

NET-SCAN

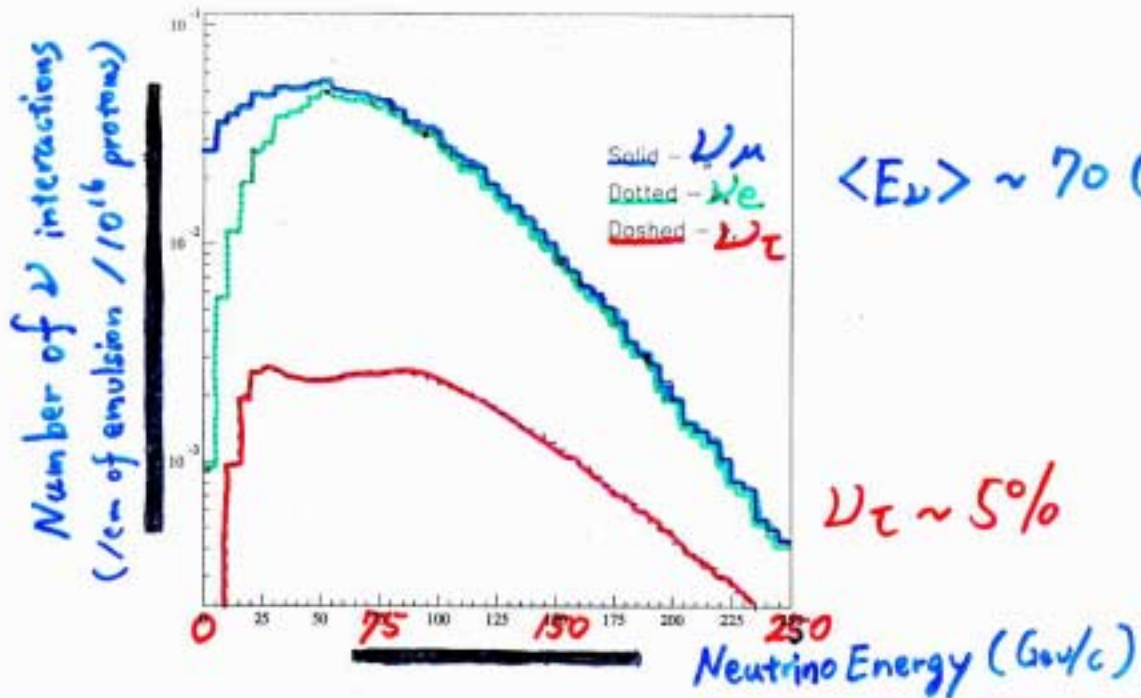
DEVELOPMENT

in DONUT

N. NONAKA

# [ $\nu$ beam]

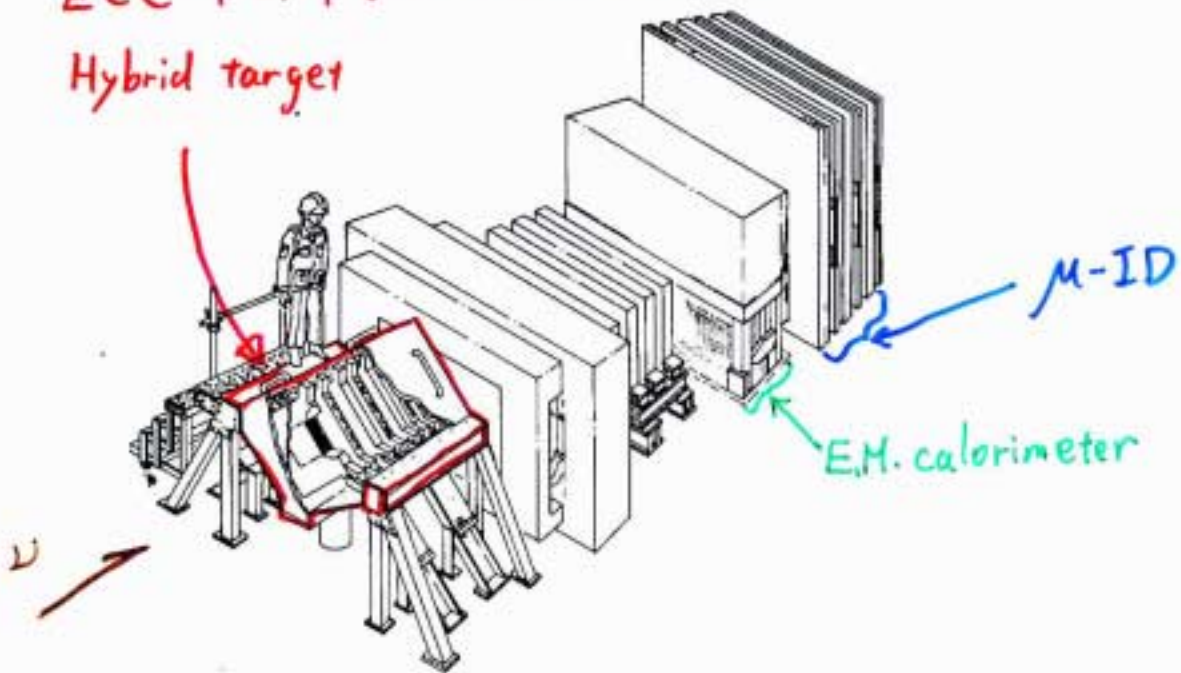
- 800 GeV Proton Dump (Tevatron FNAL)



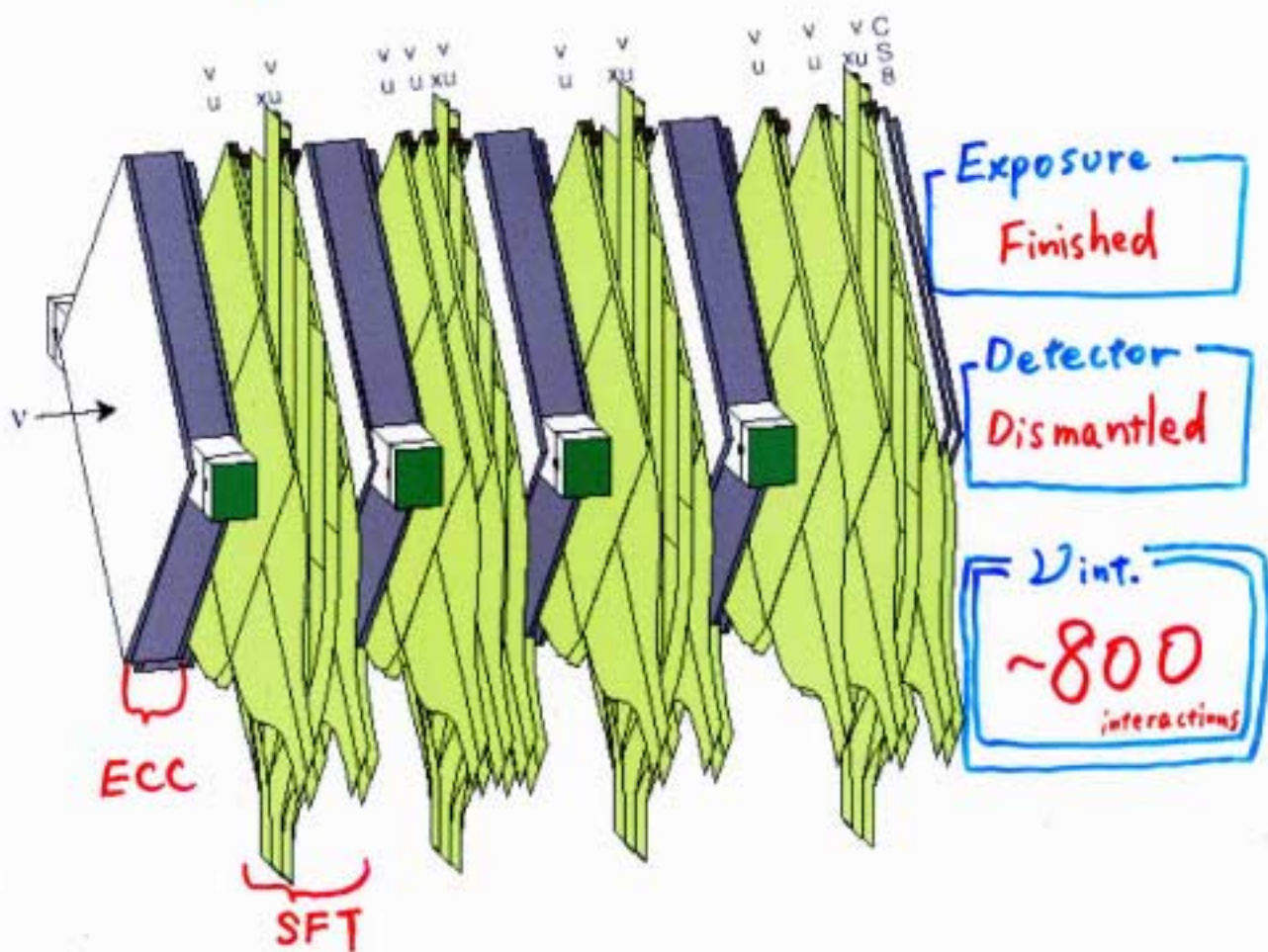
# [Detector]

ECC + SFT (Simulation Fiber Tracker)

