Control system of KURRI FFAG

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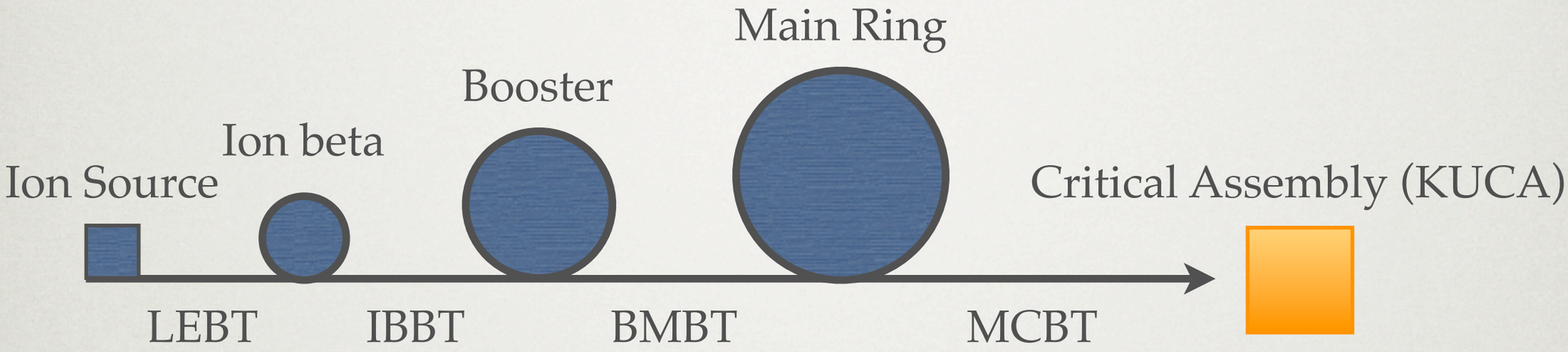
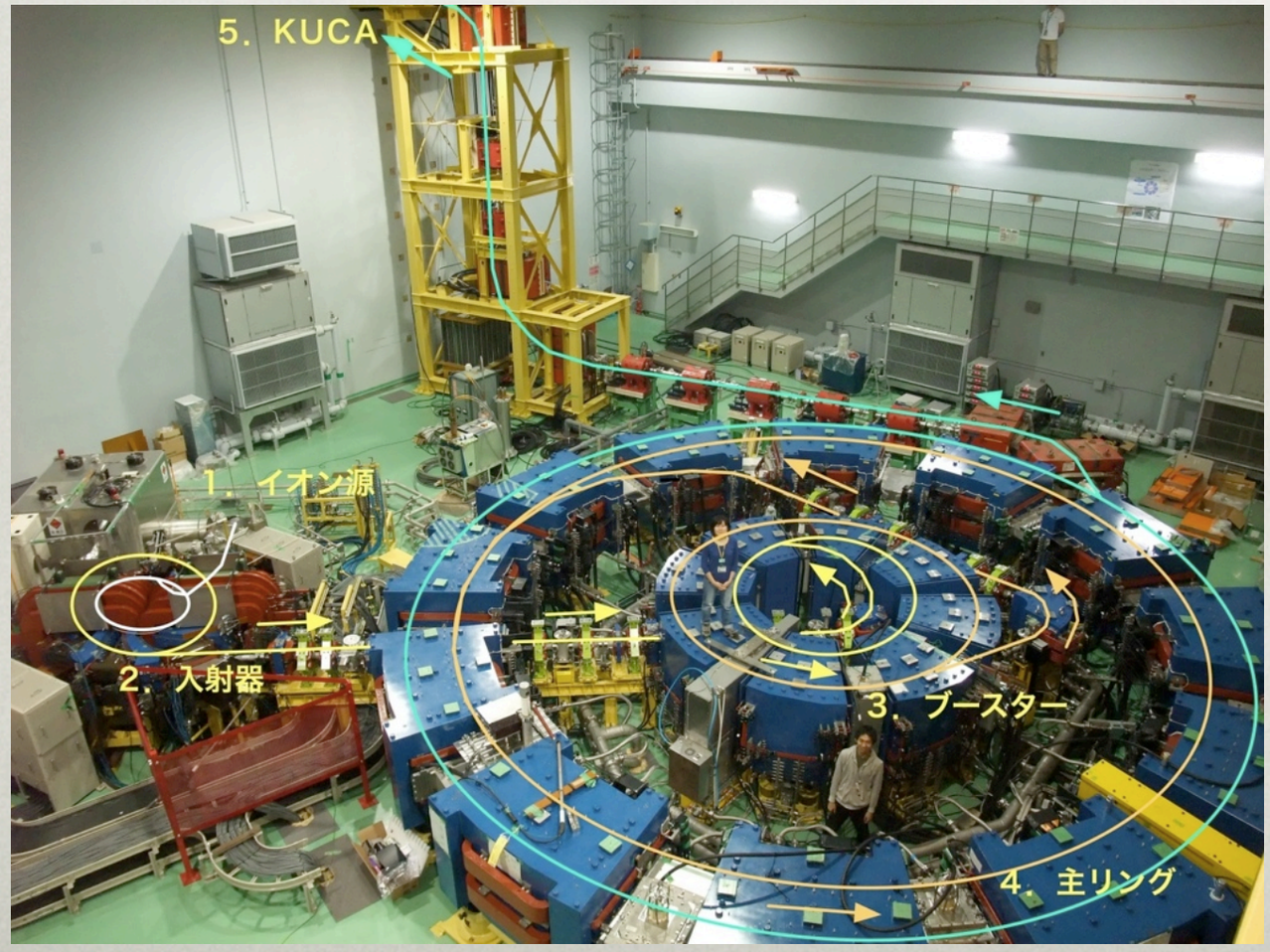
FFAG Complex at Kurri





