

# Environmental slow control system for the DESY-II Testbeam Area.



as a central monitoring system at DESY-II



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# Brief Opening

- ▶ Being **Motivated...**
  - ▶ many complex system tests at DESY-II require logging environmental parameters of both detectors and experimental area;
- ▶ **Aiming at...**
  - ▶ a central monitoring system maintained by DESY
  - ▶ to monitor:
    - ▶ Common TB parameter;
    - ▶ Area specific parameter;
    - ▶ User configurables.
- ▶ **Requiring** easy to maintain/integrate...
  - ▶ Data outstream easy to integrate to user data;
    - ▶ short learning period
    - ▶ integrated to common DAQ: i.e. EUDAQ2
  - ▶ Flexible to integrate user customizing slow control system;
  - ▶ Mobility and stability mechanically

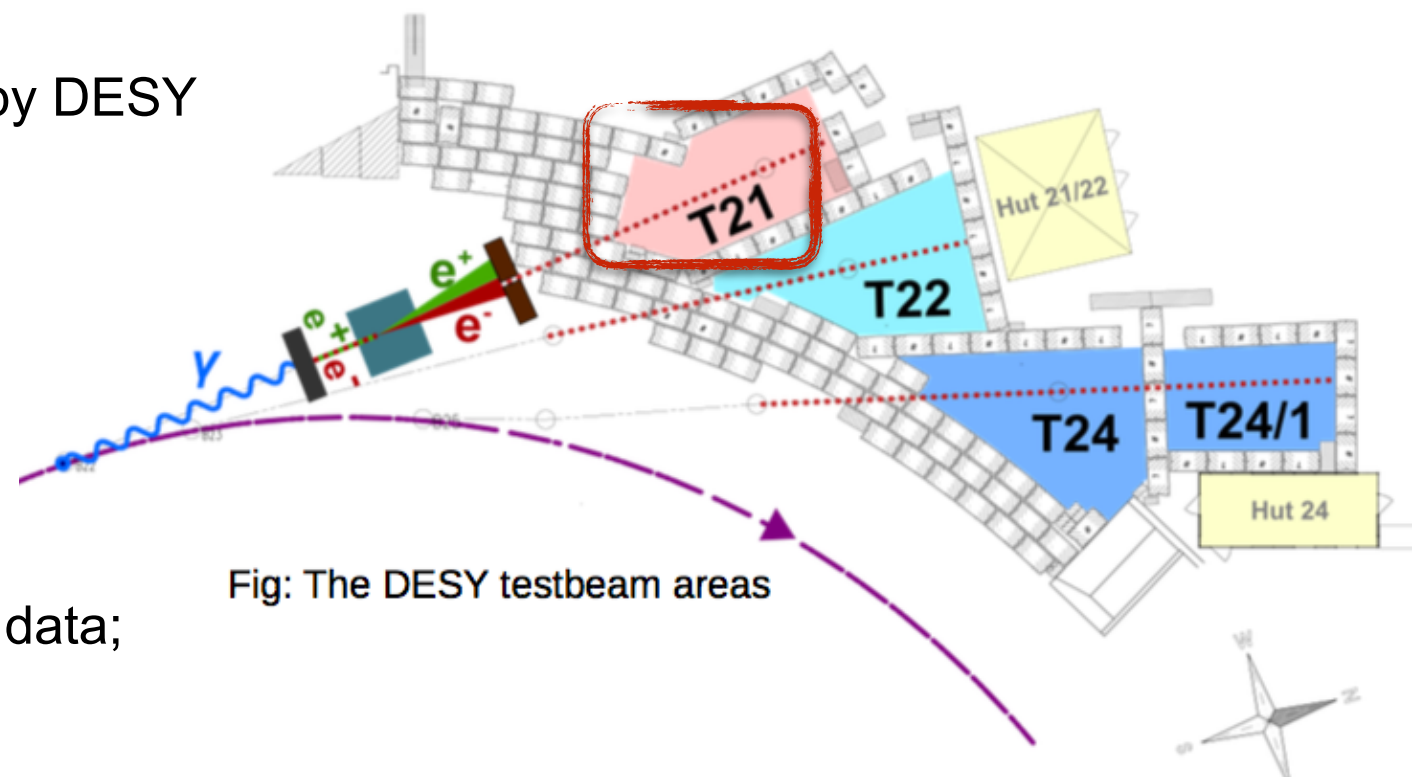
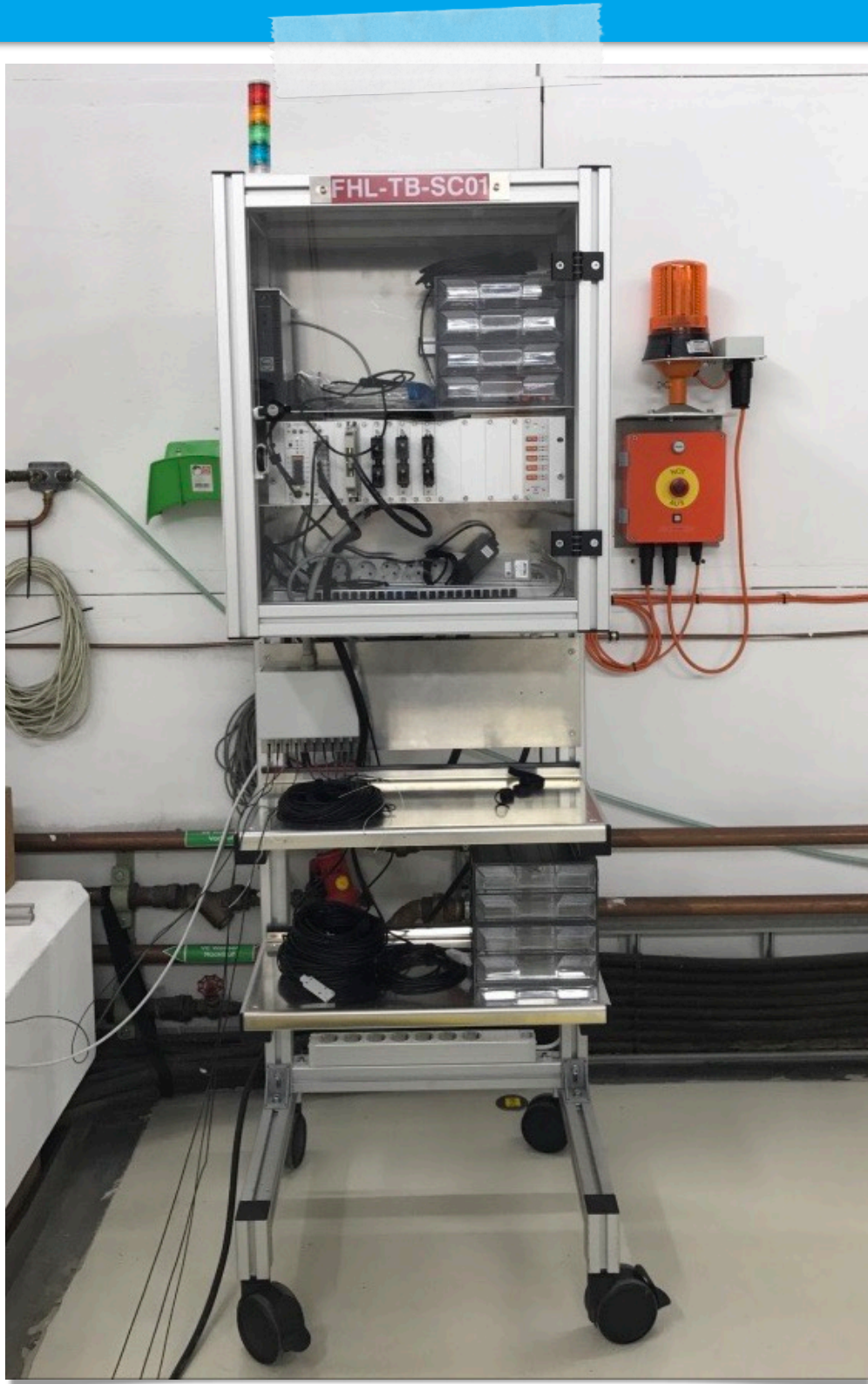


