



Beam Instrumentation for run 2b

S. Mazzoni for the BI team

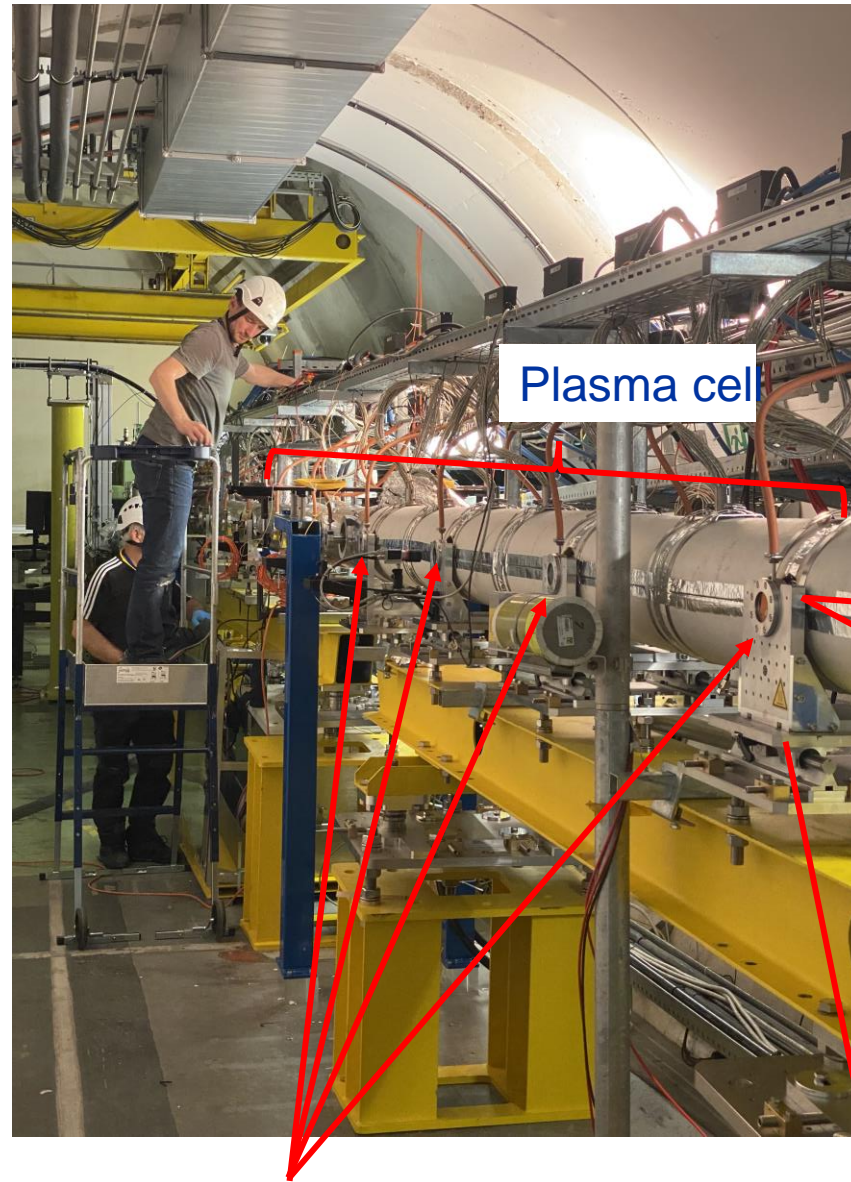
AWAKE collaboration meeting @ CERN, 4-6 October 2023

Beam instrumentation for AWAKE

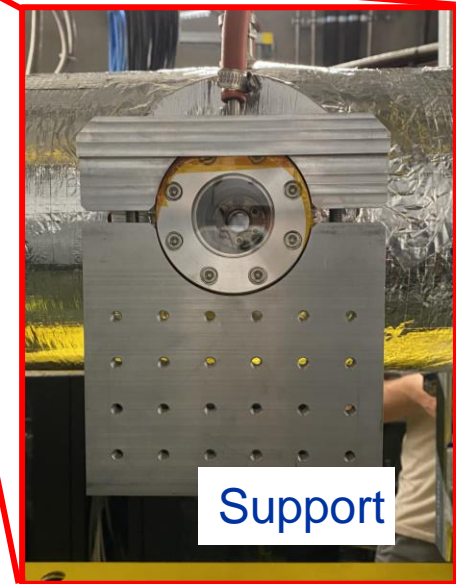
- **Presently:**
 - optimisation of digital camera readout system
 - commissioning of ChDR camera system
 - support to UCL team for spectrometer upgrade (S. Senes)
- **New team!**
 - Collette Pakuza new BI QUEST since 1st of September
 - Laurence Stent new QUEST for BPMs since 1st October
- **For run 2c:**
 - allocating resources for new / refurbished BI systems (BTV, BPMs)

