



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 30, 2023 – 12:29 PM EDT

PDB ID : 8G9Z  
Title : High-resolution crystal structure of the human selenomethionine-derived SepSecS-tRNA<sup>Sec</sup> complex  
Authors : Puppala, A.; Simonovic, M.; Castillo Suchkou, J.  
Deposited on : 2023-02-22  
Resolution : 2.07 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.

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 : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.32.2  
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) : 2.32.2

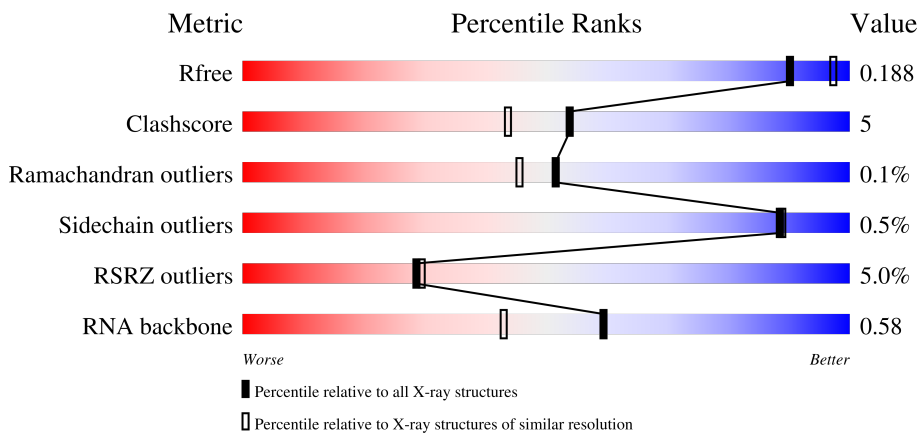
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.07 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.



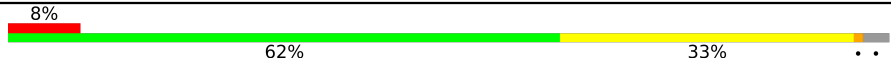
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	2684 (2.08-2.04)
Clashscore	141614	2801 (2.08-2.04)
Ramachandran outliers	138981	2768 (2.08-2.04)
Sidechain outliers	138945	2768 (2.08-2.04)
RSRZ outliers	127900	2646 (2.08-2.04)
RNA backbone	3102	1015 (2.52-1.60)

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	521	<div style="display: flex; align-items: center;"> <div style="width: 4%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 81%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 8%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 11%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">4%      81%      8%      11%</p>
1	B	521	<div style="display: flex; align-items: center;"> <div style="width: 4%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 79%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 8%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 12%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">4%      79%      8%      12%</p>
1	C	521	<div style="display: flex; align-items: center;"> <div style="width: 4%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 79%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 11%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 10%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">4%      79%      11%      10%</p>
1	D	521	<div style="display: flex; align-items: center;"> <div style="width: 4%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 78%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 10%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 12%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">4%      78%      10%      12%</p>

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Mol	Chain	Length	Quality of chain
2	E	90	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	MPD	C	1002	-	-	-	X

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 19942 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 O-phosphoseryl-tRNA(Sec) selenium transferase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	466	3725	2371	653	672	14	15	0	24	0
1	B	456	3672	2339	644	660	14	15	0	27	0
1	C	468	3788	2414	664	681	14	15	0	31	0
1	D	457	3694	2351	650	664	14	15	0	30	0

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MSE	-	expression tag	UNP Q9HD40
A	-18	GLY	-	expression tag	UNP Q9HD40
A	-17	SER	-	expression tag	UNP Q9HD40
A	-16	SER	-	expression tag	UNP Q9HD40
A	-15	HIS	-	expression tag	UNP Q9HD40
A	-14	HIS	-	expression tag	UNP Q9HD40
A	-13	HIS	-	expression tag	UNP Q9HD40
A	-12	HIS	-	expression tag	UNP Q9HD40
A	-11	HIS	-	expression tag	UNP Q9HD40
A	-10	HIS	-	expression tag	UNP Q9HD40
A	-9	SER	-	expression tag	UNP Q9HD40
A	-8	SER	-	expression tag	UNP Q9HD40
A	-7	GLY	-	expression tag	UNP Q9HD40
A	-6	LEU	-	expression tag	UNP Q9HD40
A	-5	VAL	-	expression tag	UNP Q9HD40
A	-4	PRO	-	expression tag	UNP Q9HD40
A	-3	ARG	-	expression tag	UNP Q9HD40
A	-2	GLY	-	expression tag	UNP Q9HD40
A	-1	SER	-	expression tag	UNP Q9HD40
A	0	HIS	-	expression tag	UNP Q9HD40
A	491	ALA	VAL	engineered mutation	UNP Q9HD40

