SNS Vacuum Control and Interface

BNL - April 26, 2000

Johnny Tang

Presentation Overview

- Requirements
  - ***What to Interface***
  - ***What to Control***
  - ***Standardization Considerations***
- SNS Vacuum Control Prototype System
  - ***Vacuum Control System Architecture Design***
  - ***EPICS Support***
- Summery
  - ***Current Status and Future Plans***

Requirements - *what to interface*

SNS Ring Vacuum Devices

	SV	CC	TC	GC	IP	IPC	TMPs	RGAs
HEBT	5	11	6	6	20	10	5	0
RING	8	16	16	8	42	21	8	8
RTBT	4	10	6	5	12	6	2	1
TOTAL	17	37	28	19	74	37	15	9

Requirements - *what to interface*

Vacuum Instrument Controller Interface Survey

Equipment Type	Vendor & Model No.	Interfaces Available				Comments
		Discrete & analog I/O	**RS-232 RS-422 RS-485**	**Device Net**	**IEEE 488**	
Ion Pump Controller	Varian MultiVac	X	X			Probably meets RHIC spec
	Physical Electronics (PHI)	X	X			Probably meets RHIC spec
	MKS / Pfeiffer / Leybold	?	X			RS-485 (per RHIC spec). Could not find on web
	Varian Multi-Gauge	X	X			Probably meets RHIC spec
Vacuum Partial Pressure Analyzer	MKS Type 146 Cluster Gauge	X	X			Probably meets RHIC spec
Vacuum Gauge Controller	Pfeiffer MaxiGauge	X	X			Probably meets RHIC spec. Not much info on web
	Granville-Phillips Series 360 Stabil-Ion	X	X		X	Spec'ed in LANL cost estimate
	Varian	X	X			Probably meets RHIC spec
	Pfeiffer	?	?			RS-485? Not much info on web
Turbo Pump Controller	Leybold	?	?			Couldn't find enough info on web

Requirements - *what to control*

Cold Cathode Gauge (CC)

- High Voltage On/Off (o)
- Set Trip Point Level (o)
- Pressure Reading (I)
- Set-point Level Readback (I)
- Relay Contact Status (I)

Requirements - *what to control*

Thermocouple-type Gauge (TC)

- Pressure Reading (I)
- Set-point Level Readback (I)
- Relay Contact Status (I)

Sector Valve (SV)

- Open/Close valve (O)
- Reset to clear fault (O)
- Valve Open/Close Status (I)

Requirements - *what to control*

Ion Pump (IP)

- Set On/Off (o)
- OnLine/OffLine Status (I)
- HV On/Off Status (I)
- Start/Protect Mode Status (I)
- Two Set-point On/Off Status (I)
- Pump Pressure Readback (I)
- Pump Current Readback (I)
- Pump Voltage Readback (I)