- Ion source
- Three FFAG-Rings
- Four Beam Transport Lines

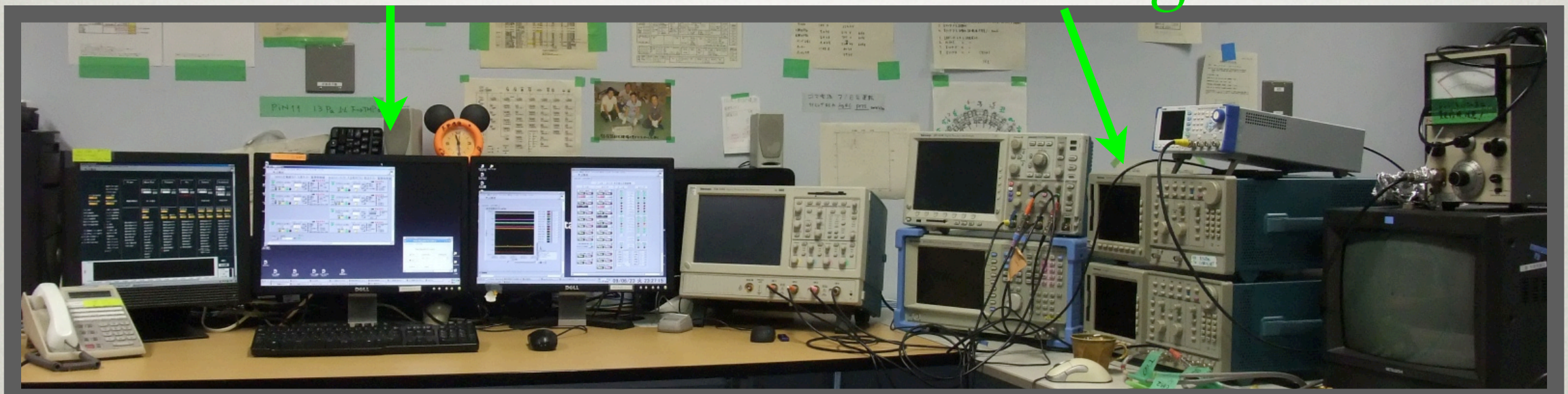
Current Control System

- Slow Control
  - PLC (FA-M3 & Melsec) : communicate with Device
  - LabVIEW (NI) : Operator Interface and communicate with PLCs
- Fast Control
  - AWG430(Tektronix) : Wave Form generator - 200 MS/s
  - WE7000(Yokogawa) : Timing pulse generator - 100 MHz Clock

