

Supplementary Table 8. Hi-C data quality metrics and interaction classification.

Metric / Category	Count / Value
valid_interaction	25836209
valid_interaction_rmdup	17089861
trans_interaction	5025984
cis_interaction	12063877
cis_shortRange (<20K)	3049076
cis_longRange (>=20K)	9014801
cis/trans ratio	2.4003015
cis/(cis+trans) proportion	70.59%

Notes: Valid interactions were defined as mapped read pairs with specific restrictions. Cis interactions refer to chromosomal contacts within the same chromosome; trans interactions refer to contacts between different chromosomes. The high cis/trans ratio (2.40) and cis proportion (70.59%) indicate high-quality Hi-C data with minimal random ligation noise.