

Planting the OACTree

Max Günther - Spring EPICS collaboration meeting 2026



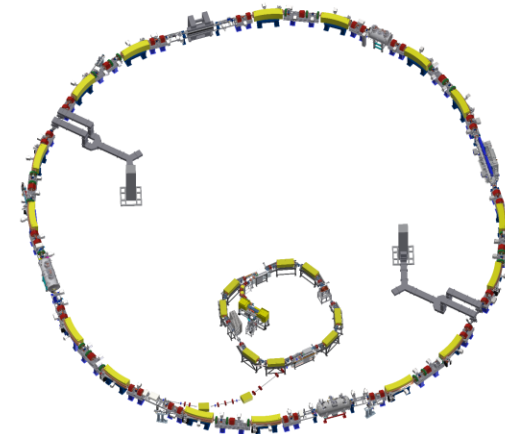
Current status of state machines

KARA Operations State Machine

Automates key accelerator operations:

- Dump beam & prepare injection
- Cycle magnets, set RF, switch on EGun/Modulator
- Timed actions (e.g. shutdown at 08:00 on Saturday)
- Currently implemented in EPICS SNL

KARA – Karlsruhe Research Accelerator



- 1 injection cycle/day (dump + re-inject): **~1 h**
- Automatic operation (no operator present): **~23 h**
- 5-day operation – **weekend: shutdown state**

The problem: SNL is Hitting its Limits

⚠ Codebase Complexity

> 2.000 lines of SNL code for the global state machine alone – and it keeps growing with every new feature request.

Testing all states and transitions is increasingly difficult.
New additions can silently break existing logic.

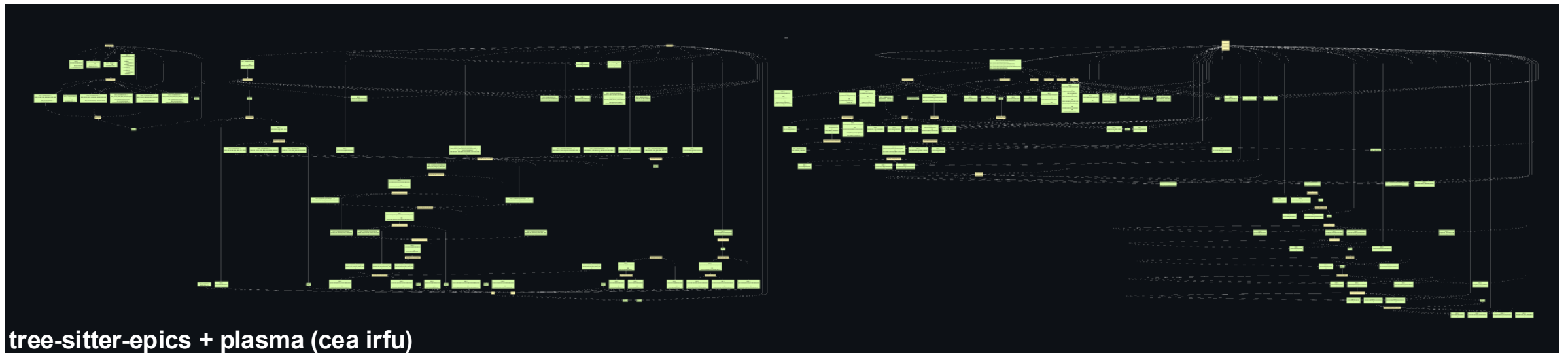
→ **Decision: stop adding features to SNL implementation.**

⚠ Operator Requests

The state machine takes over manual operator steps – but operators have **no way to influence it**.

Temporary or permanent changes (e.g. new procedures, maintenance windows) always require a controls developer to modify the code.

No self-service for operators, no flexibility.



Why OACTree?

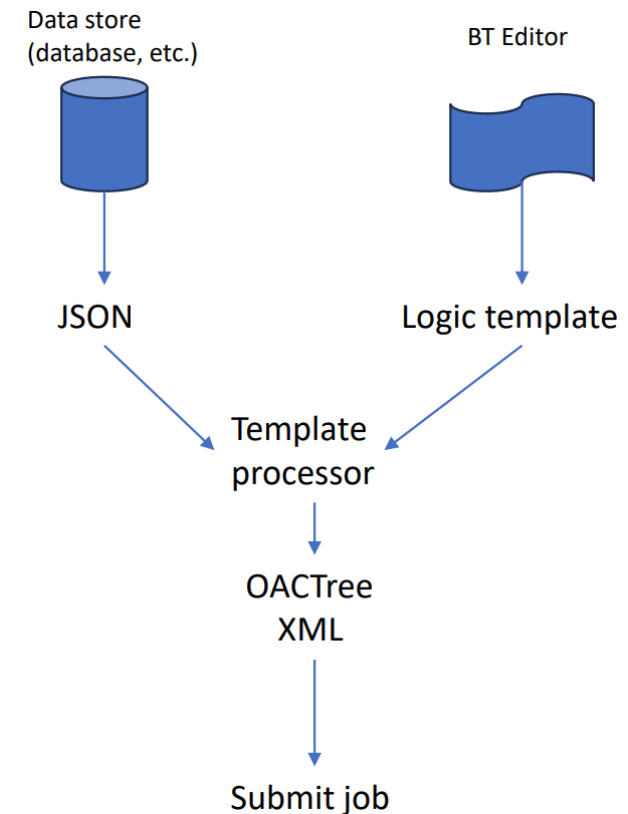
OACTree Sequencer

Operation, Automation & Control using Behavior Trees

- Goal-based Behavior Trees: decompose operations into subtrees
- XML-based sequences – no raw SNL code to maintain
- GUI editor for building & monitoring trees
- Operators can adjust sequences without developer involvement
- Cross-device sequences supported natively



Workflow: Template-Based Generation



My User Story

Exploring OACTree

Dependency / Behavior Trees

- Studied tree structure concepts as prerequisite for OACTree

vlinac as reference implementation

- Explored vlinac – a simple linac sequencer built with OACTree from **Timo Korhonen**
- Studied how sequences are structured in XML and how the tree is executed

Current status:

- Framework running, BT concepts understood roughly
- 2 Weeks in – still early stage

Next Steps

Soon

- Write first own OACTree sequences for simple KARA operations

The big goal

- Migrate the global state machine to OACTree

