QAL Lite Screenshots

Following are few screenshots of QAL Lite (and of earlier versions of QAL). Below each screenshot is a brief description of what the shot presents. <u>All material below is copyrighted</u> (Copyright © 2023 Moez A. AbdelGawad).
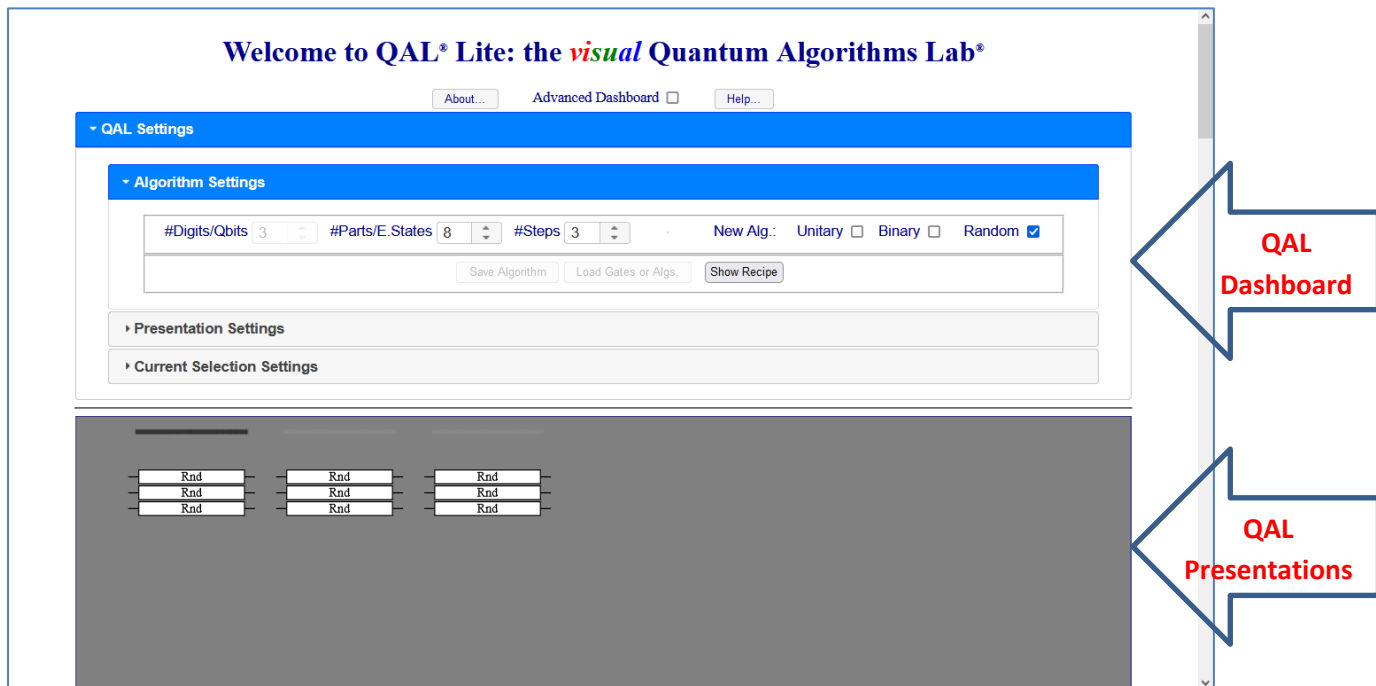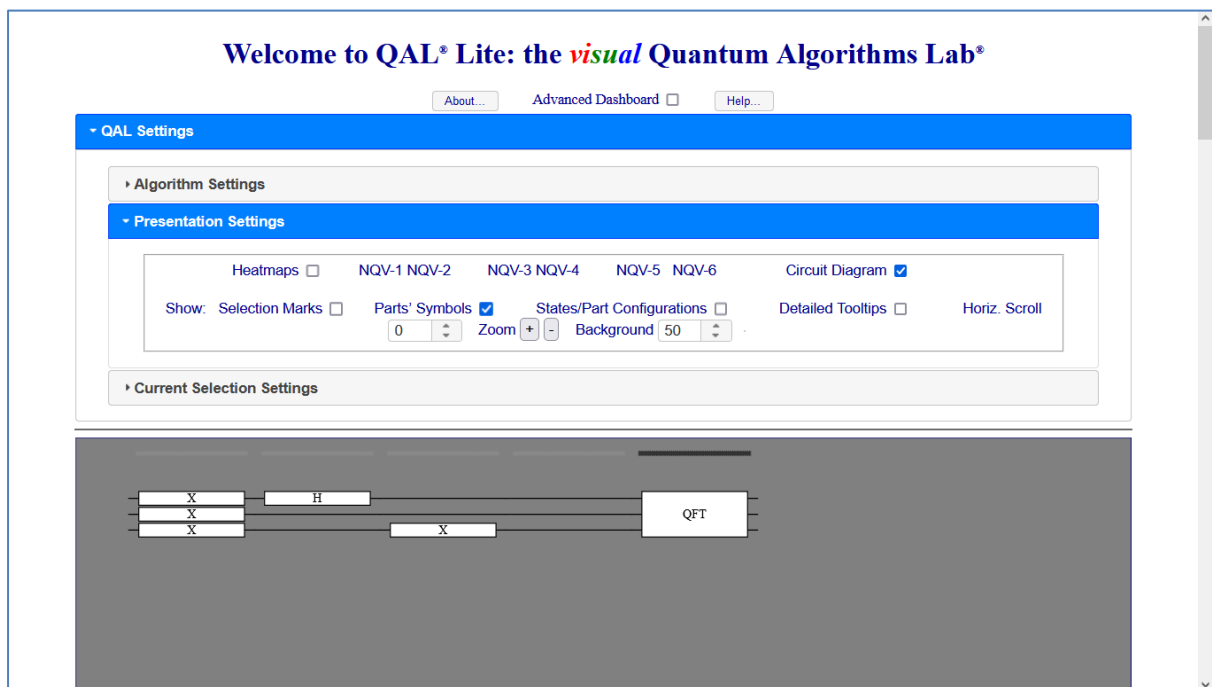

Figure 1. Initial QAL Lite Screen

Figure 2. A Basic Quantum Algorithm (presented in a QAL Circuit Diagram)
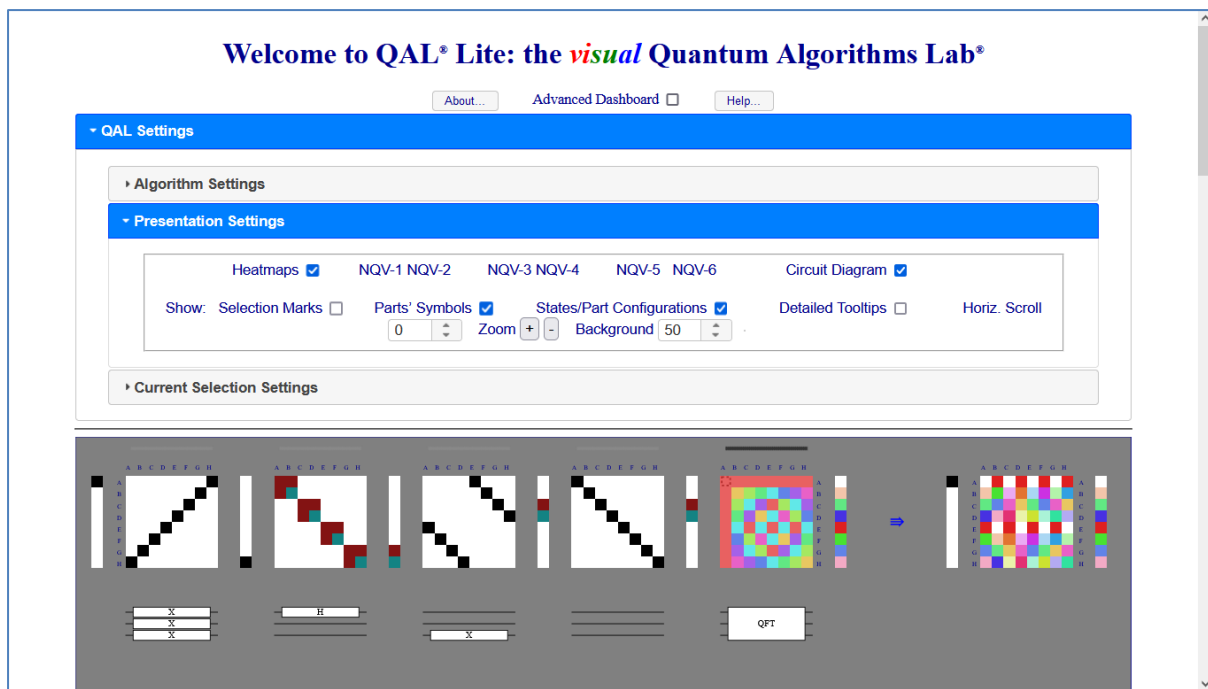
Figure 3. Basic Algorithm (Heatmaps)

