



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 28, 2026 – 01:14 AM UTC

PDB ID : 6TZZ / pdb_00006tzt
Title : Crystal structure of human alpha/epsilon-COP of the COPI vesicular coat bound to alpha-COP STM2
Authors : Travis, S.M.; Hughson, F.M.
Deposited on : 2019-08-13
Resolution : 3.06 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	:	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

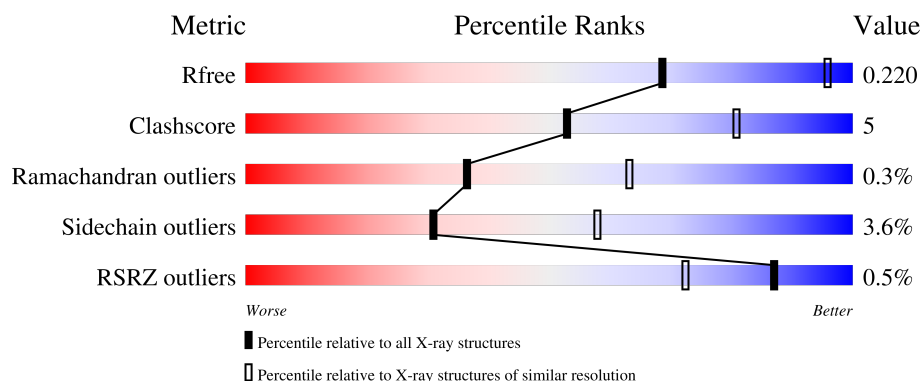
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.06 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}	180053	2469 (3.10-3.02)
Clashscore	190562	2569 (3.10-3.02)
Ramachandran outliers	187476	2424 (3.10-3.02)
Sidechain outliers	187428	2423 (3.10-3.02)
RSRZ outliers	180081	2469 (3.10-3.02)

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	322	81% 8% • 9%
1	C	322	% 76% 13% • 10%
2	B	356	% 78% 13% • 7%
2	D	356	75% 13% • 11%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 9801 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 Coatomer subunit epsilon.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	292	Total	C	N	O	S	0	1	0
			2332	1466	404	451	11			
1	C	290	Total	C	N	O	S	0	1	0
			2320	1458	403	448	11			

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	MET	-	expression tag	UNP O14579
A	-12	GLY	-	expression tag	UNP O14579
A	-11	SER	-	expression tag	UNP O14579
A	-10	SER	-	expression tag	UNP O14579
A	-9	HIS	-	expression tag	UNP O14579
A	-8	HIS	-	expression tag	UNP O14579
A	-7	HIS	-	expression tag	UNP O14579
A	-6	HIS	-	expression tag	UNP O14579
A	-5	HIS	-	expression tag	UNP O14579
A	-4	HIS	-	expression tag	UNP O14579
A	-3	SER	-	expression tag	UNP O14579
A	-2	GLN	-	expression tag	UNP O14579
A	-1	ASP	-	expression tag	UNP O14579
A	0	PRO	-	expression tag	UNP O14579
C	-13	MET	-	expression tag	UNP O14579
C	-12	GLY	-	expression tag	UNP O14579
C	-11	SER	-	expression tag	UNP O14579
C	-10	SER	-	expression tag	UNP O14579
C	-9	HIS	-	expression tag	UNP O14579
C	-8	HIS	-	expression tag	UNP O14579
C	-7	HIS	-	expression tag	UNP O14579
C	-6	HIS	-	expression tag	UNP O14579
C	-5	HIS	-	expression tag	UNP O14579
C	-4	HIS	-	expression tag	UNP O14579
C	-3	SER	-	expression tag	UNP O14579

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	GLN	-	expression tag	UNP O14579
C	-1	ASP	-	expression tag	UNP O14579
C	0	PRO	-	expression tag	UNP O14579

- Molecule 2 is a protein called Coatamer subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	330	Total	C	N	O	S	0	0	0
			2624	1684	453	472	15			
2	D	318	Total	C	N	O	S	0	0	0
			2524	1619	437	453	15			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	869	MET	-	expression tag	UNP P53621
D	869	MET	-	expression tag	UNP P53621

