

# Dechirper longitudinal phase space (LPS) measurements for beginners

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Operator Training, 11.12.2024

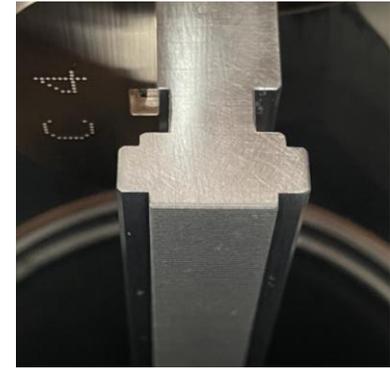
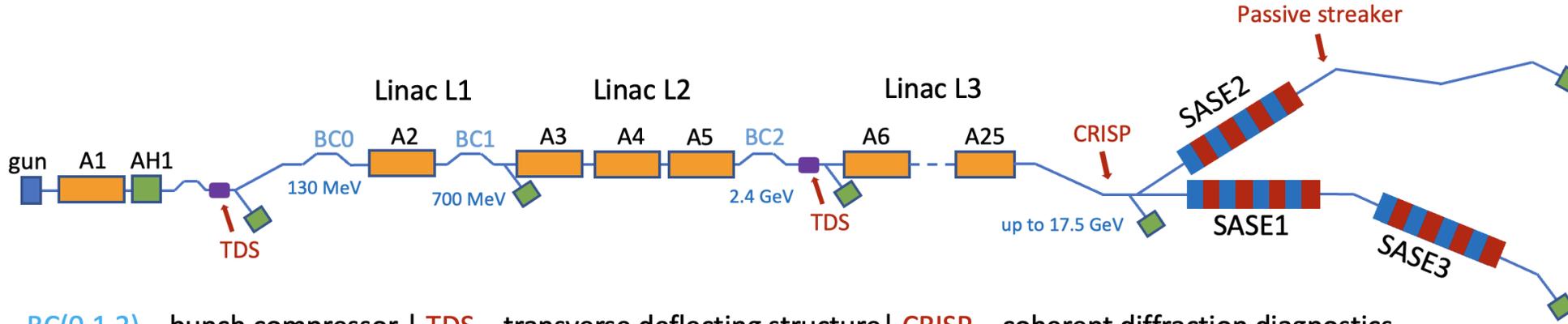


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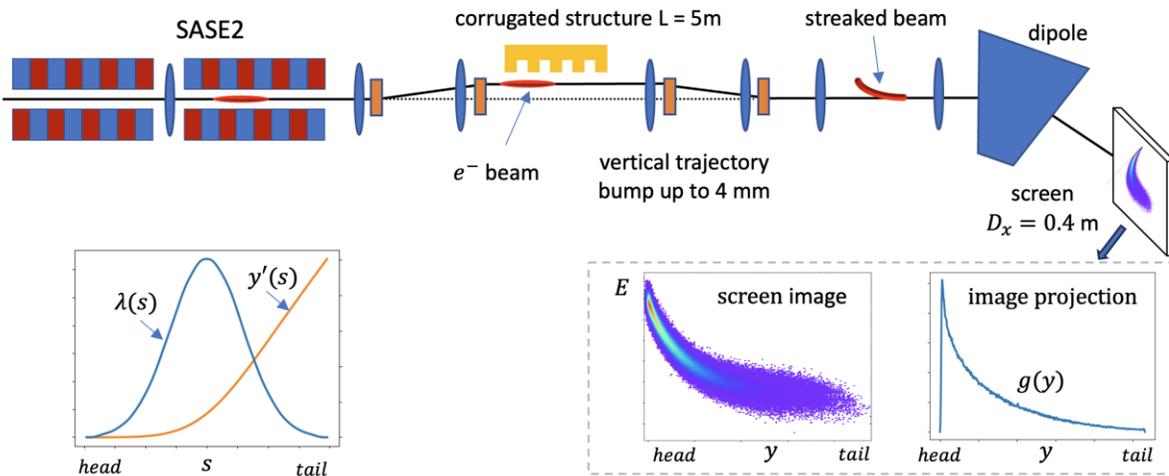
## Disclaimer

- LPS measurements with the post-SASE2 dechirper are easy to perform and relatively safe for the machine.
- **Always save the machine file before conducting measurements or making any changes to the machine. This is a good practice!**
- Minimize beam usage to reduce radiation load.
- Note: Passive streaker = dechirper = corrugated structure = wakefield structure = chirper.

