

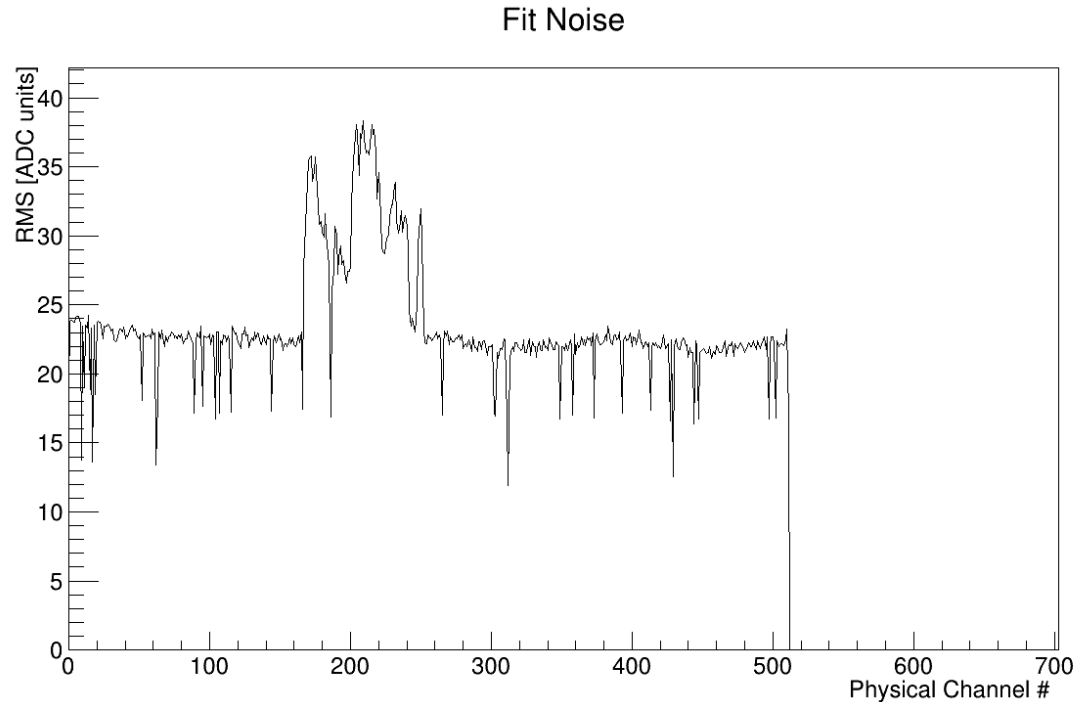
HPS Collaboration Meeting, June 23, 2021

SVT Module Production Status

Cameron Bravo (SLAC), Vitaliy Fadeyev (UCSC)

- Modules built in 2019 had some issues
 - Many pinholes in sensors which make channels dead
 - Only barely ended up with enough in the end to do 2019 run, and it wasn't exactly ideal quality modules
- Getting production line back up and running
 - Test stand at UCSC recommissioned
 - New hybrids produced with remaining APV25s
 - Some sensors arrived from CNM already, not all
 - Gimp has sensor, zero pinholes, noise better than 2019
- Planning how to use sensors from latest batch from CNM

