AI-Powered Analysis: Predicting Process Success with Deep Learning

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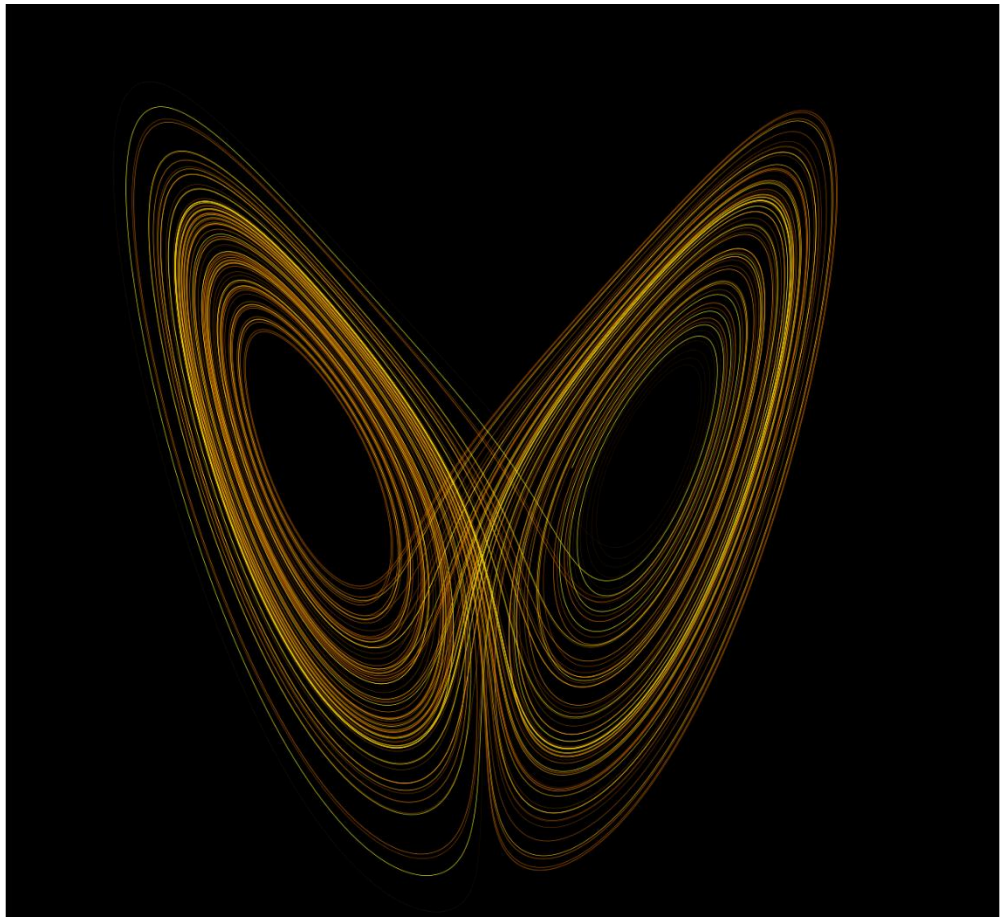
Vacuum Systems



Analysis Tools for Vacuum Systems

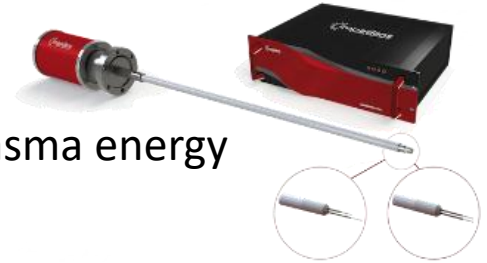
RF analysers

Plasma emission monitoring

Residual gas analysers

Power

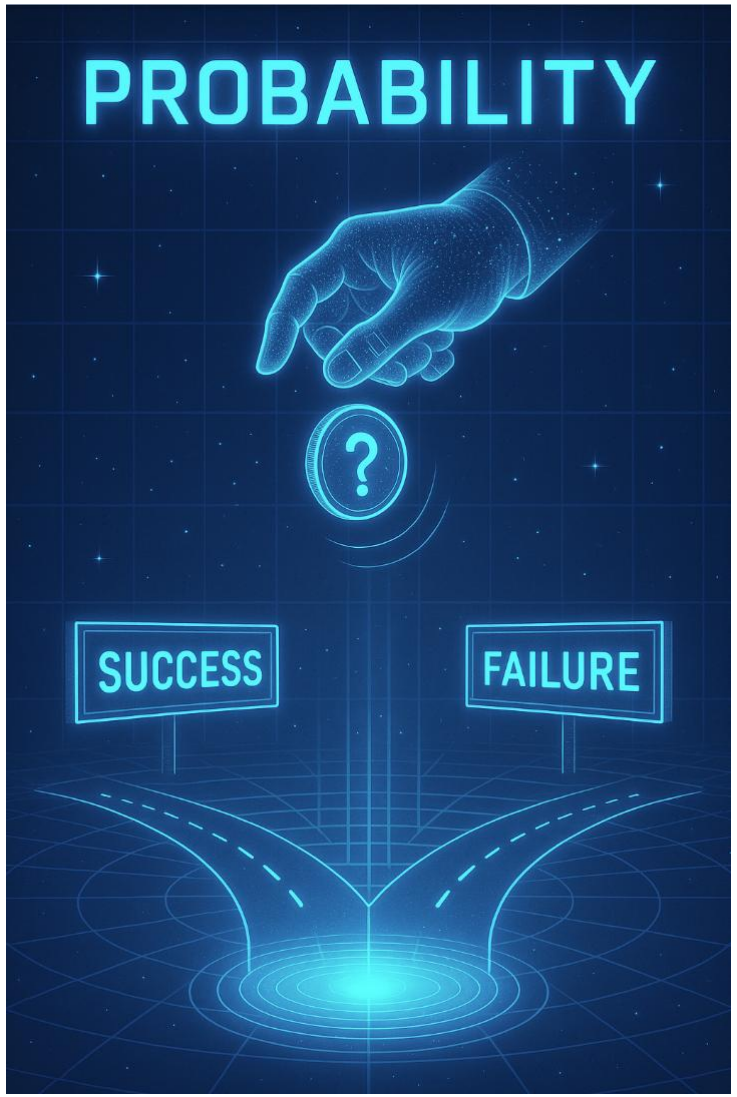
Temperature



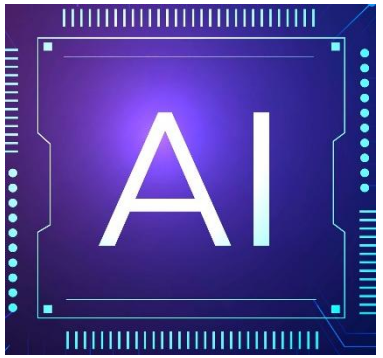
Plasma energy

What do we want to know

- Was our process successful?
- Will our process be successful?
- What causes our process to fail?