# Short introduction into passive streaker LPS measurement



BC(0,1,2) – bunch compressor | TDS – transverse deflecting structure | CRISP – coherent diffraction diagnostics



# What systems/devices we change or can potentially change during usage of the dechirper tool. **Or how to restore the machine manually**

- **Correctors in the T3 section (after SA2) and the last air coils in SA2:** *These correctors are used to create a bump and adjust the beam to get a better spot on the screen.*
- **Quadrupoles in the T3 section:** *Beam optics are adjusted here.*
- **Screen OTRC.2560.T3** *Can be still in*
- **Corrector CFX.2154.T1** in front of SA2. We suppress SASE with this corrector
- **Orbit FBs SA2 and T5D** *can be switched off*
- **Number of bunches in SA2 branch.** *Likely to be set to 0.*
- **Bunch pattern** – restore 1 Hz operation
- **Only if measuring dispersion!** (not part of the standard procedure)
  - CL energy FB
  - A24 or A25 table/scalar mode and voltage

## How to start measurements

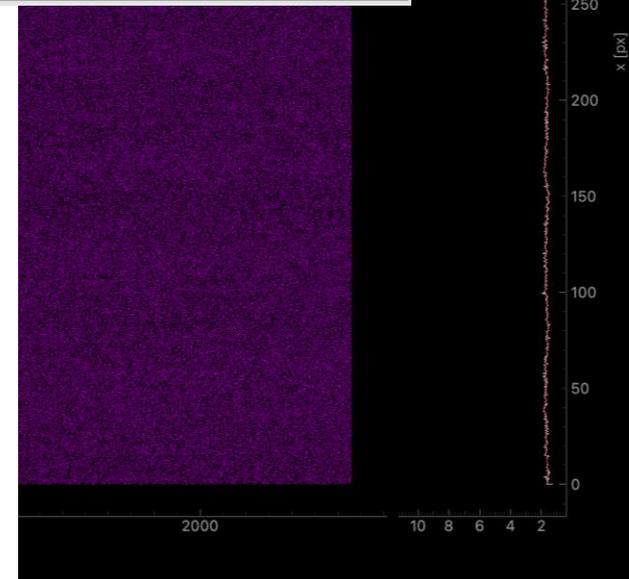
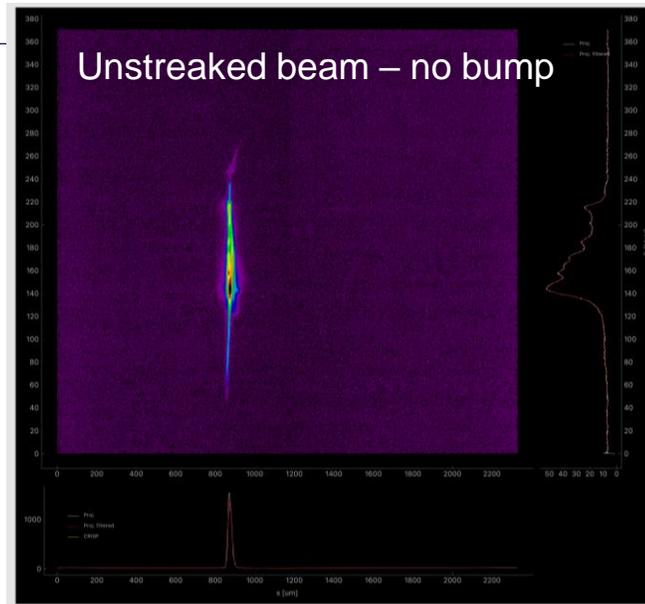
- Update CRISP
- Save machine file
- Set 1 bunch in SA2
- Open dechirper tool
- Click “Prepare measurements”
  - *The tool adjusts the orbit, inserts and powers the screen, and applies special optics.*
  - *You might need to acknowledge that the orbit is not optimal and the screen is not yet powered (this may require a bit more time).*
- Using the bunch pattern builder, set 3 Hz in the SA2 branch.
- Click “Beam ON” button. You should see unstreak beam
- Adjust bump amplitude. 2 mm is good starting point. Around 3 mm is our usual bump amplitude
- Done!

