



Full wwPDB X-ray Structure Validation Report ⓘ

May 17, 2020 – 10:26 am BST

PDB ID : 4EGQ
Title : Crystal structure of D-alanine-D-alanine ligase B from Burkholderia pseudo-mallei
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on : 2012-03-31
Resolution : 2.20 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
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

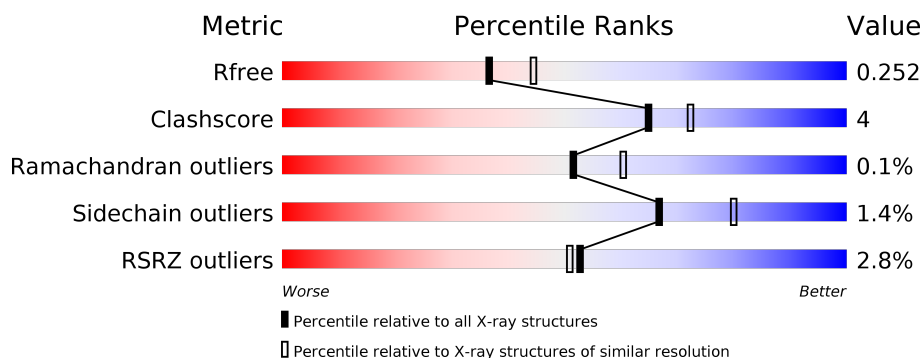
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 $\leq 5\%$. 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	316	<div> <div>3%</div> <div> <div></div> <div>84%</div> <div>7%</div> <div>9%</div> </div> </div>
1	B	316	<div> <div>%</div> <div> <div></div> <div>87%</div> <div>8%</div> <div>.</div> </div> </div>
1	C	316	<div> <div>%</div> <div> <div></div> <div>87%</div> <div>7%</div> <div>.</div> </div> </div>
1	D	316	<div> <div>5%</div> <div> <div></div> <div>84%</div> <div>6%</div> <div>.</div> <div>9%</div> </div> </div>

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8592 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 D-alanine–D-alanine ligase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	288	Total	C	N	O	S	0	0	0
			2030	1299	353	372	6			
1	B	302	Total	C	N	O	S	0	0	0
			2158	1382	367	403	6			
1	C	302	Total	C	N	O	S	0	0	0
			2168	1395	369	398	6			
1	D	288	Total	C	N	O	S	0	0	0
			2043	1316	353	368	6			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	EXPRESSION TAG	UNP Q3JNE1
A	-2	PRO	-	EXPRESSION TAG	UNP Q3JNE1
A	-1	GLY	-	EXPRESSION TAG	UNP Q3JNE1
A	0	SER	-	EXPRESSION TAG	UNP Q3JNE1
B	-3	GLY	-	EXPRESSION TAG	UNP Q3JNE1
B	-2	PRO	-	EXPRESSION TAG	UNP Q3JNE1
B	-1	GLY	-	EXPRESSION TAG	UNP Q3JNE1
B	0	SER	-	EXPRESSION TAG	UNP Q3JNE1
C	-3	GLY	-	EXPRESSION TAG	UNP Q3JNE1
C	-2	PRO	-	EXPRESSION TAG	UNP Q3JNE1
C	-1	GLY	-	EXPRESSION TAG	UNP Q3JNE1
C	0	SER	-	EXPRESSION TAG	UNP Q3JNE1
D	-3	GLY	-	EXPRESSION TAG	UNP Q3JNE1
D	-2	PRO	-	EXPRESSION TAG	UNP Q3JNE1
D	-1	GLY	-	EXPRESSION TAG	UNP Q3JNE1
D	0	SER	-	EXPRESSION TAG	UNP Q3JNE1

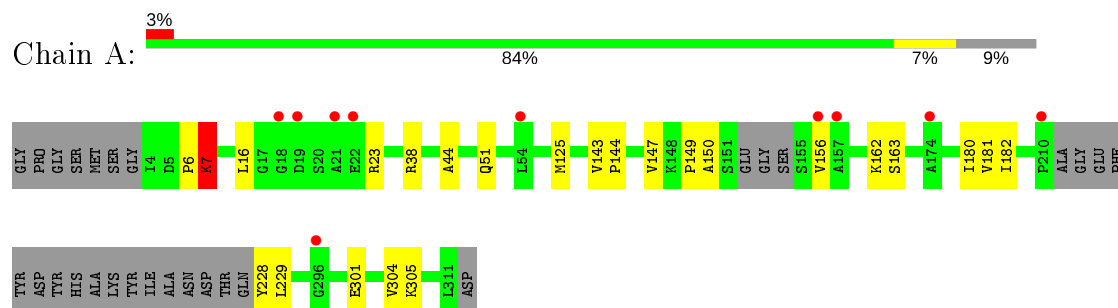
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	19	Total 19	O 19	0	0
2	B	60	Total 60	O 60	0	0
2	C	61	Total 61	O 61	0	0
2	D	53	Total 53	O 53	0	0