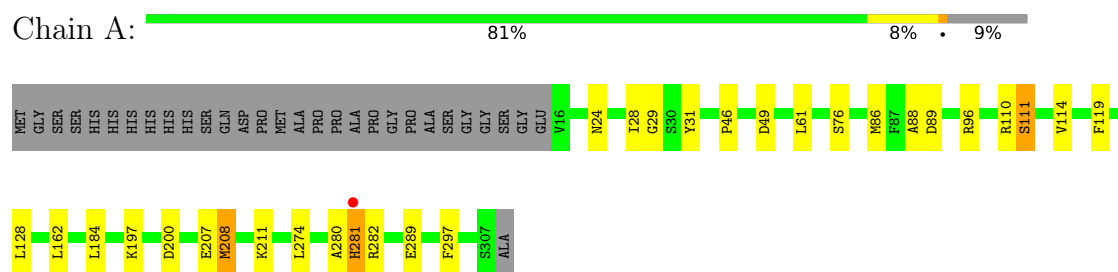
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	O	0	0
			1	1		

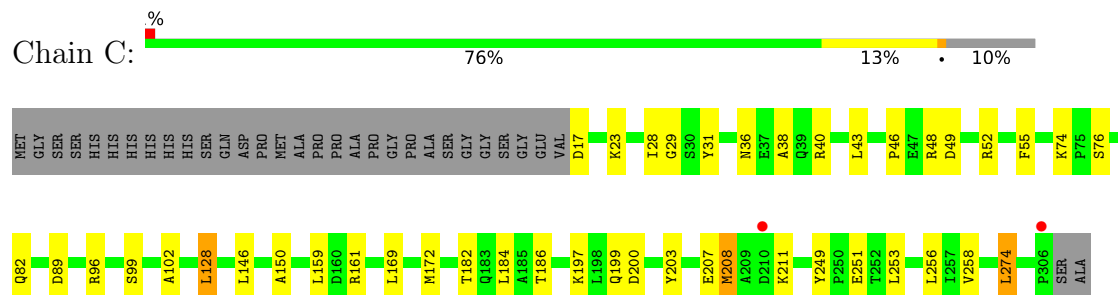
3 Residue-property plots [i](#)

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.

