



Event reconstruction at MPD: current status

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for the MPD collaboration

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2. Tracking in MAPS ITS
3. EMC reconstruction
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TPC track reconstruction



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METHODS OF PHYSICAL EXPERIMENT

Towards a Realistic Monte Carlo Simulation of the MPD Detector at NICA¹

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Abstract—During the preparation of the physics program of any experiment it is very important to perform a realistic simulation of the detector, i.e. to describe real detector effects with as many details as possible. In this paper the current status of such a simulation of the MPD TPC (Time Projection Chamber) is demonstrated, including description of relevant processes. Data reconstruction approaches are also presented along with the main results on detector performance.

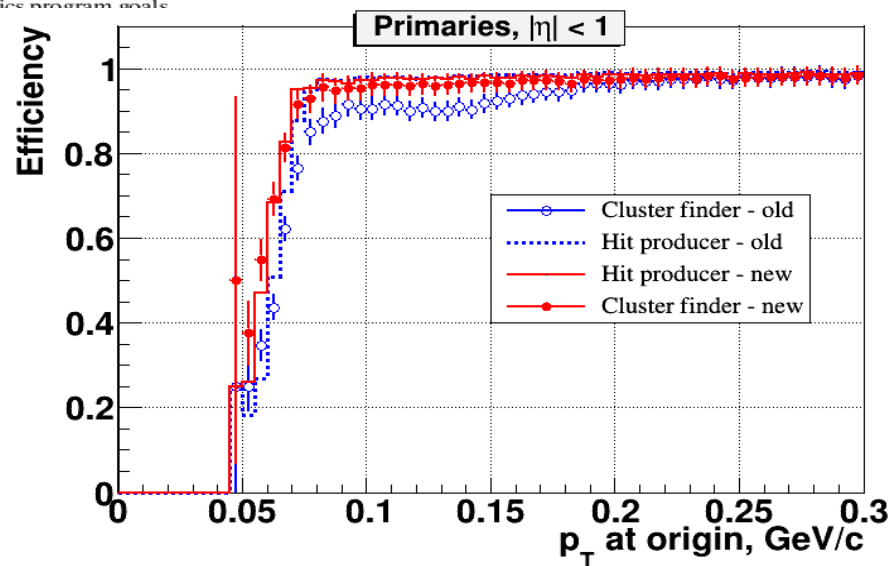
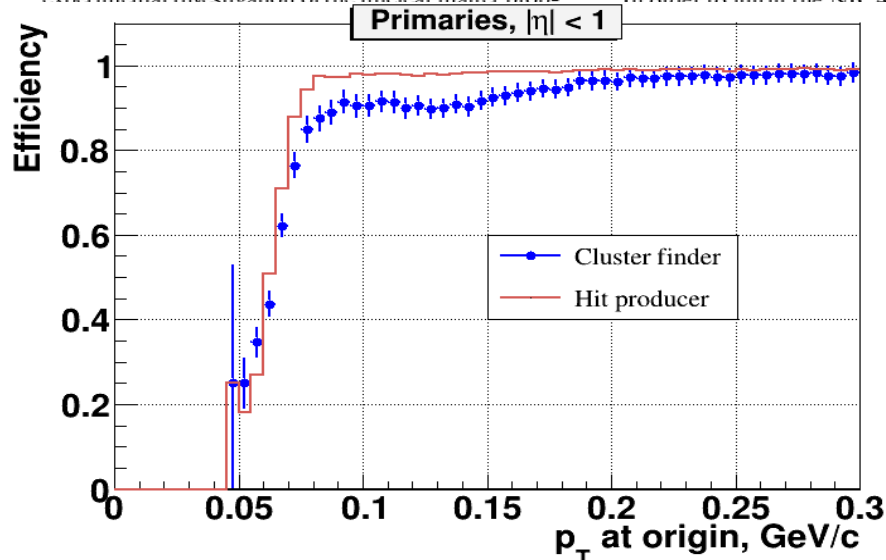
DOI: 10.1134/S1547477119010084

1. INTRODUCTION

The NICA heavy-ion program is aimed at the experimental investigation of the nuclear matter prop-

erties, needs to measure particle production practically up to the fragmentation region.

