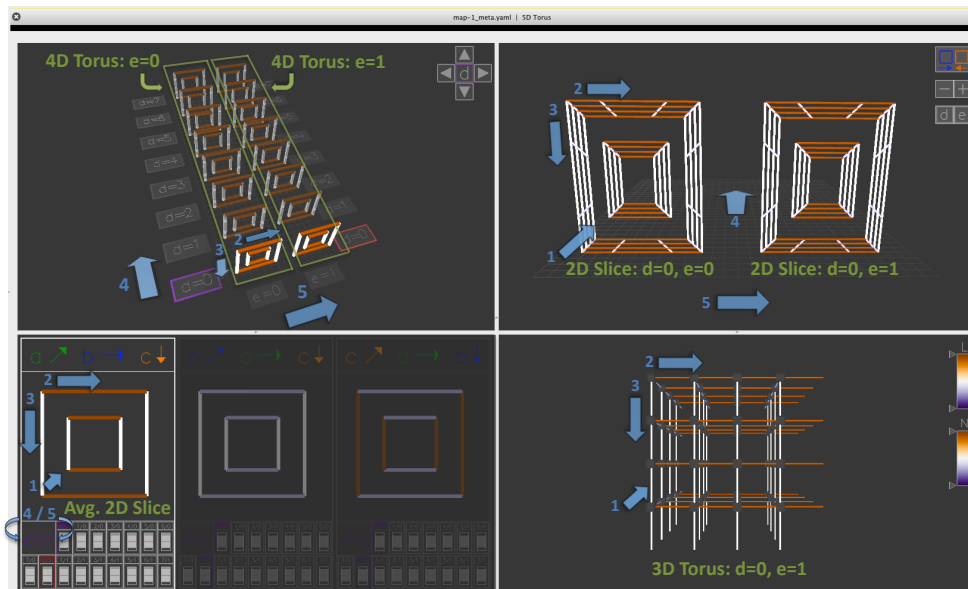


BG/Q Module: User Guide

A. BG/Q Module Overview

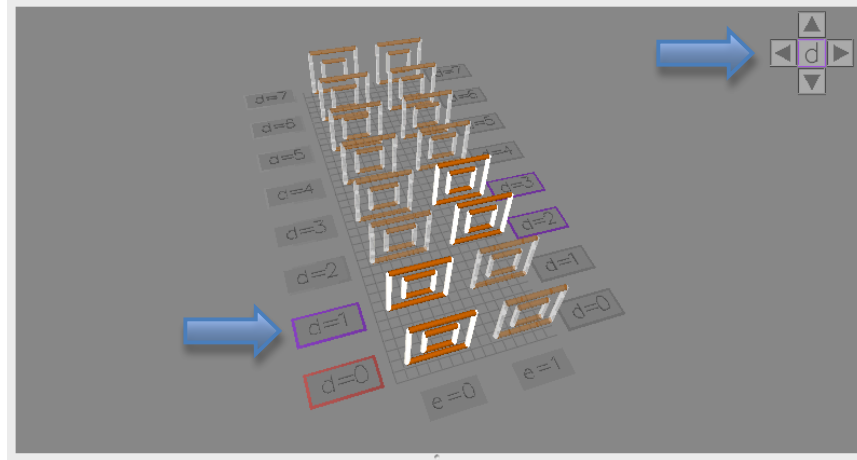
- BG/Q has a 5D torus interconnect, with dimensions called $[a, b, c, d, e]$, where the e -dimension has a maximum width of two nodes across
- Visualization is laid out as side-by-side 4D tori, $e = 0$ left, $e = 1$ on right
- Each 4D torus has 3D slices for each fourth dimension coordinate (e.g. $e=0$ torus has slices for $d = 0, d = 1, \dots, d = 7$ and same for $e = 1$)
- Each 3D torus slice is projected onto a 2D plane and drawn in the top-left, top-right, and bottom-left views, showing a subset of the links



**Top Left: View I, Overview; Bottom Left: View II, Minimaps
Top Right: View III, Slice 4D; Bottom Right: View IV, Slice 3D**

