

Lab 6 Aging Studies

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Mu2e Spring 2022 Collaboration Meeting
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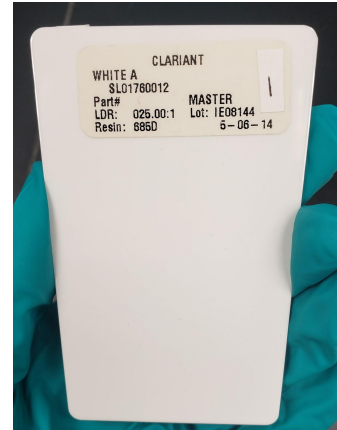
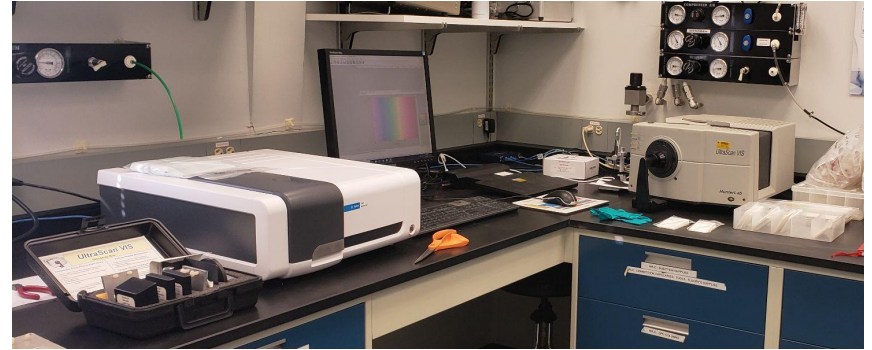
My Recent Activities

- I have been living in the Village since the beginning of January
- Main activity: working in Wideband on the CRV module test stand
- Secondary activity: working with Alan Bross in Lab 6 to continue aging studies which were started by Anna Pla



This Presentation: Aging Studies from Lab 6 Data

- Today, I'll talk about what I have been doing at Lab 6 to carry on work that has been ongoing for some time now
 - Key contacts: Alan Bross, Brian Leung, Anna Pla
- Lab 6: a team there has been trying to factorize different elements of scintillating counters to try and isolate a particular material that could contribute to aging
- We still don't have a good handle on why CRV counters age so rapidly
- Anna has retired, so Brian has been continuing to collect data on different pieces of counters to carry on the work

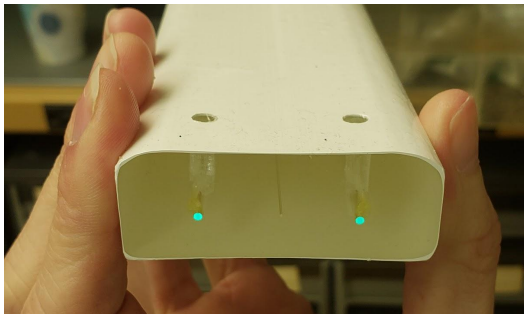
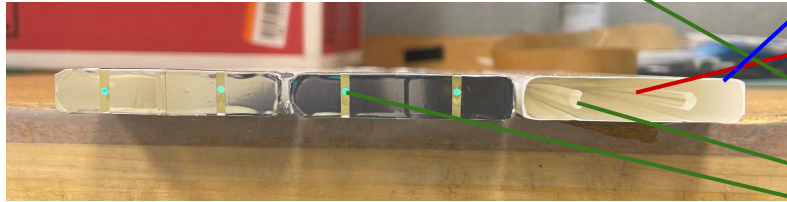
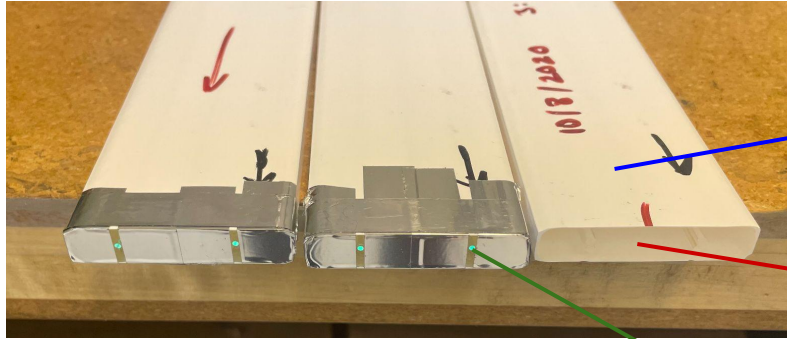


Factorizing Counter Materials??

