

CSEM - TECHNOLOGY
ORGANIZATION IN
SWITZERLAND

The CSEM logo consists of two vertical bars followed by the lowercase letters 'csem' in a blue, sans-serif font.

Technology Transfer to Industry

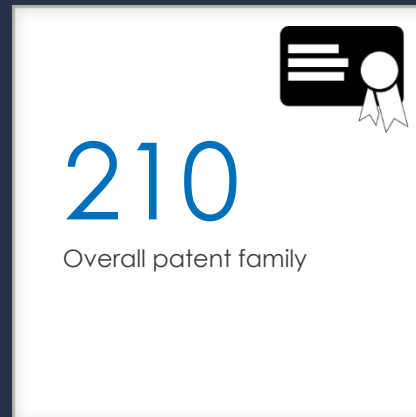
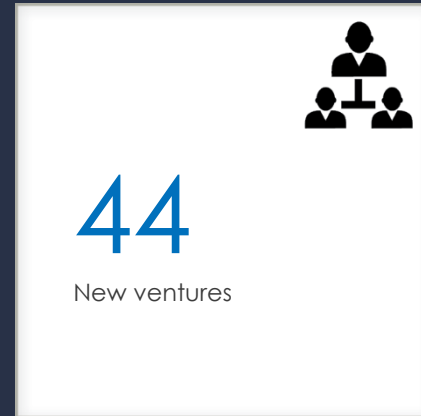
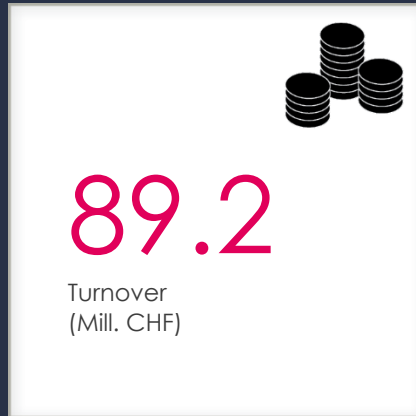
Our mission



Development and transfer of world-class (micro-)technologies to the industrial sector – in Switzerland, as a priority – in order to reinforce its competitive advantage.

- Cooperation agreements with established companies
- Encouraging the creation of start-ups

CSEM at a glance



Close to **industry**, leveraging Swiss academic research

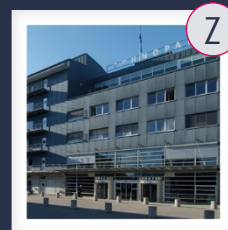
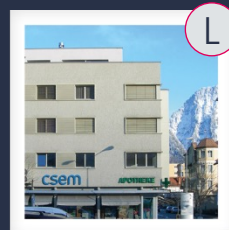
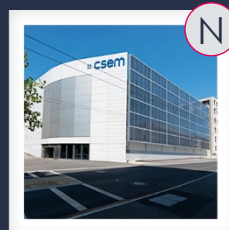
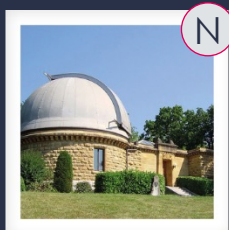
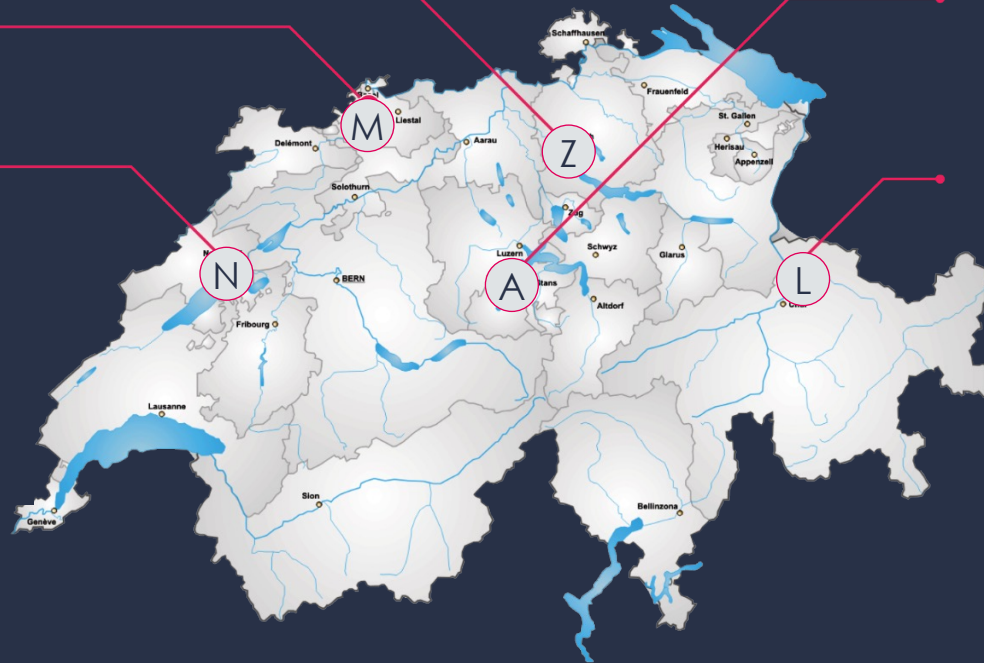
CSEM Zürich

