About myself

Artem Havryliuk

- 1-st year Master student at Kyiv Academic University
- Twice participant of the IRIS-HEP internship
- Participant of the UKRATOP internship

Project's topic:

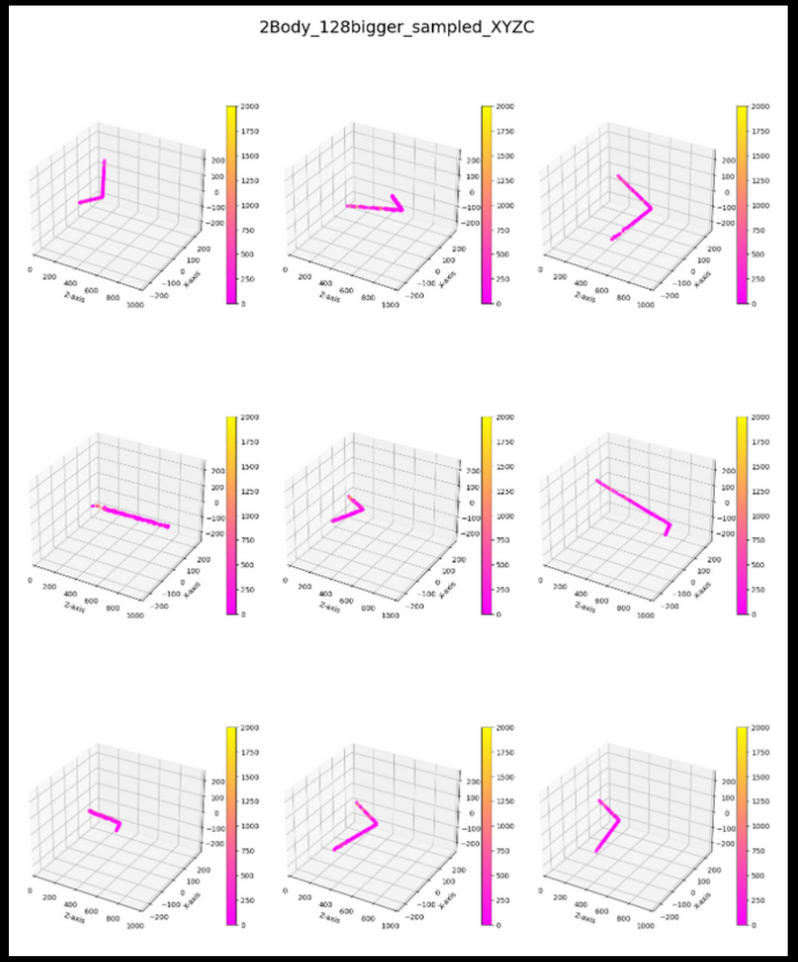
“Using Diffusion Probabilistic Models for generating Tracks from AT-TPC Detector”

