



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 18, 2026 – 04:37 PM UTC

PDB ID : 4GPS / pdb_00004gps
Title : Crystal Structure of K. lactis Dxo1 (YDR370C)
Authors : Chang, J.H.; Chiba, K.; Tong, L.
Deposited on : 2012-08-21
Resolution : 2.40 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
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

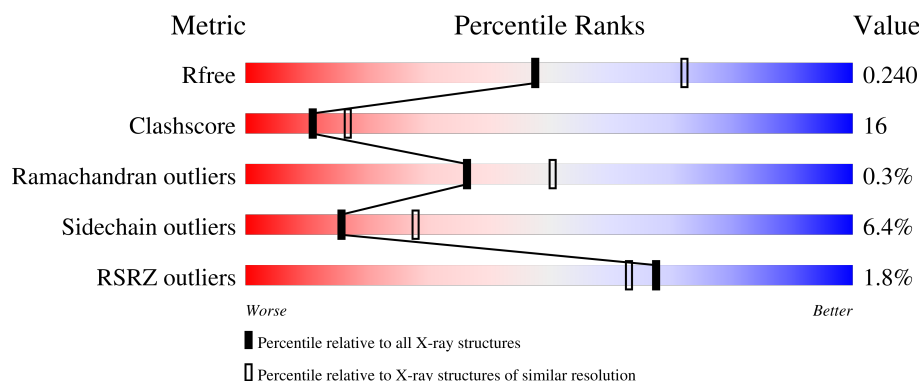
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	423	53% 21% • 22%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2852 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.

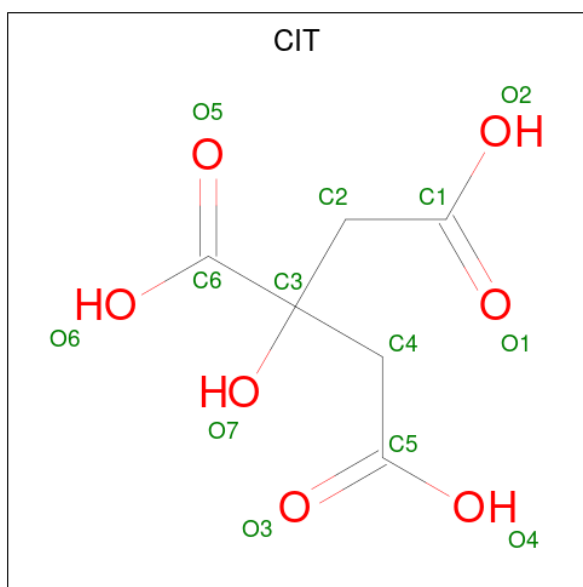
- Molecule 1 is a protein called KLLA0E02245p.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	331	Total	C	N	O	S	0	0	0
			2691	1731	445	505	10			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	expression tag	UNP Q6CPU0
A	-18	GLY	-	expression tag	UNP Q6CPU0
A	-17	SER	-	expression tag	UNP Q6CPU0
A	-16	SER	-	expression tag	UNP Q6CPU0
A	-15	HIS	-	expression tag	UNP Q6CPU0
A	-14	HIS	-	expression tag	UNP Q6CPU0
A	-13	HIS	-	expression tag	UNP Q6CPU0
A	-12	HIS	-	expression tag	UNP Q6CPU0
A	-11	HIS	-	expression tag	UNP Q6CPU0
A	-10	HIS	-	expression tag	UNP Q6CPU0
A	-9	SER	-	expression tag	UNP Q6CPU0
A	-8	SER	-	expression tag	UNP Q6CPU0
A	-7	GLY	-	expression tag	UNP Q6CPU0
A	-6	LEU	-	expression tag	UNP Q6CPU0
A	-5	VAL	-	expression tag	UNP Q6CPU0
A	-4	PRO	-	expression tag	UNP Q6CPU0
A	-3	ARG	-	expression tag	UNP Q6CPU0
A	-2	GLY	-	expression tag	UNP Q6CPU0
A	-1	SER	-	expression tag	UNP Q6CPU0
A	0	HIS	-	expression tag	UNP Q6CPU0

