

Current Status of the Re-capacitation

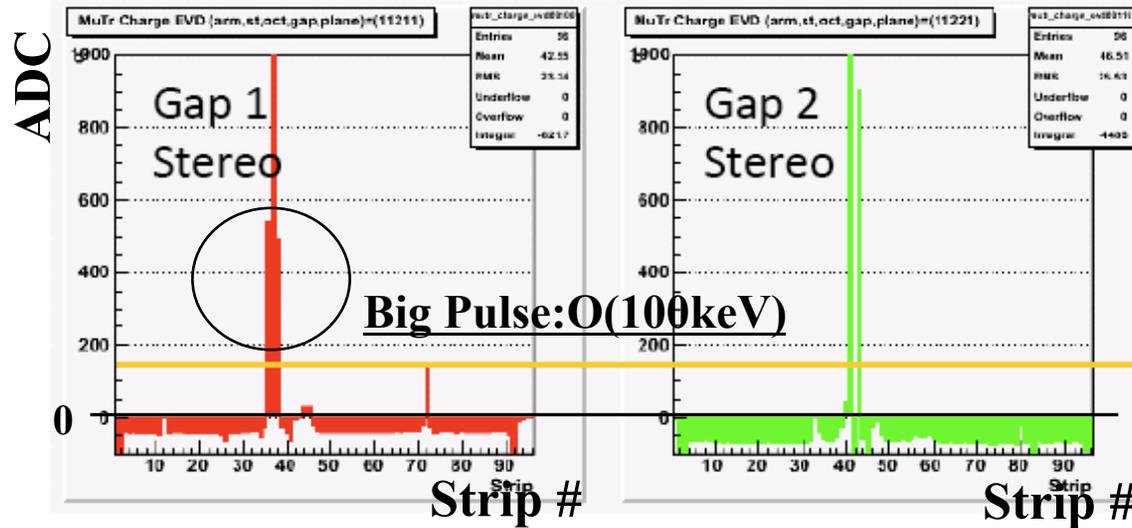
Quar. Meeting: Dec. 11, 2010

Yoshi(-mitsu) Imazu

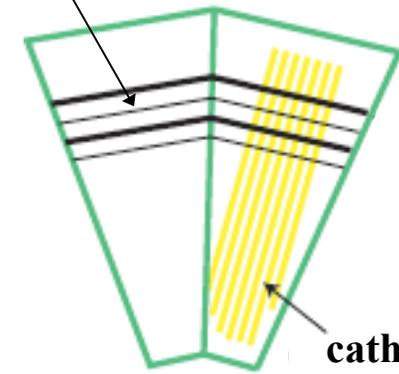
● Observation of the Trace of the Cross Talk

From run 2009 data

Hit Distribution w/o Zero Supp.



anode wires

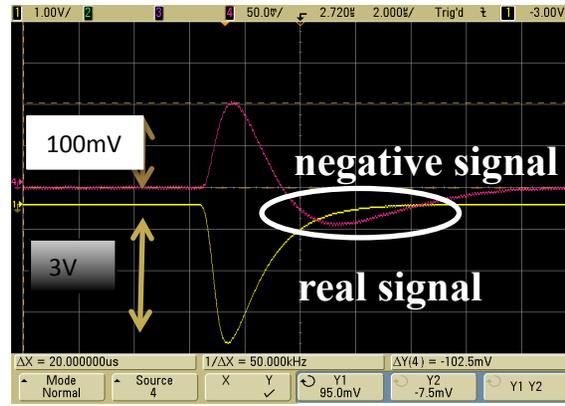
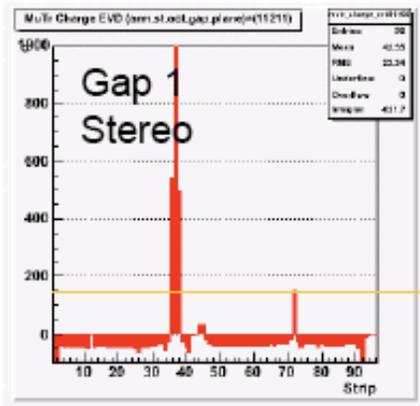


cathode strips

Observation:

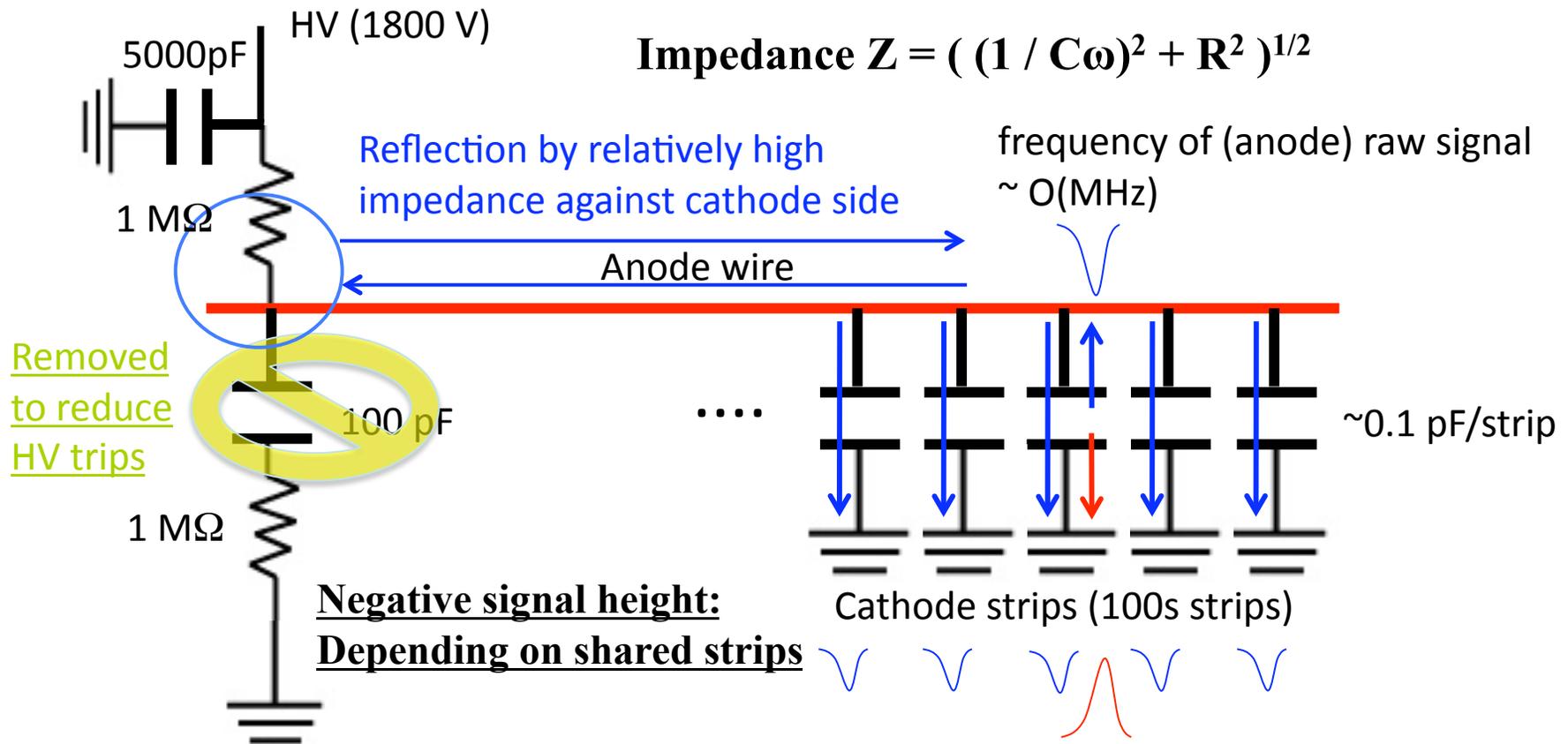
- Existence of **unexpected big deposits (Big Pulse) ($\sim O(100\text{keV})$)** in MuTr exceeding those of MIP ($\sim 1.5\text{keV}$) (Contamination: supposed to be 60%)
- **Negative undershoots over whole strips accompanied by the Big Pulse**

● Cross Talk Effect



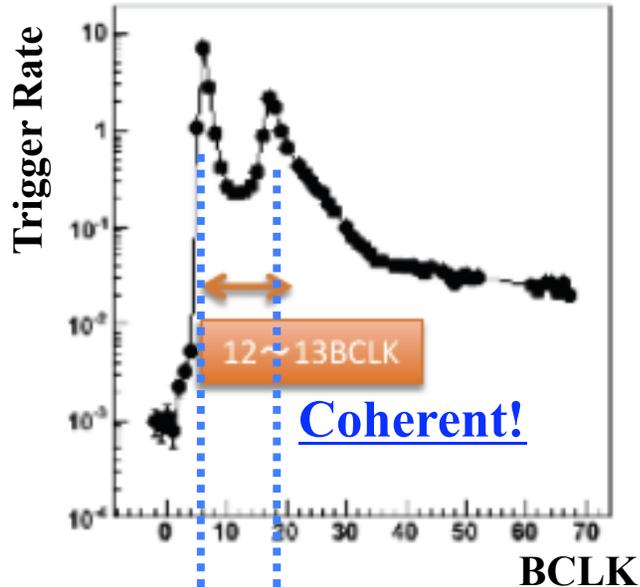
Expected Signal Structure:

Large bipolar return:
frequency dependence of the effect
(high frequency selective)



MuTRG Trigg. rate survey with 1 bunch beam supports its phenomenon

- the negative signals could fire MuTRG by its bipolar returns



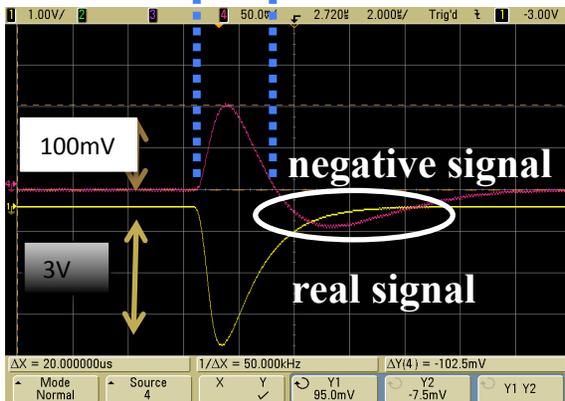
Solutions

1. cut off the source: absorber installation partially installed in the next run

The origin of the Big Pulse is expected to be low energetic thermal neutron originating from beam

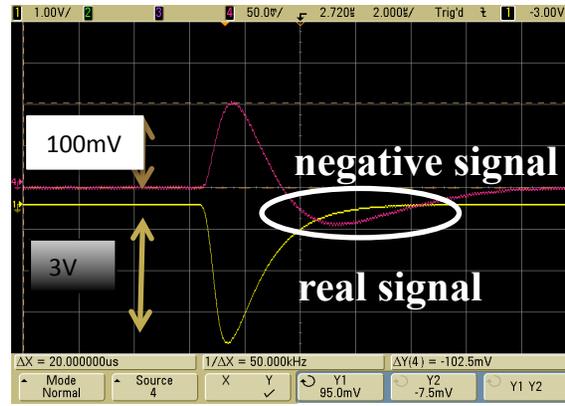
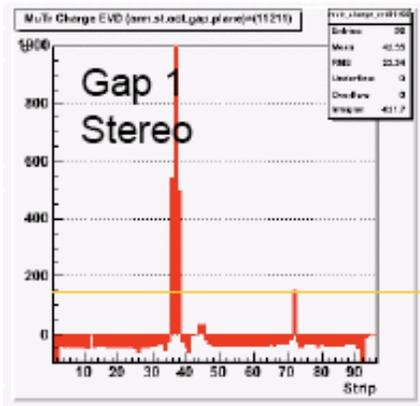
Neutron capture creates γ 's with $\sim 8\text{MeV}$

Its shower remnant could create large deposit in the chamber...



