Current iFDAQ Software Status

M. Bodlak, V. Frolov, S. Huber, **M. Jandek**, V. Jary,
I. Konorov, A. Kveton, D. Levit, **J. Novy**, D. Steffen, O. Subrt,
M. Virius

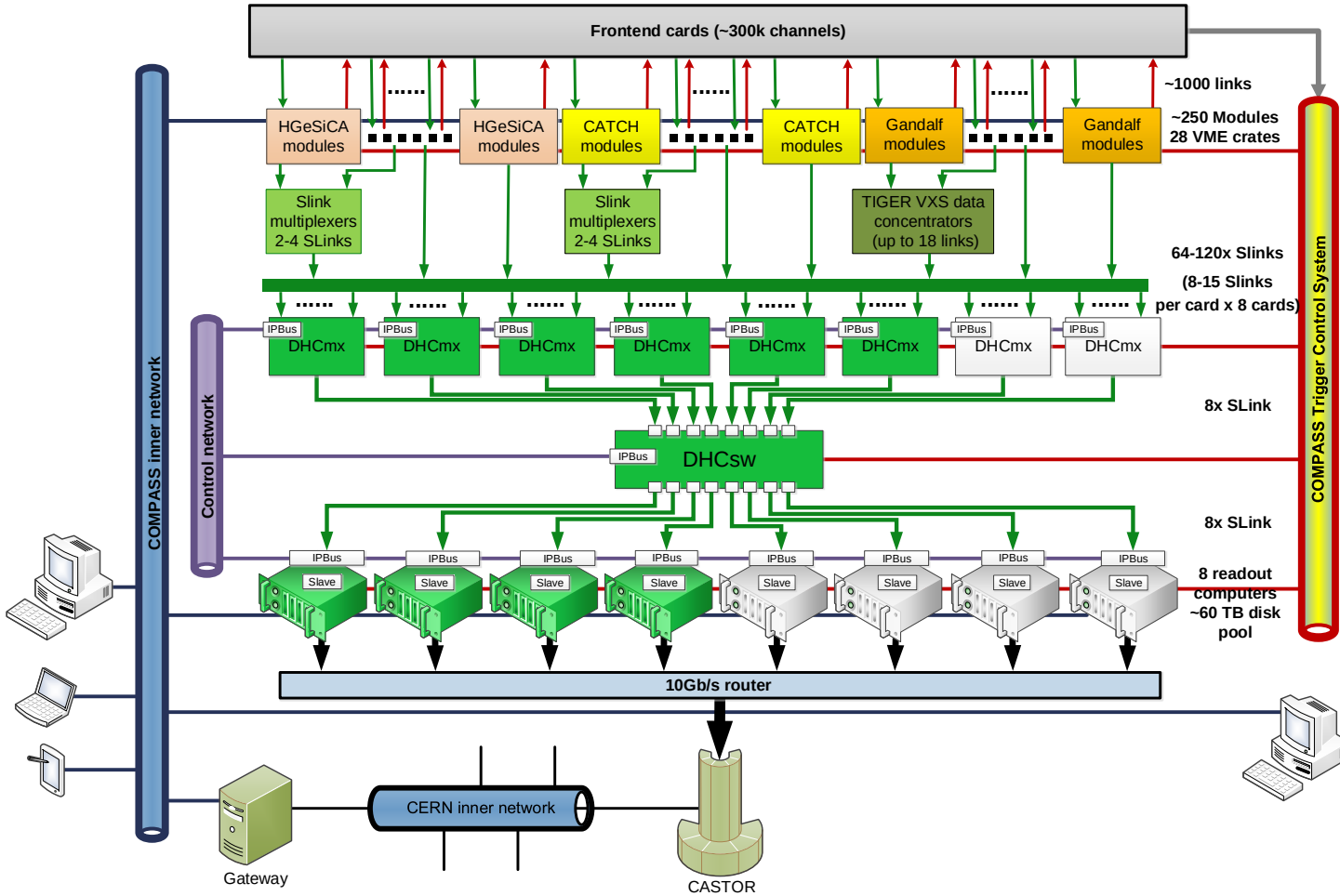
Faculty of Nuclear Sciences and Physical Engineering
Czech Technical University in Prague, Czech Republic
&
European Organization for Nuclear Research – CERN, Switzerland

