



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:15 PM UTC

PDB ID : 8WKA / pdb_00008wka
Title : Aldo-keto reductase KmAKR - T23V/Y28A/K29H/T63M/Q213A/Y296W/W297H
Authors : Xu, S.Y.; Zhou, L.; Xu, Y.; Wang, Y.J.; Zheng, Y.G.
Deposited on : 2023-09-27
Resolution : 1.99 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 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
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

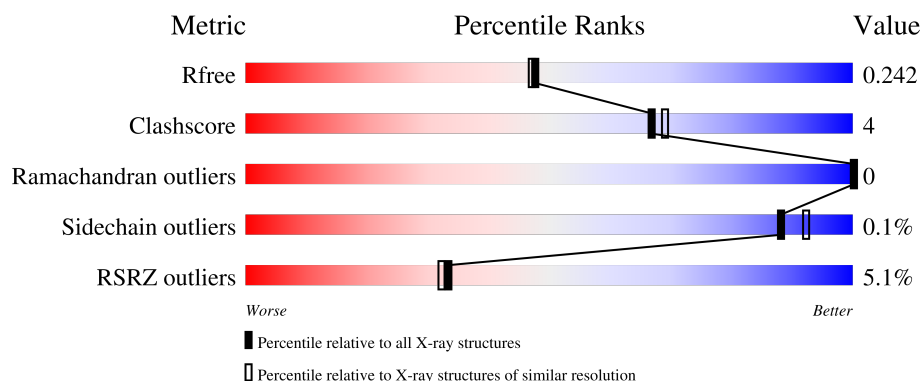
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.99 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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 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	310	5% 90% 9%
1	B	310	5% 86% 12%
1	C	310	5% 90% 9%
1	D	310	5% 89% 8%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10303 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 NADPH-dependent alpha-keto amide reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	307	Total	C	N	O	S	0	0	0
			2471	1599	396	475	1			
1	B	305	Total	C	N	O	S	0	0	0
			2454	1589	393	471	1			
1	C	307	Total	C	N	O	S	0	0	0
			2469	1597	395	476	1			
1	D	302	Total	C	N	O	S	0	0	0
			2428	1572	389	466	1			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	23	VAL	THR	engineered mutation	UNP W0TDP7
A	28	ALA	TYR	engineered mutation	UNP W0TDP7
A	29	HIS	LYS	engineered mutation	UNP W0TDP7
A	63	MET	THR	engineered mutation	UNP W0TDP7
A	109	ASN	LYS	conflict	UNP W0TDP7
A	213	ALA	GLN	engineered mutation	UNP W0TDP7
A	296	TRP	TYR	engineered mutation	UNP W0TDP7
A	297	HIS	TRP	engineered mutation	UNP W0TDP7
B	23	VAL	THR	engineered mutation	UNP W0TDP7
B	28	ALA	TYR	engineered mutation	UNP W0TDP7
B	29	HIS	LYS	engineered mutation	UNP W0TDP7
B	63	MET	THR	engineered mutation	UNP W0TDP7
B	109	ASN	LYS	conflict	UNP W0TDP7
B	213	ALA	GLN	engineered mutation	UNP W0TDP7
B	296	TRP	TYR	engineered mutation	UNP W0TDP7
B	297	HIS	TRP	engineered mutation	UNP W0TDP7
C	23	VAL	THR	engineered mutation	UNP W0TDP7
C	28	ALA	TYR	engineered mutation	UNP W0TDP7
C	29	HIS	LYS	engineered mutation	UNP W0TDP7
C	63	MET	THR	engineered mutation	UNP W0TDP7
C	109	ASN	LYS	conflict	UNP W0TDP7

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Chain	Residue	Modelled	Actual	Comment	Reference
C	213	ALA	GLN	engineered mutation	UNP W0TDP7
C	296	TRP	TYR	engineered mutation	UNP W0TDP7
C	297	HIS	TRP	engineered mutation	UNP W0TDP7
D	23	VAL	THR	engineered mutation	UNP W0TDP7
D	28	ALA	TYR	engineered mutation	UNP W0TDP7
D	29	HIS	LYS	engineered mutation	UNP W0TDP7
D	63	MET	THR	engineered mutation	UNP W0TDP7
D	109	ASN	LYS	conflict	UNP W0TDP7
D	213	ALA	GLN	engineered mutation	UNP W0TDP7
D	296	TRP	TYR	engineered mutation	UNP W0TDP7
D	297	HIS	TRP	engineered mutation	UNP W0TDP7

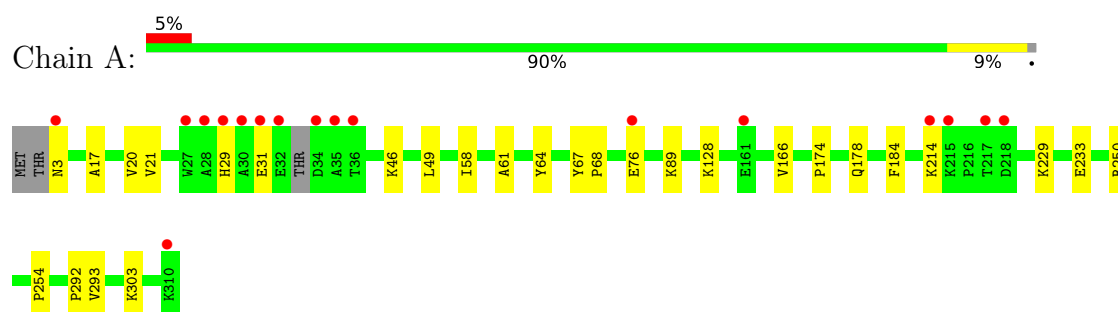
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	119	Total O 119 119	0	0
2	B	123	Total O 123 123	0	0
2	C	124	Total O 124 124	0	0
2	D	115	Total O 115 115	0	0

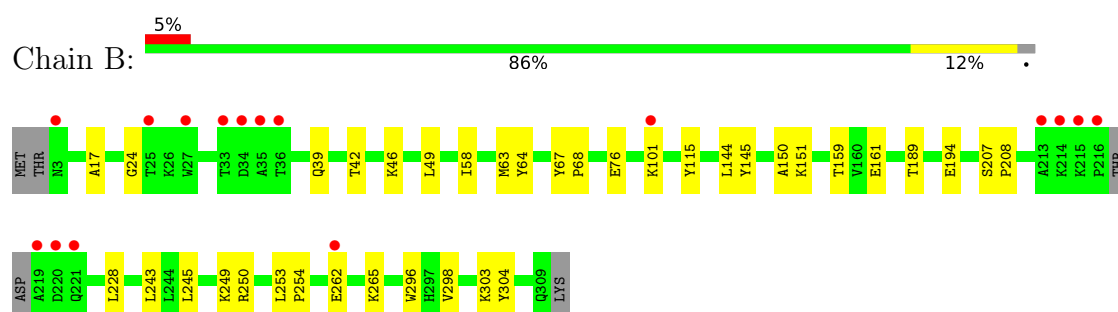
3 Residue-property plots [i](#)

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.

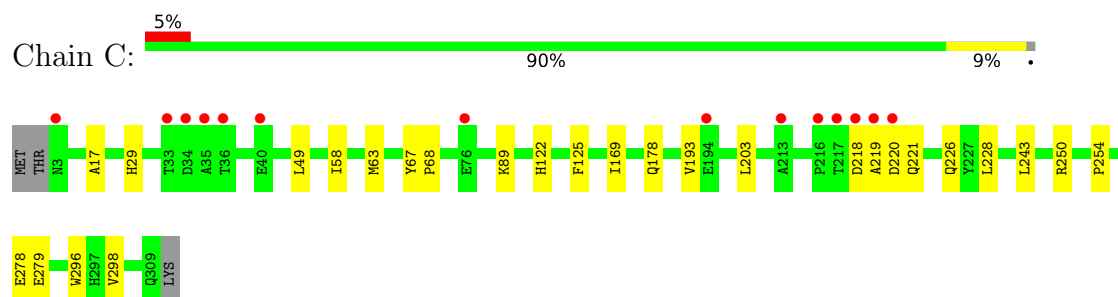
- Molecule 1: NADPH-dependent alpha-keto amide reductase



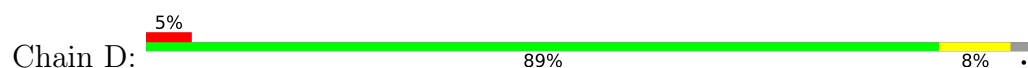
- Molecule 1: NADPH-dependent alpha-keto amide reductase

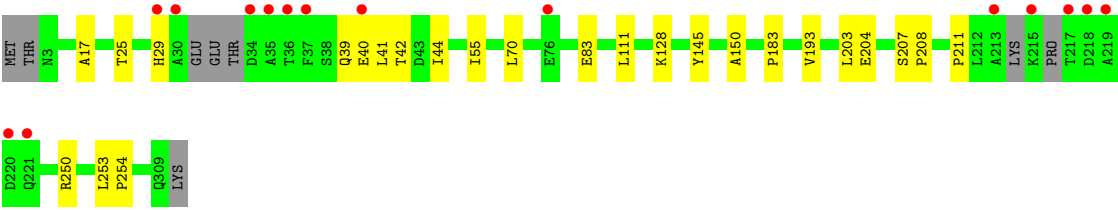


- Molecule 1: NADPH-dependent alpha-keto amide reductase



- Molecule 1: NADPH-dependent alpha-keto amide reductase





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	67.67Å 115.18Å 83.46Å 90.00° 101.46° 90.00°	Depositor
Resolution (Å)	81.80 – 1.99 81.80 – 1.99	Depositor EDS
% Data completeness (in resolution range)	99.8 (81.80-1.99) 99.8 (81.80-1.99)	Depositor EDS
R_{merge}	0.20	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.14 (at 1.98Å)	Xtriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.196 , 0.237 0.203 , 0.242	Depositor DCC
R_{free} test set	4149 reflections (4.84%)	wwPDB-VP
Wilson B-factor (Å ²)	13.1	Xtriage
Anisotropy	0.642	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 33.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	10303	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.12% 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

5.1 Standard geometry

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	0.58	0/2525	0.81	0/3421
1	B	0.57	0/2508	0.79	0/3399
1	C	0.60	0/2524	0.80	0/3423
1	D	0.57	0/2479	0.79	0/3357
All	All	0.58	0/10036	0.80	0/13600

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
1	C	0	1
1	D	0	1
All	All	0	4

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	250	ARG	Sidechain
1	B	250	ARG	Sidechain
1	C	250	ARG	Sidechain
1	D	250	ARG	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	2471	0	2483	18	0
1	B	2454	0	2466	26	0
1	C	2469	0	2478	22	0
1	D	2428	0	2436	17	0
2	A	119	0	0	0	0
2	B	123	0	0	3	0
2	C	124	0	0	1	0
2	D	115	0	0	1	0
All	All	10303	0	9863	73	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 (73) 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:303:LYS:HE2	1:C:125:PHE:CE1	2.22	0.75
1:D:40:GLU:H	1:D:40:GLU:CD	1.99	0.69
1:C:29:HIS:HD2	1:D:25:THR:OG1	1.76	0.69
1:C:296:TRP:HH2	1:D:29:HIS:CG	2.11	0.69
1:B:262:GLU:HG2	2:B:507:HOH:O	1.92	0.68
1:A:29:HIS:CG	1:B:296:TRP:HH2	2.16	0.63
1:B:49:LEU:HD21	1:B:58:ILE:HD11	1.82	0.61
1:B:298:VAL:HG11	1:D:128:LYS:HD3	1.84	0.59
1:C:89:LYS:HE2	1:C:178:GLN:OE1	2.02	0.59
1:A:128:LYS:HE3	2:C:433:HOH:O	2.04	0.58
1:C:17:ALA:O	1:C:254:PRO:HD2	2.05	0.57
1:C:220:ASP:HB2	1:C:221:GLN:NE2	2.21	0.56
1:C:29:HIS:HE1	2:D:402:HOH:O	1.88	0.55
1:A:89:LYS:HE2	1:A:178:GLN:OE1	2.07	0.55
1:A:49:LEU:HD21	1:A:58:ILE:HD11	1.89	0.55
1:B:115:TYR:CD2	1:B:151:LYS:HG2	2.42	0.54
1:C:218:ASP:O	1:C:219:ALA:C	2.51	0.53
1:D:40:GLU:CD	1:D:40:GLU:N	2.66	0.53
1:A:20:VAL:HG23	1:A:21:VAL:HG23	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:55:ILE:HD13	1:D:83:GLU:HA	1.91	0.52
1:B:67:TYR:N	1:B:68:PRO:CD	2.73	0.52
1:B:17:ALA:O	1:B:254:PRO:HD2	2.08	0.52
1:A:31:GLU:CD	1:B:63:MET:HE3	2.36	0.51
1:C:193:VAL:HA	1:C:203:LEU:HD11	1.92	0.51
1:A:166:VAL:HG11	1:A:174:PRO:HG3	1.93	0.51
1:B:161:GLU:HG2	2:B:511:HOH:O	2.10	0.51
1:A:67:TYR:N	1:A:68:PRO:CD	2.75	0.50
1:C:67:TYR:N	1:C:68:PRO:CD	2.74	0.50
1:B:228:LEU:HD11	1:B:243:LEU:CD2	2.43	0.49
1:C:63:MET:HE2	1:C:122:HIS:CE1	2.48	0.49
1:C:228:LEU:HD21	1:C:243:LEU:HD21	1.94	0.49
1:C:49:LEU:HD21	1:C:58:ILE:HD11	1.93	0.49
1:B:253:LEU:C	1:B:253:LEU:HD23	2.38	0.49
1:C:220:ASP:HB2	1:C:221:GLN:HE22	1.76	0.49
1:C:29:HIS:CD2	1:D:25:THR:OG1	2.62	0.49
1:D:39:GLN:HA	1:D:42:THR:HG22	1.95	0.48
1:B:159:THR:HG22	1:B:189:THR:HG21	1.96	0.48
1:C:220:ASP:O	1:C:226:GLN:NE2	2.45	0.48
1:A:46:LYS:HE2	1:A:76:GLU:HB3	1.96	0.48
1:B:303:LYS:HE3	1:B:304:TYR:CZ	2.49	0.48
1:B:265:LYS:HE3	2:B:421:HOH:O	2.14	0.47
1:A:184:PHE:O	1:A:292:PRO:HA	2.15	0.47
1:A:29:HIS:CG	1:B:296:TRP:CH2	3.01	0.47
1:B:46:LYS:HE2	1:B:76:GLU:CB	2.46	0.46
1:A:17:ALA:O	1:A:254:PRO:HD2	2.17	0.45
1:C:63:MET:CE	1:C:122:HIS:CE1	3.00	0.45
1:B:101:LYS:HD2	1:B:144:LEU:HD21	1.99	0.45
1:C:63:MET:HE2	1:C:122:HIS:ND1	2.31	0.45
1:C:218:ASP:O	1:C:221:GLN:N	2.29	0.45
1:A:229:LYS:O	1:A:233:GLU:HG3	2.17	0.44
1:D:204:GLU:HG2	1:D:253:LEU:HB3	1.99	0.44
1:A:61:ALA:HB3	1:A:64:TYR:CD2	2.53	0.44
1:A:128:LYS:HD3	1:C:298:VAL:HG11	2.00	0.44
1:B:228:LEU:HD11	1:B:243:LEU:HD21	2.00	0.43
1:D:207:SER:N	1:D:208:PRO:CD	2.80	0.43
1:D:17:ALA:O	1:D:254:PRO:HD2	2.19	0.43
1:A:214:LYS:HD3	1:A:293:VAL:HG13	2.00	0.43
1:B:145:TYR:HA	1:B:150:ALA:O	2.18	0.43
1:A:214:LYS:HD3	1:A:293:VAL:CG1	2.49	0.42
1:D:70:LEU:HD23	1:D:111:LEU:HD21	2.00	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:245:LEU:O	1:B:249:LYS:HG2	2.20	0.42
1:B:298:VAL:CG1	1:D:128:LYS:HD3	2.49	0.42
1:C:169:ILE:C	1:C:169:ILE:HD12	2.44	0.42
1:D:145:TYR:HA	1:D:150:ALA:O	2.20	0.41
1:B:46:LYS:HE2	1:B:76:GLU:HB3	2.01	0.41
1:D:193:VAL:HA	1:D:203:LEU:HD11	2.02	0.41
1:B:194:GLU:H	1:B:194:GLU:CD	2.28	0.41
1:B:39:GLN:HA	1:B:42:THR:HG22	2.02	0.41
1:B:24:GLY:HA2	1:B:64:TYR:CD2	2.56	0.41
1:D:183:PRO:HD2	1:D:211:PRO:HG2	2.03	0.41
1:D:41:LEU:O	1:D:44:ILE:HG22	2.21	0.40
1:C:278:GLU:HG3	1:C:279:GLU:N	2.36	0.40
1:B:207:SER:N	1:B:208:PRO:CD	2.85	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	303/310 (98%)	300 (99%)	3 (1%)	0	100	100
1	B	301/310 (97%)	299 (99%)	2 (1%)	0	100	100
1	C	305/310 (98%)	303 (99%)	2 (1%)	0	100	100
1	D	295/310 (95%)	293 (99%)	2 (1%)	0	100	100
All	All	1204/1240 (97%)	1195 (99%)	9 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	273/276 (99%)	272 (100%)	1 (0%)	84	89
1	B	271/276 (98%)	271 (100%)	0	100	100
1	C	273/276 (99%)	273 (100%)	0	100	100
1	D	268/276 (97%)	268 (100%)	0	100	100
All	All	1085/1104 (98%)	1084 (100%)	1 (0%)	88	92

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	39	GLN
1	A	131	ASN
1	A	297	HIS
1	B	39	GLN
1	B	187	ASN
1	B	290	HIS
1	C	29	HIS
1	C	131	ASN
1	C	187	ASN
1	C	221	GLN
1	C	289	GLN
1	D	3	ASN
1	D	39	GLN
1	D	131	ASN
1	D	187	ASN
1	D	222	GLN

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](#)

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, 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	307/310 (99%)	0.31	17 (5%) 30 29	5, 15, 33, 83	0
1	B	305/310 (98%)	0.39	16 (5%) 33 31	6, 16, 32, 82	0
1	C	307/310 (99%)	0.35	14 (4%) 37 36	7, 16, 33, 71	0
1	D	302/310 (97%)	0.38	15 (4%) 34 33	7, 17, 35, 73	0
All	All	1221/1240 (98%)	0.36	62 (5%) 33 32	5, 16, 35, 83	0

All (62) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	30	ALA	7.4
1	B	219	ALA	6.7
1	B	34	ASP	5.5
1	B	216	PRO	5.2
1	B	33	THR	5.2
1	A	34	ASP	5.0
1	D	34	ASP	4.9
1	C	35	ALA	4.6
1	D	217	THR	4.5
1	C	217	THR	4.5
1	B	35	ALA	4.4
1	B	213	ALA	4.1
1	B	220	ASP	4.1
1	A	217	THR	4.0
1	D	35	ALA	4.0
1	D	29	HIS	4.0
1	C	216	PRO	3.9
1	C	218	ASP	3.7
1	B	215	LYS	3.7
1	A	214	LYS	3.6
1	C	213	ALA	3.6

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Mol	Chain	Res	Type	RSRZ
1	B	36	THR	3.5
1	C	34	ASP	3.5
1	A	29	HIS	3.4
1	A	31	GLU	3.2
1	D	215	LYS	3.2
1	A	36	THR	3.1
1	D	36	THR	3.1
1	A	35	ALA	3.1
1	D	218	ASP	3.0
1	A	30	ALA	3.0
1	D	213	ALA	3.0
1	A	32	GLU	2.9
1	B	27	TRP	2.8
1	C	36	THR	2.7
1	C	33	THR	2.6
1	A	3	ASN	2.6
1	D	40	GLU	2.6
1	A	310	LYS	2.6
1	B	3	ASN	2.6
1	C	3	ASN	2.5
1	A	76	GLU	2.5
1	D	219	ALA	2.5
1	A	27	TRP	2.4
1	C	194	GLU	2.4
1	B	101	LYS	2.3
1	B	221	GLN	2.3
1	D	221	GLN	2.3
1	C	219	ALA	2.3
1	A	215	LYS	2.3
1	A	161	GLU	2.2
1	D	220	ASP	2.2
1	D	76	GLU	2.2
1	D	37	PHE	2.2
1	B	214	LYS	2.2
1	C	220	ASP	2.1
1	A	218	ASP	2.1
1	B	25	THR	2.1
1	B	262	GLU	2.1
1	A	28	ALA	2.1
1	C	76	GLU	2.0
1	C	40	GLU	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 oligosaccharides 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.