DiRC Uncertainties update

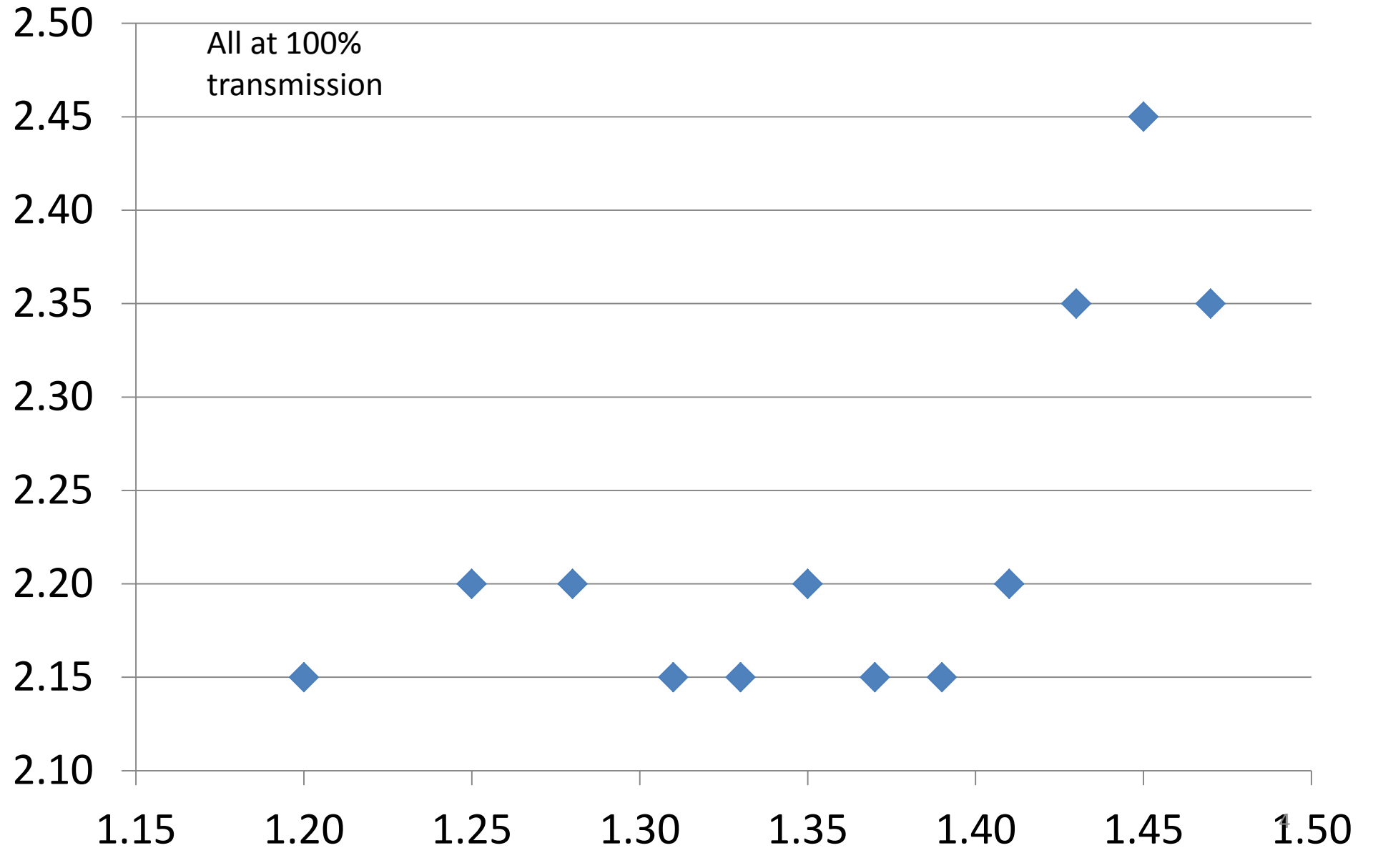
Tracking Uncertainty

- I have removed the 1.5 mrad tracking uncertainty
  - Is actually smaller at these energies
- Did not have as large an effect as expected near perpendicular
- Approximately added in quadrature for high theta tracks

