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Libera Digit 500 as a precise averaged bunch-by-bunch charge readout at ESRF

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The Libera Digit 500 at the ESRF is equipped with firmware that does a real-time internal summing-up at Turn-by-Turn rate (355KHz)
on the charge of each of the individual bunches (992 for SR , 352 for SY), effectively providing averaged data in bunch-by-bunch domain. (bunch period is 2.8nsec, RF-frequency 352MHz)
This allows very precise measurements of the evolution of these bunch charges over an acquisition duration of typically 1 second.
i.e. this summing-up reduces the noise by roughly a factor 600 w.r.t. to single shot noise.
Results obtained with tests on the beam show that e.g. a tiny loss on one bunch of the order 1E-4 can be clearly detected.
This technique works both during injection and the slow decay of the stored beam.
The inconveniences of e.g. the precise & strong dependence of the phase & synchronization of the device w.r.t. the beam phase will also be mentioned, e.g. the above technique works only well for filling-patterns with a stable beam phase over time.

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