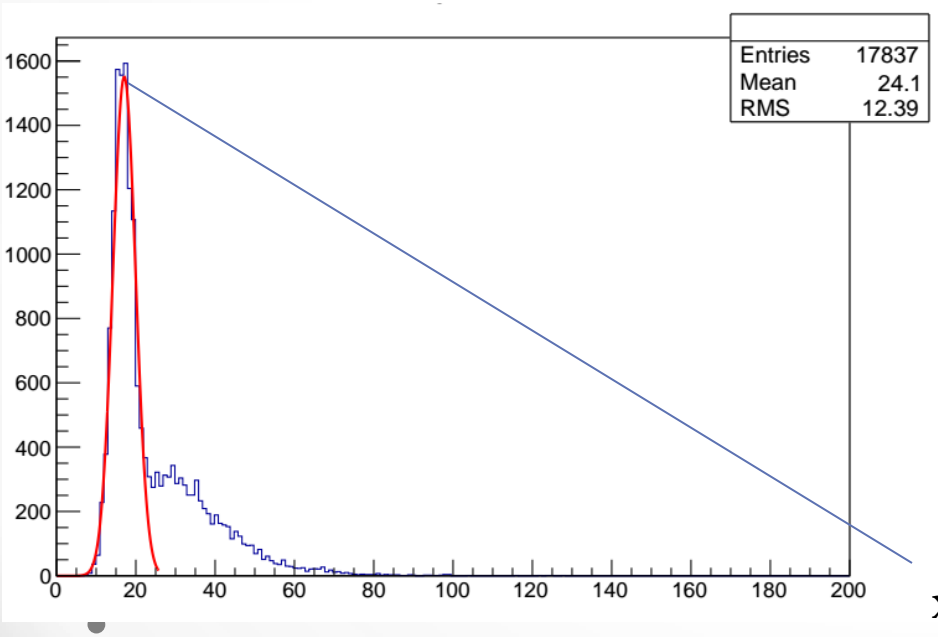
Update$_4$

Characterization of $PbWO_4$

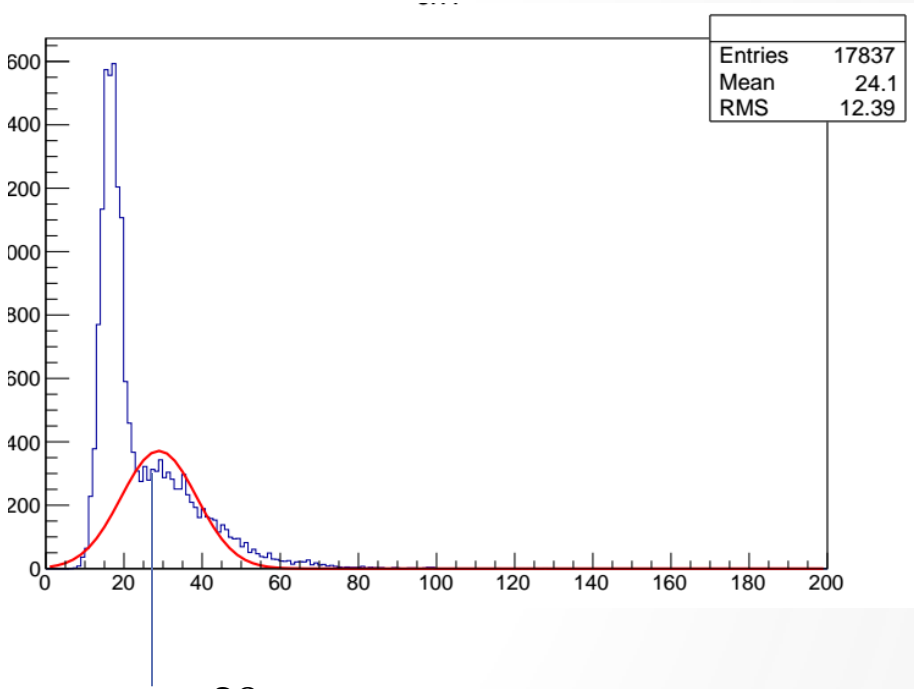
And maybe PbF_2

Calibrating the PMT with LED

Histograms of PMT measurements with led flashing at 1 photon



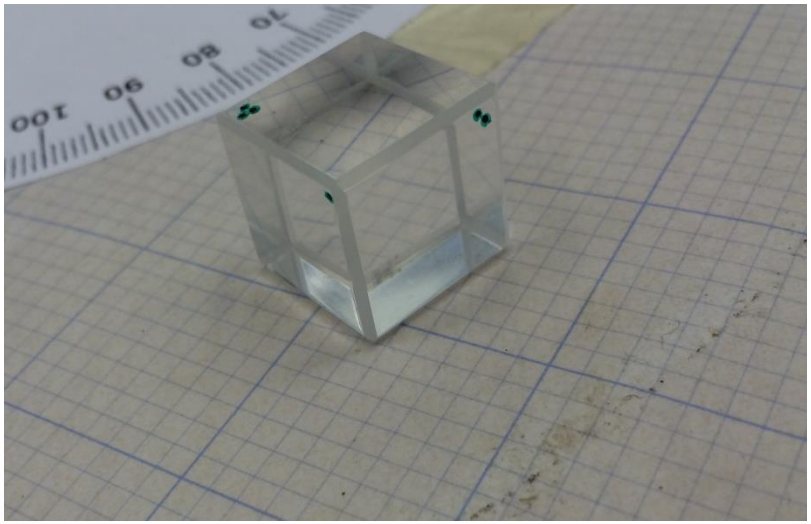
x = 17



