

# *Targeting Monitor in K2K*

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for M. Ieiri, BCG and K2K

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Primary Beam Monitors

- SPIC/LS, CT/SEC

Targeting Monitor

- Motivation

CT for Secondary particles

- Response

- Analysis

Summary

# *Proton Beam Monitors*

*- SPIC/LS/CT/SEC*

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## **Profile Monitors**

SPIC: Segmented parallel Plate Ionization Chamber

LS: Luminescence Screen (Cr-doped Almina Ceramic Plate)

## **Intensity Monitor**

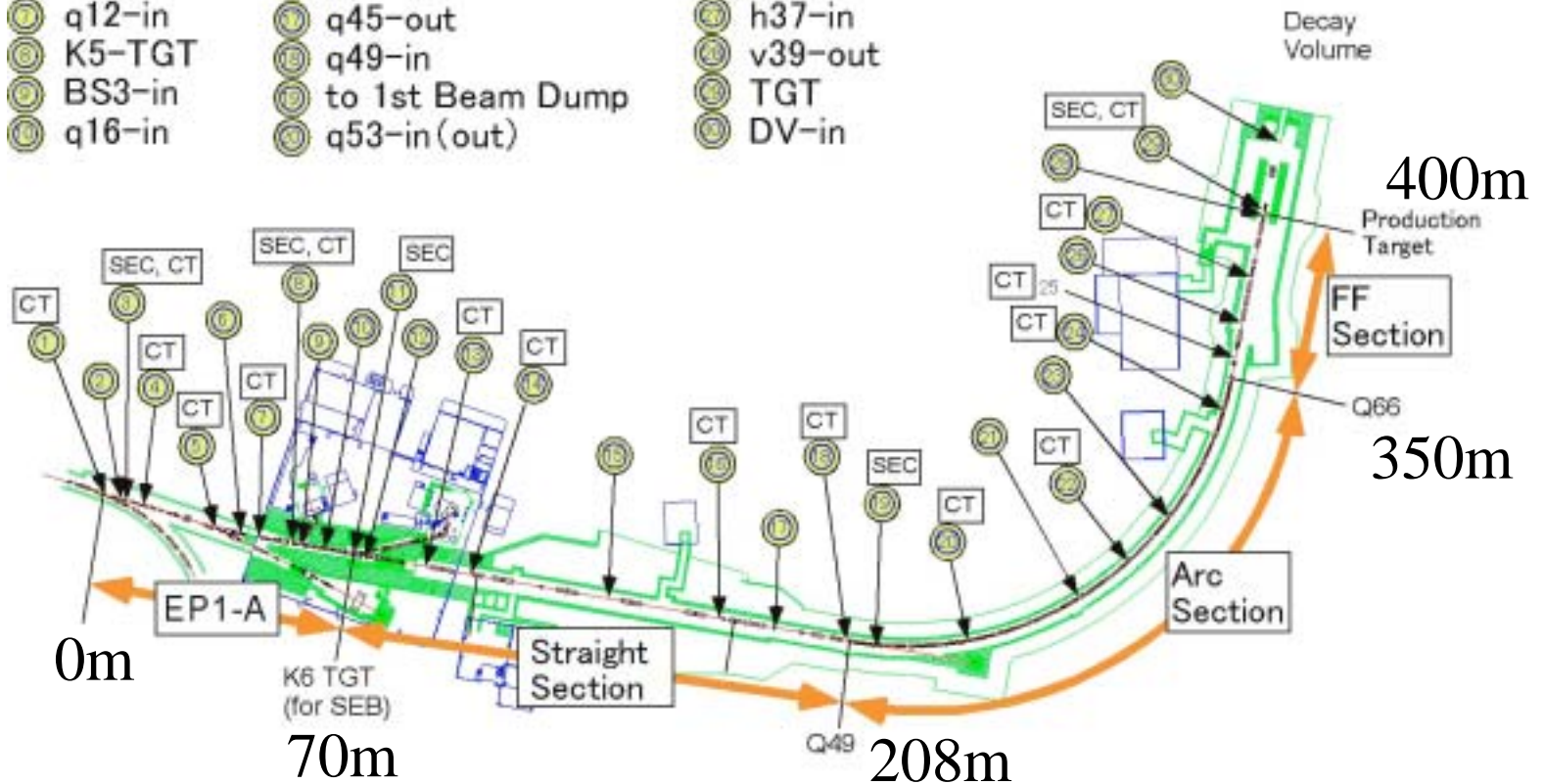
CT: Current Transformer

SEC: Secondary Emission Chamber (for Supplement)

# Proton Beam Monitors

- |            |                    |               |
|------------|--------------------|---------------|
| ① EP1-in   | ① K6-TGT           | ② q57-in(out) |
| ② q01-in   | ② bs6-in           | ③ q59-in(out) |
| ③ q01-out  | ③ q31-in           | ④ q61-in(out) |
| ④ Col.-out | ④ vd1-in           | ⑤ q65-in(out) |
| ⑤ q11-in   | ⑤ inbtwn q37—q38   | 25 b48-out    |
| ⑥ b12-out  | ⑥ h32-in           | ⑥ q68-in      |
| ⑦ q12-in   | ⑦ q45-out          | ⑦ h37-in      |
| ⑧ K5-TGT   | ⑧ q49-in           | ⑧ v39-out     |
| ⑨ BS3-in   | ⑨ to 1st Beam Dump | ⑨ TGT         |
| ⑩ q16-in   | ⑩ q53-in(out)      | ⑩ DV-in       |

