Status of EPICS at KEK

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KEK

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  - Status of Linac Control System
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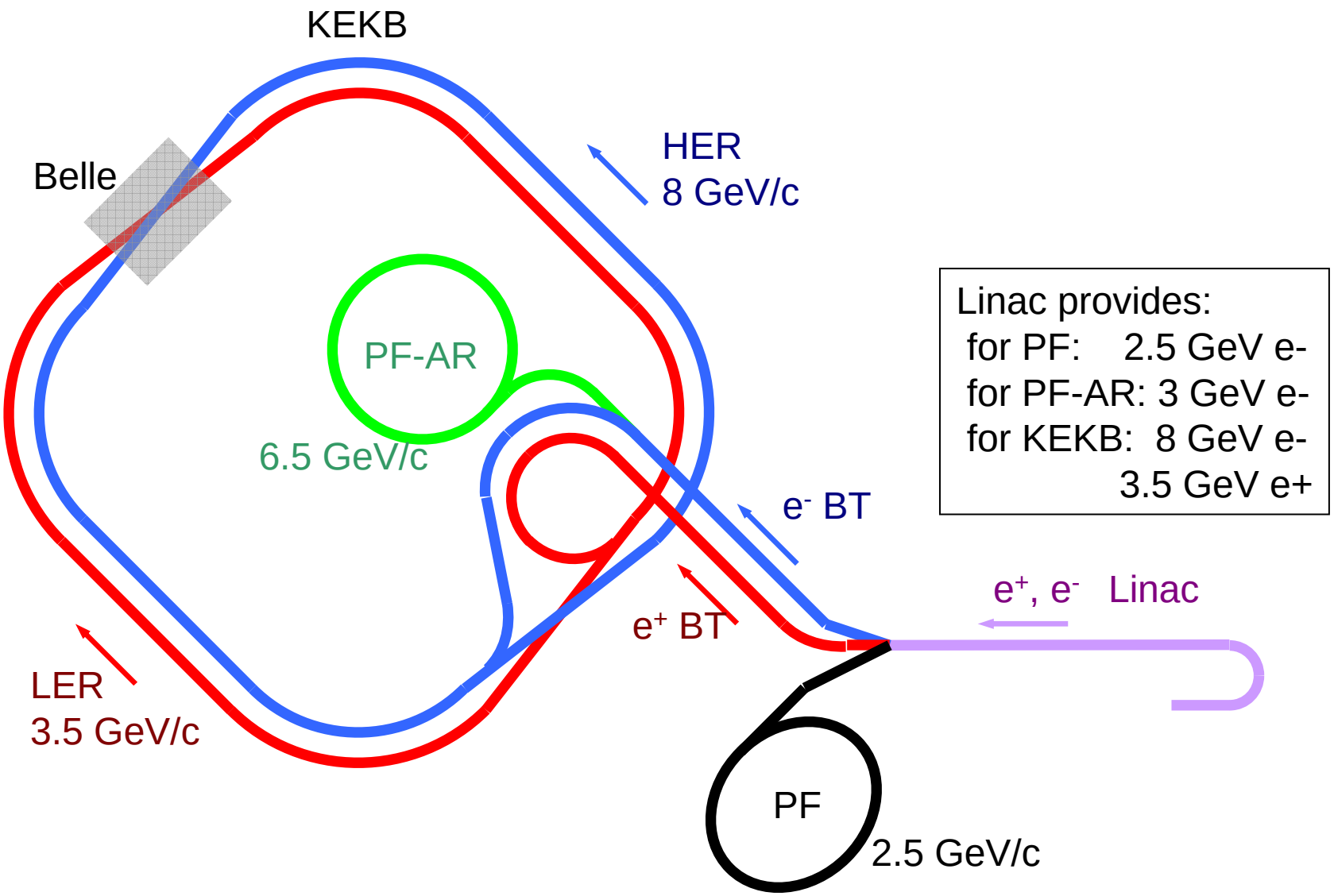
Overview of EPICS Activity at KEK

- **J-Parc** → Kamikubota-san's Talk
- **KEKB** EPICS based system
- **PF-AR** EPICS based since 2002
- **PF** EPICS based since 2005
- **Linac** Non-EPICS
- EPICS based small-size systems
  - RFGTB EPICS based system
    → Araki-san's talk at EPICS meeting in Tokai, 2004


KEKB
Belle
HER
8 GeV/c
PF-AR
6.5 GeV/c
e- BT
e+ BT
e+, e- Linac
LER
3.5 GeV/c
PF
2.5 GeV/c
Linac provides:
for PF: 2.5 GeV e-
for PF-AR: 3 GeV e-
for KEKB: 8 GeV e-
3.5 GeV e+

Status of Linac Control System

- Non-EPICS control system based on Remote Procedure Call & Distributed Shared Memory
- Linac-to-EPICS Gateway

