TRUSTED ELECTRONICS

Dr. Horst A. Gieser – Head of Analysis & Test at Fraunhofer EMFT

Co-Chair of Analysis Group Velektronik – Vertrauen ist besser

Chair of Analysis Group Fraunhofer TRAICT -Project

EMFT-Coordinator Trusted Electronics Bavaria

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Session: Sustainable, Green & Trusted Electronics @

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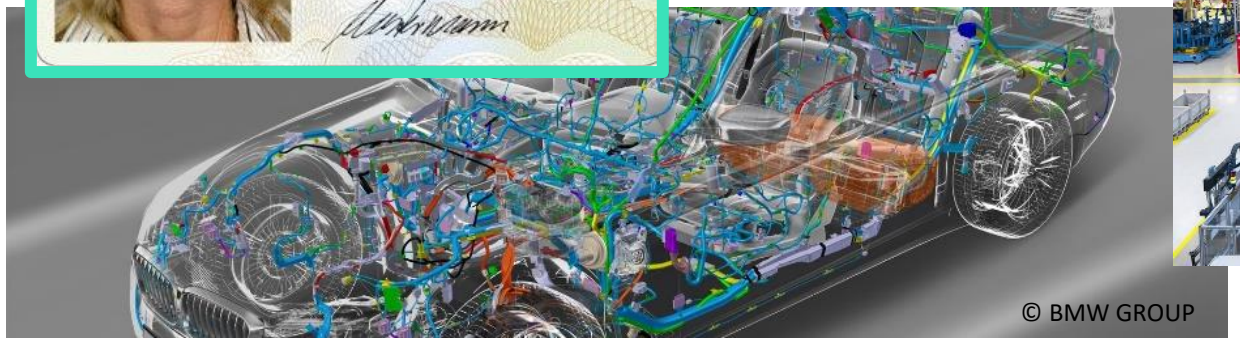
Today Electronics Everywhere – requiring different levels of trust



https://hbr.org/2021/02
/why-were-in-the-midst-of-a-global-semiconductor-shortage

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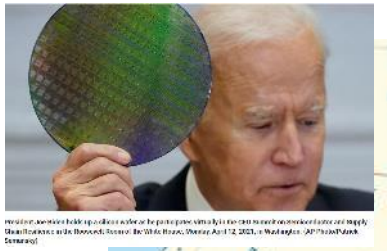
Today: Global Microelectronics – Global Value – Local Risk

Digital Souveregnty Europe



FoxNews 13.10.2021

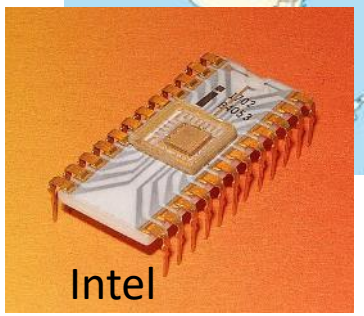
U.S.A.

