



Controls
Electronics &
Mechatronics



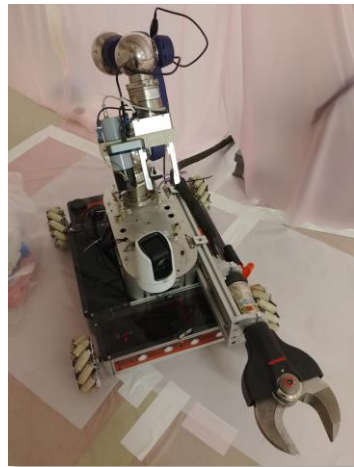
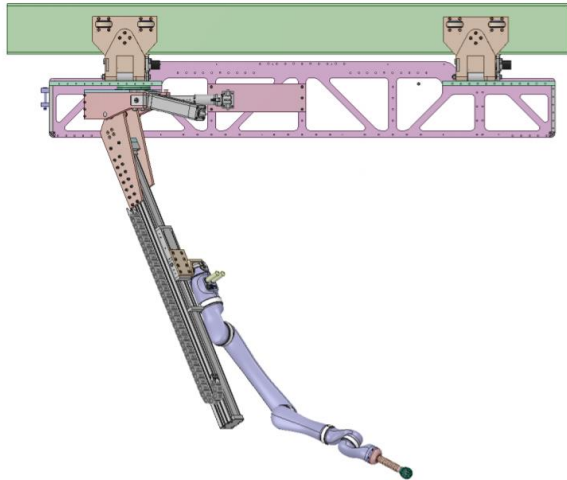
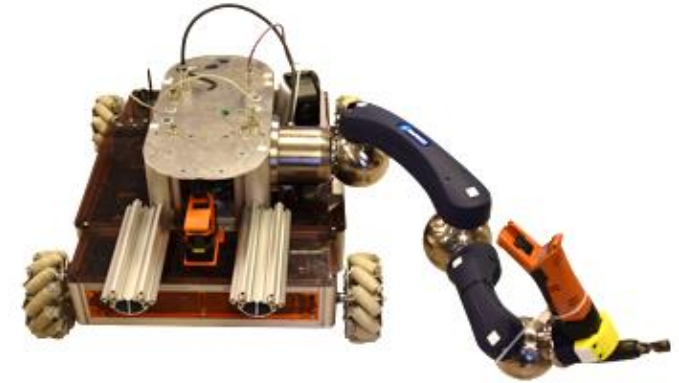
Telerobotics at CERN: Mixed-Reality Human-Robot Interfaces

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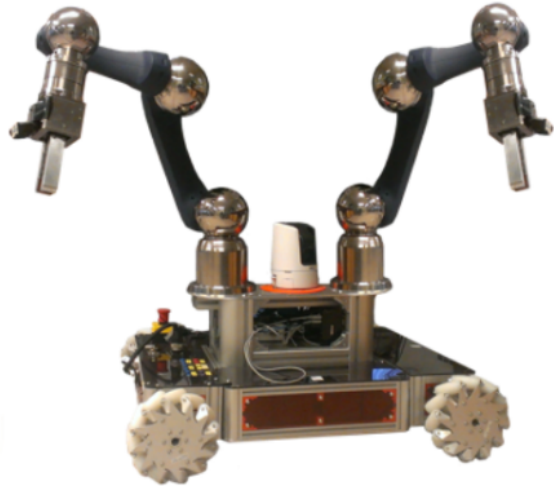
IT Lightning Talks

