Beam Instrumentation and its Readout

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Fiber Trackers (XBPF)

- 2 fiber tracker planes with an X and a Y oriented layer in each plane, placed a few meters upstream of the prototype

- fiber diameter: 1 mm.

- Track information from these planes is provided to us through software (DIP server) and can be added to our data. The tracks as defined by these planes have a timestamp with 8 ns precision.

- The HV controls of these detectors will not be in the T9 Control Room. THey will always be on, only the beam instrumentation experts can change the high voltage.

- The CERN survey team can align our detector wrt these planes. Need to figure out if/what fiducial markings need to be added to our equipment for the survey team.

Fiber Tracker Data

- Data format provided in document by Inaki (—> Can we learn from neutrino platform and use old data from DIP server?)
- The timing system of the XBPF uses a White Rabbit network, which provides high precision timestamps (8ns, very low jitter) in the Coordinated Universal Time format (UTC). Therefore what you need is:
    - Timestamp your detector signals in the UTC format as well.
    - Or correlate your signals with the Warning Extraction and End of Extraction signals provided at the patch panel, as you suggest.
- Common time reference for the timestamps on the fiber tracker information and what is available for us, is the start-of-spill and end-of-spill signals that we get through the patch panel in the control room. We therefore have to record the timing of these signals with respect to the timing of what we read from our detectors.
- in the Neutrino Platform we worked with a maximum beam intensity of ~10^3 particles per burst. If the data rate is too high we risk of saturating our CPU or one of the data buses that brings the data to you. We'll have to check what's the maximum achievable rate. If the data flow is too high, I can limit it to a maximum number of particles (thus we will lose part of the burst).
- DIP server information: https://readthedocs.web.cern.ch/display/ICKB/DIP+and+DIM

Fiber Tracker Data

variable name	var. type and size	description
acqMode	string	Acquisition mode of the XBPF. Options: STOP, ACQUIRE, Command, Timer, Timing. Value should be ACQUIRE for normal operation.
acqStamp	int 64bit	UNIX timestamp of the acquisition. (Note: an acquisition corresponds to a beam extraction)
cycleName	string	Name of the present accelerator's super-cycle.
cycleStamp	int 64bit	UNIX timestamp of the present accelerator's super-cycle.
equipmentName	string	Name of the XBPF beam monitor according to its distance to the primary target.
countsRecords	int 64bit	Number of recorded events in the present acquisition.
eventsData	array of 10 int 64bit $\times$ [countsRecords]	Event structure of the records. Format: 10 words containing the trigger timestamp, event timestamp and the 192 fibres information. More information in table 1.2. Note: the 6 data words follow little-endian order.
countsTrigs	int 64bit	Number of trigger signals received during the present acquisition. Note: in the absence of erros, should match [countsRecords]

Fiber Tracker Data

variable name	**var. type and size**	**description**
countsRecordsWithZeroEvents	int 64bit	Number of recorded events in the present acquisition with zero counts. Can be used to calculate the inefficiency of the detector.
counts	int 64bit	Total number of hits accumulated in the 192 fibres during present acquisition. Can be used to estimate the multiplicity of the detector.
profile	array of 192 int 64bit	Beam profile of the present acquisition.
mean	double	Mean of the current profile.
timeFirstEvent	int 64bit	WR timestamp of the first recorded event.
timeFirstTrigger	int 64bit	WR timestamp of the first received trigger.
timeLastEvent	int 64bit	WR timestamp of the last recorded event.
timeLastTrigger	int 64bit	WR timestamp of the last received trigger.
message	string	User-customised message.
acqType	string	Expert variable: value should be Timing.
acqTypeAllowed	string	Expert variable: value should be Timing.
profileMm	array of 192 double	Used for debugging.