Digital cameras

- Until last run: 9+ 6 beam cameras connected to servers cs-ccr-awakecam / -awakecam2 and 8(5?) laser cameras on cs-ccr-awakecam1
- For next run: 10 additional cameras (TT41.PLASMA.CAM#.DigiCam) connected to both servers.
- all material in tunnel, SW in place , fine SPS extraction trigger available. Installation Friday?



C. Pakuza
A. Topaloudis
E. Poimenidou
E. Senes
S. Burger



10 viewports along the cell

Digital cameras - continued

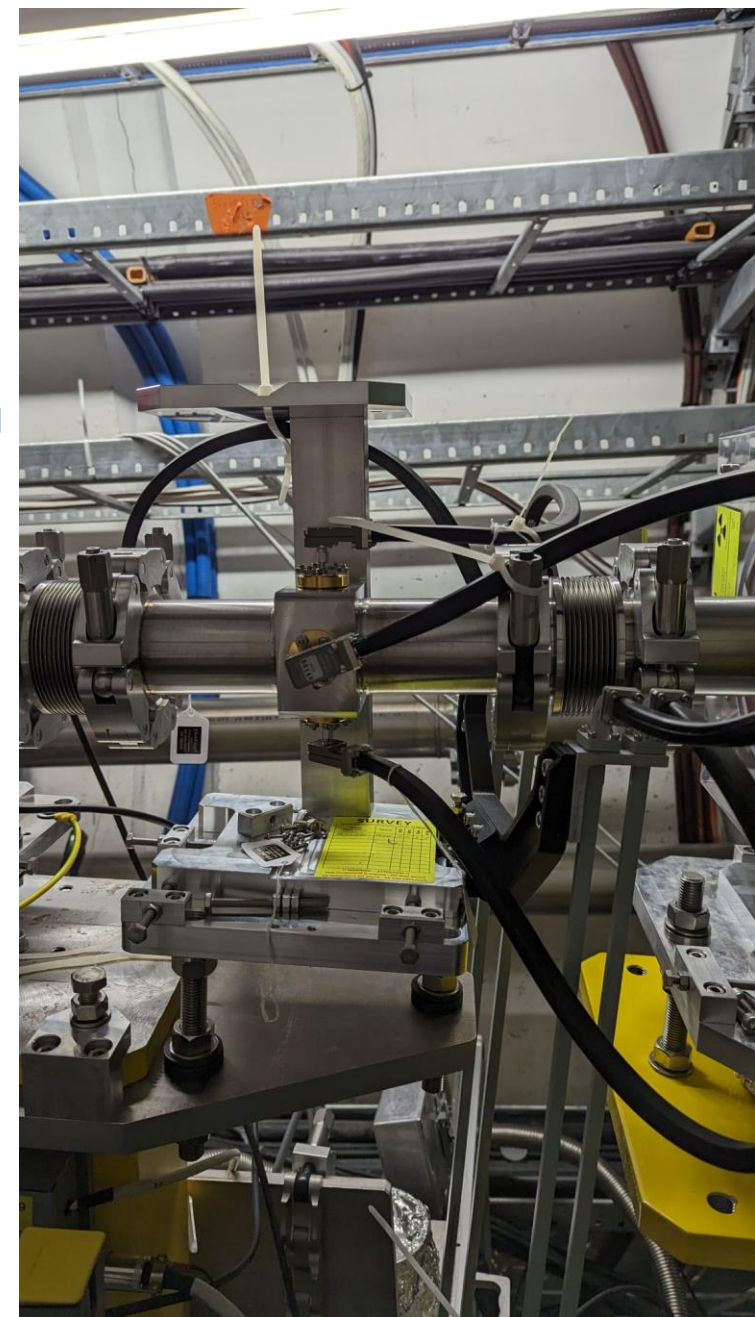
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E. Poimenidou
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S. Burger

