



**PCaPAC-2012 – Dec 4-7 2012**

# **CRYO-DACS**

A **CRYO**genic **D**ata acquisition and  
**C**ontrol **S**ystem – at IUAC, Delhi

Status report, maintenance issues & future plans

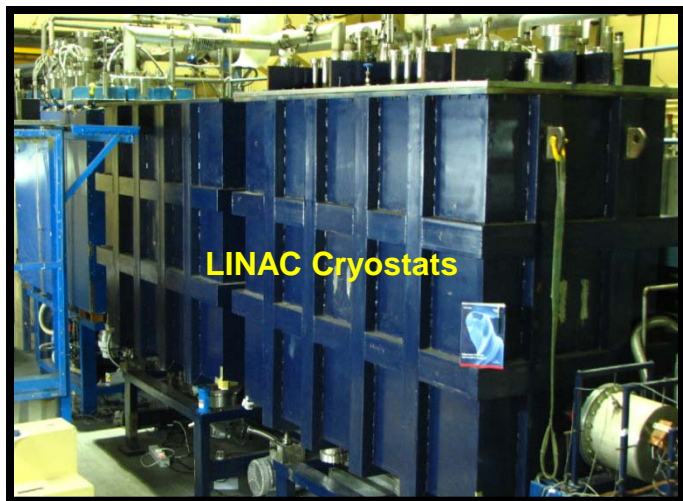
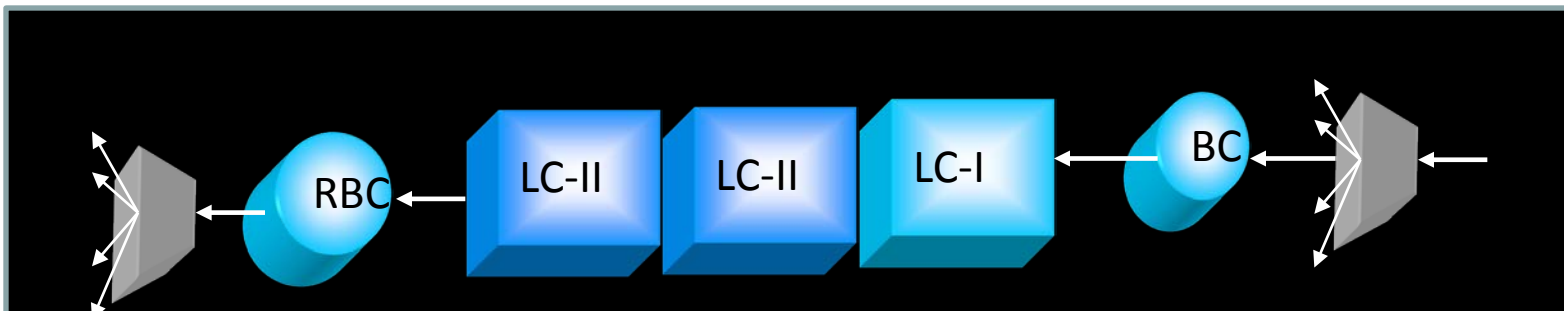
**JOBY ANTONY , D.S.MATHURIA & T.S.DATTA**

**Inter University Accelerator Centre [IUAC]**

**New Delhi - INDIA**

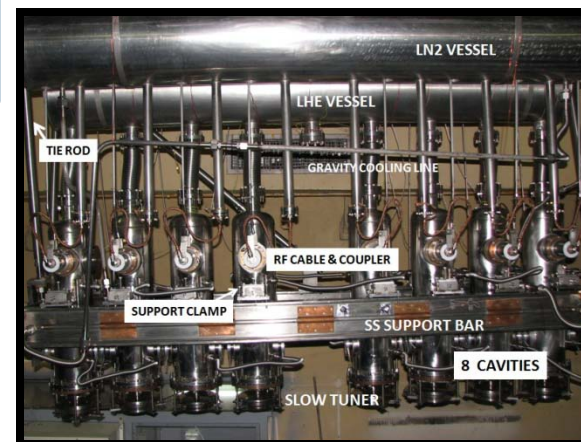


# IUAC LINAC cryogenic network



Cryo Distribution line

He Compressors



**CRYO-DACS is set-up to control and acquire many analog and digital Cryogenic parameters from equipments like beam-line Cryostats, Helium Compressors, Cryogenic distribution line etc. and ON/OFF controls of IUAC LINAC from a central Cryogenic control room. The system can do distributed logging to an RDBMS & analyze data from multiple PCs in a network.**



# CRYO-DACS I/O requirements

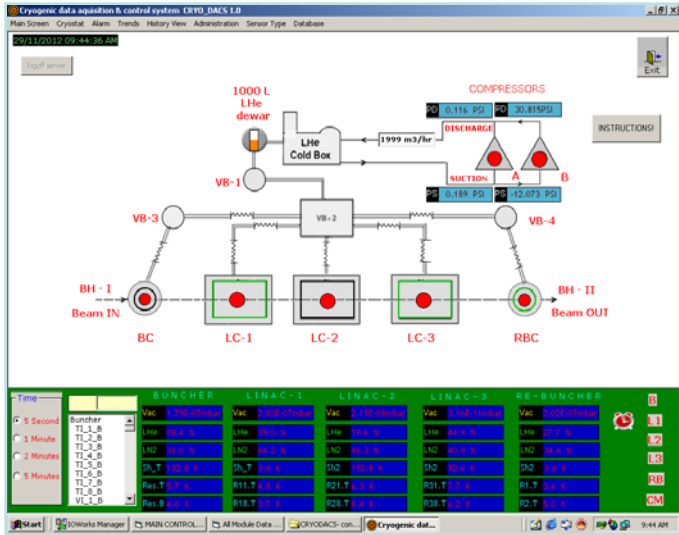
Sensor	Location	Type
Lhe Level	BUNCHER LINAC1 LINAC2 LINAC3 REBUCHER	Sup.Lhe Level Guages
LN2 Level	BUNCHER LINAC1 LINAC2 LINAC3 REBUCHER	Capacitive
Cryogenic Temperature	BUNCHER LINAC1 LINAC2 LINAC3 REBUCHER	Silicon diode
pressure sensors	BUNCHER LINAC1 LINAC2 LINAC3 REBUCHER	Peizo resistive
Cryogenic Valves LN2 & Lhe	BUNCHER LINAC1 LINAC2 LINAC3 REBUCHER	digital
Electrical heaters	LINAC	230VAC
T,P,loading,unloading,ON/OFF controls	He Compressors etc.	digital
Vacuum		voltage



