



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:40 PM UTC

PDB ID : 4Y7O / pdb_00004y7o
Title : T6SS protein TssM C-terminal domain (869-1107) from EAEC
Authors : Nguyen, V.S.; Spinelli, S.; Durand, E.; Roussel, A.; Cambillau, C.
Deposited on : 2015-02-15
Resolution : 2.24 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
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

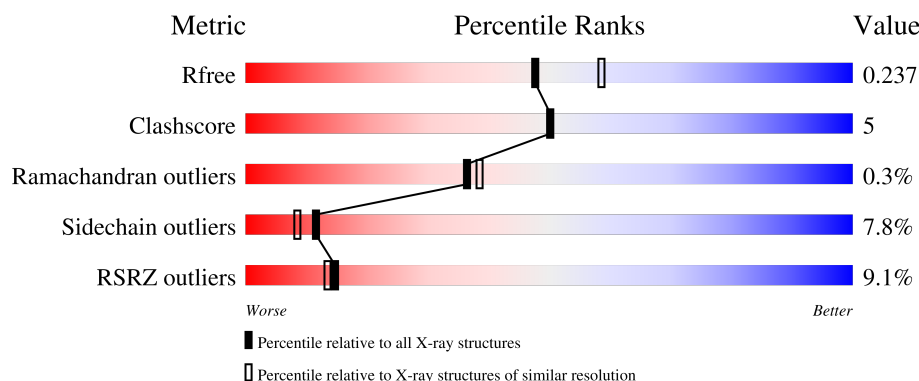
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.24 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	3416 (2.26-2.22)
Clashscore	190562	3556 (2.26-2.22)
Ramachandran outliers	187476	3500 (2.26-2.22)
Sidechain outliers	187428	3501 (2.26-2.22)
RSRZ outliers	180081	3415 (2.26-2.22)

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	240	5% 85% 12% .
1	B	240	5% 83% 15% .
2	C	155	12% 65% 14% . 21%
2	D	155	16% 64% 11% . 20%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5901 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 Type VI secretion protein IcmF.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	239	Total	C	N	O	S	0	0	0
			1841	1176	322	339	4			
1	B	239	Total	C	N	O	S	0	0	0
			1839	1172	324	339	4			

- Molecule 2 is a protein called Type VI secretion system protein VasD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	123	Total	C	N	O	S	0	0	0
			924	589	159	174	2			
2	D	124	Total	C	N	O	S	0	0	0
			914	583	150	179	2			

There are 2 discrepancies between the modelled and reference sequences:

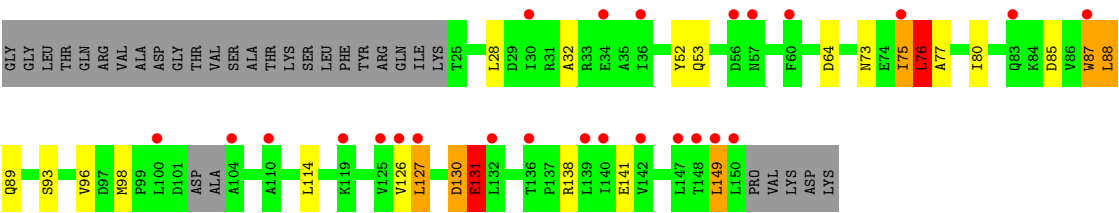
Chain	Residue	Modelled	Actual	Comment	Reference
C	1	GLY	-	expression tag	UNP H4VA93
D	1	GLY	-	expression tag	UNP H4VA93

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	158	Total 158	O 158	0	0
4	B	156	Total 156	O 156	0	0
4	C	33	Total 33	O 33	0	0
4	D	32	Total 32	O 32	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	85.47Å 85.47Å 256.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.34 – 2.24 49.34 – 2.24	Depositor EDS
% Data completeness (in resolution range)	99.2 (49.34-2.24) 99.7 (49.34-2.24)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.05 (at 2.25Å)	Xtriage
Refinement program	BUSTER 2.10.1	Depositor
R, R_{free}	0.204 , 0.224 0.211 , 0.237	Depositor DCC
R_{free} test set	2321 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	48.6	Xtriage
Anisotropy	0.311	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 55.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5901	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.11% 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:
ZN

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	0.82	1/1888 (0.1%)	1.22	7/2580 (0.3%)
1	B	0.83	2/1886 (0.1%)	1.16	4/2577 (0.2%)
2	C	0.81	0/940	1.18	2/1282 (0.2%)
2	D	0.80	0/929	1.30	5/1272 (0.4%)
All	All	0.82	3/5643 (0.1%)	1.21	18/7711 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	1053	MET	SD-CE	-8.45	1.58	1.79
1	A	1053	MET	SD-CE	-5.73	1.65	1.79
1	B	1062	VAL	CA-C	5.13	1.57	1.52

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	130	ASP	CA-C-N	10.89	141.31	121.70
2	D	130	ASP	C-N-CA	10.89	141.31	121.70
1	A	946	THR	N-CA-C	-10.27	93.97	110.20
1	A	945	ASN	CA-C-N	8.58	133.69	121.42
1	A	945	ASN	C-N-CA	8.58	133.69	121.42
2	D	76	LEU	N-CA-C	-8.38	102.09	111.14
1	A	947	ARG	CA-C-N	7.53	135.26	121.70
1	A	947	ARG	C-N-CA	7.53	135.26	121.70
1	B	1061	GLY	CA-C-N	6.50	129.22	122.27
1	B	1061	GLY	C-N-CA	6.50	129.22	122.27
2	C	57	ASN	CA-CB-CG	6.46	119.06	112.60
1	B	1062	VAL	N-CA-CB	-5.79	105.47	112.07
1	A	1065	GLY	N-CA-C	5.28	120.10	110.71
2	C	85	ASP	CA-CB-CG	5.27	117.87	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	64	ASP	CA-CB-CG	5.25	117.86	112.60
1	A	947	ARG	N-CA-C	5.25	119.86	112.72
2	D	85	ASP	CA-CB-CG	5.22	117.82	112.60
1	B	1105	VAL	N-CA-C	-5.21	106.60	111.45

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	1841	0	1802	20	0
1	B	1839	0	1791	22	0
2	C	924	0	915	8	0
2	D	914	0	877	13	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
4	A	158	0	0	0	0
4	B	156	0	0	1	0
4	C	33	0	0	1	0
4	D	32	0	0	0	0
All	All	5901	0	5385	58	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 5.

All (58) 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:1073:GLN:H	1:A:1073:GLN:HE21	1.13	0.93
1:B:1073:GLN:HE21	1:B:1073:GLN:H	1.17	0.92
1:A:1031:THR:HG22	2:C:89:GLN:HE22	1.44	0.82
1:A:999:GLN:HE22	1:A:1014:THR:H	1.25	0.81
1:A:896:PRO:O	1:A:1097:ARG:HD2	1.81	0.81

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:999:GLN:HE22	1:B:1014:THR:H	1.29	0.79
1:B:896:PRO:O	1:B:1097:ARG:HD2	1.84	0.77
1:A:1028:TRP:HZ3	1:A:1073:GLN:NE2	1.85	0.74
1:A:1050:LEU:HA	1:A:1053:MET:HE2	1.73	0.69
1:B:1073:GLN:H	1:B:1073:GLN:NE2	1.90	0.69
1:B:1050:LEU:HA	1:B:1053:MET:HE2	1.75	0.68
2:D:32:ALA:HB2	2:D:88:LEU:HD23	1.74	0.68
2:C:142:VAL:HG22	2:C:147:LEU:HD23	1.75	0.67
2:D:127:LEU:HD21	2:D:149:LEU:HG	1.76	0.66
1:A:1073:GLN:H	1:A:1073:GLN:NE2	1.90	0.66
1:A:882:ALA:HB1	1:A:919:ARG:HH21	1.63	0.64
1:A:1062:VAL:HG13	1:A:1065:GLY:HA3	1.82	0.61
2:D:53:GLN:HE21	2:D:98:MET:HE3	1.66	0.61
1:A:1028:TRP:CZ3	1:A:1073:GLN:NE2	2.67	0.60
1:A:882:ALA:HB1	1:A:919:ARG:NH2	2.18	0.59
1:B:884:VAL:HG22	1:B:1101:LEU:HD13	1.85	0.58
1:B:1062:VAL:HG22	1:B:1063:ALA:HA	1.85	0.58
1:A:946:THR:C	1:A:948:GLY:HA2	2.30	0.57
2:D:73:ASN:HB3	2:D:76:LEU:HB2	1.85	0.57
1:A:1020:GLU:H	1:A:1020:GLU:CD	2.12	0.56
1:B:1020:GLU:H	1:B:1020:GLU:CD	2.14	0.56
1:A:884:VAL:HG22	1:A:1101:LEU:HD13	1.88	0.55
1:B:934:ARG:HD3	1:B:939:TRP:CE2	2.43	0.53
2:D:131:GLU:O	2:D:138:ARG:HD2	2.08	0.53
1:B:899:ASN:HB2	1:B:1097:ARG:NH2	2.27	0.50
1:B:1036:ARG:NH2	1:B:1073:GLN:HG3	2.26	0.50
1:A:899:ASN:HB2	1:A:1097:ARG:NH2	2.27	0.50
1:A:1007:MET:HB2	2:C:65:TYR:CE1	2.48	0.48
1:A:989:VAL:HG13	1:A:1028:TRP:HD1	1.79	0.48
2:C:142:VAL:HG22	2:C:147:LEU:CD2	2.42	0.48
1:B:1006:GLN:HG2	4:B:1339:HOH:O	2.12	0.47
2:D:130:ASP:HB2	2:D:131:GLU:HB2	1.95	0.47
2:D:77:ALA:O	2:D:80:ILE:HG22	2.15	0.46
2:D:73:ASN:HD21	2:D:75:ILE:HD12	1.79	0.46
1:B:872:ALA:HB2	1:B:949:LEU:HD22	1.97	0.46
1:B:1065:GLY:HA2	1:B:1082:LEU:O	2.16	0.45
1:B:1064:SER:HB2	1:B:1084:THR:OG1	2.17	0.45
2:D:28:LEU:HB2	2:D:96:VAL:HB	1.99	0.45
2:C:32:ALA:HB2	2:C:88:LEU:HD21	1.99	0.45
2:C:55:LYS:HE3	2:C:103:ALA:HB1	1.98	0.44
2:C:118:GLN:HG2	4:C:312:HOH:O	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1036:ARG:NH2	1:A:1073:GLN:HG3	2.32	0.44
1:B:1054:ALA:HB2	1:B:1070:TRP:CE2	2.53	0.44
1:A:995:ILE:HG12	1:A:1000:LYS:HG2	2.00	0.44
2:C:28:LEU:HB2	2:C:96:VAL:HB	1.99	0.43
1:B:990:MET:O	2:D:87:TRP:HH2	2.01	0.43
2:D:52:TYR:HD2	2:D:80:ILE:HD12	1.82	0.43
1:A:1054:ALA:HB2	1:A:1070:TRP:CE2	2.54	0.43
1:B:1063:ALA:HB1	1:B:1064:SER:HA	2.01	0.42
1:B:990:MET:O	2:D:87:TRP:CH2	2.73	0.42
1:B:906:LEU:HD13	1:B:1016:PRO:HG3	2.03	0.41
1:B:1033:ALA:HB3	1:B:1036:ARG:HD3	2.02	0.41
1:B:1008:PRO:HD3	2:D:114:LEU:HD12	2.04	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	237/240 (99%)	229 (97%)	8 (3%)	0	100	100
1	B	237/240 (99%)	229 (97%)	8 (3%)	0	100	100
2	C	119/155 (77%)	115 (97%)	3 (2%)	1 (1%)	16	13
2	D	120/155 (77%)	117 (98%)	2 (2%)	1 (1%)	16	13
All	All	713/790 (90%)	690 (97%)	21 (3%)	2 (0%)	36	38

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	131	GLU
2	C	102	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	188/195 (96%)	176 (94%)	12 (6%)	16	14
1	B	187/195 (96%)	175 (94%)	12 (6%)	16	14
2	C	96/129 (74%)	87 (91%)	9 (9%)	8	5
2	D	93/129 (72%)	82 (88%)	11 (12%)	5	2
All	All	564/648 (87%)	520 (92%)	44 (8%)	11	8

All (44) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	869	THR
1	A	913	LEU
1	A	916	ASP
1	A	938	ARG
1	A	1007	MET
1	A	1028	TRP
1	A	1035	THR
1	A	1037	GLN
1	A	1064	SER
1	A	1073	GLN
1	A	1076	ARG
1	A	1101	LEU
1	B	869	THR
1	B	875	LEU
1	B	916	ASP
1	B	929	SER
1	B	1031	THR
1	B	1035	THR
1	B	1037	GLN
1	B	1062	VAL
1	B	1064	SER
1	B	1073	GLN
1	B	1076	ARG
1	B	1101	LEU

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Mol	Chain	Res	Type
2	C	38	THR
2	C	57	ASN
2	C	66	GLN
2	C	80	ILE
2	C	87	TRP
2	C	93	SER
2	C	126	VAL
2	C	131	GLU
2	C	149	LEU
2	D	75	ILE
2	D	76	LEU
2	D	87	TRP
2	D	88	LEU
2	D	89	GLN
2	D	93	SER
2	D	126	VAL
2	D	127	LEU
2	D	131	GLU
2	D	141	GLU
2	D	149	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	991	GLN
1	A	999	GLN
1	A	1073	GLN
1	A	1098	ASN
1	B	991	GLN
1	B	999	GLN
1	B	1037	GLN
1	B	1073	GLN
1	B	1098	ASN
2	C	57	ASN
2	C	89	GLN
2	D	53	GLN
2	D	73	ASN
2	D	89	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](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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 [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	239/240 (99%)	0.25	12 (5%) 34 32	34, 48, 76, 104	0
1	B	239/240 (99%)	0.25	11 (4%) 37 35	35, 48, 84, 103	0
2	C	123/155 (79%)	1.18	18 (14%) 6 5	44, 75, 102, 112	5 (4%)
2	D	124/155 (80%)	1.40	25 (20%) 3 2	55, 82, 114, 131	4 (3%)
All	All	725/790 (91%)	0.60	66 (9%) 15 13	34, 56, 101, 131	9 (1%)

All (66) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	119	LYS	5.6
2	D	150	LEU	5.5
2	D	136	THR	4.9
1	B	1062	VAL	4.8
2	D	149	LEU	4.4
2	C	33	ARG	4.4
2	D	142	VAL	4.2
1	B	1033	ALA	4.2
2	D	139	LEU	4.2
2	D	148	THR	4.0
1	A	869	THR	4.0
2	C	70	THR	3.9
1	A	931	VAL	3.9
1	B	1063	ALA	3.7
2	D	83	GLN	3.7
1	B	1061	GLY	3.6
2	C	83	GLN	3.6
1	B	869	THR	3.5
2	C	147	LEU	3.5
2	D	87	TRP	3.5
2	C	152	VAL	3.4

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Mol	Chain	Res	Type	RSRZ
2	D	140	ILE	3.3
2	C	78	GLY	3.3
1	A	1028	TRP	3.2
2	C	102	ASP	3.1
2	C	80	ILE	3.1
2	D	57	ASN	3.0
2	C	23	ILE	3.0
2	C	130	ASP	3.0
2	D	36	ILE	2.9
1	A	947	ARG	2.8
1	B	1031	THR	2.8
1	B	946	THR	2.8
2	D	147	LEU	2.7
1	A	1000	LYS	2.7
2	D	104	ALA	2.6
2	C	60	PHE	2.6
2	C	98	MET	2.6
2	D	132	LEU	2.5
2	C	106	PHE	2.5
2	C	100	LEU	2.5
1	B	944	ILE	2.5
1	B	947	ARG	2.4
2	D	30	ILE	2.4
1	A	939	TRP	2.4
2	D	34	GLU	2.3
2	D	56	ASP	2.3
2	D	100	LEU	2.3
1	A	913	LEU	2.3
2	D	119	LYS	2.3
2	D	60	PHE	2.2
1	A	945	ASN	2.2
2	C	82	ALA	2.2
2	C	51	ILE	2.2
1	B	990	MET	2.2
1	A	946	THR	2.2
2	D	75	ILE	2.1
2	D	125	VAL	2.1
1	A	1063	ALA	2.1
1	B	871	ALA	2.1
2	C	101	ASP	2.1
2	D	126	VAL	2.1
2	D	110	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	937	SER	2.0
2	D	127	LEU	2.0
1	A	919	ARG	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(Å ²)	Q<0.9
3	ZN	B	1201	1/1	0.92	0.10	89,89,89,89	0
3	ZN	A	1201	1/1	0.97	0.06	103,103,103,103	0
3	ZN	C	201	1/1	0.98	0.06	83,83,83,83	0
3	ZN	A	1202	1/1	1.00	0.03	47,47,47,47	0

6.5 Other polymers [i](#)

There are no such residues in this entry.