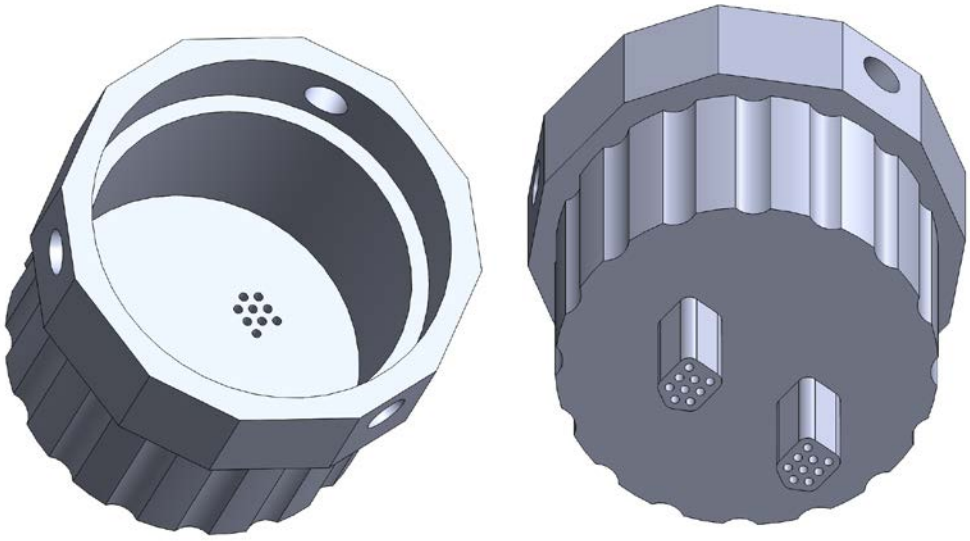

Halo Microdrive

Exit Tip Design Guide

Microdrive used for manually driving tetrodes for electrophysiology recordings

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Revision 1.4
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Table of Contents

List of Figures and Tables

1 Document Overview

This document describes the manufacturing limitations in creating a custom exit pattern for the Halo-18, Halo-10, and Halo-5 Microdrive.

2 Halo-18/Halo-10 Microdrive Exit Tip Overview

The Halo-18 Microdrive allows up to 16 tetrodes to be inserted into a freely moving animal. Two additional shuttles can be used for fiber optics or reference electrodes. The Halo-10 uses the same exit tip outline however it only allows 8 tetrodes with two additional shuttles for fiber optics of reference electrodes.

Features:

- 3 mounting holes for securing Exit Tip to Halo-18 Microdrive Center Column.
- Polymicro chimney for minimally invasive craniotomy
- Texture for improved dental acrylic adhesion
- Made from biocompatible Ultem

