tNavigator® 25.1
Rock Flow Dynamics

System Requirements

Administrator Guide

RFD
Rock Flow Dynamics

April 2025

Copyright Notice

Trade Mark

Security Notice

The software's specifications suggested by RFD are recommendations and do not limit the configurations that may be used to operate the software. It is recommended to operate the software in a secure environment whether such software is operated on a single system or across a network. The Licensee is responsible for configuring and maintaining networks and/or system(s) in a secure manner. If you have any questions about security requirements for the software, please contact your local RFD representative.

Disclaimer

The information contained in this document is subject to change without notice and should not be construed as a commitment by RFD. RFD assumes no responsibility for any error that may appear in this manual. Some states or jurisdictions do not allow disclaimer of expressed or implied warranties in certain transactions; therefore, this statement may not apply to you. Since the software, which is described in the present document, is constantly improved, you may find descriptions based on previous versions of the software.

Contents

Introduction

tNavigator is a software package, which helps build static and dynamic reservoir models, run dynamic simulations, perform extended uncertainty analysis and build surface networks as part of one integrated workflow. All the parts of the workflow share a common proprietary internal data storage system, a super-scalable parallel numerical engine, a data input/output mechanism and a graphical user interface. tNavigator supports the METRIC, LAB, FIELD systems of units.

tNavigator is a multiplatform software application written in C++; it can be installed on Linux, Windows 64-bit OS and run on systems with shared and distributed memory layouts both as a console and a GUI (local or remote).

For a comfortable experience with the GUI version, Full HD resolution (1920×1080) is recommended.

All modules with a graphical interface are supported only when the NVIDIA driver for the graphics card is loaded and configured. Integrated graphics cards are not recommended.

tNavigator runs on workstations and clusters. A cloud-based solution with full GUI capabilities via a remote desktop is also available.

tNavigator contains the following 17 functional modules licensed separately:

- Geology Designer
- Mining Designer
- Seismic
- Geosteering
- Geomechanics
- Model Designer
- Network Designer
- Well Designer
- Material Balance Analyzer
- PVT Designer
- Fracture Simulator
- RP Designer
- Black Oil Simulator
- Compositional Simulator
- Thermal Simulator

- AHM & Uncertainty (Assisted History Matching, optimization and uncertainty analysis)
- Graphical User Interface

There is an option to choose a professional domain profile when creating or opening a project in tNavigator. The choice of a profile affects the project interface: it will contain only the tools required for the tasks typically associated with the selected specialty. This option simplifies the interface by hiding the tools which are presently irrelevant but still available under the current licenses.If tools from related domains are required, it is possible to choose several options or the **Select All** option, which will activate all available profiles at once.

The following profiles are available: Geophysics, Oil & Gas Geology, Mining Geology, Geosteering, Hydraulic Fracturing, Reservoir Engineering, Production Technology.

1. Recommended Hardware for tNavigator Software Package

1.1. Operating system

The tNavigator version for *Linux* OS generally operates about 10 % faster than the version for *Windows* on the same hardware platform configuration.

1.2. CPU

To accelerate calculations, it is recommended to use dual-processor systems, as the number of memory channels is doubled.

Processors with a larger number of physical computing cores provide a greater performance boost than processors with a higher frequency but fewer cores.

Recommended processors are listed in the tables below.

1.3. RAM

When planning a hardware configuration, it is essential to use all available memory channels; otherwise, system performance may suffer. For example, a system with two *Intel Xeon Scalable* CPUs of the 1st or 2nd generation should be equipped with twelve memory modules, as each processor supports six memory channels (a total of twelve). In contrast, a system with two *AMD Epyc* CPUs of the 1st–3rd generations or 3rd-generation *Intel Xeon Scalable* CPUs will require sixteen memory modules, since these processors have eight-channel memory controllers, and a system with two 4th- or 5th-generation *AMD Epyc* will require 24 memory modules, as these processors have 12 channels each.

The necessary RAM depends on the size and type of the model being calculated: Black Oil requires 3 KB for each active cell, while a compositional model requires 1 KB for each component for each active cell. In most cases, an optimal memory capacity for modern dual-processor systems is 128–256 GB.

1.4. GPU

We only support *NVIDIA* adapters starting from the *Pascal* generation (*Tesla P/Quadro P/GTX 10xx/TITAN X* series). Adding a second GPU to the system accelerates calculations by about 20 %.

The amount of required video memory is calculated in the same way as for RAM. Please note that *NVIDIA* prohibits the use of *GeForce* and *TITAN* GPUs in data centers. We also observed periodic OS freezes related to the GPU driver when using these adapters in workstations under constant load.

Recommended GPUs are presented in the tables below.

1.5. Node communication in a cluster

To connect cluster nodes, we recommend using the *Infiniband* technology (FDR or a higher standard). This technology has been tested with Intel MPI and is effective for accelerating calculations.

2. Recommended Hardware Configurations for Different Types of Systems

2.1. Hardware for a single server/workstation

Table 1. CPUs.

