



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:07 PM UTC

PDB ID : 2E8Y / pdb_00002e8y
Title : Crystal structure of pullulanase type I from *Bacillus subtilis* str. 168
Authors : Mikami, B.; Malle, D.; Utsumi, S.; Iwamoto, H.; Katsuya, Y.
Deposited on : 2007-01-24
Resolution : 2.11 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

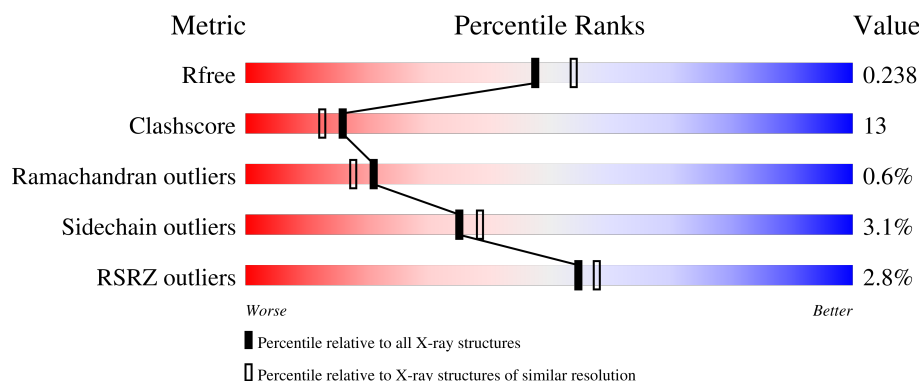
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

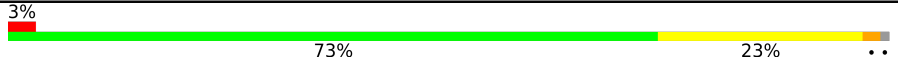
The reported resolution of this entry is 2.11 Å.

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	8290 (2.14-2.10)
Clashscore	190562	8817 (2.14-2.10)
Ramachandran outliers	187476	8738 (2.14-2.10)
Sidechain outliers	187428	8739 (2.14-2.10)
RSRZ outliers	180081	8294 (2.14-2.10)

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	718	 3% 73% 23% ..
1	B	718	 3% 75% 22% ..

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	ACT	A	751	-	-	X	-
4	GOL	A	761	-	X	-	-
4	GOL	B	762	-	X	-	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12049 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 AmyX protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	712	Total	C	N	O	S	0	0	0
			5672	3615	975	1060	22			
1	B	712	Total	C	N	O	S	0	0	0
			5672	3615	975	1060	22			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	365	LYS	MET	conflict	UNP O34587
B	365	LYS	MET	conflict	UNP O34587

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 3 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		

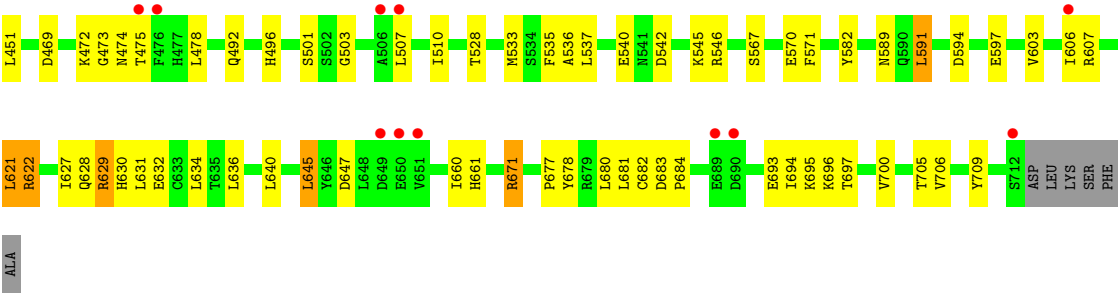
- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	333	Total 333	O 333	0	0
5	B	350	Total 350	O 350	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	70.56Å 127.68Å 189.25Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.11 15.00 – 2.11	Depositor EDS
% Data completeness (in resolution range)	99.2 (15.00-2.11) 99.2 (15.00-2.11)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.00 (at 2.10Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.201 , 0.238 0.201 , 0.238	Depositor DCC
R_{free} test set	9885 reflections (9.99%)	wwPDB-VP
Wilson B-factor (Å ²)	23.2	Xtriage
Anisotropy	0.447	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 49.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	12049	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.80% 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: ACT, GOL, CA

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	0.35	0/5820	0.87	14/7902 (0.2%)
1	B	0.35	0/5820	0.90	18/7902 (0.2%)
All	All	0.35	0/11640	0.88	32/15804 (0.2%)

There are no bond length outliers.

