

Tianping Gu, Erfei Wang, Vladimir Savinov (Pittsburgh) in collaboration with Vasily Shebalin (Hawaii)

- The main goal to achieve before the end of LS1: efficient to with resolution better than 8ns
- The main problem: photons from beam background (photons are photons, we only have arrival time)
- Challenges: TOP trigger hit (timestamp) rate, bandwidth, user FW clock frequency
- What we are doing to deal with all these matters:
- Transition to UT4 (in progress)
- Working on running user FW logic at higher clock frequency
- Will stream tentative slot-level to decisions to GRL to match with CDC 2D TRG tracks

See Tianping's talk for preliminary assessment of feasibility





## **TOP Trigger Path**



(Center-left) technical details and the data flow diagram for iTOP L1 trigger hits used in single-slot t<sub>0</sub> decisions, and (right) estimates of per-PMT background rates for individual slots at SuperKEKB design luminosity.

Each slot: 4 boardstacks, each boardstack: 8 PMTs, 4 links on boardstacks: 32MHz bandwidth 16MHz/PMT could be insufficient during injection, user FW on UT4: @128MHz (need 4x128MHz!)





Currently we use lots of FPGA resources to calculate multiple hypotheses ("along the bars") Perhaps we can get rid of these PDFs and perform to estimation differently? This would buy us a higher clock frequency for user logic

Try to use ML to come up with an algorithm to distinguish between collisions and beam background?

To deal with injection perhaps we should compress the data in trigger links on TOP FEE? This would only be needed if hit rate/PMT exceeds 16MHz (which may occur during injection)

Currently, TOP TRG work is split among three locations: TOP FEE (Hawaii), UT4 (Pittsburgh), GRL (KEK) We need to coordinate better. Also, perhaps it would be best to do CDC-TOP matching on TOP TRG UT4?

As luminosity grows, backgrounds grow also, all our gains are being erased. Is this race possible to win?

Would really like to turn on TOP FEE and TRG crates on ASAP... A lot of work needs to be done





### Money Matters and Personnel



# Future funding...

Belle II Trigger/DAQ workshop, Nov. 30, 2022

Vladimir Savinov



