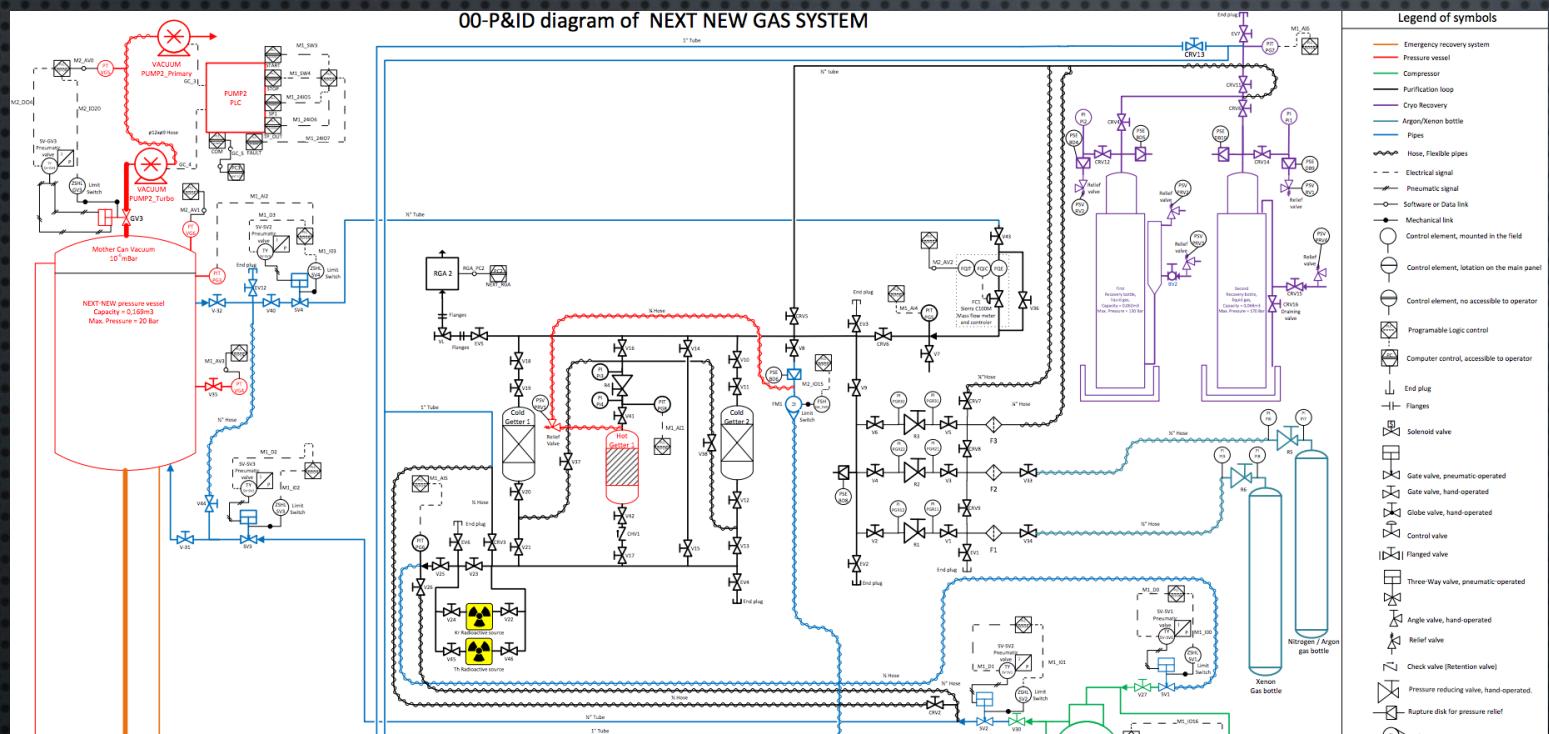
□ (Se anexa hoja complementaria de equipos a presión) P_s = Presión máxima admisible // V = Volumen // PT = Presión de prueba // P_p = Presión de precinto // D_n = Diametro nominal en milímetros

En Zaragoza
Firma de la empresa instaladora habilitada

En **NOVA** Zaragoza a 2 de mayo

Firma de la empresa instaladora habilitada

5-ESQUEMA P&ID DEL SISTEMA DE GAS Y PROCEDIMIENTO DE TRABAJO



C. Normal cryogenic gas recovery (only for Xe)

-Before starting the stage “C-Normal cryogenic gas recovery” check that the valves are like show in the CHECK LIST
“B- Normal gas re-circulation”

