Full wwPDB X-ray Structure Validation Report (i)

Feb 1, 2016 – 10:41 AM GMT

PDB ID	:	3MT5
Title	:	Crystal Structure of the Human BK Gating Apparatus
Authors	:	Yuan, P.; MacKinnon, R.
Deposited on	:	2010-04-30
Resolution	:	3.00 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

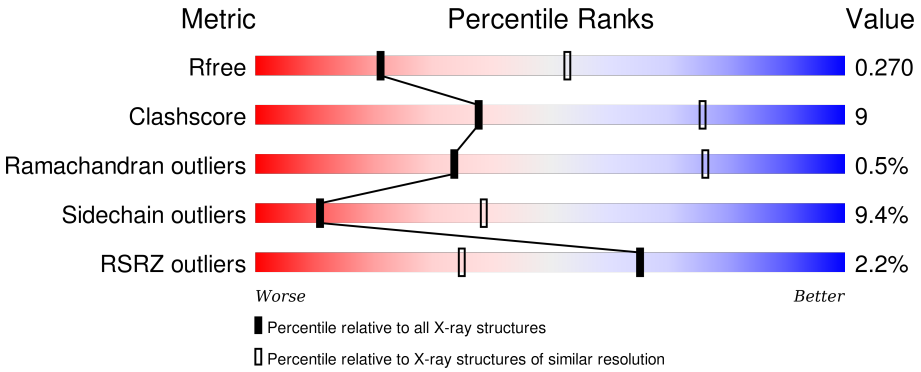
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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}	91344	1578 (3.00-3.00)
Clashscore	102246	1912 (3.00-3.00)
Ramachandran outliers	100387	1853 (3.00-3.00)
Sidechain outliers	100360	1856 (3.00-3.00)
RSRZ outliers	91569	1592 (3.00-3.00)

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 >=3, 2, 1 and 0 types of geometric quality criteria. 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 <=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	726	2% 60% 20% • 18%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4686 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 Potassium large conductance calcium-activated channel, subfamily M, alpha member 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	593	4680	2996	775	874	35	0	0	0

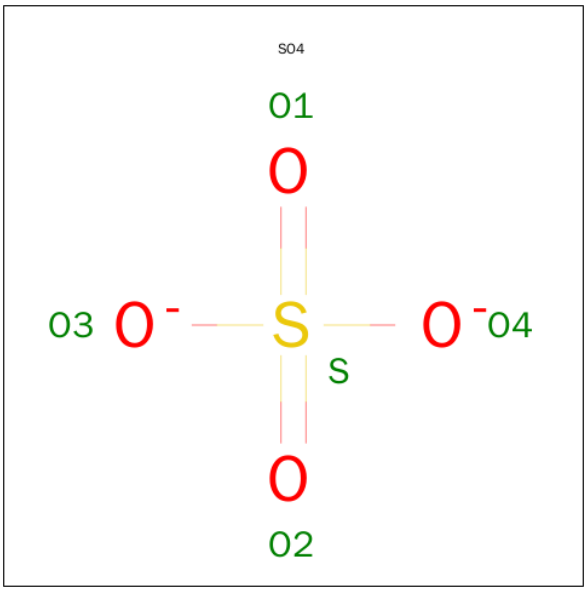
There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	340	MET	-	INITIATING METHIONINE	UNP Q5SVK2
A	1057	SER	-	EXPRESSION TAG	UNP Q5SVK2
A	1058	ASN	-	EXPRESSION TAG	UNP Q5SVK2
A	1059	SER	-	EXPRESSION TAG	UNP Q5SVK2
A	1060	LEU	-	EXPRESSION TAG	UNP Q5SVK2
A	1061	GLU	-	EXPRESSION TAG	UNP Q5SVK2
A	1062	VAL	-	EXPRESSION TAG	UNP Q5SVK2
A	1063	LEU	-	EXPRESSION TAG	UNP Q5SVK2
A	1064	PHE	-	EXPRESSION TAG	UNP Q5SVK2
A	1065	GLN	-	EXPRESSION TAG	UNP Q5SVK2

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ca		
2	A	1	1	1	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



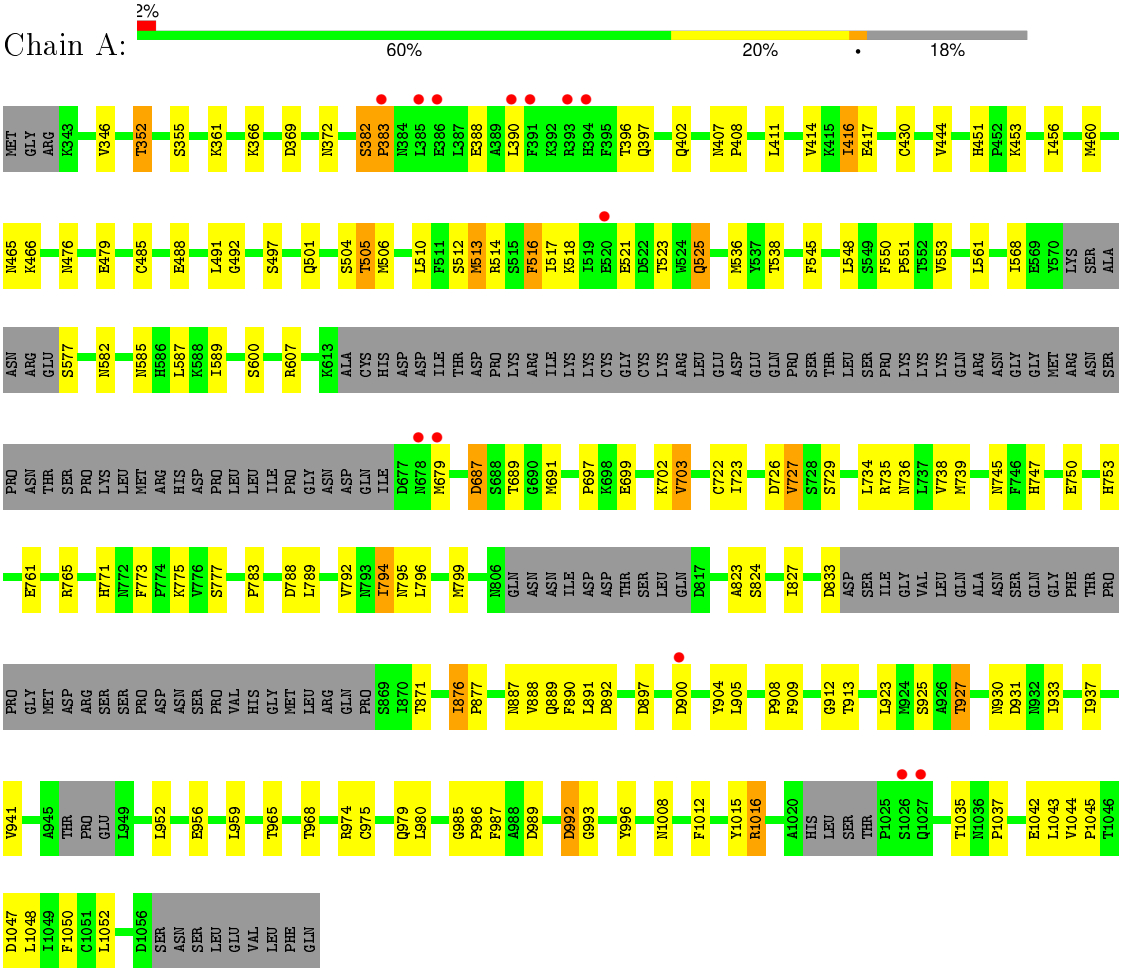
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O S 5 4 1	0	0

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 errors 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: Potassium large conductance calcium-activated channel, subfamily M, alpha member 1

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 63 2 2	Depositor
Cell constants a, b, c, α, β, γ	144.52Å 144.52Å 182.19Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.50 – 3.00 47.30 – 3.00	Depositor EDS
% Data completeness (in resolution range)	99.9 (47.50-3.00) 99.9 (47.30-3.00)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.90 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.246 , 0.278 0.237 , 0.270	Depositor DCC
R_{free} test set	1187 reflections (5.41%)	DCC
Wilson B-factor (Å^2)	70.0	Xtriage
Anisotropy	0.244	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 25.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Outliers	0 of 23124 reflections	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	4686	wwPDB-VP
Average B, all atoms (Å^2)	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.06% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CA, 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	0.50	0/4771	0.61	0/6459

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

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	4680	0	4654	86	0
2	A	1	0	0	0	0
3	A	5	0	0	0	0
All	All	4686	0	4654	86	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 9.

All (86) 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:538:THR:HG22	1:A:930:ASN:HD21	1.29	0.95

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:729:SER:O	1:A:765:ARG:NH2	2.17	0.77
1:A:506:MET:CE	1:A:1012:PHE:HD2	2.04	0.71
1:A:1012:PHE:HE1	1:A:1052:LEU:HG	1.55	0.70
1:A:506:MET:HE1	1:A:1012:PHE:HD2	1.57	0.70
1:A:1044:VAL:HG12	1:A:1045:PRO:HD2	1.75	0.68
1:A:923:LEU:O	1:A:927:THR:HG23	1.94	0.68
1:A:553:VAL:HG21	1:A:589:ILE:HD12	1.77	0.67
1:A:506:MET:CE	1:A:1012:PHE:CD2	2.78	0.67
1:A:383:PRO:HD3	1:A:402:GLN:OE1	1.95	0.66
1:A:492:GLY:HA3	1:A:941:VAL:HG13	1.78	0.64
1:A:538:THR:CG2	1:A:930:ASN:HD21	2.06	0.64
1:A:923:LEU:O	1:A:927:THR:CG2	2.46	0.64
1:A:996:TYR:CD2	1:A:1037:PRO:HG2	2.33	0.63
1:A:550:PHE:HB3	1:A:551:PRO:HD3	1.82	0.62
1:A:703:VAL:HG13	1:A:777:SER:HA	1.83	0.61
1:A:501:GLN:HG2	1:A:1015:TYR:OH	2.00	0.61
1:A:789:LEU:HG	1:A:794:ILE:HD13	1.81	0.61
1:A:476:ASN:ND2	1:A:479:GLU:HG3	2.15	0.60
1:A:536:MET:HG2	1:A:933:ILE:HD12	1.83	0.60
1:A:525:GLN:H	1:A:525:GLN:HE21	1.50	0.59
1:A:369:ASP:O	1:A:372:ASN:ND2	2.35	0.59
1:A:506:MET:HE2	1:A:1012:PHE:CD2	2.39	0.58
1:A:516:PHE:HD2	1:A:518:LYS:H	1.52	0.57
1:A:491:LEU:HD12	1:A:736:ASN:HB2	1.88	0.56
1:A:727:VAL:HG13	1:A:761:GLU:HB3	1.87	0.55
1:A:466:LYS:HD2	1:A:485:CYS:HB2	1.88	0.55
1:A:1012:PHE:CE2	1:A:1050:PHE:HB3	2.42	0.54
1:A:538:THR:HG22	1:A:930:ASN:ND2	2.10	0.54
1:A:561:LEU:HD22	1:A:607:ARG:HB3	1.88	0.54
1:A:887:ASN:HB2	1:A:890:PHE:CE2	2.44	0.53
1:A:689:THR:OG1	1:A:691:MET:HB2	2.08	0.53
1:A:993:GLY:HA2	1:A:1042:GLU:HG2	1.91	0.53
1:A:516:PHE:HD2	1:A:517:ILE:N	2.07	0.52
1:A:753:HIS:CE1	1:A:775:LYS:HD3	2.44	0.52
1:A:444:VAL:HG13	1:A:456:ILE:HD12	1.93	0.50
1:A:739:MET:HG3	1:A:773:PHE:CZ	2.47	0.50
1:A:985:GLY:C	1:A:987:PHE:H	2.15	0.50
1:A:992:ASP:N	1:A:992:ASP:OD1	2.44	0.50
1:A:346:VAL:HG21	1:A:416:ILE:HD12	1.94	0.49
1:A:888:VAL:HG23	1:A:891:LEU:HD12	1.95	0.49
1:A:788:ASP:O	1:A:792:VAL:HG22	2.13	0.49

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:460:MET:CE	1:A:465:ASN:HB3	2.43	0.49
1:A:553:VAL:HG21	1:A:589:ILE:CD1	2.43	0.48
1:A:887:ASN:HB2	1:A:890:PHE:CD2	2.48	0.48
1:A:795:ASN:HA	1:A:876:ILE:HG21	1.96	0.47
1:A:505:THR:CG2	1:A:912:GLY:HA2	2.44	0.47
1:A:1016:ARG:HG2	1:A:1047:ASP:OD1	2.14	0.47
1:A:485:CYS:HB3	1:A:488:GLU:HG2	1.96	0.47
1:A:799:MET:HA	1:A:877:PRO:HB2	1.97	0.47
1:A:889:GLN:HG2	1:A:897:ASP:HB3	1.96	0.47
1:A:823:ALA:O	1:A:827:ILE:HG13	2.15	0.47
1:A:1012:PHE:CE1	1:A:1052:LEU:HG	2.43	0.47
1:A:1044:VAL:CG1	1:A:1045:PRO:HD2	2.44	0.47
1:A:417:GLU:HA	1:A:451:HIS:ND1	2.30	0.47
1:A:904:TYR:HA	1:A:909:PHE:CD2	2.50	0.47
1:A:699:GLU:H	1:A:702:LYS:HZ2	1.63	0.47
1:A:506:MET:HE1	1:A:1012:PHE:CD2	2.42	0.46
1:A:888:VAL:HG22	1:A:908:PRO:HG2	1.98	0.46
1:A:521:GLU:H	1:A:521:GLU:CD	2.19	0.46
1:A:352:THR:HG23	1:A:355:SER:H	1.82	0.46
1:A:585:ASN:H	1:A:1008:ASN:HD21	1.65	0.45
1:A:745:ASN:ND2	1:A:975:CYS:O	2.49	0.45
1:A:361:LYS:HD3	1:A:514:ARG:HH22	1.80	0.45
1:A:687:ASP:CB	1:A:959:LEU:HD22	2.46	0.44
1:A:492:GLY:CA	1:A:941:VAL:HG13	2.45	0.44
1:A:691:MET:SD	1:A:974:ARG:NH1	2.90	0.44
1:A:722:CYS:HB3	1:A:783:PRO:HG3	1.99	0.43
1:A:407:ASN:HA	1:A:408:PRO:HD3	1.81	0.43
1:A:937:ILE:O	1:A:941:VAL:HB	2.20	0.42
1:A:513:MET:O	1:A:514:ARG:HD2	2.19	0.42
1:A:687:ASP:HB2	1:A:959:LEU:HD22	2.00	0.42
1:A:582:ASN:O	1:A:582:ASN:CG	2.56	0.42
1:A:747:HIS:O	1:A:750:GLU:HB3	2.20	0.42
1:A:382:SER:HA	1:A:402:GLN:HE22	1.84	0.42
1:A:980:LEU:HD23	1:A:980:LEU:HA	1.81	0.42
1:A:738:VAL:CG2	1:A:773:PHE:CD2	3.03	0.42
1:A:723:ILE:HD13	1:A:734:LEU:HD11	2.01	0.42
1:A:568:ILE:HD13	1:A:568:ILE:HA	1.85	0.42
1:A:497:SER:OG	1:A:504:SER:HB3	2.20	0.41
1:A:352:THR:O	1:A:355:SER:N	2.53	0.41
1:A:510:LEU:HD21	1:A:1035:THR:HG21	2.02	0.41
1:A:545:PHE:HA	1:A:548:LEU:HD12	2.03	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:980:LEU:O	1:A:1048:LEU:HA	2.21	0.41
1:A:923:LEU:O	1:A:927:THR:HG22	2.21	0.40
1:A:979:GLN:O	1:A:980:LEU:HD23	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	579/726 (80%)	547 (94%)	29 (5%)	3 (0%)	34 76

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	383	PRO
1	A	986	PRO
1	A	697	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	521/644 (81%)	472 (91%)	49 (9%)	11 39

All (49) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	352	THR
1	A	366	LYS
1	A	382	SER
1	A	388	GLU
1	A	390	LEU
1	A	396	THR
1	A	397	GLN
1	A	411	LEU
1	A	414	VAL
1	A	416	ILE
1	A	430	CYS
1	A	453	LYS
1	A	505	THR
1	A	512	SER
1	A	513	MET
1	A	516	PHE
1	A	523	THR
1	A	525	GLN
1	A	577	SER
1	A	587	LEU
1	A	600	SER
1	A	679	MET
1	A	687	ASP
1	A	703	VAL
1	A	726	ASP
1	A	727	VAL
1	A	735	ARG
1	A	771	HIS
1	A	794	ILE
1	A	796	LEU
1	A	824	SER
1	A	833	ASP
1	A	871	THR
1	A	876	ILE
1	A	892	ASP
1	A	900	ASP
1	A	905	LEU
1	A	913	THR
1	A	925	SER
1	A	927	THR
1	A	931	ASP
1	A	952	LEU
1	A	956	GLU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	965	THR
1	A	968	THR
1	A	989	ASP
1	A	992	ASP
1	A	1016	ARG
1	A	1043	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	372	ASN
1	A	379	HIS
1	A	407	ASN
1	A	525	GLN
1	A	693	HIS
1	A	753	HIS
1	A	930	ASN
1	A	1008	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	A	2002	-	4,4,4	0.24	0	6,6,6	0.08	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	SO4	A	2002	-	-	0/0/0/0	0/0/0/0

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, 95^{th} 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	593/726 (81%)	-0.11	13 (2%) 65 35	39, 63, 96, 119	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	678	ASN	3.5
1	A	386	GLU	3.5
1	A	1026	SER	3.4
1	A	900	ASP	3.4
1	A	385	LEU	3.1
1	A	679	MET	2.8
1	A	393	ARG	2.6
1	A	390	LEU	2.5
1	A	394	HIS	2.4
1	A	1027	GLN	2.3
1	A	520	GLU	2.1
1	A	391	PHE	2.1
1	A	383	PRO	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95^{th} 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	LLDF	B-factors(Å^2)	Q<0.9
3	SO4	A	2002	5/5	0.99	0.12	-1.98	50,50,51,51	0
2	CA	A	2001	1/1	0.94	0.06	-2.30	66,66,66,66	0

6.5 Other polymers

There are no such residues in this entry.