In order to fulfill the NICA physics program goals



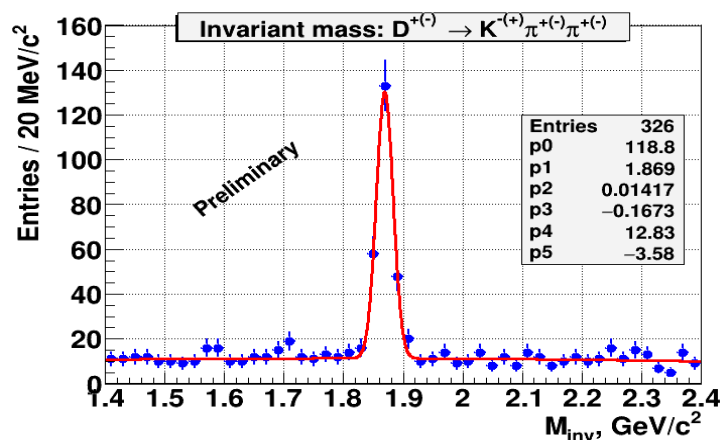
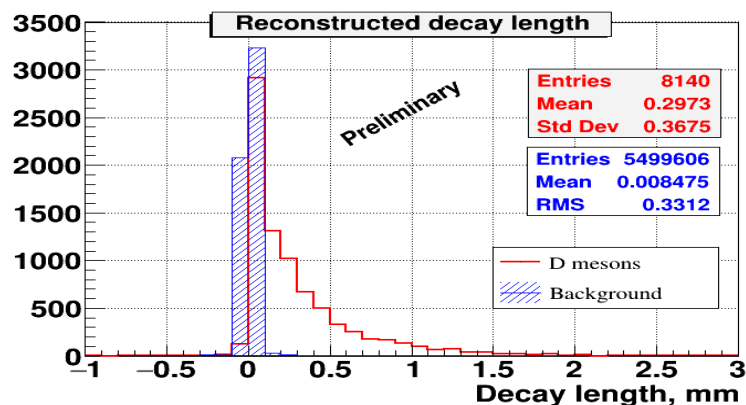
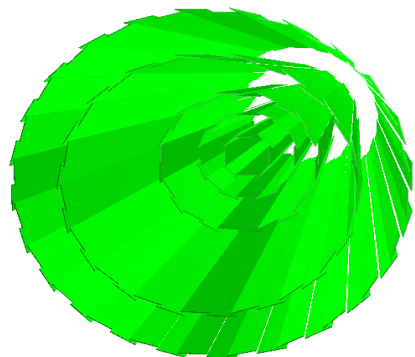
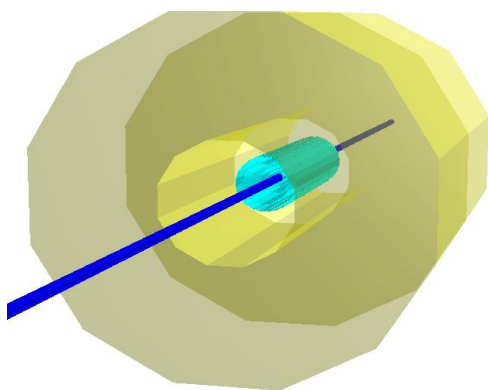
Members of MPD DAC spotted efficiency drop below 0.2 GeV/c in p_T for realistic simulation. It has been fixed – now in GIT.



ITS track reconstruction - I



MAPS ITS (Monolithic Active Pixel Sensors). Possible geometry from Yu.Murin (LHEP JINR) and V.Kondrat'ev (SPbU).



