Bunch Patterns and Beam Distribution

Patterns, Kickers, Multi-Beamline Operation

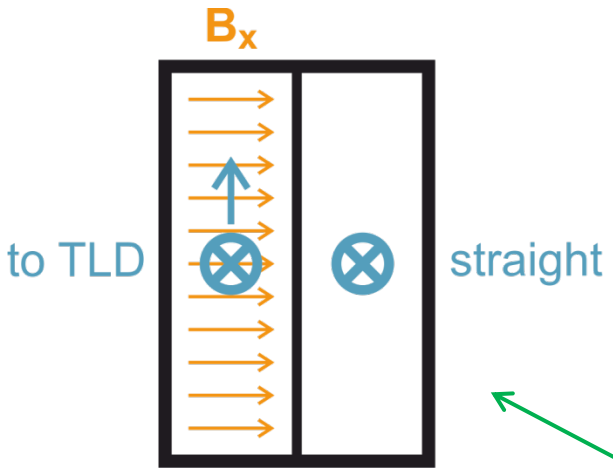
Beam Distribution Scheme

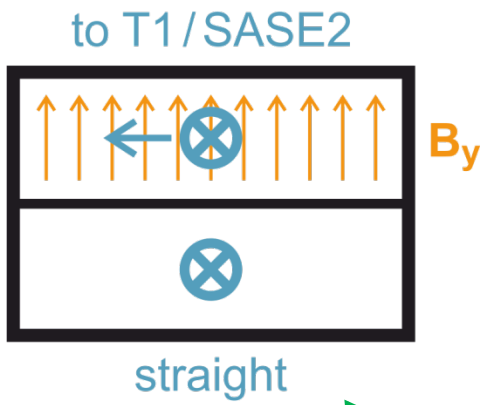
TLD Kicker

- Magnetic, pulsed
- Fast (4.5 MHz)
- Horizontal kick (left)

Lambertson Septum

- Vertical deflection (up)



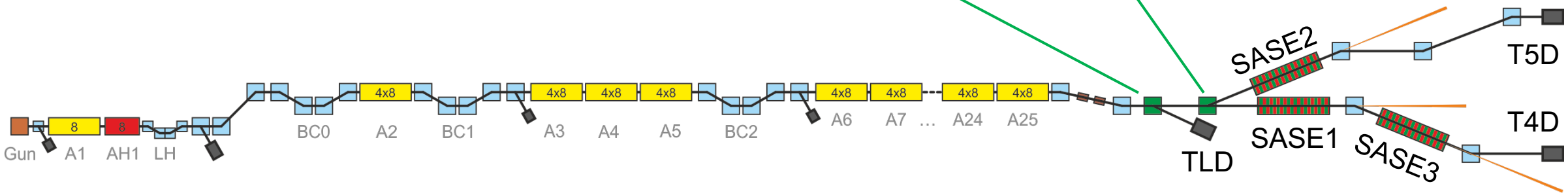


Beam Distribution Kicker

- Magnetic, pulsed
- Slow (tens of µs)
- Vertical kick (up)

Lambertson Septum

- Horizontal deflection (left)

