Full wwPDB X-ray Structure Validation Report (i)

Jun 13, 2024 – 10:26 AM EDT

PDB ID	:	4DB8
Title	:	Designed Armadillo-repeat Protein
Authors	:	Madhurantakam, C.; Varadamsetty, G.; Grutter, M.G.; Pluckthun, A.; Mittl, P.R.E.
Deposited on	:	2012-01-13
Resolution	:	2.50 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 (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:

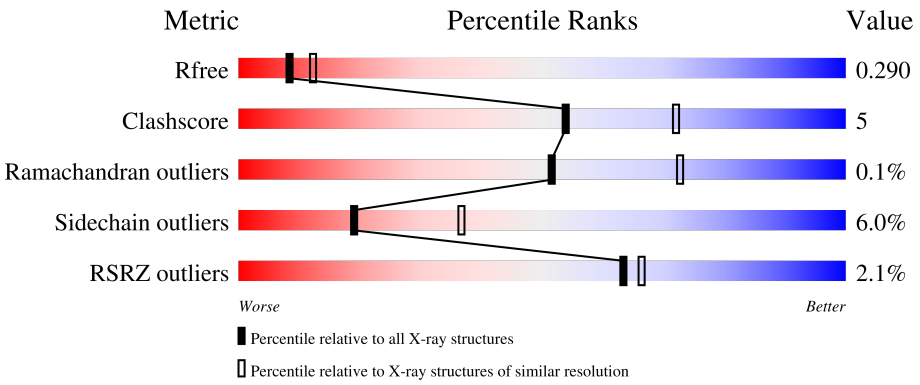
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 2.50 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	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 of 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	252	% 83% 14% • •
1	B	252	% 81% 12% • 5%
1	C	252	% 87% 5% • 6%
1	D	252	5% 83% 13% • •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 7385 atoms, of which 0 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 Armadillo-repeat Protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	247	1856	1151	323	380	2	0	1	0
1	B	239	1783	1108	304	369	2	0	1	0
1	C	238	1763	1096	299	366	2	0	0	0
1	D	246	1845	1145	321	377	2	0	0	0

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
2	A	1	1	1	0	0
2	B	2	2	2	0	0
2	D	1	1	1	0	0

- Molecule 3 is water.

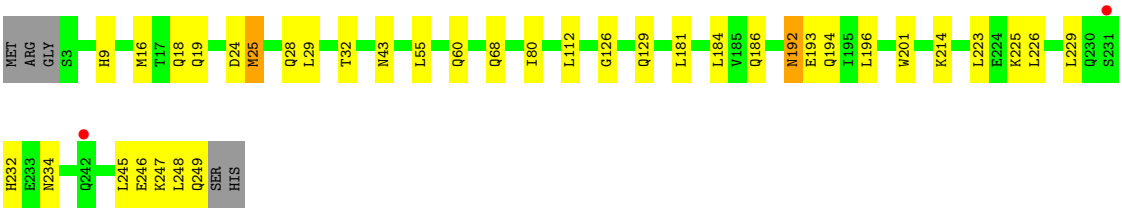
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	28	28	28	0	0
3	B	25	25	25	0	0
3	C	35	35	35	0	0
3	D	46	46	46	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

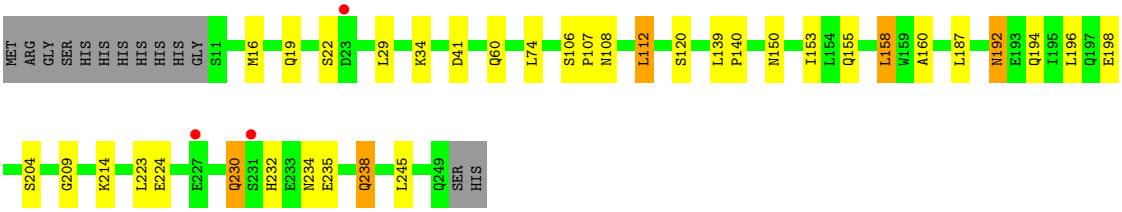
• Molecule 1: Armadillo-repeat Protein

Chain A:



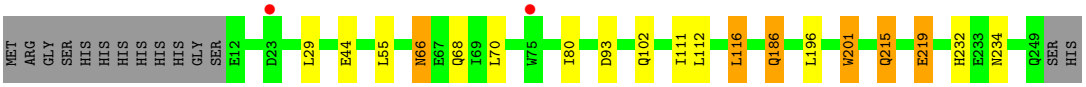
• Molecule 1: Armadillo-repeat Protein

Chain B:



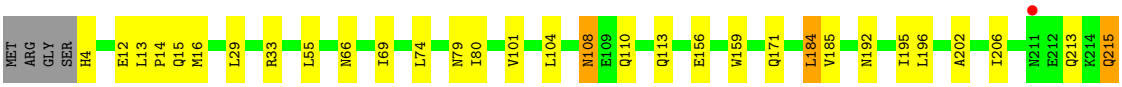
• Molecule 1: Armadillo-repeat Protein

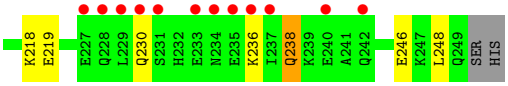
Chain C:



• Molecule 1: Armadillo-repeat Protein

Chain D:




K218
E219
E227
Q228
L229
Q230
S231
H232
E233
N234
E235
K236
I237
Q238
K239
E240
A241
Q242
E246
K247
L248
Q249
SER
HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	58.00Å 113.64Å 85.59Å 90.00° 106.83° 90.00°	Depositor
Resolution (Å)	40.00 – 2.50 39.71 – 2.50	Depositor EDS
% Data completeness (in resolution range)	95.2 (40.00-2.50) 95.3 (39.71-2.50)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.18 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.232 , 0.299 0.234 , 0.290	Depositor DCC
R_{free} test set	1751 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	36.8	Xtriage
Anisotropy	0.487	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 13.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	0.078 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	7385	wwPDB-VP
Average B, all atoms (Å^2)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.08% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: MG

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	0.33	0/1883	0.52	1/2561 (0.0%)
1	B	0.34	0/1801	0.51	1/2450 (0.0%)
1	C	0.34	0/1781	0.49	0/2426
1	D	0.33	0/1869	0.50	0/2542
All	All	0.34	0/7334	0.50	2/9979 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	112	LEU	CA-CB-CG	5.75	128.52	115.30
1	A	25	MET	CB-CA-C	-5.09	100.21	110.40

There are no chirality outliers.

There are no planarity outliers.

5.2 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 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	1856	0	1832	32	0
1	B	1783	0	1778	18	0
1	C	1763	0	1745	15	0
1	D	1845	0	1821	18	0
2	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	2	0	0	0	0
2	D	1	0	0	0	0
3	A	28	0	0	7	0
3	B	25	0	0	1	0
3	C	35	0	0	2	0
3	D	46	0	0	1	0
All	All	7385	0	7176	76	0

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 5.

All (76) 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:A:247:LYS:HB2	3:A:413:HOH:O	1.71	0.88
1:C:55:LEU:HD21	1:C:80:ILE:HD13	1.61	0.82
1:C:201:TRP:HZ3	3:C:317:HOH:O	1.63	0.81
1:C:232:HIS:HD2	1:C:234:ASN:H	1.37	0.72
1:A:55:LEU:HD21	1:A:80:ILE:HD13	1.75	0.67
1:A:225:LYS:O	1:A:229:LEU:HB2	1.95	0.67
1:A:247:LYS:N	3:A:413:HOH:O	2.27	0.67
1:A:9:HIS:HD2	1:B:198:GLU:OE1	1.76	0.66
1:A:223:LEU:HB2	3:A:409:HOH:O	1.96	0.65
1:B:192:ASN:HD22	1:B:192:ASN:C	2.02	0.63
1:B:150:ASN:HB3	1:B:153:ILE:HD12	1.83	0.60
1:A:16:MET:HA	1:A:19:GLN:HE21	1.68	0.59
1:A:43:ASN:HD21	1:D:79:ASN:HD21	1.50	0.57
1:D:101:VAL:O	1:D:104:LEU:HB2	2.04	0.57
1:A:193:GLU:HA	1:A:196:LEU:HD12	1.87	0.57
1:B:192:ASN:HD22	1:B:194:GLN:H	1.52	0.57
1:A:247:LYS:CA	3:A:413:HOH:O	2.54	0.56
1:C:55:LEU:CD2	1:C:80:ILE:HD13	2.35	0.56
1:A:247:LYS:CB	3:A:413:HOH:O	2.43	0.54
1:A:24:ASP:O	1:A:25:MET:HB3	2.08	0.54
1:D:4:HIS:N	3:D:445:HOH:O	2.41	0.54
1:D:66:ASN:HD22	1:D:69:ILE:H	1.56	0.54
1:B:120:SER:HB3	1:B:160:ALA:HB2	1.91	0.53
1:A:28:GLN:O	1:A:32:THR:HG23	2.08	0.53
1:C:232:HIS:CD2	1:C:234:ASN:H	2.22	0.53
1:D:55:LEU:HD21	1:D:80:ILE:HD13	1.91	0.52
1:D:202:ALA:O	1:D:206:ILE:HD12	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:102:GLN:NE2	3:C:333:HOH:O	2.36	0.52
1:B:16:MET:HA	1:B:19:GLN:HE21	1.74	0.51
1:B:139:LEU:HB2	1:B:140:PRO:HD3	1.92	0.51
1:D:12:GLU:O	1:D:16:MET:HG3	2.12	0.49
1:B:230:GLN:HE22	1:B:245:LEU:HD22	1.78	0.49
1:B:19:GLN:O	1:B:22:SER:HB3	2.12	0.49
1:C:66:ASN:ND2	1:C:68:GLN:H	2.12	0.48
1:B:209:GLY:O	1:B:214:LYS:HE3	2.12	0.48
1:B:232:HIS:HD2	1:B:234:ASN:H	1.61	0.48
1:C:66:ASN:HD22	1:C:68:GLN:N	2.11	0.47
1:A:214:LYS:HE2	1:A:247:LYS:O	2.14	0.47
1:B:60:GLN:NE2	3:B:424:HOH:O	2.45	0.47
1:A:25:MET:HG3	1:D:69:ILE:CD1	2.45	0.47
1:B:158:LEU:HD12	1:B:198:GLU:HG3	1.96	0.47
1:A:226:LEU:HB2	1:A:245:LEU:HD13	1.96	0.46
1:A:68:GLN:HE21	1:D:33:ARG:NH2	2.14	0.46
1:A:25:MET:HA	1:A:28:GLN:HB2	1.97	0.46
1:D:113:GLN:HG3	1:D:156:GLU:HG3	1.98	0.46
1:A:25:MET:O	1:A:25:MET:CG	2.63	0.45
1:A:18:GLN:HG2	1:C:93:ASP:HA	1.97	0.45
1:D:13:LEU:HB2	1:D:14:PRO:HD3	1.98	0.45
1:A:126:GLY:H	1:A:129:GLN:HE21	1.64	0.45
1:A:186:GLN:NE2	3:A:423:HOH:O	2.49	0.45
1:A:192:ASN:C	1:A:192:ASN:HD22	2.20	0.45
1:B:232:HIS:CD2	1:B:234:ASN:H	2.34	0.45
1:B:235:GLU:HA	1:B:238:GLN:HB2	1.98	0.45
1:A:24:ASP:O	1:A:25:MET:CB	2.66	0.44
1:A:192:ASN:HD22	1:A:193:GLU:N	2.15	0.44
1:A:18:GLN:CG	1:C:93:ASP:HA	2.47	0.44
1:B:192:ASN:ND2	1:B:194:GLN:H	2.15	0.44
1:D:215:GLN:HA	1:D:218:LYS:HD2	2.00	0.43
1:D:192:ASN:HB3	1:D:195:ILE:HB	1.99	0.43
1:C:66:ASN:HD22	1:C:68:GLN:H	1.66	0.43
1:D:108:ASN:HD21	1:D:110:GLN:HG2	1.83	0.43
1:A:68:GLN:HE21	1:D:33:ARG:HH22	1.65	0.43
1:A:247:LYS:C	1:A:249:GLN:H	2.22	0.43
1:B:158:LEU:HD21	1:B:187:LEU:HD13	2.01	0.42
1:A:126:GLY:H	1:A:129:GLN:NE2	2.18	0.42
1:A:181:LEU:HD23	1:A:184:LEU:HD12	2.01	0.42
1:C:215:GLN:O	1:C:219:GLU:HB2	2.21	0.41
1:B:106:SER:HA	1:B:107:PRO:HD3	1.92	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:66:ASN:HD21	1:C:68:GLN:HB2	1.85	0.41
1:A:232:HIS:HD2	1:A:234:ASN:H	1.67	0.41
1:C:186:GLN:HE21	1:C:186:GLN:HA	1.86	0.41
1:D:184:LEU:HD11	1:D:202:ALA:HB3	2.03	0.41
1:D:246:GLU:C	1:D:248:LEU:H	2.25	0.40
1:A:194:GLN:NE2	3:A:412:HOH:O	2.55	0.40
1:C:112:LEU:O	1:C:116:LEU:HB2	2.22	0.40
1:D:230:GLN:HA	1:D:238:GLN:HG3	2.04	0.40

There are no symmetry-related clashes.

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	246/252 (98%)	241 (98%)	4 (2%)	1 (0%)	34	54
1	B	238/252 (94%)	235 (99%)	3 (1%)	0	100	100
1	C	236/252 (94%)	233 (99%)	3 (1%)	0	100	100
1	D	244/252 (97%)	241 (99%)	3 (1%)	0	100	100
All	All	964/1008 (96%)	950 (98%)	13 (1%)	1 (0%)	51	73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	248	LEU

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	198/202 (98%)	192 (97%)	6 (3%)	41	68
1	B	190/202 (94%)	175 (92%)	15 (8%)	12	24
1	C	186/202 (92%)	175 (94%)	11 (6%)	19	37
1	D	196/202 (97%)	182 (93%)	14 (7%)	14	28
All	All	770/808 (95%)	724 (94%)	46 (6%)	19	37

All (46) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	LEU
1	A	60	GLN
1	A	112	LEU
1	A	192	ASN
1	A	201	TRP
1	A	246	GLU
1	B	29	LEU
1	B	34	LYS
1	B	41	ASP
1	B	74	LEU
1	B	108	ASN
1	B	112	LEU
1	B	155	GLN
1	B	158	LEU
1	B	192	ASN
1	B	196	LEU
1	B	204	SER
1	B	223	LEU
1	B	224	GLU
1	B	230	GLN
1	B	238	GLN
1	C	29	LEU
1	C	44	GLU
1	C	66	ASN
1	C	70	LEU
1	C	111	ILE
1	C	116	LEU
1	C	186	GLN
1	C	196	LEU
1	C	201	TRP

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Mol	Chain	Res	Type
1	C	215	GLN
1	C	219	GLU
1	D	15	GLN
1	D	29	LEU
1	D	74	LEU
1	D	108	ASN
1	D	159	TRP
1	D	171	GLN
1	D	184	LEU
1	D	185	VAL
1	D	196	LEU
1	D	213	GLN
1	D	215	GLN
1	D	219	GLU
1	D	236	LYS
1	D	238	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (45) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	HIS
1	A	19	GLN
1	A	43	ASN
1	A	47	GLN
1	A	68	GLN
1	A	71	GLN
1	A	79	ASN
1	A	89	GLN
1	A	129	GLN
1	A	163	ASN
1	A	169	ASN
1	A	186	GLN
1	A	192	ASN
1	A	194	GLN
1	A	232	HIS
1	B	19	GLN
1	B	43	ASN
1	B	60	GLN
1	B	108	ASN
1	B	163	ASN
1	B	192	ASN
1	B	215	GLN

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Mol	Chain	Res	Type
1	B	230	GLN
1	B	232	HIS
1	B	238	GLN
1	C	19	GLN
1	C	66	ASN
1	C	79	ASN
1	C	87	GLN
1	C	113	GLN
1	C	152	GLN
1	C	163	ASN
1	C	186	GLN
1	C	197	GLN
1	C	232	HIS
1	D	66	ASN
1	D	68	GLN
1	D	79	ASN
1	D	87	GLN
1	D	108	ASN
1	D	113	GLN
1	D	152	GLN
1	D	169	ASN
1	D	171	GLN
1	D	232	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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, 95th 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	247/252 (98%)	-0.07	2 (0%)	86	87	24, 39, 75, 78	0
1	B	239/252 (94%)	-0.13	3 (1%)	77	79	26, 36, 59, 61	0
1	C	238/252 (94%)	-0.11	2 (0%)	86	87	27, 35, 51, 54	0
1	D	246/252 (97%)	0.17	13 (5%)	26	28	24, 43, 95, 98	0
All	All	970/1008 (96%)	-0.03	20 (2%)	63	66	24, 37, 73, 98	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	231	SER	4.0
1	D	233	GLU	3.9
1	C	23	ASP	3.7
1	D	237	ILE	3.7
1	A	231	SER	3.2
1	D	230	GLN	2.9
1	D	234	ASN	2.8
1	D	235	GLU	2.6
1	B	23	ASP	2.6
1	D	242	GLN	2.4
1	B	231	SER	2.4
1	D	211	ASN	2.4
1	B	227	GLU	2.4
1	D	229	LEU	2.3
1	D	236	LYS	2.3
1	D	228	GLN	2.3
1	A	242	GLN	2.1
1	C	75	TRP	2.1
1	D	227	GLU	2.1
1	D	240	GLU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	MG	A	301	1/1	0.96	0.10	30,30,30,30	0
2	MG	B	302	1/1	0.96	0.09	30,30,30,30	0
2	MG	D	301	1/1	0.96	0.07	36,36,36,36	0
2	MG	B	301	1/1	0.98	0.18	30,30,30,30	0

6.5 Other polymers (i)

There are no such residues in this entry.