VIRTUS CC

Embrapii Competence Center
Intelligent Hardware for Industry

Research
Development and Innovation

VIRTUS
CEEI - UFCG

EMBRAPII
Empresa Brasileira de Pesquisa
e Inovação Industrial

MINISTÉRIO DA
CIÊNCIA, TECNOLOGIA
E INOVAÇÃO

GOVERNO FEDERAL
BRASIL
UNIÃO E RECONSTRUÇÃO

Who I Am

Danilo F. S. Santos, D. Sc.

- Professor at the Department of Electrical Engineering – Federal University of Campina Grande (UFCG), Brazil
- +15 years of RDI activities
- Operations and Innovation Director at VIRTUS/UFCG
- VIRTUS/UFCG 5G Lab Coordinator
- CNPq (Brazilian Scientific Council) Productivity Fellow
- Led +40 industry projects in the last 10 years
- IEEE Senior Member

- danilo.santos at virtus.ufcg.edu.br

VIRTUS CEEI - UFCG

Who we are

+300
Professionals

+20
Annual Partners

+30
Annual Projects

+200
RDI projects in 5 years

VIRTUS/UFCG is an RDI Center focused on the development of solutions for the Industry.

It is part of the Federal University of Campina Grande, Brazil

VIRTUS CEEI - UFCG

UFCG Universidade Federal de Campina Grande

Where we are

- **Campina Grande, Paraíba, Brazil**
- Approximately 420 thousand inhabitants
- Transport Logistics
- Hosting Infrastructure
- 120km from Joao Pessoa
- One of the main technology centers in Brazil
- 5 Universities with Technology Courses
- + 80 labs
- 1 PhD for every 669 inhabitants
- **Biggest St. John's in the World!**

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VIRTUS-CC Vectors

TICs Law

20 years experience

EMBRAPII UE - CEEI/UFCG SOFTWARE E AUTOMAÇÃO

200+ RDI projects

Relationship with Companies

CAPES Concept 6

Research and Graduate Level of Excellence

CNPq

Researchers with CNPq Grants

Research and Teaching Excellence

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Our Thematic Line

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Embrapii Competence Center
Intelligent Hardware for Industry

THEMATIC LINE

Intelligent Sensing Platforms for Industry.

GOAL

Use of advanced sensors and actuators, and processing and connectivity technologies that enable the acquisition, analysis and interpretation of data in an intelligent, safe and efficient manner.

