

Výskumné Centrum moderných  
metód riadenia a priemyselnej  
informatiky  
**ALICE CERN**

Doc. Ing. Ján Jadlovský, CSc.


# Výskumné Centrum Moderných Metód Riadenia a Priemyselnej Informatiky - VCMMRaPI



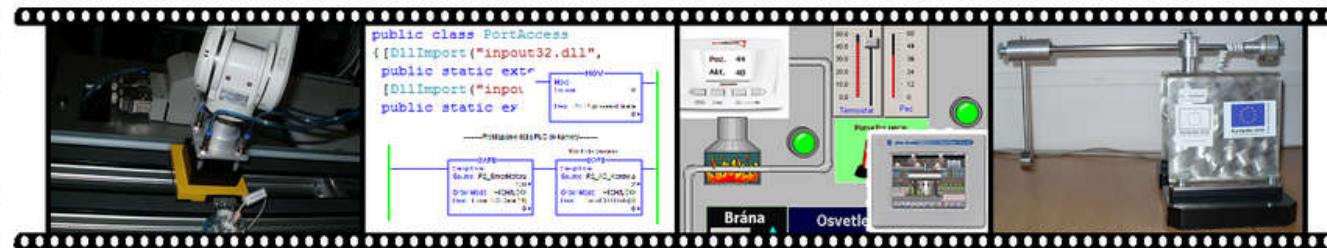
Center of Modern Control Techniques  
and Industrial Informatics

Department of cybernetics and artificial intelligence (DCAI), FEEL, Technical University of Košice

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Infrastructure  
Laboratories  
Members  
Courses  
Models  
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CERN  
Gallery  
Partners



## Profile of the Center of Modern Control Techniques and Industrial Informatics

- » We are a university research center focused on teaching and research in the field of advanced control techniques and industrial automation.
- » We are equipped with the most up-to-date resources for development, simulation and implementation for regulation, control, information, management and communication systems.
- » Technical, program and network resources were supplied by the world's leading companies in information technology and management (Rockwell Automation, Wonderware, Oracle, Mitsubishi, Mathworks and others.) which provide regular updates as well.
- » The supplied resources have been arranged into the 5-level DCS pyramid model in accordance with the international CIM standard (Computer Integrated Manufacturing), which ensures the implementation of a fully-automated control system for production companies.
- » All research and development of control system components is conducted based on the 5-level DCS pyramid model.
- » The obtained results are applied in the curriculum of courses for bachelor and master studies, in the base research and in solving practical problems in manufacturing plants.

Web centra: <http://kyb.feel.tuke.sk>

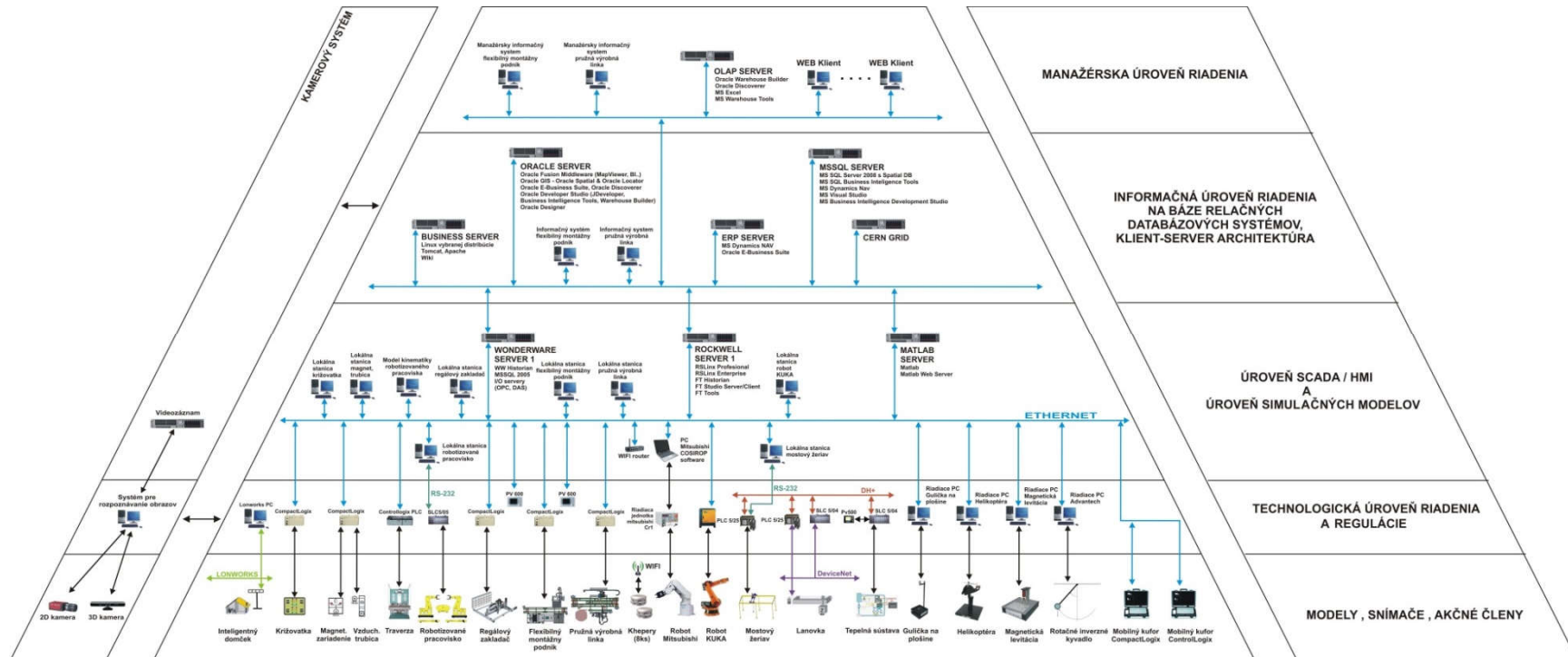
# Členovia VCMMRaPI (1)

- doc. Ing. Ján Jadlovský CSc.
  - rozpoznávanie obrazov
  - distribuované systémy riadenia
  - komplexná funkčná diagnostika jednouúčelových regulátorov
  - diagnostika výrobných riadiacich systémov
  - tvorba informačných a riadiacich systémov s aplikáciou najmodernejších informačných technológií a metód umelej inteligencie
- doc. Ing. Anna Jadlovská PhD.
  - experimentálna identifikácia modelov fyzikálnych systémov
  - metódy analýzy a syntézy nelineárnych systémov
  - návrh algoritmov pre optimálne a adaptívne riadenie dynamických systémov
  - aplikácia metód umelej inteligencie v modelovaní a prediktívnom riadení nelineárnych systémov
  - simulačné systémy (MATLAB/Simulink, aplikačné toolboxy) a ich využitie v modelovaní dynamických a ekonomických systémov

## Členovia VCMMRaPI (2)

- Ing. Slávka Jadlovská PhD.
- Ing. Jakub Čerkala
- Ing. Michal Kopčík
- Ing. Ján Čabala
- Ing. Matej Oravec
- Ing. Michal Varga
- Ing. Dominik Vošček

# Infraštruktúra Distribuovaného Systému Riadenia (DCS) VCMMRaPI



5 – úrovňový DCS model CMMRaPI

# Projekty VCMMRaPI

- **VEGA projekty**

- **Dynamic Hybrid Architectures in Multiagent Network Control Systems (2011-2013)**
- **Multiagent Network Control Systems with Automatic Reconfiguration (2008-2010)**
- **Multiagent Hybrid Control of Large Scale Systems (2005-2007)**
- **Multiagent Control of Large Scale Systems (2002-2004)**
- **Multiagent Hybrid Control of Large Scale Systems Using Artificial Intelligence Methods (1999-2001)**
- **Intelligent Methods and Algorithms of Decision Making and Control of Large Scale Systems (1996-1998)**

- **KEGA projekty**

- **CyberLabTrainSystem - Demonstrator and Trainer of Information-Control Systems (2012 – 2014)**
- **Development of modern university textbooks for the core units of newly-transformed study program "Cybernetics and information-control systems" in second degree of study (2010-2013)**
- **Cybernetic Educational Centre (2010-2011)**
- **Monitoring and Supervised Control of Simulated Processes – Virtual Laboratory IIRS (2005-2007)**
- **Monitoring of Real Processes and Supervised Control of Simulated Processes – Virtual Laboratory IIRS (2003-2005)**

- **Projekty spolufinancované Európskou Úniou**

- **Development of the Center of Information and Communication Technologies for Knowledge Systems - project supported by the Agency of the Ministry of Education for the Structural Funds of EU (2010 - 2013)**
- **Center of Information and Communication Technologies for Knowledge Systems - project supported by the Agency of the Ministry of Education for the Structural Funds (2009 - 2011)**



# Projekt TECHNICOM (2013 - 2015)



**Center for Nondestructive Diagnostics of Technological Processes  
Using Standard Software for Control and Communication**

