

LOCK-INSPECTOR:



TRAVISIONS

'A Dedicated **Subsurface Inspection Radar System** for Increasing Inland Waterway Infrastructure Resilience'

Fig. 1 – We seek to image lock wall substructure in 2D & 3D.

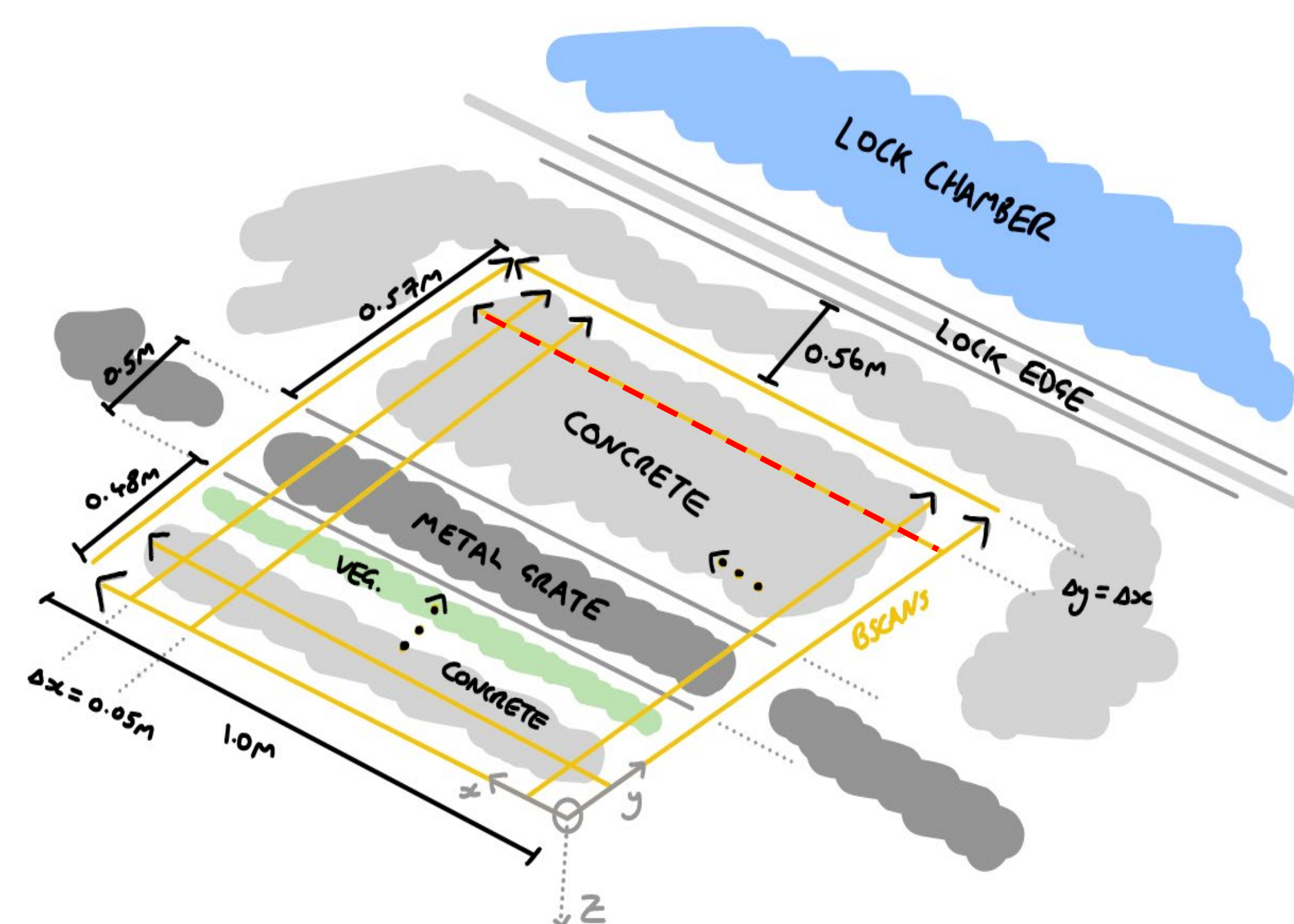


Fig. 4 – Onsite surface-level reference geometry for rebar profiling area scan. Yellow arrows denote individual SIR transects. Transect 48 shown in red.