- Molecule 2 is CITRIC ACID (CCD ID: CIT) (formula: C₆H₈O₇).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			13	6	7		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	148	Total	O	0	0
			148	148		

- Molecule 1: KLLA0E02245p



4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α , β , γ	82.82Å 82.82Å 259.85Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.93 – 2.40 29.93 – 2.40	Depositor EDS
% Data completeness (in resolution range)	93.2 (29.93-2.40) 93.1 (29.93-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.75 (at 2.39Å)	Xtriage
Refinement program	CNS 1.2	Depositor
R, R_{free}	0.197 , 0.240 0.198 , 0.240	Depositor DCC
R_{free} test set	974 reflections (4.68%)	wwPDB-VP
Wilson B-factor (Å ²)	49.6	Xtriage
Anisotropy	0.375	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 35.1	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	0.96	EDS
Total number of atoms	2852	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.90% 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

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

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	0.73	1/2745 (0.0%)	1.14	19/3717 (0.5%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	182	MET	SD-CE	-5.29	1.66	1.79

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	282	LEU	N-CA-C	-8.69	99.04	110.43
1	A	76	ILE	N-CA-C	7.72	119.42	110.62
1	A	386	THR	N-CA-C	-7.27	104.39	113.18
1	A	165	ILE	N-CA-C	-7.20	103.76	110.53
1	A	253	ILE	N-CA-C	7.00	118.19	108.12
1	A	251	ASP	N-CA-C	-6.96	104.75	113.18
1	A	278	VAL	N-CA-C	-6.74	98.79	109.17
1	A	57	ASP	N-CA-C	6.31	117.82	111.07
1	A	136	SER	N-CA-C	6.15	118.79	111.71
1	A	360	ILE	CB-CA-C	-5.70	103.33	112.16
1	A	189	ASN	N-CA-C	-5.43	103.21	110.55
1	A	92	LEU	N-CA-C	-5.41	101.85	109.96
1	A	161	LEU	N-CA-C	-5.32	103.00	110.50
1	A	160	SER	N-CA-C	5.28	116.56	108.42
1	A	325	LYS	N-CA-C	-5.26	102.96	110.59
1	A	194	VAL	CB-CA-C	-5.18	104.09	111.34
1	A	280	PHE	N-CA-C	5.17	117.93	110.28
1	A	378	THR	N-CA-C	-5.09	107.24	113.50
1	A	190	ILE	N-CA-C	5.04	115.17	108.11

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	2691	0	2723	89	0
2	A	13	0	5	3	0
3	A	148	0	0	10	0
All	All	2852	0	2728	89	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 16.

