



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 24, 2021 – 01:08 pm GMT

PDB ID : 7AZE  
Title : DNA polymerase sliding clamp from Escherichia coli with peptide 18 bound  
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G.; Burnouf, D.Y.  
Deposited on : 2020-11-16  
Resolution : 1.82 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](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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.4 (270009), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.23.2  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0267  
CCP4 : 7.1.010 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

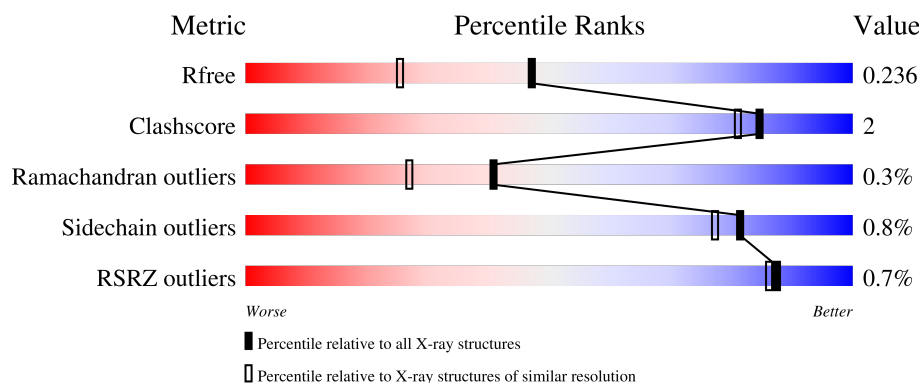
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.82 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	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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	386	<div> <div style="width: 100%; height: 10px; background-color: red; position: relative;"> <span style="position: absolute; top: -10px; left: 0;">%</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>90%</span> <span>5%</span> <span>5%</span> </div> </div>
1	B	386	<div> <div style="width: 100%; height: 10px; background-color: green; position: relative;"> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>88%</span> <span>6%</span> <span>6%</span> </div> </div>
2	H	6	<div> <div style="width: 100%; height: 10px; background-color: green; position: relative;"> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>67%</span> <span>33%</span> </div> </div>
2	I	6	<div> <div style="width: 100%; height: 10px; background-color: green; position: relative;"> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>50%</span> <span>17%</span> <span>33%</span> </div> </div>

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 6728 atoms, of which 31 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 Beta sliding clamp.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	368	Total	C	N	O	S	0	6	0
			2890	1815	507	549	19			
1	B	364	Total	C	N	O	S	0	9	0
			2875	1814	498	543	20			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP A0A073FMV0
A	-18	GLY	-	expression tag	UNP A0A073FMV0
A	-17	SER	-	expression tag	UNP A0A073FMV0
A	-16	SER	-	expression tag	UNP A0A073FMV0
A	-15	HIS	-	expression tag	UNP A0A073FMV0
A	-14	HIS	-	expression tag	UNP A0A073FMV0
A	-13	HIS	-	expression tag	UNP A0A073FMV0
A	-12	HIS	-	expression tag	UNP A0A073FMV0
A	-11	HIS	-	expression tag	UNP A0A073FMV0
A	-10	HIS	-	expression tag	UNP A0A073FMV0
A	-9	SER	-	expression tag	UNP A0A073FMV0
A	-8	SER	-	expression tag	UNP A0A073FMV0
A	-7	GLY	-	expression tag	UNP A0A073FMV0
A	-6	LEU	-	expression tag	UNP A0A073FMV0
A	-5	VAL	-	expression tag	UNP A0A073FMV0
A	-4	PRO	-	expression tag	UNP A0A073FMV0
A	-3	ARG	-	expression tag	UNP A0A073FMV0
A	-2	GLY	-	expression tag	UNP A0A073FMV0
A	-1	SER	-	expression tag	UNP A0A073FMV0
A	0	HIS	-	expression tag	UNP A0A073FMV0
B	-19	MET	-	initiating methionine	UNP A0A073FMV0
B	-18	GLY	-	expression tag	UNP A0A073FMV0
B	-17	SER	-	expression tag	UNP A0A073FMV0
B	-16	SER	-	expression tag	UNP A0A073FMV0
B	-15	HIS	-	expression tag	UNP A0A073FMV0

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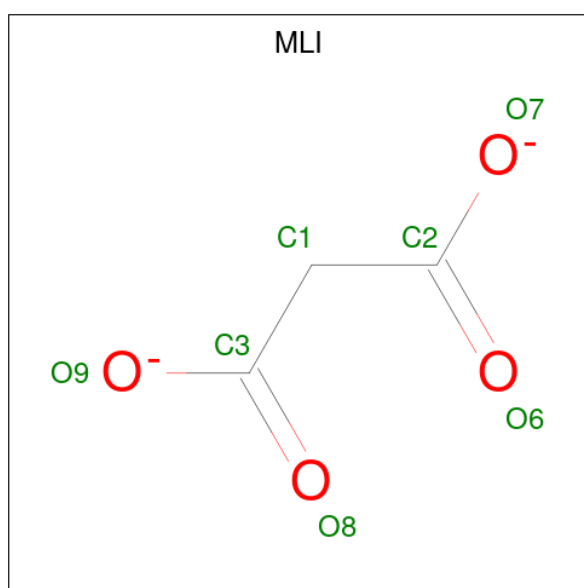
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Chain	Residue	Modelled	Actual	Comment	Reference
B	-14	HIS	-	expression tag	UNP A0A073FMV0
B	-13	HIS	-	expression tag	UNP A0A073FMV0
B	-12	HIS	-	expression tag	UNP A0A073FMV0
B	-11	HIS	-	expression tag	UNP A0A073FMV0
B	-10	HIS	-	expression tag	UNP A0A073FMV0
B	-9	SER	-	expression tag	UNP A0A073FMV0
B	-8	SER	-	expression tag	UNP A0A073FMV0
B	-7	GLY	-	expression tag	UNP A0A073FMV0
B	-6	LEU	-	expression tag	UNP A0A073FMV0
B	-5	VAL	-	expression tag	UNP A0A073FMV0
B	-4	PRO	-	expression tag	UNP A0A073FMV0
B	-3	ARG	-	expression tag	UNP A0A073FMV0
B	-2	GLY	-	expression tag	UNP A0A073FMV0
B	-1	SER	-	expression tag	UNP A0A073FMV0
B	0	HIS	-	expression tag	UNP A0A073FMV0

- Molecule 2 is a protein called Peptide 18.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	H	4	Total	C	N	O	0	0	0
			39	28	4	7			
2	I	4	Total	C	N	O	0	0	0
			39	28	4	7			

- Molecule 3 is MALONATE ION (three-letter code: MLI) (formula:  $C_3H_2O_4$ ).



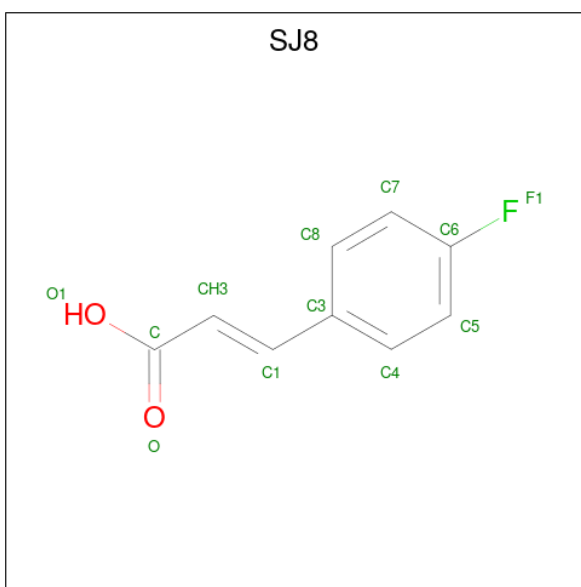
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	0	0
			9	3	2	4		

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



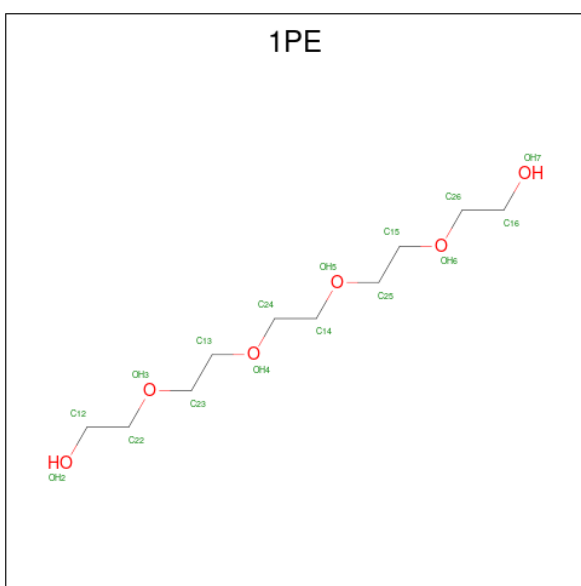
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	H	O	0	0
			14	3	8	3		
4	B	1	Total	C	H	O	0	0
			14	3	8	3		

- Molecule 5 is ( {E} )-3-(4-fluorophenyl)prop-2-enoic acid (three-letter code: SJ8) (formula:  $C_9H_7FO_2$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	F	O	0	0
			11	9	1	1		
5	B	1	Total	C	F	O	0	0
			11	9	1	1		

- Molecule 6 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula:  $C_{10}H_{22}O_6$ ).



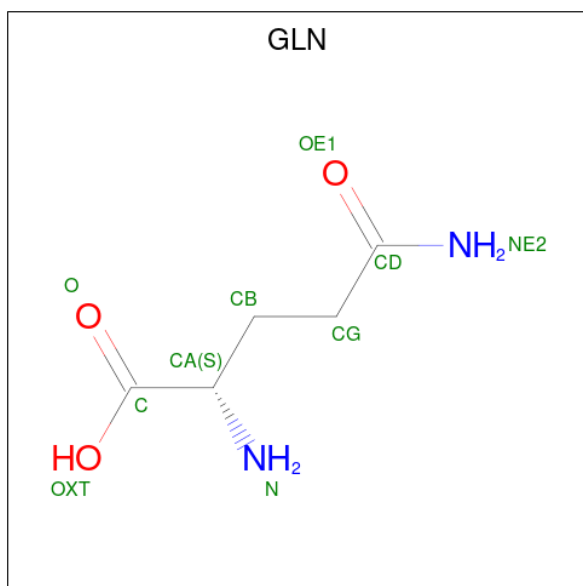
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			13	8	5		
6	B	1	Total	C	O	0	0
			13	8	5		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	B	1	Total	C	H	O	0	0
			23	6	13	4		

- Molecule 7 is GLUTAMINE (three-letter code: GLN) (formula:  $C_5H_{10}N_2O_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	H	1	Total	C	N	O	0	0
			9	5	2	2		
7	I	1	Total	C	N	O	0	0
			9	5	2	2		

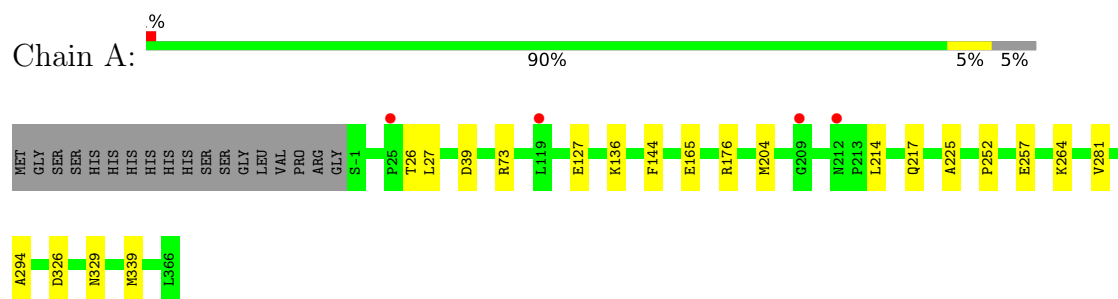
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	356	Total	O	0	8
			364	364		
8	B	364	Total	O	0	10
			374	374		
8	H	10	Total	O	0	1
			11	11		
8	I	10	Total	O	0	0
			10	10		

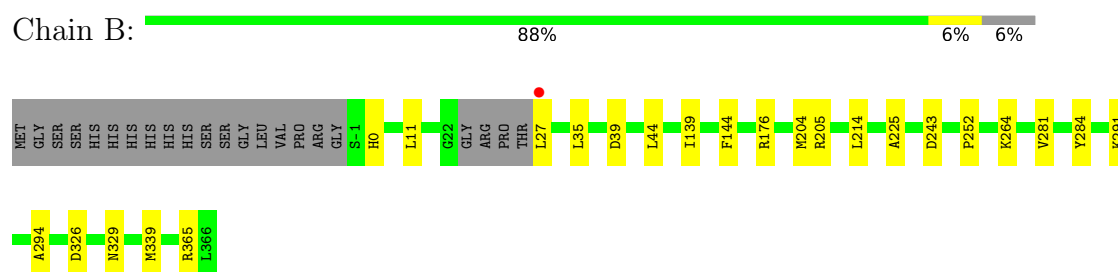
### 3 Residue-property plots [i](#)

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.

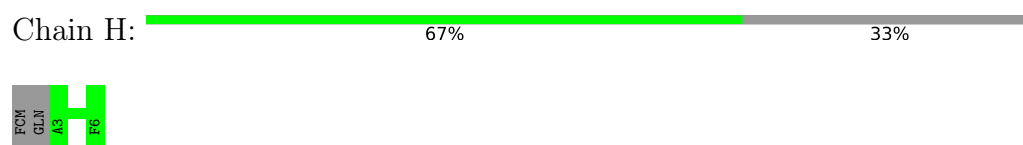
- Molecule 1: Beta sliding clamp



- Molecule 1: Beta sliding clamp



- Molecule 2: Peptide 18



- Molecule 2: Peptide 18





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	63.50Å 64.81Å 71.10Å 106.71° 100.07° 116.95°	Depositor
Resolution (Å)	52.87 – 1.82 52.86 – 1.82	Depositor EDS
% Data completeness (in resolution range)	74.5 (52.87-1.82) 74.5 (52.86-1.82)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.69 (at 1.82Å)	Xtriage
Refinement program	BUSTER 2.10.3	Depositor
R, $R_{free}$	0.193 , 0.230 0.201 , 0.236	Depositor DCC
$R_{free}$ test set	3008 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	22.6	Xtriage
Anisotropy	0.020	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	(Not available) , (Not available)	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.219 for k,h,-h-k-l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6728	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.73% 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: GOL, SJ8, ALC, MLI, 1PE

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	0.51	0/2953	0.67	0/3999
1	B	0.50	0/2949	0.65	0/3989
2	H	0.48	0/28	0.56	0/35
2	I	0.57	0/28	0.59	0/35
All	All	0.50	0/5958	0.66	0/8058

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	2890	0	2889	11	0
1	B	2875	0	2902	16	0
2	H	39	0	38	0	0
2	I	39	0	38	1	0
3	A	7	2	2	0	0
4	A	6	8	8	0	0
4	B	6	8	8	0	0
5	A	11	0	0	0	0
5	B	11	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	13	0	17	2	0
6	B	23	13	30	2	0
7	H	9	0	7	0	0
7	I	9	0	7	0	0
8	A	364	0	0	0	0
8	B	374	0	0	2	0
8	H	11	0	0	0	0
8	I	10	0	0	0	0
All	All	6697	31	5946	27	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 2.

All (27) 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:127[B]:GLU:HG2	1:A:217:GLN:HG2	1.80	0.63
1:B:365:ARG:HB2	2:I:3:ALC:HZ3	1.80	0.63
1:B:139:ILE:HG21	1:B:204:MET:HG2	1.82	0.62
1:B:243:ASP:H	6:B:604:1PE:C13	2.15	0.60
1:B:35:LEU:HD22	1:B:44[B]:LEU:CD2	2.32	0.59
1:A:264:LYS:HD2	1:A:329:ASN:OD1	2.04	0.57
1:B:35:LEU:HD22	1:B:44[B]:LEU:HD22	1.86	0.57
1:B:0[B]:HIS:HD2	8:B:922:HOH:O	1.90	0.54
1:B:281:VAL:HG12	1:B:294:ALA:HB2	1.95	0.49
1:B:243:ASP:H	6:B:604:1PE:H132	1.78	0.49
1:A:281:VAL:HG12	1:A:294:ALA:HB2	1.96	0.48
1:B:205[B]:ARG:HG2	1:B:205[B]:ARG:HH11	1.80	0.47
1:A:136:LYS:HG3	1:A:204:MET:HE1	1.98	0.46
1:A:73[B]:ARG:HE	6:A:404:1PE:H132	1.81	0.45
1:A:136:LYS:HG3	1:A:204:MET:CE	2.46	0.45
1:A:73[A]:ARG:HD2	6:A:404:1PE:H132	1.98	0.45
1:B:0[B]:HIS:CD2	8:B:922:HOH:O	2.70	0.42
1:B:252:PRO:HB2	1:B:339:MET:HB3	2.01	0.42
1:A:214:LEU:HD11	1:A:225:ALA:HB1	2.01	0.42
1:B:284[B]:TYR:HB2	1:B:291:LYS:HB3	2.01	0.41
1:A:252:PRO:HB2	1:A:339:MET:HB3	2.02	0.41
1:B:264:LYS:HD2	1:B:329:ASN:OD1	2.20	0.41
1:A:26:THR:HG23	1:A:27:LEU:H	1.85	0.41
1:B:144:PHE:CD1	1:B:326:ASP:HB3	2.55	0.41
1:B:214:LEU:HD11	1:B:225:ALA:HB1	2.02	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:144:PHE:CD1	1:A:326:ASP:HB3	2.56	0.40
1:B:11:LEU:HD23	1:B:11:LEU:HA	1.93	0.40

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	372/386 (96%)	361 (97%)	10 (3%)	1 (0%)	41	27
1	B	369/386 (96%)	359 (97%)	9 (2%)	1 (0%)	41	27
2	H	2/6 (33%)	2 (100%)	0	0	100	100
2	I	2/6 (33%)	2 (100%)	0	0	100	100
All	All	745/784 (95%)	724 (97%)	19 (3%)	2 (0%)	41	27

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	39	ASP
1	B	39	ASP

### 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	317/330 (96%)	314 (99%)	3 (1%)	78	74
1	B	319/330 (97%)	317 (99%)	2 (1%)	86	83
2	H	3/4 (75%)	3 (100%)	0	100	100
2	I	3/4 (75%)	3 (100%)	0	100	100
All	All	642/668 (96%)	637 (99%)	5 (1%)	81	77

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	165	GLU
1	A	176	ARG
1	A	257	GLU
1	B	27	LEU
1	B	176	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	186	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

10 ligands are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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	368/386 (95%)	-0.30	4 (1%) 80 78	13, 25, 47, 62	0
1	B	364/386 (94%)	-0.32	1 (0%) 94 92	12, 24, 47, 70	0
2	H	3/6 (50%)	-0.62	0 100 100	23, 23, 25, 33	0
2	I	3/6 (50%)	-0.53	0 100 100	22, 22, 24, 28	0
All	All	738/784 (94%)	-0.31	5 (0%) 87 86	12, 25, 47, 70	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	25	PRO	2.4
1	A	209	GLY	2.3
1	B	27	LEU	2.3
1	A	212	ASN	2.2
1	A	119	LEU	2.2

### 6.2 Non-standard residues in protein, DNA, RNA chains [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(Å <sup>2</sup> )	Q<0.9
2	ALC	I	3	11/12	0.95	0.09	17,21,29,29	0
2	ALC	H	3	11/12	0.96	0.10	23,26,33,33	0

### 6.3 Carbohydrates [i](#)

There are no monosaccharides 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(Å <sup>2</sup> )	Q<0.9
3	MLI	A	401	7/7	0.79	0.15	22,31,35,35	9
6	1PE	B	604	10/16	0.85	0.27	20,20,25,29	23
4	GOL	B	601	6/6	0.86	0.22	23,23,24,24	14
6	1PE	B	603	13/16	0.88	0.14	56,58,65,65	0
5	SJ8	A	403	11/12	0.88	0.18	28,46,52,53	0
4	GOL	A	402	6/6	0.92	0.11	22,23,23,23	14
5	SJ8	B	602	11/12	0.93	0.14	20,32,42,46	0
6	1PE	A	404	13/16	0.96	0.08	34,37,47,49	0
7	GLN	H	101	9/10	0.96	0.08	21,24,27,28	0
7	GLN	I	101	9/10	0.97	0.08	14,16,22,23	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.