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Godstow
A34
Oxford
A420
Cumnor
Canning Crescent
Boars Hill
Kennington
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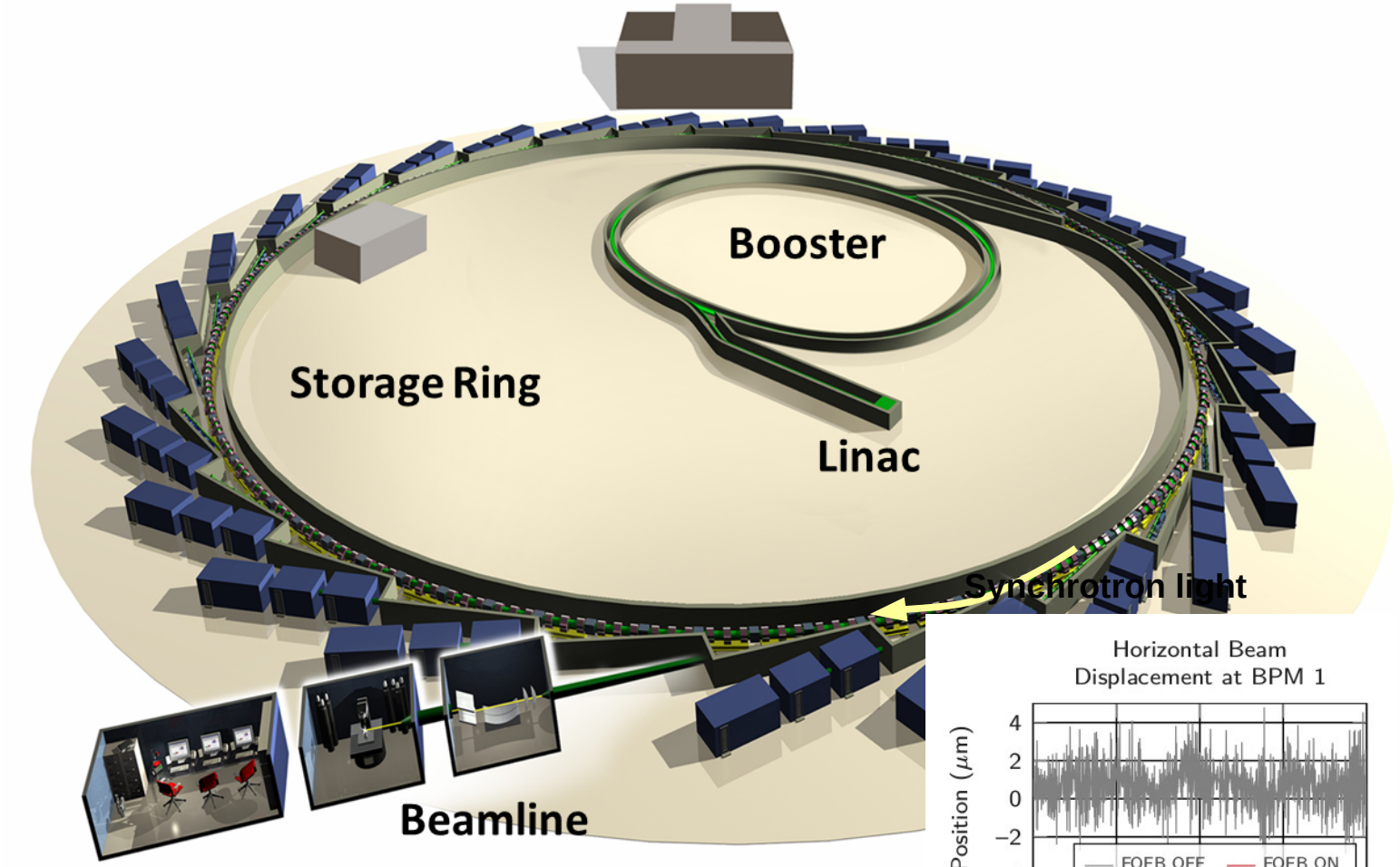
Radley
Abingdon
A34
River Thames
Sutton Courtenay
Steventon
Milton
Didcot
Harwell
Fulscot
A34
Chilton

Beam Stabilisation



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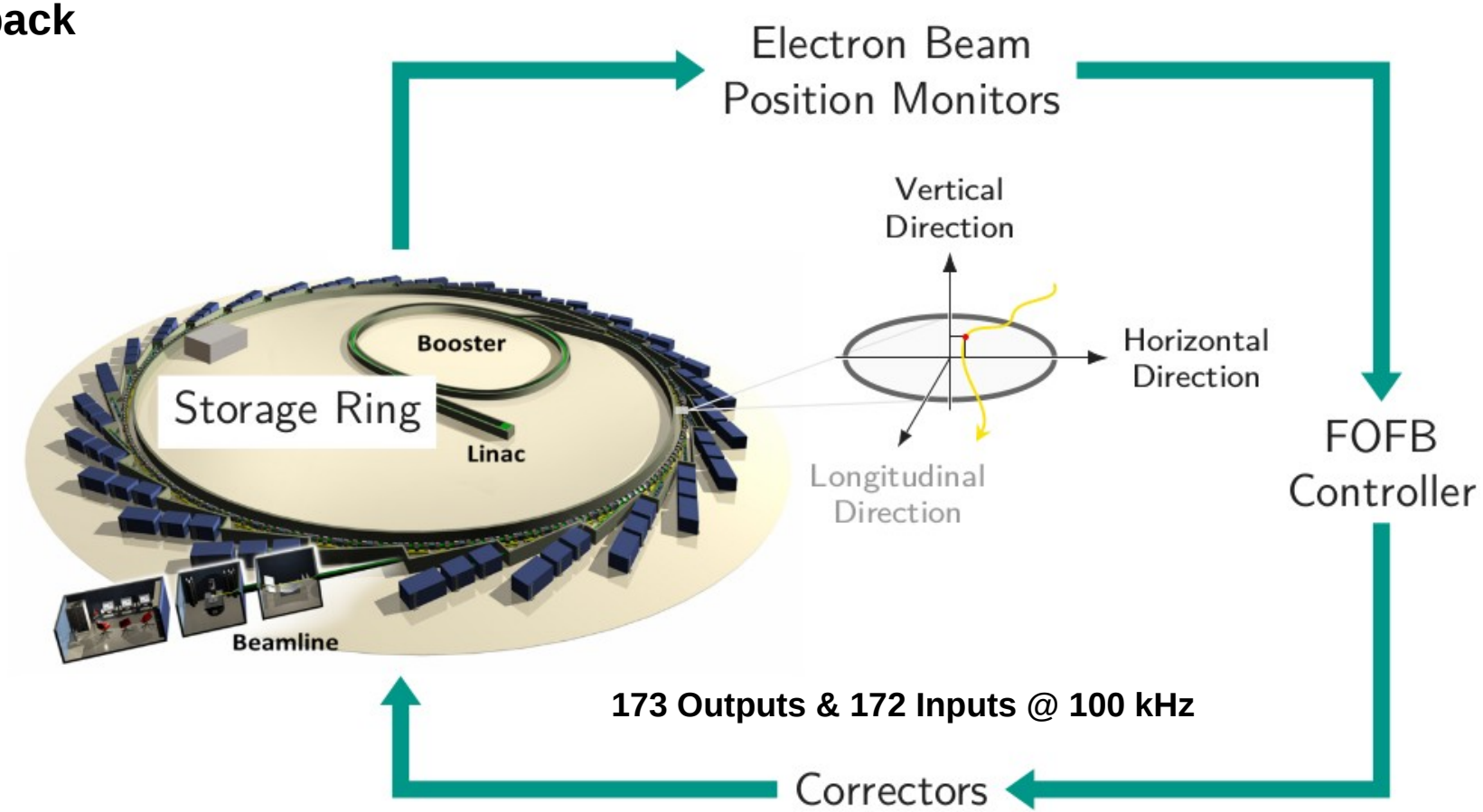
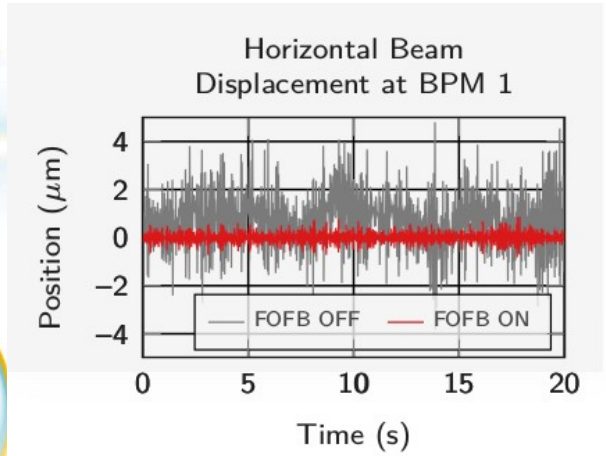
Fast Orbit Feedback





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Project Idea

Background
Eucledian projections are used in various optimisation algorithms, including an algorithm developed by the Control Group for electron beam stabilisation at Diamond Light Source. However, as Eucledian projections represent themselves an optimisation problem, they are computationally expensive to solve. To speed-up the beam stabilisation algorithm, the projection could be solved using Dykstra's method, which is an iterative algorithm for finding the Eucledian projection onto a convex set. It is efficient and fast, but can stall under certain conditions.

Problem
For use at Diamond Light Source, Dykstra's method must be modified to avoid stalling.

Suggestion/Solution
Modify Dykstra's method to avoid stalling. Focus on polyhedral sets that are encountered in most engineering applications.

Research questions
- Under which conditions does the method stall for polyhedral sets?
- How could stalling be prevented?

Method
Matlab implementation of Dykstra's method has been implemented by the Control Group and is available. This project will start from the paper that describes stalling (Bauschke) and reproduce stalling conditions for small polyhedral sets via simulations and analytically. The project will then investigate modifications of Dykstra's method.
Literature research, report, presentation.

H. H. Bauschke et al., "On Dykstra's algorithm: finite convergence, stalling, and the method of alternating projections" arXiv, 2020.

I. Kempf et al., "Fast Gradient Method for Model Predictive Control with Input Rate and Amplitude Constraints", IFAC, 2020.

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