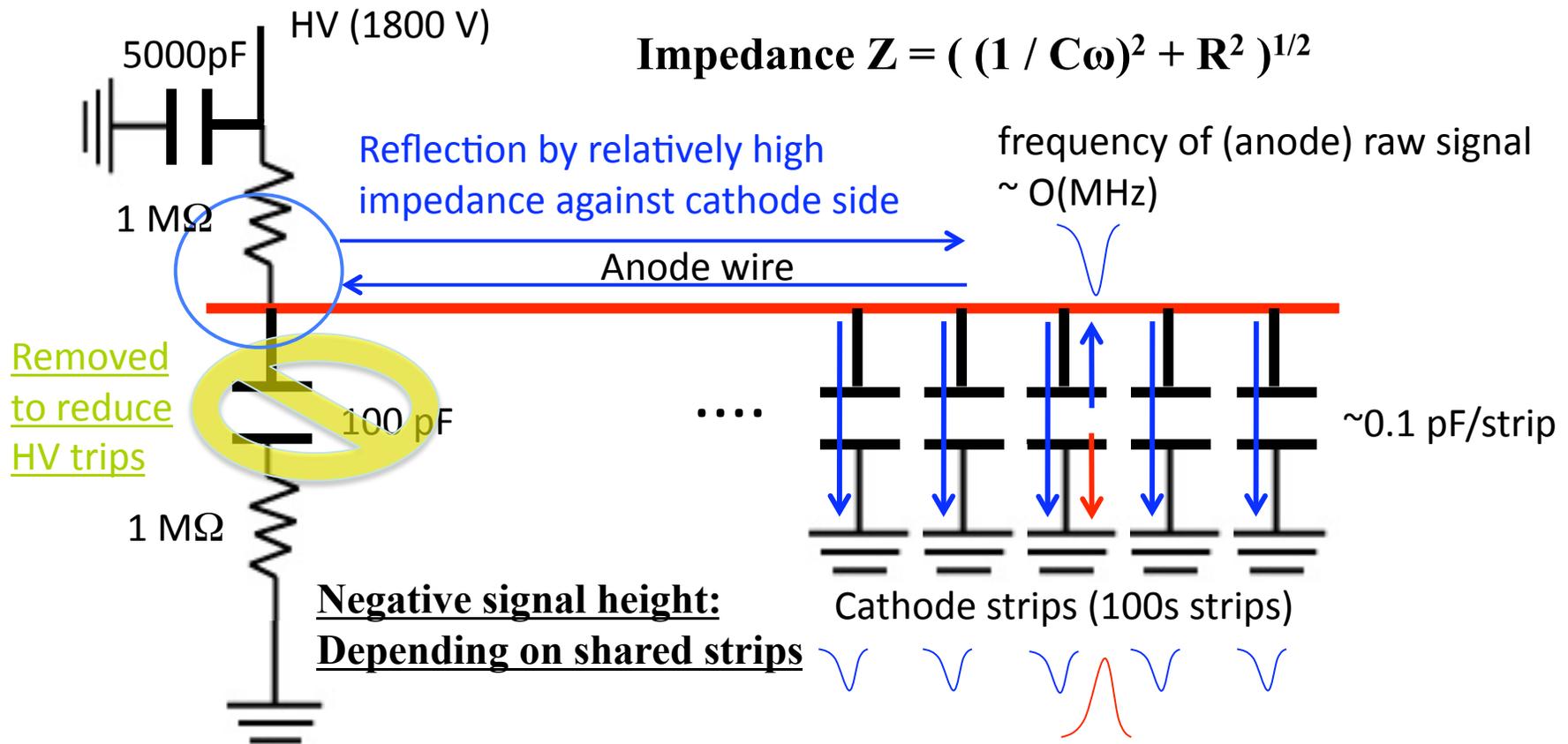
2. suppression of the consequent negative signals: Installation of new circuit in anode side (Re-capacitation)

● Cross Talk Effect

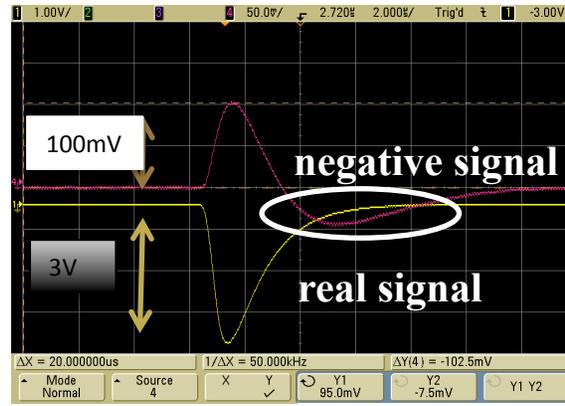
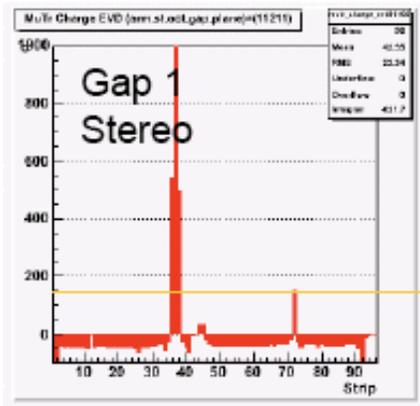


Expected Signal Structure:

Large bipolar return:
frequency dependence of the effect
(high frequency selective)

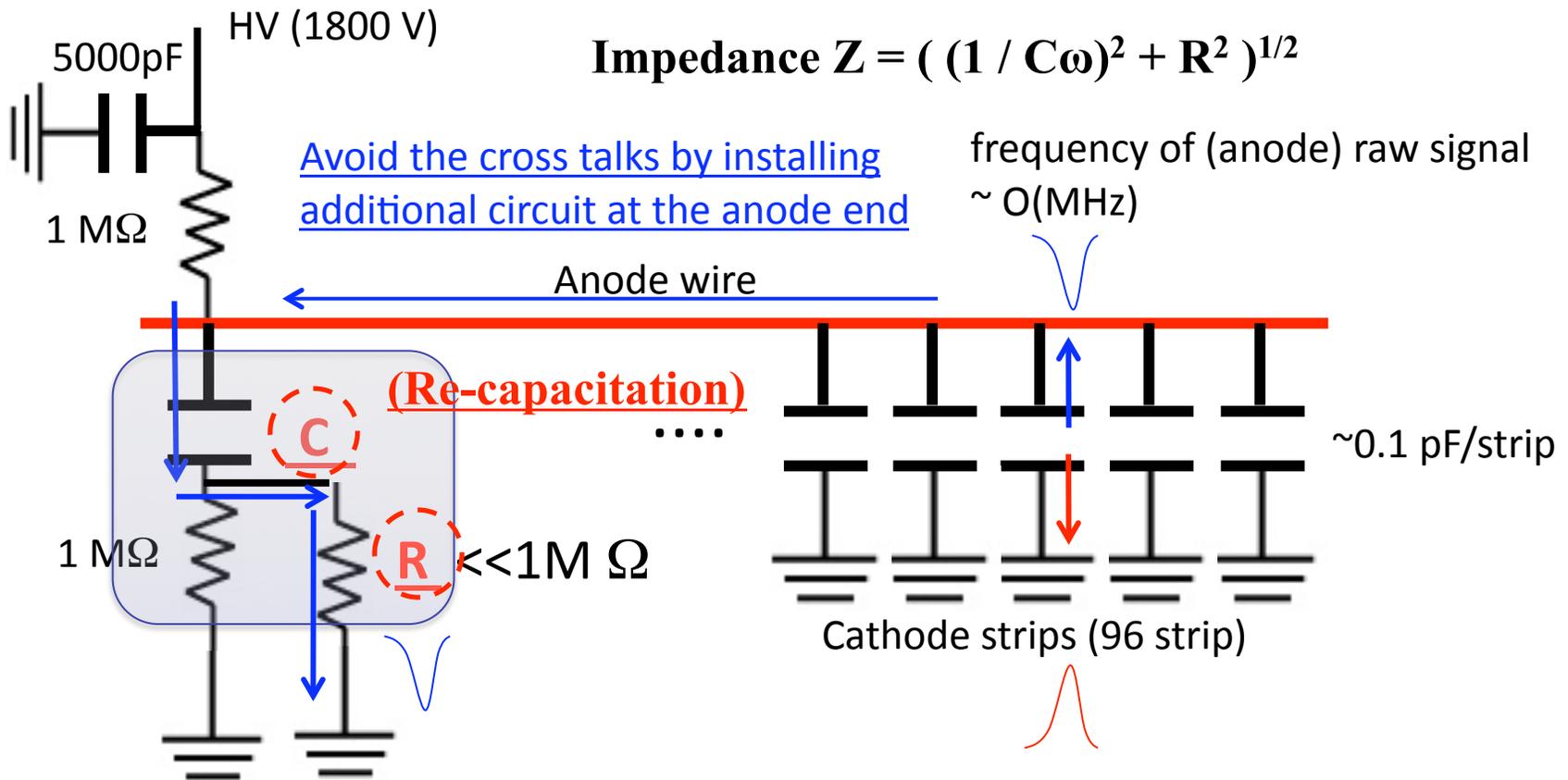


● Cross Talk Effect



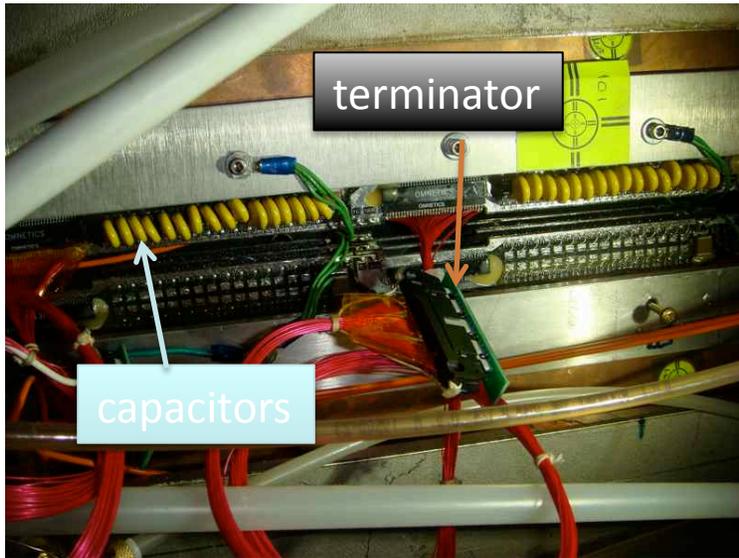
Expected Signal Structure:

Large bipolar return:
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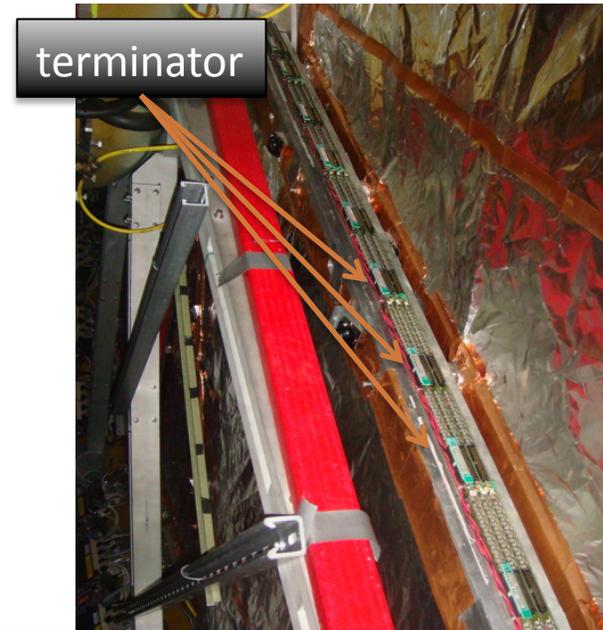
● Re-capacitations in MuTr

St. 1 Full Octant, Gap1 only



All capacitors are removed. New capacitors (soldered) and terminators installed.