# A Cryogenic control room at IUAC continuously operational since 2002



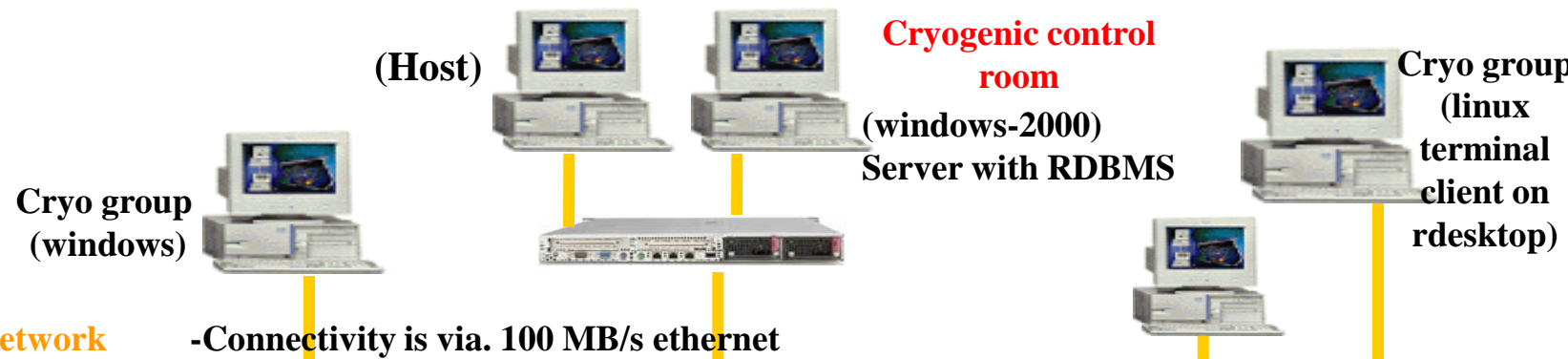
- data acquisition  
- Control console



-CRYODACS main screen



# Cryo-DACS: Distributed Architecture



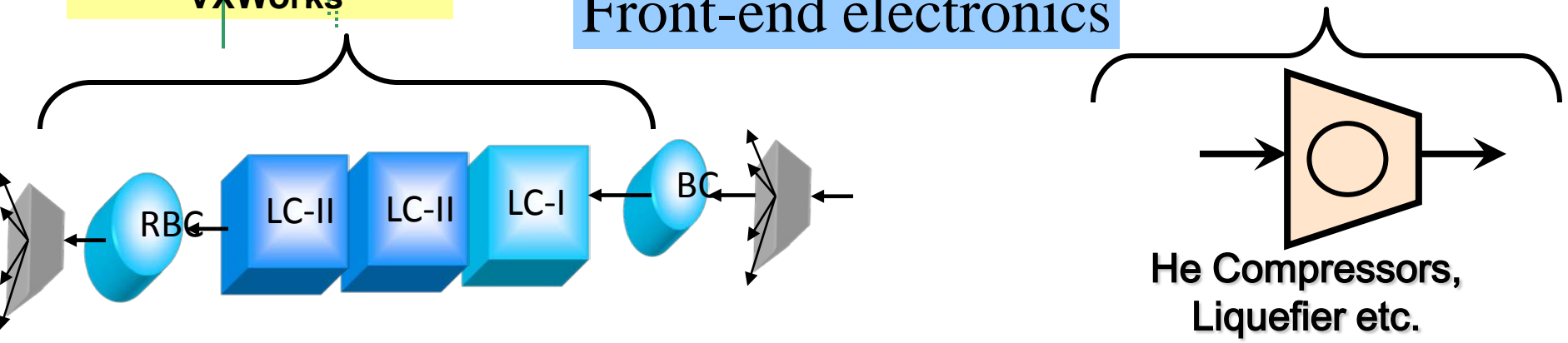
Ports for local distributed control, logging&analysis

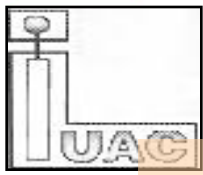
**VME crate #1**  
Target CPU1-embedded  
VXWorks

**(windows)**

**VME crate #2**  
Target CPU2-embedded  
VXWorks

## Front-end electronics

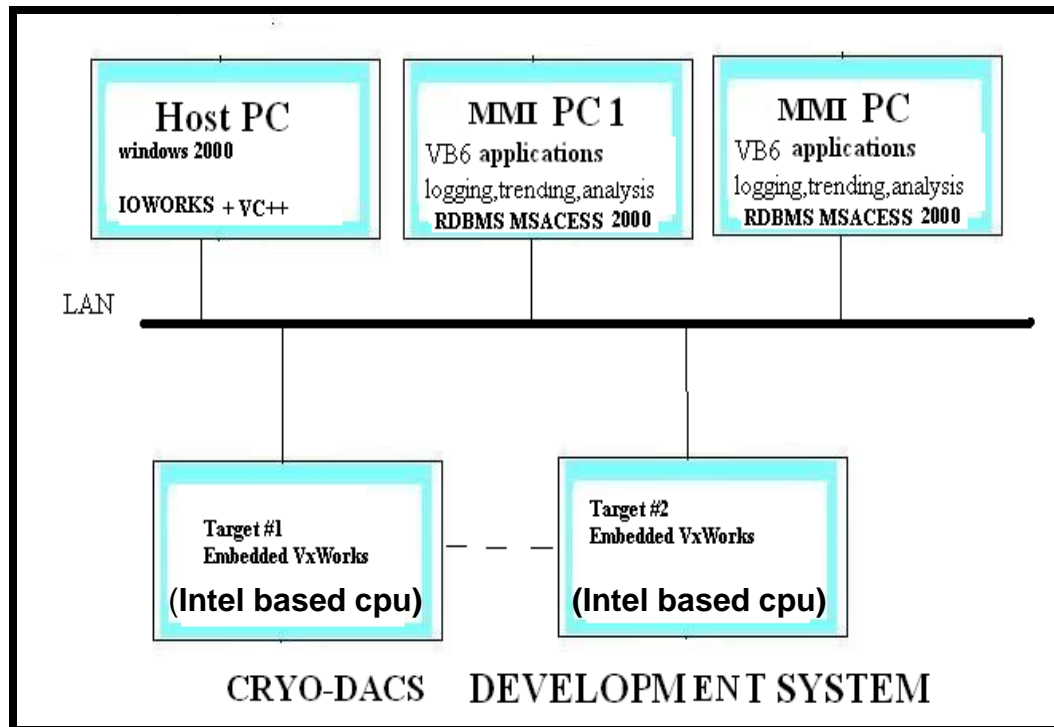


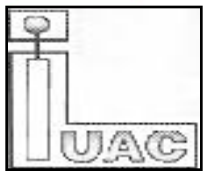


# Control Logic Development

The control logic development for CRYO-DACS using VME hardware without making Fundamental changes to application s/w is made Easier with a novel component suite called IOWORKS.

IOWORKS to Create and maintain industrial PC-based control applications in ladder logic & c++. IOWorks lets PC-based algorithms in multiple modules to communicate with the underlying h/w via s/w component that can access VME Bus through board specific drivers.





# Control Logic Development

## ioworks logic modules

The screenshot shows the IOWorks Manager interface. On the left is a project tree for 'jan28' containing modules like COMPRESSOR, GENERAL, and VME2. The main workspace displays a logic diagram with two 'PART1' blocks. Each block has inputs 'en' and 'eno' and an output 'iStatus'. The diagram is connected to a 'v1112' component. The bottom status bar shows 'Ready' and 'INIT\_BOARDS.inik'.