Example  SPIC + LS  
25 LS only



# *Beam Monitors*

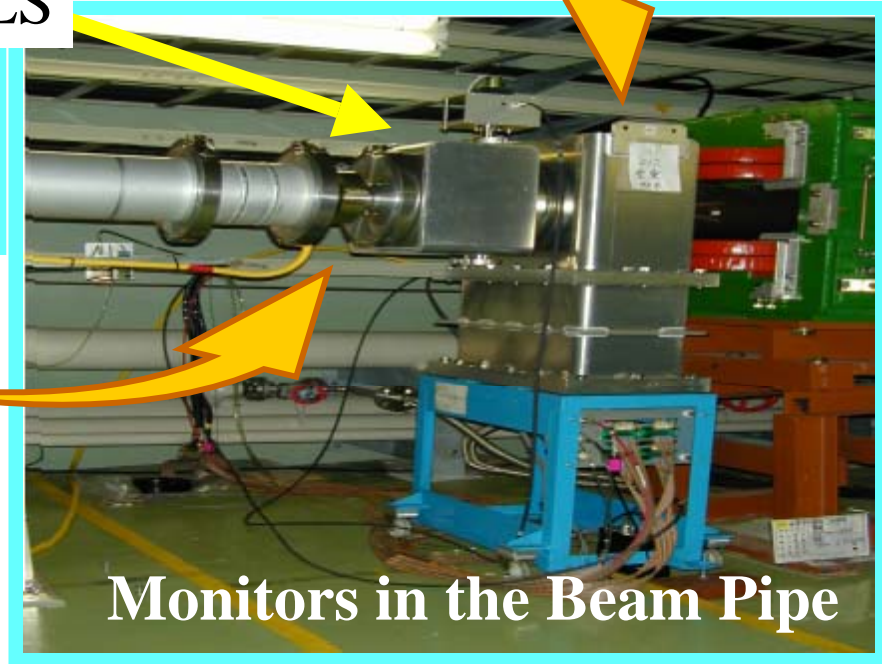
- SPIC/LS/CT



SPIC

LS

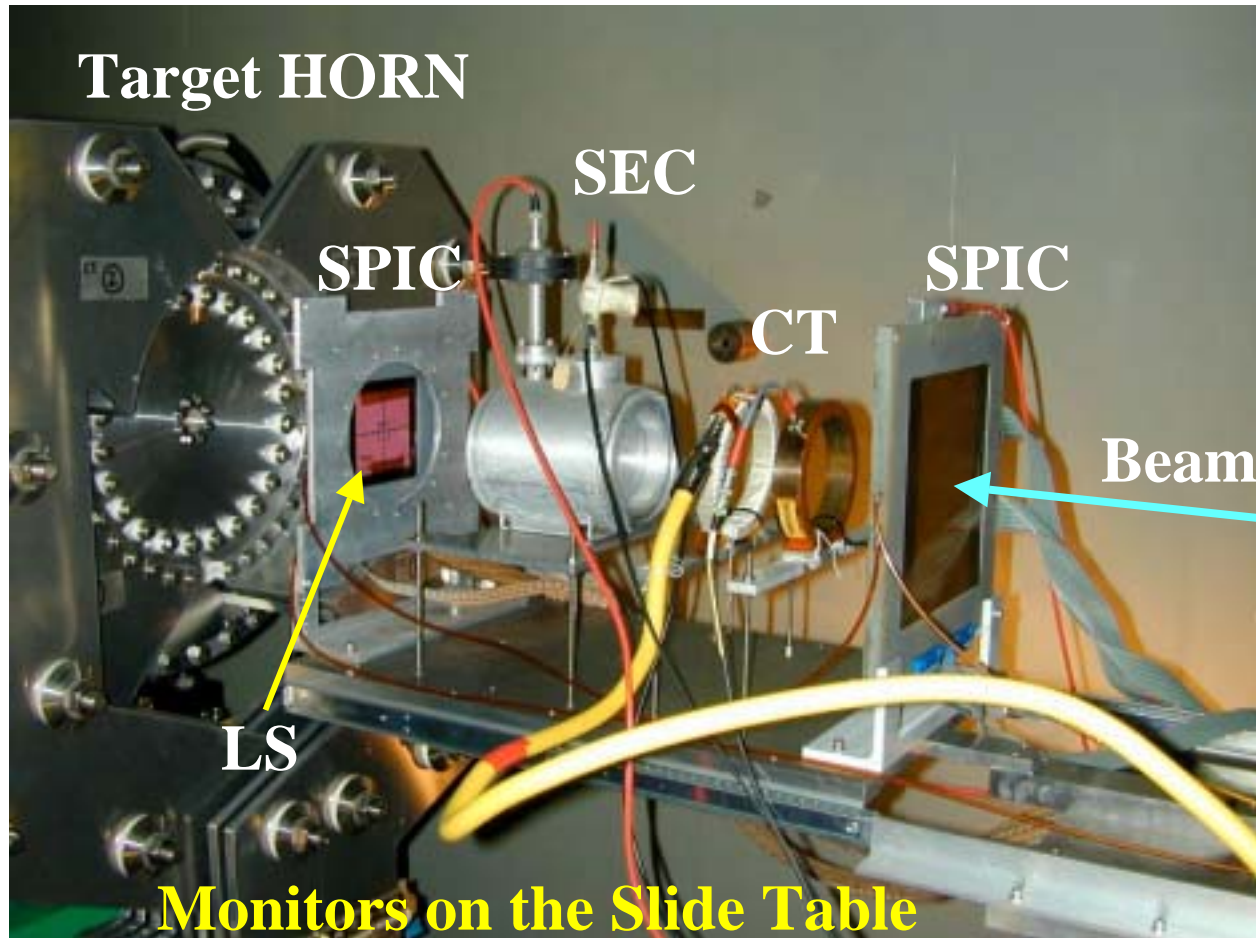
