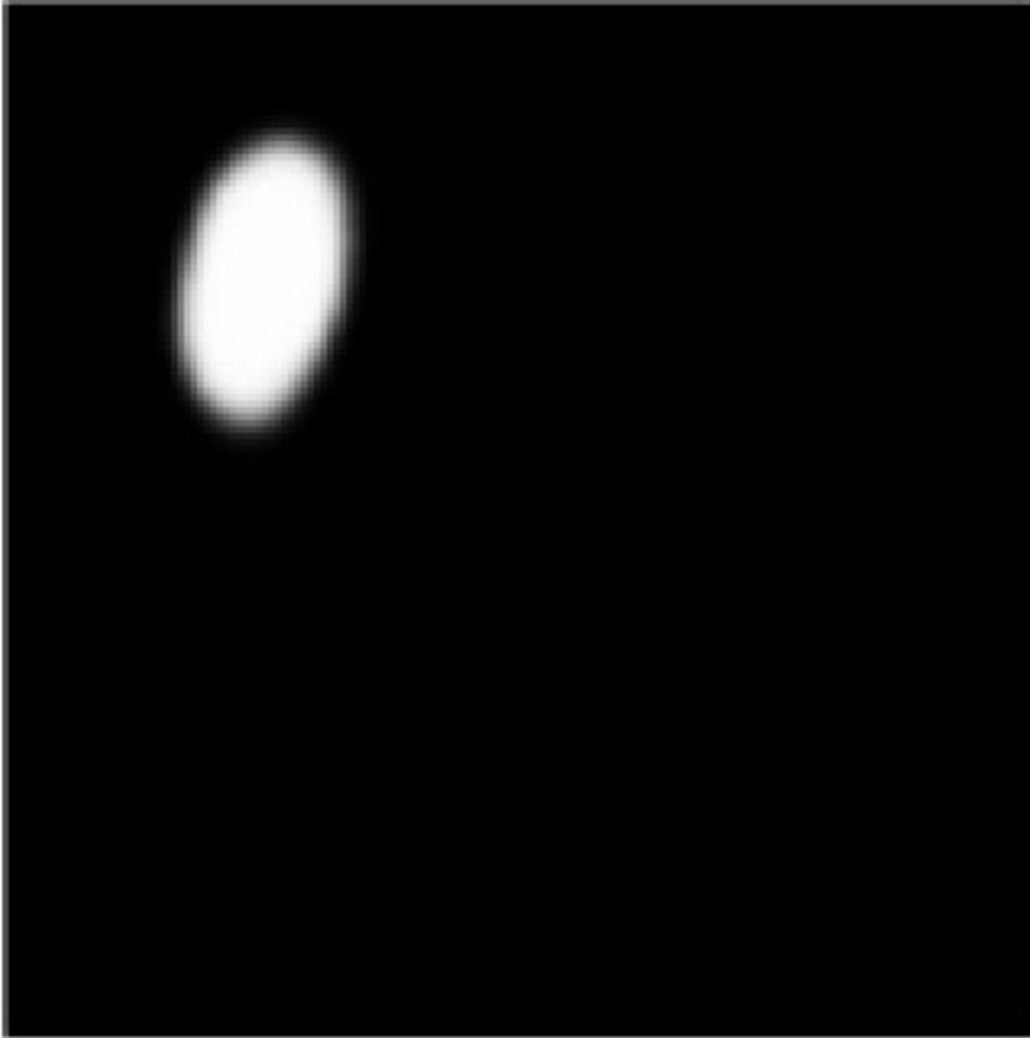


# REAL-WORLD KNOWLEDGE EXTRACTION VIA DISENTANGLED DIMENSIONALITY REDUCTION

Gregor Hartmann (HZB) & Gesa Goetzke (DESY)

*Data compression  
for humans!*

# SMART DATA COMPRESSION



## Desired information:

- Position X and Y
- Rotation
- Scaling

### $\beta$ -VAE: LEARNING BASIC VISUAL CONCEPTS WITH A CONSTRAINED VARIATIONAL FRAMEWORK

**Irina Higgins, Loic Matthey, Arka Pal, Christopher Burgess, Xavier Glorot, Matthew Botvinick, Shakir Mohamed, Alexander Lerchner**

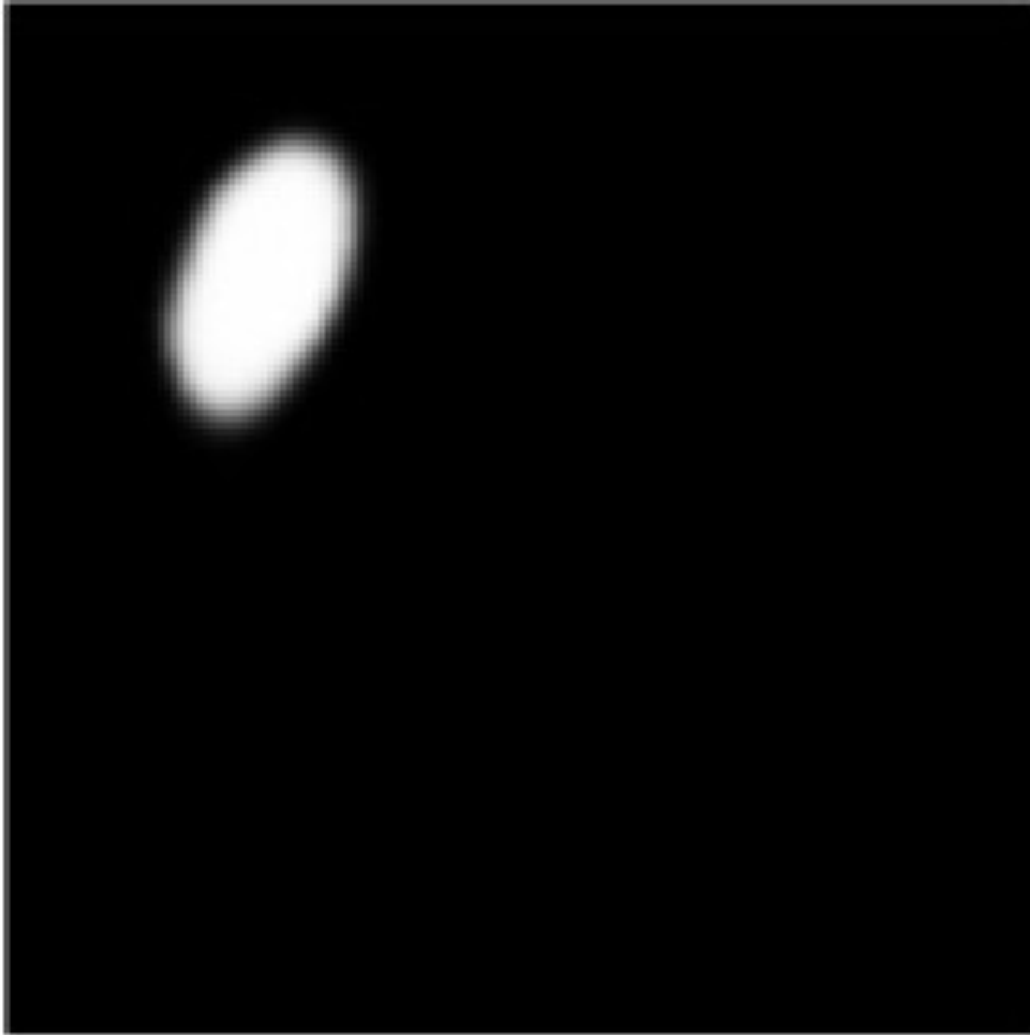
Google DeepMind

{irinah, lmatthey, arkap, cpburgess, glorotx, botvinick, shakir, lerchner}@google.com



Google DeepMind

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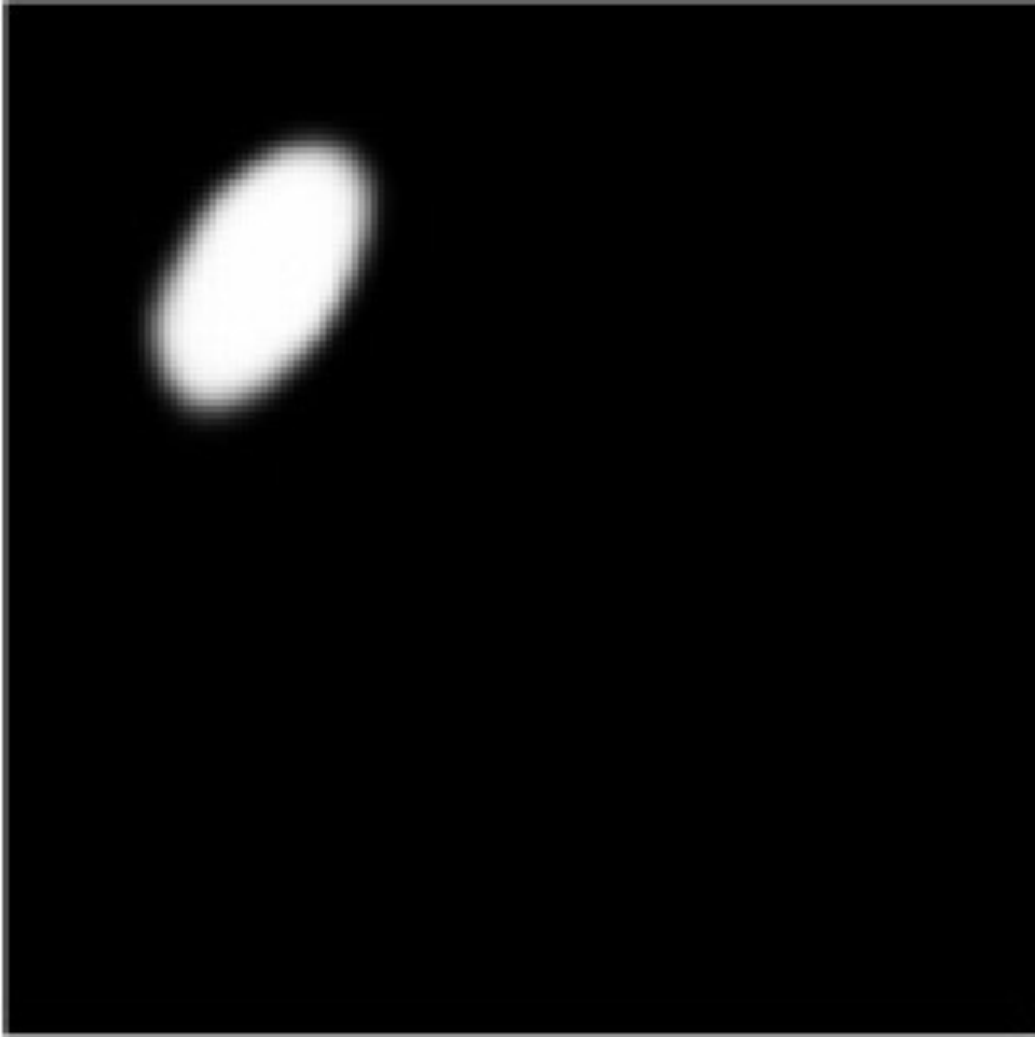
Google DeepMind

{irinah, lmatthey, arkap, cpburgess, glorotx,  
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Google DeepMind

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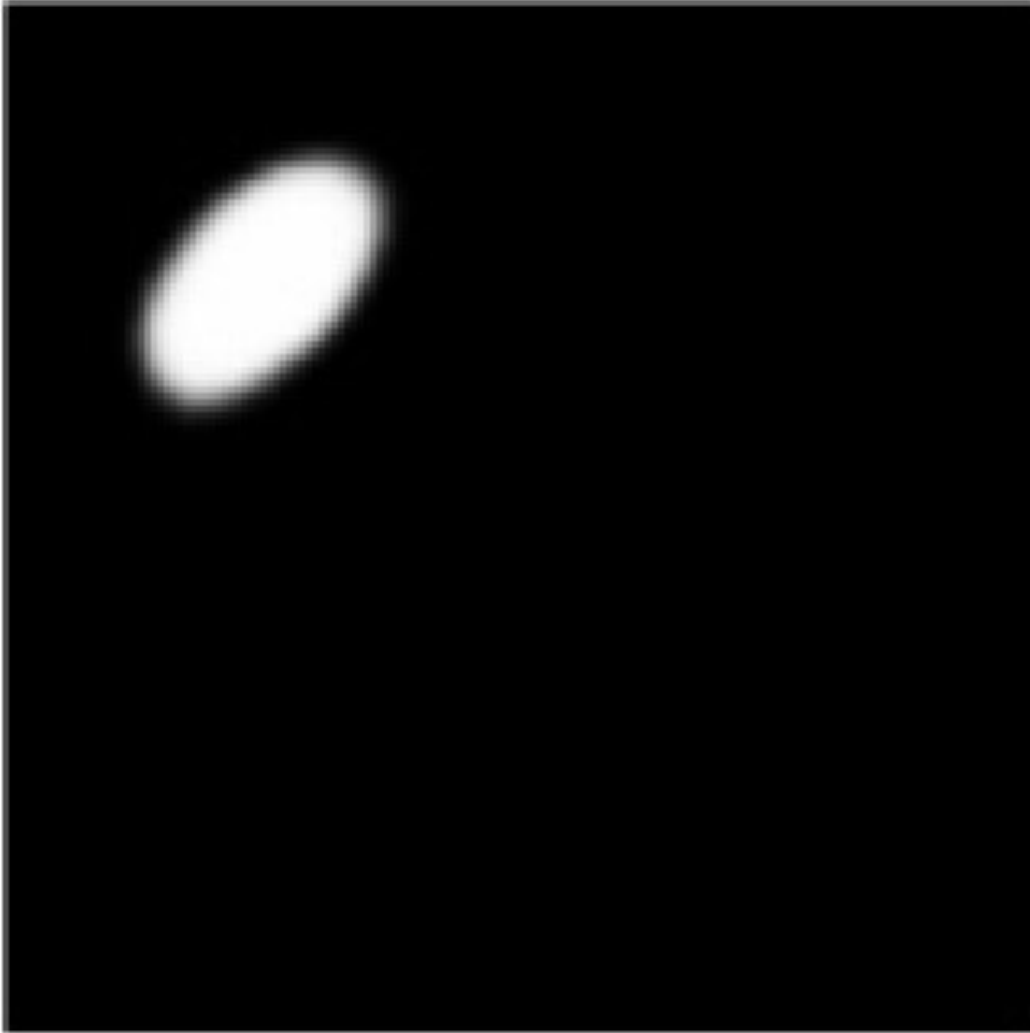
Google DeepMind

{irinah, lmatthey, arkap, cpburgess, glorotx,  
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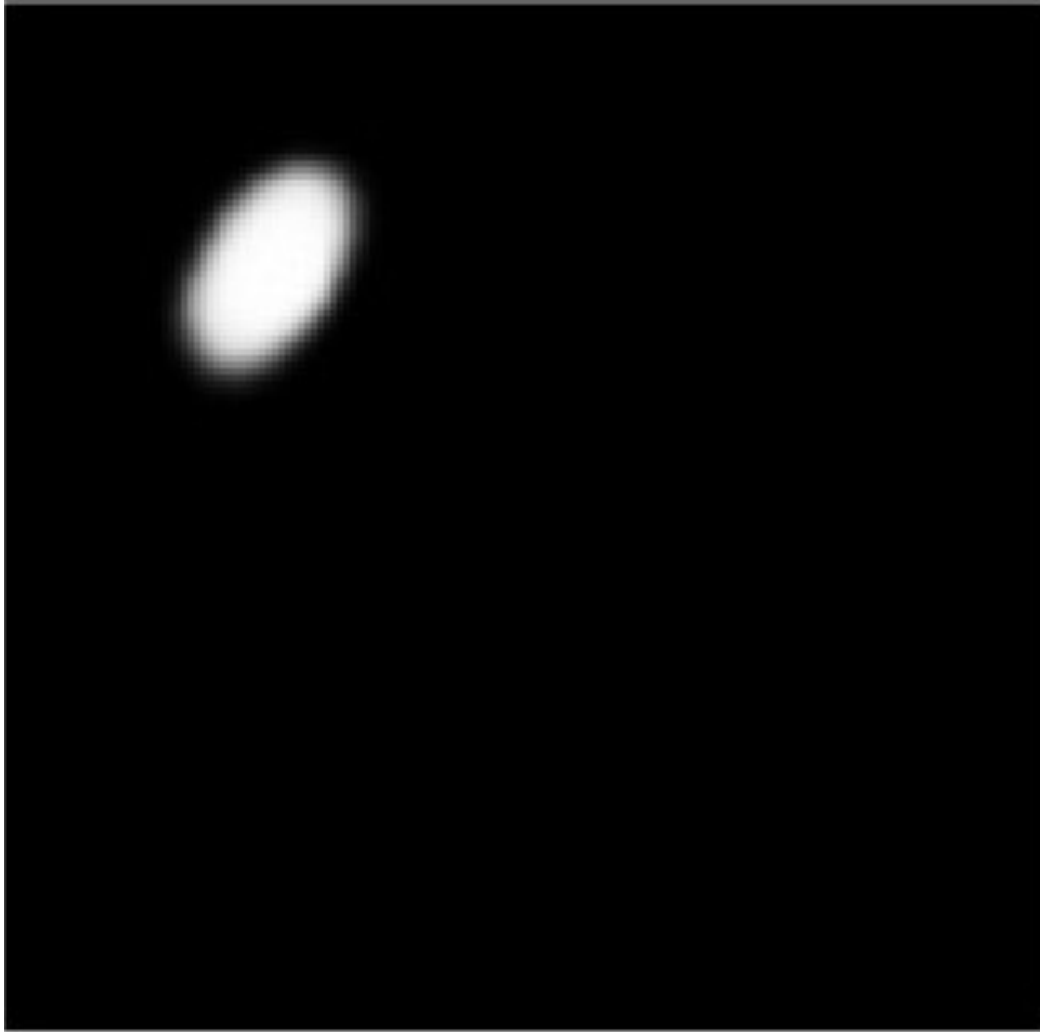
Google DeepMind

