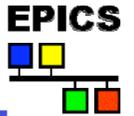
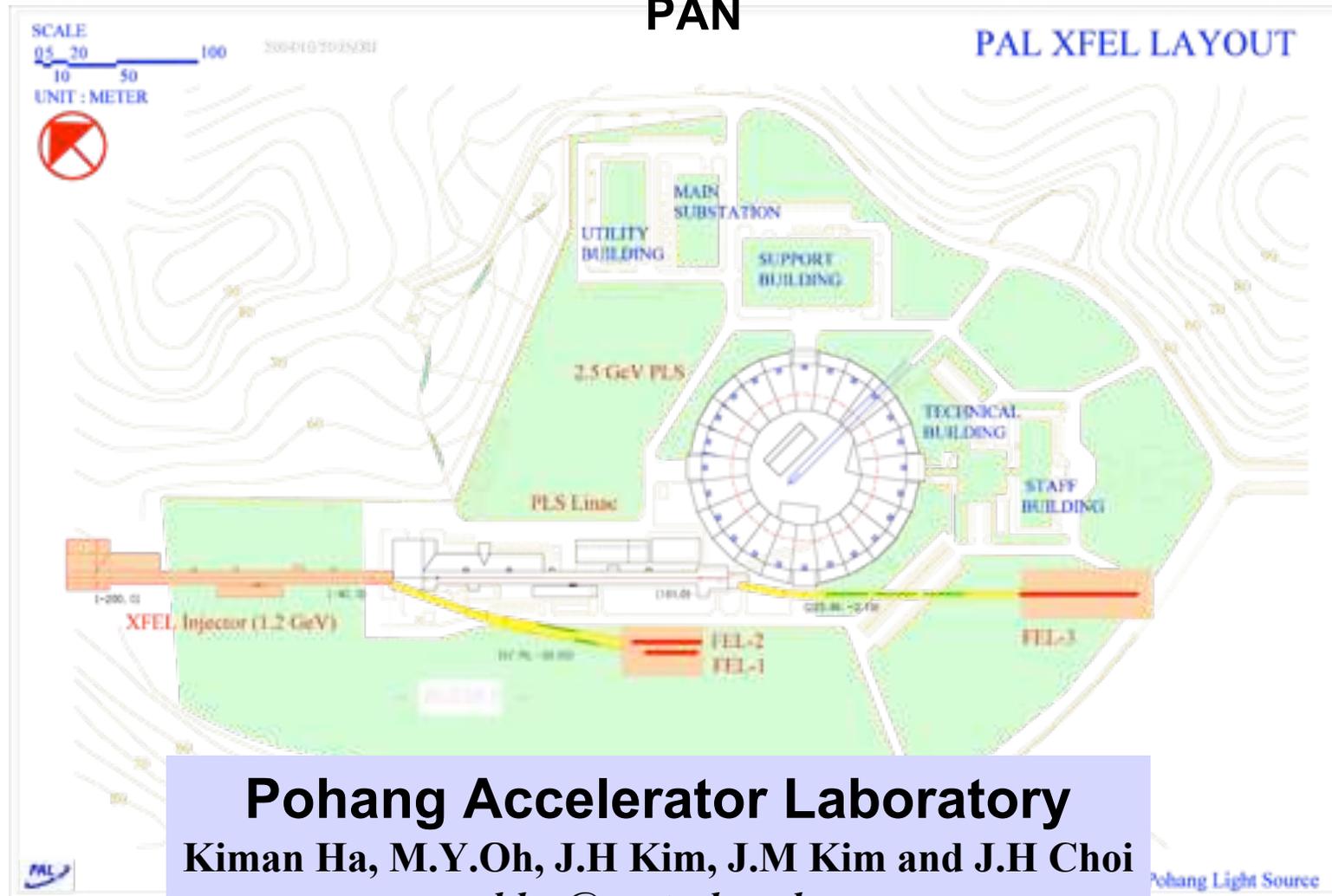


PLS Power Supply control and upgrade plan

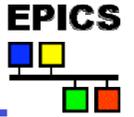


EPICS collaboration meeting 2004 Dec 8 - 10 , 2004 RICOTTI, Tokai, JAPAN



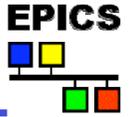
Pohang Accelerator Laboratory
Kiman Ha, M.Y.Oh, J.H Kim, J.M Kim and J.H Choi
hkm@postech.ac.kr

