AEON Control Computation Workflow: A Step-by-Step Demonstration

This guide demonstrates the process of computing control over partially specified Boolean networks using the AEON application. Follow the instructions below to explore the process, from initializing the compute engine to visualizing control perturbations.

1. Launch AEON Web Interface

Navigate to the following URL:
AEON Web Interface

This URL opens the AEON interface in your browser and connects it to the specified engine endpoint.

● DISCONNECTED   **Open in tab**   **Tabs**   ✕

Aeon/**BIODIVINE**

```
Network editor actions:                                          HELP

 • Double click to create a new variable.
 • Drag from `+` to create a new regulation.
 • Select element (click) to show the context menu.

Keyboard shortcuts:

 • (⌫) Remove selected element.
 • (N) Add new variable.
 • (E) Edit name of the selected variable.
 • (F) Edit update function of the selected variable.
 • (A,S,D) Change phenotype value of the selected variable. (A-
   not in, S-false, D-true)
 • (C) Toggle control-enabled value of the selected variable.
 • (O) Change observability of the selected regulation.
 • (M) Change monotonicity of the selected regulation.
 • (H) Show this help message.

          (this message disappears when you create the first variable)
```

v0.5.0-SNAPSHOT

Image: The AEON interface upon loading

2. Initialize the Compute Engine

From the left navigation panel, open the **Compute Engine** module. Download the appropriate engine binary for your operating system, extract the files, and run the executable. Once the compute engine is running locally, return to AEON and click the **Connect** button to establish the connection
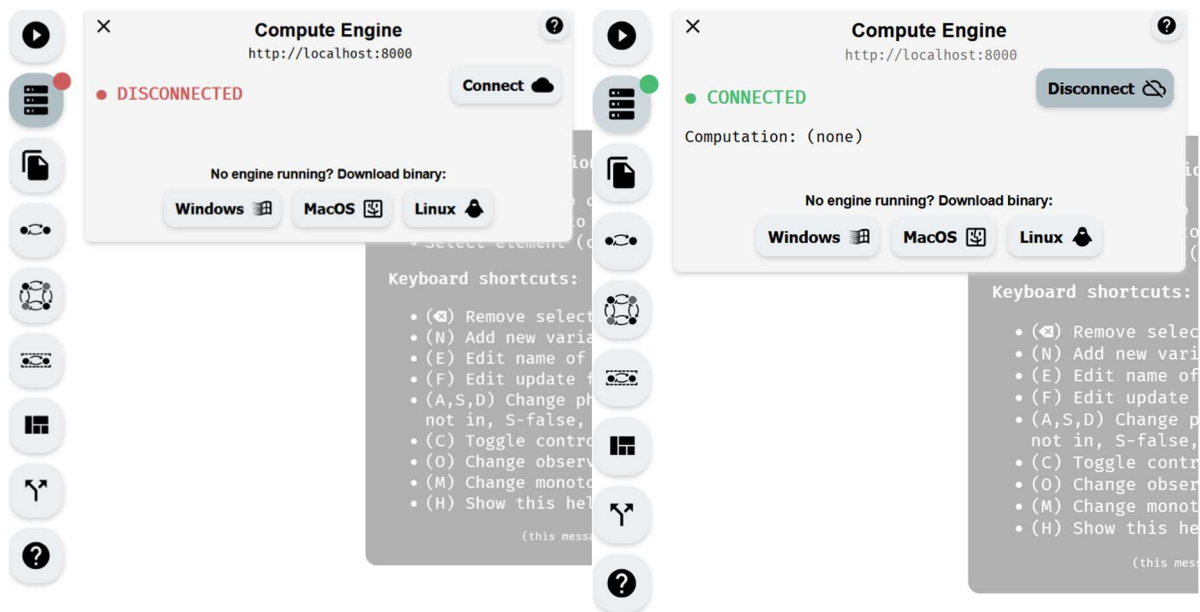
Image: Disconnected Compute Engine module   *Image: Connected Computed Engine module*

---

3. Import the Example Model (G2A)

Open the **Import/Export** module from the left panel. Click on the **G2A** button to import a sample Boolean network model.

