



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2023 – 01:14 pm GMT

PDB ID : 2J7B
Title : Beta-glucosidase from *Thermotoga maritima* in complex with gluco- tetrazole
Authors : Gloster, T.M.; Zechel, D.; Vasella, A.; Davies, G.J.
Deposited on : 2006-10-06
Resolution : 1.87 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 : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

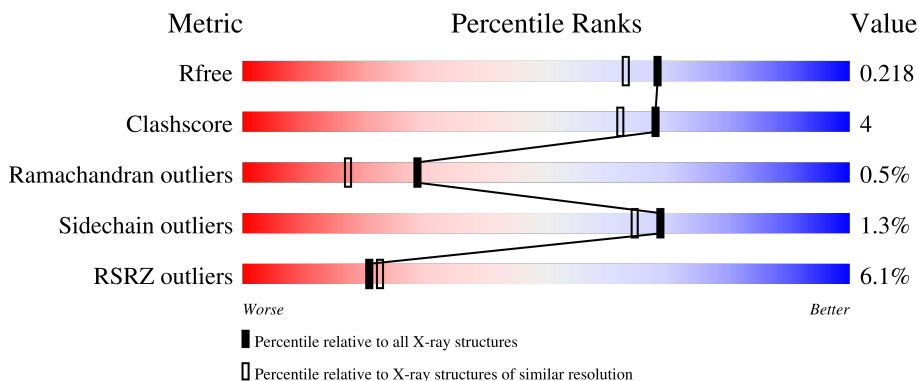
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.87 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}	130704	9470 (1.90-1.86)
Clashscore	141614	10282 (1.90-1.86)
Ramachandran outliers	138981	10152 (1.90-1.86)
Sidechain outliers	138945	10152 (1.90-1.86)
RSRZ outliers	127900	9303 (1.90-1.86)

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	468	
1	B	468	

2 Entry composition [i](#)

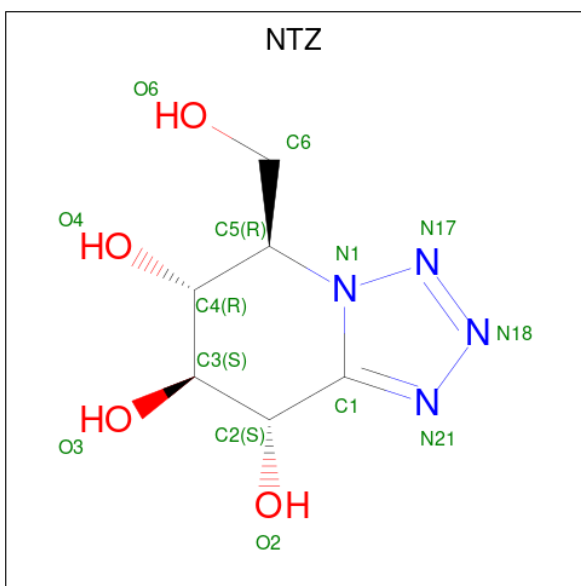
There are 5 unique types of molecules in this entry. The entry contains 8188 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 BETA-GLUCOSIDASE A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	437	Total 3694	C 2408	N 620	O 659	S 7	0	18	0
1	B	442	Total 3719	C 2415	N 622	O 675	S 7	0	18	0

- Molecule 2 is NOJIRIMYCINE TETRAZOLE (three-letter code: NTZ) (formula: C₆H₁₀N₄O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	Total 14	C 6	N 4	O 4	0	0
2	B	1	Total 14	C 6	N 4	O 4	0	0

- Molecule 3 is ACETATE ION (three-letter code: ACT) (formula: C₂H₃O₂).



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

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Ca 1 1	0	0

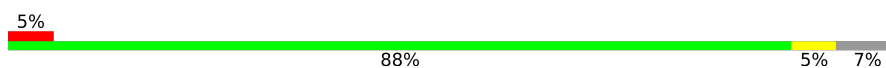
- Molecule 5 is water.

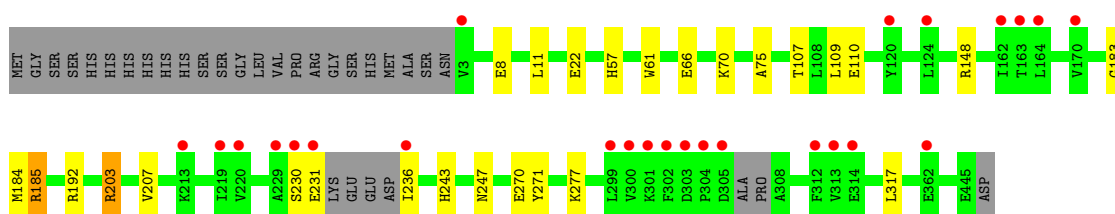
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	433	Total O 433 433	0	0
5	B	305	Total O 305 305	0	0

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.

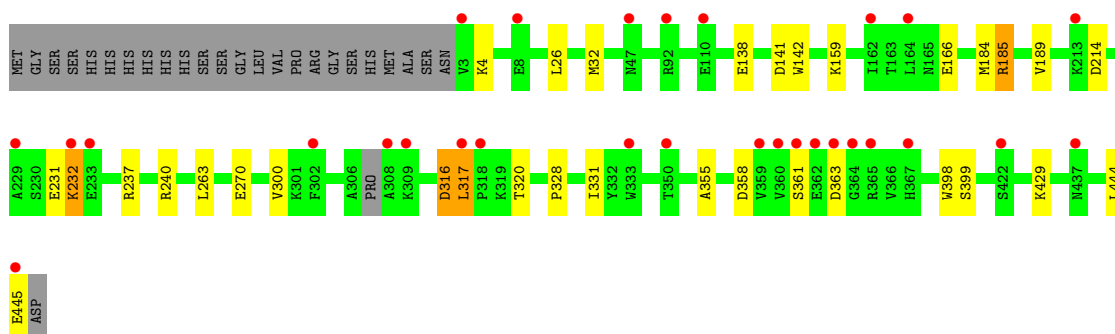
- Molecule 1: BETA-GLUCOSIDASE A

Chain A: 



- Molecule 1: BETA-GLUCOSIDASE A

Chain B: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	94.07Å 94.16Å 112.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	72.55 – 1.87 39.45 – 1.87	Depositor EDS
% Data completeness (in resolution range)	99.6 (72.55-1.87) 99.7 (39.45-1.87)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.87 (at 1.87Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.182 , 0.220 0.182 , 0.218	Depositor DCC
R_{free} test set	4165 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	25.3	Xtrriage
Anisotropy	0.050	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 57.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.012 for k,h,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	8188	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.55% 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, CA, NTZ

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	0.63	0/3858	0.65	0/5229
1	B	0.58	0/3878	0.63	0/5267
All	All	0.61	0/7736	0.64	0/10496

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	3694	0	3615	29	0
1	B	3719	0	3569	39	0
2	A	14	0	10	0	0
2	B	14	0	10	1	0
3	A	4	0	3	0	0
3	B	4	0	3	0	0
4	B	1	0	0	0	0
5	A	433	0	0	3	0
5	B	305	0	0	9	0
All	All	8188	0	7210	56	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 (56) 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:185[A]:ARG:NH2	1:B:185[A]:ARG:HG3	1.34	1.39
1:A:185[A]:ARG:NH2	1:B:185[A]:ARG:CG	2.07	1.15
1:A:203[A]:ARG:HH11	1:A:203[A]:ARG:HG3	1.12	1.08
1:A:184[B]:MET:HG2	1:B:184[B]:MET:CG	1.86	1.04
1:A:184[B]:MET:HG2	1:B:184[B]:MET:HG2	1.05	1.03
1:A:184[B]:MET:CG	1:B:184[B]:MET:HG2	1.89	1.02
1:B:240[A]:ARG:HD3	5:B:2181:HOH:O	1.63	0.98
1:A:185[A]:ARG:HH22	1:B:185[A]:ARG:HG3	1.13	0.88
1:B:240[A]:ARG:CD	5:B:2181:HOH:O	2.19	0.88
1:A:185[A]:ARG:HH22	1:B:185[A]:ARG:HH11	1.23	0.87
1:A:185[A]:ARG:HH21	1:B:185[A]:ARG:HG3	1.40	0.84
1:B:141[A]:ASP:OD2	5:B:2122:HOH:O	1.94	0.83
1:B:138[A]:GLU:OE1	5:B:2120:HOH:O	1.96	0.83
1:A:203[A]:ARG:HH11	1:A:203[A]:ARG:CG	1.96	0.77
1:A:185[A]:ARG:HH21	1:B:185[A]:ARG:CG	1.94	0.76
1:B:316:ASP:O	1:B:317:LEU:O	2.05	0.75
1:A:203[A]:ARG:HG3	1:A:203[A]:ARG:NH1	1.92	0.69
1:A:70[B]:LYS:HG3	5:A:2107:HOH:O	1.97	0.65
1:B:185[A]:ARG:HG3	1:B:185[A]:ARG:HH11	1.61	0.65
1:B:138[A]:GLU:CD	5:B:2120:HOH:O	2.36	0.63
1:B:270[B]:GLU:HG2	5:B:2197:HOH:O	1.99	0.63
1:B:231:GLU:O	1:B:232:LYS:CB	2.47	0.62
1:A:183:GLY:O	1:A:185[A]:ARG:NH2	2.34	0.61
1:B:231:GLU:O	1:B:232:LYS:HB3	2.05	0.56
1:B:138[B]:GLU:HG2	1:B:142:TRP:NE1	2.20	0.56
1:B:240[A]:ARG:HD2	5:B:2181:HOH:O	1.96	0.55
1:A:70[B]:LYS:HD2	5:A:2109:HOH:O	2.07	0.55
1:A:11:LEU:HG	1:A:75:ALA:HB2	1.91	0.52
1:A:231:GLU:O	1:A:236:ILE:HD11	2.10	0.52
1:B:320:THR:HB	1:B:355:ALA:O	2.10	0.51
1:B:26:LEU:HD21	1:B:32:MET:HG2	1.95	0.49
1:B:361:SER:HB2	1:B:363:ASP:OD1	2.12	0.49
1:B:240[A]:ARG:NH2	5:B:2183:HOH:O	2.46	0.48
1:B:184[A]:MET:SD	1:B:189:VAL:HG11	2.54	0.48
1:A:185[A]:ARG:HH21	1:B:185[A]:ARG:HG2	1.75	0.47
1:B:159:LYS:NZ	1:B:214:ASP:OD1	2.34	0.47
1:A:185[A]:ARG:NH2	1:B:185[A]:ARG:CD	2.77	0.46
1:A:66:GLU:O	1:A:70[B]:LYS:HG3	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:4:LYS:HD2	1:B:444:LEU:HD12	1.96	0.46
1:B:166:GLU:OE2	2:B:1446:NTZ:N21	2.51	0.44
1:A:243:HIS:O	1:A:247:ASN:HB2	2.17	0.44
1:A:148[B]:ARG:HB3	1:A:207:VAL:HG11	1.99	0.43
1:B:328:PRO:O	1:B:331:ILE:HG22	2.19	0.42
1:A:192:ARG:NH1	1:A:271:TYR:O	2.52	0.42
1:B:398:TRP:HA	1:B:399:SER:HA	1.81	0.42
1:B:237[B]:ARG:HG3	5:B:2178:HOH:O	2.18	0.42
1:B:358:ASP:OD2	1:B:429:LYS:NZ	2.40	0.42
1:A:148[B]:ARG:CB	1:A:207:VAL:HG11	2.50	0.42
1:A:107:THR:O	1:A:110[B]:GLU:HG2	2.20	0.41
1:A:236:ILE:HD12	1:A:236:ILE:N	2.34	0.41
5:A:2226:HOH:O	1:B:185[A]:ARG:HD3	2.19	0.41
1:B:231:GLU:O	1:B:232:LYS:CG	2.69	0.41
1:A:185[A]:ARG:NH2	1:B:185[A]:ARG:HG2	2.17	0.40
1:A:22:GLU:HA	1:A:57:HIS:HB3	2.04	0.40
1:B:240[A]:ARG:HG2	1:B:263:LEU:CD1	2.51	0.40
1:A:57:HIS:CE1	1:A:61:TRP:HA	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	449/468 (96%)	438 (98%)	10 (2%)	1 (0%)	47	37
1	B	456/468 (97%)	440 (96%)	13 (3%)	3 (1%)	22	11
All	All	905/936 (97%)	878 (97%)	23 (2%)	4 (0%)	29	22

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	317	LEU
1	A	230	SER
1	B	232	LYS
1	B	316	ASP

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	390/399 (98%)	381 (98%)	9 (2%)	50	41
1	B	387/399 (97%)	383 (99%)	4 (1%)	76	73
All	All	777/798 (97%)	764 (98%)	13 (2%)	69	54

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	GLU
1	A	109	LEU
1	A	185[A]	ARG
1	A	185[B]	ARG
1	A	203[A]	ARG
1	A	203[B]	ARG
1	A	270	GLU
1	A	277	LYS
1	A	317	LEU
1	B	185[A]	ARG
1	B	185[B]	ARG
1	B	300	VAL
1	B	445	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	129	GLN
1	B	381	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 1 is 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$
2	NTZ	A	1446	-	13,15,15	1.91	3 (23%)	12,22,22	1.52	3 (25%)
2	NTZ	B	1446	-	13,15,15	1.68	3 (23%)	12,22,22	1.86	3 (25%)
3	ACT	A	1447	-	3,3,3	0.88	0	3,3,3	2.13	2 (66%)
3	ACT	B	1447	-	3,3,3	0.84	0	3,3,3	1.33	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
2	NTZ	A	1446	-	-	0/2/22/22	0/1/2/2
2	NTZ	B	1446	-	-	0/2/22/22	0/1/2/2

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1446	NTZ	N21-N18	4.96	1.42	1.34
2	B	1446	NTZ	N17-N18	3.88	1.39	1.30
2	A	1446	NTZ	N17-N18	3.69	1.39	1.30
2	B	1446	NTZ	N21-N18	3.31	1.39	1.34
2	A	1446	NTZ	N17-N1	2.34	1.39	1.34
2	B	1446	NTZ	N17-N1	2.12	1.38	1.34

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1446	NTZ	C1-N21-N18	4.66	109.56	105.28
2	A	1446	NTZ	C1-N21-N18	3.66	108.64	105.28
2	B	1446	NTZ	N21-N18-N17	-3.01	106.70	110.09
3	A	1447	ACT	OXT-C-O	-2.70	112.09	122.05
3	A	1447	ACT	OXT-C-CH3	2.50	125.53	115.18
2	A	1446	NTZ	N21-N18-N17	-2.31	107.49	110.09
2	A	1446	NTZ	N18-N17-N1	-2.28	104.17	106.02
2	B	1446	NTZ	O2-C2-C3	2.20	113.18	108.55

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1446	NTZ	1	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	437/468 (93%)	0.11	25 (5%) 23 25	13, 23, 43, 57	0
1	B	442/468 (94%)	0.36	29 (6%) 18 19	14, 28, 44, 55	0
All	All	879/936 (93%)	0.24	54 (6%) 21 22	13, 25, 44, 57	0

All (54) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	359	VAL	5.0
1	A	229	ALA	4.5
1	B	213	LYS	4.5
1	A	230	SER	4.3
1	B	360	VAL	4.0
1	B	364	GLY	3.8
1	A	302	PHE	3.5
1	B	233	GLU	3.1
1	B	229	ALA	3.0
1	A	213[A]	LYS	3.0
1	B	3	VAL	3.0
1	B	422	SER	3.0
1	B	363	ASP	2.9
1	A	236	ILE	2.9
1	B	92	ARG	2.9
1	A	164	LEU	2.8
1	B	362	GLU	2.8
1	B	361	SER	2.8
1	A	313	VAL	2.7
1	A	220	VAL	2.7
1	B	162	ILE	2.6
1	A	362	GLU	2.5
1	A	305	ASP	2.5
1	B	302	PHE	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	317	LEU	2.5
1	A	170	VAL	2.4
1	A	120	TYR	2.4
1	B	164	LEU	2.4
1	A	301	LYS	2.4
1	B	333	TRP	2.4
1	A	162	ILE	2.4
1	A	231	GLU	2.4
1	B	110	GLU	2.4
1	B	8	GLU	2.4
1	B	318	PRO	2.4
1	A	124	LEU	2.3
1	A	312	PHE	2.3
1	A	303	ASP	2.3
1	B	365	ARG	2.3
1	A	3	VAL	2.3
1	B	445	GLU	2.3
1	B	309	LYS	2.3
1	B	232	LYS	2.3
1	B	350	THR	2.3
1	B	367	HIS	2.3
1	A	314	GLU	2.2
1	A	163	THR	2.1
1	B	437[A]	ASN	2.1
1	B	47	ASN	2.1
1	A	300	VAL	2.1
1	B	308	ALA	2.1
1	A	304	PRO	2.0
1	A	219	ILE	2.0
1	A	299	LEU	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 monosaccharides 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. 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
3	ACT	A	1447	4/4	0.74	0.23	35,36,36,38	0
3	ACT	B	1447	4/4	0.82	0.20	52,52,52,52	0
2	NTZ	B	1446	14/14	0.95	0.16	21,25,26,27	0
2	NTZ	A	1446	14/14	0.98	0.14	15,17,19,20	0
4	CA	B	1448	1/1	0.98	0.09	34,34,34,34	0

6.5 Other polymers

There are no such residues in this entry.