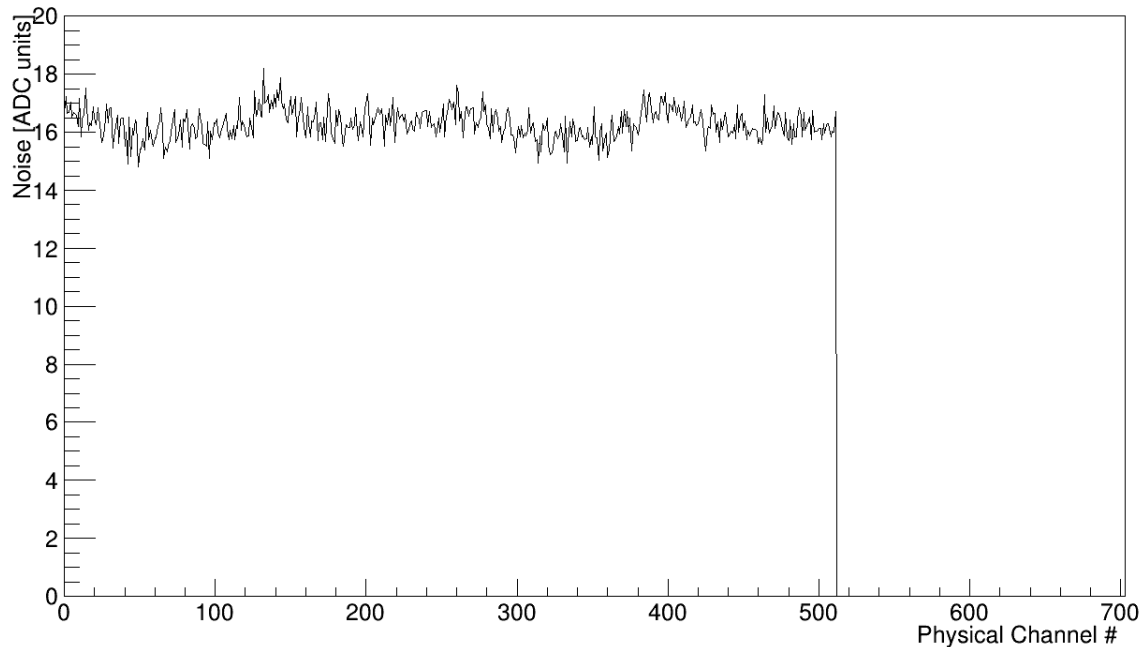
Modules Built in 2019



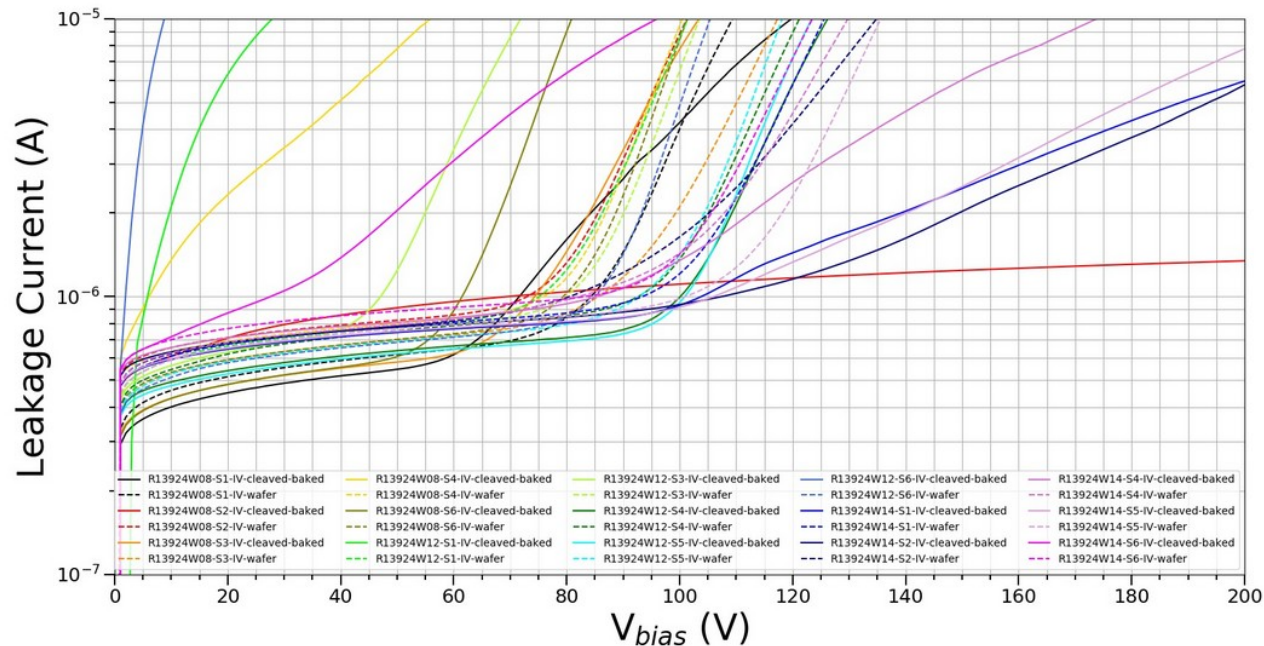
- Details about each module produced in 2019 can be found here: <https://confluence.slac.stanford.edu/display/hpsg/2019+Assembly>
- Most have too many pinholes to consider using
- CNM worked out some issues so sensor at end of production were considerably better than beginning

