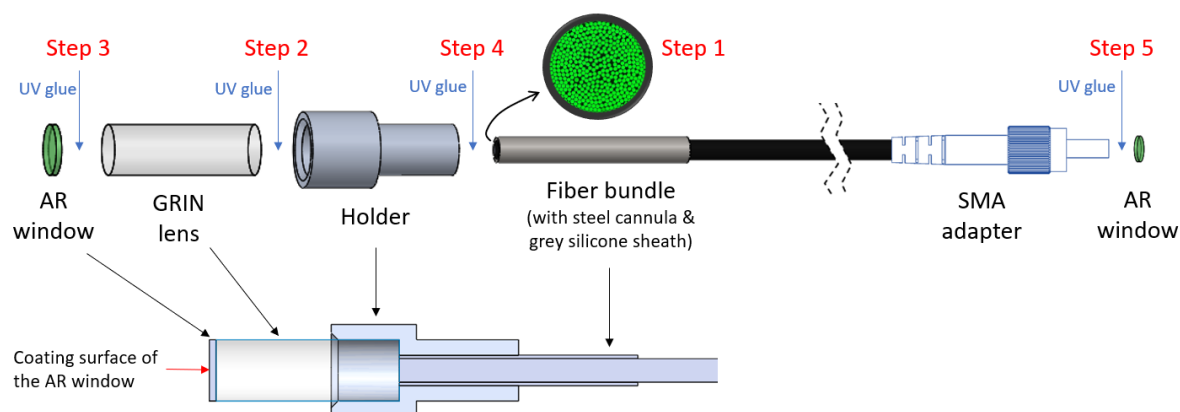


## GFB Assembly Protocol

This document describes the protocol for assembling the GRIN-end fiber bundle (GFB), which replaces the tapered fiber bundle (TFB) as the main fiber collecting and relaying the emission signal to the detection module. Please source the parts and reagents below from their respective suppliers and follow the steps below. All five steps take approximately 30min.

**Note:** A video tutorial will also be available at KISN Youtube channel shortly.

Overview of steps:



**Step 1:** Test efficiency of fiber bundle

**Step 2:** Glue GRIN lens to holder

**Step 3:** Glue AR coating to GRIN lens

**Step 4:** Glue fiber end to holder

**Step 5:** Glue AR coating to fiber end with SMA adapter

Reagents and parts:

Component Name	Supplier	Amount	Item #
Fiber bundle XMLG, Part number 1840314	SCHOTT	1	30.1
AR window dia1.8x0.2mm,S1:HT T>99%@450-700nm, AOI=0deg	Fuzhou Sunlight	2	30.2
GRIN lens <a href="#">#64-520</a>	Edmund Optics	1	30.3
GFB holder*	3A prototype	1	30.4
Scopebody P3 V2*	3A prototype	1	104.2
Silicone glue	RTV	1	o
Air duster	PRF 4-44	1	w
UV adhesive glue	Thorlabs	1	l
UV curing gun	Thorlabs	1	e
Absolute ethanol	-	1	-
Lens paper tissue	Thorlabs	1	j
Tack-It adhesive (green)	Faber Castell	1	-
Scissors/tweezers	Elfa Distralec	1-3	y
Green LED LED driver	Thorlabs	1	h.

\*2D and 3D models are available under:

[https://github.com/kavli-ntnu/MINI2P\\_toolbox/tree/main/Hardware/GFB](https://github.com/kavli-ntnu/MINI2P_toolbox/tree/main/Hardware/GFB)

### Step 1: Test efficiency of fiber bundle

- 1.1 Adjust LED power output to 30 mW – this is the reference power output to measure transmission efficiency of the fiber bundle
- 1.2 Connect fiber bundle SMA adapter to LED output and measure power at fiber tip – 25 / 30 mW = 83 %

**Note: approx. >75% transmission efficiency is acceptable.**

Note: Ensure the fiber is elongated. Transmission may be lower if the fiber is twisted.

