LIA-20 Control System Project
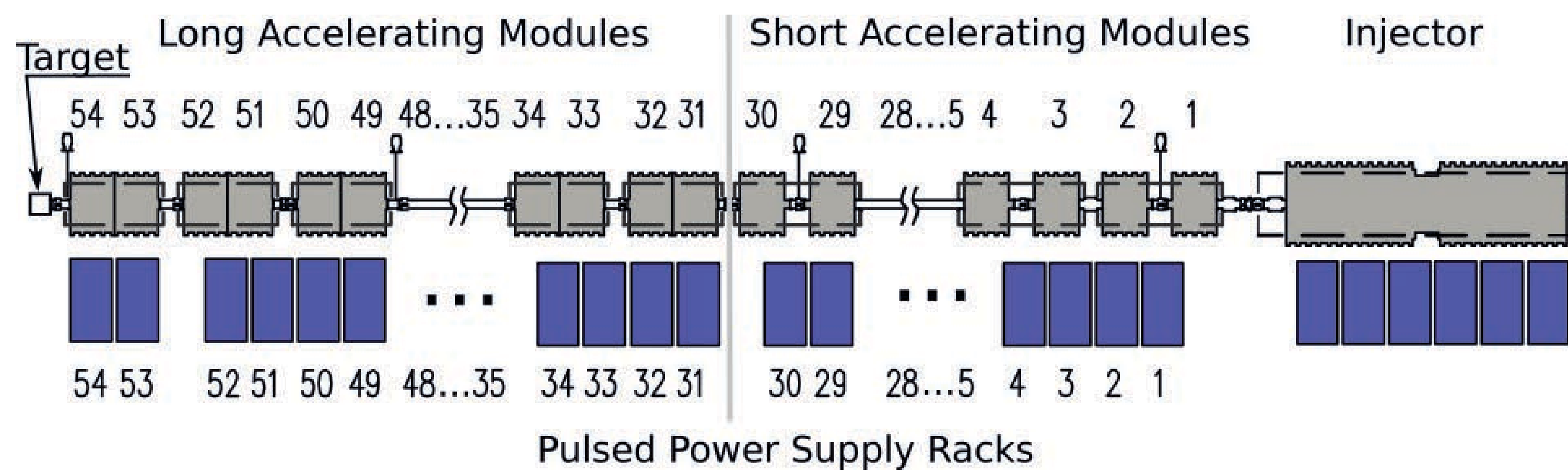
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P.A. Selivanov[1], A.I. Senchenko[1,2], S.S. Serednyakov[1,2], S.R. Singatulin[1], M.Yu. Vasilyev[1]
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Introduction

Linear Induction Accelerator LIA-20 is designed to provide three consecutive electron beams with an energy up to 20 MeV, current up to 2 kA and the beam lateral size after focusing on the target less than 1 mm. It is planned to have one of the pulses divided into 9 angles. The accelerator will be used for the flash X-Ray radiography. Successsfully commissioned LIA-2 accelerator (2 MeV, 2 kA) could be considered a prototype for the injector of the 20 MeV installation. The installation consists of a large number of complex electrophysical devices that require extensive control. First stage of comissioning will be a 5 MeV installation.

