



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 01:29 AM UTC

PDB ID : 2PCP / pdb\_00002pcp  
Title : ANTIBODY FAB COMPLEXED WITH PHENCYCLIDINE  
Authors : Lim, K.; Owens, S.M.; Arnold, L.; Sacchettini, J.C.; Linthicum, D.S.  
Deposited on : 1998-06-02  
Resolution : 2.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
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) : 2.49

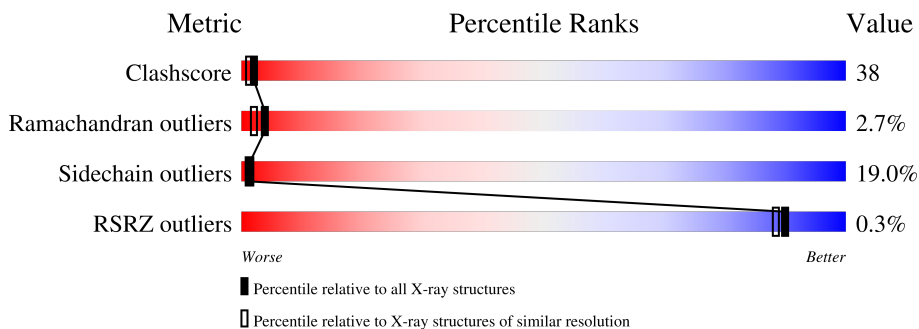
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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  $\geq 3$ , 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	216	 32% 59% 8% .
1	C	216	 31% 53% 15%
2	B	215	 27% 53% 17% .
2	D	215	 % 36% 51% 13%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 7342 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 IMMUNOGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	216	1678	1051	283	338	6	0	0	0
1	C	216	1678	1051	283	338	6	0	0	0

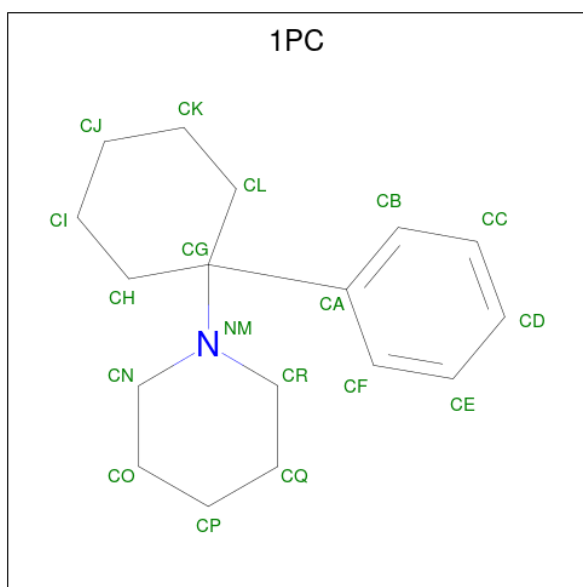
There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	27A	THR	SER	conflict	PIR PC4203
A	27E	SER	THR	conflict	PIR PC4203
A	52	THR	SER	conflict	PIR PC4203
A	92	THR	SER	conflict	PIR PC4203
A	94	ALA	VAL	conflict	PIR PC4203
A	96	TYR	ARG	conflict	PIR PC4203
C	27A	THR	SER	conflict	PIR PC4203
C	27E	SER	THR	conflict	PIR PC4203
C	52	THR	SER	conflict	PIR PC4203
C	92	THR	SER	conflict	PIR PC4203
C	94	ALA	VAL	conflict	PIR PC4203
C	96	TYR	ARG	conflict	PIR PC4203

- Molecule 2 is a protein called IMMUNOGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	215	1636	1033	268	328	7	0	0	0
2	D	215	1636	1033	268	328	7	0	0	0

- Molecule 3 is 1-(PHENYL-1-CYCLOHEXYL)PIPERIDINE (CCD ID: 1PC) (formula: C<sub>17</sub>H<sub>25</sub>N).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	N	0	0
			18	17	1		
3	C	1	Total	C	N	0	0
			18	17	1		

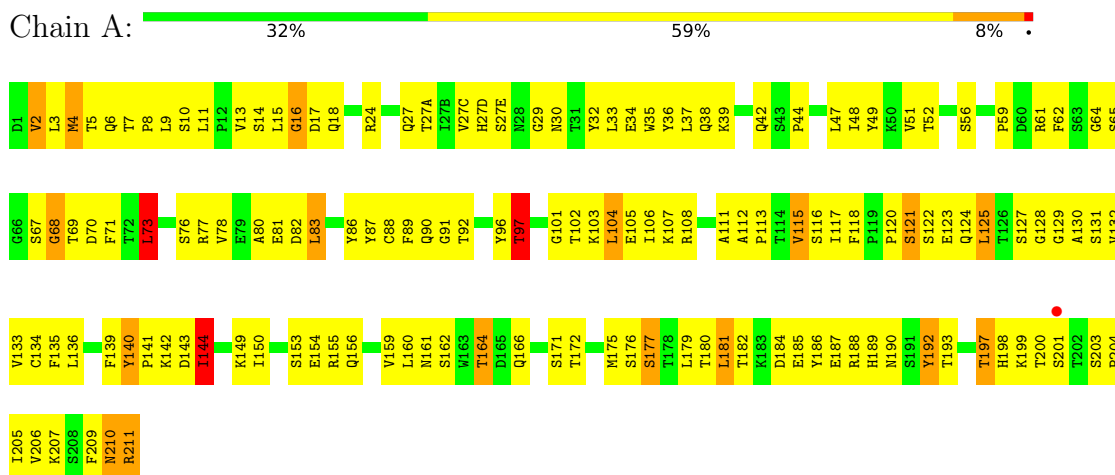
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	173	Total	O	0	0
			173	173		
4	B	163	Total	O	0	0
			163	163		
4	C	150	Total	O	0	0
			150	150		
4	D	192	Total	O	0	0
			192	192		