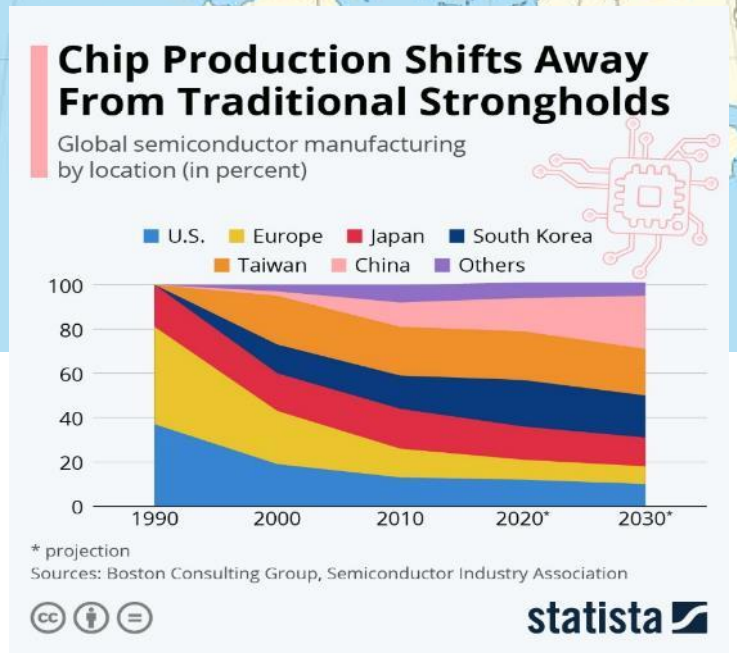
China

South Korea

Japan

Taiwan



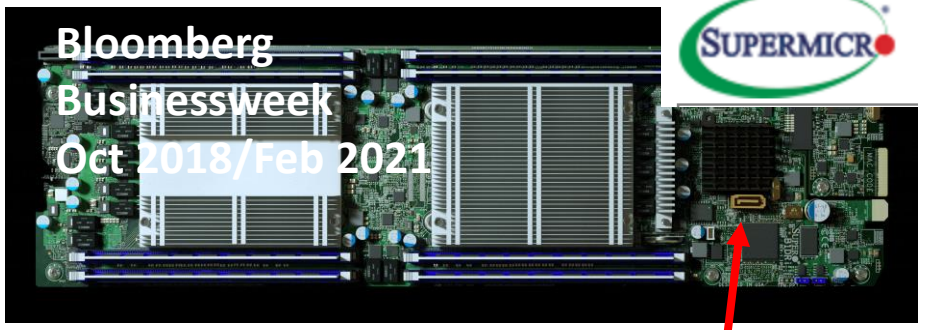


Yesterday the Citizens of Troja…

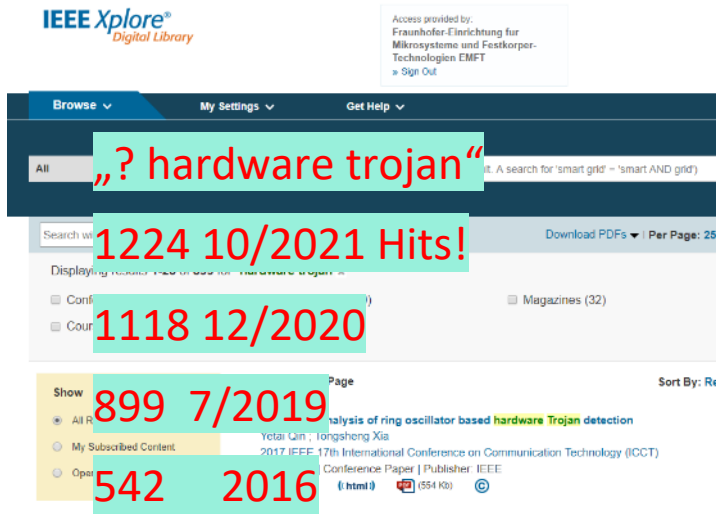
Troja. Spielfilm, USA, Malta, England, 2004, 156 Min., Regie: Wolfgang Petersen,

Today
– yes, we are vulnerable

Motivated by
NSA CottonmouthX

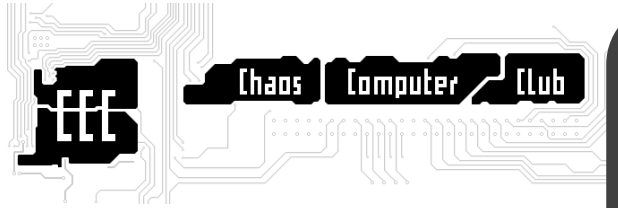


- Hundreds of new SW- virus /day
- Flaws in Design, Implementation & Supply Chain
- Compromised Hardware (Encryption, Data Leaks, Remote Control, RNG)
- Counterfeited Devices



e.g. Cyber Security

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation



Von National Security Agency - https://www.nsa.gov/resources/everyone/digital-media-center/image-galleries/places/, Gemeinfrei, https://commons.wikimedia.org/w/index.php?curid=16450

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Strong Motion for Trusted Electronics

- European, national and state authorities fortunately see and fund
- Trusted Electronics as a Conditio Qua Non for Digital Souvereignty in Global Supply Chains
- Partners from Industry and Academia are sharing the vision and are joining forces building strong alliances offering solutions for trust

- Selected current projects with Fraunhofer
  - BMBF ZEUS-Program with Vertrauenswürdige Elektronik platform
  - BMBF R&D Projects SyPASS & RESEC
  - BMBF TRAICT Trusted Resource Aware ICT
  - BMBF FMD Analysis Equipment
  - Bavaria TREB Trusted Electronics Bavaria

Velektronik
Vertrauen ist besser

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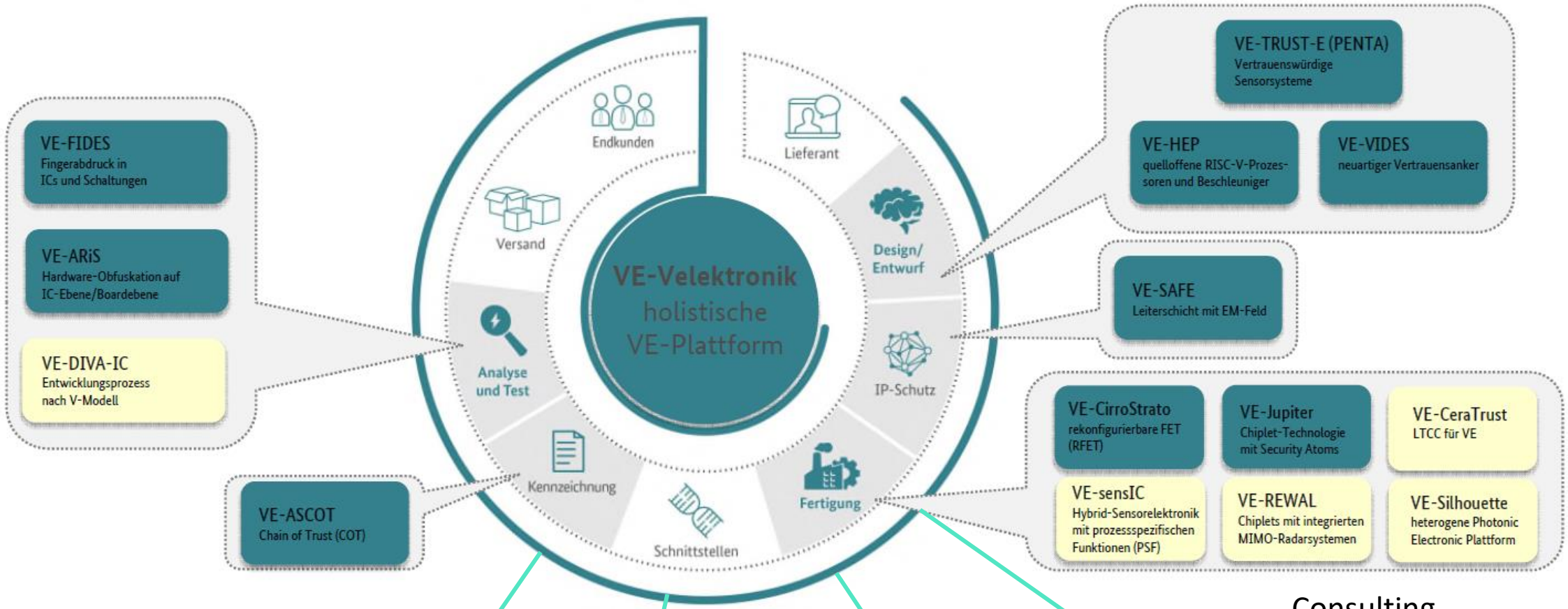
Topics addressed within BMBF funded 15 ZEUS-projects



