



# OPMRUN Graphical User Interface For OPM Flow

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# Graphical User Interface For OPM Flow

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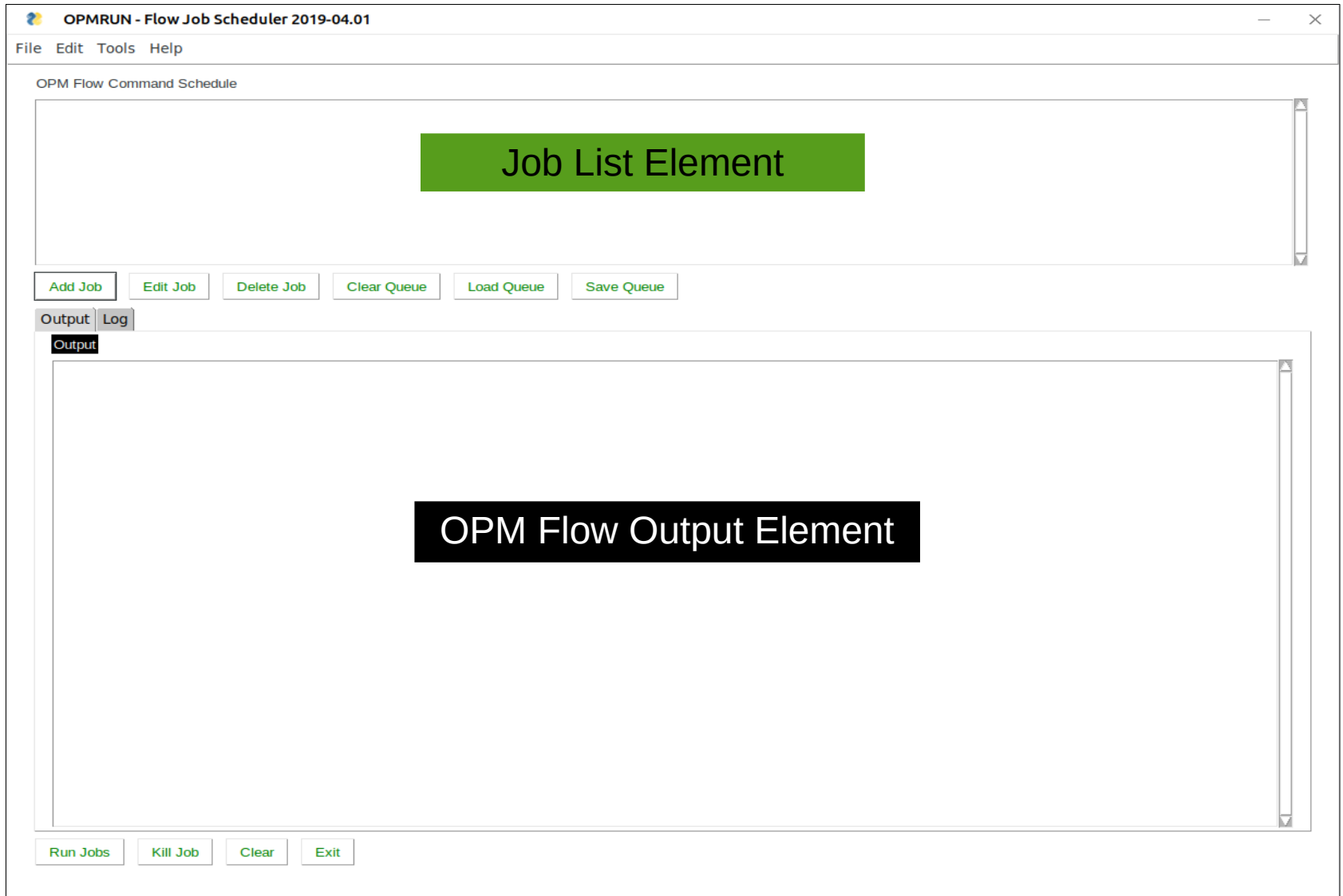
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Date	Revision	Description	Prepared	Checked	Approved
2018-11-25	2018-10-1	Initial Release	D. Baxendale	N/A	N/A
2018-12-04	2018-10-2	Update	D. Baxendale	N/A	N/A
2019-06-10	2019-04-1	Version Update	D. Baxendale	N/A	N/A

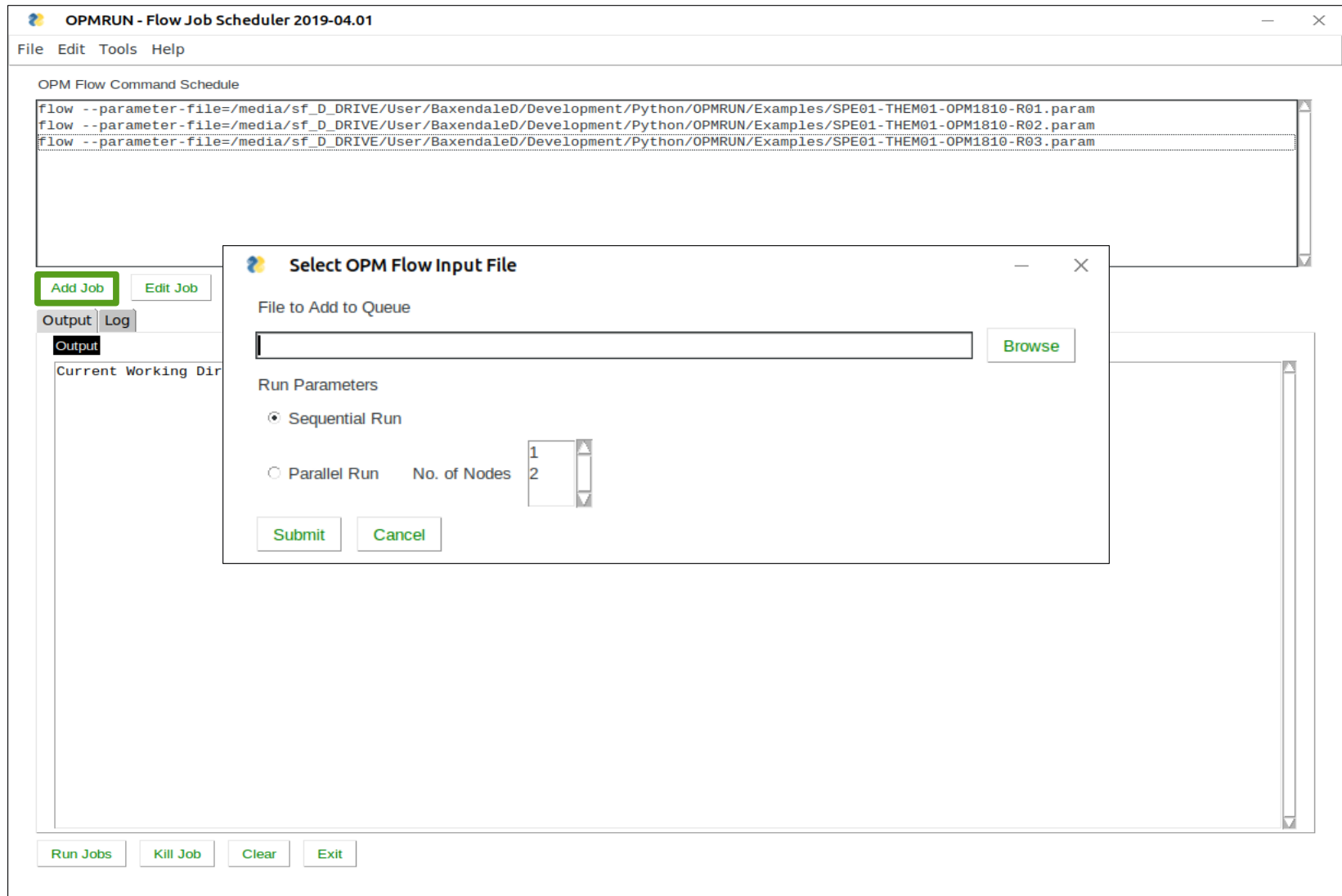
# E I P C OPMRUN:What Is It?

- A graphical user interface to OPM Flow that has similar functionality to the commercial simulator's ECLRUN program.
- Target audience are Reservoir Engineers in a production environment. Developers and experienced Linux users will already have compatible work flows.
- Allows editing and management of OPM Flow's run time parameters. Default parameters are automatically loaded from OPM Flow, and the user can reset the default set either from a parameter or PRT file. Editing of a job's parameter file is also available.
- Allows simulation jobs to be queued and run in either foreground (under OPMRUN), or background (in an xterm terminal session). Jobs in the queue can be set to run in NOSIM mode or RUN mode.
- Foreground jobs can be killed from OPMRUN.
- Queues can be edited, saved and loaded.
- Jobs can be compressed to save space (DATA , and all OPM Flow output files) and uncompressed.
- Written in Python 3 and tested under Ubuntu-Mate 18.04 TLS.
- Compiled binary version should work on all Linux systems, no need to install dependencies or Python.

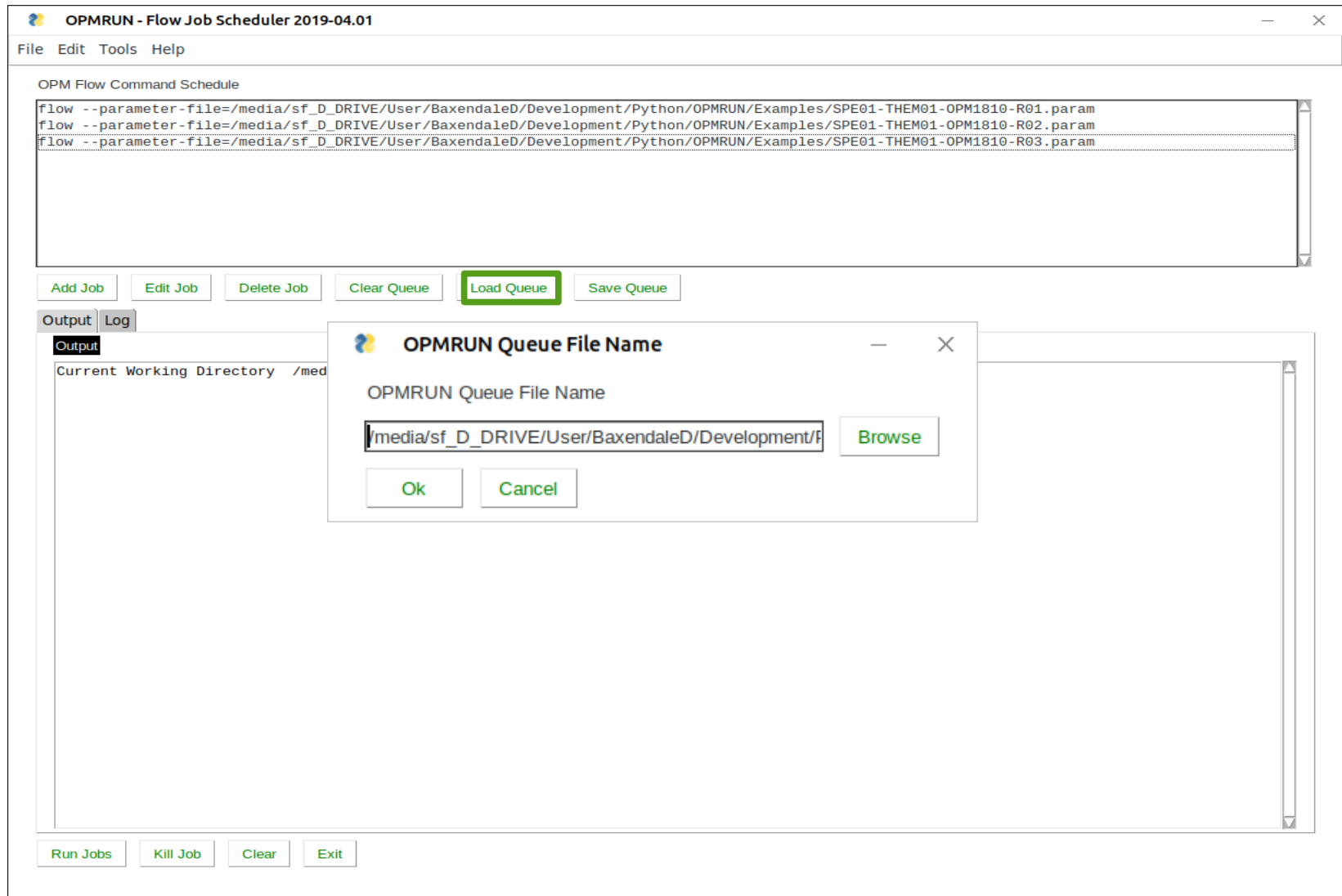
# E I P C OPMRUN: Simple And Clean Interface



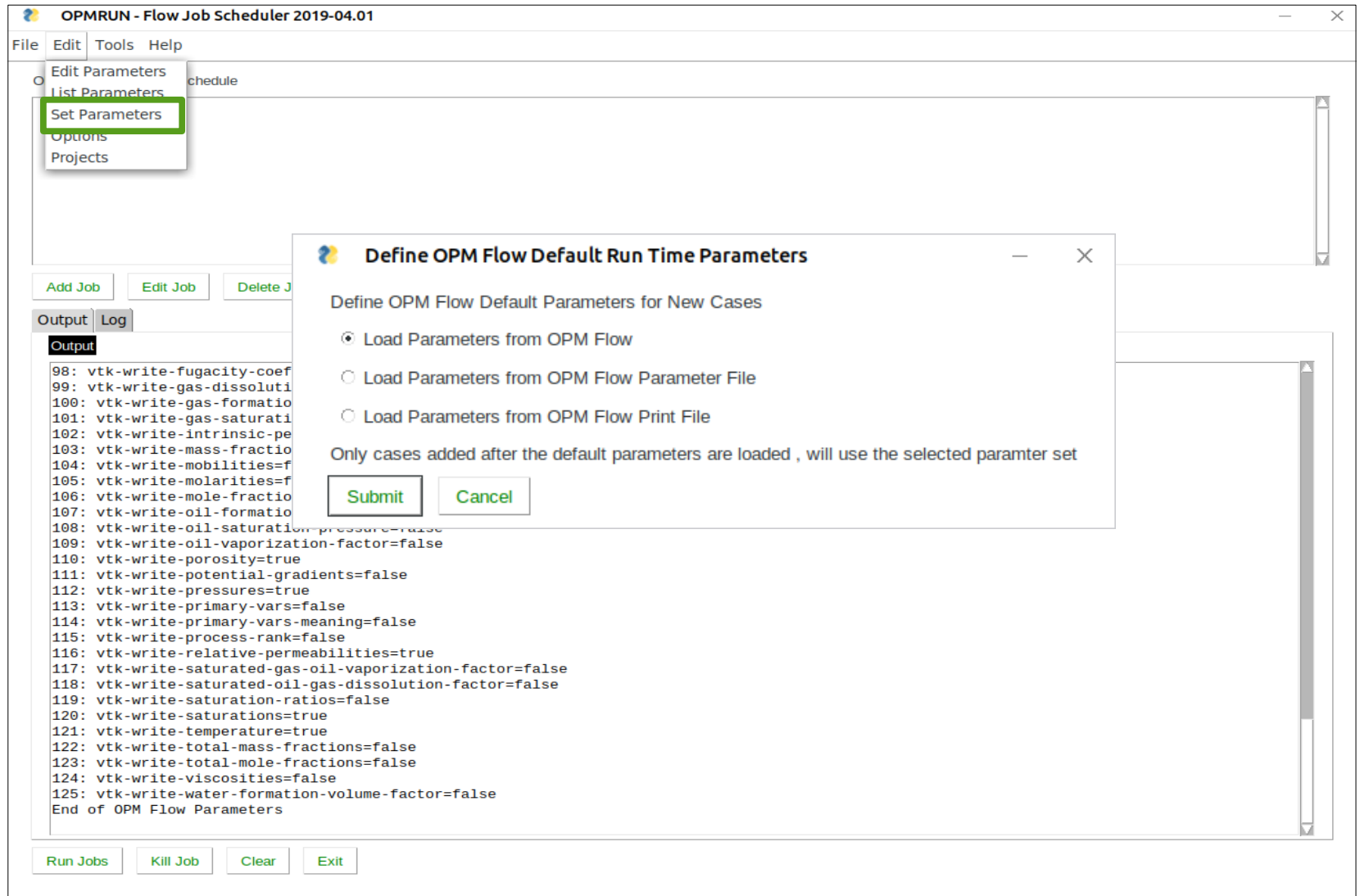
# E I P C OPMRUN: Add Job And Select Run Type



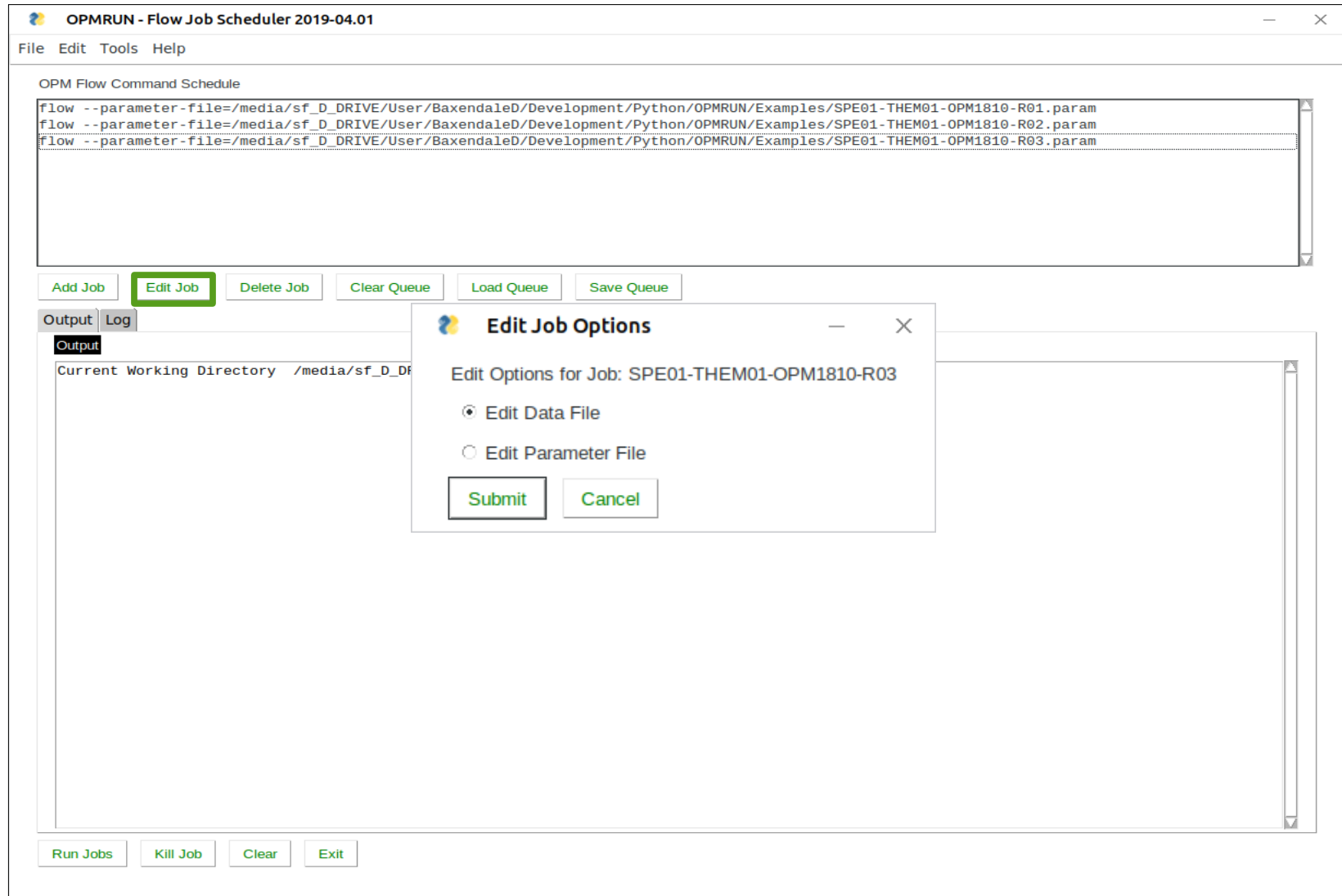
# E I P C OPMRUN: Job Queue



# E I P C OPMRUN: Set Parameter Default Options



# E I P C OPMRUN: Edit Job Data & Parameter File





# EIPC OPMRUN: Edit Parameter File With Help

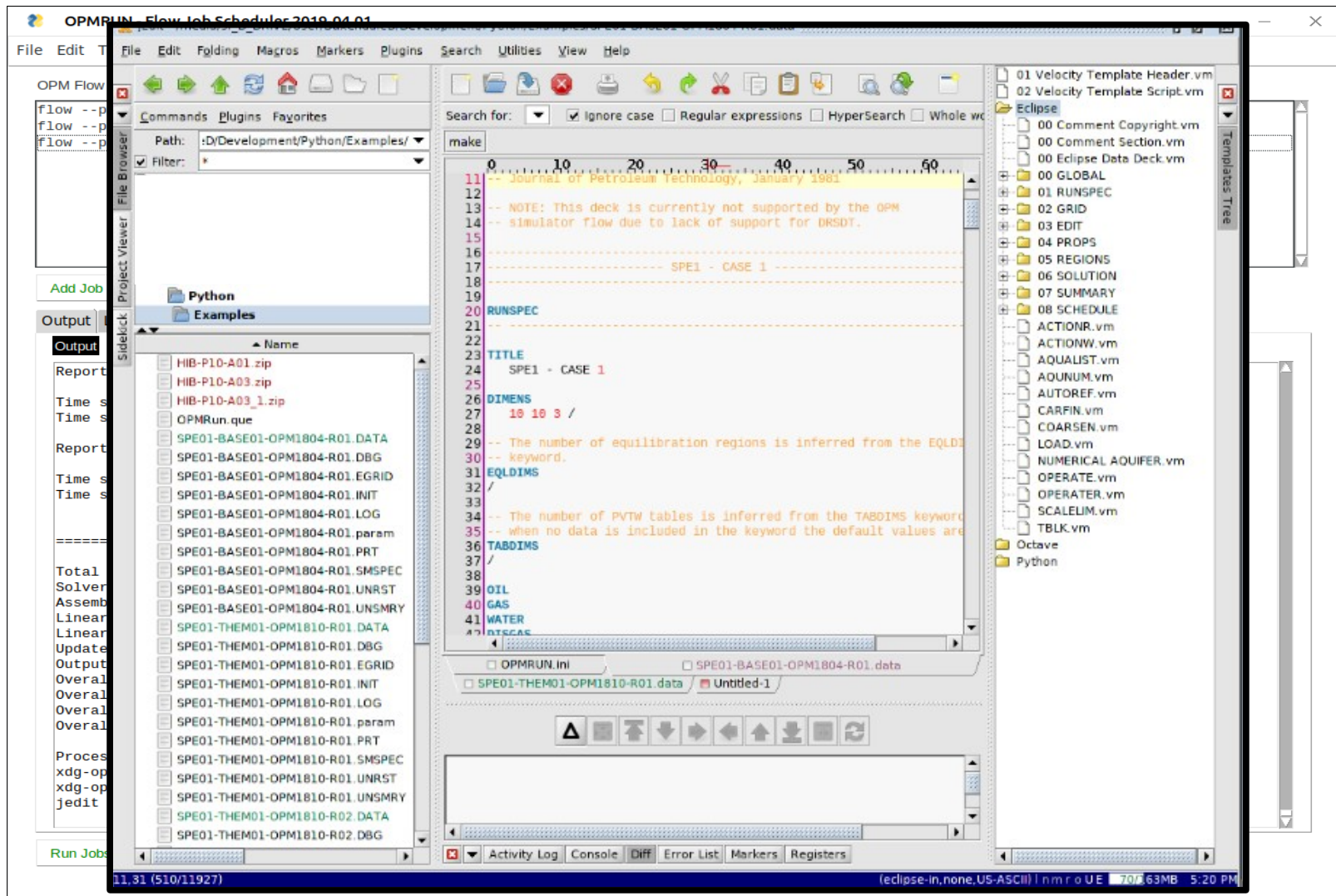
The screenshot displays the OPMRUN - Flow Job Scheduler 2019-04.01 application window. The main interface includes a menu bar (File, Edit, Tools, Help), a toolbar with 'Add Job', 'Edit Job' (highlighted with a green box), and 'Delete Job' buttons, and a 'Current Working Directory' field. A list of flow jobs is visible in the background.

The 'OPM Flow Default Parameters' dialog box is open, showing a list of parameters to be edited. The parameters are:

- cpr-ell-solvetype=0
- cpr-max-ell-iter=20
- cpr-reuse-setup=0
- cpr-solver-verbose=0
- cpr-use-drs=false
- dbhp-max-rel=1
- dp-max-rel=0.3
- ds-max=0.2
- dwelling-fraction-max=0.2
- ecl-deck-file-name="SPE01-THEM01-OPM1810-R01.DATA"
- ecl-output-double-precision=false
- ecl-output-interval=1
- ecl-strict-parsing=true
- enable-adaptive-time-stepping=true
- enable-async-ecl-output=true
- enable-async-vtk-output=true
- enable-dry-run="auto"
- enable-ecl-output=true
- enable-logging-fallout-warning=false
- enable-opm-rst-file=false

The 'Parameter to Change' field is set to 'enable-dry-run="auto"'. The 'Parameter Help' text reads: 'Specify if the simulation ought to be actually run, or just pretended to be. Default: "auto"'. The dialog box has 'Edit', 'Save', 'Cancel', and 'Exit' buttons at the bottom.

# EIP C OPMRUN: Edit Data File



# E I P C OPMRUN: Run Jobs In Queue Options

The screenshot displays the OPMRUN - Flow Job Scheduler 2019-04.01 application window. The main window has a menu bar (File, Edit, Tools, Help) and a toolbar with buttons: Add Job, Edit Job, Delete Job, Clear Queue, Output, and Log. The 'Output' tab is active, showing a log of simulation results. A 'Select Run Option' dialog box is open, prompting the user to select a run option for all 3 cases in the queue. The dialog has two radio buttons: 'Run in No Simulation Mode' and 'Run in Standard Simulation Mode' (which is selected). Below these, there are two radio buttons for 'Submit jobs for foreground or background processing': 'Foreground Processing' (selected) and 'Background Processing'. At the bottom of the dialog are 'Submit' and 'Cancel' buttons. The main window's output log shows simulation details for three time steps, including solver time, assembly time, and linear solve time. The 'Run Jobs' button is highlighted in the bottom toolbar.

OPMRUN - Flow Job Scheduler 2019-04.01

File Edit Tools Help

OPM Flow Command Schedule

```
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R01.param
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R02.param
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R03.param
```

Add Job Edit Job Delete Job Clear Queue

Output Log

Output

Time step 0, stepsize 31 days.  
Time step summary: newton its = 3, linear...

Report step 118/120 at day 3589/3650, date

Time step 0, stepsize 30 days.  
Time step summary: newton its = 3, linear...

Report step 119/120 at day 3619/3650, date

Time step 0, stepsize 31 days.  
Time step summary: newton its = 3, linear...

==== End of simulation =====

Total time (seconds): 10.131  
Solver time (seconds): 6.99308  
Assembly time (seconds): 2.94822 (Failed: 0; 0%)  
Linear solve time (seconds): 2.37584 (Failed: 0; 0%)  
Linear solve setup time (seconds): 0.274215 (Failed: 0; 0%)  
Update time (seconds): 0.990287 (Failed: 0; 0%)  
Output write time (seconds): 2.91776  
Overall Well Iterations: 0 (Failed: 0; -nan%)  
Overall Linearizations: 655 (Failed: 0; 0%)  
Overall Newton Iterations: 532 (Failed: 0; 0%)  
Overall Linear Iterations: 4312 (Failed: 0; 0%)

Process Complete (0)

Run Jobs Kill Job Clear Exit

Select Run Option

Select the Run Option for All 3 Cases in Queue?

☐ Run in No Simulation Mode

☒ Run in Standard Simulation Mode

Submit jobs for foreground or background processing

☒ Foreground Processing

☐ Background Processing

Submit Cancel

Simple selection to switch from NOSIM mode to RUN mode for all jobs in the queue.

# E I P C OPMRUN: Run Jobs In Queue Options

The screenshot displays the OPMRUN - Flow Job Scheduler 2019-04.01 application window. The main area shows a list of jobs in the queue, with the first job highlighted: `flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R01.param`. Below the job list are buttons for **Add Job**, **Edit Job**, **Delete Job**, **Clear Queue**, **Load Queue**, and **Save Queue**.

The **Output** tab is selected, showing the output of the first job. The output text includes:

```
Current Working Directory /media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples
flow --parameter-file=SPE01-THEM01-OPM1810-R01.param | tee SPE01-THEM01-OPM1810-R01.LOG
*
*           This is flow 2019.04
*
* Flow is a simulator for fully implicit three-phase black-oil flow,
*   including solvent and polymer capabilities.
*   For more information, see https://opm-project.org
*
*****
Reading deck file 'SPE01-THEM01-OPM1810-R01.DATA'
=====Saturation Functions Diagnostics=====
System: Black-oil system.
Relative permeability input format: Saturation Family I.
Number of saturation regions: 1

===== Starting main simulation loop =====

Report step 0/120 at day 0/3650, date = 01-Jan-2015
Time step 0, stepsize 1 days.
Time step summary: newton its = 4, linearizations = 5 ( 0.016 sec), linear its = 7 ( 0.004 sec)
```

A **Select Run Option** dialog box is open, asking to select the run option for all 3 cases in the queue. The options are:

- ☐ Run in No Simulation Mode
- ☒ Run in Standard Simulation Mode

Below these options, it asks to submit jobs for foreground or background processing:

- ☒ Foreground Processing
- ☐ Background Processing

The dialog box has **Submit** and **Cancel** buttons.

At the bottom of the OPMRUN window are buttons for **Run Jobs**, **Kill Job**, **Clear**, and **Exit**.

**OPM Flow output, notice the created log file for the run.**

# E I P C OPMRUN: Schedule Log For Tracking Progress

OPMRUN - Flow Job Scheduler 2019-04.01

File Edit Tools Help

OPM Flow Command Schedule

```
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R01.param
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R02.param
flow --parameter-file=/media/sf_D_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R03.param
```

Add Job Edit Job Delete Job Clear Queue Load Queue Save Queue

Output Log

Log

```
2019-06-09 19:15:53: OPMRUN Started
2019-06-09 19:33:07: Run Job 1 of 3
2019-06-09 19:33:07: Start Job: flow --parameter-file=SPE01-THEM01-OPM1810-R01.param | tee SPE01-THEM01-OPM1810-R01.LOG
2019-06-09 19:33:07: Removing Existing Output Files
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.DBG
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.EGRID
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.INIT
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.LOG
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.PRT
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.SMSPEC
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.UNRST
2019-06-09 19:33:07: rm SPE01-THEM01-OPM1810-R01.UNSMRY
2019-06-09 19:33:07: Simulation Started
2019-06-09 19:33:07: Getting Process PID Pass 1
2019-06-09 19:33:07: Simulation PID 4394
2019-06-09 19:33:17: Solver time (seconds): 6.69693
2019-06-09 19:33:17: Assembly time (seconds): 2.82351 (Failed: 0; 0%)
2019-06-09 19:33:17: Linear solve time (seconds): 2.31119 (Failed: 0; 0%)
2019-06-09 19:33:17: Linear solve setup time (seconds): 0.185799 (Failed: 0; 0%)
2019-06-09 19:33:17: Update time (seconds): 0.878205 (Failed: 0; 0%)
2019-06-09 19:33:17: Output write time (seconds): 3.14804
2019-06-09 19:33:17: Overall Well Iterations: 0 (Failed: 0; -nan%)
2019-06-09 19:33:17: Overall Linearizations: 655 (Failed: 0; 0%)
2019-06-09 19:33:17: Overall Newton Iterations: 532 (Failed: 0; 0%)
2019-06-09 19:33:17: Overall Linear Iterations: 4312 (Failed: 0; 0%)
2019-06-09 19:33:17: End Job: flow --parameter-file=SPE01-THEM01-OPM1810-R01.param | tee SPE01-THEM01-OPM1810-R01.LOG
2019-06-09 19:33:17: Completed Job No. 1
2019-06-09 19:33:17: Run Job 2 of 3
2019-06-09 19:33:17: Start Job: flow --parameter-file=SPE01-THEM01-OPM1810-R02.param | tee SPE01-THEM01-OPM1810-R02.LOG
```

Run Jobs Kill Job Clear Exit

Notice how the software cleans up the previous runs with the same name.

# E I P C OPMRUN: Manual Available

The screenshot displays the OPMRUN - Flow Job Scheduler 2019-04.01 application window. The 'Manual' menu item is highlighted in the 'Help' dropdown. The 'Output' log shows simulation results for three time steps, including solver times and iteration counts. The 'OPM Flow Documentation 2018-10 Rev-1 Reduced.pdf' window is open, showing the 'KEYWORD DOCUMENTATION STRUCTURE' section. The documentation includes a table of contents and a detailed explanation of keyword definitions and multi-section keywords.

**OPMRUN - Flow Job Scheduler 2019-04.01**

File Edit Tools Help

OPM Flow Command Line

Manual

flow --parameter=/media/sf\_D\_DRIVE/User/B...  
flow --parameter=/media/sf\_D\_DRIVE/User/B...  
flow --parameter-file=/media/sf\_D\_DRIVE/User/B...

Add Job Edit Job Delete Job Clear Queue

Output Log

Output

Time step 0, stepsize 31 days.  
Time step summary: newton its = 3, lineariz...  
Report step 118/120 at day 3589/3650, date = ...  
Time step 0, stepsize 30 days.  
Time step summary: newton its = 3, lineariz...  
Report step 119/120 at day 3619/3650, date = ...  
Time step 0, stepsize 31 days.  
Time step summary: newton its = 3, lineariz...  
==== End of simulation ====  
Total time (seconds): 9.82024  
Solver time (seconds): 6.44142  
Assembly time (seconds): 3.02338 (Failed: 0)  
Linear solve time (seconds): 2.0749 (Failed: 0)  
Linear solve setup time (seconds): 0.20137  
Update time (seconds): 0.747429 (Failed: 0)  
Output write time (seconds): 3.18788  
Overall Well Iterations: 0 (Failed: 0)  
Overall Linearizations: 655 (Failed: 0)  
Overall Newton Iterations: 532 (Failed: 0)  
Overall Linear Iterations: 4312 (Failed: 0)  
Process Complete (0)

**OPM Flow Documentation 2018-10 Rev-1 Reduced.pdf — OPEN POROUS**

File Edit View Go Bookmarks Help

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**OPM OPEN POROUS MEDIA**  
FLOW DOCUMENTATION MANUAL (2018-10)  
Revision: Rev-1

### 3 KEYWORD DOCUMENTATION STRUCTURE

The OPM Flow manual is constructed in a manner to enable the reader to reference various parts of the document by using the table contents, or by simply by pressing on a link embedded in the text. This automatic cross referencing has been extensively employed to ensure effective documentation of the keywords used by the simulator.

#### 3.1 KEYWORD DEFINITIONS

Each keyword is defined in its own section that contains a section header, that contains the keyword name in capital letters followed by a brief description of the keyword's function. This is then followed by Keyword Table Section which defines the status of the keyword and which sections of the input deck the keyword can be utilized. Table 3.1 illustrates a typical Keyword Table Section defining the keyword status with the various OPM Flow sections.

RUNSPEC	GRID	EDIT	PROPS	REGIONS	SOLUTION	SUMMARY	SCHEDULE

Table 3.1: Example Keyword Table Section

The cells are colored in such a manner as to quickly indicate to the reader the keyword's section availability and function availability, with green colored cells indicating the keyword is available for this section and is mostly or fully implemented. Cells colored gray indicate that keyword cannot be used in that particular section, and cells colored pink show that cell is only partially implemented within OPM Flow, for example OPM Flow may simply just recognize the keyword and ignore the keyword's function, or only part of the keywords function is implemented. Finally, cells colored red means that keyword is available in the commercial simulator but has not been implemented in OPM Flow. In this scenario the keyword should not be used in OPM Flow as it will result in unpredictable results, including causing the simulator to abort or throw an exception.

#### 3.2 MULTI-SECTION KEYWORDS

As there are numerous example the AED and I at the same time also keywords, the keyword Table Section as shown utilized.

Here the keyword can be by those cells colored A complete list of keywords and clicking on a specific keyword will take the reader to the keyword definition in a particular section.

Previous Page  
Next Page  
Reload  
Autoscroll  
Copy  
Select All

OPM Flow sections of the input file, for location of the keyword definitions but ten section. Thus for multi-section keyword can be found. The Keyword which sections the keyword can be

and SOLUTION sections as indicated

13 KEYWORD INDEX - ALPHABETIC

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Run Jobs Kill Job Clear Exit



# E I P C OPMRUN: Job File Compression

The screenshot displays the OPMRUN - Flow Job Scheduler 2019-04.01 application window. The 'Tools' menu is open, and 'Compress Jobs' is highlighted. The main window shows a list of jobs with columns for job name, path, and parameter file. Below the list are buttons for 'Add Job', 'Edit Job', and 'Delete Job'. The 'Output' tab is selected, showing a log of simulation results. A 'Compress Job Files' dialog box is open, prompting the user to select multiple job data files to compress. The dialog includes an 'Output' section showing the results of a compression operation, including file names, sizes, and compression ratios. The 'Compression Options' section has two radio buttons: 'Compress Job' (selected) and 'Compress Job and then Remove Job Files'. At the bottom of the dialog are buttons for 'Add', 'List', 'Submit', and 'Cancel'.

OPMRUN - Flow Job Scheduler 2019-04.01

File Edit Tools Help

Compress Jobs

Uncompress Jobs

ResInsight

media/sf\_D\_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R01.param

media/sf\_D\_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R02.param

--parameter-file=/media/sf\_D\_DRIVE/User/BaxendaleD/Development/Python/OPMRUN/Examples/SPE01-THEM01-OPM1810-R03.param

Add Job Edit Job Delete Job

Output Log

Output

Time step 0, stepsize 31 days.  
Time step summary: newton its =

Report step 118/120 at day 3589/

Time step 0, stepsize 30 days.  
Time step summary: newton its =

Report step 119/120 at day 3619/

Time step 0, stepsize 31 days.  
Time step summary: newton its =

=====  
End of simulation  
Total time (seconds): 9.0  
Solver time (seconds): 6.0  
Assembly time (seconds): 3.0  
Linear solve time (seconds): 2.0  
Linear solve setup time (seconds): 0.0  
Update time (seconds): 0.0  
Output write time (seconds): 3.0  
Overall Well Iterations: 0  
Overall Linearizations: 65  
Overall Newton Iterations: 53  
Overall Linear Iterations: 43

Process Complete (0)

Run Jobs Kill Job Clear Exit

Compress Job Files

Select Multiple Job Data Files to Compress

Output

file matches zip file -- skipping  
zip diagnostic: SPE01-THEM01-OPM1810-R03.DATA up to date  
updating: SPE01-THEM01-OPM1810-R03.DBG (in=585539) (out=46197) (deflated 92%)  
updating: SPE01-THEM01-OPM1810-R03.EGRID (in=14912) (out=916) (deflated 94%)  
updating: SPE01-THEM01-OPM1810-R03.INIT (in=27236) (out=1902) (deflated 93%)  
updating: SPE01-THEM01-OPM1810-R03.LOG (in=25558) (out=3201) (deflated 87%)  
updating: SPE01-THEM01-OPM1810-R03.PRT (in=463002) (out=18596) (deflated 96%)  
updating: SPE01-THEM01-OPM1810-R03.SMSPEC (in=1512) (out=328) (deflated 78%)  
updating: SPE01-THEM01-OPM1810-R03.UNRST (in=2531040) (out=469452) (deflated 81%)  
updating: SPE01-THEM01-OPM1810-R03.UNSMRY (in=32856) (out=10790) (deflated 67%)  
updating: SPE01-THEM01-OPM1810-R03.param (in=3854) (out=1382) (deflated 64%)  
total bytes=3698741, compressed=557689 -> 85% savings  
End Compression

Compression Options

☒ Compress Job

☐ Compress Job and then Remove Job Files

Add List Submit Cancel

# E I P C OPMRUN: OPMRUN.INI Settings File

- Stored in user's home directory in sub directory OPM. Currently limited to:
  - Defining OPMRUN output panel's size, font and font size.
  - OPM Flow manual location,
  - ResInsight location,
  - Setting the editor command,
  - Defining project names and directories.
- Use the Edit/Options menu to edit options and Edit/Projects menu to edit project names and directories.

```
1 #
2 # OPMRUN Options File
3 #
4 # File Name   : "/home/david/OPM"
5 # Created By  : david
6 # Date Created: 2019-06-09 15:42:50
7 #
8 input-width=144
9 input-height=10
10 output-width=140
11 output-height=30
12 output-font=Courier
13 output-font-size=10
14 bpm-flow-manual="/home/david/OPM/OPM Flow Documentation 2018-10 Rev-2 Reduced.pdf"
15 opm-resinsight="/usr/bin/ResInsight"
16 edit-command="jedit"
17 prj-name-01=OPM Examples
18 prj-dirc-01=/media/sf_D_DRIVE/User/Baxendaled/Development/Python/OPMRUN/Examples
19 prj-name-02=Norne 2019-04
20 prj-dirc-02=/media/sf_D_DRIVE/Linux/OPM/Norne/2019-04/
21 prj-name-03=OPM Main Directory
22 prj-dirc-03=/media/sf_D_DRIVE/Linux/OPM
23 prj-name-04=OPM Manual Runs
24 prj-dirc-04=/media/sf_D_DRIVE/Linux/OPM/Aquifer
25 prj-name-05=None
26 prj-dirc-05=
27 #
28 # End of OPMRUN Options File
```



# E I P C OPMRUN:What Is Next?

- Test on various Linux versions (binary version should work on all recent Linux distributions).
- Add more functionality:
  - Add a status tab to the bottom element with a table showing the project name, job name start time and end time, and job status (Aborted, Completed, Killed, Running, etc.).
  - Add right-click menu options to the status table to edit files, view results (DBG, LOG and PRT files), load results into ResInsight, etc.
  - Write job status files to update status table for both foreground and background jobs.
  - Add real time plotting panel to see how the run is performing.
  - Add progress bar showing the progress of each job, need the total number of days for the simulation.
- Improve code readability and documentation.
- Once stable eventually aim to be part of the OPM Flow distribution as a binary file.

End of Presentation