Fig: The DESY testbeam areas





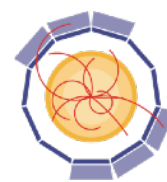
# Introduction



\* 1st rack installed in DESY-II beam area 21

## Current Status Report

- ▶ Hardware **assembled** in October 2016
- ▶ Software **succeeded in lab** at DESY end of July 2017
- ▶ **1st test beam** commissioning in August 2017: **succeeded**;
- ▶ Project **delivered** with further development ongoing;
- ▶ Documentation done, manual in updating;
- ▶ **1st user** case from 11/2017 to 01/2018 with an internship student (Lars Fischer): **successfully** processed.

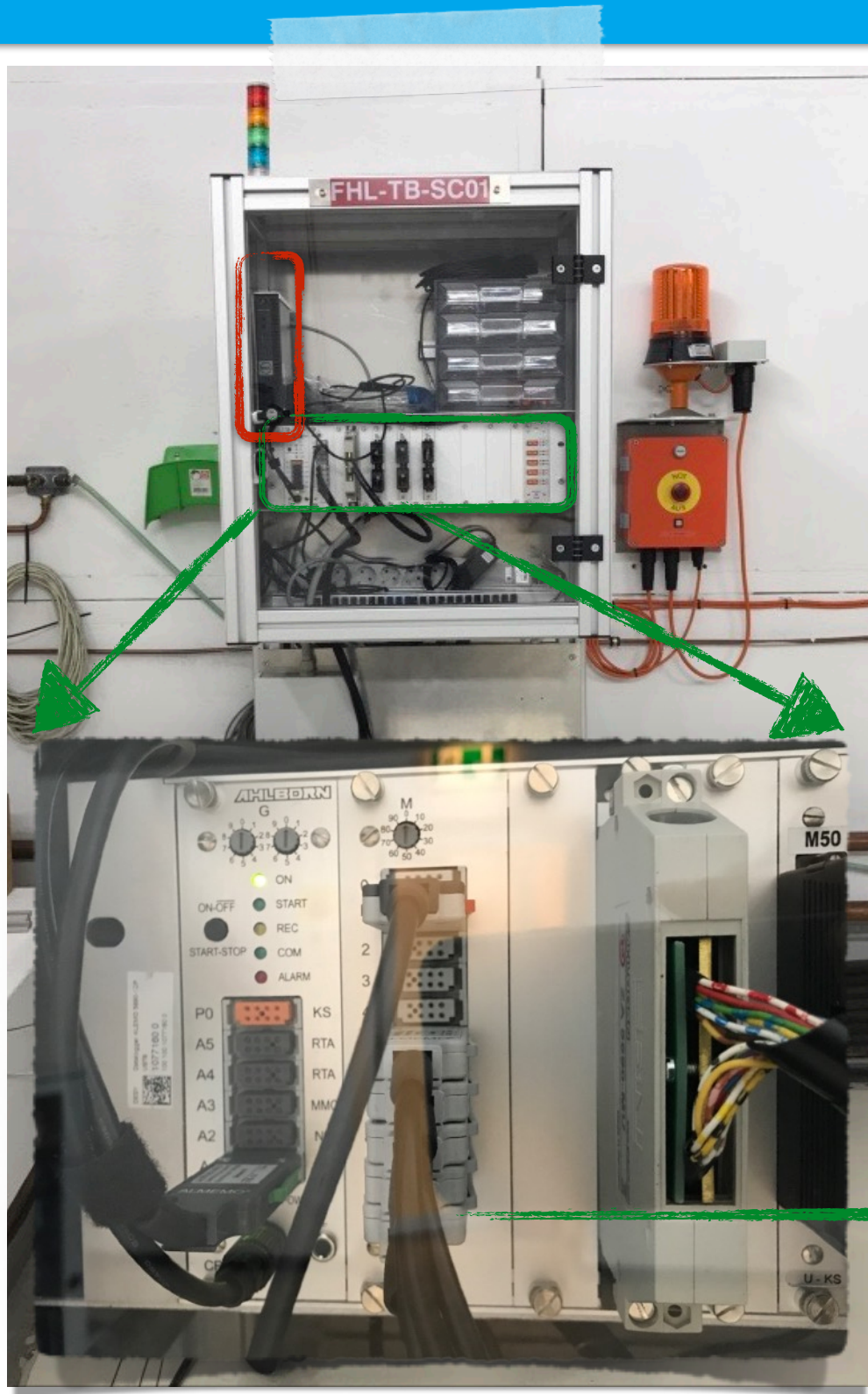


AIDA<sup>2020</sup>





# Hardware: mobility, stability, easy to maintain...



\* Currently 10 NTC and 1 DIGI connected (temperature, humidity, dew-point and pressure)

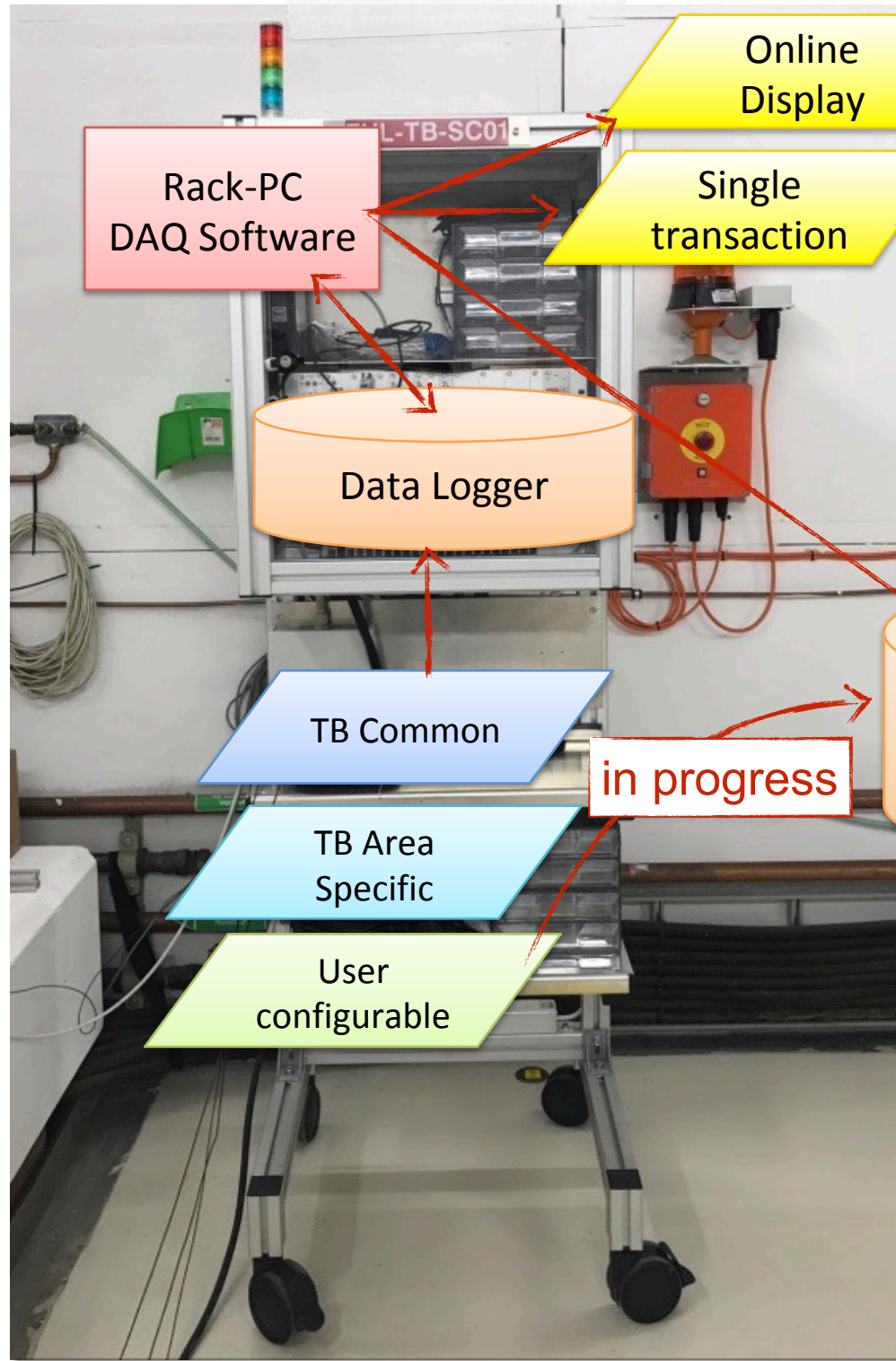
## Hardware

- ▶ A rack-based SC system built up as shown
  - ▶ Four wheels w/ brakes;
  - ▶ Fixed **data logger** able to connect to variable sensors;
  - ▶ A **rack-PC** to collect/distribute data;
  - ▶ MySQL database w/ ODBC connections;
  - ▶ EUDAQ2 module provided w/ eudaq raw data production prepared.





# Software: common DAQ terminal...



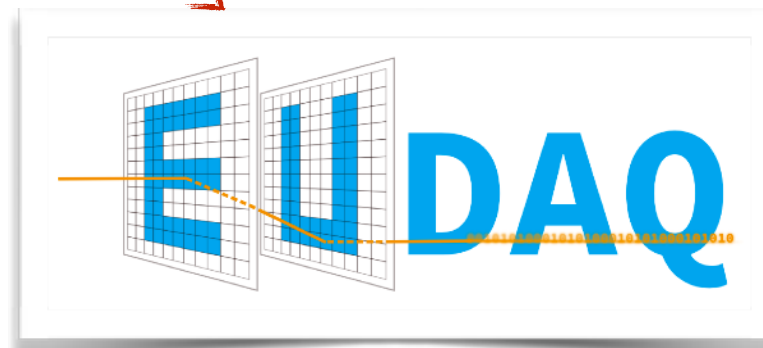
AMR WinControl 7 - Table1

	Date	Time	0.0 T.t	0.10 RH.Uw	0.20 DT.td	0.30 AP.p mbar	0.40	0.41	0.42	0.43	0.44	0.45	0.46
7	09/01/18	17:41:03	16.58 °C	26.7 %H	-2.6 °C	1009.1 mba	16.17 °C	16.1 °C	16.04 °C	16.18 °C	16.09 °C	16.11 °C	16.46 °C
8	09/01/18	17:41:37	16.54 °C	26.7 %H	-2.6 °C	1009.1 mba	16.16 °C	16.07 °C	16.01 °C	16.16 °C	16.08 °C	16.1 °C	16.42 °C
9	09/01/18	17:42:03	16.55 °C	26.8 %H	-2.5 °C	1009.1 mba	16.18 °C	16.09 °C	16.05 °C	16.17 °C	16.09 °C	16.1 °C	16.42 °C
10	09/01/18	17:42:33	16.57 °C	26.8 %H	-2.5 °C	1009.1 mba	16.17 °C	16.11 °C	16.11 °C	16.18 °C	16.09 °C	16.11 °C	16.42 °C
11	09/01/18	17:43:05	16.61 °C	26.7 %H	-2.5 °C	1009.1 mba	16.19 °C	16.05 °C	16.04 °C	16.17 °C	16.1 °C	16.06 °C	16.46 °C
12	09/01/18	17:43:33	16.56 °C	26.7 %H	-2.6 °C	1009.1 mba	16.16 °C	16.08 °C	16.01 °C	16.17 °C	16.08 °C	16.1 °C	16.46 °C
13	09/01/18	17:44:07	16.55 °C	26.8 %H	-2.5 °C	1009.1 mba	16.15 °C	16.07 °C	16.04 °C	16.17 °C	16.08 °C	16.1 °C	16.41 °C
14	09/01/18	17:44:33	16.54 °C	26.8 %H	-2.5 °C	1009.1 mba	16.18 °C	16.07 °C	16.01 °C	16.17 °C	16.09 °C	16.09 °C	16.4 °C
15	09/01/18	17:45:03	16.55 °C	26.8 %H	-2.5 °C	1009.1 mba	16.17 °C	16.07 °C	16.03 °C	16.18 °C	16.08 °C	16.08 °C	16.39 °C
16	09/01/18	17:45:35	16.54 °C	26.8 %H	-2.5 °C	1009.1 mba	16.17 °C	16.04 °C	16 °C	16.16 °C	16.08 °C	16.08 °C	16.41 °C
17	09/01/18	17:46:03	16.55 °C	26.8 %H	-2.5 °C	1009.1 mba	16.17 °C	16.05 °C	16 °C	16.16 °C	16.08 °C	16.08 °C	16.46 °C
18	09/01/18	17:46:37	16.54 °C	26.8 %H	-2.5 °C	1009.1 mba	16.15 °C	16.05 °C	15.99 °C	16.15 °C	16.07 °C	16.08 °C	16.44 °C
19	09/01/18	17:47:03	16.51 °C	26.9 %H	-2.5 °C	1009.1 mba	16.17 °C	16.06 °C	16.02 °C	16.16 °C	16.08 °C	16.1 °C	16.39 °C
20	09/01/18	17:47:33	16.5 °C	26.9 %H	-2.5 °C	1008.9 mba	16.18 °C	16.08 °C	16.04 °C	16.17 °C	16.09 °C	16.09 °C	16.46 °C
21	09/01/18	17:48:05	16.51 °C	26.9 %H	-2.5 °C	1009.1 mba	16.18 °C	16.1 °C	16.06 °C	16.18 °C	16.1 °C	16.1 °C	16.44 °C
22	09/01/18	17:48:33	16.5 °C	26.9 %H	-2.5 °C	1008.9 mba	16.16 °C	16.1 °C	16.03 °C	16.17 °C	16.08 °C	16.1 °C	16.47 °C
23	09/01/18	17:49:07	16.5 °C	26.9 %H	-2.5 °C	1008.9 mba	16.16 °C	16.06 °C	16.01 °C	16.15 °C	16.08 °C	16.09 °C	16.44 °C
24	09/01/18	17:49:33	16.52 °C	26.9 %H	-2.5 °C	1009.1 mba	16.17 °C	16.06 °C	16 °C	16.16 °C	16.08 °C	16.1 °C	16.43 °C
25	09/01/18	17:50:03	16.52 °C	26.9 %H	-2.5 °C	1008.9 mba	16.16 °C	16.05 °C	16.03 °C	16.16 °C	16.08 °C	16.09 °C	16.42 °C
26	09/01/18	17:50:35	16.54 °C	26.8 %H	-2.5 °C	1008.9 mba	16.15 °C	16.08 °C	16.02 °C	16.16 °C	16.08 °C	16.1 °C	16.41 °C
27	09/01/18	17:51:03	16.54 °C	26.8 %H	-2.5 °C	1009.1 mba	16.16 °C	16.06 °C	16.01 °C	16.17 °C	16.08 °C	16.08 °C	16.42 °C
28	09/01/18	17:51:37	16.5 °C	26.9 %H	-2.5 °C	1008.9 mba	16.16 °C	16.03 °C	15.96 °C	16.15 °C	16.07 °C	16.06 °C	16.47 °C
29	09/01/18	17:52:03	16.51 °C	26.9 %H	-2.5 °C	1009.1 mba	16.15 °C	16.03 °C	15.97 °C	16.14 °C	16.08 °C	16.07 °C	16.4 °C
30	09/01/18	17:52:33	16.51 °C	26.9 %H	-2.5 °C	1009.1 mba	16.17 °C	16.08 °C	16.04 °C	16.16 °C	16.08 °C	16.08 °C	16.44 °C
31	09/01/18	17:53:05	16.48 °C	26.9 %H	-2.5 °C	1009.1 mba	16.16 °C	16.03 °C	15.97 °C	16.15 °C	16.07 °C	16.09 °C	16.45 °C
32	09/01/18	17:53:33	16.48 °C	26.9 %H	-2.5 °C	1008.9 mba	16.15 °C	16.04 °C	16.01 °C	16.15 °C	16.07 °C	16.07 °C	16.38 °C
33	09/01/18	17:54:07	16.52 °C	26.9 %H	-2.5 °C	1009.1 mba	16.14 °C	16.06 °C	16.01 °C	16.16 °C	16.06 °C	16.1 °C	16.41 °C
34	09/01/18	17:54:33	16.5 °C	26.9 %H	-2.5 °C	1009.1 mba	16.14 °C	16.06 °C	16.01 °C	16.16 °C	16.07 °C	16.1 °C	16.47 °C
35	09/01/18	17:55:03	16.5 °C	26.9 %H	-2.5 °C	1009.1 mba	16.14 °C	16.06 °C	15.99 °C	16.15 °C	16.06 °C	16.09 °C	16.45 °C
36	09/01/18	17:55:35	16.49 °C	26.9 %H	-2.5 °C	1009.1 mba	16.16 °C	16.05 °C	16.03 °C	16.17 °C	16.08 °C	16.09 °C	16.44 °C
37	09/01/18	17:56:03	16.5 °C	26.9 %H	-2.5 °C	1009.1 mba	16.18 °C	16.06 °C	15.99 °C	16.16 °C	16.08 °C	16.08 °C	16.41 °C

Samples\_17.06.27-14.27.29.txt - Notepad

```
File Edit Format View Help
["Device","0","0","0"
"Channel","40","41","42"
"Comment",""
"Sensor","Ntc","Ntc","Ntc"
"Unit","C","C","C"
"Limit values",,,
,,,
"27/06/2017","14:27:30",26.14,26.12,26.05
"27/06/2017","14:27:59",26.13,26.15,26.11
```

