

Optical characterization of aerogel tiles

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The aerogel tiles from US



- 10 tiles
- 3 formats: large ($9.5 \times 9.5 \text{ cm}^2$), medium ($7.2 \times 7.2 \text{ cm}^2$), small ($6.5 \times 6.5 \text{ cm}^2$)
- 2 thickness: 1.7 cm, 0.95 cm
- 2 refractive indices: $n = 1.05$ (9 tiles), $n = 1.01$ (1 tile)

The aerogel tiles from US

The refractive index at 400 nm, not provided by the manufacturer, was estimated through rough measurements of density using the [empirical relation](#):

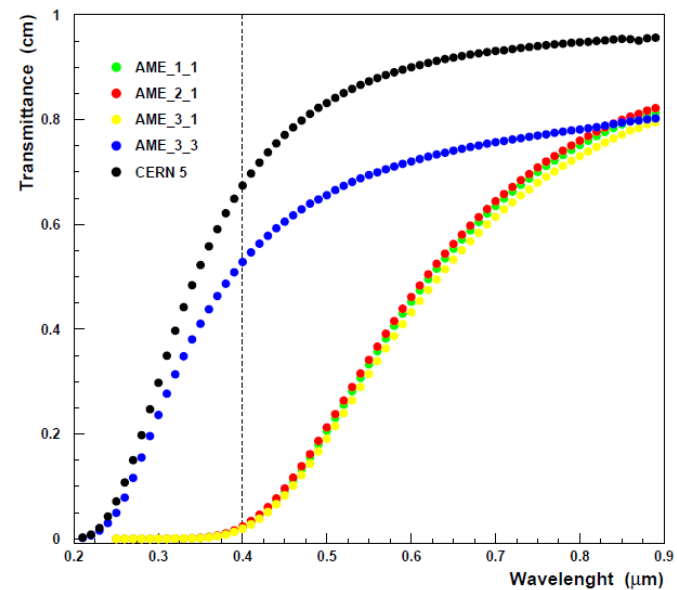
$$n^2(400 \text{ nm}) = 1 + 0.438 \cdot \rho$$

[A.F.Danilyuk et.al., Recent results on aerogel development for use in Cherenkov counters, NIM A494 (2002) 491]

Name	Size [cm^3]	ρ [g/cm^3]	n (400 nm)
AME_1_1	$9.5 \times 9.5 \times 1.7$	0.218	1.047
AME_1_2	$9.5 \times 9.5 \times 1.7$	0.223	1.048
AME_1_3	$9.5 \times 9.5 \times 1.7$	0.225	1.048
AME_2_1	$9.5 \times 9.5 \times 1.7$	0.219	1.047
AME_2_2	$9.5 \times 9.5 \times 1.7$	0.226	1.048
AME_3_1_A	$6.5 \times 6.5 \times 1.7$	0.217	1.046
AME_3_1_B	$6.5 \times 6.5 \times 1.7$	0.217	1.046
AME_3_2_A	$6.5 \times 6.5 \times 0.95$	0.246	1.052
AME_3_2_B	$6.5 \times 6.5 \times 0.95$	0.231	1.049
AME_3_3	$7.2 \times 7.2 \times 1.7$	0.070	1.015