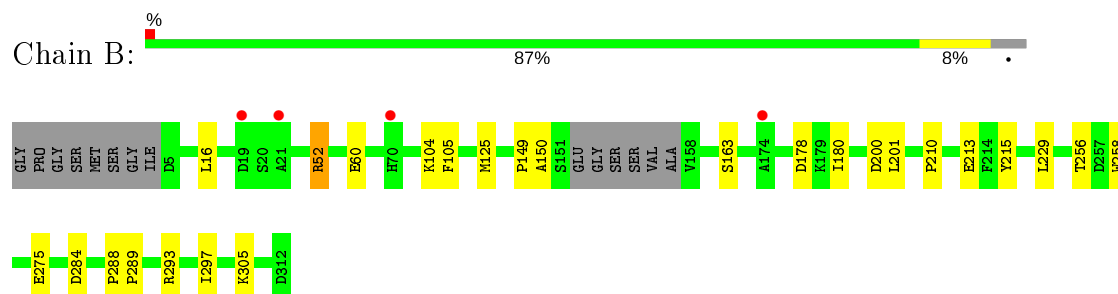
3 Residue-property plots [i](#)

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.

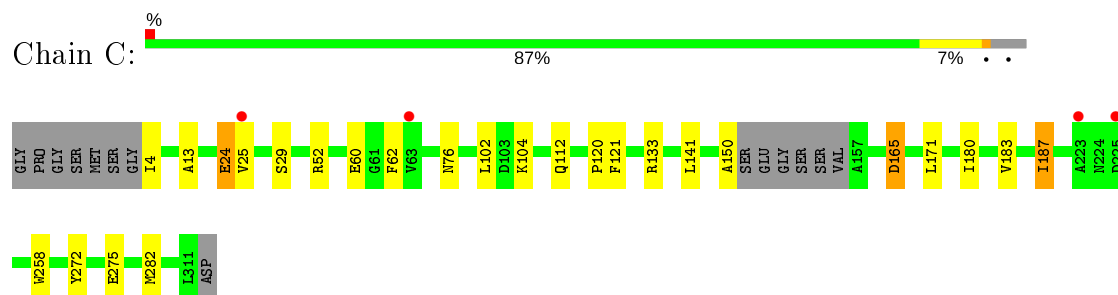
• Molecule 1: D-alanine–D-alanine ligase



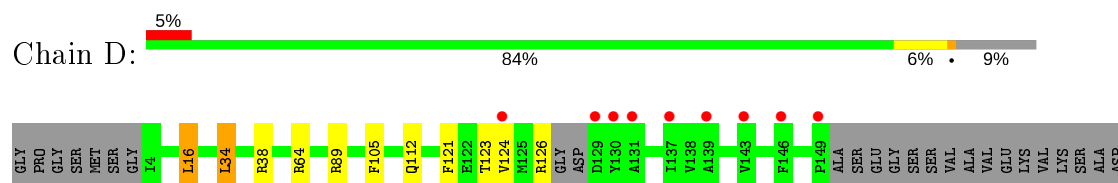
• Molecule 1: D-alanine–D-alanine ligase

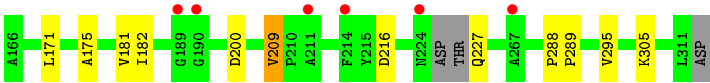


• Molecule 1: D-alanine–D-alanine ligase



• Molecule 1: D-alanine–D-alanine ligase





4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	45.39Å 66.09Å 98.56Å 84.47° 80.50° 83.59°	Depositor
Resolution (Å)	35.27 – 2.20 35.27 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.0 (35.27-2.20) 97.1 (35.27-2.20)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.81 (at 2.20Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.210 , 0.250 0.213 , 0.252	Depositor DCC
R_{free} test set	2772 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	33.8	Xtriage
Anisotropy	0.005	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 42.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	8592	wwPDB-VP
Average B, all atoms (Å ²)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.67% 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

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	0.55	0/2070	0.69	0/2828
1	B	0.61	1/2203 (0.0%)	0.72	2/3008 (0.1%)
1	C	0.64	1/2216 (0.0%)	0.74	1/3025 (0.0%)
1	D	0.58	0/2085	0.76	5/2845 (0.2%)
All	All	0.60	2/8574 (0.0%)	0.73	8/11706 (0.1%)

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	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	258	TRP	CD2-CE2	5.87	1.48	1.41
1	B	258	TRP	CD2-CE2	5.69	1.48	1.41

