

List of components for cScope. "Imaging cortical dynamics in GCaMP transgenic rats with a head mounted widefield macroscope" by Scott et al.								
Label	Quantity	Unit	Part Number	Suggested Vendor	Description	Link	Approx. Cost	Notes
Lenses								
CrW	1	Ea	Custom part	TowerOptical	N-BK7 Glass, 8mm*8mm, 3mm thick, flatness lambda/4 @ 633 nm, Surf 80/50 Scratch- Dig	<a href="http://www.tower">http://www.tower</a>	\$13	Custom window, price/unit is for 25 units order
CrW	1	Ea	Custom part	TowerOptical	N-BK7 Glass, 8mm*4mm, 3mm thick, flatness lambda/4 @ 633 nm, Surf 80/50 Scratch- Dig	<a href="http://www.tower">http://www.tower</a>	\$12	Custom window, price/unit is for 25 units order
L1	1	Ea	45910	Edmund Optics	N-SF11 Plano-Concave Lens, Ø6mm, f = -6.0 mm, VIS-NIR Coated	<a href="http://www.edmu">http://www.edmu</a>	\$39	
L2	2	Ea	LA1560-A	Thorlabs	N-BK7 Plano-Convex Lens, Ø1/2", f = 25.0 mm, AR Coating: 350-700 nm	<a href="https://www.thorl">https://www.thorl</a>	\$29	
L3	1	Ea	LA1304-A	Thorlabs	N-BK7 Plano-Convex Lens, Ø1/2", f = 40.0 mm, AR Coating: 350-700 nm	<a href="https://www.thorl">https://www.thorl</a>	\$28	
L4	1	Ea	LB1450-A	Thorlabs	N-BK7 Bi-Convex Lens, Ø1/2", f = 20.0 mm, ARC: 350-700nm	<a href="https://www.thorl">https://www.thorl</a>	\$32	
L5	1	Ea	LC1054-A	Thorlabs	N-BK7 Plano-Concave Lens, Ø1/2", f = -25.0 mm, AR Coating: 350-700 nm	<a href="https://www.thorl">https://www.thorl</a>	\$27	
L6	1	Ea	LA4765-A-SP	Thorlabs	UV Fused Silica Plano-Convex Lens, Ø1/2", f = 50.2 mm, AR Coating for 350nm-650nm		\$127	This is a non-catalog item (the lens exist in catalog but not with this AR coating) The referenced item number is in the supplier's system and sales agent needs to be contacted to quote the item. Unit price indicated here is for an order of 5. Alternatively, the catlog item LA4765 can be used with the downside of several percent loss in signal.
L7	1	Ea	47-269	Edmund Optics	N-BK7 Half-Ball Lens, Ø3.0mm	<a href="http://www.edmu">http://www.edmu</a>	\$31	Lens part of excitation path
L8	1	Ea	LB1494-A	Thorlabs	N-BK7 Bi-Convex Lens, Ø9.0 mm, f = 12.0 mm, ARC: 350-700nm	<a href="https://www.thorl">https://www.thorl</a>	\$31	Lens part of excitation path
Filters and dichroic mirror								
F1	1	Ea	ET470/40x	Chroma	Diced Excitation filter, 4.5 x 5 x 1mm	<a href="https://www.chro">https://www.chro</a>	\$25 - \$50	These are custom diced filters. It is more cost effective to order 20 of each.
F2	1	Ea	ET525/50m	Chroma	Diced Emission filter, 14 x 15 x 1mm	<a href="https://www.chro">https://www.chro</a>	\$245	These are custom diced filters. It is more cost effective to order 5 of them.
F3	1	Ea	ET525/50m	Chroma	Diced Emission filter, 10 x 10 x 1mm	<a href="https://www.chro">https://www.chro</a>	\$200	This is the second emission filter set against the CMOS sensor. It is more cost effective to order several of them. Price is an estimate as we have not ordered this part ourselves, but diced this filter out of a 1" filter instead.
F4	1	Ea	FF496-SDi01-14x19.5-EB	Semrock	496 nm edge BrightLine® single-edge short-pass dichroic beamsplitter, 14 x 19.5 x 2mm, custom size, Edge Blacken	<a href="https://www.sem">https://www.sem</a>	\$268	This is a custom diced dichroic. It is more cost effective to order several of them. Price given here is for an order of 2.
3D printed parts								
Provide STL files with names changed to more helpful. Name_date will be the convention.								