- 1.3 Secure fiber bundle under the scope and observe the face of the fiber bundle under minimum LED output
- 1.4 Count the number of dead cores

**Note: <3 dead cores are acceptable, ≥4 is not recommended (see Figs. 1-2).**

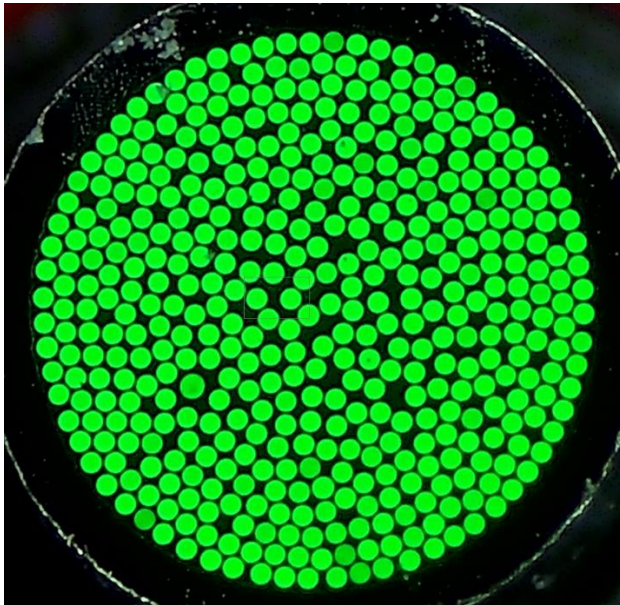


Figure 1, Example of face of the fiber bundle as seen from the inside of P3 under the microscope with 0 dead cores.

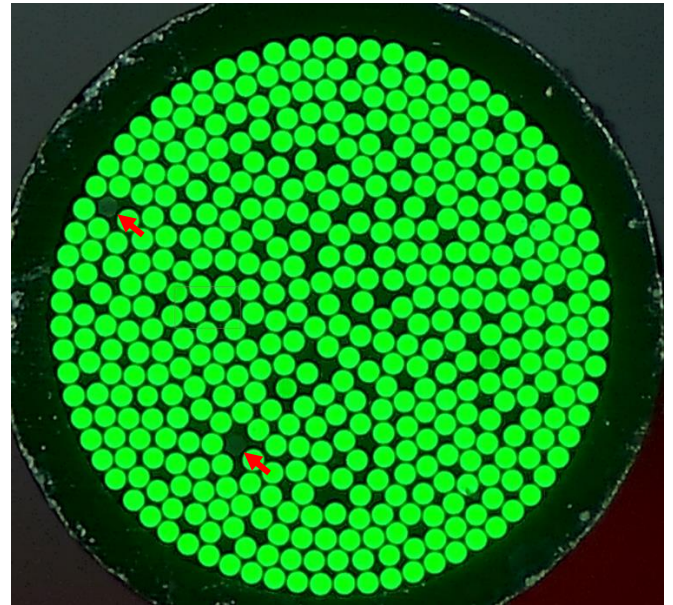


Figure 2, Example of face of the fiber bundle as seen from the inside of P3 under the microscope with 2 dead cores (red arrow).

### Step 2: Glue GRIN lens to holder

- 2.1 Clean GFB holder and P3 by placing in 100% ethanol and sonicating for 5 mins
- 2.2 Dry the GFB holder and P3 using lens paper and air duster
- 2.3 Secure GFB holder with sticky tac under the scope, larger end facing up
- 2.4 Carefully place the GRIN lens inside – the orientation is not relevant
- 2.5 Apply UV glue around the rim of the holder and cure with UV light for at least 1 min

### Step 3: Glue AR coating to GRIN lens

- 3.1 Clean dust off GRIN lens with 100% ethanol-soaked lens paper
- 3.2 Add a small drop of UV glue on the face of the GRIN lens  
Note: Too much glue may overflow onto the coating, while too little may leave air bubble
- 3.3 Place the coating on the GRIN lens and gently position it at the center using forceps

**Important: Orientation of the coating is critical.**

S1 surface is the coating and should be placed on the GRIN lens to face the air. S2 surface faces the GRIN lens (Tip, S1 surface faces down on the packaging. Flip upside down and place on the GRIN lens so that S1 surface faces the air)

- 3.4 Cure with UV light for at least 1 min.
- 3.5 Clean surface of the coating with 100% ethanol-soaked lens paper

#### Step 4: Glue fiber end to holder

- 4.1 Insert GFB holder with GRIN lens into P3
  - Note: When viewed from inside of P3, the GRIN lens should stick out of the P3. This ensures that the GRIN lens is all the way inside of P3.
- 4.2 Secure the GFB holder using the P3 as an anchor. The smaller end of the holder should face up
- 4.3 Add a few drops of glue into the cylindrical cavity of the holder
  - Note: Make sure there's enough glue to cover the face of the GRIN lens and walls of the holder, and that there are no bubbles inside
- 4.4 Clean the fiber tip with a cotton swab
- 4.5 Insert fiber tip into the cavity, and gently move it up down to remove any bubbles
- 4.6 While holding it down, cure with UV light immediately
  - Note: Its important to ensure that the face of the fiber tip is touching the grin lens
- 4.7 Pull the jacket of the fiber over the metal sleeve and secure with superglue
- 4.8 Cover the metal sleeve with silicone glue for extra security (superglue alone is not sufficient)
- 4.9 Flip P3 upside down and shine UV light from the inside to ensure any residual UV glue on the inside is cured
  - Note: this step is to cure the glue between the inner surface of the GRIN lens and the end of the fiber bundle.

#### Step 5: Glue AR coating to fiber end with SMA adapter

- 5.1 Clean the tip of SMA adapter with 100% ethanol
- 5.2 Add a small drop of UV glue
- 5.3 Place the AR coating with S1 surface facing the air (S2 surface faces the SMA adapter)
  - Important: Orientation of the coating is critical.**
- 5.4 Cure with UV light for at least 1 min

**Final check:** Connect the LED and observe the fiber tip from the inside of P3 under the scope. The face of the fiber bundle should be visible, with no visible air bubbles.

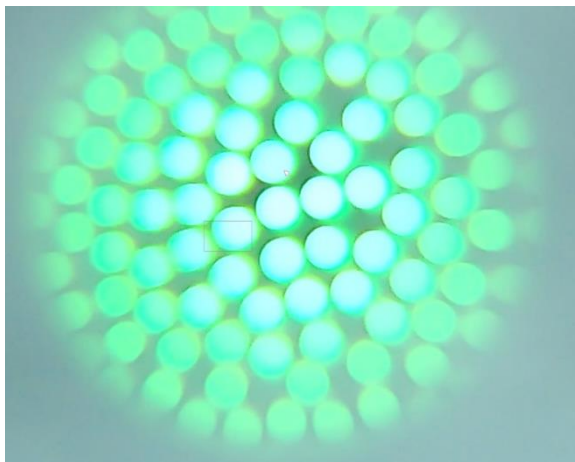


Figure 3, Face of the fiber bundle as seen from the inside of P3 under the scope once all the steps have been completed.

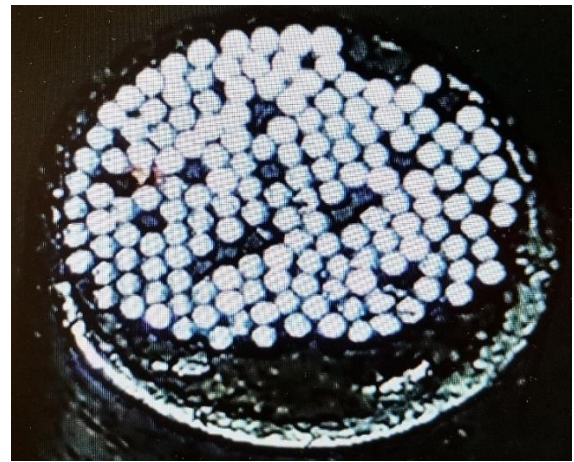


Figure 4, Example of light guide with multiple areas with dead cores. Also note the collection efficiency was under 50%.