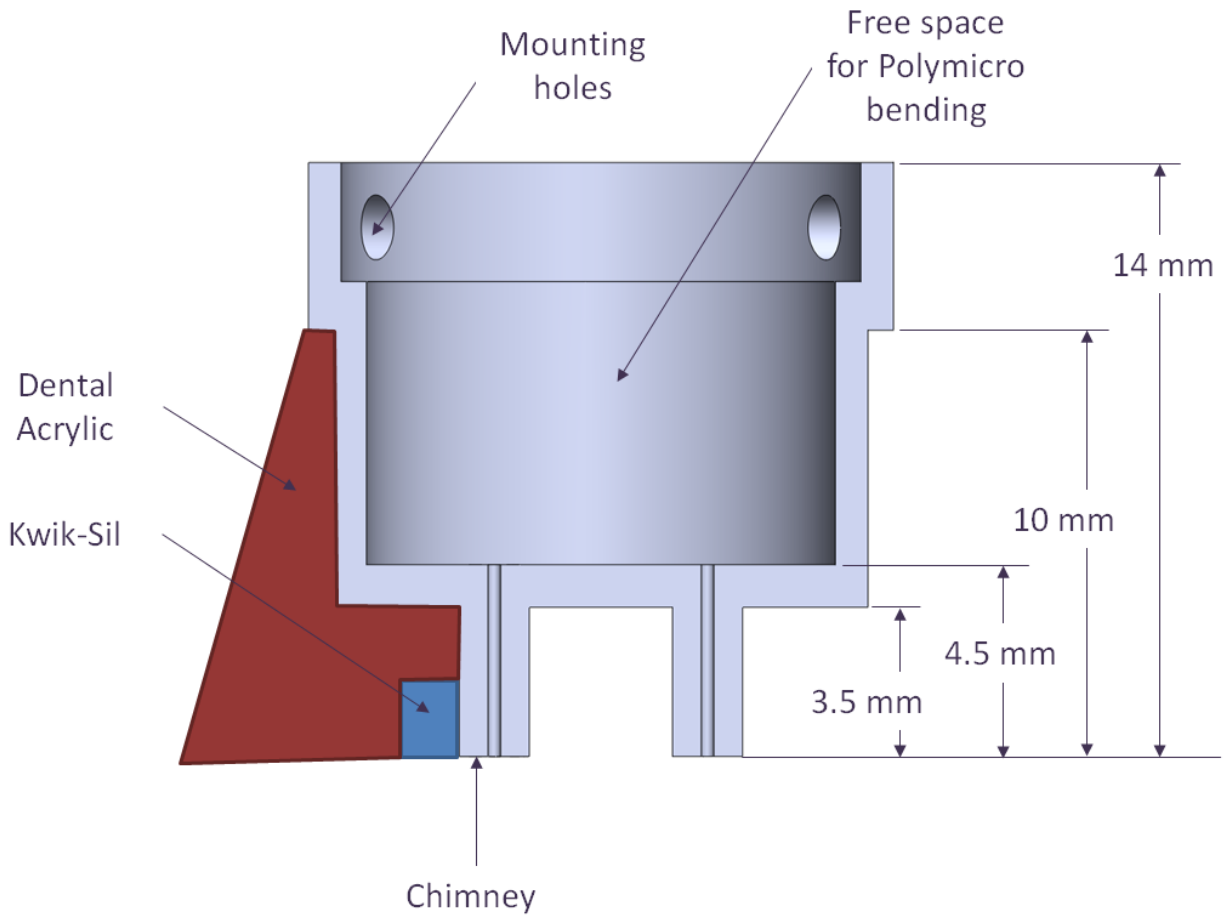


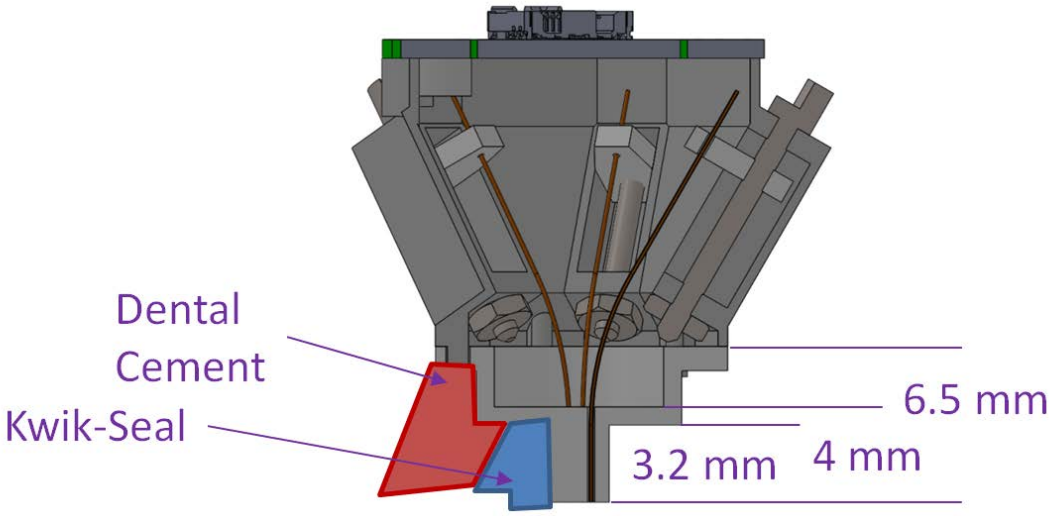
Figure 2.1 Exit Tip diagram

3 Halo-5 Exit Tip Overview

The Halo-5 Microdrive allows up to 4 tetrodes to be inserted into a freely moving animal. One additional shuttle can be used for fiber optics or a reference electrode. The Halo-5 does not need any special hole size considerations to use an optical fiber because there is no center column necessary to hold the EIB. The Halo-5 exit tip is also smaller than the Halo-10/Halo-18 in height and diameter.

