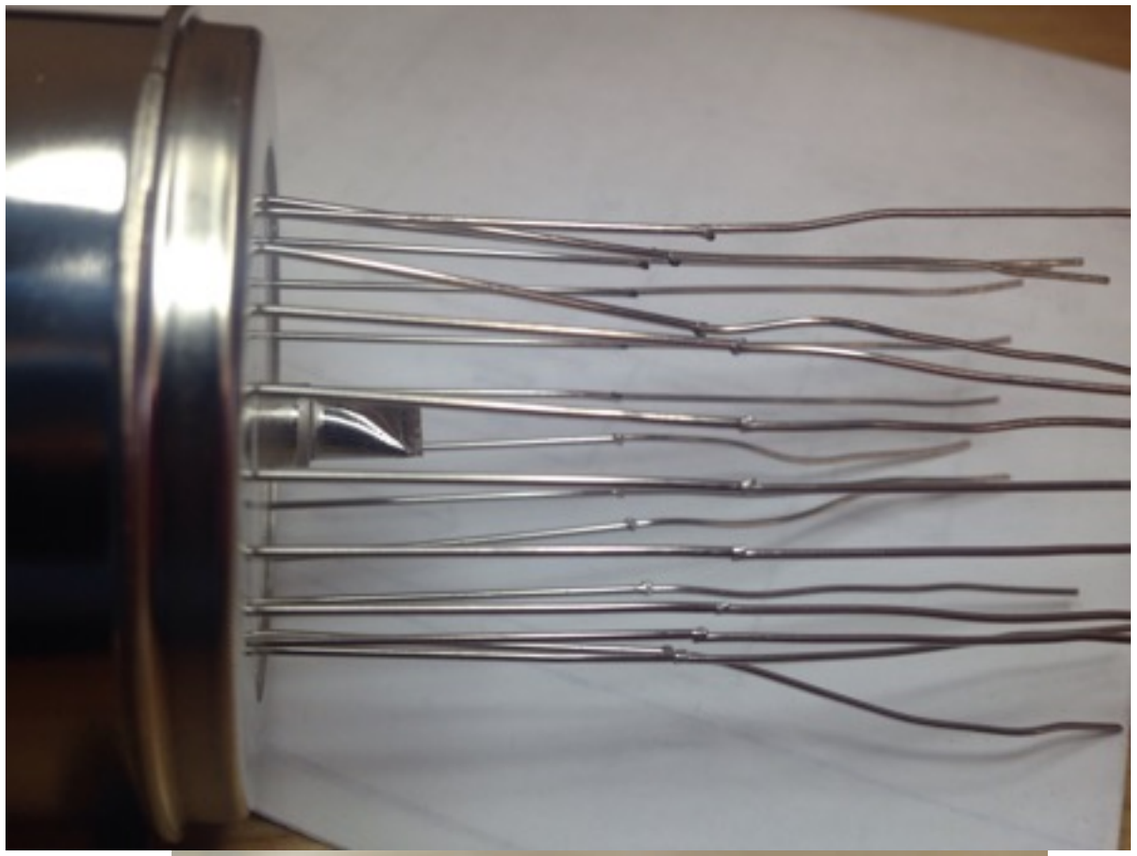
PMT issues encountered at SLAC

Kimberly Palladino

March 12, 2016

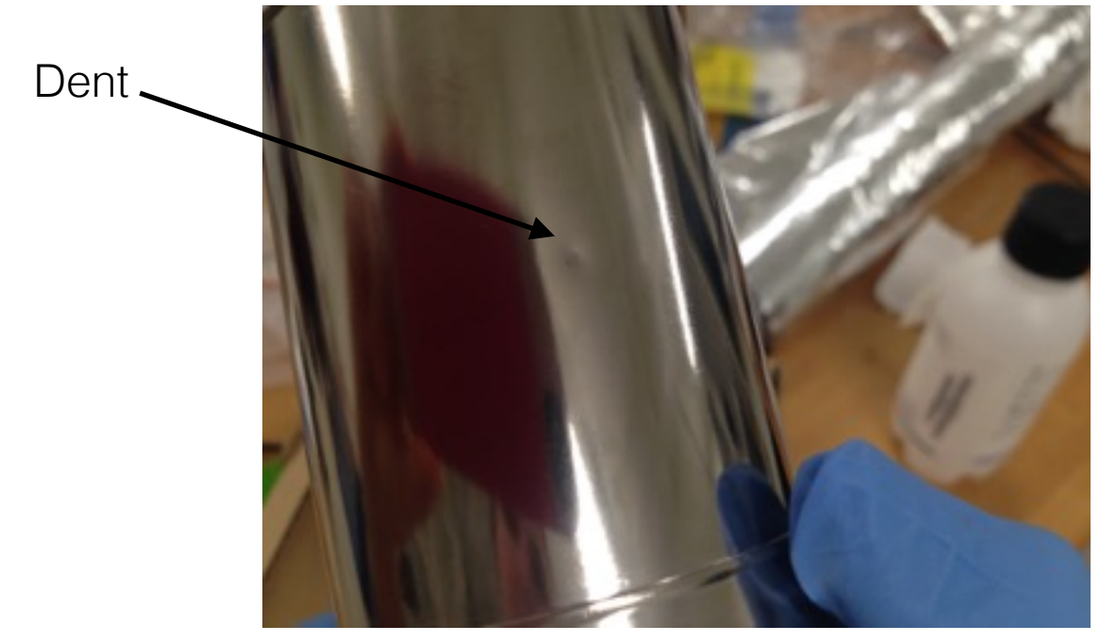
New PMT: KB0095

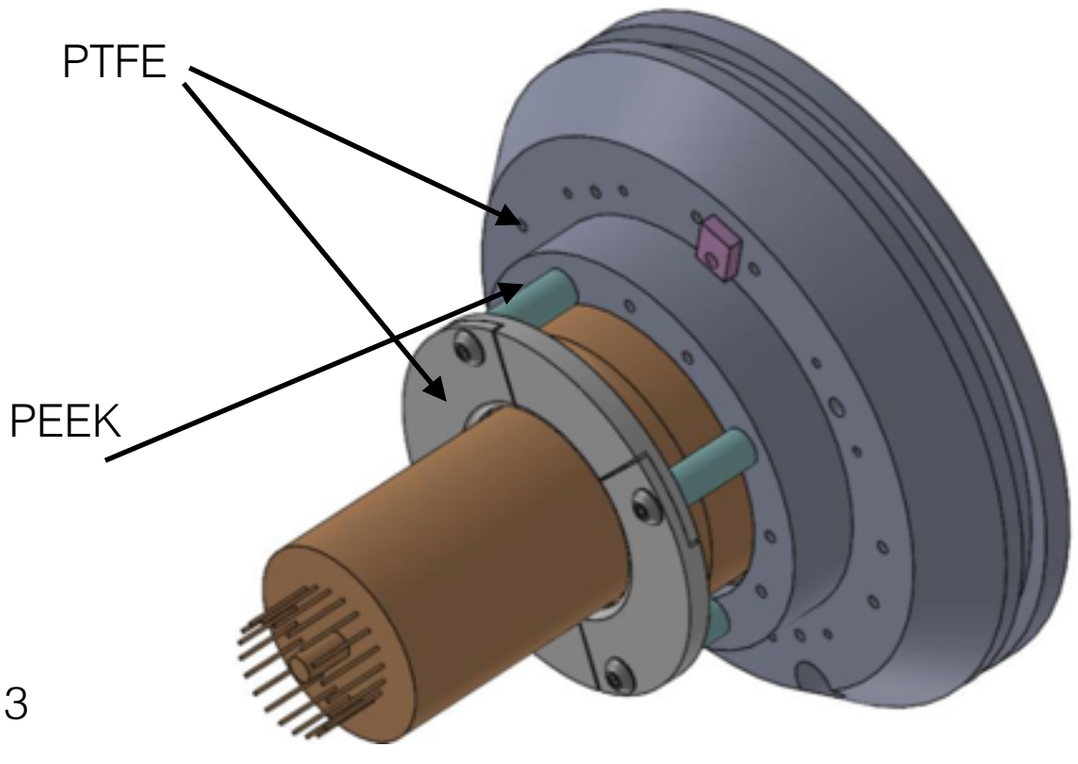
- PMT carried to UCSB by Samuel
- Hand carried by Scott Ha. and Shaun up to SLAC
- Pins cut beneath braze point (29 mm) with new snips by Kim and Tomasz on Wed. March 9th: very gentle, about 2/3 of pins we removed by bending after cut mostly through
