hut@ihep.ac.cn lao MU

the principle and structure of the fast luminosity monitor

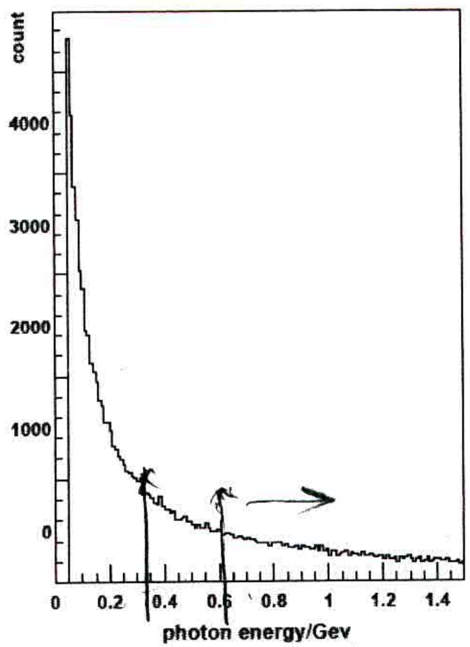
The fast luminosity monitor
is based on

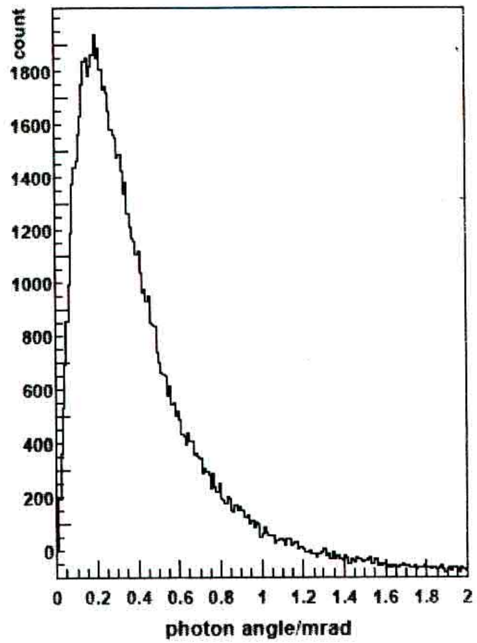
the single Bremsstrahlung process

- $e^+ e^- \rightarrow e^+ e^- \gamma$

  determine the luminosity by detecting the γ
- Big cross section (~161 mb when k_t=50MeV), so fast updating is available

- The angle of emitting γ and the colliding axis is very small, the γ whose angle is <0.5 mrad account for 66% @1.89GeV



