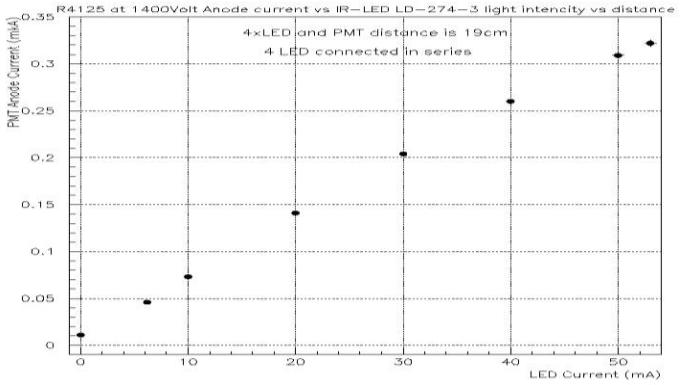
NPS Calorimeter Prototype:
Status 08 May 2014

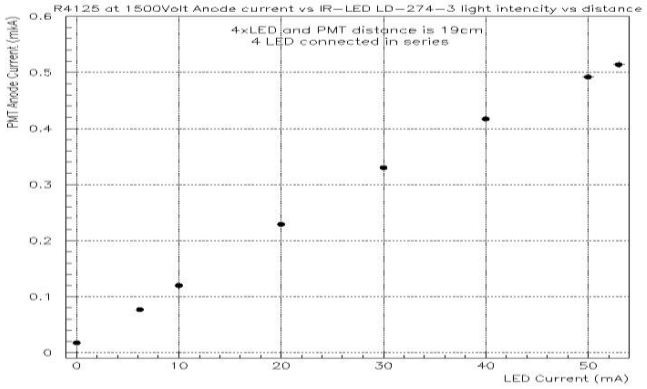
PMT and HV Dividers

- R4125 PMT HV dividers:
  - 12 HV dividers have been assembled by JLab electronic group.
  - All dividers are tested, found that one of the assembled dividers is not working, still investigating what is the cause.

PMT anode current vs IR driving current

I did measurements for PMT anode current versus 4x IR LEDs LD-274-3 driving current for different PMT HV 1400V, 1500V and 1600V, results are shown in fig.1.





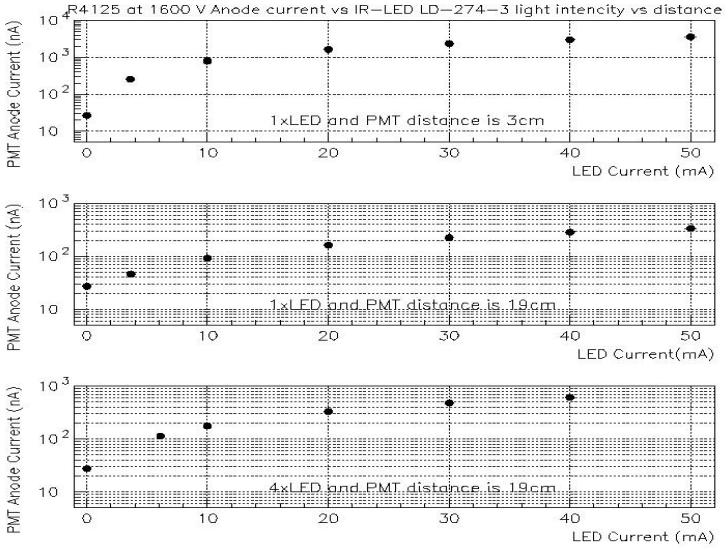


Fig.1 PMT Anode Dark Current measurement for different PMT HVs, and Different LED Driving current.

These measurements were done with 4 IR LEDs at 19cm distance from PMT. With PMT high voltage ON and LED driving current OFF the dark current of PMT is 11nA for 1400V, 18nA for 1500V and 28nA for 1600V, and with PMT high voltage ON and LED driving current 50mA the results are 309nA for 1400V, 492nA for 1500V and 758nA for 1600V. For 50mA LED driving current the 4-IR LEDs will have ~4x2x10^16photon/cm^2/sec. For R4125 PMT the maximum anode current is ~0.1mA, and thus there will likely not be an effect on the PMT. However, we need to do more investigations.

For PMT HV=1600V and by using the active divider (with amplifier) gain is ~3.8x10^7. Most likely we will not go to higher HVs than 1600V, we will work in 10^5 gain range, and if we use less than 1500-1600V these numbers will decrease.

The prototype construction:

- JLab Machine shop already finished machining the Copper material prototype, on Monday May-05 I took prototype from machine shop to EEL-126 see figure 2.

Figure 2. NPS Prototype

$PbWO_4$ Lead tungstate crystals:

We received the $PbWO_4$ crystals from SICCAS. I did some preliminary examination of the crystals by eye, did measurements of dimensions see Fig. 3, and

transmittance measurement for randomly selected 2 crystals for now. The dimensions for all crystals are 20mm±0.15mmX20mm±0.15mmX200mm.