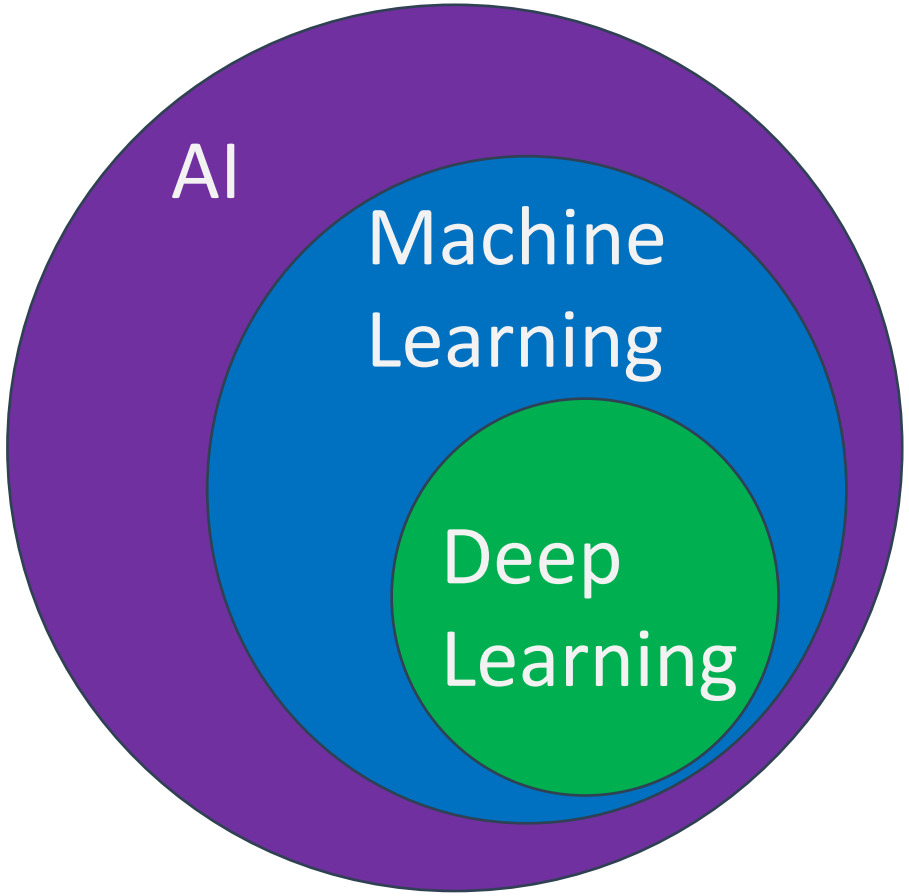
Can AI Help?

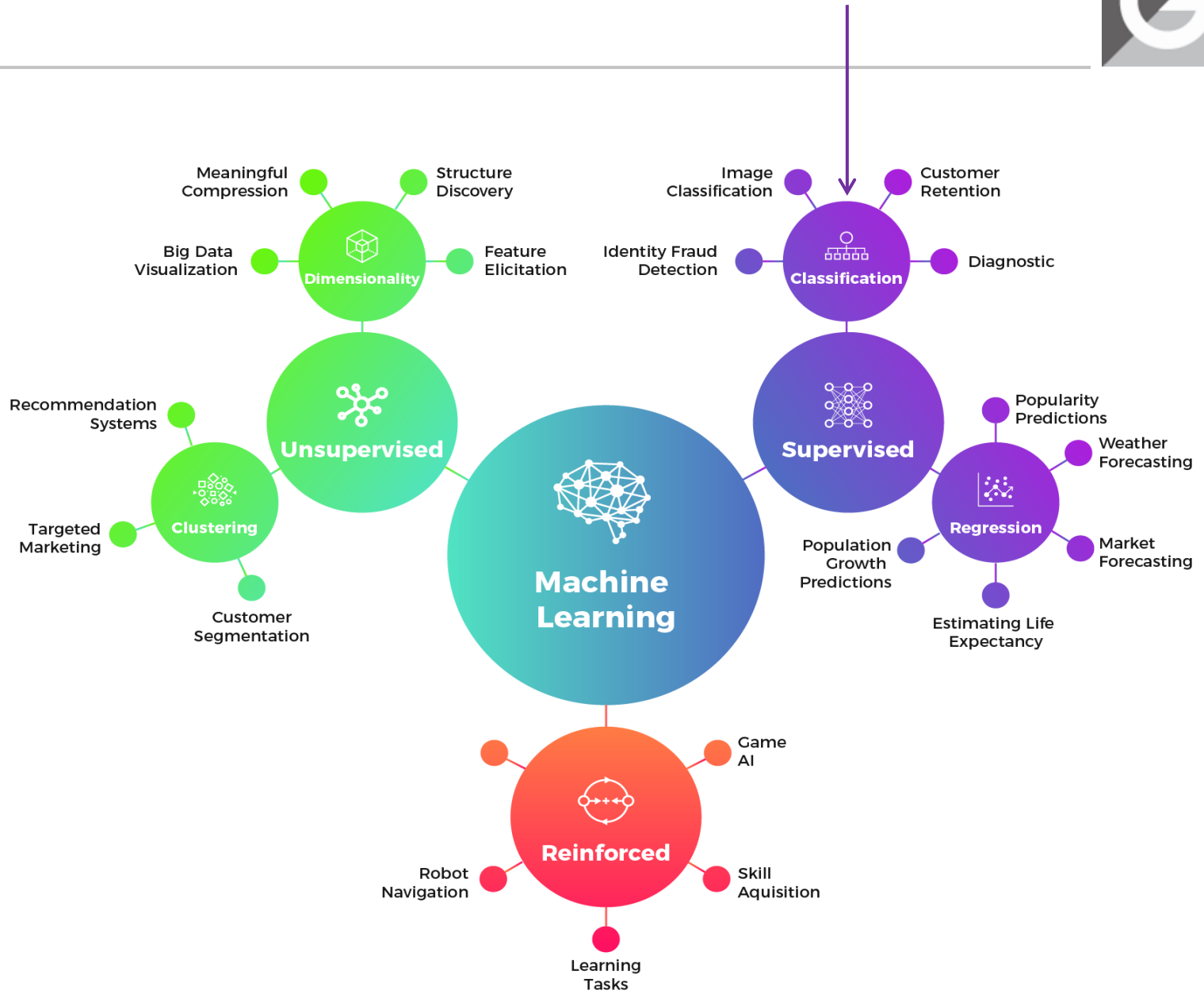


Post Process Classification?
Real-time prediction?

