Tor Vergata proposal

By: M.Gelfusa, R.Rossi, E.Peluso, L.Spolladore A.Murari,

In collaboration with T.Craciunescu, J.Vega and their teams

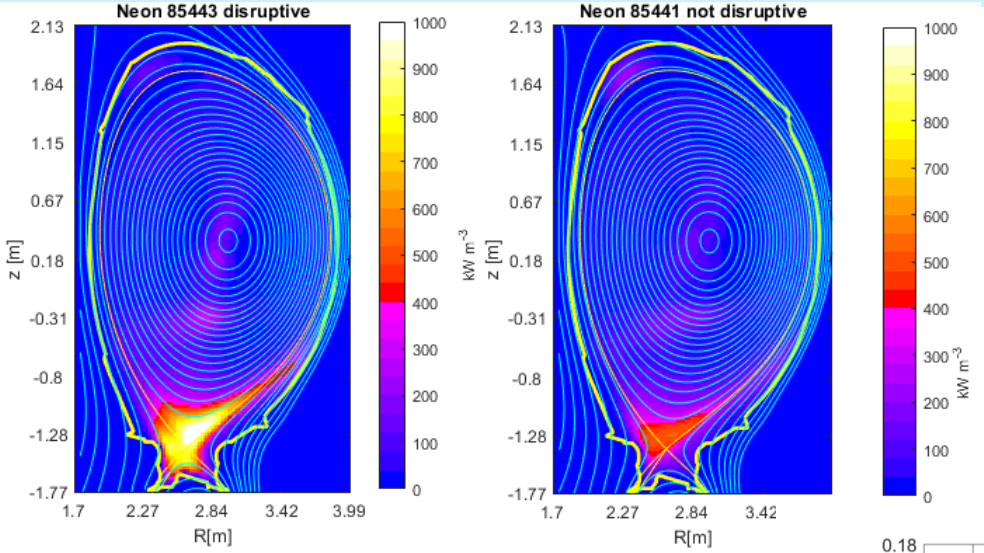
This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 633053.
The views and opinions expressed herein do not necessarily reflect those of the European Commission.

Overview

- Traditionally we are interested in radiation measurements (tomography, detachment etc.) for scenario development and disruptions prediction.
- There is a good synergy because in metallic devices most disruptions are due to some form of radiation collapse.
- We are also constantly collaborating with T. Craciunescu and J. Vega in these fields and also the proposed activities for the WPSA are meant to be carried out in close contact with them.

Maximum Likelihood Tomography

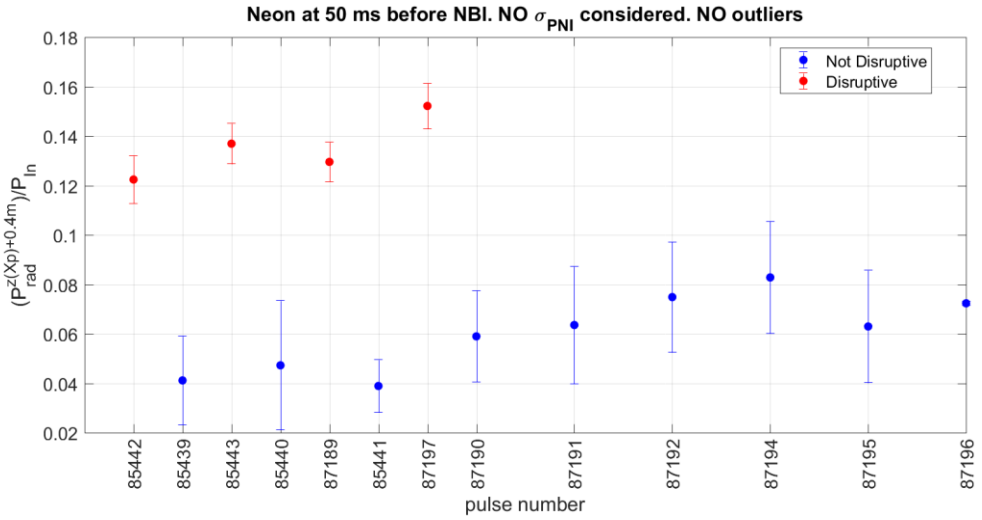
- The ML inversion provides a principled and computationally manageable method to calculate the confidence intervals in the reconstructions. It also resolves well concentrated emissions.



Discharges with N and Neon seeding present a very similar phenomenology.

The disruption is preceded by the formation of a MARFE above the X point.

In the case of Kr seeding, a crescent shape region in the outer equatorial plane is the critical part.



Open-World Machine Learning

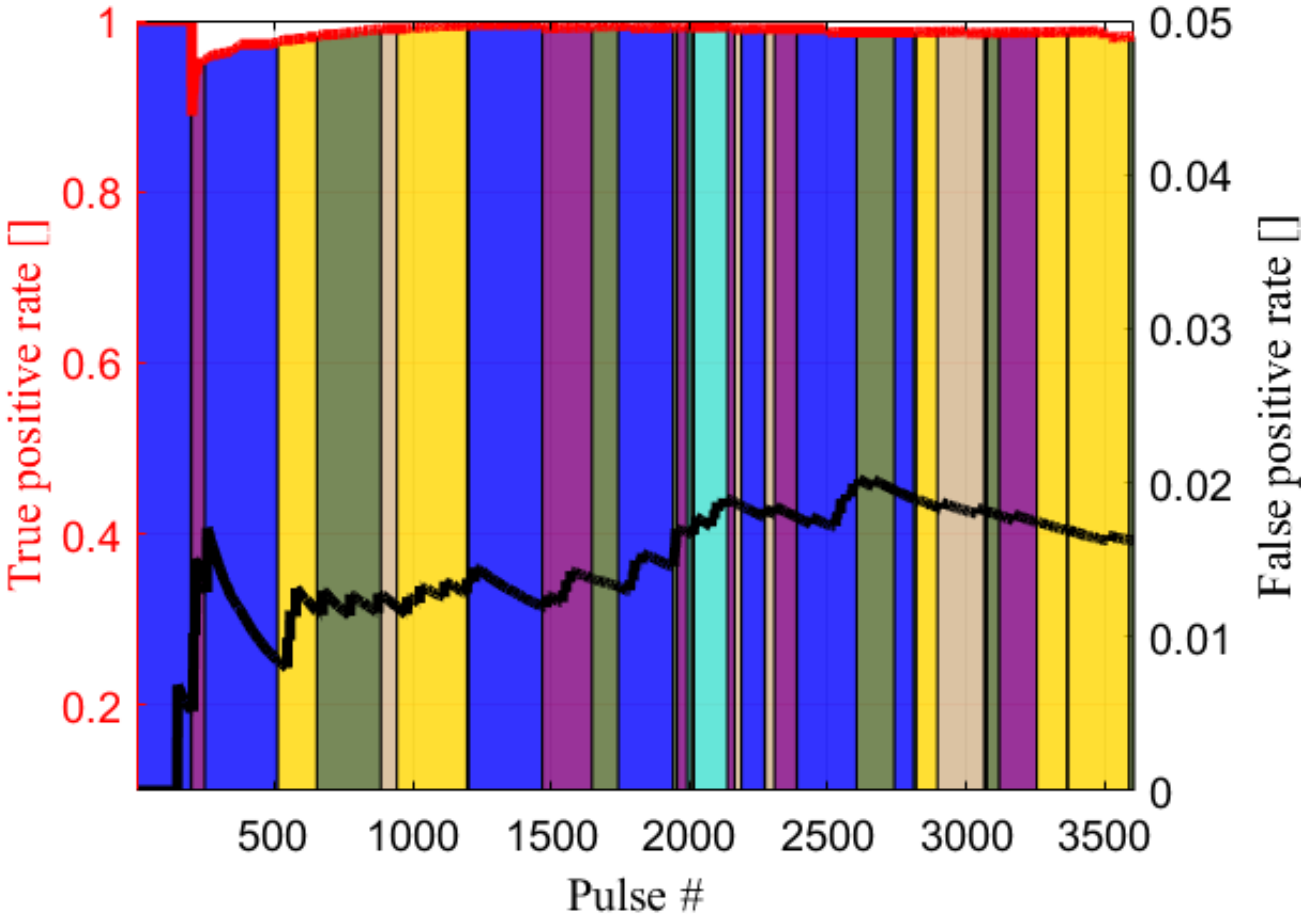
Motivations *for open-world learning:*

- Plasmas are not necessarily stationary physical objects (*adaptive learning*).
- It would be advantageous to transfer knowledge from one problem to another (*transfer learning*).

- In Tokamaks there are two main historical effects which violate the stationarity assumption: a) Evolution of the experimental programme between discharges b) Memory effects during shots.
- Transfer Learning could be very important at the beginning of operation of new devices (different disr. types)

Results for mitigation on JET

	Good	Missed	Early	Tardy	All D	False ND	False Alarms	All ND
Counts	576	10	1	0	587	47	48	3014
Percentage	98.13%	1.70%	0.17%	0.00%		1.56%	1.59%	

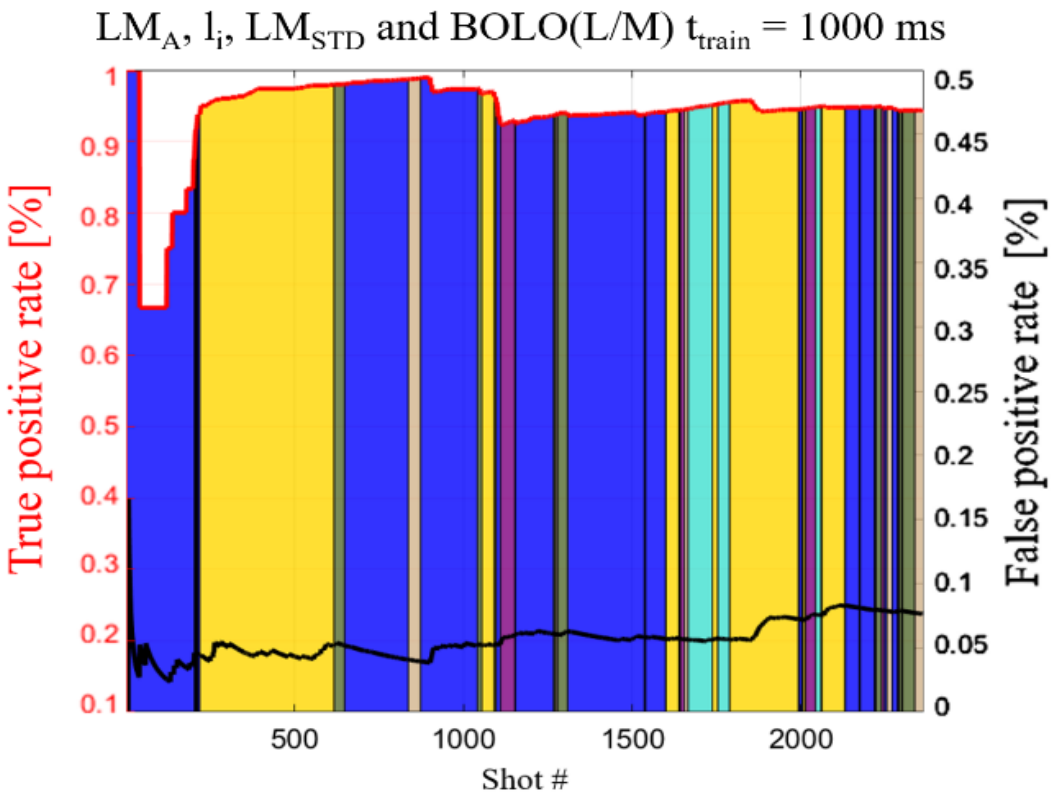


Implementation from scratch.

Success rate always above 90% and false alarms never much above 2%.

Statistics conservative.

Transfer from AUG to JET for prevention



Different colours indicate different decision functions. LM_A locked mode amplitude normalised, LM_{STD} locked mode std deviation, li internal inductance, BOLO profile indicator.

JET	Success rate	Missed	Early	Tardy	False	Mean [ms]
LM_A, LM_{STD}, li ,Bolo	94.17% (404/429)	1.63% (7/429)	3.73% (16/429)	0.47% (2/429)	7.69% (150/1951)	489.7

Proposal

Proposal medium term:

1. Survey the most important radiation patterns leading to disruptions
2. Compare the emissions in JET with C and ILW wall
3. On the basis of the previous analysis, submit a proposal for the implementation of ML tomography and disruption predictors.

Proposal for this year:

1. In the short term, we intend to support J. Vega's proposal by helping with the classification of the disruptions due to radiation collapse, including a comparison of different adaptive strategies.

Many Thanks for Your Attention!

QUESTIONS?