



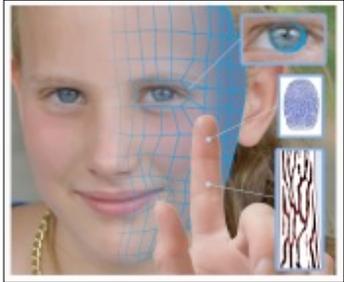
Federal Office  
for Information Security

# New Developments in Biometric Security Testing and Certification @ BSI

IFPC 2018 @NIST, Nov. 28th, 2018

Ralph Breithaupt BSI, Department D14 „New Technologies“

# 1. Testing of Biometric Systems for Smart Borders: BEC



- We can only trust biometric systems as far as we test them
- **“know your algorithm”** is a basic necessity...  
... but often not sufficient!
- The higher the potential risk the more it is important to **“know your system”**  
(algorithm, sensors, MM-interfaces, processes, people,...)
- In the context of the national implementation of the EU-Smart Borders initiative, the German government decided to found its own testing facility, the:



**Biometric Evaluation Center (BEC)**

# 1. Testing of Biometric Systems for Smart Borders: BEC



Bundespolizei

**BEC**

**Biometric Evaluation Center**



Hochschule  
Bonn-Rhein-Sieg  
University of Applied Sciences

- The Biometric Evaluation Center is a cooperation project of:
  - Federal Police (BPol)
  - Federal Office for Information Security (BSI)
  - University (AS) Bonn-Rhein-Sieg (HBRS)
  
- Its core task is the evaluation of biometric systems:
  - **Biometric Performance**
  - **Vulnerability**
  - **Usability**
  
- Initial focus:  
border control-systems (egates, kiosks, manual control...)

# 1. Testing of Biometric Systems for Smart Borders: BEC



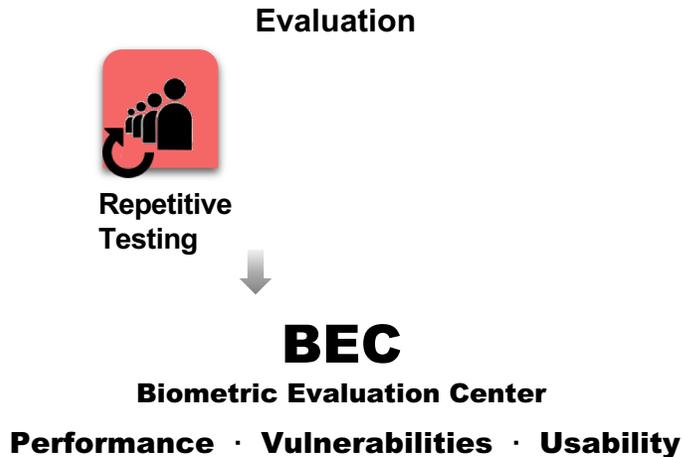
**BEC**

**Biometric Evaluation Center**

- The BEC is located on the campus of HBRS
- 1st floor: ~400m<sup>2</sup>, 2x offices, 2x secure testing rooms, 4x universal labs, 1x training/conference room
- Modification with additional security measures (steel reinforced walls, alarm systems, cameras, access control) and environment control features (esp. light)
- 3-5 BSI employees + 1-2 HBRS liaisons
- ~9000 students and ~1000 employees on campus (many students from China, India, Africa )
- Elderly home and big shopping mall nearby
- Close to Federal Police outpost, (fairly) close to BSI
- Close to 3 major international airports (Köln/Bonn, Düsseldorf, Frankfurt)



## 2. BEC: Core Tasks & Objectives:



- **Repetitive (long term) Testing:**
  - 100 – 150 permanent test subjects
  - 1 – 3 test sessions per person per week
  - for 1-3 years
  - Incentive: small fee per session + annual lottery

### *objectives:*

- Long term comparability
- Personal variation analysis (biometrics & PAD) (due to factors like: stress, short term aging, sleep deprivation, weather, etc...)
- Biometric/PAD threshold optimization
- Template enhancement (PAD sensors)

