EGU26-18729
EGU General Assembly 2026

EyeRAD: an INFN network for airborne radioactivity monitoring

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The EyeRAD project establishes a national network across eight sections of the Italian National Institute of Nuclear Physics (INFN) (Milano, Milano-Bicocca, Ferrara, Bari, Napoli, LNF-Frascati, LNGS-Assergi, and LNS–Catania) for the monitoring of atmospheric radioactivity. A key challenge of the network lies in the heterogeneity of the detection systems employed, which range from high-resolution HPGe spectrometers to scintillation detectors like NaI(Tl) and $CeBr_3$ used for early warning. To ensure comparable analytical sensitivity and rapid response despite this instrumental diversity, a harmonized measurement protocol has been developed and validated.

All laboratories operate identical high-volume air samplers with a nominal flow rate of 1000 L·min□¹, collecting atmospheric particulate matter on glass fiber filters corresponding to a sampled volume of approximately $1.4x10^3$ m³ per 23-hour session. The measurement strategy adopts a sequential counting approach performed at fixed intervals (typically 2, 5, 24, 48, and 72 hours) after sampling. This schedule is physically motivated by the decay kinetics of short-lived radon progeny specifically ^{214}Pb and ^{214}Bi from the ^{222}Rn chain, and ^{212}Pb and ^{208}Tl from the ^{220}Rn chain which dominate the gamma background in the initial hours. The progressive decay of these natural contributions significantly enhances the detectability of longer-lived radionuclides.

The protocol includes the monitoring of ^{210}Pb as a tracer for natural background stability and aerosol load, and cosmogenic ^{7}Be as an independent quality indicator, with measured concentrations consistently falling within the expected 2-8mBqm^{-3} range. In terms of sensitivity, the protocol achieves Minimum Detectable Activities (MDAs) for anthropogenic radionuclides ^{131}I and ^{137}Cs in the order of 1-3x10^{-5} Bqm^{-3}, and approximately 10^{-2} Bqm^{-3} for ^{210}Pb (based on 24-hour live time measurements with HPGe detectors). Finally, to ensure accessibility and transparency, all results and metadata are centrally collected and published via a public web application (https://www.eyerad-infn.it/).

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