Quality Yield Cockpit
A system that ensure expected quality by maximising yield

Figure 1: Cocoa Processing Landscape
Starting from bean cleaning (left) to the finished products (right).
The classical way of nib roasting including the optional alkalization is marked in orange.
The bean roasting line including the bacterization process is marked in grey.
Both roasting lines require a separation of the cocoa from shell using a winnower device (arrow).
The winnowing process step is a key regarding of quality monitoring (e.g. shell content in nib < 1,75%) and cocoa yield (e.g. < 0,5% nibs in shells) within a cocoa processing plant.
So, fare of the de-shelling system is analog and controlled by one sampling person every 7 hours. Within these 7 hours, product quality as well the environmental parameters might vary and causing undetected changes within the winnowing system which have an important impact on quality and yield.
Therefore, a new system called "Quality Yield Cockpit" (QYC) was invented.
The QYC allows to detect the changes and act accordingly online.
In this way, the desired quality can be managed and the yield optimized.
Processing data has shown that an additional gain of up to 20-30 € per processed tone of cocoa can be archived by correct adjustment and monitoring of the winnowing device.

Figure 2: Digital Transformation into Artificial Intelligence
Digital transformation from process systems via essential interim steps from analogy connectivity to an artificial intelligence solution.
Figure on the left shows a Winnower that is required for separating the cocoa kernel from the cocoa shell. The picture section show the sieving "Tray 2" and "Tray 3" including a camera system.
The camera including the new developed software enables to detect the shell content in nibs during the whole separation process.
The system is called Quality Yield Cockpit (QYC) since it allows to react on time to meet required quality by maximizing the yield.

Figure 3: Performance evaluation of analog hand sampling versus Quality Yield Cockpit (QYC)
QYC 2 and QYC 3 reflects the tray 2 and tray 3 that separates the shells from the nibs. Remaining shells are online monitored and quantified for both trays. In parallel, analog hand sampling (hand 2, hand 3) was performed and via hand separation gravimetrically analysed.
In both cases 3 x samples were taken and gravimetrically analysed. The hand sampling show a standard deviation of 0,1. In total 3 x samples at 3 different month (April, June, July) was taken from tray 2 and tray 3, gravimetrically analysed and compared with the results from the Quality Yield Cockpit (QYC).
The QYC-System value in tray 2 and tray 3 are within the hand sampling standard deviation and does not show a significant difference to the traditional shell counting.
Therefore the conclusion can be made, that the Quality Yield Cockpit can be seen as minimum as good as the analog hand sampling.

Figure 4: Winnower Performance Monitoring using Quality Yield Cockpit (QYC)
Winnower performance of the month April 21, June 21 and July 21 without winnower adjustment is shown in figure 4.
The month April 21 contains the highest shell content at tray 2 (QYC 2) compared to June 21 and July 21. Whereas the month June 21 and July 21 show equal shell content at tray 2.
The fluctuation on tray 3 is less dominant than ins tray 2 and show a lower shell content level than in tray 2. Furthermore, the highest shell content with 0,7% is seen on tray 2 whereas April 21 with 0,4% and June 21 with 0,3% is the lowest on tray 3.
All three month April 21, June 21 and July 21 passed the liquor quality checks in regards to taste, swimming particles and silicate contend.
Regarding yield management the April 21 is most interesting since the quality is within the specification by showing the highest shell content. Since 80% of the cocoa nib mass flow is passing on tray 2 and tray 3, the high shell content in April 21 should have the highest yield as seen in table 1.