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Towards autonomous accelerator control at ALS: a multi-agent LLM approach

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This paper demonstrates progress towards a novel approach to particle accelerator control at ALS using a decentralized multi-agent framework powered by Large Language Models (LLMs). Our distributed control system deploys specialized autonomous agents to manage critical accelerator subsystems while maintaining coordinated operation through LLM-driven communication protocols.

The system demonstrates fundamental capabilities essential for next-generation accelerator operations, given the flexible nature of agent specialization, this framework provides a robust platform for integrating and coordinating diverse control algorithms and approaches already established in accelerator operations. Our prototype shows the system's ability to autonomously diagnose and resolve basic operational issues using existing control infrastructure.

This work represents an advancement toward practical autonomous accelerator operation, establishing a scalable foundation for managing increasingly sophisticated accelerator configurations. The demonstrated success of this distributed control architecture opens new possibilities for improving operational efficiency across various accelerator facilities.

Footnotes

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Author: SULC, Antonin (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH)

Co-authors: KAMMERING, Raimund (Deutsches Elektronen-Synchrotron); HELLERT, Thorsten (Lawrence Berkeley National Laboratory)

Presenter: SULC, Antonin (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH)

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