13 May 2022

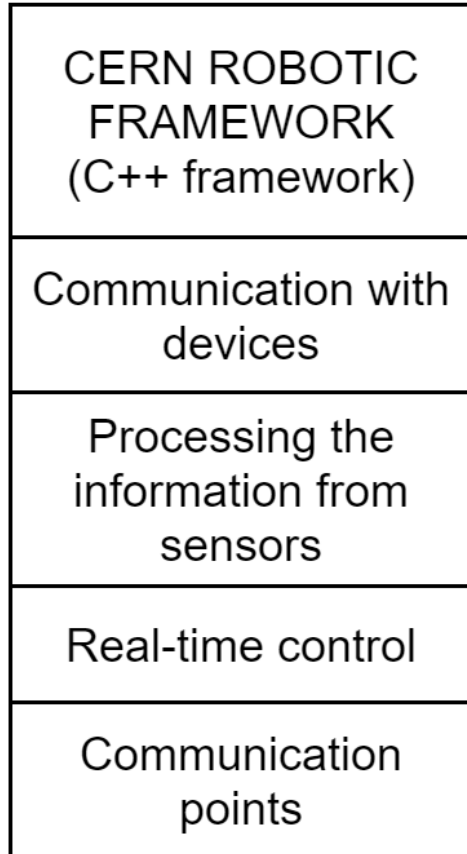
Need for versatile Human-Robot Interface for CERN robots



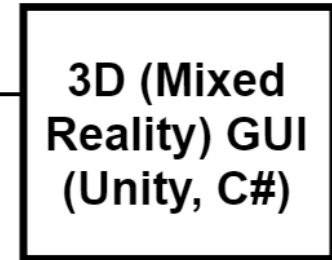
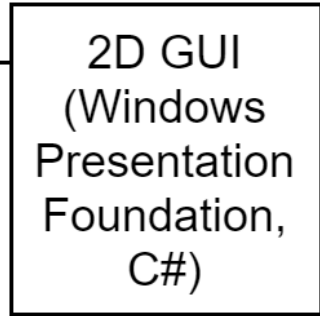
How the robots are controlled. Architecture.



