



Beam Loss Monitor

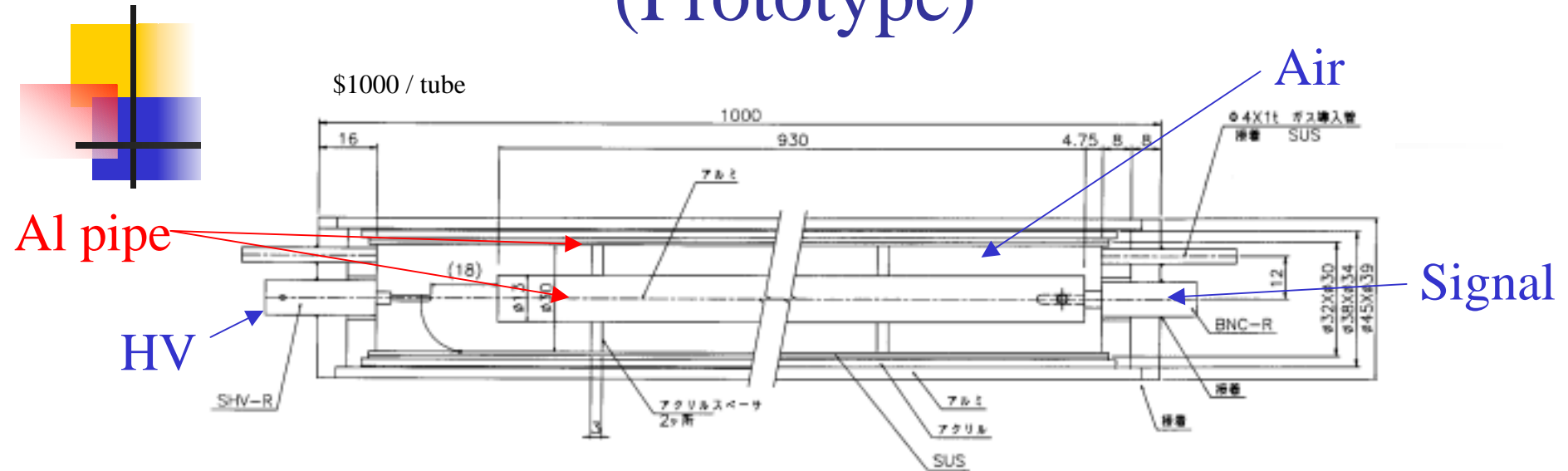
Yoshinori Sato (KEK, IPNS)
Target & Monitor Sub-Group



Requirements for BLM

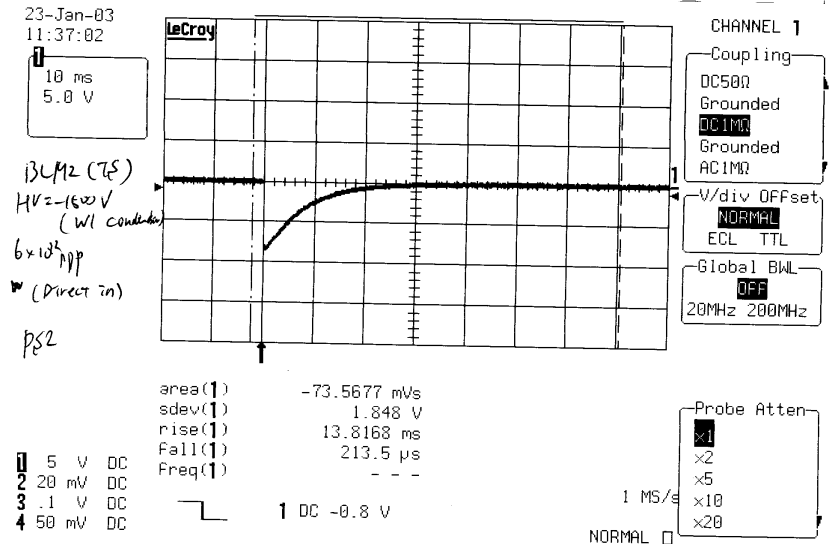
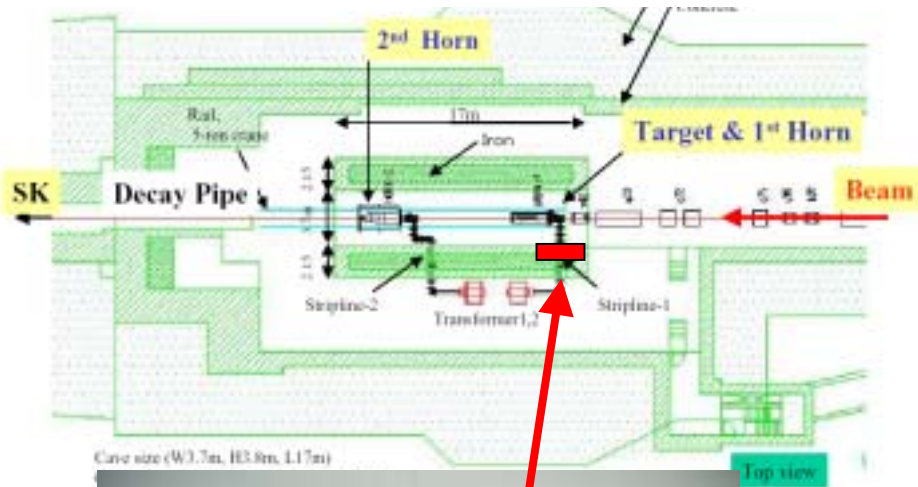
- Detect accidental beam loss
 - $\sim 1\text{W/m}$ or larger
- Issue the termination signal to the accelerator control (MPS)
- Easy maintenance
- Radiation resistant (Long life)
- Low cost

