



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 21, 2023 – 12:05 AM JST

PDB ID : 7E15
Title : Protein ternary complex working for DNA replication initiation
Authors : Oyama, T.; Ishino, Y.
Deposited on : 2021-01-30
Resolution : 2.45 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

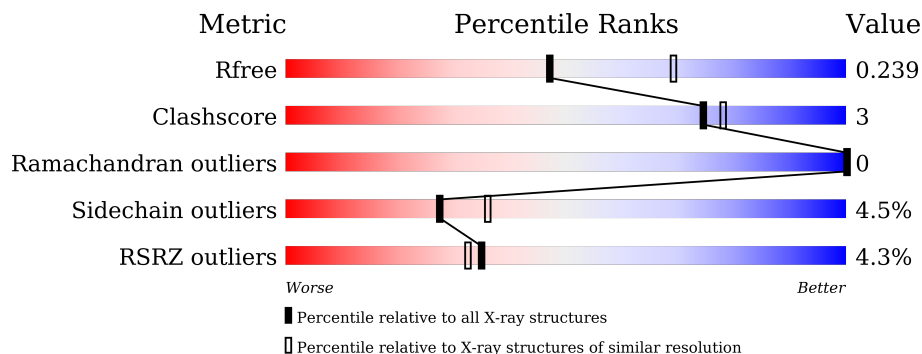
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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 $\leq 5\%$. 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	477	 6% 86% 11%
1	D	477	 4% 85% 10%
2	B	80	 60% 8% 31%
2	E	80	 58% 10% 31%
3	C	64	 2% 88% 8% 5%
3	F	64	 3% 88% 6% 5%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 8974 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 SsDNA-specific exonuclease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	462	3545	2239	624	670	12	0	0	0
1	D	459	3506	2215	614	665	12	0	0	0

- Molecule 2 is a protein called Gins51.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	55	428	279	73	73	3	0	0	0
2	E	55	428	279	73	73	3	0	0	0

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	109	MET	-	initiating methionine	UNP Q5JF31
B	110	GLY	-	expression tag	UNP Q5JF31
B	111	SER	-	expression tag	UNP Q5JF31
B	112	SER	-	expression tag	UNP Q5JF31
B	113	HIS	-	expression tag	UNP Q5JF31
B	114	HIS	-	expression tag	UNP Q5JF31
B	115	HIS	-	expression tag	UNP Q5JF31
B	116	HIS	-	expression tag	UNP Q5JF31
B	117	HIS	-	expression tag	UNP Q5JF31
B	118	HIS	-	expression tag	UNP Q5JF31
B	119	SER	-	expression tag	UNP Q5JF31
B	120	SER	-	expression tag	UNP Q5JF31
B	121	GLY	-	expression tag	UNP Q5JF31
B	122	GLU	-	expression tag	UNP Q5JF31
B	123	ASN	-	expression tag	UNP Q5JF31
B	124	LEU	-	expression tag	UNP Q5JF31

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Chain	Residue	Modelled	Actual	Comment	Reference
B	125	TYR	-	expression tag	UNP Q5JF31
B	126	PHE	-	expression tag	UNP Q5JF31
B	127	GLN	-	expression tag	UNP Q5JF31
B	128	GLY	-	expression tag	UNP Q5JF31
B	129	HIS	-	expression tag	UNP Q5JF31
B	130	MET	-	expression tag	UNP Q5JF31
E	109	MET	-	initiating methionine	UNP Q5JF31
E	110	GLY	-	expression tag	UNP Q5JF31
E	111	SER	-	expression tag	UNP Q5JF31
E	112	SER	-	expression tag	UNP Q5JF31
E	113	HIS	-	expression tag	UNP Q5JF31
E	114	HIS	-	expression tag	UNP Q5JF31
E	115	HIS	-	expression tag	UNP Q5JF31
E	116	HIS	-	expression tag	UNP Q5JF31
E	117	HIS	-	expression tag	UNP Q5JF31
E	118	HIS	-	expression tag	UNP Q5JF31
E	119	SER	-	expression tag	UNP Q5JF31
E	120	SER	-	expression tag	UNP Q5JF31
E	121	GLY	-	expression tag	UNP Q5JF31
E	122	GLU	-	expression tag	UNP Q5JF31
E	123	ASN	-	expression tag	UNP Q5JF31
E	124	LEU	-	expression tag	UNP Q5JF31
E	125	TYR	-	expression tag	UNP Q5JF31
E	126	PHE	-	expression tag	UNP Q5JF31
E	127	GLN	-	expression tag	UNP Q5JF31
E	128	GLY	-	expression tag	UNP Q5JF31
E	129	HIS	-	expression tag	UNP Q5JF31
E	130	MET	-	expression tag	UNP Q5JF31

