CRYOGENIC HELIUM REFRIGERATOR DISPLAY

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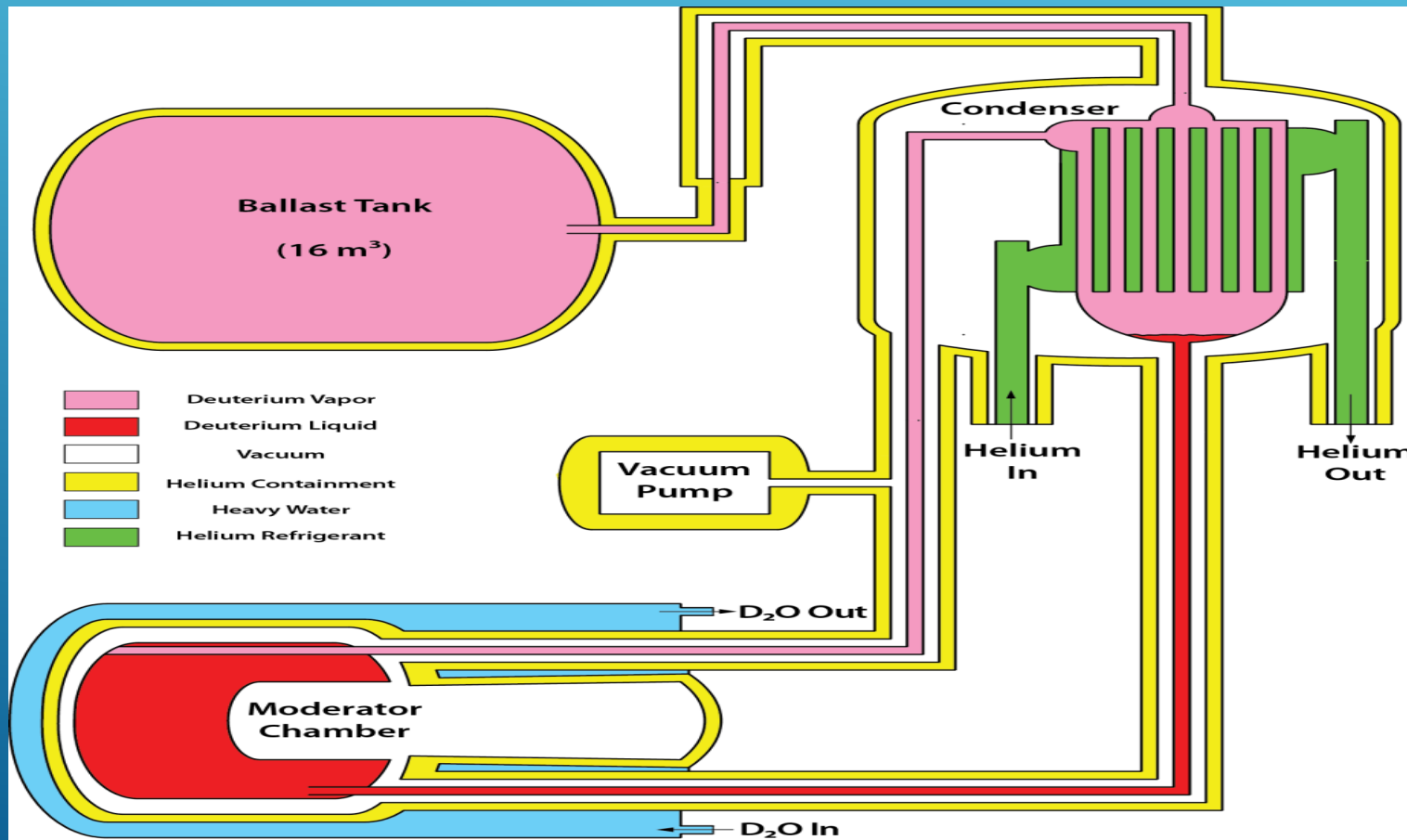
- The NIST Center for Neutron Research (NCNR) operates a facility for biology, chemistry, physics, and materials research using a continuous neutron source

- In order to compensate for flux loss, the NCNR is constructing a deuterium cryostat