Structure of the Linear Accelerator Part

Problems of scale:
480 modulators
Length ~ 120 m
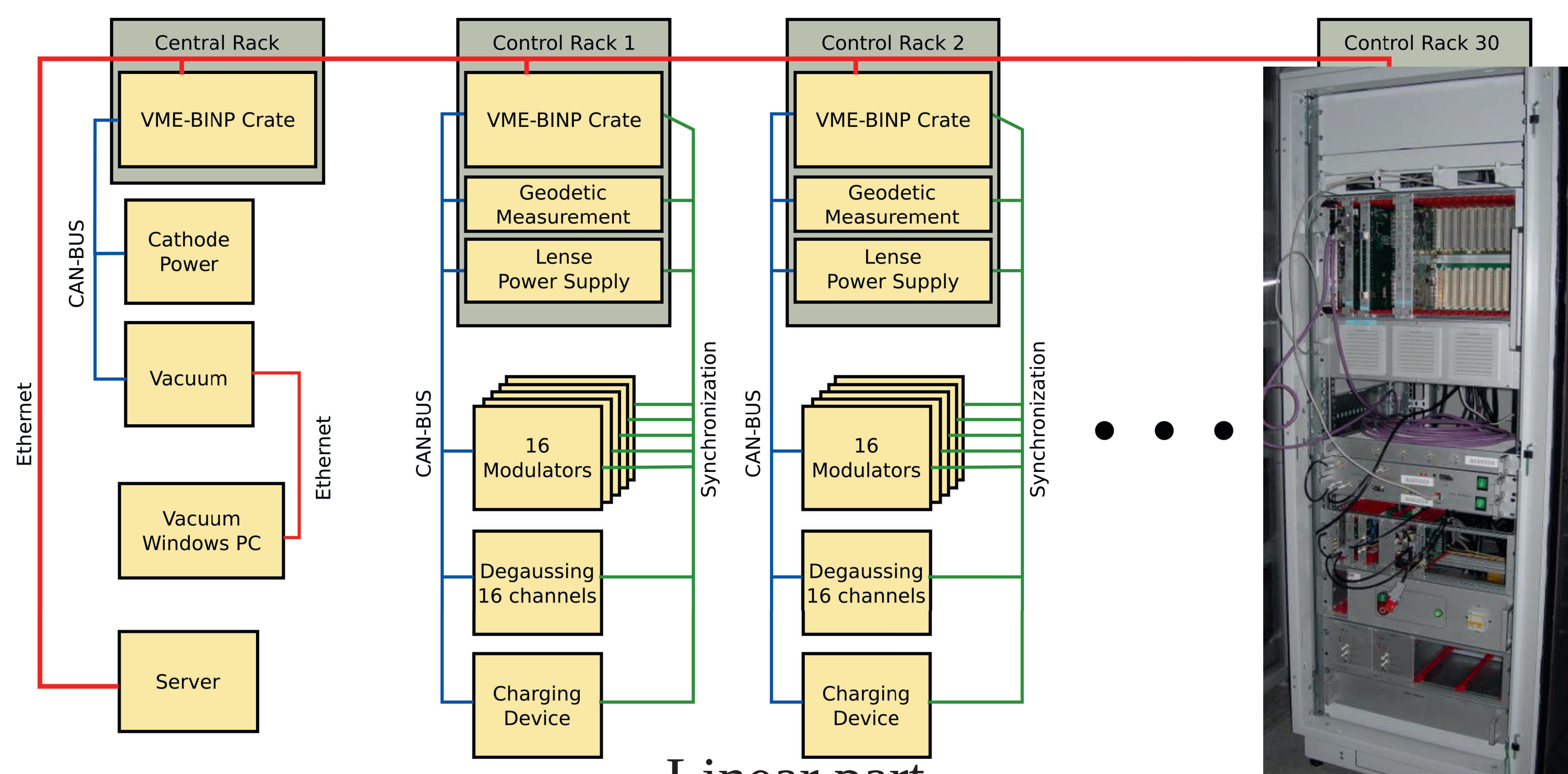> 6000 control channels
Realibility requirements

