



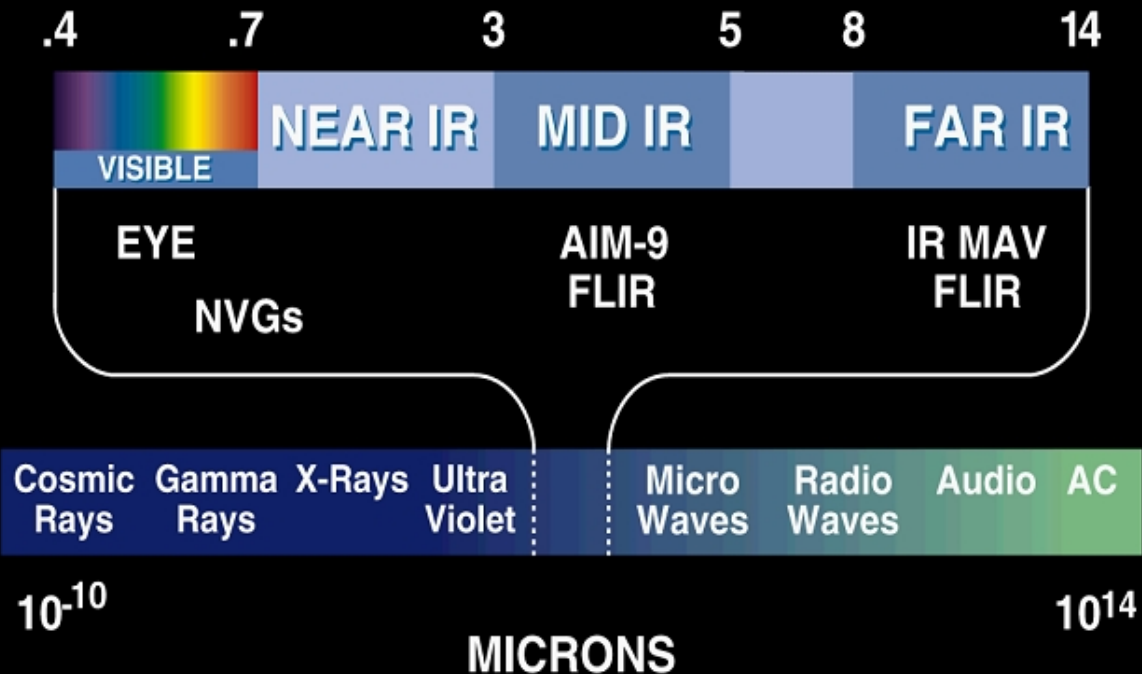
# Nachtsicht heute und morgen



- NVG analog und digital
- Sensor Fusion
- Simulierter Realflug

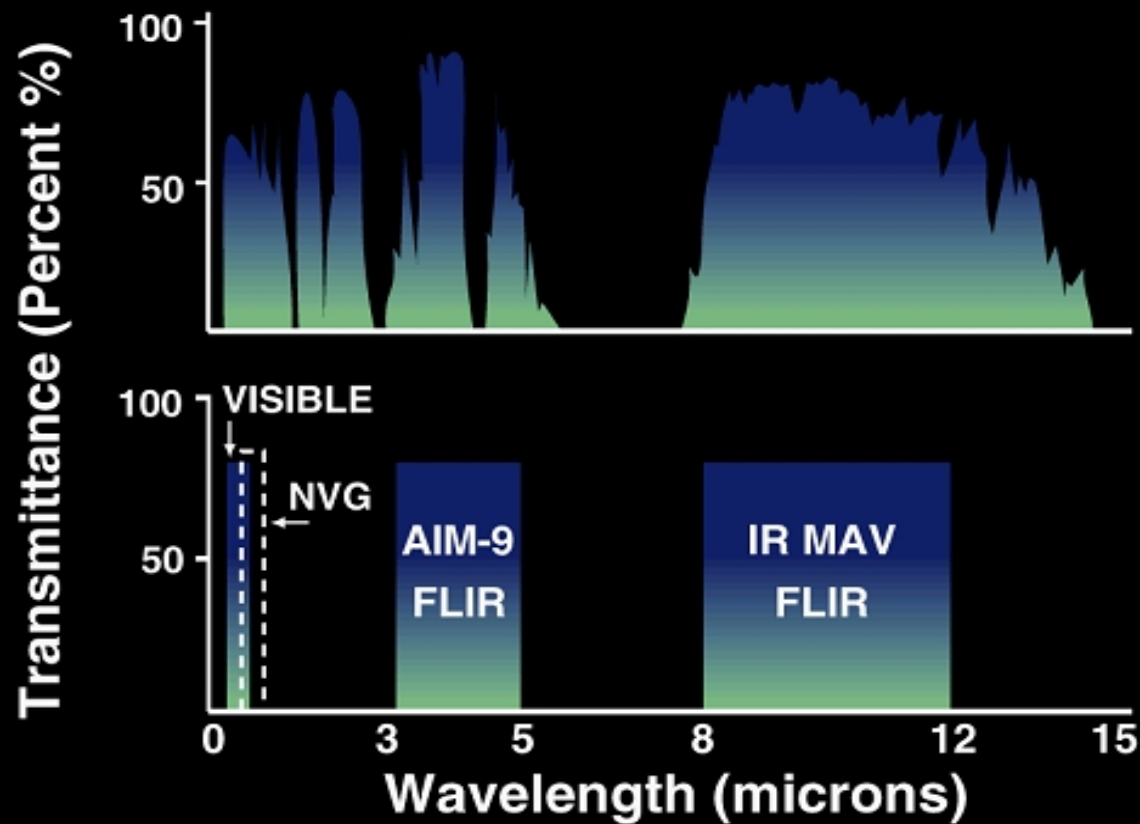