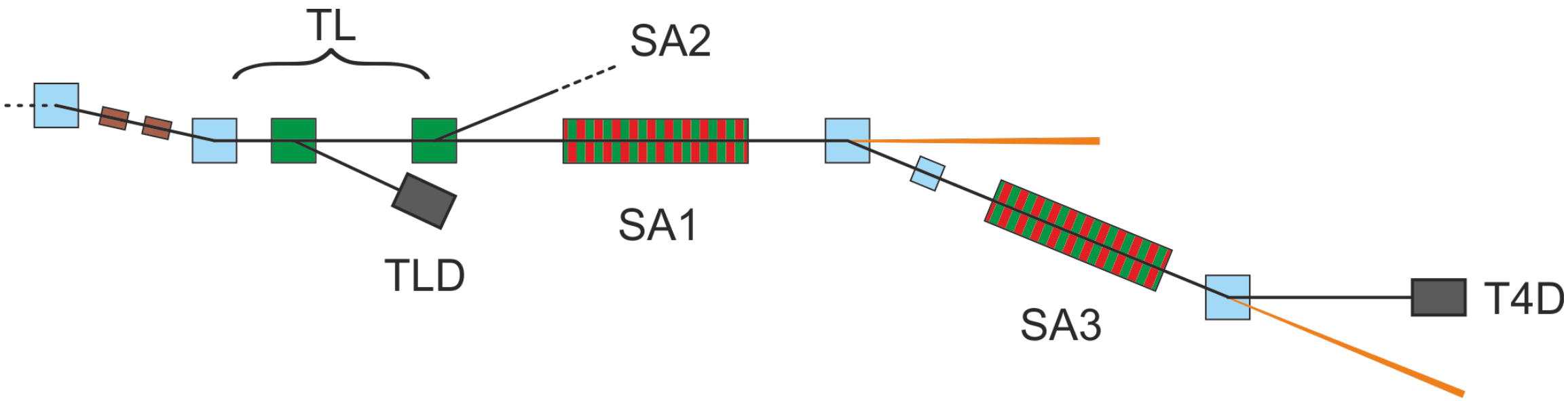


Fresh Bunch Mode: Implementation

Lasing in SA1 induces energy spread => less or no lasing in SA3

Lasing can be suppressed

- on individual bunches
- by exciting a trajectory oscillation with a fast kicker *(soft kick)*.



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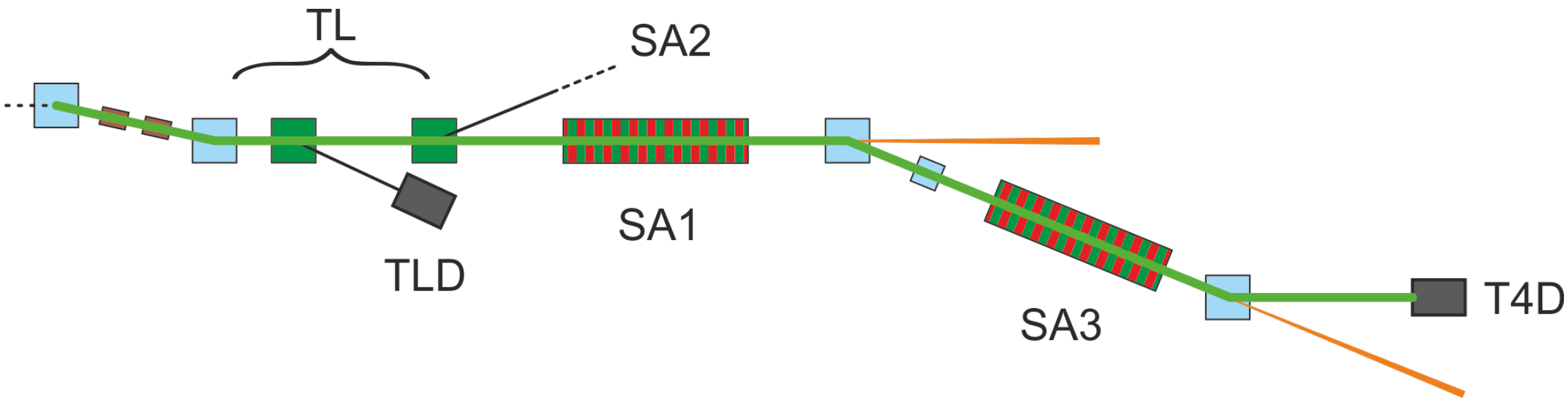

