

Parameters

Parameter	Value
Batch_size	16
Number of samples	4096
Lr (learning rate)	5e-5
Number of epochs	150
Optimizer	rmsprop
Dist_ae (reconstruction loss function for autoencoding)	L1
Gen_iterations_limit	25
Diter_1	100
Giter_1	1
Diter_2	5
Giter_2	1
Sampled Cube Edge	128
Test Cube Edge	512

Parameter	Value
Nz (embedded space channels)	32
Lambda_AE_X & Y	8
Lambda_rg	16
Sigma list	[1.0, 2.0, 4.0, 8.0, 16.0]
Minimum variance estimated	1e-30
Left_clamp	-0.01
Right_clamp	0.01
Redshift_raw_file	fields_z=0.0.hdf5
Redshift_file	redshift0_4th_root.h5
Inverse transform	4_root
Slurm	10180061

Architectures — Changes in bold & italic>

• Encoder

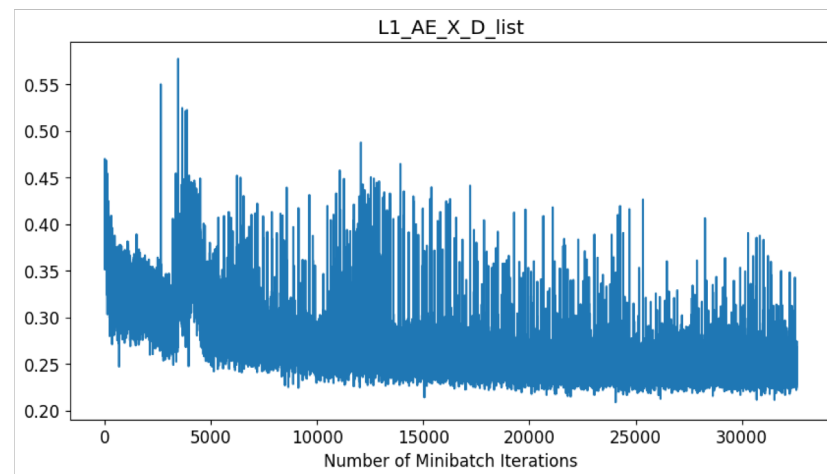
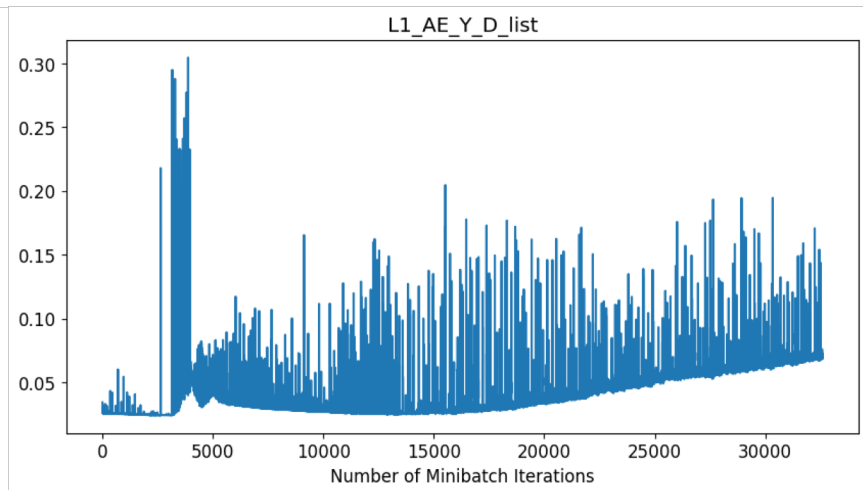
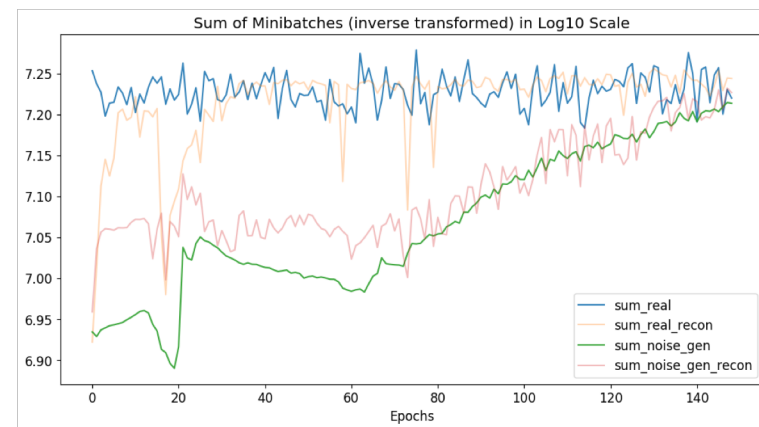
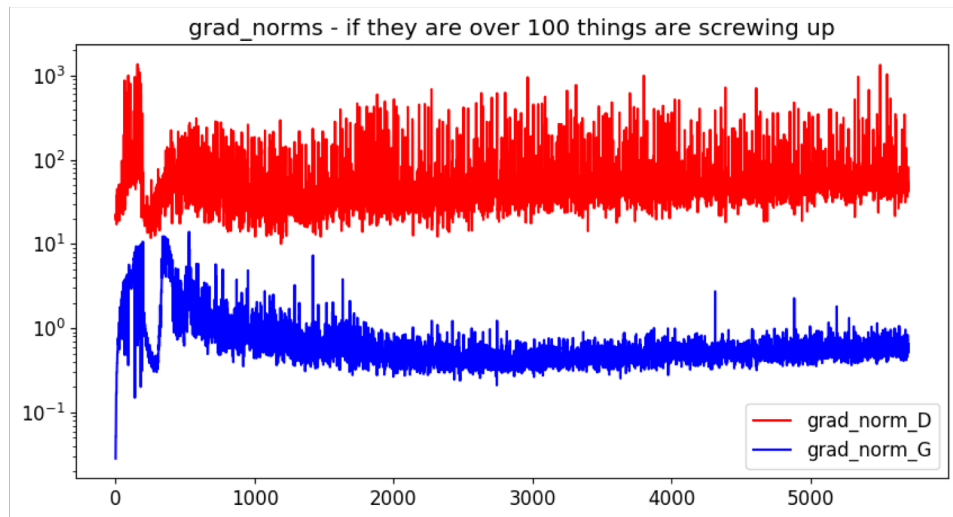
```
(encoder): Encoder(  
  (conv_net): Sequential(  