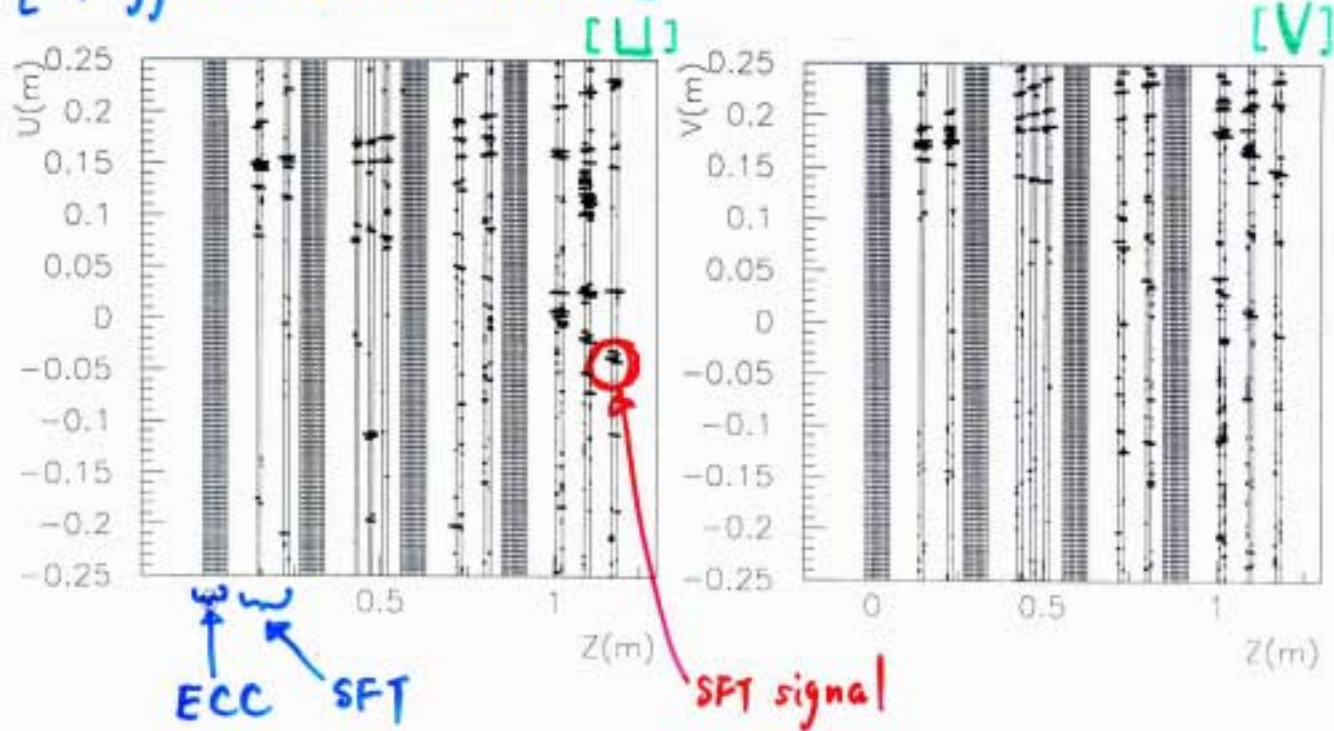
Hybrid target



# [ ECC-SFT Hybrid Target ]



## [ Triggered $\nu$ interaction ]

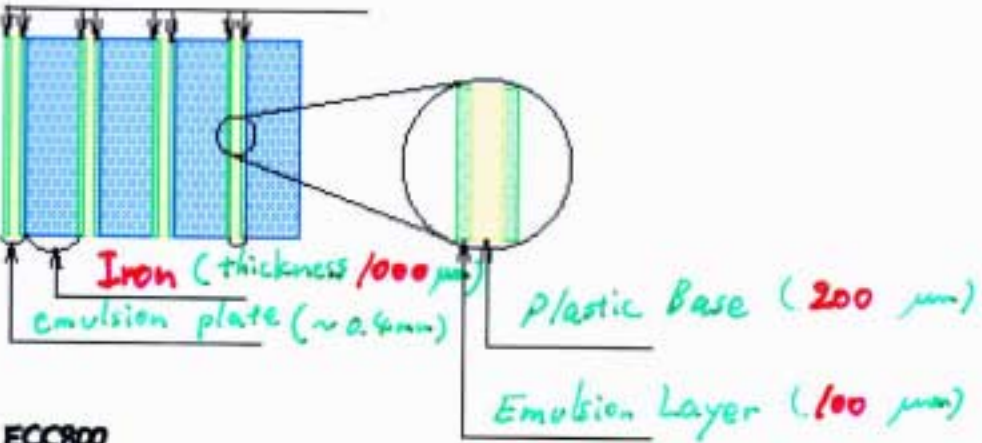




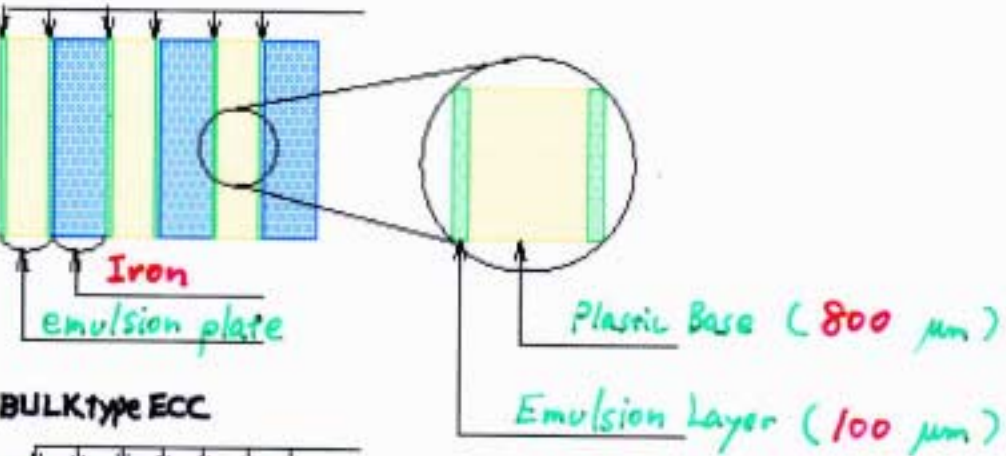
# DONUT ECC

↓

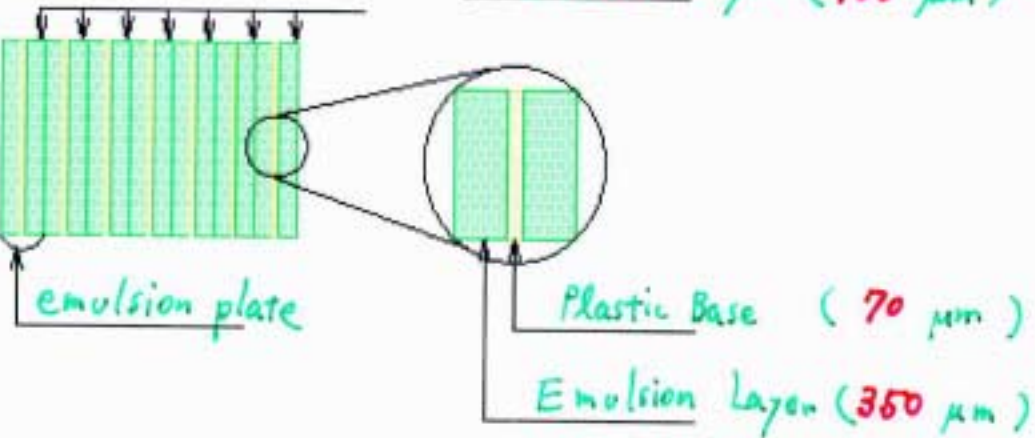
ECC200



ECC800



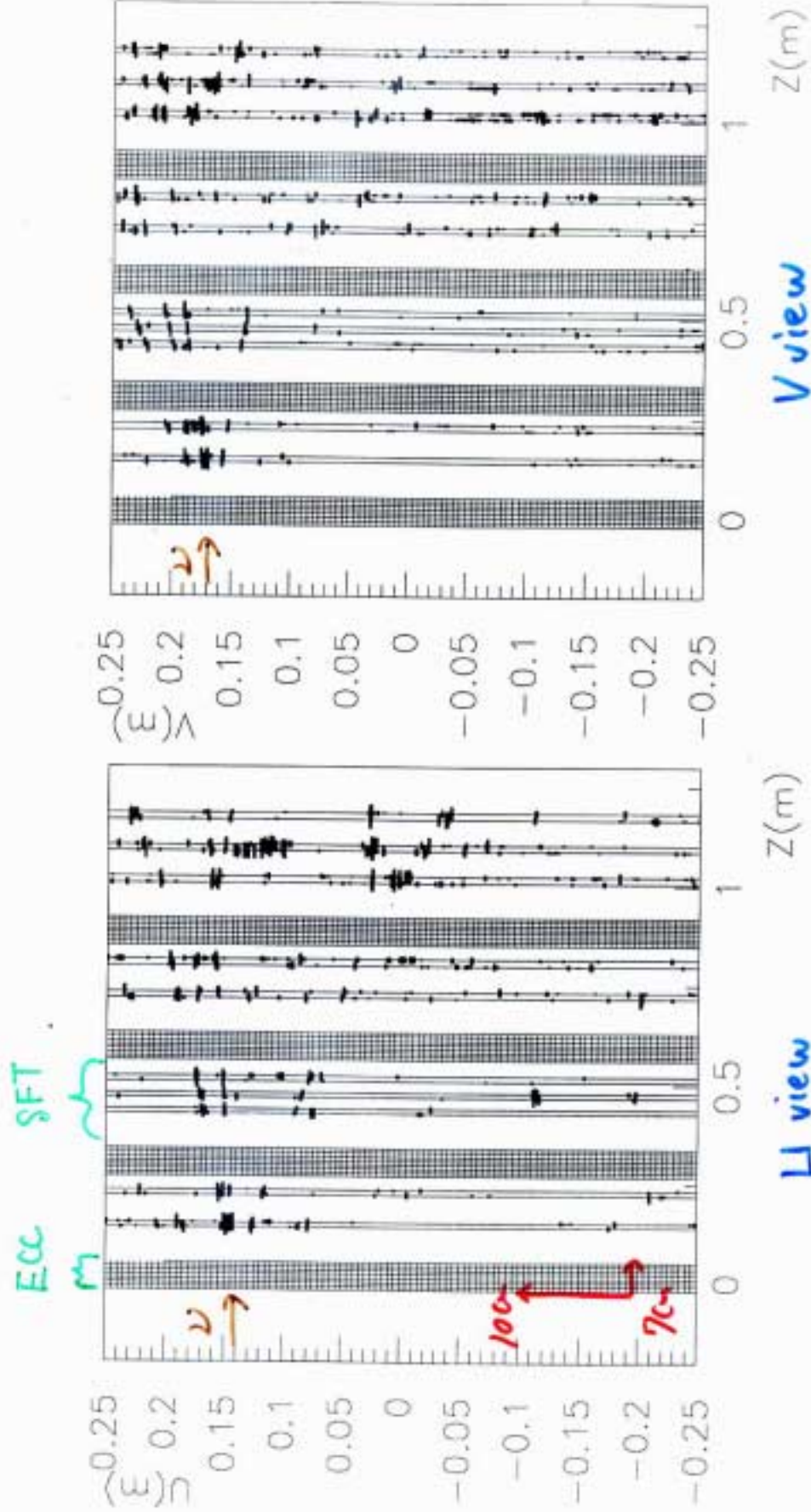
BULKtype ECC



# Simple event

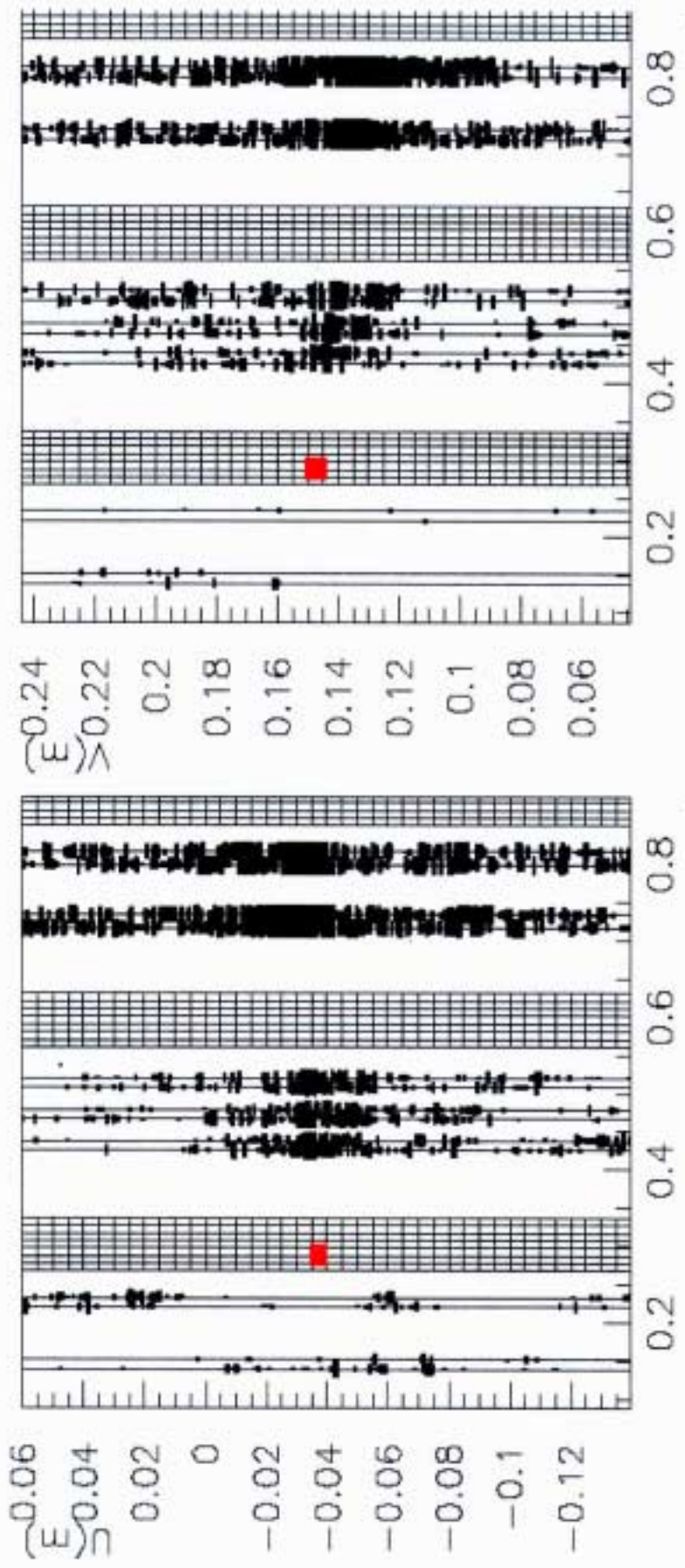
Location Method: Scan Back Location (in proposal)