Features:

- Through holes for alignment to the Halo-5 Body.
- Polymicro chimney for minimally invasive craniotomy
- Texture for improved dental acrylic adhesion
- Made from biocompatible Ultem

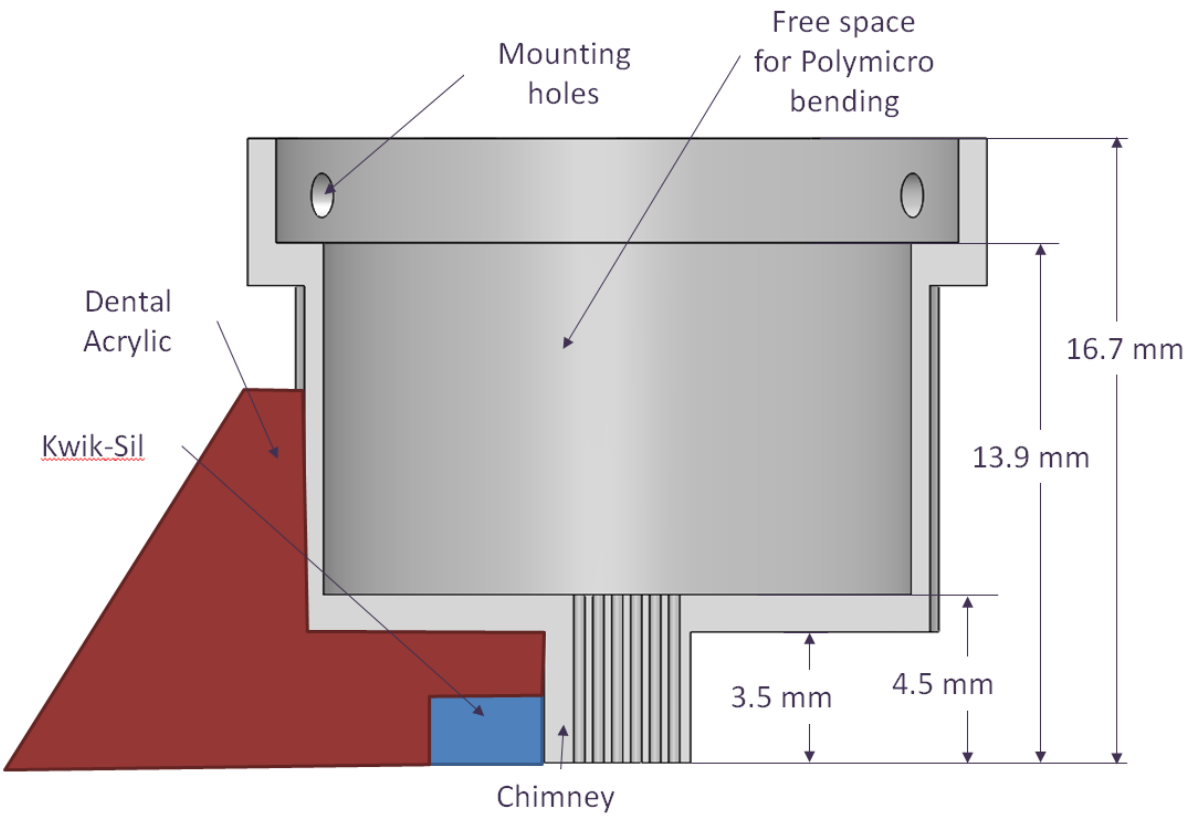


4 Halo-28 Exit Tip Overview

The Halo-28 allows up to 24 tetrodes to be inserted into a freely moving animal. Four additional shuttles can be used for fiber optics of reference electrodes.

Features:

- 3 mounting holes for securing Exit Tip to Halo-18 Microdrive Center Column.
- Polymicro chimney for minimally invasive craniotomy
- Texture for improved dental acrylic adhesion
- Made from biocompatible Ultem



5 Designing an Exit Tip

The following instructions will guide the user through the specification of a custom exit pattern which will be machined into the exit tip at Neuralynx.

5.1 Standard tetrode research

Polymicro tubing with an O.D. of 164 um and an I.D. of 100 um is normally used for tetrode encapsulation in this microdrive (other polymicro dimensions may be accommodated). To allow the polymicro tubing to pass through with no friction a .3mm drill bit is used to create the through holes. Adjacent holes can be no closer than 0.5mm center to center. The pattern supplied below gives the tightest possible grouping of holes. Maximum exit tip diameter is 10mm. Plot the holes as you want them passed through the Microdrive and implanted into the research subject. Coordinate the through hole locations with an image of the rat skull.

