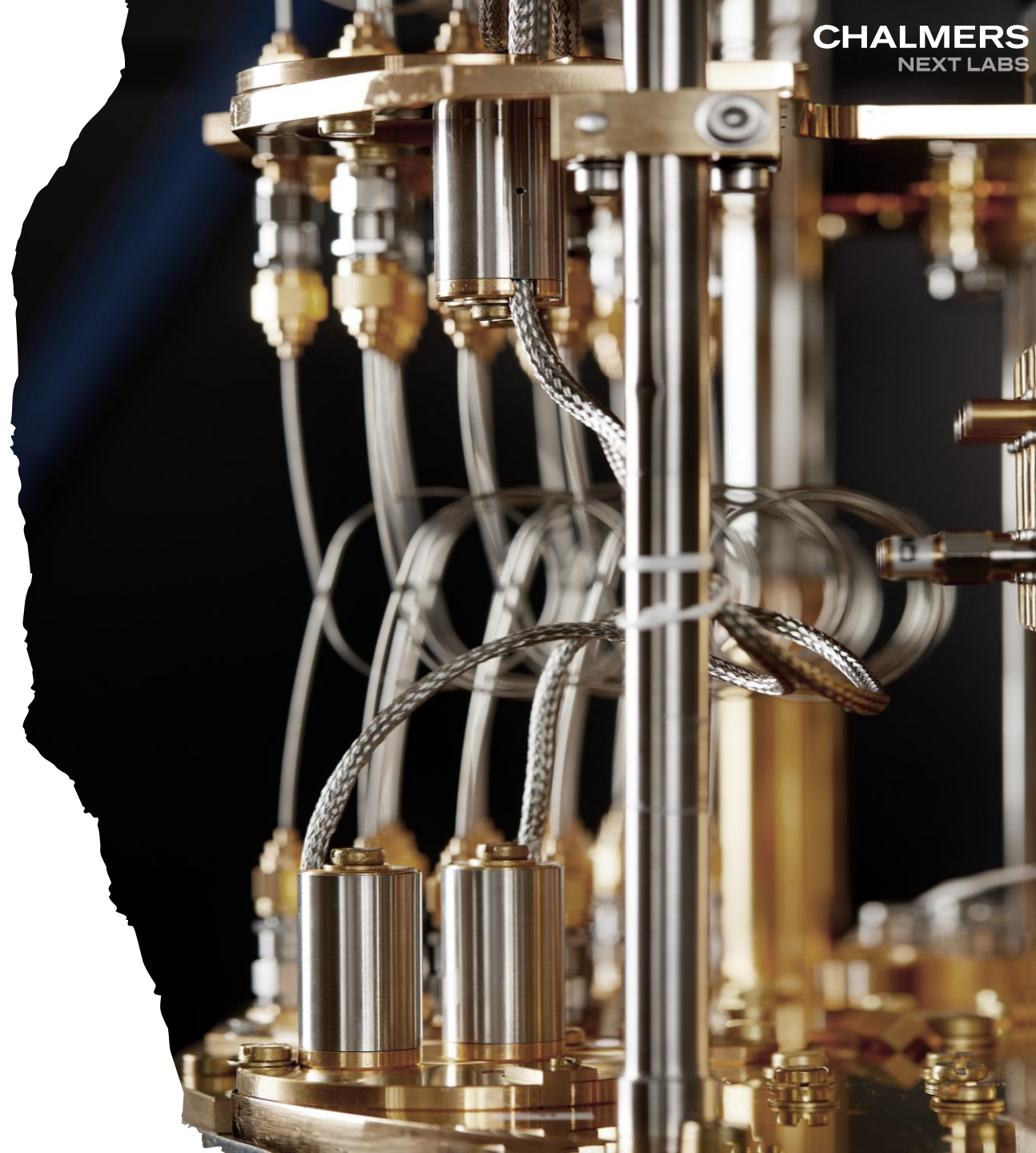




The software stack for the quantum computer at WACQT

Chalmers Next Labs.
A subsidiary of the Chalmers Group

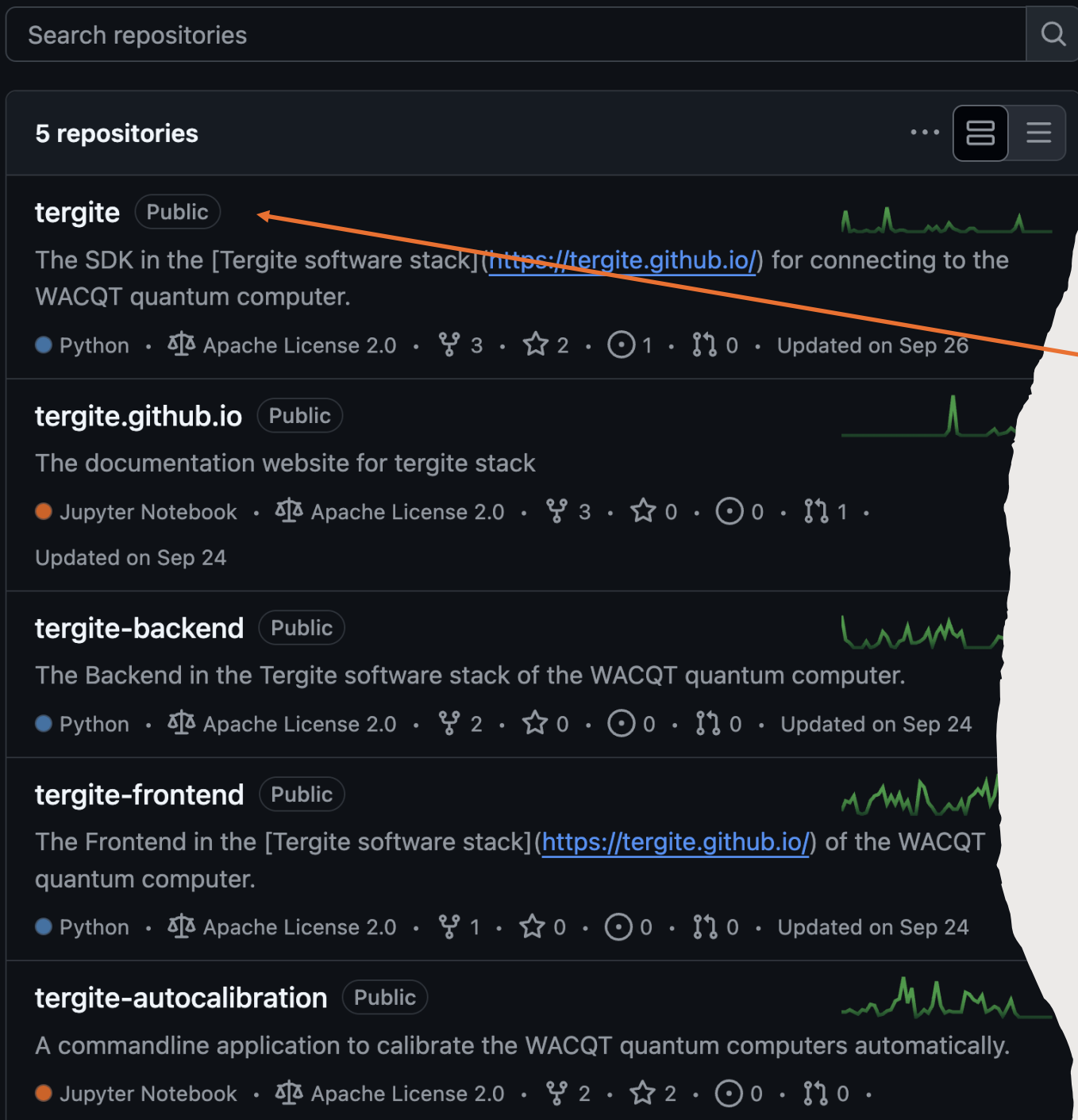
Martin Ahindura,
Development Engineer,
By God's grace





What is Tergite?

- Software stack for the WACQT quantum computer (QAL 9000)
- Gives multi-user access (online)
- Users can:
 - Submit quantum jobs
 - Retrieve job results
 - See device parameters
 - Low-level access compared to other providers
- Computer admins can also:
 - (Re)calibrate device
 - Turn on/off device
 - Manage user access
 - Monitor it



What can I do with Tergite?

- Connect to WACQT's [QAL 9000](#).

Search repositories

5 repositories

tergite Public
 The SDK in the [Tergite software stack](<https://tergite.github.io/>) for connecting to the WACQT quantum computer.
 Python · Apache License 2.0 · 3 · 2 · 1 · 0 · Updated on Sep 26

tergite.github.io Public
 The documentation website for tergite stack
 Jupyter Notebook · Apache License 2.0 · 3 · 0 · 0 · 1 · Updated on Sep 24

