Full wwPDB X-ray Structure Validation Report ⓘ

Jun 11, 2024 – 02:41 PM EDT

PDB ID	:	6MHL
Title	:	Crystal structure of ketosynthase twelve from bacillaene polyketide synthase in Bacillus amyloliquefaciens
Authors	:	Meinke, J.L.; Keatinge-Clay, A.T.
Deposited on	:	2018-09-18
Resolution	:	1.82 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:

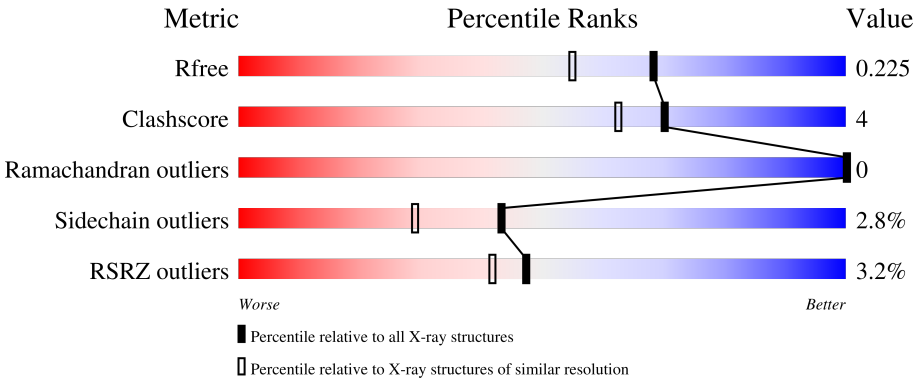
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.82 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	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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 <=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	616	3%, 83%, 7%, 9%
1	B	616	3%, 83%, 6%, 9%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 9266 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 Hybrid NRPS/PKS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	561	Total	C	N	O	S	0	0	0
			4366	2755	750	848	13			
1	B	561	Total	C	N	O	S	0	0	0
			4365	2755	748	848	14			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	initiating methionine	UNP Q1RS70
A	-19	GLY	-	expression tag	UNP Q1RS70
A	-18	SER	-	expression tag	UNP Q1RS70
A	-17	SER	-	expression tag	UNP Q1RS70
A	-16	HIS	-	expression tag	UNP Q1RS70
A	-15	HIS	-	expression tag	UNP Q1RS70
A	-14	HIS	-	expression tag	UNP Q1RS70
A	-13	HIS	-	expression tag	UNP Q1RS70
A	-12	HIS	-	expression tag	UNP Q1RS70
A	-11	HIS	-	expression tag	UNP Q1RS70
A	-10	SER	-	expression tag	UNP Q1RS70
A	-9	SER	-	expression tag	UNP Q1RS70
A	-8	GLY	-	expression tag	UNP Q1RS70
A	-7	LEU	-	expression tag	UNP Q1RS70
A	-6	VAL	-	expression tag	UNP Q1RS70
A	-5	PRO	-	expression tag	UNP Q1RS70
A	-4	ARG	-	expression tag	UNP Q1RS70
A	-3	GLY	-	expression tag	UNP Q1RS70
A	-2	SER	-	expression tag	UNP Q1RS70
A	-1	HIS	-	expression tag	UNP Q1RS70
B	-20	MET	-	initiating methionine	UNP Q1RS70
B	-19	GLY	-	expression tag	UNP Q1RS70
B	-18	SER	-	expression tag	UNP Q1RS70
B	-17	SER	-	expression tag	UNP Q1RS70
B	-16	HIS	-	expression tag	UNP Q1RS70

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	-15	HIS	-	expression tag	UNP Q1RS70
B	-14	HIS	-	expression tag	UNP Q1RS70
B	-13	HIS	-	expression tag	UNP Q1RS70
B	-12	HIS	-	expression tag	UNP Q1RS70
B	-11	HIS	-	expression tag	UNP Q1RS70
B	-10	SER	-	expression tag	UNP Q1RS70
B	-9	SER	-	expression tag	UNP Q1RS70
B	-8	GLY	-	expression tag	UNP Q1RS70
B	-7	LEU	-	expression tag	UNP Q1RS70
B	-6	VAL	-	expression tag	UNP Q1RS70
B	-5	PRO	-	expression tag	UNP Q1RS70
B	-4	ARG	-	expression tag	UNP Q1RS70
B	-3	GLY	-	expression tag	UNP Q1RS70
B	-2	SER	-	expression tag	UNP Q1RS70
B	-1	HIS	-	expression tag	UNP Q1RS70

- Molecule 2 is water.

