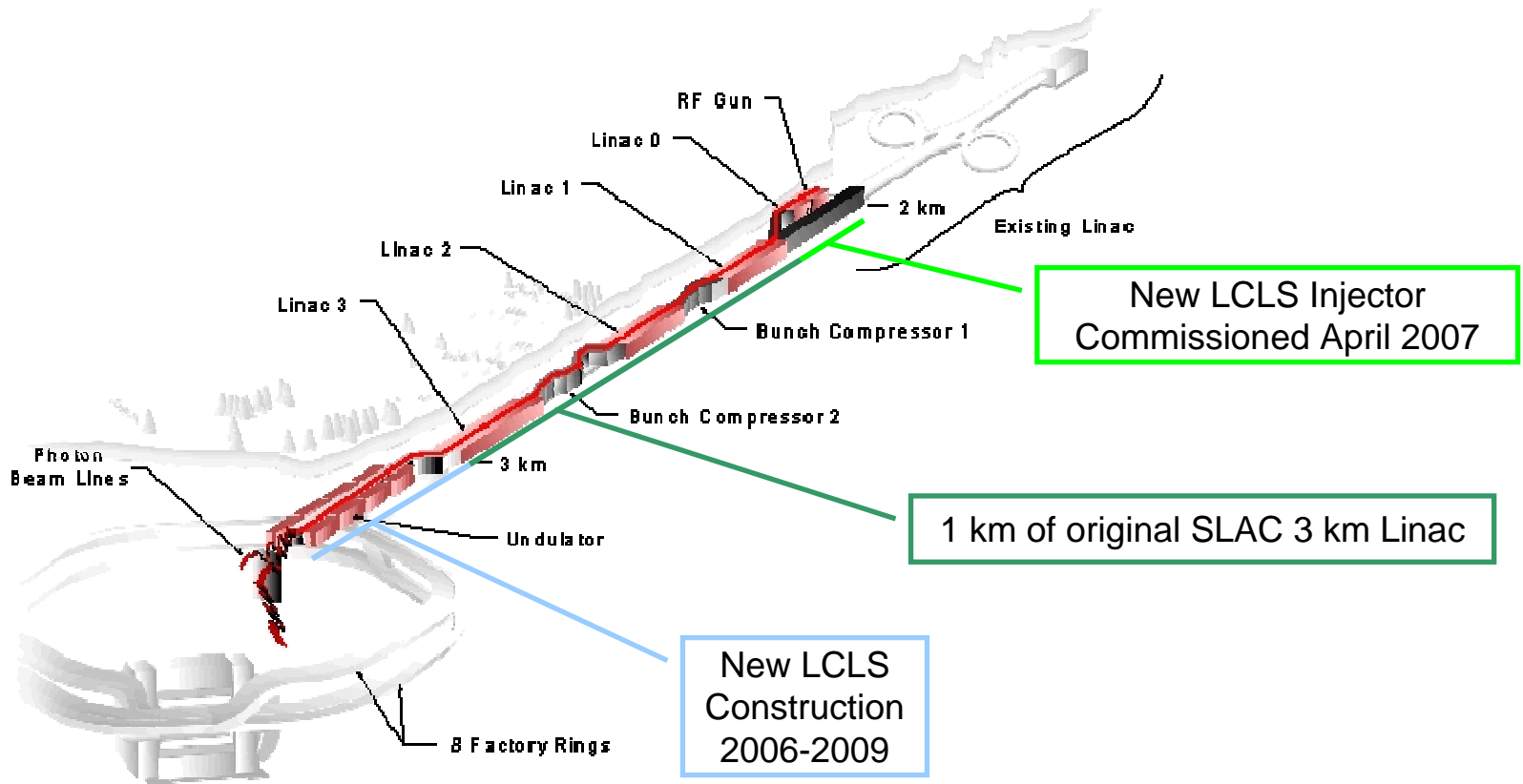


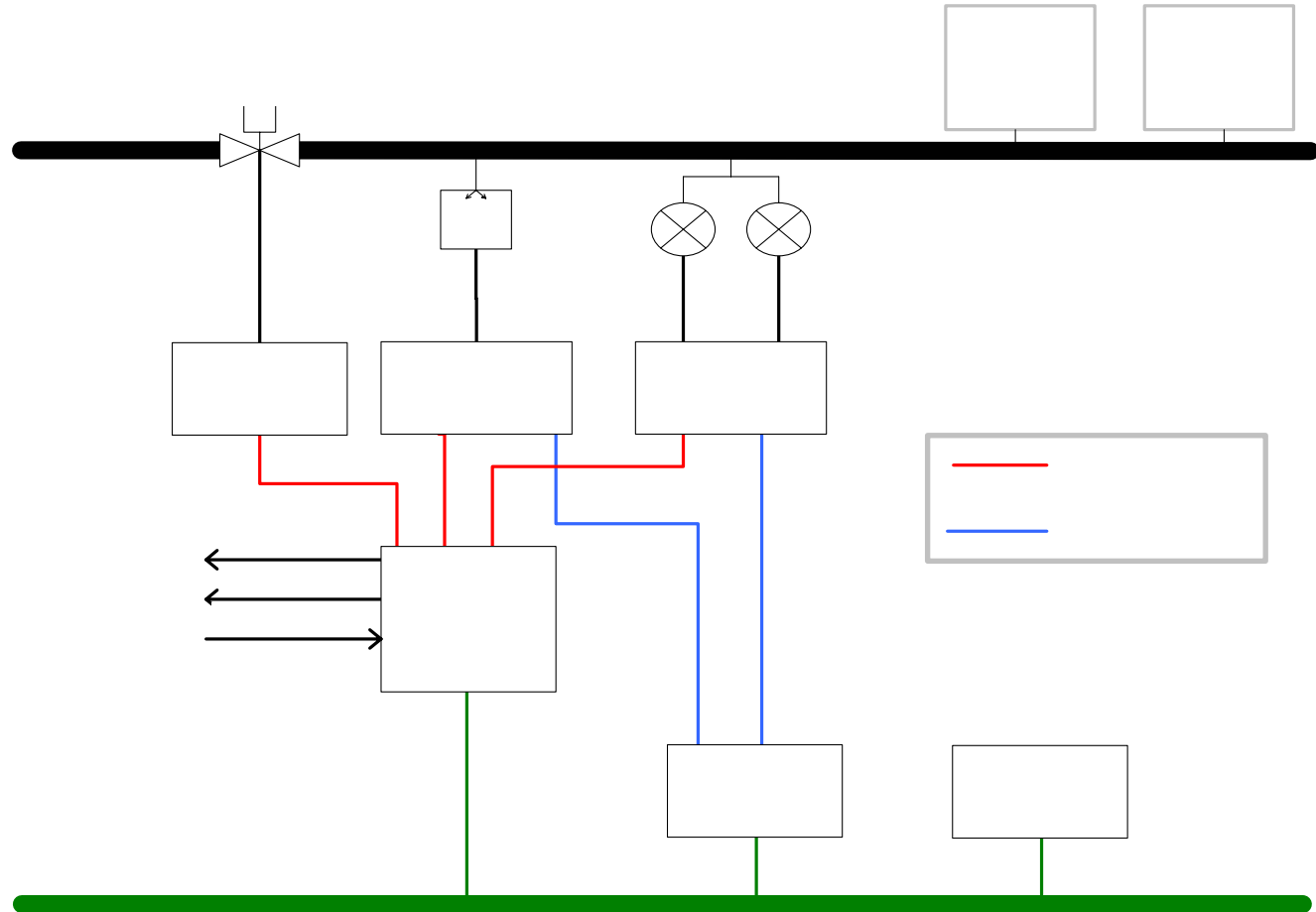
# LCLS Vacuum System

Stephen Schuh  
SLAC Controls Department  
24 April 2007

# Vacuum System Overview



# Vacuum System Block Diagram



# Hardware and Software

<i>Vacuum Device</i>	<i>Controller</i>	<i>EPICS Support</i>
Interlocks and Control System IO	Allen-Bradley ControlLogix Programmable Logic Controller (PLC)	EtherIP (SNS)
MKS Cold cathode and Pirani gauges	MKS 937A gauge controller	StreamDevice (SLS) Protocol (Diamond)
VAT Valves	SLAC Valve Controller and Allen-Bradley ControlLogix PLC	EtherIP (SNS)
Varion ion pumps	Gamma Digital Multiple Pump Controller	StreamDevice (SLS) Protocol (SLAC)