- What do I mean by factorizing scintillating counter materials?
- Generally, scintillating counters like the ones used in Mu2e CRV have 3 main components: plastic scintillator, inner fibers, outer reflector coating
- Different kinds of these counters that all have these 3 basic components have been used in many experiments before Mu2e (ex. T2K, Minerva, Nova)
- However, Mu2e is aging at an unprecedented rate compared to past expts.
- Maybe, if we separate scintillator, reflector, and fiber and analyze separately, we can get an idea if one of these components ages more than others

Dicounter Photos and 3 Basic Components

Photos from Alan's dropbox of
Mu2e dicounter samples



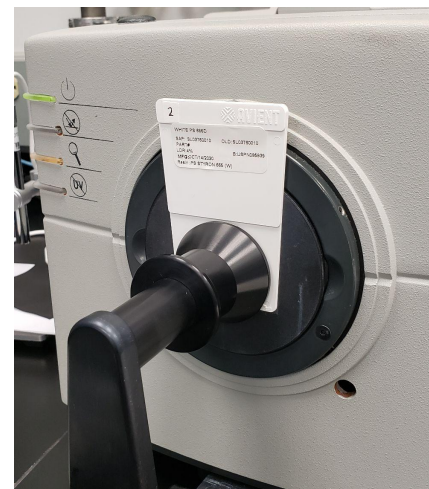
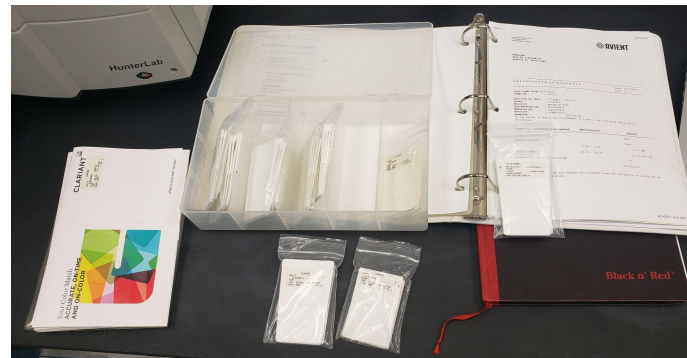
Thin, white coating on the outside of the discounters = reflective cladding

