Laser System Health Diagnostics at EU XFEL
A voucher project with DESY
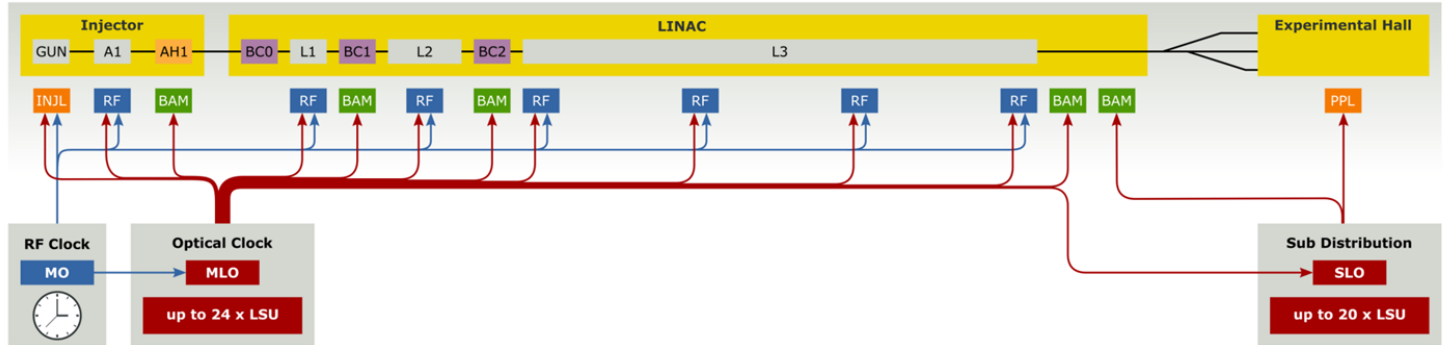
HELMHOLTZ **AI**

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HZDR / 9 March 2021
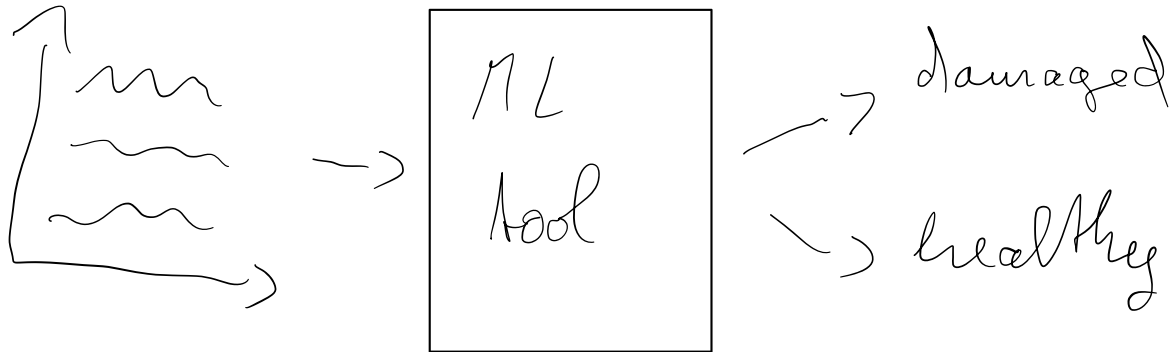
Background

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- this is the EU XFEL
- synchronisation of all elements is crucial
- optical signals from lasers (MLO and SLO) are used for that

Objective

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Goal:
Early and reliable damage detection for synchronisation laser

