



# Industrial Control & Monitoring

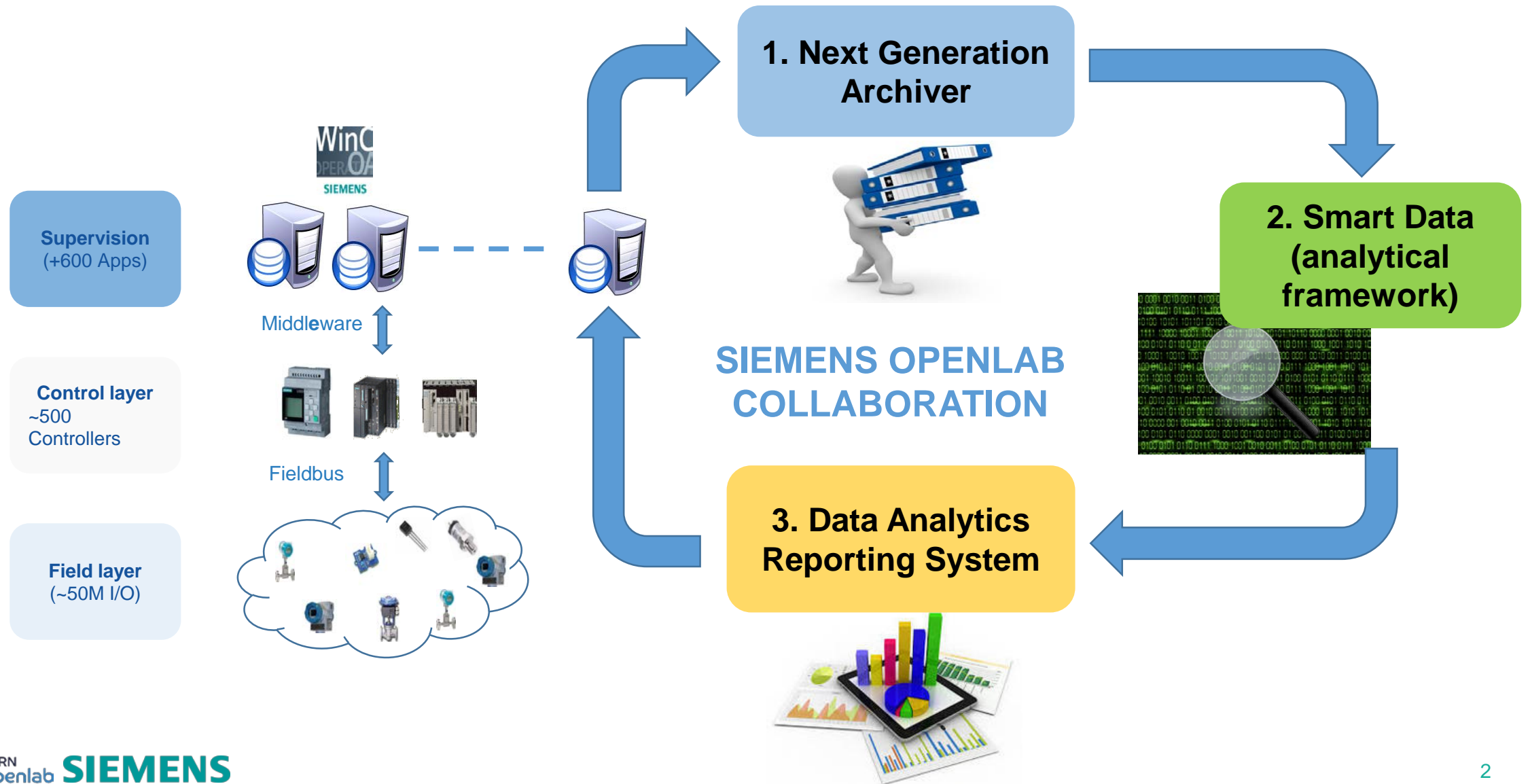
*CERN openlab Open Day*

*BE-ICS*

Piotr Golonka, Manuel Gonzalez-Berges, Jakub Guzik, Brad Schofield, [Piotr Seweryn](#), Filippo Tilaro, Fernando Varela

21/09/2017

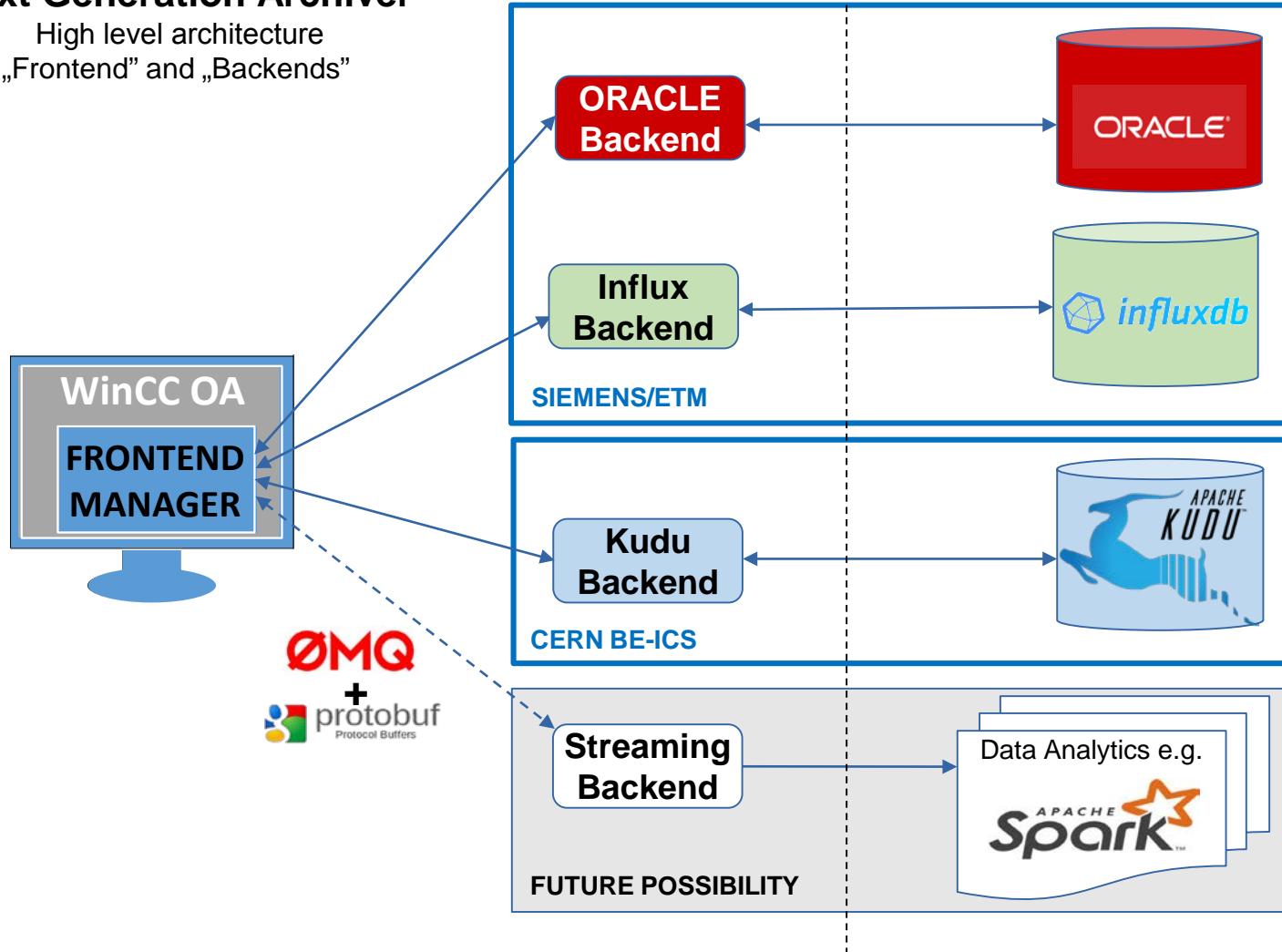
# Siemens openlab projects



# 1. Next Generation Archiver

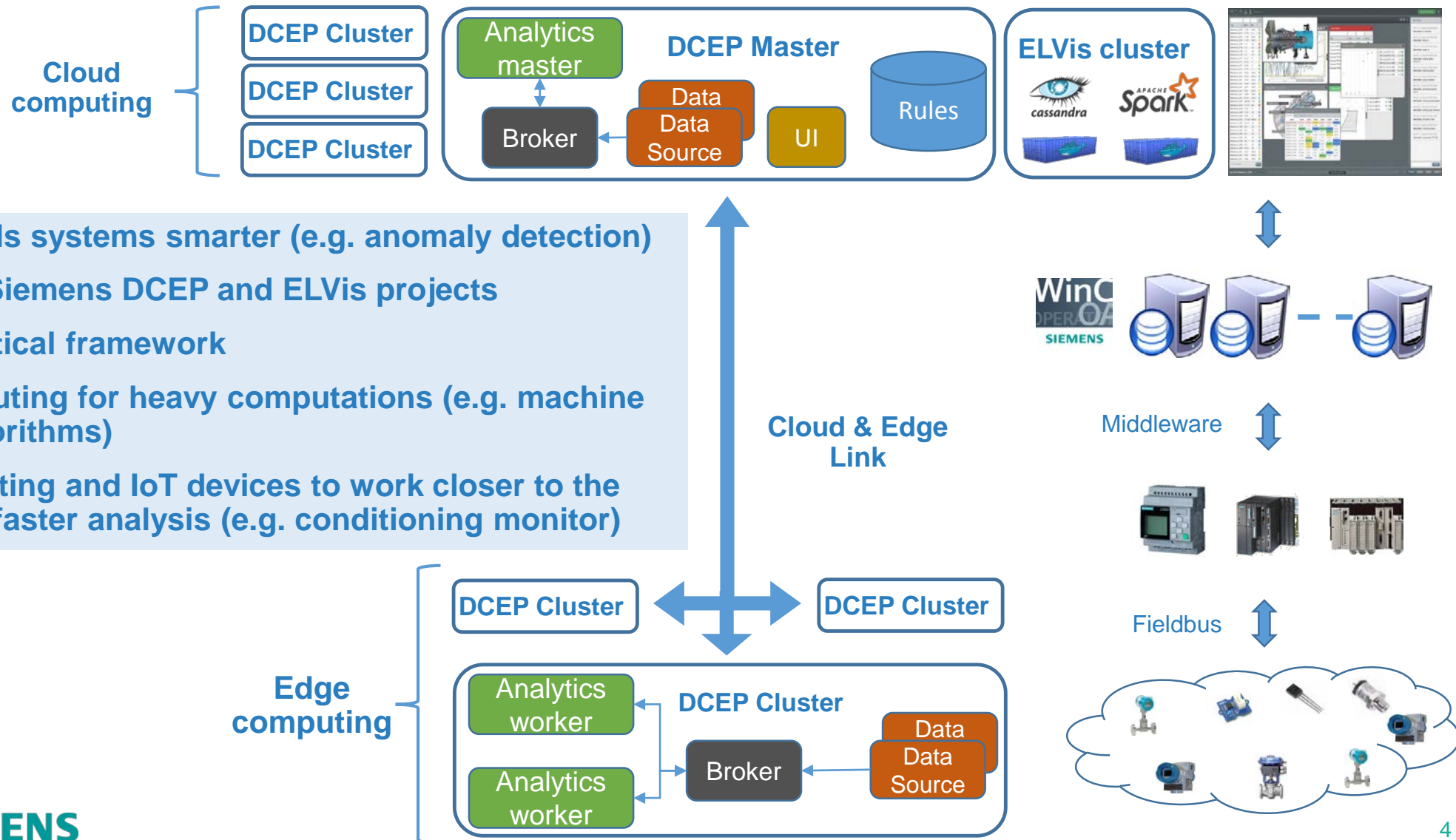
## Next Generation Archiver

High level architecture  
„Frontend” and „Backends”



- Scale up to the expected data rates beyond 2020 and enable data analytics
- Successor of WinCC OA's Oracle RDB Archiver
  - high-performance, cost-effective, robustness
- Support for SQL and NOSQL databases
- Open architecture (plugin based)
- Internal prototype ready, first version for WinCC OA 3.X in mid 2018
- Joint development with Siemens/ETM:
  - One team, good communication, sprint planning, stand-ups, regular follow-up telcos!

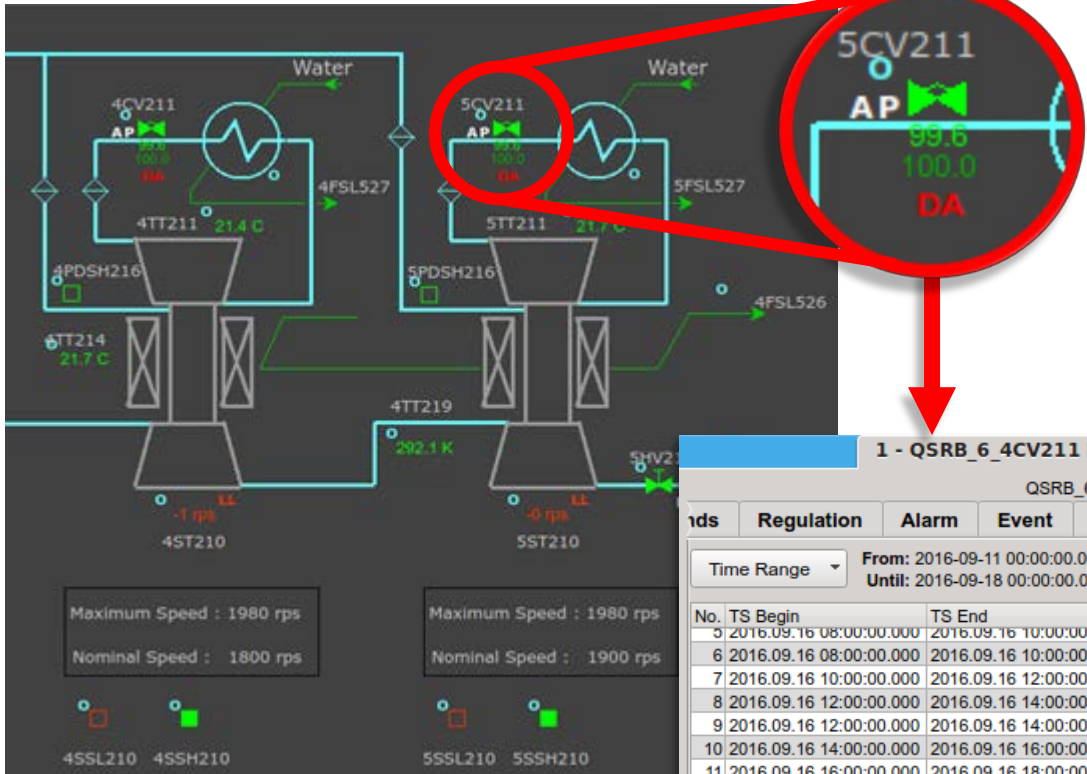
# 2. Smart Data for Industrial Control Systems



- Make controls systems smarter (e.g. anomaly detection)
- Combining Siemens DCEP and ELVis projects
- Single analytical framework
- Cloud computing for heavy computations (e.g. machine learning algorithms)
- Edge computing and IoT devices to work closer to the field layer – faster analysis (e.g. conditioning monitor)

# 3. Data Analytics Reporting System for WinCC OA

Attract operators attention



Easy and direct access to the analytics results

1 - QSRB\_6\_4CV211 Brake valve 4TU210

QSRB\_6\_4CV211

No.	TS Begin	TS End	Type	Comment
5	2016.09.16 08:00:00.000	2016.09.16 10:00:00.000	Correlation Analysis	KNN-graph and correlati
6	2016.09.16 08:00:00.000	2016.09.16 10:00:00.000	Correlation Analysis	KNN-graph and correlati
7	2016.09.16 10:00:00.000	2016.09.16 12:00:00.000	Correlation Analysis	KNN-graph and correlati
8	2016.09.16 12:00:00.000	2016.09.16 14:00:00.000	Correlation Analysis	KNN-graph and correlati
9	2016.09.16 12:00:00.000	2016.09.16 14:00:00.000	Correlation Analysis	KNN-graph and correlati
10	2016.09.16 14:00:00.000	2016.09.16 16:00:00.000	Correlation Analysis	KNN-graph and correlati
11	2016.09.16 16:00:00.000	2016.09.16 18:00:00.000	Correlation Analysis	KNN-graph and correlati
12	2016.09.16 18:00:00.000	2016.09.16 20:00:00.000	Correlation Analysis	KNN-graph and correlati
13	2016.09.16 20:00:00.000	2016.09.16 22:00:00.000	Correlation Analysis	KNN-graph and correlati

Buttons: Present Selected, Present All, Present Last...

Controls: On, Off, Set Value..., Inc., Dec., Allow-Restart, Limits, Auto Mode, Manual Mode, Forced Mode, Ack. Alarm, Select

AnalysisModule: AnalysisResults

### DATA ANALYTICS - INDIVIDUAL ANALYSES VIEW

Options

Type	Alias	Begin	
2	CA	QSRB_6_4CV211AO	2016-09-16 00:00
2	CA	QSRB_6_4CV211AO	2016-09-16 02:00
2	CA	QSRB_6_4CV211AO	2016-09-16 04:00
2	CA	QSRB_6_4CV211AO	2016-09-16 06:00
2	CA	QSRB_6_4CV211AO	2016-09-16 08:00
2	CA	QSRB_6_4CV211AO	2016-09-16 10:00
2	CA	QSRB_6_4CV211AO	2016-09-16 12:00
2	CA	QSRB_6_4CV211AO	2016-09-16 14:00
2	CA	QSRB_6_4CV211AO	2016-09-16 16:00
2	CA	QSRB_6_4CV211AO	2016-09-16 18:00
2	CA	QSRB_6_4CV211AO	2016-09-16 20:00
2	OA	QSRB_6_5CV211AO	2016-09-15 17:00

Analysis ID: 60552446-b650-11e6-a4fc-02163e008c5b

Object: QSRB\_6\_5CV211AO.PosSt

Type: Oscillation Analysis

TS Begin: 2016.09.15 17:00:04.000

TS End: 2016.09.15 21:59:50.000

Signals in time

Amplitude-Frequency

Threshold(Frequency)

Amplitude-Period juxtaposition

No.	Amplitude	Period
1	0.58264794125926	110.89204545455
2	0.64330856478838	118.28484848485
3	0.85347594872231	153.67716535433
4	0.85969552681293	134.6
5	0.9733114467467	152.4765625
6	1.0841298811063	165.39830508475
7	1.3140846365301	157.39516129032
8	1.3954806029795	172.71681415929
9	1.862287386939	171.20175438596

Detected anomalies

# Summary

- 3 openlab projects developed in collaboration with Siemens to integrate their solutions including analytical frameworks in the CERN controls systems infrastructure.
- Advancing at good pace.
- A big **thanks** to **Siemens** for the fruitful collaboration and continuous support!

## Summer students:

- **Lauri Sainio**: “Web reporting framework for control data analysis”.
- **Urishita Puri**: “Simplified Frontend for data generation and testing purposes”.

## 2017 publications in international conferences:

- *An expert knowledge based methodology for online detection of signal oscillations – CIVEMSA 2017, F. Tilaro, M. Gonzalez, B. Bradu, M. Roshchin*
- *Model Learning Algorithms for Faulty Sensors Detection in CERN Control Systems - ICALEPCS 2017, F. Tilaro, B. Bradu, M. Gonzalez-Berges, F. Varela, M. Roshchin*
- *Automatic PID Performance Monitoring Applied to LHC Cryogenics - ICALEPCS 2017, B. Bradu, E. Blanco, F. Tilaro, R. Marti*
- *Data Analytics Reporting Tool for CERN SCADA Systems - ICALEPCS 2017, P. J. Seweryn, M. Gonzalez-Berges, J. B. Schofield, F. M. Tilaro*
- *Future Archiver for CERN SCADA Systems – ICALEPCS 2017, P. Golonka, M. Gonzalez, J. Guzik, R. Kulaga*



# Thank you!

*CERN BE-ICS*

<https://be-dep-ics.web.cern.ch/>