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# gfu Insights & Trends

11. Juli 2017

Welcome / Willkommen



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# **Forschung für neue Ansichten – Virtuelle Realität von der Wissenschaft zur Praxis**

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Fraunhofer Heinrich-Hertz-Institut

# We Are in the Middle of a VR Hype!

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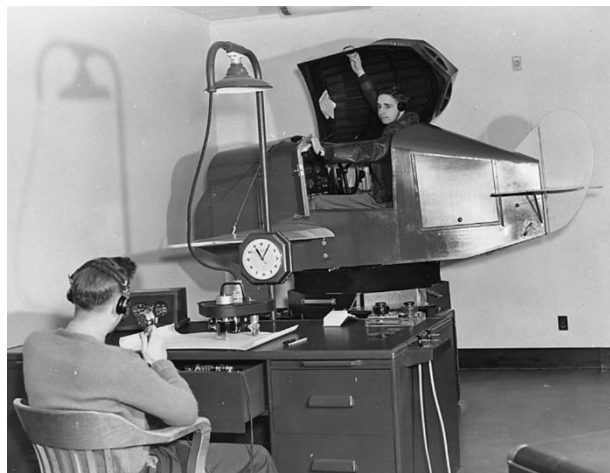


Why ?



# Virtual Reality is Not New!

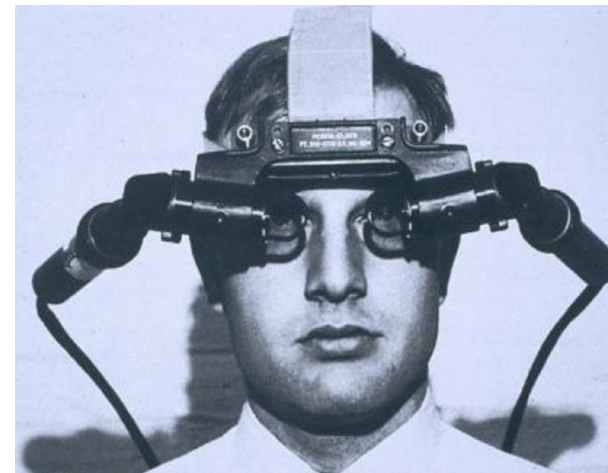
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Link Trainer, 1929



Senorama, 1950



Sword of Damocles, 1968

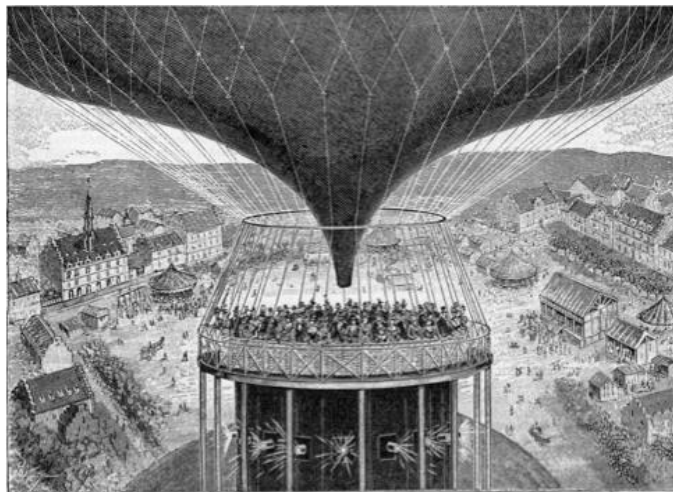


# Even 360 Degree Video is Not New!

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Cineorama, 1897, Cameras & Projection



Circarama, 1967



# But, ...

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Suitable and affordable technology for the mass market is available now!

