

CRYOGENIC HELIUM REFRIGERATOR DISPLAY

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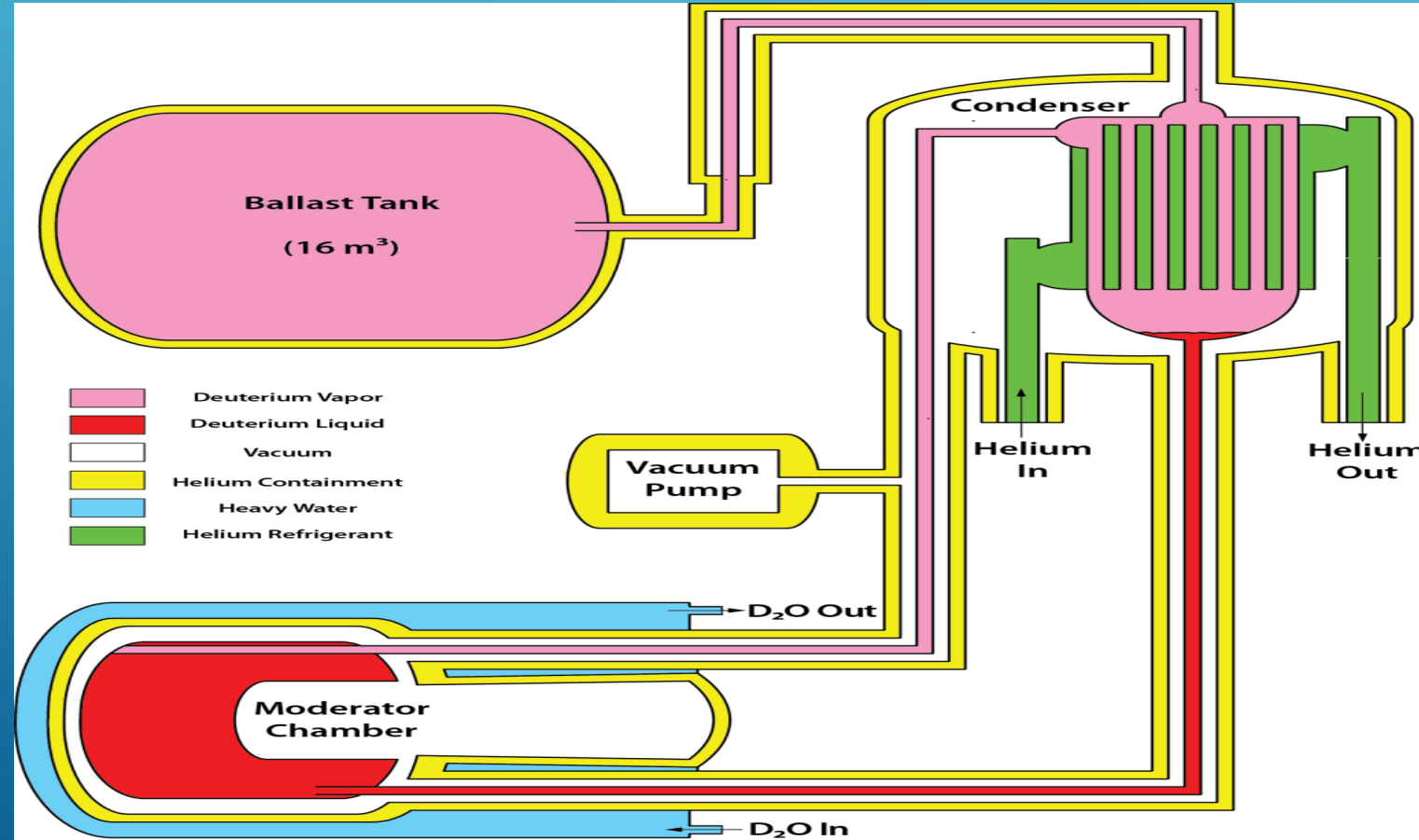


▶ The NIST Center for Neutron Research (NCNR) operates a facility for biology, chemistry, physics, and materials research using a continuous neutron source

