

Synchronization (timing) from ELENA to the experiments



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ADUC, 19th November 2012

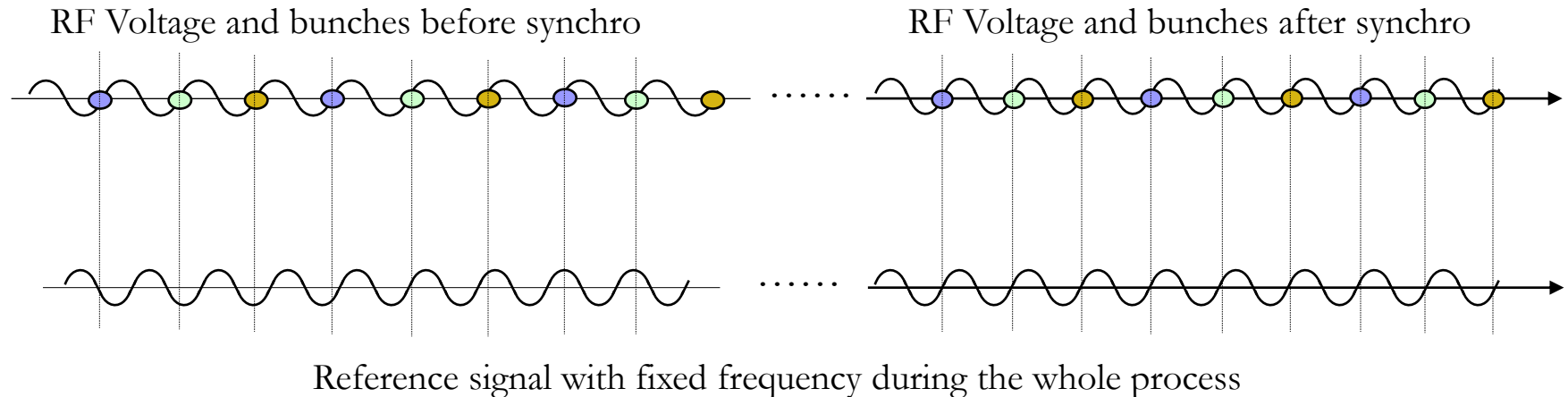
Motivation:

- Trigger discussion on needs of experiments for timings (when and precision) related to the beam
- Initial worry to shorten duration between cooling and extraction not such an issue any more (overestimation of blow-up due to IBS)

Outline:

- RF Synchronization w.r.t. external signals
- Motivations to for Synchronization of the AD RF to an external reference
- Do we (& the experiments) need synchronization to an external reference?

