# ORBIT by IONIC

## See your data like never before.

*Desktop and VR exploration of cytometry data. ORBIT runs entirely on your own computer: nothing you load is uploaded anywhere. This sheet is the five-minute tour; the Quickstart that comes with the app lists every control.*

## Part 1 · The desktop in five minutes

1 **Start.** ORBIT is a single HTML file. Open it in Chrome or Edge; no installation and no network connection are needed. A synthetic demo dataset loads so there is always something to look at. The Display button in the toolbar holds the look of the plot and a Light / Dark switch; click any section heading to fold it.

2 **Add your data.** Drop FCS or CSV files anywhere on the plot, in any order and as many times as you like: new files are added beside the ones already loaded. A metadata sheet (CSV with a filename column and columns such as Donor, Group, Timepoint) is recognised by its content wherever you drop it. OMIQ exports work as they are: cluster names, TriMap or UMAP axes and the CyTOF cofactor are picked up automatically.

3 **Look.** Drag to rotate, wheel to zoom, Shift-drag to pan. X, Y, Z are any three channels; C colours the cells by a fourth. Click a legend entry to hide a cluster, Alt-click to show only that one, hover a cell for its values. Click a legend colour dot to give that cluster your own colour (picker, R G B or hex); files that carry population colours bring them along. Arrow keys step through samples; the tiles under the plot show the others live.

4 **Define populations.** Three ways. Clusters: click Compare visible groups in the legend; they stay in the list even after you colour by a marker. Gates: + Sphere, then Fit to visible cells, or drag it with move mode (G). Hand-drawn: Ctrl-drag a box around cells (set Sweep reaches to Front 10% so cells behind the target are left alone), rotate, sweep again, then Group as region; the region is learned from your sweep and applied to every file. Esc clears a selection.

5 **Side by side and pooled groups. Side by side…** in the toolbar draws a second sample, or a whole group with its files pooled, in the right half of the plot. Both halves share axes, colours and gates and turn and zoom together; you hover, sweep and gate in the left half. Shift+click a tile does the same. **Samples as** (Files section) shows one cloud per file, each metadata group concatenated into one cloud, or all files in one cloud coloured by group. For example: groups concatenated by condition, then side by side, with unstimulated pooled on the left and stimulated on the right. Statistics still use the individual files.

6 **Compare.** In Statistics pick what to compare from the Compare select, in words: "Post vs Pre within each population", all populations within a group, a single pair, or the two-way ANOVA; then the test family and Paired by Donor when samples are paired. The plot puts the compared groups side by side for each population with a bracket and stars between them; one compact table per test gives n, the statistic, the difference with its 95% CI, Cohen's d, p and the Benjamini-Hochberg q. The right rail shows the median-expression table and the z-scored heatmap.

7 **Keep it.** Save session writes one JSON file with every axis, colour, gate, region, population and view choice; open it later next to the same files and you are back where you were. Write populations to FCS or CSV adds a Population_ORBIT channel (plus 0/1 channels and your population colours) to each file, so the populations you defined here go on to your other analysis tools. Save… exports PNG, SVG, PDF (with editable text) or a rotating GIF; Batch export makes one plot per sample or group. PCA, k-means and UMAP run inside the app from the Compute section.

### Keys worth knowing

| Key | Does | Key | Does |
|---|---|---|---|
| ← → | previous / next sample (or pooled group) | Ctrl+click, Ctrl+drag | select a cell, a box of cells (Ctrl+Alt removes) |
| [ ] | previous / next metadata value | Esc | clear the selection |
| , . | previous / next colour channel | G | left-drag moves the selected gate |
| Shift+click tile | show that sample side by side | Delete | delete the selected gate |
| R | reset the view | Ctrl+Z / Ctrl+Y | undo / redo, including VR |

# Part 2 · In the headset

*Developed and tested on the Meta Quest 3, connected to a Windows PC with Quest Link. Set up the data, axes, colours and populations on the screen first; the headset is for looking and shaping. Click Enter VR in the toolbar and put the headset on ; the switch can take up to a minute. The Quest's own browser can also run ORBIT with no PC, from a copy saved on the headset.*

## What you see

Your primary sample floats in front of you with the other samples in a ring around you, each with its card. High above, four cards: the Samples card (tick metadata groups to compare, switch how samples are shown, open side by side), the median-expression table, the comparison table and the plot. Coloured by a marker, the plot card shows that marker's expression per population and group, so cycling the colour walks it through the markers. Below the sample sit its card, the colour legend and a controls banner that repeats this list.

## Controls

| Do this | With |
|---|---|
| Rotate the sample any way / zoom | Right stick / left stick |
| Move or resize by hand | Hold the grip; both grips to scale |
| Read a cell (colour value, then every marker highest first) | Point the laser at it |
| Select one cell / paint a selection | Tap the trigger / hold the trigger and sweep (grip too to erase); Sweep reaches set on the desktop limits the depth |
| Make the selection a region on every sample | Hold A (or X) for a second |
| Clear the selection | Hold B (or Y) for a second |
| Drop a sphere gate where the laser points | Hold the stick click |
| Edit a gate: resize along one axis | Tap the trigger on a cube node, push the stick, tap again to release |
| Sphere ↔ box / gate off and on | A / B while the gate is being edited |
| Finish editing | Tap the trigger on empty space |
| Previous / next primary sample (or group) | Click the left / right stick |
| Bring a ring sample to the centre | Point at it and squeeze the grip |
| Compare metadata groups | Tick values on the Samples card |
| Show each file, groups concatenated, or all in one cloud | Tap ⟳ Show as on the Samples card |
| Put a second cloud beside the primary | Tap ◫ Side by side on the Samples card, or tap the trigger on a ring cloud |
| Swap / close the side cloud | Grip on it / tap the trigger on it |
| Change the colour channel | Tap A / B (or X / Y) |
| Leave VR | Hold A and B together for a second (rather than Quit from the Meta menu) |

## Good to know

Every action gives a short vibration. Gates drawn in the headset appear on every ring sample and on the desktop, and the side-by-side choice carries both ways. Undo on the desktop covers everything you did in VR. If the picture stutters, pick Balanced or Low power under VR performance before entering; the cards keep their size at every setting.

## Take it with you

PCA, k-means and UMAP run inside the app; an optional Python companion adds HDBSCAN and faster UMAP. A copy of ORBIT can carry a dataset and a saved session inside it and open straight into your data, on a laptop or in the Quest browser. Your session file and the populations written back to FCS travel with your data.