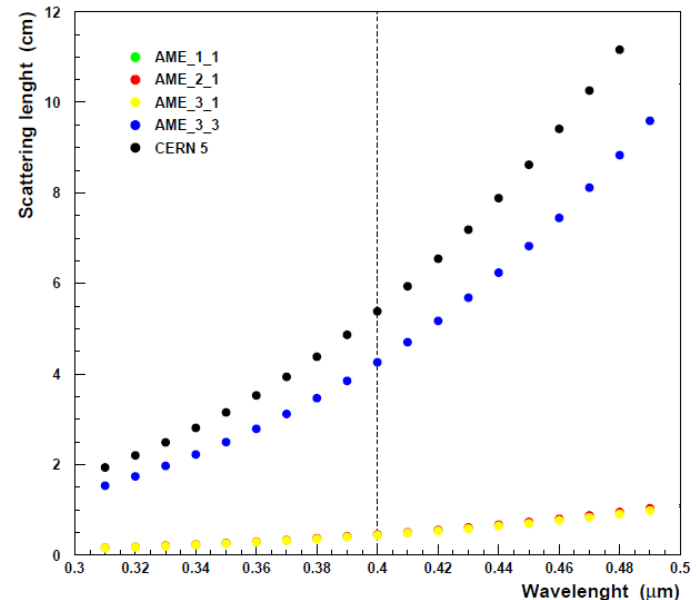
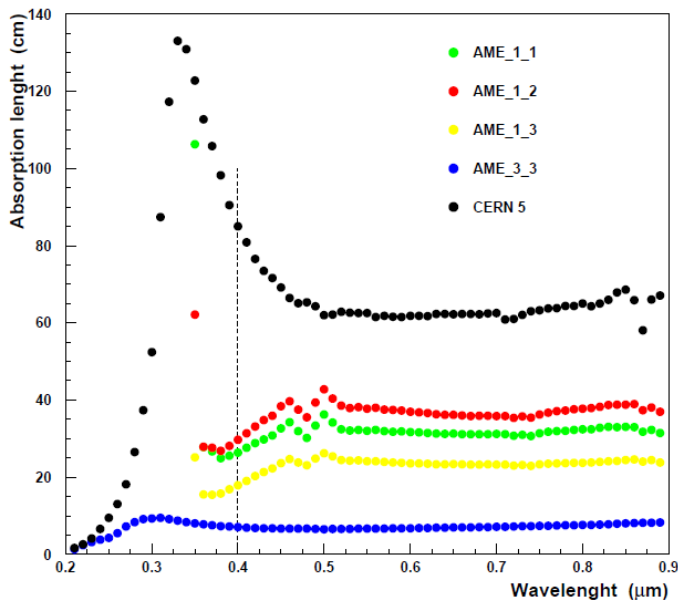
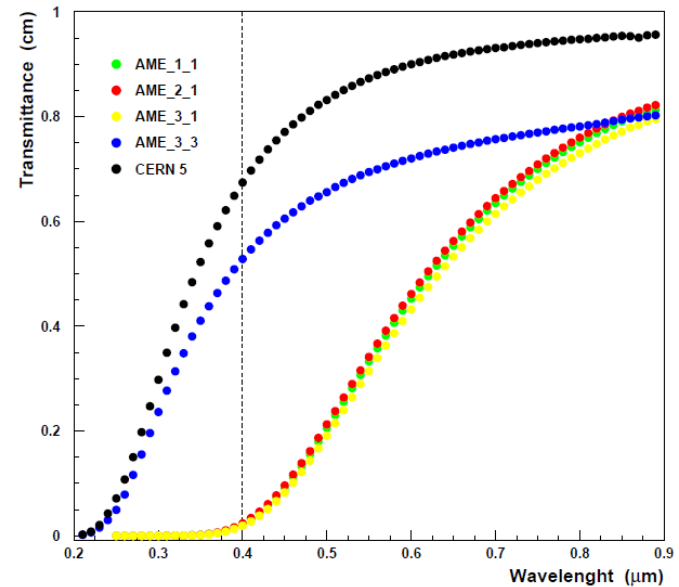
Optical properties

Name	Transmit (400nm)
AME_1_1	2.2 %
AME_2_1	2.4 %
AME_3_1_A	1.9 %
AME_3_3	52.8 %
CERN5	67.4 %



Optical properties

Name	Transmit (400nm)	Abs. length (cm)	Scatt. length (cm)
AME_1_1	2.2 %	26.4	0.4
AME_2_1	2.4 %	29.7	0.5
AME_3_1_A	1.9 %	17.9	0.4
AME_3_3	52.8 %	7.1	4.3
CERN5	67.4 %	85.0	5.4



Basic formalism

Transmittance

$$T = e^{-\frac{t}{\Lambda_{tot}}} = e^{-t\left(\frac{1}{\Lambda_A} + \frac{1}{\Lambda_S}\right)} = e^{-\frac{t}{\Lambda_A}} \cdot e^{-\frac{t}{\Lambda_S}} = A \cdot e^{-\frac{Ct}{\lambda^4}}$$

Hunt formula

$$A = TF = e^{-\frac{t}{\Lambda_A}}$$

\Rightarrow

$$\Lambda_A = \frac{-t}{\ln A} \quad \text{Absorption length}$$

Transflectance

$$\Lambda_S = \frac{\lambda^4}{Ct} \quad \text{Scattering length}$$

Procedure: measure $T(\lambda)$ \rightarrow fit with Hunt formula \rightarrow extract Λ_A and Λ_S

