

Nº 179664

IPT at a glance

Adriano Galindo Leal
Rynaldo Zanotele Hemerly de Almeida

*Palestra apresentada para CNHI, IPT,
2025. 27 slides.*

A série “Comunicação Técnica” compreende trabalhos elaborados por técnicos do IPT, apresentados em eventos, publicados em revistas especializadas ou quando seu conteúdo apresentar relevância pública.

PROIBIDO A REPRODUÇÃO, APENAS PARA CONSULTA.



IPT AT A GLANCE

PRESENTERS:

Dr. Adriano Leal

Dr. Rynaldo Zanotele Hemerly de Almeida

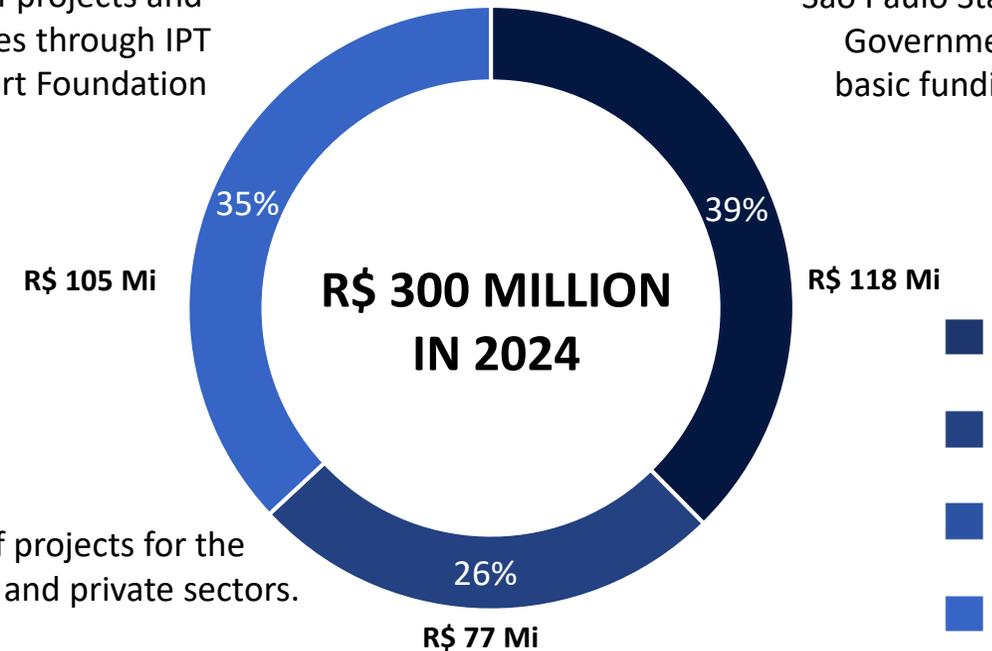
WHO ARE WE ?

IPT PROVIDES TECHNICAL SOLUTIONS FOR INDUSTRY, GOVERNMENTS AND SOCIETY, ENABLING THEM TO OVERCOME THE CHALLENGES OF OUR TIME

INCOMES

Sale of projects and services through IPT Support Foundation (FIPT)