- The Cold Source will soon use a new high powered refrigerator

BACKGROUND

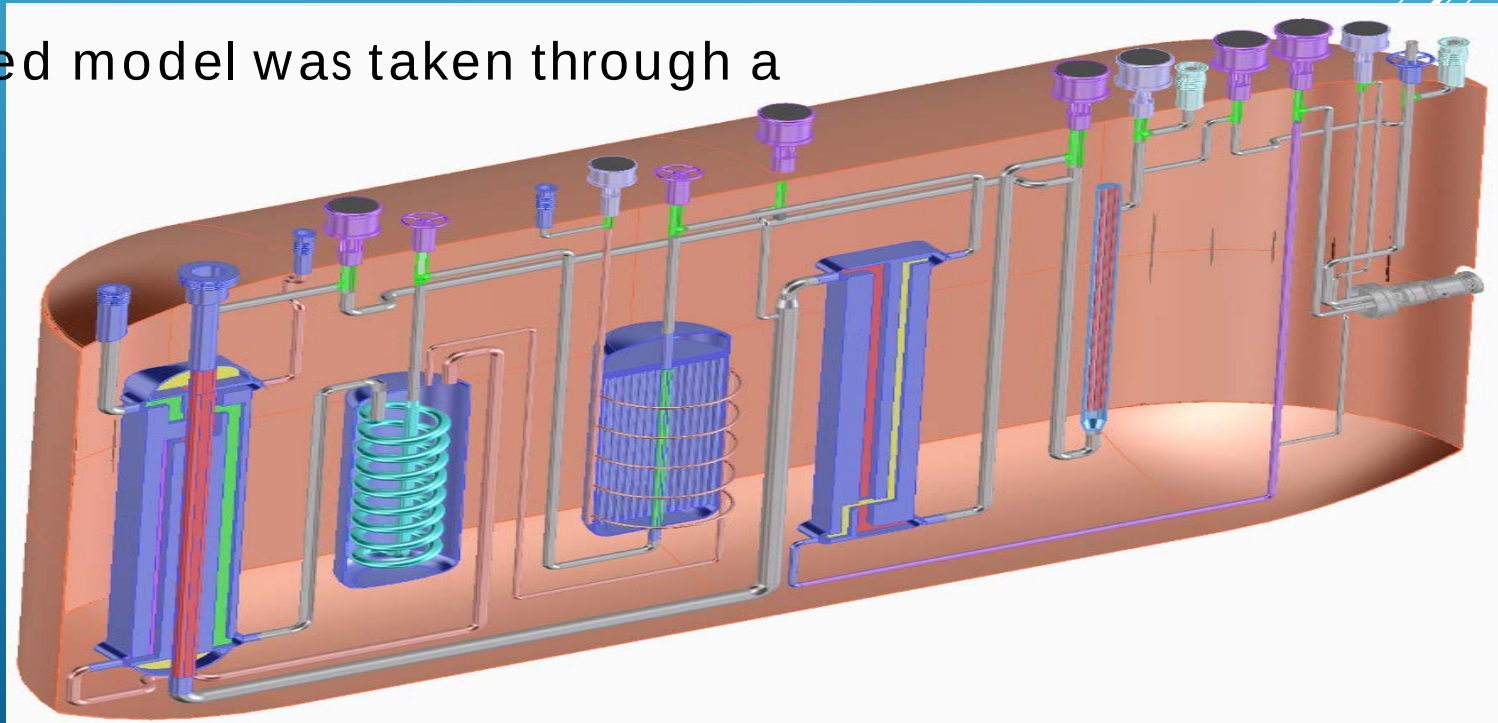


OVERVIEW AND IMPORTANCE

- The new high powered refrigerator for the new deuterium cryostat in C200 needs a screen display of the instruments
- An intuitive display provides insight into the inner workings of the system, and improves troubleshooting response times
- Remote operability allows us to reduce radiation dosage
- The display is a Human Machine Interface that allows for remote control and viewing of the refrigerator