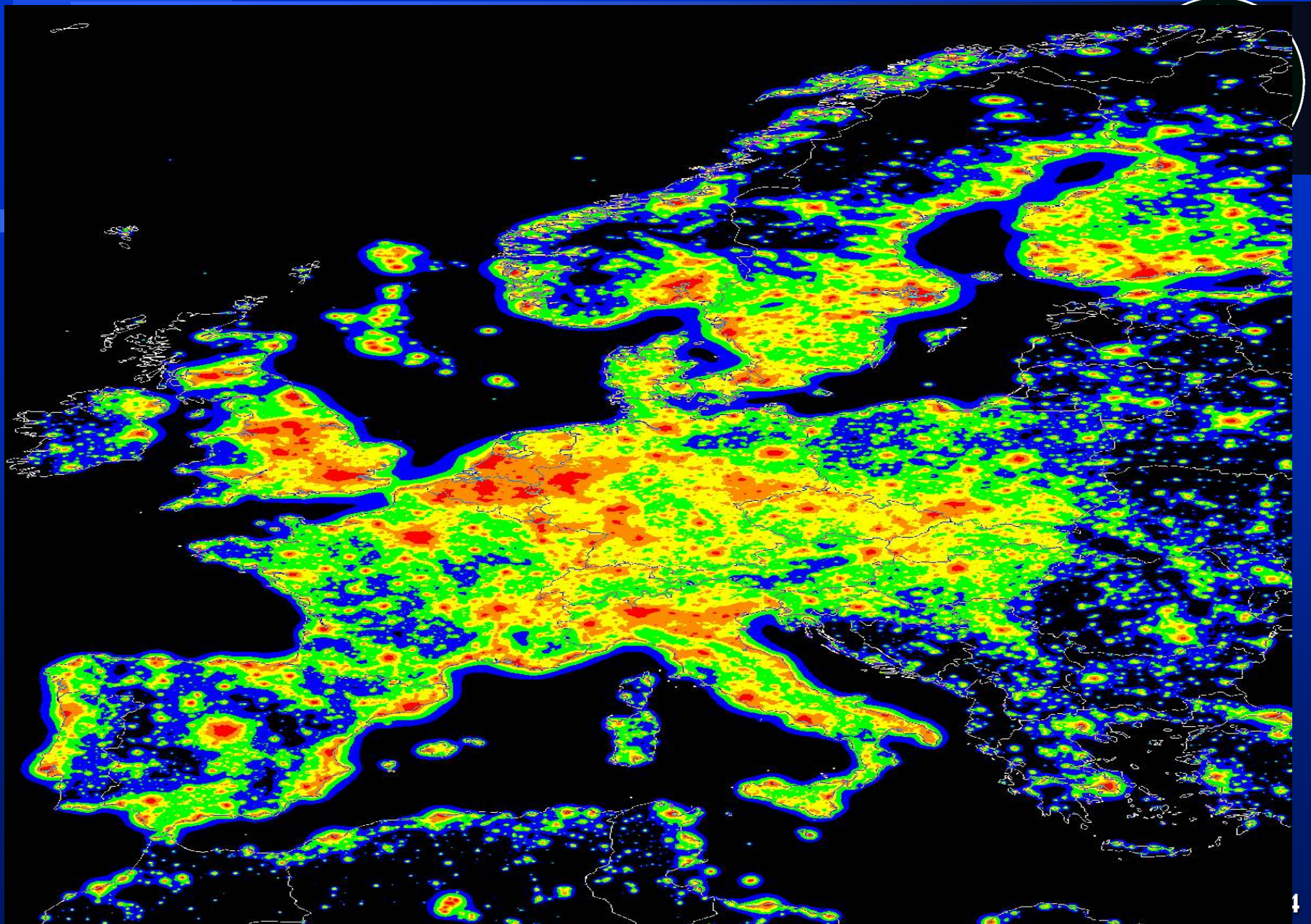
# Elektromagnetisches Spektrum





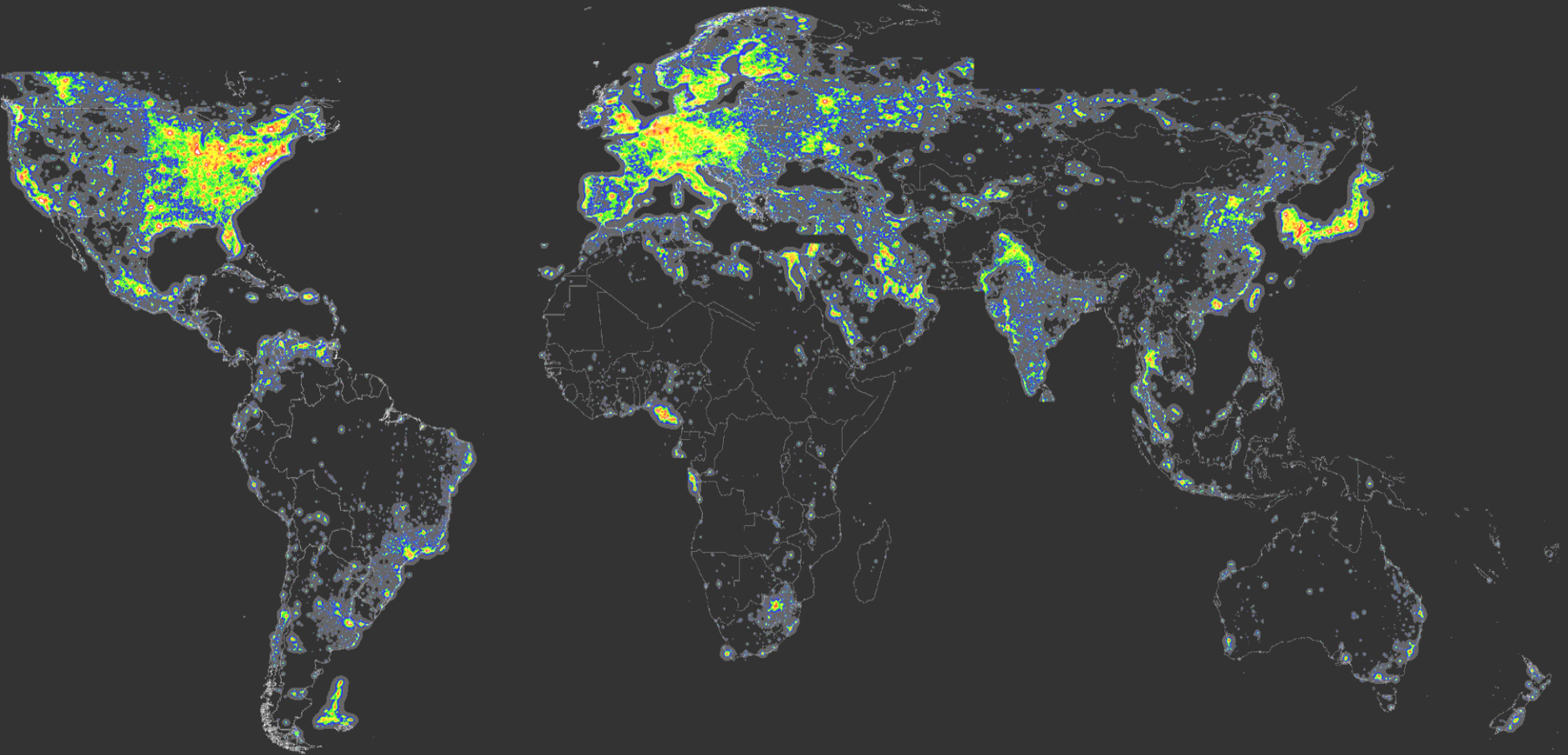
# Durchlässigkeit der Atmosphäre Transmission