Fiber Tracker Data

Table 1.2: Event structure

32-bit word	meaning
0	trigger time stamp 32 LSB
1	trigger time stamp 32 MSB
2	event time stamp 32 LSB
3	event time stamp 32 MSB
4	DATA 0 LSB
5	DATA 1
6	DATA 2
7	DATA 3
8	DATA 4
9	DATA 5 MSB

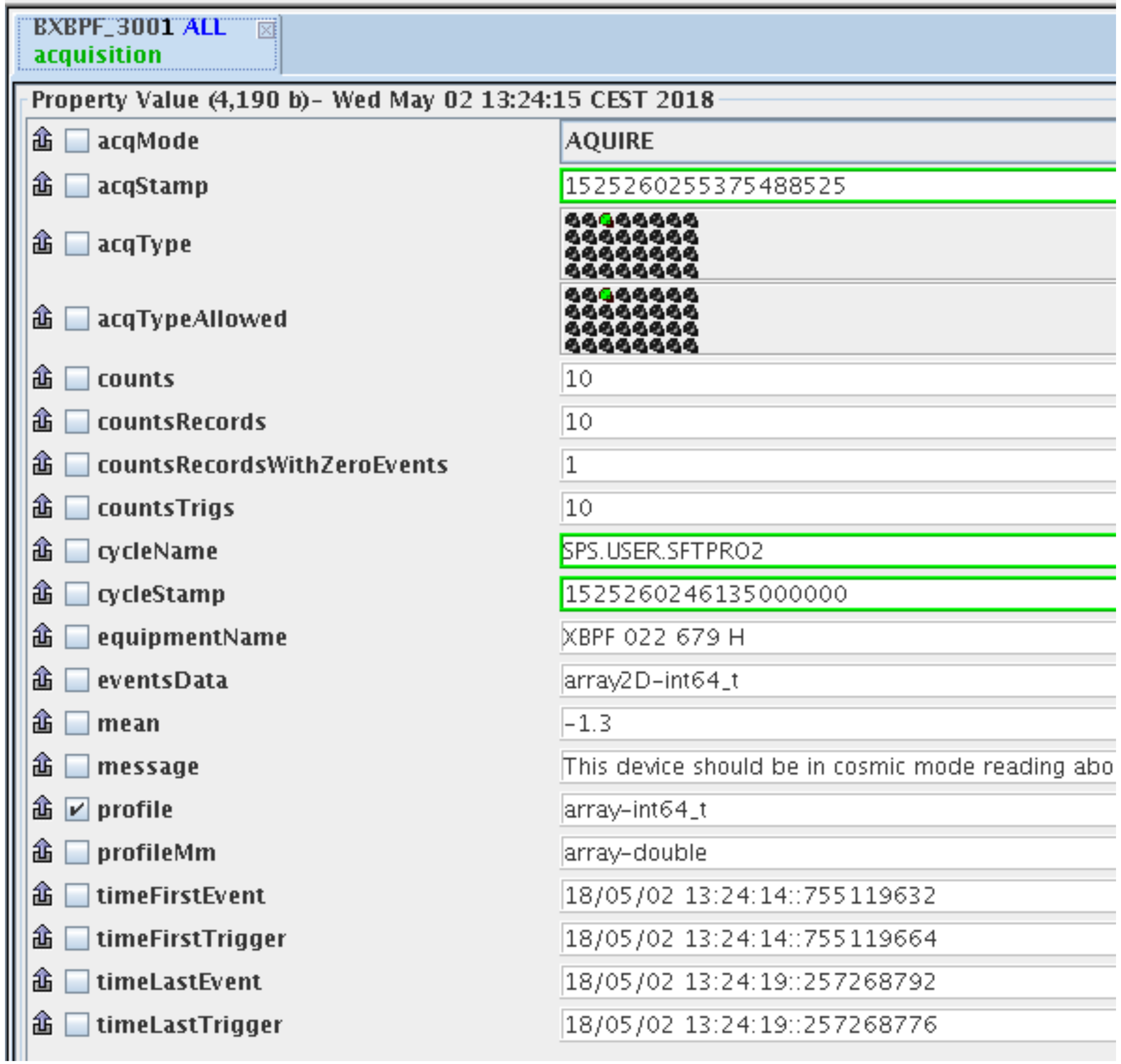

Figure 2.1: Screenshot of the FESA class of the XBPF.

Cherenkovs

- 2 Cherenkov detectors in the beam, just a few meters upstream of our prototype.
- analog signals from these will also arrive at the patch panel.
- will have their settings defined (pressure) for the different beam momenta, and we change that with CESAR
- They are filled with N2 or CO2. If we need to change the gas we have to contact Inaki.

Scintillator telescope

- 2 particle defining scintillator planes of about 10 cm diameter.
- signal will be drawn to the patch panel in the control room.
- In the same rack they will have a NIM crate with the logic defining the coincidence between these planes which will be our trigger signal.
- The analog signal from these planes will also be available to us.