CSEM Muffenz

CSEM Neuchâtel

CSEM Alpnach

CSEM Landquart



Recent **success stories** of technology transfer

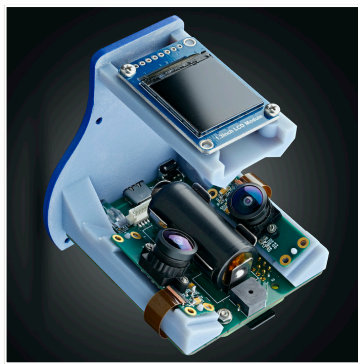
Bühler

In-line monitoring
of grains with
Machine
learning



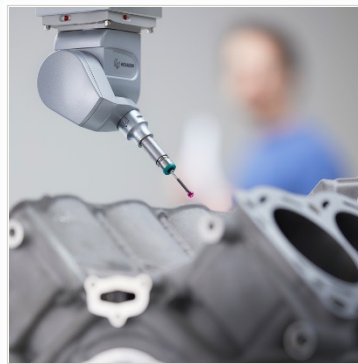
Global ID

Secure
identification
with embedded
encryption



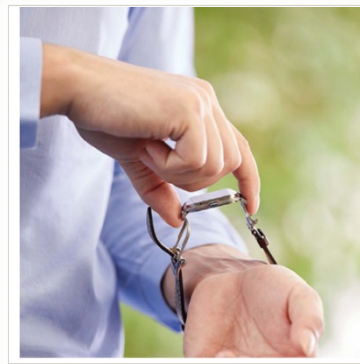
TESA - Hexagon

New generation
of probes for
precision
measuring



Biowatch

Biometric
wearable for
secure
identification

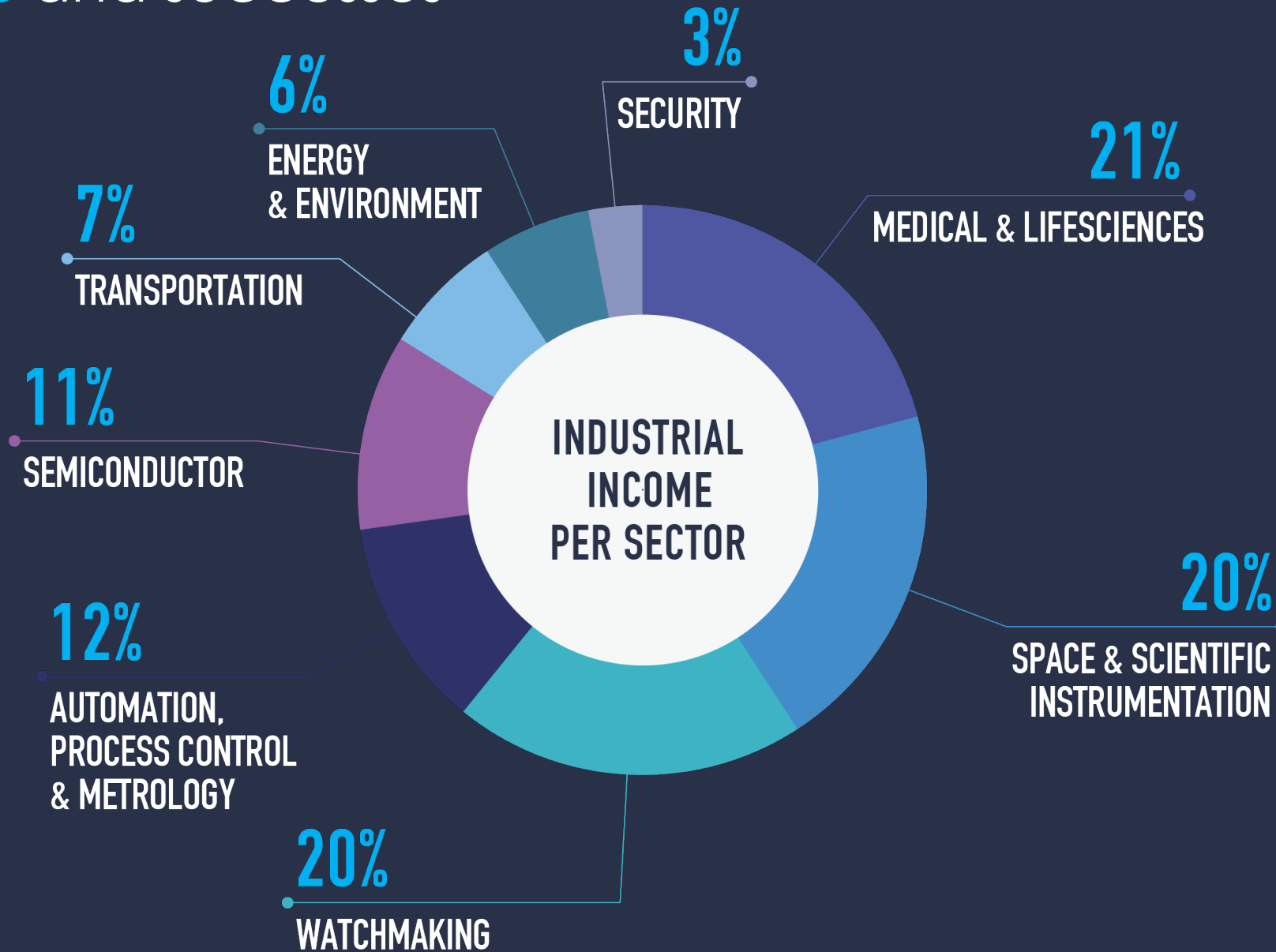


Krummenacher Saatechnik

Smart seeder for
better weed
control



Markets and successes





PEGGASUS

Real time feedback using edge AI vision system for human-machine interaction in the cockpit



Andrea Dunbar,
Head of Edge AI & Vision Group
24th January, 2022

SWISS PHOTONICS

Events & News Clusters Funding

Smart Surveillance Sensors

Tue, 24.05.2022, FHGR Chur

FH GR Fachhochschule Graubünden
University of Applied Sciences

Smart Surveillance Sensors

Improving Safety in the Next Generation Cockpits

Goal:

Improving **human-computer interaction** in the cockpit

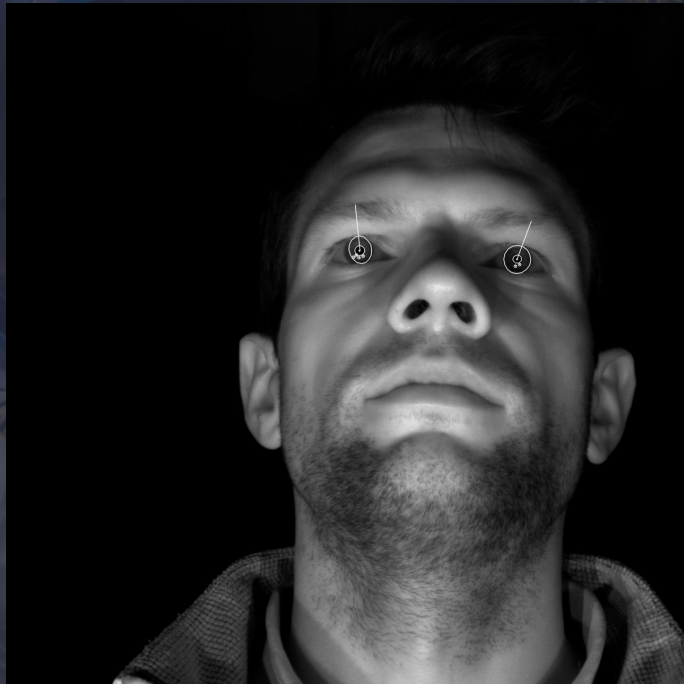
Methodology:

Developing a vision system for :

- Eye gaze detection
- Gesture recognition

Human Computer Interaction In Future Cockpits

Eye Gaze Detection



Gesture Recognition



Avoiding The Classic Engineering Pitfall ...

