Full wwPDB NMR Structure Validation Report (i)

Nov 9, 2024 – 12:16 PM EST

PDB ID	:	6UYJ
BMRB ID	:	28042
Title	:	hRpn13:hRpn2:K48-diubiquitin
Authors	:	Lu, X.; Walters, K.J.
Deposited on	:	2019-11-13

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 (i) 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 (i)) were used in the production of this report:

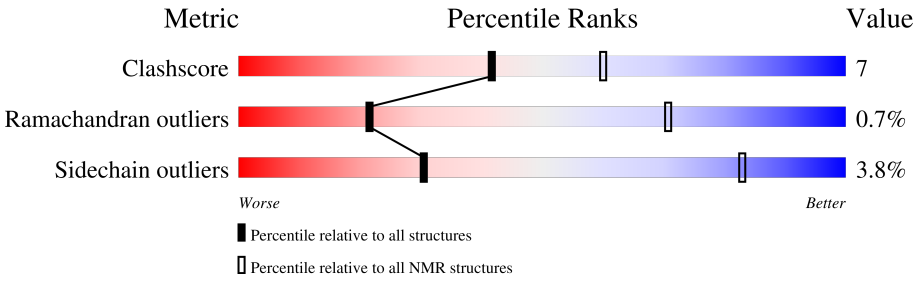
MolProbity	:	4.02b-467
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment is 85%.

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	210492	14027
Ramachandran outliers	207382	12486
Sidechain outliers	206894	12463

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 <=5%

Mol	Chain	Length	Quality of chain
1	C	77	74% 13% 13%
2	D	76	80% 13% 7%
3	A	154	58% 15% • 27%
4	B	18	78% 22%

2 Ensemble composition and analysis

This entry contains 15 models. Model 9 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

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	C:1-C:7, C:12-C:71 (67)	0.33	11
2	D:1-D:71, A:21-A:132, B:940-B:953 (197)	0.53	9

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	4, 5, 6, 7, 10, 12, 13, 15
2	1, 8, 9
3	2, 3, 11
Single-model clusters	14

3 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4542 atoms, of which 2275 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Ubiquitin.

Mol	Chain	Residues	Atoms						Trace
1	C	77	Total	C	H	N	O	S	0
			1241	382	631	106	121	1	

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	77	ASP	MET	engineered mutation	UNP P0CG47

- Molecule 2 is a protein called Ubiquitin.

Mol	Chain	Residues	Atoms						Trace
2	D	76	Total	C	H	N	O	S	0
			1232	378	629	107	117	1	

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	48	ARG	LYS	engineered mutation	UNP P0CG47

- Molecule 3 is a protein called Proteasomal ubiquitin receptor ADRM1.

Mol	Chain	Residues	Atoms						Trace
3	A	113	Total	C	H	N	O	S	0
			1851	593	918	162	172	6	

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP Q16186
A	-2	PRO	-	expression tag	UNP Q16186
A	-1	GLY	-	expression tag	UNP Q16186
A	0	SER	-	expression tag	UNP Q16186

- Molecule 4 is a protein called 26S proteasome non-ATPase regulatory subunit 1.

Mol	Chain	Residues	Atoms					Trace
4	B	14	Total	C	H	N	O	0
			218	77	97	15	29	

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	936	GLY	-	expression tag	UNP Q99460
B	937	PRO	-	expression tag	UNP Q99460
B	938	GLY	-	expression tag	UNP Q99460
B	939	SER	-	expression tag	UNP Q99460

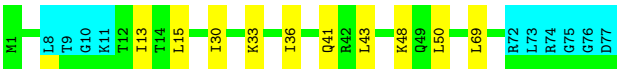
4 Residue-property plots

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.

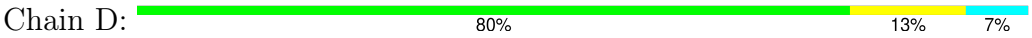
• Molecule 1: Ubiquitin

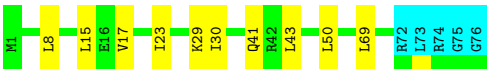
Chain C:



• Molecule 2: Ubiquitin

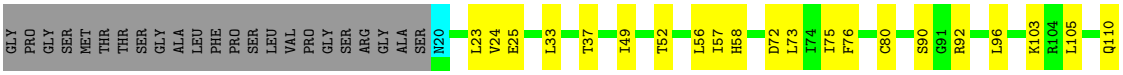
Chain D:





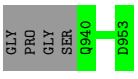
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

Chain B:



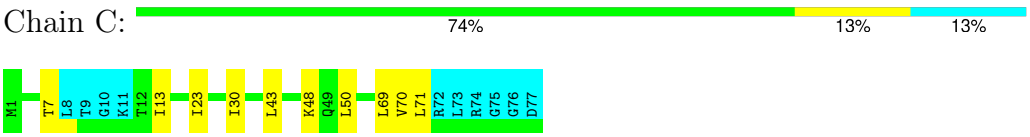
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

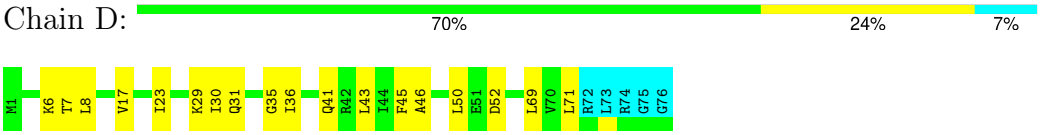
• Molecule 1: Ubiquitin

Chain C:



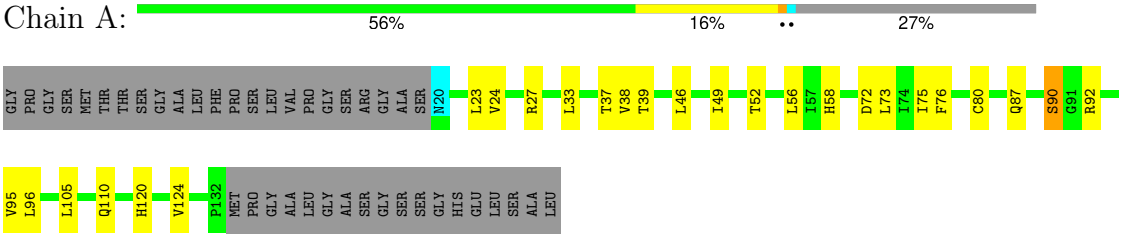
• Molecule 2: Ubiquitin

Chain D:



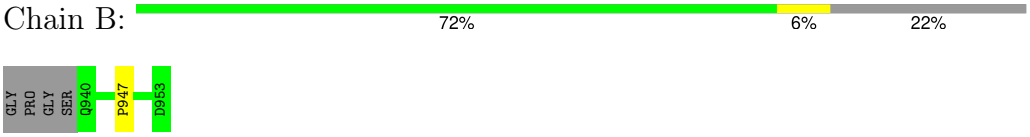
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

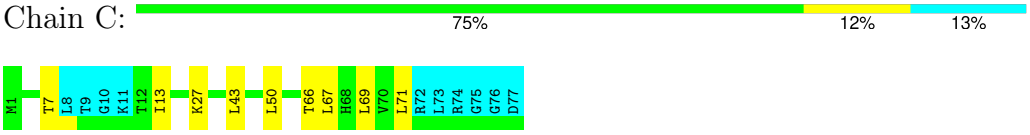
Chain B:



4.2.2 Score per residue for model 2

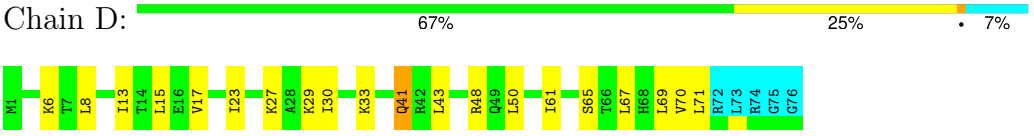
• Molecule 1: Ubiquitin

Chain C:

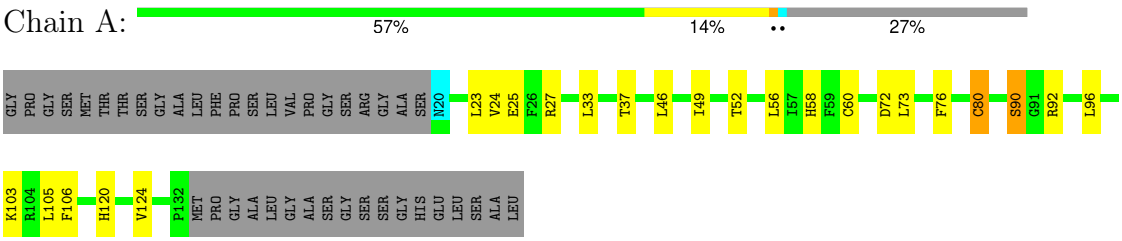


• Molecule 2: Ubiquitin

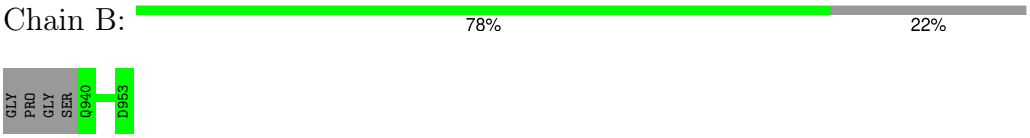
Chain D:



• Molecule 3: Proteasomal ubiquitin receptor ADRM1

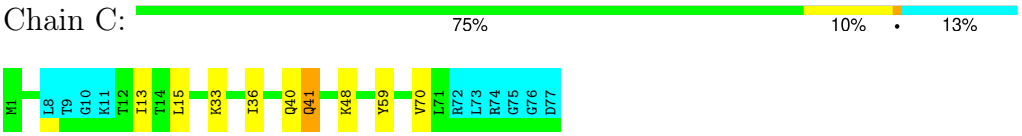


• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

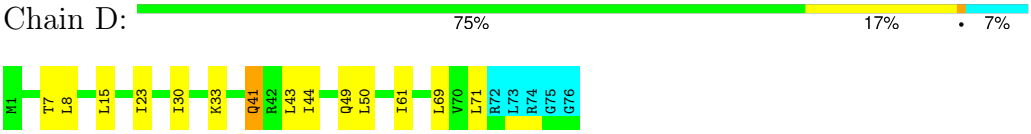


4.2.3 Score per residue for model 3

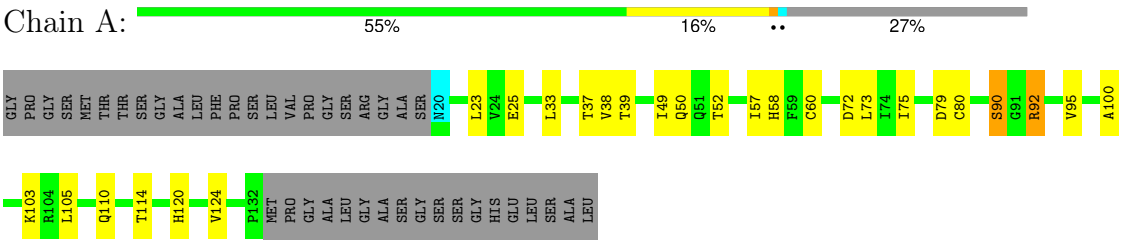
• Molecule 1: Ubiquitin



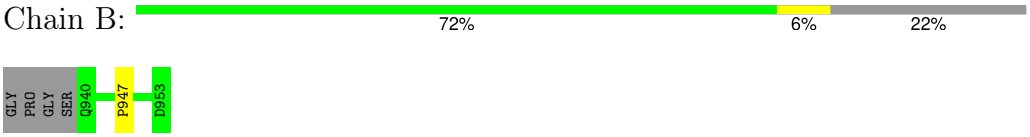
• Molecule 2: Ubiquitin



• Molecule 3: Proteasomal ubiquitin receptor ADRM1



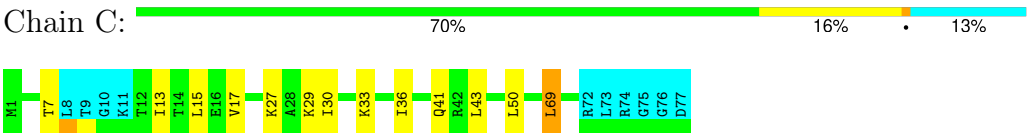
• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1



4.2.4 Score per residue for model 4

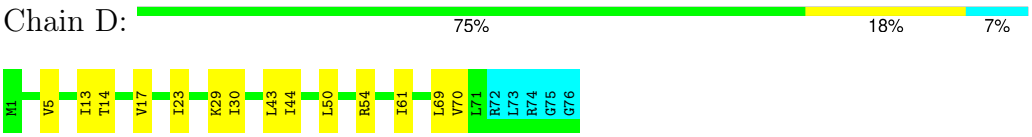
• Molecule 1: Ubiquitin

Chain C:



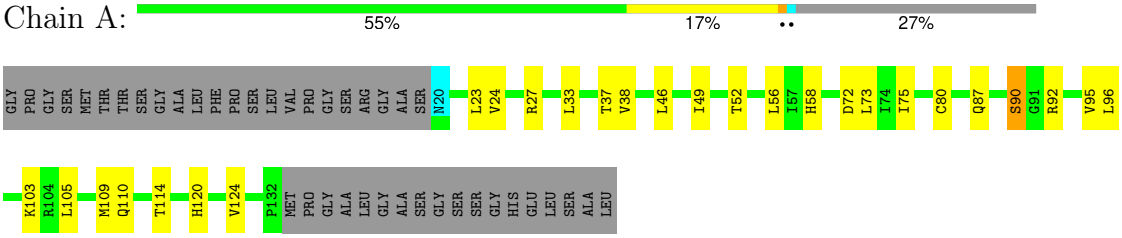
• Molecule 2: Ubiquitin

Chain D:



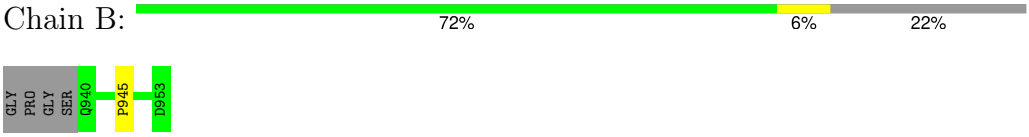
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

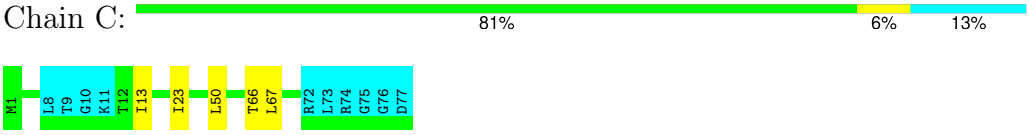
Chain B:



4.2.5 Score per residue for model 5

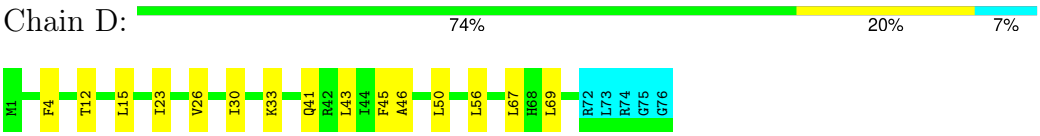
• Molecule 1: Ubiquitin

Chain C:



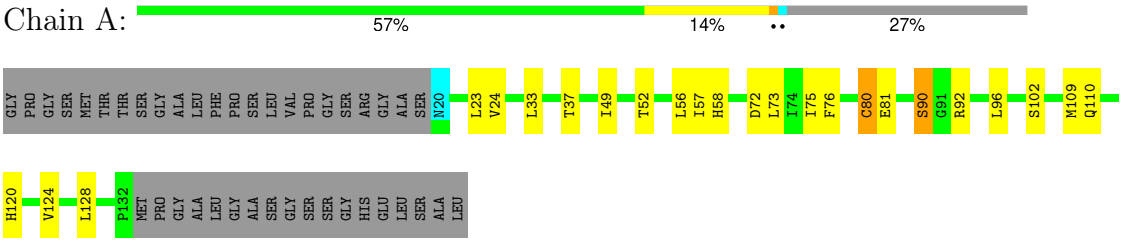
• Molecule 2: Ubiquitin

Chain D:



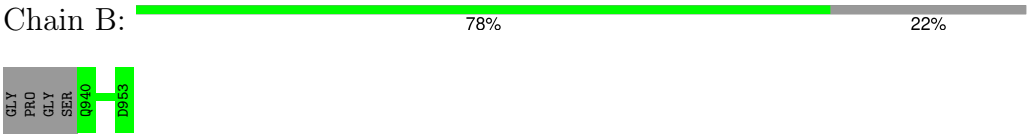
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

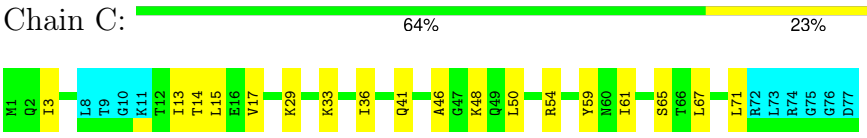
Chain B:



4.2.6 Score per residue for model 6

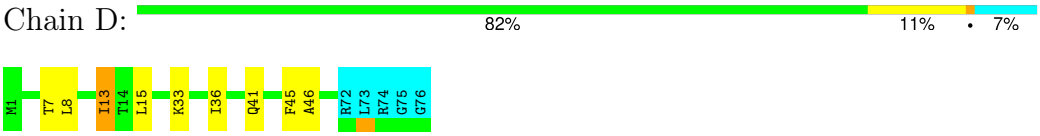
• Molecule 1: Ubiquitin

Chain C:



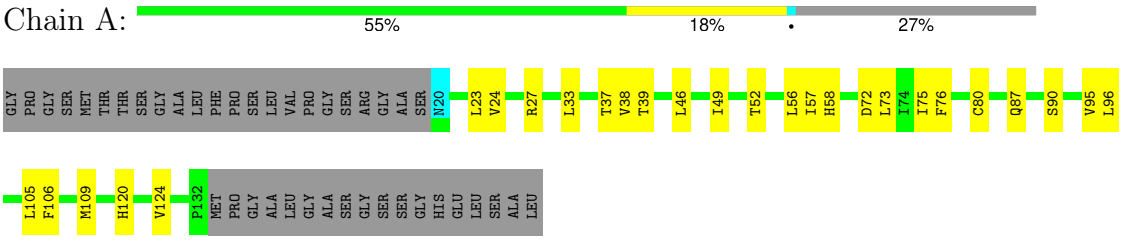
• Molecule 2: Ubiquitin

Chain D:



• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



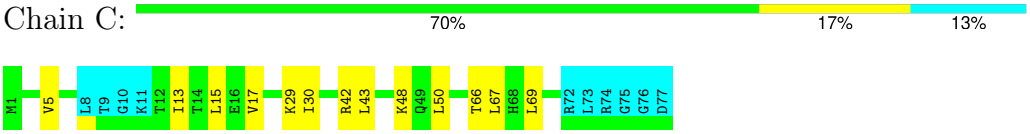
• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

Chain B:

4.2.7 Score per residue for model 7

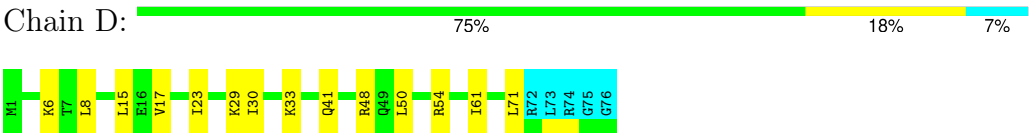
• Molecule 1: Ubiquitin

Chain C:



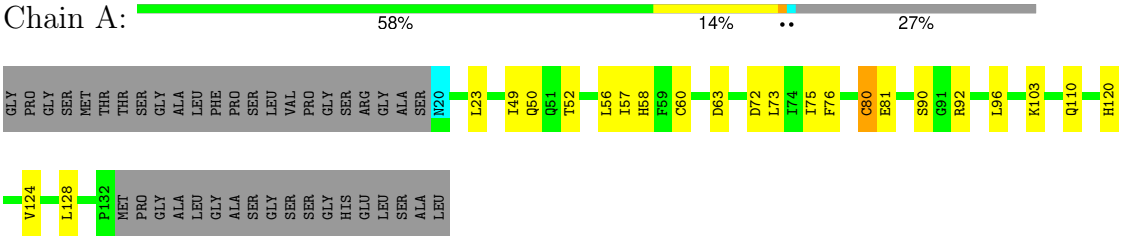
• Molecule 2: Ubiquitin

Chain D:



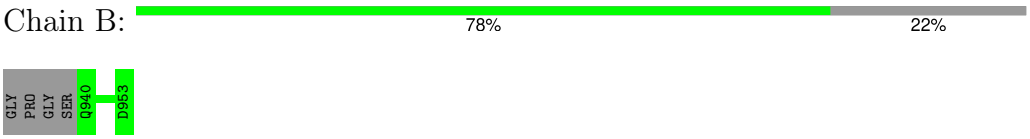
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

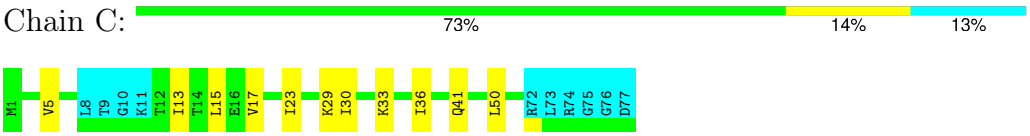
Chain B:



4.2.8 Score per residue for model 8

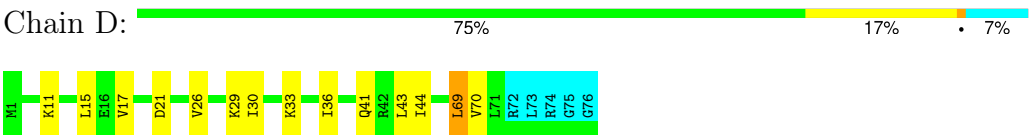
• Molecule 1: Ubiquitin

Chain C:



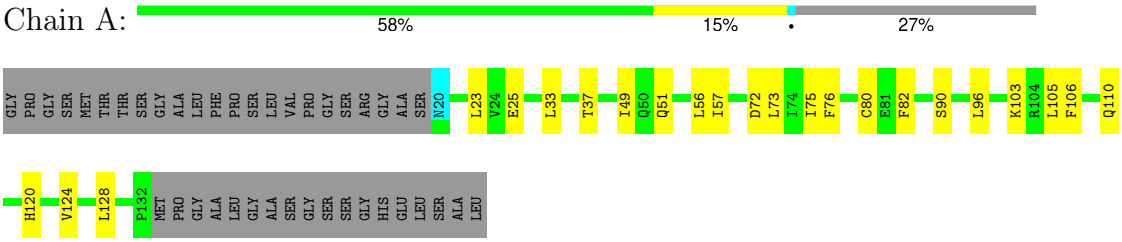
• Molecule 2: Ubiquitin

Chain D:



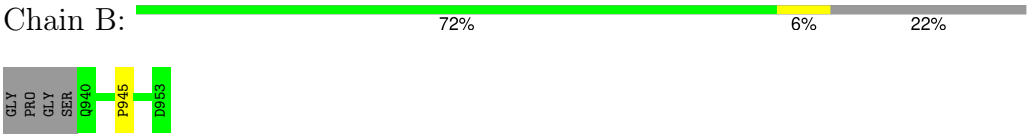
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

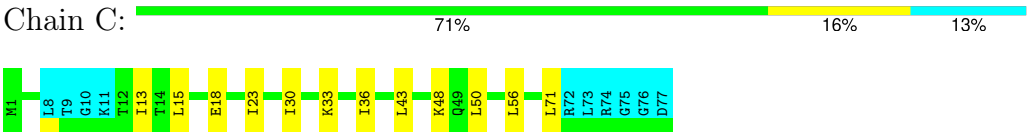
Chain B:



4.2.9 Score per residue for model 9 (medoid)

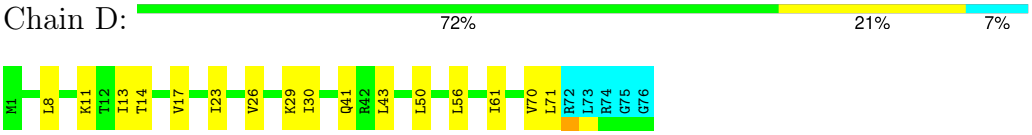
• Molecule 1: Ubiquitin

Chain C:



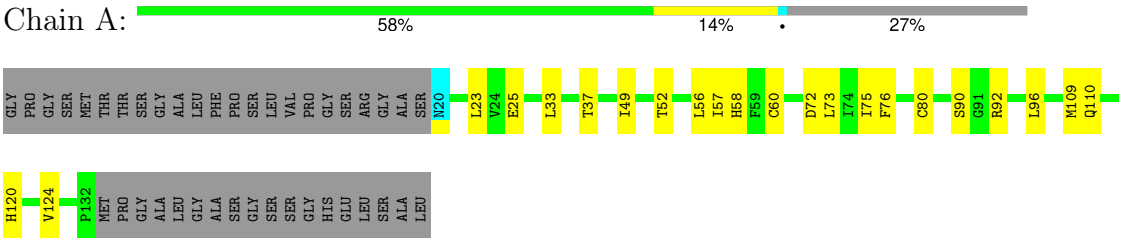
• Molecule 2: Ubiquitin

Chain D:



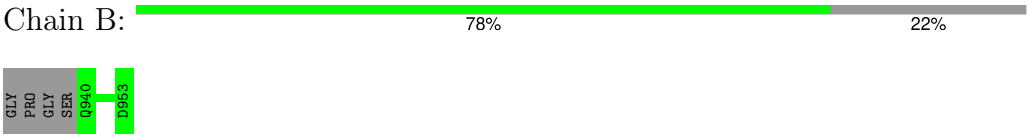
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

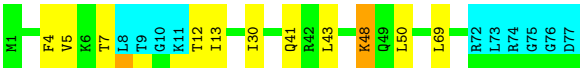
Chain B:



4.2.10 Score per residue for model 10

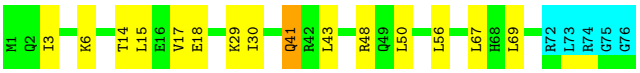
• Molecule 1: Ubiquitin

Chain C:



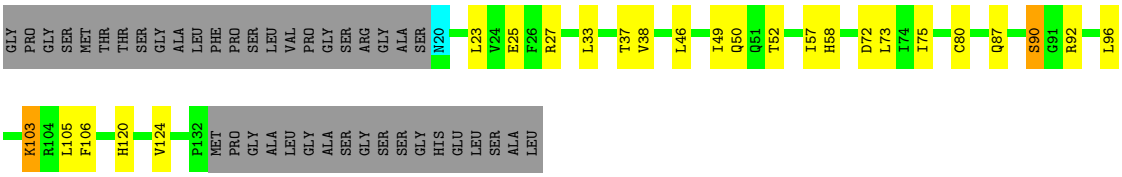
• Molecule 2: Ubiquitin

Chain D:



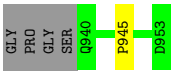
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

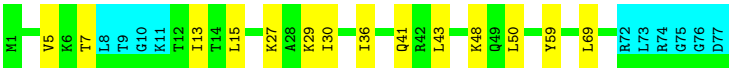
Chain B:



4.2.11 Score per residue for model 11

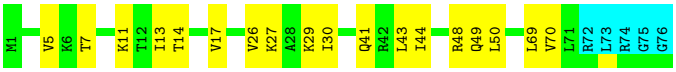
• Molecule 1: Ubiquitin

Chain C:



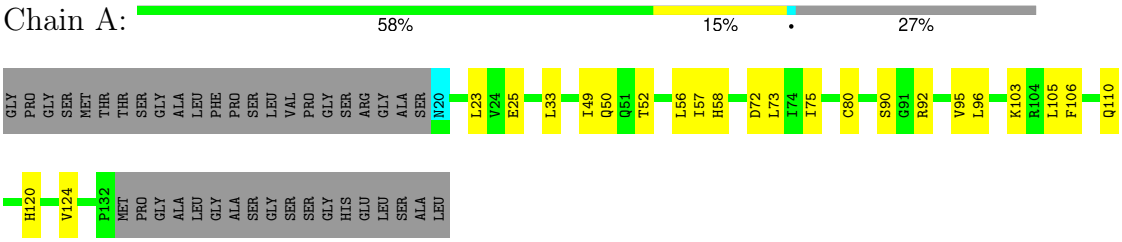
• Molecule 2: Ubiquitin

Chain D:



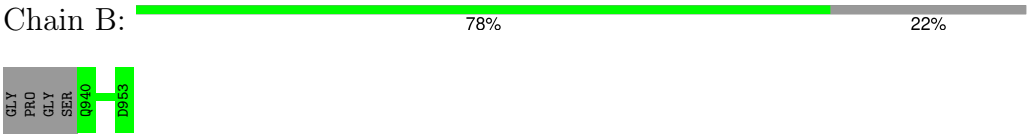
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

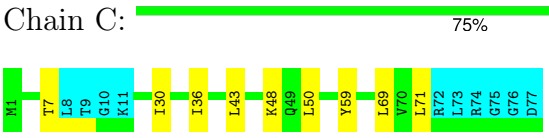
Chain B:



4.2.12 Score per residue for model 12

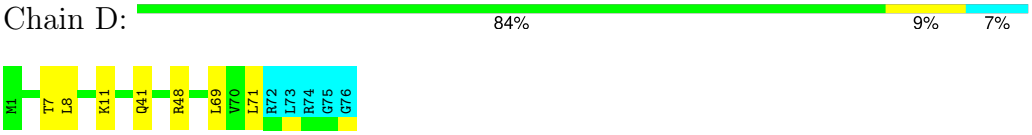
• Molecule 1: Ubiquitin

Chain C:



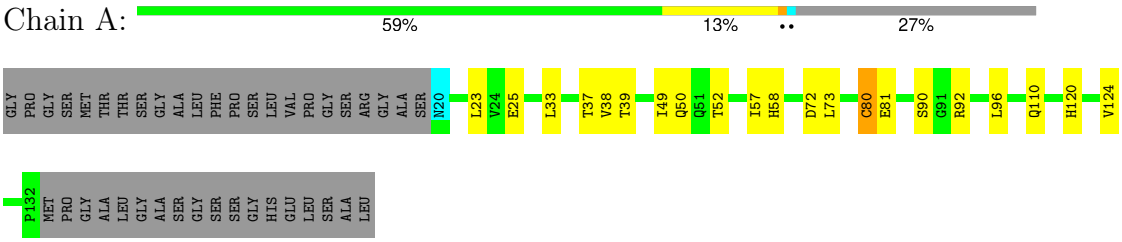
• Molecule 2: Ubiquitin

Chain D:



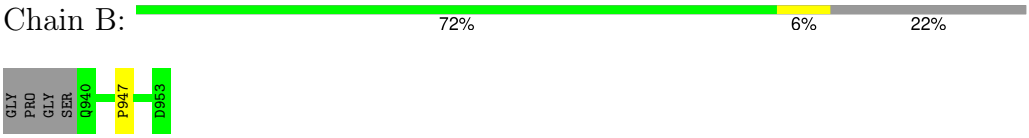
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

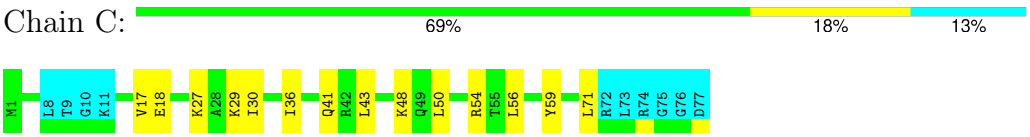
Chain B:



4.2.13 Score per residue for model 13

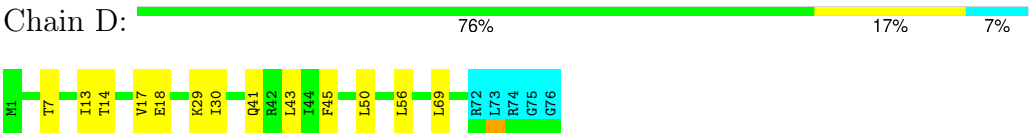
• Molecule 1: Ubiquitin

Chain C:



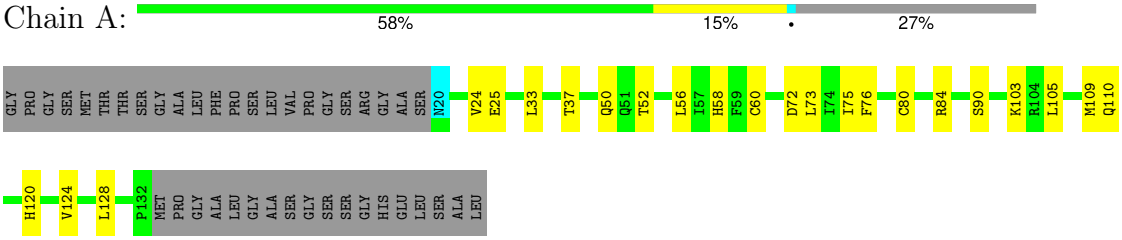
• Molecule 2: Ubiquitin

Chain D:



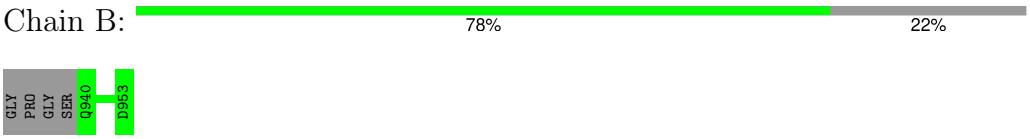
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

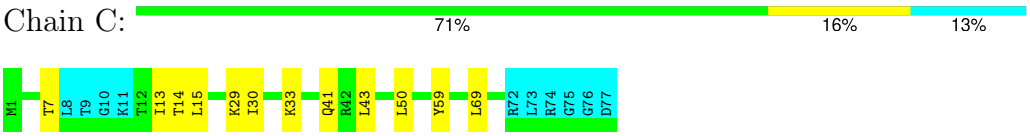
Chain B:



4.2.14 Score per residue for model 14

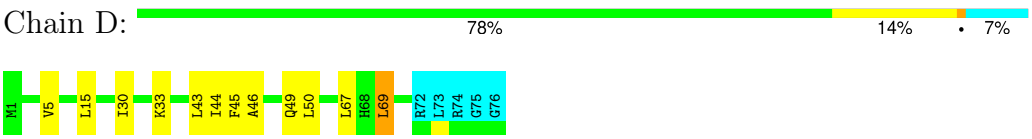
• Molecule 1: Ubiquitin

Chain C:



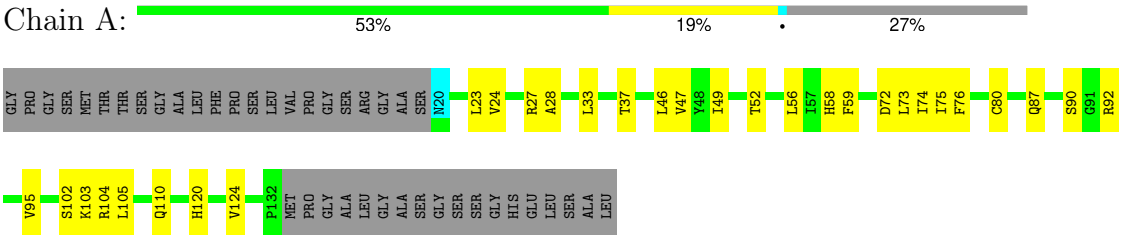
• Molecule 2: Ubiquitin

Chain D:



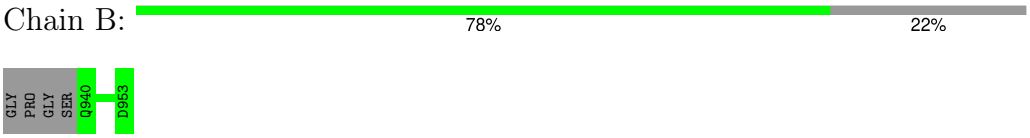
• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

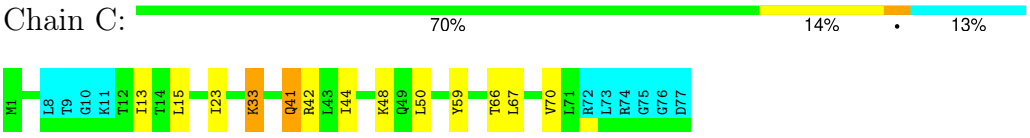
Chain B:



4.2.15 Score per residue for model 15

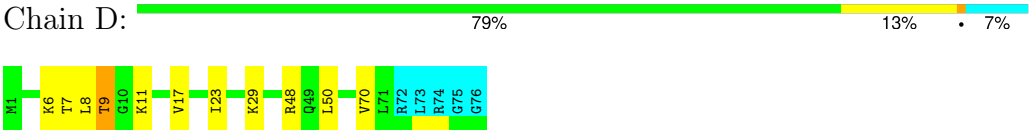
• Molecule 1: Ubiquitin

Chain C:



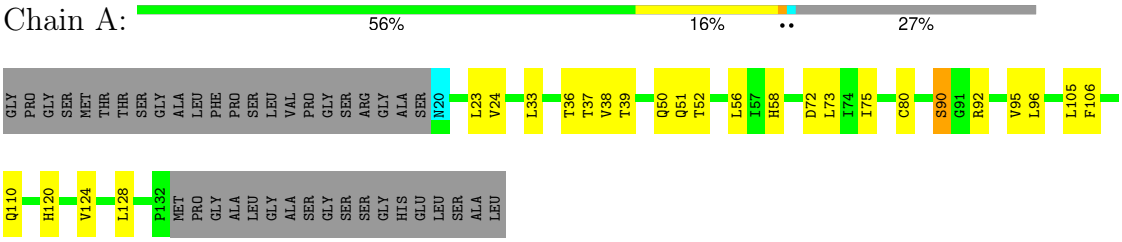
• Molecule 2: Ubiquitin

Chain D:



• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A:



• Molecule 4: 26S proteasome non-ATPase regulatory subunit 1

Chain B:

5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 100 calculated structures, 15 were deposited, based on the following criterion: *structures with the least restraint violations*.

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

Software name	Classification	Version
X-PLOR NIH	structure calculation	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	3302
Number of shifts mapped to atoms	3302
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	85%

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	C	535	550	549	7±3
2	D	565	586	586	9±3
3	A	925	912	912	13±2
4	B	121	97	96	0±0
All	All	32190	32175	32156	423

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 7.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:C:7:THR:HG22	1:C:69:LEU:HD23	0.85	1.49	12	6
1:C:23:ILE:HD12	1:C:50:LEU:HD23	0.84	1.46	15	4
2:D:30:ILE:HD11	2:D:43:LEU:HD21	0.76	1.55	5	7
1:C:5:VAL:HG11	1:C:30:ILE:HD11	0.74	1.58	7	4
2:D:30:ILE:CD1	2:D:43:LEU:HD21	0.74	2.13	3	8
2:D:23:ILE:HD12	2:D:50:LEU:HD23	0.73	1.58	3	5
3:A:120:HIS:O	3:A:124:VAL:HG23	0.68	1.89	3	15
3:A:72:ASP:O	3:A:73:LEU:HD23	0.68	1.87	6	15
2:D:70:VAL:HG11	3:A:56:LEU:HD11	0.68	1.66	11	5
2:D:23:ILE:HD12	2:D:50:LEU:HD13	0.67	1.67	1	3
3:A:80:CYS:SG	3:A:96:LEU:HD11	0.67	2.30	10	9

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:C:7:THR:CG2	1:C:69:LEU:HD23	0.67	2.20	12	1
3:A:56:LEU:HD22	3:A:76:PHE:CZ	0.66	2.26	14	9
1:C:17:VAL:HG12	1:C:29:LYS:NZ	0.65	2.07	6	2
3:A:33:LEU:HD12	3:A:37:THR:O	0.64	1.92	8	13
2:D:50:LEU:HD21	2:D:61:ILE:HD11	0.64	1.69	7	5
1:C:30:ILE:CD1	1:C:43:LEU:HD21	0.64	2.22	9	3
2:D:41:GLN:HB2	2:D:69:LEU:HD11	0.62	1.72	2	5
3:A:75:ILE:HG21	3:A:80:CYS:SG	0.62	2.34	9	7
1:C:30:ILE:HD13	1:C:69:LEU:CD1	0.62	2.25	4	1
2:D:7:THR:HG22	2:D:69:LEU:HD23	0.61	1.72	13	5
1:C:36:ILE:HD13	1:C:71:LEU:HD21	0.60	1.74	12	1
3:A:39:THR:HG22	4:B:947:PRO:HB3	0.60	1.74	15	4
2:D:26:VAL:HG21	2:D:56:LEU:HD11	0.60	1.74	9	2
2:D:48:ARG:HB3	3:A:73:LEU:HD22	0.59	1.74	11	5
1:C:43:LEU:HB3	1:C:50:LEU:HD12	0.59	1.74	12	8
1:C:17:VAL:HG12	1:C:29:LYS:HE3	0.59	1.73	8	3
1:C:43:LEU:CB	1:C:50:LEU:HD12	0.58	2.27	2	5
2:D:48:ARG:HG2	3:A:73:LEU:HD22	0.58	1.73	2	1
2:D:5:VAL:HG11	2:D:30:ILE:HD11	0.58	1.74	4	2
1:C:15:LEU:HD21	1:C:33:LYS:HG3	0.58	1.75	14	6
1:C:36:ILE:HG22	1:C:41:GLN:HG2	0.57	1.77	3	1
2:D:30:ILE:HD12	2:D:41:GLN:OE1	0.57	1.99	1	2
2:D:17:VAL:HG12	2:D:29:LYS:NZ	0.57	2.14	1	1
2:D:23:ILE:CD1	2:D:50:LEU:HD23	0.56	2.29	3	4
1:C:15:LEU:HD13	1:C:29:LYS:HB3	0.55	1.78	14	3
3:A:33:LEU:HD13	3:A:38:VAL:HG22	0.55	1.78	15	6
2:D:15:LEU:HD21	2:D:33:LYS:HG3	0.55	1.79	7	1
2:D:17:VAL:HG12	2:D:29:LYS:HE3	0.54	1.80	9	7
1:C:7:THR:HG22	1:C:69:LEU:CB	0.54	2.33	4	1
3:A:103:LYS:HD3	3:A:105:LEU:HD21	0.54	1.78	13	5
1:C:15:LEU:HD13	1:C:29:LYS:CB	0.54	2.31	7	3
2:D:4:PHE:CD2	2:D:12:THR:HG21	0.54	2.37	5	1
1:C:15:LEU:HD21	1:C:33:LYS:CD	0.54	2.32	15	1
1:C:7:THR:HG22	1:C:69:LEU:HB3	0.53	1.80	4	1
3:A:79:ASP:OD1	3:A:100:ALA:HB3	0.53	2.02	3	1
2:D:50:LEU:HD21	2:D:61:ILE:CD1	0.53	2.33	3	2
1:C:23:ILE:CD1	1:C:50:LEU:HD23	0.53	2.27	15	1
2:D:8:LEU:HD11	2:D:71:LEU:H	0.53	1.62	9	6
1:C:66:THR:C	1:C:67:LEU:HD12	0.53	2.25	15	4
3:A:75:ILE:HB	3:A:128:LEU:HD22	0.53	1.81	8	5
1:C:27:LYS:CG	1:C:43:LEU:HD22	0.53	2.34	13	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:D:43:LEU:HB2	2:D:50:LEU:HD12	0.53	1.80	14	1
2:D:36:ILE:HG22	2:D:41:GLN:HG2	0.52	1.81	6	1
1:C:5:VAL:CG1	1:C:30:ILE:HD11	0.52	2.31	7	1
3:A:57:ILE:HG21	3:A:128:LEU:HD23	0.52	1.80	8	1
2:D:43:LEU:CB	2:D:50:LEU:HD12	0.52	2.35	14	1
1:C:61:ILE:HG23	1:C:65:SER:OG	0.51	2.04	6	1
3:A:39:THR:HG23	4:B:947:PRO:HG3	0.51	1.82	6	1
1:C:5:VAL:HG11	1:C:30:ILE:CD1	0.51	2.34	7	2
3:A:23:LEU:CD1	3:A:57:ILE:HD12	0.50	2.37	8	9
3:A:33:LEU:HD22	3:A:106:PHE:CE1	0.50	2.41	8	4
3:A:81:GLU:O	3:A:96:LEU:HD12	0.50	2.06	7	3
1:C:36:ILE:CG2	1:C:71:LEU:HD22	0.50	2.36	6	2
3:A:57:ILE:CG2	3:A:128:LEU:HD23	0.50	2.36	8	1
2:D:17:VAL:HG12	2:D:29:LYS:CD	0.49	2.36	2	7
2:D:15:LEU:HD13	2:D:29:LYS:CB	0.49	2.37	10	1
1:C:15:LEU:HD21	1:C:33:LYS:CG	0.49	2.37	14	1
2:D:43:LEU:HD23	2:D:69:LEU:HD12	0.49	1.84	4	1
3:A:92:ARG:HE	3:A:114:THR:HG21	0.49	1.68	4	1
3:A:95:VAL:HG23	3:A:105:LEU:O	0.49	2.08	11	7
3:A:33:LEU:HD13	3:A:38:VAL:CG2	0.49	2.38	15	7
2:D:15:LEU:HD21	2:D:33:LYS:HD2	0.49	1.83	8	6
2:D:7:THR:CG2	2:D:13:ILE:HD11	0.48	2.38	6	1
2:D:65:SER:O	2:D:67:LEU:HD12	0.48	2.08	2	1
2:D:18:GLU:O	2:D:56:LEU:HD12	0.48	2.09	13	2
2:D:43:LEU:HB3	2:D:50:LEU:HD12	0.48	1.84	11	4
1:C:18:GLU:O	1:C:56:LEU:HD12	0.48	2.09	9	2
3:A:92:ARG:NE	3:A:114:THR:HG22	0.48	2.23	3	1
1:C:4:PHE:HD2	1:C:12:THR:HG21	0.48	1.69	10	1
3:A:72:ASP:C	3:A:73:LEU:HD23	0.48	2.29	6	1
3:A:23:LEU:HD11	3:A:51:GLN:HB2	0.48	1.85	8	2
3:A:59:PHE:CB	3:A:75:ILE:HD13	0.48	2.39	14	1
1:C:42:ARG:NE	1:C:44:ILE:HD11	0.48	2.24	15	1
3:A:74:ILE:C	3:A:75:ILE:HD12	0.47	2.29	14	1
3:A:75:ILE:HG23	3:A:80:CYS:SG	0.47	2.49	4	3
2:D:17:VAL:HG12	2:D:29:LYS:HZ2	0.47	1.70	1	1
3:A:27:ARG:HA	3:A:46:LEU:HD12	0.47	1.85	6	6
1:C:15:LEU:HD21	1:C:33:LYS:HD3	0.47	1.85	15	1
2:D:44:ILE:HD12	2:D:70:VAL:HG21	0.47	1.87	4	2
1:C:36:ILE:HG22	1:C:41:GLN:HG3	0.46	1.85	4	5
3:A:52:THR:HG23	3:A:58:HIS:CD2	0.46	2.45	2	14
3:A:23:LEU:HD12	3:A:49:ILE:HG22	0.46	1.87	8	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:C:30:ILE:HD13	1:C:69:LEU:HD22	0.46	1.87	12	1
1:C:41:GLN:HB2	1:C:69:LEU:HD11	0.46	1.87	10	1
2:D:17:VAL:HG12	2:D:29:LYS:CE	0.46	2.41	2	3
2:D:45:PHE:HB3	2:D:50:LEU:HD21	0.46	1.88	13	2
2:D:44:ILE:HG23	2:D:49:GLN:HA	0.45	1.86	3	3
2:D:30:ILE:HD13	2:D:69:LEU:HD11	0.45	1.88	14	2
2:D:15:LEU:HD13	2:D:29:LYS:HB3	0.45	1.89	10	1
2:D:41:GLN:CB	2:D:69:LEU:HD11	0.45	2.41	3	2
3:A:56:LEU:HD22	3:A:76:PHE:CE2	0.45	2.47	6	3
1:C:23:ILE:HG21	1:C:50:LEU:O	0.45	2.12	8	1
2:D:21:ASP:OD1	2:D:26:VAL:HG23	0.45	2.11	8	1
2:D:4:PHE:HD2	2:D:12:THR:HG21	0.45	1.71	5	1
1:C:17:VAL:HG12	1:C:29:LYS:HZ2	0.45	1.70	6	2
2:D:44:ILE:HD12	2:D:70:VAL:CG2	0.44	2.42	8	2
1:C:61:ILE:HG23	1:C:65:SER:CB	0.44	2.43	6	1
1:C:36:ILE:HG23	1:C:71:LEU:HD22	0.44	1.90	9	1
1:C:27:LYS:HG3	1:C:43:LEU:HD11	0.44	1.88	2	1
2:D:5:VAL:CG1	2:D:69:LEU:HD12	0.44	2.43	14	1
1:C:30:ILE:HD13	1:C:69:LEU:HD11	0.44	1.89	4	1
2:D:27:LYS:HG3	2:D:43:LEU:HD22	0.44	1.90	11	1
1:C:27:LYS:HG2	1:C:43:LEU:HD11	0.43	1.89	4	1
2:D:30:ILE:HG21	2:D:41:GLN:OE1	0.43	2.13	11	1
1:C:36:ILE:HD13	1:C:71:LEU:CD2	0.43	2.42	12	2
1:C:43:LEU:HB2	1:C:50:LEU:HD12	0.43	1.90	7	1
2:D:17:VAL:HG12	2:D:29:LYS:HE2	0.43	1.90	8	1
2:D:67:LEU:N	2:D:67:LEU:HD12	0.43	2.28	5	1
1:C:4:PHE:CD2	1:C:12:THR:HG21	0.43	2.48	10	1
3:A:75:ILE:HD12	3:A:75:ILE:N	0.43	2.28	14	1
1:C:50:LEU:HD23	1:C:59:TYR:CE2	0.43	2.48	12	5
2:D:36:ILE:HD13	2:D:71:LEU:CD2	0.43	2.44	1	1
2:D:36:ILE:HD13	2:D:71:LEU:HD21	0.43	1.90	1	1
2:D:45:PHE:O	2:D:46:ALA:HB3	0.43	2.14	6	4
1:C:30:ILE:HD11	1:C:43:LEU:HD11	0.43	1.90	14	1
2:D:30:ILE:HG21	2:D:69:LEU:HD11	0.42	1.91	14	2
1:C:3:ILE:HG22	1:C:65:SER:HB3	0.42	1.90	6	1
3:A:33:LEU:HD22	3:A:106:PHE:CZ	0.42	2.49	15	2
2:D:36:ILE:HG22	2:D:41:GLN:HG3	0.42	1.92	8	1
3:A:80:CYS:HB3	3:A:96:LEU:HD11	0.42	1.91	4	3
1:C:50:LEU:HD11	1:C:67:LEU:CD2	0.42	2.44	6	1
2:D:50:LEU:HD11	2:D:67:LEU:HD23	0.42	1.90	14	1
3:A:23:LEU:N	3:A:49:ILE:O	0.42	2.53	5	13

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
3:A:28:ALA:HB3	3:A:47:VAL:HG23	0.41	1.91	14	1
1:C:27:LYS:HG3	1:C:43:LEU:HD22	0.41	1.92	13	1
1:C:50:LEU:HD11	1:C:67:LEU:HD23	0.41	1.91	6	1
3:A:103:LYS:CD	3:A:105:LEU:HD21	0.41	2.45	11	2
2:D:31:GLN:O	2:D:35:GLY:N	0.41	2.53	1	1
2:D:3:ILE:HD12	2:D:67:LEU:HD22	0.41	1.92	10	1
1:C:17:VAL:HG12	1:C:29:LYS:CD	0.40	2.46	13	1
1:C:30:ILE:HD12	1:C:43:LEU:HD11	0.40	1.93	13	1
1:C:30:ILE:HG21	1:C:41:GLN:OE1	0.40	2.17	10	1
2:D:26:VAL:HG12	2:D:43:LEU:HD21	0.40	1.93	11	1

6.3 Torsion angles (i)

6.3.1 Protein backbone (i)

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	C	66/77 (86%)	65±1 (98±2%)	1±1 (2±1%)	0±0 (0±1%)	32	76
2	D	70/76 (92%)	69±1 (98±2%)	1±1 (2±1%)	0±1 (0±1%)	27	74
3	A	111/154 (72%)	105±1 (95±1%)	5±1 (4±1%)	1±0 (1±0%)	17	67
4	B	12/18 (67%)	11±1 (92±7%)	1±1 (6±5%)	0±0 (3±4%)	6	40
All	All	3885/4875 (80%)	3741 (96%)	115 (3%)	29 (1%)	21	71

All 10 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
3	A	90	SER	15
4	B	945	PRO	5
2	D	54	ARG	2
2	D	52	ASP	1
1	C	40	GLN	1
1	C	46	ALA	1
1	C	42	ARG	1
1	C	41	GLN	1

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Mol	Chain	Res	Type	Models (Total)
2	D	7	THR	1
2	D	9	THR	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	C	62/69 (90%)	60±1 (97±1%)	2±1 (3±1%)	41 89
2	D	65/68 (96%)	63±1 (97±2%)	2±1 (3±2%)	36 86
3	A	104/132 (79%)	98±1 (95±1%)	6±1 (5±1%)	21 74
4	B	14/16 (88%)	14±0 (100±0%)	0±0 (0±0%)	100 100
All	All	3675/4275 (86%)	3536 (96%)	139 (4%)	30 83

All 34 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	C	13	ILE	13
3	A	110	GLN	12
3	A	92	ARG	11
3	A	24	VAL	8
3	A	25	GLU	8
3	A	90	SER	7
3	A	50	GLN	7
2	D	13	ILE	6
2	D	6	LYS	5
3	A	87	GLN	5
2	D	41	GLN	5
3	A	60	CYS	5
3	A	80	CYS	5
2	D	14	THR	5
3	A	109	MET	5
2	D	11	LYS	5
1	C	41	GLN	3
3	A	103	LYS	3
1	C	69	LEU	2

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Mol	Chain	Res	Type	Models (Total)
3	A	102	SER	2
1	C	14	THR	2
1	C	54	ARG	2
2	D	69	LEU	2
2	D	27	LYS	1
2	D	8	LEU	1
3	A	63	ASP	1
3	A	82	PHE	1
1	C	48	LYS	1
1	C	27	LYS	1
3	A	84	ARG	1
3	A	104	ARG	1
1	C	33	LYS	1
2	D	9	THR	1
3	A	36	THR	1

6.3.3 RNA

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains

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

6.5 Carbohydrates

There are no oligosaccharides in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

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

The completeness of assignment taking into account all chemical shift lists is 85% for the well-defined parts and 84% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

Chemical shift list name: *starch_output*

7.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	3302
Number of shifts mapped to atoms	3302
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	6

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	270	0.01 ± 0.08	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	249	0.19 ± 0.13	None needed (< 0.5 ppm)
$^{13}C'$	211	0.14 ± 0.12	None needed (< 0.5 ppm)
^{15}N	178	0.72 ± 0.28	Should be applied

7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 85%, i.e. 3164 atoms were assigned a chemical shift out of a possible 3704. 0 out of 39 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	1090/1299 (84%)	449/524 (86%)	465/528 (88%)	176/247 (71%)
Sidechain	1894/2170 (87%)	1291/1394 (93%)	577/690 (84%)	26/86 (30%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	180/235 (77%)	103/116 (89%)	75/113 (66%)	2/6 (33%)
Overall	3164/3704 (85%)	1843/2034 (91%)	1117/1331 (84%)	204/339 (60%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 84%, i.e. 3302 atoms were assigned a chemical shift out of a possible 3930. 0 out of 42 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	1126/1384 (81%)	467/561 (83%)	481/560 (86%)	178/263 (68%)
Sidechain	1996/2311 (86%)	1360/1483 (92%)	609/728 (84%)	27/100 (27%)
Aromatic	180/235 (77%)	103/116 (89%)	75/113 (66%)	2/6 (33%)
Overall	3302/3930 (84%)	1930/2160 (89%)	1165/1401 (83%)	207/369 (56%)

7.1.4 Statistically unusual chemical shifts (i)

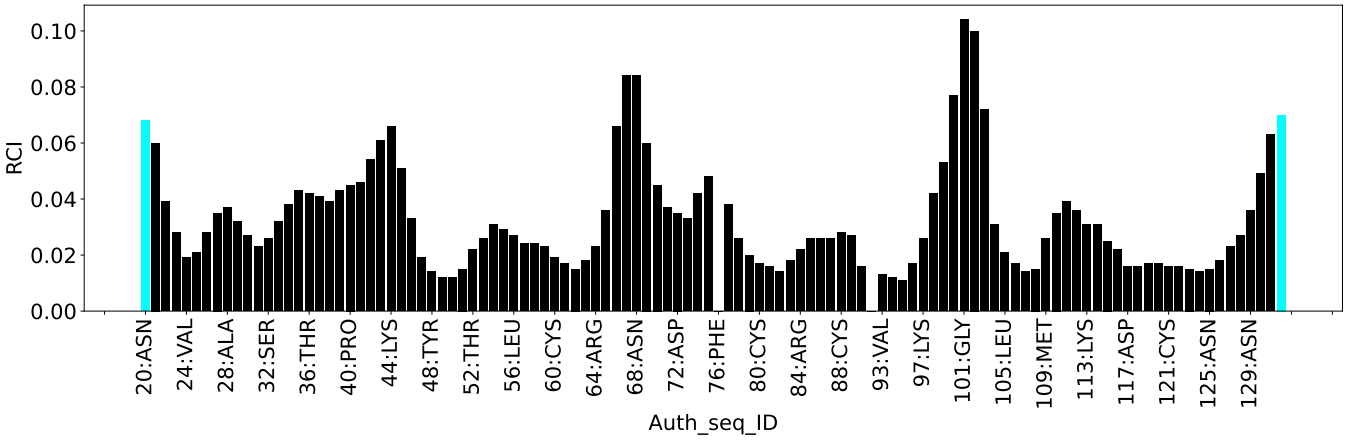
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	30	LYS	HE2	1.60	1.95 – 3.88	-6.8
1	A	47	VAL	HB	0.07	0.43 – 3.54	-6.2
1	A	38	VAL	HB	0.10	0.43 – 3.54	-6.0
1	A	60	CYS	HB3	0.41	0.69 – 5.10	-5.6
1	A	30	LYS	HG3	-0.07	0.04 – 2.67	-5.4
1	B	944	PRO	HA	2.75	2.78 – 6.00	-5.1

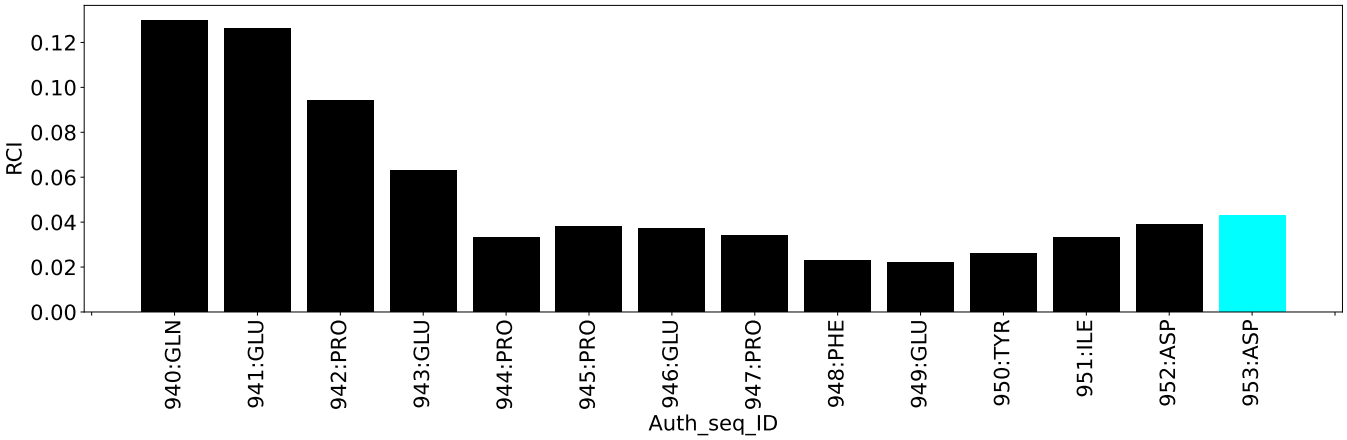
7.1.5 Random Coil Index (RCI) plots (i)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

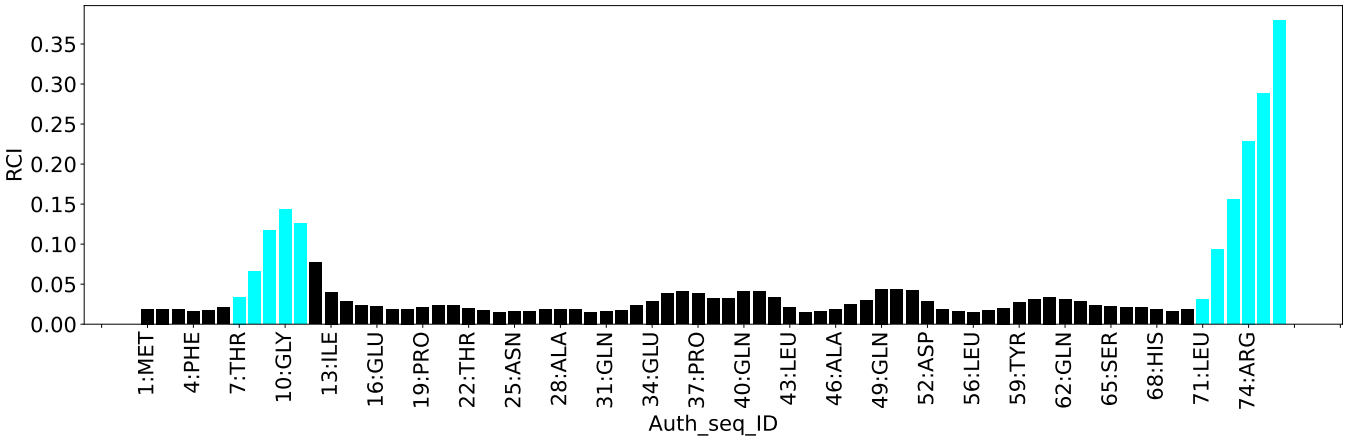
Random coil index (RCI) for chain A:



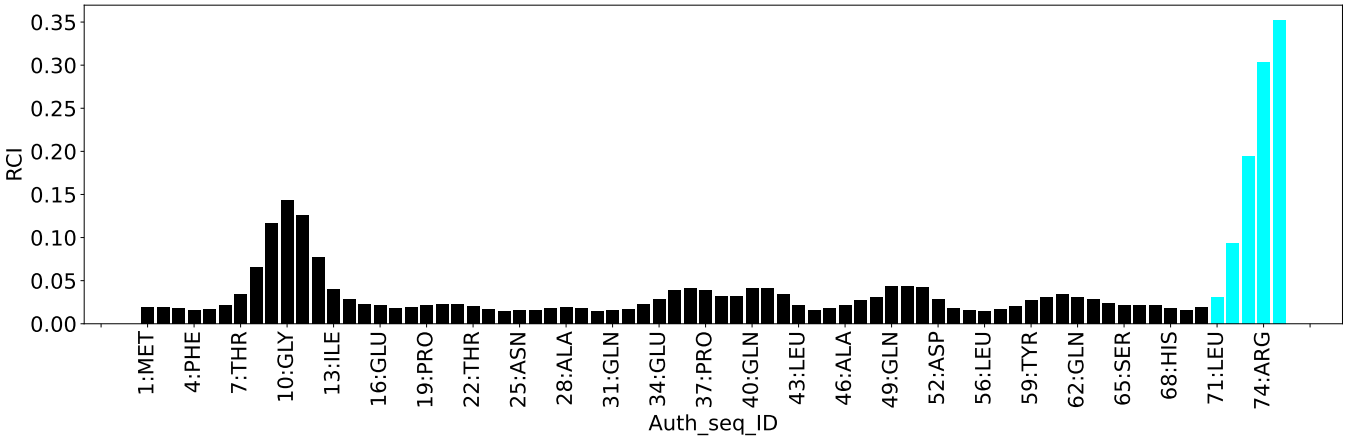
Random coil index (RCI) for chain B:



Random coil index (RCI) for chain C:



Random coil index (RCI) for chain D:


RCI
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1:MET
4:PHE
7:THR
10:GLY
13:ILE
16:GLU
19:PRO
22:THR
25:ASN
28:ALA
31:GLN
34:GLU
37:PRO
40:GLN
43:LEU
46:ALA
49:GLN
52:ASP
56:LEU
59:TYR
62:GLN
65:SER
68:HIS
71:LEU
74:ARG
Auth_seq_ID