Difficulties with AI

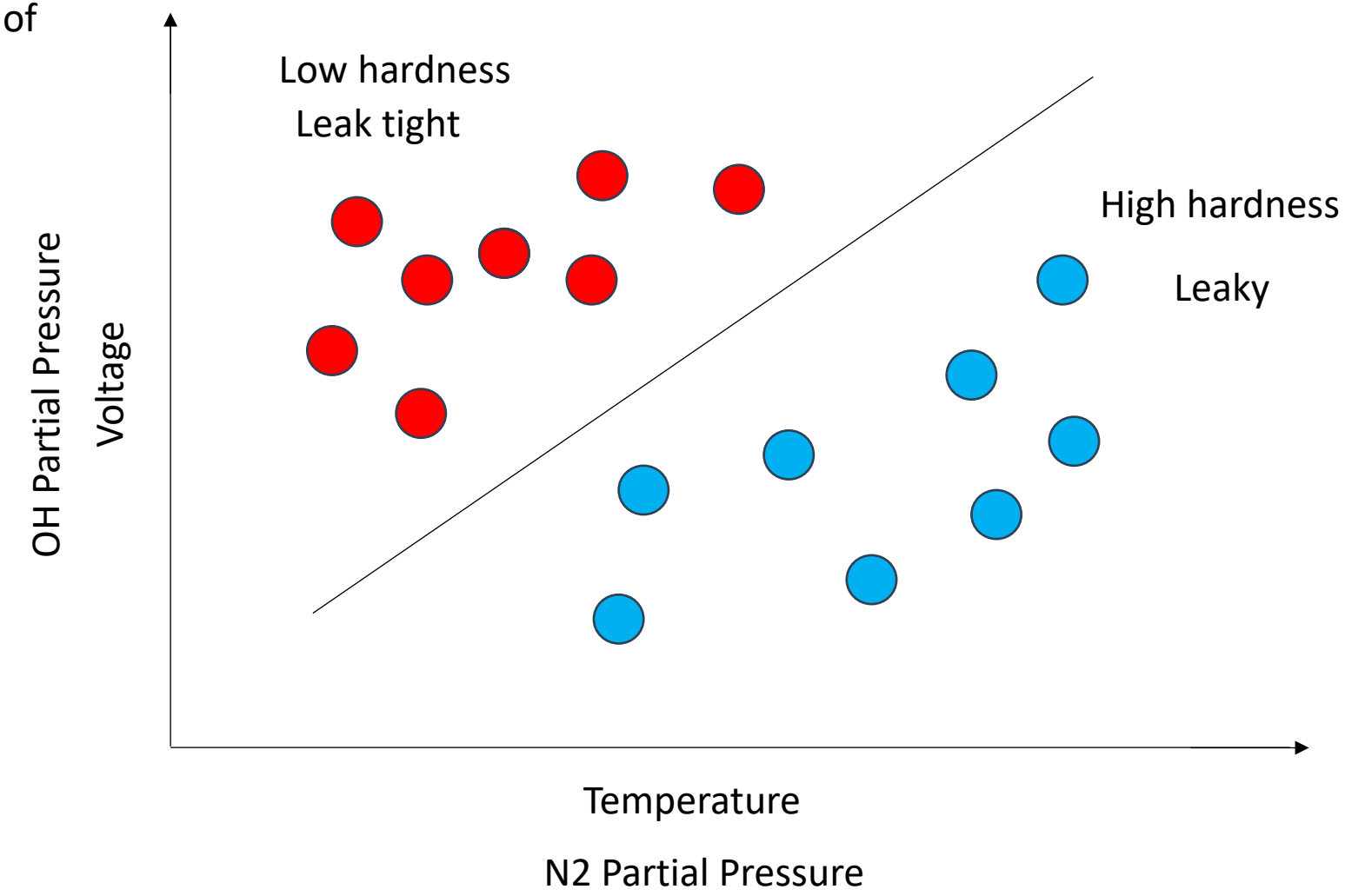
- AI is a very broad term!





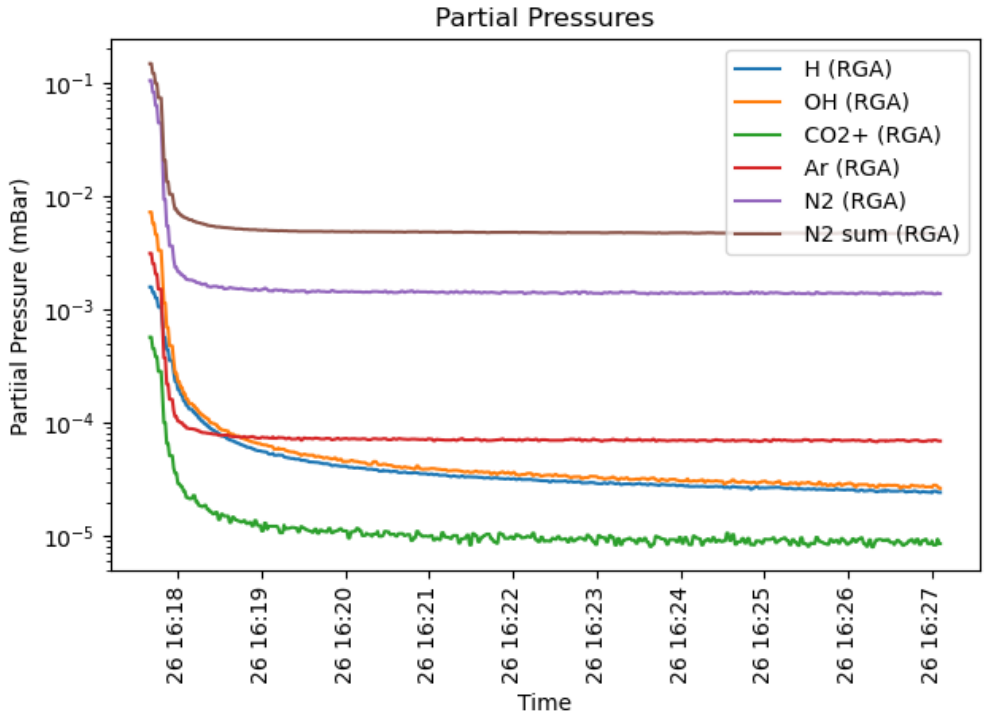
What is Supervised Classification?

- Finds line between different categories of data
- Uses this line to ‘classify’ data



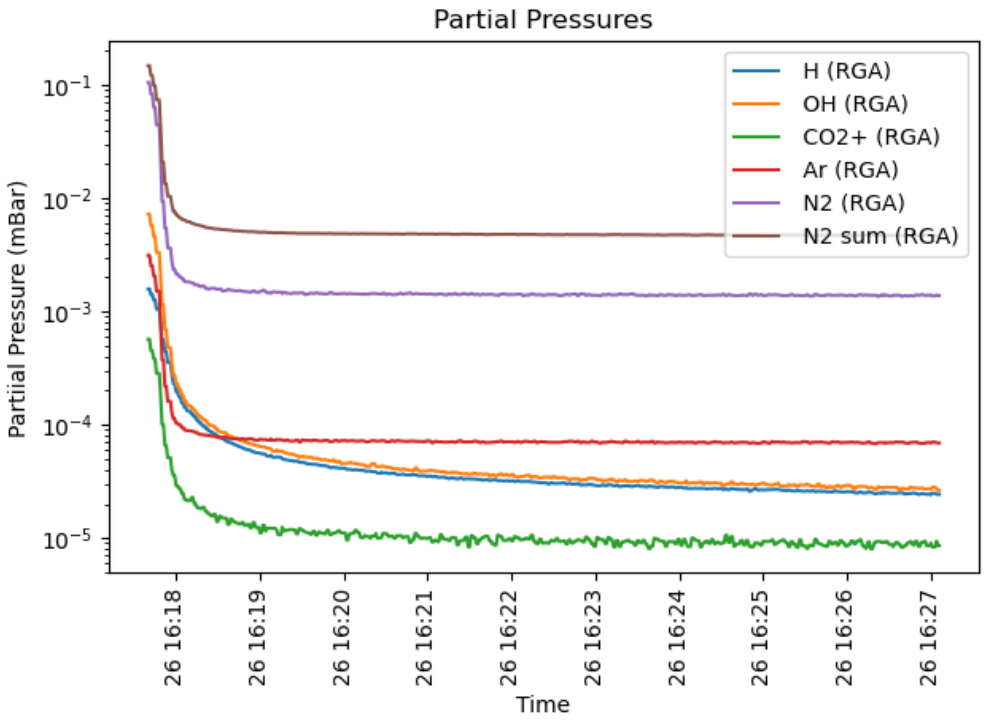
AI for Remote Plasma OES

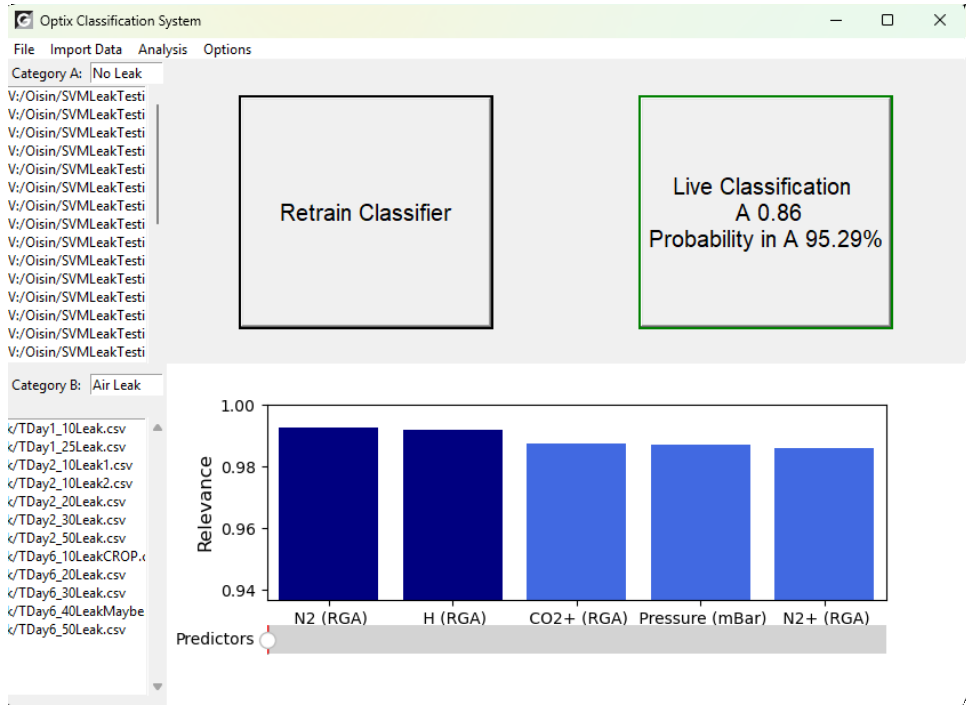
- Can we use RPOES to detect process faults (e.g. air leaks)?
- Train an AI system using multiple RPOES datasets.



AI for Residual Plasma OES

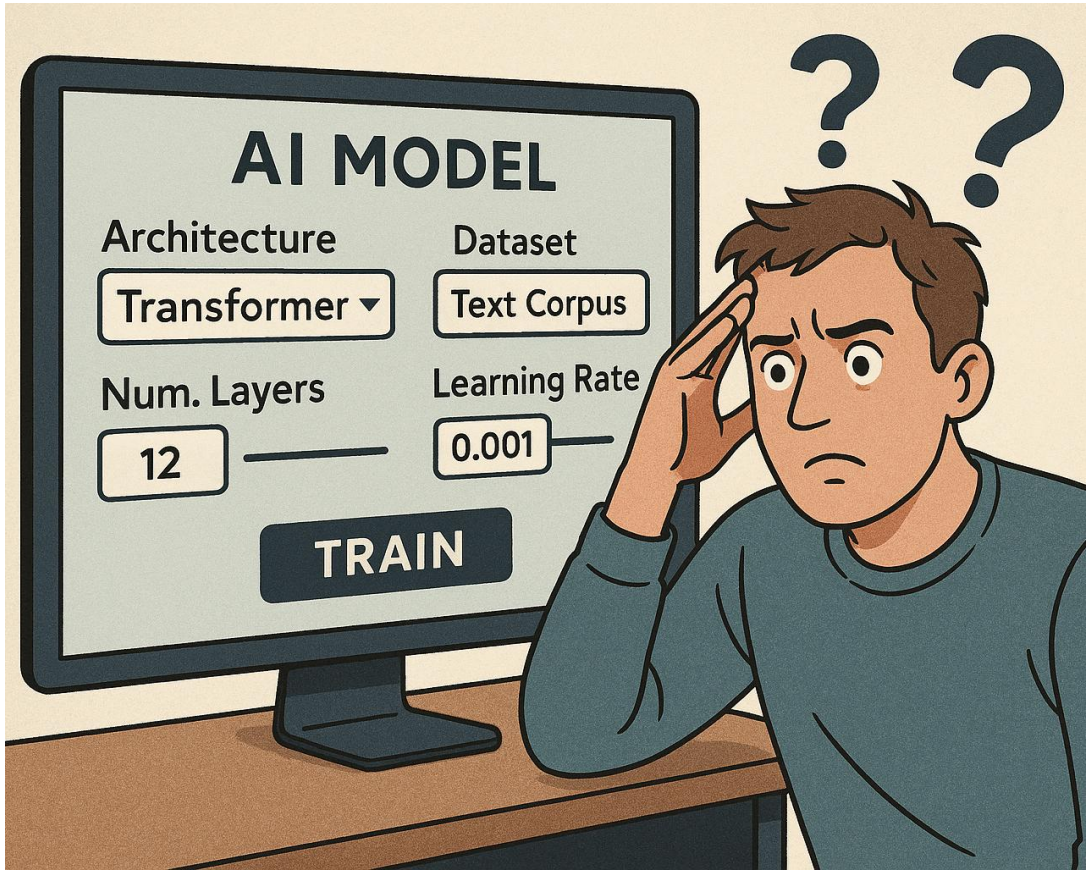
- Can we use RPOES to detect process faults (e.g. air leaks)?
- Train an AI system using multiple Optix datasets.