## 2. BEC: Core Tasks & Objectives:

Evaluation



Repetitive  
Testing

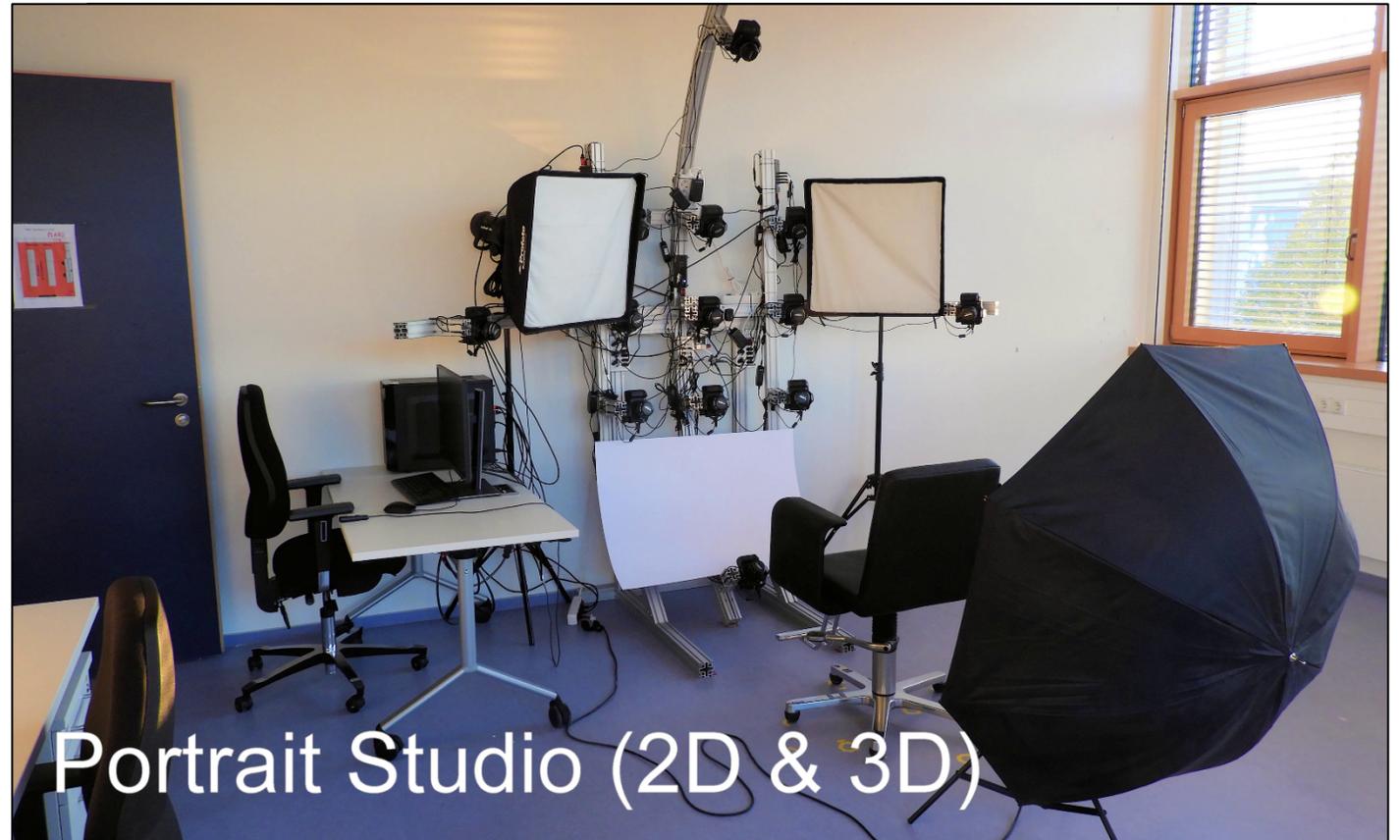


**BEC**

**Biometric Evaluation Center**

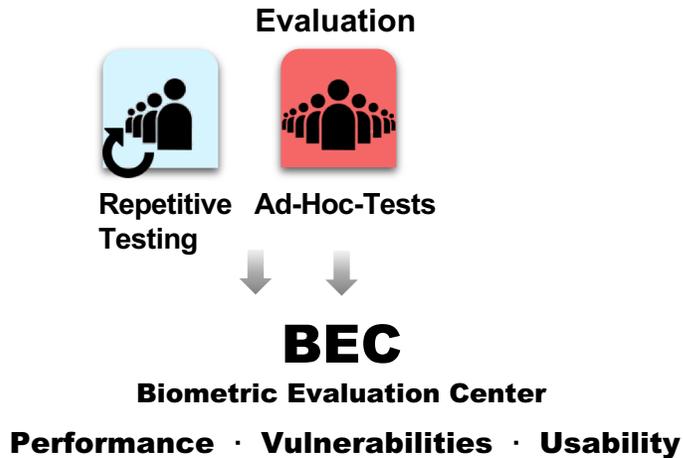
**Performance · Vulnerabilities · Usability**

- **Test Subject Enrollment in 2D & 3D:**
  - Portrait Studio with 13 (soon 21) synchr. Cameras
  - High quality 3D model reconstruction (PhotoScan)



Portrait Studio (2D & 3D)

## 2. BEC: Core Tasks & Objectives



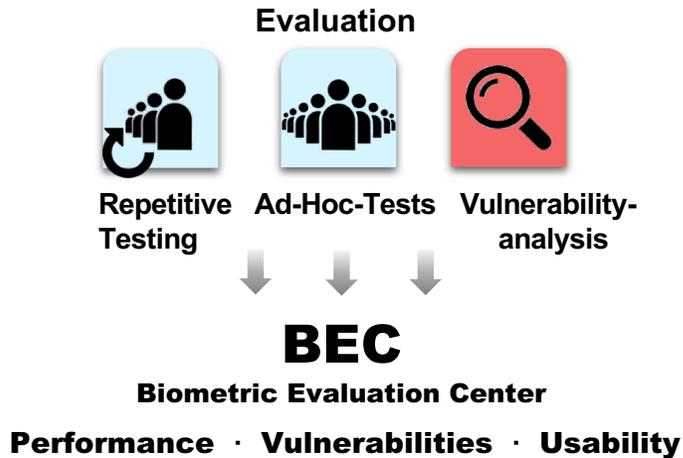
- **Ad-Hoc (one time) Tests:**

- 1000 – 3000 one time test subjects

***objectives:***

- Higher statistical significance
- Better demographic distribution
- Recruitment of new permanent test subjects

## 2. BEC: Core Tasks & Objectives



### ■ Vulnerability Analysis:

- Development of Attack-Tool-Boxes & data bases for each biometric modality (starting with face & finger)
- Continuous enhancements & improvements
- Continuous attack tests on biometric systems (black box & white box)
- Analysis of biological foundations & sensor tech.

