



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 11:38 AM UTC

PDB ID : 3P16 / pdb_00003p16
Title : Crystal structure of DNA polymerase III sliding clamp
Authors : Gui, W.J.; Lin, S.Q.; Chen, Y.Y.; Zhang, X.E.; Bi, L.J.; Jiang, T.
Deposited on : 2010-09-30
Resolution : 2.89 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

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

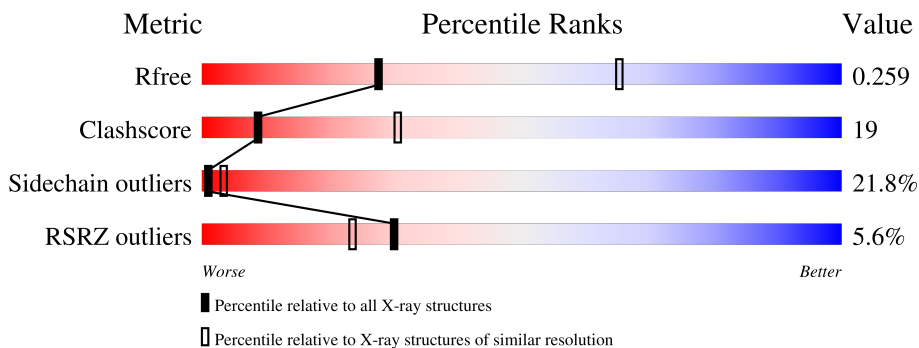
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.89 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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	408	5% 54% 38% 8%
1	B	408	4% 60% 31% 6%
1	C	408	6% 55% 28% 8% 9%
1	D	408	4% 54% 31% 5% 10%
1	E	408	5% 52% 30% 9% 10%
1	F	408	7% 51% 33% 7% 9%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 16587 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 DNA polymerase III subunit beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	375	Total	C	N	O	S	0	0	0
			2776	1755	474	541	6			
1	B	383	Total	C	N	O	S	0	0	0
			2836	1796	485	549	6			
1	C	370	Total	C	N	O	S	0	0	0
			2744	1737	469	532	6			
1	D	369	Total	C	N	O	S	0	0	0
			2738	1734	468	530	6			
1	E	369	Total	C	N	O	S	0	0	0
			2738	1734	468	530	6			
1	F	372	Total	C	N	O	S	0	0	0
			2755	1744	471	534	6			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	HIS	-	expression tag	UNP Q50790
A	-4	HIS	-	expression tag	UNP Q50790
A	-3	HIS	-	expression tag	UNP Q50790
A	-2	HIS	-	expression tag	UNP Q50790
A	-1	HIS	-	expression tag	UNP Q50790
A	0	HIS	-	expression tag	UNP Q50790
B	-5	HIS	-	expression tag	UNP Q50790
B	-4	HIS	-	expression tag	UNP Q50790
B	-3	HIS	-	expression tag	UNP Q50790
B	-2	HIS	-	expression tag	UNP Q50790
B	-1	HIS	-	expression tag	UNP Q50790
B	0	HIS	-	expression tag	UNP Q50790
C	-5	HIS	-	expression tag	UNP Q50790
C	-4	HIS	-	expression tag	UNP Q50790
C	-3	HIS	-	expression tag	UNP Q50790
C	-2	HIS	-	expression tag	UNP Q50790
C	-1	HIS	-	expression tag	UNP Q50790

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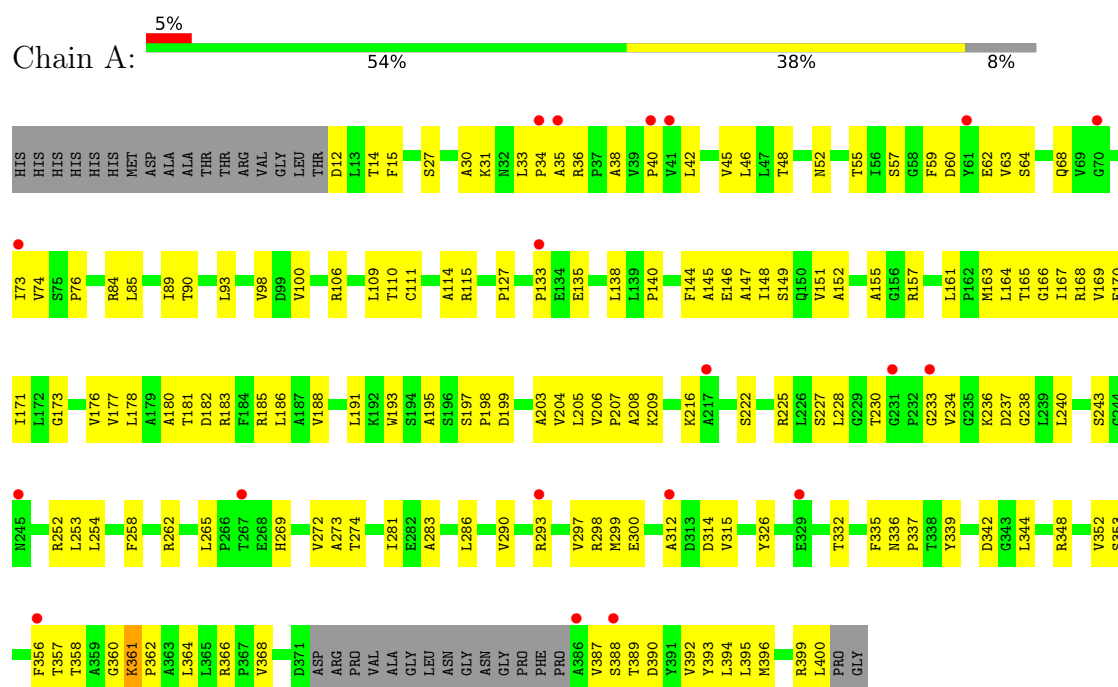
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Chain	Residue	Modelled	Actual	Comment	Reference
C	0	HIS	-	expression tag	UNP Q50790
D	-5	HIS	-	expression tag	UNP Q50790
D	-4	HIS	-	expression tag	UNP Q50790
D	-3	HIS	-	expression tag	UNP Q50790
D	-2	HIS	-	expression tag	UNP Q50790
D	-1	HIS	-	expression tag	UNP Q50790
D	0	HIS	-	expression tag	UNP Q50790
E	-5	HIS	-	expression tag	UNP Q50790
E	-4	HIS	-	expression tag	UNP Q50790
E	-3	HIS	-	expression tag	UNP Q50790
E	-2	HIS	-	expression tag	UNP Q50790
E	-1	HIS	-	expression tag	UNP Q50790
E	0	HIS	-	expression tag	UNP Q50790
F	-5	HIS	-	expression tag	UNP Q50790
F	-4	HIS	-	expression tag	UNP Q50790
F	-3	HIS	-	expression tag	UNP Q50790
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F	-1	HIS	-	expression tag	UNP Q50790
F	0	HIS	-	expression tag	UNP Q50790

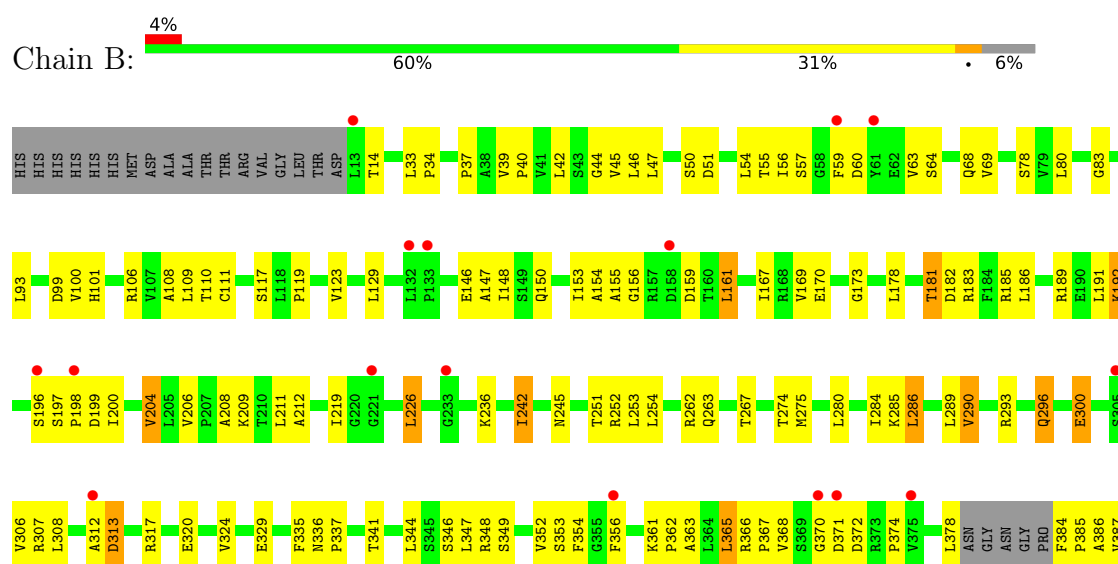
3 Residue-property plots

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: DNA polymerase III subunit beta

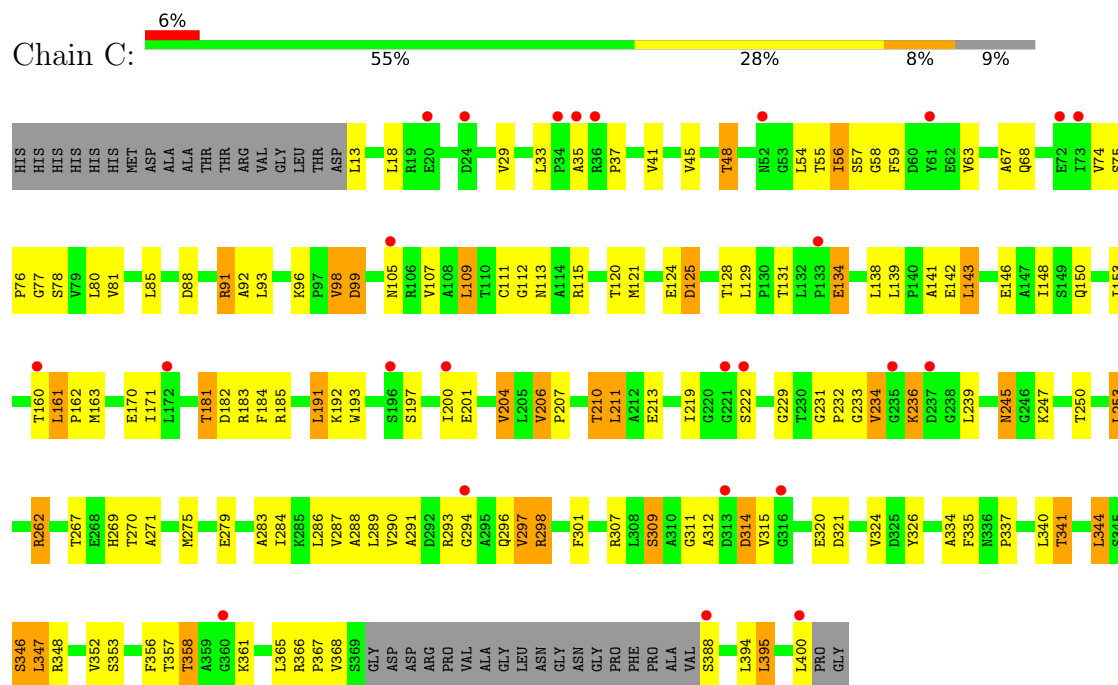


• Molecule 1: DNA polymerase III subunit beta

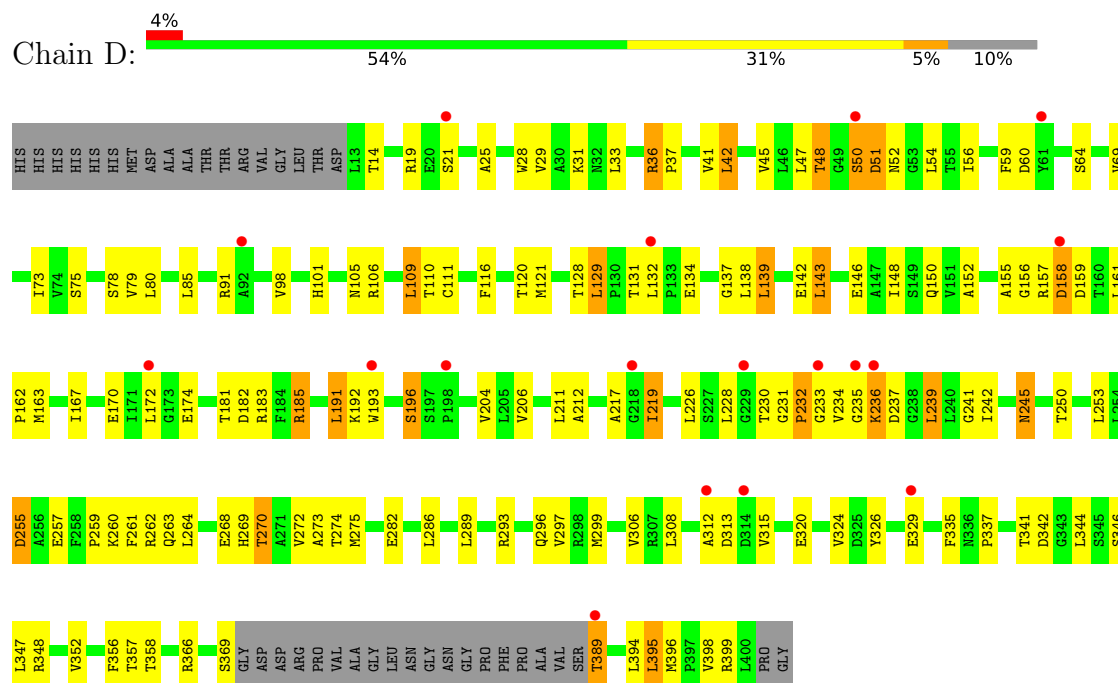




• Molecule 1: DNA polymerase III subunit beta

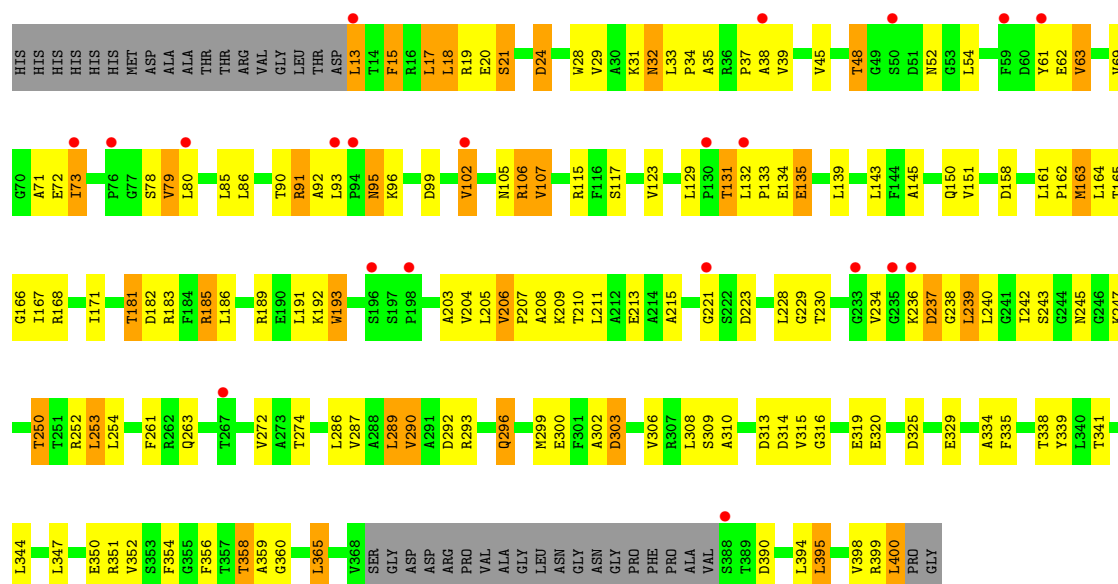


• Molecule 1: DNA polymerase III subunit beta

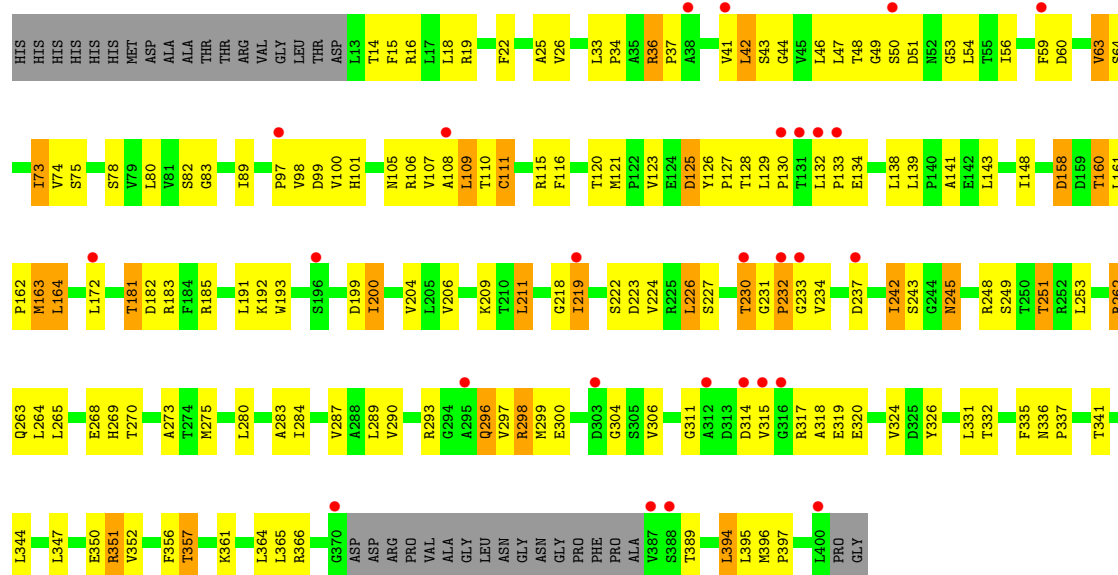


• Molecule 1: DNA polymerase III subunit beta





• Molecule 1: DNA polymerase III subunit beta



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	88.05Å 132.97Å 113.78Å 90.00° 109.05° 90.00°	Depositor
Resolution (Å)	50.00 – 2.89 50.00 – 2.89	Depositor EDS
% Data completeness (in resolution range)	97.7 (50.00-2.89) 97.7 (50.00-2.89)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.08 (at 2.90Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.260 , 0.287 (Not available) , 0.259	Depositor DCC
R_{free} test set	2746 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	59.4	Xtriage
Anisotropy	0.277	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 49.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	16587	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.11% 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	0.67	0/2821	0.96	2/3845 (0.1%)
1	B	0.61	0/2884	0.95	6/3932 (0.2%)
1	C	0.61	0/2789	0.95	3/3801 (0.1%)
1	D	0.58	0/2783	0.90	3/3793 (0.1%)
1	E	0.67	0/2783	0.96	4/3793 (0.1%)
1	F	0.63	1/2800 (0.0%)	0.95	4/3816 (0.1%)
All	All	0.63	1/16860 (0.0%)	0.94	22/22980 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	296	GLN	CA-C	5.42	1.55	1.52

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	296	GLN	N-CA-C	6.77	119.45	108.76
1	B	181	THR	N-CA-C	6.73	119.35	108.32
1	E	15	PHE	N-CA-C	6.53	118.78	108.79
1	C	181	THR	N-CA-C	6.32	119.00	108.13
1	B	161	LEU	CA-C-N	5.83	125.97	119.32

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	2776	0	2826	165	0
1	B	2836	0	2890	92	0
1	C	2744	0	2801	79	0
1	D	2738	0	2796	93	0
1	E	2738	0	2796	121	0
1	F	2755	0	2813	105	0
All	All	16587	0	16922	626	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 19.

The worst 5 of 626 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:E:234:VAL:HG11	1:E:236:LYS:NZ	1.48	1.28
1:A:30:ALA:HA	1:A:34:PRO:HG2	1.24	1.16
1:A:161:LEU:HD12	1:A:161:LEU:H	1.01	1.15
1:E:234:VAL:HG22	1:E:236:LYS:HG3	1.23	1.11
1:E:134:GLU:OE1	1:E:230:THR:HG22	1.49	1.08

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	B	170/322 (53%)	133 (78%)	37 (22%)	1	3
1	C	294/322 (91%)	229 (78%)	65 (22%)	1	3

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	293/322 (91%)	231 (79%)	62 (21%)	1	4
1	E	293/322 (91%)	228 (78%)	65 (22%)	1	3
1	F	295/322 (92%)	231 (78%)	64 (22%)	1	3
All	All	1345/1610 (84%)	1052 (78%)	293 (22%)	1	3

5 of 293 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	33	LEU
1	F	347	LEU
1	F	78	SER
1	F	199	ASP
1	C	368	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	263	GLN
1	E	32	ASN
1	F	245	ASN
1	F	101	HIS
1	F	105	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 [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 [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	375/408 (91%)	0.56	19 (5%)	33	26	24, 50, 81, 95	0
1	B	383/408 (93%)	0.41	16 (4%)	40	32	17, 49, 80, 100	0
1	C	370/408 (90%)	0.48	25 (6%)	23	18	19, 46, 79, 122	0
1	D	369/408 (90%)	0.39	18 (4%)	35	27	21, 47, 79, 103	0
1	E	369/408 (90%)	0.58	21 (5%)	29	23	24, 52, 85, 118	0
1	F	372/408 (91%)	0.51	27 (7%)	21	17	19, 49, 85, 102	0
All	All	2238/2448 (91%)	0.49	126 (5%)	30	23	17, 49, 83, 122	0

The worst 5 of 126 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	295	ALA	5.6
1	F	50	SER	5.5
1	D	235	GLY	5.2
1	F	387	VAL	4.7
1	E	236	LYS	4.6

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.