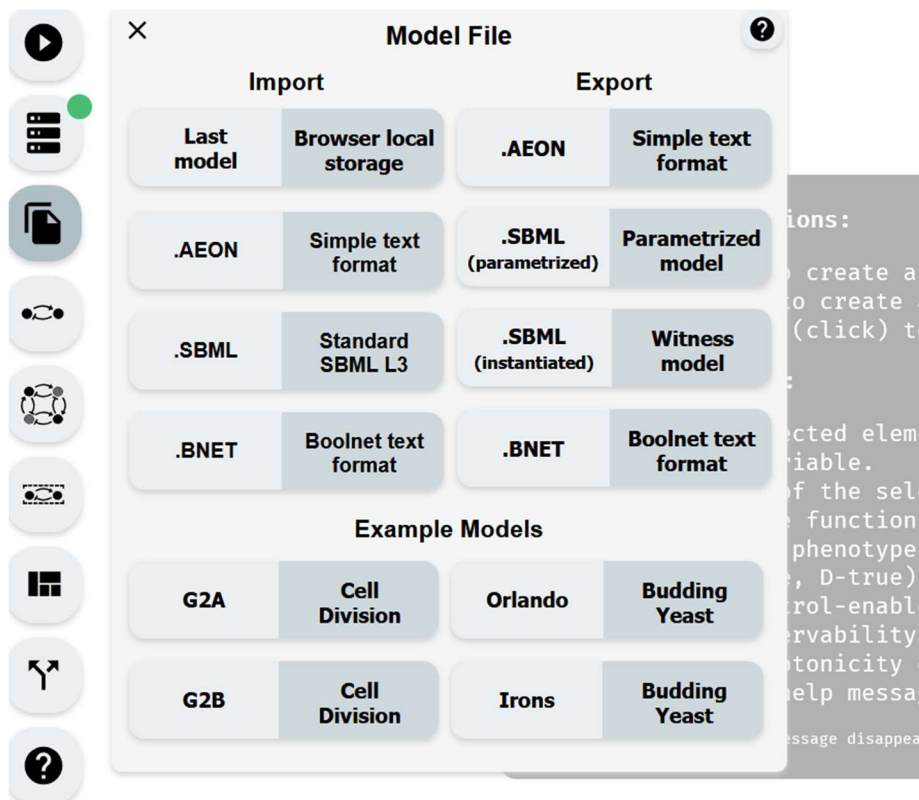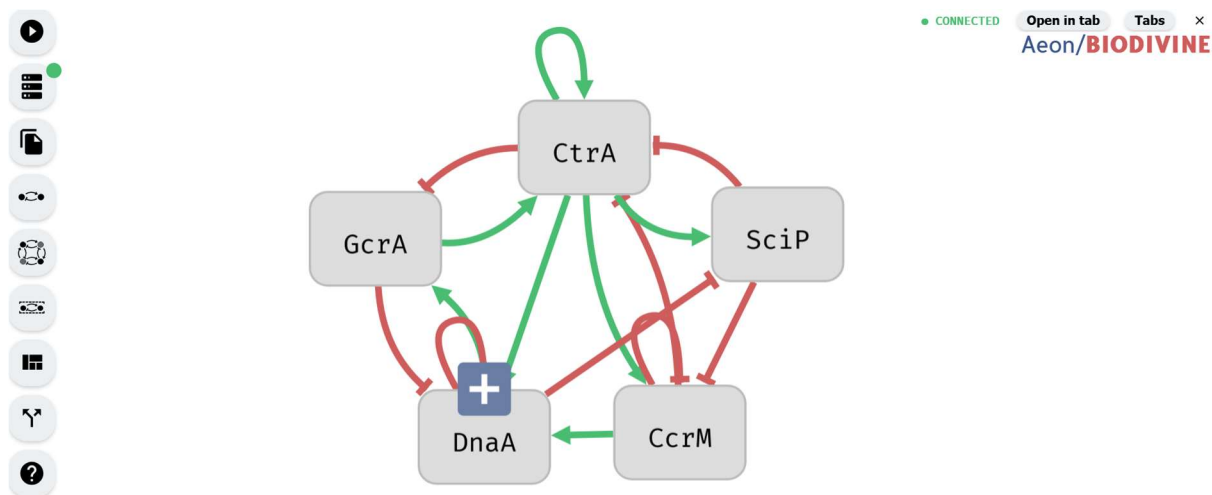The G2A model should now appear in the main editor view.

Image: Import/Export module

Image: Editor showing the imported G2A model.

