Full wwPDB X-ray Structure Validation Report ⓘ

May 17, 2020 – 03:43 am BST

PDB ID	:	4Y00
Title	:	Crystal Structure of Human TDP-43 RRM1 Domain with D169G Mutation in Complex with an Unmodified Single-stranded DNA
Authors	:	Chiang, C.H.; Kuo, P.H.; Yang, W.Z.; Yuan, H.S.
Deposited on	:	2015-02-05
Resolution	:	3.00 Å(reported)

This is a Full wwPDB X-ray 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/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see references ①) were used in the production of this report:

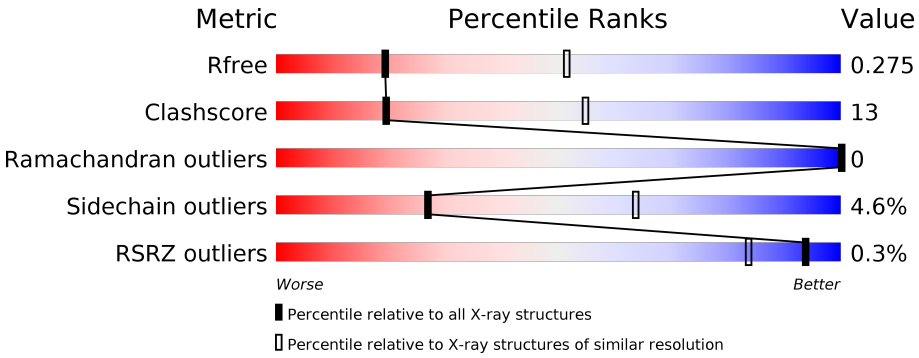
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 Å.

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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. 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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	103	51% 21% • 24%
1	B	103	51% 23% • 24%
1	C	103	% 55% 17% • 25%
1	D	103	51% 21% • 25%
2	E	10	60% 20% 20%
2	F	10	40% 50% 10%

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Mol	Chain	Length	Quality of chain
2	G	10	30% 10% 60%
2	H	10	10% 20% 70%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5791 atoms, of which 2760 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called TAR DNA-binding protein 43.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	78	Total	C	H	N	O	S	0	0	0
			1264	405	633	106	115	5			
1	B	78	Total	C	H	N	O	S	0	0	0
			1264	405	633	106	115	5			
1	C	77	Total	C	H	N	O	S	0	0	0
			1253	402	628	105	113	5			
1	D	77	Total	C	H	N	O	S	0	0	0
			1253	402	628	105	113	5			

There are 52 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	89	MET	-	expression tag	UNP Q13148
A	90	ARG	-	expression tag	UNP Q13148
A	91	GLY	-	expression tag	UNP Q13148
A	92	SER	-	expression tag	UNP Q13148
A	93	HIS	-	expression tag	UNP Q13148
A	94	HIS	-	expression tag	UNP Q13148
A	95	HIS	-	expression tag	UNP Q13148
A	96	HIS	-	expression tag	UNP Q13148
A	97	HIS	-	expression tag	UNP Q13148
A	98	HIS	-	expression tag	UNP Q13148
A	99	GLY	-	expression tag	UNP Q13148
A	100	SER	-	expression tag	UNP Q13148
A	169	GLY	ASP	engineered mutation	UNP Q13148
B	89	MET	-	expression tag	UNP Q13148
B	90	ARG	-	expression tag	UNP Q13148
B	91	GLY	-	expression tag	UNP Q13148
B	92	SER	-	expression tag	UNP Q13148
B	93	HIS	-	expression tag	UNP Q13148
B	94	HIS	-	expression tag	UNP Q13148
B	95	HIS	-	expression tag	UNP Q13148
B	96	HIS	-	expression tag	UNP Q13148