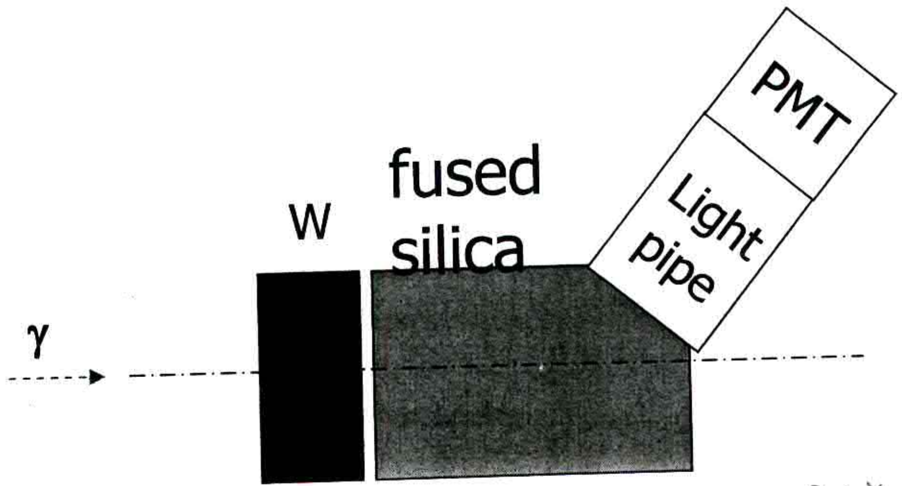


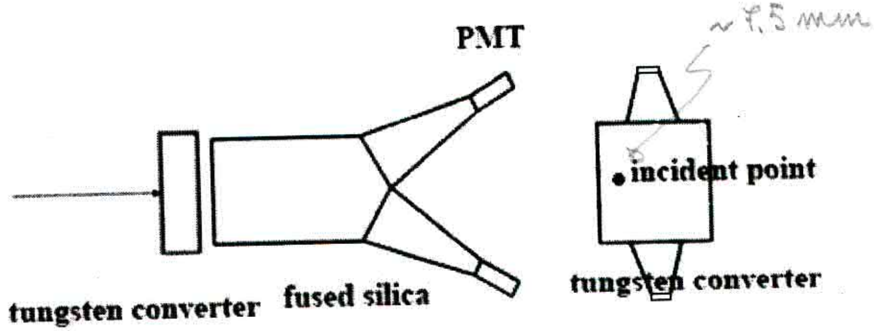
"zero degree luminosity monitor"

the principle and structure of the fast luminosity monitor

- fused silica is chosen as the Cherenkov radiator
  - High Anti-radiation performance ($>10^9$ rad/y)
  - $n=1.46$
- Tungsten is chosen as converter
- Only as a counter, so the structure is simple and space needed is small;
- Mainly used for relative luminosity measurement