CT



Monitors in the Beam Pipe

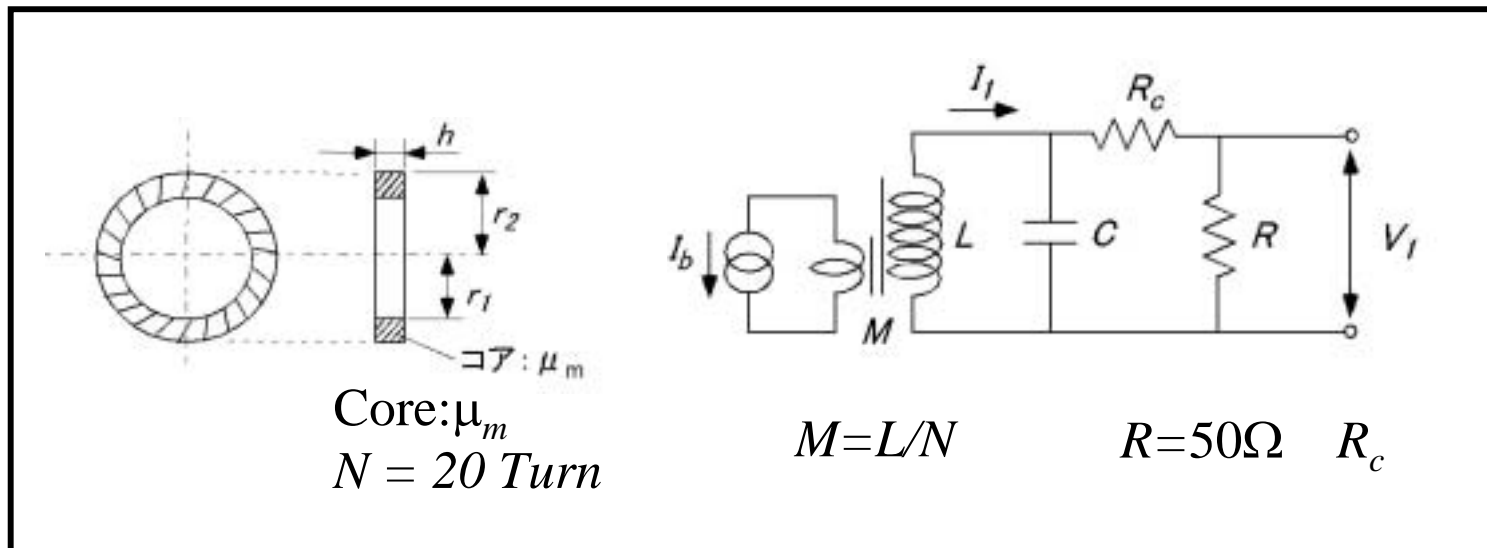
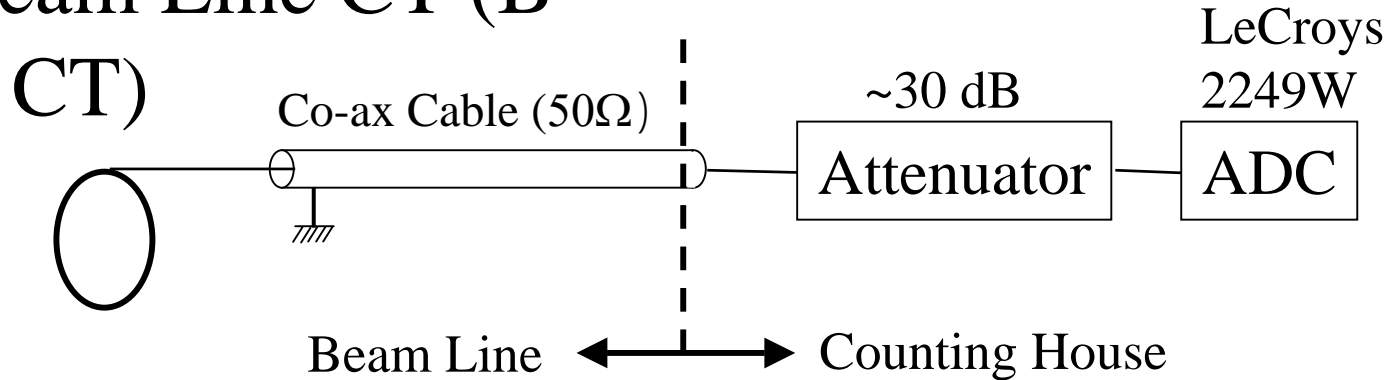
# *Beam Monitors*