ROBOT WITH INSTALLED EQUIPMENT AND ITS ON-BOARD COMPUTER



Communication over mobile 4G network, WiFi or CERN internal network



TELEOPERATOR CONTROLLING THE ROBOT VIA A PC OR USING HEAD-MOUNTED DEVICES



Main camera
 Mini PTZ Camera

Secondary camera
 Endoscopic Camera



Robot movement

TIM Arm



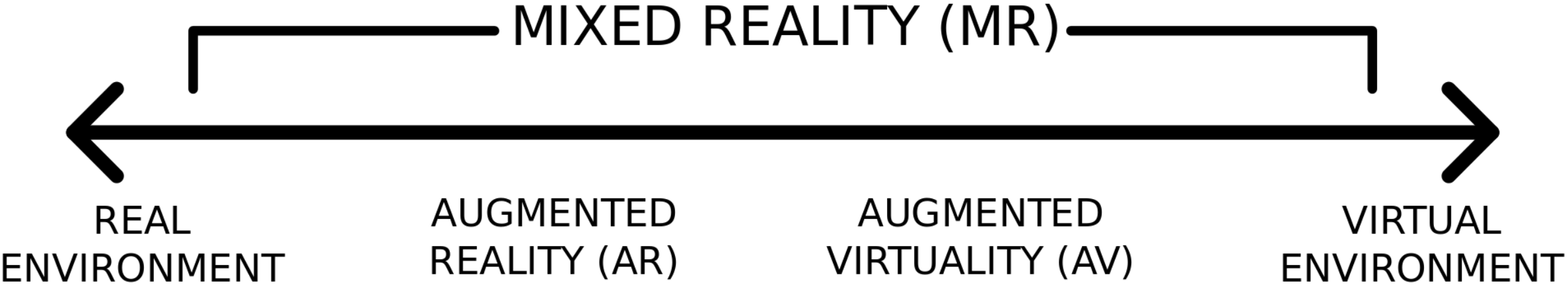
TIM Arm



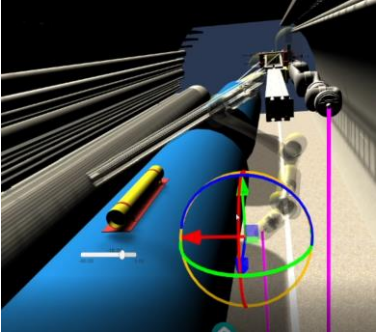
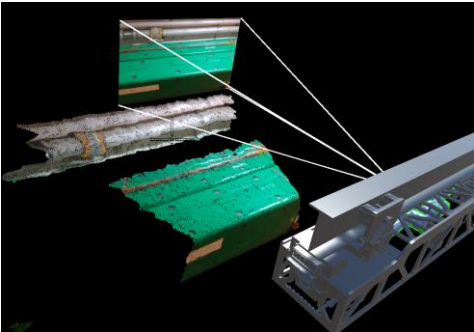
Input device