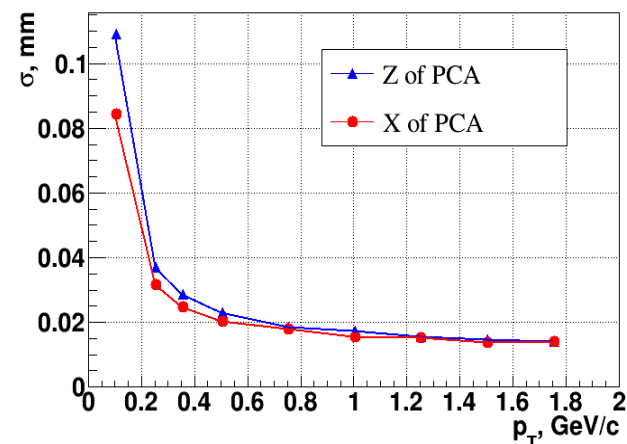
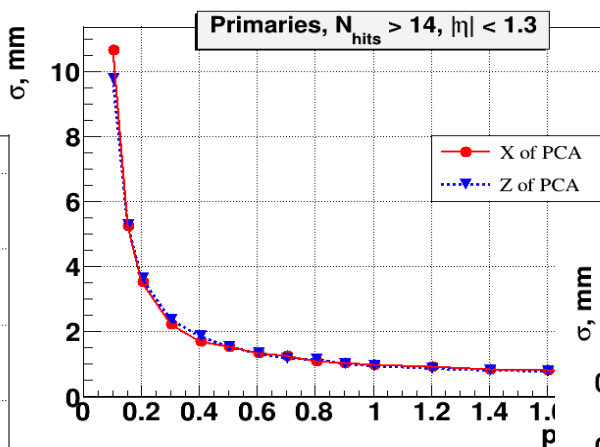
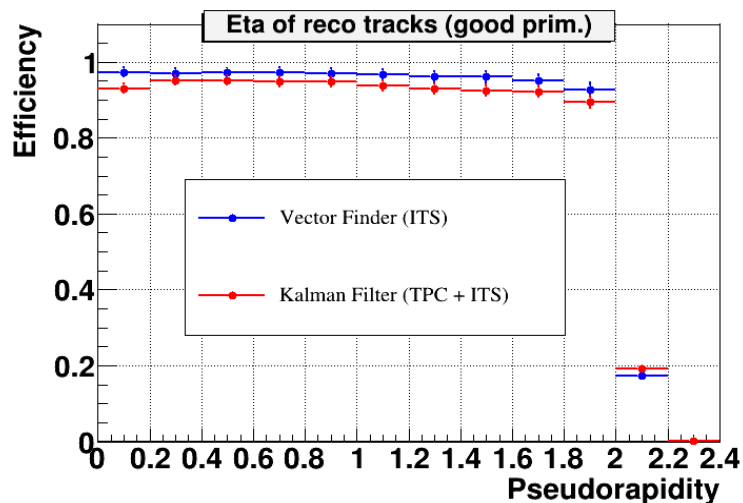
A Monte-Carlo study of the NICA/MPD inner tracking system main characteristics, Zinchenko D.A., Zinchenko A.I., Nikonov E.G., 25th International Conference "Mathematics. Computing. Education" MCE-2018, 29 January to 3 February 2018, Dubna, Computer Research and Modeling, 2019, vol. 11, no. 1, pp. 87-94



ITS track reconstruction - II



Vector Finder - a prior-constrained combinatorial search (claimed to be similar in concept with CBM “cellular automaton”)



A “vector finder” approach to track reconstruction in the Inner Tracking System of MPD/NICA. D.Zinchenko, E.Nikonov, A.Zinchenko, The XXIII International Scientific Conference of Young Scientists and Specialists (AYSS-2019), 15 - 19 April 2019, LIT, JINR, Dubna, Russia.

A track finding algorithm for the inner tracking system of MPD/NICA, D.Zinchenko, E.Nikonov and A.Zinchenko, 24th International Baldin Seminar on High Energy Physics Problems “Relativistic Nuclear Physics and Quantum Chromodynamics” (ISHEPP 2018), EPJ Web Conf. 204, 07006 (2019).

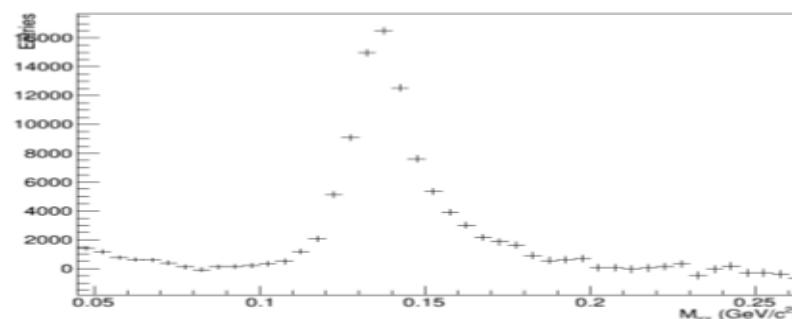
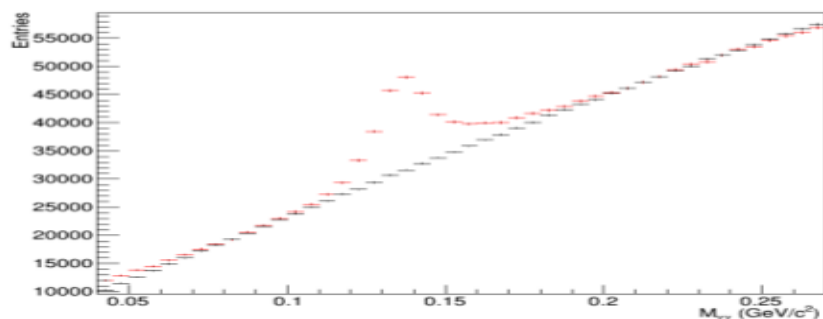


<https://indico.jinr.ru/getFile.py/access?contribId=0&resId=0&materialId=slides&confId=867>

