



POLITÉCNICA

STRAST

# Timing Analysis Tools in a Model-Driven Development Environment

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# Overview

- Increasing trend towards automatic code generation in real-time systems
  - arising from model-driven engineering
- Timing analysis tools can be integrated in MDE environments
  - required for real-time analysis in critical systems
- We have used such a setup to assess differences between manually-generated and tool-generated code

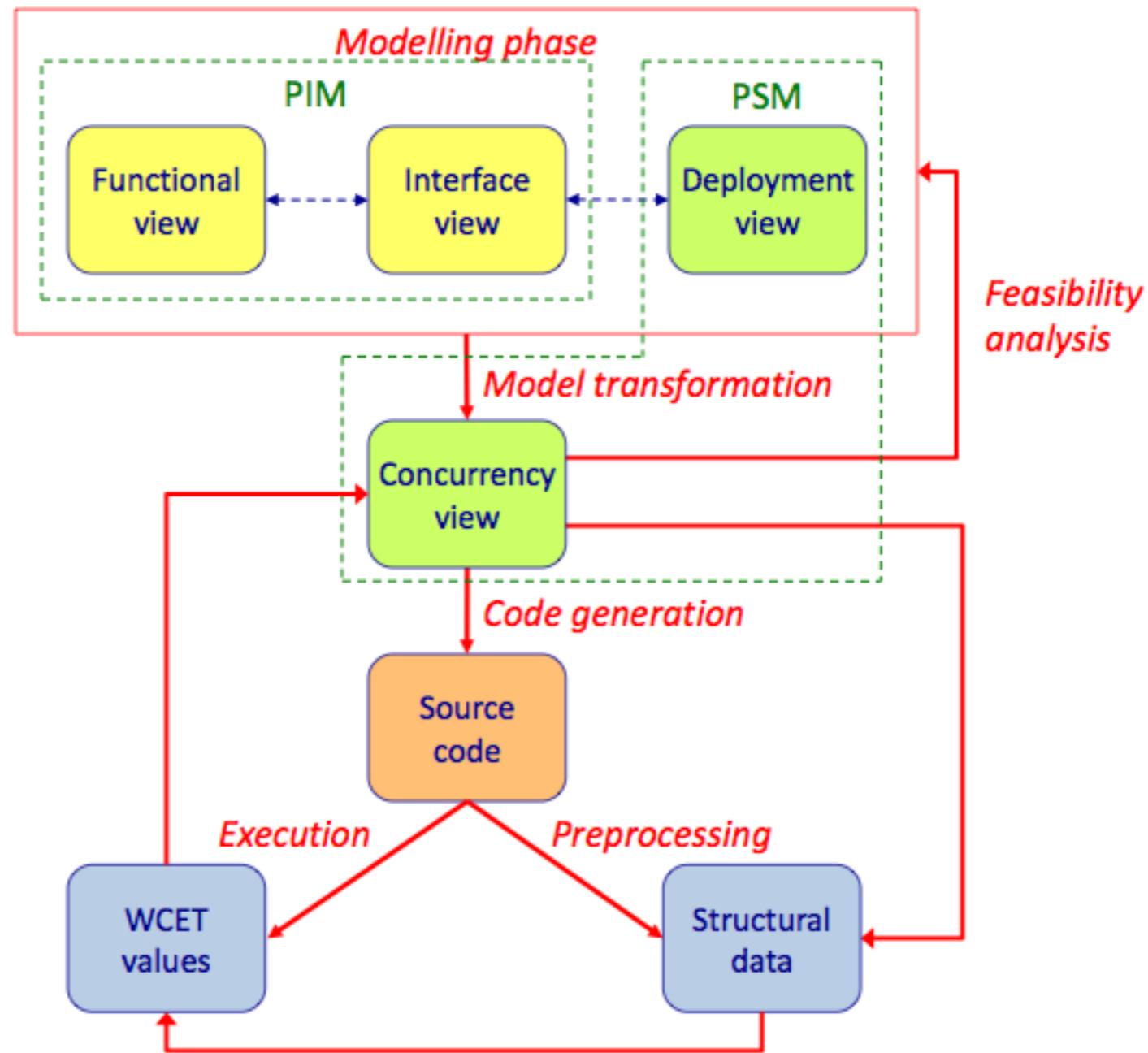
# The TASTE toolset

- Developed and maintained under the auspices of ESA/ESTEC
  - following ASSERT FP6 project
- **AADL**-centred, complemented with other languages
  - ASN.1 for data modelling
  - SDL for event-driven behaviour
  - Simulink for continuous-time functionality

