



BWS LHC motion control development and laboratory measurements for 2023

Beam Wire Scanner CONS team meeting #7
27.03.2023

BWS LHC motion control development and laboratory measurements for 2023

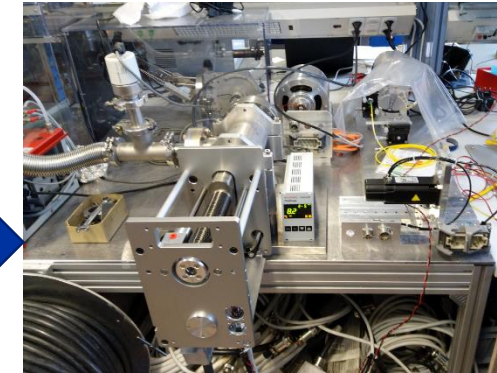
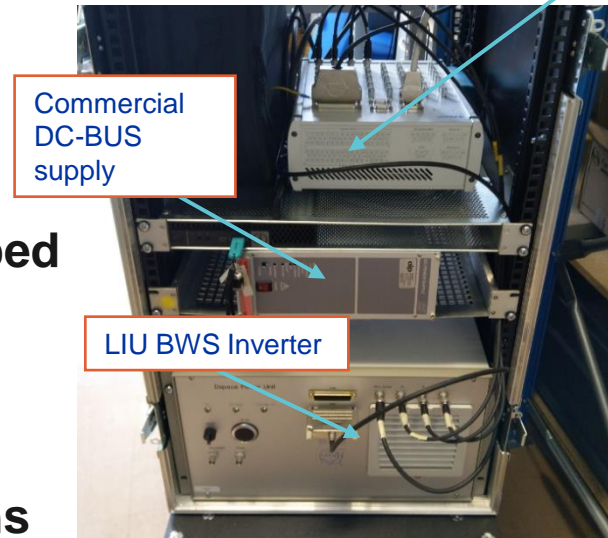
- **Mechatronic system tests in the 865 BWS lab (hybrid, BAT, Linear Motor Bench)**
- **Linear calibration bench usage plan proposal**

Mechatronic tests in the 865 BWS lab in 2023

1. Based on rapid prototyping platform “Dspace”
2. Now the platform is operational with the license upgrades (14.03)
3. BAT system reuses the software developed for the hybrid + 2 magnetic encoders (first motion on the 24.03.2023)
4. Study the BAT coupling link (permanent magnet based) to mitigate the oscillations and have an improved positioning of the in-vacuum part (V. Varadan)
5. Then modification of the controller to use three phases linear motors.
 - change controller Park transform
 - use LVDT encoder instead of resolver

1. Dspace control system (running Simulink models)

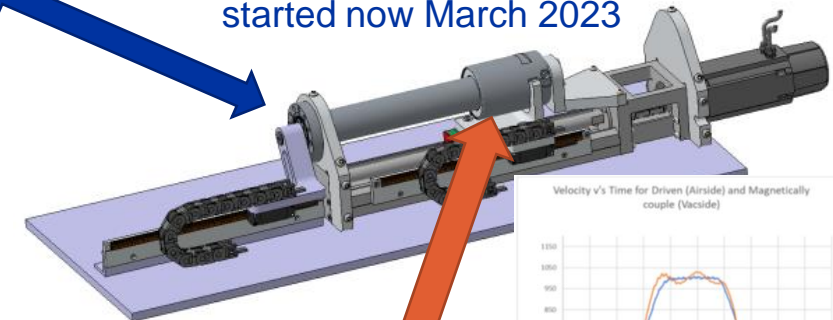
Hybrid system tests in 2020 & 2022



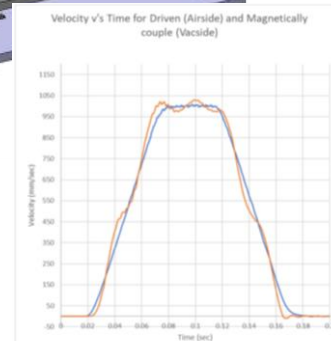
3. Tests of BAT system started now March 2023



Tests of Linear Motor bench starting September 2023 (when available)
EDMS 2868812



4.



