

# Integrative Structure Validation Report ?

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

*IHMValidation Version 3.0*  
*Python-IHM Version 2.5*  
*EMDB validation analysis Version 0.0.1.dev127*  
*ChimeraX Version 1.9*  
*Chimera Version 1.19*  
*MapQ Version 1.8.1*

PDB ID	9A05   pdb_00009a05
PDB-Dev ID	PDBDEV_00000041
Structure Title	Integrative structure and function of the yeast exocyst complex
Structure Authors	Ganesan SJ; Feyder MJ; Chemmama IE; Fang F; Rout MP; Chait BT; Shi Y; Munson M; Sali A
Deposited on	2020-02-04

This is a PDB-IHM Structure Validation Report.

We welcome your comments at [helpdesk@pdb-ihm.org](mailto:helpdesk@pdb-ihm.org)

A user guide is available at [https://pdb-ihm.org/validation\\_help.html](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 1 model(s). A total of 21 dataset(s) were used to build this entry.

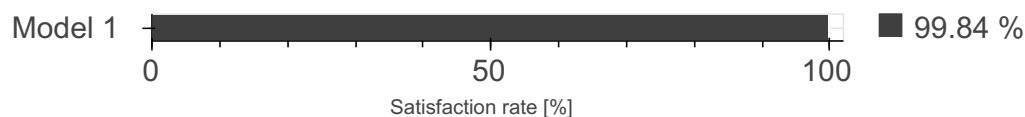
Name	Type	Count
3DEM volume	Experimental data	2

Name	Type	Count
Crosslinking-MS data	Experimental data	2
Experimental model	Starting model	9
Comparative model	Starting model	8

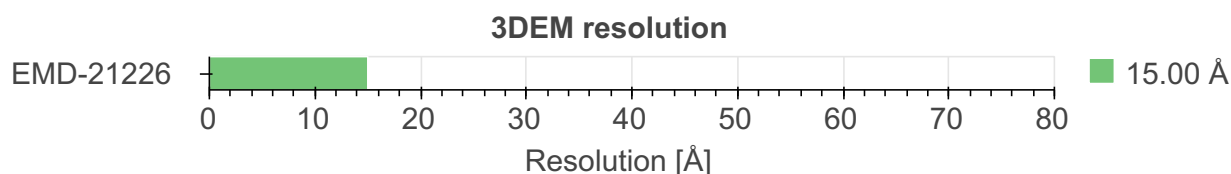
## 1.2. Overall quality ?

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.

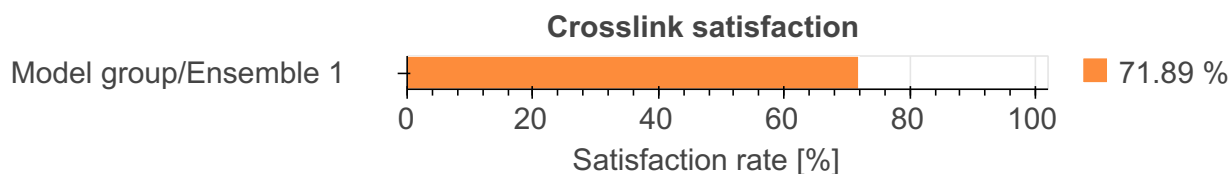
### Model Quality: Excluded Volume Analysis ?



### Data Quality ?



### Fit to Data Used for Modeling ?



## 2. Model Details ?

### 2.1. Ensemble information ?

This entry consists of 1 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	1	Sec03	A	1336	731-884, 924-956, 991-1137, 1157-1223, 1242-1333	1-730, 885-923, 957-990, 1138-1156, 1224-1241, 1334-1336	100.00 / 36.90	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		2	Sec05	B	971	232-327, 350-371, 457-501, 529-556, 627-658, 686-786, 806-921, 945-957	1-231, 328-349, 372-456, 502-528, 557-626, 659-685, 787-805, 922-944, 958-971	100.00 / 46.65	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		3	Sec06	C	805	411-805	1-410	100.00 / 49.07	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		4	Sec08	D	1065	159-230, 326-361, 393-420, 549-570, 588-610, 631-648, 660-672, 690-698, 745-772, 825-972	1-158, 231-325, 362-392, 421-548, 571-587, 611-630, 649-659, 673-689, 699-744, 773-824, 973-1065	100.00 / 37.28	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		5	Sec10	E	871	230-280, 319-399, 414-460, 568-624, 639-864	1-229, 281-318, 400-413, 461-567, 625-638, 865-871	100.00 / 53.04	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		6	Sec15	F	910	474-525, 566-639, 663-685, 703-769	1-473, 526-565, 640-662, 686-702, 770-910	100.00 / 23.74	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead

ID	Model(s)	Entity ID	Molecule name	Chain(s) [auth]	Total residues	Rigid segments	Flexible segments	Model coverage/ Starting model coverage (%)	Scale
		7	Exo70	G	623	67-116, 121-221, 234-295, 301-414, 419-623	1-66, 117-120, 222-233, 296-300, 415-418	100.00 / 85.39	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead
		8	Exo84	H	753	344-451, 525-570, 578-647, 650-711, 715-753	1-343, 452-524, 571-577, 648-649, 712-714	100.00 / 43.16	Multiscale: Coarse-grained: 1 - 50 residue(s) per bead

### 2.3. Datasets used for modeling ?

There are 21 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	Experimental model	PDB	<a href="#">pdb_00002pft</a>
2	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
3	Experimental model	PDB	<a href="#">pdb_00002d2s</a>
4	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
5	Experimental model	PDB	<a href="#">pdb_00002a2f</a>
6	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
7	Experimental model	PDB	<a href="#">pdb_00002fji</a>
8	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
9	Experimental model	PDB	<a href="#">pdb_00003fhn</a>
10	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
11	Experimental model	PDB	<a href="#">pdb_00005h11</a>
12	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
13	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
14	Experimental model	PDB	<a href="#">pdb_00002b1e</a>
15	Experimental model	PDB	<a href="#">pdb_00001zc3</a>
16	Comparative model	Zenodo	<a href="#">10.5281/zenodo.3951752</a>
17	Experimental model	PDB	<a href="#">pdb_00002d2s</a>
18	Crosslinking-MS data	Zenodo	<a href="#">10.5281/zenodo.3951752</a>

ID	Dataset type	Database name	Data access code
19	Crosslinking-MS data	Zenodo	<a href="https://zenodo.org/record/3951752">10.5281/zenodo.3951752</a>
20	3DEM volume	EMDB	<a href="https://www.ebi.ac.uk/EMDB/EMDB-21226">EMD-21226</a>
21	3DEM volume	Zenodo	<a href="https://zenodo.org/record/3951752">10.5281/zenodo.3951752</a>

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	200000	False	True

*There are 3 software packages reported in this entry.*

ID	Software name	Software version	Software classification	Software location
1	<a href="#">IMP PMI module</a>	2.13.0	integrative model building	<a href="https://integrativemodeling.org">https://integrativemodeling.org</a>
2	<a href="#">Integrative Modeling Platform (IMP)</a>	2.13.0	integrative model building	<a href="https://integrativemodeling.org">https://integrativemodeling.org</a>
3	<a href="#">MODELLER</a>	SVN	comparative modeling	<a href="https://salilab.org/modeller/">https://salilab.org/modeller/</a>

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.

3.3. 3DEM ?

*This section describes quality of the 3DEM datasets*

[EMD-21226](#)

3.3.1. Experimental information ?

EM reconstruction method:	SINGLE PARTICLE		
Resolution:	15.00 Å		
Recommended level:	4.100		
Estimated volume:	1324.18 nm <sup>3</sup>		
Specimen preparation:	Preparation ID	1	Staining: NEGATIVE; Material: Uranyl Acetate

Map-only validation report:

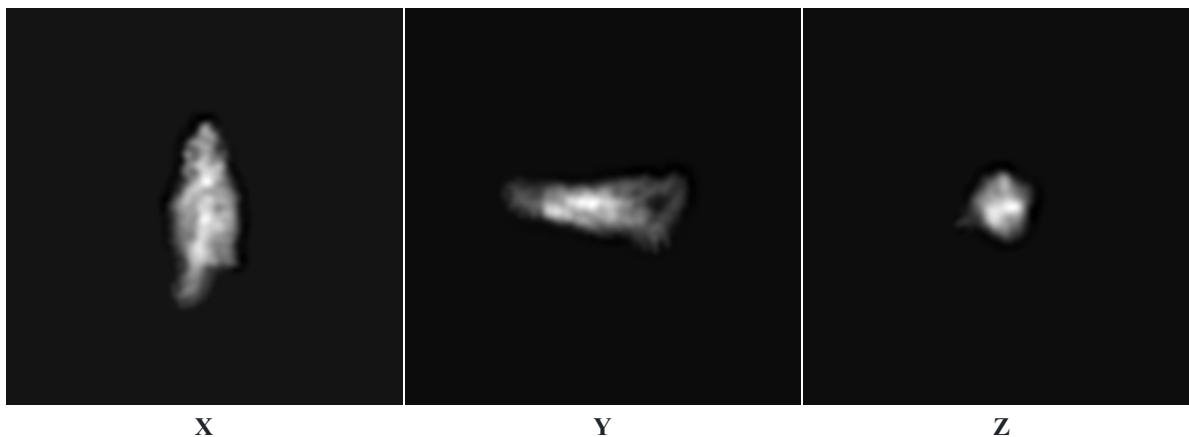
[wwPDB validation report](#)

### 3.3.2. Map visualisation ?

This section contains visualisations of the EMDB entry EMD-21226. These allow visual inspection of the internal detail of the map and identification of artifacts. Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

#### 3.3.2.1. Orthogonal projections ?

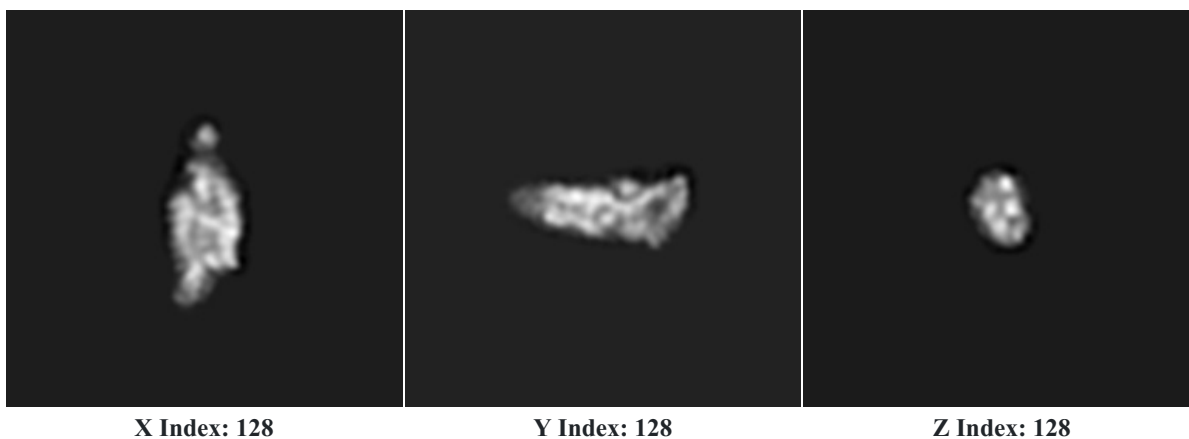
##### Primary map



The images above show the map projected in three orthogonal directions.

#### 3.3.2.2. Central slices ?

##### Primary map



The images above show central slices of the map in three orthogonal directions.

#### 3.3.2.3. Largest variance slices ?

##### Primary map



X Index: 129

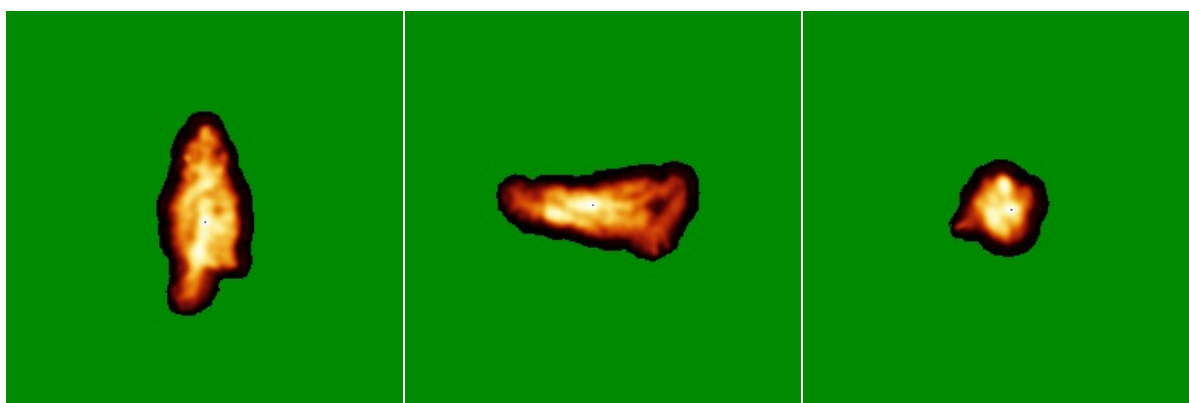
Y Index: 127

Z Index: 119

The images above show the largest variance slices of the map in three orthogonal directions.

#### 3.3.2.4 Orthogonal standard-deviation projections (false-color) ?

##### Primary map



X

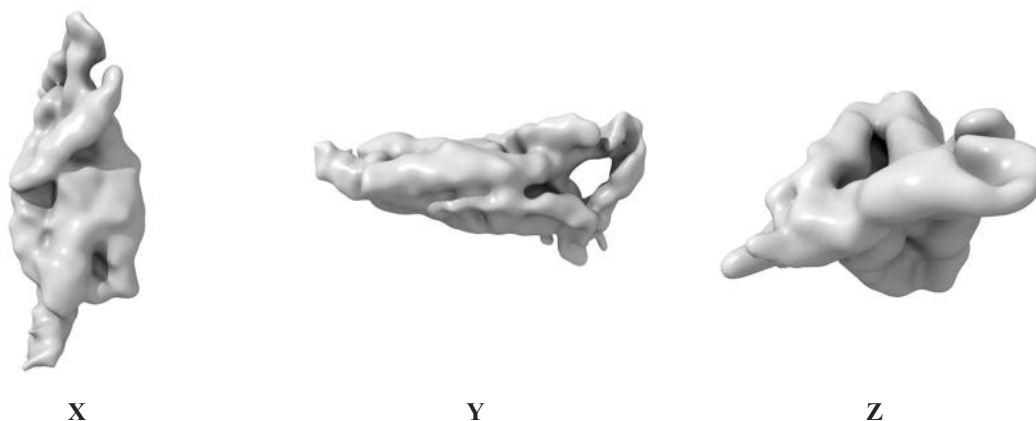
Y

Z

The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

#### 3.3.2.5. Orthogonal surface views ?

##### Primary map



X

Y

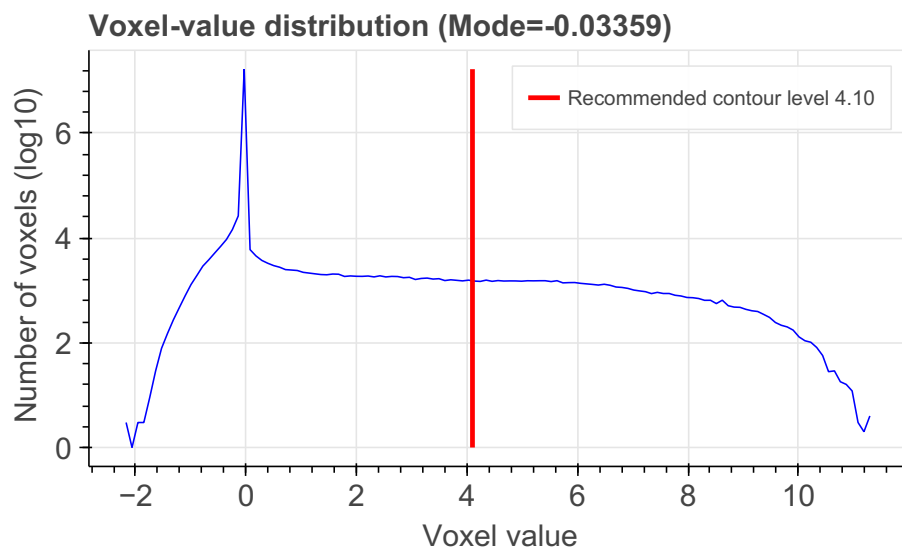
Z

The images above show the 3D surface view of the map at the recommended contour level 4.100 . These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

#### 3.3.3. Map analysis ?

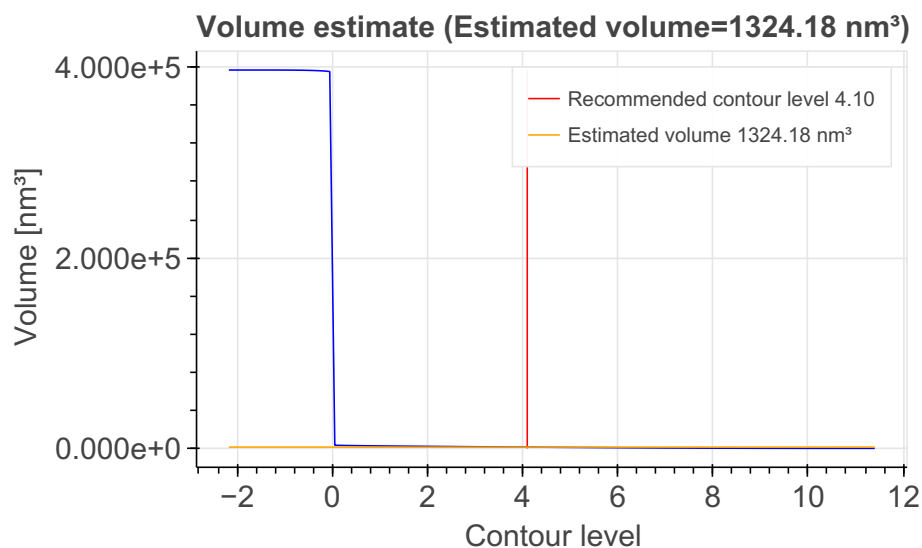
*This section contains the results of statistical analysis of the map.*

##### 3.3.3.1. Map-value distribution ?



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

### 3.3.3.2. Volume estimate ?

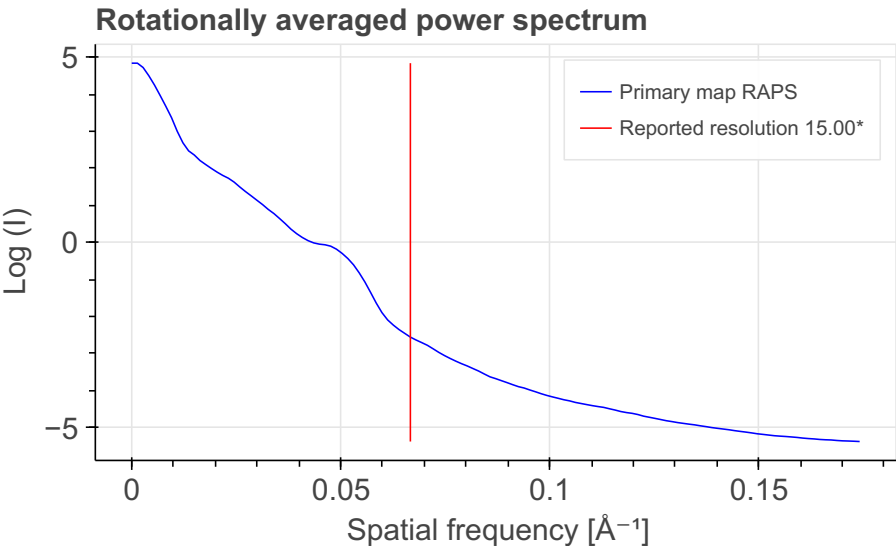


The volume at the recommended contour level is 1324.18 nm<sup>3</sup>.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.

### 3.3.3.3. Rotationally averaged power spectrum ?





\*Reported resolution corresponds to spatial frequency of 0.067  $\text{\AA}^{-1}$

3.3.4. Fourier-Shell correlation ?

3.3.4.2. Resolution estimates ?

Resolution estimate ( $\text{\AA}$ )	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	-	15.00	-

Author-provided FSC curve is not available.

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-particle or particle-atom pairs for which excluded volume was analysed.

Model ID	Analysed	Number of violations	Excluded Volume Satisfaction (%)
1	5717271	9141	99.84

5. Fit to Data Used for Modeling Assessment ?

5.2. Crosslinking-MS ?

5.2.1. Restraint types ?

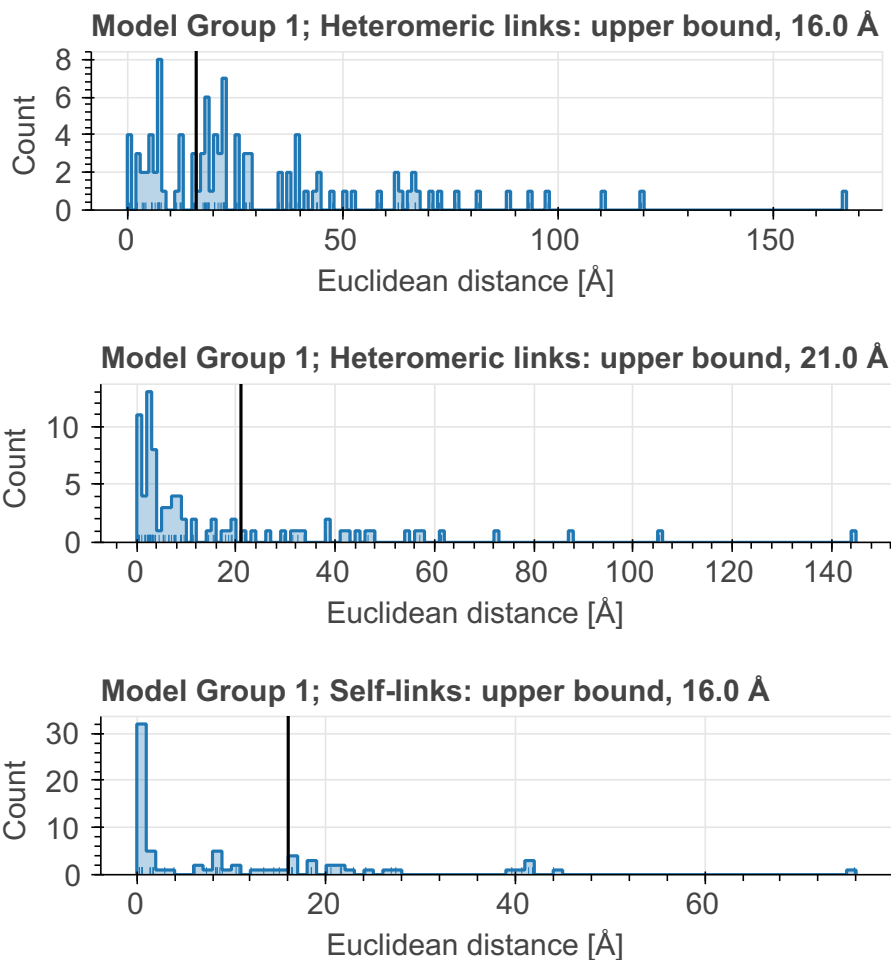
This table summarizes information about crosslinker(s) used for data generation, and how crosslinking information was translated into actual modeling restraints. Restraints assigned "by-residue" are interpreted as between CA atoms. Restraints between coarse-grained beads are indicated as "coarse-grained".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

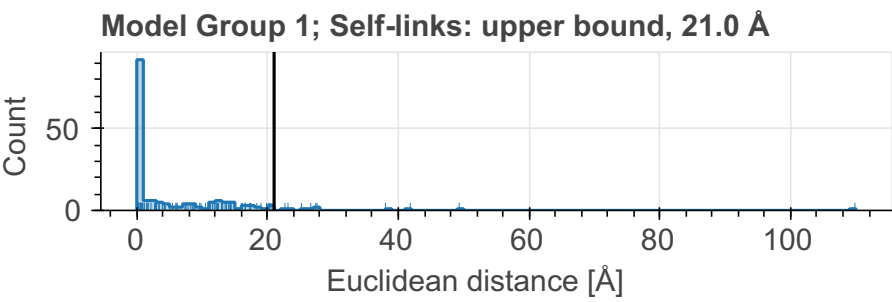
There are 434 crosslinking restraints combined in 434 restraint groups.

