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**WLS attenuation length. & Inconsistencies between DF T characteristics measurements**

CM. Cattadori for the working group  
UniMiB & INFN Milano Bicocca  
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**WLS: Attenuation length (l<sub>l</sub>)**

- In LAr the critical angle for Total Internal Reflection at the surface is  $\theta_c = 95^\circ$
- For  $\theta > \theta_c$  photons are trapped and guided to SPMTs.
- For  $\theta < \theta_c$  photons leave the lightguide and impinge onto the DF.
- Due to multiple reflections the optical path inside large size WLS (as for FD2 of DUNE) may reach a couple of meters.

The WLS attenuation length  $l_l$  is the leading parameter to maximize the photon transmission at the edges of a large area WLS-lightguide.

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**WLS for LAr detectors**

- Requirements:
  - Crystaline
  - Wide band (no emission, only Cherenkov emission)
  - High tolerance (0.3-3 mm) on the surface roughness
  - Low optical absorption
  - Fiber polished
  - Absorber: 300-360 nm (limited by DF emission)
  - Emission: 420-500 nm to match the SPMTs
  - Optical Path (0.1-1)

Absorption and Emission can be tailored on different wavelengths

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**New measurements of G2P WLS lightguide**

- T measurements at the spectrophotometer on 4 mm thick plates may suffer of systematics to infer  $l_l$  length (0.1 m)
- One 1-cm thick WLS plate has been casted
- T measurements have been performed with lasers at three  $\lambda$ : 400-450 nm. After subtraction of reflections effects at the entrance, these are used as reference.
- The  $T(\lambda)$  measured at the spectrophotometer are corrected (shifted)
- The  $l_l$  length ( $l_l$ ) is derived (the method and the results will be published)

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**WLS for FD2: Attenuation length (l<sub>l</sub>)**

- The  $l_l$  of the DUNE FD2:
  - ~37 m at 430 nm (measurement of WLS PL spectrum)
  - The dye concentration has been tailored on the FD2 WLS shape
- An optical simulation is employed to evaluate the effect of the dye concentration on the light collection efficiency
- chromophore concentration
- lightguide shape and size

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**WLS for FD2: Attenuation length (l<sub>l</sub>)**

- The dye concentration of the DUNE FD2 must be tailored for the FD2 WLS core - optical path
- Optimization driven by  $l_l$
- Lower the WLS lightguide thickness (8 mm) the chromophore concentration must be lower by the ratio of the resulting light loss and the DF light receiving efficiency

Attenuation Length of the WLS for different dye concentrations

$l_l = \frac{1}{\mu} \cdot \frac{1}{A} \cdot \frac{1}{c} \cdot \frac{1}{d}$

- $\mu$  = molar extinction coeff.
- $c$  = concentration
- $d$  = optical path

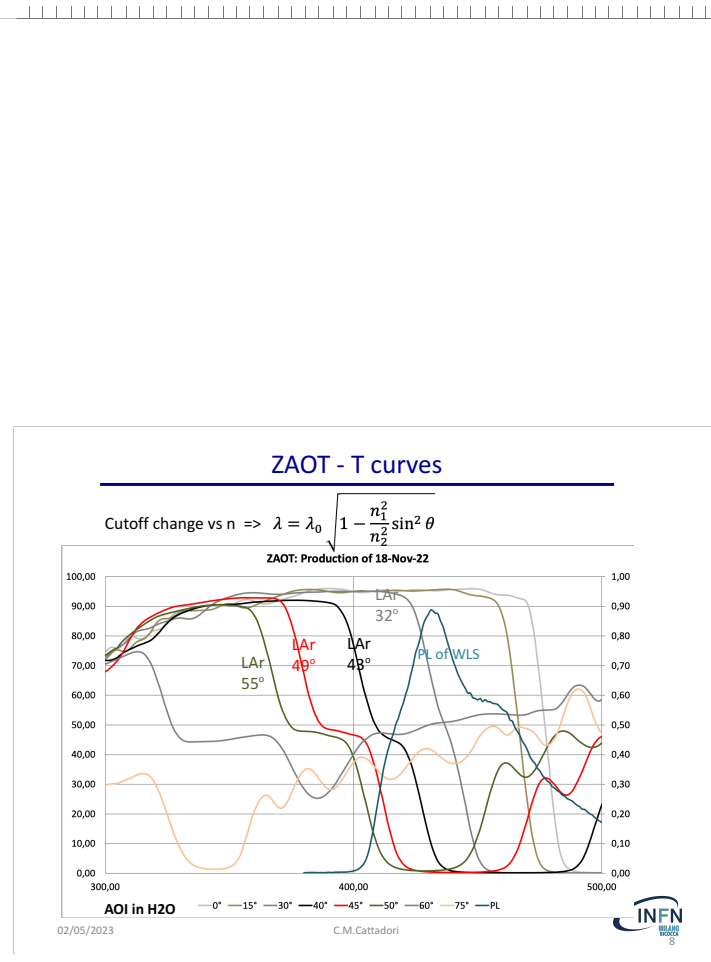
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**Dichroic Filters**

- Dichroic Filter (DF) are made of thin film multilayer coatings on a glass/fused silica substrate. They act as Fabry-Pérot interferometer to separate transmitted light.
- For large volume LAr detection  $\Rightarrow$  Large area DF
- The glass substrate is coated with optically thin (10-15 nm) to demultiplex the 338 nm light to  $>500$  nm

ZACOT (our industrial partner) solution

- Bioflux 33 Optical Glass
- OPTO 30 compound solution
- 8270



Fai clic per aggiungere le note del relatore

