LEAKAGE DETECTION IN ENGINE ROOM BY IR USING MACHINE LEARNING TECHNOLOGIES

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Content

- VEBIC as a demonstrator
- Target: 750 hours of unmanned engine room operation
- First leakage test set-up
- Second leakage test set-up
- Footage analysis with machine learning
- Results & Conclusion

VEBIC as a demonstrator

ENGINE LABORATORY

- Medium speed diesel engine
- Measuring equipment
- Alternators
- Frequency converters
- Transformers
- Data acquisition systems

FUEL LABORATORY

- Unique combination of fuel and engine research
- Fuel and lubricant studies
- Regional co-operation with other chemistry and environmental laboratories

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VEBIC as a demonstrator

- FREESI Laboratory
  - Smart and flexible energy solutions

- VEBIC platform used as proof-of-concept for the EDGE-project
- Use what we learn in a real life installation

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Target: 750 hours of unmanned engine operation

A dive into the 4L20 maintenance schedule

- < 50 hours, but up to 500 hours
- Eg. Checking pressure over fuel oil filter

- Safety

Fire hazard in the engine room

- Fuel oil + heated surface
- Fuel oil + exhaust gas

- Early detection!

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Planning

- FLIR AX8 thermal & visual camera as machine vision
- Footage with and without artificial exhaust gas leakage
- Can AI learn difference between these footages and classify them correctly?

FLIR AX8

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First leakage test set-up

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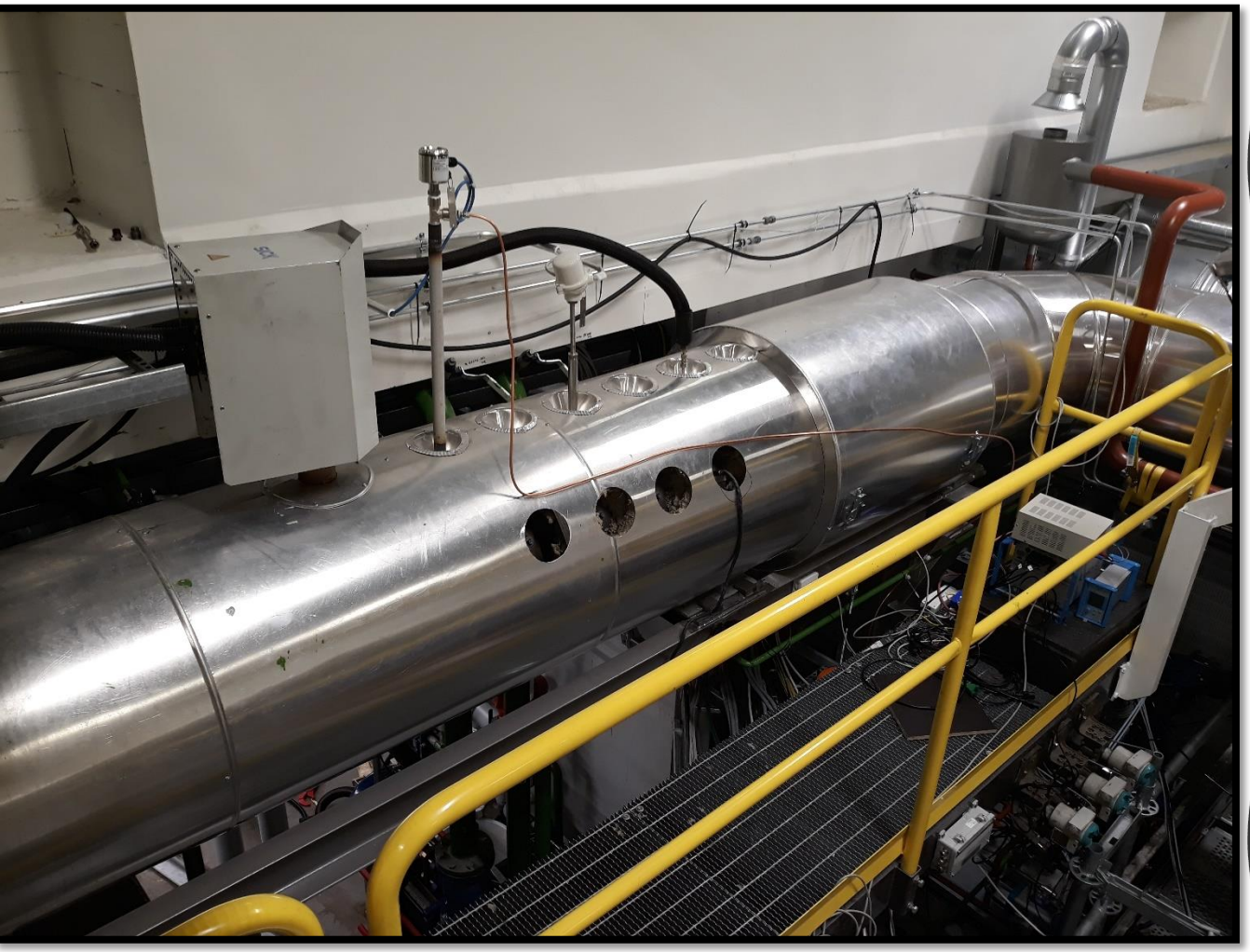

