



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 29, 2024 – 12:24 pm BST

PDB ID : 2JH3
Title : The crystal structure of DR2241 from *Deinococcus radiodurans* at 1.9 Å resolution reveals a multi-domain protein with structural similarity to chelatases but also with two additional novel domains
Authors : Leiros, H.-K.S.; Mcsweeney, S.M.
Deposited on : 2007-02-20
Resolution : 1.90 Å (reported)

This is a wwPDB X-ray Structure Validation Summary 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
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

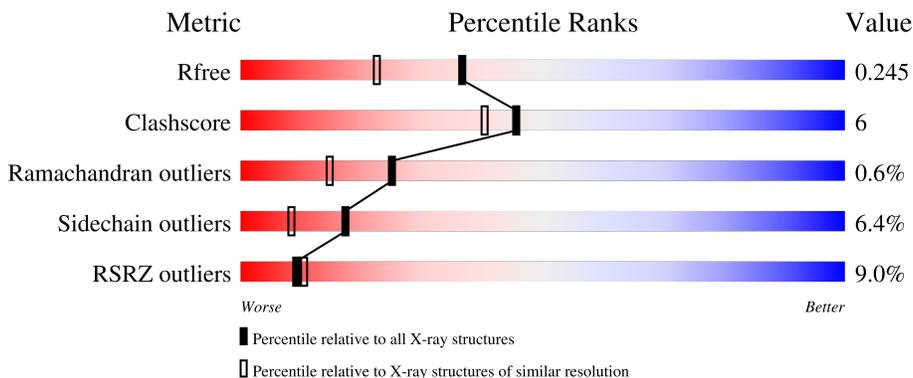
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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 $\leq 5\%$. 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	474	 6% 79% 14% ...
1	B	474	 14% 76% 17% ...
1	C	474	 4% 78% 15% ...
1	D	474	 11% 80% 13% ...

2 Entry composition [i](#)

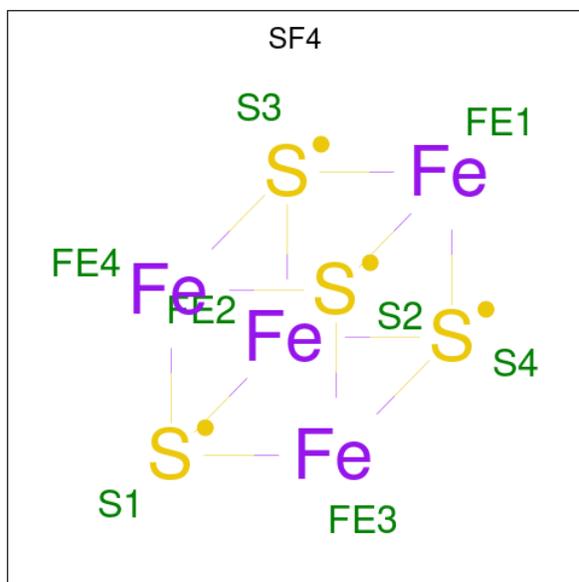
There are 3 unique types of molecules in this entry. The entry contains 14998 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 RIBOSOMAL PROTEIN S2-RELATED PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	459	Total 3502	C 2188	N 667	O 641	S 6	55	0	0
1	B	459	Total 3502	C 2188	N 667	O 641	S 6	101	0	0
1	C	459	Total 3502	C 2188	N 667	O 641	S 6	77	0	0
1	D	456	Total 3476	C 2174	N 661	O 635	S 6	104	0	0

- Molecule 2 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe₄S₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
2	A	1	Total 8	Fe 4	S 4	0	0
2	B	1	Total 8	Fe 4	S 4	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
2	C	1	8	4	4	0	0
2	D	1	8	4	4	0	0