- Molecule 3 is a protein called DNA polymerase II small subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	61	Total	C	N	O	S	0	0	0
			488	322	78	87	1			
3	F	61	Total	C	N	O	S	0	0	0
			489	322	77	89	1			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	41	Total	O	0	0
			41	41		

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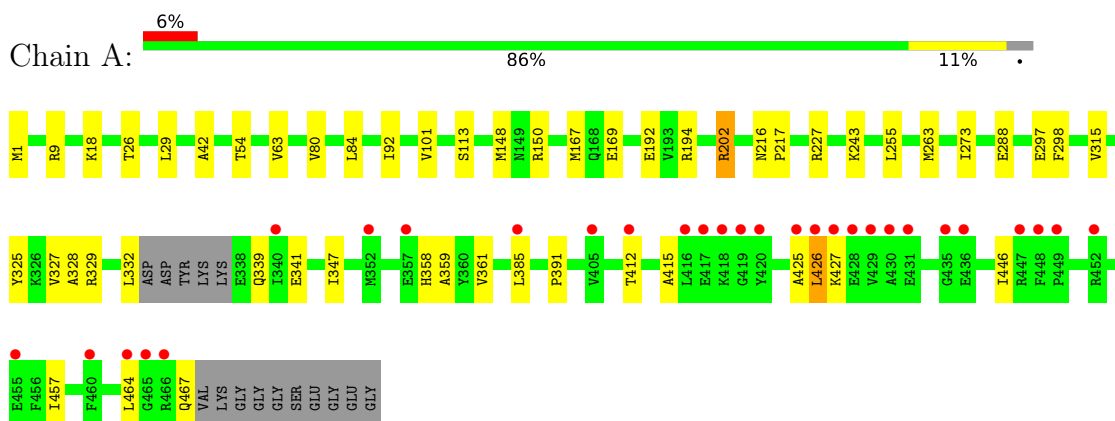
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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	2	Total O 2 2	0	0
4	C	4	Total O 4 4	0	0
4	D	38	Total O 38 38	0	0
4	E	2	Total O 2 2	0	0
4	F	3	Total O 3 3	0	0

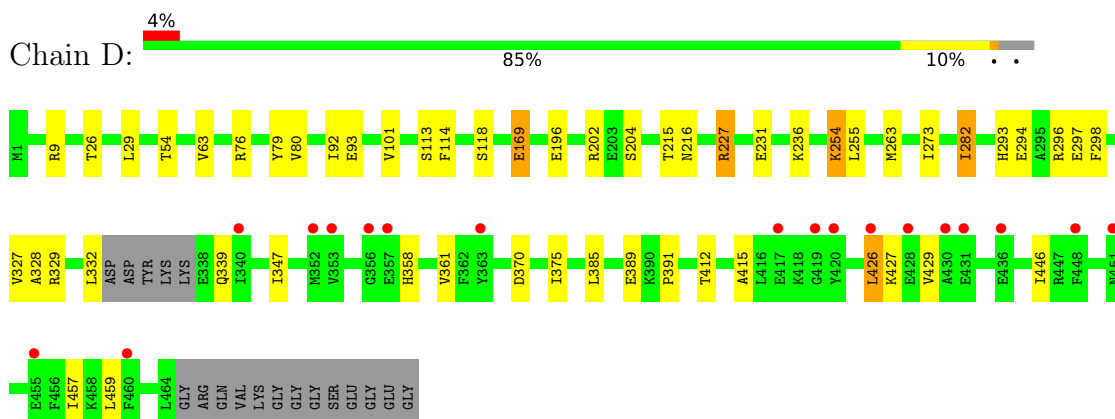
3 Residue-property plots [i](#)

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.

