SOFTWARE PLATFORM FOR PRESCRIPTIVE ANALYTICS AND OPTIMIZATION OF INDUSTRIAL SYSTEMS

Сергей Николаев, CEO

cyberphysics

cyberphysics

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Company founded

>25
Employees

Management Team

Sergei Nikolaev, CEO

Ph.D. in Mechanical engineering

Expert in Industrial AI

Ighor Uzhinsky,
Scientific supervisor

25 years experience
in the leading US aerospace company

Ph.D. in Math

Sergei Belov, CTO

Expert in applied AI
and physics-based modelling

Michael Gusev, DBD

Ph.D. in Applied mechanics

Expert in production optimization

Fabio Cacciatori,
Strategic development

Serial Entrepreneur
20 years experience
in EU IT businesses

- Unique scientific technologies
- Data Scientists
- The best production systems experts
- Modeling, machine learning and software engineers

What we offer?

PRESCRIPTIVE ANALYTICS OF EQUIPMENT

ONLINE TECHNICAL CONDITION ANALYSIS

ONLINE OPTIMIZATION OF OPERATING MODES

- Data- and physics-based optimization of equipment operating modes
- The most advanced no-code production asset optimization platform
- Adjustment of modes and real-time analysis of technical condition

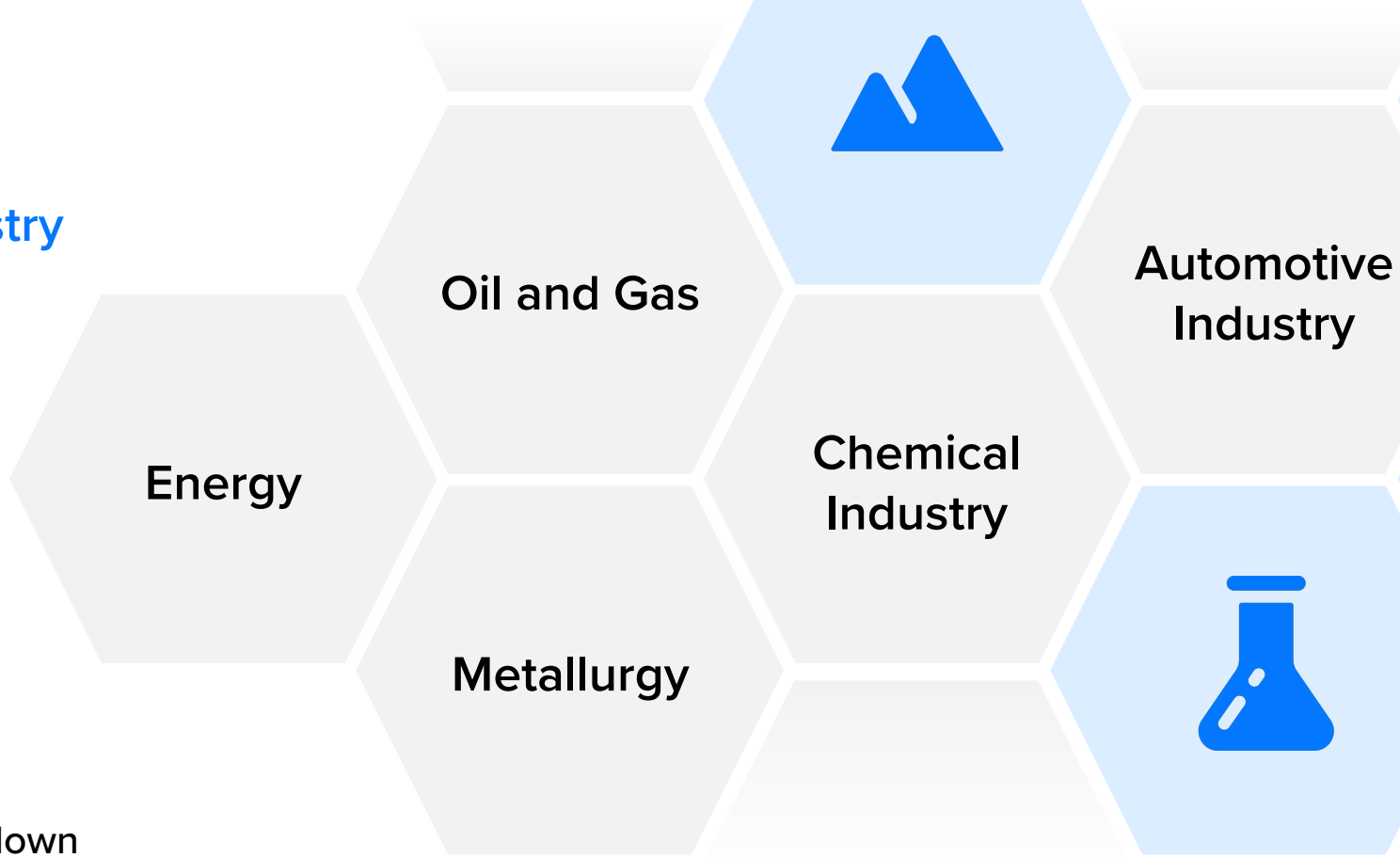
1 **Digital twins for any type of equipment**

2 **Built-in libraries of ready-made digital models**

3 **User configurable in no-code mode**

Who is the platform for?

Digital twins of equipment for any industry



CASE RESULTS

- Up to 3% cost savings: reduced fuel gas consumption
- Optimal molding mode for plastic parts in 2 sec instead of 20 days
- 80% decrease of accidents and related losses for a roller press
- Saving up to $60 000 from an emergency shutdown

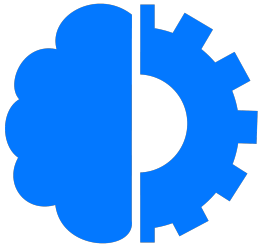
USERS

- chief engineers,
- technologists,
- specialists responsible for the reliability of the industrial equipment.

OUR CLIENTS

EVRAZ
FCA FIAT CHRYSLER AUTOMOBILES
GAZPROM
NLMK
BOSCH
TMK
URALKALI®
United engine corporation

Why Cyberphysics?



Cyberphysics implements unique technology
HYBRID EXPLAINABLE AI
(real data + physics models)

We solve problems that cannot be solved by classical ML approaches, for example: analysis of temperature inside molten metal, corrosion effects, analysis of equipment efficiency

No expensive data scientists needed thanks to **no-code** modeling

Model development in just 2 weeks thanks to a library of pre-configured models

CyberPhysics solution

INPUTS

- Data from IIoT/SCADA system
- Technical specs
- Operating modes

PROBLEMS

- Non-optimal operating modes of equipment
- Excessive consumption of fuel and materials
- Product quality problems
- Emergency stops

CYBERPHYSICS IMPLEMENTATION

No-code development of digital models	Integration with SCADA/IIoT	Interface configuration Online recommendations: - Online mode optimization - Technical condition analysis & prediction
Data preparation and analysis	Models validation	
4-5 weeks	**2-3 weeks**	**1-2 weeks**

