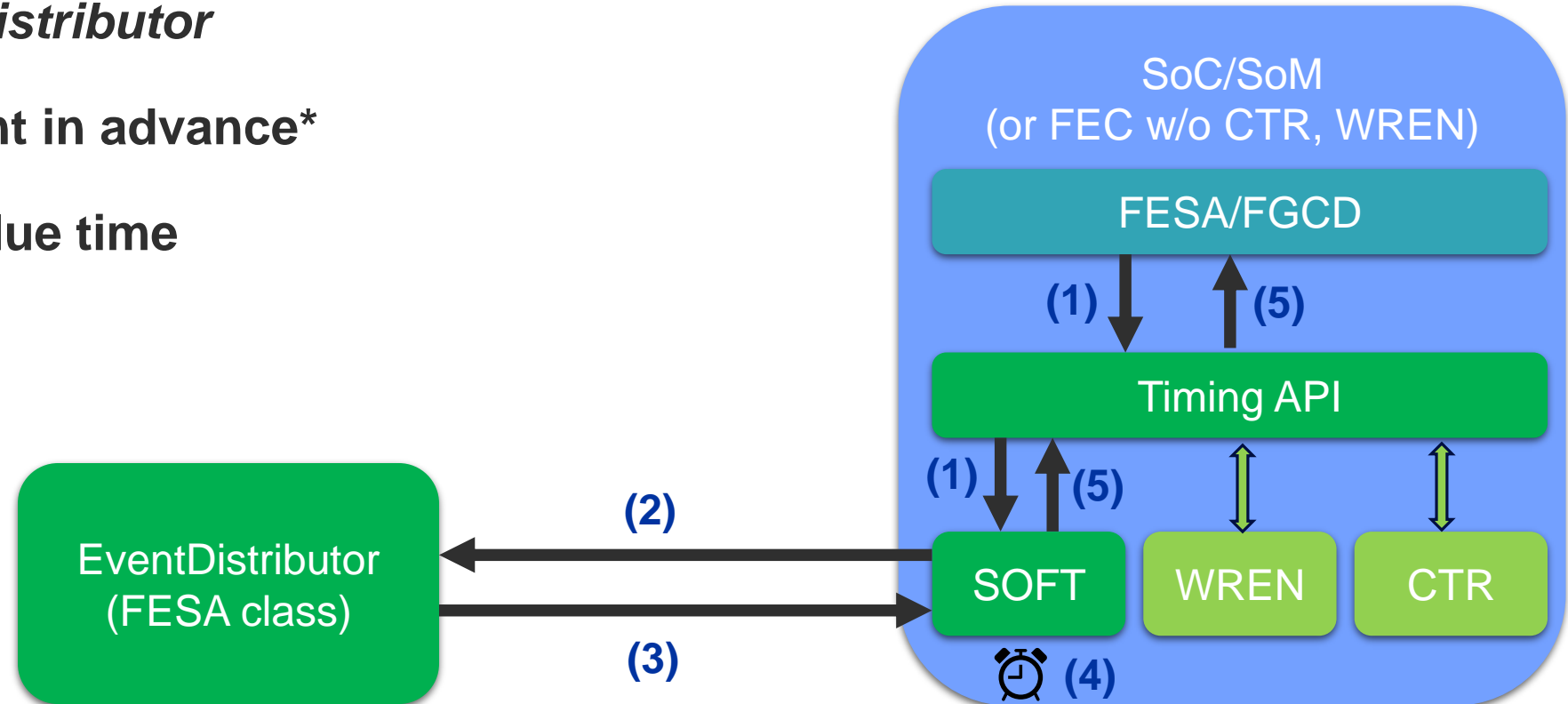# Timing on SoC/SoM, without CTR

G. Kruk on behalf of the White Rabbit Timing team

31.10.2024

Timing on SoC, without a CTR/WREN

1. **FESA subscribes to a Central Timing event**

2. **Subscribe to *EventDistributor***

3. **Notify about the event in advance***

4. **Wait until the event due time**

5. **Trigger the event**

*) Not possible for all events, see next slide

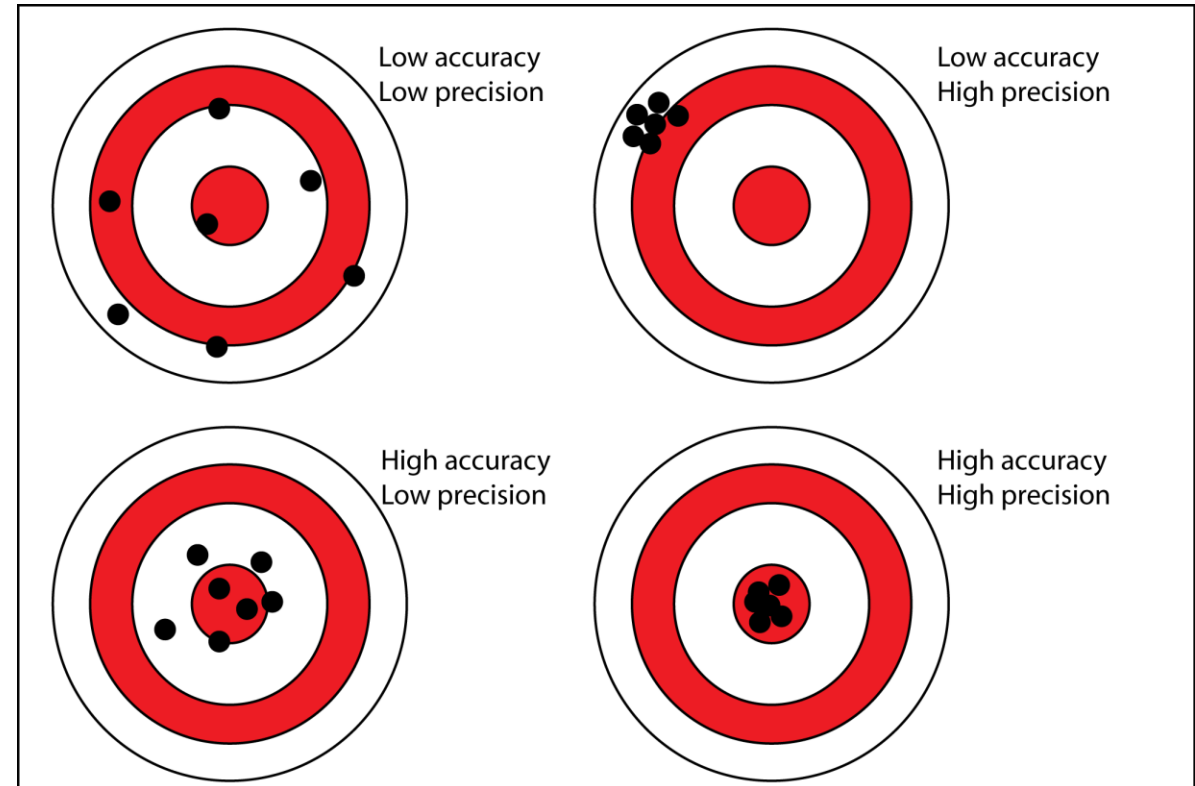# Timing on SoC: Asynchronous Events

- **Scheduled events can be sent in advance**

  - LIC (LEI, PSB, CPS, SPS) cycles are scheduled 2-3 sec in advance

    - All regular events can be sent out ~1 sec in advance

  - LHC uses event tables, mostly started by Java applications (typically sequencer)

    - Can send the events immediately but with postponed due time (to be seen if by 1 sec or less)

- **Asynchronous events can't be sent in advance**

  - Triggered by TTL pulses:

    - SPS: *SX.AWK-10HZ-CT, SX.AWK-1HZ-CT, AWAKE Ej (SEX.F-W180-CT, …), SX.BIS-OPEN-CT*

    - LHC: *HX.DUMPED1-CT, HX.DUMPED2-CT, HX.PM1-CT, HX.BINST1-CT, HX.BINST2-CT*

  - Safe Machine Parameter (SMP) messages, distributed at 10Hz

    - Beam energy, intensity, safe machine flags, beta*, …