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	589	ASN	N-CA-C	7.16	122.11	113.23
1	B	589	ASN	N-CA-C	6.89	121.78	113.23
1	B	283	LYS	CA-C-N	6.84	127.41	119.47
1	B	283	LYS	C-N-CA	6.84	127.41	119.47
1	A	381	ARG	N-CA-C	6.63	119.35	111.33
1	B	510	ILE	N-CA-C	-6.50	104.69	111.58
1	A	225	PHE	N-CA-C	6.41	119.09	111.33
1	B	225	PHE	N-CA-C	6.08	118.69	111.33
1	B	100	PHE	N-CA-C	6.06	120.81	113.17
1	B	357	PHE	N-CA-C	5.93	120.38	113.20
1	B	413	ILE	N-CA-C	5.85	116.04	110.42
1	B	528	THR	N-CA-C	-5.77	102.92	110.53
1	B	381	ARG	N-CA-C	5.75	118.29	111.33
1	B	274	ASN	N-CA-C	-5.72	102.83	110.55
1	A	373	GLY	N-CA-C	5.71	119.69	113.58
1	B	594	ASP	N-CA-C	-5.62	105.23	111.36
1	B	111	THR	N-CA-C	-5.62	100.52	109.23
1	A	274	ASN	N-CA-C	-5.53	103.08	110.55
1	B	110	TYR	N-CA-C	5.53	118.82	109.76
1	A	111	THR	N-CA-C	-5.50	100.35	108.99
1	B	41	THR	N-CA-C	5.49	118.02	109.52
1	B	58	LYS	N-CA-C	5.48	117.89	109.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	510	ILE	N-CA-C	-5.41	105.85	111.58
1	B	332	VAL	N-CA-C	5.36	115.62	108.11
1	A	591	LEU	N-CA-C	-5.34	101.07	109.25
1	A	413	ILE	N-CA-C	5.30	116.02	110.62
1	A	210	SER	N-CA-C	5.21	117.37	111.02
1	A	701	ASN	N-CA-C	5.16	116.71	108.41
1	A	100	PHE	N-CA-C	5.10	120.14	113.30
1	A	192	GLY	N-CA-C	-5.07	105.82	112.82
1	B	271	LEU	N-CA-C	-5.03	102.96	110.20
1	A	594	ASP	N-CA-C	-5.00	105.91	111.36

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	5672	0	5521	160	0
1	B	5672	0	5521	137	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	4	0	3	3	0
3	B	4	0	3	0	0
4	A	6	0	4	1	0
4	B	6	0	4	0	0
5	A	333	0	0	11	0
5	B	350	0	0	8	0
All	All	12049	0	11056	295	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 13.