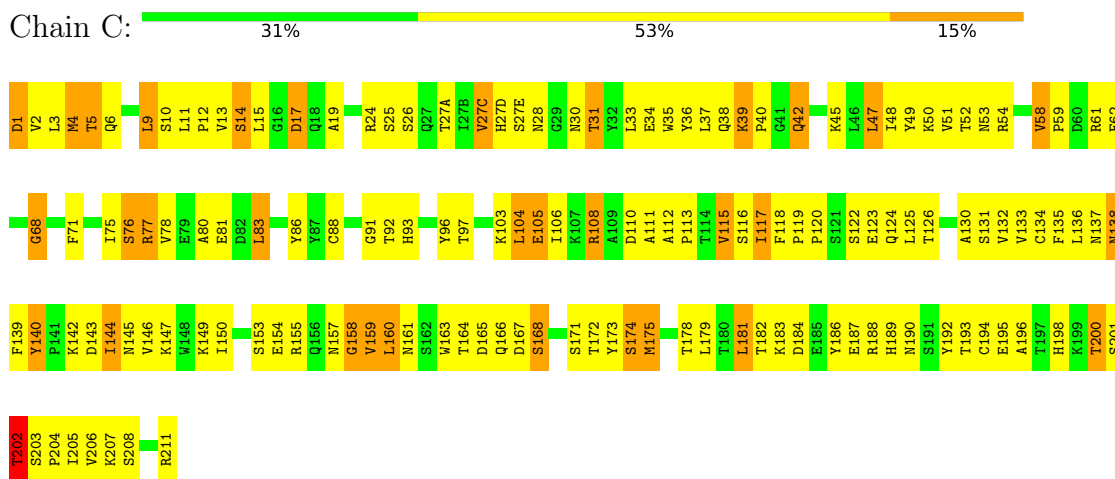
### 3 Residue-property plots [i](#)

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.

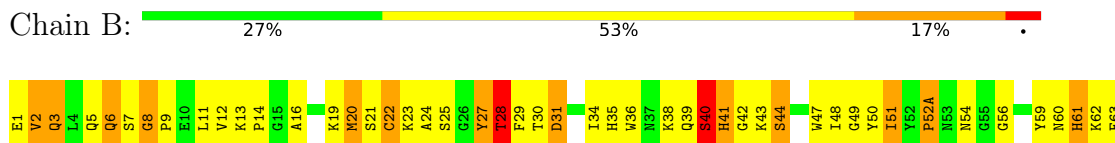
#### • Molecule 1: IMMUNOGLOBULIN



#### • Molecule 1: IMMUNOGLOBULIN



#### • Molecule 2: IMMUNOGLOBULIN





## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	53.46Å 67.72Å 68.04Å 62.11° 84.66° 83.17°	Depositor
Resolution (Å)	6.00 – 2.20 6.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	78.7 (6.00-2.20) 74.9 (6.00-2.20)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	0.09	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.51 (at 2.08Å)	Xtrriage
Refinement program	X-PLOR 3.1	Depositor
R, $R_{free}$	0.196 , 0.290 0.208 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.8	Xtrriage
Anisotropy	0.418	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 142.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.109 for -h,-l,-k	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	7342	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	23.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.25% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: 1PC

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	0.88	1/1717 (0.1%)	1.30	18/2330 (0.8%)
1	C	0.95	2/1717 (0.1%)	1.37	26/2330 (1.1%)
2	B	0.97	2/1681 (0.1%)	1.38	25/2295 (1.1%)
2	D	0.92	1/1681 (0.1%)	1.50	30/2295 (1.3%)
All	All	0.93	6/6796 (0.1%)	1.39	99/9250 (1.1%)

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	A	0	2
1	C	0	1
2	B	0	1
2	D	0	2
All	All	0	6

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	196	ALA	CA-CB	-7.26	1.43	1.53
2	B	51	ILE	CA-CB	6.90	1.63	1.55
1	C	204	PRO	CA-C	-5.90	1.46	1.52
1	A	4	MET	SD-CE	-5.53	1.65	1.79
2	B	28	THR	CA-CB	5.31	1.59	1.52

The worst 5 of 99 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	129	ALA	N-CA-C	-14.21	85.02	108.32
2	D	128	SER	N-CA-C	11.08	126.20	109.25
2	D	150	GLU	CA-C-N	-9.77	107.63	119.84
2	D	150	GLU	C-N-CA	-9.77	107.63	119.84
1	A	201	SER	N-CA-C	-9.35	93.66	108.90

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	140	TYR	Sidechain
1	A	192	TYR	Sidechain
2	B	50	TYR	Sidechain
1	C	140	TYR	Sidechain
2	D	50	TYR	Sidechain

## 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	1678	0	1621	128	0
1	C	1678	0	1621	122	0
2	B	1636	0	1578	166	0
2	D	1636	0	1578	115	0
3	B	18	0	25	5	0
3	C	18	0	25	8	0
4	A	173	0	0	4	0
4	B	163	0	0	6	0
4	C	150	0	0	4	0
4	D	192	0	0	8	0
All	All	7342	0	6448	494	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 38.

The worst 5 of 494 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:A:190:ASN:HB2	1:C:203:SER:HB2	1.31	1.10
1:A:8:PRO:HG3	1:A:11:LEU:HD13	1.36	1.07
2:B:199:ARG:HD2	2:B:200:PRO:HA	1.36	1.05
2:D:171:VAL:HG12	2:D:191:VAL:HG23	1.37	1.03
2:B:127:GLY:HA2	2:D:131:GLN:HB2	1.36	1.02

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	214/216 (99%)	193 (90%)	19 (9%)	2 (1%)	14	14
1	C	214/216 (99%)	190 (89%)	21 (10%)	3 (1%)	9	7
2	B	213/215 (99%)	181 (85%)	20 (9%)	12 (6%)	1	0
2	D	213/215 (99%)	181 (85%)	26 (12%)	6 (3%)	4	2
All	All	854/862 (99%)	745 (87%)	86 (10%)	23 (3%)	4	2

5 of 23 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	68	GLY
2	B	131	GLN
2	B	198	PRO
2	B	214	ALA
1	C	68	GLY

### 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	192/192 (100%)	168 (88%)	24 (12%)	4	4
1	C	192/192 (100%)	155 (81%)	37 (19%)	1	1
2	B	186/186 (100%)	138 (74%)	48 (26%)	0	0
2	D	186/186 (100%)	151 (81%)	35 (19%)	1	1
All	All	756/756 (100%)	612 (81%)	144 (19%)	1	1

5 of 144 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	54	ASN
2	D	210	VAL
2	D	77	THR
2	D	116	THR
2	B	107	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	157	ASN
2	D	39	GLN
2	D	35	HIS
2	D	53	ASN
2	B	41	HIS

### 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 oligosaccharides in this entry.

## 5.6 Ligand geometry

2 ligands are modelled in this entry.

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	1PC	B	227	-	19,20,20	3.43	9 (47%)	24,27,27	1.62	3 (12%)
3	1PC	C	212	-	19,20,20	3.36	7 (36%)	24,27,27	1.43	2 (8%)

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	1PC	B	227	-	-	2/12/30/30	0/3/3/3
3	1PC	C	212	-	-	0/12/30/30	0/3/3/3

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	212	1PC	CH-CG	9.02	1.62	1.54
3	C	212	1PC	CL-CG	7.97	1.61	1.54
3	B	227	1PC	CH-CG	7.15	1.60	1.54
3	B	227	1PC	CN-NM	6.35	1.56	1.47
3	B	227	1PC	CG-CA	6.00	1.60	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	227	1PC	CL-CG-CH	-5.60	99.57	108.52
3	C	212	1PC	CL-CG-CH	-3.38	103.11	108.52
3	B	227	1PC	CI-CH-CG	-3.32	107.73	113.18
3	C	212	1PC	CI-CH-CG	-3.03	108.21	113.18
3	B	227	1PC	CL-CG-NM	-2.50	104.56	109.86

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	227	1PC	CL-CG-NM-CR
3	B	227	1PC	CL-CG-NM-CN

There are no ring outliers.

2 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	227	1PC	5	0
3	C	212	1PC	8	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 [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	216/216 (100%)	-0.68	1 (0%) 87 85	7, 19, 34, 75	0
1	C	216/216 (100%)	-0.58	0 100 100	4, 22, 35, 57	0
2	B	215/215 (100%)	-0.47	0 100 100	5, 23, 39, 56	0
2	D	215/215 (100%)	-0.48	2 (0%) 81 79	6, 24, 41, 61	0
All	All	862/862 (100%)	-0.55	3 (0%) 90 88	4, 22, 38, 75	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	201	SER	5.7
2	D	129	ALA	2.9
2	D	130	ALA	2.7

### 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 oligosaccharides 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	1PC	C	212	18/18	0.90	0.10	3,19,31,31	0
3	1PC	B	227	18/18	0.92	0.06	4,17,26,26	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.