P1	1	Ea	Collar_16-dec22	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$50	Note 1: Price is for an order of 3. Note 2: STL files can be used directly and sent for 3d printing. When asked for units during order process, enter "mm". <a href="https://www.3dsystems.com/">https://www.3dsystems.com/</a>
P2	1	Ea	CollarCover	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$45	Notes 1 & 2.
P3	1	Ea	Objective	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$60	Notes 1 & 2.
P4	1	Ea	CoreBody	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$70	Notes 1 & 2.
P5	1	Ea	BodyFrontCover	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$55	Notes 1 & 2.
P6	1	Ea	BodySideCover	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$55	Notes 1 & 2.
P7	1	Ea	CameraSlider	3D Systems	SLA,High-Res ABS-Like (Black) (Renshape 7820 / VisiJet SL Black)	<a href="https://github.com">https://github.com</a>	\$53	Notes 1 & 2.
P8	0	Ea	Diffuser	3D Systems	SLA,High-Res ABS-like,White	<a href="https://github.com">https://github.com</a>	\$55	Notes 1 & 2. NOTE the material color is different from other pieces.
P9	1	Ea	HeadPlateCap	3D Systems	SLA, material choice and color aren't critical	<a href="https://github.com">https://github.com</a>	\$50	Notes 1 & 2. Use these window protective caps, if the collars are left attached at all times.
P10	1	Ea	CollarCap	3D Systems	SLA, material choice and color aren't critical	<a href="https://github.com">https://github.com</a>	\$50	Notes 1 & 2. Use these window protective caps, if the collars are removed when experiments are over.
P11	1	Ea	Rig_HeadPlate_Mounting1	3D Systems	SLA, material choice isn't critical	<a href="https://github.com">https://github.com</a>	\$52	RECOMMENDED. Jig used to assemble head plates and 3.5*8.0mm glass together before surgery. Note 2. Price is for quantity of 1.
P12	1	Ea	Rig_HeadPlate_Mounting2	3D Systems	SLA, material choice isn't critical	<a href="https://github.com">https://github.com</a>	\$52	RECOMMENDED. Jig used to assemble head plates and 8.0*8.0mm glass together before surgery. Note 2. Price is for quantity of 1.
Machined parts and stock material								
Stock1	1	Ea	89055K57	McMaster-Carr	Titanium rod	<a href="https://www.mcm">https://www.mcm</a>	\$32	Titanium stock to manufacture the head plates.
Stock2	1	Ea	SM05S10M	Thorlabs	Brass cylinder	<a href="https://www.thorl">https://www.thorl</a>	\$8	Stock Brass cylinders to cut the two types of lens spacers needed in the optical assembly. One microscope requires 2 "thick" spacers and 1 "thin" spacer.
Stock3	1	Ea	5HA14	Grainger	Copper Shim Stock Roll, 110 Grade, 0.0030" Thickness	<a href="https://www.grair">https://www.grair</a>	\$111	Stock to cut Heat sinking of 480nm LED

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HP	1	Ea	Headplate	local machine shop	Titanium headplate for 3.5 by 8mm window	<a href="https://github.com">https://github.com</a>	---	Built from stock titanium rod above
HP	1	Ea	Headplate	local machine shop	Titanium headplate for 8 by 8mm window	<a href="https://github.com">https://github.com</a>	---	Built from stock titanium rod above
Sp1	1	Ea	LensesSpacer1	local machine shop	"Thin" Brass spacer	<a href="https://github.com">https://github.com</a>	---	Built from stock brass cylinders above
Sp2	2	Ea	LensesSpacer2	local machine shop	"Thick" Brass spacer	<a href="https://github.com">https://github.com</a>	---	Built from stock brass cylinders above
Cop	1	Ea	CopperHeatSink	local machine shop	"CopperShim"	<a href="https://github.com">https://github.com</a>	---	Built from stock copper shim above
Grids, and Resolution targets								
Target1	1	Ea	R1L1S3P	Thorlabs	Star target	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$220	Used to evaluate the Contrast Transfer Function. And RECOMMENDED to establish proper focus.
Target2	1	Ea	R1DS1P	Thorlabs	Positive 1951 USAF Test Target	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$125	OPTIONAL: Alternate and simple tool to evaluate system resolution
Target3	1	Ea	R1L3S3P	Thorlabs	Grid Distortion Target	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$225	NECESSARY if using Matlab image deformation code provided
Microscope Core Body Assembly Jig								
	1	Ea	C1520	Thorlabs	Adaptor plate	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$30	Useful Jig to place lenses within the core body of the objective
	1	Ea	TR2	Thorlabs	Ø1/2" Optical Post, L = 2"	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$5	Useful Jig to place lenses within the core body of the objective
LEDs powering								
	2	Ea	A000062	Newark element14	Arduino Due	<a href="http://www.newark.com">http://www.newark.com</a>	\$47	One arduino is used to delayDAQ card firing signal. The second is used to turn ON/OFF individual LED circuits (fluorescence source, intrinsic imaging source).