### *objectives:*

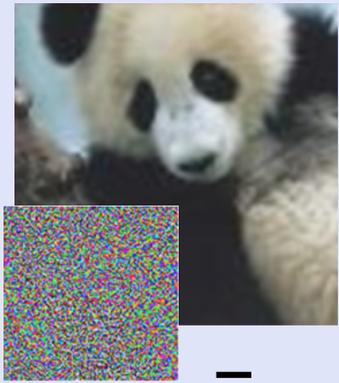
- State of the Art attack capabilities @ BEC
- Long term analysis (tester dependencies, artefact ageing, environmental influences, ...)

# 2. BEC: Core Tasks & Objectives: Vulnerability Analysis-Face

## Artifacts



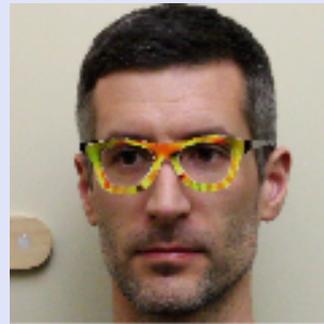
## Attacks on Deep Learning



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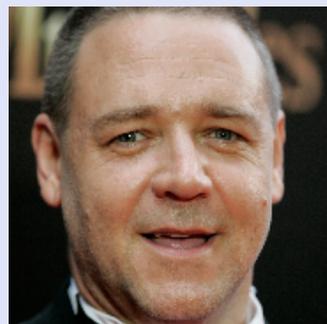
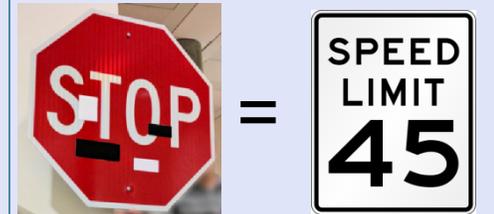
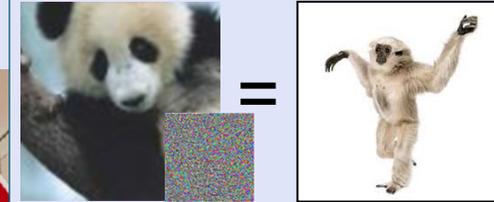


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## Attacks on Deep Learning



## 2. BEC: Core Tasks & Objectives: VA-Training with Experts



- Master Class with **Rob Burman**

(make up & special effects for: The Thing, Ghostbusters, The Fly, Tremors, Terminator 2, Waterworld, Star Trek, Flubber ... more than 300 movies & TV series, company: R. B. Sculpture Studio)

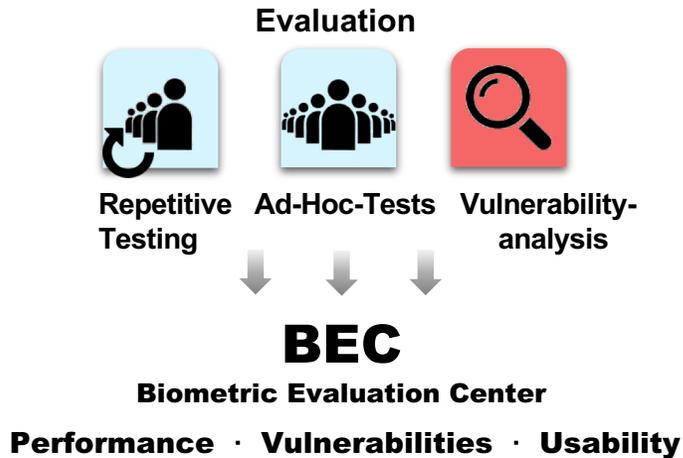


- Cooperation with „Akademie - Die Maske“ Cologne, (School for Make Up Artists)

- Cooperation with Make-Up-Manufacturers **Kryolan & KauPo**



## 2. BEC: Core Tasks & Objectives: VA-Training with Experts

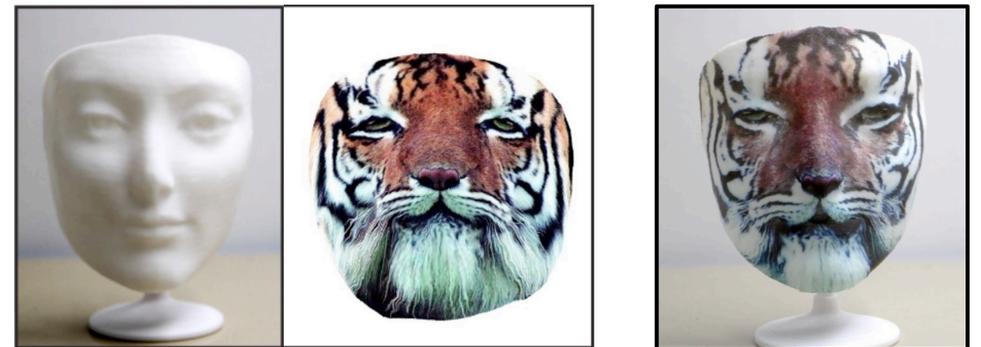


### ■ Face masks - Lessons learned:

- Inside knowledge of the necessary techniques
- Very high requirements for artistic talent, craftsmanship and patience-only few masters
- Process takes too much time & effort!
- BEC must compensate with new technology to cut corners, e.g. upcoming projects:

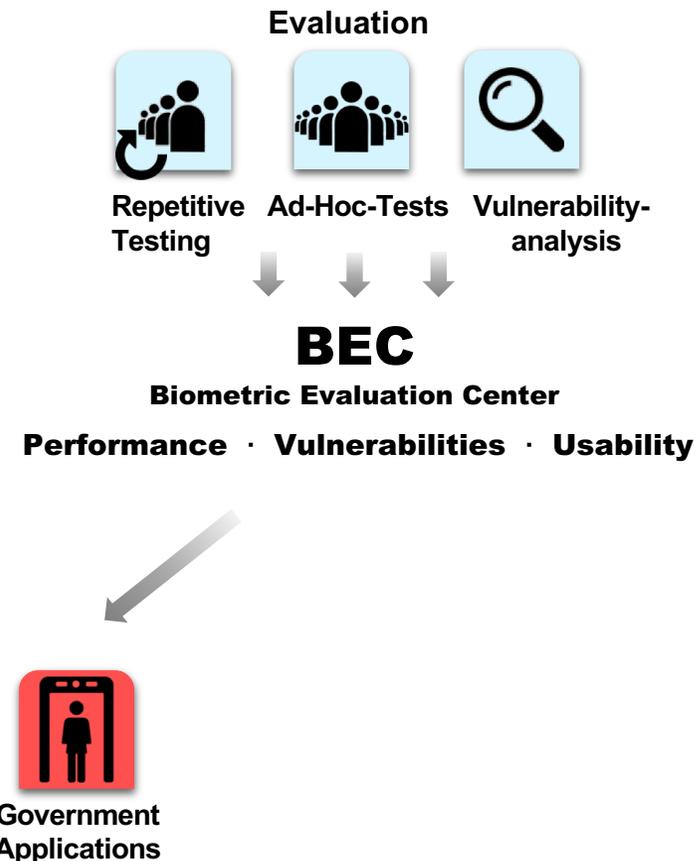


Realistic 3D Color Printing “Cuttlefish”  
[Urban et al, Fraunhofer IGD]



Computational Hydrographic Printing  
[Zhang et al., Columbia University/Zhejiang University]

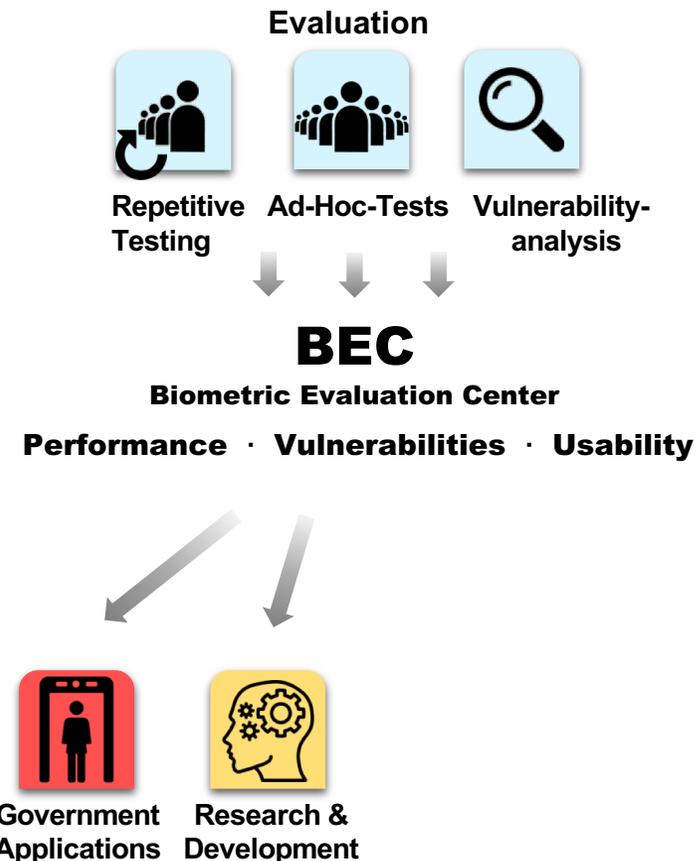
## 2. BEC: Core Tasks & Objectives: Smart Borders



### ■ Government Applications (Smart Borders):

- Continuous evaluation of egates & kiosk systems
- With 2 installed regular egates: evaluation of regular updates twice per year before roll out  
Direct comparison of old & new HW/SW-versions
- Evaluation of prototypes during acquisition processes (next: kiosk systems)
- Simulation of planned or suspicious airport installations
- Usability studies

