Technical description for a confocal microscope

Project: ERC StG AgingNiche

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Max price: EUR 588.235,00 net and EUR 700.000,00 in total, including VAT and all fees, expenses and other costs. (If either of these price caps is exceeded, the tender must be excluded from the evaluation).

Specification for a scanning point confocal fluorescence microscope to be installed at the Center for Organoid Systems, Chair of Integrated Organoid Systems (Prof. Dr. Anna Dowbaj). All the following criteria must be met, unless specified as optional.

This laser scanning confocal microscope is intended for use in the organoid and tissue slices characterization, as well as live imaging of organoids and tissue culture cells. The confocal laser scanning microscope should offer maximum flexibility in laser excitation, be equipped with minimum 3 channels suitable for spectral imaging a scan head capable of rapidly capturing a wide field of view at high resolution, and a set of immersion objectives capable of capturing images at both low and high magnifications. The instrument should be fitted with a computer, and the relevant software for task control and data analysis must also be included. Delivery costs, installation, training and warranty must be included in the final cost.

General confocal microscope requirements

- Inverted binocular microscope
- Fully motorized (objective turret with at least 6 objective positions, laser/filter/XYZ-movements automatic controlled through the software, minimum Z-step no more than 20nm)
- High resolution objectives (5x, 10x, 20x, 40x with glycerol immersion or multi-immersion, 63x or similar with glycerol immersion or multi-immersion) with long working distances and high numerical aperture
- LED Epifluorescence illumination for the following excitation wavelengths far red (730 nm), red (630 nm), yellow (590 nm), green (555 nm), blue (469 nm), violet (423nm) and UV (385 nm) with a compatible filter set; the values of excitation wavelengths can be 10% different to specified
- Overview camera
- Complete, large-scale live-cell incubation system, including temperature and CO_2 control
- Sample holders for microscope slides, multi-well plates and tissue culture Petri dishes
- Compliance with all applicable EU and German safety requirements
- Vibration-isolation optical table for the installation of the machine

Computer system, software and data analysis requirements:

- A system control unit (PC, monitor, keyboard, screen) must be available
- Minimal computer requirements: Win10, 512 GB RAM, 20TB HD. Intel Xeon W7-3455 with 24GB NVIDIA RTX or equivalent, at least 30-inch monitor
- Software for controlling the imaging system, which supports image capture and analysis, enables the reliable elimination of autofluorescence signals, enables the acquisition of time series, enables the acquisition of 3D images via Z-stacks, and basic 2D and 3D analysis tools (E.g. grey value-based segmentation and 3D rendering)
- Software with an intuitive user interface for setting up the desired measurement tasks (see above)
- The software which allows tile scan and stitching capabilities, multi-position experiments with differing time, positions and Z-stacks possible
- Automated AI-based sample location wizard for easy sample location
- Software interface for exporting and importing data, also to common formats
- Saving and autosaving data in specified folders together with all settings and metadata

Minimum laser lines:

- 405nm, 445nm, 488nm, 514nm, 561nm, 640nm, 730nm; the values of excitation wavelengths can be 10% different to specified
- Motorized collimation for 405 nm laser for precise imaging in XYZ with all other wavelengths

Minimum detector requirements:

- The system shall incorporate an additional super-resolution confocal detection unit utilizing a spatially resolved multi-channel detector array (minimum 30 detection elements or equivalent), allowing reassignment of detected photons to improve spatial resolution and signal-to-noise ratio
- Resolution: area detector with a resolution of 0.2 AU [per detector element] (10% difference allowed) and oversampling of 1.2 AU (10% difference allowed), providing a 4–8 times better signal-to-noise ratio compared to conventional methods
- The technology used must provide 1.5–1.8-fold improvement in lateral resolution compared with conventional confocal microscopy, improved axial resolution compared with conventional confocal detection, enhanced detection sensitivity through optimized photon reassignment, super-resolution imaging without requiring specialized fluorescent probes or computational deconvolution as the sole means of resolution enhancement
- The confocal spectral detection unit must allow freely selectable wavelength, transmission/reflected light detection and alignment of spectral scans with reference spectra; the detector must be capable of lambda scanning

- In total, the detectors should have particularly wide, extended detection range from a maximum of 400 nm to a minimum of 850 nm
- Laser based transmitted light detector

Scanner:

- Linear scanner system (no spinning disk) with high resolution of at least 8000 x 8000 pixels (with a constant pixel dwell time), with at least 80 per cent active scan time and beam blanking (no laser exposure outside the imaged scan area)
- Scan speed with linear scanning behaviour at least 12 FPS at 512 × 512 pixels, up to 6500 lines/sec at 512 × 1
- XY scan speed of at least 45 FPS at 512×512 pixels and a resolution of at least 160 nm (e.g. by parallelizing the readout and beam-shaping the excitation, alternatively by only parallelizing it should reach over 20 FPS at 140 nm lateral resolution)
- An automated scanning stage capable of scanning the sample at high speed (at least 10 mm/s) and with high precision (at least 5 µm)
- Scanning zoom (hardware) 0.6–40× in 0.1 steps (10% difference allowed)
- Large field of view, at least for e.g. for 20x objective maximally zoomed out 700 x 700 µm
- Following scan modes should be possible: point, line, frame, z-stack, time series, lambda

Other requirements:

- On-site delivery and installation included in the price
- User training on how to operate the system and the software (at least for 5 separate users on minimum of 2 training days)
- A further, more in-depth training course for the same number of staff, is to take place after 1–2 years of use
- Both trainings should take place in the laboratory of Integrated Organoid Systems
- Possibility of the users to maintain and clean the system as far as possible independently
- 2-year warranty including at least yearly maintenance included in the system price
- Customer service and technical support must be available by telephone during standard business hours in Germany between 9:00 and 17:00
- A demo system can be offered, as long as 2-year full warranty is included
- Delivery and installation latest by 28.02.2027

All required specifications must be clearly set out in the tender documents. The technical description for all components must be submitted with the tender. The handover must take place at the Center for Organoid Systems in Garching. The total price must include the costs of delivery and commissioning at the laboratory of Integrated Organoid Systems, Center for Organoid Systems, Technical University of Munich, Boltzmannstr. 12, 85748 Garching b. München.