Outline

- iFDAQ Architecture
- iFDAQ Status
- iFDAQ Problems during 2018 run
- iFDAQ Uptime

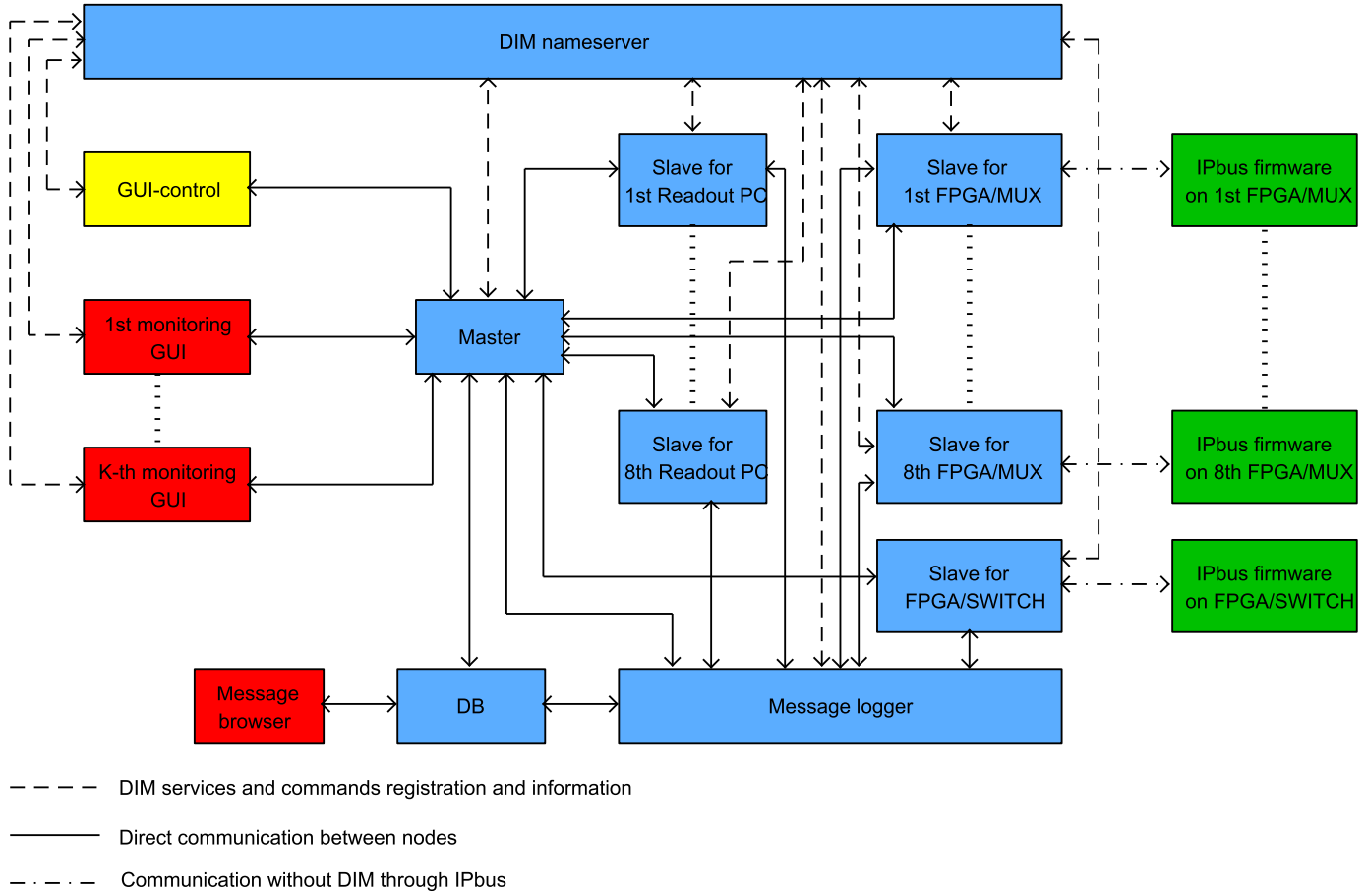
Hardware Structure

- Hardware based E.B.
- Data concentrated by 6 (up to 8) DAQ modules with multiplexer firmware
- Distribution to 4 (up to 8) readout computers by DAQ module switch firmware
- Full events received by servers
- Consistency check at many layers
- Events checked and transferred to DATE data format



Software Structure

- Runcontrol GUI is a graphical user interface
- Master is a main control process
- Slave-readout readouts and verifies the data
- Slave-control monitors and controls the FPGA cards
- MessageLogger stores informative and error messages into the database