The screenshot shows the 'Part Edit Dialog - Edit Part' window. The 'Name of Part' is 'NSCLIN'. The 'Number of Input Pins' is 2 and the 'Number of Output Pins' is 2. The 'Class of Part' is 'FUNCTION'. The 'Input Mask for Constants' section is empty. The 'Input Pins' table is as follows:

Type	Pin Name	Type	Pin Name	Tmp Names
ANY_INT	en	ANY_INT	eno	
ANY_REAL	v	ANY_REAL	T	

The 'Section Being Edited' is 'RULE'. The rule text is:

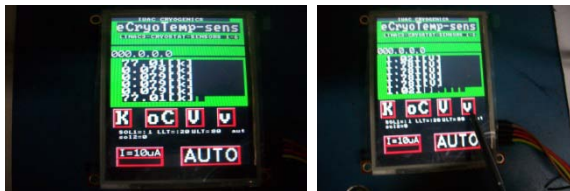
```
Float64 x1, x2, x3, x4, x5, x6, x7, x8, x9, x10;  
if ($In2 > 1.1)  
{  
  if ($In2 < 1.650)
```

The dialog also shows a preview of the logic diagram on the right side.

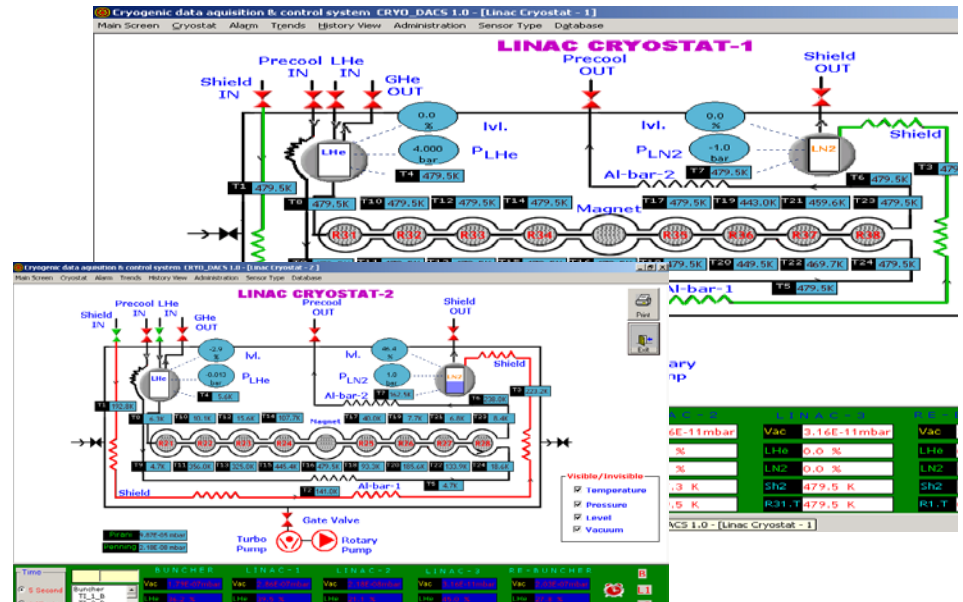


# The Cryogenic Thermometry

- Cryogenic Temperature (Total 128 channels)
- Sensor –DT470 Si.diode Range - 4.2 Kelvin – 300 Kelvin
- Precision +/- 0.1K at 4.2K +/- 1K at 100K +/- 2K at 300K



**Indigenous FPGA based 16 channel Cryogenic Temperature monitors with 16 ch. linearizer (0-10V linear output) – Total 8 nos (128 channel) installed**



# The Valve controls



The screenshot displays a software interface titled "valve controls" with a blue border. It is organized into several panels, each representing a different valve system:

- BUNCHER:** Contains two sub-panels. The first is for the "LN2 VLAVE" (set to "AUTO") with current level settings of 20% (llt) and 80% (ult), and a status indicator for "BUNCHER LN2 VALVE" (red). The second is for the "LHE VALVE" (set to "MAN") with a status indicator for "BUNCHER LHE VALVE" (red). Both include level gauges showing 40% LN2 and 0% LHe.
- LINAC1:** Contains two sub-panels. The first is for the "LN2 VLAVE" (set to "MAN") with a status indicator for "LINAC1 LN2 VALVE" (red). The second is for the "LHE VALVE" (set to "MAN") with a status indicator for "LINAC1 LHE VALVE" (red). Both include level gauges showing 0% LN2 and 0% LHe.
- LINAC2:** Contains two sub-panels. The first is for the "LN2 VLAVE" (set to "MAN") with a status indicator for "LINAC2 LN2 VALVE" (red). The second is for the "LHE VALVE" (set to "MAN") with a status indicator for "LINAC2 LHE VALVE" (red). Both include level gauges showing 10% LN2 and 0% LHe.
- LINAC3:** Contains two sub-panels. The first is for the "LN2 VLAVE" (set to "AUTO") with current level settings of 20% (llt) and 80% (ult), and a status indicator for "LINAC3 LN2 VALVE" (green). The second is for the "LHE VALVE" (set to "MAN") with a status indicator for "LINAC3 LHE VALVE" (red). Both include level gauges showing 10% LN2 and 0% LHe.
- REBUNCHER:** Contains two sub-panels. The first is for "LN2 VLAVE1" (set to "MAN") with a status indicator for "REBUNCHER LN2 VALVE1" (red). The second is for "LHE VALVE" (set to "MAN") with a status indicator for "REBUNCHER LHE VALVE" (red). Both include level gauges showing 0% LN2 and 0% LHe.
- REBUNCHER VALVE-2:** Contains one sub-panel for "LN2 VLAVE2" (set to "MAN") with a status indicator for "REBUNCHER LN2 VALVE1" (red). The gauge shows 0% LN2.



# Compressor controls

**Cryogenic data acquisition & control system CRYO\_DACS 1.0 - [Compressor 1]**

Main Screen Cryostat Alarm Trends History View Administration Sensor Type Database

### Helium Compressor - A

**Analog Values**

(PSI)	(PSI)	(PSI)	'C	'C	Turns	kW
Suction Pressure	Discharge Pressure	Oil Pressure	Oil Temperature-1	Oil Temperature-2	Loading Turns	Input Power
0.189	0.116	-1.603	34.1	0.0	10.0	0.1

**Digital Values**

Start 0, Reset 0

Motor ON (Red), Anti-Recycle (Yellow), Motor Overload (Yellow), Hi-Discharge Temperature (Yellow)

---

**Cryogenic data acquisition & control system CRYO\_DACS 1.0 - [Compressor 2]**

Main Screen Cryostat Alarm Trends History View Administration Sensor Type Database

### Helium Compressor - B

**Analog Values**

-15 to 15 (PSI)	-15 to 300 (PSI)	-15 to 300 (PSI)	0 to 120 'C	0 to 120 'C	0 to 100 Turns	0 to 300 kW
Suction Pressure	Discharge Pressure	Oil Pressure	Oil Temperature-1	Oil Temperature-2	Loading Turns	Input Power
-12.073	30.815	30.240	100.0	0.0	0.4	0.0

**Digital Values**

Start 0, Reset 0, Stop 0

Motor ON (Red), Anti-Recycle (Yellow), Load Limiting (Yellow), Loading (Green), Unloading (Yellow), Panel Control Remote/Local (Yellow), Computer Control Enable/Disable (Green), Motor Overload (Yellow), Hi-Discharge Temperature (Red), Hi-Oil Temperature (Yellow), Hi-Discharge Low Suc. (Yellow), Low Water Pres. (Red), Low-Oil Pressure (Red), Oil-Pres. Timer-Bypass (Yellow)

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**Time**

5 Second, 1 Minute, 2 Minutes, 5 Minutes

Buncher	Vac 1.78E-07
TI_1_B	LHe 39.0 %
TI_2_B	LN2 36.0 %
TI_3_B	Sh_T 133.4 K
TI_4_B	Res.T 5.6 K
TI_5_B	Res.B 4.0 K
TI_6_B	
TI_7_B	
TI_8_B	
VI_1_B	

