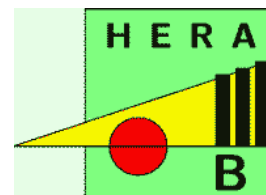


# **IX International Conference on Calorimetry in Particle Physics**

Annecy-France  
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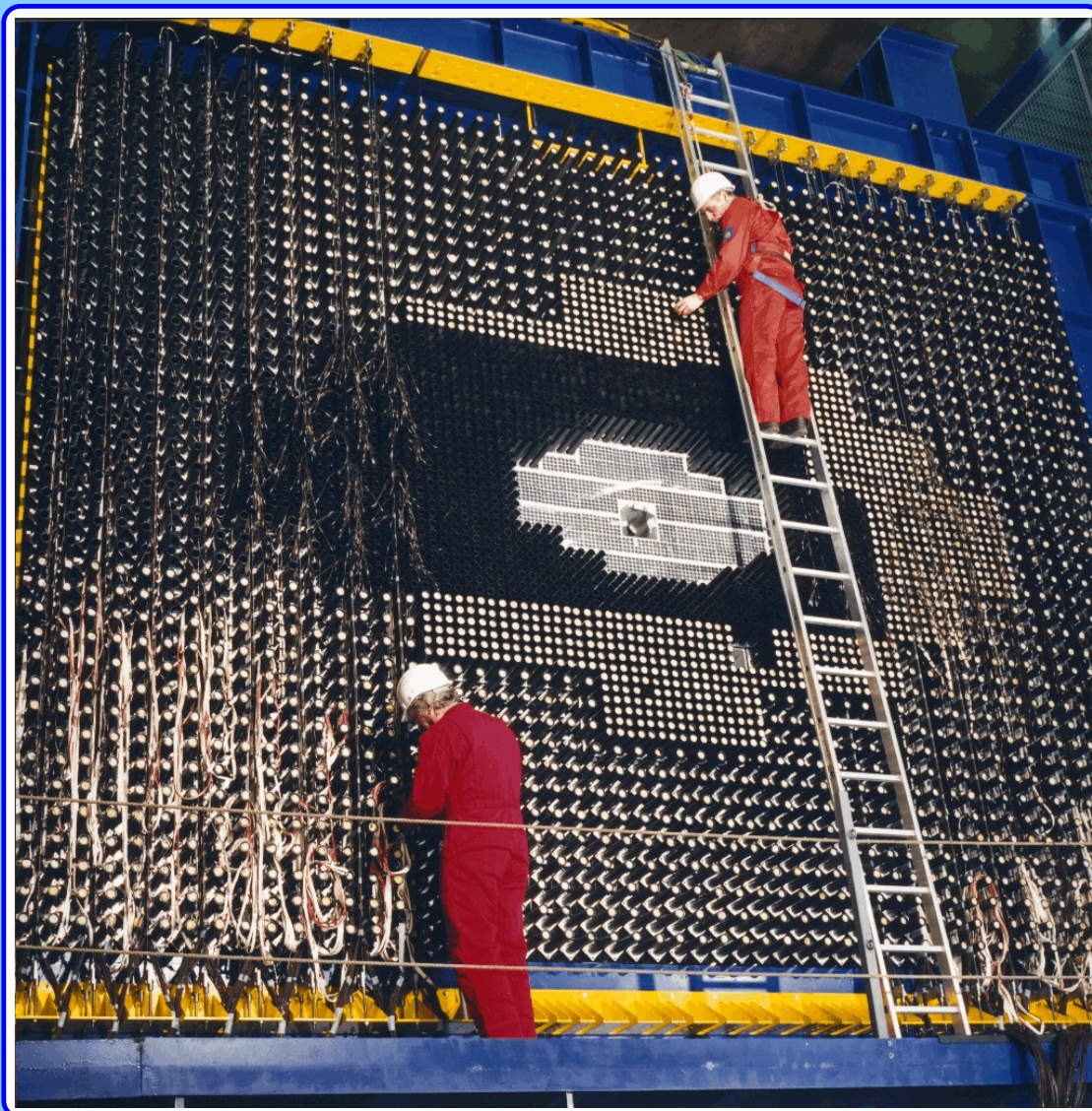
## **HERA-B ECAL Electronics and Monitoring**



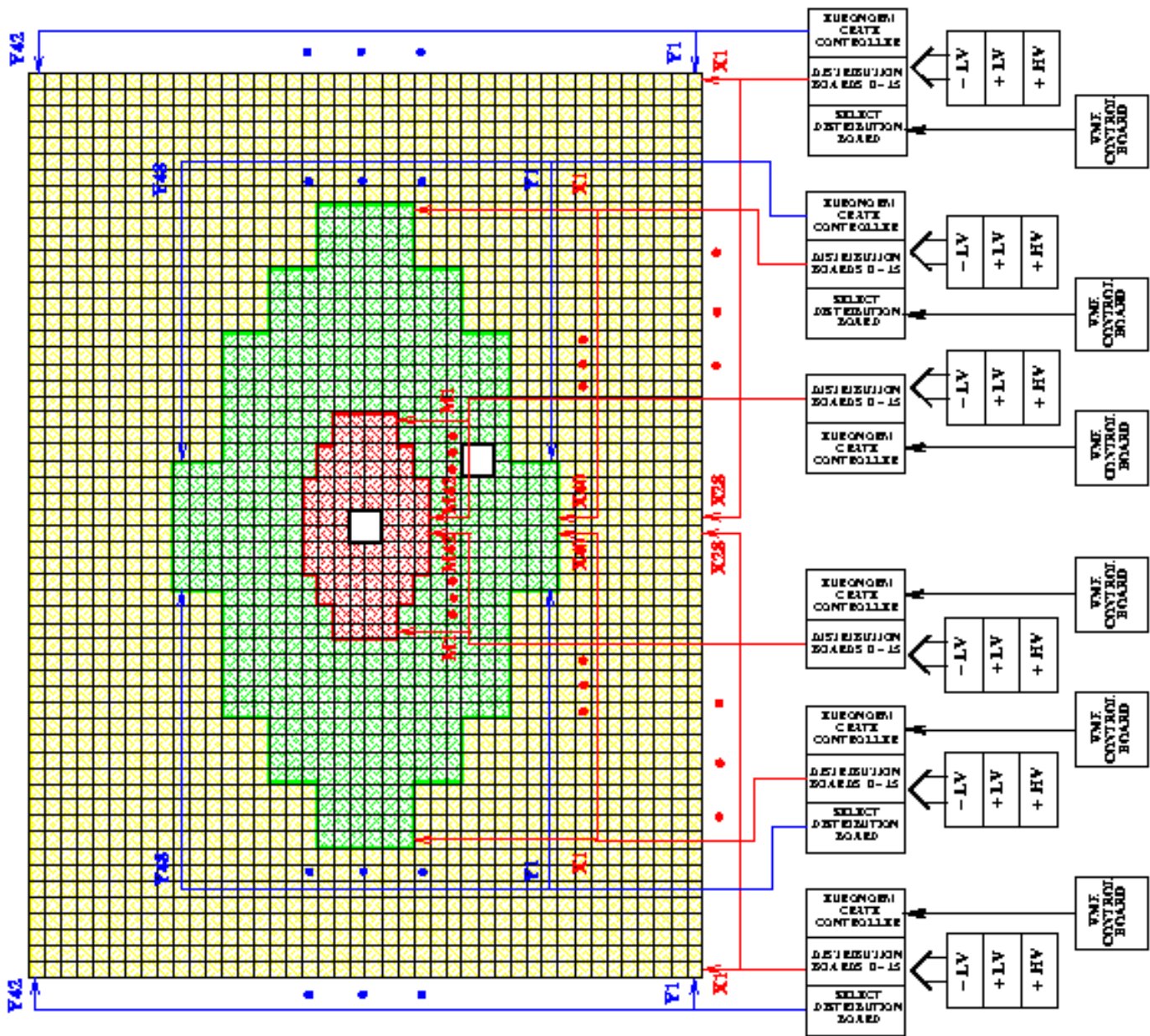
Matchikhilian Irina ( ITEP, Moscow )  
for the HERA-B ECAL group