Camera Systems

Mechatronic Systems

Mobile Robot Systems

Flexible Manufacturing Systems &  
Automated Production Lines

Systems Focused on Vibration Diagnostics  
for Mechatronic Systems

## Partneri VCMMRaPI

- Rockwell Automation
- Oracle
- Wonderware
- Mathworks
- Humusoft
- Mitsubishi

**Rockwell**  
**Automation**

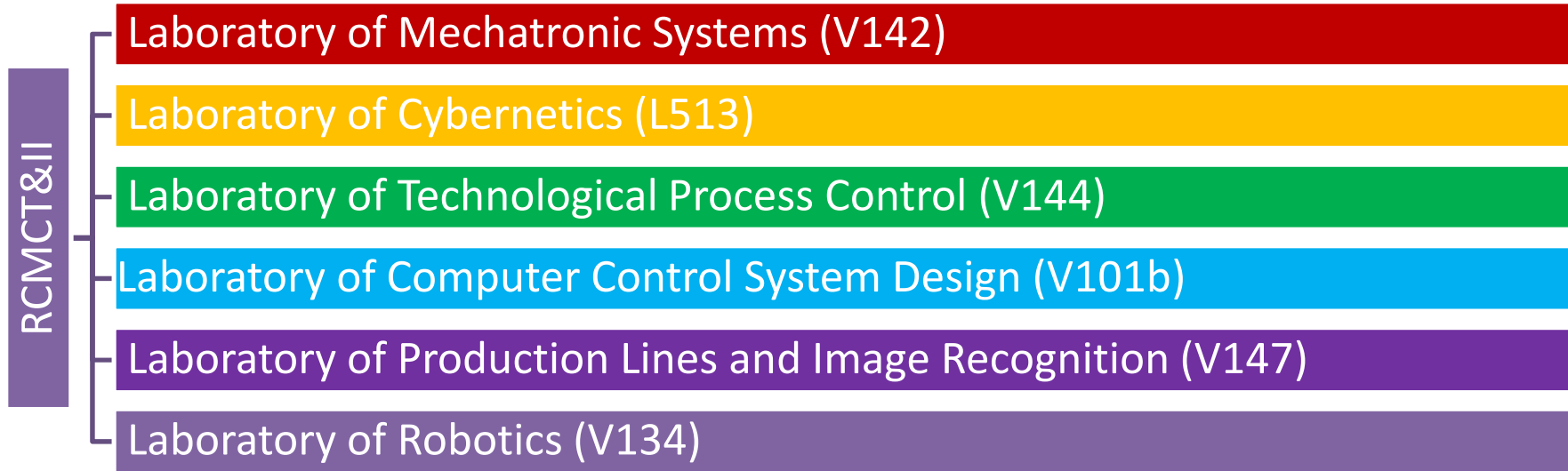


**ORACLE**<sup>®</sup>

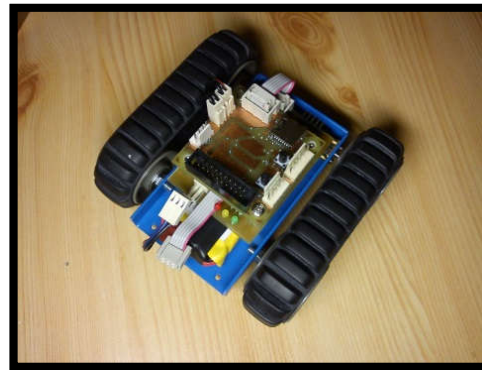
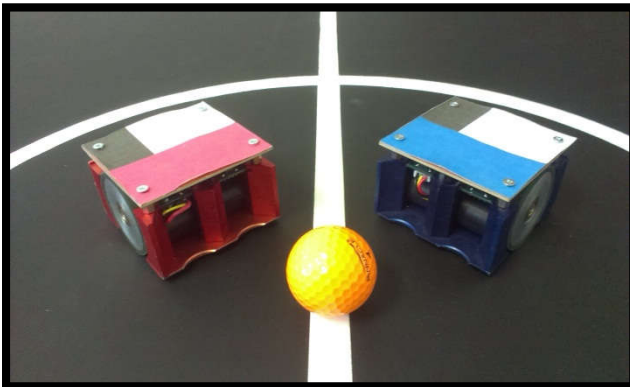




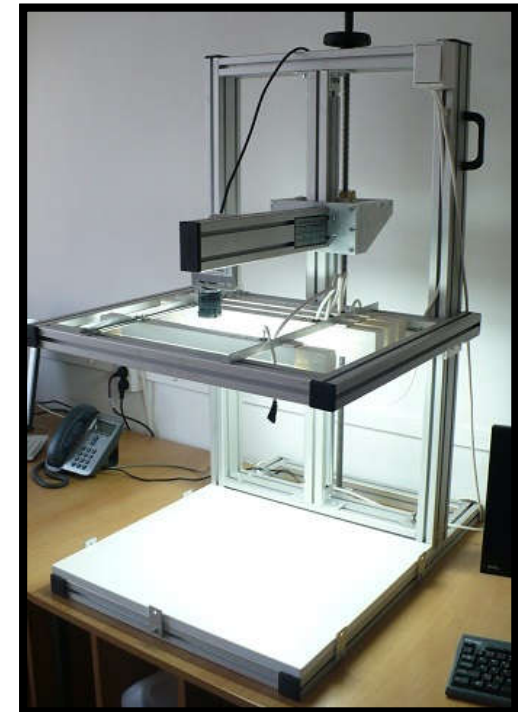
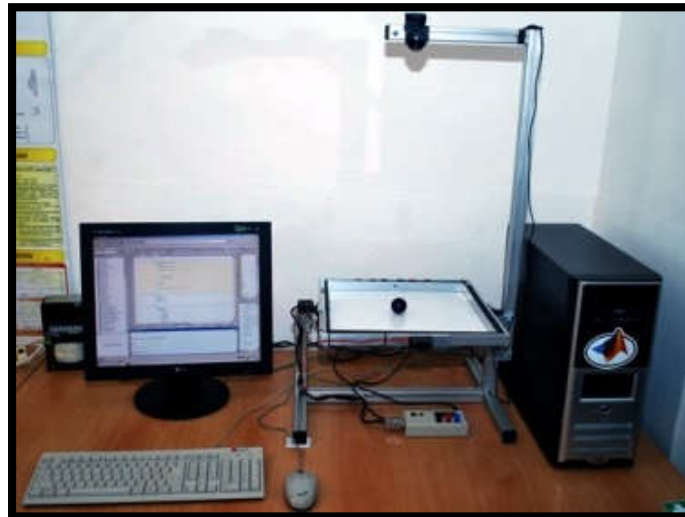
# Laborat3ria VCMMPaPI

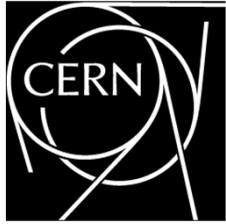


# Laboratórne modely VCMMRaPI (1)



# Laboratórne modely VCMMRaPI (2)

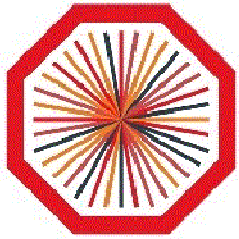




## Spolupráca s CERN-om

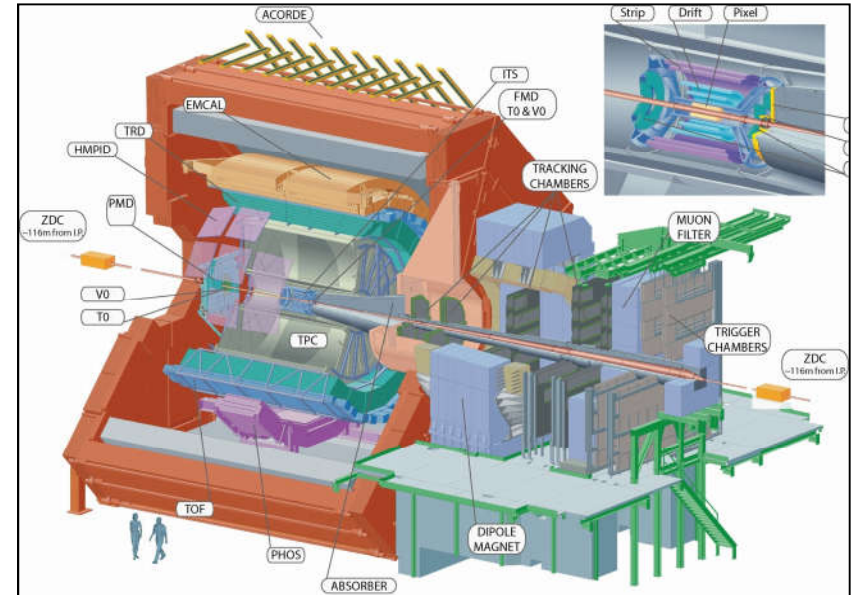
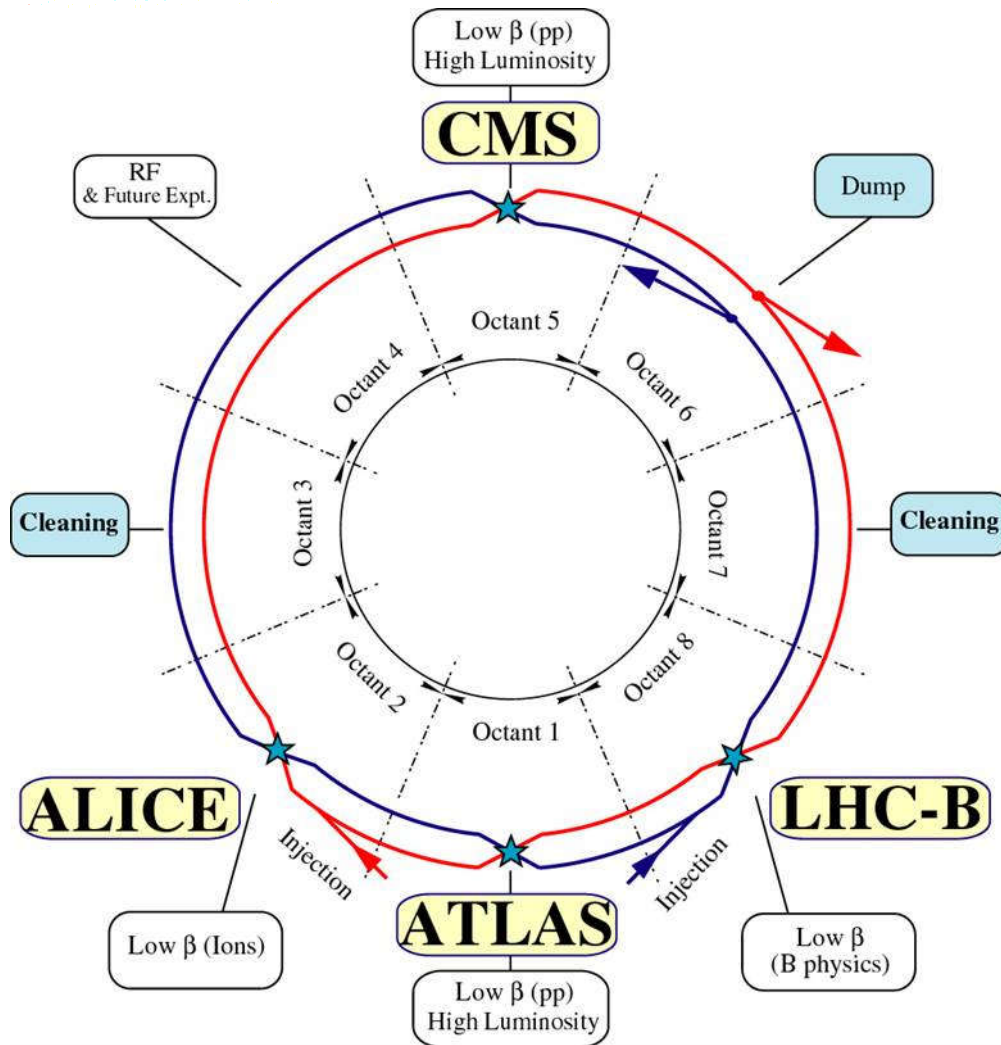
- **12. október 2012** - TUKE prijatá ako asociovaný člen projektu ALICE (CERN)
- VCMRaPI a jeho členovia pracujú na úlohách projektu ALICE
- Prvá z úloh: AMANDA
- **13. marca 2015** - TUKE prijatá ako plný člen projektu ALICE
- Nové úlohy na ALICE DCS