Air-filled Ionization Chamber (Prototype)



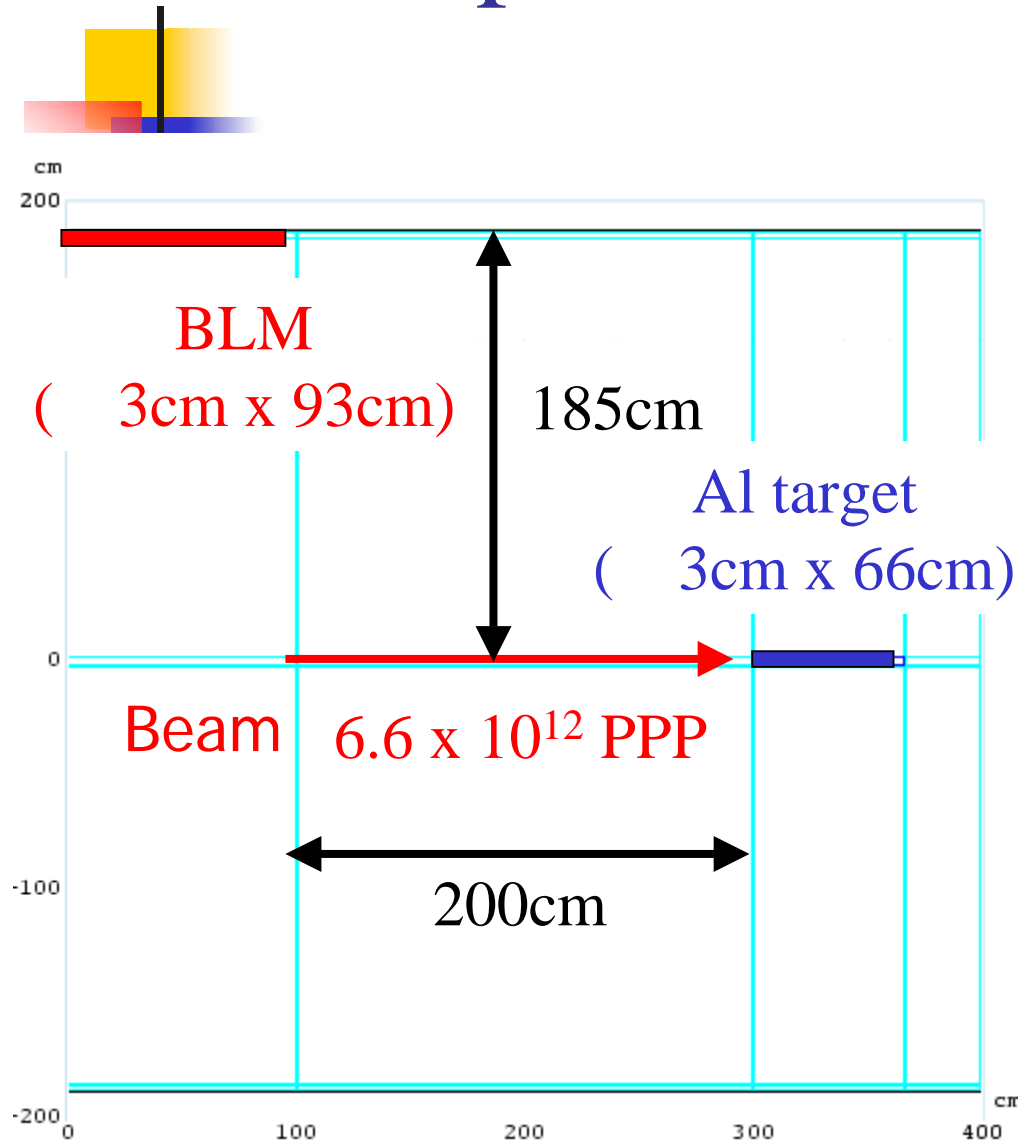
Installation to the target station in the neutrino beam line

(Al, 3cm x 66cm, ~ 6kW Loss)



Collected charge ~73nC @ 1M

Comparison with MARS (TS)



Hadron fluence (MARS)

$$1.1 \times 10^{-6} \text{ h/cm}^2/\text{p}$$

Expected particle at BLM

$$2.0 \times 10^9 \text{ h/pulse}$$

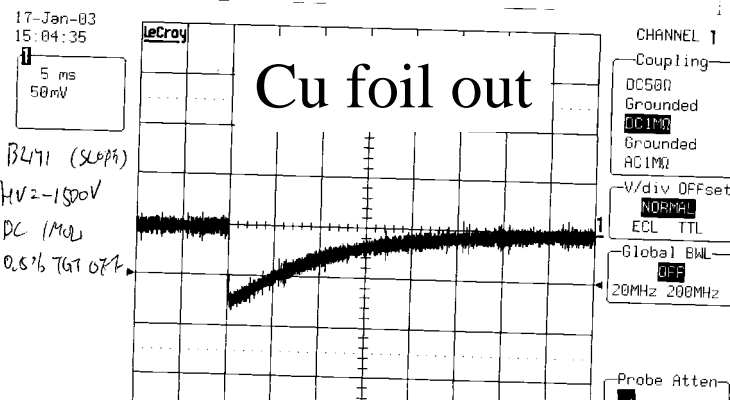
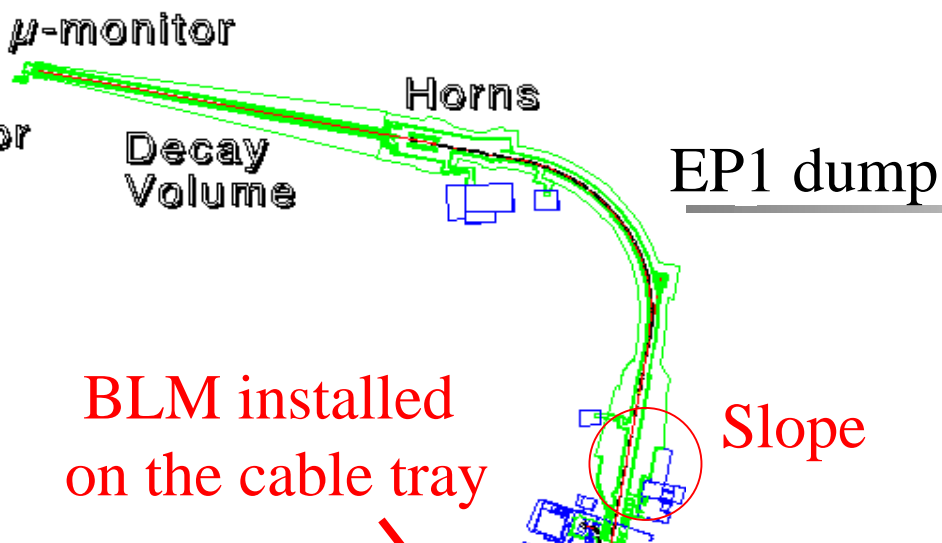
Expected # of ion pair

