

Electronic supplementary material: text

Geometry of sample volume

Assuming single beta cells are spherical our two photon cross section will transect the sphere with a spherical segment that is of even thickness. Where-ever the transect is made (top, middle bottom of the sphere) the surface area of this segment is equal and governed by the equation:

$$\text{Area} = 2\pi R h$$

where R is the radius of the sphere and h is the thickness of the segment. This means that our random sections through cells will always be sampling from cell membrane of identical areas.

The exception to this is where a segment is at the very top or bottom of the cell such that some of the volume of the two-photon volume actually falls outside of the cell volume. In this case the two-photon cross section is “skimming” a smaller area of the cell membrane which we estimate accounts for less than 10% of our cell recordings.