- MessageBrowser provides an intuitive access to messages stored in the database



iFDAQ Status

- iFDAQ Software is stable since October 2017
- DIALOG helped to increase stability of the iFDAQ
- DAQ Debugger detected all remaining software issues
- Cross-Switch was introduced during 2018 run
- Database communication in master process was moved to separate execution thread

Problems during 2018

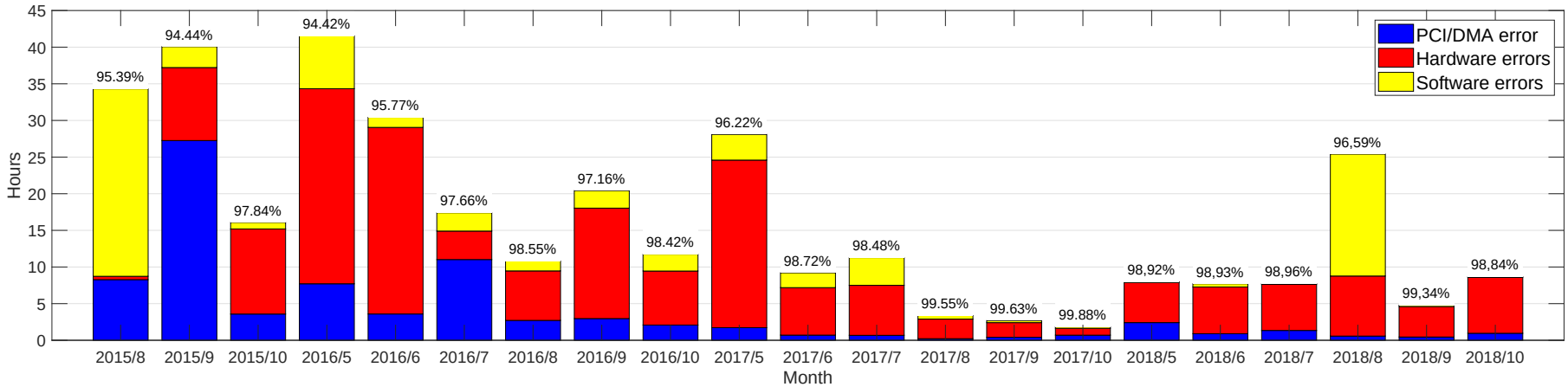
- MUX12 required periodic manual restarts.
  - Probable cause is influence of radiation on the component
  - Unfortunately, no remote restart option is available, therefore access was required to recover MUX12 each time
- Master process was crashing when database was under increased workload
  - Fixed by moving the database routines to separate execution thread

Problems during 2018

- Collected data for several runs were tagged with incorrect run number
- Two distinct causes were identified
  - Race condition while obtaining the run number from the database
  - Hardware reports incorrect run number to master process
- A fix for the first – Master process hosts the database communication in separate execution thread
- Further investigation of both problems is required
- The data was not lost, just mislabeled

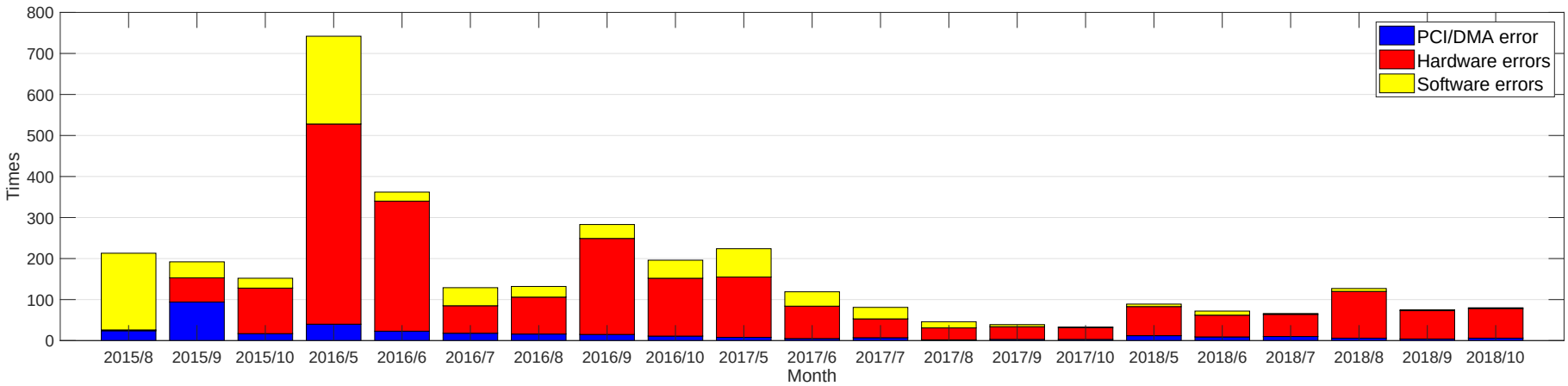
iFDAQ Uptime

- The iFDAQ UpTime – time when iFDAQ is able to take data
- Hardware errors – Errors originating in frontend cards or iFDAQ hardware (components up to readout slaves).
- Peak in August 2018 is related to the water leak that affected the entire CERN north area.

