



# SIMULATION STUDIES WITH LAMBDA PARTICLES FOR BENCHMARK TEST AT miniCBM EXPERIMENT

FOR CBM COLLABORATION

A. Agarwal<sup>1,2\*</sup>, A. K. Dubey<sup>1,2</sup> and N. Herrmann<sup>3</sup>

<sup>1</sup>Variable Energy Cyclotron Centre, Kolkata-700064, India

<sup>2</sup>Homi Bhabha National Institute, Mumbai-400094, India

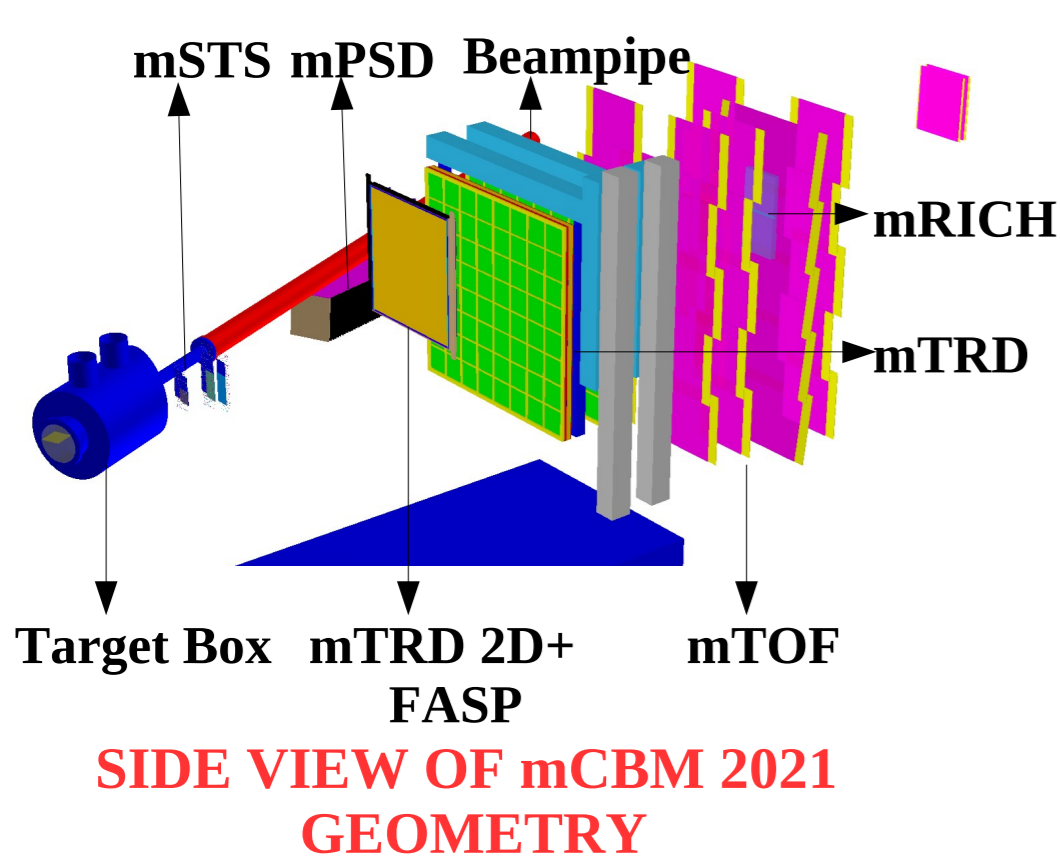
<sup>3</sup>Gesellschaft für Schwerionenforschung(GSI), Germany