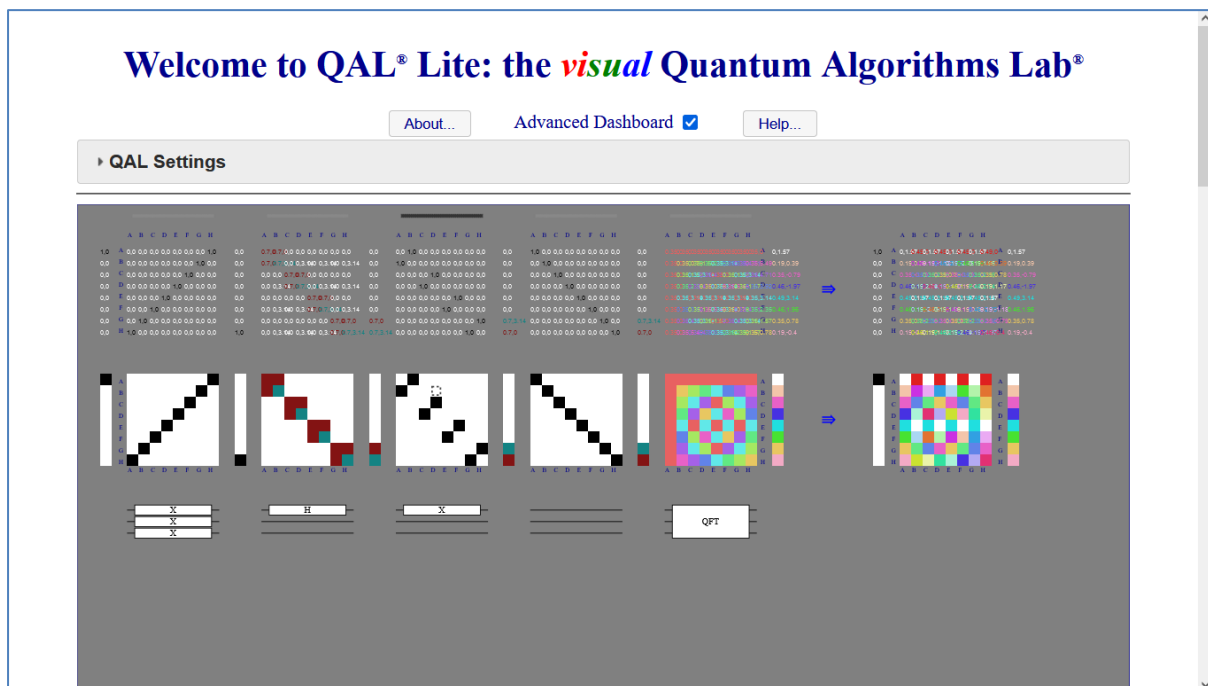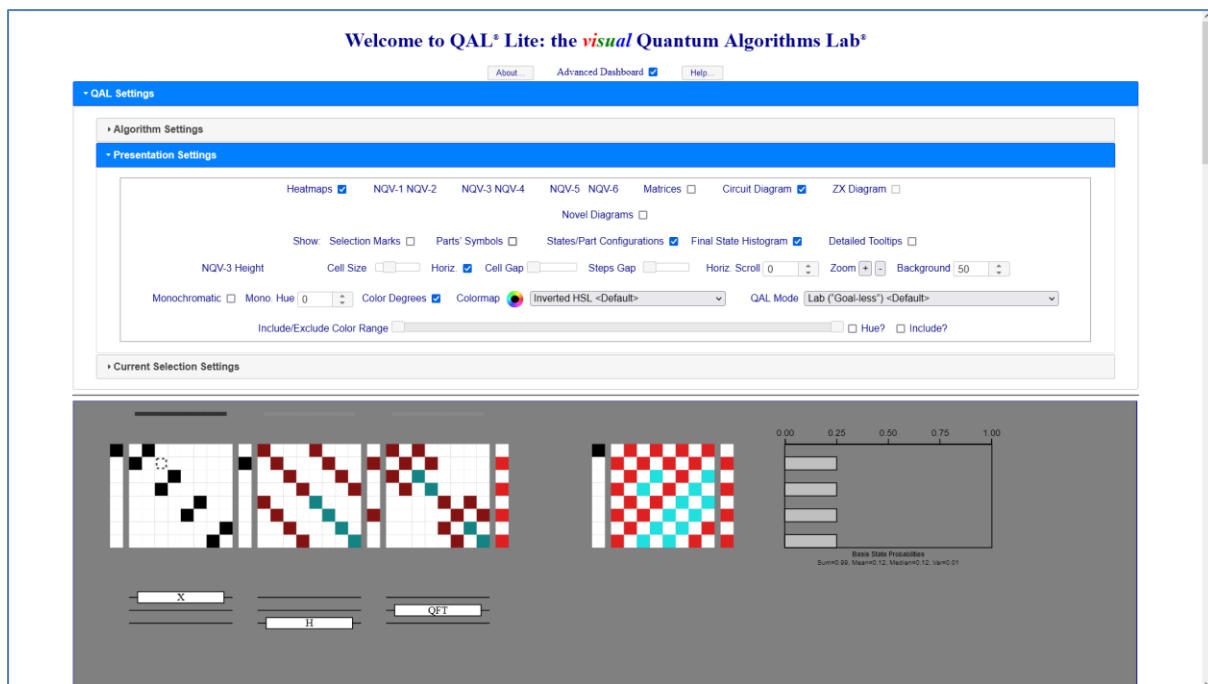**Figure 4. Modified Basic Algorithm** (Heatmaps + Matrices)