- **Effort to improve performance of readout system. Goal is zero loss of extraction images**
- **Presence performance OK!**
 - at times cameras get into parameters synchronization loop. An automatic disconnect / connect loop is being implemented
 - loss of extraction images very low after re-synch code (August run). 'A few images lost per day'. Getting to ZERO!
- **10 additional cameras might affect performance! Evaluating possibility of connecting a 4th server (lead time for server approx. 4 months. EN/EL team contacted to understand if fibre connection is available)**

ChDR and HFB BPMs

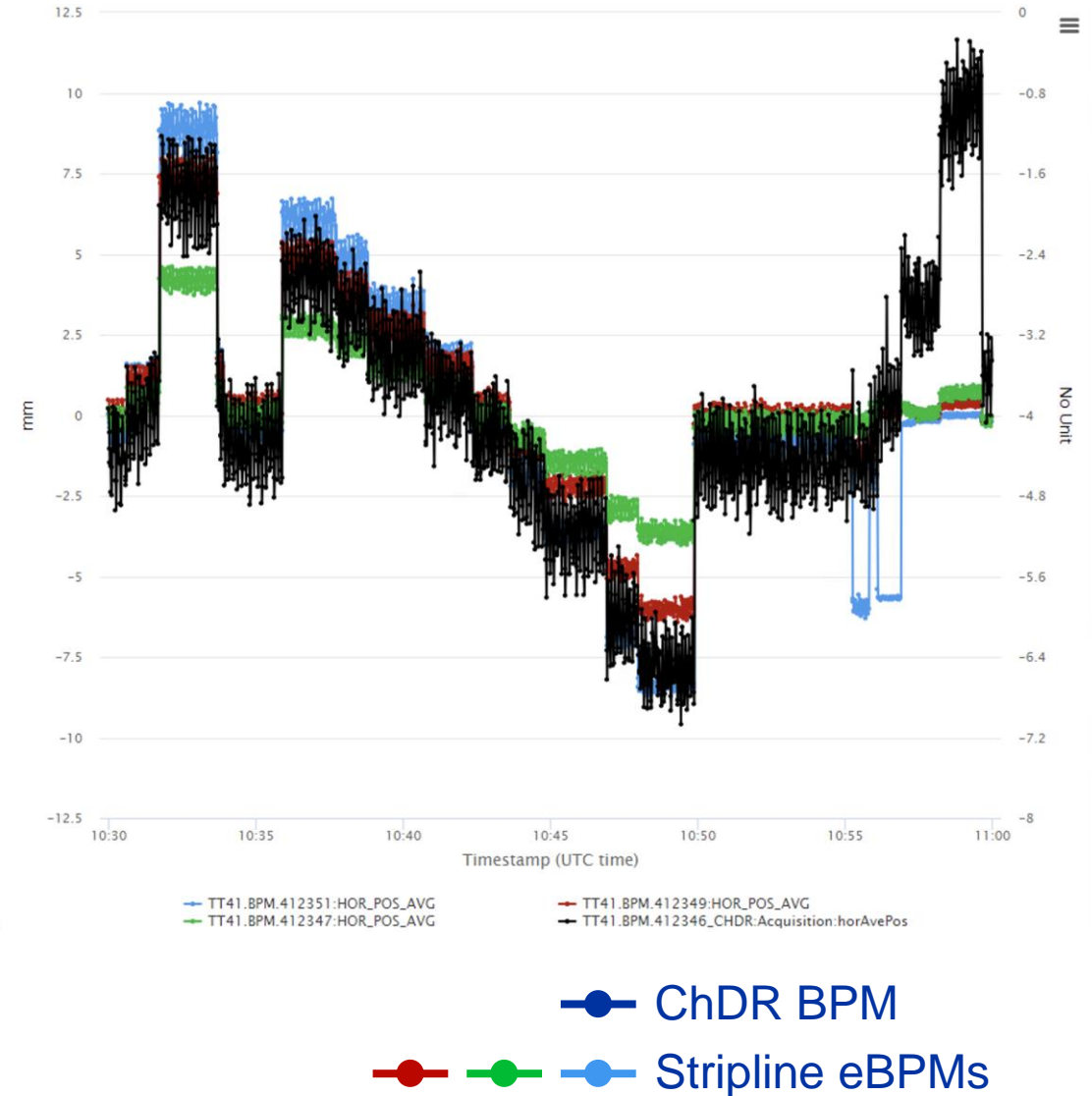
- **Connecting the second TRIUMF electronics module to the HF button for comparison between ChDR BPM and HF with the same electronics**
 - FESA set-up for the device
 - Device connected. Tests planned for today or tomorrow
 - To be tested next run – Oxford University (Beth and Weida) & BI