(3.) Findings & Discussion:

- ❑ We can assume rebar profiles are representative of a 'typical' EU lock | Diameter $\approx 10\text{mm}$ | Pitch $\approx 150\text{mm}$ | Recess $\approx 30\text{mm}$.
- ❑ Results also suggest our UK facility test-wall is a **viable lock wall analogue** | Diameter $\approx 30\text{mm}$ | Pitch $\approx 100\text{mm}$ | Recess $\approx 20\text{mm}$.

(4.) Research Outlook:

- ❑ Optimisation & integration of 3D visualisation workflow [2].
- ❑ Characterisation study of void-washout defect profile with (i) no rebar; (ii) lock-like rebar; (iii) rebar suppression [3] applied.
- ❑ SIR interfacing with CRISTAL Digital Twin Lock (DTL).

Fig. 6 – We believe combining the finalised DTL with Augmented Reality hardware may soon allow onsite surveyors to **see through lock walls...**

(0.) Key Project Characteristics:

- ❑ Development of a pioneering Subsurface Inspection Radar (SIR) system to facilitate comprehensive & efficient **Lock Wall Subsurface Inspection (LWSSI)** for improving targeted maintenance of EU Inland Waterways Infrastructure.
- ❑ A key task of **EU-Horizon Europe Project 'CRISTAL'** (Grant no. 101069838), with technology & knowledge transfer from SIR in Rail (Grant no. 835567) (2019).

(1.) Challenges Facing LWSSI Technology:

- ❑ Concealed **void-washout defect growth** behind lock walls. Early identification critical to avoid structural failure and minimise disruption from lock closures.
- ❑ LWSSI-SIR requires: (i) **maximal wall coverage** [1] (ii) **automation**; (iii) **3D visuals**.