- User centric approach



- Avionics experts

- Use case specific data

- Use case scenarios

- Definition of system specifications

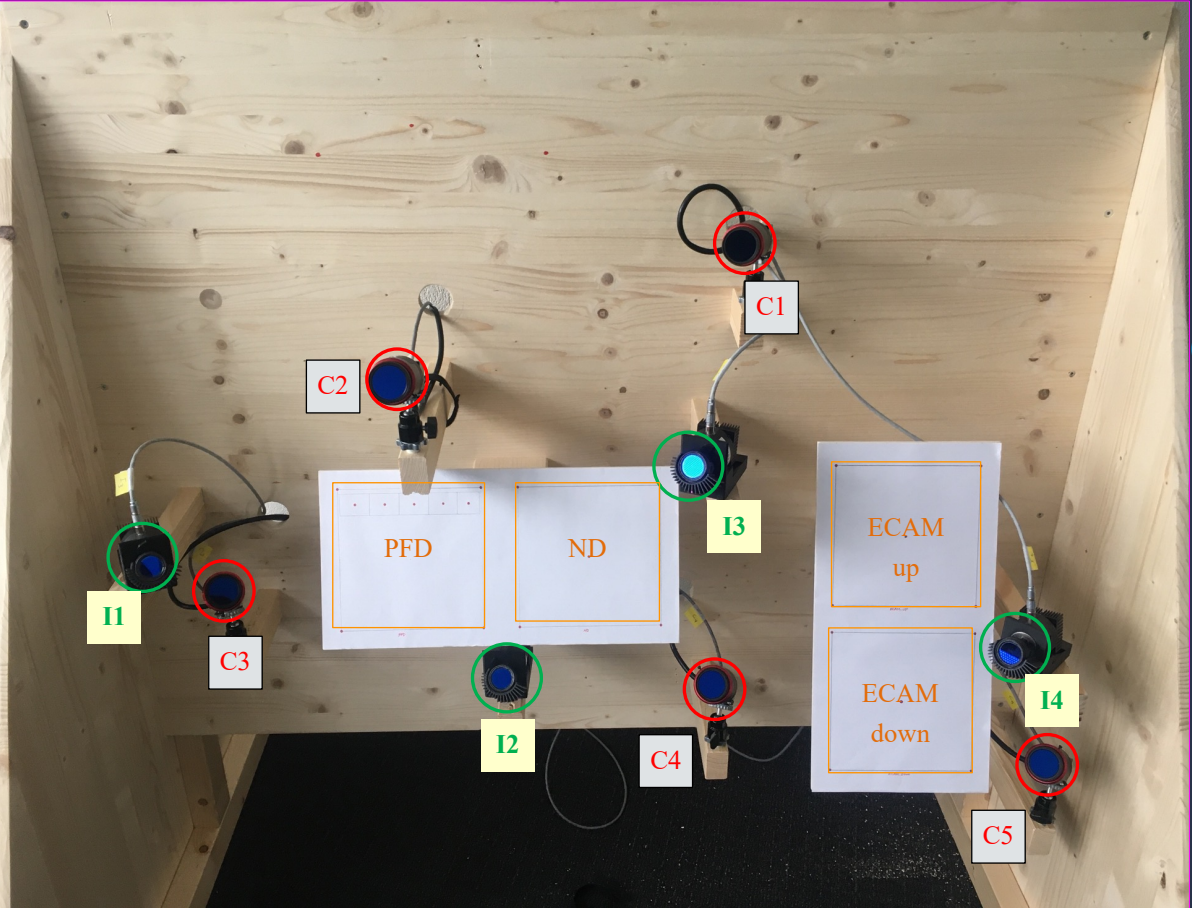
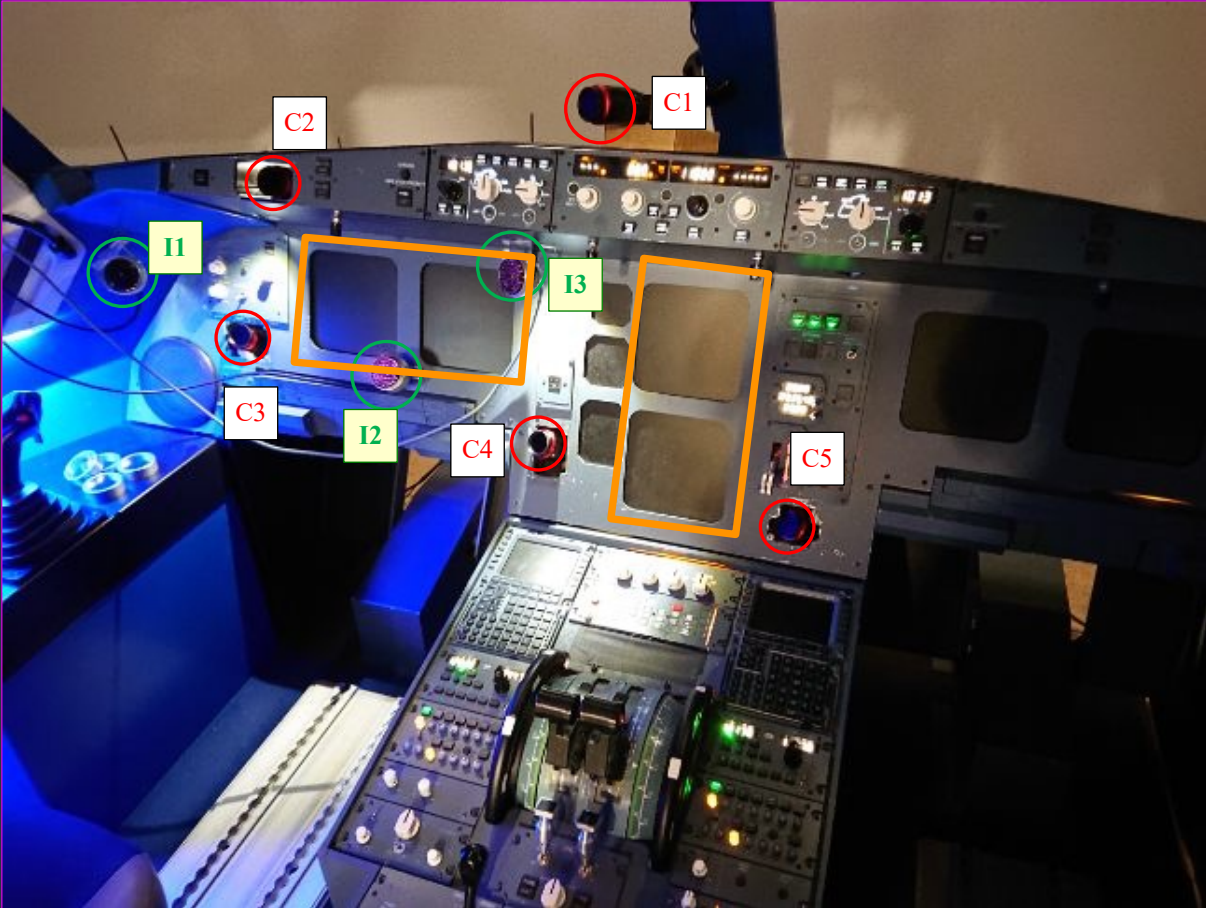
Avionics Use Case Requirements