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Time	BUNCHER	LINAC-1	LINAC-2	LINAC-3	RE-BUNCHER	
5 Second	Vac 1.79E-07mbar	Vac 5.81E-07mbar	Vac 7.19E-06mbar	Vac 3.16E-11mbar	Vac 5.03E-07mbar	B
1 Minute	LHe 38.7 %	LHe 38.9 %	LHe 19.0 %	LHe 44.8 %	LHe 38.0 %	L1
2 Minutes	LN2 36.0 %	LN2 64.1 %	LN2 46.1 %	LN2 40.6 %	LN2 34.4 %	L2
5 Minutes	Sh_T 133.4 K	Sh_T 3.6 K	Sh2 192.4 K	Sh2 92.8 K	Sh2 3.8 K	L3
	Res.T 3.8 K	R11.T 4.8 K	R21.T 6.4 K	R31.T 7.1 K	R1.T 3.6 K	RB
	Res.B 4.0 K	R18.T 3.7 K	R28.T 6.4 K	R38.T 6.1 K	R2.T 5.0 K	CM

Start IOWorks Manager MAIN CONTROL...

9:46 AM



# Distributed data logging & alarm management

**Microsoft Access** | cryodacs : Database

**Cryogenic data aquisition & control system CRYO\_DACS 1.0 - [Alarm Enable/Disable Property Page.....]**

File Edit View Insert Format Records Tools Window Help

Main Screen Cryostat Alarm Trends History View Administration Sensor Type Database

Alarm Enable / Disable

Enable Alarm  Disable Alarm

Set  
Exit

Temperature Tags

TI\_1\_L1  TI\_9\_L1  TI\_17\_L1  
 TI\_2\_L1  TI\_10\_L1  TI\_18\_L1  
 TI\_3\_L1  TI\_11\_L1  TI\_19\_L1  
 TI\_4\_L1  TI\_12\_L1  TI\_20\_L1  
 TI\_5\_L1  TI\_13\_L1  TI\_21\_L1  
 TI\_6\_L1  TI\_14\_L1  TI\_22\_L1  
 TI\_7\_L1  TI\_15\_L1  TI\_23\_L1  
 TI\_8\_L1  TI\_16\_L1  TI\_24\_L1

Vacuum Tag  
 VI\_2\_L1

Pressure  
 PI\_1\_L1  
 PI\_2\_L1

Level  
 LI\_1\_L1  
 LI\_2\_L1

All

The data base

Time  
 5 Second  
 1 Minute  
 2 Minutes  
 5 Minutes

SRRC	TAGNO	DESCRIPTION	EVALUE	TYPE	EGUHI	EGULOW	EGUUNIT	HWDEV
1	TI_1_B	TEMPERATURE FOR LN2 VESSEL	457.2946	ANALOG	556	4	KELVIN	3113A
2	TI_2_B	SHIELD TOP TEMPERATURE	461.1414	ANALOG	556	4	KELVIN	3113A
3	TI_3_B	SHIELD BOTTOM TEMPERATURE	463.5894	ANALOG	556	4	KELVIN	3113A
4	TI_4_B	HE VESSEL TOP TEMPERATURE	423.5529	ANALOG	556	4	KELVIN	3113A
5	TI_5_B	HE VESSEL BOTTOM TEMPERATURE	467.9609	ANALOG	556	4	KELVIN	3113A
6	TI_6_B	RESONATOR TOP TEMPERATURE	426.7992	ANALOG	556	4	KELVIN	3113A
7	TI_7_B	RESONATOR BOTTOM TEMPERATURE	428.3504	ANALOG	556	4	KELVIN	3113A
8	TI_8_B	RESONATOR PICKUP	430.0257	ANALOG	556	4	KELVIN	3113A
13	VI_1_B	BUNCHER PIRANI VACUUM	3.162E-06	ANALOG	0	0.001	mb	3113A
14	VI_2_D	BUNCHER PENNING VACUUM	3.162E-11	ANALOG	0.001	1E-09	mb	3113A
16	LI_1_B	BUNCHER LHE LEVEL	0	ANALOG	0	43	%	3113A
18	LI_2_B	BUNCHER LN2 LEVEL	0	ANALOG	0	78	%	3113A
20	PI_1_B	BUNCHER LHE PRESSURE	-0.002198	ANALOG	1	-1	BAR	3113A
22	PI_2_B	BUNCHER LN2 PRESSURE	0	ANALOG	4	0	BAR	SPARE
24	DI_1_B	TURBO BUNCHER STATUS	0	ON-OFF	0	0		2536
25	DI_2_B	BUNCHER ROTARY STATUS	0	ON-OFF	0	1		2536
26	DI_3_B	BUNCHER GATE VALVE STATES	0	ON-OFF	0	0		2536
27	DI_4_B	BUNCHER LN2 CONTROL VALVE STATUS	0	ON-OFF	0	1		2536
28	DI_5_B	BUNCHER LHE CONTROL VALVE STATUS	0	ON-OFF	0	1		2536
36	DO_1_B	LN2 CONTROL VALVE O/P	0	DIGITAL OUTPUT	0	0		2536
37	DO_2_D	LHE CONTROL VALVE O/P	0	DIGITAL OUTPUT	0	0		2536

Start | IOWorks Manager | MAIN CONTROL CON... | All Module Data Logg... | CRYODACS-control | Cryogenic data aq... | 9:47 AM

Start | IOWorks Manager | MAIN CONTROL CON... | All Module Data Logg... | CRYODACS-control | Cryogenic data aq... | 11:33 PM



