



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 14, 2019 – 12:35 AM EDT

PDB ID : 5DHF
Title : Crystal Structure of hRio2 NES Peptide in complex with CRM1-Ran-RanBP1
Authors : Fung, H.Y.; Chook, Y.M.
Deposited on : 2015-08-30
Resolution : 2.29 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.0 (224370), CSD as540be (2019)
Xtriage (Phenix) : 1.13
EDS : rb-20031633
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20031633

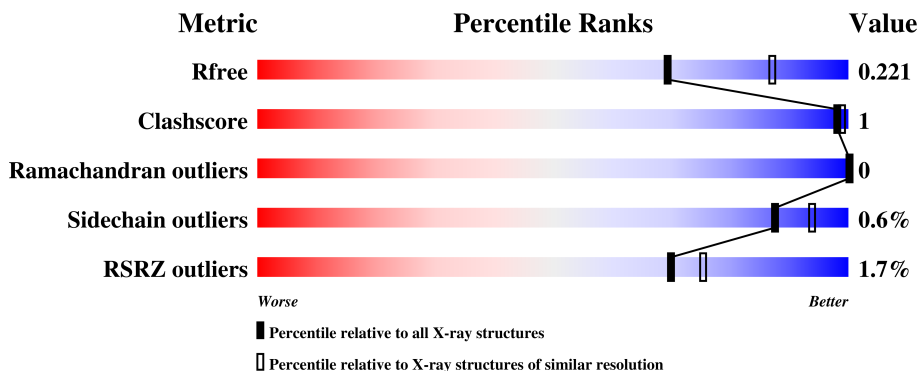
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.29 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}	111664	6121 (2.30-2.26)
Clashscore	122126	6842 (2.30-2.26)
Ramachandran outliers	120053	6755 (2.30-2.26)
Sidechain outliers	120020	6755 (2.30-2.26)
RSRZ outliers	108989	5992 (2.30-2.26)

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. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	237	 2% 86% 14%
2	B	143	 3% 87% 11%
3	C	1024	 % 94%
4	D	19	 5% 68% 32%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 11268 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 GTP-binding nuclear protein Ran.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	205	1652	1067	283	296	6	0	1	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	initiating methionine	UNP P62826
A	-19	GLU	-	expression tag	UNP P62826
A	-18	THR	-	expression tag	UNP P62826
A	-17	GLY	-	expression tag	UNP P62826
A	-16	SER	-	expression tag	UNP P62826
A	-15	SER	-	expression tag	UNP P62826
A	-14	HIS	-	expression tag	UNP P62826
A	-13	HIS	-	expression tag	UNP P62826
A	-12	HIS	-	expression tag	UNP P62826
A	-11	HIS	-	expression tag	UNP P62826
A	-10	HIS	-	expression tag	UNP P62826
A	-9	HIS	-	expression tag	UNP P62826
A	-8	SER	-	expression tag	UNP P62826
A	-7	SER	-	expression tag	UNP P62826
A	-6	GLY	-	expression tag	UNP P62826
A	-5	LEU	-	expression tag	UNP P62826
A	-4	PRO	-	expression tag	UNP P62826
A	-3	ARG	-	expression tag	UNP P62826
A	-2	GLY	-	expression tag	UNP P62826
A	-1	SER	-	expression tag	UNP P62826
A	0	HIS	-	expression tag	UNP P62826

- Molecule 2 is a protein called Ran-specific GTPase-activating protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	127	1041	661	180	195	5	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	59	GLY	-	expression tag	UNP P41920
B	60	GLY	-	expression tag	UNP P41920
B	61	SER	-	expression tag	UNP P41920

- Molecule 3 is a protein called Exportin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	994	8133	5221	1346	1523	43	0	15	0

There are 46 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	GLY	-	expression tag	UNP P30822
C	-1	GLY	-	expression tag	UNP P30822
C	0	SER	-	expression tag	UNP P30822
C	?	-	VAL	deletion	UNP P30822
C	?	-	GLN	deletion	UNP P30822
C	?	-	ARG	deletion	UNP P30822
C	?	-	LEU	deletion	UNP P30822
C	?	-	PRO	deletion	UNP P30822
C	?	-	ALA	deletion	UNP P30822
C	?	-	THR	deletion	UNP P30822
C	?	-	GLU	deletion	UNP P30822
C	?	-	MET	deletion	UNP P30822
C	?	-	SER	deletion	UNP P30822
C	?	-	PRO	deletion	UNP P30822
C	?	-	LEU	deletion	UNP P30822
C	?	-	ILE	deletion	UNP P30822
C	?	-	GLN	deletion	UNP P30822
C	?	-	LEU	deletion	UNP P30822
C	?	-	SER	deletion	UNP P30822
C	?	-	VAL	deletion	UNP P30822
C	?	-	GLY	deletion	UNP P30822
C	?	-	SER	deletion	UNP P30822
C	?	-	GLN	deletion	UNP P30822
C	?	-	ALA	deletion	UNP P30822

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Chain	Residue	Modelled	Actual	Comment	Reference
C	?	-	ILE	deletion	UNP P30822
C	?	-	SER	deletion	UNP P30822
C	?	-	THR	deletion	UNP P30822
C	?	-	GLY	deletion	UNP P30822
C	?	-	SER	deletion	UNP P30822
C	?	-	GLY	deletion	UNP P30822
C	?	-	ALA	deletion	UNP P30822
C	?	-	LEU	deletion	UNP P30822
C	?	-	ASN	deletion	UNP P30822
C	?	-	PRO	deletion	UNP P30822
C	?	-	GLU	deletion	UNP P30822
C	?	-	TYR	deletion	UNP P30822
C	?	-	MET	deletion	UNP P30822
C	?	-	LYS	deletion	UNP P30822
C	?	-	ARG	deletion	UNP P30822
C	?	-	PHE	deletion	UNP P30822
C	441	ASP	VAL	engineered mutation	UNP P30822
C	537	GLY	ASP	engineered mutation	UNP P30822
C	539	CYS	THR	engineered mutation	UNP P30822
C	540	GLU	VAL	engineered mutation	UNP P30822
C	541	GLN	LYS	engineered mutation	UNP P30822
C	1022	CYS	TYR	engineered mutation	UNP P30822

- Molecule 4 is a protein called Serine/threonine-protein kinase RIO2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	13	Total	C	N	O	Se	0	0	0
			111	71	15	24	1			

- Molecule 5 is PHOSPHOAMINOPHOSPHONIC ACID-GUANYLATE ESTER (three-letter code: GNP) (formula: C₁₀H₁₇N₆O₁₃P₃).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total C O 6 3 3	0	0
7	C	1	Total C O 6 3 3	0	0
7	C	1	Total C O 6 3 3	0	0
7	C	1	Total C O 6 3 3	0	0

- Molecule 8 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	C	2	Total Cl 2 2	0	0

- Molecule 9 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	C	1	Total Zn 1 1	0	0

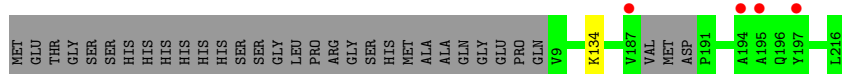
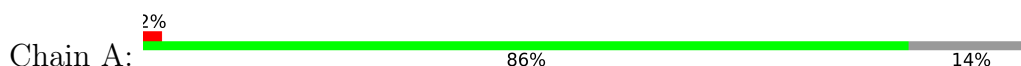
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	55	Total O 55 55	0	0
10	B	6	Total O 6 6	0	0
10	C	210	Total O 210 210	0	0

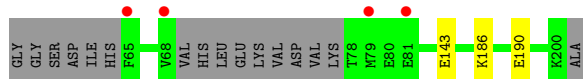
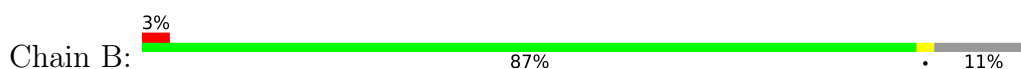
3 Residue-property plots [i](#)

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.

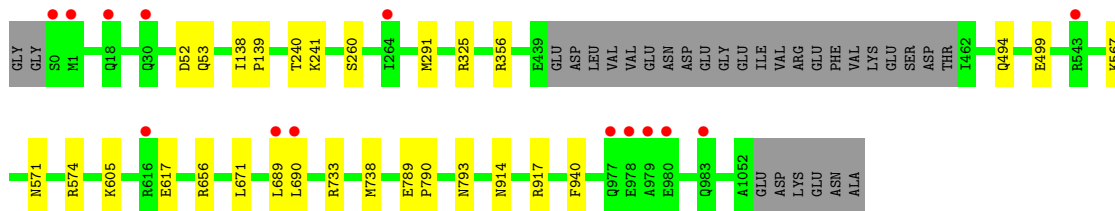
- Molecule 1: GTP-binding nuclear protein Ran



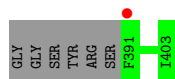
- Molecule 2: Ran-specific GTPase-activating protein 1



- Molecule 3: Exportin-1



- Molecule 4: Serine/threonine-protein kinase RIO2



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	106.48Å 106.48Å 303.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.72 – 2.29 47.62 – 2.28	Depositor EDS
% Data completeness (in resolution range)	76.8 (45.72-2.29) 92.0 (47.62-2.28)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.47 (at 2.29Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.178 , 0.218 0.189 , 0.221	Depositor DCC
R_{free} test set	2000 reflections (2.59%)	wwPDB-VP
Wilson B-factor (Å ²)	27.0	Xtrriage
Anisotropy	0.041	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 40.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	11268	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.90% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: GOL, MG, ZN, GNP, CL

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	0.22	0/1692	0.39	0/2292
2	B	0.22	0/1059	0.37	0/1414
3	C	0.22	0/8291	0.37	0/11231
4	D	0.24	0/111	0.32	0/146
All	All	0.22	0/11153	0.37	0/15083

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 [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	1652	0	1655	0	0
2	B	1041	0	1038	2	0
3	C	8133	0	8217	13	0
4	D	111	0	98	0	0
5	A	32	0	12	0	0
6	A	1	0	0	0	0
7	A	6	0	8	0	0
7	C	18	0	24	0	0
8	C	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
9	C	1	0	0	0	0
10	A	55	0	0	0	0
10	B	6	0	0	0	0
10	C	210	0	0	1	0
All	All	11268	0	11052	15	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 1.

All (15) 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)
3:C:571:ASN:OD1	3:C:574[B]:ARG:NH2	2.28	0.67
3:C:325:ARG:NH2	10:C:1203:HOH:O	2.31	0.64
2:B:186:LYS:NZ	2:B:190:GLU:OE1	2.31	0.63
3:C:733:ARG:NH2	3:C:793[B]:ASN:OD1	2.36	0.56
3:C:574[B]:ARG:NH1	3:C:617:GLU:OE1	2.38	0.56
3:C:567:LYS:NZ	3:C:605:LYS:O	2.40	0.55
3:C:494:GLN:NE2	3:C:499:GLU:O	2.46	0.48
2:B:143:GLU:N	2:B:143:GLU:OE1	2.50	0.45
3:C:914:ASN:OD1	3:C:917:ARG:NH2	2.50	0.44
3:C:138:ILE:HB	3:C:139:PRO:HD3	1.99	0.43
3:C:690:LEU:HB2	3:C:738[A]:MET:SD	2.59	0.43
3:C:240:THR:OG1	3:C:241:LYS:N	2.52	0.43
3:C:789:GLU:HB2	3:C:790:PRO:HD3	2.02	0.42
3:C:52:ASP:OD1	3:C:53:GLN:N	2.53	0.41
3:C:260:SER:O	3:C:325:ARG:NH1	2.54	0.41

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all 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	202/237 (85%)	197 (98%)	5 (2%)	0	100	100
2	B	123/143 (86%)	116 (94%)	7 (6%)	0	100	100
3	C	1005/1024 (98%)	989 (98%)	16 (2%)	0	100	100
4	D	11/19 (58%)	9 (82%)	2 (18%)	0	100	100
All	All	1341/1423 (94%)	1311 (98%)	30 (2%)	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	178/203 (88%)	177 (99%)	1 (1%)	87	94
2	B	109/122 (89%)	109 (100%)	0	100	100
3	C	922/933 (99%)	915 (99%)	7 (1%)	83	91
4	D	12/15 (80%)	12 (100%)	0	100	100
All	All	1221/1273 (96%)	1213 (99%)	8 (1%)	87	92

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	134	LYS
3	C	291	MET
3	C	356[A]	ARG
3	C	356[B]	ARG
3	C	656	ARG
3	C	671	LEU
3	C	689	LEU
3	C	940	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 4 are monoatomic - leaving 5 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	GNP	A	301	6	28,34,34	3.73	11 (39%)	30,54,54	1.31	2 (6%)
7	GOL	A	303	-	5,5,5	0.38	0	5,5,5	0.14	0
7	GOL	C	1104	-	5,5,5	0.37	0	5,5,5	0.24	0
7	GOL	C	1105	-	5,5,5	0.38	0	5,5,5	0.16	0
7	GOL	C	1106	-	5,5,5	0.38	0	5,5,5	0.14	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	GNP	A	301	6	-	0/16/38/38	0/3/3/3
7	GOL	A	303	-	-	0/4/4/4	0/0/0/0
7	GOL	C	1104	-	-	0/4/4/4	0/0/0/0
7	GOL	C	1105	-	-	0/4/4/4	0/0/0/0
7	GOL	C	1106	-	-	0/4/4/4	0/0/0/0

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	301	GNP	C4-N9	-8.30	1.36	1.47
5	A	301	GNP	C5-C6	-7.95	1.39	1.52
5	A	301	GNP	C2'-C1'	-7.15	1.30	1.53
5	A	301	GNP	O4'-C4'	-6.30	1.30	1.45
5	A	301	GNP	O3'-C3'	-2.85	1.36	1.43
5	A	301	GNP	C5-C4	-2.72	1.35	1.52
5	A	301	GNP	C8-N9	-2.62	1.36	1.45
5	A	301	GNP	O2'-C2'	2.94	1.49	1.43
5	A	301	GNP	PG-O1G	4.65	1.51	1.46
5	A	301	GNP	PB-O1B	4.74	1.51	1.46
5	A	301	GNP	O4'-C1'	8.29	1.61	1.42

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	301	GNP	PA-O3A-PB	-2.44	123.92	132.46
5	A	301	GNP	C4-C5-N7	4.31	108.18	102.46

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

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, 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	205/237 (86%)	-0.16	4 (1%) 65 71	17, 34, 79, 100	0
2	B	127/143 (88%)	0.10	4 (3%) 49 55	35, 50, 81, 100	0
3	C	994/1024 (97%)	-0.22	14 (1%) 75 79	17, 38, 71, 105	0
4	D	12/19 (63%)	1.15	1 (8%) 11 14	65, 80, 93, 95	0
All	All	1338/1423 (94%)	-0.17	23 (1%) 70 75	17, 39, 76, 105	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	689	LEU	4.4
3	C	616	ARG	4.0
1	A	187	VAL	4.0
3	C	979	ALA	3.9
4	D	391	PHE	3.2
3	C	1	MET	3.2
1	A	195	ALA	3.2
2	B	79	MET	3.2
3	C	978	GLU	3.1
1	A	194	ALA	3.1
2	B	65	PHE	3.1
2	B	68	VAL	2.9
2	B	81	GLU	2.7
3	C	690	LEU	2.6
3	C	543	ARG	2.5
3	C	18	GLN	2.4
1	A	197	TYR	2.3
3	C	0	SER	2.3
3	C	264	ILE	2.3
3	C	983	GLN	2.2
3	C	980	GLU	2.2

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Mol	Chain	Res	Type	RSRZ
3	C	977	GLN	2.1
3	C	30	GLN	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 carbohydrates 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
7	GOL	C	1105	6/6	0.62	0.34	63,66,67,67	0
7	GOL	C	1104	6/6	0.76	0.17	61,62,62,64	0
7	GOL	C	1106	6/6	0.80	0.18	71,73,75,77	0
7	GOL	A	303	6/6	0.82	0.24	55,57,57,57	0
8	CL	C	1102	1/1	0.85	0.15	67,67,67,67	0
8	CL	C	1101	1/1	0.90	0.10	55,55,55,55	0
9	ZN	C	1103	1/1	0.92	0.41	65,65,65,65	1
6	MG	A	302	1/1	0.97	0.12	24,24,24,24	0
5	GNP	A	301	32/32	0.98	0.12	20,27,31,36	0

6.5 Other polymers [i](#)

There are no such residues in this entry.