



Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 12:52 am BST

PDB ID : 6N70
Title : Crystal Structure of ATPase delta1-79 Spa47 R191A
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Deposited on : 2018-11-27
Resolution : 2.74 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

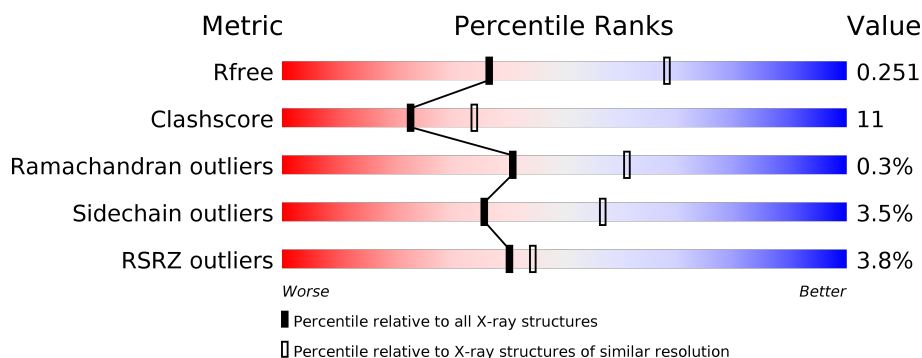
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.74 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	1271 (2.76-2.72)
Clashscore	141614	1322 (2.76-2.72)
Ramachandran outliers	138981	1297 (2.76-2.72)
Sidechain outliers	138945	1298 (2.76-2.72)
RSRZ outliers	127900	1243 (2.76-2.72)

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	352	<div> <div>3%</div> <div> <div></div> <div>71%</div> <div>25%</div> <div>..</div> </div> </div>
1	B	352	<div> <div>4%</div> <div> <div></div> <div>74%</div> <div>20%</div> <div>..</div> </div> </div>

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5389 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 ATP synthase SpaL/MxiB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	348	Total	C	N	O	S	0	0	0
			2713	1722	461	521	9			
1	B	339	Total	C	N	O	S	0	0	0
			2644	1681	446	508	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	79	ASN	-	expression tag	UNP P0A1C1
A	191	ALA	ARG	engineered mutation	UNP P0A1C1
B	79	ASN	-	expression tag	UNP P0A1C1
B	191	ALA	ARG	engineered mutation	UNP P0A1C1

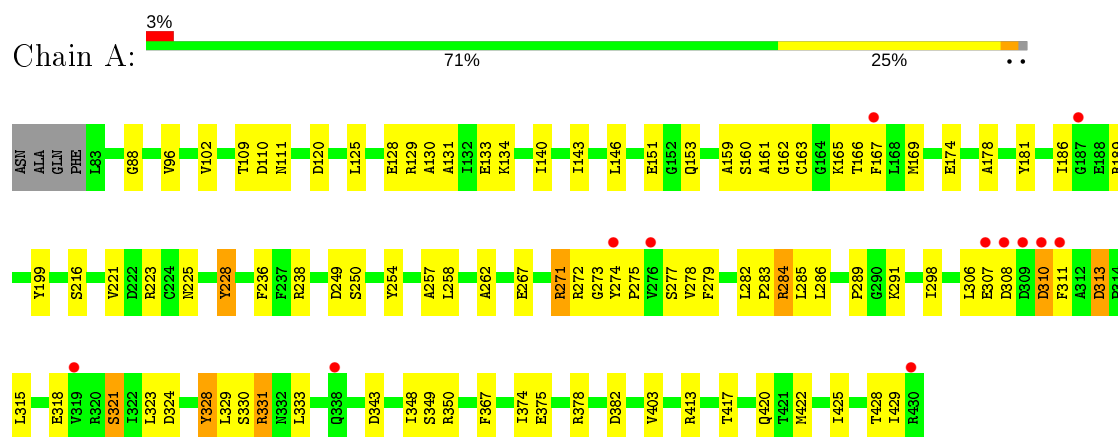
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	15	Total	O	0	0
			15	15		
2	B	17	Total	O	0	0
			17	17		