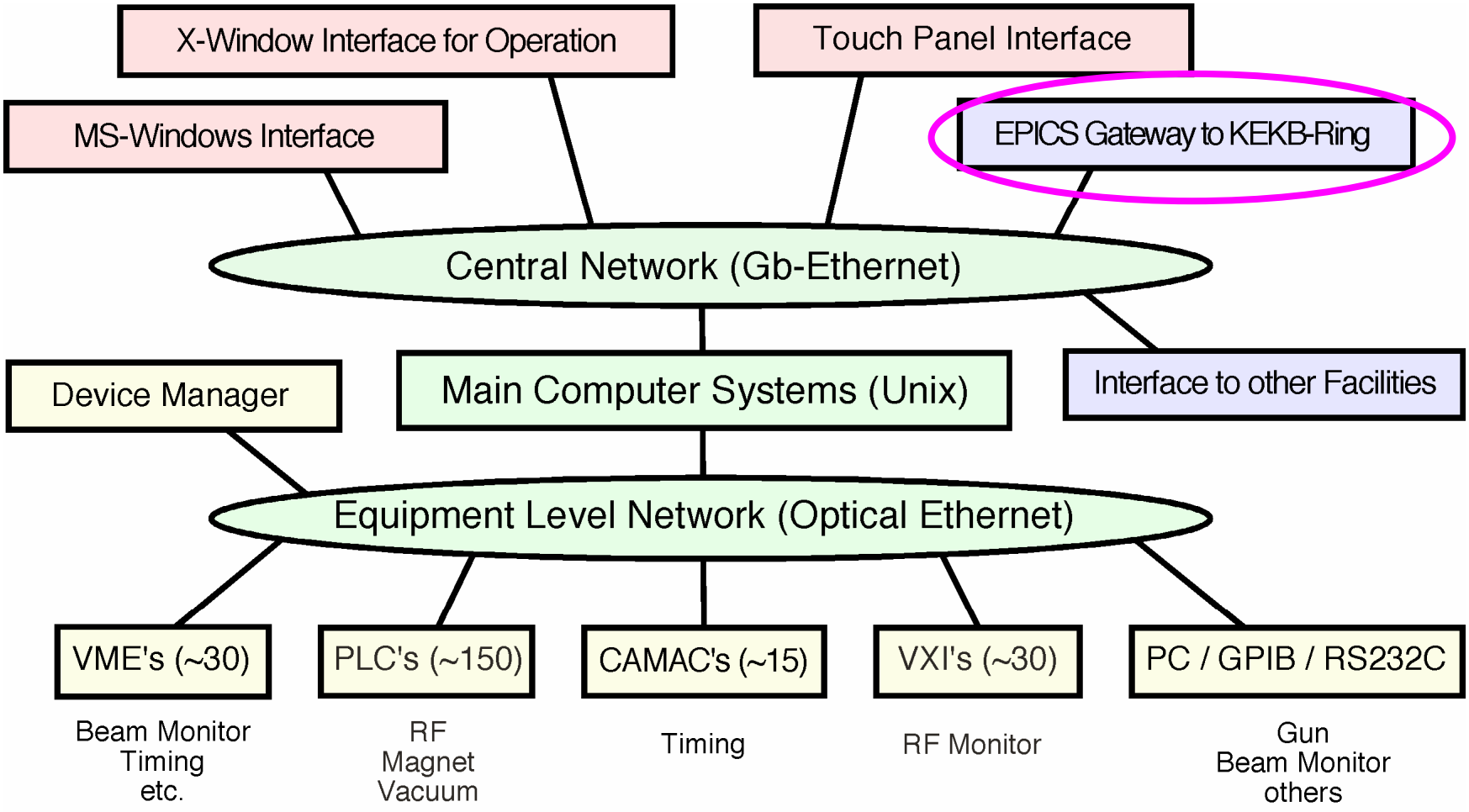
  1 Portable Channel Access Server (Old)

  ~ 4950 records

  3 SoftIOC on Linux with AsynDriver (New)

  ~ 9672 records

  Many of above records are archived in KEKBLog and/or Channel Archiver (~ 400MB/day)


X-Window Interface for Operation
Touch Panel Interface
MS-Windows Interface
EPICS Gateway to KEKB-Ring
Central Network (Gb-Ethernet)
Device Manager
Main Computer Systems (Unix)
Interface to other Facilities
Equipment Level Network (Optical Ethernet)
VME's (~30)
PLC's (~150)
CAMAC's (~15)
VXI's (~30)
PC / GPIB / RS232C
Beam Monitor
Timing
etc.
RF
Magnet
Vacuum
Timing
RF Monitor
Gun
Beam Monitor
others

Plan in the coming summer shutdown

- real IOC's will be installed
  - ~10 Windows IOC's on DSO7104 Oscilloscopes for BPM
  - ~7 MVME5500 IOC's for Event/Timing and Low Level RF

Status of KEKB/PF-AR Control System

- KEKB History --- The first application of EPICS in Japan
  - Mar. 1998 part of e- BT line commissioning
  - Jun. 1998 part of e+, e- BT lines commissioning
  - Dec. 1998 KEKB rings commissioning started