# of Dist. :  $\sim 200/800$



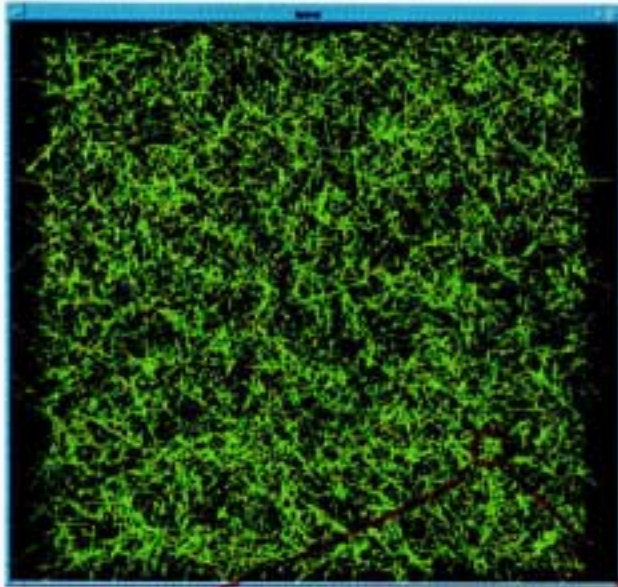
# Typical Event

# of Vint :  $\sim 600/800$



Too much SFT signals, 3dim. track reconstruction is Difficult!