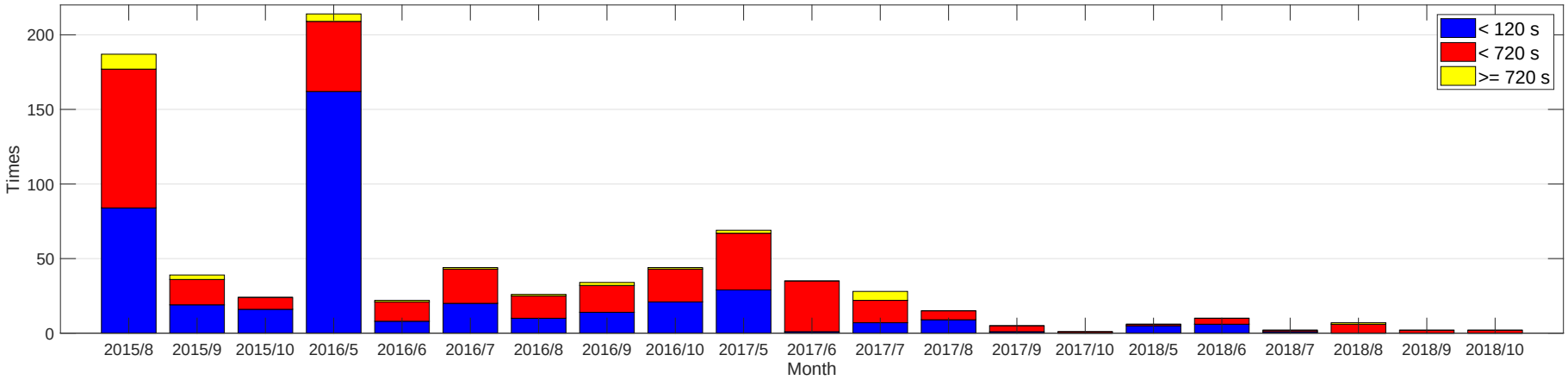


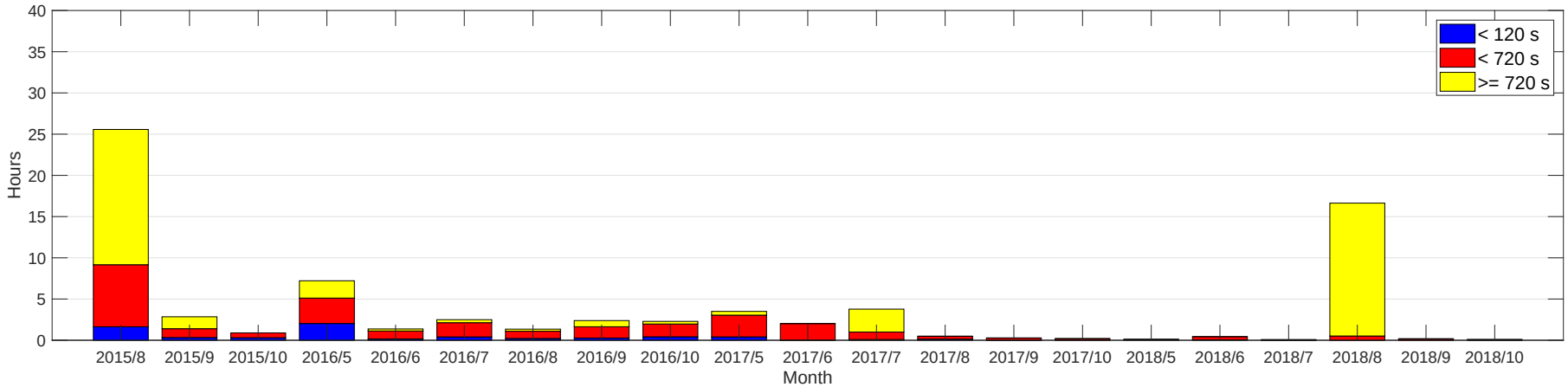
Number of errors

- Number of errors that occurred during each month of data taking
- The peak during August 2018 is not present – most of the downtime was caused by a single error