## 2. BEC: Core Tasks & Objectives: R&D



### ■ Research & Development:

- Flexible integration of research projects into the evaluation processes
- Lab-space & -equipment available for up to 8 PHD- & master-students
- Researchers can use all non-restricted data
- !They have no direct access to the data: biometric data is highly protected on BSI-IT – students can use BSI analysis framework to generate reports!
- Competitions & invitations of promising researchers
- BSI-research projects: e.g. FACETRUST

## 2. BEC: Core Tasks & Objectives: R&D-FACETRUST



**Current eGate-technology is finally fast & reliable, but:**

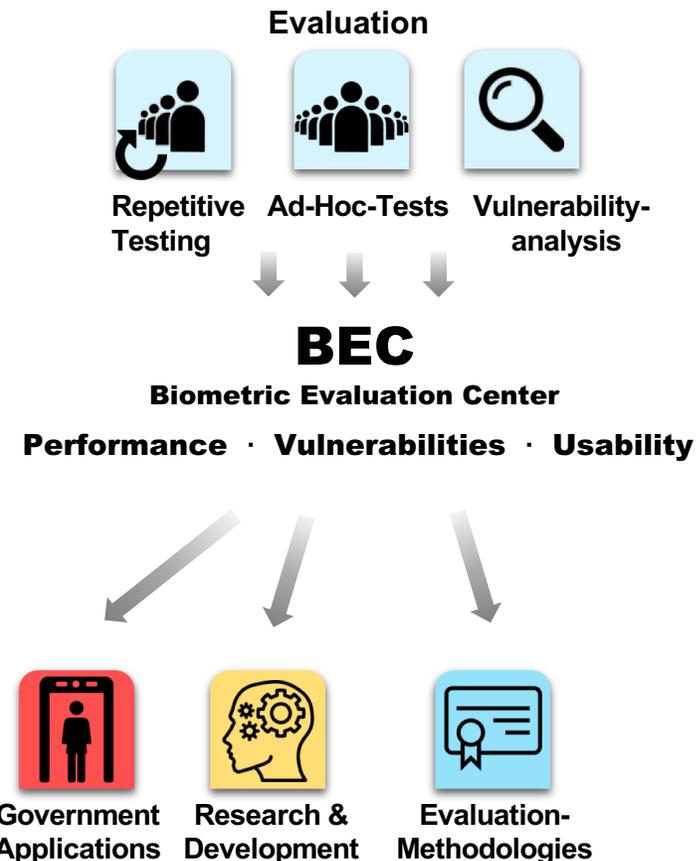
- PAD: can always be improved (speed & reliability)
- Morphing: there is currently no reliable morphing detection technology available

**Goals of the BSI-project “FaceTrust”:**

- Project partners:
  - Secunet [basic technology, coordination & integration]
  - University HBRS [enhanced PAD technology]
  - University Darmstadt (HDa) [Morphing Detection]
- Comprehensive compilation of the current state of the art of attack vectors on face biometric systems [attack-toolboxes]
- Development of new & improved attack detection technologies
- Development of the next generation eGate HW/SW-prototype



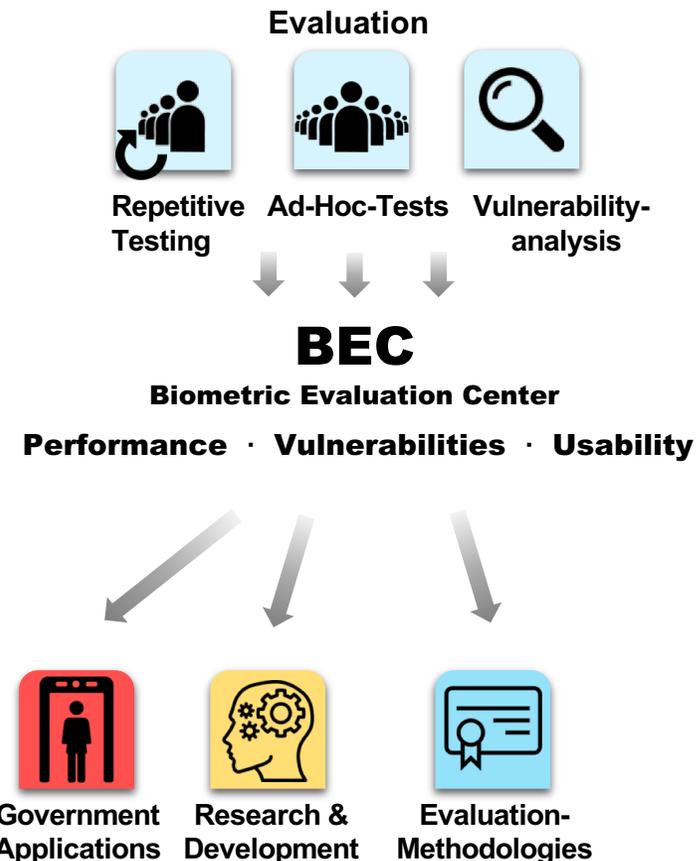
## 2. BEC: Core Tasks & Objectives: Evaluation Methodologies



