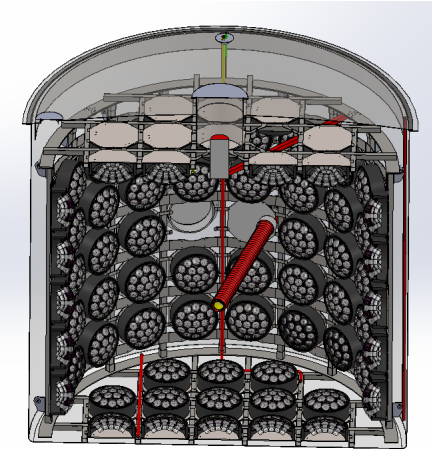
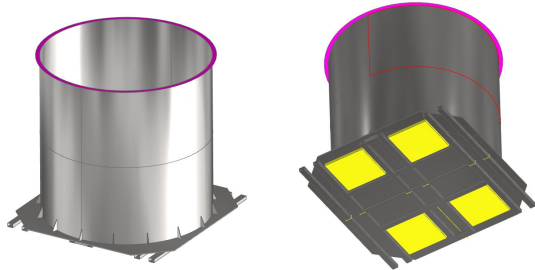
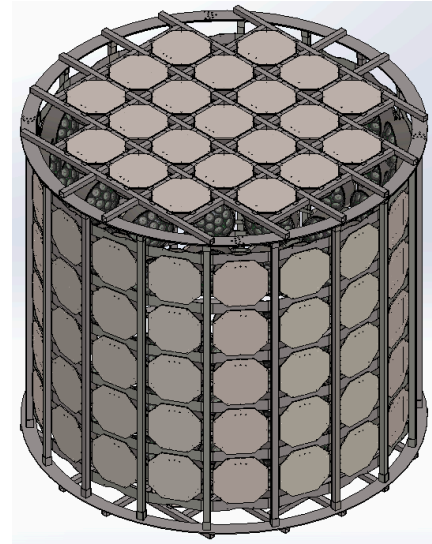


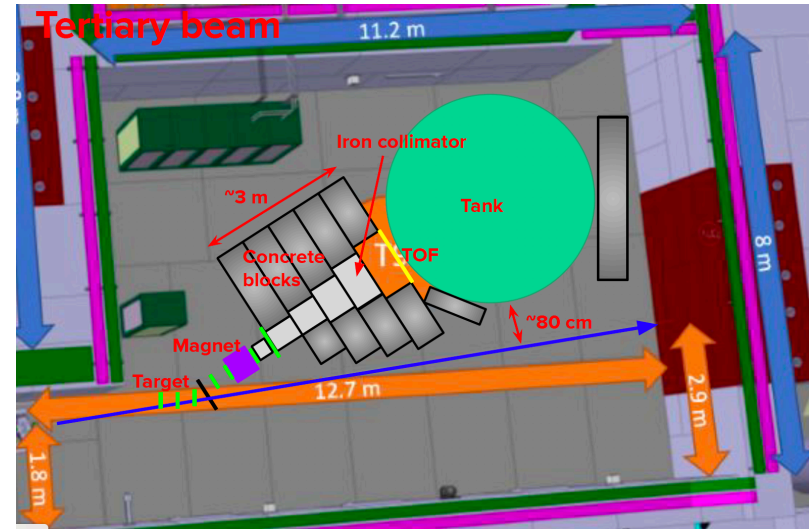
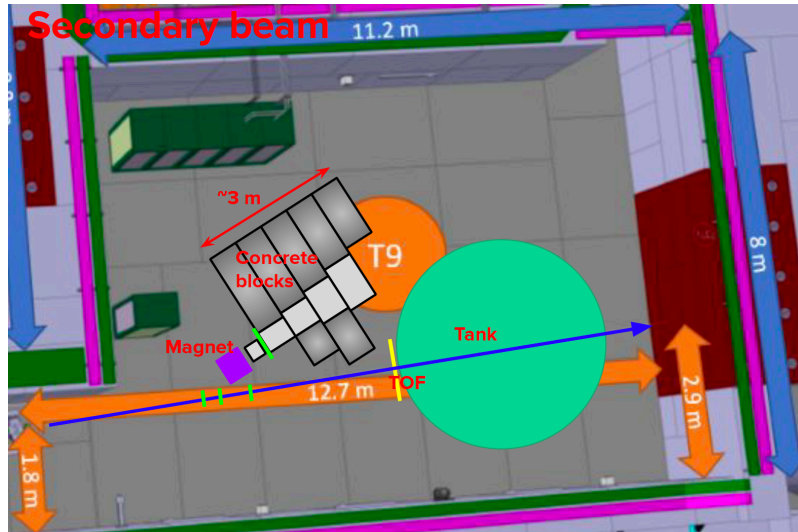
WCTE Mechanical Structure Introduction