Credit: P. Cinzano, F. Falchi (University of Padova), C. D. Elvidge (NOAA National Geophysical Data Center, Boulder).  
Copyright Royal Astronomical Society. Reproduced from the Monthly Notices of the RAS by permission of Blackwell Science.







# Prinzip der Restlichtverstärkung

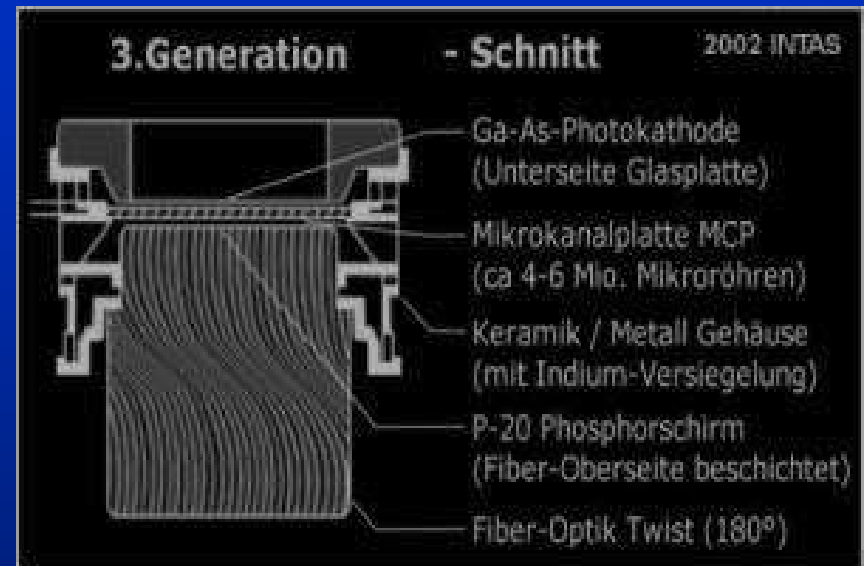


BEVOR ES NACHTSICHTGERÄTE GAB



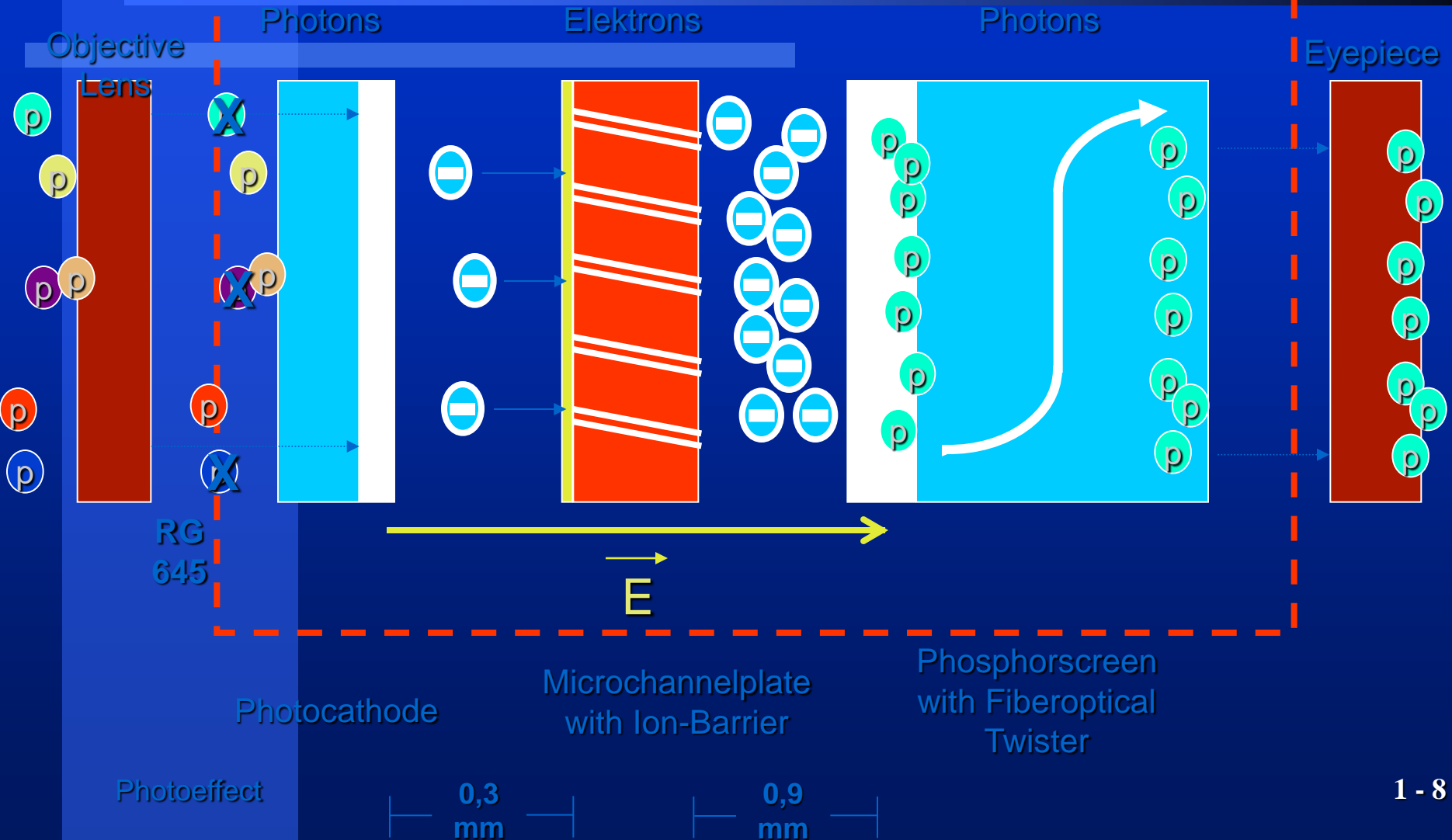
## 3. Generation

- **Gallium-Arsenid Photokathode (GaAs)**
- **Mikrokanalplatte MCP**, 6-12 Mio. Mikrokanäle
- **P-43 Phosphorschirm**, (ältere Röhren mit P-20)





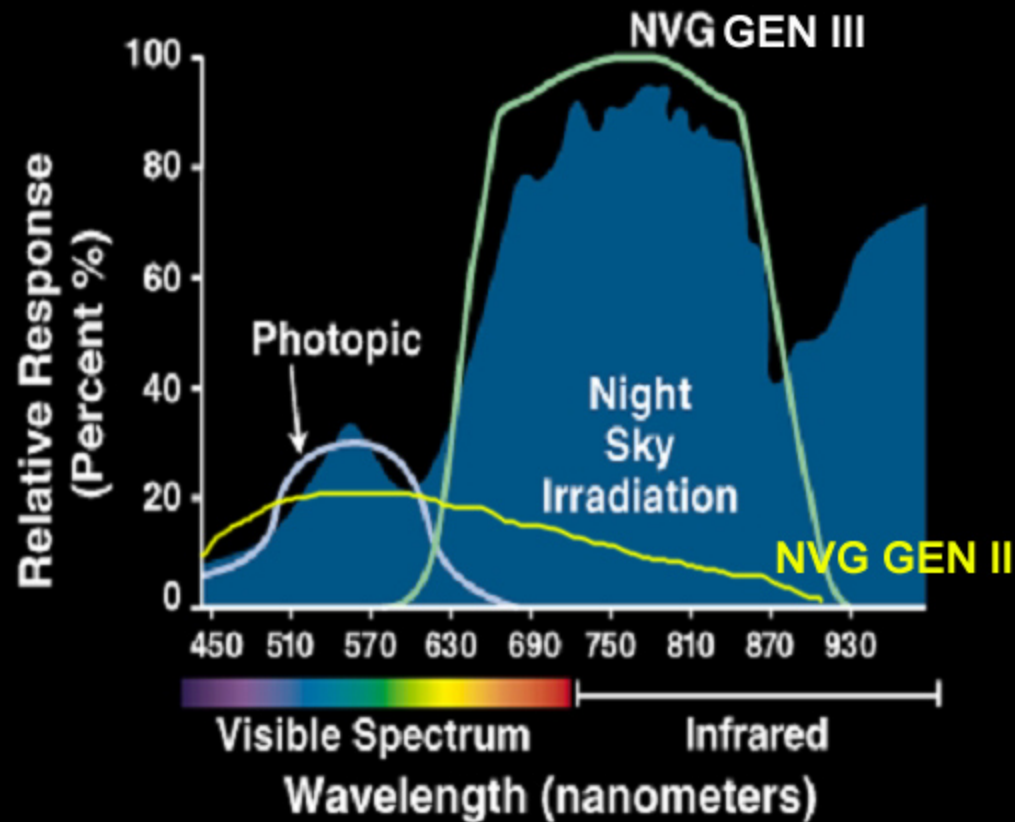
# Working Principles of the Light Amplifier Tube