Edge AI needed for real-time operation with minimum latency

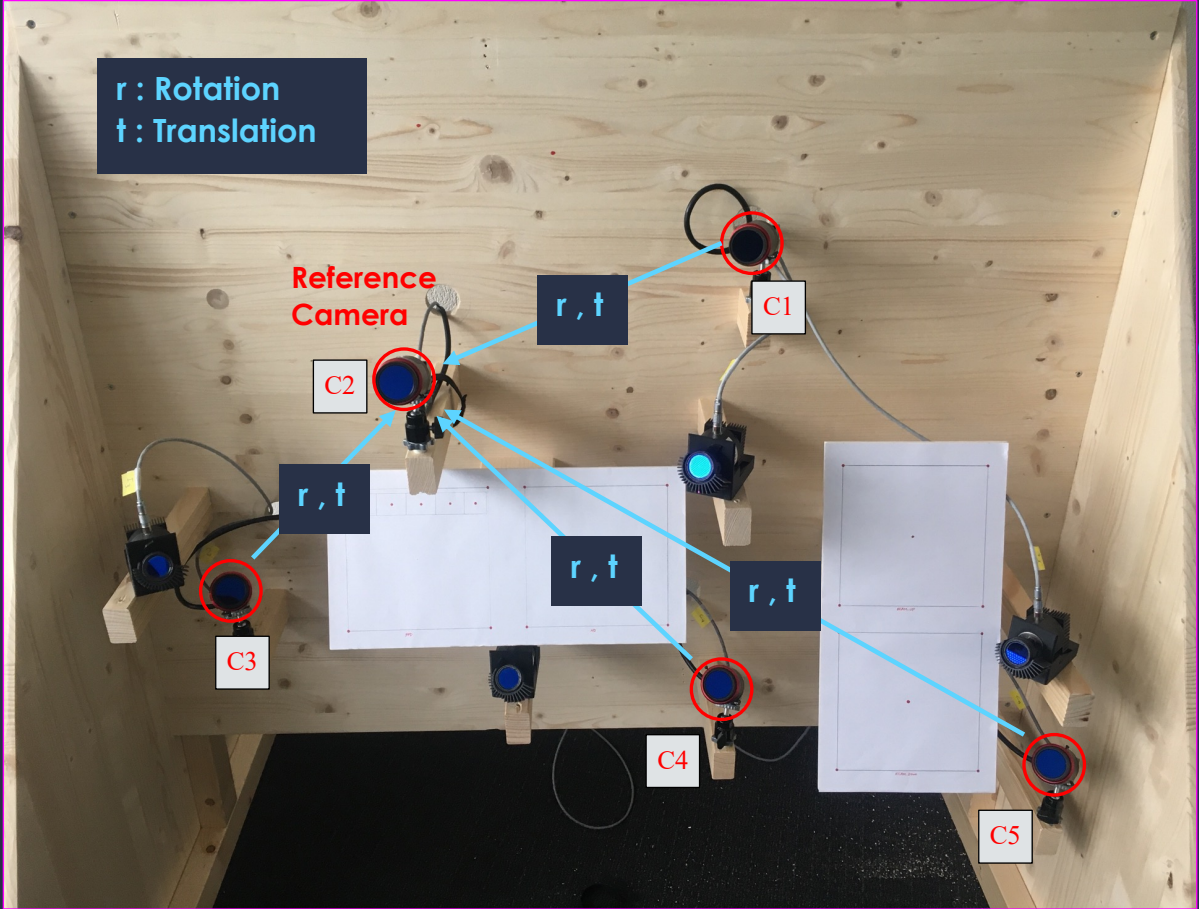
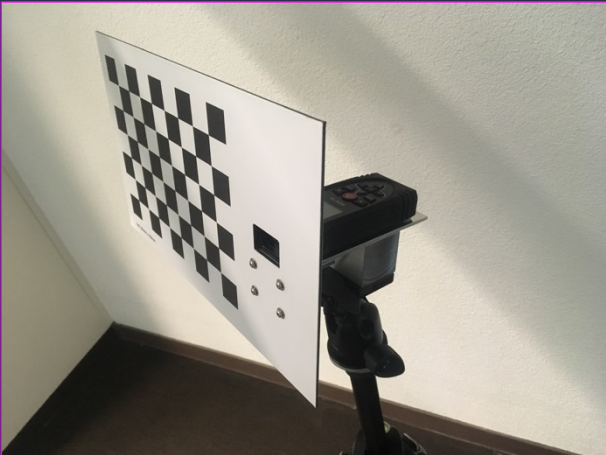
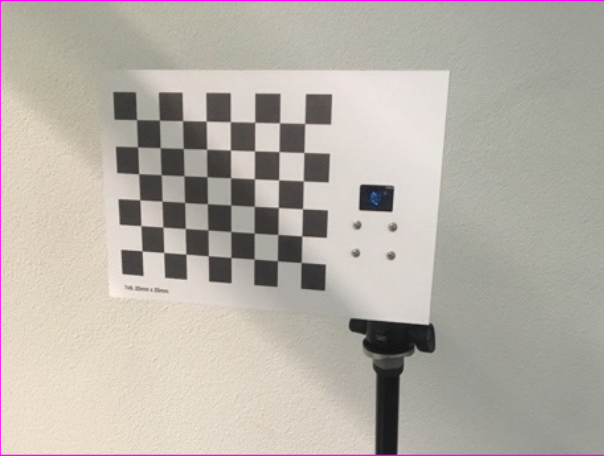
- Unobtrusive system
- Large field of view to be covered
- 1-2 degree gaze accuracy
- Real-time eye gaze at 50-60 frames per second
- Robustness to varying conditions in the cockpit