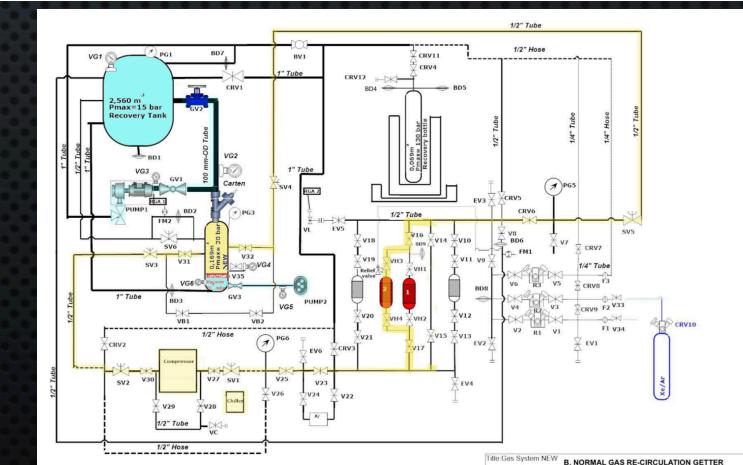
- If the hot getter is working, "purifying", follow the next steps to turn off
 - Open the manual valves V28 and V29
 - Press the button "purify/bypass" and wait until in the screen shows "bypass mode". If there is an error, turn off manually the hot getter and call the technician.
 - Close the manual valves V28 and V29
 - Select state A, and wait until the green light with the OK label is switch on. (If the OK label is not on, call a technician).
 - The Control System must:
 - Turn off the **compressor**
 - Turn off **PUMPI**
 - Close **GV1**
 - The Operators and Control System have to check the following conditions are met:
 - OPEN: SV1, SV2, SV3, SV4 and SV5**(green light)
 - Close manual valves

V27	V30
 - Manually close manual valves (ONLY if we want to use any cold gas purifiers)

V11(V19)	V12(V20)
 - Fill the recovery bottle's cryogenic bucket with liquid nitrogen and insure that the recovery gas bottle has cooled sufficiently. Follow the instructions defined in the specific NEXT Process Procedure **NEXT_NEW_012**
 - Open manual valves in the order give

CRV2	CRV3	CRV5	CRV11	CRV4	V26
 - Wait until the pressure in the main vessel has fallen to around 100 mbar absolute
 - Close the valves

CRV4	CRV11



6-ANÁLISIS DE CRITICALIDAD DE FALLO

7	Component	Carten Valve																	
		Failure Mode	Potential Effects of Failure	S	Potential Causes of Failure	O	Criticality	Existing Preventive Actions	Recommended Preventive Actions	Responsibility & Target Completion Date	Action Results								
11	Carten valve does not open in an emergency evacuation	Less effective emergency evacuation of depleted Xe gas	III	Carten valve failure , No pneumatic pressure available	D	Tolerable	[1] In case the carten valve does not open, there's an alternative though less effective evacuation path: BD2-5V4. (2) A pressurized air tank for NEXT and a pneumatic system with regulators have been installed. If the pressure of the air tank is low, the control system sends emails to the Shifter to solve that manually.			<table border="1"> <thead> <tr> <th>Actions Taken</th><th>S</th><th>O</th><th>RISK</th></tr> </thead> <tbody> <tr> <td></td><td>III</td><td>D</td><td>Tolerable</td></tr> </tbody> </table>		Actions Taken	S	O	RISK		III	D	Tolerable
Actions Taken	S	O	RISK																
	III	D	Tolerable																