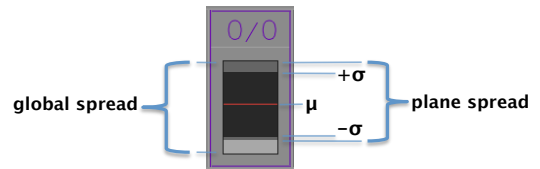
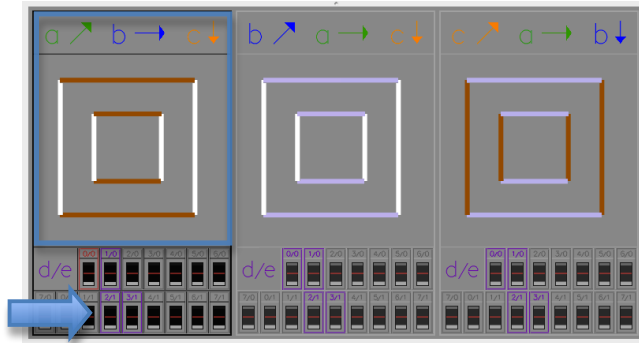
- One 3D slice (e.g. $d = 0, e = 0$), shown top-left with a red border around the label, is drawn bottom-right as a 3D torus to show all links/nodes
- How the dimensions a to e are mapped to 1 to 5 depends on the minimap selected in lower left (e.g. $a=1, b=2, c=3, d=4, e=5$)
- User can toggle on/off fourth dimension links in the top-right window
- Each view has its own mouse I/O and, currently, keyboard I/O
 - Future revisions will have combined keyboard I/O for all views
- Generally, everything with a grey or colored border is a clickable button
- Toolbars for the top right and bottom right views can be clicked and dragged to another location, by clicking the toolbar below the icons

B. View I: Overview



Operation	I/O
Select 2D slice to expand as 3D torus	Left-click label next to slice
Turn on/off 2D slice	Right-click label next to slice
Change fourth-dimension mapping	Click left/right arrows
Change first through third dimensions	Click up/down arrows
Zoom In/Out	Mouse wheel up/down
Translate Left/Right	Mouse wheel left/right
Translate Up/Down	Shift + Mouse wheel up/down

C. View II: Minimaps

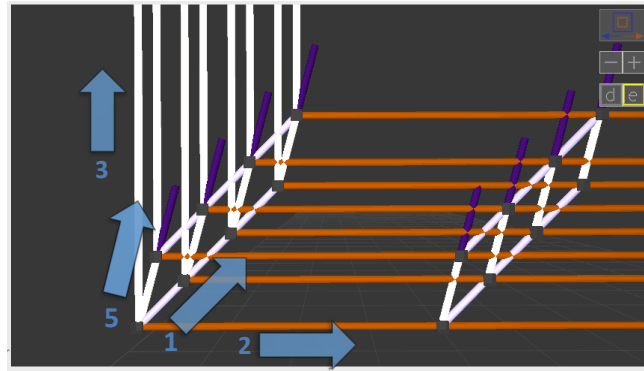


Label

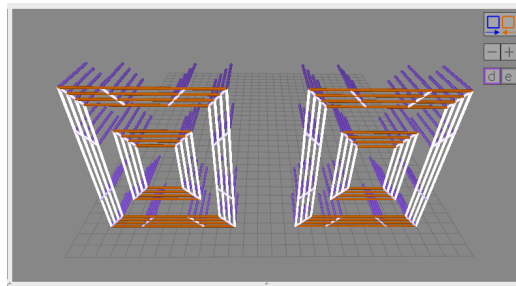
Operation	I/O
Change first through fourth dimensions	Left-click minimap, upper region *
Select 2D slice to expand as 3D torus	Left-click that label, lower region
Turn on multiple 2D slices	Left-click + drag labels, lower region
Turn on/off 2D slice	Right-click that label, lower region
Scroll Up/Down	Shift + Mouse wheel up/down
Change Number Minimaps Wide	Keyboard {1, 2, 3, 4, 5, 6, 7, 8, 9}
Reverse Scrolling Direction	Keyboard {r, R}

* When selecting a new minimap, the minimaps that share the fourth dimension are sorted to be at the top, and the scrolling position is reset to be back at the top. This is so if the number of minimaps across is 3 or more, when the user selects a new minimap it will always displayed in the view, without needing to scroll down.