Devices for Operation

Windows® PCs

Waveform generator

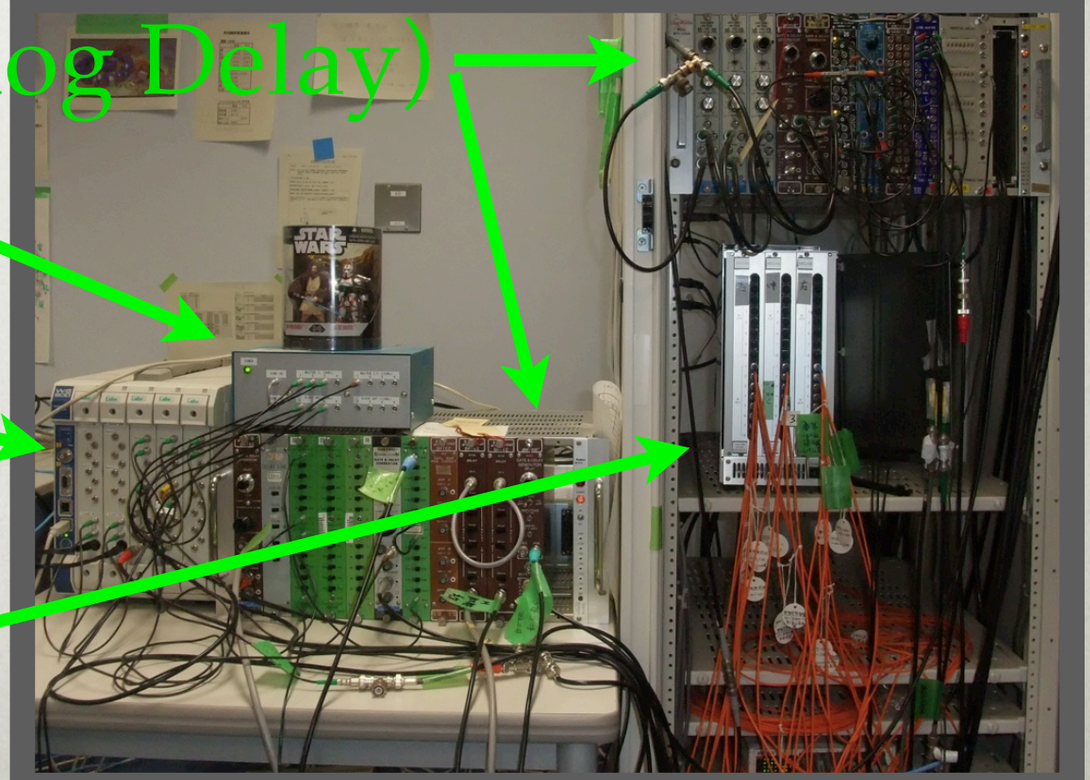


NIM(Digital & Analog Delay)