---

4. Configure Control-Enabled Variables

Navigate to the **Control-Enabled Variables** module. By default, all variables are Control-Enabled (indicated by yellow markers).
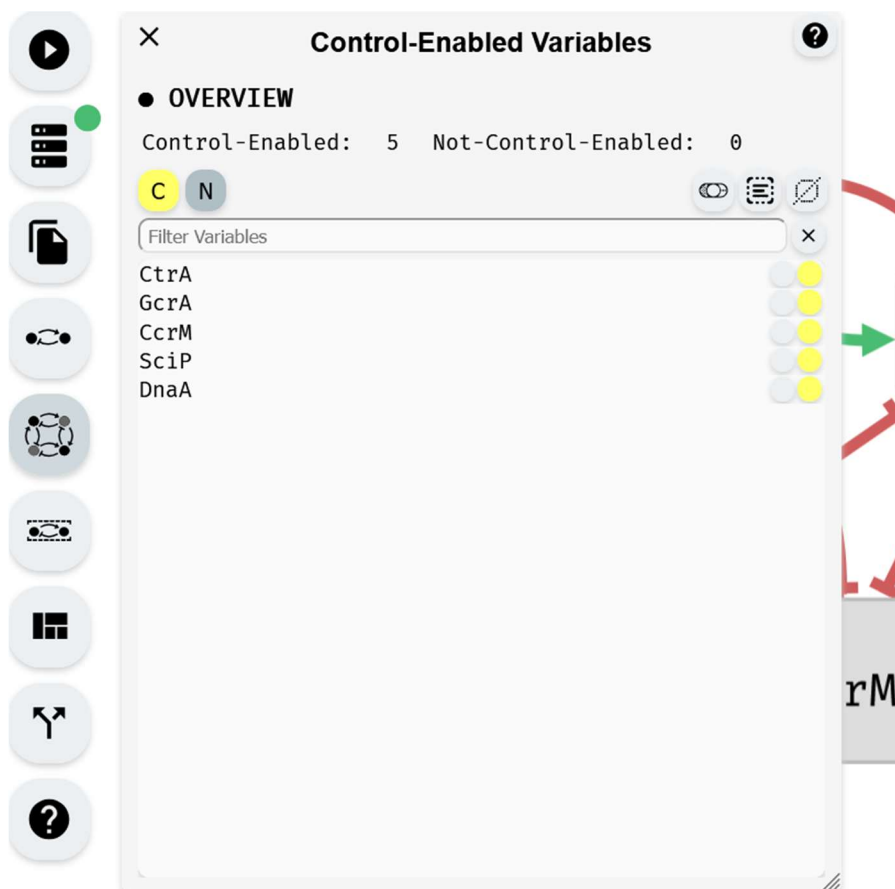
Image: Control-Enabled Variables module

We want to disable control for the variables **CtrA** and **GcrA**. To do this, right-click on each of their names and click the **'N'** button to mark them as Not-Control-Enabled.
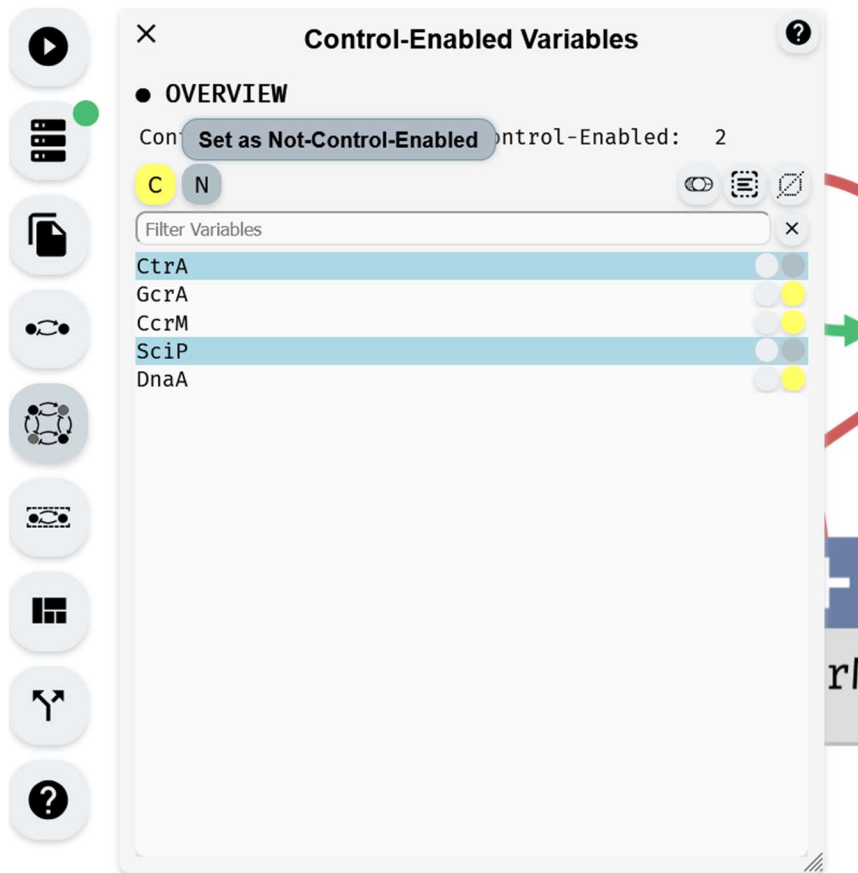

Image: Control-Enabled Variables module with CtrA and GcrA set to Not-Control-Enabled.

---

5. Define the Phenotype Specification

Go to the **Phenotype** module. Initially, all indicators are grey, meaning no variables are included in the phenotype.
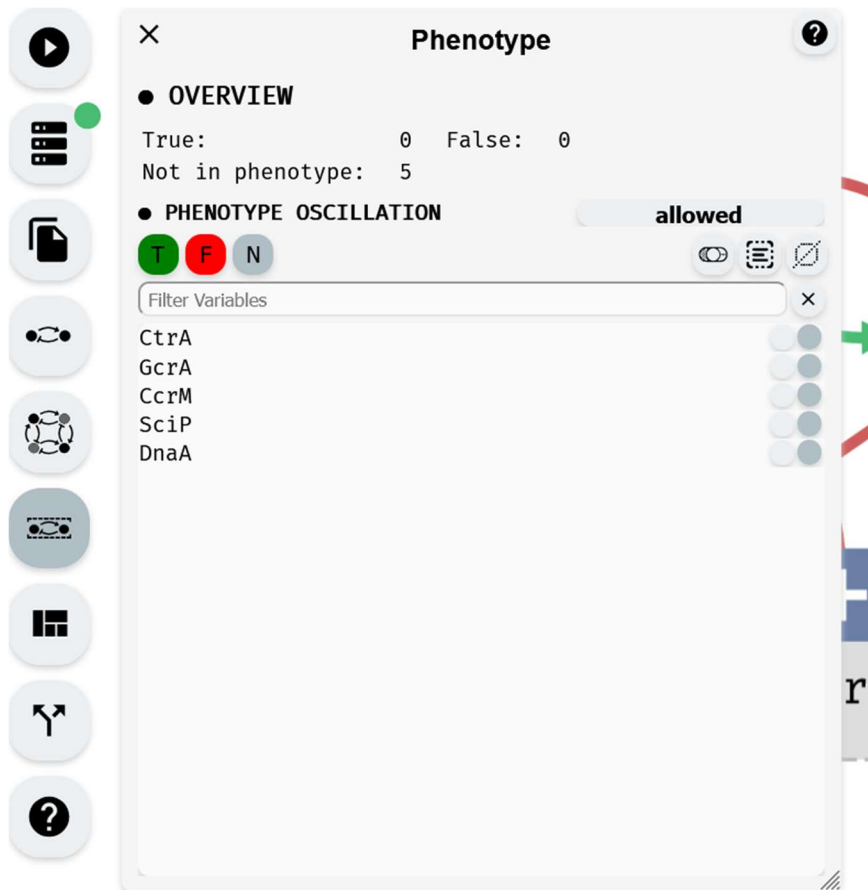
Image: Phenotype module

We will configure the phenotype to:

- Set **CtrA** to **true** (green 'T' button).

- Set **CcrM** to **false** (red 'F' button).

Step-by-step:

1. **Click on the CtrA** variable to select it.

2. Click the **green 'T' button** to mark CtrA as True in the phenotype.

3. **Click again on CtrA to deselect it**.