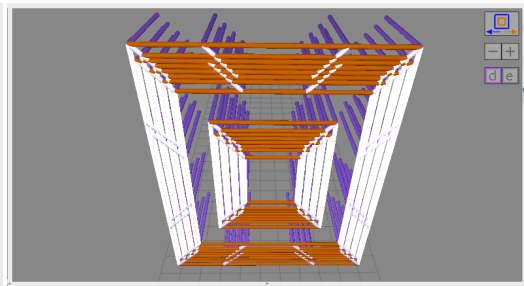
D. View III: Slice 4D



General Mapping

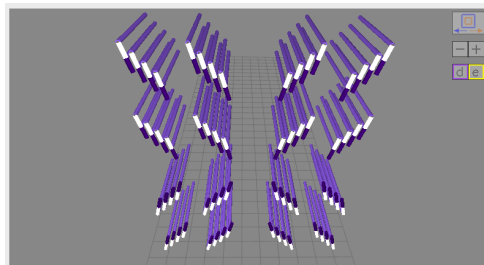


5th Dimension Offset

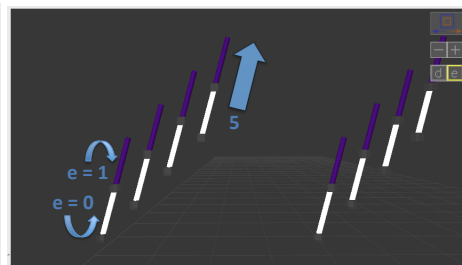


5th Dimension Inset

By default selected 2D slices of the two 4D tori, $e=0$ (left) and $e=1$ (right) are laid out offset, as shown in the bottom left. All diagonal links are shown, and half of the horizontal and vertical links. Fourth dimension links are shown toggled on here. *Left-clicking* the top most button switches from viewing the two 4D tori as offset to the $e=1$ tori scaled slightly down and inset inside the $e=0$ tori. When everything but the 4th dimension is toggled on, the layout is as follows. Note, here $d=4$ and $e=5$.



4th and 5th Dimensions On

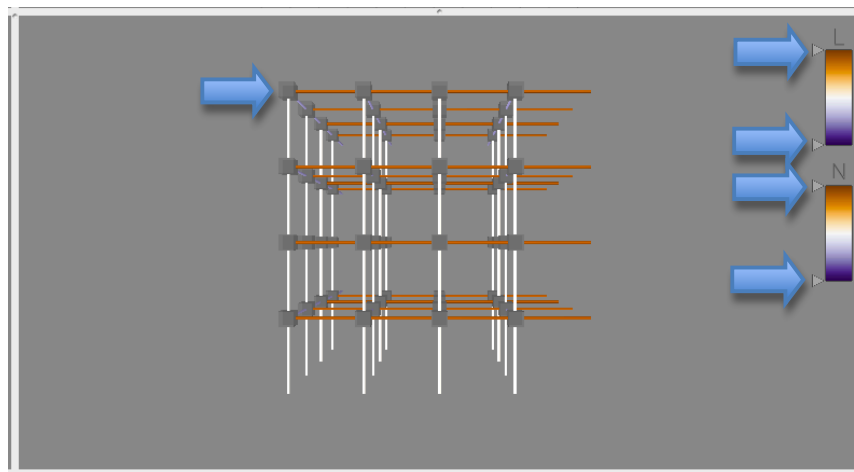


5th Dimension Only

<i>Operation</i>	<i>I/O</i>
Offset/Inset 5 th Dimension	<i>Left-click</i> top right button
Decrease/Increase Slice Spacing	<i>Left-click</i> middle (-/+) button Keyboard {-, _} / Keyboard {=, +}
Turn On/Off 4 th Dimension Links	<i>Left-click</i> 'd' button**
Turn On/Off 5 th Dimension Links	<i>Left-click</i> 'e' button**
Zoom In/Out	Mouse-wheel Up/Down
Translate Left/Right	Mouse-wheel Left/Right
Translate Up/Down	<i>Shift</i> + Mouse-Wheel Up/Down
Re-set View to Straight On	Keyboard {f, F}
Decrease/Increase Link Width	Keyboard {L} / Keyboard {l}
Decrease/Increase Node Size	Keyboard {N} / Keyboard {n}

** *Left* click once to toggle on/off these links. Click again to turn off first through third dimension links. Note: e-links can only be viewed when the 4D tori are inset, so the offset/inset button is grayed out. Also, if already viewing only the fourth dimension links when clicking to turn on the e-links, successive clicks only toggle e-links off again, since the first through third dimension links are already removed. To get the first through third dimension links back, the *d* button would need to be clicked again, since that is what caused them to be turned off. This will be simplified in the future with a button to turn on/off the first through third dimensions.

E. View IV: Slice 3D



<i>Operation</i>	<i>I/O</i>
Change Bounds of Link Colormap	<i>Left-click + drag</i> sliders under 'L'
Change Bounds of Node Colormap	<i>Left-click + drag</i> sliders under 'N'
Select Only Links Leaving One Node	<i>Right-click</i> the node (cube)
Zoom In/Out	Mouse-wheel Up/Down
Translate Left/Right	Mouse-wheel Left/Right
Translate Up/Down	<i>Shift</i> + Mouse-Wheel Up/Down

Reset Bounds for Both Colormaps	Keyboard {r, R}
Decrease/Increase Link Width	Keyboard {L} / Keyboard {I}
Decrease/Increase Node Size	Keyboard {N} / Keyboard {n}

Please direct any bugs or suggestions to *Collin Michael McCarthy* on Jira for the PAVE group, or via email at cmccarthy@ucdavis.edu