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Beta Source test for TaichuPix2

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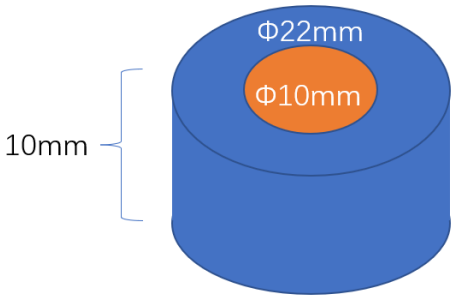
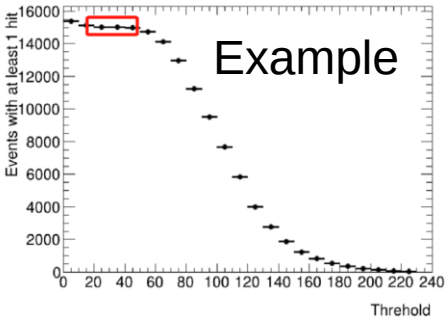
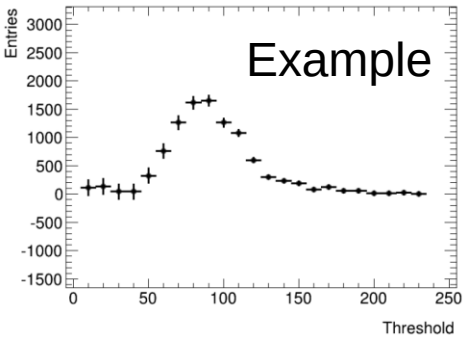
CEPC
Circular Electron Positron Collider

New beta source experiment



- 54 MBq(±15%)
- Disk source
- 5E+6 nps （±50%）





- $^{90}\mathrm{Sr}/^{90}\mathrm{Y}$ reaction
- $^{90}\mathrm{Sr} \rightarrow {}^{90}\mathrm{Y} + e^- + \bar{\nu}_e$ half life 28.8 years/ 0.546 MeV
- $^{90}\mathrm{Y} \rightarrow {}^{90}\mathrm{Zr} + e^- + \bar{\nu}_e$ half life 68 h/ 2.280 MeV

Becquerel:The becquerel is the SI derived unit of radioactivity. One becquerel is defined as the activity of a quantity of radioactive material in which one nucleus decays per second.

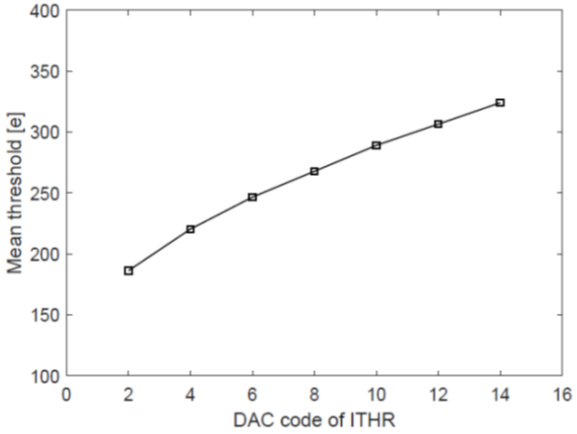
A Landau fit can be obtained with beta source threshold scan.