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	34	LEU	CB-CG-CD2	-6.34	100.22	111.00
1	B	52	ARG	NE-CZ-NH1	6.30	123.45	120.30
1	D	64	ARG	CA-CB-CG	5.95	126.49	113.40
1	D	64	ARG	N-CA-CB	-5.87	100.04	110.60
1	B	52	ARG	NE-CZ-NH2	-5.44	117.58	120.30
1	D	216	ASP	CB-CG-OD1	5.36	123.12	118.30
1	C	133	ARG	NE-CZ-NH2	-5.06	117.77	120.30
1	D	216	ASP	CB-CG-OD2	-5.02	113.78	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	7	LYS	Peptide

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	2030	0	1935	18	0
1	B	2158	0	2048	13	1
1	C	2168	0	2079	15	1
1	D	2043	0	1953	21	0
2	A	19	0	0	0	0
2	B	60	0	0	1	0
2	C	61	0	0	0	0
2	D	53	0	0	1	0
All	All	8592	0	8015	67	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 4.

All (67) 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:124:VAL:HG22	1:D:181:VAL:HG13	1.33	1.08
1:D:124:VAL:CG2	1:D:181:VAL:CG1	2.32	1.07
1:D:124:VAL:HG23	1:D:181:VAL:CG1	2.00	0.92
1:D:124:VAL:HG22	1:D:181:VAL:CG1	1.99	0.90
1:D:124:VAL:HG21	1:D:171:LEU:HD22	1.56	0.87
1:A:143:VAL:HG13	1:A:144:PRO:HA	1.59	0.84
1:D:124:VAL:HG23	1:D:181:VAL:HG12	1.58	0.82
1:B:150:ALA:HB3	1:B:180:ILE:HG23	1.62	0.79
1:A:125:MET:HG2	1:A:180:ILE:HD12	1.66	0.76
1:A:6:PRO:O	1:A:7:LYS:CB	2.35	0.73
1:D:295:VAL:HG12	1:D:295:VAL:O	1.87	0.73
1:C:52:ARG:NH2	1:C:60:GLU:OE2	2.24	0.70
1:D:124:VAL:CG2	1:D:181:VAL:HG13	2.02	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:150:ALA:HB3	1:A:180:ILE:HG23	1.74	0.69
1:A:149:PRO:HG2	1:A:156:VAL:HG11	1.73	0.69
1:C:4:ILE:O	1:C:4:ILE:HG23	1.94	0.68
1:A:143:VAL:CG1	1:A:144:PRO:HA	2.26	0.64
1:C:24:GLU:OE2	1:C:25:VAL:HG23	1.98	0.63
1:A:150:ALA:HA	1:A:182:ILE:HD12	1.80	0.62
1:D:209:VAL:HG12	1:D:227:GLN:HA	1.83	0.61
1:A:301:GLU:O	1:A:304:VAL:HG12	2.02	0.60
1:C:120:PRO:HB2	1:C:141:LEU:HD22	1.87	0.57
1:B:149:PRO:HB3	1:B:178:ASP:HB2	1.87	0.56
1:D:200:ASP:OD1	1:D:305:LYS:HE2	2.07	0.53
1:B:200:ASP:OD1	1:B:305:LYS:HE2	2.09	0.52
1:C:112:GLN:HG3	1:C:121:PHE:CE2	2.44	0.52
1:B:104:LYS:HE3	1:B:275:GLU:OE1	2.10	0.51
1:D:112:GLN:OE1	1:D:121:PHE:CZ	2.64	0.51
1:A:143:VAL:HG11	1:A:162:LYS:O	2.10	0.51
1:D:126:ARG:NH1	1:D:175:ALA:O	2.44	0.51
1:D:295:VAL:CG1	1:D:295:VAL:O	2.58	0.50
1:D:105:PHE:CD1	1:D:182:ILE:HD11	2.46	0.49
1:A:149:PRO:CG	1:A:156:VAL:HG11	2.41	0.48
1:C:171:LEU:HD21	1:C:183:VAL:HG21	1.95	0.48
1:B:215:TYR:CE1	1:B:229:LEU:HD11	2.49	0.48
1:C:150:ALA:CB	1:C:180:ILE:HG23	2.44	0.47
1:C:104:LYS:HE3	1:C:275:GLU:OE1	2.15	0.47
1:D:124:VAL:CG2	1:D:181:VAL:HG11	2.35	0.46
1:B:210:PRO:HD2	1:B:213:GLU:OE2	2.16	0.46
1:A:147:VAL:HG13	1:A:181:VAL:CG2	2.46	0.45
1:C:171:LEU:HD21	1:C:183:VAL:CG2	2.46	0.45
1:B:125:MET:HG2	1:B:180:ILE:HD12	1.98	0.45
1:A:304:VAL:HG13	1:A:305:LYS:N	2.32	0.44
1:B:105:PHE:CZ	1:B:180:ILE:HG12	2.53	0.44
1:A:23:ARG:HH22	1:A:51:GLN:HE22	1.65	0.44
1:C:150:ALA:HB3	1:C:180:ILE:HG23	2.00	0.44
1:D:124:VAL:CG2	1:D:181:VAL:HG12	2.23	0.44
1:D:34:LEU:O	1:D:38:ARG:HG2	2.18	0.44
1:A:147:VAL:CG1	1:A:181:VAL:HG21	2.49	0.43
1:D:123:THR:HG23	2:D:444:HOH:O	2.18	0.43
1:D:288:PRO:HB2	1:D:289:PRO:HD3	2.01	0.43
1:A:147:VAL:HG13	1:A:181:VAL:HG21	2.01	0.43
1:B:215:TYR:CD1	1:B:229:LEU:HD11	2.54	0.43
1:C:13:ALA:HB2	1:C:62:PHE:CD1	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:187:ILE:HD12	1:C:272:TYR:CE2	2.54	0.42
1:C:4:ILE:O	1:C:4:ILE:CG2	2.63	0.42
1:D:112:GLN:OE1	1:D:121:PHE:CE2	2.72	0.42
1:A:228:TYR:CB	1:A:229:LEU:HD12	2.50	0.42
1:A:150:ALA:HA	1:A:182:ILE:CD1	2.49	0.41
1:C:76:ASN:CB	1:C:102:LEU:HD12	2.51	0.41
1:B:256:THR:HG23	2:B:448:HOH:O	2.20	0.41
1:D:16:LEU:O	1:D:16:LEU:HD12	2.20	0.41
1:B:288:PRO:HB2	1:B:289:PRO:HD3	2.03	0.41
1:A:38:ARG:NH2	1:A:44:ALA:O	2.54	0.40
1:C:29:SER:OG	1:C:282:MET:HB2	2.20	0.40
1:B:201:LEU:HD22	1:B:297:ILE:HD13	2.03	0.40
1:B:284:ASP:O	1:B:293:ARG:NH2	2.45	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:B:60:GLU:OE2	1:C:165:ASP:OD1[1_445]	2.09	0.11