São Paulo State Government basic funding



OUR NUMBERS*



125 YEARS OF CONTRIBUTIONS TO SOCIETY



> 1,000 EMPLOYEES AND PARTNERS



50% REVENUE IN INNOVATION



> 3,700 CUSTOMERS SERVED



> 16,200 TECHNICAL DOCUMENTS ISSUED

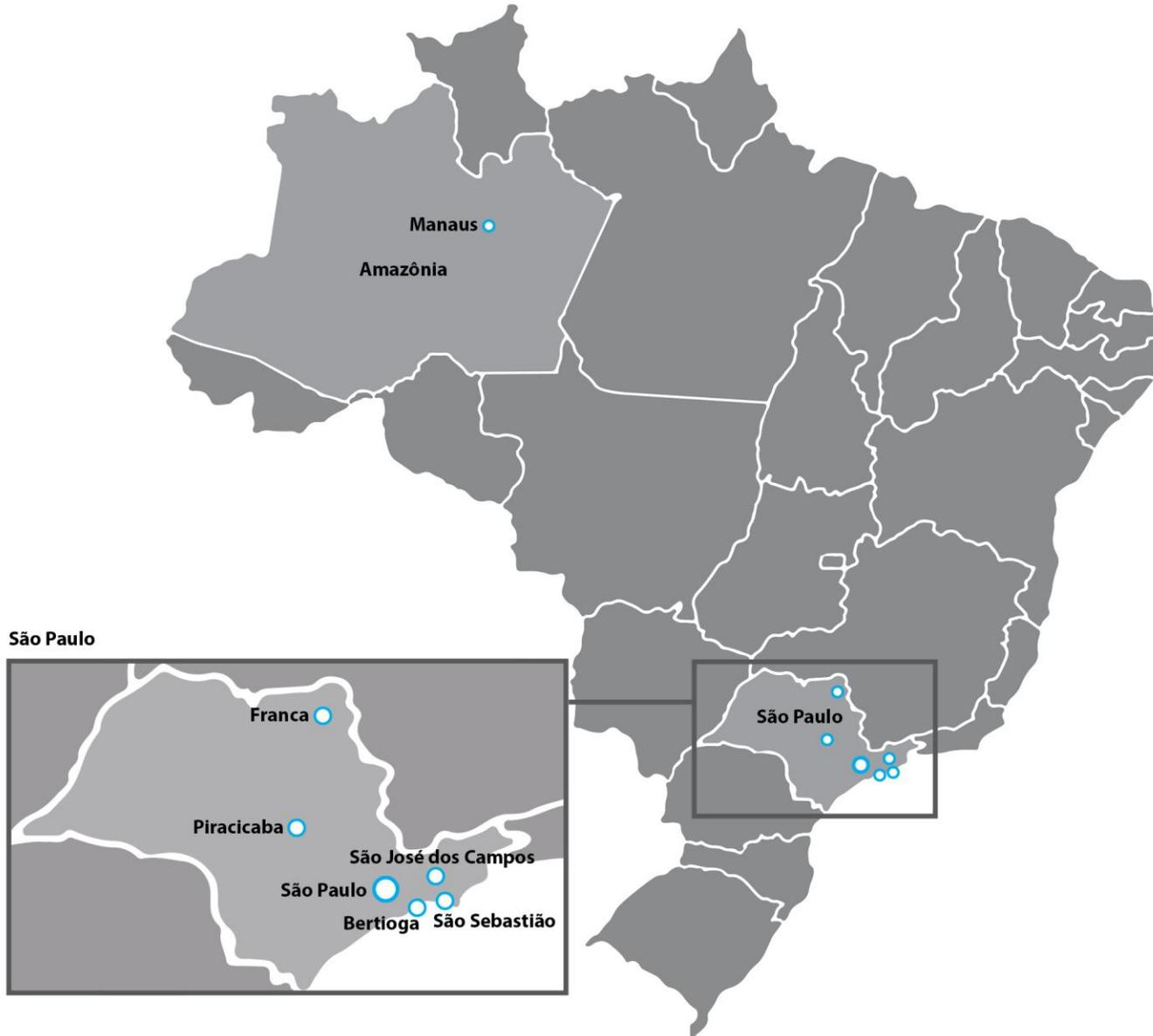


> 2,000 TESTING AND ANALYSIS PROCEDURES IN THE PORTFOLIO



35% OF IPT PROJECTS WITH DIRECT IMPACT ON ESG

IPT units in Brazil



- 1 **São Paulo, SP**
IPT Headquarters and Laboratory Park
- 2 **Bertioga, SP**
Solid Waste Biodigestion Plant
- 3 **Franca, SP**
Textile Technology and Protective Products Lab
- 4 **São José dos Campos, SP**
Light Structures Laboratory
- 5 **São Sebastião, SP**
Floating Laboratory
- 6 **Piracicaba, SP**
Energy Infrastructure Laboratory
- 7 **Manaus, AM**
IPT Amazônia Center

WHAT WE DO ?

RESEARCH,
DEVELOPMENT AND
INNOVATION

PRODUCTS AND
PROCESSES
SOFTWARES
FROM THE BENCH TO
THE PILOT
FUNDING
EMBRAPII

TESTS, TRIALS
AND ANALYSIS

TECHNICAL ANALYSIS OF
PRODUCTS AND
MATERIALS
PRODUCT EVALUATION
PRODUCT
CERTIFICATION

INSPECTION AND
MONITORING

CONSTRUCTION AND
STRUCTURES
MACHINERY AND
EQUIPMENT
ACCREDITED INSPECTION
BODY

METROLOGICAL
DEVELOPMENT,
MEASUREMENTS
AND CALIBRATIONS

PROFICIENCY PROGRAMS
STANDARDS
DEVELOPMENT
ADVANCED METROLOGY

CERTIFIED
REFERENCE
MATERIALS

METALS
CERAMIC
MINERAL
VISCOSITY
NORMAL SAND

TRAINING AND
QUALIFICATION

PROFESSIONAL MASTER
SHORT COURSES
CORPORATE EDUCATION



BUSINESS UNITS

BIONANOMANUFACTURING

Processes, Chemistry, PPEs, Biotech, Nanotech, Microfabrication

CITIES, INFRASTRUCTURE AND ENVIRONMENT

Territorial planning, Sustainability, Risks, Civil works

ENERGY

Generation, Infrastructure, Efficiency, Clean energy

TECHNOLOGICAL EDUCATION

Master's Degree, International MBA, Specialization

BUILDING AND HOUSING

Confort, Performance, Safety, Materials, Sustainability

ADVANCED MATERIALS

Metallic, Polymeric, Composite, Cellulosic, Corrosion

DIGITAL TRANSFORMATION

IoT, Embedded Systems, Intelligent Transport Systems, AI, Analytics

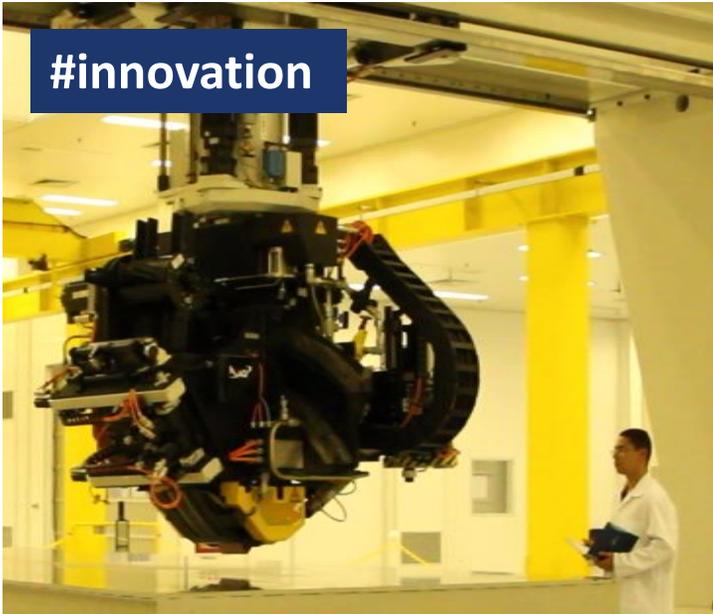
METROLOGICAL AND REGULATORY TECHNOLOGIES

