Integrative Structure Validation Report

October 09, 2025 - 04:37 PM PDT

The following software was used in the production of this report:

IHMValidation Version 3.0
Python-IHM Version 2.5

PDB ID	9A01 | pdb_00009a01
PDB-Dev ID	PDBDEV_00000037
Structure Title	Integrative structure of the canonical human COP9 Signalosome
Structure Authors	Gutierrez C; Chemmama IE; Mao H; Yu C; Echeverria I; Block SA; Rychnovsky SD; Zheng N; Sali A; Huang L
Deposited on	2019-11-13

This is a PDB-IHM Structure Validation Report.

We welcome your comments at helpdesk@pdb-ihm.org

A user guide is available at https://pdb-ihm.org/validation_help.html with specific help available everywhere you see the ? symbol.

List of references used to build this report is available here.

1. Overview

1.1. Summary

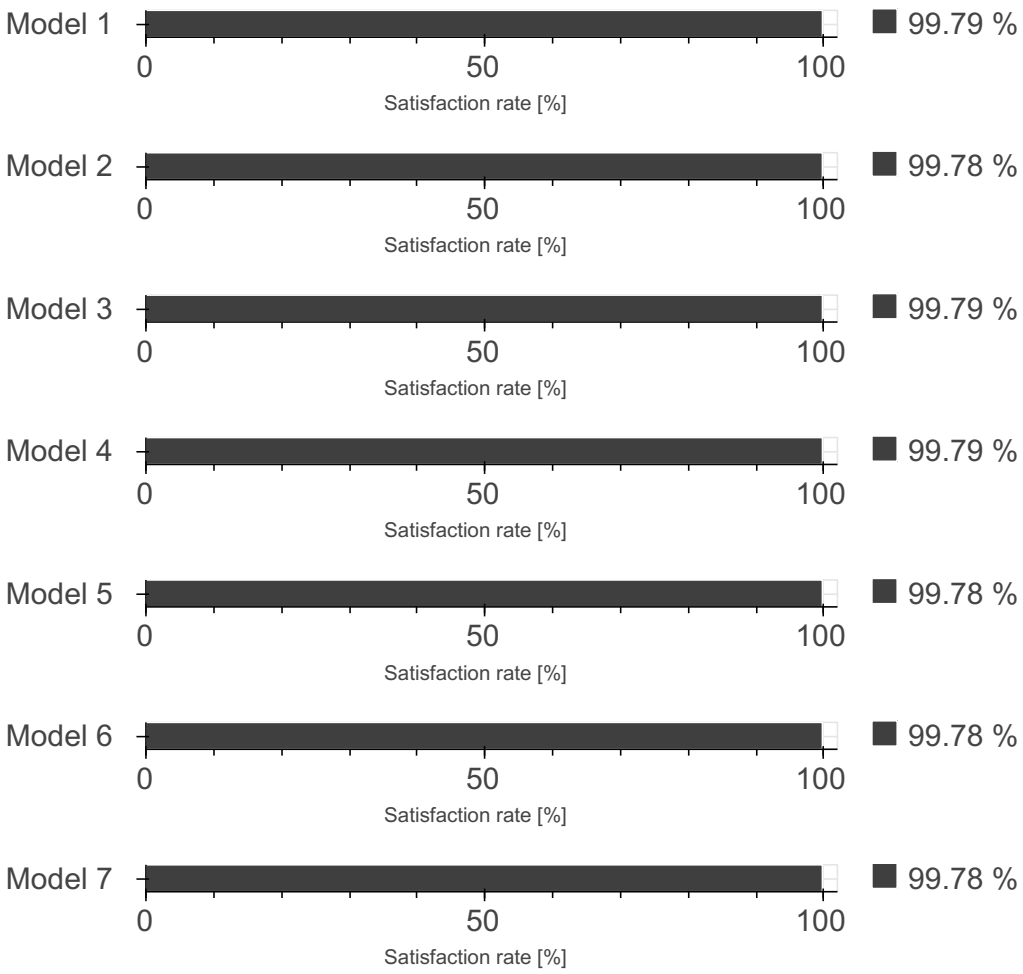
This entry consists of 7 model(s). A total of 11 dataset(s) were used to build this entry.

Name	Type	Count
Crosslinking-MS data	Experimental data	6
Experimental model	Starting model	3
Comparative model	Starting model	2

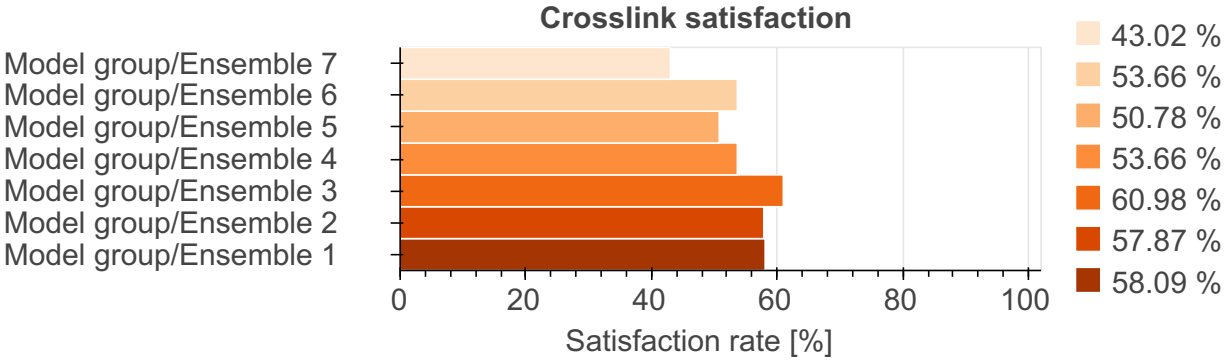
1.2. Overall quality

This validation report contains model quality assessments for all structures, data quality and fit to model assessments for SAS and crosslinking-MS datasets. Data quality and fit to model assessments for other datasets and model uncertainty are under development. Number of plots is limited to 256.

Model Quality: Excluded Volume Analysis



Fit to Data Used for Modeling



2. Model Details

2.1. Ensemble information

This entry consists of 7 distinct ensemble(s).

2.2. Representation

This entry has 1 representation(s).