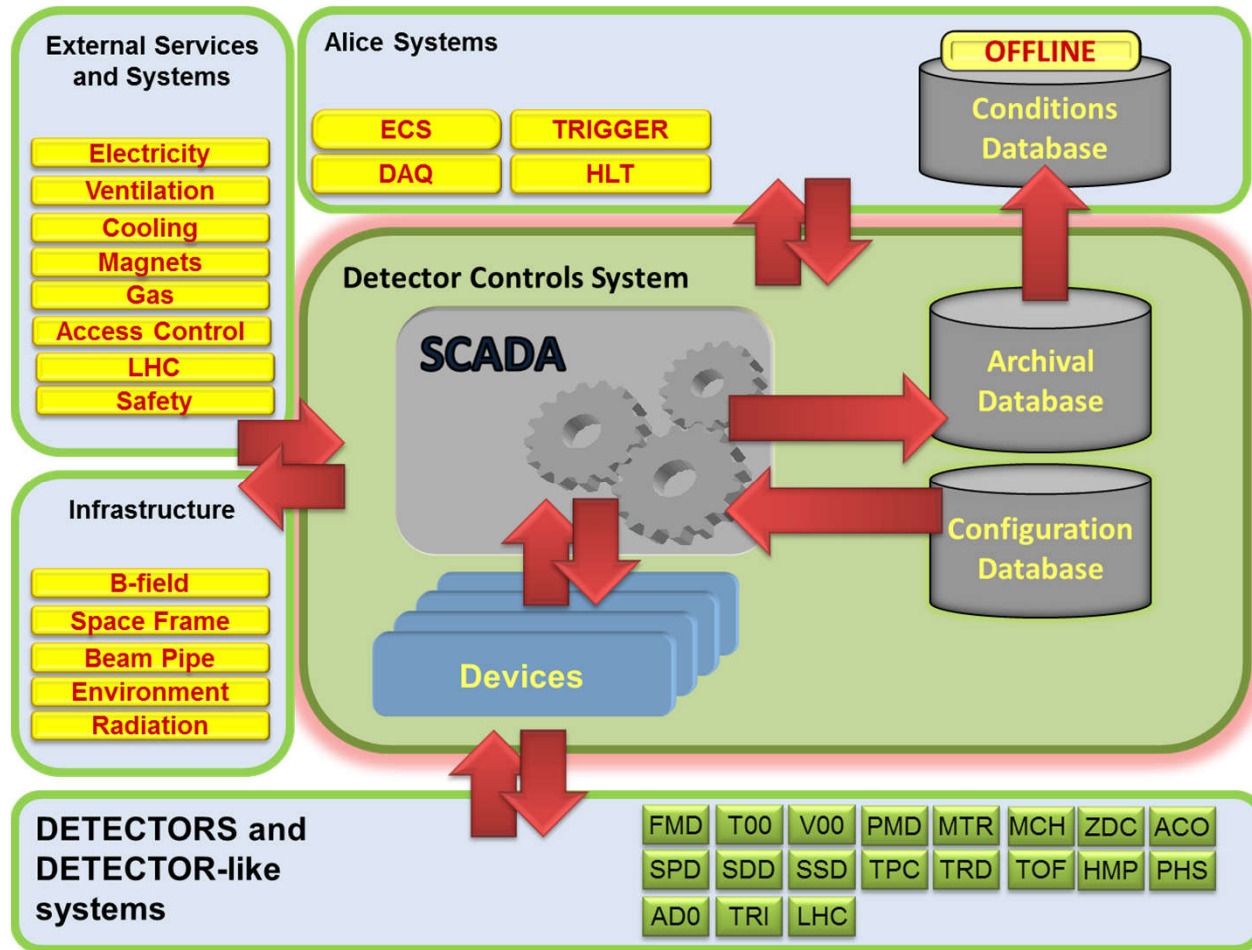


**ALICE**

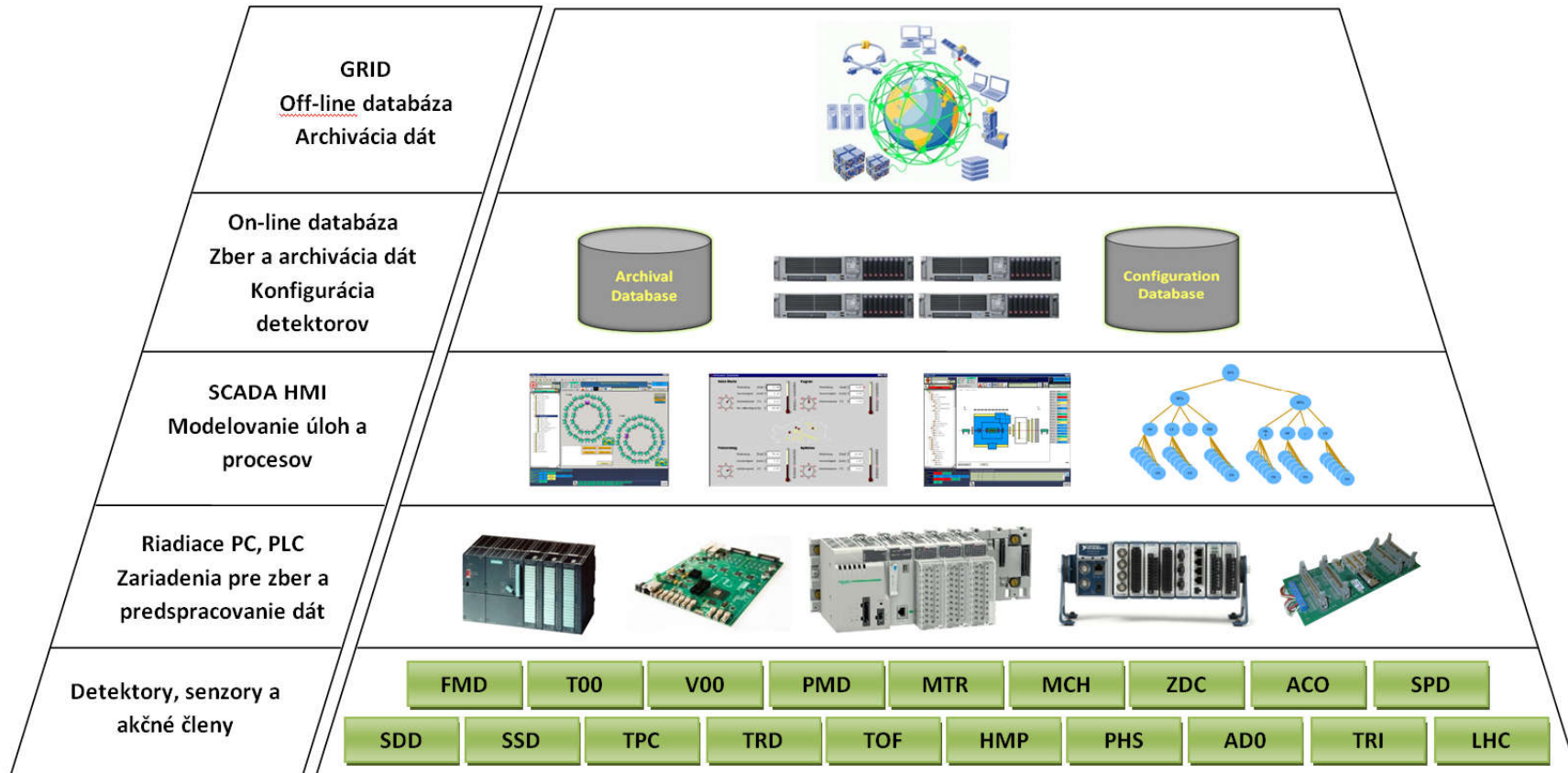
# Detektor ALICE



# Alice DCS



# Infraštruktúra Alice DCS



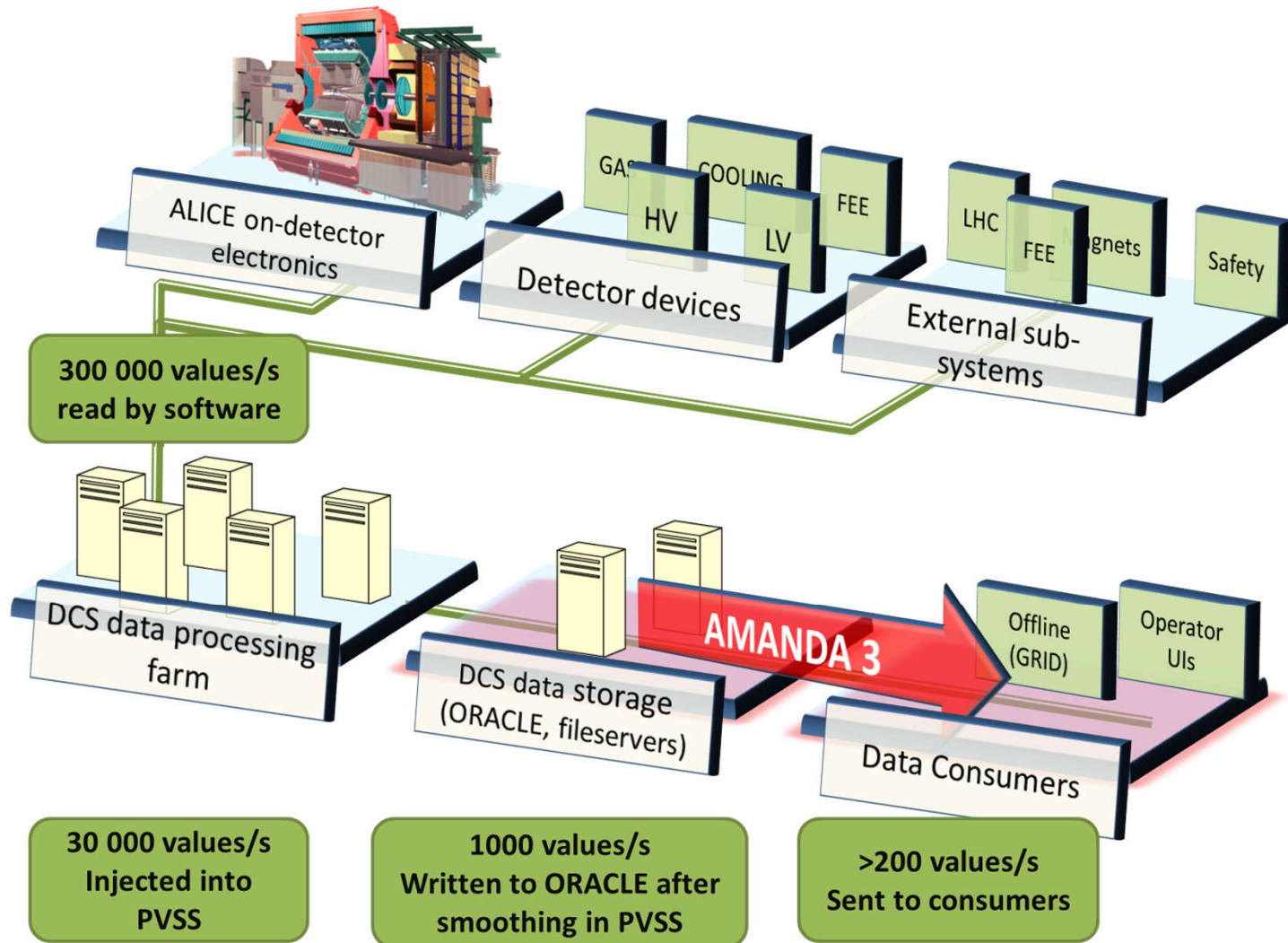
5 – úrovňový DCS model Alice DCS

# Úlohy na projekte ALICE

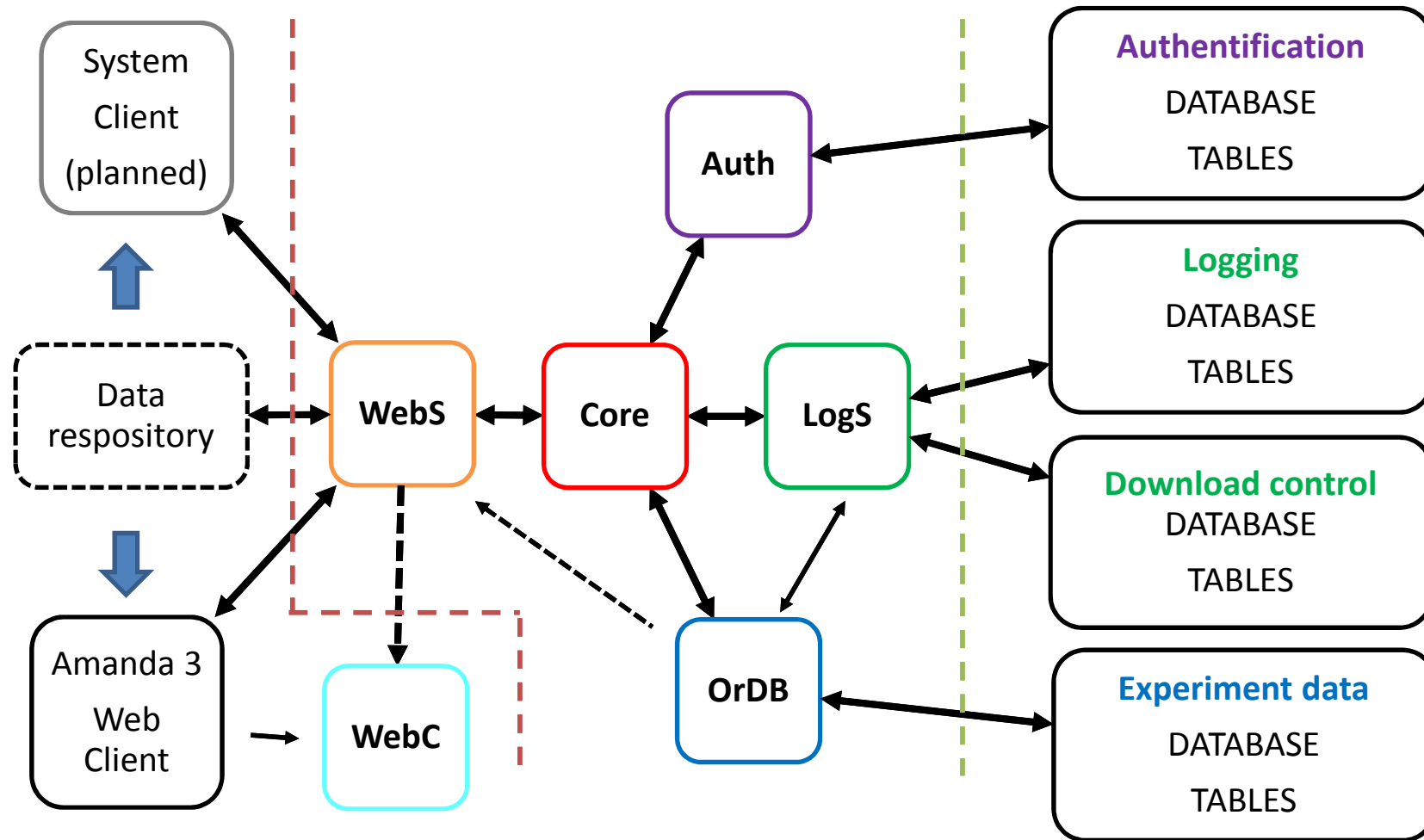
- **Alice MANager for Dcs Archives (AMANDA 3)**
  - sprostredkovanie prenosu dát z offline databázy projektu ALICE pomocou webového rozhrania
- **ALICE Inner Tracking System Upgrade of the Hybrid Integrated Circuit test system (ITS Upgrade of the HIC test system)**
  - zabezpečenie zberu a sprostredkovania dát testovacieho systému SPD v prostredí WINCC OA
- **Alice Low-level FRont-End Device (ALFRED) API**
  - Návrh a programová realizácia univerzálneho API pre riadenie a zber dát zo špeciálnych zariadení projektu ALICE



# Alice DCS – Distribuovaný riadiaci systém



# AMANDA 3 – koncept (1)



# AMANDA 3 – koncept (2)

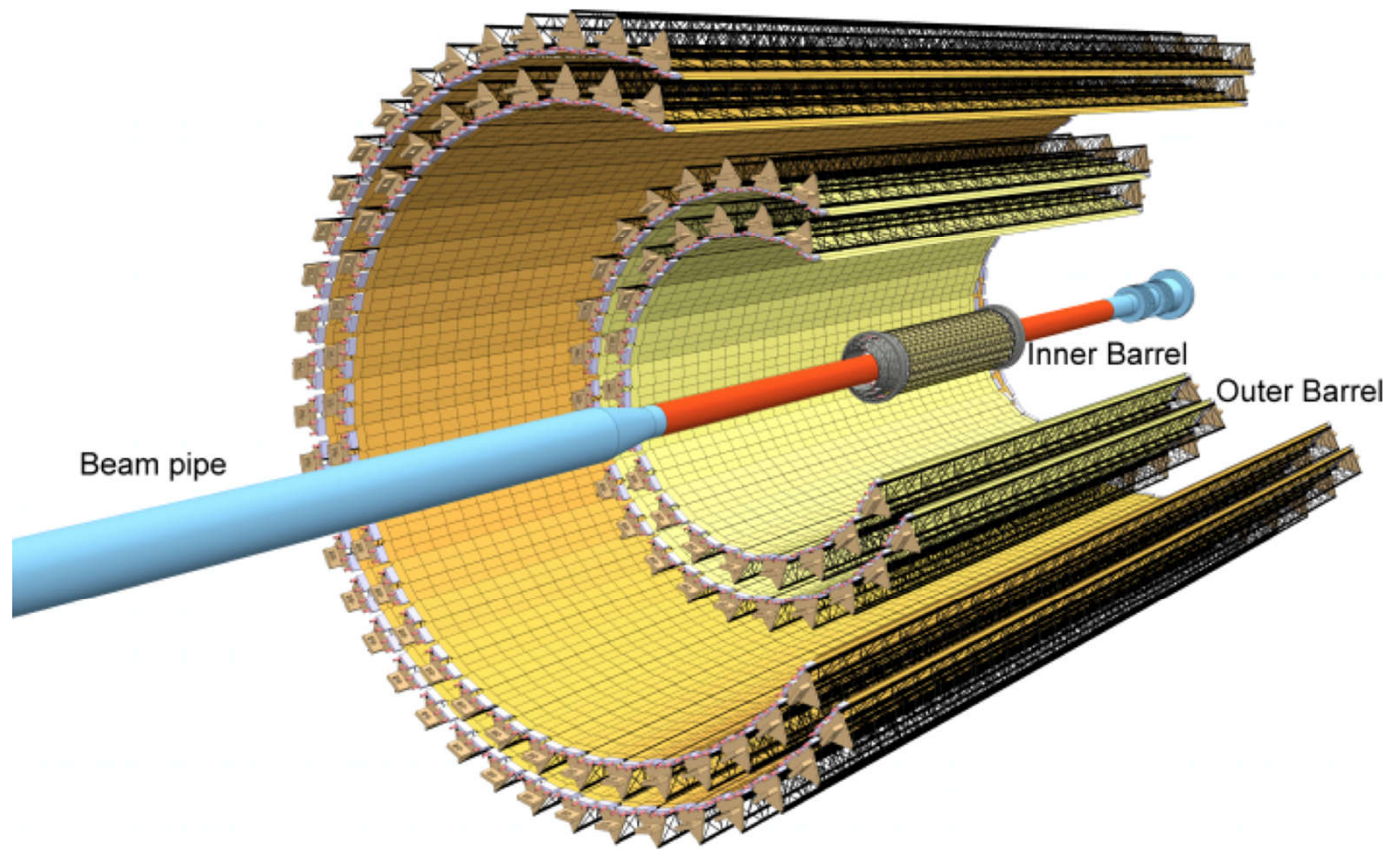
## Amanda 3 sa skladá z:

- **1** ASP.NET webovej stránky
- **2** podporných služieb
- **5** hlavných služieb založených na WCF
- **2** pripojené databázy

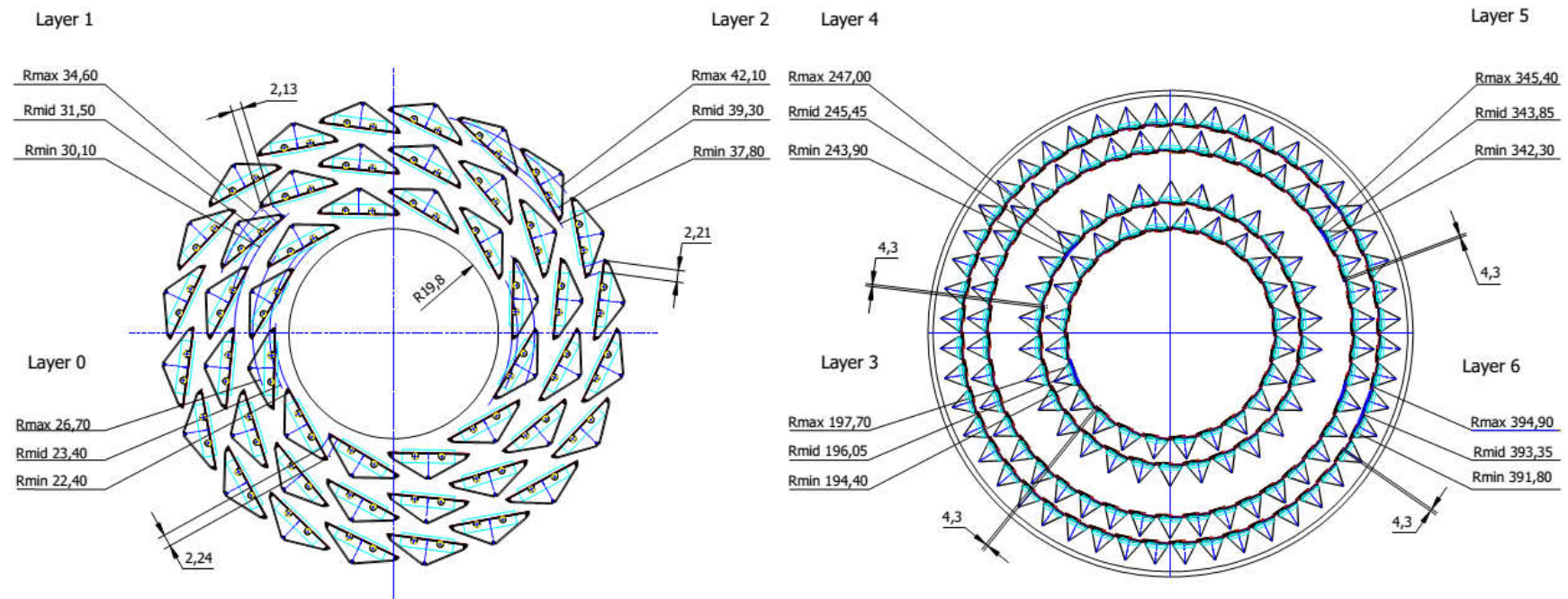


The screenshot shows the AMANDA 3 Web Client interface. At the top left is the ALICE logo, followed by the title "AMANDA 3 Web Client" in green. To the right is the CERN logo and the version number "ver. 1.1.0.1". Below the title, it says "online: 2". The main content area is a grey box with the heading "Authentication:". It contains two input fields: "User name:" with the value "user@cern.ch" and "Password:". Below these fields is a "Log In" button. At the bottom of the page, there is a copyright notice: "© CERN-ALICE 2014" and "created by Technical University of Košice".

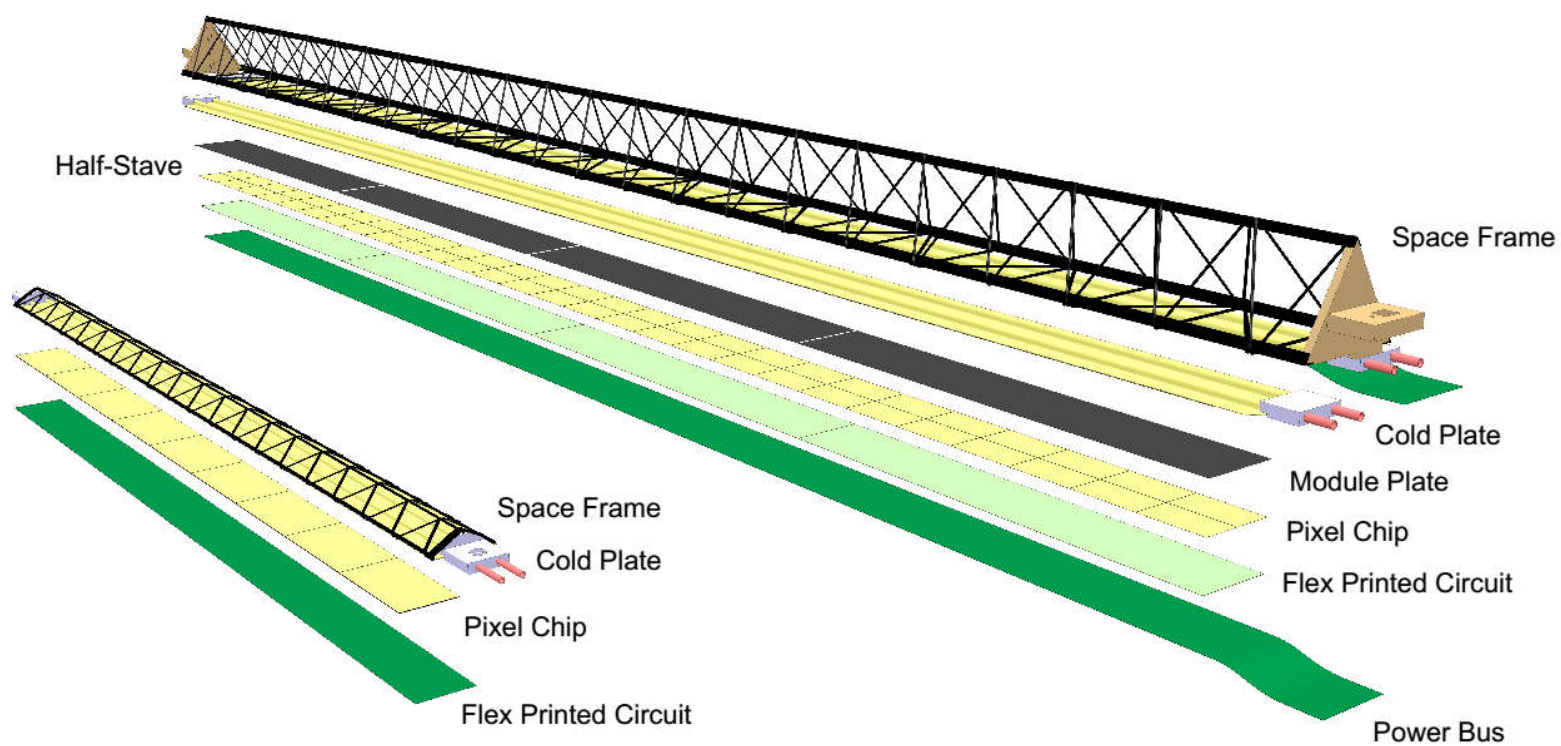
# ALICE Inner Tracking System Upgrade



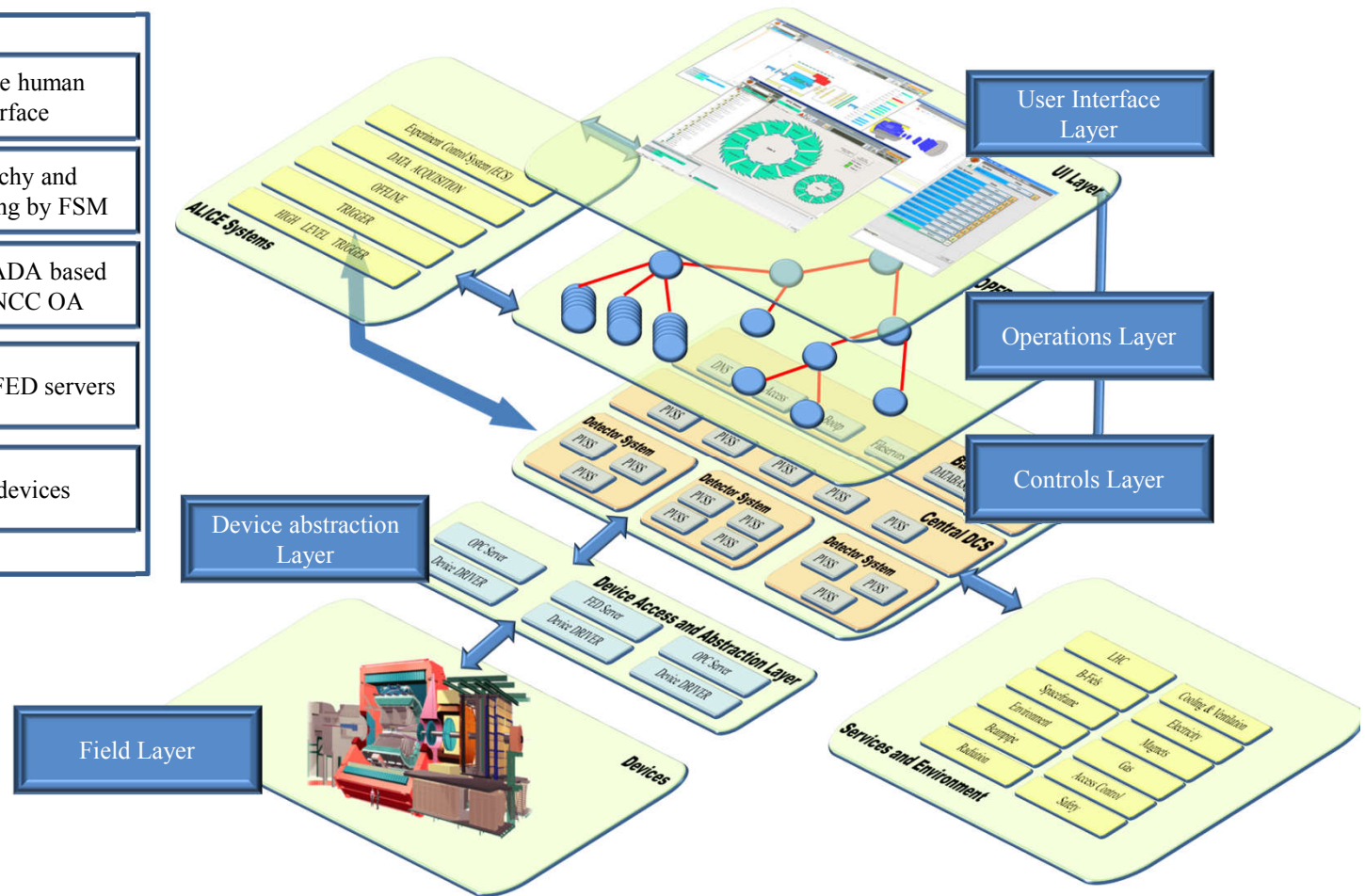
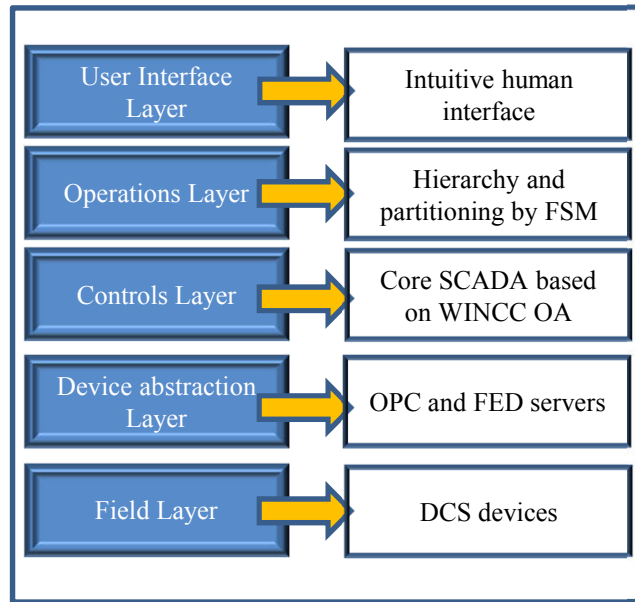
# ALICE Inner Tracking System Upgrade



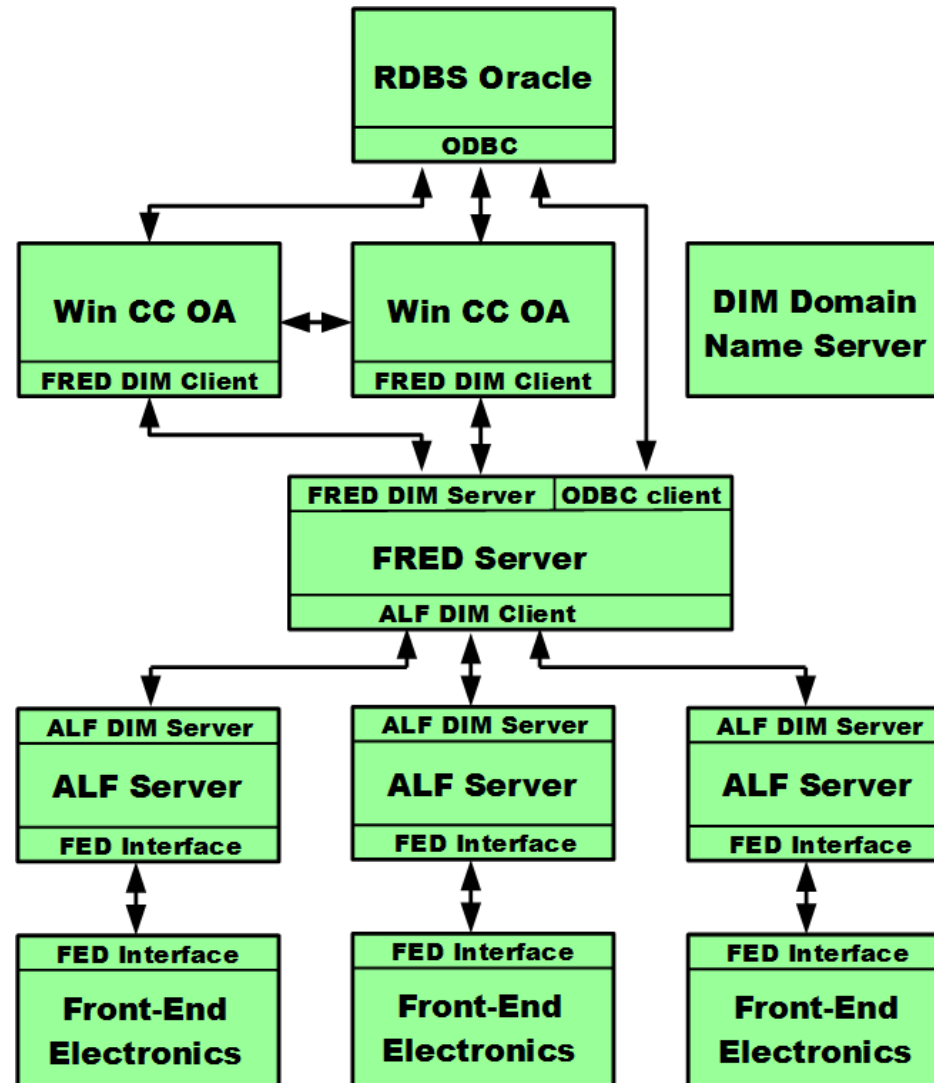
# ALICE Inner Tracking System Upgrade



# DCS Architektúra



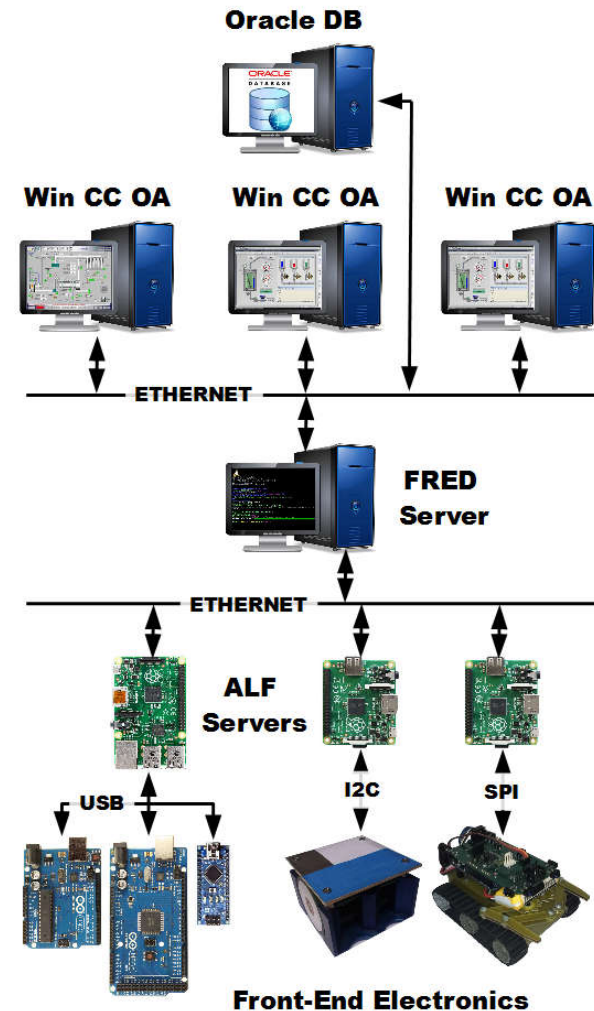
# Bloková schéma aplikačného programového rozhrania ALFRED





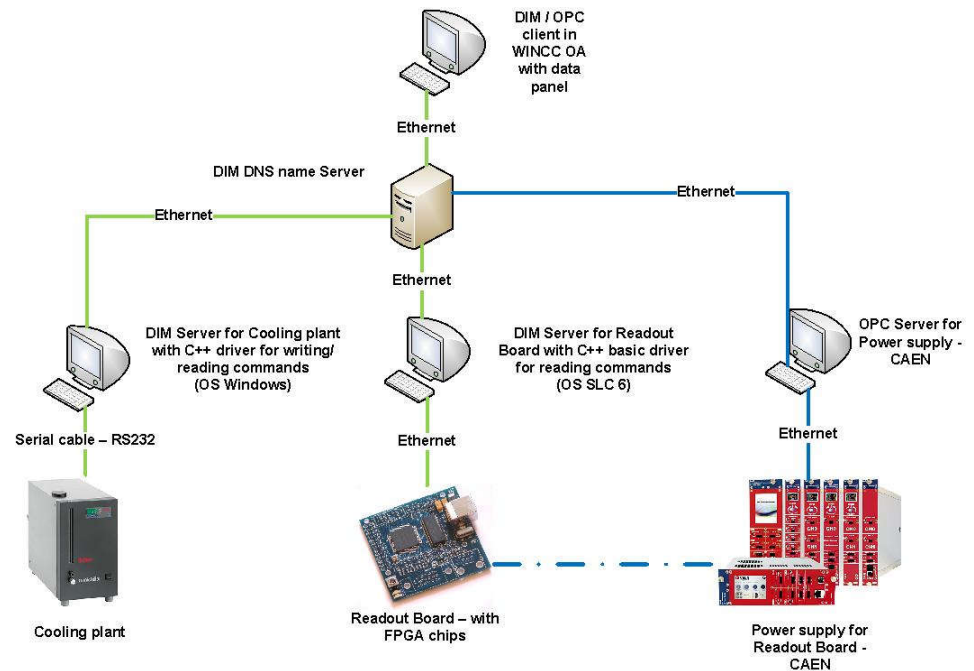
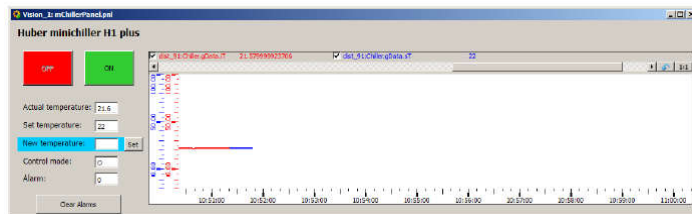
# Vývojové pracovisko pre testovanie API ALFRED

- Front-End Electronics – Špeciálne zariadenia bez možnosti komunikácie pomocou štandardizovaných protokolov. Prevažne modely KKUI a prípravky s jednočipovými mikropočítačmi.
- ALF Servery – PC a minipočítače Raspberry Pi pre komunikáciu s FED zariadeniami
- Win CC OA – SCADA/HMI klient.
- FRED Server – Rozhranie medzi WinCC a ALF Servermi
- Oracle DB Server – slúži pre uchovávanie nameraných a konfiguračných dát a programov pre Front-End Electronics .



# ITS Upgrade of the HIC test system

- HIC test systém pozostáva z:
  - Cooling control system (CCS)
  - FED control system (FCS)
  - Power Control System (PCS)
- Práca na sprostredkovaní dát pomocou DIM API a OPC
- Vizualizácia dát vo WINCC OA

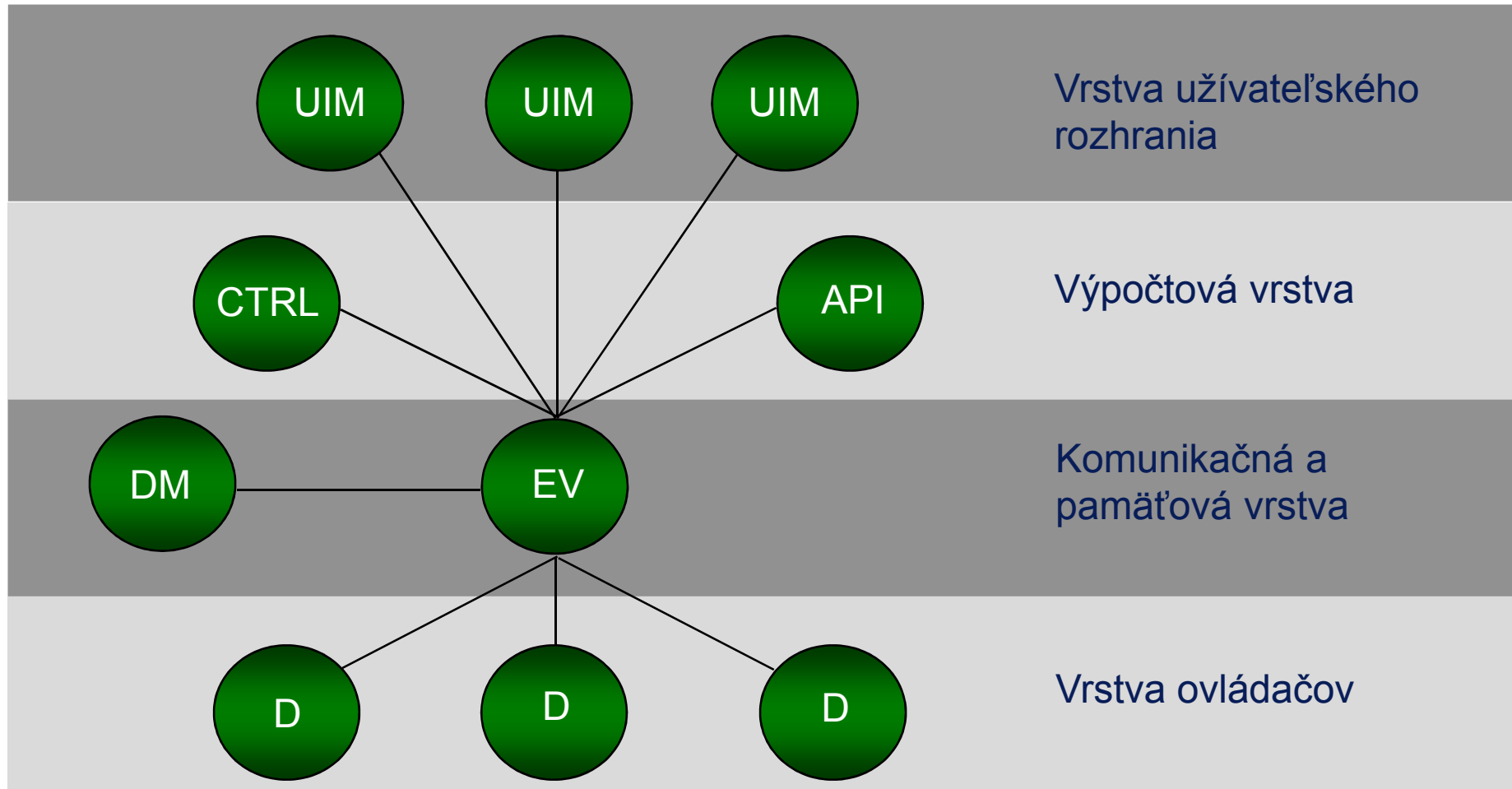


# WINCC OA

## Funkcionalita WINCC OA:

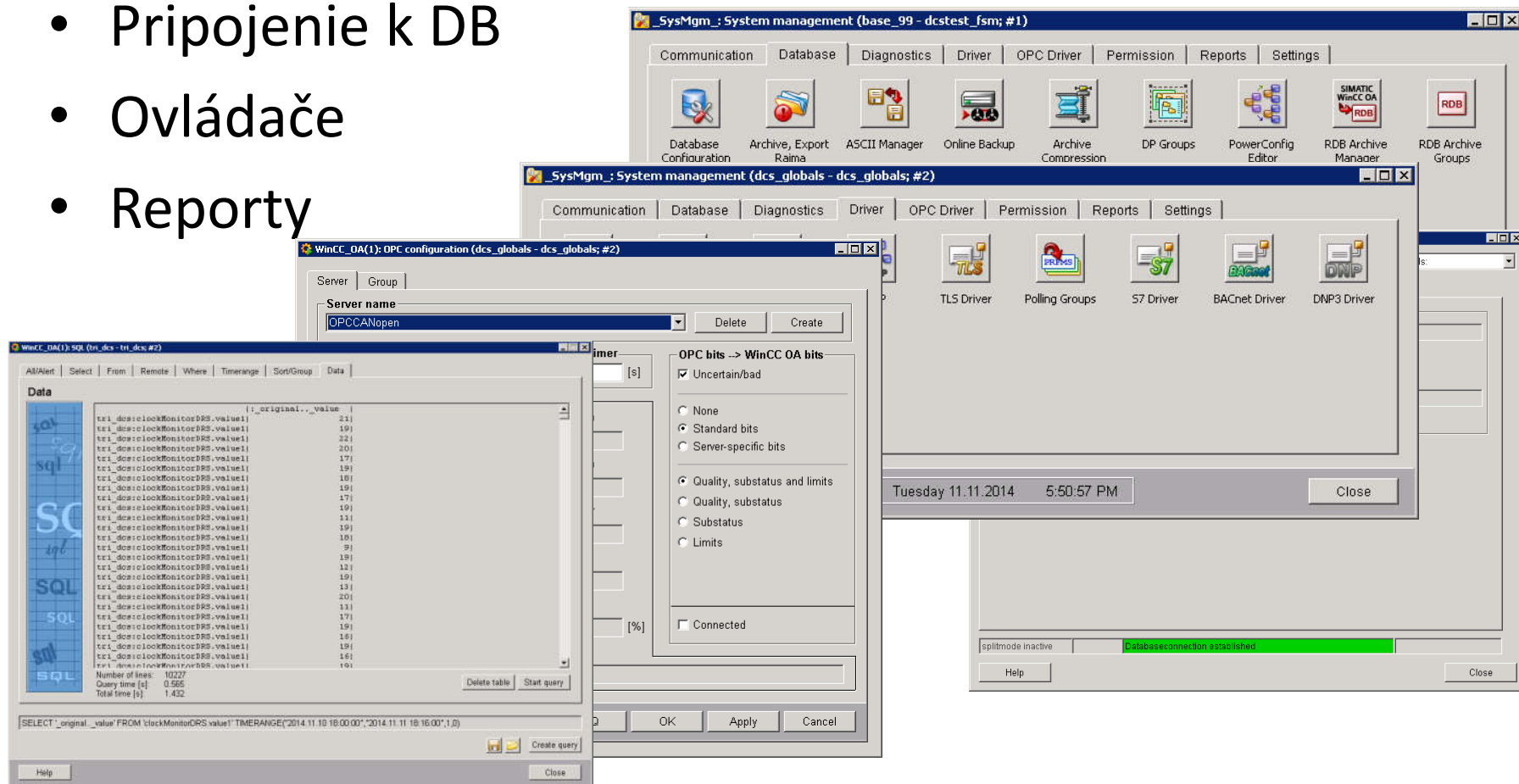
- Modelovania štruktúry zariadení
  - Datapointy a ich elementy
- prístup k dátam z PLC, riadiacich PC, ...
  - OPC, ProfiBus, Drivers
- ALARMY
  - generovanie, maskovanie, atď.
  - zobrazovanie, filtrovanie, sumarizácia
- archivácia dát, trendy, logovanie
- Tvorba užívateľského rozhrania
- Nastavenie prístupových práv