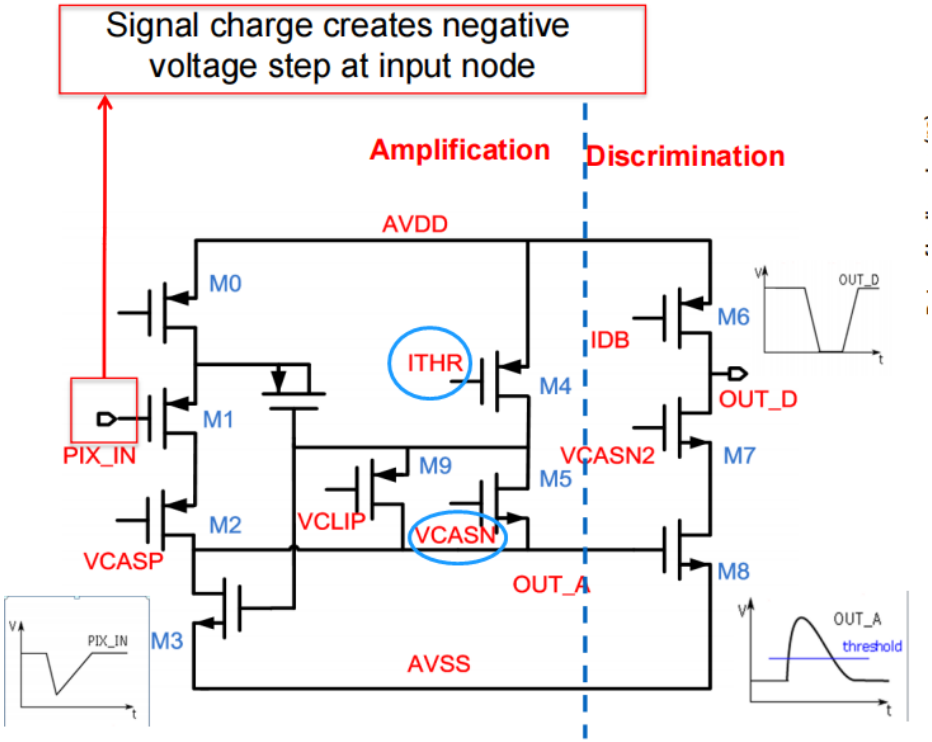
Threshold Settings

- Two parameters will affect the threshold(ITHR & VCASN),

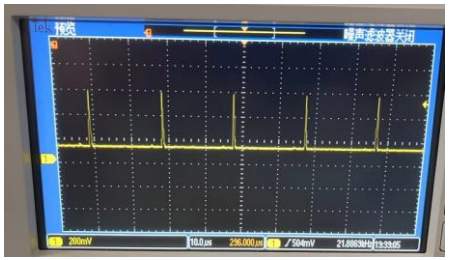
→Higher ITHR leads to higher Threshold

→ Higher VCASN results in a lower threshold



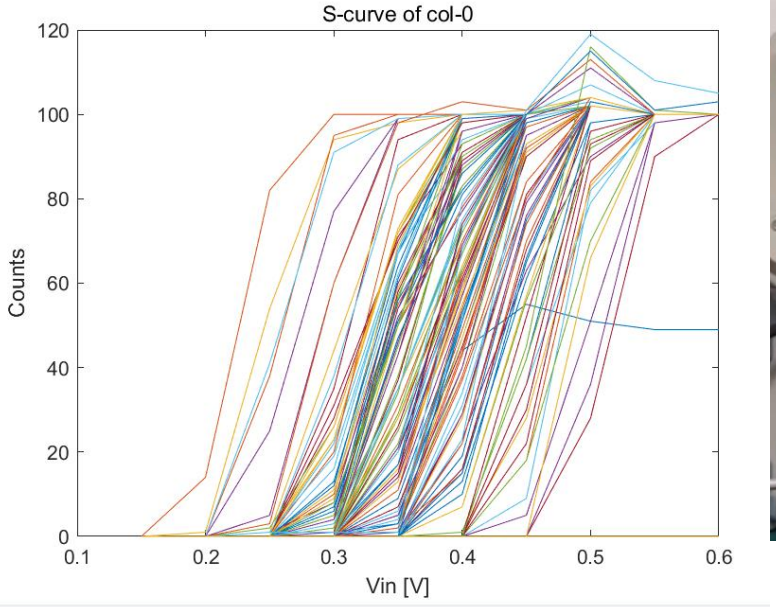


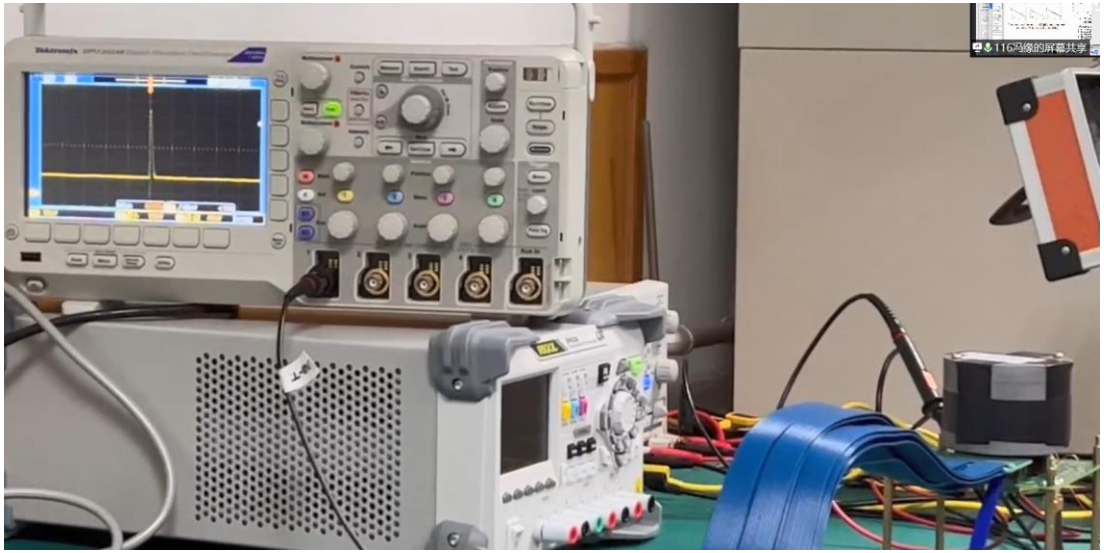
