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P3.139 Real-time volumetric rendering of radiation fields using 3D textures

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The operation of nuclear fusion facilities must be carefully planned and monitored due to the potential damage to equipment or personnel caused by radiation fields. A method for visualising such three-dimensional (3D) radiation fields in real-time is presented. An interactive volumetric representation is achieved using view-dependent ray casting of a scalar field in three dimensions.

Real-time performance is achieved by exploiting parallel processing on the graphics processing unit, with scalar field data uploaded as 3D textures. Lack of consumer hardware support for true 3D texturing is mitigated with software indexing of two-dimensional textures containing multiple XY planes through the volume. Integration with a commercial-off-the-shelf software framework, Unreal Engine 4, allows fusing with context geometry derived from computer-aided design engineering models and viewing with virtual reality headsets.

We present a novel technique for visualisation of 3D field data in real time. While targeted at rendering radiation fields for remote maintenance planning in nuclear facilities, the method inherently generalises to the visualisation of any scalar quantity that can be sampled in a three-dimensional field, such as neutron dose, plasma density, temperature or pressure. Qualitative results are presented and future extensions discussed.

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