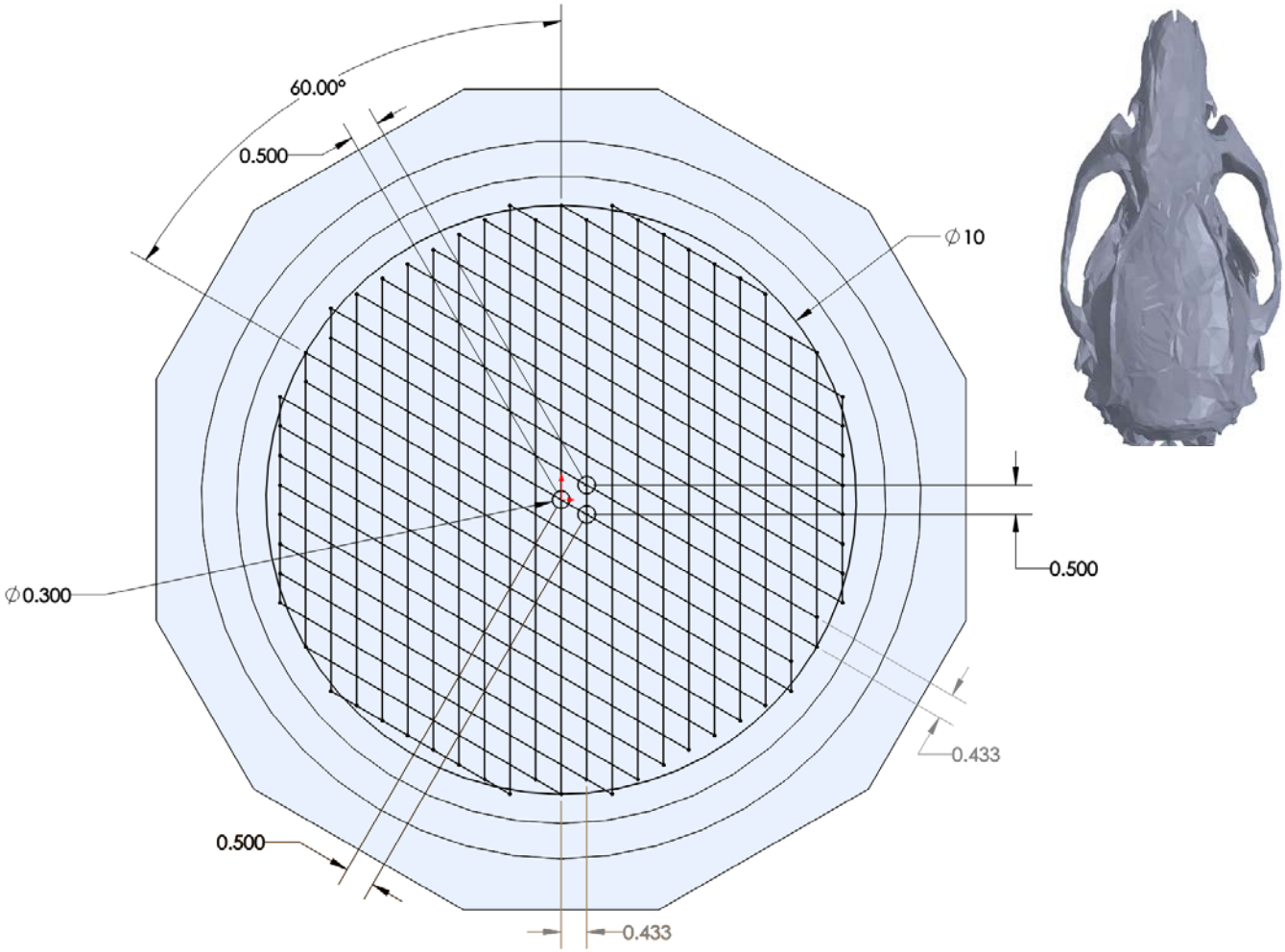


Figure 5.1 Top down view of Exit Tip through hole references, dimensions in mm

The Halo Microdrive Exit tip is designed with “chimneys,” the protrusion from the base of the exit tip for a group of closely spaced tetrodes. Chimneys have three benefits:

- Smaller Craniotomies
- The 4.5mm hole depth aids in vertical electrode travel
- The hole depth also provides tetrode wire protection and allows tetrode wires to protrude 3mm out of the polymicro tubing (this reduces tissue damage near targeted recording sites).

There needs to be at least 0.25mm of material between any through hole and the edge of chimney.