*-at the Production Target*



# B-CT Response

## Beam Line CT (B-

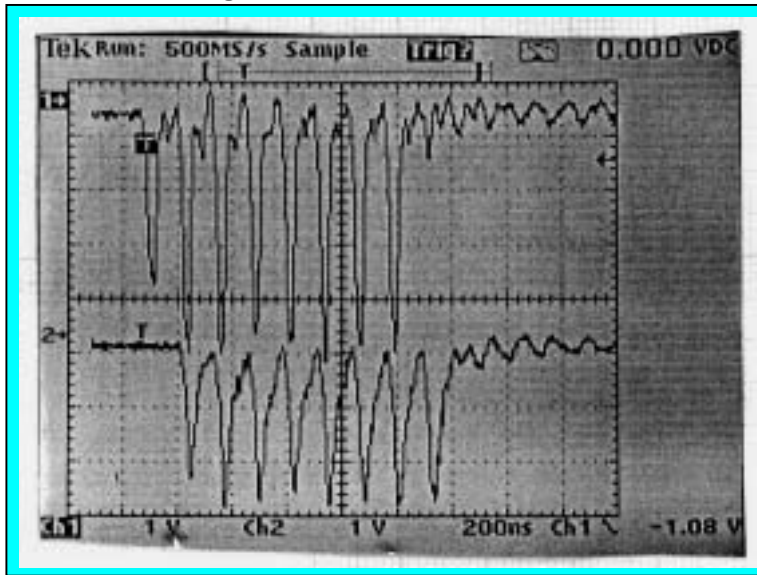


# B-CT Response (Cont.)

Signal

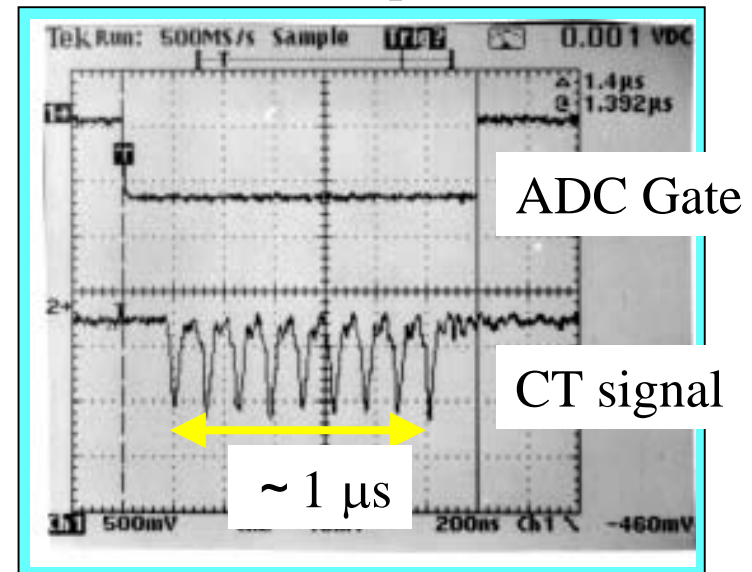
$$f_{RF} = 7.9 \text{ MHz}$$

Raw Signal (No Attenuation)



$\sim 10^{11} \text{ p/V}$

ADC input



$\sim 4 \times 10^9 \text{ p/pC}$





# Targeting Monitor

- Motivation

To monitor

## Secondary Particles at Production

To be monitored...

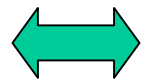
Production Efficiency

Spatial Distribution

Charge Distribution

}

Targeting CT



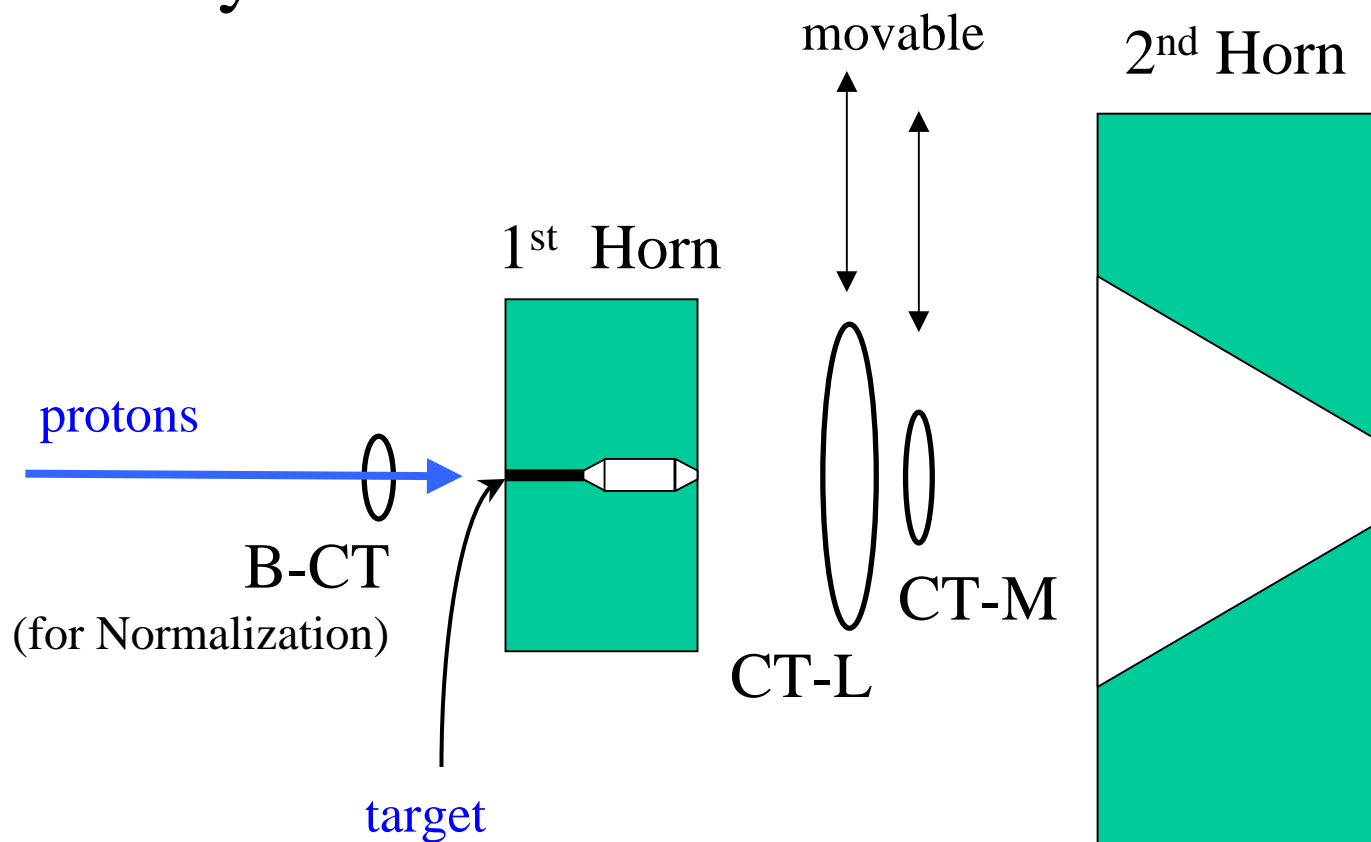
$\pi$  Cherenkov Monitor for  $P_\pi$  vs  $\theta_\pi$

