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**Report on the Doctoral Thesis by Ing. Ondřej Ficker entitled 'Experimental Studies of Runaway Electrons in Tokamaks'**

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Dear Doc. Ing. Čuba,

The manuscript presented by Ondřej Ficker describes experimental studies on Runaway Electrons (REs) in tokamaks. REs are a key concern for the development of the tokamak path towards electricity production since 1) their generation during disruptions in large tokamaks appears difficult if not impossible to avoid, and 2) REs could cause substantial damage to the plasma facing components via extremely large heat loads. In his thesis, Mr. Ficker describes the study of a large number of aspects of RE physics, primarily in the COMPASS tokamak but also notably in the JET tokamak.

Below I address one by one the points mentioned in the instructions given to me for this report.

How much the topic of the thesis is up to date

REs are presently a 'hot topic' in the tokamak community due to the concern they represent for future large tokamaks, in particular ITER. Mr. Ficker's studies are clearly addressing questions of present interest to the community, such as the generation of REs during plasma startup and

disruptions, the deconfinement of REs by magnetohydrodynamic activity and, last but not least, the effect of injecting material, in particular deuterium, into a disruption-generated RE beam. The latter injection is at the heart of a promising scheme to mitigate RE beam impacts, discovered a few years ago on the DIII-D and JET tokamaks, and which is the object of very active research.

#### What are the methods applied in the thesis

Mr. Ficker applied a broad range of methods to study REs. First of all, he explored the operational parameter space, in particular in COMPASS, in order to identify regions of interest and develop relevant experimental scenarios to study both startup REs disruption-generated REs, as described in Chapter 4 of his manuscript. He then analysed and compared several pulses (typically scanning relevant parameters) to draw information and trends on RE physics, as described in Chapters 5 and 7. In order to perform these studies, Mr. Ficker exploited a large number of diagnostics. For several of them, he developed specific signal processing and data analysis methods, as described in Chapter 3 but also in Chapter 6, which presents an original method to evaluate the energy of the REs based on magnetic field measurements.

#### Whether the goal of the thesis has been achieved

Yes, the goals of the thesis, as formulated on page 1 of the manuscript, have been fully achieved.

#### What is the scientific value of the results

I would say that the scientific value of Mr. Ficker's thesis is twofold. First, it substantially contributes to the world-wide set of observations on REs in tokamaks, providing key material to test models. It can for example be imagined that Mr. Ficker's thesis be used as a basis to identify specific pulses for detailed modelling using codes like DREAM or JOREK. Second, Mr. Ficker's thesis is valuable for anyone interested in experimental techniques and diagnostics used to study REs. One particularly remarkable aspect is the original method proposed by Mr. Ficker to evaluate the energy of the REs based on magnetic field measurements.

#### What is your overall evaluation of the thesis

Mr. Ficker's thesis is of high quality and contains a very substantial amount of useful work. Without hesitation, I recommend Mr. Ficker's thesis for presentation and defense.

Best regards

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