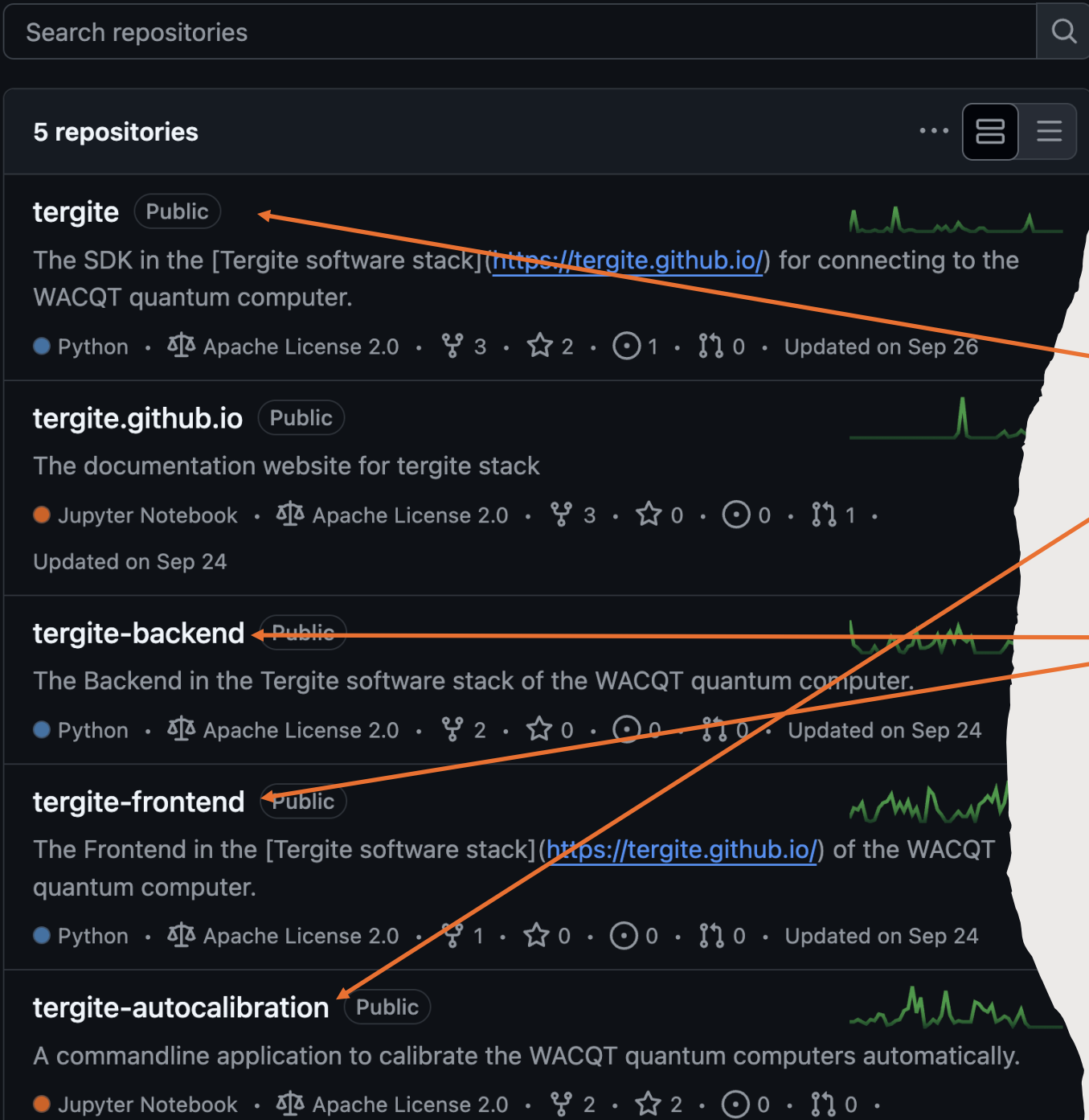
tergite-backend Public
 The Backend in the Tergite software stack of the WACQT quantum computer.
 Python · Apache License 2.0 · 2 · 0 · 0 · 0 · Updated on Sep 24

tergite-frontend Public
 The Frontend in the [Tergite software stack](<https://tergite.github.io/>) of the WACQT quantum computer.
 Python · Apache License 2.0 · 1 · 0 · 0 · 0 · Updated on Sep 24

tergite-autocalibration Public
 A commandline application to calibrate the WACQT quantum computers automatically.
 Jupyter Notebook · Apache License 2.0 · 2 · 2 · 0 · 0 ·

What can I do with Tergite?

- Connect to WACQT's [QAL 9000](#).
- Calibrate your own quantum chips.
 - If their design is similar WACQT's

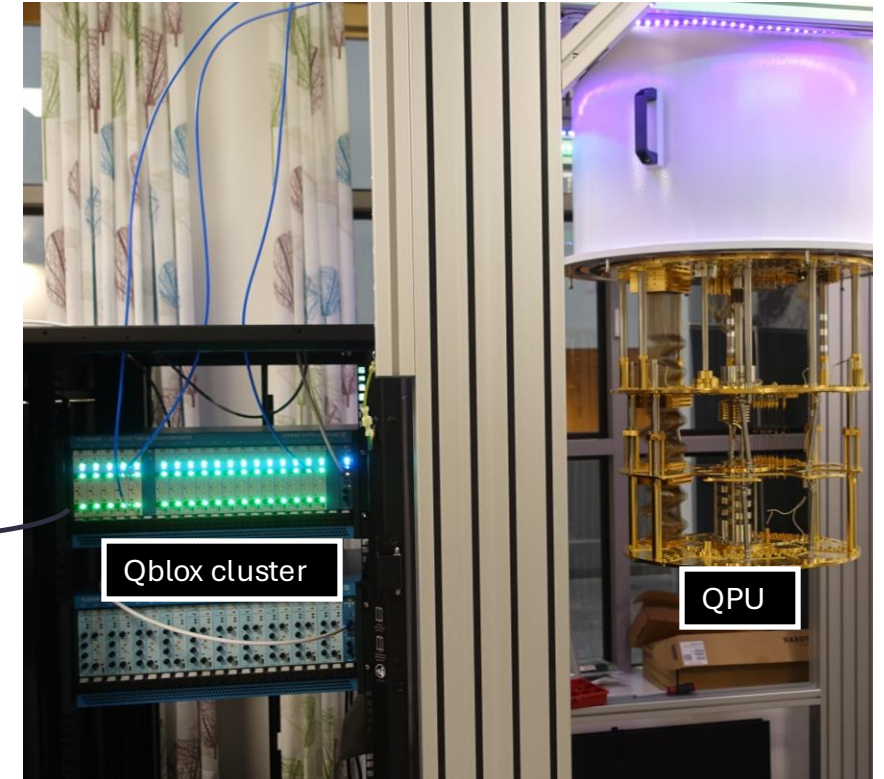


What can I do with Tergite?