One of the 9 accredited Embrapii Competence Centers of Brazil

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VIRTUS-CC Actions

VIRTUS CC
CEEI - UFCG

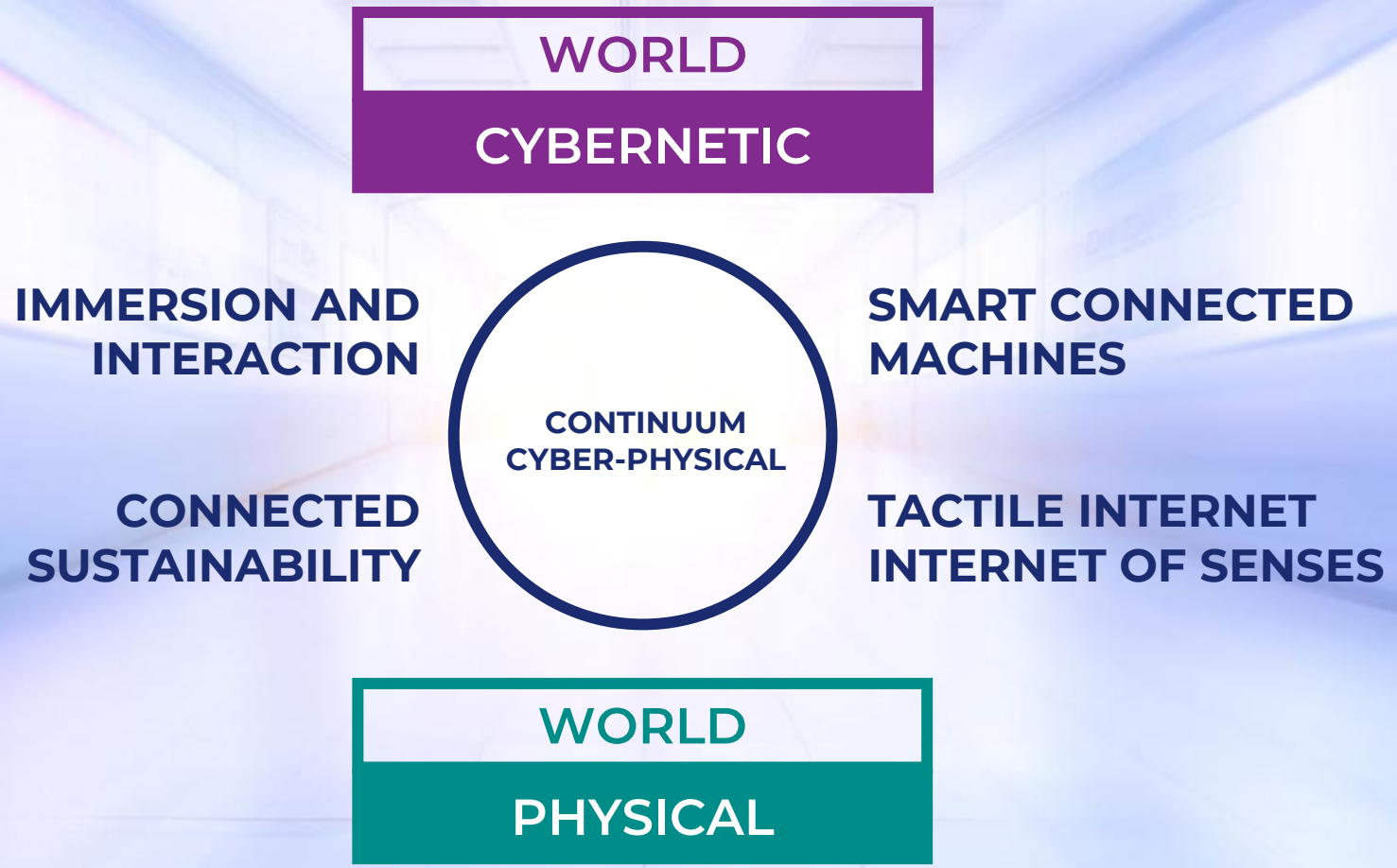
Expanding and strengthening scientific competence and technology in **Research, Development and Innovation**.

Training and Competence Building of students, professionals and researchers from all over the country.

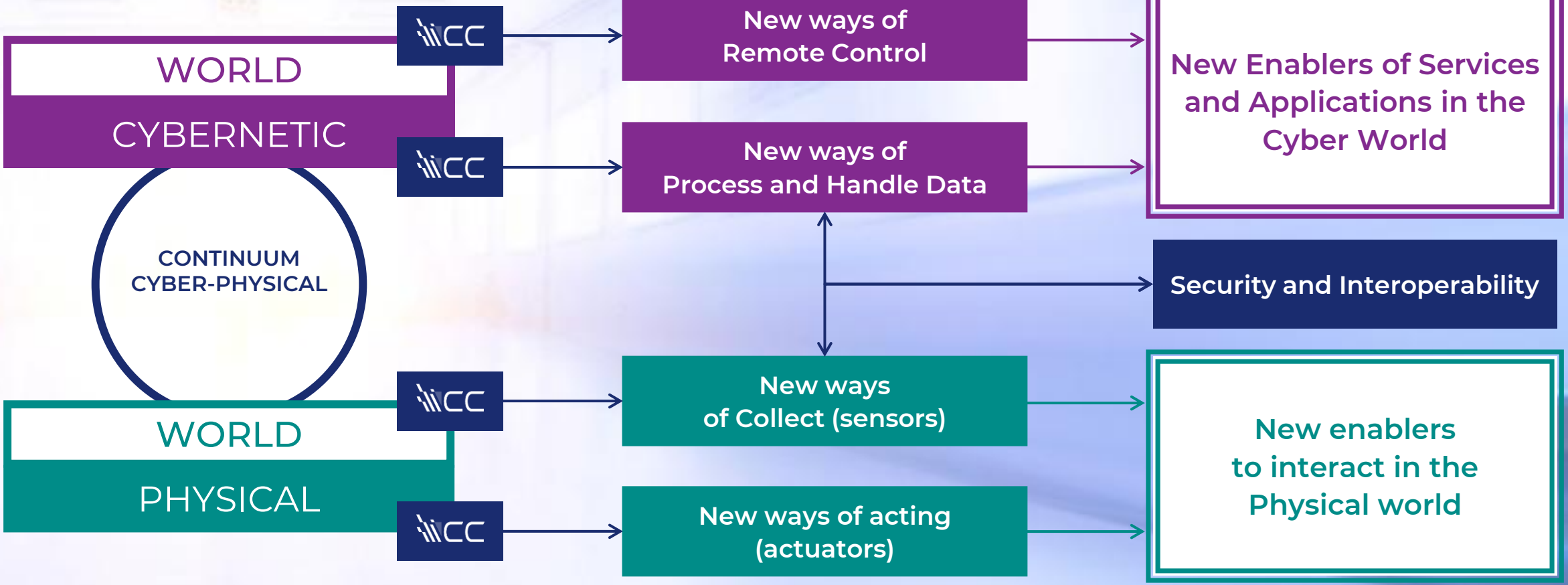
In the diffusion of benefits to the companies of the **Technological Membership**.