Vision System Setup: In The cockpit – In The LAB



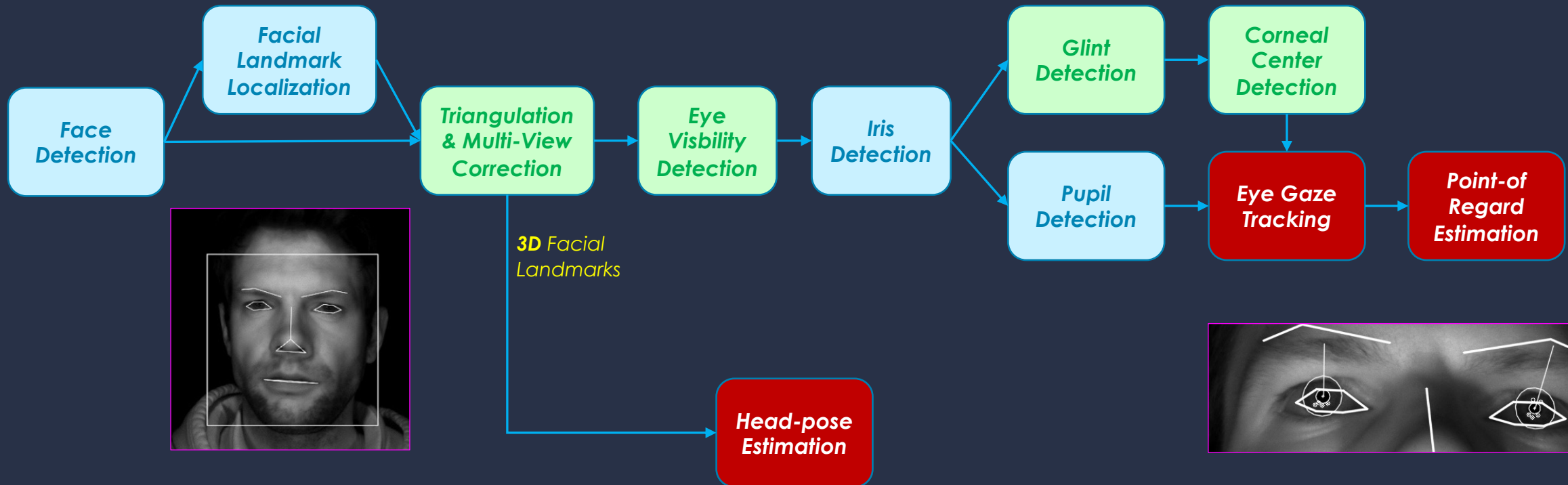
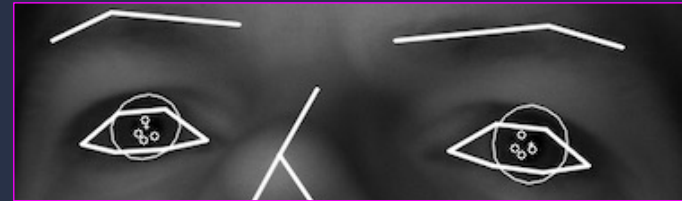
Is A Calibrated Multi-camera System Required?



