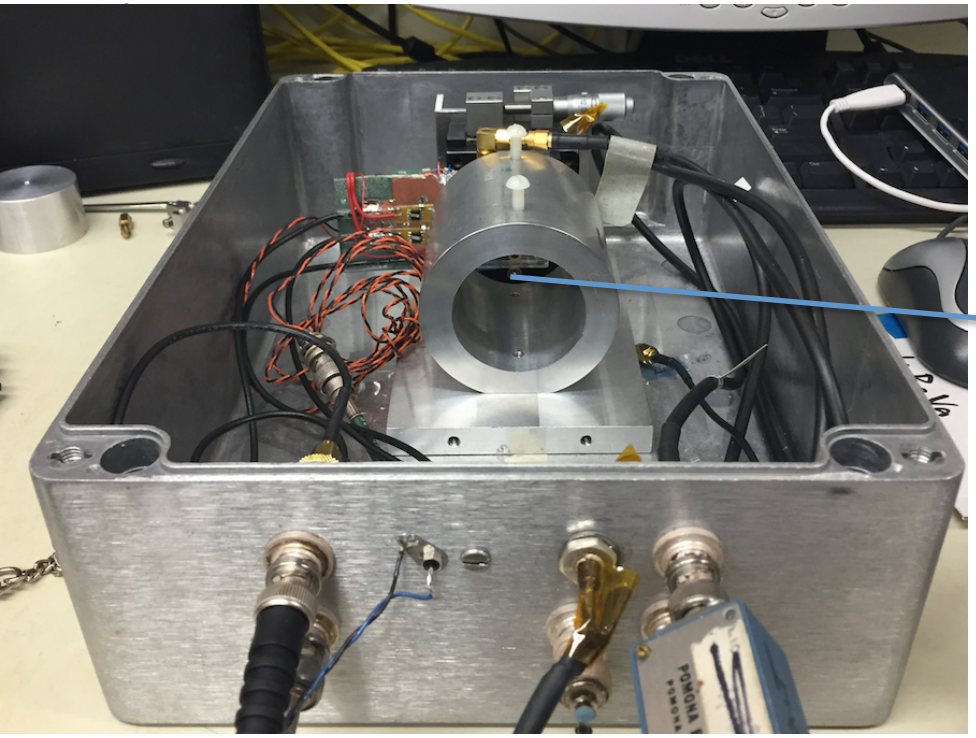
Beta test of CHESS1 chip

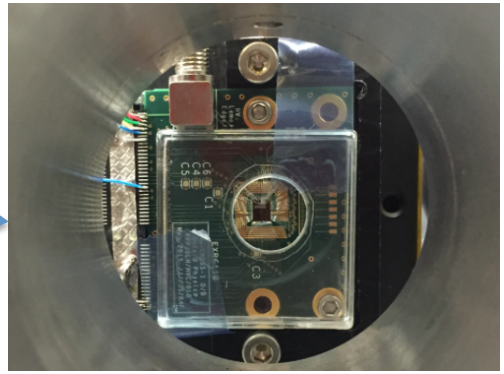
Vitaliy Fadeyev, Zach Galloway , Herve Grabas
Alexander Grillo , Zhijun Liang , Abe Seiden
Jennifer Volk, Forest Martinez-Mckinney

University of California, Santa Cruz

Beta test setup

- CHESS1 chip Mount on daughter board from Jaya John
- Sr90 beta source is used
- Trigger rate ~0.1 Hz , self trigger
- CHESS chip Biased at 110V





Reminder of active array in CHESS1 chip

- Active array APA08 is used
- Channel 7,8 is connected for readout
- Self trigger
  - Trigger on pixel 8