The screenshot displays the Dechirper Diagnostic Tool interface. On the left, a plot shows the beam profile with 'Proj.' (blue) and 'Proj. filtered' (red) curves. The vertical axis is labeled 'x [px]' and ranges from 0 to 450. The horizontal axis has markers at 2000, 10, 8, 6, 4, and 2. On the right, the control panel includes:

- Setup:** A 'Prepare measurement' button (1) and a list of checked options: Beam ON, Orbit Set, Beam OFF, Screen IN, Special Optics Set (Dx=30.4 cm), and Orbit FB T5D OFF. A 'Screen Trigger is ON' indicator and a 'Restore' button are also present.
- Bump Control:** Input fields for Y (3.00 mm) (2) and X (0.00 mm). A 'Set Bump' button (3) is located to the right.
- Screen Control:** CRISP status is 'OK'. Other options include 'Flip Current', 'Online Recon', and 'Auto ROI'. A 'Beam ON' button (4) is highlighted.
- Other controls:** 'Kill SASE', 'Counter' (18), 'Subtract Background', 'Take Background', 'Rep. Rate' (3.33 Hz), 'Energy Calibration' (Disp. Dx [m]: 0.30, Beam Energy [GeV]: 14.00), 'Energy Axis', and 'Display Energy Axis' (checked).
- GUI:** A 'Send to LogBook' button at the bottom.

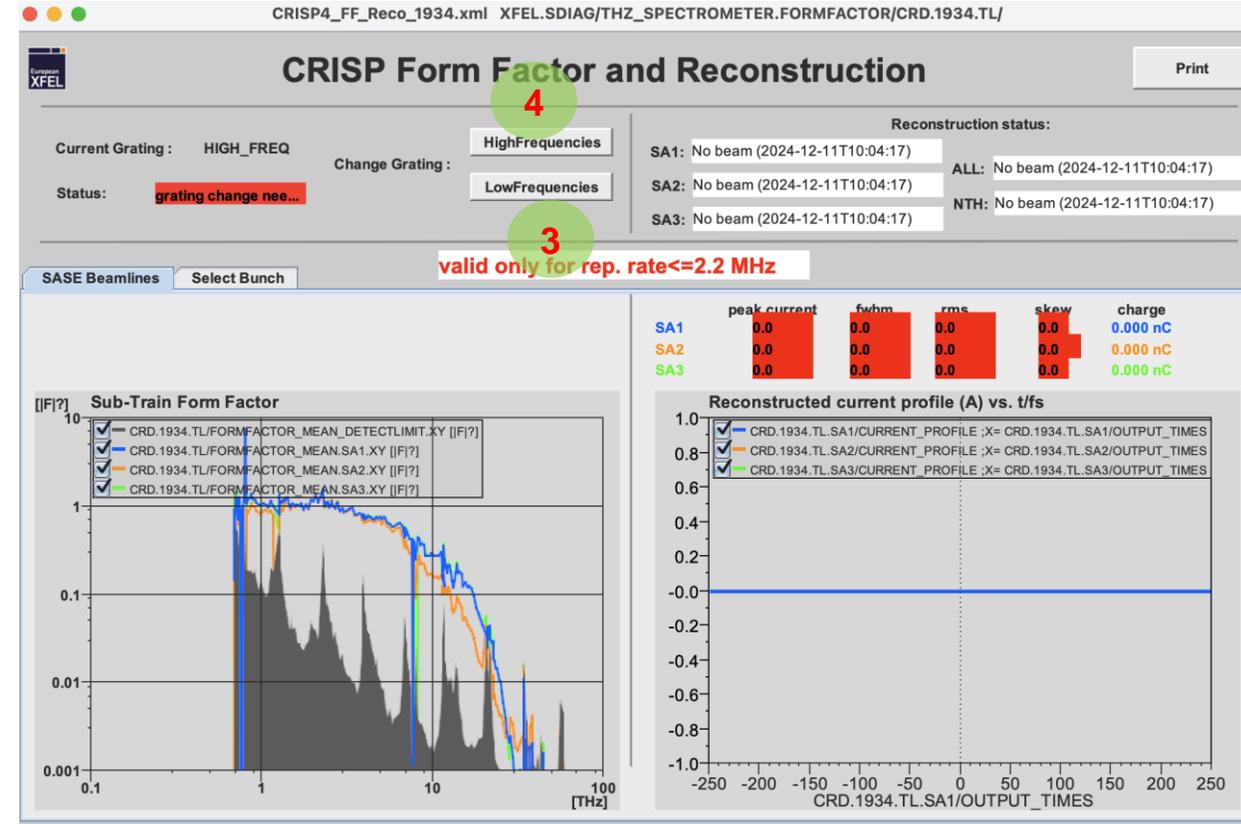
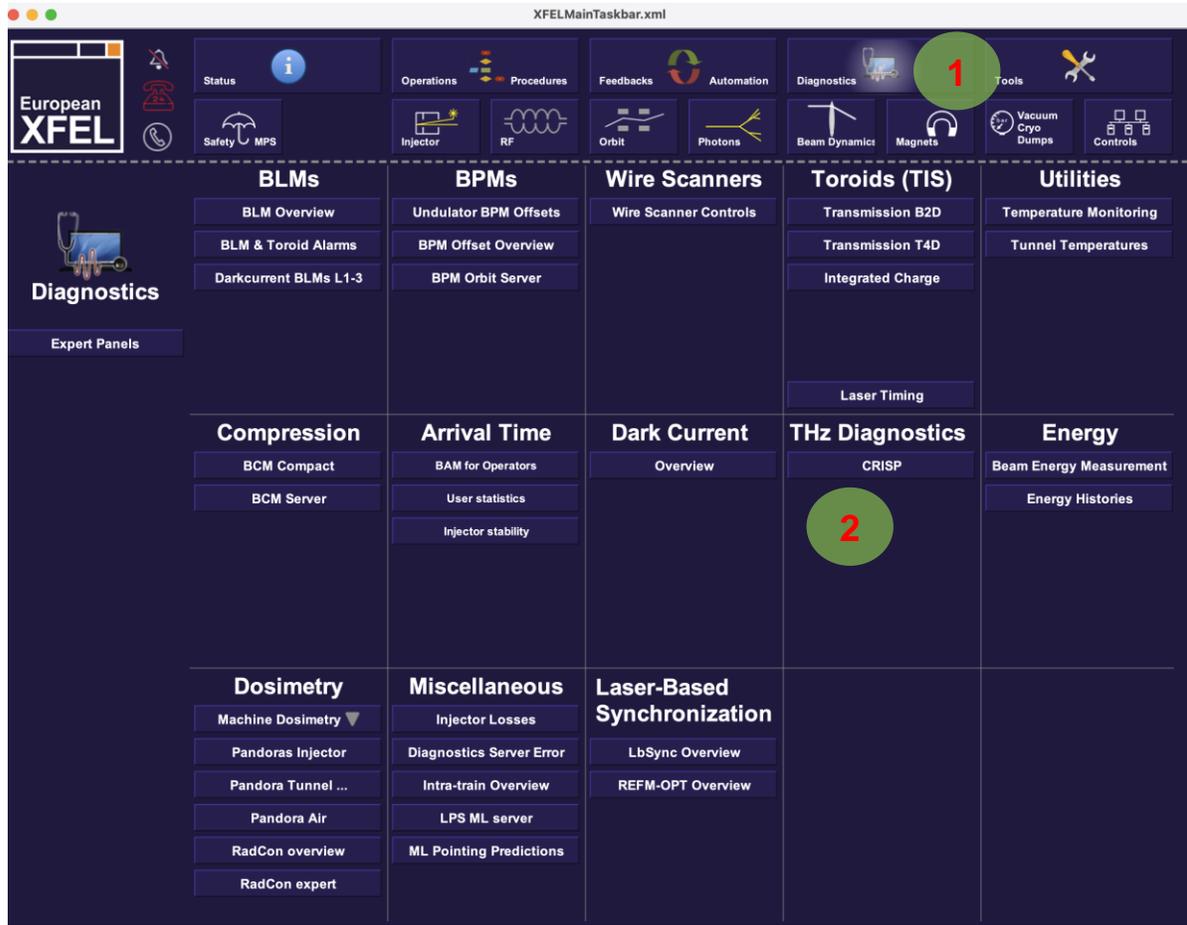