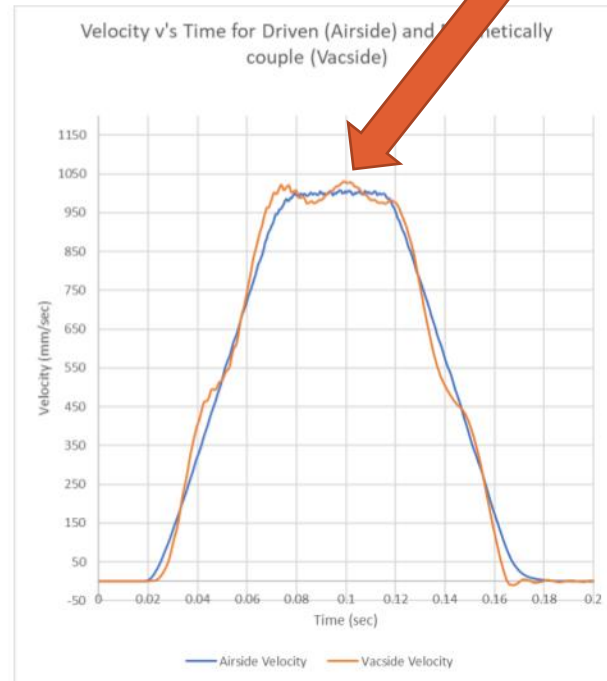
NPL measurements

Below free option from UHV design

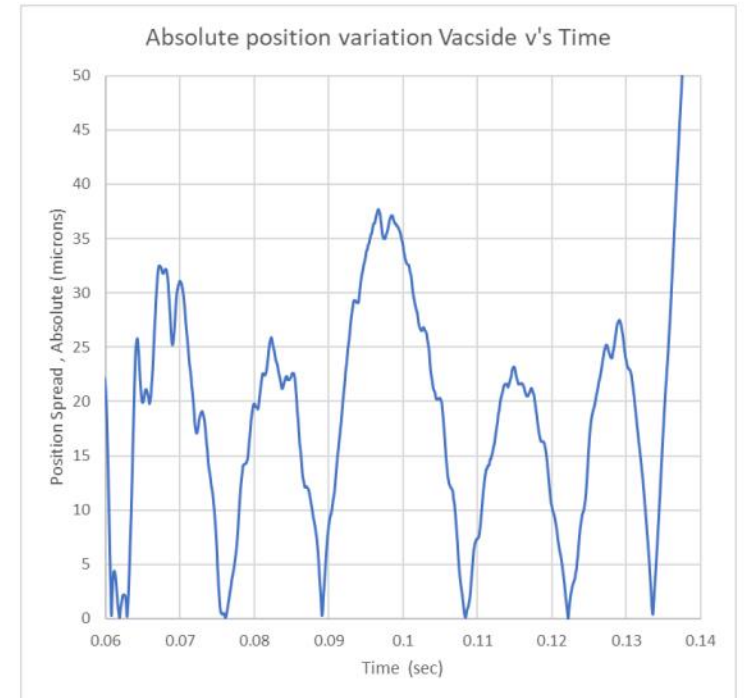


BAT Drive - Performance

- Achieve good reproducibility in lab condition (NPL)
- Study starting at CERN to reproduce these measurements and work on the trajectory to mitigate oscillations
- Effect on the carbon wire to be assessed using an external system (calibration bench)