Plastic scintillator, main bulk of the dicounter

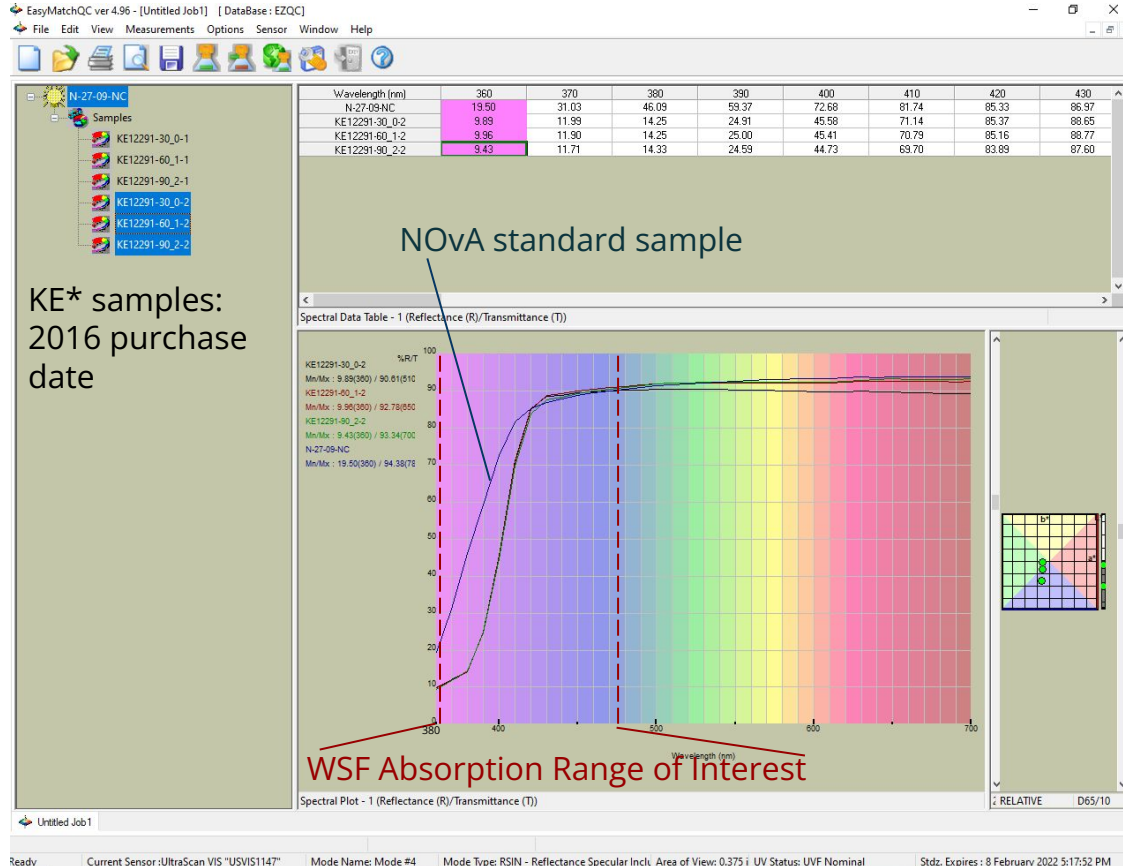
Wavelength shifting fibers to carry signal to readout; some samples may be fiberless and just have holes or epoxy?

Taking Data on TiO₂ Reflective Cladding

- Every time an experiment orders reflective cladding to use in detectors, the TiO₂ arrives in small pellets. The TiO₂ is co-extruded with the scintillator onto the surface of each scintillating bar
- Along with each order of pellets, the manufacturer also makes small sample cards, called 'coupons' to demonstrate surface reflectivity, we have saved purchase orders and coupons and that is what I have been measuring!
- Data: use spectrophotometer to collect ratio of reflectance/transmittance over a range of light wavelengths. Each coupon has date, ID #, other info



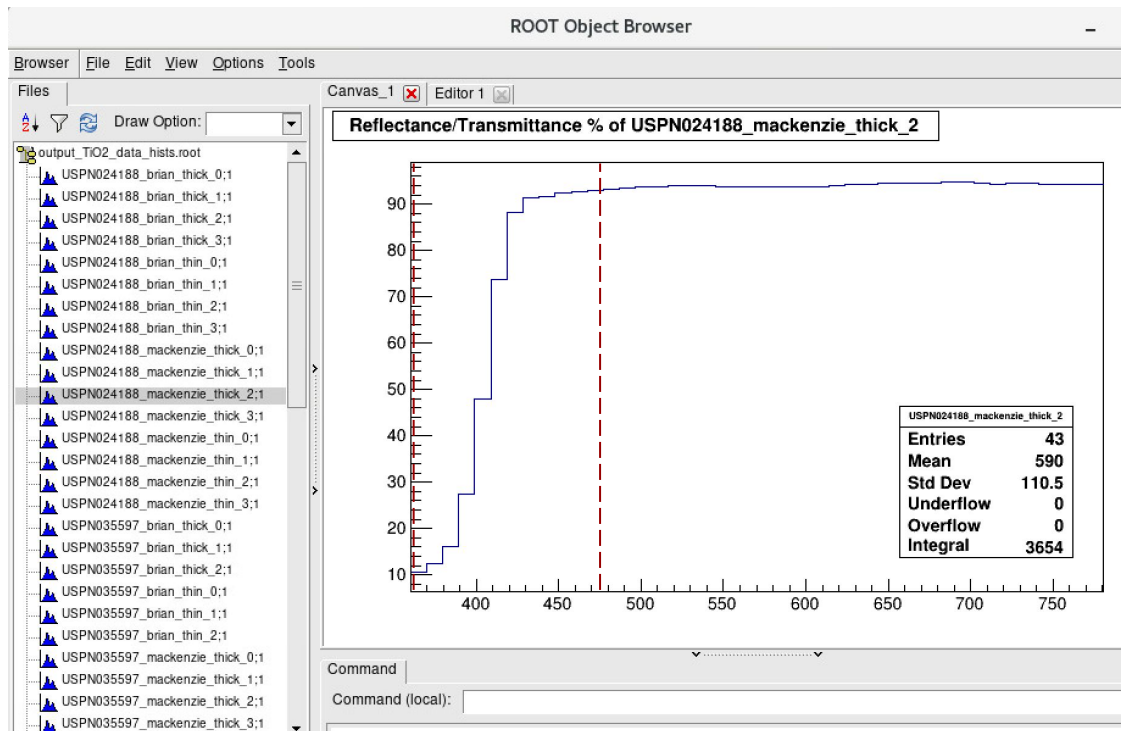
Data on Spectrophotometer GUI



- This is a typical screenshot of the GUI from the spectrophotometer
- Each time you begin taking data, you calibrate and standardize the spec. using a well-defined sample of Nova reflector (N-27-09-NC)
- Then, you take data of your samples, in this case, I was taking data on a group of coupons that had 3 thicknesses on each card, so here I am showing the spectra for each thickness of one coupon and the standard Nova sample
- Data prints above in a table, these are saved to Excel files and then I have been putting these into ROOT for manipulation

ROOT File of TiO₂ Coupon Data

- So far, I have made a ROOT macro that takes the data which has been stored in excel files, I copy each set into a vector, then make histograms of each spectrum
- I am currently developing a second ROOT macro to do more complicated analysis work with these spectra, like making averages, taking differences, etc.
- I have taken data on each coupon, and Brian also took data on many coupons in the past... I may be able to use these sets to look for aging

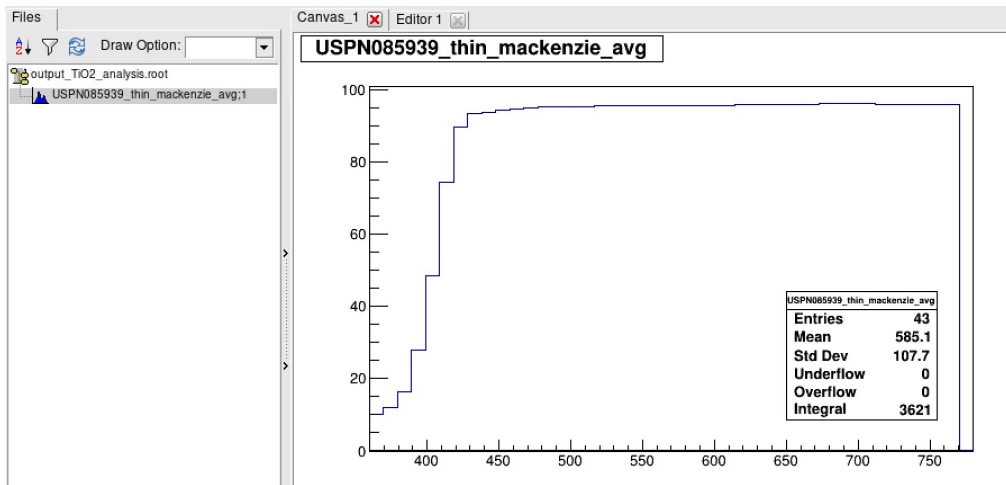


Analysis Macro Plans

- Still getting the analysis macro up and running at this point
- Some plots that I would like to make:
 - Averages for each set of coupons, each thickness
 - Differences between spectra for my data and Brian's data for same coupons
 - Plot of R/T ratio for an interesting wavelength with manufacturing date on the x-axis
- Open to other ideas!! I have been developing this from absolute scratch, so it has taken me awhile to cobble something together

Making Progress...

- My analysis macro is developing rapidly, I have gotten an average histogram to work so far!
- I'll keep adding to this file to make interesting plots to search for signs of aging
 - Trying to be smart and do hard things now to save time in the future



Backup

<http://kuraraypsf.jp/psf/ws.html>

