WORLDWIDE PDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 02:07 PM EDT

PDB ID	:	9D3J / pdb_00009d3j
Title	:	Structure of L9 Fab in complex with CSP_Res5-Y_mC2 Scaffold
Authors	:	Jain, M.; Agrawal, S.; WIlson, I.A.
Deposited on	:	2024-08-10
Resolution	:	3.50 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	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
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)	:	2.48.1

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 3.50 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.
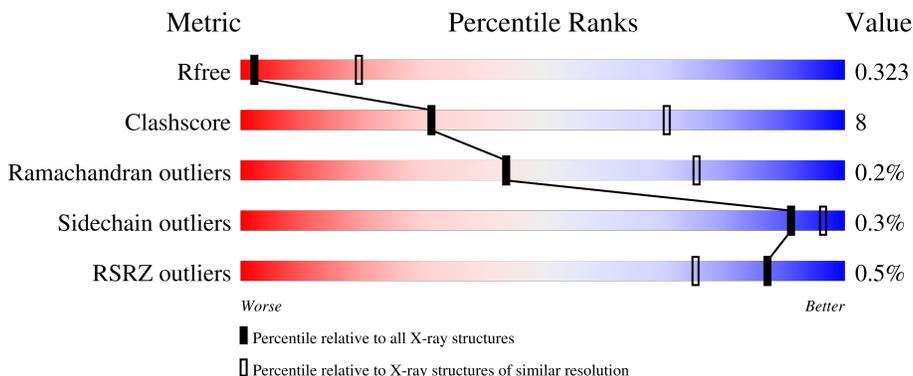
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1094 (3.56-3.44)
Clashscore	180529	1045 (3.54-3.46)
Ramachandran outliers	177936	1032 (3.54-3.46)
Sidechain outliers	177891	1033 (3.54-3.46)
RSRZ outliers	164620	1093 (3.56-3.44)

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 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	C	64	77% 11% 12%
1	D	64	69% 9% 22%
2	A	224	56% 24% 20%
2	E	224	74% 20% 5%
3	B	214	% 61% 14% 25%

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Mol	Chain	Length	Quality of chain
3	F	214	

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 6469 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 PfCSP_Res5-Y_mC2 Scaffold.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	C	56	Total	C	N	O	0	0	0
			395	249	68	78			
1	D	50	Total	C	N	O	0	0	0
			355	224	62	69			

- Molecule 2 is a protein called L9 Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	180	Total	C	N	O	S	0	0	0
			1390	885	236	262	7			
2	E	212	Total	C	N	O	S	0	0	0
			1608	1021	271	309	7			

- Molecule 3 is a protein called L9 Fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	B	161	Total	C	N	O	S	0	0	0
			1251	786	210	252	3			
3	F	193	Total	C	N	O	S	0	0	0
			1470	909	251	304	6			

3 Residue-property plots ⓘ

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: PfCSP_Res5-Y_mC2 Scaffold

Chain C:

• Molecule 1: PfCSP_Res5-Y_mC2 Scaffold

Chain D:

• Molecule 2: L9 Fab heavy chain

Chain A:

• Molecule 2: L9 Fab heavy chain

Chain E:

• Molecule 3: L9 Fab light chain

Chain B:

%

61%　　14%　　25%

D1 L11 S12 A13 S14 V15 G16 D17 R18 V19 T20 I21 W32 L33 A34 W35 Q38 P44 I48 A51 L54 S63 F71 T72 L73 T74 S77 V104 E105 I106 LYS R108 P113 S114 V115 F116 I117 PHE PRO PRO SER ASP GLU GLN L125 S131 VAL

VAL CYS L135 L136 N137 N138 F139 K149 VAL ASP ASN ALA LEU GLN SER GLY N158 L175 T180 LEU SER LYS ALA ASP TYR GLU LYS HIS LYS VAL TYR ALA CYS GLU VAL THR HIS GLN GLY LEU SER SER PRO VAL THR LYS SER PHE ASN ARG GLY GLU CYS

• Molecule 3: L9 Fab light chain

Chain F:

%

73%　　17%　　10%

D1 M4 S7 S12 T22 A25 R31 W32 L33 Y36 K50 A51 P59 S60 R61 G66 F71 T72 K107 P113 S114 V115 PHE ILE PHE P119 Q124 LEU K126 S127 A130 S131 F139 R142 GLU ALA LYS VAL GLN TRP LYS VAL ASP