4. **Now click on CcrM** to select it.
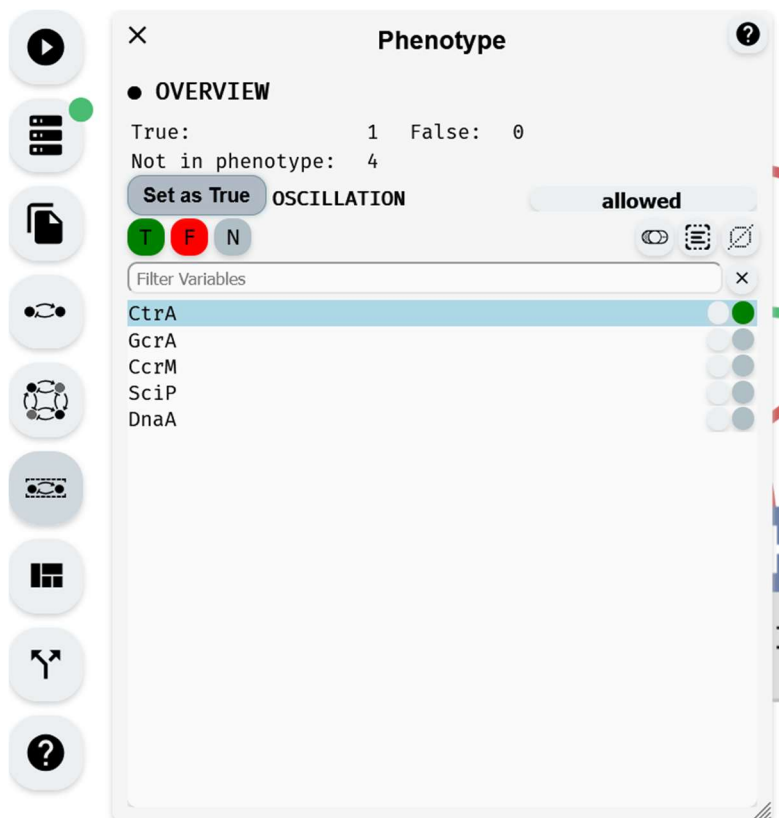
5. Click the **red 'F' button** to mark CcrM as False.

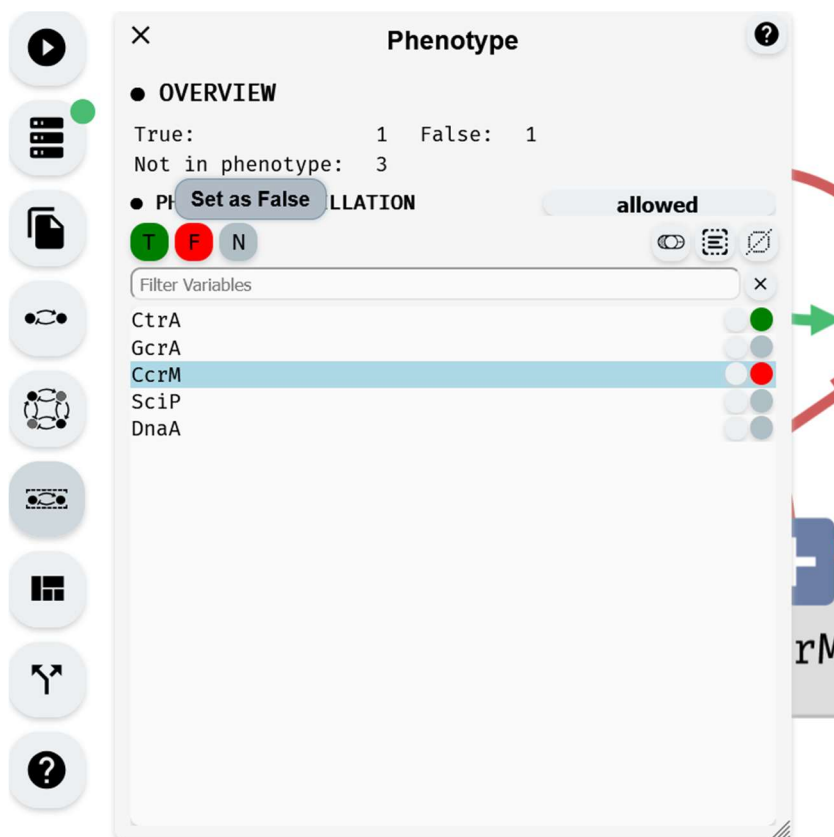*Image: Adding the CtrA variable into the phenotype as True*

Image: Adding the CcrM variable into the phenotype as False

6. Oscillation Settings

The **Oscillation** setting is displayed within the phenotype module and defaults to **Allowed**, meaning the computation considers both oscillating and non-oscillating dynamics.

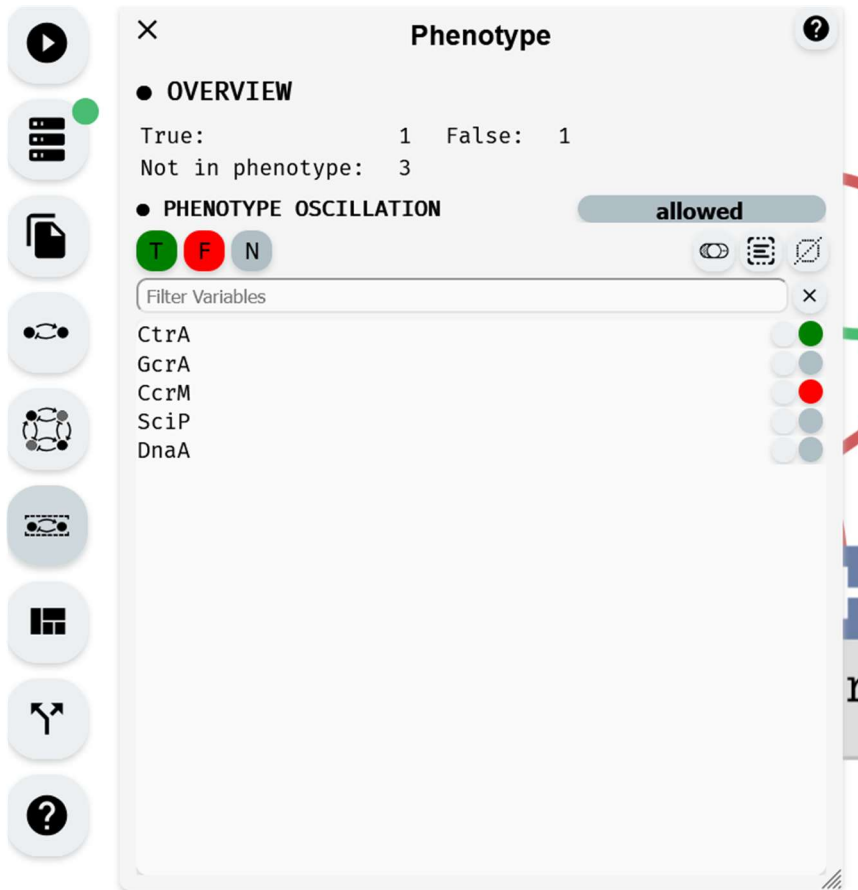No changes are required here, so we retain the default setting.

Image: Oscillation setting in the Phenotype module marked as "allowed".

7. Start Control Computation

Open the **Start Computation** module. Switch the **Computation Mode** to **Control**.

Adjust the following parameters:

- **Min Robustness**: 20%
- **Max Size**: 2
- **Max Number of Results**: 1,000,000

