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P3.020 A new tungsten wire calorimeter for the negative ion source testbed BATMAN-Upgrade

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Within the framework of the ion source development for the ITER and DEMO Neutral Beam Injection (NBI) systems, IPP Garching has recently upgraded the radiofrequency-driven negative ion source testbed BATMAN. One of the requirements for the ITER NBI system is to produce a beam power density homogeneity above 90% over its large extraction area of about 0.2 m2. This requirement is going to be addressed, on a smaller scale, in BATMAN-Upgrade with ITER like beam optics. The testbed is equipped with several beam diagnostic tools to measure beam power, uniformity and divergence. A new tungsten wire calorimeter (TWC) has recently been developed to characterize the beam quantitatively and with an improved spatial and temporal resolution. The TWC consists of an array of thin tungsten wires with a diameter of 0.3 mm, placed in the beam path. The wires are heated up by the powerful beam up to 3000 ℃ and emit visible light, which is observed by an optical camera. While the existing TWC provides a qualitative impression of beam power characteristics and are placed at a distance of almost 2 m from the beam extraction system, the new TWC is positioned only 20 cm downstream of the extraction system and should allow observing the single beamlets for the first time in this testbed. In order to determine the correlation between the pixel intensity measured by the camera and the power density impinging on the wires, one wire is equipped with an ohmic heating system which will allow heating up the wire with a known power, thus enabling calibration of the diagnostic tool.
In this paper the design, including FEM simulations of the wire thermal behavior, manufacturing and installation of the new TWC inside the BATMAN Upgrade testbed is described. First results are also presented.

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