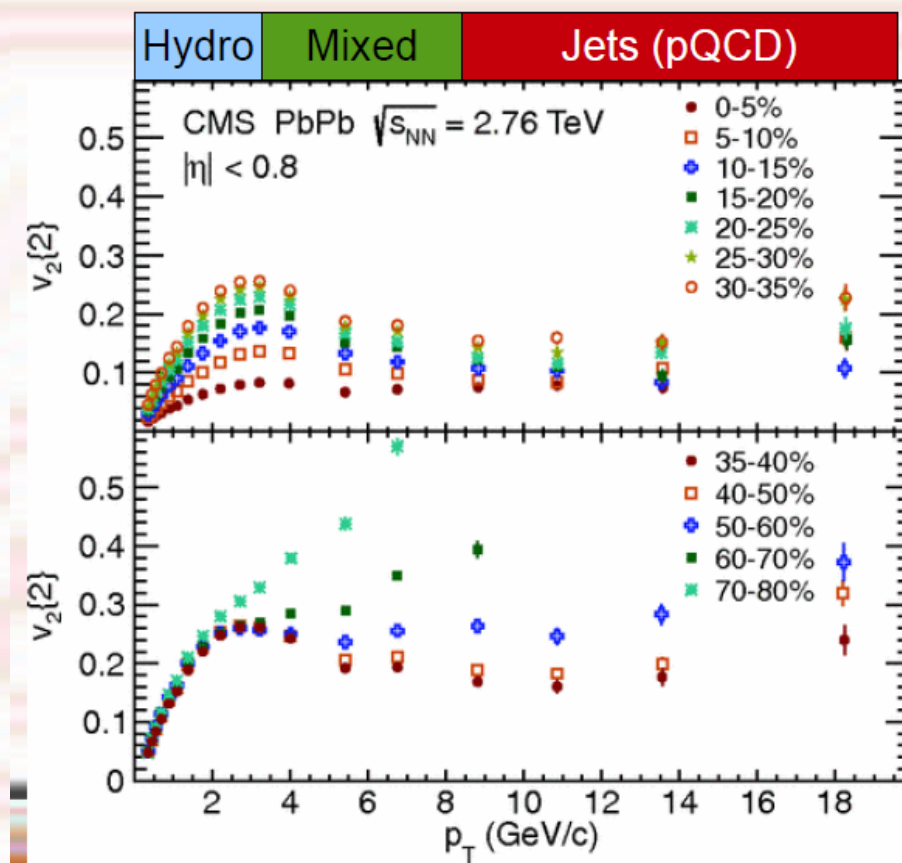
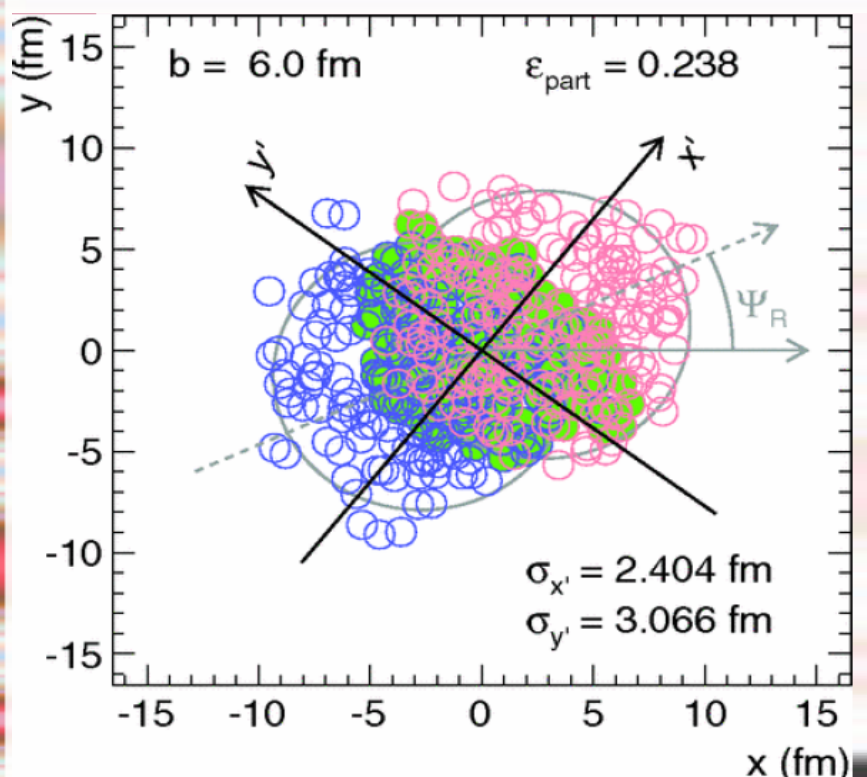