- Pins were shortened with PTFE jig to 25 mm and 15 mm by Tomasz on Fri. March 11
- PMT tested in System test vessel Saturday March 12



Inspection after run in system test vessel

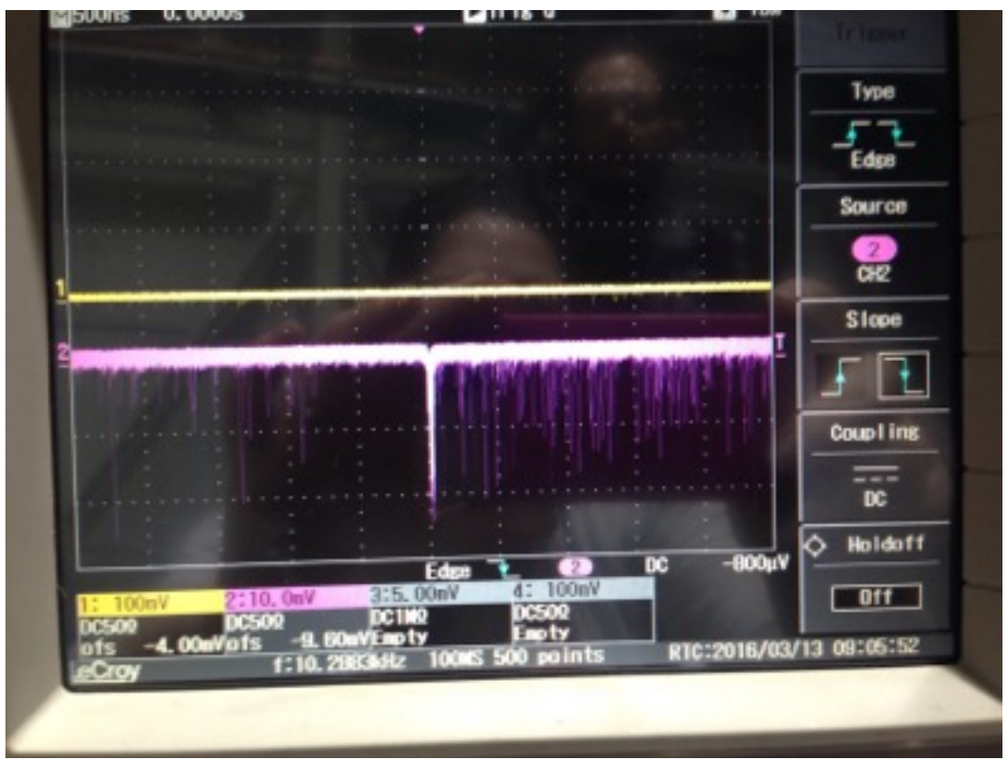
- Some hints of problems
  - Dent: don't believe it was us, see image of how held in system test vessel
  - Small, 1 mm^2, white fleck inside PMT that moves as PMT is rotated, seen on side wall, and photocathode, appears to have fallen to back of PMT, no photo taken