CAD MODEL

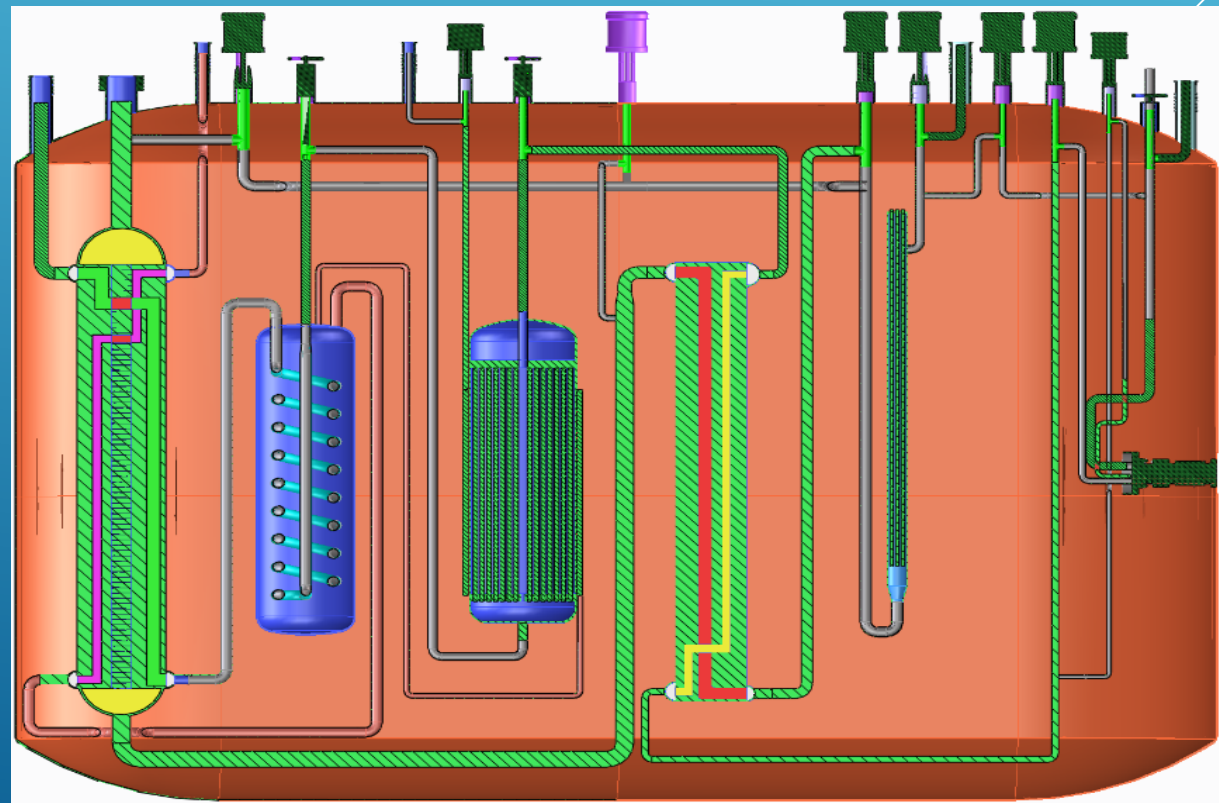
- A CAD model was created in Creo Elements
- Represents a near accurate view of the refrigerator
- Flow paths are illustrative and colored
- The cross section of the completed model was taken through a clipping workplane