All (89) 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:312:ASN:HD22	1:A:315:SER:H	1.14	0.89
1:A:162:ARG:HH21	2:A:501:CIT:H41	1.44	0.83
1:A:145:GLN:HB2	3:A:710:HOH:O	1.80	0.81
1:A:250:ASN:HB3	1:A:252:GLU:H	1.48	0.78
1:A:385:ASP:OD2	1:A:389:THR:HB	1.86	0.76
1:A:76:ILE:H	1:A:76:ILE:HD12	1.51	0.75
1:A:152:ASN:HD22	1:A:154:GLU:H	1.38	0.72
1:A:249:LEU:HD22	1:A:357:PHE:CZ	2.26	0.71
1:A:345:PHE:N	3:A:604:HOH:O	2.24	0.69
1:A:385:ASP:HB3	1:A:387:ASN:H	1.57	0.69
1:A:157:THR:H	1:A:189:ASN:ND2	1.92	0.67
1:A:152:ASN:HD22	1:A:152:ASN:C	2.02	0.66
1:A:152:ASN:ND2	1:A:154:GLU:H	1.93	0.66
1:A:306:LEU:HD12	1:A:329:ILE:HG13	1.79	0.65
1:A:312:ASN:ND2	1:A:315:SER:H	1.92	0.65
1:A:212:ASN:N	3:A:635:HOH:O	2.29	0.64
1:A:89:LYS:HB3	1:A:264:ILE:CD1	2.28	0.63
1:A:162:ARG:NH2	2:A:501:CIT:H41	2.12	0.63
1:A:182:MET:HE2	1:A:368:LEU:CD1	2.29	0.62
1:A:50:VAL:HG11	1:A:54:TYR:CG	2.34	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:157:THR:H	1:A:189:ASN:HD22	1.47	0.62
1:A:306:LEU:CD1	1:A:329:ILE:HG13	2.30	0.62
1:A:75:ILE:HD12	1:A:88:ARG:NH1	2.15	0.61
1:A:333:ILE:CD1	1:A:350:PRO:HG3	2.33	0.59
1:A:50:VAL:HG11	1:A:54:TYR:CD2	2.37	0.59
1:A:212:ASN:ND2	1:A:215:ILE:HD13	2.18	0.59
1:A:52:VAL:HG12	1:A:347:LYS:HD2	1.83	0.58
1:A:89:LYS:HB3	1:A:264:ILE:HD13	1.86	0.57
1:A:214:LYS:O	1:A:218:THR:HG23	2.05	0.56
1:A:212:ASN:CG	1:A:215:ILE:HD13	2.32	0.55
1:A:85:GLU:HG2	3:A:638:HOH:O	2.07	0.55
1:A:303:LYS:NZ	3:A:639:HOH:O	2.39	0.55
1:A:250:ASN:HB2	1:A:253:ILE:HB	1.89	0.54
1:A:50:VAL:CG1	1:A:54:TYR:CG	2.91	0.54
1:A:344:LYS:C	3:A:604:HOH:O	2.51	0.54
1:A:385:ASP:HB2	1:A:389:THR:H	1.72	0.54
1:A:275:LYS:CE	1:A:297:GLN:HE22	2.22	0.53
1:A:356:TRP:CE2	1:A:360:ILE:HG12	2.44	0.53
1:A:187:ASP:O	1:A:188:LYS:HB2	2.08	0.53
1:A:59:THR:H	1:A:327:GLN:HE22	1.57	0.53
1:A:89:LYS:CB	1:A:264:ILE:HD13	2.39	0.52
1:A:50:VAL:CG1	1:A:54:TYR:CB	2.88	0.51
1:A:249:LEU:HD22	1:A:357:PHE:CE1	2.45	0.51
1:A:173:PHE:HA	1:A:345:PHE:HB3	1.93	0.51
1:A:303:LYS:HD2	3:A:726:HOH:O	2.11	0.50
1:A:331:HIS:O	1:A:335:ASN:OD1	2.28	0.50
1:A:164:HIS:HD2	3:A:634:HOH:O	1.94	0.50
1:A:89:LYS:HB3	1:A:264:ILE:HD11	1.93	0.49
1:A:46:LYS:HB2	1:A:46:LYS:NZ	2.27	0.48
1:A:333:ILE:HD12	1:A:350:PRO:HG3	1.95	0.48
1:A:335:ASN:ND2	1:A:338:ILE:HB	2.28	0.48
1:A:356:TRP:CZ2	1:A:360:ILE:HG12	2.48	0.48
1:A:160:SER:HB2	1:A:192:ILE:HB	1.96	0.47
1:A:180:LEU:CD2	1:A:194:VAL:HG13	2.45	0.47
1:A:180:LEU:HD23	1:A:194:VAL:CG1	2.45	0.47
1:A:103:SER:O	1:A:104:LYS:HG3	2.14	0.47
1:A:140:LEU:N	1:A:258:GLN:HE22	2.13	0.47
1:A:306:LEU:HD12	1:A:329:ILE:CG1	2.45	0.47
1:A:303:LYS:O	1:A:303:LYS:CG	2.64	0.46
1:A:290:LYS:HG2	1:A:294:MET:HE3	1.97	0.46
1:A:81:LEU:HD21	1:A:139:ILE:HG12	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:250:ASN:ND2	1:A:362:GLN:OE1	2.50	0.45
1:A:335:ASN:HD22	1:A:338:ILE:H	1.63	0.45
1:A:52:VAL:CG1	1:A:347:LYS:HD2	2.48	0.44
1:A:47:PHE:CE1	1:A:49:HIS:HB3	2.52	0.44
1:A:260:GLU:O	1:A:261:MET:HE2	2.18	0.44
1:A:180:LEU:HD23	1:A:194:VAL:HG13	2.00	0.44
1:A:53:ASN:HA	1:A:339:VAL:HG22	1.99	0.43
1:A:326:ILE:HG23	1:A:327:GLN:N	2.33	0.43
1:A:107:ASN:ND2	1:A:110:VAL:H	2.17	0.43
1:A:298:THR:HG21	1:A:306:LEU:HG	2.01	0.43
1:A:150:THR:HG22	1:A:150:THR:O	2.19	0.43
1:A:62:LEU:HG	1:A:299:ASN:OD1	2.19	0.42
1:A:297:GLN:NE2	3:A:609:HOH:O	2.52	0.42
1:A:326:ILE:HG22	3:A:683:HOH:O	2.18	0.42
1:A:335:ASN:HB2	1:A:337:SER:H	1.84	0.42
1:A:249:LEU:C	1:A:249:LEU:HD12	2.44	0.42
1:A:249:LEU:CD2	1:A:357:PHE:CZ	3.01	0.42
1:A:172:PRO:HG2	1:A:173:PHE:CE1	2.55	0.41
1:A:189:ASN:HD22	1:A:189:ASN:HA	1.72	0.41
1:A:315:SER:O	1:A:316:ASN:HB2	2.21	0.41
1:A:105:TRP:CG	1:A:111:LYS:HB2	2.55	0.41
1:A:182:MET:HE2	1:A:368:LEU:HD11	2.02	0.41
1:A:293:ARG:NH1	2:A:501:CIT:O1	2.45	0.41
1:A:275:LYS:NZ	1:A:297:GLN:HE22	2.20	0.40
1:A:303:LYS:O	1:A:303:LYS:HG3	2.21	0.40
1:A:69:VAL:HG11	1:A:147:TYR:CZ	2.57	0.40
1:A:113:SER:O	1:A:117:ILE:HD12	2.21	0.40
1:A:329:ILE:HD12	1:A:329:ILE:HG23	1.86	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	323/423 (76%)	312 (97%)	10 (3%)	1 (0%)	36	50