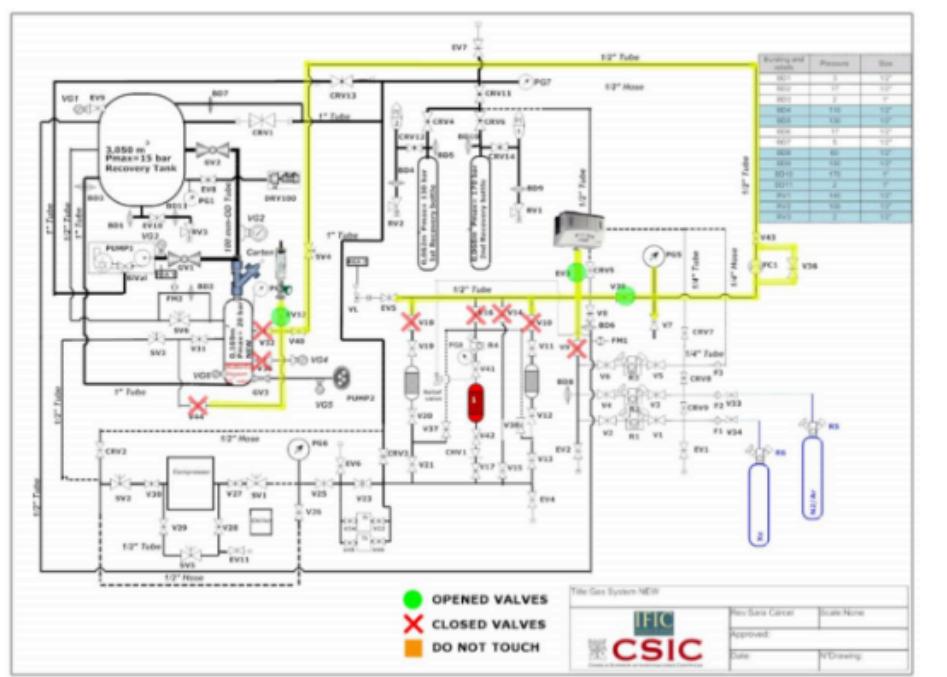
8	Component	Pneumatic valves																		
		Failure Mode	Potential Effects of Failure	S	Potential Causes of Failure	O	Risk score	Existing Preventive Actions	Recommended Preventive Actions	Responsibility & Target Completion Date	Action Results									
12	Not enough pneumatic pressure of the valves	Re-circulation stops because all the valves will close.	III	Pneumatic pipe disconnection, NEXT's pneumatic system failure	C	Tolerable	[1] A pressurized air tank for NEXT and a pneumatic system with regulators have been installed. If the pressure of the air tank is low, the control system sends emails to the Shifter to solve that manually. Valves are closed if not enough pressure is present. In case of failure will place the system into a safe state. Additionally, the compressor will be shut down from the Control System.				<table border="1"> <thead> <tr> <th>Actions Taken</th><th>S</th><th>O</th><th>RISK</th></tr> </thead> <tbody> <tr> <td></td><td>III</td><td>C</td><td>Tolerable</td></tr> </tbody> </table>		Actions Taken	S	O	RISK		III	C	Tolerable
Actions Taken	S	O	RISK																	
	III	C	Tolerable																	
13	No 24 VDC voltage available to actuate the valves	Re-circulation stops because all the valves will close and compressor and chiller will stop operation	III	Power supply in cRIO fails, Cable disconnection	C	Tolerable	[1] An UPS is available for the cRIO chassis (Control System). In case of failure will place the system into a safe state (detected with limit switches). Additionally, the compressor will be shut down from the Control System.				<table border="1"> <thead> <tr> <th>Actions Taken</th><th>S</th><th>O</th><th>RISK</th></tr> </thead> <tbody> <tr> <td></td><td>III</td><td>C</td><td>Tolerable</td></tr> </tbody> </table>		Actions Taken	S	O	RISK		III	C	Tolerable
Actions Taken	S	O	RISK																	
	III	C	Tolerable																	

9	Component	Main power									
	Failure Mode	Potential Effects of Failure	S	Potential Causes of Failure	O	Risk score	Existing Preventive Actions	Recommended Preventive Actions	Responsibility & Target Completion Date	Action Results	

14	Power failure	Loss of: monitoring, acquisition and control of the experiment.	III	LSC without power	A	Intolerable	Upon mains AC power failure, the Gas System automatically brought by default to the Safe	3 Control System(CompactRio chassis)			<table border="1"> <thead> <tr> <th>Actions Taken</th><th>I</th><th>S</th><th>O</th><th>RISK</th></tr> </thead> <tbody> <tr> <td>Potencial effect of failure</td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	Actions Taken	I	S	O	RISK	Potencial effect of failure				
Actions Taken	I	S	O	RISK																	
Potencial effect of failure																					
3	Power supply fails	Unknown state of te gas system	False response	2	0,00	1	1,02E-06	43800	0,00E+00	0,00E+00											
								4	Hardward cabling fails and cRIO program and logic fails	Rare events (like open/close valves where we could lose the gas, lost of communication,...)	Rupture	2	0,00	0,18	8,00E-06	43800	0,00E+00	0,00E+00			
								5	Pressure Vessel	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								7	Vessel rupture	Explosion	Leaking	1	0	0,82	8,00E-06	43800	0,00E+00	0,00E+00			
								6	Compressor	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								8	Power fail	Gas re-circulation is stopped	No Flow	4	0	0,06	8,00E-06	43800	0,00E+00	0,00E+00			
								9	Hydraulic Oil leak	Compressor stops and re-circulations stops	No Output	3	0,00	0,67	2,12E-05	43800	0,00E+00	0,00E+00			
								10	Chiller failure	Compressor is stopped	No Flow	4	0	0,06	8,00E-06	43800	0,00E+00	0,00E+00			
								7	Carten Valve	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								11	Carten valve does not open in an emergency evacuation	No effective emergency evacuation of depleted Xe gas	Stuck Closed	3	0	0,20	7,19E-06	43800	0,00E+00	0,00E+00			
								8	Pneumatic valves	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								12	Not enough pneumatic pressure at the valves	Re-circulation stops because all the valves will close.	Stuck Closed	3	0	0,20	7,19E-06	43800	0,00E+00	0,00E+00			
								13	No 24 VDC voltage available to actuate the valves	Re-circulation stops because all the valves will close and compressor and chiller will stop operation	Stuck Closed	3	0	0,20	7,19E-06	43800	0,00E+00	0,00E+00			
								9	Main Power	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								14	Power failure	Loss of: monitoring, acquisition and control of the experiment.	Data loss	3	0	0,34	2,61E-06	43800	0,00E+00	0,00E+00			
								10	System	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								15	Fire	Gas heats up and causes overpressure	Fire	1	0,01	0,82	7,00E-07	43800	2,51E-04	2,51E-04			
								11	Hot getter	Potencial effect of failure	Failure modes	Severity Class	Failure Effect Probability β	Failure mode Ratio α	Failure rate λp	Operating Time t	Cm	Cr			
								16	Exothermic reaction	Gas inside the getter heats up and causes overpressure, venting hot gasses (>400°C) through the relief valve	False response	3	0,00	1	1,20E-06	43800	0,00E+00	0,00E+00			

