



Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 12:17 pm BST

PDB ID : 4C88
Title : Esterase LpEst1 from *Lactobacillus plantarum*: native structure
Authors : Alvarez, Y.; Esteban-Torres, M.; Cortes-Cabrera, A.; Gago, F.; Acebron, I.; Benavente, R.; Mardo, K.; de-las-Rivas, B.; Munoz, R.; Mancheno, J.M.
Deposited on : 2013-09-30
Resolution : 2.65 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
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

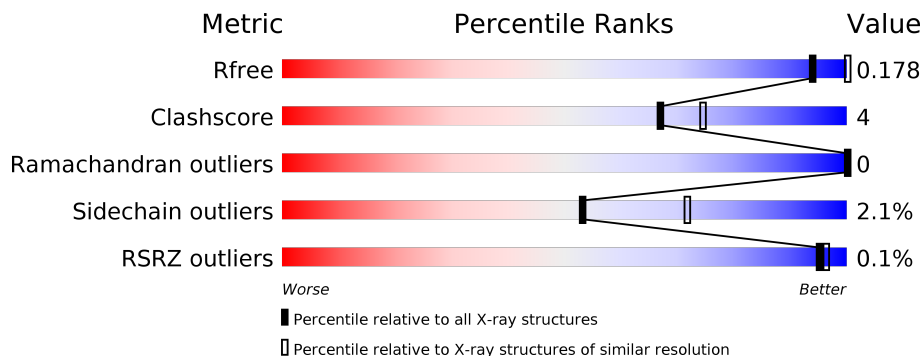
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.65 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}	130704	1332 (2.68-2.64)
Clashscore	141614	1374 (2.68-2.64)
Ramachandran outliers	138981	1349 (2.68-2.64)
Sidechain outliers	138945	1349 (2.68-2.64)
RSRZ outliers	127900	1318 (2.68-2.64)

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 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	354	 88% 8% 5%
1	B	354	 86% 9% 5%
1	C	354	 84% 11% . .
1	D	354	 86% 9% 5%

2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 12192 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 ESTERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	338	Total 2610	C 1664	N 441	O 496	S 9	0	2	0
1	B	337	Total 2614	C 1666	N 442	O 497	S 9	0	3	0
1	C	339	Total 2638	C 1679	N 449	O 501	S 9	0	4	0
1	D	338	Total 2618	C 1668	N 443	O 498	S 9	0	3	0

There are 68 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-16	GLY	-	expression tag	UNP Q88Y25
A	-15	GLY	-	expression tag	UNP Q88Y25
A	-14	SER	-	expression tag	UNP Q88Y25
A	-13	HIS	-	expression tag	UNP Q88Y25
A	-12	HIS	-	expression tag	UNP Q88Y25
A	-11	HIS	-	expression tag	UNP Q88Y25
A	-10	HIS	-	expression tag	UNP Q88Y25
A	-9	HIS	-	expression tag	UNP Q88Y25
A	-8	HIS	-	expression tag	UNP Q88Y25
A	-7	GLY	-	expression tag	UNP Q88Y25
A	-6	GLU	-	expression tag	UNP Q88Y25
A	-5	ASN	-	expression tag	UNP Q88Y25
A	-4	LEU	-	expression tag	UNP Q88Y25
A	-3	TYR	-	expression tag	UNP Q88Y25
A	-2	PHE	-	expression tag	UNP Q88Y25
A	-1	GLN	-	expression tag	UNP Q88Y25
A	0	GLY	-	expression tag	UNP Q88Y25
B	-16	GLY	-	expression tag	UNP Q88Y25
B	-15	GLY	-	expression tag	UNP Q88Y25
B	-14	SER	-	expression tag	UNP Q88Y25
B	-13	HIS	-	expression tag	UNP Q88Y25

