Minutes of the Technical Board Meeting June 5, 2018

Indico page of the meeting (click)

Present: Vincent Andrieux, Jens Barth, Yann Bedfer, Oleg Denisov, Nori Doshita, Christian Dreisbach, Igor Konorov, Alain Magnon, Gerd Mallot, Daniele Panzieri, Bakur Parsamyan, Stephane Platchkov, Caroline Riedl, Fulvio Tessarotto, Annika Vauth, Moritz Veit.

Remotely connected: Bernhard Ketzer, Jan Friedrich, Anna Martin, Marcin Ziembicki.

Communications, new, issues (Caroline Riedl): Caroline will continue to carry out communication tasks as TC until the September meeting, however probably remotely from Illinois and definitively out of office in July. The 2018 Drell-Yan run has started successfully mid-May, one period of physics data taken. The polarized target is performing excellent with only few problems, all of which can be solved. A few cooling issues have occurred, the most important ones related to the target pump room, the tap water temperature in 888, and the maintenance of the ACs in the 888 barracks. All of these issues are being followed up with EN-CV.

News from the EATM (Annika Vauth): The new beam permit procedure is too complicated; it caused us the loss of one beam day and therefore it will be revised by CERN. EN-EA has installed PT100 thermo sensors on the CEDARs. North Area consolidation: budget cuts of almost 60% and therefore the renovation of the flammable gas detection in 888 is postponed. EN-EA and BE-BI plan to form a new working group **BI WG** (instrumentation in secondary beams and transfer lines). Members are not yet assigned but COMPASS (and the future new collaboration) will certainly have an interest to participate.

Polarized target (Nori Doshita): The NH3 target was loaded on April 17 and TE-calibrated April 20-24. Four temperature points were taken: 1.44 K, 1.27 K, 0.98 K, 0.98 K. The results look very good and better than in 2015. The target magnet was commissioned by about April 20 with the help of EP-DT and generous support by Fabrice including a list of changes compared to 2015. In particular, a new field rotation procedure from solenoid to dipole was introduced that had served well in SMC times, helping to minimize polarization losses (trim coils at opposite polarity during rotation in 2018, while they were off in 2015). Indeed the observed loss in 2015 is less than 0.1%, while it was 0.5% in 2015. The target was first polarized on April 28. The reached polarizations are higher in 2018 by up to (absolute) 7% as compared to 2015. This could be due to a better performance of the dilution refrigerator (better cleaning off LN2?), allowing for a smoother circulation of 3He. The relaxation time is found to be

larger by up to 500 h as compared to 2015. Measurements of relaxation times without beam have started. MW EIO tube problem: a spare isolator is to be inserted. The old isolator causes a blockage of the EIO tube.

Trigger 2018 setup (Moritz Veit): outer hodoscopes: changed back the central region to the configuration of 2015 and produced two new slabs for HO03 since the old ones had been modified for the GPD runs 2016/17. Moved the middle horizontal hodoscopes back to the position of 2015. Return of H1 to the position of the survey report of 2010. Installation of new mu-metall shielding in the central hole region of H1, resulting in 5-10% gain of signal amplitude. As requested, an additional TDC was installed to get the un-prescaled trigger bits. This yet has to be integrated into coral and phast. Continuous measurements of dead time of middle and outer trigger were implemented and weekly measurements of LAS-LAS dead times are planned during the run. Since 2011, a blade center with 8 computational nodes has been available but was not used. Thanks to Moritz it is fully working again since the begin of the 2018 run using spare parts from TUM. 8 computation nodes (HP Blades) with each 8 cores, 1 master node, 1 storage node. HTCondor installation for distributing the jobs over the Cluster. Plan to decode part of the recorded data to determine T0s and hodoscope parameters on a daily basis. 2.5 hours per run when using all 64 cores. Invitation to other detector experts who need computing time.

Proton radius test measurement (Christian Dreisbach): with the removal of the test TPC on May 15, the 2018 test beam has been successfully completed. The TPC filled with hydrogen acts as active target and measures the elastically recoiling proton. Four silicon stations up- and downstream of the target measure the angles of the scattered muons. Both systems operated well and it was demonstrated that the TPC can achieve the required energy resolution (down to small Q^2) in the given environment. Vertices were correctly reconstructed with the silicon stations and a basic Q^2 spectrum was extracted. The challenge is the correlation of muon and proton events since the two systems are read out with independent DAQs. It was possible to extract a preliminary but promising timing correlation.

For the actual future measurement possibly taking place in 2022 (see Letter of Intent), different options for the TPC are discussed: modify existing IKAR or build a new TPC with up to 25 bar pressure. The construction of the SciFi "kink trigger" elements is ongoing and a beam test with the SI telescope will possibly take place in September.

DAQ 2021 (Igor Konorov): the time line for the future project of triggerless readout (100% of data, no external trigger) is presented: step 1 will be the construction of such DAQ for the proton-radius measurement. 2018 form group; a preliminary list of

responsibilities of COMPASS institutions exists; it is planned to have another workshop this year. 2019: development of prototype; 2020: production; 2021: pilot run. In step 2 beyond LS3, the concept will be extended to all other detectors. Possible improvements of the iFTDC are considered (time resolution down to 100 ps, better dynamic non-linearity range DNL). The production of 3 FPGAs is scheduled for September.