Requirements - *Standardization*

Objectives of Standardization

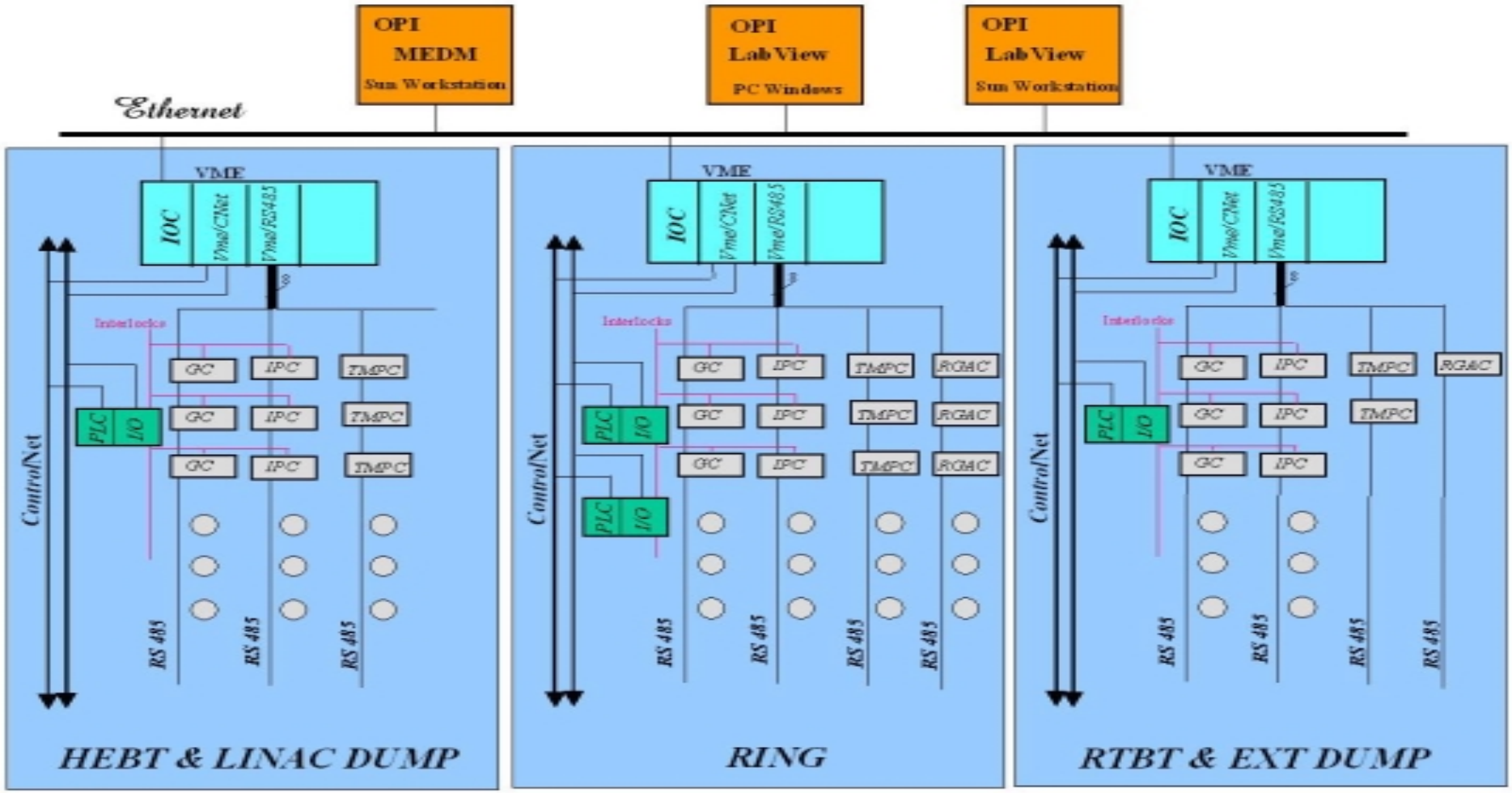
- To share software and hardware resources among the SNS collaborating labs
- To minimize the number of PLC or device controller manufactures and models
- To reduce effort to develop EPICS software drivers
- To reduce operation effort to support multiple PLC or device controller models
- To obtain the best pricing by pooling of orders
- To concentrate efforts to develop best practices