Table 3.4-a Active Pixel Array Spatial Specification for HV-CMOS Technology

APA #	Pixel Dimensions	Diode Area Fraction
APA01	45µm x 100µm	30%
APA02	45µm x 100µm	50.4%
APA03	45µm x 200µm	30%
APA04	45µm x 200µm	50.4%
APA05	45µm x 400µm	30%
APA06	45µm x 400µm	50.4%
APA07	45µm x 800µm	30%
APA08	45µm x 800µm	50.4%

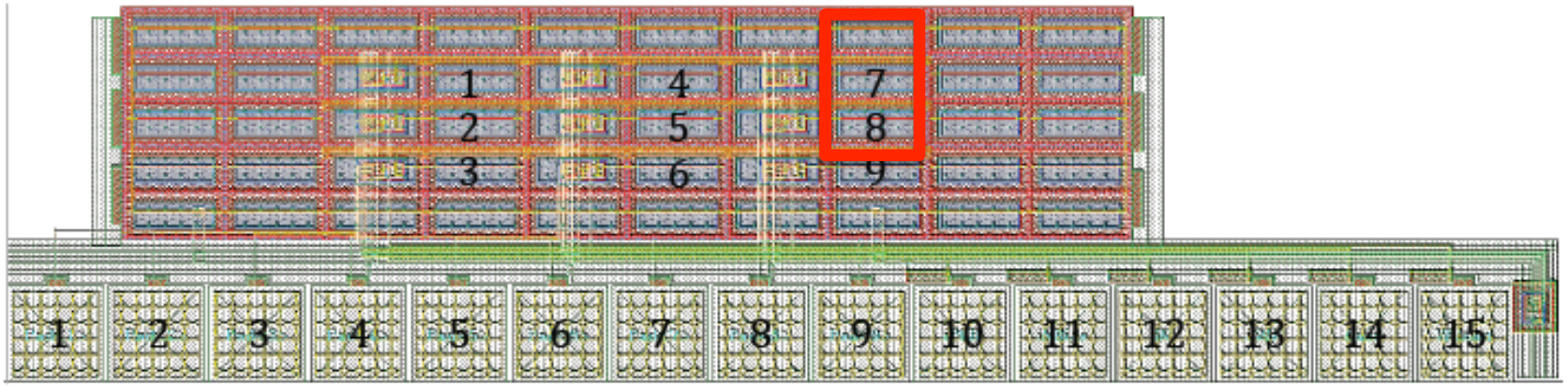
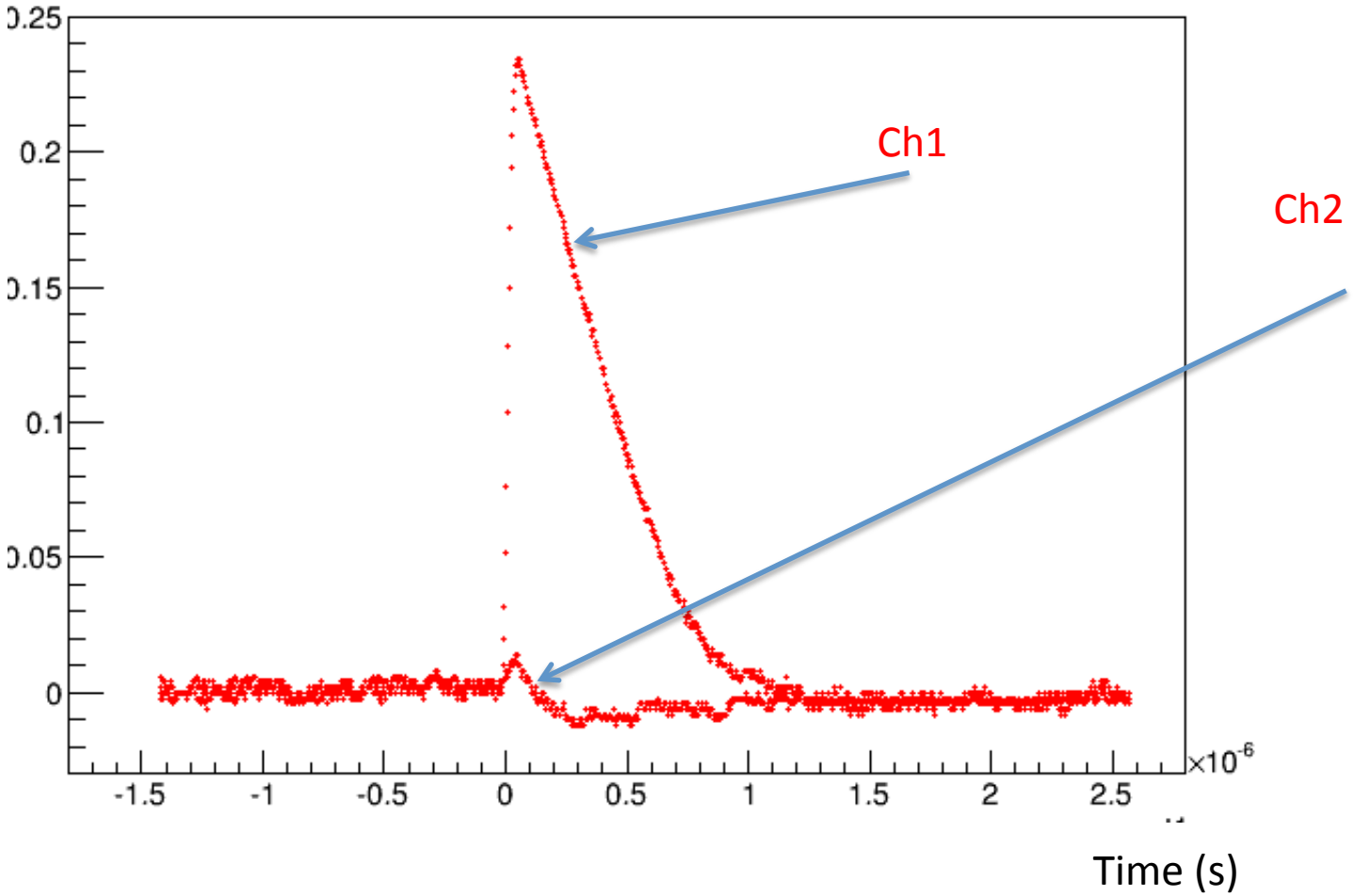


