

# LTB Signal Generation & Decoding

as of February 2023

- What we have is a logical OR of both paddle ends: paddle ends (A/B sides) are assumed to be connected on consecutive SMA inputs: SMA1+2, 3+4, 5+6, etc. Each channel has three discriminators, with different threshold values
- Default thresholds:
  - (HIT) thr0 = 40.0 mV (~0.75 min-i)
  - (BETA) thr1 = 32.0 mV (~2.5 min-i)
  - (VETO) thr2 = 375.0 mV (~30 min-i)

\*\*\*min-i based on the peak of the LG distribution at the middle of the paddle with 58.0 V bias voltage, which is at 12.5 mV
- The HIT/BETA/VETO determination is made on each paddle end, then the firmware does an OR of the two ends to determine the highest level hit.
- If any of the 8 paddles are HIT, a start bit (bit0) is sent on both LINK0 and LINK1 of the Harting cable output. The next 8 bits will indicate the status of the 8 paddles connected to SMA1+2 on bit1, 3+4 on bit2, 5+6 on bit3, etc, for a total of 9 bits per LINK
- For each paddle, represent the 2 bits, sent on LINK0 and LINK1, with [LINK0, LINK1]. Then, the threshold level reached by the paddle end with the higher signal is given by:
  - [0,0]: no hit, below thr0
  - [1,0]: HIT, between thr0 and thr1
  - [0,1]: BETA, between thr1 and thr2
  - [1,1]: VETO, above thr2
- Example signal:  
LINK0: 100000000  
LINK1: 100001000

This would indicate that one end of the TOF paddle connected to SMAs 9+10 (position 5 in the bit pattern) reached a threshold encoded with [0,1], which represents a hit of BETA, or a voltage between thr1 and thr2. The other end of this paddle was at a lower voltage which could be in any of the 3 states no hit, HIT, or BETA (but \*not\* VETO).