



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 04:36 PM UTC

PDB ID : 5ITO / pdb_00005ito
Title : Structure of the periplasmic binding protein M117N-NocT from *A. tumefaciens*
in complex with octopine
Authors : Vigouroux, A.; Morera, S.
Deposited on : 2016-03-17
Resolution : 2.35 Å (reported)

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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

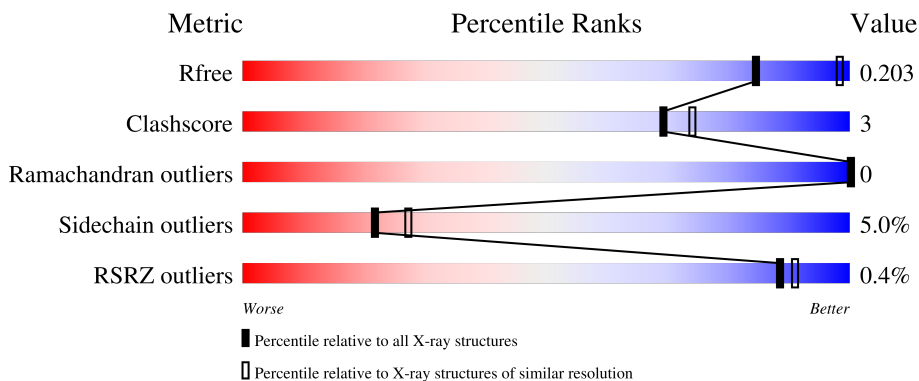
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



The reported resolution of this entry is 2.35 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	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	265	 85% 10% . .
1	B	265	 83% 12% . .

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
2	PEG	A	301	-	-	X	-

2 Entry composition i

There are 7 unique types of molecules in this entry. The entry contains 4101 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 Nopaline-binding periplasmic protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	255	1957	1251	320	375	11	0	0	0
1	B	255	1958	1253	321	373	11	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	25	MET	-	initiating methionine	UNP P35120
A	117	ASN	MET	conflict	UNP P35120
A	284	HIS	-	expression tag	UNP P35120
A	285	HIS	-	expression tag	UNP P35120
A	286	HIS	-	expression tag	UNP P35120
A	287	HIS	-	expression tag	UNP P35120
A	288	HIS	-	expression tag	UNP P35120
A	289	HIS	-	expression tag	UNP P35120
B	25	MET	-	initiating methionine	UNP P35120
B	117	ASN	MET	conflict	UNP P35120
B	284	HIS	-	expression tag	UNP P35120
B	285	HIS	-	expression tag	UNP P35120
B	286	HIS	-	expression tag	UNP P35120
B	287	HIS	-	expression tag	UNP P35120
B	288	HIS	-	expression tag	UNP P35120
B	289	HIS	-	expression tag	UNP P35120

- Molecule 2 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



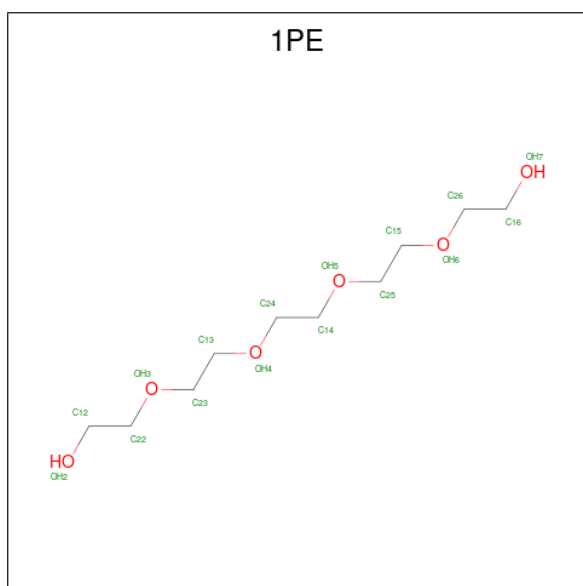
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			7	4	3		

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



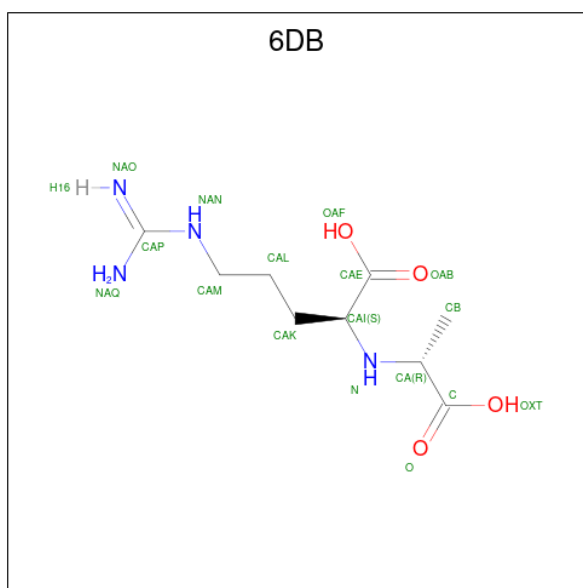
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 4 is PENTAETHYLENE GLYCOL (CCD ID: 1PE) (formula: $C_{10}H_{22}O_6$).



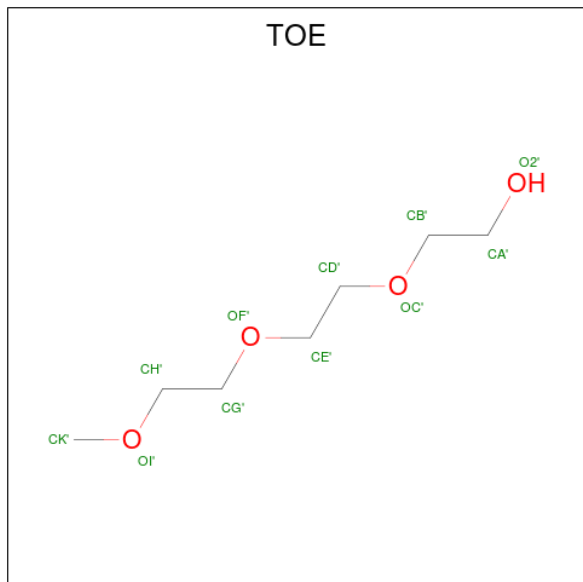
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			16	10	6		

- Molecule 5 is octopine (CCD ID: 6DB) (formula: $C_9H_{18}N_4O_4$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			17	9	4	4		
5	B	1	Total	C	N	O	0	0
			17	9	4	4		

- Molecule 6 is 2-[2-(2-METHOXY-ETHOXY)-ETHOXY]-ETHOXYL (CCD ID: TOE) (formula: C₇H₁₆O₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			11	7	4		
6	A	1	Total	C	O	0	0
			11	7	4		


- Molecule 7 is water.

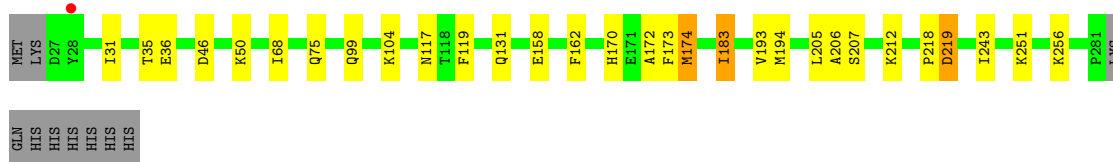
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	70	Total	O	0	0
			70	70		
7	B	25	Total	O	0	0
			25	25		

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.

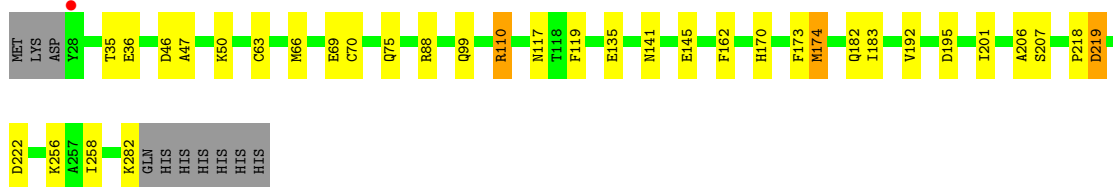
- Molecule 1: Nopaline-binding periplasmic protein

Chain A:  85% 10% . .



- Molecule 1: Nopaline-binding periplasmic protein

Chain B:  83% 12% . .



4 Data and refinement statistics i

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α , β , γ	113.59Å 113.59Å 37.89Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	25.98 – 2.35 25.98 – 2.35	Depositor EDS
% Data completeness (in resolution range)	100.0 (25.98-2.35) 99.9 (25.98-2.35)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.61 (at 2.34Å)	Xtriage
Refinement program	BUSTER 2.10.0	Depositor
R, R_{free}	0.175 , 0.207 0.176 , 0.203	Depositor DCC
R_{free} test set	1142 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	44.6	Xtriage
Anisotropy	0.049	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 48.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.025 for -h,-k,l 0.024 for h,-h-k,-l 0.015 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4101	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.85% 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: PEG, 1PE, TOE, EDO, 6DB

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	0.88	1/1995 (0.1%)	1.24	6/2695 (0.2%)
1	B	0.79	1/1996 (0.1%)	1.27	5/2695 (0.2%)
All	All	0.84	2/3991 (0.1%)	1.26	11/5390 (0.2%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	174	MET	SD-CE	-10.78	1.52	1.79
1	B	174	MET	SD-CE	-7.72	1.60	1.79

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	219	ASP	CA-CB-CG	6.48	119.08	112.60
1	B	218	PRO	CA-C-N	6.35	128.78	120.28
1	B	218	PRO	C-N-CA	6.35	128.78	120.28
1	A	46	ASP	CA-CB-CG	6.29	118.89	112.60
1	A	219	ASP	CA-CB-CG	6.20	118.80	112.60

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	1957	0	1967	16	0
1	B	1958	0	1976	13	0
2	A	7	0	10	4	0
3	A	4	0	6	1	0
3	B	8	0	12	1	0
4	A	16	0	22	1	0
5	A	17	0	0	0	0
5	B	17	0	0	0	0
6	A	22	0	32	0	0
7	A	70	0	0	0	0
7	B	25	0	0	0	0
All	All	4101	0	4025	28	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 28 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:104:LYS:HA	2:A:301:PEG:H32	1.49	0.92
1:A:212:LYS:HD2	3:A:302:EDO:H22	1.54	0.88
1:A:162:PHE:HB3	1:A:183:ILE:HD12	1.74	0.69
1:A:172:ALA:HB2	4:A:303:1PE:H141	1.76	0.68
1:A:104:LYS:HA	2:A:301:PEG:C3	2.27	0.64

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	253/265 (96%)	248 (98%)	5 (2%)	0	100	100
1	B	253/265 (96%)	248 (98%)	5 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	506/530 (96%)	496 (98%)	10 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	209/219 (95%)	201 (96%)	8 (4%)	29	39
1	B	209/219 (95%)	196 (94%)	13 (6%)	16	19
All	All	418/438 (95%)	397 (95%)	21 (5%)	22	27

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	135	GLU
1	B	182	GLN
1	B	282	LYS
1	B	219	ASP
1	B	145	GLU

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

Mol	Chain	Res	Type
1	A	99	GLN
1	A	272	GLN
1	B	75	GLN
1	B	136	ASN
1	B	272	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

9 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
3	EDO	B	301	-	3,3,3	0.59	0	2,2,2	0.26	0
5	6DB	A	304	-	16,16,16	1.57	1 (6%)	17,20,20	1.16	3 (17%)
6	TOE	A	306	-	10,10,10	0.56	0	9,9,9	1.76	3 (33%)
2	PEG	A	301	-	6,6,6	0.42	0	5,5,5	0.36	0
3	EDO	B	302	-	3,3,3	0.60	0	2,2,2	0.08	0
5	6DB	B	303	-	16,16,16	1.56	1 (6%)	17,20,20	1.21	3 (17%)
4	1PE	A	303	-	15,15,15	0.71	0	14,14,14	0.41	0
3	EDO	A	302	-	3,3,3	0.44	0	2,2,2	0.30	0
6	TOE	A	305	-	10,10,10	0.64	0	9,9,9	1.57	2 (22%)

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	EDO	B	301	-	-	0/1/1/1	-
5	6DB	A	304	-	-	1/19/19/19	-
6	TOE	A	306	-	-	4/8/8/8	-
2	PEG	A	301	-	-	0/4/4/4	-
3	EDO	B	302	-	-	0/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	6DB	B	303	-	-	1/19/19/19	-
4	1PE	A	303	-	-	10/13/13/13	-
3	EDO	A	302	-	-	0/1/1/1	-
6	TOE	A	305	-	-	5/8/8/8	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	303	6DB	CAP-NAN	5.40	1.43	1.33
5	A	304	6DB	CAP-NAN	5.17	1.43	1.33

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	304	6DB	CAK-CAL-CAM	2.27	118.63	112.07
6	A	306	TOE	OC'-CD'-CE'	2.27	120.68	110.35
5	B	303	6DB	OAF-CAE-CAI	2.20	120.94	113.51
6	A	306	TOE	OF'-CE'-CD'	2.19	120.35	110.35
6	A	305	TOE	OF'-CE'-CD'	2.19	120.34	110.35

There are no chirality outliers.

5 of 21 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	303	1PE	OH4-C13-C23-OH3
4	A	303	1PE	OH6-C15-C25-OH5
6	A	305	TOE	O2'-CA'-CB'-OC'
6	A	305	TOE	OF'-CG'-CH'-OI'
5	A	304	6DB	CAE-CAI-N-CA

There are no ring outliers.

4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	301	PEG	4	0
3	B	302	EDO	1	0
4	A	303	1PE	1	0
3	A	302	EDO	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	255/265 (96%)	-0.54	1 (0%) 88 91	29, 40, 62, 94	0
1	B	255/265 (96%)	-0.01	1 (0%) 88 91	43, 61, 90, 109	0
All	All	510/530 (96%)	-0.28	2 (0%) 88 91	29, 51, 84, 109	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	28	TYR	2.1
1	A	28	TYR	2.1

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 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	PEG	A	301	7/7	0.81	0.26	55,59,62,64	0
6	TOE	A	306	11/11	0.82	0.13	57,61,62,64	0
4	1PE	A	303	16/16	0.85	0.13	60,66,68,68	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	EDO	B	301	4/4	0.86	0.12	73,73,74,74	0
3	EDO	B	302	4/4	0.86	0.12	53,56,61,64	0
6	TOE	A	305	11/11	0.88	0.12	67,70,76,76	0
3	EDO	A	302	4/4	0.93	0.07	58,58,58,59	0
5	6DB	B	303	17/17	0.93	0.08	42,48,64,67	0
5	6DB	A	304	17/17	0.97	0.05	30,35,41,42	0

6.5 Other polymers [i](#)

There are no such residues in this entry.