- Connect to WACQT's [QAL 9000](#).
- Calibrate your own quantum chips.
 - If their design is similar WACQT's
- Add multi-user online access to your quantum computer
 - Tergite is free and open-source
 - Apache 2.0 License
 - Quarterly release cycle
 - <https://github.com/orgs/tergite/repositories>

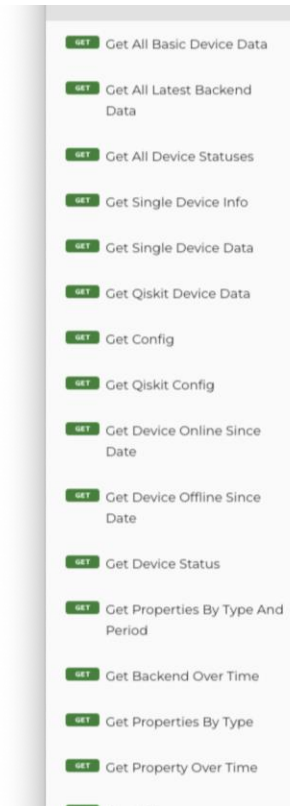
How does Tergite work?

- Stack of
 - Backend
 - OpenPulse -> Qblox-specific
 - Queue jobs
 - Track device parameters



How does Tergite work?

- Stack of
 - Backend
 - OpenPulse -> Qblox-specific
 - Queue jobs
 - Track device parameters
 - Frontend
 - User-access control
 - Exposes it to the internet
 - Comprises:
 - REST API



Get All Basic Device Data

Gets the basic summarized data for all backends.

AUTHORIZATIONS: > OAuth2PasswordBearer

Responses

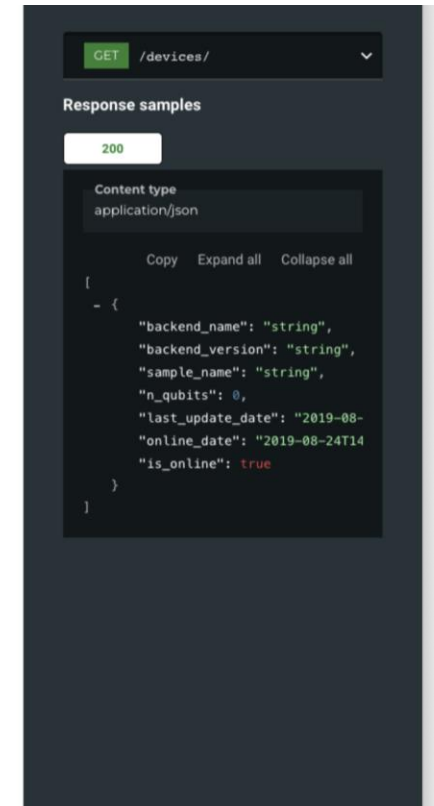
200 Successful Response

RESPONSE SCHEMA: application/json

Array [

backend_name required	string (Backend Name)
backend_version required	string (Backend Version)
sample_name required	string (Sample Name)
n_qubits required	integer (N Qubits)
last_update_date required	string <date-time> (Last Update Date)
online_date required	string <date-time> (Online Date)
is_online required	boolean (Is Online)

]



REST API docs at <https://api.qal9000.se/redoc>

How does Tergite work?

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 - Exposes it to the internet
 - Comprises:
 - REST API
 - Dashboard

The screenshot shows the WACQT (Wallenberg Centre for Quantum Technology) dashboard. The interface includes a sidebar with navigation options: Dashboard, Devices, Admin, Requests (with a notification badge), and Projects. The main content area is titled 'Dashboard' and features a 'Project: Select project' dropdown and an 'API token' input field. A 'Devices Online' gauge shows 50% completion. Below this is a 'Devices' table listing available devices with their qubit counts and status. The 'Jobs' section provides a table of job status across different devices.