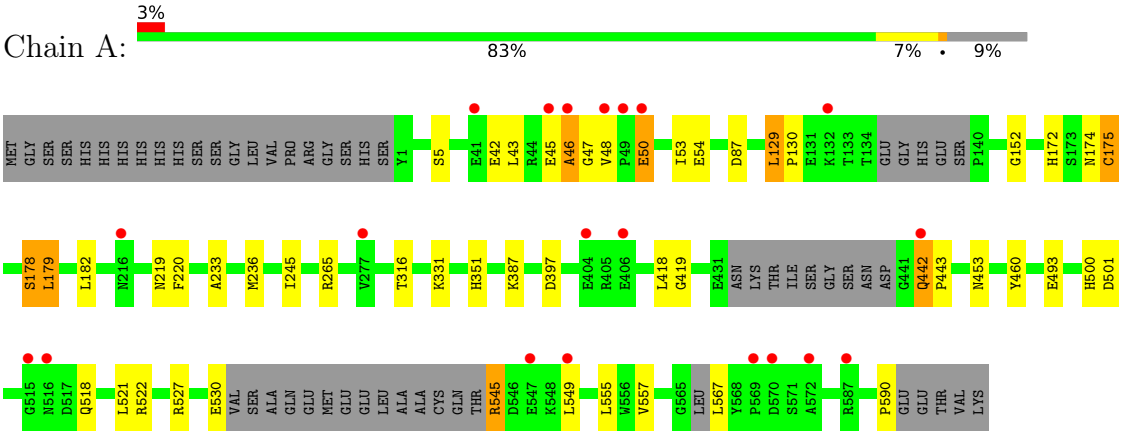
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	247	Total O 247 247	0	0
2	B	288	Total O 288 288	0	0

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.

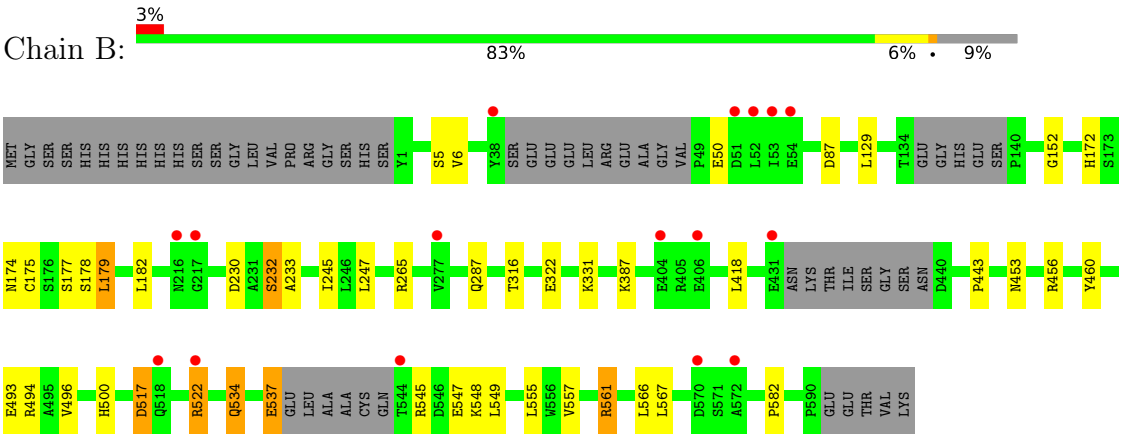
• Molecule 1: Hybrid NRPS/PKS

Chain A:



• Molecule 1: Hybrid NRPS/PKS

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	132.22Å 85.13Å 134.30Å 90.00° 110.55° 90.00°	Depositor
Resolution (Å)	50.00 – 1.82 32.90 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.9 (50.00-1.82) 99.9 (32.90-1.70)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.22 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.8.0073	Depositor
R, R_{free}	0.188 , 0.219 0.198 , 0.225	Depositor DCC
R_{free} test set	7709 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	21.3	Xtriage
Anisotropy	0.031	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 40.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	9266	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 3.86% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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	0.90	1/4471 (0.0%)	0.87	5/6061 (0.1%)
1	B	0.95	3/4470 (0.1%)	0.90	4/6060 (0.1%)
All	All	0.93	4/8941 (0.0%)	0.89	9/12121 (0.1%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	175	CYS	CB-SG	-6.54	1.71	1.82
1	B	178	SER	CB-OG	-5.64	1.34	1.42
1	B	177	SER	CB-OG	-5.08	1.35	1.42
1	A	130	PRO	N-CD	5.06	1.54	1.47