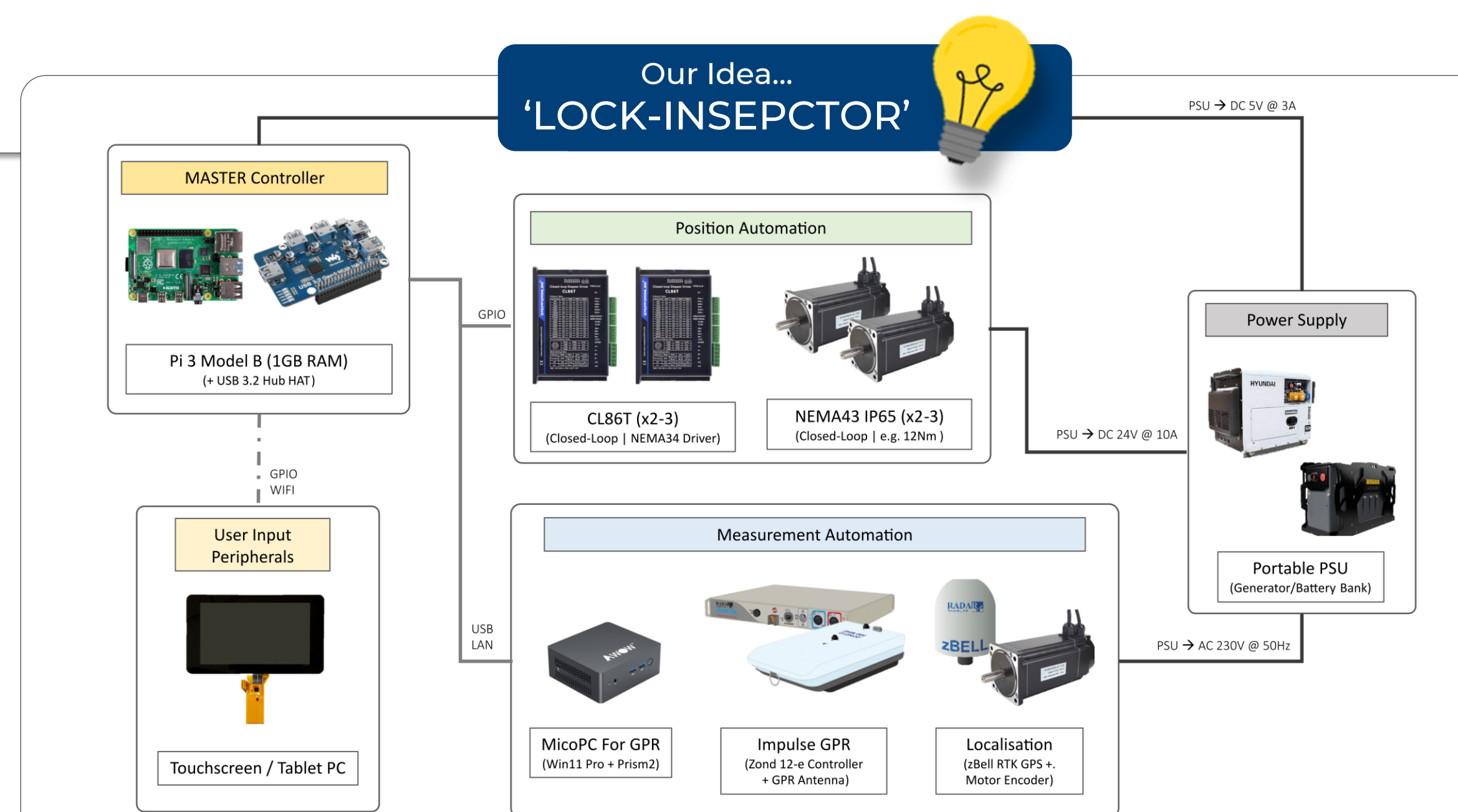


Fig. 2 – LOCK-INSPECTOR subsystems include (i) Power Supply; (ii) Positioning & (iii) Measurement Automation. A Pi3 provides central control.

(2.) Capability Study – Toul Lock (France):

- ❑ Rebar **resonance artifacts** can limit SIR penetration.
- ❑ Estimation **challenges** for SIR penetration in a lock:
 - (i) undocumented rebar geometry $\rightarrow$ **onsite SIR scan**.
 - (ii) vertical wall inaccessible $\rightarrow$ **prelim. 'lock-top' scan**.
- ❑ We seek rebar **diameter, pitch and first-layer recess depth** behind vertical wall using a Proceq GP8000 rebar profiler.

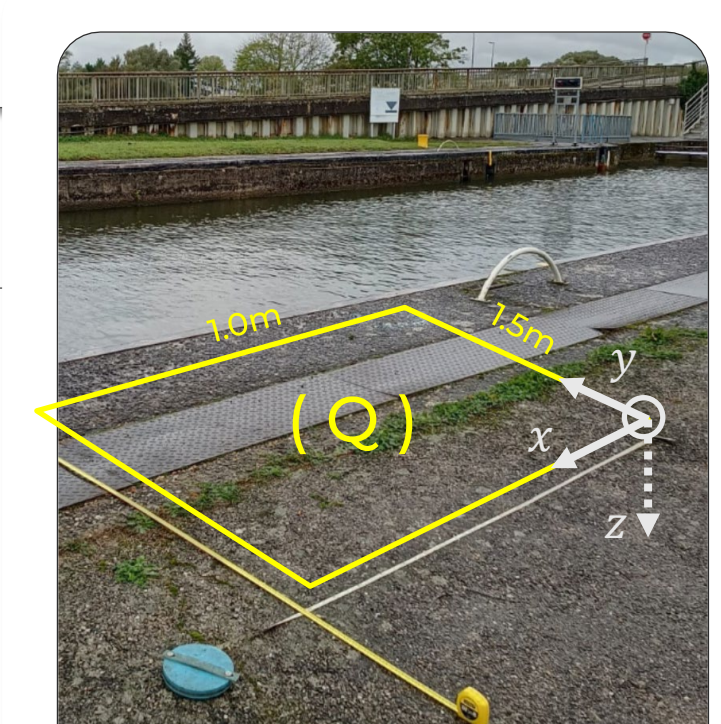


Fig. 3 – Our survey quadrant on lock top.