Outline



- Status of orbit feedback**
- Present status of power supply control**
- Digital power supply upgrade plan**
- Hardware review and test result**
- Summary**

Orbit feedback status



-Orbit feedback operation started for user service in November

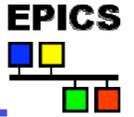
-Orbit stability with feedback(RMS)

- short term (1 hour) : $< 1 \mu\text{m}$

- long term (12 hours) : $< 3 \mu\text{m}$

-Both V and H corrector PS's are involved for feedback

Present PS upgrade status



-Upgrade status

- .Kept vertical Orbit Stability less than $3 \mu\text{m}$ by feedback operation

- .Replaced 22 sets of Corrector PS and their Control system in September

-EPICS Control and embedded controller

- .Collaboration with BESSY-II (Ralph, Ingo) and Kristi(SLAC)

- .Same as BESSY-II, 24Bit DAC Controller

- .CANbus field bus with EPICS IOC

- .Event System for PS time synchronization

Next plan of power supply upgrade

-Requirements of corrector PS

- .Fast Corrector control system(>1kHz)
- .Vertical PS need 20bit of step resolution
- .Horizontal PS need 16bit step resolution

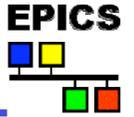
-2005, will replace all vertical PS

- . 2ppm step resolution
- . +/-10ppm long term stability

-Feed-forward for ID gap changed

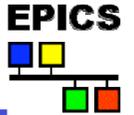
- .Install steering magnet
- . +/-5A 16bit 1kHz bandwidth PS

Fast Control System requirement



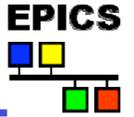
- PS : >1kHz BW, > 18bit output resolution**
- 1 to 5kHz set point**
- Event system synchronization**
 - >BPM measurement**
 - >PS control trigger**
- Fast beam position and feedback algorithm processing**

Background of Digital PS development



- Implementation of modern power converter technology
 - .Recent DSP&FPGA show very powerful performance
- Requirements of beam physicists for orbit stabilization
 - .Slow, fast, and epics based robust control system
- High speed control applications: >4kHz
- High output resolutions: >18bit
- Low cost and small number of hardware components
 - .Reduce error source
 - .Easy maintenance