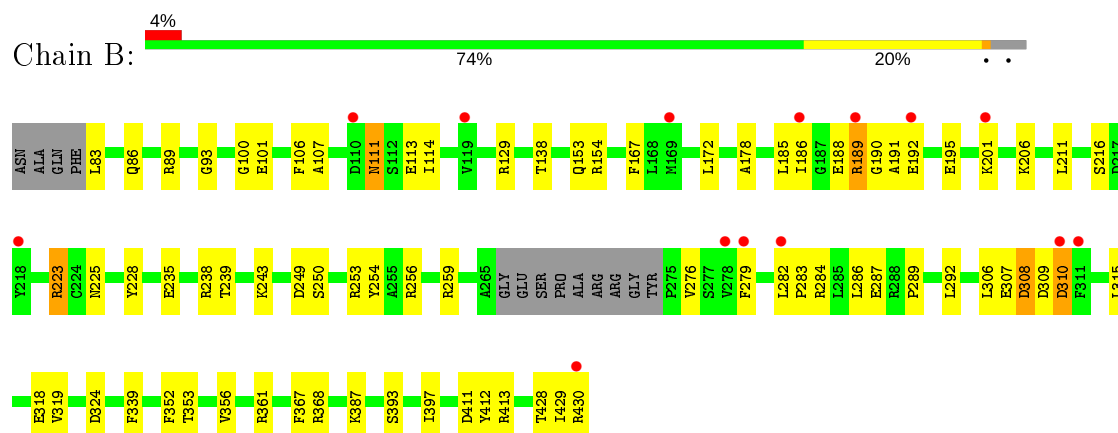
3 Residue-property plots [i](#)

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: ATP synthase SpaL/MxiB



• Molecule 1: ATP synthase SpaL/MxiB



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	43.77Å 154.24Å 55.13Å 90.00° 109.54° 90.00°	Depositor
Resolution (Å)	43.09 – 2.74 43.09 – 2.74	Depositor EDS
% Data completeness (in resolution range)	98.3 (43.09-2.74) 93.6 (43.09-2.74)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.67 (at 2.73Å)	Xtriage
Refinement program	PHENIX 1.13 _2998	Depositor
R, R_{free}	0.196 , 0.252 0.196 , 0.251	Depositor DCC
R_{free} test set	894 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	51.0	Xtriage
Anisotropy	0.326	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 50.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5389	wwPDB-VP
Average B, all atoms (Å ²)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.21% 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](#)

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	0.30	0/2760	0.49	0/3731
1	B	0.27	0/2688	0.46	0/3632
All	All	0.28	0/5448	0.47	0/7363

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

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	271	ARG	Peptide

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	2713	0	2719	69	0
1	B	2644	0	2655	54	0
2	A	15	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	17	0	0	3	0
All	All	5389	0	5374	123	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 11.