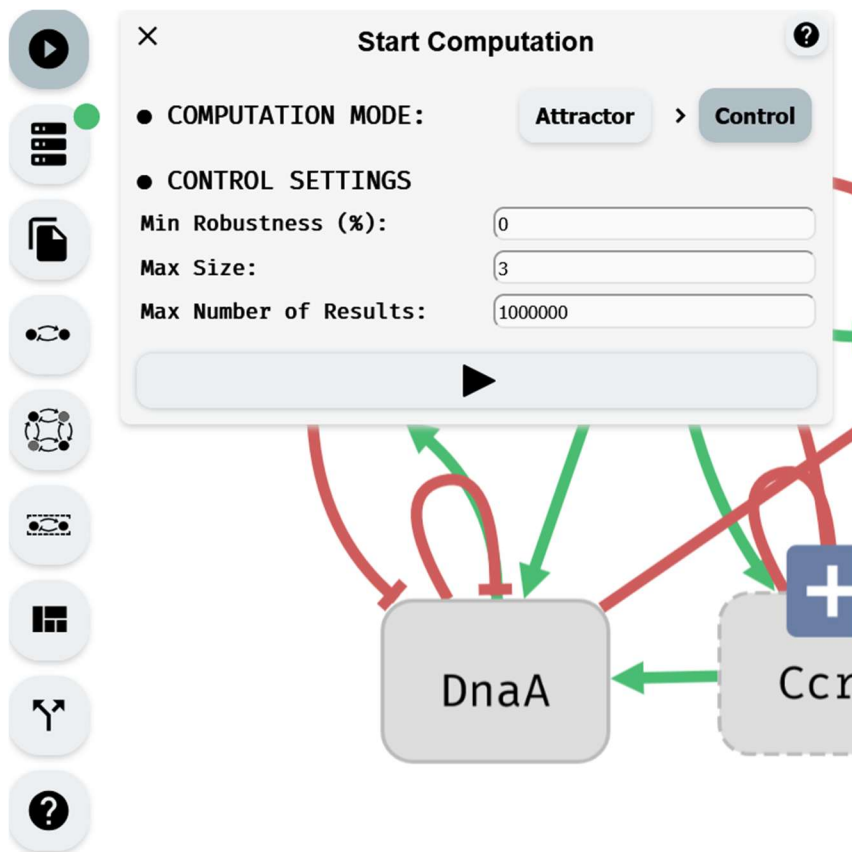Once configured, initiate the computation by clicking the large **Play** button.
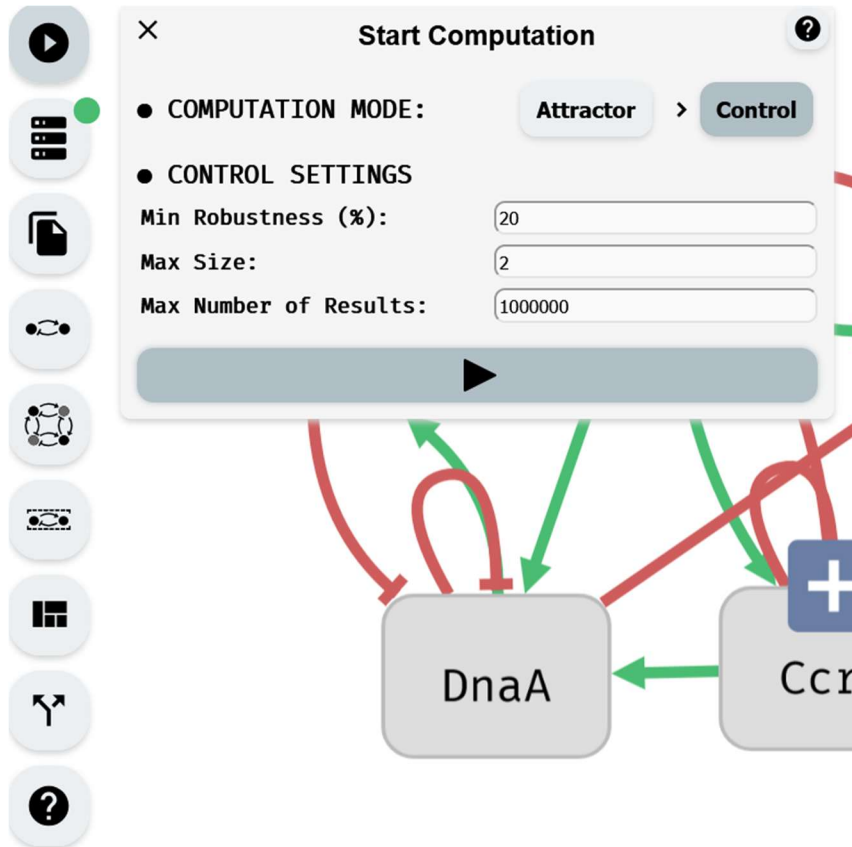
Image: Start Computation module

Image: Start Computation module with configured parameters and play button highlighted