Master Clock Generator

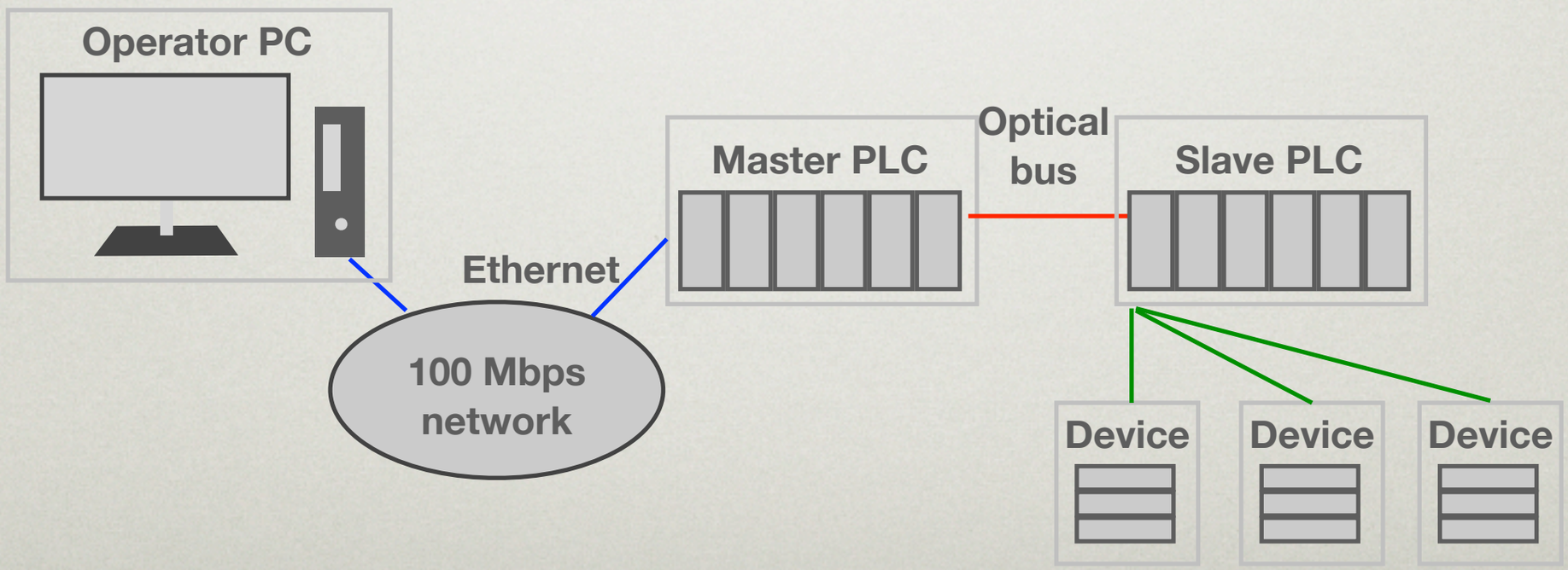
Digital Delay

VME(OE convertor)



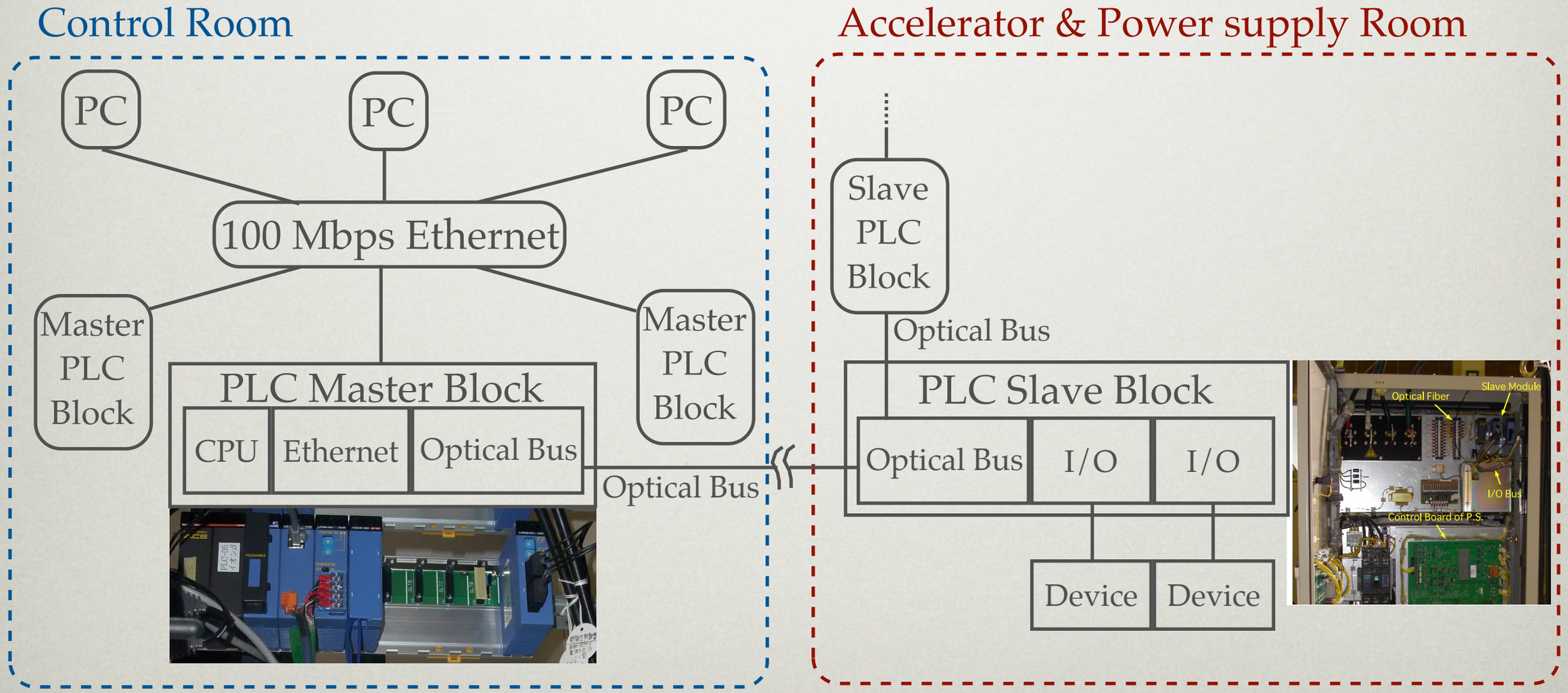
Slow Control

- Magnet control, Vacuum System, Interlock System...
- Network based PLC System with LabVIEW running on Windows® operating system



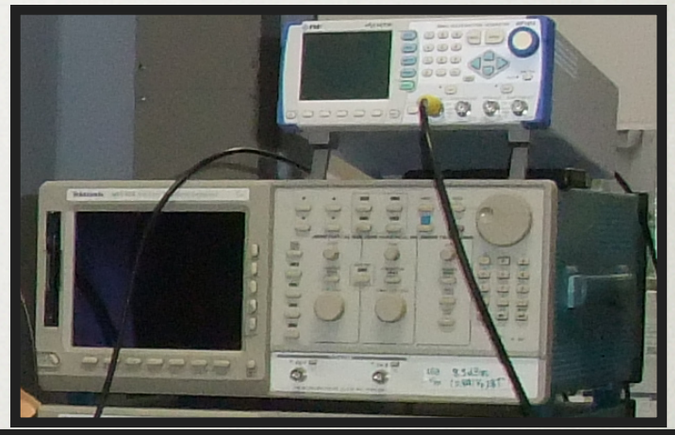
Master & Slave PLC System

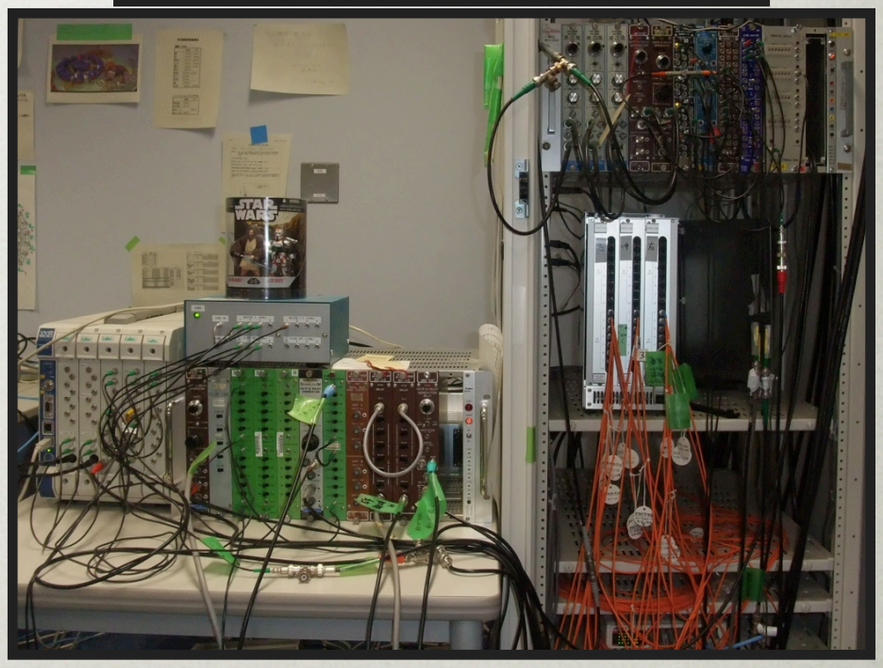
- For the protection from neutron radiation, master & slave system has been adopted



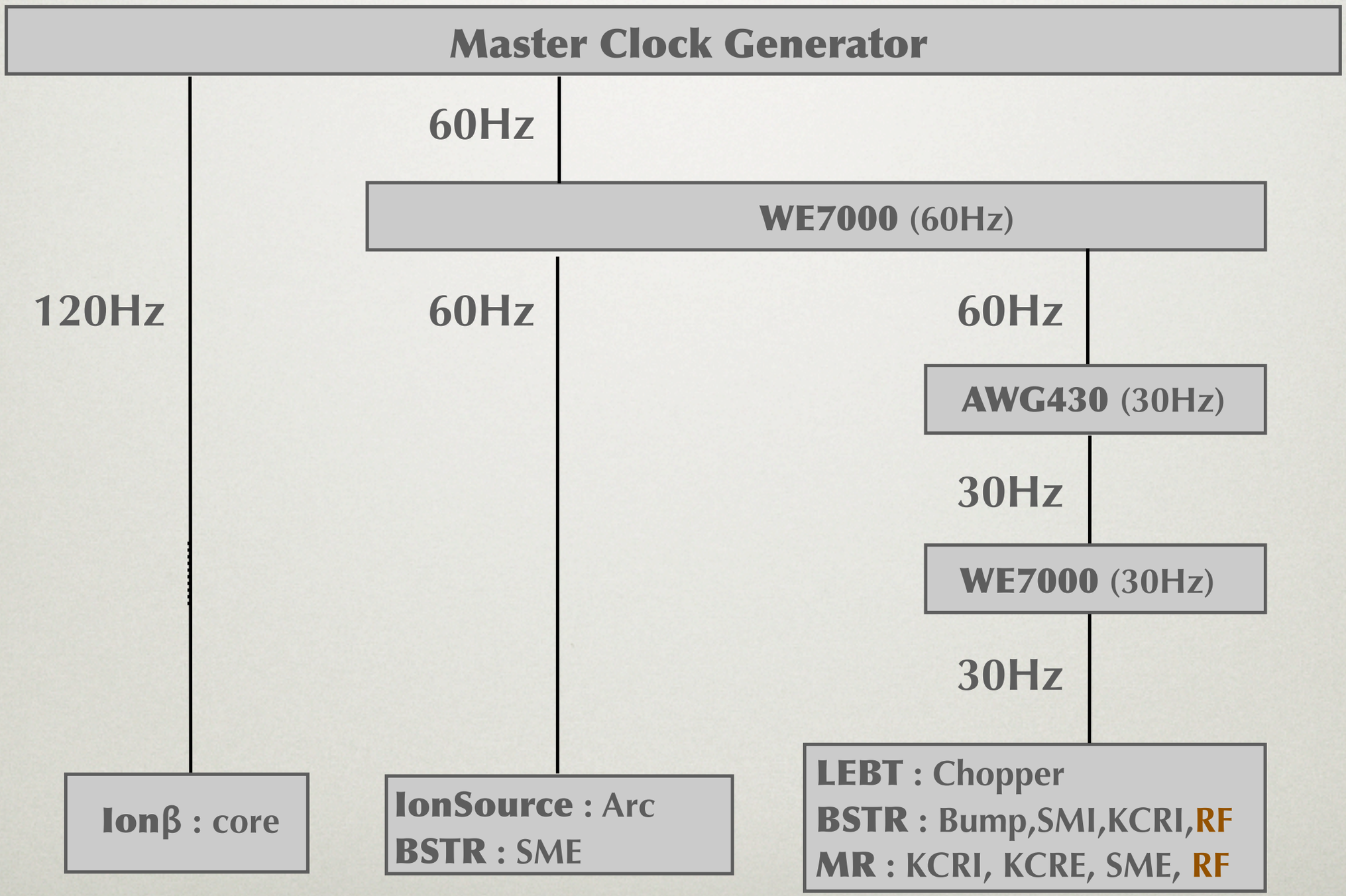
Fast Control

- Generate Timing pulse for
  - Ion source : Arc
  - LEBT : Chopper
  - Ion beta : Core
  - Booster : Injection Septum, Bump, Extraction Septum, Extraction Kicker
  - Main Ring : Injection Kicker, Extraction Kicker, Extraction Septum
- Generate Waveform for RF cavity





Timing Diagram at 30Hz operation



Problems of the Current system

- Since Current system works well, but...
- Security!!
  - Since Windows® based system has been de-facto standard system over the world, Windows® is confronting with great security problems.
- Black Box System
  - Completely, Windows® based system is black box.
    - Sometimes strange behavior is occurred!!

Microsoft®

Windows®

Hello, EPICS

Advantage of EPICS

- Everything is open
  - Customizable
    - Since Linux & EPICS are open source projects, anyone can read and modify program
  - Low cost
- Stability & Security
  - Running on Unix based system

What is EPICS?

EPICS?

- Experimental Physics and Industrial Control System

EPICS?

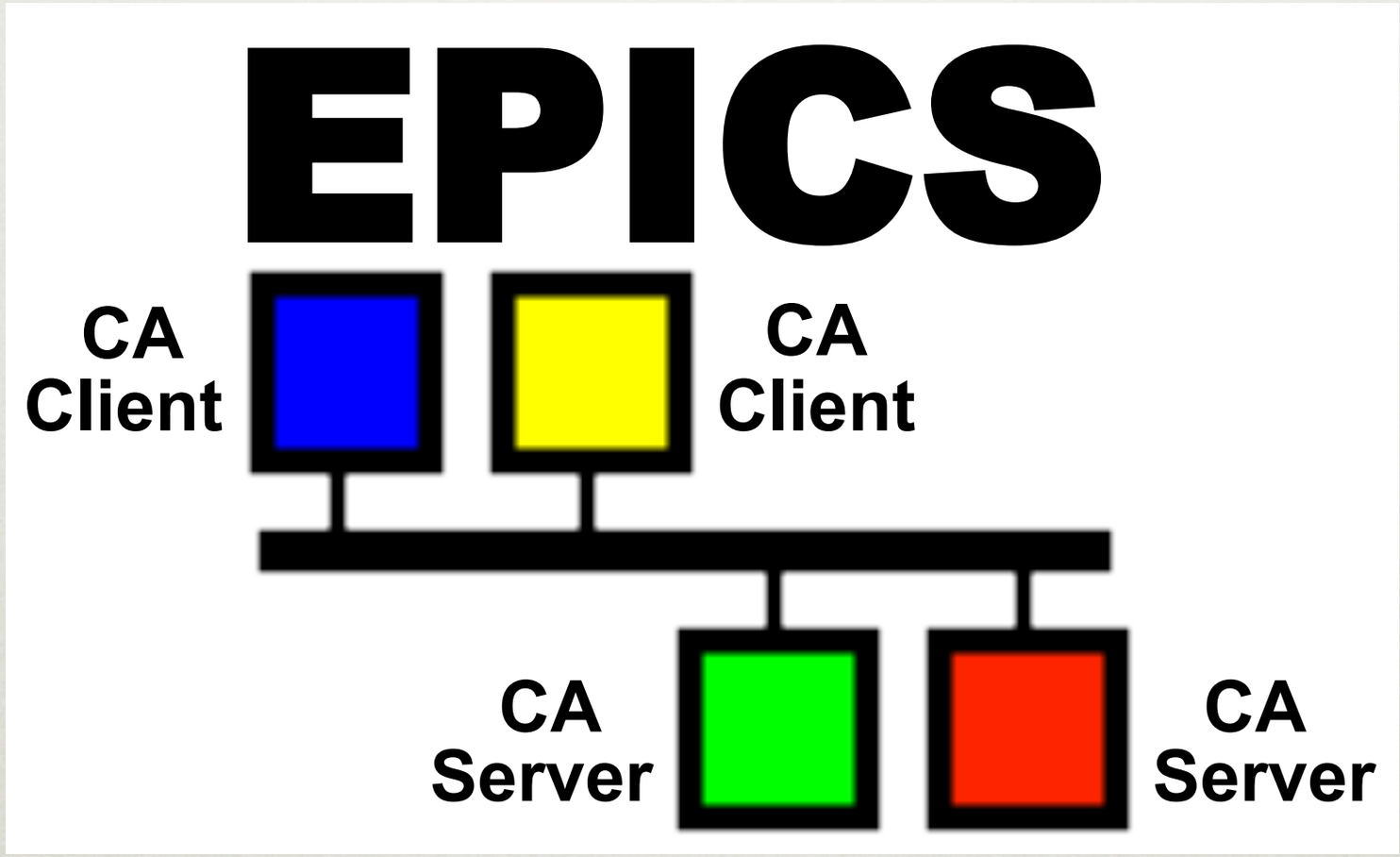
- A Control System Architecture
- A Software Toolkit
- A Collaboration