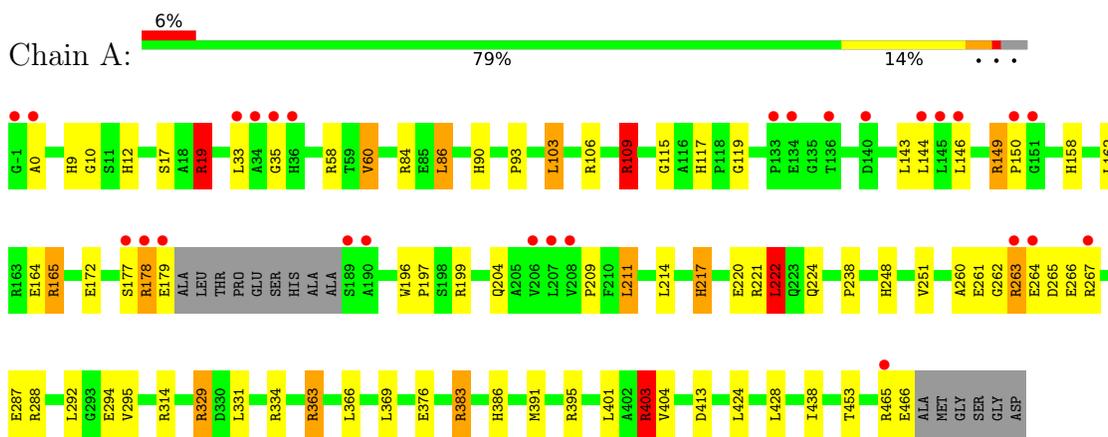
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	298	298	298	0	0
3	B	184	184	184	0	0
3	C	285	285	285	0	0
3	D	217	217	217	0	0

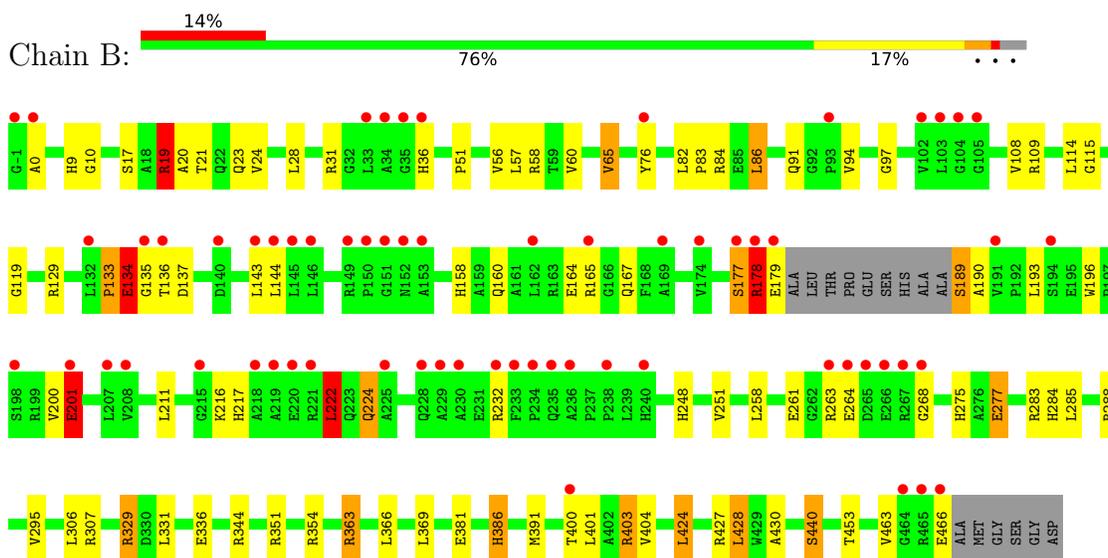
3 Residue-property plots [i](#)

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.

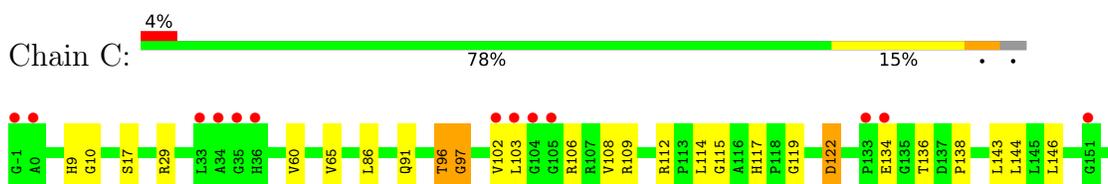
• Molecule 1: RIBOSOMAL PROTEIN S2-RELATED PROTEIN



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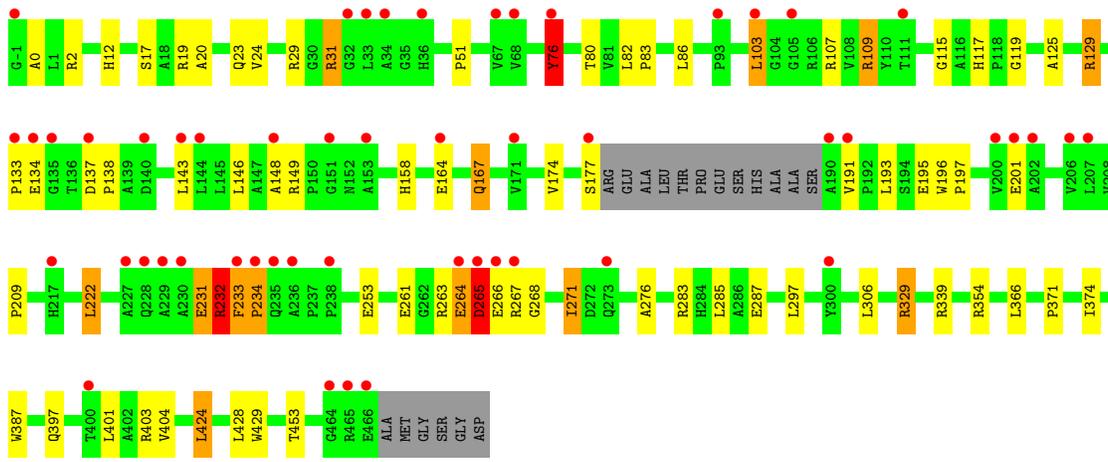
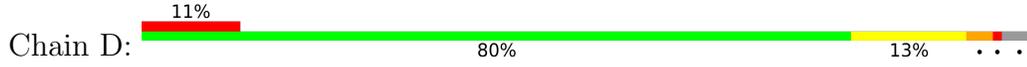


• Molecule 1: RIBOSOMAL PROTEIN S2-RELATED PROTEIN





● Molecule 1: RIBOSOMAL PROTEIN S2-RELATED PROTEIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	124.78Å 128.69Å 135.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.90 19.93 – 1.90	Depositor EDS
% Data completeness (in resolution range)	98.7 (20.00-1.90) 98.7 (19.93-1.90)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.93 (at 1.90Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.189 , 0.238 0.197 , 0.245	Depositor DCC
R_{free} test set	3400 reflections (2.02%)	wwPDB-VP
Wilson B-factor (Å ²)	25.9	Xtrriage
Anisotropy	0.048	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 55.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.015 for k,h,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	14998	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.78% 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: SF4

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	1.43	8/3580 (0.2%)	1.08	27/4882 (0.6%)
1	B	1.33	18/3580 (0.5%)	1.14	38/4882 (0.8%)
1	C	1.11	7/3580 (0.2%)	1.10	22/4882 (0.5%)
1	D	1.10	9/3554 (0.3%)	1.12	29/4848 (0.6%)
All	All	1.25	42/14294 (0.3%)	1.11	116/19494 (0.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	1	2
1	B	0	4
1	D	0	2
All	All	1	8

The worst 5 of 42 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	220	GLU	CD-OE1	51.89	1.82	1.25
1	B	277	GLU	CD-OE2	30.24	1.58	1.25
1	D	263	ARG	CD-NE	-26.41	1.01	1.46
1	B	277	GLU	CD-OE1	-26.07	0.96	1.25
1	B	386	HIS	CG-CD2	21.61	1.72	1.35

The worst 5 of 116 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	76	TYR	CB-CG-CD1	-18.94	109.64	121.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	189	SER	O-C-N	-15.57	97.78	122.70
1	D	233	PHE	CB-CG-CD1	13.55	130.29	120.80
1	B	354	ARG	NE-CZ-NH1	-13.05	113.78	120.30
1	C	354	ARG	NE-CZ-NH1	-12.78	113.91	120.30