Mechanics, Electrical, Flow Measurement, Aerodynamics, Chemistry



IPT'S HALLMARKS

#innovation



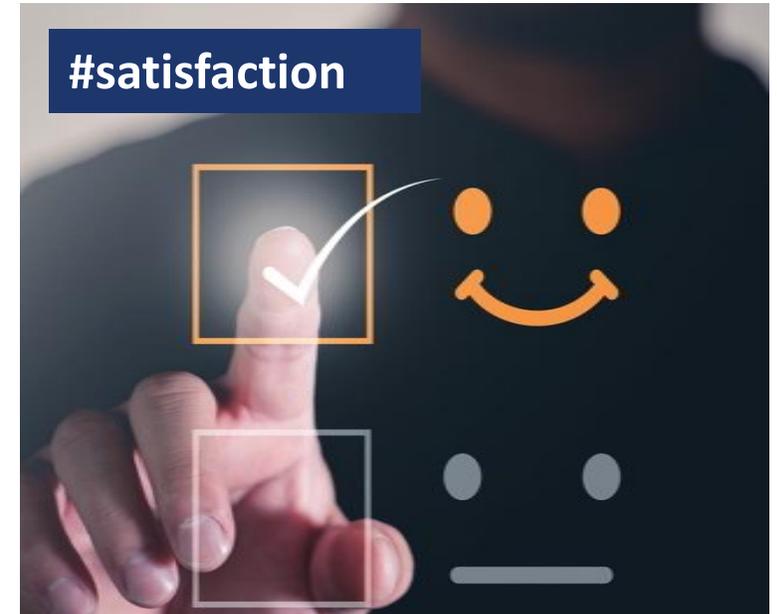
+ 120,000 square meters of laboratories
+ 1,000 qualified professionals
Countless ways to innovate

#quality



+ 2,000 tests and calibrations
+ 20,000 technical documents per year
Reference in quality services

#satisfaction



Level of Excellence in NPS
NPS 84
(Net Promoter Score)





O IPT opens its campus to the largest open innovation action in hardtech in Brazil, connecting distinct stakeholders of this ecosystem.

Cornerstone of the CITI Project – São Paulo State International Technology and Innovation Center.



Mode 1

Innovation hub

Become part of a unique and transformative ecosystem that brings together companies and startups that undertake together in the creation of technologies that drive new businesses.



Mode 2

Innovation center

Install your company's Technology Center within the IPT campus and leverage your development capacity.



INNOVATION CENTERS



V2COM
WEG Group

Google

T
TUPY

inteli



Portaria Principal

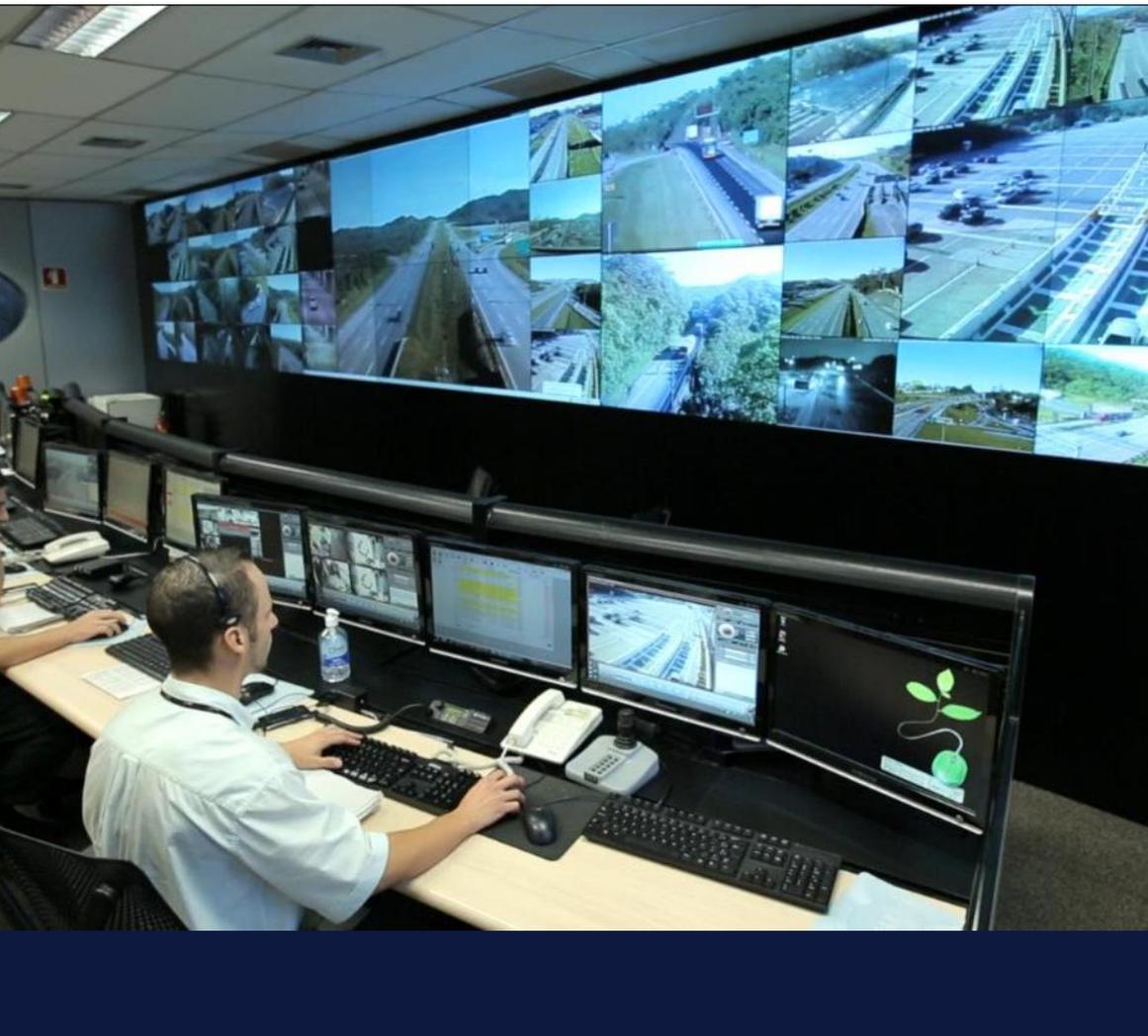


VALE

GranBio

CECIL





ipt

INSTITUTO DE
PESQUISAS
TECNOLÓGICAS

TECNOLOGIAS DIGITAIS

DIGITAL TECHNOLOGIES



DIGITAL TECHNOLOGIES

INTERNET OF THINGS AND EMBEDDED SYSTEMS

EMBEDDED SYSTEMS
INTERNET OF THINGS
WIRELESS SENSOR NETWORKS
CONNECTIVITY AND DATA TRANSMISSION (LPWAN, RFID, 5G)
INFORMATION SECURITY AND CYBERSECURITY