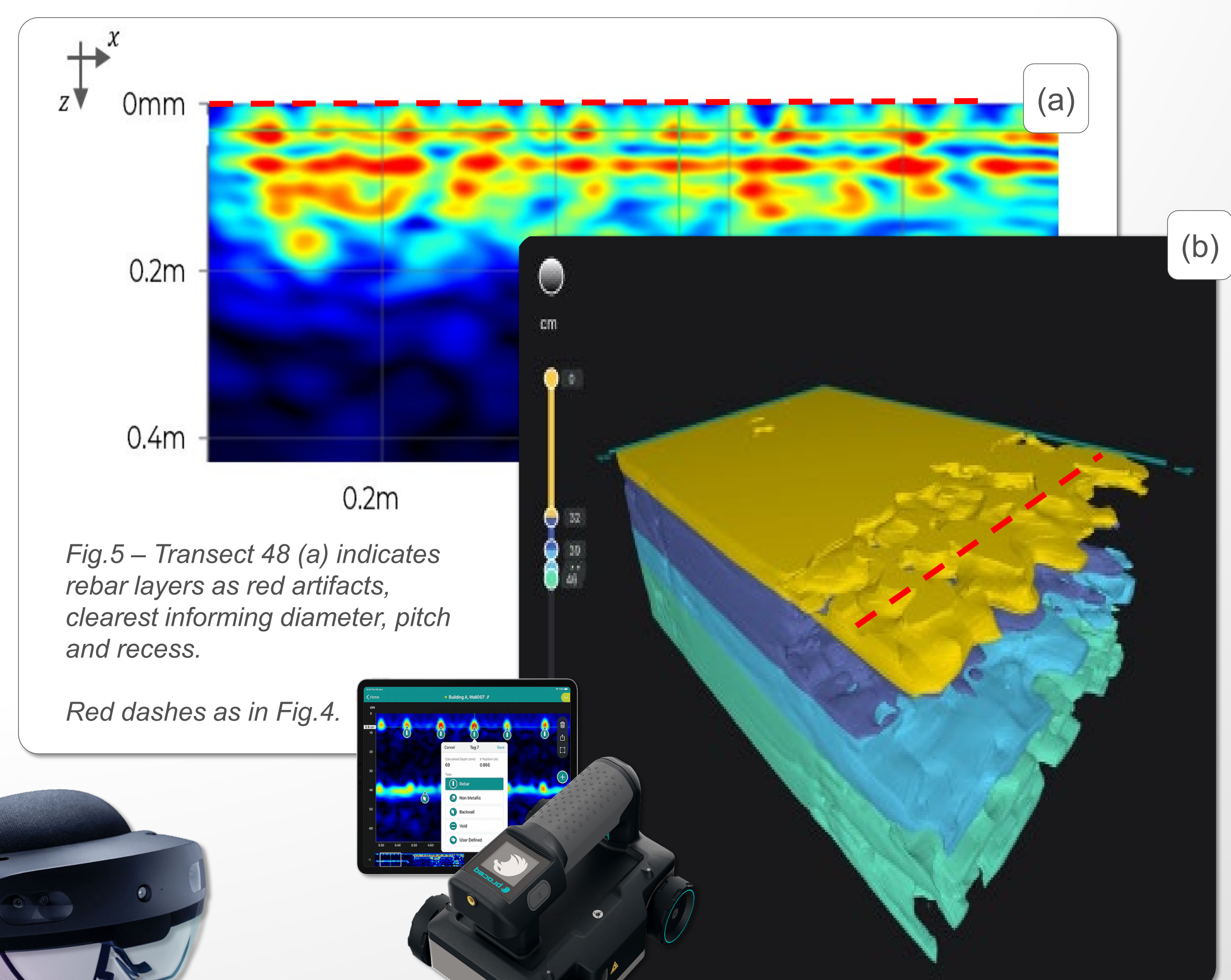


Fig. 5 – Transect 48 (a) indicates rebar layers as red artifacts, clearest informing diameter, pitch and recess.

Red dashes as in Fig. 4.

Fig. 5 cont. – Proceq GP8000 SIR system (left) returns estimated 3D feature profiles (b). Yellow volume denotes rebar artifacts nearest lock top.

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