# Distributed data logging & alarm management

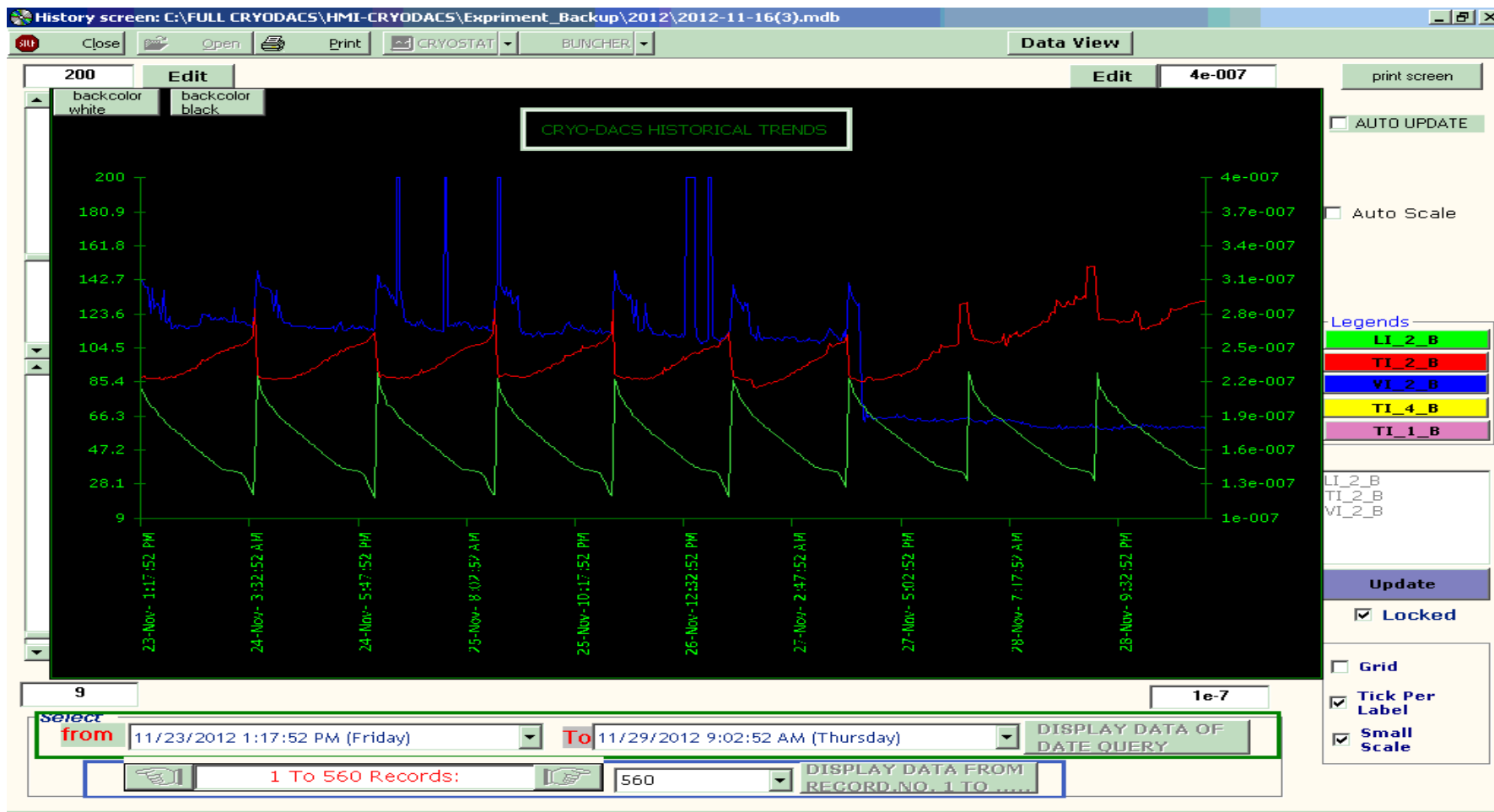
The screenshot displays a Windows XP desktop environment. The taskbar at the bottom shows the Start button, several application icons, and the system tray with the time 11:37 PM. The active window is a Microsoft Access database named '2002'. The window title bar reads '2002' and the menu bar includes 'File', 'Edit', 'View', 'Insert', 'Format', 'Records', 'Tools', 'Window', and 'Help'. The toolbar contains various icons for database operations. The main area shows a table named 'AC1 : Table' with the following columns: dtaccess, DI\_2\_L1, DI\_3\_L1, DI\_5\_L1, DI\_6\_L1, DO\_1\_L1, DO\_2\_L1, LI\_1\_L1, LI\_2\_L1, PI\_1\_L1, PI\_2\_L1, TI\_1\_L1, and TI\_2\_L1. The data rows show a sequence of timestamps from 12:15:23 PM to 12:15:52 PM, with corresponding values for each column. The values for DI and DO columns are mostly 0, while LI, PI, and TI columns contain values like 0.02442002, 0, and -1. The TI columns contain the value 545.9463. A small paperclip icon is visible in the bottom right corner of the window.

dtaccess	DI_2_L1	DI_3_L1	DI_5_L1	DI_6_L1	DO_1_L1	DO_2_L1	LI_1_L1	LI_2_L1	PI_1_L1	PI_2_L1	TI_1_L1	TI_2_L1
8/1/2003 12:15:23 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:24 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:25 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:26 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:27 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:28 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:29 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:30 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:31 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:32 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:33 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:34 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:35 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:36 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:37 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:38 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:39 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:40 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:41 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:42 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:43 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:44 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:45 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:46 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:47 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:48 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:49 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:50 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:51 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463
12:15:52 PM	0	0	0	0	0	0	0	0.02442002	0	-1	545.9463	545.9463



# Data Trending & analysis of offline&online data

Backend RDBMS tables– Front end GUIs

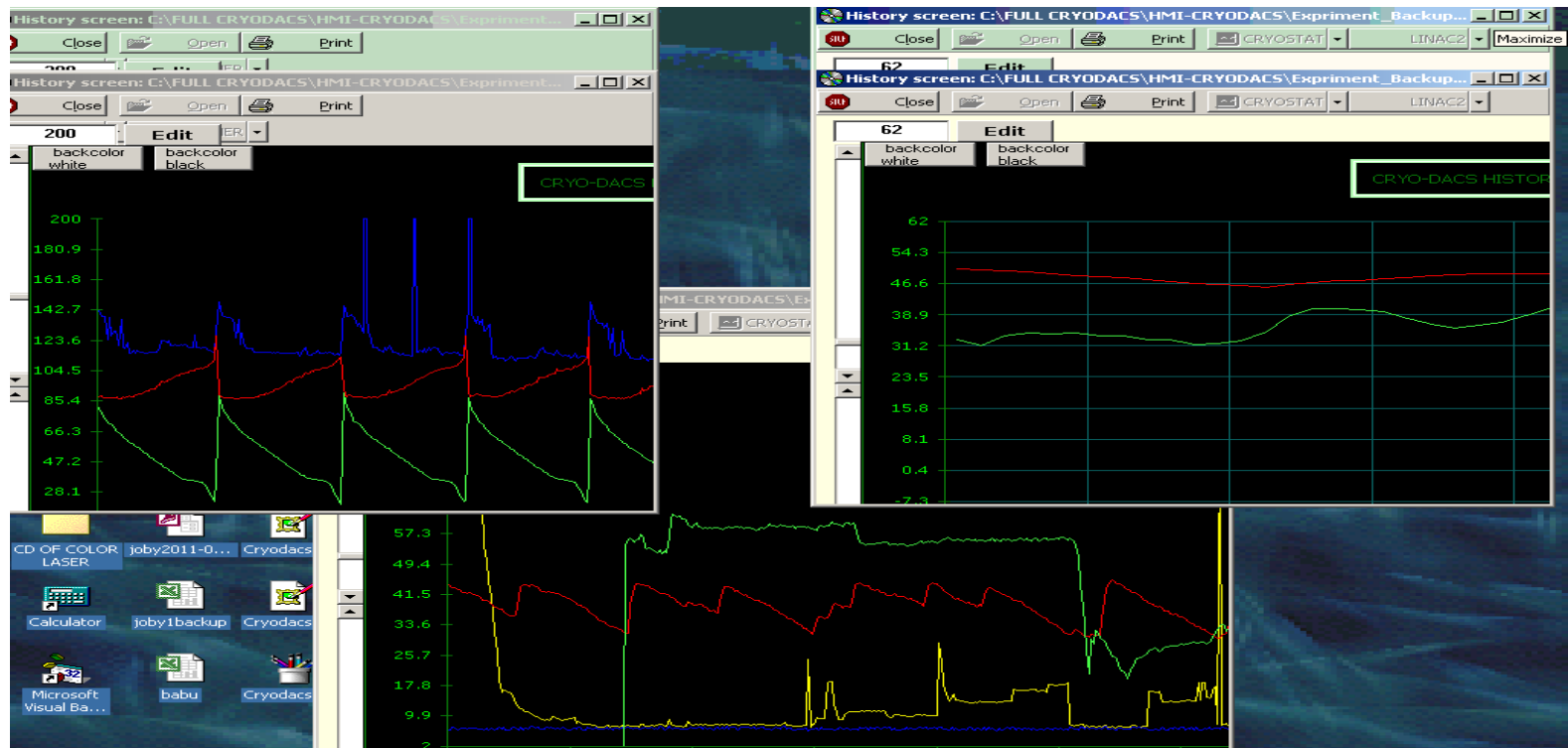




# Data Trending & analysis of offline&online data

## Backend RDBMS tables– Front end GUIs

Multiple such trends can be analyzed simultaneously e.g. yesterday's, today's, or last years etc. etc.



