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Development of measuring systems for the target of the European spallation source (ESS)

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The target of the European spallation source (ESS) consists of a rotating wheel, divided up into 36 cassettes containing tungsten. The wheel is flanged to a 6m long shaft. Primarily the rotation speed and the position of the target wheel are defined and measured by the drive unit at the top of the shaft. However there are degrees of freedom which cannot be measured by the drive unit e.g. thermal expansion and tilting of the wheel itself. Also the temperature can be measured only indirectly by measuring the in- and outlet temperature of the cooling fluid. The target monitoring plug (TMP) is a component to measure the x,y,z position, the tilting, the thermal expansion and the temperature of the target wheel. It contains different measurement techniques to measure the absolute position of the target wheel and the shaft relative to the spallation center. Furthermore the temperature of the cooling fluid of each individual cassette of the rotating target wheel and the temperature of outer edge of the wheel are measured. Four chromatic confocal distance measurement systems register the angle of the shaft and its relative xy-position. The z position of the target is determined by a laser distance measurement based on a phase comparison method. One pyrometer determines the temperature of the cooling fluid based on the amount of the thermal radiation emitted by the inner surface of so called moving cups which extend into the cassettes. The second pyrometer measures the thermal radiation emitted by the edge of the wheel and calculates its temperature. The TMP itself, our solutions to avoid electronic components inside the vacuum vessel and mounting all optical components in safe distances to radiation sources with no direct streaming path are presented as well as the first experimental test results.

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