Table 1: Results without or with the meta-formulation applied to the physics component, supporting our theory that the physics component does not suffer from the type of un-identifiability as the neural component (although the meta-formulation does still moderately improve the accuracy of its estimation).

	MSE of zp	MSE of x (Pre)
without meta formulation	9.17(1.33)e-3	8.82(2.03)e-2
with meta formulation	5.63(0.42)e-3	3.37(0.22)e-2

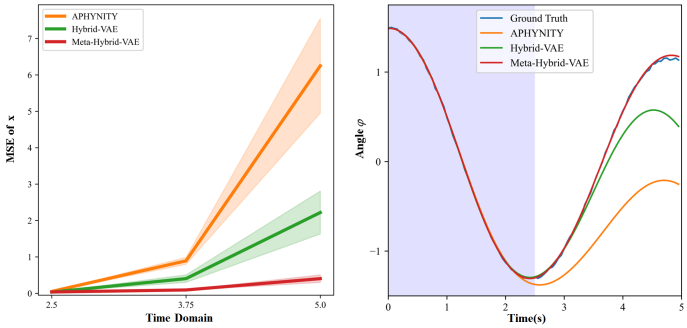

Fig 1: Left: The presented meta-hybrid-VAE significantly improved the prediction (y-axis: MSE of pendulum position) over longer time intervals beyond the training interval (0-2.5ms). Right: an example of predicted pendulum position over time.

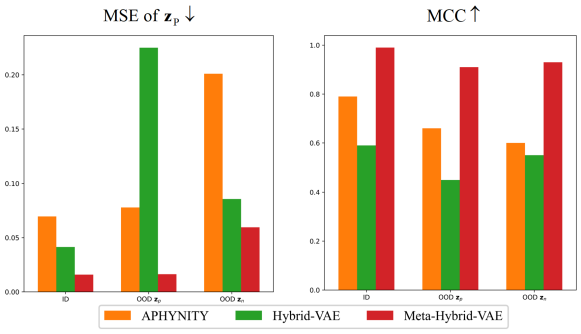

Fig 2: Identifiability results in in-distribution (ID), out-of-distribution physics component (OoD-zp), and OoD neural component (OoD-zn) test settings.

Table 2: The presented meta-formulation is able to improve the identifiability of a general non-hybrid VAE, similar to the identifiable-VAE (i-VAE) constructed using known class labels in [6].

	VAE	iVAE	meta-VAE
MCC	0.67 (0.04)	0.91 (0.03)	0.88 (0.00)

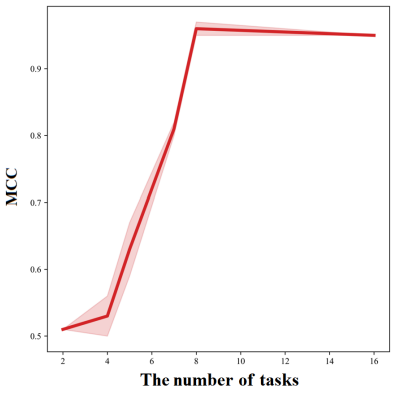

Fig 3: Empirical verification of the identifiability condition formulated in Theorem 1-iv: for a 3-dimensional parameter vector to be identified in the neural component of the hybrid model, with a Gaussian assumption of 2-dimensional sufficient statistics, a minimum of 3*2+1 = 7 distinct "tasks" (*i.e.*, distinct parameters generating data) is needed to identify the parameters.

Table 3: The identifiability results of the presented meta-hybrid-VAE are minimally affected by the number of parameters (on Pendulum), as long as the theoretical condition for identifiability (see Fig 3) is met.

Number of parameter	MSE of zp	MCC
2	1.28(0.01)e-2	0.97(0.01)
3	3.62(0.01)e-2	0.99(0.00)
4	1.59(0.07)e-2	0.99(0.00)

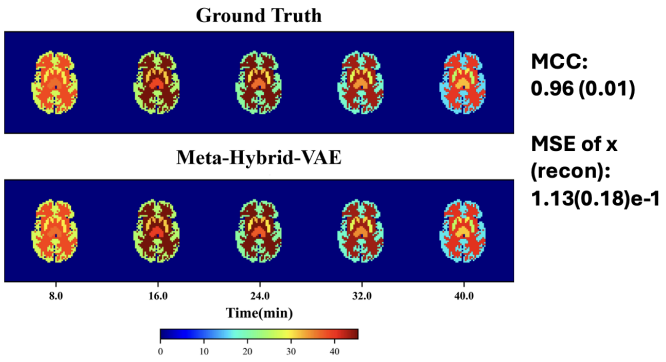

Fig 4: Identifiability results on PET images where **x**'s are generated from pixel-level 2-tissue compartment models, with 4 unknown kinetics parameters in each region of interest (ROI) with 5 ROIs in total. The hybrid model uses 1-tissue compartment model as the prior physics, which does not share any physics parameter with the data-generating kinetic model. The identifiability of the hybrid model is thus measured with the MCC metric.