Test runs of KB0095:
In system test vessel (in air, room temp)

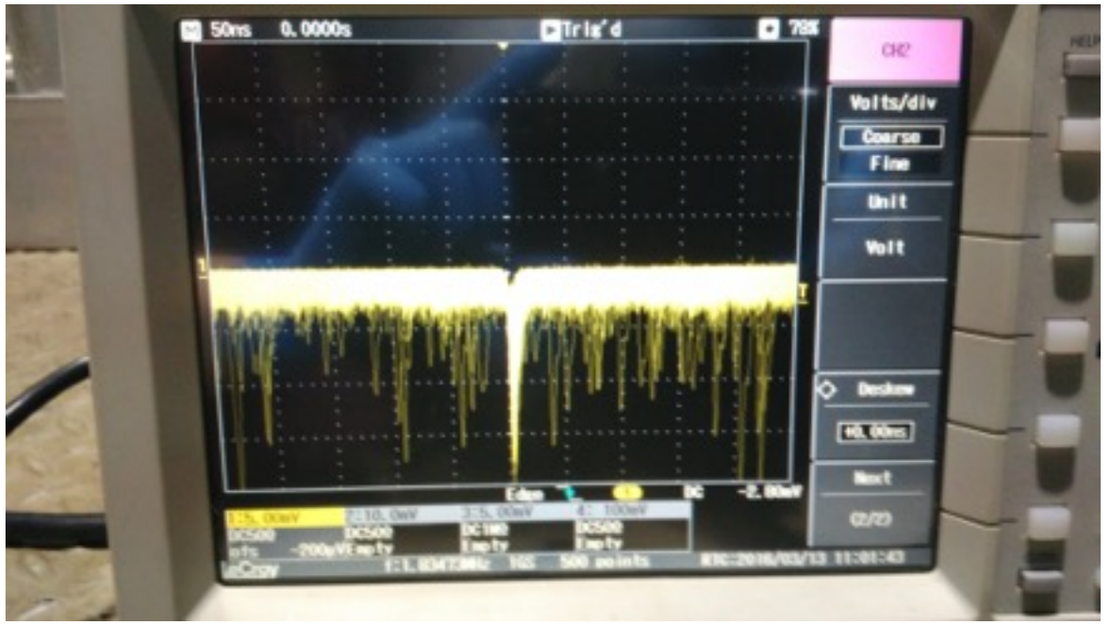
- First ramp up: At first at 1500V and (expected) 16uA but a minute later the current went to 20uA and there were a lot of small photoelectrons.
    - Verified no light leak
- Second ramp up: KB0045 on first, 60 Hz background, ramped up KB0095: 900 V saw triggers matching bigger ones in top PMT, at 1000V things still ok, at 1200 V saw 60 kHz of light in bottom PMT, when switched to triggering on top PMT also saw 60 kHz, took a ~3 min camera image and saw no light though while this was happening. Turned off bottom PMT, top PMT rate dropped back to 600 Hz (had played with threshold a little)

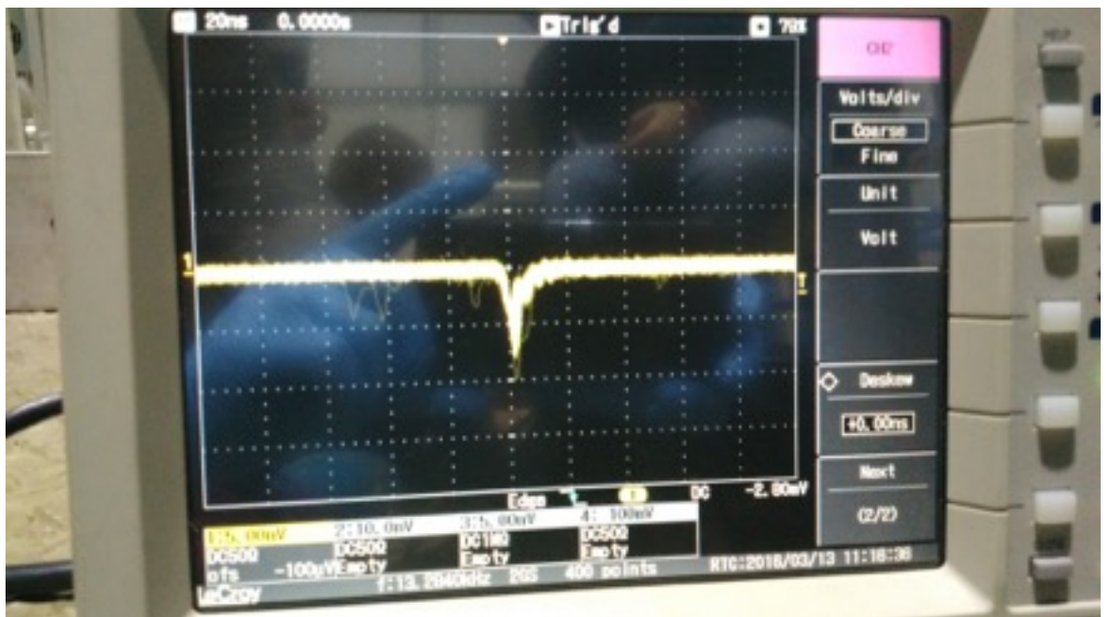


- KB0095 in pink, 10 mV /div. 500 ns/ div, triggering at -800uV, at 1200 V, trade at 10.3 kHz at time of picture
- KB0045 in yellow, at 100 mV/div

Test in dark box

- More uniform testing: threshold of -2.8 mV, ramp up in 50 V steps
- Test 1: Extra light seen at 1400V (MHz)
- Test 2: Extra light seen at 1200V (100 kHz)
- Test 3: Weird shape at 1450 (13 kHz)





KB0095 Conclusions

- PMT produces light
- Onset of light and total light production are quite variable
    - Could it be related to the white speck?
- Base tested fine on its own

Options for action

1. Run with KB0095 anyway - low voltage, ramp down if an issue
2. Run with KB0090 (see later slides) low voltage
3. Run with no bottom PMT
4. Run with old 2” PMT
    1. Exploring this: making a fixture to hold it in place
5. Test PMTs at UCSB to find another good PMT
    1. Kim can drive down with jig and new snips, and base and cables for testing

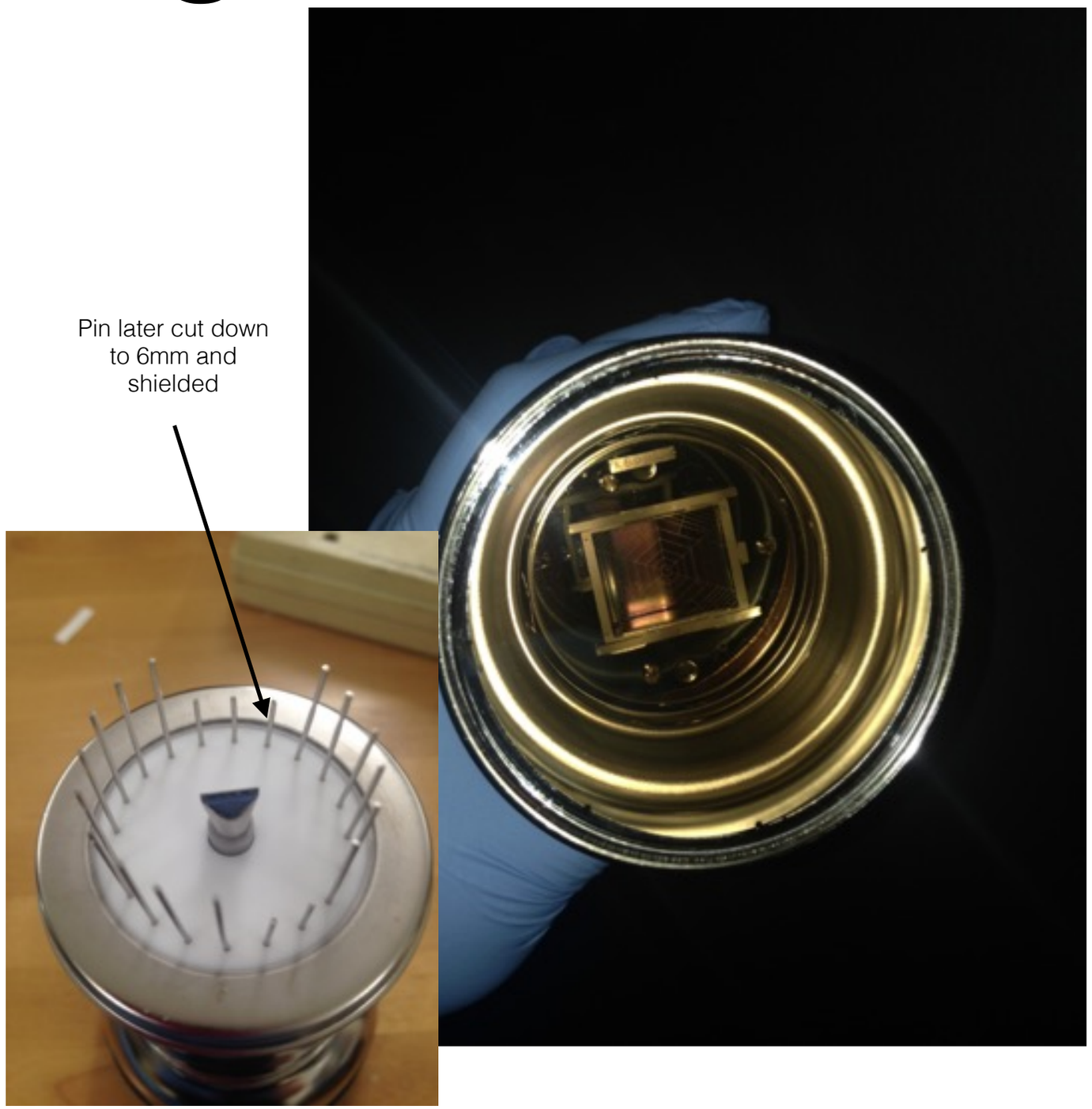
Older slides:
Problem with KB0090

Kimberly Palladino
March 2, 2016

Everything looks ok

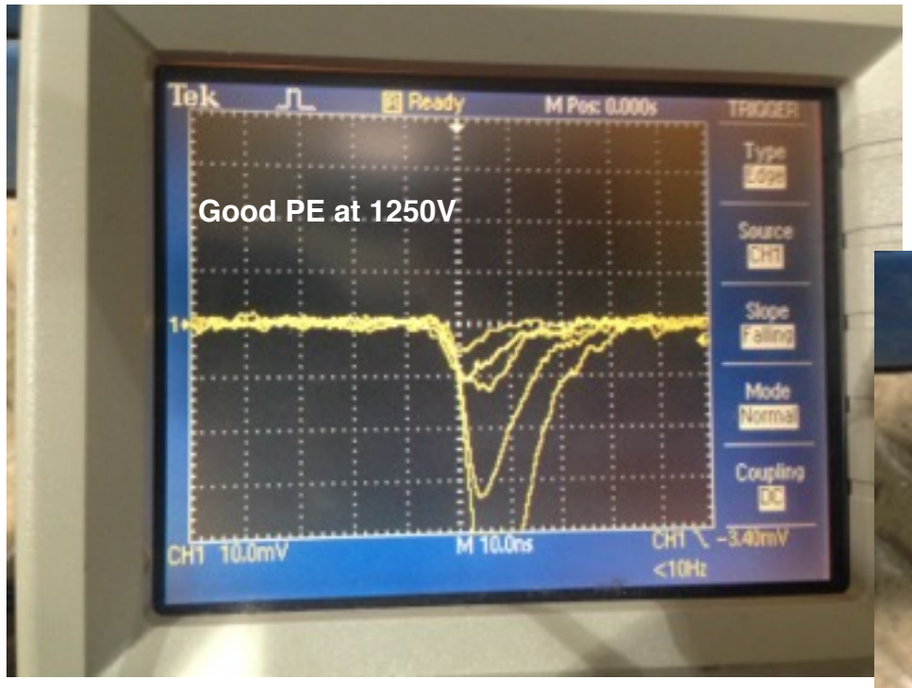
- Pins were cut with non-standard technique: only the 5 shortened to miss the base, pliers holding pins still, snips cutting through

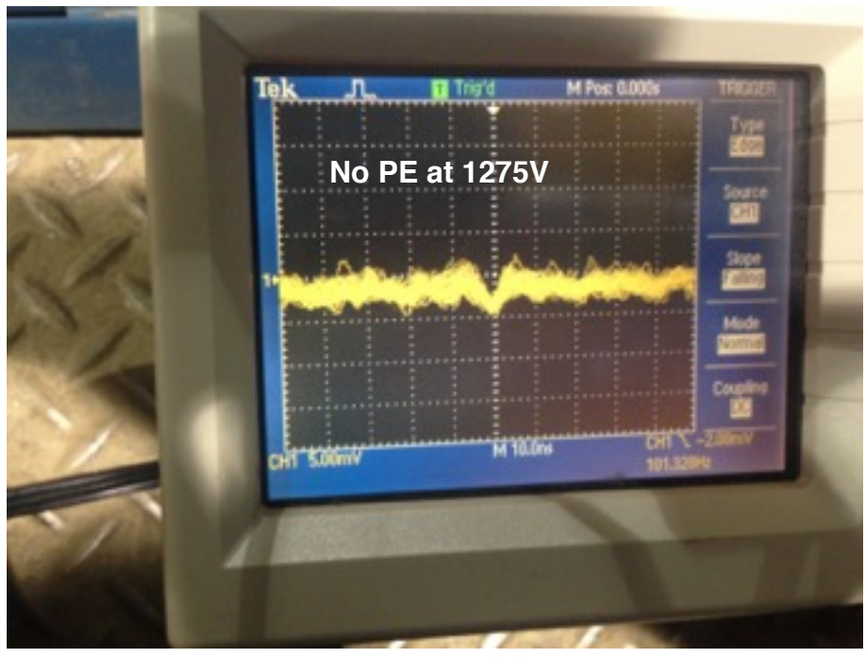
- PMT looks fine on inspection



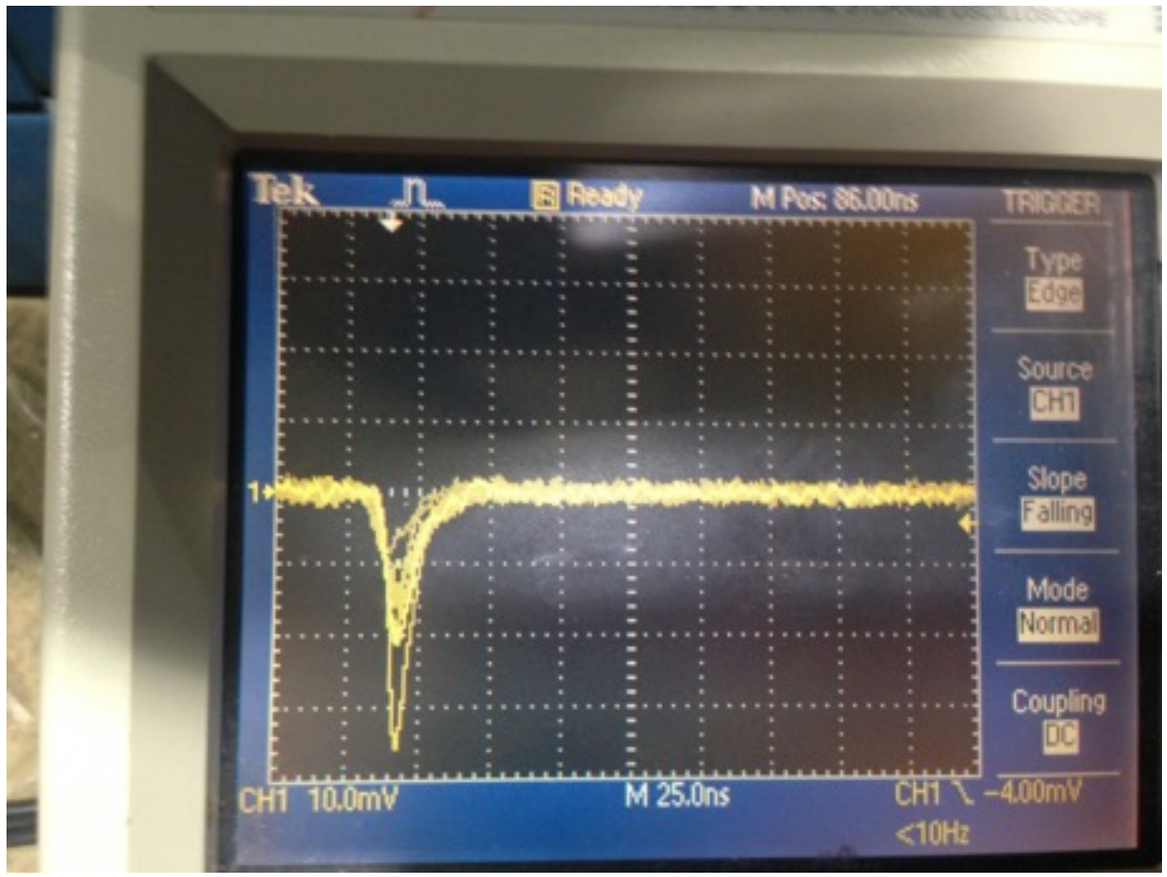
Ramp Up: Stops working

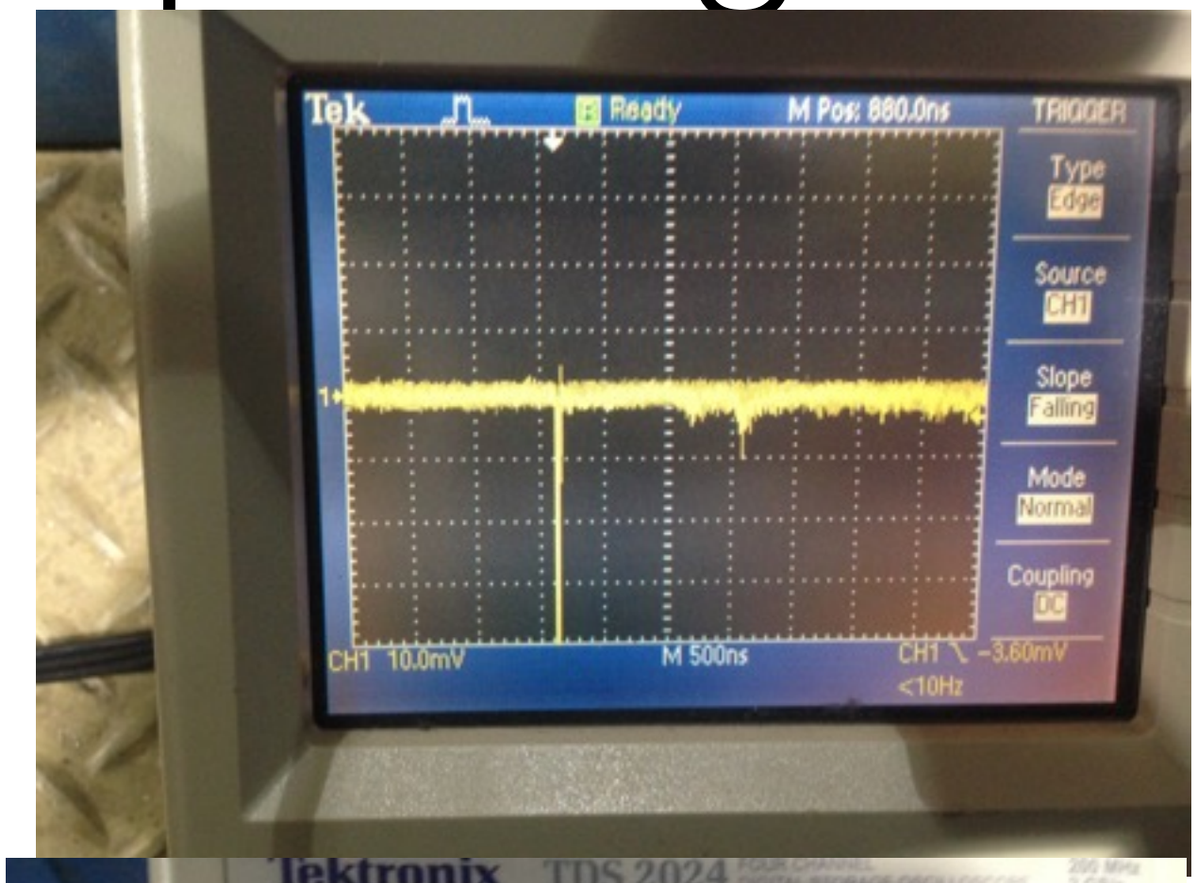
- See some PE ~-1000 V, better at -1200 to -1260
- Very little after pulsing
- Current draw from supply matches Ohms law for 92.4 MOhm base: ~13 uA at -1250 V
- Abruptly at 1275-1285 (differs by 5 V in different ramp ups) current jumps to double, 26 uA and stop seeing PE
- Must drop to <500V for current draw to return to normal

