ALLEGRO core optimisation for UO2 fuel

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ALLEGRO is a GenIV prototype reactor concept of gas cooled fast reactors (GFR), which will be used to examine the viability of the GFRs and to test a new type of carbide fuel. Originally, MOX (with 25.5 vol.% of Pu content) fuel rods were intended to be used in the start-up ALLEGRO configuration. However, recently some issues emerged about the application of MOX, therefore UO2 fuel was proposed to be used instead. Hence, the applicability of UO2 fuel in ALLEGRO core must be examined. Preliminary examinations showed that the *keff* value of the core reduces considerably from ~1.035 to ~0.85 by replacing MOX by UO2 fuel. However, the UO2 core could be feasible by the increase of the fuel amount to compensate the lower concentration of fissile elements compared to the MOX core. A parametric study was carried out to find those core parameters which make the reactor feasible in terms of reactor physics. Since one of the main aim of ALLEGRO reactor is to test the behavior of a new type of carbide fuel under neutron irradiation, the dpa for SiC was examined as well for different core designs. Values of dpa per year reduce by the increase of fuel amount while the total thermal power is kept constant, which increases the irradiation time needed to reach the target value (75 dpa). Several different core configurations were investigated throughout the examination to find the optimal design. However, further thermal-hydraulic and safety analysis are needed to find a core design which is equally feasible from reactor physics and a thermal-hydraulics point of view.