### ■ New Evaluation Methodologies:

- Constant development & evaluation of biometric evaluation Methodologies:
- Development of technical guidelines and Common Criteria protection profiles
- Dev. of new manufacturing techniques for artefacts (VA)  
goal: providing standard testing templates for evaluation labs, researchers & manufacturers
- High end quality/accuracy measurement of artefacts

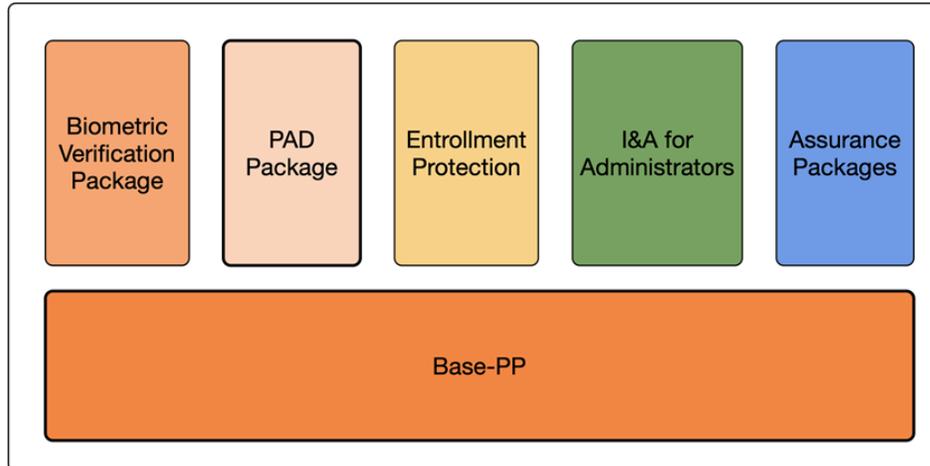
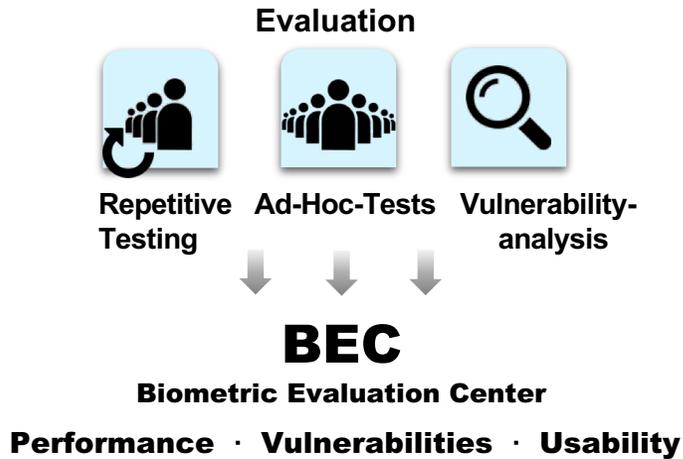
## 2. BEC: Core Tasks & Objectives: EM – Example: IBMPP



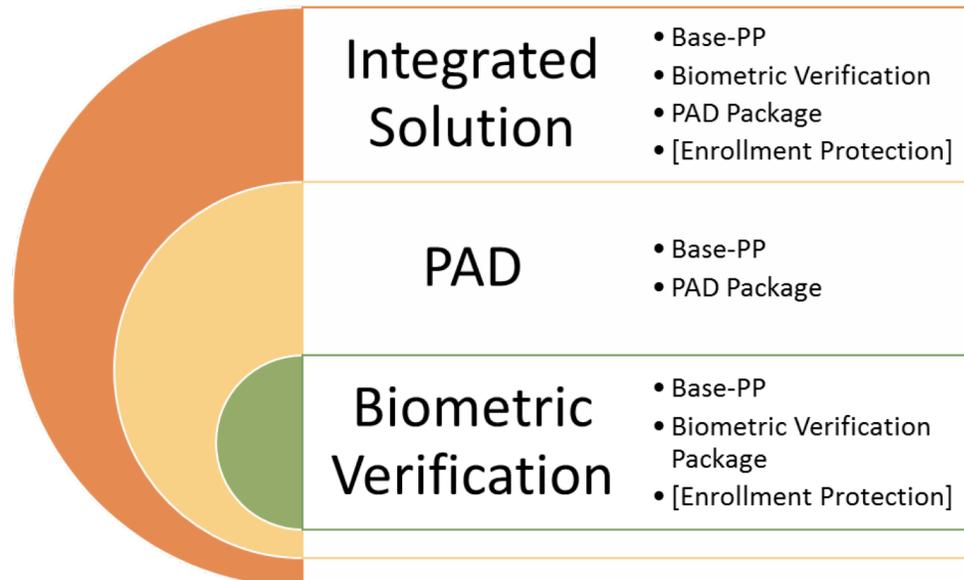
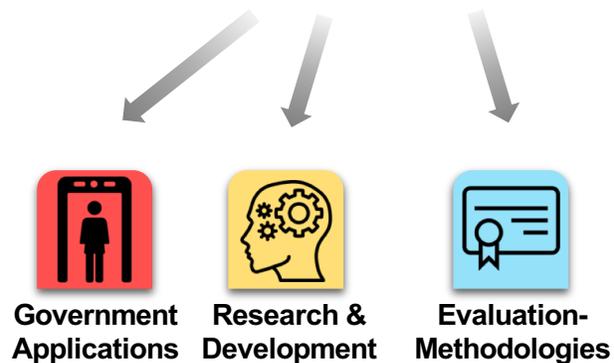
- “Integrated Biometric Mechanisms” Protection Profile:
  - First Protection Profiles for Finger-PAD in 2009 by BSI FSDPP (entry level VAN/EAL)/FSDPP\_OSP → since then basic requirement in Germany for government applications but little international acceptance!
  - Objectives for the new Protection Profile:
    - Updates based on the results of the EU-project B.E.A.T. project and the underlying ISO standards 30107 and 19989
    - basic approach for all biometric modalities
    - flexibility by modularization
  - The IBMPP for fingerprint-PAD and face-PAD has been finalized (developed by Konfidas) – official evaluation pending (early 2019)