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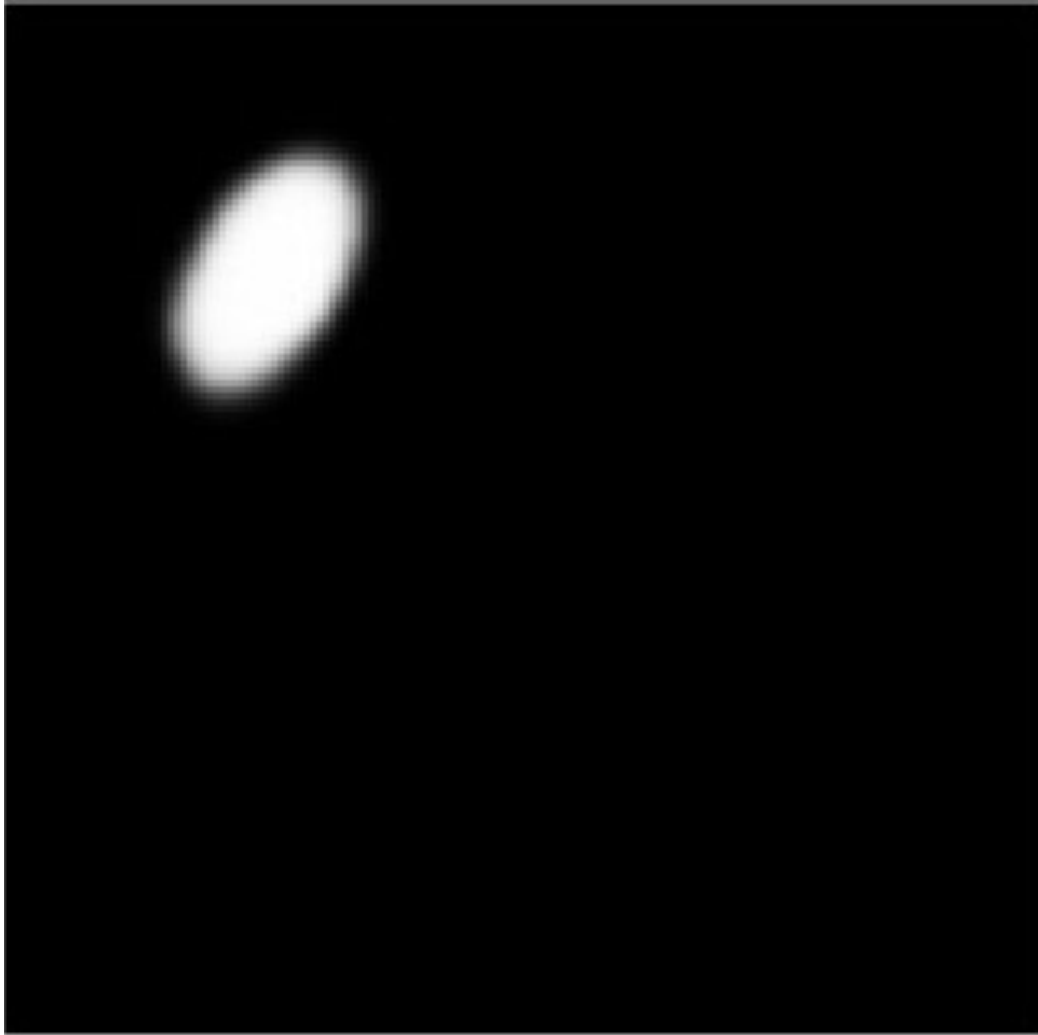
Google DeepMind

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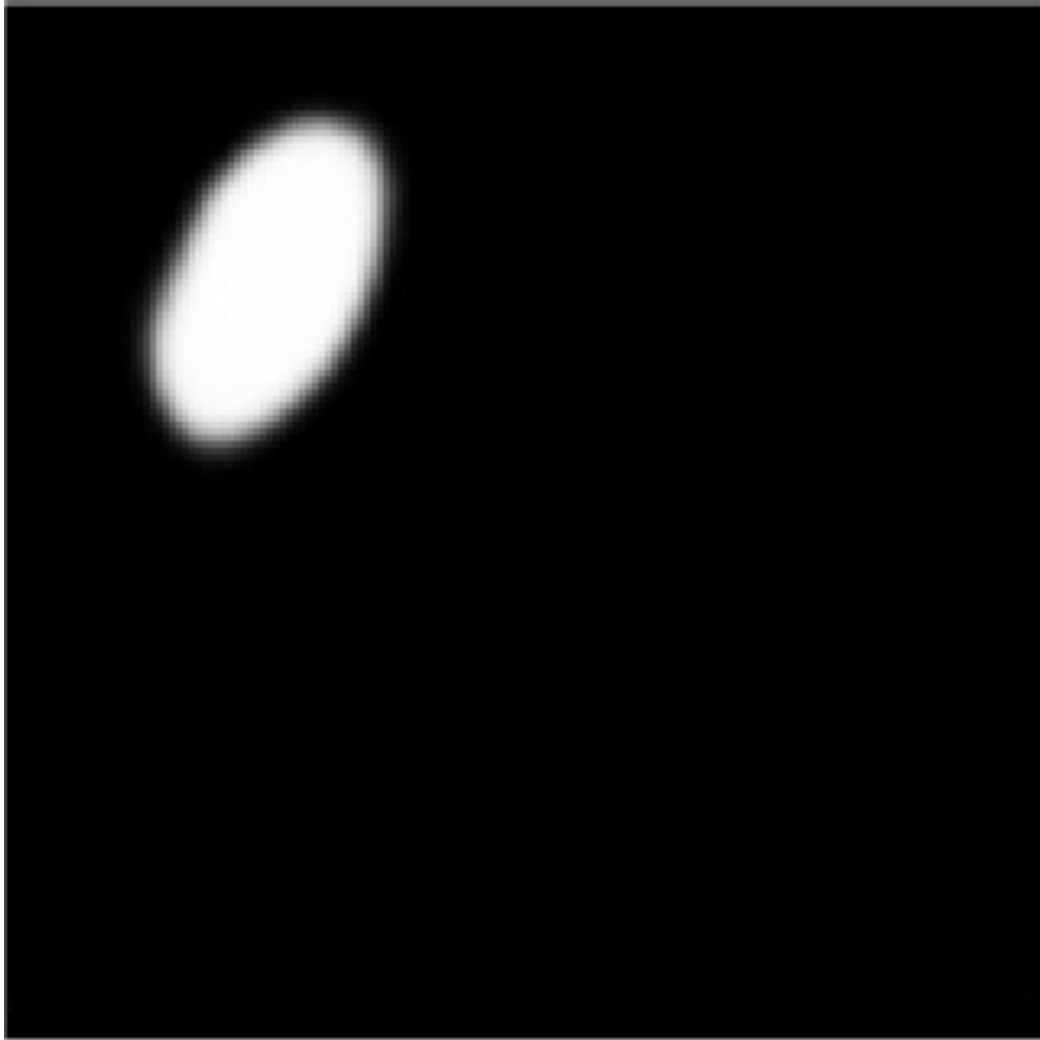
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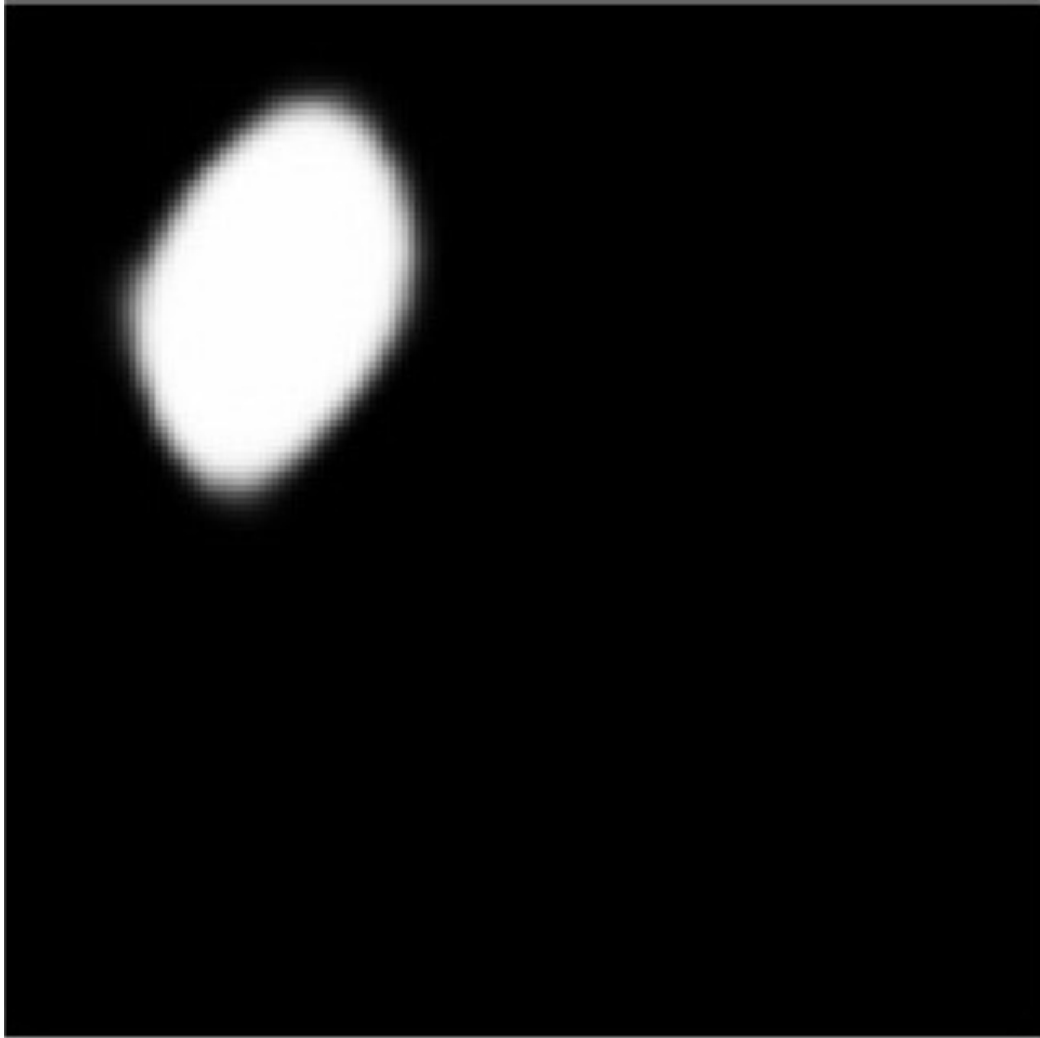
{irinah, lmatthey, arkap, cpburgess, glorotx,  
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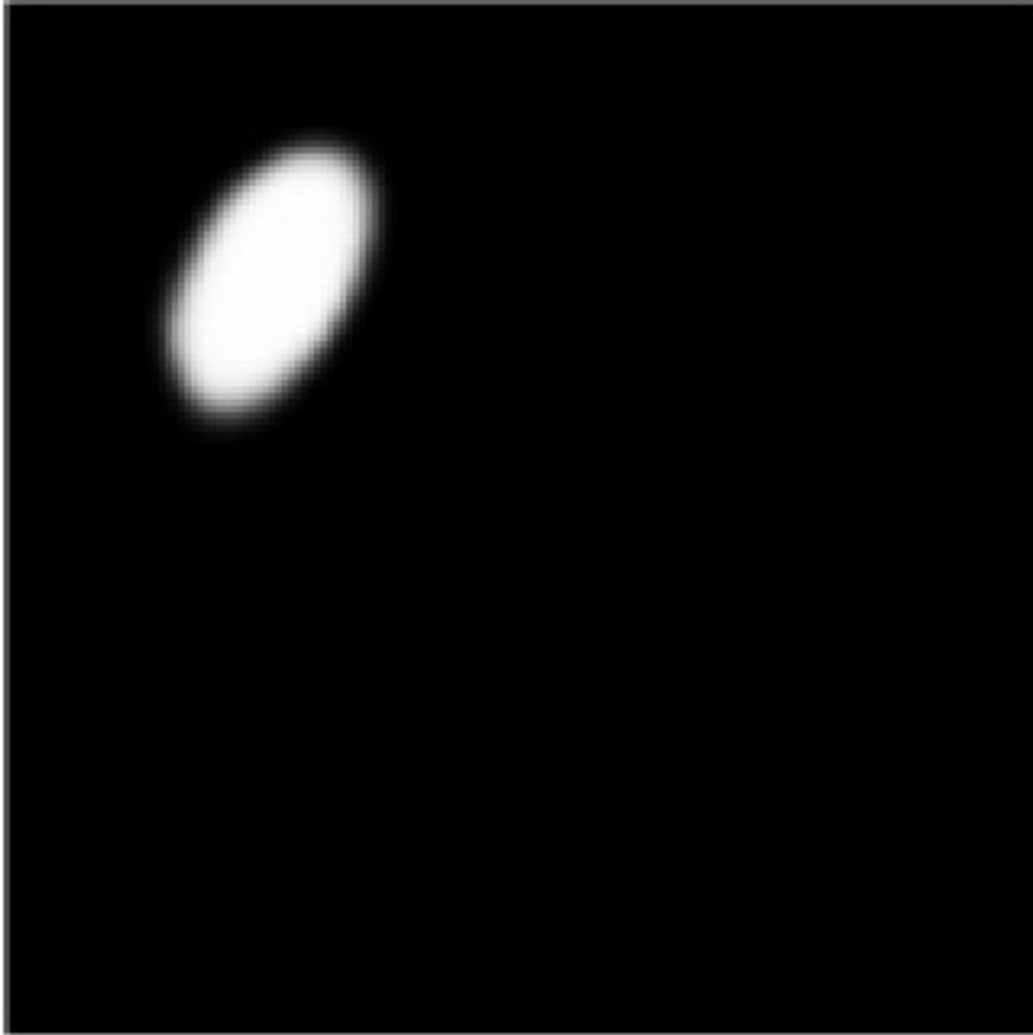
Google DeepMind