▶ 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





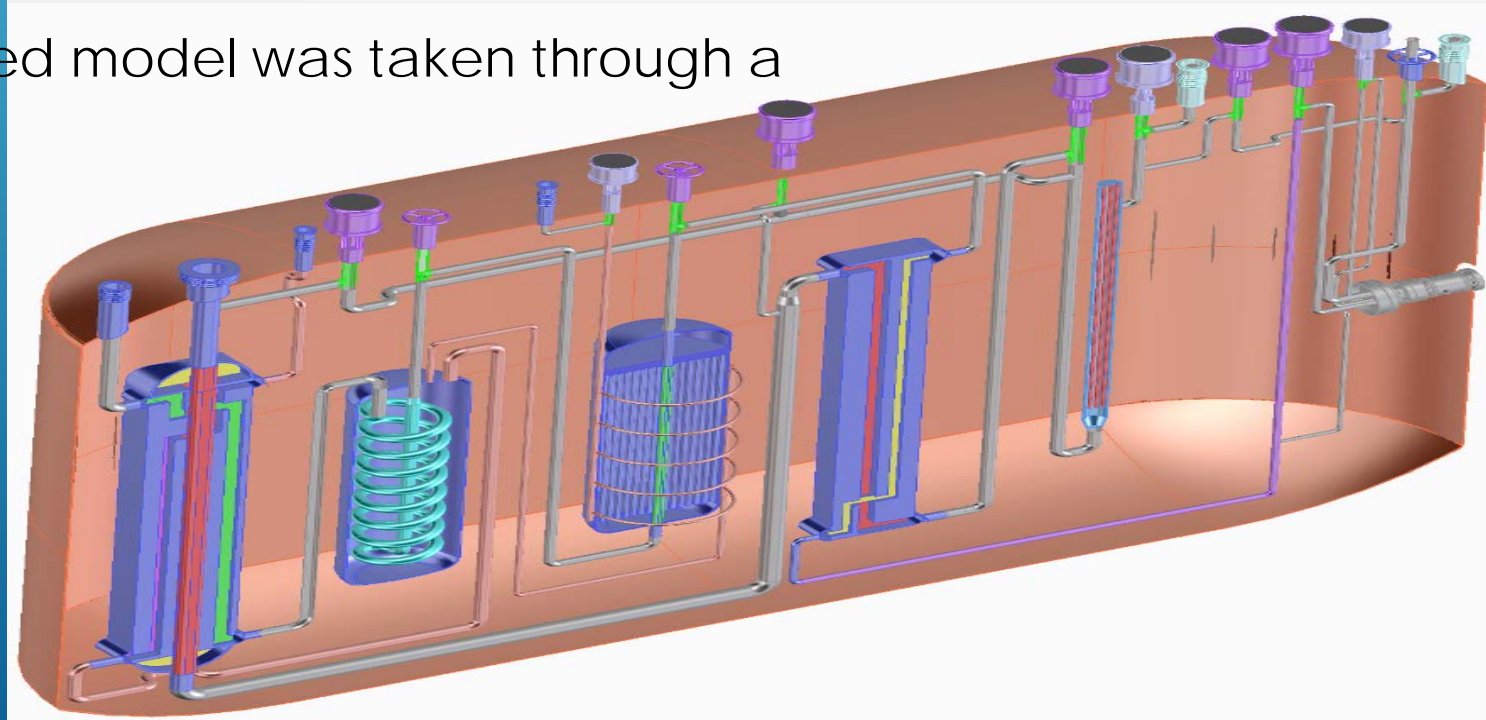
- ▶ The new high powered refrigerator for the new deuterium cryostat in C200 needs a screen display of the instruments
- ▶ An intuitive display provides insight into the inner workings of the system, and improves troubleshooting response times
- ▶ Remote operability allows us to reduce radiation dosage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

