



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 29, 2024 – 06:13 PM JST

PDB ID : 8IA1
Title : plastidial glycerol-3-phosphate acyltransferases (GPAT) from the green alga
Myrmecia incisa
Authors : Song, X.
Deposited on : 2023-02-07
Resolution : 2.31 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
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

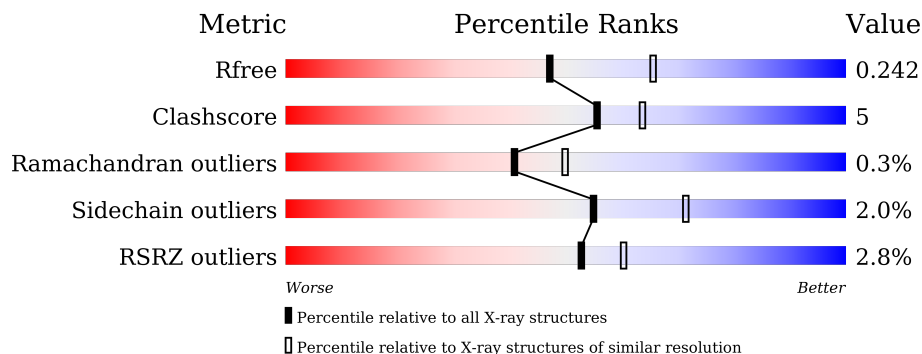
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.31 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	5974 (2.34-2.30)
Clashscore	141614	6604 (2.34-2.30)
Ramachandran outliers	138981	6523 (2.34-2.30)
Sidechain outliers	138945	6523 (2.34-2.30)
RSRZ outliers	127900	5855 (2.34-2.30)

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	372	 85% 11% . .
1	B	372	 84% 13% .
1	C	372	 83% 13% . .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8916 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 Glycerol-3-phosphate acyltransferase, chloroplastic.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	361	2855	1814	500	530	11	0	0	0
1	B	361	2855	1814	500	530	11	0	0	0
1	C	361	2855	1814	500	530	11	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP A0A0B5EHP8
B	1	MET	-	initiating methionine	UNP A0A0B5EHP8
C	1	MET	-	initiating methionine	UNP A0A0B5EHP8

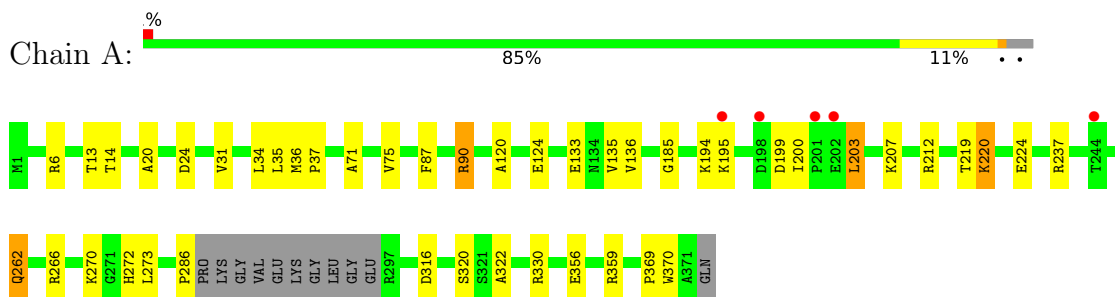
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	174	Total 174	O 174	0	0
2	B	90	Total 90	O 90	0	0
2	C	87	Total 87	O 87	0	0

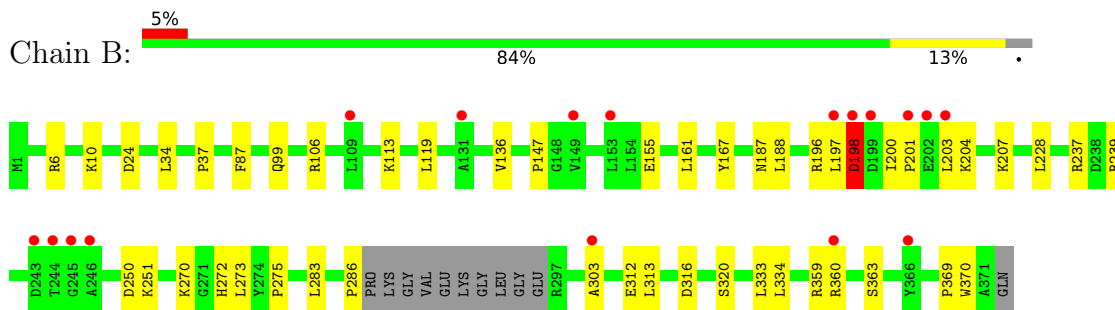
3 Residue-property plots [i](#)

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.

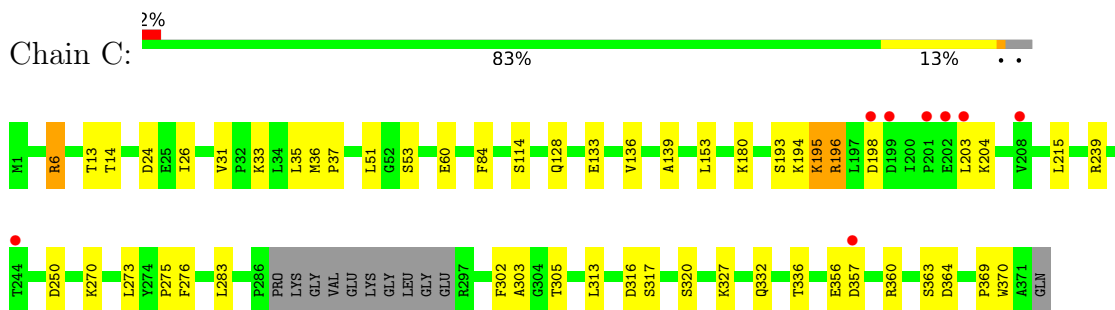
- Molecule 1: Glycerol-3-phosphate acyltransferase, chloroplastic



- Molecule 1: Glycerol-3-phosphate acyltransferase, chloroplastic



- Molecule 1: Glycerol-3-phosphate acyltransferase, chloroplastic



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	51.09Å 81.55Å 88.49Å 110.85° 106.79° 99.93°	Depositor
Resolution (Å)	37.32 – 2.31 37.32 – 2.31	Depositor EDS
% Data completeness (in resolution range)	89.2 (37.32-2.31) 89.2 (37.32-2.31)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.04 (at 2.31Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.183 , 0.242 0.183 , 0.242	Depositor DCC
R_{free} test set	2321 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å ²)	28.1	Xtrriage
Anisotropy	0.040	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 51.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	8916	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.15% 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](#)

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	0/2924	0.62	1/3971 (0.0%)
1	B	0.41	0/2924	0.56	0/3971
1	C	0.38	0/2924	0.55	0/3971
All	All	0.42	0/8772	0.58	1/11913 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	203	LEU	CA-CB-CG	5.71	128.42	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	198	ASP	Peptide

