

APPENDIX 4 - USER REQUIREMENTS SPECIFICATION (URS)

MPI LED VR-CAVE WITH LATENCY TRACKING TOOL

1. Introduction

This URS contains the required specifications that are applicable to the European tender regarding to the purchase and maintenance of a LED VR-CAVE with latency tracking tool.

To confirm their compliance with requirements described in this document, Tenderer must sign this form and upload the form with their proposal. If Tenderer disagrees, partially agrees, or is unable to comply fully with any of the requirement, their bid will be considered invalid and will not be assessed further, resulting in Tenderer being ineligible for the award of the Contract.

MPI VR-LAB UPGRADE project aims to enhance the current virtual reality capabilities of the university's lab. This upgrade will involve the installation of advanced 3D stereoscopic systems, seamless video walls, and state-of-the-art software and hardware to support cutting-edge research and experiments in addition to a state-of-the-art latency tracking system to help further improve research and reliability.

2. Requirements

Nr.	Hardware / Physical requirements
1.	The PC running the 3D engine must connect to various devices USB, parallel port, serial port (or UsbToParallel\UsbToSerial cables)
2.	Maximum power consumption LED panel: typical 158 Watt/m ² , max 430 Watt
3.	Typical BTU: 20,328, max 54,660 for the screens.
4.	Heat load towards participants: typical 11,180 BTU, max 30,000 BTU
5.	Lower than 45dB general (noise) sound level. Measured from the middle of the CAVE.
6.	Sound output: minimum 5.1 speaker set
7.	Low latencies and a thorough workflow of measuring different kinds of latencies (see Latency Tracking and Analysis)
8.	Cluster PCs must be upgradeable by MPI (e.g., GPU). No vendor lock-in or custom hardware
9.	Tenderer guarantees that the system that is to be delivered and all accessories are new and available on the Dutch market (not refurbished or previously used), are not a prototype, contain the Best Available Techniques (BAT) and are equipped with the most recent available version of the associated hardware and software.
10.	The system (LED-CAVE) is equipped with a power connection suitable for use in the Netherlands, not three-phase electric power
Nr.	LED Walls
11.	Seamless and frame-synchronized LED walls
12.	No visible seams between panel corners (brightness, color, gaps, viewing angles)
13.	4-sided LED CAVE including floor
14.	Floor load capacity: at least 250 kg/m ²
15.	MIP technology
16.	Minimum dimensions: 330 cm wide, 255 cm high per side
17.	True pixel rendering (no virtual pixel resolution)
18.	Accurate depth perception
19.	Viewing angle: at least 155°
20.	Automatic calibration or no need for recalibration
21.	Refresh rate: 120 Hz (60 Hz per eye)
22.	Rendering at 60 Hz for shutter glasses stereoscopic image
Nr.	Resolution
23.	Native rendering resolution (no down- or upscaling)
24.	The LED display system (walls and floor) shall have a maximum nominal pixel pitch of 1.2 mm. It is acknowledged that, in line with industry practice, the actual physical pixel pitch of products marketed as “1.2 mm” may vary slightly due to manufacturing tolerances. Such offers will be considered compliant provided they are within the standard tolerance for “1.2 mm class” products.
Nr.	Software

25.	Unreal Engine 5.5 or higher. At 60Hz per eye (120Hz total refresh) a. High-quality Metahumans in rich naturalistic environments (known unreal demo) At 60Hz per eye (120Hz total refresh)High-quality Lumen and Nanite rendering at 60Hz per eye (120Hz total refresh) b. Support for DirectX 12
26.	Unity 2022.3 or higher
27.	Vicon tracker datasupport
28.	For Unity we need MiddleVR.
29.	Software-independent, compatible with other CAVE software
30.	Cluster PCs must run on standard versions of Windows 11 or higher
31.	Software interface to allow users to quickly switch between different content types within the CAVE a. Controllable via both iOS and Windows devices b. Compatibility with multiple VR software environments including Autodesk suite, Unreal Engine, Revit, Blender, Unity, SketchUp, and Adobe suite c. Video playback at native resolution d. Integration of 2D applications for document review e. Ability to manipulate and control multiple canvas sections f. Open API for integration of tracking units and other required hardware
32.	Support for custom audio channel mapping to ensure audio aligns precisely with the simulation.
Nr.	Latency Tracking and Analysis
33.	Links physical movement (e.g., with an IMU or motion tracker) to a real-time application generating image output via multiple render nodes
34.	Performs time registration with millisecond resolution.
35.	Is tested in a similar stereoscopic CAVE setup with at least a multi-GPU Unreal Engine cluster and genlock synchronization
36.	Consists of hardware and software components enabling end-to-end latency logging (tracking event to photon output)
37.	Has inbuilt support for Unity, Unreal Engine, MiddleVR, nDisplay
38.	Comes with extensive documentation and example analysis data code
39.	Has support for investigating latency at different stages of the workflow – movement, mocap tracking, head node, render nodes, photons on screen
40.	Can measure the nVidia genlock signal
41.	Has digital IO capabilities that can be used to send ERP markers to EEG signals
42.	Has analog IO capabilities that can be used to record photons and audio to analyze the delay in the visual and audio system making delays in these systems understandable and useable to trigger cues so they sync up with each other and recorded physiological data.
Nr.	Support and aftercare