16 PEOPLE
2 PhDs
5 MScs
8 GRADUATES
1 TECHNICIAN

SOFTWARE ENGINEERING AND INTELLIGENT TRANSPORTATION

DATA ARCHITECTURE AND INTEGRATION
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)
TRANSPORTATION SIMULATION & MONITORING
INTEROPERABILITY OF SYSTEMS AND DEVICES
DESIGN AND DEVELOPMENT OF SOFTWARE SYSTEMS AND APPLICATIONS
COMPLIANCE AND SYSTEM TESTS



30 PEOPLE
1 PhD
11 MScs
14 GRADUATES
4 TECHNICIANS

ARTIFICIAL INTELLIGENCE AND ANALYTICS

PRESCRIPTIVE AND PREDICTIVE MAINTENANCE
COMPUTER VISION AND MACHINE LEARNING ALGORITHMS FOR AI IoT
INTELLIGENT OPERATION OF INDUSTRY 4.0 EQUIPMENT
BIOINFORMATICS
DATA LAKE ANALYTICS, GOVERNANCE AND QUALITY
AUGMENTED & VIRTUAL REALITY



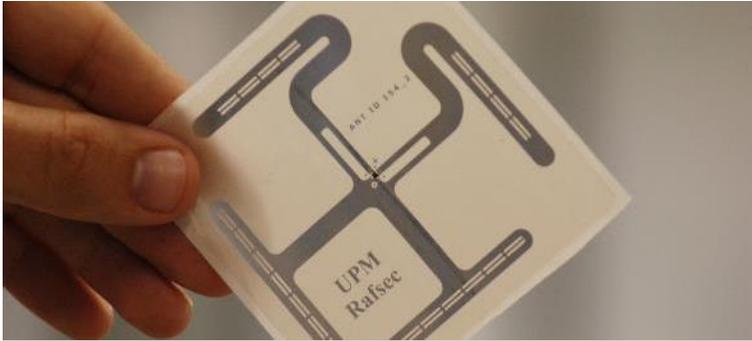
11 PEOPLE
3 PhDs
6 MScs
2 GRADUATES

BACKGROUND INFO

- Center for Applied Research in AI in partnership with Industry, MCTI and FAPESP (IASMIN PLATFORM)
 - 6 companies
 - 9 international S & T Institutes
 - 84 associated researchers
- > BRL 20 million in projects with the IT Law (2021 to 2023)
- > BRL 43 million in projects with Brazilian Government in the last 5 years.



TECHNOLOGICAL AXES



Industry 4.0

- Interoperability of systems and devices
- Compliance and systems Testing
- Prescriptive and Predictive Maintenance
- Development of artificial intelligence applications for industry
- Computer Vision
- Digital Twins



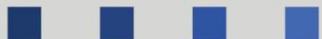
Smart Cities

- Data architecture and integration
- Development of applications for public management
- Wireless Sensor Networks
- Intelligent agents (IA)
- Operational Control Centers and Situation Rooms



Mobility and transportation

- Intelligent Transportation Systems (ITS)
- Evaluation of equipment applied to mobility (radars, traffic lights, cameras)
- Data integration and approaches for *big data* application
- Simulation and scenarios in Intelligent Transportation



O que o IPT fará

- Mentoria para o desenvolvimento de soluções de IA
- Sinônimo de mentor: conselheiro, guia, mestre, guru, líder, professor, instrutor, educador
- Direcionamento de pesquisa acadêmica para melhor entendimento da fenomenologia intrínseca da sua solução
- Direcionamento na definição ou melhoria na arquitetura ou algoritmo de seu agente de IA
- Auxílio na definição de modelos de validação do agente de IA
- Verificação qualitativa do dataset e eventuais códigos desenvolvidos pela startup para avaliar melhorias;
- Recomendações de plataformas pagas ou software livre





PLATAFORMA

IASMIN

Inteligência Artificial, Soluções para Manufatura Inteligente

IPT - Instituto de Pesquisas Tecnológicas
Av. Prof. Almeida Prado, 532 - Butantã, São Paulo - SP, 05508-901

ipt[□]
INSTITUTO DE
PESQUISAS
TECNOLÓGICAS

Leading Institution



Jefferson de Oliveira Gomes Main Researcher

Former President of the IPT, advisor of the Center of the 4th industrial revolution of the world economic forum, Director of the Fraunhofer Project Center FPC@ITA.

He has already worked in the assembly of national innovation centers such as: Embrapii, SESI SENAI Inovação, CCM Manufacturing Competence Center – ITA.



Maria Cristina Machado Executive Manager and Technical Director of Digital Technologies Business Unit

Research Lines and Leaders



Izabel Machado

USP

Real time
monitoring and
control



Alexandre Simões

UNESP

Autonomous systems,
robotics and machine
tools



Lilian Berton

UNIFESP

Prescriptive
maintenance and
intelligent operations



Paulo Eigi Miyagi

USP

Digital Twin



Flávio Soares Silva

USP

Supply chain
integration and
interoperability



Marcos Simplicio

USP

Cibersecurity



Universidade do Minho



— we are —

11

PRINCIPAL RESEARCHERS

73

ASSOCIATE RESEARCHERS

9

INTERNATIONAL INSTITUTES



<https://plataformaiasmin.org.br/>



After the initial cycle of three years, we'll be ready to for big achievements for the Brazilian industry



REAL TIME MONITORING AND CONTROL

Automated Industrial Processes with real time monitoring and control.

Embedded Technologies with proven local and remote communications.

Equipment's and solutions development and integration with pre-existing ones.