Figure 3–3 Layout for the 45µm x 200µm Active Pixel Array with pixel numbering and pad layout. The connection to the pad layout are identified in Table 3.3.2

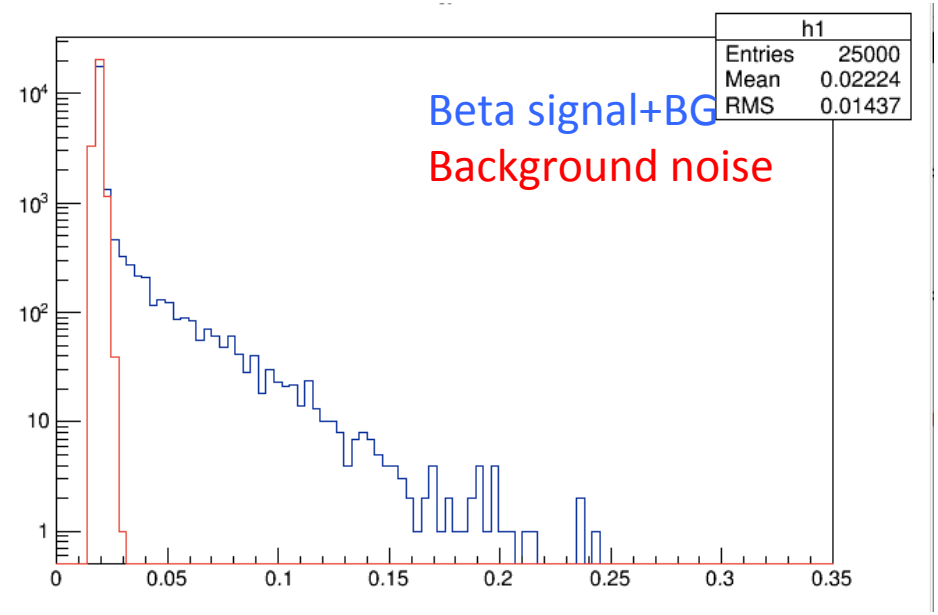
Pulse shape in usual case

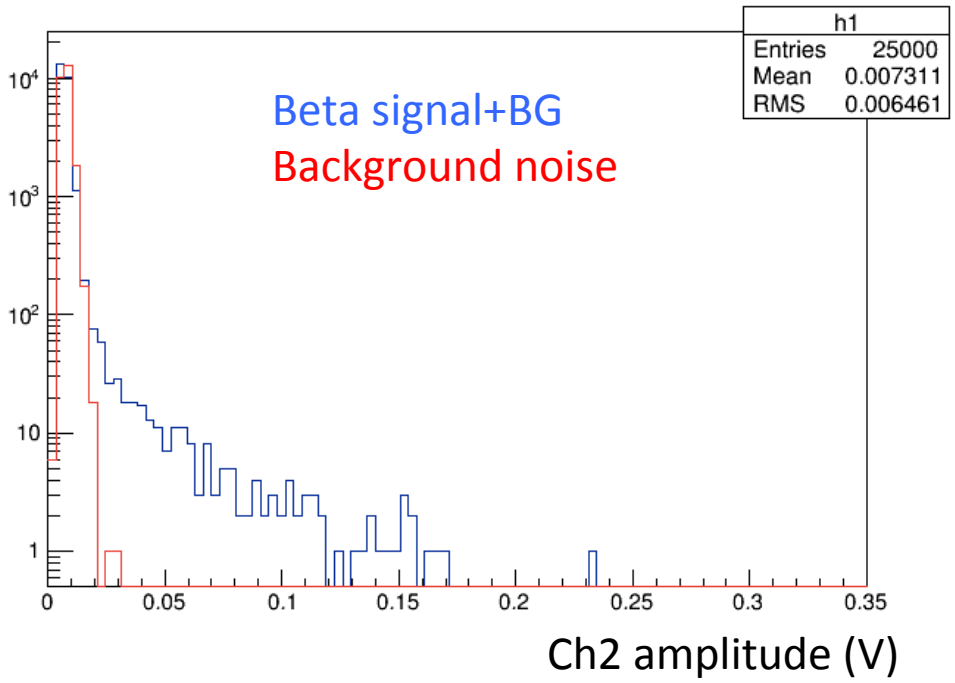
Output(V)



Signal amplitude distribution

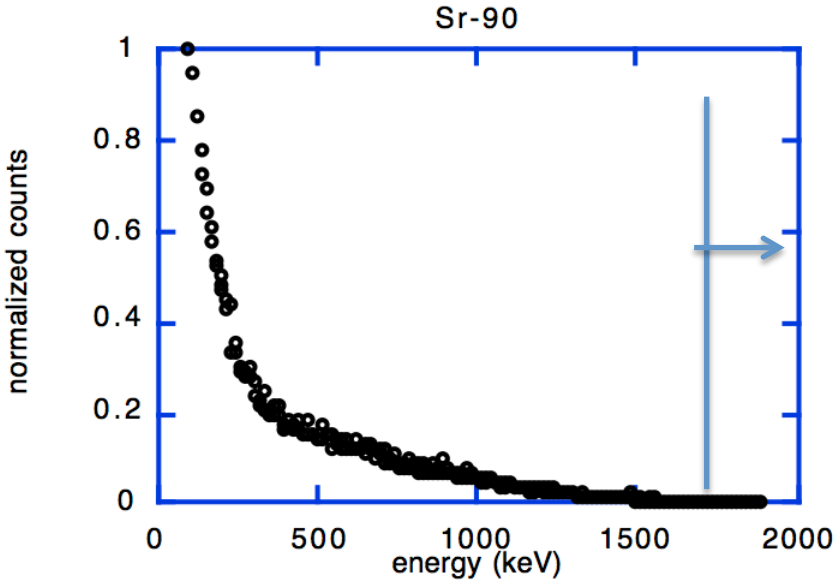
- No visible MIP peak yet
- Self triggering on channel 1.
- The noise peak (red curve) is obtained without beta source

