



## Triggering new discoveries: Advancements in Real-Time Analysis for Expanding Physics Reach at LHCb

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**YouTube Live: <https://youtube.com/live/jez-Lh1HEeA?feature=share>**

*Dr Brij Kishor Jashal is a Scientific Officer "E" at Department of High Energy Physics, Tata Institute of Fundamental Research. Before, joining TIFR, He was a Research Scientist at Indian Space Research Organization (ISRO) working on designing key infrastructure and services for a national project called India water resource information system (India-WRIS). During the last decade at TIFR, He has been playing key role in managing the national computing centre for High Energy Physics which includes Tier-II and Tier-III centres for researchers of CMS collaboration under the aegis of The Worldwide LHC Computing Grid (WLCG). In addition, he is a member of WLCG Grid Deployment Board from India and currently a Level-2 convener of Monitoring & Analytics group under CMS Offline and Software computing. His research work at LHCb experiment during last five years have been focused on study of rare radiative b decays, trigger strategies for long living particles, Real Time Analysis, High Level Trigger (HLT) frameworks and algorithms on Hybrid computing architectures.*

The physics opportunities offered by the next generation of Large Hadron Collider (LHC) based experiments come with challenges. The large number of proton-proton collisions due to the high luminosity means having to deal with higher pile-up and high data-rates. To cope with these conditions, the LHCb experiment has developed sophisticated two-stage trigger systems to select interesting events for analysis. For LHCb Run3 and beyond, the first stage of the trigger, the High-Level Trigger 1 (HLT1), has been implemented on Graphic Processor Units (GPUs) and is capable of reducing the visible collision rate from 30MHz to 1 MHz. These triggers are designed to identify events that could be of scientific interest and to discard events that are not relevant. One alluring research avenue in particle physics is the study of Long-lived particles (LLPs) of the Standard Model (SM) as well as beyond the standard model (BSM). Many interesting decay modes involve strange particles with large lifetimes such as  $\Lambda$  or Ks. Exotic LLPs are also predicted in many new theoretical models. The selection and reconstruction of these LLPs is a challenge. These particles can decay far from the primary interaction vertex and are hard to select by the trigger systems of the experiments and difficult to isolate from the SM backgrounds. In this colloquium an introduction of the Real Time Analysis paradigm of LHC based experiments is provided and new trigger system of LHCb is introduced. Some of the key reconstruction and selection algorithms, which have been developed for highly parallel computing architectures, are presented. How these algorithms are instrumental in the studies and searches of LLPs from the SM and BSM are discussed.