Full wwPDB X-ray Structure Validation Report (i)

Jan 31, 2016 – 09:20 PM GMT

PDB ID	:	1OIH
Title	:	CRYSTAL STRUCTURE OF THE ALKYLSULFATASE ATSK, A NON-HEME FE(II) ALPHAKETOGLUTARATE DEPENDENT DIOXYGENASE
Authors	:	Mueller, I.; Kahnert, A.; Pape, T.; Dierks, T.; Meyer-Klauke, W.; Kertesz, M.; Uson, I.
Deposited on	:	2003-06-18
Resolution	:	1.89 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:

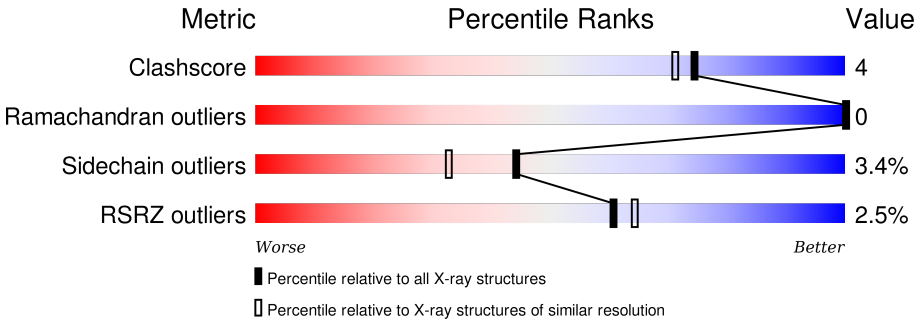
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)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

1 Overall quality at a glance

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

The reported resolution of this entry is 1.89 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))
Clashscore	102246	5398 (1.90-1.90)
Ramachandran outliers	100387	5338 (1.90-1.90)
Sidechain outliers	100360	5339 (1.90-1.90)
RSRZ outliers	91569	4766 (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 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	301	76% 6% 16%
1	B	301	2% 78% 6% 15%
1	C	301	3% 75% 5% 20%
1	D	301	4% 74% 6% 19%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 8416 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 ALKYLSULFATASE ATSK.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	A	254	Total	C	N	O	0	1	0
			1971	1246	365	360			
1	B	255	Total	C	N	O	0	1	0
			1970	1245	362	363			
1	C	242	Total	C	N	O	0	0	0
			1846	1171	336	339			
1	D	244	Total	C	N	O	0	1	0
			1865	1183	340	342			

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Na	0	1
			1	1		
2	A	1	Total	Na	0	1
			1	1		
2	D	1	Total	Na	0	1
			1	1		
2	C	1	Total	Na	0	1
			1	1		

- Molecule 3 is water.

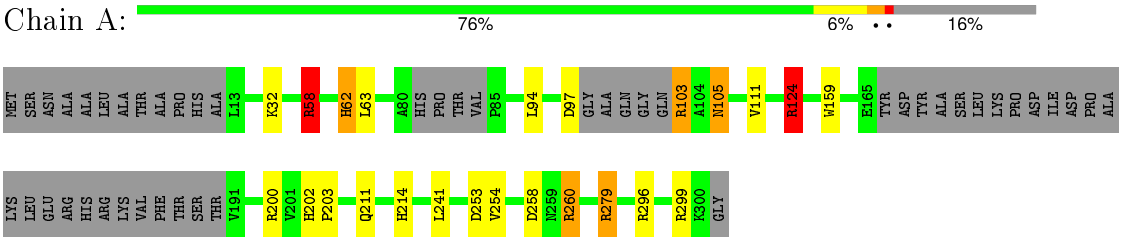
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	214	Total	O	0	0
			214	214		
3	B	225	Total	O	0	0
			225	225		
3	C	168	Total	O	0	0
			168	168		
3	D	153	Total	O	0	0
			153	153		

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.

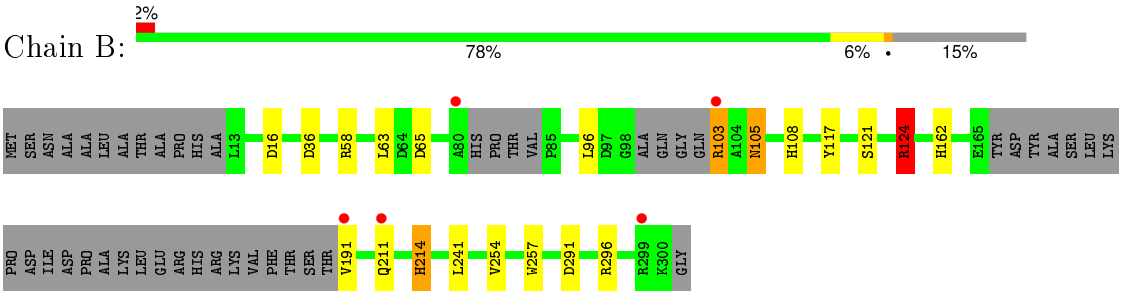
- Molecule 1: PUTATIVE ALKYLSULFATASE ATSK

Chain A:



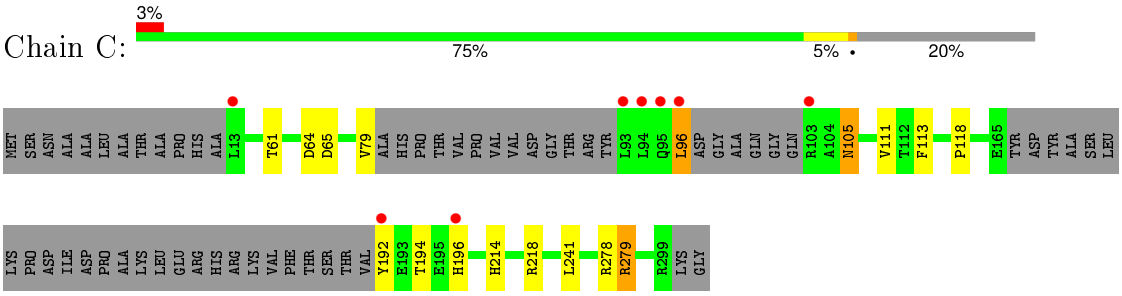
- Molecule 1: PUTATIVE ALKYLSULFATASE ATSK

Chain B:



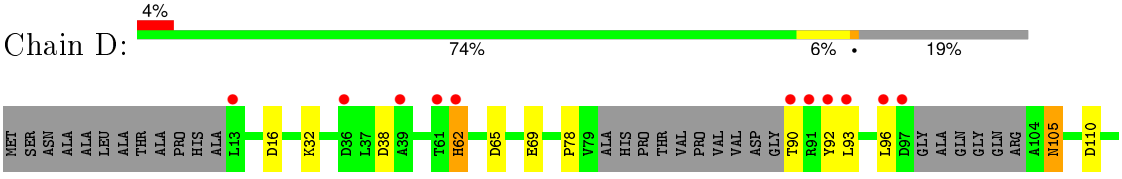
- Molecule 1: PUTATIVE ALKYLSULFATASE ATSK

Chain C:



- Molecule 1: PUTATIVE ALKYLSULFATASE ATSK

Chain D:




A138
D156
N164
GLU
TYR
ASP
TYR
ALA
SER
LEU
LYS
PRO
ASP
ILE
ASP
PRO
ALA
LYS
LEU
GLU
ARG
HIS
ARG
LYS
VAL
PHE
THR
SER
THR
VAL
Y192
H196
T262
R278
D291
S295
R299
LYS
GLY

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	72.24Å 145.34Å 159.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.89 17.93 – 1.89	Depositor EDS
% Data completeness (in resolution range)	99.2 (20.00-1.89) 99.2 (17.93-1.89)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.79 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.1.19	Depositor
R, R_{free}	0.170 , 0.191 0.184 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å^2)	23.2	Xtriage
Anisotropy	0.428	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 53.7	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Outliers	1 of 132527 reflections (0.001%)	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8416	wwPDB-VP
Average B, all atoms (Å^2)	30.0	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 24.68 % 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 3.6624e-03.The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: NA

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	0.96	1/2018 (0.0%)	1.02	8/2749 (0.3%)
1	B	0.95	0/2017	0.98	7/2751 (0.3%)
1	C	0.92	0/1888	0.93	2/2579 (0.1%)
1	D	0.96	0/1911	0.95	5/2610 (0.2%)
All	All	0.95	1/7834 (0.0%)	0.97	22/10689 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	159	TRP	CB-CG	-5.99	1.39	1.50

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	124	ARG	NE-CZ-NH2	8.00	124.30	120.30
1	A	58	ARG	NE-CZ-NH1	-7.14	116.73	120.30
1	B	58	ARG	NE-CZ-NH2	-7.14	116.73	120.30
1	D	38	ASP	CB-CG-OD2	6.99	124.59	118.30
1	A	124	ARG	NE-CZ-NH1	-6.98	116.81	120.30
1	A	97	ASP	CB-CG-OD2	6.45	124.10	118.30
1	A	103	ARG	NE-CZ-NH2	-6.18	117.21	120.30
1	D	110	ASP	CB-CG-OD2	6.09	123.78	118.30
1	B	103	ARG	NE-CZ-NH1	-6.07	117.27	120.30
1	D	16	ASP	CB-CG-OD1	6.05	123.75	118.30
1	D	156	ASP	CB-CG-OD1	5.78	123.50	118.30
1	D	291	ASP	CB-CG-OD2	5.78	123.50	118.30
1	B	124	ARG	NE-CZ-NH1	5.74	123.17	120.30
1	A	260	ARG	NE-CZ-NH1	-5.60	117.50	120.30
1	B	291	ASP	CB-CG-OD2	5.59	123.34	118.30
1	B	16	ASP	CB-CG-OD2	5.48	123.23	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	58	ARG	NE-CZ-NH2	5.39	123.00	120.30
1	C	218	ARG	NE-CZ-NH2	5.32	122.96	120.30
1	C	64	ASP	CB-CG-OD2	5.32	123.08	118.30
1	B	65	ASP	CB-CG-OD2	5.20	122.98	118.30
1	A	279	ARG	NE-CZ-NH2	5.10	122.85	120.30
1	B	36	ASP	CB-CG-OD2	5.02	122.82	118.30

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	1971	0	1932	24	0
1	B	1970	0	1915	10	0
1	C	1846	0	1771	15	0
1	D	1865	0	1780	11	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	214	0	0	2	0
3	B	225	0	0	3	0
3	C	168	0	0	1	0
3	D	153	0	0	0	0
All	All	8416	0	7398	60	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 4.

All (60) 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:202:HIS:HD2	1:A:203:PRO:HD2	1.30	0.96
1:C:194:THR:HG21	1:C:196:HIS:HE1	1.34	0.93

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:62:HIS:HD2	1:A:63:LEU:N	1.74	0.86
1:A:32:LYS:HG3	1:A:62:HIS:CE1	2.12	0.84
1:A:62:HIS:CD2	1:A:63:LEU:N	2.50	0.79
1:C:194:THR:HG21	1:C:196:HIS:CE1	2.19	0.77
1:C:105:ASN:HD22	1:C:105:ASN:H	1.33	0.76
1:A:202:HIS:CD2	1:A:203:PRO:HD2	2.19	0.75
1:C:194:THR:CG2	1:C:196:HIS:CE1	2.70	0.74
1:B:105:ASN:HD22	1:B:105:ASN:H	1.35	0.73
1:A:105:ASN:HD22	1:A:105:ASN:H	1.38	0.71
1:A:32:LYS:CG	1:A:62:HIS:CE1	2.73	0.71
1:D:69:GLU:OE2	1:D:92:TYR:N	2.24	0.70
1:D:105:ASN:HD22	1:D:105:ASN:H	1.41	0.69
1:A:103:ARG:HB3	3:A:2188:HOH:O	1.98	0.64
1:A:202:HIS:HD2	1:A:203:PRO:CD	2.11	0.60
1:A:32:LYS:CG	1:A:62:HIS:HE1	2.13	0.59
1:A:32:LYS:HG3	1:A:62:HIS:ND1	2.16	0.59
1:A:241:LEU:HD23	3:A:2169:HOH:O	2.03	0.58
1:D:196:HIS:ND1	1:D:295:SER:HB3	2.19	0.57
1:D:62:HIS:CD2	1:D:62:HIS:C	2.78	0.57
1:A:202:HIS:CD2	1:A:260:ARG:HD2	2.40	0.56
1:A:62:HIS:HD2	1:A:63:LEU:H	1.51	0.54
1:A:200:ARG:HB2	1:A:211[B]:GLN:HG3	1.89	0.54
1:C:111:VAL:O	1:C:111:VAL:HG22	2.10	0.52
1:A:32:LYS:HE3	1:A:62:HIS:ND1	2.26	0.50
1:C:194:THR:HG22	1:C:196:HIS:CE1	2.46	0.50
1:B:162:HIS:HE1	3:B:2157:HOH:O	1.94	0.50
1:A:202:HIS:HE1	1:A:258:ASP:OD2	1.95	0.49
1:C:111:VAL:HG23	1:C:113:PHE:CZ	2.47	0.49
1:A:32:LYS:HG2	1:A:62:HIS:CE1	2.48	0.49
1:A:62:HIS:CD2	1:A:62:HIS:C	2.86	0.48
1:D:65:ASP:HA	1:D:93:LEU:HD22	1.95	0.48
1:C:111:VAL:HG13	1:C:118:PRO:CD	2.43	0.48
1:C:96:LEU:HD21	1:C:279:ARG:HH11	1.79	0.48
1:B:241:LEU:HD23	3:B:2179:HOH:O	2.13	0.47
1:D:196:HIS:ND1	1:D:295:SER:CB	2.79	0.46
1:B:103:ARG:HB3	3:B:2197:HOH:O	2.16	0.46
1:C:105:ASN:N	1:C:105:ASN:HD22	2.03	0.45
1:A:202:HIS:CE1	1:A:258:ASP:OD2	2.69	0.45
1:B:105:ASN:HD22	1:B:105:ASN:N	2.06	0.44
1:D:93:LEU:HD21	1:D:278:ARG:HD3	2.00	0.44
1:C:96:LEU:HD21	1:C:279:ARG:NH1	2.33	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:117:TYR:OH	1:B:211[A]:GLN:NE2	2.51	0.43
1:A:124:ARG:HB2	1:A:254:VAL:HG22	1.99	0.43
1:B:108:HIS:HD1	1:B:214:HIS:CE1	2.35	0.43
1:D:78:PRO:HB2	1:D:92:TYR:CG	2.54	0.43
1:B:96:LEU:N	1:B:96:LEU:HD22	2.33	0.43
1:A:32:LYS:HG2	1:A:62:HIS:HE1	1.82	0.42
1:A:58:ARG:NH1	1:A:253:ASP:OD1	2.53	0.42
1:C:111:VAL:CG1	1:C:118:PRO:CD	2.98	0.42
1:C:111:VAL:HG13	1:C:118:PRO:HD2	2.01	0.41
1:C:65:ASP:OD2	1:C:278:ARG:HD2	2.20	0.41
1:D:65:ASP:CA	1:D:93:LEU:HD22	2.51	0.41
1:C:241:LEU:HD23	3:C:2127:HOH:O	2.21	0.41
1:D:138:ALA:O	1:D:262:THR:HA	2.20	0.41
1:D:32:LYS:CB	1:D:62:HIS:HE1	2.34	0.40
1:B:124:ARG:HB2	1:B:254:VAL:HG22	2.02	0.40
1:A:94:LEU:HD23	1:A:279:ARG:NH1	2.37	0.40
1:B:121:SER:HB2	1:B:257:TRP:CZ2	2.56	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	247/301 (82%)	238 (96%)	9 (4%)	0	100	100
1	B	248/301 (82%)	238 (96%)	10 (4%)	0	100	100
1	C	234/301 (78%)	225 (96%)	9 (4%)	0	100	100
1	D	237/301 (79%)	228 (96%)	9 (4%)	0	100	100
All	All	966/1204 (80%)	929 (96%)	37 (4%)	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	201/244 (82%)	193 (96%)	8 (4%)	38	26
1	B	200/244 (82%)	194 (97%)	6 (3%)	48	38
1	C	183/244 (75%)	176 (96%)	7 (4%)	40	28
1	D	184/244 (75%)	179 (97%)	5 (3%)	52	43
All	All	768/976 (79%)	742 (97%)	26 (3%)	44	33

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	58	ARG
1	A	62	HIS
1	A	105	ASN
1	A	111	VAL
1	A	124	ARG
1	A	214	HIS
1	A	296	ARG
1	A	299	ARG
1	B	63	LEU
1	B	105	ASN
1	B	124	ARG
1	B	191	VAL
1	B	214	HIS
1	B	296	ARG
1	C	61	THR
1	C	79	VAL
1	C	96	LEU
1	C	105	ASN
1	C	192	TYR
1	C	214	HIS
1	C	279	ARG
1	D	62	HIS
1	D	90	THR
1	D	96	LEU

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Mol	Chain	Res	Type
1	D	105	ASN
1	D	299	ARG

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

Mol	Chain	Res	Type
1	A	62	HIS
1	A	105	ASN
1	B	105	ASN
1	B	162	HIS
1	C	105	ASN
1	D	105	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 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

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	254/301 (84%)	-0.28	0 100 100	16, 24, 44, 70	0
1	B	255/301 (84%)	-0.31	5 (1%) 68 71	16, 24, 43, 70	0
1	C	242/301 (80%)	-0.15	8 (3%) 50 53	17, 28, 50, 63	0
1	D	244/301 (81%)	0.10	12 (4%) 33 36	17, 31, 58, 79	0
All	All	995/1204 (82%)	-0.16	25 (2%) 61 64	16, 26, 51, 79	0

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	92	TYR	7.1
1	C	192	TYR	4.8
1	D	13	LEU	4.5
1	C	94	LEU	4.2
1	C	93	LEU	4.1
1	C	13	LEU	3.7
1	C	96	LEU	3.7
1	D	96	LEU	3.7
1	D	299	ARG	3.4
1	C	95	GLN	3.3
1	C	103	ARG	3.1
1	D	91	ARG	3.0
1	D	90	THR	2.9
1	D	97	ASP	2.6
1	D	62	HIS	2.6
1	D	93	LEU	2.6
1	B	299	ARG	2.4
1	B	211[A]	GLN	2.3
1	D	36	ASP	2.3
1	D	39	ALA	2.3
1	B	103	ARG	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	191	VAL	2.2
1	B	80	ALA	2.1
1	D	61	THR	2.0
1	C	196	HIS	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. 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
2	NA	D	1300[A]	1/1	0.84	0.13	-	38,38,38,38	1
2	NA	B	1301[A]	1/1	0.87	0.11	-	30,30,30,30	1
2	NA	C	1300[A]	1/1	0.80	0.32	-	38,38,38,38	1
2	NA	A	1301[A]	1/1	0.89	0.11	-	31,31,31,31	1

6.5 Other polymers (i)

There are no such residues in this entry.