New Hybrids Built in 2021

Sample 3 Noise



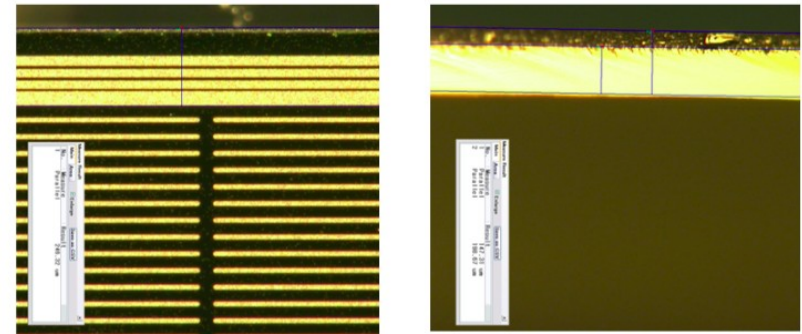
- Built 25 hybrids with 100% yield
 - Did have a few hiccups, but were able to recover all
 - 2 gimps also produced (minor mistake with wire gauge)
- Also have a single hybrid from 2019 that never received a sensor



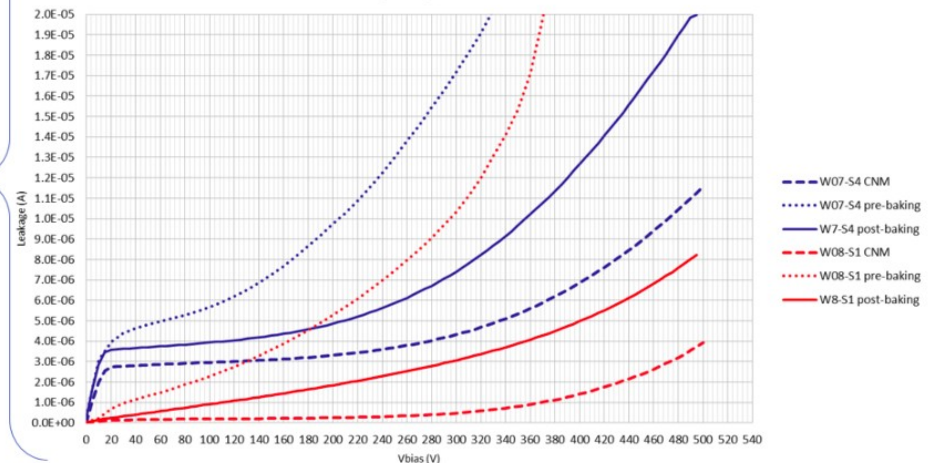
- IV curve taken before and after cleaving at CNM
 - Baking cycles used at CNM and UCSC to improve breakdown voltage of sensors
- 10+1 sensors chosen from first shipment to produce the gimp and 10 half-modules for 2021 run
- CNM reports 80% of the sensors have zero pinholes!

Sensor Cleaving Lane Issue

- Have several signs that the earlier breakdown for these sensors are related to un-intended metal deposition in the cleaving lane
 - One device had cleaving lane “shifted” and this device has a much higher breakdown voltage
- The default cleaving method is more reliable this time
 - Symmetry of the device structure around the cleaving lane
 - No passivation along cleaving lane
- Tried to “shift” the location of cleaving lane, didn’t work so well
- Collaborator performed laser-scribing on 2 devices in 2019, with good results. This could be used to help “shift” the cleaving lane more successfully and remove unintended Al
 - This has some some minor negative effects, but should be acceptable
- 21 un-cleaved sensors were delivered yesterday and will be sent to NRL to be laser-scribed and cleaved