CONVERTING TO DISPLAY

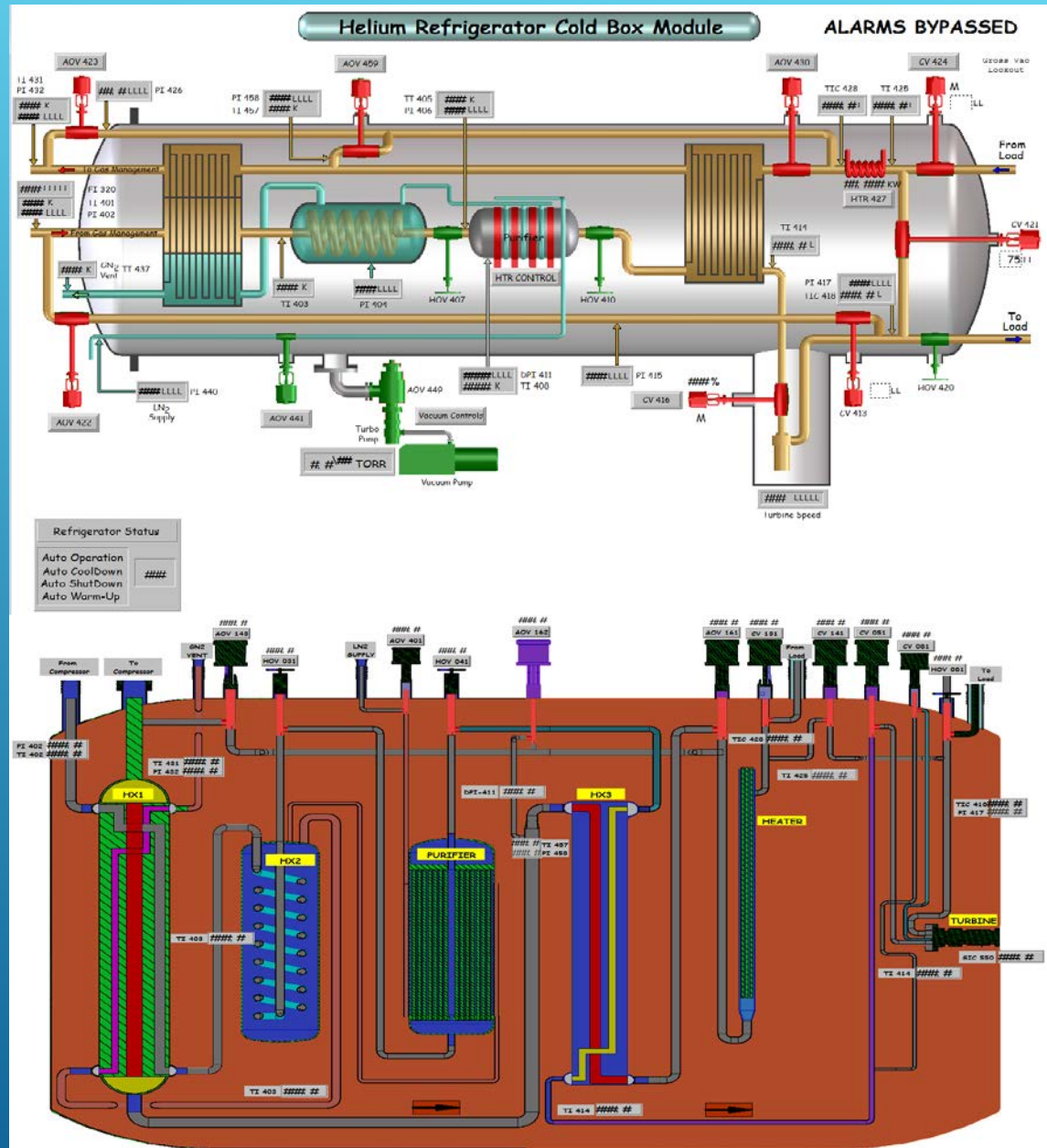
- The cross section was converted to a high resolution print tiff file