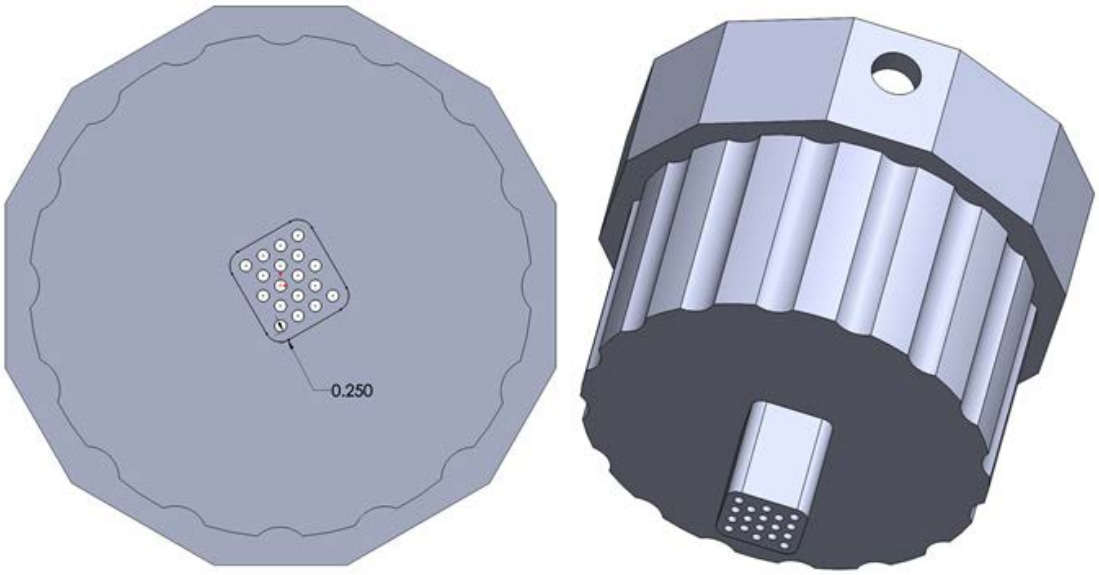


Figure 5.2 Exit post dimension requirement

Multiple chimneys need to be at least 1.1mm away from each other.

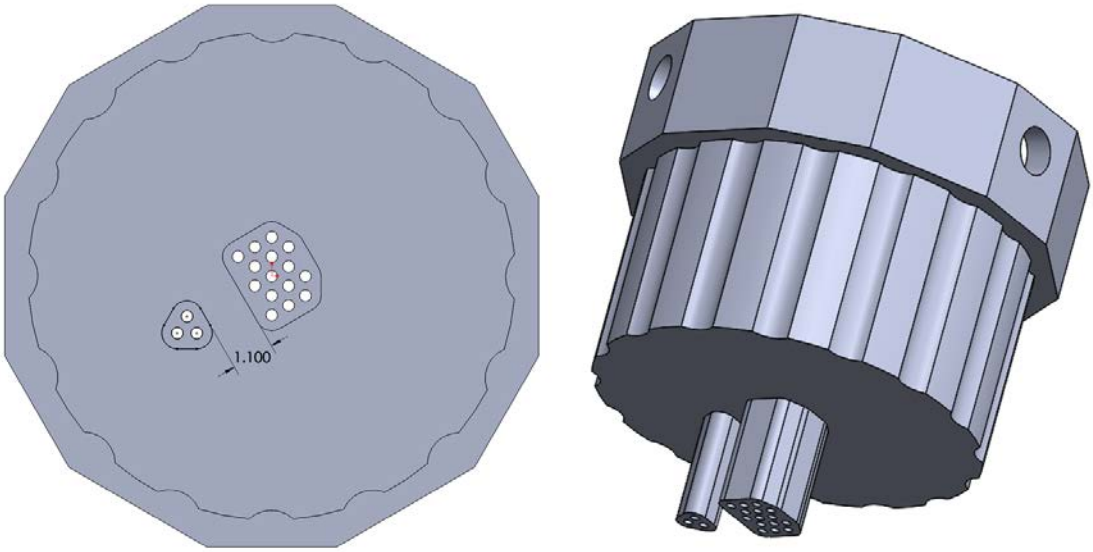


Figure 5.3 multiple chimney dimension requirements

5.2 Fiber optic integration

An optical fiber can be passed through the exit tip. To accomplish this, a polyimide tube with an O.D. of 500 um and an I.D. of 350 um is used to guide the fiber from the Center Column to the base Exit Tip.

