

Module Testing with Nd:YAG Laser

K. Hara (U Tsukuba)
SCT Japan Group

Contents:

Laser testing system

Mean response vs. time

Consistency with DAQ calibration results

new dead channels

new low gain channels

Gain spread

Cross-talk

Summary

YAG Laser Test System

VME SCTdaq system

Laser power supply

IV meters

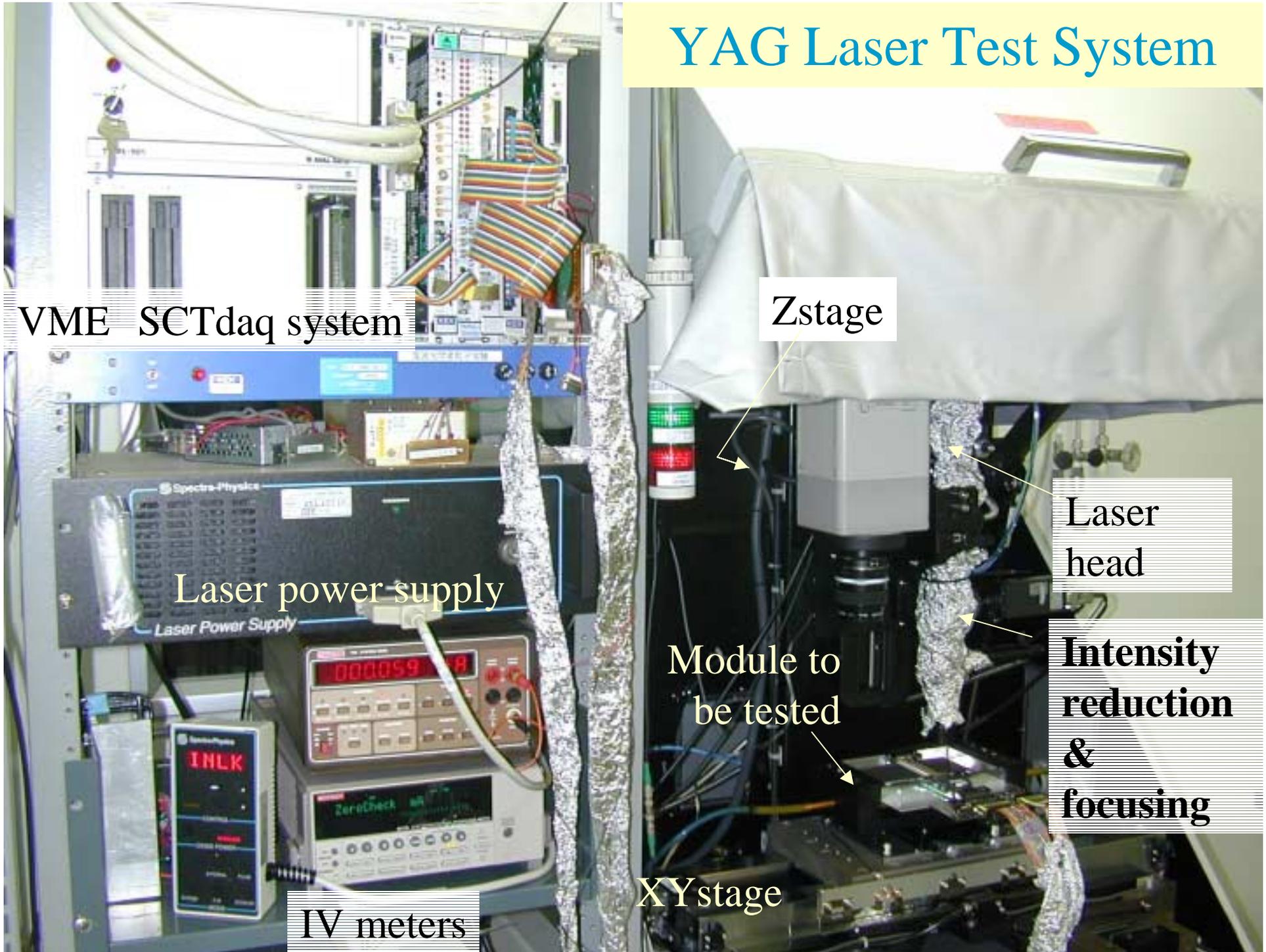
Zstage

Laser head

Intensity reduction & focusing

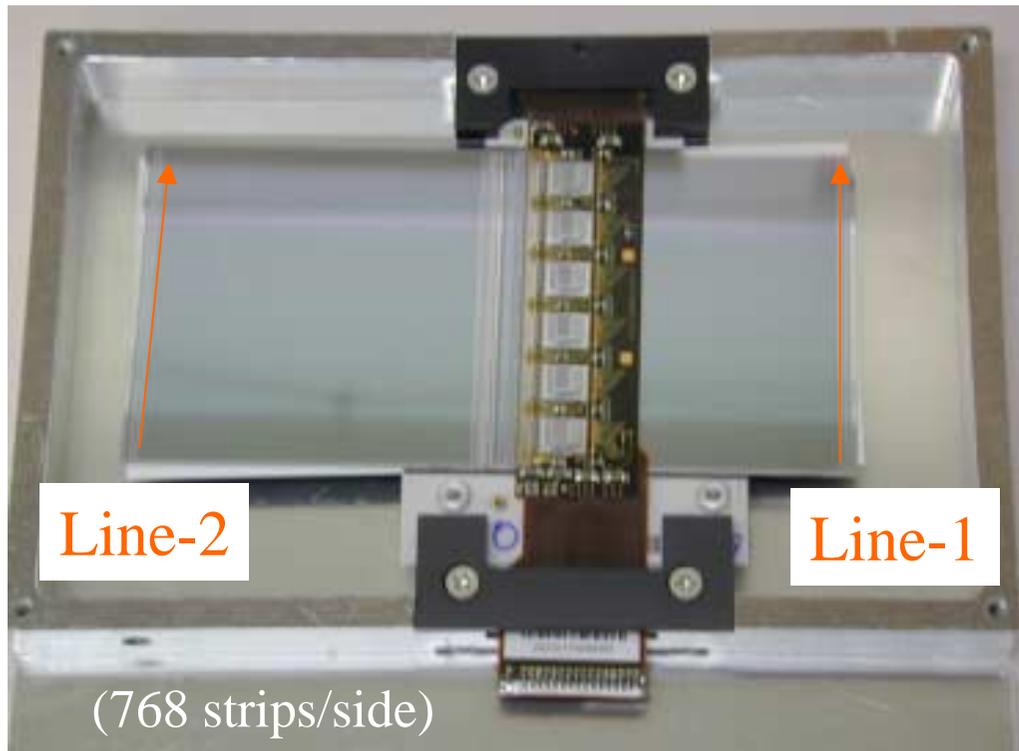
Module to be tested

XY stage



System parameters

① Measurement (incl. setting-up) should complete in 1 hr per side



Response be measured along two lines at both ends



Strip breaks
incomplete wirebonds

...

Record Vth curves of both neighbors as well



Information on cross-talks

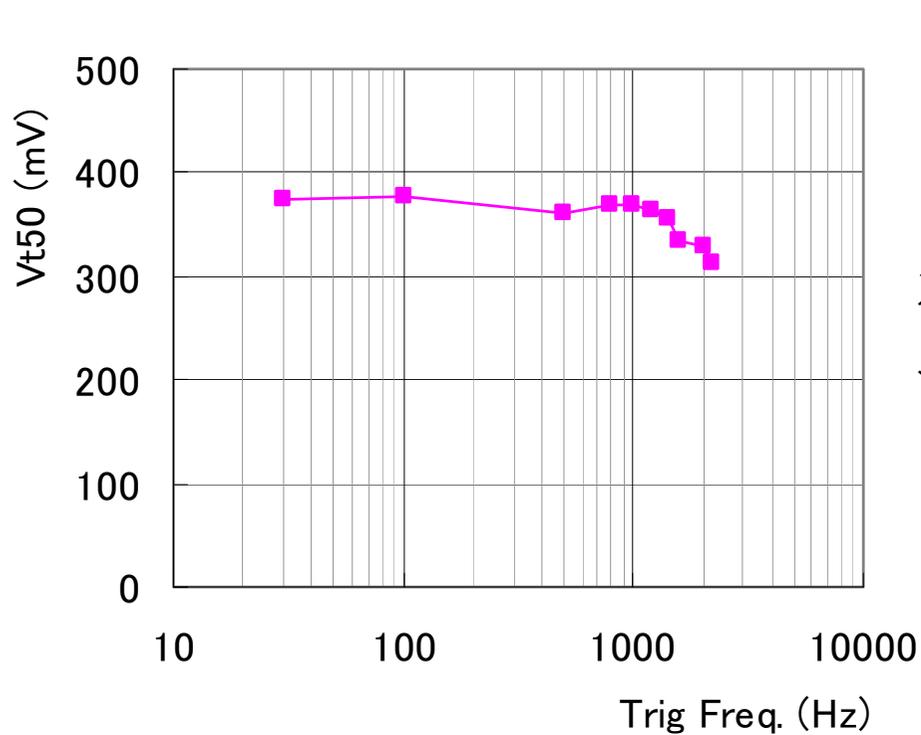
Vth curve: 50 events at each of 10 points: 100, 130, [220, 360,20]

if $VT_{50} < 220$ [150, 360,20]

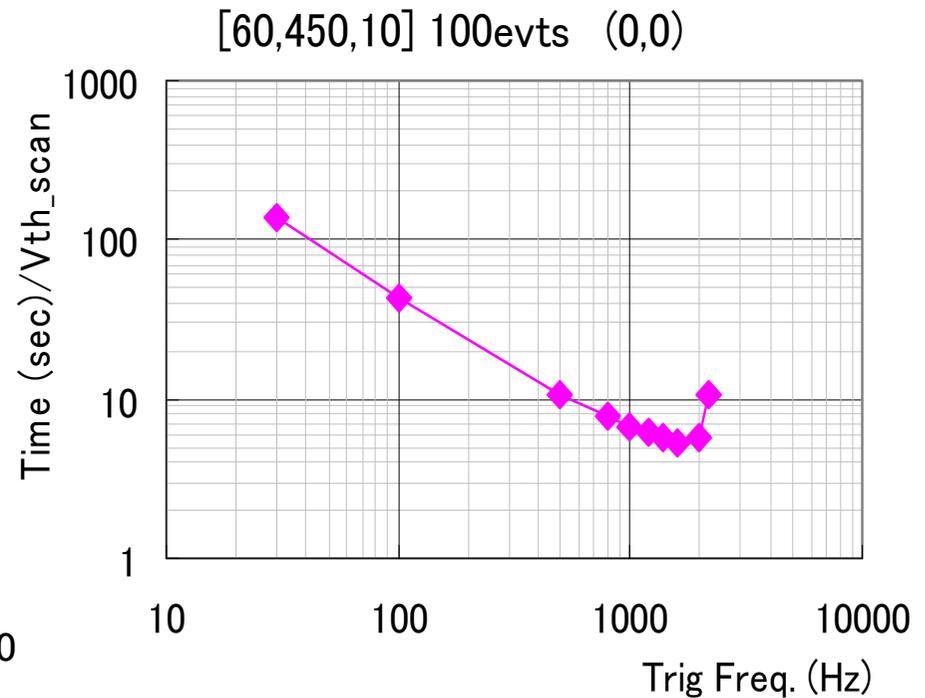
If $VT_{50} > 360$ [220, 480,40]

System parameters

① to complete in 1 hr ... (trigger rate dependence)



Response (=laser output) decreases above 1 kHz frequency



DAQ speed will not improve above 2 kHz

Trigger rate = 1 kHz

For each strip

Vth curve (50 ev@10 Vth) : 1.1s

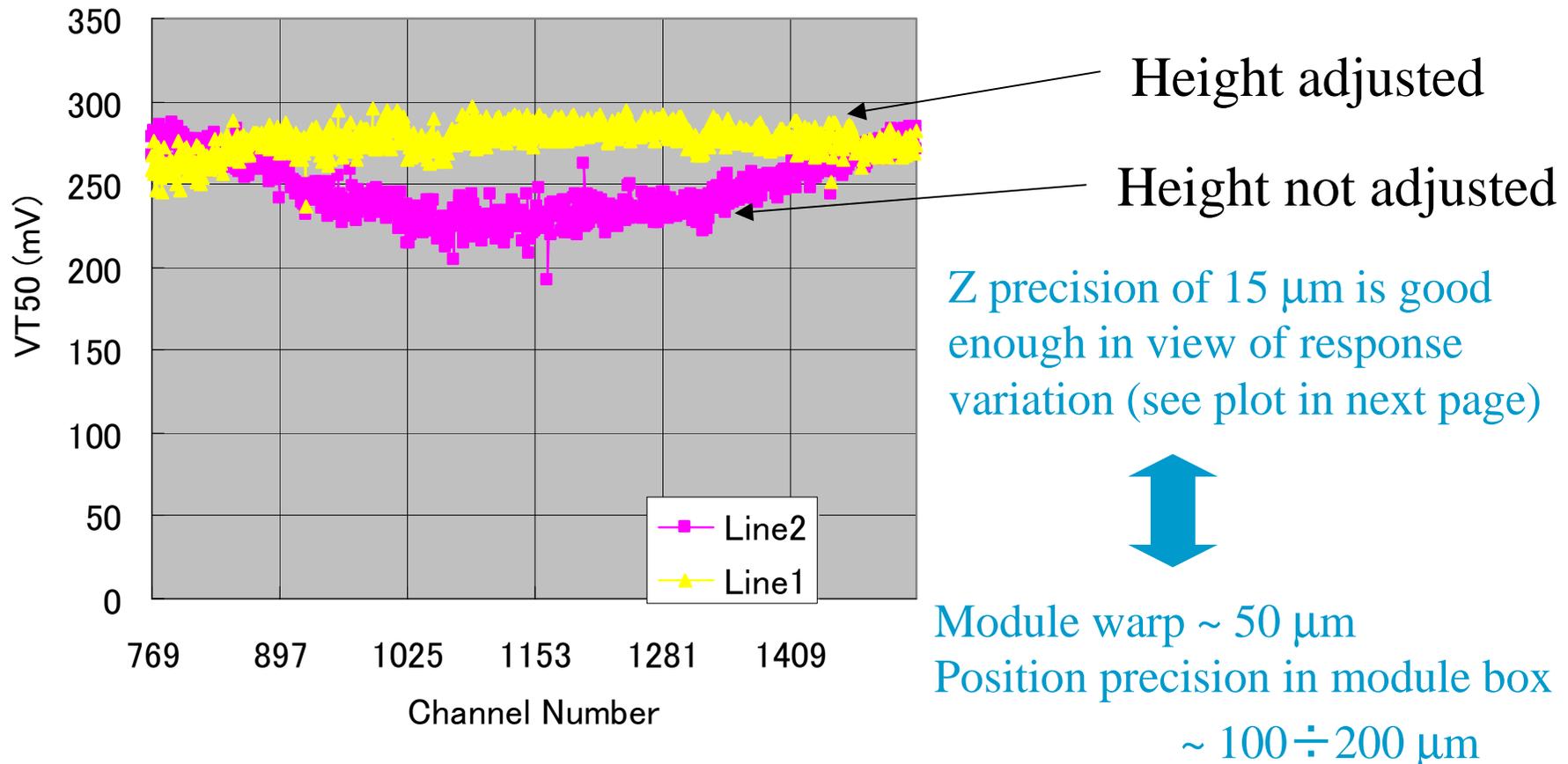
stage movement: 0.2s



meas. along 2 lines + movem't = 40 min
pedestal, XY-Z calib < 15 min

System parameters

② Height adjustment



Minimum effort is required to calibrate the height

⇒ measure height at three points along the scan line; interpolate with a parabola