- PF-AR History
  - 2001 1 year shutdown of PF-AR for upgrade
    - Control system was completely replaced to EPICS
  - Jan. 2002 operation of PF-AR restarted

Host computers in 2006

- Host computers for EPICS development
  - 2 HP-UX servers
  - 1 Sun server (New)
  - 1 Linux server (New)
- Host computers for Operation & Accelerator Modeling calculation (“SAD cluster”)
  - 3 Alpha servers
  - 2 Linux servers
  - 8 Macintosh OSX servers

SAD

- SAD (Strategic Accelerator Design) is a computer program complex for accelerator design developed in KEK since 1986.
  - http://acc-physics.kek.jp/SAD/sad.html
- Most of the high level applications for operation are developed by SAD
- Workshop SAD2006
  - Sep. 5-7 2006 at KEK
  - http://acc-physics.kek.jp/SAD/SAD2006/

IOC in 2006

- ~ 110 VME/VxWorks IOC with EPICS 3.13.1

  CPU: Force PowerCore6750, PowerCore6603e

  Force CPU64, CPU40
- 1 VME/VxWorks IOC with EPICS 3.14.8
- Several PC/Linux IOC with EPICS 3.14
  - For Software records
  - For Ethernet devices (NetDev)

Field bus in 2006

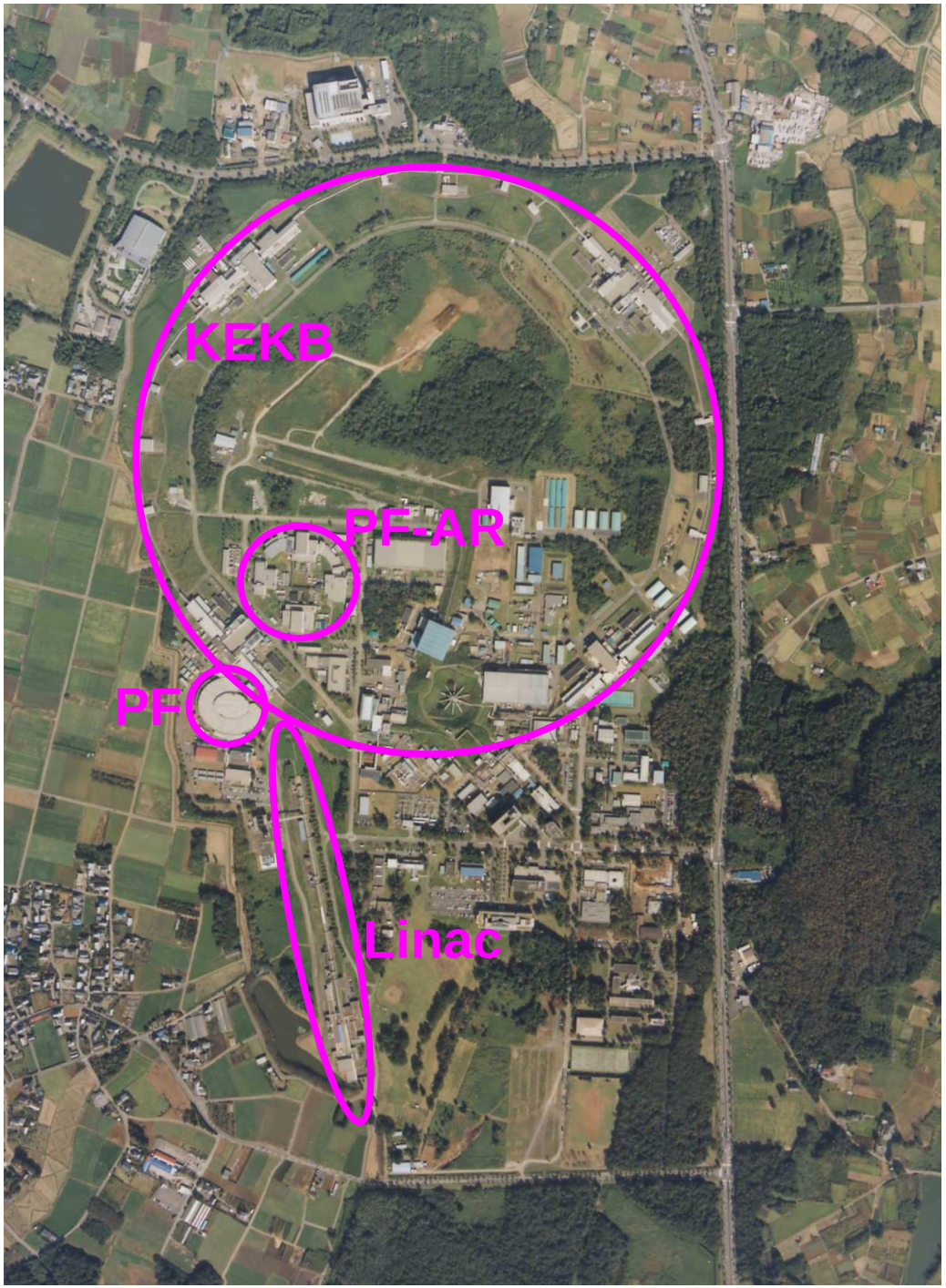
- **Arcnet** for Magnet PS
- **VXI-MXI** for BPM
- **Modbus plus** for interfacing to interlock systems
- **GPIB, RS-232C** for many kinds of instruments
- **CAMAC** for RF control and some devices
  (about 20 years old legacy system)
- We plan to replace CAMAC modules to PLC with Ethernet
- A Mitsubishi **PLC with Ethernet** is used for the special magnet PS (for local orbit feedback)
- Test of a Yokogawa **PLC with Ethernet** is now going in a Klystron Test Station.