# Timing analysis in AADL

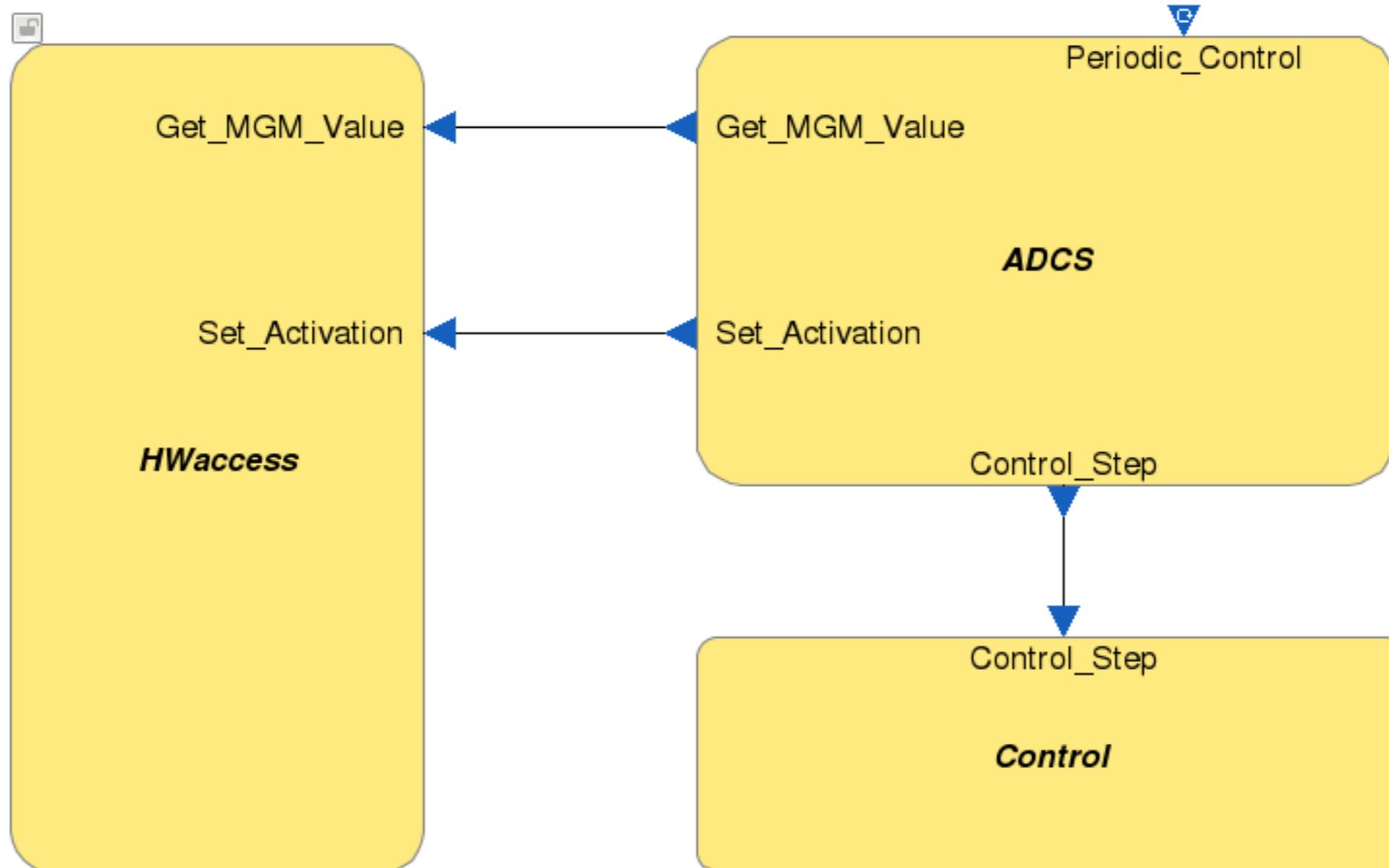
- **MBSDL** (Model-Based Software Development Lifecycle)
  - ESA project carried out by Indra, UPM, Unican
- Rapita Verification Suite (**RVS**) integrated in TASTE by UPM
  - RVS data extracted from AADL and for implementation code
  - Ocarina transformation scripts
- **Structural analysis** computes possible execution paths
- **Dynamic analysis** provides execution traces with time data
  - used to estimate WCET values

# Extended ASSERT process

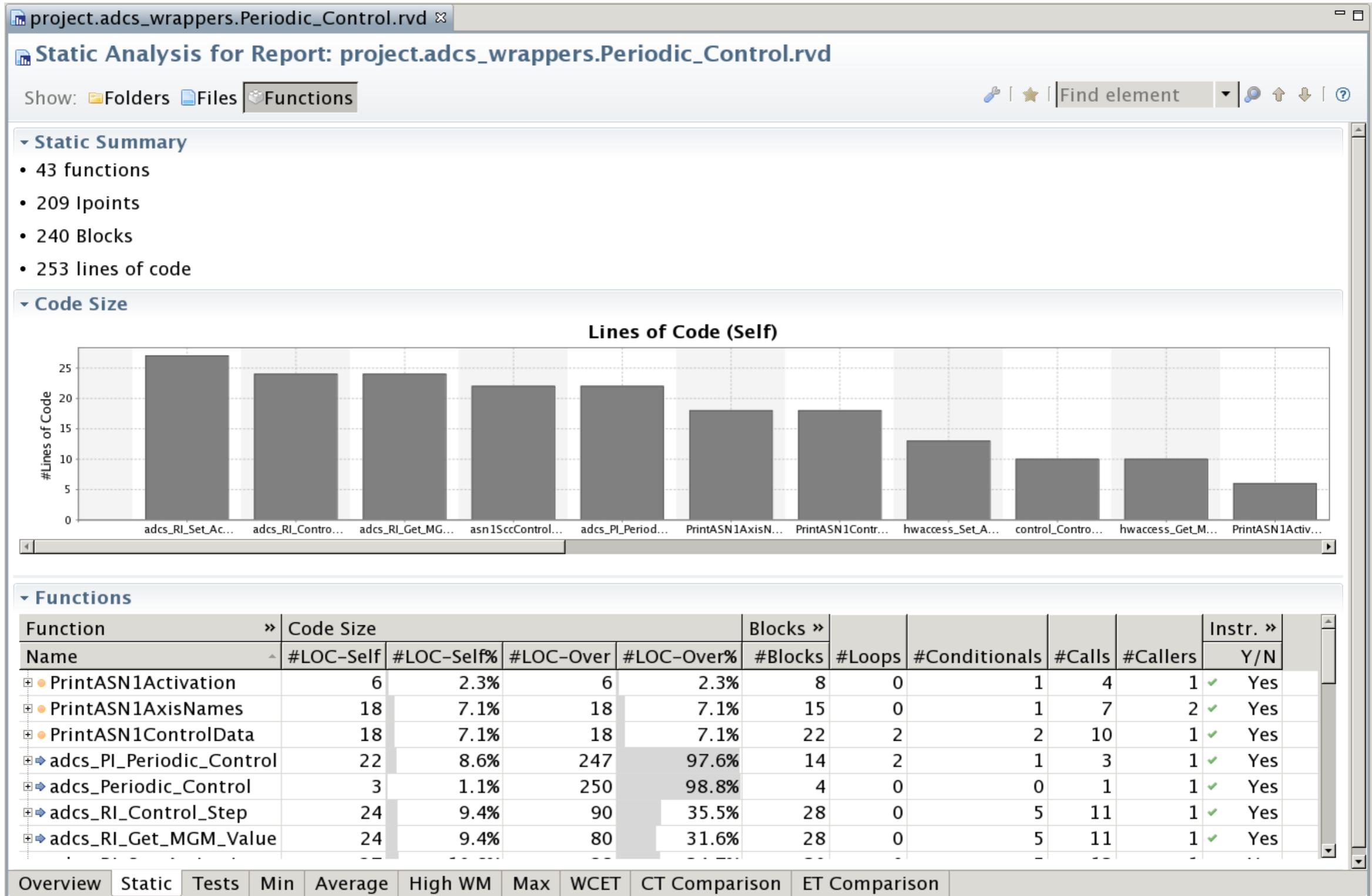


# Case study

## UPMSat2 ADCS



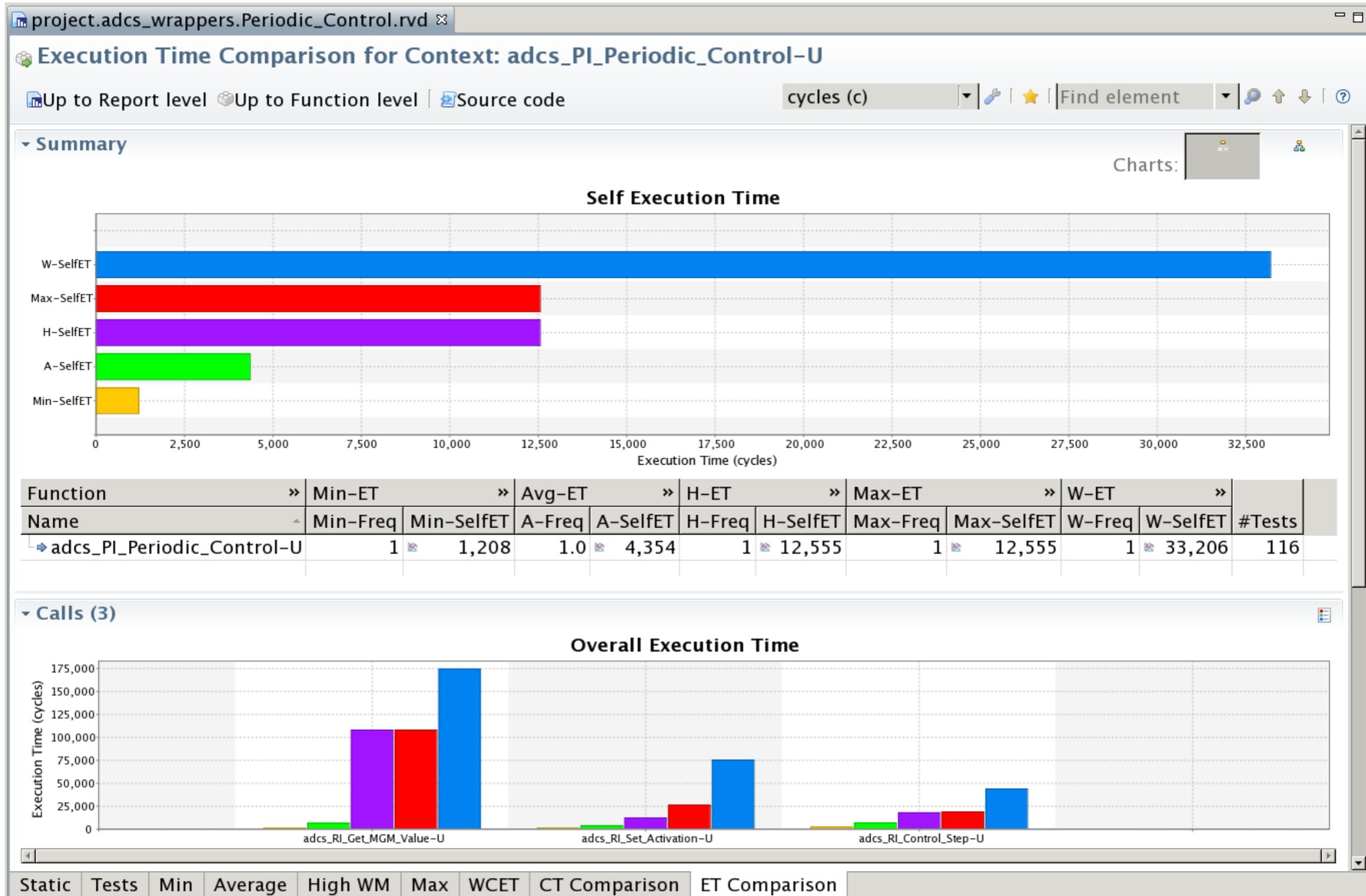
# Structural analysis of periodic task



# Structural analysis

	Original code	TASTE
Source files	15	304
AADL		19
Ada	8	50
C	5	89
Python	2	2
Lines of code	814	74032
hand-coded lines	814	57

# Timing analysis



# Timing analysis comparison

WCET (cycles)	Original code	TASTE
Control algorithm	7074	9131
Control task	30812	33206

# Conclusions

- The structural complexity of automatically generated code is significantly higher than that of hand-written code
- The execution time values are only 10 % – 30 % higher
- Differences due to glue code generated by tools
  - and to different code generation methods

# More information

<http://web.dit.upm.es/str/upmsat2/>