The big issue is the manpower of the project: because of the upcoming retirement of the only COMPASS CERN staff person (GM), no PhD students can be hired from this point in time via the CERN Gentner program (click), for which a CERN-affiliated supervisor is required. Currently only two PhD students are working on the project, which will be critically delayed if the collection of more manpower will not be successful by the end of 2018.

CEDAR status (Marcin Ziembicki, Igor Konorov): at the time of the TB meeting, the discriminators were installed in a crate and the interconnects to the TDC were being finalized. The final assembly of the dividers inside the base was yet to be done. The production of the missing mechanical pieces was well on its way except for the anodizing, which might be too late for the dead lines at CERN, in which case the mounting will be used uncoated. The optical system (Adam Klekotko) is not yet completed but well on its way. Marcin, Robert K. and Adam will arrive at CERN on June 17 and perform all pending installations during the long MD June 18-21. Adam will install and start up the optical system.

A new iFTDC firmware core has been developed and tested by Igor and his team. They achieved 0.5 ns bin width or ∼200 ps resolution and ∼20% DNL. They will commission the system on June 14 at CERN, and it will be installed by Marcin and his team the week after.

Lithium absorber history (Caroline Riedl): In 2015, there were 2 sheets of 6Li absorber (32 mm thick) and 1 sheet of polyethylene (PE, 1 cm thick) installed at the backend of the hadron absorber. The first 6Li sheet was upstream of the most downstream 10 cm steel plate, while the second 6Li sheet and the PE sheet were downstream of that steel plate.

- The 6Li had been added following a proposal by Matthias Perdekamp that thermal neutrons can be captured by heavy elements at the backend of the hadron absorber. The capture causes the excitation of e.g. a Fe nucleus, which upon de-excitation emits a photon. The gamma produces an electron-positron pair, and these charged particles make it into DC0, leaving an unwanted ionization and lastly inefficiency for real signal events there.

- The PE had been inserted to address a concern from Dietrich von Harrach. He believes that the background in DC0 stems from soft shower tails that exit downstream of the absorber and he suggested a sheet of polyethylene to stop these shower tails.

The installations in 2015 were done in a rush and not everyone agreed that a clear message was extracted from the 2015 data whether the 6Li and/or the PE resulted in any improvement of the situation. In 2014, an inefficiency of the 2nd layer of DC0 (X2) had been observed. For a better understanding of the situation, and for possible improvements during future runs, a dedicated set of measurements was carried out at the very beginning of the 2018 DY run ($\sim$ May 8-10), while changing as little as possible in the setup. Unfortunately the target solenoid was off during configuration #2 and DC4 was in garage position during configuration #5.

1. Only Li1 (between 2 10 cm steel plates)
2. No absorber sheet
3. Only PE
4. Li1* & Li2, both at backend of absorber
5. Li1, Li2, PE (as 2015 - Li1 between steel plates)

Right after the completion of this set of 2018 runs, the chicane was moved for transverse mode of the target and the dipole was switched on.

Lithium absorber analysis (Yann Bedfer): the (ion2-chamber-) normalized current in DC0 is compared for configurations #1, #3, #4, #5, and respectively divided by #2 (no absorber). This DCS-related work was supported by Christophe Pires. In the ratio #X/#2, an overall effect of 3-10% drop in current is found not only in DC0 (and here in all layers about equally, while the sharp drop in efficiency was observed only for the 2nd layer in 2015), but rather unexpectedly also in DC1 and the MMs. This "pedestal effect" might be due to the solenoid being off in #2 (unlike for all the other configurations). There is a 3% drop in config #3 (PE only), 5% drop for #1&4 (not much difference if both or only 1 lithium sheet), and the best configuration is the 2015 and also current 2018 with 2 lithium and 1 PE, with about 10% drop.

The next steps could be: try to normalize to different period with #2 configuration (no absorber layers at all). This will be difficult because the first 6Li layer was installed already on April 19, after which date a lot of commissioning and changes took place. Therefore it might be better to just compare the relative changes between 1, 3, 4, 5. Anyway the final answer can only be given by a look at real or pseudo efficiencies.

Radiation 2018 discussion (Caroline Riedl, Vincent Andrieux, ...): In a meeting with RP (Radio Protection) on May 18, 2018 (Frederic Aberle, Yann Pira, Claudia Ahdida, Johannes Bernhard, Vincent, Caroline) future RP measurement campaigns were discussed. They will be started around mid-June. We are keeping a close look on the integrated dose measured by the environmental radiation monitor ("cow meadow"). Christophe Pires has added the integral of the counts to DCS. While PMSG824 (G=gammas) seems to not give a reasonable measurement, PMSN824 (N=neutrons) rises reasonably during times with beam and stays rather constant during no-beam times. It has reached $\sim 10\%$ of the yearly allowed dose at the time of the TB meeting June 5 (which surprised Caroline but it seems to be as expected); as a reminder, nominal intensity was reached May 8 and the beam will end November 11.