Algorithmic Pipeline For Eye Gaze Detection

Analytical Approach

Data-driven Approach

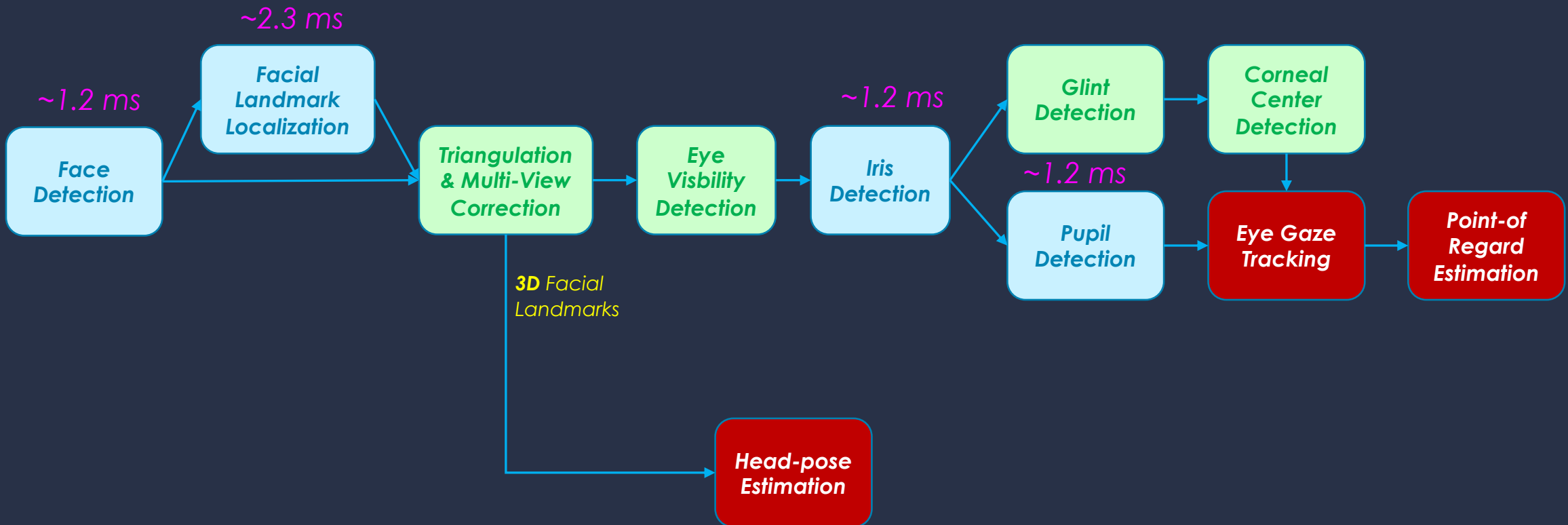


Timing Is Critical In The Cockpit

Analytical Approach

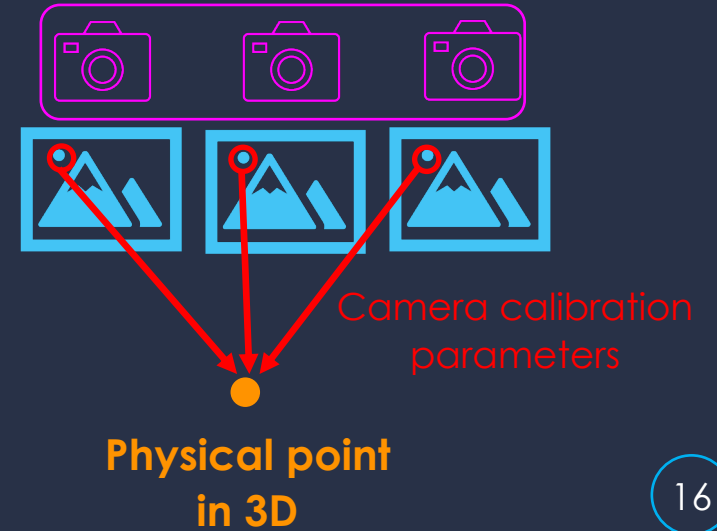
Data-driven Approach

16 ms