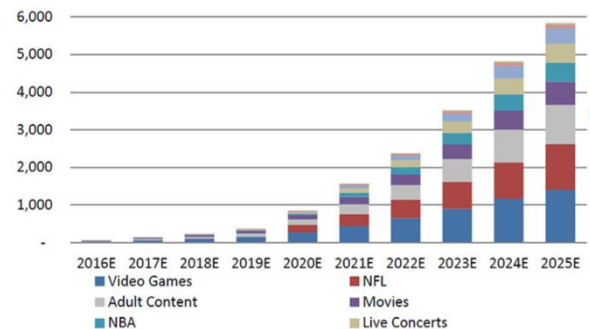


**Huge Market:** Each smart phone is a potential VR device!



# Promising Market Forecasts

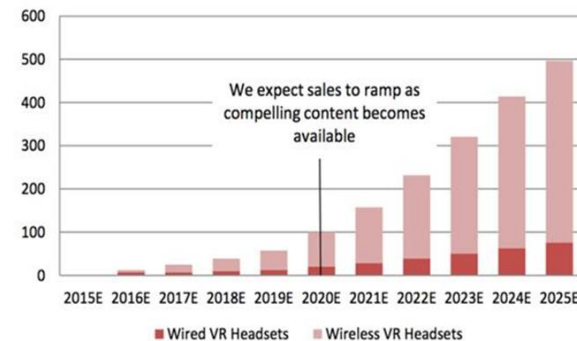
VIRTUAL REALITY REVENUE BY INDUSTRY  
(In Millions)



Live 36% revenue in '25

Source : Piper Jaffray, October '15

VIRTUAL REALITY HEADSET SALES  
(In Millions)



We expect sales to ramp up as compelling content becomes available

Source: Piper Jaffray estimates

Google Cardboard

Samsung Gear + Galaxy Smartphone

Sony PlayStation®VR

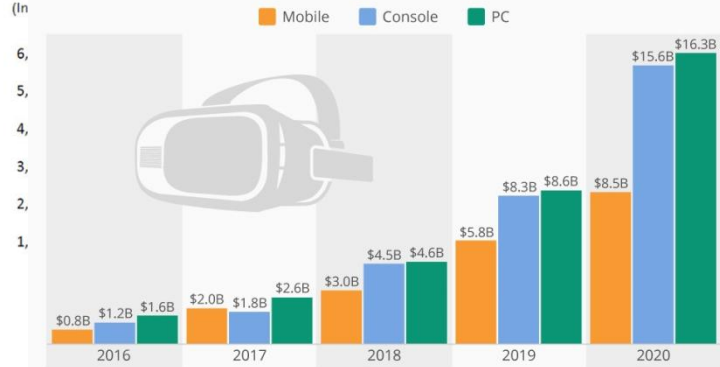
Facebook's Oculus Rift

- High investments in VR market (e.g. 2B US\$ from Facebook to Oculus)
- 2016 is considered as year zero for market penetration
- 2020 might be the ramp-up point for world-wide investments
- Market forecasts depend on client platform (mobile, console, PC)



# Promising Market Forecasts

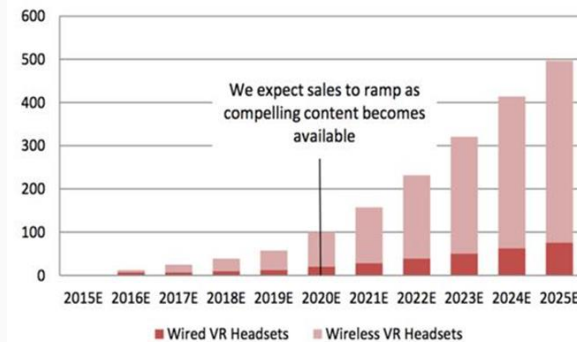
Forecasted market size of virtual reality hardware and software from 2016 to 2020, by platform



Source: @StatistaCharts Source: Superdata via VRFocus



VIRTUAL REALITY HEADSET SALES (In Millions)