Velektronik
Vertrauen ist besser

Trust by | Design | Manufacturing | Analysis

- Consulting
- Services
- Standardization

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Fraunhofer Network 4 Advanced Analysis

Formation initiated in the FhG /BMBF TRAICT-Project

System in the Box → Transistor

Target Definition

- Conditions
- Recherche Documentation
- Analysis concept
- Preparation Prestudy

Non-Destructive

passive

- XRAY
- Ultrasonic
- Thermal
- Inductive Fingerprinting
- Eddy Current

active

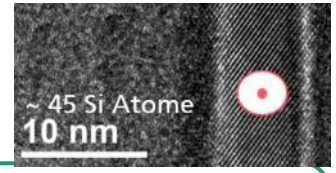
- Electrical Test
- EM-Emission
- Transient Thermal LockIn
- Photoemission
- LaserVoltageProbing

Report

Destructive

- Package – opening/removal
- Infrared analysis
- Technology analysis
- Delayering
- Chip Scanning
- Layout Extraction
- Circuit Extraction

CC-EAL6



XRAY nCT, AFAM

comparison

comparison

future

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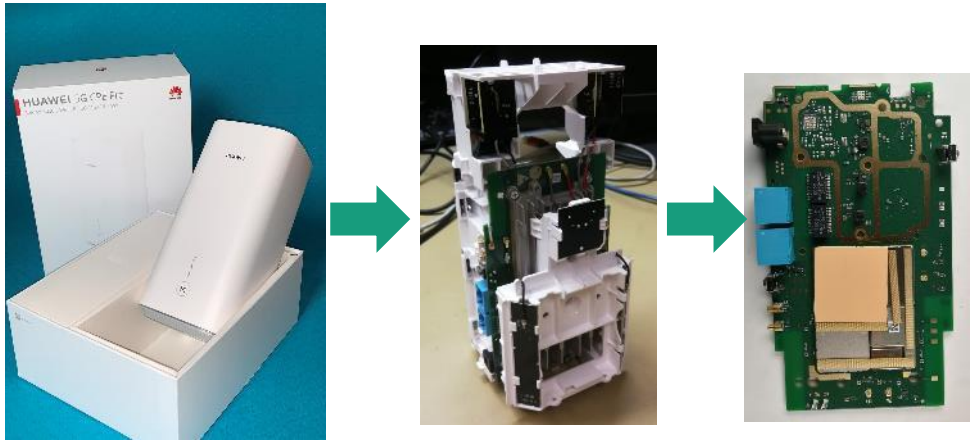
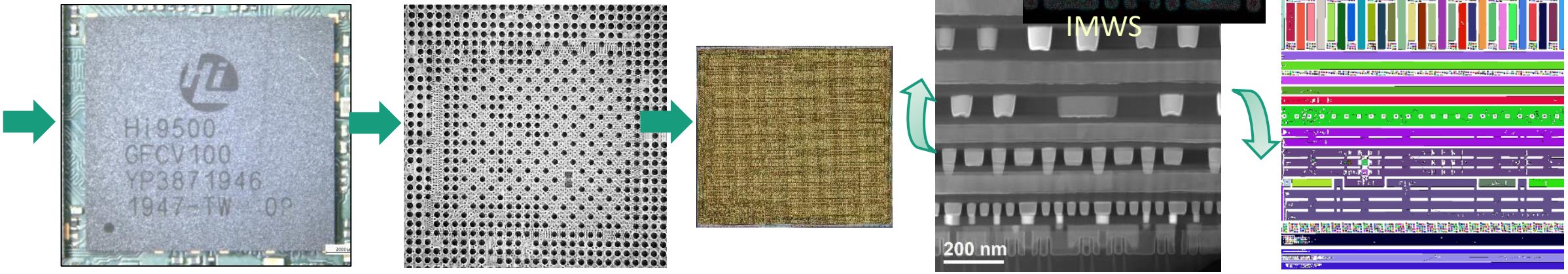
Example: Tear Down of a 5G WLAN Router

- Bought from Amazon
- Remove Case and identify 5G-Components
- Demonstrate various Methods for Test and Analysis
- Active – Passive – Destructive
- Analysis of Key Component of Interest
- Technology Characterization – Trust Features
- Scanning & Partial Reconstruction of the Layout





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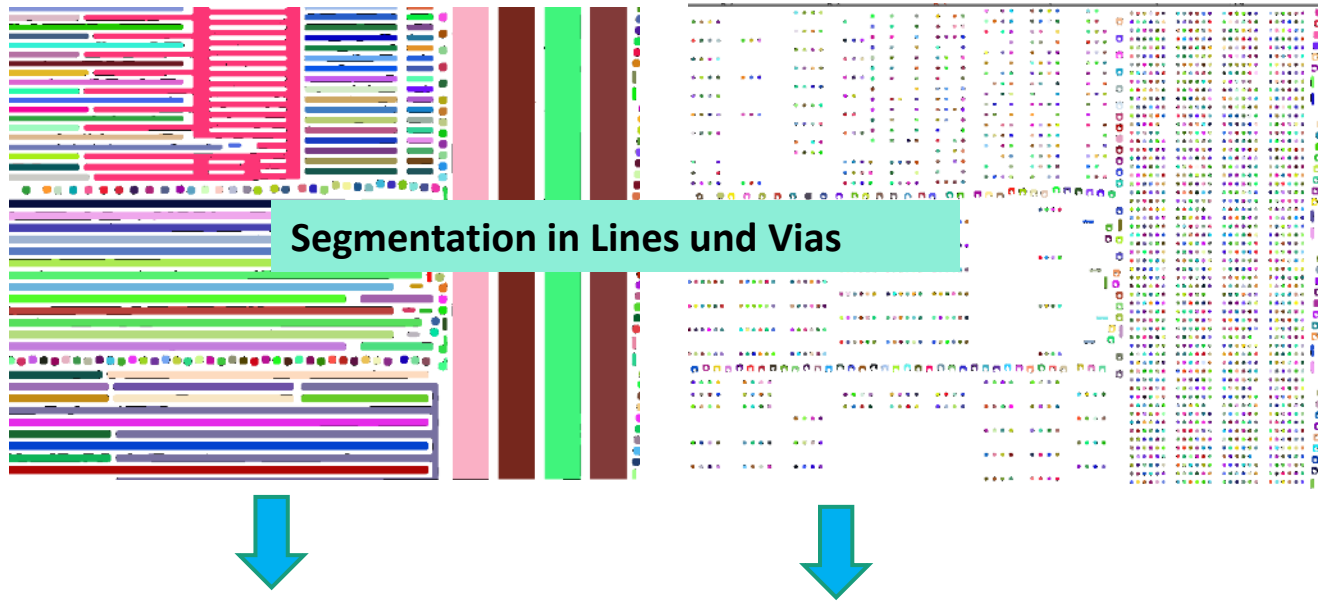
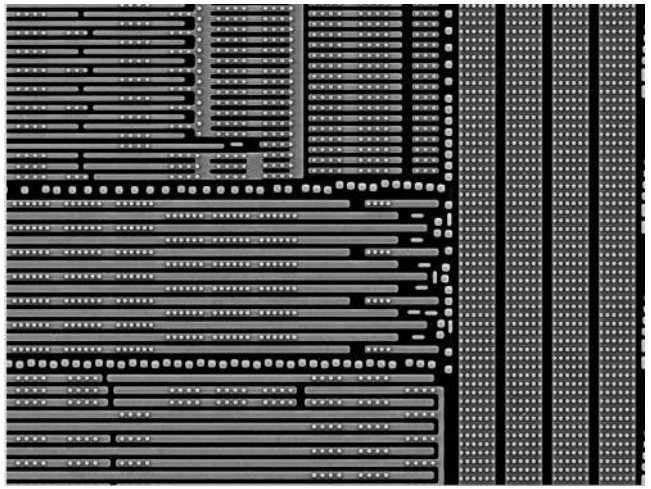
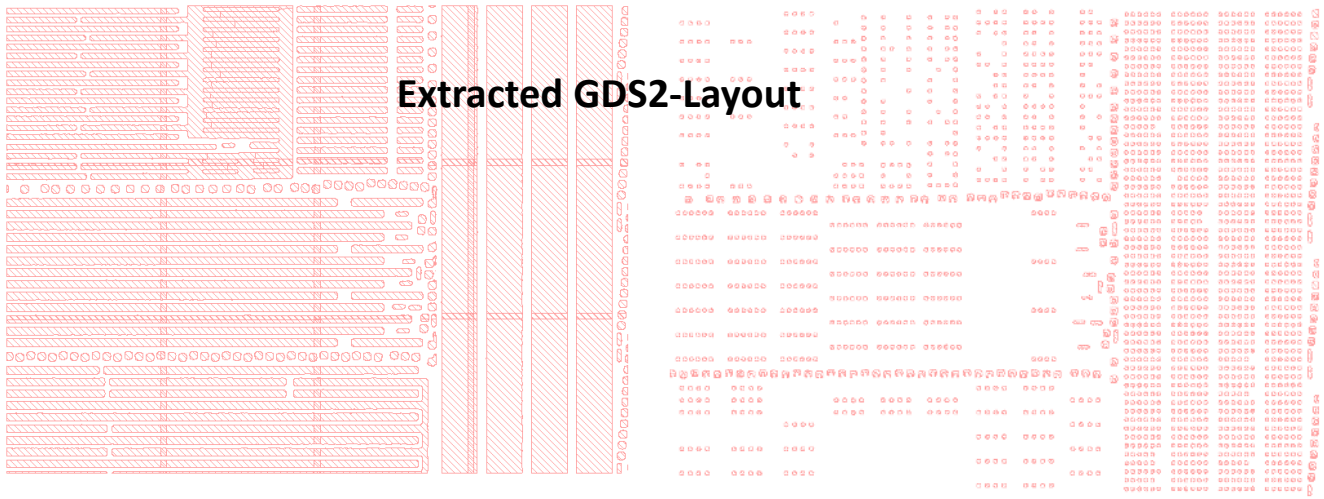
Example Scanning & Layout Reconstruction

- Large Area Scanning Raith 150TWO
- Image Stitching
- Segmentation of Pictures
- GDS2-Extraktion of Layout
- Comparison with Trusted Layout or Golden Device



SEM-
Detailbild
(3x4 Stitch)





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RESEC Systems und Methods for Analysis and Reconstruction of Highly Integrated Security Circuits

Fraunhofer EMFT

infineon

CC EAL6

Preparation and Analysis Methods
- Delayering with Ion milling
- Chip scanning process
- Layout and circuit extraction

RE Software Platform
- Image processing
- Stitching 2D & 3D
- Analog and digital circuits analysis
- Reference analysis sample

TUM

Chip Scanner Demonstrator
- ultra fast UHR imaging
- low acceleration voltage and WD
- new high speed detectors
- high speed stage and motion platform

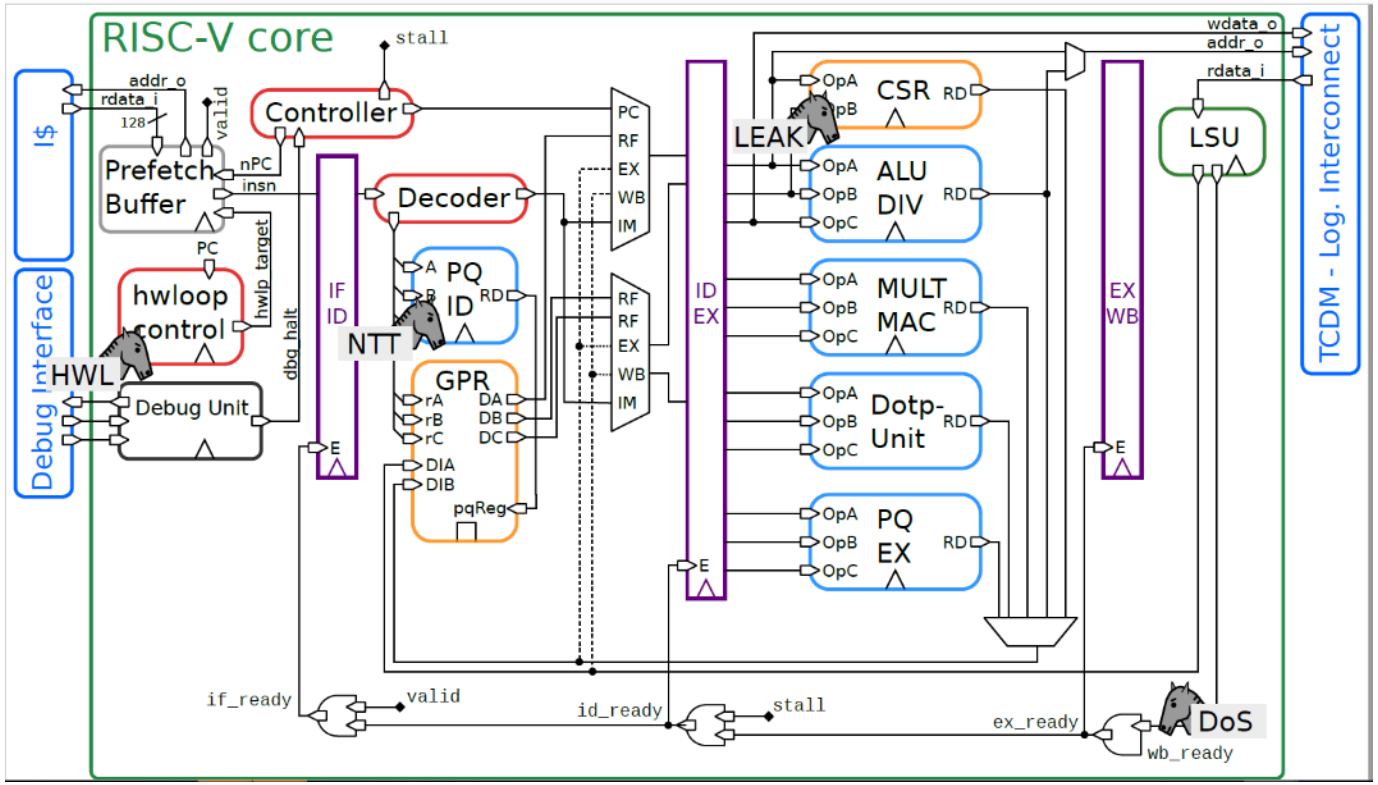
RAITH NANOFABRICATION

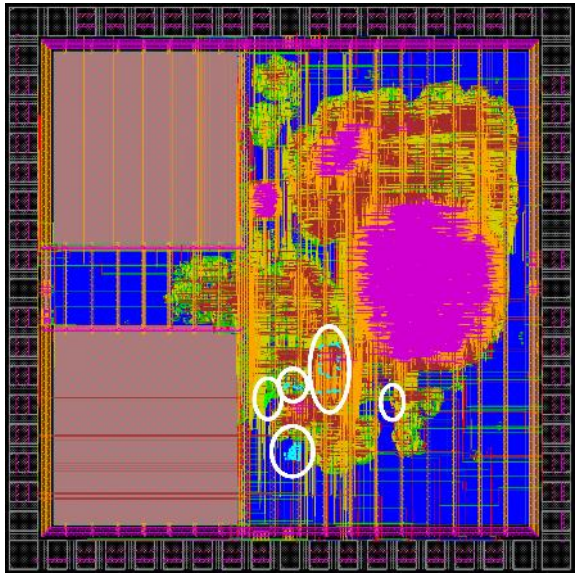
Chip Design with HW Trojans, Circuit Identification
- Design and manufacturing of RISC V with inserted Trojans
- Identification of modifications
- RE and Security assessment