Work at Low Intensity  
Need Off-line Analysis

# Targeting CT

-Setup

## CT Layout

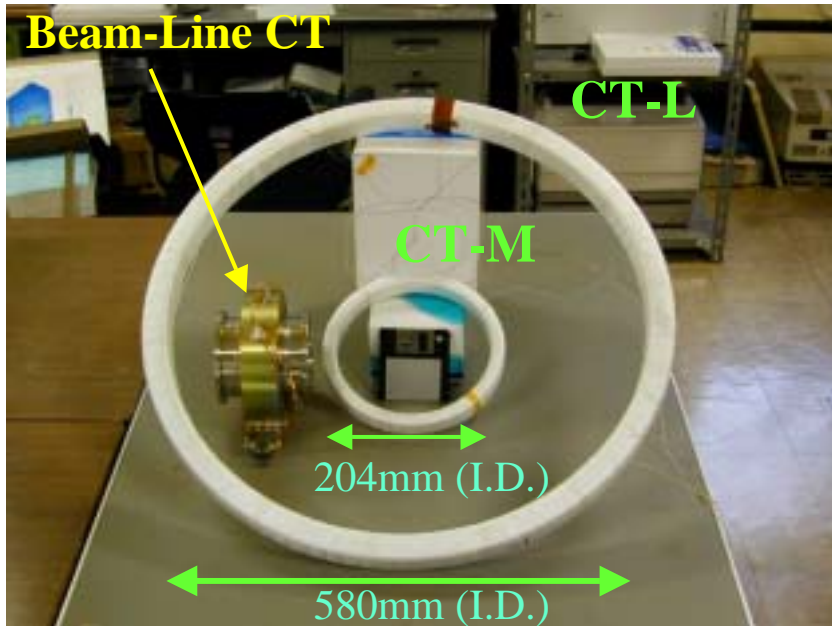


# CT for 2ndary Particles

## Targeting CT

[mm]	I.D.	O.D.
CT-L	580	600
CT-M	204	224
B-CT	130	150

Size



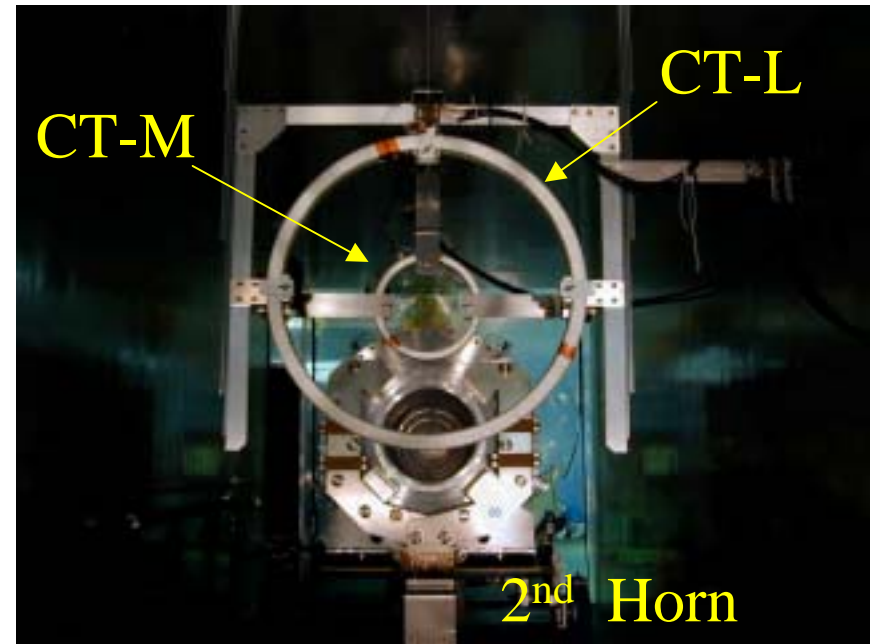
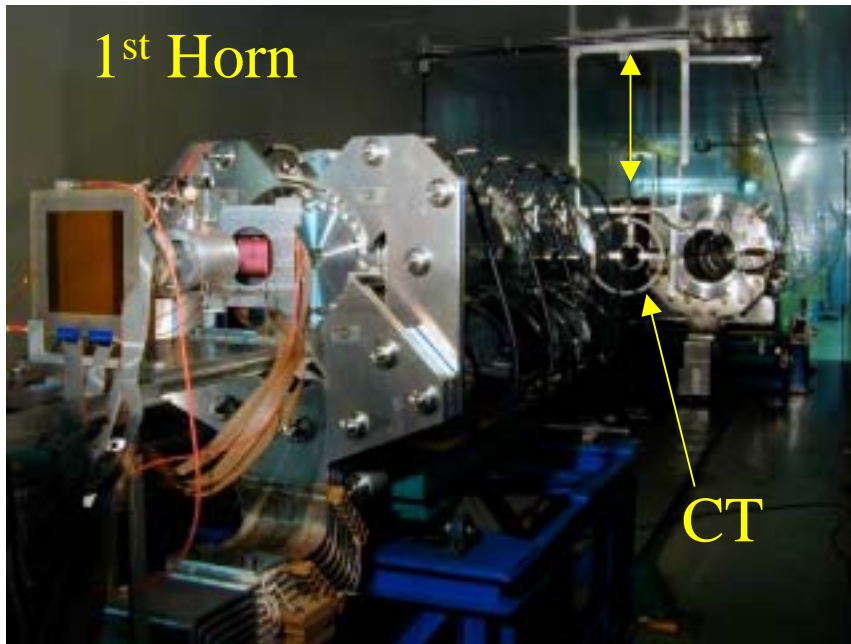
## Test by Dummy Current