Source: Piper Jaffray estimates

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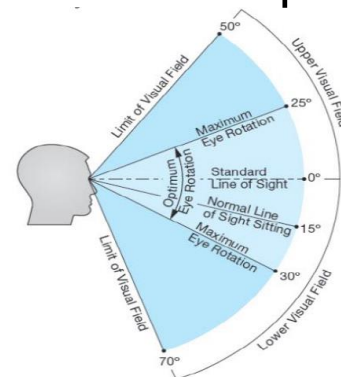
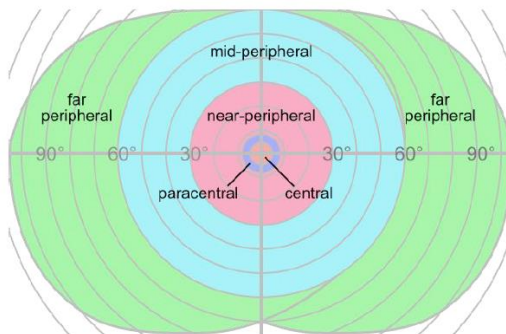
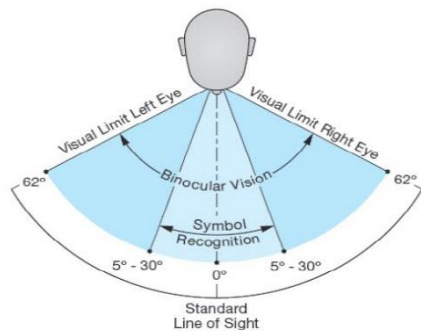


# Why does VR (still) look so bad?

## Required Resolution for 360° Sphere

- acuity of human eye: 1 arc min  $\Rightarrow$  60 pixels are needed for 1 degree
- Sphere: 360 x 180 degrees  $\Rightarrow$  **22k x 11k pixels** for 360° video panorama
- displayed FOV: 120 degrees  $\Rightarrow$  **8k resolution per eye** for headset display

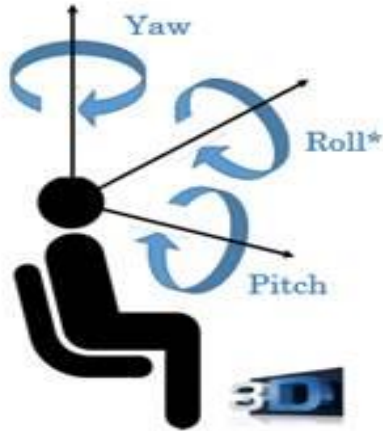
Today's headsets have **1k – 2k** per eye !!!