# 2. BEC: Core Tasks & Objectives: EM - Example

- “Integrated Biometric Mechanisms” Protection Profile:

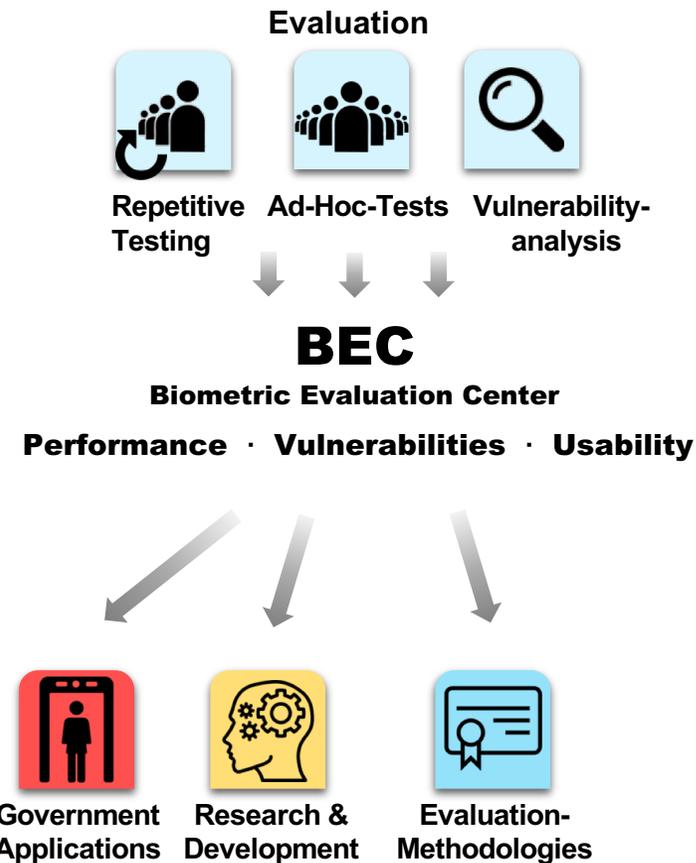


- IBMPP:  
Functional view



- Functional packages cannot be arbitrarily combined
- Base-PP shall not be used in isolation
- The IBMPP allows for three typical solutions
- I&A for Administrators can be augmented for every combination