Akira Konaka
(TRIUMF)

November 24, 2020
@ WCTE workshop

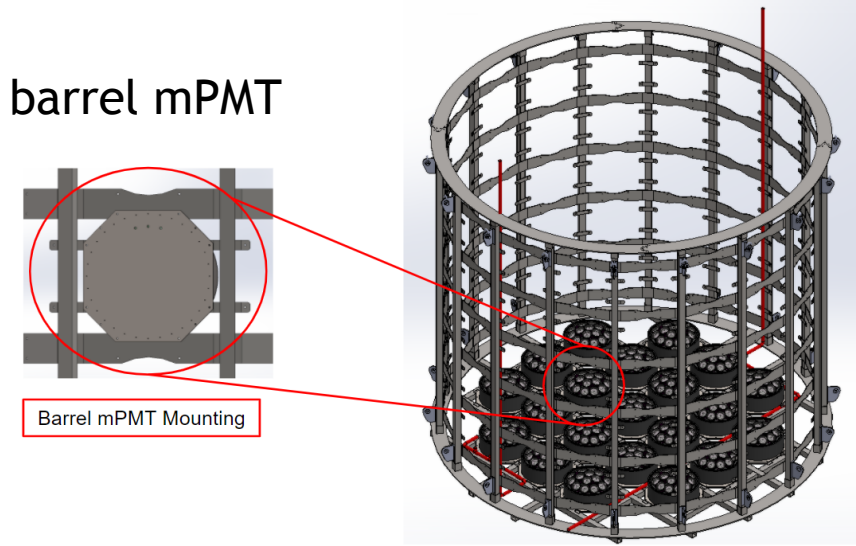
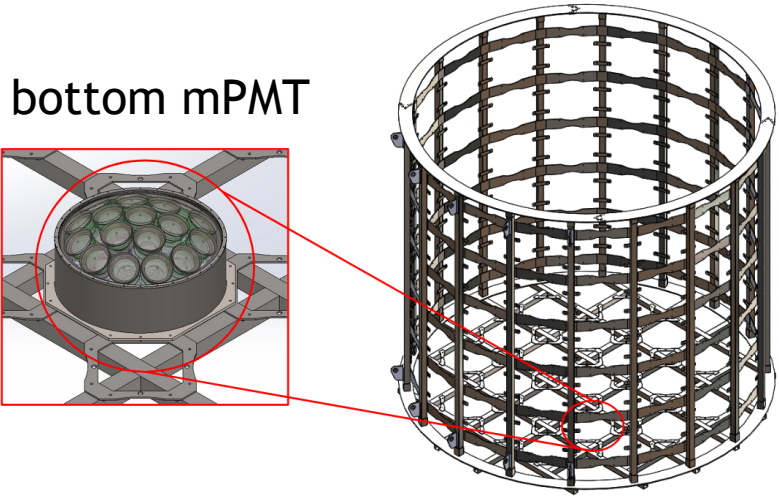


Novel dual tertiary/secondary beam configurations

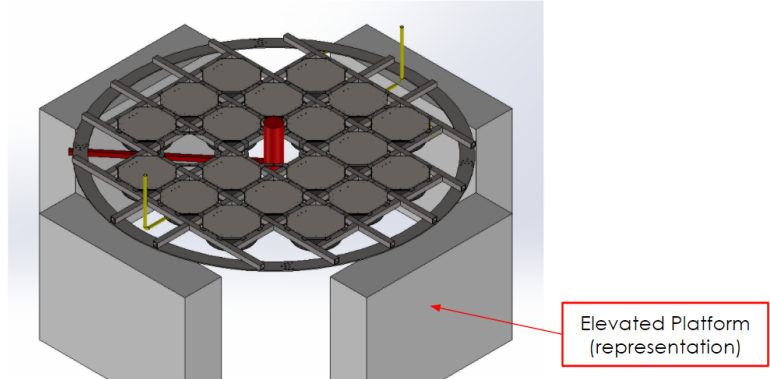


- Tertiary beam: ~50cm in diam.
 - sub-GeV pions (and kaons?)
- Secondary beam: ~10cm in diam.
 - muons, electrons protons
 - extendable beam port in the tank