All (123) 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:B:306:LEU:HD13	1:B:310:ASP:HA	1.05	1.04
1:B:306:LEU:CD1	1:B:310:ASP:HA	1.92	0.99
1:B:86:GLN:HB3	1:B:114:ILE:HD11	1.52	0.90
1:B:306:LEU:HD13	1:B:310:ASP:CA	1.98	0.88
1:A:272:ARG:HH21	1:A:279:PHE:HB2	1.40	0.85
1:B:276:VAL:HG23	1:B:284:ARG:HH22	1.42	0.84
1:A:272:ARG:HE	1:A:279:PHE:HB2	1.41	0.84
1:A:272:ARG:NH2	1:A:279:PHE:HB2	1.95	0.80
1:A:272:ARG:NE	1:A:279:PHE:HB2	1.97	0.79
1:B:318:GLU:OE2	1:B:318:GLU:N	2.13	0.78
1:B:153:GLN:HG3	1:B:324:ASP:HB2	1.67	0.77
1:A:159:ALA:HB2	1:A:329:LEU:HB2	1.67	0.76
1:A:272:ARG:HH21	1:A:279:PHE:CB	1.97	0.75
1:A:262:ALA:HB1	1:A:267:GLU:HB2	1.68	0.74
1:A:225:ASN:HA	1:A:228:TYR:HD2	1.56	0.71
1:A:109:THR:HG22	1:A:111:ASN:H	1.57	0.70
1:A:403:VAL:HG13	1:A:428:THR:HG23	1.73	0.70
1:A:272:ARG:CZ	1:A:279:PHE:HB2	2.22	0.69
1:B:86:GLN:HE21	1:B:101:GLU:HA	1.58	0.68
1:A:159:ALA:HB1	1:A:163:CYS:HB2	1.76	0.68
1:A:328:TYR:CE2	1:A:343:ASP:HB3	2.29	0.68
1:B:154:ARG:HH21	1:B:287:GLU:HA	1.57	0.68
1:A:225:ASN:HA	1:A:228:TYR:CD2	2.29	0.67
1:A:375:GLU:HA	1:A:378:ARG:HG3	1.77	0.67
1:B:216:SER:HA	1:B:223:ARG:HH21	1.60	0.67
1:B:393:SER:O	1:B:397:ILE:HD12	1.96	0.65
1:A:228:TYR:CD1	1:A:284:ARG:NH2	2.65	0.65
1:A:216:SER:HA	1:A:223:ARG:HH12	1.62	0.64
1:B:411:ASP:OD2	1:B:413:ARG:NH1	2.33	0.62
1:B:86:GLN:HG3	1:B:100:GLY:O	1.98	0.62
1:A:216:SER:HA	1:A:223:ARG:NH1	2.14	0.61
1:A:166:THR:HA	1:A:169:MET:HE2	1.83	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:315:LEU:HA	1:A:318:GLU:OE1	2.03	0.58
1:B:106:PHE:HB2	1:B:201:LYS:HG3	1.85	0.58
1:A:284:ARG:HG3	1:A:285:LEU:N	2.17	0.58
1:A:285:LEU:HG	1:A:286:LEU:HD23	1.84	0.58
1:A:153:GLN:HG3	1:A:324:ASP:HB2	1.84	0.58
1:B:111:ASN:ND2	1:B:113:GLU:H	2.02	0.57
1:A:120:ASP:OD2	1:A:284:ARG:NH1	2.37	0.56
1:B:189:ARG:CZ	1:B:190:GLY:H	2.17	0.56
1:B:154:ARG:NE	1:B:286:LEU:O	2.37	0.56
1:A:258:LEU:HD11	1:A:278:VAL:O	2.05	0.55
1:B:89:ARG:HB2	1:B:111:ASN:ND2	2.21	0.55
1:A:140:ILE:HD12	1:A:143:ILE:HD12	1.88	0.55
1:A:313:ASP:OD1	1:A:315:LEU:HB3	2.07	0.55
1:A:310:ASP:OD2	1:A:328:TYR:HE1	1.90	0.55
1:B:235:GLU:O	1:B:239:THR:HG23	2.06	0.55
1:B:192:GLU:HA	1:B:195:GLU:HB3	1.89	0.55
1:A:88:GLY:HA2	1:A:236:PHE:CE2	2.42	0.54
1:B:111:ASN:HD21	1:B:113:GLU:HB3	1.71	0.54
1:B:368:ARG:NH2	2:B:502:HOH:O	2.32	0.54
1:B:307:GLU:O	1:B:309:ASP:N	2.40	0.54
1:A:417:THR:OG1	1:A:420:GLN:HG3	2.08	0.54
1:A:146:LEU:HD11	1:A:367:PHE:CD2	2.43	0.53
1:B:282:LEU:HB3	1:B:283:PRO:HD3	1.90	0.53
1:A:96:VAL:HG12	1:A:102:VAL:HG12	1.89	0.53
1:A:330:SER:HB3	1:A:333:LEU:HD23	1.89	0.53
1:A:367:PHE:CG	1:A:425:ILE:HD11	2.44	0.53
1:B:253:ARG:NH1	1:B:256:ARG:HD3	2.24	0.52
1:A:129:ARG:NH2	1:A:289:PRO:O	2.43	0.52
1:A:160:SER:HB3	1:A:306:LEU:O	2.09	0.51
1:A:223:ARG:HD2	1:A:257:ALA:HB2	1.92	0.51
1:B:129:ARG:NH2	1:B:289:PRO:O	2.44	0.51
