



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2018 – 11:44 am GMT

PDB ID : 2PY8
Title : RbcX
Authors : Tanaka, S.; Sawaya, M.R.; Kerfeld, C.A.; Yeates, T.O.
Deposited on : 2007-05-15
Resolution : 2.45 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

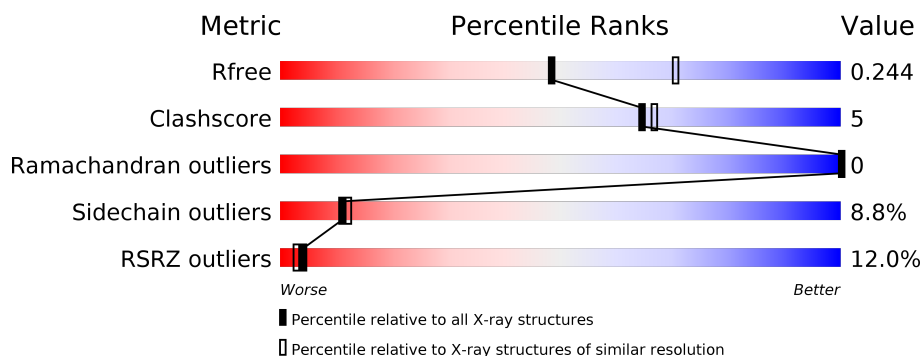
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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}	111664	1259 (2.48-2.44)
Clashscore	122126	1323 (2.48-2.44)
Ramachandran outliers	120053	1314 (2.48-2.44)
Sidechain outliers	120020	1314 (2.48-2.44)
RSRZ outliers	108989	1238 (2.48-2.44)

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	147	<div> <div>5%</div> <div>72% 10% 18%</div> </div>
1	B	147	<div> <div>6%</div> <div>66% 11% 22%</div> </div>
1	C	147	<div> <div>5%</div> <div>68% 14% 16%</div> </div>
1	D	147	<div> <div>22%</div> <div>59% 10% 30%</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3827 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 Hypothetical protein rbcX.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	120	Total	C	N	O	S	0	0	0
			962	605	171	185	1			
1	B	114	Total	C	N	O	S	0	0	0
			915	575	164	175	1			
1	C	123	Total	C	N	O	S	0	0	0
			984	617	174	192	1			
1	D	103	Total	C	N	O	S	0	0	0
			825	519	147	158	1			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	137	ALA	-	EXPRESSION TAG	UNP Q55670
A	138	ALA	-	EXPRESSION TAG	UNP Q55670
A	139	ALA	-	EXPRESSION TAG	UNP Q55670
A	140	LEU	-	EXPRESSION TAG	UNP Q55670
A	141	GLU	-	EXPRESSION TAG	UNP Q55670
A	142	HIS	-	EXPRESSION TAG	UNP Q55670
A	143	HIS	-	EXPRESSION TAG	UNP Q55670
A	144	HIS	-	EXPRESSION TAG	UNP Q55670
A	145	HIS	-	EXPRESSION TAG	UNP Q55670
A	146	HIS	-	EXPRESSION TAG	UNP Q55670
A	147	HIS	-	EXPRESSION TAG	UNP Q55670
B	137	ALA	-	EXPRESSION TAG	UNP Q55670
B	138	ALA	-	EXPRESSION TAG	UNP Q55670
B	139	ALA	-	EXPRESSION TAG	UNP Q55670
B	140	LEU	-	EXPRESSION TAG	UNP Q55670
B	141	GLU	-	EXPRESSION TAG	UNP Q55670
B	142	HIS	-	EXPRESSION TAG	UNP Q55670
B	143	HIS	-	EXPRESSION TAG	UNP Q55670
B	144	HIS	-	EXPRESSION TAG	UNP Q55670
B	145	HIS	-	EXPRESSION TAG	UNP Q55670
B	146	HIS	-	EXPRESSION TAG	UNP Q55670