C. Pakuza
B. Spear
W. Zhang
M. Wendt
E. Senes
M. Krupa
E. Poimenidou
V. Verzilov
S. Liu



ChDR and HFB BPMs

- As agreed during last TB, analysis of logged ChDR BPM signals
 - Test with electrons only, 21 September
 - Ballistic beam
 - No magnetic elements between the relevant BPMs
 - Horizontal position scan only
 - Requires more tests (protons!)



ChDR and HFB BPMs

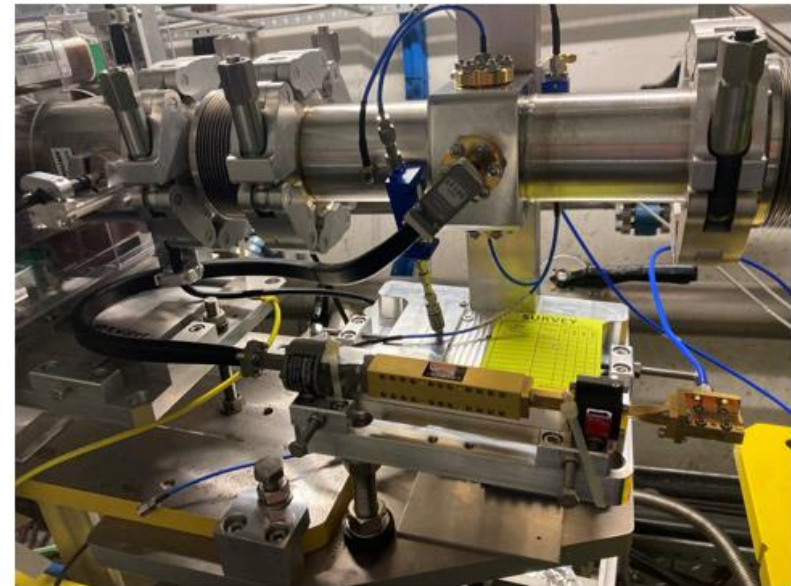
from B. Spears' presentation to August TB
<https://indico.cern.ch/event/1316989/>

Setup for the August Proton run

The Ka-Band read-out arms are identical and pass a frequency range $\sim 20\text{...}32$ GHz, given by the low-pass filter and the WR28 dimensions. At the end there is a Ka-Band diode detector.

The ChDR radiator is connected through a quarter wavelength -transformer to the WR28 read-out arm, the HF-button utilizes a R281B coaxial-to-WG adapter and a flexible WR28 waveguide.

The following results are **preliminary**, and need further thoughts on quantifying how accurate the position resolution would be due to the jitter of the proton beam and the limitations of the diodes



Conclusion

- The proton spectrum at 3E11 is extending up to 110GHz, much higher than the predicted cut-off at 30GHz
- The ratio of proton to electron signal improves as we work in higher frequency bands
- Position sensitivity with low intensity 1E11 proton bunches is consistent with measurements made only with Electrons
- Testing with the 3E11 protons for the HF button rules out the waveguide setup, but purely coaxial setup at 30GHz would be worth investigating.
- To measure electrons at large proton (3E11) intensities we need to work at higher frequencies (V-band, W-band)
- Our knowledge of the high frequency content of the proton beam before the BPMs is limited by current instrumentation (would an upstream Proton BPM working at high frequencies help with this?)
- However, this is incompatible with the current plans to install TRIUMF electronics working in the Ka-band regime, we will look at developing a new acquisition system for higher frequency bands

AWAKE BI meetings

- Monthly BI meetings will resume. Next 18 October
<https://indico.cern.ch/event/1332385/>
- Join egroup 'awake-instrumentation' (egroups.cern.ch) or ask me