	Severity	Probability of occurrence Cr	Risk Classification	
			Fire	Electrical shock
	I	$2,51 \cdot 10^{-4}$	High risk- Undesirable	Medium risk- Tolerable
	II	$5,26 \cdot 10^{-4}$	Medium risk- Tolerable	Medium risk- Tolerable

7-DETECCIÓN DE FUGAS A PRESIÓN Y VACÍO



Test a vacío

- El background de Helio en el test a vacío es de 5E-11 mbar l/s durante todo el test.
- Se detectan niveles de fuga en los VCR menores de 5E-10 mbar l/s. Valor admitido como válido para este tipo de uniones.
- El resto del sistema presenta valores por debajo del background.

Test a presión (100 bar)

- El background de Helio con autocero es de 1E-8 mbar l/s, se utiliza el método de Sniffer.
- El sistema no presentaba fuga alguna por encima del nivel de background.



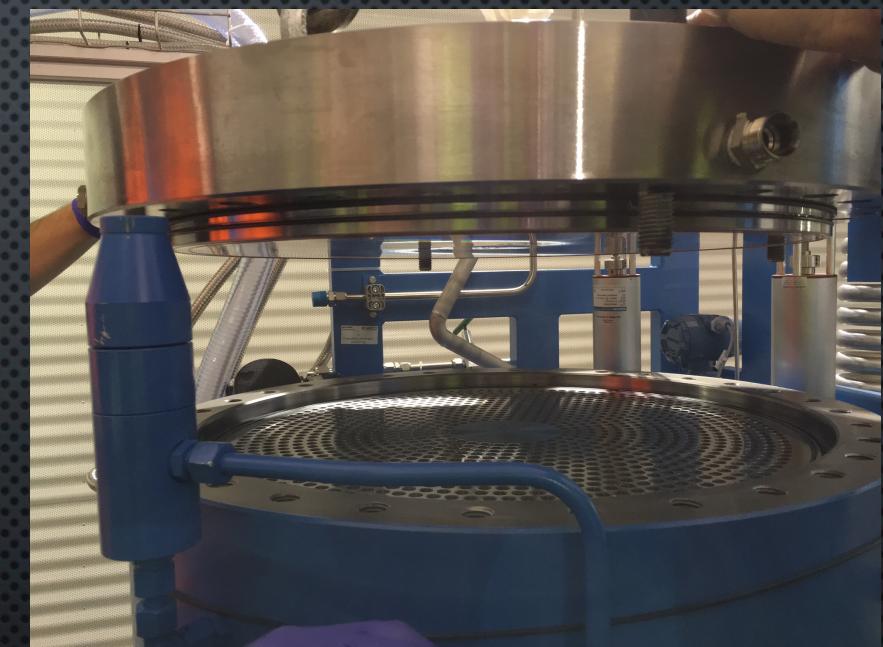
8-MANTENIMIENTO DE EQUIPOS



Maintenance equipment NEW

2017

Compressor		Model	SERA			
Location	Frequency/maintenance	Maintenance Kit location	Oil in the wastes room-Kit in the platform			
In the platform	At least once a year	Change the oil Diaphragm set replacement		1/6/17 9/2/17		
Notes						
Person in charge and signature	Sera Company by Oliver Blank					
PUMP3		Model	nxds20i			
Location	Frequency/maintenance	Maintenance Kit location	In the gas system cupboard			
In the platform	12 months	Inspect and clean the inlet strainer, the external fan cover if required		25/7/17		
Notes						
Person in charge and signature						
Chiller		Model				
Location	Frequency/maintenance	Maintenance Kit location				
In the platform	Every year	Change the glicol		9/11/17		
Notes						
Person in charge and signature						



GRACIAS POR SU ATENCIÓN