ID	Model(s)	Entity ID	Molecule name	Chain(s) [auth]	Total residues	Rigid segments	Flexible segments	Model coverage/ Starting model coverage (%)	Scale
1	1-7	1	CSN1	A	491	44-107, 128-227, 246-426, 431-462	1-43, 108-127, 228-245, 427-430, 463-491	100.00 / 76.78	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		2	CSN2	B	443	30-179, 192-289, 308-397, 417-443	1-29, 180-191, 290-307, 398-416	100.00 / 82.39	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		3	CSN3	C	423	3-163, 177-361, 368-401	1-2, 164-176, 362-367, 402-423	100.00 / 89.83	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		4	CSN4	D	406	3-131, 139-361, 365-406	1-2, 132-138, 362-364	100.00 / 97.04	Multiscale: Coarse-grained: 1 - 7 residue(s) per bead
		5	CSN5	E	334	25-283, 296-333	1-24, 284-295, 334	100.00 / 88.92	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		6	CSN6	F	327	29-207, 215-267, 271-316	1-28, 208-214, 268-270, 317-327	100.00 / 85.02	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		7	CSN7	G	264	8-158, 163-212	1-7, 159-162, 213-264	100.00 / 76.14	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead
		8	CSN8	H	209	11-164, 194-209	1-10, 165-193	100.00 / 81.34	Multiscale: Coarse-grained: 1 - 10 residue(s) per bead

2.3. Datasets used for modeling

There are 11 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	Experimental model	Zenodo	10.5281/zenodo.3827934
2	Comparative model	Zenodo	10.5281/zenodo.3827934
3	Experimental model	PDB	pdb_00004d10
4	Experimental model	Zenodo	10.5281/zenodo.3827934

ID	Dataset type	Database name	Data access code
5	Comparative model	Zenodo	10.5281/zenodo.3827934
6	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934
7	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934
8	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934
9	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934
10	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934
11	Crosslinking-MS data	Zenodo	10.5281/zenodo.3827934

2.4. Methodology and software

This entry is a result of 1 distinct protocol(s).

Step number	Protocol ID	Method name	Method type	Method description	Number of computed models	Multi state modeling	Multi scale modeling
1	1	Sampling	Replica exchange monte carlo	Not available	5250000	False	True

There are 3 software packages reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	IMP PMI module	20200514.develop.17be5981c6	integrative model building	https://integrativemodeling.org
2	Integrative Modeling Platform (IMP)	20200514.develop.17be5981c6	integrative model building	https://integrativemodeling.org
3	MODELLER	SVN	comparative modeling	https://salilab.org/modeller/

3. Data quality

3.2. Crosslinking-MS

At the moment, data validation is only available for crosslinking-MS data deposited as a fully compliant dataset in the PRIDE Crosslinking database. Correspondence between crosslinking-MS and entry entities is established using pyHMMER. Only residue pairs that passed the reported threshold are used for the analysis. The values in the report have to be interpreted in the context of the experiment (i.e. only a minor fraction of in-situ or in-vivo dataset can be used for modeling).

Crosslinking-MS dataset is not available in the PRIDE Crosslinking database.

4. Model quality

For models with atomic structures, MolProbity analysis is performed. For models with coarse-grained or multi-scale structures, excluded volume analysis is performed.

4.1a. Excluded Volume Analysis

Excluded volume satisfaction for the models in the entry are listed below. The Analysed column shows the number of particle-partice or particle-atom pairs for which excluded volume was analysed.

Model ID	Analysed	Number of violations	Excluded Volume Satisfaction (%)
1	3171421	6767	99.79
2	3171421	6862	99.78
3	3171421	6769	99.79
4	3171421	6810	99.79
5	3171421	6831	99.78
6	3171421	6840	99.78
7	3171421	6830	99.78

5. Fit to Data Used for Modeling Assessment

5.2. Crosslinking-MS

5.2.1. Restraint types

This table summarizes information about crosslinker(s) used for data generation, and how crosslinking information was translated into actual modeling restraints. Restraints assigned "by-residue" are interpreted as between CA atoms. Restraints between coarse-grained beads are indicated as "coarse-grained". Restraint group represents a set of crosslinking restraints applied collectively in the modeling.

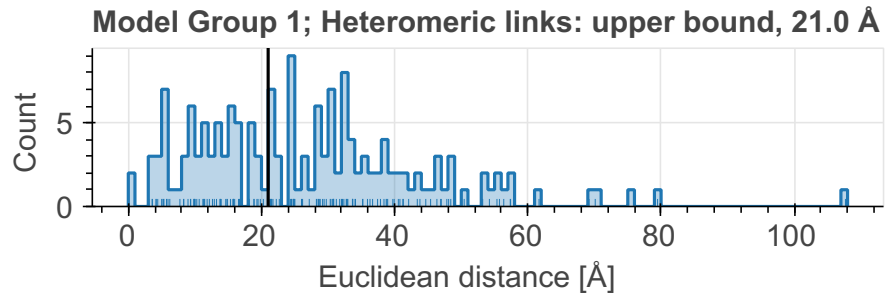
There are 451 crosslinking restraints combined in 451 restraint groups.

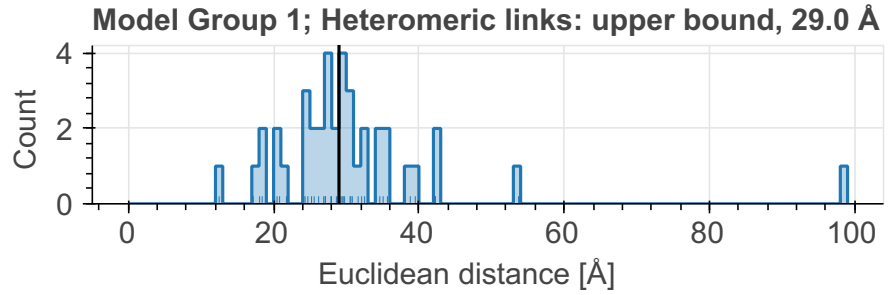
Linker	Residue 1	Atom 1	Residue 2	Atom 2	Restraint type	Distance, Å	Count
DSSO	LYS	CA	LYS	CA	upper bound	21.00	167
DSSO	LYS	coarse-grained	LYS	coarse-grained	upper bound	21.00	35
DSSO	LYS	coarse-grained	MET	coarse-grained	upper bound	21.00	12
BMSO	CYS	CA	CYS	CA	upper bound	29.00	66
BMSO	ARG	CA	CYS	CA	upper bound	29.00	1
BMSO	ALA	CA	CYS	CA	upper bound	29.00	1
DHSO	GLU	CA	GLU	CA	upper bound	21.00	71
DHSO	GLU	coarse-grained	GLU	coarse-grained	upper bound	21.00	59
DHSO	ASP	coarse-grained	ASP	coarse-grained	upper bound	21.00	1
DHSO	ASP	coarse-grained	GLU	coarse-grained	upper bound	21.00	16
DHSO	ASP	CA	GLU	CA	upper bound	21.00	19
DHSO	GLU	CA	HIS	CA	upper bound	21.00	1
DHSO	GLU	CA	GLY	CA	upper bound	21.00	1
DHSO	ARG	CA	GLU	CA	upper bound	21.00	1