	2	Ea	--	Amazon, Ebay,...	USB male to USB microB	<a href="https://www.amazon.com">https://www.amazon.com</a>	\$10	To connect Arduino to computer.
	2	Ea	IRL540PBF-ND	Digikey	MOSFET N-CH 100V 28A TO-220AB, pack of 10	<a href="https://www.digikey.com">https://www.digikey.com</a>	\$18	We built an enclosure in which 2 MOSFET (one for each LED circuits) were located. Wires run from that box to individual LEDs, to power supplies, and to arduino.
	2	Ea			Resistors 300 kohms			
	4	Ea	BC-32671	Digikey	Jumper wires (pack of 10 pieces)	<a href="http://www.digikey.com">http://www.digikey.com</a>	\$5	Male-female jumper wires can be used to connect arduino to MOSFET and also be cut, plugged directly to arduino on one side and soldered to Banana/BNC terminals on the other.
FWir	2	Ea	9510T2	McMaster Carr	Flexible wire for connecting LEDs (50ft per roll) (one Black and one White)	<a href="https://www.mcmaster.com">https://www.mcmaster.com</a>	\$32	40-45ft are needed per microscope (4*10-12ft). Usefull to have several colors.
CP1	1	Ea	PRT-08233	SparkFun Electronic	Polarized Connectors - Header (2-Pin)- qty 25	<a href="https://www.sparkfun.com">https://www.sparkfun.com</a>	\$4	Male connector that inserts into the 3d printed collar connector for Green illumination (intrinsic imaging).
CP2	2	Ea	PRT-08100	SparkFun Electronic	Polarized Connectors - Crimp Pins (pack of 20)	<a href="https://www.sparkfun.com">https://www.sparkfun.com</a>	\$2	
	1	Ea	CA2824	Thorlabs	SMA Coaxial Cable, SMA Male to BNC Male	<a href="https://www.thorlabs.com">https://www.thorlabs.com</a>	\$16	Connects DAQ sync output to Arduino box
	2	Ea	GPS-1830D	Newark element14	GW INSTEK GPS-1830D Bench Power Supply	<a href="http://www.newark.com">http://www.newark.com</a>	\$199	used with the blue and green LEDs circuits.
LED2	4	Ea	LXZ1-PM01-SM-01A	Luxeon Star LEDs	Saber Micro-Z1 - LUXEON™ Z 5mm Square Single LED Module Green - 103 lm (LXZ1-PM01) on Mounting Base (SM-01A)	<a href="http://www.luxeon.com">http://www.luxeon.com</a>	\$7	
HS	2	Ea	345-1054-ND	DigiKey	Wakefield-Vette HEATSINK 14-16PIN DIP BLK - #651-B	<a href="https://www.digikey.com">https://www.digikey.com</a>	\$3	
Alum	1	Roll	681975B	Amazon	adhesive Nashua Aluminum Foil Tape	<a href="https://www.amazon.com">https://www.amazon.com</a>	\$12	
CMOS and fluorescence excitation LED are borrowed from the MINISCOPE project (UCLA)						<a href="http://miniscope.org">miniscope.org</a>		
Here, we reproduce partially the list of items detailed in the miniscope.org website and used in cScope. Consulting the miniscope.org site and instructional videos therein is highly recommended.								
LED1	1	Ea	LXML-PB01-0030	Digikey	Excitation LED, LED LUXEON REBEL BLUE SMD (pack of 10)	<a href="http://www.digikey.com">http://www.digikey.com</a>	\$4	This LED gets soldered onto the Exication LED PCB. See miniscope.org
PCB1	1	Ea		Silver Circuits	2 layer, 0.031" Excitation LED PCB (\$250 for 100 PCBs)	<a href="http://miniscope.org">http://miniscope.org</a>	\$3	Information, fabrication, and assembly files can be found at miniscope.org
COAX	10	ft	CW2040-3650SR	Cooner Wire	50ohm coax silicone rubber jacketed cable	<a href="http://www.coonerwire.com">http://www.coonerwire.com</a>	\$80	
CON	1	Ea	CONSMA013.062	Digikey	Edge Mount SMA Connector for use with Coax to SMA PCB	<a href="http://www.digikey.com">http://www.digikey.com</a>	\$5	This connector along with the Coax to SMA PCB below is the easiest way to connectorize the coax cable
SMA-P	1	Ea	Miniscope Cable2SMA	OSH Park	2 layer, 0.062" Coax to SMA PCB	<a href="https://oshpark.com">https://oshpark.com</a>	\$1	This board can be used in conjunction with CONSMA013.062 above.
	1	Ea		Amazon, ebay,...	SuperSpeed USB3.0 Standard-A to Micro-B	<a href="https://www.amazon.com">https://www.amazon.com</a>	\$6	Cable for connecting DAQ Box to computer. Using short cable is reommended (we used 1').
The two items below were ordered through the group orders organized by miniscope.org								
CMOS	1	Ea	CMOS Imaging Sensor PC	SierraCircuit	CMOS sensor mounted on PCB. One for each microscope.	<a href="http://miniscope.org">http://miniscope.org</a>	\$115	Ordered through the miniscope.org. Sierra Circuits handles sourcing the electrical components, PCB fabrication, and PCB assembly
	1	Ea	DAQ PCB	SierraCircuit	DAQ to which camera is connected. One needed for each running microsc	<a href="http://miniscope.org">http://miniscope.org</a>	\$200	Ordered through the miniscope.org. Sierra Circuits handles sourcing the electrical components, PCB fabrication, and PCB assembly

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Hardware								
S1	4	screw	96817A036	McMaster-Carr	M1.2x4mm, Thread-Forming Screws for Thin Plastic, pack of 25	<a href="https://www.mcm">https://www.mcm</a>	\$10	
S2	4	screw	96817A011	McMaster-Carr	M1.0x4mm, Thread-Forming Screws for Thin Plastic, pack of 25	<a href="https://www.mcm">https://www.mcm</a>	\$10	
S3	5-10	screw	96817A009	McMaster-Carr	M1.0x3mm, Thread-Forming Screws for Thin Plastic, pack of 25	<a href="https://www.mcm">https://www.mcm</a>	\$10	
S4	2	screw	95868A130	McMaster-Carr	2-56 Nylon Socket Head Screws, pack of 100	<a href="https://www.mcm">https://www.mcm</a>	\$10	Used to tighten the microscope in place once sled into the collar.
S5	1	screw	92311A313	McMaster-Carr	2-56 , 18-8 Stainless Steel Cup-Point Set Screw, pack of 100	<a href="https://www.mcm">https://www.mcm</a>	\$11	Used to tighten collar in place once screwed on the head plate
S6	2	screw	91251A052	McMaster-Carr	0-80, 18-8 Stainless Steel Cup-Point Set Screw, pack of 50	<a href="https://www.mcm">https://www.mcm</a>	\$3	Used to tighten the focussing arm in position
PTFE	1	roll	6305A42	McMaster-Carr	Ultra-Slippery Tape (Made with Teflon® PTFE), General Purpose, 1/4" Width	<a href="https://www.mcm">https://www.mcm</a>	\$16	
VIT	3	in	96515K11	McMaster Carr	Round-Profile Multipurpose O-Ring Cord Stock, Viton®, 1/32 Fractional Width	<a href="https://www.mcm">https://www.mcm</a>	\$11	Rubber cord for filling in any gaps between the core body and filters/dichroic
BAF	1	Ea	T205-1.0	Thorlabs	Black Aluminum Foil Tape	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$29	Used to create a baffle glued to the backside of the dichroic mirror
COP	1	Ea	9709K85	McMaster Carr	Copper Shim Stock 6" x 50" Roll, 0.003" Thick	<a href="https://www.mcm">https://www.mcm</a>	\$28	Used to improve heat transfer from the blue LED
HS	1	Ea	HS-ASST-9	Newark element14	assorted heat shrink tubing including small diameter 1/16"	<a href="http://www.newark">http://www.newark</a>	\$17	Insulate soldered connections such as 2-pin connector. Many other similar products will do.
Tools and lab supplies								
Tool1	1	Ea	VP10C	Thorlabs	Vacuum Pick-Up Tool	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$66	Can be used to manipulate lenses. Note that subsequent lens surface cleaning is often necessary.
Tool2	1	Ea	TZ1	Thorlabs	Optic Tweezers w/ Carbon-Fiber Tips	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$46	To handle lenses
Tool3	1	Ea	NOA61	Thorlabs	Optical adhesive	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$33	Used to secure all lenses in the 3d printed parts
Tool4	1	Ea	CS2010	Thorlabs	UV curing system	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$2,020	To polymerize Norland Optical Adhesive
Tool5	1	Ea	WES51	Digikey	SOLDER STATION ANALOG 50W	<a href="http://www.digikey">http://www.digikey</a>	\$130	Soldering iron with temperature control is highly recommended
Tool6	1	Ea	301	Digikey	WISE 2.25" NYLON JAWS	<a href="http://www.digikey">http://www.digikey</a>	\$55	Useful vice for holding PCBs during soldering. Useful for holding microscope 3d printed parts during assembly process.
Tool7	1	Ea	386844	Digikey	63/37 400 2% .015DIA/28SWG Solder	<a href="http://www.digikey">http://www.digikey</a>	\$15	Suggested solder
Tool8	1	Ea	CW8400	Digikey	FLUX DISPENSING PEN LEAD-FREE	<a href="http://www.digikey">http://www.digikey</a>	\$15	Flux pen to aid in soldering
Tool9	1	Ea	ST-450	Digikey	WIRE STRIPPER 26-36AWG	<a href="http://www.digikey">http://www.digikey</a>	\$41	Small gauge wire stripper
Tool10	1	Ea	PA70058	Digikey	WIRE STRIPPERS 22-10, 30-20AWG	<a href="http://www.digikey">http://www.digikey</a>	\$21	Wire stripper
Tool11	1	Ea	2522A771	McMaster Carr	Through-hole Tap, 0-80 Thread	<a href="https://www.mcm">https://www.mcm</a>	\$12	Tap for set screw holes
Tool12	1	Ea	26955A21	McMaster Carr	Through-hole Tap, 2-56 Thread	<a href="https://www.mcm">https://www.mcm</a>	\$10	Tap for set screw holes
Tool13	1	Ea	4261A58	McMaster Carr	Precision Needle File, Rectangular, Finish No. 2, 6-1/4" Long	<a href="https://www.mcm">https://www.mcm</a>	\$15	Precision file for cleaning up Delrin parts
Tool14	1	Ea	52995A24	McMaster Carr	Miniature Precision Torx Driver, Size T2	<a href="https://www.mcm">https://www.mcm</a>	\$7	Driver for self threading M1 screws.
Tool15	1	Ea	52995A26	McMaster Carr	Miniature Precision Torx Driver, Size T3	<a href="https://www.mcm">https://www.mcm</a>	\$6	Driver for self threading M1.2 screws.
Tool16	1	Ea	ONE 199L-QP	TCPGlobal	Black 1-Shot Lettering Enamels	<a href="http://www.tcpglobal">http://www.tcpglobal</a>	\$10	Not required but suggested for blackening filters edge
Tool17	1	Pk	4001-BG10	Grainger	Hardman Double Bubble Red Extra Fast Setting Epoxy (3-5 minute) (pack of 10)	<a href="https://www.grainger">https://www.grainger</a>	\$28	suggested 5min epoxy
Tool18	1	Ea	--	ebay,amazon...	Through-hole Tap, M14x0.75 Thread	---	\$25	multiple sources available on Ebay, Amazon,... This tap is used to correct for the imperfections of the 3d printed collar thread.
Tool19	1	Pk		Grainger	Fine sand paper			Used to clean up and open collar inner diameter, and objective
Tool20	1	Ea	C1520	Thorlabs	Adaptor plate	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$30	Useful Jig to place lenses within the core body of the objective
Tool21	1	Ea	TR2	Thorlabs	Ø1/2" Optical Post, L = 2"	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$5	Useful Jig to place lenses within the core body of the objective
Tool22	1	box	MC-5	Thorlabs	Lens Tissues	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$10	
Tool23	1	Pk	CTA10	Thorlabs	Cotton-Tipped Applicators (pk of 100)	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$4	
Tool24	1	Ea	CA3	Thorlabs	Air duster	<a href="https://www.thorlabs">https://www.thorlabs</a>	\$12	
Tool25	1	Bottle	--	---	Optical grade Methanol	---	---	
Tool26	1	Ea	--	Mcmaster Carr	Adjustable-Arm Illuminated Magnifier	<a href="https://www.mcm">https://www.mcm</a>	\$150	OPTIONAL: Parts are small. This helps a lot.
Tool27	1	Ea			Multimeter			testing LED circuit
Tool28	1	Ea	AATA-5G	Newark element14	Artic Silver	<a href="http://www.newark">http://www.newark</a>	\$15	Thermal adhesive used in the Blue LED heat sinking procedure