$5 \times 5 \text{ mm}^2$

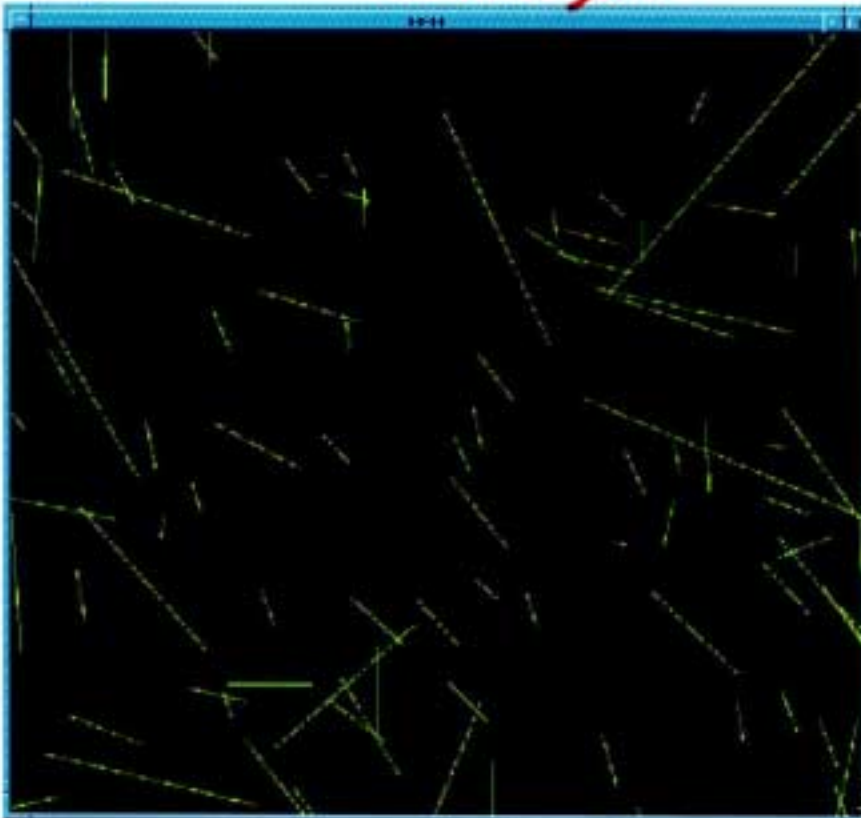
Scanning time

$\sim 15 \text{ min}$  by UTS

Number of tracks

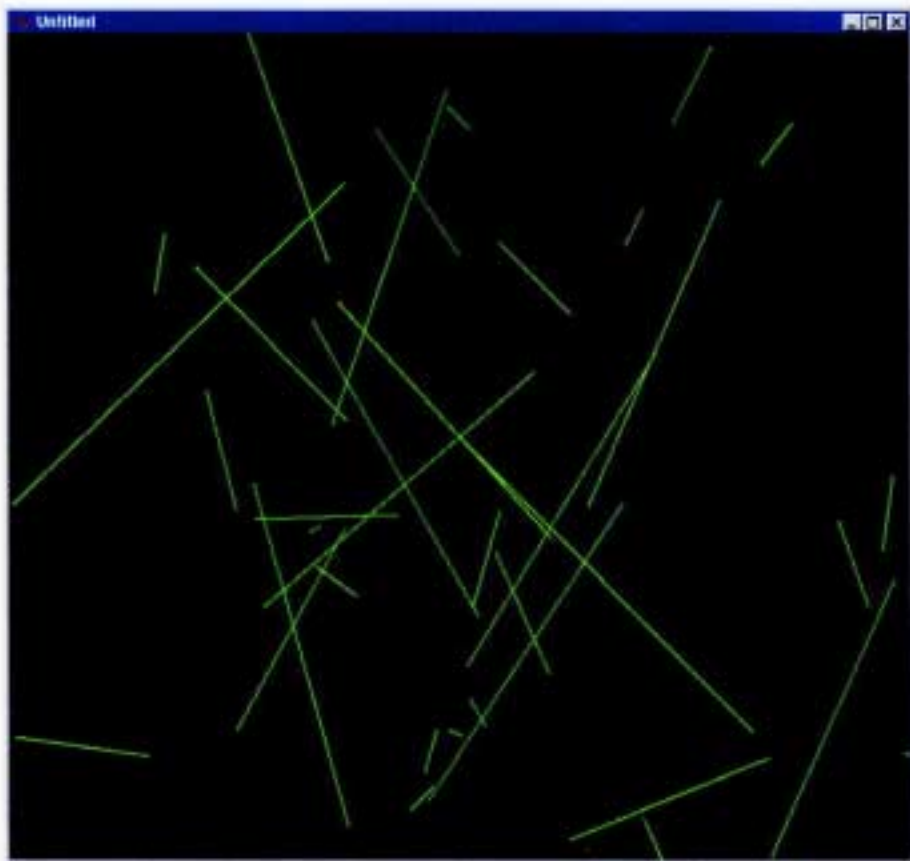
$\sim 10,000 / 5 \times 5 \text{ mm}^2$

$300 \times 300 \mu\text{m}^2$



$\sim 100 \text{ tracks}$

# CHORUS

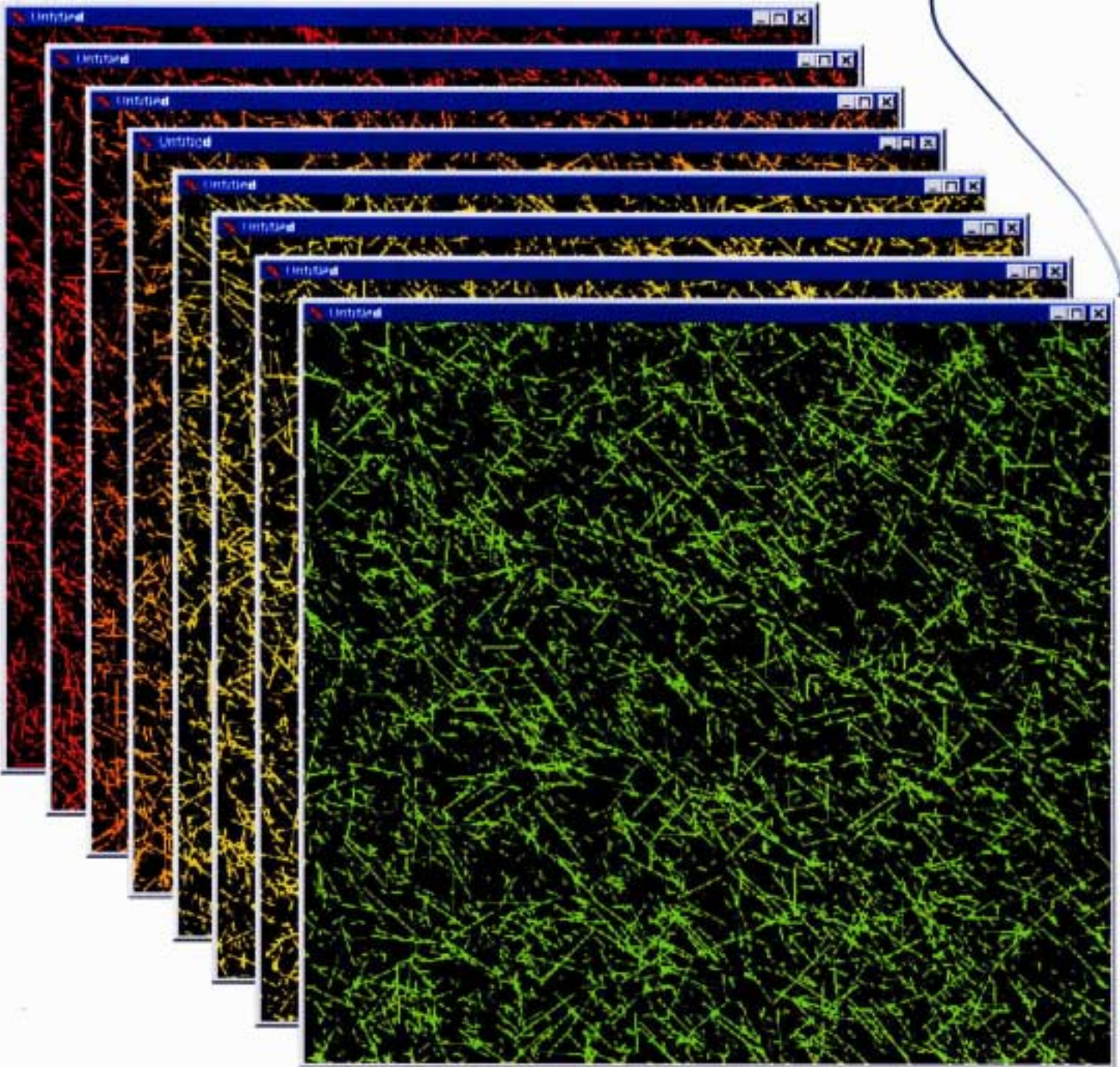


~30 tracks

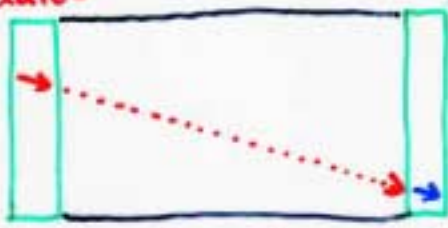


Length = 15 ~ 20 mm

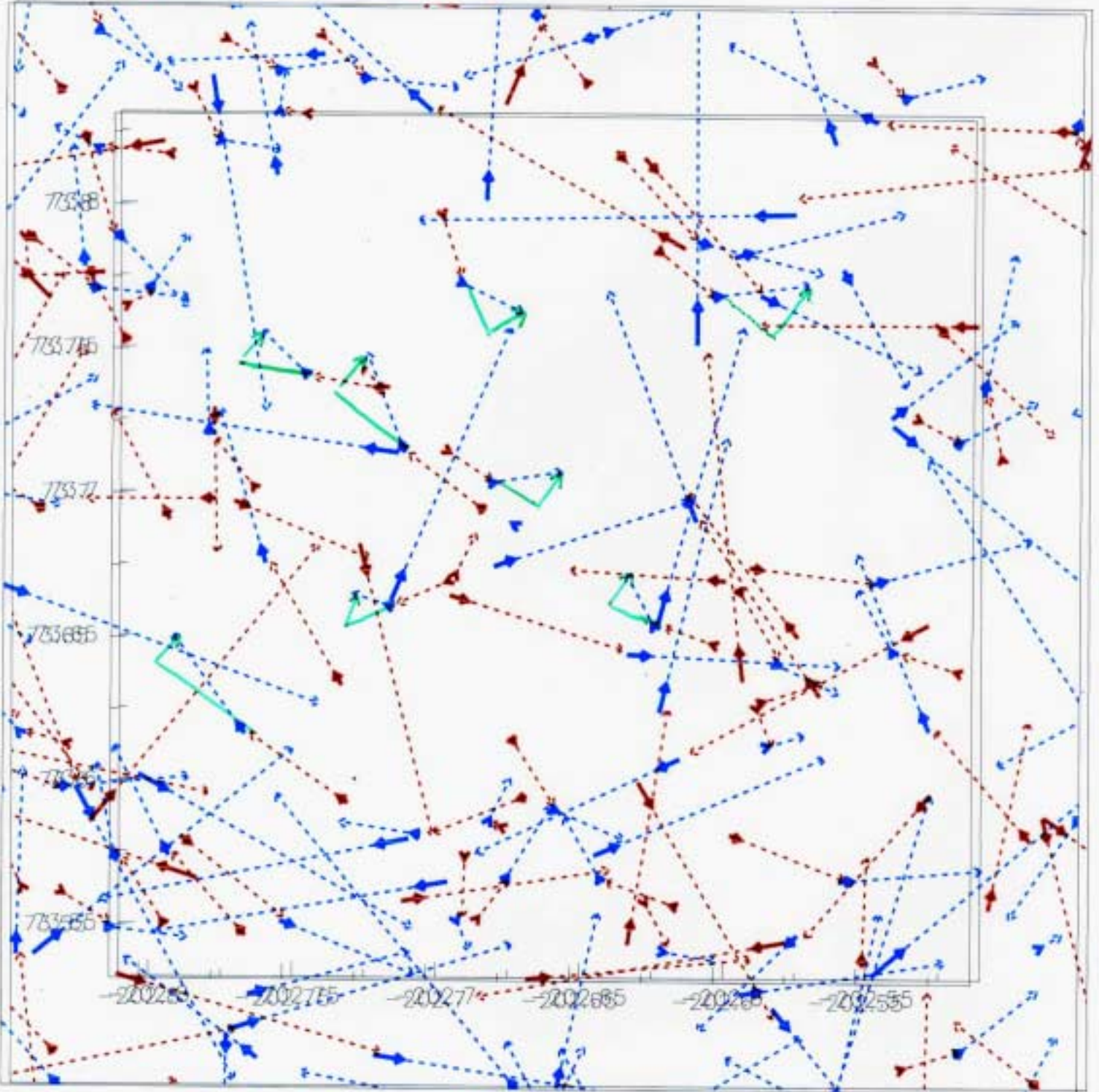
10 ~ 20 plates







→ Slope displacement



← 300 x 300  $\mu\text{m}^2$  →

## Calibration

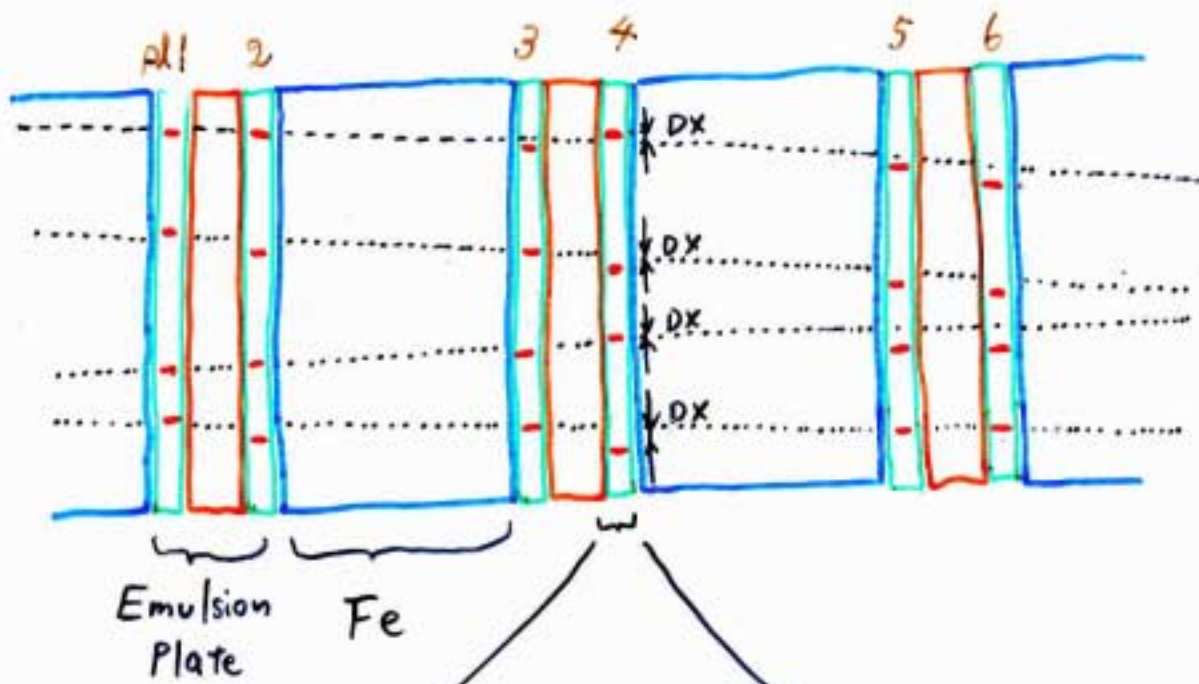
1. Position shift
2. Rotation
3. Distortion
4. Shrinkage
5. Distance between 2 plates



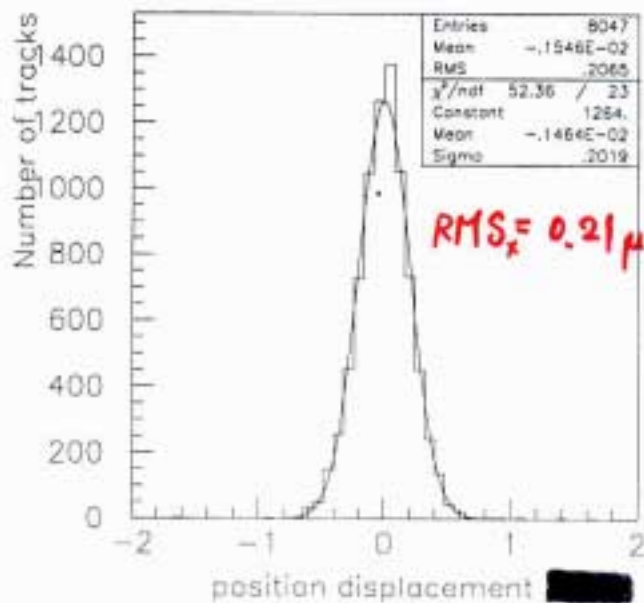
# NET-SCAN DATA Quality

1. Position Accuracy
2. Read-out efficiency
3. Miss Connection Ratio

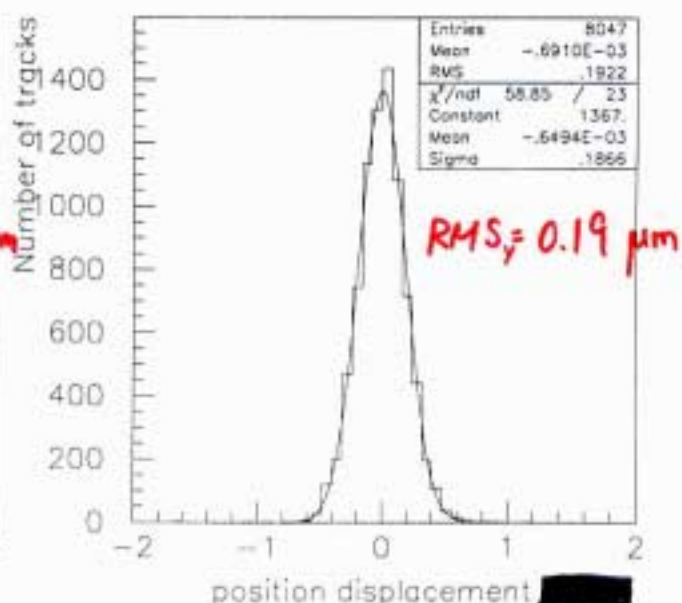
# Position Accuracy



At pl 4, position displacement, distribution



$DX (\mu\text{m})$



$DY (\mu\text{m})$

50x50c



NETSCAN DATA #2

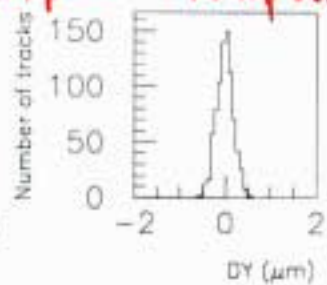
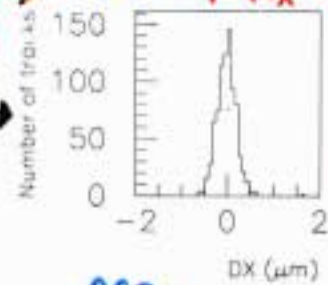
Pl. ~ 5 8.2, 1



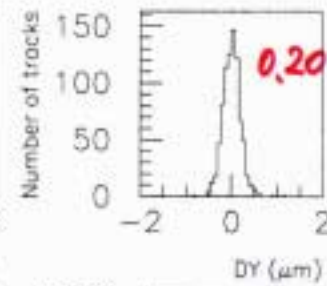
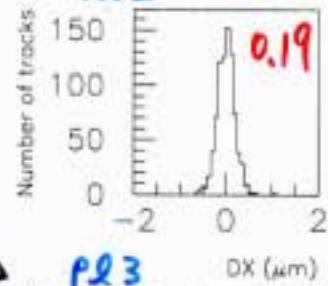
Pl 1

$RMS_x = 0.21 \mu m$

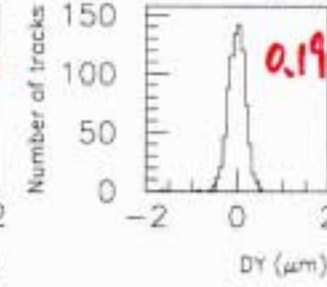
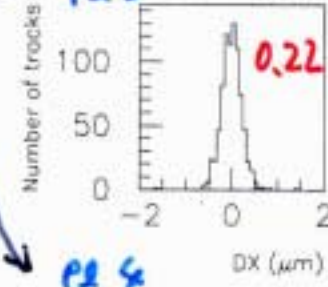
$RMS_y = 0.19 \mu m$



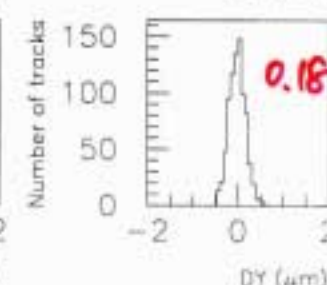
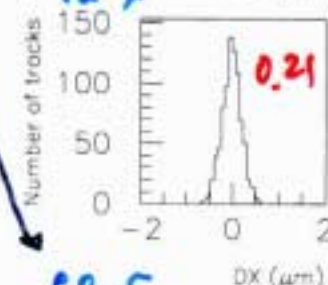
Pl 2