# User Interface

**LCLS Home Screen: Electron Beam Systems**

Help... Home Screen... Exit

Subsystems and Areas

	IN20	LI21	LI22	LI23	LI24	LI25	LI26	LI27	LI28	LI29	LI30	BSY1	LTU1	UND1	DMP1
All															
BPM/Toro/FC/BLen															
Feedback															
Magnet		■	■	■	■										
Profile Monitor															
Wire Scanner															
Collimator/Motion															
Laser															
RF		■	■												
Event															
Network															
Watr/Pwr/Gas/Smok															
Vacuum		■	■	■	■	■									
Temperature		■	■	■											
MPS															
PPS															
BCS															

Applications

- SCP...
- Bunch Length...
- Image Acquisition...
- Matlab Feedback...
- User Dev Displays...

Tools

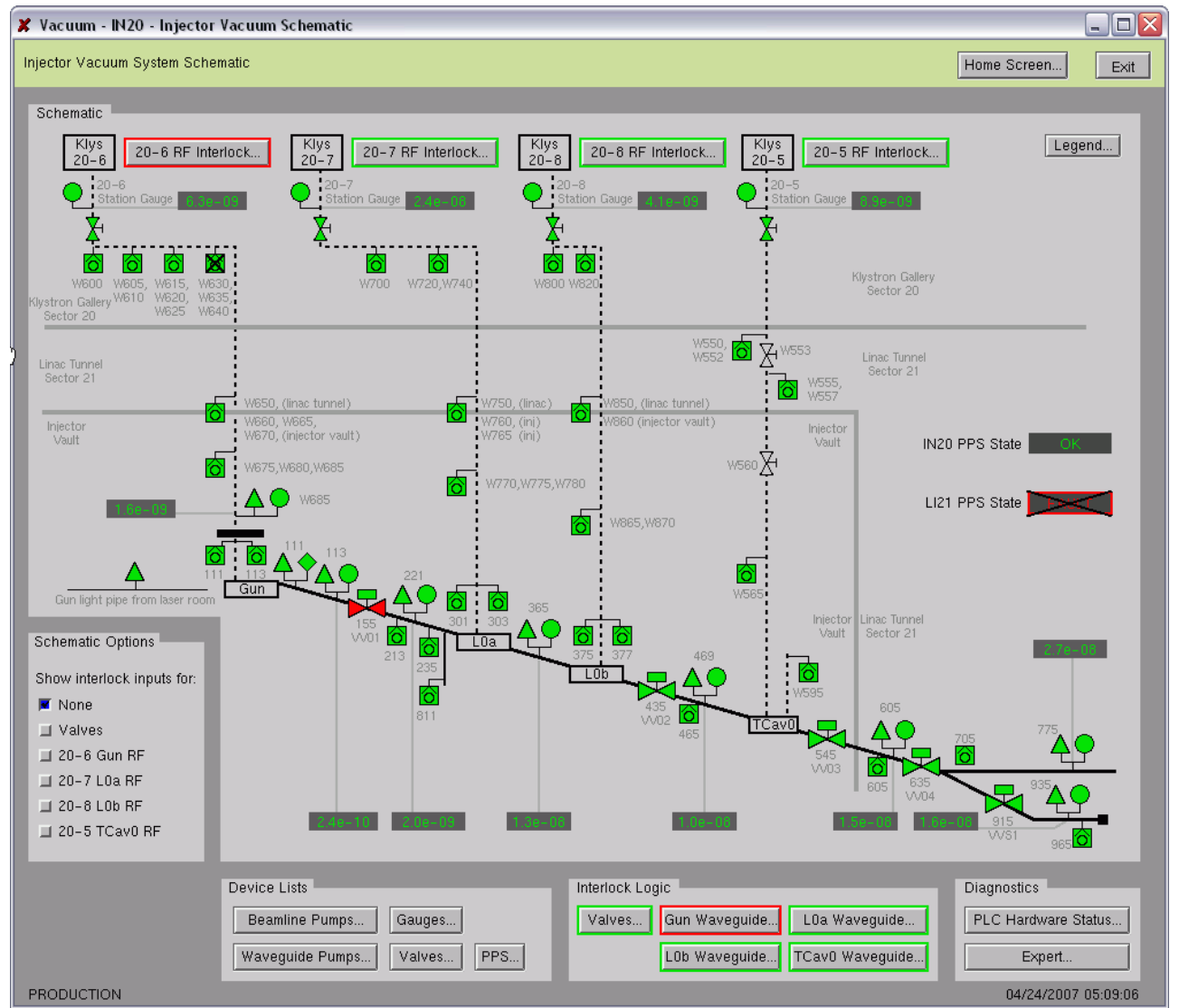
- Archive Viewer...
- CMLog...
- Strip Tool...
- Alarm Handler...
- Firefox...
- Matlab...
- IRMIS...