Velocity v's time Airside and Vacsider (from encoder readings) single cycle

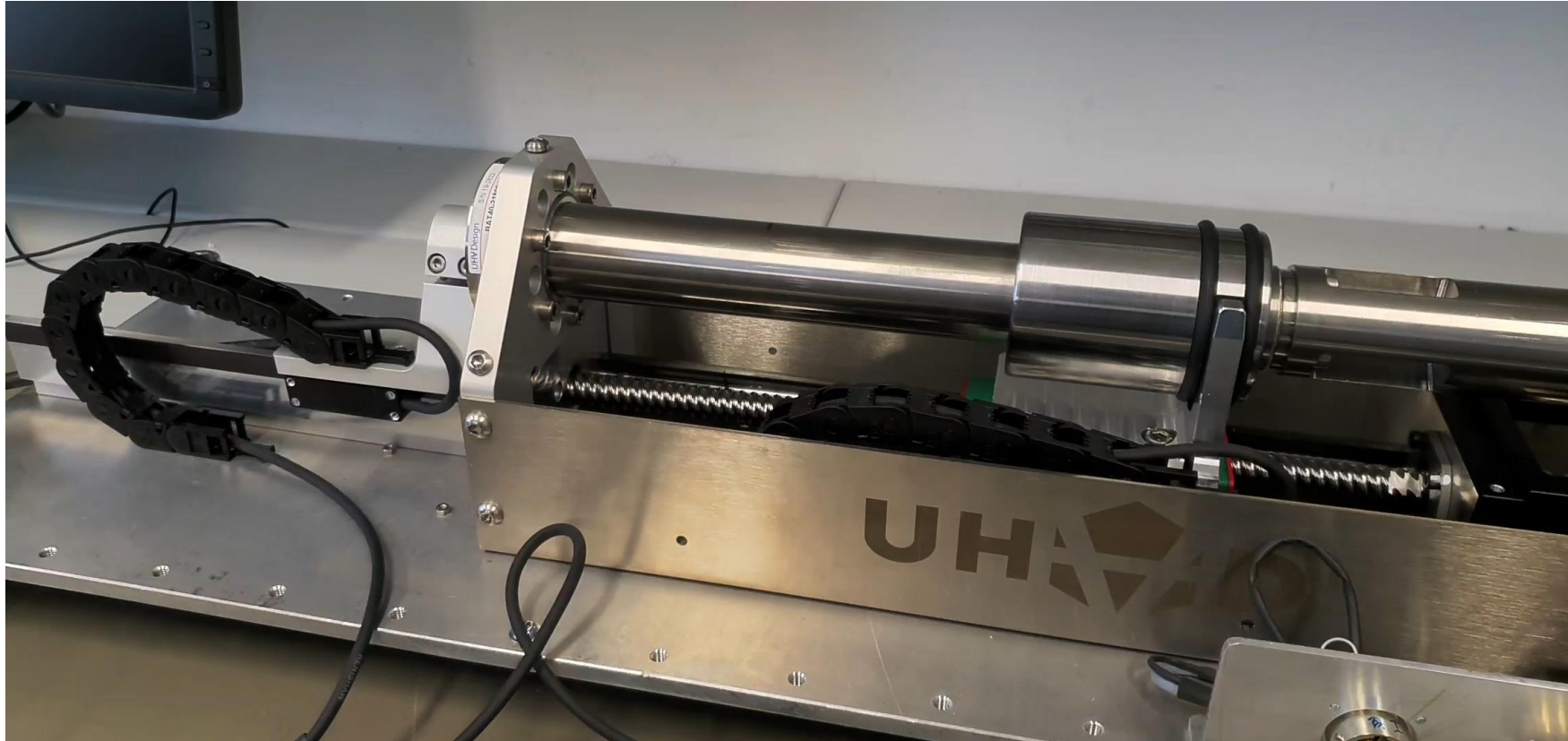


Absolute positional variation over 5 cycles during ~1m/sec phase

Courtesy of Nick Clark Chief Scientist at UHV Design Ltd



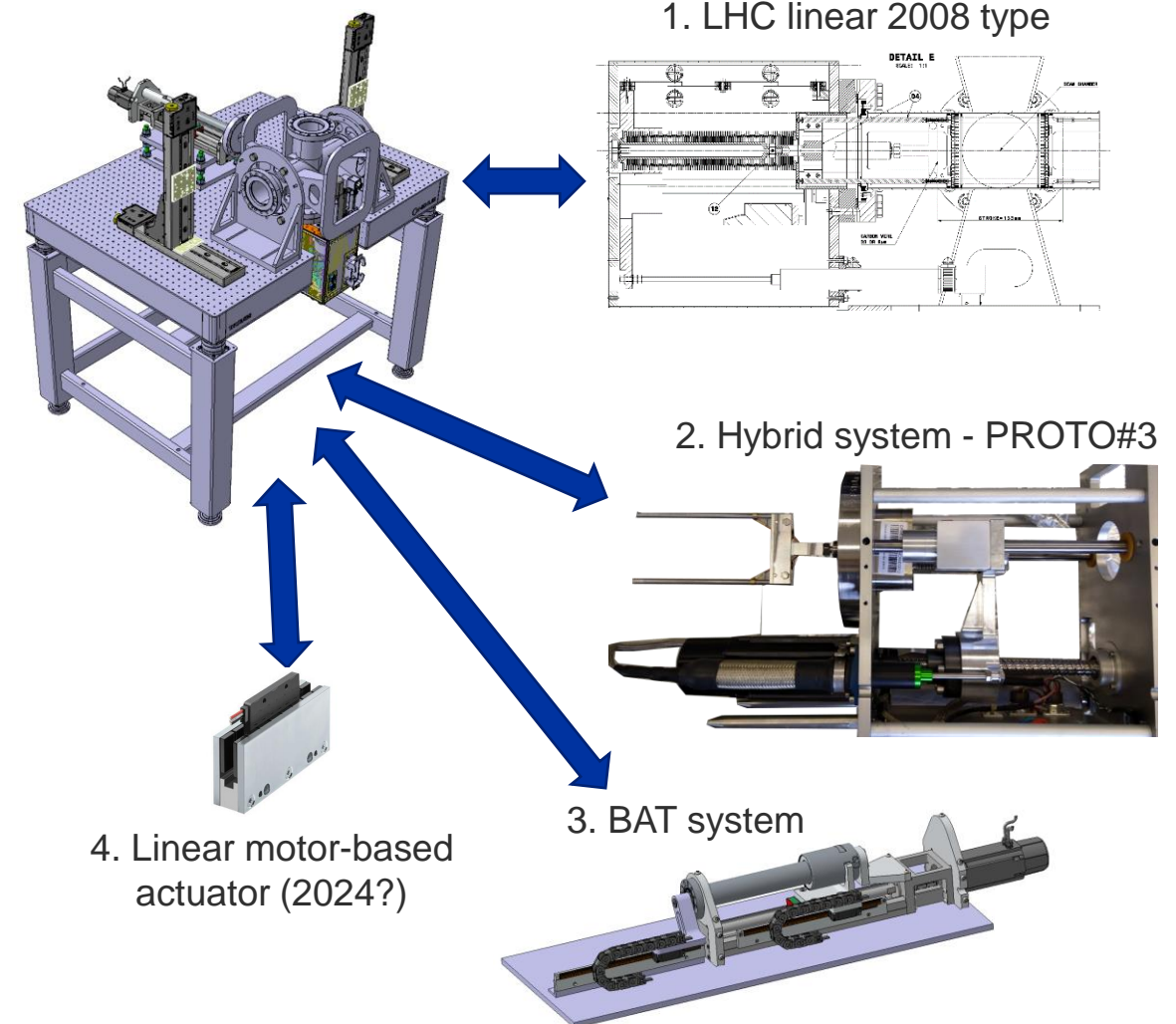
Preliminary tests at CERN 24.03.2023



Motion analysis will be presented next meeting

Linear calibration bench usage proposal for 2023

1. To start as soon as possible
 - with one operational spare (LHC 2008 type)
 - validate bench with known system
 - use the operational HW/SW (motion part)
 - observe if any issue can be identified (in support to operation)
2. Move to hybrid system
 - PROTO#3 to be fixed (to behave as the 2 in the LHC)
 - use of the LIU based electronics
 - compare results with OP system
 - change motion trajectory if required
3. BAT system
 - will require dedicated vacuum parts (forks & more)
 - use the “Dspace” controller at first
 - if good performance move to LIU based electronics
4. Linear motor-based mechanism for 2024?





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