CPU		Model	Sockets
Intel Xeon Scalable Gen. 1–2	option1	Xeon Silver 4210R	2
	option2	Xeon Silver 4214R	2
	option3	Xeon Silver 4216	2
	option4	Xeon Gold 6226R	2
Intel Xeon Scalable Gen. 3	option1	Xeon Silver 4310	2
	option2	Xeon Silver 4314	2
	option3	Xeon Silver 4316	2
	option4	Xeon Gold 5318Y	2
	option5	Xeon Gold 5320	2
	option6	Xeon Gold 6330	2
	option7	Xeon Gold 6338	2
Epyc Gen. 1–3/ Threadripper Pro	option1	Epyc 7443P	1
	option2	Epyc 7543P	1
	option3	Ryzen Threadripper Pro 5965WX	1
	option4	Ryzen Threadripper Pro 5975WX	1
	option1	Epyc 7313	2
	option2	Epyc 7413	2
	option3	Epyc 7453	2
	option4	Epyc 7513	2
Epyc Gen. 4–5/ Threadripper Pro	option1	Epyc 9454P	1
	option2	Epyc 9455P	1
	option3	Epyc 9555P	1
	option4	Ryzen Threadripper Pro 7975WX	1
	option1	Epyc 9454	2
	option2	Epyc 9554	2
	option3	Epyc 9455	2
	option4	Epyc 9555	2

Table 2. RAM.

System			DIMM size	DIMM quantity
Xeon Gen. 1–2		option1	8GB	12
		option2	16GB	12
Xeon Gen. 3		option1	8GB	16
		option2	16GB	16
Epyc Gen. 1–3/Threadripper Pro	1 CPU	option1	16GB	8
		option2	32GB	8
Epyc Gen. 1–3	2 CPU	option1	8GB	16
		option2	16GB	16
Epyc Gen. 4–5	1 CPU	option1	16GB	12
		option2	32GB	12
	2 CPU	option1	8GB	24
		option2	16GB	24

Table 3. GPU.

NVIDIA GPU series/products			
Workstation	option1	NVIDIA GeForce RTX 4090 24GB	1
	option2	NVIDIA Quadro RTX A6000 48GB	1
	option3	NVIDIA Quadro RTX A5000 24GB	1
	option4	NVIDIA Quadro RTX A4000 16GB	1
Server	option1	NVIDIA A100 40GB	1
	option2	NVIDIA A30 24GB	1
	option3	NVIDIA A40 48GB	1
	option4	NVIDIA A10 24GB	1

Table 4. Storage.

Storage system			
Operating system	option1	256 GB SSD	1
	option2	512 GB SSD	1
Data storage (Enterprise Class HDD)	option1	4+ TB HDD	1
	option2	4+ TB HDD JBOD/RAID1	2

(to be continued)

(continued)

	option3	4+ TB HDD JBOD/RAID5	3+

2.2. Hardware for a cluster head node

Table 5. *CPU.*

CPU		Model	Sockets
Intel Xeon Scalable Gen. 2	option1	Xeon Silver 4210R	2
	option2	Xeon Silver 4214R	2
Intel Xeon Scalable Gen. 3	option1	Xeon Silver 4310	2
	option2	Xeon Silver 4314	2
AMD Epyc Gen. 3	option1	Epyc 7313P	1
	option2	Epyc 7443P	1
	option3	Epyc 7453	1
	option1	Epyc 7313	2
AMD Epyc Gen. 5	option1	Epyc 9355P	1
	option2	Epyc 9455P	1
	option1	Epyc 9255	2

Table 6. *RAM.*

System		DIMM size	DIMM quantity
Xeon Gen. 1–2		8GB	12
Xeon Gen. 3		8GB	16
Epyc Gen. 1–3	1 CPU	16GB	8
	2 CPU	8GB	16
Epyc Gen. 4–5	1 CPU	8GB	12
	2 CPU	8GB	24

Table 7. Storage.

Storage system			
Operating system		256GB SSD	2
Data storage	option1	Network storage	
(Enterprise Class HDD)	option2	4+ TB HDD RAID50	12+

2.3. Hardware for a cluster compute node

Table 8. CPU.

CPU		Model	Sockets
Intel Xeon Scalable Gen. 1–2	option1	Xeon Silver 4210R	2
	option2	Xeon Silver 4214R	2
	option3	Xeon Silver 4216	2
	option4	Xeon Gold 6226R	2
Intel Xeon Scalable Gen. 3	option1	Xeon Silver 4310	2
	option2	Xeon Silver 4314	2
	option3	Xeon Silver 4316	2
	option4	Xeon Gold 5318Y	2
	option5	Xeon Gold 5320	2
	option6	Xeon Gold 6330	2
	option7	Xeon Gold 6338	2
Epyc Gen. 1–3	option1	Epyc 7443P	1
	option2	Epyc 7543P	1
	option3	Epyc 7643	1
	option4	Epyc 7663	1
	option1	Epyc 7413	2
	option2	Epyc 7513	2
	option3	Epyc 7643	2
	option4	Epyc 7663	2
Epyc Gen. 4–5	option1	Epyc 9454P/9455P	1
	option2	Epyc 9554P/9555P	1

(to be continued)