Other Refinements

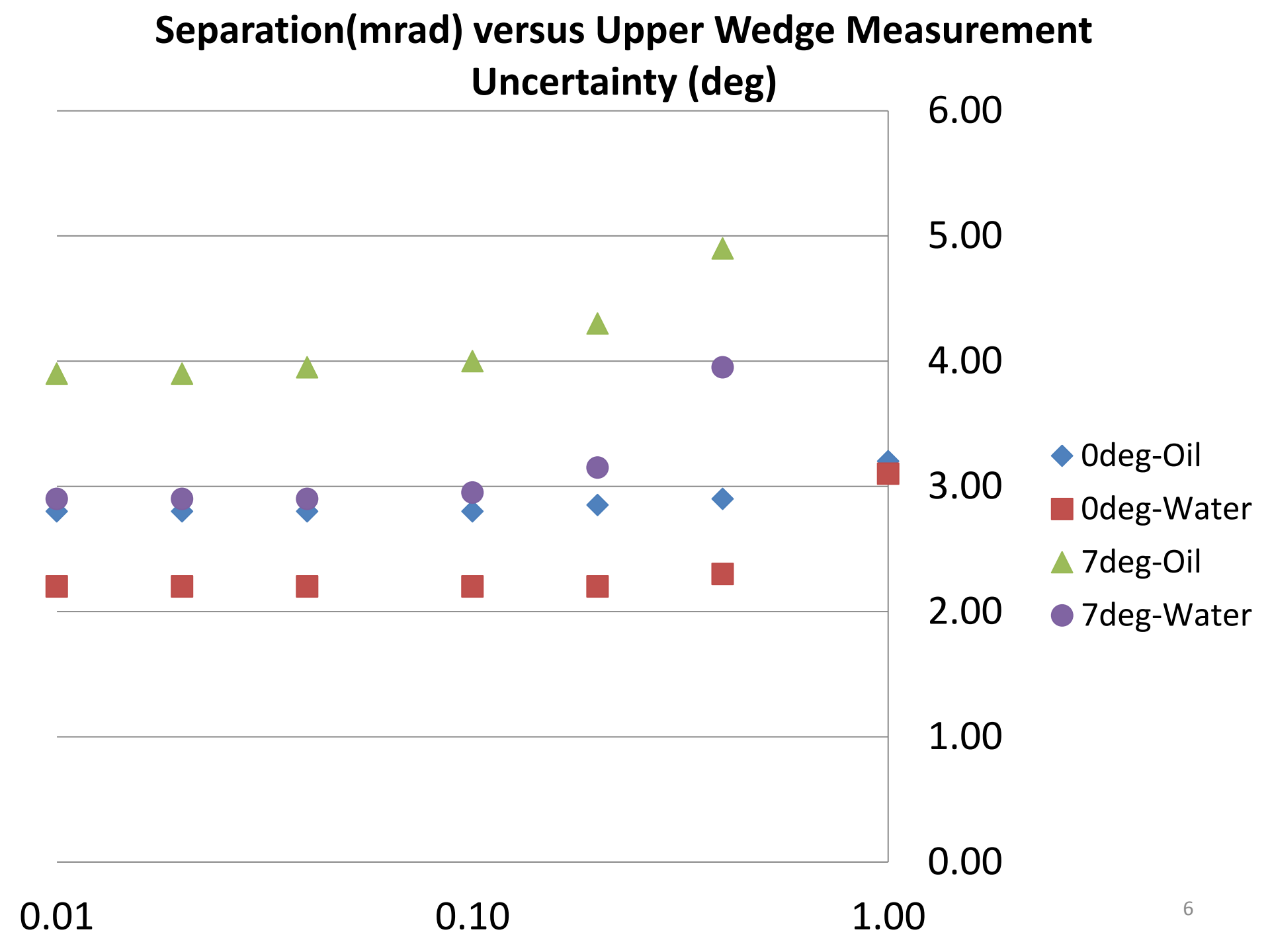
- Studies performed very similarly to before
- Included loss in oil, as well as oil index of refraction
  - Transmit ~77% of photons in oil
  - Also tried water (near perfect transmission
- Performed uncertainty studies at higher angles as well
- Lower indexes of refraction perform better even without gains from transmission
  - When the index was too low, it spread way to far transversely on the PMT plane, so I couldn't check air
- Used 6mm square PMTs instead of 5mm square ones