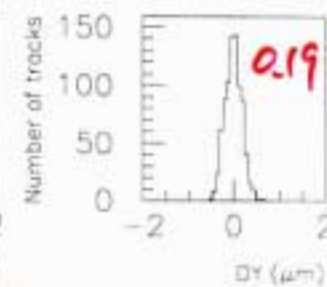
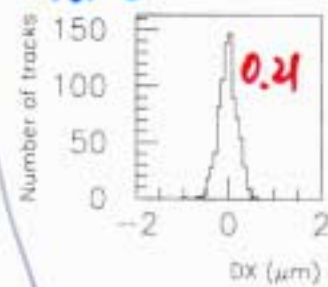
Pl 3



Pl 4



Pl 5



Pl 6



NETSCAN DATA #4

7cm

NET SCAN DATA #3

20cm



$0.5 \times 0.5 \text{ cm}^2$

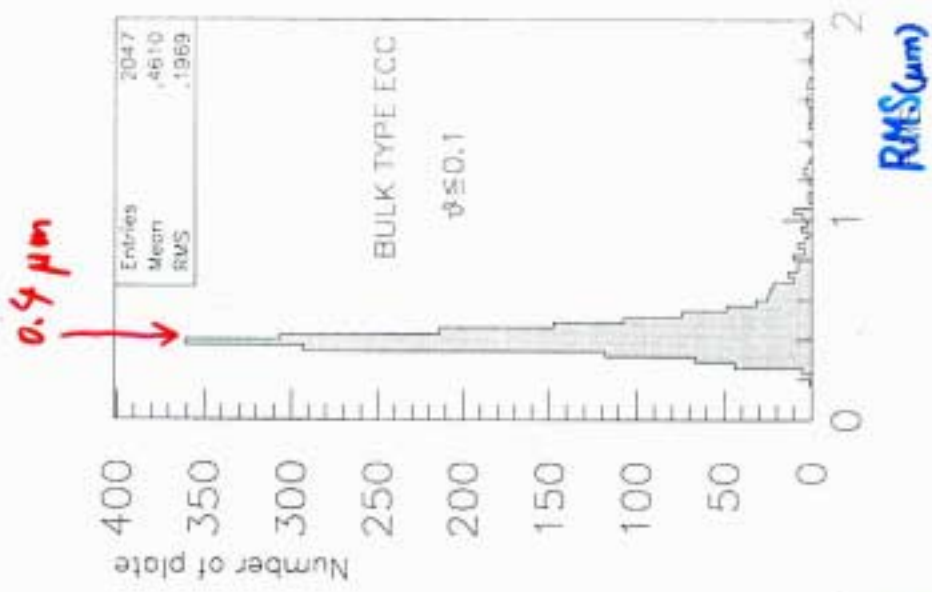
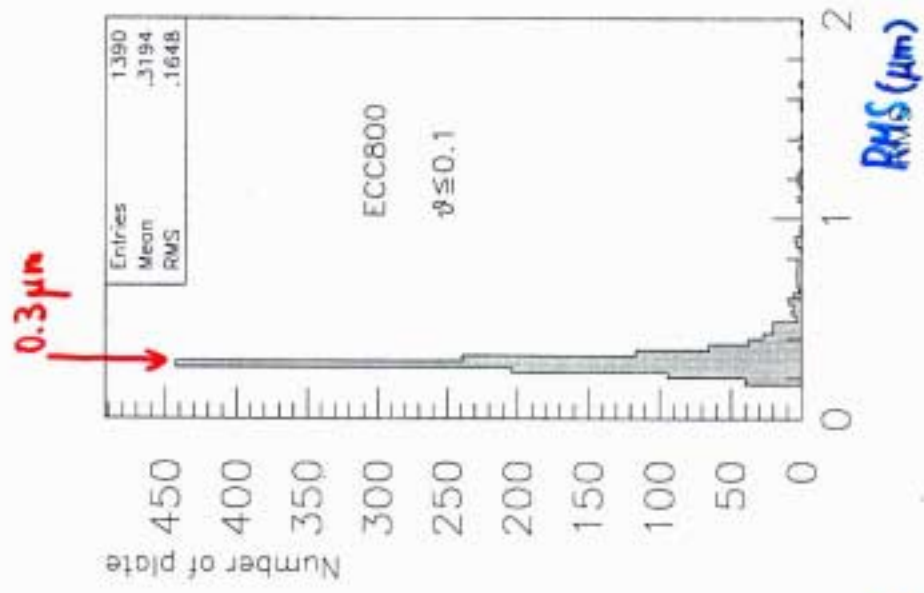
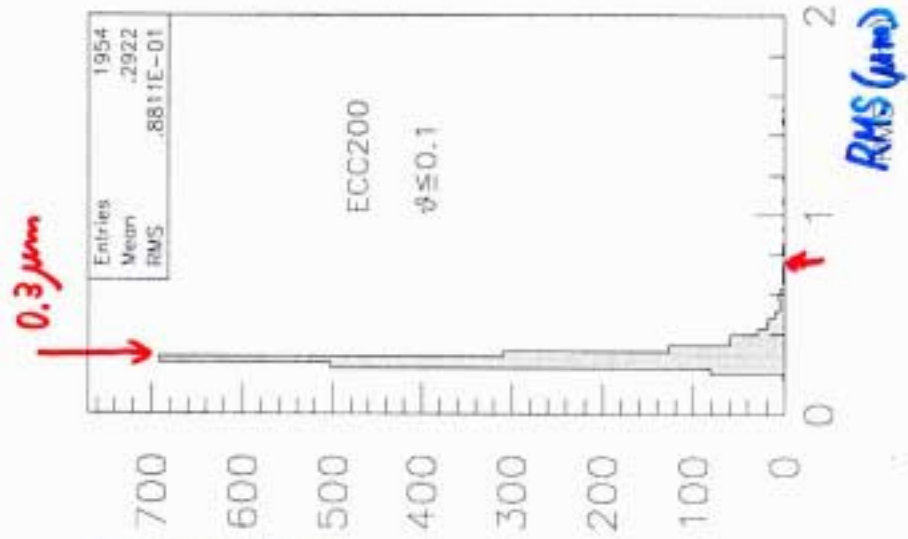


