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Ablation Workshop: Code Comparison

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## Test Case Series 1

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# Ablation Workshop Test Case

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**A simple one-dimensional test case is defined for the purpose of inter-code comparison. This year the focus is set on in-depth physics and chemistry. Material properties, boundary conditions, and output format are provided.**

## I. Test case objectives

Three types of material-response codes have been identified in the community:

- Type 1: CMA type codes (heat transfer, pyrolysis decomposition, simplified transport of the pyrolysis gases)
- Type 2: CMA + Averaged momentum equation for the transport of the pyrolysis gases
- Type 3: Higher fidelity codes (possibly including treatment of the finite-rate chemistry, multi-component diffusion, radiative heating, etc).

There are two objectives to this test:

1. inter-calibration of codes of the same type (focus: numerics and interpretation of the data);
2. comparison of codes of different types (focus: modeling approach).

## II. Test case

For this first inter-comparison exercise, we decided to use a simple test case. The idea for this year is to compare the in-depth physics and chemistry implemented in the codes.

Summary of the one-dimensional test for 2011: sample of TACOT of 5 cm, heated on one side at 1664K for 1 minute at atmospheric pressure, adiabatic boundary condition on the other side.

Initial conditions:  $p = 1\text{atm}$  (101325 Pa),  $T = 298\text{K}$ . The initial gas composition in the material is left open.

Boundary conditions:

- Temperature: Top:  $t=0$  s,  $T=298$  K;  $t=0.1$  s,  $T=1644$  K;  $t=60$  s,  $T=1644\text{K}$  / Bottom: adiabatic
- Pressure: Top:  $p = 1\text{atm}$  / Bottom: no flux.

More elaborated test cases will be defined for next year (surface recession, multi-dimensional).

## III. Material data

The material properties are furnished in the attached spreadsheet. Equations referencing to the way the material properties are used in CMA/FIAT are provided in the spreadsheet. For more information on the CMA model, please consult the CMA manual (provided in the 'reference' directory).

## IV. Code output

The type of output desired is provided in the directory 'output' together with two suggested plots for visual comparison (see figure 1 for illustration).

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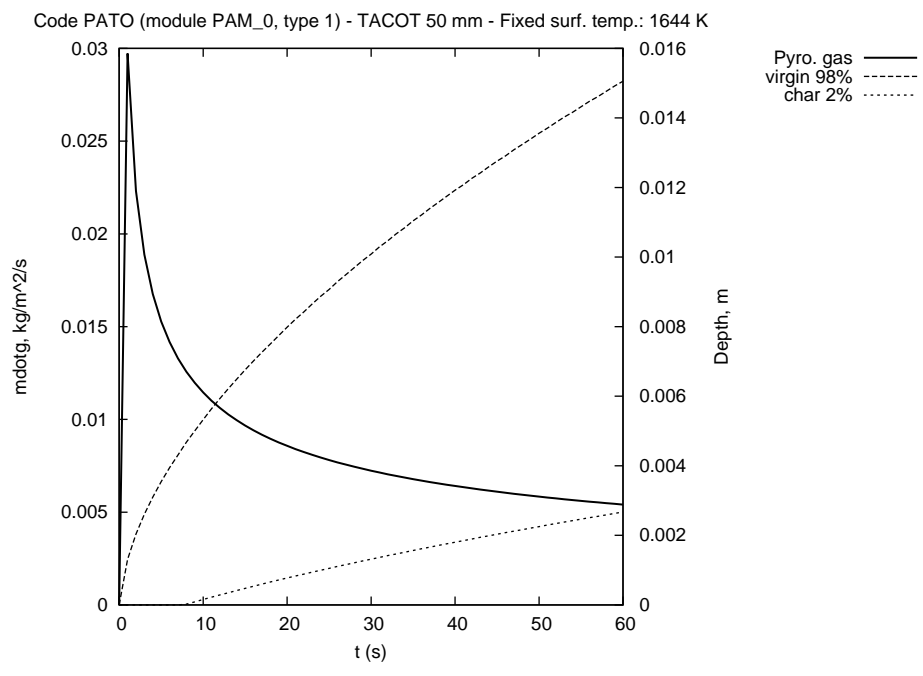
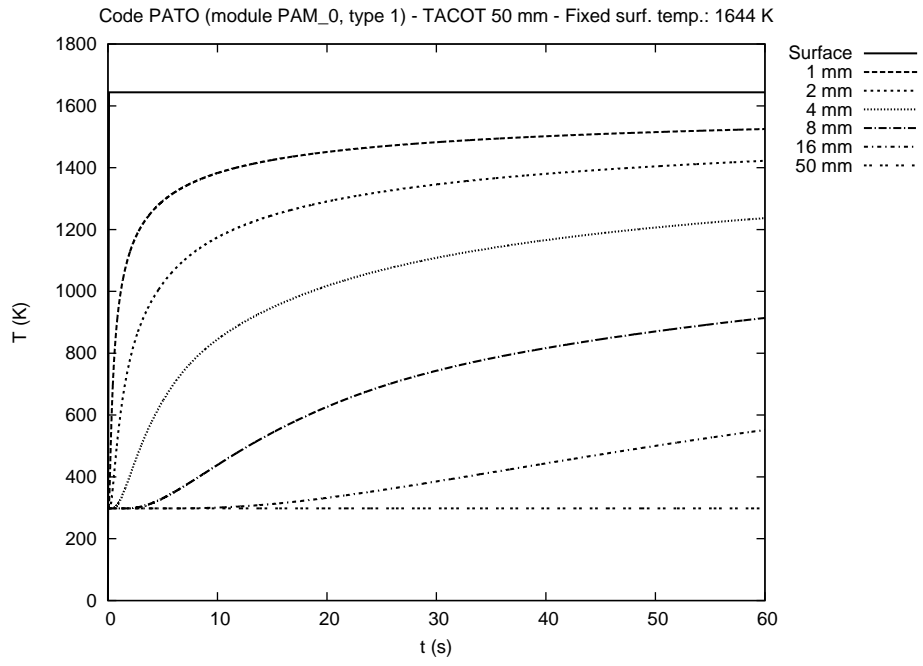


Figure 1. Suggested output for visual comparison of the results.