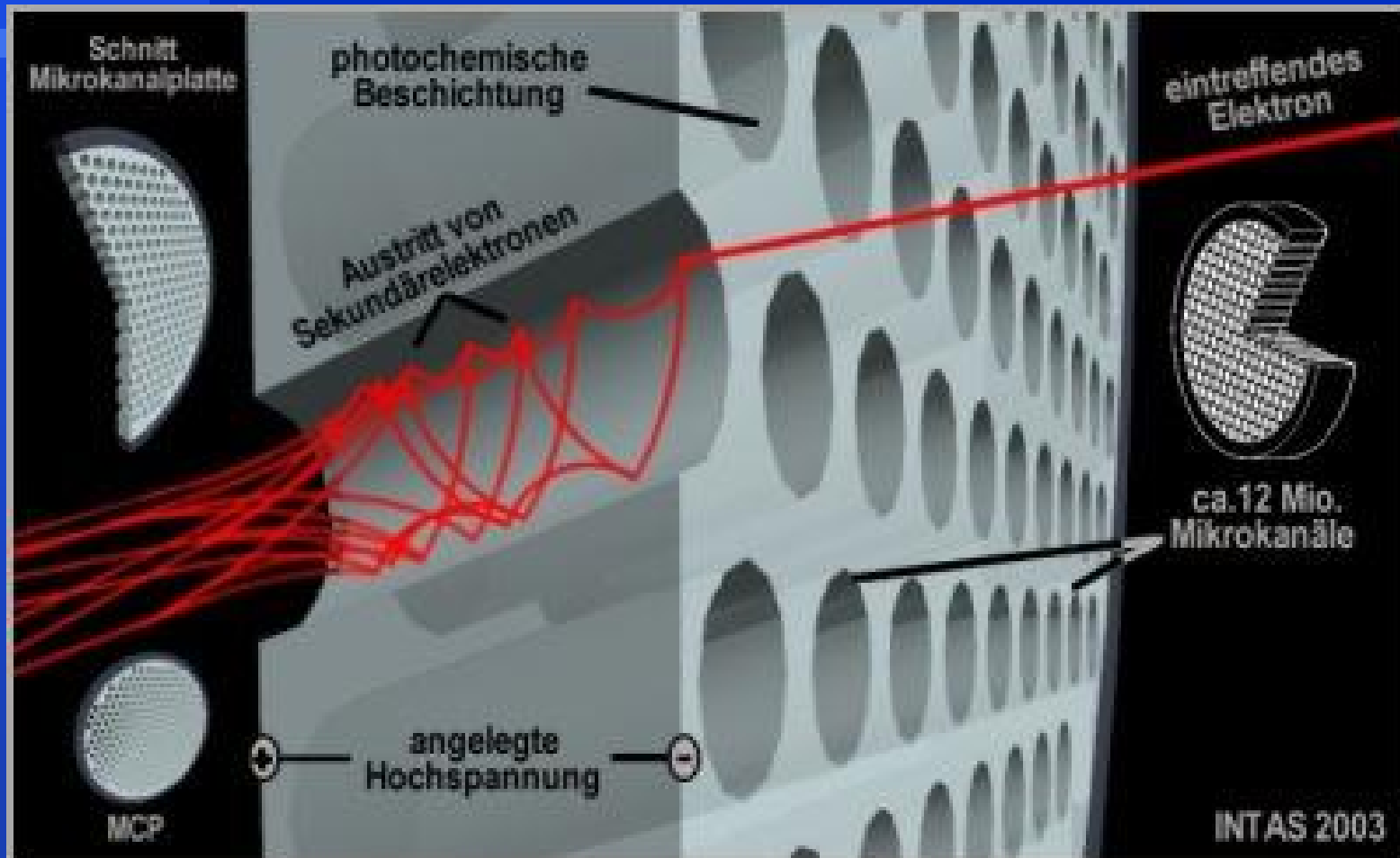


# Prinzip der Restlichtverstärkung



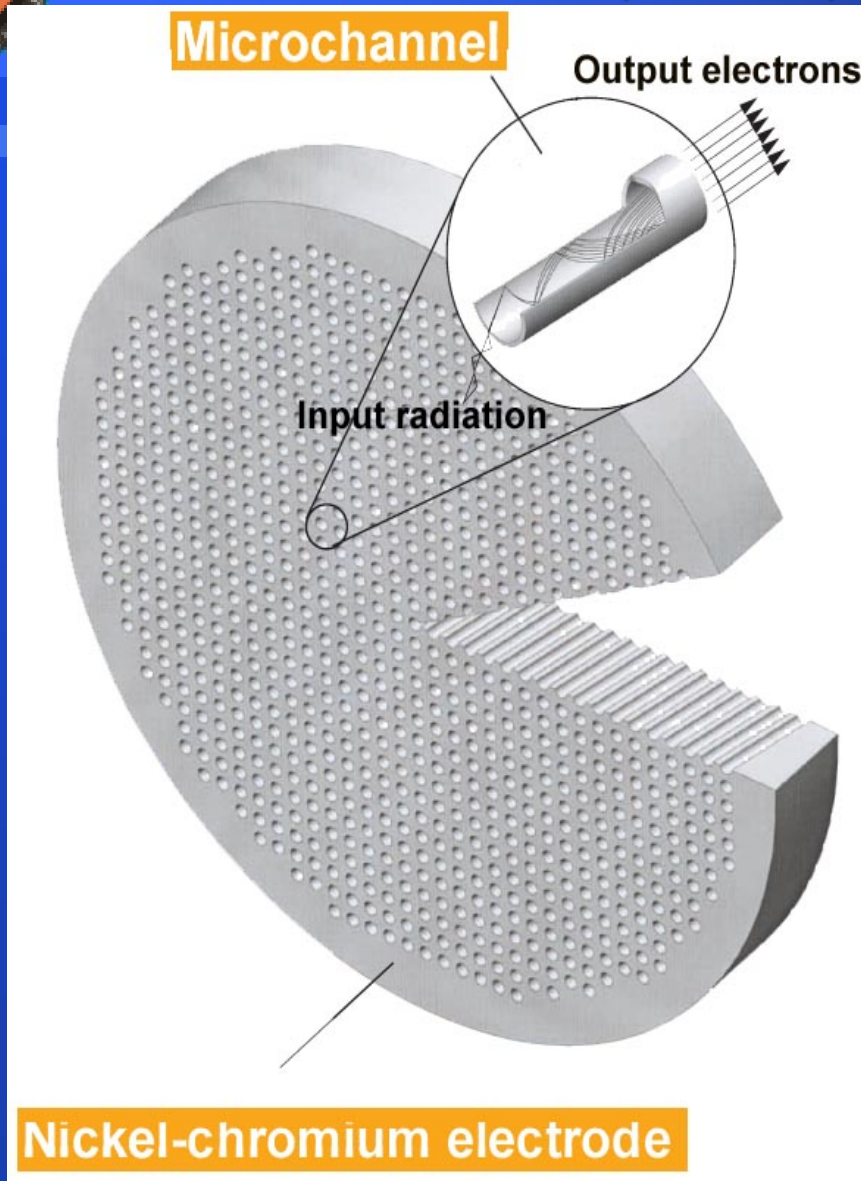


# Prinzip der Restlichtverstärkung





# Micro Channel Plate (MCP)



**Chanal diameter:**

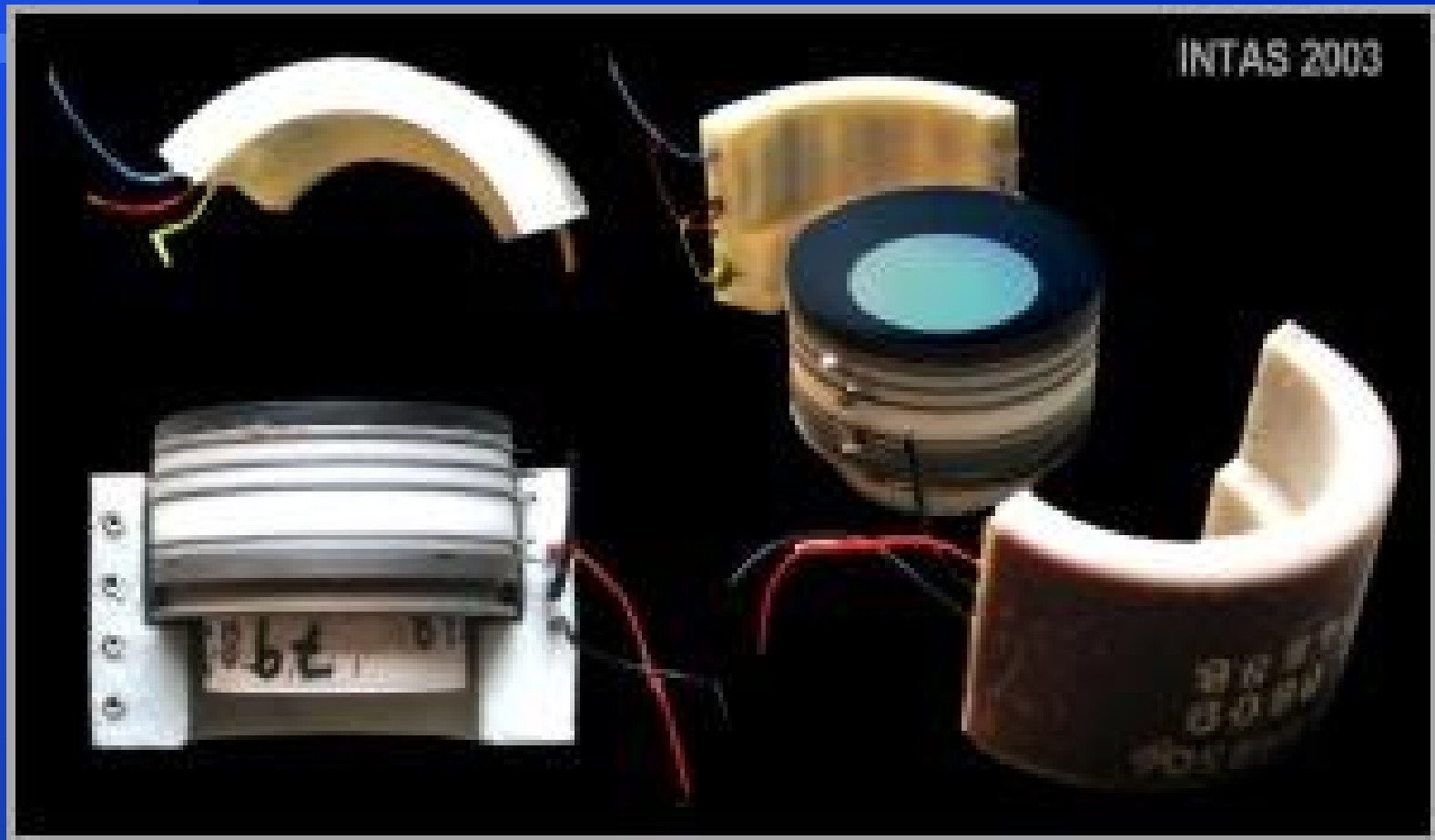