# Position Accuracy of NETSCAN DATA

337 NETSCAN DATA  
5,500 emulsion plates

$$RMS \equiv \sqrt{RMS_x^2 + RMS_y^2}$$

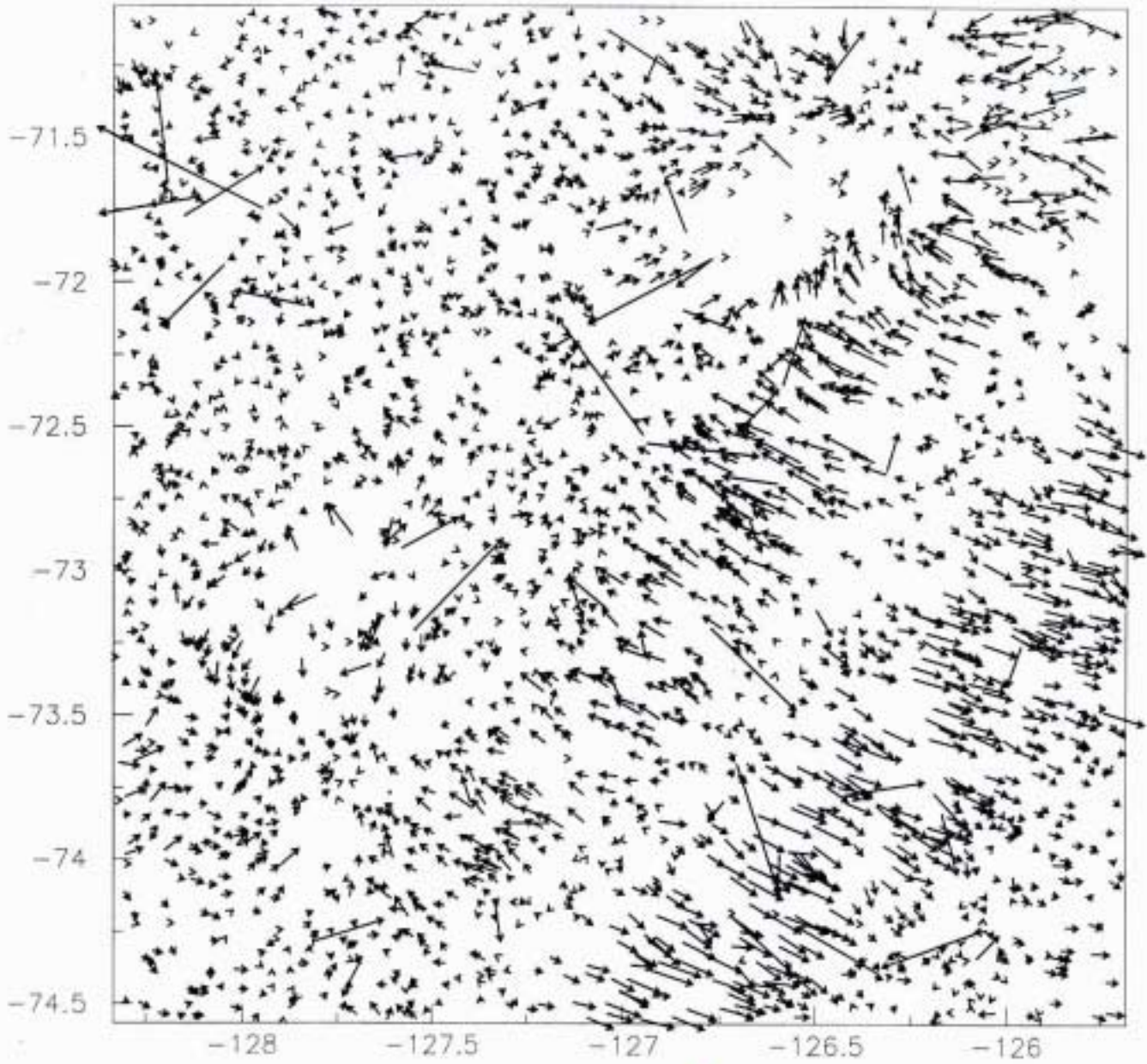
Number of emulsion plates



for each tracks

RMS = 0.80  $\mu\text{m}$

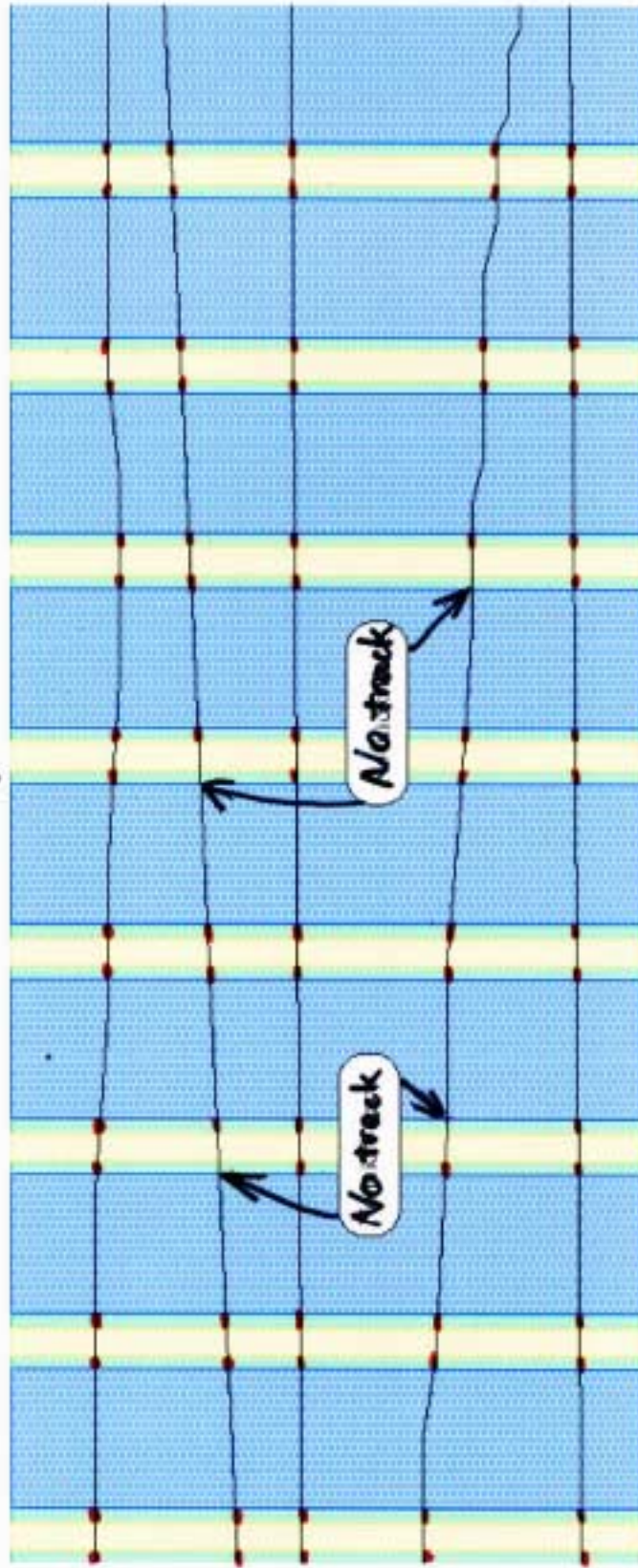
4x4  $\text{m}^2$





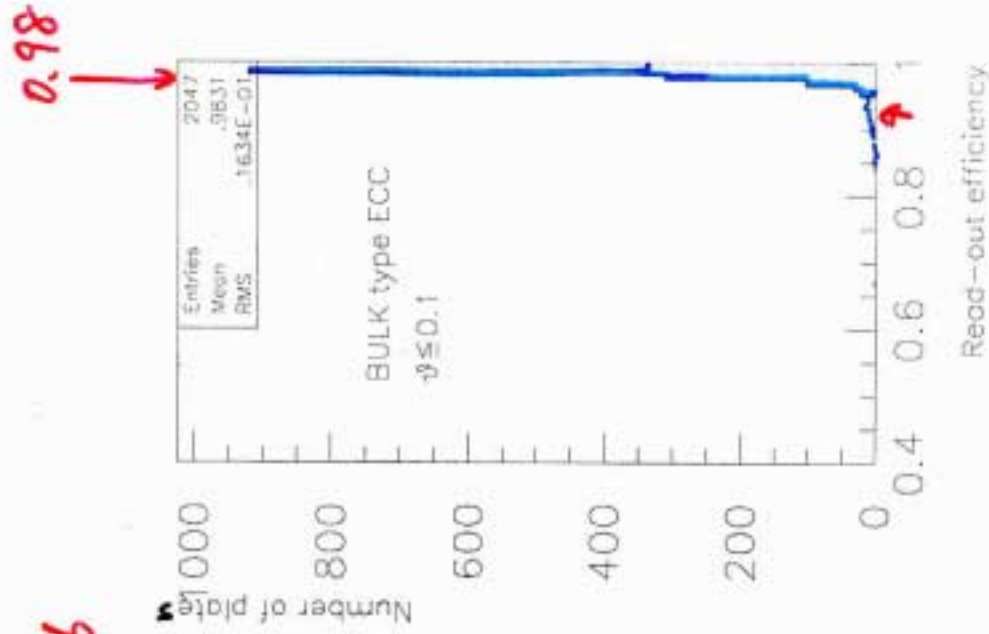
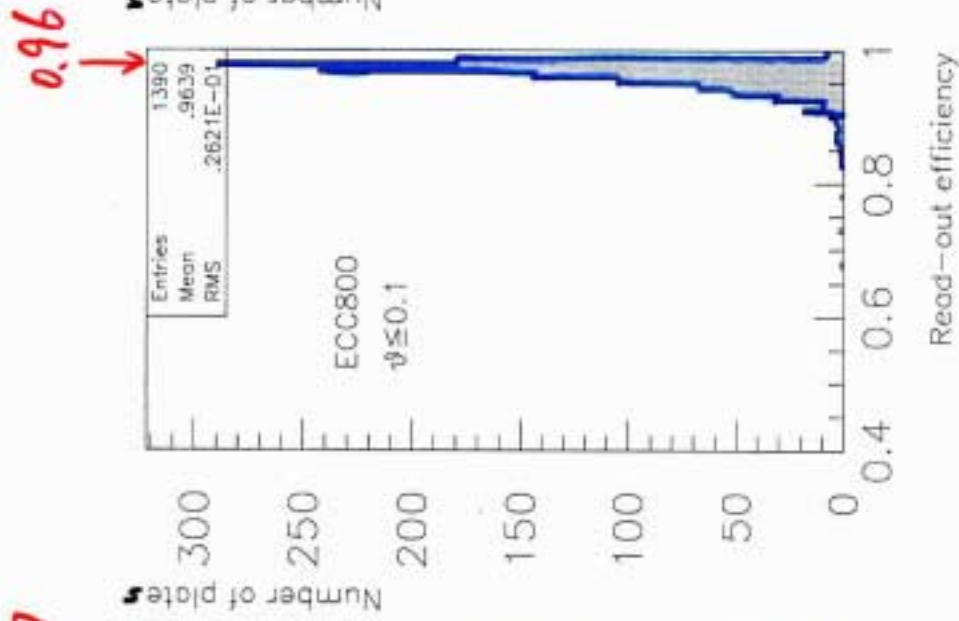
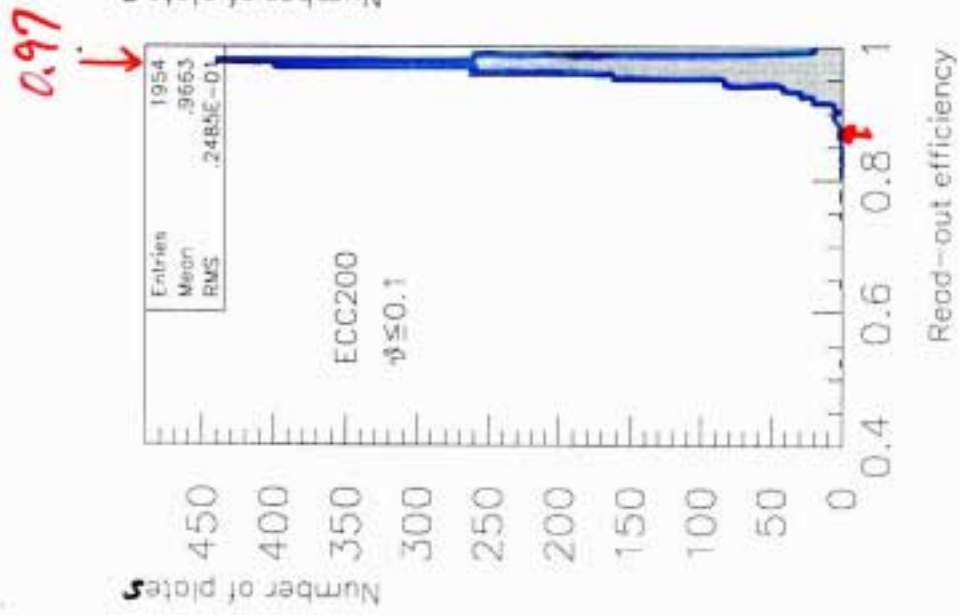
# Read-out efficiency

$$\text{Read-out efficiency} = \frac{4}{5} = 0.8$$



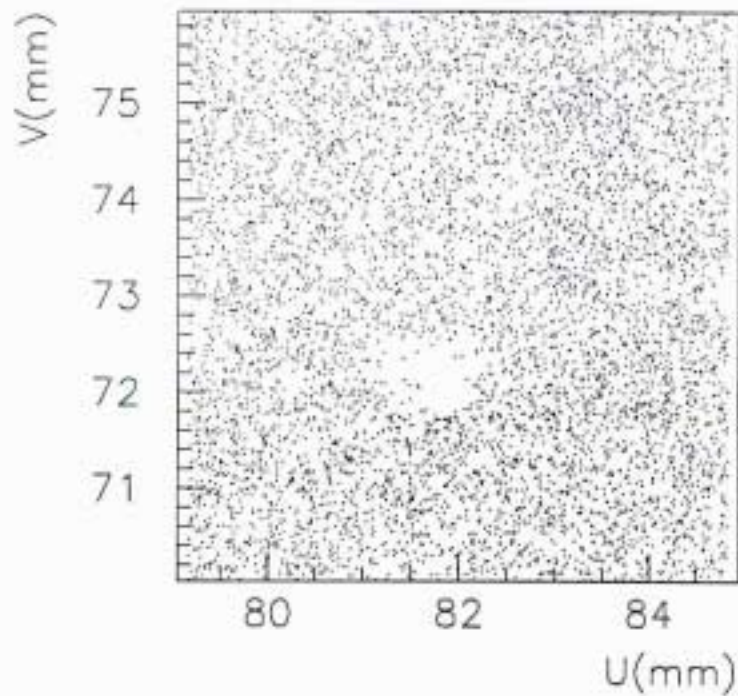


# Read out efficiency



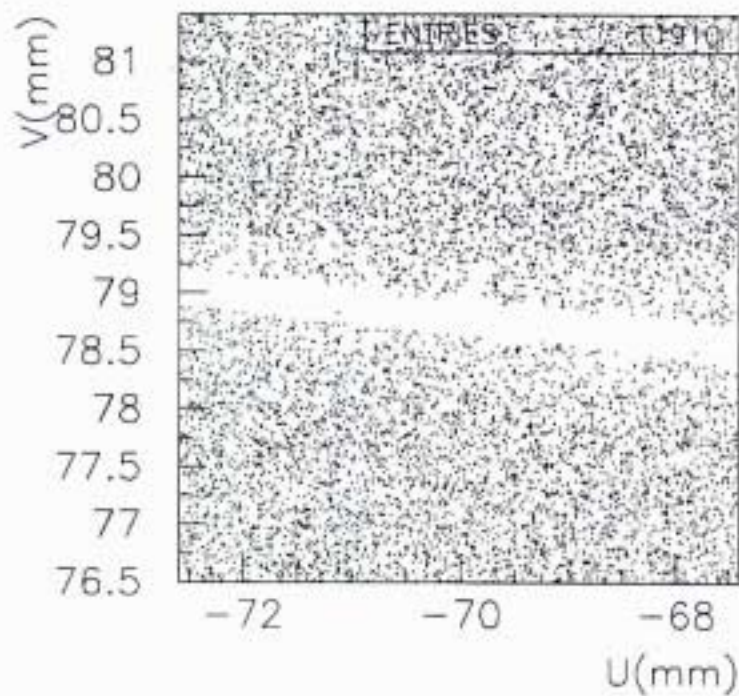
[position distribution]

(dot : 1 track)