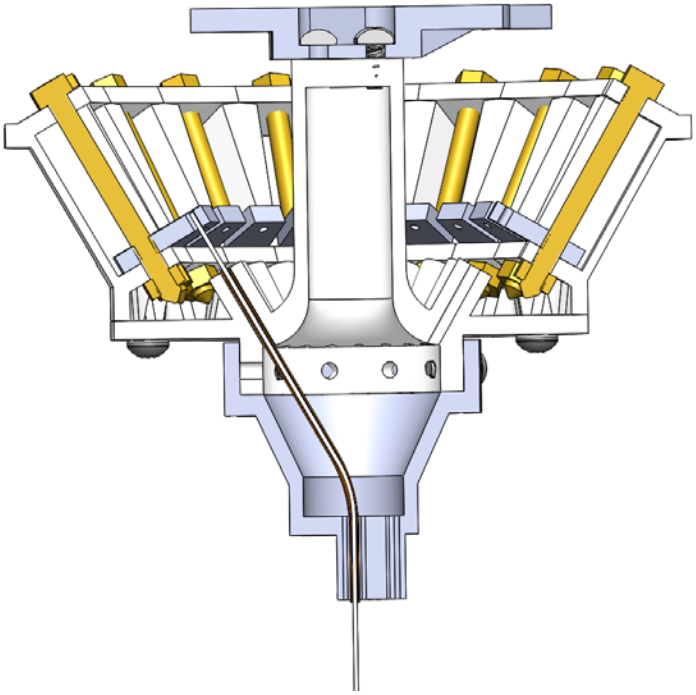


Figure 5.4 Halo-18 Microdrive with Optical Fiber integrations

A 0.5mm hole is drilled into the chimney to accommodate the polyimide tube. Minimum chimney plastic thickness rules stated above must be followed. See below for an example pattern of mixed hole sizes.

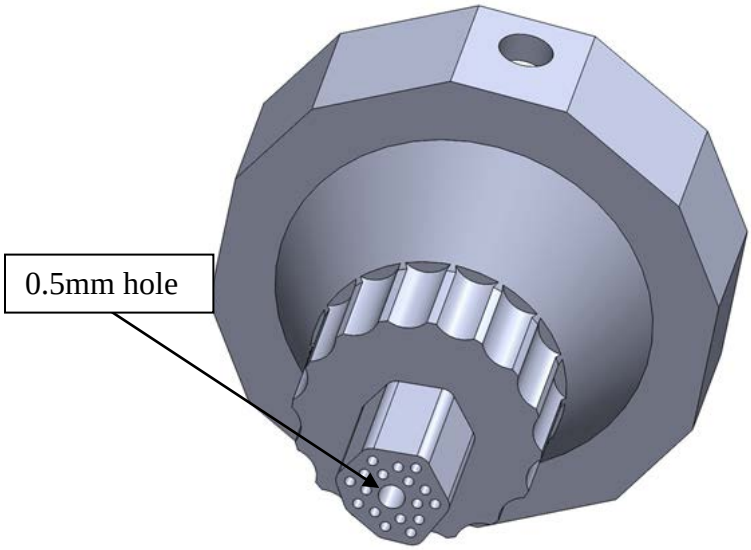


Figure 5.5 Exit pattern with Optical Fiber integration

5.3 Ordering a custom Exit Tip

To begin the ordering process for a custom Exit Tip that meets your specific needs please complete the *Neuralynx Exit Tip Design Guide Form* on the following page. After you have completed the form contact a Neuralynx Support representative at support@neuralynx.com and provide them with the completed form. Note that the form can be filled out electronically or by hand. Based on the information you provide in the Exit Tip Design Guide Form on the following page, Neuralynx will provide you with an engineering drawing of the proposed Exit Tip design. If the proposed design meets your needs then you will need to return a signed and dated copy of the engineering drawing to Neuralynx before the Exit Tip can be manufactured. If you find the proposed design requires alterations contact the Neuralynx representative you have been working with to discuss the changes you need. An updated engineering drawing will then be resubmitted to you for your approval. After Neuralynx receives your approved copy of the engineering drawing the manufacturing process of the Exit Tip will begin. Please provide the following information on the *Neuralynx Exit Tip Design Guide Form*:

- Lab Name: Name of the Lab or Company you work for
- Primary Contact: Your first and last name
- Date: Date you completed the form
- Exit Pattern Diagram
    - Tetrode Holes: Place a solid dot (•) at the desired grid intersection for each tetrode hole
    - Optical Fiber Holes: Place a small circle (○) at the desired grid intersection for each optical fiber hole
    - Chimney Areas: Use a red line (----) to circle groups of holes you want included in a chimney (this step is optional, Neuralynx will do this for you if chimney areas are not provided)
    - Note that holes and chimneys must be within the 10 mm circle for the Halo-10/Halo-18 and 6.5mm for the Halo-5.
    - Note that the *Subject Front* arrow points toward the nose of the subject
    - Note that all dimensions are in millimeters
    - If needed, you can also specify off-grid coordinates by simply noting the X-Y Cartesian coordinates from the center of the grid to each hole.
- Official Use Only: A Neuralynx representative fills out this section

Please provide Neuralynx with any additional documentation that will assist in the design of your custom Exit Tip.