N152 E161 T164 D170 S171 T172 Y173 S174 S177 L181 D185 TYR GLU LYS HIS LYS VAL TYR ALA C194 T197 H198 Q199 G200 P204 K207 S208 C214

4　Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	119.94Å　119.94Å　217.70Å 90.00°　　90.00°　　90.00°	Depositor
Resolution (Å)	26.90　–　3.50	Depositor
	26.90　–　3.50	EDS
% Data completeness (in resolution range)	99.7 (26.90-3.50)	Depositor
	91.0 (26.90-3.50)	EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.24 (at 3.46Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.272　,　0.323	Depositor
	0.272　,　0.323	DCC
R_{free} test set	2000 reflections (9.65%)	wwPDB-VP
Wilson B-factor (Å^2)	111.8	Xtriage
Anisotropy	0.297	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 82.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.46, < L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	6469	wwPDB-VP
Average B, all atoms (Å^2)	140.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.60% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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	C	0.08	0/400	0.22	0/548
1	D	0.12	0/359	0.34	0/492
2	A	0.12	0/1426	0.34	1/1934 (0.1%)
2	E	0.09	0/1650	0.28	0/2243
3	B	0.09	0/1274	0.28	0/1723
3	F	0.10	0/1495	0.30	0/2022
All	All	0.10	0/6604	0.30	1/8962 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	75	SER	N-CA-C	-5.00	108.92	114.62

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	C	395	0	393	5	0
1	D	355	0	360	3	0
2	A	1390	0	1331	32	0
2	E	1608	0	1550	26	0
3	B	1251	0	1223	21	0
3	F	1470	0	1425	21	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	6469	0	6282	102	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 8.

All (102) 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)
3:B:115:VAL:HG12	3:B:117:ILE:HG12	1.73	0.70
3:B:113:PRO:HB3	3:B:139:PHE:HB3	1.73	0.70
3:B:16:GLY:HA2	3:B:77:SER:HA	1.75	0.68
2:A:147:CYS:N	2:A:203:CYS:SG	2.67	0.67
2:A:207:HIS:HD1	2:A:210:SER:HG	1.42	0.67
2:E:123:THR:HG22	2:E:210:SER:HB2	1.78	0.66
2:A:72:ARG:HH21	2:A:74:ASN:HA	1.63	0.64
3:F:22:THR:HA	3:F:72:THR:HA	1.80	0.61
2:A:67:ARG:NH2	2:A:90:ASP:OD2	2.33	0.61
2:E:34:MET:HG3	2:E:98:ARG:HB2	1.82	0.61
2:A:40:ALA:HB3	2:A:43:LYS:HB2	1.83	0.60
3:F:31:ARG:HH21	3:F:50:LYS:HE3	1.66	0.59
1:C:40:VAL:HG22	2:A:101:TYR:HB2	1.83	0.59
2:E:204:ASN:HD21	2:E:213:LYS:HG2	1.67	0.59
2:A:45:LEU:HD21	3:B:44:PRO:HG3	1.83	0.59
1:D:24:LEU:HD21	1:D:52:VAL:HB	1.84	0.58
3:F:124:GLN:HA	3:F:127:SER:HA	1.84	0.58
2:A:155:GLU:O	2:A:157:VAL:HG12	2.05	0.57
2:E:130:PRO:HB3	2:E:216:LYS:HD3	1.87	0.56
3:B:63:SER:HG	3:B:74:THR:HG1	1.51	0.56
2:E:13:GLN:HG2	2:E:16:ARG:HB2	1.88	0.56
2:E:164:GLY:O	2:E:166:LEU:N	2.39	0.56
3:B:20:THR:HG22	3:B:74:THR:HG22	1.88	0.55
2:E:166:LEU:HD21	2:E:189:VAL:HG11	1.89	0.55
2:A:207:HIS:CD2	2:A:209:PRO:HD2	2.41	0.55
2:E:47:TRP:HZ2	2:E:50:VAL:HG12	1.71	0.54
3:F:66:GLY:HA3	3:F:71:PHE:HA	1.88	0.54
1:C:34:ILE:HG12	3:B:32:TRP:HH2	1.72	0.54
3:F:124:GLN:OE1	3:F:131:SER:N	2.42	0.53
3:F:113:PRO:HB3	3:F:139:PHE:HB3	1.90	0.53
2:E:7:SER:OG	2:E:21:SER:OG	2.28	0.52
2:E:91:THR:HG23	2:E:117:THR:HA	1.91	0.52
2:A:52:TRP:HB2	2:A:57:ASN:HB2	1.92	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:93:VAL:HG22	2:A:115:LEU:HG	1.90	0.52
2:E:131:LEU:HB2	2:E:146:GLY:HA3	1.92	0.51
2:A:37:VAL:O	2:A:95:TYR:N	2.44	0.51
2:A:83:MET:HE2	2:A:86:LEU:HD21	1.92	0.51
3:F:161:GLU:HA	3:F:177:SER:HA	1.92	0.50
3:B:15:VAL:HG22	3:B:106:ILE:HD11	1.92	0.50
2:A:73:ASP:HB2	2:A:80:PHE:HE2	1.77	0.50
2:E:110:TRP:HE1	3:F:36:TYR:HE2	1.59	0.49
2:A:7:SER:OG	2:A:21:SER:OG	2.25	0.49
2:A:97:HIS:CE1	2:A:99:ASN:HB3	2.47	0.49
2:E:195:SER:HB3	2:E:198:THR:OG1	2.11	0.49
2:A:102:ASP:OD1	2:A:103:GLY:N	2.39	0.49
3:B:1:ASP:OD1	3:B:1:ASP:N	2.46	0.49
3:B:136:LEU:HB2	3:B:175:LEU:HB3	1.94	0.48
2:A:150:LYS:HG3	2:A:184:SER:HB3	1.95	0.48
2:E:6:GLU:N	2:E:6:GLU:OE1	2.48	0.47
3:F:12:SER:HB2	3:F:107:LYS:HG3	1.95	0.47
3:F:170:ASP:OD1	3:F:170:ASP:N	2.43	0.47
2:A:87:ARG:O	2:A:118:VAL:HG21	2.14	0.47
2:E:12:VAL:HG11	2:E:86:LEU:HD22	1.97	0.47
3:B:13:ALA:HB1	3:B:17:ASP:HB2	1.96	0.47
2:A:149:VAL:HB	2:A:185:LEU:HG	1.97	0.46
2:A:28:ILE:HA	2:A:77:ASN:HD21	1.80	0.46
3:B:33:LEU:HB3	3:B:51:ALA:HB2	1.97	0.46
3:F:170:ASP:OD2	3:F:172:THR:OG1	2.28	0.46
2:A:24:ALA:HB3	2:A:77:ASN:HB3	1.96	0.46
3:F:7:SER:HB3	3:F:22:THR:HG23	1.98	0.45
2:A:13:GLN:HB2	2:A:16:ARG:HG3	1.99	0.45
3:B:48:ILE:HG12	3:B:54:LEU:HG	1.98	0.45
2:E:34:MET:HE2	2:E:98:ARG:HD2	1.97	0.45
1:D:28:VAL:O	1:D:32:ARG:HG3	2.17	0.45
2:E:69:THR:O	2:E:82:GLN:N	2.49	0.45
2:A:7:SER:HG	2:A:21:SER:HG	1.59	0.45
2:A:188:VAL:HG11	3:B:135:LEU:HD21	1.99	0.45
1:D:43:ALA:HA	1:D:46:TRP:HD1	1.83	0.44
2:A:36:TRP:HD1	2:A:70:ILE:HD11	1.82	0.44
1:C:43:ALA:HA	1:C:46:TRP:HD1	1.82	0.44
3:B:35:TRP:CD2	3:B:73:LEU:HD12	2.52	0.44
3:B:11:LEU:HD23	3:B:104:VAL:HG22	2.00	0.44
3:F:199:GLN:OE1	3:F:200:GLY:N	2.50	0.44
3:F:33:LEU:HB3	3:F:51:ALA:HB2	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:47:TRP:HZ2	2:A:50:VAL:HG12	1.82	0.43
2:E:40:ALA:HB3	2:E:43:LYS:HB2	2.01	0.43
2:A:159:VAL:HG13	2:A:205:VAL:HG12	2.01	0.42
3:F:4:MET:HE3	3:F:25:ALA:HB2	2.01	0.42
2:A:38:ARG:NH2	2:A:90:ASP:HA	2.35	0.42
1:C:24:LEU:O	1:C:28:VAL:HG23	2.20	0.42
2:E:97:HIS:CE1	2:E:99:ASN:HB3	2.55	0.42
2:E:33:GLY:HA2	2:E:52:TRP:HA	2.02	0.42
2:E:131:LEU:HD12	2:E:146:GLY:HA3	2.01	0.41
3:F:181:LEU:HD13	3:F:185:ASP:O	2.20	0.41
2:E:48:VAL:HG13	2:E:64:VAL:HG21	2.03	0.41
3:F:207:LYS:HG3	3:F:208:SER:H	1.84	0.41
3:B:35:TRP:CE3	3:B:73:LEU:HD12	2.56	0.41
1:C:38:PRO:HB2	2:A:52:TRP:CZ2	2.56	0.41
2:A:34:MET:HG2	2:A:98:ARG:HD2	2.02	0.41
3:B:11:LEU:HD22	3:B:21:ILE:HD11	2.02	0.41
3:B:38:GLN:HB2	3:B:44:PRO:HB3	2.03	0.41
2:E:77:ASN:OD1	2:E:77:ASN:N	2.54	0.41
2:E:154:PRO:O	2:E:207:HIS:NE2	2.50	0.41
3:F:164:THR:HG22	3:F:174:SER:H	1.84	0.41
2:E:134:SER:HB2	2:E:136:LYS:HE2	2.02	0.41
2:E:142:THR:HG22	2:E:192:PRO:HA	2.02	0.40
2:A:162:ASN:HD21	2:A:202:ILE:HG23	1.85	0.40
3:B:33:LEU:HD22	3:B:71:PHE:CG	2.57	0.40
3:F:59:PRO:HB2	3:F:61:ARG:HG2	2.04	0.40
3:B:11:LEU:HD21	3:B:19:VAL:HB	2.03	0.40
3:F:124:GLN:HG3	3:F:130:ALA:HA	2.04	0.40
3:F:197:THR:HB	3:F:204:PRO:HB3	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	C	54/64 (84%)	51 (94%)	3 (6%)	0	100	100
1	D	48/64 (75%)	43 (90%)	5 (10%)	0	100	100
2	A	172/224 (77%)	157 (91%)	14 (8%)	1 (1%)	22	56
2	E	206/224 (92%)	192 (93%)	13 (6%)	1 (0%)	25	59
3	B	151/214 (71%)	136 (90%)	15 (10%)	0	100	100
3	F	183/214 (86%)	171 (93%)	12 (7%)	0	100	100
All	All	814/1004 (81%)	750 (92%)	62 (8%)	2 (0%)	44	75

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	157	VAL
2	E	165	ALA

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	C	34/40 (85%)	34 (100%)	0	100	100
1	D	32/40 (80%)	32 (100%)	0	100	100
2	A	153/190 (80%)	153 (100%)	0	100	100
2	E	178/190 (94%)	176 (99%)	2 (1%)	70	83
3	B	142/189 (75%)	142 (100%)	0	100	100
3	F	170/189 (90%)	170 (100%)	0	100	100
All	All	709/838 (85%)	707 (100%)	2 (0%)	91	96

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	2	VAL
2	E	12	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	57	ASN
2	A	82	GLN
3	B	79	GLN
3	B	138	ASN
3	F	6	GLN
3	F	37	GLN
3	F	138	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	C	56/64 (87%)	-0.27	0	100	100	72, 130, 189, 203	0
1	D	50/64 (78%)	-0.11	0	100	100	80, 132, 192, 212	0
2	A	180/224 (80%)	-0.22	0	100	100	85, 132, 193, 212	0
2	E	212/224 (94%)	-0.26	0	100	100	83, 138, 180, 219	0
3	B	161/214 (75%)	-0.15	2 (1%)	76	57	90, 150, 203, 253	0
3	F	193/214 (90%)	-0.09	2 (1%)	79	61	86, 135, 197, 230	0
All	All	852/1004 (84%)	-0.18	4 (0%)	87	75	72, 138, 198, 253	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	F	181	LEU	3.2
3	F	119	PRO	2.8
3	B	113	PRO	2.2
3	B	137	ASN	2.1

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 ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.