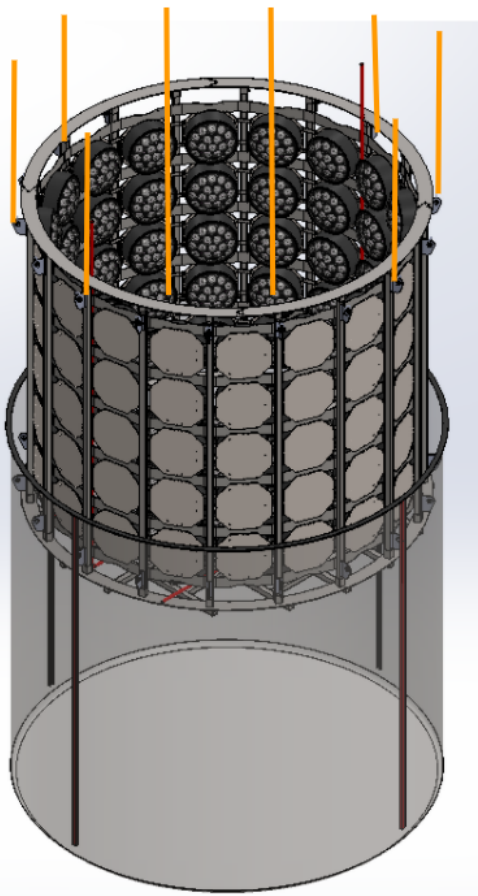
- Tank moving system
 - stable system against movement
 - similar challenge as IWCD



