

# High $\gamma$ -ray dose radiation effects on the performances of Brillouin scattering based optical fiber sensors

Xavier Phéron,<sup>1,2\*</sup> Sylvain Girard,<sup>3</sup> Aziz Boukenter,<sup>2</sup> Benoit Brichard,<sup>4</sup> Sylvie Delepine-Lesoille,<sup>1</sup> Johan Bertrand,<sup>1</sup> and Youcef Ouerdane<sup>2</sup>

<sup>1</sup>Andra, 1-7 rue Jean Monnet, 92298 Chatenay-Malabry, France

<sup>2</sup>Laboratoire Hubert Curien, UMR CNRS 5516, Bât F, 18 rue Pr. Benoît Lauras, 42000 Saint-Étienne, France

<sup>3</sup>CEA, DAM, DIF, F91297 Arpajon, France

<sup>4</sup>SCK•CEN, Boeretang 200, BE-2400 MOL, Belgium

\*Xavier.pheron@univ-st-etienne.fr

**Abstract:** The use of distributed strain and temperature in optical fiber sensors based on Brillouin scattering for the monitoring of nuclear waste repository requires investigation of their performance changes under irradiation. For this purpose, we irradiated various fiber types at high gamma doses which represented the harsh environment constraints associated with the considered application. Radiation leads to two phenomena impacting the Brillouin scattering: 1) decreasing in the fiber linear transmission through the radiation-induced attenuation (RIA) phenomenon which impacts distance range and 2) modifying the Brillouin scattering properties, both intrinsic frequency position of Brillouin loss and its dependence on strain and temperature. We then examined the dose dependence of these radiation-induced changes in the 1 to 10 MGy dose range, showing that the responses strongly depend on the fiber composition. We characterized the radiation effects on strain and temperature coefficients, dependencies of the Brillouin frequency, providing evidence for a strong robustness of these intrinsic properties against radiations. From our results, Fluorine-doped fibers appear to be very promising candidates for temperature and strain sensing through Brillouin-based sensors in high gamma-ray dose radiative environments.

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