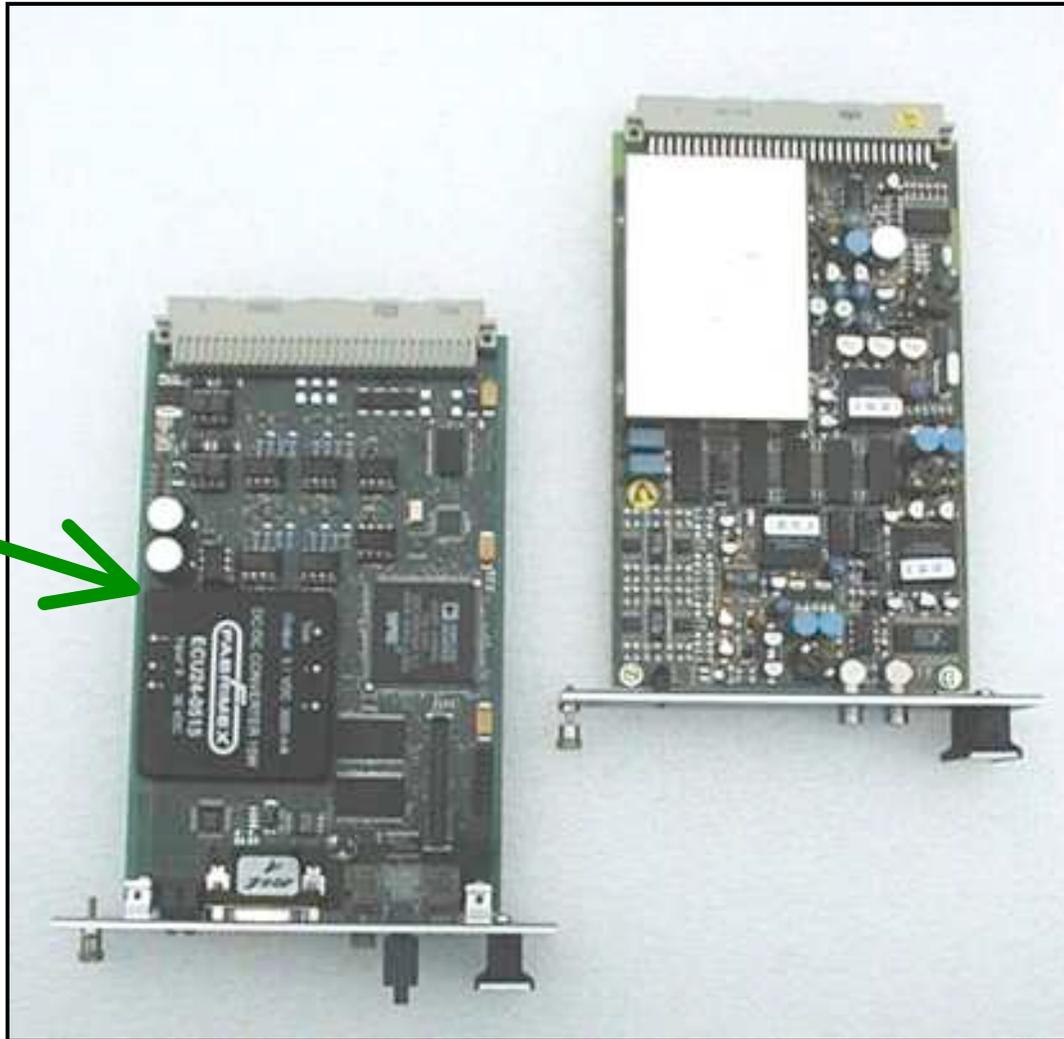
Digital Controller Advantage



- Modern digital technology(DSP, FPGA,ADC)**
- Cost effective and precise power supply**
- High flexibility and modularity**
- High functionality**
- Built in all functions for PS**
 - .Current regulator(PI, feed forwarder)**
 - .Direct PWM generation**
 - .Fast control port**
 - .Analog, Digital I/O**

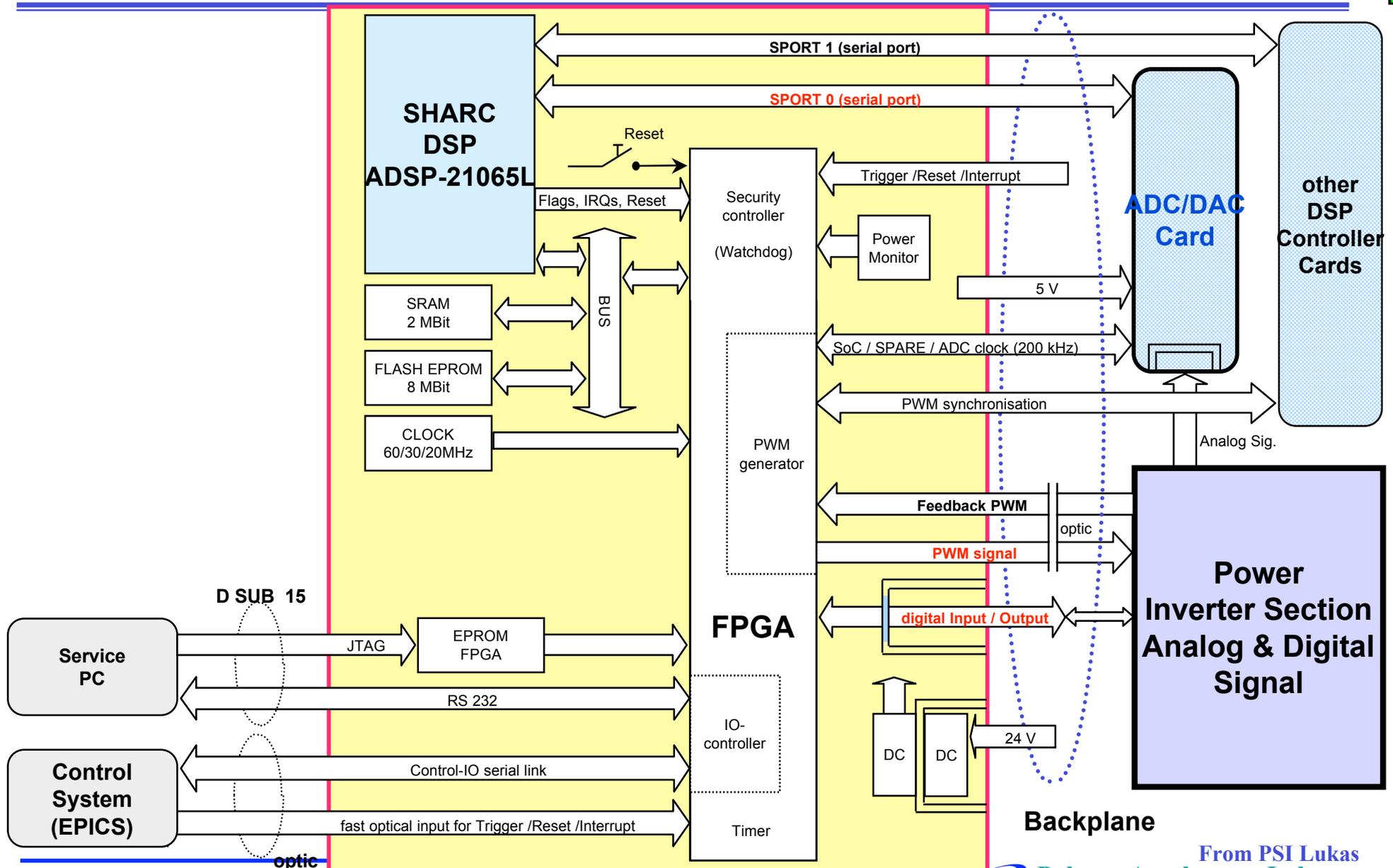
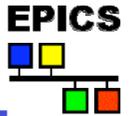
Digital Control Unit

