



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 05:23 PM UTC

PDB ID : 1GPI / pdb_00001gpi
Title : Cellobiohydrolase Cel7D (CBH 58) from *Phanerochaete chrysosporium*. Catalytic module at 1.32 Angstrom resolution
Authors : Munoz, I.G.; Mowbray, S.L.; Stahlberg, J.
Deposited on : 2001-11-05
Resolution : 1.32 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

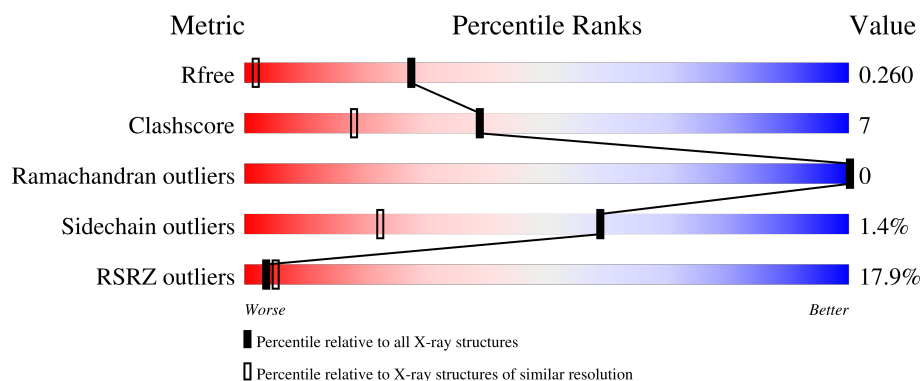
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.32 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	2531 (1.34-1.30)
Clashscore	190562	2585 (1.34-1.30)
Ramachandran outliers	187476	2528 (1.34-1.30)
Sidechain outliers	187428	2528 (1.34-1.30)
RSRZ outliers	180081	2528 (1.34-1.30)

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	431	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3659 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 EXOGLUCANASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	431	3198	1962	541	667	28	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	57	ASP	ASN	conflict	UNP Q09431
A	277	VAL	ASP	conflict	UNP Q09431
A	?	-	HIS	deletion	UNP Q09431

- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	14	8	1	5	0	0

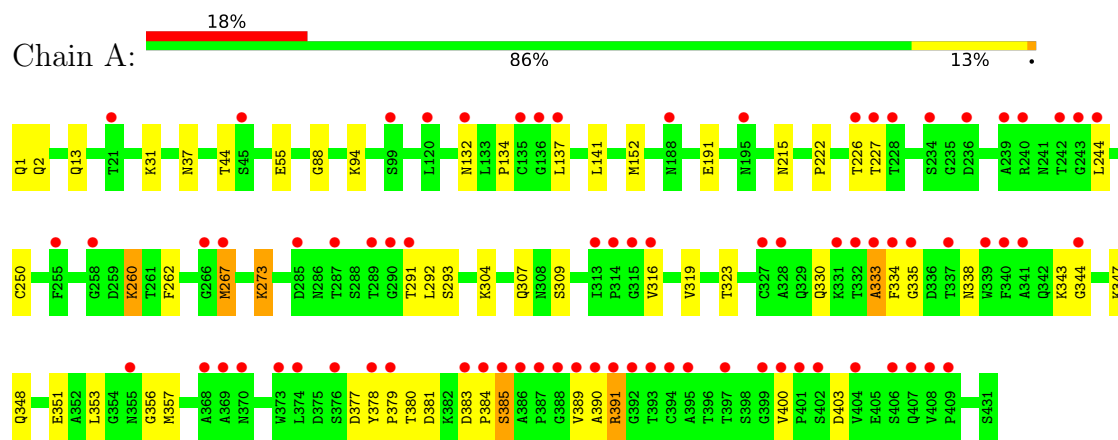
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	447	Total 447	O 447	0	0

3 Residue-property plots

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: EXOGLUCANASE I



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	86.31Å 46.62Å 99.08Å 90.00° 103.19° 90.00°	Depositor
Resolution (Å)	13.00 – 1.32 13.00 – 1.32	Depositor EDS
% Data completeness (in resolution range)	99.0 (13.00-1.32) 98.8 (13.00-1.32)	Depositor EDS
R_{merge}	0.03	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.05 (at 1.32Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.213 , 0.242 0.231 , 0.260	Depositor DCC
R_{free} test set	8989 reflections (10.04%)	wwPDB-VP
Wilson B-factor (Å ²)	12.9	Xtriage
Anisotropy	0.588	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.49 , 59.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3659	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 7.86% 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: NAG, PCA

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	1.35	9/3256 (0.3%)	1.20	4/4429 (0.1%)

