

# ParTraP : a language and its toolset for the specification of parametric trace properties

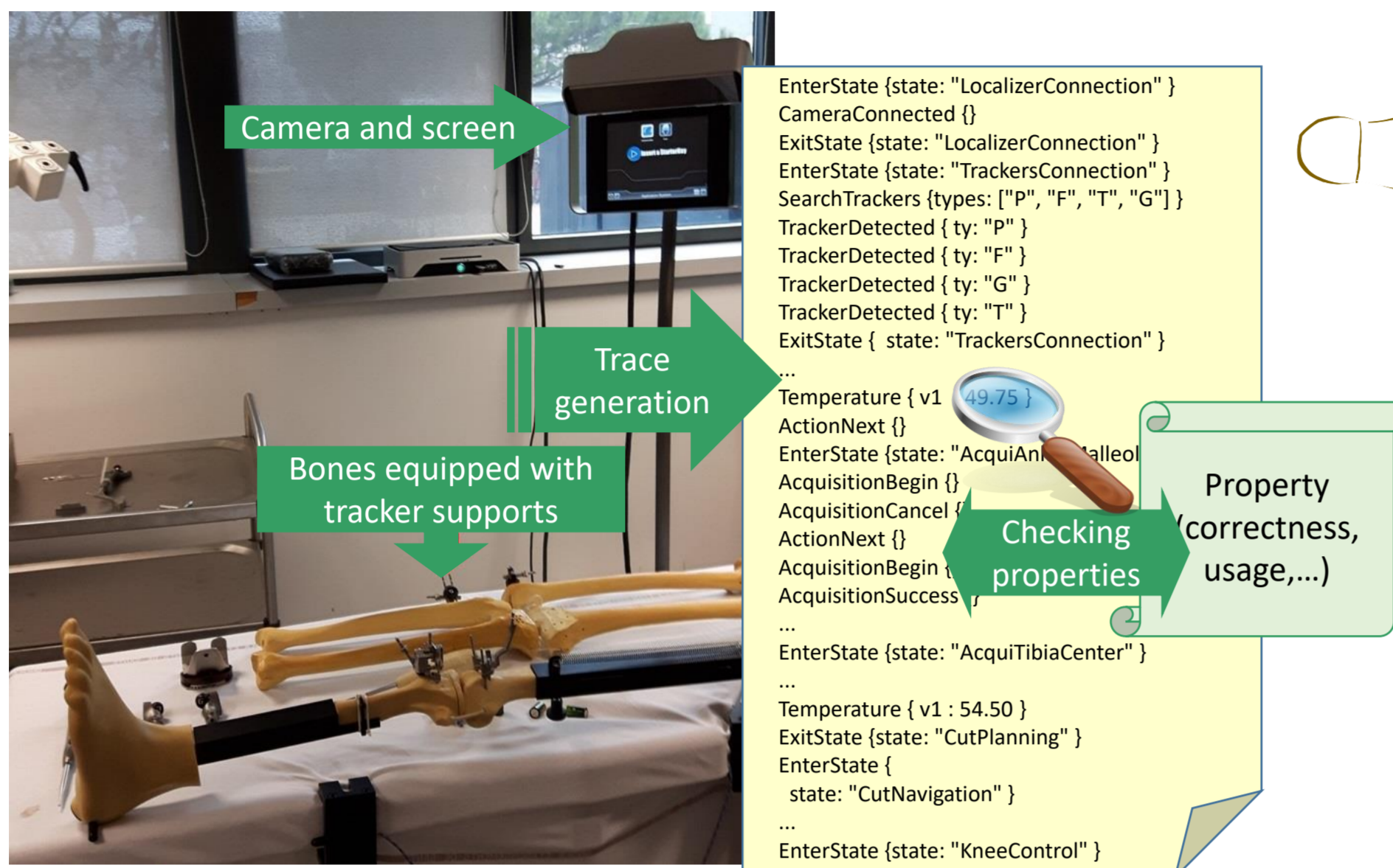
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## Context : Computer-aided Surgery



High quality software required but formal methods are not mandatory!

## ParTraP : Parametric Trace Property language

Context and Needs:

- Off-line trace monitoring (traces sent to Blue Ortho after the surgery)
- Temporal properties expressed on parametric events
- Properties valid on a restricted scope of the trace
- An intuitive language for SW Engineers not trained in formal methods

Design choices for the ParTraP language [FormaliSE18]

- Declarative with keyword-oriented syntax
- The use of Dwyer's specification patterns
- Possible inclusion of Python assertions

## Sample properties

« The temperature of the camera must stay above 25°C »

**ValidTemp** : absence\_of Temp t where t.v1 < 25;

Or using Python assertions:

```
import math
```

**ValidTemp** : absence\_of Temp t where \$math.fabs(t.v1) < 25\$;

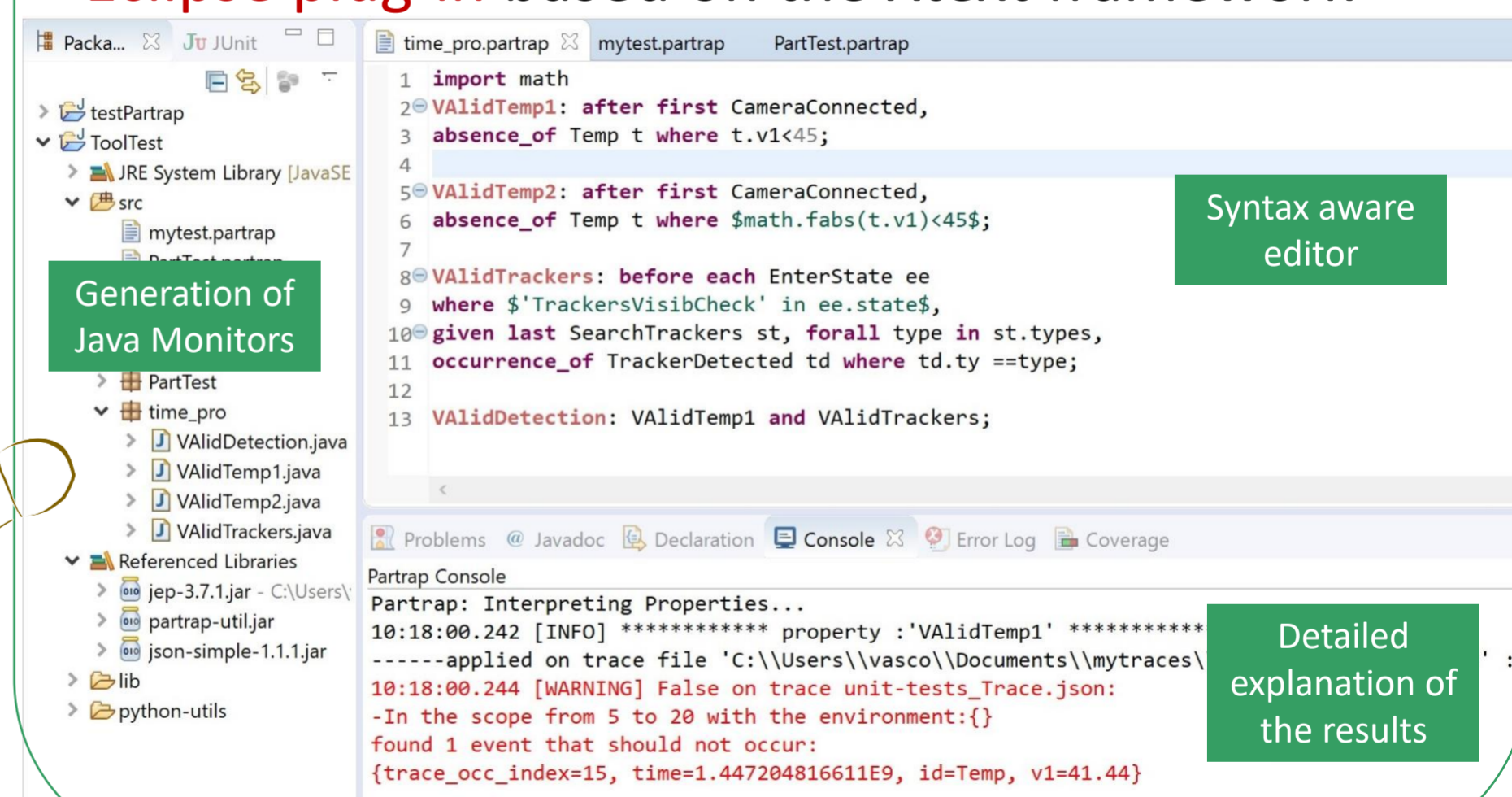
**ValidTemp1** : after first CameraConnected, ValidTemp;

« Each EnterState should be followed by an ExitState with the same state parameter »

**ValidExit** : EnterState ee followed by ExitState xx where ee.state == xx.state;

## ParTraP-IDE [RV18]

Eclipse plug-in based on the Xtext framework



## Example and Counter-example generator

Helps software engineers to figure out the meaning of their formulae!

Given a ParTraP property, our prototype tool based on Z3 SMT solver, finds a valuation of the trace which satisfies the property.

For example the following property

```
(assert (afterFirst "CameraConnected"
  (absence_of_where "Temp" t (< (v1 t) 25.0))))
```

Produces the following trace where Temp events are absent

```
[{"id": "CameraConnected", "time": 5263, "v1": 2.0},
 {"id": "C", "time": 5264, "v1": 0.0},
 {"id": "CameraConnected", "time": 5853, "v1": 4.0}]
```

## Availability

ParTraP-IDE is distributed as open-source at

<http://vasco.imag.fr/tools/partrap/>

A « lightweight formal method » to fit the needs of software engineers not trained in FM

- Keyword oriented
- Python expressions
- Detailed explanations of results
- Examples generation

[FormaliSE18] Yoann Blein, Yves Ledru, Lydie du Bousquet, Roland Groz:

« Extending specification patterns for verification of parametric traces ».

FormaliSE@ICSE 2018: 10-19, ACM, 2018, <https://doi.org/10.1145/3193992>

[RV18] Ansem Ben Cheikh, Yoann Blein, Salim Chehida, German Vega, Yves Ledru, Lydie du Bousquet:

« An Environment for the ParTraP Trace Property Language (Tool Demonstration) ».

RV 2018: 437-446, Springer, 2018, [https://doi.org/10.1007/978-3-030-03769-7\\_26](https://doi.org/10.1007/978-3-030-03769-7_26)



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