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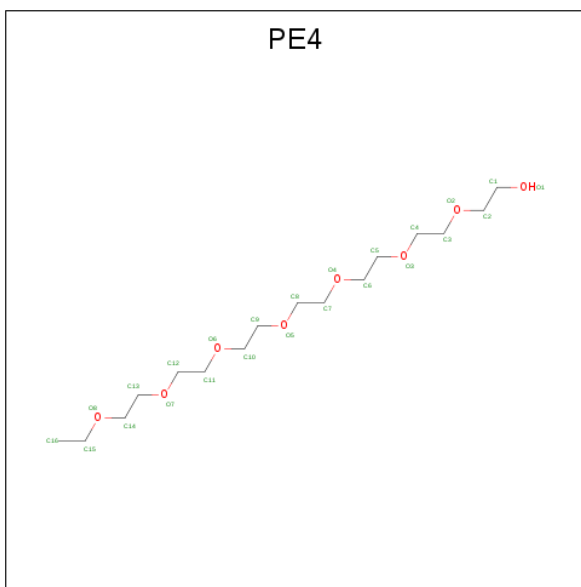
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Chain	Residue	Modelled	Actual	Comment	Reference
B	147	HIS	-	EXPRESSION TAG	UNP Q55670
C	137	ALA	-	EXPRESSION TAG	UNP Q55670
C	138	ALA	-	EXPRESSION TAG	UNP Q55670
C	139	ALA	-	EXPRESSION TAG	UNP Q55670
C	140	LEU	-	EXPRESSION TAG	UNP Q55670
C	141	GLU	-	EXPRESSION TAG	UNP Q55670
C	142	HIS	-	EXPRESSION TAG	UNP Q55670
C	143	HIS	-	EXPRESSION TAG	UNP Q55670
C	144	HIS	-	EXPRESSION TAG	UNP Q55670
C	145	HIS	-	EXPRESSION TAG	UNP Q55670
C	146	HIS	-	EXPRESSION TAG	UNP Q55670
C	147	HIS	-	EXPRESSION TAG	UNP Q55670
D	137	ALA	-	EXPRESSION TAG	UNP Q55670
D	138	ALA	-	EXPRESSION TAG	UNP Q55670
D	139	ALA	-	EXPRESSION TAG	UNP Q55670
D	140	LEU	-	EXPRESSION TAG	UNP Q55670
D	141	GLU	-	EXPRESSION TAG	UNP Q55670
D	142	HIS	-	EXPRESSION TAG	UNP Q55670
D	143	HIS	-	EXPRESSION TAG	UNP Q55670
D	144	HIS	-	EXPRESSION TAG	UNP Q55670
D	145	HIS	-	EXPRESSION TAG	UNP Q55670
D	146	HIS	-	EXPRESSION TAG	UNP Q55670
D	147	HIS	-	EXPRESSION TAG	UNP Q55670

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Cl 1 1	0	0

- Molecule 3 is 2-{2-[2-(2-{2-[2-(2-ETHOXY-ETHOXY)-ETHOXY]-ETHOXY}-ETHOXY)-ETHOXY]-ETHOXY}-ETHANOL (three-letter code: PE4) (formula: C₁₆H₃₄O₈).

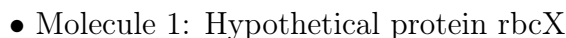
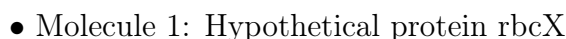


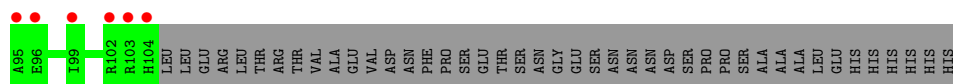
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total 16	C 10	O 6	0	0
3	C	1	Total 22	C 14	O 8	0	0
3	D	1	Total 15	C 10	O 5	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	27	Total O 27 27	0	0
4	B	26	Total O 26 26	0	0
4	C	32	Total O 32 32	0	0
4	D	2	Total O 2 2	0	0

- Molecule 1: Hypothetical protein rbcX





4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	129.83Å 129.83Å 92.74Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.50 – 2.45 19.49 – 2.45	Depositor EDS
% Data completeness (in resolution range)	99.9 (19.50-2.45) 99.9 (19.49-2.45)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.94 (at 2.46Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.209 , 0.249 0.207 , 0.244	Depositor DCC
R_{free} test set	1495 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	51.1	Xtriage
Anisotropy	0.170	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 50.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3827	wwPDB-VP
Average B, all atoms (Å ²)	71.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.89% 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: PE4, CL

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	0.47	0/977	0.56	0/1328
1	B	0.64	1/928 (0.1%)	0.63	0/1260
1	C	0.56	0/999	0.63	0/1358
1	D	0.40	0/838	0.49	0/1138
All	All	0.53	1/3742 (0.0%)	0.58	0/5084

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	84	ASP	CG-OD2	7.43	1.42	1.25

There are no bond angle outliers.

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	962	0	968	2	0
1	B	915	0	928	10	0
1	C	984	0	986	15	0
1	D	825	0	829	7	0
2	A	1	0	0	0	0
3	B	16	0	20	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	22	0	29	5	0
3	D	15	0	18	0	0
4	A	27	0	0	0	0
4	B	26	0	0	0	0
4	C	32	0	0	0	0
4	D	2	0	0	0	0
All	All	3827	0	3778	34	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 (34) 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:109:LEU:HA	1:B:112:THR:HG22	1.66	0.77
3:B:602:PE4:O7	3:C:601:PE4:O8	2.04	0.75
3:B:602:PE4:O7	3:C:601:PE4:C14	2.41	0.69
1:D:57:LEU:HD21	1:D:71:ILE:HG21	1.75	0.67
1:B:51:GLN:HE22	3:B:602:PE4:H82	1.62	0.65
1:A:61:LEU:HD23	1:A:61:LEU:O	1.99	0.63
3:B:602:PE4:O7	3:C:601:PE4:H141	2.00	0.62
1:C:109:LEU:C	1:C:109:LEU:HD23	2.22	0.60
1:C:26:ILE:HD12	1:C:71:ILE:HG12	1.83	0.59
1:C:19:THR:HG22	1:C:75:ARG:HH11	1.68	0.58
1:D:36:PRO:O	1:D:39:ILE:HG22	2.04	0.58
1:C:19:THR:CG2	1:C:75:ARG:HH11	2.18	0.57
1:D:19:THR:HG22	1:D:75:ARG:HD3	1.87	0.56
1:D:61:LEU:HB3	1:D:68:VAL:HG21	1.89	0.55
1:B:21:GLN:HG2	1:C:6:ILE:HG23	1.89	0.54
1:C:51:GLN:HE22	3:C:601:PE4:H91	1.73	0.53
1:D:15:GLN:O	1:D:19:THR:HG23	2.11	0.50
1:B:7:ALA:HB2	1:C:82:VAL:HG22	1.96	0.48
1:C:16:SER:HA	1:C:19:THR:HG23	1.95	0.47
1:B:109:LEU:CA	1:B:112:THR:HG22	2.40	0.47
1:C:26:ILE:CD1	1:C:71:ILE:HA	2.44	0.47
1:C:26:ILE:HD11	1:C:71:ILE:HA	1.96	0.46
1:D:2:GLN:O	1:D:6:ILE:HG23	2.16	0.45
1:D:23:VAL:HG12	1:D:27:GLN:HE21	1.81	0.45
1:C:19:THR:HG22	1:C:75:ARG:HD2	2.00	0.44
1:C:37:GLN:HA	1:C:37:GLN:HE21	1.82	0.43
1:C:20:TYR:CE2	3:C:601:PE4:H81	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:109:LEU:C	1:A:109:LEU:HD23	2.39	0.43
1:B:108:ARG:HB3	1:C:65:LYS:NZ	2.33	0.43
1:B:109:LEU:HA	1:B:112:THR:CG2	2.43	0.42
1:B:27:GLN:NE2	1:B:42:ASN:OD1	2.47	0.42
1:B:51:GLN:HE22	3:B:602:PE4:C8	2.31	0.42
1:B:98:ASN:O	1:B:102:ARG:HB2	2.20	0.42
1:C:26:ILE:HD12	1:C:71:ILE:CG1	2.49	0.41

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	118/147 (80%)	115 (98%)	3 (2%)	0	100	100
1	B	112/147 (76%)	109 (97%)	3 (3%)	0	100	100
1	C	121/147 (82%)	119 (98%)	2 (2%)	0	100	100
1	D	101/147 (69%)	100 (99%)	1 (1%)	0	100	100
All	All	452/588 (77%)	443 (98%)	9 (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	107/130 (82%)	95 (89%)	12 (11%)	6	6
1	B	101/130 (78%)	94 (93%)	7 (7%)	17	21
1	C	110/130 (85%)	97 (88%)	13 (12%)	6	5
1	D	91/130 (70%)	87 (96%)	4 (4%)	31	41
All	All	409/520 (79%)	373 (91%)	36 (9%)	11	12

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	GLN
1	A	4	LYS
1	A	14	LEU
1	A	37	GLN
1	A	39	ILE
1	A	60	LEU
1	A	66	GLU
1	A	67	LEU
1	A	70	ARG
1	A	76	GLU
1	A	82	VAL
1	A	106	LEU
1	B	14	LEU
1	B	25	ARG
1	B	39	ILE
1	B	60	LEU
1	B	63	GLU
1	B	70	ARG
1	B	108	ARG
1	C	19	THR
1	C	27	GLN
1	C	34	ASN
1	C	37	GLN
1	C	41	LEU
1	C	45	LEU
1	C	60	LEU
1	C	63	GLU
1	C	67	LEU
1	C	70	ARG
1	C	105	LEU
1	C	111	ARG
1	C	122	GLU
1	D	6	ILE

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Mol	Chain	Res	Type
1	D	14	LEU
1	D	55	THR
1	D	66	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	43	GLN
1	B	51	GLN
1	C	2	GLN
1	C	34	ASN
1	C	37	GLN
1	C	51	GLN
1	D	27	GLN
1	D	42	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 1 is monoatomic - leaving 3 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	PE4	B	602	-	15,15,23	0.50	0	14,14,22	0.40	0
3	PE4	C	601	-	21,21,23	0.50	0	20,20,22	0.39	0
3	PE4	D	603	-	14,14,23	0.53	0	13,13,22	0.46	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	PE4	B	602	-	-	0/13/13/21	0/0/0/0
3	PE4	C	601	-	-	0/19/19/21	0/0/0/0
3	PE4	D	603	-	-	0/12/12/21	0/0/0/0

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.

2 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	602	PE4	5	0
3	C	601	PE4	5	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

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	120/147 (81%)	0.42	7 (5%) 23 20	58, 71, 99, 109	0
1	B	114/147 (77%)	0.49	9 (7%) 12 10	45, 60, 93, 100	0
1	C	123/147 (83%)	0.36	7 (5%) 24 20	43, 58, 82, 106	0
1	D	103/147 (70%)	1.64	32 (31%) 0 0	77, 92, 106, 112	0
All	All	460/588 (78%)	0.69	55 (11%) 4 3	43, 68, 101, 112	0

All (55) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	102	ARG	6.2
1	D	2	GLN	6.1
1	A	121	SER	5.4
1	D	5	HIS	5.3
1	D	77	ASP	5.3
1	C	124	SER	5.3
1	D	104	HIS	5.2
1	D	85	PHE	5.2
1	D	92	ASN	4.9
1	D	80	GLU	4.5
1	D	32	GLU	4.5
1	D	69	LEU	4.3
1	B	115	GLU	4.0
1	D	99	ILE	3.8
1	C	121	SER	3.6
1	D	37	GLN	3.6
1	D	93	SER	3.4
1	D	95	ALA	3.3
1	D	47	SER	3.3
1	C	123	THR	3.2
1	D	28	SER	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	33	THR	3.2
1	D	4	LYS	3.2
1	D	3	THR	3.1
1	A	118	ASN	3.0
1	D	36	PRO	2.9
1	D	96	GLU	2.9
1	D	14	LEU	2.9
1	D	88	GLY	2.8
1	B	114	ALA	2.8
1	A	18	LEU	2.8
1	D	18	LEU	2.7
1	C	68	VAL	2.7
1	D	86	LEU	2.7
1	C	32	GLU	2.7
1	D	57	LEU	2.7
1	D	62	ASP	2.7
1	C	122	GLU	2.6
1	A	14	LEU	2.6
1	A	86	LEU	2.6
1	B	111	ARG	2.6
1	D	35	PRO	2.5
1	B	105	LEU	2.5
1	D	103	ARG	2.4
1	D	29	GLU	2.3
1	A	92	ASN	2.3
1	D	31	GLY	2.3
1	B	18	LEU	2.3
1	B	34	ASN	2.2
1	D	34	ASN	2.2
1	B	68	VAL	2.1
1	A	116	VAL	2.1
1	B	14	LEU	2.1
1	C	14	LEU	2.0
1	D	65	LYS	2.0

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

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. 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(\AA^2)	Q<0.9
3	PE4	D	603	15/24	0.86	0.22	23,41,51,52	15
3	PE4	B	602	16/24	0.95	0.18	28,36,59,60	16
3	PE4	C	601	22/24	0.95	0.19	27,35,38,41	22
2	CL	A	500	1/1	0.98	0.21	43,43,43,43	0

6.5 Other polymers [i](#)

There are no such residues in this entry.