$$3.7 \times 10^{11} = \underline{59 \text{ nC/pulse}}$$

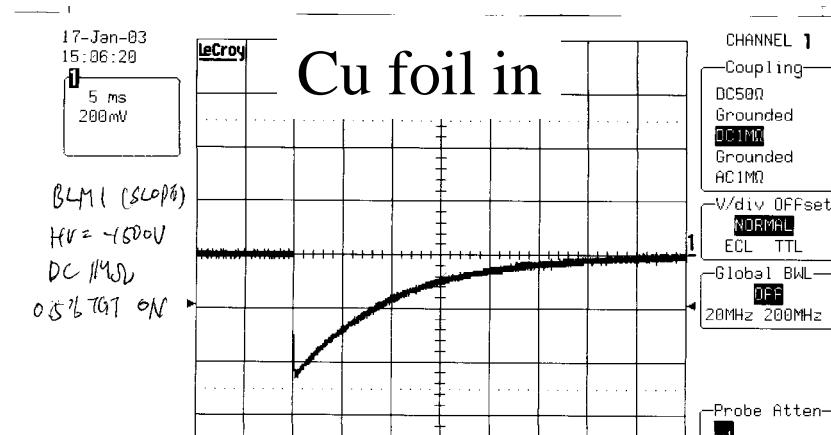
Measured charge by BLM

$$\underline{73 \text{ nC/pulse}}$$

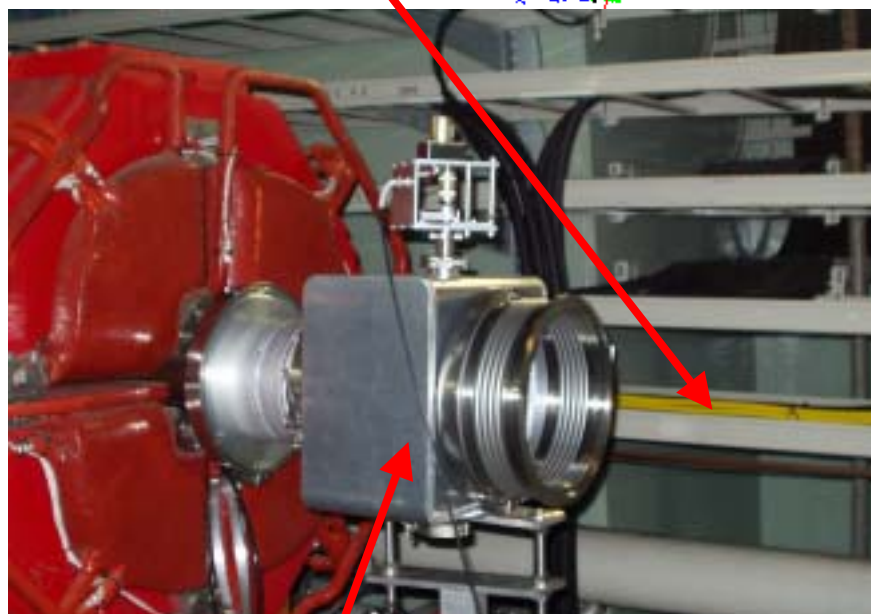
Installation to Slope section



Collected charge ~ **0.7 nC@1M Ω**

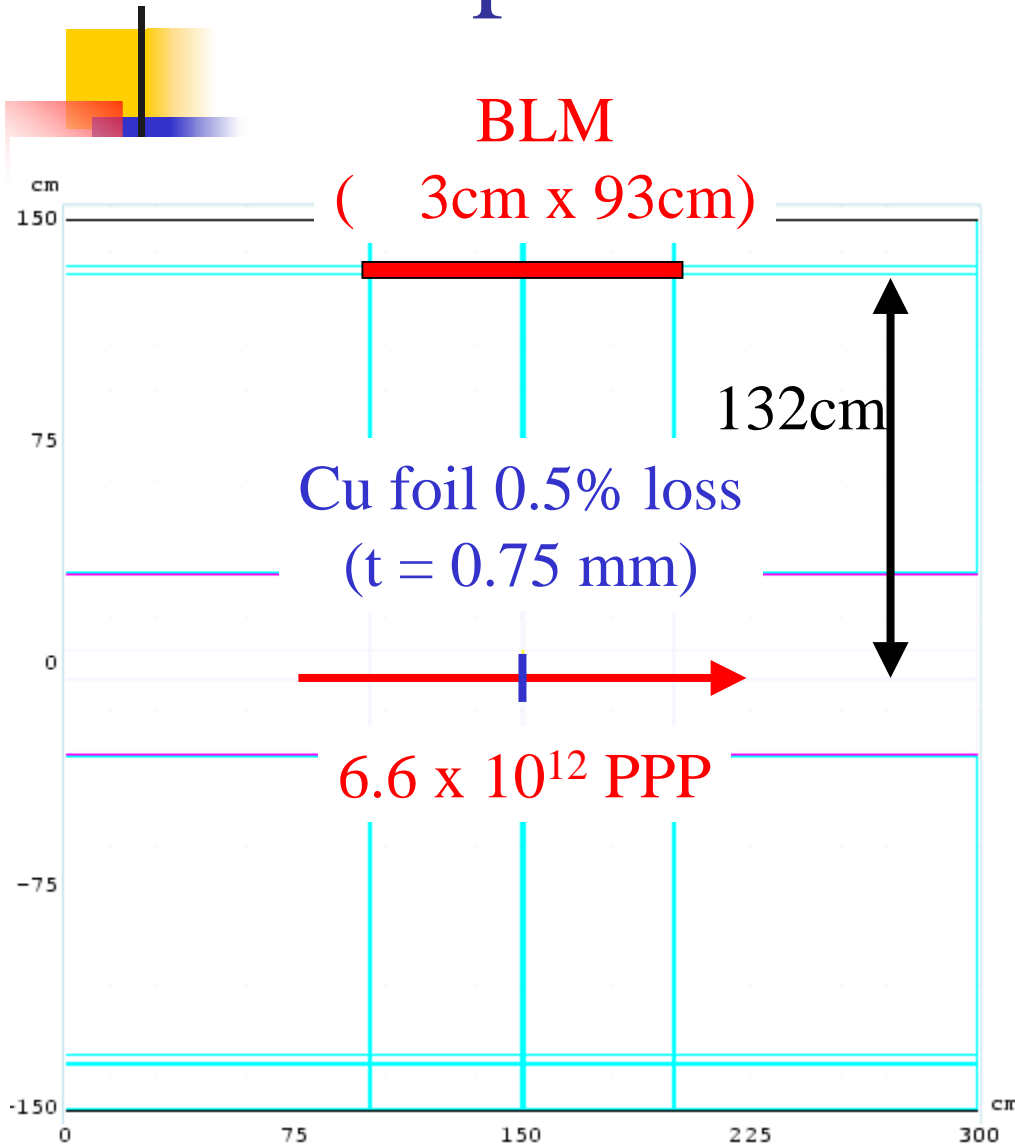