and then to a bitmap file

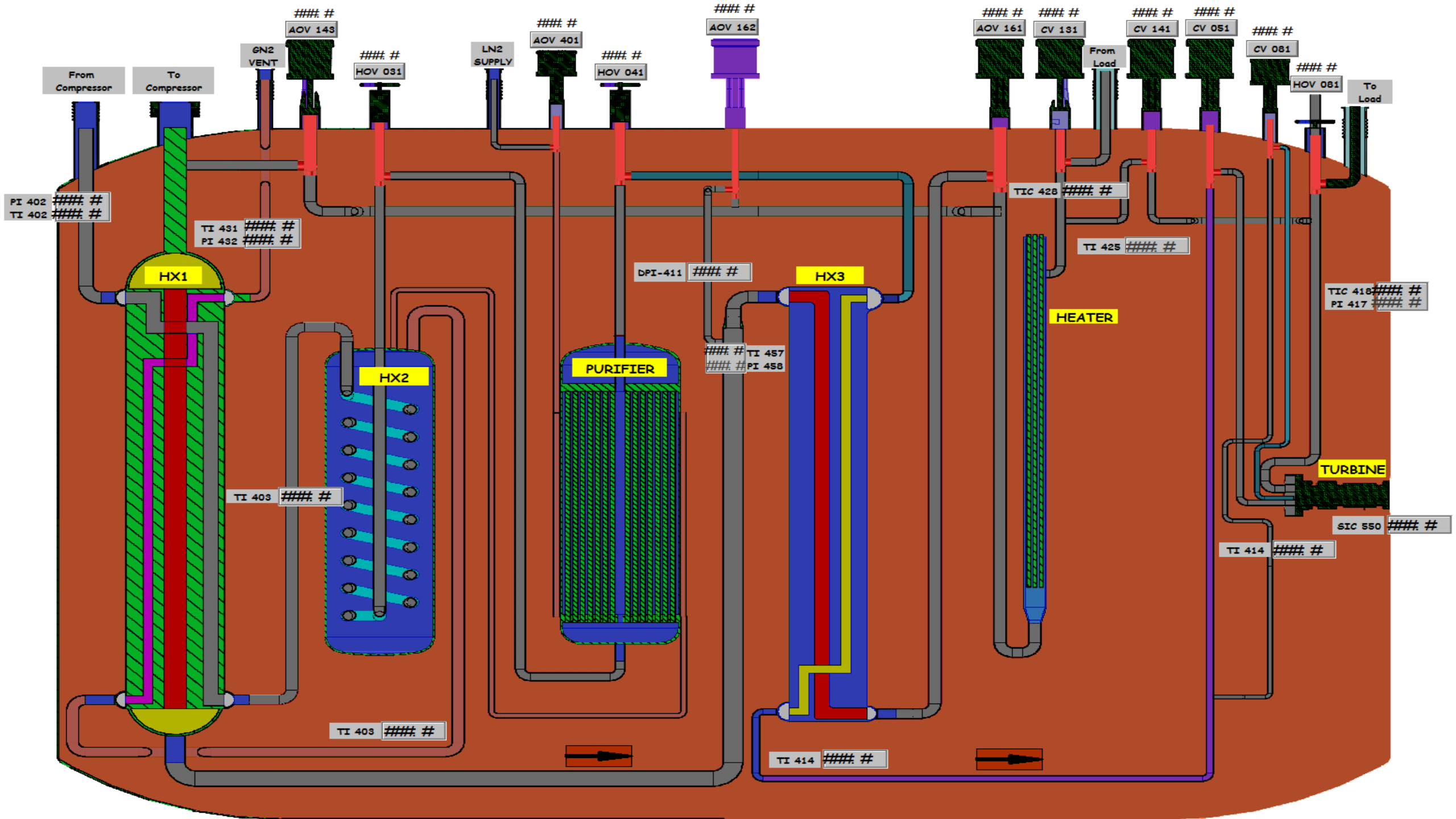
- The bitmap image was placed in Factory Talk Viewer as a wallpaper