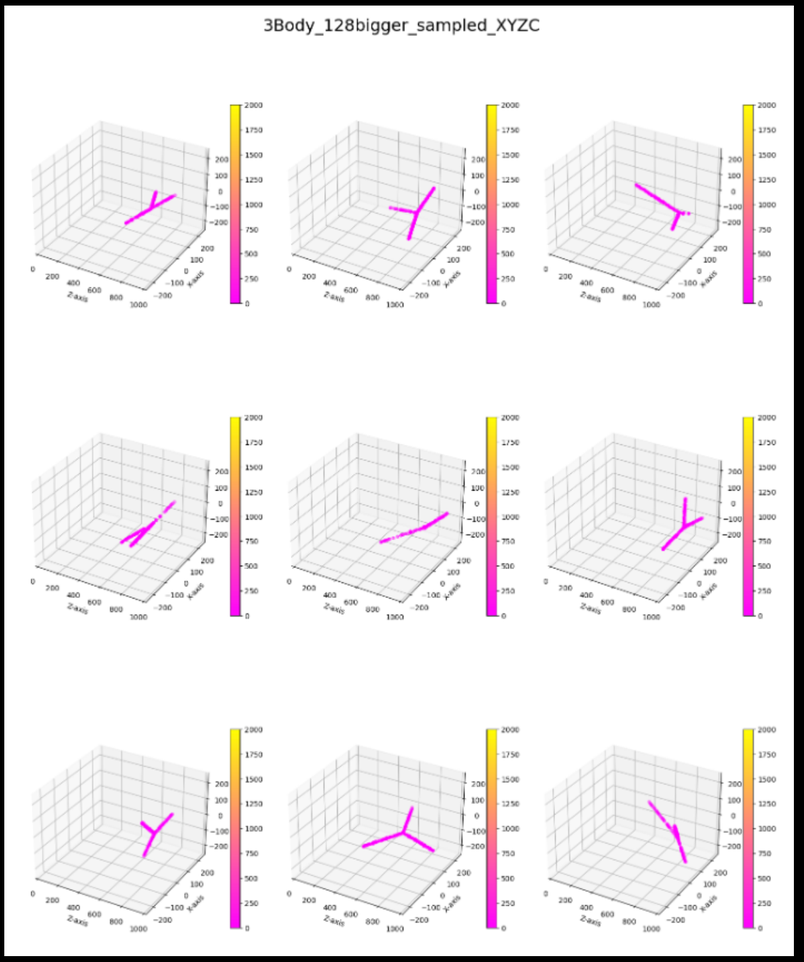
Mentor: Dr. Michelle Kuchera

Artem Havryliuk

AT-TPC

The Active Target Time Projection Chamber (AT-TPC) experiment is a state-of-the-art particle detector used to study nuclear physics.