**4 bis 12  $\mu\text{m}$**

**Effective surface of  
the MCP:**

**ca. 80 bis 85%**



# Prinzip der Restlichtverstärkung







# System Design





# LOW Signal Noise Ratio







SNR 7:1

SNR 21:1

1 - 15



# Comparison of EBI



● Low EBI



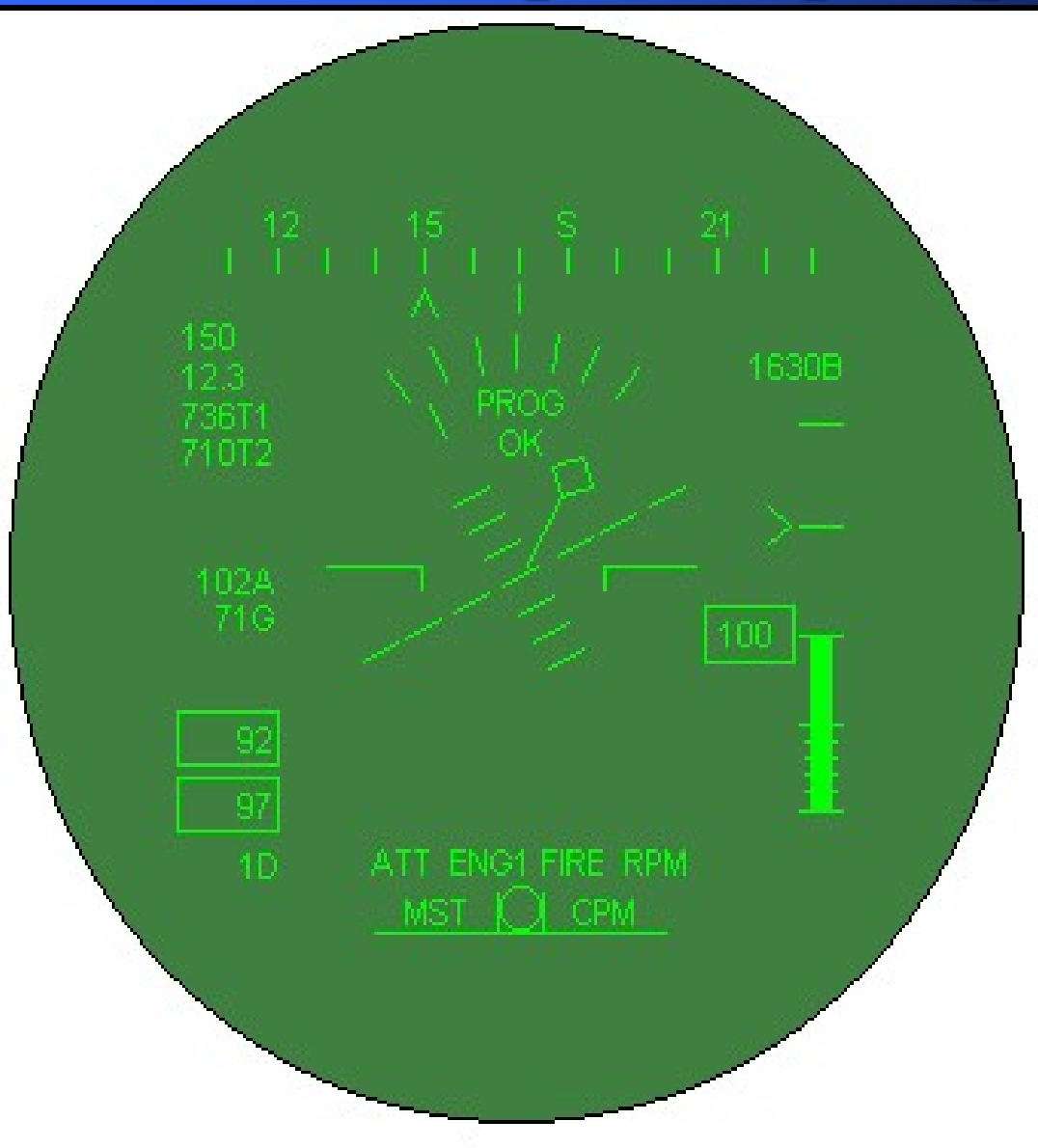
High EBI





# AN/AVS-6/9

## Heads-up-Display



# HMD





# HMD



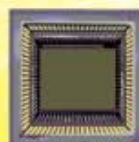
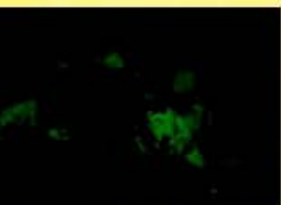