DSP-controller
incl. FPGA
16 Bit Digital
Out
8 bit Digital
Input
1 RS232
1 Fiber optics

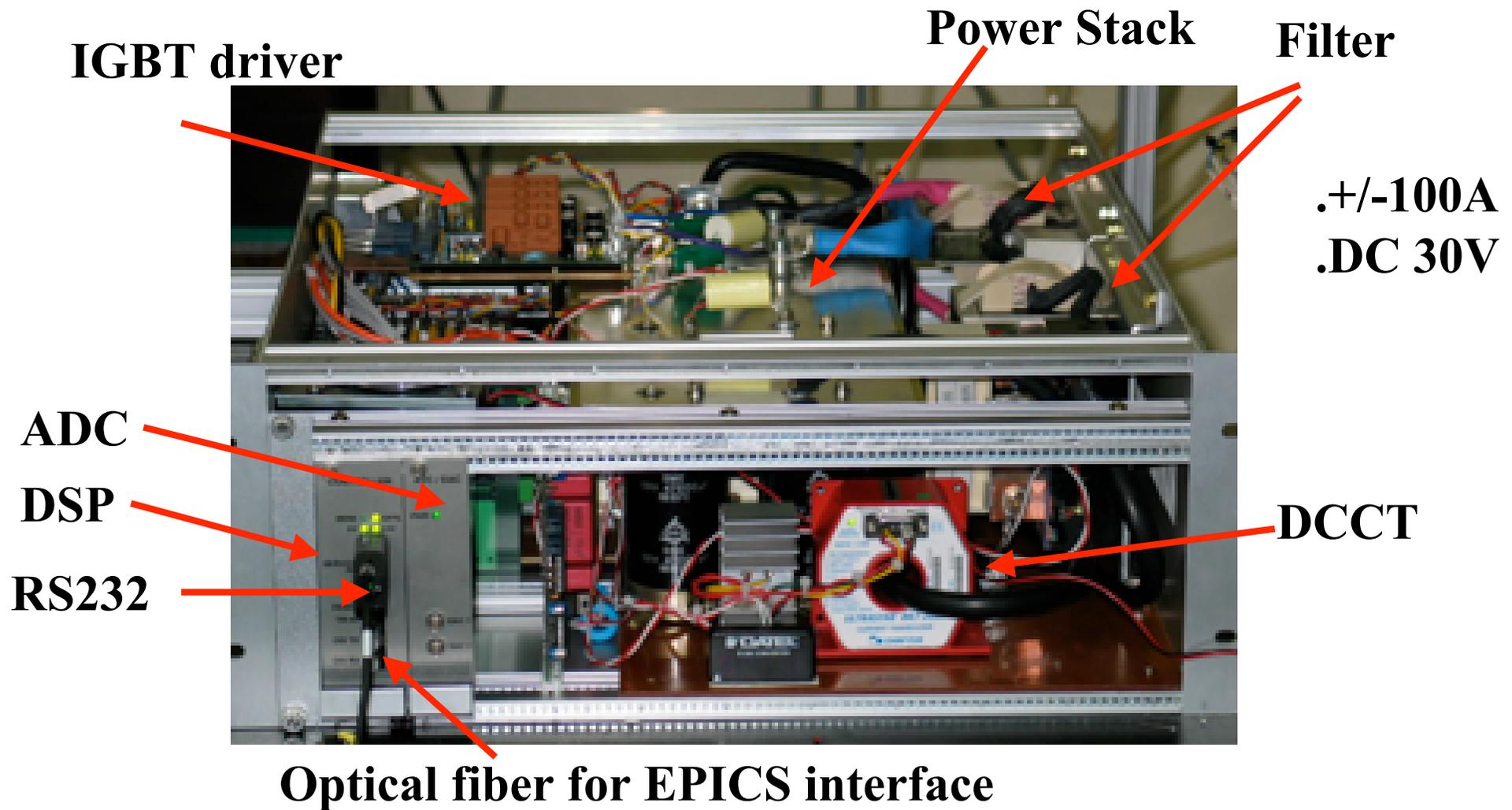
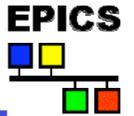