Data

Example Data - all channels

- from different sources of the laser system

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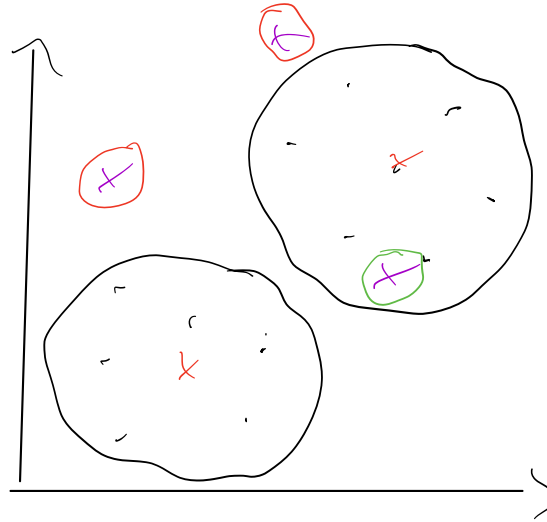- very high rate: number of data points per sample: 3 249 984
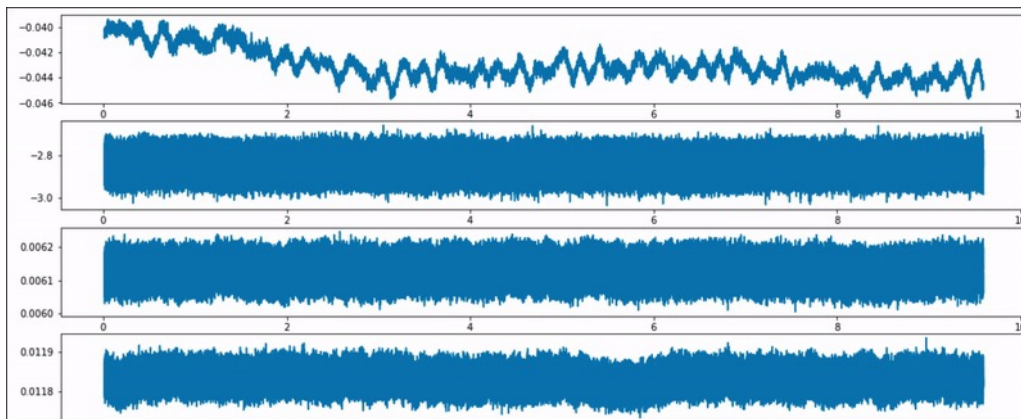
Example Data: healthy vs. damaged

- healthy data: for training + testing (58 samples), damaged data: for testing only (22 samples)
- one example comparison:
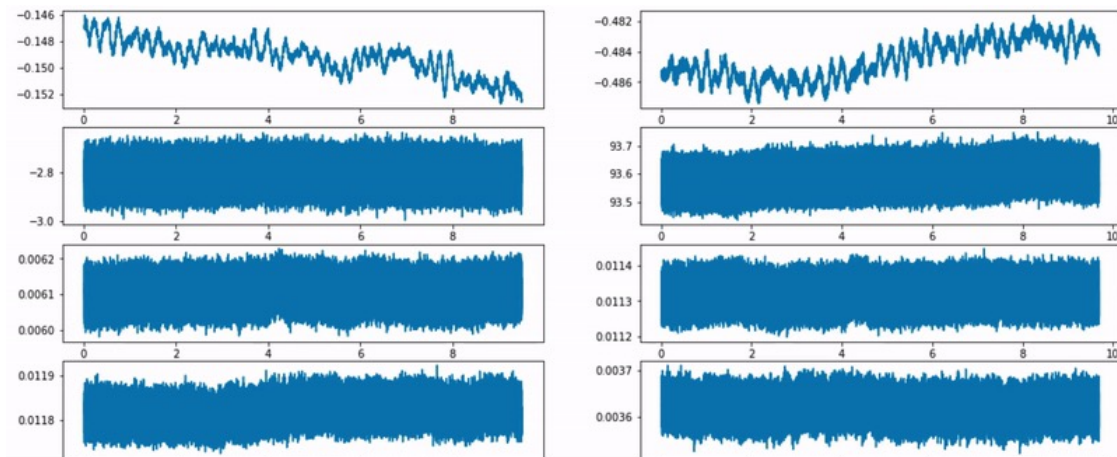
Algorithm

