**Improving the time resolution of Thomson scattering via machine learning on reflectometry data**

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When measuring the electron density profile at JET, the preferred diagnostic is usually HRTS (high resolution Thomson scattering) [1], which provides good accuracy in terms of radial position (on the order of 1 cm) but has a low sampling rate (20 Hz) [2]. This makes it infeasible to analyze pedestal dynamics in detail, especially for phenomena such as ELMs (edge localized modes), which occur on faster time scales, and would require at least a sampling rate in the range of 100 Hz to 1 kHz to capture the transient processes associated with ELM crashes. On the other hand, the reflectometry system at JET [3] provides a high temporal resolution (on the order of 1-10 kHz) but is not as accurate in terms of the radial position of the density measurements, which led to the development of new reconstruction methods [4]. In this work, we develop a virtual diagnostic which combines the spatial accuracy of HRTS with the temporal resolution of the reflectometer diagnostic. For this purpose, we train a neural network to predict HRTS-like profiles from reflectometry data. Once trained, we observe that the model agrees closely with HRTS, and is able to overcome some problems that occur in reflectometry-based reconstructions. In addition, the model estimates the density values at the same positions as HRTS, but with a much higher time resolution, which enables the analysis and visualization of ELM dynamics throughout a pulse. We illustrate the results on the pulse that achieved the current energy record in the recent D-T (deuterium-tritium) campaign at JET.

**References**

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