



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 17, 2024 – 01:44 PM EDT

PDB ID : 3QJH  
Title : The crystal structure of the 5c.c7 TCR  
Authors : Ely, L.K.; Newell, E.W.; Davis, M.M.; Garcia, K.C.  
Deposited on : 2011-01-28  
Resolution : 1.90 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.

The types of validation reports are described at

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

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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) : 1.20.1  
EDS : 2.37.1  
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) : 2.37.1

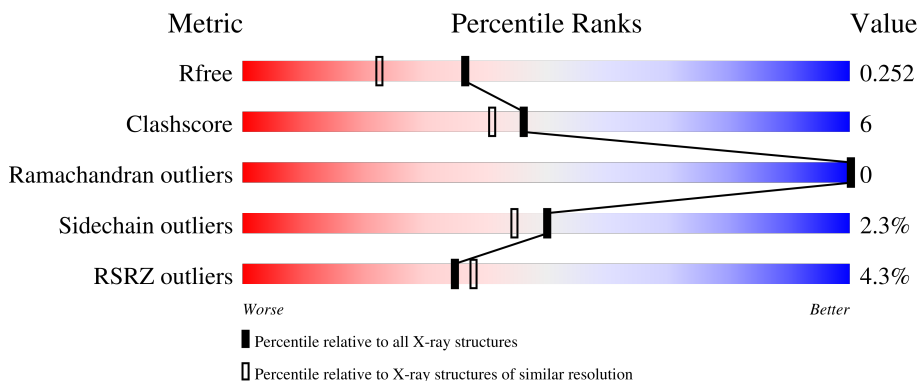
# 1 Overall quality at a glance

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  $\geq 3$ , 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	205	 4% 77% 17% • 5%
1	C	205	 5% 83% 12% 5%
2	B	243	 5% 87% 12% •
2	D	243	 2% 86% 13% •

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7223 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 5c.c7 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	195	1502	933	259	302	8	0	0	0
1	C	195	1503	935	259	301	8	0	0	0

- Molecule 2 is a protein called 5c.c7 beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	243	1915	1206	333	367	9	0	0	0
2	D	242	1915	1208	334	364	9	0	0	0

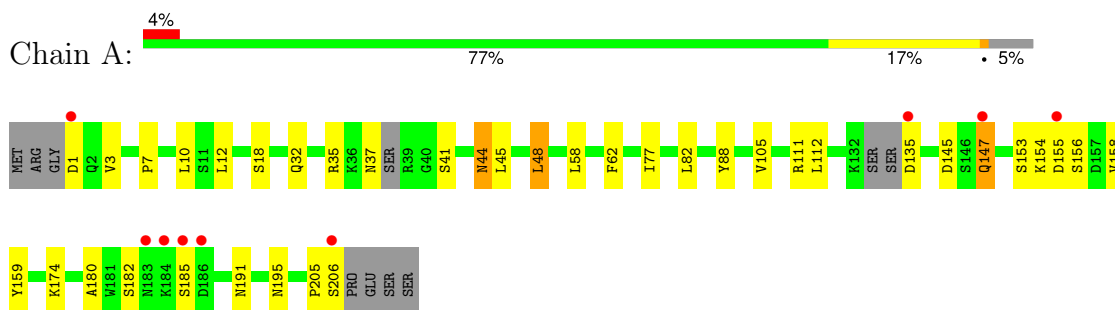
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	78	Total 78	O 78	0	0
3	B	111	Total 111	O 111	0	0
3	C	79	Total 79	O 79	0	0
3	D	120	Total 120	O 120	0	0

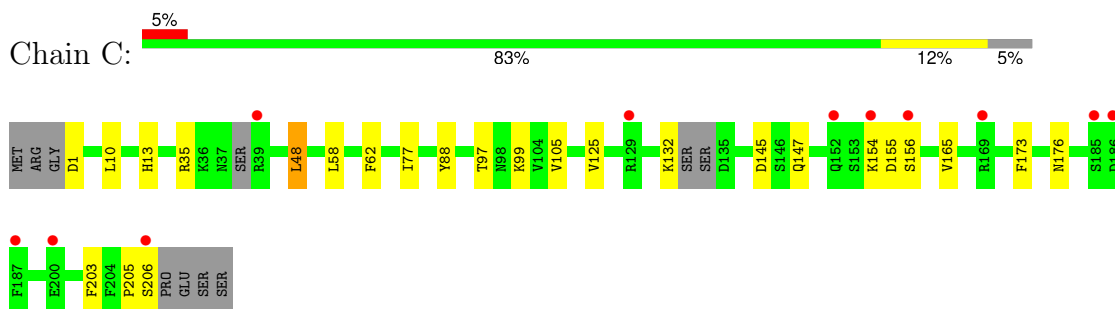
### 3 Residue-property plots [i](#)

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.

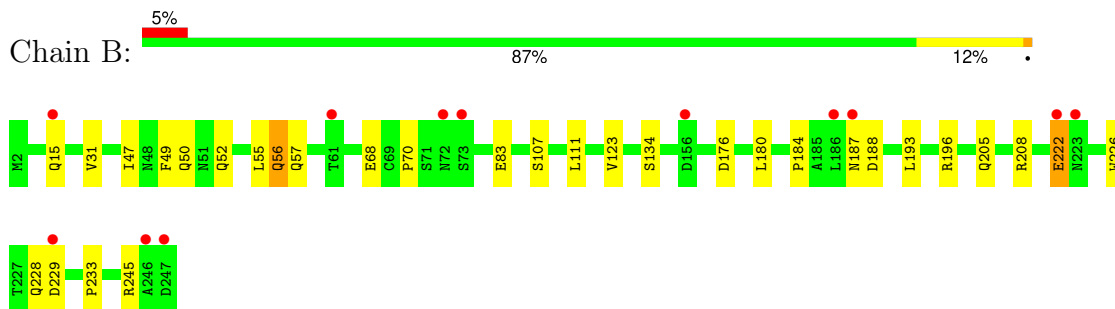
- Molecule 1: 5c.c7 alpha chain



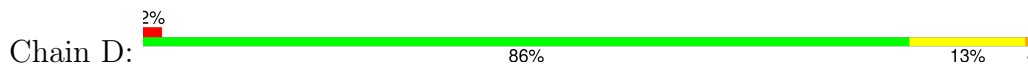
- Molecule 1: 5c.c7 alpha chain

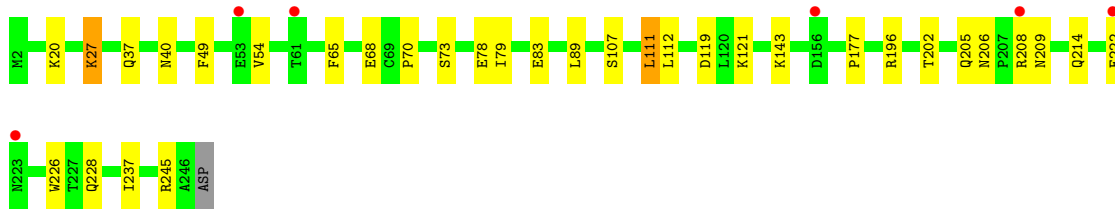


- Molecule 2: 5c.c7 beta chain



- Molecule 2: 5c.c7 beta chain





## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	133.17Å 139.46Å 61.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.32 – 1.90 46.32 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.5 (46.32-1.90) 99.5 (46.32-1.90)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	0.04	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.35 (at 1.90Å)	Xtrriage
Refinement program	PHENIX 1.6.4_486	Depositor
R, $R_{free}$	0.225 , 0.256 0.223 , 0.252	Depositor DCC
$R_{free}$ test set	4568 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.5	Xtrriage
Anisotropy	0.237	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 47.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.011 for k,h,-l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	7223	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.27% 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	0.41	0/1529	0.54	0/2069
1	C	0.43	0/1530	0.55	0/2069
2	B	0.40	0/1964	0.52	0/2673
2	D	0.42	0/1964	0.54	0/2672
All	All	0.42	0/6987	0.54	0/9483

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	1502	0	1413	29	0
1	C	1503	0	1420	20	0
2	B	1915	0	1795	19	1
2	D	1915	0	1816	25	1
3	A	78	0	0	3	0
3	B	111	0	0	4	0
3	C	79	0	0	1	0
3	D	120	0	0	4	0
All	All	7223	0	6444	84	2

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.

All (84) 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:154:LYS:HD3	1:C:156:SER:HA	1.50	0.94
1:A:32:GLN:NE2	1:A:44:ASN:OD1	2.04	0.90
2:B:184:PRO:HG2	1:C:154:LYS:HG3	1.59	0.84
2:B:15:GLN:HE22	2:B:83:GLU:HG2	1.44	0.81
1:A:1:ASP:O	1:A:105:VAL:HG23	1.86	0.75
1:C:97:THR:OG1	1:C:99:LYS:HG2	1.88	0.74
2:B:52:GLN:OE1	3:B:331:HOH:O	2.08	0.71
2:B:15:GLN:NE2	2:B:83:GLU:HG2	2.05	0.71
3:A:281:HOH:O	1:C:13:HIS:HE1	1.76	0.67
1:A:154:LYS:CD	1:C:156:SER:HA	2.25	0.66
2:D:222:GLU:HA	3:D:295:HOH:O	1.97	0.65
1:C:132:LYS:HE2	3:C:245:HOH:O	1.97	0.65
1:A:185:SER:HA	3:A:422:HOH:O	1.98	0.64
1:A:35:ARG:HD3	1:A:88:TYR:CZ	2.34	0.62
2:D:65:PHE:CE2	2:D:79:ILE:HG12	2.34	0.62
1:A:153:SER:CB	1:A:158:VAL:HG23	2.30	0.61
2:B:56:GLN:HG2	3:B:315:HOH:O	2.01	0.61
1:A:154:LYS:HD3	1:C:156:SER:CA	2.27	0.61
1:A:153:SER:OG	1:A:158:VAL:HG23	2.02	0.60
2:D:222:GLU:N	2:D:222:GLU:OE1	2.35	0.60
2:D:119:ASP:OD1	2:D:121:LYS:HD3	2.03	0.59
2:B:50:GLN:HB2	2:B:55:LEU:HD11	1.84	0.58
1:A:147:GLN:OE1	2:D:40:ASN:CG	2.41	0.58
2:D:49:PHE:CE1	2:D:54:VAL:HG22	2.40	0.56
1:C:145:ASP:OD2	1:C:147:GLN:HG2	2.05	0.56
1:C:205:PRO:O	1:C:206:SER:HB3	2.05	0.55
2:B:47:ILE:HG13	2:B:57:GLN:HB3	1.88	0.55
2:B:222:GLU:HA	3:B:282:HOH:O	2.06	0.54
1:A:153:SER:HA	1:A:195:ASN:ND2	2.23	0.54
1:C:203:PHE:CE2	1:C:205:PRO:HG3	2.44	0.53
1:A:205:PRO:O	1:A:206:SER:HB3	2.09	0.52
2:D:107:SER:HB2	3:D:270:HOH:O	2.08	0.52
1:A:155:ASP:OD1	1:A:158:VAL:HG22	2.11	0.51
2:B:226:TRP:CE2	2:B:228:GLN:HB2	2.46	0.51
2:B:176:ASP:HB2	2:B:193:LEU:HD12	1.93	0.50
2:D:214:GLN:HG3	2:D:237:ILE:CG2	2.42	0.50
2:D:226:TRP:CZ2	2:D:228:GLN:HG3	2.47	0.50
1:A:82:LEU:HD22	1:A:174:LYS:HD3	1.95	0.49
1:A:3:VAL:HG23	1:A:105:VAL:HG22	1.94	0.49
2:B:226:TRP:CZ2	2:B:228:GLN:HG3	2.48	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:20:LYS:HE3	2:D:78:GLU:OE2	2.14	0.48
1:C:35:ARG:HD3	1:C:88:TYR:CZ	2.48	0.48
1:A:58:LEU:CD2	1:A:77:ILE:HG12	2.44	0.47
1:C:58:LEU:HD22	1:C:77:ILE:HG12	1.96	0.47
2:D:205:GLN:HA	2:D:245:ARG:O	2.13	0.47
2:D:206:ASN:HB3	2:D:209:ASN:ND2	2.28	0.47
1:A:154:LYS:O	1:C:155:ASP:HA	2.15	0.47
2:B:31:VAL:HA	2:B:49:PHE:O	2.15	0.46
2:D:226:TRP:NE1	2:D:228:GLN:HB2	2.31	0.46
1:A:44:ASN:HD22	1:A:45:LEU:N	2.13	0.46
1:A:48:LEU:HD13	1:A:62:PHE:HB3	1.98	0.46
1:A:159:TYR:O	1:A:180:ALA:HA	2.16	0.46
2:D:111:LEU:HD22	2:D:112:LEU:N	2.31	0.46
2:B:68:GLU:HG3	2:B:70:PRO:HD3	1.98	0.46
2:B:226:TRP:NE1	2:B:228:GLN:HB2	2.31	0.46
1:C:173:PHE:CD2	2:D:143:LYS:HE2	2.51	0.45
1:C:165:VAL:HG22	1:C:176:ASN:OD1	2.16	0.45
2:D:37:GLN:HE21	2:D:89:LEU:HD23	1.82	0.45
2:B:180:LEU:C	2:B:180:LEU:HD12	2.38	0.44
1:A:145:ASP:OD1	1:A:147:GLN:HB2	2.17	0.44
2:D:226:TRP:CE2	2:D:228:GLN:HB2	2.52	0.44
2:B:123:VAL:HG12	2:B:233:PRO:HB2	1.99	0.43
1:C:58:LEU:CD2	1:C:77:ILE:HG12	2.48	0.43
2:B:205:GLN:HA	2:B:245:ARG:O	2.19	0.43
1:A:12:LEU:HD21	1:A:18:SER:HB2	2.01	0.43
1:A:135:ASP:HA	3:A:216:HOH:O	2.19	0.43
1:C:125:VAL:O	1:C:205:PRO:HD2	2.19	0.43
1:A:7:PRO:HB3	1:C:10:LEU:HD11	2.01	0.42
1:A:147:GLN:HE22	2:D:40:ASN:HB3	1.85	0.42
2:D:202:THR:HG23	3:D:343:HOH:O	2.20	0.42
2:B:107:SER:HB2	3:B:272:HOH:O	2.20	0.42
2:B:187:ASN:O	2:B:188:ASP:HB2	2.21	0.41
1:A:158:VAL:HG12	1:A:182:SER:HB2	2.03	0.41
2:D:37:GLN:NE2	2:D:89:LEU:HD23	2.36	0.41
1:A:10:LEU:HD23	1:A:112:LEU:HD13	2.02	0.41
1:A:111:ARG:NH1	1:A:112:LEU:O	2.54	0.41
2:D:70:PRO:HB2	2:D:73:SER:HB2	2.03	0.41
2:D:177:PRO:HD2	3:D:360:HOH:O	2.20	0.41
2:D:27:LYS:HB3	2:D:27:LYS:HE2	1.69	0.40
2:D:68:GLU:HG3	2:D:70:PRO:HD3	2.03	0.40
1:C:1:ASP:O	1:C:105:VAL:HG23	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:145:ASP:C	1:A:147:GLN:H	2.24	0.40
1:C:48:LEU:HD13	1:C:62:PHE:HB3	2.02	0.40
2:D:214:GLN:HG3	2:D:237:ILE:HG21	2.03	0.40

All (2) 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)
2:D:83:GLU:OE2	2:D:208:ARG:NH1[1_556]	1.90	0.30
2:B:83:GLU:OE2	2:B:208:ARG:NH1[1_554]	2.03	0.17

### 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	189/205 (92%)	189 (100%)	0	0	100	100
1	C	189/205 (92%)	187 (99%)	2 (1%)	0	100	100
2	B	241/243 (99%)	235 (98%)	6 (2%)	0	100	100
2	D	240/243 (99%)	232 (97%)	8 (3%)	0	100	100
All	All	859/896 (96%)	843 (98%)	16 (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	166/181 (92%)	159 (96%)	7 (4%)	30	20
1	C	166/181 (92%)	165 (99%)	1 (1%)	86	87
2	B	206/215 (96%)	200 (97%)	6 (3%)	42	35
2	D	208/215 (97%)	205 (99%)	3 (1%)	67	65
All	All	746/792 (94%)	729 (98%)	17 (2%)	50	45

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	ASN
1	A	41	SER
1	A	44	ASN
1	A	48	LEU
1	A	147	GLN
1	A	156	SER
1	A	191	ASN
2	B	56	GLN
2	B	111	LEU
2	B	134	SER
2	B	196	ARG
2	B	222	GLU
2	B	229	ASP
1	C	48	LEU
2	D	27	LYS
2	D	111	LEU
2	D	196	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	15	GLN
2	B	36	GLN
2	B	56	GLN
2	D	36	GLN
2	D	37	GLN
2	D	100	ASN

### 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

### 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	195/205 (95%)	0.39	9 (4%) 32 35	21, 31, 49, 67	0
1	C	195/205 (95%)	0.52	11 (5%) 24 27	20, 31, 51, 70	0
2	B	243/243 (100%)	0.29	12 (4%) 29 33	21, 30, 49, 68	2 (0%)
2	D	242/243 (99%)	0.31	6 (2%) 57 60	18, 29, 45, 56	2 (0%)
All	All	875/896 (97%)	0.37	38 (4%) 35 38	18, 30, 49, 70	4 (0%)

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	185	SER	7.4
1	A	185	SER	6.1
1	C	186	ASP	4.9
1	A	186	ASP	4.1
2	D	222	GLU	3.7
2	B	61	THR	3.6
1	A	206	SER	3.5
2	B	247	ASP	3.4
2	B	229	ASP	3.4
2	D	223	ASN	3.3
1	C	206	SER	3.3
2	D	61	THR	3.3
2	B	223	ASN	3.1
2	D	53	GLU	2.9
2	B	187	ASN	2.9
1	C	187	PHE	2.9
1	A	184	LYS	2.9
1	C	129	ARG	2.6
1	C	156	SER	2.6
2	D	156	ASP	2.5
2	B	246	ALA	2.5

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Mol	Chain	Res	Type	RSRZ
1	C	200	GLU	2.4
2	B	222	GLU	2.4
2	B	72	ASN	2.4
2	D	208	ARG	2.4
1	A	1	ASP	2.3
1	C	154	LYS	2.3
1	A	147	GLN	2.3
1	C	152	GLN	2.3
2	B	156	ASP	2.2
1	A	183	ASN	2.2
2	B	186	LEU	2.2
1	C	169	ARG	2.1
1	A	155	ASP	2.1
2	B	15	GLN	2.1
2	B	73	SER	2.1
1	A	135	ASP	2.0
1	C	39	ARG	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.