Hydrodynamics simulations with GPU

**Marcin Słodkowski
Heavy Ion Reaction Group
Faculty of Physics
Warsaw University of Technology**

Scientific objectives

- ◆ Initial state fluctuations → efficient event-by-event hydro simulation
- ◆ Jet – QGP interactions → high spatial resolution



Cooperation

- ◆ We created group of developers of hydrodynamic program based on CUDA/GPU
- ◆ We implemented 2 types of algorithms to solve equations of relativistic hydrodynamic
- ◆ We are collaborating with Faculty of Mathematics and Information Technology at WUT

Our HYDRO group

- ◆ From our Faculty of Physics WUT we have
- ◆ 4 members.
 - ◆ Daniel Kikoła, Patryk Marcinkowski, Marcin Słodkowski, Jan Sikorski
- ◆ From Faculty of Mathematics we have 3 members
 - ◆ Joana Porter-Sobieraj, Bartosz Zygmunt, Sebastian Cygert

Our achievement

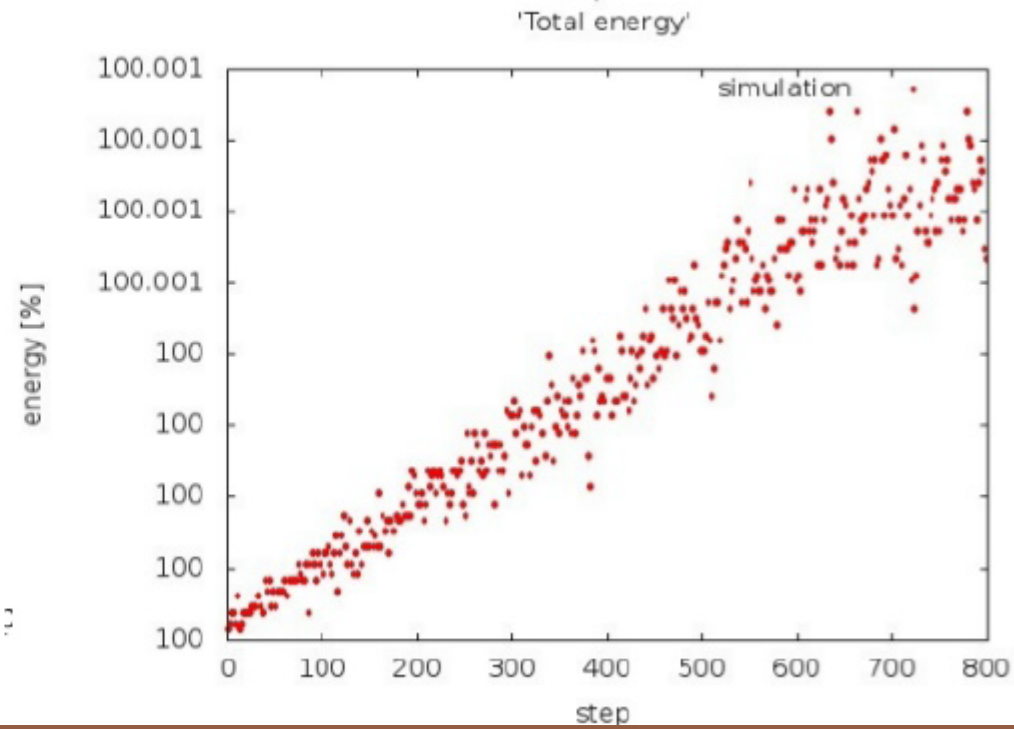
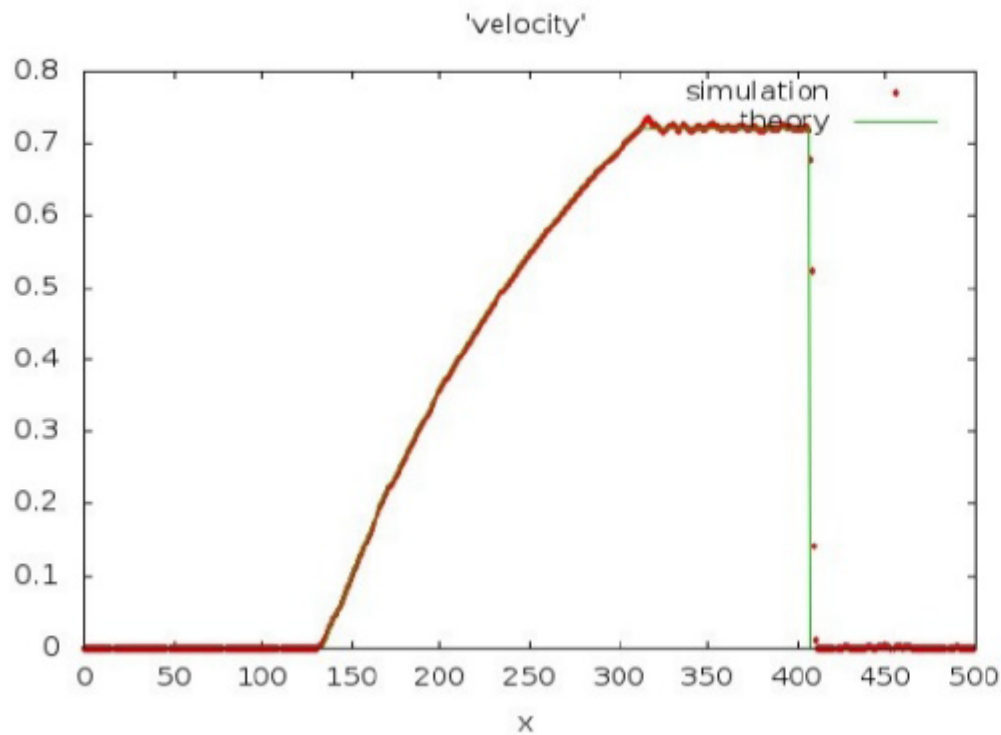
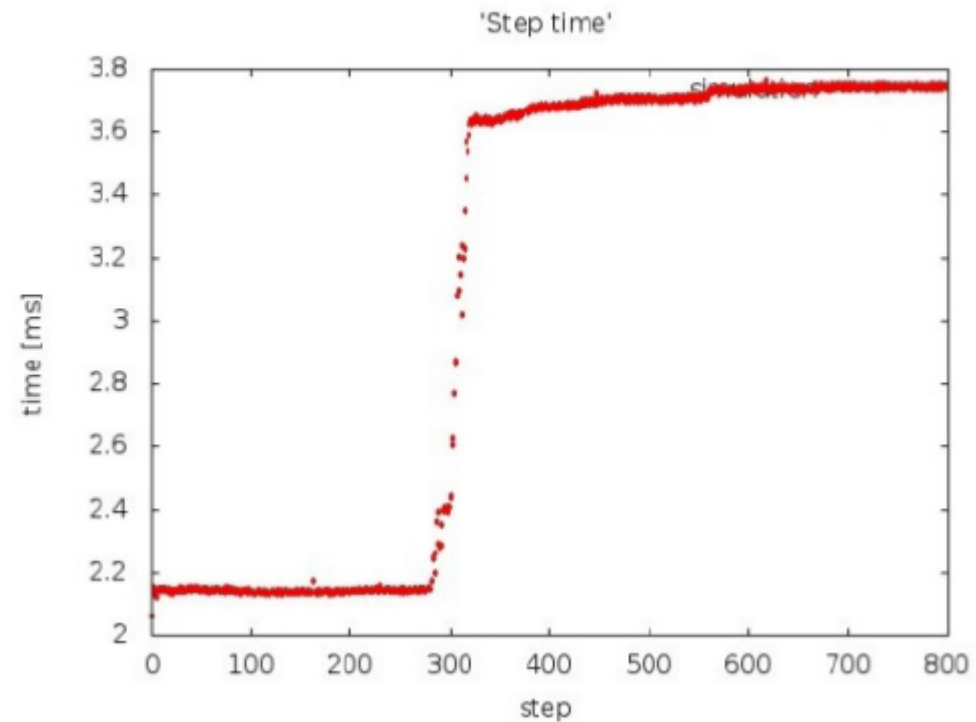
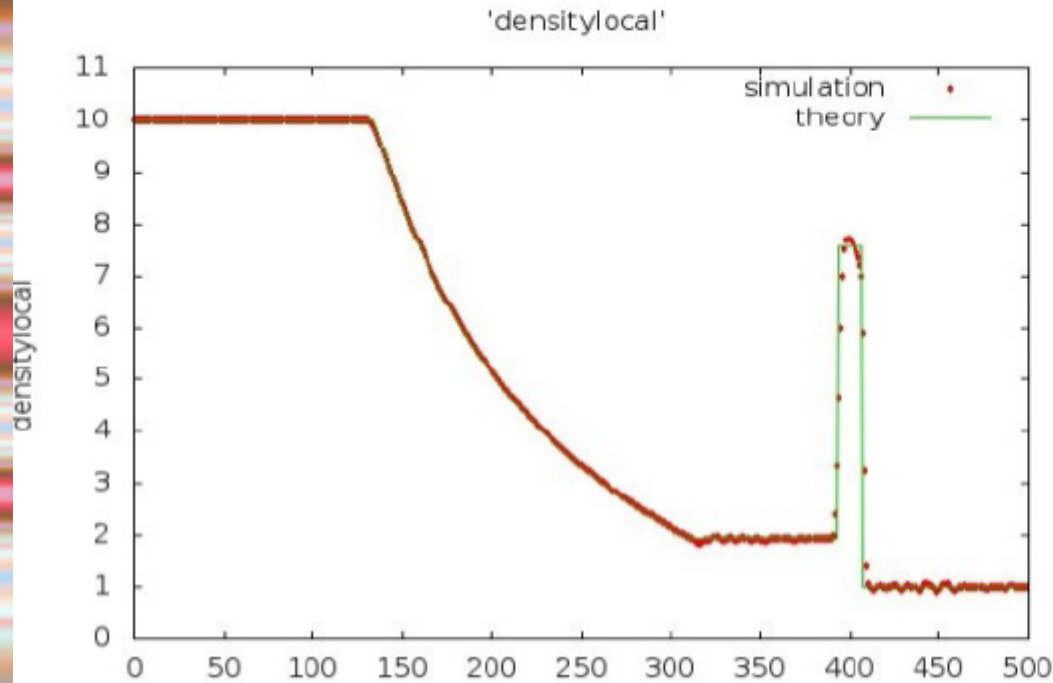
- ◆ Now we are testing our implementation
- ◆ We have already implemented Musta-Force and WENO algorithms
- ◆ We are performing qualitative and performance tests
- ◆ In near future we are planning to implement freeze-out conditions to create hypersurface

Our publications

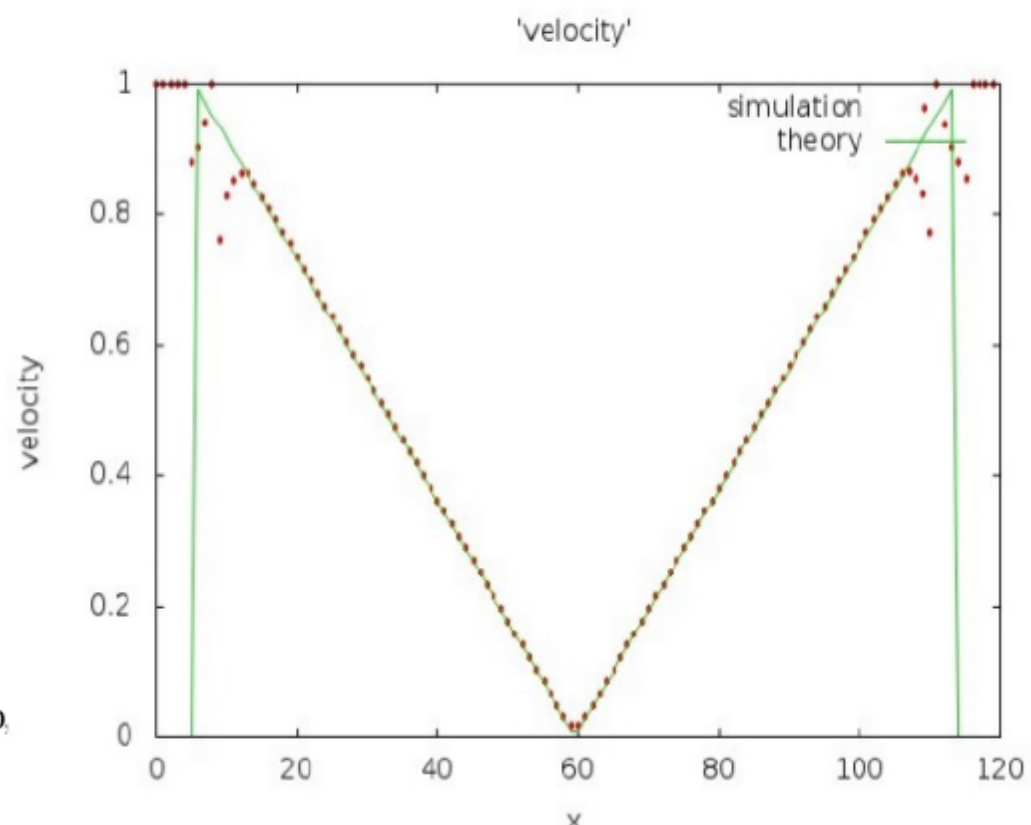
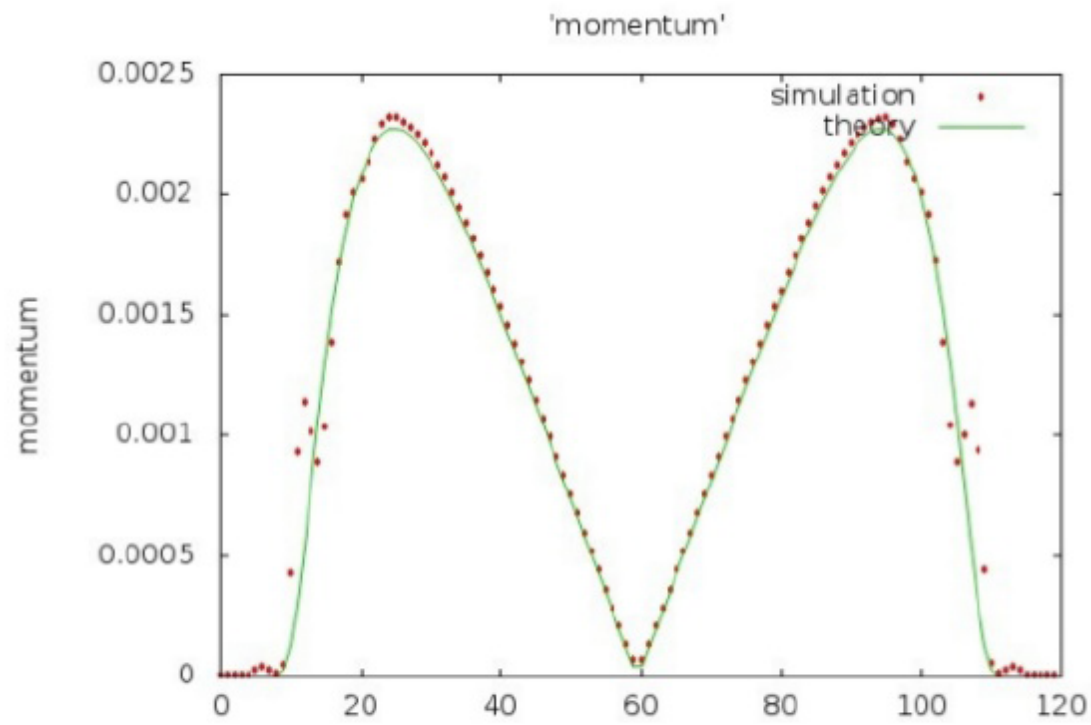
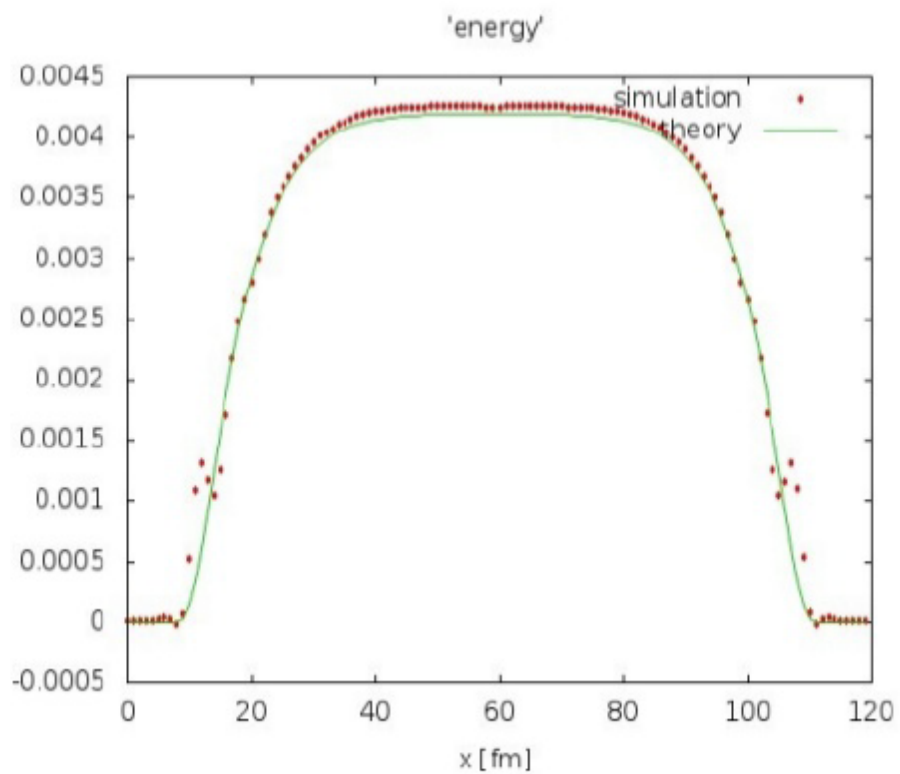
- ◆ Cygert S., Kikoła D., Porter-Sobieraj J., Sikorski J., Słodkowski M. "Using GPUs for Parallel Stencil Computations in Relativistic Hydrodynamic Simulation. In Parallel Processing and Applied Mathematics" Processing and Applied Mathematics (pp. 500-509). Springer Berlin Heidelberg 2014
- ◆ Sikorski J., Cygert S., Porter-Sobieraj J., Słodkowski M., et al. "Relativistic hydrodynamics on graphics processing units" Journal of Physics: Conference Series (Vol. 509, No. 1, p. 012059). IOP Publishing. 2014
- ◆ Cygert, S., Słodkowski, M., et al. "Towards an efficient multi-stage Riemann solver for nuclear physics simulations." Computer Science and Information Systems (FedCSIS), 2013 Federated Conference on (pp. 441-446) 2013