# Two Main Categories in the VR Market

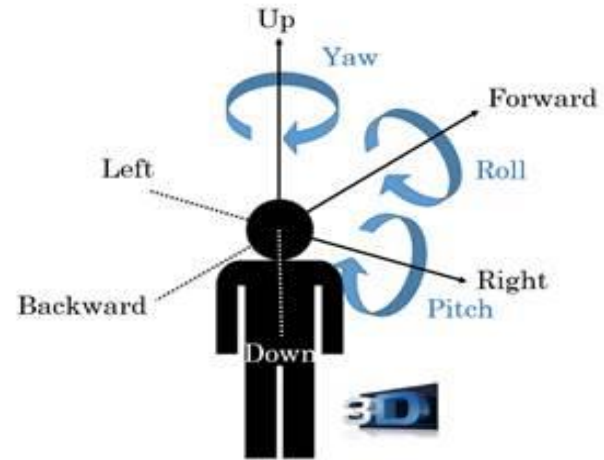


## 3 Degrees of Freedom



- Viewer sits/stands at a fixed point
- 360° video
- transport: basic streaming

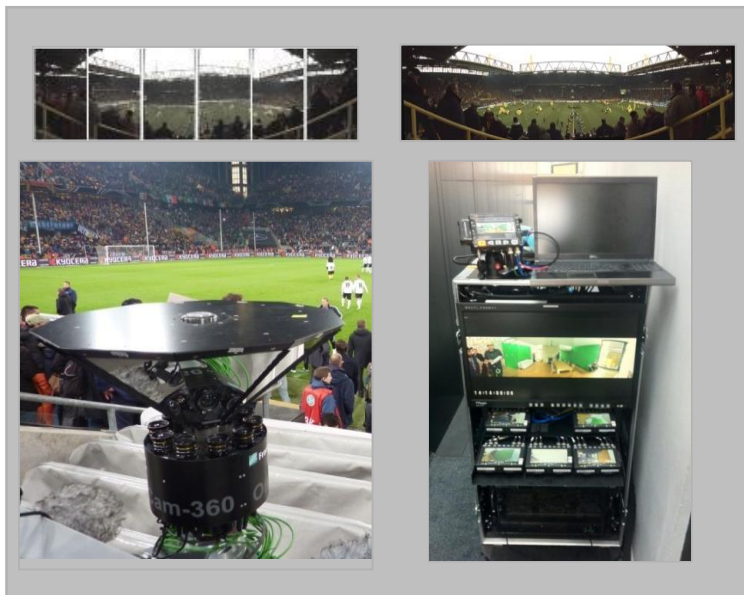
## 6 Degrees of Freedom



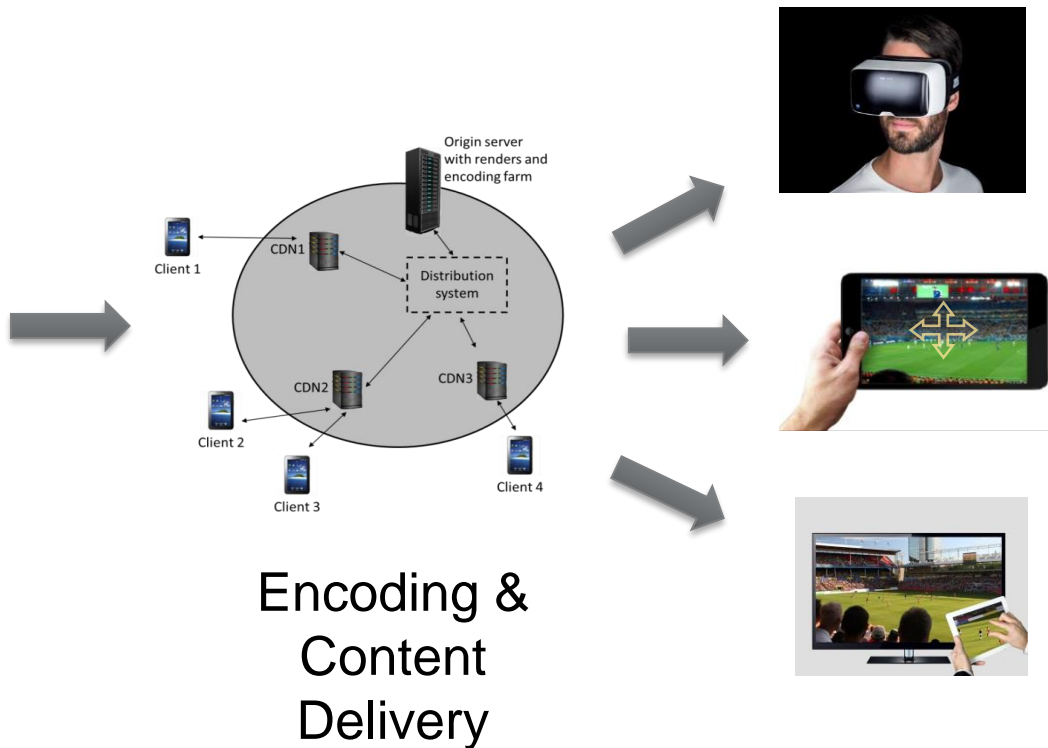
- Viewer can freely walk around
- 6DoF 360° video
- rendering: 6DoF video + 3D graphics



# Processing Chain of 360° Video



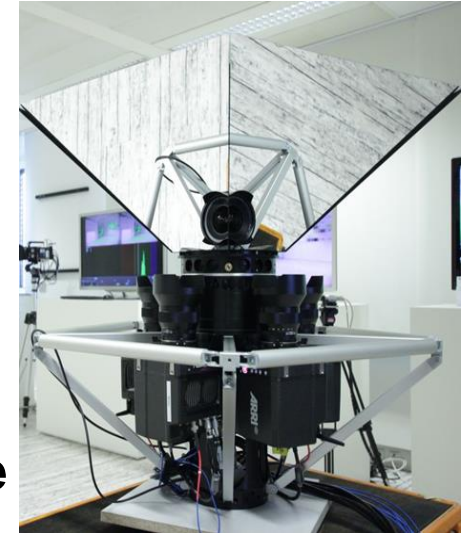
Omni-Directional Camera & Related Stitching