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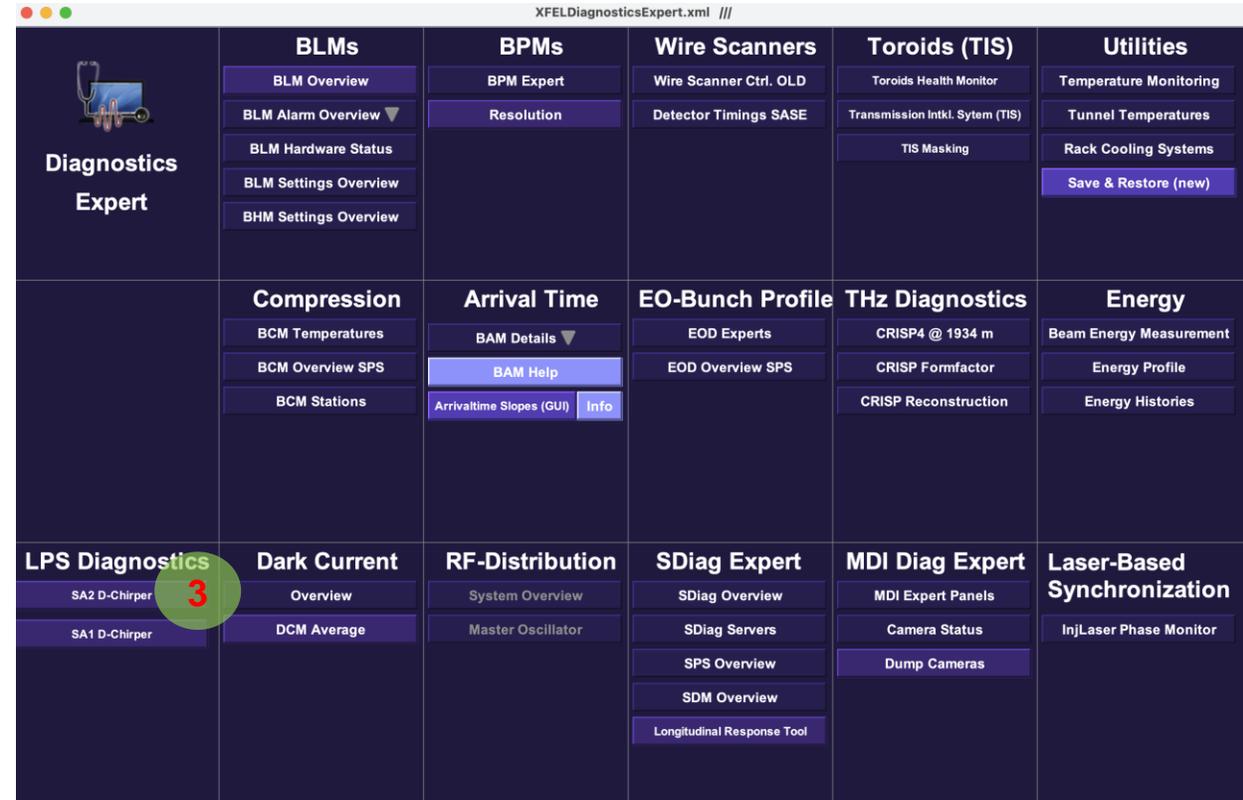
**Need more details?**