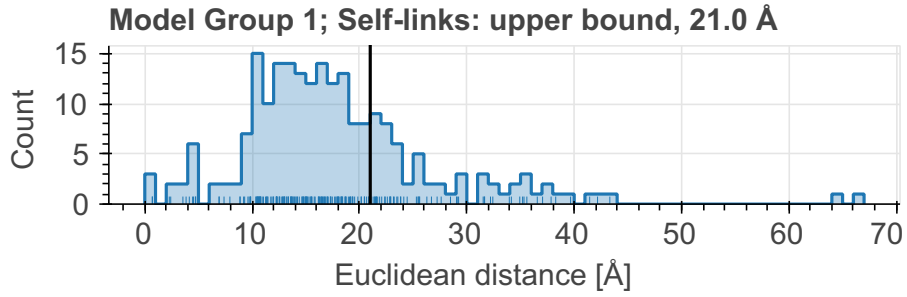
Distograms of individual restraints

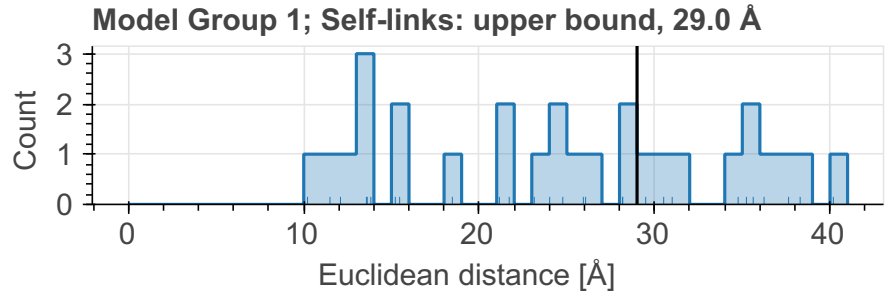
Distograms (i.e., histogram plots of distances) provide an overview of distributions of distances between residues for which chemical crosslinks were identified. The shift of the distogram relative to the threshold value may indicate a poor model. Restraints with

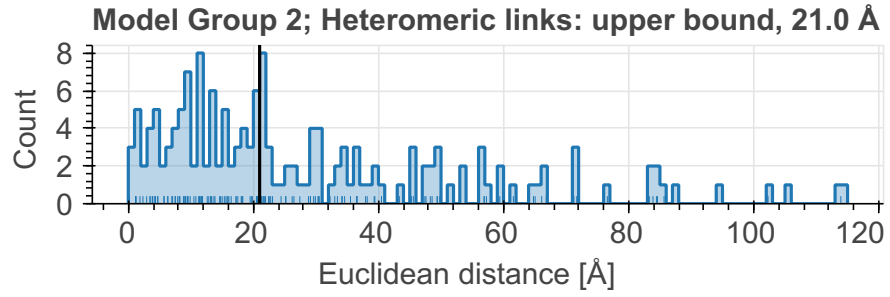
identical thresholds are grouped into one plot. Only the best distance per restraint per model group/ensemble is plotted. Inter- and intramolecular (including self-links) restraints are also grouped into one plot. Distance for a restraint between coarse-grained beads is calculated as a minimal distance between shells; if beads intersect, the distance will be reported as 0.0. A bead with the highest available resolution for a given residue is used for the assessment.