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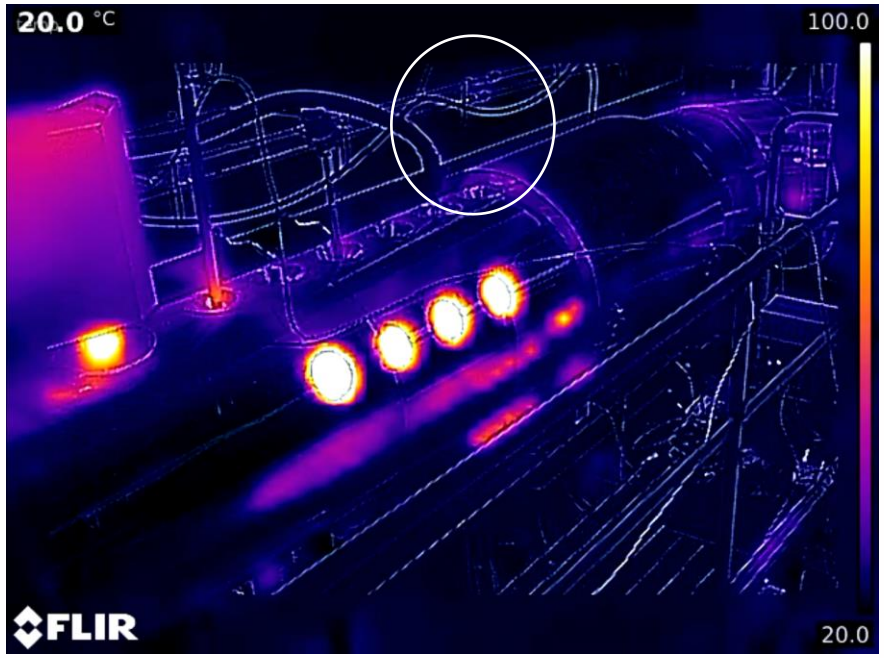
Set-up 1 thermal profile

NO LEAKAGE



LEAKAGE

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Second leakage test set-up

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Open valve

To pressure sensor

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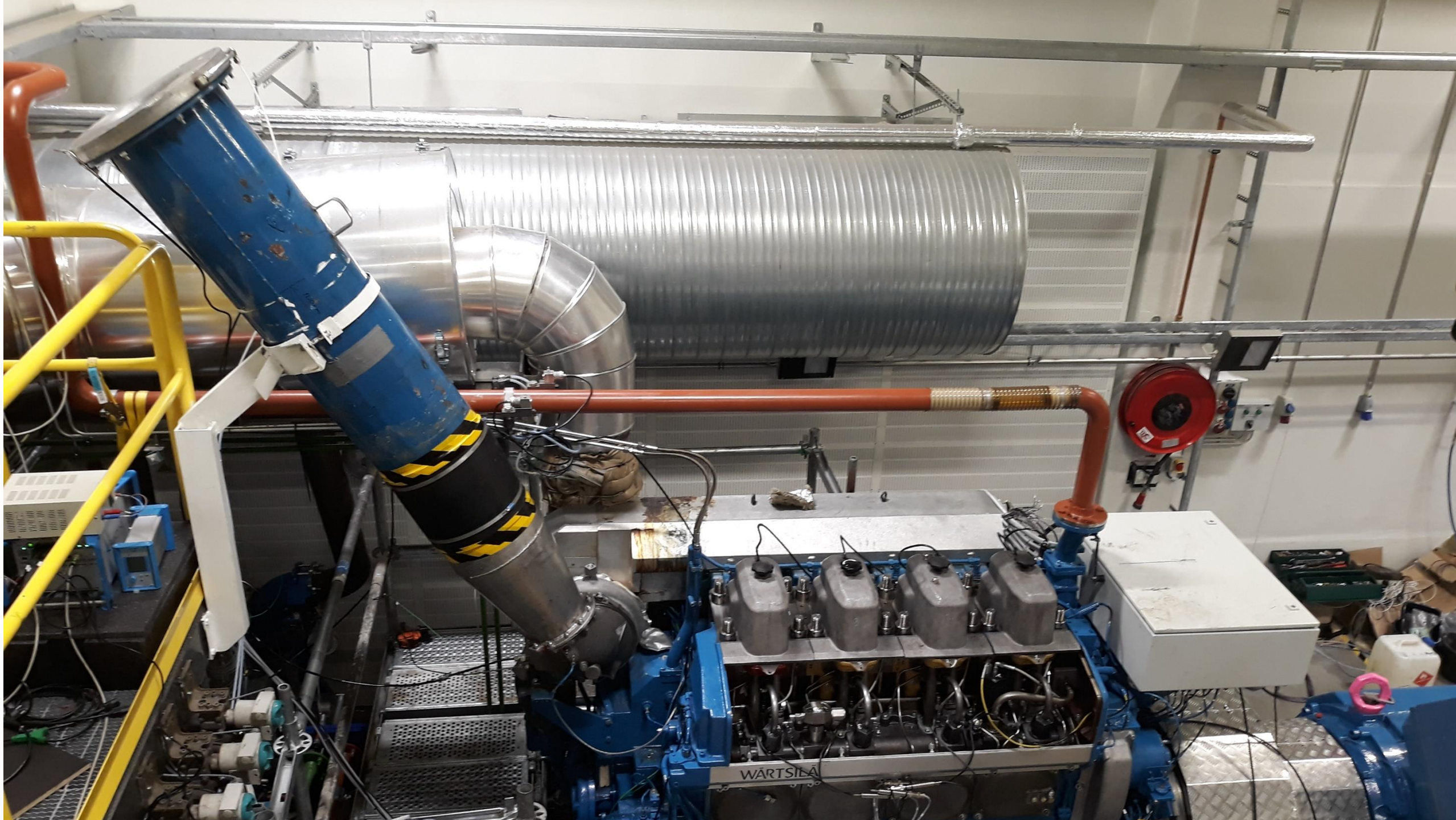
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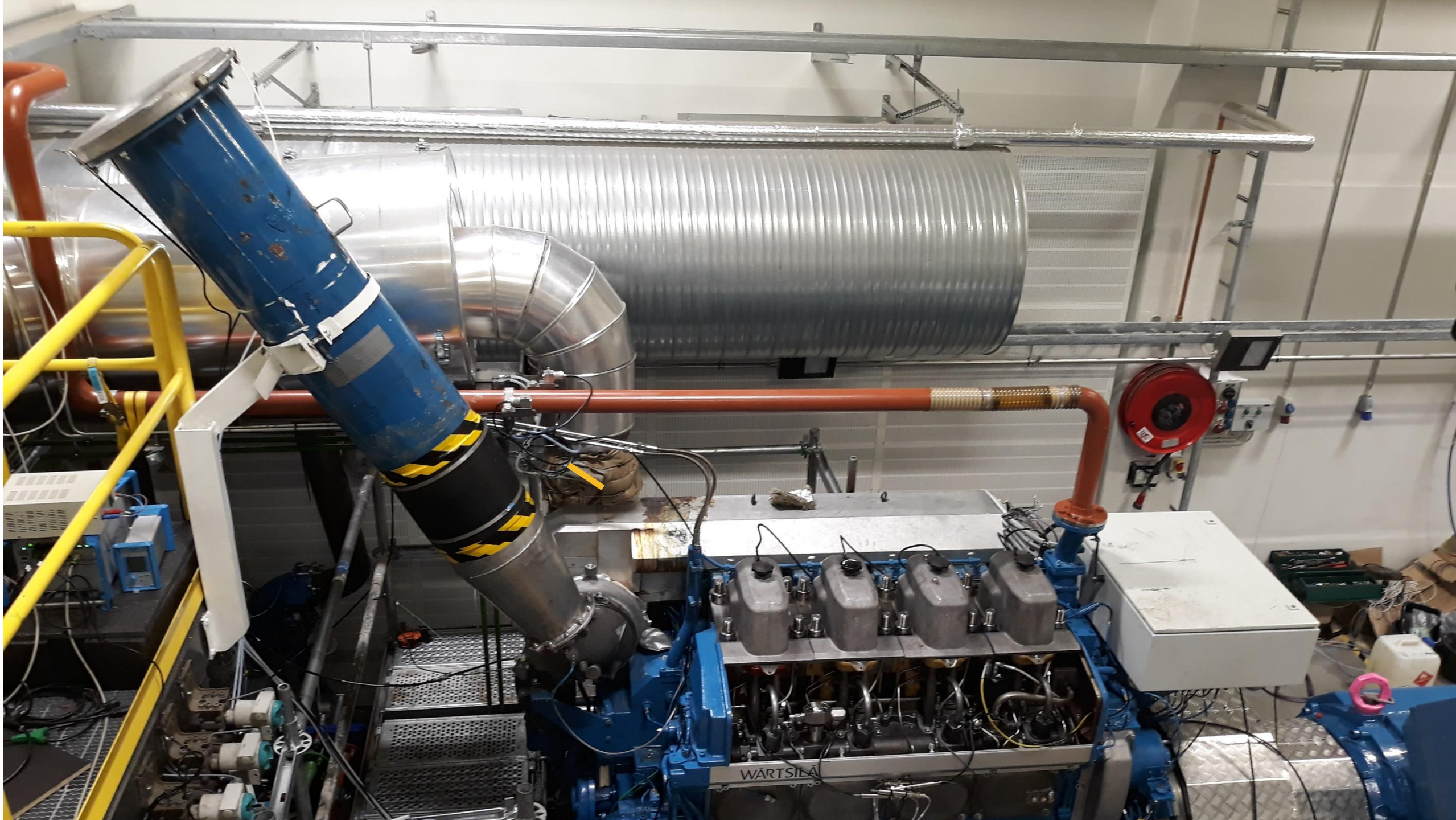
WÄRTSILÄ

Set-up 2 thermal profile at full load

NO LEAKAGE

LEAKAGE

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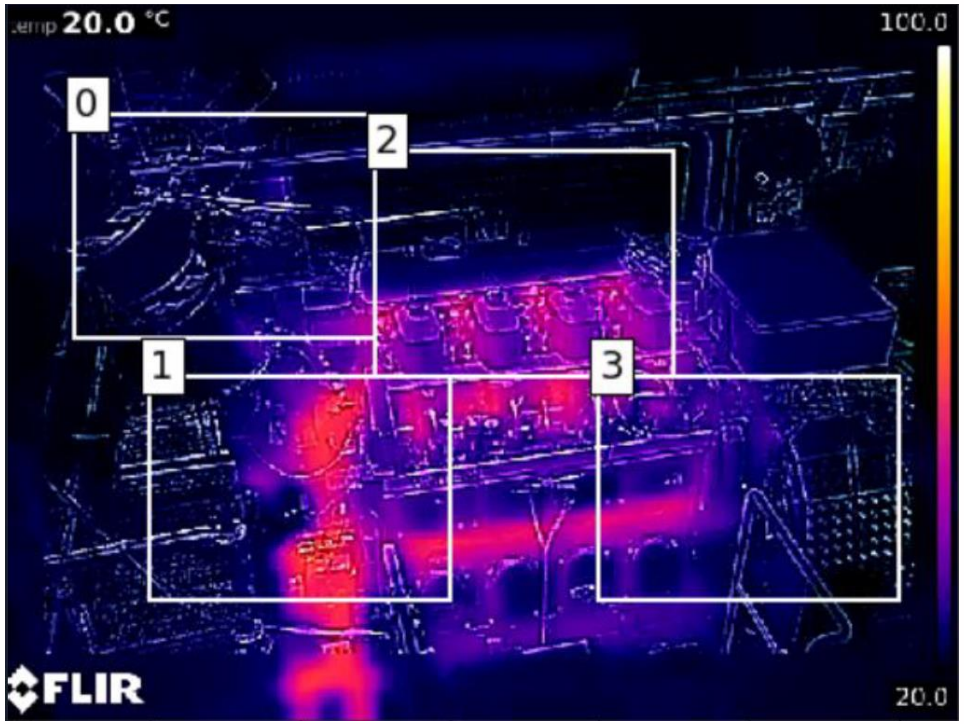
Footage analysis with machine learning

- Three different data sets (1, 2, 3) were filmed with and without artificial leakage
- Task to algorithmically classify video frames into positive (leakage) and negative (no leakage) cases
- Different feature descriptors and binary classifiers were used to find the best combination for leakage detection
- Data sets used to train, validate and test each method
- Test set evaluated

Footage analysis with machine learning



- On the left bounding boxes are used
- Feature descriptor focuses only on the information in these areas
- Descriptor can be used on the whole frame if no bounding boxes are set

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Results & conclusion

- Using bounding box experiments, leakages can be discriminated using dataset 2 for training & validation and dataset 3 for testing
- However, when dataset 3 was used for training & validation and dataset 2 for testing, similar results could not be achieved
- Datasets could be classified without bounding boxes, but the actual test model could not be made to detect leakages
- **Exhaust gas leakages could not be detected with the existing data and used computer vision methods**

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THANK YOU!

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