# How to update CRISP



- Press Low Frequencies and wait
- Current Grating: LOW\_FREQ
- Press High Frequencies and wait
- Current Grating: HIGH\_FREQ
- Whole procedure will take about couple of minutes

# How to open Dechirper tool







# How to make 3 Hz

- Set 1 bunch in SA2 brunch
- Open bunch pattern builder
- Add pattern
- In B Pattern set D instead of 2
- Set new Pattern Sequence [A] 2 [B]
- Apply & Switch

**BUNCH PATTERN SERVER: PATTERN BUILDER (MACHINE PATTERN)**

**1. & 2. Pulse Types**  
 0: No bunch • G: G1D • I: I1D • b: B1D • B: B2D • D: TLD • 1: SA1 • 2: SA2 • 3: SA3 •  
 4: SA4 • X: TLD w/ marker • Y: SA3 w/ bit 17

**3. Pulse Patterns**  
 [A] [B] Add Pattern Remove Pattern

Start Time	Description	Sub-Pattern	# Ticks	# Repetitions
800.0 μs	Pre-bunches	D	86	86.00
857.2 μs	SA2	D	356	356.00
1093.8 μs	Transition	D	25	25.00
1110.4 μs	SA1	13	600	300.00
1509.1 μs		D	1	1.00

**4. Bunch Counters**  
 BUNCH\_COUNTER\_1 Pulse IDs generating these bunches: 1  
 SA1 Excess bunches at the end of the train are replaced by: D

**5. Tail Clean-Up**  
 Remove the following pulse types from the end of the pattern: D  
 ...but leave this many tail pulses untouched: 0

**6. Pattern Sequence**  
 Sequence: [A] 2 [B] → [A] 2 [B]

**7. Review Pattern**  
 ... for event ID: [wavy icon]

**8. Apply, Save & Load**  
 Apply & Switch Send this pattern to the timing system and switch it to user mode.  
 Reset Retrieve the pattern that has last been sent to the timing system.  
 Save Save this pattern to the list without applying it.  
 Load Load the pattern that is selected in the list below.

**9. Timing System Configuration**  
 Change destination to TLD if MPS limits the number of bunches (otherwise, suppress remaining bunch train):  
 For destination T4D (SASE1/3)  
 For destination T5D (SASE2)  
 These switches have immediate effect on the timing system.

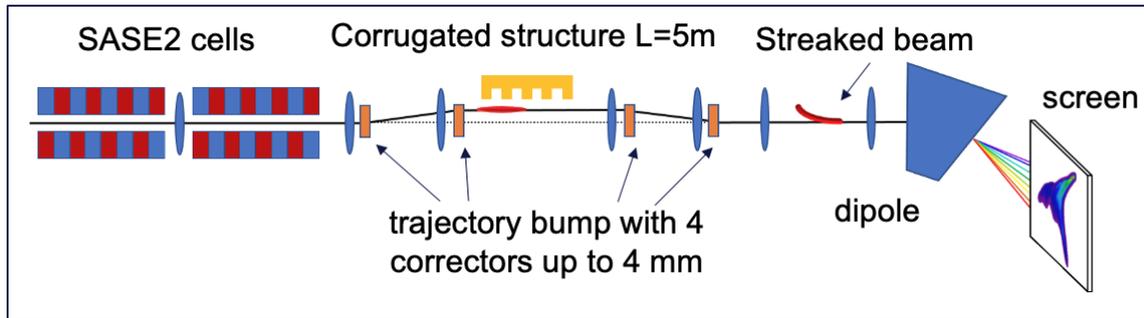
*Machine Pattern*

View Pattern... Open the Pattern Viewer in a separate window.

→ User Lasers Send to vxfellog... Help

# Passive streaker tool improvements

## Online reconstruction. Video from BKR



Video from BKR