NRL Cleaved pre vs post bake with CNM Reference

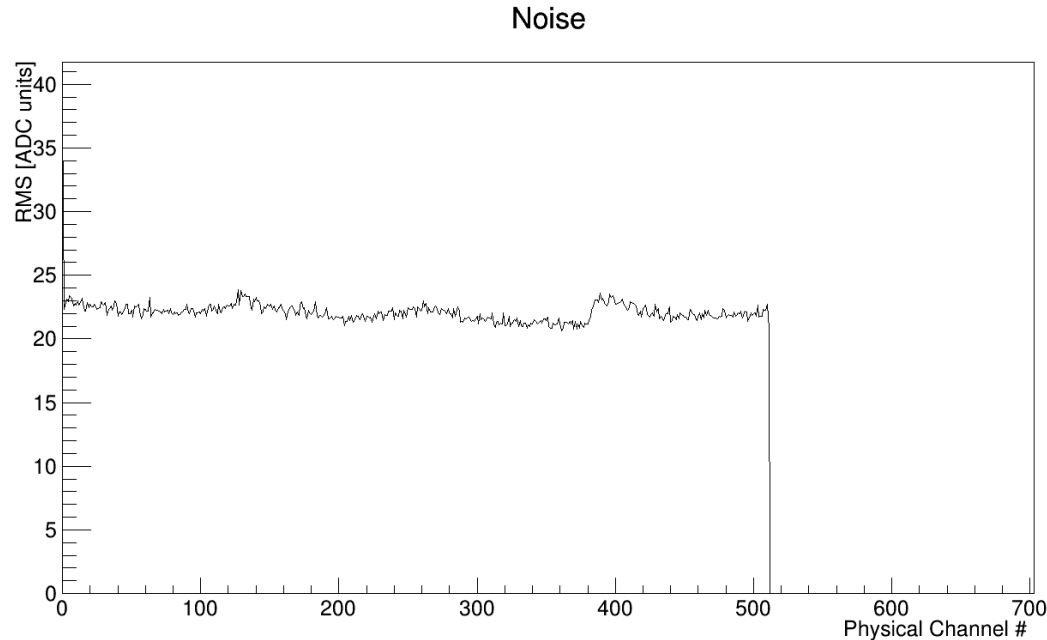


Sensor Cleaving Lane Issue

- We are also planning to study if we can introduce beneficial irradiation to the sensors
 - Surface effects from TID typically increases the interface charge, that roughly maxes out at ~1 Mrad
 - Bulk damage creates distributed defects, that “quench” local discharges
 - Typically see higher breakdown voltages after hadron irradiation
 - It’s probably good to “go through” the type inversion as well
- Both types of effects can be helpful for avoiding issues with non-uniform irradiation present in the experiment, i.e. making the devices more rad-hard
 - However, this is not proven at the moment

Irradiations	Dose/Fluence	Surface	Bulk
Gammas at BNL (6)	1 Mrad	X	
Gammas at Sandia (with UNM) (5)	100 Mrad	X	X
Neutrons in Ljubljana (20)	3.1e13 neq/cm ²		X

Half-Module Production Status



- Gimp finished last week and QC shows it is even usable
 - Need to double check 28 gauge wire used for power in pigtail won't drop voltage too much, it's probably fine
 - Zero pinholes!
- First two production half-modules glued on Monday and delivered to UCSC yesterday

- Production of SVT modules is going smoothly so far
 - Only a few minor issues that we managed to fix quickly
 - Gimp is possibly even usable with zero pinholes
 - CNM reports 80% of the sensors have zero pinholes
- Vitaliy had an idea to try irradiating the sensors in an effort to improve rad-hardness, sensors are unevenly irradiated in our experiment
 - Irradiation with gammas and neutrons underway
- I am probably going to miss some of this meeting to keep pushing on building these new modules, no time to wait until next week
 - Hopefully I can get 2 more glued and to UCSC this week
- Plan is to make 10+1 half-modules now with good sensors we already have at SLAC, will make ~15 more later after deciding if we want to use laser-scribed sensors, or if we want to order more from CNM, or we could decide to use irradiated devices