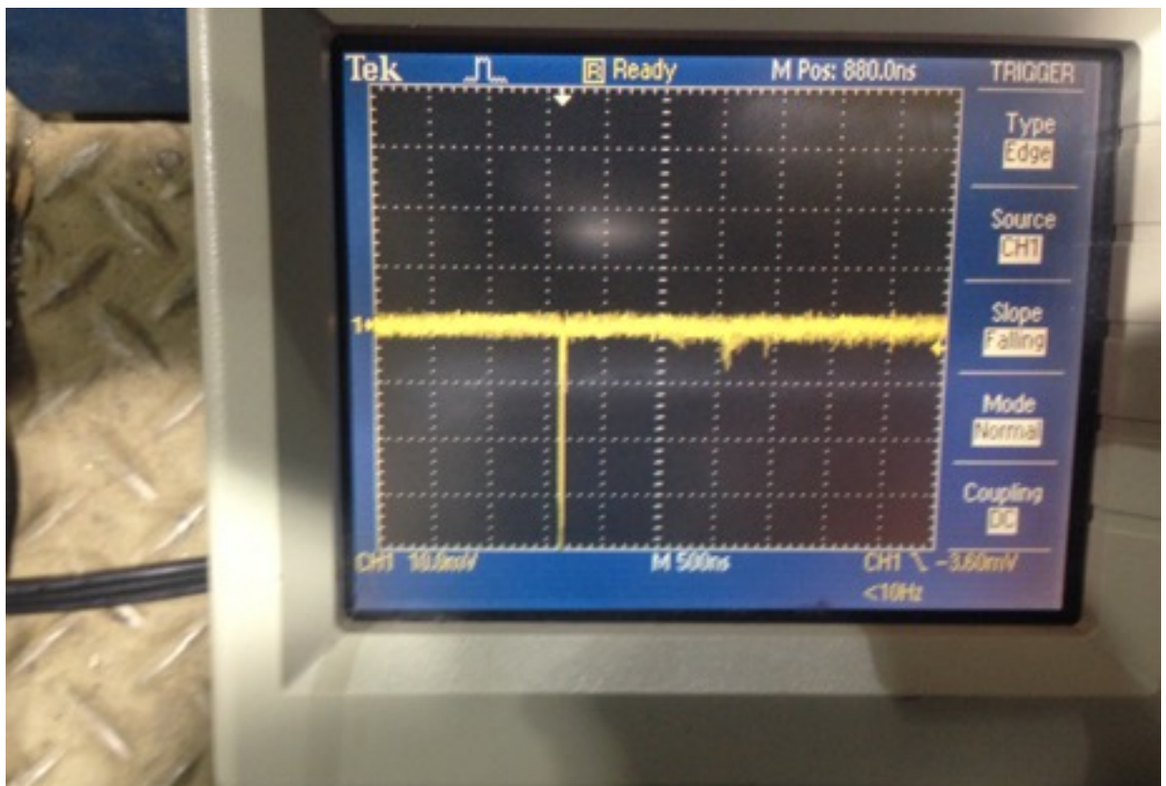


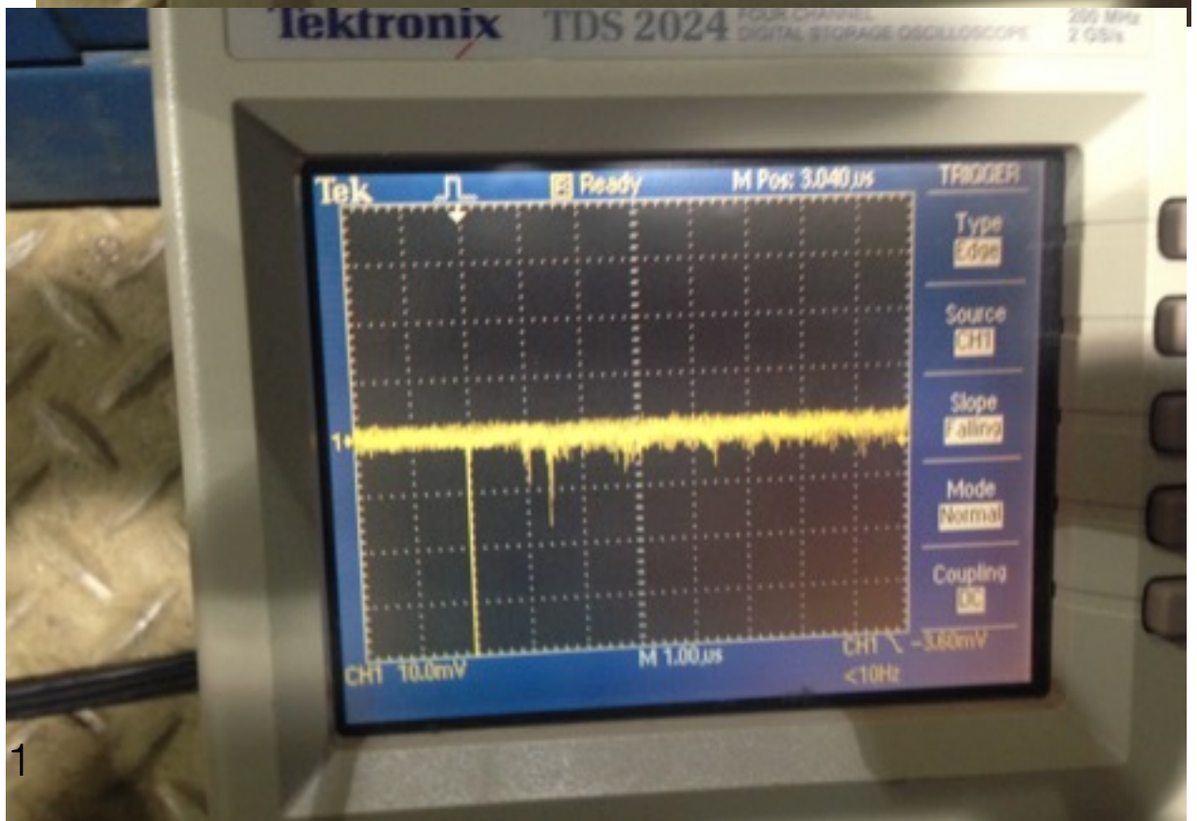


More Afterpulsing

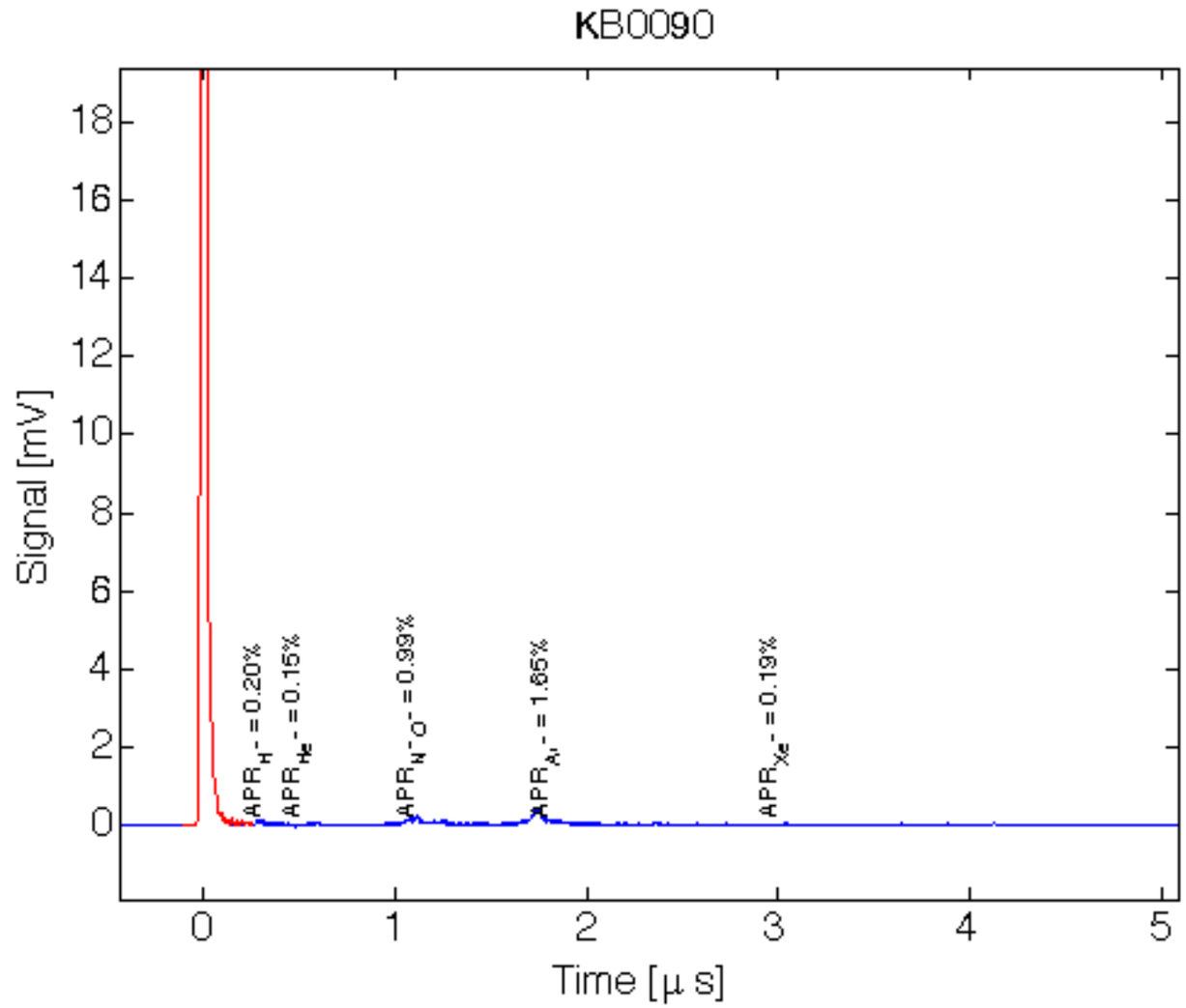








PMT tested at Brown



PMT KB0045

- Functioning well

- Taking back up noise data at SLAC prior to running system test