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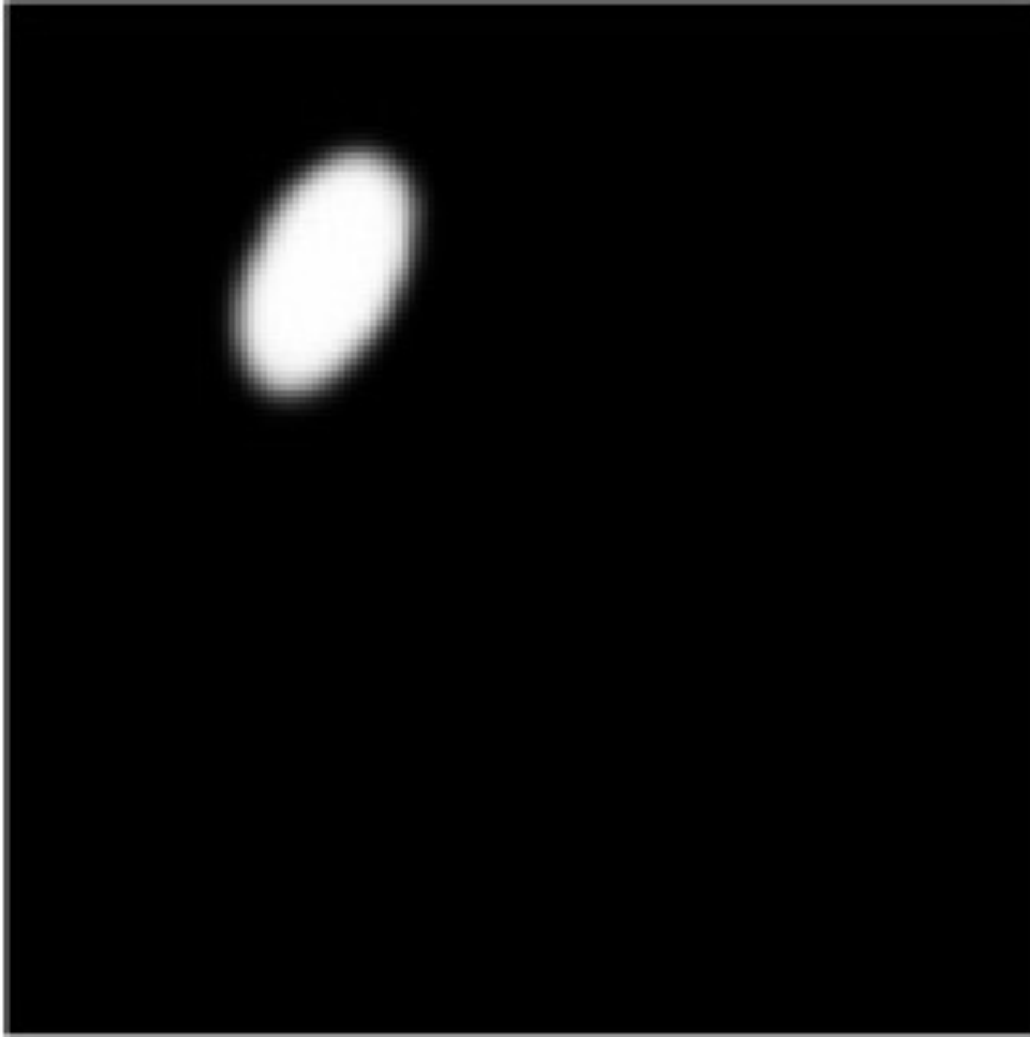
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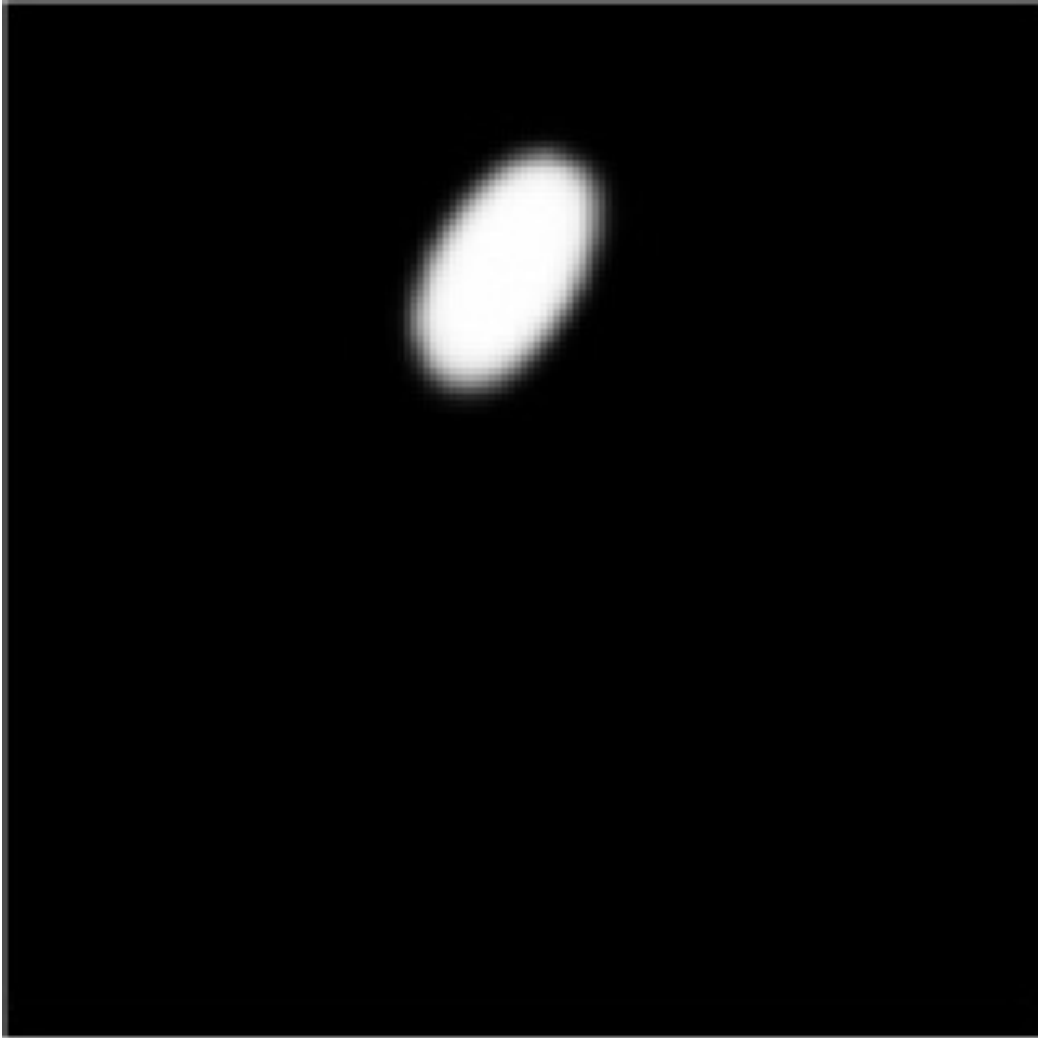
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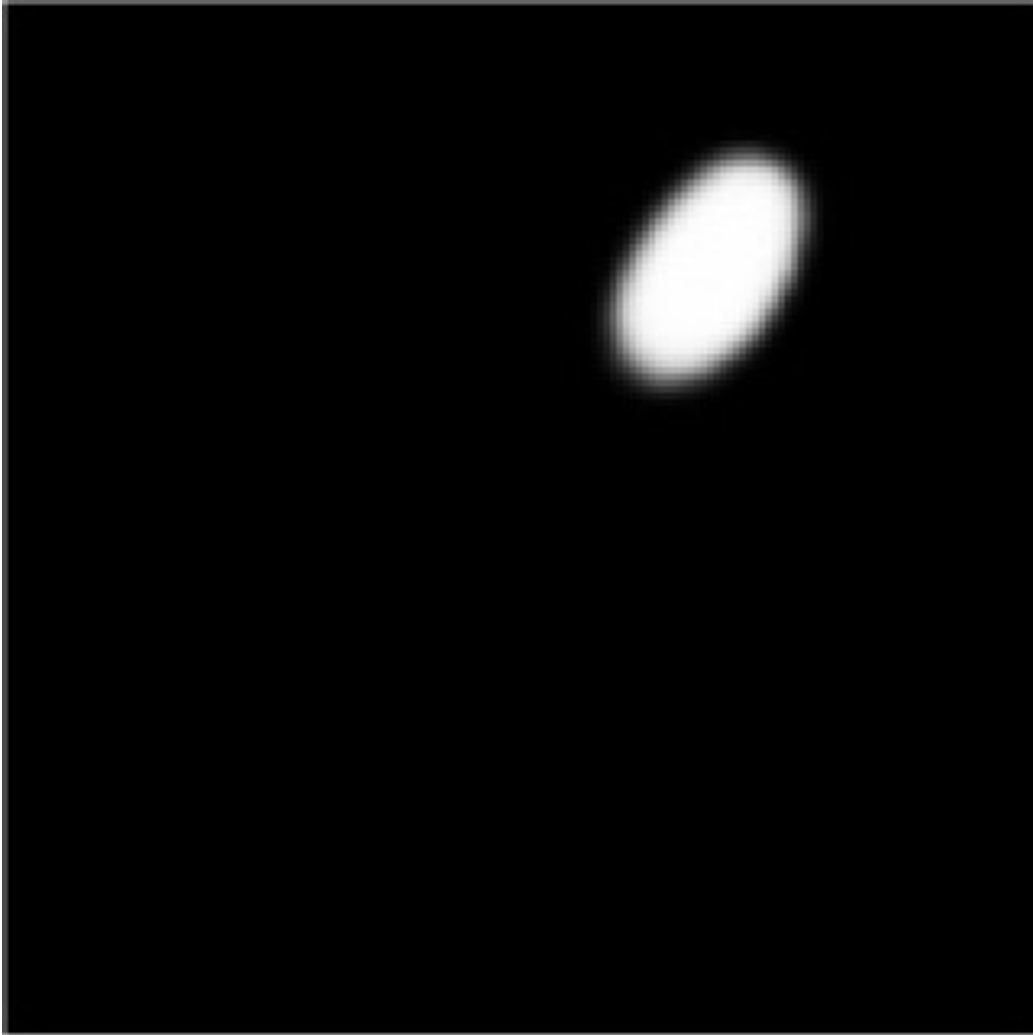
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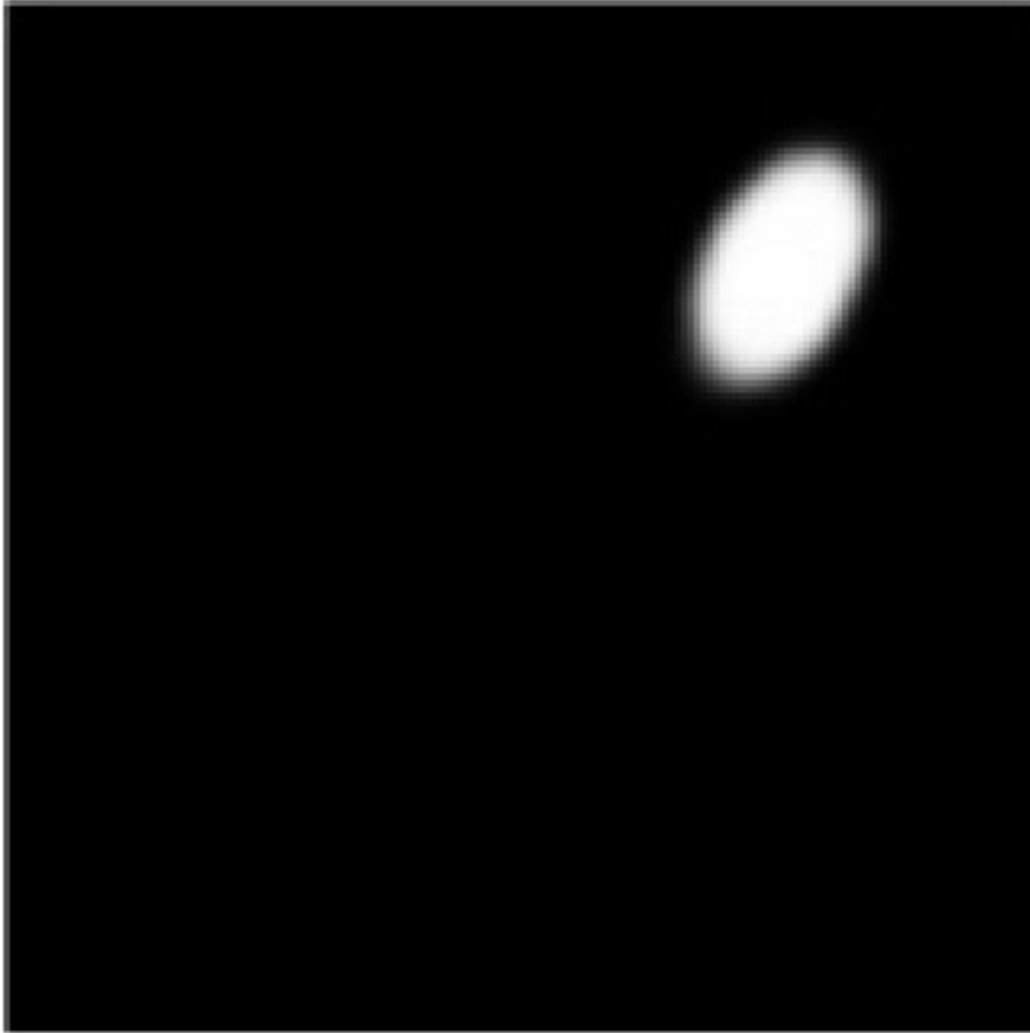
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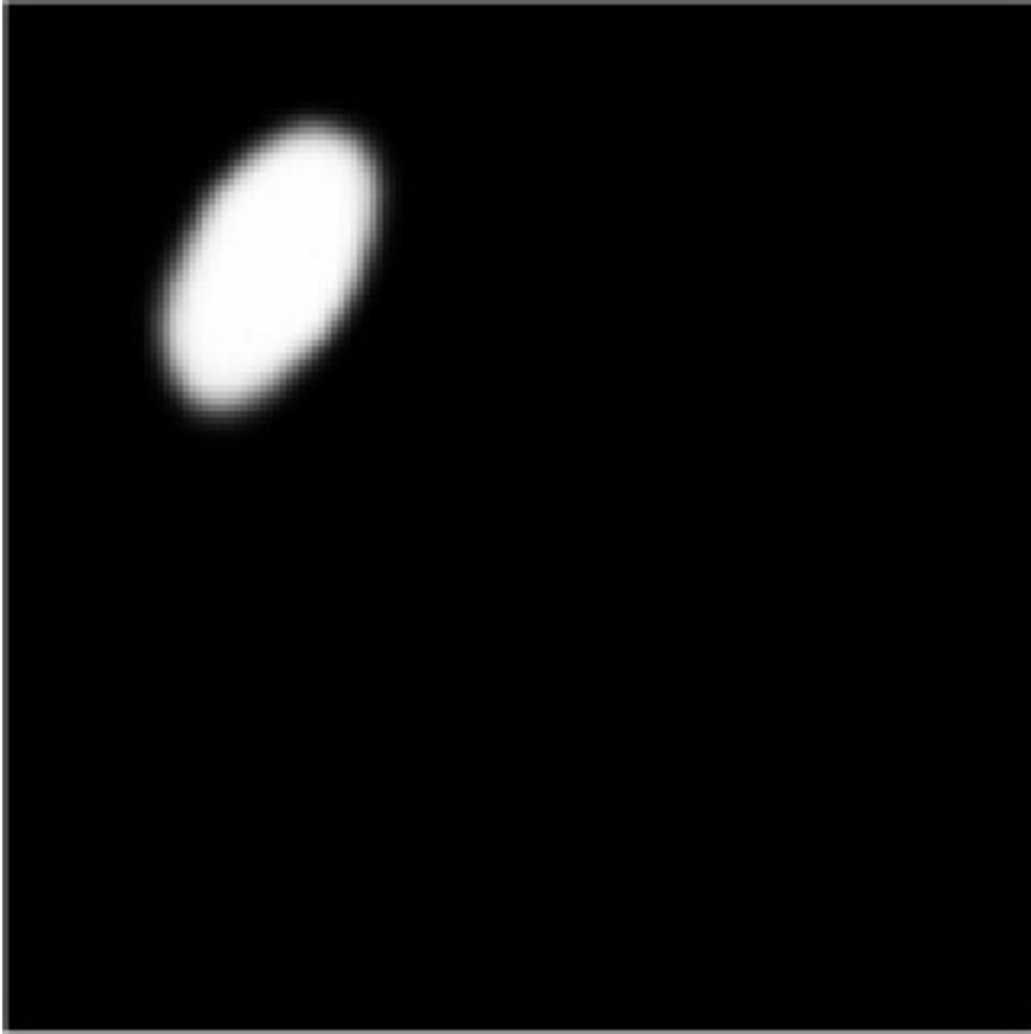
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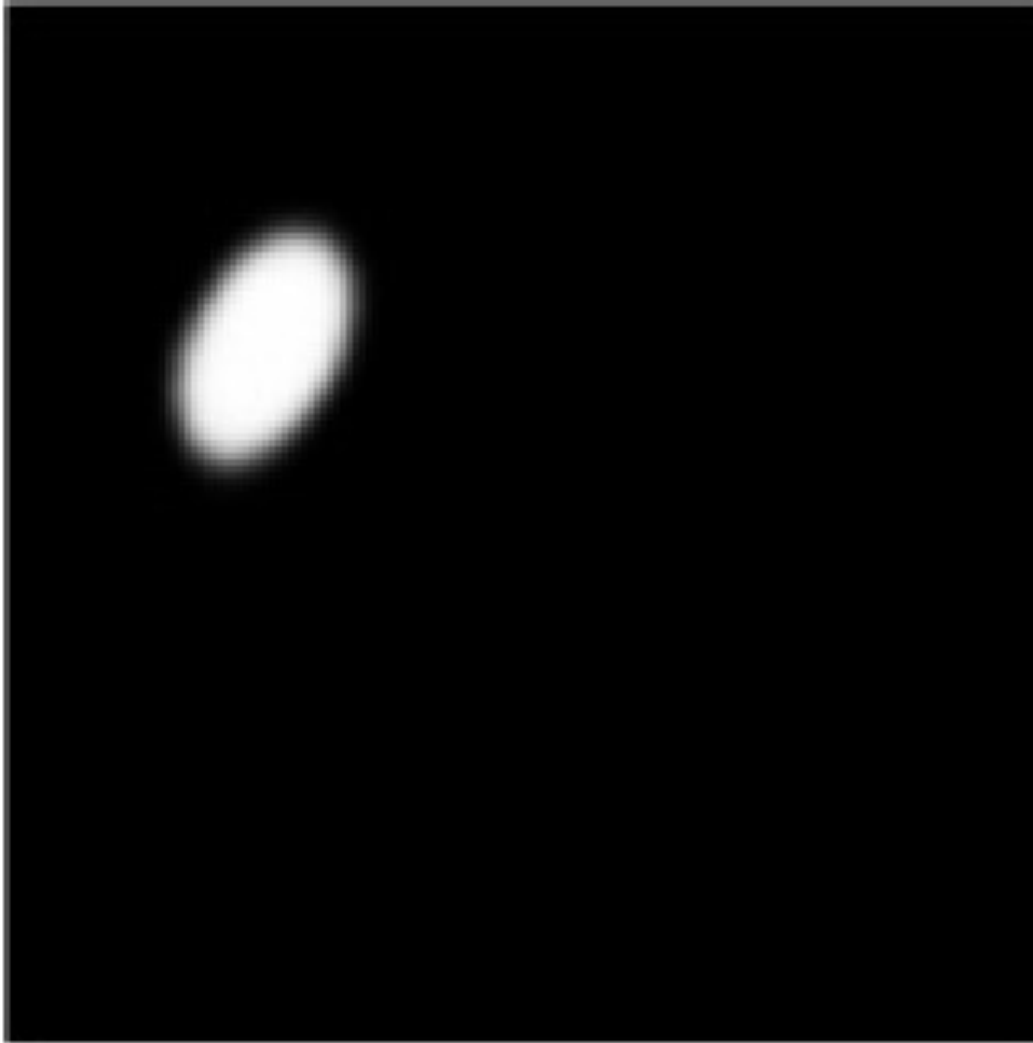
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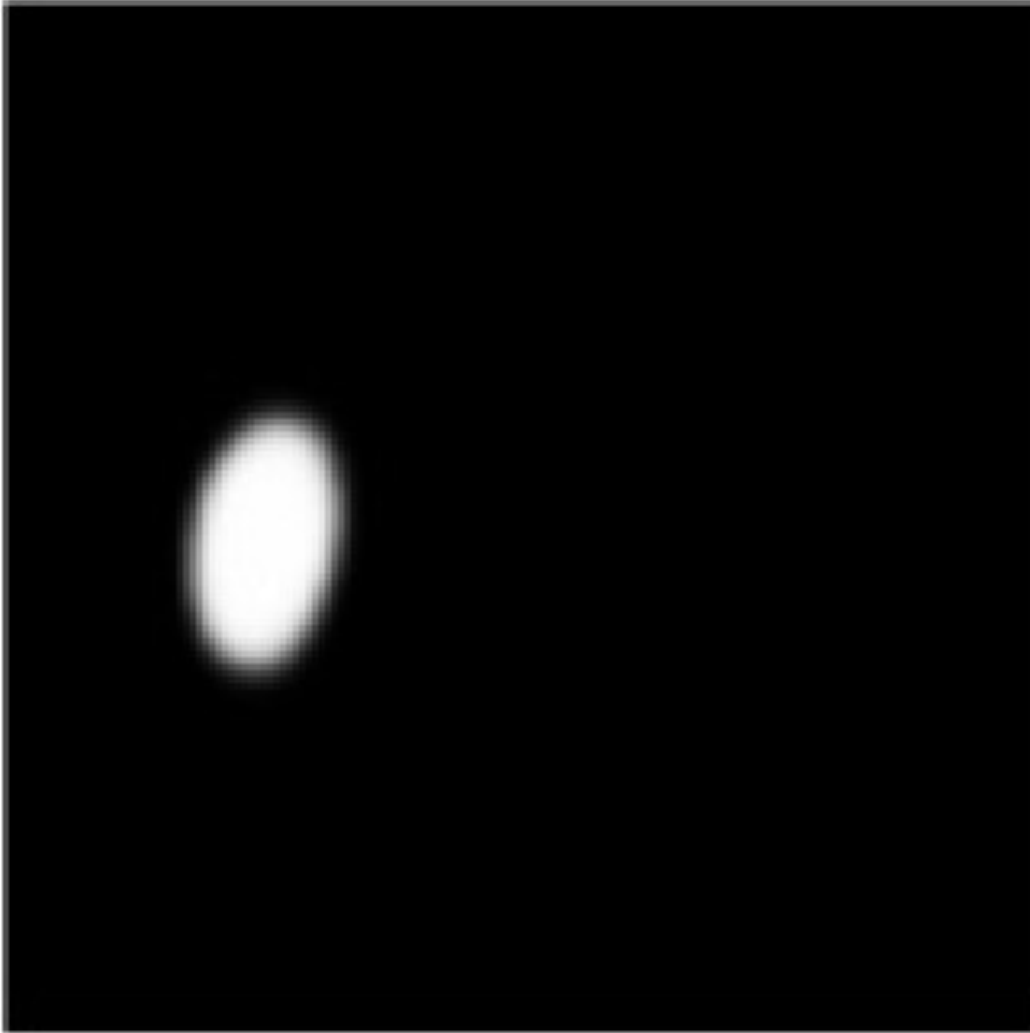
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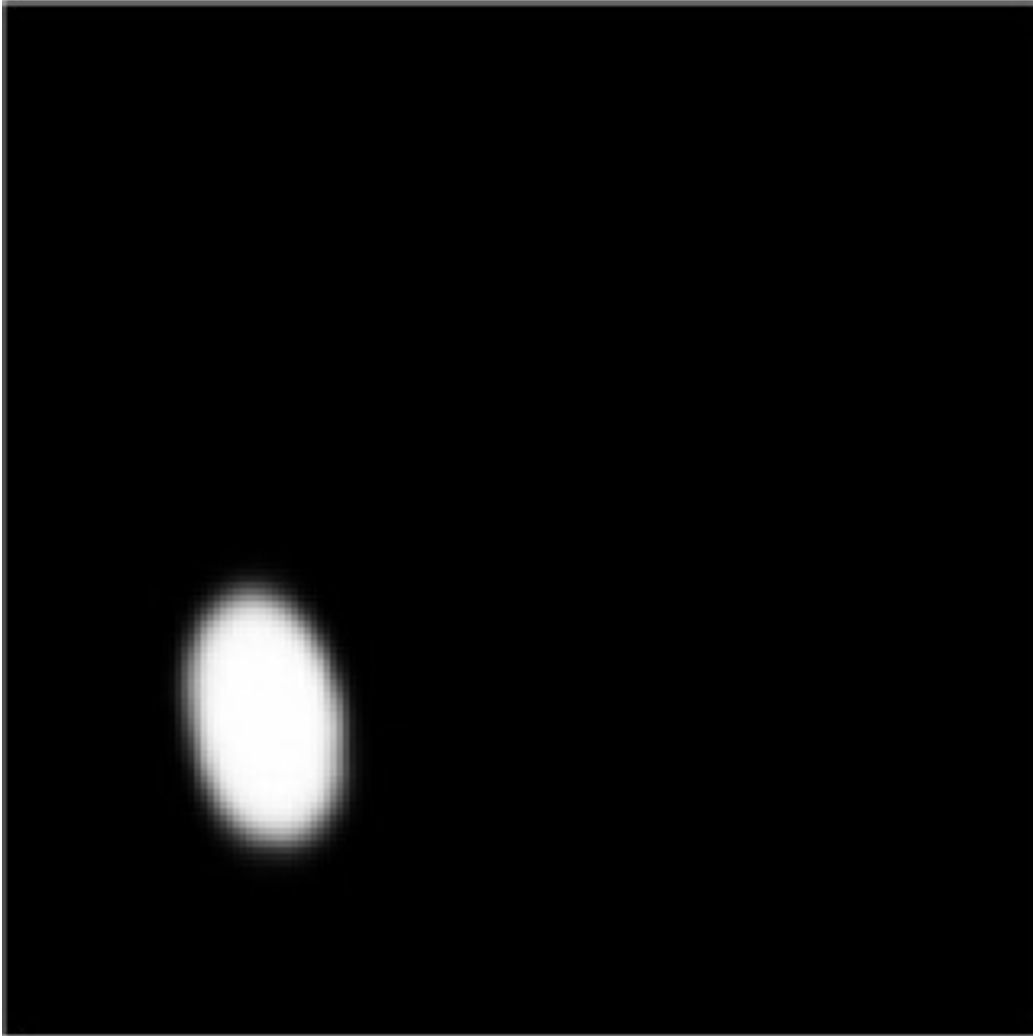
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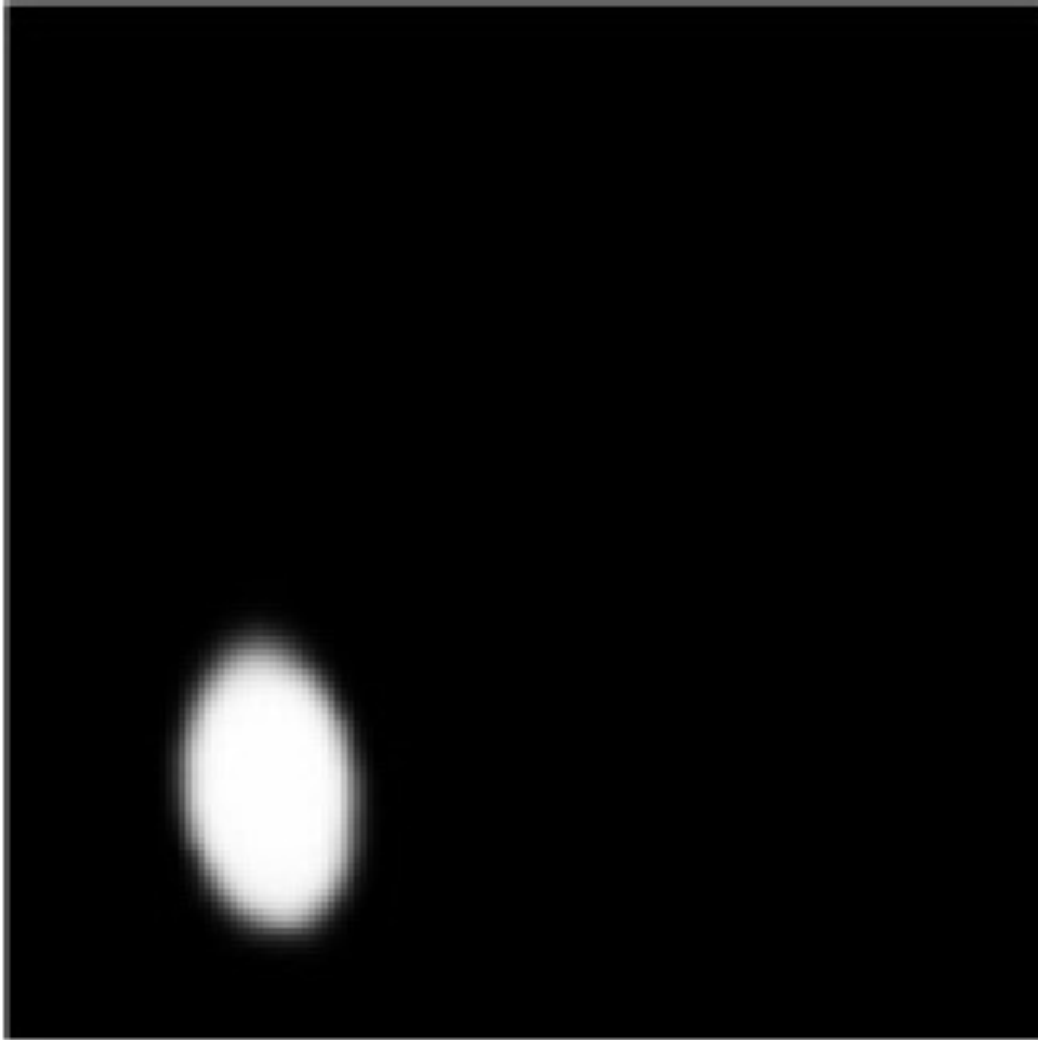
Google DeepMind