Map

IN20 LI21 LI22 LI23 LI24 LI25 LI26 LI27 LI28 LI29 LI30 BSY1 LTU1 UND1 DMP1

PRODUCTION 04/24/2007 05:32:02

# User Interface: Injector



# User Interface: Legend

**Vacuum Schematic Legend**

**Beam Line, Waveguide, Manifold**

- Beam Line
- - - Waveguide
- |— Waveguide with Window
- - - Vacuum Manifold

**Pneumatic Gate Valve**

- Valve Open, Interlocks Complete
- Valve Closed, Moving, or Inconsistent Interlocks Complete
- Valve Open, Interlocks Faulted
- Valve Closed, Moving, or Inconsistent Interlocks Faulted

**Manual Gate Valve**

- Valve Open
- Valve Closed, Moving, or Inconsistent
- Valve Without Position Readout

**Cold Cathode Gauge**

- Pressure Set Point OK
- Pressure Set Point Faulted
- No Set Point Information in Control System
- Gauge is Bypassed

**Pirani Gauge**

- Pressure Set Point OK
- Pressure Set Point Faulted
- No Set Point Information in Control System

**Ion Pump**

- High Voltage On, Pressure Set Point OK
- High Voltage On, Pressure Set Point Faulted
- High Voltage Off, Pressure Set Point OK
- High Voltage Off, Pressure Set Point Faulted
- No High Voltage or Pressure Set Point Information in Control System
- Pump is Bypassed

**Hot Filament Gauge**

- Hot Filament Gauge Off
- Hot Filament Gauge On

PRODUCTION 04/24/2007 05:33:41

Beamline Pumps... Gauges... Valves... Gun Waveguide... L0a Waveguide... PLC Hardware Status...  
 Waveguide Pumps... Valves... PPS... L0b Waveguide... TCav0 Waveguide... Expert...