1:B:307:GLU:HG3	1:B:308:ASP:OD2	2.11	0.49
1:A:174:GLU:HG2	1:A:199:TYR:OH	2.12	0.49
1:A:274:TYR:CG	1:A:275:PRO:HA	2.47	0.49
1:A:310:ASP:OD1	1:A:310:ASP:N	2.46	0.49
1:A:328:TYR:OH	1:A:331:ARG:NH1	2.46	0.49
1:B:238:ARG:HD2	1:B:292:LEU:HG	1.95	0.49
1:B:315:LEU:O	1:B:319:VAL:HG22	2.13	0.48
1:A:374:ILE:O	1:A:378:ARG:HG3	2.13	0.48
1:A:161:ALA:HA	1:A:162:GLY:HA2	1.54	0.48
1:A:272:ARG:NH2	1:A:279:PHE:CB	2.64	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:310:ASP:OD1	1:A:331:ARG:HD2	2.14	0.48
1:A:310:ASP:OD2	1:A:328:TYR:CE1	2.67	0.48
1:B:339:PHE:HE2	1:B:412:TYR:HB3	1.79	0.48
1:A:110:ASP:OD2	1:A:110:ASP:N	2.45	0.47
1:A:125:LEU:HB3	1:A:128:GLU:HG3	1.96	0.47
1:A:130:ALA:HB3	1:A:291:LYS:HG3	1.97	0.47
1:A:328:TYR:CD2	1:A:343:ASP:HB3	2.50	0.47
1:B:339:PHE:CE2	1:B:412:TYR:HB3	2.50	0.47
1:A:307:GLU:HA	1:A:308:ASP:HA	1.60	0.46
1:A:328:TYR:HE2	1:A:343:ASP:HB3	1.75	0.46
1:A:282:LEU:HB3	1:A:283:PRO:HD3	1.97	0.46
1:B:189:ARG:HG3	1:B:191:ALA:H	1.80	0.45
1:A:178:ALA:HB3	1:A:181:TYR:CZ	2.51	0.45
1:B:353:THR:O	1:B:361:ARG:NH1	2.49	0.45
1:A:318:GLU:O	1:A:321:SER:HB3	2.16	0.45
1:A:367:PHE:HA	1:A:429:ILE:HD11	1.98	0.45
1:A:249:ASP:HA	1:A:250:SER:HA	1.51	0.45
1:B:189:ARG:NE	1:B:190:GLY:H	2.15	0.45
1:B:93:GLY:HA2	1:B:106:PHE:CE1	2.52	0.45
1:B:225:ASN:HA	1:B:228:TYR:HD2	1.83	0.45
1:B:315:LEU:HA	1:B:318:GLU:OE1	2.17	0.44
1:B:367:PHE:HE1	1:B:428:THR:HG21	1.81	0.44
1:B:429:ILE:O	1:B:430:ARG:HB2	2.17	0.44
1:A:272:ARG:HE	1:A:279:PHE:HD2	1.64	0.44
1:B:154:ARG:HH11	1:B:154:ARG:HG3	1.81	0.44
1:A:131:ALA:HB3	1:A:133:GLU:OE2	2.18	0.44
1:A:286:LEU:HD13	1:A:323:LEU:HD21	2.00	0.44
1:B:107:ALA:HB2	1:B:206:LYS:CG	2.48	0.43
1:A:221:VAL:HG12	1:A:225:ASN:HD21	1.83	0.43
1:B:189:ARG:HH12	1:B:216:SER:HB2	1.82	0.43
1:B:138:THR:HG23	1:B:172:LEU:HD23	2.00	0.43
1:A:238:ARG:HD3	1:A:298:ILE:HG13	2.01	0.43
1:B:249:ASP:HA	1:B:250:SER:HA	1.66	0.42
1:B:368:ARG:HD2	2:B:502:HOH:O	2.19	0.42
1:B:185:LEU:HG	1:B:211:LEU:HD11	2.02	0.42
1:B:83:LEU:N	2:B:506:HOH:O	2.52	0.42
1:A:272:ARG:NE	1:A:277:SER:OG	2.53	0.41
1:A:348:ILE:HG12	1:A:349:SER:N	2.36	0.41
1:B:352:PHE:O	1:B:356:VAL:HG22	2.20	0.41
1:A:134:LYS:NZ	1:A:151:GLU:OE2	2.52	0.41
1:A:258:LEU:HD11	1:A:279:PHE:HA	2.01	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:129:ARG:NH2	1:B:154:ARG:HH22	2.18	0.41
1:B:186:ILE:HG21	1:B:254:TYR:HB2	2.02	0.41
1:B:259:ARG:HG3	1:B:279:PHE:CZ	2.56	0.41
1:B:178:ALA:HA	1:B:243:LYS:HE2	2.03	0.40
1:A:422:MET:HA	1:A:425:ILE:HG22	2.03	0.40
1:B:188:GLU:CD	1:B:192:GLU:HG2	2.41	0.40
1:B:259:ARG:HG3	1:B:279:PHE:HZ	1.86	0.40
1:A:186:ILE:HG21	1:A:254:TYR:HB2	2.03	0.40
1:A:272:ARG:HG3	1:A:273:GLY:H	1.86	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	346/352 (98%)	335 (97%)	11 (3%)	0	100	100
1	B	335/352 (95%)	326 (97%)	7 (2%)	2 (1%)	25	44
All	All	681/704 (97%)	661 (97%)	18 (3%)	2 (0%)	41	61