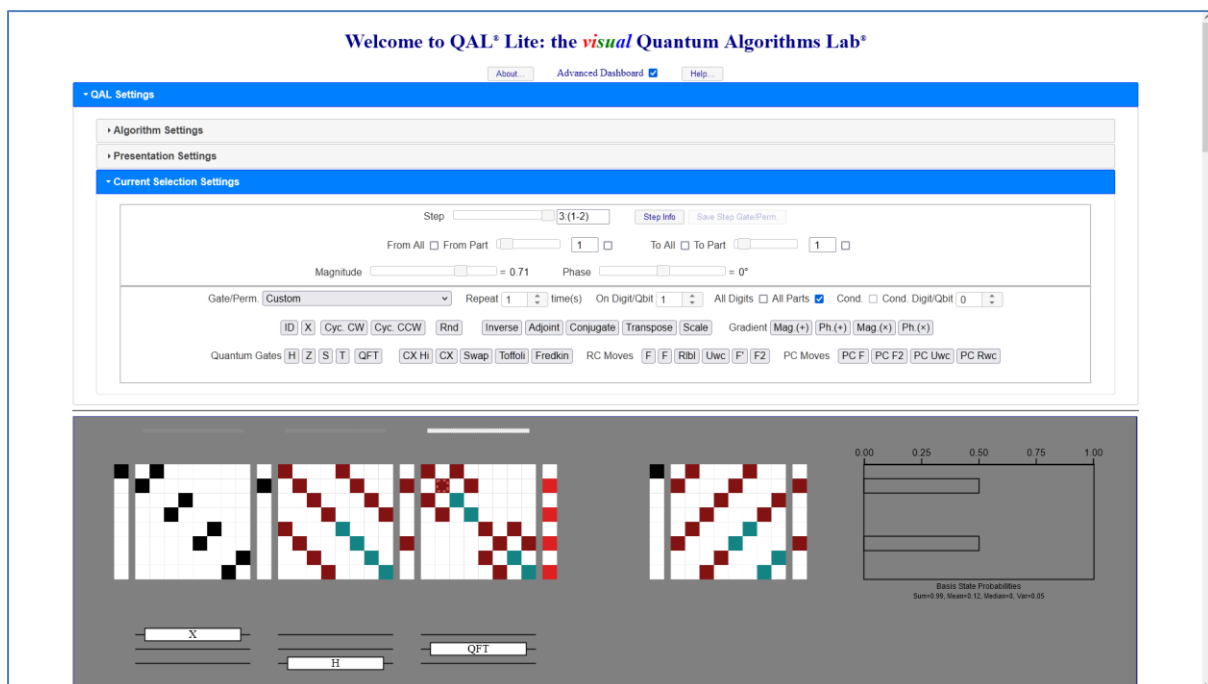**Figure 5. A Second Basic Quantum Algorithm and a Final State Histogram**

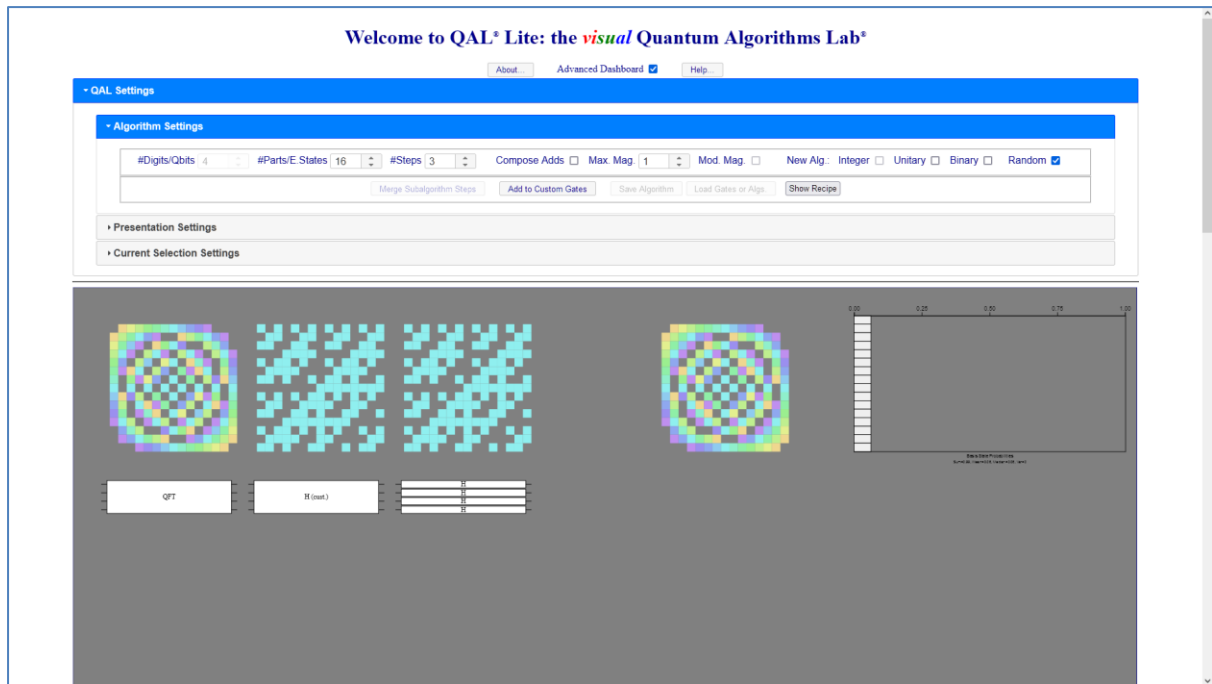**Figure 6. A QAL Subalgorithm**

Figure 7. Effect of Some QAL Presentation Settings

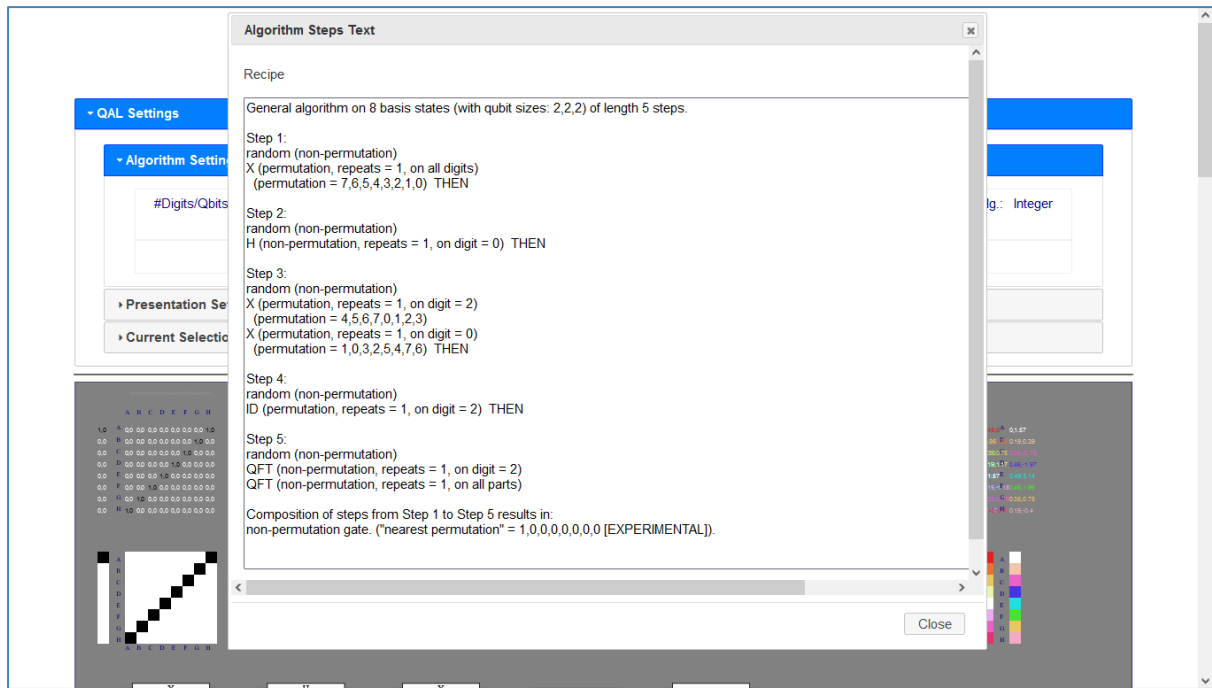**Figure 8. Further QAL Presentation Settings and Changing Final State Probabilities**