Input type
 Keyboard

Reality-Virtuality Continuum



Here
Are
We



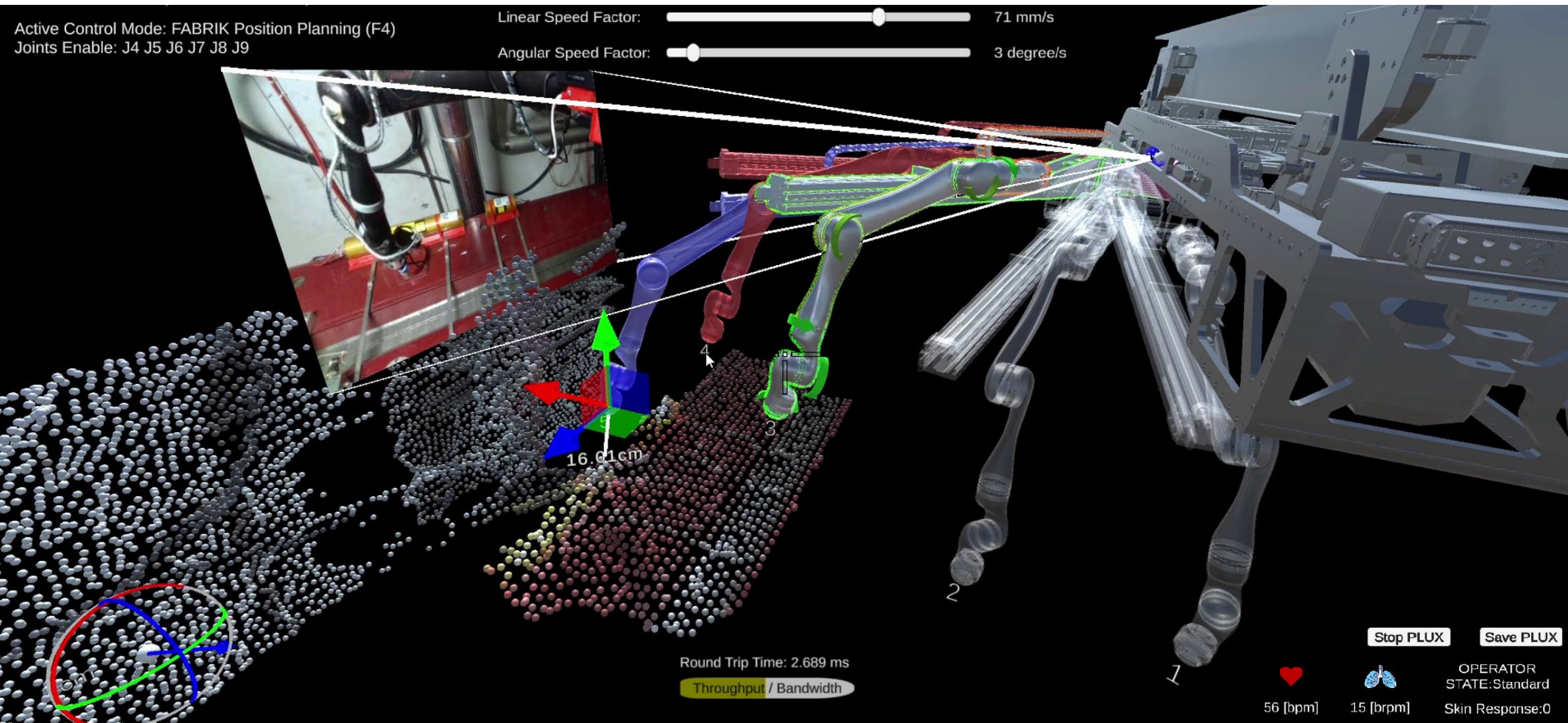
Augmented Virtuality on screens



Active Control Mode: FABRIK Position Planning (F4)
Joints Enable: J4 J5 J6 J7 J8 J9