{[irinah](mailto:irinah@google.com), [lmatthey](mailto:lmatthey@google.com), [arkap](mailto:arkap@google.com), [cpburgess](mailto:cpburgess@google.com), [glorotx](mailto:glorotx@google.com), [botvinick](mailto:botvinick@google.com), [shakir](mailto:shakir@google.com), [lerchner](mailto:lerchner@google.com)}@google.com



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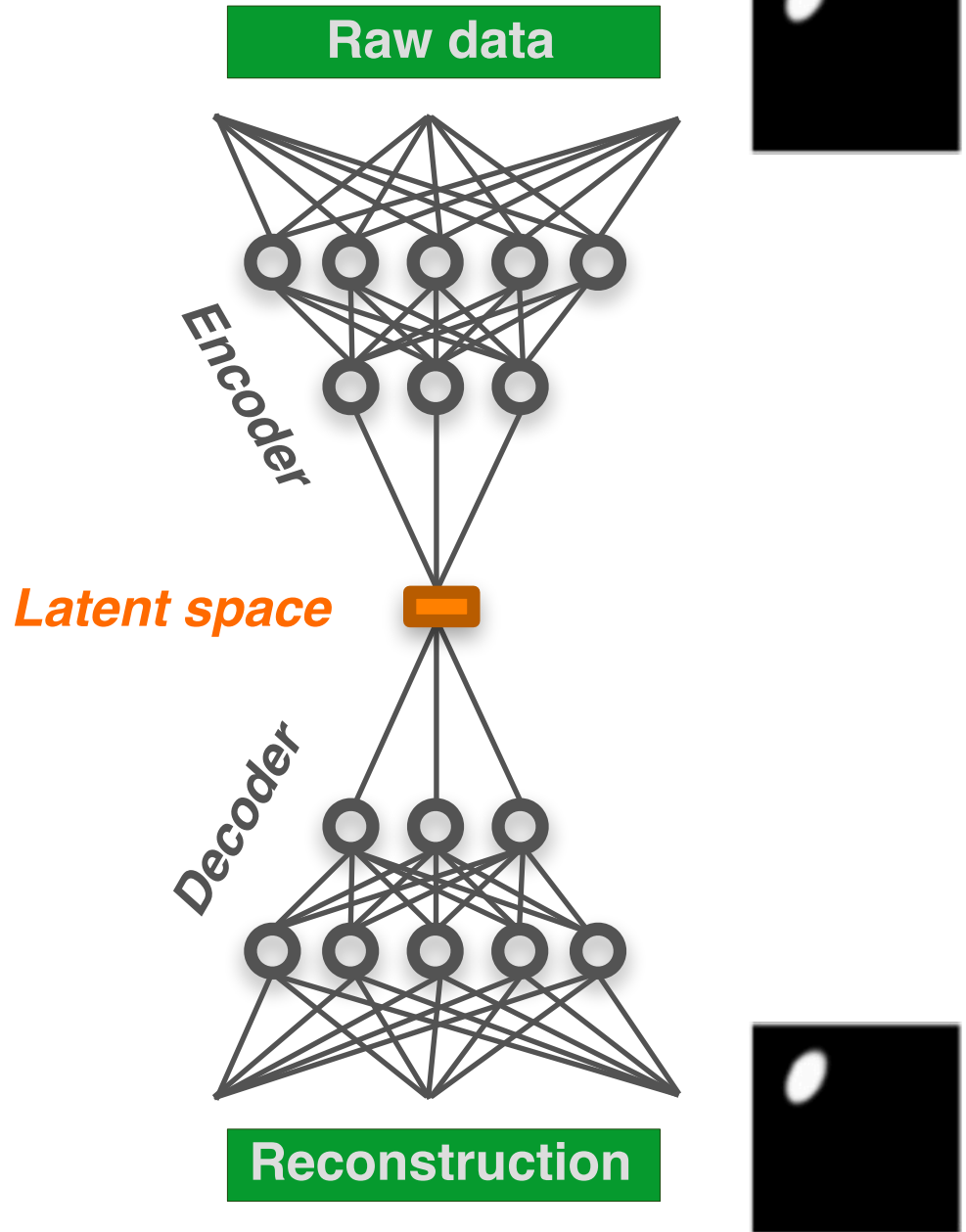
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botvinick, shakir, lerchner}@google.com



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# DISENTANGLED VAE

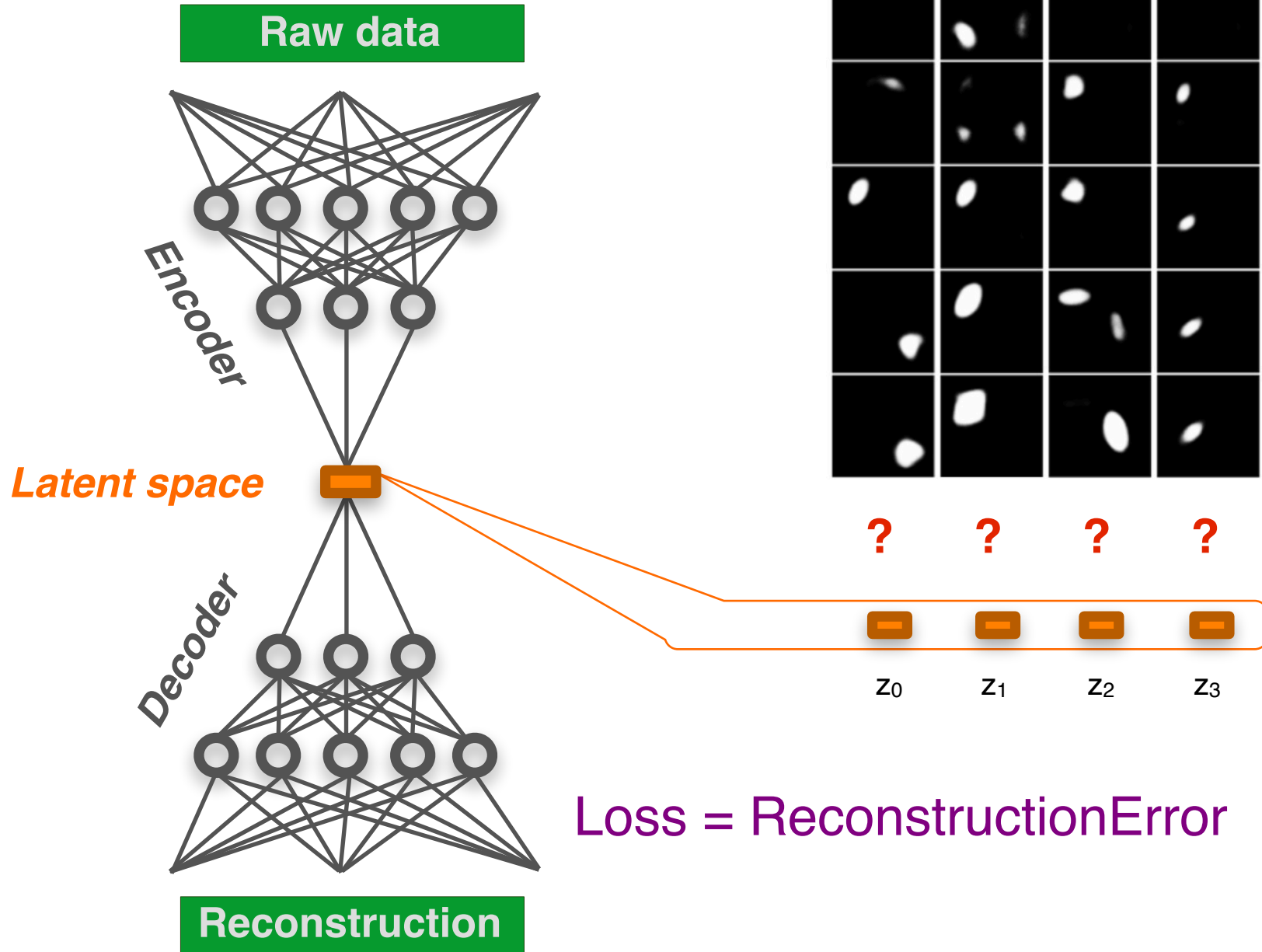


**Desired information:**

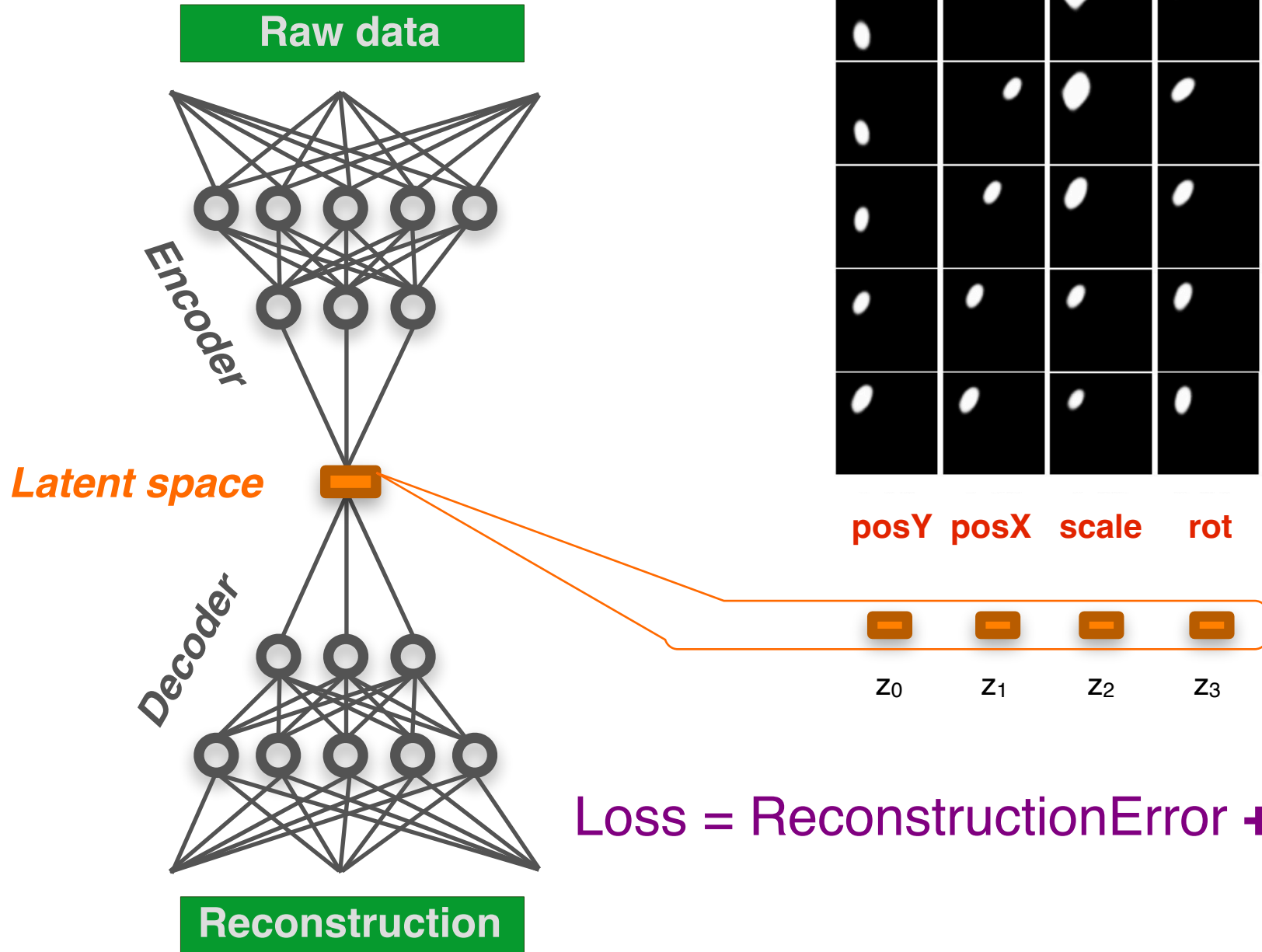
- Position X and Y
- Rotation
- Scaling

Loss = ReconstructionError

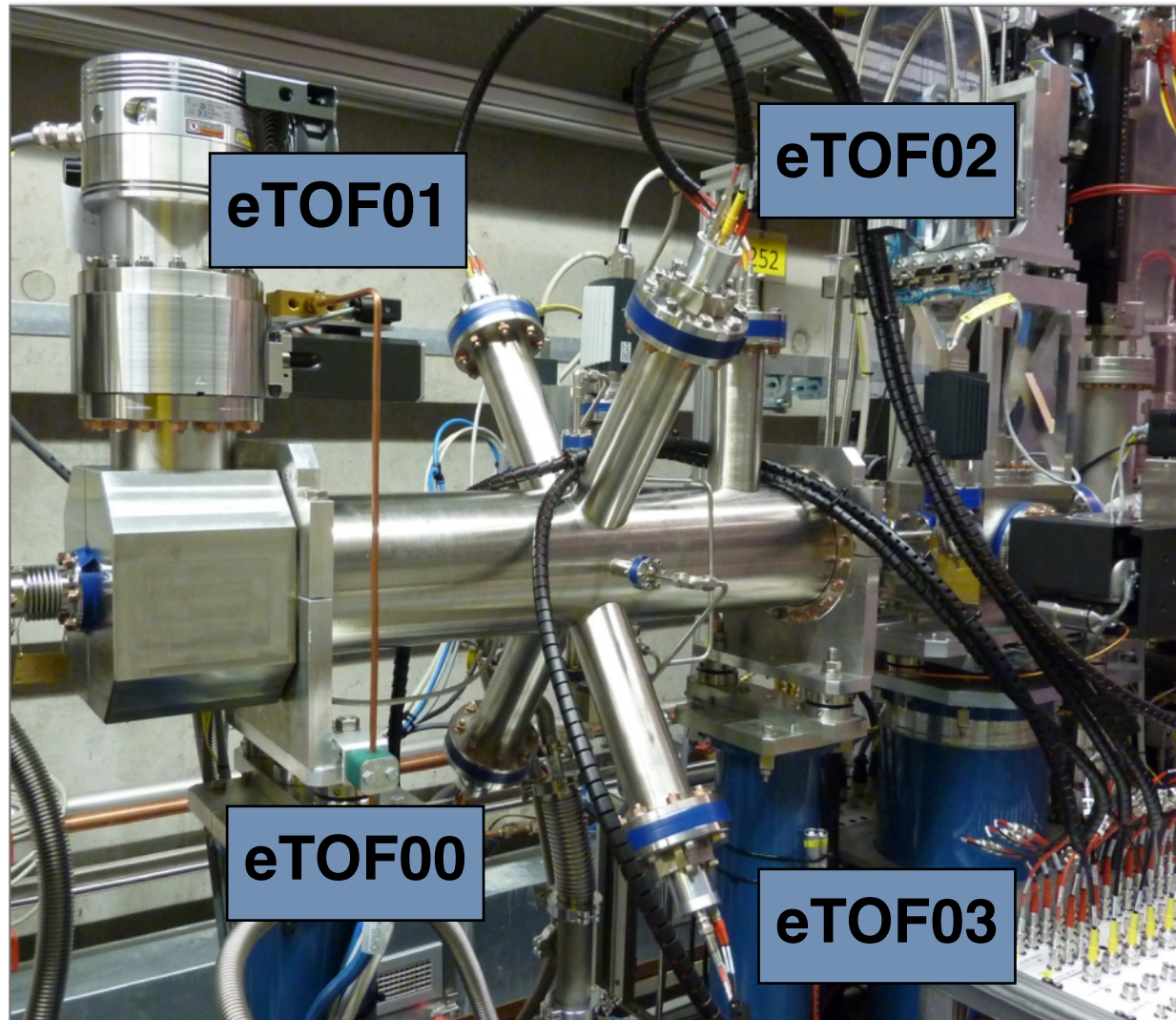
# DISENTANGLED VAE



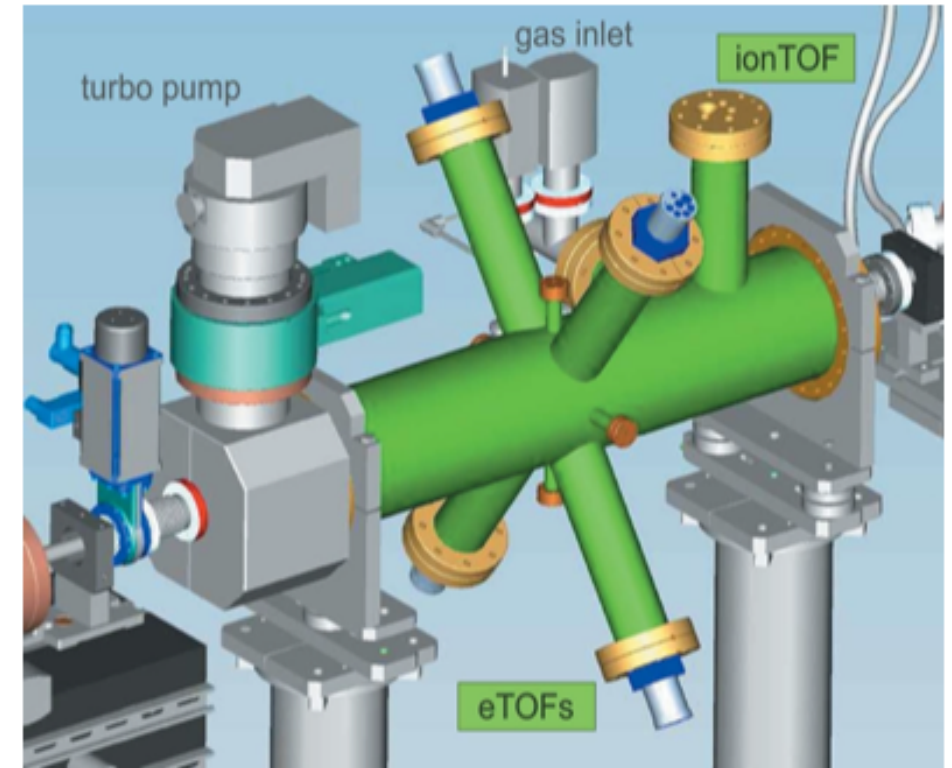
# DISENTANGLED VAE



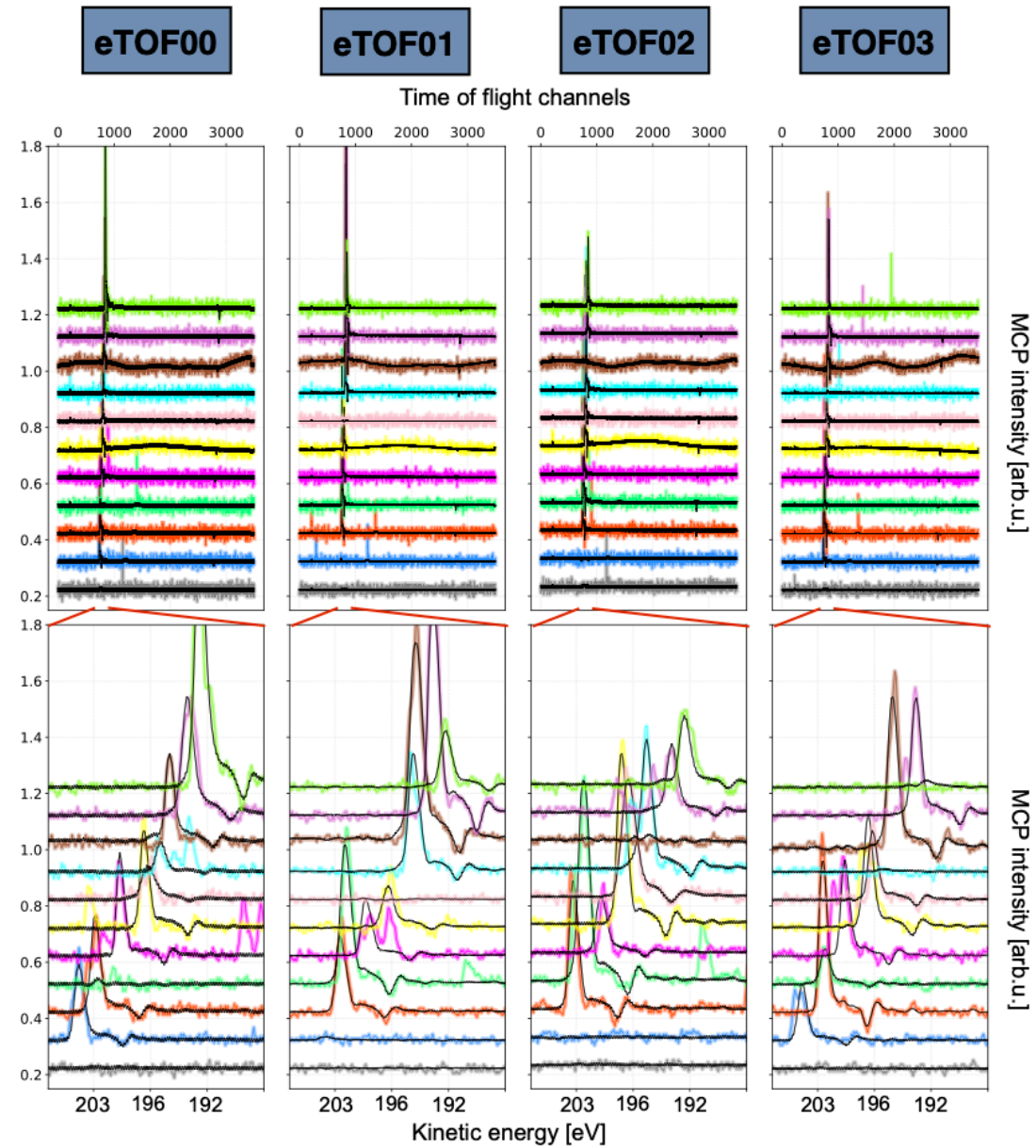
# OPIS



$$E_{pho} = E_{kin} + E_{bin}$$

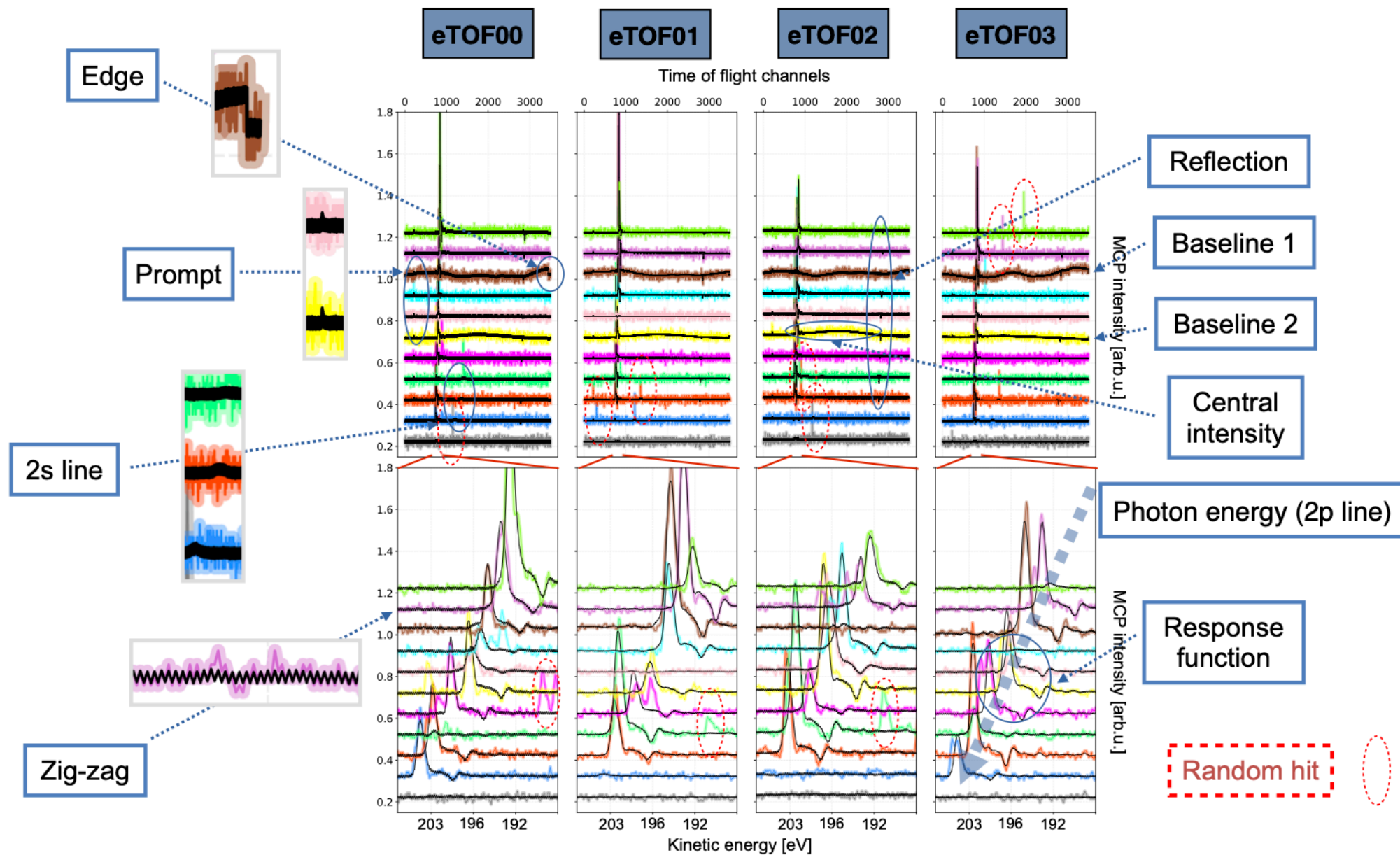


# OPIS: DATA AND FEATURES

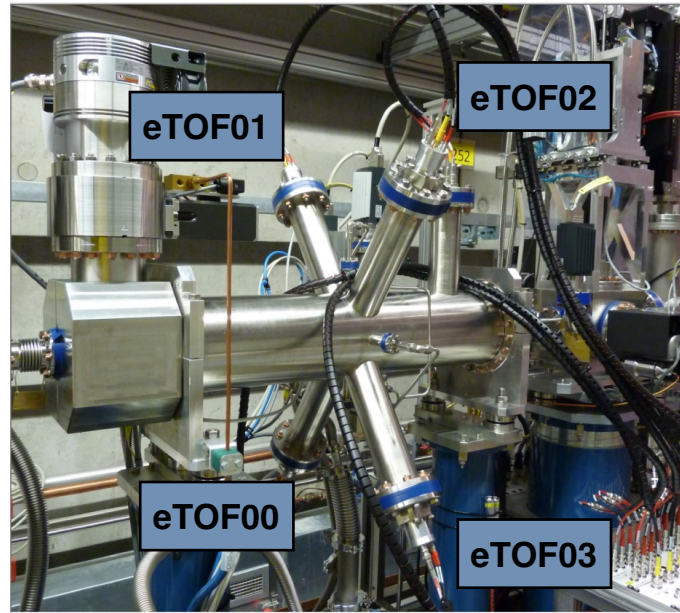
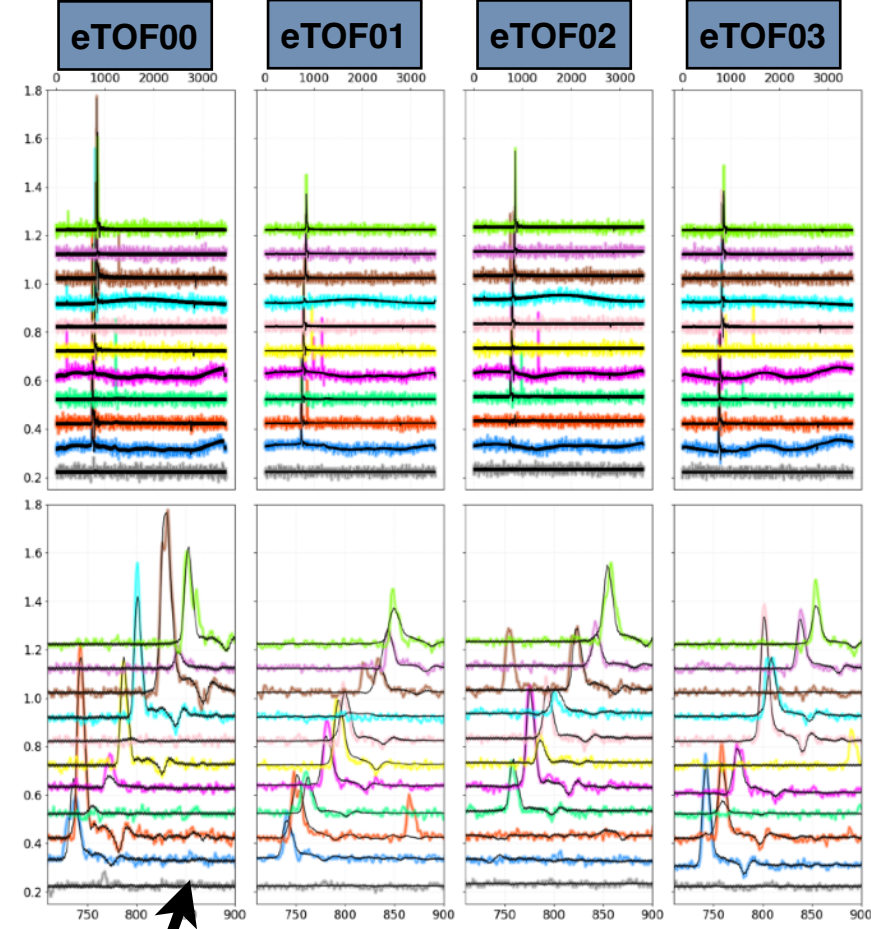
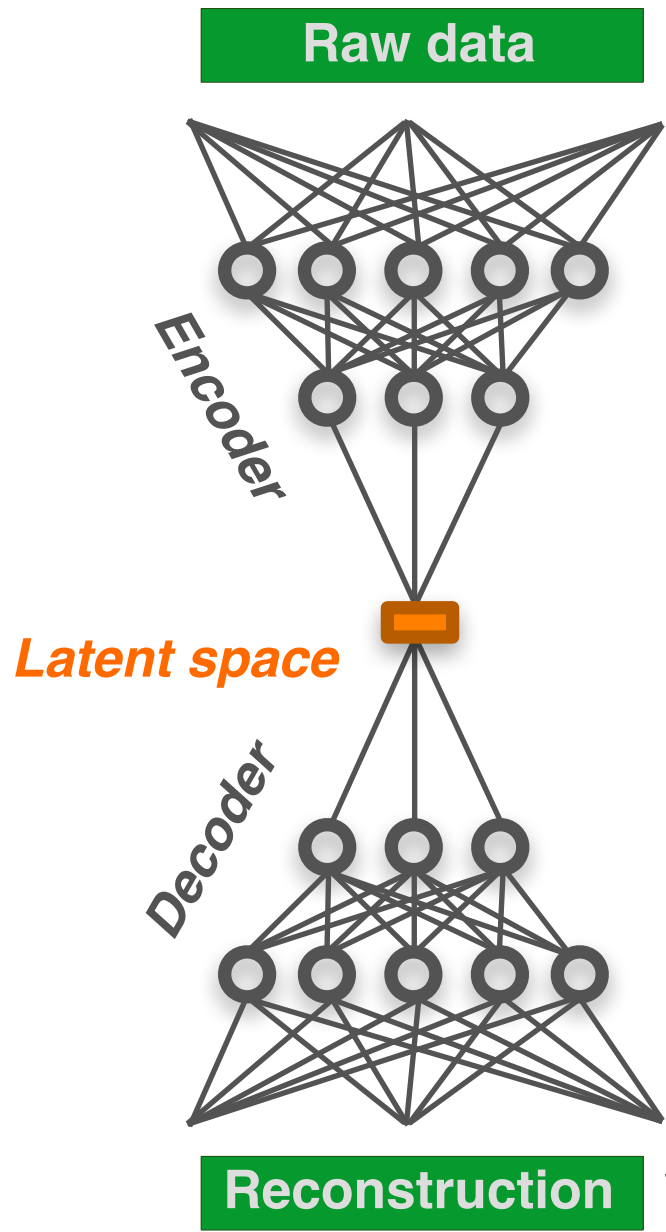




# OPIS: DATA AND FEATURES

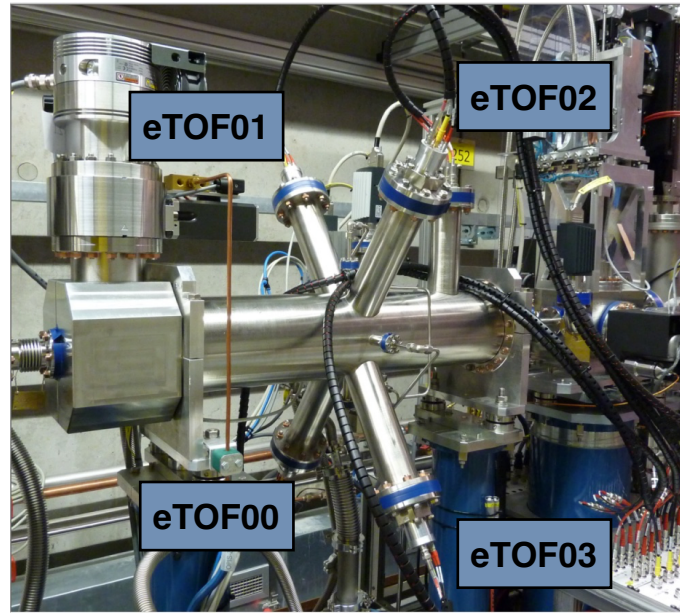
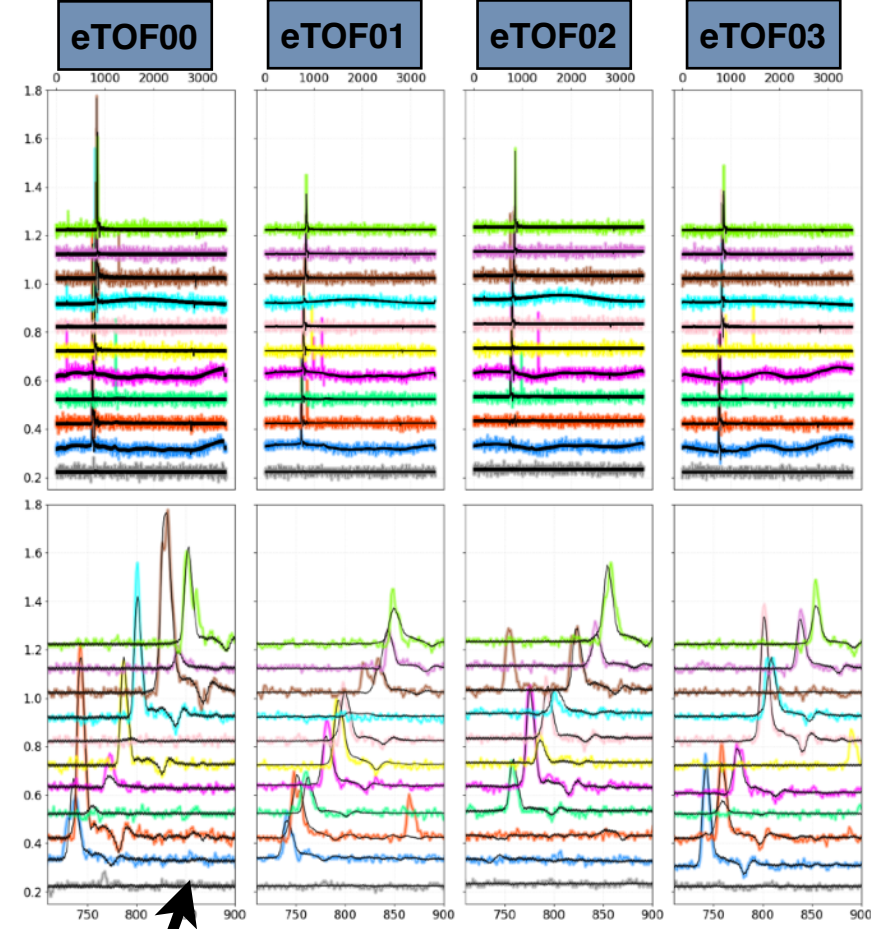
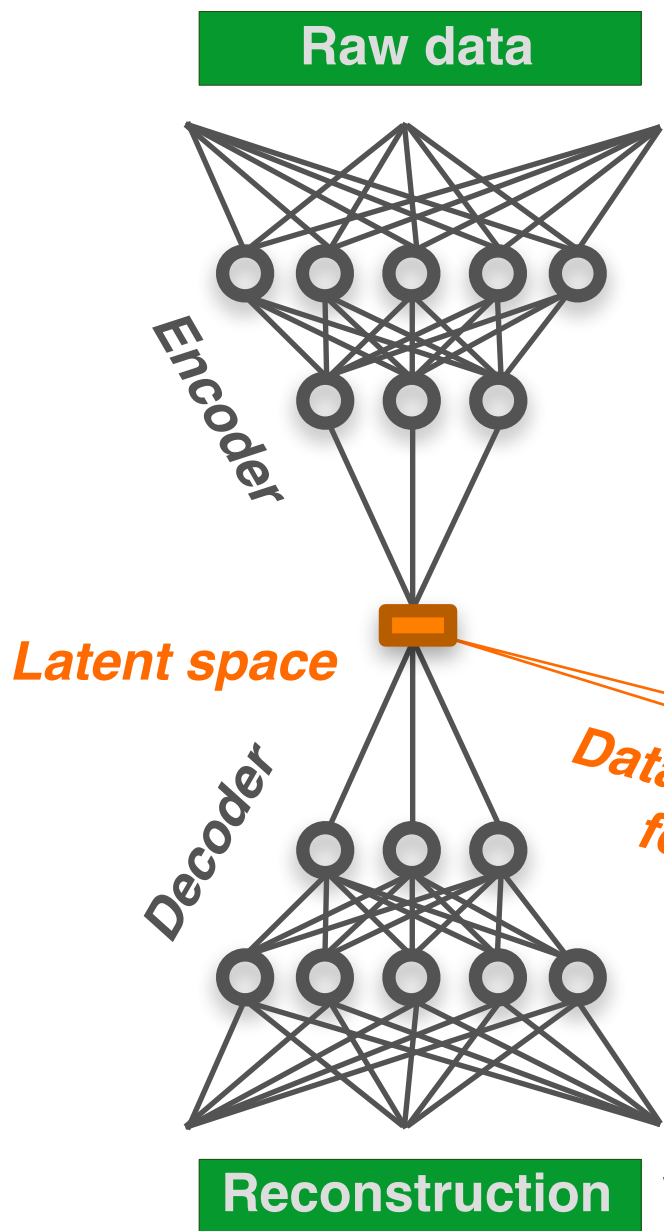


# OPIS



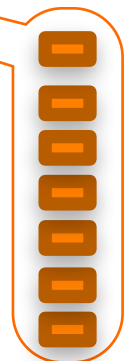
Reconstructed Data

# OPIS



*Data compression for humans*

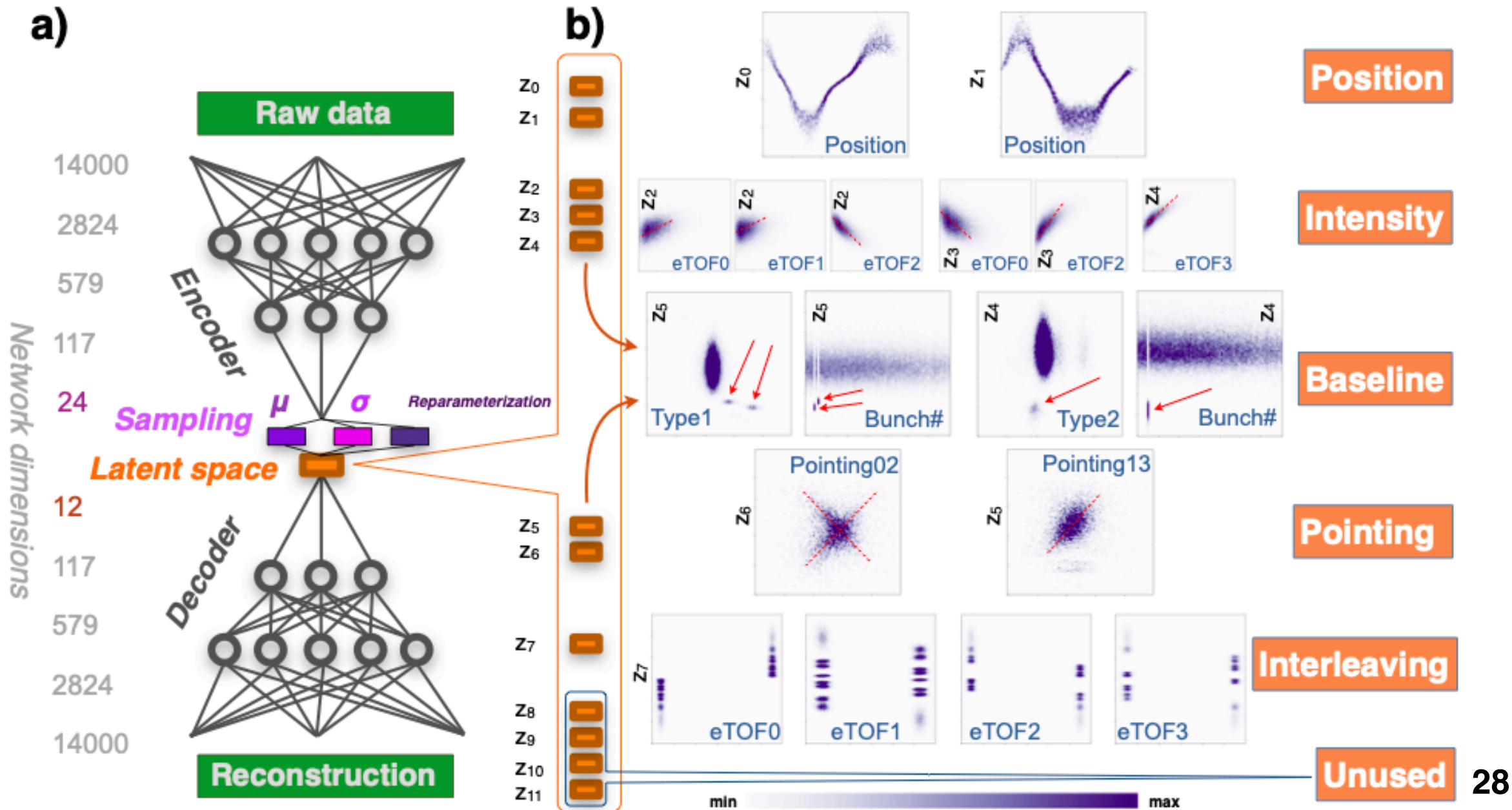
*Reconstructed Data*



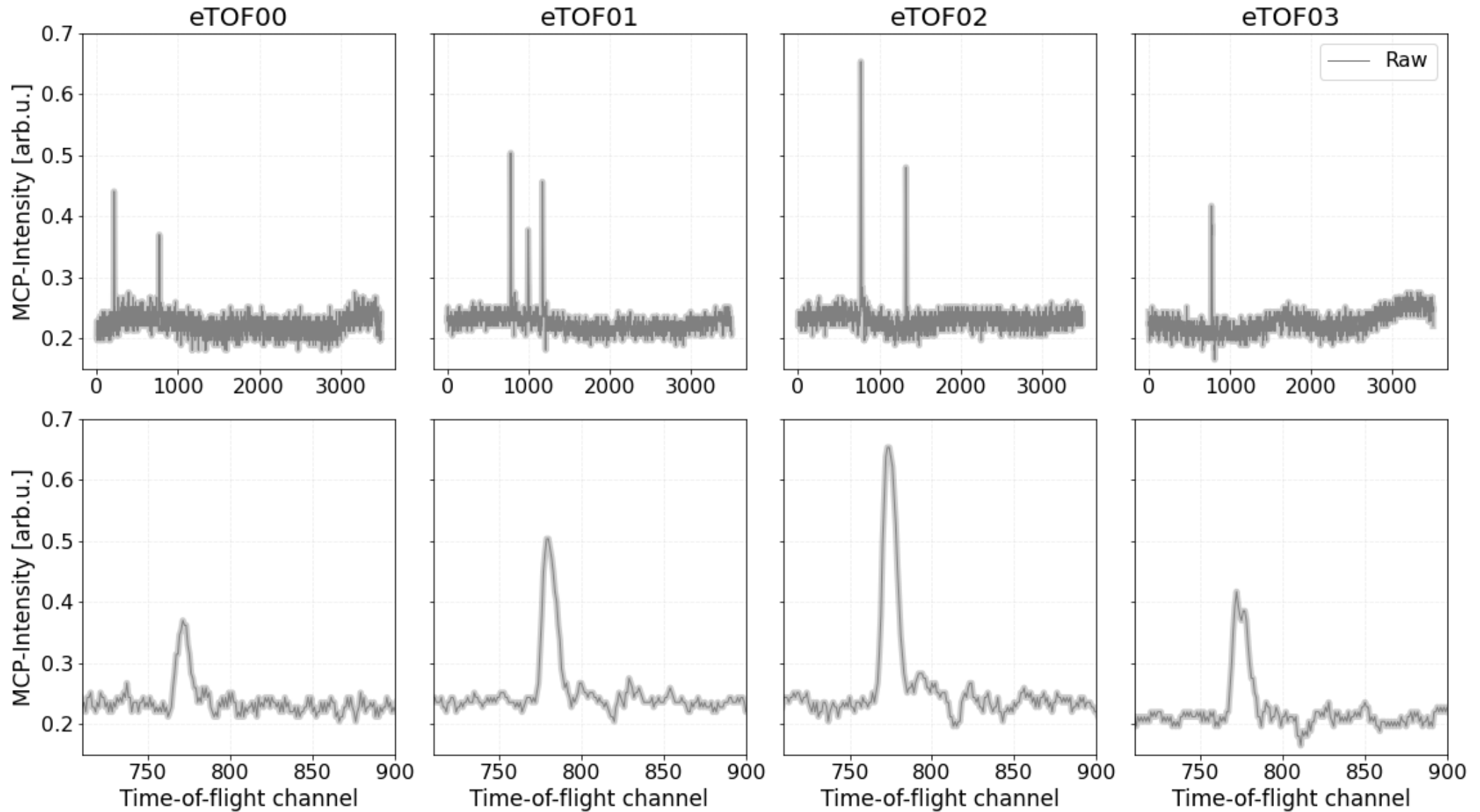
- Wavelength
- Intensity
- Baseline
- Interleaving
- Pointing

