



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 19, 2017 – 11:56 AM EDT

PDB ID : 5GXY
Title : Crystal structure of endoglucanase CelQ from Clostridium thermocellum complexed with cellobiose and Tris
Authors : Jeng, W.Y.; Liu, C.I.; Wang, A.H.J.
Deposited on : unknown
Resolution : 1.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20029824
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20029824

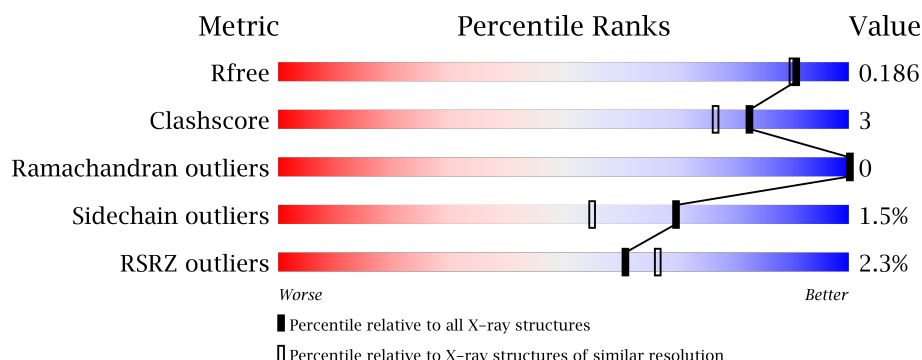
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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}	100719	3453 (1.70-1.70)
Clashscore	112137	3876 (1.70-1.70)
Ramachandran outliers	110173	3815 (1.70-1.70)
Sidechain outliers	110143	3815 (1.70-1.70)
RSRZ outliers	101464	3491 (1.70-1.70)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	610	<div> <div style="width: 100%; height: 10px; position: relative;"> <div style="position: absolute; top: -10px; left: 0; width: 100%;"></div> <div style="position: absolute; top: 10px; left: 0; width: 100%;"></div> <div style="position: absolute; left: 0; top: 0; width: 100%; height: 100%; background: linear-gradient(to right, red 0%, red 1%, orange 1%, orange 2%, yellow 2%, yellow 92%, green 92%, green 99%, grey 99%, grey 100%);"></div> <div style="position: absolute; left: 0; top: 0; width: 100%; height: 100%; background: linear-gradient(to right, red 0%, red 1%, orange 1%, orange 2%, yellow 2%, yellow 92%, green 92%, green 99%, grey 99%, grey 100%);"></div> </div> <div> </div> <div> </div> </div>
1	B	610	<div> <div style="width: 100%; height: 10px; position: relative;"> <div style="position: absolute; top: -10px; left: 0; width: 100%;"></div> <div style="position: absolute; top: 10px; left: 0; width: 100%;"></div> <div style="position: absolute; left: 0; top: 0; width: 100%; height: 100%; background: linear-gradient(to right, red 0%, red 3%, orange 3%, orange 4%, yellow 4%, yellow 92%, green 92%, green 99%, grey 99%, grey 100%);"></div> <div style="position: absolute; left: 0; top: 0; width: 100%; height: 100%; background: linear-gradient(to right, red 0%, red 3%, orange 3%, orange 4%, yellow 4%, yellow 92%, green 92%, green 99%, grey 99%, grey 100%);"></div> </div> <div> </div> <div> </div> </div>

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	CL	B	704	-	-	X	-
5	BGC	A	711	-	-	-	X
5	BGC	B	711	-	-	-	X
7	7PE	B	713	-	-	-	X

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 11125 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 Glucanase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	599	Total	C	N	O	S	0	2	0
			4806	3071	799	918	18			
1	B	599	Total	C	N	O	S	0	4	0
			4815	3078	799	920	18			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	27	MET	-	initiating methionine	UNP Q9AJF8
A	251	THR	ILE	engineered mutation	UNP Q9AJF8
A	629	LEU	-	expression tag	UNP Q9AJF8
A	630	GLU	-	expression tag	UNP Q9AJF8
A	631	HIS	-	expression tag	UNP Q9AJF8
A	632	HIS	-	expression tag	UNP Q9AJF8
A	633	HIS	-	expression tag	UNP Q9AJF8
A	634	HIS	-	expression tag	UNP Q9AJF8
A	635	HIS	-	expression tag	UNP Q9AJF8
A	636	HIS	-	expression tag	UNP Q9AJF8
B	27	MET	-	initiating methionine	UNP Q9AJF8
B	251	THR	ILE	engineered mutation	UNP Q9AJF8
B	629	LEU	-	expression tag	UNP Q9AJF8
B	630	GLU	-	expression tag	UNP Q9AJF8
B	631	HIS	-	expression tag	UNP Q9AJF8
B	632	HIS	-	expression tag	UNP Q9AJF8
B	633	HIS	-	expression tag	UNP Q9AJF8
B	634	HIS	-	expression tag	UNP Q9AJF8
B	635	HIS	-	expression tag	UNP Q9AJF8
B	636	HIS	-	expression tag	UNP Q9AJF8