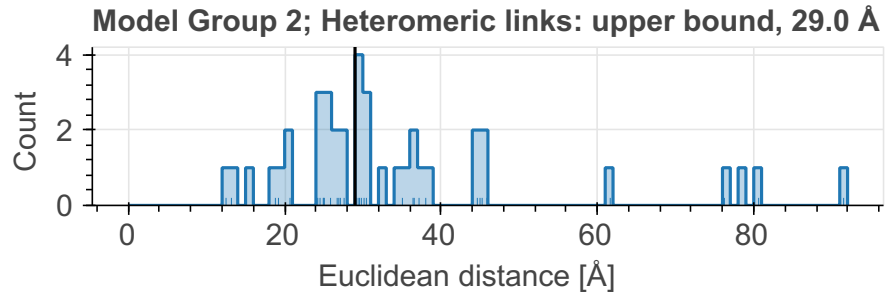


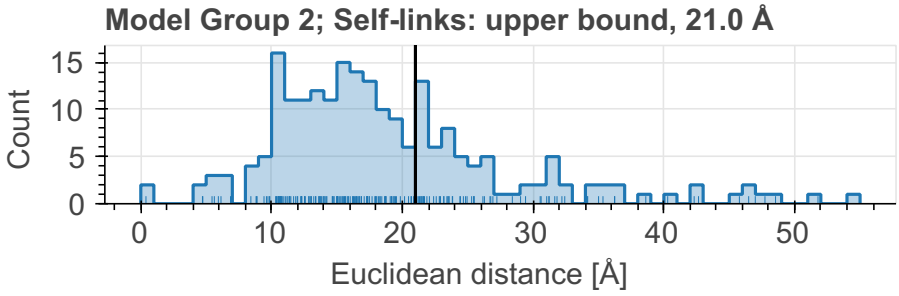









Model Group 2; Heteromeric links: upper bound, 29.0 Å
Count
Euclidean distance [Å]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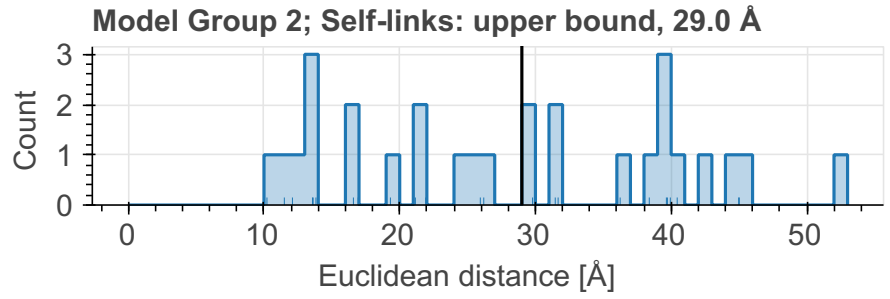
Count
Euclidean distance [Å]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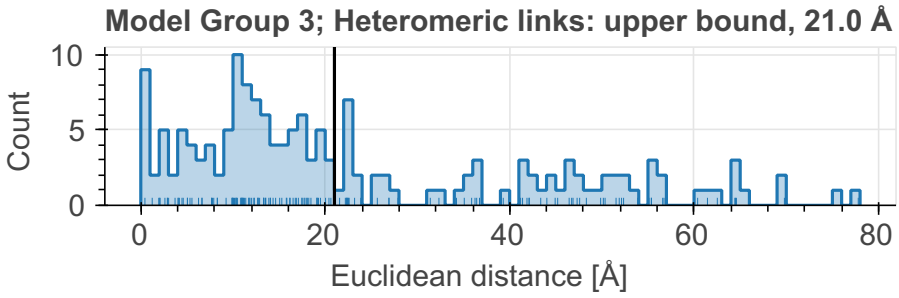
Count
Euclidean distance [Å]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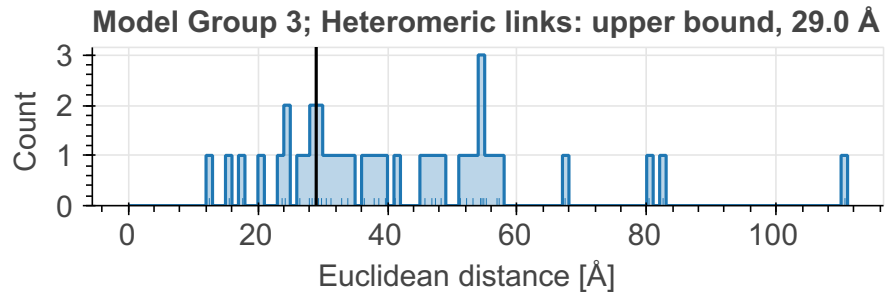
Count
Euclidean distance [Å]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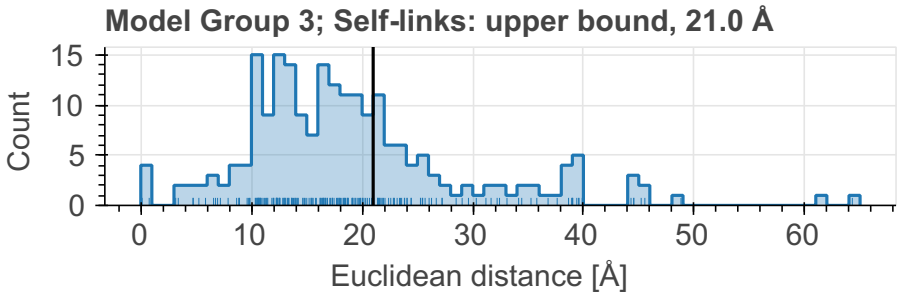
Count
Euclidean distance [Å]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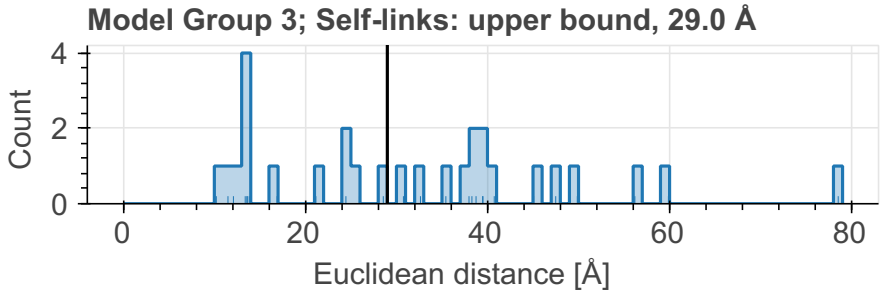
Count
Euclidean distance [Å]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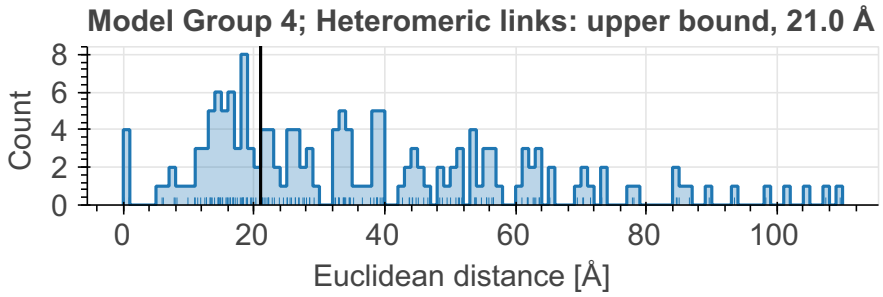
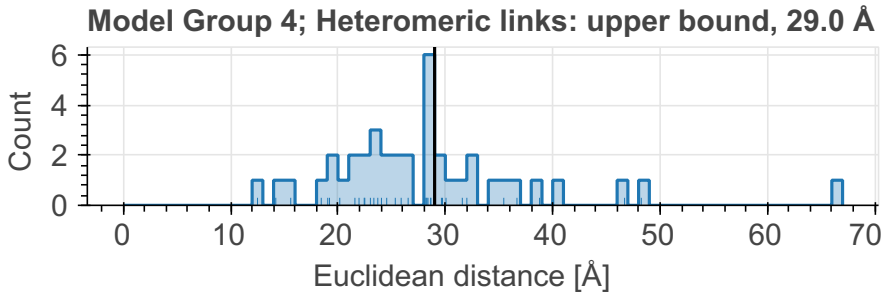
Count
Euclidean distance [Å]


Model Group 4; Heteromeric links: upper bound, 21.0 Å
Count
Euclidean distance [Å]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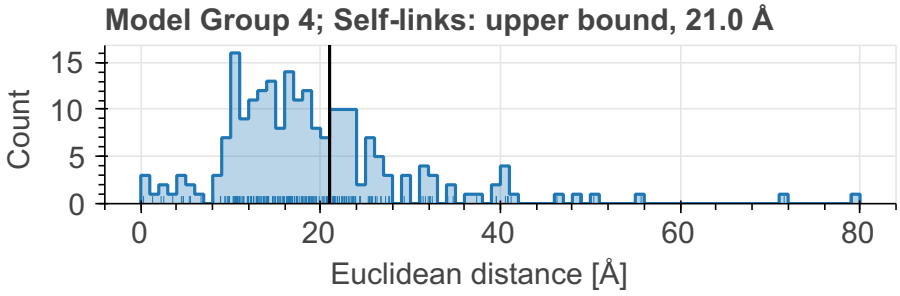
Count
Euclidean distance [Å]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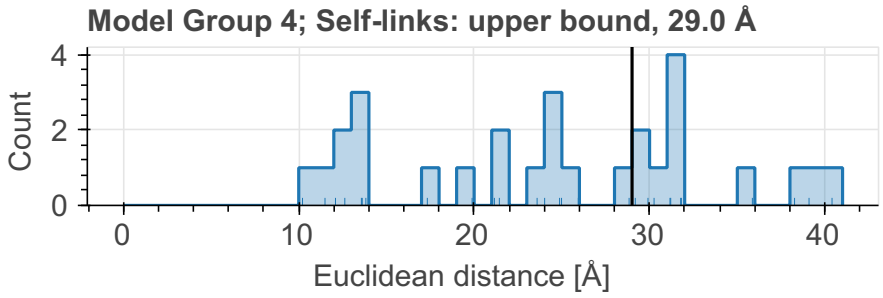
Count
Euclidean distance [Å]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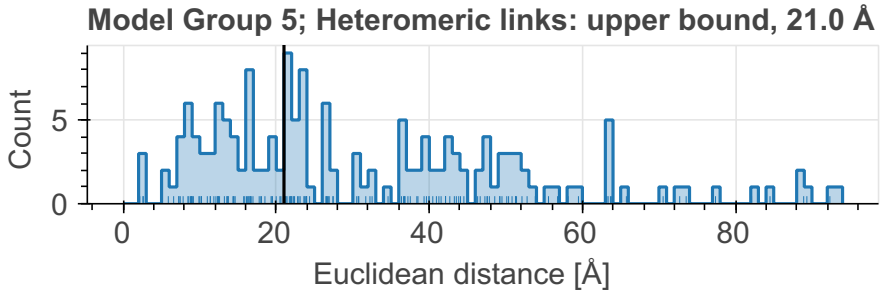
Count
Euclidean distance [Å]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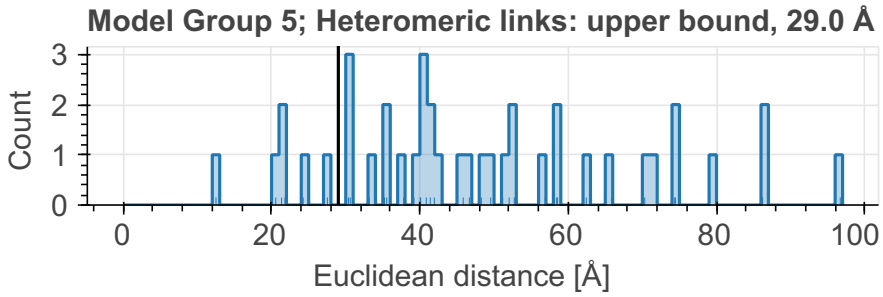
Count
Euclidean distance [Å]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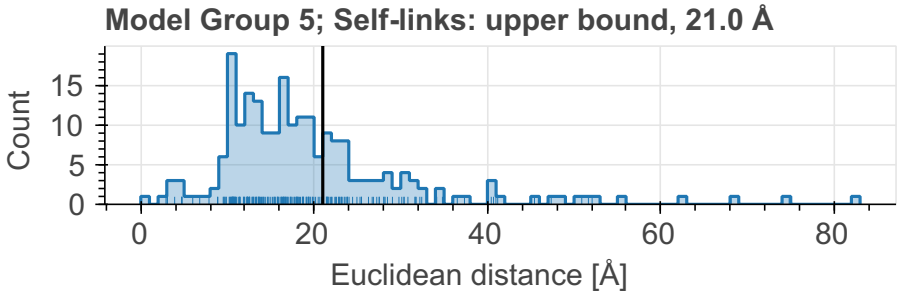
Count
Euclidean distance [Å]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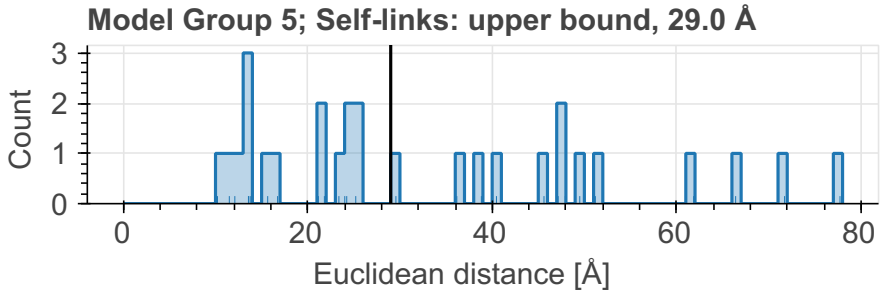
Count
Euclidean distance [Å]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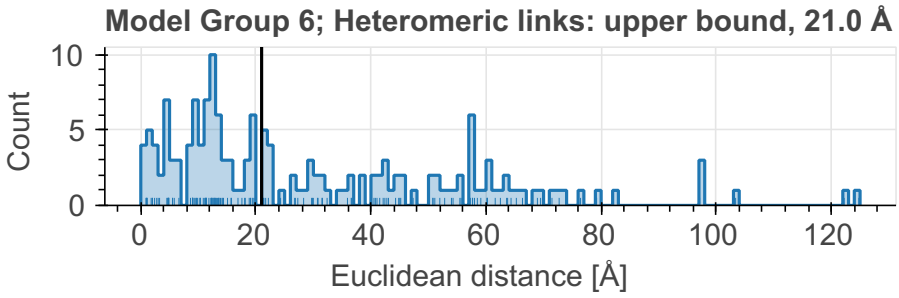
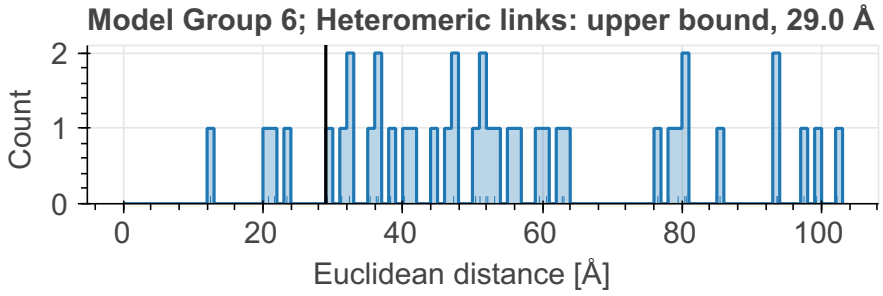
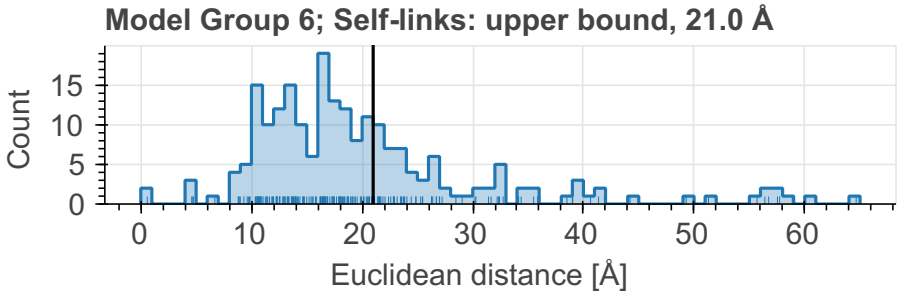
Count
Euclidean distance [Å]


Model Group 6; Heteromeric links: upper bound, 21.0 Å
Count
Euclidean distance [Å]


Model Group 6; Heteromeric links: upper bound, 29.0 Å
Count
Euclidean distance [Å]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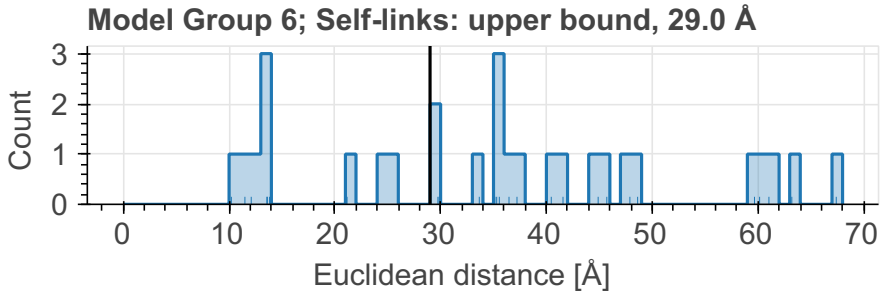
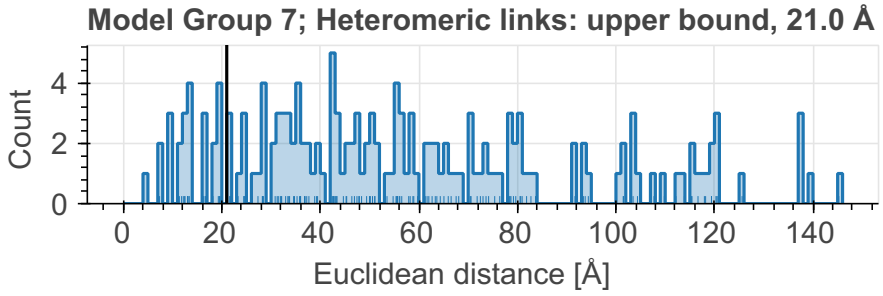
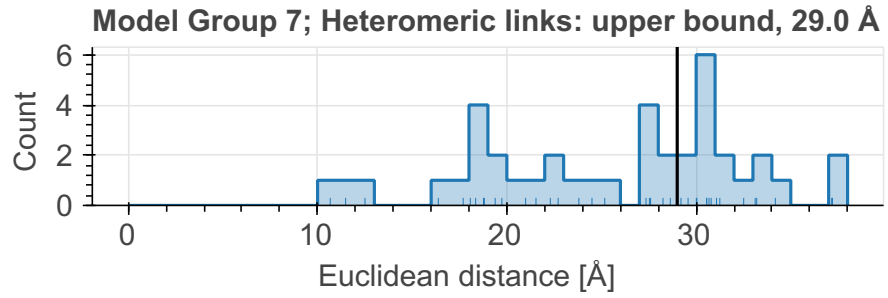
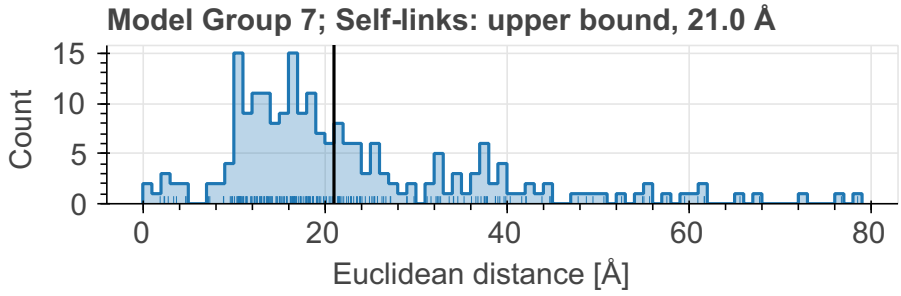
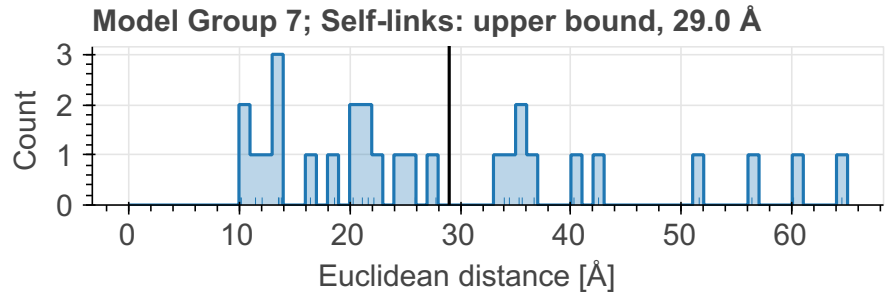
Count
Euclidean distance [Å]


