# State Machine Automatic Conditioning (SMAC) program

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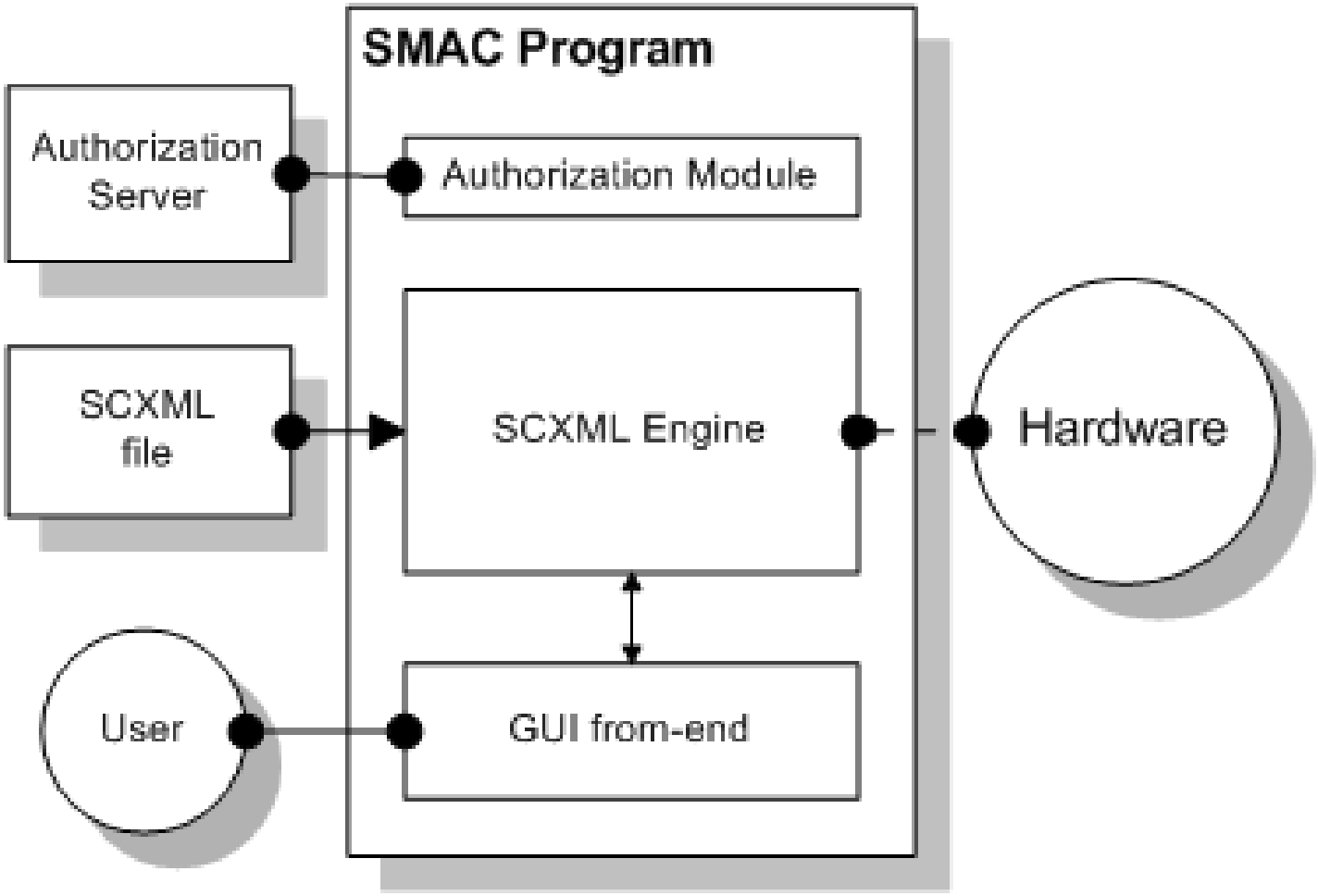
# The **old** conditioning program causes a number of **problems**

- Not flexible as needed (for gun and booster)
- Complicated structure
  - Meta server and GUI application talking to the device servers / FEC's
  - LabView GUI – nice but not easy to operate
- Interlock handling not fully sufficient
- Stability not sufficient ("remote" conditioning)
- Practical not portable – too many dependencies on platforms and protocols

# The idea
## using a generic event-driven state machine based on standards

- the State Chart XML (SCXML) recommendation (as part of Unified Modeling Language)
- State Chart formalism enables clustering (abstraction), orthogonality (concurrency), successive refinements ("zoom")
- all logic modeled in the XML document
  → legible, flexible, portable
- Jakarta Commons SCXML (open source Java SCXML engine, library, SCXML 0.9 API)
- pure Java design

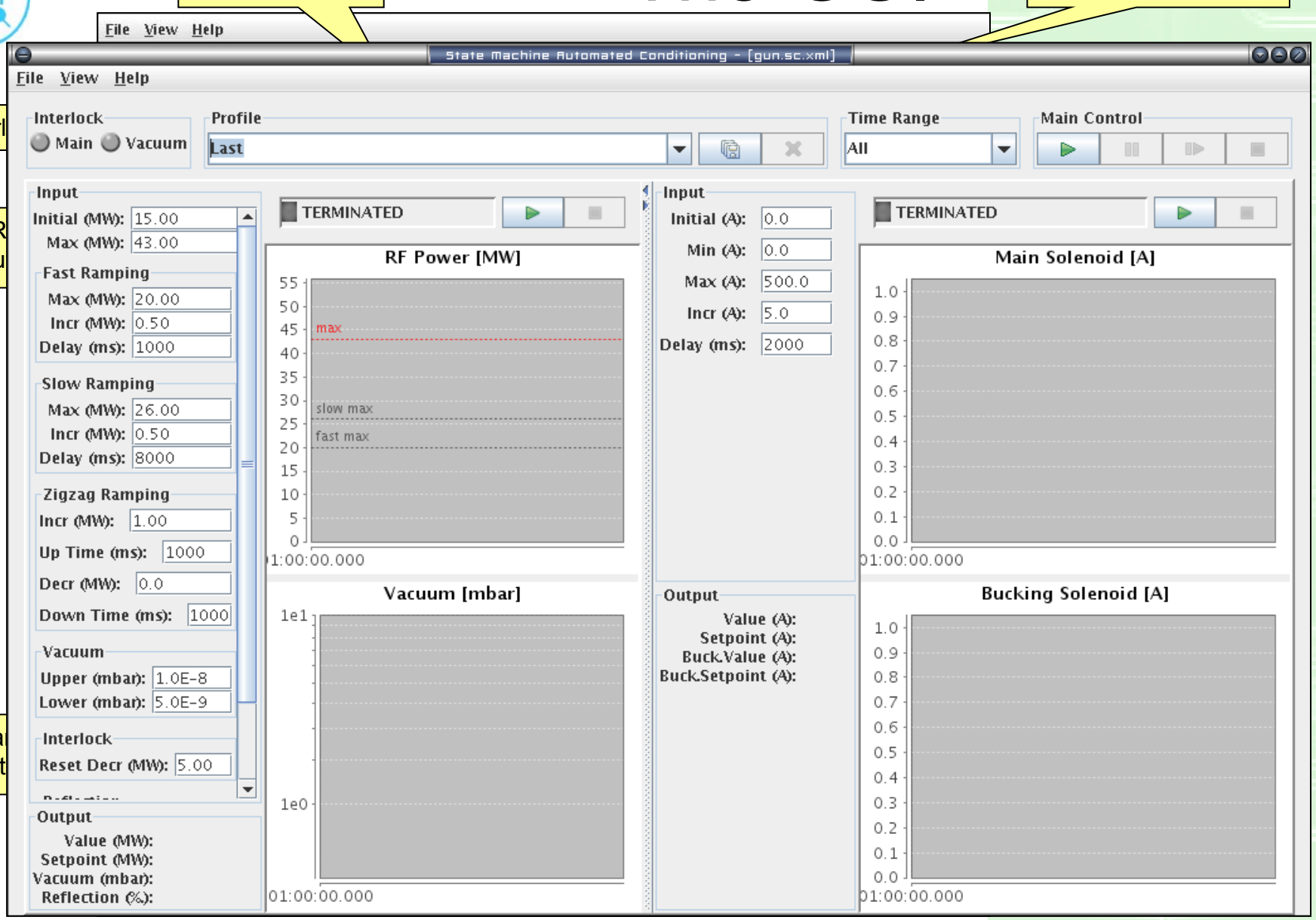
# Simple structure



# “program” code segment

```
406         <!-- Parallel process for RF Ramping -->
407         <state id="flow_rf_ramping" initial="idle_rf_ramping">
408
409             <datamodel> [2 lines]
412
413             <state id="idle_rf_ramping"> [14 lines]
428
429             <parallel id="process_rf_ramping"> [410 lines]
840
841             <history id="hist_rf_ramping" type="shallow"> [2 lines]
844
845             <state id="error_rf_ramping"> [5 lines]
851
852             <state id="interrupted_rf_ramping"> [6 lines]
859
860             <state id="terminated_rf_ramping"> [5 lines]
866
867             <transition event="terminate" target="terminated"/>
868
869         </state>
870
871         <transition cond="!empty(error)" target="error_state"/>
872
873     </parallel>
```

# The GUI


profile manager
controls all processes
File View Help
State Machine Automated Conditioning - [gun.sc.xml]
File View Help
Interl
RF R
Inpu
RF Ra
Output
Interlock
Main
Vacuum
Profile
Last
Time Range
All
Main Control
Input
Initial (MW): 15.00
Max (MW): 43.00
Fast Ramping
Max (MW): 20.00
Incr (MW): 0.50
Delay (ms): 1000
Slow Ramping
Max (MW): 26.00
Incr (MW): 0.50
Delay (ms): 8000
Zigzag Ramping
Incr (MW): 1.00
Up Time (ms): 1000
Decr (MW): 0.0
Down Time (ms): 1000
Vacuum
Upper (mbar): 1.0E-8
Lower (mbar): 5.0E-9
Interlock
Reset Decr (MW): 5.00
Output
Value (MW):
Setpoint (MW):
Vacuum (mbar):
Reflection (%):
TERMINATED
RF Power [MW]
max
slow max
fast max
01:00:00.000
Vacuum [mbar]
1e1
1e0
01:00:00.000
Input
Initial (A): 0.0
Min (A): 0.0
Max (A): 500.0
Incr (A): 5.0
Delay (ms): 2000
Output
Value (A):
Setpoint (A):
Buck.Value (A):
Buck.Setpoint (A):
TERMINATED
Main Solenoid [A]
01:00:00.000
Bucking Solenoid [A]
01:00:00.000