



Full wwPDB NMR Structure Validation Report ⓘ

Mar 6, 2026 – 12:28 PM UTC

PDB ID : 2PX9 / pdb_00002px9
Title : The intrinsic affinity between E2 and the Cys domain of E1 in Ubiquitin-like modifications
Authors : Wang, J.H.; Hu, W.D.; Cai, S.; Lee, B.; Song, J.; Chen, Y.
Deposited on : 2007-05-14

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

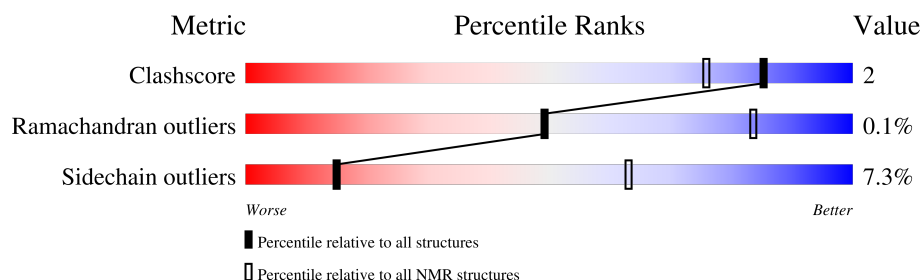
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	NMR archive (#Entries)
Clashscore	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	217	
2	B	158	

2 Ensemble composition and analysis

This entry contains 20 models. Model 10 is the overall representative, medoid model (most similar to other models).

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:166-A:213, A:239-A:291, A:304-A:382, B:1-B:158 (338)	0.86	10

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 16, 20
2	6, 17, 18, 19
3	8, 15
Single-model clusters	7

3 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 5984 atoms, of which 2971 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called SUMO-activating enzyme subunit 2.

Mol	Chain	Residues	Atoms						Trace
1	A	217	Total	C	H	N	O	S	0
			3444	1093	1699	303	341	8	

- Molecule 2 is a protein called SUMO-conjugating enzyme UBC9.

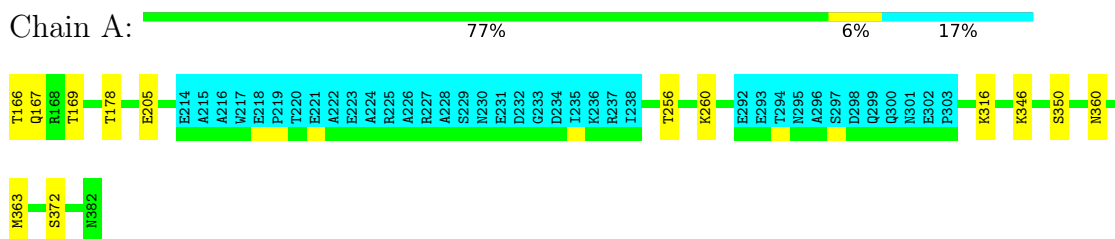
Mol	Chain	Residues	Atoms						Trace
2	B	158	Total	C	H	N	O	S	0
			2540	815	1272	218	227	8	

4 Residue-property plots [i](#)

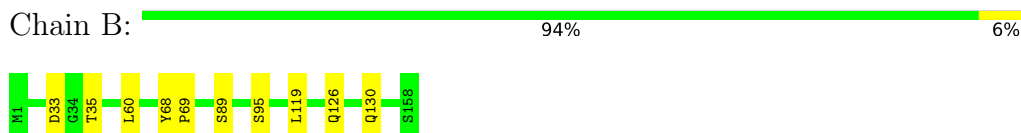
4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: SUMO-activating enzyme subunit 2



- Molecule 2: SUMO-conjugating enzyme UBC9

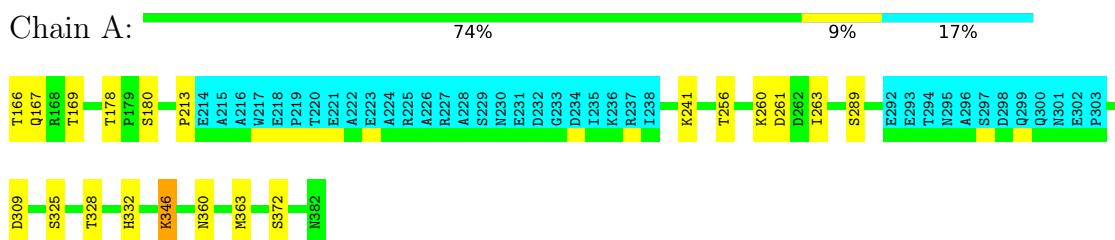


4.2 Scores per residue for each member of the ensemble

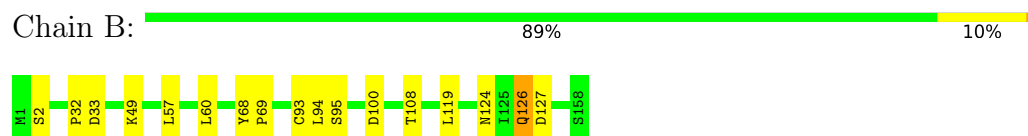
Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