DPM - Diffusion Probabilistic Models

Forward process: Real Point Cloud of a desired shape -> Noisy Point Cloud

Reverse process: Noisy Point Cloud -> Generated Point Cloud of a desired shape

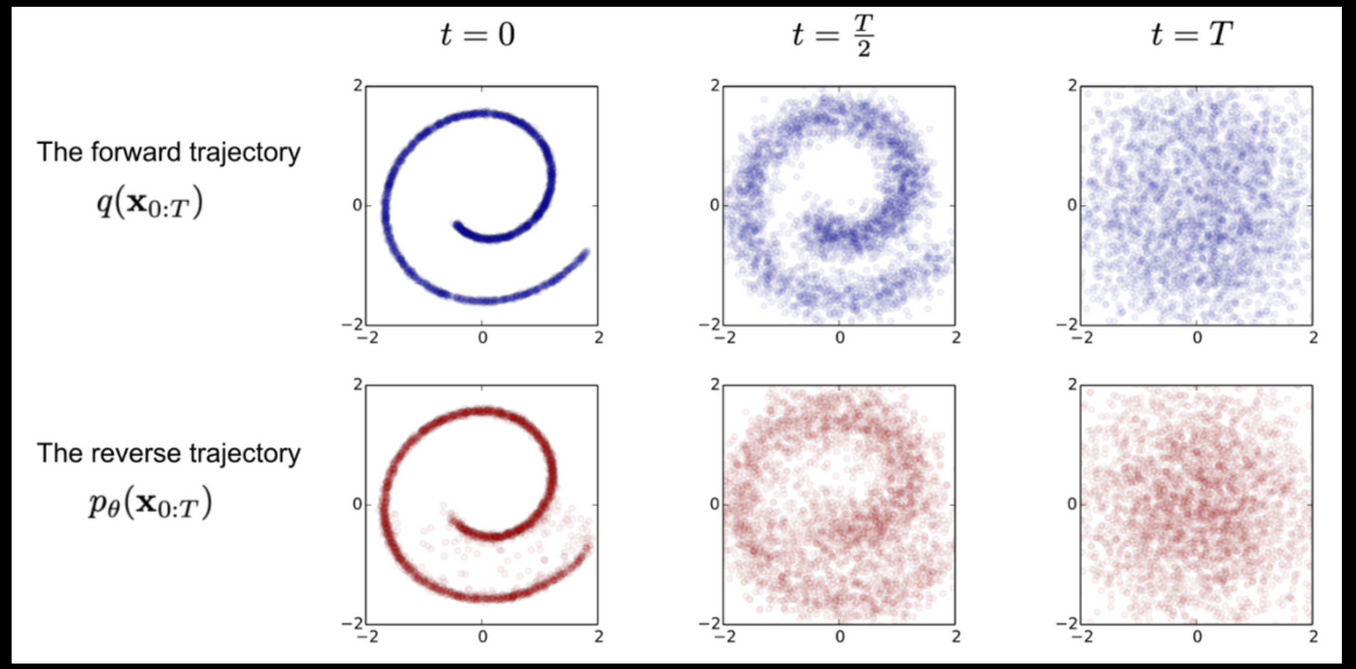


Fig.1 An example of training a diffusion model for modeling a 2D swiss roll data. Image source: [3] Sohl-Dickstein et al., 2015

Learn the reverse diffusion process that transforms the noise distribution to the distribution of a desired shape

A starting point

- Article: Diffusion Probabilistic Models for 3D Point Cloud Generation.

- Preliminary work in Dr. Kuchera’s group

- What is missing: conditions for generation, the existing approach uses different models for different objects, and our goal is to create one model with which it will be possible to generate certain point clouds

