KEKB Control System

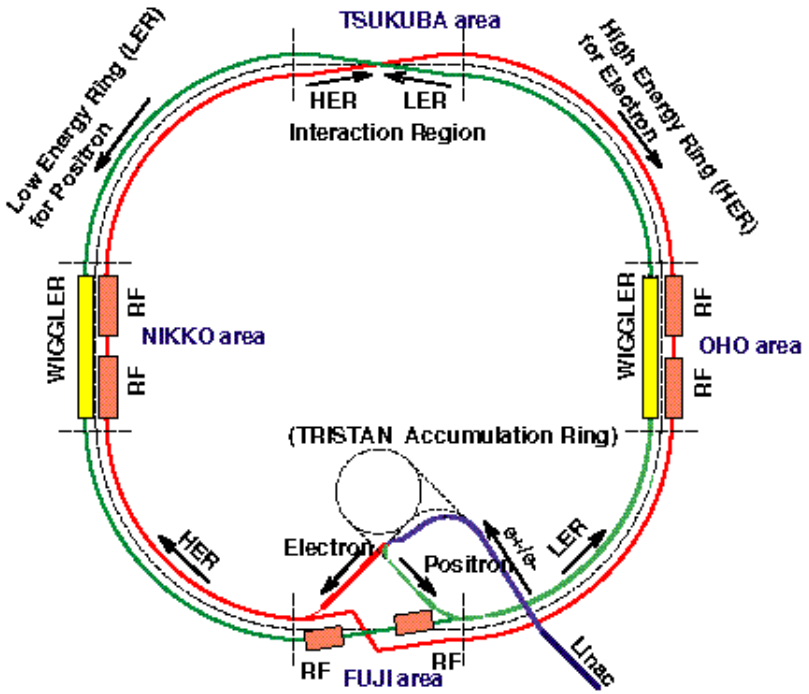
for EPICS Collaboration meeting
Nov. 2000
presented by Noboru Yamamoto

What's in this talk

- KEKB Status
  - KEKB ring and its status
  - KEKB control system Status
  - Operation statistics
  - Upgrade/improvement
  - Future Plans
- KEK-JAERI Joint Project (formally known as JHF)
- Training session in Shanghai

KEKB: what it is?

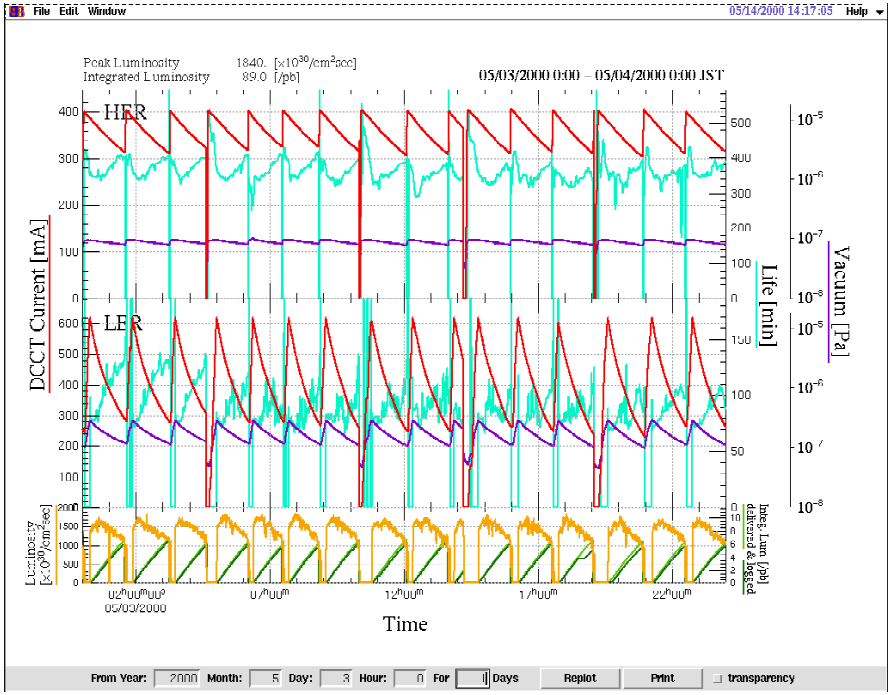
KEKB is an asymmetric electron-positron collider designed and running for B-meson physics.



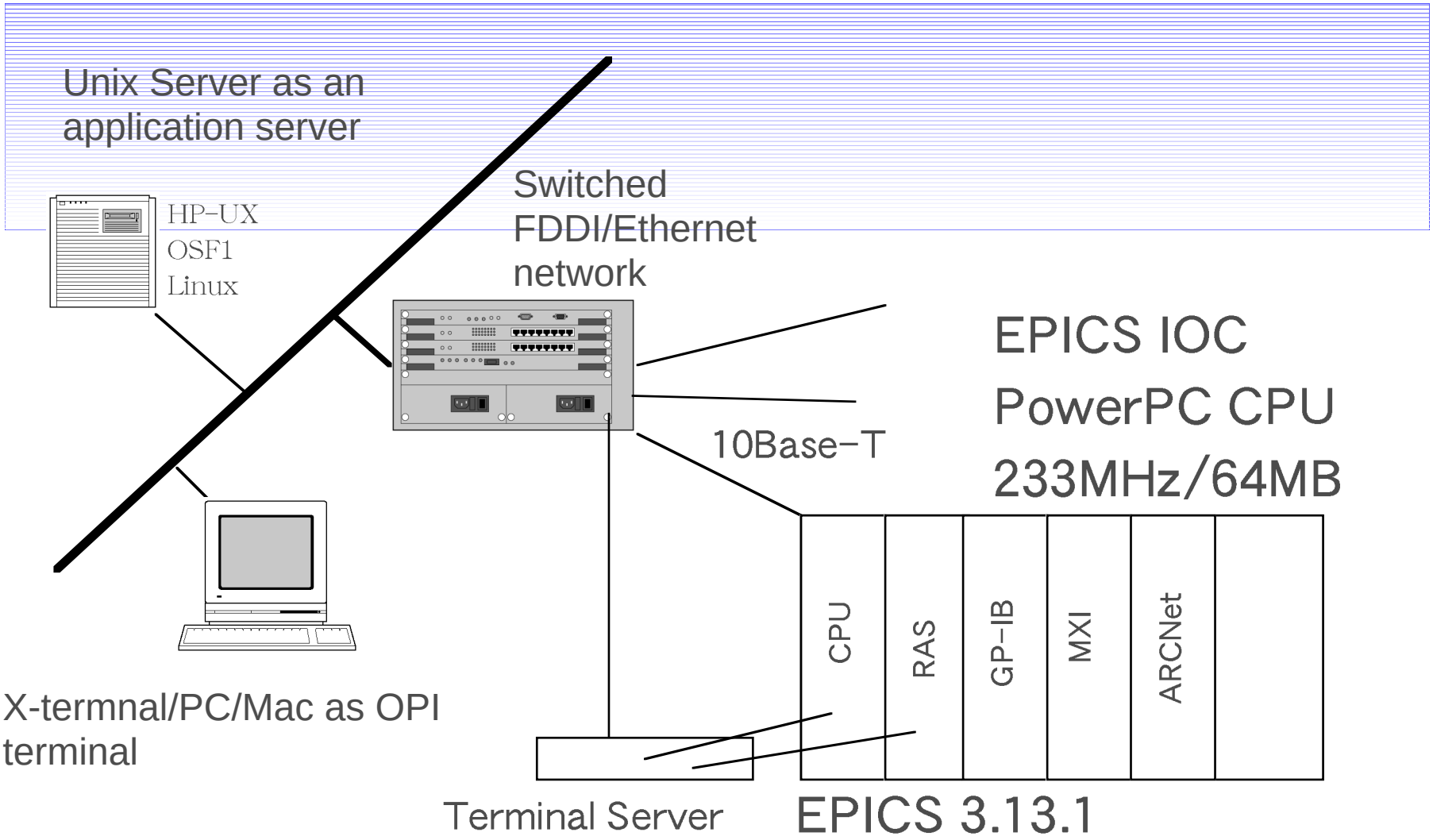
KEKB Status:

Running for the HE physics experiments

- Beam current 620mA(positron) x 400mA(electron)
- Peak Luminosity: 2e33 1/cm^2/sec
- Luminosity per day: 89 1/pb



KEKB control system status



Statistics:IOC

EPICS Records

- Total 242,597records on 94 IOCs [was 208,716 records on 90 IOCs]
- Max. 25,147 records on IOCMGD06
- Average 2,788.5 records [was 2,319]

Memory Usage on IOCs

- Allocated memory max. 48,149 KB(was 54,429 KB)
- Allocated memory min. 1,324 KB(was 1,309 KB)
- Allocated memory ave. 12,142 KB (4,594 KB)

EPICS related tools

- EPICS R3.13.1
  - Base
  - CAPFAST + e2db + dbLoadTemplate
  - medm.2.4.x, dm2k
  - StripTool/striptool
  - AR_cmd
  - probe
- ORACLE
- SAD/Tk
- Python/Tk
- Tcl/Tk

Statistics: Host Computers and Network

CPU load

- Load average 4-6 (was 15-20)
- Users 160
- Processes 900

Network Load

- around 2000 Packets/sec @ FDDI interface of a HP-UX host

Statistics:Software

Applications and Operator Display

	SAD	medm	python	misc	Total
In Top level Applications	141	74	42	6	263

Changes:HW

No Major change in HW

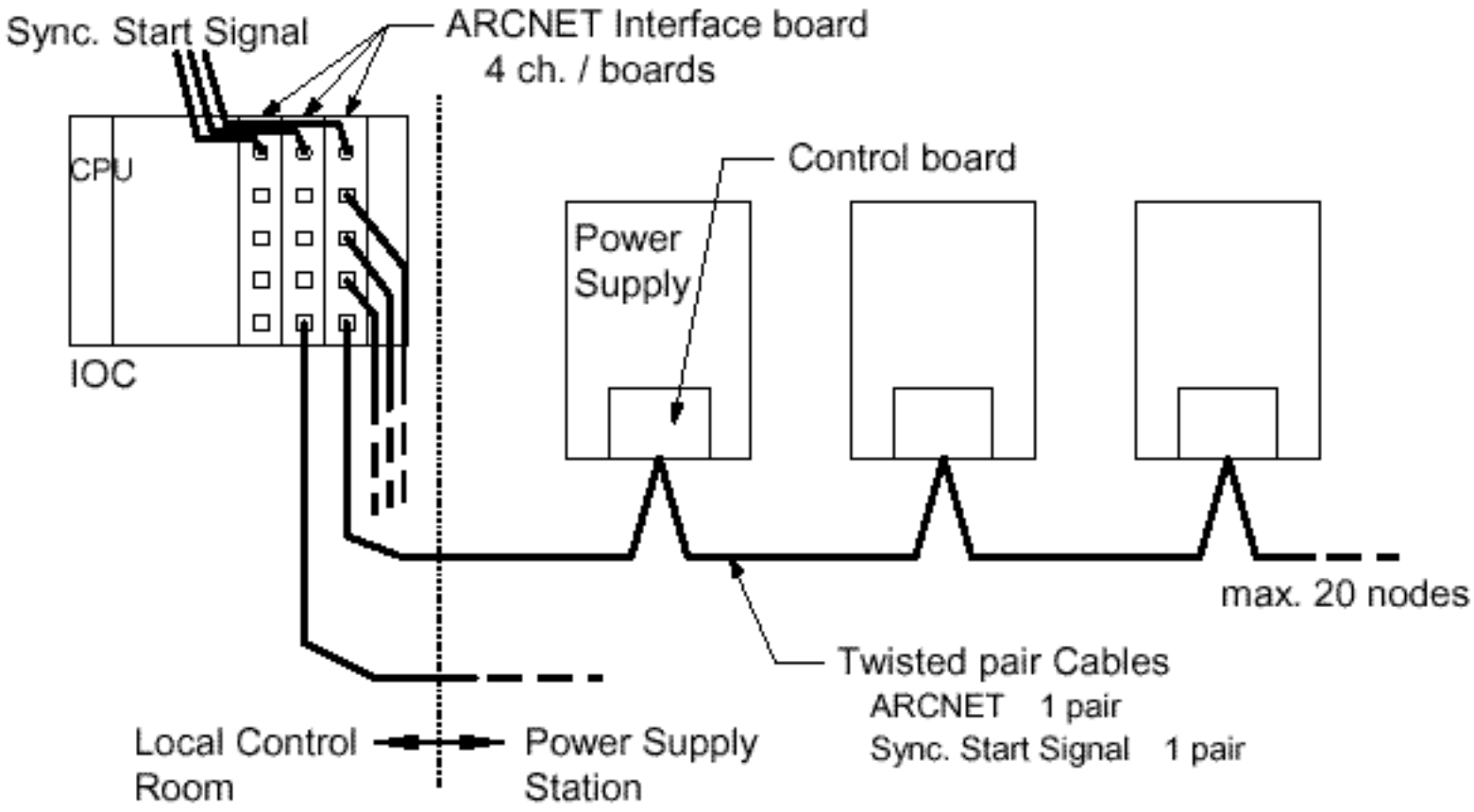
ARCNET HUB

- It enhanced stability of ARCNET operation(reduced number of automatic network reconfiguration)

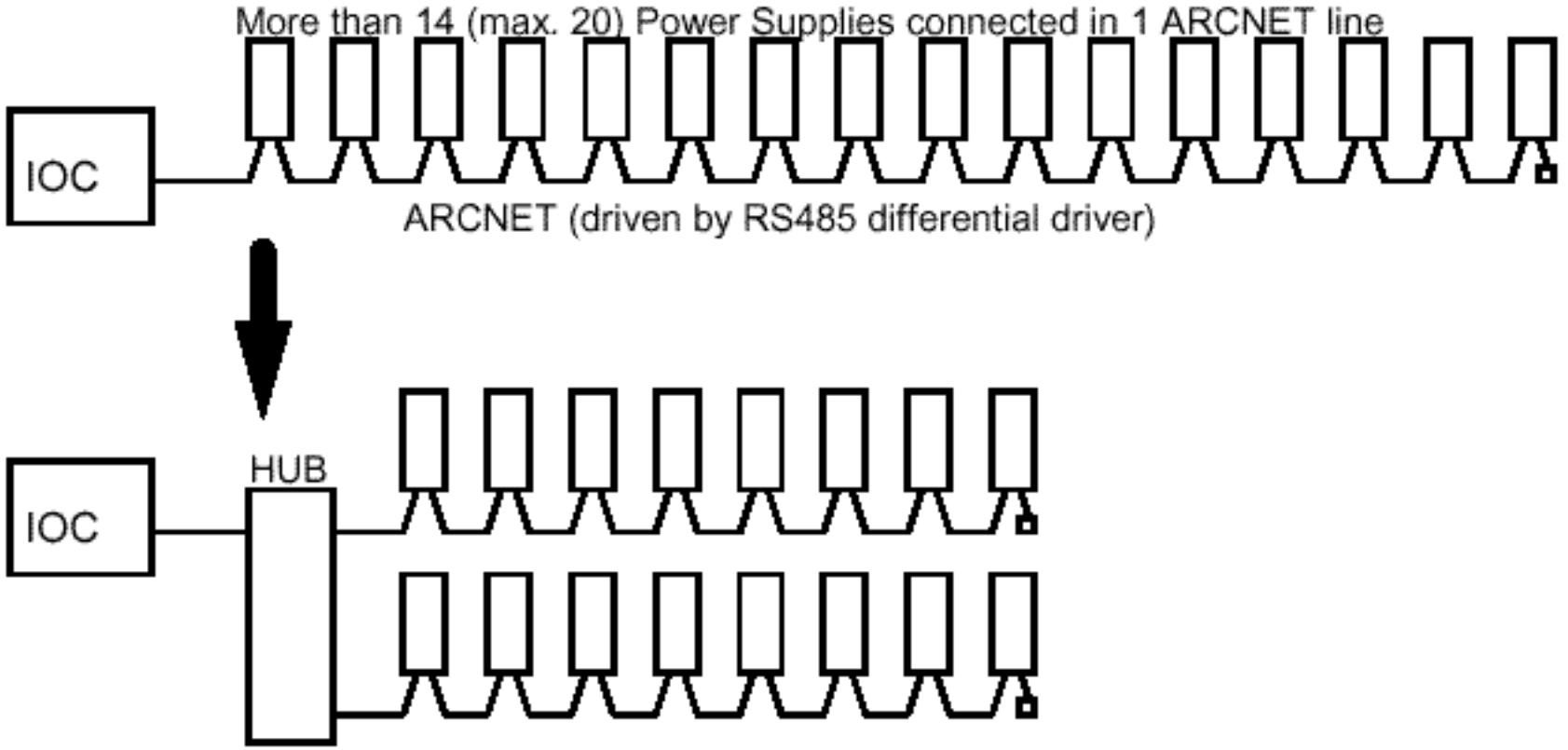
Additional WS and Storage for Operation

- Current WS in Control/Operation
  - 1 HP-UX WS
    - ORACLE
    - EPICS development
    - Operator interface
  - 3 Digital Unix WS and 3 Linux WS
    - Operator interface
    - Most optics related calculation

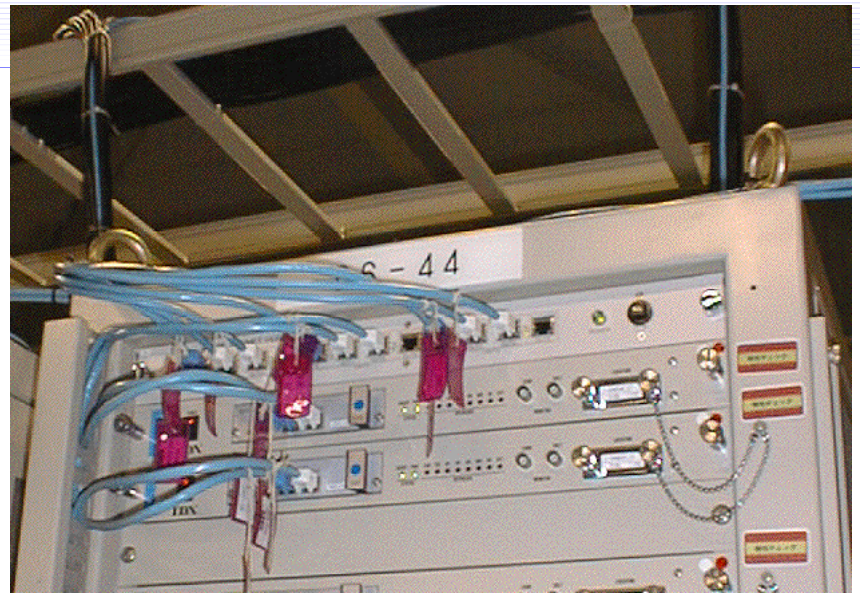
Configuration of Magnet Power Supply Control System



ARCNET HUB


More than 14 (max. 20) Power Supplies connected in 1 ARCNET line
IOC
ARCNET (driven by RS485 differential driver)
HUB
IOC

ARCNET HUB @ Work



ARCNET --- Magnet Power Supply Control

ARCNET HUBs were introduced for more stable operation.

Installation of HUBs

- A “HUB Box” contains 3 HUBs
- 33 HUB Boxes were installed for 97 ARCNET lines

(mainly for the steering magnet power supplies)

Number of ARCNET reconfiguration (by lost token)

- Without HUBs :10^2 times / day / 1 ARCNET line (worst case)
  (ARCNET reconfiguration does not mean loss of communication.)
- With HUBs :No reconfiguration observed

Changes:HW

No Major change in HW

ARCNET HUB

Additional WS and Storage for Operation

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  - 1 HP-UX WS
    - ORACLE
    - EPICS development
    - Operator interface
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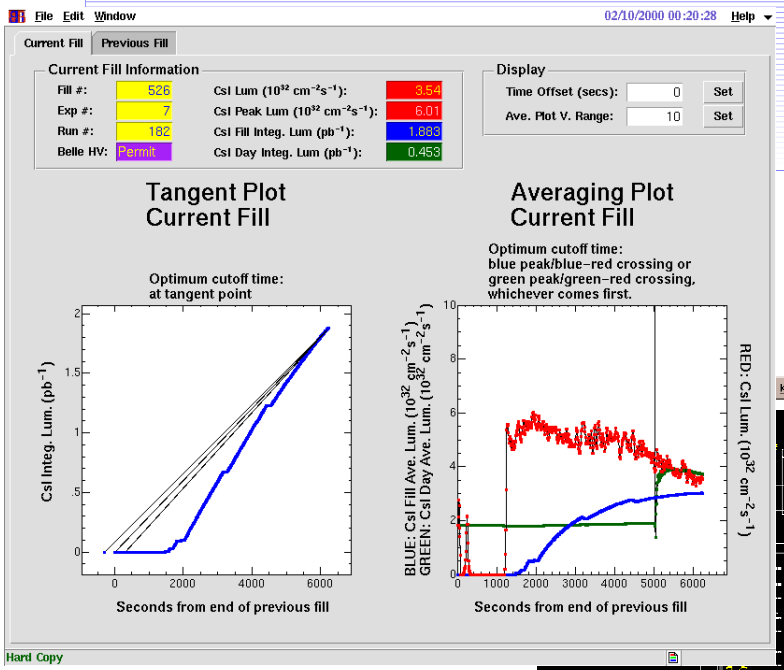
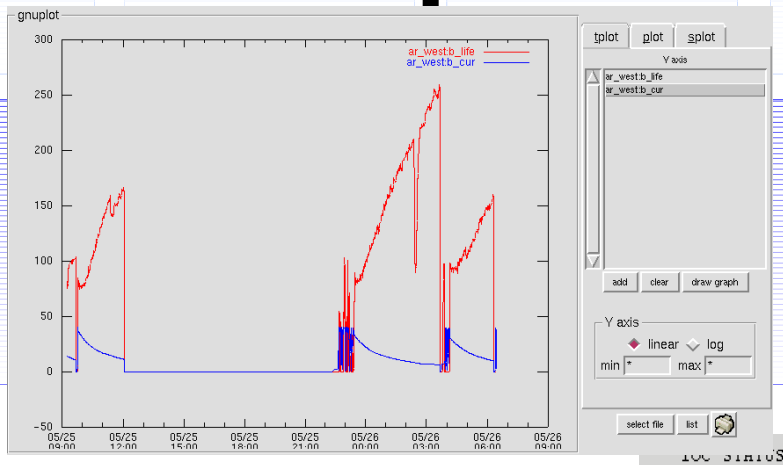
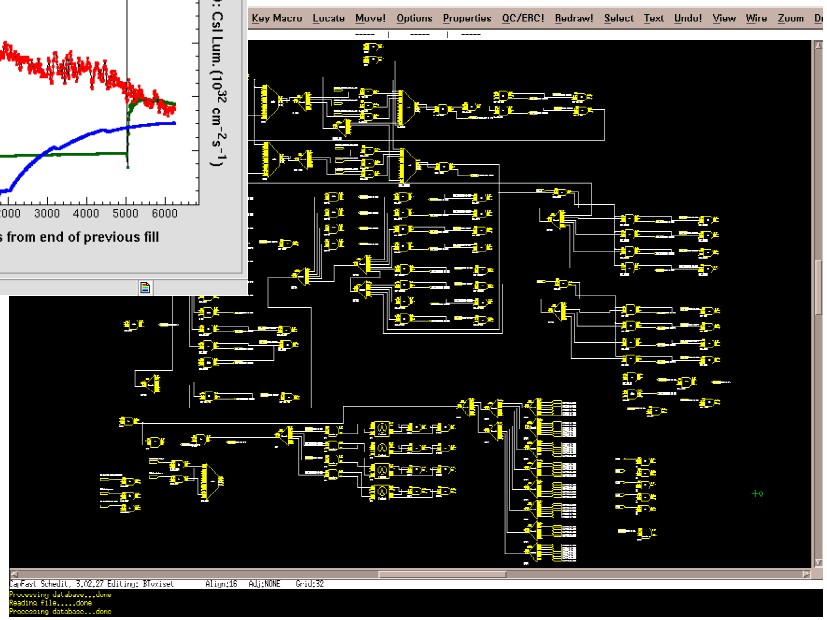
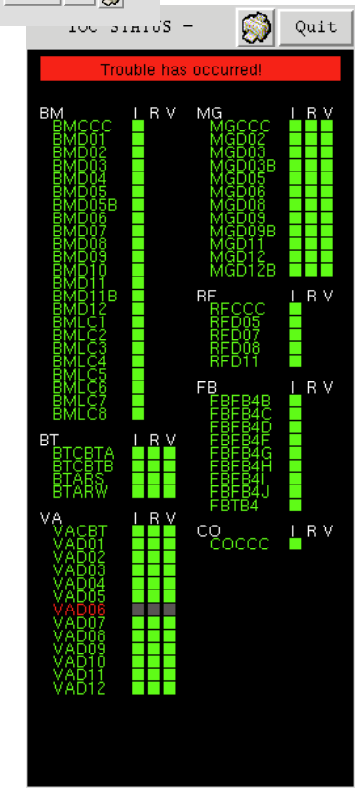
Examples of New/Improved Software









FPGA on ARCNET driver board

Update FPGA program on ARCNET driver board

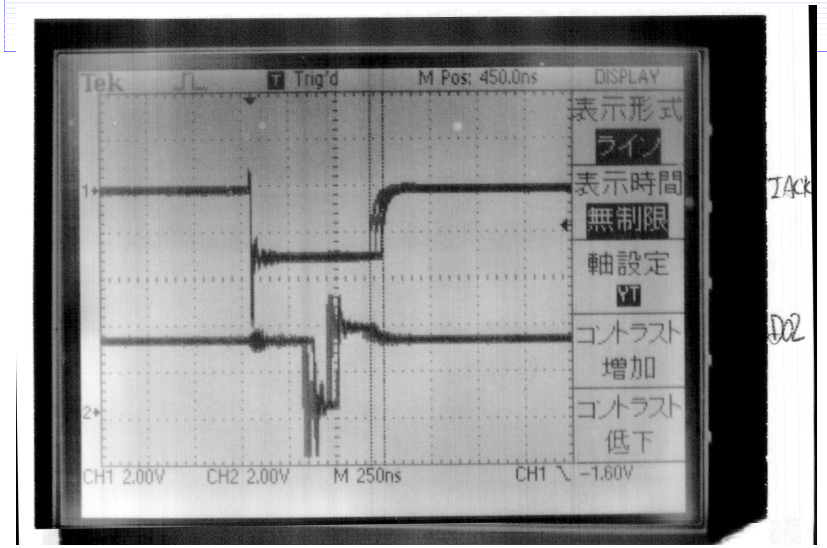
- The bug in the program prevents us from the operation of 8 ARCNET driver boards in the same IOC.
- Detailed analysis of signals on VME bus using an oscilloscope was needed to identify the source of the problem.

ARCNET driver: VME bus signal

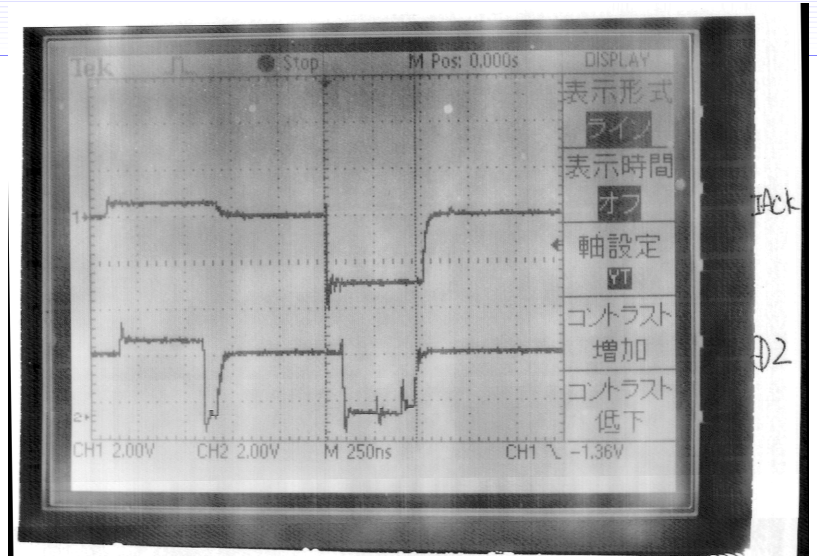
"Normal" Signal

IACK

D2



Abnormal Signal



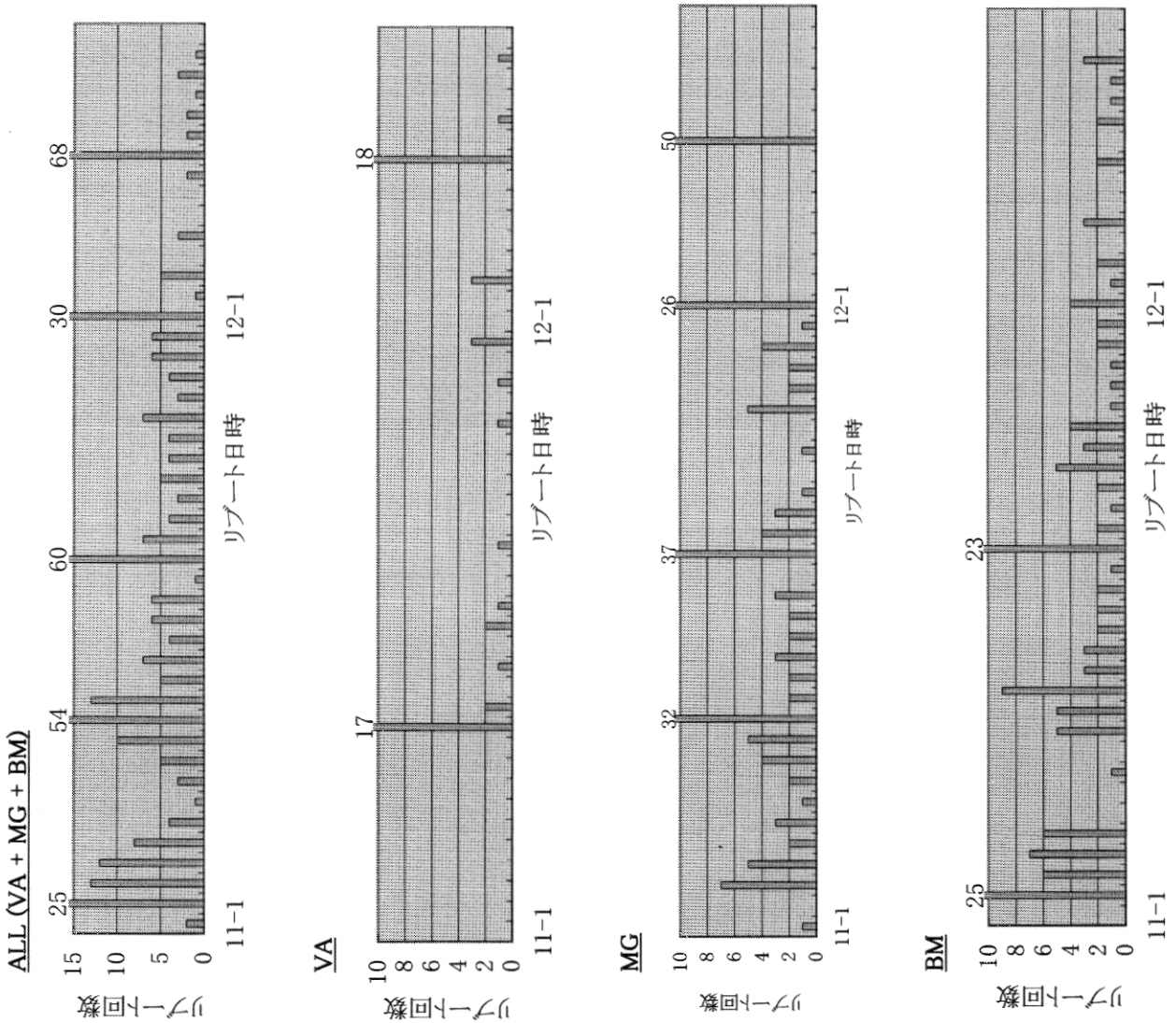
"Corrupt cmd in msg 5" in CA

In some situation, "Corrupt cmd in msg 5" appears on IOC log. When CA software outputs this message, it also consume small chunk of main memories on IOC and will not release it until IOC crashes.

It was found that one of network equipments responds to the CA name resolution(CA search) packet.

Solution of this is to reboot One particular Terminal server on the net.

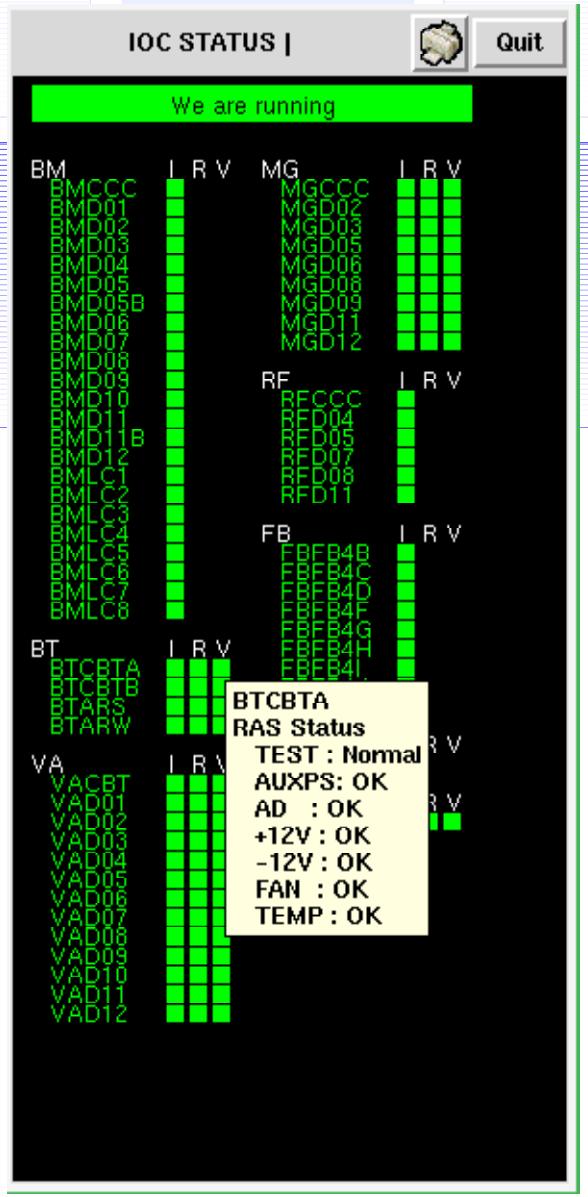
IOC reboots

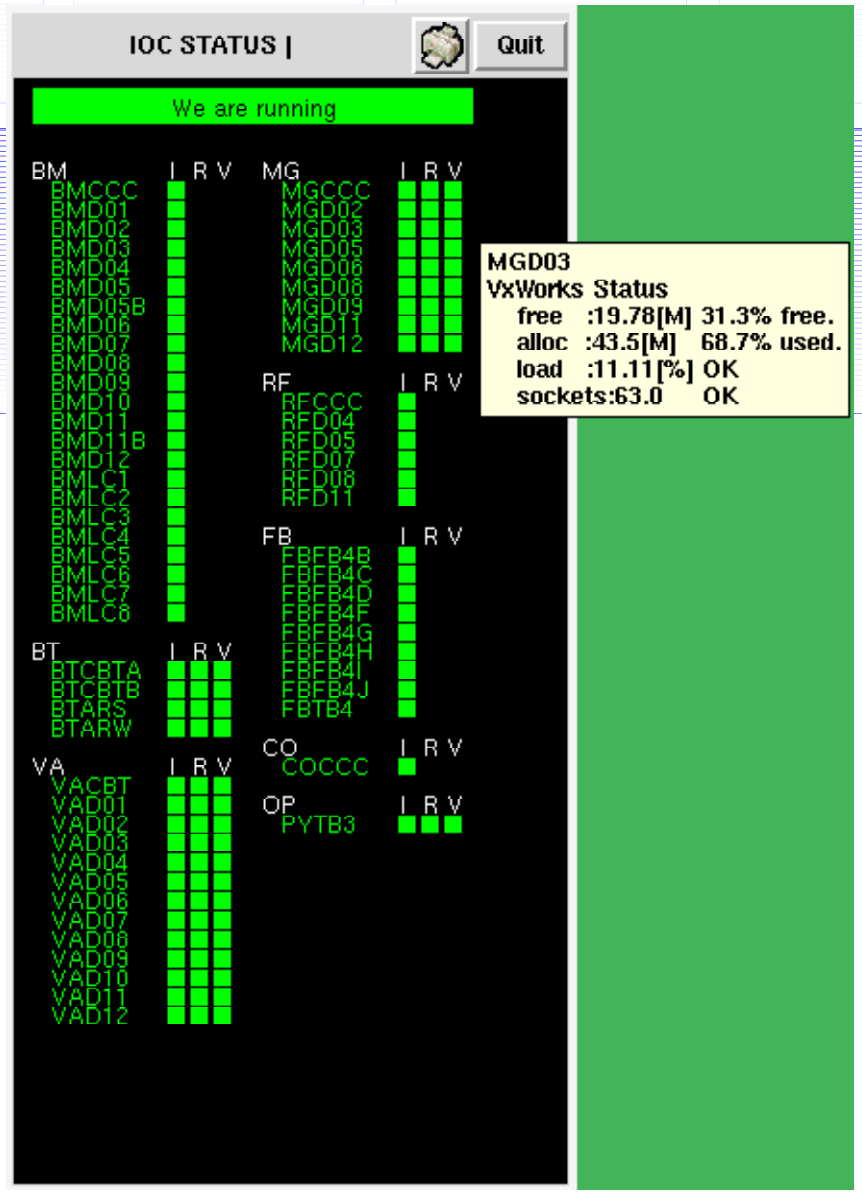


最近2ヶ月間のIOCリブート回数の変化 (1999.11.01 – 1999.12.15)

IOC status monitor

- Monitors a console port of IOC through Terminal server
- Monitors VxWorks status using devVXStats.c
- Timestamp record processed every second
- RAS board support

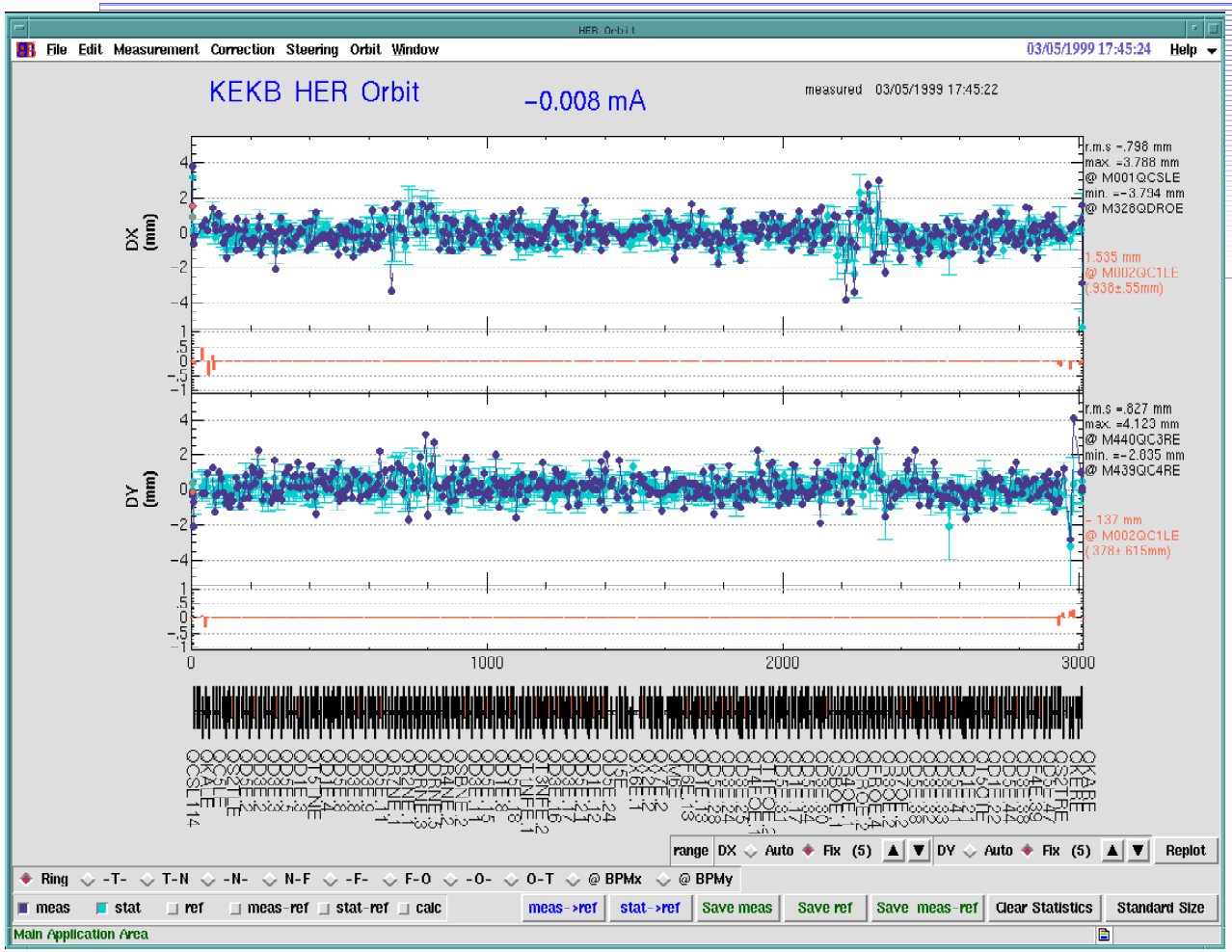

IOC STATUS |
Quit
We are running
BM I R V
BMCCC
BMD01
BMD02
BMD03
BMD04
BMD05
BMD05B
BMD06
BMD07
BMD08
BMD09
BMD10
BMD11
BMD11B
BMD12
BMLC1
BMLC2
BMLC3
BMLC4
BMLC5
BMLC6
BMLC7
BMLC8
MG I R V
MGCCC
MGD02
MGD03
MGD05
MGD06
MGD08
MGD09
MGD11
MGD12
RF I R V
RFCCC
RFD04
RFD05
RFD07
RFD08
RFD11
FB I R V
FBFB4B
FBFB4C
FBFB4D
FBFB4F
FBFB4G
FBFB4H
FBFB4I
BT I R V
BTCBTA
BTCBTB
BTARS
BTARW
VA I R V
VACBT
VAD01
VAD02
VAD03
VAD04
VAD05
VAD06
VAD07
VAD08
VAD09
VAD10
VAD11
VAD12
BTCBTA
RAS Status
TEST : Normal
AUXPS: OK
AD : OK
+12V : OK
-12V : OK
FAN : OK
TEMP : OK


IOC STATUS |
Quit
We are running
BM I R V
BMCCC
BMD01
BMD02
BMD03
BMD04
BMD05
BMD05B
BMD06
BMD07
BMD08
BMD09
BMD10
BMD11
BMD11B
BMD12
BMLC1
BMLC2
BMLC3
BMLC4
BMLC5
BMLC6
BMLC7
BMLC8
MG I R V
MGCCC
MGD02
MGD03
MGD05
MGD06
MGD08
MGD09
MGD11
MGD12
RF I R V
RFCCC
RFD04
RFD05
RFD07
RFD08
RFD11
FB I R V
FBFB4B
FBFB4C
FBFB4D
FBFB4F
FBFB4G
FBFB4H
FBFB4I
FBFB4J
FBTB4
BT I R V
BTCBTA
BTCBTB
BTARS
BTARW
VA I R V
VACBT
VAD01
VAD02
VAD03
VAD04
VAD05
VAD06
VAD07
VAD08
VAD09
VAD10
VAD11
VAD12
CO I R V
COCCC
OP I R V
PYTB3
MGD03
VxWorks Status
free :19.78[M] 31.3% free.
alloc :43.5[M] 68.7% used.
load :11.11[%] OK
sockets:63.0 OK