Read-out efficiency

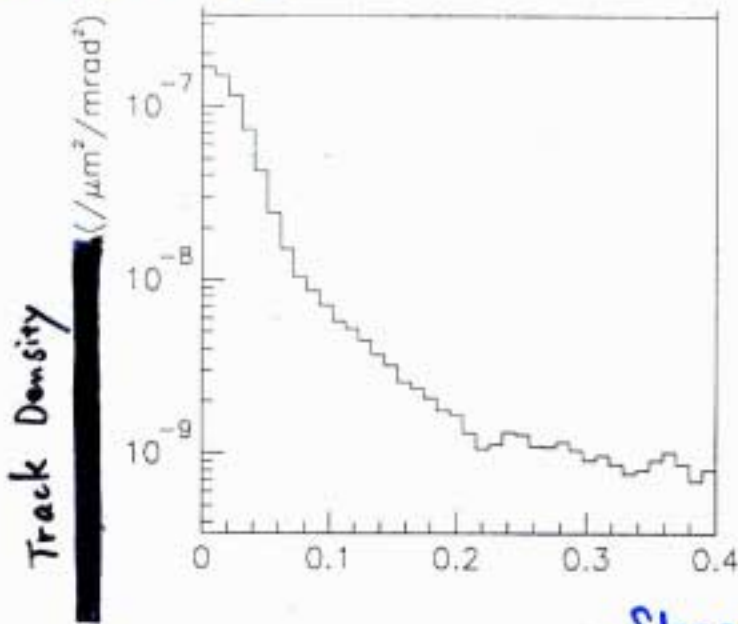
0.93



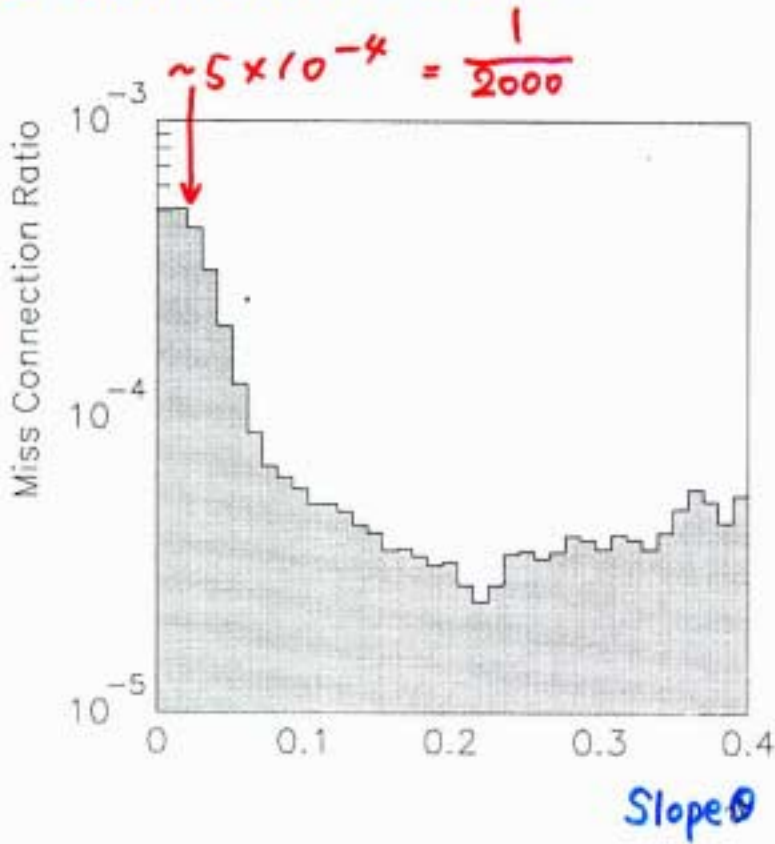
Read-out efficiency

0.87

# [Track Density]

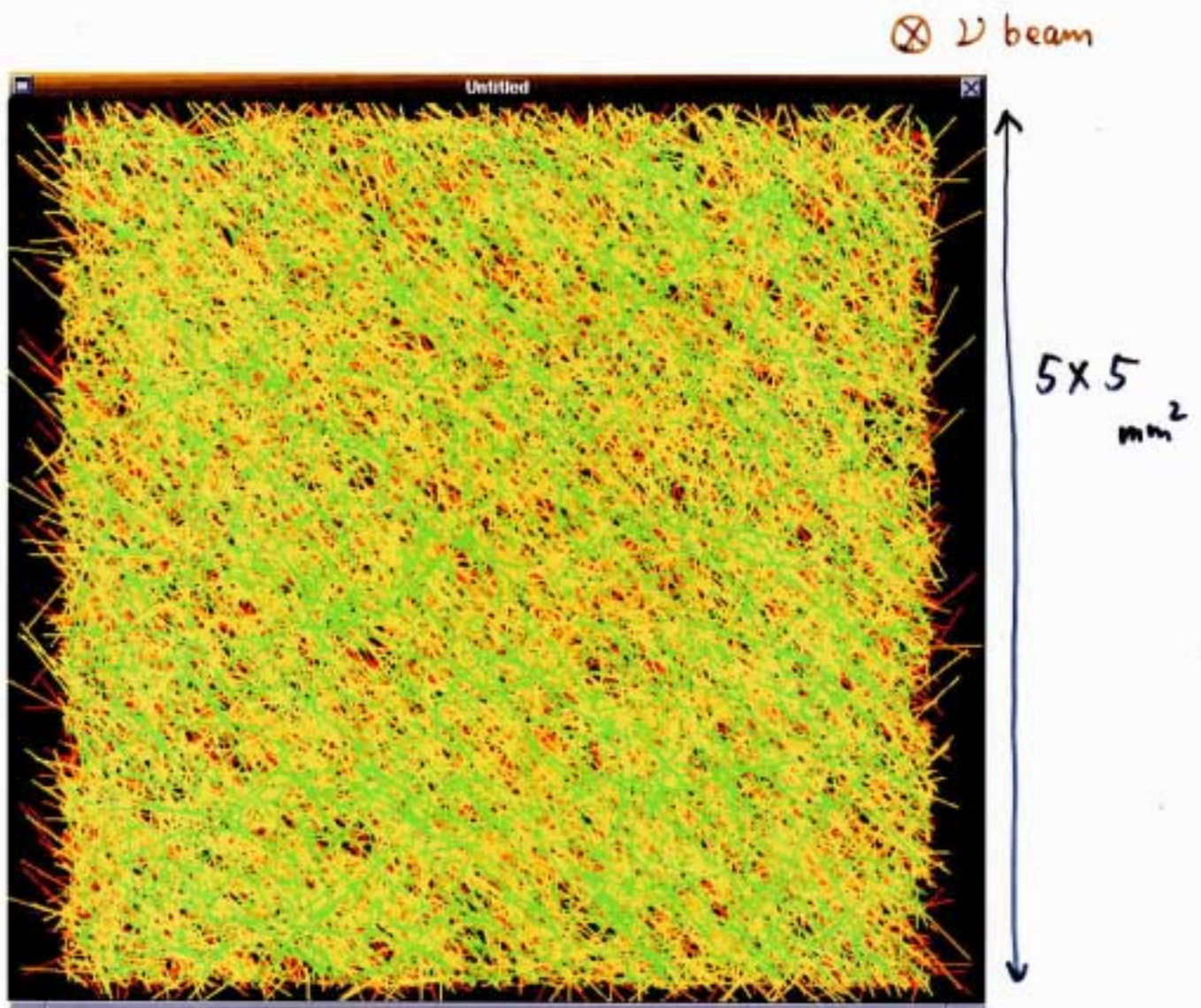


# [Miss Connection Rate]



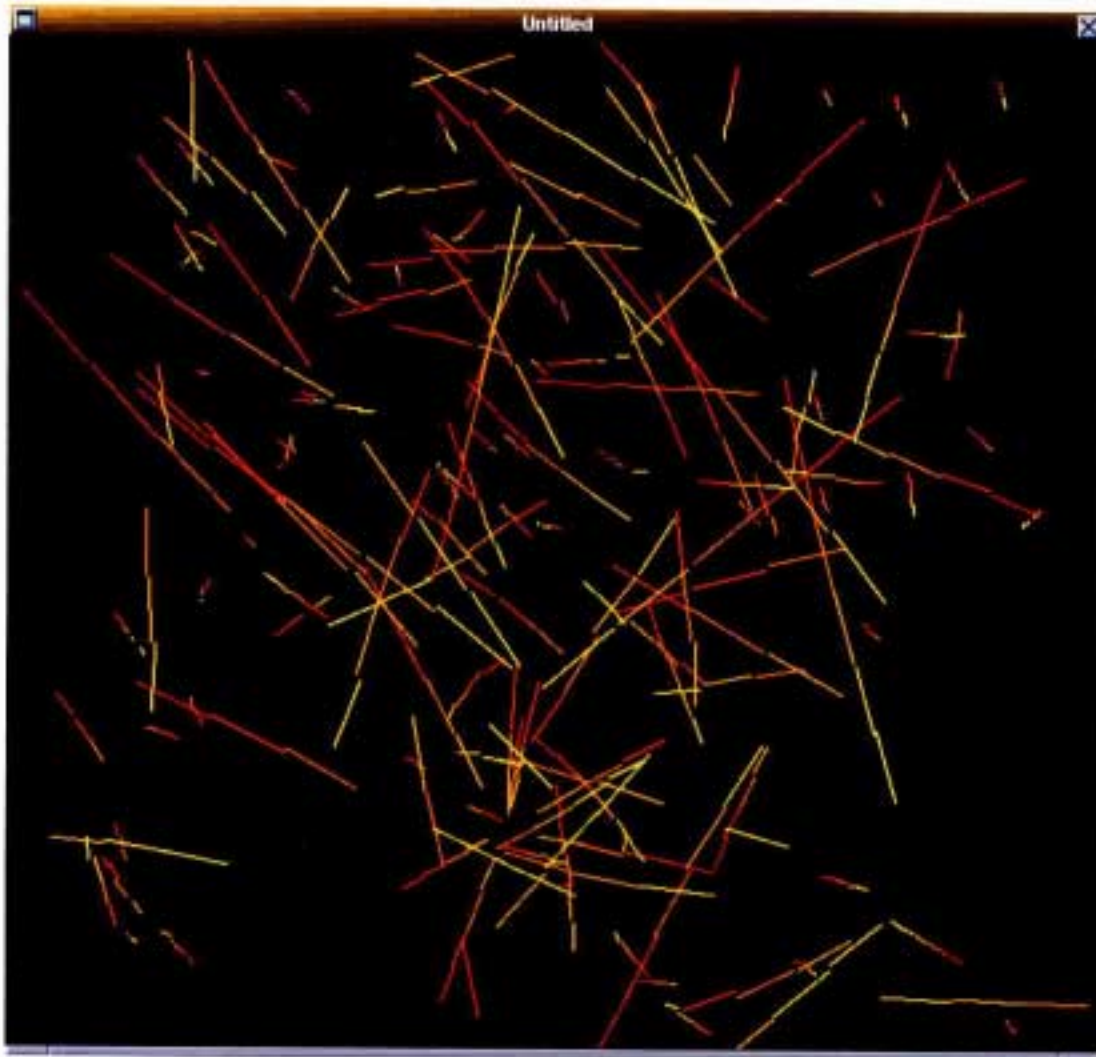


# Vertex Hunting



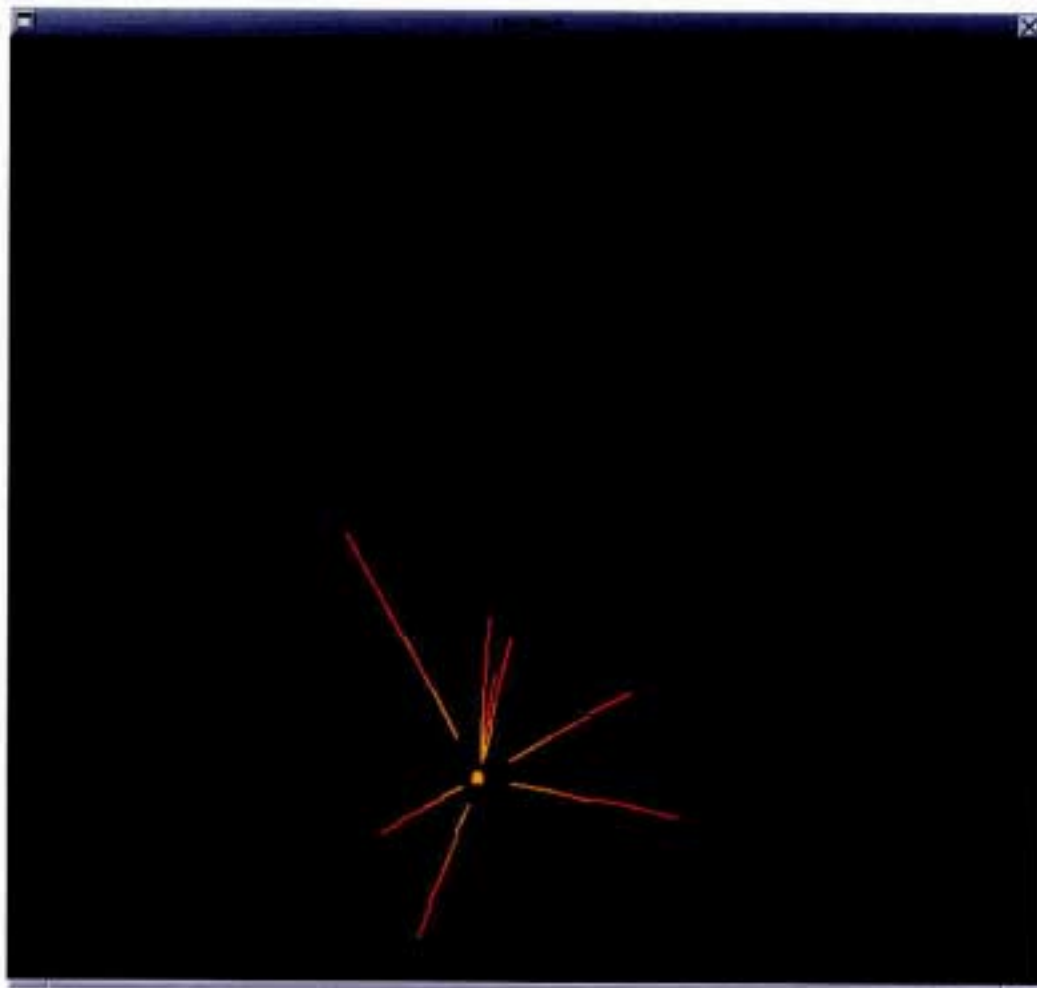
Number of tracks  $\sim 100,000 / 5 \times 5 \text{ mm}^2 / 10 \text{ plates}$