x = 29

The Cube

- Measured refractive index is much lower than that of the long crystals (1.9 vs 2.2)
- Transmittance is much higher than long crystal (@ 420nm ~69% vs ~73%)



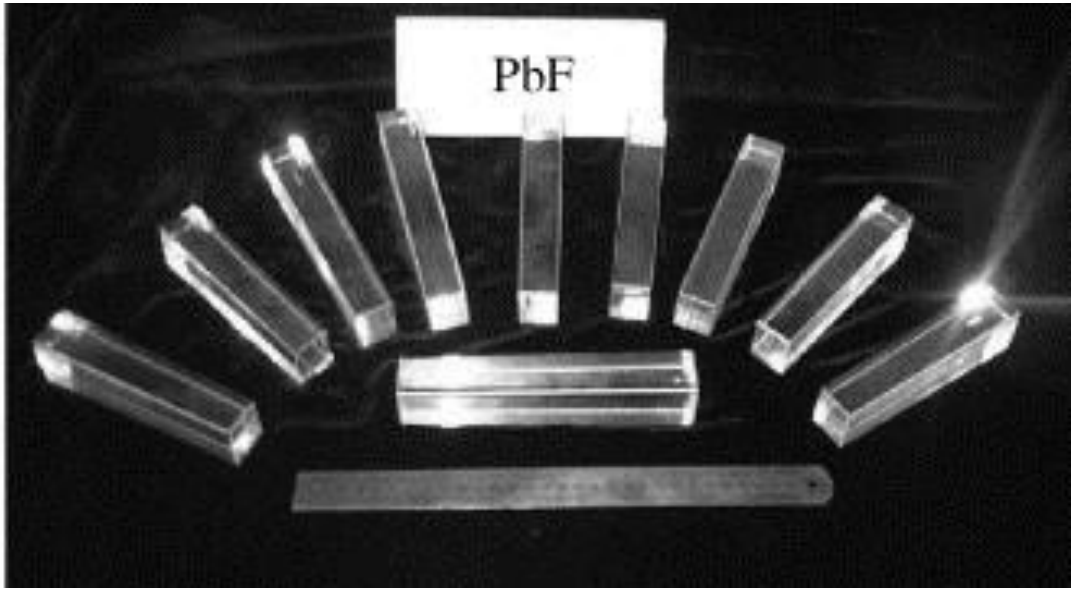
Chemical composition using XRF

The cube

No tungsten in $PbWO_4$…?

	Element	Conc. (%)
1	Al	0.006
2	B	0.000
3	Ca	0.000
4	Cl	1.119
5	F	6.566
6	K	0.044
7	Li	0.000
8	Mg	0.063
9	Na	0.130
10	O	6.889
11	P	0.142
12	Pb	85.014
13	S	0.026
14	Si	0.000

Lead Fluoride

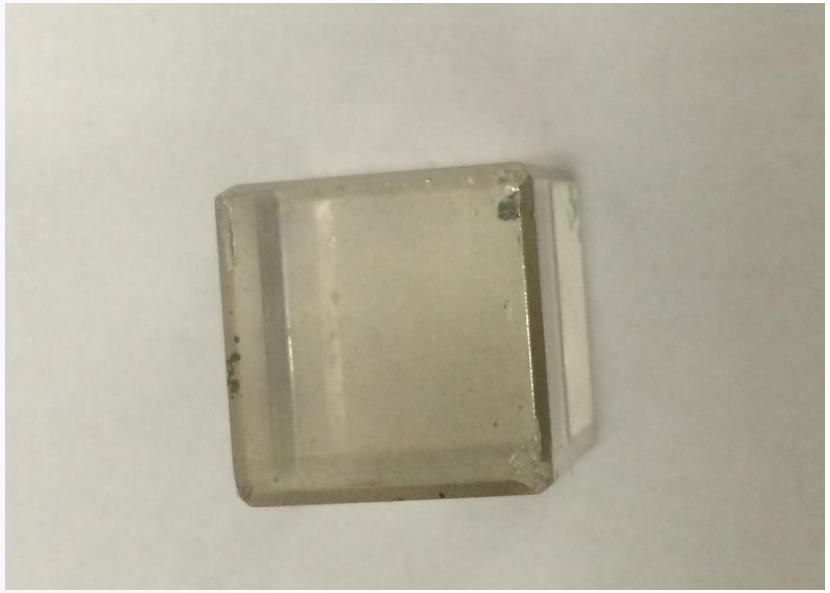


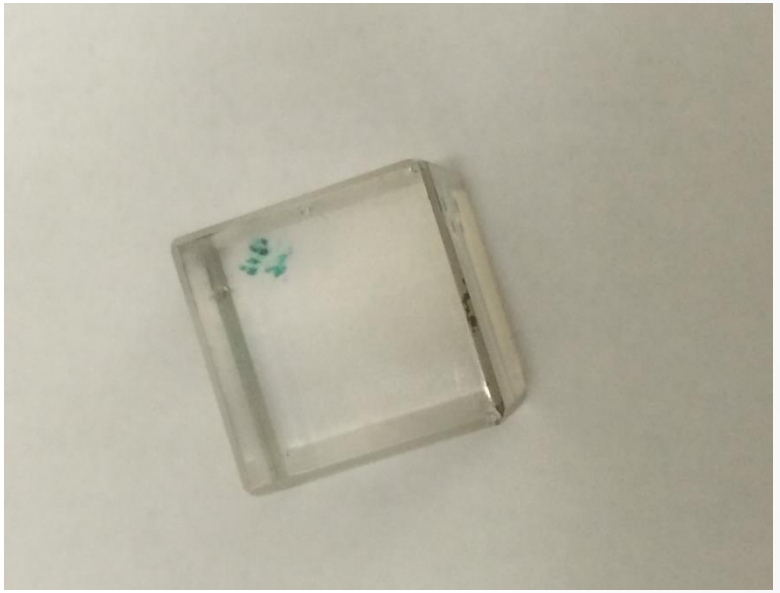
Looks very similar to PWO

Maybe oxygen trapped within accounts for the ~7% measurement of oxygen

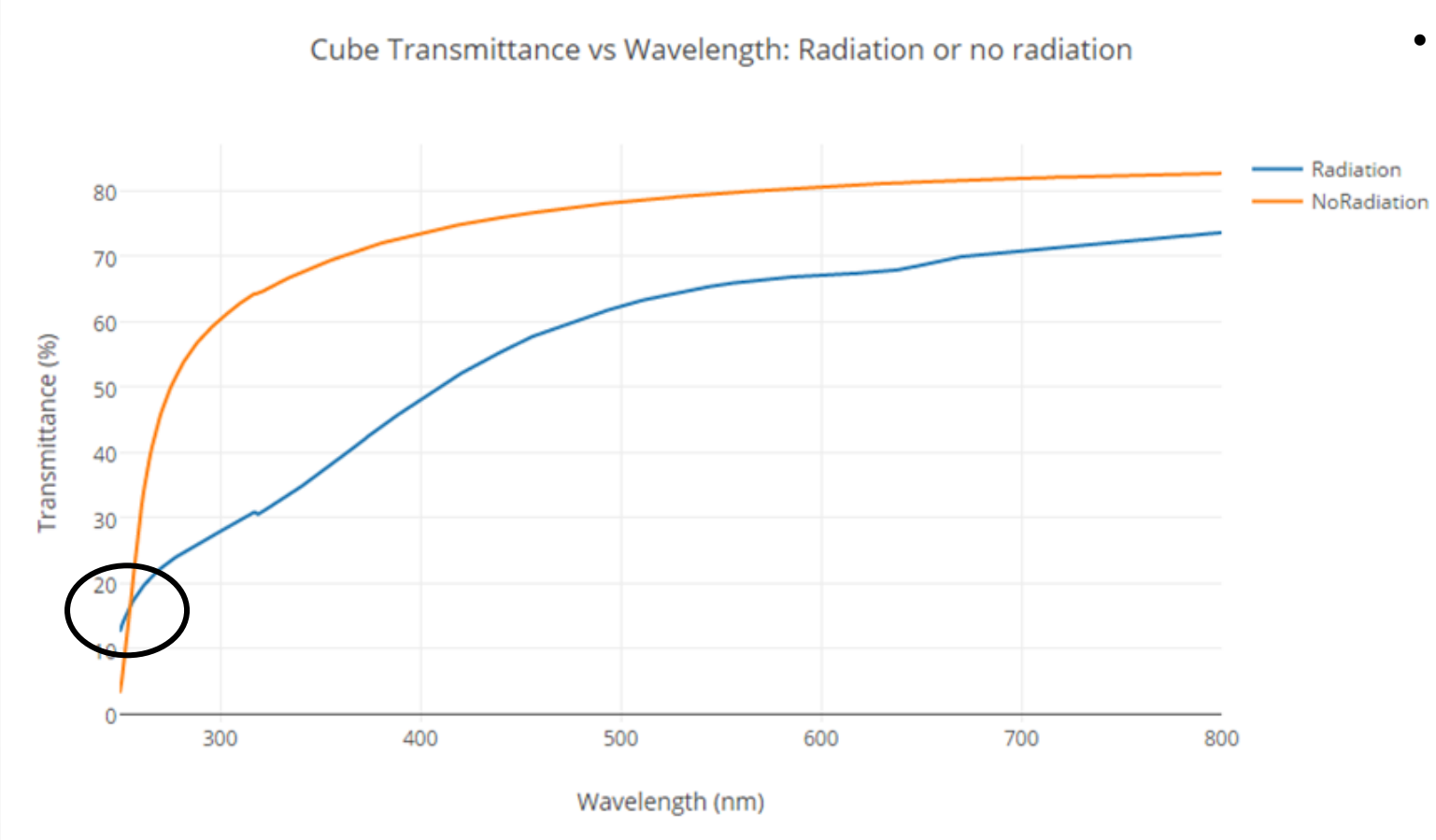
- This would mean that the oxygen was not part of the chemical make up and could be 'removed' from the list.
- Using Stoichiometry, 84.5% of PbF_2's mass should be lead, and 15.5% fluorine.
- With Oxygen removed, the new mass breakdowns for Pb and F would be 91.3% and 7.1%, respectively

Radiation Damage?





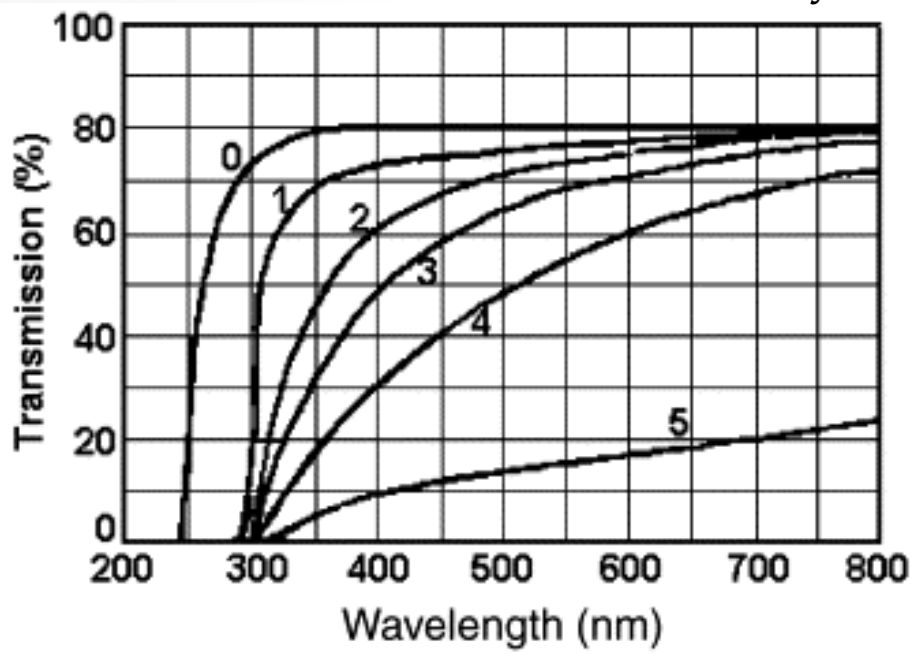
Transmittance: Damaged vs Not damaged

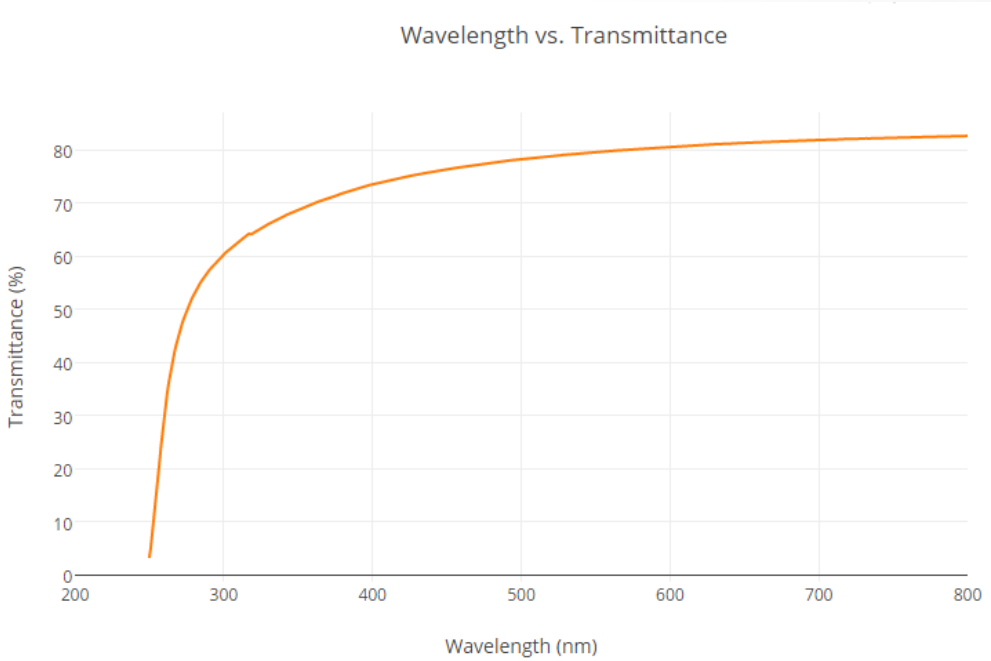


- A very dramatic difference

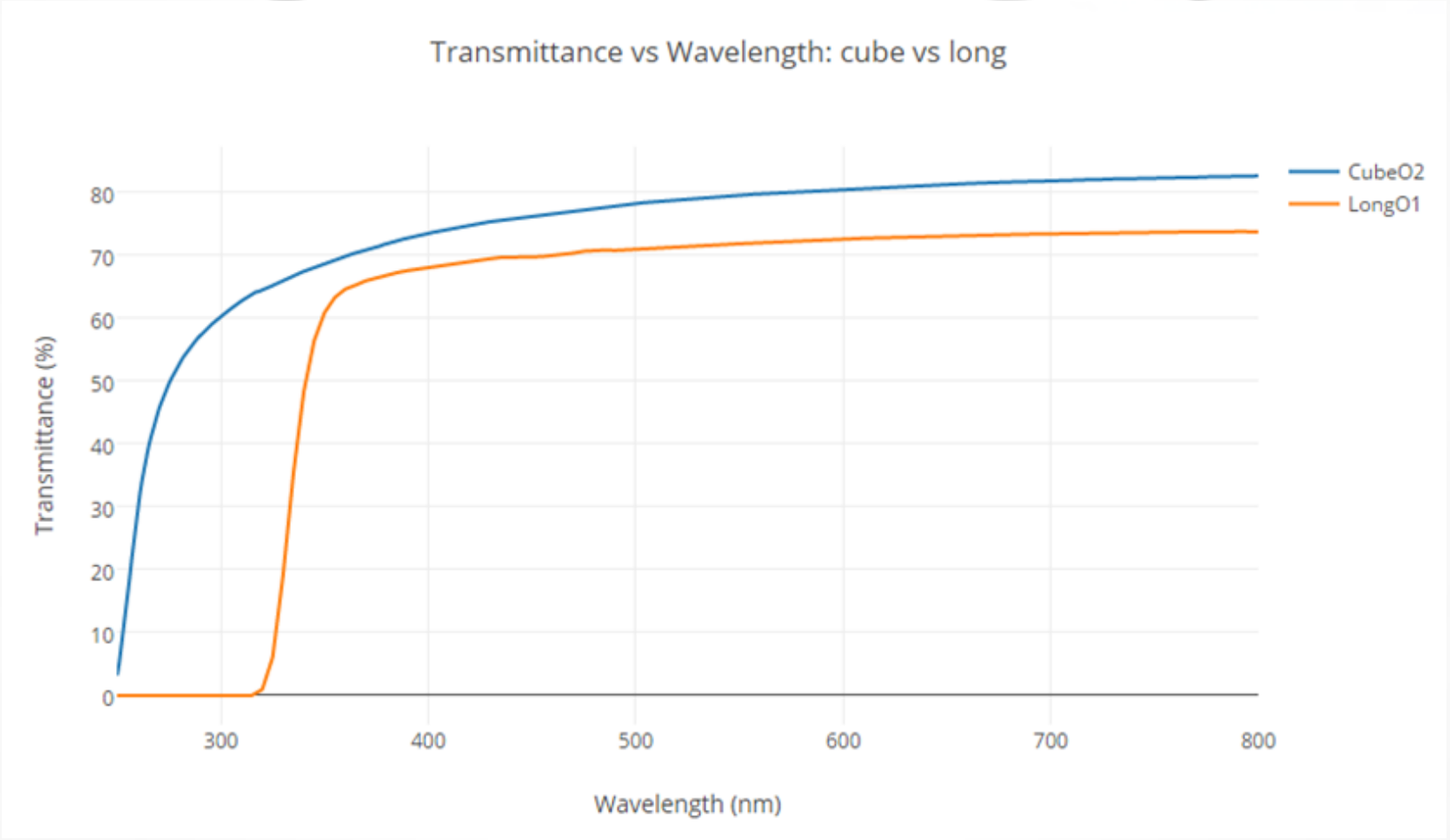
Comparison to literature

This study looked at a crystal which became more opaque due to trapped oxygen towards one side, higher numbers indicate closer to that side. ‘0’ is clear, reference crystal.

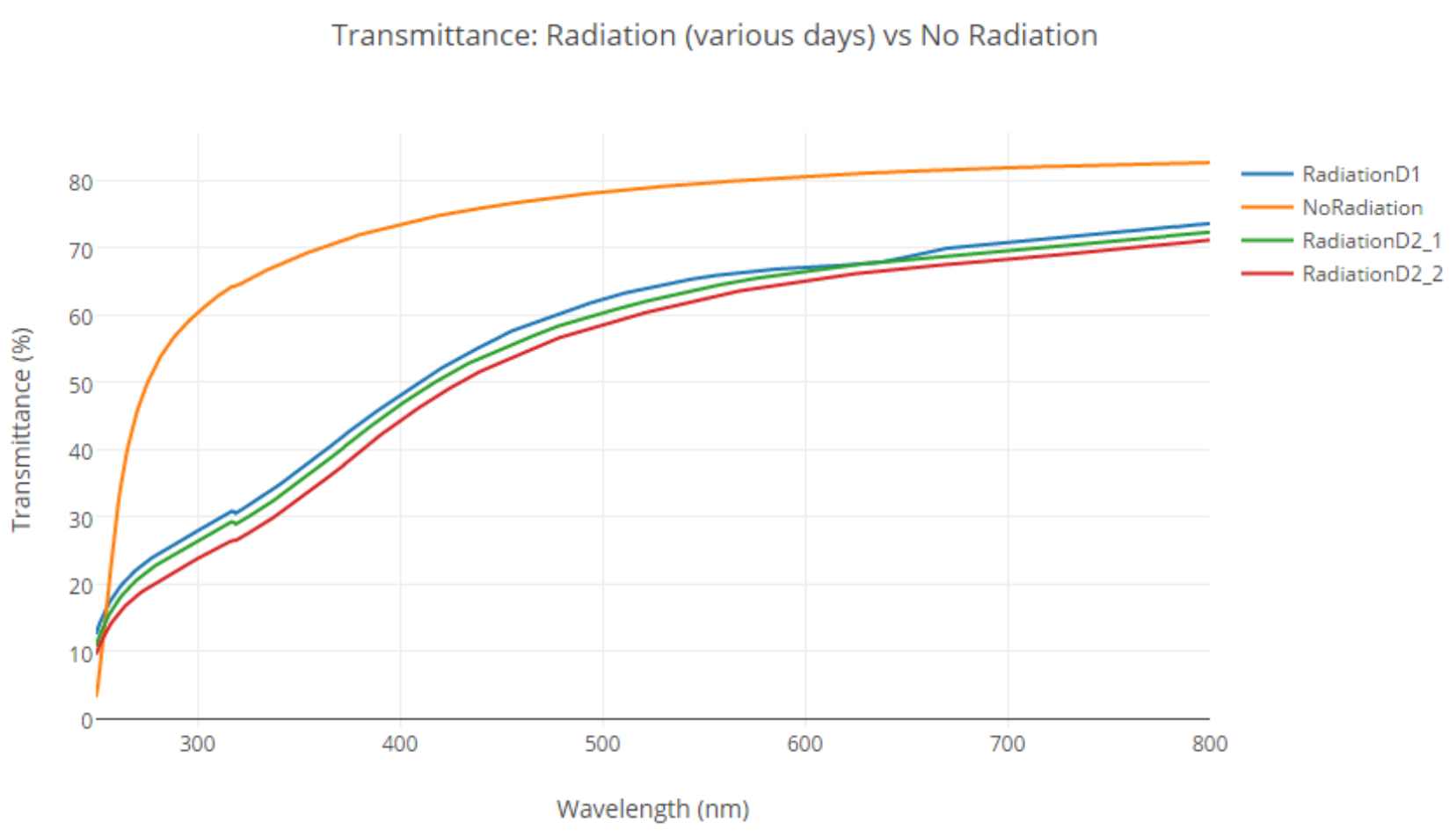




Comparison to big crystal



Does crystal fix itself over time?



What's next?

- Continue investigating the cube
- Testing different scenarios with the freezer set-up
- Begin calculating light yield