All (295) 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:207:LYS:HE2	1:A:207:LYS:H	1.00	1.07
1:B:230:ASN:HD21	1:B:250:ALA:H	1.03	1.00
1:A:230:ASN:HD21	1:A:250:ALA:H	1.10	1.00
1:A:207:LYS:HE2	1:A:207:LYS:N	1.75	0.99
1:A:87:ILE:H	1:A:171:ASN:HD21	1.12	0.92
1:A:111:THR:HG22	1:A:113:ASP:H	1.35	0.91
1:B:640:LEU:HD21	1:B:660:ILE:HD11	1.50	0.91
1:A:207:LYS:H	1:A:207:LYS:CE	1.86	0.89
1:A:660:ILE:HB	1:A:706:VAL:CG1	2.05	0.87
1:A:660:ILE:HB	1:A:706:VAL:HG13	1.57	0.86
1:A:263:LEU:HD22	1:A:606:ILE:HD11	1.57	0.86
1:A:160:HIS:HD2	1:A:196:ARG:H	1.21	0.84
1:B:160:HIS:HD2	1:B:196:ARG:H	1.22	0.83
1:A:339:ASN:HD21	1:A:340:HIS:HD2	1.26	0.82
1:A:496:HIS:HE1	1:A:503:GLY:H	1.27	0.82
1:B:263:LEU:HD22	1:B:606:ILE:HD11	1.63	0.80
1:B:230:ASN:HD21	1:B:250:ALA:N	1.80	0.80
1:A:339:ASN:ND2	1:A:340:HIS:HD2	1.81	0.78
1:B:22:ILE:HD12	1:B:59:TYR:HE1	1.48	0.78
1:B:22:ILE:HD13	1:B:30:MET:O	1.83	0.78
1:B:251:ASN:HB2	1:B:597:GLU:OE1	1.83	0.78
1:B:339:ASN:ND2	1:B:340:HIS:HD2	1.81	0.77
1:B:660:ILE:CG2	1:B:706:VAL:HB	2.15	0.77
1:A:87:ILE:N	1:A:171:ASN:HD21	1.82	0.77
1:A:87:ILE:H	1:A:171:ASN:ND2	1.83	0.76
1:B:87:ILE:H	1:B:171:ASN:ND2	1.85	0.74
1:B:39:GLU:HG3	1:B:40:ILE:HG13	1.68	0.74
1:B:341:VAL:H	1:B:374:ASN:HD21	1.33	0.74
1:B:677:PRO:HG3	1:B:695:LYS:HE2	1.68	0.74
1:B:603:VAL:O	1:B:606:ILE:HG13	1.87	0.73
1:A:22:ILE:HD13	1:A:30:MET:O	1.88	0.72
1:B:87:ILE:H	1:B:171:ASN:HD21	1.35	0.72
1:B:496:HIS:HE1	1:B:503:GLY:H	1.36	0.71
1:B:339:ASN:HD21	1:B:340:HIS:HD2	1.36	0.71
1:A:142:GLN:HG3	5:A:957:HOH:O	1.90	0.71
1:B:660:ILE:HG23	1:B:706:VAL:HB	1.71	0.71
1:B:622:ARG:HD3	5:B:913:HOH:O	1.90	0.70
1:B:22:ILE:HD12	1:B:59:TYR:CE1	2.25	0.70
1:A:542:ASP:HB3	3:A:751:ACT:H2	1.73	0.70
1:A:621:LEU:HD23	1:A:627:ILE:HA	1.72	0.70
1:A:456:ARG:HD3	5:A:1051:HOH:O	1.91	0.69
1:B:207:LYS:CD	1:B:207:LYS:H	2.03	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:22:ILE:HD11	1:B:34:PHE:HZ	1.56	0.69
1:B:207:LYS:H	1:B:207:LYS:HD2	1.57	0.68
1:A:603:VAL:O	1:A:606:ILE:HG13	1.93	0.68
1:A:692:THR:HG22	5:A:1088:HOH:O	1.92	0.68
1:B:14:ASP:HB3	1:B:17:ILE:HD13	1.76	0.68
1:B:54:GLU:HG3	1:B:55:ALA:H	1.58	0.68
1:A:87:ILE:HG13	1:A:171:ASN:HD21	1.59	0.68
1:A:435:GLU:HG2	5:A:989:HOH:O	1.95	0.67
1:A:571:PHE:HZ	1:A:591:LEU:HD22	1.59	0.66
1:A:671:ARG:HG2	1:A:697:THR:HG22	1.78	0.66
1:B:621:LEU:HD23	1:B:627:ILE:HA	1.79	0.65
1:B:133:HIS:HB3	1:B:136:LYS:HB2	1.77	0.65
1:B:307:ASN:HD21	1:B:309:HIS:HB2	1.62	0.63
1:A:52:SER:C	1:A:53:LEU:HD12	2.24	0.63
1:A:341:VAL:H	1:A:374:ASN:HD21	1.46	0.63
1:A:307:ASN:HD21	1:A:309:HIS:HB2	1.63	0.63
1:A:242:LEU:HD23	5:A:820:HOH:O	1.99	0.63
1:A:492:GLN:HG2	1:A:507:LEU:HD11	1.80	0.63
1:B:211:HIS:HD2	1:B:213:VAL:H	1.48	0.62
1:A:230:ASN:HD21	1:A:250:ALA:N	1.89	0.62
1:A:307:ASN:ND2	1:A:309:HIS:H	1.97	0.62
1:A:316:THR:O	1:A:320:GLN:HG3	1.98	0.62
1:A:413:ILE:HB	5:A:896:HOH:O	1.99	0.62
1:B:540:GLU:O	1:B:545:LYS:HE3	1.99	0.62
1:B:207:LYS:HD2	1:B:207:LYS:N	2.15	0.61
1:B:339:ASN:ND2	1:B:340:HIS:CD2	2.67	0.61
1:B:631:LEU:C	1:B:631:LEU:HD23	2.25	0.61
1:A:211:HIS:CD2	1:A:213:VAL:HG22	2.36	0.61
1:A:6:ARG:HD3	1:A:84:ASP:OD2	2.00	0.61
1:A:73:HIS:HB2	1:A:85:LEU:HB2	1.82	0.61
1:A:546:ARG:HH11	3:A:751:ACT:CH3	2.13	0.60
1:A:38:THR:HB	1:A:41:THR:OG1	2.01	0.60