- **Asynchronous events would still work but with the interrupt *some* milliseconds after event due time**

  - With a noticeable jitter (publication by FESA, CMW transmission over TN, reception)

Timing on SoC: LTIM?

- **LTIM == Local Timing**

  - Local triggers (pulses, interrupts) generated on the FEC by the timing receiver module

  - Typically, Central Timing event (CTIM) + delay [clock ticks]

    - But supports more advanced scenarios e.g. started or stopped by external signals (TTL)

  - Clock: 1KHz, 1MHz, 10MHz, 40MHz, 1GHz, LTIM, ext. TTL pulses (e.g. RF bunch or revolution)

  - Single triggers, trigger trains

- **Without the receiver module, a VERY simplified version (subset of functionality)**

  - Clock: 1KHz, 1MHz

  - Single interrupts, interrupt trains (N interrupts equally spaced in time)

  - CTIM + delay [ms/us]

Timing on SoC: Accuracy and Precision

- **Accuracy (as good as on the OS):**

  - **NTP: sub-millisecond**

  - **PTP: sub-microsecond**

  - **To be measured**

- **Precision:**

  - **Plan A: system call (clock_nanosleep)**

    - **Expecting between tens and hundreds of microseconds**

  - **Plan B (if need be): dedicated kernel module**

  - **To be measured**

home.cern