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Chain	Residue	Modelled	Actual	Comment	Reference
B	97	HIS	-	expression tag	UNP Q13148
B	98	HIS	-	expression tag	UNP Q13148
B	99	GLY	-	expression tag	UNP Q13148
B	100	SER	-	expression tag	UNP Q13148
B	169	GLY	ASP	engineered mutation	UNP Q13148
C	89	MET	-	expression tag	UNP Q13148
C	90	ARG	-	expression tag	UNP Q13148
C	91	GLY	-	expression tag	UNP Q13148
C	92	SER	-	expression tag	UNP Q13148
C	93	HIS	-	expression tag	UNP Q13148
C	94	HIS	-	expression tag	UNP Q13148
C	95	HIS	-	expression tag	UNP Q13148
C	96	HIS	-	expression tag	UNP Q13148
C	97	HIS	-	expression tag	UNP Q13148
C	98	HIS	-	expression tag	UNP Q13148
C	99	GLY	-	expression tag	UNP Q13148
C	100	SER	-	expression tag	UNP Q13148
C	169	GLY	ASP	engineered mutation	UNP Q13148
D	89	MET	-	expression tag	UNP Q13148
D	90	ARG	-	expression tag	UNP Q13148
D	91	GLY	-	expression tag	UNP Q13148
D	92	SER	-	expression tag	UNP Q13148
D	93	HIS	-	expression tag	UNP Q13148
D	94	HIS	-	expression tag	UNP Q13148
D	95	HIS	-	expression tag	UNP Q13148
D	96	HIS	-	expression tag	UNP Q13148
D	97	HIS	-	expression tag	UNP Q13148
D	98	HIS	-	expression tag	UNP Q13148
D	99	GLY	-	expression tag	UNP Q13148
D	100	SER	-	expression tag	UNP Q13148
D	169	GLY	ASP	engineered mutation	UNP Q13148

- Molecule 2 is a DNA chain called DNA (5'-D(P*TP*TP*GP*AP*GP*CP*GP*T)-3').

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	E	8	Total	C	H	N	O	P	0	0	0
			257	79	91	29	50	8			
2	F	9	Total	C	H	N	O	P	0	0	0
			275	89	91	34	53	8			
2	G	4	Total	C	H	N	O	P	0	0	0
			106	39	22	18	23	4			
2	H	3	Total	C	H	N	O	P	0	0	0
			95	29	34	10	19	3			

- Molecule 3 is water.

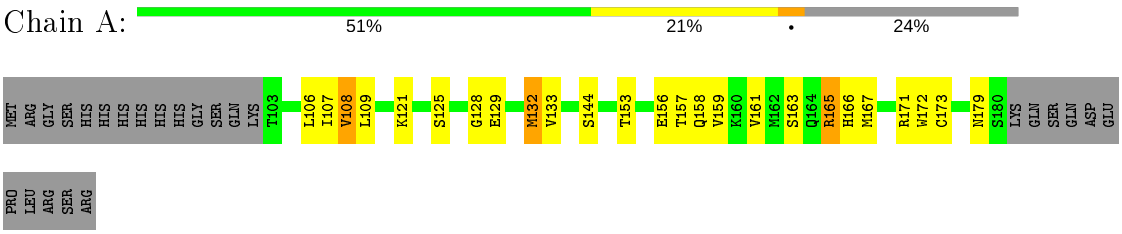
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	7	Total O 7 7	0	0
3	B	7	Total O 7 7	0	0
3	C	1	Total O 1 1	0	0
3	D	6	Total O 6 6	0	0
3	E	1	Total O 1 1	0	0
3	F	1	Total O 1 1	0	0
3	H	1	Total O 1 1	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

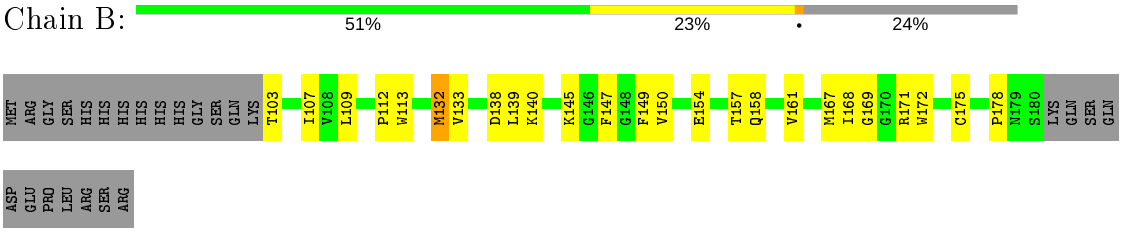
- Molecule 1: TAR DNA-binding protein 43

Chain A:



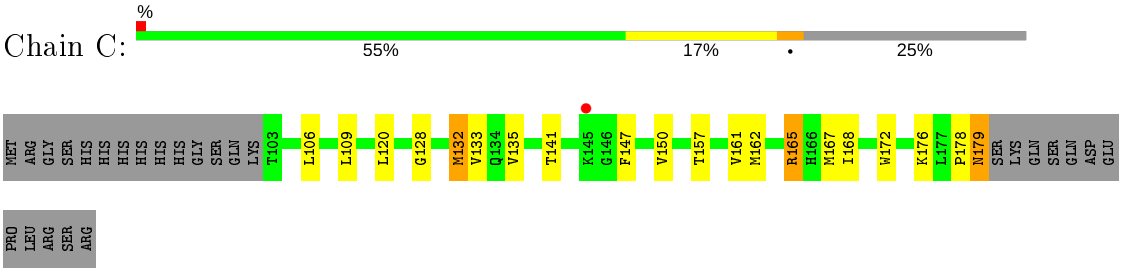
- Molecule 1: TAR DNA-binding protein 43

Chain B:



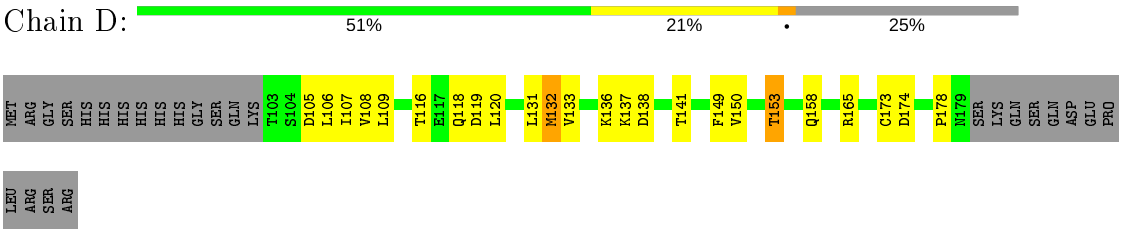
- Molecule 1: TAR DNA-binding protein 43

Chain C:



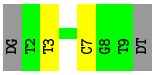
- Molecule 1: TAR DNA-binding protein 43

Chain D:



• Molecule 2: DNA (5'-D(P*TP*TP*GP*AP*GP*CP*GP*T)-3')

Chain E:



• Molecule 2: DNA (5'-D(P*TP*TP*GP*AP*GP*CP*GP*T)-3')

Chain F:

• Molecule 2: DNA (5'-D(P*TP*TP*GP*AP*GP*CP*GP*T)-3')

Chain G:

• Molecule 2: DNA (5'-D(P*TP*TP*GP*AP*GP*CP*GP*T)-3')

Chain H:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	97.64Å 97.64Å 96.87Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	16.85 – 3.00 23.45 – 2.90	Depositor EDS
% Data completeness (in resolution range)	97.2 (16.85-3.00) 89.8 (23.45-2.90)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.05	Depositor
$< I/\sigma(I) >$ [1]	2.85 (at 2.89Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.266 , 0.295 0.253 , 0.275	Depositor DCC
R_{free} test set	1183 reflections (9.91%)	wwPDB-VP
Wilson B-factor (Å^2)	74.3	Xtriage
Anisotropy	0.139	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 19.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.478 for -h,-k,l	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	5791	wwPDB-VP
Average B, all atoms (Å^2)	83.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.09% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|>5$	RMSZ	#$\|Z\|>5$
1	A	0.23	0/645	0.40	0/866
1	B	0.24	0/645	0.40	0/866
1	C	0.24	0/639	0.41	0/858
1	D	0.23	0/639	0.41	0/858
2	E	0.42	0/185	1.06	0/284
2	F	0.41	0/206	1.18	0/317
2	G	0.42	0/94	0.76	0/143
2	H	0.44	0/67	1.18	0/101
All	All	0.28	0/3120	0.60	0/4293

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	631	633	631	16	1
1	B	631	633	631	20	0
1	C	625	628	626	16	0
1	D	625	628	626	18	0
2	E	166	91	92	2	0
2	F	184	91	104	8	1
2	G	84	22	45	5	0
2	H	61	34	35	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	7	0	0	1	0
3	B	7	0	0	4	0
3	C	1	0	0	0	0
3	D	6	0	0	1	0
3	E	1	0	0	0	0
3	F	1	0	0	2	0
3	H	1	0	0	0	0
All	All	3031	2760	2790	74	1

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 13.