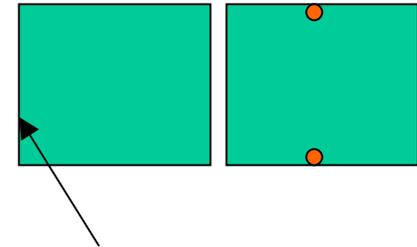
System parameters

③ XY precision achievable

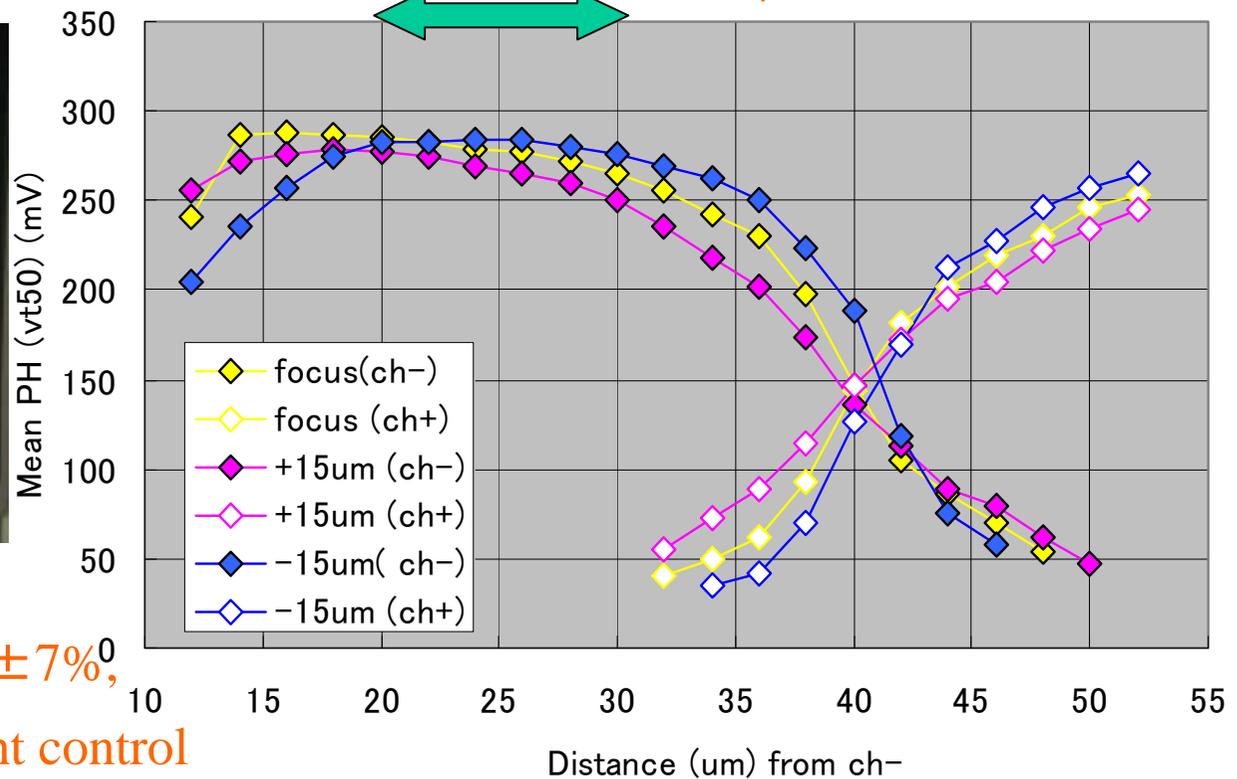
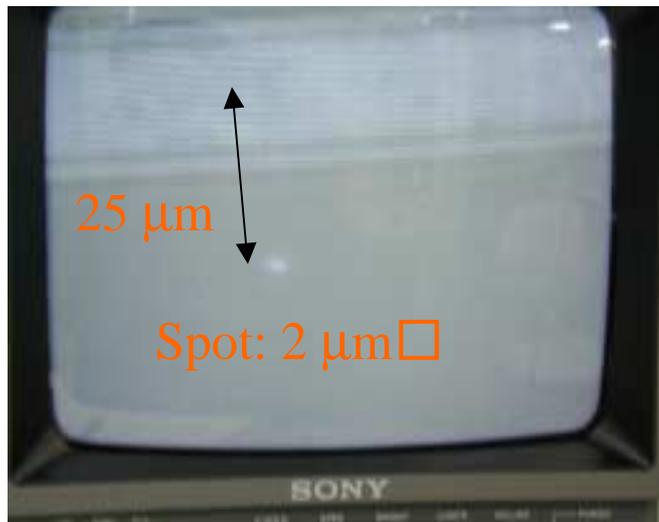
Use 2 sensor fiducials

(no computer-aided pattern recognition, so far)

Thermal deformation should be minimized; wait long enough*
(we have a Cu block at 10degC under the module)

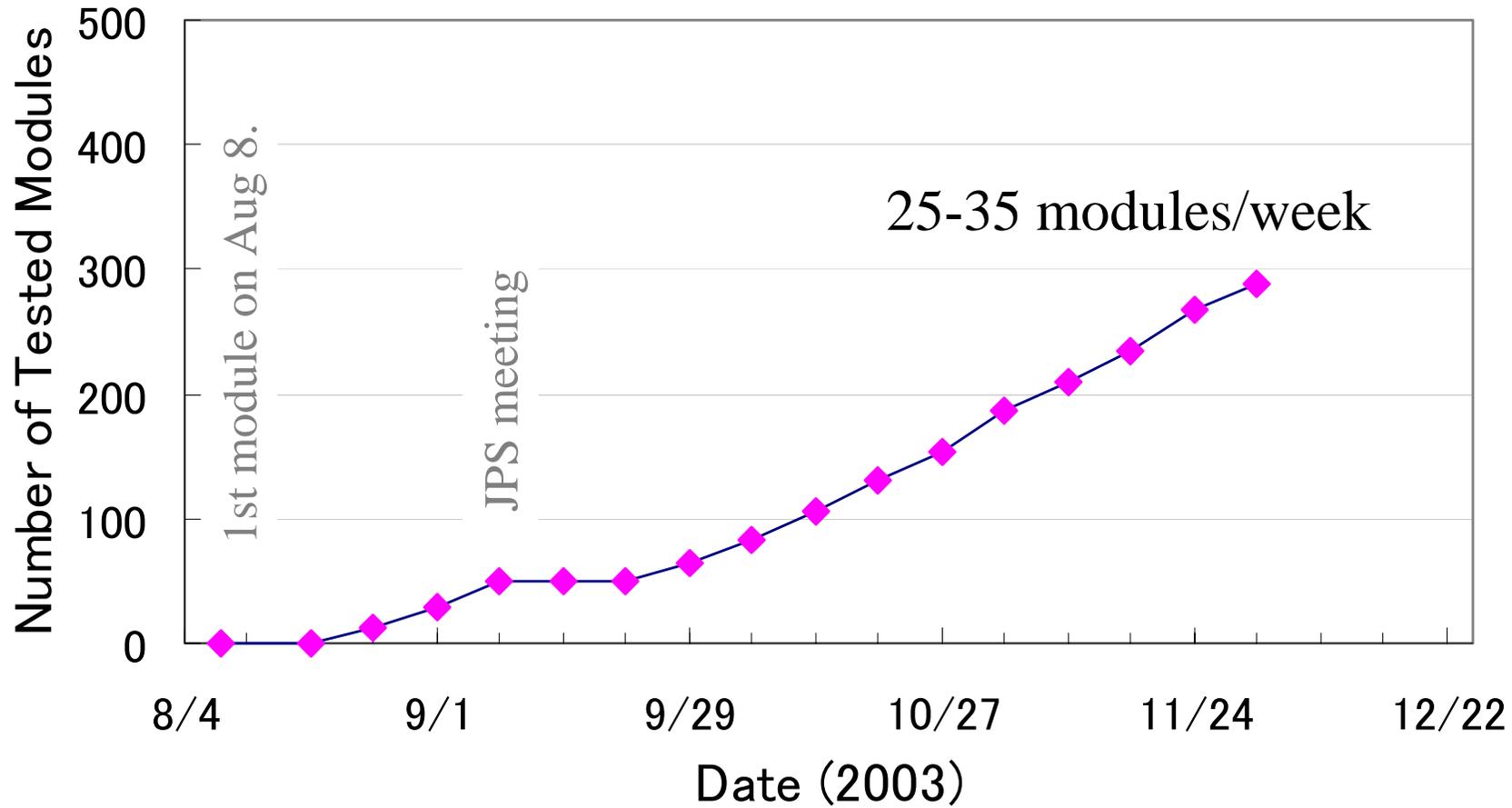


Deviation: 5 μm at this side
*10-20 μm if not careful

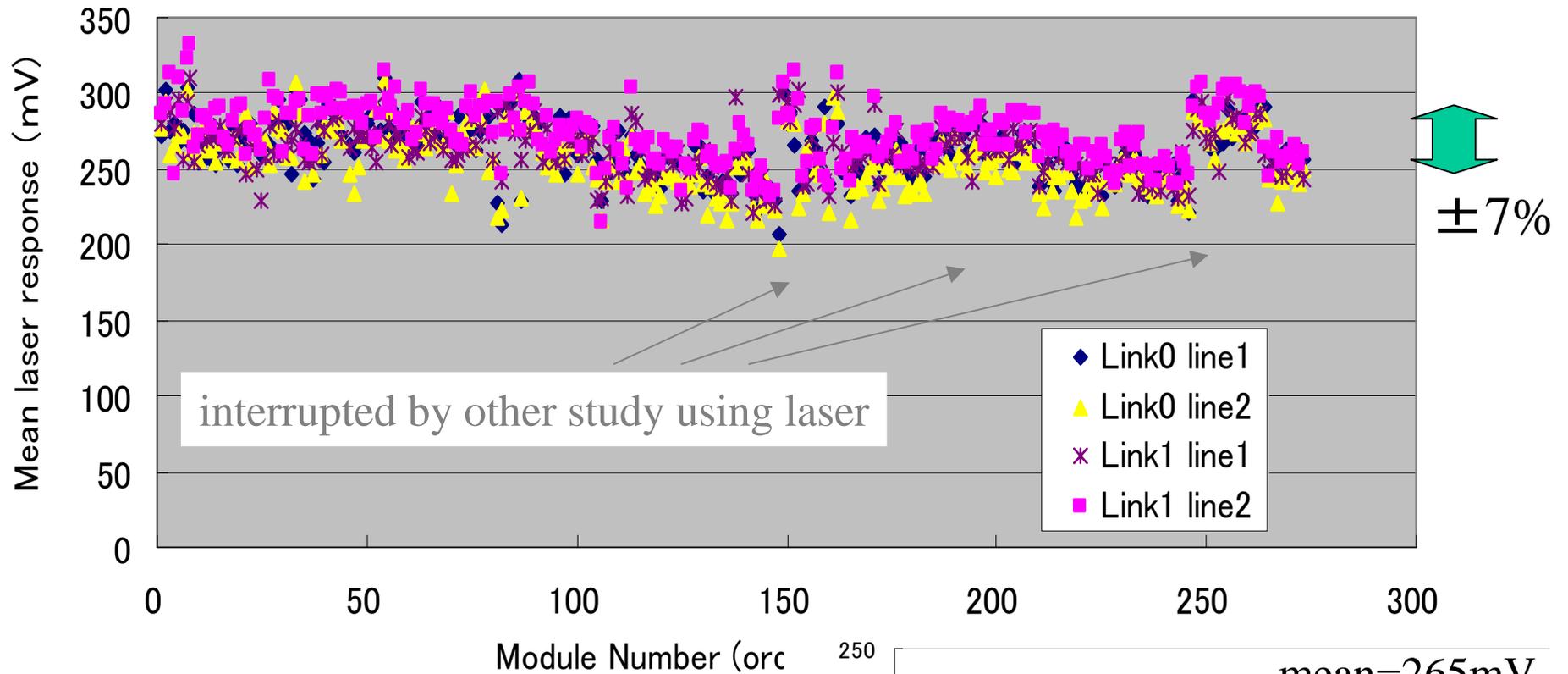


\Rightarrow absolute gain can vary by $\pm 7\%$,
including uncertainty in height control

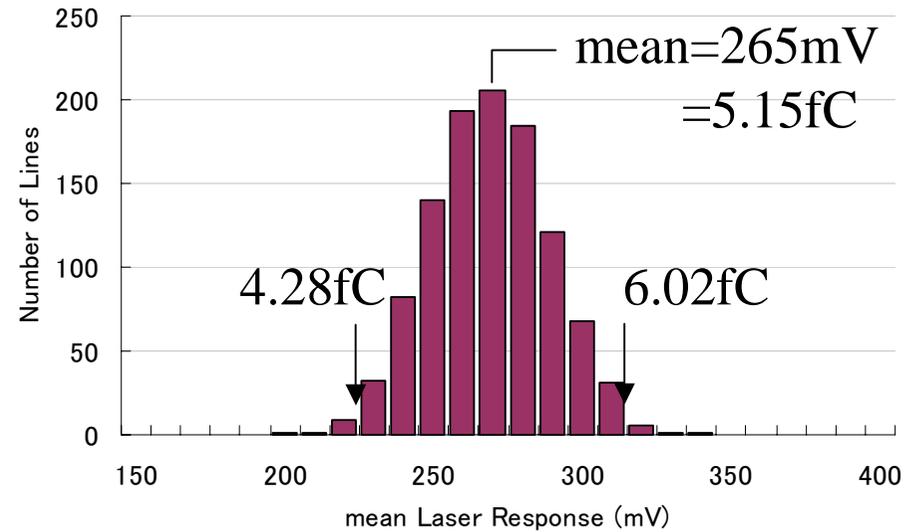
Number of Tested Modules



Mean Response vs. Time

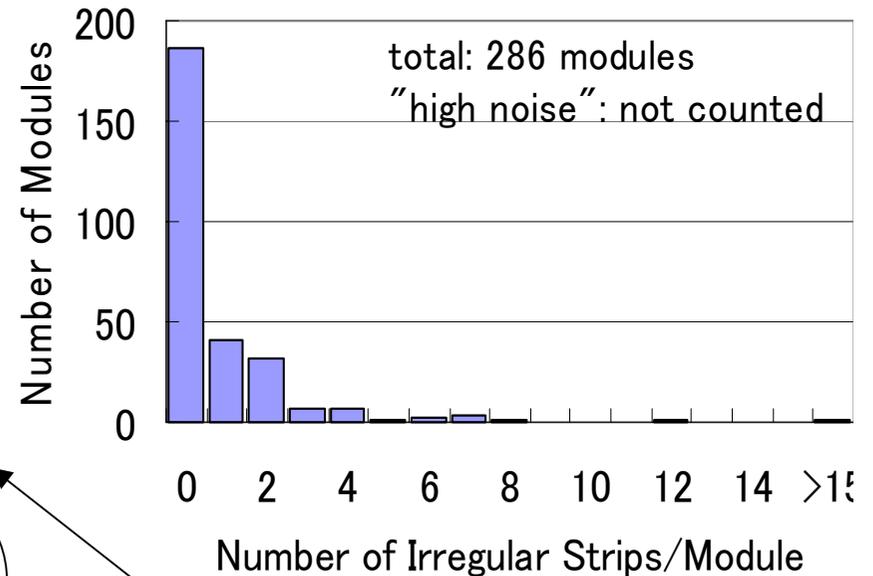


Short-term variation explained by $\pm 7\%$
Long-term drift of $\sim 10\%$ /month may exist
We adjust the laser intensity to keep 4-6 fC



Consistency with DAQ calibration

Total number of irregular channels		346
#irregulars consistent with DAQ		125
#irregulars "inconsistent" with DAQ		110
DEAD	high gain	5
DEAD	low gain	48
DEAD	OK	21
OK	high gain	0
OK	low gain	24
OK	dead	6
unbonded	OK	1
high noise	(lowG)	2
partbonded	dead	1
partbonded	low gain	1
high noise	Not judged	112



These are not inconsistent:
Various criteria being applied in
DAQ to judge the channel is
dead... (need a check)

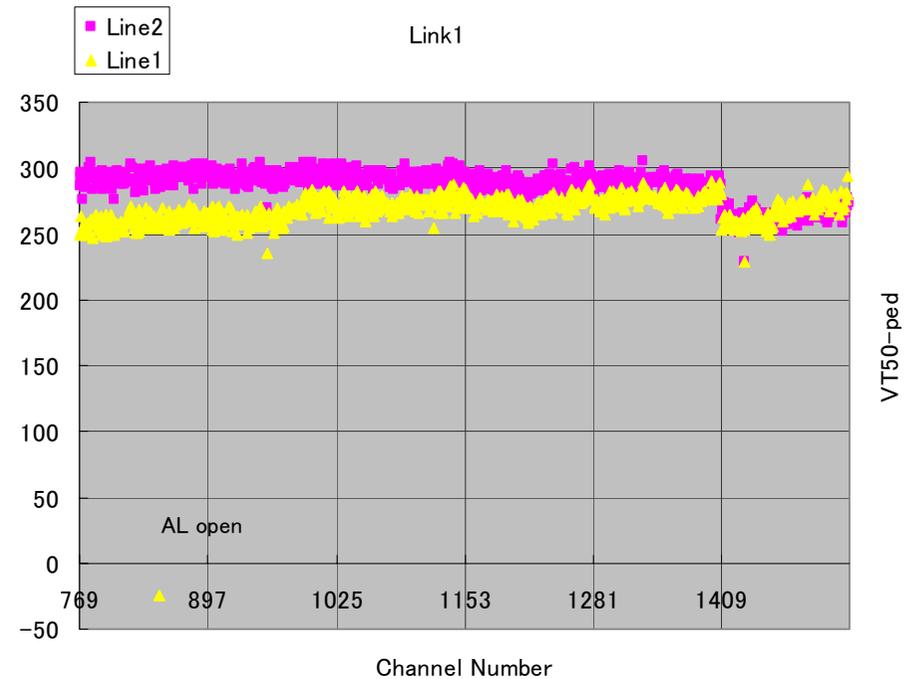
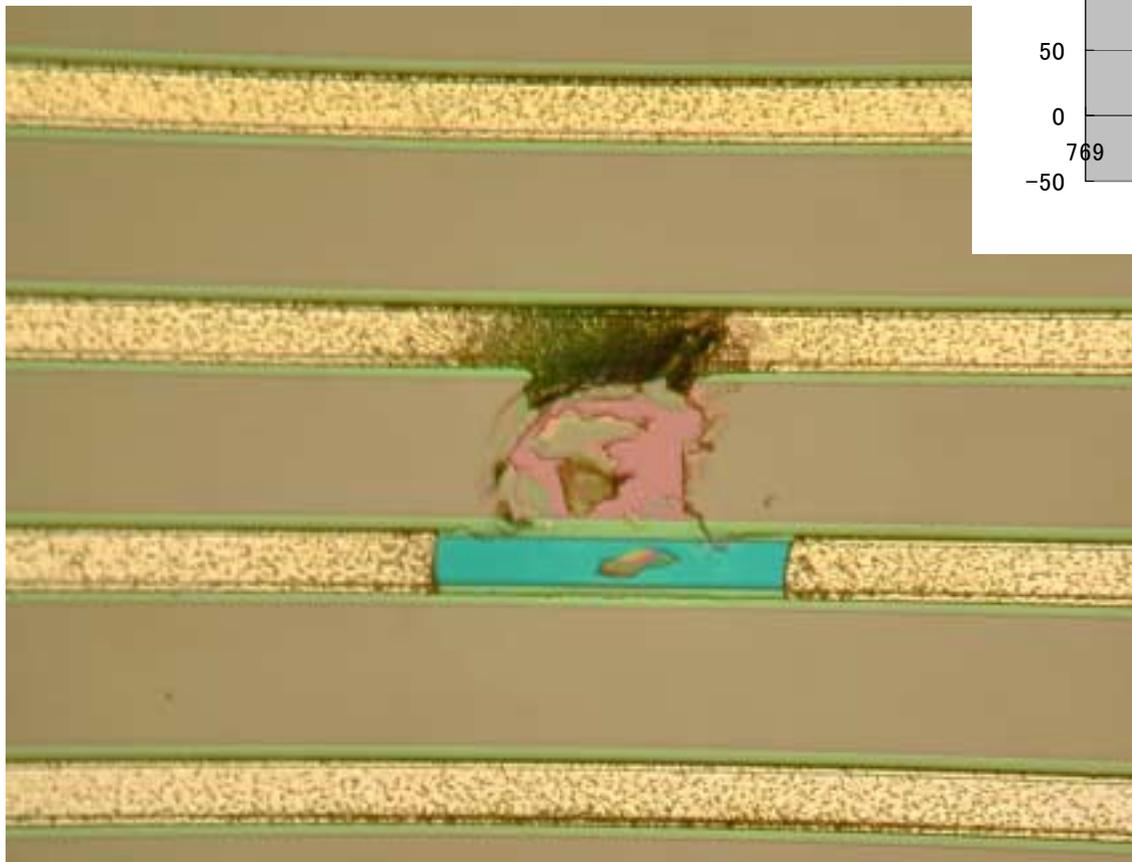
next slides

ENC=801 (unbonded is correct)

Bonded, but low gain (DAQ gain=46) \Rightarrow small ENC \Rightarrow partbonded

Of 6 “new” dead

- 5 are identified as Al break
- 4 are known from HPK probing
- 1 was not known by HPK (see photo)



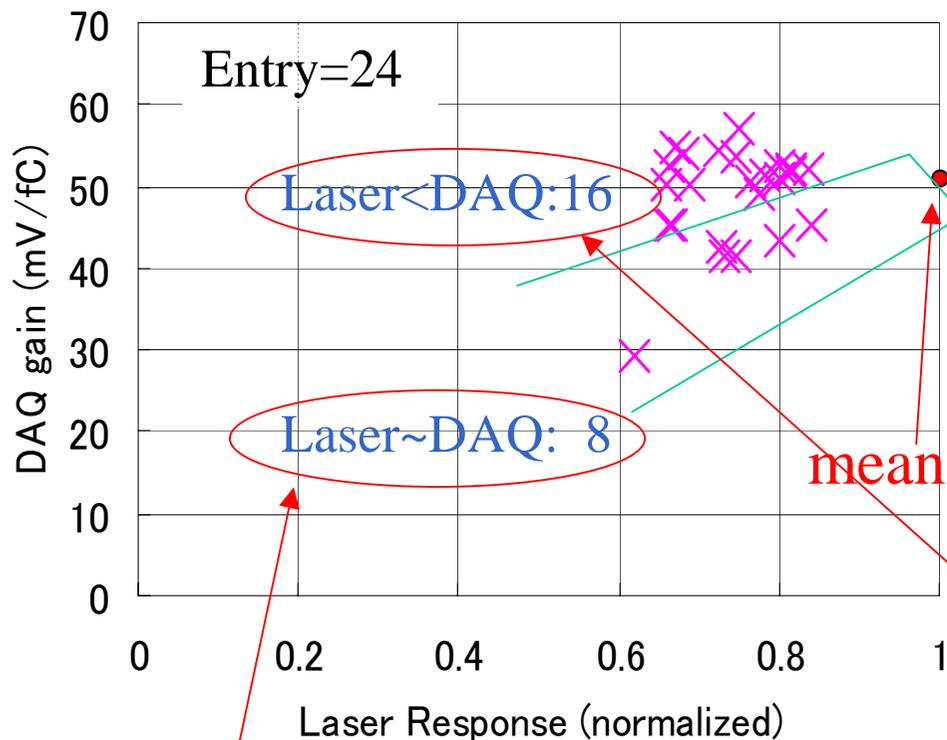
Guess: the Al bridge evaporated in the process of probing when the next neighbor strip was at 120V

1 un-identified:

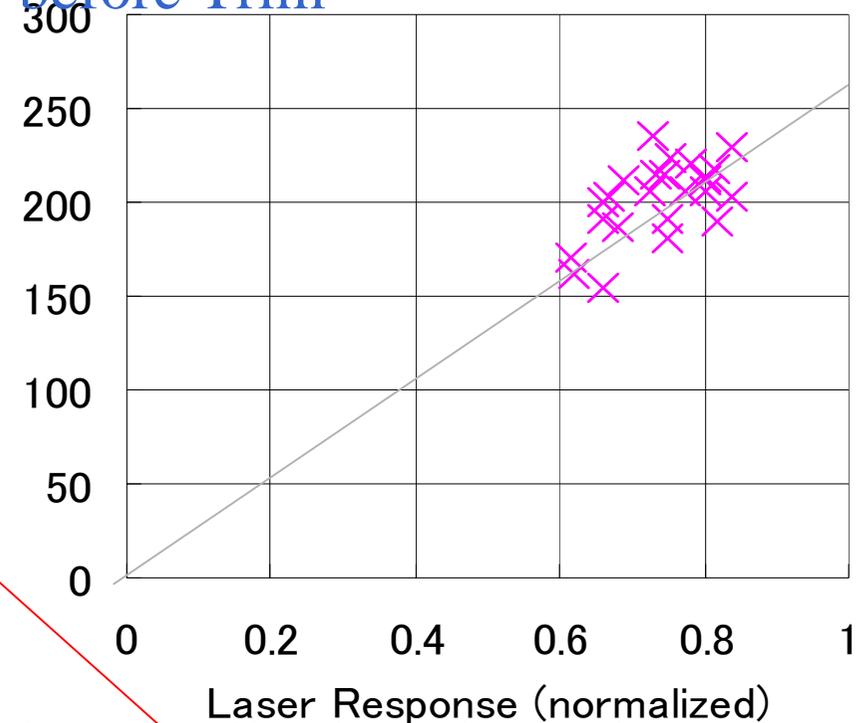
Such a new break may exist under the hybrid

Of 24 “low Gain” channel

DAQ gain given after Trim



Response from DAQ gain, offset, before Trim

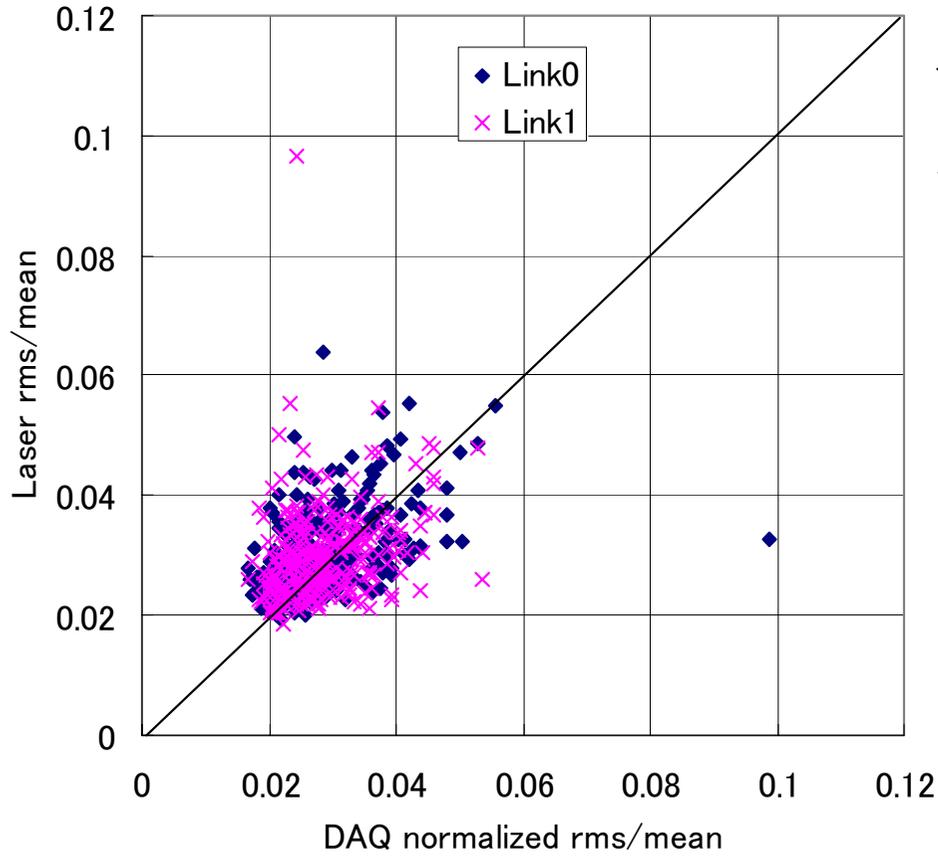


Laser response normalized by of neighboring channels

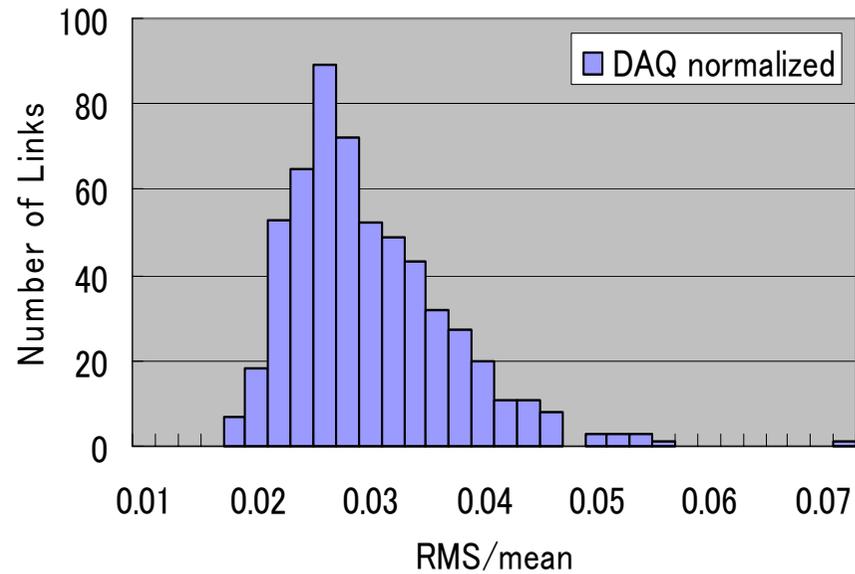
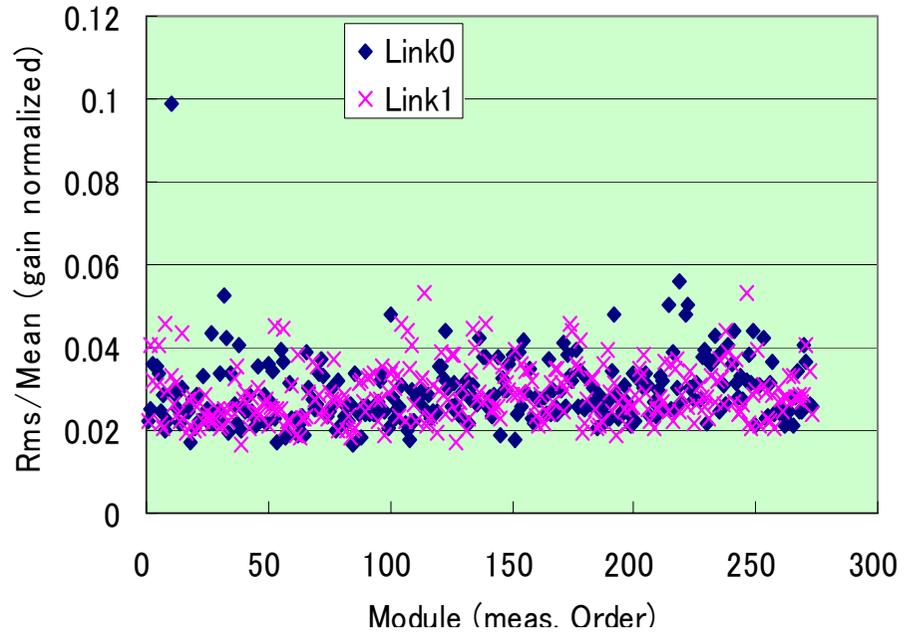
consistent with DAQ, though the channel was judged OK

Channels with large negative offsets: $-(41 \div 77)$ mV

Gain Spread



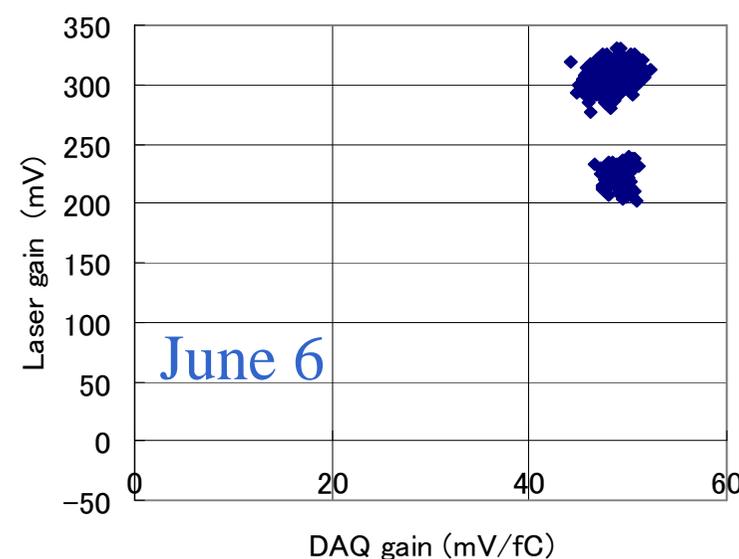
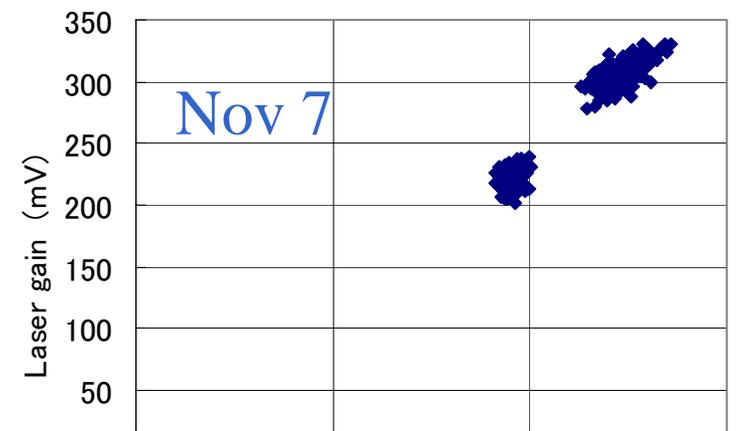
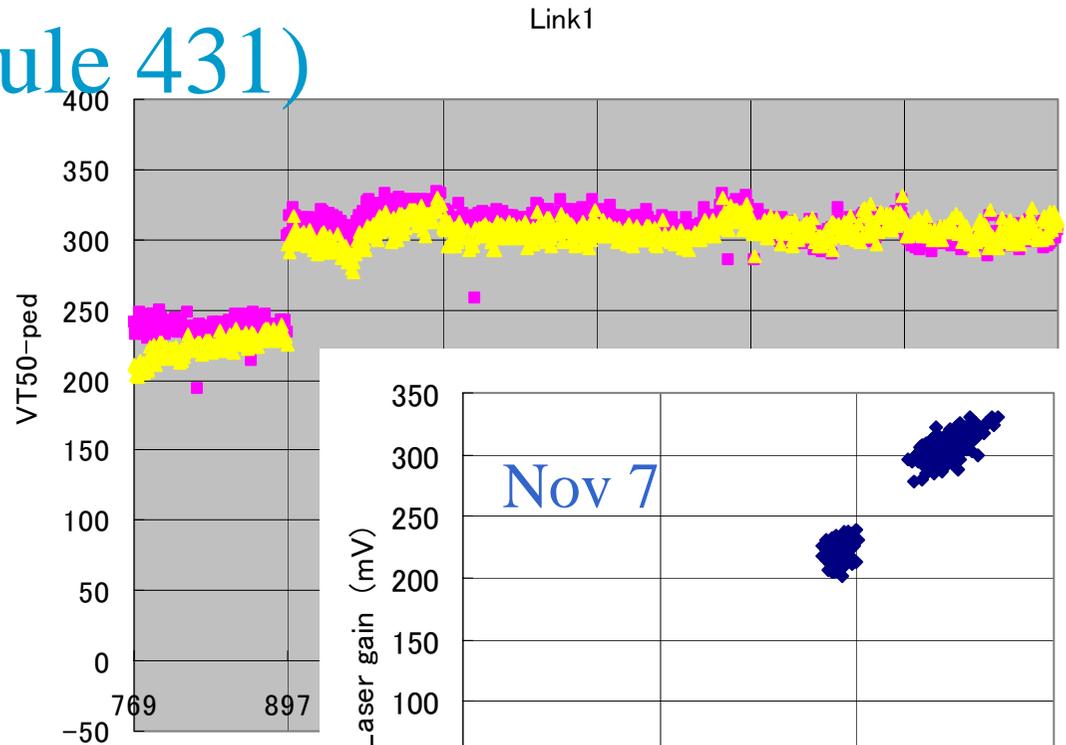
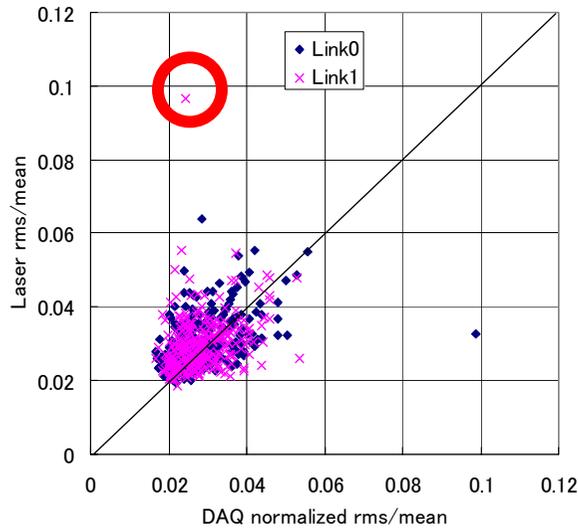
Spread corrected with DAQ gain is not much improved except for modules with large spread...



(rms spread)/mean ~ 2.9%

< 4% for 92.8% of Links

Gain Spread (Module 431)

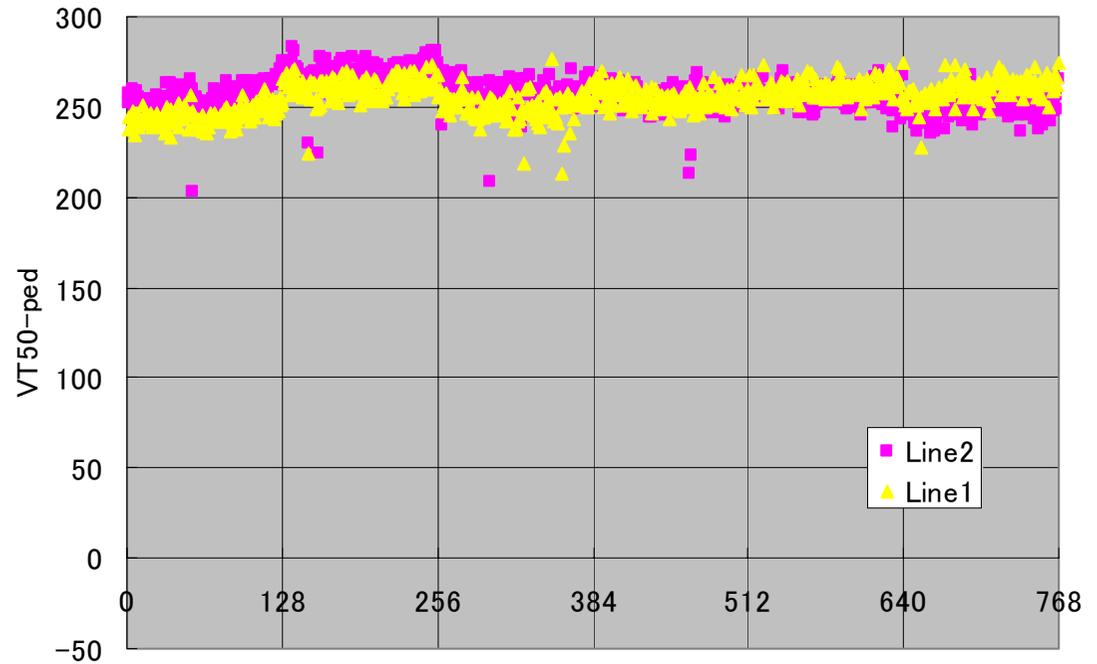
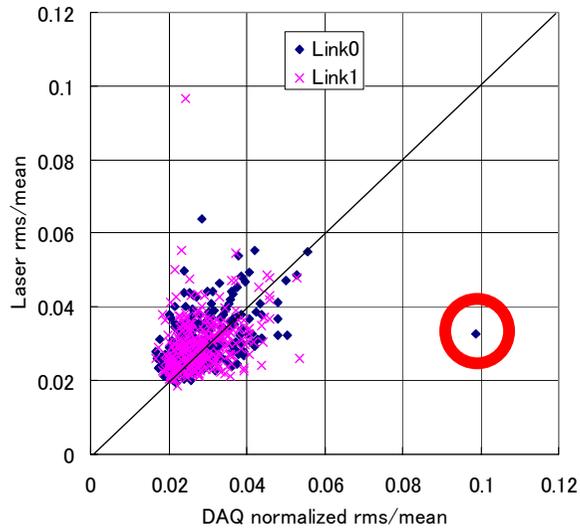


Small gain of M08 chip is nicely corrected by DAQ calibration on Nov 7

Q: why M08 is not judged low gain?
A: M08 was just normal when tested on June 6 ... what happened!?

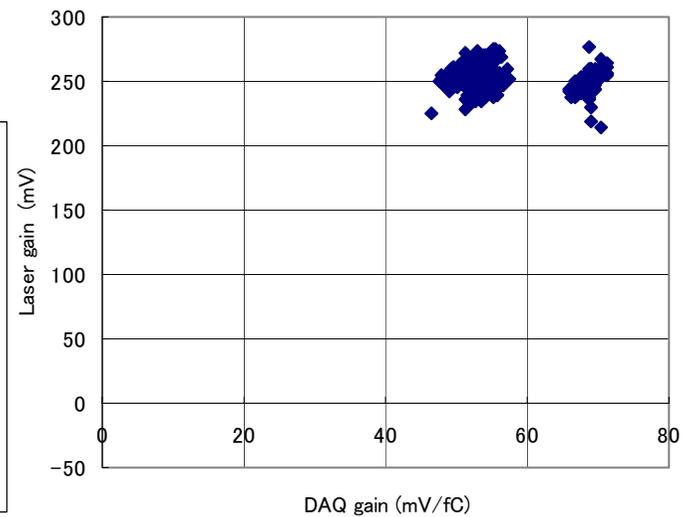
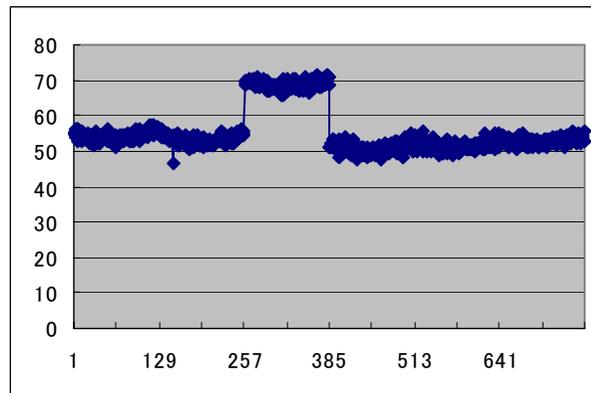
Gain Spread (Module 40)

Link0



Laser response looks just normal,
but S02 DAQ gain is too high...

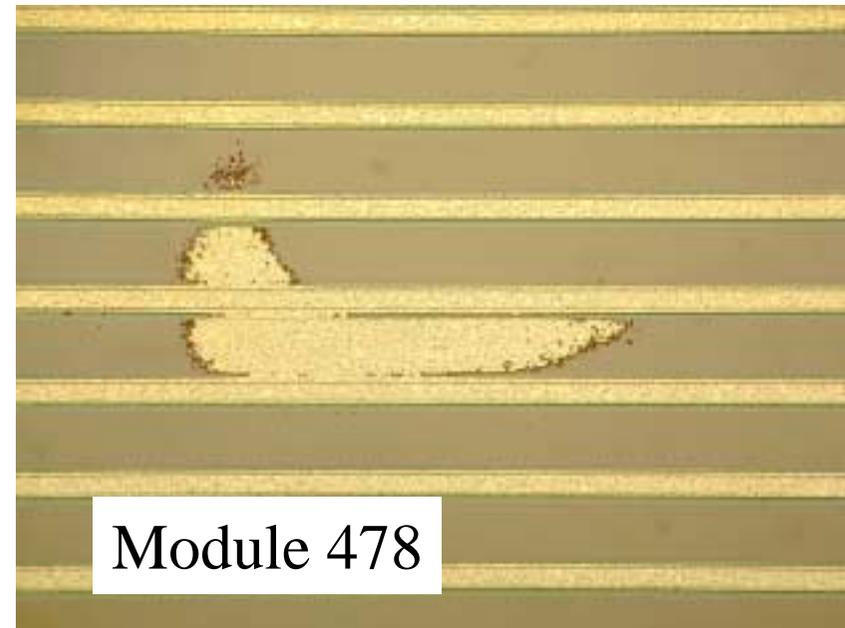
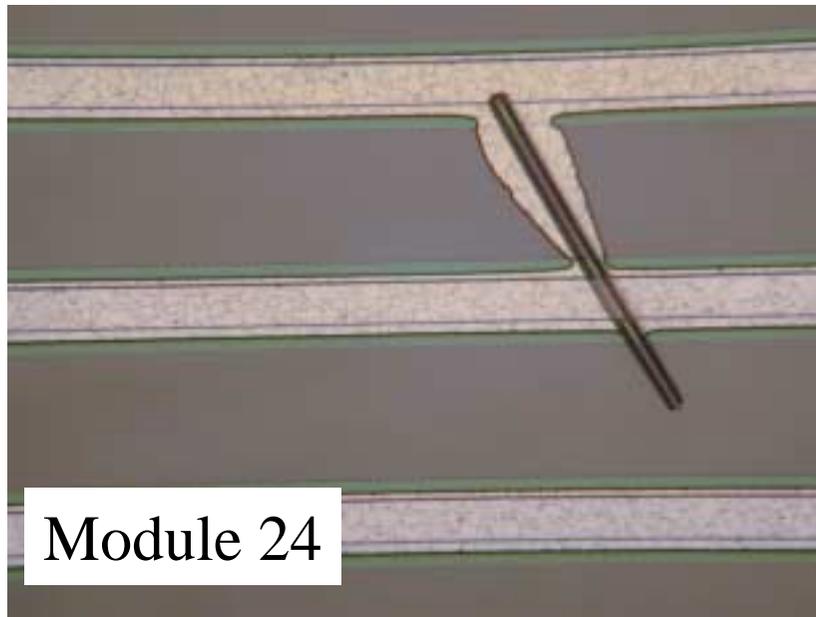
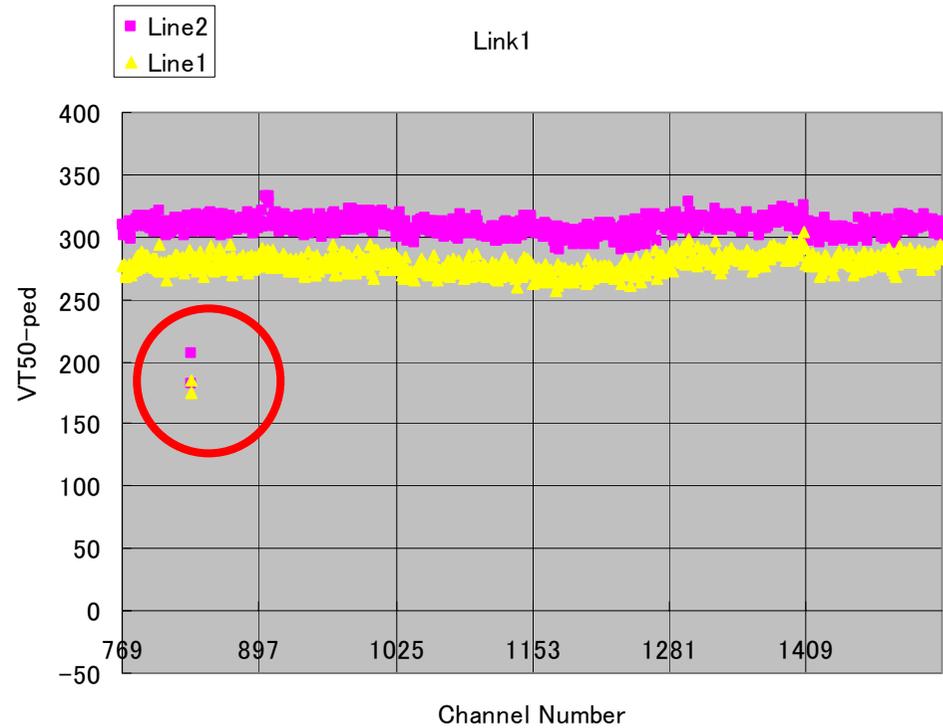
Z39993-W04-9



Others : cross talk

cross-talk is distinctive:
1/2 response in successive channels

DAQ judged these as DEAD



Summary

Laser testing is in progress:

DAQ results are verified mostly

Some findings

6 “new” dead \Rightarrow 5 are identified AI breaks (4 since HPK)

24 “new” low gain \Rightarrow 8 are low since DAQ,

others with large negative offset

one chip may have calibration line 40% off

Current Problem: Mustard reports “no header”/ “no data”

probably, data are lost during module

to VME transmission (?)

this limits the gain uniformity precision



reset Mustard when “this” curve is obtained
re-route the cables if this continues...

