



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 10:03 PM UTC

PDB ID : 4XUP / pdb_00004xup
Title : Structure of the N-terminal CBM22-1-CBM22-2 tandem domain from *Paenibacillus barcinonensis* Xyn10C
Authors : Sainz-Polo, M.A.; Sanz-Aparicio, J.
Deposited on : 2015-01-26
Resolution : 2.43 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

<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

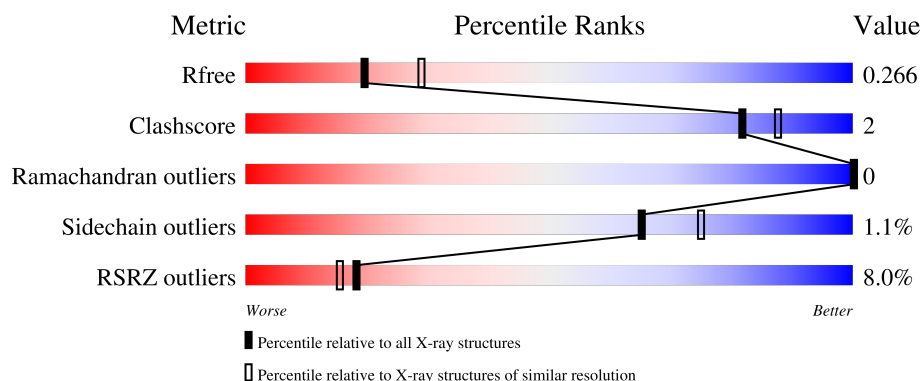
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.43 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	2340 (2.46-2.42)
Clashscore	190562	2400 (2.46-2.42)
Ramachandran outliers	187476	2379 (2.46-2.42)
Sidechain outliers	187428	2379 (2.46-2.42)
RSRZ outliers	180081	2340 (2.46-2.42)

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	334	10% 90% 7% ..
1	B	334	4% 89% 6% . .
1	C	334	4% 43% 52%
1	D	334	5% 91% . .
1	E	334	3% 45% 52%

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Mol	Chain	Length	Quality of chain
1	F	334	13% 92% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12540 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 Endo-1,4-beta-xylanase C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	330	Total	C	N	O	S	0	0	0
			2549	1595	431	520	3			
1	B	321	Total	C	N	O	S	0	0	0
			2489	1561	420	505	3			
1	C	159	Total	C	N	O		0	0	0
			1221	762	208	251				
1	D	321	Total	C	N	O	S	0	0	0
			2489	1561	421	504	3			
1	E	159	Total	C	N	O		0	0	0
			1223	763	209	251				
1	F	325	Total	C	N	O	S	0	0	0
			2517	1577	426	511	3			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	87	ALA	PRO	conflict	UNP O69230
A	98	GLY	ARG	conflict	UNP O69230
A	177	ASP	TYR	conflict	UNP O69230
B	87	ALA	PRO	conflict	UNP O69230
B	98	GLY	ARG	conflict	UNP O69230
B	177	ASP	TYR	conflict	UNP O69230
C	87	ALA	PRO	conflict	UNP O69230
C	98	GLY	ARG	conflict	UNP O69230
C	177	ASP	TYR	conflict	UNP O69230
D	87	ALA	PRO	conflict	UNP O69230
D	98	GLY	ARG	conflict	UNP O69230
D	177	ASP	TYR	conflict	UNP O69230
E	87	ALA	PRO	conflict	UNP O69230
E	98	GLY	ARG	conflict	UNP O69230
E	177	ASP	TYR	conflict	UNP O69230
F	87	ALA	PRO	conflict	UNP O69230
F	98	GLY	ARG	conflict	UNP O69230

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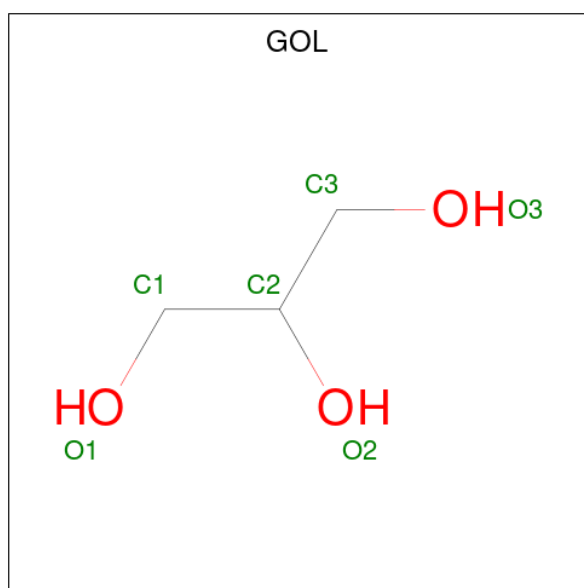
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Chain	Residue	Modelled	Actual	Comment	Reference
F	177	ASP	TYR	conflict	UNP O69230

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

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total 2 Ca 2	0	0
2	B	2	Total 2 Ca 2	0	0
2	C	1	Total 1 Ca 1	0	0
2	D	2	Total 2 Ca 2	0	0
2	E	1	Total 1 Ca 1	0	0
2	F	2	Total 2 Ca 2	0	0

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).

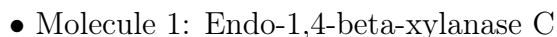
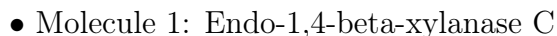
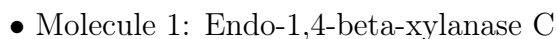


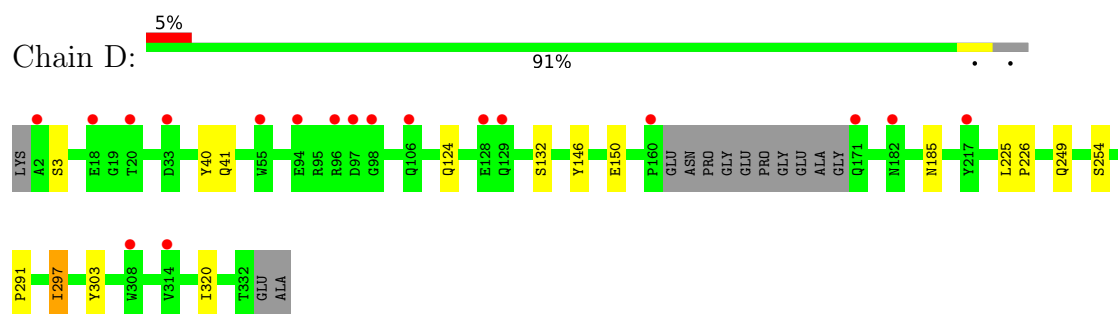
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total 6 C 3 O 3	0	0
3	D	1	Total 6 C 3 O 3	0	0

- Molecule 4 is water.

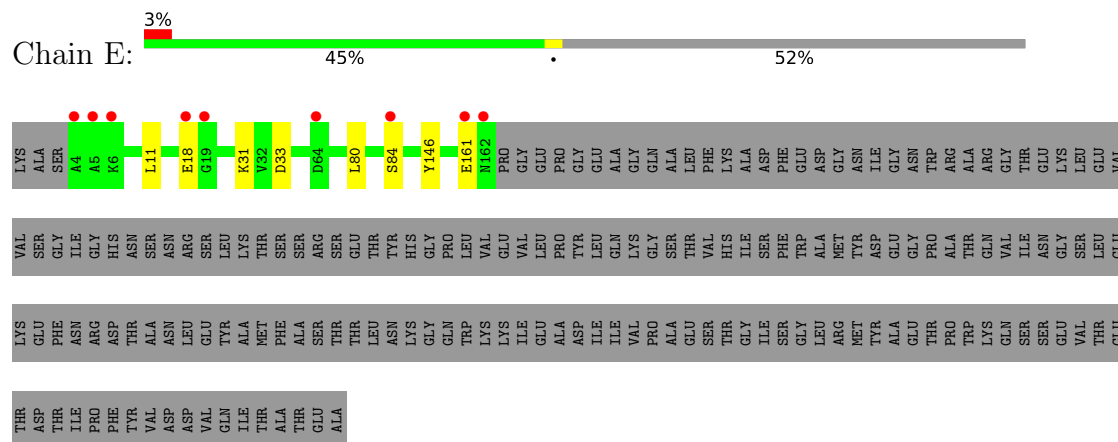
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	8	Total 8	O 8	0	0
4	B	6	Total 6	O 6	0	0
4	C	2	Total 2	O 2	0	0
4	D	8	Total 8	O 8	0	0
4	E	2	Total 2	O 2	0	0
4	F	4	Total 4	O 4	0	0

- Molecule 1: Endo-1,4-beta-xylanase C

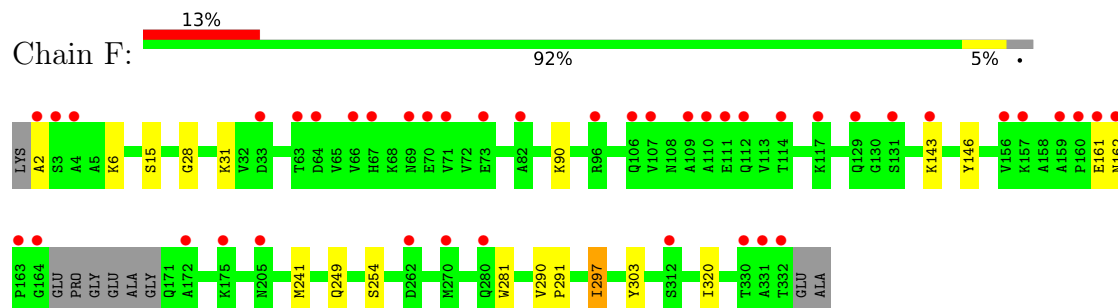




• Molecule 1: Endo-1,4-beta-xylanase C



• Molecule 1: Endo-1,4-beta-xylanase C



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	84.17Å 110.36Å 118.52Å 90.00° 90.63° 90.00°	Depositor
Resolution (Å)	118.52 – 2.43 118.52 – 2.43	Depositor EDS
% Data completeness (in resolution range)	99.3 (118.52-2.43) 99.3 (118.52-2.43)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.14 (at 2.42Å)	Xtriage
Refinement program	REFMAC 5.8.0103	Depositor
R, R_{free}	0.227 , 0.265 0.231 , 0.266	Depositor DCC
R_{free} test set	4072 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	43.0	Xtriage
Anisotropy	0.390	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 25.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.029 for h,-k,-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	12540	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.02% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CA, GOL

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	0.97	3/2598 (0.1%)	0.98	3/3526 (0.1%)
1	B	0.93	1/2537 (0.0%)	0.98	4/3443 (0.1%)
1	C	1.00	0/1241	0.99	3/1683 (0.2%)
1	D	0.94	0/2537	0.98	1/3443 (0.0%)
1	E	1.04	1/1243 (0.1%)	0.95	1/1686 (0.1%)
1	F	0.95	2/2566 (0.1%)	0.98	2/3483 (0.1%)
All	All	0.96	7/12722 (0.1%)	0.98	14/17264 (0.1%)

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	162	ASN	C-O	7.97	1.27	1.23
1	A	162	ASN	CA-C	7.71	1.59	1.53
1	E	161	GLU	CA-C	7.33	1.58	1.52
1	F	162	ASN	N-CA	7.13	1.50	1.46
1	A	317	THR	CA-C	5.27	1.59	1.52

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	146	TYR	N-CA-C	6.13	118.38	109.07
1	F	146	TYR	N-CA-C	5.59	117.57	109.07
1	C	90	LYS	N-CA-CB	-5.48	101.29	110.99
1	B	146	TYR	N-CA-C	5.47	117.38	109.07
1	E	146	TYR	N-CA-C	5.46	117.15	108.79

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	2549	0	2455	24	0
1	B	2489	0	2406	15	0
1	C	1221	0	1184	9	0
1	D	2489	0	2407	13	0
1	E	1223	0	1184	6	0
1	F	2517	0	2430	11	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	1	0	0	0	0
2	D	2	0	0	1	0
2	E	1	0	0	0	0
2	F	2	0	0	0	0
3	B	6	0	8	0	0
3	D	6	0	8	2	0
4	A	8	0	0	0	0
4	B	6	0	0	1	0
4	C	2	0	0	0	0
4	D	8	0	0	2	0
4	E	2	0	0	0	0
4	F	4	0	0	1	0
All	All	12540	0	12082	61	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.

The worst 5 of 61 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:D:150:GLU:OE2	4:D:501:HOH:O	1.89	0.91
1:A:108:ASN:HD22	1:D:41:GLN:NE2	1.84	0.76
1:B:41:GLN:HB3	4:B:501:HOH:O	1.87	0.75
1:A:216:THR:HG21	1:A:308:TRP:HA	1.66	0.74
1:B:183:ILE:HG13	1:B:196:VAL:HG23	1.73	0.70

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	326/334 (98%)	321 (98%)	5 (2%)	0	100	100
1	B	317/334 (95%)	310 (98%)	7 (2%)	0	100	100
1	C	157/334 (47%)	152 (97%)	5 (3%)	0	100	100
1	D	317/334 (95%)	312 (98%)	5 (2%)	0	100	100
1	E	157/334 (47%)	151 (96%)	6 (4%)	0	100	100
1	F	321/334 (96%)	315 (98%)	6 (2%)	0	100	100
All	All	1595/2004 (80%)	1561 (98%)	34 (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	270/273 (99%)	265 (98%)	5 (2%)	50	63
1	B	265/273 (97%)	262 (99%)	3 (1%)	65	75
1	C	128/273 (47%)	127 (99%)	1 (1%)	73	81
1	D	265/273 (97%)	262 (99%)	3 (1%)	65	75
1	E	128/273 (47%)	128 (100%)	0	100	100
1	F	268/273 (98%)	265 (99%)	3 (1%)	65	75
All	All	1324/1638 (81%)	1309 (99%)	15 (1%)	65	75

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

Mol	Chain	Res	Type
1	B	297	ILE
1	F	90	LYS
1	C	111	GLU
1	F	297	ILE
1	D	297	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 43 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	38	GLN
1	F	122	GLN
1	E	56	ASN
1	F	38	GLN
1	F	203	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 10 are monoatomic - leaving 2 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	GOL	B	403	-	5,5,5	0.84	0	5,5,5	1.16	0
3	GOL	D	403	-	5,5,5	1.03	0	5,5,5	0.88	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
3	GOL	B	403	-	-	1/4/4/4	-
3	GOL	D	403	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	403	GOL	O1-C1-C2-C3
3	D	403	GOL	O2-C2-C3-O3
3	D	403	GOL	O1-C1-C2-O2

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	403	GOL	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 [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	330/334 (98%)	0.56	32 (9%) 13 10	23, 47, 75, 84	0
1	B	321/334 (96%)	0.33	15 (4%) 36 33	26, 45, 70, 86	0
1	C	159/334 (47%)	0.51	13 (8%) 17 15	28, 47, 75, 84	0
1	D	321/334 (96%)	0.46	18 (5%) 30 27	23, 48, 69, 83	0
1	E	159/334 (47%)	0.18	9 (5%) 29 26	20, 38, 67, 77	0
1	F	325/334 (97%)	0.88	43 (13%) 7 5	31, 55, 74, 84	0
All	All	1615/2004 (80%)	0.52	130 (8%) 18 15	20, 48, 73, 86	0

The worst 5 of 130 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	163	PRO	5.1
1	A	131	SER	4.5
1	F	111	GLU	4.3
1	A	2	ALA	4.3
1	B	2	ALA	4.2

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	GOL	B	403	6/6	0.73	0.19	48,53,56,57	0
3	GOL	D	403	6/6	0.74	0.18	44,50,51,52	0
2	CA	D	401	1/1	0.96	0.04	36,36,36,36	0
2	CA	F	402	1/1	0.98	0.05	50,50,50,50	0
2	CA	C	401	1/1	0.99	0.04	43,43,43,43	0
2	CA	A	1001	1/1	0.99	0.04	38,38,38,38	0
2	CA	D	402	1/1	0.99	0.04	40,40,40,40	0
2	CA	A	1002	1/1	0.99	0.05	55,55,55,55	0
2	CA	B	401	1/1	0.99	0.02	42,42,42,42	0
2	CA	B	402	1/1	0.99	0.06	42,42,42,42	0
2	CA	F	401	1/1	1.00	0.01	36,36,36,36	0
2	CA	E	401	1/1	1.00	0.01	26,26,26,26	0

6.5 Other polymers [i](#)

There are no such residues in this entry.