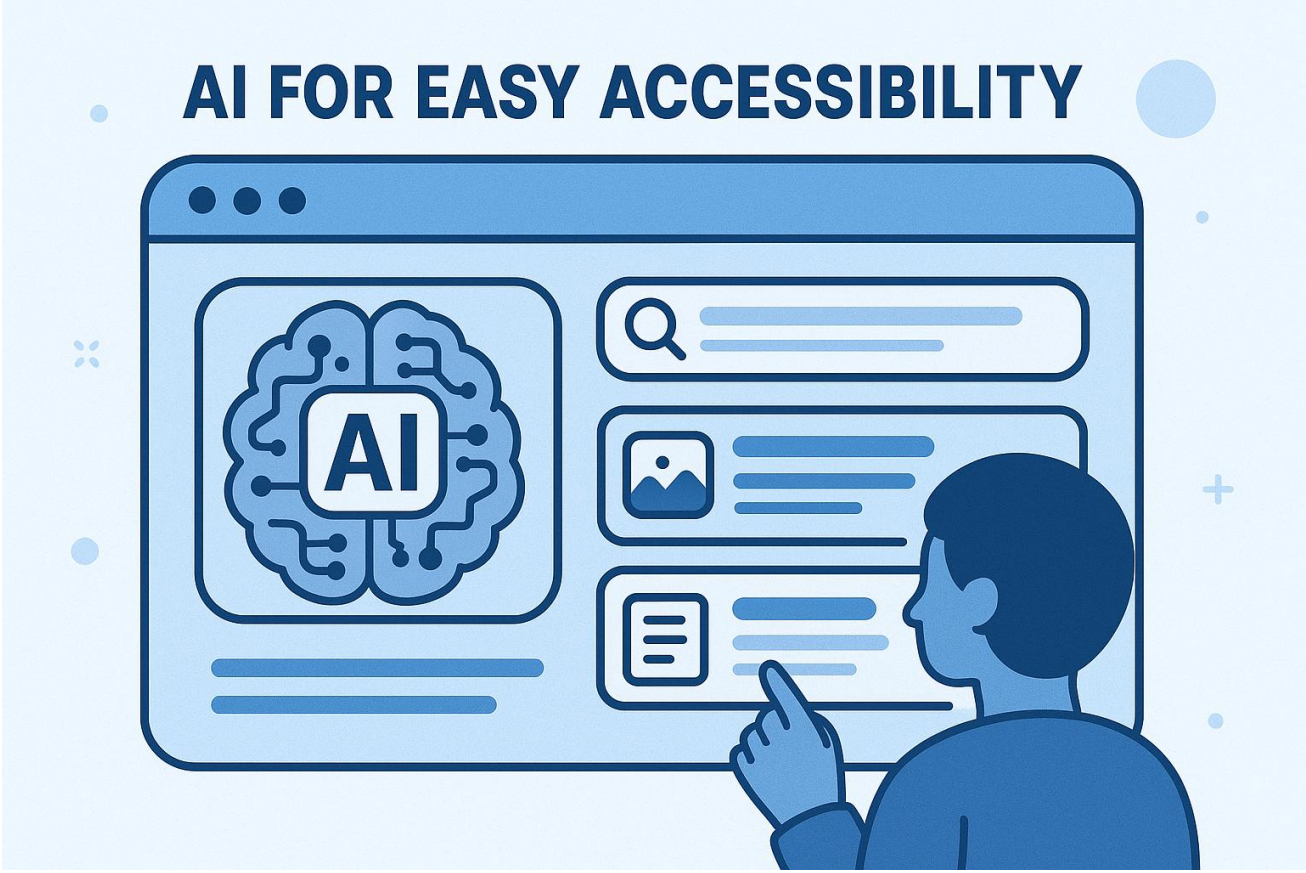




Issues With “Simple Classification”

- Off the shelf classifiers require configuration

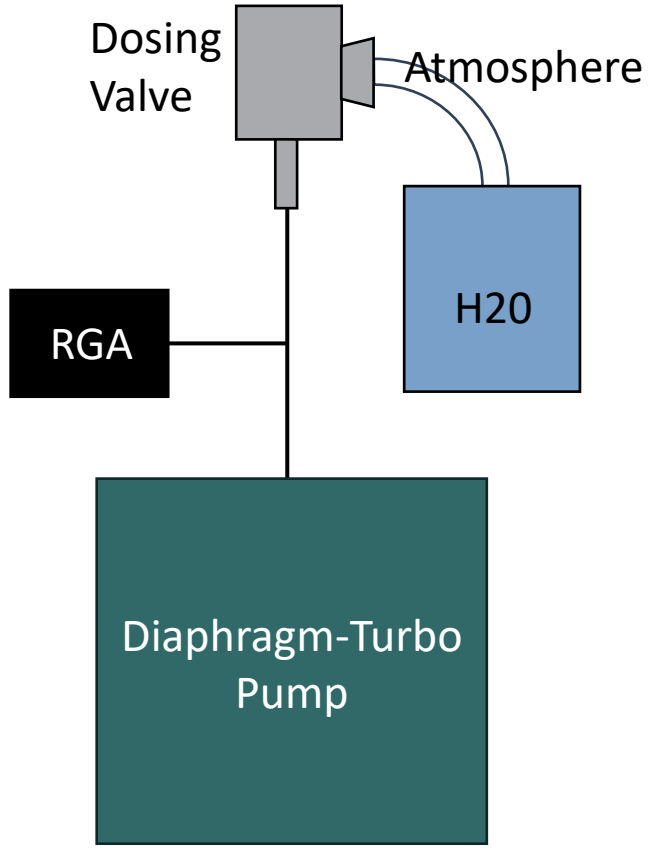




Multiclassification of Leaks

Training

- Vacuum pumpdown with dosing valve
- Valve was either connected to air or water reservoir
- 3 Classes: No Leak, Air Leak, Water Leak
- Training set of 86 samples



Test

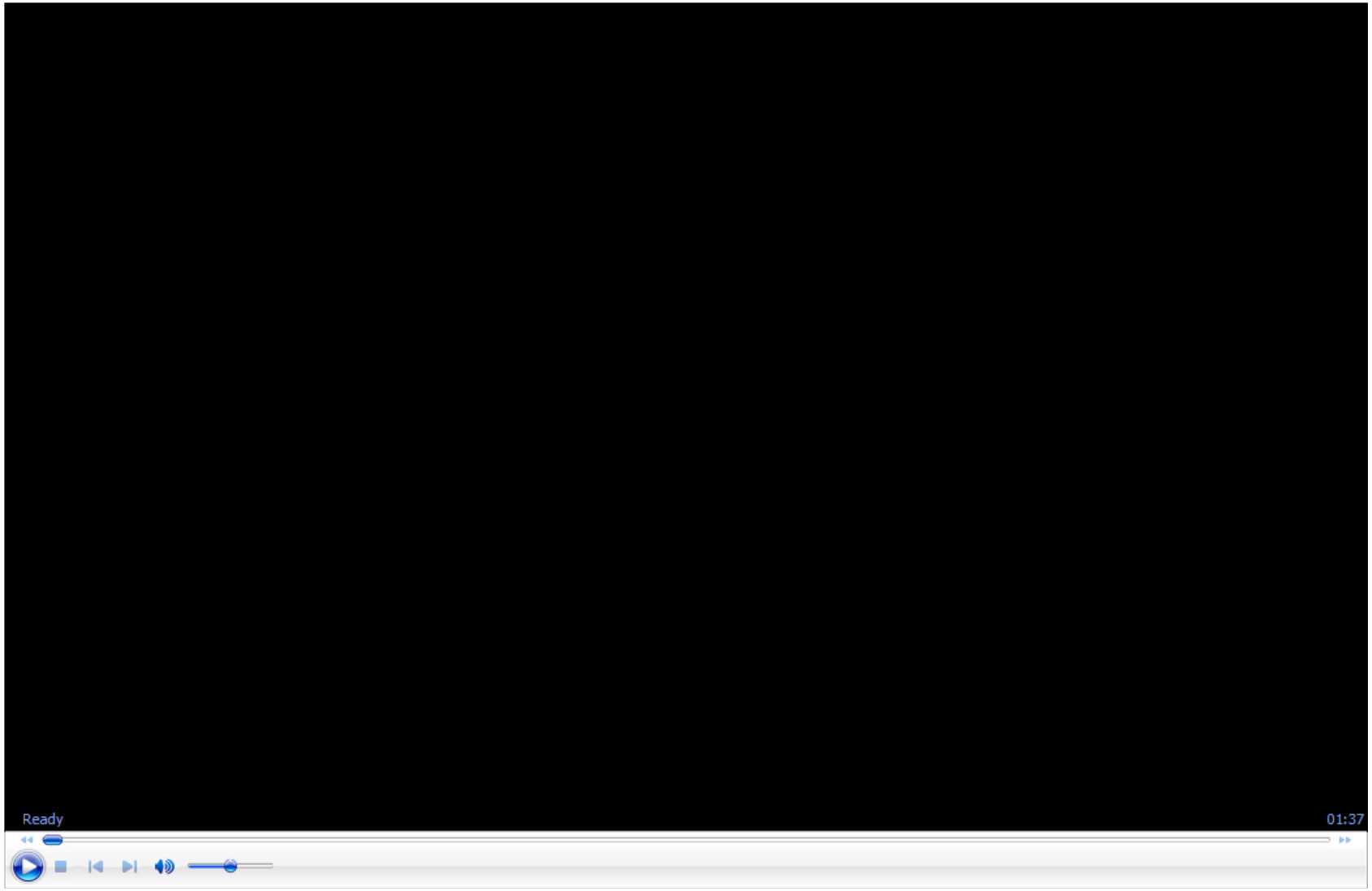
- Test Set of 51 samples

Real \ Predicted	No Leak	Air Leak	Water
No Leak	59%	12%	29%
Air Leak	12%	82%	6%
Water	0%	12%	88%

Live Tracking

- Predictive AI: Will Vacuum Process be successful?