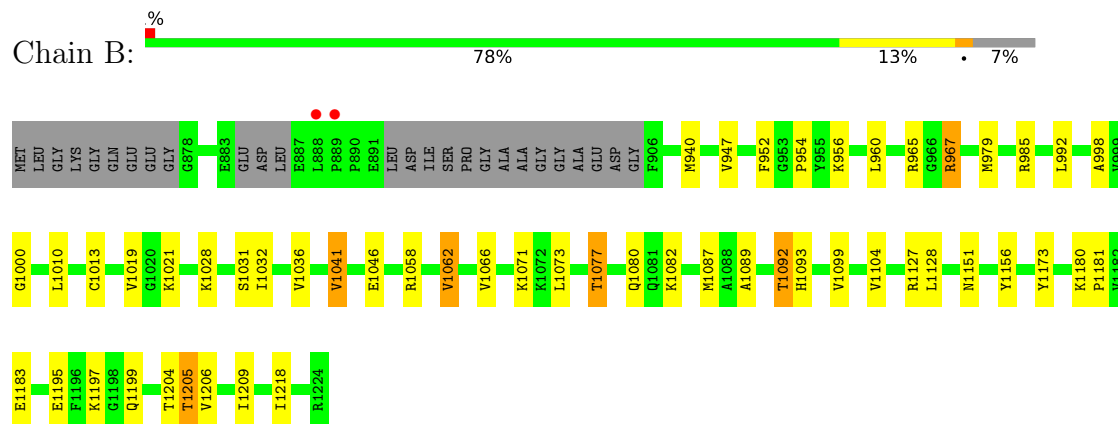
- Molecule 1: Coatomer subunit epsilon



- Molecule 1: Coatomer subunit epsilon

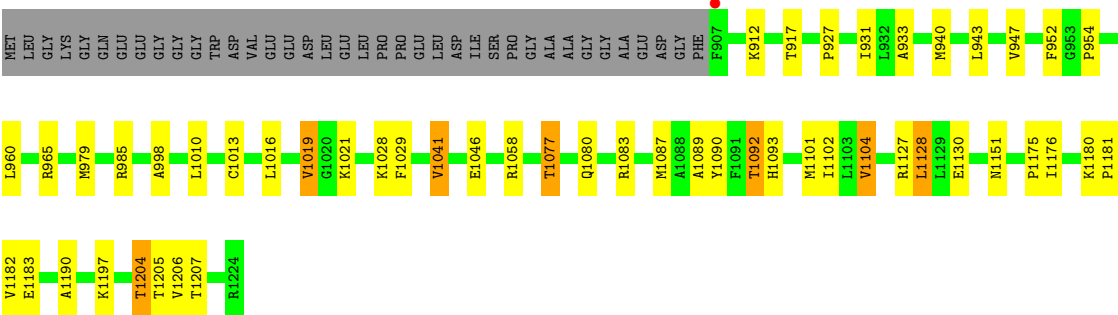


- Molecule 2: Coatomer subunit alpha



- Molecule 2: Coatomer subunit alpha





4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	138.47Å 138.47Å 192.87Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.62 – 3.06 29.62 – 3.06	Depositor EDS
% Data completeness (in resolution range)	99.8 (29.62-3.06) 99.6 (29.62-3.06)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.28 (at 3.06Å)	Xtriage
Refinement program	PHENIX 1.13-2998	Depositor
R, R_{free}	0.178 , 0.223 0.180 , 0.220	Depositor DCC
R_{free} test set	1998 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å ²)	81.1	Xtriage
Anisotropy	0.044	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 39.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.022 for -h,-k,l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9801	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.97% 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	0.46	0/2376	0.65	0/3216
1	C	0.39	0/2364	0.62	0/3200
2	B	0.43	0/2682	0.65	0/3634
2	D	0.40	0/2579	0.64	0/3497
All	All	0.42	0/10001	0.64	0/13547