- Name plate for each instrument is added
- A numerical value attached to a tag is added
- Flow descriptions are added
- Closed states(red valves) are added to each valve line

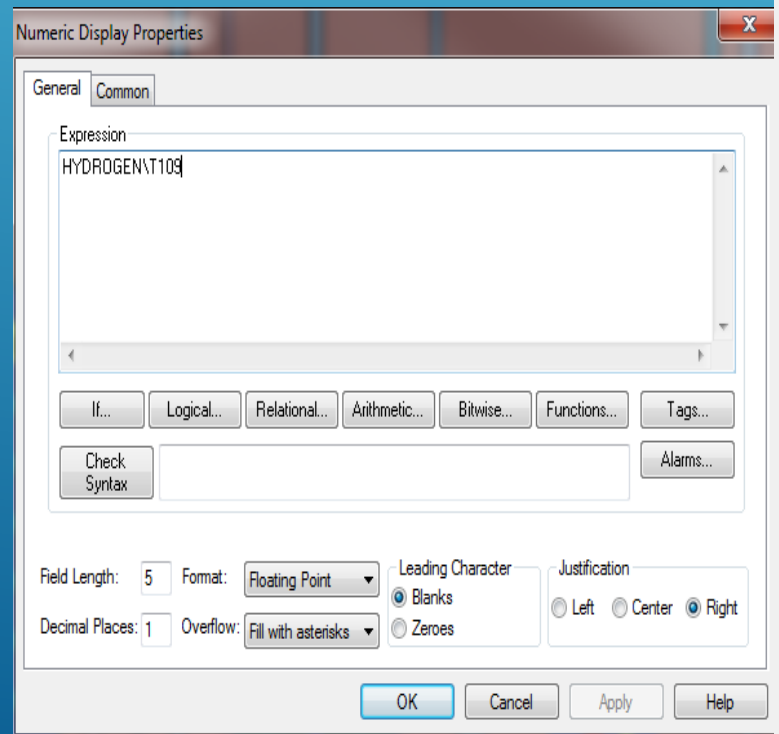
CREATING THE DISPLAY

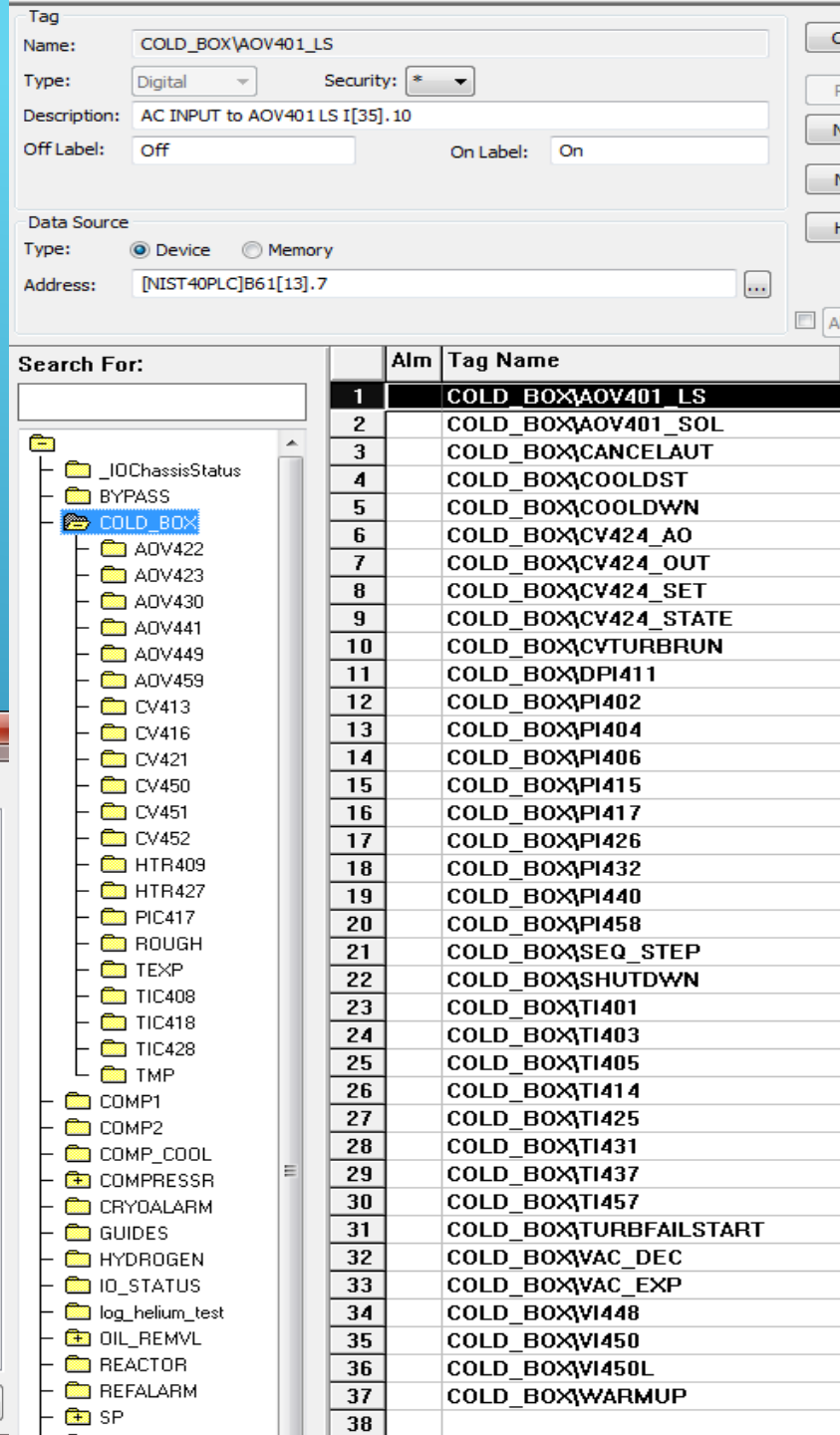


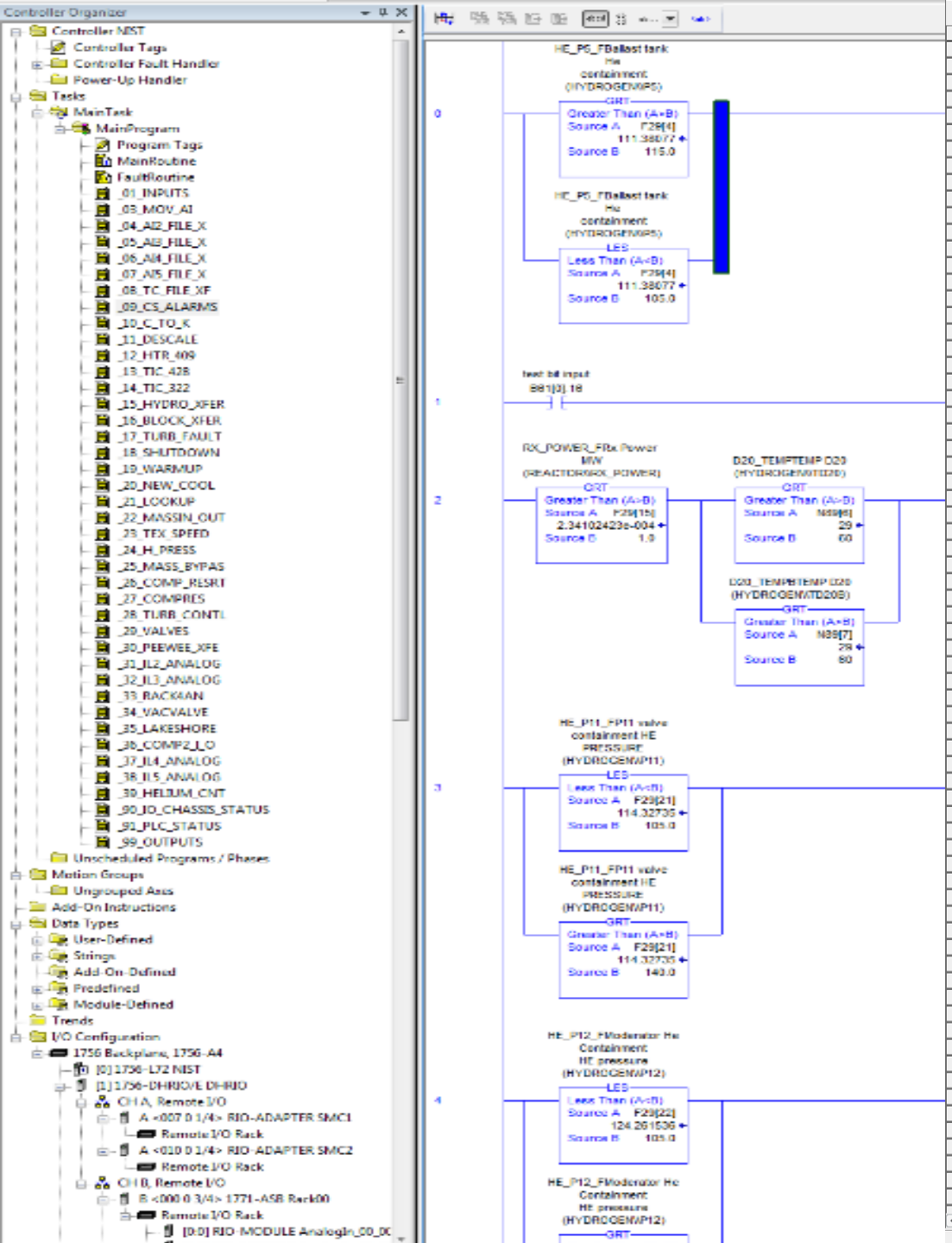

From Compressor
To Compressor
GN2 VENT
AOV 143
HOV 031
LN2 SUPPLY
AOV 401
HOV 041
AOV 162
AOV 161
CV 131
From Load
CV 141
CV 051
CV 081
HOV 081
To Load
PI 402
TI 402
TI 431
PI 432
HX1
HX2
HX3
PURIFIER
DPI-411
TI 457
PI 458
TIC 428
TI 425
HEATER
TIC 416
PI 417
TURBINE
SIC 550
TI 414
TI 403
TI 403
TI 414

- Each instrument has live data values from the reactor
- Each parameter has a unique identifier, or “address”

TAGS







Scope: NIST Show: All Tags Enter Name Filter...