## 2. BEC: Core Tasks & Objectives: EM-Examples

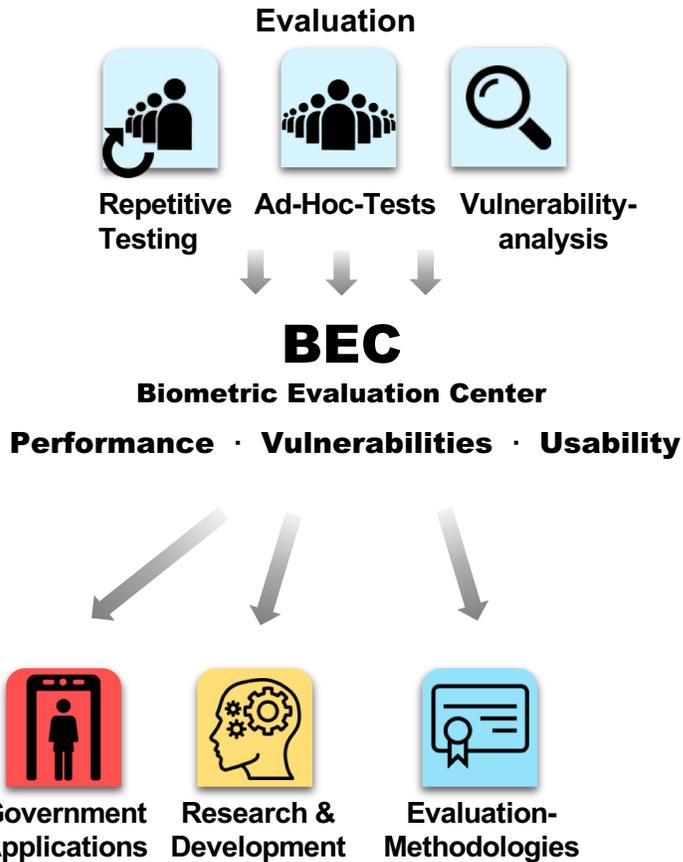


### CO<sub>2</sub>/Fibre-Laser Engraver for finger artefacts



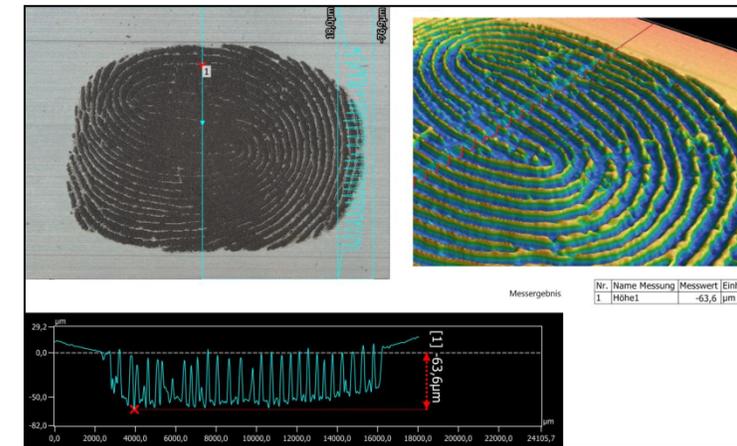
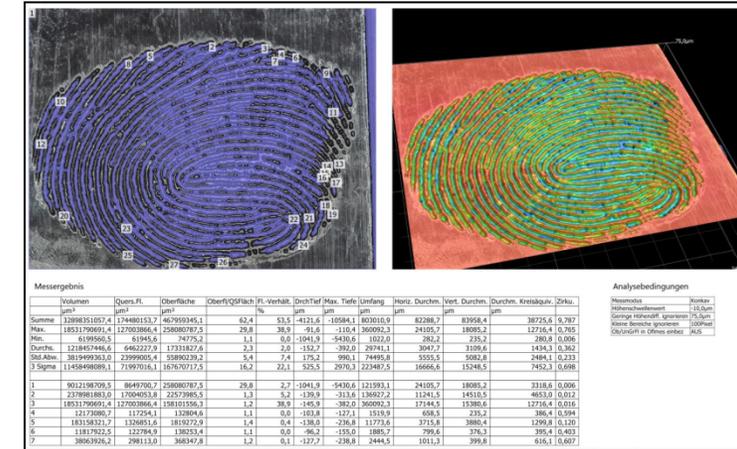
- Fast & reproducible creation of molds and positives
- resolution: 450/1000dpi, depth controllable
- Many usable materials available (for metal use a fiber laser)

# 2. BEC: Core Tasks & Objectives: EM-Examples

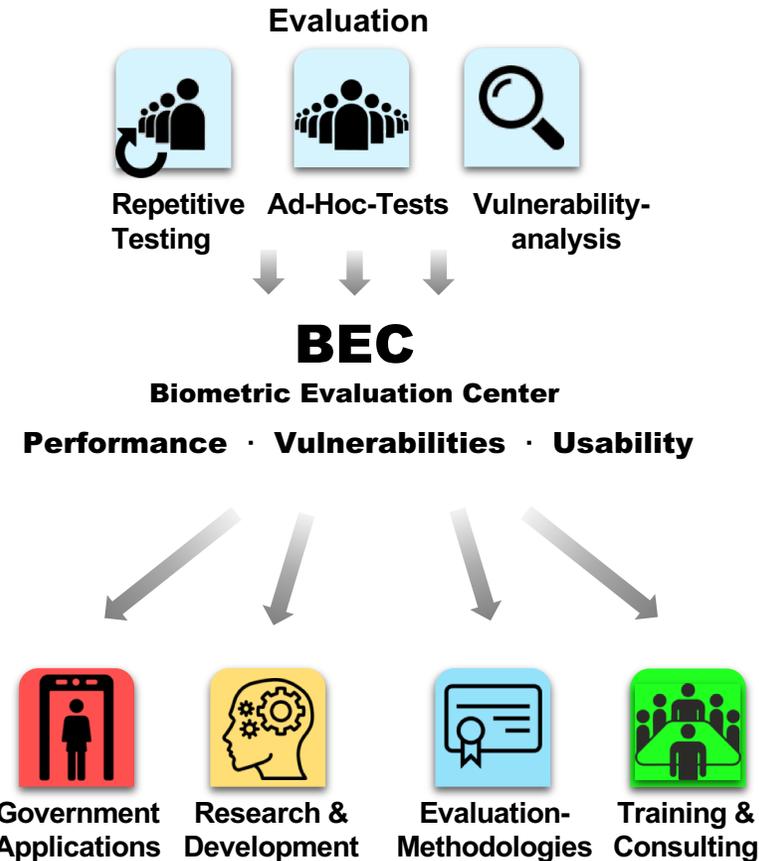


**Artefact Quality Services:**  
for Certification Labs, Manufacturers,  
Research Labs, etc...

- 2D/3D high resolution measurement of artefacts
- Quality assessment of manufacturing processes
- Material analysis
- Time degradation studies



## 2. BEC: Core Tasks & Objectives: Training & Consulting



- **Training & Consulting Workshops:**
  - BPol (border guards, trainers, managers,...)
  - FRONTEX (March & November 2019)
  - Government end user
  - Manufacturers & Developers
  - Exchange of experience with evaluation labs, research facilities, certification bodies & other agencies, ...

# Thank you for your attention!



## Contact

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