WENO 7

- time per step, stability

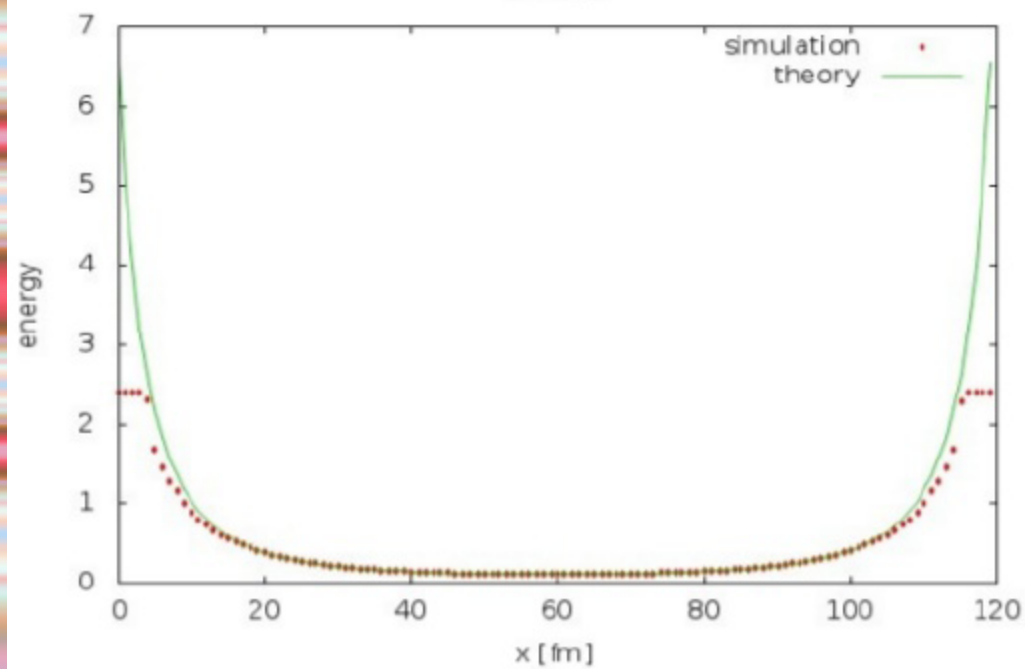


WENO 7

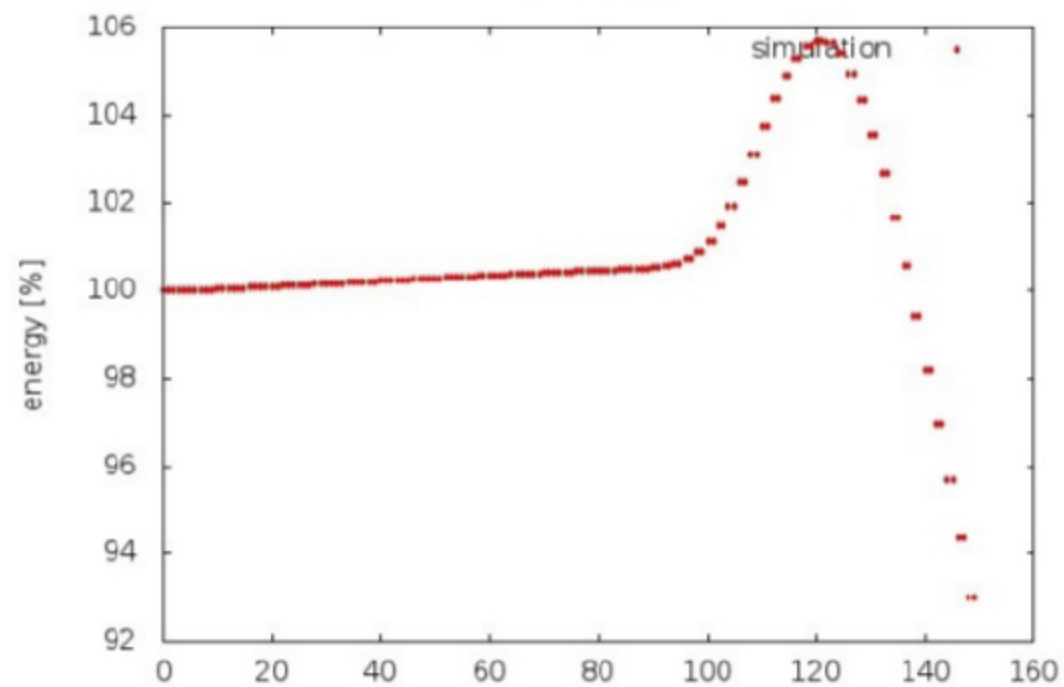


WENO 7