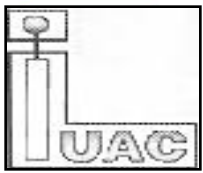


## **Summary**

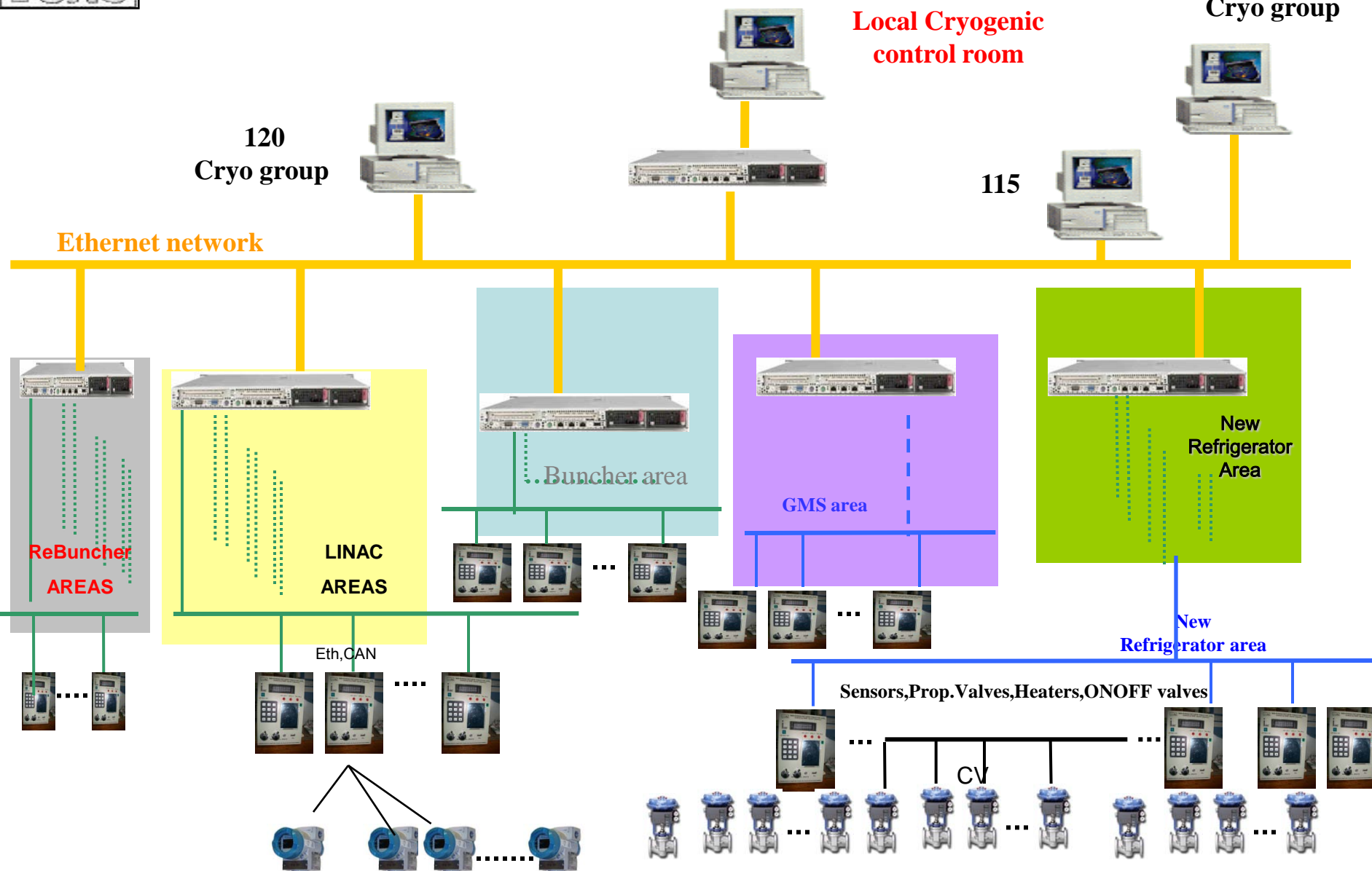
- **The system is continuously operational since 2002 with 95% uptime**
- **Stable & rugged system**
- **Quick development tools**
- **Hot swapping of logic modules at target has been a very useful feature for on-line logic Modifications from Host without affecting the client applications**
- **Remote reboot feature was useful from host as the crates are Sitting in -no access radiation areas**

## **Failures&maintenance Issues**

- **There was only one failure throughout , root cause was dust**
- **Regular cleaning of modules has removed this failure permanently**
- **Most of the tools, OS etc. have become obsolete**



# Future plans-complete automation of cryogenic systems using Indigenously developed embedded device server hardware: Distributed Architecture over Ethernet





## A group of six different types of distributed embedded hardware

### Device servers (websensors) to cater the Cryogenic community needs in cryogenic instrumentation

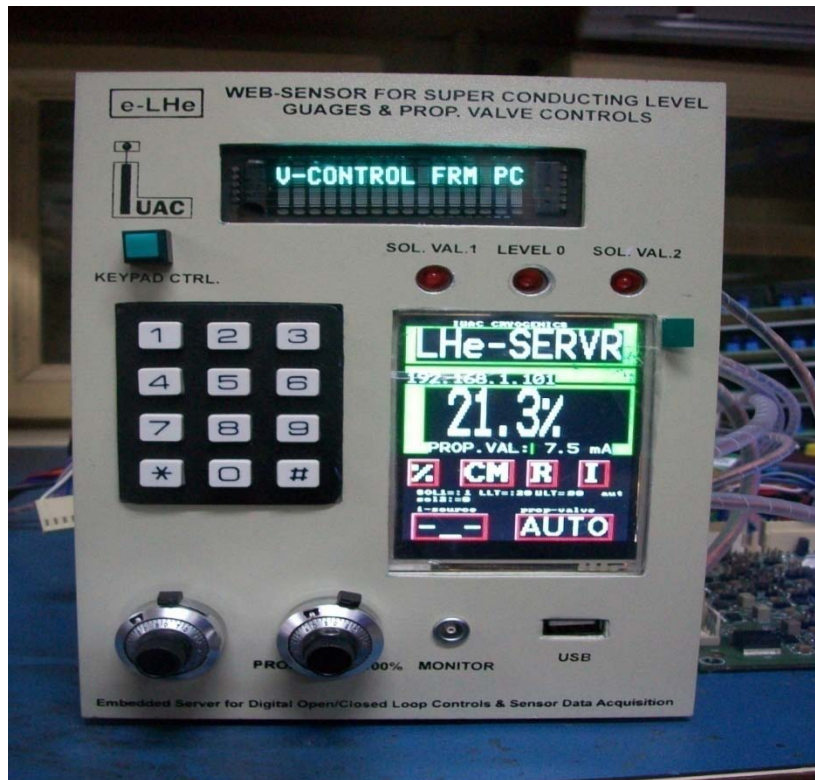
Features :