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	2855	0	2806	30	0
1	B	2855	0	2806	26	0
1	C	2855	0	2806	31	0
2	A	174	0	0	1	0
2	B	90	0	0	2	0
2	C	87	0	0	1	0
All	All	8916	0	8418	87	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 (87) 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:133:GLU:HG2	1:C:270:LYS:HB3	1.51	0.93
1:B:113:LYS:NZ	2:B:402:HOH:O	2.23	0.72
1:C:153:LEU:HD11	1:C:305:THR:HG23	1.74	0.69
1:A:219:THR:OG1	1:A:266:ARG:NH2	2.25	0.69
1:C:114:SER:OG	1:C:305:THR:HG22	1.95	0.67
1:B:155:GLU:OE2	2:B:401:HOH:O	2.13	0.66
1:C:316:ASP:O	1:C:320:SER:HB3	1.98	0.64
1:A:203:LEU:HD11	1:A:207:LYS:HE3	1.80	0.63
1:B:197:LEU:HD21	1:B:204:LYS:HG3	1.80	0.63
1:A:133:GLU:HG2	1:A:270:LYS:HB2	1.82	0.61
1:B:161:LEU:HD22	1:B:228:LEU:HD22	1.82	0.60
1:A:203:LEU:O	1:A:203:LEU:HD13	2.03	0.58
1:C:360:ARG:O	1:C:363:SER:OG	2.19	0.58
1:B:197:LEU:O	1:B:198:ASP:HB2	2.04	0.58
1:C:356:GLU:OE2	1:C:360:ARG:NH1	2.36	0.57
1:A:212:ARG:HH11	1:A:212:ARG:HG2	1.69	0.57
1:C:6:ARG:HD2	1:C:24:ASP:OD2	2.06	0.56
1:A:13:THR:HG23	1:A:14:THR:HG23	1.88	0.55
1:B:283:LEU:HD12	1:B:303:ALA:HB3	1.89	0.55
1:A:322:ALA:O	1:A:330:ARG:NH1	2.40	0.53
1:B:136:VAL:HB	1:B:273:LEU:HD23	1.91	0.52
1:B:369:PRO:HD2	1:B:370:TRP:CZ3	2.43	0.52
1:A:220:LYS:O	1:A:224:GLU:HG3	2.09	0.52
1:B:6:ARG:HD2	1:B:24:ASP:OD2	2.10	0.52
1:A:136:VAL:HB	1:A:273:LEU:HD23	1.91	0.52
1:A:6:ARG:HD3	1:A:20:ALA:HB1	1.93	0.50
1:A:31:VAL:HB	1:A:35:LEU:HD12	1.93	0.50
1:A:90:ARG:HG3	1:A:185:GLY:O	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:34:LEU:O	1:B:37:PRO:HD2	2.13	0.48
1:C:275:PRO:HD3	1:C:313:LEU:HD22	1.95	0.48
1:C:283:LEU:HD12	1:C:303:ALA:HB3	1.94	0.48
1:C:193:SER:OG	1:C:195:LYS:HB3	2.14	0.47
1:A:322:ALA:HB3	1:A:330:ARG:HG3	1.96	0.47
1:A:6:ARG:HD2	1:A:24:ASP:OD2	2.13	0.47
1:B:187:ASN:O	1:B:188:LEU:HD23	2.13	0.47
1:B:316:ASP:O	1:B:320:SER:HB3	2.14	0.47
1:C:369:PRO:HD2	1:C:370:TRP:CZ3	2.50	0.47
1:C:139:ALA:HA	1:C:276:PHE:O	2.15	0.47
1:A:262:GLN:OE1	1:A:266:ARG:NH1	2.46	0.46
1:C:31:VAL:HB	1:C:35:LEU:HD12	1.96	0.46
1:B:237:ARG:NH1	1:B:286:PRO:HB3	2.30	0.46
1:C:26:ILE:HD13	1:C:33:LYS:HA	1.97	0.46
1:C:203:LEU:HG	1:C:203:LEU:O	2.16	0.46
1:A:369:PRO:HD2	1:A:370:TRP:CZ3	2.51	0.46
1:C:198:ASP:OD1	1:C:204:LYS:HE3	2.16	0.45
1:C:128:GLN:HG2	1:C:133:GLU:OE1	2.16	0.45
1:B:239:ARG:NH1	1:B:250:ASP:OD1	2.42	0.45
1:B:10:LYS:HD2	1:B:10:LYS:HA	1.81	0.45
1:B:198:ASP:HA	1:B:204:LYS:HD2	2.00	0.44
1:C:364:ASP:OD1	1:C:364:ASP:N	2.50	0.44
1:C:239:ARG:HD3	1:C:250:ASP:OD1	2.18	0.44
1:B:147:PRO:HB3	1:B:167:TYR:CZ	2.53	0.44
1:C:53:SER:HB2	1:C:302:PHE:CG	2.52	0.44
1:C:133:GLU:CG	1:C:270:LYS:HB3	2.36	0.43
1:A:34:LEU:O	1:A:37:PRO:HD2	2.18	0.43
1:B:275:PRO:HG3	1:B:313:LEU:HD21	2.01	0.43
1:A:194:LYS:HB2	1:A:194:LYS:HE2	1.64	0.43
1:C:239:ARG:NH2	2:C:410:HOH:O	2.46	0.43
1:A:356:GLU:HG3	1:A:359:ARG:NH2	2.33	0.43
1:C:136:VAL:HB	1:C:273:LEU:HD23	2.02	0.42
1:C:195:LYS:HG2	1:C:196:ARG:HD3	2.00	0.42
1:B:119:LEU:HD11	1:B:369:PRO:HG3	2.01	0.42
1:B:200:ILE:HA	1:B:201:PRO:HD3	1.87	0.42
1:C:327:LYS:HA	1:C:327:LYS:HD2	1.68	0.42
1:A:316:ASP:O	1:A:320:SER:HB3	2.19	0.42
1:A:6:ARG:NH1	1:A:24:ASP:OD1	2.53	0.42
1:A:120:ALA:O	1:A:124:GLU:HG3	2.20	0.42
1:A:71:ALA:O	1:A:75:VAL:HG23	2.20	0.42
1:B:272:HIS:ND1	1:B:312:GLU:OE2	2.53	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:36:MET:HB3	1:A:37:PRO:HD3	2.01	0.41
1:C:84:PHE:HE1	1:C:180:LYS:HG2	1.85	0.41
1:A:199:ASP:OD1	1:A:200:ILE:N	2.52	0.41
1:A:369:PRO:HD2	1:A:370:TRP:CE3	2.55	0.41
1:B:334:LEU:HD12	1:B:334:LEU:HA	1.91	0.41
2:A:454:HOH:O	1:B:34:LEU:HD23	2.19	0.41
1:B:203:LEU:O	1:B:207:LYS:HG3	2.20	0.41
1:C:13:THR:HG23	1:C:14:THR:HG23	2.02	0.41
1:C:196:ARG:HD2	1:C:196:ARG:HA	1.91	0.41
1:A:237:ARG:NH1	1:A:286:PRO:HB3	2.35	0.41
1:A:220:LYS:HB2	1:A:220:LYS:HE2	1.97	0.41
1:A:356:GLU:HG3	1:A:359:ARG:HH22	1.86	0.41
1:B:333:LEU:HD23	1:B:333:LEU:HA	1.90	0.41
1:B:360:ARG:HA	1:B:363:SER:HB3	2.03	0.41
1:C:332:GLN:NE2	1:C:336:THR:OG1	2.51	0.41
1:C:36:MET:HB3	1:C:37:PRO:HD3	2.02	0.40
1:C:51:LEU:HD11	1:C:60:GLU:HG2	2.03	0.40
1:A:135:VAL:HG22	1:A:272:HIS:HB2	2.04	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	357/372 (96%)	351 (98%)	5 (1%)	1 (0%)	41	50
1	B	357/372 (96%)	349 (98%)	7 (2%)	1 (0%)	41	50
1	C	357/372 (96%)	350 (98%)	6 (2%)	1 (0%)	41	50
All	All	1071/1116 (96%)	1050 (98%)	18 (2%)	3 (0%)	41	50