Linear Speed Factor: 71 mm/s

Angular Speed Factor: 3 degree/s



16.01cm

Round Trip Time: 2.689 ms

Throughput / Bandwidth

Stop PLUX

Save PLUX

56 [bpm]

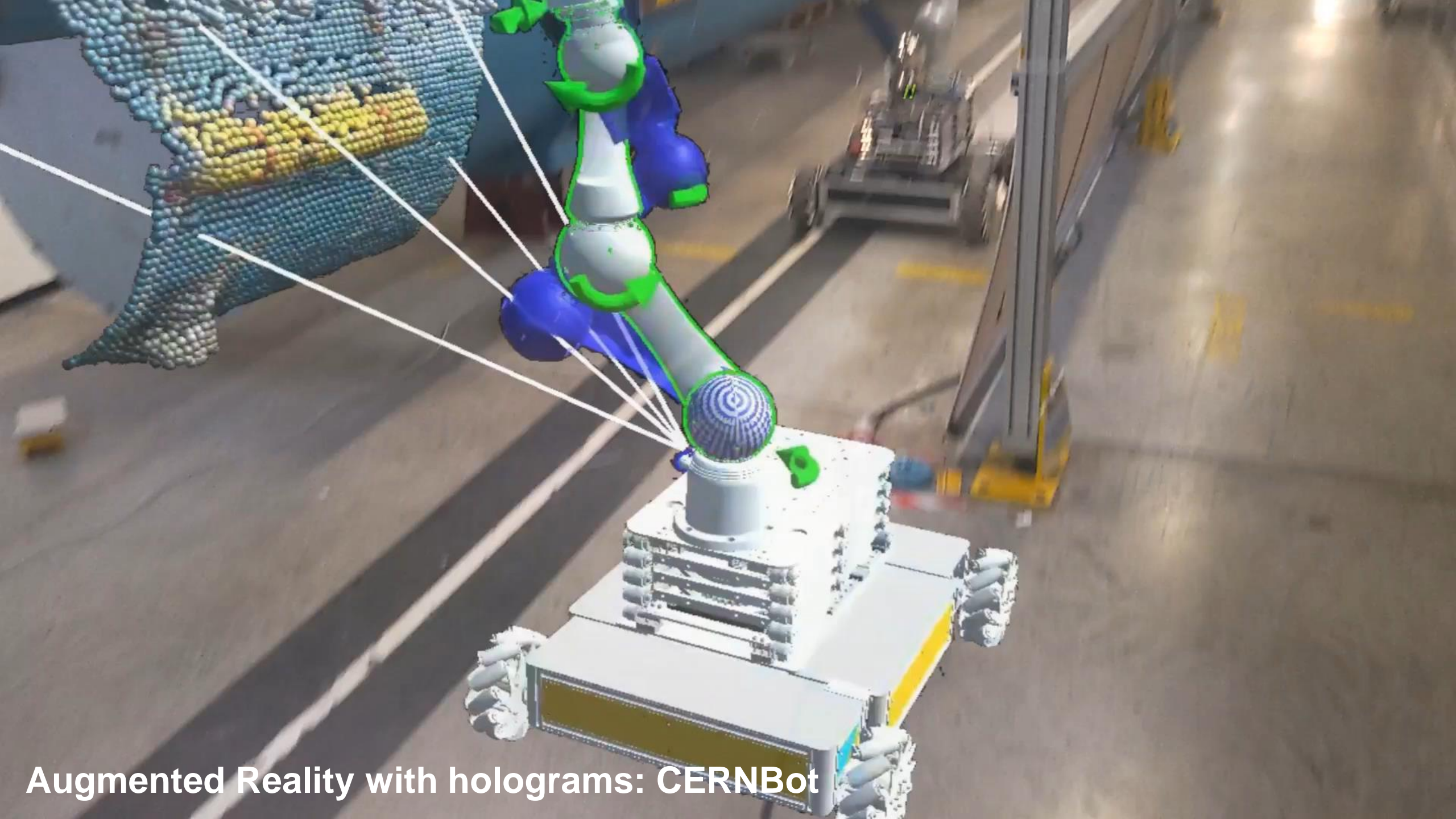
15 [brpm]