# ICMOS™



Image intensifier



CMOS  
camera-on-a-chip  
1.3M pixels



Real time  
Read out  
&  
processing



Digital  
output





# Digital Sensor Fusion

## State-of-the-Art EOS 16mm I<sup>2</sup> Sensor



Image Courtesy of  
Lawrence Livermore National  
Laboratory

- Available LIGHT
- Micro Format
- High Resolution
- "Halo Free" I<sup>2</sup>



## State-of-the-Art Uncooled IR Sensor

- HEAT Imaging
- Smoke Penetration
- Long Range

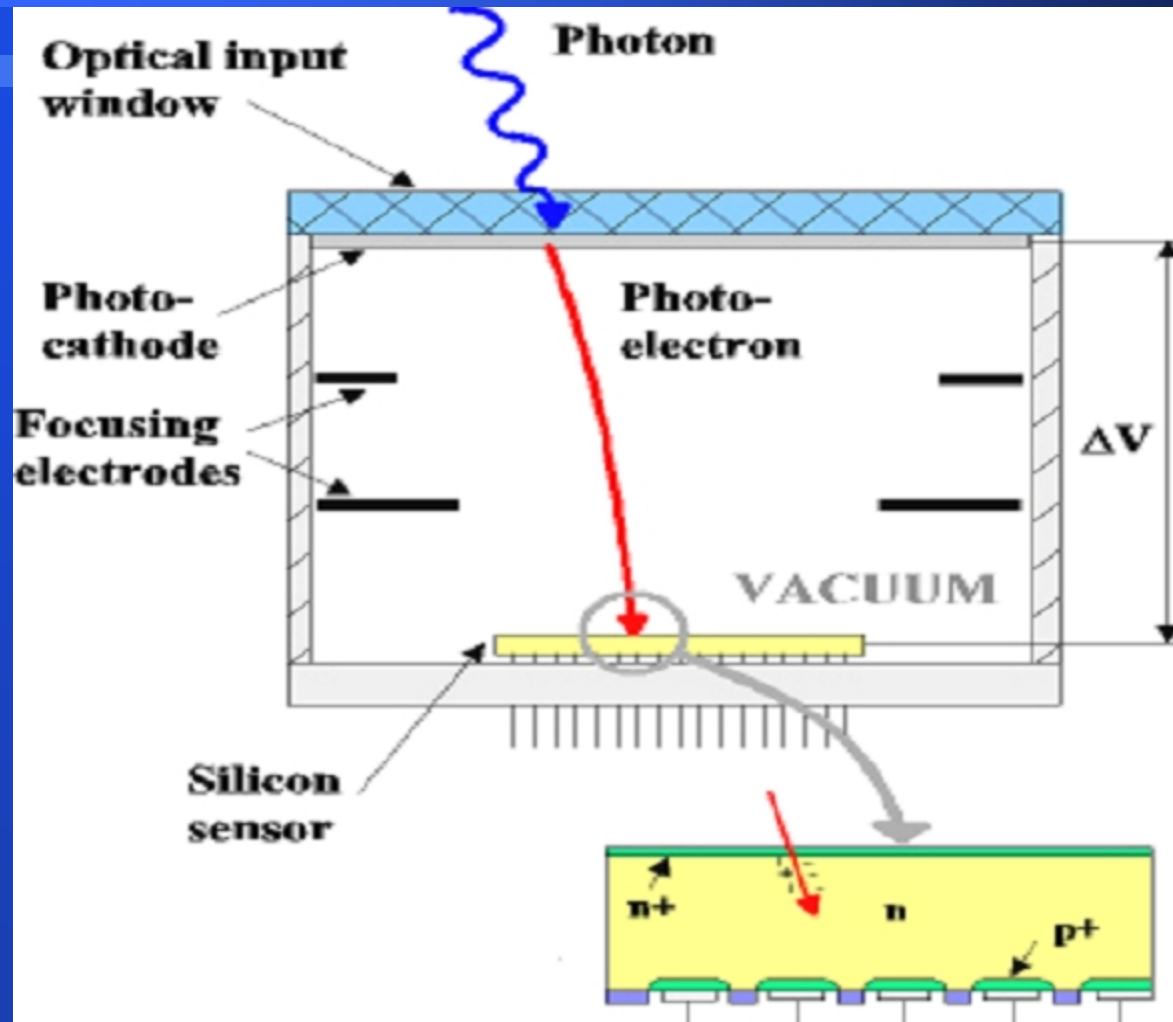
## DIGITAL IMAGE FUSION



**"FUTURE OF NIGHT AND  
ENHANCED VISION  
PRODUCTS"**



# Ausblick

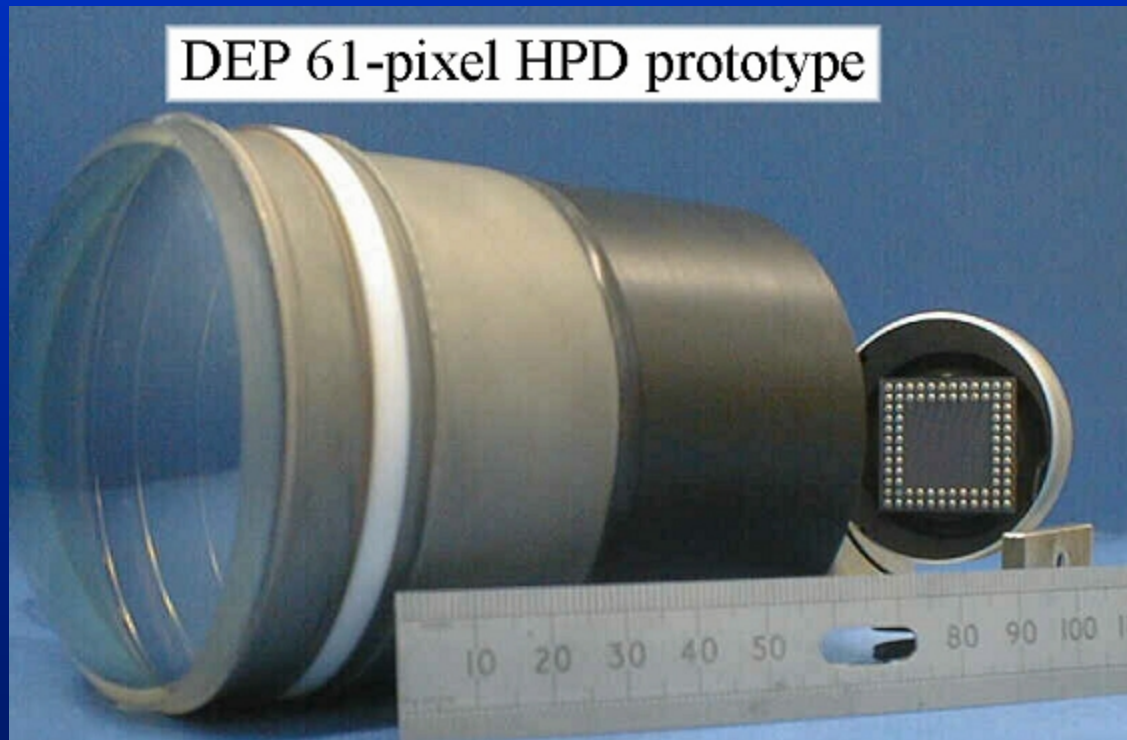




# Ausblick



DEP 61-pixel HPD prototype





# Ausblick



**SWIR**



**VISIBLE**





# Ausblick



## Long range surveillance with SWIR imaging



SWIR



Visual



Camera: Bobcat-640



# Ausblick



8-12  $\mu\text{m}$



0.9-1.7  $\mu\text{m}$





# Ausblick



## Sicht nach innen

Instrumente  
Navigation  
Hindernisse  
Fluglage

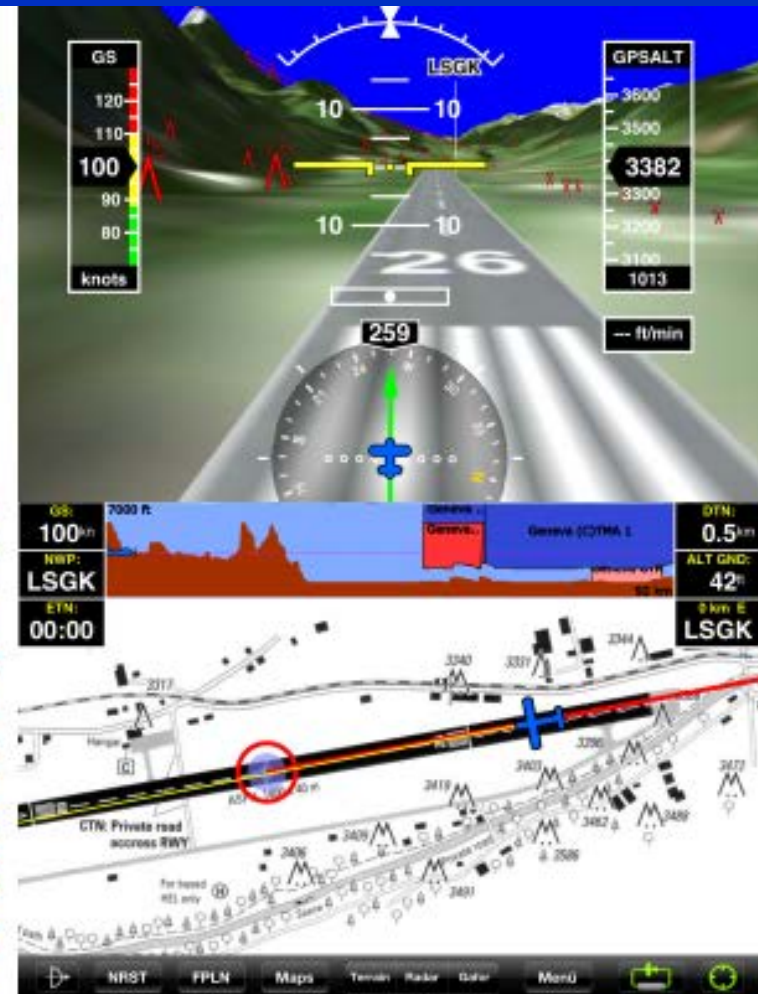
## Sicht nach draußen

Fluglage  
Navigation  
Hindernisse  
Wetter

ZIELOBJEKT  
Umfeld



# Ausblick







# Ausblick