Upgrade of the KEK-PF Control System

Photon Factory, KEK

T.Obina
(takashi.obina@kek.jp)

Jun/2006 EPICS meeting



KEK Site

Linac

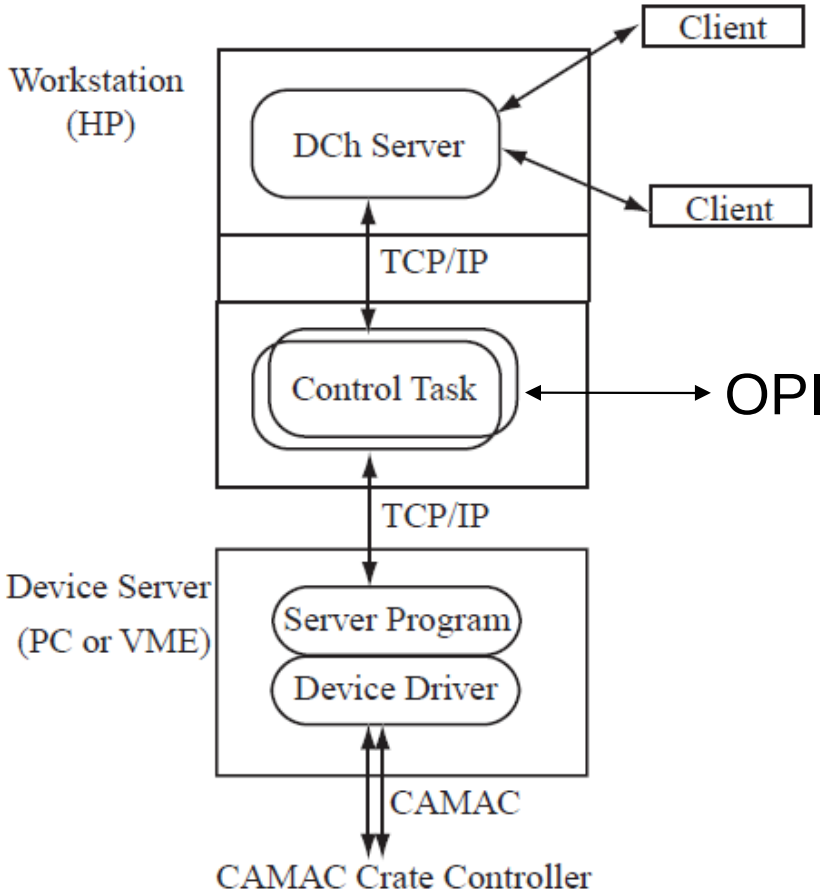
PF	2.5GeV e-
PF-AR	6.5GeV e-
KEKB	8.0GeV e-
	3.5GeV e+

Brief History

- 1982: Comissioning (420nm.rad)
- 1986: Medium emittance (130nm.rad)
- 1997: Low emittance (36nm.rad)
- 2005: Straight-Sections Upgrade
  - Main purpose of the project
    - enlarge the existing straight sections
    - increase the number of straight sections (7 -> 13)
  - Control : EPICS