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	308	ASP
1	B	310	ASP

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	290/293 (99%)	275 (95%)	15 (5%)	23	39
1	B	284/293 (97%)	279 (98%)	5 (2%)	59	75
All	All	574/586 (98%)	554 (96%)	20 (4%)	36	57

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	165	LYS
1	A	167	PHE
1	A	189	ARG
1	A	228	TYR
1	A	271	ARG
1	A	284	ARG
1	A	310	ASP
1	A	311	PHE
1	A	313	ASP
1	A	321	SER
1	A	328	TYR
1	A	331	ARG
1	A	350	ARG
1	A	382	ASP
1	A	413	ARG
1	B	111	ASN
1	B	167	PHE
1	B	189	ARG
1	B	223	ARG
1	B	387	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	225	ASN
1	B	86	GLN
1	B	111	ASN

5.3.3 RNA ⓘ

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	348/352 (98%)	0.16	12 (3%) 45 50	29, 64, 141, 249	0
1	B	339/352 (96%)	0.14	14 (4%) 37 41	31, 60, 136, 272	0
All	All	687/704 (97%)	0.15	26 (3%) 40 44	29, 62, 138, 272	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	279	PHE	5.6
1	A	311	PHE	5.2
1	A	274	TYR	5.1
1	B	311	PHE	4.6
1	B	310	ASP	4.0
1	B	430	ARG	3.9
1	A	307	GLU	3.6
1	A	310	ASP	3.3
1	A	187	GLY	3.3
1	B	169	MET	3.0
1	B	278	VAL	2.7
1	A	276	VAL	2.6
1	A	308	ASP	2.4
1	A	309	ASP	2.4
1	B	110	ASP	2.4
1	B	201	LYS	2.4
1	B	218	TYR	2.3
1	B	282	LEU	2.2
1	B	192	GLU	2.2
1	A	319	VAL	2.2
1	B	189	ARG	2.1
1	A	338	GLN	2.0
1	A	167	PHE	2.0
1	B	119	VAL	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	430	ARG	2.0
1	B	186	ILE	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.