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	561	ARG	NE-CZ-NH2	-6.94	116.83	120.30
1	B	494	ARG	NE-CZ-NH2	-6.68	116.96	120.30
1	A	46	ALA	CB-CA-C	-6.34	100.59	110.10
1	B	522	ARG	NE-CZ-NH1	5.98	123.29	120.30
1	A	397	ASP	CB-CG-OD2	-5.52	113.33	118.30
1	A	545	ARG	NE-CZ-NH1	5.39	123.00	120.30
1	A	129	LEU	C-N-CD	5.35	139.63	128.40
1	B	175	CYS	CB-CA-C	-5.18	100.04	110.40
1	A	501	ASP	CB-CG-OD1	5.12	122.91	118.30

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	4366	0	4202	35	0
1	B	4365	0	4203	29	0
2	A	247	0	0	3	0
2	B	288	0	0	6	0
All	All	9266	0	8405	62	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 4.

All (62) 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:549:LEU:HD22	1:B:567:LEU:CD2	2.01	0.89
1:A:545:ARG:O	1:A:549:LEU:HD13	1.78	0.83
1:A:50:GLU:O	1:A:54:GLU:HG3	1.81	0.80
1:B:549:LEU:HD22	1:B:567:LEU:HD22	1.65	0.77
1:B:453:ASN:HA	1:B:493:GLU:HG3	1.73	0.70
1:B:331:LYS:HD3	2:B:632:HOH:O	1.92	0.70
1:B:545:ARG:O	1:B:549:LEU:HG	1.91	0.70
1:B:549:LEU:CD2	1:B:567:LEU:CD2	2.72	0.68
1:B:179:LEU:HD22	1:B:182:LEU:HD12	1.75	0.67
1:A:453:ASN:HA	1:A:493:GLU:HG3	1.78	0.66
1:B:453:ASN:CA	1:B:493:GLU:HG3	2.27	0.64
1:A:442:GLN:O	1:A:545:ARG:NH2	2.31	0.63
1:A:45:GLU:O	1:A:46:ALA:HB3	2.01	0.61
1:A:178:SER:OG	2:A:601:HOH:O	2.16	0.61
1:A:42:GLU:O	1:A:45:GLU:O	2.20	0.59
1:A:152:GLY:H	1:B:172:HIS:CD2	2.22	0.58
1:A:453:ASN:CA	1:A:493:GLU:HG3	2.35	0.57
1:A:172:HIS:CD2	1:A:174:ASN:H	2.22	0.57
1:A:521:LEU:HD22	1:A:557:VAL:HG21	1.86	0.56
1:B:287:GLN:HE22	1:B:322:GLU:HA	1.70	0.56
1:B:172:HIS:CD2	1:B:174:ASN:H	2.23	0.55
1:B:230:ASP:OD2	1:B:232:SER:HB2	2.07	0.54
1:B:182:LEU:HD21	1:B:245:ILE:HD11	1.89	0.54
1:A:182:LEU:HD21	1:A:245:ILE:HD11	1.89	0.53
1:A:43:LEU:O	1:A:48:VAL:HG13	2.09	0.53
1:B:5:SER:OG	1:B:265:ARG:HD2	2.09	0.52
1:A:545:ARG:N	2:A:602:HOH:O	2.44	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:561:ARG:HD2	2:B:841:HOH:O	2.10	0.50
1:A:5:SER:OG	1:A:265:ARG:HD2	2.10	0.50
1:A:175:CYS:HB3	1:A:351:HIS:HE1	1.77	0.50
1:A:179:LEU:HD22	1:A:182:LEU:HD12	1.93	0.48
1:A:518:GLN:OE1	1:A:518:GLN:N	2.43	0.48
1:B:456:ARG:NH1	2:B:603:HOH:O	2.32	0.48
1:A:172:HIS:CD2	1:B:152:GLY:H	2.31	0.48
1:A:220:PHE:CZ	1:A:236:MET:HE2	2.49	0.48
1:A:175:CYS:HB3	1:A:351:HIS:CE1	2.49	0.47
1:A:233:ALA:O	1:A:316:THR:HG22	2.14	0.47
1:A:45:GLU:O	1:A:46:ALA:CB	2.61	0.47
1:B:453:ASN:C	1:B:493:GLU:HG3	2.35	0.47
1:B:6:VAL:CG1	1:B:247:LEU:HB3	2.46	0.46
1:B:233:ALA:O	1:B:316:THR:HG22	2.16	0.45
1:A:549:LEU:HG	1:A:567:LEU:CD2	2.46	0.45
1:B:456:ARG:NH1	1:B:582:PRO:O	2.48	0.45
1:A:45:GLU:C	1:A:47:GLY:H	2.19	0.45
1:A:50:GLU:HA	1:A:53:ILE:HD12	1.99	0.45
1:B:537:GLU:O	2:B:601:HOH:O	2.21	0.45
1:A:418:LEU:HD23	1:A:419:GLY:N	2.32	0.44
1:A:129:LEU:HD23	1:A:590:PRO:HG3	1.99	0.44
1:A:220:PHE:CZ	1:A:236:MET:CE	3.01	0.44
1:A:545:ARG:O	1:A:549:LEU:CD1	2.60	0.43
1:B:549:LEU:CD2	1:B:567:LEU:HD23	2.49	0.42
1:B:517:ASP:OD2	1:B:522:ARG:NH1	2.52	0.42
1:A:453:ASN:C	1:A:493:GLU:HG3	2.40	0.42
1:B:418:LEU:C	1:B:418:LEU:HD23	2.40	0.42
1:B:496:VAL:HG23	1:B:557:VAL:CG1	2.50	0.42
1:A:549:LEU:HG	1:A:567:LEU:HD22	2.01	0.41
1:B:443:PRO:HB2	1:B:500:HIS:ND1	2.35	0.41
1:B:547:GLU:HG2	2:B:765:HOH:O	2.20	0.41
1:A:443:PRO:HB2	1:A:500:HIS:ND1	2.35	0.41
1:A:219:ASN:O	1:A:236:MET:HG2	2.21	0.40
1:B:534:GLN:HB2	2:B:837:HOH:O	2.20	0.40
1:A:590:PRO:C	2:A:612:HOH:O	2.60	0.40

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	551/616 (89%)	537 (98%)	14 (2%)	0	100	100
1	B	551/616 (89%)	539 (98%)	12 (2%)	0	100	100
All	All	1102/1232 (89%)	1076 (98%)	26 (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	464/511 (91%)	451 (97%)	13 (3%)	43	29
1	B	465/511 (91%)	452 (97%)	13 (3%)	43	29
All	All	929/1022 (91%)	903 (97%)	26 (3%)	43	29

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	GLU
1	A	87	ASP
1	A	175	CYS
1	A	178	SER
1	A	179	LEU
1	A	331	LYS
1	A	387	LYS
1	A	442	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	460	TYR
1	A	522	ARG
1	A	527	ARG
1	A	530	GLU
1	A	555	LEU
1	B	50	GLU
1	B	87	ASP
1	B	129	LEU
1	B	179	LEU
1	B	232	SER
1	B	387	LYS
1	B	460	TYR
1	B	517	ASP
1	B	534	GLN
1	B	537	GLU
1	B	548	LYS
1	B	555	LEU
1	B	566	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	172	HIS
1	B	14	GLN
1	B	172	HIS
1	B	287	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 monosaccharides 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

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, 95^{th} 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	561/616 (91%)	-0.26	20 (3%)	42	37	14, 24, 54, 79	0
1	B	561/616 (91%)	-0.36	16 (2%)	51	46	14, 23, 52, 71	0
All	All	1122/1232 (91%)	-0.31	36 (3%)	47	42	14, 23, 53, 79	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	52	LEU	4.7
1	A	46	ALA	4.6
1	A	41	GLU	3.9
1	A	406	GLU	3.9
1	A	570	ASP	3.6
1	A	569	PRO	3.4
1	B	54	GLU	3.4
1	B	277	VAL	3.1
1	B	406	GLU	3.1
1	A	549	LEU	3.1
1	B	216	ASN	3.0
1	B	217	GLY	3.0
1	A	45	GLU	3.0
1	B	38	TYR	3.0
1	B	570	ASP	2.8
1	A	216	ASN	2.7
1	A	404	GLU	2.6
1	A	587	ARG	2.6
1	A	515	GLY	2.5
1	A	48	VAL	2.5
1	B	518	GLN	2.5
1	B	51	ASP	2.5
1	B	572	ALA	2.4
1	A	547	GLU	2.4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	132	LYS	2.4
1	B	544	THR	2.4
1	A	50	GLU	2.3
1	A	572	ALA	2.3
1	A	49	PRO	2.3
1	B	53	ILE	2.3
1	A	277	VAL	2.2
1	B	522	ARG	2.2
1	B	404	GLU	2.2
1	A	442	GLN	2.1
1	A	516	ASN	2.1
1	B	431	GLU	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 monosaccharides 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.