RESLUTS

Increasing productivity

Costs reduction

Optimization of fuel and material consumption

Improving product quality

Fewer emergency stops

Transfer of unscheduled maintenance to planned

Key Technology

DATA

Synthetic Data

Equation-based models and meta-models

Historical data

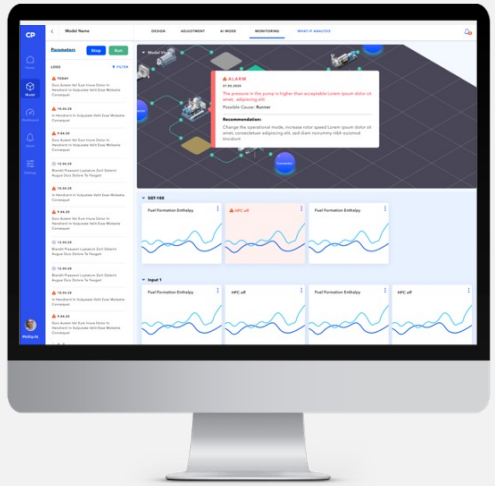
IIoT, SCADA, MES

Integration with "real" data sources /
Synthetic data collection

HYBRID MODELING

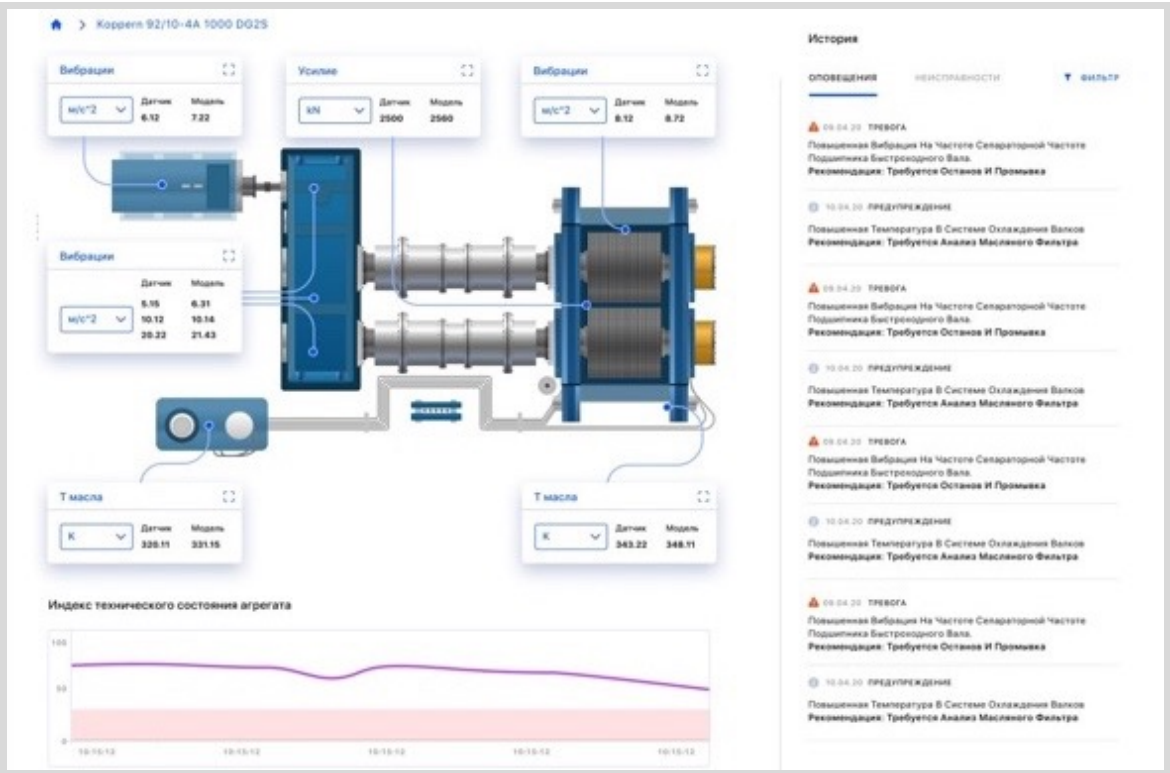
Digital models of "physics" of subsystems and processes

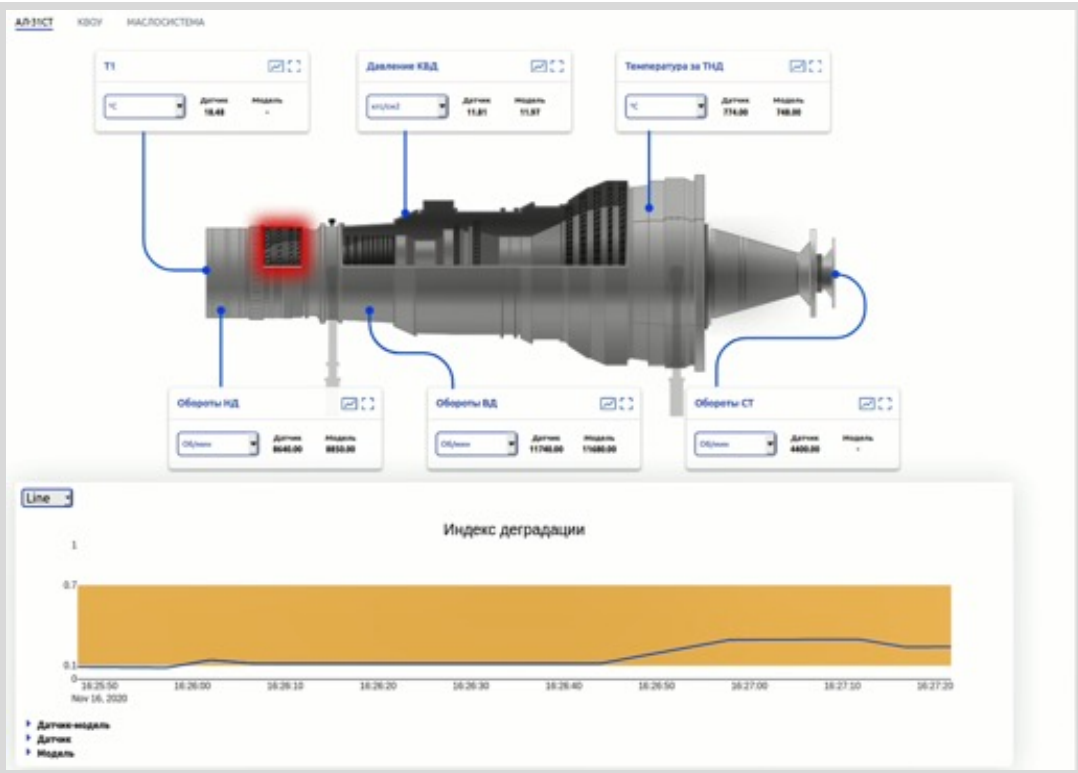
ONLINE PRESCRIPTIVE ANALYTICS



Operational and prescriptive system monitoring
What-If Analysis for Selecting Subsystem Settings

Examples of CyberPhysics solution implementation





Prescriptive analytics of roller press

Gas turbine technical condition monitoring

Examples of completed projects

NLMK

Optimization of the process of mixing steel in a vacuum apparatus (4.3 million tons of steel per year)

-40%
Reduction of lining wear

+1
Increase of steel grade

x2
Increase of stirring speed of steel mixing

FCA
FIAT CHRYSLER AUTOMOBILES

Optimization of the injection molding process for plastic parts

2 sec VS 20 days
Acceleration of the prediction of the optimal casting mode

Scaling potential
€500 000
Defects prediction

GAZPROM

Technical condition diagnostics at the park of gas-pumping units

400 hours
Defect recognition before breakage

Up to 5%
Optimization of fuel gas consumption

Case: Technical condition diagnostics at the park of gas-pumping units

GAZPROM

MAIN ISSUES:	CYBERPHYSICS SOLUTION:	RESULTS:
Emergency shutdowns and **high costs** for equipment repairs / maintenance **(up to $1.7 million per year for 10 units)**	Development of **digital models of the main systems**: gas-air path, oil system, integrated air cleaning device	Defect recognition for the most critical subsystem - the flow path - **400 HOURS** before the breakdown. **An emergency stop was predicted ($700 - 800 000)**
Increased costs caused by the impossibility of prompt localization and cause defention of the defect	**Defect classifier** for localizing defects and issuing recommendations	Simulation of equipment operation with an error **LESS than 2%** (Prevention of emergency stops and minimization of losses for maintenance)
High fuel consumption due to non-optimal operating conditions of the equipment	**Physical and mathematical modeling** for the dynamics of the operation of gas turbine plants in real time	**Up to 3%** reduction in operating costs due to lower fuel gas consumption. *Decrease by 4% (250 m3 per hour - 100 thousand rubles per day per workshop) - in development

Case: Technical condition diagnostics of a roller press

URALKALI®

MAIN ISSUES:	CYBERPHYSICS SOLUTION:	RESULTS:
Emergency **shutdowns** and **downtime** leading to **increased costs**	Building a **hybrid model** based on vibration analysis and predictive models	Saving around **$30 000** on average from one emergency stop (not including the cost of equipment repair)
Increased maintenance costs due to lack of recommendations for elimination and prevention of defects	Prediction of defects, identification of causes and recommendations for their elimination within a **prescriptive approach**	Emergency shutdown and shortage of 2000 tons of products prevented – **$60 000**
Low transparency of the technical condition of a large number of pieces of equipment	**Real-time forecast** of the technical condition index	**80%** fewer accidents – **from tens to singles emergency stops per year**

Case: Optimization of steel smelting and reduction of wear of refractory materials

MAIN ISSUES:	CYBERPHYSICS SOLUTION:	RESULTS:
Suboptimal choice of slag and lining combination	Using a unique **physical testing** methodology combined with **digital simulation**	Lining durability increase due to optimally selected slag **by NOT LESS THAN 5% (up to $120 000 per year)**
Long cycle of commissioning of the steelmaking process due to testing of various types of lining **(up to 1 month)**	**Platform solution** in the form of a mathematical model recommending the optimal slag for a given type of lining	**Forecast of the resource** of refractory products from various suppliers on model / real slags
The problem of suppliers selection of slag and lining, and their combination in terms of efficiency	Unique equipment of our own design for testing and refining the lining wear model	Recommendations for the chemical composition of the slag **to increase the resistance** of refractories while maintaining the technological properties of the slag

Case: Optimization of the process of stirring steel in a vacuum apparatus (4.3 million tons of steel per year)

MAIN ISSUES:	CYBERPHYSICS SOLUTION:	RESULTS:
Increased wear of the lining	**Detailed model** of mixing hydrodynamics and lining wear rate	**Up to 10% decrease** of lining wear. **Saving on average $130 000 per year**
Increased stirring time for steel	Creation of **a detailed dynamic model** of production processes	**Doubling** the stirring speed of steel with ferroalloys
Low productivity and effectiveness	Optimal parameters based on a combination of **digital models and real operating data**	**0.5%** productivity increase. Increase in production output **by $60 - 70 000 per vacuum unit per year**

CYBERPHYSICS

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We look forward to cooperation!