OPERATOR STATE: Standard

Skin Response: 0

Augmented Virtuality on screens: LHC train robot

Augmented Reality with holograms: LHC train robot



Augmented Reality with holograms: CERNBot

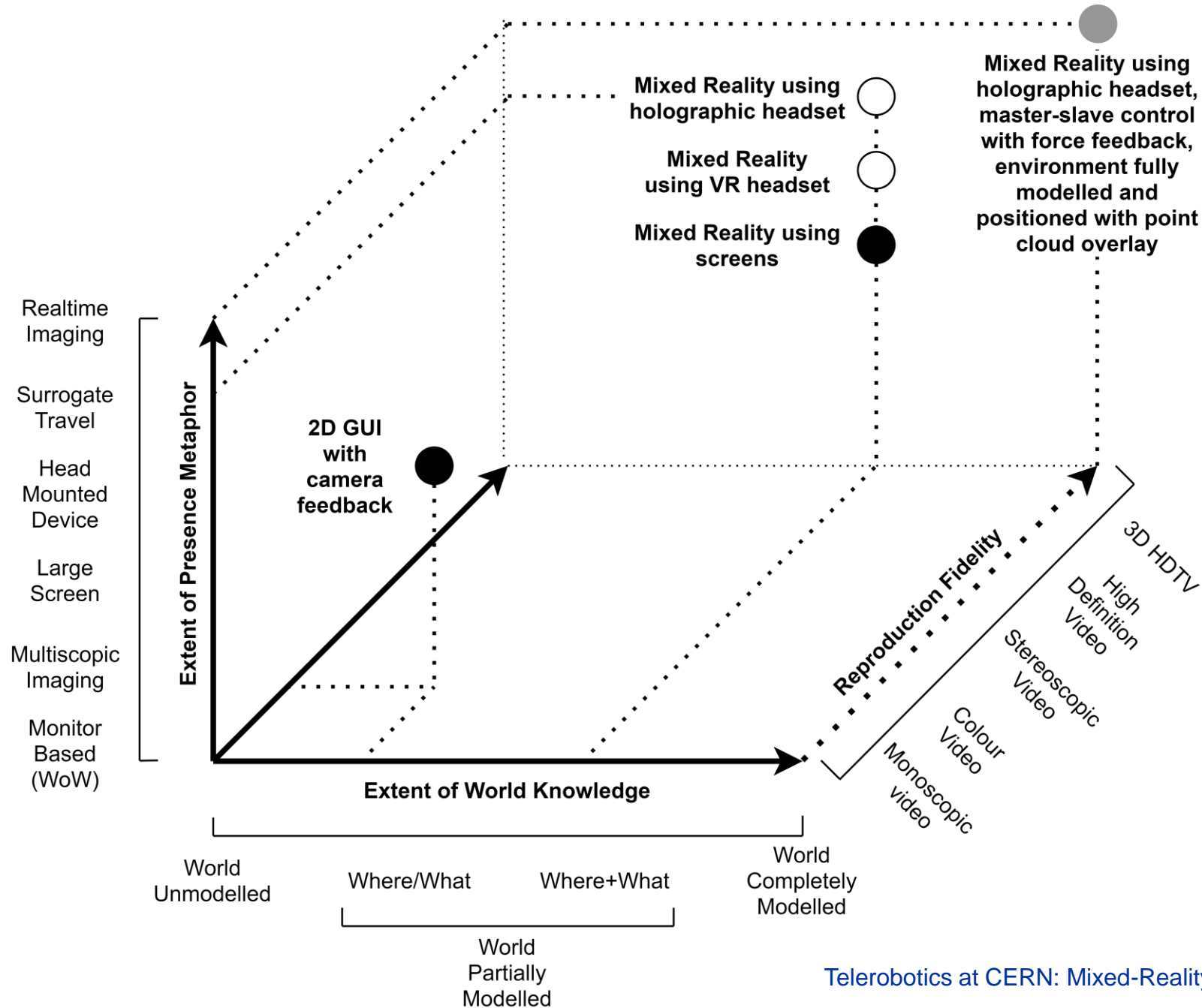
Thanks, let's discuss!