Model Group 6; Self-links: upper bound, 29.0 Å
Count
Euclidean distance [Å]


Model Group 7; Heteromeric links: upper bound, 21.0 Å
Count
Euclidean distance [Å]







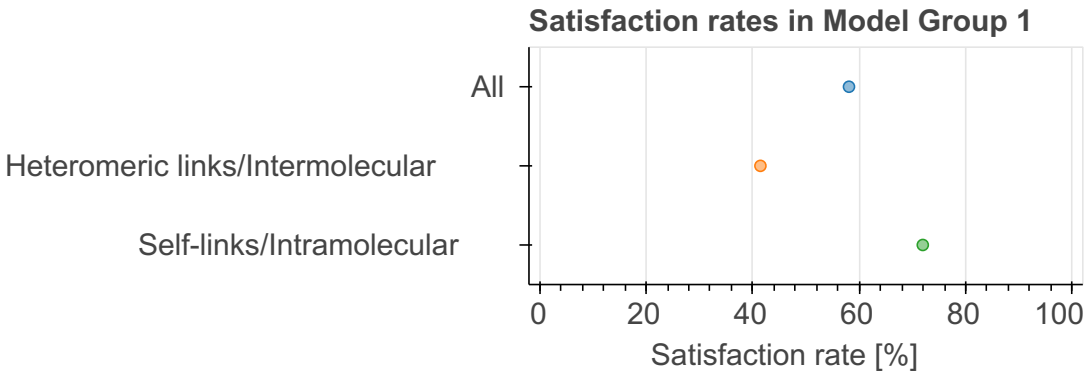
5.2.2. Satisfaction of restraints

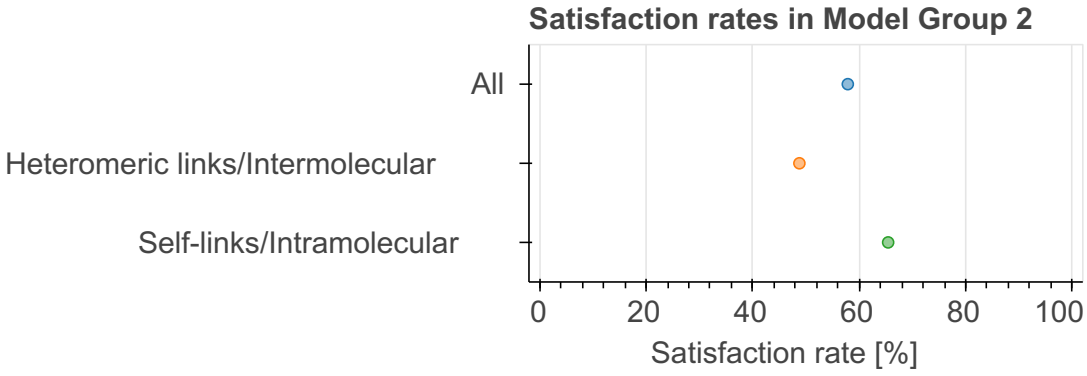
Satisfaction of restraints is calculated on a restraint group (a set of crosslinking restraints applied collectively in the modeling) level. Satisfaction of a restraint group depends on satisfaction of individual restraints in the group and the conditionality (all/any). A restraint group is considered satisfied, if the condition was met in at least one model of the model group/ensemble. The number of measured restraints can be smaller than the total number of restraint groups if crosslinks involve non-modeled residues. Only deposited models are used for validation right now.

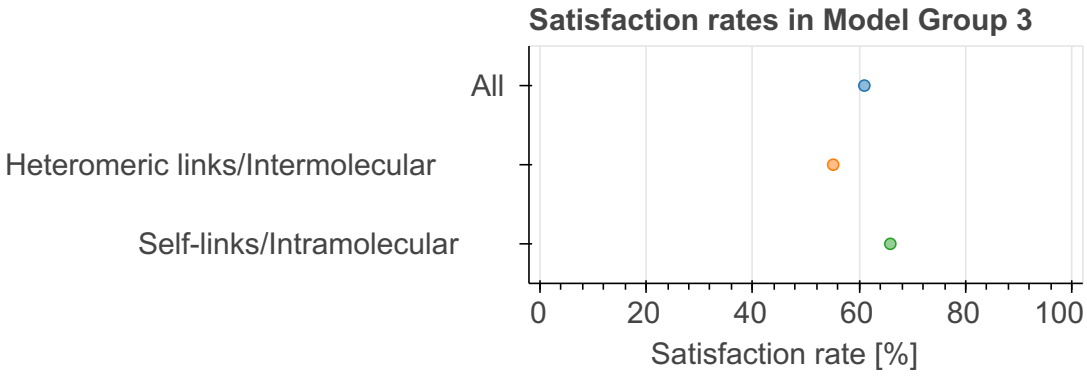
State group	State	Model group	# of Deposited models/Total	Restraint group type	Satisfied (%)	Violated (%)	Count (Total=451)
1	1	1	1/54702	All	58.09	41.91	451
				Heteromeric links/ Intermolecular	41.46	58.54	205
				Self-links/ Intramolecular	71.95	28.05	246
1	1	2	1/132407	All	57.87	42.13	451
				Heteromeric links/ Intermolecular	48.78	51.22	205
				Self-links/ Intramolecular	65.45	34.55	246
1	1	3	1/98186	All	60.98	39.02	451
				Heteromeric links/ Intermolecular	55.12	44.88	205
				Self-links/ Intramolecular	65.85	34.15	246
1	1	4	1/87368	All	53.66	46.34	451
				Heteromeric links/ Intermolecular	39.51	60.49	205
				Self-links/ Intramolecular	65.45	34.55	246
1	1	5	1/243067	All	50.78	49.22	451
				Heteromeric links/ Intermolecular	32.68	67.32	205
				Self-links/ Intramolecular	65.85	34.15	246
1	1	6	1/312515	All	53.66	46.34	451
				Heteromeric links/ Intermolecular	42.44	57.56	205
				Self-links/ Intramolecular	63.01	36.99	246
1	1	7	1/357350	All	43.02	56.98	451
				Heteromeric links/ Intermolecular	23.41	76.59	205
				Self-links/ Intramolecular	59.35	40.65	246

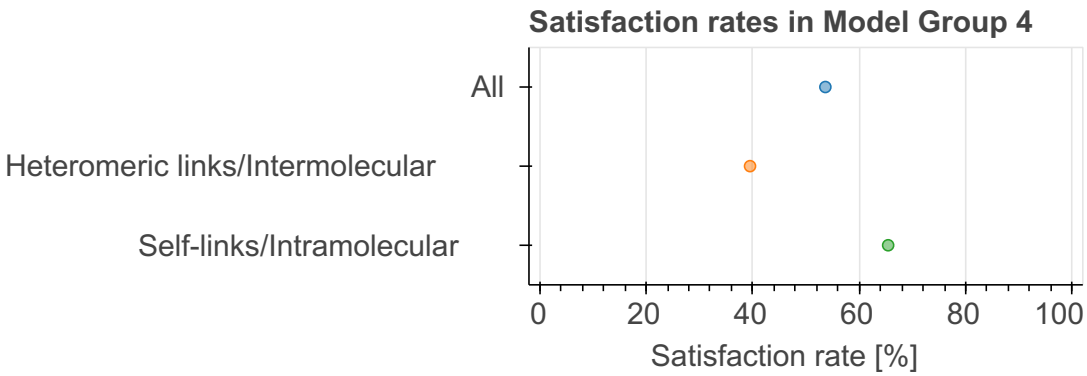
Per-model satisfaction rates in ensembles

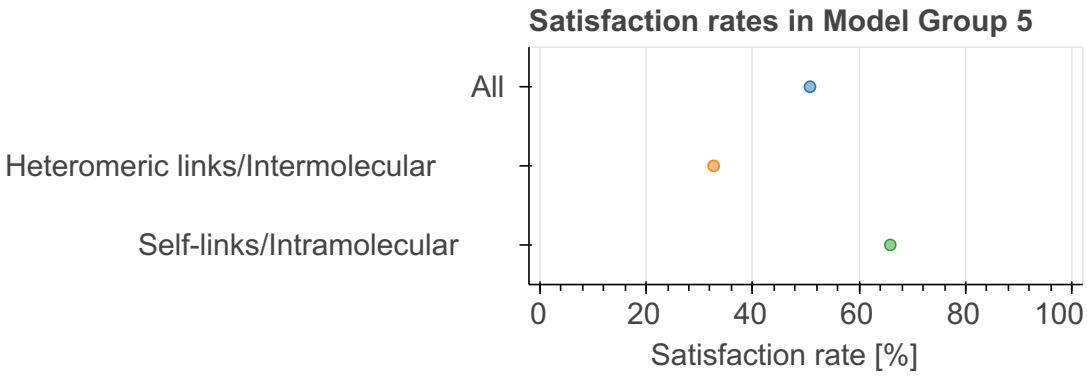
Every point represents one model in a model group/ensemble. Where possible, boxplots with quartile marks are also plotted.

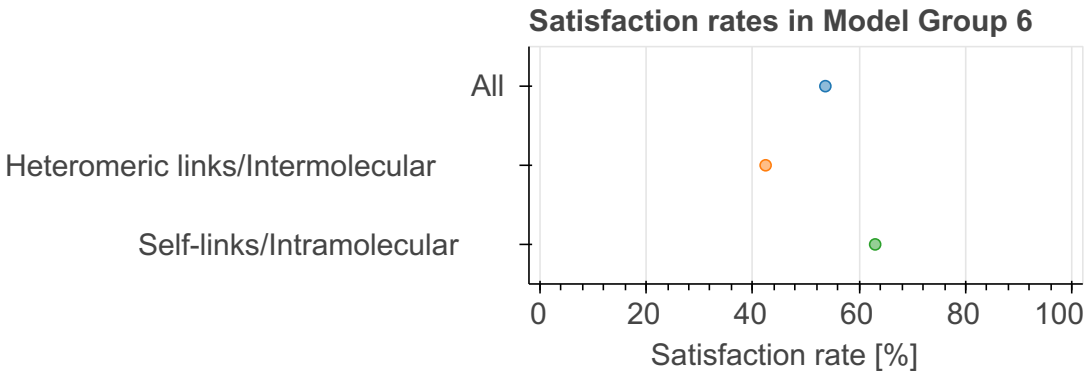

Satisfaction rates in Model Group 1
All
Heteromeric links/Intermolecular
Self-links/Intramolecular
0
20
40
60
80
100
Satisfaction rate [%]

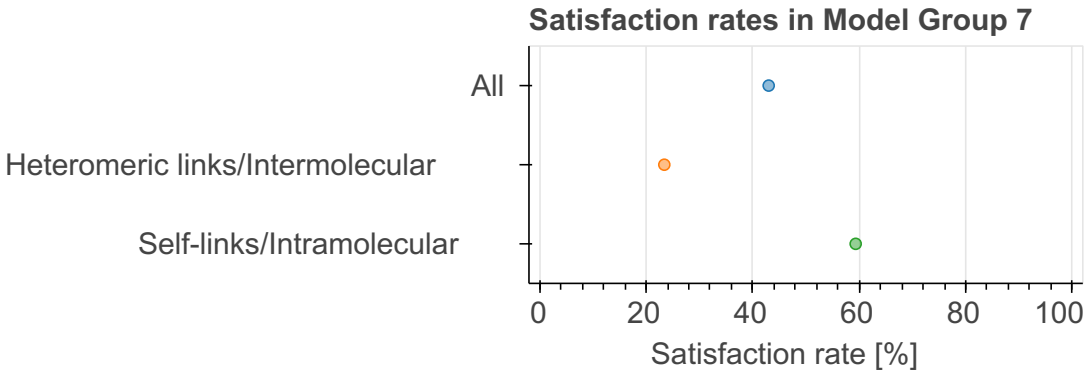

Satisfaction rates in Model Group 2
All
Heteromeric links/Intermolecular
Self-links/Intramolecular
0
20
40
60
80
100
Satisfaction rate [%]


Satisfaction rates in Model Group 3
All
Heteromeric links/Intermolecular
Self-links/Intramolecular
0
20
40
60
80
100
Satisfaction rate [%]


Satisfaction rates in Model Group 4
All
Heteromeric links/Intermolecular
Self-links/Intramolecular
0
20
40
60
80
100
Satisfaction rate [%]







6. Fit to Data Used for Validation Assessment

Validation for this section is under development.

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