Frequent failures of the network switches during the presence of the 2018 beam are observed (SEU - Single Event Upset) - at the time of the TB meeting, 7 SEUs within 3 weeks since May 9 (start of high intensity beam). *Since the TB meeting, the frequent failures of network switches and HV crates continue.* 2 network switches can be controlled remotely w/o access necessity (SM1 & 2), while 1 network switch cannot (yet) be controlled remotely (gallery), thus requiring access and resulting in a loss of beam time. It is planned to make this 3rd network switch also remotely controllable (Moritz Veit and Vladimir Frolov organization of long cable [EN-EA cabling workshop] and network switch).

Salvatore Danzeca (EN-SMM, SMM=Survey, Mechatronics and Measurements) has been contacted about a possible revival of the 2015 BatMon campaign. In 2015, during a period of 6 weeks thermal and high-energy neutrons were measured at dedicated locations in and around the experimental area.

DCS: recent and pending integrations and plans 2021+ (Christophe Pires): The DCS main PC was exchanged. There is no change for users since the new PC has the same name as the old one. 4 GB of RAM were moved from the old pccompass07 to pccompass04. The old PC now serves as spare. The HDD for manual backups was moved to pccompass04.

The integration of CEDAR HV and VME crate is ongoing; the DIP monitoring has been successfully restarted. The monitoring of the target has improved (temperature, cold box, He4 pump system, trim coils current, alarms and notifications). The integrated radiation dose from the environmental monitor has been included into DCS. There is a new "spill and integration" tool to count spills, integrate T6 and ion chamber 2, to calculate mean values, dead times. The monitoring of the proton-radius setup has been included.

With regards to the future 2021, the support for WINCC OA 3.15 will stop at the end of LS2. The then recommended and supported version will be **WINCC OA 3.16**.

The client-server architecture "OPC-DA" is being phased out. A set of hardware used at COMPASS will not be suitable any longer after the **migration to OPC-UA** (unified architecture), see Christophe's talk for explicit listing of CAEN, ISEG, and Wiener modules. These CAEN modules have actually not been supported since 2008 and the ISEG modules are 20 years old, which will make them clearly outdated by 2021. COMPASS and its successor will have to move to OPC-UA.

Further old and unsupported, not any longer produced equipment are the **Embedded Local Monitor Board (ELMB)**, a general-purpose plug-on I/O module, and **SLIC**, which is used to monitor certain CAEN equipment. COMPASS has been using SLIC already 10 years w/o support at this point. In the modern world, OPC servers control CAEN equipment.

It is essential to create **future task forces** that plan and carry out in a common effort new projects beyond the responsibility of individual institutions. This will help to prepare both the COMPASS run in 2021 but also the runs of Collaboration X in 2022++. Two task forces are currently on the table, in different states of readiness:

- "DAQFEET": under the lead of Igor Konorov, initiated during the Prague workshop in November 2017, recommended by the COMPASS Collaboration Board.
- NEW: "DCS & Power Supplies": on June 5, 2018, *the TB expresses the necessity of founding such project with focus on a uniform device (LHC!) protocol,* and *the TB encourages Christophe to investigate the possibility together with CERN support.*

COMPASS changeover to 2021 (Caroline Riedl): The transversity run with transversely polarized deuterium target in 2021 has been approved by the SPSC in early June. Our plan is to start with the change over of the target area from Drell-Yan to SIDIS asap after end of the beam (Nov. 11, 2018), allowing for empty-target calibration and tests of the polarized target ($\sim$ 2 weeks), finishing by $\sim$ June 2019 and doing as much as possible by end of January 2019. We will re-install the 2010 setup: go to muon beam, no absorber, move target 2.3 m more downstream. Support from the following CERN groups is required:

- EN-HE removal of absorber, displacement of target platform, removal of big chambers to be repaired
- EN-EL disconnection and connection of PT magnet power lines
- EN-CV cooling water
- TE-CRG removal of pump lines and re-installation of old or modified pump lines. Disconnection and reconnection of LHe line.

- EP-DT for the commissioning of the polarized target; in particular the target magnet.

These needs of COMPASS during and right after LS2 have been communicated at the EATM in spring 2018. There is the request to detail this request explicitly with EN-CV. Caroline will follow up on this. In a meeting with Oliver Pirotte, Johan Bremer (both TE-CRG), Gerd Mallot, Vladimir Anosov, and Caroline Riedl on May 30, 2018, the changeover planning related to cryo was discussed. The necessity of refurbishing the almost 40 year old cryogenic pumps (helium 3 and 4 mixture pumps, for which COMPASS is responsible) has to be investigated. The most recent such refurbishment had taken place in the year 2000.

A similar planning meeting had taken place with EN-HE (heavy handling) shortly before (Vladimir Anosov and Gerd Mallot).

The consolidation of the two overhead cranes in EHN2 during LS2 was agreed upon with Roberto Rinaldesi (if works starts not before July 1, 2019). The refurbishment of the 40-ton crane (PR-539) will take about 6-8 weeks and the replacement of the 5-ton crane (PR-545) 1.5 weeks.

The next TB meeting is scheduled for September 3, 2018.