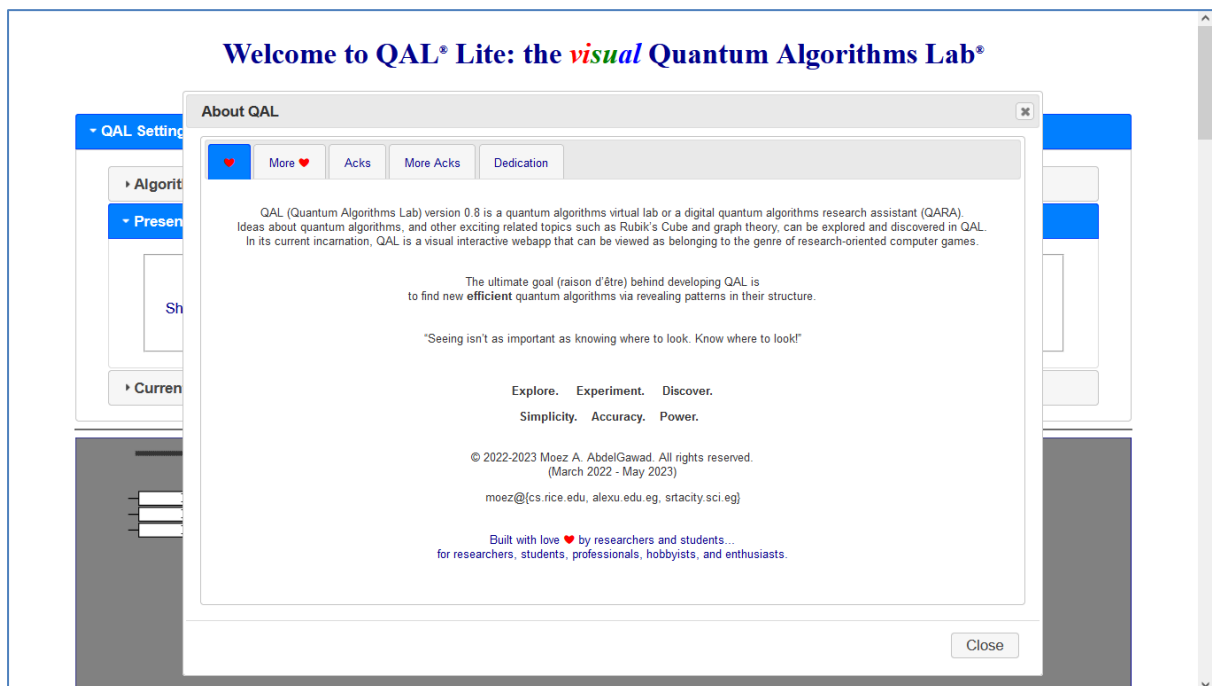**Figure 9. QAL Quantum Recipe** (Textual Quantum Algorithm Steps)
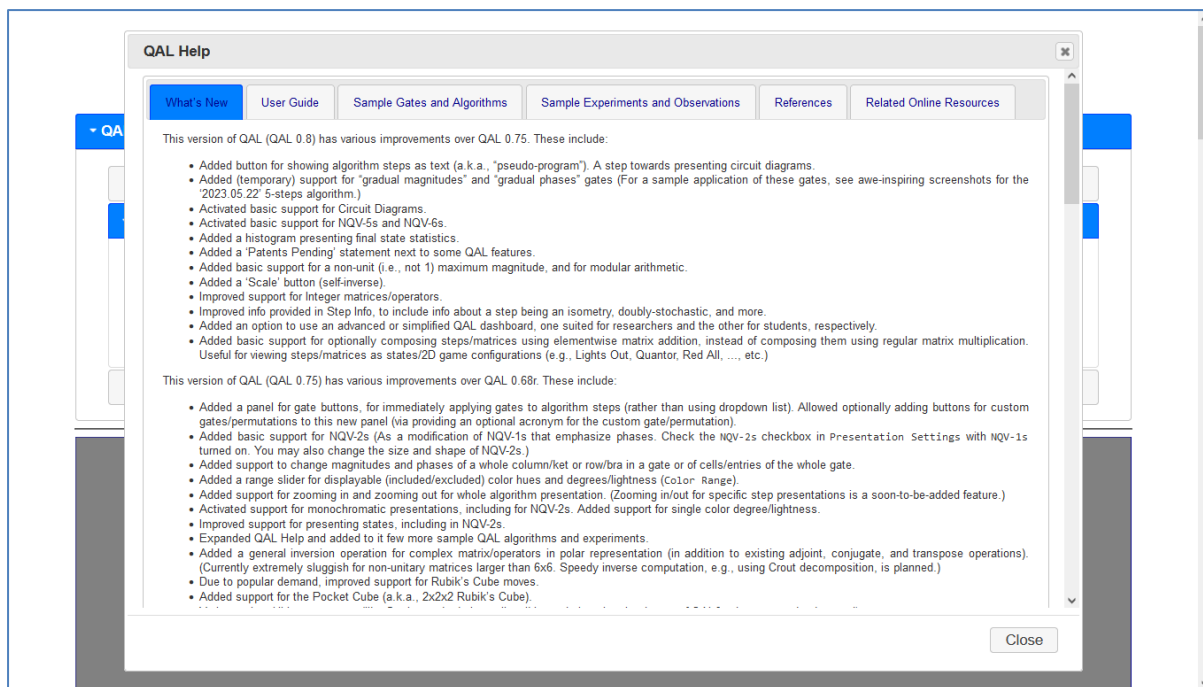

Figure 10. About QAL Dialog Box

QAL Help

What's New | User Guide | Sample Gates and Algorithms | Sample Experiments and Observations | References | Related Online Resources

This version of QAL (QAL 0.8) has various improvements over QAL 0.75. These include:

- Added button for showing algorithm steps as text (a.k.a. "pseudo-program"). A step towards presenting circuit diagrams.
- Added (temporary) support for "gradual magnitudes" and "gradual phases" gates (For a sample application of these gates, see awe-inspiring screenshots for the '2023.05.22' 5-steps algorithm.)
- Activated basic support for Circuit Diagrams.
- Activated basic support for NQV-5s and NQV-6s.
- Added a histogram presenting final state statistics.
- Added a 'Patents Pending' statement next to some QAL features.
- Added basic support for a non-unit (i.e., not 1) maximum magnitude, and for modular arithmetic.
- Added a 'Scale' button (self-inverse).
- Improved support for Integer matrices/operators.
- Improved info provided in Step Info, to include info about a step being an isometry, doubly-stochastic, and more.
- Added an option to use an advanced or simplified QAL dashboard, one suited for researchers and the other for students, respectively.
- Added basic support for optionally composing steps/matrices using elementwise matrix addition, instead of composing them using regular matrix multiplication. Useful for viewing steps/matrices as states/2D game configurations (e.g., Lights Out, Quantor, Red All, ..., etc.)