Gain Competitive Advantage: Use Case Specific Data

- Data annotation: A costly and time consuming procedure



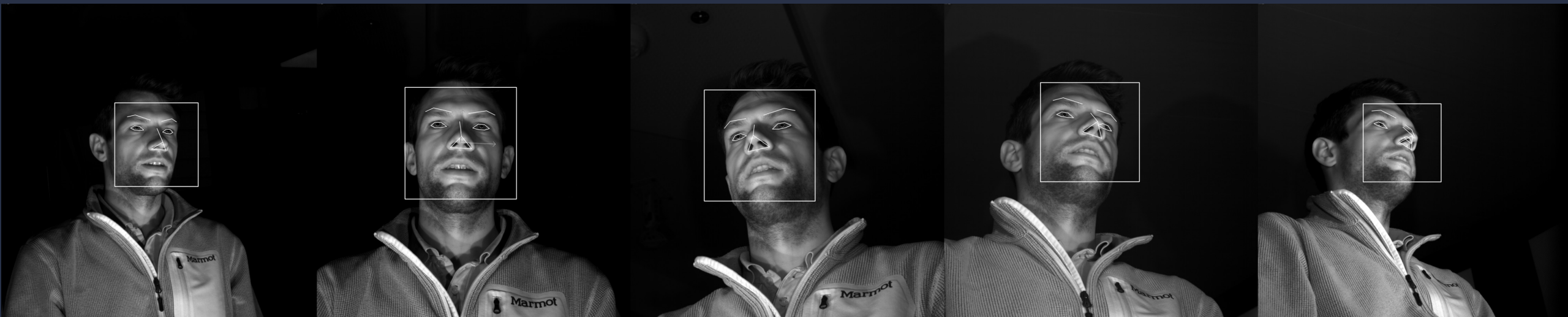
C1

C2

C3

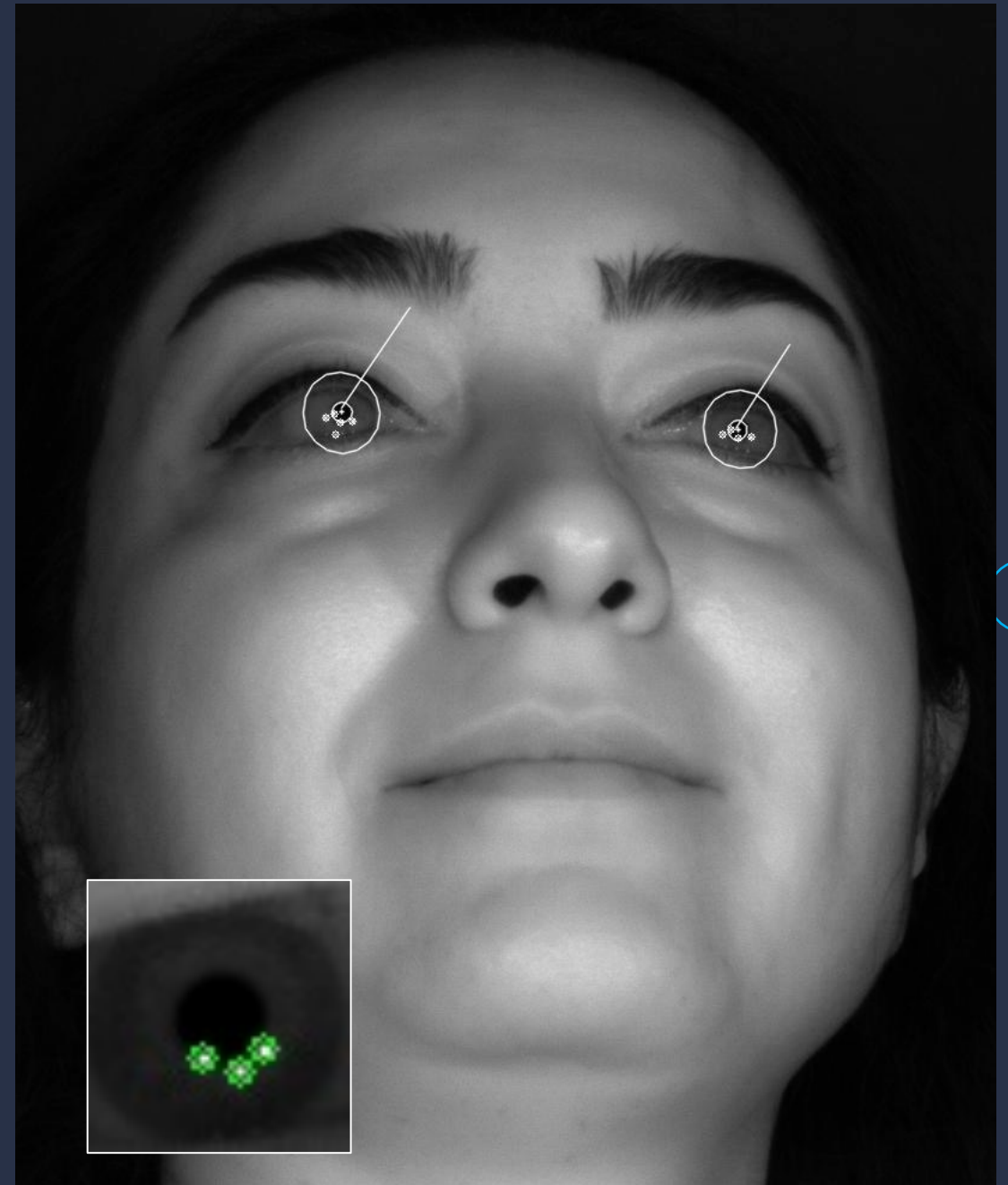
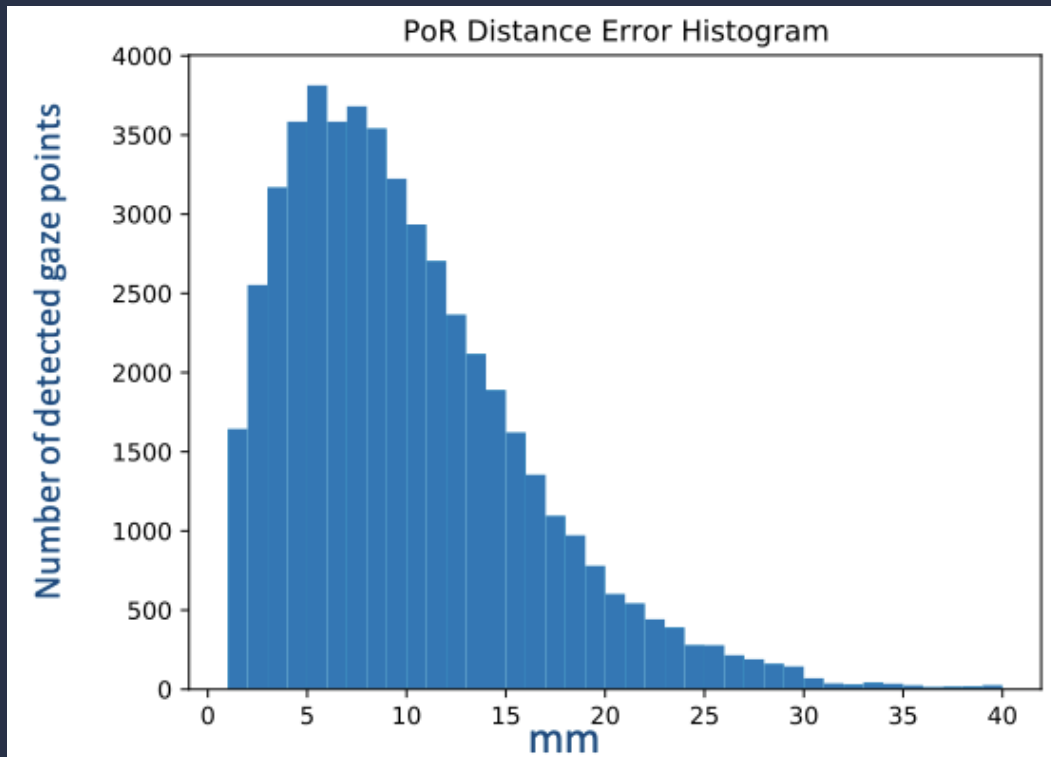
C4