Collected charge ~ **4.5 nC@1M Ω**



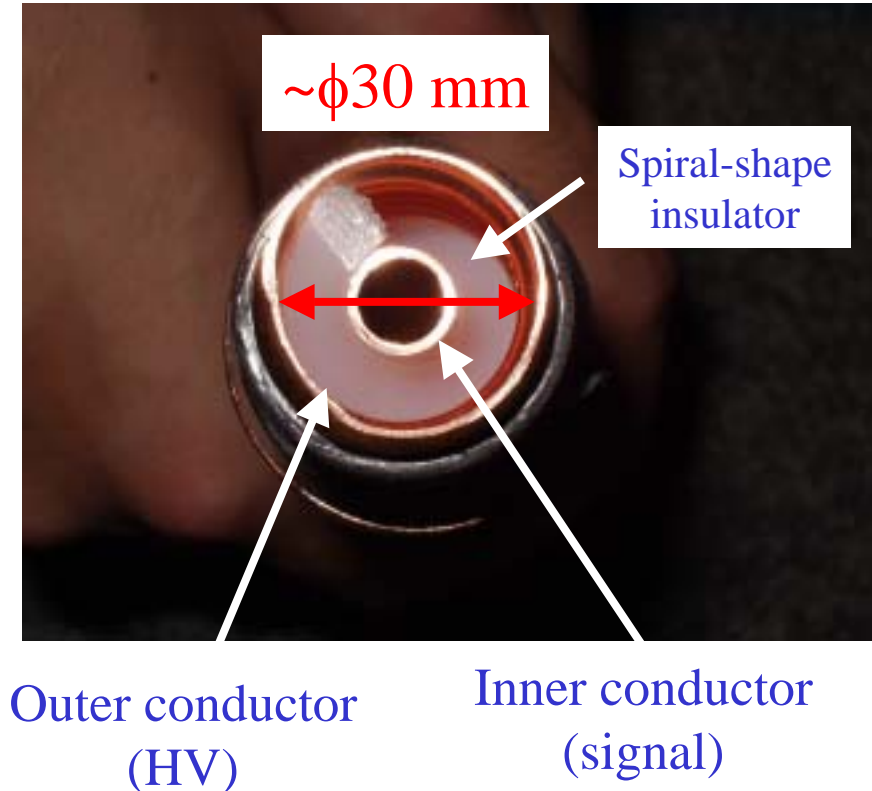
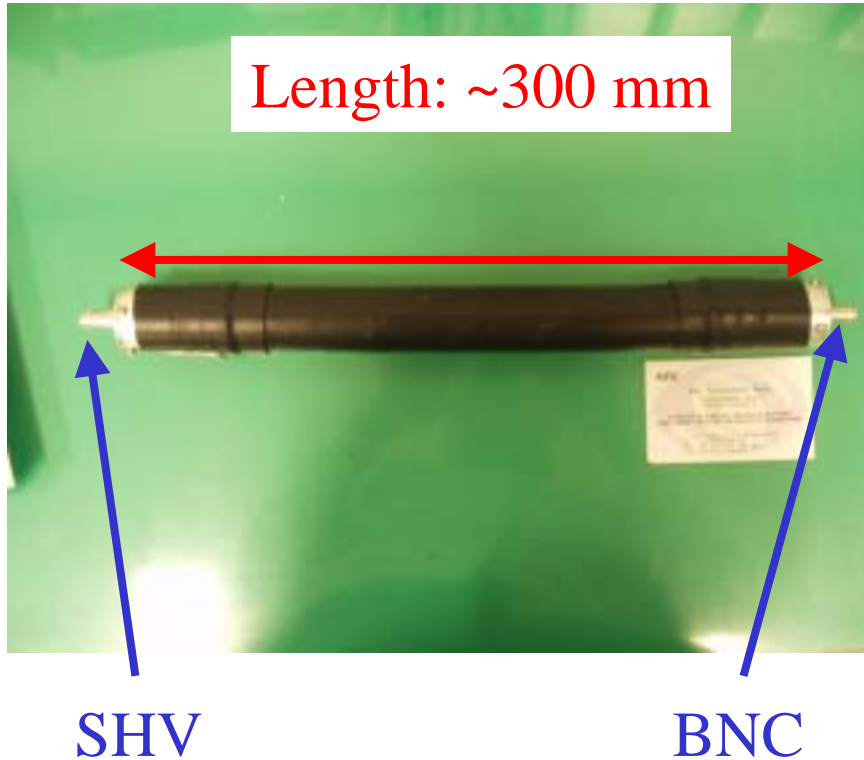
Cu foil (0.75mm) ~ 0.5% loss (28W)

Comparison with MARS (Slope)



Hadron fluence (MARS)
 $\sim 5.0 \times 10^{-8} \text{ h/cm}^2/\text{p}$
Expected particle at BLM
 $8.4 \times 10^7 \text{ h/pulse}$
Expected # of ion pair
 $1.5 \times 10^{10} = \underline{2.4 \text{ nC/pulse}}$
Measured charge by BLM
3.8 nC/pulse

New (Production type) BLM using HF coaxial cable





Read-out electronics with EPICS

64ch Scanning-ADC

Work by
S. Inaba

BLM

Cables
(~200m)