## ABSTRACT

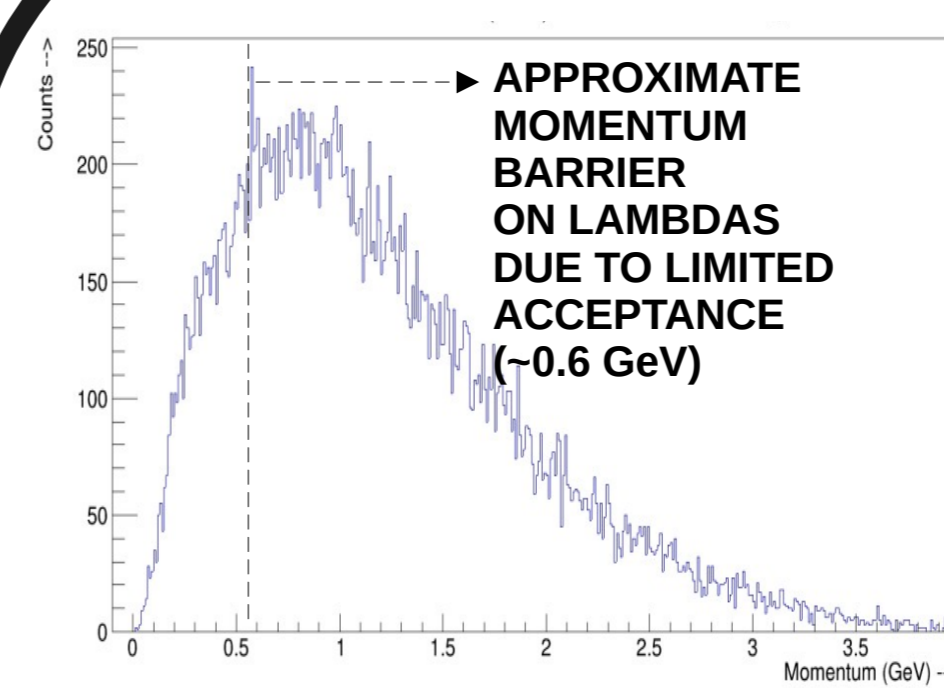
The Compressed Baryonic Matter (CBM) experiment at the upcoming Facility for Anti-proton and Ion Research (FAIR), Darmstadt, Germany will study dense regions of phase space diagram of strongly interacting matter in nucleus-nucleus collisions of Kinetic Energies = 2-11 AGeV. Unprecedented interaction rates reaching upto ~10 MHz will be the unique feature at CBM along with a free-streaming mode of data acquisition for all the detector subsystems. A precursor to CBM called mini-CBM experiment has been setup at SIS18 beamline of GSI as part of FAIR-phase 0 program. Real size Prototype detectors of various subsystems of CBM such as the Silicon Tracking Station (STS), Muon Chamber (MuCh) system, Time of Flight (TOF) Detector etc. have been installed at mCBM. Testing the reconstruction abilities of the detectors in self-triggered mode at the highest rates in mCBM is one of main goals at mCBM. In this poster, we present the simulation results on time-based reconstruction of  $\Lambda$  as part of the benchmark study in mCBM experiment of 2021.

## SIMULATION INFORMATION

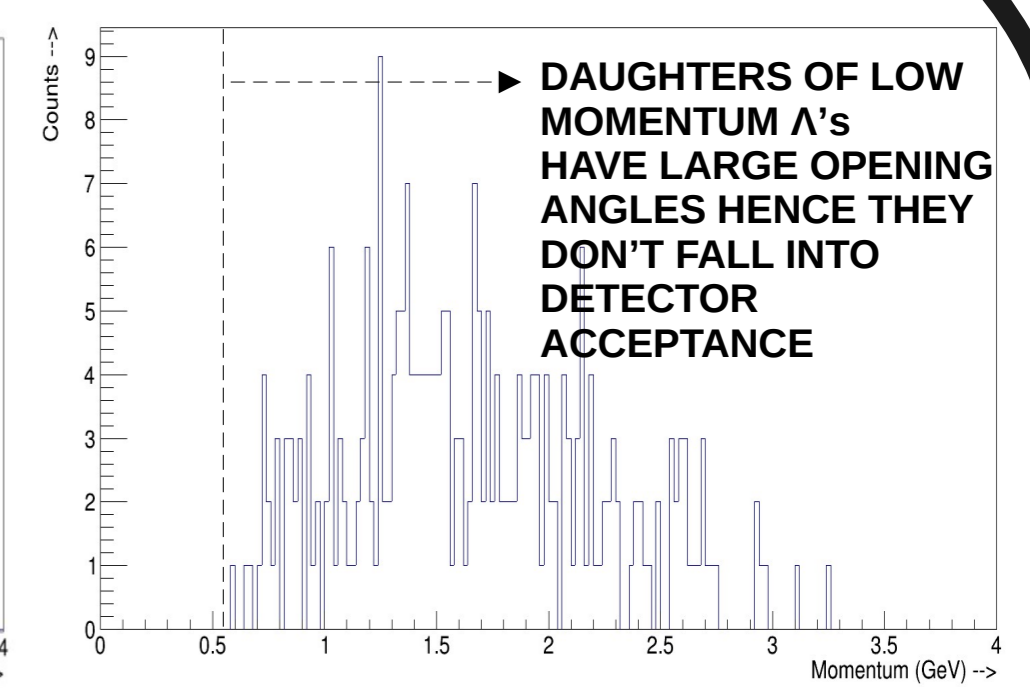


- PROJECTILE:  $^{16}\text{O}$  (8+)
- TARGET:  $^{58}\text{Ni}$  (28+)
- BEAM KINETIC ENERGY: 2 AGeV
- NUMBER OF SIMULATED EVENTS: 100 Million ( $10^8$ )
- EVENT GENERATOR: Ultra Relativistic Quantum Molecular Dynamics (UrQMD)
- SIMULATION ENGINE: GEANT 3