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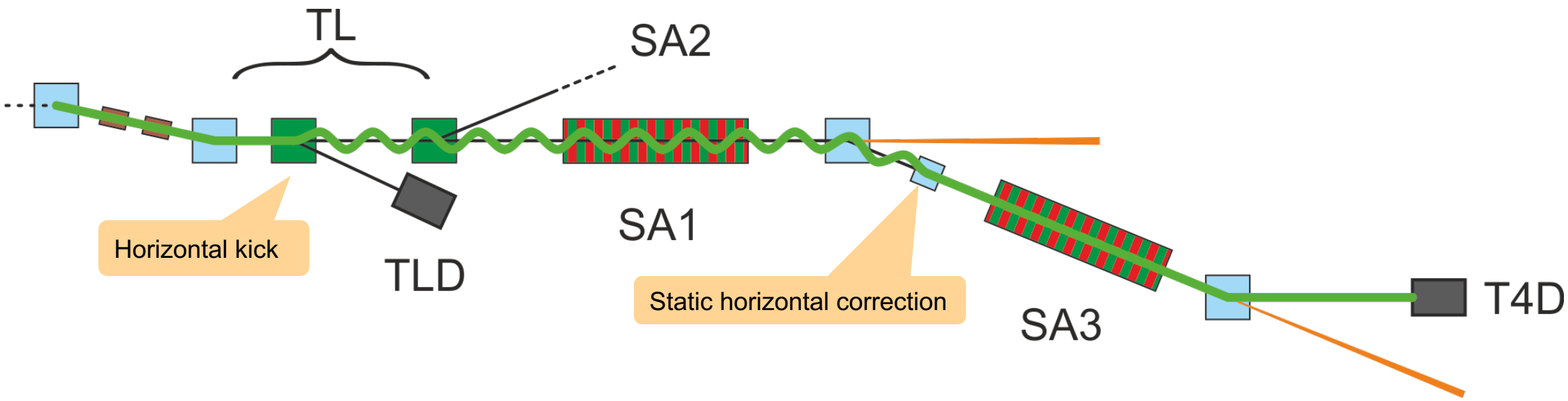

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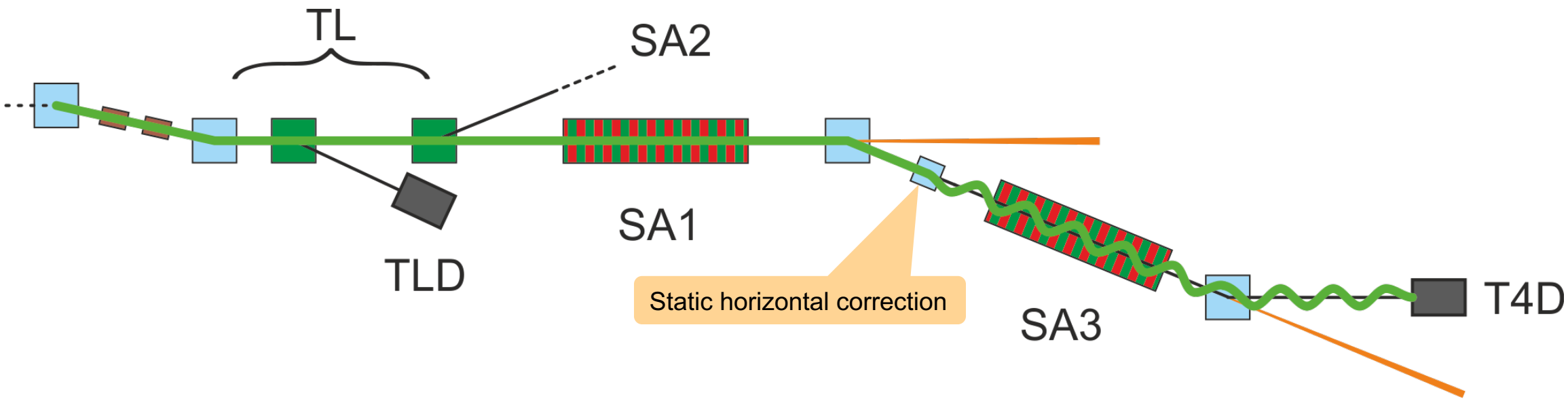
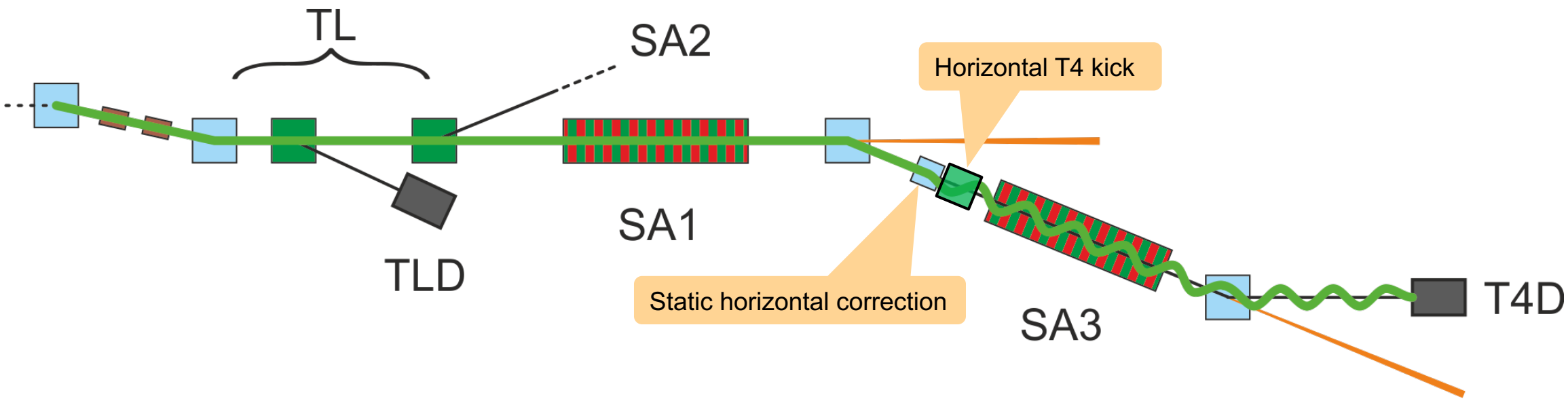


