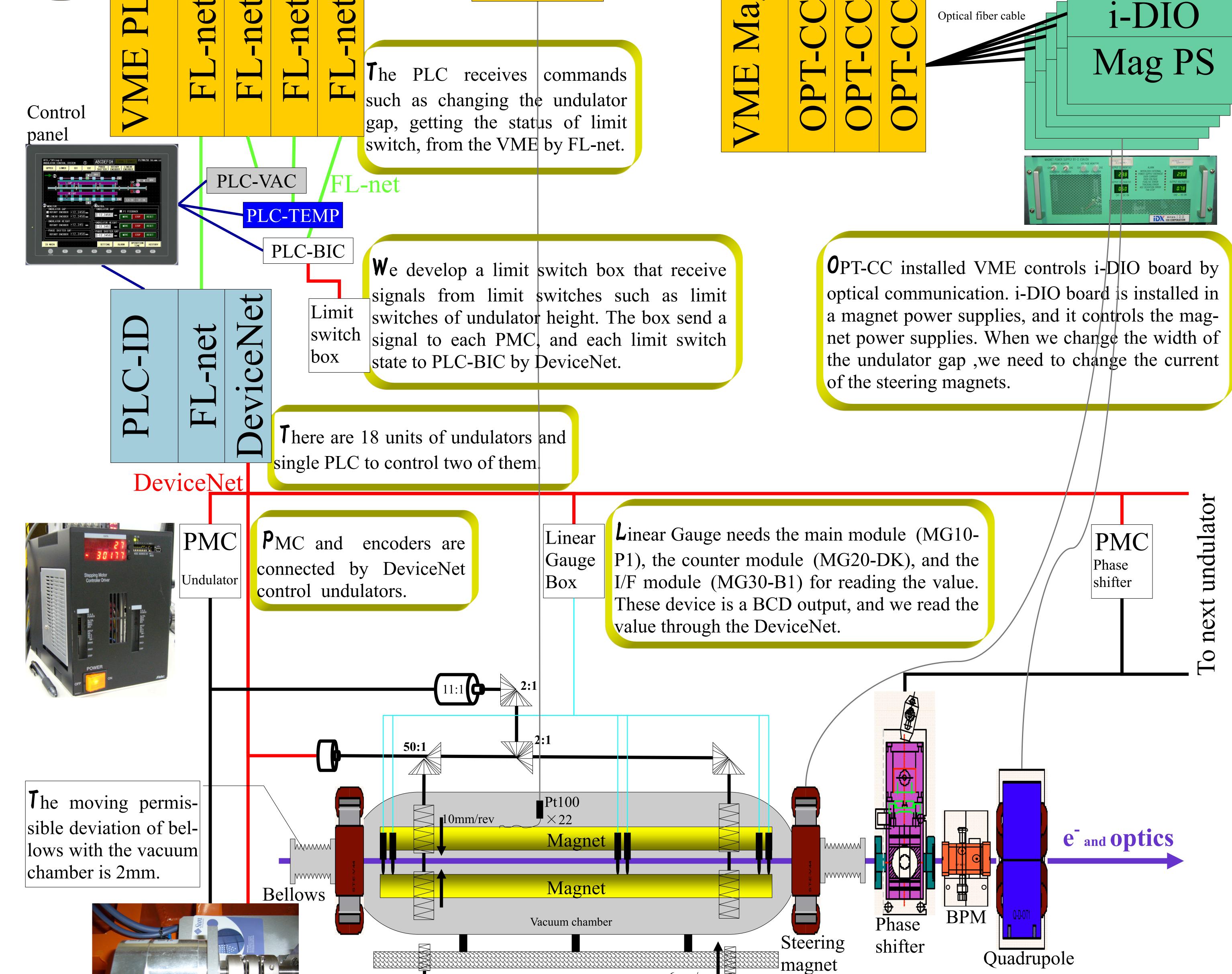# DEVELOPMENT OF THE UNDULATOR CONTROL SYSTEM FOR XFEL/SPRING-8

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RIKEN/SPring-8
JASRI/SPring-8

Console
GUI

DB

Ethernet

We monitor the magnet array temperature by Pt100 RTD. E-069 connect to twenty-four pairs of a four-terminal RTD. Temperature resolution of E-069 is 0.1℃.
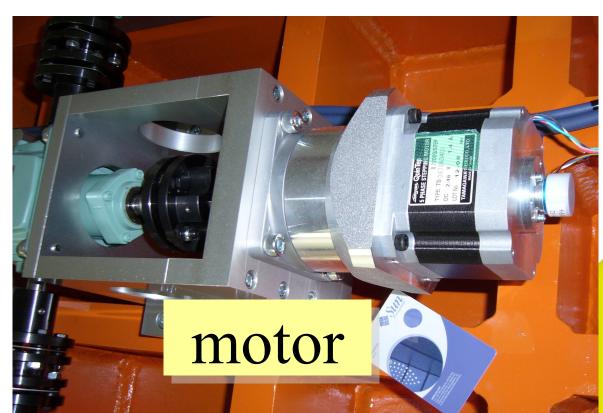
E-069

VME PLC
FL-net FL-net FL-net FL-net

VME Mag
OPT-CC OPT-CC OPT-CC

Optical fiber cable

i-DIO
Mag PS

Control panel

The PLC receives commands such as changing the undulator gap, getting the status of limit switch, from the VME by FL-net.

PLC-VAC
FL-net
PLC-TEMP
PLC-BIC

We develop a limit switch box that receive signals from limit switches such as limit switches of undulator height. The box send a signal to each PMC, and each limit switch state to PLC-BIC by DeviceNet.

Limit switch box

OPT-CC installed VME controls i-DIO board by optical communication. i-DIO board is installed in a magnet power supplies, and it controls the magnet power supplies. When we change the width of the undulator gap ,we need to change the current of the steering magnets.

PLC-ID
FL-net
DeviceNet

There are 18 units of undulators and single PLC to control two of them.

DeviceNet

PMC
Undulator

PMC and encoders are connected by DeviceNet control undulators.

Linear Gauge Box

Linear Gauge needs the main module (MG10-P1), the counter module (MG20-DK), and the I/F module (MG30-B1) for reading the value. These device is a BCD output, and we read the value through the DeviceNet.

PMC
Phase shifter

To next undulator

The moving permissible deviation of bellows with the vacuum chamber is 2mm.

11:1   2:1
50:1   2:1

Pt100 ×22
10mm/rev
Magnet
Magnet
Vacuum chamber

e⁻ and optics

Bellows

Steering magnet

Phase shifter

BPM

Quadrupole magnet

Encoder   Encoder
24:1   2:1
Motor
6mm/rev
Bevel gear
15:1   2:1

Motor	Gap	Height
A reduction gear	2000:1	1440:1
Resolution	18.2nm/rev	8.3nm/rev

motor

For the lasing, we set the undulator gaps less than 1-micrometer positioning accuracy. We have to control the undulator gap to be less than sub-micrometer resolution. This table shows that the resolution of these motors is sufficient.

Undulator
without a vacuum chamber