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	265	ASP	CA

5 of 8 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	19	ARG	Sidechain
1	A	217	HIS	Sidechain
1	B	189	SER	Peptide,Mainchain
1	B	19	ARG	Sidechain
1	B	386	HIS	Sidechain

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	3502	0	3479	36	0
1	B	3502	0	3479	51	0
1	C	3502	0	3479	48	0
1	D	3476	0	3455	40	0
2	A	8	0	0	0	0
2	B	8	0	0	0	0
2	C	8	0	0	0	0
2	D	8	0	0	0	0
3	A	298	0	0	8	0
3	B	184	0	0	11	0
3	C	285	0	0	11	0
3	D	217	0	0	4	0
All	All	14998	0	13892	173	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 6.

The worst 5 of 173 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:C:275:HIS:CE1	1:C:363:ARG:HH21	1.42	1.36
1:B:0:ALA:HB1	1:B:268:GLY:H	1.14	1.05
1:C:275:HIS:CE1	1:C:363:ARG:NH2	2.25	1.04
1:C:275:HIS:HE1	1:C:363:ARG:HH21	0.99	0.96
1:A:329:ARG:NH2	3:A:2183:HOH:O	1.97	0.95

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	455/474 (96%)	438 (96%)	17 (4%)	0	100	100
1	B	455/474 (96%)	431 (95%)	19 (4%)	5 (1%)	14	5
1	C	455/474 (96%)	436 (96%)	17 (4%)	2 (0%)	34	24
1	D	452/474 (95%)	425 (94%)	24 (5%)	3 (1%)	22	12
All	All	1817/1896 (96%)	1730 (95%)	77 (4%)	10 (1%)	25	15

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	178	ARG
1	B	190	ALA
1	C	178	ARG
1	B	119	GLY
1	B	135	GLY

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	351/360 (98%)	327 (93%)	24 (7%)	16	7
1	B	351/360 (98%)	330 (94%)	21 (6%)	19	9
1	C	351/360 (98%)	328 (93%)	23 (7%)	16	8
1	D	348/360 (97%)	327 (94%)	21 (6%)	19	9
All	All	1401/1440 (97%)	1312 (94%)	89 (6%)	17	8

5 of 89 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	270	ASP
1	D	103	LEU
1	C	331	LEU
1	C	406	ARG
1	D	177	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	397	GLN
1	C	117	HIS
1	D	397	GLN
1	C	12	HIS
1	C	158	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](#)

4 ligands are modelled in this entry.

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
2	SF4	C	650	1	0,12,12	-	-	-		
2	SF4	D	650	1	0,12,12	-	-	-		
2	SF4	A	650	1	0,12,12	-	-	-		
2	SF4	B	650	1	0,12,12	-	-	-		

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
2	SF4	C	650	1	-	-	0/6/5/5
2	SF4	D	650	1	-	-	0/6/5/5
2	SF4	A	650	1	-	-	0/6/5/5
2	SF4	B	650	1	-	-	0/6/5/5

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	459/474 (96%)	0.14	27 (5%) 22 25	15, 30, 52, 62	25 (5%)
1	B	458/474 (96%)	0.61	64 (13%) 2 2	19, 39, 74, 105	33 (7%)
1	C	456/474 (96%)	0.15	21 (4%) 32 35	15, 29, 48, 67	26 (5%)
1	D	456/474 (96%)	0.47	52 (11%) 5 5	19, 37, 65, 75	36 (7%)
All	All	1829/1896 (96%)	0.34	164 (8%) 9 10	15, 33, 63, 105	120 (6%)

The worst 5 of 164 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	105	GLY	9.5
1	A	33	LEU	8.8
1	B	179	GLU	8.0
1	B	264	GLU	7.7
1	A	-1	GLY	6.7

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(\AA^2)	Q<0.9
2	SF4	A	650	8/8	1.00	0.10	16,17,19,19	0
2	SF4	B	650	8/8	1.00	0.09	19,20,21,21	0
2	SF4	C	650	8/8	1.00	0.10	17,18,21,21	0
2	SF4	D	650	8/8	1.00	0.08	20,21,23,23	0

6.5 Other polymers [i](#)

There are no such residues in this entry.