



Full wwPDB X-ray Structure Validation Report ⓘ

May 26, 2020 – 04:06 pm BST

PDB ID : 3BVQ
Title : Crystal Structure of Apo NotI Restriction Endonuclease
Authors : Lambert, A.R.; Sussman, D.; Shen, B.; Stoddard, B.L.
Deposited on : 2008-01-07
Resolution : 2.80 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
Mogul : 1.8.5 (274361), CSD as541be (2020)
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

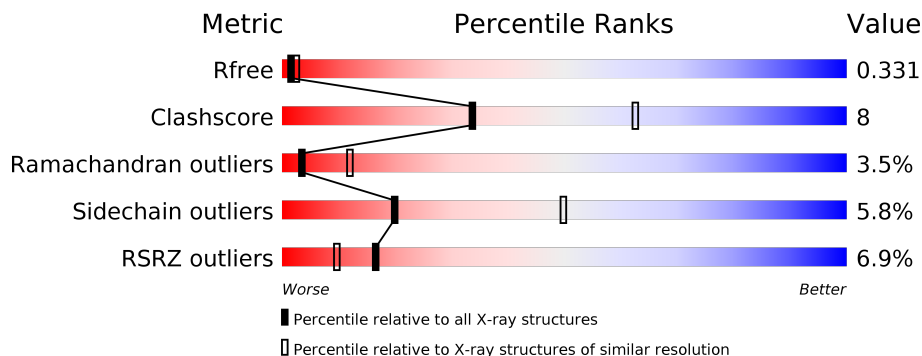
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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	383	
1	B	383	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5160 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.

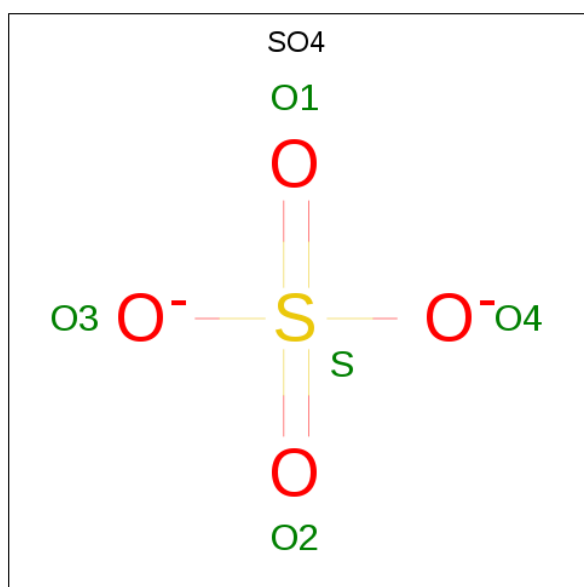
- Molecule 1 is a protein called NotI restriction endonuclease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	S				Se
1	A	342	2542	1628	434	470	5	5	0	0	0
1	B	352	2606	1661	439	496	5	5	0	0	0

- Molecule 2 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Fe	0	0
			1	1		
2	A	1	Total	Fe	0	0
			1	1		

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O₄S).

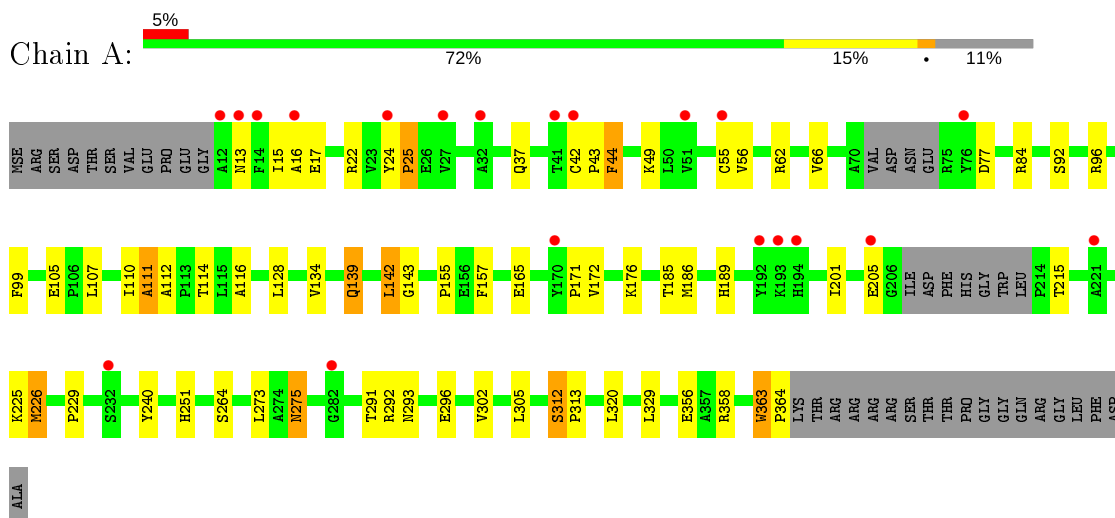


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

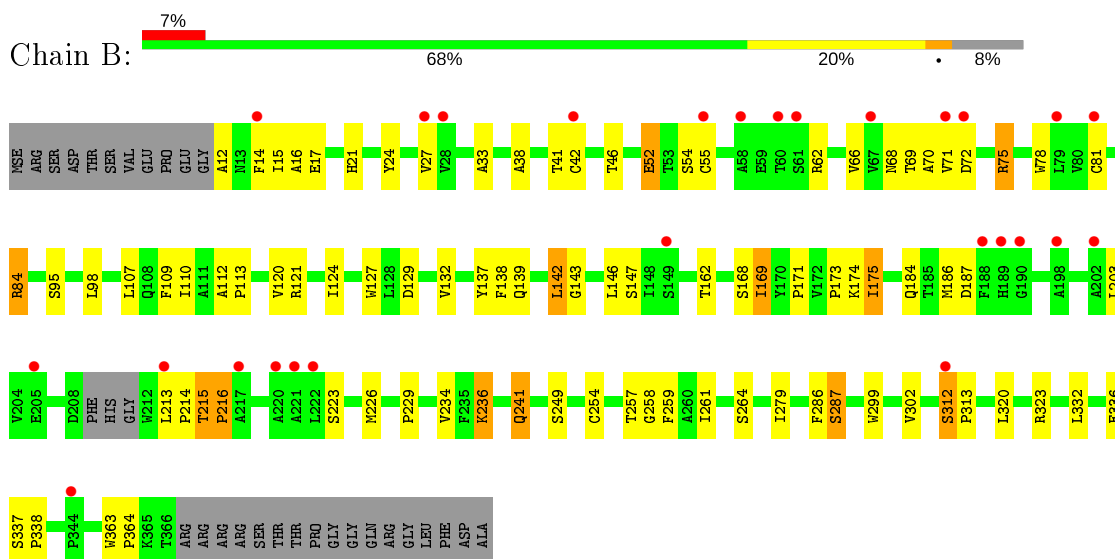
3 Residue-property plots [i](#)

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: NotI restriction endonuclease



- Molecule 1: NotI restriction endonuclease



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	74.89Å 74.89Å 274.11Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.83 – 2.80 45.82 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.6 (45.83-2.80) 99.6 (45.82-2.80)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	9.34 (at 2.81Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.262 , 0.335 0.262 , 0.331	Depositor DCC
R_{free} test set	1028 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	55.5	Xtrriage
Anisotropy	0.963	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 54.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	5160	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.47% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: FE, SO4

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	0/2605	0.53	1/3551 (0.0%)
1	B	0.36	0/2670	0.52	0/3648
All	All	0.36	0/5275	0.52	1/7199 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	364	PRO	N-CA-CB	5.91	110.39	103.30

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	2542	0	2371	34	0
1	B	2606	0	2398	55	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
All	All	5160	0	4769	84	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 (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:B:249:SER:HB3	1:B:257:THR:HG22	1.22	1.11
1:B:312:SER:HB3	1:B:313:PRO:HD3	1.41	1.03
1:B:249:SER:HB3	1:B:257:THR:CG2	2.05	0.87
1:A:302:VAL:HB	1:A:320:LEU:HB2	1.72	0.72
1:B:249:SER:CB	1:B:257:THR:HG22	2.11	0.71
1:B:287:SER:HA	1:B:323:ARG:O	1.91	0.70
1:A:42:CYS:SG	1:A:55:CYS:HB2	2.31	0.70
1:A:77:ASP:HB2	1:A:305:LEU:HD13	1.74	0.69
1:A:92:SER:O	1:A:96:ARG:HG3	1.92	0.69
1:B:312:SER:HB3	1:B:313:PRO:CD	2.21	0.68
1:B:46:THR:HG23	1:B:52:GLU:HA	1.75	0.67
1:A:15:ILE:HG23	1:A:226:MSE:HE1	1.76	0.67
1:B:15:ILE:HG23	1:B:226:MSE:HE1	1.75	0.66
1:B:69:THR:HG21	1:B:229:PRO:HD3	1.78	0.66
1:B:312:SER:CB	1:B:313:PRO:HD3	2.24	0.65
1:A:110:ILE:HD11	1:A:134:VAL:HG13	1.79	0.65
1:A:186:MSE:HE2	1:A:229:PRO:HB3	1.81	0.63
1:B:14:PHE:HD2	1:B:223:SER:HB2	1.64	0.62
1:A:112:ALA:HB3	1:A:143:GLY:HA3	1.83	0.59
1:B:16:ALA:HB3	1:B:66:VAL:HG12	1.84	0.59
1:A:110:ILE:O	1:A:111:ALA:CB	2.50	0.58
1:A:273:LEU:HD21	1:A:329:LEU:HD12	1.87	0.56
1:B:213:LEU:N	1:B:214:PRO:HD2	2.20	0.56
1:B:215:THR:H	1:B:216:PRO:CD	2.19	0.56
1:A:363:TRP:CH2	1:B:173:PRO:HG3	2.41	0.56
1:B:41:THR:HA	1:B:54:SER:HA	1.88	0.54
1:A:24:TYR:HB3	1:A:25:PRO:HD3	1.87	0.54
1:B:241:GLN:NE2	1:B:259:PHE:HZ	2.05	0.54
1:B:302:VAL:HB	1:B:320:LEU:HB2	1.88	0.54
1:B:215:THR:H	1:B:216:PRO:HD3	1.71	0.54
1:B:139:GLN:HB3	1:B:142:LEU:HD12	1.90	0.54
1:B:168:SER:HB2	1:B:174:LYS:HB3	1.89	0.53
1:A:110:ILE:CD1	1:A:134:VAL:HG13	2.39	0.53
1:A:42:CYS:SG	1:A:55:CYS:CB	2.96	0.53
1:B:137:TYR:HA	1:B:162:THR:O	2.09	0.52
1:B:70:ALA:HA	1:B:75:ARG:HG3	1.92	0.52
1:B:69:THR:HG1	1:B:78:TRP:HE1	1.56	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:15:ILE:HG23	1:B:226:MSE:CE	2.38	0.52
1:A:110:ILE:O	1:A:111:ALA:HB3	2.11	0.51
1:A:17:GLU:HG2	1:A:22:ARG:HD2	1.92	0.51
1:A:139:GLN:HB3	1:A:142:LEU:HD12	1.92	0.51
1:A:16:ALA:HB3	1:A:66:VAL:HG12	1.92	0.51
1:B:332:LEU:HA	1:B:336:GLU:HB2	1.93	0.51
1:A:155:PRO:HG2	1:A:157:PHE:CE2	2.47	0.50
1:B:186:MSE:HE1	1:B:234:VAL:HG12	1.94	0.50
1:A:312:SER:CB	1:A:313:PRO:CD	2.89	0.50
1:B:112:ALA:HB3	1:B:143:GLY:HA3	1.94	0.50
1:B:17:GLU:HB2	1:B:66:VAL:HB	1.93	0.49
1:A:251:HIS:HE1	1:A:296:GLU:OE2	1.94	0.49
1:B:14:PHE:CD2	1:B:223:SER:HB2	2.46	0.49
1:A:111:ALA:O	1:A:114:THR:HG22	2.12	0.49
1:B:286:PHE:O	1:B:287:SER:HB2	2.13	0.49
1:B:112:ALA:N	1:B:113:PRO:HD2	2.28	0.48
1:B:12:ALA:O	1:B:75:ARG:NH2	2.46	0.48
1:B:249:SER:O	1:B:254:CYS:O	2.31	0.48
1:A:291:THR:O	1:A:293:ASN:N	2.47	0.48
1:B:138:PHE:HB2	1:B:162:THR:HB	1.96	0.48
1:A:17:GLU:HB2	1:A:66:VAL:HB	1.95	0.48
1:B:120:VAL:O	1:B:124:ILE:HG12	2.14	0.47
1:A:96:ARG:O	1:A:99:PHE:O	2.32	0.47
1:B:95:SER:OG	1:B:109:PHE:HZ	1.98	0.47
1:B:121:ARG:HD2	1:B:169:ILE:HD11	1.97	0.47
1:B:184:GLN:HB2	1:B:261:ILE:HG22	1.97	0.47
1:B:279:ILE:O	1:B:286:PHE:O	2.33	0.46
1:A:240:TYR:CD1	1:B:236:LYS:HB3	2.50	0.46
1:B:16:ALA:HB2	1:B:68:ASN:HB2	1.96	0.46
1:A:358:ARG:HG3	1:B:146:LEU:HD21	2.00	0.44
1:A:165:GLU:OE1	1:A:176:LYS:HD3	2.18	0.44
1:A:356:GLU:HG3	1:B:175:ILE:HD13	2.00	0.44
1:A:44:PHE:CZ	1:A:84:ARG:HD2	2.52	0.43
1:B:38:ALA:HA	1:B:203:LEU:HD21	1.99	0.43
1:B:42:CYS:HB2	1:B:55:CYS:HA	2.00	0.43
1:B:241:GLN:NE2	1:B:259:PHE:CZ	2.86	0.43
1:B:68:ASN:OD1	1:B:75:ARG:HG2	2.19	0.43
1:B:337:SER:HB3	1:B:338:PRO:HD3	2.01	0.42
1:A:116:ALA:O	1:B:364:PRO:HG3	2.19	0.42
1:B:21:HIS:CD2	1:B:33:ALA:HA	2.55	0.42
1:A:186:MSE:CE	1:A:229:PRO:HB3	2.50	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:81:CYS:O	1:B:84:ARG:HB2	2.20	0.42
1:A:96:ARG:NH2	1:A:105:GLU:O	2.52	0.41
1:B:127:TRP:HB3	1:B:132:VAL:HB	2.02	0.41
1:B:258:GLY:HA2	1:B:299:TRP:O	2.20	0.41
1:B:17:GLU:CB	1:B:66:VAL:HB	2.52	0.40
1:A:42:CYS:HA	1:A:43:PRO:HD3	1.80	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	336/383 (88%)	300 (89%)	23 (7%)	13 (4%)	3	10
1	B	348/383 (91%)	315 (90%)	22 (6%)	11 (3%)	4	13
All	All	684/766 (89%)	615 (90%)	45 (7%)	24 (4%)	3	12

All (24) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	62	ARG
1	A	292	ARG
1	B	62	ARG
1	B	216	PRO
1	A	111	ALA
1	A	225	LYS
1	A	312	SER
1	A	13	ASN
1	A	189	HIS
1	B	142	LEU
1	A	142	LEU
1	A	205	GLU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	72	ASP
1	B	215	THR
1	A	25	PRO
1	A	49	LYS
1	B	24	TYR
1	B	287	SER
1	A	171	PRO
1	B	75	ARG
1	A	275	ASN
1	B	71	VAL
1	B	312	SER
1	B	171	PRO

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	248/311 (80%)	234 (94%)	14 (6%)	21	51
1	B	256/311 (82%)	241 (94%)	15 (6%)	19	49
All	All	504/622 (81%)	475 (94%)	29 (6%)	20	50

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	GLN
1	A	44	PHE
1	A	56	VAL
1	A	107	LEU
1	A	128	LEU
1	A	139	GLN
1	A	172	VAL
1	A	185	THR
1	A	201	ILE
1	A	215	THR
1	A	226	MSE

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	264	SER
1	A	275	ASN
1	A	363	TRP
1	B	27	VAL
1	B	52	GLU
1	B	84	ARG
1	B	98	LEU
1	B	107	LEU
1	B	110	ILE
1	B	129	ASP
1	B	147	SER
1	B	169	ILE
1	B	175	ILE
1	B	187	ASP
1	B	236	LYS
1	B	241	GLN
1	B	264	SER
1	B	363	TRP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	68	ASN
1	A	139	GLN
1	A	189	HIS
1	A	251	HIS
1	A	263	GLN
1	A	319	HIS
1	B	13	ASN
1	B	118	GLN
1	B	230	ASN
1	B	241	GLN
1	B	251	HIS
1	B	252	GLN
1	B	319	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	SO4	B	802	-	4,4,4	0.13	0	6,6,6	0.07	0
3	SO4	A	801	-	4,4,4	0.13	0	6,6,6	0.13	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	337/383 (87%)	0.40	20 (5%) 22 14	50, 60, 87, 90	0
1	B	347/383 (90%)	0.45	27 (7%) 13 7	34, 61, 87, 90	0
All	All	684/766 (89%)	0.42	47 (6%) 16 10	34, 61, 87, 90	0

All (47) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	222	LEU	6.7
1	A	76	TYR	5.1
1	A	205	GLU	4.6
1	B	60	THR	4.5
1	A	24	TYR	4.3
1	A	16	ALA	4.1
1	B	79	LEU	4.0
1	A	170	TYR	3.8
1	B	14	PHE	3.8
1	A	12	ALA	3.6
1	A	41	THR	3.5
1	B	61	SER	3.2
1	B	213	LEU	3.1
1	B	72	ASP	3.1
1	B	220	ALA	2.9
1	A	51	VAL	2.8
1	B	217	ALA	2.8
1	B	188	PHE	2.8
1	B	198	ALA	2.8
1	A	55	CYS	2.7
1	B	81	CYS	2.7
1	A	27	VAL	2.7
1	A	232	SER	2.7
1	B	190	GLY	2.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	194	HIS	2.5
1	B	312	SER	2.5
1	B	58	ALA	2.5
1	B	221	ALA	2.5
1	B	71	VAL	2.4
1	B	42	CYS	2.4
1	A	282	GLY	2.4
1	A	14	PHE	2.3
1	A	193	LYS	2.3
1	B	202	ALA	2.3
1	B	205	GLU	2.3
1	B	55	CYS	2.2
1	B	149	SER	2.2
1	B	28	VAL	2.2
1	A	221	ALA	2.2
1	A	32	ALA	2.2
1	B	67	VAL	2.1
1	B	27	VAL	2.1
1	B	344	PRO	2.1
1	A	192	TYR	2.1
1	B	189	HIS	2.0
1	A	42	CYS	2.0
1	A	13	ASN	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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
-----	------	-------	-----	-------	------	-----	-----------------------------	-------

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	SO4	A	801	5/5	0.85	0.22	100,100,100,101	0
3	SO4	B	802	5/5	0.91	0.18	90,90,90,90	0
2	FE	A	901	1/1	0.94	0.35	74,74,74,74	0
2	FE	B	902	1/1	0.95	0.37	73,73,73,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.