Fostering an enabling **open innovation environment** for Startup Attraction and Creation.

Our vision – World in 2030



World in 2030 and VIRTUS-CC



Our lines of action

Research Lines

- Smart Transducers & Instrumentation
- Software/Hardware Co-Design
- Model-Based Design
- AI & Big Data Analytics

Smart Hardware for Industry

TECHNOLOGICAL LAYERS:

- Physical Components
- Connectivity Components
- Application Infrastructure
- Information and Communications Security

What we're exploring

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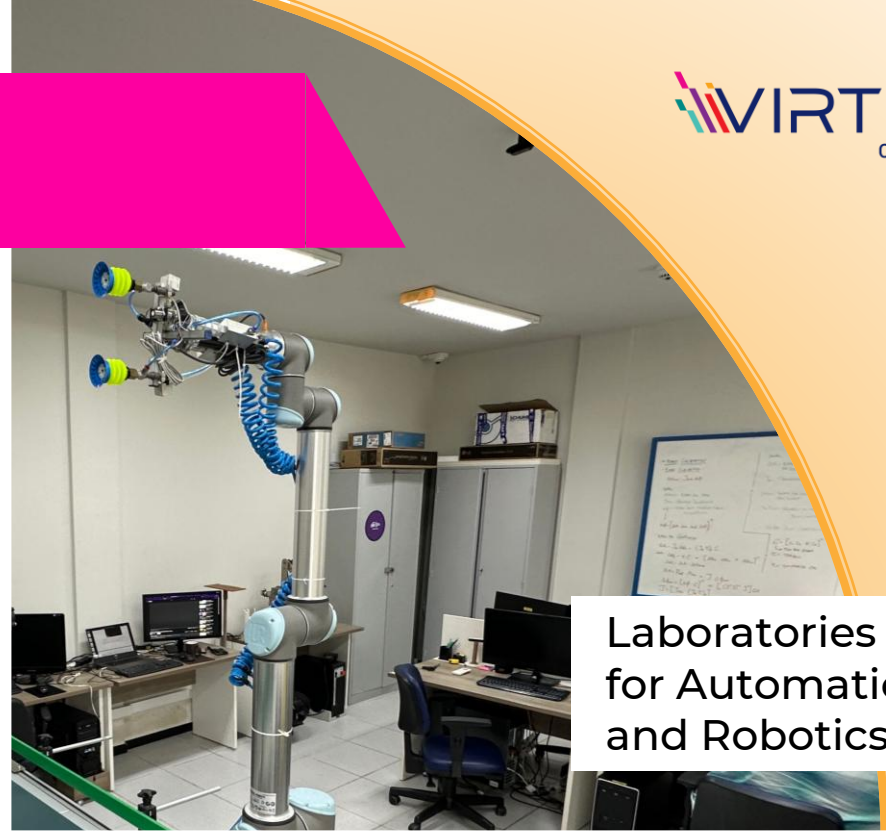
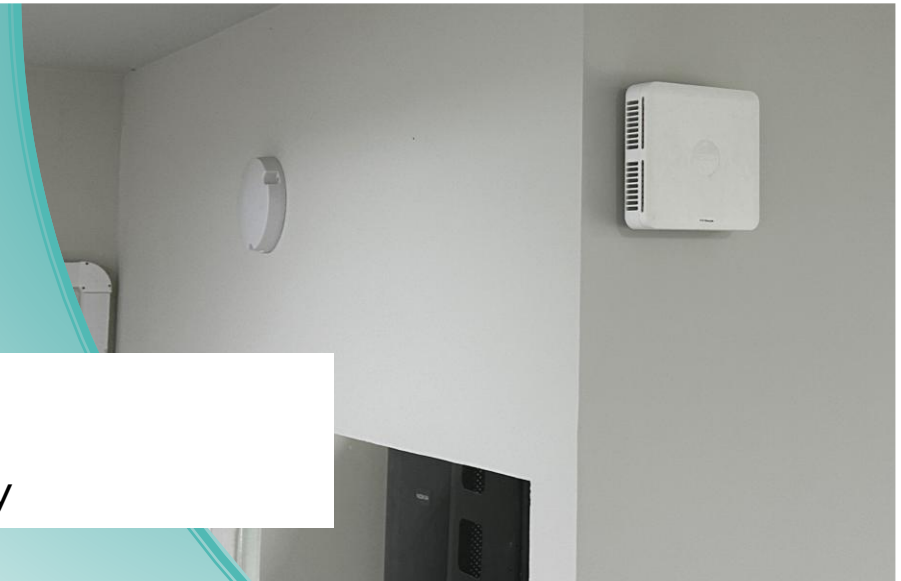
Smart Transducers & Instrumentation	Software Hardware Co-Design	Model-Based Design	AI & Big Data Analytics
Biosensors	Photonics and Microelectronics	Digital Twins	Intelligent Automation
Embedded systems	Industrial Internet of Things	Interoperability	Artificial intelligence