St. 2 Partial Octant, Full Gaps



Capacitors are remaining. new terminal cards mounted to the anode readout connector.

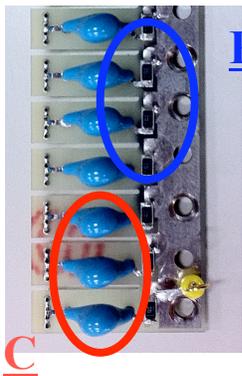
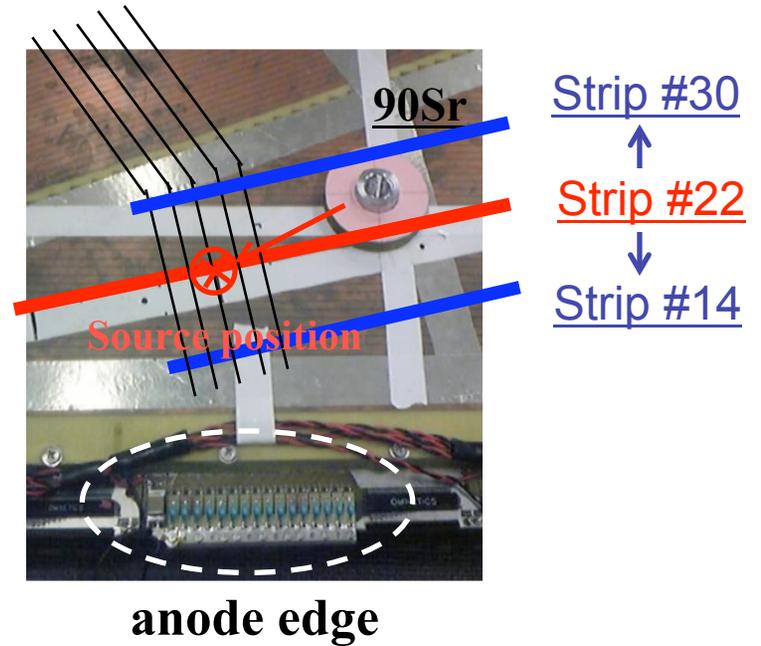
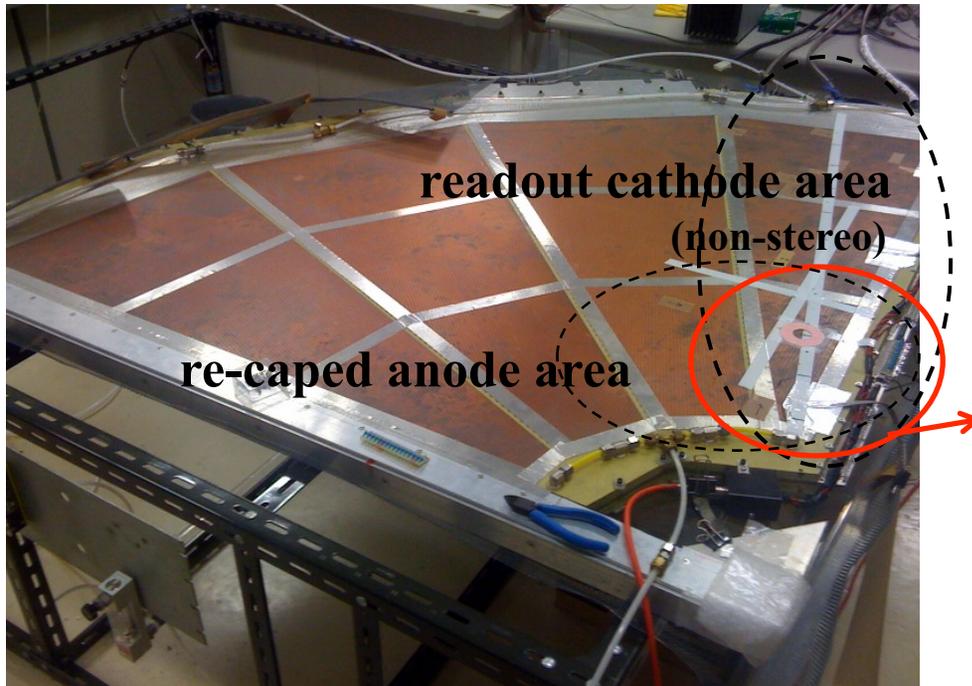
St. 3

All Capacitors had removed. It is very difficult to take out Station-3 chamber. Thus “clamp type” recap-board is under development.

→ Now Installing the prototype (shortly reported in the following)

● Cross Talk Effect with a Test Bench @RIKEN

- Observation and evaluation of the cross talk effect w/ or w/o the circuit
- Optimization of the circuit parameter (C, R)



w/ the circuit



w/o the circuit



Sr-90

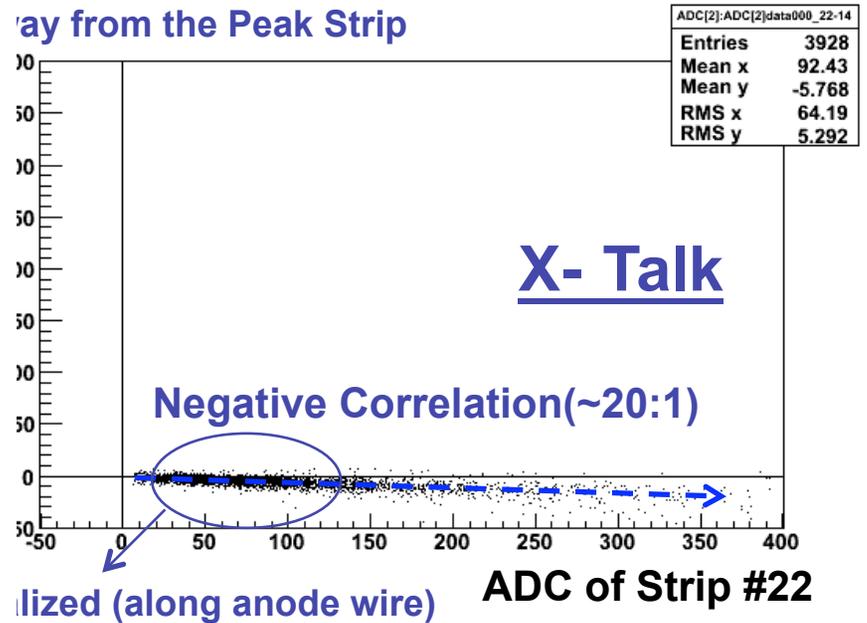
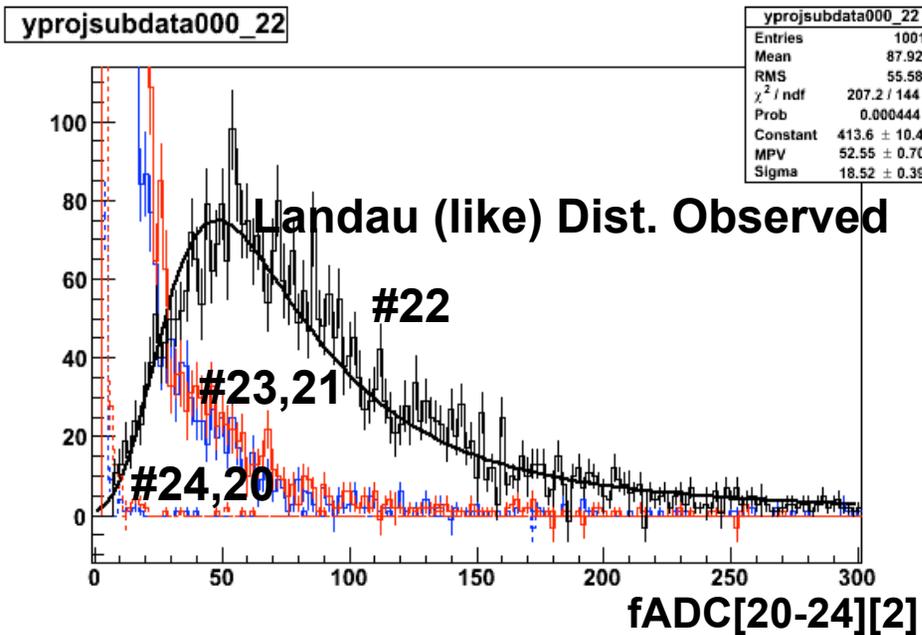
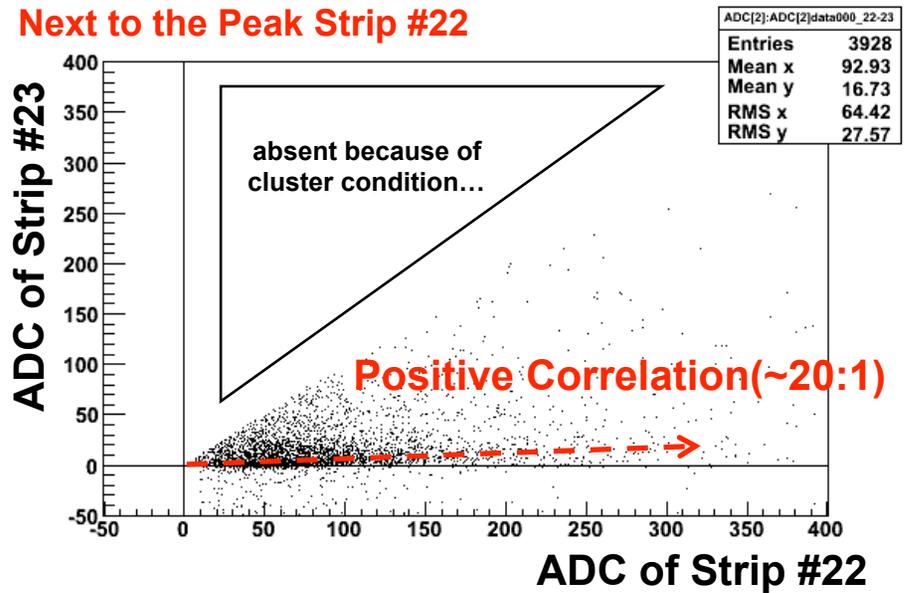
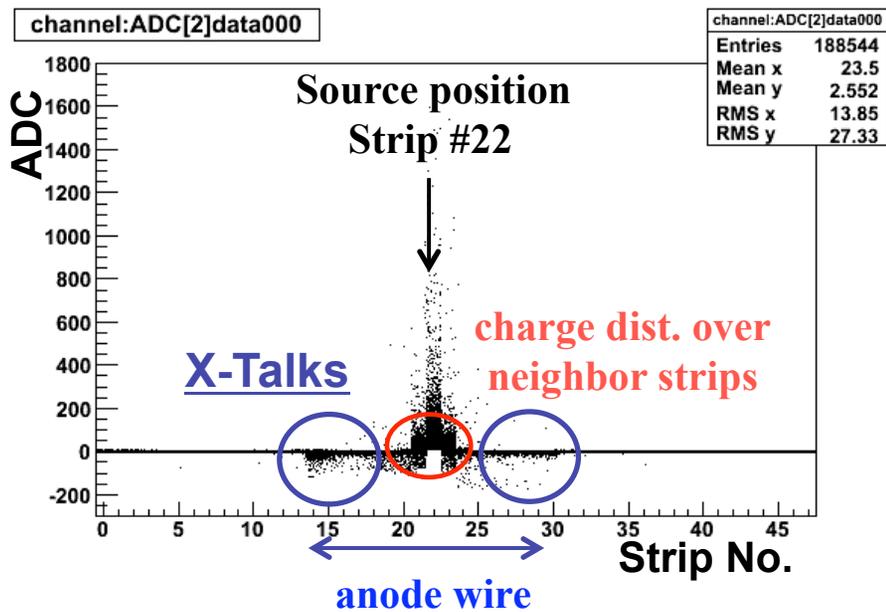
HV: +1.8kV
Cur: 10uA