the principle and structure of the fast luminosity monitor



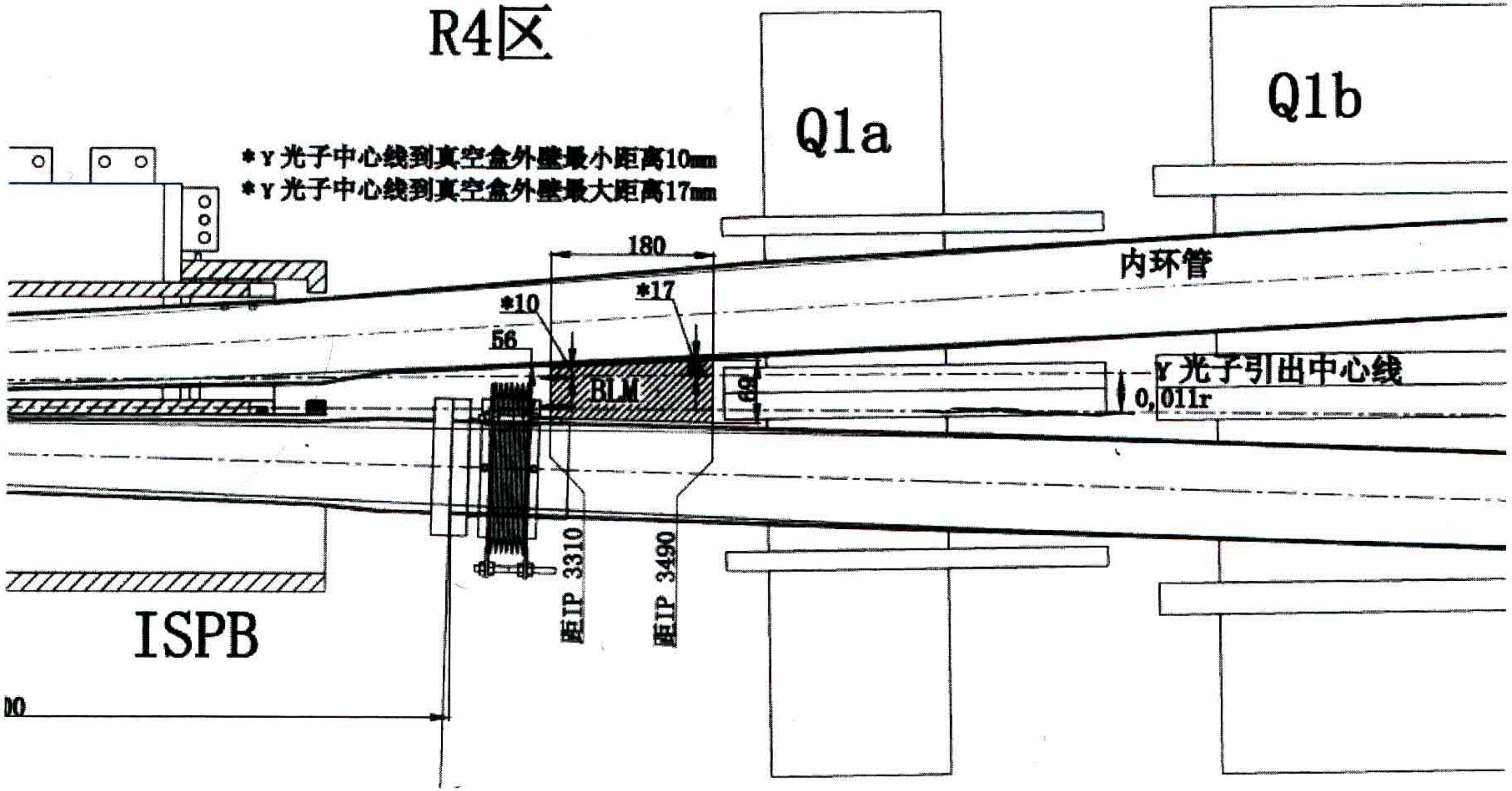


$X_0 = \frac{6.76}{19.3} = 0.35$ cm

- The thicket of tungsten converter is 1.2cm (3.4 X_0)
- The size of fused silica is 4.5 x 4.0 x 6.6 cm^3

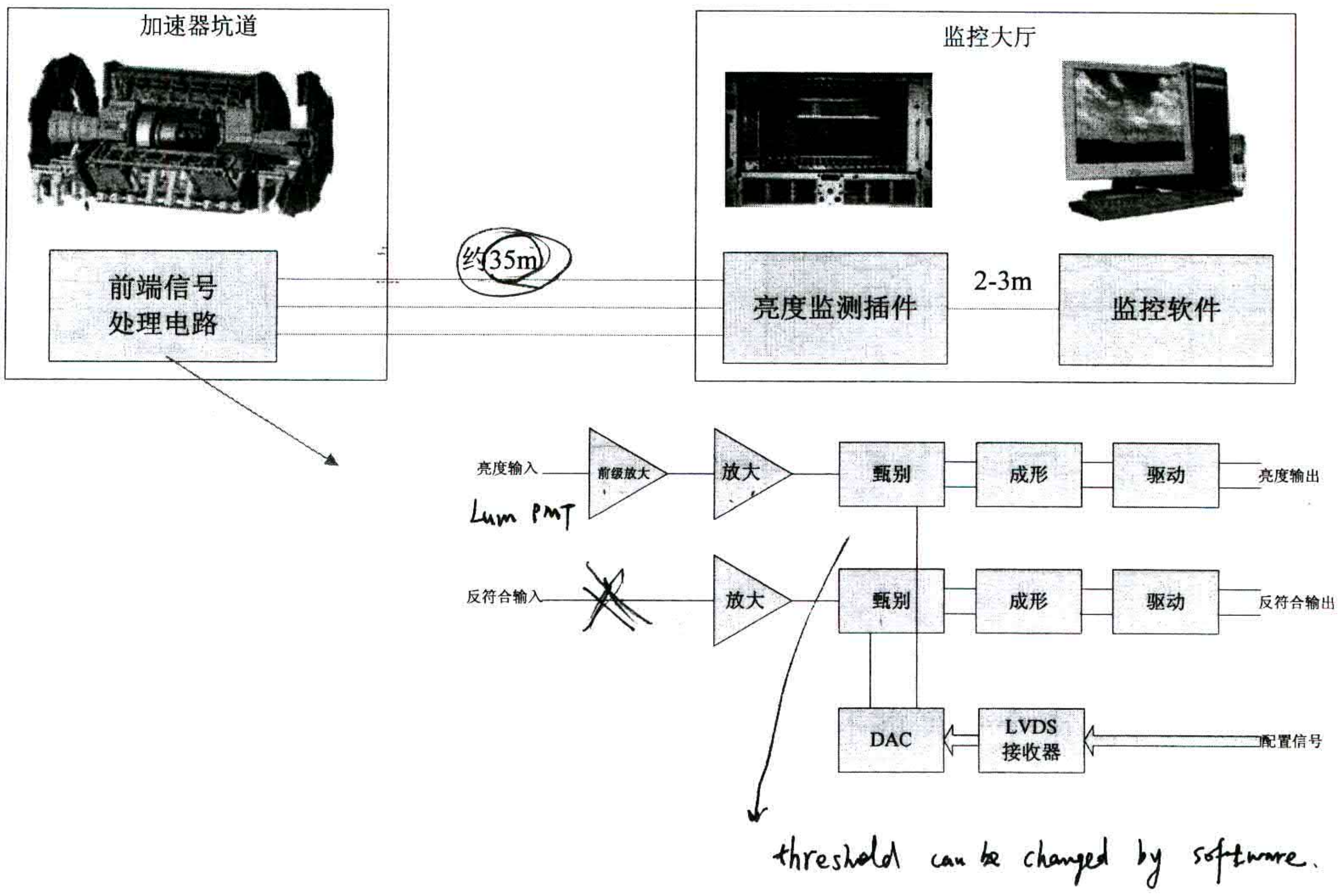
$X_0 = \frac{21.82}{2.33} = 9.4$ cm

surrounded by tungsten shield



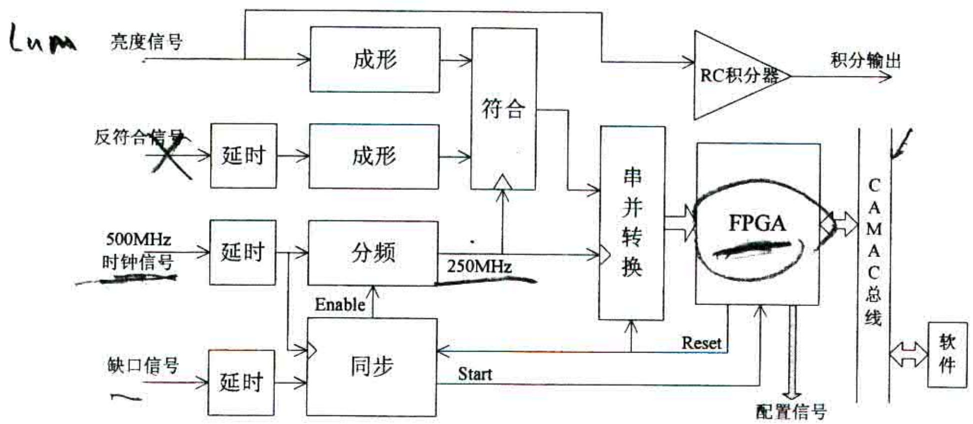
R4区
Q1a
Q1b
*γ光子中心线到真空盒外壁最小距离10mm
*γ光子中心线到真空盒外壁最大距离17mm
180
内环管
*10
*17
56
BLM
69
γ光子引出中心线
0,011r
距IP 3310
距IP 3490
ISPB

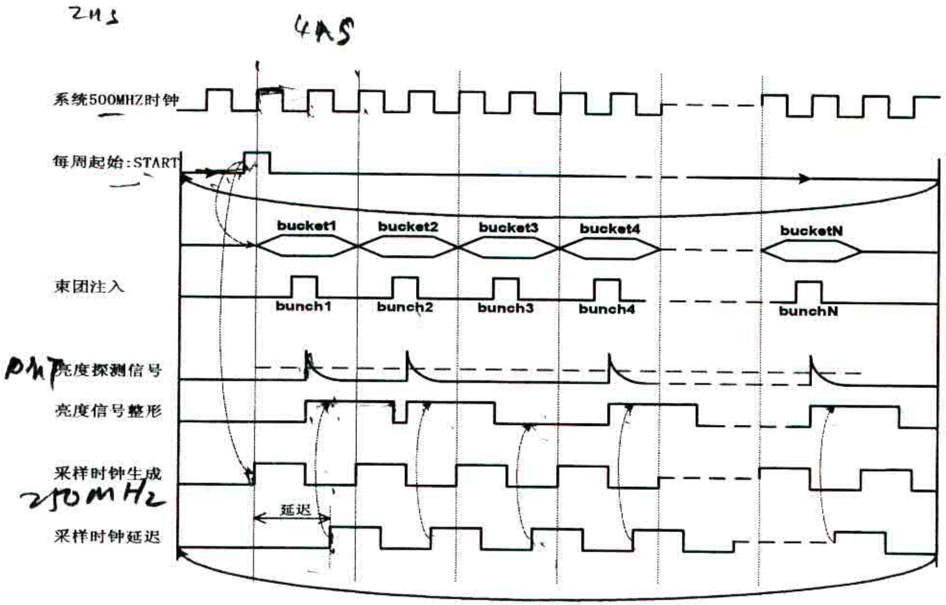
结构与前端电路


加速器坑道
前端信号处理电路
约35m
监控大厅
亮度监测插件
2-3m
监控软件
亮度输入
Lum PMT
前级放大
放大
甄别
成形
驱动
亮度输出
反符合输入
放大
甄别
成形
驱动
反符合输出
DAC
LVDS 接收器
配置信号
threshold can be changed by software.

Lab View

后端电子学（旧）



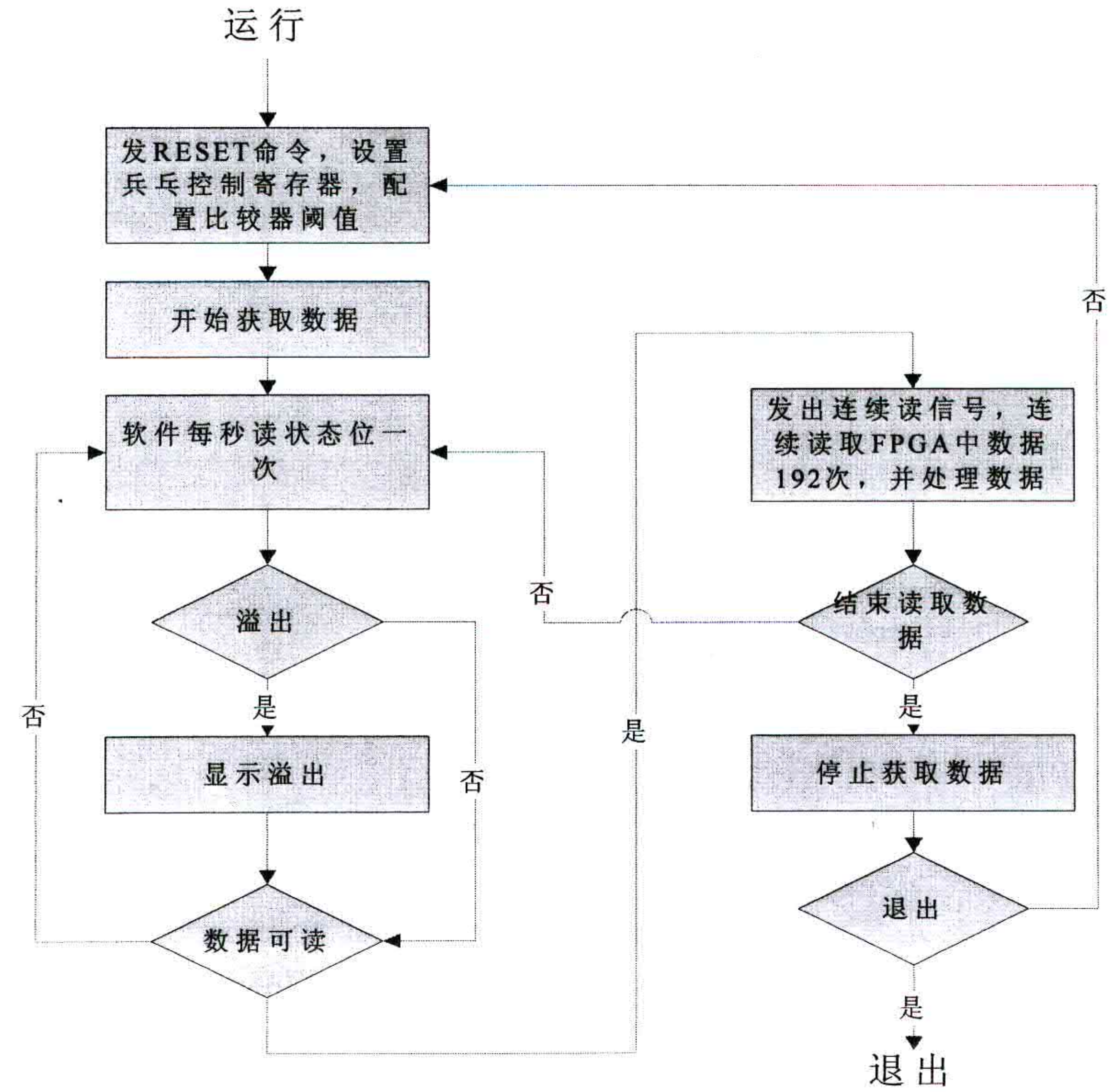


- 500MHz时钟信号、缺口信号由加速器提供

4ns

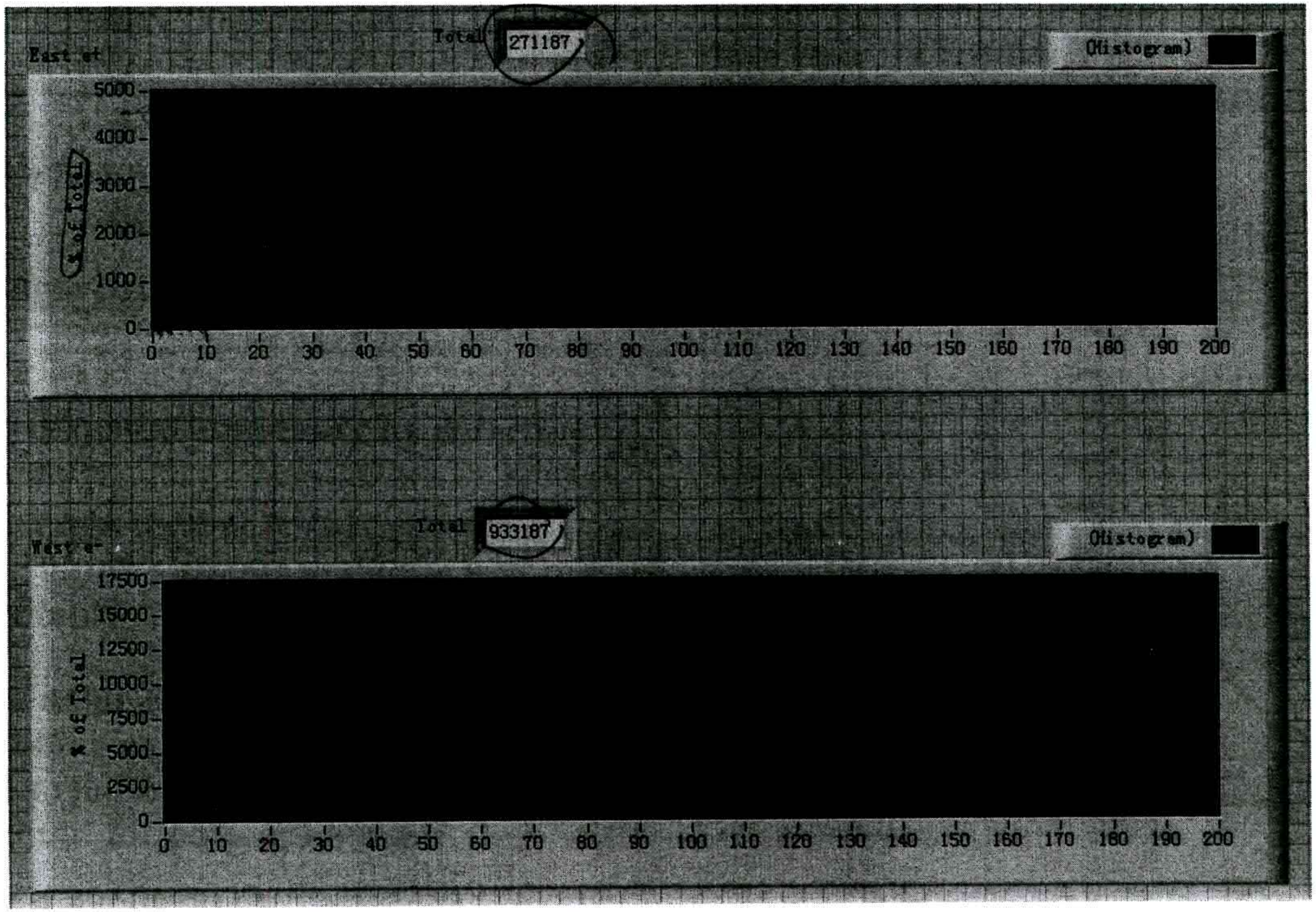
- 第一个感应出缺口信号的负电子束团被认为是每一环的第一个束团

PC机软件



运行
发RESET命令，设置兵乓控制寄存器，配置比较器阈值
开始获取数据
软件每秒读状态位一次
溢出
是
显示溢出
否
数据可读
否
是
发出连续读信号，连续读取FPGA中数据192次，并处理数据
结束读取数据
否
是
停止获取数据
退出
否
是
退出

bunch by bunch measurement



Two monitors work independently.

The absolute value is depended on the beam condition like ~~angle~~ angle etc.

Relative luminosity of each colliding bunch pair is shown in the figure above which helps in beam tuning