Name	Value	Force Mask	Data Type	Description	Constant	Alias For
Local:2:I	{...}	{...}	AB:1756_IF8_Float:I:0			
LocalRackFaultCode	0		DINT			
LocalRackFaultInfo	0		DINT			
Logix_Status	{...}	{...}	Logix_Status_FP			
major_fault_record	{...}	{...}	Fault_Handling			
Memory_Message	{...}	{...}	MESSAGE			
N7	{...}	{...}	DINT[18]			
N10	{...}	{...}	INT[16]			
N12	{...}	{...}	INT[22]			
N14	{...}	{...}	INT[12]			
N16	{...}	{...}	INT[22]			
N18	{...}	{...}	INT[12]			
N20	{...}	{...}	INT[22]			
N22	{...}	{...}	INT[12]			
N24	{...}	{...}	INT[22]			
N26	{...}	{...}	INT[12]			
N28	{...}	{...}	INT[28]			
N34	{...}	{...}	INT[5]			
N36	{...}	{...}	INT[14]			
N38	{...}	{...}	INT[5]			
N40	{...}	{...}	INT[14]			
N42	{...}	{...}	INT[12]			
N44	{...}	{...}	INT[22]			
N45	{...}	{...}	DINT[25]			
N46	{...}	{...}	DINT[11]			
N47	{...}	{...}	DINT[23]			
N48	{...}	{...}	DINT[23]			
N49	{...}	{...}	INT[61]			
N51	{...}	{...}	DINT[10]			
N53	{...}	{...}	DINT[23]			
N54	{...}	{...}	DINT[24]			
N57	{...}	{...}	DINT[23]			
N58	{...}	{...}	DINT[100]			
N59	{...}	{...}	DINT[4]			
N60	{...}	{...}	DINT[51]			
N60[0]	32		DINT	CV_TI401ControlView Cold Box Inlet Tempera...		
N60[1]	19		DINT	CV_PI402 ControlView Cold Box Inlet Pressure		
N60[2]	30		DINT	CV_TI403ControlView HX1 Outlet Temperatur...		
N60[3]	29		DINT	CV_TI405_CControlView HX2 Outlet Tempera...		
N60[4]	291		DINT	CV_TI414ControlView Heat Exchanger 3 Outl...		
N60[5]	25		DINT	CV_PI458ControlView Helium Return HX3 Out...		
N60[6]	295		DINT	CV_TI425_COND_RETURNCOLDBOX RET...		
N60[7]	296		DINT	CV_TI457ControlView Helium Return Heat Ex...		
N60[8]	13		DINT	CV_PI426ControlView Helium Return Bypass ...		
N60[9]	13		DINT	CV_PI432ControlView Helium Return Pressure...		
N60[10]	30		DINT	CV_TIC_418_SETPControlView TIC 418 TUR...		
N60[11]	295		DINT			
N60[12]	90		DINT	CV_TIC_418_OUTControlView TIC 418 TUR...		
N60[13]	32		DINT	CV_TI_431ControlView Helium Return Temper...		
N60[14]	31		DINT	CV_TI437ControlView Nitrogen Vent Tempera...		
N60[15]	310		DINT	CV_TIC_428_SETPTControlView TIC 428 He ...		
N60[16]	300		DINT			
N60[17]	11		DINT	CV_TIC_428_OUTControlView TIC 428 Output		
N60[18]	39		DINT	CV_PI440ControlView Liquid Nitrogen Supply ...		
N60[19]	-6		DINT	CV_VI450ControlView Cold Box Vacuum (COL...		
N60[20]	80		DINT	CV_TIC_408_SET ControlView Purifier Tempe...		
N60[21]	80		DINT	TE408_PUR_HTRControlView Purifier Tempe...		
N60[22]	3		DINT	CV_TIC_408_OUTControlView TIC408 Output...		
N60[23]	15		DINT	CV_PI404 ControlView Nitrogen Bath Pressure...		
N60[24]	0		DINT	CV_PI406ControlView Heat Exchanger 2 Outl...		
N60[25]	80		DINT	CV_PIC_H2_P3_SETPControlView PIC 417 S...		
N60[26]	419		DINT	CV_H2_P3ControlView P3(H2 PRESSURE k...		
N60[27]	100		DINT	CV_PIC_H2_P3_OUT ControlView PID H2 P3...		
N60[28]	5		DINT	CV_DPI411ControlView Purifier Differential Pre...		
N60[29]	0		DINT	CV_SI_550_SPEED ControlView Turbine Exp...		
N60[30]	100		DINT	CV_CV_424_SETOUT ControlView CV424 Se...		
N60[31]	3		DINT	CV_408_PERCENT_OUTTIC_408 PURIFIER...		
N60[32]	20		DINT	CV_LLC_442_OUTControlView LLC 442 TUR...		
N60[33]	72		DINT	CV_CV_421_SET ControlView CV421 HE Byp...		
N60[34]	12		DINT	CV_PI415ControlView Expander Bypass Press...		

Monitor Tags | Edit Tags

FUTURE WORK

The display is editable and will change

- New screens will always be added along with the current to support the ongoing cold source project

The tag database will have continuous updates

- New tags are able to be referenced for the current display or any future display

ACKNOWLEDGEMENTS

- Many thanks to Julie Borchers, Yamali Hernandez, Mike Middleton, NCNR staff, and SHIP staff

NIST

National Institute of
Standards and Technology

U.S. Department of Commerce