Standardization Effort at BNL

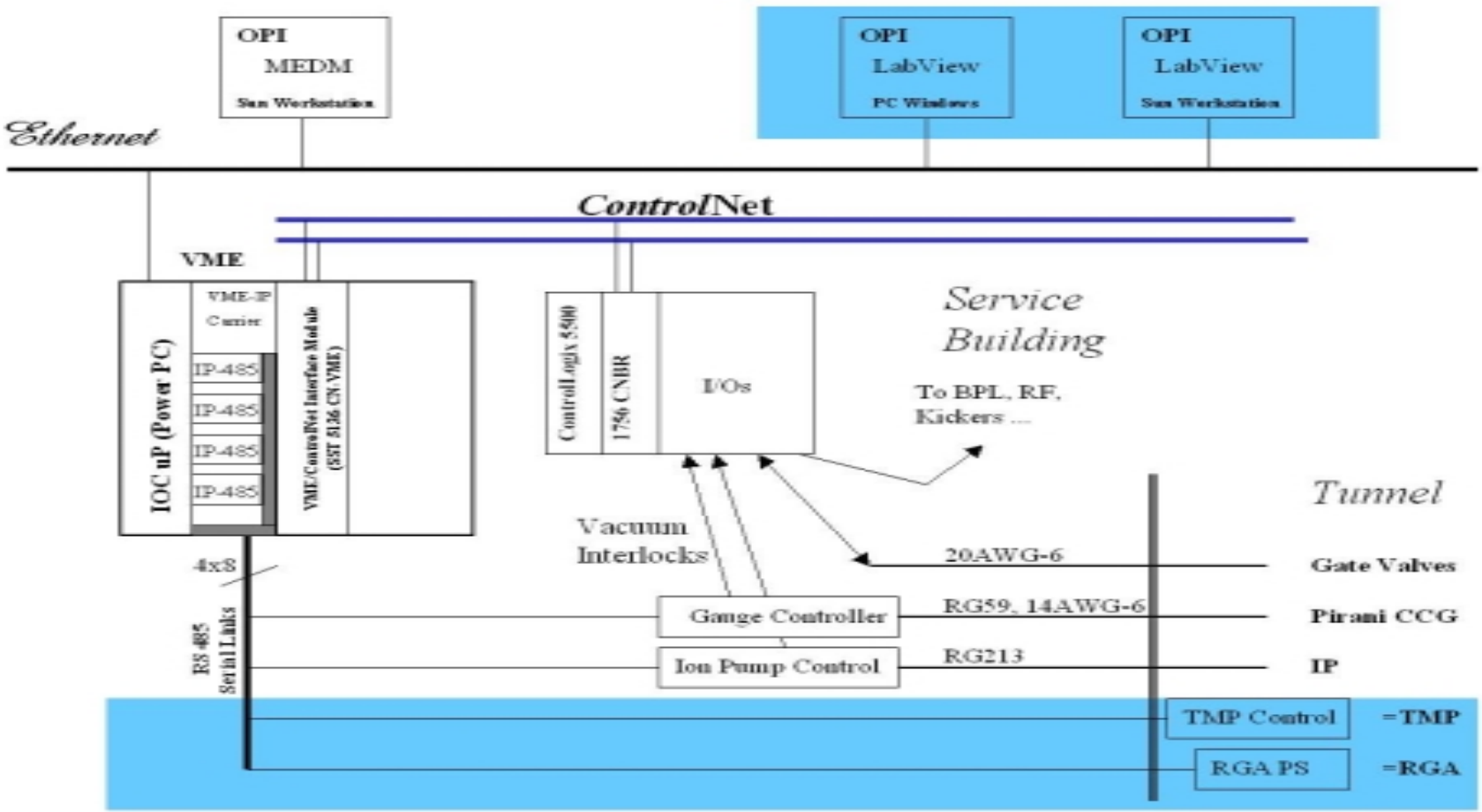
PLC Architecture Standards R/D Conducted at BNL

- Evaluated three Allen-Bradley's PLC models
- Studied the possibility of using Ethernet to link IOC and PLC for real-time control
- Implemented a prototype system of using ControlNet to link IOC and PLC or remote I/O modules, such as Flex I/O or A-B 1771 I/O modules
- Tested IP-DeviceNet module
- Compared VME RS485 link vs PLC RS485 link

SNS Vacuum Control System - *Architecture*



SNS Vacuum Control System - *Architecture*



SNS Vacuum Control System - *ControlNet*

ControlNet is a real-time, deterministic control-layer network providing for high speed transport of both real-time I/O and messaging data on a single physical media link

- Passive Media Components vs. powered switches or hubs

  loss of any one node will not result in a network failure

- Media Redundancy

  ControlNet offers physical media redundancy as a standard option

- Determinism

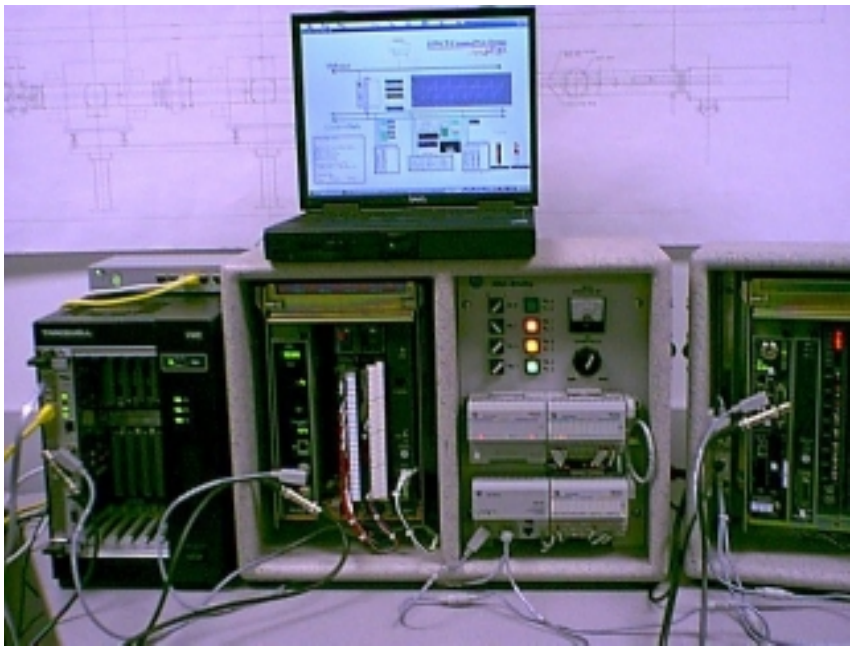
  by having bandwidth that can be scheduled, data on controlNet is guaranteed to arrive at specified intervals regardless of the number of nodes on the network

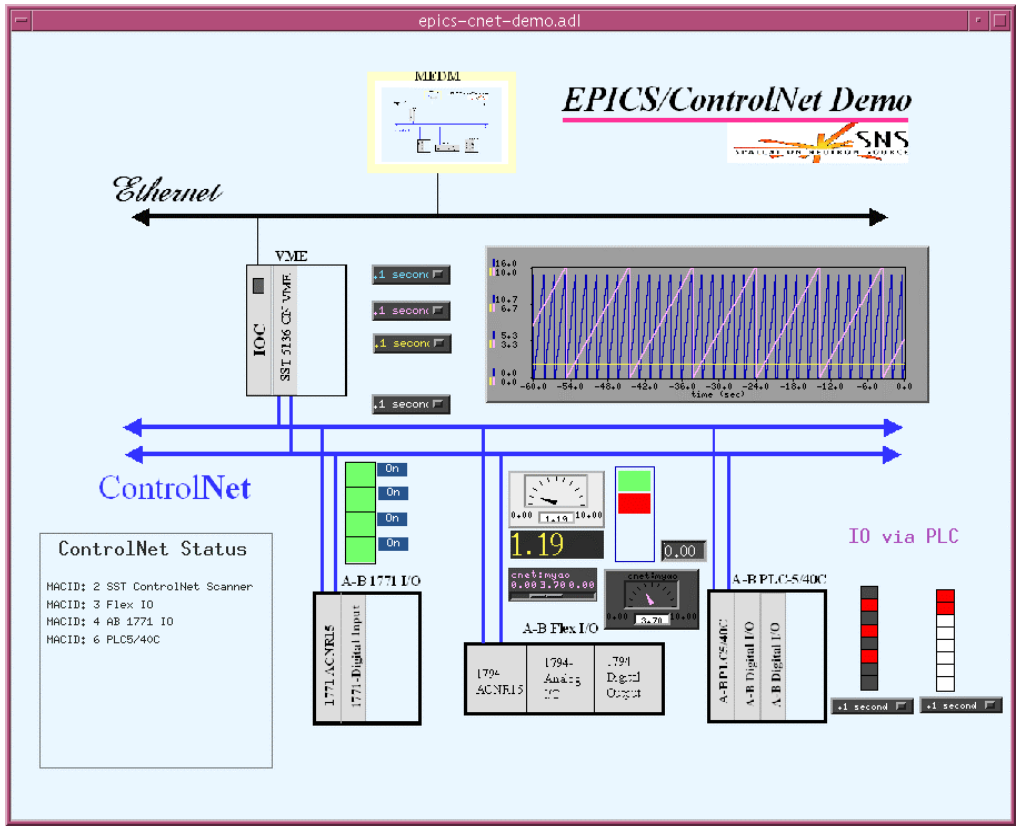
- Open Standard Protocol

  there are 57 companies as ControlNet members to develop ControlNet products for interoperability today

SNS Vacuum Control System - *ControlNet*

EPICS/ControlNet Testing System

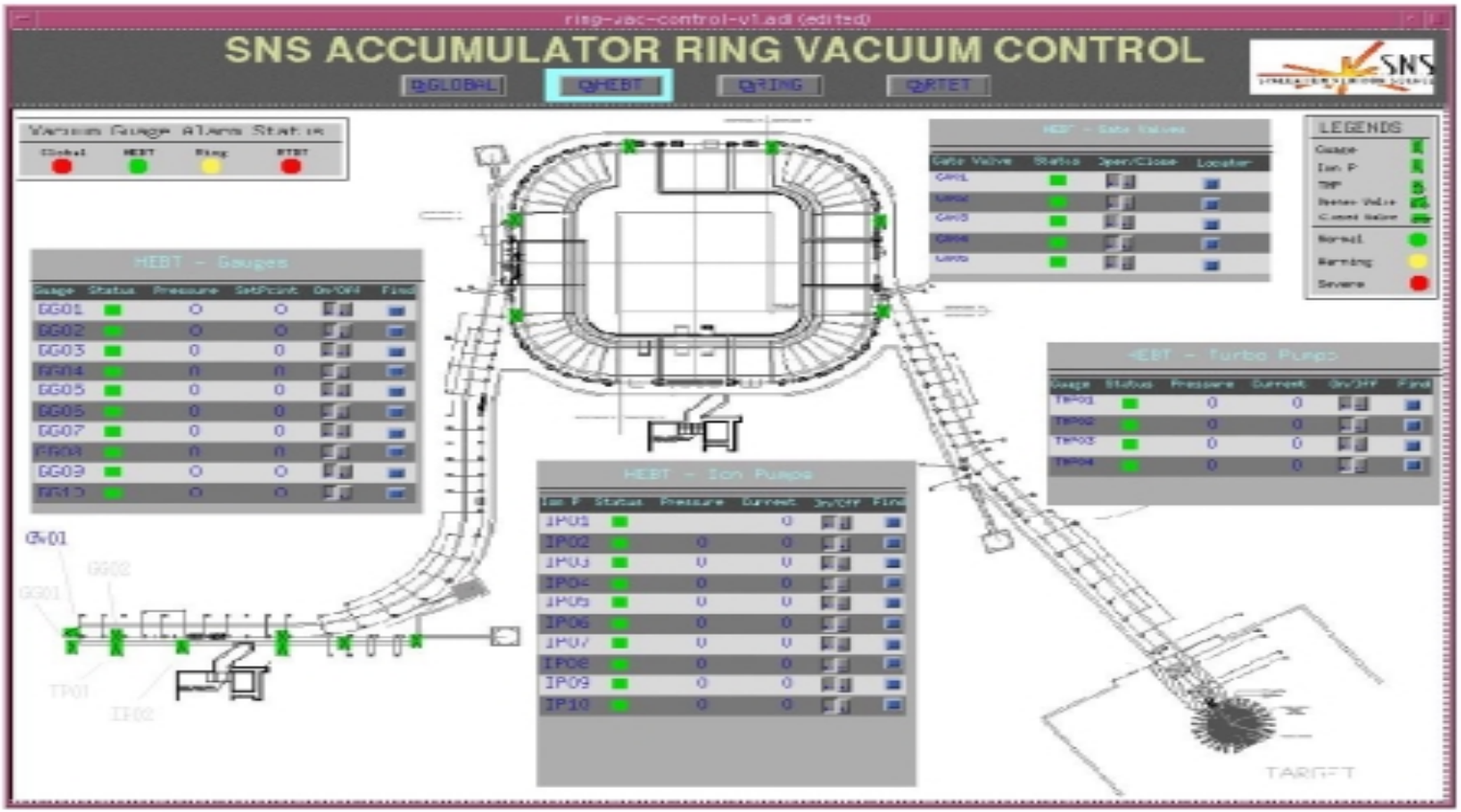




SNS Vacuum Control System - *OPI*

EPICS OPI Prototype for SNS Vacuum Control

Operator Interface for SNS Vacuum Instrumentation Controls



Summery - *Current Status*

What have achieved so far ?

- *SNS Ring Vacuum Control System Architecture proposal has been accepted and is recommended as a Vacuum Control System standard for SNS project by the SNS Global I&C work group*
- *ControlNet EPICS support has been successfully tested*
- *EPICS OPI prototype for SNS Ring Vacuum Control System has been implemented and well accepted by the SNS Ring Vacuum Engineers*
- *A SNS Ring Vacuum Control System test stand is currently under development*

Summery - *Future Plans*

What is next ?

- *The SNS Ring Vacuum Control Prototype System is expected to be completed in three months*
- *Working with the SNS Ring Vacuum group to complete SNS ring vacuum instrumentation control interface specifications and requirements documentation for the SNS vacuum control system by the end of FY00*
- *Start SNS Ring Vacuum Instrumentation Control System software design and implementation from FY01*