Fig.3 $PbWO_4$ crystals.

- Transmittance measurements for the SICCAS $PbWO_4$ crystal were done by using Carl Zorn's setup, for 3 points of each crystal: two edges and for the center points. Results are shown in figure 4.

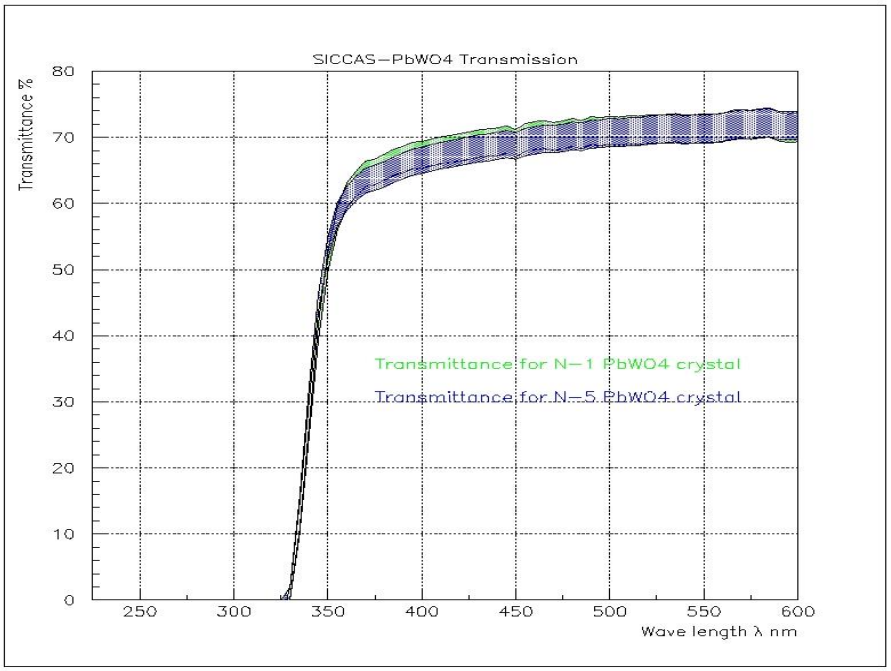


Fig.4: Light Transmission measurement $PbWO_4$ (20mmX20mmX200mm) versus the wave length. Colored area represents the spread between the data measured at different points of the crystals.

Curing with IR and Blue LEDs:

The LED system is ready for curing. I made systems for curing, one for IR LEDs and for Blue LEDs, for now it is for only 4 LEDs, see fig. 5.

On 28-Apr I gave the $PbWO_4$ crystals to RadCon for irradiating for 20kRad, but because of there is a long line in RadCon for irradiating, they promise to give the crystals on upcoming Monday.

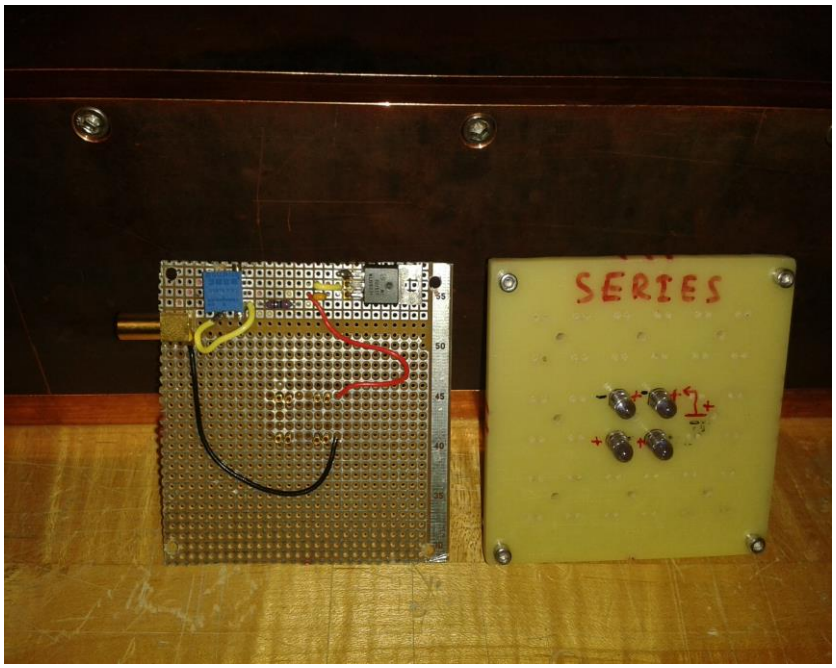


Fig. 5. IR LED curing system.

Future proposed activities

- Figure out problem and fix the not working HV voltage divider
- Take from RadCon radiated crystals
- Measure transmittance of the radiated crystals
- Cure with Blue and IR LEDs.
- Look for the other types of IR LED with a wavelength >1000 nm

- Check sensitivity of the PMT R4125 relative to the light λ>1000 nm
- Develop fiber connection scheme of the monitoring system