## SIMULATION RESULTS

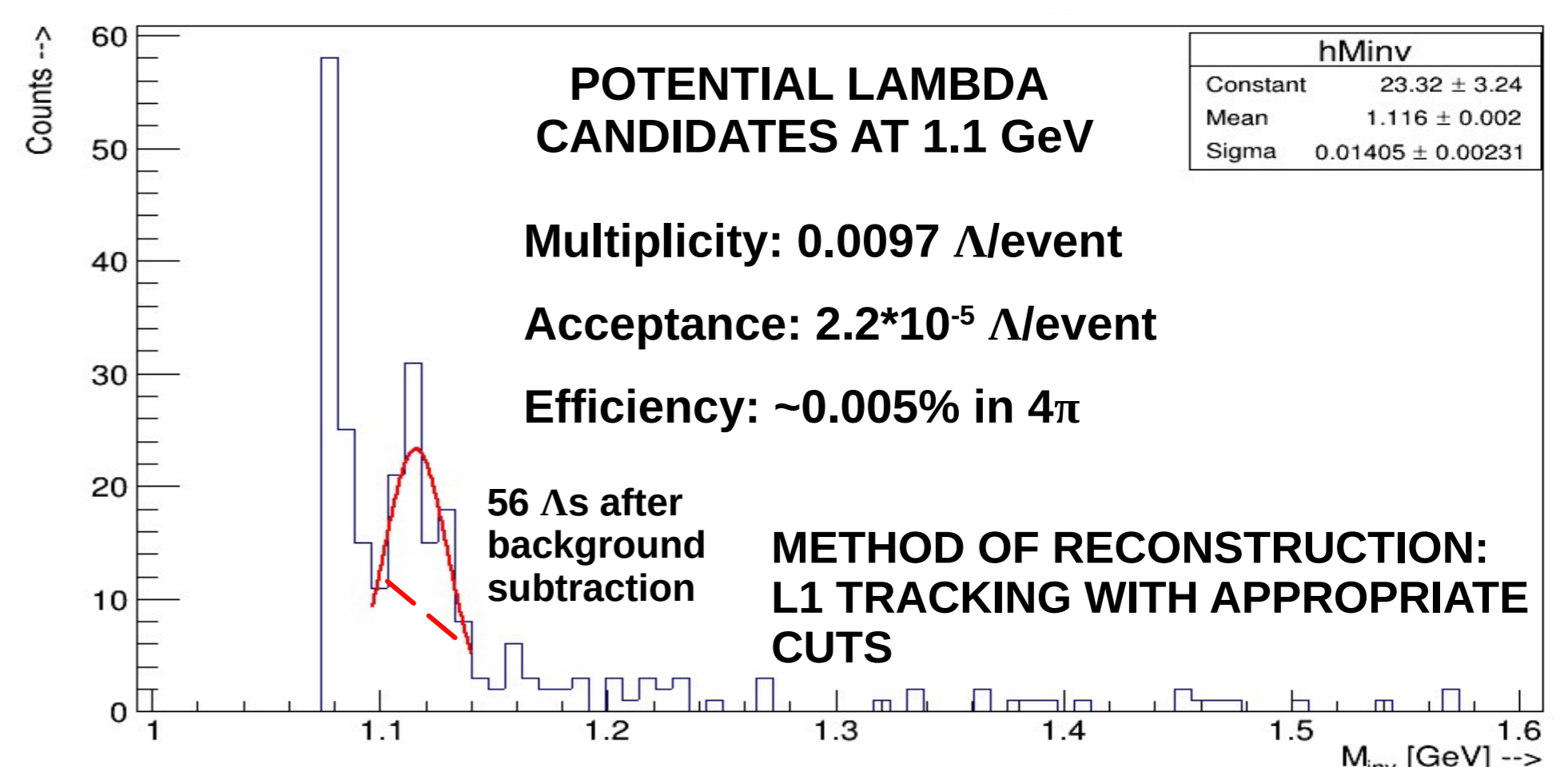


**LAMBDA MOMENTUM DISTRIBUTION FROM O-Ni COLLISIONS AT T = 2AGeV**



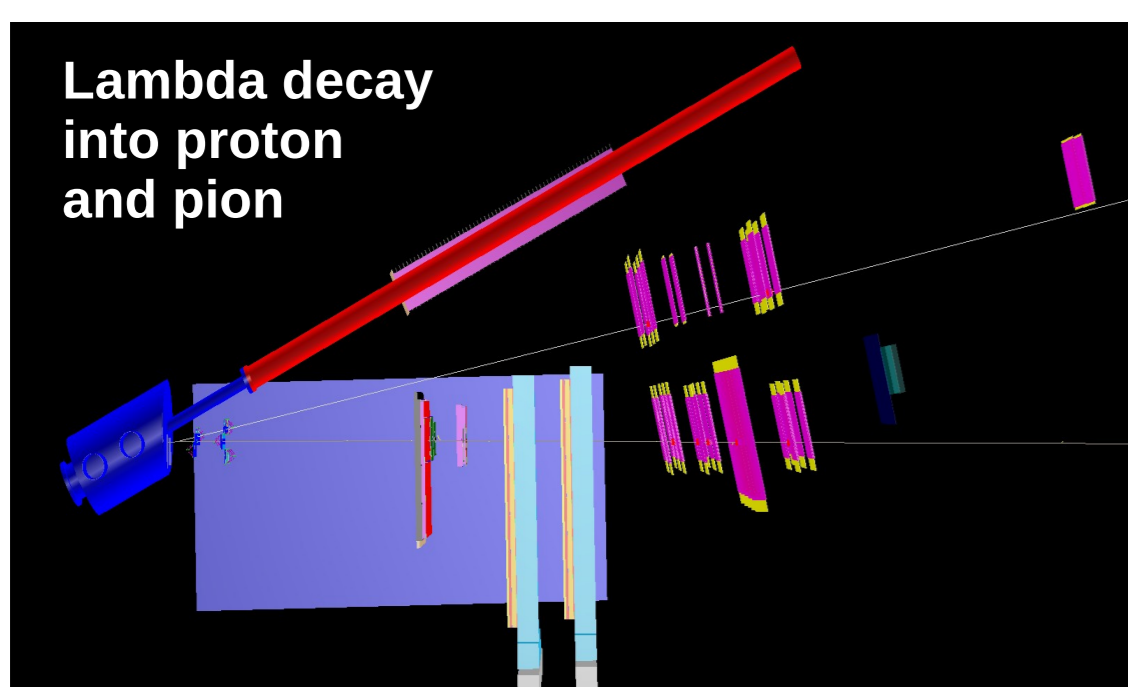
**LAMBDA MOMENTUM DISTRIBUTION FROM O-Ni COLLISIONS AT T = 2AGeV IN THE ACCEPTANCE OF STS AND TOF**

SIMULATION IS PERFORMED IN TIME BASED MODE i.e. THE EVENTS ARE NOT SEPERATED IN TIME BUT OVERLAPPING. THE INTERACTION RATE IS  $10^5$  EVENTS/s. TIME COINCIDENCE WINDOW IS 200 ns. A CONDITION OF MINIMUM 2 TOF HITS IS APPLIED