**No a-priori knowledge!**

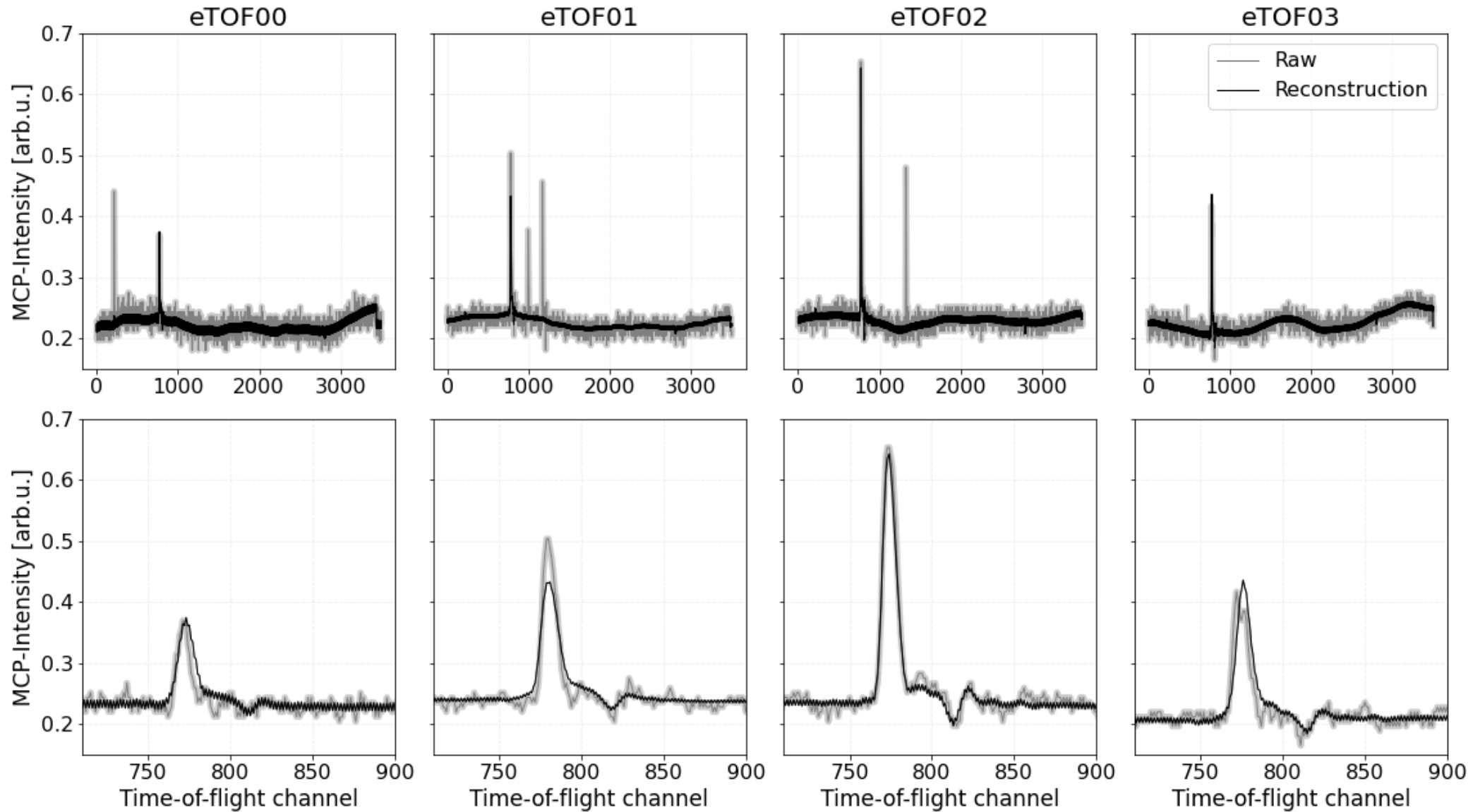
# OPIS ENCODING



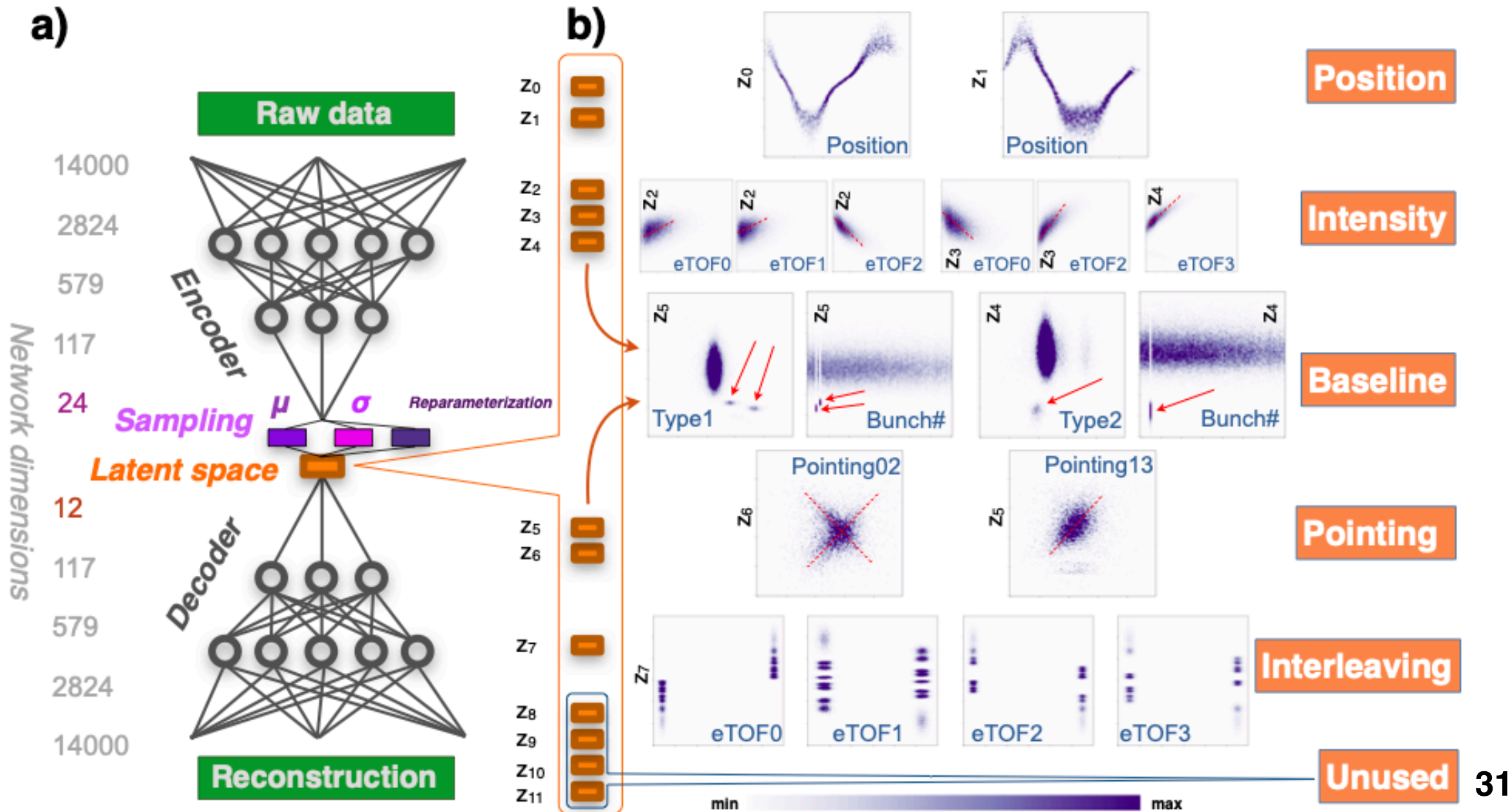
# DATA CLEANING



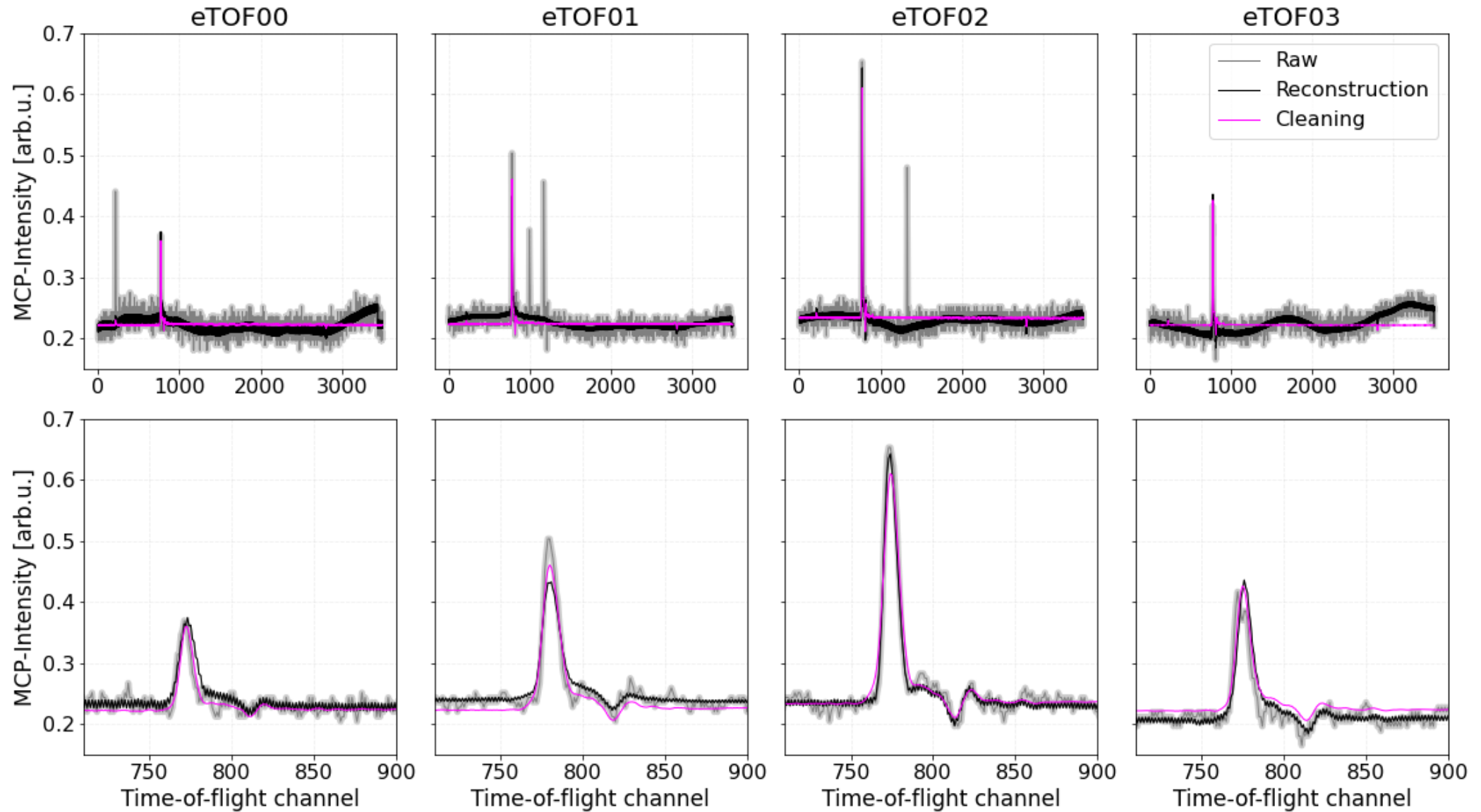
# DATA CLEANING



# OPIS ENCODING

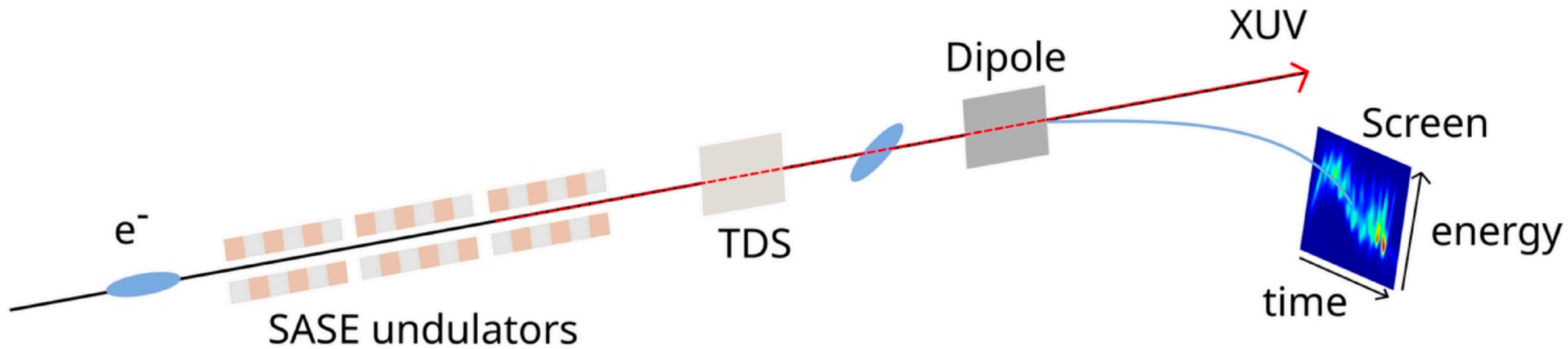


# DATA CLEANING



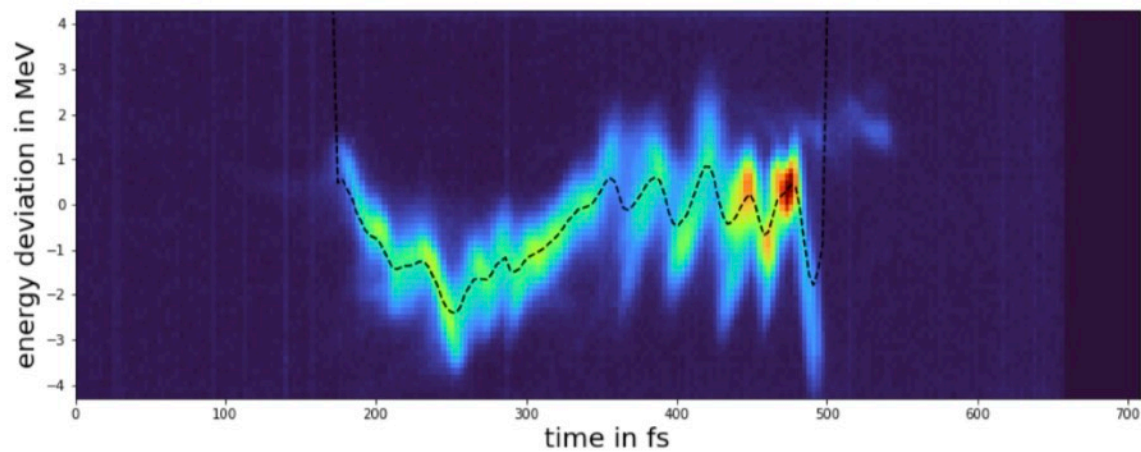
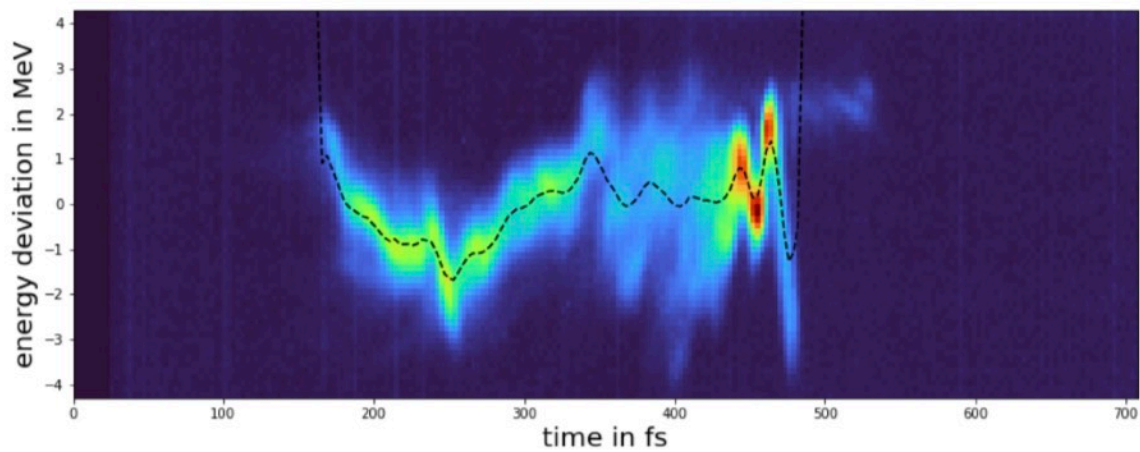


# POLARIX

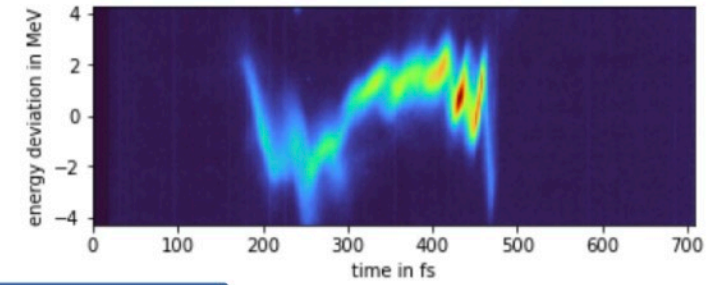
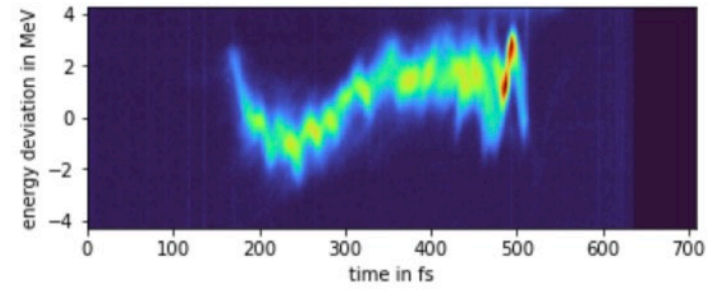
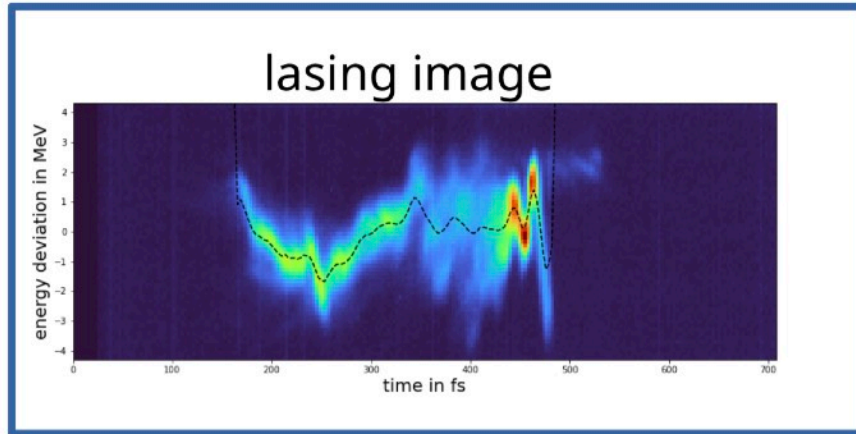


lasing image

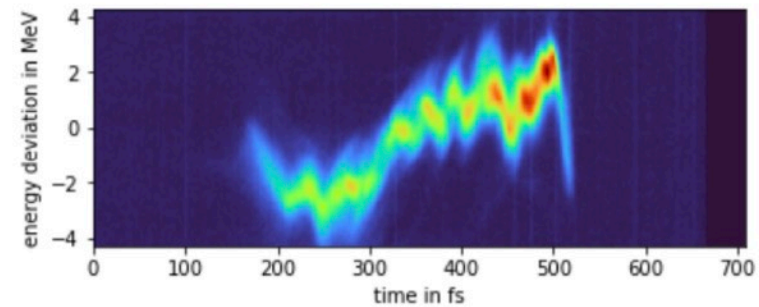
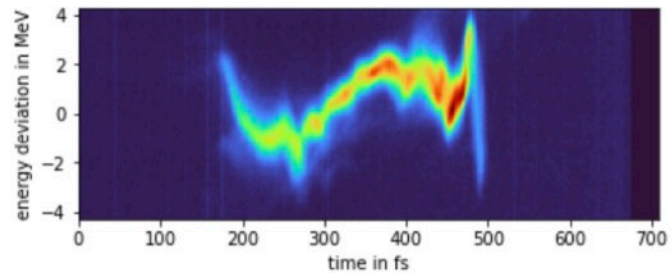
reference image



