ONLINE OPTIMISATIONS OF LIFETIME AND INJECTION EFFICIENCY IN THE ESRF EBS STORAGE RING

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Design of EBS:
Multi-objective optimisations of sextupoles and octupoles

Operation of EBS:
Online optimisations to make use the independent sextupoles and octupoles power supplies

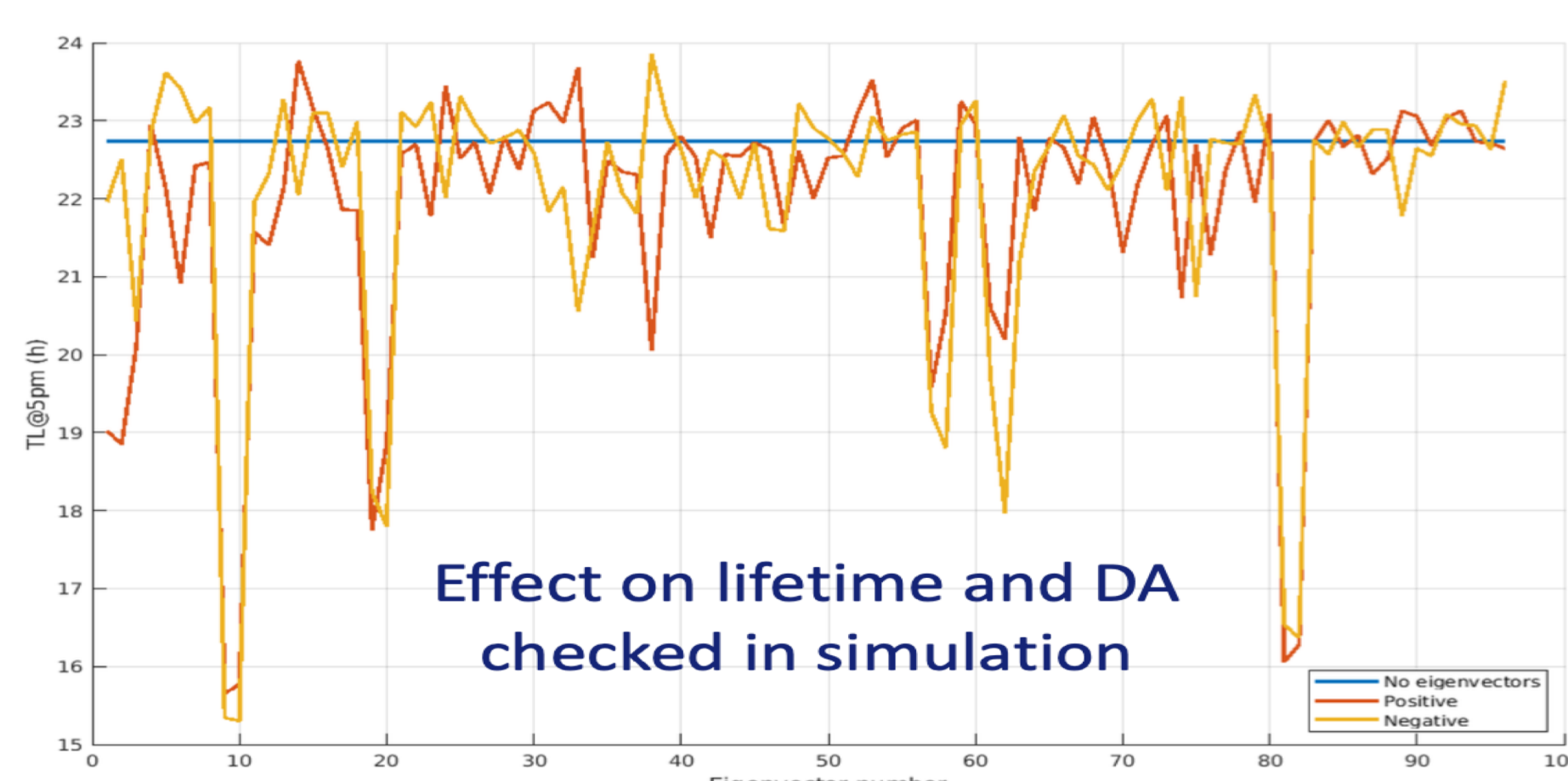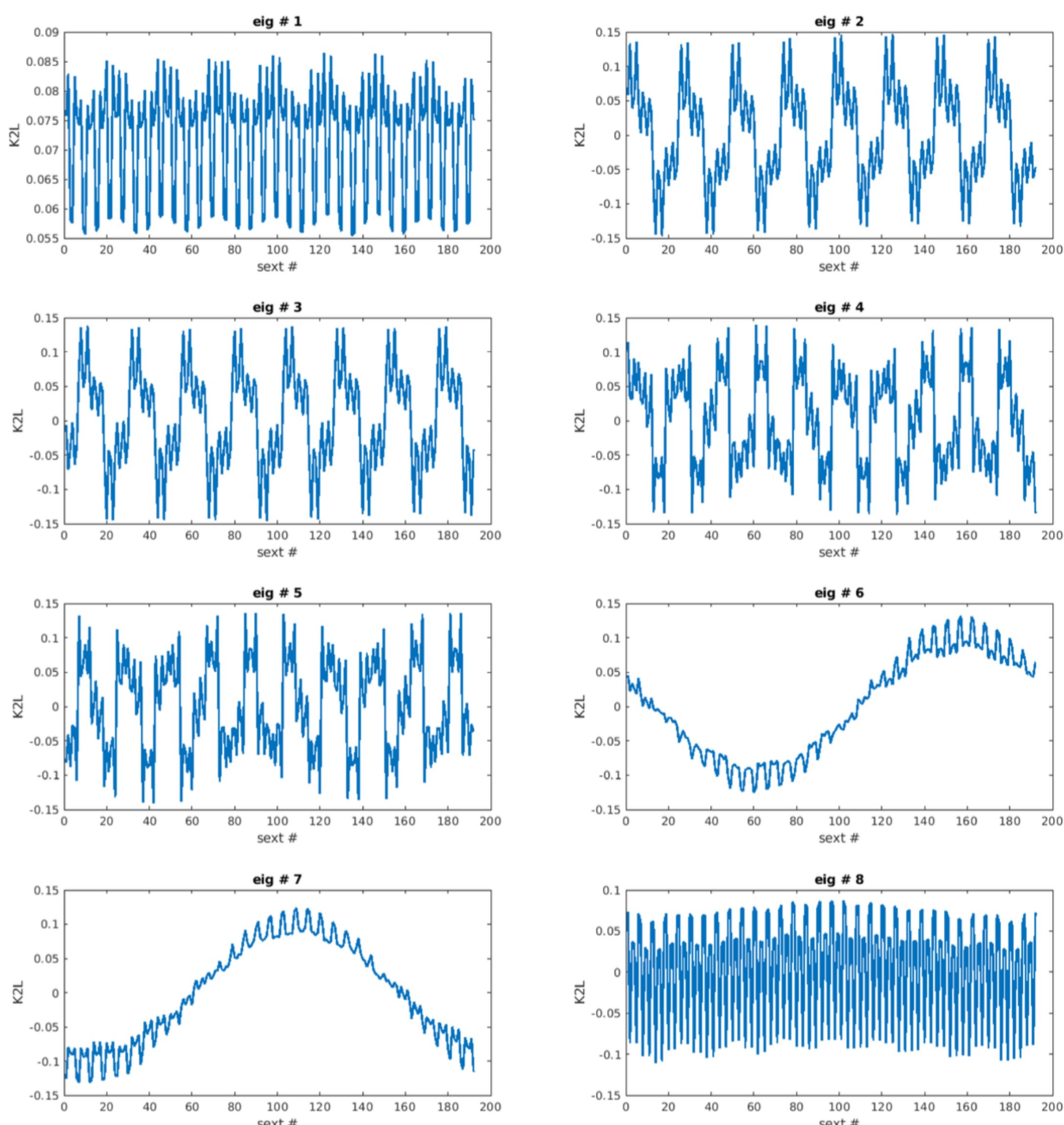### Which KNOBS should we use for online optimisations?

The idea is that with sextupoles we can correct off-energy linear optics.

We can define some pseudo-sextupolar singular vectors:
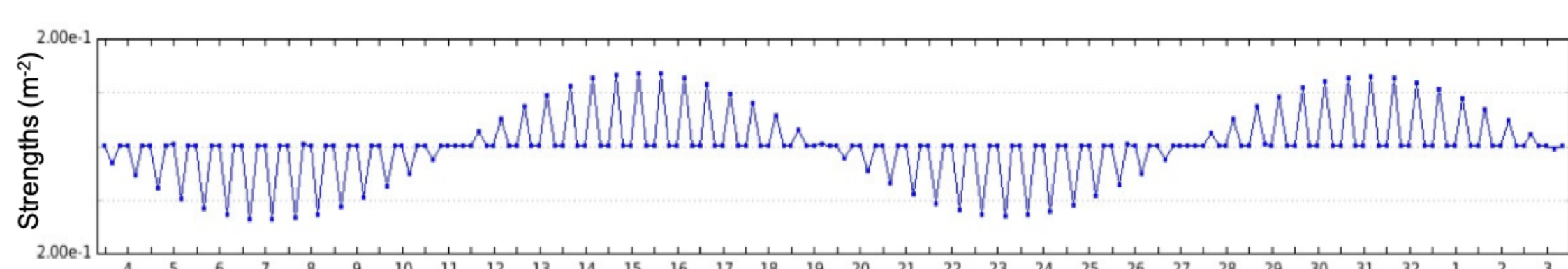
$$J_{quad} = \frac{\delta ORM}{\delta K_{quad}}$$

$$K_{quad} \propto 2K_{sext}\eta_h$$

$$J_{sext} = J_{quad} \cdot 2\eta_h$$

Effect on lifetime and DA checked in simulation

Other knobs tested:
- Sine waves of sextupoles
- Sine waves of octupoles
- Skew quads eigenvalues for coupling

First optimizer
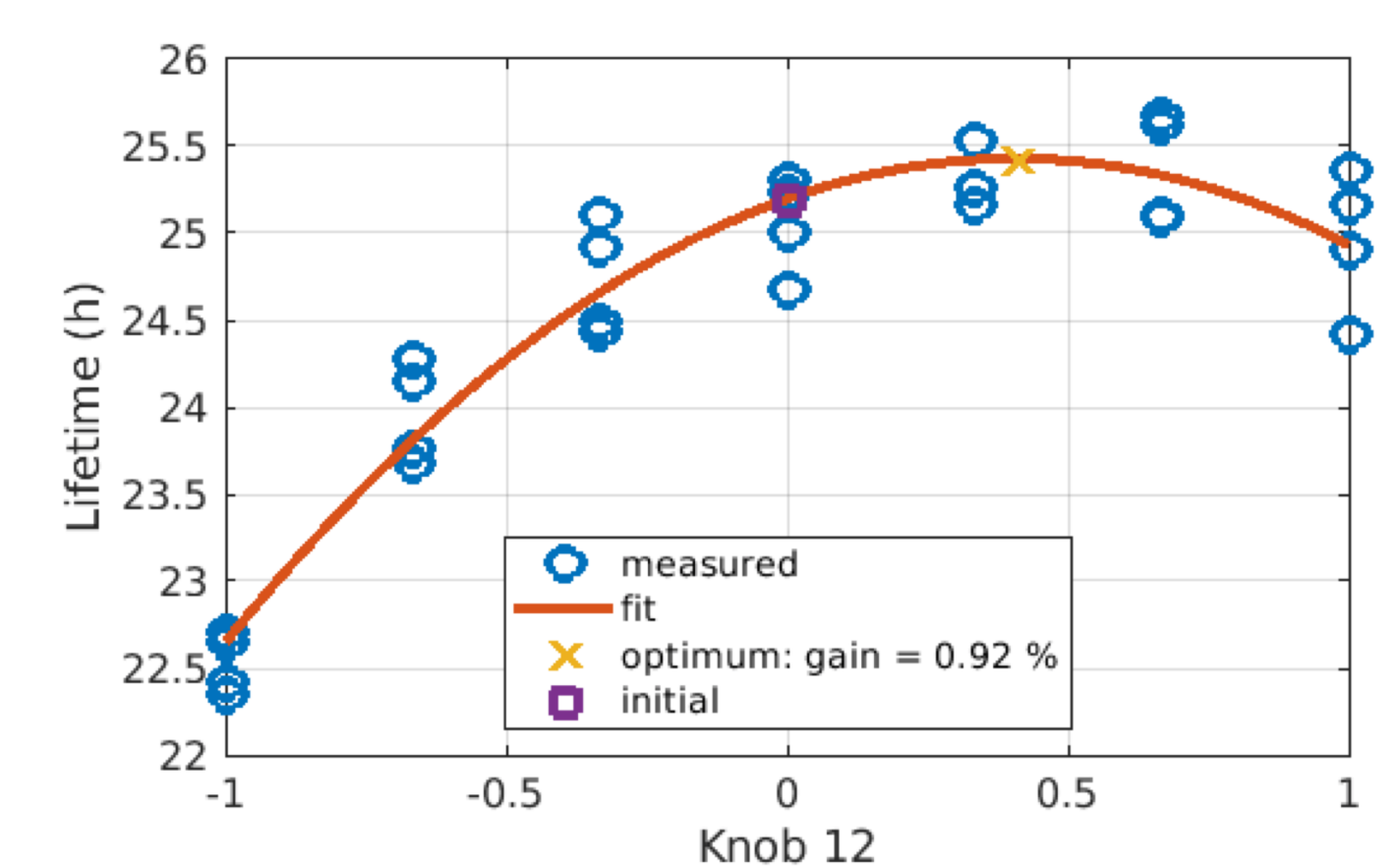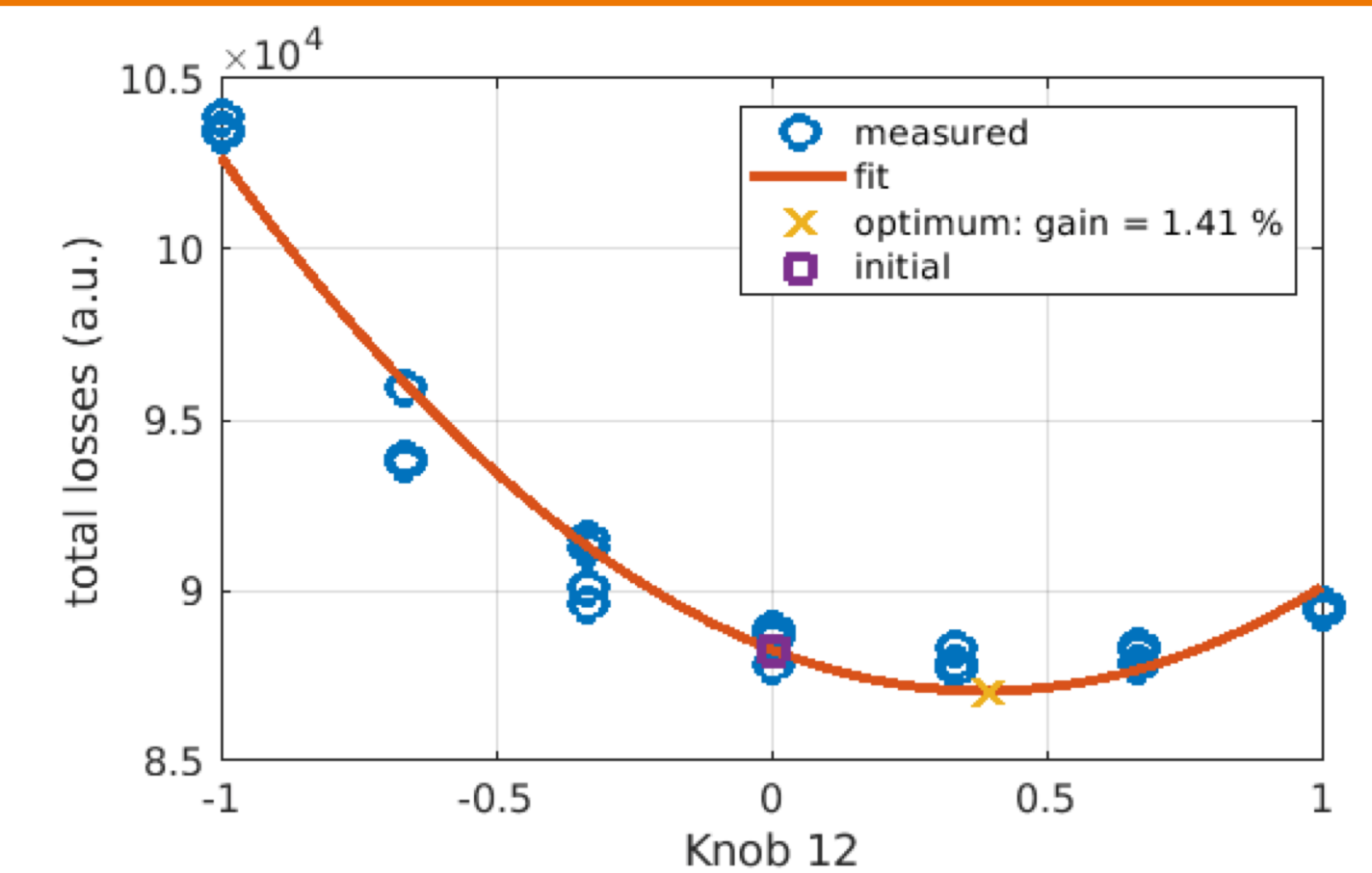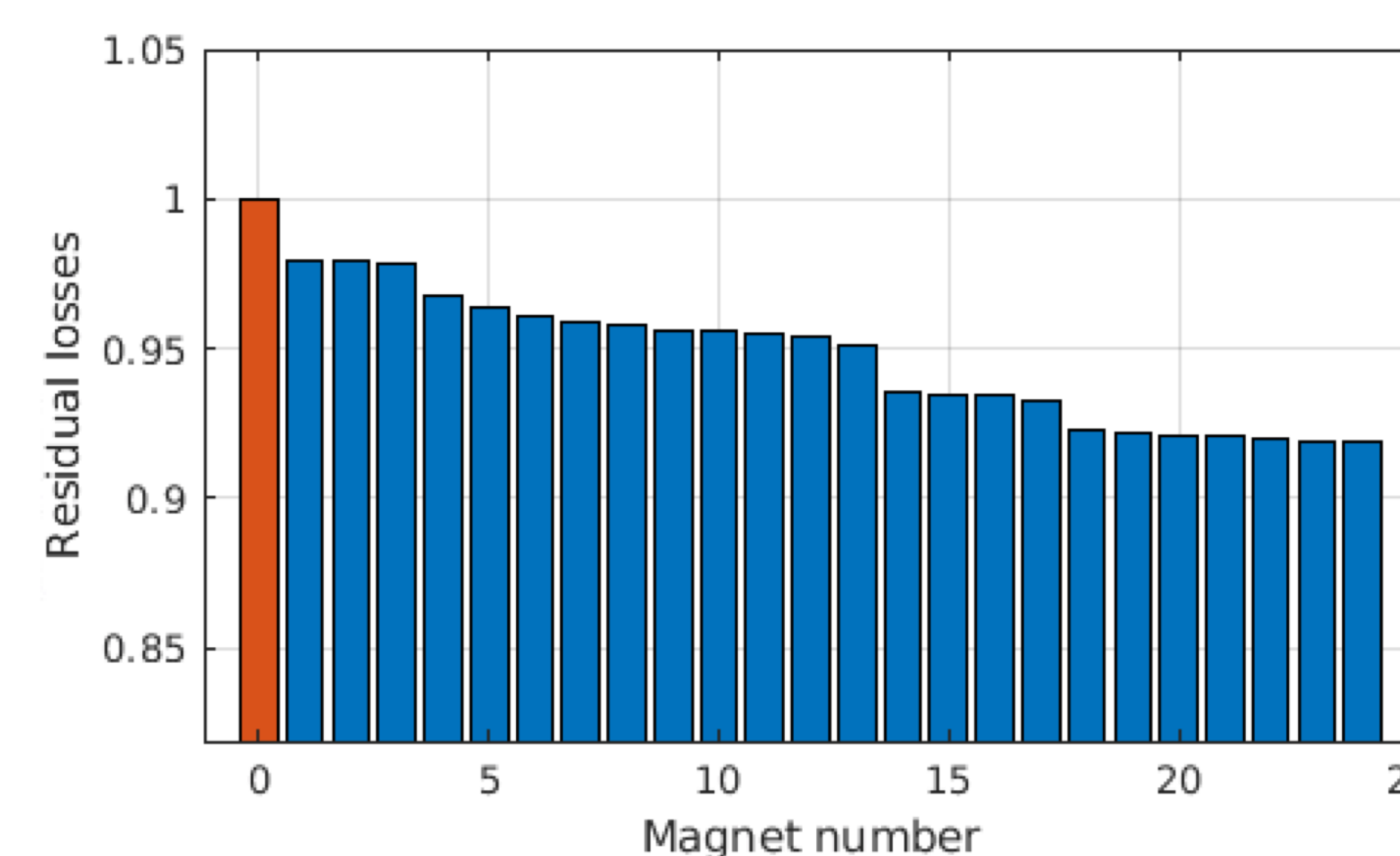Matlab based code. It can scan knobs of all kind of magnets, minimizing losses measured with BLM.

24 sextupolar knobs and 4 octupolar knobs selected

Badger + Xopt   Developed at SLAC

EASY INTERFACE
EASY SETUP
EASY INSTALLATION
MANY OPTIMIZERS + Xopt

Scalable Global Optimization via Local Bayesian Optimization
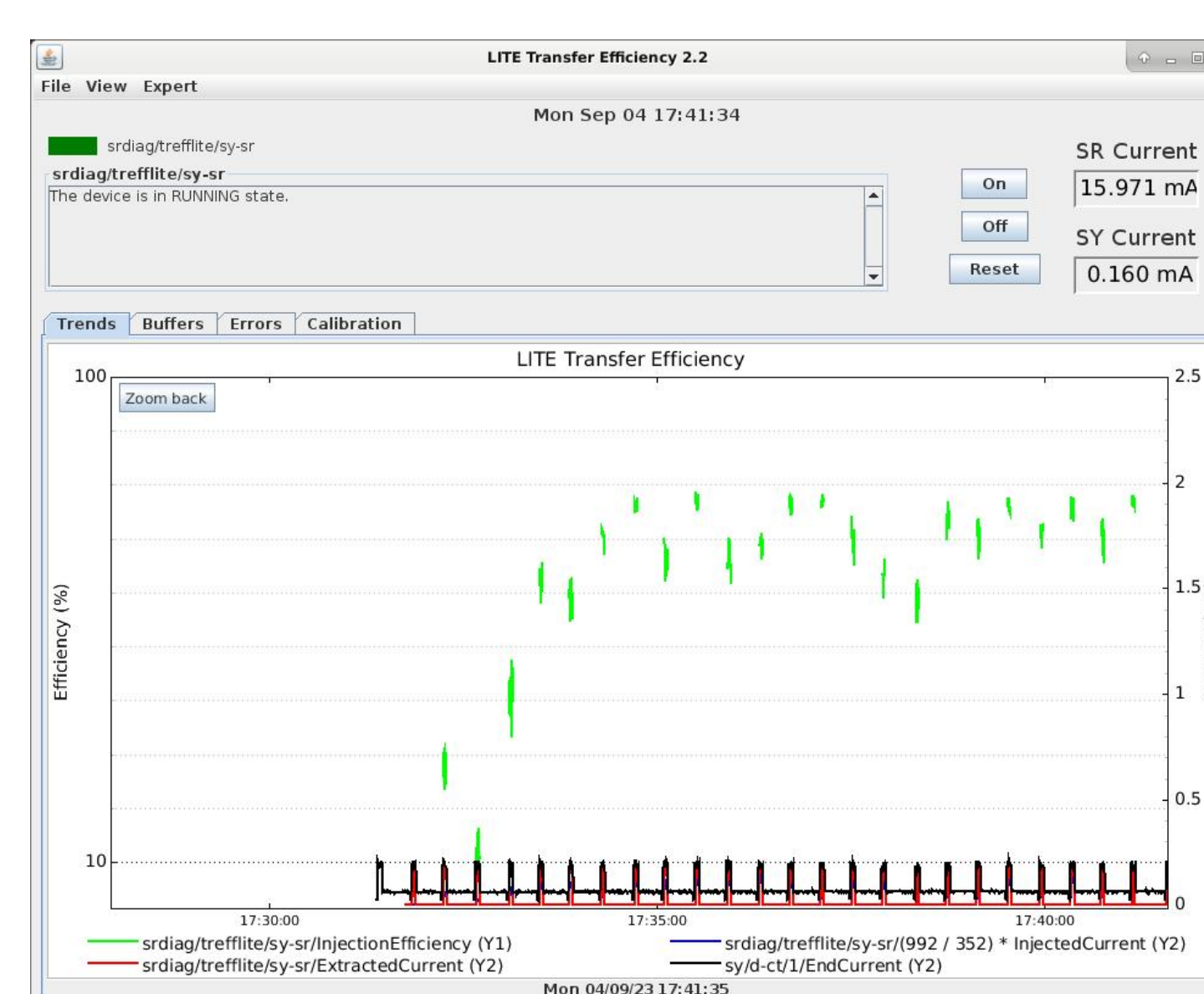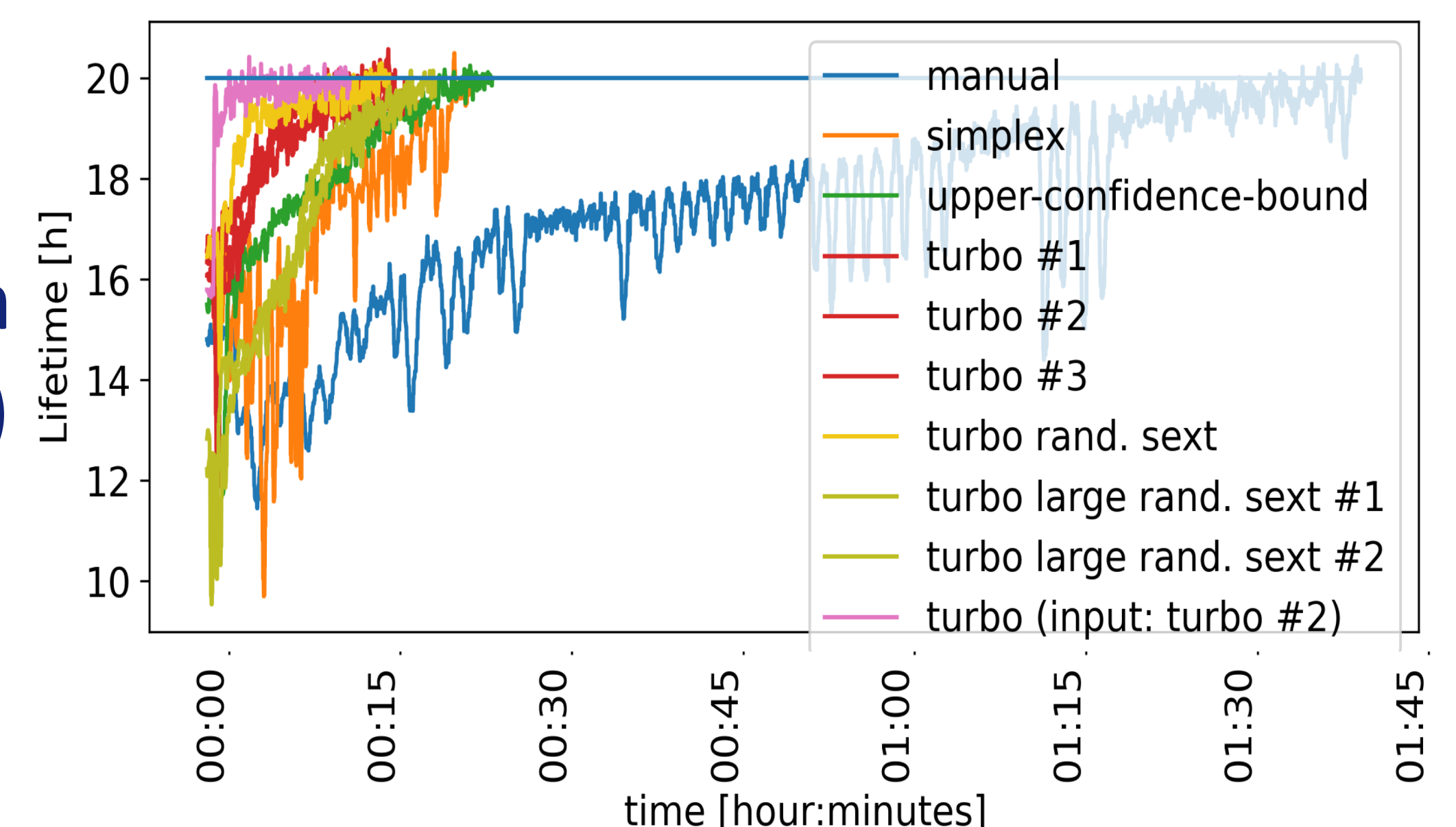
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Different optimisers tested within badger. Trust Region Bayesian Optimization (TuRBO) selected to be the most effective and fast.

Badger is also used to optimise injection efficiency.
Injection elements, transfer line magnets, timing parameters can be optimized to maximize the injection efficiency measured with 8 injection shots.