# Targeting CT

-Setup (Cont.)

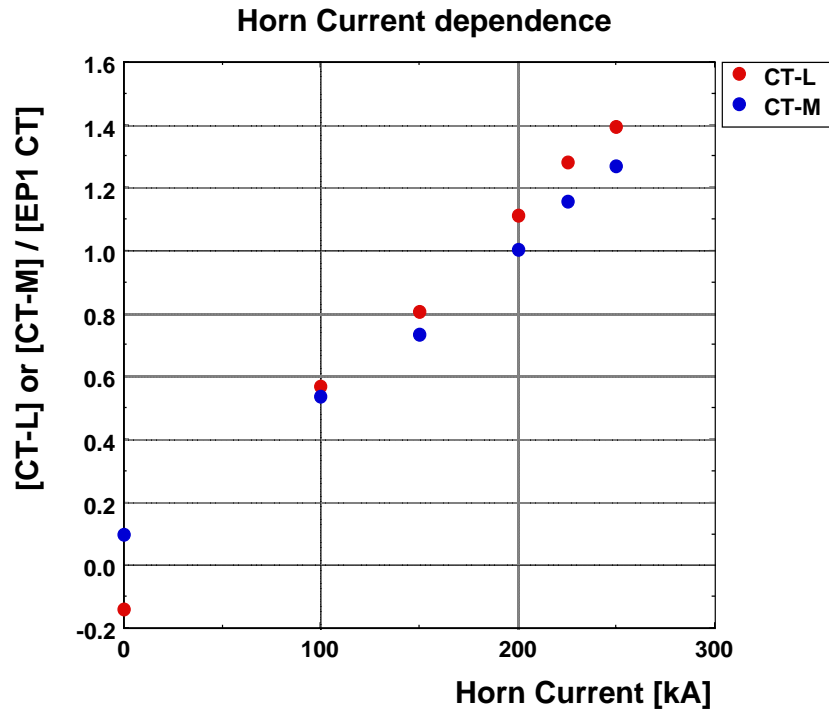
Targeting CT installed just behind the 1st HORN



# CT Response

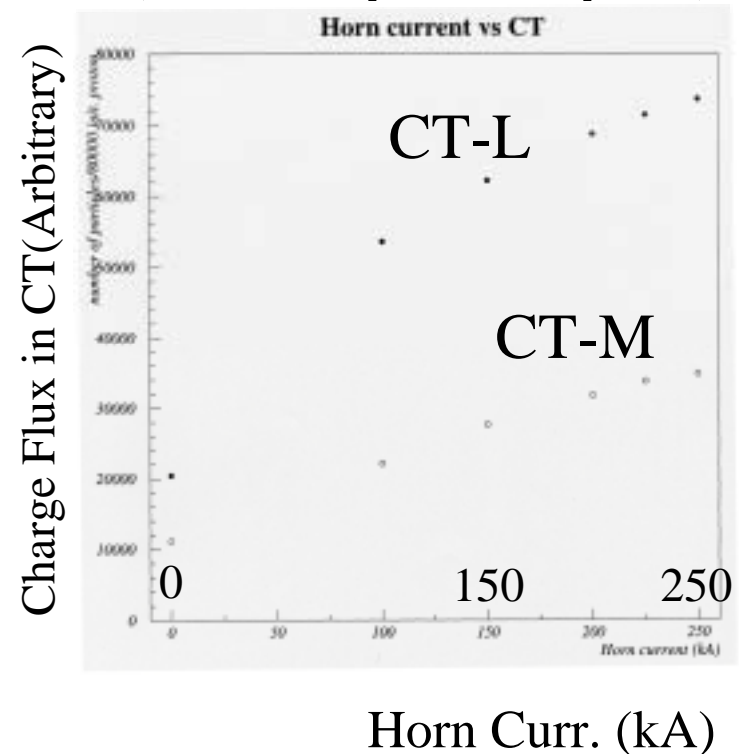
## - Horn Current Dependence

### Measurement



### Monte Carlo Simulation

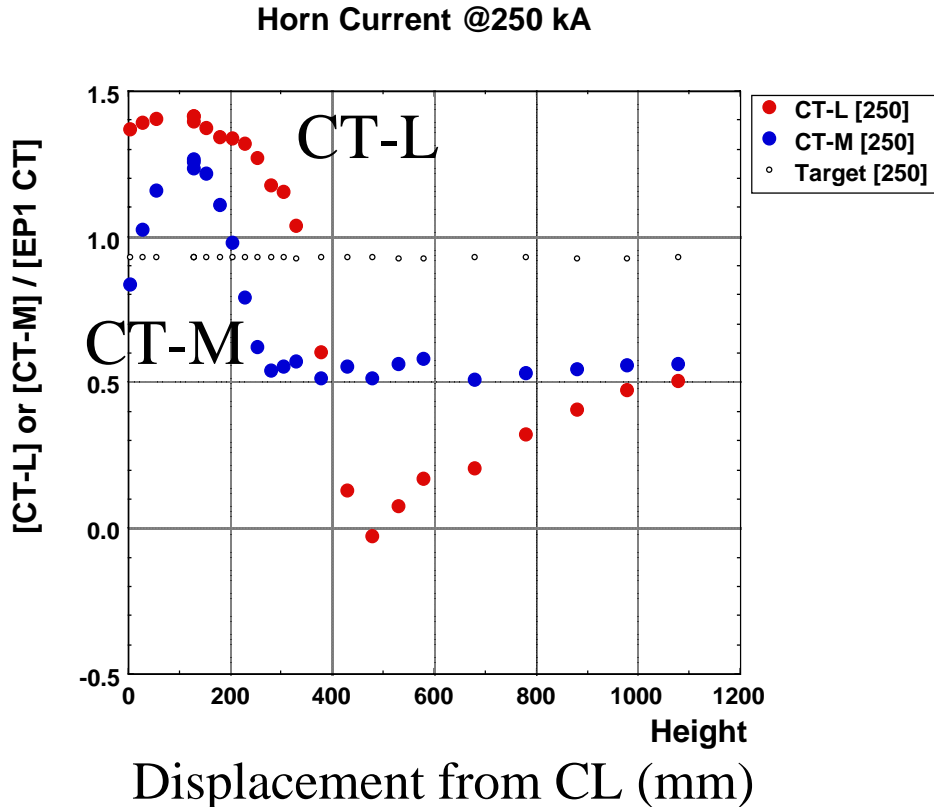
Charge Flux ( $N^+ - N^-$ ) thru CT  
(GEANT by T. Maruyama)



# CT Response

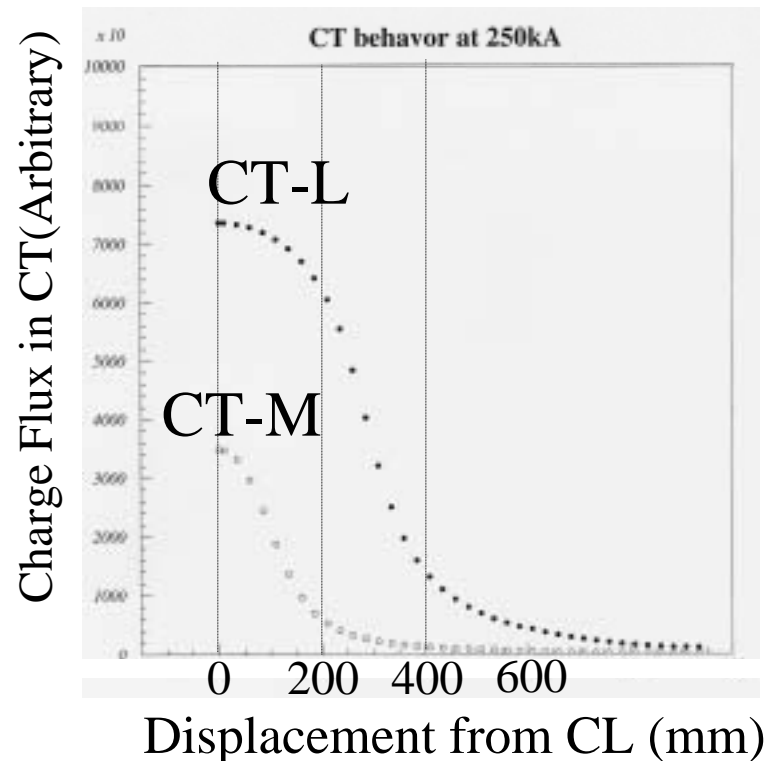
## - Radial Position Dependence

Measurement



Monte Carlo Simulation

Charge Flux vs CT pos.

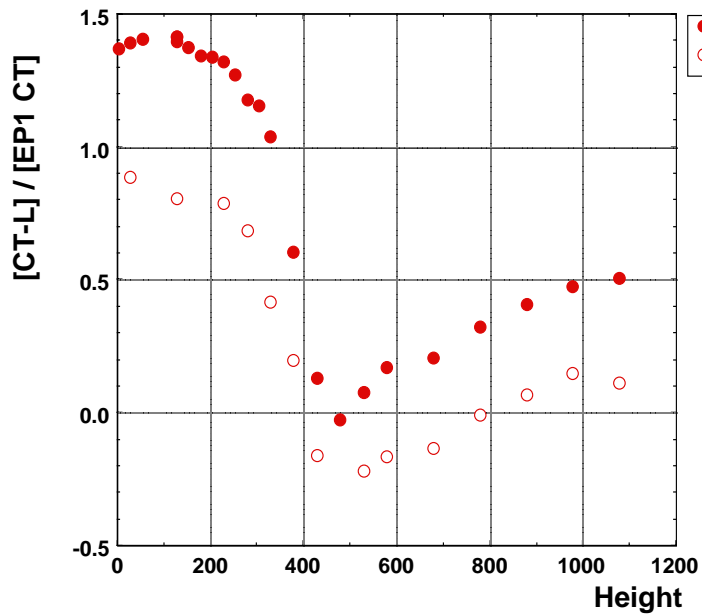


# CT Response

- Radial Pos. Dependence in Diff. Horn Curr.

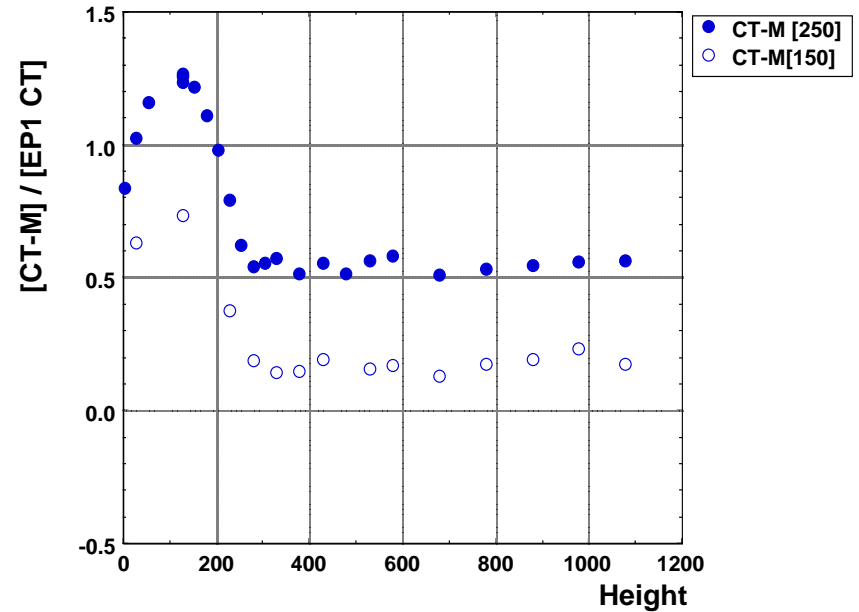
## Measurement

Large CT [Horn Current @250 kA & 150 kA]



Displacement from CL (mm)

Middle CT [Horn Current @250 kA & 150 kA]

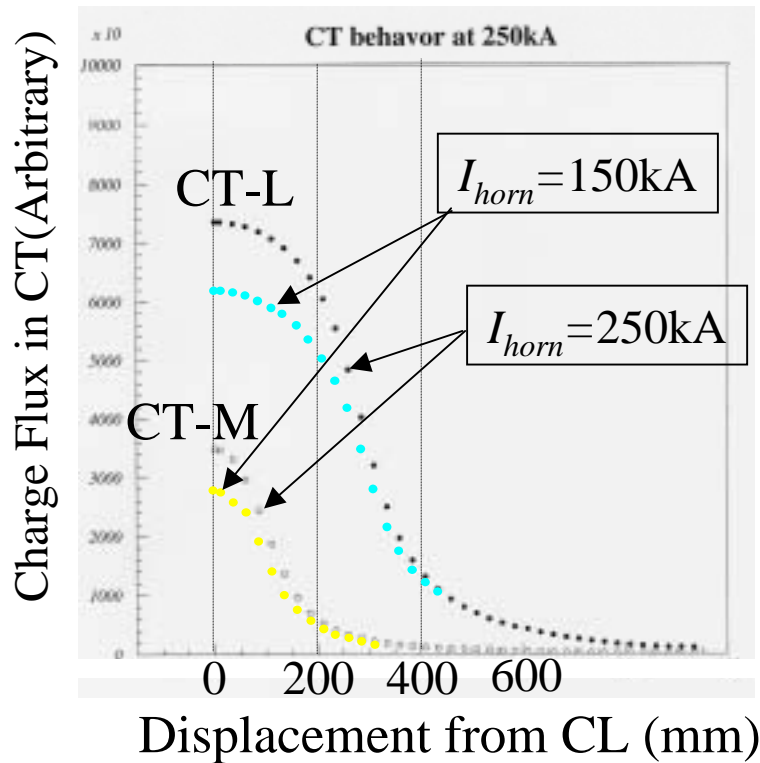


Displacement from CL (mm)

# CT Response

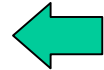
- Radial Pos. Dependence in Diff. Horn Curr. (Cont.)

## Monte Carlo Simulation



## Particle Contents in CT-L at $I_{horn} = 250kA$

p	63%
$\pi^+$	30%
$\mu^+$	3%
e+	11%
$\Sigma$ Pos.	107%
$\pi^-$	-1%
$\mu^-$	-0.1%
e-	-6%
$\Sigma$ Neg.	-7%



(preliminary)



# *CT Response*

## *- Other Result*

Effect of LS out ( $\sim 2.5\text{g/cm}^2$  removed from BL)

Signal	Increase	Normalized
CT-L	+2.8%	-2.1%
CT-M	+3.2%	-1.7%
Beam Transmission	+5.0%	---

Effect of Beam Incident-Angle Change

	No tilt	H-tilt	V-tilt
CT-L	1	+2%	+3%
CT-M	1	+0.8%	-2%

# Summary

B-CT works fine.

- Its response can be understood well.

Targeting CT has been examined.

- CT signal increases linearly with  $I_{horn}$
- Radial Dependence of CT signal was observed



Simple Charge-Flux Distribution thru CT does not explain...

... For Further Understanding of the Response, we need to consider

1. Effect of the particles hit the core...?
2. Asymmetric current source out of CT...?
3. Misunderstanding of Low-E particle affects CT...?

- Other Result

Detect the CT-L/M output change when LS out

Targeting CT works at T-Station,  
having some sensitivity to the primary beam condition on TGT.  
CT is potentially useful for a targeting  
monitor.