



# Full wwPDB X-ray Structure Validation Report ⓘ

May 26, 2020 – 05:44 am BST

PDB ID : 4BRO  
Title : Legionella pneumophila NTPDase1 crystal form IV (part-open)  
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Deposited on : 2013-06-04  
Resolution : 1.99 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](mailto: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.

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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

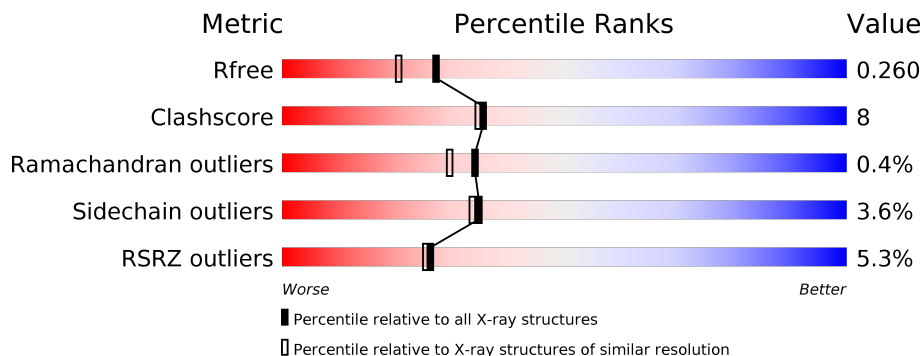
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.99 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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  $\geq 3$ , 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	368	
1	B	368	

## 2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 5726 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 ECTONUCLEOSIDE TRIPHOSPHATE DIPHOSPHOHYDROLASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	351	2825	1800	464	547	14	0	6	0
1	B	351	2796	1778	460	544	14	0	4	0

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	34	MET	-	expression tag	UNP Q5ZUA2
A	394	LEU	-	expression tag	UNP Q5ZUA2
A	395	GLU	-	expression tag	UNP Q5ZUA2
A	396	HIS	-	expression tag	UNP Q5ZUA2
A	397	HIS	-	expression tag	UNP Q5ZUA2
A	398	HIS	-	expression tag	UNP Q5ZUA2
A	399	HIS	-	expression tag	UNP Q5ZUA2
A	400	HIS	-	expression tag	UNP Q5ZUA2
A	401	HIS	-	expression tag	UNP Q5ZUA2
A	137	ASP	GLU	conflict	UNP Q5ZUA2
A	149	VAL	ALA	conflict	UNP Q5ZUA2
B	34	MET	-	expression tag	UNP Q5ZUA2
B	394	LEU	-	expression tag	UNP Q5ZUA2
B	395	GLU	-	expression tag	UNP Q5ZUA2
B	396	HIS	-	expression tag	UNP Q5ZUA2
B	397	HIS	-	expression tag	UNP Q5ZUA2
B	398	HIS	-	expression tag	UNP Q5ZUA2
B	399	HIS	-	expression tag	UNP Q5ZUA2
B	400	HIS	-	expression tag	UNP Q5ZUA2
B	401	HIS	-	expression tag	UNP Q5ZUA2
B	137	ASP	GLU	conflict	UNP Q5ZUA2
B	149	VAL	ALA	conflict	UNP Q5ZUA2

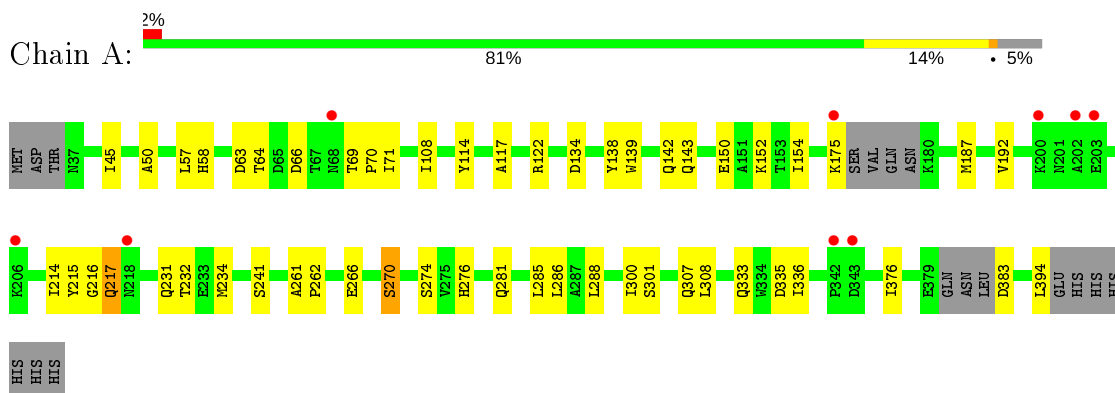
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	71	Total O 73 73	0	2
2	B	32	Total O 32 32	0	0