Fresh Bunch Mode: Additional Kick in T4

There is a new “TLD-type” kicker in the T4 section, in front of SA3.
It is fired for SA1 bunches to increase the oscillation amplitude in SA3.



Beam Distributon: Get Your Kicks (All Four of Them)

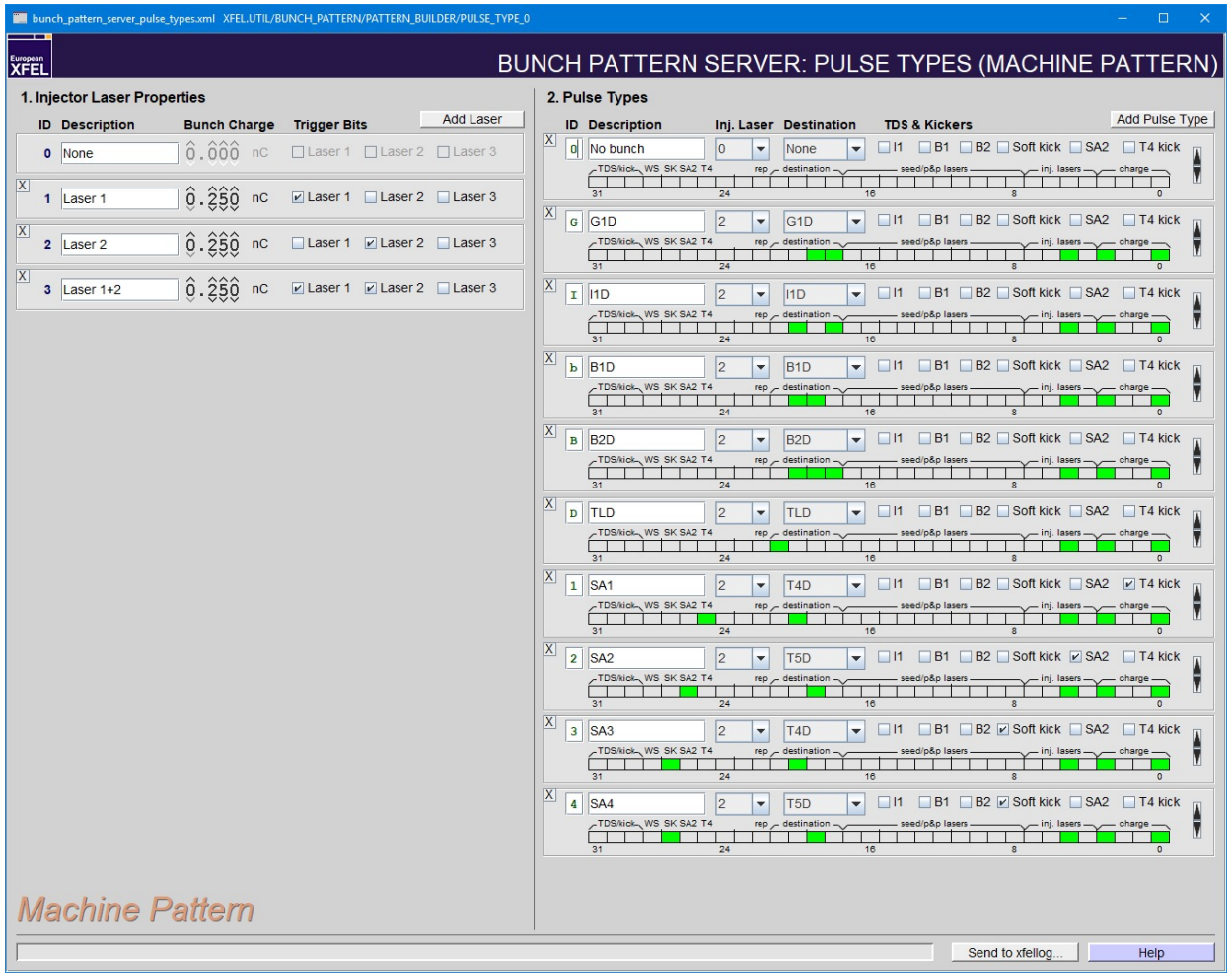
Four types of kicks can be triggered by the timing system:

- Kick to TLD (fast)
  Destination: TLD

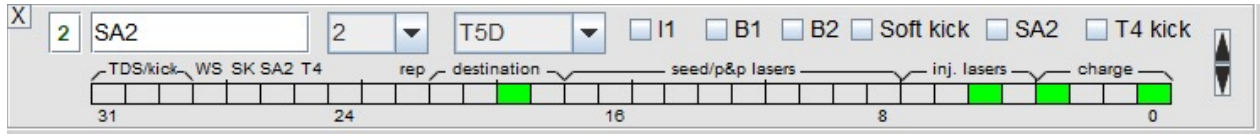
- Kick to south branch/SASE2 (slow)
  Destination: T5D or Bit: "SA2"

- Soft kick (fast, one of the TLD kickers)
  Bit: "SK" (Soft Kick)

- T4 kick in front of SASE3 (fast)
  Bit: "T4"

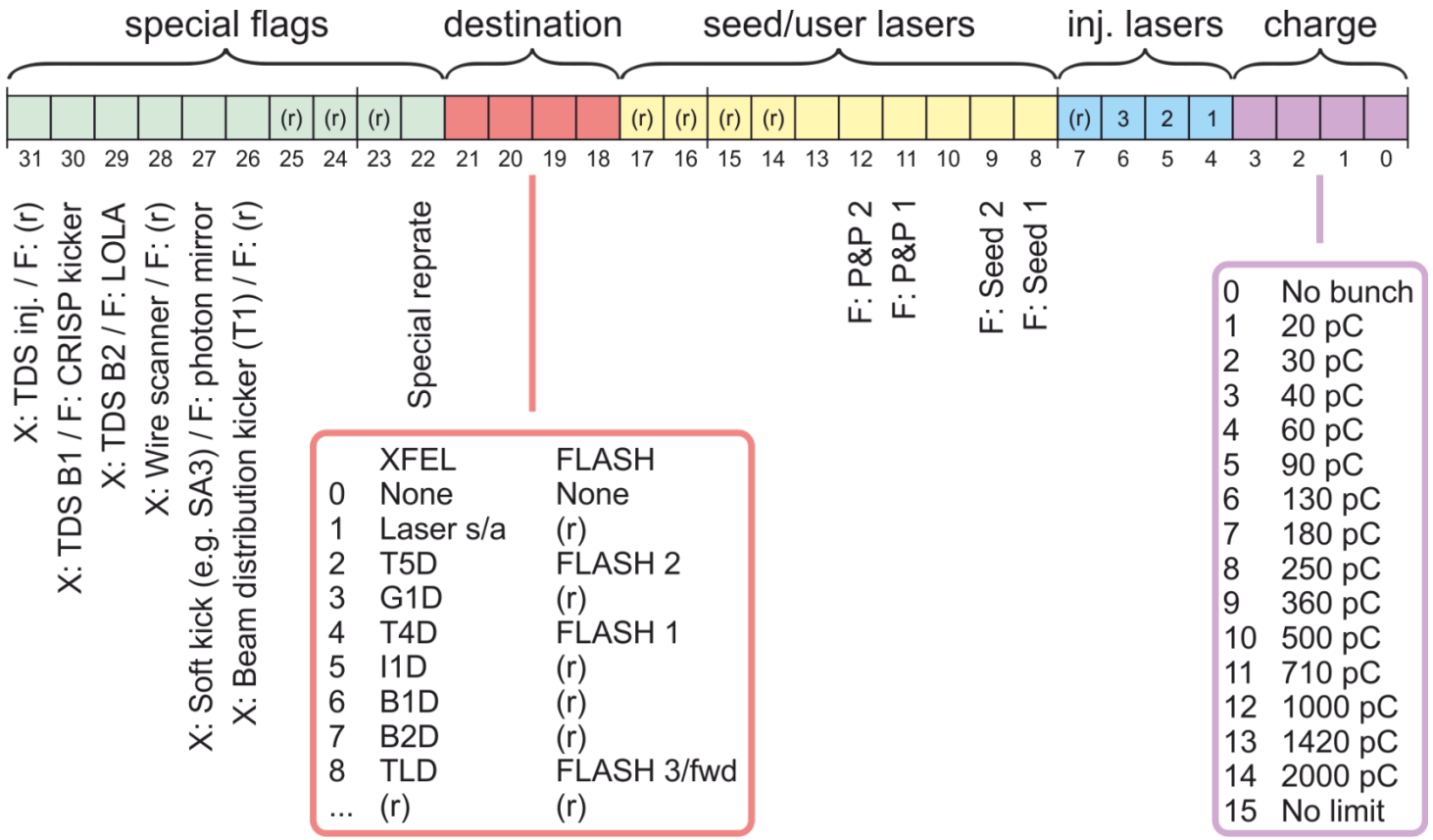


The Timing Pattern in Detail



- The timing pattern is an information block that is distributed by the timing system before each macropulse.
- Based on it, timing boards generate triggers.
- Based on it, hard- and software can classify bunches/pulses.

- Table with 7200 entries
- 9 MHz raster (111 ns step)
- Covers a time span of 800 µs (RF flat-top of FLASH)
- Each entry is described by a 32-bit number (integer/word).



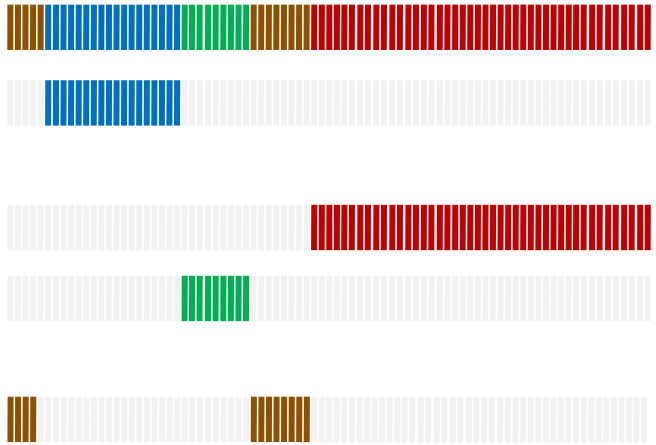
Live from the Virtual XFEL

Subtrains – Reflecting the Pattern in the Control System

A subtrain is the set of all bunches in a macropulse that share some common feature. Five of them are defined at the XFEL.

They appear mainly in property names:

X.**SA2**.TRAIN.MEAN_PKPK the mean value and peak-to-peak variation over all bunches of subtrain **SA2**



ALL contains all bunches.

SA1 contains all bunches with destination T4D that are *not* affected by a *soft kick* in TL.

SA2 contains all bunches with destination T5D.

SA3 contains all bunches with destination T4D that *are* affected by a *soft kick* in TL.

DUD contains all bunches that are not going through a SASE undulator, i.e. those with destination G1D, I1D, B1D, B2D, or TLD.