Sync. operation of Magnet

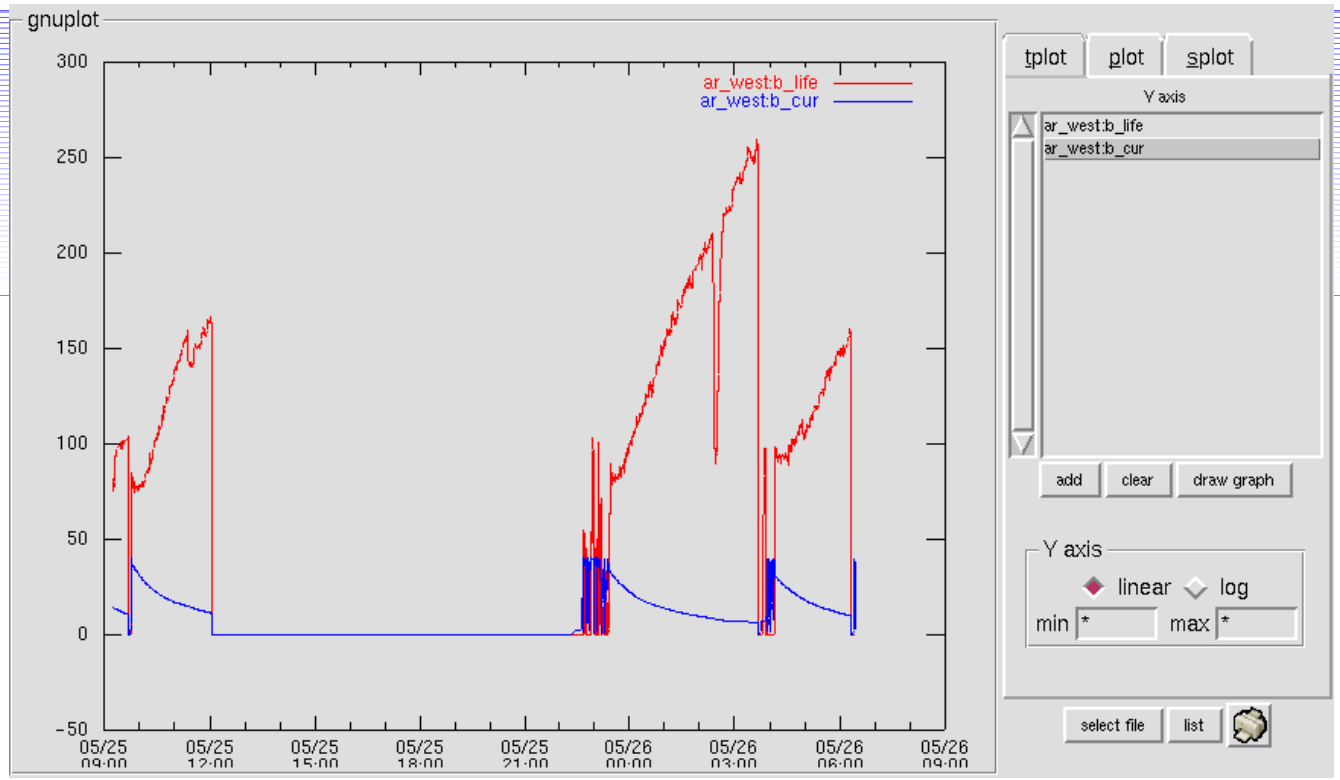
- Once ramp pattern is set to the each MG-PS controller, trriger pulse is sent to the PS to start PS ramp in synchronized way.
- Before setting the new value, the application(on WS) should get the semaphore for the modification of magnet setting and the trigger signal generation.
- Need Lock/Modify/commit/Unlock mechanism.
  - SyncSetServer (on Unix WS in Python + a few records on IOC)
  - Network Semaphore (on VxWorks)

SAD Application Example



Beam orbit correction application. read BPM readings and calculate new setting of orbit correctors.

ARR.py/ ARR_plot.py



ARR.py/ ARR_plot.py

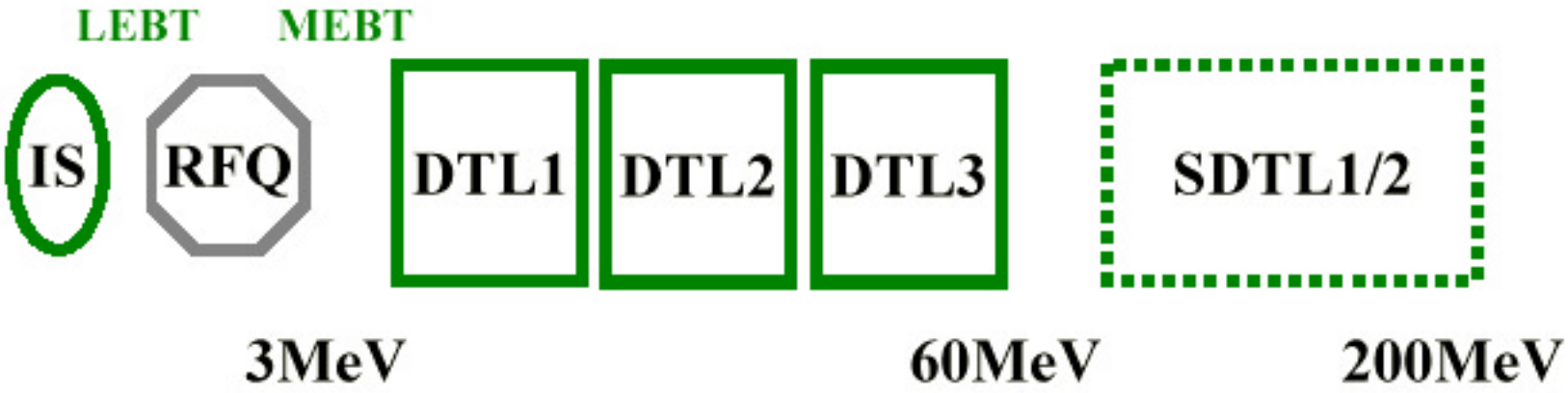
JAERI-KEK Joint project

- KEK's JHF (Japane Hadron Facility) project and JAERI's NSP(Neutron Science Project)
- It is a High-Intensity Proton Accelerator.
- This project have not been approved yet
- 60-MeV LINAC is now under construction at the KEK site
- More info. on JAERI-KEK joint project can be found at
  - http://www.jaeri.go.jp/english/press/990528/index.html

60 MeV Linac (KEK)

JAERI-KEK
Joint Project
Control

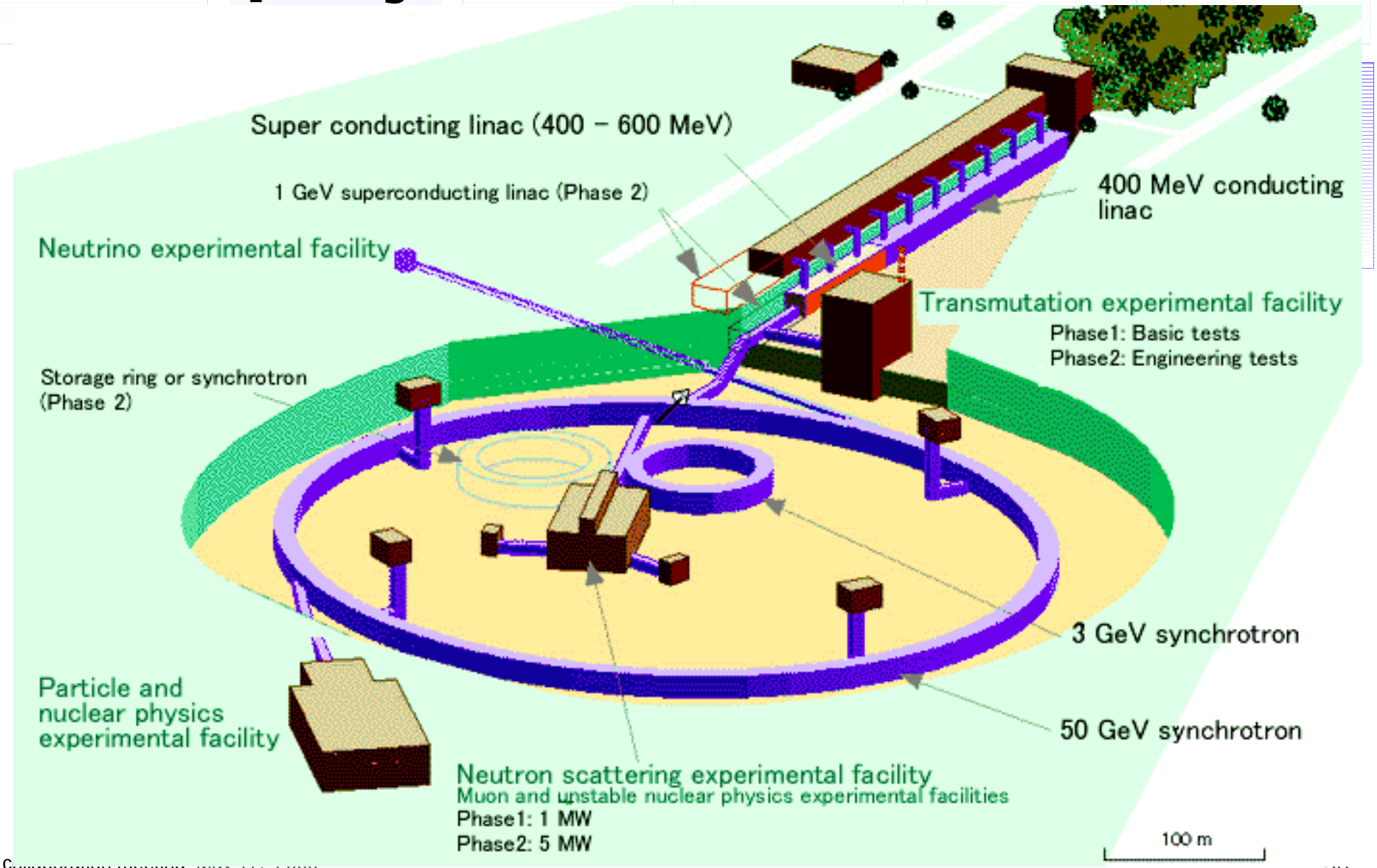
The construction of the LINAC building was completed in April, 2000.