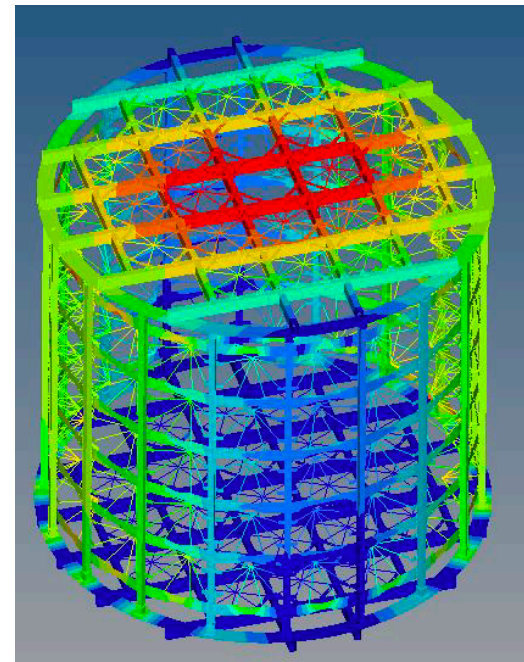
top mPMT

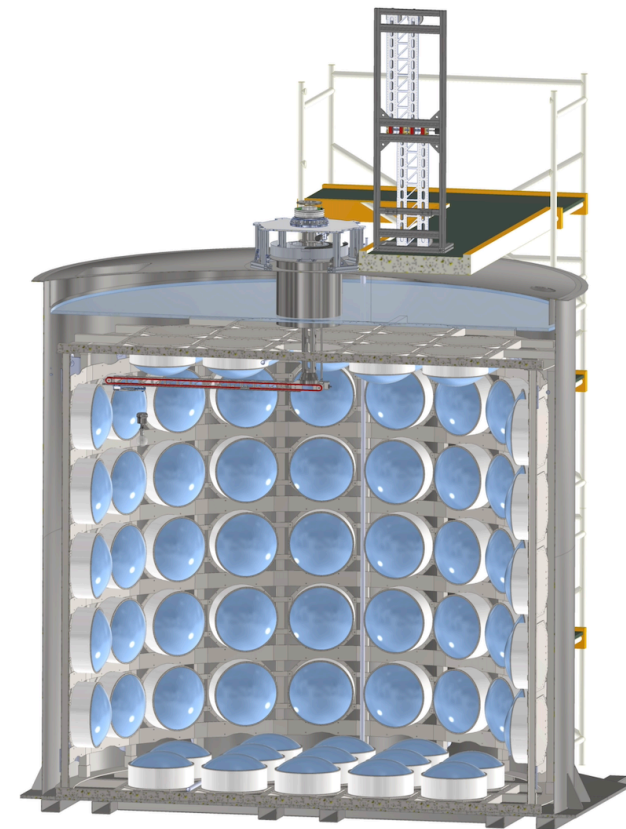
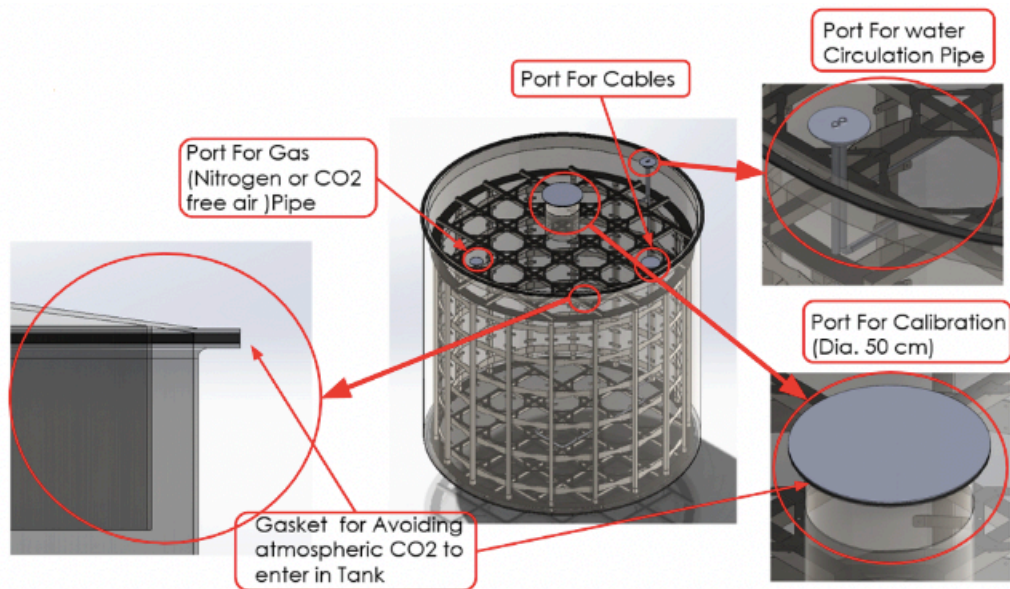


- mPMT support structure based on commercial beams
 - bottom mPMT from inside
 - barrel mPMT from outside
 - top mPMT separately assembled



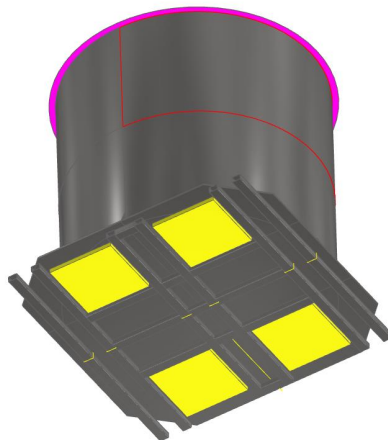
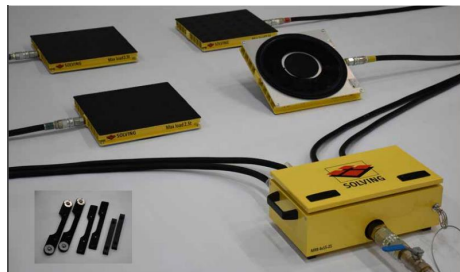
- Support structure to be stable at each steps
 - assembly process
 - without top lid or tank
 - mPMT load without water
 - transport to beam area
 - with mPMT and water
 - transport between tertiary and secondary beamlines
- Design and simulation
 - Shadul Josh's talk





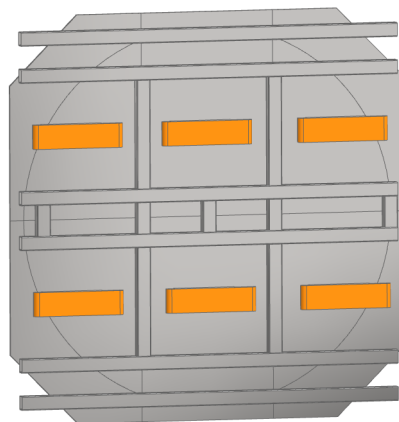
- Service ports on the lid
 - calibration system, water circulation, gas
 - Calibration: Lauren Anthony's talk on Wednesday
 - access for maintenance works

Air Pallet

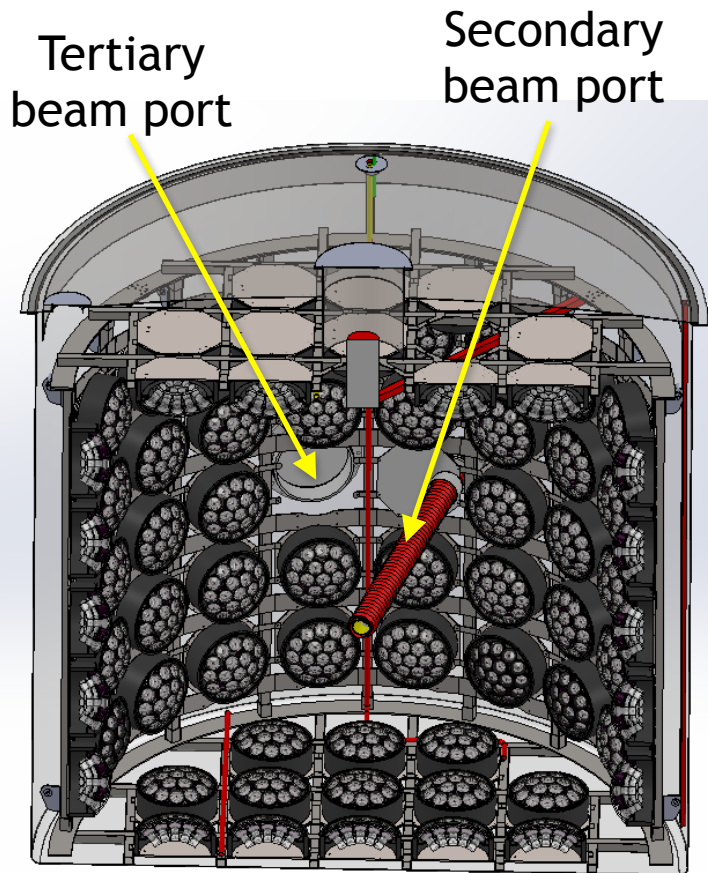


- Move the tank between secondary/tertiary beamlines
 - without draining water
 - important for Gd water
 - avoid detector damage
 - avoid sloshing, rupture
 - controlled movement

Hydraulic rail

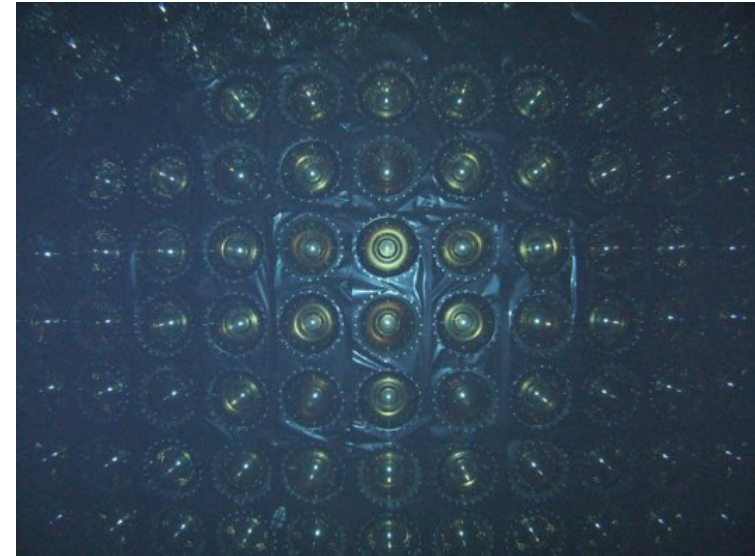


- Oliver Jeremy's talk



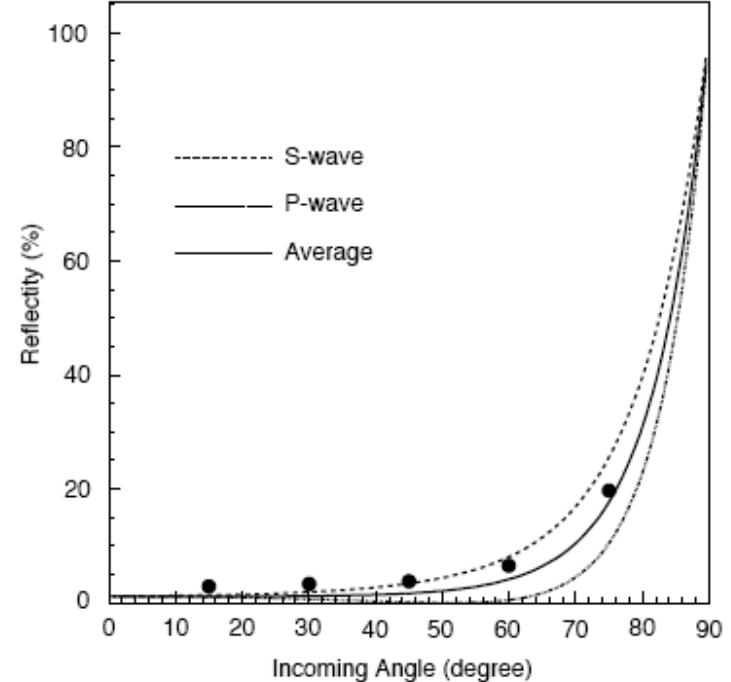
- Dual beam ports
 - remove neighboring mPMT's
 - move between secondary and tertiary beamline without rotation
 - Secondary beam port
 - 10cm diameter
 - extension pipe into the tank
 - study To-Wall dependence
 - Tertiary beam port
 - 50cm diameter
 - neutrons/ γ shielded by the water in the entrance region ($\sim 30\text{cm}$)
- Presentation by Shubham Garode