- Molecule 1: SUMO-activating enzyme subunit 2

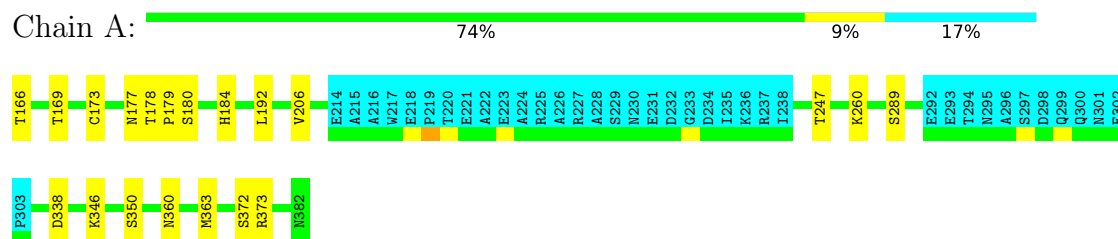


- Molecule 2: SUMO-conjugating enzyme UBC9

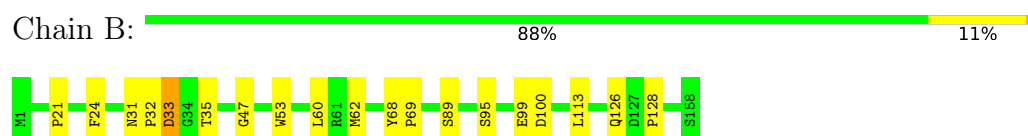


4.2.2 Score per residue for model 2

- Molecule 1: SUMO-activating enzyme subunit 2

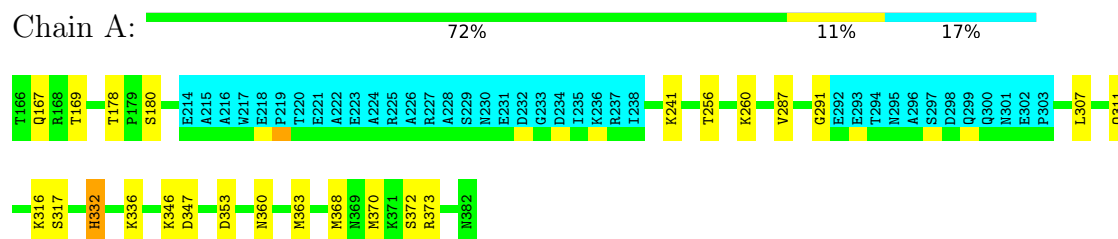


- Molecule 2: SUMO-conjugating enzyme UBC9

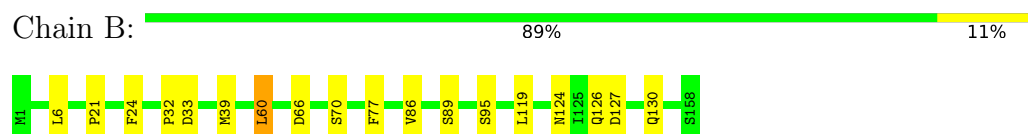


4.2.3 Score per residue for model 3

- Molecule 1: SUMO-activating enzyme subunit 2

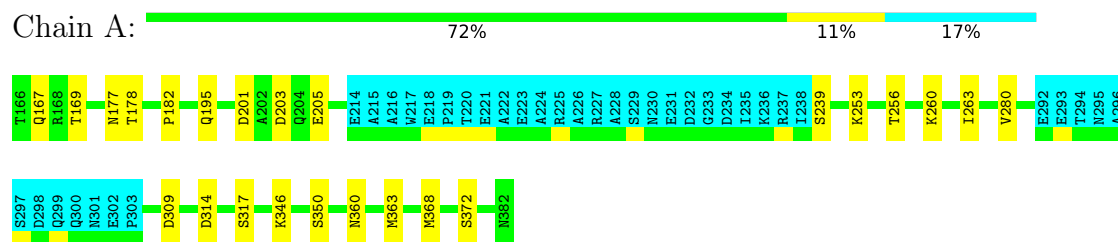


- Molecule 2: SUMO-conjugating enzyme UBC9

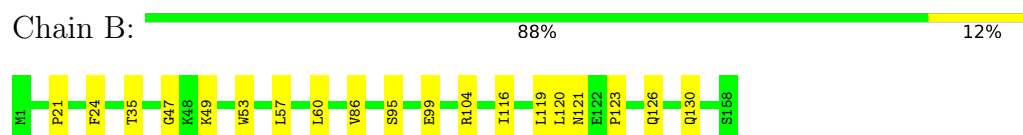


4.2.4 Score per residue for model 4

- Molecule 1: SUMO-activating enzyme subunit 2

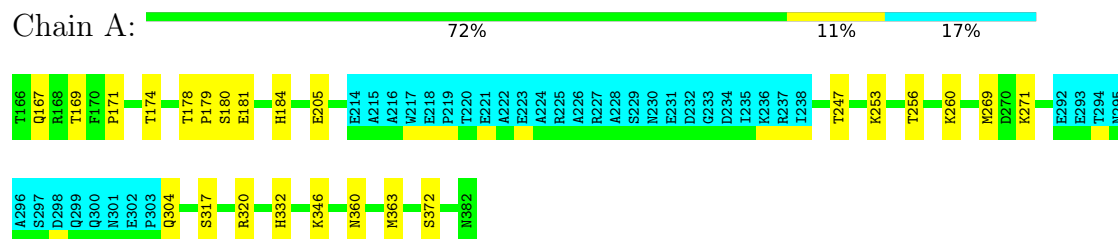


- Molecule 2: SUMO-conjugating enzyme UBC9

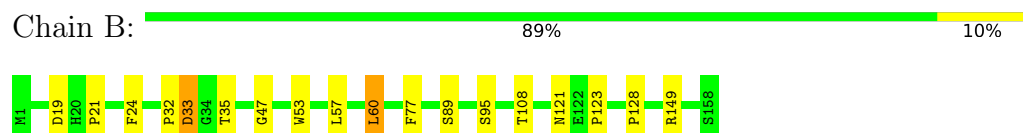


4.2.5 Score per residue for model 5

- Molecule 1: SUMO-activating enzyme subunit 2

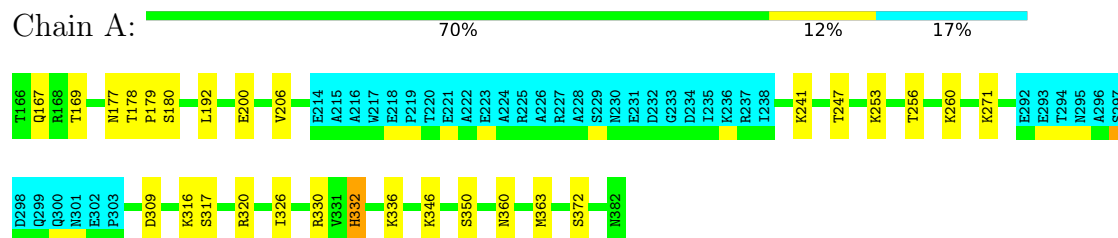


- Molecule 2: SUMO-conjugating enzyme UBC9

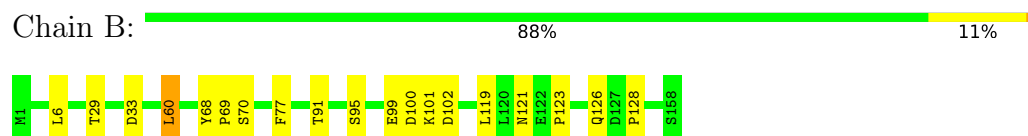


4.2.6 Score per residue for model 6

- Molecule 1: SUMO-activating enzyme subunit 2

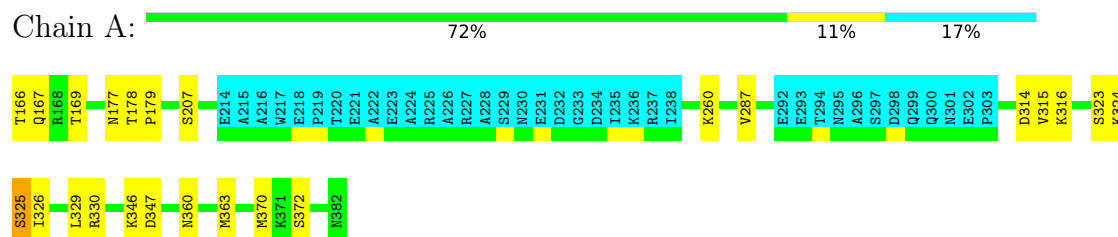


- Molecule 2: SUMO-conjugating enzyme UBC9

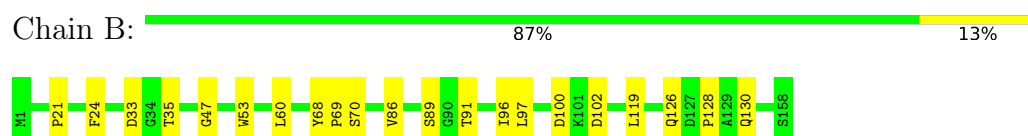


4.2.7 Score per residue for model 7

- Molecule 1: SUMO-activating enzyme subunit 2

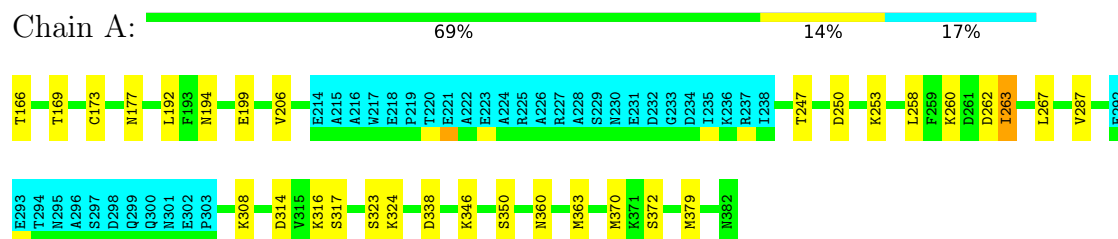


- Molecule 2: SUMO-conjugating enzyme UBC9

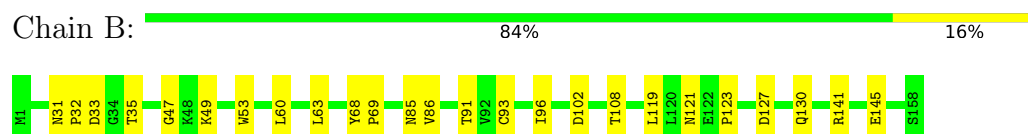


4.2.8 Score per residue for model 8

- Molecule 1: SUMO-activating enzyme subunit 2

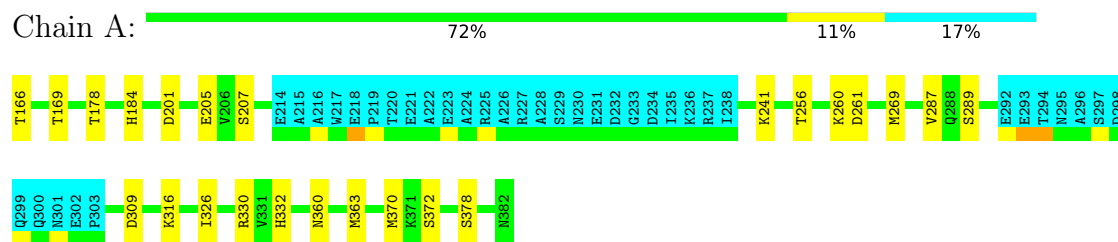


- Molecule 2: SUMO-conjugating enzyme UBC9

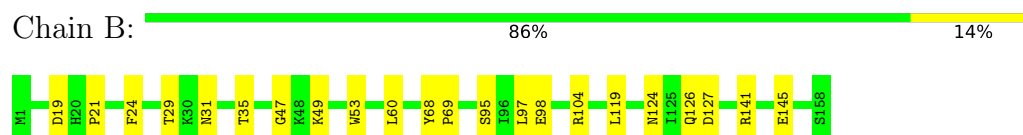


4.2.9 Score per residue for model 9

- Molecule 1: SUMO-activating enzyme subunit 2

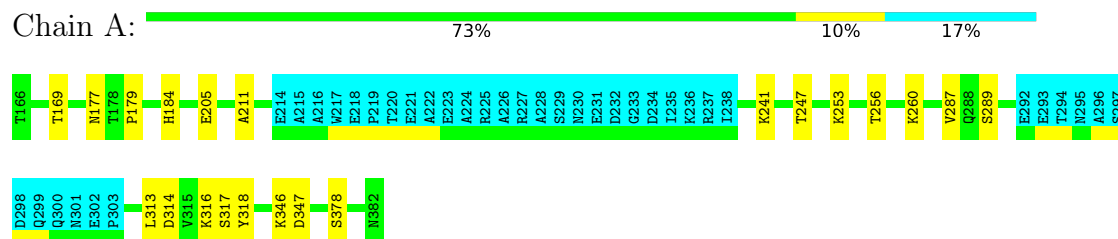


- Molecule 2: SUMO-conjugating enzyme UBC9

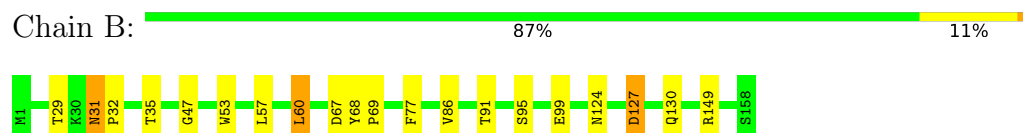


4.2.10 Score per residue for model 10 (medoid)

- Molecule 1: SUMO-activating enzyme subunit 2

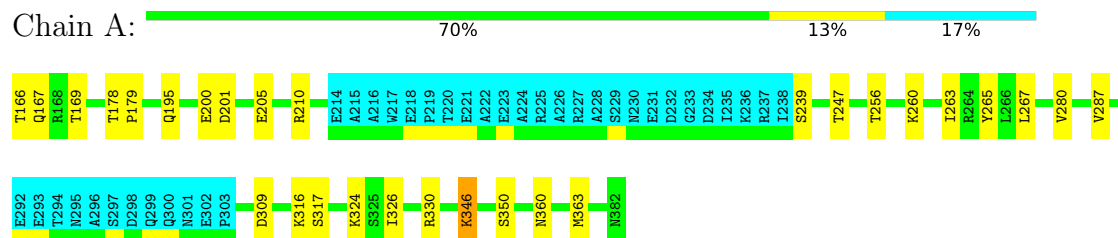


- Molecule 2: SUMO-conjugating enzyme UBC9



4.2.11 Score per residue for model 11

- Molecule 1: SUMO-activating enzyme subunit 2



- Molecule 2: SUMO-conjugating enzyme UBC9

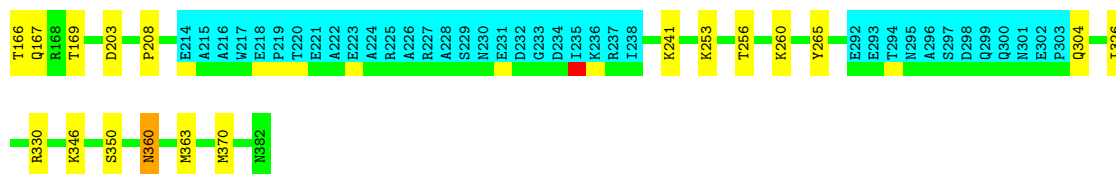
Chain B: 



4.2.12 Score per residue for model 12

- Molecule 1: SUMO-activating enzyme subunit 2

Chain A: 



- Molecule 2: SUMO-conjugating enzyme UBC9

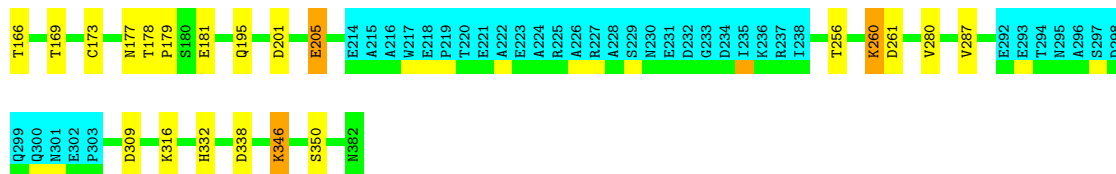
Chain B: 



4.2.13 Score per residue for model 13

- Molecule 1: SUMO-activating enzyme subunit 2

Chain A: 



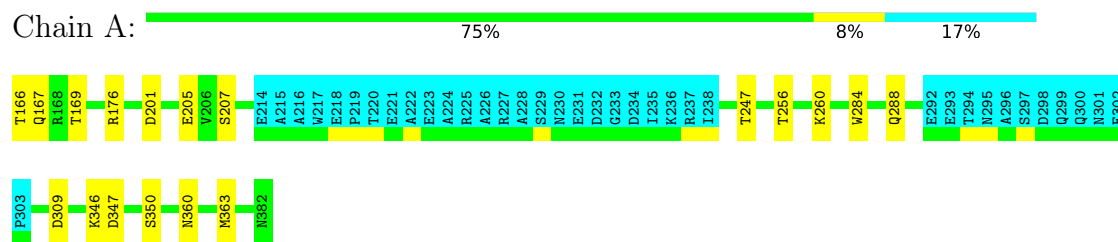
- Molecule 2: SUMO-conjugating enzyme UBC9

Chain B: 

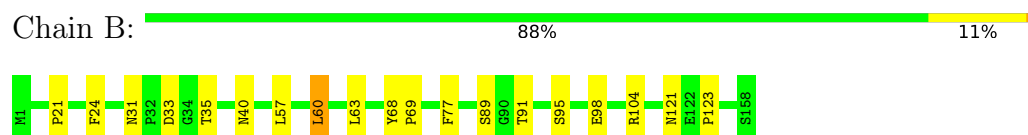


4.2.14 Score per residue for model 14

- Molecule 1: SUMO-activating enzyme subunit 2

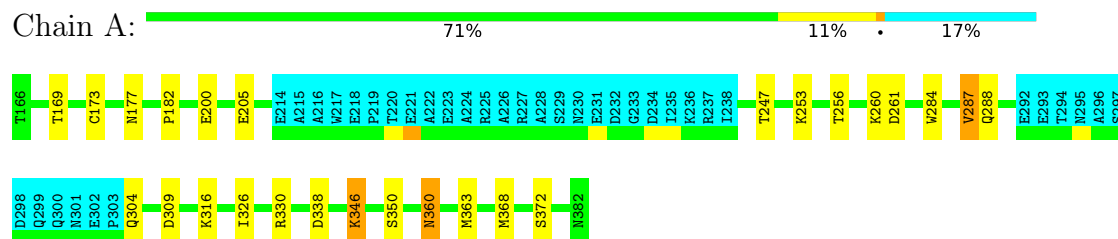


- Molecule 2: SUMO-conjugating enzyme UBC9

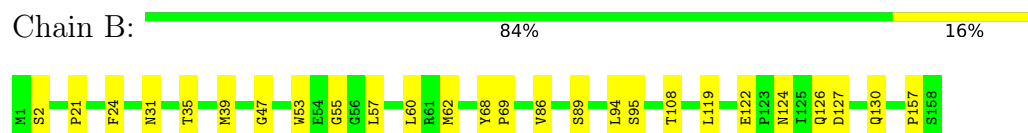


4.2.15 Score per residue for model 15

- Molecule 1: SUMO-activating enzyme subunit 2

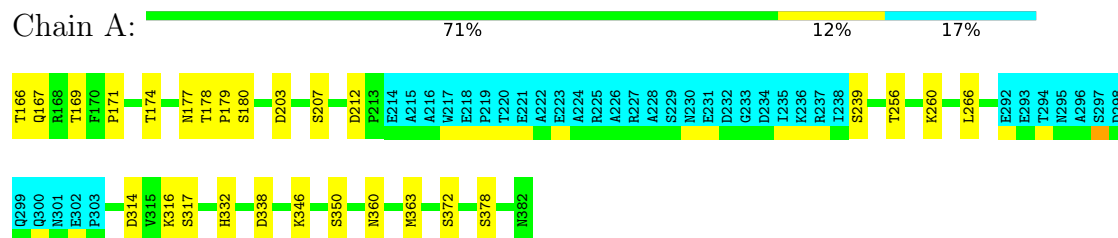


- Molecule 2: SUMO-conjugating enzyme UBC9



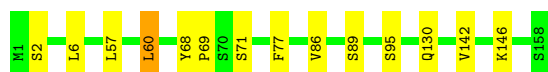
4.2.16 Score per residue for model 16

- Molecule 1: SUMO-activating enzyme subunit 2



- Molecule 2: SUMO-conjugating enzyme UBC9

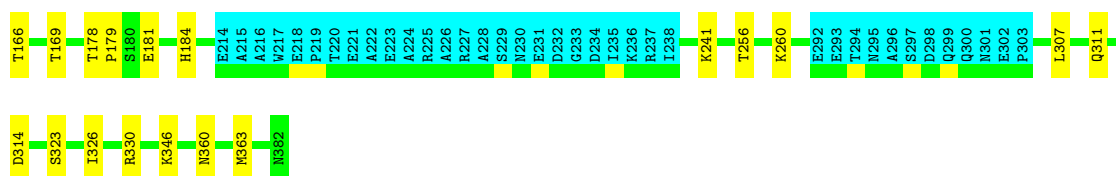
Chain B:  91% 8%



4.2.17 Score per residue for model 17

- Molecule 1: SUMO-activating enzyme subunit 2

Chain A:  75% 8% 17%



- Molecule 2: SUMO-conjugating enzyme UBC9

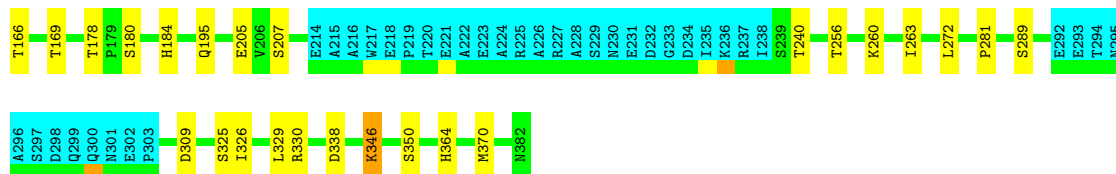
Chain B:  88% 10%



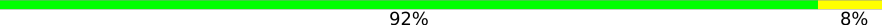
4.2.18 Score per residue for model 18

- Molecule 1: SUMO-activating enzyme subunit 2

Chain A:  71% 11% 17%



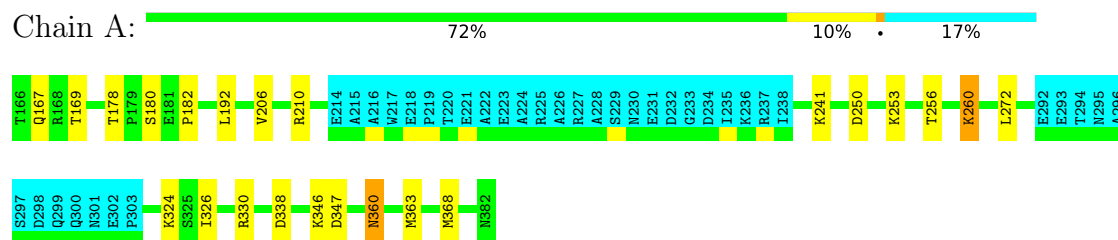
- Molecule 2: SUMO-conjugating enzyme UBC9

Chain B:  92% 8%

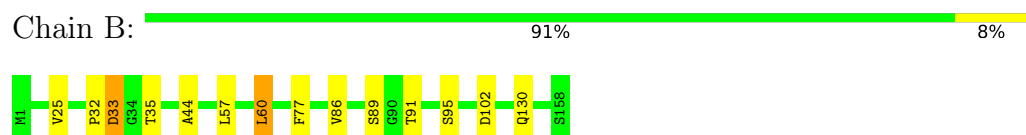


4.2.19 Score per residue for model 19

- Molecule 1: SUMO-activating enzyme subunit 2

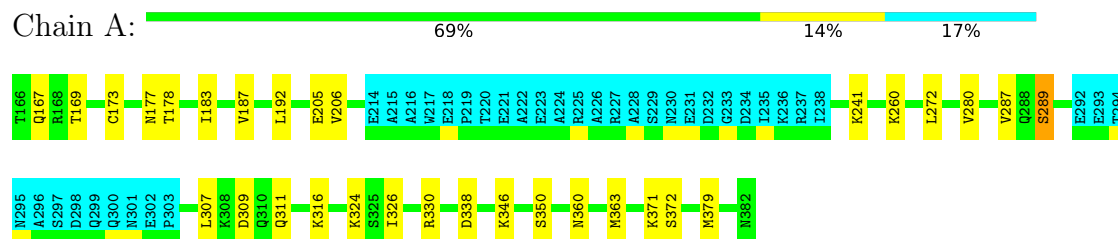


- Molecule 2: SUMO-conjugating enzyme UBC9

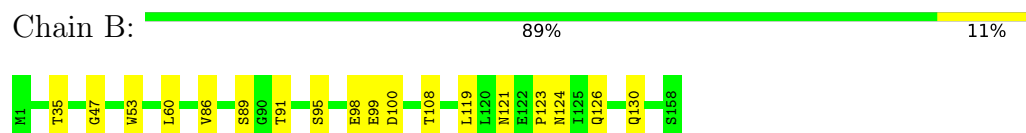


4.2.20 Score per residue for model 20

- Molecule 1: SUMO-activating enzyme subunit 2



- Molecule 2: SUMO-conjugating enzyme UBC9



5 Refinement protocol and experimental data overview ⓘ

Of the 1000 calculated structures, 20 were deposited, based on the following criterion: *structures with the lowest energy*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
HADDOCK	refinement	

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

6.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	1456	1445	1439	6±2
2	B	1268	1272	1270	6±1
All	All	54480	54340	54180	238

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:360:ASN:HA	1:A:363:MET:SD	0.66	2.29	4	17
2:B:96:ILE:HA	2:B:102:ASP:O	0.58	1.97	18	3
1:A:326:ILE:O	1:A:330:ARG:HG3	0.56	2.00	12	10
1:A:182:PRO:HA	1:A:368:MET:SD	0.55	2.41	19	3
1:A:195:GLN:NE2	1:A:205:GLU:HA	0.55	2.16	18	4
1:A:173:CYS:O	1:A:177:ASN:HB2	0.55	2.02	15	5
1:A:256:THR:O	1:A:260:LYS:HB3	0.55	2.02	5	16
2:B:68:TYR:CD1	2:B:69:PRO:HA	0.54	2.36	10	14
1:A:177:ASN:O	1:A:179:PRO:HD3	0.52	2.03	16	6
1:A:192:LEU:HD13	1:A:206:VAL:HG21	0.52	1.80	2	5
2:B:21:PRO:HB2	2:B:24:PHE:CD1	0.52	2.39	2	9
2:B:32:PRO:O	2:B:33:ASP:HB3	0.52	2.04	19	5
1:A:201:ASP:HA	2:B:104:ARG:NH1	0.52	2.20	9	4

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:250:ASP:OD2	1:A:253:LYS:HG2	0.51	2.05	19	2
1:A:176:ARG:HD3	1:A:205:GLU:O	0.51	2.05	14	1
2:B:121:ASN:O	2:B:123:PRO:HD3	0.50	2.07	4	8
1:A:258:LEU:HA	1:A:262:ASP:OD2	0.49	2.08	8	1
2:B:124:ASN:ND2	2:B:127:ASP:HB2	0.48	2.23	10	1
2:B:86:VAL:O	2:B:130:GLN:HB2	0.48	2.08	10	10
1:A:287:VAL:O	1:A:316:LYS:HG2	0.48	2.09	7	9
2:B:65:LYS:HE2	2:B:67:ASP:OD1	0.48	2.09	17	1
2:B:128:PRO:HB3	2:B:134:TYR:CG	0.48	2.44	12	1
2:B:68:TYR:CG	2:B:69:PRO:HA	0.47	2.44	1	8
1:A:363:MET:SD	1:A:370:MET:HA	0.47	2.50	8	3
1:A:363:MET:O	1:A:368:MET:HG2	0.47	2.09	3	1
2:B:124:ASN:HD21	2:B:126:GLN:NE2	0.47	2.07	1	1
2:B:124:ASN:ND2	2:B:126:GLN:HB3	0.47	2.24	15	5
2:B:31:ASN:HB3	2:B:35:THR:OG1	0.47	2.10	15	2
2:B:60:LEU:HB3	2:B:77:PHE:CD1	0.47	2.44	5	9
1:A:263:ILE:O	1:A:267:LEU:HG	0.46	2.10	8	2
1:A:346:LYS:HD3	1:A:346:LYS:H	0.46	1.69	13	4
2:B:47:GLY:HA3	2:B:53:TRP:O	0.46	2.10	4	10
1:A:317:SER:HA	1:A:320:ARG:NE	0.46	2.25	5	2
1:A:332:HIS:O	1:A:336:LYS:HG2	0.46	2.11	3	2
1:A:208:PRO:HB2	1:A:265:TYR:CD2	0.46	2.46	12	1
1:A:313:LEU:HB2	1:A:318:TYR:CE2	0.46	2.46	10	1
1:A:363:MET:HB2	1:A:368:MET:SD	0.45	2.50	19	2
2:B:126:GLN:O	2:B:128:PRO:HD3	0.45	2.11	18	4
1:A:284:TRP:O	1:A:288:GLN:HG2	0.45	2.12	14	2
2:B:32:PRO:O	2:B:33:ASP:HB2	0.45	2.12	3	3
1:A:263:ILE:HD11	1:A:281:PRO:HA	0.45	1.88	18	1
2:B:25:VAL:HB	2:B:44:ALA:HB3	0.45	1.89	19	1
1:A:171:PRO:O	1:A:174:THR:HG22	0.44	2.12	5	2
2:B:141:ARG:O	2:B:145:GLU:HG2	0.44	2.11	9	3
1:A:307:LEU:O	1:A:311:GLN:HG2	0.44	2.12	3	3
2:B:108:THR:HG22	2:B:110:LYS:H	0.44	1.73	11	1
1:A:371:LYS:HE2	1:A:379:MET:SD	0.44	2.53	20	1
1:A:210:ARG:HA	1:A:265:TYR:OH	0.43	2.13	11	1
2:B:100:ASP:OD2	2:B:101:LYS:HG3	0.43	2.12	11	1
1:A:284:TRP:O	1:A:287:VAL:HG12	0.43	2.13	15	1
1:A:325:SER:O	1:A:329:LEU:HG	0.43	2.12	18	2
1:A:194:ASN:HB3	1:A:199:GLU:O	0.43	2.14	8	1
1:A:201:ASP:HA	2:B:104:ARG:CZ	0.42	2.44	14	1
2:B:85:ASN:ND2	2:B:127:ASP:HB2	0.42	2.29	8	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:315:VAL:HA	1:A:370:MET:HE1	0.42	1.92	7	1
1:A:353:ASP:OD1	1:A:373:ARG:HD2	0.42	2.14	3	1
1:A:364:HIS:HB2	1:A:370:MET:HE3	0.41	1.91	18	1
2:B:149:ARG:HA	2:B:149:ARG:NE	0.41	2.30	5	2
2:B:94:LEU:HD13	2:B:119:LEU:HD11	0.41	1.92	1	2
1:A:360:ASN:OD1	1:A:370:MET:HB3	0.41	2.16	12	1
2:B:142:VAL:O	2:B:146:LYS:HG3	0.41	2.15	16	1
2:B:124:ASN:OD1	2:B:126:GLN:HB3	0.41	2.15	17	1
1:A:360:ASN:O	1:A:363:MET:HG2	0.41	2.16	14	1
2:B:60:LEU:HD13	2:B:60:LEU:N	0.41	2.31	16	1
2:B:116:ILE:O	2:B:120:LEU:HG	0.41	2.16	4	2
1:A:181:GLU:O	1:A:184:HIS:HB2	0.41	2.16	5	2
2:B:31:ASN:OD1	2:B:32:PRO:HD2	0.41	2.16	10	1
2:B:124:ASN:HD21	2:B:126:GLN:CD	0.40	2.24	11	1
1:A:183:ILE:O	1:A:187:VAL:HG23	0.40	2.16	20	1
1:A:346:LYS:H	1:A:346:LYS:HD3	0.40	1.76	1	1
2:B:55:GLY:O	2:B:157:PRO:HD3	0.40	2.16	15	1

