

# Full wwPDB NMR Structure Validation Report (i)

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Title	:	hRpn13:hRpn2:K48-diubiquitin
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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 (1)) were used in the production of this report:

:	4.02b-467
:	20231227.v01 (using entries in the PDB archive December 27th 2023)
:	v_1n_11_5_13_A (Berjanski et al., 2005)
:	Wang et al. $(2010)$
:	v1.2
:	Engh & Huber $(2001)$
:	Parkinson et al. (1996)
:	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	(#Entries)	(#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	С	77	74%			13%	13%	
2	D	76	80%			13%	7%	
3	А	154	58%	15%	•	27%	5	
4	В	18	78%			22	%	



# 2 Ensemble composition and analysis (i)

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,	0.53	9					
	B:940-B:953 (197)							

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	С	Η	Ν	0	S	0
1	U	11	1241	382	631	106	121	1	0

There is a discrepancy between the modelled and reference sequences:

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

• Molecule 2 is a protein called Ubiquitin.

Mol	Chain	Residues		Atoms					Trace
9	Л	76	Total	С	Η	Ν	Ο	S	0
	D	70	1232	378	629	107	117	1	0

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
9	Δ	119	Total	С	Η	Ν	0	S	0
3	A	115	1851	593	918	162	172	6	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
А	-3	GLY	-	expression tag	UNP Q16186
А	-2	PRO	-	expression tag	UNP Q16186
А	-1	GLY	-	expression tag	UNP Q16186
А	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	D	1.4	Total	С	Η	Ν	0	0
4 B	14	218	77	97	15	29	0	

There are 4 discrepancies between the modelled and reference sequences:

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



#### Residue-property plots (i) 4

#### Average score per residue in the NMR ensemble 4.1

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.

13%

13%

- Chain C: 74% • Molecule 2: Ubiquitin 80% 58% 15%
- Molecule 1: Ubiquitin



#### Scores per residue for each member of the ensemble 4.2

Colouring as in section 4.1 above.



### 4.2.1 Score per residue for model 1

• Molecule 1: Ubiquitin

Chain C:	74%	13%	13%
M1 17 19 19 113 113 113 113 113 113 113 113 1	L89 171 172 173 177 177 177		
• Molecule 2: Ubiquitin			
Chain D:	70%	24%	7%
M1 K6 L18 117 L18 117 117 117 117 117 117 117 117 117 1	144 144 144 144 144 144 144 144 144 150 150 150 169 171 171 171 171 171 171 171 171 171 17		
• Molecule 3: Proteasoma	al ubiquitin receptor AD	RM1	
Chain A:	56%	16% ••	27%
CLY CLY CLY CLY CLY THR THR THR THR THR THR THR CLY CLY CLY CLY CLY CLY CLY CLY CLY CLY	ARG GLY ALA ALA SER SER 123 123 123 123 123 123 123 123 123 123	L46 149 152 156 157 157 157 173	174 175 776 80 81 83 89 89 89
V95 1106 11105 0110 0110 0124 1120 0117 0124 012 017 017 017 017	SER SER SER SER SER CLY HIS CLY HIS CLU LEU LEU LEU		
• Molecule 4: 26S proteas	some non-ATPase regula	tory subunit 1	
Chain B:	72%	6%	22%
CLY CLY SER 940 940 941 983			
4.2.2 Score per resid	ue for model 2		
• Molecule 1: Ubiquitin			
Chain C:	75%	12%	13%
M1 17 19 113 113 113 113 113 113 113 113 113	L 100 L 170 L 171 L 172 L 173 R 774 G 76 G 76 G 76 D 77		
• Molecule 2: Ubiquitin			
Chain D:	67%	25%	• 7%
M 17 113 113 114 114 114 113 113 113 113 113	K33 64 143 143 164 164 164 166 166 166 166 166 166 166	V10 L71 L72 L73 L73 L73 C76 G76	
• Molecule 3: Proteasoma	al ubiquitin receptor AD	RM1	

D W I D E DATA BANK

Chain A:	57%	14%	••	27%	-
GLY PRO GLY SER MET THR THR	SER LLEU LLEU PRO PRO PRO PRO PRO PRO PRO PRO PRO CL23 RLA SER ALA ALA ALA CL23 CL23 CL23 CL23 CL23 CL23 CL23 CL23	L46 149 T52	L56 157 H58 F59 C60	L73 F76 C80	890 691 196 196
K103 R104 F105 H120 H120	V124 PRC PRC PRC PRC PRC PRC PRC PRC PRC PRC				
• Molecul	e 4: 26S proteasome non-ATPase reg	julatory su	ıbunit 1		
Chain B:	78%			22%	-
GLY PRO GLY SER <mark>Q940</mark> D953					
4.2.3 S	core per residue for model 3				
• Molecul	e 1: Ubiquitin				
Chain C:	75%		10%	• 13%	-
M1 L8 T9 G10 K11 T12	113 113 113 136 136 136 136 136 136 136				
• Molecul	e 2: Ubiquitin				
Chain D:	75%		179	6 • 7%	0
M1 L15 L15	123 130 130 144 144 144 144 144 144 144 144 144 14				
• Molecul	e 3: Proteasomal ubiquitin receptor .	ADRM1			
Chain A:	55%	16%		27%	-
GLY PRO GLY SER MET THR THR	SER CLA LEU PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO	149 050 151 152	H58 F59 C60 D72 L73 L73	175 D79 C80 S90	<b>G91</b> R92 V95 A100
K103 R104 L105 q110	1114 1120 11220 1124 1120 1124 1124 1124				
• Molecul	e 4: 26S proteasome non-ATPase reg	julatory su	ıbunit 1		
Chain B:	72%		6%	22%	-
GLY PRO GLY SER <b>Q940</b> P947	88 8				



### 4.2.4 Score per residue for model 4

• Molecule 1: Ubiquitin

Chain C:	70%	16%	• 13%
M1 17 18 19 113 113 113 113 113 113 113 113 113	130 K33 136 L43 L43 L43 L43 L43 R72 L73 R72 L73 R74	G75 D77	
• Molecule 2: Ubiquitin	l		
Chain D:	75%	18%	7%
M V5 113 114 123 130 130 130 144	L50 R54 L71 L71 L71 R72 R72 G77 G77 G76		
• Molecule 3: Proteason	mal ubiquitin receptor A	ADRM1	
Chain A:	55%	17% •• 2	27%
DLY DLY CLY CLY THR THR THR THR THR THR THR CLY CLY CLY CLY CLU PHE PHC PHC	GLY SER ARG CLY ALA ALA SER N20 N20 N20 N22 L23 L23 L23 L23 L23 L23 L33 L23 V24 V24 V24 V24 V24 V24 V24 V24 V24 V23 V23 V24 V24 V24 V23 V24 V23 V24 V24 V24 V24 V24 V24 V24 V24 V24 V24	L46 149 152 152 157 157 158 158 158 158 174	1/0 C80 C91 R92 R92 R92
代103 1410-6 1410-6 1410-6 1411-1 1412-0 14	ALA ALA LEU ALA ALA ALA ALA ALA ALA ALA ALA ALA AL		
• Molecule 4: 26S prote	easome non-ATPase reg	gulatory subunit 1	
Chain B:	72%	6%	22%
cury cury ser 1945 1945 1965			
4.2.5 Score per resi	idue for model 5		
• Molecule 1: Ubiquitin	1		
Chain C:	81%	6%	13%
M1 L8 T19 C10 C10 L50 L50 L50 L50 L50 L57 L67 L75	L73 G75 G75 D77		
• Molecule 2: Ubiquitin	l		
Chain D:	74%	20%	7%
M1 F4 112 112 123 123 123 123 123 123 123 123	R42 L443 1445 F45 F45 F45 L50 L50 L56 H69 L67 L68 R72 L73 L73 R74 K74	676 676	
• Molecule 3: Proteason	mal ubiquitin receptor A	ADRM1	



Chain .	A:	57%	14% ••	2	7%	
GLY PRO GLY SER MET	THR THR SER GLY ALA ALA PLEU PHE PRO SER CLEU VAL CLEU VAL SER SER	ARG GLY ALA SER N20 V24 L23 L23 L23 T27 T37	149 152 156 157 157 157 157 157 157	1/4 175 776 80 E81	890 691 R92 L96	8102 M109 Q110
H120 V124 L128	P132 MET PRO CLY ALA ALA ALA ALA ALA SER SER SER SER SER SER SER	HIS GLU SER ALA LEU LEU				
• Mole	cule 4: 26S proteas	ome non-ATPase	regulatory sub	ounit 1		
Chain I	B:	78%			22%	
GLY PRO GLY SER <b>Q940</b>	8 8					
4.2.6	Score per residu	ie for model 6				
• Mole	cule 1: Ubiquitin					
Chain	C:	64%		23%	13%	
M 13 13 13 13 13 13 13 13 13 13 13 13 13	19 610 113 114 114 115 115 115 115 115 115 115 115	136 41 44 44 44 44 44 44 44 44 44 44 44 44	L61 161 365 365 166 L67 L67 L71 L71 L73 L73	R/4 G75 D77 D77		
• Mole	cule 2. Ubiquitin					
	cule 2. Obiquitin					
Chain I	D:	82%			11% • 7%	•
Chain I ⊑ <mark>⊧ ≌</mark>		82% 877 876 876 876			11% • 7%	•
Chain I <mark>E F3</mark> • Mole	D:	82%	or ADRM1		11% • 7%	
Chain I E E B • Mole Chain J	D:	82% 55%	or ADRM1 18%		11% • 7% 27%	
Chain I E F 3 • Mole Chain I	D: 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	82% 85 2 8 9 5 1 ubiquitin receptor 555%	or ADRM1 18%	Lee 157 158 158 D72 173 173	11% • 7%	890 V95 L96
Chain I E E 3 • Mole Chain I Chain I Chain I	Cule 2: Obiquitin D: Cule 3: Proteasoma A: Et E S 5 7 6 E E S 5 7 8 5 E E S 5 7 6 E E S 5 7 8 5 E E S 5 7 6 E E S 5 7 8 5 E E S 5 7 8 6 E E S 5 7 8 5 E E S 5 7 8 6 E E S 5 7 8 5 E E S 5 7 8 6 E E S 5 7 8 6 7 8 7 8 6 5 7 8 6 7 8 7 8 6 7 8 7 8 6 7 8 7 8 6 7 8 7 8	82%	or ADRM1 18%	156 158 158 158 152 173	27%	S90 V95 L96
Chain I Molec Chain I Chain	D:	82% S Z S S l ubiquitin receptor 55% W D T S S S S S D S S S S S D S S S S S S S S S S S S S S S S S S S	or ADRM1 18%	ounit 1	27% 27%	<b>590</b> V95 L96
Chain I Chain I Chain I Chain I Chain I Chain I Chain I	E E	82% St X S S l ubiquitin receptor 55% St X V S S S S S S S S S S S S S S S S S S S	or ADRM1 18% 28 8 9 9 9 9	• • • • • • • • • • • • • • • • • • •	11% • 7% 27% 22%	890 890 196



### 4.2.7 Score per residue for model 7

• Molecule 1: Ubiquitin

Chain C: 70%	17% 13%	•
M1 V5 V5 V1 V1 V1 V1 V1 V1 V1 V1 V1 V1 V1 V1 V1	010 D77	
• Molecule 2: Ubiquitin	_	
Chain D: 75%	18% 7%	-
M K6 76 115 115 115 1130 1130 1130 1130 1130 11		
• Molecule 3: Proteasomal ubiquitin receptor	ADRM1	
Chain A: 58%	14% •• 27%	-
GLY PRO GLY MET THR MET THR MET FRO GLY FRO GLY GLY GLY GLY GLY GLY GLY GLY GLY GLY	113 ( <b>P59</b> <b>P59</b> <b>P63</b> <b>P63</b> <b>P63</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P75</b> <b>P76</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P77</b> <b>P</b>	K1 <mark>03</mark> Q110 H120
V124 V124 L128 NET ALA ALA ALA SER SER SER SER SER CUT CUT CUT CUT CUT CUT CUT CUT CUT CUT		
• Molecule 4: 26S proteasome non-ATPase re	gulatory subunit 1	
Chain B: 78%	22%	
Chain B: 78%	22%	
Chain B: 78%	22%	
Chain B: 78% Image: Second per residue for model 8   • Molecule 1: Ubiquitin	22%	
Chain B: 78%	22%	
Chain B: 78% <b>4.2.8 Score per residue for model 8</b> • Molecule 1: Ubiquitin Chain C: 73% <b>2 5 8 6 7 7 7 7 7 7 7 7 7 7</b>	22%	
Chain B: 78% <b>4.2.8 Score per residue for model 8</b> • Molecule 1: Ubiquitin Chain C: 73% <b>9 9 9 9 9 9 9 9 9 9</b>	22%	
Chain B: 78% <b>4.2.8 Score per residue for model 8</b> • Molecule 1: Ubiquitin Chain C: 73% <b>9 9 9 9 9 9 9 9 9 9</b>	22% 14% 13% 17% • 7%	

• Molecule 3: Proteasomal ubiquitin receptor ADRM1



Chain A:	58%	15%	• 27%	
GLY PRO SER MET THR THR THR THR GLY GLY LEU PHE	PRO SER LEU VAL VAL PRO GLY GLY GLY GLY C SER C 25 C 25 C 25 C 25 C 25 C 25 C 25 C 2	137 149 050 051 157 157 172 172	174 175 776 776 780 681 782 782	L96 K103 R104 F105 F106 G110
H120 V124 L128 P132 MET PMET ALA	LEU GLY ALA SER SER SER SER CLY HIS CLEU LEU LEU LEU			
• Molecule 4: 26	S proteasome non-ATPa	se regulatory su	bunit 1	
Chain B:	72%		6% 22%	2
GLY PRO GLY GLA P940 P945 D953				
4.2.9 Score p	er residue for model	9 (medoid)		
• Molecule 1: Ul	biquitin			
Chain C:	71%		16%	13%
M1 112 113 113 113 113 113 113 113 113 11	123 136 136 136 136 136 143 143 143 143 143 143 143 143 143 143	R72 L73 R74 G75 G76 D77		
• Molecule 2: Ul	biquitin			
Chain D:	72%		21%	7%
M1 L8 K11 T12 T14 T14 V17 V17	V26 K29 I30 Q41 L43 L43 L50 L50 L50 L51 L51 V70 V70	R72 L73 R74 G75 G76		
• Molecule 3: Pr	oteasomal ubiquitin rece	ptor ADRM1		
Chain A:	58%	14%	• 27%	
GLY PRO CLY SER MET THR THR THR SER GLY ALA LEU PHE	PR0 SER VAL LEU VAL LEU PR0 CLY GLY GLY GLY GLY CL2 CL2 CL2 CL2 CL2 CL2 CL2 CL2 CL2 CL2	137 149 149 156 157 158 158 158 158	D72 D72 L73 I74 F76 F76 C80	890 691 R92 L96 M109 0110
H120 V124 P132 MET PR0 GLY ALA GLY ALA	SER GLY SER SER GLY HIS CLU CLU LEU LEU LEU			
• Molecule 4: 26	S proteasome non-ATPa	se regulatory su	bunit 1	
Chain B:	78%		22%	2
GLY PRO GLY SER <mark>Q940</mark> D953				



**L96** 

### 4.2.10 Score per residue for model 10

• Molecule 1: Ubiquitin

Chain C:	73%	13% •	13%
M1 F4 V5 T7 T7 T9	C10 113 113 113 113 113 113 113 113 113 1		
• Molecule	2: Ubiquitin		
Chain D:	74%	18%	• 7%
M1 Q2 I3 K6 F14 L15	113   113     114   113     113		
• Molecule	3: Proteasomal ubiquitin receptor ADRM1		
Chain A:	56% 15% ••	279	%
GLY PRO GLY SER MET THR THR SER	GLY PHE PHE PHE PHE PHE PRO SER SER SER SER SER SER SER SER SER SER	I57 H58 D72 L73 I74	175 C80 087 890 691
K103 R104 L105 F106 H120	V124 P132 MET MET MET MET MET ALA GLY GLY GLY GLU GLU CLU CLU CLU LEU LEU		
• Molecule	4: 26S proteasome non-ATPase regulatory sub	ounit 1	
Chain B:	72%	6%	22%
GLY PRO GLY SER <b>0940</b> P9 <mark>45</mark>	0000 0000		
4.2.11 Se	core per residue for model 11		
• Molecule	1: Ubiquitin		
Chain C:	69%	18%	13%
M1 V5 L8 L8 G10 G10	K11 113 114 114 114 125 130 130 130 130 130 130 130 130		
• Molecule	2: Ubiquitin		
Chain D:	70%	24%	7%
M1 V5 V6 T7 T12 T12	113 114 114 114 126 120 130 130 144 144 144 144 144 144 144 144 144 14		
• Molecule	3: Proteasomal ubiquitin receptor ADRM1		

D W I D E DATA BANK

Chain A	:	58%	15%	•	27%	-
GLY PRO GLY SER MET THR	THR SER GLY GLY ALA PHE PRO SER VAL VAL VAL SER SER	ARG GLY ALA SER N20 N20 N20 L33 E25 E25	149 050 051 152 152 157 157 157 157 157 157	L73 174 175 C80 S90	691 R92 V95 L96 K103	R104 L105 F106 Q110
H120 V124 P132	ME.I GLY ALA ALA ALA ALA ALA ALA ALA ALA SER SER SER HIS	GLU LEU ALA LEU LEU				
• Molect	ıle 4: 26S proteas	ome non-ATPas	se regulatory s	ubunit 1		
Chain B	:	78%			22%	
GLY PRO GLY SER <b>Q</b> 940	Po An					
4.2.12	Score per resid	lue for model	12			
• Molect	ıle 1: Ubiquitin					
Chain C	:	75%		12%	13%	•
M1 178 610 610	K11 I 30 I 43 I 48 I 50 I 50 I 50 I 50	L69 L69 L71 L71 L73 L73 R72 C75 G75 G75 G75 D77				
• Molecu	ıle 2: Ubiquitin					
Chain D	:	84%			9% 7%	•
M1 L8 K11 K11	Q41 R48 L69 V70 K72 K72 K72 C75 C75 C76					
• Molect	ıle 3: Proteasoma	l ubiquitin rece	ptor ADRM1			
Chain A	:	59%	13%	••	27%	-
GLY PRO GLY SER MET THR	IHK SER GLY GLY ALA ALA PHE PRO SER VAL VAL SER SER	ARG GLY SELA SELA N20 L23 C24 E25 E25 E25 E25	137 138 139 149 050 050 157 157	H58 D72 L73 C80 E81	890 691 R92 L96	q110 H120 V124
P132 MET PRO GLY ALA	LEU GLY ALA ALA SER SER SER GLY CLY CLU CLU SER SER ALA	LEU				
• Molect	ıle 4: 26S proteas	ome non-ATPas	se regulatory s	ubunit 1		
Chain B	:	72%		6%	22%	
GLY PRO GLY SER Q940	5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6					



#### 4.2.13 Score per residue for model 13

• Molecule 1: Ubiquitin

Chain C:	69%	1;	8%	13%
M1 L8 G10 G10 K11 K11 K27 K29 130 K29 130 K29 H130 K29 H130 K29 H130 K29 H130 K29 H130 H136 K29 H136 H136 H136 H136 H136 H136 H136 H136	L 43 L 43 L 50 L 50 L 50 L 56 L 56 L 56 L 56 L 56 L 56 L 71 L 71	R72 R74 G75 D77 D77		
• Molecule 2: Ubiquitin				
Chain D:	700/		170/	70/
	76%		17%	7%
M 113 114 113 114 130 130 144 143 144 143	L56 L56 L56 L56 L57 L73 L73 L73 C75 G75 G75			
• Molecule 3: Proteasoma	al ubiquitin recepto	or ADRM1		
Chain A:	58%	15% •	27%	
GLY PRO GLY GLY MET THR THR THR THR THR THR CLY PHE PHE PHE PHE PHE PHE PHE PRO CLY SER CLY SER CLY SER CLY SER CLY SER CLY SER CLY SER CLY SER CLY CLY CLY CLY CLY CLY CLY CLY CLY CLY	act A	450 451 152 156 157 157 157 759 759 759 772 173	174 175 776 C80 C80	Mot S90 K103 R104 L105 M109 Q110
H120 V124 L128 L128 D132 MET MET PRO CLY ALA ALA ALA SER SER SER SER	GLY GLY LEU SER ALA LEU LEU			
• Molecule 4: 26S proteas	some non-ATPase	regulatory subun	nit 1	
Chain B:	78%		22%	, o
CLY CLY CLY SER D953				
4.2.14 Score per resi	due for model 14	4		
• Molecule 1: Ubiquitin				
Chain C:	71%		16%	13%
M1 17 18 19 113 113 113 113 113 113 113 113 113	143 143 150 150 169 169 173 173 173 173 173 173 173 173 173 173	220		
• Molecule 2: Ubiquitin				
Chain D:	78%		14%	• 7%
M VS 115 115 144 144 144 144 144 1450 150 150	168 168 173 173 173 173 175 175			

R L D W I D E PDB EIN DATA BANK

• Molecule 3: Proteasomal ubiquitin receptor ADRM1

Chain A	A: 53%	19% •	27%	-
GLY PRO GLY SER MET	THR THR SER ALA ALA ALA ALA PRO PRO PRO ALA ALA ALA ALA ALA ALA ALA ALA ALA AL	T37 L46 V47 Y48 149 T52	L56 L56 H58 F59 F59 L73 L73 L73 L73 T76 F76 F76 C80	087 890 <b>691</b> 892
V95 S102 K103	LLOG H120 H120 H120 H120 H120 H124 ME1 ME1 ME1 ME1 ME1 ME1 ME1 ME1 ME1 ME1	LEKC		
• Moleo	cule 4: 26S proteasome non-ATPase	regulatory sub	ounit 1	
Chain I	3: 78%		22%	-
GLY PRO GLY SER <b>Q940</b>				
4.2.15	Score per residue for model 15	5		
• Moleo	cule 1: Ubiquitin			
Chain (	C: 70%		14% • 13%	-
L8 G10 610	1112 1113 1113 1114 1114 1114 1114 1114	L/3 R74 G76 D77 D77		
• Moleo	cule 2: Ubiquitin			
Chain I	): 79%		13% • 7%	6
M1 T7 L8 T2 T2	<b>q10</b> K11 K11 K11 123 123 123 R12 <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q49</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40qq40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40</b> <b>q40qq40</b> <b>q40</b> <b>q40qq40qq40qqqqqqqqqqqqq</b>			
• Moleo	cule 3: Proteasomal ubiquitin recepto	or ADRM1		
Chain A	A: 56%	16% •	• 27%	_
GLY PRO GLY SER MET	THR THR SER ALA ALA ALA ALA PRO PRO PRO PRO OLY OLY ALA ALA ALA ALA ALA ALA ALA ALA ALA A	138 139 155 155 157 157 157 158	D72 L73 L75 L75 C80 C80 C80 C80 C80 C80 C80 C80 C80 C80	V95 L96 L105 F106
q110 H120 V124	L1 28 11 28 MET MET MET MET MET ALA ALA ALA ALA ALA ALA SER ALA ALA SER LEU LEU LEU			
• Moleo	cule 4: 26S proteasome non-ATPase	regulatory sub	ounit 1	
Chain I	3: 67%	11	% 22%	-
GLY PRO GLY SER <mark>Q940</mark>	P945 P945 P953			



# 5 Refinement protocol and experimental data overview (i)

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 (i)

# 6.1 Standard geometry (i)

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 (i)

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	С	535	550	549	$7\pm3$
2	D	565	586	586	9±3
3	А	925	912	912	$13 \pm 2$
4	В	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	$Clash(\lambda)$	Distance(Å)	Models	
Atom-1	Atom-2	Clash(A)	Distance(A)	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



6	U	Y	J
-	-		-

			$\mathbf{D}$	Models	
Atom-1	Atom-2	Clash(A)	Distance(A)	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



A + 1	1 J	$O_{1} = 1$	$\mathbf{D}^{*}$	Mod	lels
Atom-1	Atom-2	Clash(A)	Distance(A)	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

3:A:52:THR:HG23

3:A:23:LEU:HD12

Continued on next page...

1.85

2.45

1.87

4

2

8

5

14

1



0.46

0.46

0.46

1:C:41:GLN:HG3

3:A:58:HIS:CD2

3:A:49:ILE:HG22

6	U	Y	J
-	-		-

			$\mathbf{D}$	Models	
Atom-1	Atom-2	Clash(A)	Distance(A)	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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		(1,1,(3))	$\mathbf{D}$	Models	
Atom-1	Atom-2	Clash(A) Distance(A)		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	Perc	entiles
1	С	66/77~(86%)	$65 \pm 1 \ (98 \pm 2\%)$	1±1 (2±1%)	0±0 (0±1%)	32	76
2	D	70/76~(92%)	$69{\pm}1$ (98 ${\pm}2\%$ )	1±1 (2±1%)	0±1 (0±1%)	27	74
3	А	111/154~(72%)	$105 \pm 1 (95 \pm 1\%)$	$5\pm1$ (4±1%)	1±0 (1±0%)	17	67
4	В	12/18~(67%)	$11{\pm}1 (92{\pm}7\%)$	$1\pm1~(6\pm5\%)$	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	А	90	SER	15
4	В	945	PRO	5
2	D	54	ARG	2
2	D	52	ASP	1
1	С	40	GLN	1
1	С	46	ALA	1
1	С	42	ARG	1
1	С	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 side chain 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 side chain conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Perce	ntiles
1	С	62/69~(90%)	$60{\pm}1$ (97 ${\pm}1\%$ )	$2\pm1$ ( $3\pm1\%$ )	41	89
2	D	65/68~(96%)	$63\pm1$ (97 $\pm2\%$ )	$2\pm1 (3\pm2\%)$	36	86
3	А	104/132~(79%)	$98 \pm 1 \ (95 \pm 1\%)$	$6\pm1 (5\pm1\%)$	21	74
4	В	14/16~(88%)	$14\pm0~(100\pm0\%)$	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	С	13	ILE	13
3	А	110	GLN	12
3	А	92	ARG	11
3	А	24	VAL	8
3	А	25	GLU	8
3	А	90	SER	7
3	А	50	GLN	7
2	D	13	ILE	6
2	D	6	LYS	5
3	А	87	GLN	5
2	D	41	GLN	5
3	А	60	CYS	5
3	А	80	CYS	5
2	D	14	THR	5
3	А	109	MET	5
2	D	11	LYS	5
1	С	41	GLN	3
3	А	103	LYS	3
1	С	69	LEU	2



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

There are no chain breaks in this entry.



# 7 Chemical shift validation (i)

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 (i)

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 (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	${\rm Correction}\pm{\rm precision},ppm$	Suggested action
$^{13}C_{\alpha}$	270	$0.01\pm0.08$	None needed ( $< 0.5$ ppm)
$^{13}C_{\beta}$	249	$0.19 \pm 0.13$	None needed ( $< 0.5$ ppm)
$^{13}C'$	211	$0.14 \pm 0.12$	None needed ( $< 0.5$ ppm)
<sup>15</sup> N	178	$0.72 \pm 0.28$	Should be applied

#### 7.1.3 Completeness of resonance assignments (i)

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	$^{1}\mathrm{H}$	$^{13}\mathrm{C}$	$^{15}$ 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%)



Contentaca	Contentada fronte proceto ao pago								
	Total	$^{1}\mathrm{H}$	$^{13}\mathrm{C}$	$^{15}$ 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	$^{1}\mathrm{H}$	$^{13}\mathrm{C}$	$^{15}\mathbf{N}$
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	А	30	LYS	HE2	1.60	1.95 - 3.88	-6.8
1	А	47	VAL	HB	0.07	0.43 - 3.54	-6.2
1	А	38	VAL	HB	0.10	0.43 - 3.54	-6.0
1	А	60	CYS	HB3	0.41	0.69-5.10	-5.6
1	А	30	LYS	HG3	-0.07	0.04 - 2.67	-5.4
1	В	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:





