

versiondog on the trail of the Big Bang

Backing up and monitoring of Industrial control system programs for the Large Hadron Collider (LHC) at CERN near Geneva, the world's largest particle accelerator, has been entrusted to the data management system versiondog. The European Organization for Nuclear Research uses the system to manage the data of around 500 components, making versiondog one of CERN's standard technologies.

"We have made significant gains in certainty and quality when it comes to data availability in areas where many programmable logic controllers are in use. Implementing versiondog has put us on a new quality level," says Jerónimo Ortolá Vidal, Automation engineer at the Industrial Controls and Safety systems Group of the Beams Department at CERN. The LHC was commissioned in 2008 to carry out cutting-edge research into particle physics. versiondog from AUVESY is the leading manufacturer-independent software solution for backup, version control and documentation of project data for industrial control systems. It uses standardised workflow and centralised data storage, makes automatic backups and ensures easily comprehensible documentation of each step in the development process. The SmartCompare function enables detailed program comparison with the same familiar presentation as the system editor. Support is provided for audit trail documentation in accordance with ISO 900x, VDA 6.x, FDA 21 CFR 11, GAMP and GMP.

versiondog has been in use at CERN for a year. There is now a centralised repository where the project data

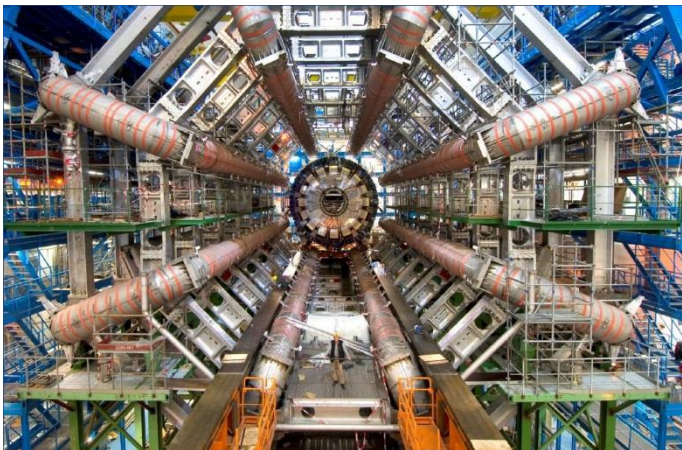


Fig. 1: The particle detector ATLAS is 46 metres long, 25 metres in diameter, and weighs about 7,000 tonnes – Image: CERN

of the control systems from Siemens (SIMATIC S7, TIA Portal, WinCC flexible) and Schneider Electric (Unity Pro) is safeguarded and managed. "We want to make all the processes of the control system and their surrounding ancillary equipment homogeneous," says Ortolá. "Our goal is to always have a clear overview of all PLCs and HMIs and all the changes that are made to their control programs. We want to be able to manage all program versions using a standardised procedure, and it is extremely important to us to be able to store and safeguard data centrally. versiondog helps us do that."

CERN - looking deeply into matter

CERN was founded in 1954 as a research organisation for fundamental physics. It is located at Meyrin near Geneva. A remarkable international collaboration, the European Organization for Nuclear Research is now run by 22 member states. With an annual budget of over one billion euros, the Organization receives visits from around 11,000 scientists all over the world who are working on various projects. The main focus of their research is the exploration of the fundamental particles that make up the Universe. Powerful accelerators are used to bring particles to near light speed. The biggest is the LHC (Large Hadron Collider).

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To reach it, it is first necessary to descend 100 m underground. Then you would need a bicycle if you wanted to follow the 27 km circumference of the collider. Doing so, you would pass several thousand electromagnets, some as big as a freight container, masses of cables, gigantic detectors and many computers. All this to do research on the smallest particles in nature. To help answer questions about the origin of the universe. And other questions, such as why is there far more matter than antimatter in the universe? Inside the ring, elementary particles are accelerated by the electromagnets to speeds close to that of light, i.e. in the region of 300,000 km per second. Then they are smashed together at predetermined collision zones. This causes a shower of particles, the trails of which can be traced and analysed by huge detectors. The Worldwide LHC Computing Grid (WLCG) was developed to handle the enormous quantity of data produced. Dispersed across the globe, this computing and data storage network can deal with data volumes in the order of 30 Petabytes.

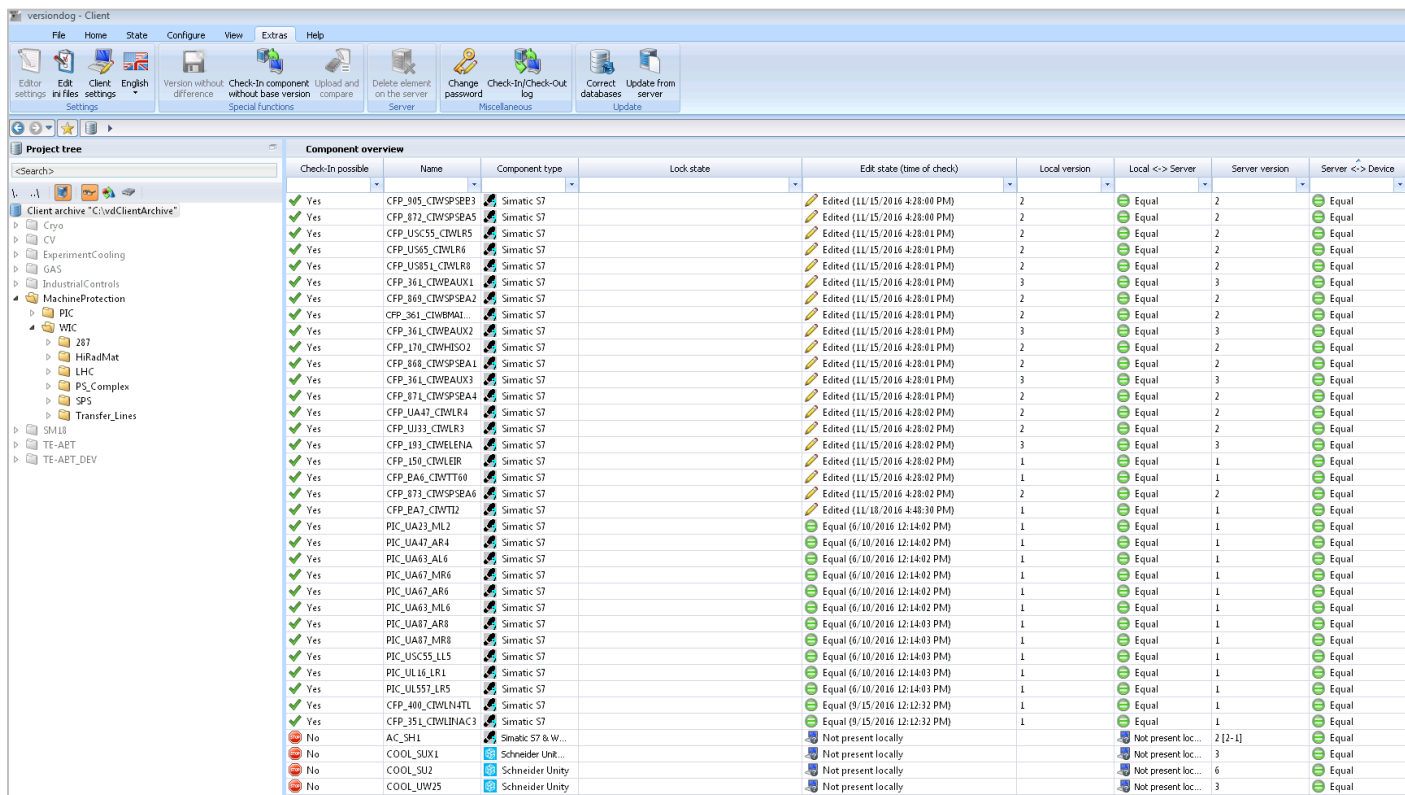


Fig. 2: The Large Hadron Collider lies in a tunnel 27 kilometres in circumference – Image: CERN

Now we can see what has changed

The control programs of CERN's auxiliary and utility systems (cryogenics, cooling systems, air conditioning, gas supply, electricity, interlocks, etc.) undergo a continual process of development and modification. The cryogenics have a particularly important role to play here because when the LHC is in operation, the magnets have to be kept at a constant temperature of 1.9 Kelvin (-271 degrees Celcius). Things have improved a lot since versiondog has been on the scene. All changes, no matter when they are made, where, or by whom, are detected then saved and documented centrally. Plain to see for everyone. All members of staff now go to the same place to access the same control software. The most recently approved and released version is always available. It is backed up regularly and changes made by colleagues can no longer be missed, overwritten or lost by mistake. There are already 10 teams managing around 500 control systems with versiondog. In the near future, around 1,500 components in use at CERN are set to be integrated into the versiondog system.

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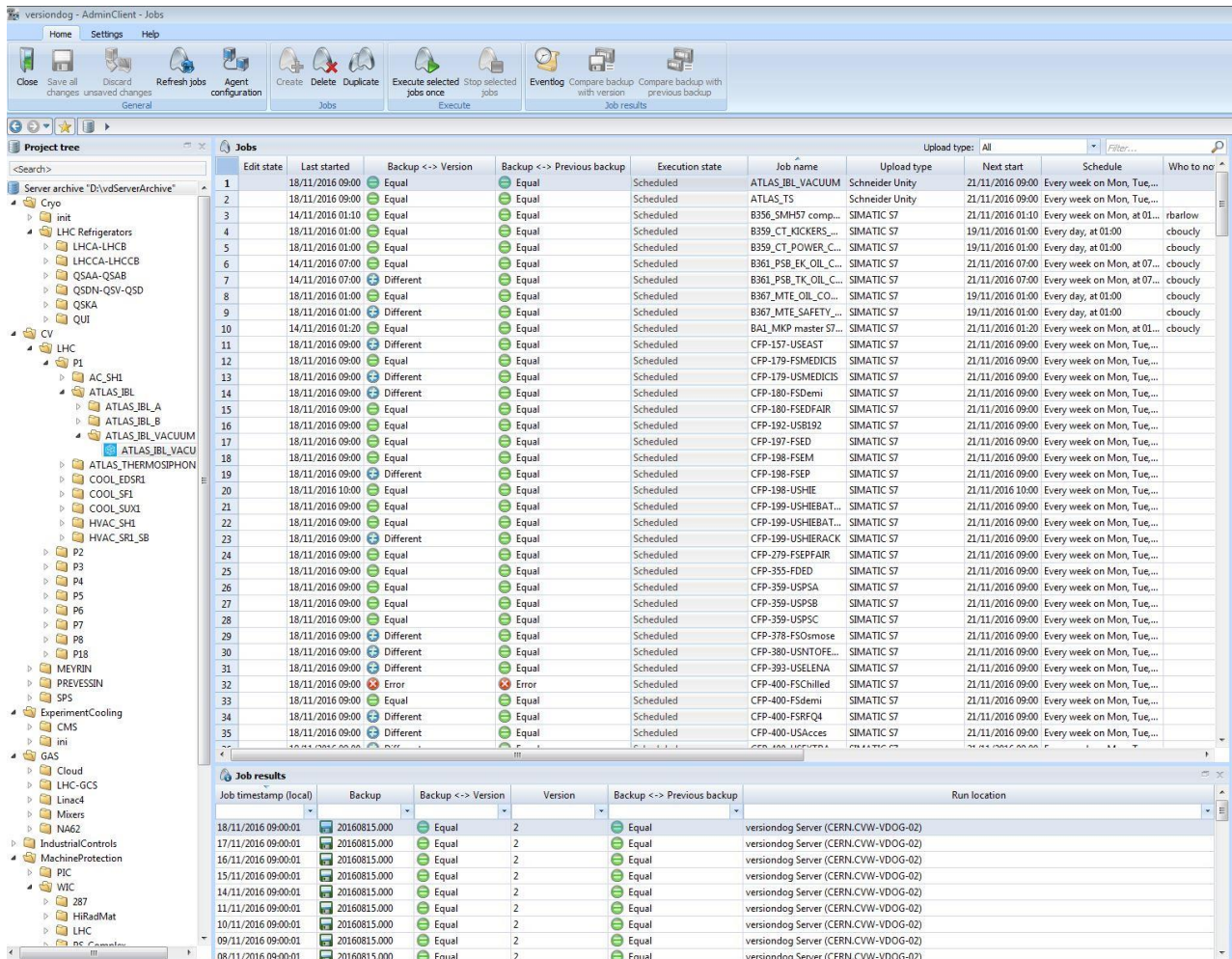
| Check-In possible | Name | Component type | Lock state | Edit state (time of check) | Local version | Local <-> Server | Server version | Server <-> Device |
|-------------------|-------------------|-------------------|------------|--------------------------------|---------------|--------------------|----------------|-------------------|
| Yes | CFP_005_CWSPSEB3 | Simatic S7 | | Edited (11/15/2016 4:28:00 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_072_CWSPSEB5 | Simatic S7 | | Edited (11/15/2016 4:28:00 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_USC55_CWLR5 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_US65_CWLR6 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_US851_CWLR8 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_361_CWBEAUX1 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 3 | Equal | 3 | Equal |
| Yes | CFP_868_CWSPSEB2 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 2 | Equal | 2 | Equal |
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| Yes | CFP_170_CWBEISO2 | Simatic S7 | | Edited (11/15/2016 4:28:01 PM) | 2 | Equal | 2 | Equal |
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| Yes | CFP_U133_CWLR3 | Simatic S7 | | Edited (11/15/2016 4:28:02 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_153_CWLEINA | Simatic S7 | | Edited (11/15/2016 4:28:02 PM) | 3 | Equal | 3 | Equal |
| Yes | CFP_150_CWLEIR | Simatic S7 | | Edited (11/15/2016 4:28:02 PM) | 1 | Equal | 1 | Equal |
| Yes | CFP_BA6_CWTTT60 | Simatic S7 | | Edited (11/15/2016 4:28:02 PM) | 2 | Equal | 2 | Equal |
| Yes | CFP_873_CWSPSEB6 | Simatic S7 | | Edited (11/15/2016 4:28:02 PM) | 1 | Equal | 1 | Equal |
| Yes | CFP_BA7_CWTT2 | Simatic S7 | | Edited (11/18/2016 4:48:30 PM) | 1 | Equal | 1 | Equal |
| Yes | PIC_UA23_ML2 | Simatic S7 | | Equal (6/10/2016 12:14:02 PM) | 1 | Equal | 1 | Equal |
| Yes | PIC_UA47_AR4 | Simatic S7 | | Equal (6/10/2016 12:14:02 PM) | 1 | Equal | 1 | Equal |
| Yes | PIC_UA83_AL6 | Simatic S7 | | Equal (6/10/2016 12:14:02 PM) | 1 | Equal | 1 | Equal |
| Yes | PIC_UA87_MR6 | Simatic S7 | | Equal (6/10/2016 12:14:02 PM) | 1 | Equal | 1 | Equal |
| Yes | PIC_UA87_AR6 | Simatic S7 | | Equal (6/10/2016 12:14:02 PM) | 1 | Equal | 1 | Equal |
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| Yes | PIC_UA87_AR8 | Simatic S7 | | Equal (6/10/2016 12:14:03 PM) | 1 | Equal | 1 | Equal |
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| Yes | PIC_UL557_LRS | Simatic S7 | | Equal (6/10/2016 12:14:03 PM) | 1 | Equal | 1 | Equal |
| Yes | CFP_400_CWLN4TL | Simatic S7 | | Equal (9/15/2016 12:12:32 PM) | 1 | Equal | 1 | Equal |
| Yes | CFP_351_CWLNAC3 | Simatic S7 | | Equal (9/15/2016 12:12:32 PM) | 1 | Equal | 1 | Equal |
| No | AC_SH1 | Simatic S7 & W... | | Not present locally | | Not present loc... | 2 [2-1] | Equal |
| No | COOL_SUX1 | Schneider Unit... | | Not present locally | | Not present loc... | 3 | Equal |
| No | COOL_SU2 | Schneider Unity | | Not present locally | | Not present loc... | 6 | Equal |
| No | COOL_UW25 | Schneider Unity | | Not present locally | | Not present loc... | 3 | Equal |

Fig. 3: A clear overview of all components is available at one click – Image: CERN

versiondog brings certainty

Management of the various individual processes and control systems is the responsibility of a number of different departments. Within this structure, Ortolá's department provides CERN wide support service. It was with the goal of standardising processes across departments in mind that the versiondog system was introduced. Staff now have a much clearer picture of processes and their current status. Any and all changes are comprehensible and visible to everyone. And they can be undone if necessary. Furthermore, a backup of all data is performed once a week. "Errors made while modifying programs have been reduced to an absolute minimum since we have been using versiondog," explains Ortolá. "Centralised data storage guarantees that we are always working with the latest and most recently approved and released program versions." But if for some reason a system goes down, the latest version is immediately available. What's more, the system checks that the version running on a control system (the online version) really does correspond to the latest version that was saved on the server (the offline version). Before versiondog, changes could go unnoticed. Regular online-offline comparisons ensure that this can no longer happen. If a discrepancy is detected, the system informs the appropriate administrator by email. All this means that versiondog has led to an improvement in quality and an increase in the level of work process standardisation at CERN.

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| Job ID | Edit state | Last started | Backup <-> Version | Backup <-> Previous backup | Execution state | Job name | Upload type | Next start | Schedule | Who to no |
|--------|------------|------------------|--------------------|----------------------------|-----------------|----------------------|-----------------|------------------|-----------------------------|-----------|
| 1 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | ATLAS_JBL_VACUUM | Schneider Unity | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 2 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | ATLAS_TS | Schneider Unity | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 3 | | 14/11/2016 01:10 | Equal | Equal | Scheduled | B356_SMH57 comp... | SIMATIC S7 | 21/11/2016 01:10 | Every week on Mon, at 01... | rbarlow |
| 4 | | 18/11/2016 01:00 | Equal | Equal | Scheduled | B359_CT_KICKERS... | SIMATIC S7 | 19/11/2016 01:00 | Every day, at 01:00 | cbouchy |
| 5 | | 18/11/2016 01:00 | Equal | Equal | Scheduled | B359_CT_POWER_C... | SIMATIC S7 | 19/11/2016 01:00 | Every day, at 01:00 | cbouchy |
| 6 | | 14/11/2016 07:00 | Equal | Equal | Scheduled | B361_PSB_EK_OIL_C... | SIMATIC S7 | 21/11/2016 07:00 | Every week on Mon, at 07... | cbouchy |
| 7 | | 14/11/2016 07:00 | Different | Equal | Scheduled | B361_PSB_TK_OIL_C... | SIMATIC S7 | 21/11/2016 07:00 | Every week on Mon, at 07... | cbouchy |
| 8 | | 18/11/2016 01:00 | Equal | Equal | Scheduled | B367_MTE_OIL_CO... | SIMATIC S7 | 19/11/2016 01:00 | Every day, at 01:00 | cbouchy |
| 9 | | 18/11/2016 01:00 | Different | Equal | Scheduled | B367_MTE_SAFETY... | SIMATIC S7 | 19/11/2016 01:00 | Every day, at 01:00 | cbouchy |
| 10 | | 14/11/2016 01:20 | Equal | Equal | Scheduled | BAL_MKP master S7... | SIMATIC S7 | 21/11/2016 01:20 | Every week on Mon, at 01... | cbouchy |
| 11 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-157-USEAST | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 12 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-179-FSMEDICIS | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 13 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-179-USMEDICIS | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 14 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-180-FSDemi | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 15 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-180-FSEDFAIR | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 16 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-192-USB192 | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 17 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-197-FSED | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 18 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-198-FSEM | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 19 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-198-FSEP | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 20 | | 18/11/2016 10:00 | Equal | Equal | Scheduled | CFP-198-USHE | SIMATIC S7 | 21/11/2016 10:00 | Every week on Mon, Tue... | |
| 21 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-198-USHEBAT... | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 22 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-199-USHERACK | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 23 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-279-FSEPFAIR | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 24 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-355-FDED | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 25 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-359-USPSA | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 26 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-359-USPSB | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 27 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-359-USPSC | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 28 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-378-FSOmose | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 29 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-380-USNTOFE... | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 30 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-393-USELENA | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 31 | | 18/11/2016 09:00 | Error | Error | Scheduled | CFP-400-FSChilled | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 32 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-400-FSdemi | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 33 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-400-FSRFQ4 | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 34 | | 18/11/2016 09:00 | Different | Equal | Scheduled | CFP-400-USAcces | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |
| 35 | | 18/11/2016 09:00 | Equal | Equal | Scheduled | CFP-400-USAcces | SIMATIC S7 | 21/11/2016 09:00 | Every week on Mon, Tue... | |

Fig. 4: All backup jobs and their status are listed in the AdminClient – Image: CERN

Moving forward

Research and development in a facility such as CERN never comes to an end. Ortolá is continually adapting the versiondog system to the changing needs of the Organization. When he needs support, he gets it directly from the data management specialists AUVESY. There he can find the help he needs with individual elements of configuration and with broader adaptations of the system to new conditions.

Ortolá sums up: "versiondog makes it possible for us at CERN to safeguard our control system data and store it centrally, which is a crucial element for the Organization."

www.versiondog.com



Fig. 5: WinCC OA HMI in the LHC cryogenics control – Image: CERN

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