What we're building

Instrumentation, Prototyping and Biosensors Laboratories



Laboratories for Automation and Robotics

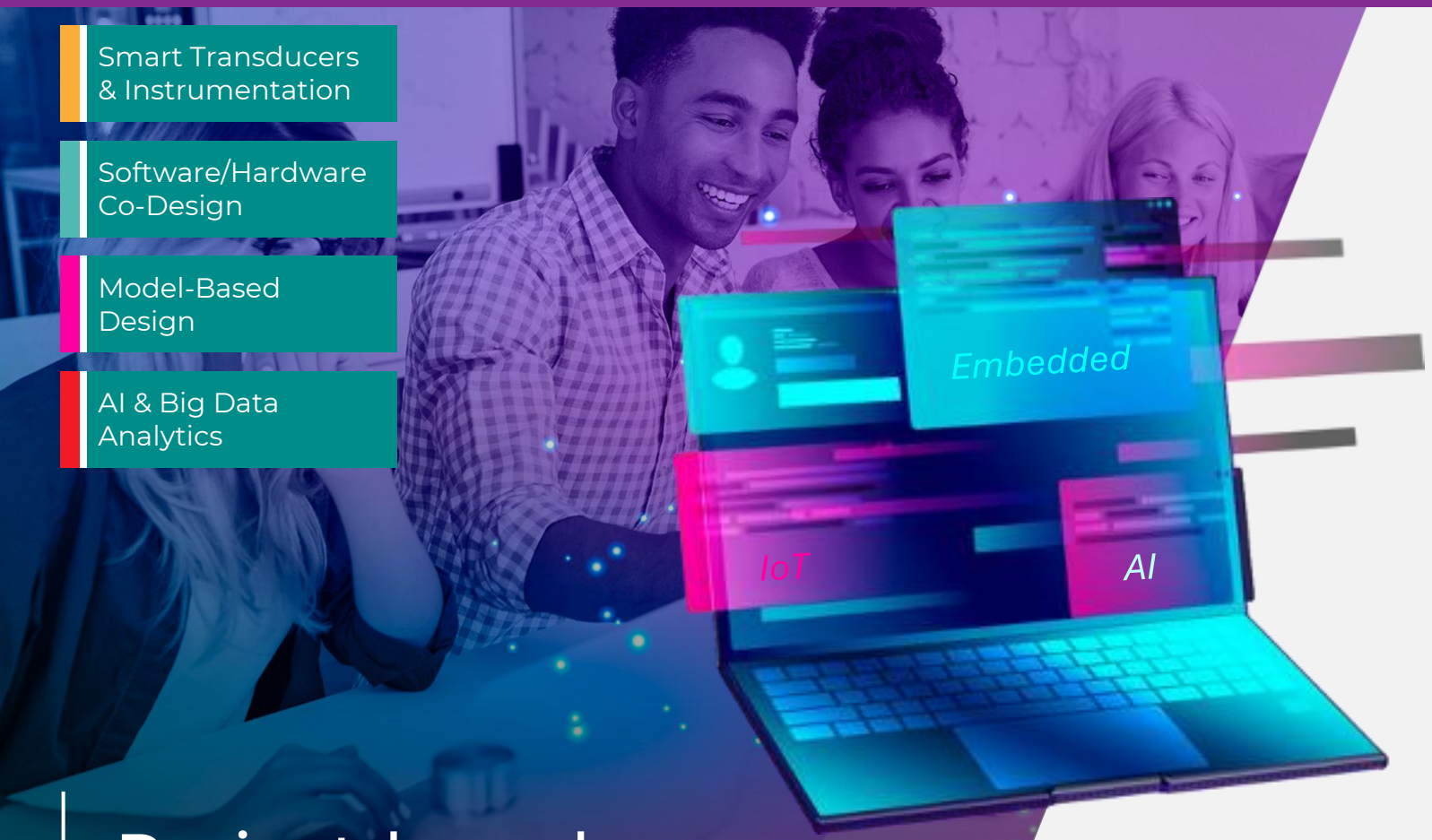


Laboratories for research in IoT Connectivity

Laboratories for Cybersecurity Research

Training

- Smart Transducers & Instrumentation
- Software/Hardware Co-Design
- Model-Based Design
- AI & Big Data Analytics