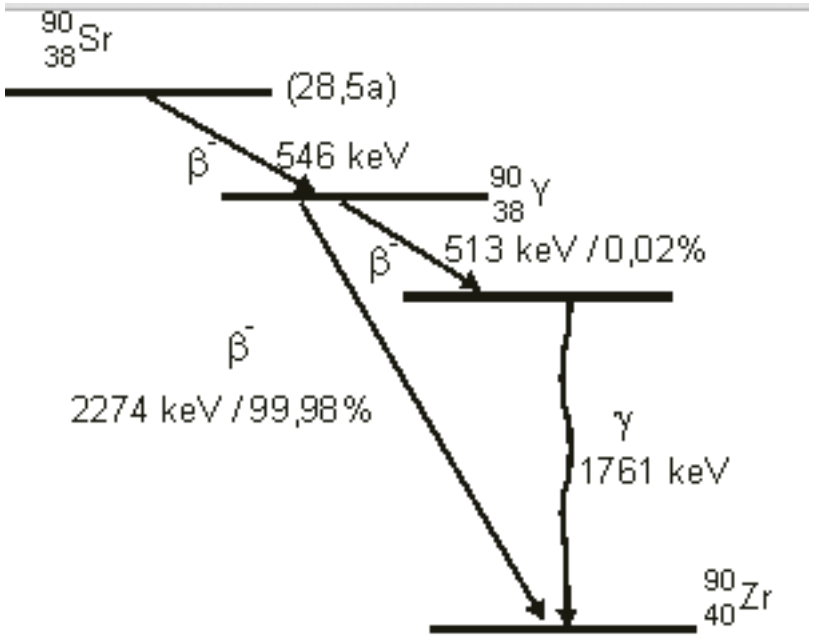




Why no MIP peak ?

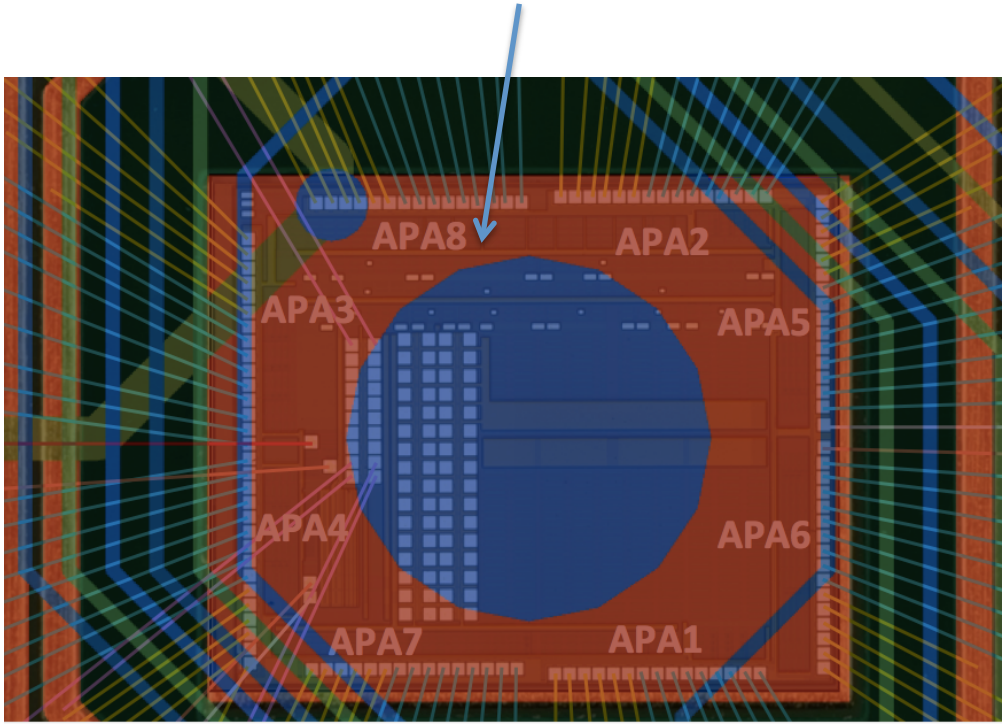
- SR90 Beta source we used has lots of low energy electrons.
  - Self triggering includes both low energy electrons and high energy electrons -
  - dE/dx of these low energy electrons are different from MIP.
  - We need to select to high energy electron (MIP)