### **Outline:**

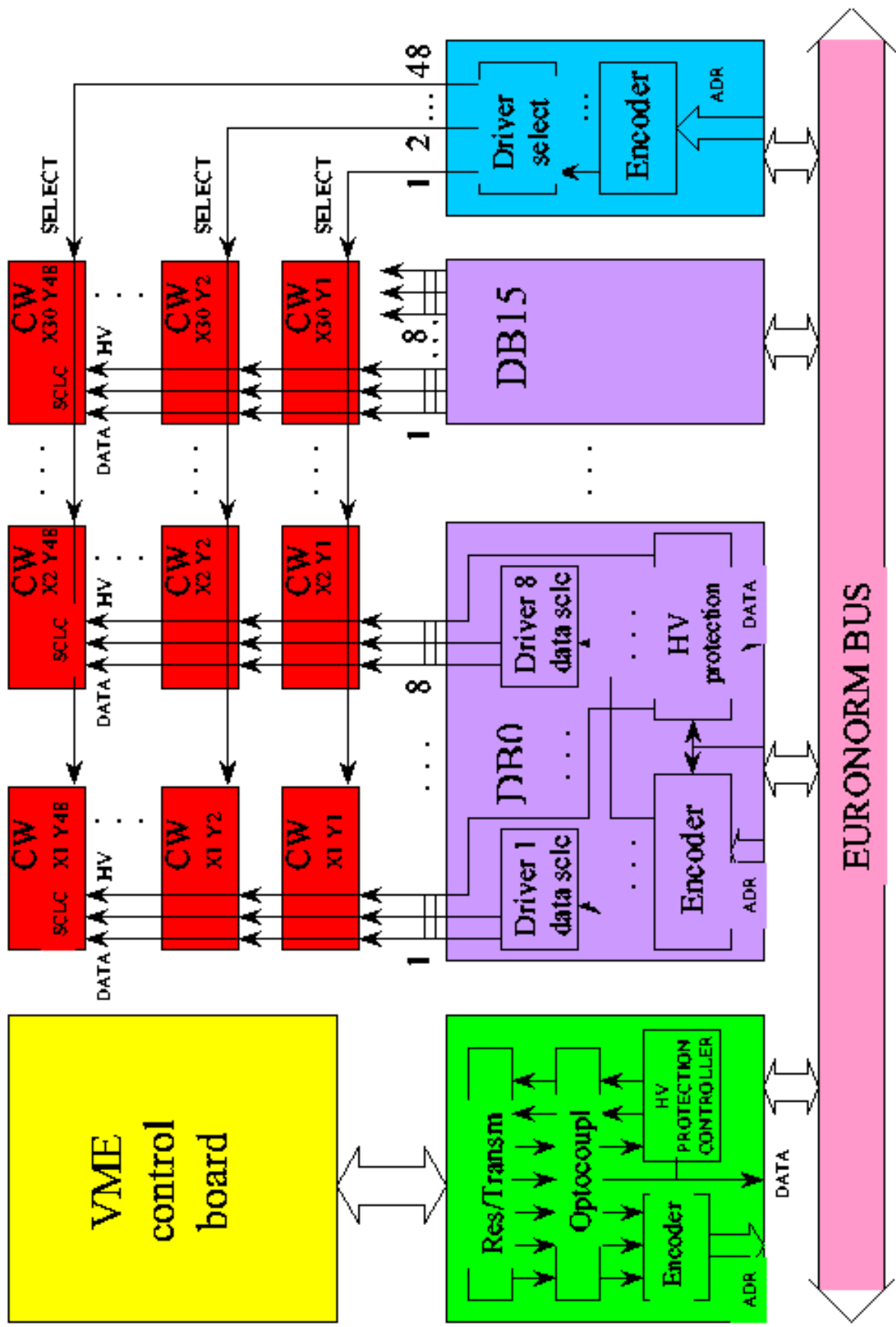
- **High/low voltage control electronics**
- **Readout and Pretrigger**
- **LED Monitoring system**
- **Readout chain performance**
- **Conclusions**



	Inner section	Middle section	Outer section
Number of channels	2100	2128	1728
Absorber	Tungsten	Lead	Lead
Volume ratio	W:Sc = 2 : 1	Pb:Sc = 3 : 6	Pb:Sc = 3 : 6
Cell size	2.24 cm x 2.24 cm	5.59 cm x 5.59 cm	11.18 cm x 11.18 cm
Mollere radius	1.42 cm	4.15 cm	4.15 cm
Depth	13 cm ( 23 X <sub>0</sub> )	34 cm ( 20 X <sub>0</sub> )	34 cm ( 20 X <sub>0</sub> )
WLS fibre	Kuraray Y-11	BCF - 91A	BCF - 91A
PM type	R-5600 + FEU-68	FEU-84-3	FEU-84-3