    (conv_1): Conv3d(1, 2, kernel_size=(4, 4, 4), stride=(2, 2, 2),  
padding=(1, 1, 1), bias=False)  
    (batchnorm_1): BatchNorm3d(2, eps=1e-05, momentum=0.1,  
affine=True, track_running_stats=True)  
    (leakyrelu_1): LeakyReLU(negative_slope=0.01, inplace)  
    (conv_2): Conv3d(2, 4, kernel_size=(4, 4, 4), stride=(2, 2, 2),  
padding=(1, 1, 1), bias=False)  
    (batchnorm_2): BatchNorm3d(4, eps=1e-05, momentum=0.1,  
affine=True, track_running_stats=True)  
    (leakyrelu_2): LeakyReLU(negative_slope=0.01, inplace)  
    (conv_3): Conv3d(4, 8, kernel_size=(4, 4, 4), stride=(2, 2, 2),  
padding=(1, 1, 1), bias=False)  
    (batchnorm_3): BatchNorm3d(8, eps=1e-05, momentum=0.1,  
affine=True, track_running_stats=True)  
    (leakyrelu_3): LeakyReLU(negative_slope=0.01, inplace)  
    (conv_4): Conv3d(8, 16, kernel_size=(4, 4, 4), stride=(2, 2, 2),  
padding=(1, 1, 1), bias=False)  
  )  
)
```

• Decoder

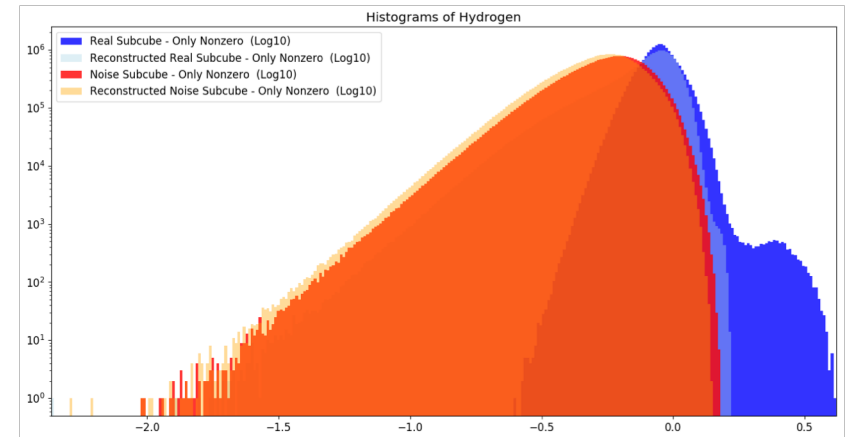
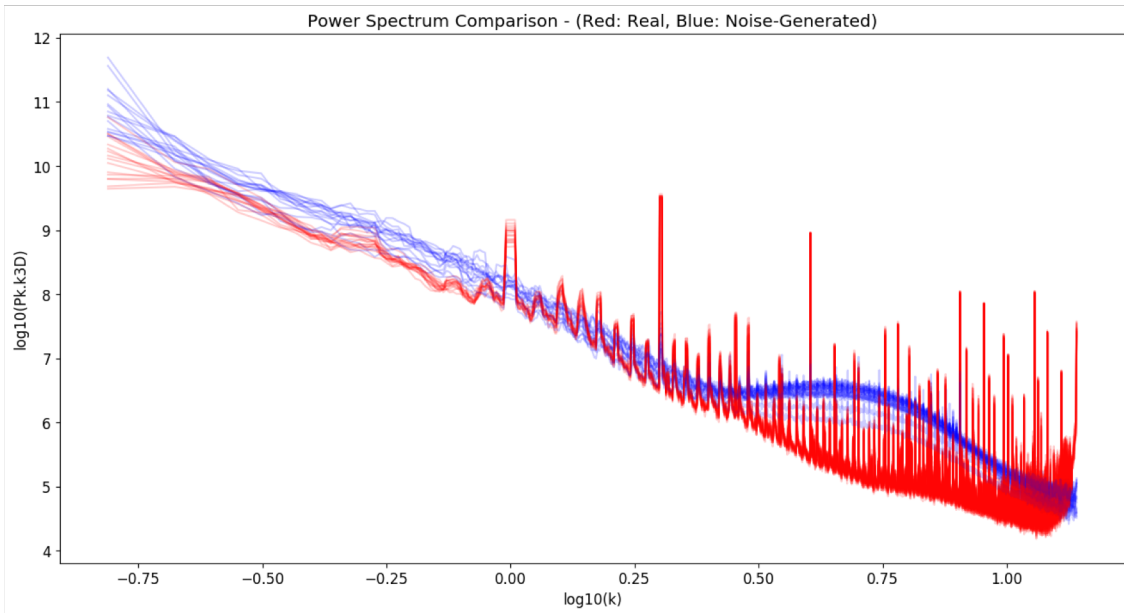
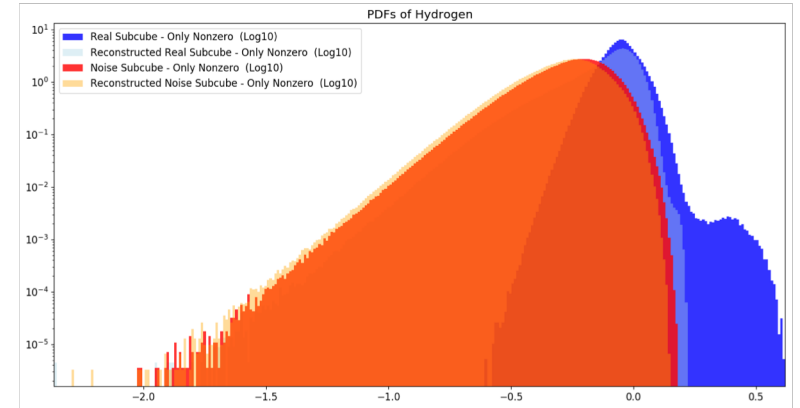
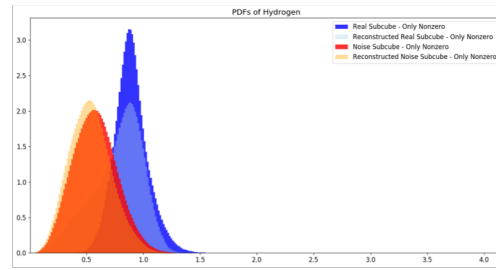
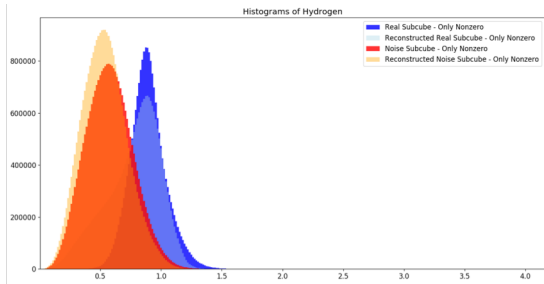
```
(decoder): Decoder(  
  (deconv_net): Sequential(  
    (deconv_1): ConvTranspose3d(16, 8, kernel_size=(4, 4, 4), stride=(2, 2, 2), padding=(1, 1, 1), bias=False)  
    (batchnorm_1): BatchNorm3d(8, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
    (leakyrelu_1): LeakyReLU(negative_slope=0.01, inplace)  
    (deconv_2): ConvTranspose3d(8, 4, kernel_size=(4, 4, 4), stride=(2, 2, 2), padding=(1, 1, 1), bias=False)  
    (batchnorm_2): BatchNorm3d(4, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
    (leakyrelu_2): LeakyReLU(negative_slope=0.01, inplace)  
    (deconv_3): ConvTranspose3d(4, 2, kernel_size=(4, 4, 4), stride=(2, 2, 2), padding=(1, 1, 1), bias=False)  
    (batchnorm_3): BatchNorm3d(2, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
    (leakyrelu_3): LeakyReLU(negative_slope=0.01, inplace)  
    (conv_4): ConvTranspose3d(2, 1, kernel_size=(4, 4, 4), stride=(2, 2, 2), padding=(1, 1, 1), bias=False)  
    (relu_4): ReLU(inplace)  
  )  
)
```