Neuralynx Exit Tip Design Guide Form

Lab Name: _____

Primary Contact: _____

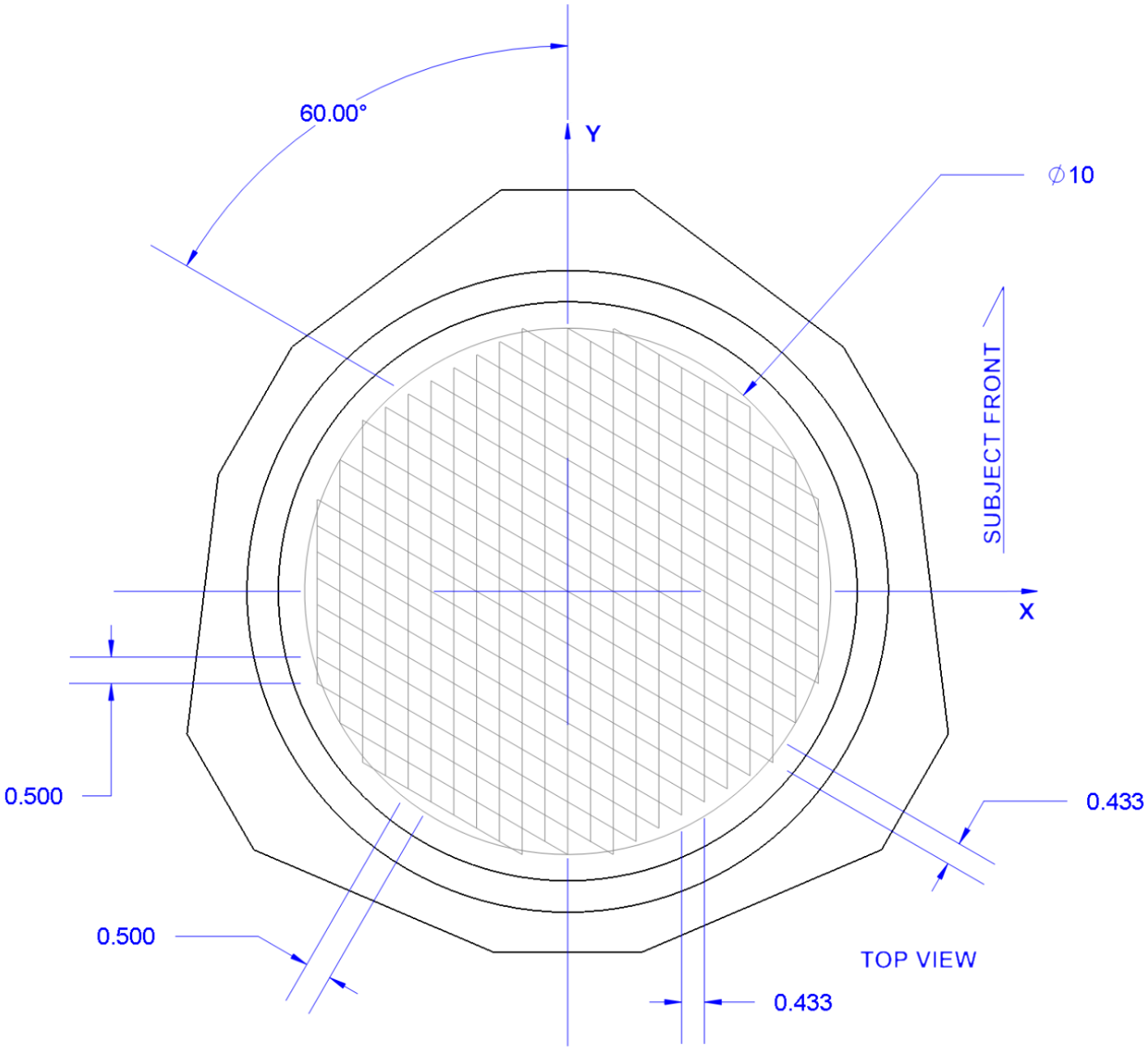
Date: _____

Official Use Only:

Representative: _____

Custom Item #: _____

Exit Pattern Diagram:



Neuralynx Halo-5 Exit Tip Design Guide Form

Lab Name: _____

Primary Contact: _____

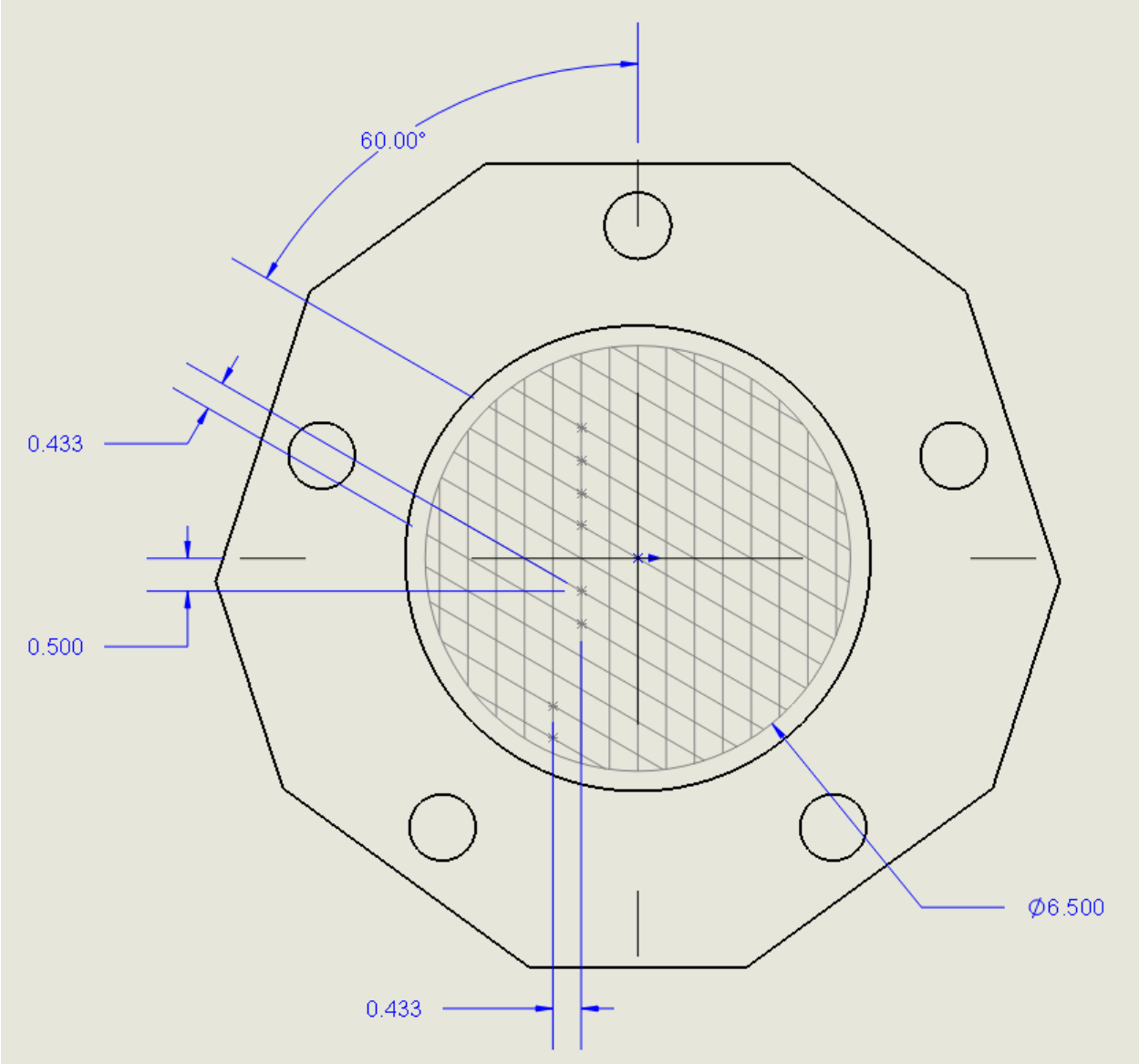
Date: _____

Official Use Only:

Representative: _____

Custom Item #: _____

Exit Pattern Diagram:



Neuralynx Halo-28 Exit Tip Design Guide Form

Lab Name: _____

Primary Contact: _____

Date: _____

Official Use Only:

Representative: _____

Custom Item #: _____

Exit Pattern Diagram: