

Deep Learning for Spectrogram Analysis of Reflectometry Data

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FSD Science Coordination Meeting

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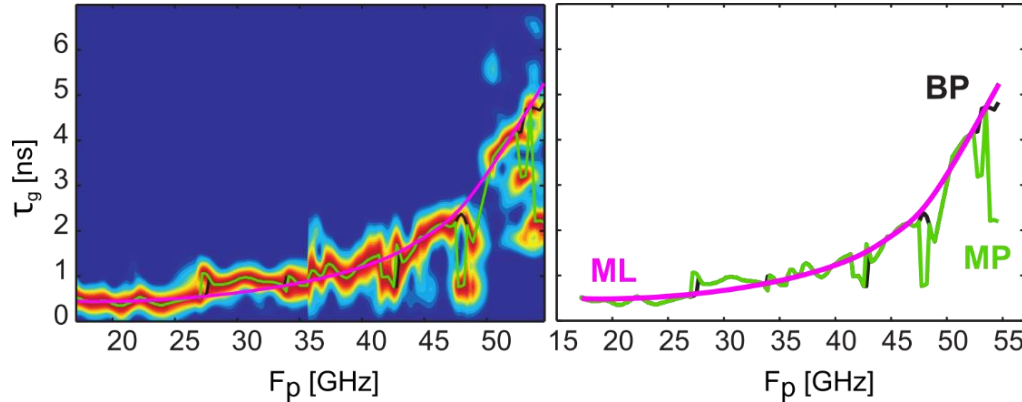
Improve capabilities of conventional **reflectometry diagnostics**



Automatically extracting physically **relevant features** from time-frequency representations (spectrograms) of reflectometry signals

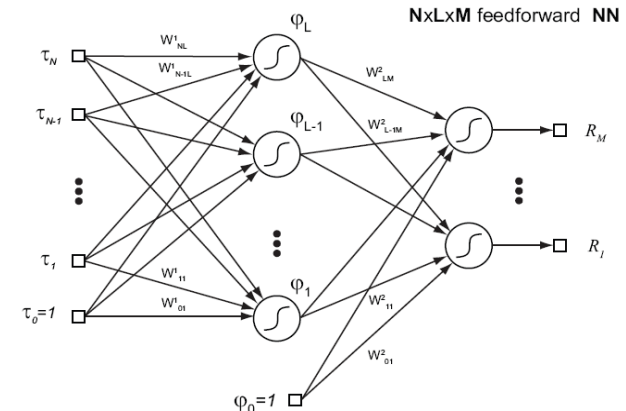


n_e - electron density profile and fluctuations



- O-mode FMCW data for n_e profile reconstruction
- Replace maximum peak (MP) or best-path (BP) algorithms using **Machine Learning (ML)** models
- Image segmentation task \rightarrow Convolutional Neural Networks

- **Full-wave Simulations:** combine experimental data with superimposed turbulence models into REFMUL code to obtain synthetic FMCW training data replicating AUG system;
- **Tool and Database Development:** tools to access AUG and REFMUL data, create data structures, process data and build database;
- **CNN Modelling and Validation:** test different architectures of CNN models (e.g. region-based, fully convolutional) using the Tensorflow/Keras framework;



Timeline



| Task Nº | Task Denomination | Participant responsible for task | Acronyms of partners involved in task | 2024 | | | | | | | | | 2025 | | | | | | | | | | | | | | |
|---------|---------------------------------|----------------------------------|---------------------------------------|----------------------------|---|---|----|---|----|----|----|----|-----------------|----|----|----|----|----|----|-------|----|----|----|--|--|--|--|
| | | | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | | |
| 1 | Project Management | JV | JV, JS | [Light blue shaded cells] | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Communication and Dissemination | JV | JV, JS, FdS, XX | [Light blue shaded cells] | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Full-wave Simulations | FdS | FdS, JV | [Medium blue shaded cells] | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Tool and Database Development | JS | JS, JV, XX | [Dark blue shaded cells] | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | CNN Modeling and validation | JS | JS, JV, XX | [Purple shaded cells] | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | D1 | | | D2 | | | | | | D4 | | | | D5 | | | D6,D7 | | | | | | | |
| | | | | D3/Progress Report | | | | | | | | | D8/Final Report | | | | | | | | | | | | | | |