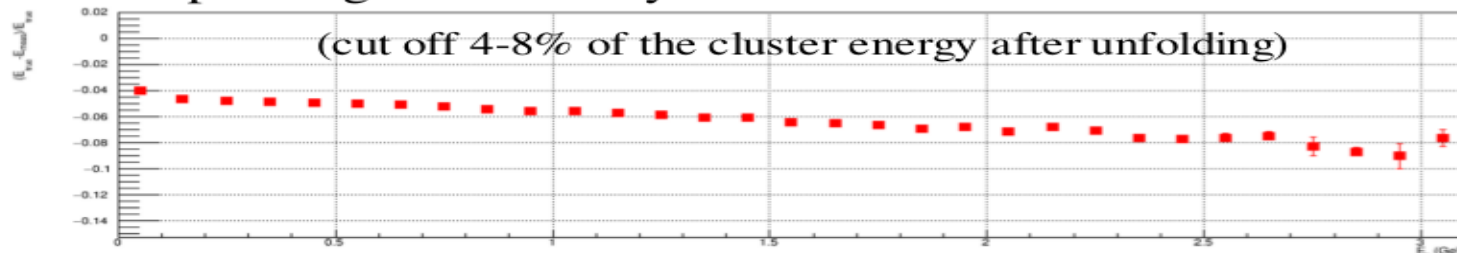
Detector performance: π^0

V.Riabov

- UrQMD, minbias AuAu@11, realistic vertex distribution
- $E_\gamma > 0.1$ GeV, $|y| < 1.0$, $p_T > 2.0$ GeV/c, track veto
- Tested all methods of minimization. The best performance is achieved by limiting the cluster size after unfolding to 3x3 cells around the cluster center



- Corresponding non-linearity correction should have been taken into account



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Currently there are 3 EMC reconstruction procedures:

- 1) principal developer M.Martemianov (ITEP, Moscow)
- 2) principal developer A.Zinchenko (JINR, Dubna)
- 3) principal developer V.Riabov (PNPI, St. Petersburg)

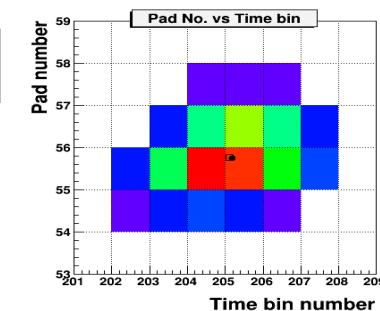
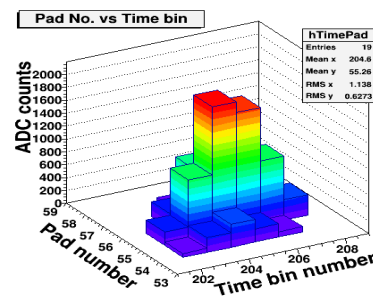
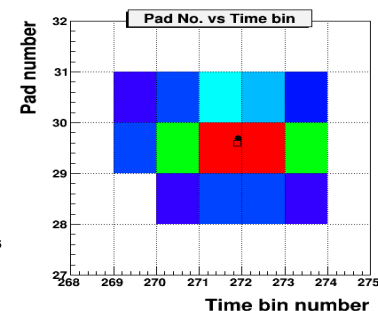
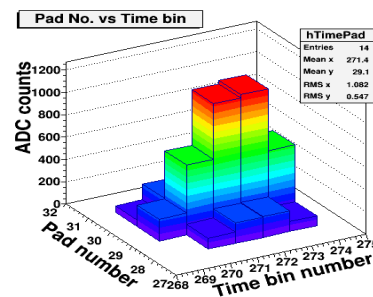
Workshop on NICA/MPD ECal and Software, April 8-10 2019,
Tsinghua University, Beijing, China



Higher School of Economics group presentation

<http://indico.jinr.ru/conferenceDisplay.py?confId=573>

Generative models for
detector response
simulation - TPC



POSSIBLE APPLICATION AREAS OF MACHINE LEARNING TECHNIQUES AT MPD/NICA
EXPERIMENTANDEVALUATION OF THEIR IMPLEMENTATION PROSPECTS IN DISTRIBUTED COMPUTING
ENVIRONMENT, D.A. Zinchenko, E.G. Nikonov, A.I. Zinchenko, VIII International Conference "Distributed
Computing and Grid-technologies in Science and Education" (GRID 2018), Dubna, Moscow region, Russia,
September 10 -14, 2018 , <http://ceur-ws.org/Vol-2267>, 615-619



Future developments



- MPD TPC digitization and cluster finding are rather CPU-intensive – parallel processing (GPUs, OpenMP), generative models
- Detector alignment framework is required