

Supplementary dataset description

We provide both real sequencing data (**Table 1**) and simulated data (**Table 2**) used to generate the recovery results presented in this study. This release is intended to ensure reproducibility and enable independent verification of the performance of the proposed readout framework.

Table 1. Description of the real sequencing datasets.

Index	Sequencing data	Code rate	File name
Exp-1	DNA-40.5Kb-DR-SE150 (R=1/4)	1/4	DNA-40.5Kb-DR-SE150.fastq
Exp-2	DNA-40.32Kb-ER-SE150 (R=1/2)	1/2	DNA-40.32Kb-ER-SE150.fastq
Exp-3	DNA-40.5Kb-EM-SE150 (R=2/3)	2/3	DNA-40.5Kb-EM-SE150.fastq
Exp-4	DNA-40.5Kb-MC-SE150 (R=5/6)	5/6	DNA-40.5Kb-MC-SE150.fastq
Exp-5	DNA-40.5Kb-DR-SE250 (R=1/4)	1/4	DNA-40.5Kb-DR-SE250.fastq
Exp-6	DNA-40.32Kb-ER-SE250 (R=1/2)	1/2	DNA-40.32Kb-ER-SE250.fastq
Exp-7	DNA-40.5Kb-EM-SE250 (R=2/3)	2/3	DNA-40.5Kb-EM-SE250.fastq
Exp-8	DNA-40.5Kb-MC-SE250 (R=5/6)	5/6	DNA-40.5Kb-MC-SE250.fastq
Exp-9	DNA-40.5Kb-DR-ONT-1 (R=1/4)	1/4	DNA-40.5Kb-DR-ONT-1.fastq
Exp-10	DNA-40.5Kb-EM-ONT-1 (R=2/3)	2/3	DNA-40.5Kb-EM-ONT-1.fastq
Exp-11	DNA-40.5Kb-DR-ONT-2 (R=1/4)	1/4	DNA-40.5Kb-DR-ONT-2.fastq
Exp-12	DNA-40.5Kb-EM-ONT-2 (R=2/3)	2/3	DNA-40.5Kb-EM-ONT-2.fastq
Exp-13	DNA-40.5Kb-Mix-SE150	1/4 + 2/3	DNA-40.5Kb-Mix-SE150.fastq

Table 2. Description of the simulated dataset.

Index	Sequencing data	Code rate	File name
Sim-1	DNA-40.5Kb-DR-Sim-1 (R=1/4)	1/4	DNA-40.5Kb-DR-Sim-1.fastq
Sim-2	DNA-40.32Kb-ER-Sim-1 (R=1/2)	1/2	DNA-40.32Kb-ER-Sim-1.fastq
Sim-3	DNA-40.5Kb-EM-Sim-1 (R=2/3)	2/3	DNA-40.5Kb-EM-Sim-1.fastq
Sim-4	DNA-40.5Kb-MC-Sim-1 (R=5/6)	5/6	DNA-40.5Kb-MC-Sim-1.fastq
Sim-5	DNA-20Kb-RB-Sim-1 (R=0.93)	0.93	DNA-20Kb-RB-Sim-1.fastq
Sim-6	DNA-40.5Kb-DR-Sim-2 (R=1/4)	1/4	DNA-40.5Kb-DR-Sim-2.fastq
Sim-7	DNA-40.32Kb-ER-Sim-2 (R=1/2)	1/2	DNA-40.32Kb-ER-Sim-2.fastq
Sim-8	DNA-40.5Kb-EM-Sim-2 (R=2/3)	2/3	DNA-40.5Kb-EM-Sim-2.fastq
Sim-9	DNA-40.5Kb-MC-Sim-2 (R=5/6)	5/6	DNA-40.5Kb-MC-Sim-2.fastq
Sim-10	DNA-20Kb-RB-Sim-2 (R=0.93)	0.93	DNA-20Kb-RB-Sim-2.fastq