Linker	Residue 1	Atom 1	Residue 2	Atom 2	Restraint type	Distance, Å	Count
DSS	LYS	coarse-grained	LYS	coarse-grained	upper bound	21.00	207
DSS	LYS	CA	LYS	CA	upper bound	21.00	43
DSS	LYS	coarse-grained	VAL	coarse-grained	upper bound	21.00	2
DSS	LYS	coarse-grained	PRO	coarse-grained	upper bound	21.00	4
EDC	GLU	coarse-grained	LYS	coarse-grained	upper bound	16.00	105
EDC	ASP	coarse-grained	LYS	coarse-grained	upper bound	16.00	54
EDC	GLU	CA	LYS	CA	upper bound	16.00	15
EDC	ASP	CA	LYS	CA	upper bound	16.00	4

#### 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.





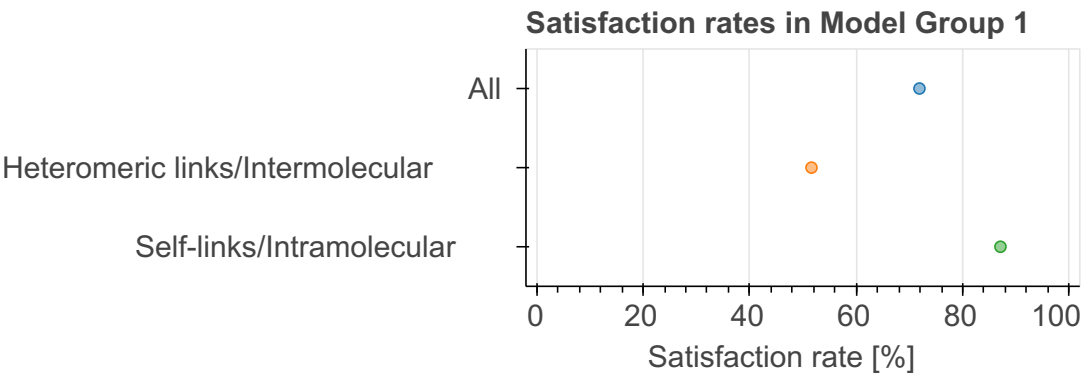
5.2.2. Satisfaction of restraints ?

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=434)
1	1	1	1/9669	All	71.89	28.11	434
				Heteromeric links/ Intermolecular	51.61	48.39	186
				Self-links/ Intramolecular	87.10	12.90	248

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.



5.3. 3DEM

This section describes fit of models to the 3DEM data. Only results for the representative model, selected as a first model with the largest number of asymmetric units.

3DEM validation for coarse-grained structures is under development.

6. Fit to Data Used for Validation Assessment ?

Validation for this section is under development.

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### Acknowledgments

*The development of integrative model validation metrics, implementation of a model validation pipeline, and creation of a validation report for integrative structures are funded by NSF awards to the [PDB-IHM team](#) (DBI-1756248, DBI-2112966, DBI-2112967, DBI-2112968, and DBI-1756250) and awards from NSF, NIH, and DOE to the [RCSB PDB](#) (DBI-2321666, R01GM157729, and DE-SC0019749). The PDB-IHM team and members of the [Sali lab](#) contributed model validation metrics and software packages.*

*Dr. Jill Trewhella, Dr. Dina Schneidman, and members of the [SASBDB](#) repository are acknowledged for their advice and support in implementing SAS validation methods. Team members from the labs of Dr. Juri Rappsilber, Dr. Alexander Leitner, Dr. Andrea Graziadei, and members of [PRIDE](#) database are acknowledged for their advice and support in implementing crosslinking-MS validation methods. We are grateful to Dr. Shruthi Viswanath for discussions about uncertainty assessment of integrative structural models.*

*Members of the [wwPDB Integrative/Hybrid Methods Task Force](#) provided recommendations and community support for the project.*