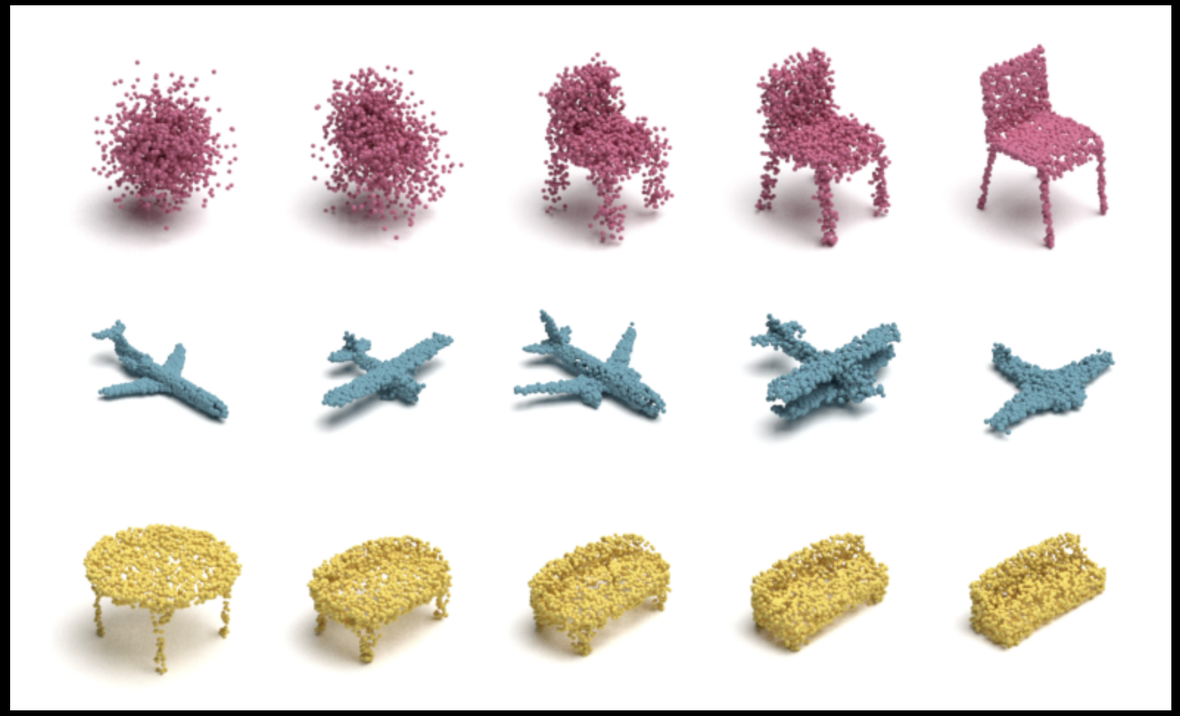
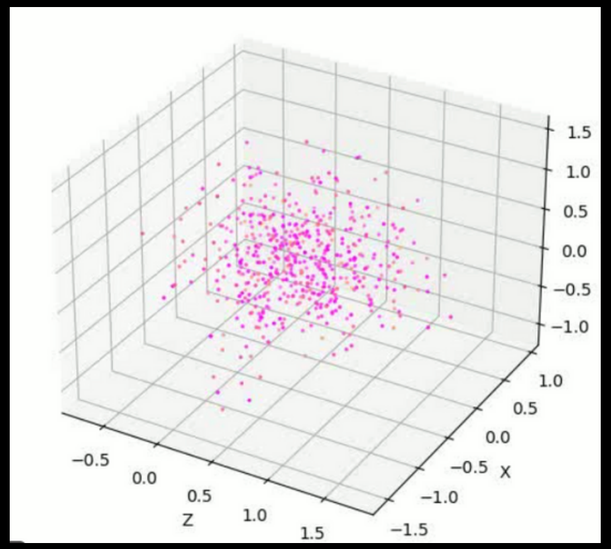
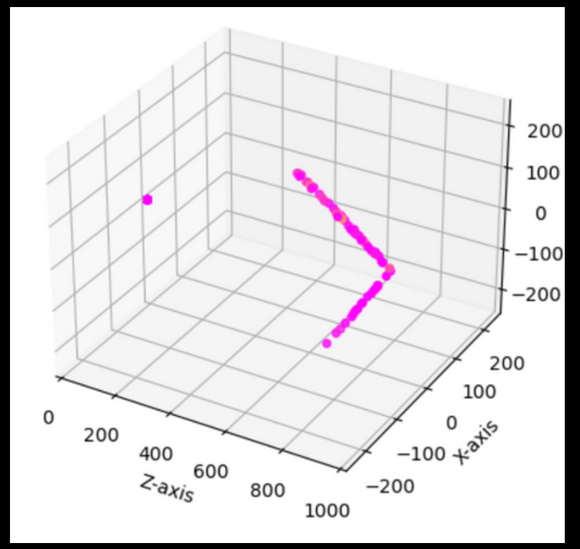