6.3 Torsion angles

6.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the backbone conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	178/217 (82%)	169±1 (95±1%)	9±1 (5±1%)	0±0 (0±0%)	44	80
2	B	156/158 (99%)	150±2 (96±1%)	6±2 (4±1%)	0±0 (0±0%)	49	83
All	All	6680/7500 (89%)	6377 (95%)	293 (4%)	10 (0%)	49	83

All 7 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	179	PRO	3
1	A	180	SER	2
1	A	177	ASN	1
2	B	128	PRO	1

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Mol	Chain	Res	Type	Models (Total)
2	B	101	LYS	1
1	A	212	ASP	1
2	B	32	PRO	1

6.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the sidechain conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	160/189 (85%)	147±2 (92±2%)	13±2 (8±2%)	13	60
2	B	137/137 (100%)	128±1 (93±1%)	9±1 (7±1%)	17	66
All	All	5940/6520 (91%)	5504 (93%)	436 (7%)	15	63

All 81 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	169	THR	20
2	B	60	LEU	20
1	A	346	LYS	19
2	B	95	SER	18
1	A	178	THR	15
2	B	89	SER	13
1	A	166	THR	12
1	A	167	GLN	12
1	A	372	SER	12
1	A	350	SER	12
2	B	35	THR	12
1	A	309	ASP	10
2	B	57	LEU	10
2	B	33	ASP	10
2	B	119	LEU	10
1	A	241	LYS	9
2	B	108	THR	9
2	B	91	THR	9
1	A	247	THR	8
1	A	338	ASP	8
1	A	332	HIS	7

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Mol	Chain	Res	Type	Models (Total)
2	B	99	GLU	7
1	A	180	SER	6
1	A	289	SER	6
2	B	127	ASP	6
1	A	260	LYS	6
2	B	31	ASN	6
1	A	317	SER	6
1	A	253	LYS	6
1	A	314	ASP	6
1	A	205	GLU	6
2	B	49	LYS	5
1	A	347	ASP	5
1	A	207	SER	5
1	A	324	LYS	5
1	A	261	ASP	4
2	B	126	GLN	4
1	A	184	HIS	4
1	A	280	VAL	4
2	B	29	THR	4
1	A	263	ILE	3
2	B	2	SER	3
2	B	100	ASP	3
2	B	6	LEU	3
2	B	70	SER	3
1	A	203	ASP	3
1	A	239	SER	3
1	A	304	GLN	3
1	A	200	GLU	3
2	B	102	ASP	3
1	A	323	SER	3
2	B	97	LEU	3
1	A	378	SER	3
1	A	360	ASN	3
1	A	272	LEU	3
1	A	325	SER	2
2	B	62	MET	2
2	B	39	MET	2
1	A	269	MET	2
1	A	271	LYS	2
2	B	19	ASP	2
2	B	63	LEU	2
2	B	67	ASP	2

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Mol	Chain	Res	Type	Models (Total)
2	B	98	GLU	2
1	A	328	THR	1
1	A	373	ARG	1
2	B	113	LEU	1
2	B	66	ASP	1
1	A	308	LYS	1
1	A	379	MET	1
2	B	27	VAL	1
2	B	130	GLN	1
2	B	147	ARG	1
1	A	181	GLU	1
2	B	40	ASN	1
1	A	287	VAL	1
2	B	122	GLU	1
1	A	266	LEU	1
1	A	316	LYS	1
2	B	71	SER	1
1	A	240	THR	1

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided