

# ***Imaging Facility Risk Assessment***

<b>Background Information</b>		Date: 15 <sup>th</sup> May 2022; review by 14 <sup>th</sup> May 2023 Name of Assessor: Matt Wayland
Describe the product and application	<p>The Departmental Confocal Facility is used for the fluorescent imaging of biological specimens. This risk assessment applies to the normal operation of the 16 lasers connected to the Olympus FV3000 (S/N: 6H87913), Leica SP5 Upright (S/N: 5100000515) and Leica SP5 Inverted (S/N: 5100000889) confocal microscopy systems. Please note that this risk assessment specifically excludes the spinning disk/ablation system in room T13E. Please see separate risk assessments for (a) the normal operation and (b) the maintenance and alignment of the spinning disk/ablation system.</p>	
Describe the Laser	<p>The confocal facility consists of three confocal heads:</p> <p>The Leica SP5 Upright confocal head is attached to four lasers:</p> <ol style="list-style-type: none"> <li>1. Diode Laser (Coherent), Class 3B, continuous wave, &lt; 60mW maximum power (&lt; 6 at focal plane), emitted wavelengths 405 nm;</li> <li>2. Argon Ion Laser (Lasos), Class 3B, continuous wave, &lt; 200mW maximum power (&lt; 30 at focal plane), emitted wavelengths 458, 476, 488, 496 and 514 nm;</li> <li>3. Diode-pumped solid state laser (Lasos), Class 3B, continuous wave, &lt; 12 mW maximum power (&lt; 4 mW at focal plane), emitted wavelength 561 nm;</li> <li>4. Helium neon laser (Lasos), continuous wave, &lt; 15 mW maximum power (&lt; 4 mW at focal plane), emitted wavelength 633 nm.</li> </ol> <p>The Leica SP5 Inverted confocal head is attached to five lasers:</p> <ol style="list-style-type: none"> <li>1. Diode Laser (Coherent), Class 3B, continuous wave, 60 mW maximum power, emitted wavelengths 405 nm;</li> <li>2. Argon Laser (Lasos), Class 3B, continuous wave, 200mW maximum power, emitted wavelengths 458, 476, 488, 496 and 514 nm;</li> <li>3. Diode-pumped solid state laser (Lasos), Class 3B, continuous wave, 20 mW maximum power, emitted wavelengths 561 nm;</li> <li>4. Helium-neon laser (Lasos), Class 3B, continuous wave, 2 mW maximum power, emitted wavelengths 594 nm;</li> <li>5. Helium-neon laser (Lasos), Class 3B, continuous wave, 15 mW maximum power, emitted wavelengths 633 nm.</li> </ol>	

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	<p>The Olympus FV3000 confocal head is attached to seven lasers:</p> <ol style="list-style-type: none"> <li>1. Near-violet diode laser (Coherent OBIS), class 3B, continuous wave, 50 mW maximum power, emitted wavelength 405 nm;</li> <li>2. Cyan diode laser (Coherent OBIS), class 3B, continuous wave, 75 mW maximum power, emitted wavelength 440 nm;</li> <li>3. Blue diode laser (Coherent OBIS), class 3B, continuous wave, 20 mW maximum power, emitted wavelength 488 nm;</li> <li>4. Yellow diode laser (Coherent OBIS), class 3B, continuous wave, 50 mW maximum power, emitted wavelength 515 nm;</li> <li>5. Green/yellow diode laser (Coherent OBIS), class 3B, continuous wave, 20 mW maximum power, emitted wavelength 561 nm;</li> <li>6. Orange diode laser (Coherent OBIS), class 3B, continuous wave, 20 mW maximum power, emitted wavelength 594 nm;</li> <li>7. Red diode laser (Coherent OBIS), class 3B, continuous wave, 40 mW maximum power, emitted wavelength 640 nm.</li> </ol>
Describe the Beam Delivery System	The laser beams are delivered by a closed fibre optic system to the confocal head. The laser light is merged in the laser merge unit then passed through an AOTF and into the optical system of the microscope.
Describe the Laser Process	Laser light is applied, through the microscope objective, to the sample. The laser beam scans the sample. Emitted fluorescent light, from appropriate dyes or proteins, is collected through the objective, and detected by PMTs.
Describe the Environment	The system is in a dedicated, purpose-refurbished room, T13 inner. Access to the room is controlled by swipe card. The room itself is enclosed and air conditioned. It contains four microscopes, three confocal apparatus, 10 lasers, two PCs and miscellaneous small equipment.
Who uses the product or could affect its operation?	Authorised users (see appendix A for list of authorised users), maintenance staff (see appendix B for list of maintenance staff), service engineers.
Underline the part(s) of the life cycle of interest	<i>Planning, Design, Manufacture, Testing, Transport, Installation, Commissioning, <b>Normal Operation, Maintenance, Servicing</b>, Modification, Decommissioning, Disposal</i>

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STEP 1	STEP 2	STEP 3			
List significant hazards	List groups of people who are at risk	List existing controls	Are these controls OK?	What is the risk factor from these hazards?	Actions Required (See over)
<p><b>The Laser:</b> Electric shock from high voltage power supply</p>	All	Lasers are fully contained in cabinets. Only qualified service personnel are permitted to open these boxes. Instructions to this effect are contained in the local rules and are part of pre-use training required for authorisation.	Yes	Low	
Cooling system		The laser cabinet for the Argon Ion laser is actively ventilated. Integrity of the system is checked by users. System is serviced regularly on contract.	Yes	Low	
Explosion of mercury arc lamp		Lamp is changed regularly after 200 hours by Matt Wayland. Transformer of lamp and lamp housing is designed to contain, explosion. Room is actively vented to the outside and vent is at a safe distance (>6m) from other air inlets. In the event of lamp explosion the room is to be evacuated and sealed off immediately. Inform the Departmental Chemical Safety Officer to initiate decontamination. See also Local Rules for details.	Yes	Low	
		All optical guides and other			

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Equipment interconnections — trip hazard and possible damage to equipment (e.g., fibre breakage).		equipment interconnections are kept out of the way.				
<p><b>Beam Delivery:</b></p> <p>Exposure to laser radiation, Class 3B, UV-A and visible wavelengths.</p> <p>UV-A — short term: burns to skin — long term: premature cataracts in lens of eye. Associated with malignant melanoma in skin</p> <p>Visible — retinal hazard</p>	All	<p>Laser beam delivery:</p> <ol style="list-style-type: none"> <li>1. Optical fibres: encased in flexible metal coverings throughout and attached by screws on fixings at all points. They are routed behind the equipment. Only qualified service personnel are permitted to disconnect this equipment.</li> <li>2. Microscope optics: Beam contained, interlocked to prevent viewing laser through microscope optics.</li> <li>3. Open beam (in air, water or immersion oil) from objective front lens to sample: &lt; 5 mm, divergent when objectives in place. User instructed not to insert reflective material into beam path. User must not change (i.e., take off or fit) objectives.</li> </ol>	Yes	Low		

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		<p>Users may not alter the UV light source. Exposure is limited at the sample.</p> <p>Users are advised to</p> <ol style="list-style-type: none"> <li>1. block the UV light source using the manual shutter slider</li> <li>2. have one of the UV filters in the light path when changing samples.</li> </ol> <p>Avoid exposure to UV as much as possible.</p> <p>Instructions contained in the local rules and are part of pre-use training required for authorisation.</p>	<p>Yes</p> <p>Yes</p> <p>Yes</p>	<p>Low</p> <p>Low</p> <p>Low</p>	
	Maintenance staff	<p>Maintenance staff trained by service personnel on how to maintain equipment safety. Attended laser safety course.</p>	<p>Yes</p>	<p>Low</p>	
<b>The Laser Process:</b>					
Reflections of laser radiation from sample and metalwork during scanning operation.	Users	<p>Light intensity at the process site is reduced. Extra protection by a light shield is given on the Leica inverted microscope.</p> <p>User training and the local rules emphasise shutting off of</p>	<p>Yes</p>	<p>Low</p>	

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Chemical hazards from samples	Users	lasers for changing samples and avoiding reflections of laser light from samples.  Users are not permitted to change (i.e., take off or fit) the objective lenses.  On the inverted microscope, an interlocking switch prevents laser illumination when the condenser stand is tilted back.	Yes	Low	
Biological hazards from samples	Users	Only microscope oil and ethanol are used. Exposure to the former is controlled by wearing gloves.			
Contamination	All	Refer to individual biological risk assessment  Ditto			
<b>Environment &amp; People:</b>					
Risk of tripping or inadvertent damage to system due to overcrowding.	Users	Each microscopy room is equipped and intended for a maximum of 5 people in normal circumstances, as explained during training. <b>Maximum occupancy of rooms is reduced to one during COVID pandemic.</b>	Yes	Low	
Use by inadequately trained users	Users	All optical guides are behind and under a bench.	Yes	Low	

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Prolonged use of equipment can result in eye strain and ergonomical hazards (e.g., RSI, back problems)	Users	<p>All users must be authorised; before this can occur they must have received proper training. They must also sign a declaration that they have read the local rules.</p> <p>Ambient lighting kept as low as possible, restrict length of time using equipment, workstations designed for ease of use and fully adjustable chairs provided.</p>	Yes	Low		
<p><b>Exposure to COVID-19:</b></p> <p>Everyone is at risk of infection from asymptomatic carriers. Transmission occurs through respiratory droplets produced when a person with the infection coughs, sneezes, or talks. A person may also contract COVID-19 by touching a surface that has contaminated droplets on it, then touching their mouth, nose, or eyes.</p>	All	<p><b>Facility Access and Booking</b></p> <ul style="list-style-type: none"> <li>• Only trained, authorized users may operate a microscope. Swipe-card access is restricted accordingly and users must not let others into the facility.</li> <li>• A microscope or image analysis workstation must be booked on PPMS in advance of a session. Users must only work within booked sessions and should not walk in to see if a microscope or image analysis workstation is free.</li> <li>• Bookings must allow</li> </ul>	Yes	Low		

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		<p>for a user free time slot of 15 minutes between sessions.</p> <ul style="list-style-type: none"> <li>• Users must knock on the door of a microscope room and wait for a reasonable time for a response before entering.</li> <li>• Only one user is permitted to use a microscope per session.</li> <li>• No more than one person at any one time in any of the confocal microscopy rooms.</li> <li>• A maximum of two users in the office area (Room T13B) at any one time; one operating a computer workstation and the other operating the Leica fluorescence stereoscope.</li> <li>• Only one computer workstation may be used in person at any one time. Remote access will be available for both computer workstations.</li> </ul>				



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		<p><b>Training and technical support</b></p> <ul style="list-style-type: none"> <li>New users will not be trained during the initial restart phase. However, methods of training new users will be investigated during this time.</li> <li>Technical support will be provided remotely. Contact Matt Wayland by phone (07733 268757) or e-mail (<a href="mailto:mw283@cam.ac.uk">mw283@cam.ac.uk</a>).</li> </ul> <p><b>PPE</b></p> <ul style="list-style-type: none"> <li>Users should wash hands and put on gloves immediately upon entering the imaging facility. Glove removal should be the last step before exiting the facility. Users should not touch bare surfaces without gloves; that includes door handles, microscope parts, computers and peripheral devices.</li> <li>If gloves come into</li> </ul>				

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		<p>contact with immersion oil, they should be cleaned using 70% ethanol.</p> <ul style="list-style-type: none"> <li>• Gloves must be disposed of after use in bins and must never be reused.</li> </ul> <p><b>Equipment</b></p> <ul style="list-style-type: none"> <li>• Users should cover keyboard, mouse, eyepieces and other touchable surfaces with protective plastic wrap before starting their microscopy session and remove and dispose of the wrap at the end of their session. Users may wear safety glasses as an alternative to covering the eyepieces with plastic wrap.</li> <li>• Exposed surfaces that have been touched and are not covered in wrap must be cleaned/ disinfected at the end of the session by wiping with 70% ethanol. Do not use</li> </ul>				

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		spray bottles to avoid creating explosive aerosols.				

Persons at risk				Risk	Life Cycle	Other	
Staff	S	Public	P	High	Set-up		
Contractor	C	Other	O	Medium	Normal Operation	Service	
Visitor	V			Low	Maintenance	Other	