Experimental observations and modelling of magnetic field
direction-dependent poloidal and toroidal asymmetries in
radiation profiles during N\textsubscript{2} seeding in LHD

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Various noble gasses have been seeded in the Large Helical Device (LHD) to reduce the divertor heat load through enhanced radiation. With N\textsubscript{2} seeding the radiation enhancement is observed to be from 20 - 100\% depending on the discharge, while the reduction in divertor heat load indicated by I\textsubscript{sat} was more than 50\% in some locations but varied strongly toroidally. Radiation is observed by two imaging bolometers, viewing the same vertically elongated cross-section from top and bottom ports, respectively, at a location which is 36\degree toroidally removed from the N\textsubscript{2} gas puff nozzle located at the bottom of the machine. During N\textsubscript{2} seeding, these measurements both confirm that additional radiation from the outboard side is coming exclusively from the top of the cross-section, indicating up/down asymmetry. Modelling by EMC3-EIRENE using a full torus model can reproduce both the up/down asymmetry and the upper localization of the radiation at a cross-section which is 36\degree toroidally separated from the N\textsubscript{2} source located at the bottom of the cross-section as is the case in the experiment. Additionally, a dependence of the toroidal and poloidal radiation asymmetry on the direction of the magnetic field is observed using both the two imaging bolometers and three toroidally separated arrays of resistive bolometers when N\textsubscript{2} seeding is performed at three different toroidal locations, which indicates the role of drifts in the transport of the N\textsubscript{2} impurity. However, this magnetic field direction-dependence cannot be modelled by EMC3-Eirene.