AUTONOMOUS SYSTEMS, ROBOTICS AND MACHINETOOLS

Tested physical systems in and environment that simulated real industrial conditions for developed prototypes.

Tested and validated robots, machines and machine tools in operating environment.



PRESCRIPTIVE MAINTENANCE AND INTELLIGENT OPERATIONS

Prove and test prescriptive maintenance solutions development that apply AI.

Validate domain expertise.

Monitoring platform development with cyberphysical AI agents based on digital signature of process variables in the manufacturing environment to improve operations..



INTEGRATION AND INTEROPERABILITY OF VALUE CHAINS

Analyze empirically the effectiveness of developed systems in the Innovation nucleolus and apply them experimentally



CYBERSECURITY

Adapt and implement proposed mechanisms in real applications. When needed, the methodology foresees a test and homologation phase with real data. The implementation is done substituting the existing system with load balance and redundancy.



DIGITAL TWINS

Implemented digital twin models in a laboratory environment, ready to be Applied in robotics, mining, O&G and manufacturing cells.



OUR APPROACH



WP1: STATE OF ART



WP2: R&D&I



WP3: PoC



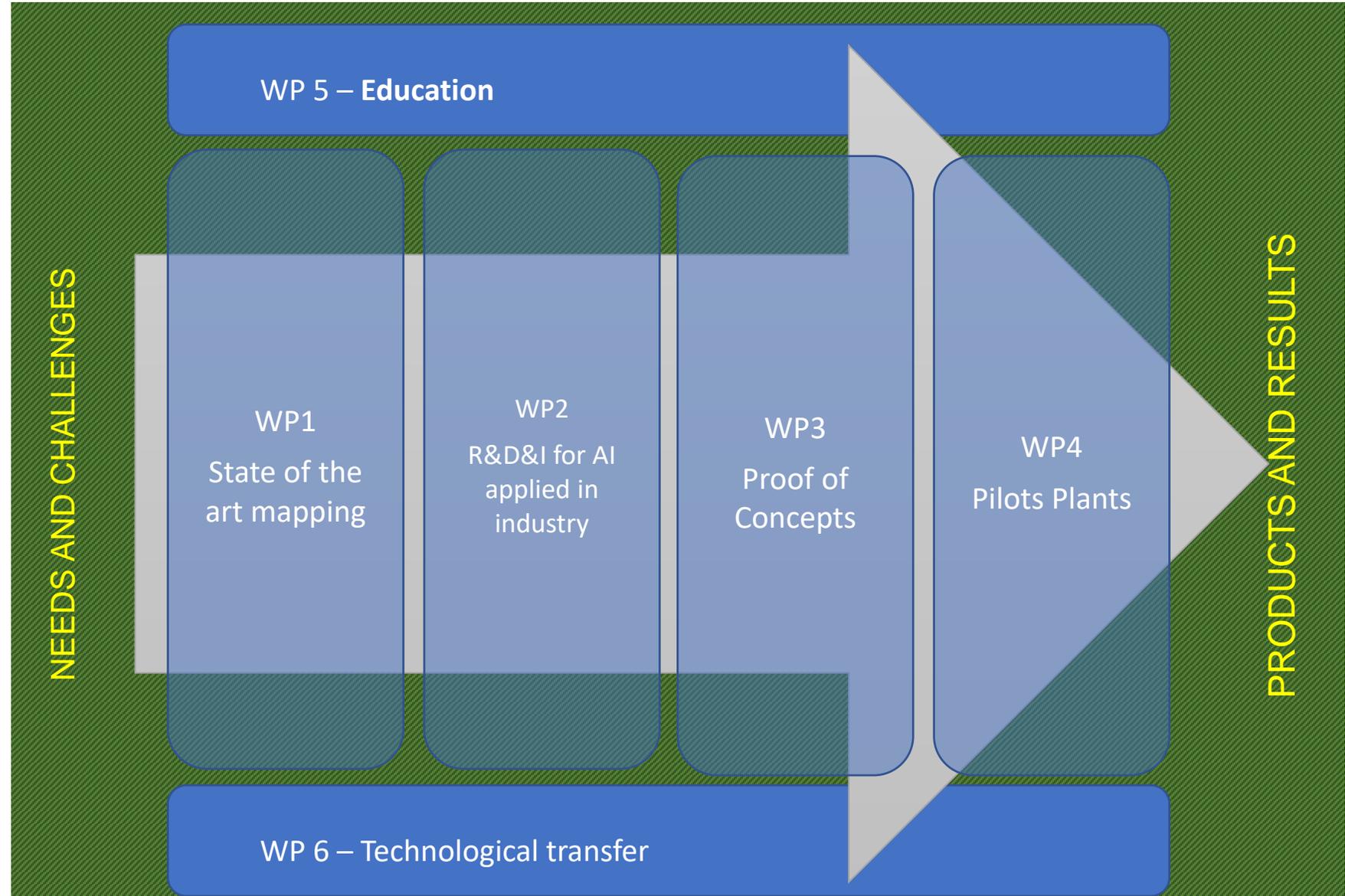
WP 4: PILOTS



**WP5: HR TRAINING AND
DISSEMINATION**



**WP6: TECHNOLOGICAL
TRANSFER**



DELIVERABLES

- **FAPESP**

- Training of 1 master, 2 doctors and 1 post-doc FAPESP scholarship holders
- Students must publish a minimum of 8 articles (2 articles per student)

- **Companies**

- Develop an open source library
- Develop automatic monitoring systems based on machine learning
- Systems for automating the data collection, modeling and scoring process as much as possible
- Automatic generation of explanations to identify possible causes of deviation
- Provide monitoring visibility across multiple system components



PROJECT GOALS

Anus	Work Package (WP)	Goals	Deliverable
1	WP1 – Survey of the State of the Art and Challenges	Identification of initial technical requirements and challenges.	Scientific publications, workshops, technical meetings, training courses.
2	WP2 - AI Methods Applied in Industry	Survey of the challenges faced by partner industries and development of AI methods.	Publications, workshops, technical meetings, algorithms, AI standards, training courses.
3	WP3 - Proofs of Concept (PoC) for Industry Solutions	Development of at least one proof of concept per partner company.	Implemented proofs of concept, publications, workshops, technical meetings, technology transfer, courses.
4	WP4 - Demonstration Plants	Implementation of concepts and PoCs in demonstration plants, with at least one application per partner company.	Technology implementation, publications, workshops, technical meetings, technology transfer, courses.
5	WP5 and WP6 - Education and Dissemination of Knowledge and Technology Transfer	Work with the data from the demonstration plants to validate the research.	Validation of methods, standards and algorithms, publications, workshops, technical meetings, technology transfer, courses.

RESULTS



Best Article Award



104 Publications



Workshops

#4 National

#2 International



International projects

“UnViM: Ensuring Production Excellence through Machine Learning and Uncertainty Quantification in Virtual Measurement”



FINEP Project

FINEP Multiuser Laboratory Approved



MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO



Linha 2 - Transformação Digital

LINHA 2 - TRANSFORMAÇÃO DIGITAL						
Ref	Executor	Sigla do Projeto	Região	Médo Final	Situação do Projeto	V. Aprovado
1 0883/24	Associação Laboratório Interinstitucional de E-Astronomia Lines	LINEA	SE	4.574	Recomendado dentro do limite de recursos	6.939.269,48
2 0923/24	Instituto de Pesquisas Tecnológicas do Estado de São Paulo S.A. - IPT	INFRA_IASMIN	SE	4.574	Recomendado dentro do limite de recursos	14.427.639,05
3 1030/24	UNIVERSIDADE FEDERAL DE VIDOSA	Data2Know	SE	4.315	Recomendado dentro do limite de recursos	13.592.914,62
4 0898/24	UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE	AvançaTech	NE	4.259	Recomendado dentro do limite de recursos	13.000.464,42
5 0900/24	FUND CENTROS DE REFERÊNCIA EM TECNOLOGIAS INOVADORAS	CETEMA	S	4.259	Recomendado dentro do limite de recursos	14.979.379,81
6 1039/24	INSTITUTO ATLÂNTICO	NexusAI	NE	3.926	Recomendado dentro do limite de recursos	13.236.450,87
7 1037/24	UNIVERSIDADE FEDERAL DE CAMPINA GRANDE	CTD2M	NE	3.815	Recomendado dentro do limite de recursos	14.958.902,71

PRÓ-INFRA Thematic Centers



Dozens of technical meetings with companies

Biweekly meetings with the representative of the companies

Monthly meetings with the principal investigators



Training

34 challenges identified with partner companies



WP3 - PROOFS OF CONCEPT

- **WP3.1 - Real-Time Monitoring:** Develop pilot plants to test and validate AI sensors and devices in the industry.
- **WP3.2 - Digital Twins:** Create detailed simulations of industrial processes based on digital twins.
- **WP3.3 - Interoperability and Chain Integration:** Implement prototypes for decentralized management of interactions between industrial systems.
- **WP3.4 - Prescriptive Maintenance and Intelligent Operation:** Develop and validate models for failure prediction and optimization of production processes.
- **WP3.5 - Autonomous Systems, Robotics and Machine Tools:** Create prototypes of intelligent machines and autonomous systems for operation in factory environments.
- **WP3.6 - Cybersecurity:** Test and validate solutions for intrusion detection and cyber incident response in industrial environments.

CRITERIA - PROOFS OF CONCEPT

- **Scientific and Technological Relevance**
- **Technical Feasibility and Resource Availability**
 - Infrastructure, equipment, and technical expertise required for implementation.
 - Availability of essential data and tools for testing.
- **Potential Impact**
 - Expected benefits for the company
 - Contribution to academia.
- **Scalability and Applicability**
 - Possibility of expansion to different scenarios and sectors.
 - Ease of implementation in real environments after the testing phase.
- **Company engagement**
 - Interest of companies.
- **Cost and Execution Time**
 - Budget required for implementation and testing.
 - Estimated time to obtain concrete results.
- **Measurement and Validation of Results**
 - Strategy for monitoring and adjustments based on the results obtained.
- **Potential for Publication and Intellectual Property**
 - Opportunity to generate scientific publications or patents.

RESOURCES

8 Scholarship
Professors

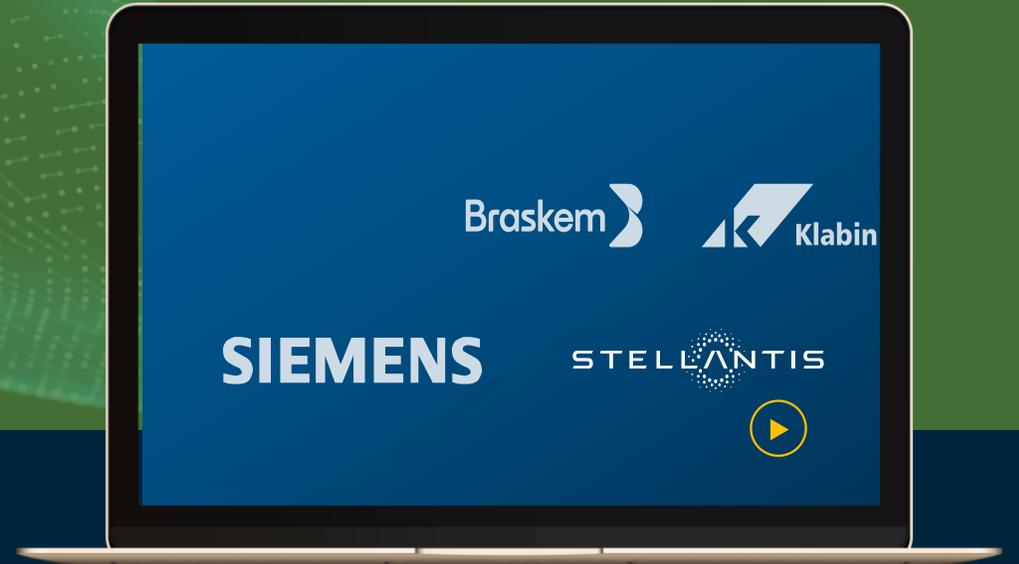
15 Scholarship
Holders – ICs,
Masters and
Doctors FAPESP

4 Technical Fellows
– FAPESP

Scholarships paid
with the resources
of partner
companies

[https://plataformaiasmin.org.br/
leal@ipt.br](https://plataformaiasmin.org.br/leal@ipt.br)

CNH Industrial could be a valuable Member!
Please, consider this Your Invitation.



Universidade do Minho





ipt

INSTITUTO DE
PESQUISAS
TECNOLÓGICAS

ENERGIA

ENERGY



ipt

SÃO
PAULO
GOVERNO
DO ESTADO

ENERGY

BIOENERGY

BIOMASS ENERGY – THERMOCHEMICAL PROCESS
LIQUID AND SOLID FUELS CHARACTERIZATION
GAS EMISSION AND AIR POLLUTION MEASUREMENTS
INDUSTRIAL COMBUSTION
HYDROGEN



36 PEOPLE
3 PhDs
7 MScs
12 GRADUATES
13 TECHNICIANS
1 ADM

END USE AND ENERGY MANAGEMENT

POWER QUALITY, EMC EVALUATION AND ELECTRICAL MODELING
PERFORMANCE AND SAFETY OF MATERIALS, EQUIPMENT AND SYSTEMS
END USE, ENERGY MANAGEMENT AND DISTRIBUTED SYSTEMS
ELETRIFIABLE SERVICES AND LIGHTING SYSTEM
PHOTOVOLTAIC SYSTEMS



17 PEOPLE
2 PhDs
2 MScs
8 GRADUATES
4 TECHNICIANS
1 ADM

ENERGY INFRASTRUCTURE

NUMERICAL MODELING OF STRUCTURES AND SYSTEMS
MECHANICAL TESTS ON EQUIPMENT AND SYSTEMS
EXPERIMENTAL STRUCTURAL PERFORMANCE EVALUATION
OPERATIONAL SAFETY EVALUATION
SYSTEM DEVELOPMENT



39 PEOPLE
5 PhDs
4 MScs
13 GRADUATES
15 TECHNICIANS
2 ADM

Fast facts

- SPECIALIZED AND MULTIDISCIPLINARY Team
- ISO 9001 E 17025 ACCREDITATION
- EXPERIENCE IN ANEEL, ANP AND ROTA 2030 PROJECTS
- ENERGY TRANSITION AND DECARBONIZATION ORIENTED



TECHNOLOGICAL AXES



■ Energy

- Development of advanced biofuels
- Hydrogen from multiple sources
- Power quality in equipment
- Experimental evaluation of components and structures
- Characterization of liquid and solid fuels
- Energy CAPACITY studies



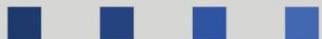
Oil and Gas

- Tests on components (risers, umbilicals and MOORING LINES)
- Full-scale experimental evaluation
- Evaluation of the electrical transfer function in umbilicals
- Application of natural gas in combustion engines
- Electromagnetic risk assessment in oil & gas systems
- EMI evaluation in umbilicals
- Computational simulation of subsea equipment instalation



■ Mobility and Transportation

- Maneuverability Evaluation of vessels in waterways
- Energy efficiency of transport MODALS
- Operational safety evaluation of rolling stock
- Energy security in transport systems
- Component reliability evaluation
- *Powertrain* rating
- Evaluation of alternative fuels for transport systems



TECHNOLOGICAL AXES



- Environment
- Emissions assessment – industrial and vehicular
- Energy transition in industry (fossil fuels by renewables)
- Conversion of industrial and urban solid waste (waste-to-energy)
- Life cycle analysis on luminaires
- Analysis of diesel oil for generator sets

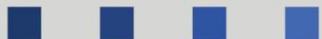


Agribusiness

- Energy APPLICATION OF RESIDUES
- Accelerated durability tests on machines
- Distributed generation in agribusiness
- Development and automation of equipment
- Fuel PERFORMANCE evaluation in agricultural engines

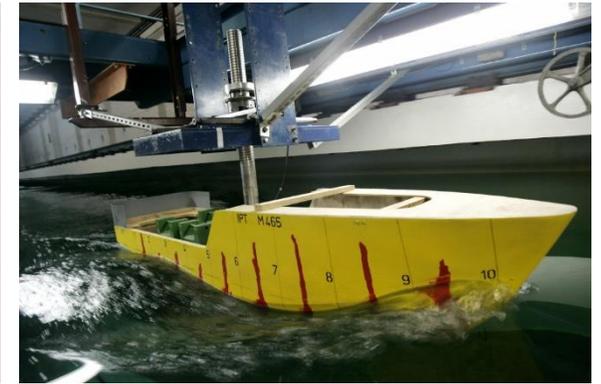


- Infrastructure
- Evaluation and design of lightning systems
- Accelerated durability testing on EQUIPMENT
- Evaluation of hydroelectric power plant protection systems – log boom
- Offshore structures evaluation
- Structural evaluation in turbines for hydroelectric generation



INFRASTRUCTURE SPOTLIGHTS

- Combustion plant
- Towing tank
- Goniophotometer for lighting systems
- Integrating sphere for lamp testing
- Anechoic chamber



INFRASTRUCTURE SPOTLIGHTS

- Engine performance test beds
- Accelerated durability test beds
- 2600 tf MOORING LINE testing machine



INFRASTRUCTURE SPOTLIGHTS

- Gasification and pyrolysis plant
- Industrial emissions measurement Mobile Laboratory
- Elemental analyzer for fuels and biomass



Thank you!

- Dr. Adriano Leal
- leal@ipt.br

- Dr. Rynaldo Zanotele Hemerly de Almeida
- rynaldo@ipt.br

 [linkedin.com/school/iptsp/](https://www.linkedin.com/school/iptsp/)

 [instagram.com/ipt_oficial/](https://www.instagram.com/ipt_oficial/)

 [youtube.com/@IPTbr/](https://www.youtube.com/@IPTbr/)

www.ipt.br

 **ipt**
INSTITUTO DE
PESQUISAS
TECNOLÓGICAS

 **SÃO
PAULO**
GOVERNO
DO ESTADO



MAINTENANCE

- Maintenance is one of the main application areas of Industry 4.0, as machines must be available for daily use and repairs and maintenance costs must be minimized.
- The main categorizations of the area are:

Descriptive: Analyze what caused the failure

Predictive:
Determining when the monitored asset will fail

Prescriptive:
Minimize your impact on the industry in question

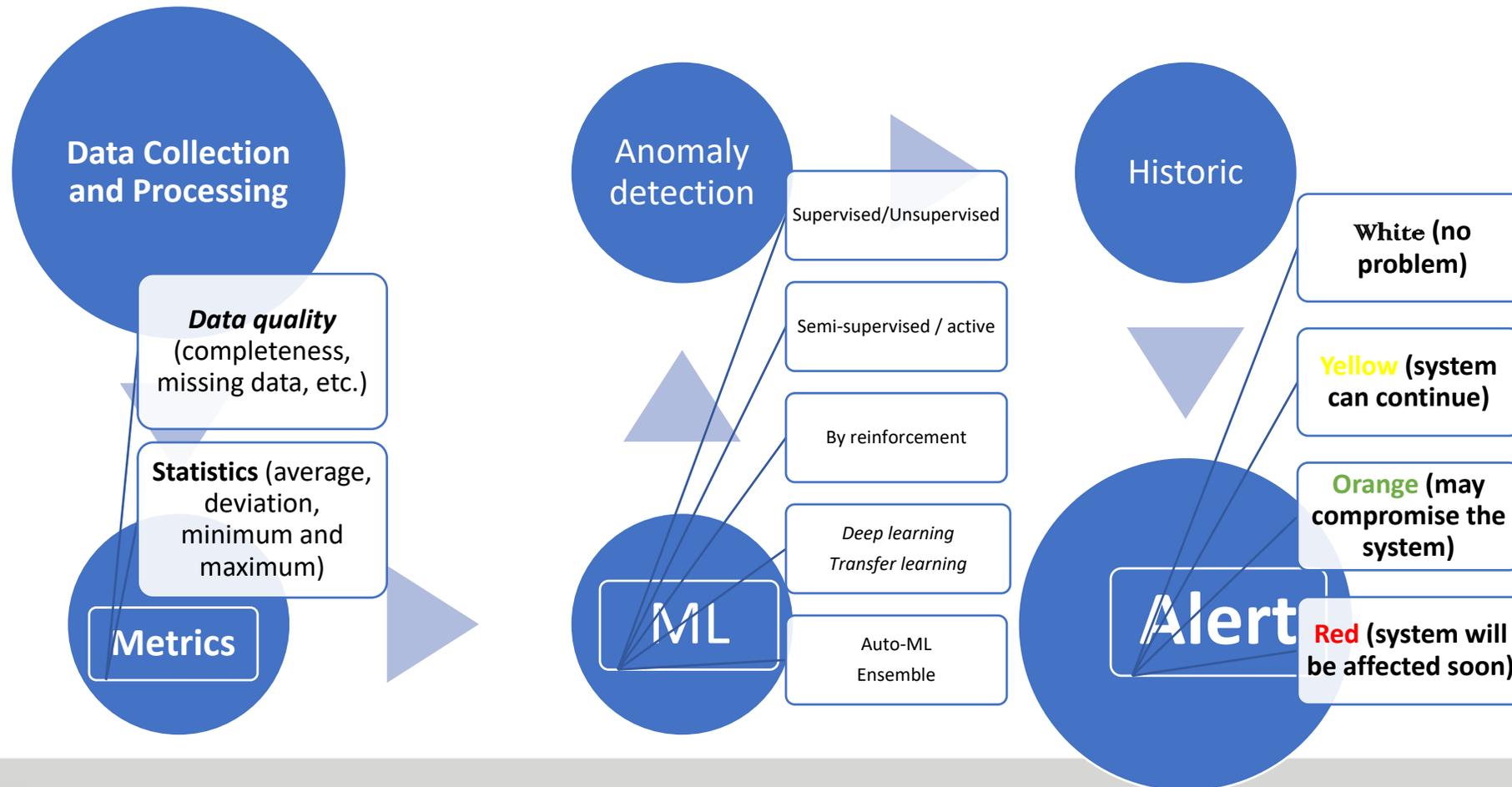
PREDICTIVE VS PRESCRIPTIVE MAINTENANCE

- While predictive maintenance can tell you the estimated duration until a failure event, prescriptive maintenance will allow you to calculate the effects of varying operating conditions up to the time of failure.
- Prescriptive maintenance can be seen as a tool that provides multiple scenarios and simulations without having to experience each one in real life.
- **Prescriptive maintenance not only predicts failure events, but also recommends actions to be taken.** The potential results when such recommended actions are taken are then calculated and anticipated.

GOALS

- Explore different learning paradigms (supervised, unsupervised, semi-supervised, deep learning, etc) to perform predictive and prescriptive maintenance.
- Creation of hybrid models that combine Machine Learning with physical, numerical models, etc.
- Explore transfer learning between deep learning models.
- Detect anomalies in streaming data.
- The application of parameter optimization techniques via auto-ML to reduce the number of tasks required.
- Use of explainable AI to facilitate model interpretation.

METHODOLOGY FOR DEVELOPING A DATA MONITORING LIBRARY AND MAINTENANCE ASSISTANCE



INDUSTRY 4.0

- The fourth industrial revolution (Industry 4.0) aims to provide an industrial environment for real-time, intelligent, interoperable and autonomous manufacturing environments. To realize this vision, Industry 4.0 is based on innovative information and communications, technologies such as cyber-physical systems (CPS), Internet of Things (IoT) and cloud computing.