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-12	HIS	-	expression tag	UNP Q88Y25
B	-11	HIS	-	expression tag	UNP Q88Y25
B	-10	HIS	-	expression tag	UNP Q88Y25
B	-9	HIS	-	expression tag	UNP Q88Y25
B	-8	HIS	-	expression tag	UNP Q88Y25
B	-7	GLY	-	expression tag	UNP Q88Y25
B	-6	GLU	-	expression tag	UNP Q88Y25
B	-5	ASN	-	expression tag	UNP Q88Y25
B	-4	LEU	-	expression tag	UNP Q88Y25
B	-3	TYR	-	expression tag	UNP Q88Y25
B	-2	PHE	-	expression tag	UNP Q88Y25
B	-1	GLN	-	expression tag	UNP Q88Y25
B	0	GLY	-	expression tag	UNP Q88Y25
C	-16	GLY	-	expression tag	UNP Q88Y25
C	-15	GLY	-	expression tag	UNP Q88Y25
C	-14	SER	-	expression tag	UNP Q88Y25
C	-13	HIS	-	expression tag	UNP Q88Y25
C	-12	HIS	-	expression tag	UNP Q88Y25
C	-11	HIS	-	expression tag	UNP Q88Y25
C	-10	HIS	-	expression tag	UNP Q88Y25
C	-9	HIS	-	expression tag	UNP Q88Y25
C	-8	HIS	-	expression tag	UNP Q88Y25
C	-7	GLY	-	expression tag	UNP Q88Y25
C	-6	GLU	-	expression tag	UNP Q88Y25
C	-5	ASN	-	expression tag	UNP Q88Y25
C	-4	LEU	-	expression tag	UNP Q88Y25
C	-3	TYR	-	expression tag	UNP Q88Y25
C	-2	PHE	-	expression tag	UNP Q88Y25
C	-1	GLN	-	expression tag	UNP Q88Y25
C	0	GLY	-	expression tag	UNP Q88Y25
D	-16	GLY	-	expression tag	UNP Q88Y25
D	-15	GLY	-	expression tag	UNP Q88Y25
D	-14	SER	-	expression tag	UNP Q88Y25
D	-13	HIS	-	expression tag	UNP Q88Y25
D	-12	HIS	-	expression tag	UNP Q88Y25
D	-11	HIS	-	expression tag	UNP Q88Y25
D	-10	HIS	-	expression tag	UNP Q88Y25
D	-9	HIS	-	expression tag	UNP Q88Y25
D	-8	HIS	-	expression tag	UNP Q88Y25
D	-7	GLY	-	expression tag	UNP Q88Y25
D	-6	GLU	-	expression tag	UNP Q88Y25
D	-5	ASN	-	expression tag	UNP Q88Y25

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-4	LEU	-	expression tag	UNP Q88Y25
D	-3	TYR	-	expression tag	UNP Q88Y25
D	-2	PHE	-	expression tag	UNP Q88Y25
D	-1	GLN	-	expression tag	UNP Q88Y25
D	0	GLY	-	expression tag	UNP Q88Y25

- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	473	Total O 473 473	0	0
2	B	457	Total O 457 457	0	0
2	C	447	Total O 447 447	0	0
2	D	335	Total O 335 335	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, α , β , γ	168.34Å 168.34Å 184.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	53.68 – 2.65 53.68 – 2.65	Depositor EDS
% Data completeness (in resolution range)	100.0 (53.68-2.65) 97.8 (53.68-2.65)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.84 (at 2.65Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.137 , 0.175 0.139 , 0.178	Depositor DCC
R_{free} test set	3737 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	23.7	Xtriage
Anisotropy	0.434	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 52.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.028 for -h,k,-l	Xtriage
Reported twinning fraction	0.030 for -H,K,-L	Depositor
Outliers	0 of 74256 reflections	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	12192	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.46% 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

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	0.32	0/2675	0.49	0/3671
1	B	0.32	0/2679	0.49	0/3677
1	C	0.32	0/2703	0.49	0/3708
1	D	0.31	0/2683	0.48	0/3682
All	All	0.32	0/10740	0.49	0/14738

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	2610	0	2551	14	0
1	B	2614	0	2553	21	2
1	C	2638	0	2577	30	0
1	D	2618	0	2556	17	1
2	A	473	0	0	3	0
2	B	457	0	0	8	3
2	C	447	0	0	8	1
2	D	335	0	0	4	5
All	All	12192	0	10237	81	6

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 4.

All (81) 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:C:166:THR:O	1:C:194[B]:ARG:NH1	2.05	0.89
1:C:163:ASP:O	1:C:194[B]:ARG:NH2	2.09	0.85
1:B:178:ASN:HA	1:B:181:MET:HE3	1.77	0.67
1:C:98:HIS:O	1:C:167:MET:N	2.28	0.66
1:B:47:LEU:HD13	1:B:237:LEU:HD11	1.78	0.65
1:D:166:THR:OG1	2:D:2166:HOH:O	2.14	0.64
1:C:301:THR:OG1	2:C:2402:HOH:O	2.12	0.63
1:B:93:GLN:O	2:B:2243:HOH:O	2.16	0.62
1:D:88:GLU:HB3	1:D:134:ASN:HB3	1.83	0.61
1:D:286:ARG:NH1	2:D:2309:HOH:O	2.31	0.60
1:D:20:PRO:HA	1:D:309:GLN:HB2	1.83	0.60
1:C:164:ALA:O	1:C:194[A]:ARG:NH1	2.33	0.60
2:A:2157:HOH:O	1:C:-1:GLN:N	2.35	0.59
1:B:88:GLU:HB3	1:B:134:ASN:HB3	1.85	0.58
1:C:295:ARG:NH2	2:C:2396:HOH:O	2.37	0.57
1:C:194[B]:ARG:HB3	1:C:194[B]:ARG:HH11	1.69	0.57
1:A:47:LEU:HD13	1:A:237:LEU:HD11	1.87	0.56
2:B:2207:HOH:O	1:D:83:ARG:NH1	2.40	0.55
1:C:82:ASN:ND2	2:C:2200:HOH:O	2.35	0.54
1:A:166:THR:O	1:A:194:ARG:HD3	2.07	0.54
1:C:96:ILE:HD11	1:C:130[A]:CYS:SG	2.48	0.54
1:C:239:ARG:NE	2:C:2369:HOH:O	2.30	0.53
1:D:96:ILE:HD11	1:D:130[A]:CYS:SG	2.49	0.53
1:B:264:LEU:O	1:B:295:ARG:NH1	2.40	0.52
1:B:160:GLU:OE1	2:B:2313:HOH:O	2.19	0.51
1:B:1:MET:SD	2:B:2006:HOH:O	2.59	0.51
1:C:98:HIS:HA	1:C:166:THR:HA	1.92	0.51
1:A:151:ASP:O	1:A:155:ILE:HG12	2.11	0.51
1:C:-1:GLN:NE2	2:C:2006:HOH:O	2.41	0.50
1:A:73:VAL:HG22	1:A:90:LEU:HG	1.93	0.49
1:C:178:ASN:HA	1:C:181:MET:HE3	1.95	0.49
1:D:202:TYR:HB3	1:D:279:VAL:HG23	1.94	0.49
1:A:78:ILE:HD11	1:A:155:ILE:HD13	1.95	0.48
1:C:281:GLU:O	2:C:2410:HOH:O	2.20	0.48
1:A:53:ALA:O	1:A:56:SER:HB2	2.13	0.48
1:C:88:GLU:HB3	1:C:134:ASN:HB3	1.95	0.47
1:C:160:GLU:HG2	1:C:194[A]:ARG:HG3	1.95	0.47
1:C:194[A]:ARG:NH1	2:C:2298:HOH:O	2.47	0.47
1:B:166:THR:O	1:B:194:ARG:HD3	2.15	0.47
1:C:20:PRO:HA	1:C:309:GLN:HB2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:256:SER:HA	1:D:261:ILE:HG21	1.96	0.47
1:D:53:ALA:O	1:D:56:SER:HB2	2.15	0.47
1:D:193[A]:ASN:OD1	1:D:193[A]:ASN:N	2.48	0.47
1:C:127:LYS:HE3	2:C:2438:HOH:O	2.14	0.47
1:D:47:LEU:HD13	1:D:237:LEU:HD11	1.98	0.46
1:C:202:TYR:CE2	1:C:314:ALA:HA	2.51	0.46
1:B:16:LYS:NZ	2:B:2059:HOH:O	2.48	0.45
1:B:177:ALA:O	1:B:181:MET:HG3	2.17	0.45
1:D:151:ASP:O	1:D:155:ILE:HG12	2.16	0.45
1:C:202:TYR:CZ	1:C:314:ALA:HA	2.52	0.44
1:A:156:PHE:O	1:A:160:GLU:HG3	2.17	0.44
1:A:20:PRO:HA	1:A:309:GLN:HB2	1.99	0.44
1:A:269:PHE:CE2	1:A:295:ARG:HG2	2.53	0.44
1:D:27:GLY:HA2	2:D:2056:HOH:O	2.18	0.44
1:A:256:SER:HA	1:A:261:ILE:HG21	2.01	0.43
1:A:83:ARG:NH1	2:A:2228:HOH:O	2.51	0.43
1:C:177:ALA:O	1:C:181:MET:HG3	2.18	0.43
1:A:272:THR:HA	1:A:273:PRO:HD3	1.89	0.43
1:A:163:ASP:OD2	2:A:2257:HOH:O	2.21	0.43
1:D:73:VAL:HG22	1:D:90:LEU:HG	2.00	0.43
1:A:174:SER:OG	1:A:175:ALA:N	2.52	0.42
1:C:74:GLN:OE1	1:C:76:ARG:NH1	2.51	0.42
1:C:19:LYS:HA	1:C:20:PRO:HD2	1.94	0.42
1:B:19:LYS:HA	1:B:20:PRO:HD2	1.93	0.42
1:B:211:HIS:HD2	1:B:216:TRP:CD1	2.37	0.42
1:C:272:THR:HA	1:C:273:PRO:HD3	1.86	0.42
1:B:12:ASN:ND2	1:B:294:GLN:OE1	2.51	0.42
1:B:301:THR:OG1	2:B:2412:HOH:O	2.17	0.42
1:B:20:PRO:HA	1:B:309:GLN:HB2	2.01	0.41
1:C:194[B]:ARG:HB3	1:C:194[B]:ARG:NH1	2.34	0.41
1:D:268:ASN:ND2	2:D:2301:HOH:O	2.54	0.41
1:B:1:MET:H2	1:B:2:PRO:HD3	1.86	0.41
1:C:311:LEU:HD12	1:C:315:PHE:CG	2.55	0.41
1:B:202:TYR:HB3	1:B:279:VAL:HG23	2.02	0.41
1:B:258:SER:HB2	1:D:189:GLN:O	2.21	0.41
1:D:272:THR:HA	1:D:273:PRO:HD3	1.85	0.41
1:B:98:HIS:CD2	1:B:165:GLU:HB2	2.56	0.41
1:B:1:MET:SD	2:B:2005:HOH:O	2.63	0.40
1:C:60:THR:HG21	1:C:63:ILE:HD11	2.04	0.40
1:C:59:LEU:HD12	1:C:59:LEU:HA	1.84	0.40
1:B:295:ARG:NH2	2:B:2426:HOH:O	2.38	0.40

All (6) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1:MET:N	2:D:2320:HOH:O[3_655]	2.15	0.05
2:C:2126:HOH:O	2:D:2113:HOH:O[8_454]	2.15	0.05
2:B:2083:HOH:O	2:D:2147:HOH:O[3_655]	2.16	0.04
1:B:93:GLN:O	2:D:2092:HOH:O[3_655]	2.18	0.02
1:D:50:ASP:OD2	2:B:2289:HOH:O[4_565]	2.19	0.01
2:B:2008:HOH:O	2:D:2099:HOH:O[3_655]	2.19	0.01

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	338/354 (96%)	331 (98%)	7 (2%)	0	100	100
1	B	338/354 (96%)	333 (98%)	5 (2%)	0	100	100
1	C	341/354 (96%)	333 (98%)	8 (2%)	0	100	100
1	D	339/354 (96%)	332 (98%)	7 (2%)	0	100	100
All	All	1356/1416 (96%)	1329 (98%)	27 (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	280/291 (96%)	276 (99%)	4 (1%)	67	81
1	B	281/291 (97%)	277 (99%)	4 (1%)	67	81
1	C	283/291 (97%)	274 (97%)	9 (3%)	39	56
1	D	281/291 (97%)	275 (98%)	6 (2%)	53	72
All	All	1125/1164 (97%)	1102 (98%)	23 (2%)	53	73

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	48	GLU
1	A	117	ASN
1	A	295	ARG
1	A	300	ASP
1	B	4	ILE
1	B	10	THR
1	B	76	ARG
1	B	163	ASP
1	C	4	ILE
1	C	36	GLN
1	C	50	ASP
1	C	59	LEU
1	C	76	ARG
1	C	117	ASN
1	C	236	ASP
1	C	295	ARG
1	C	296	LEU
1	D	76	ARG
1	D	117	ASN
1	D	123	LEU
1	D	166	THR
1	D	215	LEU
1	D	218	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	268	ASN
1	C	198	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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	338/354 (95%)	-0.91	1 (0%) 94 95	11, 19, 43, 67	0
1	B	337/354 (95%)	-0.91	0 100 100	10, 19, 44, 89	0
1	C	339/354 (95%)	-0.85	1 (0%) 94 95	11, 20, 47, 85	0
1	D	338/354 (95%)	-0.73	0 100 100	11, 27, 58, 73	0
All	All	1352/1416 (95%)	-0.85	2 (0%) 95 96	10, 21, 50, 89	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	98	HIS	3.0
1	A	98	HIS	2.4

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.