



Wire-Cell ProtoDUNE Local Meeting

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Wire-Cell DNN Signal Processing

3 channels vs 6 channels validation

https://github.com/lastgeorge/DNN_ROI_SP/blob/main/docs/training_6ch_vs_3ch.md

- **PDHD Raw Dataset:** /nfs/data/1/hnam/train_data_PDHD_fixedbug_separateWC
- No dead-channel Augmentation

Data Pre-processing (`scripts/build_training_dataset_direct.py`)

- stack channels from the raw dataset
- Configurations

run id	data file	input ch	truth_th	GPUs
old3ch_th100_ep90	pdhd_rebin4_th100.h5	3	100	1
new6ch_slice012_th150_ep90	pdhd_direct_6ch_rebin4_th150_pad1.h5 *	3	150	1
new6ch_all_th150_ep90_ddp2	pdhd_direct_6ch_rebin4_th150_pad1.h5	6	150	2 (DDP)

Training

- 90 epochs, seed=0, SGD lr=0.1, momentum=0.9, weight_decay=5e-4, batch_size=1
- 100 events (90 train + 10 val)
- 590 events(531 train + 59 val)

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- Current figure in the draft

three additional channels contribute a further small gain. The six-channel input is adopted for all subsequent training.

- Training results with Xin's datasets:
- `/nfs/data/1/xqian/toolkit-dev/DNN_ROI_SP/data/pdhd/processed/pdhd_rebin4_th100.h5`
- `/nfs/data/1/xqian/toolkit-dev/DNN_ROI_SP/data/pdhd/pdhd_direct_6ch_rebin4_th150_pad1.h5`

Run comparison — six_channel_three_way_Xin

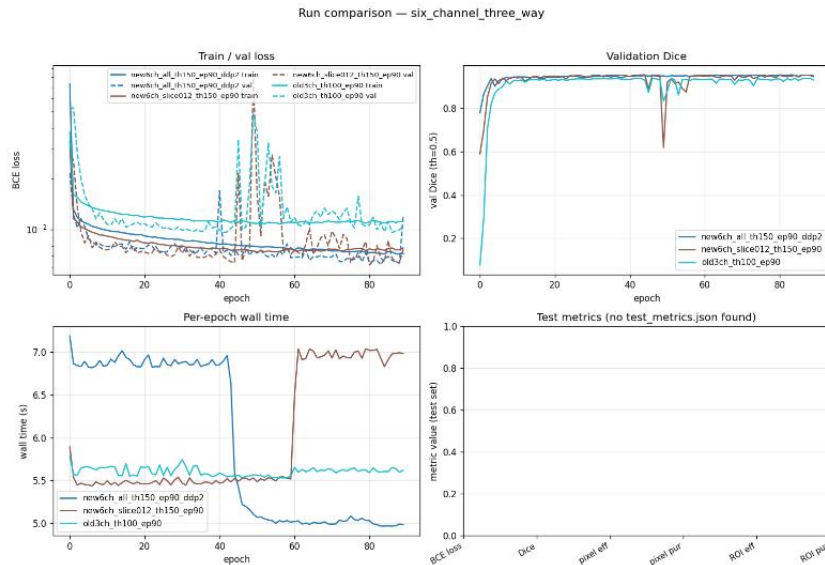
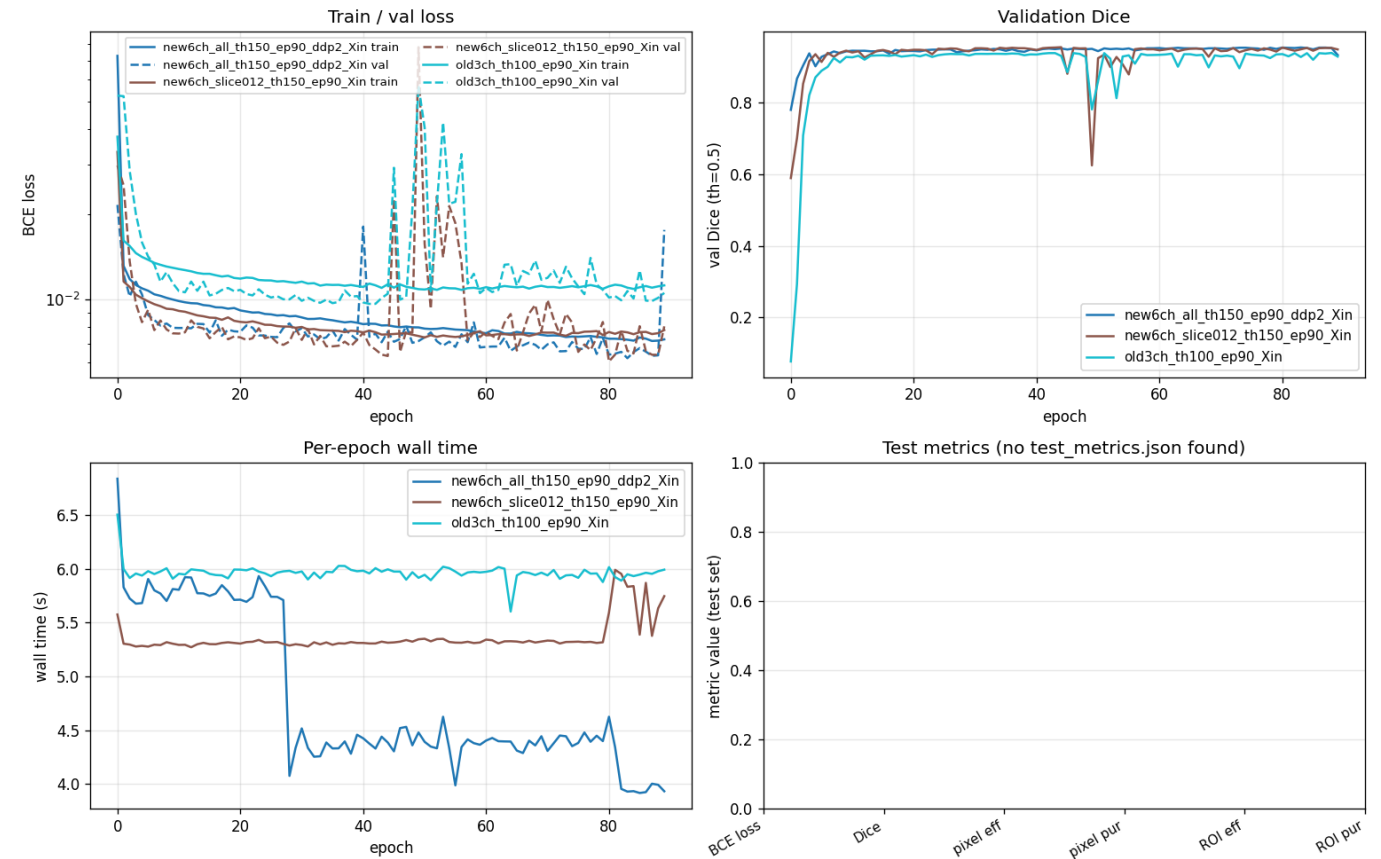


Figure 2. Three-way training comparison establishing the six-channel input: the original three-channel configuration, the same three channels drawn from the new sample, and the full six-channel input. The six-channel input does not degrade performance and yields a small additional gain.



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- Training results with my datasets:
- `/nfs/data/1/yujin/DNN_ROI_SP/data/pdhd/processed/pdhd_rebin4_th100.h5`
- `/nfs/data/1/yujin/DNN_ROI_SP/data/pdhd/processed/pdhd_direct_6ch_rebin4_th150_pad1.h5`

Run comparison — six_channel_three_way_100events

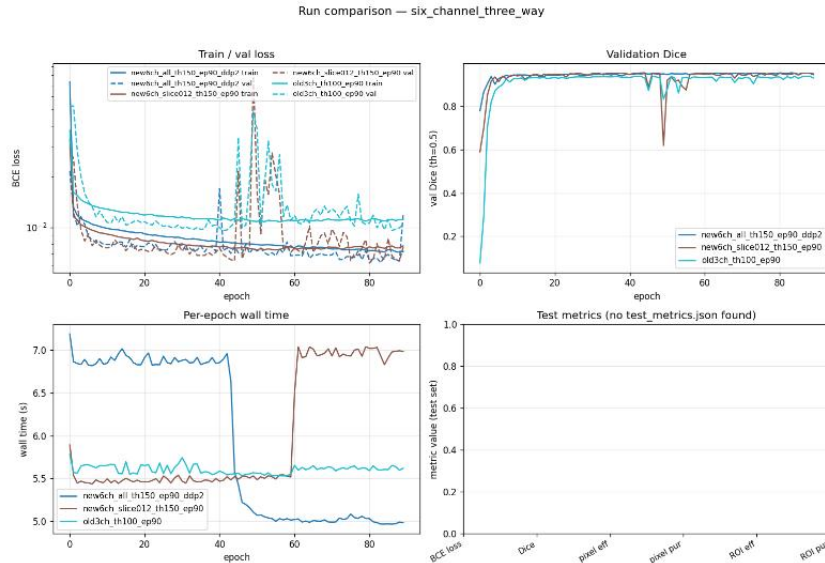
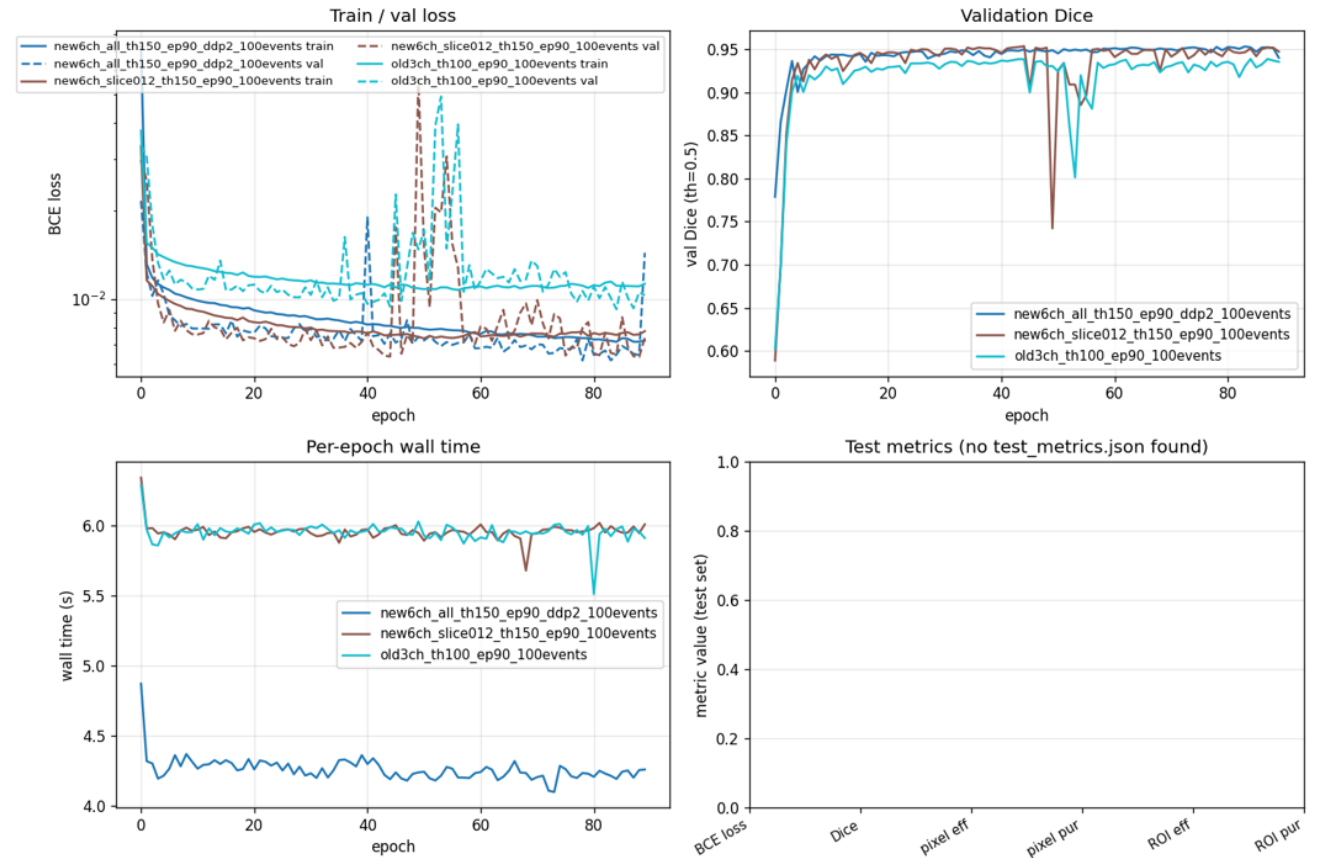


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metric	old3ch_th100	new6ch_slice012 (Δ vs old3ch)	new6ch_all_ddp2 (Δ vs slice012)
best epoch	41	80	83
val BCE loss	0.00961	0.00617 (-36 %)	0.00619 ($\approx$)
val Dice	0.9358	0.9519 (+0.016)	0.9536 (+0.002)
pixel efficiency	0.9037	0.9227 (+0.019)	0.9269 (+0.004)
pixel purity	0.9705	0.9832 (+0.013)	0.9821 ($\approx$)
ROI efficiency	0.8158	0.8631 (+0.047)	0.8662 (+0.003)
ROI purity	0.9899	0.9922 (+0.002)	0.9909 ($\approx$)

- Training results with Xin's datasets

Metric	old3ch_th100	new6ch_slice	new6ch_all
best epoch	41	80	83
val BCE loss	0.009673	0.006052 (-37.4%)	0.006215 (+2.7%)
Val Dice	0.935769	0.952568 (+0.0168)	0.952854 (+0.0003)
pixel efficiency	0.904812	0.924560 (+0.0197)	0.924105 (-0.0005)
pixel purity	0.969148	0.982453 (+0.0133)	0.983640 (+0.0112)
ROI efficiency	0.816906	0.866782 (+0.0499)	0.864017 (-0.0028)
Roi purity	0.988843	0.989778 (+0.0009)	0.992107 (+0.0023)

- Training results with my datasets

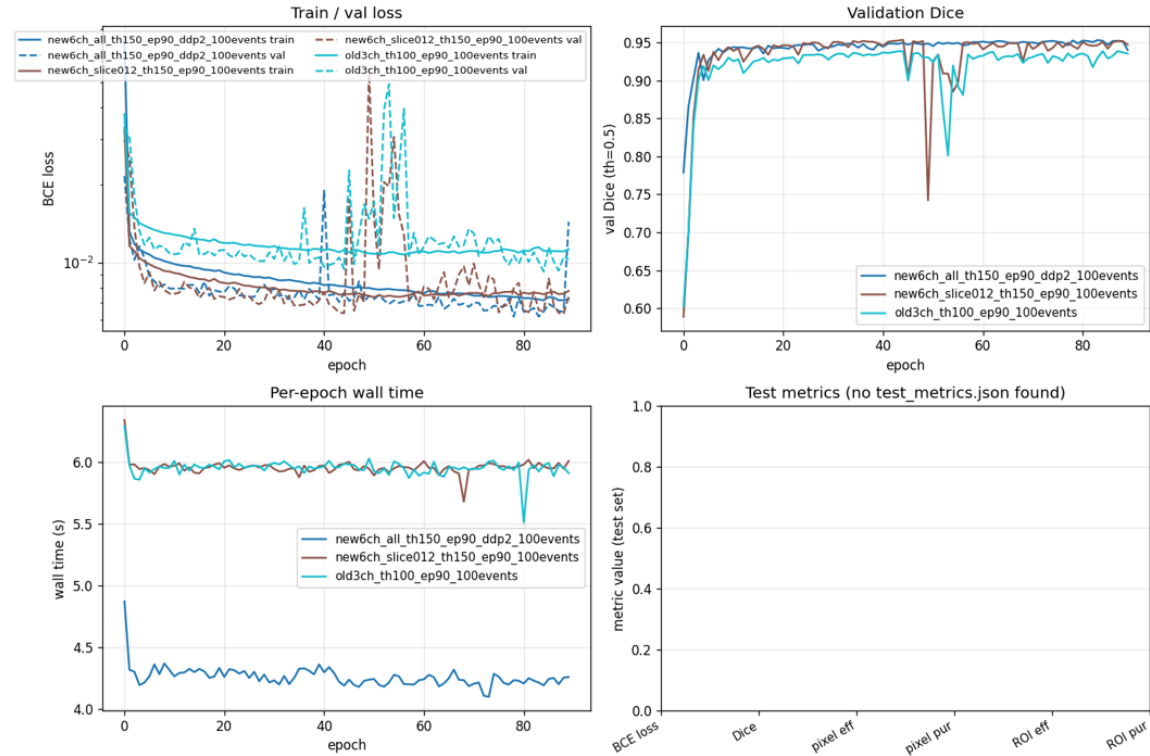
Metric	old3ch_th100	new6ch_slice	new6ch_all
best epoch	84	88	78
val BCE loss	0.009248	0.006358 (-31.3%)	0.006190 (-2.6%)
Val Dice	0.938748	0.951877 (+0.0131)	0.952780 (+0.0009)
pixel efficiency	0.901140	0.930523 (+0.0294)	0.930871 (+0.0003)
pixel purity	0.979935	0.974416 (-0.0055)	0.975908 (+0.0149)
ROI efficiency	0.820036	0.860076 (+0.0400)	0.865425 (+0.0053)
Roi purity	0.990242	0.994176 (+0.0039)	0.991427 (-0.0027)

Wire-Cell DNN Signal Processing

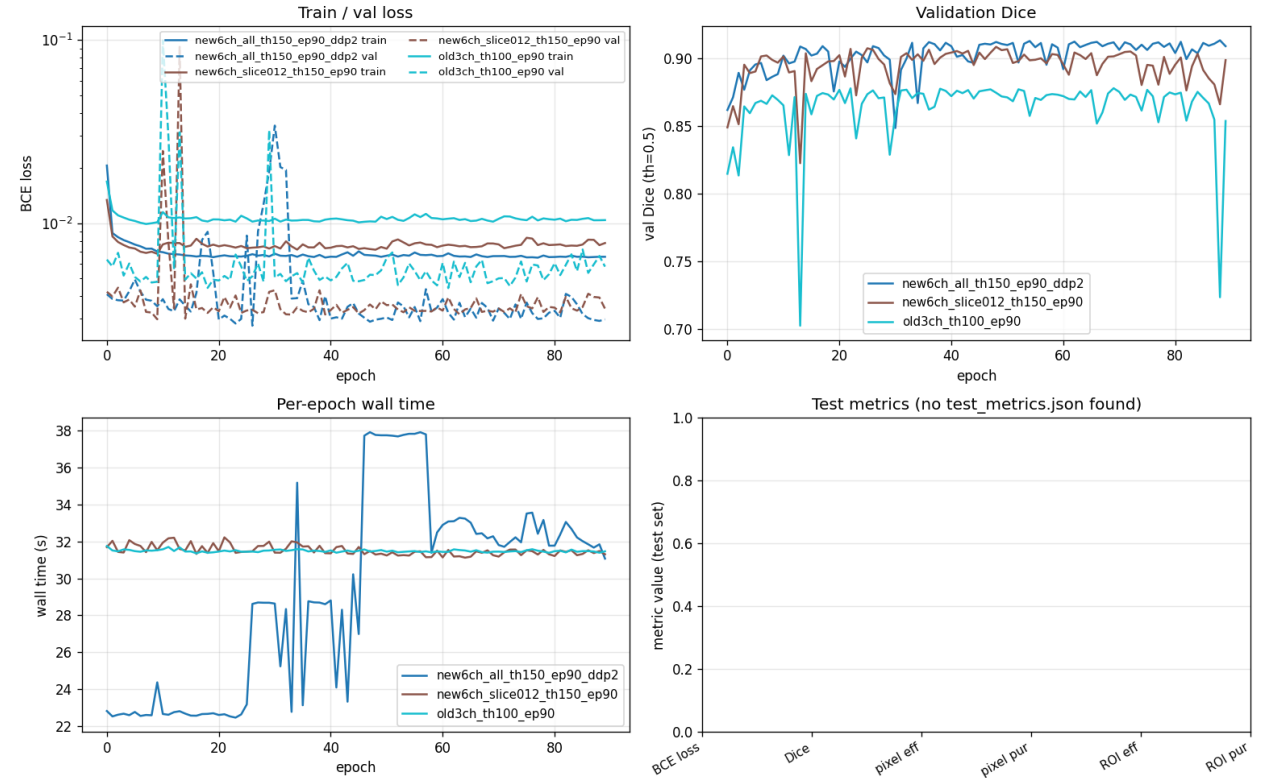
3 channels vs 6 channels validation

- Training results with my datasets; 100 events
- Training results with my datasets; 590 events

Run comparison — six_channel_three_way_100events



Run comparison — six_channel_three_way



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ROI efficiency	0.8158	0.8631 (+0.047)	0.8662 (+0.003)
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- Training results with my datasets; 100 events

Metric	old3ch_th100	new6ch_slice	new6ch_all
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Roi purity	0.990242	0.994176 (+0.0039)	0.991427 (-0.0027)

- Training results with my datasets; 590 events

Metric	old3ch_th100	new6ch_slice	new6ch_all
best epoch	61	9	26
val BCE loss	0.004418	0.002984 (-32.5%)	0.002752 (-7.8%)
val Dice	0.869741	0.896515 (+0.0268)	0.908686 (+0.0121)
pixel efficiency	0.797166	0.829350 (+0.0322)	0.871504 (+0.0422)
pixel purity	0.957410	0.975883 (+0.0185)	0.949446 (-0.0264)
ROI efficiency	0.634105	0.688518 (+0.0544)	0.733924 (+0.0454)
ROI purity	0.956780	0.977191 (+0.0204)	0.950377 (-0.0268)

Backup