VME

To MPS

Integrator / Comparator
VME card



Cost estimation

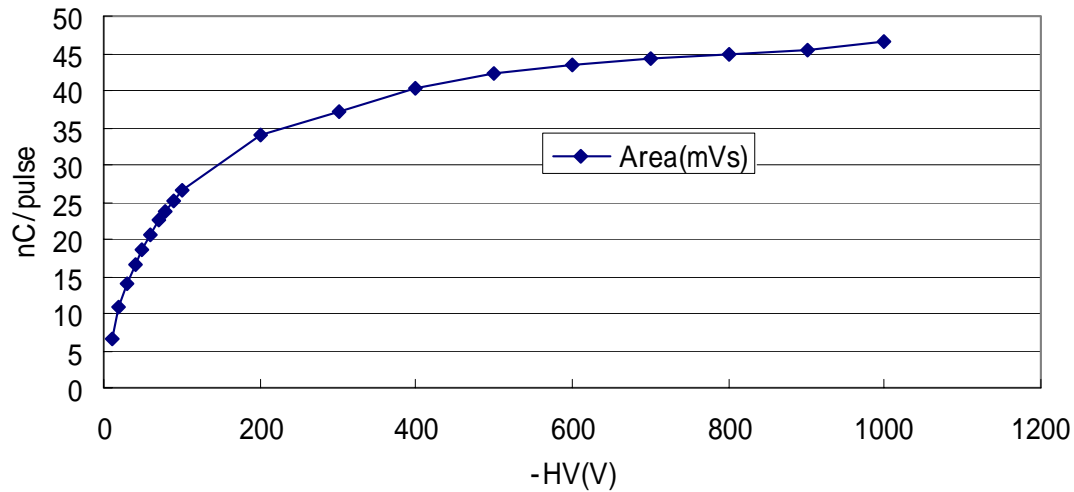
- Monitor (Production type)
 - HF-coaxial cable: ~ \$50 / m
 - Connectors, etc.: ~ \$30 / ch
 - Assembly: < \$200 / ch
- Cabling: ~ \$700 / ch (each BLM) ?
- Readout electronics: ~ \$100 / ch (Goal)
- Total cost: ~ \$1000 / ch (Goal)



Summary

- Prototype and production type of air-ionization chamber as BLM have been tested in the K2K beam line.
- Collected charge by BLM agree with the calculated one by MARS program.
- Readout electronics are designed and tested.
- BLM spacial configuration should be determined.
- Long term stability and radiation hardness will be tested.

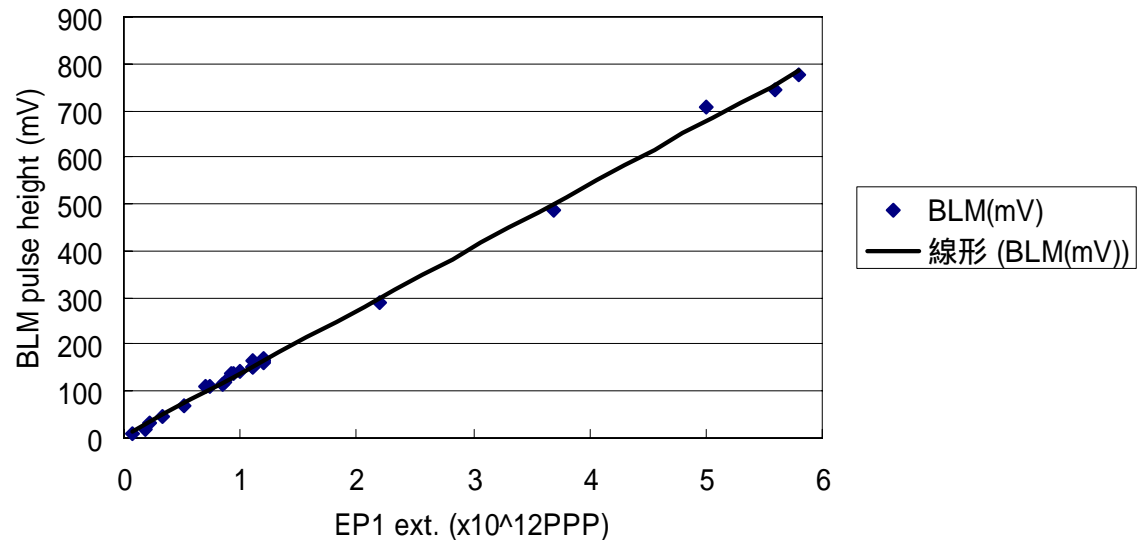
Plateau curve of BLM at TS
(6.1×10^{12} PPP)



Plateau curve @ TS
(New BLM)

Linearity @ Slope
(Prototype)

BLM@Slope beam current dependence



Expected BLM signal distribution