- Black sheets between photosensors reduces reflection
 - it takes only 20nsec for reflected lights to go across WCTE
 - serious background light (ghost ring)
 - SK black sheet looks little shiny/wavy
- Many Industry develops black sheets
 - but only in air and not in water!
 - it would be important to study this
 - new useful development

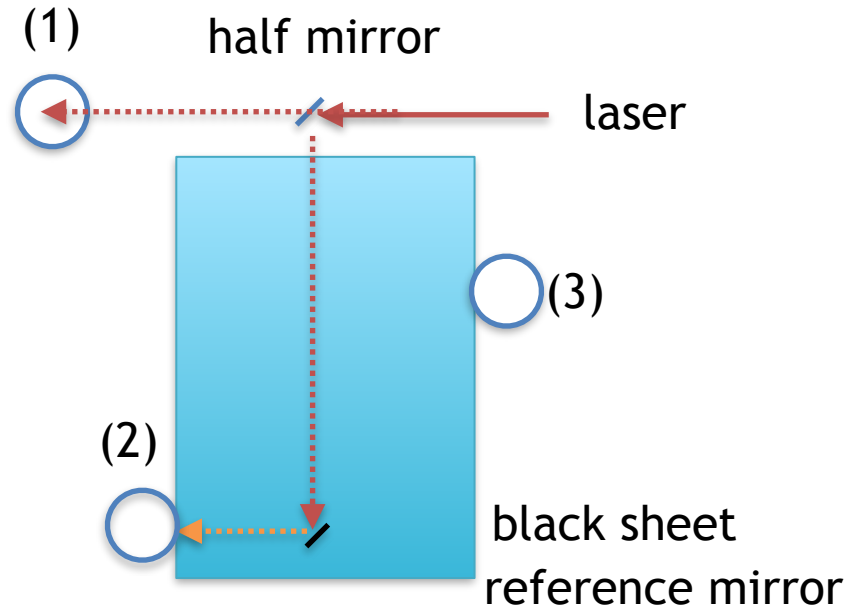


SK PMT and black sheet in water

- Reflection on the black sheet is due to Fresnel reflection
 - reflection at the boundary of two different index of refraction
 - index matching reduces reflection
- Reflective index of black sheet
 - Carbon black: $n \sim (1.2-2.0) + (0.1-1.0)i$
 - carbon $n = 1.95 + 0.7i$ with air $n = 1.0 + 0i$
 - Base plastic: $n = 1.31-1.4$ for teflon
 - possible to match water $n = 1.33$
 - SK uses PET ($n = 1.575$)



- laser light is injected into a half mirror
 - one goes to intensity monitor (1)
 - the other is sent into a water tank through a small window
- black sheet in a water tube
 - specular reflected light is detected by monitor (2)
 - inside the tank is in white to make it to an integrated sphere and monitored by (3)
- replace black sheet with mirror as a reference



(1,2,3) are light monitors, ideally using an integrated sphere
Inside the water tank is painted white

- WCTE is a movable detector similar to HK IWCD
 - stable structure needed for both assembly and movement
 - design of the structure and assembly is under way
 - concept for moving system is being developed
 - opportunity for contributions
- Dual beam port for WCTE tank
 - tertiary beam port extendable secondary beam port
 - opportunity for contributions
- Tank lid design include supporting services
 - opportunity for contributions
- Black sheet R&D helps reduce reflection light
 - significant background for small detector like WCTE
 - opportunity for contributions