Chamber

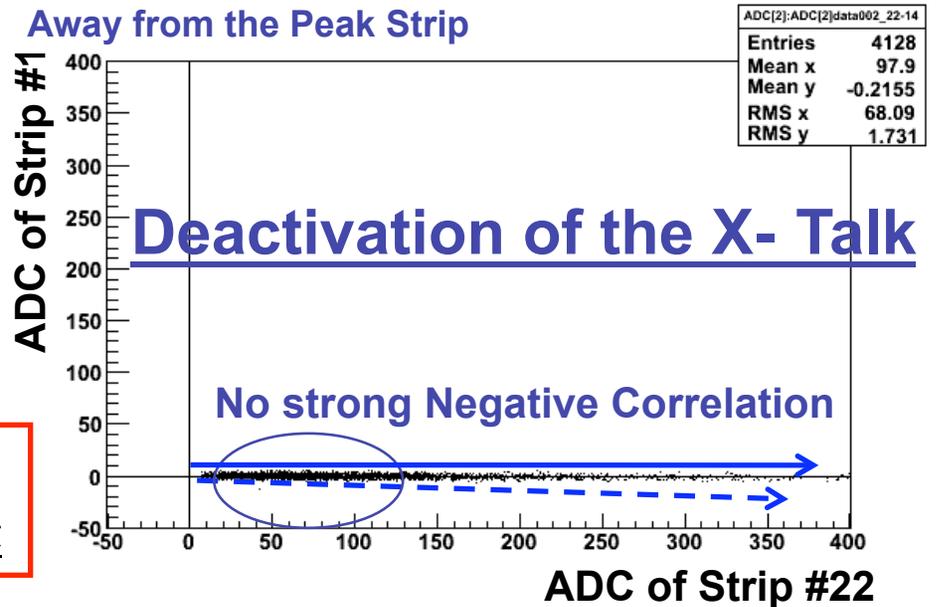
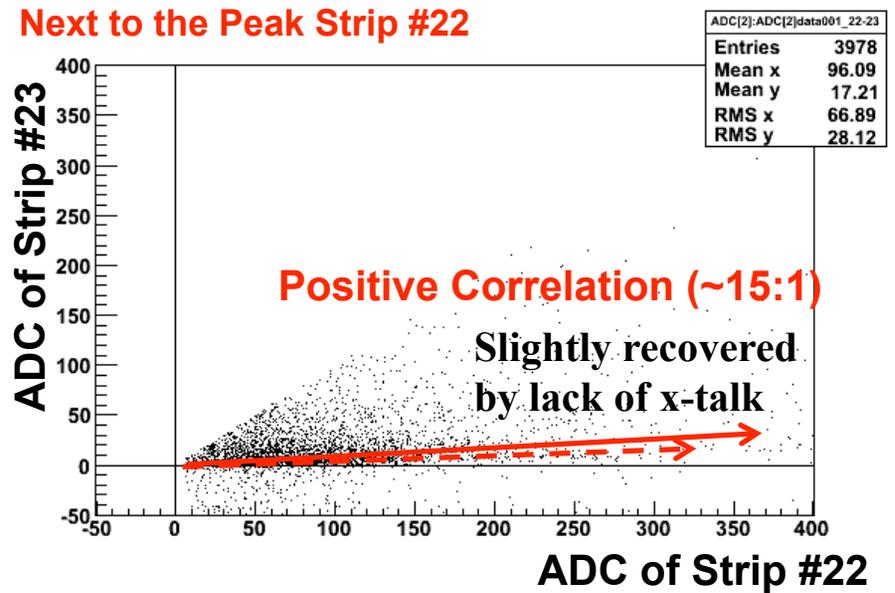
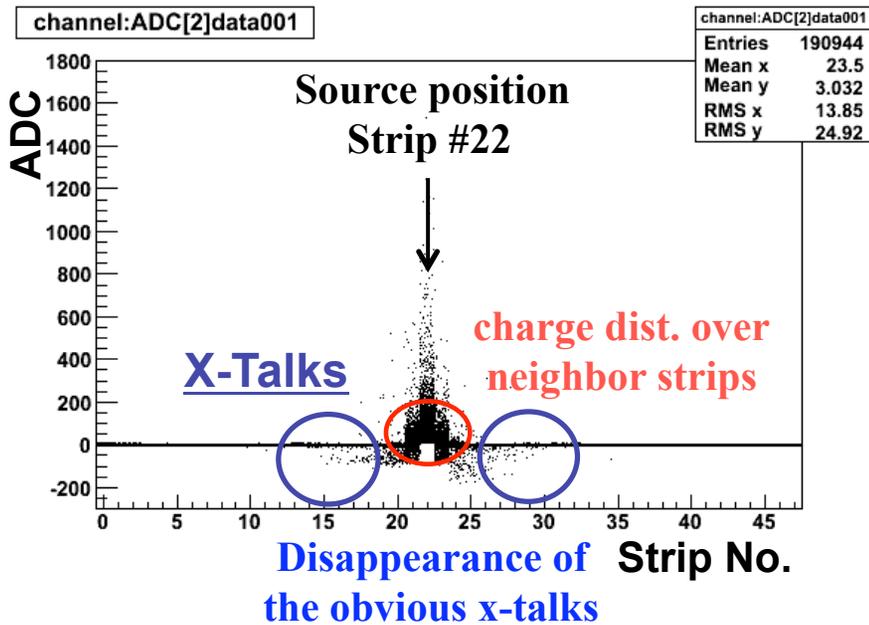
PMT

3×4 Scinti.
4cm Below

● Observed Cross Talk Effect w/o the circuit

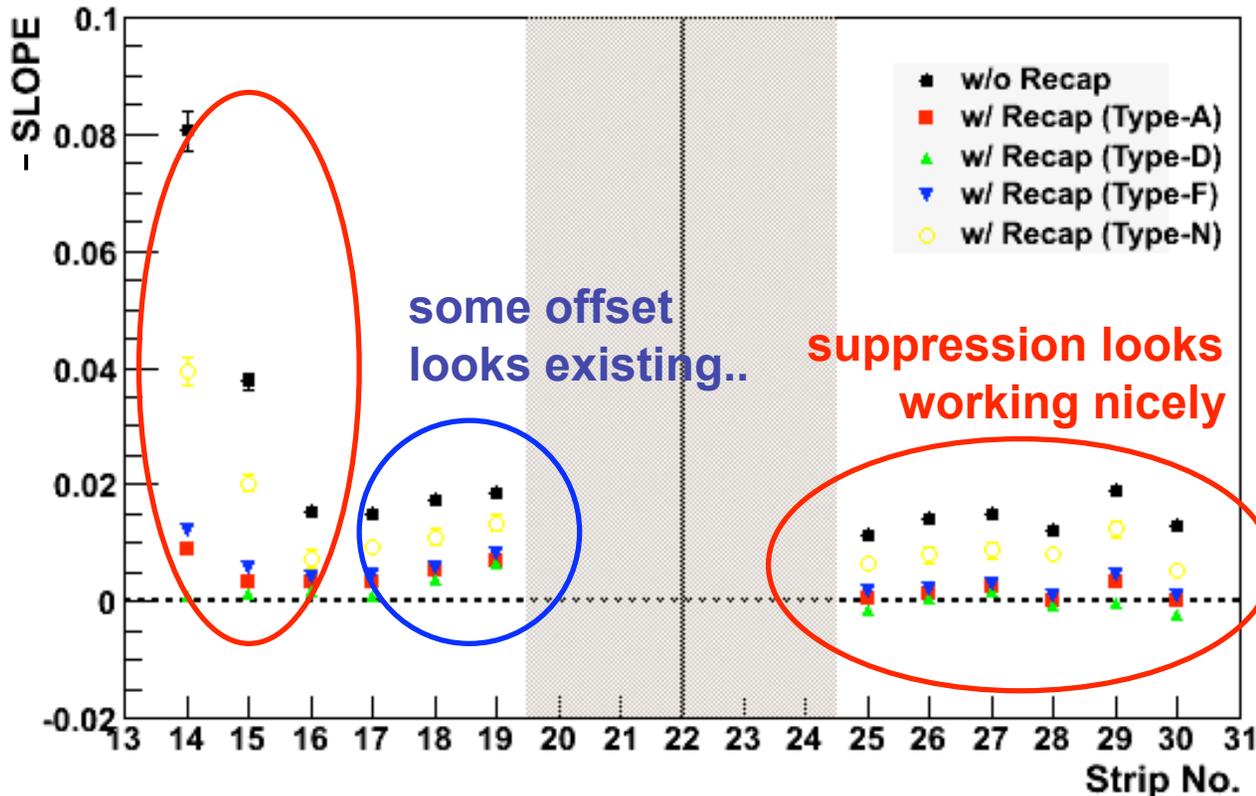


● **Observed Cross Talk Effect w/ the circuit (C = 100pF, R=360ohm)**



The installation of the compensating circuits surely suppress the x-talk effect

- Evaluation of the suppression effect by the circuit (ReCap) installation
 - Based on the correlation slope



Different types of C, R combinations

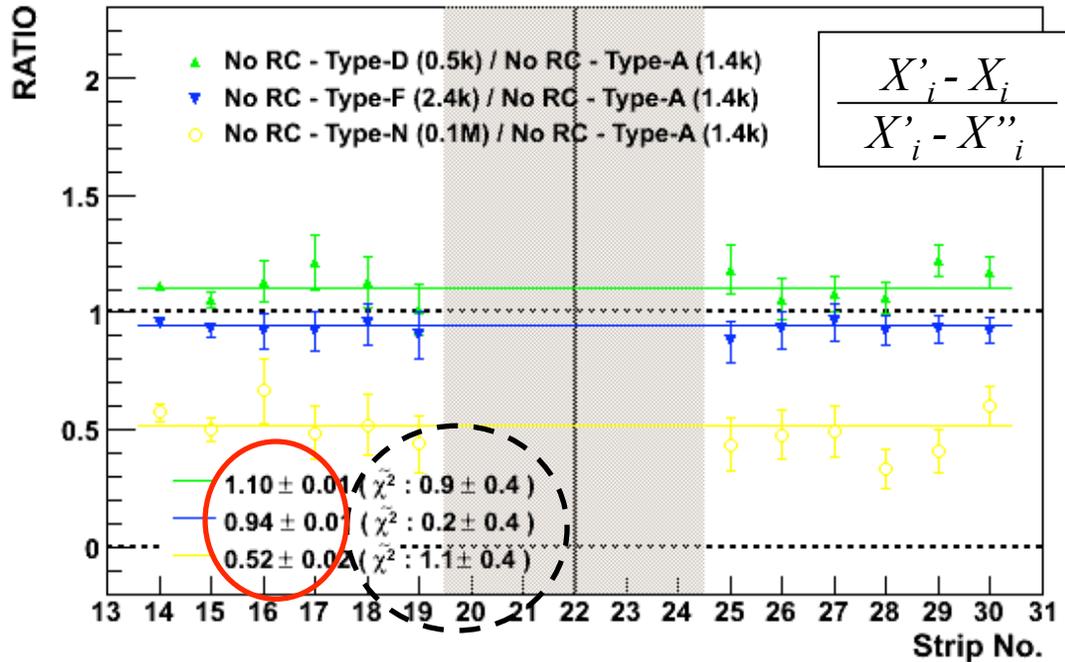
Type-A (100pF, 360Ω)

