



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:56 PM UTC

PDB ID : 3CBW / pdb_00003cbw
Title : Crystal structure of the YdhT protein from *Bacillus subtilis*
Authors : Bonanno, J.B.; Rutter, M.; Bain, K.T.; Iizuka, M.; Romero, R.; Smith, D.; Wasserman, S.; Sauder, J.M.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on : 2008-02-23
Resolution : 1.27 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

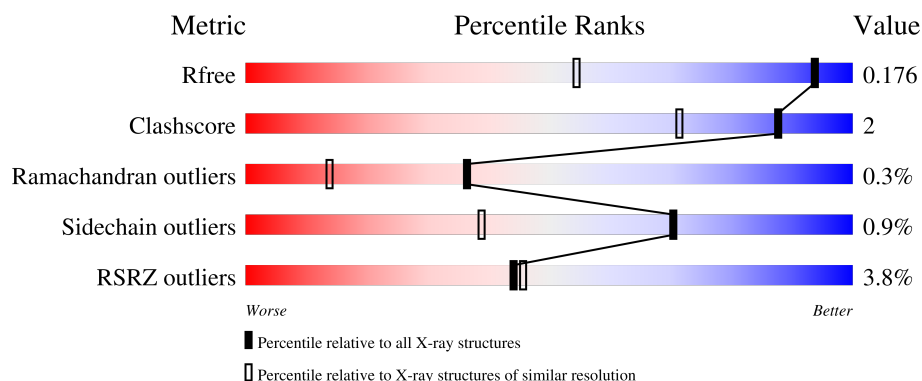
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

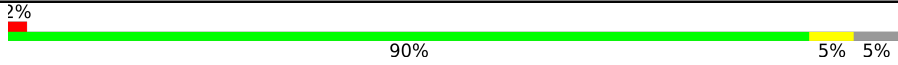
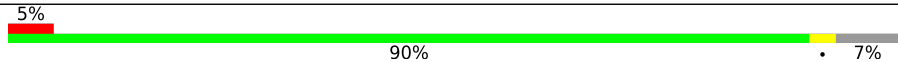
The reported resolution of this entry is 1.27 Å.

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	1693 (1.28-1.24)
Clashscore	190562	1730 (1.28-1.24)
Ramachandran outliers	187476	1695 (1.28-1.24)
Sidechain outliers	187428	1694 (1.28-1.24)
RSRZ outliers	180081	1693 (1.28-1.24)

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	353	
1	B	353	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6012 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 YdhT protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	336	Total	C	N	O	S	0	5	0
			2702	1728	448	518	8			
1	B	330	Total	C	N	O	S	0	7	0
			2679	1716	448	506	9			

There are 28 discrepancies between the modelled and reference sequences:

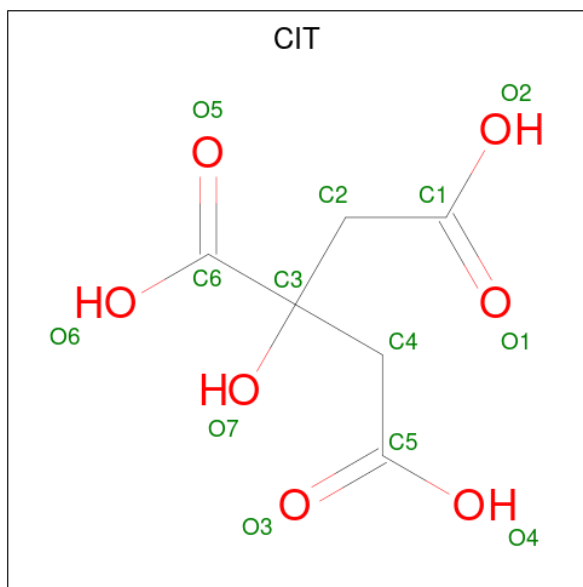
Chain	Residue	Modelled	Actual	Comment	Reference
A	18	MET	-	expression tag	UNP O05512
A	19	SER	-	expression tag	UNP O05512
A	20	LEU	-	expression tag	UNP O05512
A	153	LYS	ASN	engineered mutation	UNP O05512
A	158	SER	ALA	engineered mutation	UNP O05512
A	160	VAL	ALA	engineered mutation	UNP O05512
A	363	GLU	-	expression tag	UNP O05512
A	364	GLY	-	expression tag	UNP O05512
A	365	HIS	-	expression tag	UNP O05512
A	366	HIS	-	expression tag	UNP O05512
A	367	HIS	-	expression tag	UNP O05512
A	368	HIS	-	expression tag	UNP O05512
A	369	HIS	-	expression tag	UNP O05512
A	370	HIS	-	expression tag	UNP O05512
B	18	MET	-	expression tag	UNP O05512
B	19	SER	-	expression tag	UNP O05512
B	20	LEU	-	expression tag	UNP O05512
B	153	LYS	ASN	engineered mutation	UNP O05512
B	158	SER	ALA	engineered mutation	UNP O05512
B	160	VAL	ALA	engineered mutation	UNP O05512
B	363	GLU	-	expression tag	UNP O05512
B	364	GLY	-	expression tag	UNP O05512
B	365	HIS	-	expression tag	UNP O05512
B	366	HIS	-	expression tag	UNP O05512
B	367	HIS	-	expression tag	UNP O05512

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	368	HIS	-	expression tag	UNP O05512
B	369	HIS	-	expression tag	UNP O05512
B	370	HIS	-	expression tag	UNP O05512

- Molecule 2 is CITRIC ACID (CCD ID: CIT) (formula: $C_6H_8O_7$).



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

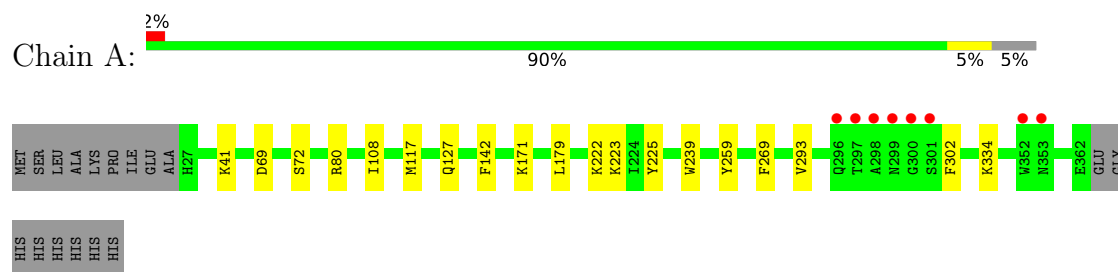
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	319	Total	O	0	0
			319	319		
3	B	273	Total	O	0	0
			273	273		

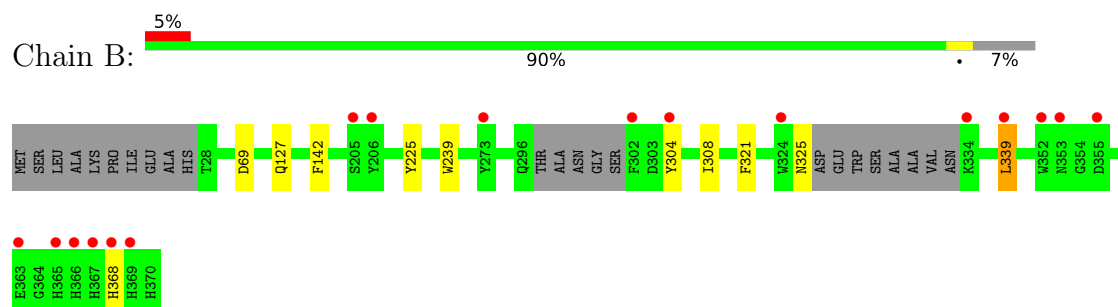
3 Residue-property plots [i](#)

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: YdhT protein



- Molecule 1: YdhT protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	57.73Å 69.62Å 72.50Å 90.00° 91.09° 90.00°	Depositor
Resolution (Å)	20.00 – 1.27 20.00 – 1.27	Depositor EDS
% Data completeness (in resolution range)	96.3 (20.00-1.27) 96.2 (20.00-1.27)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.52 (at 1.27Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.149 , 0.172 0.153 , 0.176	Depositor DCC
R_{free} test set	7332 reflections (4.84%)	wwPDB-VP
Wilson B-factor (Å ²)	9.5	Xtriage
Anisotropy	0.261	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 41.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.000 for -h,l,k 0.014 for -h,-l,-k 0.018 for h,-k,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	6012	wwPDB-VP
Average B, all atoms (Å ²)	14.0	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 38.44 % 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 3.6861e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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	0.49	0/2796	0.68	0/3809
1	B	0.48	0/2777	0.69	0/3774
All	All	0.49	0/5573	0.69	0/7583

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	2702	0	2564	12	0
1	B	2679	0	2552	9	0
2	B	39	0	15	2	0
3	A	319	0	0	4	0
3	B	273	0	0	2	0
All	All	6012	0	5131	21	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 2.

All (21) 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:B:308:ILE:HB	1:B:339:LEU:HD12	1.63	0.79
1:A:41:LYS:HE2	3:A:649:HOH:O	1.82	0.78
1:B:304:TYR:CD1	1:B:339:LEU:HD22	2.25	0.71
1:B:304:TYR:HD1	1:B:339:LEU:HD22	1.58	0.69
1:B:321:PHE:CZ	1:B:339:LEU:HD21	2.40	0.57
1:A:223:LYS:HE2	3:A:425:HOH:O	2.10	0.52
1:A:72:SER:HB2	3:A:637:HOH:O	2.09	0.51
1:A:80:ARG:NH1	3:A:513:HOH:O	2.43	0.51
1:B:325:ASN:HB2	3:B:487:HOH:O	2.11	0.50
1:A:225:TYR:HA	1:A:239:TRP:CH2	2.49	0.48
1:B:368:HIS:CD2	2:B:2:CIT:O1	2.69	0.46
1:A:117:MET:CG	1:A:179:LEU:HD23	2.45	0.46
1:B:325:ASN:CB	3:B:487:HOH:O	2.65	0.45
1:A:222:LYS:HE2	1:A:259:TYR:CE2	2.53	0.44
1:B:225:TYR:HA	1:B:239:TRP:CH2	2.53	0.43
1:A:269:PHE:CE2	1:A:293:VAL:HG23	2.54	0.43
1:A:117:MET:HG3	1:A:179:LEU:CD2	2.49	0.42
1:A:302:PHE:O	1:A:334:LYS:HG2	2.21	0.41
1:A:108:ILE:HB	1:A:171:LYS:HD3	2.03	0.40
1:B:368:HIS:HD2	2:B:2:CIT:O1	2.04	0.40
1:A:117:MET:HG3	1:A:179:LEU:HD23	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	339/353 (96%)	332 (98%)	6 (2%)	1 (0%)	36	14
1	B	331/353 (94%)	327 (99%)	3 (1%)	1 (0%)	36	14
All	All	670/706 (95%)	659 (98%)	9 (1%)	2 (0%)	36	14

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	69	ASP
1	B	69	ASP

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	289/300 (96%)	287 (99%)	2 (1%)	76	47
1	B	287/300 (96%)	284 (99%)	3 (1%)	68	34
All	All	576/600 (96%)	571 (99%)	5 (1%)	70	39

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	127	GLN
1	A	142	PHE
1	B	127	GLN
1	B	142	PHE
1	B	339	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	85	GLN
1	A	122	ASN
1	A	177	GLN
1	A	219	GLN
1	B	38	GLN
1	B	52	ASN
1	B	56	ASN
1	B	85	GLN
1	B	177	GLN
1	B	276	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

3 ligands are 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	B	2	-	12,12,12	1.04	0	17,17,17	1.54	3 (17%)
2	CIT	B	1	-	12,12,12	1.13	0	17,17,17	1.64	3 (17%)
2	CIT	B	3	-	12,12,12	1.06	0	17,17,17	1.50	2 (11%)

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	B	2	-	-	3/16/16/16	-
2	CIT	B	1	-	-	4/16/16/16	-
2	CIT	B	3	-	-	2/16/16/16	-

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	CIT	O6-C6-C3	3.99	120.79	113.14
2	B	3	CIT	O6-C6-C3	3.79	120.41	113.14
2	B	2	CIT	O6-C6-C3	3.68	120.19	113.14
2	B	1	CIT	O2-C1-C2	2.86	123.42	114.35
2	B	3	CIT	O2-C1-C2	2.67	122.80	114.35
2	B	2	CIT	O4-C5-C4	2.39	121.93	114.35
2	B	2	CIT	O6-C6-O5	-2.15	116.98	123.86
2	B	1	CIT	O4-C5-C4	2.13	121.09	114.35

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	CIT	O2-C1-C2-C3
2	B	1	CIT	O1-C1-C2-C3
2	B	1	CIT	C4-C3-C6-O6
2	B	2	CIT	C4-C3-C6-O6
2	B	3	CIT	O2-C1-C2-C3
2	B	3	CIT	O1-C1-C2-C3
2	B	1	CIT	C2-C3-C6-O6
2	B	2	CIT	C3-C4-C5-O3
2	B	2	CIT	C3-C4-C5-O4

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2	CIT	2	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	336/353 (95%)	-0.15	8 (2%) 59 61	5, 11, 19, 30	5 (1%)
1	B	330/353 (93%)	0.03	17 (5%) 33 34	6, 12, 23, 31	8 (2%)
All	All	666/706 (94%)	-0.06	25 (3%) 44 46	5, 12, 21, 31	13 (1%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	302	PHE	5.2
1	B	304	TYR	4.7
1	A	298	ALA	4.2
1	B	367	HIS	4.1
1	B	366	HIS	3.5
1	B	339	LEU	3.2
1	A	301	SER	3.0
1	B	324	TRP	3.0
1	B	355	ASP	2.9
1	A	299	ASN	2.9
1	B	368	HIS	2.9
1	A	352	TRP	2.7
1	B	205	SER	2.6
1	A	353	ASN	2.6
1	B	365	HIS	2.5
1	A	297	THR	2.5
1	B	206	TYR	2.4
1	B	273	TYR	2.3
1	A	296	GLN	2.3
1	B	353	ASN	2.2
1	B	363	GLU	2.2
1	B	352	TRP	2.1
1	B	369	HIS	2.1
1	A	300	GLY	2.0

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	334	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($\text{\AA}^2$)	Q<0.9
2	CIT	B	2	13/13	0.84	0.13	20,28,34,34	0
2	CIT	B	3	13/13	0.86	0.10	21,31,34,34	0
2	CIT	B	1	13/13	0.94	0.07	16,17,18,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.