# Adaptive human-AI collaboration at the industrial workstation

Concept note for HORIZON-CL4-2027-02-DIGITAL-EMERGING-52-two-stage · draft for discussion

EEC Service, UAB · September 2026

## THE PROBLEM

AI is arriving on the factory floor faster than the means to tell whether it is helping the people who work there. Systems are built to a fixed level of autonomy and stay there, regardless of whether the operator is fresh or exhausted, experienced or new. The result is automation that is either too passive to help or too assertive to trust, with no objective basis for knowing which.

## THE CONCEPT

**A closed loop at the workstation: measure the operator, interpret the signal, adapt the machine, act - and measure again.**

- **Measure.** Continuous physiological measurement of the operator, unobtrusively and at the workstation.
- **Interpret.** Signals become interpreted operator state - stress, workload, fatigue - in real time, with quality control before any metric.
- **Adapt.** An AI co-pilot adjusts its own level of autonomy to that state, to task criticality and to machine state, and manages the handover so the operator is never surprised or out of the loop.
- **Act.** The adaptation is carried into the machine itself - robot, cell or line - in real time on embedded hardware.

Two conditions hold throughout. The operator remains in authority, able to understand why the system changed behaviour and to override it. And the data is governed - consented, minimised at source, auditable, and compliant with the AI Act regime that worker-state monitoring falls under.

## WHAT EEC SERVICE BRINGS

- **Today.** The interpretation layer, working on the inter-beat interval stream from whatever produces it. At a workstation where the operator needs both hands, that source is a chest-strap ECG, and we have verified the layer on a commercial chest strap as well as on our own sensor - same layer, different input. It outputs interpreted operator state in real time, with artefact rejection and per-beat signal-quality indicators before any metric is computed.
- **A second channel to check against.** Because the cardiac stream comes from its own sensor with its own quality control, it can be compared with other modalities. Agreement or disagreement between it and EEG, skin conductance or gaze is itself informative and flags doubtful measurements. How far it can serve as a reference - including independent validation of the interpreted state - is work for the project, not a claim we make today.
- **As project research, with a gap we should name.** Extending interpretation across modalities - computing operator state from fused physiological, gaze and task data to the same standard we apply to the cardiac stream - is research the project would undertake rather than a capability anyone brings ready-made. Our own specialism is the cardiac stream. Doing the fusion work properly needs signal expertise beyond it, which we are now discussing with a research group working with EEG, skin conductance and eye tracking.

*On our own optical sensor, plainly: it is a finger clip and needs a free hand. Where the operator's hands are occupied it is the wrong instrument and we would not propose it; where placement allows, it adds optical pulse-wave morphology that electrical sensing cannot provide. A question about the interaction design rather than about us, and worth settling early.*

## THE ROLES

- **Coordination** · OPEN - talks under way with experienced Horizon coordinators
- **Human-AI orchestration and the co-pilot concept** · Italy, concept drafted
- **Operator-state measurement and interpretation** · EEC Service, Lithuania
- **Edge AI, application layer, ergonomics and field validation, digital twins, robotics integration, data governance** · Netherlands, Portugal, Spain, Sweden/Egypt, Greece - in discussion
- **Signal fusion and independent validation; knowledge capture and co-learning** · Italy, Portugal/Lithuania - in discussion
- **Manufacturing use cases** · candidates identified

## ORCHESTRATION CONCEPT

*[ Drafted by our orchestration partner in Italy - how the AI co-pilot combines operator state with task, machine and knowledge data to adapt autonomy. Shared in full once agreed with that partner. ]*

## FIT TO THE CALL

The concept addresses human-AI teamwork through natural interaction models and interfaces that adapt to differing human needs and abilities; with co-learning and knowledge capture in discussion, it aims to cover all three of the topic's fields. TRL 4-5 rising to 6. SSH, Digital Humanism, gender perspective and accessibility sit in the requirements work package rather than being appended. Stage 1 closes 2 February 2027, evaluated blind on excellence and impact; the consortium is assessed at Stage 2.

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