This version of QAL (QAL 0.75) has various improvements over QAL 0.68r. These include:

- Added a panel for gate buttons, for immediately applying gates to algorithm steps (rather than using dropdown list). Allowed optionally adding buttons for custom gates/permutations to this new panel (via providing an optional acronym for the custom gate/permutation).
- Added basic support for NQV-2s (As a modification of NQV-1s that emphasize phases. Check the NQV-2s checkbox in Presentation Settings with NQV-1s turned on. You may also change the size and shape of NQV-2s.)
- Added support to change magnitudes and phases of a whole column/ket or row/bra in a gate or of cells/entries of the whole gate.
- Added a range slider for displayable (included/excluded) color hues and degrees/lightness (Color Range).
- Added support for zooming in and zooming out for whole algorithm presentation. (Zooming in/out for specific step presentations is a soon-to-be-added feature.)
- Activated support for monochromatic presentations, including for NQV-2s. Added support for single color degree/lightness.
- Improved support for presenting states, including in NQV-2s.
- Expanded QAL Help and added to it few more sample QAL algorithms and experiments.
- Added a general inversion operation for complex matrix/operators in polar representation (in addition to existing adjoint, conjugate, and transpose operations). (Currently extremely sluggish for non-unitary matrices larger than 6x6. Speedy inverse computation, e.g., using Crout decomposition, is planned.)
- Due to popular demand, improved support for Rubik's Cube moves.
- Added support for the Pocket Cube (a.k.a., 2x2x2 Rubik's Cube).

Close

Figure 11. QAL Lite Help Dialog Box

Current Selection Settings

Gate/Perm. QFT | Repeat 1 time(s) | On Digit/Qbit 0 | All Digits ☑

Step | 1:(1-1) | Step Info | Save Step Gate/Perm.

From Part 12 ☑ | To Part 1 ☑

Magnitude = 0.1 | Phase = 43.2° ≈(1/4;7/30)π

At algorithm step 1, going from part (a.k.a. 'state') 29 to part 61 has magnitude 0.1 and phase 4.33 = 248.4° ≈(11/8;41/30)π
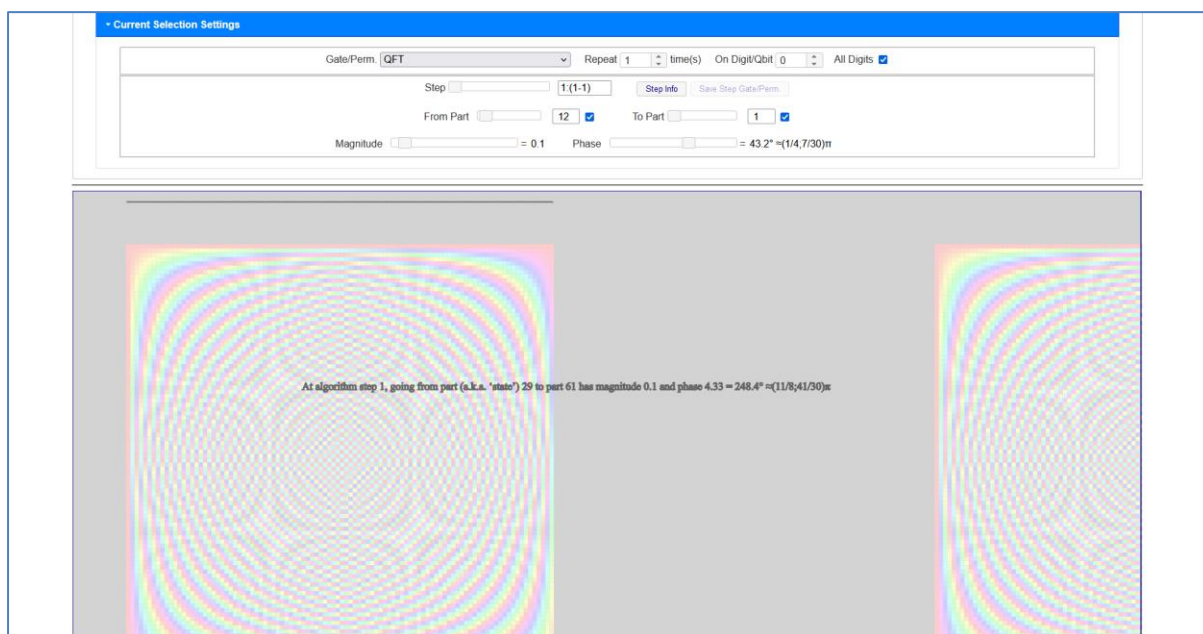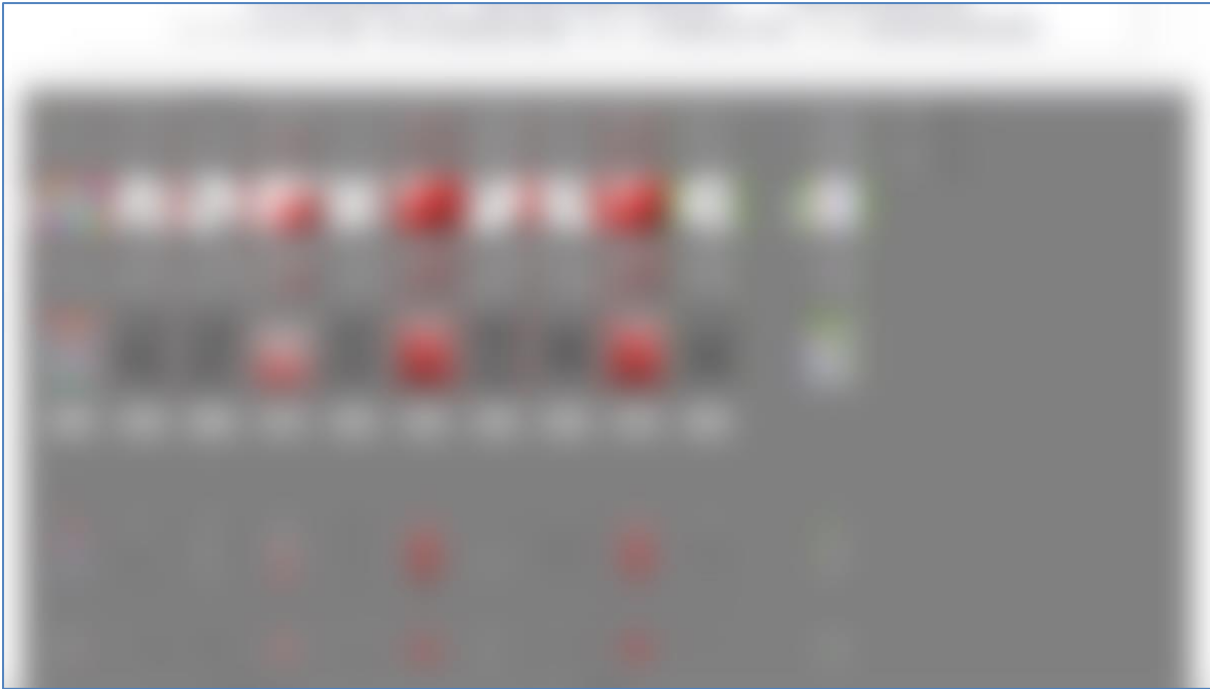
Figure 12. QAL 0.6 (QFT Heatmap)