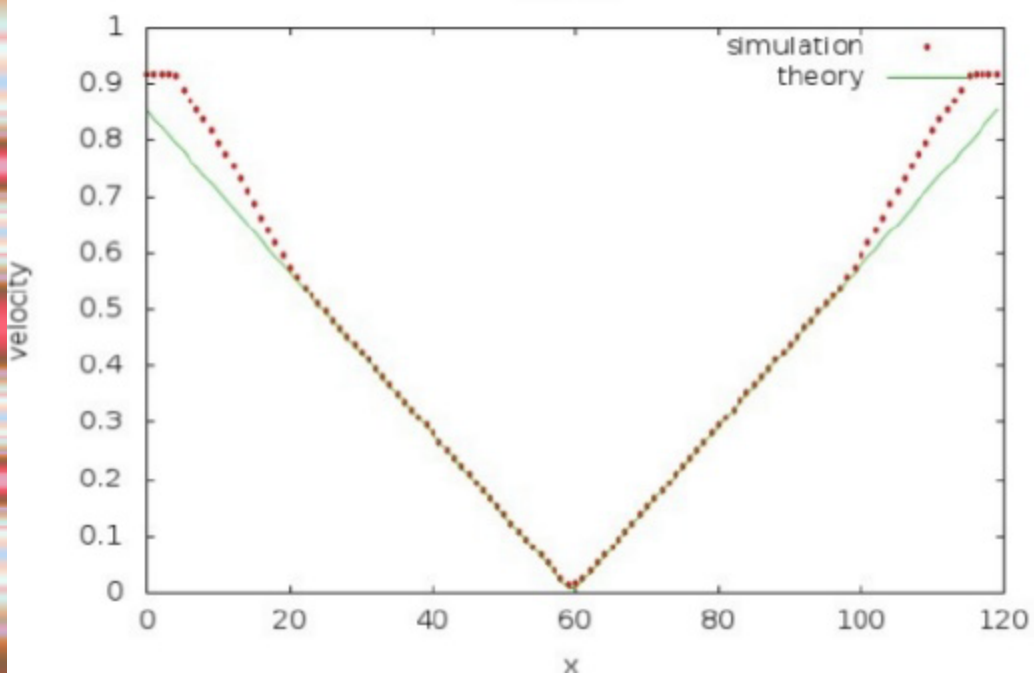
'energy'



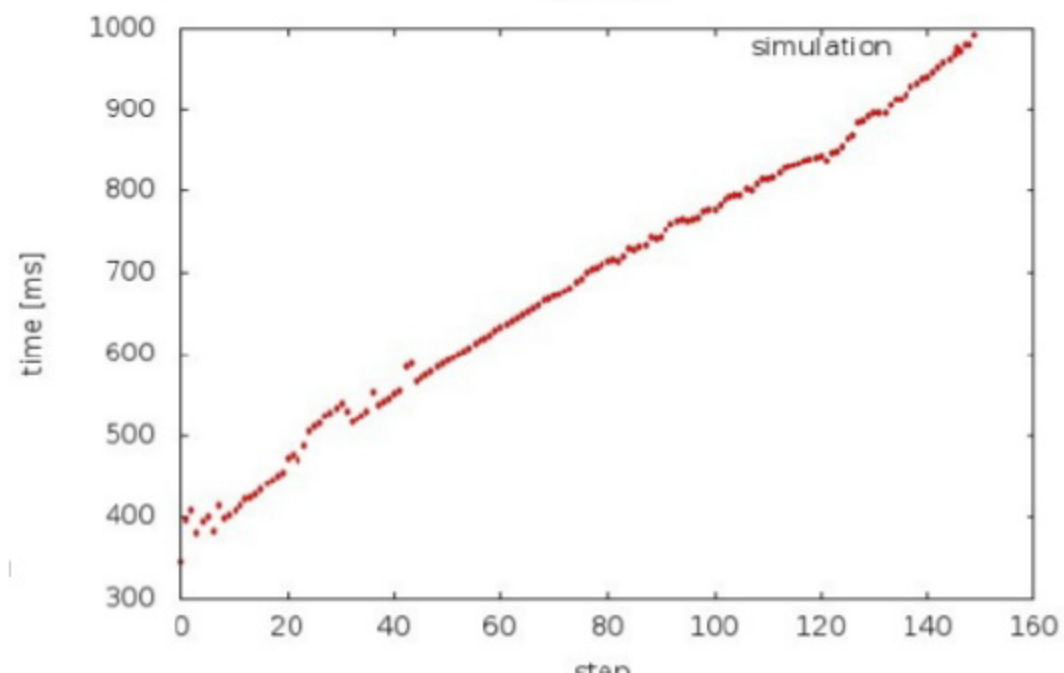
'Total energy'



'velocity'



'Step time'



Thank you for your attentions