(continued)

	option3	Epyc 9634P/9655P	1
	option1	Epyc 9454/9455	2
	option2	Epyc 9554/9555	2
	option3	Epyc 9634/9655	2

Table 9. *RAM.*

System		DIMM size	DIMM quantity
Xeon Gen. 1–2		8GB	12
Xeon Gen. 3		8GB	16
Epyc Gen. 1–3	1 CPU	16GB	8
	2 CPU	8GB	16
Epyc Gen. 4–5	1 CPU	8GB	12
	2 CPU	8GB	24

Table 10. *GPU.*

NVIDIA GPU series/products			
Server	option1	NVIDIA A100 40GB	1
	option2	NVIDIA A30 24GB	1
	option3	NVIDIA A40 48GB	1
	option4	NVIDIA A10 24GB	1

Table 11. *Storage.*

Storage system	
Operating system	Network boot recommended
Data storage	Network storage

3. System requirements for Geology Designer and Seismic modules

Attention! It should be noted that the system requirements are more dependent on the specific project. In each case, the requirements and timing of calculations can vary significantly depending on the configuration of the PC used, the system load at the period of time, the throughput and processing capabilities of the nodes and components, and so on. This chapter provides an average statistic that aims to form an idea of the computing power required for users of the Geology Designer and Seismic modules.

This chapter describes the dependence of system requirements on data sizes and types for such objects as: **Seismic data (SEG-Y cubes), Well trajectories, Log curves, 3D grids and their properties.**

- Most calculations support parallel computing, so increasing the number of cores reduces the time needed to compute. However, with fewer cores, the processors run at a higher frequency, which in turn speeds up the performance. For consistently high performance, 10 to 20 cores are recommended.
- The use of discrete graphics cards is optional. In terms of geological modeling and work with seismic data, graphics cards are mainly used for visualization purposes. The only calculations that can (yet do not have to) be performed on graphics cards are interpolation procedures based on Kriging and SGS (Sequential Gaussian Simulation) methods. If such calculations are performed for large-scale models containing tens of millions of blocks, significant acceleration can be achieved using high-performance graphics cards. Since the visualization of seismic data is performed using the memory of a graphics card, it is recommended to use cards with a large amount of memory to work with large volumes of seismic data. When selecting a configuration with a discrete graphics card, preference should be given to cards manufactured by nVidia®, starting with the Pascal® generation (Tesla P®/Quadro P®/GTX 10xx®/TITAN X® series).

Table 1. *System requirements to work with seismic data.*

Data type	Data	Recommended RAM capacity	Recommended disk storage capacity		Note
Seismic	**10 GB**	**16 GB**[*1]	**Before closing the project:**	**After closing the project:**	***1.** For easier use, it is recommended that the available RAM memory capacity be larger than the size of the imported SEG-Y cube. If this recommendation is not followed, the loaded cube will be imported with significantly less RAM, however, in this case the calculation time may increase many times. ***2.** The project size can exceed the size of the original seismic cube in SEG-Y format up to 3 times, due to the fact that working copies of the project are created. When you save the project and close tNavigator, the working copies are deleted and the resulting project size with the loaded seismic cube is 1.15 times the size of the original seismic cube. ***3.** The actual project size on disk may be smaller than the original seismic cube file if it has a large number of empty traces.
			Up to 30 GB[*2,3]	**12 GB**	
	50 GB	**64 GB**[*1]	**Up to 150 GB**[*2,3]	**58 GB**	
	100 GB	**128 GB**[*1]	**Up to 300 GB**[*2,3]	**115 GB**	

Table 2. *System requirements to work with trajectories and logs and to construct 3D grids.*

Data type	Data	Recommended RAM capacity	Recommended disk storage capacity	Note
Wells + Well logs	**250 wells + 10 logs (140 million points)**	**2 GB**[*1,2]	**0.2 GB**	***1.** When you reduce or increase the number of objects in increments, the recommended RAM capacity is incremented. For example, to work with **10000 wells + 1 log (110 million points)** approximately 6.4 GB of RAM are required. ***2.** By default, tNavigator will use all available RAM to speed up calculations, unless appropriate settings are configured to limit usage.
	2500 wells + 10 logs (280 million points)	**16 GB**[*1,2]	**2 GB**	
	5000 wells + 10 logs (550 million points)	**32 GB**[*1,2]	**4 GB**	
	10000 wells + 10 logs (1.1 million points)	**64 GB**[*1,2]	**8 GB**	
3D-Grids	**10 million blocks**	**10 GB**	**0.2 GB**	To build a grid 2 horizons and 1 fault were used.
	20 million blocks	**16 GB**	**0.4 GB**	

Table 3. System requirements for 3D properties modeling.

Data type	Method	Data	Recommended RAM capacity	Recommended disk storage capacity	Note
3D-Properties (10 realizations)	SGS	10 million blocks	8 GB	1 GB	Number of points for kriging = 20
		20 million blocks	16 GB	2 GB	
	Kriging	10 million blocks	8 GB	1 GB	Number of points for kriging = 20
		20 million blocks	16 GB	2 GB	
	Amazonas	10 million blocks	8 GB	1 GB	
		20 million blocks	16 GB	2 GB	