1:B:606:ILE:HD12	1:B:607:ARG:N	2.16	0.60
1:B:22:ILE:HD11	1:B:34:PHE:CZ	2.37	0.60
1:A:339:ASN:ND2	1:A:340:HIS:CD2	2.68	0.59
1:B:211:HIS:CD2	1:B:213:VAL:HG22	2.37	0.59
1:B:469:ASP:OD2	1:B:475:THR:HG23	2.03	0.59
1:A:694:ILE:C	1:A:694:ILE:HD12	2.28	0.59
1:B:365:LYS:HE2	1:B:365:LYS:N	2.17	0.59
1:B:606:ILE:HD12	1:B:606:ILE:C	2.28	0.59
1:B:16:ASN:C	1:B:17:ILE:HD12	2.28	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:133:HIS:HB3	1:A:136:LYS:HB3	1.83	0.58
1:A:87:ILE:HG13	1:A:171:ASN:ND2	2.17	0.58
1:B:307:ASN:ND2	1:B:309:HIS:H	2.01	0.58
1:B:91:ILE:HD12	1:B:354:PRO:O	2.04	0.58
1:A:22:ILE:HD12	1:A:59:TYR:CE1	2.39	0.58
1:A:622:ARG:HD3	5:A:939:HOH:O	2.01	0.58
1:A:13:ASP:HB2	1:A:17:ILE:HD11	1.84	0.58
1:A:118:LYS:HG2	1:A:152:ALA:HB2	1.86	0.57
1:B:345:GLU:H	1:B:345:GLU:CD	2.11	0.57
1:A:680:LEU:HD12	1:A:688:GLN:HG3	1.85	0.57
1:B:54:GLU:HG3	1:B:55:ALA:N	2.19	0.57
1:B:472:LYS:NZ	1:B:475:THR:HG22	2.20	0.57
1:A:40:ILE:HG22	1:A:40:ILE:O	2.05	0.56
1:A:340:HIS:HE1	5:A:830:HOH:O	1.88	0.56
1:A:606:ILE:C	1:A:606:ILE:HD12	2.30	0.56
1:A:26:GLN:NE2	1:A:30:MET:HE3	2.21	0.56
1:B:660:ILE:HD13	1:B:700:VAL:HG21	1.88	0.56
1:A:128:ALA:HA	1:A:143:MET:HG3	1.87	0.55
1:B:571:PHE:HZ	1:B:591:LEU:HD22	1.70	0.55
1:B:339:ASN:HD21	1:B:340:HIS:CD2	2.22	0.55
1:A:211:HIS:HD2	1:A:213:VAL:H	1.54	0.55
1:B:536:ALA:C	1:B:537:LEU:HD12	2.32	0.55
1:A:533:MET:HE3	1:A:545:LYS:HB3	1.89	0.55
1:B:356:TYR:O	1:B:380:ARG:HD3	2.06	0.54
1:B:1:MET:HG2	1:B:2:VAL:N	2.23	0.54
1:B:1:MET:HG2	1:B:2:VAL:HG23	1.90	0.54
1:B:694:ILE:HD12	1:B:694:ILE:C	2.33	0.54
1:A:111:THR:HB	1:A:114:HIS:O	2.08	0.54
1:B:221:HIS:CD2	1:B:223:ARG:H	2.26	0.54
1:A:546:ARG:HD3	3:A:751:ACT:H1	1.90	0.53
1:A:536:ALA:C	1:A:537:LEU:HD12	2.33	0.53
1:A:571:PHE:CZ	1:A:591:LEU:HD22	2.42	0.53
1:B:91:ILE:CD1	1:B:354:PRO:O	2.56	0.53
1:A:22:ILE:HD11	1:A:34:PHE:CZ	2.44	0.53
1:A:631:LEU:C	1:A:631:LEU:HD23	2.33	0.53
1:B:17:ILE:HD12	1:B:17:ILE:N	2.23	0.53
1:A:26:GLN:NE2	1:A:29:ILE:HD12	2.23	0.53
1:A:211:HIS:HD2	1:A:213:VAL:HG22	1.72	0.53
1:A:661:HIS:HE1	5:A:813:HOH:O	1.92	0.53
1:A:370:THR:HG23	1:A:375:ASP:OD2	2.09	0.53
1:A:463:PHE:HA	1:A:518:ILE:HB	1.89	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:91:ILE:HD12	1:A:354:PRO:O	2.09	0.53
1:B:260:VAL:HG13	1:B:265:VAL:HG21	1.90	0.52
1:A:22:ILE:HD11	1:A:34:PHE:HZ	1.75	0.52
1:B:694:ILE:HD12	1:B:694:ILE:O	2.08	0.52
1:B:6:ARG:HD3	1:B:84:ASP:OD2	2.10	0.52
1:A:23:PRO:HG2	1:A:26:GLN:HB2	1.92	0.51
1:A:221:HIS:CD2	1:A:223:ARG:HB3	2.45	0.51
1:B:160:HIS:CD2	1:B:196:ARG:H	2.13	0.51
1:B:49:GLU:CG	1:B:60:VAL:HB	2.40	0.51
1:B:570:GLU:HB2	1:B:606:ILE:HG12	1.92	0.51
1:A:22:ILE:HD12	1:A:59:TYR:HE1	1.76	0.51
1:B:118:LYS:HG2	1:B:152:ALA:HB2	1.92	0.51
1:B:435:GLU:HB2	1:B:437:TRP:CE2	2.45	0.51
1:A:203:THR:C	1:A:205:PRO:HD3	2.35	0.51
1:A:309:HIS:O	1:A:311:PRO:HD3	2.11	0.50
1:B:630:HIS:O	1:B:645:LEU:HA	2.11	0.50
1:B:263:LEU:CD2	1:B:606:ILE:HD11	2.39	0.50
1:A:630:HIS:O	1:A:645:LEU:HA	2.12	0.50
1:B:303:SER:HA	5:B:877:HOH:O	2.12	0.50
1:A:496:HIS:CE1	1:A:503:GLY:H	2.18	0.49
1:B:324:THR:HA	1:B:327:GLN:HE21	1.78	0.49
1:A:204:ALA:N	1:A:205:PRO:HD3	2.27	0.49
1:B:25:GLU:H	1:B:25:GLU:CD	2.20	0.49
1:B:41:THR:HG22	1:B:42:ASP:N	2.27	0.49
1:B:260:VAL:CG1	1:B:265:VAL:HG21	2.42	0.49
1:B:681:LEU:C	1:B:681:LEU:HD13	2.37	0.49
1:B:695:LYS:O	1:B:697:THR:N	2.45	0.49
1:A:76:ARG:HD2	1:A:82:LYS:HE2	1.94	0.49
1:A:413:ILE:HD13	1:A:456:ARG:CZ	2.43	0.49
1:B:492:GLN:HG2	1:B:507:LEU:HD11	1.95	0.49
1:A:263:LEU:CD2	1:A:606:ILE:HD11	2.35	0.48
1:A:12:VAL:HG23	1:A:85:LEU:HD22	1.94	0.48
1:A:496:HIS:HE1	1:A:503:GLY:N	2.03	0.48
1:A:682:CYS:O	1:A:706:VAL:HA	2.12	0.48
1:A:31:THR:HB	1:A:32:PRO:HD2	1.96	0.48
1:A:679:ARG:CZ	1:A:693:GLU:HG3	2.43	0.48
1:B:49:GLU:HG2	1:B:60:VAL:HB	1.95	0.48
1:A:91:ILE:CD1	1:A:354:PRO:O	2.62	0.48
1:B:73:HIS:HE1	5:B:845:HOH:O	1.96	0.48
1:B:41:THR:CG2	1:B:42:ASP:N	2.77	0.48
1:A:570:GLU:HB2	1:A:606:ILE:HG12	1.95	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:677:PRO:CG	1:B:695:LYS:HE2	2.42	0.47
1:A:485:LEU:HA	1:A:548:ARG:HD3	1.96	0.47
1:A:359:ARG:HB3	1:A:442:PRO:HG2	1.95	0.47
1:A:111:THR:HG22	1:A:113:ASP:N	2.16	0.47
1:A:136:LYS:HD3	1:A:162:TYR:OH	2.13	0.47
1:B:282:GLU:OE2	1:B:309:HIS:HE1	1.96	0.47
1:B:631:LEU:HD23	1:B:632:GLU:N	2.30	0.47
1:A:290:TRP:CD2	1:A:582:TYR:HA	2.49	0.47
1:B:334:LEU:HD22	1:B:400:VAL:HG11	1.96	0.47
1:A:145:ARG:HB2	1:A:151:TYR:CE1	2.50	0.47
1:A:221:HIS:CD2	1:A:223:ARG:H	2.33	0.47
1:B:427:LYS:O	1:B:430:ILE:HG23	2.15	0.47
1:A:339:ASN:HD21	1:A:340:HIS:CD2	2.17	0.47
1:A:75:VAL:HG23	1:A:83:THR:HG22	1.97	0.46
1:B:12:VAL:O	1:B:12:VAL:HG13	2.16	0.46
1:A:454:ALA:N	1:A:455:PRO:CD	2.78	0.46
1:A:694:ILE:HD12	1:A:694:ILE:O	2.16	0.46
1:A:683:ASP:HB2	1:A:684:PRO:CD	2.45	0.46
1:B:370:THR:HG23	1:B:375:ASP:OD2	2.16	0.46
1:B:671:ARG:HG2	1:B:697:THR:HG22	1.96	0.46
1:B:680:LEU:HD13	1:B:680:LEU:C	2.40	0.46
1:A:10:ALA:CB	1:A:75:VAL:HG21	2.46	0.46
1:A:26:GLN:HE22	1:A:29:ILE:HD12	1.80	0.46
1:A:640:LEU:HD13	1:A:640:LEU:C	2.40	0.46
1:A:73:HIS:HD2	5:A:993:HOH:O	1.99	0.46
1:A:695:LYS:O	1:A:697:THR:N	2.42	0.46
1:B:571:PHE:CZ	1:B:591:LEU:HD22	2.50	0.46
1:A:680:LEU:C	1:A:680:LEU:HD13	2.41	0.46
1:B:133:HIS:CG	1:B:134:PRO:HD2	2.51	0.46
1:A:39:GLU:C	1:A:40:ILE:HG13	2.41	0.45
1:A:445:HIS:HD2	1:B:632:GLU:OE2	1.99	0.45
1:A:536:ALA:O	1:A:537:LEU:HD12	2.16	0.45
1:B:660:ILE:CD1	1:B:700:VAL:HG21	2.44	0.45
1:A:76:ARG:CZ	1:A:80:GLY:HA2	2.46	0.45
1:A:223:ARG:HD2	4:A:761:GOL:O3	2.16	0.45
1:A:307:ASN:C	1:A:307:ASN:HD22	2.22	0.45
1:A:548:ARG:NH1	1:A:703:ILE:CD1	2.78	0.45
1:B:496:HIS:HE1	1:B:503:GLY:N	2.09	0.45
1:A:681:LEU:HD13	1:A:681:LEU:C	2.41	0.45
1:B:307:ASN:C	1:B:307:ASN:HD22	2.24	0.45
1:A:548:ARG:NH1	1:A:703:ILE:HD11	2.32	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:19:THR:HG23	1:A:58:LYS:HE3	1.99	0.45
1:A:512:PRO:HD2	1:A:516:GLN:NE2	2.32	0.45
1:A:648:LEU:O	1:A:649:ASP:C	2.60	0.45
1:B:478:LEU:HD11	1:B:535:PHE:CD2	2.52	0.45
1:B:370:THR:OG1	1:B:372:VAL:HG22	2.18	0.44
1:B:33:PRO:HD2	1:B:78:SER:HB3	2.00	0.44
1:A:596:ARG:HD3	1:A:596:ARG:C	2.42	0.44
1:A:616:HIS:HB3	1:A:652:ASP:OD2	2.18	0.44
1:B:243:THR:HA	1:B:324:THR:HG21	1.99	0.44
1:A:362:GLU:HB3	1:B:636:LEU:HB3	1.99	0.44
1:A:679:ARG:NH2	1:A:693:GLU:HG3	2.32	0.44
1:B:496:HIS:CE1	1:B:501:SER:HA	2.53	0.44
1:A:288:TYR:CD1	1:A:289:ASN:N	2.86	0.44
1:B:207:LYS:H	1:B:207:LYS:HZ2	1.65	0.44
1:B:661:HIS:HE1	5:B:891:HOH:O	2.00	0.44
1:A:160:HIS:CD2	1:A:196:ARG:H	2.14	0.44
1:A:413:ILE:HD13	1:A:456:ARG:NH2	2.32	0.44
1:B:496:HIS:CE1	1:B:503:GLY:H	2.25	0.44