43.	Response time for technical failures: - Tenderer must acknowledge failure reports within 1 days during working days (Mon–Fri, 09:00–17:00 CET). - Tenderer must provide a remote diagnosis and solution proposal within 4 days. - If remote resolution is not possible, on-site intervention must be arranged within 2 weeks in the Netherlands.
44.	Possibility of immediate hardware replacement by MPI.
45.	Availability (during working days and possibly beyond) Tenderer guarantees to have a service/helpdesk available for employees of Client from the moment of commencement of the Agreement and up to and including the last day on which the last maintenance agreement expires (operational level), whereby: - within the service/helpdesk at least one point of contact is present on working days during office hours (09:00-17:00), by telephone or via an online portal; - adequate backup is available; - the service/helpdesk is well informed of the objective and general content of the Agreement for the purpose of providing services to Client; - communication is in Dutch or English (written and verbal); - an official complaints procedure has been set up. The contact details of the quality officer within the organization are made available
46.	Quality and completeness of training offerings: After delivery and installation, the Tenderer must provide on-site training for MPI staff covering: - System operation: starting, shutting down, switching between applications (Unreal, Unity, video, 2D docs). - Latency tracking tool: setup, measurement workflow, exporting data. - Basic maintenance: replacing LED panels, cleaning, software updates. - Troubleshooting: diagnosing common issues in hardware, software, and network. The training must include: - At least 1 training day on-site. - Documentation and training materials (in Dutch or English). - A contact point for follow-up questions.
47.	Support for software updates of game engines and system drivers: - The system must remain fully functional after updates to Unreal Engine, Unity, and other specified software (Metahumans, Lumen, Nanite, MiddleVR, nDisplay) for a period of 2 years. - No custom/proprietary modifications to the engines or drivers may be required for running the system.
48.	Pixel warranty: The Tenderer ensures that all LED wall and floor panels meet high visual performance standards, and commits to immediate repair or replacement of panels in the event of dead or defective pixels. - The warranty applies for the full duration of the system warranty (minimum 2 years).
49.	Minimum 2-year warranty on complete system
50.	Broken LED panels repaired without additional cost
51.	Service Level Agreement (minimum requirements): - Helpdesk availability: Mon–Fri, 09:00–17:00 CET, via phone and online portal. - Initial response time: ≤1 day during helpdesk hours. - Remote resolution time: ≤4 working days for software-related issues.

	- On-site intervention: within 4 working days in the Netherlands if the issue cannot be solved remotely.
52.	Maintenance generally takes place from Monday to Friday between 9 AM to 5 PM. These times are leading for the response time. If malfunctions are reported outside of this time period, the response time will be counted from the stated start time, which is Monday to Friday at 9 AM
53.	When defects are detected, they will be reported by telephone or email to a central reporting point established for this purpose by Tenderer.
54.	The maintenance will be performed by Client after the training has been completed. Tenderer must provide Client with an appendix containing instructions of the maintenance.
Nr.	Delivery and implementation
55.	Tenderer delivers under Delivery Duty Paid (Incoterms ICC 2020) at MPI at the following address: Wundtlaan 1, 6525 XD Nijmegen, the Netherlands
56.	The CAVE (with Unreal/Unity demo) must be delivered and installed within 8 months after winning tender and no later than 31 December 2026.
57.	The entire system and how it operates is well documented. Full specifications of the equipment and other separate components are available before installation takes place. All relevant documents will be made available to Client after delivery and installation, in Dutch and/or English.
58.	MPI will require a SAT (Site Acceptance Test) at MPI's location, performed by Tenderer. During this SAT, the Tenderer shall carry out the procedure as described in Annex 8, in order to demonstrate that the delivered system functions correctly and meets the required specifications. During the SAT Tenderer also shows the system's capability for connecting and smoking commonly used 'standard'
Nr.	Company
59.	Compliance with ISO standards (minimum ISO 27001)