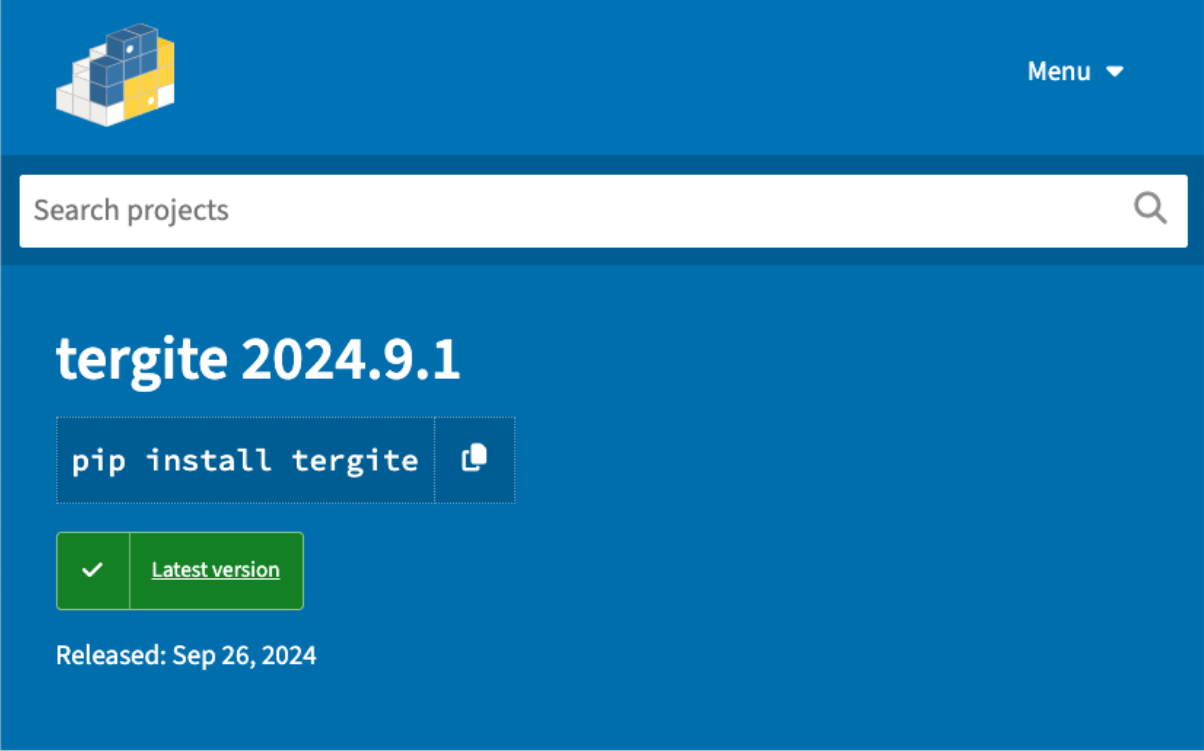
Device	Qubits	Status	Last Seen
Loke	8	Offline	6 months ago
Thor	5	Online	N/A
Pingu	20	Offline	6 months ago

Job ID	Device	Duration	Created at ↓	Status
1	Loke	400 seconds	20 Jun 2024, 11:12	successful
4	Loke	400 seconds	20 Jun 2024, 13:12	successful
5	Pingu	800 seconds	19 Jun 2024, 14:12	successful
6	Thor	400 seconds	21 Jun 2024, 01:12	failed

Dashboard at <https://www.qal9000.se>

How does Tergite work?

- Stack of
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 - REST API
 - Dashboard
 - Python client (SDK)
 - Pip-installed
 - Qiskit-based