Before Upgrade

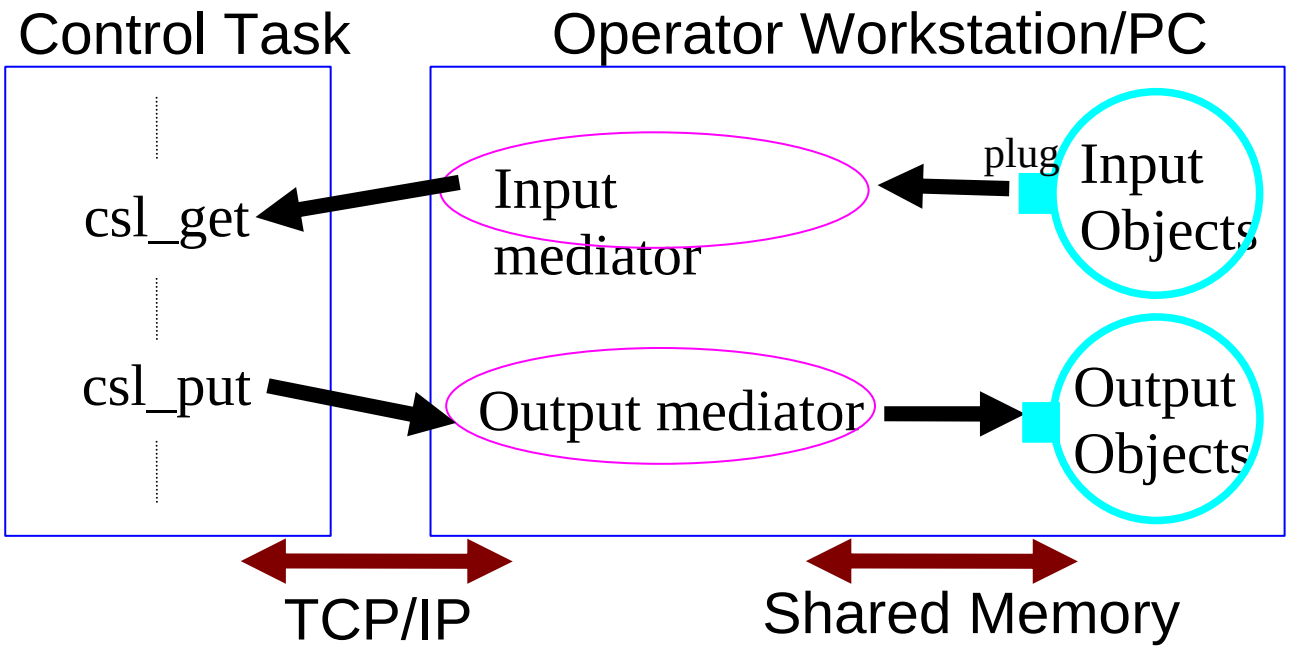
- based on our in-house software
  - "Device Server" and "Data Channel"



- Device Server
  - many plathome
    - PC, VME, WS
  - CAMAC, GPIB, etc
- Data Channel (DCh)
  - not used for equipment control
  - Shared memory + Client Lib
  - keep latest information
    - always updated

Control Task and OPI

- Control Task
  - FORTAN or C (running on Workstaions)
- Operator Interface
  - Communicate through Input/Output Mediator
  - GUI: developed by VAPS



Upgrade Policy

- DataChannel&Device Server
  - Advantage
    - many OS: Unix(HP/Sun/Linux), OS-9, HP-RT, Windows,etc
    - Simple, light-weight
    - Easy & Fast Development (Device controller or GUI)is possible
  - Disadvantage
    - Control Task & OPI is closely related
    - DCh: no session management
    - DCh: no Event notification

Extend the functionality of DataChannel ?
or
Adopt EPICS ?

Hardware : IOC

- RF
  - VME(PPC 750 + VxWorks) for CAMAC
  - PC(Soft IOC on Linux) + PLC with Ethernet : HV Controller
  - PC(Soft IOC on Linux) + LAN/GPIB : GPIB inst.
- Magnet
  - VME(PPC750 + VxWorks) for CAMAC : Large Power Supply
  - VME(Intel PIII + Linux) : Small Power Supply
  - PC(Soft IOC on Linux) + LAN/GPIB : DMM, GPIB inst.
- Timing
  - VME(PowerPC 750 + VxWorks) with Bus Interrupt board
- Insertion Device
  - VME(PowerPC750 + VxWorks) + LAN/GPIB

