



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 29, 2023 – 07:43 AM EDT

PDB ID : 3PI6
Title : Crystal structure of the CFTR inhibitory factor Cif with the H177Y mutation
Authors : Bahl, C.D.; Madden, D.R.
Deposited on : 2010-11-05
Resolution : 1.50 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 ⓘ 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
Xtriage (Phenix) : 1.13
EDS : 2.35
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) : 2.35

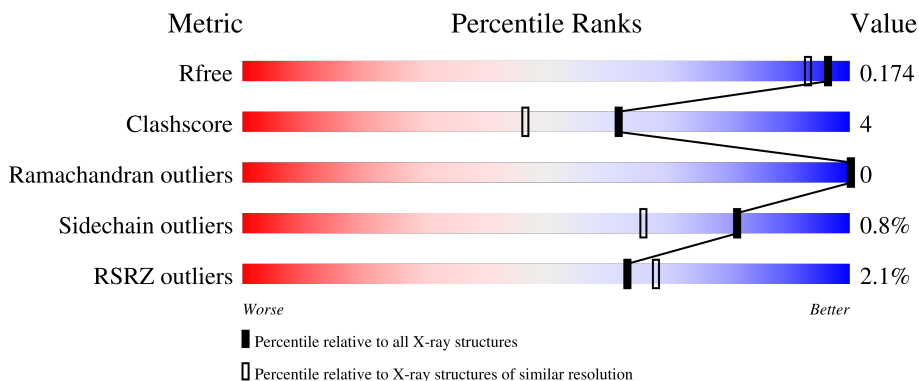
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.50 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	2936 (1.50-1.50)
Clashscore	141614	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)
RSRZ outliers	127900	2884 (1.50-1.50)

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 $\leq 5\%$. 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	301	 2% 91% 7%
1	B	301	 2% 89% 9%
1	C	301	 3% 86% 11%
1	D	301	 2% 93% 6%

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 10872 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 hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	297	2424	1567	412	434	11	7	9	0
1	B	296	2392	1545	408	428	11	7	5	0
1	C	296	2408	1558	409	430	11	7	7	0
1	D	298	2404	1551	414	428	11	7	3	0

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	177	TYR	HIS	engineered mutation	UNP Q02P97
A	320	HIS	-	expression tag	UNP Q02P97
A	321	HIS	-	expression tag	UNP Q02P97
A	322	HIS	-	expression tag	UNP Q02P97
A	323	HIS	-	expression tag	UNP Q02P97
A	324	HIS	-	expression tag	UNP Q02P97
A	325	HIS	-	expression tag	UNP Q02P97
B	177	TYR	HIS	engineered mutation	UNP Q02P97
B	320	HIS	-	expression tag	UNP Q02P97
B	321	HIS	-	expression tag	UNP Q02P97
B	322	HIS	-	expression tag	UNP Q02P97
B	323	HIS	-	expression tag	UNP Q02P97
B	324	HIS	-	expression tag	UNP Q02P97
B	325	HIS	-	expression tag	UNP Q02P97
C	177	TYR	HIS	engineered mutation	UNP Q02P97
C	320	HIS	-	expression tag	UNP Q02P97
C	321	HIS	-	expression tag	UNP Q02P97
C	322	HIS	-	expression tag	UNP Q02P97
C	323	HIS	-	expression tag	UNP Q02P97
C	324	HIS	-	expression tag	UNP Q02P97
C	325	HIS	-	expression tag	UNP Q02P97

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Chain	Residue	Modelled	Actual	Comment	Reference
D	177	TYR	HIS	engineered mutation	UNP Q02P97
D	320	HIS	-	expression tag	UNP Q02P97
D	321	HIS	-	expression tag	UNP Q02P97
D	322	HIS	-	expression tag	UNP Q02P97
D	323	HIS	-	expression tag	UNP Q02P97
D	324	HIS	-	expression tag	UNP Q02P97
D	325	HIS	-	expression tag	UNP Q02P97

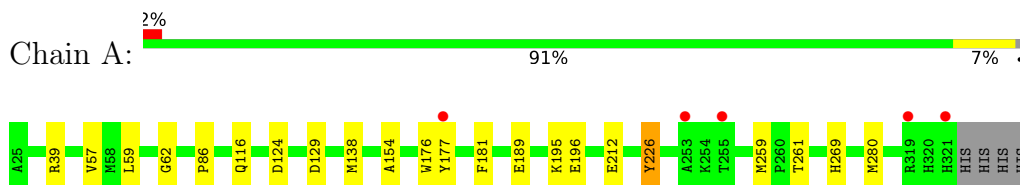
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	335	Total 335	O 335	0	0
2	B	290	Total 290	O 290	0	0
2	C	328	Total 328	O 328	0	0
2	D	291	Total 291	O 291	0	0

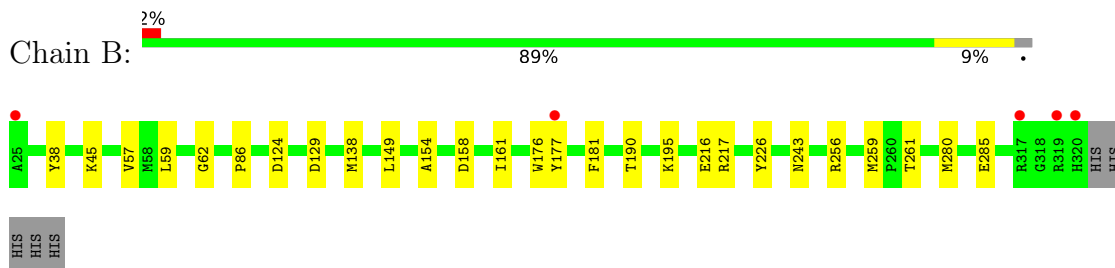
3 Residue-property plots [i](#)

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.

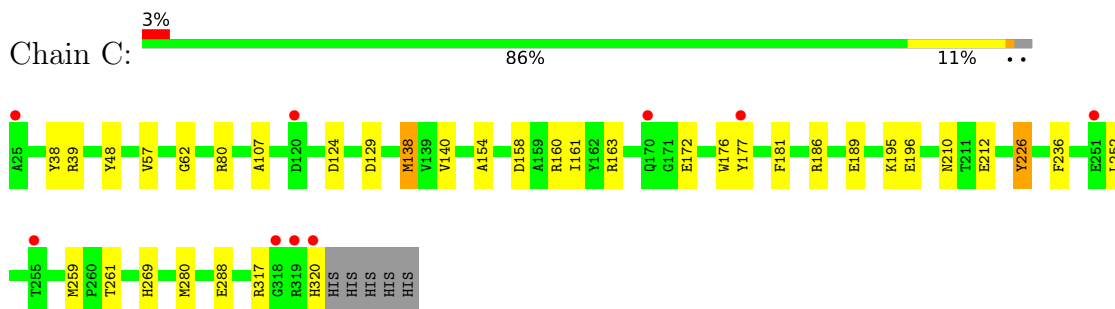
- Molecule 1: hydrolase



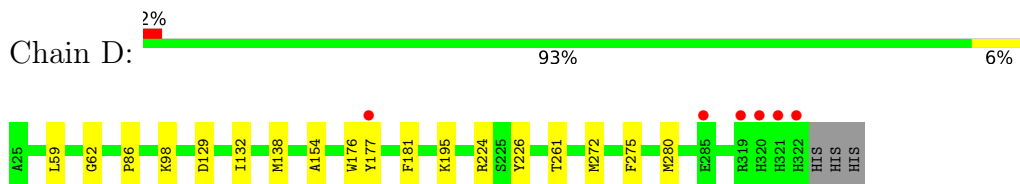
- Molecule 1: hydrolase



- Molecule 1: hydrolase



- Molecule 1: hydrolase



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	168.39Å 84.06Å 89.33Å 90.00° 100.39° 90.00°	Depositor
Resolution (Å)	43.93 – 1.50 43.93 – 1.50	Depositor EDS
% Data completeness (in resolution range)	99.8 (43.93-1.50) 99.8 (43.93-1.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.18 (at 1.50Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, R_{free}	0.164 , 0.181 0.154 , 0.174	Depositor DCC
R_{free} test set	9754 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	11.6	Xtrriage
Anisotropy	0.284	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 47.6	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	0.97	EDS
Total number of atoms	10872	wwPDB-VP
Average B, all atoms (Å ²)	14.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.35% 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	0.35	0/2525	0.53	0/3426
1	B	0.32	0/2480	0.52	0/3365
1	C	0.34	0/2505	0.53	0/3398
1	D	0.32	0/2488	0.54	0/3376
All	All	0.33	0/9998	0.53	0/13565

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	2424	0	2357	20	0
1	B	2392	0	2321	20	0
1	C	2408	0	2352	30	0
1	D	2404	0	2324	17	0
2	A	335	0	0	2	0
2	B	290	0	0	3	0
2	C	328	0	0	2	0
2	D	291	0	0	4	0
All	All	10872	0	9354	83	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 4.

All (83) 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:212[B]:GLU:HG3	2:C:348:HOH:O	1.70	0.92
1:B:217:ARG:HD2	2:B:787:HOH:O	1.75	0.86
1:C:39:ARG:HG2	1:C:48:TYR:HE1	1.42	0.84
1:C:39:ARG:HG2	1:C:48:TYR:CE1	2.15	0.81
1:A:195[B]:LYS:HE2	1:B:195[B]:LYS:NZ	2.04	0.73
1:B:129:ASP:HA	1:B:154:ALA:HB2	1.72	0.71
1:D:129:ASP:HA	1:D:154:ALA:HB2	1.73	0.69
1:C:129:ASP:HA	1:C:154:ALA:HB2	1.74	0.68
1:B:149:LEU:HB3	1:B:261[B]:THR:HG22	1.76	0.68
1:A:129:ASP:HA	1:A:154:ALA:HB2	1.76	0.67
1:C:195[A]:LYS:HE2	1:D:195[A]:LYS:NZ	2.11	0.65
1:C:195[A]:LYS:HE2	1:D:195[A]:LYS:HZ3	1.61	0.64
1:A:261[A]:THR:HG21	1:A:280:MET:CE	2.29	0.63
1:A:196:GLU:HB3	1:A:226:TYR:CE2	2.35	0.62
1:B:256:ARG:HH21	1:B:285:GLU:HA	1.69	0.57
1:C:261[A]:THR:HG21	1:C:280:MET:CE	2.34	0.57
1:C:186:ARG:HD2	1:C:189[B]:GLU:OE2	2.04	0.56
1:A:62:GLY:HA3	1:A:129:ASP:HB3	1.88	0.55
1:A:261[A]:THR:HG21	1:A:280:MET:HE3	1.88	0.55
1:D:224:ARG:CD	2:D:1210:HOH:O	2.55	0.54
1:C:62:GLY:HA3	1:C:129:ASP:HB3	1.89	0.54
2:A:406:HOH:O	1:C:269:HIS:HD2	1.90	0.54
1:C:261[A]:THR:HG21	1:C:280:MET:HE3	1.89	0.54
1:C:57[A]:VAL:HG22	1:C:124:ASP:HB2	1.89	0.53
1:D:177[A]:TYR:HD2	1:D:181:PHE:CE2	2.27	0.52
1:D:224:ARG:HD2	2:D:1210:HOH:O	2.09	0.52
1:A:269:HIS:HD2	2:C:401:HOH:O	1.92	0.52
1:A:261[A]:THR:HG21	1:A:280:MET:HE2	1.92	0.51
1:B:261[A]:THR:HG21	1:B:280:MET:CE	2.40	0.51
1:B:261[A]:THR:HG21	1:B:280:MET:HE2	1.92	0.51
1:A:57:VAL:HG22	1:A:124:ASP:HB2	1.93	0.51
1:C:196:GLU:HB3	1:C:226:TYR:CE2	2.46	0.51
1:C:288:GLU:OE1	1:C:317:ARG:NH1	2.40	0.50
1:B:57:VAL:HG22	1:B:124:ASP:HB2	1.94	0.50
1:B:259:MET:O	1:B:261[B]:THR:HG23	2.12	0.49
1:B:62:GLY:HA3	1:B:129:ASP:HB3	1.94	0.49
1:D:261:THR:HG21	1:D:280:MET:CE	2.43	0.48
1:D:62:GLY:HA3	1:D:129:ASP:HB3	1.96	0.48
1:D:98:LYS:NZ	2:D:935:HOH:O	2.46	0.48
1:D:177[A]:TYR:CD2	1:D:181:PHE:CE2	3.01	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:177[A]:TYR:HD2	1:A:181:PHE:CE2	2.33	0.47
1:C:259:MET:O	1:C:261[B]:THR:HG23	2.15	0.47
1:D:176:TRP:CZ2	1:D:177[B]:TYR:CE1	3.03	0.46
1:A:176:TRP:CZ2	1:A:177[B]:TYR:CZ	3.04	0.46
1:A:177[A]:TYR:CD2	1:A:181:PHE:CE2	3.03	0.46
1:B:158:ASP:O	1:B:161[A]:ILE:HG12	2.15	0.45
1:C:158:ASP:O	1:C:161:ILE:HG12	2.16	0.45
1:C:38:TYR:O	1:C:39:ARG:HD2	2.16	0.45
1:D:132:ILE:HD12	1:D:154:ALA:HB3	1.97	0.45
1:D:261:THR:HG21	1:D:280:MET:HE2	1.99	0.45
1:B:177[A]:TYR:HD2	1:B:181:PHE:CE2	2.35	0.44
1:B:217:ARG:NH2	2:B:787:HOH:O	2.49	0.44
1:D:224:ARG:HD3	2:D:1210:HOH:O	2.17	0.44
1:C:160:ARG:HG2	1:C:163:ARG:HH22	1.82	0.44
1:A:195[B]:LYS:HE3	1:B:190:THR:O	2.18	0.44
1:A:176:TRP:CZ2	1:A:177[B]:TYR:CE1	3.06	0.44
1:D:272:MET:HE3	1:D:275:PHE:CD1	2.54	0.43
1:A:259:MET:O	1:A:261[B]:THR:HG23	2.18	0.43
1:C:80:ARG:HD3	1:C:320:HIS:CD2	2.53	0.43
1:C:261[A]:THR:HG21	1:C:280:MET:HE2	2.01	0.43
1:B:59:LEU:O	1:B:86:PRO:HD2	2.19	0.43
1:C:160:ARG:HG2	1:C:163:ARG:NH2	2.34	0.43
1:C:210:ASN:HB3	1:C:212:GLU:OE2	2.19	0.43
1:C:189[A]:GLU:HG3	1:C:236:PHE:HD2	1.84	0.42
1:D:176:TRP:CZ2	1:D:177[B]:TYR:CZ	3.08	0.42
1:B:216:GLU:HG2	2:B:1111:HOH:O	2.19	0.42
1:C:140:VAL:HG11	1:C:252:LEU:HB3	2.01	0.42
1:C:177[A]:TYR:HD2	1:C:181:PHE:CE2	2.37	0.42
1:A:189[B]:GLU:OE2	2:A:612:HOH:O	2.22	0.42
1:C:176:TRP:CZ2	1:C:177[B]:TYR:CZ	3.07	0.42
1:C:189[A]:GLU:HG3	1:C:236:PHE:CD2	2.54	0.42
1:D:59:LEU:O	1:D:86:PRO:HD2	2.20	0.42
1:C:129:ASP:HA	1:C:154:ALA:CB	2.48	0.41
1:B:177[A]:TYR:CD2	1:B:181:PHE:CE2	3.08	0.41
1:B:38:TYR:CD1	1:B:45:LYS:HE2	2.56	0.41
1:C:177[A]:TYR:CD2	1:C:181:PHE:CE2	3.09	0.41
1:A:39:ARG:HD2	1:A:116:GLN:OE1	2.20	0.40
1:B:176:TRP:CZ2	1:B:177[B]:TYR:CE1	3.09	0.40
1:C:107:ALA:HB1	1:C:138:MET:HB3	2.03	0.40
1:C:172:GLU:HB2	1:C:176:TRP:NE1	2.36	0.40
1:A:59:LEU:O	1:A:86:PRO:HD2	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:243:ASN:HD22	1:B:243:ASN:HA	1.75	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	304/301 (101%)	299 (98%)	5 (2%)	0	100	100
1	B	299/301 (99%)	292 (98%)	7 (2%)	0	100	100
1	C	302/301 (100%)	296 (98%)	6 (2%)	0	100	100
1	D	299/301 (99%)	293 (98%)	6 (2%)	0	100	100
All	All	1204/1204 (100%)	1180 (98%)	24 (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	253/248 (102%)	251 (99%)	2 (1%)	81	66
1	B	248/248 (100%)	246 (99%)	2 (1%)	81	66
1	C	251/248 (101%)	249 (99%)	2 (1%)	81	66
1	D	248/248 (100%)	246 (99%)	2 (1%)	81	66

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1000/992 (101%)	992 (99%)	8 (1%)	81 66

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

Mol	Chain	Res	Type
1	A	138	MET
1	A	226	TYR
1	B	138	MET
1	B	226	TYR
1	C	138	MET
1	C	226	TYR
1	D	138	MET
1	D	226	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	53	GLN
1	A	105	GLN
1	A	243	ASN
1	A	269	HIS
1	A	308	ASN
1	B	53	GLN
1	B	105	GLN
1	B	170	GLN
1	B	243	ASN
1	B	308	ASN
1	C	53	GLN
1	C	105	GLN
1	C	243	ASN
1	C	269	HIS
1	C	308	ASN
1	D	105	GLN
1	D	170	GLN
1	D	243	ASN
1	D	308	ASN
1	D	321	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](#)

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 [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	297/301 (98%)	0.14	5 (1%) 70 75	5, 11, 26, 43	4 (1%)
1	B	296/301 (98%)	0.06	5 (1%) 70 75	6, 12, 30, 46	3 (1%)
1	C	296/301 (98%)	0.21	9 (3%) 50 55	5, 11, 27, 44	3 (1%)
1	D	298/301 (99%)	0.12	6 (2%) 65 70	5, 10, 26, 52	4 (1%)
All	All	1187/1204 (98%)	0.13	25 (2%) 63 68	5, 11, 28, 52	14 (1%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	319	ARG	6.2
1	C	25	ALA	6.0
1	D	319	ARG	5.1
1	D	322	HIS	5.0
1	B	25	ALA	4.7
1	D	321	HIS	4.5
1	C	320	HIS	3.0
1	C	319	ARG	3.0
1	B	317	ARG	2.9
1	A	319	ARG	2.8
1	C	251	GLU	2.7
1	A	255	THR	2.7
1	D	320	HIS	2.7
1	B	320	HIS	2.6
1	B	177[A]	TYR	2.6
1	C	177[A]	TYR	2.4
1	D	177[A]	TYR	2.4
1	C	120	ASP	2.3
1	C	318	GLY	2.3
1	D	285	GLU	2.3
1	A	177[A]	TYR	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	253	ALA	2.2
1	C	255	THR	2.1
1	C	170	GLN	2.1
1	A	321	HIS	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.