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Distributed computing and oncological radiotherapy: technology transfer from HEP and experience with prototype systems

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We show how nowadays it is possible to achieve the goal of accuracy and fast computation response in radiotherapic dosimetry using Monte Carlo
methods, together with a distributed computing model.
Monte Carlo methods have never been used in clinical practice because, even if they are more accurate than available commercial software, the
calculation time needed to accumulate sufficient statistics is too long for a realistic use in radiotherapic treatment.
We present a complete, fully functional prototype dosimetric system for radiotherapy, integrating various components based on HEP software
systems: a Geant4-based simulation, an AIDA-based dosimetric analysis, a web-based user interface, and distributed processing either on a local
computing farm or on geographically spread nodes.
The performance of the dosimetric system has been studied in three execution modes: sequential on a single dedicated machine, parallel on a
dedicated computing farm, parallel on a grid test-bed. An intermediate software layer, the DIANE system, makes the three execution modes
completely transparent to the user, allowing to use the same code in any of the three configurations.
Thanks to the integration in a grid environment, any hospital, even small ones or in less wealthy countries, that could not afford the high costs of
commercial treatment planning software, may get the chance of using advanced software tools for oncological therapy, by accessing distributed
computing resources, shared with other hospitals and institutes belonging to the same virtual organization

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