



Question, setup, and scoring

Can a BP-trained trace interpolator reconstruct masked traces on both a complete synthetic benchmark and a real marine line, with no Viking field retraining?

BP 2007: complete synthetic targets; 75% of receiver traces are masked in groups of eight; used for training and testing.

Viking Line 12: no field retraining; observed field traces are masked and scored after BP-only training.

Four visible-only inputs

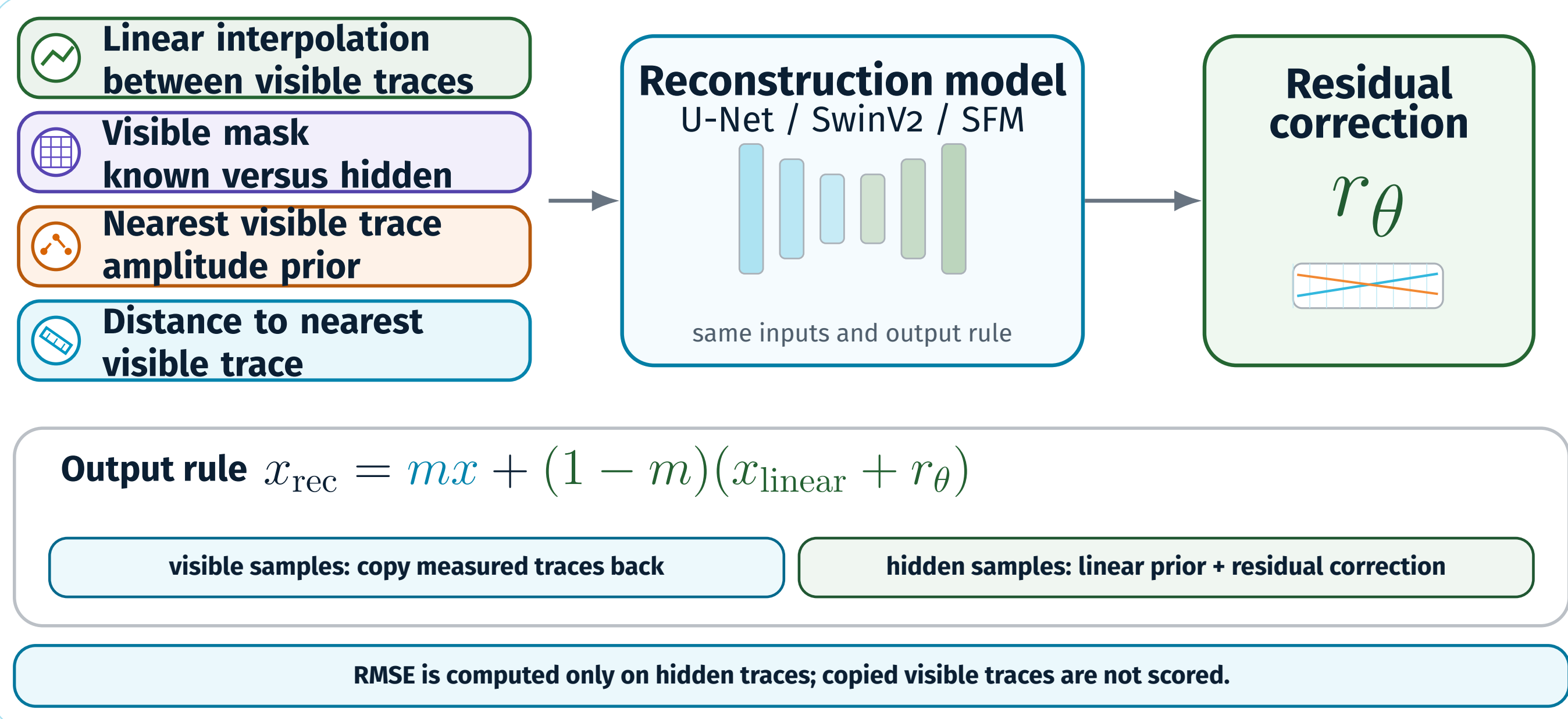


Figure 1. Learned models receive four visible-only inputs, predict a residual correction, copy visible traces back, and score only masked traces.

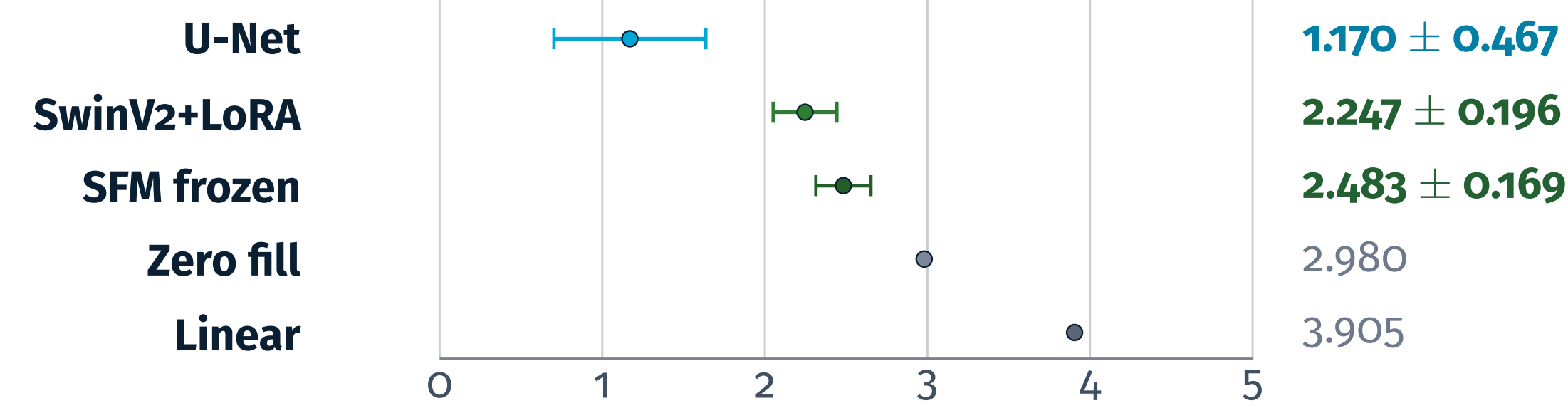
Scored samples are masked traces only.

This avoids making a reconstruction look better by copying measured traces.

Results on masked traces

RMSE on masked traces (mean \pm 95% CI)

BP 2007 synthetic amplitude scale ≈ 1



Viking Line 12 field test amplitude scale $\approx 10^1$

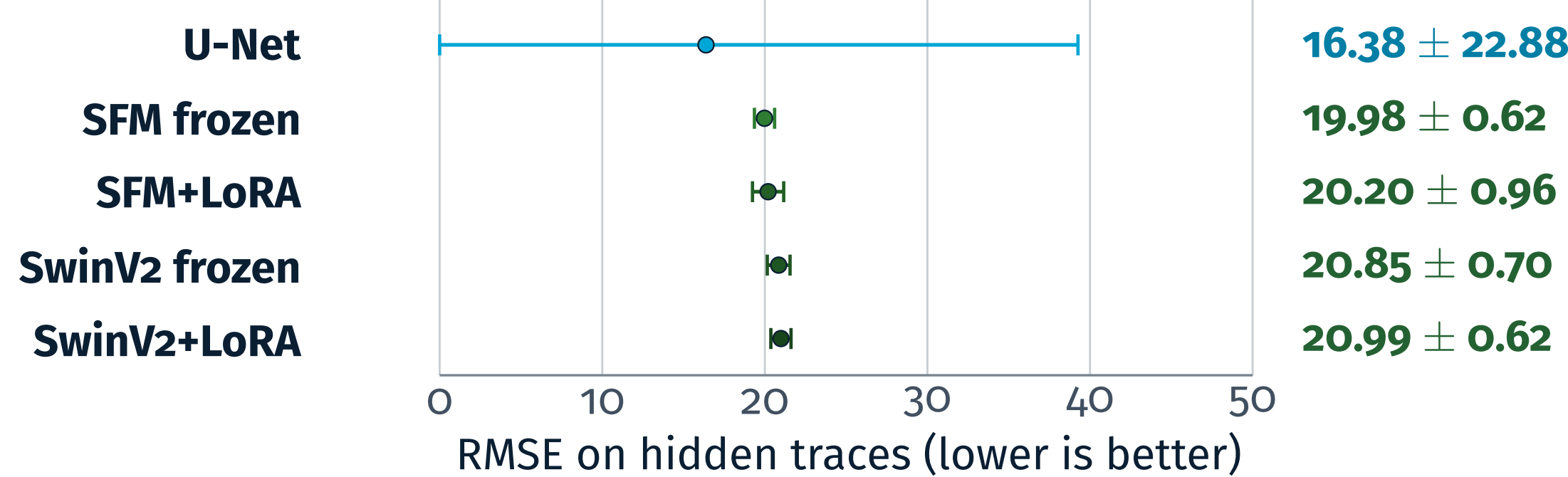


Figure 2. RMSE on masked traces for BP 2007 and Viking Line 12. BP and Viking use different amplitude scales, so they are shown separately.

🏆 BP 2007: U-Net reaches 1.170 ± 0.467 RMSE. The best pre-trained BP method, SwinV2 + LoRA, reaches 2.247 ± 0.196 . Across 2952 matched BP unit/mask/repeat cases, U-Net beats both adapted transfer models in **100%** of cases.

🌊 Viking Line 12: U-Net has the lowest mean RMSE, **16.38**, but repeat variation is large (± 22.88). Frozen SFM is the steadier pretrained field result: 19.98 ± 0.62 RMSE and highest Viking SSIM, **0.7345**.