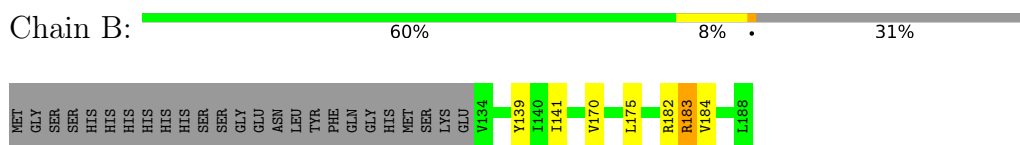
- Molecule 1: SsDNA-specific exonuclease



- Molecule 1: SsDNA-specific exonuclease

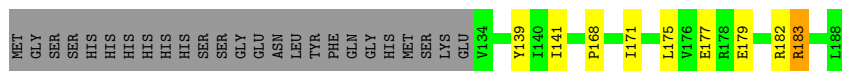


- Molecule 2: Gins51

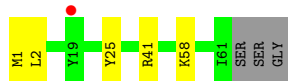
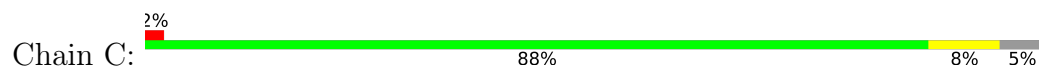


- Molecule 2: Gins51

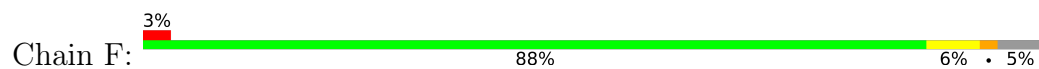




- Molecule 3: DNA polymerase II small subunit



- Molecule 3: DNA polymerase II small subunit



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	69.30Å 48.31Å 205.76Å 90.00° 96.19° 90.00°	Depositor
Resolution (Å)	47.01 – 2.45 47.01 – 2.45	Depositor EDS
% Data completeness (in resolution range)	95.3 (47.01-2.45) 99.3 (47.01-2.45)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.35 (at 2.45Å)	Xtrriage
Refinement program	PHENIX 1.19_4092	Depositor
R, R_{free}	0.216 , 0.242 0.217 , 0.239	Depositor DCC
R_{free} test set	2365 reflections (4.70%)	wwPDB-VP
Wilson B-factor (Å ²)	30.8	Xtrriage
Anisotropy	0.424	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 44.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.54$, $\langle L^2 \rangle = 0.38$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8974	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 48.79 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.1836e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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	0.24	0/3603	0.41	0/4865
1	D	0.24	0/3564	0.41	0/4816
2	B	0.26	0/436	0.42	0/590
2	E	0.26	0/436	0.42	0/590
3	C	0.24	0/497	0.39	0/671
3	F	0.24	0/498	0.40	0/673
All	All	0.24	0/9034	0.41	0/12205

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	3545	0	3496	21	0
1	D	3506	0	3436	27	0
2	B	428	0	452	3	0
2	E	428	0	452	4	0
3	C	488	0	501	2	0
3	F	489	0	496	2	0
4	A	41	0	0	0	0
4	B	2	0	0	0	0
4	C	4	0	0	0	0
4	D	38	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	E	2	0	0	0	0
4	F	3	0	0	0	0
All	All	8974	0	8833	57	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 3.