OVERVIEW AND IMPORTANCE



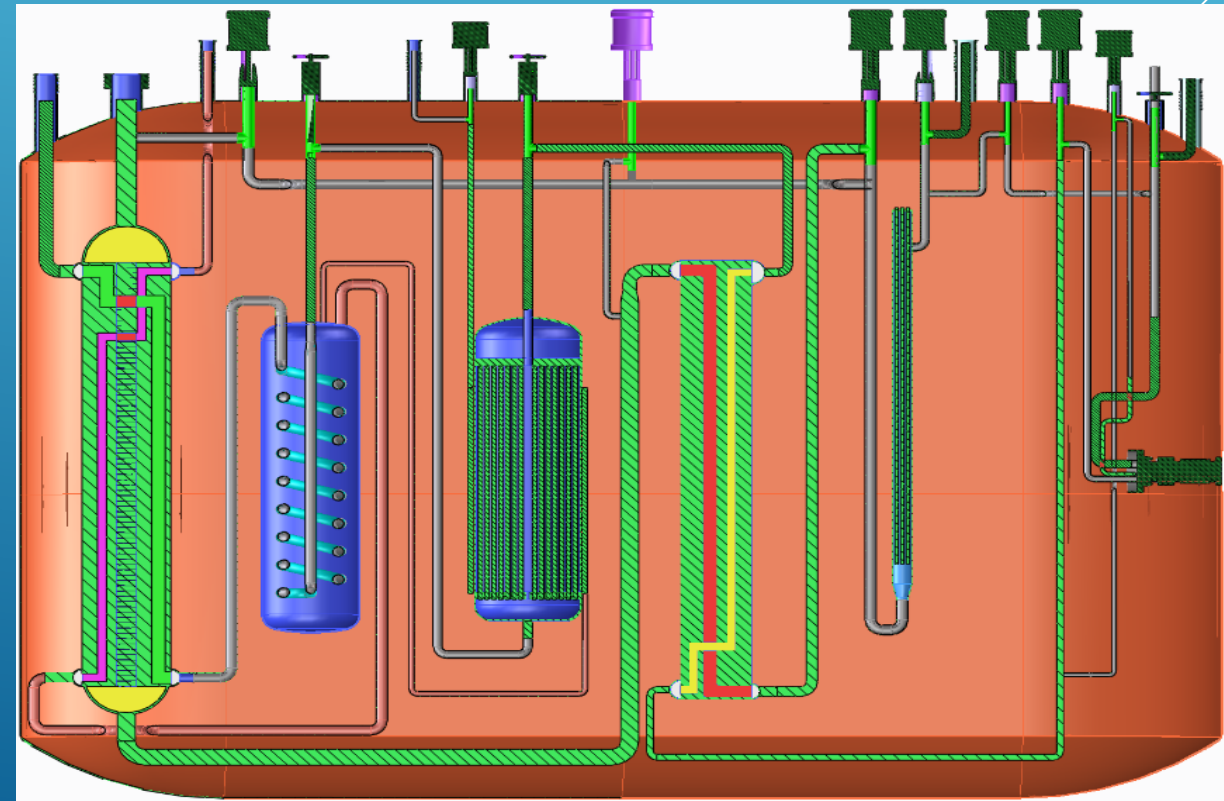
- ▶ A CAD model was created in Creo Elements
- ▶ Represents a near accurate view of the refrigerator
- ▶ Flow paths are illustrative and colored
- ▶ The cross section of the completed model was taken through a clipping workplane

CAD MODEL

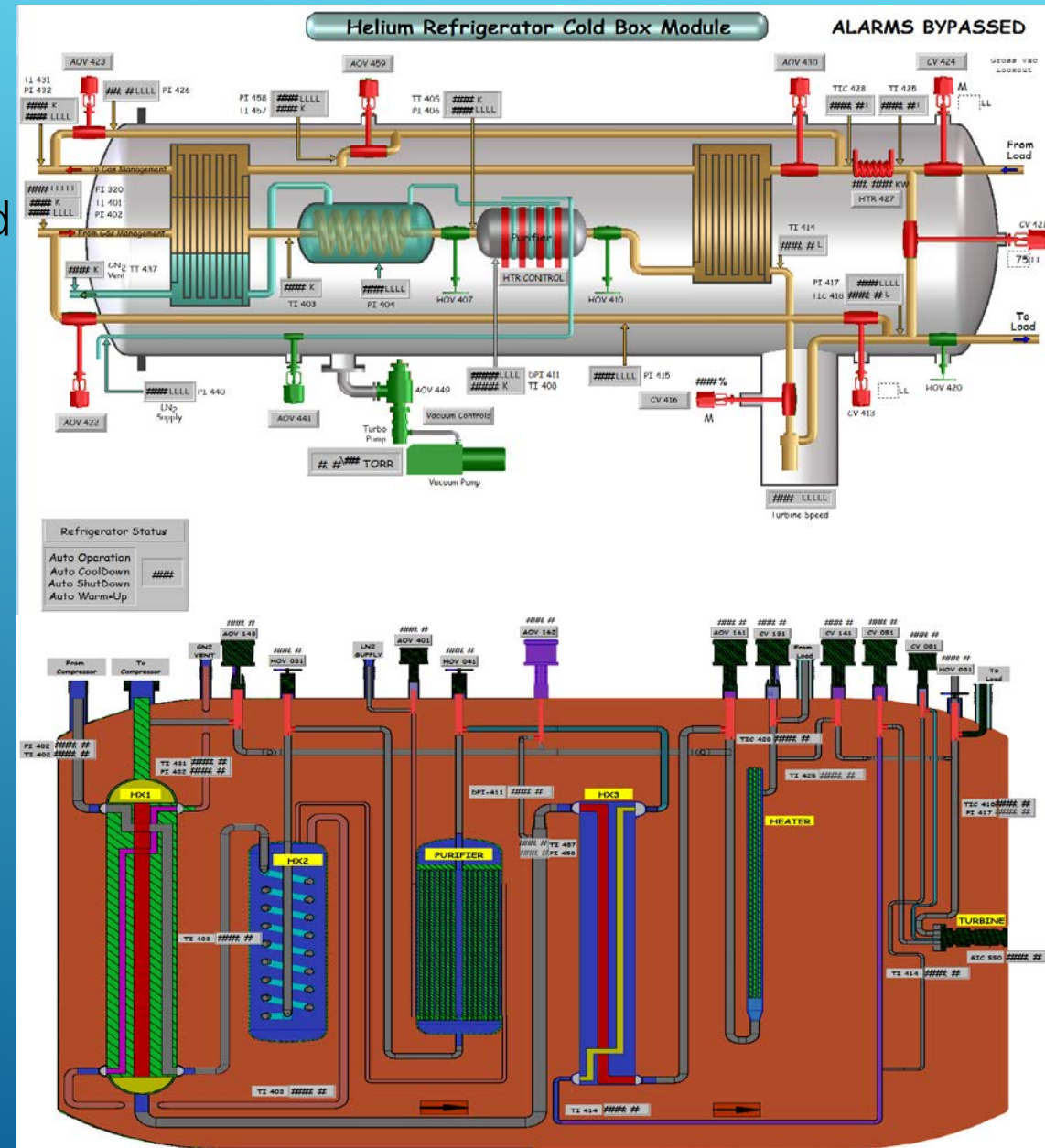


- ▶ The cross section was converted to a high resolution print tiff file and then to a bitmap file
- ▶ The bitmap image was placed in Factory Talk Viewer as a wallpaper

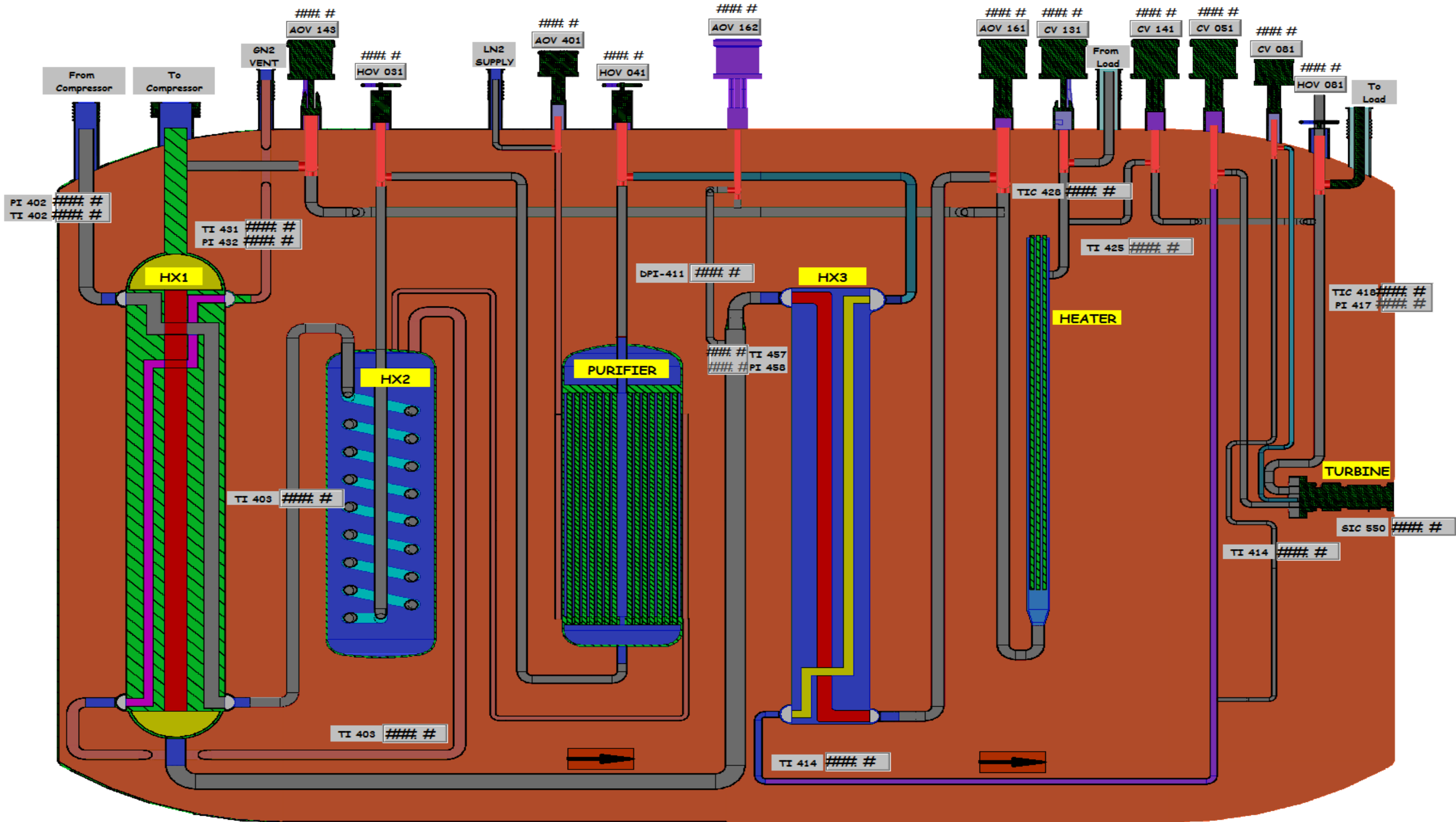
CONVERTING TO DISPLAY



- ▶ 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



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

Tag
 Name: COLD_BOX\AOV401_LS
 Type: Digital Security: *
 Description: AC INPUT to AOV401 LS I[35].10
 Off Label: Off On Label: On
 Data Source
 Type: Device Memory
 Address: [NIST40PLC]B61[13].7

Search For:

	Alm	Tag Name
1		COLD_BOX\AOV401_LS
2		COLD_BOX\AOV401_SOL
3		COLD_BOX\CANCELAUT
4		COLD_BOX\COOLDST
5		COLD_BOX\COOLDWN
6		COLD_BOX\CV424_AO
7		COLD_BOX\CV424_OUT
8		COLD_BOX\CV424_SET
9		COLD_BOX\CV424_STATE
10		COLD_BOX\CVTURBRUN
11		COLD_BOX\DPi411
12		COLD_BOX\PI402
13		COLD_BOX\PI404
14		COLD_BOX\PI406
15		COLD_BOX\PI415
16		COLD_BOX\PI417
17		COLD_BOX\PI426
18		COLD_BOX\PI432
19		COLD_BOX\PI440
20		COLD_BOX\PI458
21		COLD_BOX\SEQ_STEP
22		COLD_BOX\SHUTDWN
23		COLD_BOX\TI401
24		COLD_BOX\TI403
25		COLD_BOX\TI405
26		COLD_BOX\TI414
27		COLD_BOX\TI425
28		COLD_BOX\TI431
29		COLD_BOX\TI437
30		COLD_BOX\TI457
31		COLD_BOX\TURBFFAILSTART
32		COLD_BOX\VAC_DEC
33		COLD_BOX\VAC_EXP
34		COLD_BOX\VI448
35		COLD_BOX\VI450
36		COLD_BOX\VI450L
37		COLD_BOX\WARMUP
38		

Numeric Display Properties

General Common

Expression
 HYDROGEN\T109

If... Logical... Relational... Arithmetic... Bitwise... Functions... Tags...
 Check Syntax Alarms...

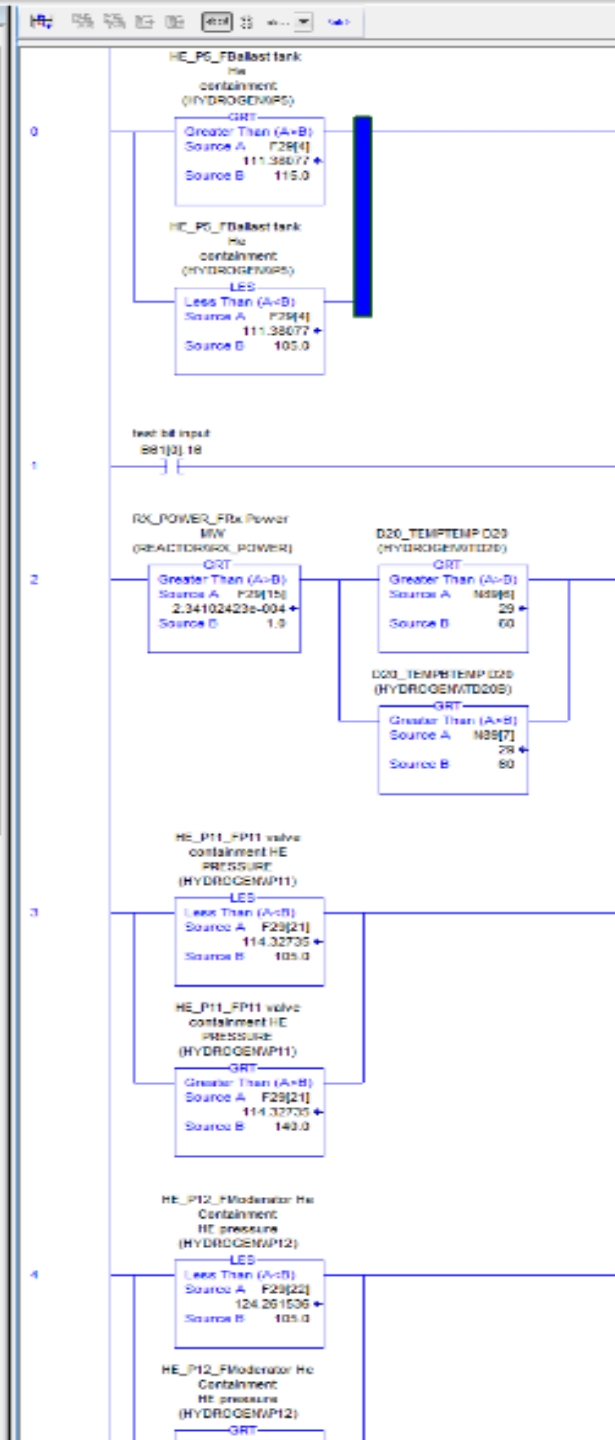
Field Length: 5 Format: Floating Point Leading Character: Blanks Zeroes Justification: Left Center Right
 Decimal Places: 1 Overflow: Fill with asterisks

OK Cancel Apply Help

TAGS

Controller NEST

- Controller Tags
- Controller Fault Handler
- Power-Up Handler
- Tasks
 - MainTask
 - MainProgram
 - Program Tags
 - MainRoutine
 - FaultRoutine
 - 01_INPITS
 - 05_MOV_AI
 - 04_AD_FILE_X
 - 05_AB_FILE_X
 - 06_AD_FILE_X
 - 07_AS_FILE_X
 - 08_TC_FILE_XF
 - 09_CS_ALARMS
 - 10_C_TO_K
 - 11_DESCALE
 - 12_HTR_409
 - 13_TIC_428
 - 14_TIC_322
 - 15_HYDRO_XFER
 - 16_BLOCK_XFER
 - 17_TURB_FAULT
 - 18_SHUTDOWN
 - 19_WARMUP
 - 20_NEW_COOL
 - 21_LOOKUP
 - 22_MASSIN_OUT
 - 23_TEX_SPEED
 - 24_H_PRESS
 - 25_MASS_BYPAS
 - 26_COMP_RESRT
 - 27_COMPRES
 - 28_TURB_CONTL
 - 29_VALVES
 - 30_PEEWEE_XFE
 - 31_IL2_ANALOG
 - 32_IL3_ANALOG
 - 33_RACKIAN
 - 34_VACVALVE
 - 35_LAKESHORE
 - 36_COMP2_LO
 - 37_IL4_ANALOG
 - 38_IL5_ANALOG
 - 39_HELIUM_CNT
 - 39_IO_CHASSIS_STATUS
 - 39_PLC_STATUS
 - 39_OUTPUTS
 - Unscheduled Programs / Phases
 - Motion Groups
 - Ungrouped Axis
 - Add-On Instructions
 - Date Types
 - User-Defined
 - Strings
 - Add-On-Defined
 - Prefdefined
 - Module-Defined
 - Trends
 - I/O Configuration
 - 1756 Backplane, 1756-A4
 - 1756-L72 NIST
 - 1756-DHROV/DHROD
 - CH A, Remote I/O
 - A <007 0 1/4> RIO-ADAPTER SMC1
 - Remote I/O Rack
 - A <010 0 1/4> RIO-ADAPTER SMC2
 - Remote I/O Rack
 - CH B, Remote I/O
 - B <000 0 3/4> 1771-ASB Rack00
 - Remote I/O Rack
 - [0-0] RIO-MODULE AnalogIn_00_0C



Scope: NIST | Show: All Tags

Name	Value	Force Mask	Data Type	Description	Constant	Alias For
Local21	[...]	[...]				
LocalRackFaultCode	0		DINT		<input type="checkbox"/>	
LocalRackFaultInfo	0		DINT		<input type="checkbox"/>	
Logix_Status	[...]	[...]	Logix_Status_FP		<input type="checkbox"/>	
major_fault_record	[...]	[...]	Fault_Handling		<input type="checkbox"/>	
Memory_Message	[...]	[...]	MESSAGE		<input type="checkbox"/>	
N7	[...]	[...]	DINT(18)		<input type="checkbox"/>	
N10	[...]	[...]	INT(16)		<input type="checkbox"/>	
N12	[...]	[...]	INT(22)		<input type="checkbox"/>	
N14	[...]	[...]	INT(12)		<input type="checkbox"/>	
N16	[...]	[...]	INT(22)		<input type="checkbox"/>	
N18	[...]	[...]	INT(12)		<input type="checkbox"/>	
N20	[...]	[...]	INT(22)		<input type="checkbox"/>	
N22	[...]	[...]	INT(12)		<input type="checkbox"/>	
N24	[...]	[...]	INT(22)		<input type="checkbox"/>	
N26	[...]	[...]	INT(12)		<input type="checkbox"/>	
N28	[...]	[...]	INT(28)		<input type="checkbox"/>	
N34	[...]	[...]	INT(5)		<input type="checkbox"/>	
N36	[...]	[...]	INT(14)		<input type="checkbox"/>	
N38	[...]	[...]	INT(5)		<input type="checkbox"/>	
N40	[...]	[...]	INT(14)		<input type="checkbox"/>	
N42	[...]	[...]	INT(12)		<input type="checkbox"/>	
N44	[...]	[...]	INT(22)		<input type="checkbox"/>	
N45	[...]	[...]	DINT(25)		<input type="checkbox"/>	
N46	[...]	[...]	DINT(11)		<input type="checkbox"/>	
N47	[...]	[...]	DINT(23)		<input type="checkbox"/>	
N48	[...]	[...]	DINT(23)		<input type="checkbox"/>	
N49	[...]	[...]	INT(61)		<input type="checkbox"/>	
N51	[...]	[...]	DINT(10)		<input type="checkbox"/>	
N53	[...]	[...]	DINT(23)		<input type="checkbox"/>	
N54	[...]	[...]	DINT(24)		<input type="checkbox"/>	
N57	[...]	[...]	DINT(23)		<input type="checkbox"/>	
N58	[...]	[...]	DINT(100)		<input type="checkbox"/>	
N59	[...]	[...]	DINT(4)		<input type="checkbox"/>	
N60	[...]	[...]	DINT(51)		<input type="checkbox"/>	
N60[0]	32		DINT	CV_T1401ControlView Cold Box Inlet Temper...		
N60[1]	19		DINT	CV_P1402 ControlView Cold Box Inlet Pressure		
N60[2]	30		DINT	CV_T1403ControlView HX1 Outlet Temperatu...		
N60[3]	29		DINT	CV_T1405_ControlView HX2 Outlet Tempera...		
N60[4]	291		DINT	CV_T1414ControlView Heat Exchanger 3 Out...		
N60[5]	25		DINT	CV_P1458ControlView Helium Return HX3 Out...		
N60[6]	295		DINT	CV_T1425_COND_RETURNCOLDBOX RET...		
N60[7]	296		DINT	CV_T1457ControlView Helium Return Heat Ex...		
N60[8]	13		DINT	CV_P1426ControlView Helium Return Bypass ...		
N60[9]	13		DINT	CV_P1432ControlView Helium Return Pressure...		
N60[10]	30		DINT	CV_TIC_418_SETPTControlView TIC 418 TUR...		
N60[11]	295		DINT	CV_TIC_418_OUTControlView TIC 418 TUR...		
N60[12]	90		DINT	CV_TL_431ControlView Helium Return Temper...		
N60[13]	32		DINT	CV_T1437ControlView Nitrogen Vent Tempera...		
N60[14]	31		DINT	CV_TIC_428_SETPTControlView TIC 428 He...		
N60[15]	310		DINT			
N60[16]	300		DINT			
N60[17]	11		DINT	CV_TIC_428_OUTControlView TIC 428 Output		
N60[18]	39		DINT	CV_P1440ControlView Liquid Nitrogen Supply ...		
N60[19]	-6		DINT	CV_V1450ControlView Cold Box Vacuum [CDL...		
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_P1404 ControlView Nitrogen Bath Pressure...		
N60[24]	0		DINT	CV_P1406ControlView Heat Exchanger 2 Out...		
N60[25]	80		DINT	CV_PIC_H2_P3_SETPTControlView 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_DP1411ControlView 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_P1415ControlView Expander Bypass Press...		

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

FUTURE WORK



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

ACKNOWLEDGEMENTS



NIST
**National Institute of
Standards and Technology**
U.S. Department of Commerce

A decorative graphic consisting of several parallel white lines of varying lengths, arranged in a diagonal pattern from the bottom right towards the center of the page.