Analog- Digital-
Converter
8 Analog Input
2 Analog Output

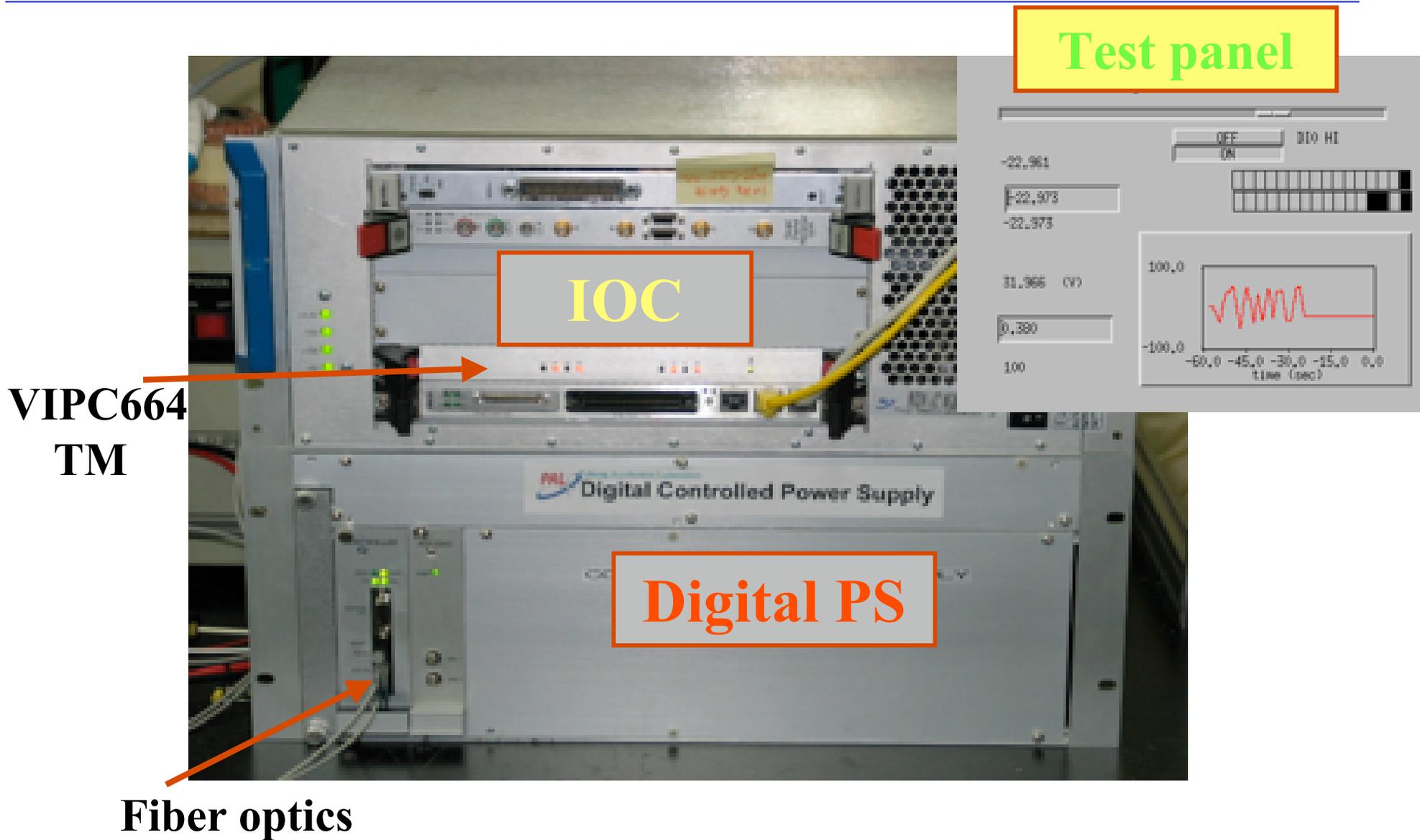
Block diagram of Controller Card without software functions



