

Liquid Argon optical properties to be used in Geant4 and Opticks Simulations

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Abstract. In Geant4 and Opticks optical properties like e.g. the materials refractive index are inputs that have to be provided. In this paper we collect the optical properties relevant for liquid Argon TPC's.

1. Introduction

optical properties given as

Light yield ~ few 10,000's of photons per MeV (depends on E field, particle type and purity)
(SCINTILLATIONYIELD: 50000/MeV when no electric field present)
Wavelength of emission is 128nm (FWHM= 10nm)

Light with two characteristic time constants:

- fast component (SCINTILLATIONTIMECONSTANT1): 6 ns
(SCINTILLATIONYIELD1): 0.75

- slow component (SCINTILLATIONTIMECONSTANT2): 1500 ns
(SCINTILLATIONYIELD2): 0.25
(RESOLUTIONSCALE): 1

Refraction Index: $n = 1.358 \pm 0.003$ at 128 nm (M. Babicz et al 2020 JINST 15 P09009)
(compared to $n= 1.45 \pm 0.07$ (ArXiv:1502.04213))

Group velocity: $1/v_g = 7.46 \pm 0.08$ ns/m at 128 nm

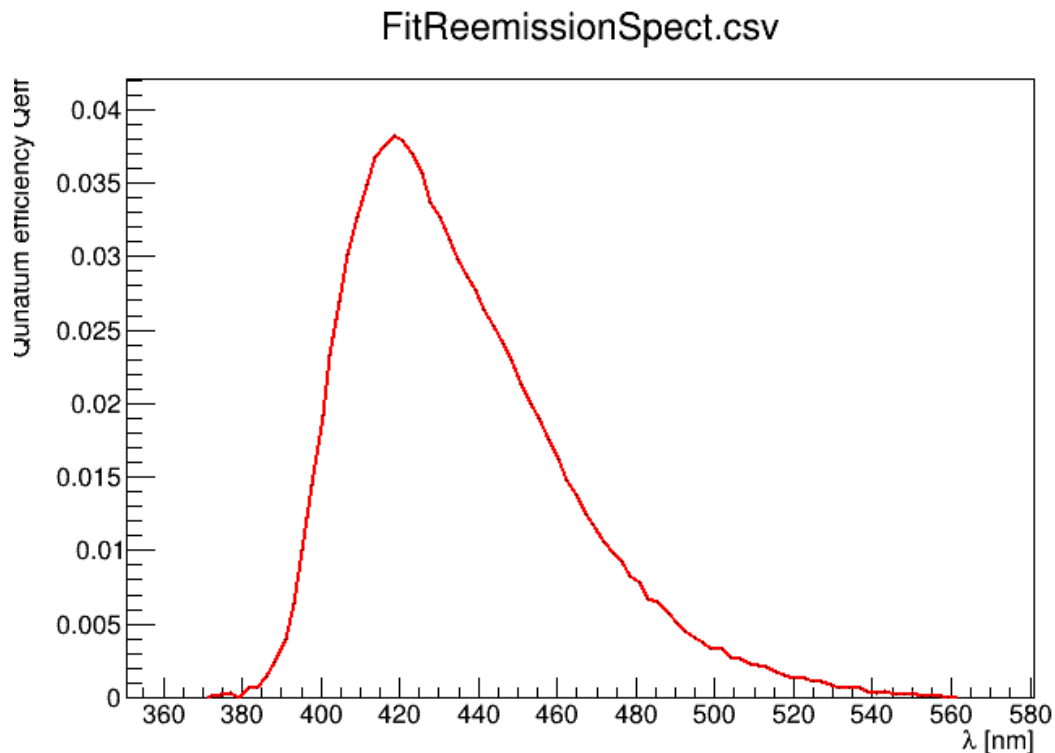
Argon is highly transparent to its own scintillation light. (ABSLENGTH)
>1.1 m (ArXiv:1511.07725)

Rayleigh scattering length (RAYLEIGH): 90 cm (M. Babicz et al 2020 JINST 15 P09009)
55+/- 5 cm (ArXiv:1502.04213)

2. Requirements

3. Conclusions and Outlook

DoSSiER provides a repository to collect and organize validation and regression test results and the experimental data used for physics validation tests. The web application component



of DoSSiER allows easy access to the information for members of simulation collaborations and the general user community. The web service component allows for programmatic access to the data stored in DoSSiER. We are in the process of adding new tests and experimental data to the repository. Originally we concentrated on Geant4 tests of hadronic and electromagnetic physics that are of interest for high energy physics experiments, but in the future we plan to include tests that are of interest in other areas such as medical and space science. Also we are in the process of adding GEANIE and GeantV data in cooperation with the respective collaborations. The website front-page (currently reachable at <http://g4devel.fnal.gov:8080/DoSSiER/>) is already available to the general public interested in providing feedback. Additional data-sets and simulation results are expected in the near future and we plan to improve the website based on the comments of the first users in the next few years, the current priority being the extension of included simulations and data. With the addition of more data we expect that this tool will become the main entry point to serve as result repository for both higher level (e.g. shower shapes in calorimeters) and microscopic (e.g. cross-sections, final state multiplicities) validations. To achieve this goal we are working in close collaboration with simulation experts.

References

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