



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 10, 2026 – 03:19 AM UTC

PDB ID : 2OQH / pdb_00002oqh
Title : Crystal structure of an isomerase from *Streptomyces coelicolor* A3(2)
Authors : Agarwal, R.; Burley, S.K.; Swaminathan, S.; New York SGX Research Center
for Structural Genomics (NYSGXRC)
Deposited on : 2007-01-31
Resolution : 1.98 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

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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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

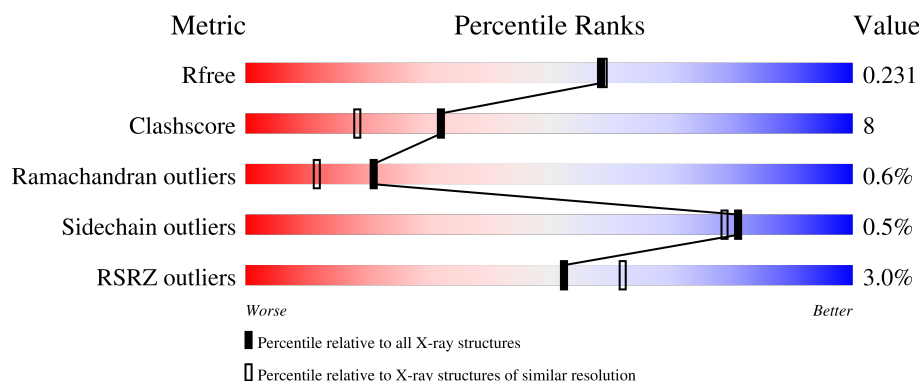
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.98 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}	180053	1506 (1.98-1.98)
Clashscore	190562	1534 (1.98-1.98)
Ramachandran outliers	187476	1518 (1.98-1.98)
Sidechain outliers	187428	1518 (1.98-1.98)
RSRZ outliers	180081	1506 (1.98-1.98)

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	385	 3% 74% 18% • 6%
1	B	385	 3% 79% 17% • •
1	C	385	 2% 79% 15% • •
1	D	385	 4% 81% 15% • •

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 11989 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 Putative isomerase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	360	Total	C	N	O	S	Se	0	0	0
			2691	1705	469	501	6	10			
1	B	374	Total	C	N	O	S	Se	0	0	0
			2802	1771	487	528	6	10			
1	C	368	Total	C	N	O	S	Se	0	0	0
			2753	1743	478	516	6	10			
1	D	371	Total	C	N	O	S	Se	0	0	0
			2778	1755	484	523	6	10			

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	-	cloning artifact	UNP Q9F3A5
A	2	SER	-	cloning artifact	UNP Q9F3A5
A	3	LEU	-	cloning artifact	UNP Q9F3A5
A	51	MSE	MET	modified residue	UNP Q9F3A5
A	63	MSE	MET	modified residue	UNP Q9F3A5
A	84	MSE	MET	modified residue	UNP Q9F3A5
A	108	MSE	MET	modified residue	UNP Q9F3A5
A	151	MSE	MET	modified residue	UNP Q9F3A5
A	232	MSE	MET	modified residue	UNP Q9F3A5
A	247	MSE	MET	modified residue	UNP Q9F3A5
A	259	MSE	MET	modified residue	UNP Q9F3A5
A	294	MSE	MET	modified residue	UNP Q9F3A5
A	326	MSE	MET	modified residue	UNP Q9F3A5
A	378	GLU	-	cloning artifact	UNP Q9F3A5
A	379	GLY	-	cloning artifact	UNP Q9F3A5
A	380	HIS	-	cloning artifact	UNP Q9F3A5
A	381	HIS	-	cloning artifact	UNP Q9F3A5
A	382	HIS	-	cloning artifact	UNP Q9F3A5
A	383	HIS	-	cloning artifact	UNP Q9F3A5
A	384	HIS	-	cloning artifact	UNP Q9F3A5
A	385	HIS	-	cloning artifact	UNP Q9F3A5

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MSE	-	cloning artifact	UNP Q9F3A5
B	2	SER	-	cloning artifact	UNP Q9F3A5
B	3	LEU	-	cloning artifact	UNP Q9F3A5
B	51	MSE	MET	modified residue	UNP Q9F3A5
B	63	MSE	MET	modified residue	UNP Q9F3A5
B	84	MSE	MET	modified residue	UNP Q9F3A5
B	108	MSE	MET	modified residue	UNP Q9F3A5
B	151	MSE	MET	modified residue	UNP Q9F3A5
B	232	MSE	MET	modified residue	UNP Q9F3A5
B	247	MSE	MET	modified residue	UNP Q9F3A5
B	259	MSE	MET	modified residue	UNP Q9F3A5
B	294	MSE	MET	modified residue	UNP Q9F3A5
B	326	MSE	MET	modified residue	UNP Q9F3A5
B	378	GLU	-	cloning artifact	UNP Q9F3A5
B	379	GLY	-	cloning artifact	UNP Q9F3A5
B	380	HIS	-	cloning artifact	UNP Q9F3A5
B	381	HIS	-	cloning artifact	UNP Q9F3A5
B	382	HIS	-	cloning artifact	UNP Q9F3A5
B	383	HIS	-	cloning artifact	UNP Q9F3A5
B	384	HIS	-	cloning artifact	UNP Q9F3A5
B	385	HIS	-	cloning artifact	UNP Q9F3A5
C	1	MSE	-	cloning artifact	UNP Q9F3A5
C	2	SER	-	cloning artifact	UNP Q9F3A5
C	3	LEU	-	cloning artifact	UNP Q9F3A5
C	51	MSE	MET	modified residue	UNP Q9F3A5
C	63	MSE	MET	modified residue	UNP Q9F3A5
C	84	MSE	MET	modified residue	UNP Q9F3A5
C	108	MSE	MET	modified residue	UNP Q9F3A5
C	151	MSE	MET	modified residue	UNP Q9F3A5
C	232	MSE	MET	modified residue	UNP Q9F3A5
C	247	MSE	MET	modified residue	UNP Q9F3A5
C	259	MSE	MET	modified residue	UNP Q9F3A5
C	294	MSE	MET	modified residue	UNP Q9F3A5
C	326	MSE	MET	modified residue	UNP Q9F3A5
C	378	GLU	-	cloning artifact	UNP Q9F3A5
C	379	GLY	-	cloning artifact	UNP Q9F3A5
C	380	HIS	-	cloning artifact	UNP Q9F3A5
C	381	HIS	-	cloning artifact	UNP Q9F3A5
C	382	HIS	-	cloning artifact	UNP Q9F3A5
C	383	HIS	-	cloning artifact	UNP Q9F3A5
C	384	HIS	-	cloning artifact	UNP Q9F3A5
C	385	HIS	-	cloning artifact	UNP Q9F3A5

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Chain	Residue	Modelled	Actual	Comment	Reference
D	1	MSE	-	cloning artifact	UNP Q9F3A5
D	2	SER	-	cloning artifact	UNP Q9F3A5
D	3	LEU	-	cloning artifact	UNP Q9F3A5
D	51	MSE	MET	modified residue	UNP Q9F3A5
D	63	MSE	MET	modified residue	UNP Q9F3A5
D	84	MSE	MET	modified residue	UNP Q9F3A5
D	108	MSE	MET	modified residue	UNP Q9F3A5
D	151	MSE	MET	modified residue	UNP Q9F3A5
D	232	MSE	MET	modified residue	UNP Q9F3A5
D	247	MSE	MET	modified residue	UNP Q9F3A5
D	259	MSE	MET	modified residue	UNP Q9F3A5
D	294	MSE	MET	modified residue	UNP Q9F3A5
D	326	MSE	MET	modified residue	UNP Q9F3A5
D	378	GLU	-	cloning artifact	UNP Q9F3A5
D	379	GLY	-	cloning artifact	UNP Q9F3A5
D	380	HIS	-	cloning artifact	UNP Q9F3A5
D	381	HIS	-	cloning artifact	UNP Q9F3A5
D	382	HIS	-	cloning artifact	UNP Q9F3A5
D	383	HIS	-	cloning artifact	UNP Q9F3A5
D	384	HIS	-	cloning artifact	UNP Q9F3A5
D	385	HIS	-	cloning artifact	UNP Q9F3A5

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

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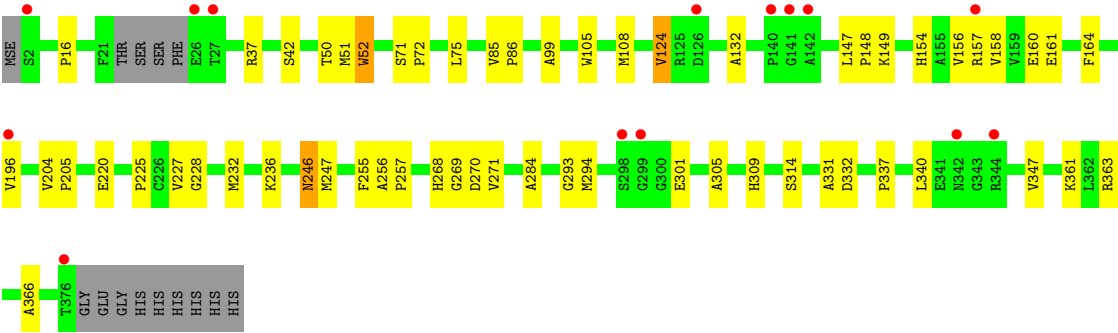
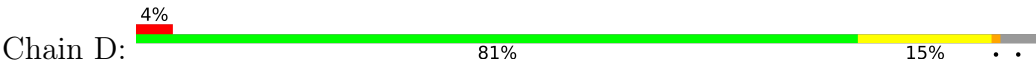
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	O	S	0	0
			5	4	1		
2	C	1	Total	O	S	0	0
			5	4	1		
2	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	215	Total	O	0	0
			215	215		
3	B	235	Total	O	0	0
			235	235		
3	C	240	Total	O	0	0
			240	240		
3	D	255	Total	O	0	0
			255	255		

ARG
ASP
GLY
ASP
LEU
THR
GLY
GLY
HIS
HIS
HIS
HIS
HIS

● Molecule 1: Putative isomerase



4 Data and refinement statistics

Property	Value	Source
Space group	P 4	Depositor
Cell constants a, b, c, α , β , γ	120.34Å 120.34Å 126.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.45 – 1.98 36.45 – 1.98	Depositor EDS
% Data completeness (in resolution range)	97.0 (36.45-1.98) 97.1 (36.45-1.98)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.09 (at 1.98Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.205 , 0.231 0.205 , 0.231	Depositor DCC
R_{free} test set	3682 reflections (2.94%)	wwPDB-VP
Wilson B-factor (Å ²)	16.9	Xtriage
Anisotropy	0.038	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 44.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.011 for -h,-l,-k 0.000 for -h,l,k 0.000 for l,-k,h 0.008 for -l,-k,-h 0.032 for h,-k,-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	11989	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 36.85 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.6883e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: 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	0.41	0/2738	0.95	10/3717 (0.3%)
1	B	0.41	0/2851	0.92	6/3871 (0.2%)
1	C	0.41	0/2802	0.96	10/3805 (0.3%)
1	D	0.41	0/2825	0.94	8/3834 (0.2%)
All	All	0.41	0/11216	0.94	34/15227 (0.2%)

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
1	B	0	1
All	All	0	2

There are no bond length outliers.

The worst 5 of 34 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	124	VAL	N-CA-C	-9.43	104.28	113.53
1	C	124	VAL	N-CA-C	-9.37	104.00	113.47
1	A	124	VAL	N-CA-C	-8.42	104.97	113.47
1	B	124	VAL	N-CA-C	-7.66	105.73	113.47
1	D	293	GLY	N-CA-C	-7.25	102.81	112.82

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	272	TYR	Sidechain
1	B	272	TYR	Sidechain

5.2 Too-close contacts

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	2691	0	2681	45	0
1	B	2802	0	2784	48	0
1	C	2753	0	2741	44	0
1	D	2778	0	2762	39	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
2	C	5	0	0	0	0
2	D	5	0	0	0	0
3	A	215	0	0	11	0
3	B	235	0	0	4	0
3	C	240	0	0	14	0
3	D	255	0	0	7	0
All	All	11989	0	10968	176	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.

The worst 5 of 176 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:75:LEU:HD11	1:B:108:MSE:HE1	1.45	0.98
1:B:49:GLU:HG2	1:B:304:ILE:HB	1.45	0.96
1:D:246:ASN:HB3	3:D:755:HOH:O	1.77	0.82
1:A:75:LEU:HD11	1:A:108:MSE:HE1	1.59	0.82
1:B:105:TRP:HA	1:B:108:MSE:HE3	1.62	0.81

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	356/385 (92%)	343 (96%)	9 (2%)	4 (1%)	11	4
1	B	372/385 (97%)	363 (98%)	8 (2%)	1 (0%)	36	27
1	C	366/385 (95%)	357 (98%)	7 (2%)	2 (0%)	24	14
1	D	367/385 (95%)	354 (96%)	11 (3%)	2 (0%)	24	14
All	All	1461/1540 (95%)	1417 (97%)	35 (2%)	9 (1%)	21	12

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	52	TRP
1	A	3	LEU
1	A	41	ASP
1	A	52	TRP
1	C	270	ASP

5.3.2 Protein sidechains ⓘ

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	278/289 (96%)	278 (100%)	0	100	100
1	B	291/289 (101%)	289 (99%)	2 (1%)	76	73
1	C	286/289 (99%)	284 (99%)	2 (1%)	76	73
1	D	288/289 (100%)	286 (99%)	2 (1%)	76	73
All	All	1143/1156 (99%)	1137 (100%)	6 (0%)	81	79

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	268	HIS
1	D	196	VAL
1	D	268	HIS
1	B	268	HIS
1	B	157	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	268	HIS
1	C	369	ASN
1	C	364	HIS
1	D	154	HIS
1	A	309	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 ligands are modelled in this entry.

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	$\# Z > 2$
2	SO4	C	501	-	4,4,4	0.42	0	6,6,6	0.15	0
2	SO4	A	501	-	4,4,4	0.37	0	6,6,6	0.10	0
2	SO4	B	501	-	4,4,4	0.42	0	6,6,6	0.27	0
2	SO4	D	501	-	4,4,4	0.39	0	6,6,6	0.09	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 [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	350/385 (90%)	0.33	11 (3%) 51 61	8, 19, 27, 34	0
1	B	364/385 (94%)	0.14	12 (3%) 49 59	8, 18, 26, 31	0
1	C	358/385 (92%)	0.16	6 (1%) 69 78	7, 18, 26, 31	0
1	D	361/385 (93%)	0.14	14 (3%) 43 53	8, 18, 26, 32	0
All	All	1433/1540 (93%)	0.19	43 (3%) 52 62	7, 18, 27, 34	0

The worst 5 of 43 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	2	SER	5.0
1	A	157	ARG	3.5
1	B	23	SER	3.4
1	D	27	THR	3.3
1	D	26	GLU	3.2

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 oligosaccharides 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.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	SO4	B	501	5/5	0.90	0.17	37,38,39,40	0
2	SO4	D	501	5/5	0.92	0.20	35,37,38,38	0
2	SO4	C	501	5/5	0.93	0.19	37,39,40,40	0
2	SO4	A	501	5/5	0.93	0.17	37,39,40,40	0

6.5 Other polymers [i](#)

There are no such residues in this entry.