Strong Suppression

w/o Recap: Max 0.08 → w/ Recap (Type-A): Max 0.01 (PeakStrip:X-talk=100:1)
~1/10

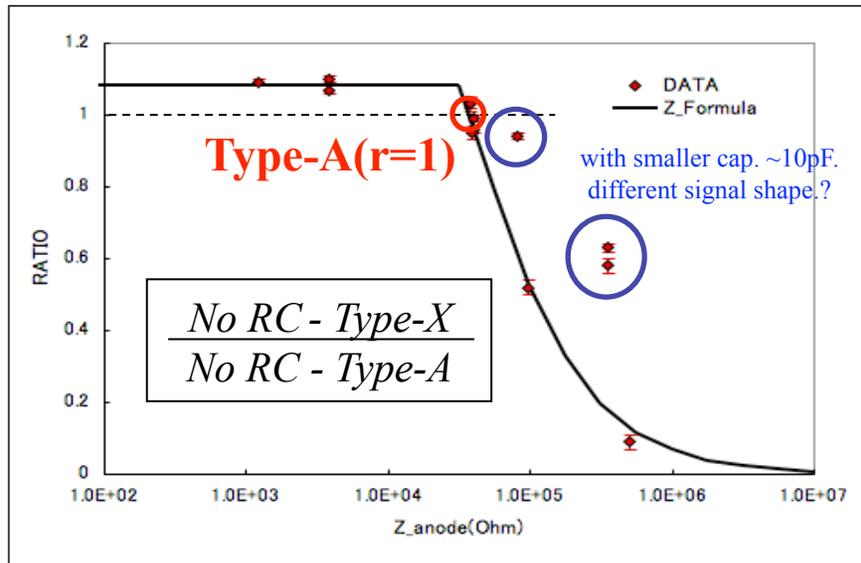
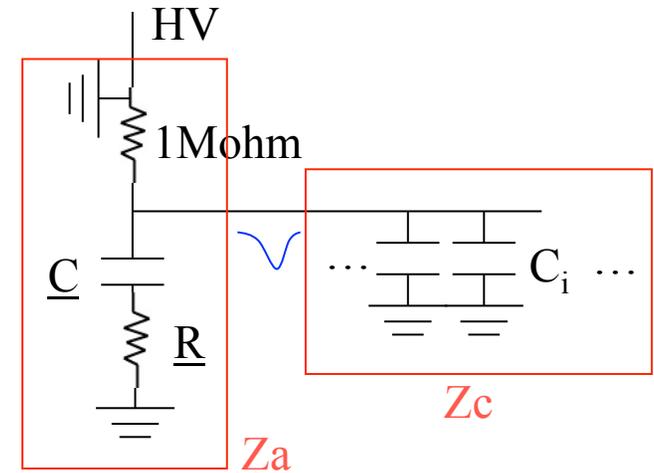
- MuTRG becomes insensitive to its bipolar return of ~100(200)
MIP deposit for 40(100)mV MuTRG threshold.

● Optimization of the ReCap parameter (C, R)



X-talk Effect X_i in each cathode strip

$$X_i \propto C_i | (Z_a - Z_c) / (Z_a + Z_c) |$$



● Current Combination of C=100pF, R=360Ω (Type-A) shows enough (almost saturated) suppression

larger(smaller) C(R): will not improve so much the suppression effect of the current C-R combination

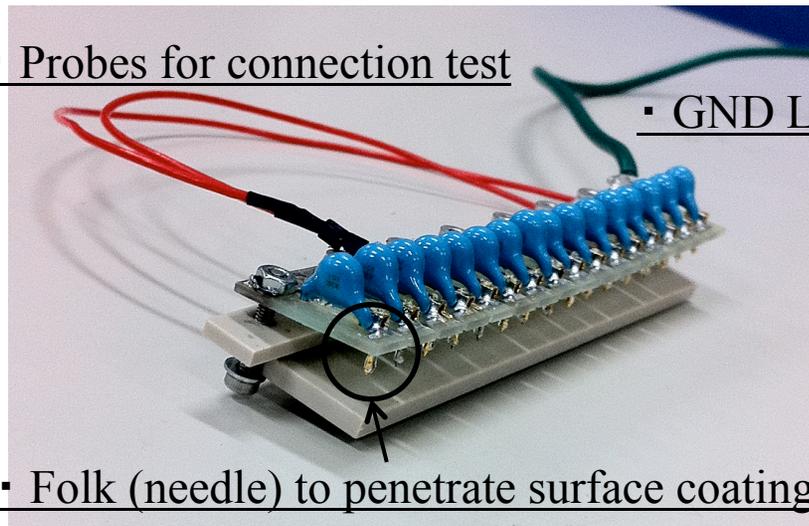
● Racap Clamp R&D (for st. 3) & Prototype installation

St. 3 : limited space → Mechanical installation of the circuit (Recap clamp)

Design was/ has been developed, reflecting field studie

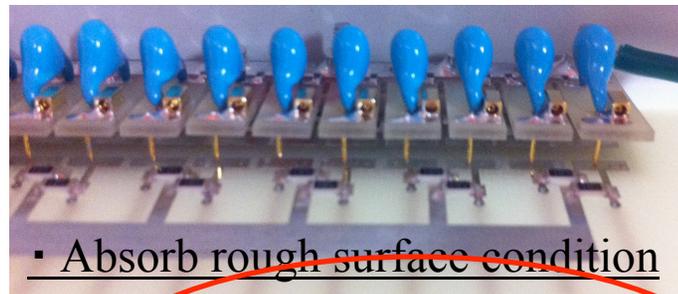
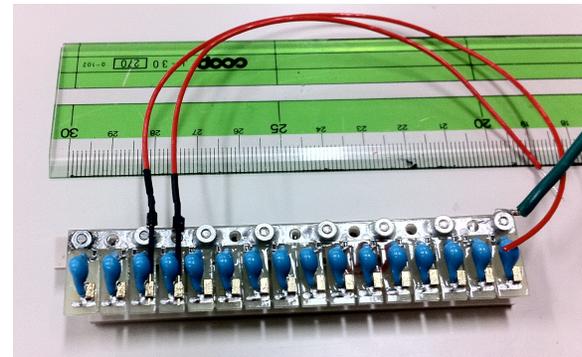
(Itaru, Kentaro, Yoshi Fukao, Imazu)

▪ Probes for connection test

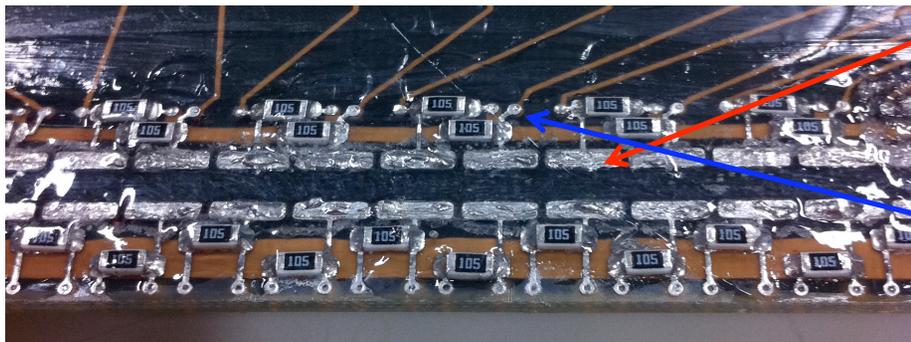


▪ GND Line

▪ Folk (needle) to penetrate surface coating



▪ Absorb rough surface condition



Leftover pad for the capacitance

Big Target

Rough surface

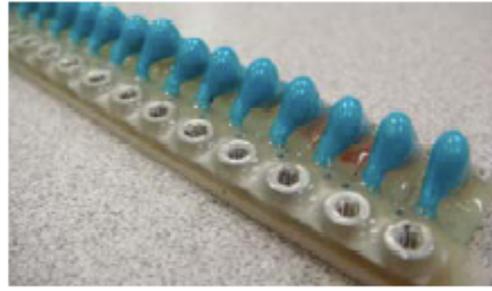
Through-hole to anode wire

Clean but Small Target (1Φ)

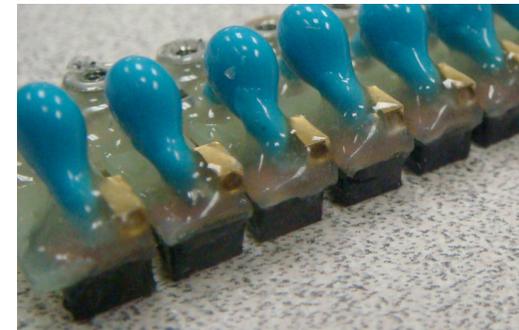
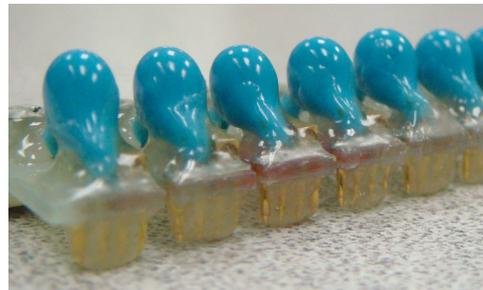
Need fine tuning

● Prototype Clamp Installation

- To prevent moisture, polymer coating is carefully applied on the clamp



- 3 types of prototype clamps for testing (3 clamps for each type in our hand)
 - 1-pin Fork
 - 4-pin Fork
 - Conductive Rubber



**Install target: Gap1 of Oct. 7-8 in North St. 3,
considering easy accessibility**



	N371	N381
861	1954.6	1924.4
75.4		
.48	0.36	0.52
.51	0.56	0.51
.55	0.58	0.52
.60	0.57	0.56
.54	0.50	0.51
.56	0.53	0.59
.57	0.57	0.55
.55	0.61	0.61



**careful installation of the clamps,
allowing for traceability of possible failures**

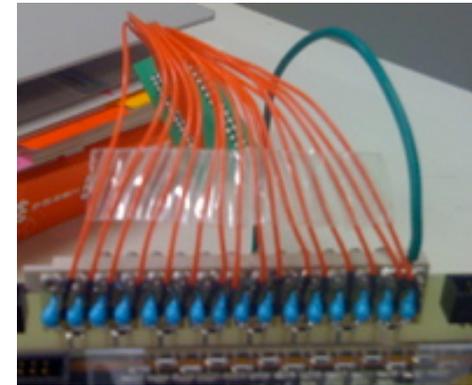
- Check the anode surface condition with scope
- Check clamp alignment and connection with scope etc.

all 9 clamps were “once” Installed in the bottom anode cards.

● Observation

- Basically the designed clamp package mechanically works nice

achieving good alignment,
effective work of testing probes,...



We could achieve more than 95% contact

Connection failure observed in some channels were reasonably explained by measurements with the testing probes and scope observation.