May-17-2000

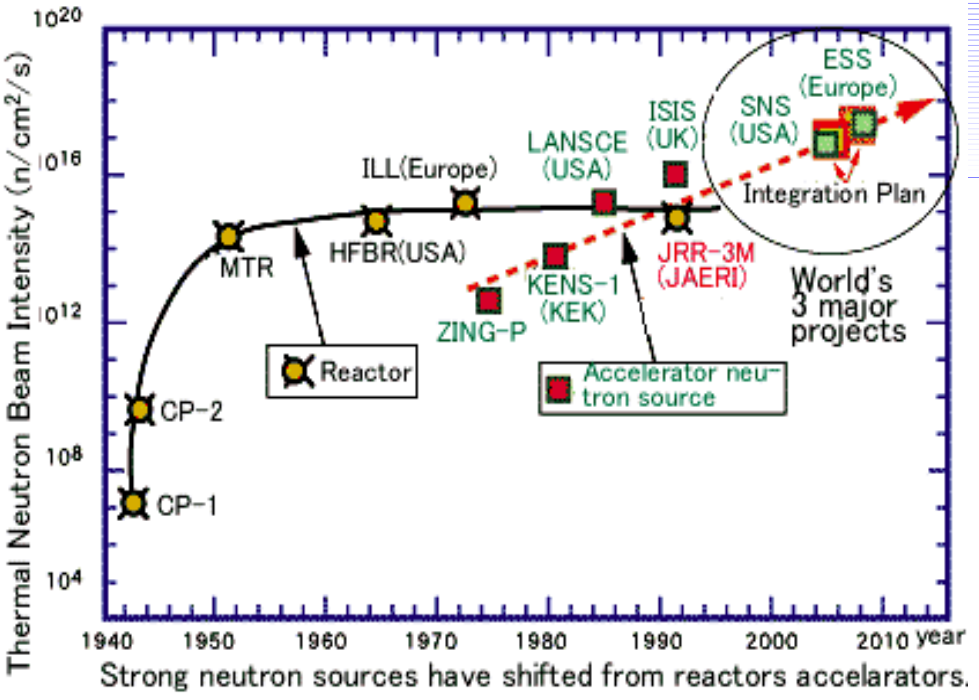
J.Chiba (KEK)

Joint project Accelerator Plan



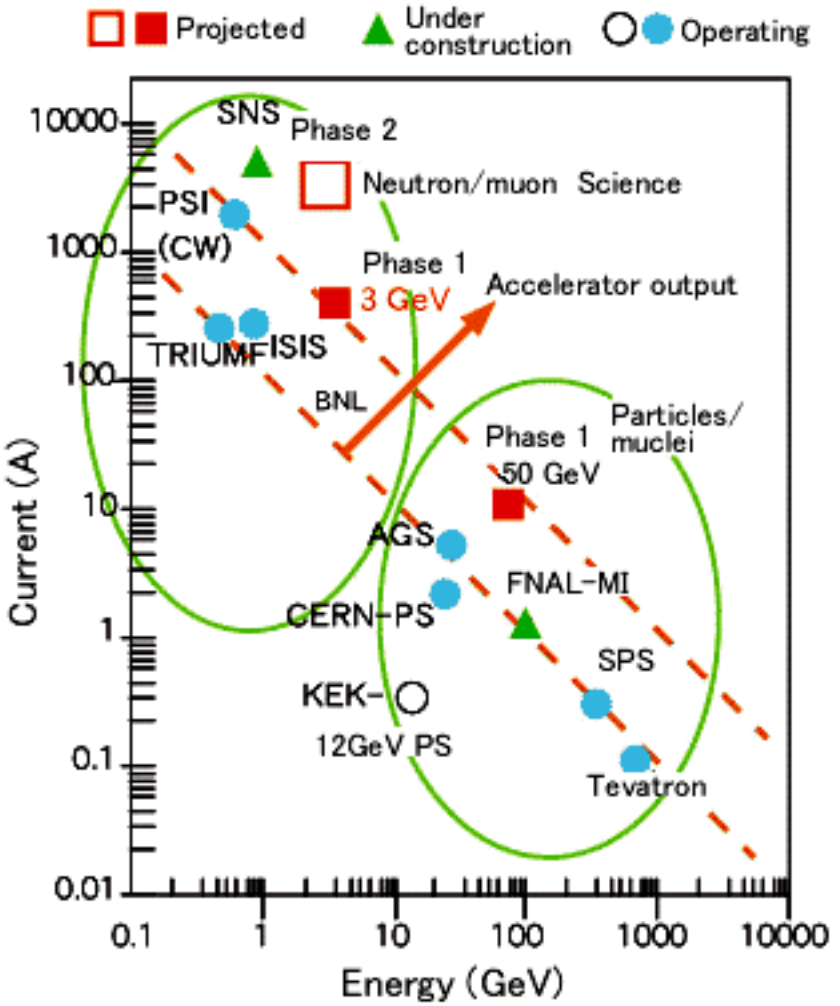
Present Status in the World

Development of Research-Purpose Neutron Sources



USA: SNS project (1 MW). Under construction. Completion scheduled in 2006.
Europe: ESS project (5 MW). At R&D stage.

Major High Energy Proton Accelerators in the World



EPICS seminar in Shanghai

Participants

38 participants

- 30 from China (SSRC, NSRL and IHEP)
- 1 from Korea (POSTECH)
- 1 from Tahiland (NSRC)
- 6 from JAPAN

Time Table

EPICS Seminar in Shanghai

	Monday, 8/28	Tuesday, 8/29	Wednesday, 8/30	Thursday, 8/31	Friday, 9/1
9:00	on Accelerator Control systems. by T. Katoh	EPICS manager tasks (by N. Yamamoto)	Database Practice (Intro) by T. Nakamura	Sequencer and SNL by T. Nakamura	Portable CA Server by. K. Furukawa
	EPICS Overview (part-1) by N. Yamamoto		Database Practice		
	Break	Break		Break	Break
10:30 –	EPICS Overview (part-2) by N.Yamamoto	High Level Application Development tools by N. Yamamoto		Sequencer and SNL Practice	Portable CA Server(cont.)
11:45-13:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00 –	EPICS system example:KEKB by T.Nakamura	EPICS Database by T. Namamura	CA Client Lecture by. K. Furukawa	Record/Device/Driver Support (lecture) by. J.-I. Odagiri	Channel Archiver by N. Yamamoto
				Break	Break
	Break	Break	Break	Record/Device/Driver Practice	Q/A
14:45-	Display Manager Overview (incl. short practice) by N.Yamamoto	IOC application development/Debugging + Practice by. J.-I. Odagiri	CA Client Practice		
16:30					