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 [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	2332	0	2297	18	0
1	C	2320	0	2287	26	0
2	B	2624	0	2670	27	0
2	D	2524	0	2584	32	0
3	B	1	0	0	1	0
All	All	9801	0	9838	98	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 (98) 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)
2:D:1204:THR:HG22	2:D:1206:VAL:H	1.35	0.91
2:B:954:PRO:HG2	2:B:1206:VAL:HG12	1.53	0.89
2:D:954:PRO:HG2	2:D:1206:VAL:HG12	1.55	0.88
2:D:1092:THR:HG23	2:D:1127:ARG:HH12	1.39	0.87
2:B:1183:GLU:HG3	2:B:1197:LYS:HB2	1.67	0.77
1:C:89:ASP:OD2	1:C:96:ARG:NH1	2.20	0.74
1:A:289:GLU:OE1	2:B:967:ARG:NH2	2.21	0.73
1:A:184:LEU:HD21	1:A:208:MET:HE1	1.69	0.73
2:B:1066:VAL:HG13	2:B:1087:MET:HE2	1.74	0.70
1:C:46:PRO:HA	1:C:49:ASP:HB2	1.76	0.66
1:C:23:LYS:HG2	1:C:55:PHE:CE2	2.31	0.64
2:D:1077:THR:HB	2:D:1080:GLN:H	1.65	0.62
2:B:1013:CYS:SG	2:B:1028:LYS:HB3	2.40	0.61
2:D:985:ARG:HB3	2:D:998:ALA:HA	1.81	0.61
1:C:17:ASP:OD1	1:C:48:ARG:NH1	2.33	0.61
1:A:89:ASP:OD2	1:A:96:ARG:NH1	2.35	0.59
2:D:1204:THR:HG21	2:D:1207:THR:HG23	1.84	0.59
1:A:207:GLU:HG2	1:A:211:LYS:HE2	1.85	0.59
2:B:965:ARG:NE	2:B:1000:GLY:HA3	2.17	0.59
2:B:1092:THR:HG23	2:B:1127:ARG:HH22	1.67	0.59
2:D:1183:GLU:HG3	2:D:1197:LYS:HB2	1.85	0.59
1:C:199:GLN:HG3	1:C:203:TYR:CE2	2.38	0.59
1:A:61:LEU:HD21	1:A:88:ALA:HB2	1.86	0.57
1:C:172:MET:HG3	1:C:182:THR:HG23	1.86	0.57
2:D:1090:TYR:CZ	2:D:1175:PRO:HD3	2.38	0.57
2:D:1092:THR:HG22	2:D:1093:HIS:ND1	2.21	0.56
1:A:184:LEU:CD2	1:A:208:MET:HE1	2.36	0.56
2:B:1058:ARG:O	2:B:1062:VAL:HG13	2.07	0.55
1:A:207:GLU:O	1:A:211:LYS:HG2	2.07	0.54
1:C:28:ILE:HG22	1:C:208:MET:HE3	1.89	0.54
1:C:36:ASN:O	1:C:40:ARG:HG2	2.08	0.53
2:D:940:MET:HE3	2:D:952:PHE:CG	2.43	0.53
2:D:1176:ILE:HG21	2:D:1182:VAL:HG12	1.90	0.53
1:C:184:LEU:HD21	1:C:208:MET:HE1	1.89	0.53
1:C:197:LYS:O	1:C:200:ASP:HB2	2.10	0.52
2:B:1089:ALA:O	2:B:1092:THR:HB	2.10	0.51
2:B:1092:THR:HG22	2:B:1093:HIS:HD2	1.76	0.51
1:C:43:LEU:HD21	1:C:52:ARG:NH1	2.26	0.50
1:C:74:LYS:O	1:C:82:GLN:NE2	2.41	0.50
2:B:1019:VAL:HG13	2:B:1021:LYS:HG3	1.93	0.50
2:B:1082:LYS:HE2	2:B:1156:TYR:HB3	1.93	0.50
1:C:150:ALA:HA	1:C:172:MET:HE1	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:1077:THR:HB	2:B:1080:GLN:H	1.78	0.48
2:B:940:MET:HE3	2:B:952:PHE:CG	2.49	0.48
2:D:979:MET:HE3	2:D:979:MET:HB3	1.73	0.48
2:D:1130:GLU:O	2:D:1130:GLU:HG2	2.13	0.48
2:D:1204:THR:HG23	2:D:1206:VAL:HG22	1.96	0.48
1:A:281:HIS:CD2	1:A:282:ARG:HE	2.32	0.48
1:C:159:LEU:HD22	2:D:912:LYS:HG2	1.96	0.48
2:B:1041:VAL:HG13	2:B:1046:GLU:HB2	1.96	0.47
1:A:110:ARG:O	1:A:111:SER:HB3	2.14	0.47
1:A:197:LYS:O	1:A:200:ASP:HB2	2.14	0.47
1:A:28:ILE:HG22	1:A:208:MET:HE3	1.96	0.46
2:B:1180:LYS:HB3	2:B:1181:PRO:HD2	1.96	0.46
1:C:184:LEU:CD2	1:C:208:MET:HE1	2.45	0.46
1:A:280:ALA:O	1:A:282:ARG:HG2	2.15	0.46
2:D:1204:THR:CG2	2:D:1206:VAL:HG22	2.45	0.46
1:C:38:ALA:O	1:C:52:ARG:HD2	2.15	0.46
2:B:1092:THR:HG23	2:B:1127:ARG:NH2	2.31	0.46
2:D:1176:ILE:HG21	2:D:1182:VAL:CG1	2.46	0.46
2:D:927:PRO:O	2:D:931:ILE:HG13	2.17	0.45
1:C:29:GLY:HA2	1:C:31:TYR:CE1	2.52	0.45
1:C:128:LEU:HD12	1:C:128:LEU:HA	1.74	0.45
1:C:169:LEU:HD21	1:C:186:THR:HG22	1.99	0.45
2:D:1010:LEU:HD12	2:D:1010:LEU:HA	1.71	0.45
1:C:207:GLU:O	1:C:211:LYS:HG2	2.16	0.44
1:A:86:MET:HE1	1:A:119:PHE:HE1	1.82	0.44
2:B:1010:LEU:HA	2:B:1010:LEU:HD12	1.71	0.44
1:C:256:LEU:HD23	1:C:256:LEU:HA	1.82	0.44
2:B:985:ARG:HB3	2:B:998:ALA:HA	1.98	0.44
1:C:99:SER:O	1:C:102:ALA:HB3	2.18	0.44
2:D:1089:ALA:O	2:D:1092:THR:HB	2.18	0.44
2:B:1032:ILE:O	2:B:1036:VAL:HG23	2.18	0.43
1:A:86:MET:HE1	1:A:119:PHE:CE1	2.54	0.43
2:D:1016:LEU:HD23	2:D:1016:LEU:HA	1.81	0.43
1:C:146:LEU:HD11	1:C:172:MET:HB2	2.01	0.43
2:B:1204:THR:O	2:B:1205:THR:HG22	2.18	0.43
1:C:274:LEU:HD12	1:C:274:LEU:HA	1.78	0.43
2:D:1180:LYS:HB3	2:D:1181:PRO:HD2	2.01	0.43
2:D:1019:VAL:HG13	2:D:1021:LYS:HG3	2.01	0.42
2:D:1083:ARG:O	2:D:1087:MET:HG3	2.19	0.42
2:B:1087:MET:HE3	2:B:1173:TYR:HB3	2.01	0.42
2:B:1199:GLN:O	2:B:1209:ILE:HG13	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:1101:MET:HA	2:D:1104:VAL:HG13	2.00	0.42
2:B:979:MET:HE3	2:B:979:MET:HB3	1.81	0.42
1:A:46:PRO:HA	1:A:49:ASP:HB2	2.00	0.42
1:A:162:LEU:HD23	2:B:992:LEU:HD21	2.01	0.42
2:B:1071:LYS:NZ	3:B:1301:HOH:O	2.53	0.42
2:D:917:THR:HB	2:D:933:ALA:HB1	2.02	0.41
2:D:1013:CYS:HB3	2:D:1029:PHE:CZ	2.54	0.41
2:D:1058:ARG:HD2	2:D:1190:ALA:HA	2.03	0.41
1:A:29:GLY:HA2	1:A:31:TYR:CE1	2.55	0.41
1:C:258:VAL:HG22	2:D:965:ARG:HA	2.01	0.41
2:D:1041:VAL:HG13	2:D:1046:GLU:HB2	2.02	0.41
1:A:297:PHE:CD2	2:B:956:LYS:HG3	2.56	0.41
1:C:249:TYR:CE2	1:C:251:GLU:HB2	2.56	0.41
2:D:1013:CYS:SG	2:D:1028:LYS:HB3	2.61	0.41
2:D:1102:ILE:HG23	2:D:1128:LEU:HD13	2.03	0.41