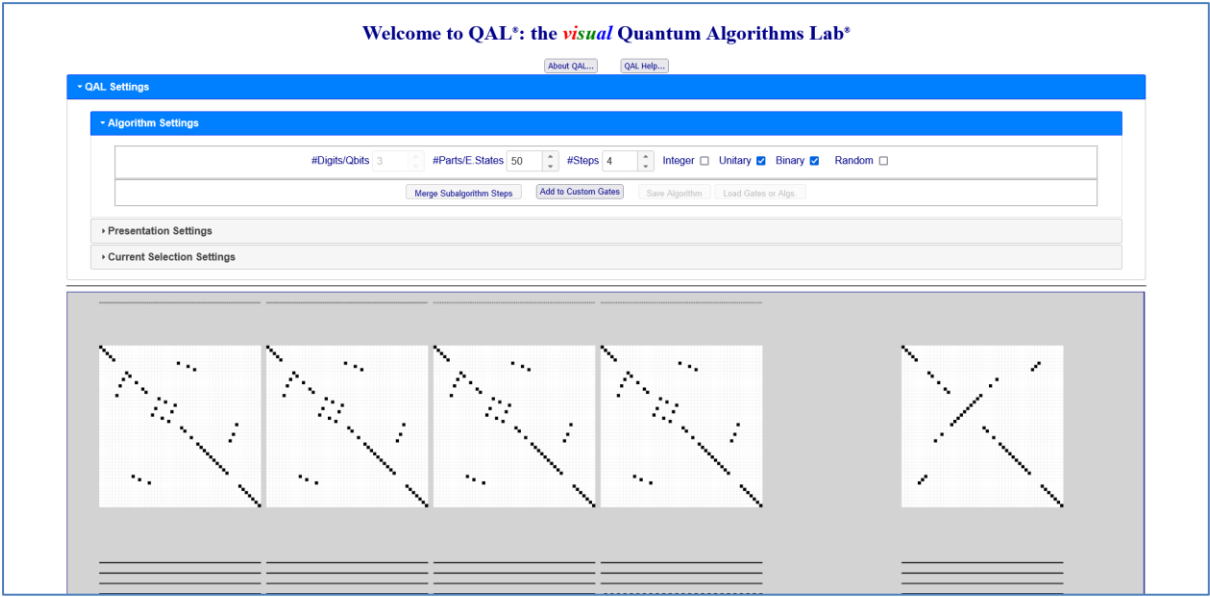**Figure 13. Blurred QAL 0.8** (incl. QALA NIVs)
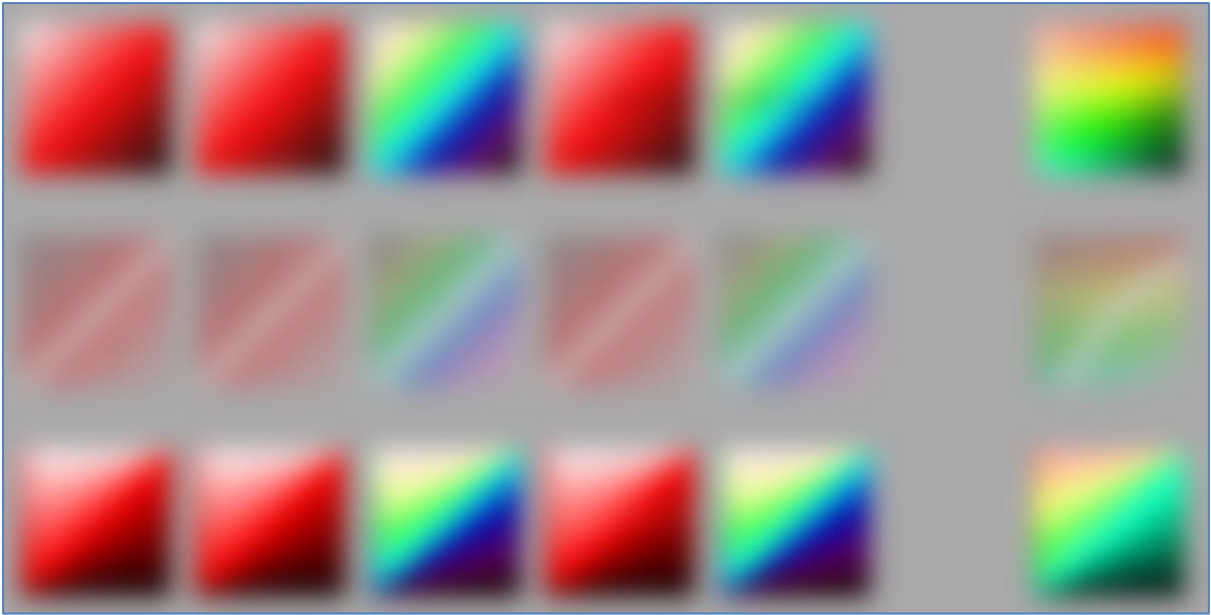

Figure 14. Rubik's Cube Moves in QAL 0.8

Figure 15. Blurred QAL 0.71

Figure 16. Blurred QAL (QNA/SCCSDs)

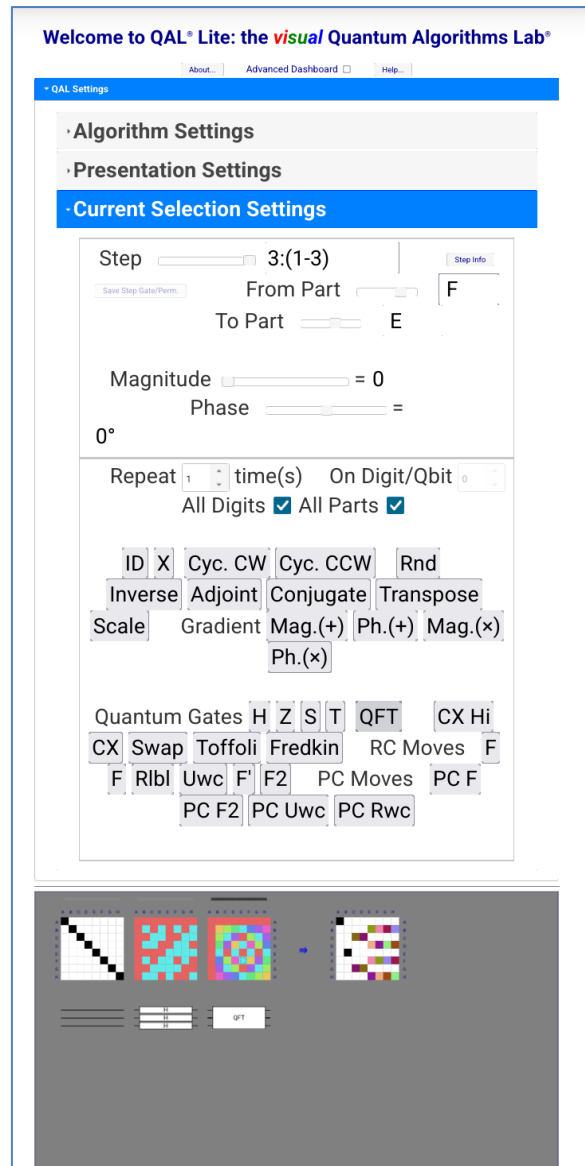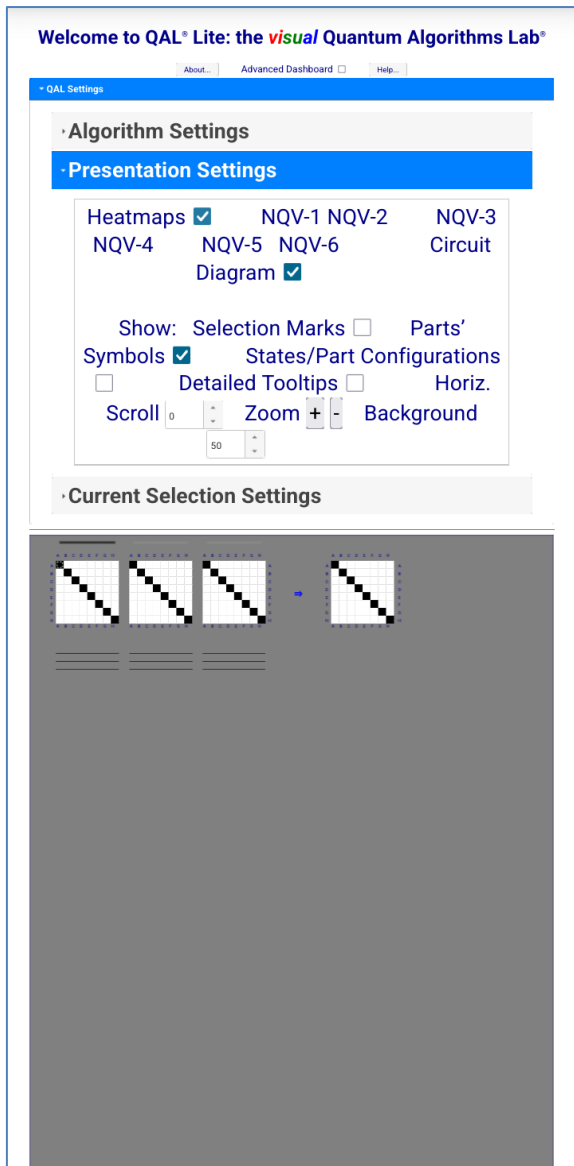**Welcome to QAL® Lite: the *visual* Quantum Algorithms Lab®**

About... Advanced Dashboard ☐ Help...