Menu ▾

Search projects 🔍

tergite 2024.9.1

```
pip install tergite
```

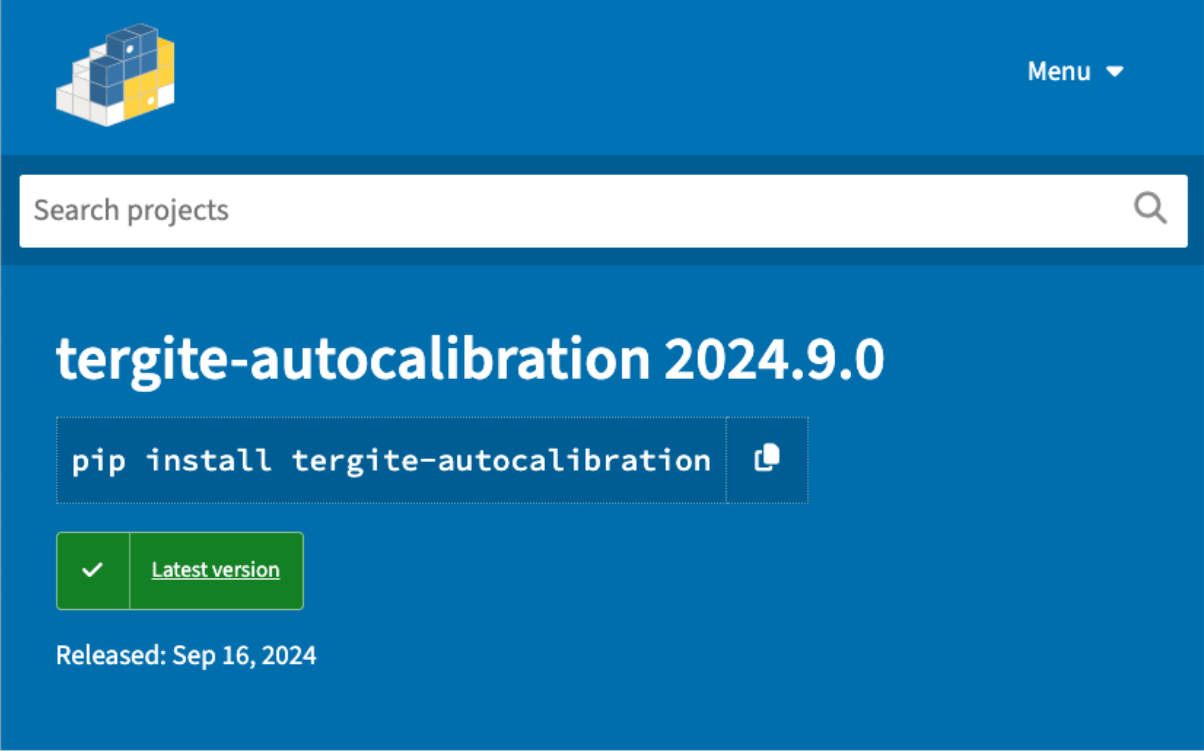
✓ Latest version

Released: Sep 26, 2024

The SDK in the Tergite software stack for connecting to the Swedish quantum

How does Tergite work?

- Stack of
 - Backend
 - OpenPulse -> Qblox-specific
 - Queue jobs
 - Track device parameters
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 - Comprises:
 - REST API
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- Python client (SDK)
 - Pip-installed
 - Qiskit-based
- Calibration tool
 - Pip-installed
 - CLI



Menu ▾

Search projects 🔍

tergite-autocalibration 2024.9.0

```
pip install tergite-autocalibration
```

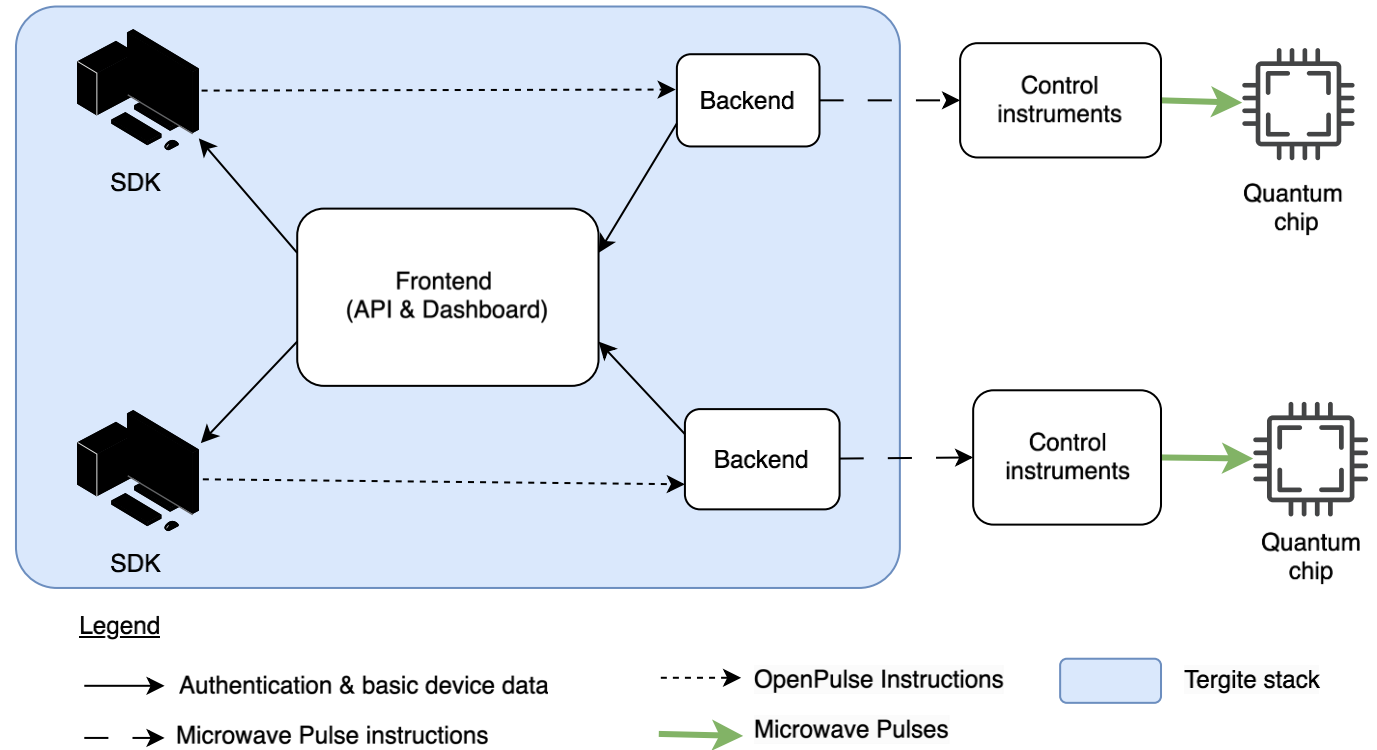
✓ Latest version

Released: Sep 16, 2024

commandline application to calibrate the WACQT quantum computers

How does Tergite work?