RF Synchronization w.r.t. external signals



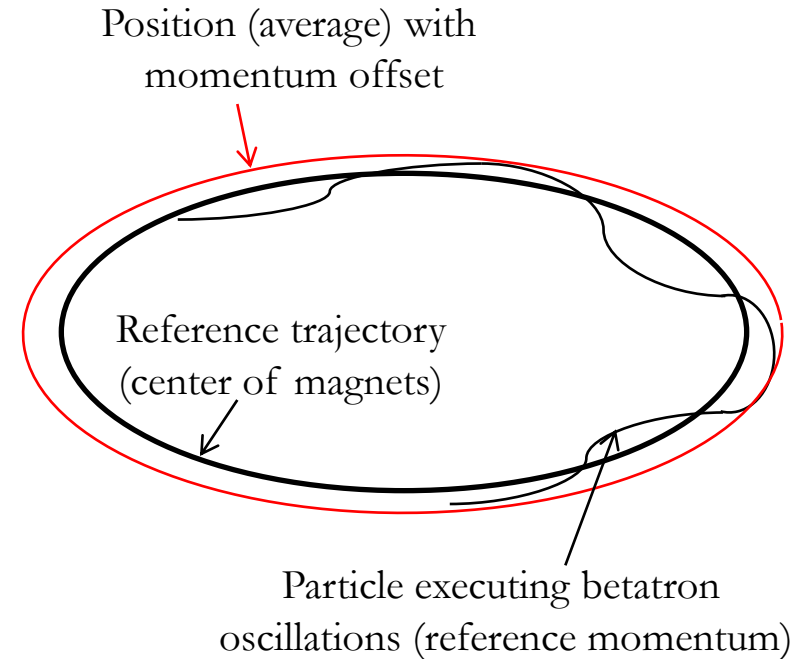
■ Synchronization process

- Before: No relation between an external reference signal and the RF and beam structure (frequency and phase offset)
- Traditionally two steps:
 - Make RF frequency equal (almost) to reference
 - Adjust phase of the RF equal to reference
- After: Phase (and in consequence frequency) fit an external reference signal
- Typical motivation
 - Make sure that bunches extracted from one machine end up at the right position w.r.t. to the RF system of the receiving machine

Motivations to for Synchronization of the AD RF to an external reference



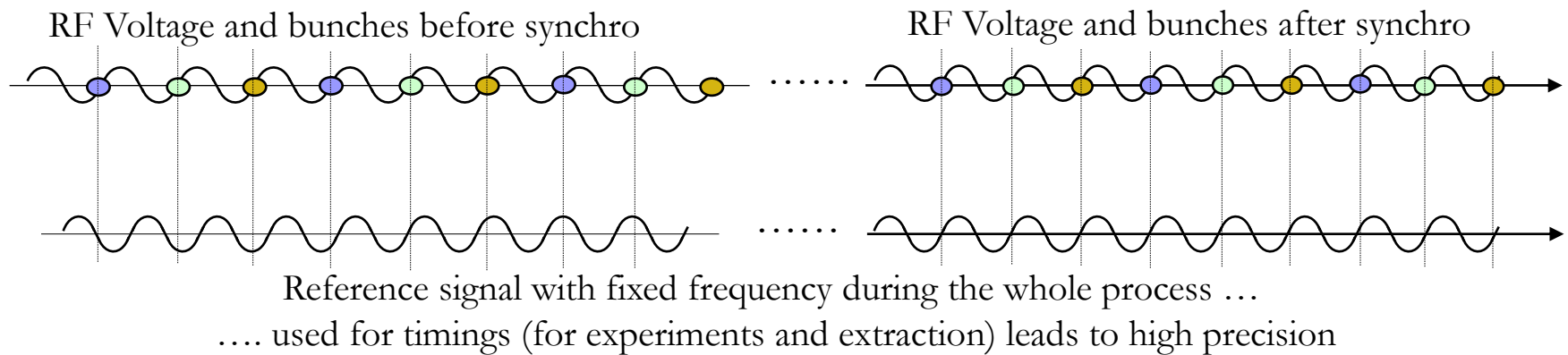
- Precise definition of the beam energy (valid for low energy, i.e. AD extraction)
 - Without synchro frequency determined by:
 - Magnetic field (measured or “synthetic” i.e. computed from programmed cycle) and
 - “Radial loop” (feedback based on position pick-up moving beam to vacuum chamber center)
 - Relative momentum variations comparable to (relative) magnetic field variations
 - With synchronization (revolution frequency always the same)
 - Small variations of circumference due to strong focusing lead to small energy variations
- Precise timings well before extraction (very small jitter between warnings and actual extraction)
 - Reference train can be generated with very good frequency stability
 - Used for the generation of the timings to the experiment and timings of the extraction elements
 - Yields low jitter for timings



Do we (& the experiments) need synchronization to an external reference?



- Precise definition of the beam energy
 - Less an argument than for AD with larger relative momentum spread and lattice
 - Fixed frequency at extraction can as well be obtained by other means with fully digital low level RF



- Precise timings well before extraction (small jitter between warnings and actual extraction)
 - ... using the external reference for the generation of timings
- What are the needs of the experiments for timings related to beam delivered?
 - Which (how much in advance w.r.t. beam) timings do you need with which precision?
... if needed, synchronization can be implemented
 - When (and how) can we get this information?