Model size and parameter counts

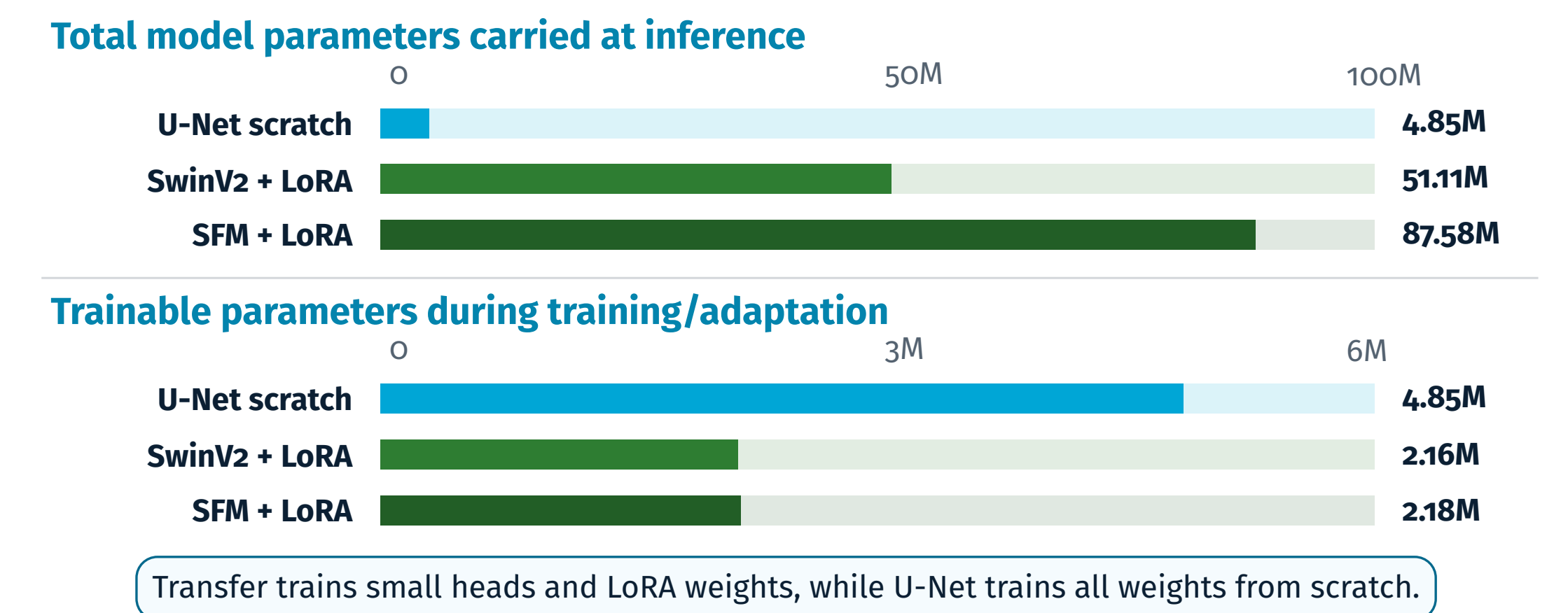


Figure 3. U-Net is much smaller in total parameters than the pretrained backbones. Trainable count is a different comparison: transfer trains small heads and LoRA weights, while U-Net trains all weights from scratch.

📌 Model capacity comparison: SwinV2 and SFM use reconstruction heads of about **1.29M** trainable parameters. U-Net's decoder-side reconstruction capacity is within about **9%** of that range.

🏆 BP 2007 result: U-Net gives the lowest masked-trace RMSE in this comparison and uses only **4.85M** total parameters.

⚠️ What the two datasets show: BP 2007 tests reconstruction against a complete synthetic target. Viking Line 12 hides observed field traces after BP-only training, so the two results should be read separately.

Example field reconstruction

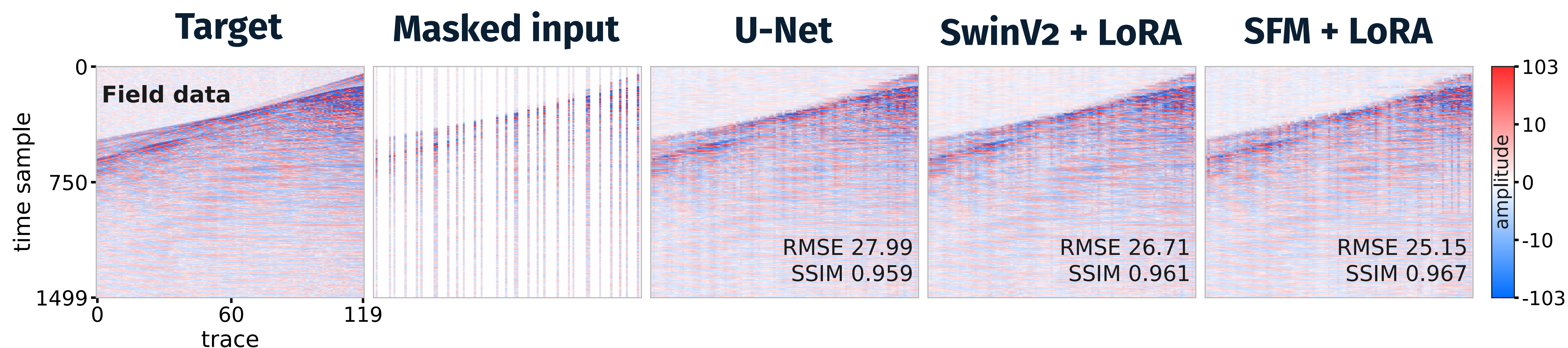


Figure 4. Example BP-trained reconstructions on Viking Line 12. Panels show target, masked input, and three model predictions. Metrics inside panels are for this example only.