- Stack of
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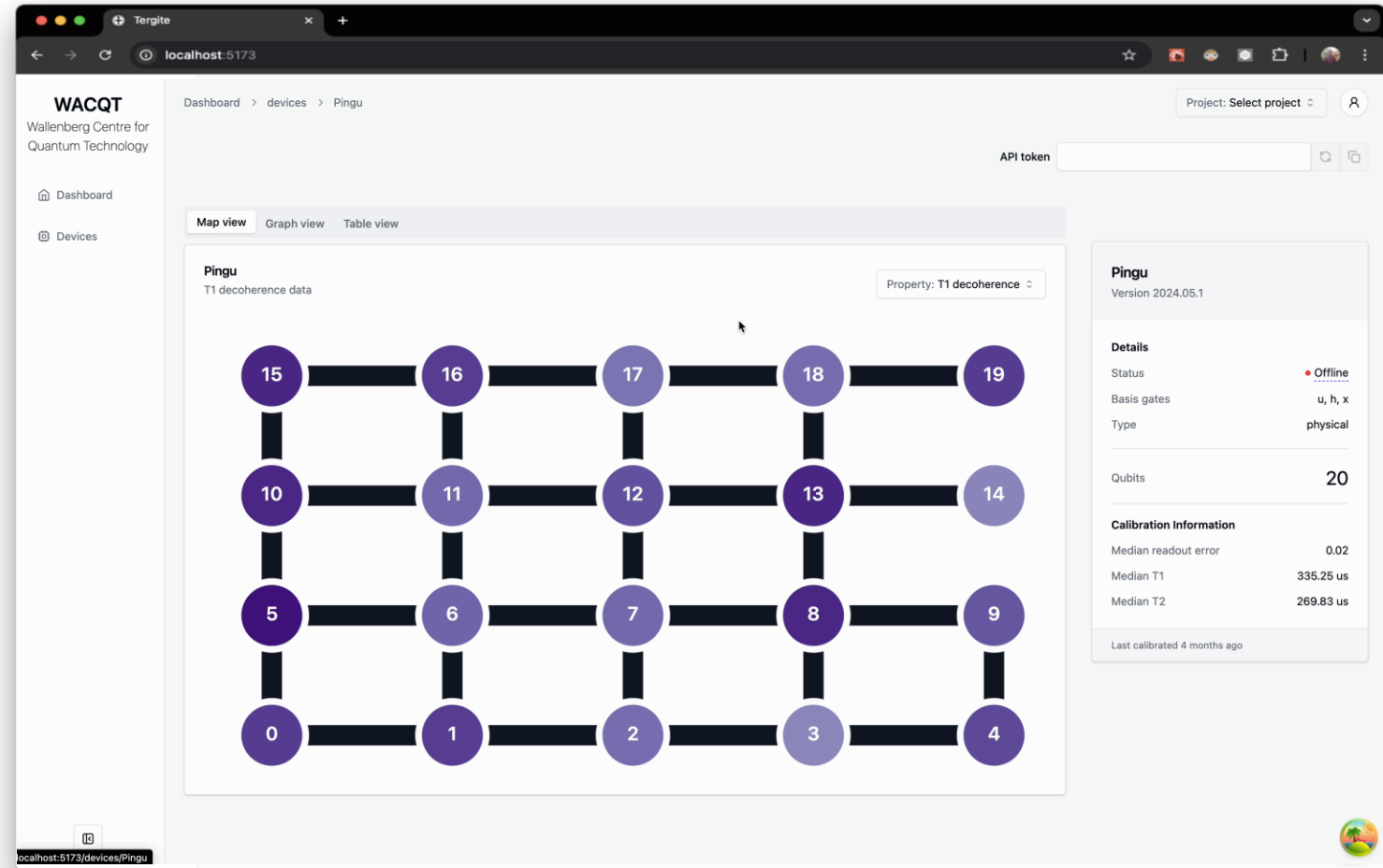


How can I test it out?

- Visit <https://www.qal9000.se>

Or

- Host your own. See https://tergite.github.io/tutorials/01_quick_start.html



Demo

<https://www.qal9000.se>

https://colab.research.google.com/drive/15dpkuCOt1bxlsTvbDmQOkgnQ_5KjnuLX?usp=sharing