QAL Settings

› Algorithm Settings

· Presentation Settings

Heatmaps ☑ NQV-1 NQV-2 NQV-3
NQV-4 NQV-5 NQV-6 Circuit
Diagram ☑

Show: Selection Marks ☐ Parts'
Symbols ☑ States/Part Configurations
☐ Detailed Tooltips ☐ Horiz.
Scroll 0 Zoom + - Background
50

› Current Selection Settings

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› Algorithm Settings

› Presentation Settings

· Current Selection Settings

Step ⎯⎯ 3:(1-3) Step Info
Save Step Gate/Perm. From Part F
To Part E

Magnitude ⎯⎯ = 0
Phase ⎯⎯ =
0°

Repeat 1 time(s) On Digit/Qbit 0
All Digits ☑ All Parts ☑

ID X Cyc. CW Cyc. CCW Rnd
Inverse Adjoint Conjugate Transpose
Scale Gradient Mag.(+) Ph.(+) Mag.(×)
Ph.(×)

Quantum Gates H Z S T QFT CX Hi
CX Swap Toffoli Fredkin RC Moves F
F Rlbl Uwc F' F2 PC Moves PC F
PC F2 PC Uwc PC Rwc

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▸ QAL Settings

A B C D E F G H

QFT

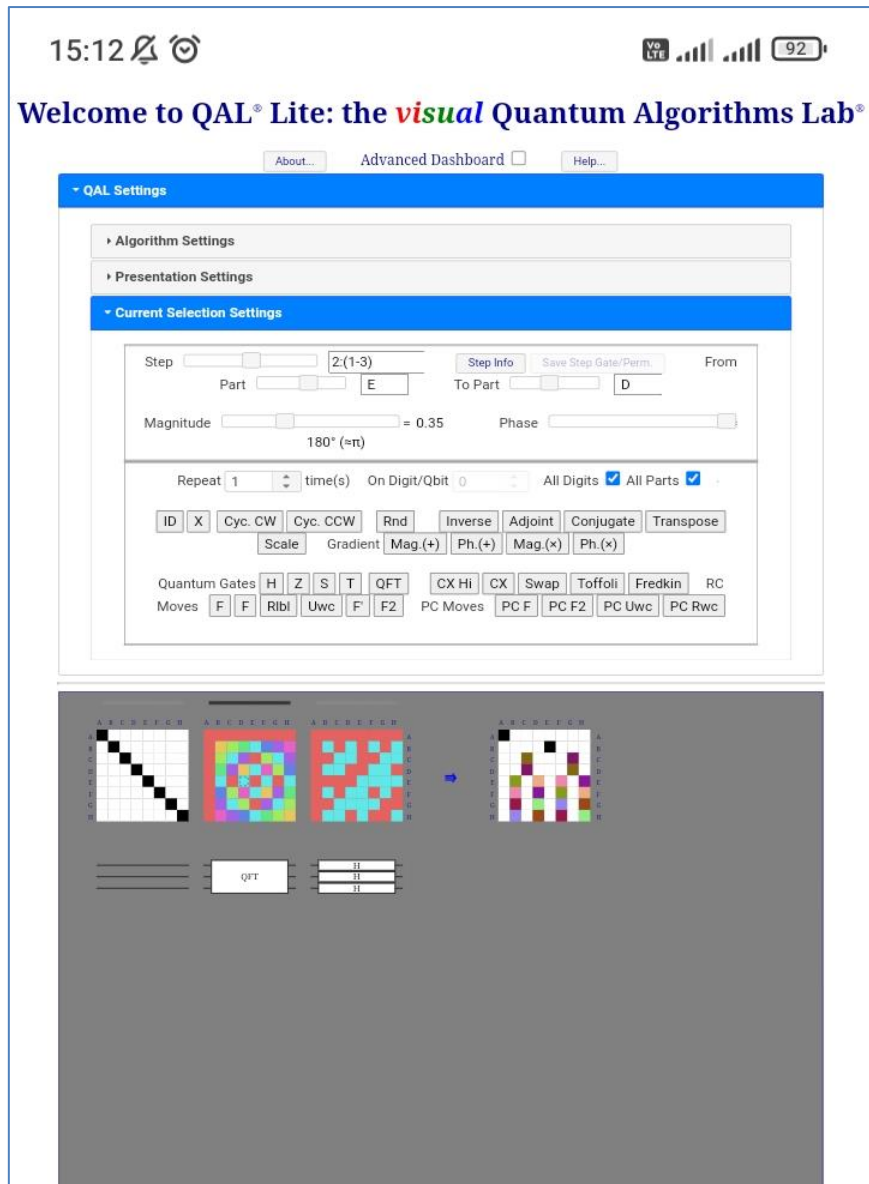**Figure 17. QAL Lite on Samsung Galaxy A12** (as a web app, on Firefox 110.1)

Figure 18. QAL Lite on Xiaomi Redmi 9A (as a web app, on Chrome 97.0)
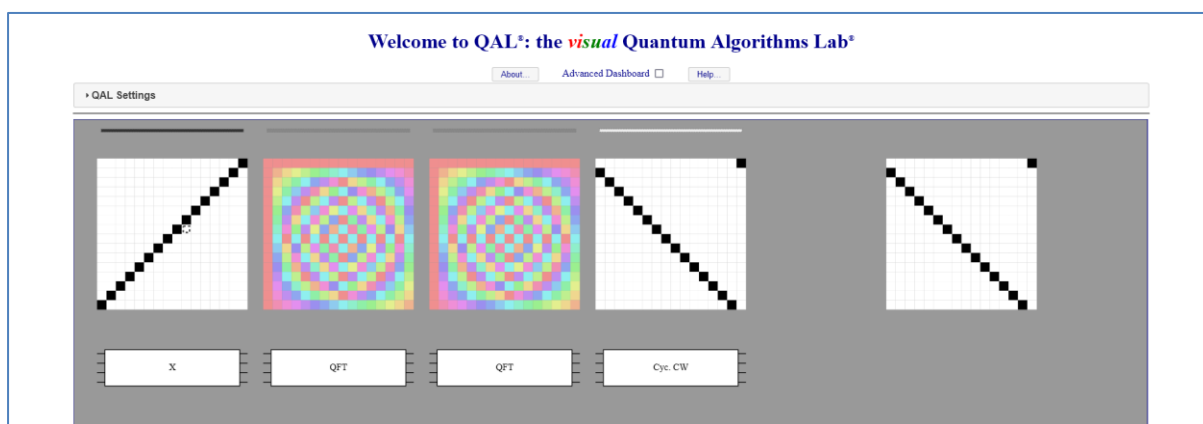
Figure 19. Visual confirmation that 'X then QFT^2' is "successor" (=Cycle CW)
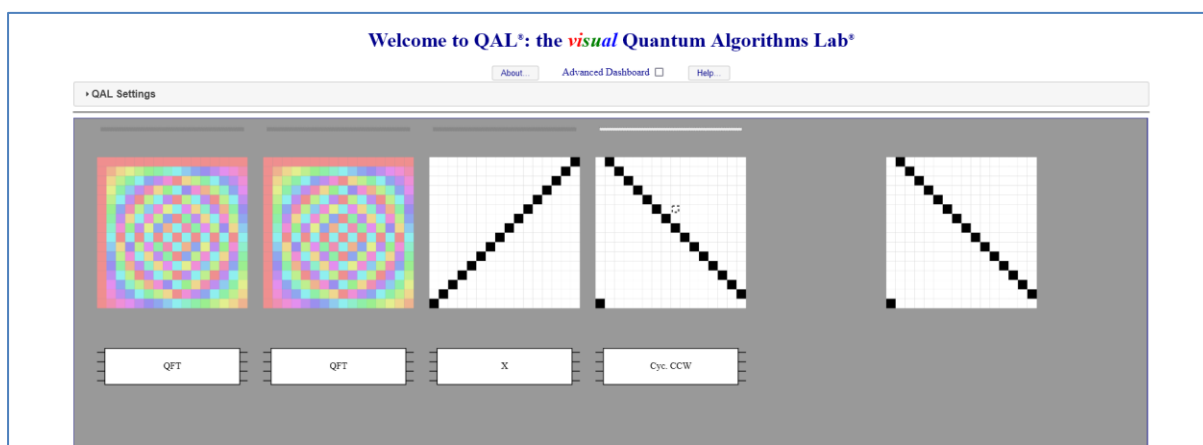

