

The state-of-the-art quantum technology

The Transformer & its Applications to High Energy Physics Problems

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Quantum computer hardware

IBM hardware:

- Log in here: <https://quantum.ibm.com>
- Username: Abdualazem.Fadol@gmail.com
- Password: Ihep@2024-2025
- Three devices are available with 127 qubits.

OriginQ hardware:

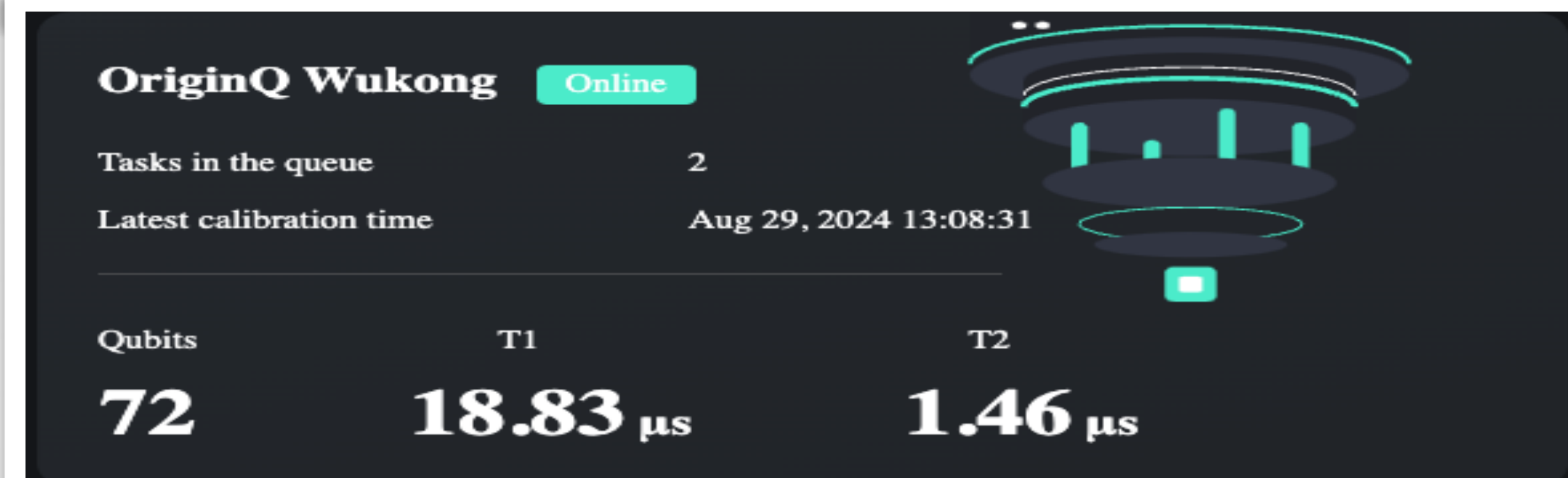
- Log in here: <https://qcloud.originqc.com.cn>
- There's no free quota. We have up to 72 qubits.
- We can use Chen's account.
- Remaining time: 55657.709 s

Quafu hardware:

- Log in here: <https://quafu.baqis.ac.cn>
- You need to create an account.
- Task quota: 1k/month.

- The best approach is to experiment with IBM & Quafu.

Device	QPU status	Processor type	Qubits	2Q error (best/layered)	CLOPS
ibm_marrakesh	Online	Heron r2	156	8.33e-4/3.75e-3	180K
ibm_fez	Online	Heron r2	156	1.43e-3/4.78e-3	180K
ibm_torino	Online	Heron r1	133	1.44e-3/7.14e-3	200K
ibm_kyiv	Online	Eagle r3	127	3.57e-3/1.51e-2	30K
ibm_brisbane	Online	Eagle r3	127	2.77e-3/1.52e-2	30K
ibm_kawasaki	Online	Eagle r3	127	3.71e-3/1.77e-2	29K
ibm_brussels	Online	Eagle r3	127	2.62e-3/2.02e-2	37K
ibm_quebec	Online	Eagle r3	127	2.97e-3/2.19e-2	32K
ibm_sherbrooke	Online	Eagle r3	127	2.44e-3/2.30e-2	30K
ibm_nazca	Online	Eagle r3	127	3.99e-3/2.87e-2	29K
ibm_strasbourg	Online	Eagle r3	127	3.26e-3/3.55e-2	37K
ibm_renselaer	Online	Eagle r3	127	4.11e-3/3.58e-2	32K



Computer Resources

Your Resources | All Resources

Name	Status	Queue	Available Qubits	Error Rate
物理所怀柔园区综合极端条件装置提供	Online	1	11	N/A
Baihua	Maintenance	174	119	4e-3
Dongling	Maintenance	207	105	1e-3

Validating the model in a quantum hardware

- ❑ **Training a quantum model on quantum hardware is not feasible:**
 - Quantum hardware constraints: noise, decoherence, and gate fidelity.
 - Time complexity: training is significantly slower compared to simulators.
 - Cost and queue: running a large circuit on hardware involves long wait times, even with free access.
- ❑ **A practical approach would involve a hybrid strategy:**
 - Train the model (or part of it) on a simulator to optimise parameters.
 - Test the trained model on hardware to validate its performance on a real quantum system.
- ❑ Training should be done on a simulator with a noise model to mimic real hardware behaviour.

Summary

- Modifying the framework to include noise model in the simulator.**
- Understanding the discrepancies when using a pre-trained model:**
 - **Add a module to handle loading the trained model**
 - **Figure out how to apply the model & what metric to use.**
 - **Should one use the score or flow Pan's implementation?**

