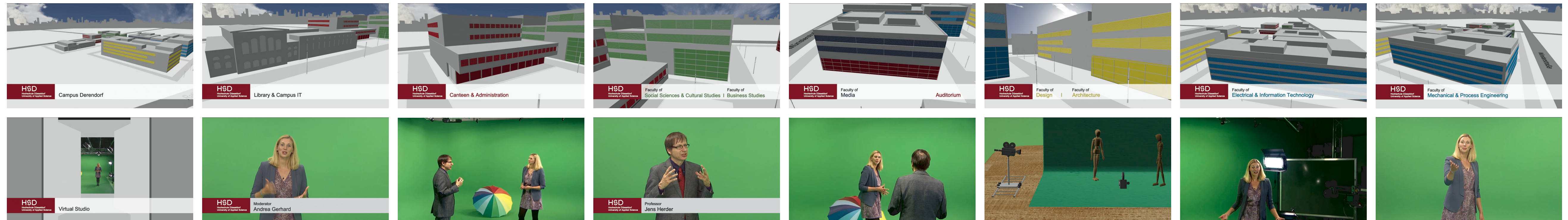# Semi-Automatic Camera and Switcher Control for Live Broadcast

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Live video broadcasting requires a multitude of professional expertise to enable multi-camera productions. Robotic systems allow the automation of common and repeated tracking shots. However, predefined camera shots do not allow quick adjustments when required due to unpredictable events. We introduce a modular automated robotic camera control and video switch system, based on fundamental cinematographic rules. The actors' positions are provided by a markerless tracking system. In addition, sound levels of actors' lavalier microphones are used to analyse the current scene. An expert system determines appropriate camera angles and decides when to switch from one camera to another. A test production was conducted to observe the developed prototype in a live broadcast scenario and served as a video-demonstration for an evaluation.

http://vsvr.medien.hs-duesseldorf.de/
productions/rob2015/

Virtual studio layout
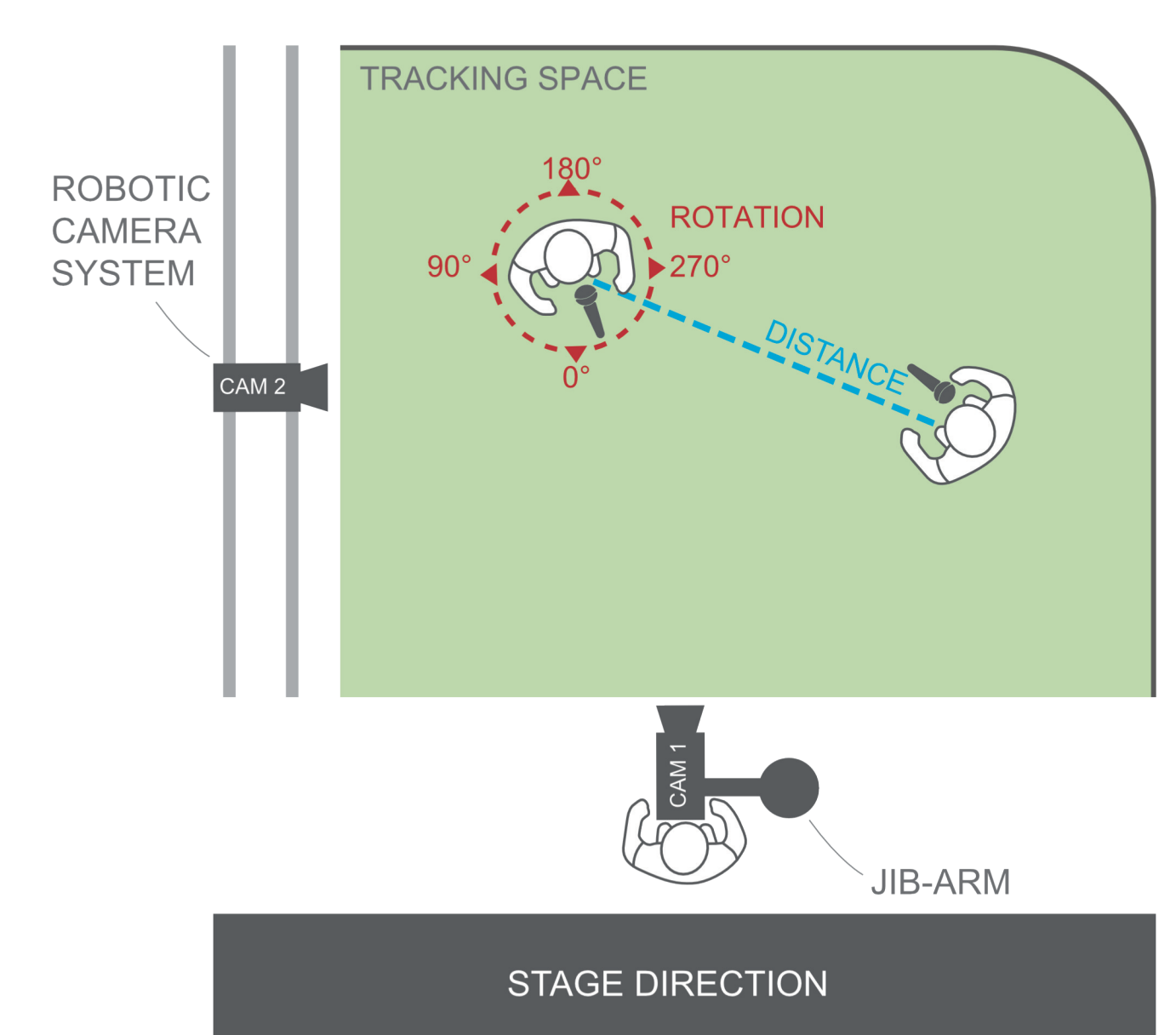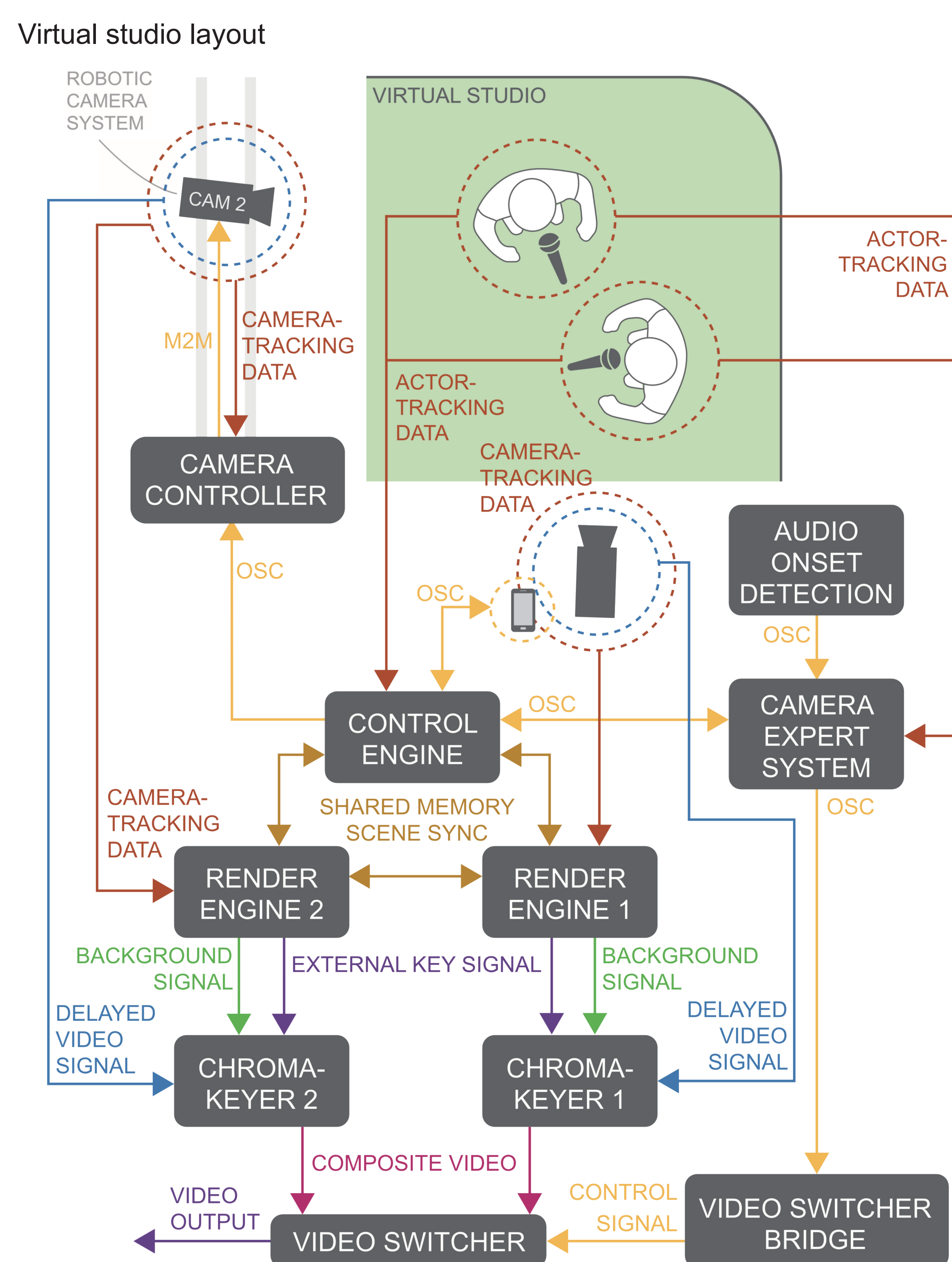
Simplified top view perspective of our virtual studio setup; actors' orientation and voice level as well as time are used to determine a camera cut; the jib-arm has a 120 cm radius and is tracked
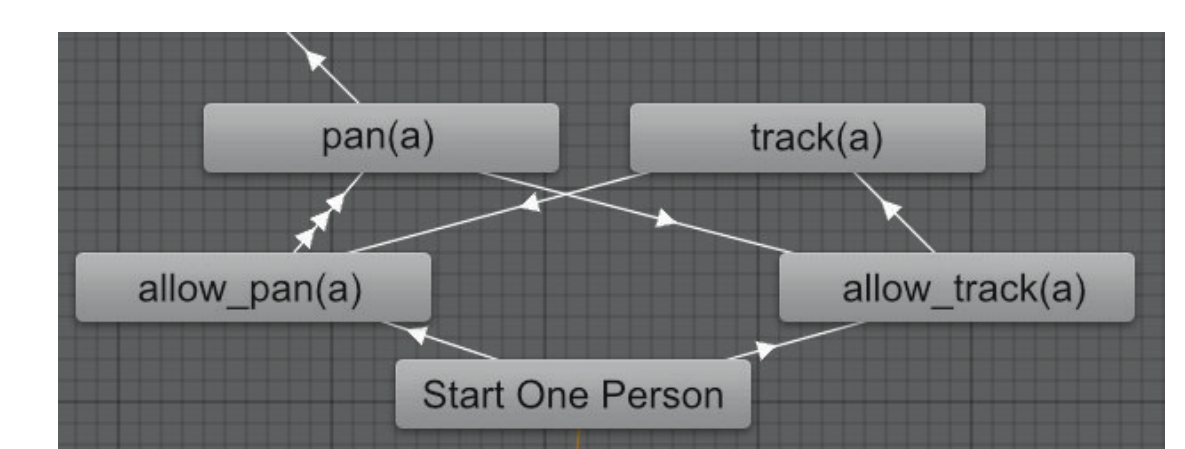
Extract from the Mecanim hierarchical state machine; A cut between the cameras happens when the camera had enough time to prepare the shot or the actor has faced the camera; allow_pan(a)/allow_track(a) are temporary states and pan(a)/track(a) the executing states.
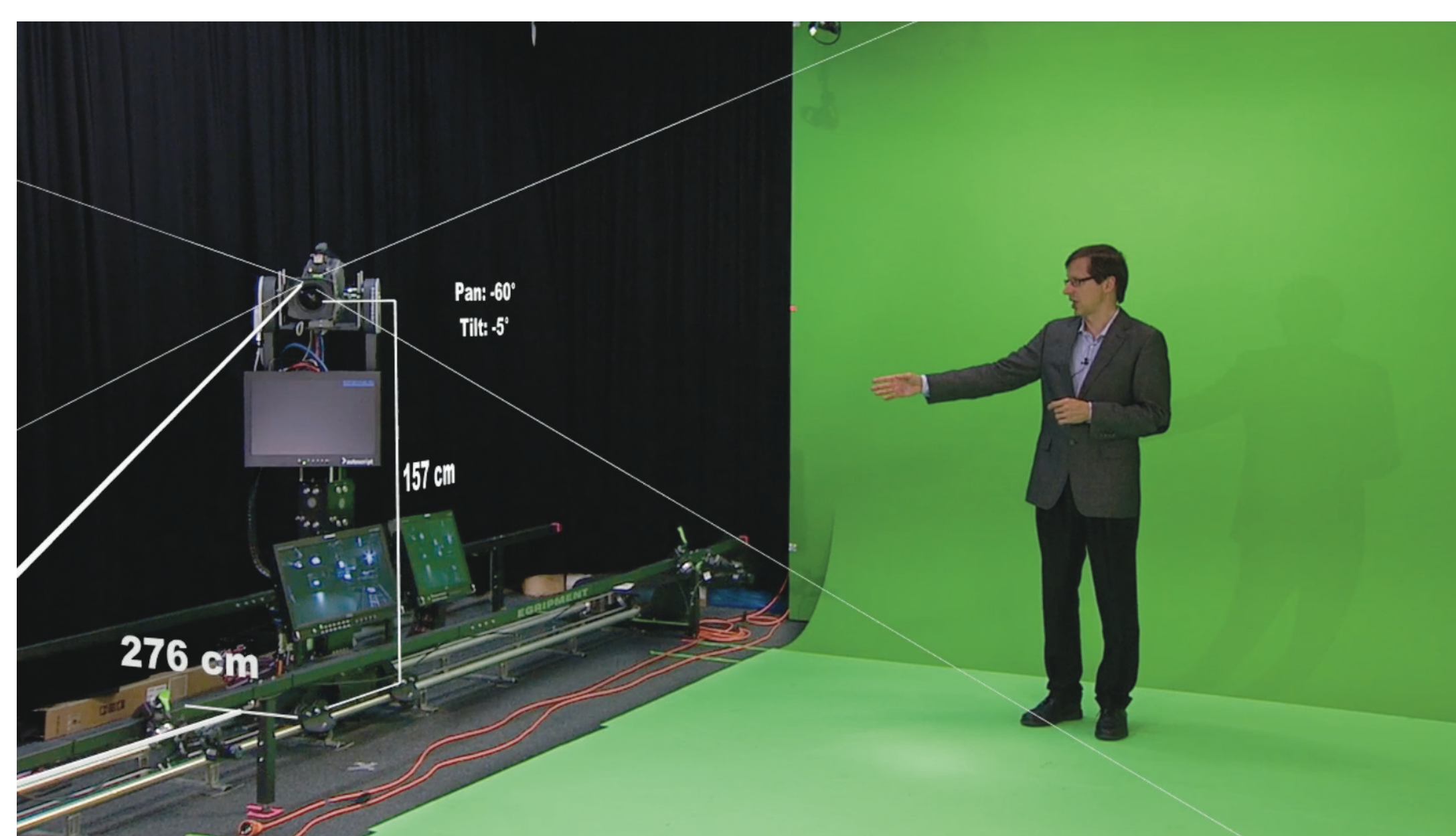
Augmented reality on robotic camera, showing the degrees of freedom as well as the constraints; dolly track of 4,04 m; lift column 1,57-2,11 cm; field of view 9°-96°
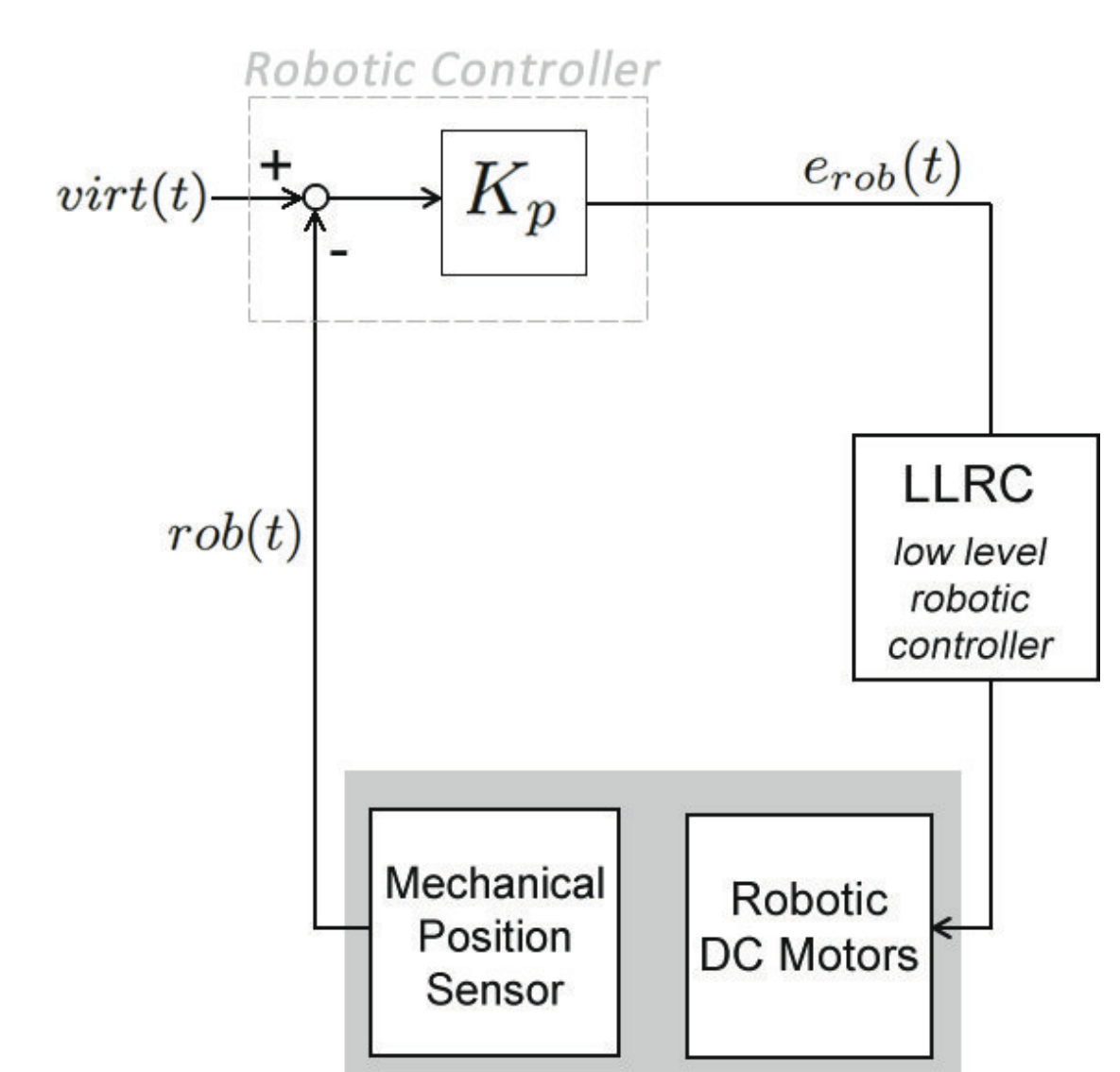
Block diagram of the closed control loop with the error deviation:
$$e_{rob}(t) = K_p\,(virt(t) - rob(t))$$

Low-level camera modules

pan(Actor1)
camera pan following specified actor

track(Actor1)
track movement following specified actor, no panning

apex(Actor1,Actor2)
apex/master shot showing both actors

ext(Actor1,Actor2)
external shot, over the shoulder of one actor facing the second

int(Actor1,Actor2)
internal shot, near-frontal view on first specified actor