- 1. Ethernet based WEB compatible embedded hardware instruments (many types) dedicated for a sensor-actuators combination, built in-house
- 2. Each device will run a small embedded IO server (lightweight stack in ARM processors) with unique IP&MAC in a private network
- 3. Sensor transfer function should be embedded to device itself, control system PC should not worry about it.
- 4. Remote device reboot feature over LAN .
- 5. Inter bus communication between device servers via. CAN bus w/o any PC.
- 6. All control loops must run embedded in device level itself, control PC-independent.
- 7. USB ports in each device front-panel for re-programming firmware.
- 8. Multiple clients should be able to control and monitor any where in the globe
- 9. support of heterogeneous OS & languages like labview, c, c++, Qt, python, java, .NET, HTML, javascript etc. For client applications
- 10. Remote embedded variables must be accessible and sharable across LAN via. RPC over HTTP.
- 11. Device status of every action must be displayed in a graphical display in front-panel
- 12. in-house Compact, low cost SMD design, RoHS, reflow soldered boards manufactured
- 13. Predefined Power ON restore initialization conditions are taken care in each device-server



# Embedded development at IUAC

## COTS ARM BASED design



### Cryogenic community requirements

- 1.LHe server :measurements in Boost&pulse modes & prop.valve /actuator controls
- 2.LN2 server: measurements using C-type sensors & prop.valve /actuator controls
3. Cryogenic Temperature sever: 4.2K to 300K measurement&control
4. E-plugs for low&high power ON/OFF controls e.g heaters. Pumps etc.
- 5.Cryogenic Pressure/vacuum server: measurement & associated controls

# Device health monitor & embedded Tags in instruments



**CADS( COMPLETE AUTOMATION OF LINAC DISTRIBUTION SYSTEM )USING INDIGENOUSLY DEVELOPED HARDWARE**

**DEVICE HEALTH MONITORING PAGE Call 9013461534 if any failure**

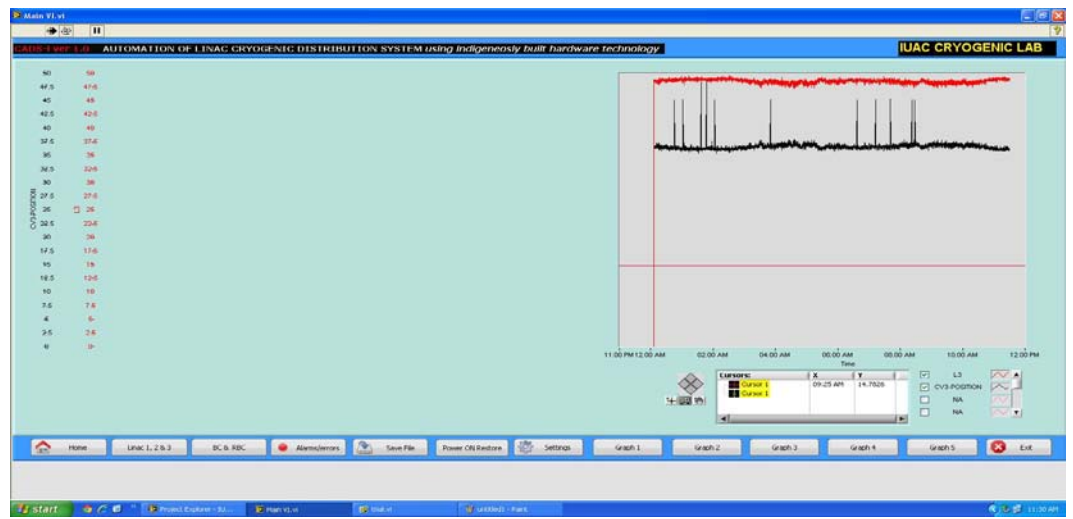
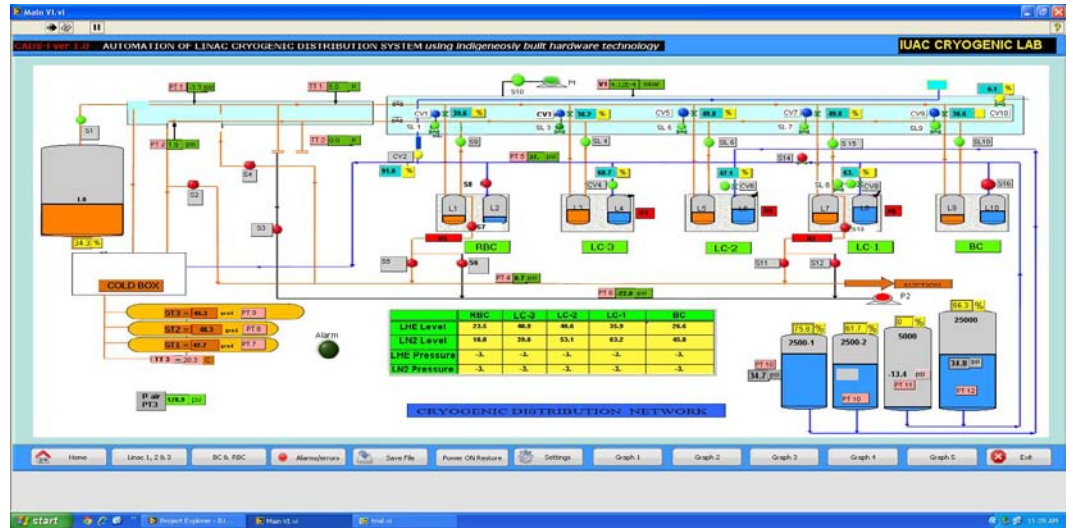
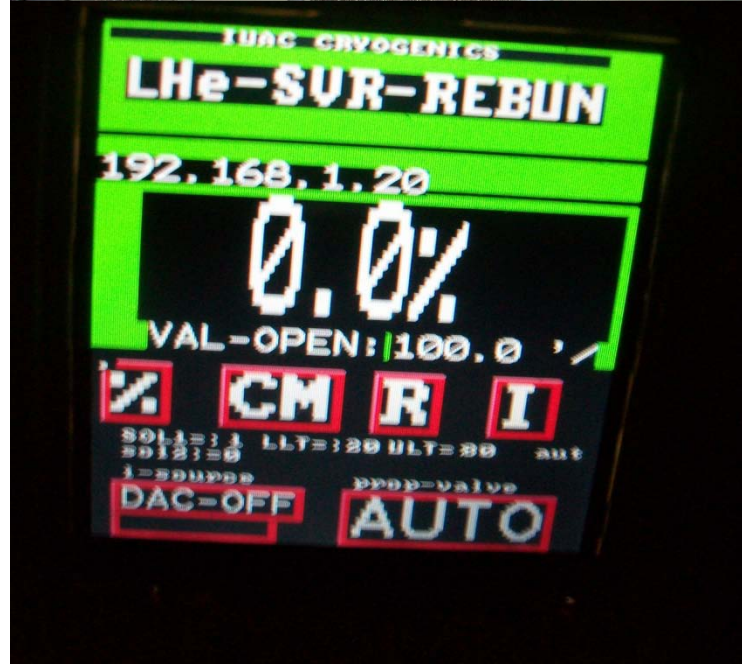
UAC DEVICE IP NUMBER	UAC DEVICE DESCRIPTION & LOCATION
192.168.1.2	GMS MAINBOARD PRESSURE SERVER
192.168.1.3	GMS DAUGHTERBOARD-I PRESSURE SERVER USE p07 TO REBOOT
192.168.1.5	
192.168.1.6	GMS MAINBOARD PRESSURE SERVER
192.168.1.8	GMS DAUGHTERBOARD-I PRESSURE SERVER USE p07 TO REBOOT
192.168.1.9	GMS MAINBOARD OUTSIDE LEVEL SERVER
192.168.1.11	
192.168.1.12	GMS DAUGHTERBOARD-I OUTSIDE LEVEL SERVER USE p07 TO REBOOT
192.168.1.13	GMS MAINBOARD TANK PRESSURE SERVER
192.168.1.14	GMS DAUGHTERBOARD-I TANK PRESSURE SERVER USE p07 TO REBOOT
192.168.1.15	192.168.1.11 BUNCHER MAINBOARD LHe
192.168.1.16	192.168.1.12 BUNCHER DAUGHTERBOARD-I LHe
192.168.1.17	192.168.1.13 BUNCHER DAUGHTERBOARD-II LHe
192.168.1.20	
192.168.1.21	192.168.1.14 BUNCHER MAINBOARD LN2