Separation vs Index of Refraction of Liquid Medium

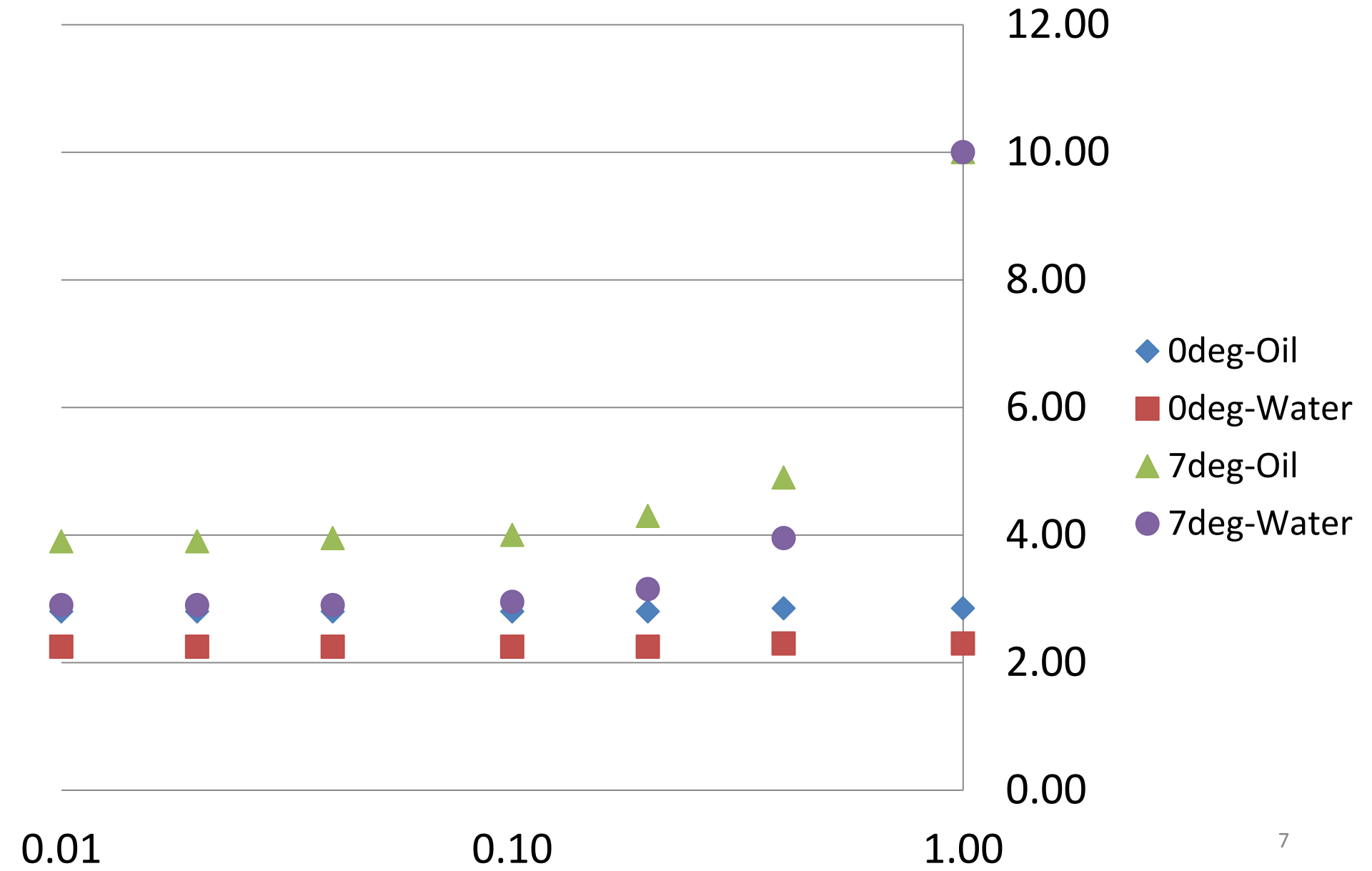


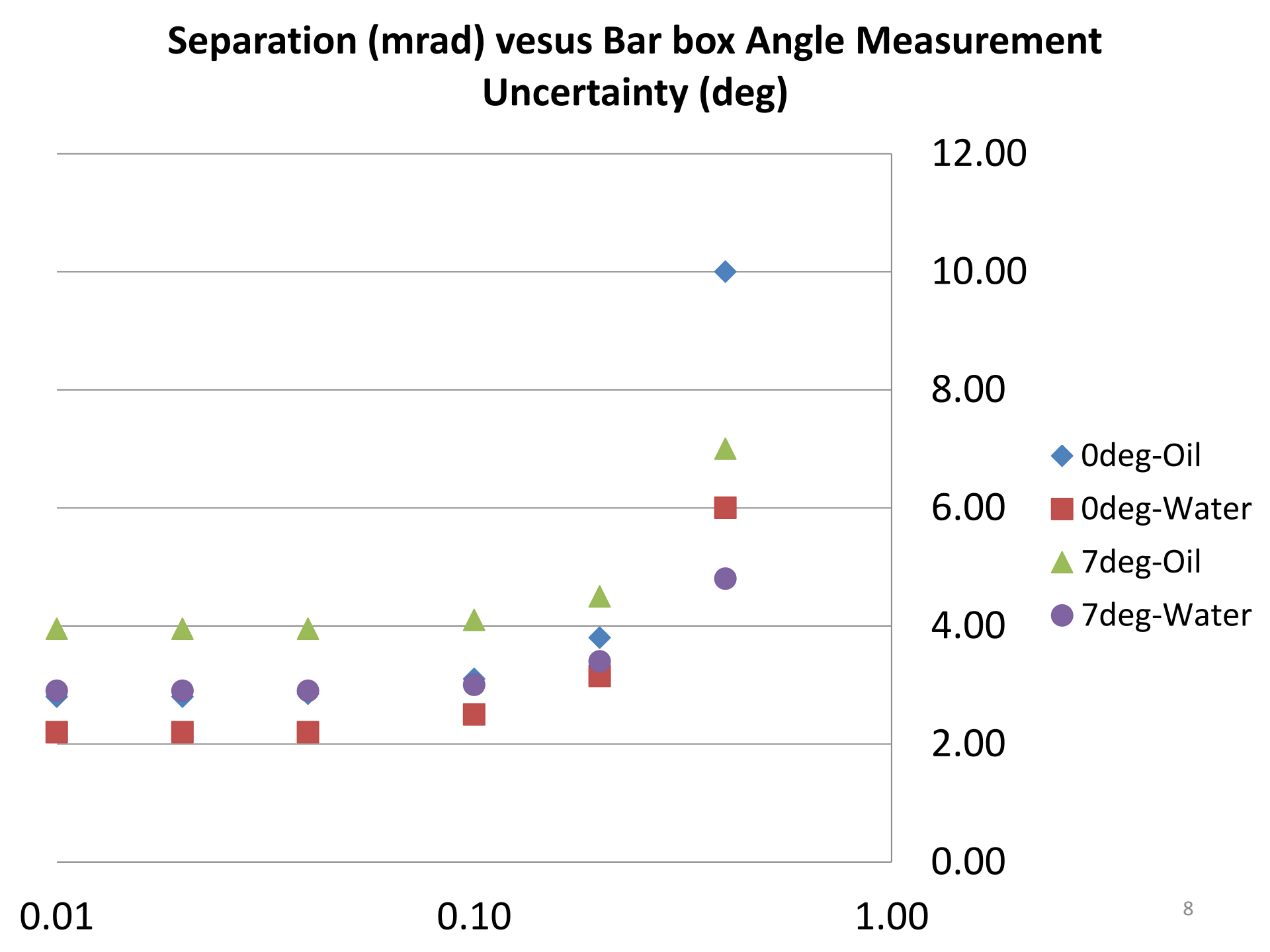
Errors and Angles

- Checked 3 types of angles for a perpendicular track and high theta trajectory in both oil and water
- New Terminology: Old “Non Uniformity” -> ”Measurement Uncertainty”
  - Now, for Measurement Uncertainty, all photons in a given event see the same angle, while they do not for Non uniformity.
  - Still trying to implement non uniformity on the focusing mirror

