**Key point of the SYRTE meeting on march 18th 2021**

During the meeting some interesting points arose:

In the final configuration the GNSS system needs to receive the signals from the atomic clock (10 MHz and PPS) since they are more stable than the one generated internally. This configuration guarantees a greater stability of the satellites reception (verify). To generate the 125MHz for the front-end the 10MHz and the PPS from the atomic clock are used since, in the short term, they are much more stable and precise than the signals coming from the GNSS receiver.

The basic idea for the events time tagging is the following. When the system starts, the atomic clock and the GNSS receiver are turned on. When both are stable, the phase difference between the PPS generated by both instruments is measured (how?). Then a UTC time is associated to the specific atomic clock PPS using the information coming from the GNSS receiver and considering the phase difference just measured. At this point the time base is built using only the signals from the atomic clock as described before and the GNSS info are collected only through the data produced by the receiver. Regularly the phase difference between the PPSs is re-evaluated and the UTC time tagging is corrected again if needed. The frequency of this correction depends on the atomic clock stability and the amount of drift accumulated. The time tag associated to each event can be further refined once the GNSS data collected by the local receiver is readjusted offline using the UTC(k) information. This correction could be done once every day or week. The basic idea is as if we had a watch that we used all day to keep track of our activities and periodically check it against a more precise clock.

It’s important to notice that, for the events reconstruction, our system is only sensible to jitter since we care only about the difference in time while the light illuminats the PMTs and this time window is very short. Moreover, since the entire electronics is clocked from the same source it will be subjected to the same drift. The UTC information is only needed for the event date.

A point has been made about the stability monitoring of the atomic clock. Using only one instrument we wouldn’t be able to detect glitches on the clock generation if they happen. To detect them at least another source and a comparator are needed. This setup will tell only that a problem occurred but not which one failed. Using three sources and two comparators we could know (with a certain confidence level) which one failed. Obviously, the more sources we use the more expensive the system is and a tradeoff has to be found. One possible solution could be using two or three atomic clocks of the same kind but this choice will force us to use only rubidium clocks since the same system with passive hydrogen masers will be too expensive. This solution is not necessarily bad because the rubidium clocks are less precise (2ps jitter at 1 second) but still inside our specs. A more creative solution could be a hybrid system composed from a passive hydrogen maser, used as a time base, monitored by a rubidium clock. A system like that would allow us to detect glitches at the resolution of the rubidium but still keeping the short-term excellent characteristics of the passive hydrogen maser (we should evaluate if such a system makes sense). A third option could be monitoring the atomic clock with the GNSS system. Also in this case only glitches greater than the GNSS precision will be detected (is this the SK solution?).

Another point to evaluate is the sensitivity of the atomic clock to the environmental characteristics of the experimental hall. Today there is not a lot of information available but we expect to have a possible cold but stable temperature with relative high humidity. From the passive hydrogen maser datasheet (https://www.vremya-ch.com/english/product/indexbf96.html?Razdel=13&Id=42) can be read that it works between at his best between 10 and 35 deg C and its sensitivity is < +- 1x10-14 1/deg C so it shouldn’t be a problem for us if we find a room in that temperature range. The datasheet doesn’t mention any dependency from the humidity. Another aspect to evaluate are the vibrations since HK will be hosted in an active mine.