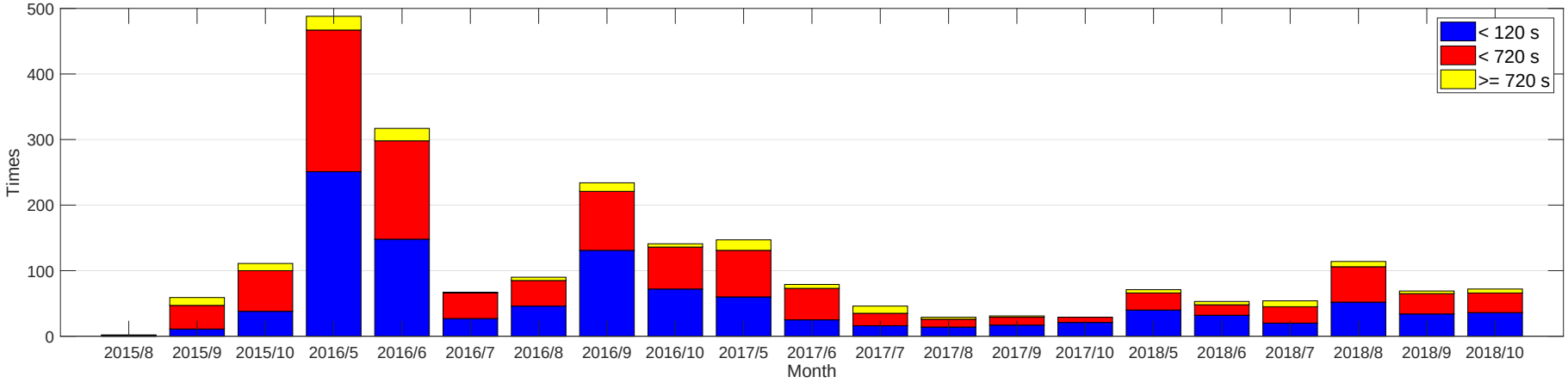


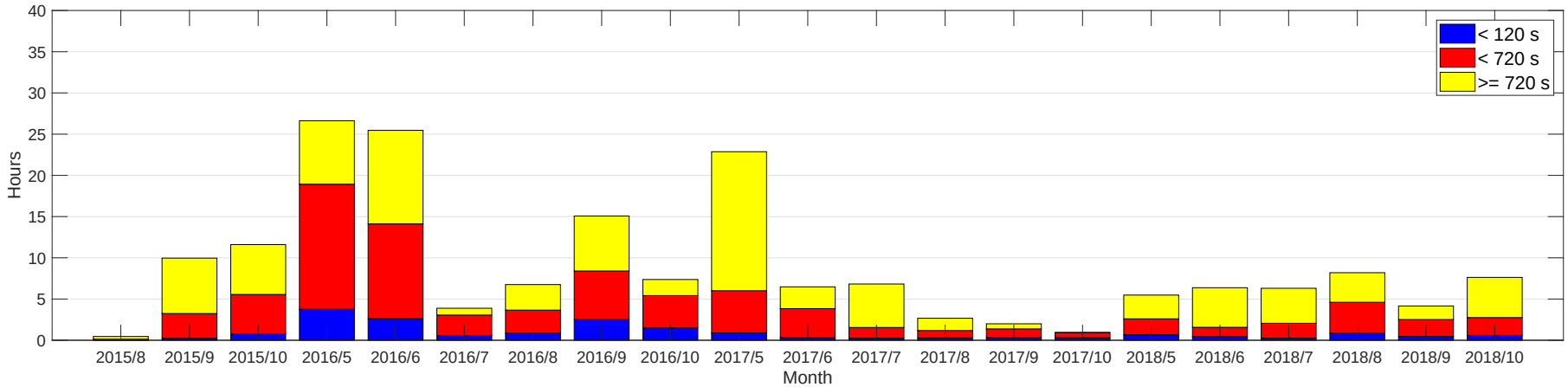
iFDAQ Software Errors



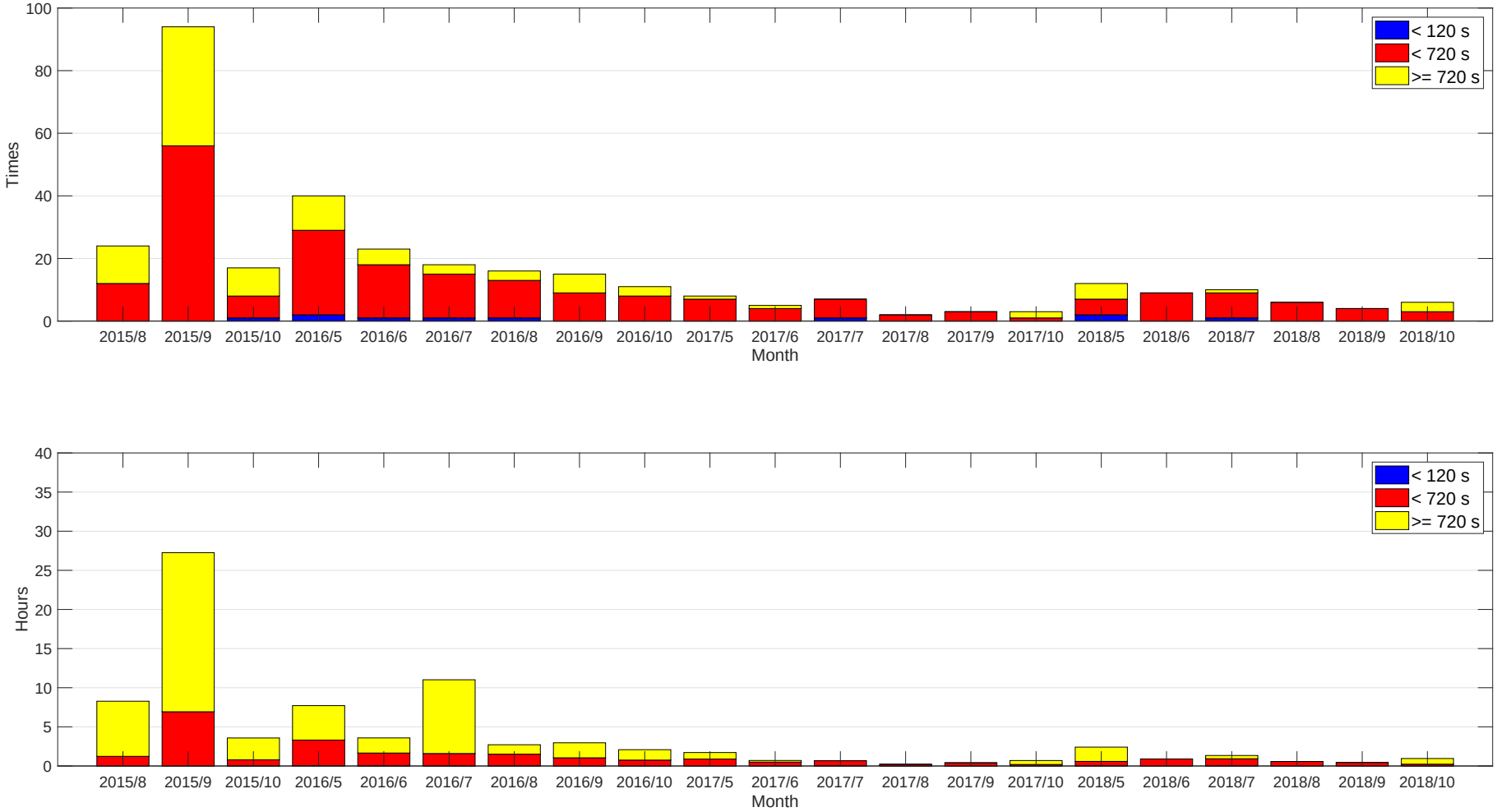


iFDAQ Hardware Errors





iFDAQ PCI/DMA Errors



Conclusion

- Major iFDAQ stability improvements from recent time
  - Continuously running DAQ, without starts and stops
  - New communication library DIALOG
  - DAQ Debugger creates reports concerning a crash for further investigation
  - Database communication in master process running in separate thread
- iFDAQ Software is stable since October 2017
- iFDAQ uptime for 2018 is around 98.60% $\simeq$ 10 hour loss / month of data-taking
- IFDAQ uptime when disregarding the waterleak downtime is around 98.91 $\simeq$ 7.2 hour loss / month of data-taking

Thank you for your attention

References

P. Abbon, et al.(the COMPASS collaboration): *The COMPASS experiment at CERN*. In: Nucl. Instrum. Methods Phys. Res., A 577, 3 (2007) pp. 455–518.

V. Y. Alexakhin, et al. (the COMPASS Collaboration): *COMPASS-II Proposal*. CERN-SPSC-2010-014, SPSC-P-340. May 2010.

M. Nakao , S. Y. Suzuki: *Network shared memory framework for the Belle data acquisition control system*. Real Time Conference, 1999. Santa Fe 1999. 11th IEEE NPSS.

C. Gaspar, M. Dönszelmann, Ph. Charpentier: *DIM, a Portable, Light Weight Package for Information Publishing, Data Transfer and Inter-process Communication*. International Conference on Computing in High Energy and Nuclear Physics, Padova, Italy, 1-11th February 2000.

C. Gaspar, M. Dönszelmann: *DIM – A Distributed Information Management System for the DELPHI Experiment at CERN*. Proceedings of the 8th Conference on Real-Time Computer applications in Nuclear, Particle and Plasma Physics, Vancouver, Canada, June 1993.

C. Gaspar, J. J. Schwarz: *A Highly Distributed Control System for a Large Scale Experiment*. 13th IFAC workshop on Distributed Computer Control Systems – DCCS'95, Toulouse, France, 27-29th September 1995.

M. Bodlak, et al.: *Development of new data acquisition system for COMPASS experiment*. Nuclear and Particle Physics Proceedings, 37th International Conference on High Energy Physics (ICHEP). April–June 2016, vol. 273–275, pp. 976–981. Available at: http://dx.doi.org/10.1016/j.nuclphysbps.2015.09.153.

M. Bodlak, et al.: *FPGA based data acquisition system for COMPASS experiment*. Journal of Physics: Conference Series. 2014-06-11, vol. 513, issue 1, s. 012029-. DOI: 10.1088/1742-6596/513/1/012029. Available at: http://stacks.iop.org/1742-6596/513/i=1/a=012029?key=crossref.78788d23de2b4a6a34d127c361123b8c.

M. Bodlak, et al.: *New data acquisition system for the COMPASS experiment*. Journal of Instrumentation. 2013-02-01, vol. 8, issue 02, C02009-C02009. DOI: 10.1088/1748-0221/8/02/C02009. Available at: http://stacks.iop.org/1748-0221/8/i=02/a=C02009?key=crossref.a76044facdf29d0fb21f9eefe3305aa5.

References

M. Bodlak, et al.: *Developing Control and Monitoring Software for the Data Acquisition System of the COMPASS Experiment at CERN*. Acta polytechnica: Scientific Journal of the Czech Technical University in Prague. Prague, CTU, 2013, issue 4. Available at: http://ctn.cvut.cz/ap/.

T. Anticic, et al. (ALICE DAQ Project): *ALICE DAQ and ECS User's Guide* CERN, EDMS 616039, January 2006.

C. Ghabrous Larrea, et al.: *IPbus: a flexible Ethernet-based control system for xTCA hardware*, 2015 JINST 10 C02019. doi:10.1088/1748-0221/10/02/C02019.

CASTOR – CERN Advanced Storage manager. Available at: http://castor.web.cern.ch. (Accessed: 2017-05-01).

Electronic developments for COMPASS at Freiburg. Available at: http://hpfr02.physik.uni-freiburg.de/projects/compass/electronics/catch.html. (Accessed: 2017-05-01).

The GANDALF Module. (online). Available at: http://hpfr03.physik.uni-freiburg.de/gandalf/pages/information/about-gandalf.php?lang=EN. (Accessed: 2017-05-01).

iMUX/HGESICA module. (online). Available at: https://twiki.cern.ch/twiki/pub/Compass/Detectors/FrontEndElectronics/imux_manual.pdf. (Accessed: 2017-05-01).

Linux at CERN. (online). Available at: http://linux.web.cern.ch/linux/scientific6/. (Accessed: 2017-05-01).

S-Link – High Speed Interconnect. (online). Available at: http://hsi.web.cern.ch/HSI/s-link/. (Accessed: 2017-05-01).