All (74) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:119:ASP:O	3:D:206:HOH:O	2.01	0.79
1:B:138:ASP:OD1	3:B:207:HOH:O	2.04	0.75
2:F:5:DA:N7	3:F:101:HOH:O	2.20	0.73
1:B:139:LEU:N	3:B:207:HOH:O	2.22	0.72
1:B:171:ARG:NH2	3:F:101:HOH:O	2.25	0.70
1:A:121:LYS:O	1:A:125:SER:OG	2.03	0.69
1:B:169:GLY:O	3:B:201:HOH:O	2.15	0.65
1:A:159:VAL:O	1:A:163:SER:N	2.32	0.62
1:C:172:TRP:NE1	2:E:3:DT:O2	2.33	0.62
1:D:132:MET:SD	1:D:133:VAL:N	2.74	0.61
1:C:178:PRO:HA	2:G:6:DG:N2	2.16	0.61
1:A:128:GLY:HA3	1:A:157:THR:HG21	1.84	0.59
1:C:147:PHE:CZ	2:G:6:DG:H4'	2.39	0.57
1:C:179:ASN:OD1	2:G:6:DG:N2	2.38	0.56
1:D:178:PRO:HA	2:H:7:DC:N3	2.20	0.56
1:B:161:VAL:HG12	1:B:175:CYS:HB2	1.88	0.56
1:B:140:LYS:NZ	3:B:202:HOH:O	2.35	0.55
1:A:156:GLU:OE1	3:A:204:HOH:O	2.17	0.55
1:D:132:MET:C	1:D:132:MET:SD	2.86	0.54
1:D:138:ASP:OD1	1:D:141:THR:N	2.40	0.53
1:A:132:MET:SD	1:A:133:VAL:N	2.82	0.53
1:C:179:ASN:OD1	1:C:179:ASN:N	2.41	0.53
1:D:106:LEU:HB2	1:D:150:VAL:HG13	1.92	0.52
1:D:178:PRO:HA	2:H:7:DC:C2	2.45	0.51
1:C:106:LEU:HD21	1:C:162:MET:SD	2.51	0.50
1:A:129:GLU:HB2	1:A:153:THR:HB	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:157:THR:O	1:C:161:VAL:HG23	2.12	0.49
1:B:154:GLU:O	1:B:157:THR:OG1	2.26	0.48
1:D:165:ARG:NH1	1:D:174:ASP:OD1	2.44	0.48
1:B:103:THR:N	1:B:158:GLN:OE1	2.47	0.48
1:D:118:GLN:N	1:D:118:GLN:OE1	2.46	0.48
2:F:5:DA:C2	2:F:6:DG:C8	3.02	0.47
1:A:165:ARG:NH2	1:A:172:TRP:HB3	2.31	0.46
1:A:109:LEU:HD22	1:A:109:LEU:N	2.31	0.46
1:A:166:HIS:O	1:A:173:CYS:N	2.46	0.46
1:A:106:LEU:HD11	1:A:158:GLN:HG3	1.98	0.46
1:C:165:ARG:NH2	1:C:172:TRP:HB3	2.31	0.46
1:C:106:LEU:HD22	1:C:176:LYS:C	2.37	0.45
1:A:132:MET:SD	1:A:132:MET:C	2.95	0.45
1:A:165:ARG:NH2	1:A:172:TRP:CB	2.79	0.45
1:B:113:TRP:CZ2	2:F:4:DG:C4	3.03	0.45
1:B:107:ILE:HB	1:B:149:PHE:CE2	2.52	0.45
1:D:149:PHE:CZ	2:H:8:DG:C4	3.05	0.45
1:D:116:THR:O	1:D:120:LEU:HG	2.17	0.45
1:B:109:LEU:N	1:B:109:LEU:HD22	2.32	0.45
1:C:128:GLY:HA3	1:C:157:THR:HG21	1.99	0.45
1:C:120:LEU:HD11	1:C:135:VAL:HG22	1.99	0.44
1:C:133:VAL:HG12	1:C:150:VAL:HG23	1.99	0.44
1:C:167:MET:C	1:C:168:ILE:HG13	2.38	0.44
1:A:167:MET:SD	1:A:171:ARG:N	2.91	0.44
1:B:132:MET:C	1:B:132:MET:SD	2.96	0.44
1:C:179:ASN:CG	2:G:6:DG:N2	2.71	0.44
1:D:178:PRO:HA	2:H:7:DC:O2	2.18	0.43
1:B:178:PRO:HA	2:F:7:DC:N3	2.33	0.43
1:C:132:MET:C	1:C:132:MET:SD	2.97	0.43
1:B:113:TRP:CZ2	2:F:4:DG:C5	3.07	0.43
1:B:112:PRO:HA	2:F:4:DG:O6	2.19	0.43
2:G:6:DG:O5'	2:G:6:DG:H8	2.01	0.43
1:D:136:LYS:C	1:D:137:LYS:HG3	2.40	0.42
1:A:157:THR:O	1:A:161:VAL:HG23	2.19	0.42
1:D:131:LEU:HD11	1:D:153:THR:OG1	2.20	0.42
1:C:165:ARG:NH2	1:C:172:TRP:CB	2.83	0.42
1:D:131:LEU:HD12	1:D:131:LEU:N	2.35	0.42
1:B:113:TRP:CE2	2:F:4:DG:C5	3.08	0.41
1:D:133:VAL:HG12	1:D:150:VAL:HG23	2.01	0.41
1:B:167:MET:HB2	1:B:172:TRP:CZ3	2.55	0.41
1:A:107:ILE:HG12	1:A:108:VAL:N	2.36	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:133:VAL:HG12	1:B:150:VAL:HG23	2.03	0.41
1:D:107:ILE:HG12	1:D:108:VAL:N	2.36	0.41
2:F:5:DA:H2'	2:F:6:DG:N2	2.35	0.41
1:B:167:MET:C	1:B:168:ILE:HG13	2.42	0.40
1:A:179:ASN:ND2	2:E:7:DC:N3	2.69	0.40
1:B:145:LYS:HB2	1:B:147:PHE:CE1	2.57	0.40
1:D:109:LEU:O	1:D:173:CYS:HA	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:144:SER:O	2:F:1:DG:O5'[4_469]	1.98	0.22