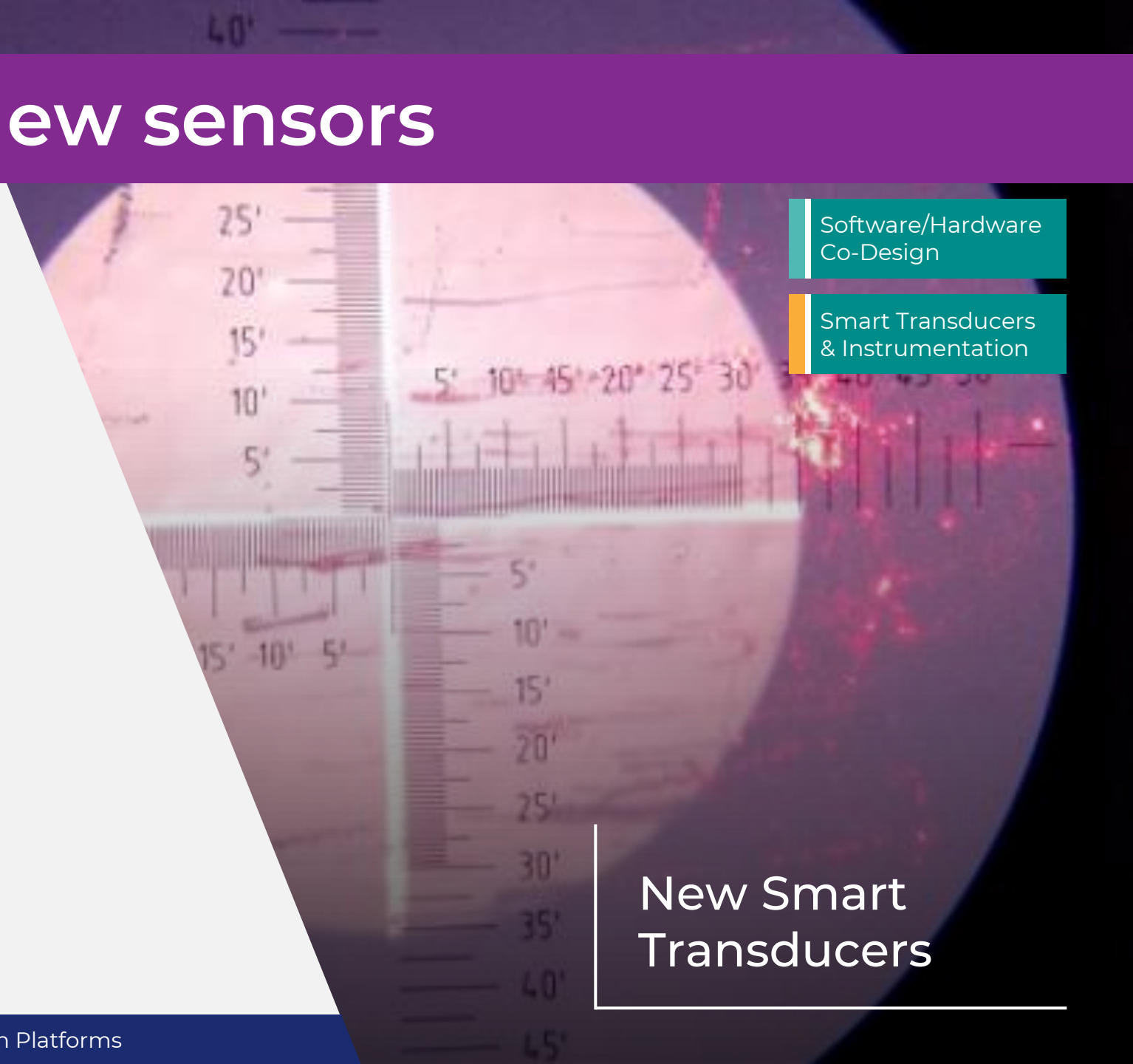


Project-based Learning

- **Intelligent Sensing**
- **Microelectronics and Photonics**
- **Biosensors**
- **Embedded Systems and IoT**
- **Algorithms for Hardware**
- **Artificial Intelligence**
- **Industry 4.0**
- And much more

New sensors

- New sensors
- Plasmonic, Fluorescence and Electrochemical Sensors
- Biosensors
- Software for data processing
- Multiple applications
  - ML/AI for data processing