All (57) 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:D:236:LYS:O	1:D:254:LYS:NZ	2.30	0.65
1:A:202:ARG:NH2	1:A:288:GLU:OE2	2.34	0.61
1:D:263:MET:HE3	1:D:273:ILE:HG12	1.82	0.61
1:A:263:MET:HE3	1:A:273:ILE:HG12	1.84	0.59
1:D:196:GLU:OE1	1:D:202:ARG:NH1	2.36	0.59
1:D:227:ARG:NH2	1:D:231:GLU:OE1	2.36	0.59
1:A:92:ILE:HG21	1:A:101:VAL:HG11	1.86	0.58
3:F:41:ARG:NH1	3:F:53:GLU:OE1	2.36	0.57
1:D:429:VAL:HG13	1:D:459:LEU:HD23	1.87	0.57
1:A:325:TYR:CZ	1:A:329:ARG:HD2	2.40	0.56
1:A:347:ILE:HA	1:A:385:LEU:HD21	1.87	0.55
1:D:426:LEU:HG	1:D:446:ILE:HB	1.89	0.55
1:A:425:ALA:HB2	1:A:467:GLN:HE22	1.73	0.54
1:D:347:ILE:HA	1:D:385:LEU:HD21	1.89	0.54
1:A:426:LEU:HG	1:A:446:ILE:HB	1.90	0.54
1:A:29:LEU:HD23	1:A:80:VAL:HB	1.90	0.53
1:A:26:THR:HG23	1:A:54:THR:HG22	1.92	0.51
1:A:359:ALA:HB2	1:A:464:LEU:HD12	1.94	0.49
1:D:92:ILE:HG21	1:D:101:VAL:HG11	1.94	0.49
1:D:412:THR:HG23	1:D:415:ALA:H	1.78	0.49
1:A:192:GLU:OE1	1:A:194:ARG:NH1	2.35	0.48
1:A:412:THR:HG23	1:A:415:ALA:H	1.78	0.48
1:D:26:THR:HG23	1:D:54:THR:HG22	1.95	0.48
1:D:204:SER:OG	1:D:297:GLU:OE2	2.24	0.48
1:A:358:HIS:O	1:A:391:PRO:HD2	2.12	0.48
1:D:93:GLU:HG3	1:D:114:PHE:HD1	1.80	0.47
2:E:141:ILE:HD12	2:E:175:LEU:HD13	1.96	0.47
1:D:9:ARG:HH22	1:D:113:SER:HB3	1.80	0.46
1:D:361:VAL:HG11	1:D:457:ILE:HG12	1.99	0.45
2:B:139:TYR:CE2	2:B:183:ARG:HG2	2.51	0.45
3:C:2:LEU:HD23	3:C:25:TYR:HB2	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:361:VAL:HG11	1:A:457:ILE:HG12	1.99	0.44
1:D:327:VAL:HG21	2:E:182:ARG:NH2	2.32	0.44
1:D:389:GLU:HA	1:D:415:ALA:HB2	1.99	0.44
2:B:141:ILE:HD12	2:B:175:LEU:HD13	2.00	0.44
1:A:9:ARG:NH2	1:A:113:SER:HB3	2.33	0.43
1:D:29:LEU:HD23	1:D:80:VAL:HB	2.01	0.43
1:D:202:ARG:HD3	1:D:294:GLU:HG3	2.00	0.43
2:E:139:TYR:CE2	2:E:183:ARG:HG2	2.54	0.43
1:D:169:GLU:OE1	1:D:296:ARG:NH2	2.49	0.43
1:A:18:LYS:HD2	1:A:148:MET:HA	2.01	0.42
1:D:9:ARG:NH2	1:D:113:SER:HB3	2.33	0.42
1:D:328:ALA:O	1:D:332:LEU:HG	2.18	0.42
1:D:375:ILE:HG13	4:D:520:HOH:O	2.19	0.42
1:A:425:ALA:HB2	1:A:467:GLN:NE2	2.34	0.42
1:A:42:ALA:HB2	1:A:315:VAL:HG13	2.01	0.42
1:A:328:ALA:O	1:A:332:LEU:HG	2.19	0.42
1:D:358:HIS:O	1:D:391:PRO:HD2	2.20	0.42
2:E:168:PRO:HG2	2:E:171:ILE:HD12	2.01	0.42
1:D:76:ARG:HB2	1:D:79:TYR:CZ	2.55	0.41
1:D:426:LEU:HD12	1:D:426:LEU:HA	1.80	0.41
3:C:58:LYS:HE3	3:C:58:LYS:HB3	1.83	0.41
1:D:282:ILE:HG13	1:D:293:HIS:CE1	2.56	0.41
3:F:33:GLU:OE2	3:F:58:LYS:HE2	2.21	0.41
1:A:216:ASN:HA	1:A:217:PRO:HA	1.91	0.41
1:A:327:VAL:HG21	2:B:182:ARG:NH2	2.36	0.41
1:D:370:ASP:OD1	1:D:370:ASP:N	2.51	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	458/477 (96%)	445 (97%)	13 (3%)	0	100	100
1	D	455/477 (95%)	443 (97%)	12 (3%)	0	100	100
2	B	53/80 (66%)	51 (96%)	2 (4%)	0	100	100
2	E	53/80 (66%)	53 (100%)	0	0	100	100
3	C	59/64 (92%)	58 (98%)	1 (2%)	0	100	100
3	F	59/64 (92%)	57 (97%)	2 (3%)	0	100	100
All	All	1137/1242 (92%)	1107 (97%)	30 (3%)	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	355/383 (93%)	339 (96%)	16 (4%)	27	36
1	D	349/383 (91%)	335 (96%)	14 (4%)	31	41
2	B	44/66 (67%)	41 (93%)	3 (7%)	16	19
2	E	44/66 (67%)	41 (93%)	3 (7%)	16	19
3	C	51/55 (93%)	49 (96%)	2 (4%)	32	42
3	F	51/55 (93%)	49 (96%)	2 (4%)	32	42
All	All	894/1008 (89%)	854 (96%)	40 (4%)	27	36