5.3 Torsion angles (i)

5.3.1 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 X-ray entries followed by that with respect to entries of similar resolution.

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	76/103 (74%)	71 (93%)	5 (7%)	0	100	100
1	B	76/103 (74%)	70 (92%)	6 (8%)	0	100	100
1	C	75/103 (73%)	72 (96%)	3 (4%)	0	100	100
1	D	75/103 (73%)	73 (97%)	2 (3%)	0	100	100
All	All	302/412 (73%)	286 (95%)	16 (5%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 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 X-ray entries followed by that with respect to entries of similar

resolution.

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	71/94 (76%)	68 (96%)	3 (4%)	30	66
1	B	71/94 (76%)	70 (99%)	1 (1%)	67	88
1	C	70/94 (74%)	65 (93%)	5 (7%)	14	46
1	D	70/94 (74%)	66 (94%)	4 (6%)	20	56
All	All	282/376 (75%)	269 (95%)	13 (5%)	27	64

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	108	VAL
1	A	132	MET
1	A	165	ARG
1	B	132	MET
1	C	109	LEU
1	C	132	MET
1	C	141	THR
1	C	165	ARG
1	C	179	ASN
1	D	105	ASP
1	D	132	MET
1	D	153	THR
1	D	158	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	179	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	A	78/103 (75%)	-0.35	0 100 100	56, 72, 84, 93	0
1	B	78/103 (75%)	-0.31	0 100 100	60, 71, 83, 85	0
1	C	77/103 (74%)	-0.22	1 (1%) 77 51	64, 84, 98, 114	0
1	D	77/103 (74%)	-0.30	0 100 100	63, 77, 100, 106	0
2	E	8/10 (80%)	-0.54	0 100 100	58, 68, 80, 86	0
2	F	9/10 (90%)	-0.42	0 100 100	61, 65, 73, 90	0
2	G	4/10 (40%)	-0.55	0 100 100	52, 57, 83, 85	0
2	H	3/10 (30%)	-0.46	0 100 100	73, 73, 84, 87	0
All	All	334/452 (73%)	-0.31	1 (0%) 94 84	52, 75, 96, 114	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	145	LYS	3.7

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

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

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.