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	345	PHE

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	312/397 (79%)	292 (94%)	20 (6%)	16	28

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	LEU
1	A	46	LYS
1	A	52	VAL
1	A	75	ILE
1	A	93	ARG
1	A	108	LYS
1	A	113	SER
1	A	120	THR
1	A	136	SER
1	A	148	GLU
1	A	152	ASN
1	A	154	GLU
1	A	194	VAL
1	A	218	THR
1	A	249	LEU
1	A	278	VAL
1	A	335	ASN
1	A	336	SER
1	A	339	VAL
1	A	360	ILE

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	49	HIS
1	A	107	ASN
1	A	152	ASN
1	A	185	GLN
1	A	189	ASN
1	A	250	ASN
1	A	258	GLN
1	A	279	HIS
1	A	297	GLN
1	A	312	ASN
1	A	316	ASN
1	A	327	GLN
1	A	334	ASN
1	A	335	ASN
1	A	366	GLN
1	A	373	GLN
1	A	387	ASN

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](#)

1 ligand is 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	CIT	A	501	-	12,12,12	1.05	0	17,17,17	1.34	1 (5%)

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
2	CIT	A	501	-	-	0/16/16/16	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	CIT	O6-C6-C3	3.32	119.50	113.14

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	CIT	3	0

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	331/423 (78%)	-0.32	6 (1%) 67 63	35, 50, 81, 111	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	238	HIS	3.5
1	A	38	GLY	2.9
1	A	125	ASP	2.7
1	A	344	LYS	2.3
1	A	376	THR	2.1
1	A	303	LYS	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](#)

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(Å ²)	Q<0.9
2	CIT	A	501	13/13	0.91	0.11	76,83,88,91	0

6.5 Other polymers [i](#)

There are no such residues in this entry.