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

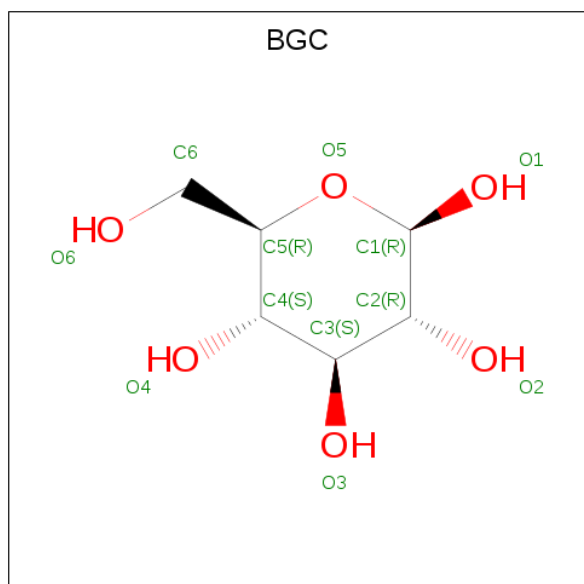
- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	4	Total	Cl	0	0
			4	4		
3	A	5	Total	Cl	0	0
			5	5		

- Molecule 4 is BROMIDE ION (three-letter code: BR) (formula: Br).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	3	Total	Br	0	0
			3	3		
4	A	3	Total	Br	0	0
			3	3		

- Molecule 5 is BETA-D-GLUCOSE (three-letter code: BGC) (formula: C₆H₁₂O₆).



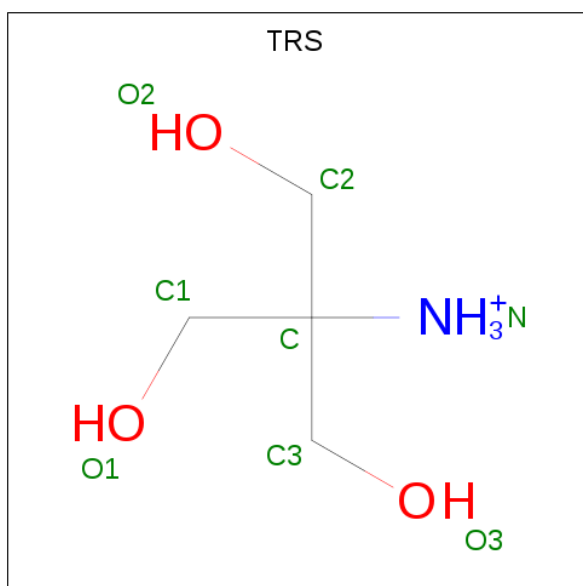
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			11	6	5		

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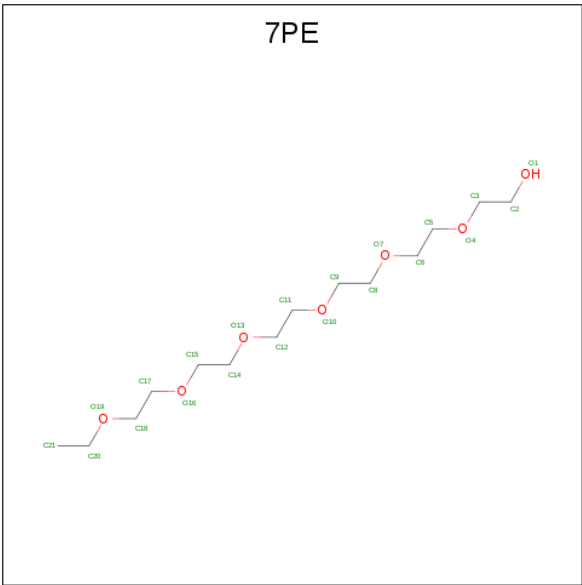
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			12	6	6		
5	B	1	Total	C	O	0	0
			11	6	5		
5	B	1	Total	C	O	0	0
			12	6	6		

- Molecule 6 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: $C_4H_{12}NO_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			8	4	1	3		
6	B	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 7 is 2-(2-(2-(2-(2-(2-ETHOXYETHOXY)ETHOXY)ETHOXY)ETHOXY)ETHOXY)ETHANOL (three-letter code: 7PE) (formula: $C_{14}H_{30}O_7$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	B	1	Total	C	O	0	0
			21	14	7		

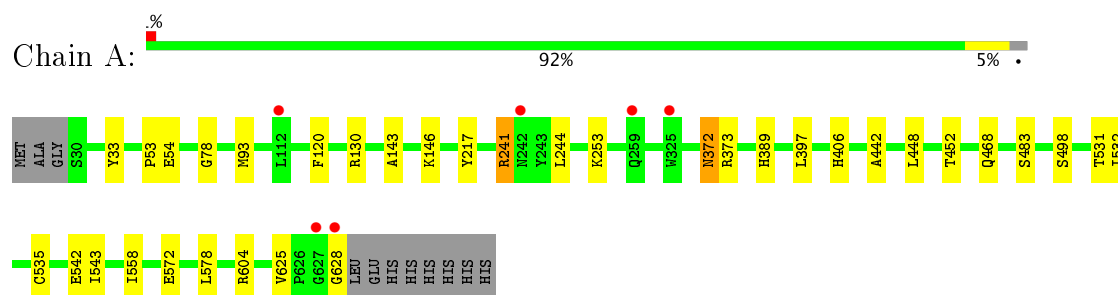
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	672	Total	O	0	0
			672	672		
8	B	730	Total	O	0	0
			730	730		

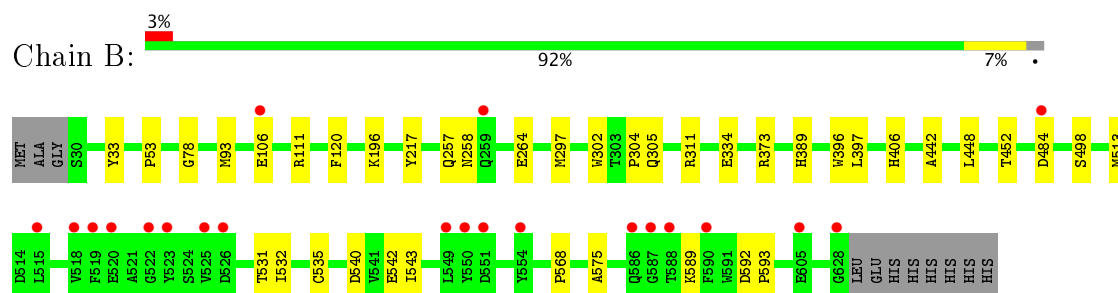
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Glucanase



• Molecule 1: Glucanase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	108.22Å 108.82Å 139.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	27.74 – 1.70 27.67 – 1.70	Depositor EDS
% Data completeness (in resolution range)	98.5 (27.74-1.70) 98.5 (27.67-1.70)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.16 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.160 , 0.187 0.160 , 0.186	Depositor DCC
R_{free} test set	8919 reflections (5.28%)	DCC
Wilson B-factor (Å ²)	15.2	Xtriage
Anisotropy	0.345	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 49.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.012 for k,h,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	11125	wwPDB-VP
Average B, all atoms (Å ²)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.93% 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: BGC, CL, CA, BR, 7PE, TRS

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	0.36	0/4957	0.68	0/6750
1	B	0.41	0/4972	0.72	0/6771
All	All	0.39	0/9929	0.70	0/13521

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	4806	0	4491	22	0
1	B	4815	0	4504	35	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	5	0	0	0	0
3	B	4	0	0	3	0
4	A	3	0	0	0	0
4	B	3	0	0	0	0
5	A	23	0	21	0	0
5	B	23	0	21	3	0
6	A	8	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	8	0	12	1	0
7	B	21	0	30	1	0
8	A	672	0	0	4	0
8	B	730	0	0	7	0
All	All	11125	0	9091	54	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 3.

The worst 5 of 54 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:532:ILE:HG21	1:B:535:CYS:SG	1.74	1.25
1:B:540[B]:ASP:OD1	8:B:801:HOH:O	1.79	0.98
1:B:532:ILE:HD11	1:B:543:ILE:HD11	1.52	0.91
1:B:532:ILE:HD11	1:B:543:ILE:CD1	2.04	0.88
1:B:532:ILE:CG2	1:B:535:CYS:SG	2.62	0.85

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	599/610 (98%)	583 (97%)	16 (3%)	0	100	100
1	B	601/610 (98%)	585 (97%)	16 (3%)	0	100	100
All	All	1200/1220 (98%)	1168 (97%)	32 (3%)	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	489/496 (99%)	479 (98%)	10 (2%)	60	42
1	B	491/496 (99%)	486 (99%)	5 (1%)	80	71
All	All	980/992 (99%)	965 (98%)	15 (2%)	70	55

5 of 15 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	406	HIS
1	A	468	GLN
1	B	406	HIS
1	A	397	LEU
1	B	373	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	255	ASN
1	A	372	ASN
1	A	565	ASN
1	B	255	ASN
1	B	258	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 carbohydrates in this entry.

5.6 Ligand geometry

Of 26 ligands modelled in this entry, 19 are monoatomic - leaving 7 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	$\# Z > 2$
5	BGC	A	711	5	11,11,12	0.28	0	13,15,17	0.85	0
5	BGC	A	712	5	12,12,12	0.47	0	17,17,17	0.70	1 (5%)
6	TRS	A	713	-	7,7,7	0.30	0	9,9,9	0.72	0
5	BGC	B	710	5	11,11,12	0.22	0	13,15,17	1.46	3 (23%)
5	BGC	B	711	5	12,12,12	0.49	0	17,17,17	0.77	0
6	TRS	B	712	-	7,7,7	0.38	0	9,9,9	1.23	0
7	7PE	B	713	-	20,20,20	0.53	0	19,19,19	0.61	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
5	BGC	A	711	5	-	0/2/19/22	0/1/1/1
5	BGC	A	712	5	-	0/2/22/22	0/1/1/1
6	TRS	A	713	-	-	0/9/9/9	0/0/0/0
5	BGC	B	710	5	-	0/2/19/22	0/1/1/1
5	BGC	B	711	5	-	0/2/22/22	0/1/1/1
6	TRS	B	712	-	-	0/9/9/9	0/0/0/0
7	7PE	B	713	-	-	0/18/18/18	0/0/0/0

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
5	B	710	BGC	O4-C4-C3	-3.39	102.99	110.36
5	B	710	BGC	O2-C2-C3	-2.85	104.59	110.17
5	B	710	BGC	C1-O5-C5	-2.12	109.25	112.17
5	A	712	BGC	O5-C1-C2	-2.04	106.66	110.04

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	713	TRS	1	0
5	B	710	BGC	3	0
6	B	712	TRS	1	0
7	B	713	7PE	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	599/610 (98%)	-0.23	6 (1%) 82 86	10, 18, 31, 45	0
1	B	599/610 (98%)	-0.23	21 (3%) 44 50	7, 13, 35, 48	0
All	All	1198/1220 (98%)	-0.23	27 (2%) 61 66	7, 16, 33, 48	0

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	587	GLY	5.5
1	B	526	ASP	5.2
1	B	519	PHE	4.9
1	A	627	GLY	4.2
1	B	590	PHE	4.1

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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(\AA^2)	Q<0.9
7	7PE	B	713	21/21	0.77	0.22	6.52	22,42,48,48	0
5	BGC	B	711	12/12	0.96	0.13	3.14	17,19,27,28	0
5	BGC	A	711	11/12	0.94	0.11	3.03	22,26,30,32	0
5	BGC	A	712	12/12	0.97	0.14	1.71	21,23,27,28	0
3	CL	B	706	1/1	0.99	0.10	1.58	13,13,13,13	0
5	BGC	B	710	11/12	0.92	0.10	1.29	20,26,30,33	0
6	TRS	B	712	8/8	0.96	0.08	0.49	13,17,17,19	0
3	CL	A	706	1/1	0.99	0.06	-0.39	19,19,19,19	0
6	TRS	A	713	8/8	0.97	0.06	-0.81	19,22,23,24	0
3	CL	A	703	1/1	0.90	0.07	-0.88	43,43,43,43	0
4	BR	B	703	1/1	1.00	0.04	-0.95	18,18,18,18	0
4	BR	B	709	1/1	0.98	0.07	-1.13	39,39,39,39	0
2	CA	B	701	1/1	1.00	0.05	-1.26	11,11,11,11	0
4	BR	A	709	1/1	0.98	0.05	-1.30	31,31,31,31	0
2	CA	B	702	1/1	0.97	0.05	-2.59	30,30,30,30	0
2	CA	A	701	1/1	0.99	0.04	-3.10	19,19,19,19	0
4	BR	A	710	1/1	0.99	0.02	-4.44	29,29,29,29	0
2	CA	A	702	1/1	0.99	0.03	-5.81	25,25,25,25	0
3	CL	A	707	1/1	0.95	0.05	-	36,36,36,36	0
3	CL	B	705	1/1	0.96	0.05	-	25,25,25,25	0
4	BR	B	708	1/1	1.00	0.06	-	27,27,27,27	0
3	CL	B	704	1/1	1.00	0.08	-	26,26,26,26	0
4	BR	A	708	1/1	0.99	0.06	-	27,27,27,27	0
3	CL	A	704	1/1	0.99	0.04	-	18,18,18,18	0
3	CL	B	707	1/1	0.96	0.06	-	26,26,26,26	0
3	CL	A	705	1/1	0.95	0.05	-	32,32,32,32	0

6.5 Other polymers ⓘ

There are no such residues in this entry.