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	282/316 (89%)	280 (99%)	1 (0%)	1 (0%)	34	37
1	B	298/316 (94%)	296 (99%)	2 (1%)	0	100	100
1	C	298/316 (94%)	296 (99%)	2 (1%)	0	100	100
1	D	280/316 (89%)	276 (99%)	4 (1%)	0	100	100
All	All	1158/1264 (92%)	1148 (99%)	9 (1%)	1 (0%)	51	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	7	LYS

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	184/240 (77%)	182 (99%)	2 (1%)	73	85
1	B	197/240 (82%)	194 (98%)	3 (2%)	65	78
1	C	200/240 (83%)	197 (98%)	3 (2%)	65	78
1	D	183/240 (76%)	180 (98%)	3 (2%)	62	76
All	All	764/960 (80%)	753 (99%)	11 (1%)	67	80

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	LEU
1	A	163	SER
1	B	16	LEU
1	B	52	ARG
1	B	163	SER
1	C	24	GLU
1	C	165	ASP
1	C	187	ILE
1	D	16	LEU
1	D	89	ARG
1	D	209	VAL

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](#)

There are no ligands in this entry.

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	288/316 (91%)	0.18	10 (3%) 44 42	22, 44, 71, 93	0
1	B	302/316 (95%)	0.07	4 (1%) 77 75	21, 36, 54, 66	0
1	C	302/316 (95%)	0.06	4 (1%) 77 75	20, 33, 50, 67	0
1	D	288/316 (91%)	0.25	15 (5%) 27 26	22, 36, 64, 77	0
All	All	1180/1264 (93%)	0.14	33 (2%) 53 51	20, 37, 63, 93	0

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	190	GLY	5.7
1	A	210	PRO	5.1
1	B	21	ALA	5.0
1	D	143	VAL	4.6
1	D	149	PRO	3.7
1	D	267	ALA	3.6
1	D	224	ASN	3.4
1	D	189	GLY	3.3
1	D	129	ASP	2.9
1	C	225	ASP	2.9
1	D	130	TYR	2.8
1	D	211	ALA	2.8
1	A	54	LEU	2.7
1	C	25	VAL	2.6
1	A	296	GLY	2.6
1	A	21	ALA	2.6
1	A	157	ALA	2.6
1	B	19	ASP	2.6
1	A	18	GLY	2.5
1	D	214	PHE	2.5
1	A	174	ALA	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	19	ASP	2.5
1	D	137	ILE	2.4
1	D	124	VAL	2.4
1	A	156	VAL	2.2
1	B	70	HIS	2.2
1	D	131	ALA	2.1
1	C	223	ALA	2.1
1	A	22	GLU	2.0
1	B	174	ALA	2.0
1	D	146	PHE	2.0
1	C	63	VAL	2.0
1	D	139	ALA	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.