Tag List.txt - Notepad

TAG_NAME	IP_ADDRESS	COMMAND	MULTIPLIER	RANGE	LIMIT_LO	LIMIT_HI	COMMENT	Type
PT1	192.168.1.32	rpc/pressure1_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	NEW REF
PT2	192.168.1.32	rpc/pressure2_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	NEW REF
PT3	192.168.1.2	rpc/pressure1_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT4	192.168.1.32	rpc/pressure3_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	NEW REF
PT5	192.168.1.62	rpc/pressure1_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	LINAC1 1
PT6	192.168.1.32	rpc/pressure4_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	NEW REF
PT7	192.168.1.2	rpc/pressure2_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT8	192.168.1.2	rpc/pressure3_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT9	192.168.1.2	rpc/pressure4_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT10	192.168.1.8	rpc/pressure1_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT11	192.168.1.8	rpc/pressure3_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
PT12	192.168.1.8	rpc/pressure2_psi/read	1	-14.7 TO +14.7 psi	-10	10	To read pressure	GMS 1
TT1	192.168.1.35	rpc/temperature1_psi/read	1	4.2k TO 350k	10	300	To read temperature	NEW REF
TT2	192.168.1.35	rpc/temperature2_psi/read	1	4.2k TO 350k	10	300	To read temperature	NEW REF
TT3	192.168.1.2	rpc/pressure5_psi/read	1	4.1k TO 350k	20	80	Temperature channel read	GMS 1
V1	192.168.1.91	rpc/pressure1_psi/read	1	1000 mbar - 0 - 5e-4 mbar	0.005	0.009	To read VACUUM	LINAC
L0	192.168.1.32	rpc/pressure5_psi/read	1	0 TO 100%	20	80	To read pressure/level	NEW REF- 1
L1	192.168.1.20	rpc/vdata/read	10	0 TO 100%	20	80	To read he level	RBC 1
L2	192.168.1.23	rpc/vdata/read	10	0 TO 100%	20	80	To read LN2 level	RBC 1
L3	192.168.1.38	rpc/vdata/read	10	0 TO 100%	20	80	To read he level	LINAC 1
L4	192.168.1.41	rpc/vdata/read	10	0 TO 100%	20	80	To read LN2 level	LINAC 1
L5	192.168.1.47	rpc/vdata/read	10	0 TO 100%	20	80	To read he level	LINAC 1
L6	192.168.1.50	rpc/vdata/read	10	0 TO 100%	20	80	To read LN2 level	LINAC 1
L7	192.168.1.56	rpc/vdata/read	10	0 TO 100%	20	80	To read he level	LINAC 1
L8	192.168.1.59	rpc/vdata/read	10	0 TO 100%	20	80	To read LN2 level	LINAC 1
L9	192.168.1.11	rpc/vdata/read	10	0 TO 100%	20	80	To read he level	BUNCHER 1
L10	192.168.1.14	rpc/vdata/read	10	0 TO 100%	20	80	To read LN2 level	BUNCHER 1
LNT-1	192.168.1.5	rpc/pressure1_psi/read	1	0 TO 100%	20	80	To read level	GMS 1
LNT-2	192.168.1.5	rpc/pressure2_psi/read	1	0 TO 100%	20	80	To read level	GMS 1
LNT-3	192.168.1.5	rpc/pressure3_psi/read	1	0 TO 100%	20	80	To read level	GMS 1
LNT-4	192.168.1.5	rpc/pressure4_psi/read	1	0 TO 100%	20	80	To read level	GMS 1
CV1-POSITION	192.168.1.20	rpc/ldata/read	100	0 TO 100%	20	80	To read the current valve position	
CV2-POSITION	192.168.1.23	rpc/ldata/read	100	0 TO 100%	20	80	To read the current valve position	



# some test GUIs in Windows LabView & Qt

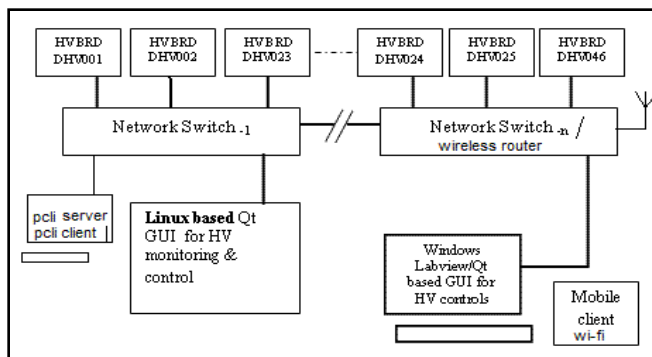




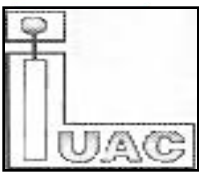
# Ethernet based computer controlled Voltage generation & control for NAND detectors : A low cost solution of H/W & S/W

**High Voltage Power supply controls solution using compact, distributed Ethernet based boards and linux Qt based GUI, pcli etc.**

- A compact, low cost Ethernet based high voltage power supply controller module
- The modules can be distributed over LAN using a network switch for interconnect.
- Each module has its own unique MAC and ip address so that each can be specifically selected at a time for read write operations.
- A network of 50 such controllers have been planned in the first phase of NAND.
- A user friendly GUI has been developed using Qt as the preferred language as Qt offers vast socket programming libraries and compatibility to both linux and windows, as shown in figure
- it is easily expandable to a large number of power supplies, low cost, globally accessible, multiple users in a network can set or read any power supply value simultaneously



An **indigenous** low cost compact HV board with Ethernet



# PCLI pserve at IUAC (pelletron control server/client of IUAC)

➤ PCLI support for NAND HV power supplies

Pcli distributed client GUI  
using shaft encoder interface

Code to set 25 power supply to  
zero volts using python client  
& pserve

```
import pelcon  
p=pelcon.pserve()
```

for k in range(1,25):

```
    s = 'DHV%03d'%k
```

```
    print s, p.set_value(s, 'VC', 'V', 0)
```



Thank You