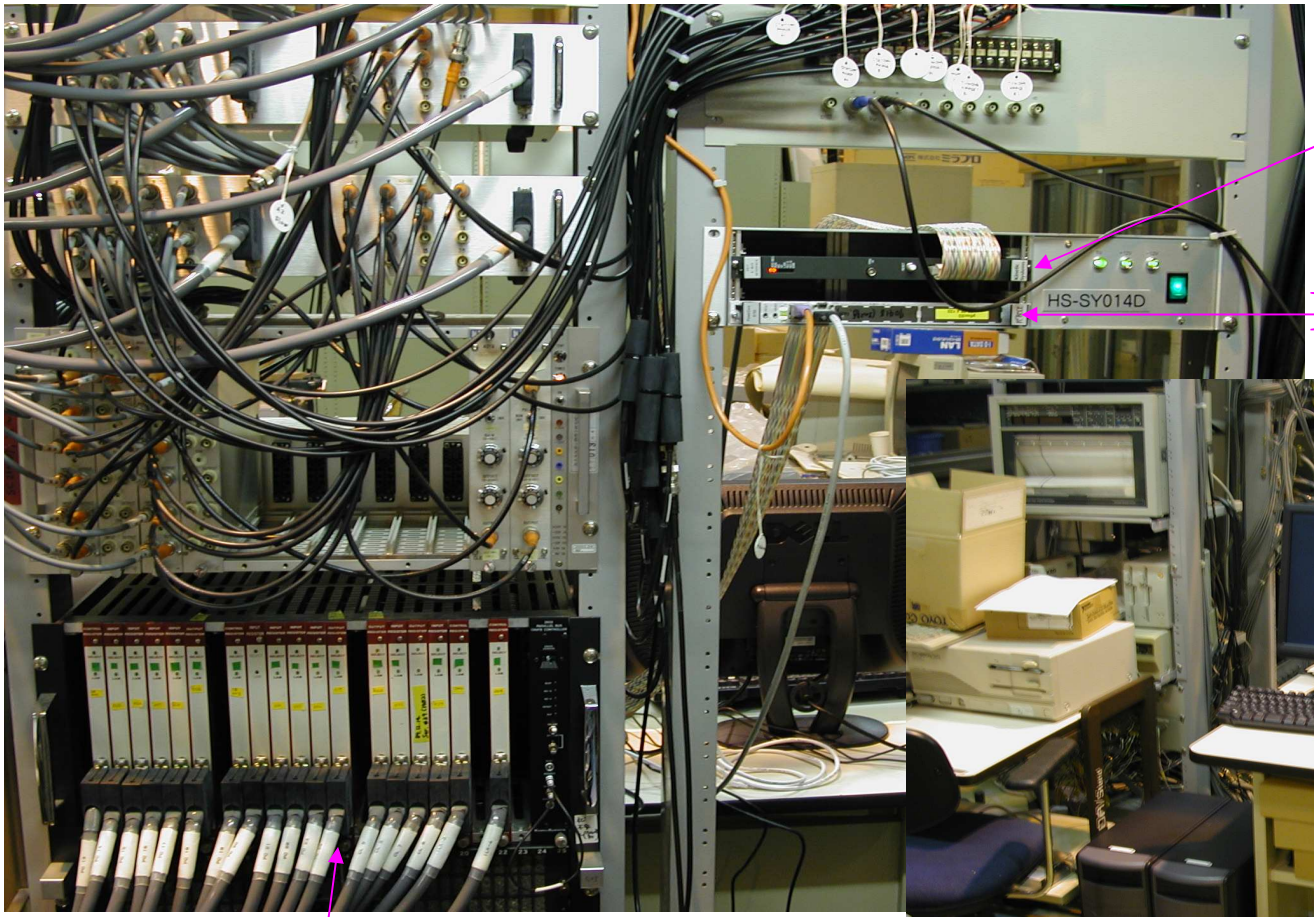
    we plan to replace with LinuxIOC

Hardware (cont.)

- Vacuum
  - PC(Soft IOC on Linux) + PLC with Ethernet
    - Omron PLC

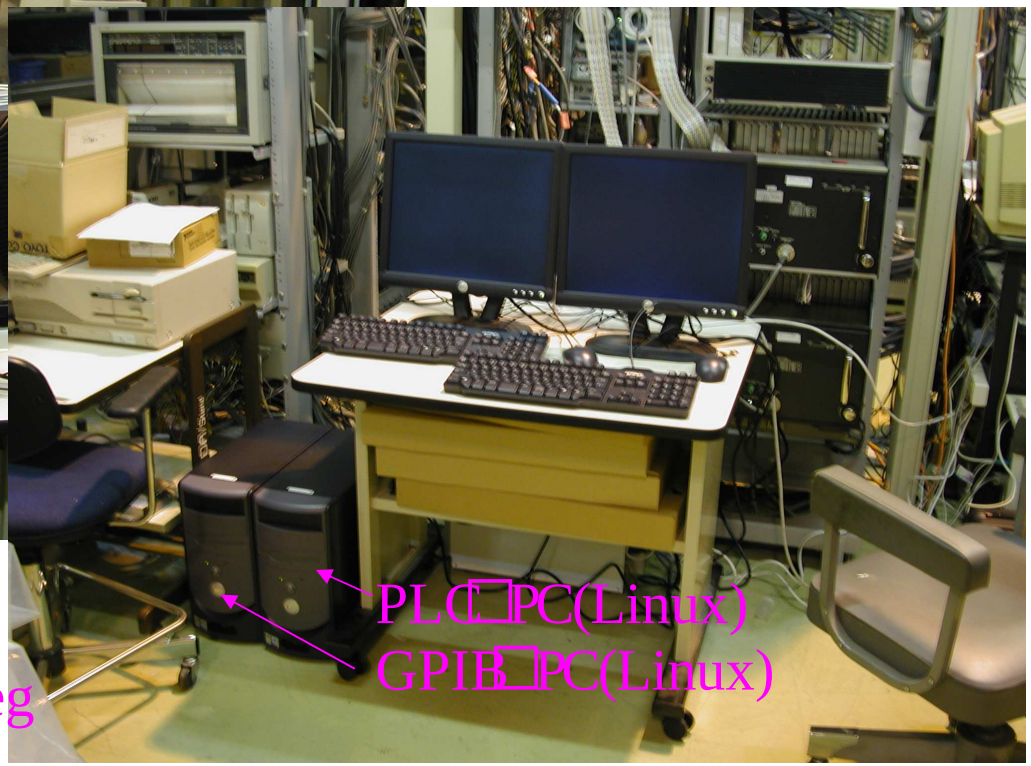
- Device support for Omron PLC is developed by M. Komiyama (RIKEN) and J-I. Odagiri (KEK)