C5

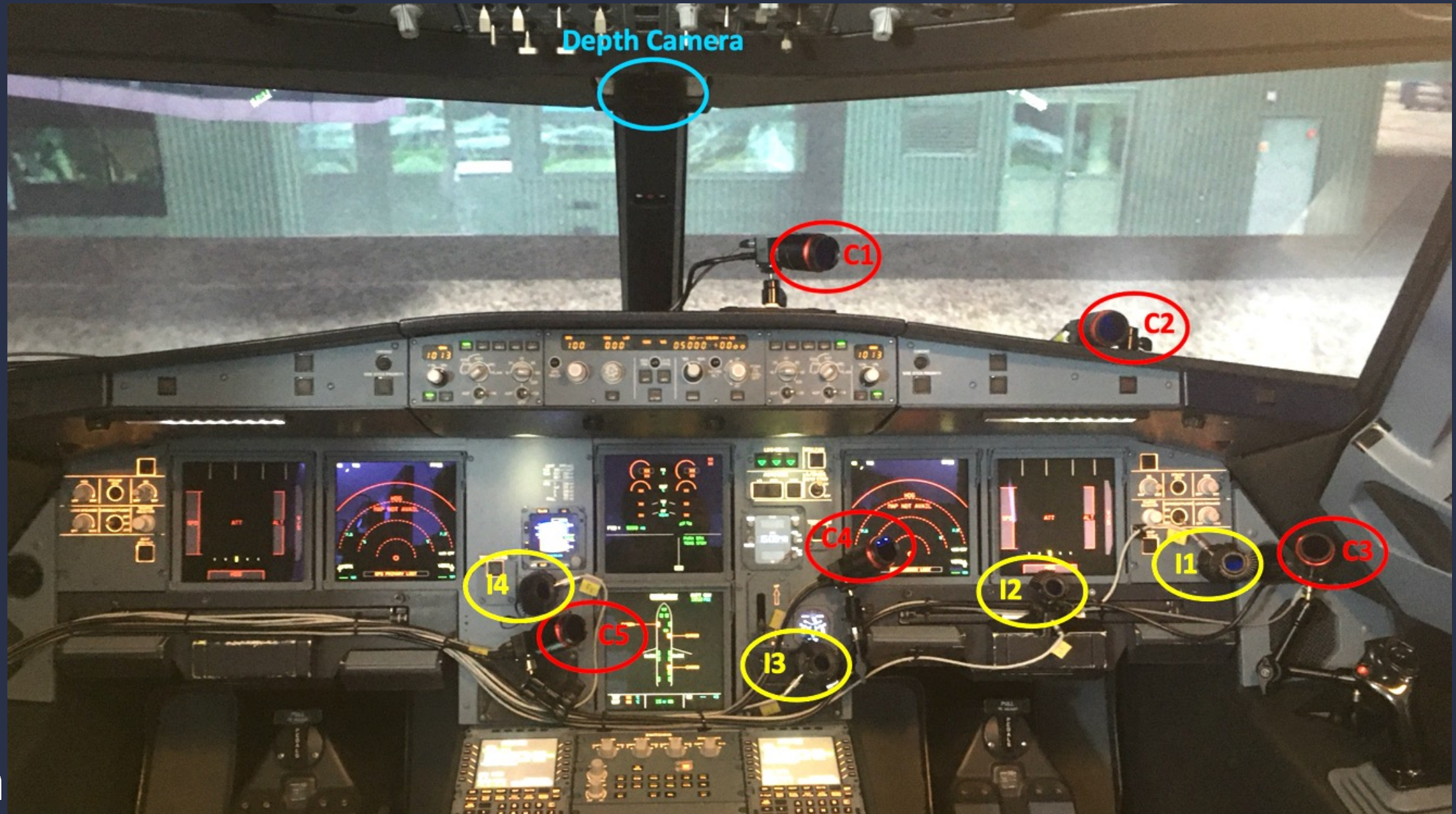


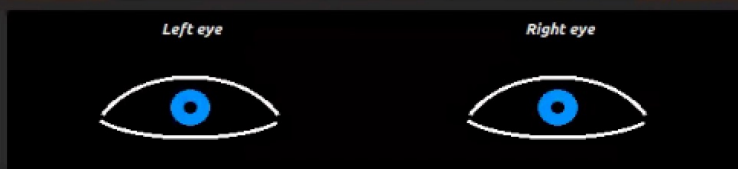
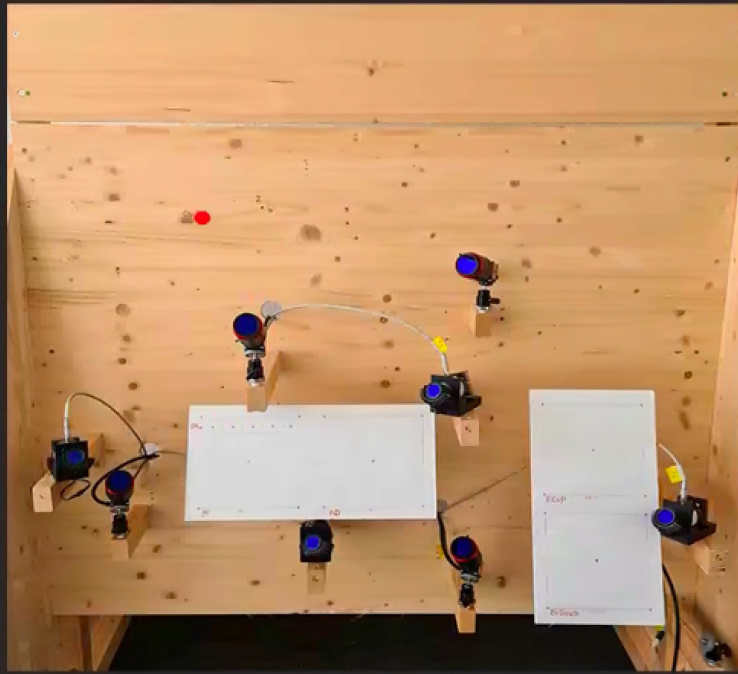
Eye Gaze Detection at 60 fps

- Instruments located at 75-110 cm from the pilots' eyes

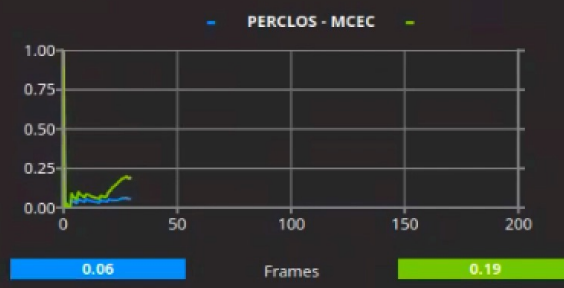
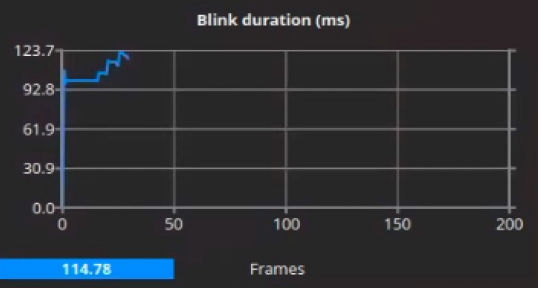


PEGGASUS System Installed in the Cockpit Simulator





	Blink rate		Focus distance		Head distance
	40.53		88.78		66.59



C2

40.00

OW 1



Attentive



Awake





Highlights

- The system was evaluated in a flight simulator study with 10 professional airline pilots
- The pilots rated the PEGGASUS vision system better than a mobile eye-tracker in terms of comfort and low distraction



Future Work

Pilot training use cases



Other applications



Thank you!

And thanks to the CSEM team and the partners.

Engin Türetken, Sareh Saeedi, Siavash Bigdeli, Patrick Stadelmann, Nicolas Cantale, Luis Lutnyk, Martin Raubal L. Andrea Dunbar

[Pegasus](#)

Andrea.Dunbar@csem.ch