Fig.2 Diffusion Probabilistic Models for 3D Point Cloud Generation

General idea - Create Conditional DPM Generator



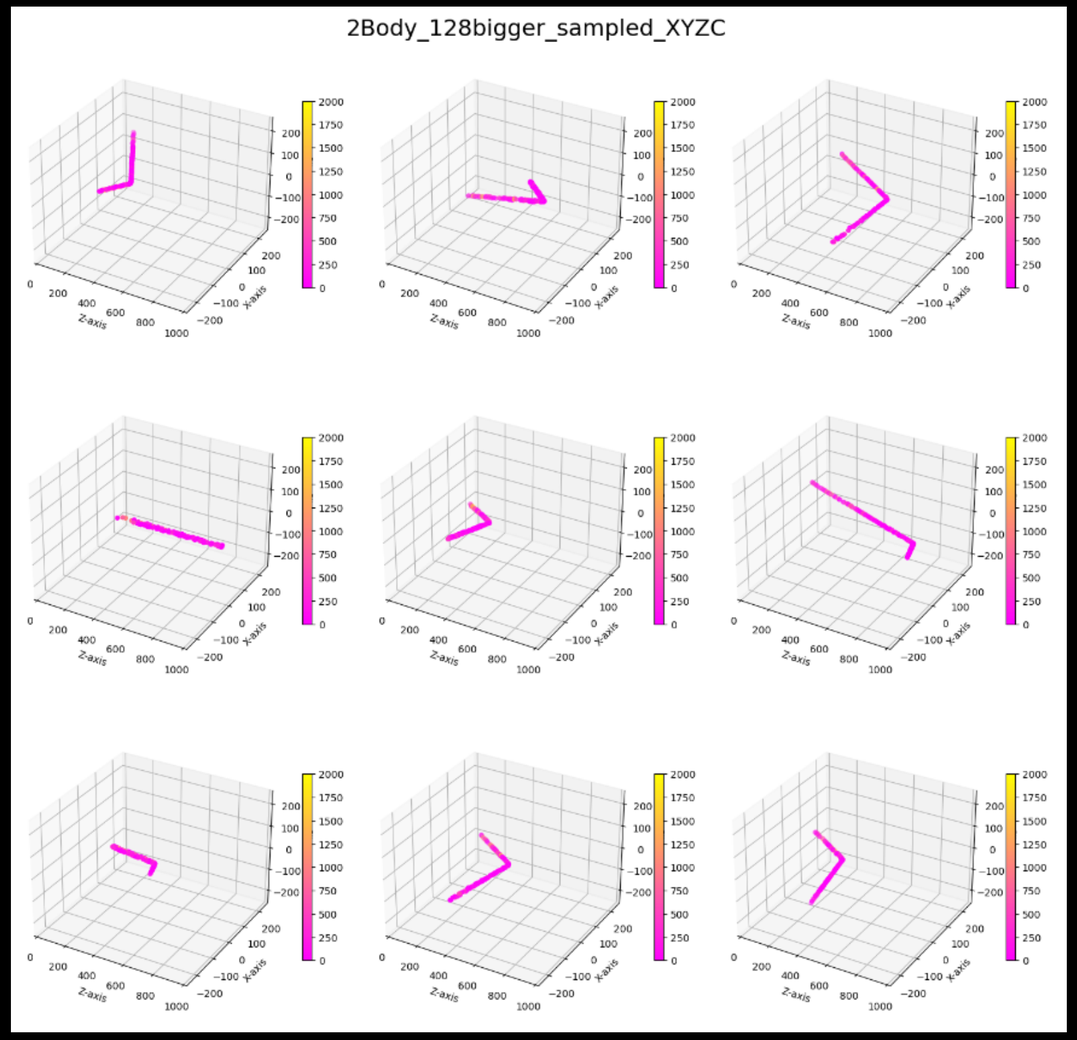
DPM

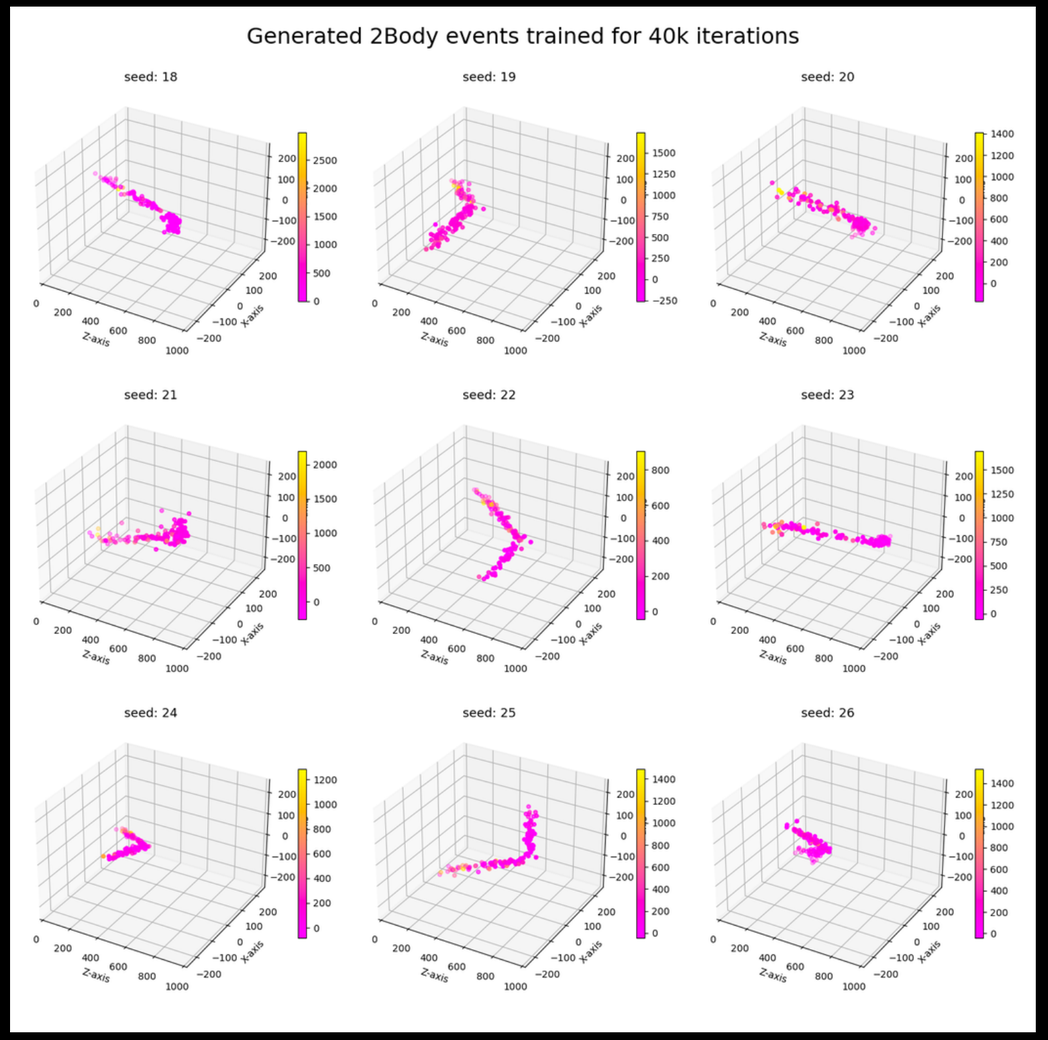


[Conditional encoding]

Event of desired type

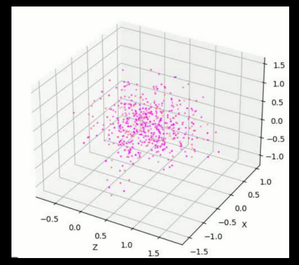
First results: Real 2Body and Generated 2Body Events





Next Steps

- Adding the condition of what type of event to generate



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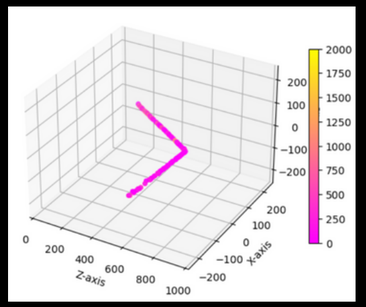
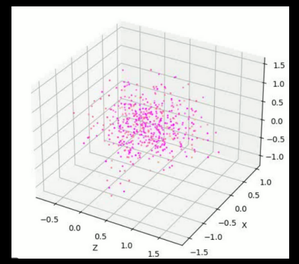
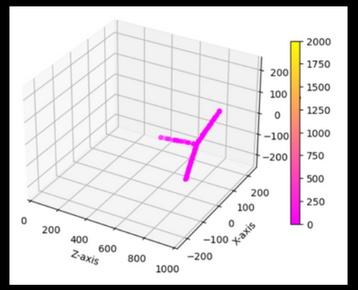


Event type: 2Body

2Body event



DPM



Event type: 3Body

3Body event

Thank you!