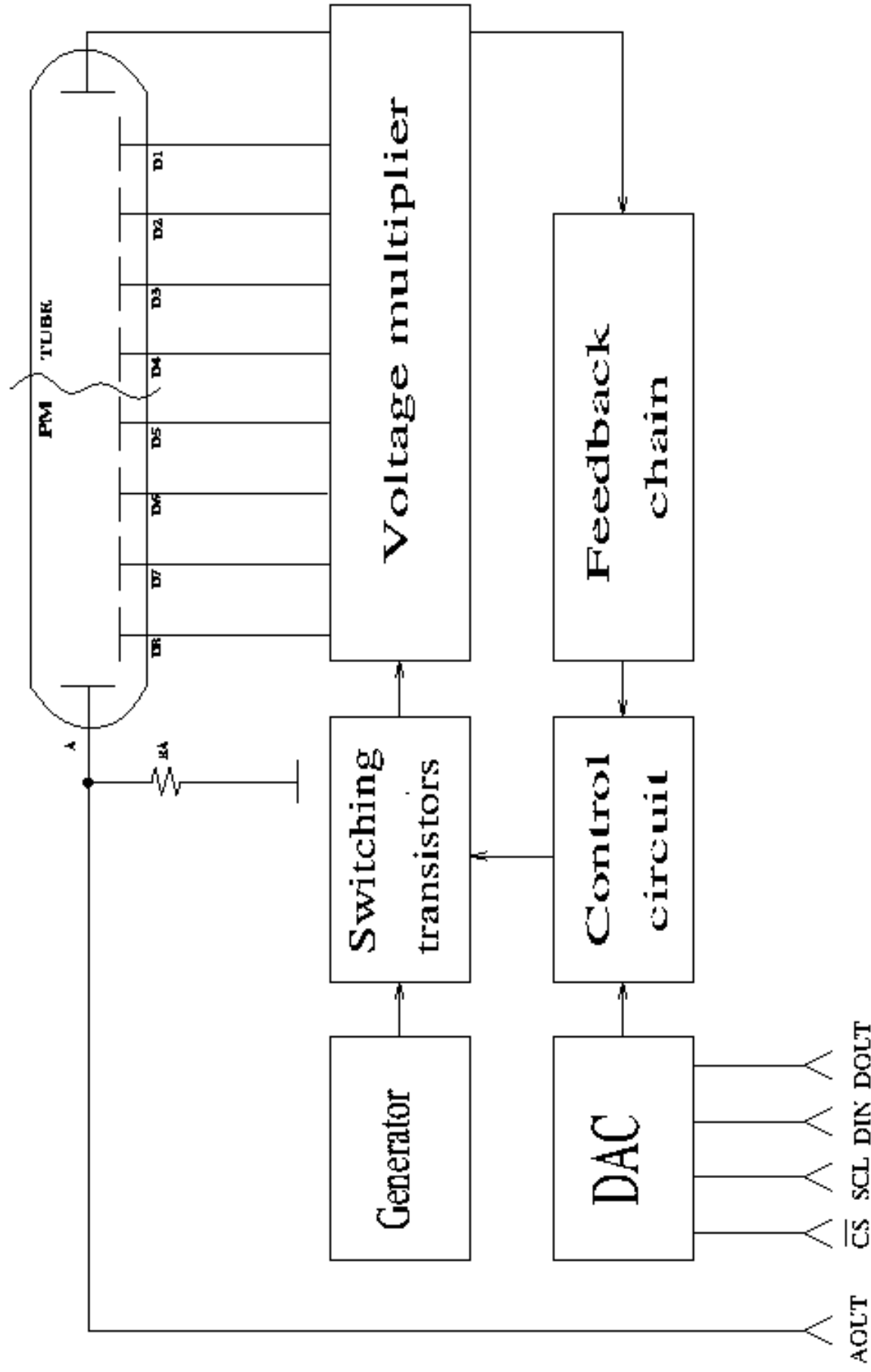


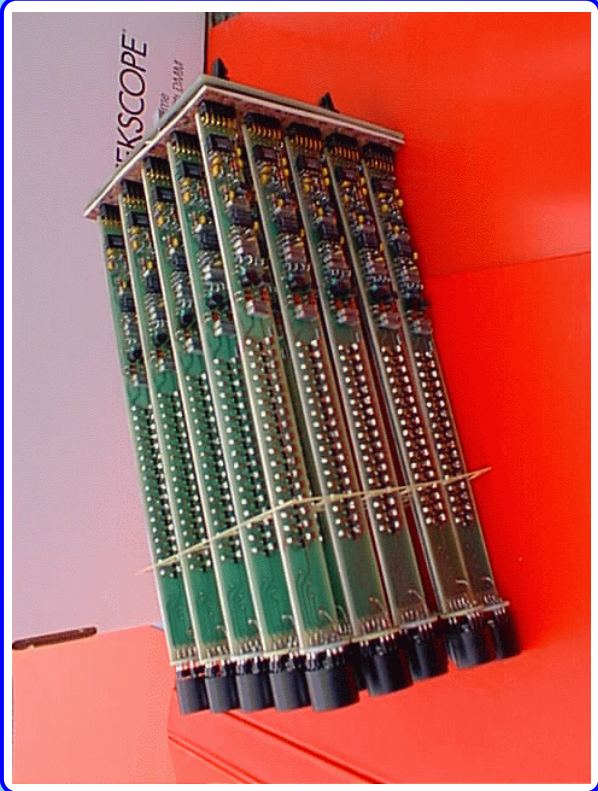
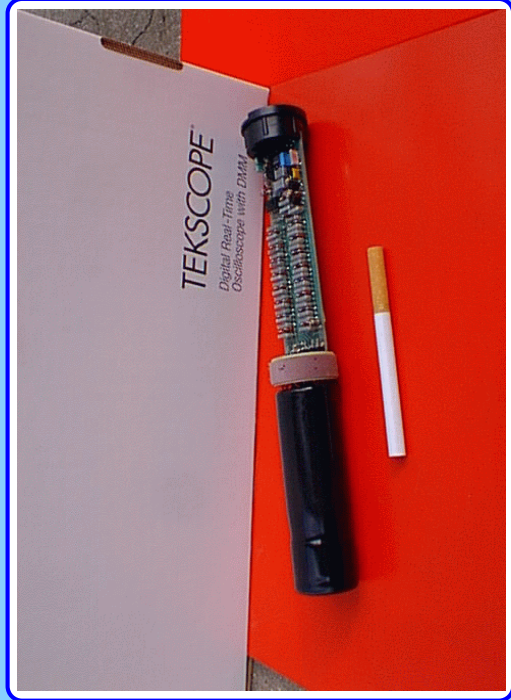
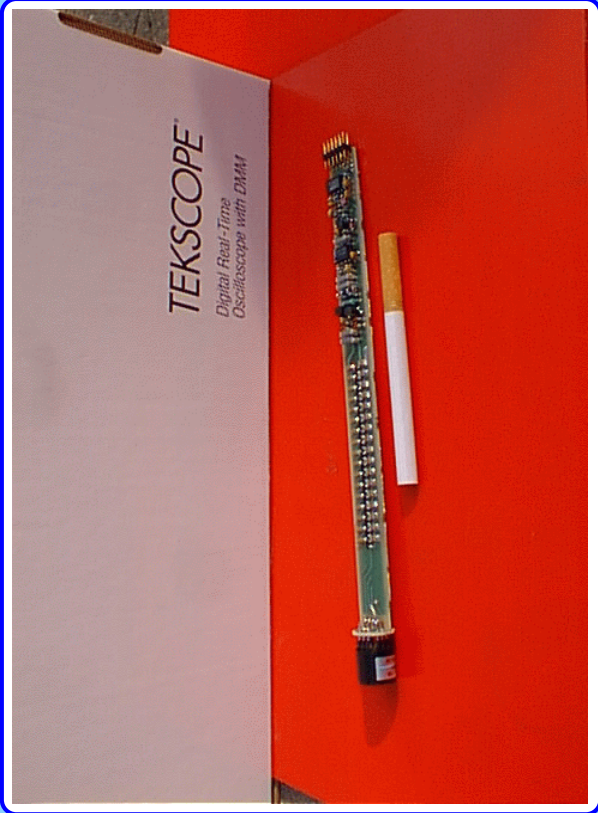




1/6 ECAL HV CONTROL SYSTEM.

# DC-DC CONVERTER BASE BLOCK DIAGRAM



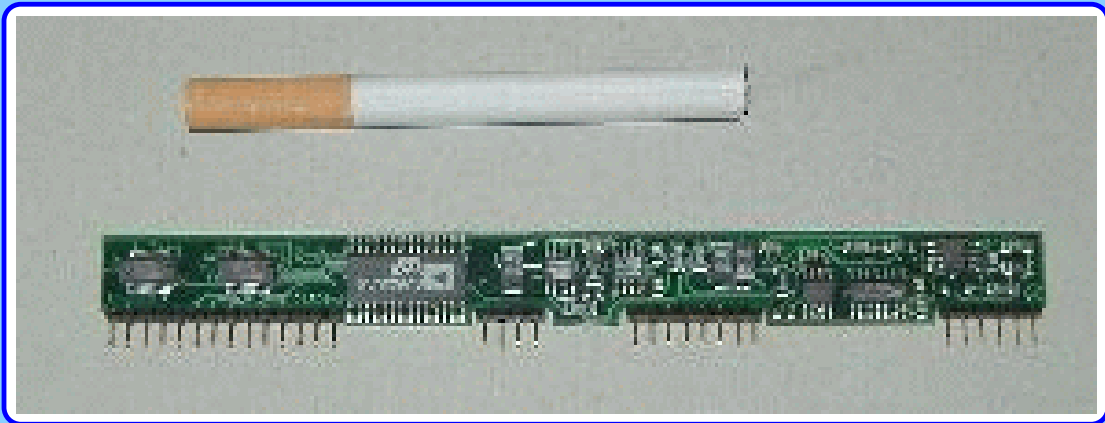
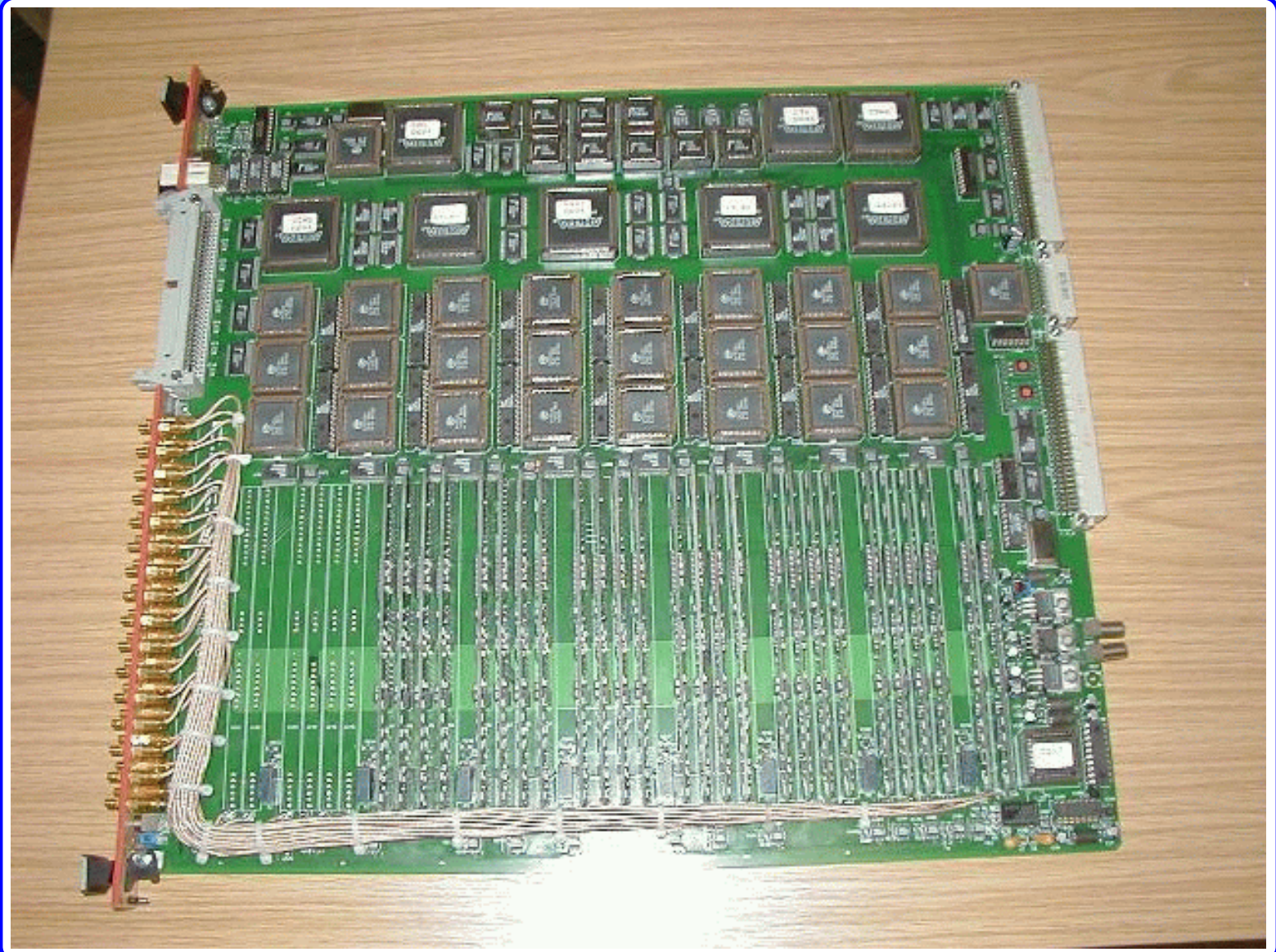


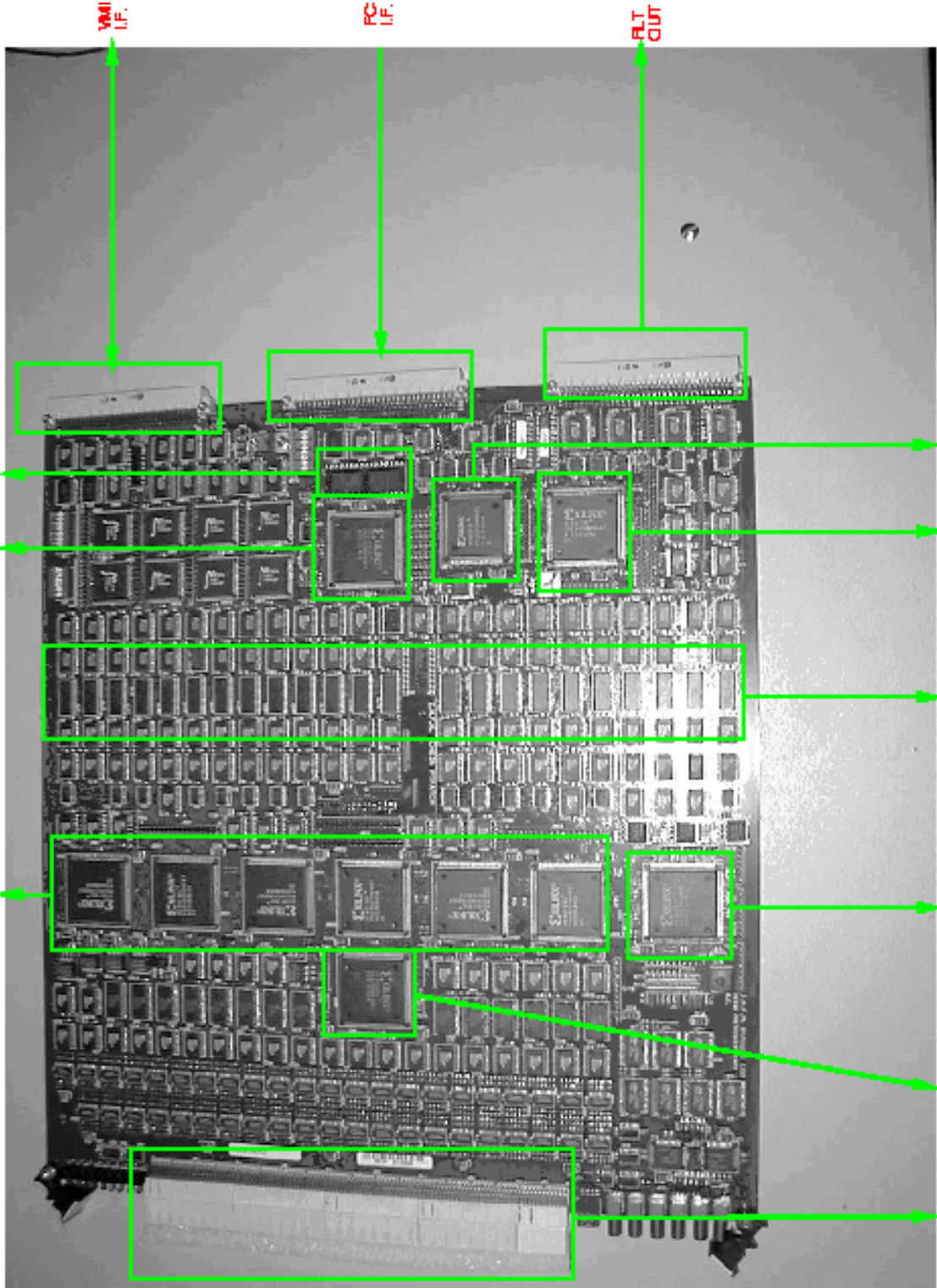


## ***Readout electronics***

- ***12 - bit linear ADC***
- ***13 - bit ( 12 - bit nonlinear for the innermost section)***
- ***32 / 25 channels / board***
- ***SHARC interface***
- ***256 events deep pipeline***
- ***Serial interface to PT ( calibrated 7 - bit compressed data )***
- ***Analog sum output***
- ***Full diagnostics***
- ***9U VME standard.***







VMM I.F.

PC I.F.

FLT. COUT

MESSAGE FORMATTER

INPUT BUFFER AND MUX

INPUT

FLASH MEMORY

BREM. RECOVERY

MESSAGE BUFFER

DATA PROCESSING UNIT (LUTs)

CONTROLLER

LOCAL MAXIMUM FINDER UNIT

INPUT



## **LED monitoring system**

- **Individual LED for each channel**

**Blue** LED's for HAMAMATSU PM's

**Red** LED's for the rest of ECAL

- **Any desirable pattern:**

**Very important for pretrigger test purposes.**

- **LED pulse amplitude -**

**full ADC dynamic range**

**( independent adjustment for each of 16 sectors)**

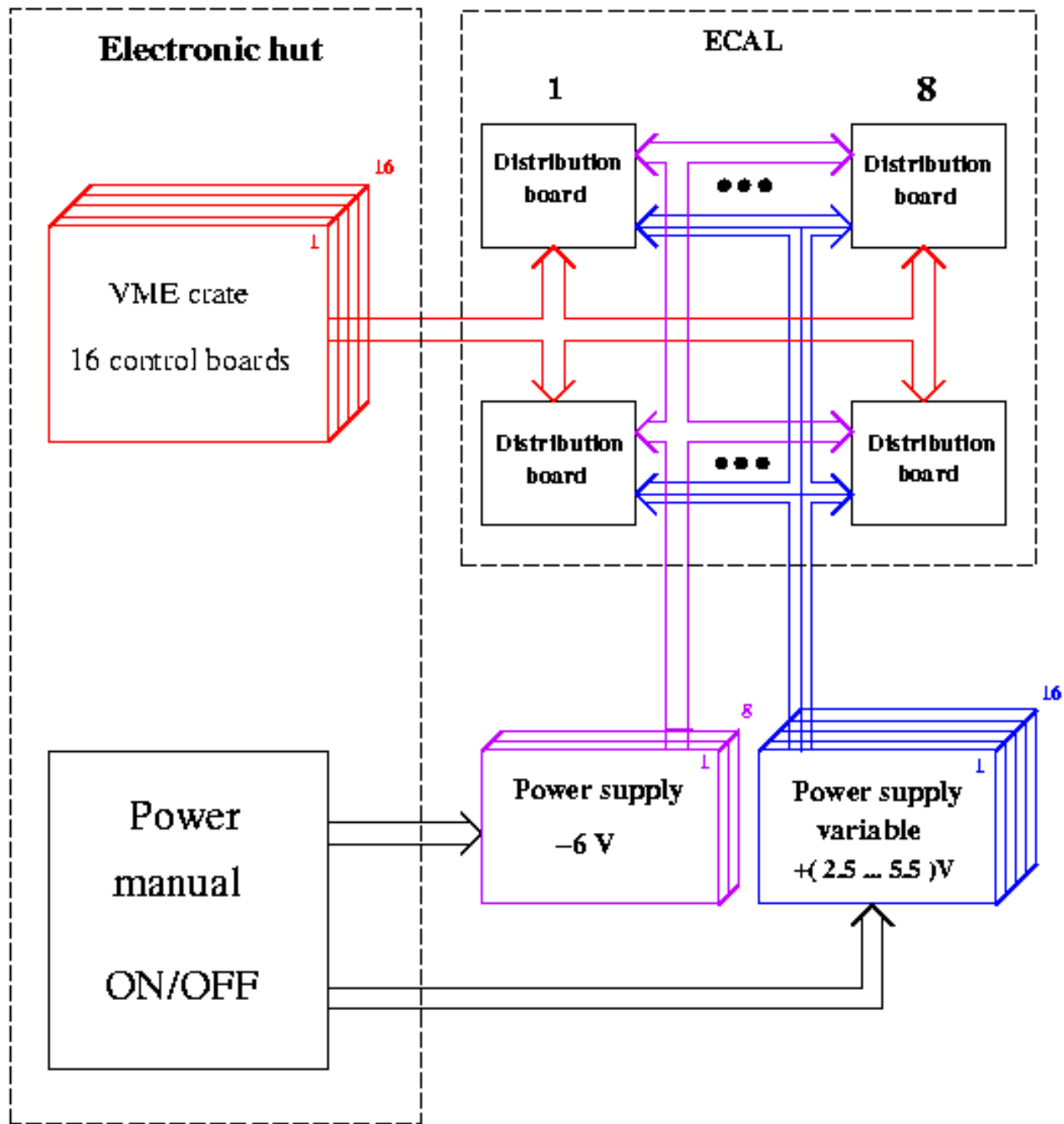
- **Ignition pulse width adjustment -**

**5 - 12 ns - Inner ECAL only,**

**84 independent modules, 3 bit precision.**

**Normally LED's are fired at one of the "empty" HERA BX**

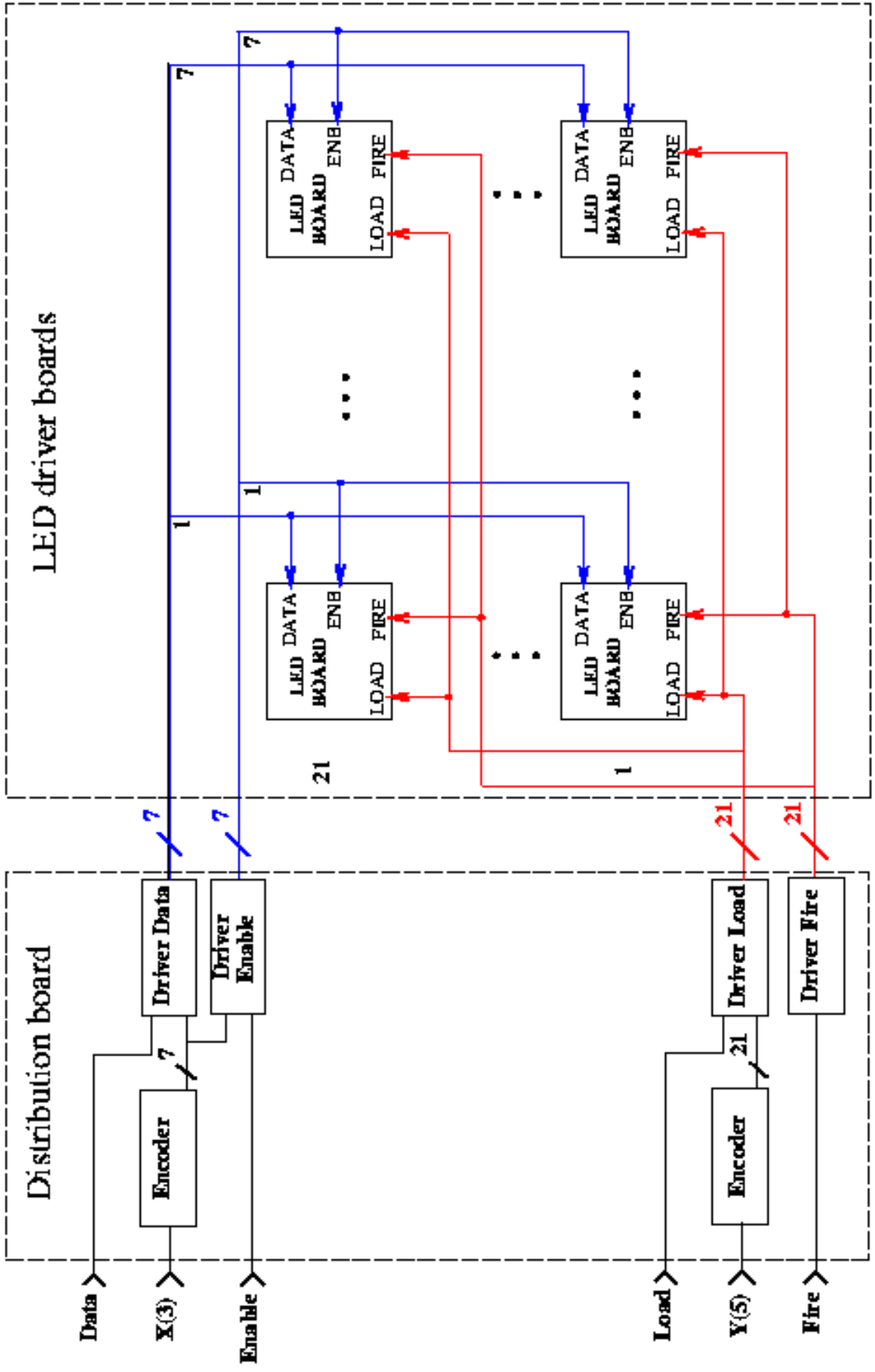
**with the frequency ~ 10 Hz( prescaled HERA cycle ).**

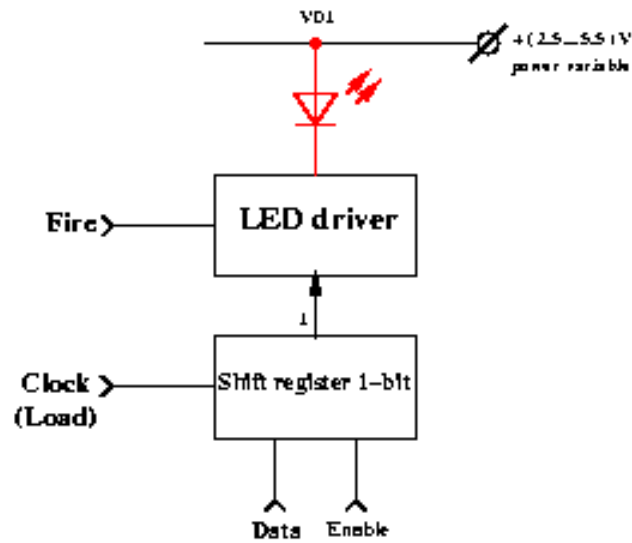


LED system general view.

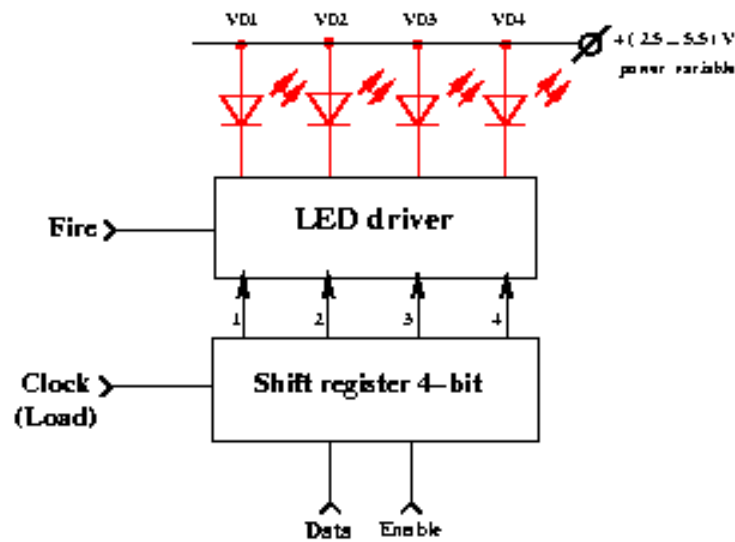


# From control board

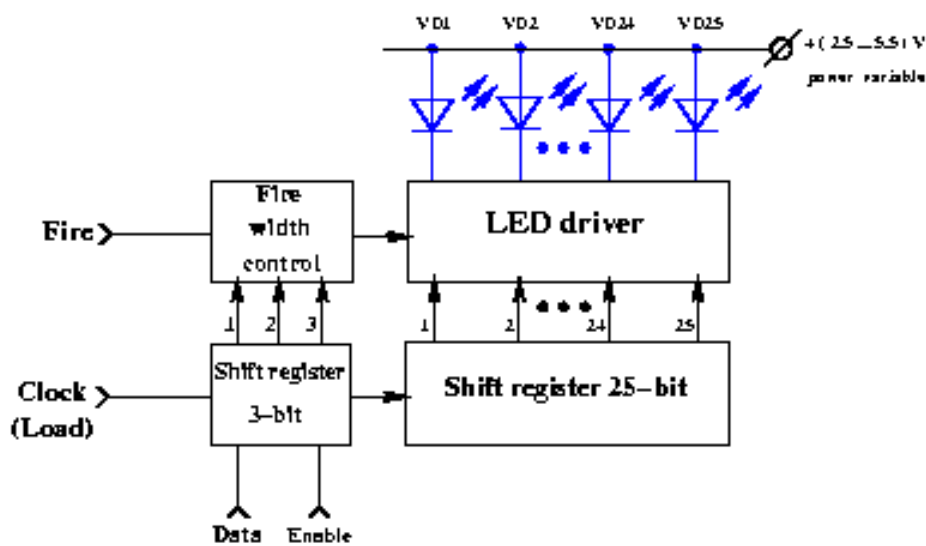




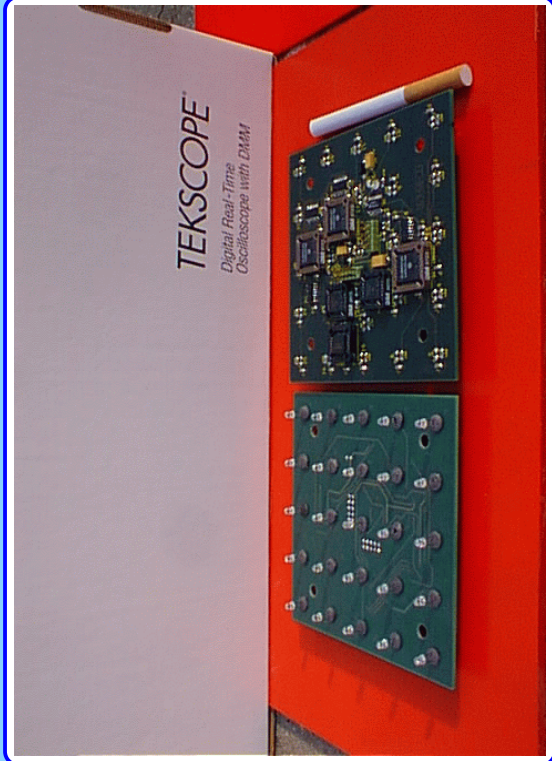
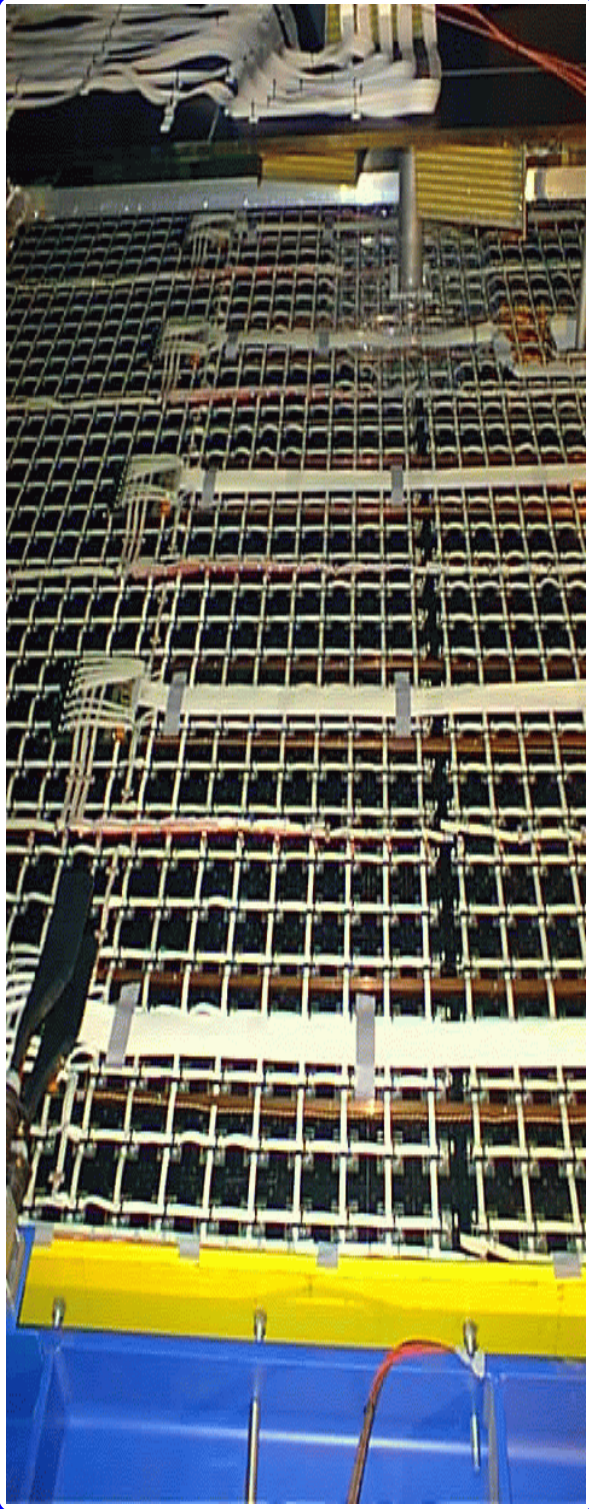
Circuit of the Outer Ecal LED driver board.



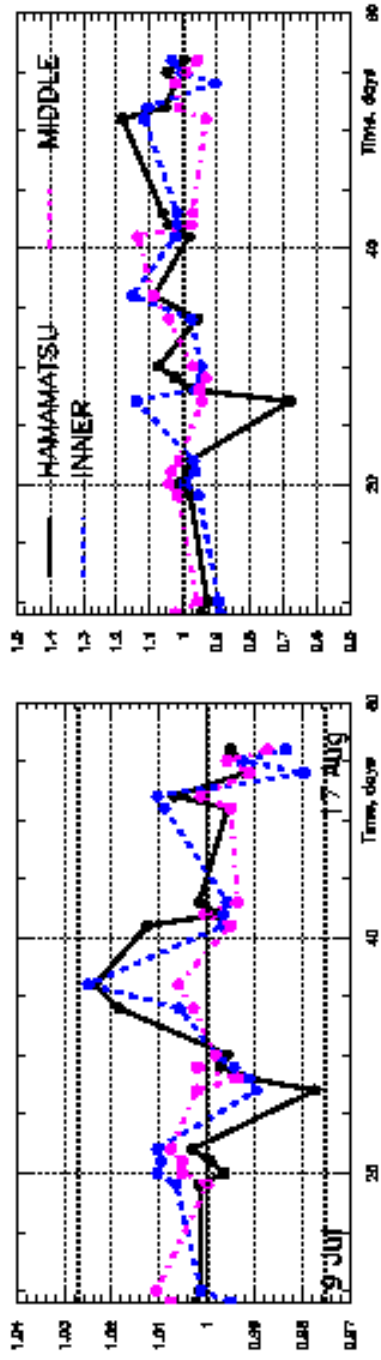
Circuit of the Middle Ecal LED driver board.



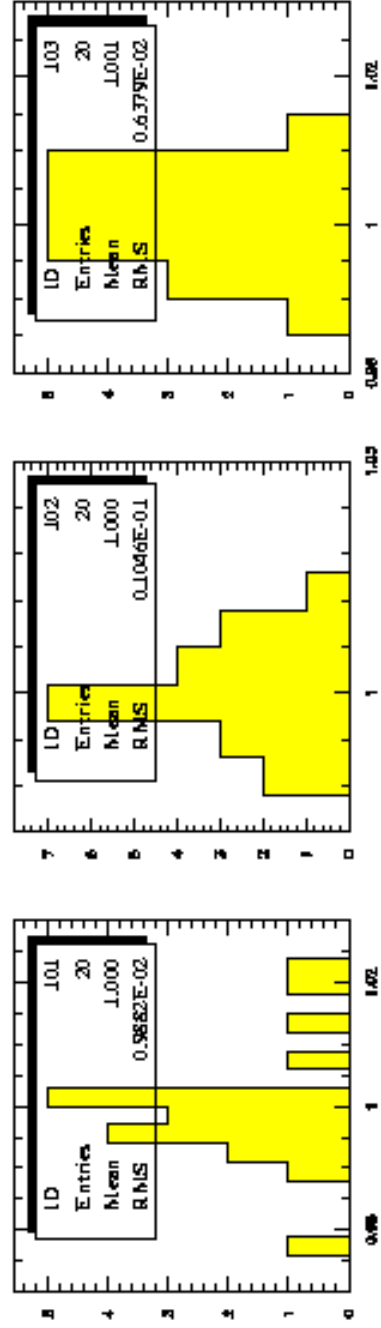
Circuit of the Inner Ecal LED driver board.



### ECAL stability measurements: pi0 SLT



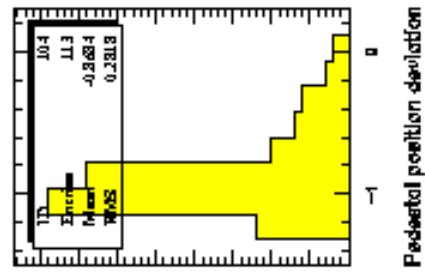
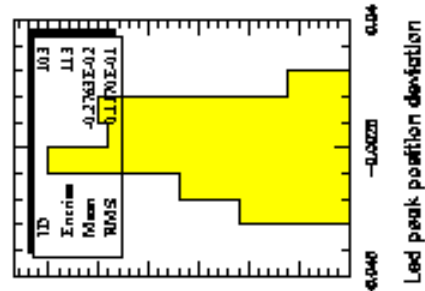
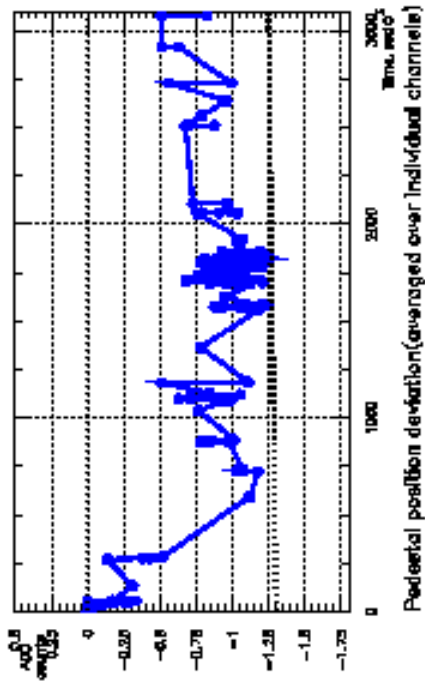
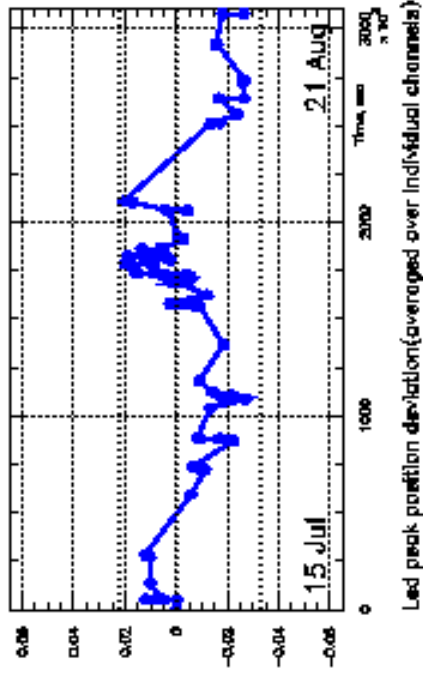
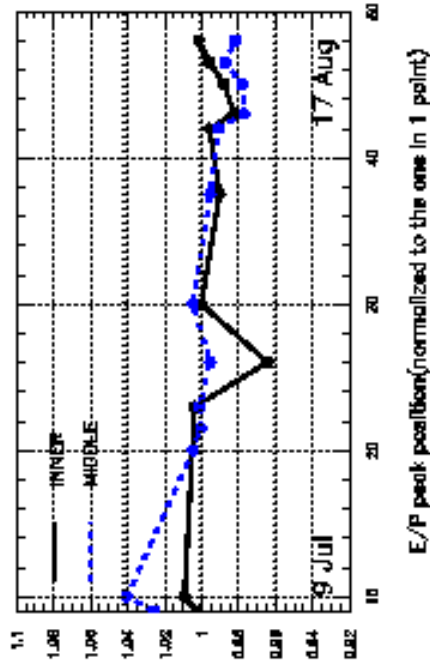
$\pi^0$  peak position(normalized to the one in 1 point)       $\pi^0$  peak width(normalized to the one in 1 point)



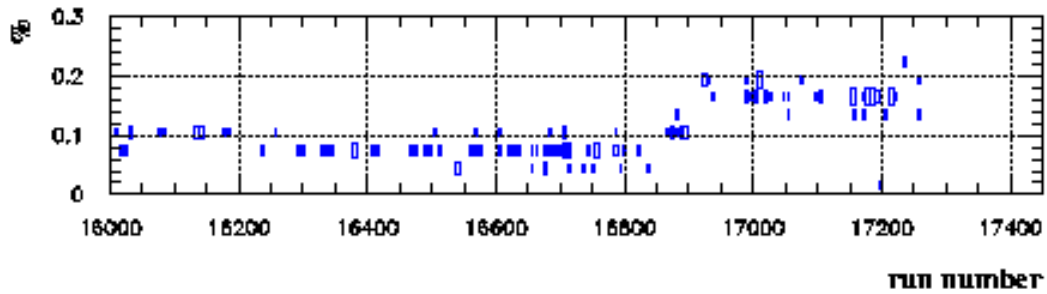
$\pi^0$  peak position(HAMAMATSU)       $\pi^0$  peak position(INNER)       $\pi^0$  peak position(MIDDLE)



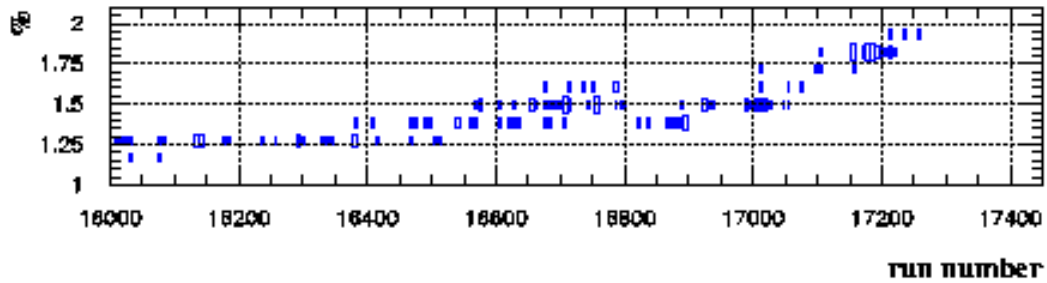
## ECAL stability measurements



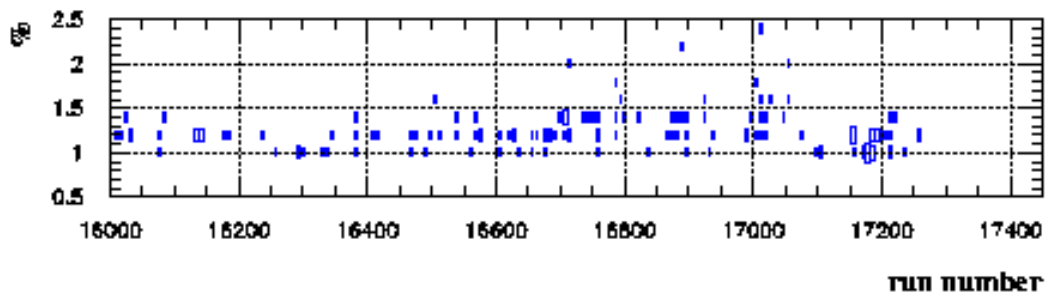
28 Jun - 25 Aug 2000



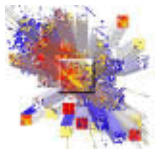
Hot channels



Radiation damaged chips near beam pipe



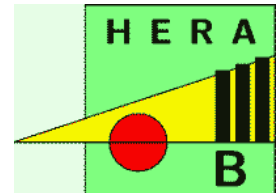
Other dead channels



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## **HERA-B ECAL Electronics and Monitoring**



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for the HERA-B ECAL group

### Conclusions:

- **During last 2 years of data taking  
ECAL electronics was installed  
and commissioned**
- **Overall system shows a good performance**
- **All problems known already have solutions**