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	291/322 (90%)	279 (96%)	10 (3%)	2 (1%)	18	45
1	C	289/322 (90%)	278 (96%)	11 (4%)	0	100	100
2	B	324/356 (91%)	303 (94%)	20 (6%)	1 (0%)	36	63
2	D	316/356 (89%)	299 (95%)	16 (5%)	1 (0%)	36	63
All	All	1220/1356 (90%)	1159 (95%)	57 (5%)	4 (0%)	36	63

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	281	HIS
1	A	111	SER
2	B	1151	ASN
2	D	1151	ASN

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	A	250/272 (92%)	244 (98%)	6 (2%)	43	66
1	C	249/272 (92%)	243 (98%)	6 (2%)	43	66
2	B	288/306 (94%)	273 (95%)	15 (5%)	21	48
2	D	278/306 (91%)	267 (96%)	11 (4%)	28	56
All	All	1065/1156 (92%)	1027 (96%)	38 (4%)	31	58

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	ASN
1	A	76	SER
1	A	114	VAL
1	A	128	LEU
1	A	208	MET
1	A	274	LEU
2	B	947	VAL
2	B	960	LEU
2	B	967	ARG
2	B	1031	SER
2	B	1041	VAL
2	B	1062	VAL
2	B	1073	LEU
2	B	1077	THR
2	B	1092	THR
2	B	1099	VAL
2	B	1104	VAL
2	B	1128	LEU

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Mol	Chain	Res	Type
2	B	1195	GLU
2	B	1205	THR
2	B	1218	ILE
1	C	76	SER
1	C	128	LEU
1	C	161	ARG
1	C	208	MET
1	C	253	LEU
1	C	274	LEU
2	D	943	LEU
2	D	947	VAL
2	D	960	LEU
2	D	1019	VAL
2	D	1041	VAL
2	D	1077	THR
2	D	1092	THR
2	D	1104	VAL
2	D	1128	LEU
2	D	1204	THR
2	D	1205	THR

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	271	ASN
2	D	951	GLN
2	D	971	GLN
2	D	994	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 [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	292/322 (90%)	-0.80	1 (0%) 90 80	34, 54, 95, 165	1 (0%)
1	C	290/322 (90%)	-0.36	2 (0%) 84 66	40, 84, 129, 170	1 (0%)
2	B	330/356 (92%)	-0.53	2 (0%) 85 69	43, 69, 108, 149	0
2	D	318/356 (89%)	-0.52	1 (0%) 90 80	55, 76, 105, 126	0
All	All	1230/1356 (90%)	-0.55	6 (0%) 87 72	34, 72, 111, 170	2 (0%)

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	888	LEU	2.8
1	C	306	PRO	2.3
2	B	889	PRO	2.3
1	C	210	ASP	2.3
2	D	907	PHE	2.2
1	A	281	HIS	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 oligosaccharides 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.