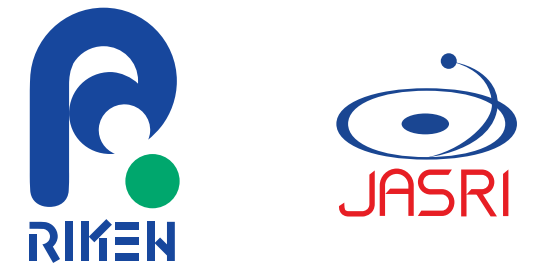# Application of Machine Learning to Accelerator Operations at SACLA/SPring-8
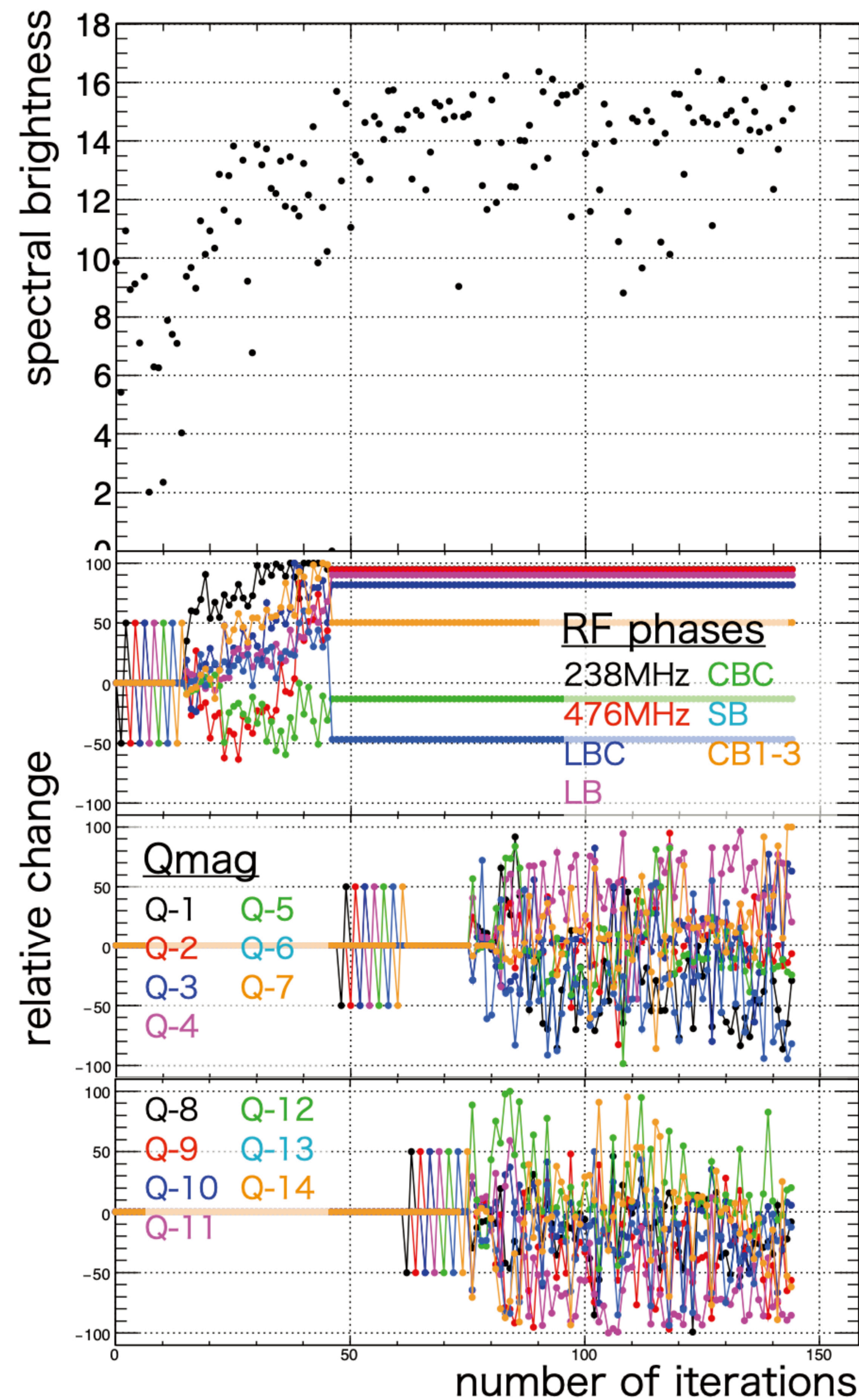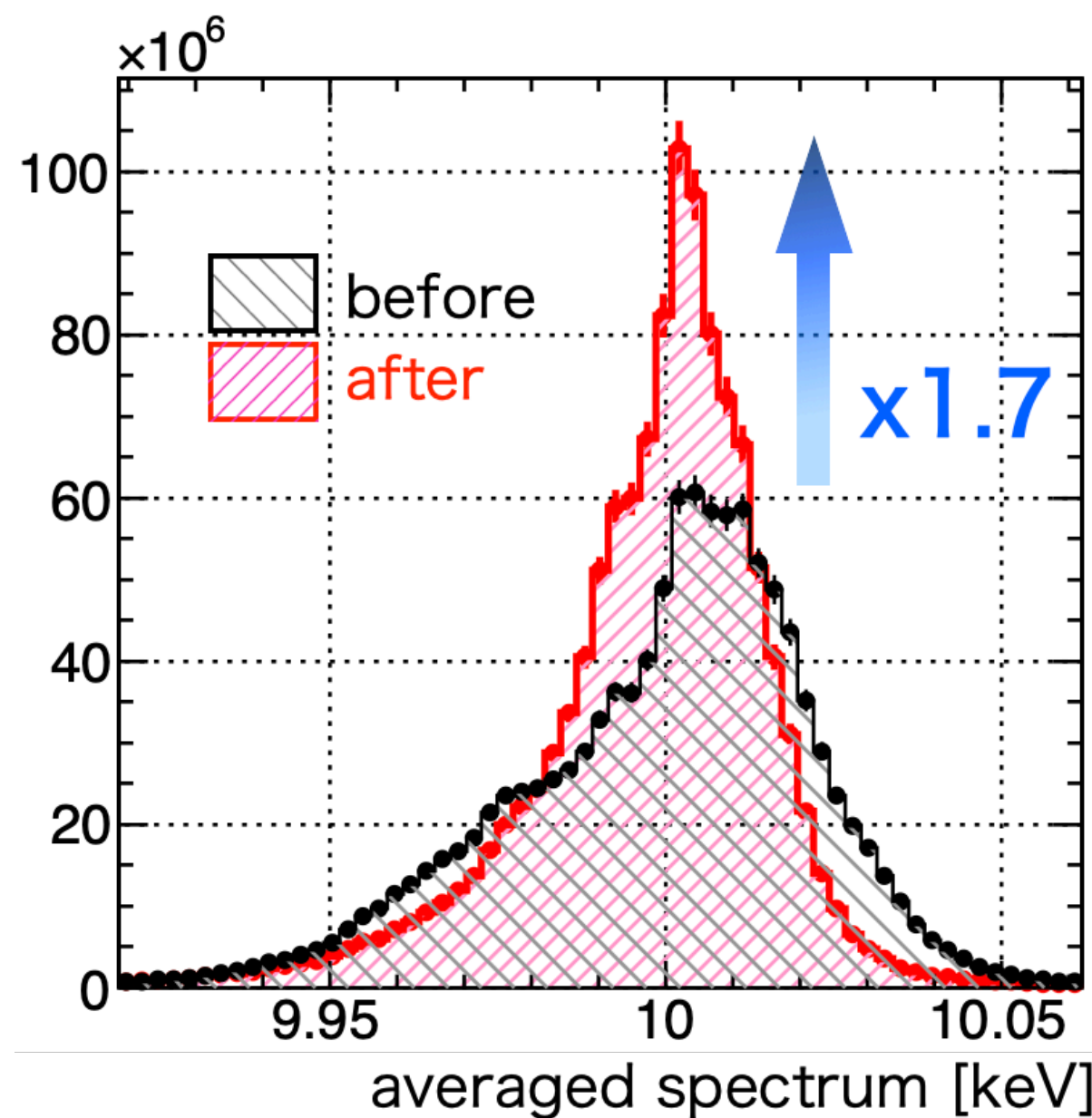
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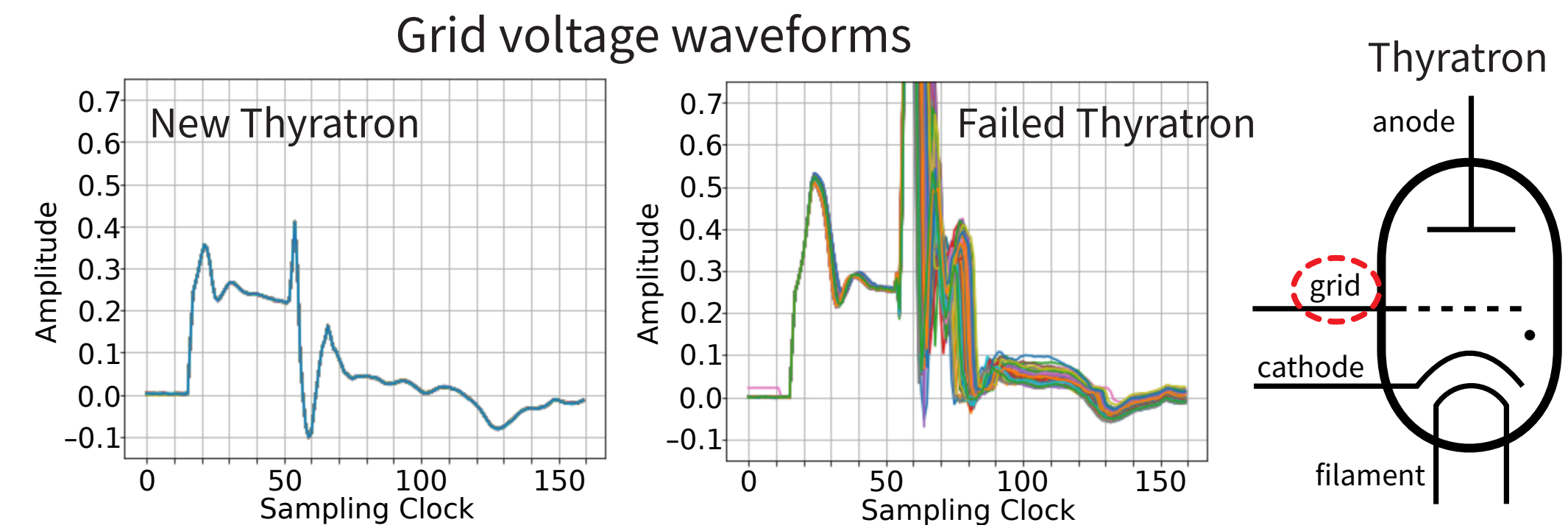
XFEL Optimization

- We developed a Gaussian Process (GP) optimizer for XFEL.

- The optimizer succeeded in maximizing the XFEL pulse energy.

- We recently developed and installed a new high-resolution inline spectrometer.

- The new spectrometer enabled us to optimize the spectral brightness.

- The spectral brightness was improved by a factor of 1.7 over the pulse energy optimization.

Failure Prognosis of Thyratrons

- A thyratron is a high-power switch to drive a pulsed klystron.

- The grid voltage waveform varies with its operation time.

- We are developing a health check algorithm by using the grid waveform.

- We applied principal component analysis (PCA) to reduce the dimensionality of the waveform data and support vector machine (SVM) to classify thyratrons into normal or abnormal.

- This system can emit warning if the grid waveform enters the abnormal area of the SVM result.

Grid voltage waveforms

Scatter plots of 1st and 2nd principal component values