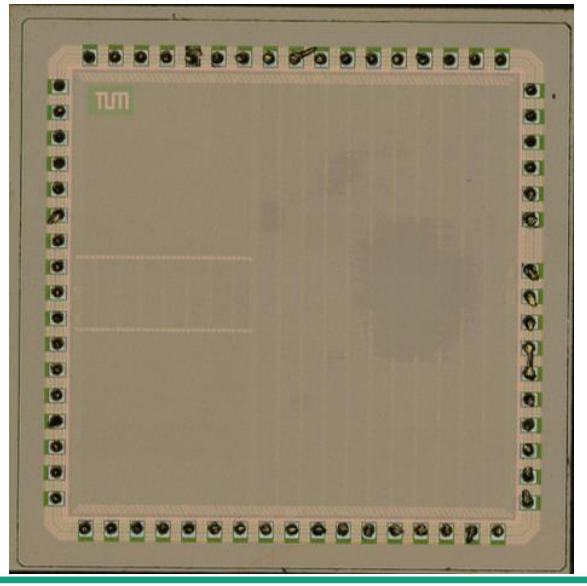
RESEC: Scientific Demonstrator for Integrated HW-Trojans

A.Hepp, G.Sigl ACM 2021

- 1st-Time Right: 4 Trojans with different levels of complexity
- Post-quantum RISC V
- Goal: Identification by Physical Analysis







Alexander Hepp and Georg Sigl. 2021. Tapeout of a RISC-V crypto chip with hardware trojans: a case-study on trojan design and pre-silicon detectability. In Proceedings of the 18th ACM International Conference on Computing Frontiers (CF '21). Association for Computing Machinery, New York, NY, USA, 213–220. DOI:https://doi.org/10.1145/3457388.3458869

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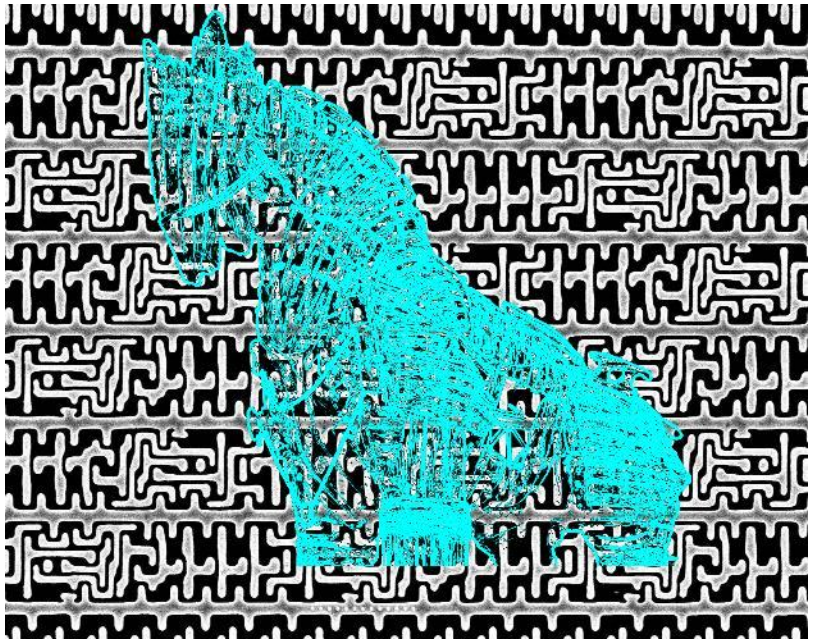
Our Common Charta – Trusted Electronics for a Secure World



Thank you very much for your kind attention

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Gratefully acknowledging my Colleagues of Velektronik, TRAICT, RESEC,TREB & for inviting me