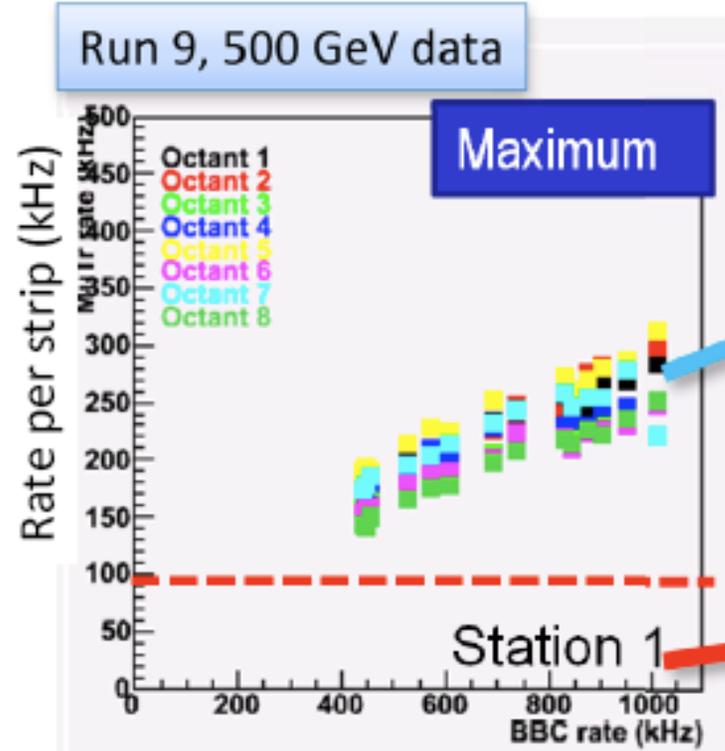
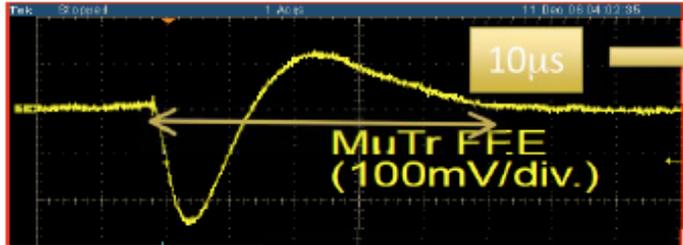
- After ramp up the HV to the running voltage, relatively higher currents were observed in the installed section

Now the clamps were all removed again. Still under investigation

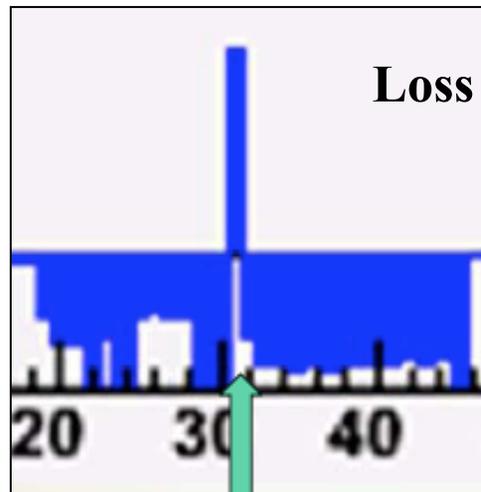
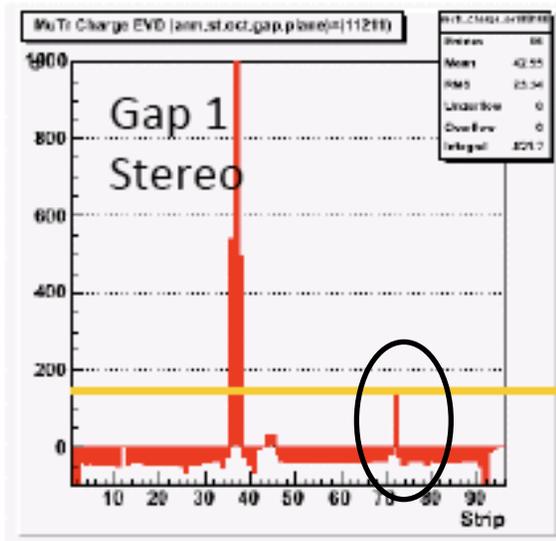
Back Up Slides

- **Effect to Off-line Analysis**

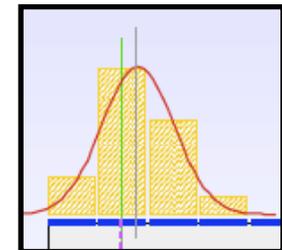
- **Pileups**



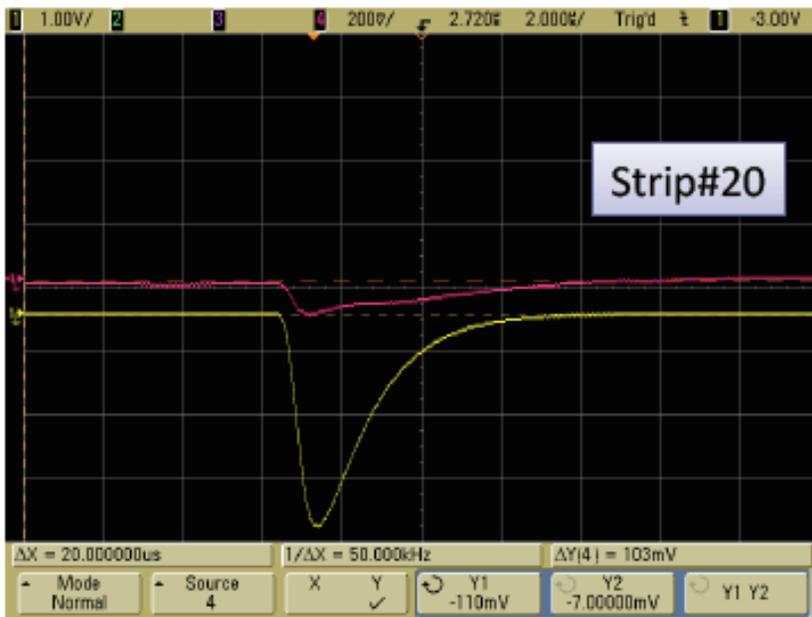
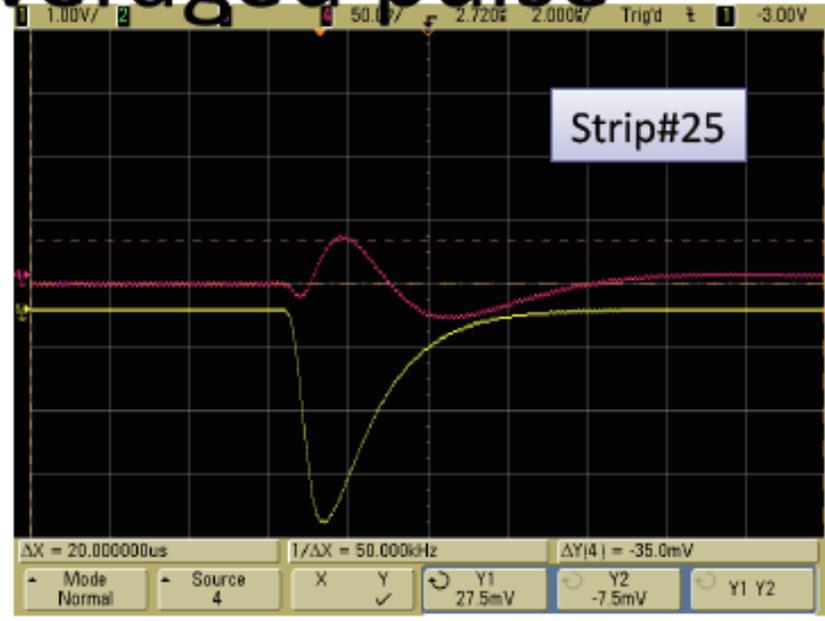
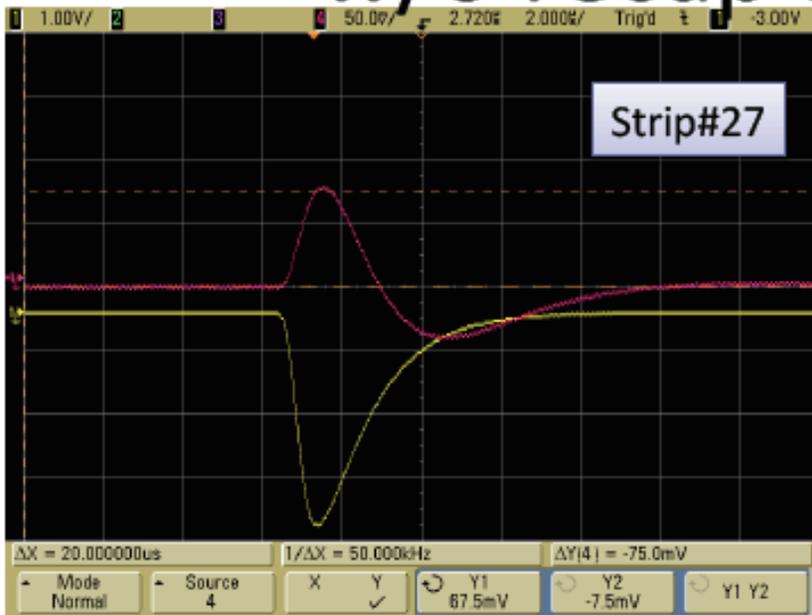
- **Charge Distribution**



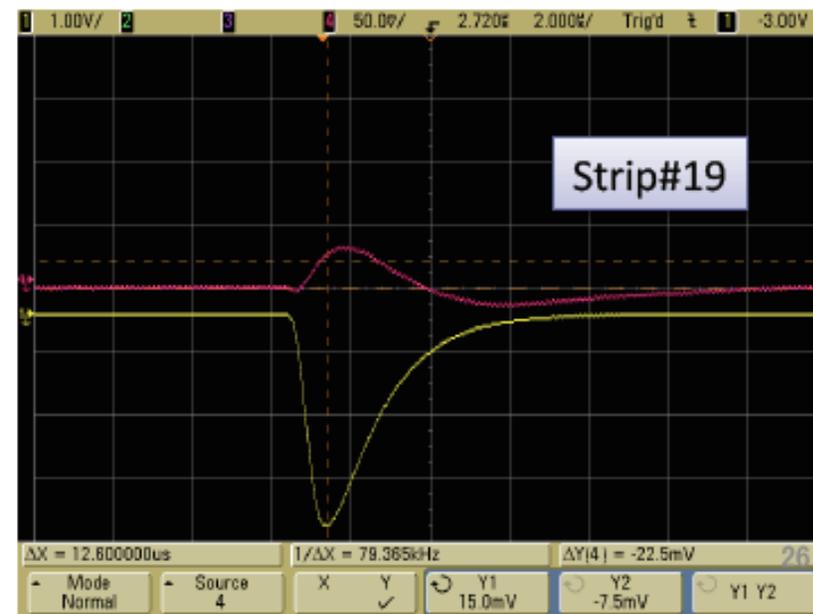
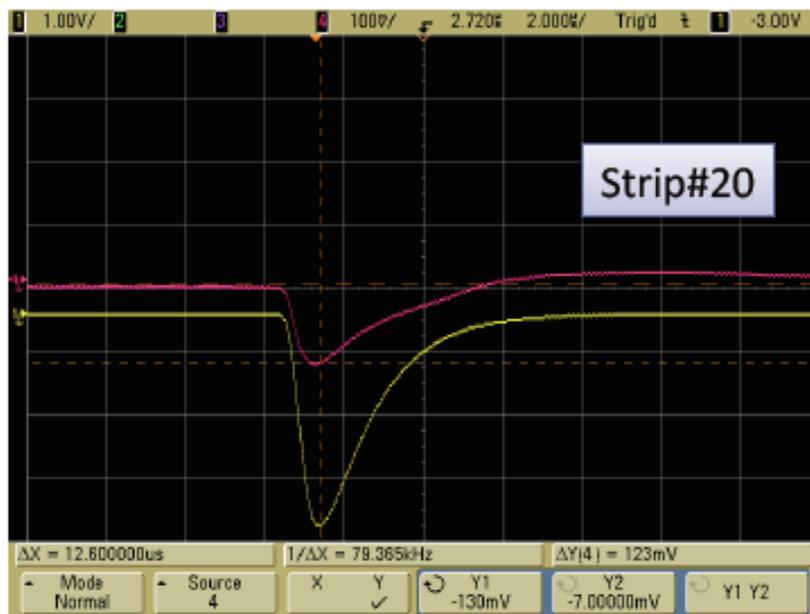
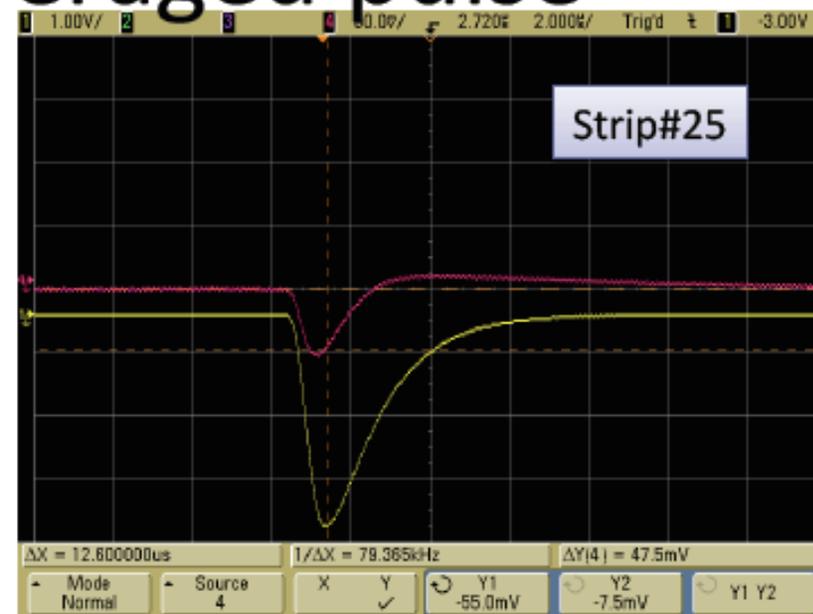
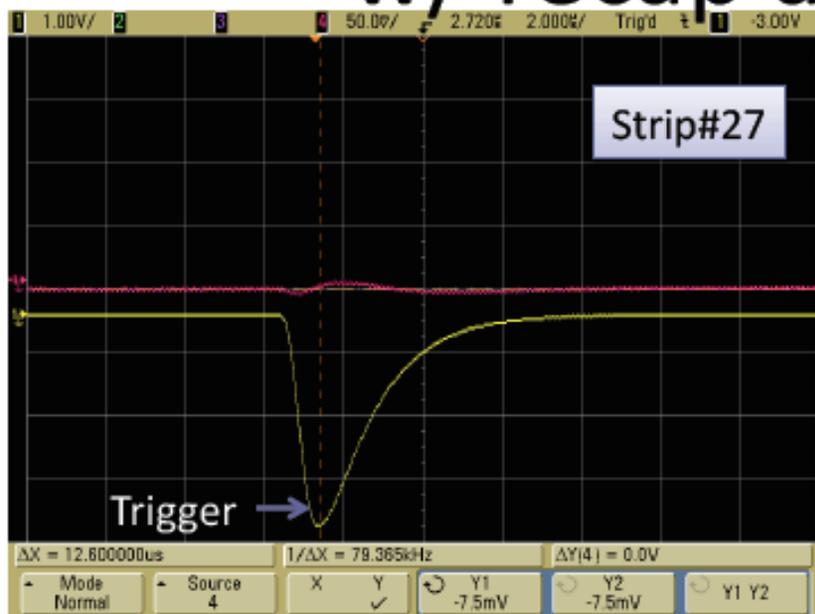
Loss of real charge dist.



Source @ 21 ~ 22 w/o recap averaged pulse

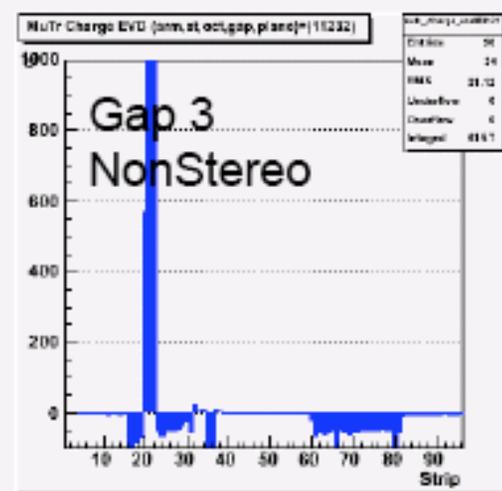
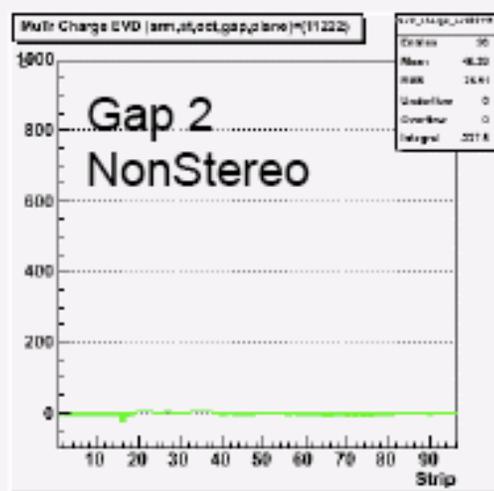
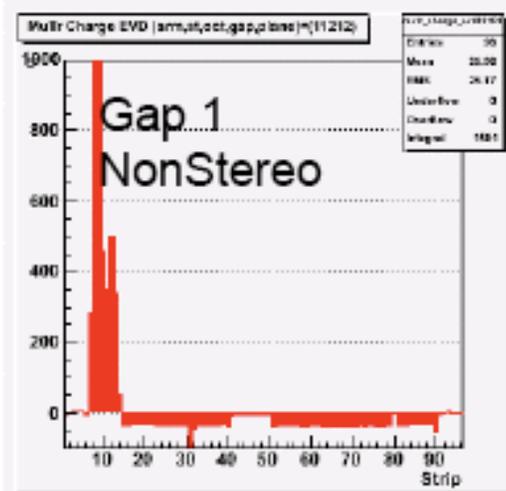
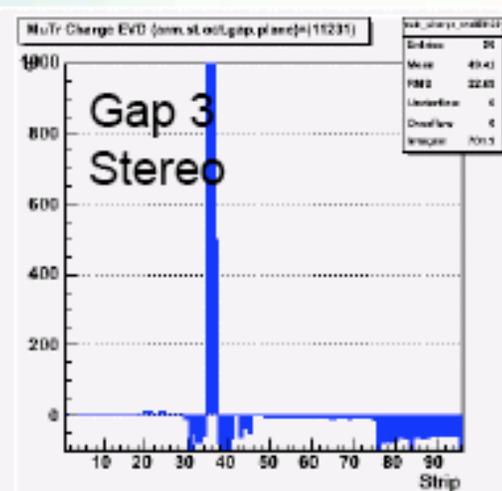
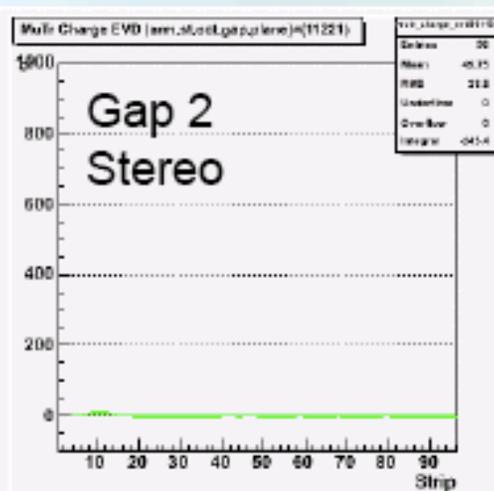
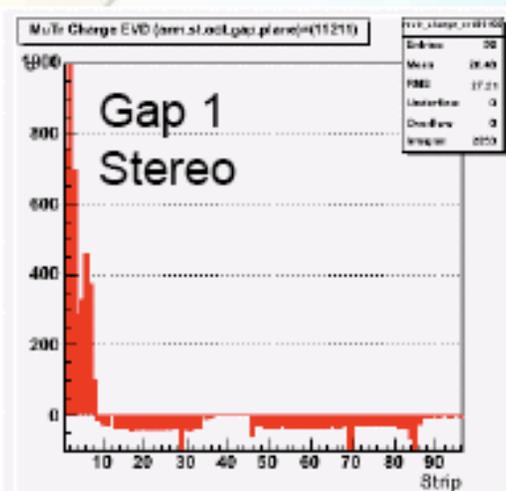


Source @ 21 ~ 22 w/ recap averaged pulse



Hit distribution (200 GeV, zerosup OFF)

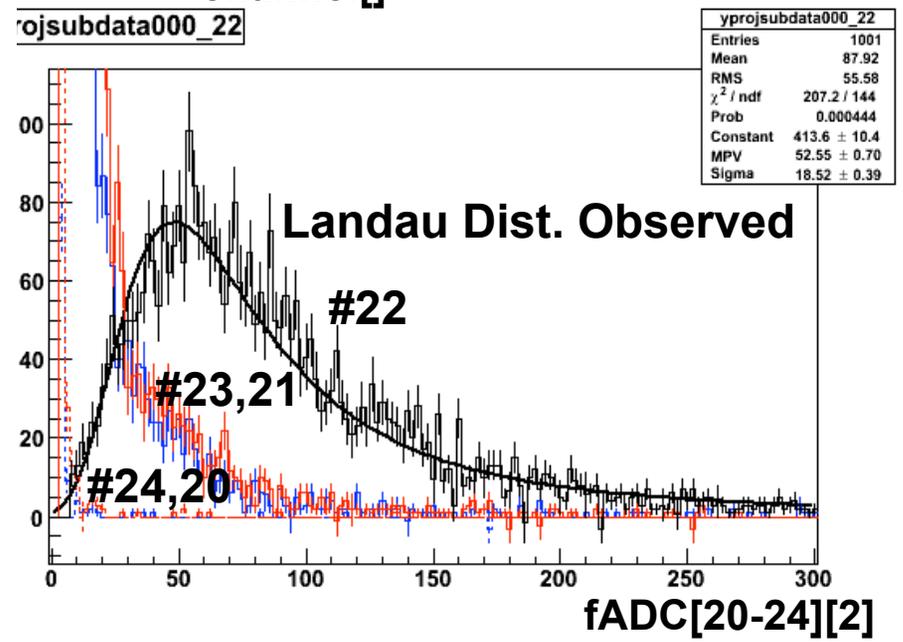
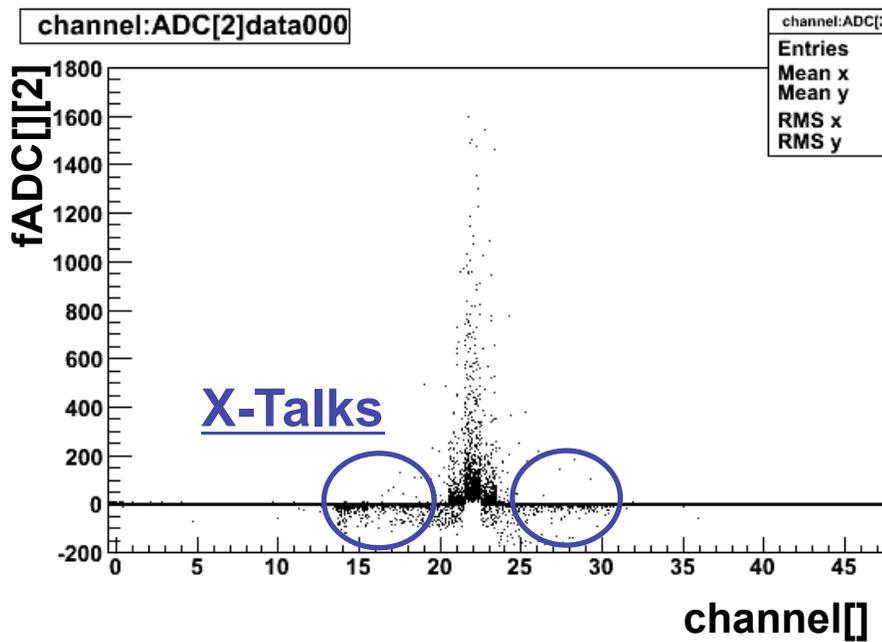
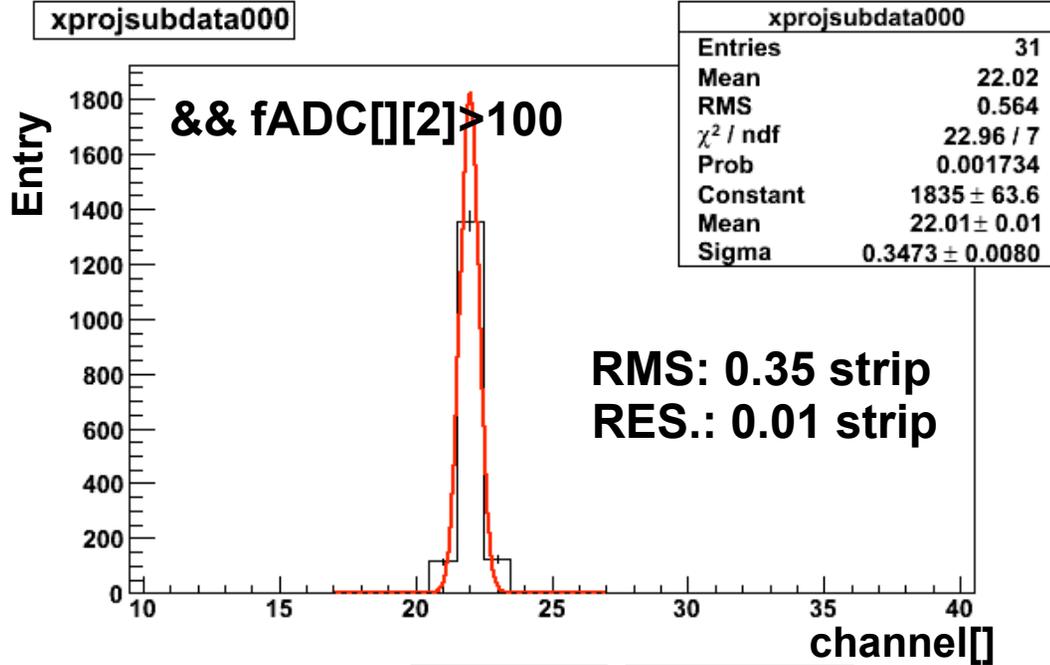
Pedestal - ADC(3)



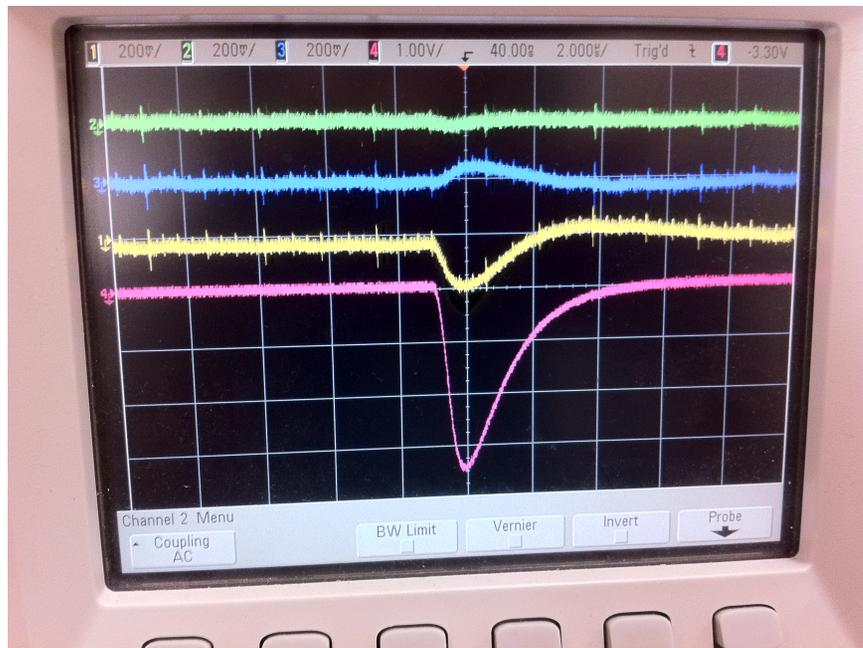
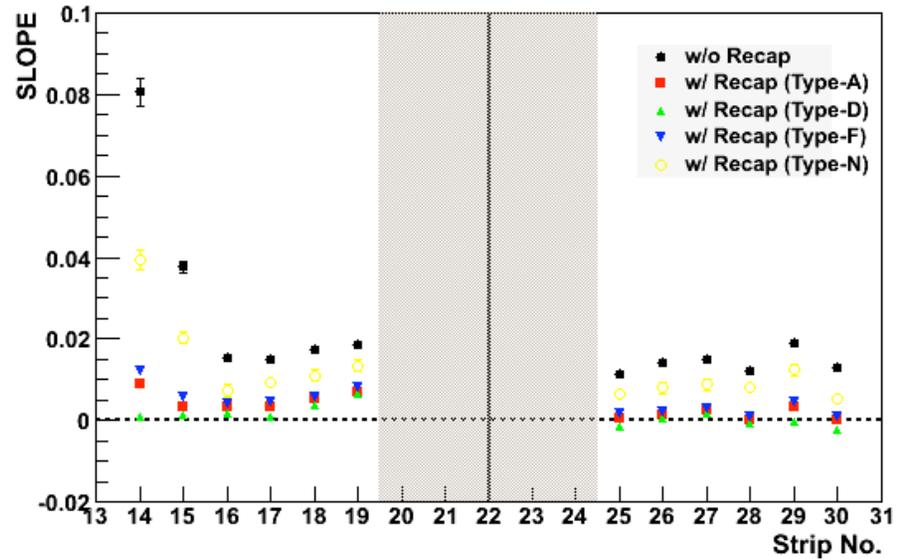
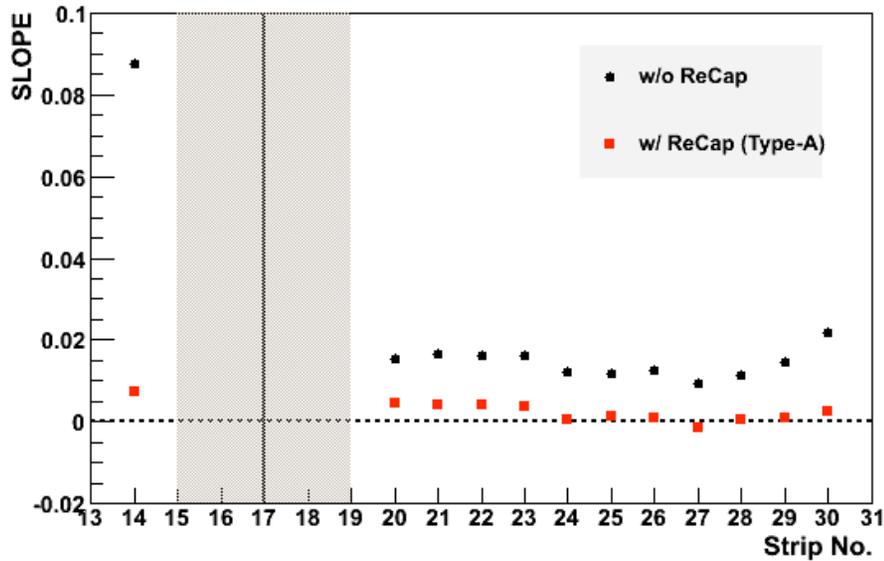
mutr_strip_event000978_clk2424488676q

Strip

Ex. w/o Recap (15 min meas.)



Different Behavior at Different Source Position



St. 28

St. 19

St. 24

St. 22

w/ Recap (Type-A)

- Failure Case 2: lower resistance ($0(\Omega)$ vs $2M\Omega$ (normal cond.))
 between certain channels + sound voltages in all channels

by the measured resistance pattern between channels,
 the reason can be traceable to some extent

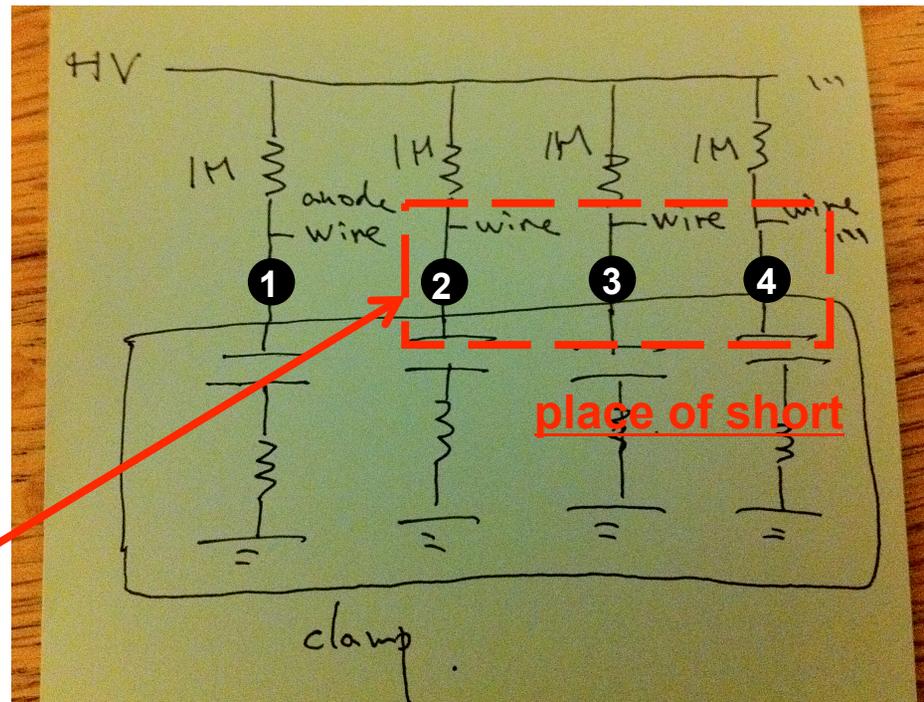
measured resistance

1-2,3,4: $1.3M\Omega$

1-others: $2.0M\Omega$

2-3,3-4,2-4: $\sim 0.0\Omega$

→ There is a short over the three channels somewhere in



● : measured points

scope survey did not find obviously strange pad and probe alignments...
 wires? circuit in anode card?

→ might be investigated later...