When VCASN is set to 485mV with ITHR of 1000, the Taichupix2 is easy to be self-oscillation.



Threshold Settings

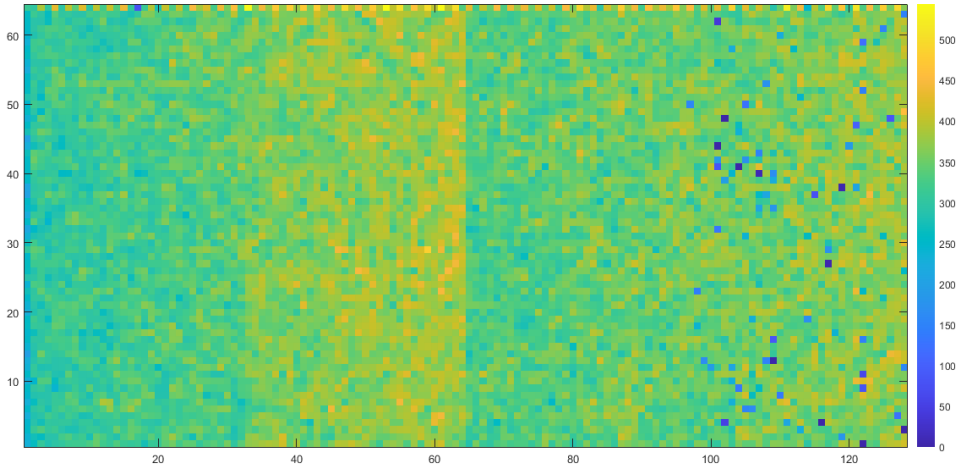
- **To the TC2-1 chip，a critical value goes to the VCASN of 485mV and ITHR of 1001**
- **The measured threshold is around 436.96 mV**
- **The TaichuPix2 chip is working correctly**