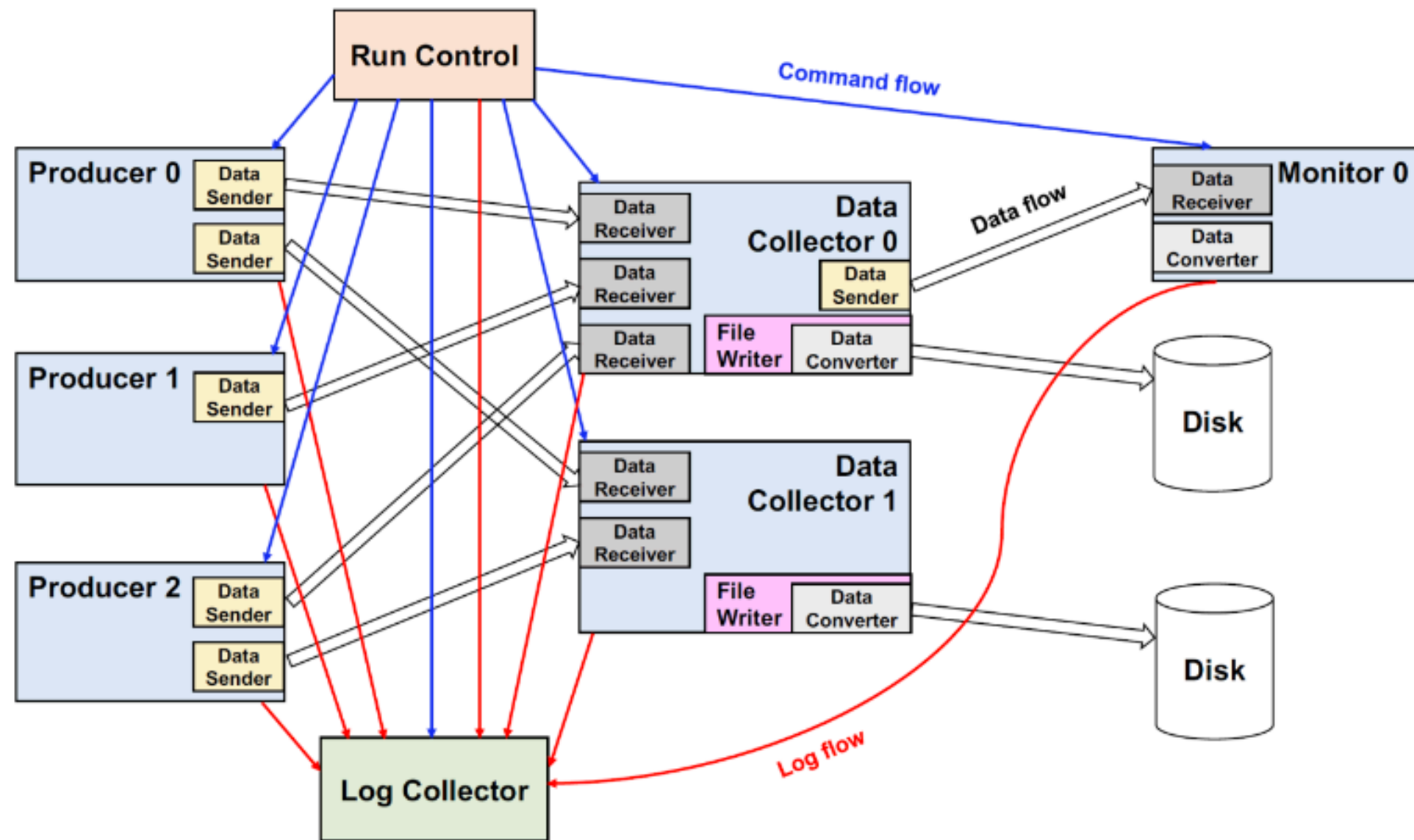
System to be accessed via the EUDAQ for user



# A glimpse at EUDAQ2

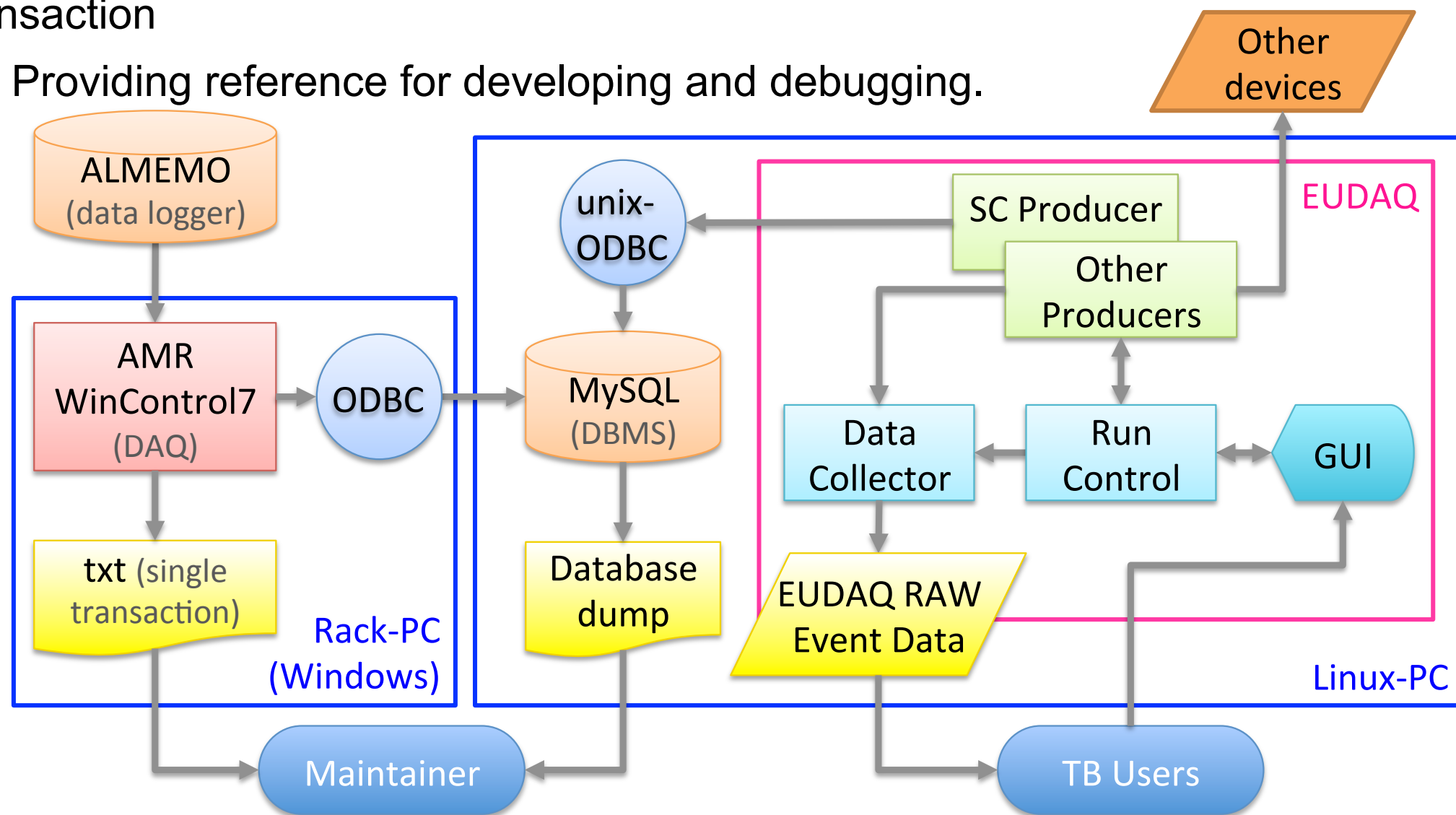


- ▶ Eudaq2 now provides nice scheme for derivatives development
- ▶ With the sync keeping easily
- ▶ For our use, we modify the following modules:
  - ▶ Run control and it's GUI
  - ▶ Producer
  - ▶ DataCollector
  - ▶ Eudaq std evt/clip evt converter
  - ▶ EuCliConverter/Reader



# A bite for Developers

- ▶ A correspondent DAQ software AMR from Alhborn company;
- ▶ Able to export data every 90 seconds (adjustable) to any database
  - ▶ MySQL is chosen here;
- ▶ For each data-taking from AMR, it can do online monitoring and save data in a single transaction
  - ▶ Providing reference for developing and debugging.





# A bite for Users

The image shows two software windows. The top window is 'AMR WinControl 7 - [Channels, Devices and Connections]' with a menu bar (File, Edit, View, Data, Programming, Settings, Window, Help) and a toolbar. A red box highlights a play button icon. Below it, a text box says 'single button to start AMR to poll data (other setting prepared by Maintainer/developer)'. The main area displays a table of data points. The bottom window is 'eudaq Run Control v2.0.0-101-g3c93457'. It shows the 'State: Current State: Running' in green. Under 'Control', there are fields for 'Init file:', 'Config file:', 'Next RunN:', and 'Log:', each with a corresponding 'Load' button. There are also 'Init', 'Config', 'Start', 'Stop', 'Reset', and 'Terminate' buttons. The 'Run Number:' is 61. Under 'Connections', there is a table with columns: type, name, state, connection, message, and information. A text box at the bottom left shows an example .conf file content.

single button to start AMR to poll data (other setting prepared by Maintainer/developer)

**Current State: Running**

Control

Init file:  Load Init

Config file:  Load Config

Next RunN:  Start Stop

Log:  Reset Terminate

Log

Run Number: 61

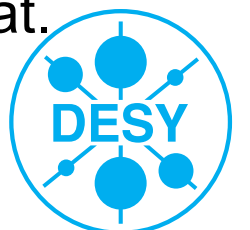
Connections

type	name	state	connection	message	information
Producer	tbsc	CONF	tcp://127.0....	Started	<EventN> 3
Data Collec...	tbscDC	CONF	tcp://127.0....	Started	<EventN> 3 <FILEBYTES> 1017 <_SERVER> tcp://22219

**[Datacollector.tbscDC]**  
DISABLE\_PRINT = 1  
**[Producer.tbsc]**  
EUDAQ\_DC = "tbscDC"  
TBSC\_DEBUG = "false"  
TBSC\_INTERVAL\_SEC = 90  
TBSC\_PARA\_MASK = "timer,ch0,ch10,ch20,ch30,ch40,ch41"

example .conf file

- ▶ MySQL database is currently built up on the same PC as Eudaq2
  - ▶ Ideally if data increasing rapidly, can be moved to a centralized PC
  - ▶ Able to dump an xml file for cross-check
- ▶ EUDAQ2 module [on Github](#)
  - ▶ **Producer/DataCollector provided**
  - ▶ **DataConverter provided**
  - ▶ Misc.: example ini/conf files, SQL file to setup an example MySQL DB, and other mini tools provided
  - ▶ Able to produce/sync to user data stream in the std **EUDAQ raw** format.



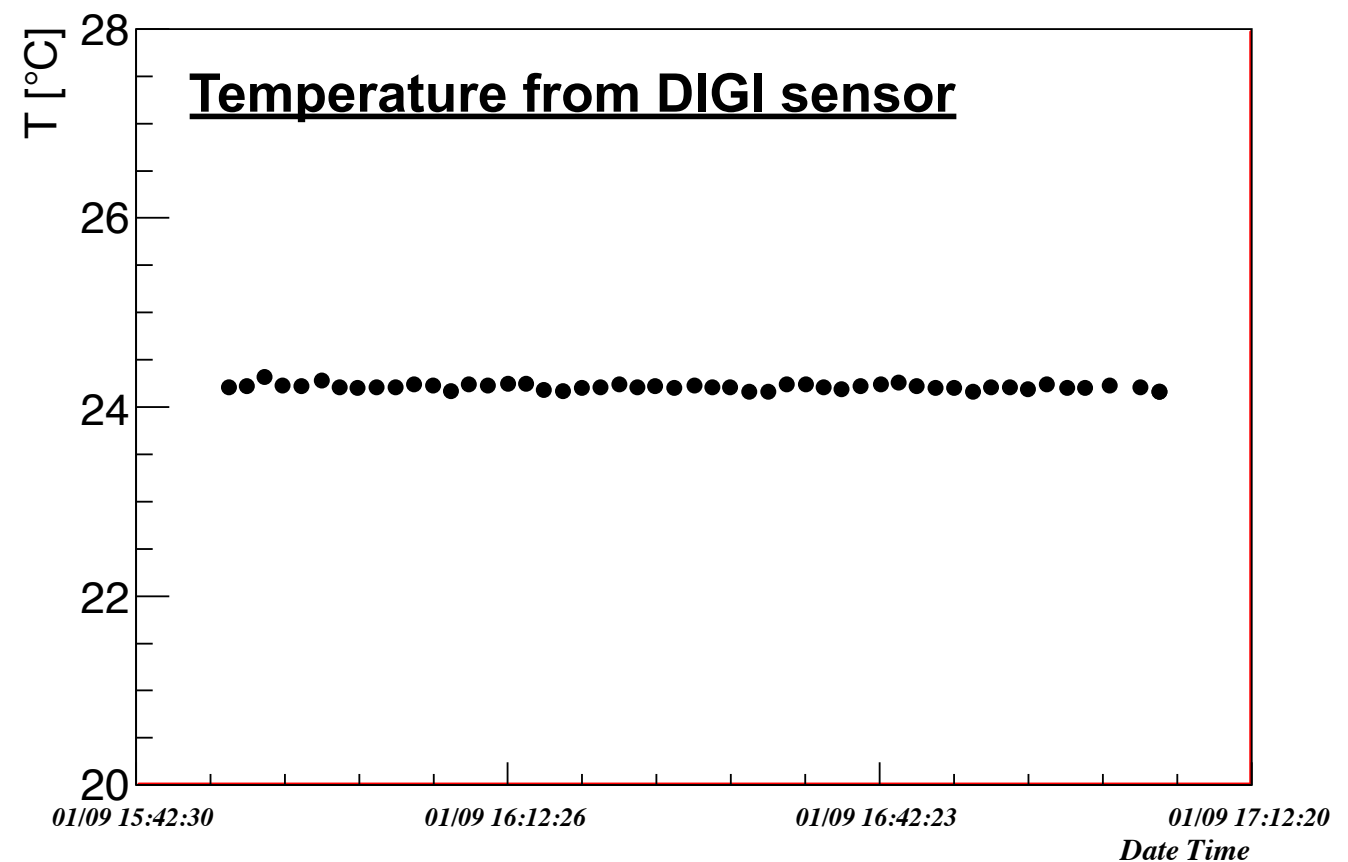
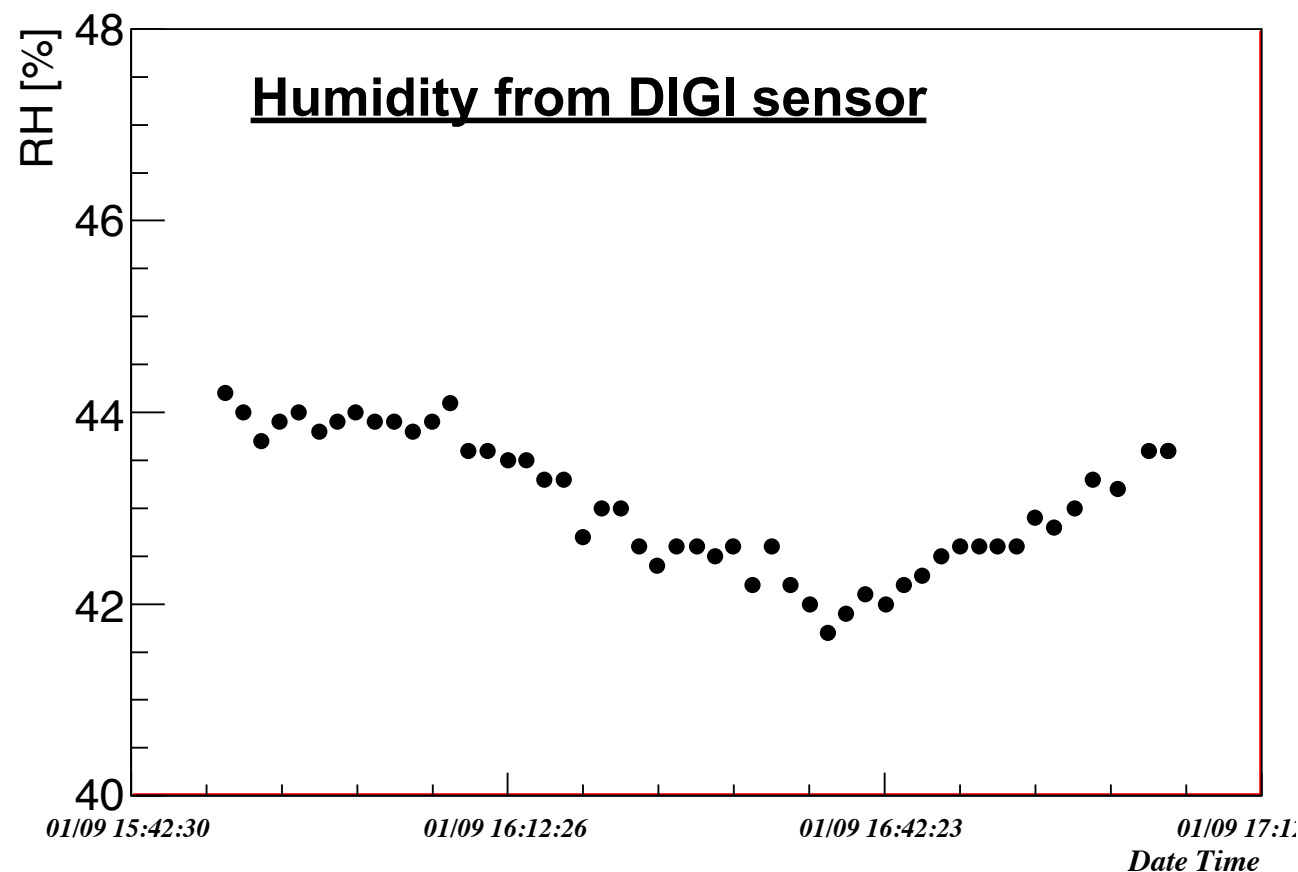


# 1st test beam commissioning: system validated

## Example:

- Data collected at DESY TB Area 21 on 01/09/2017 from 16:50 to 18:05:
- cross checked with MySQL database dumped csv file;
- perfect agreed as expected,

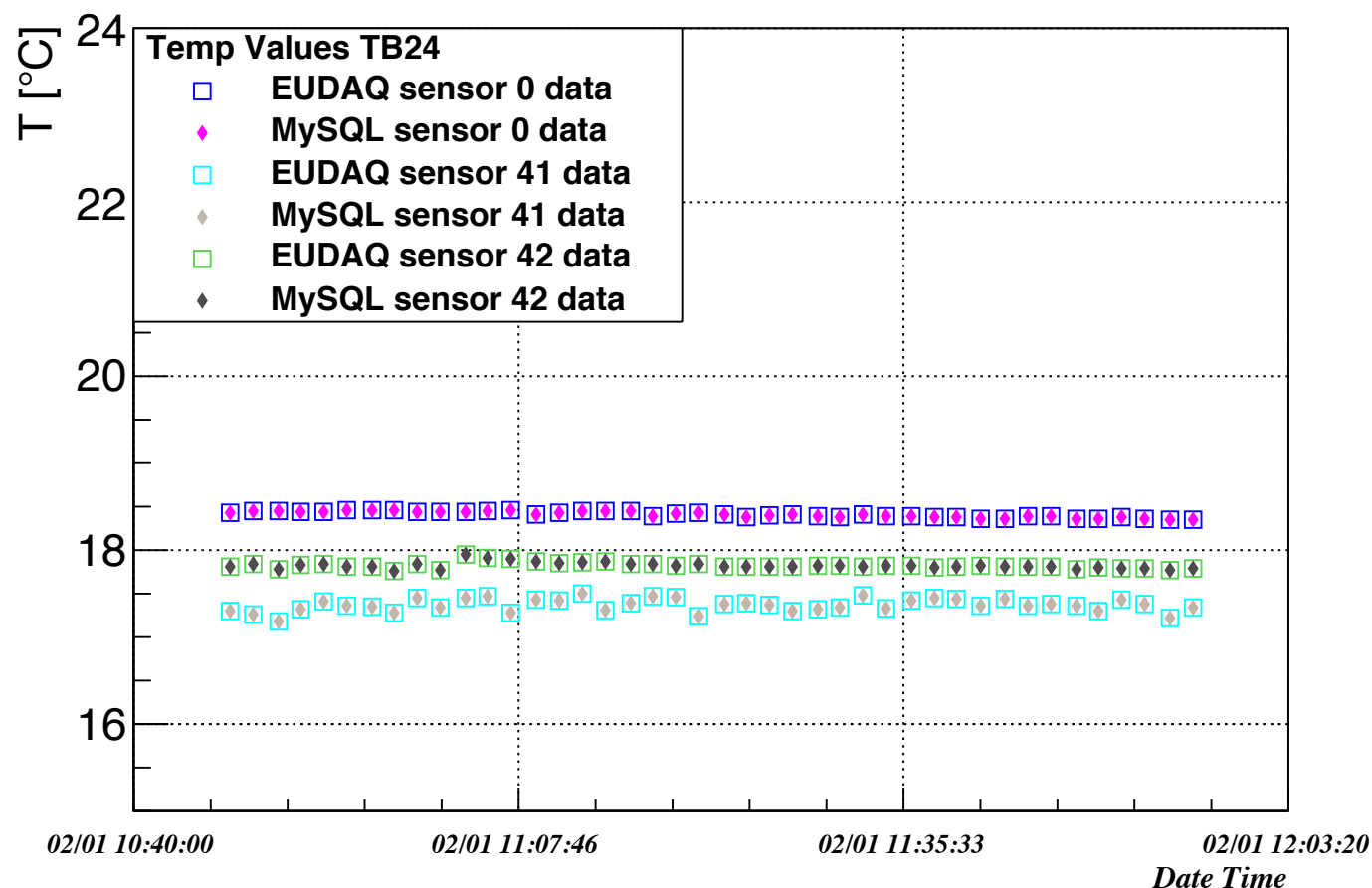
Date Time	T	RH
01/09/17 16:49	24.21	44.2
01/09/17 16:51	24.22	44
01/09/17 16:52	24.32	43.7
01/09/17 16:54	24.23	43.9
01/09/17 16:55	24.22	44
01/09/17 16:57	24.28	43.8



# 1st user commissioning

## Testing a second rack in DESY-II beam area 24:

- ▶ Data collected on 02/01/2018 from 10:40 to 12:00;
- ▶ Cross checked with MySQL database dumped csv file;
- ▶ Perfect **agreed** as **expected**;
- ▶ Able to conduct cross-rack comparison with EUDAQ2.
- ▶ Installation and data taking by intern student:
  - ▶ proof for short learning period;
  - ▶ 1st user experience helped to update the system.





# Environmental slow control system at DESY-II testbeam

## Closing

- ▶ System ready w/ first test beam commissioning succeed
- ▶ manual is on updating see <http://cds.cern.ch/record/2284369>.
- ▶ project delivered on 27/10/2017;
- ▶ 1st user experience from one intern student Lars Fischer:
  - ▶ successfully install a second rack;
  - ▶ manage to take data and validate system.
- ▶ **More users are welcomed!**

## Outlook

- ▶ Possible further development/update under discussion
  - ▶ possible to use **DQM4HEP** as the **online monitor** module for the system (see [Remi's talk](#));
  - ▶ possible to **integrate user's** customized **slow control** system, benefiting from the SQL module used in this system.



# Environmental slow control system at DESY-II testbeam

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- ▶ 1st user experience from former student Lars Fischer:
  - ▶ successfully install a second rack;
  - ▶ manage to take data and validate system.
- ▶ **More users are welcomed!**

谢谢观赏!

Many thanks for your attention!

Danke schön!

Merci beaucoup!

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# Everyone needs back up :)



# User: how SC data looks like in EUDAQ2.raw

*EUDAQ .conf file section for the Slow Control Producer: here to choose which channels to save to EUDAQ data stream*

```
[Producer.scp]
TBSC_DEBUG = "false"
TBSC_INTERVAL_SEC = 90
TBSC_PARA_MASK="ch1,ch11,ch41"
```

*Print out an example of the EUDAQ RAW event for Slow Control Producer*

```
kpix@aida2020-kpix2:~/afs/eudaq/eudaq_dev/bin$ more out.txt
<Event>
  <Type>2149999981</Type>
  <Extendword>2433815158</Extendword>
  <Description>SCRawEvt</Description>
  <Flag>0x00000000</Flag>
  <RunN>0</RunN>
  <StreamN>0</StreamN>
  <EventN>0</EventN>
  <TriggerN>0</TriggerN>
  <Timestamp>0x0000000000000000 -> 0x0000000000000000</Timestamp>
  <Timestamp>0 -> 0</Timestamp>
  <Tags>
    <Tag>ch1=28.66</Tag>
    <Tag>ch11=31.3</Tag>
    <Tag>ch41=28.1</Tag>
    <Tag>test=ttt</Tag>
  </Tags>
  <Block_Size>0</Block_Size>
</Event>
```





# MySQL database structure

## Preliminary MySQL database structure

```
kpix@aida2020-kpix2: ~ x kpix@aida2020-kpix2: /afs/desy.de/user/m/mengqing/eu... x kpix@aida2020-kpix2: ~/afs/eudaq/eudaq_dev/build x
Your MySQL connection id is 22
Server version: 5.7.18 MySQL Community Server (GPL)

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Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> use aidaTest;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> select * from aida_channels;
+-----+-----+-----+-----+-----+
| chid | id   | unit | sensor | comment |
+-----+-----+-----+-----+-----+
| ch0  | 0.0  | \u2103 | DIGI   | T,t     |
| ch10 | 0.10 | %H    | DIGI   | RH,Uw   |
| ch20 | 0.20 | \u2103 | DIGI   | DT,td   |
| ch30 | 0.30 | mb    | DIGI   | AP,p mbar |
| ch40 | 0.40 | \u2103 | Ntc    |         |
| ch41 | 0.41 | \u2103 | Ntc    |         |
| ch42 | 0.42 | \u2103 | Ntc    |         |
| ch43 | 0.43 | \u2103 | Ntc    |         |
| ch44 | 0.44 | \u2103 | Ntc    |         |
| ch45 | 0.45 | \u2103 | Ntc    |         |
| ch46 | 0.46 | \u2103 | Ntc    |         |
| ch47 | 0.47 | \u2103 | Ntc    |         |
| ch48 | 0.48 | \u2103 | Ntc    |         |
| ch49 | 0.49 | \u2103 | Ntc    |         |
+-----+-----+-----+-----+-----+
14 rows in set (0.00 sec)

mysql> select * from aidaSC;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| counter | timer | ch0 | ch10 | ch20 | ch30 | ch40 | ch41 | ch42 | ch43 | ch44 | ch45 | ch46 | ch47 | ch48 | ch49 |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 0000000001 | 2017-08-29 13:56:18 | 24.64 | 52.8 | 14.4 | 1010.8 | 24.43 | 24.31 | 24.49 | 24.4 | 24.31 | 24.34 | 24.46 | 16.9 | 24.69 | 26.3 |
| 0000000002 | 2017-08-29 13:56:53 | 24.71 | 52.7 | 14.5 | 1010.7 | 24.49 | 24.33 | 24.41 | 24.42 | 24.35 | 24.36 | 24.48 | 16.92 | 24.69 | 26.44 |
```



# ODBC setup example from rack-pc

The screenshot shows a Windows XP desktop environment. In the background, a table with columns: Channel, Unit, Sensor, Low Lim., Upr. Lim., Base, Factor, Exp, Monitor is visible. The 'Control Panel' window is open, showing 'Administrative Tools'. The 'ODBC Data Source Administrator' window is open, showing the 'System DSN' tab. The 'System Data Sources' list contains one entry: 'AIDAsc\_Database' using the 'MySQL ODBC 5.3 ANSI Driver'. The 'MySQL Connector/ODBC Data Source Configuration' window is also open, showing the 'Connection Parameters' tab. The configuration details are as follows:

Field	Value
Data Source Name	AIDAsc_Database
Description	AIDA Slow control Test Database
Connection Type	TCP/IP Server
Server	131.169.184.178
Port	3306
User	aidascuserw
Password	.....
Database	AIDAsc

The 'Connection' tab in the MySQL window shows various options, all of which are unchecked:

- Allow big result sets
- Use compression
- Enable automatic reconnect
- Don't prompt when connecting
- Allow multiple statements
- Interactive Client
- Can Handle Expired Password
- Enable Cleartext Authentication
- Disable default SSL