# Five Generations of OmniCam by HHI



**360°+  
top sphere**



## 3rd generation (2013)

- 10 HD Cams (15 kg)
- 1.920 x 10.000 pixel

## 4th generation (2017)

- 10+1 HD Cams (8 kg)
- 10.000 x 2.500 pixel

## 5th generation (2017)

- 5+1 Alexa Mini
- 14.000 x 3.000 pixel

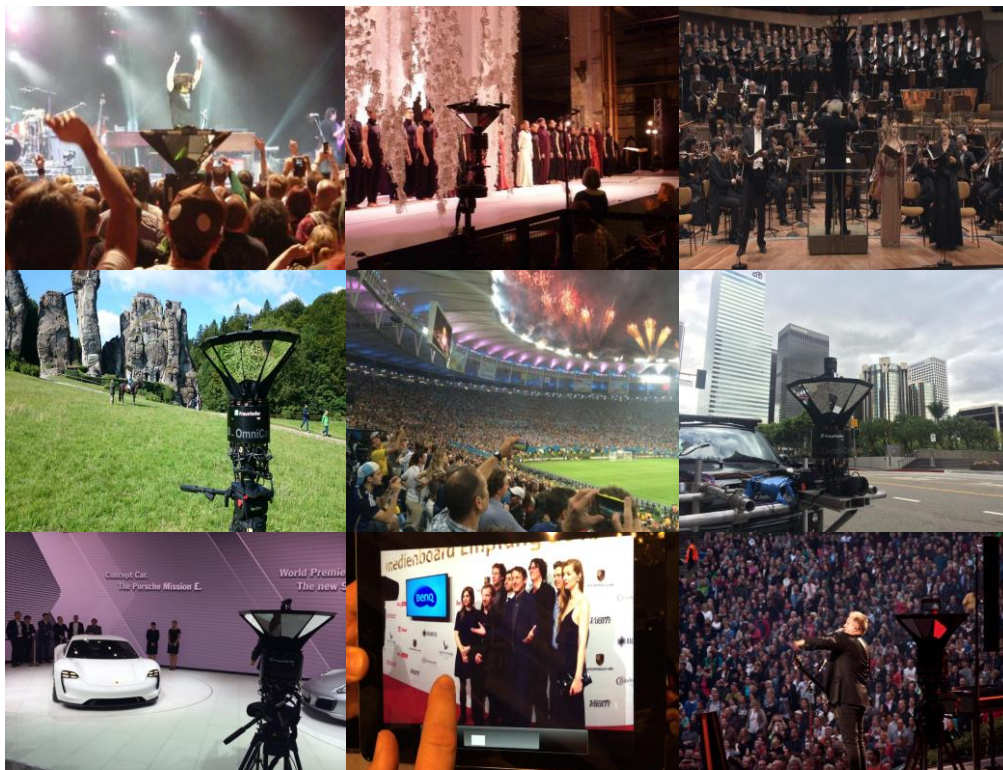
# Example for Omnicam-360 Production





# Recent Omnicam-360 Productions

- Counting Crows Concert, London, 2013
- XGames, ESPN, München, 2013
- Bon Jovi Concert, Brisbane, 2013
- FIFA World Cup Final, Rio, 2014
- Berlin Philharmonics, Anniversary Concert, 2014
- Berlin Philharmonics, Mauerfall Konzert, 2014
- MirrorSys Teaser Film, Berlin, 2015
- Lärmcafe, Deutsche Bahn, 2015
- Herbert Grönemeyer, Berlin, 2015
- Lover, Rundfunkchor, Berlin, 2015
- Human Requiem, Rundfunkchor, 2015
- State Parliament Visitor Center, Düsseldorf 2015
- Berlinale Reception Party, Berlin, 2015
- Porsche Press Conference, IAA, 2015
- BMW Commercial, Los Angeles, 2015
- Helicopter Flight, Los Angeles, 2015
- Mittendrin, Konzerthaus Berlin, 2015
- Berlin Philharmonics, Mahler Symphonie No. 6, 2016





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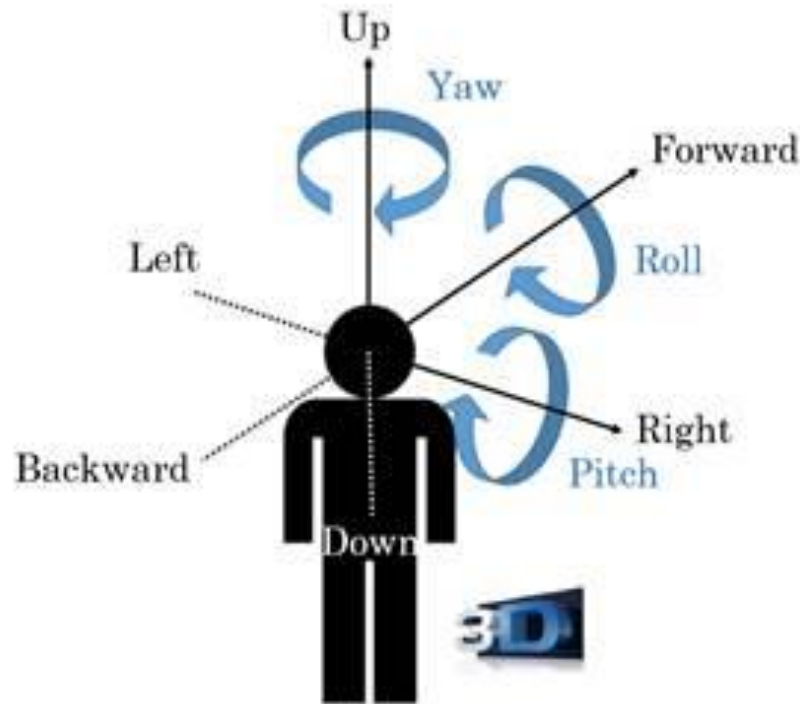
# 6DoF VR with Interaction

## ❑ Interaction possibilities

- Position and orientation in 3D space
- Touching objects

## ❑ Interaction devices

- different input devices already available







# Interaction in VR - Examples

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Interaction  
in  
Virtual Reality



# Overview of VR-Input Devices

## Wearable Controller Devices



*HTC Vive*



*Oculus Touch*

*5DT Glove*

Wearable  
Data  
Gloves



Wearable  
Full Body  
Suits



*PrioVR*

Non-intrusive Hand &  
Body Tracking



*Kinect 2*

*Leap Motion*



Gaze Trackers



VR Treadmills



*Cyberith Virtualizer*



# Volumetric Video

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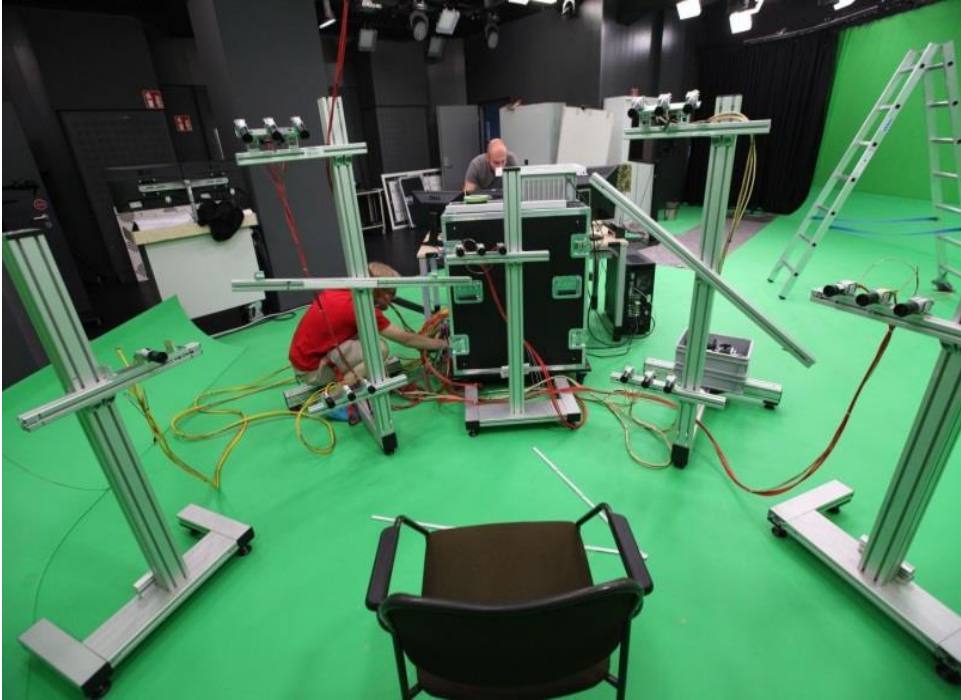
- The advantage of computer generated virtual environments is, that a free navigation is possible in such environments.
- However, computer generated persons (still) look unnatural
- Therefore the generation of 3D models of real persons is an interesting option
- These 3D models can than be integrated in the virtual environments and be used for VR and AR application