RF Control



Kinetic VME-Kbus

HOC(pcore750, VxWorks)



PLC PC(Linux)

GPIB PC(Linux)

CAMAC

Input register, output reg, Control reg

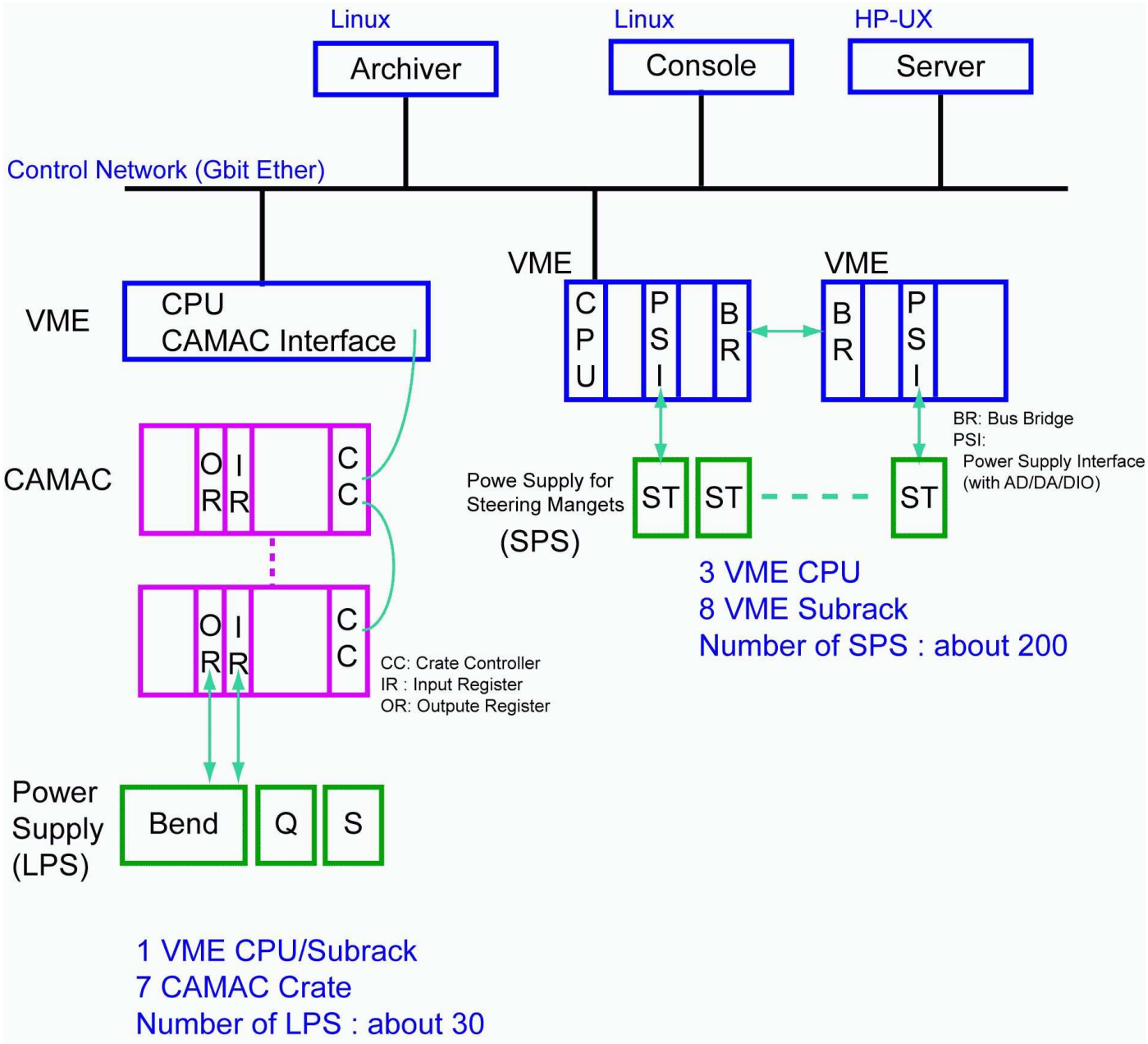
RF Control Panel (Example)

MEDM(DM2K), SAD/Tkinter

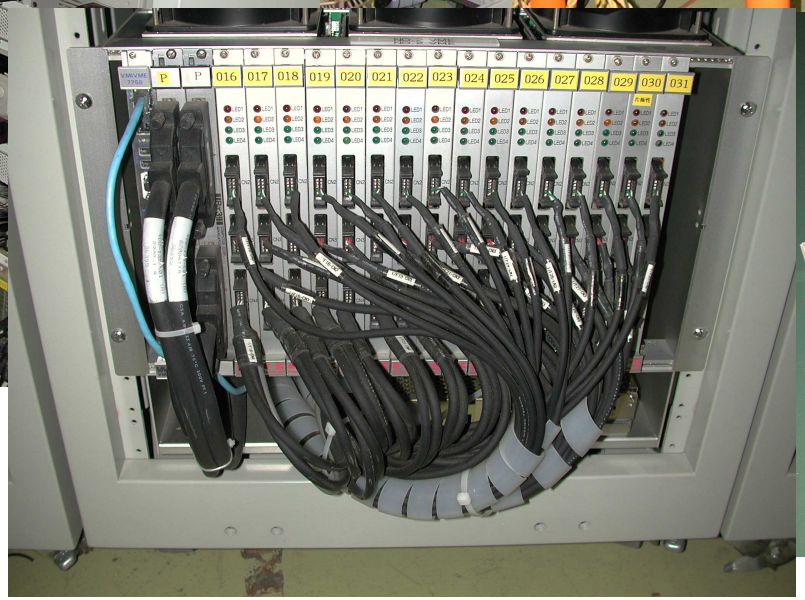
Magnet Control

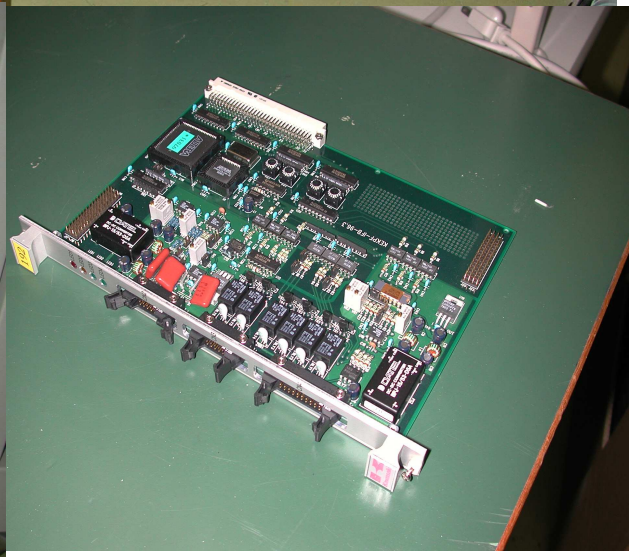
- Two types of power supplies
  - Large Power Supply (LPS) B,Q,S
  - Small Power Supply (SPS) Steering Magnet, BT, etc

- LPS: CAMAC (Input/Output register)
- SPS: Dedicated Controller Board
  - 1 Power Supply Interface (PSI) for 1 Power Supply
  - PSI : ADC, DAC, DIO(for relay, interlock, etc)
- 3 VME CPU(Linux) + Bus Bridge
  - total 7 VME subrack


Linux
Archiver
Linux
Console
HP-UX
Server
Control Network (Gbit Ether)
VME
CPU
CAMAC Interface
VME
C P U
P S I
B R
VME
B R
P S I
BR: Bus Bridge
PSI:
Power Supply Interface
(with AD/DA/DIO)
CAMAC
O R
I R
C C
Powe Supply for
Steering Mangets
(SPS)
ST
ST
ST
3 VME CPU
8 VME Subrack
Number of SPS : about 200
CC: Crate Controller
IR : Input Register
OR: Outpute Register
Power
Supply
(LPS)
Bend
Q
S
1 VME CPU/Subrack
7 CAMAC Crate
Number of LPS : about 30

Magnet Control





Archive/Retrieval

- Channel Archiver (2.8.1)
- Number of records / Data Amount
  - Mon: 250record 300MB
  - BT : 50record 14MB
  - ID : 15record 1MB
  - Mag: 750record 40MB
  - OP : 40record 10MB
  - RF : 1200record 60MB
  - Vac: 2100record 130MB
- Total 500-600MB/day
- Retreival
  - Web (CGI) and ArchiveExport command

Everywhere Python

- We use python as the programming language for OPI applications
- We begin to try using python also for IOC applications. (Linux IOC)
  - Multi-threadable CaPython
  - devPython
  - Python calc record

Multi-threadable CaPython

- Python + CA library + Multithreading
  = “Multi-threadable CaPython”
  - It can describe control logics on IOC
  - Alternative of the SNL/sequencer
  - Provides richer functionality
  - Allow quicker development of applications
- Current Status: under development

devPython

- Device support which invoke python interpreter
- Python program is specified through INST_IO parameter
- Currently ai record is tested
- We expect…
  - Non-EPICS subsystem written in python can be easily integrated into EPICS system.

Python calc record

- Alternative of calc record (or subroutine record)
- More powerful than calc record
- Easier than C programming (subroutine record)
- Current status: Just an idea