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	198	ASP
1	C	195	LYS
1	A	90	ARG

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	303/311 (97%)	299 (99%)	4 (1%)	69	81
1	B	303/311 (97%)	295 (97%)	8 (3%)	46	62
1	C	303/311 (97%)	297 (98%)	6 (2%)	55	71
All	All	909/933 (97%)	891 (98%)	18 (2%)	55	71

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	87	PHE
1	A	195	LYS
1	A	220	LYS
1	A	262	GLN
1	B	87	PHE
1	B	99	GLN
1	B	106	ARG
1	B	196	ARG
1	B	198	ASP
1	B	251	LYS
1	B	270	LYS
1	B	359	ARG
1	C	6	ARG
1	C	194	LYS
1	C	196	ARG
1	C	215	LEU
1	C	317	SER
1	C	357	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such

sidechains are listed below:

Mol	Chain	Res	Type
1	A	99	GLN
1	C	3	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, 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	361/372 (97%)	-0.26	5 (1%) 75 80	12, 25, 47, 98	0
1	B	361/372 (97%)	0.03	17 (4%) 31 38	19, 34, 61, 91	0
1	C	361/372 (97%)	-0.08	8 (2%) 62 69	20, 35, 58, 98	0
All	All	1083/1116 (97%)	-0.10	30 (2%) 53 60	12, 31, 58, 98	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	201	PRO	5.0
1	B	197	LEU	4.8
1	B	201	PRO	4.8
1	A	198	ASP	4.1
1	C	203	LEU	4.0
1	C	202	GLU	3.9
1	A	244	THR	3.9
1	C	198	ASP	3.6
1	B	202	GLU	3.5
1	B	243	ASP	3.5
1	B	244	THR	3.4
1	A	195	LYS	3.4
1	C	199	ASP	3.1
1	B	203	LEU	2.9
1	B	109	LEU	2.5
1	B	360	ARG	2.4
1	A	202	GLU	2.4
1	B	149	VAL	2.4
1	C	357	ASP	2.3
1	C	201	PRO	2.3
1	B	245	GLY	2.3
1	B	198	ASP	2.3
1	C	208	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	131	ALA	2.1
1	B	303	ALA	2.1
1	C	244	THR	2.1
1	B	246	ALA	2.0
1	B	366	TYR	2.0
1	B	153	LEU	2.0
1	B	199	ASP	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 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.