



中央研究院物理研究所
INSTITUTE OF PHYSICS, ACADEMIA SINICA

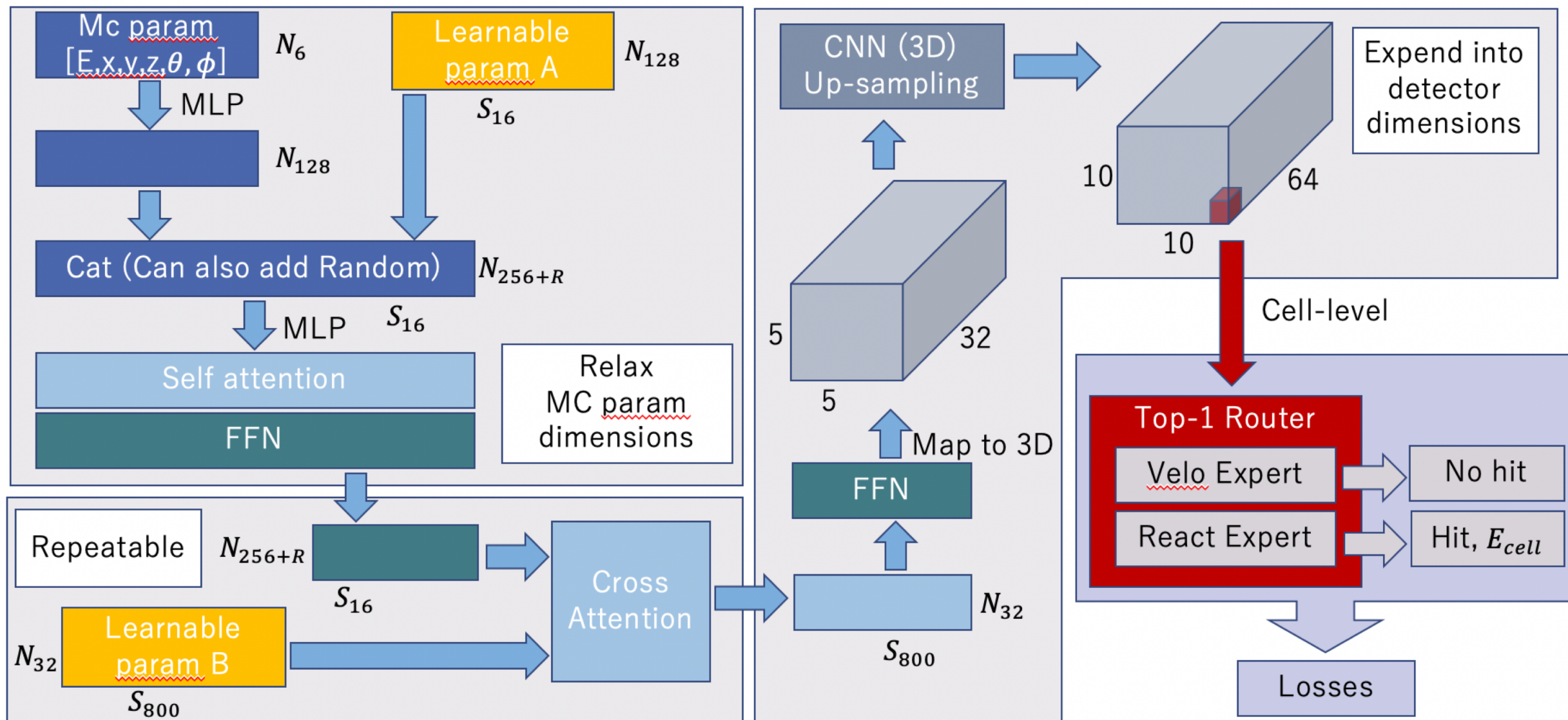
Status Update

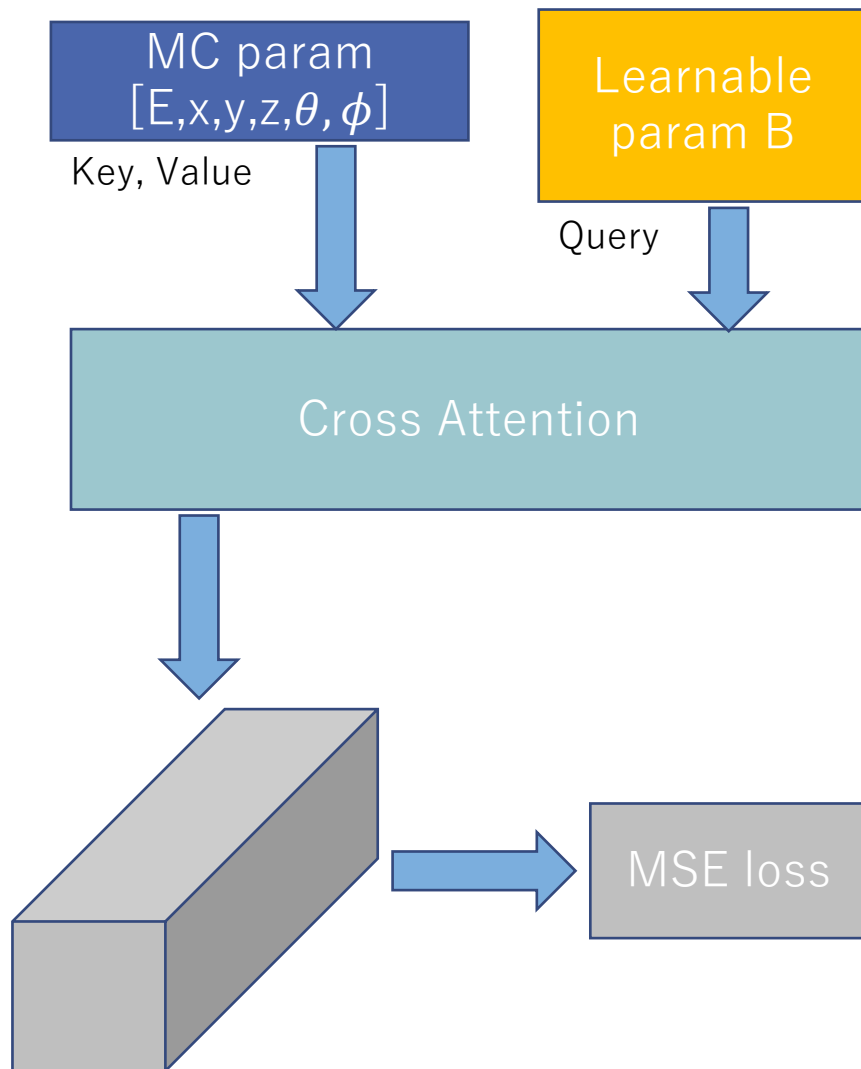
2025/12/24

ZDC internal

WAI YUEN CHAN

ZDC-ML framework: HCAL Generator workflow





Stage 1: MC encoding
 Stage 2: Cross Attention
 Stage 3: 3D mapping

$$\text{MSE loss: } L_{MSE} = \overline{(\sum E_{gen} - \sum E_{MC})^2}$$

$\sum E_{gen}$: Energy sum of 6400 cells in model generated matrix

$\sum E_{MC}$: Energy sum of 6400 cells in MC truth matrix

Parameter Count at Each Stage

Stage	Operation	Input Shape	Output Shape	Parameters
Stage 1	mc_mlp	[batch, 6]	[batch, 128]	768 + 128 = 896
	stage1_to_cross	[batch, 128]	[batch, 32]	4,096 + 32 = 4,128
Stage 2	learnable_param_b	-	[400, 32]	12,800
	cross_attention	[batch, 400, 32]	[batch, 400, 32]	~4,096
Stage 3	spatial_proj	[batch, 400, 32]	[batch, 100, 32]	40,100
	map_to_3d	[batch, 32, 10, 10]	[batch, 64, 10, 10]	2,048 + 64 = 2,112
Total				~64,032