Components
• Pulsed Power Supply Rack:
 • 8 modulators
 • Demagnetizing device
 • Charging devices
 • Beam position monitors
 • Lense power supplies
 • Cathode power supply
 • AM positioning system
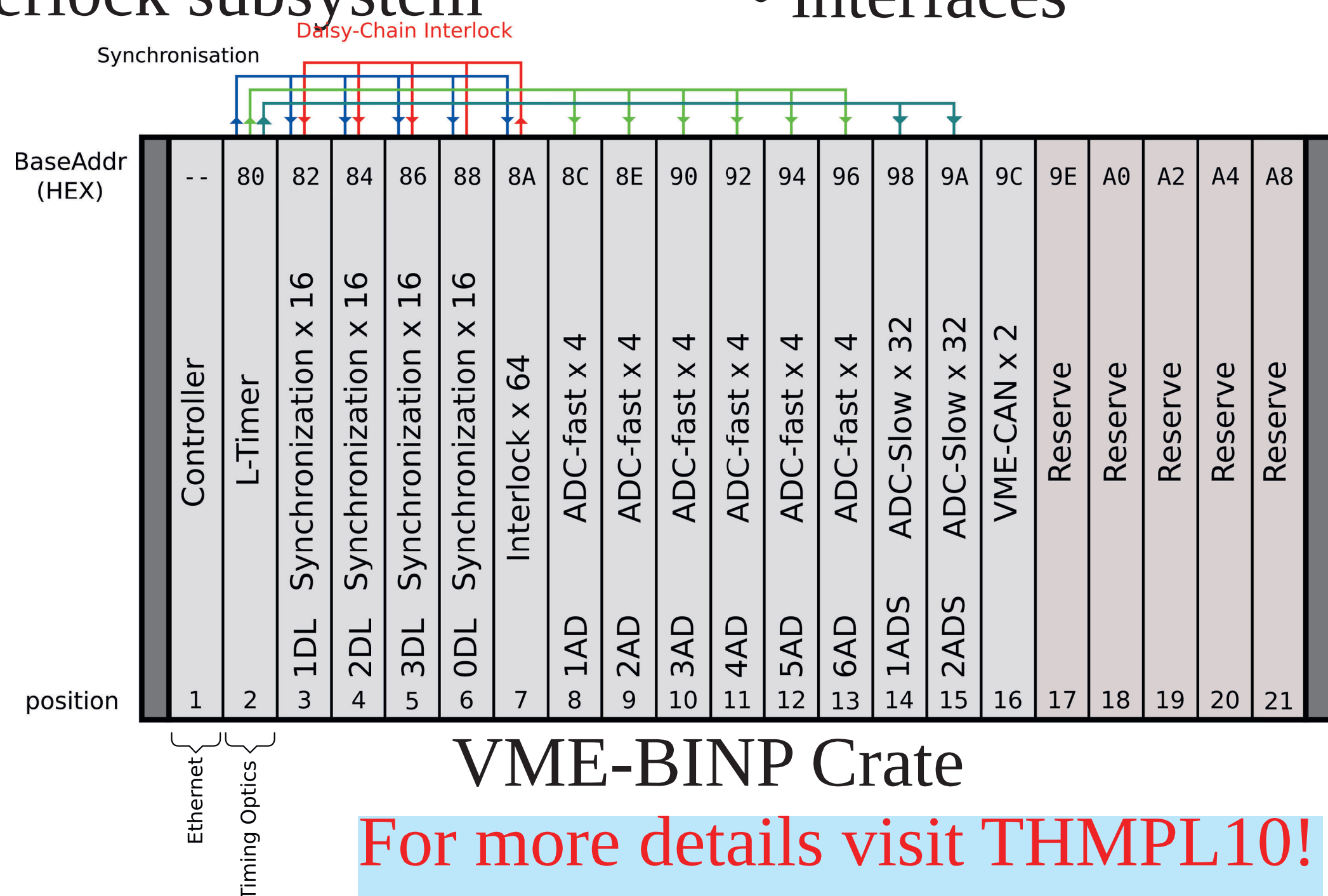 • Vacuum pumps
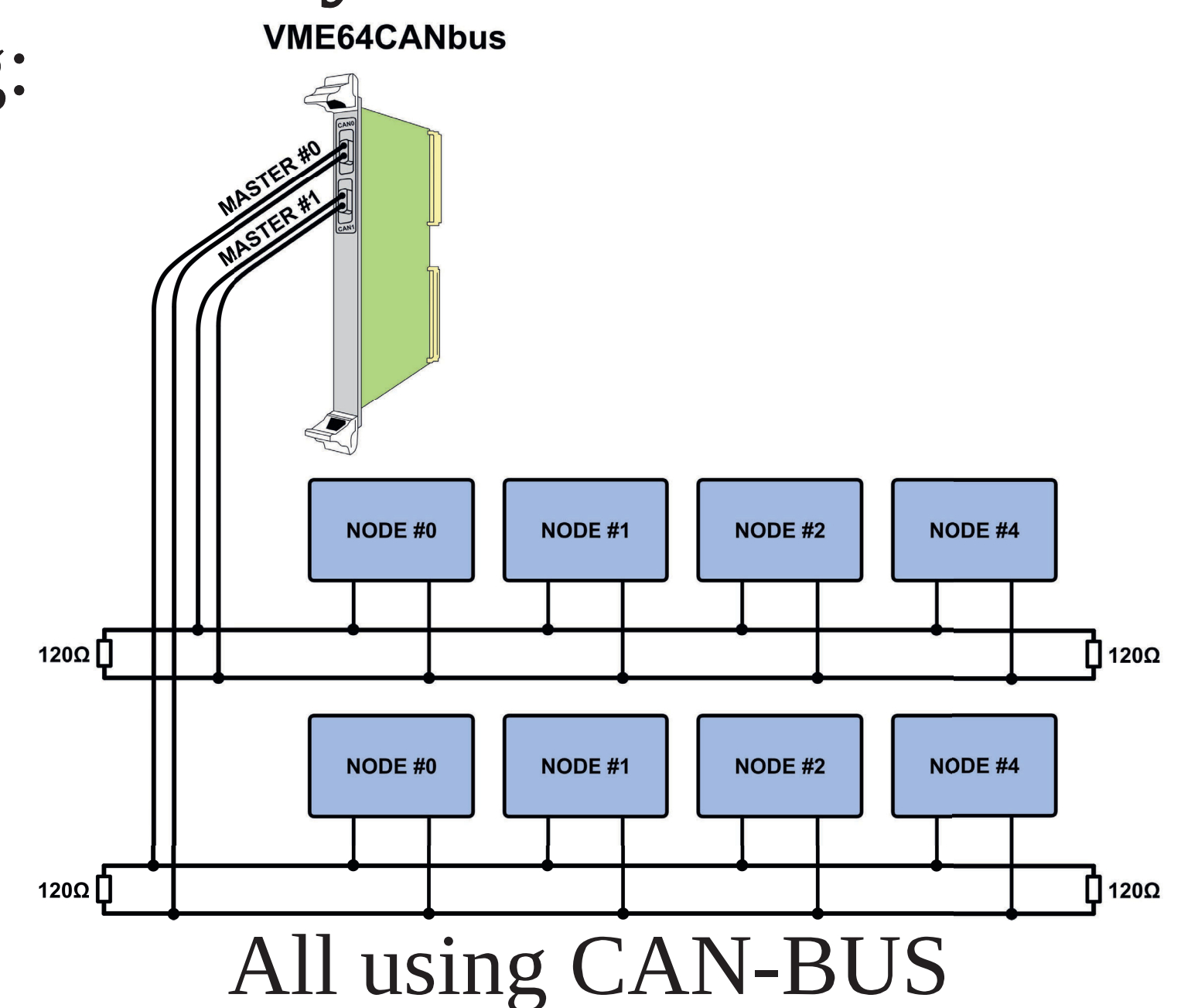 ...

Control System Structure

Linear part

• Timing subsystem
 • timers
 • delay lines
• Measurement subsytem
 • «fast» (<10 us)
 • «slow» (>10 us)
• Fast interlock subsystem

• Slow controls subsystem
• Geodetic measurements
• Vacuum,power supplies, etc.
• System infrastructure:
 • crates
 • controllers
 • interfaces

Slow Controls Subsystem

1. Beamline elements positioning:
  Angle poisitioning (water)
  X-Y positioning (wire)
2. Pulsed power control
  Modulators
  Degaussing
  Lense power supplies
3. Cathode heater control
4. Vacuum control
5. Crate power control

All using CAN-BUS

Measurement Subsystem

For more details visit THMPL09!

"Fast" signals
Duration ~10 us, 4 ns per point
 • 16 inductor voltages
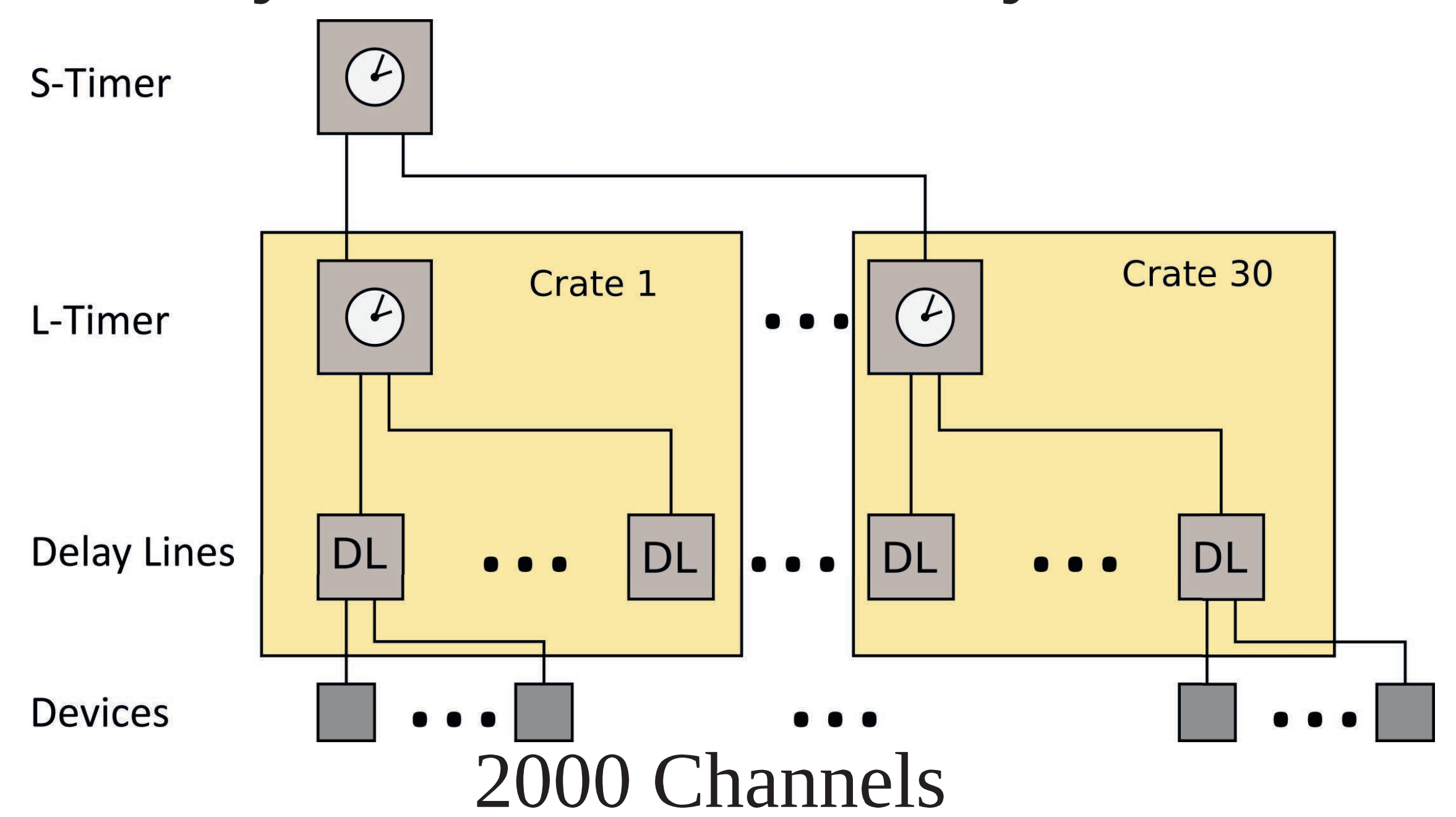 • 4 BPM signals
Kicker voltages 1 ns per point

Total > 480 channels

"Slow" signals
Duration > 10 us, ~125kSPS
 • 1 charging voltage
 • 16 forming line voltage
 • 2 degauss currents
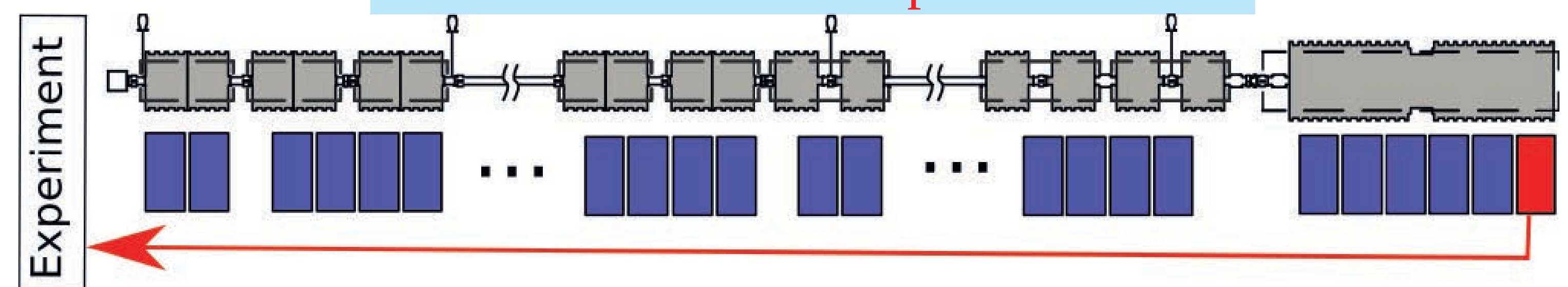 • 1-3 lense currents

Total > 1860 channels

Synchronization Subsystem

2000 Channels

The synchronization subsystem provides all the controlled and controlling devices with the start pulses. The overall accuracy must be better than 4 ns across 70 m of length. This means that the propagation delays between the control units must be taken into consideration and negated.
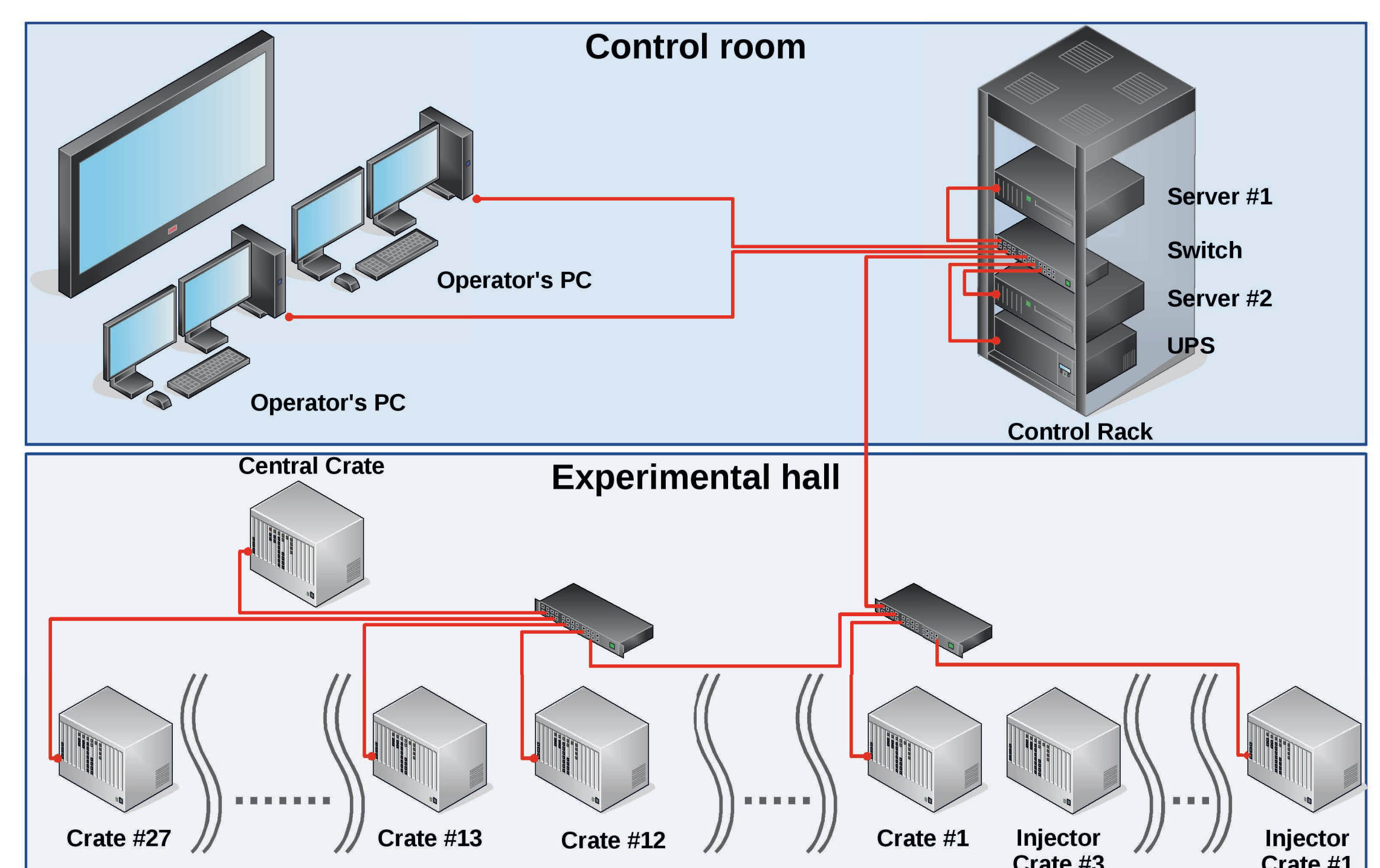
Fast Interlock Subsystem

For more details look up TUPHA103!

Inhibit the experiment at ~ 200 m, with reaction time < 20 us

System Infrastructure

The system infrastructure is built upon COTS hardware: Intel x86-64 servers and multi-monitor x86-64 client machines.
Ubuntu LTS is used both on server and client machines. Debian is used on controllers.
Software is TANGO-Based

VME-BINP Crate
For more details visit THMPL10!

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