After penetrating tracks are rejected  
After cosmic ray tracks are rejected, ...



Number of remaining tracks  $\sim 800$  tracks

Only tracks making the vertex





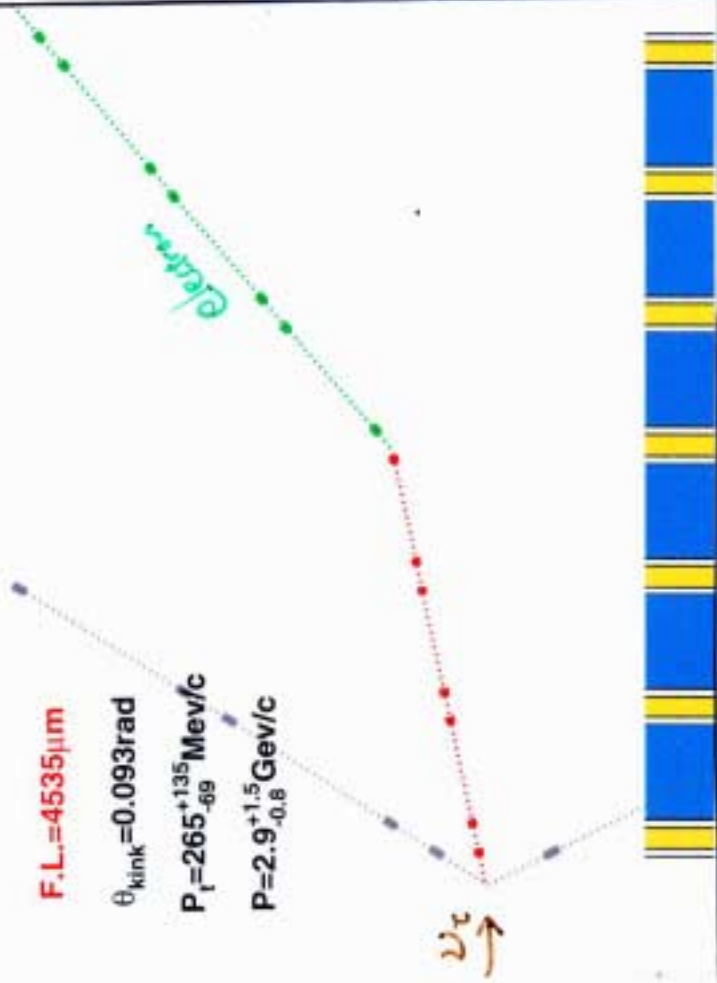
(Ref. Phys Lett. B  
(2001) 518)

**F.L.=4535 $\mu$ m**

$\theta_{\text{kink}}=0.093\text{rad}$

$P_f=265^{+135}_{-69}$  Mev/c

$P=2.9^{+1.5}_{-0.8}$  Gev/c

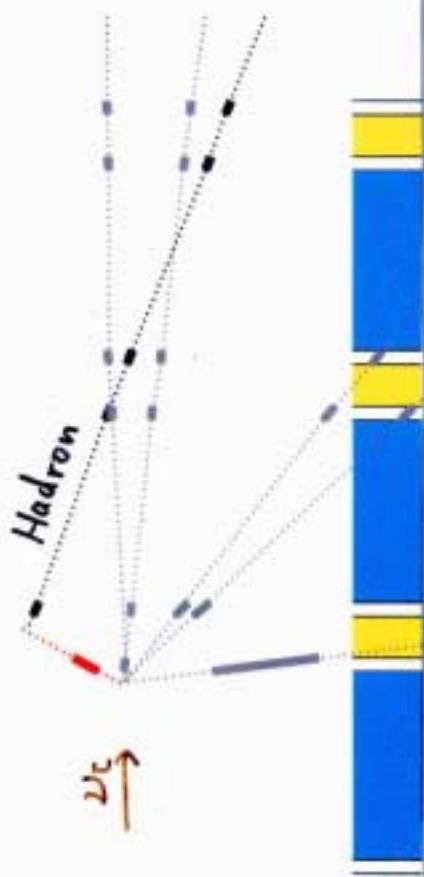


**F.L.=280 $\mu$ m**

$\theta_{\text{kink}}=0.090\text{rad}$

$P_f=414^{+144}_{-81}$  Mev/c

$P=4.6^{+1.6}_{-0.9}$  Gev/c

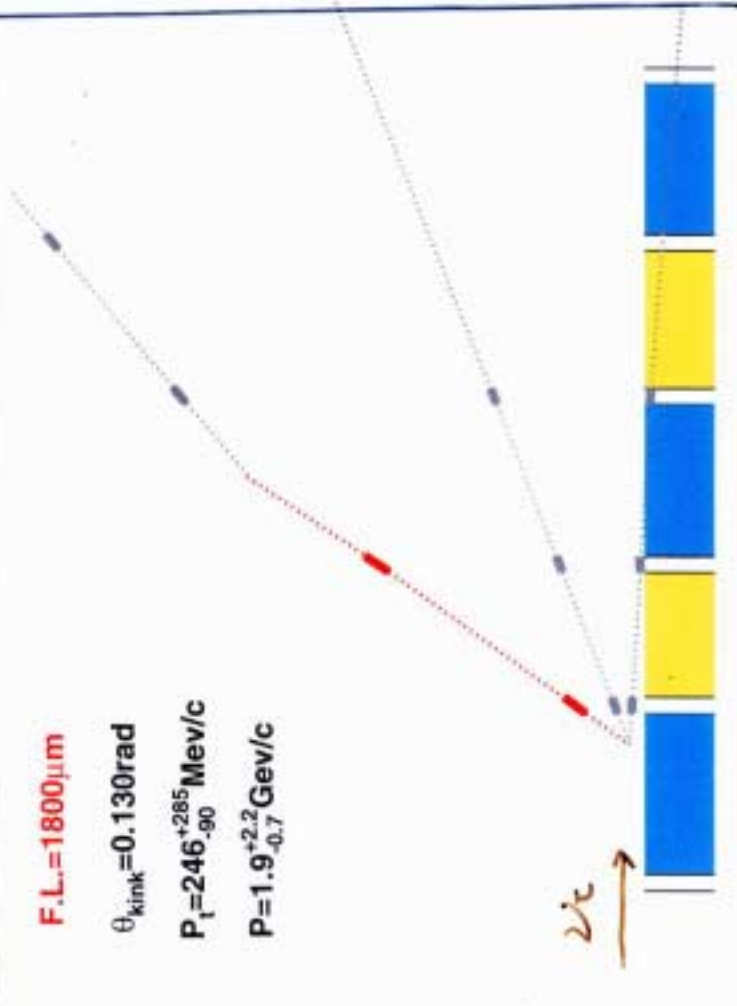


**F.L.=1800 $\mu$ m**

$\theta_{\text{kink}}=0.130\text{rad}$

$P_f=246^{+285}_{-90}$  Mev/c

$P=1.9^{+2.2}_{-0.7}$  Gev/c

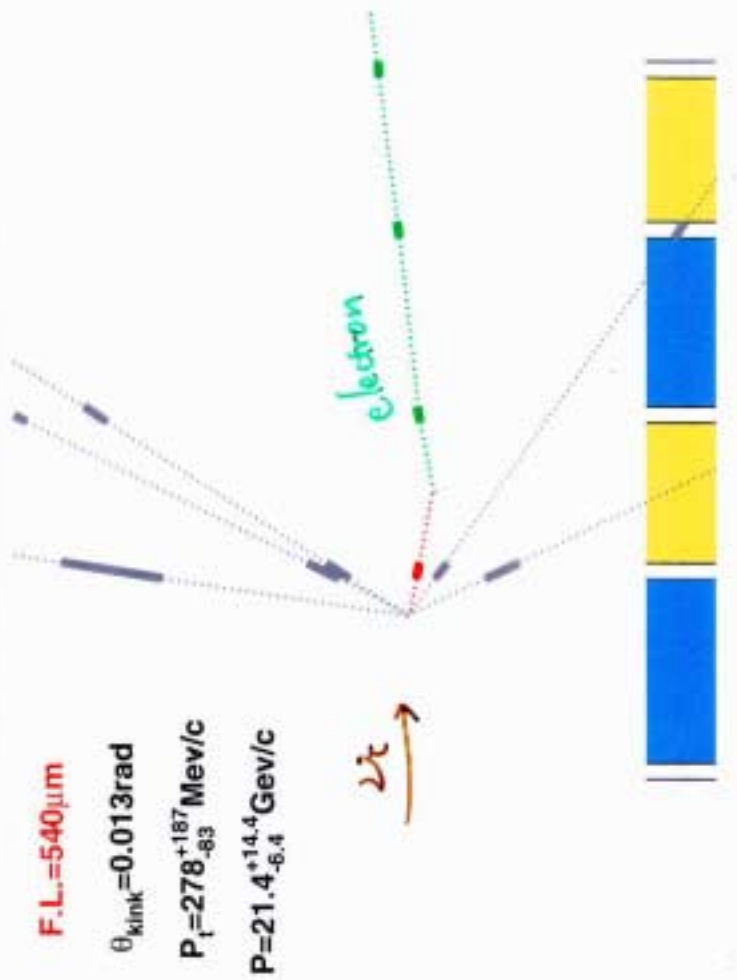


**F.L.=540 $\mu$ m**

$\theta_{\text{kink}}=0.013\text{rad}$

$P_f=278^{+187}_{-83}$  Mev/c

$P=21.4^{+14.4}_{-6.4}$  Gev/c



# Summary

> NET SCAN was developed in DONUT.  
↓  
↳ discover

## > NET SCAN DATA Quality

- Position accuracy  $\sim 0.3 \mu\text{m}$
- Read out efficiency  $\sim 0.97$
- Miss Connection Rate  $\sim \frac{1}{2000}$

· Emulsion plate

- DONUT
- CHORUS
- FNAL E653
- WA75
- Ballone exp.

online

· Read-out system  
**U.T.S.**

· **NAKANO** (Nagoya)

offline

**NET-SCAN**

- Aoki (Kobe)
- Kodama (Aichi edu.)
- Komatsu (Nagoya)
- Nonaka. (Nagoya)

**D.S.T.**

Physics analysis