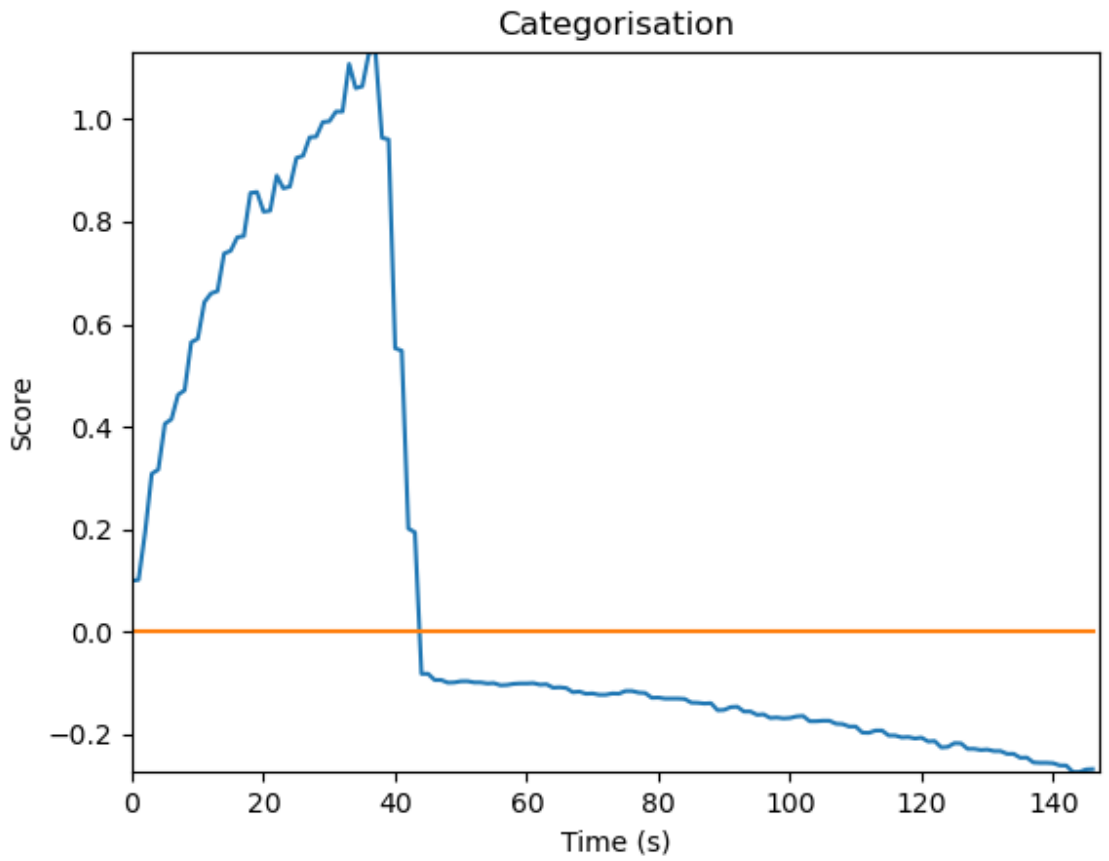
A: No Leak

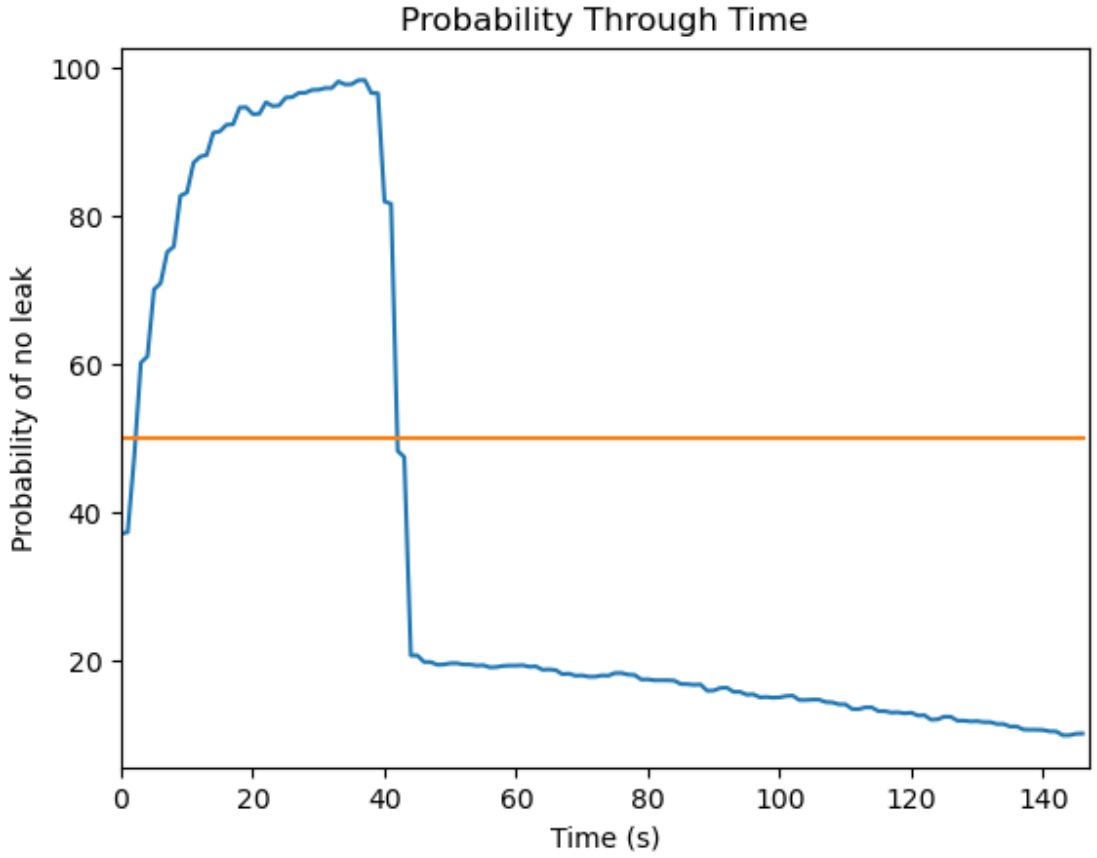


B: Air Leak

Live Tracking

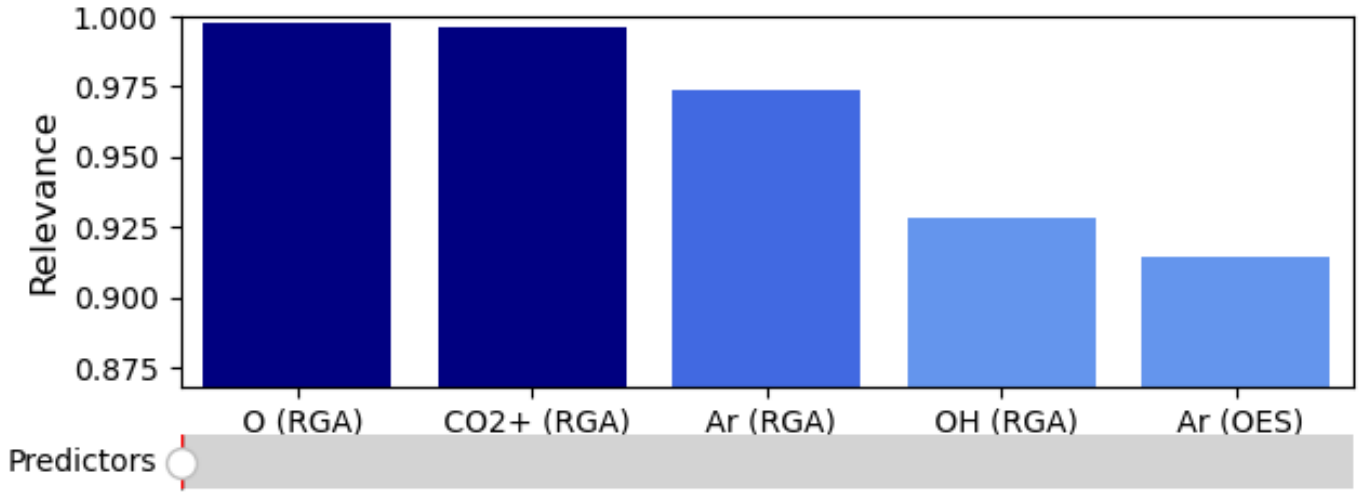
- Predictive AI: Will Vacuum Process be successful?

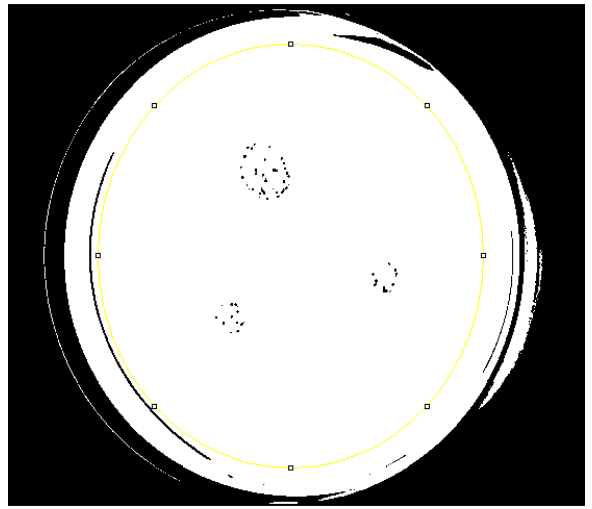




Biocidal Coating Development

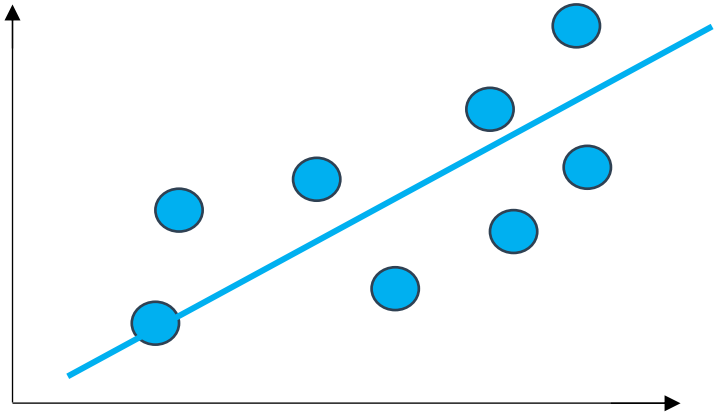
- Early-stage development of Biocidal coatings
- Can AI help with determining what vacuum conditions are important?





Future Work

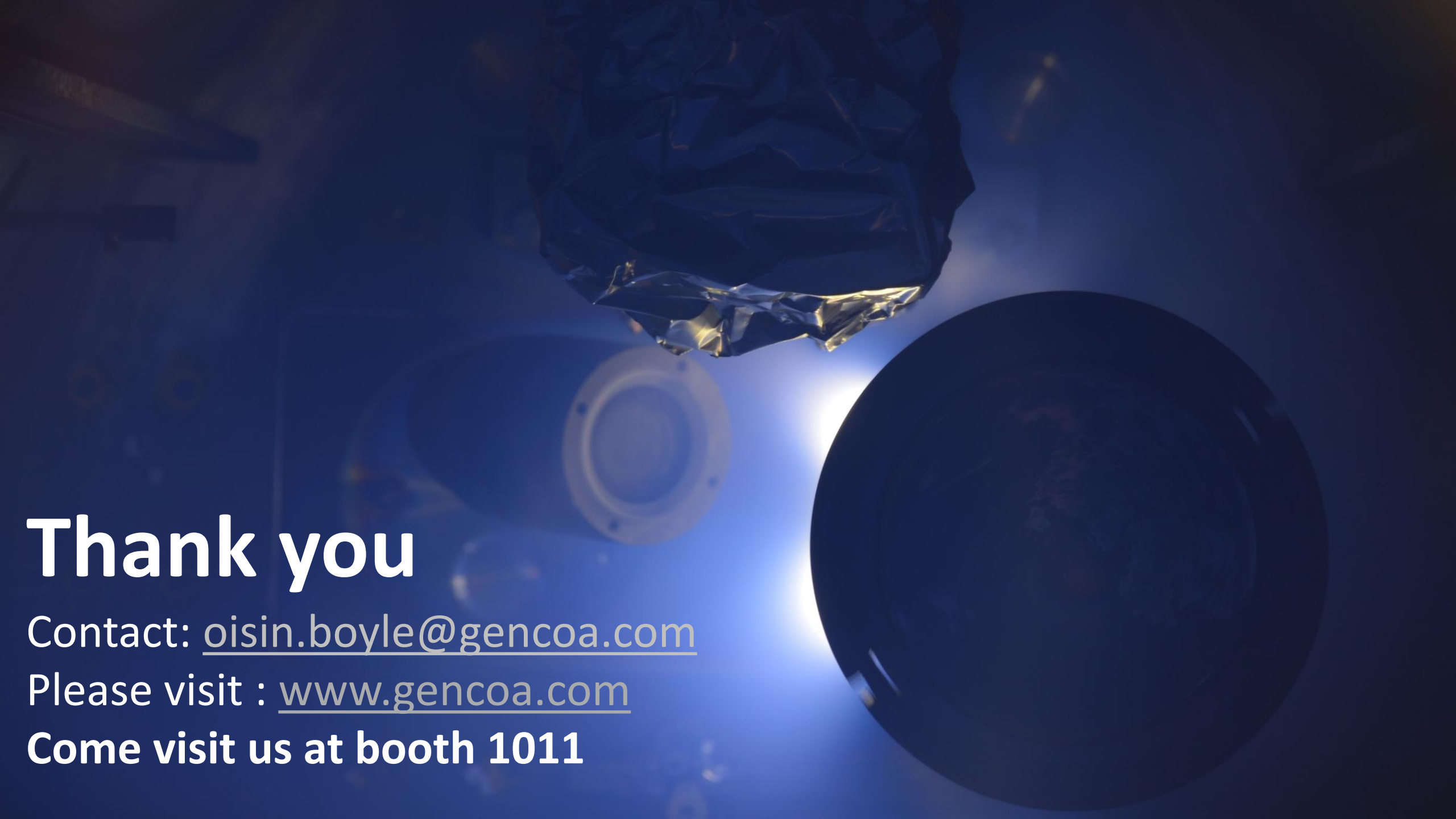
- Regression; output a score (i.e. leak rate)



- Investigation of AI for other vacuum quality issues
- Large scale material development monitoring
- Multi-sensor tests

Summary

- Vacuum systems are highly complex, with multiple measurements
- AI can be used to analyse this data
- Find relevant characteristics that lead to successful or failed processes
- Enable post-process classification and real time prediction
- Demonstration with leaky systems but can be applied more generally!



Thank you

Contact: oisin.boyle@gencoa.com

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