k-means

Data transformation

Feature extraction

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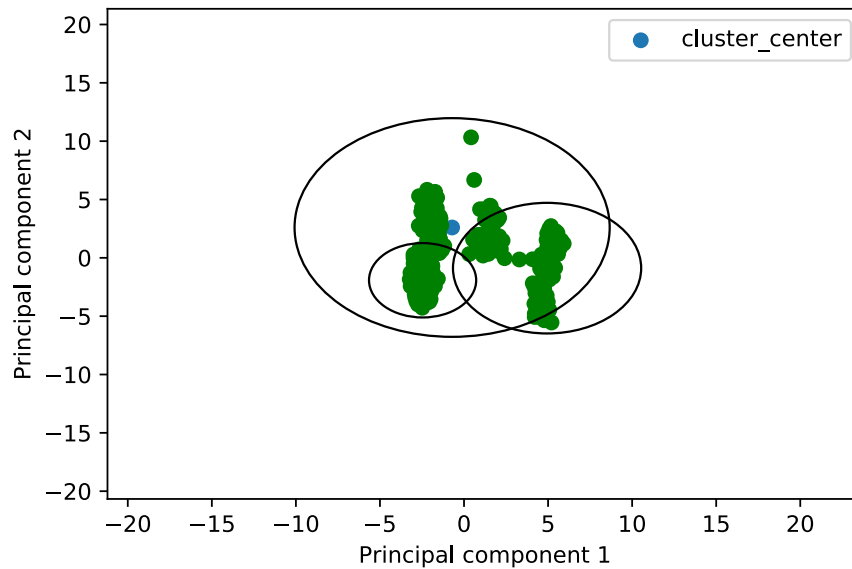
Dimensionality reduction

- reduce dimensionality of data using: principle component analysis (PCA)
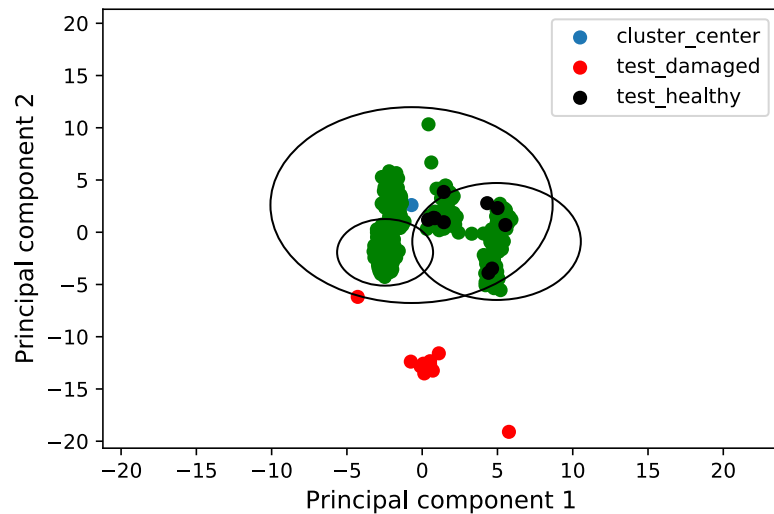- combines features into defined number of principle components
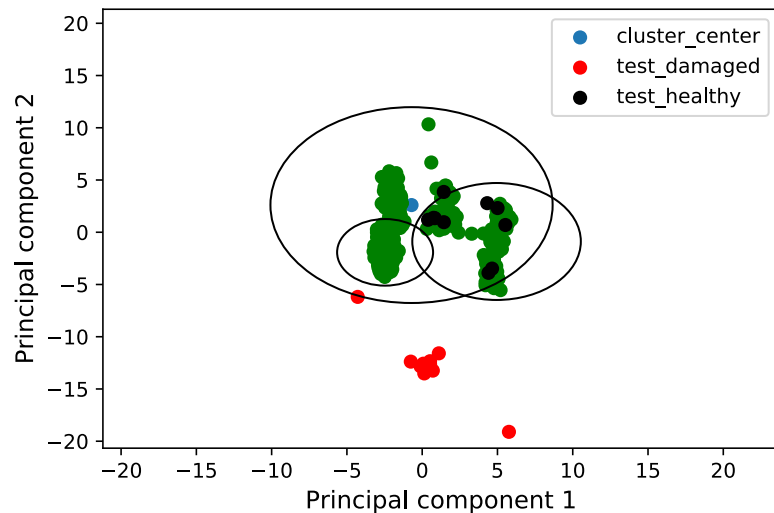
Results

Training results

Test results

Test results

Accuracy:

Overall and reproducible accuracy (f1-score): 0.99

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$\rightarrow$ Transferability can not be guaranteed

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