A Collaboration

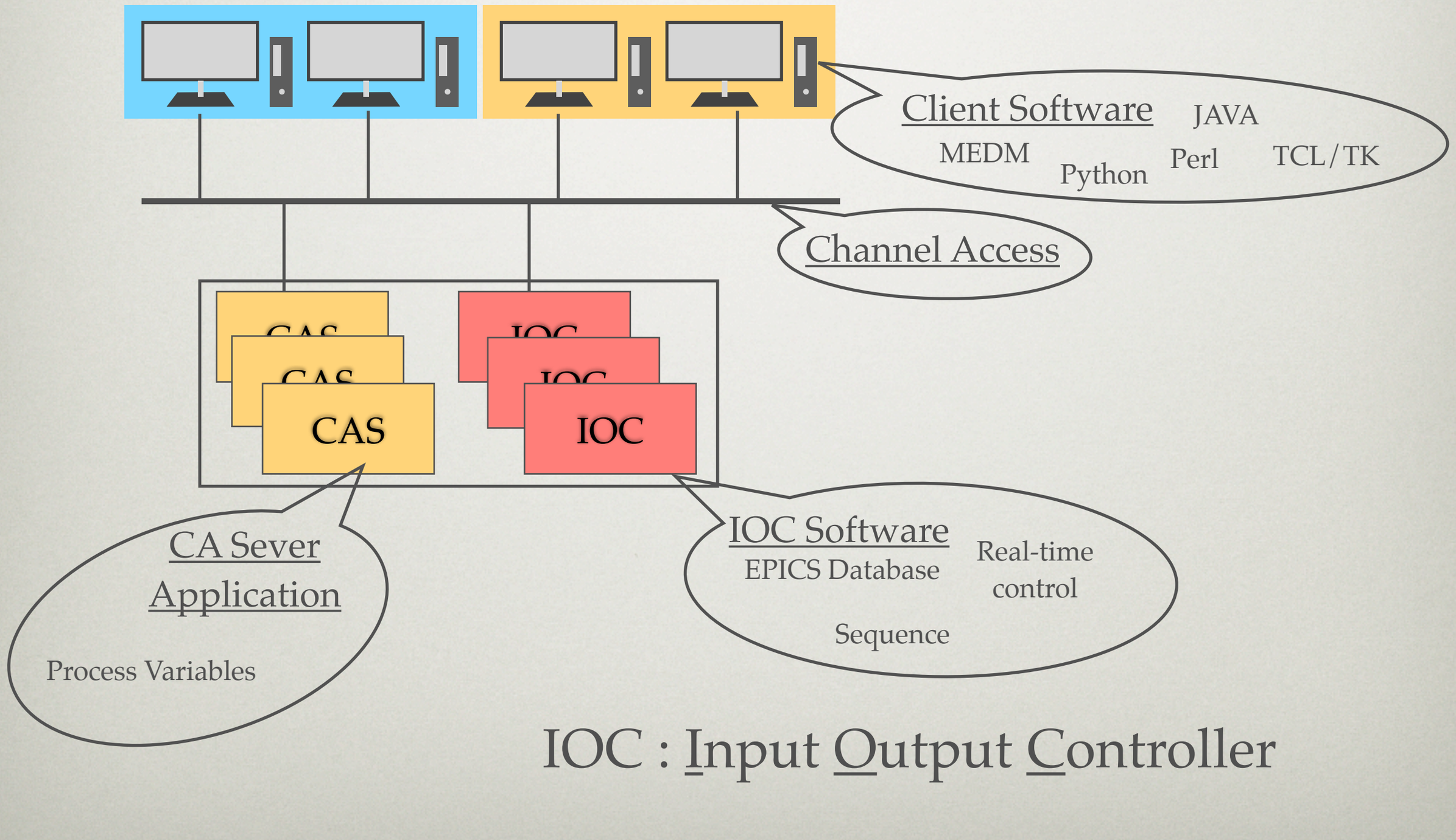
- Begin in 1989 between LANL/GTA & ANL/APS
  - Bob Dalesio & Marty Kraimer
- Open source
- Major Collaboration
  - SLAC, DESY, PSI, KEK
    - KEKB & J-PARC (Linac, RSC, MR) Control systems are based on EPICS.

A Control System Architecture

- Network-based "client/server" model



Canonical From of an EPICS Control System



IOC : Input Output Controller

Migration to EPICS

- At the end of this year, two Q-magnets will be installed into reactor.
- To control this two Q-magnets, new control system based on EPICS and NetDev tool has been developed.
- And then, gradually control system will be replaced to EPICS.

Summary

- PLC + LabVIEW® control system works well
- Because of security issue, we have a plan to install EPICS instead of LabVIEW®
- New two Q-magnets will be first devices which controlled by EPICS.