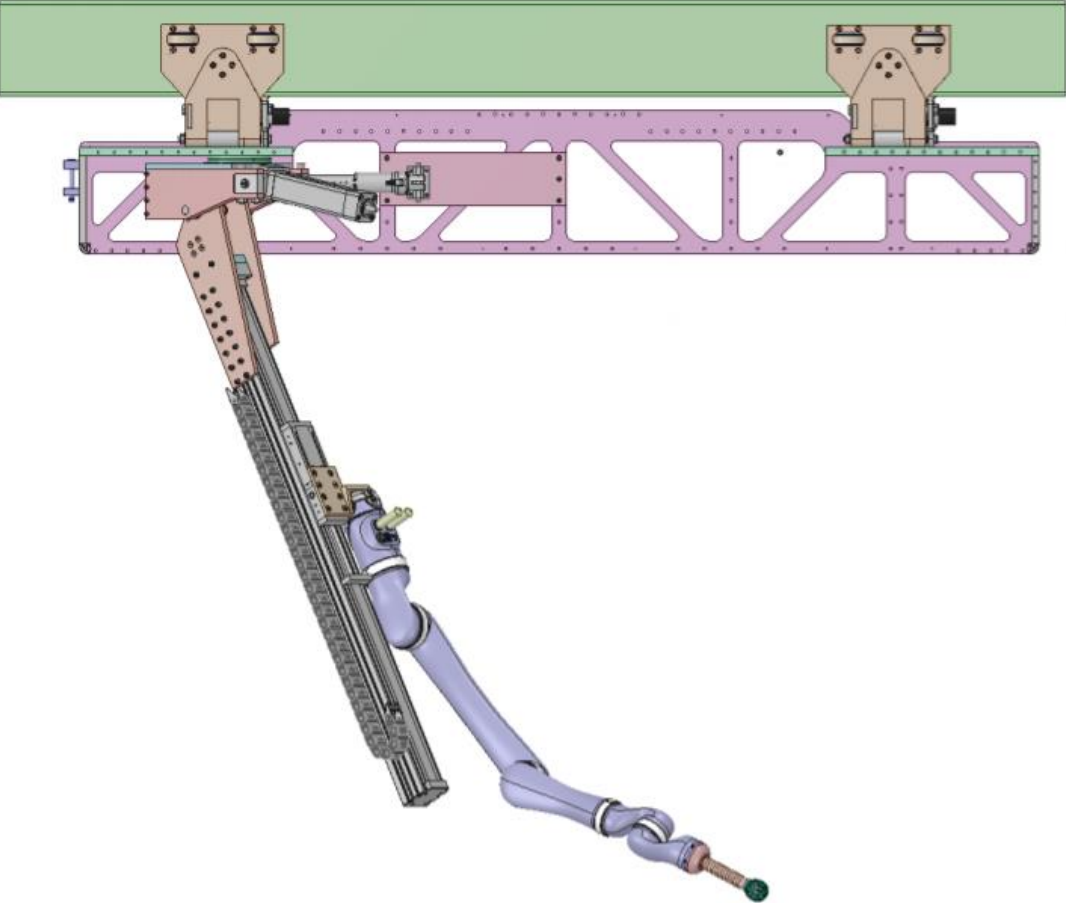


beams.cern

CERN Human- Robot Interfaces



Redundant manipulator = need for easier control



Augmented Virtuality VS Augmented Reality

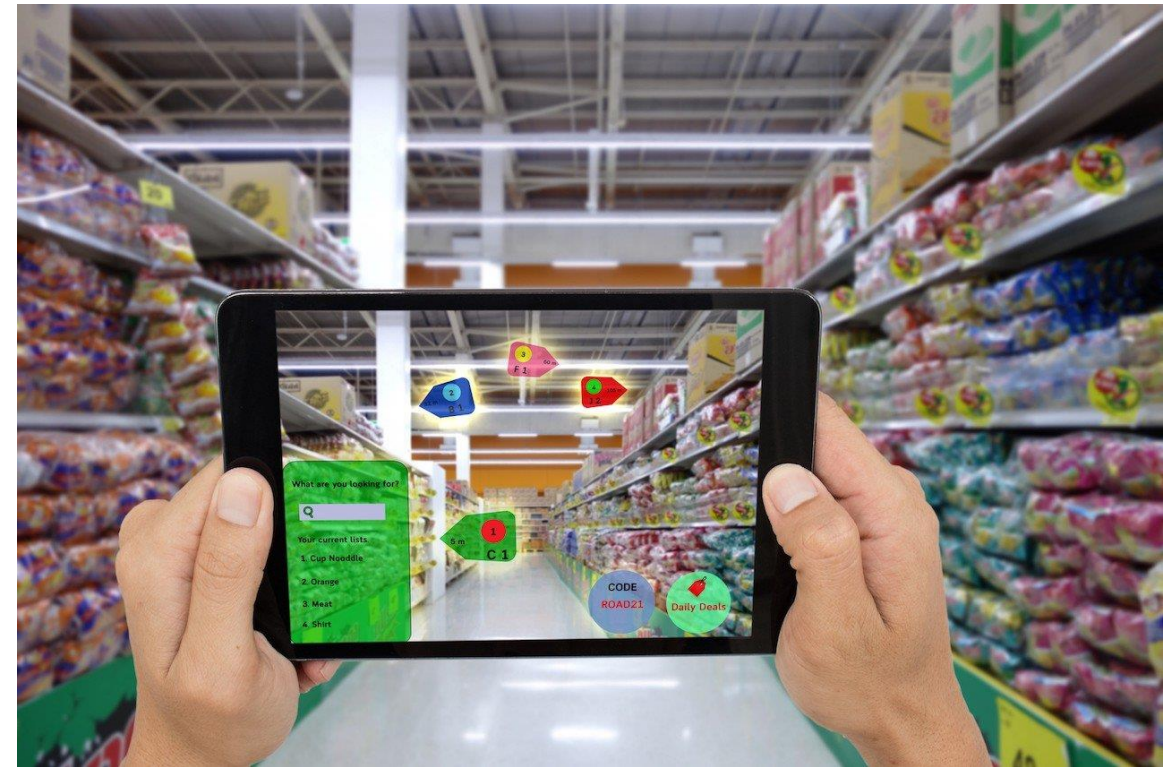


Reality in Virtuality



<https://ichi.pro/pl/co-to-jest-rzeczywistosc-mieszana-106540088967984>

Virtuality in Reality



<https://industrywired.b-odn.net/wp-content/uploads/2020/09/AR.jpeg>