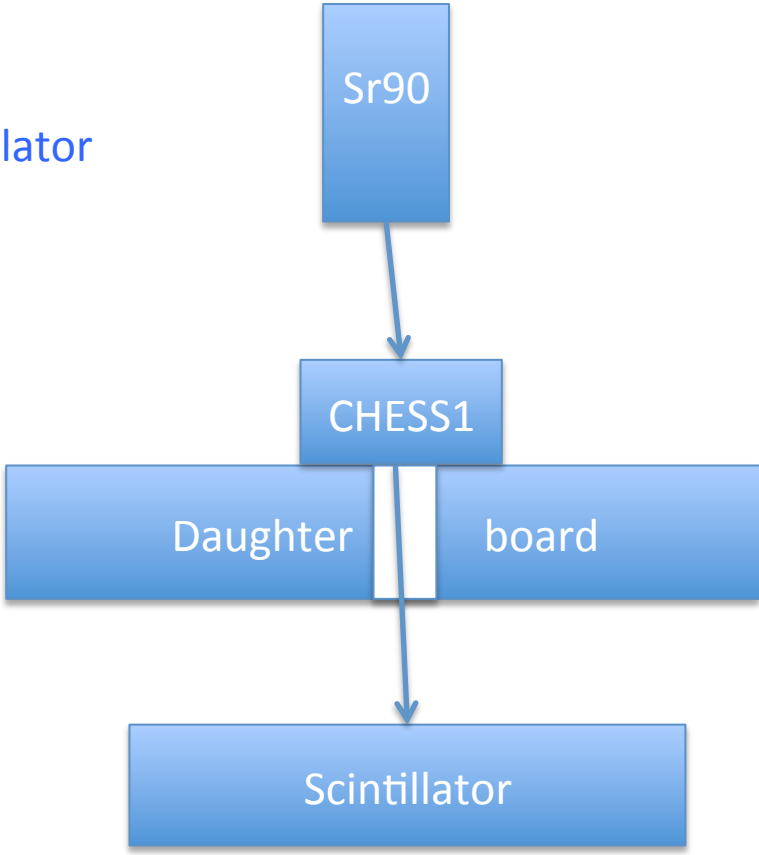




New setup for beta testing

- Try to add scintillator in the setup
  - Use scintillator trigger to select the high energy electron
- Met a problem that
  - The hole in daughter board is not big enough
  - Electron can not go through APA08 and hit scintillator
    - Blocked by the board.
  - The plan is Milling part of the board



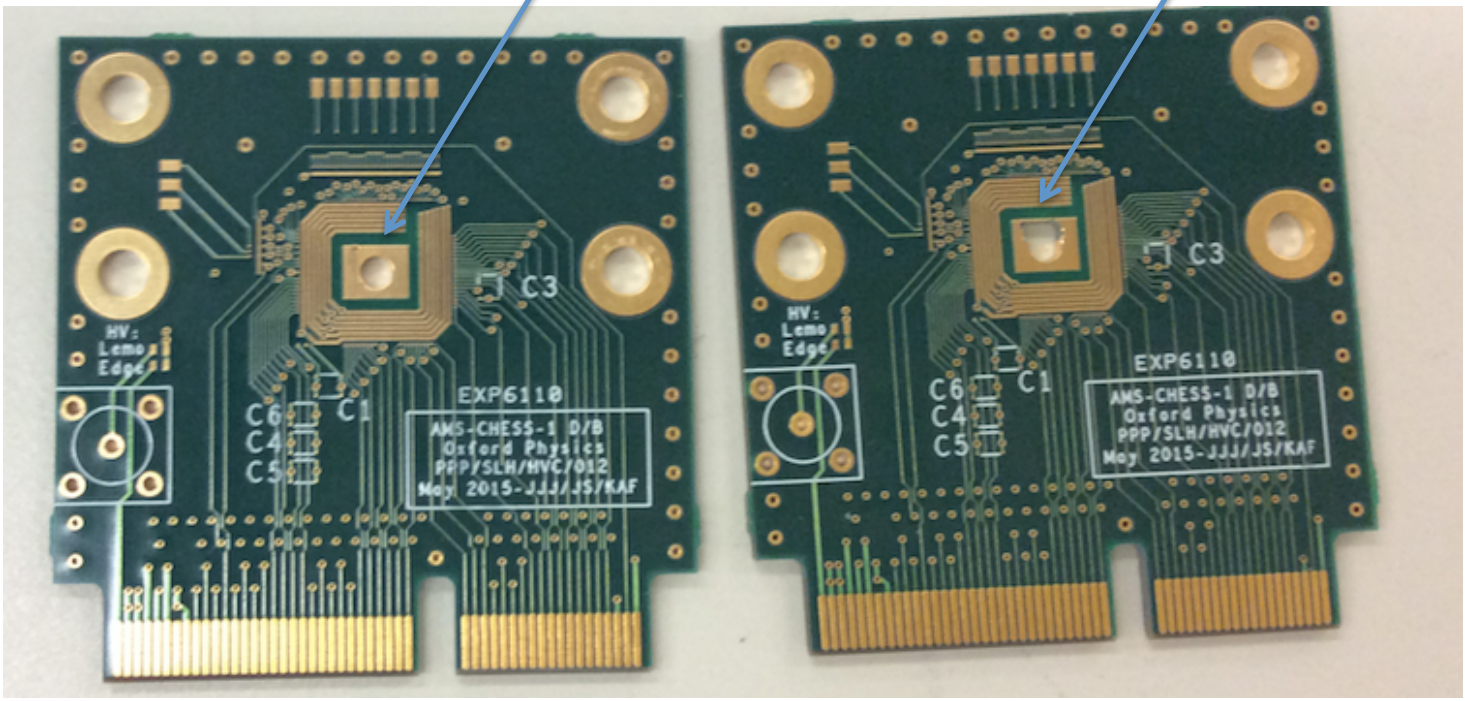


Milling the daughter board

- Milling part of the daughter board
  - So that beta particle can go through pixel array APA08.

Before Milling

After Milling



Summary

- Observe significant signal from active pixel in beta source test .
- Still trying to find the MIP peak yet.
  - Self triggering does not work well
  - Need to select high energy electrons from Sr90 by using Scintillator trigger
- Milling part of the daughter board.
  - So that beta particle can go through pixel array APA08.
  - Going to bond a CHESS1 chip on this new board.

- Next step :
  - Quantify the landau peak position of MIP in beta test
  - Quantify the fraction of charge sharing between pixels
  - Reduce the readout noise by optimizing the built-in amplifier configuration.

backup

Correlation in signal amplitude between two pixel