Contributors

CHALMERS
NEXT LABS



WACQT | Wallenberg Centre for
Quantum Technology



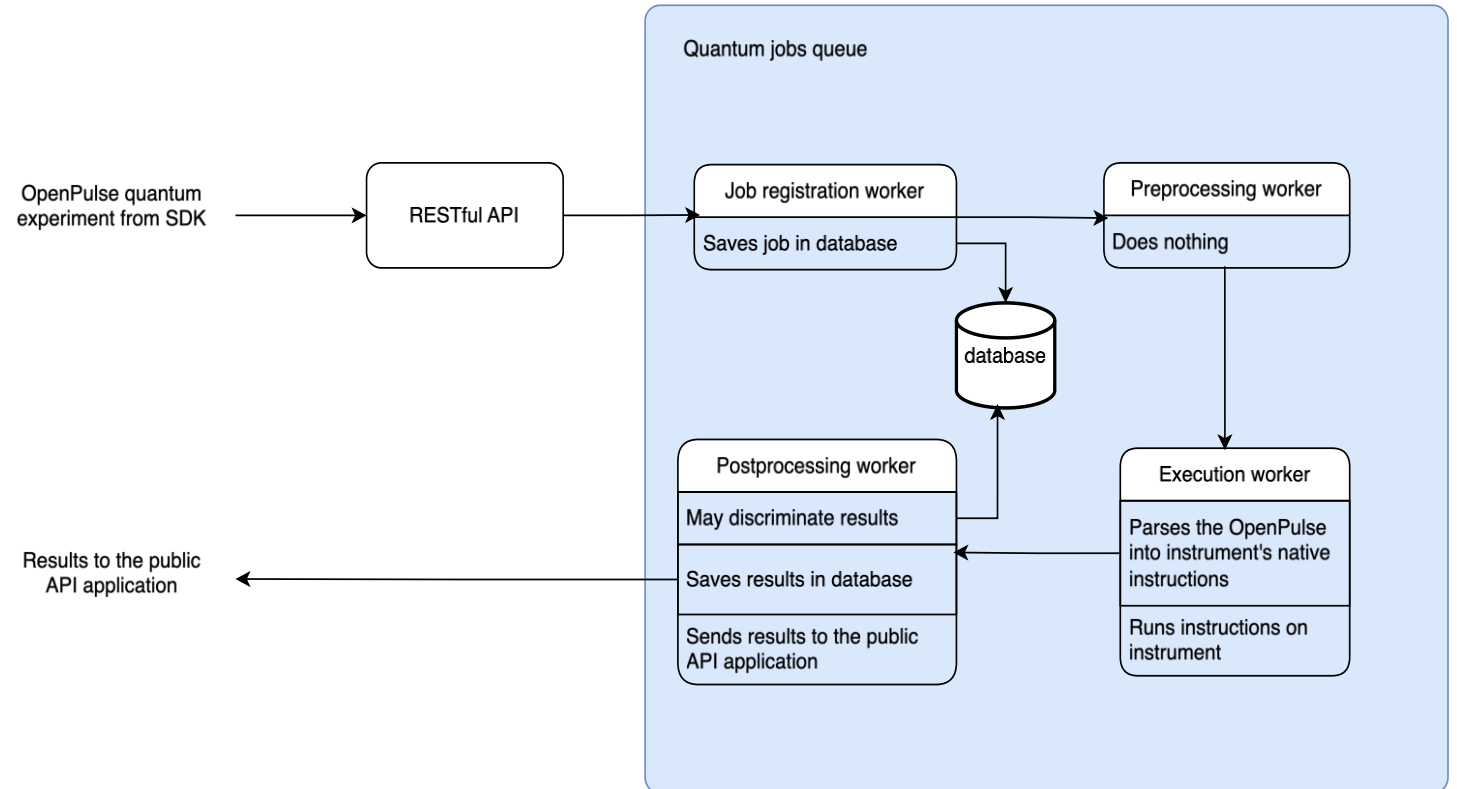
- Miroslav Dobsicek
- Martin Ahindura
- Stefan Hill
- Eleftherios Moschandreou
- Adilet Tuleouv
- Pontus Vikstål
- Abdullah-Al Amin
- David Wahlstedt
- Axel Anderson
- Nicklas Botö
- Fabian Forslund
- Liangyu Chen
- Tong Liu
- Joel Sandas
- Amr Osman
- Andreas Lund
- Simon Genne
- Arvid Holmqvist
- Bashar Oumari
- Michele Faucci Giannelli
- Damien Crielaard
- Gustav Grännsjö
- Johan Blomberg
- Sofie Skönvall
- Raiyan Yahya
- Mårten Skogh
- Junjie Li
- Sandro Stucki
- Vlad Dragos
- Simon Genne
- Jamal Aldiwani
- David Andreasson
- Karl Gunnarsson
- Alexander Jyborn
- Lucas Karlsson
- Jakob Ristner
- Björn Rosengren
- Jakob Wik

Bonus

A little glimpse under the hood

Tergite backend

- Uses a FIFO queue
 - Uses rq library running on redis
 - Use of booked time slots under investigation
 - Priority queues seem not worth it yet
- Simulators based on [qiskit-dynamics](#)
 - Two-qubit gate simulator in next release (~Dec 16)
- Compilation to quantify-schedules (Qblox) using [quantify-scheduler package](#)



Tergite Public REST API

- Uses Oauth2 flows
 - API tokens are revocable
 - API tokens life spans are extendable
- API access is project-based
- Tracks usage per project
 - Projects with ≤ 0 QPU seconds have no access
- Usage can be tracked in [Puhuri cloud allocation service](#)