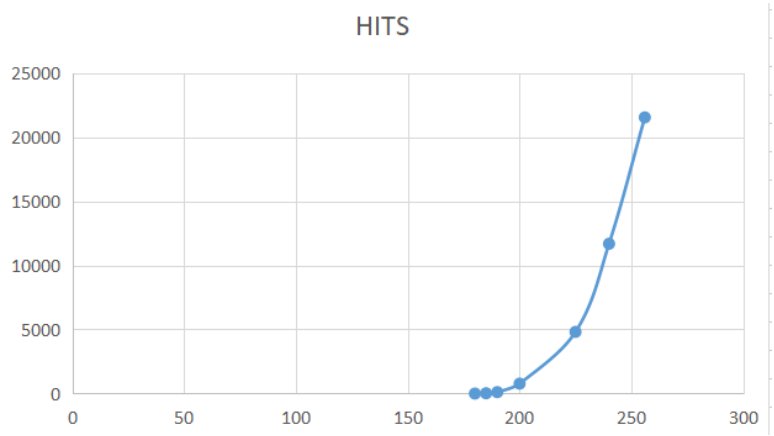


Beta Source test

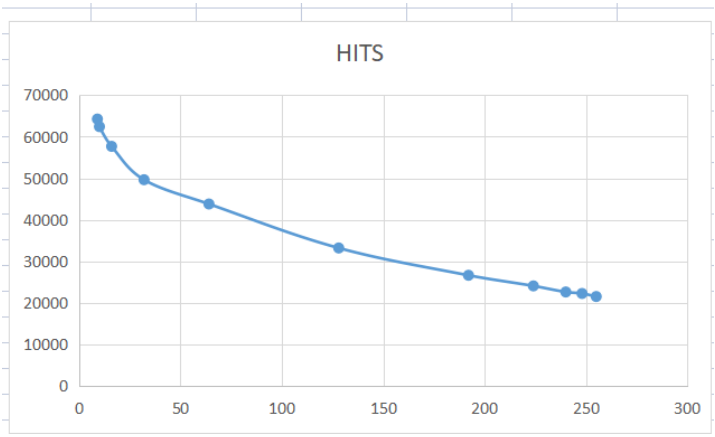
- **A hitmap obtained from Sr.90 test**



- **HITs number vs VCASN scan**



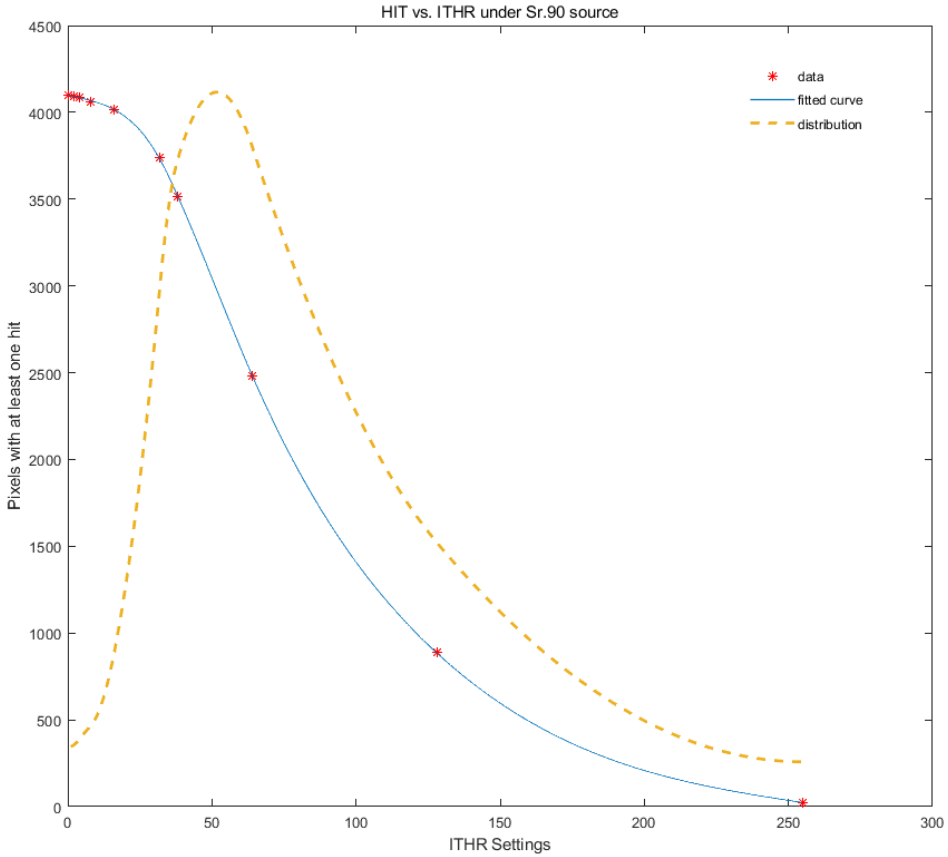
- **HITs number vs ITHR scan**



- **The range of ITHR is not enough to prevent recording the beta energy deposition.**
- **To lower down the VCASN, hits can go to 0 to prevent recording the Sr.90 completely.**

Landau distribution

- To Set the VCASN to 354.8mV, scan the ITHR from 0 to 255
- Calculate how many pixels were fired from the charge injection.
- A fit curve can be obtained.
- To differentiate the fit curve, new curve indicates a landau distribution



- **With ITHR =0 and VCASN=354.8mV, all the pixels inside sector1&sector2 can be fired by the beta source.**
- **The threshold is around 390 e-**
- **Further study will be on performance with a lower threshold .**

Thanks for your attention!