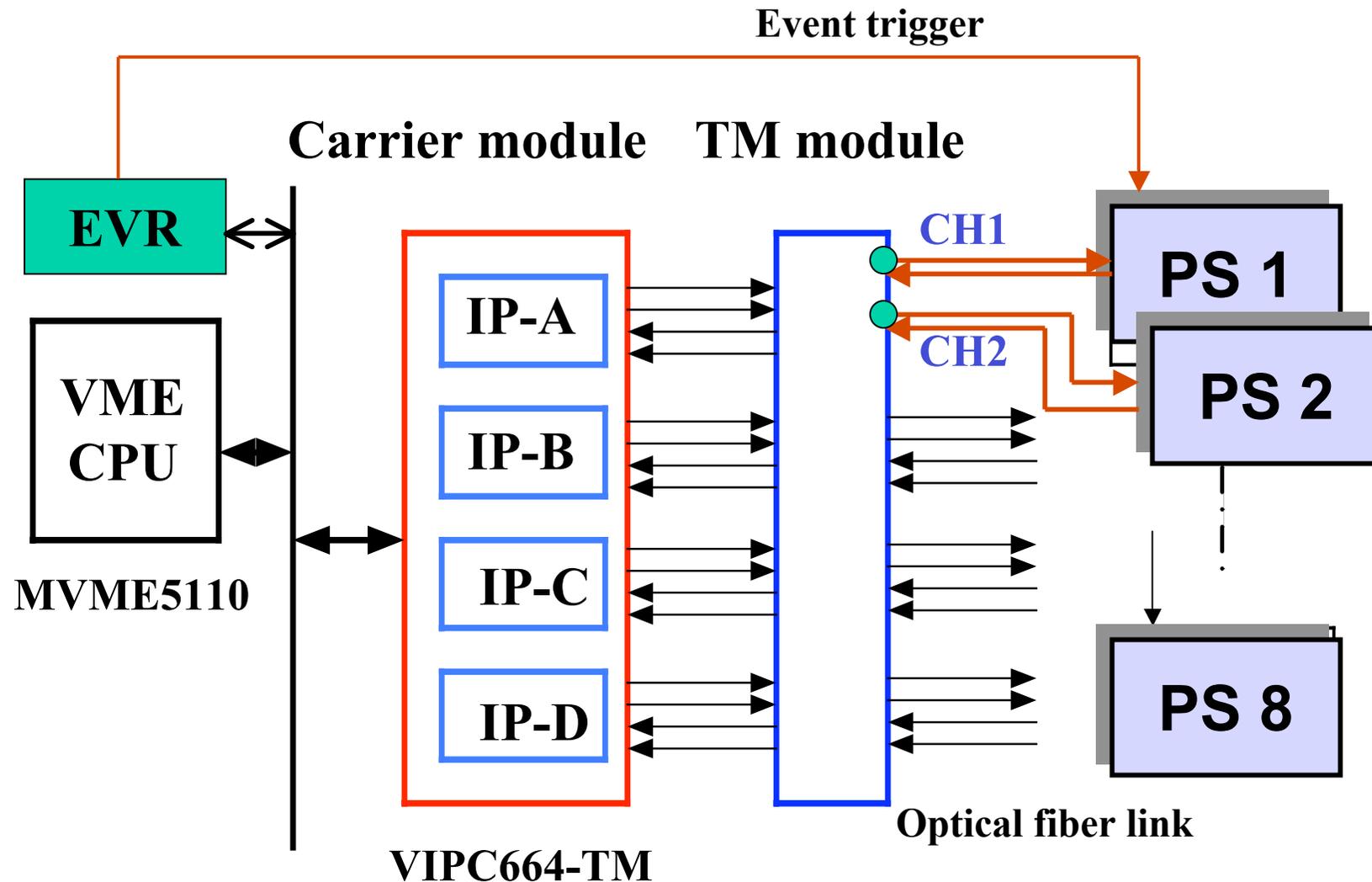
Prototype of Digital PS for PLS



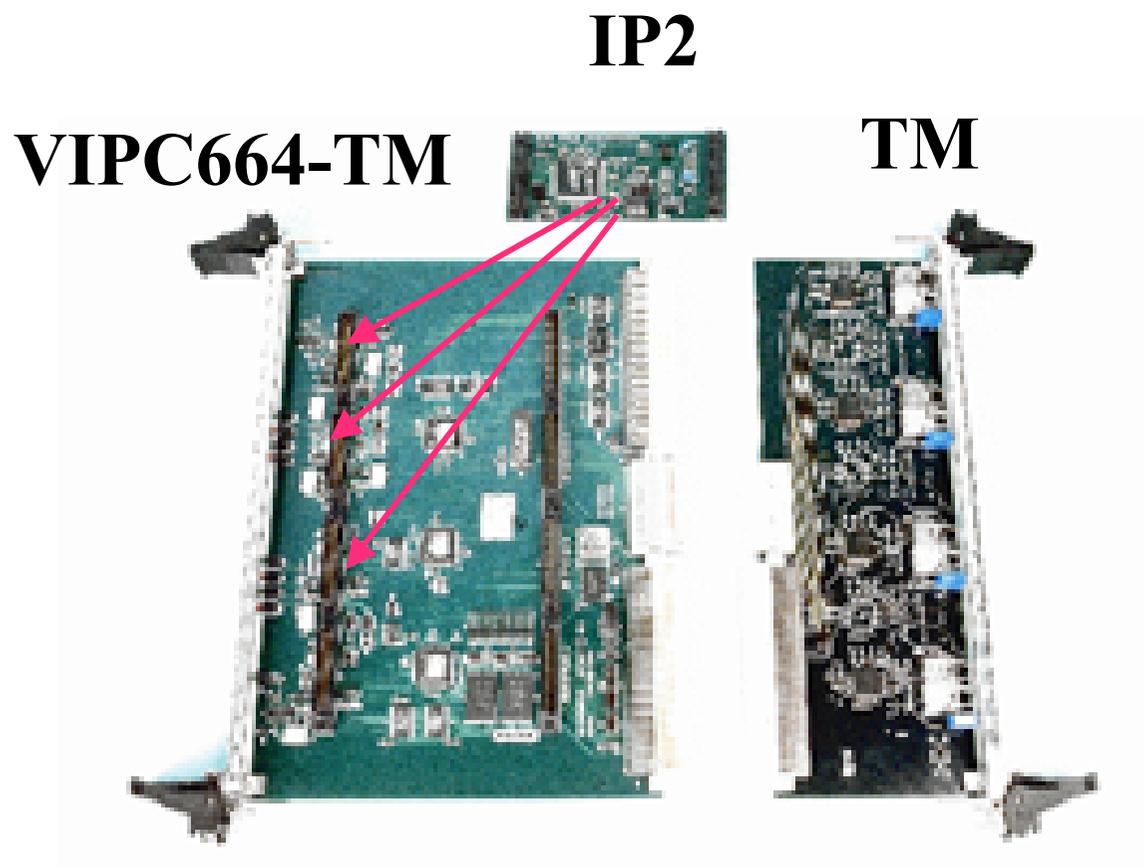
IOC control test



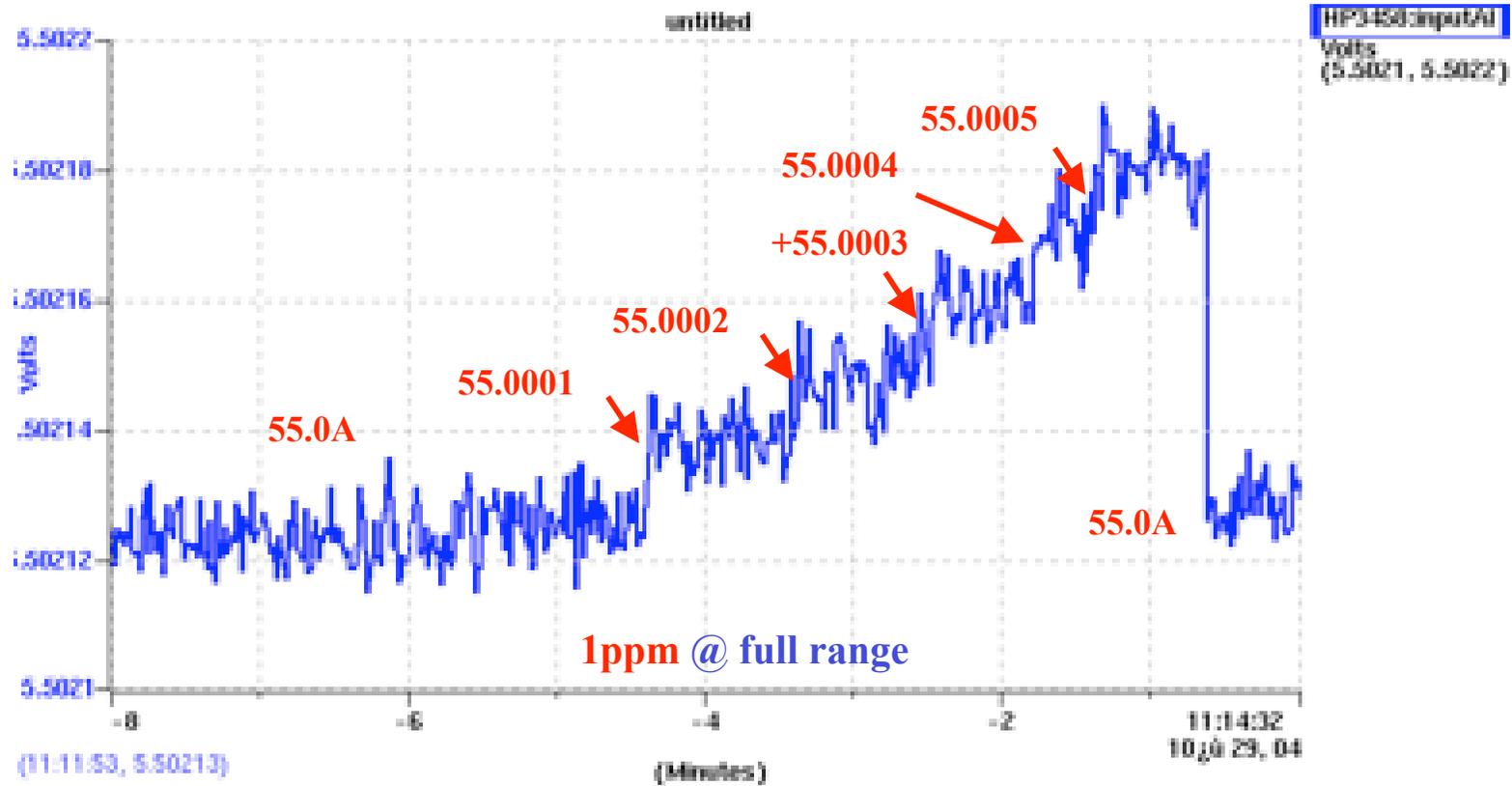
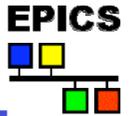
IOC and PS configuration



Control hardware components



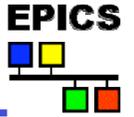
Step response test



V*10 is Amps

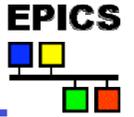
Step response @55(A), 100uA step(1ppm)

Summary



- The PLS orbit feedback operation is based on EPICS control system.
- CANbus IOC and control are working well without any problem
- Satisfactory result of prototype Digital controlled PS
- Next Digital PS will be operated for orbit feedback
- This high performance PS technology will be helpful for our new project, 4th generation PAL-XFEL

Overview



PLS(Pohang Light Source) has successfully upgraded storage ring straight section 20bit power supplies and control system for global orbit feedback operation in collaboration with BES Y-II.

Now we are looking for EPICS based fast control system and cost effective precise digital controlled power supply in collaboration with PSI and DIAMOND.

I will present the current status of PLS global orbit feedback system, and experimental results of 1ppm resolution digital controlled power supply for the next upgrade of PLS.