Discriminator = Encoder + Decoder | Generator = Decoder

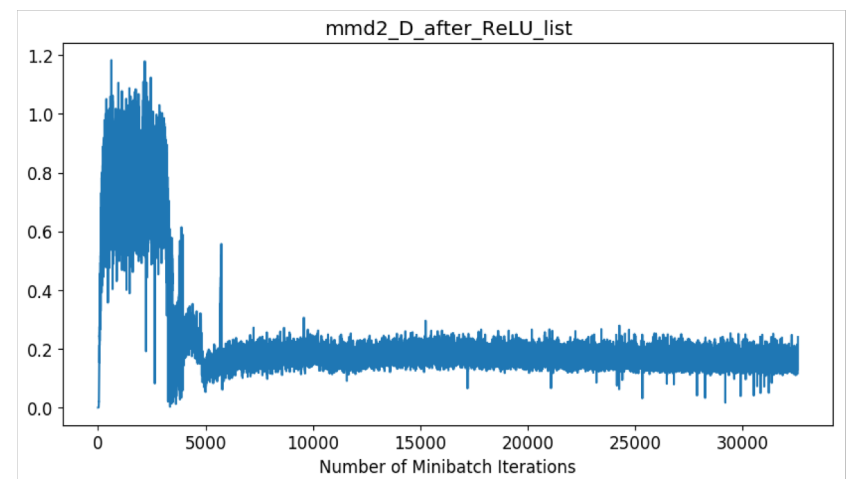
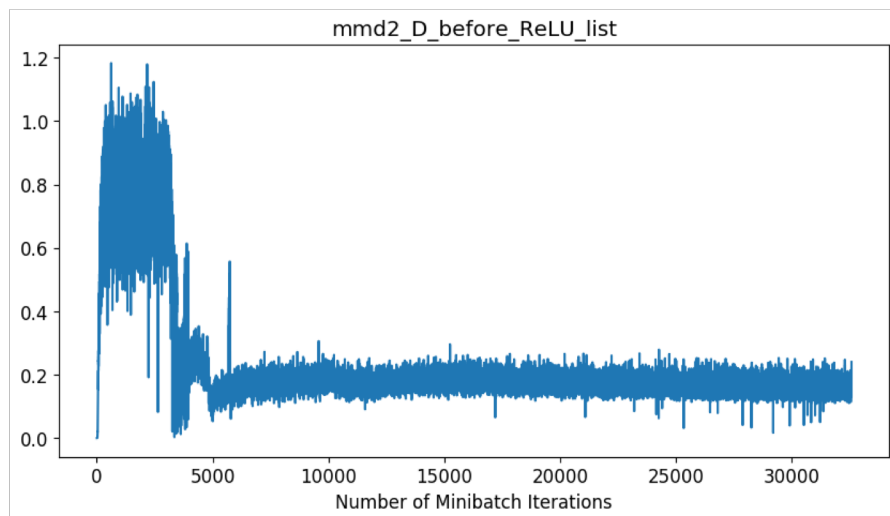
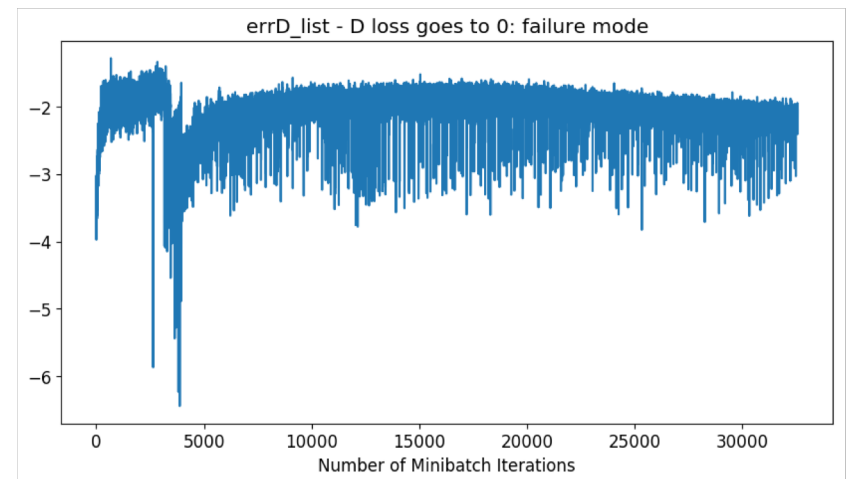
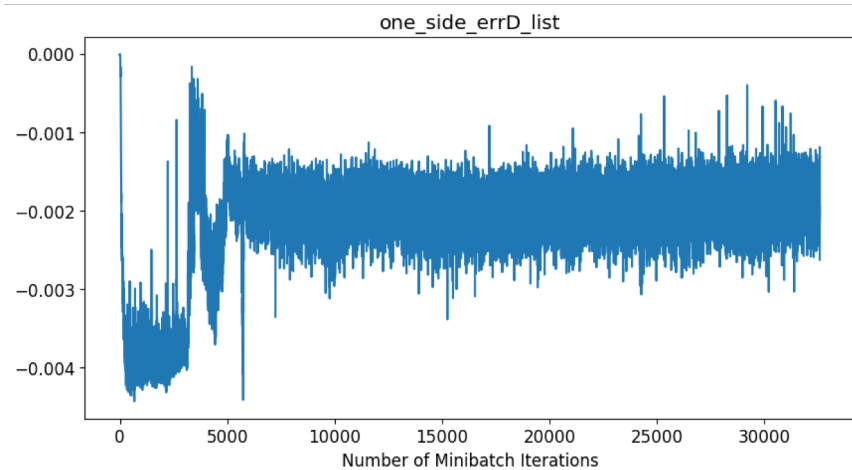
Plots - Training



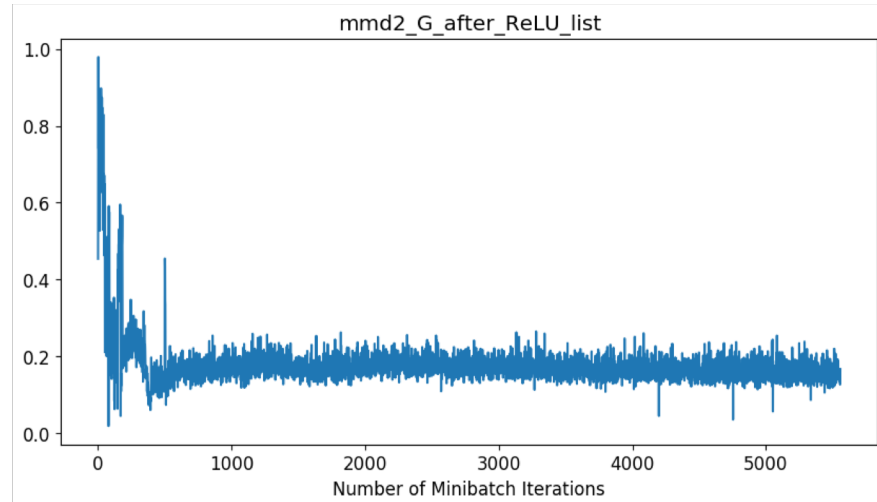
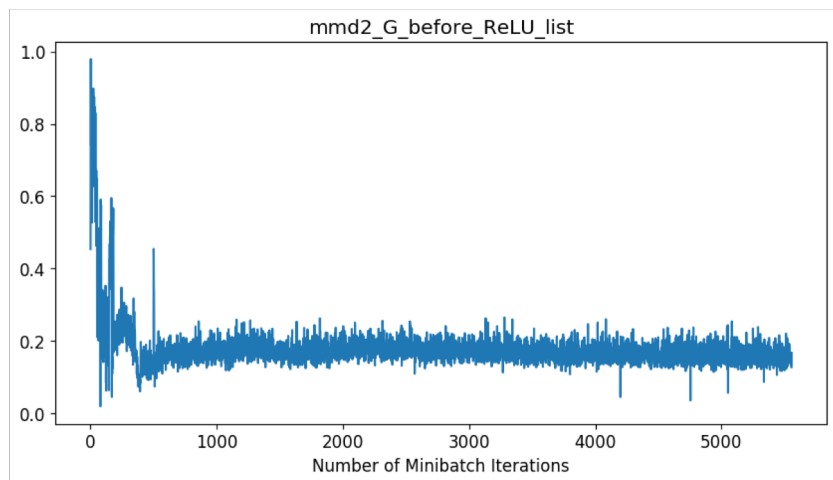
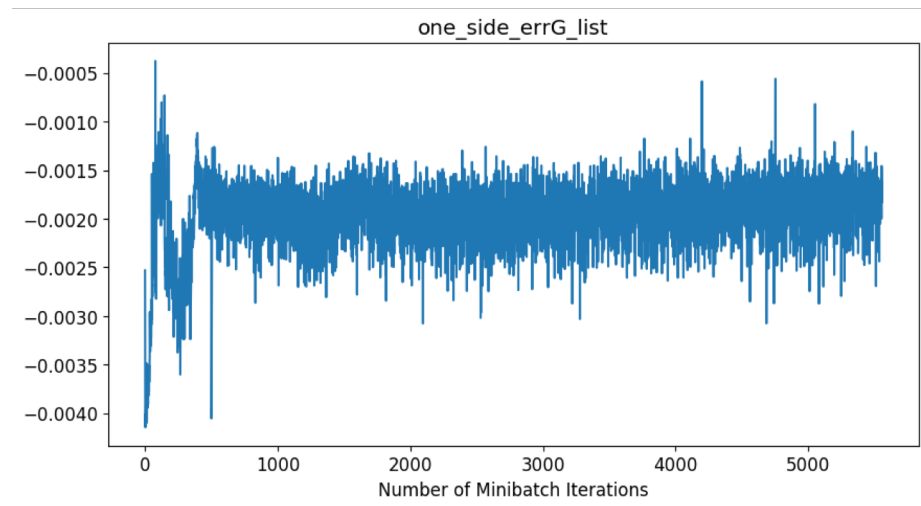
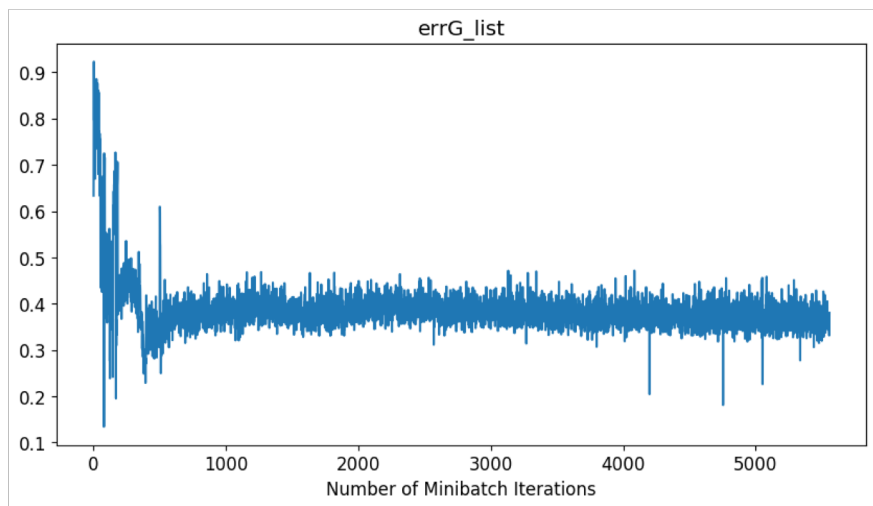
Plots – Matter Distributions



Plots - Discriminator

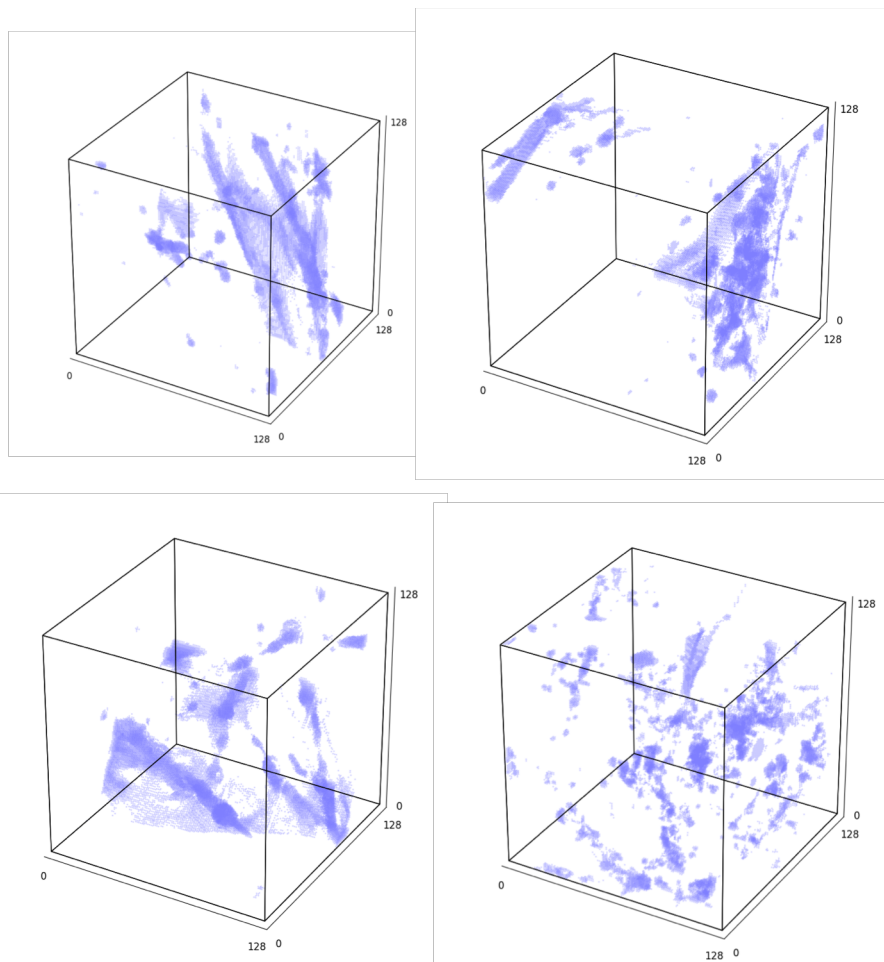


Plots - Generator



3D Plots of Real / Noise Input / AE Real / AE Noise

REAL



NOISE-INPUT GENERATED

Upper Left: Epoch 145, Upper Right: Epoch 140, Lower Left Epoch 135, Lower Right Epoch 130