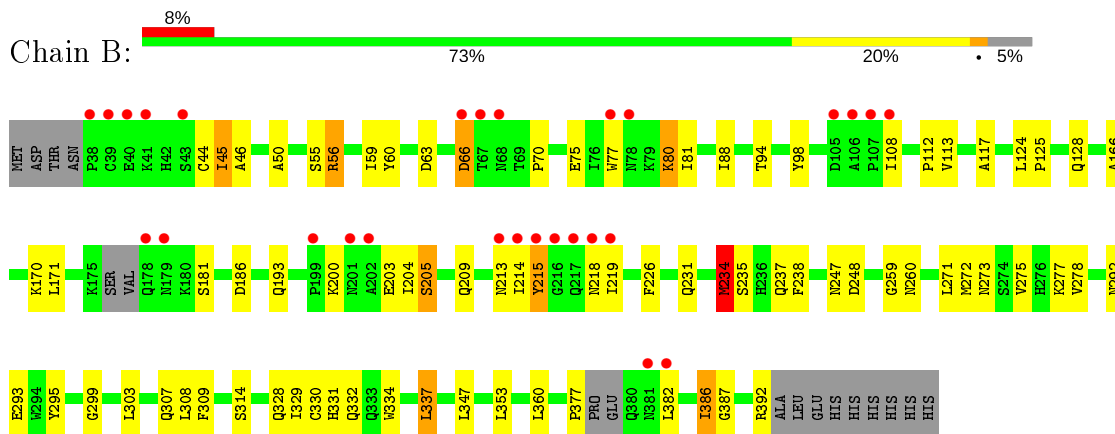
### 3 Residue-property plots [i](#)

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: ECTONUCLEOSIDE TRIPHOSPHATE DIPHOSPHOHYDROLASE I



- Molecule 1: ECTONUCLEOSIDE TRIPHOSPHATE DIPHOSPHOHYDROLASE I



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	155.99Å 155.99Å 79.22Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	34.17 – 1.99 34.17 – 1.99	Depositor EDS
% Data completeness (in resolution range)	99.1 (34.17-1.99) 99.4 (34.17-1.99)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.86 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.215 , 0.241 0.236 , 0.260	Depositor DCC
$R_{free}$ test set	1448 reflections (1.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	30.3	Xtriage
Anisotropy	0.317	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 50.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	0.000 for h,-h-k,-l	Xtriage
Reported twinning fraction	0.837 for H, K, L 0.163 for K, H, -L	Depositor
Outliers	0 of 74531 reflections	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	5726	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.74% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	0.66	0/2916	0.80	5/3975 (0.1%)
1	B	0.53	0/2879	0.69	2/3924 (0.1%)
All	All	0.60	0/5795	0.75	7/7899 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	234	MET	CG-SD-CE	7.70	112.51	100.20
1	B	337	LEU	CA-CB-CG	7.48	132.51	115.30
1	A	234	MET	CG-SD-CE	6.82	111.11	100.20
1	A	134	ASP	CB-CG-OD1	6.81	124.43	118.30
1	A	122	ARG	NE-CZ-NH2	-5.97	117.32	120.30
1	A	134	ASP	CB-CG-OD2	-5.14	113.67	118.30
1	A	308	LEU	CA-CB-CG	-5.14	103.48	115.30

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	2825	0	2692	24	0
1	B	2796	0	2643	66	0
2	A	73	0	0	2	0
2	B	32	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5726	0	5335	89	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 8.

All (89) 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:272:MET:HE1	1:B:360:LEU:HD12	1.48	0.95
1:B:214:ILE:HD11	1:B:219:ILE:HD12	1.52	0.92
1:B:44:CYS:HB2	1:B:60:TYR:O	1.71	0.91
1:B:234:MET:CE	1:B:238:PHE:HD2	1.85	0.88
1:B:234:MET:CE	1:B:238:PHE:CD2	2.61	0.82
1:B:234:MET:HE3	1:B:238:PHE:HD2	1.47	0.79
1:B:88:ILE:HD12	1:B:94:THR:HG22	1.64	0.78
1:B:234:MET:HE1	1:B:238:PHE:CD2	2.22	0.75
1:B:234:MET:HE3	1:B:238:PHE:CD2	2.24	0.73
1:B:181:SER:H	1:B:292:ASN:HB2	1.54	0.72
1:A:307:GLN:CD	1:A:307:GLN:H	1.94	0.70
1:B:328:GLN:O	1:B:332:GLN:HG3	1.92	0.70
1:B:231:GLN:HG3	1:B:353:LEU:HD22	1.76	0.68
1:B:170:LYS:HD2	1:B:382:LEU:HB2	1.76	0.68
1:B:234:MET:O	1:B:234:MET:HE3	1.96	0.66
1:B:81:ILE:HD12	1:B:81:ILE:O	1.95	0.65
1:B:337:LEU:HG	1:B:347:LEU:HD21	1.80	0.64
1:B:231:GLN:HG3	1:B:353:LEU:CD2	2.28	0.63
1:B:234:MET:HE2	1:B:235:SER:HA	1.79	0.63
1:B:272:MET:HE1	1:B:360:LEU:CD1	2.27	0.63
1:B:272:MET:HE2	1:B:360:LEU:HA	1.82	0.61
1:B:272:MET:CE	1:B:360:LEU:HA	2.32	0.59
1:B:81:ILE:HD12	1:B:81:ILE:C	2.24	0.58
1:B:205:SER:HB3	2:B:2019:HOH:O	2.03	0.57
1:A:335:ASP:HB2	2:A:2069:HOH:O	2.04	0.57
1:B:170:LYS:HB2	1:B:382:LEU:HD13	1.87	0.57
1:B:213:ASN:HA	1:B:218:ASN:HA	1.87	0.56
1:B:247:ASN:O	1:B:248:ASP:HB2	2.04	0.56
1:B:334:TRP:HZ3	1:B:347:LEU:HD23	1.70	0.56
1:B:63:ASP:O	1:B:70:PRO:HA	2.04	0.56
1:A:281:GLN:O	1:A:285:LEU:HD13	2.05	0.56
1:B:299:GLY:HA3	2:B:2016:HOH:O	2.05	0.55
1:B:186:ASP:HB3	1:B:193:GLN:HB2	1.88	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:152:LYS:HE2	1:A:154:ILE:HG22	1.90	0.54
1:B:303:LEU:HD11	1:B:309:PHE:CE2	2.44	0.52
1:B:307:GLN:H	1:B:307:GLN:CD	2.13	0.52
1:A:63:ASP:O	1:A:70:PRO:HA	2.09	0.52
1:B:259:GLY:HA3	1:B:330:CYS:O	2.10	0.52
1:A:175:LYS:HE3	1:A:215:TYR:HB3	1.92	0.51
1:A:64:THR:HA	1:A:69:THR:O	2.09	0.51
1:B:328:GLN:HB2	1:B:329:ILE:HD12	1.91	0.51
1:A:139:TRP:O	1:A:143[B]:GLN:HG2	2.11	0.51
1:B:234:MET:HG3	1:B:235:SER:N	2.26	0.51
1:A:216:GLY:O	1:A:217:GLN:HB3	2.11	0.50
1:A:307:GLN:CD	1:A:307:GLN:N	2.65	0.50
1:B:50:ALA:HB3	1:B:117:ALA:HA	1.92	0.50
1:B:66:ASP:N	1:B:66:ASP:OD1	2.36	0.50
1:B:273:ASN:O	1:B:277:LYS:HD3	2.12	0.49
1:B:81:ILE:HD13	1:B:98:TYR:CE1	2.48	0.49
1:A:63:ASP:HB2	1:A:71:ILE:HG13	1.95	0.48
1:B:234:MET:HE3	1:B:234:MET:C	2.34	0.48
1:B:204:ILE:HB	1:B:209:GLN:NE2	2.29	0.48
1:B:166:ALA:HA	1:B:386:ILE:HD11	1.96	0.48
1:A:262:PRO:O	1:A:266:GLU:HG3	2.14	0.47
1:A:376:ILE:N	1:A:376:ILE:HD12	2.29	0.47
1:A:276:HIS:HE2	1:B:237[B]:GLN:HG3	1.80	0.47
1:A:270:SER:O	1:A:274:SER:HB2	2.15	0.47
1:B:214:ILE:O	1:B:215:TYR:C	2.54	0.46
1:B:308:LEU:O	1:B:328:GLN:HG3	2.16	0.46
1:A:231:GLN:HG3	1:A:232:THR:N	2.30	0.46
1:B:392:ARG:HG3	1:B:392:ARG:H	1.58	0.46
1:B:307:GLN:N	1:B:307:GLN:CD	2.69	0.46
1:B:271:LEU:HD12	1:B:275:VAL:HB	1.97	0.45
1:B:124:LEU:HD13	1:B:128:GLN:HG2	1.99	0.45
1:B:45:ILE:HG22	1:B:112:PRO:HG2	1.99	0.45
1:B:59:ILE:HD12	1:B:77:TRP:HB3	1.99	0.45
1:A:333:GLN:HB3	1:A:336:ILE:HG22	1.98	0.44
1:B:125:PRO:HG2	1:B:128:GLN:HB2	1.99	0.44
1:B:55:SER:HB2	1:B:81:ILE:HD11	2.00	0.44
1:B:231:GLN:CG	1:B:353:LEU:HD21	2.48	0.44
1:A:50:ALA:HB3	1:A:117:ALA:HA	2.01	0.43
1:A:58:HIS:NE2	2:A:2003:HOH:O	2.37	0.43
1:B:226:PHE:CE2	1:B:278:VAL:HG22	2.53	0.43
1:B:386:ILE:HG13	1:B:387:GLY:N	2.34	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:261:ALA:HB3	1:A:262:PRO:HD3	2.00	0.43
1:B:60:TYR:CE1	1:B:386:ILE:HG22	2.53	0.43
1:A:286:LEU:HA	1:A:286:LEU:HD23	1.77	0.42
1:B:308:LEU:HD23	1:B:308:LEU:HA	1.82	0.42
1:A:138:TYR:O	1:A:142:GLN:HG3	2.19	0.42
1:B:231:GLN:CG	1:B:353:LEU:CD2	2.97	0.42
1:B:46:ALA:HB3	1:B:113:VAL:HG13	2.01	0.42
1:A:45:ILE:HD11	1:A:114:TYR:CE1	2.55	0.42
1:A:187:MET:HA	1:A:192:VAL:HG12	2.02	0.41
1:B:292:ASN:O	1:B:293:GLU:HG3	2.20	0.41
1:B:260:ASN:HD22	1:B:331:HIS:CE1	2.38	0.41
1:B:171:LEU:HD11	1:B:295:TYR:CZ	2.56	0.41
1:B:56:ARG:HG3	1:B:80:LYS:HG3	2.03	0.41
1:B:334:TRP:HZ3	1:B:347:LEU:CD2	2.33	0.40
1:B:314:SER:OG	1:B:377:PRO:HG3	2.21	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	351/368 (95%)	329 (94%)	21 (6%)	1 (0%)	41	37
1	B	349/368 (95%)	330 (95%)	17 (5%)	2 (1%)	25	19
All	All	700/736 (95%)	659 (94%)	38 (5%)	3 (0%)	34	30

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	217	GLN
1	B	200	LYS
1	B	215	TYR

### 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	315/328 (96%)	303 (96%)	12 (4%)	33	31
1	B	309/328 (94%)	299 (97%)	10 (3%)	39	38
All	All	624/656 (95%)	602 (96%)	22 (4%)	35	35

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	57	LEU
1	A	66	ASP
1	A	108	ILE
1	A	150	GLU
1	A	214	ILE
1	A	241	SER
1	A	270	SER
1	A	288	LEU
1	A	300	ILE
1	A	301	SER
1	A	383	ASP
1	A	394	LEU
1	B	45	ILE
1	B	56	ARG
1	B	66	ASP
1	B	75	GLU
1	B	80	LYS
1	B	108	ILE
1	B	203	GLU
1	B	205	SER
1	B	234	MET
1	B	386	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	147	GLN
1	B	289	ASN
1	B	292	ASN
1	B	331	HIS
1	B	349	GLN

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	351/368 (95%)	0.30	9 (2%) 56 54	18, 28, 46, 64	0
1	B	351/368 (95%)	0.54	28 (7%) 12 11	22, 36, 61, 76	0
All	All	702/736 (95%)	0.42	37 (5%) 26 25	18, 32, 55, 76	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	77	TRP	4.8
1	B	216	GLY	4.8
1	B	43	SER	4.6
1	B	202	ALA	4.2
1	A	202	ALA	3.8
1	B	214	ILE	3.5
1	A	68	ASN	3.4
1	B	108	ILE	3.4
1	B	66	ASP	3.4
1	B	67	THR	3.3
1	B	178	GLN	3.1
1	B	68	ASN	3.0
1	B	218	ASN	3.0
1	A	203	GLU	2.9
1	B	213	ASN	2.8
1	B	38	PRO	2.8
1	A	218	ASN	2.8
1	B	106	ALA	2.6
1	B	199	PRO	2.6
1	B	179	ASN	2.6
1	B	215	TYR	2.5
1	A	200	LYS	2.5
1	B	40	GLU	2.5
1	B	382	LEU	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	217	GLN	2.4
1	B	39	CYS	2.4
1	A	342	PRO	2.4
1	B	78	ASN	2.4
1	B	105	ASP	2.3
1	B	41	LYS	2.3
1	B	381	ASN	2.3
1	A	175	LYS	2.2
1	B	107	PRO	2.2
1	A	343	ASP	2.1
1	B	219	ILE	2.1
1	B	201	ASN	2.0
1	A	206	LYS	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.