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RELAP5-3D Code Architect

# RELAP5-3D New Developments 2026

INL/CON-26-92641

Battelle Energy Alliance manages INL for the  
U.S. Department of Energy's Office of Nuclear Energy

 Idaho National Laboratory

# Platforms supported

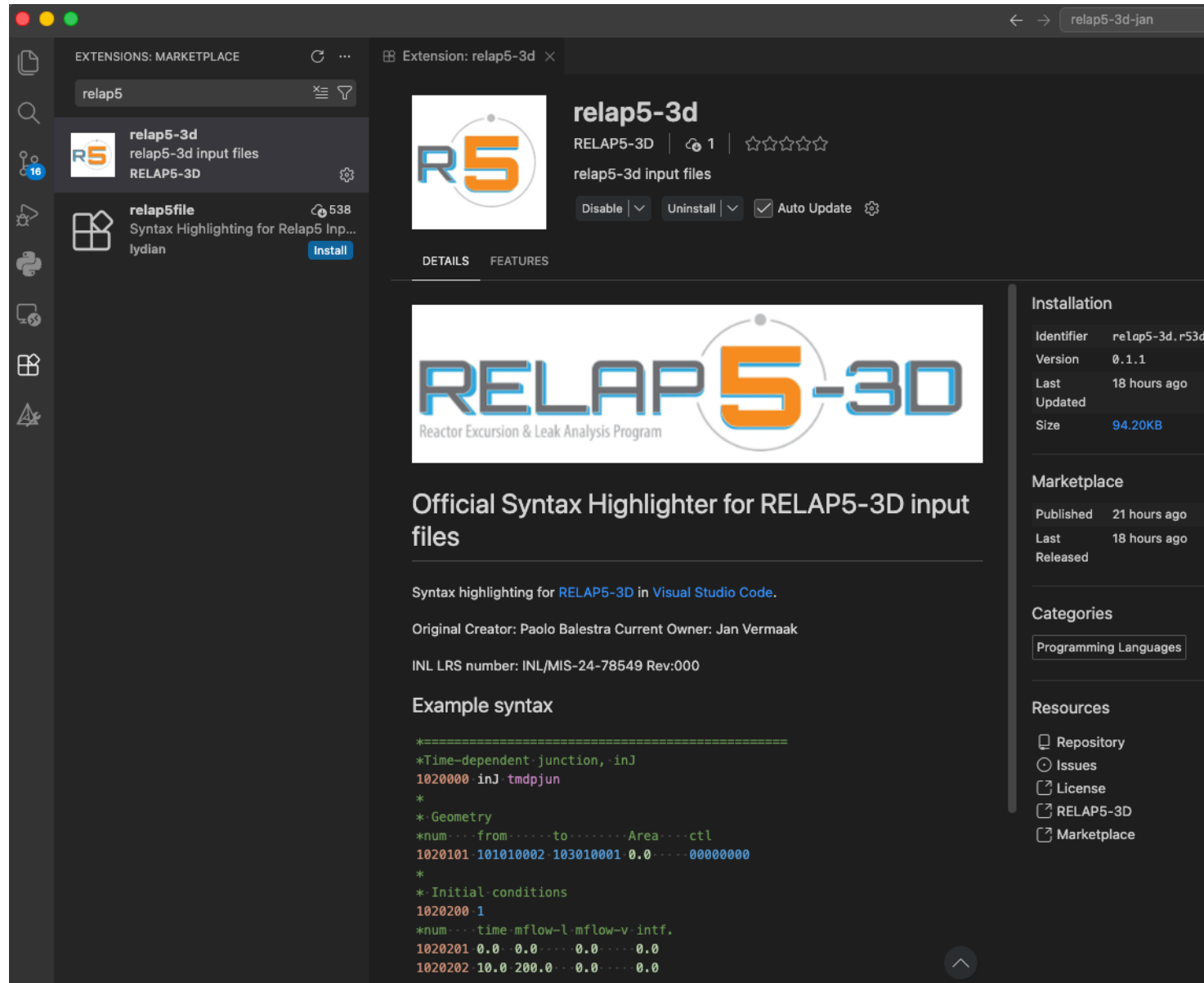
- Platforms supported:
  - Red Hat Linux 8/9
  - Windows 11



- MacOS<sup>NEW!!</sup>
  - Only ARM processors, Intel not supported
  - Digital Signatures are still a problem (contact Code Custodian)

Reminder: Level 2 executables does not guarantee ASME NQA-1, and does not mean developmental assessment passed!

# Visual Studio Code – RELAP5-3D input file syntax highlighting



The screenshot displays the Visual Studio Code interface with the RELAP5-3D extension installed. The left sidebar shows the 'EXTENSIONS: MARKETPLACE' view with a search for 'relap5'. Two extensions are listed: 'relap5-3d' (relap5-3d input files, RELAP5-3D) and 'relap5file' (Syntax Highlighting for Relap5 Input files, lydian). The main panel shows the details for the 'relap5-3d' extension, including its logo, version (0.1.1), and a list of features. Below the details, there is a section for 'Official Syntax Highlighter for RELAP5-3D input files' with a description, original creator, current owner, and an example of the syntax highlighting for RELAP5-3D input files.

**relap5-3d**  
RELAP5-3D | 1 | ☆☆☆☆☆  
relap5-3d input files  
Disable | Uninstall | Auto Update

**RELAP5-3D**  
Reactor Excursion & Leak Analysis Program

**Official Syntax Highlighter for RELAP5-3D input files**

Syntax highlighting for RELAP5-3D in Visual Studio Code.

Original Creator: Paolo Balestra Current Owner: Jan Vermaak

INL LRS number: INL/MIS-24-78549 Rev:000

**Example syntax**

```
*****  
*Time-dependent junction, inJ  
1020000 inJ tmdpjun  
*  
*Geometry  
*num from to Area ctl  
1020101 101010002 103010001 0.0 00000000  
*  
*Initial conditions  
1020200 1  
*num time mflow-l mflow-v intf.  
1020201 0.0 0.0 0.0 0.0  
1020202 10.0 200.0 0.0 0.0
```

**Installation**

| Identifier   | relap5-3d.r53d |
|--------------|----------------|
| Version      | 0.1.1          |
| Last Updated | 18 hours ago   |
| Size         | 94.20KB        |

**Marketplace**

| Published     | 21 hours ago |
|---------------|--------------|
| Last Released | 18 hours ago |

**Categories**

Programming Languages

**Resources**

- Repository
- Issues
- License
- RELAP5-3D
- Marketplace



## New Features

**Non-dimensional numbers**

## New Features:

$\mu$ , Viscosity  
 $C_p$ , Heat Capacity  
 $k$ , Thermal-conductivity  
 $\rho$ , Density  
 $v$ , Velocity  
 $D_h$ , Hydraulic diameter

- Prandtl numbers (Pr):

$$Pr = \frac{\mu C_p}{k}$$

prandf

Dimensionless Prandtl number for the liquid phase.

prandg

Dimensionless Prandtl number for the gas phase.

- Reynold's number (Re):

$$Re = \frac{\rho v D_h}{\mu}$$

reynf

Dimensionless Reynold's number for the liquid phase.

reynng

Dimensionless Reynold's number for the gas phase.

MORE COMING!  
e.g. Grashof,  
Rayleigh



New Command Line Argument  
**-inp**

## -inp Command Line Argument

-inp    Shortcut for file name assignments. Given a file name like model123.i this argument will assign the input file name, to be processed, as this exact name but will extract the base name "model123" and assign arguments "-O model123.o", "-p model123.plt" and "-r model123.r".

## -inp Command Line Argument 1

```
relap5.x -i model123.i
```

```
Thermodynamic properties file for h2o is tpfh2o,  
tpfh2o version 1.1.1, tables of thermodynamic properties of light water
```

```
Start time: 15:56:58
```

| cputime                    | prob.time | time step    | err.est  | Crnt.limit | adv.cnt. |
|----------------------------|-----------|--------------|----------|------------|----------|
| 0.0                        | 0.00000   | 1.000000E-02 | 0.00000  | 0.00000    | 0        |
| Hydro/Kinetics/TH cycles:  |           | 114000       | 37000    | 43793000   |          |
| End time, cycles, seconds: |           | 15:56:58     | 48062000 | 4.8062E-02 |          |

```
Transient terminated by end of time step cards.
```

## -inp Command Line Argument 2

```
relap5.x -i model123.i
```

```
Open error number      17 on file outdta perhaps file already exists.  
STOP output
```

## -inp Command Line Argument 3

```
relap5.x -i model123.i -o model123.o
```

```
Thermodynamic properties file for h2o is tpfh2o,  
tpfh2o version 1.1.1, tables of thermodynamic properties of light water  
Start time: 15:56:58  
  cputime  prob.time    time step    err.est      Crnt.limit    adv.cnt.  
    0.0    0.00000    1.000000E-02  0.00000      0.00000        0  
Hydro/Kinetics/TH cycles:         114000        37000      43793000  
End time, cycles, seconds:        15:56:58      48062000      4.8062E-02  
  
Transient terminated by end of time step cards.
```

## -inp Command Line Argument 4

```
relap5.x -i model123.i -o model123.o
```

```
Open error number      17 on file model123.o perhaps file already exists.  
STOP output
```

## -inp Command Line Argument 5

```
relap5.x -i model123.i -0 model123.o
```

```
Thermodynamic properties file for h2o is tpfh2o,  
tpfh2o version 1.1.1, tables of thermodynamic properties of light water  
Start time: 15:56:58  
  cputime  prob.time      time step    err.est      Crnt.limit    adv.cnt.  
    0.0    0.00000    1.000000E-02    0.00000      0.00000         0  
Hydro/Kinetics/TH cycles:          114000          37000      43793000  
End time, cycles, seconds:      15:56:58      48062000      4.8062E-02  
  
Transient terminated by end of time step cards.
```

```
ls
```

```
model123.i      model123.o      plotfl      restrt
```

## -inp Command Line Argument 6

```
relap5.x -i model123.i -O model123.o -r model123.r
```

```
Thermodynamic properties file for h2o is tpfh2o,  
tpfh2o version 1.1.1, tables of thermodynamic properties of light water  
Start time: 15:56:58  
  cputime  prob.time      time step    err.est      Crnt.limit    adv.cnt.  
    0.0    0.00000    1.000000E-02    0.00000      0.00000         0  
Hydro/Kinetics/TH cycles:          114000          37000      43793000  
End time, cycles, seconds:      15:56:58      48062000      4.8062E-02  
  
Transient terminated by end of time step cards.
```

```
ls
```

```
model123.i      model123.o      model123.plt      model123.r
```

## -inp Command Line Argument 7

```
relap5.x -inp model123.i
```

```
Thermodynamic properties file for h2o is tpfh2o,  
tpfh2o version 1.1.1, tables of thermodynamic properties of light water  
Start time: 15:56:58  
  cputime  prob.time    time step    err.est      Crnt.limit    adv.cnt.  
    0.0    0.00000    1.000000E-02  0.00000      0.00000        0  
Hydro/Kinetics/TH cycles:          114000          37000      43793000  
End time, cycles, seconds:      15:56:58      48062000      4.8062E-02  
  
Transient terminated by end of time step cards.
```

```
ls
```

```
model123.i    model123.o    model123.plt    model123.r
```



New Command Line Argument  
**-template**

## -template Command Line Argument

-template Provides a simple input template for the option indicated. Supported options are: tmdpvol, tmdpjun, sngljun, snglvol, pipe, pump, valve. Specials values include

- input1; a complete model with a pipe,
- input2; a complete model with a pipe AND a heat structure,
- input3: a complete model with a pump.

MORE COMING!

# -template Command Line Argument 1

```
relap5.x -template tmdpvol
```

```
*===== Geometry
```

| *CardNum | Area        | Length | Volume | Varphi | Theta | ElCh | Roughn. | Dh     | ctl     |
|----------|-------------|--------|--------|--------|-------|------|---------|--------|---------|
| CCC0101  | 0.159592907 | 1.0    | 0.0    | 0.0    | 0.0   | 0.0  | 0.0     | 0.2032 | 0000001 |

```
*
```

```
*===== Initialization
```

```
*CardNum ctl
```

```
CCC0200 003
```

```
*CardNum time P T
```

```
CCC0201 0.0 1.502e6 425.0
```

```
*
```

## -template Command Line Argument 2

```
relap5.x -template input1
```

```
* Title card - always required
= Sample input deck
* #####
*# * Components
*
*== *=====
* *Ti *Pipe, conPipe
* *
10 *Ca *CardNum name      type
* 101 1030000  conPipe  pipe
* *
* *
* *
20 *Ca *Geometry
* *CardNum      NumVols
* 101 1030001      9
*# *
* *
* *
*== *CardNum      Area          nv
* *Ca 1030101      0.159592907  4
* *T 101 1030102      0.079796453  5
* *
```

## -template Command Line Argument 3

```
relap5.x -template tmdpvol+tmdpjun
```

```
*=====
*Time-dependent volume
*
*CardNum name      type
CCC000
*
*=====
*Time-dependent junction, inJ
*CardNum
CCC010
*CardNum name      type
*
CCC0000  tmdpjun1 tmdpjun
*=====
*CardNum
* Geometry
CCC020
*CardNum from      to      Area      ctl
*CardNum CCC0101  CCC010000 CCC000000 0.0      00000000
CCC020
*
* Initial conditions
*CardNum ctl
*
```

## Coming Soon

- Control Variable functions for querying fluid properties

$$Nu = 0.027 Re^{0.8} Pr^{0.33} \left( \frac{\mu}{\mu_w} \right)^{0.14}, \mu_w(T_w)$$

- Plug-in based heat transfer correlations
  - Supply a dylib/so/dll
  - Set volume/range-of-vols to use HTC defined in plug-in (regime specific)
- Upgrades to CHF correlations, collaboration with UWM
- Plug-in based friction factor correlations
- Expansion of V&V cases for liquid metals and molten salts
- 3D Heat Conduction
- Upgraded models for MSR DNP modelling
- Packed-bed/Porous-flow volumes



## Coming Soon 2

- relap5.py, RELAP5\_3D\_PYTHON.py
  - Python integrated RELAP5-3D execution
  - On the fly-plotting
  - Call-back functions
  - Interactive controls
- Useful for:
  - Not having to open APT-plot
  - Real-time interactivity

DEMO

also:  
librelap5\_3d\_shared.dylib (MacOS)  
librelap5\_3d\_shared.so (Linux)  
librelap5\_3d\_shared.dll (Windows)



# Idaho National Laboratory

*Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.*

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