# Capturing of Persons for VR



Principle



Real setup @ HHI with 23 cameras



# Capturing of Persons for VR



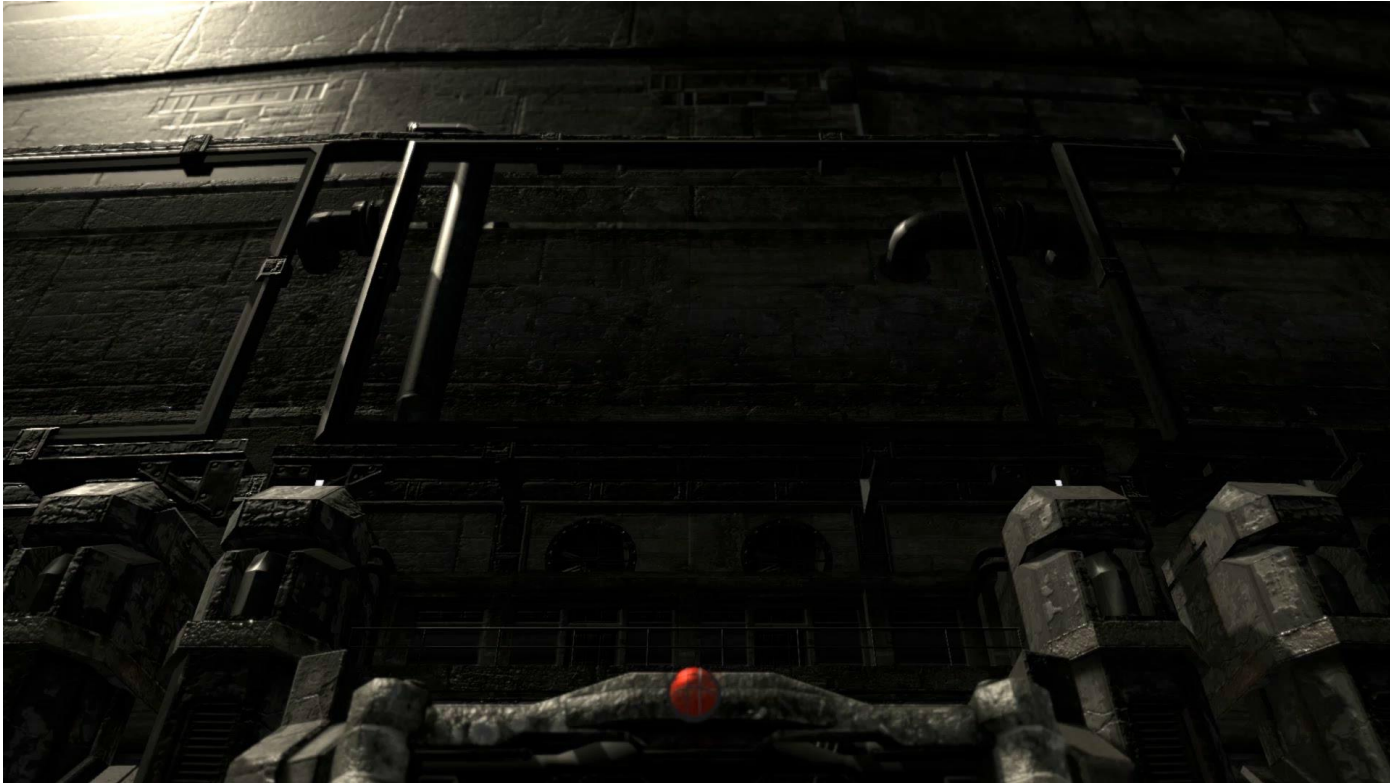
Principle



shooting volumetric video of an actor

# UFA/HHI Production: Gateway to Infinity

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# Thank you

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## WE PUT SCIENCE INTO ACTION.

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