8. Monitor the Computation

Once initiated, a status bar in the top-right corner of the interface will display **Running** along with an active timer, indicating that the control computation is in progress.
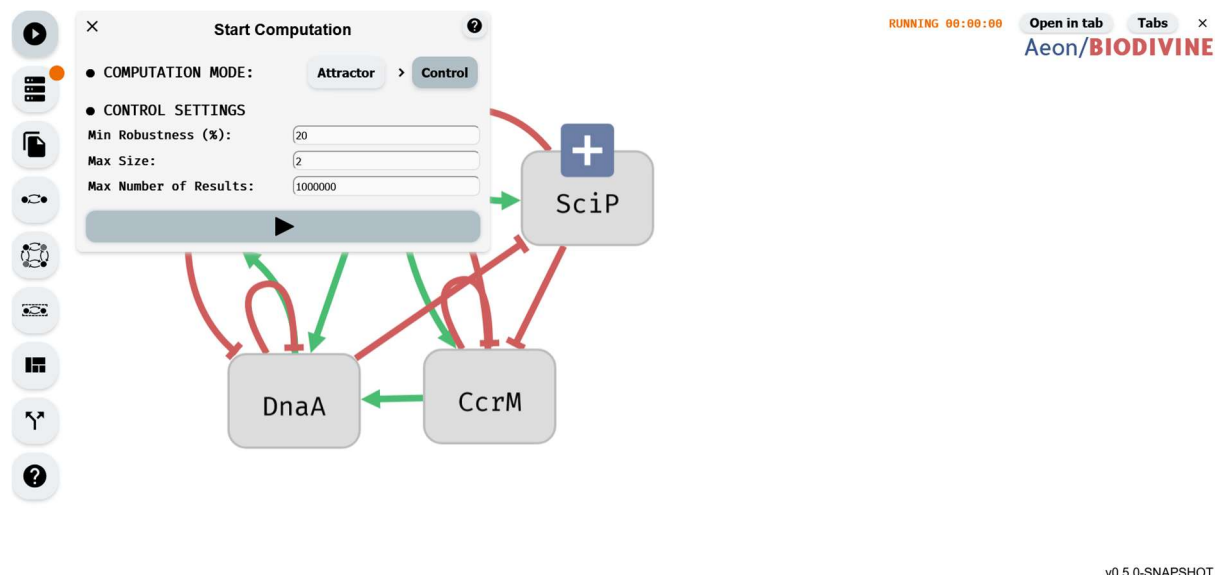
Image: AEON interface during an active computation — the Status bar in the upper-right corner displays "Running" along with a timer, indicating progress

9. Analyze Computation Results

Upon completion, the **Results** module will open automatically, summarizing the computed control perturbations.

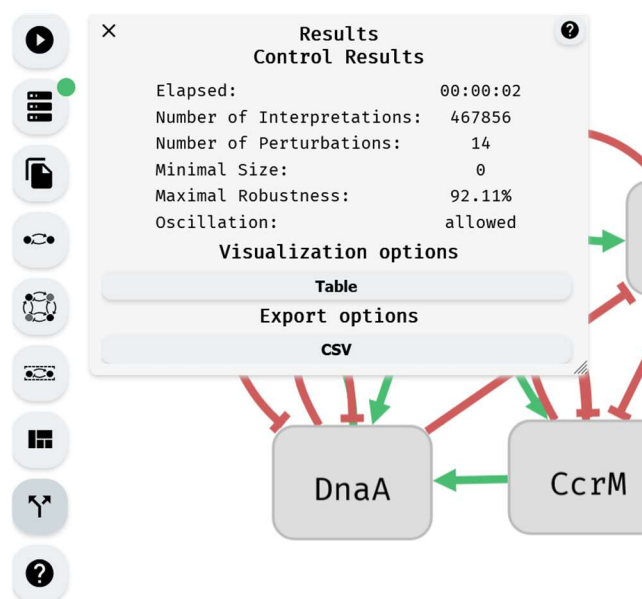Click on the **Table** button to view a tabular visualization of the results.

Image: The Results module displaying a summary of the control computation

Number of Interpretations:	467856	Maximal Robustness:	92.11%	Phenotype: CtrA, CcrM
Number of Perturbations:	14	Oscillation:	allowed	
Minimal Size:	0			Control-Enabled: GcrA,CcrM,DnaA

❷   **Filters**   **Return to model**

ID	Perturbations	Size	Interpretations	Rob(%)
1	{}	0	240716	51.45
2	GcrA	1	119082	25.45
3	GcrA	1	228366	48.81
4	DnaA	1	207138	44.27
5	DnaA	1	261744	55.95
6	CcrM	1	311688	66.62
7	GcrA, DnaA	2	110580	23.64
8	DnaA, GcrA	2	142956	30.56
9	DnaA, GcrA	2	273372	58.43
10	DnaA, GcrA	2	228684	48.88
11	GcrA, CcrM	2	184680	39.47
12	GcrA, CcrM	2	340200	72.71
13	DnaA, CcrM	2	233928	50.00
14	CcrM, DnaA	2	430920	92.11

Image: Table visualization of the computed control perturbations