# WHICH ONE?



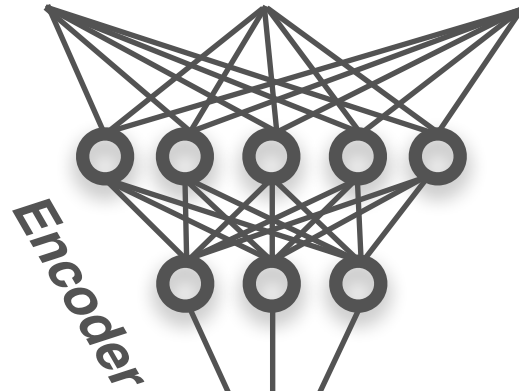
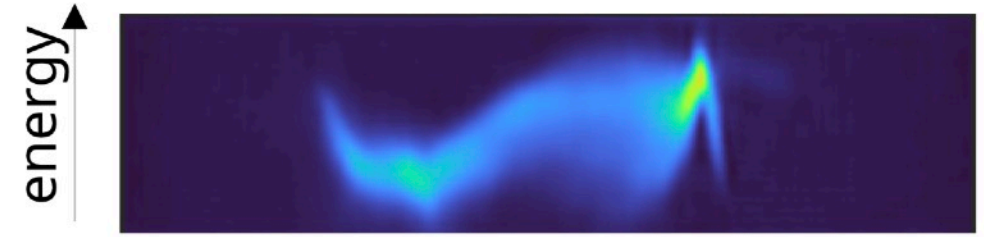
reference image ?



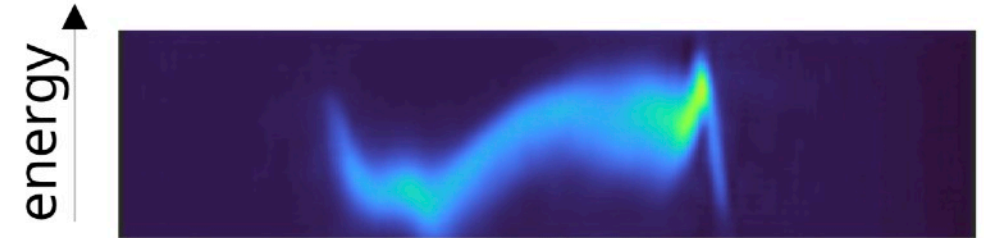
# JUST CREATE IT

Raw data

$Z_9 = -2.5$

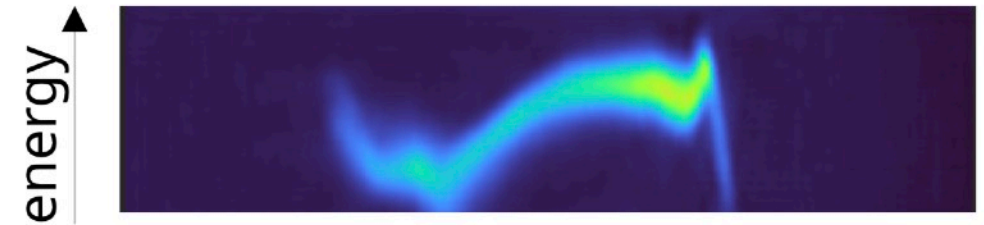


$Z_9 = 0$



Latent space

$Z_9 = 2.5$



Decoder

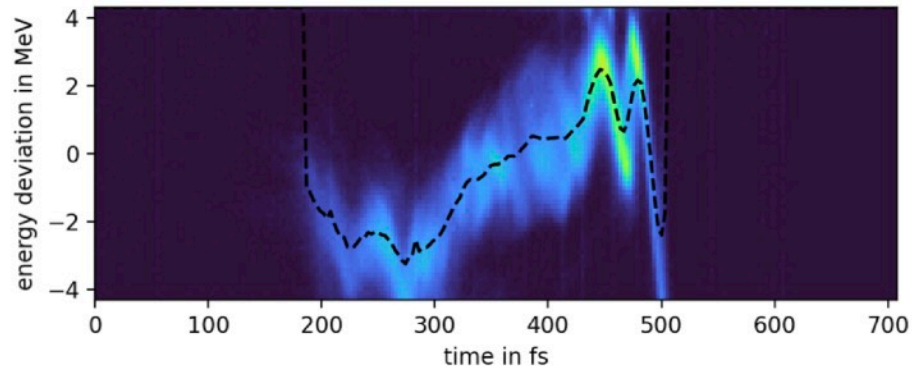
Data compression  
for humans

Reconstruction

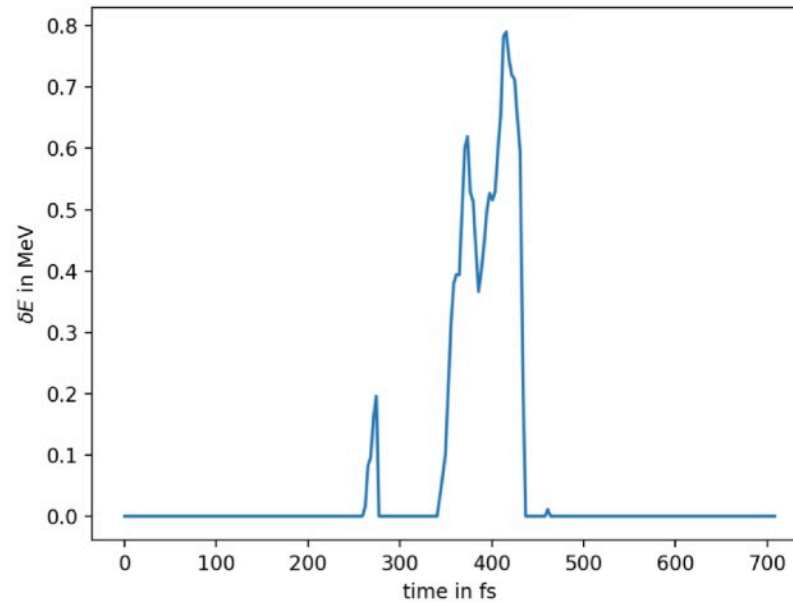
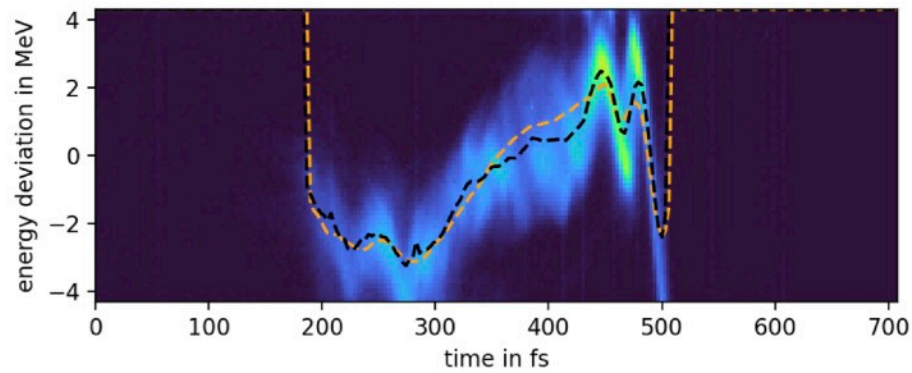
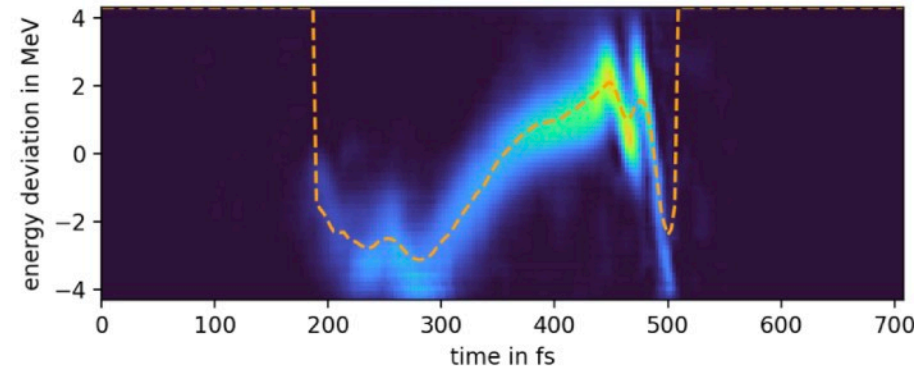


# TIME DISTRIBUTION EXTRACTION

## raw image



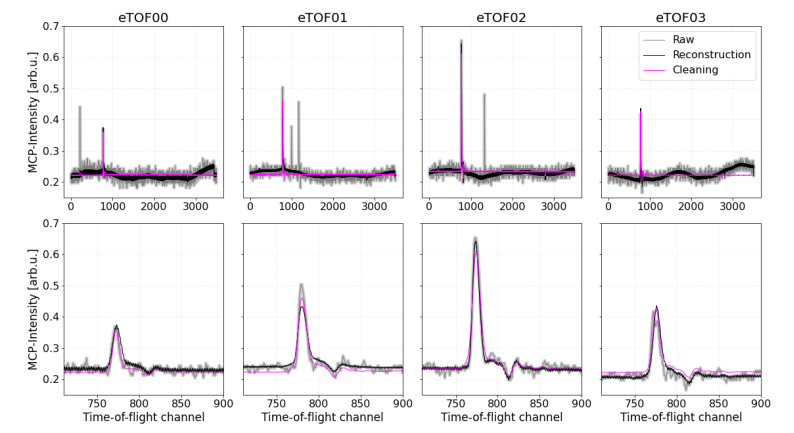
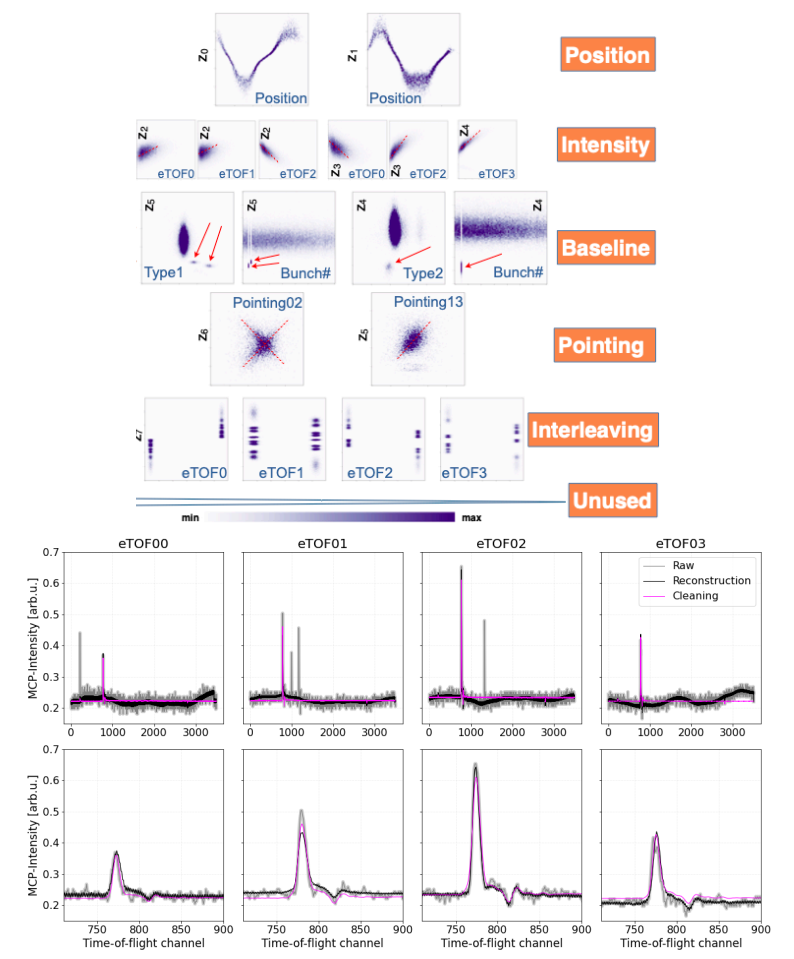
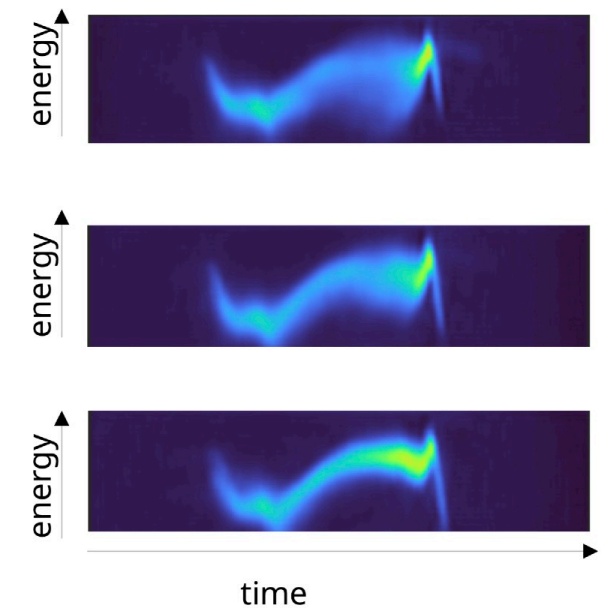
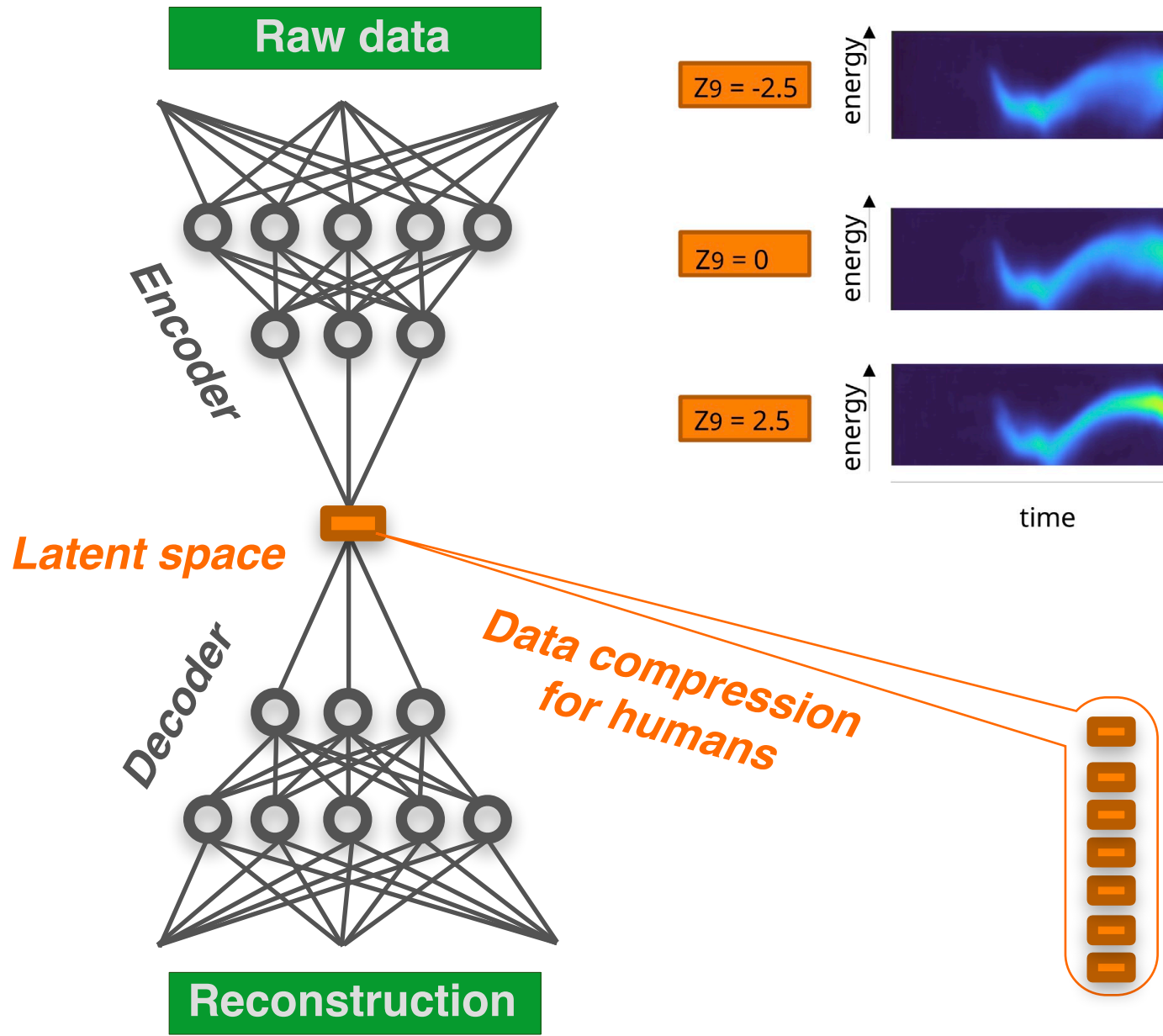
## created reference



# SUMMARY

## Polarix

## OPIS



$$\text{Loss} = \text{ReconstructionError} + \text{DisentanglementError}$$