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	63	VAL
1	A	84	LEU
1	A	150	ARG
1	A	167	MET
1	A	169	GLU
1	A	202	ARG

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Mol	Chain	Res	Type
1	A	227	ARG
1	A	243	LYS
1	A	255	LEU
1	A	297	GLU
1	A	298	PHE
1	A	339	GLN
1	A	341	GLU
1	A	426	LEU
1	A	427	LYS
2	B	170	VAL
2	B	183	ARG
2	B	184	VAL
3	C	1	MET
3	C	41	ARG
1	D	63	VAL
1	D	118	SER
1	D	169	GLU
1	D	215	THR
1	D	216	ASN
1	D	227	ARG
1	D	254	LYS
1	D	255	LEU
1	D	282	ILE
1	D	298	PHE
1	D	329	ARG
1	D	339	GLN
1	D	426	LEU
1	D	427	LYS
2	E	177	GLU
2	E	179	GLU
2	E	183	ARG
3	F	2	LEU
3	F	41	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA

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	462/477 (96%)	0.09	29 (6%) 20 16	12, 29, 84, 93	0
1	D	459/477 (96%)	0.05	18 (3%) 39 36	12, 29, 83, 95	0
2	B	55/80 (68%)	-0.33	0 100 100	17, 28, 50, 55	0
2	E	55/80 (68%)	-0.27	0 100 100	20, 28, 49, 57	0
3	C	61/64 (95%)	-0.29	1 (1%) 72 69	22, 33, 51, 57	0
3	F	61/64 (95%)	-0.18	2 (3%) 46 43	24, 34, 52, 56	0
All	All	1153/1242 (92%)	0.00	50 (4%) 35 32	12, 30, 82, 95	0

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	419	GLY	4.7
1	A	464	LEU	4.5
1	A	435	GLY	3.7
1	A	429	VAL	3.7
1	D	340	ILE	3.7
1	D	357	GLU	3.6
1	A	420	TYR	3.6
1	D	420	TYR	3.3
1	A	448	PHE	3.1
1	D	417	GLU	3.1
1	D	431	GLU	3.0
1	D	460	PHE	3.0
1	D	436	GLU	3.0
1	A	460	PHE	2.9
1	A	417	GLU	2.9
1	A	431	GLU	2.8
1	A	430	ALA	2.8
3	F	19	TYR	2.7
1	D	352	MET	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	385	LEU	2.7
1	A	449	PRO	2.6
1	A	418	LYS	2.6
1	A	447	ARG	2.6
1	A	352	MET	2.6
1	D	419	GLY	2.5
1	A	436	GLU	2.5
1	D	353	VAL	2.4
1	A	340	ILE	2.4
1	A	357	GLU	2.4
1	A	412	THR	2.4
1	A	465	GLY	2.3
3	C	19	TYR	2.3
1	A	427	LYS	2.2
1	D	363	TYR	2.2
1	A	425	ALA	2.2
1	A	416	LEU	2.2
1	A	405	VAL	2.2
1	A	455	GLU	2.2
3	F	61	ILE	2.1
1	A	426	LEU	2.1
1	A	466	ARG	2.1
1	D	428	GLU	2.1
1	D	451	ASN	2.1
1	D	455	GLU	2.1
1	D	356	GLY	2.1
1	A	428	GLU	2.1
1	D	426	LEU	2.1
1	A	452	ARG	2.0
1	D	448	PHE	2.0
1	D	430	ALA	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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.