1:A:640:LEU:HD21	1:A:660:ILE:CG2	2.48	0.44
1:B:472:LYS:HZ2	1:B:475:THR:HG22	1.82	0.44
1:A:39:GLU:O	1:A:40:ILE:HB	2.17	0.43
1:A:359:ARG:NH2	1:A:443:LEU:HD11	2.33	0.43
1:A:73:HIS:HB2	1:A:85:LEU:CB	2.46	0.43
1:A:136:LYS:HG2	1:A:137:SER:H	1.83	0.43
1:A:221:HIS:HD2	1:A:223:ARG:HB3	1.83	0.43
1:B:12:VAL:HB	1:B:85:LEU:HD21	2.01	0.43
1:B:364:GLY:C	1:B:365:LYS:HE2	2.43	0.43
1:A:136:LYS:HG2	1:A:137:SER:N	2.33	0.43
1:A:307:ASN:ND2	1:A:307:ASN:C	2.76	0.43
1:B:32:PRO:HA	1:B:33:PRO:C	2.44	0.43
1:B:26:GLN:NE2	1:B:29:ILE:HD12	2.34	0.43
1:B:682:CYS:O	1:B:706:VAL:HA	2.19	0.43
1:A:117:PHE:O	1:A:152:ALA:HA	2.18	0.43
1:A:37:GLU:N	1:A:74:CYS:O	2.49	0.43
1:B:221:HIS:HD2	1:B:223:ARG:H	1.67	0.43
1:B:472:LYS:NZ	5:B:963:HOH:O	2.51	0.42
1:B:542:ASP:O	1:B:546:ARG:HG3	2.19	0.42
1:B:683:ASP:HB2	1:B:684:PRO:CD	2.49	0.42
1:A:606:ILE:HD12	1:A:607:ARG:N	2.35	0.42
1:B:661:HIS:HD2	1:B:705:THR:OG1	2.02	0.42
1:A:592:ASP:OD1	1:A:594:ASP:HB2	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:24:ALA:C	1:A:26:GLN:H	2.28	0.42
1:A:39:GLU:O	1:A:40:ILE:CB	2.68	0.42
1:B:591:LEU:HD23	1:B:591:LEU:HA	1.95	0.42
1:A:395:LEU:O	1:A:399:ASN:HA	2.20	0.42
1:B:473:GLY:O	1:B:474:ASN:C	2.63	0.42
1:B:628:GLN:HE21	1:B:628:GLN:HA	1.84	0.42
1:B:290:TRP:CD2	1:B:582:TYR:HA	2.54	0.42
1:A:501:SER:HB3	1:A:510:ILE:HB	2.00	0.42
1:A:527:HIS:CE1	1:A:579:GLU:HB2	2.55	0.42
1:B:275:ASP:HA	1:B:301:GLU:HA	2.00	0.42
1:B:365:LYS:HE2	1:B:365:LYS:CA	2.49	0.42
1:A:230:ASN:ND2	1:A:250:ALA:H	1.94	0.42
1:A:283:LYS:HB2	1:A:283:LYS:HE3	1.75	0.42
1:A:591:LEU:HD23	1:A:591:LEU:HA	1.87	0.42
1:B:221:HIS:CD2	1:B:223:ARG:HB3	2.55	0.42
1:B:370:THR:HG22	1:B:410:ILE:HG13	2.01	0.42
1:A:275:ASP:HA	1:A:301:GLU:HA	2.02	0.42
1:A:288:TYR:CD1	1:A:288:TYR:C	2.98	0.42
1:A:35:ARG:HH12	1:A:44:PRO:HB3	1.85	0.41
1:A:640:LEU:HD13	1:A:641:ILE:N	2.35	0.41
1:B:231:SER:OG	1:B:236:LYS:HE3	2.20	0.41
1:A:662:HIS:NE2	1:A:664:SER:OG	2.52	0.41
1:A:38:THR:OG1	1:A:73:HIS:ND1	2.49	0.41
1:B:342:TYR:HA	5:B:940:HOH:O	2.20	0.41
1:A:38:THR:HG22	1:A:39:GLU:N	2.35	0.41
1:B:239:TYR:CZ	1:B:304:TYR:HB2	2.56	0.41
1:B:324:THR:HA	1:B:327:GLN:NE2	2.35	0.41
1:A:35:ARG:NH1	1:A:44:PRO:HB3	2.35	0.41
1:B:533:MET:HE3	1:B:545:LYS:HB3	2.03	0.41
1:A:17:ILE:O	1:A:17:ILE:HG13	2.20	0.41
1:A:539:GLN:HG2	5:A:1058:HOH:O	2.20	0.41
1:A:239:TYR:CZ	1:A:304:TYR:HB2	2.56	0.41
1:A:427:LYS:HB3	1:A:430:ILE:HG23	2.02	0.41
1:A:73:HIS:CB	1:A:85:LEU:HB2	2.48	0.40
1:B:211:HIS:HE1	5:B:1049:HOH:O	2.04	0.40
1:A:631:LEU:HD23	1:A:632:GLU:N	2.37	0.40
1:B:1:MET:CG	1:B:2:VAL:N	2.84	0.40
1:B:695:LYS:HE3	5:B:1107:HOH:O	2.21	0.40
1:A:115:THR:HB	1:A:159:LEU:HD12	2.03	0.40
1:A:636:LEU:HD23	1:A:636:LEU:C	2.46	0.40
1:B:218:TYR:CZ	1:B:567:SER:HA	2.56	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:324:THR:O	1:B:328:HIS:HD2	2.03	0.40
1:B:678:TYR:O	1:B:693:GLU:HA	2.22	0.40
1:B:681:LEU:HB2	1:B:709:TYR:CE2	2.57	0.40
1:B:120:TRP:CE2	1:B:382:MET:HG3	2.57	0.40
1:B:133:HIS:CB	1:B:136:LYS:HB2	2.49	0.40
1:B:326:HIS:HE1	1:B:399:ASN:O	2.04	0.40
1:B:629:ARG:NH2	1:B:647:ASP:OD1	2.45	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	710/718 (99%)	683 (96%)	21 (3%)	6 (1%)	16	12
1	B	710/718 (99%)	685 (96%)	22 (3%)	3 (0%)	30	28
All	All	1420/1436 (99%)	1368 (96%)	43 (3%)	9 (1%)	21	18