PRODUCTION 04/24/2007 05:09:06

# User Interface: Device Information

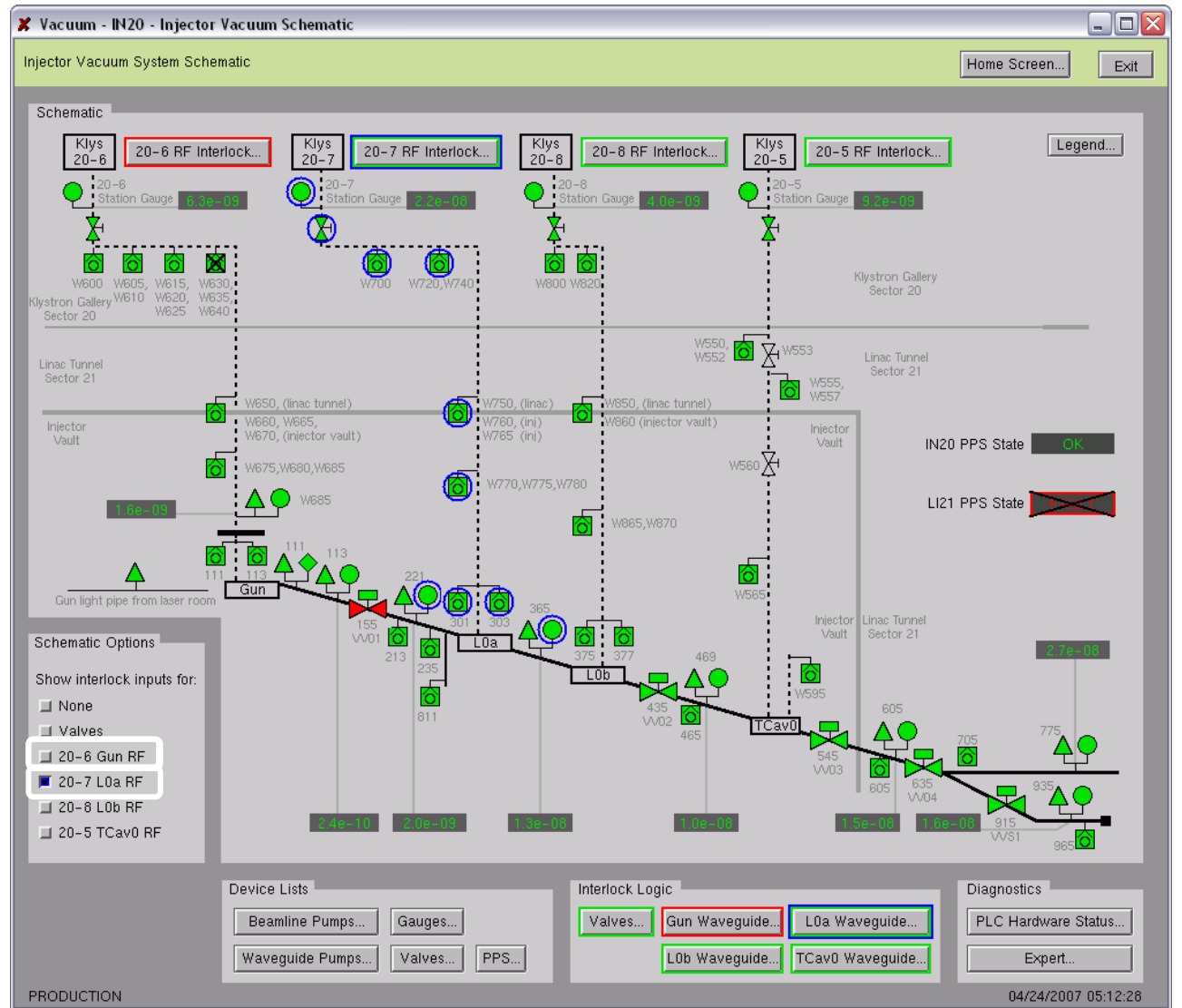
The screenshot displays the 'Vacuum - IN20 - Injector Vacuum Schematic' interface. The main window shows a schematic of the vacuum system with various components like Klystrons, RF Interlocks, and pumps. A detailed window for 'Vacuum Ion Pump - VPIO:IN20:301' is open, showing the following data:

Parameter	Value
Pressure (log scale)	Pressure (log scale) gauge
Pressure (Torr)	1.9e-09
Current (Amp)	1.1e-06
Voltage (V)	5300 V
State	ON
Status	RUNNING
Status Code	NO_ERROR
Ion Pump HV Control	Turn Off / Turn On
Interlock Output: Pressure Status 1	Status: OK
Bypass Status	NOT_BYPASSED
Interlock Output: Pressure Status 2	Status: FAULT
External Interlock	HV Enable: OK

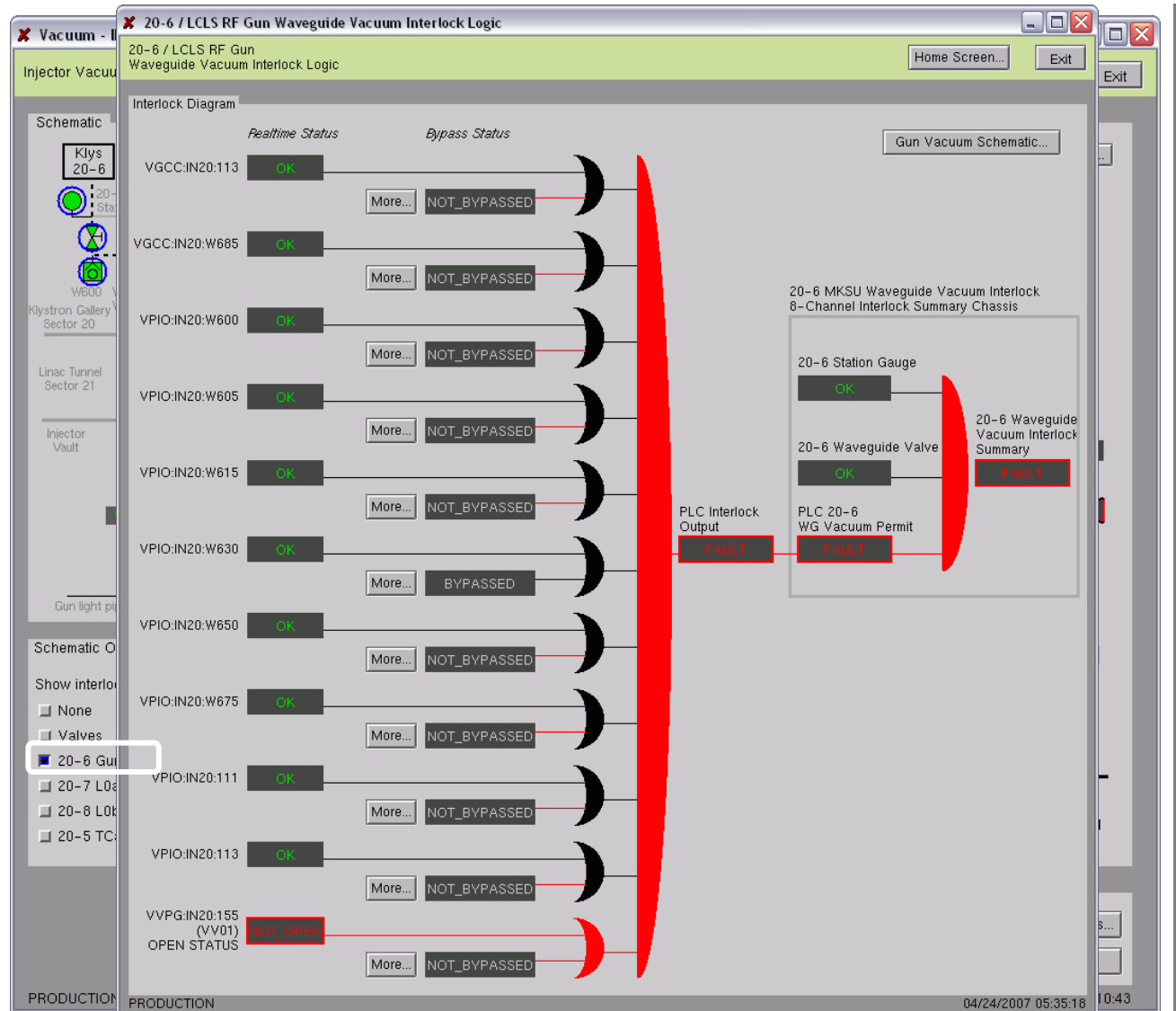
At the bottom of the interface, the status is 'PRODUCTION' with a timestamp of '04/13/2007 19:09:35'. A date and time stamp '04/24/2007 05:09:06' is visible in the bottom right corner.



# User Interface: Dynamic Display



# User Interface: Logic Diagram



# Issues

- Problems anticipated and avoided
  - Don't rely on serial communication for critical status (thanks SNS)
  
- Open issues
  - Bug in firmware on Gamma pump controller  
Found workaround, firmware fix from vendor pending
  - Best way to keep IOC files and PLC logic in sync?
  - PLC status that doesn't depend on PLC being in run mode?