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

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	152	MET	SD-CE	-14.63	1.43	1.79
1	A	391	ARG	NE-CZ	-6.92	1.25	1.33
1	A	390	ALA	CA-CB	-6.66	1.44	1.53
1	A	390	ALA	CA-C	6.57	1.60	1.52
1	A	333	ALA	CA-C	-6.08	1.44	1.52
1	A	273	LYS	CA-C	5.45	1.57	1.52
1	A	338	ASN	CA-C	-5.44	1.47	1.53
1	A	316	VAL	C-O	-5.39	1.18	1.24
1	A	356	GLY	C-O	-5.16	1.18	1.24

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	88	GLY	N-CA-C	-5.85	107.00	114.37
1	A	385	SER	N-CA-C	-5.64	106.44	113.38
1	A	323	THR	CA-C-O	-5.61	115.07	121.58
1	A	293	SER	CA-C-O	5.28	124.63	118.77

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	215	ASN	Mainchain

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	3198	0	2972	42	0
2	A	14	0	13	0	0
3	A	447	0	0	16	3
All	All	3659	0	2985	42	3

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 7.

All (42) 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:377:ASP:OD2	3:A:2408:HOH:O	1.58	1.20
1:A:267:MET:HA	1:A:267:MET:HE2	1.49	0.93
1:A:334:PHE:O	3:A:2383:HOH:O	1.92	0.87
1:A:132:ASN:ND2	3:A:2213:HOH:O	2.03	0.85
1:A:384:PRO:O	3:A:2415:HOH:O	1.93	0.84
1:A:384:PRO:CB	3:A:2415:HOH:O	2.28	0.82
1:A:333:ALA:HB2	3:A:2359:HOH:O	1.88	0.74
1:A:400:VAL:HG21	1:A:403:ASP:OD2	1.88	0.74
1:A:400:VAL:HG22	3:A:2427:HOH:O	1.89	0.73
1:A:134:PRO:HD2	1:A:137:LEU:HD12	1.70	0.73
1:A:377:ASP:CG	3:A:2408:HOH:O	2.19	0.73
1:A:307:GLN:NE2	3:A:2352:HOH:O	2.24	0.71
1:A:400:VAL:CG2	1:A:403:ASP:OD2	2.42	0.68
1:A:384:PRO:C	3:A:2415:HOH:O	2.37	0.66
1:A:384:PRO:HB2	3:A:2415:HOH:O	1.91	0.66
1:A:267:MET:HE2	1:A:267:MET:CA	2.26	0.65
1:A:222:PRO:HD2	1:A:250:CYS:O	2.02	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:GLU:OE2	1:A:191:GLU:OE2	2.21	0.58
1:A:226:THR:HG23	1:A:343:LYS:HD2	1.86	0.58
1:A:379:PRO:HB2	1:A:381:ASP:OD1	2.05	0.56
1:A:380:THR:HG22	3:A:2407:HOH:O	2.07	0.54
1:A:378:TYR:HA	1:A:379:PRO:C	2.32	0.54
1:A:13:GLN:HE22	1:A:31:LYS:HE2	1.73	0.53
1:A:383:ASP:OD2	1:A:385:SER:OG	2.27	0.49
1:A:389:VAL:O	1:A:391:ARG:HD2	2.13	0.48
1:A:400:VAL:CG2	1:A:403:ASP:CG	2.86	0.48
1:A:227:THR:HG21	1:A:244:LEU:HD13	1.96	0.48
1:A:347:LYS:O	1:A:351:GLU:HG3	2.15	0.47
1:A:2:GLN:HG3	1:A:44:THR:HG21	1.96	0.47
1:A:335:GLY:C	3:A:2385:HOH:O	2.57	0.47
1:A:94:LYS:NZ	3:A:2154:HOH:O	2.44	0.45
1:A:262:PHE:CG	1:A:309:SER:HB3	2.51	0.45
1:A:353:LEU:HD23	1:A:357:MET:SD	2.58	0.44
1:A:400:VAL:O	1:A:400:VAL:HG23	2.18	0.44
1:A:344:GLY:HA3	1:A:348:GLN:HB2	2.00	0.43
1:A:343:LYS:O	1:A:348:GLN:HG2	2.19	0.43
1:A:319:VAL:HB	3:A:2366:HOH:O	2.20	0.41
1:A:304:LYS:NZ	3:A:2346:HOH:O	2.48	0.41
1:A:141:LEU:C	1:A:141:LEU:HD23	2.45	0.41
1:A:291:THR:O	1:A:292:LEU:C	2.62	0.41
1:A:260:LYS:HE3	1:A:260:LYS:HB3	1.27	0.41
1:A:132:ASN:HD22	1:A:132:ASN:HA	1.65	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:2039:HOH:O	3:A:2390:HOH:O[1_545]	0.49	1.71
3:A:2220:HOH:O	3:A:2238:HOH:O[3_455]	0.58	1.62
3:A:2443:HOH:O	3:A:2443:HOH:O[2_655]	2.11	0.09

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	429/431 (100%)	421 (98%)	8 (2%)	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	351/351 (100%)	346 (99%)	5 (1%)	59	22

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

Mol	Chain	Res	Type
1	A	37	ASN
1	A	260	LYS
1	A	267	MET
1	A	273	LYS
1	A	330	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	GLN
1	A	115	GLN
1	A	132	ASN
1	A	307	GLN
1	A	410	ASN
1	A	412	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

1 non-standard protein/DNA/RNA residue 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	$\# Z > 2$
1	PCA	A	1	1	7,8,9	1.58	2 (28%)	9,10,12	1.16	1 (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
1	PCA	A	1	1	-	0/0/11/13	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1	PCA	CD-N	3.31	1.42	1.34
1	A	1	PCA	CA-N	2.30	1.49	1.46

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	PCA	CB-CA-C	-2.03	109.88	112.66

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	NAG	A	435	1	14,14,15	1.09	1 (7%)	17,19,21	1.56	5 (29%)

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	NAG	A	435	1	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	435	NAG	C1-C2	2.30	1.55	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	435	NAG	C4-C3-C2	2.82	115.15	111.02
2	A	435	NAG	C1-O5-C5	-2.63	108.66	112.19
2	A	435	NAG	C6-C5-C4	-2.59	106.66	113.02
2	A	435	NAG	O7-C7-C8	-2.29	117.97	122.05
2	A	435	NAG	C8-C7-N2	2.13	119.64	116.12

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	435	NAG	C4-C5-C6-O6
2	A	435	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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	430/431 (99%)	1.02	77 (17%) 3 5	8, 17, 25, 32	0

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	395	ALA	4.9
1	A	394	CYS	4.6
1	A	400	VAL	4.4
1	A	390	ALA	4.4
1	A	334	PHE	4.3
1	A	227	THR	4.2
1	A	389	VAL	4.2
1	A	378	TYR	4.0
1	A	386	ALA	3.8
1	A	408	VAL	3.7
1	A	376	SER	3.7
1	A	384	PRO	3.6
1	A	335	GLY	3.6
1	A	313	ILE	3.5
1	A	404	VAL	3.5
1	A	385	SER	3.5
1	A	331	LYS	3.4
1	A	369	ALA	3.3
1	A	226	THR	3.3
1	A	255	PHE	3.2
1	A	236	ASP	3.2
1	A	328	ALA	3.1
1	A	332	THR	3.1
1	A	243	GLY	3.0
1	A	289	THR	3.0
1	A	228	THR	2.9
1	A	333	ALA	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	399	GLY	2.9
1	A	407	GLN	2.8
1	A	392	GLY	2.8
1	A	314	PRO	2.8
1	A	195	ASN	2.7
1	A	234	SER	2.7
1	A	132	ASN	2.7
1	A	379	PRO	2.7
1	A	137	LEU	2.7
1	A	370	ASN	2.6
1	A	45	SER	2.6
1	A	291	THR	2.6
1	A	409	PRO	2.6
1	A	267	MET	2.6
1	A	373	TRP	2.5
1	A	258	GLY	2.5
1	A	383	ASP	2.5
1	A	135	CYS	2.5
1	A	387	PRO	2.5
1	A	393	THR	2.4
1	A	397	THR	2.4
1	A	21	THR	2.3
1	A	242	THR	2.3
1	A	188	ASN	2.3
1	A	388	GLY	2.3
1	A	374	LEU	2.3
1	A	239	ALA	2.3
1	A	339	TRP	2.3
1	A	341	ALA	2.3
1	A	287	THR	2.3
1	A	344	GLY	2.3
1	A	327	CYS	2.2
1	A	240	ARG	2.2
1	A	315	GLY	2.2
1	A	402	SER	2.2
1	A	120	LEU	2.2
1	A	340	PHE	2.2
1	A	355	ASN	2.2
1	A	290	GLY	2.1
1	A	99	SER	2.1
1	A	285	ASP	2.1
1	A	368	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	401	PRO	2.1
1	A	136	GLY	2.0
1	A	244	LEU	2.0
1	A	391	ARG	2.0
1	A	406	SER	2.0
1	A	266	GLY	2.0
1	A	316	VAL	2.0
1	A	337	THR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	PCA	A	1	8/9	0.96	0.06	12,12,13,13	0

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	NAG	A	435	14/15	0.73	0.13	24,25,32,32	0

6.5 Other polymers [i](#)

There are no such residues in this entry.