Figure 20. Visual confirmation that 'QFT^2 then X' is "predecessor" (=Cycle CCW)
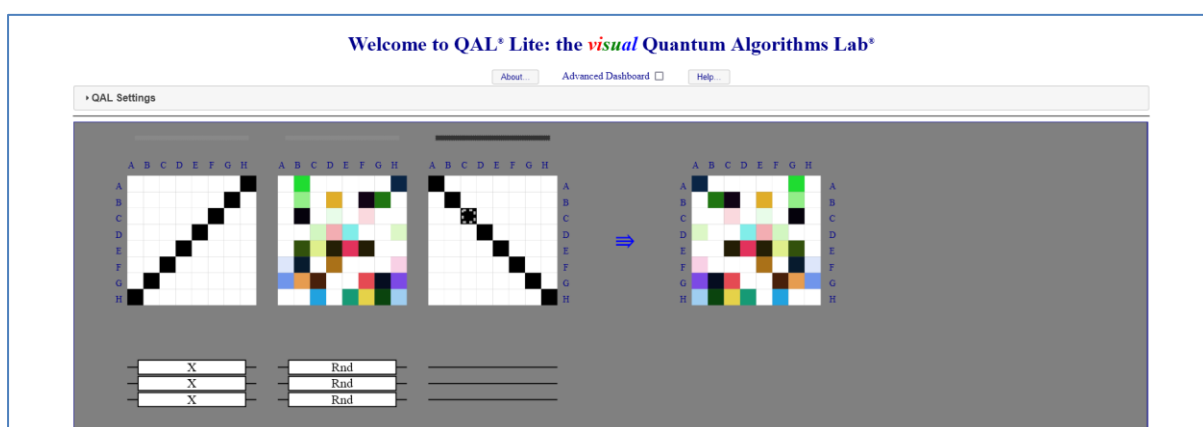

Figure 21. Visual confirmation that 'pre-multiply with X' is "flip horizontally" (thru vertical axis)
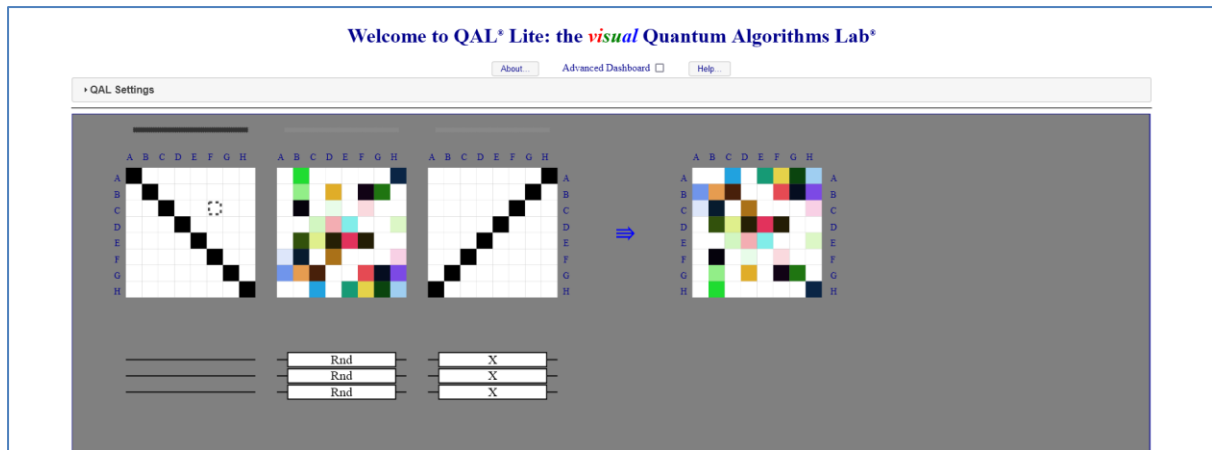
Figure 22. Visual confirmation that 'post-multiply with X' is "flip vertically" (thru horizontal axis)
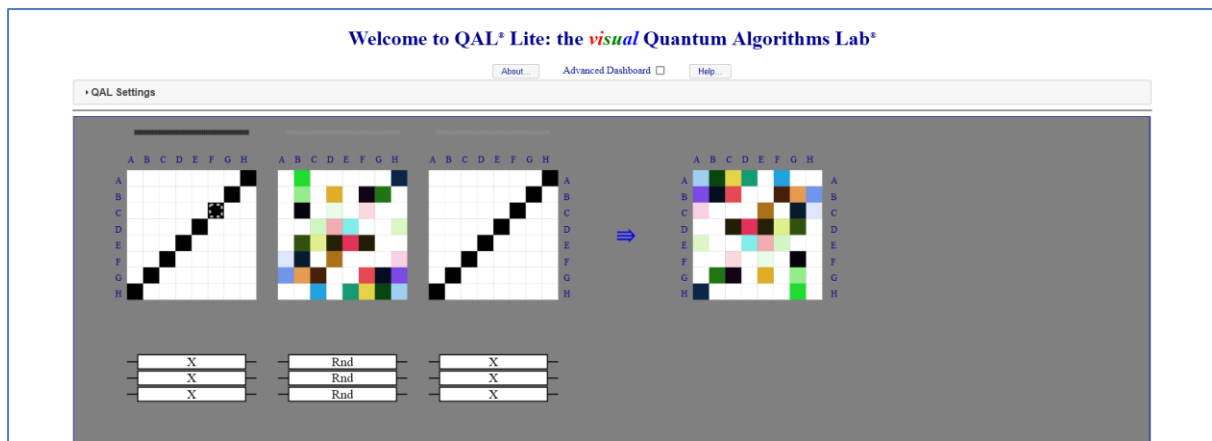

Figure 23. Visual confirmation that 'pre-multiply and post-multiply with X' is "reflect through origin" (rotate 180°)

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More QAL screenshots and tutorial videos to come. Keep watching…

More info on QAL can be found in the accompanying 'QAL Abstract' document available online.

You can check QAL Lite and play with it, for free, at:

http://eng.staff.alexu.edu.eg/staff/moez/QAL/Lite/