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	40	ILE
1	A	696	LYS
1	B	696	LYS
1	A	25	GLU
1	A	649	ASP
1	B	2	VAL
1	A	272	PRO
1	A	711	ALA
1	B	272	PRO

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	608/615 (99%)	590 (97%)	18 (3%)	36	40
1	B	608/615 (99%)	588 (97%)	20 (3%)	33	36
All	All	1216/1230 (99%)	1178 (97%)	38 (3%)	35	38

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	17	ILE
1	A	85	LEU
1	A	97	ASP
1	A	207	LYS
1	A	257	LEU
1	A	334	LEU
1	A	362	GLU
1	A	365	LYS
1	A	408	LEU
1	A	427	LYS
1	A	451	LEU
1	A	539	GLN
1	A	591	LEU
1	A	621	LEU
1	A	622	ARG
1	A	645	LEU
1	A	671	ARG
1	A	706	VAL
1	B	25	GLU
1	B	85	LEU
1	B	135	ASN
1	B	207	LYS
1	B	242	LEU
1	B	257	LEU
1	B	334	LEU
1	B	345	GLU
1	B	365	LYS

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Mol	Chain	Res	Type
1	B	380	ARG
1	B	408	LEU
1	B	437	TRP
1	B	451	LEU
1	B	591	LEU
1	B	621	LEU
1	B	622	ARG
1	B	629	ARG
1	B	634	LEU
1	B	645	LEU
1	B	671	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (54) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	26	GLN
1	A	133	HIS
1	A	135	ASN
1	A	142	GLN
1	A	160	HIS
1	A	171	ASN
1	A	180	GLN
1	A	199	GLN
1	A	211	HIS
1	A	221	HIS
1	A	230	ASN
1	A	248	GLN
1	A	307	ASN
1	A	309	HIS
1	A	312	GLN
1	A	327	GLN
1	A	339	ASN
1	A	340	HIS
1	A	374	ASN
1	A	445	HIS
1	A	477	HIS
1	A	496	HIS
1	A	516	GLN
1	A	526	ASN
1	A	527	HIS
1	A	549	GLN
1	A	580	ASN

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Mol	Chain	Res	Type
1	A	628	GLN
1	A	661	HIS
1	B	26	GLN
1	B	133	HIS
1	B	135	ASN
1	B	142	GLN
1	B	160	HIS
1	B	171	ASN
1	B	180	GLN
1	B	211	HIS
1	B	221	HIS
1	B	230	ASN
1	B	248	GLN
1	B	251	ASN
1	B	307	ASN
1	B	309	HIS
1	B	327	GLN
1	B	339	ASN
1	B	340	HIS
1	B	374	ASN
1	B	496	HIS
1	B	516	GLN
1	B	549	GLN
1	B	583	GLN
1	B	604	HIS
1	B	628	GLN
1	B	661	HIS

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 oligosaccharides in this entry.

5.6 Ligand geometry

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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	ACT	B	752	-	3,3,3	5.20	1 (33%)	3,3,3	0.72	0
4	GOL	B	762	-	5,5,5	4.84	5 (100%)	5,5,5	6.14	3 (60%)
4	GOL	A	761	-	5,5,5	4.80	5 (100%)	5,5,5	6.15	3 (60%)
3	ACT	A	751	-	3,3,3	5.15	1 (33%)	3,3,3	0.85	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
4	GOL	B	762	-	-	2/4/4/4	-
4	GOL	A	761	-	-	2/4/4/4	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	752	ACT	O-C	8.98	1.61	1.22
3	A	751	ACT	O-C	8.90	1.60	1.22
4	B	762	GOL	C3-C2	-8.26	1.20	1.51
4	A	761	GOL	C3-C2	-8.21	1.20	1.51
4	B	762	GOL	O1-C1	4.57	1.61	1.42
4	A	761	GOL	O1-C1	4.49	1.61	1.42
4	B	762	GOL	O2-C2	-3.17	1.34	1.43
4	B	762	GOL	O3-C3	3.13	1.55	1.42
4	A	761	GOL	C1-C2	-3.09	1.40	1.51
4	A	761	GOL	O3-C3	3.07	1.55	1.42
4	A	761	GOL	O2-C2	-2.97	1.34	1.43
4	B	762	GOL	C1-C2	-2.91	1.40	1.51

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	762	GOL	O3-C3-C2	11.28	161.16	110.38
4	A	761	GOL	O3-C3-C2	11.28	161.16	110.38
4	A	761	GOL	O2-C2-C3	7.07	138.45	109.18
4	B	762	GOL	O2-C2-C3	7.00	138.15	109.18
4	B	762	GOL	O1-C1-C2	3.44	125.87	110.38
4	A	761	GOL	O1-C1-C2	3.37	125.53	110.38

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	761	GOL	C1-C2-C3-O3
4	B	762	GOL	C1-C2-C3-O3
4	B	762	GOL	O1-C1-C2-O2
4	A	761	GOL	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	761	GOL	1	0
3	A	751	ACT	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

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	712/718 (99%)	-0.01	21 (2%) 53 56	15, 24, 47, 70	0
1	B	712/718 (99%)	-0.13	19 (2%) 56 59	13, 23, 42, 59	0
All	All	1424/1436 (99%)	-0.07	40 (2%) 55 58	13, 24, 44, 70	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	40	ILE	4.7
1	A	1	MET	4.3
1	A	135	ASN	3.9
1	A	39	GLU	3.7
1	B	506	ALA	3.6
1	B	1	MET	3.5
1	A	650	GLU	3.5
1	B	40	ILE	3.4
1	B	690	ASP	3.4
1	A	38	THR	3.3
1	A	692	THR	3.3
1	B	475	THR	3.2
1	B	650	GLU	3.1
1	B	606	ILE	3.1
1	B	712	SER	2.9
1	B	437	TRP	2.9
1	A	53	LEU	2.8
1	B	649	ASP	2.8
1	A	41	THR	2.8
1	B	135	ASN	2.8
1	B	476	PHE	2.8
1	B	507	LEU	2.7
1	A	25	GLU	2.6
1	A	506	ALA	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	606	ILE	2.5
1	A	476	PHE	2.5
1	A	690	ASP	2.4
1	A	52	SER	2.4
1	A	712	SER	2.4
1	B	41	THR	2.4
1	B	651	VAL	2.3
1	B	54	GLU	2.3
1	A	680	LEU	2.3
1	B	43	PHE	2.3
1	A	17	ILE	2.3
1	A	29	ILE	2.2
1	A	649	ASP	2.1
1	B	134	PRO	2.1
1	A	251	ASN	2.1
1	B	689	GLU	2.1

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
3	ACT	B	752	4/4	0.81	0.16	33,33,33,35	0
4	GOL	A	761	6/6	0.82	0.15	37,41,42,43	0
4	GOL	B	762	6/6	0.83	0.15	34,37,39,43	0
3	ACT	A	751	4/4	0.84	0.11	26,28,29,31	0
2	CA	B	742	1/1	0.99	0.02	18,18,18,18	0
2	CA	A	741	1/1	1.00	0.01	19,19,19,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.