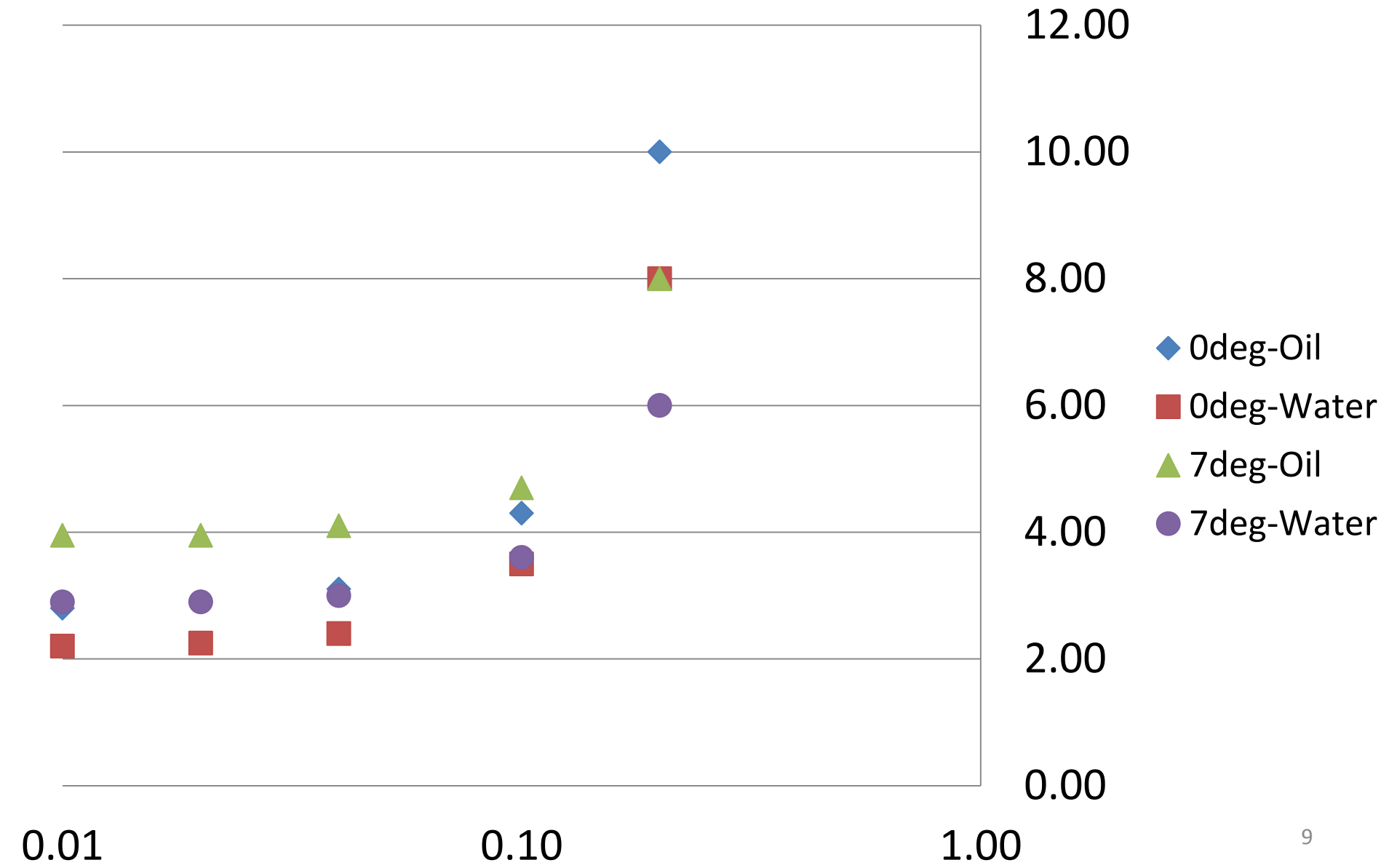

Separation(mrad) versus Upper Wedge Measurement Uncertainty (deg)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.01
0.10
1.00
0deg-Oil
0deg-Water
7deg-Oil
7deg-Water

Separation (mrad) versus Upper Wedge Non-Uniformity (deg)




Separation (mrad) vesus Bar box Angle Measurement Uncertainty (deg)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.01
0.10
1.00
0deg-Oil
0deg-Water
7deg-Oil
7deg-Water

Separation (mrad) vesus Focusing Mirror Angle Measurement Uncertainty



Conclusions

- Water is consistently better than oil – getting ~2.2 to oil's ~2.8 in ideal conditions
  - This is partially due to the increased separation from the indexes, but mostly due to the fact that water transmits 24-25 photons to oil's 17-18.
- The focusing mirror angle is by far the most sensitive