**INVARIANT MASS RECONSTRUCTION FOR POTENTIAL PAIRS OF PIONS AND PROTONS FOR O-Ni COLLISIONS AT T = 2 AGEV**

## SIMULATION RESULTS



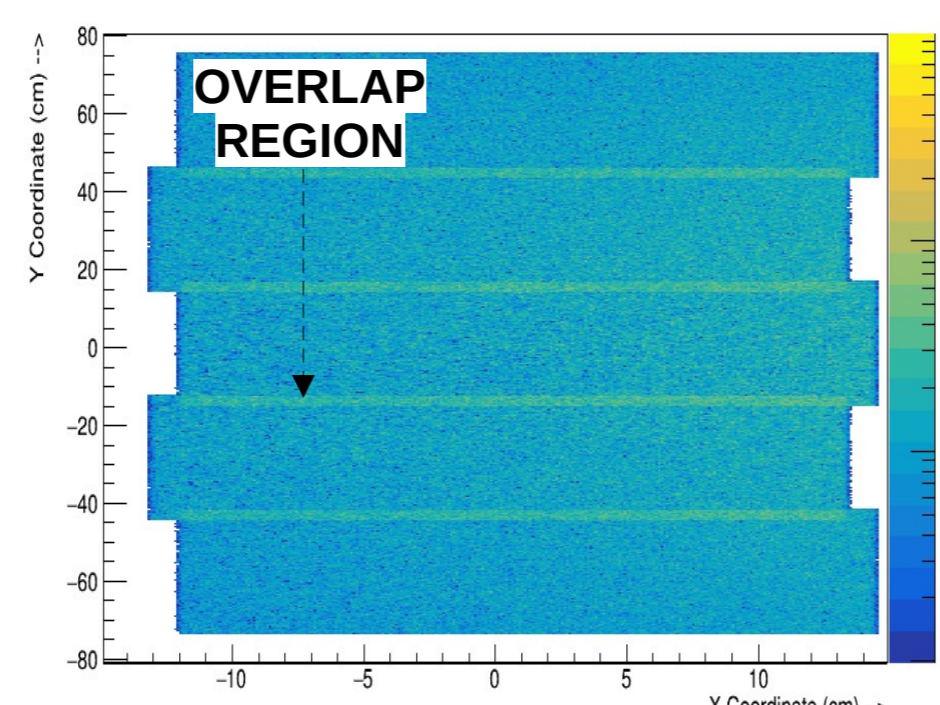
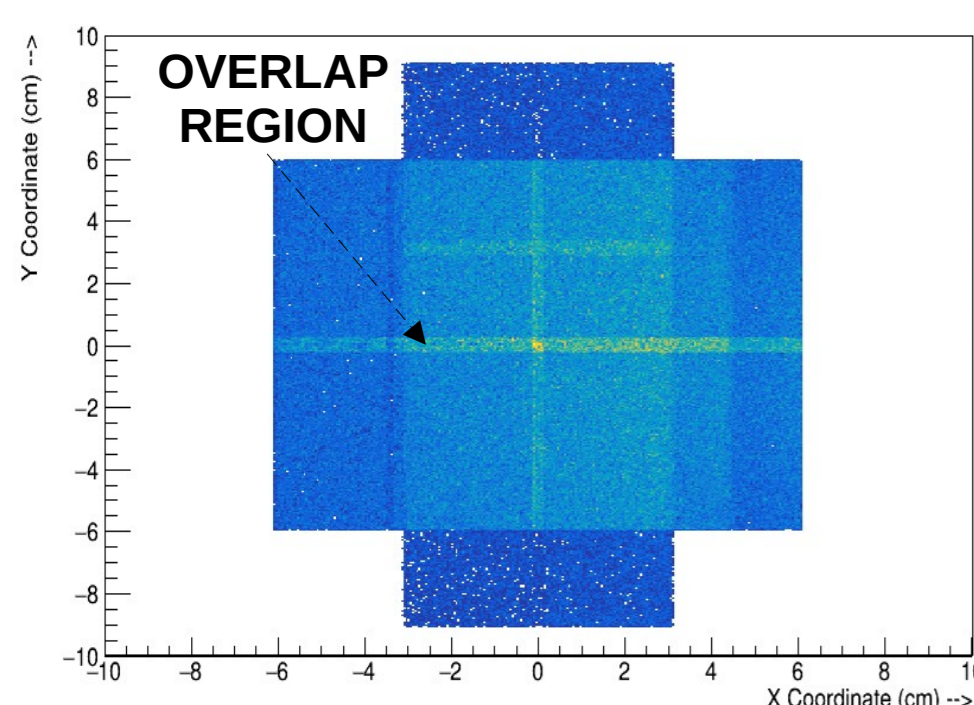
ONLY PRIMARY DECAY CHANNEL OF  $\Lambda$  HAS BEEN CONSIDERED FOR RECONSTRUCTION i.e.



BRANCHING RATIO OF DECAY TO PROTON AND PION IS ~63.9% (Source: pdg.lbl.gov/in)

**LAMBDA DECAY IN THE ACCEPTANCE OF mCBM 2021 GEOMETRY**

DETECTORS EMPLOYED IN LAMBDA RECONSTRUCTION: STS AND TOF



## SUMMARY

We have employed several techniques/cuts to reconstruct potential lambda baryons using proton and pion track candidates without using any magnetic field in free streaming simulated data.

## OUTLOOK

Efforts have been made to use data from mCBM experiment 2022 to reconstruct Lambdas using similar method. Further refinement in technique is required to take into account the extreme sensitivity of the technique on detector alignment.

## REFERENCES

<https://indico.gsi.de/event/13807/contributions/58678/attachments/38142/51365/mCBM%20simulation%20meeting%2014%20Dec.pdf>

\* Email ID: a.agarwal@vecc.gov.in