Software/Hardware Co-Design

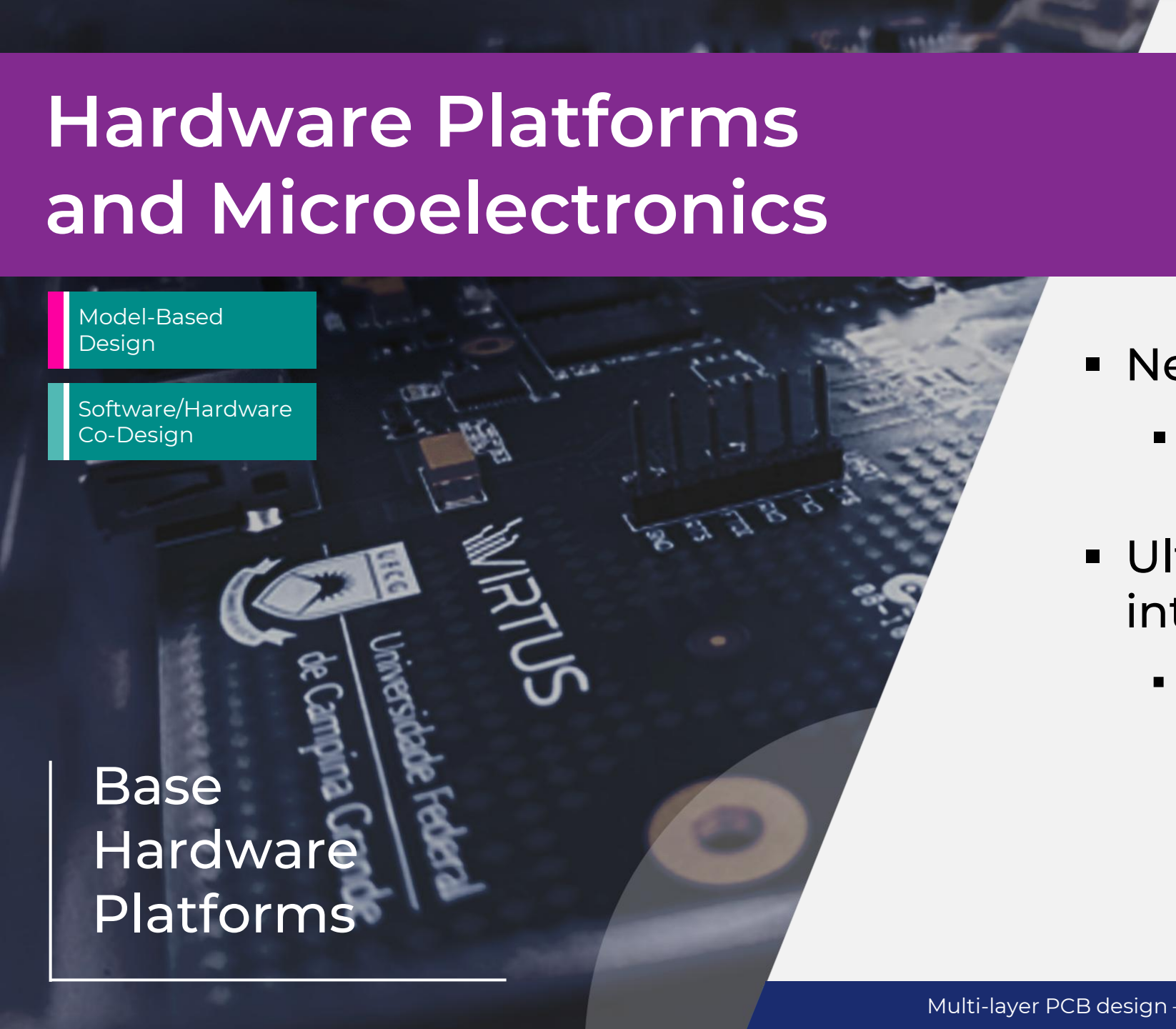
Smart Transducers & Instrumentation

New Smart Transducers

Hardware Platforms and Microelectronics

Model-Based Design

Software/Hardware Co-Design



Base Hardware Platforms

- New Hardware Platforms
  - Ex. Photonics and Optical Sensory Systems
- Ultra-low-power integrated circuits
  - Neuromorphic Computing, In-Memory Computing, High Bandwidth Memory (HBM) and Chiplets

Interoperability in Automation

- *Open Process Automation (O-PAS)*
- *Intelligent robotics*
- *Computer Vision*
- *Smart and interoperable factories*

AI & Big Data Analytics

Model-Based Design

Enhanced Production

Security in IoT

Model-Based Design

AI & Big Data Analytics

Smart Cybersecurity for Embedded Systems

- New technologies for smart sensing platforms.
  - TEE, DLTs and more
- AI-powered security systems
  - Ex. DDoS Detection
- Analysis of ML models using formal methods for security purposes[ref]

IoT and Industry 4.0 interoperability

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- Software/Hardware Co-Design
- AI & Big Data Analytics
- Model-Based Design

IoT for Smart-Factoring

- 5G-Edge infrastructure for experimental IIoT[ref]
- IIoT for Smart Factories
  - Secure microtransactions system for equipment control
  - Intelligent interoperability across different layers.
- LLM for smart private networks
  - Agentic approach for smart networks[ref]

AI applied to intelligent platforms

- AI applied to intelligent hardware platforms
  - AI Integration and deployment across distributed systems (ex. Edge and FL)[ref]
- AI and LLM for system observability
  - Concept of system observability using LLM and BI systems
- AI application for different Industry scenarios[ref]

Want to be a part of it?

Partner up!

What you'll get access to:

- Current and future infrastructure.
- Advanced trainings.
- Participation in Research Activities.
- Interaction with researchers specialized in RDI for the industry.
- Participation in open innovation environments.
- Experience with Brazilian TIC Law
- And much more.

- Different membership and cooperation modes, let's talk!

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