# Vrstvy WINCC OA



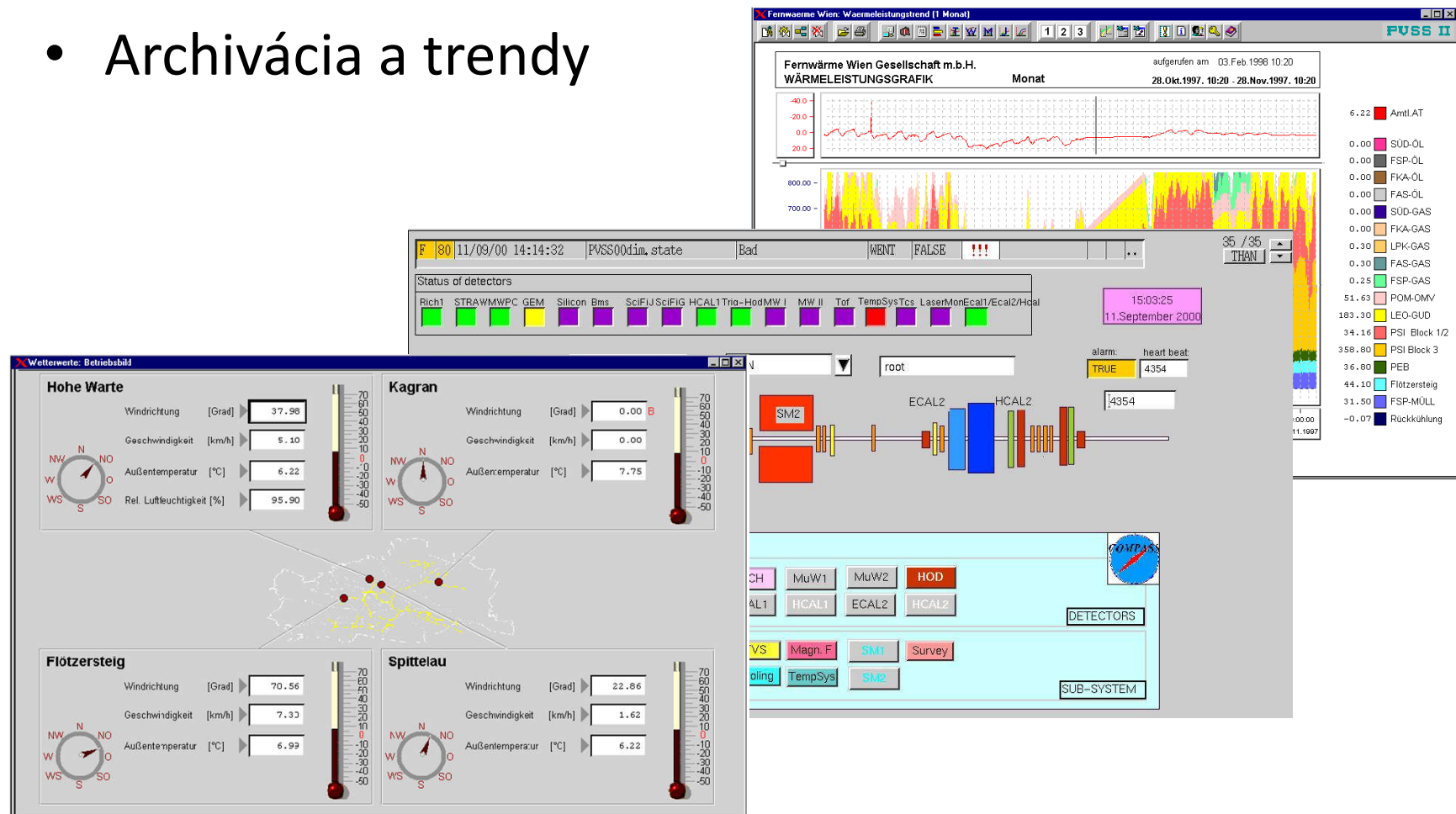
# WINCC OA a jeho funkcionality (1)

- Konfigurácia pomocou štandardných panelov
- Pripojenie k DB
- Ovládače
- Reporty

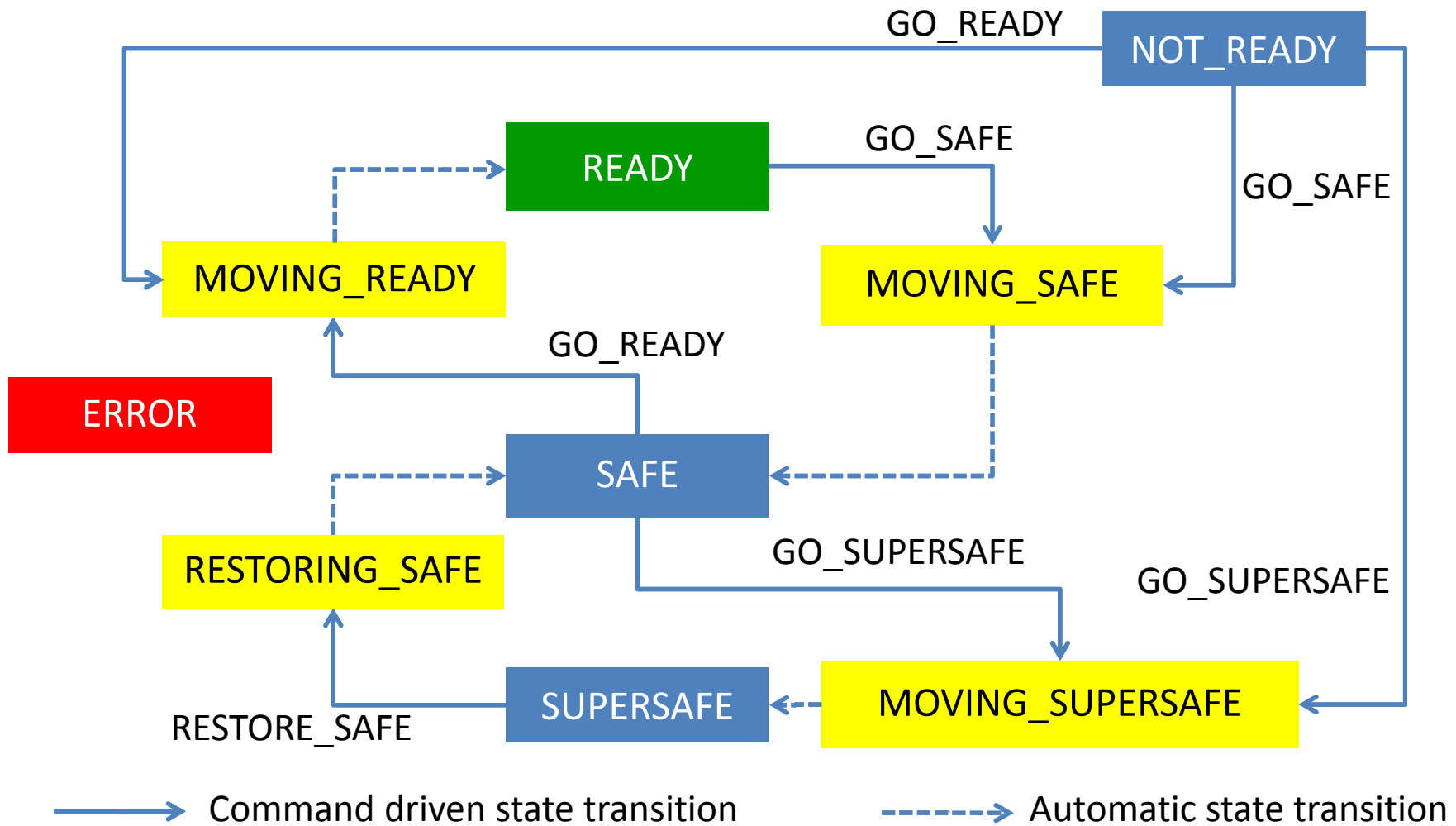


# WINCC OA a jeho funkcionality (2)

- Vizualizácia rôznych typov dát
- Archivácia a trendy



# WINCC OA a Finite State Machine (1)



# WINCC OA a Finite State Machine (2)

The screenshot displays the SIMATIC Manager interface for the Alice Magnet Control System. The main window shows the system status as 'OFF' and the sub-system as 'MAGNET'. A configuration dialog titled 'States and Actions (dcs\_ui - dcs\_ui; #1)' is open, showing the configuration for the 'AliDcsSafe\_CU' object.

**States and Actions Configuration:**

- Object Type:** AliDcsSafe\_CU
- Panel:** AliDcsSafe\_CU.pnl
- Simple Config:** Copy from Type: [ ]
- Object Parameters:** [ ]
- State List:**
  - Ini: SUPERSAFE
  - SAFE
  - MOVING\_SAFE
  - MOVING\_SUPERSAFE
  - NOT\_SAFE
- Action List:**
  - RESTORE\_SAFE
- State:** SUPERSAFE (Color: Blue)
- Action:** RESTORE\_SAFE (Visib: Y)
- Buttons:** Add, Remove
- Action Parameters:** [ ]
- When List:**
  - when ( \$ANY\$FwCHILDREN in\_state NOT\_SAFE ) move\_to NOT\_SAFE
  - when ( \$ANY\$FwCHILDREN in\_state MOVING\_SAFE ) move\_to MOVING\_SAFE
  - when ( \$ANY\$FwCHILDREN in\_state MOVING\_SUPERSAFE ) move\_to MOVING\_SUPERSAFE
  - when ( \$ANY\$FwCHILDREN in\_state SAFE ) move\_to SAFE
- Buttons:** Add, Remove
- Buttons:** Type Overview, Type Diff..., Apply, OK, Cancel

**Alice Magnet Control System - OFF**

**L3 Solenoid**

Current	16.600 A	Emergency Shutdown	TRUE
Set Current	0.000 A	Polarity	NEGATIVE
Temp In	18.14 C	Ramping Sts	FALSE
Temp Out	17.50 C	Steady Sts	FALSE
Nitrogen Pr	0.39 bar	PLC Watchdog	40

**Dipole Current**

Other | 1:1 | log | auto

Time Range | Y Axes | Save | Other | 1:1 | log | auto

11/20/2014 2:50:00 PM | 11/20/2014 3:10:00 PM

Dipole Pol 1.00

**Solenoid Current**

Time Range | Y Axes | Save | Other | 1:1 | log | auto

11/19/2014 6:00:00 PM | 11/20/2014 4:00:00 AM | 11/20/2014 12:00:00 PM

Solenoid 16.6

**Temperatures In & Out**

Time Range | Y Axes | Save | Other | 1:1 | log | auto

11/20/2014 4:00:00 AM | 11/20/2014 12:00:00 PM

Dipole Pol 16.13

**Solenoid Temperatures In & Out**

Time Range | Y Axes | Save | Other | 1:1 | log | auto

11/19/2014 6:00:00 PM | 11/20/2014 4:00:00 AM | 11/20/2014 12:00:00 PM

Solenoid 18.14 | Solenoid 17.50

Close



Ďakujem za pozornosť.