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	MSE	-	expression tag	UNP Q9HD40
B	-18	GLY	-	expression tag	UNP Q9HD40
B	-17	SER	-	expression tag	UNP Q9HD40
B	-16	SER	-	expression tag	UNP Q9HD40
B	-15	HIS	-	expression tag	UNP Q9HD40
B	-14	HIS	-	expression tag	UNP Q9HD40
B	-13	HIS	-	expression tag	UNP Q9HD40
B	-12	HIS	-	expression tag	UNP Q9HD40
B	-11	HIS	-	expression tag	UNP Q9HD40
B	-10	HIS	-	expression tag	UNP Q9HD40
B	-9	SER	-	expression tag	UNP Q9HD40
B	-8	SER	-	expression tag	UNP Q9HD40
B	-7	GLY	-	expression tag	UNP Q9HD40
B	-6	LEU	-	expression tag	UNP Q9HD40
B	-5	VAL	-	expression tag	UNP Q9HD40
B	-4	PRO	-	expression tag	UNP Q9HD40
B	-3	ARG	-	expression tag	UNP Q9HD40
B	-2	GLY	-	expression tag	UNP Q9HD40
B	-1	SER	-	expression tag	UNP Q9HD40
B	0	HIS	-	expression tag	UNP Q9HD40
B	491	ALA	VAL	engineered mutation	UNP Q9HD40
C	-19	MSE	-	expression tag	UNP Q9HD40
C	-18	GLY	-	expression tag	UNP Q9HD40
C	-17	SER	-	expression tag	UNP Q9HD40
C	-16	SER	-	expression tag	UNP Q9HD40
C	-15	HIS	-	expression tag	UNP Q9HD40
C	-14	HIS	-	expression tag	UNP Q9HD40
C	-13	HIS	-	expression tag	UNP Q9HD40
C	-12	HIS	-	expression tag	UNP Q9HD40
C	-11	HIS	-	expression tag	UNP Q9HD40
C	-10	HIS	-	expression tag	UNP Q9HD40
C	-9	SER	-	expression tag	UNP Q9HD40
C	-8	SER	-	expression tag	UNP Q9HD40
C	-7	GLY	-	expression tag	UNP Q9HD40
C	-6	LEU	-	expression tag	UNP Q9HD40
C	-5	VAL	-	expression tag	UNP Q9HD40
C	-4	PRO	-	expression tag	UNP Q9HD40
C	-3	ARG	-	expression tag	UNP Q9HD40
C	-2	GLY	-	expression tag	UNP Q9HD40
C	-1	SER	-	expression tag	UNP Q9HD40
C	0	HIS	-	expression tag	UNP Q9HD40
C	491	ALA	VAL	engineered mutation	UNP Q9HD40

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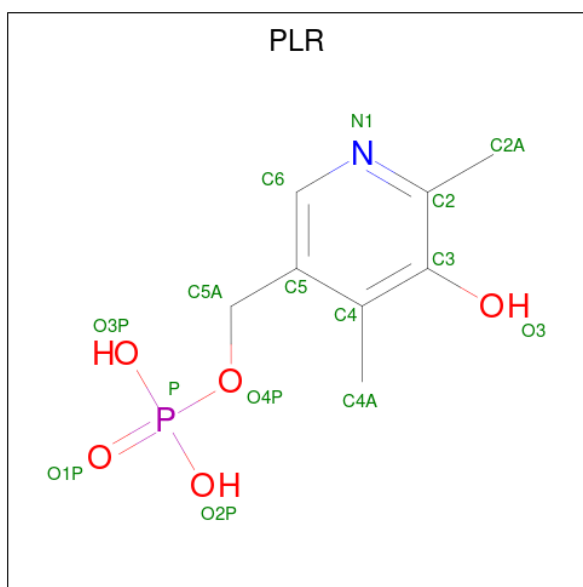
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Chain	Residue	Modelled	Actual	Comment	Reference
D	-19	MSE	-	expression tag	UNP Q9HD40
D	-18	GLY	-	expression tag	UNP Q9HD40
D	-17	SER	-	expression tag	UNP Q9HD40
D	-16	SER	-	expression tag	UNP Q9HD40
D	-15	HIS	-	expression tag	UNP Q9HD40
D	-14	HIS	-	expression tag	UNP Q9HD40
D	-13	HIS	-	expression tag	UNP Q9HD40
D	-12	HIS	-	expression tag	UNP Q9HD40
D	-11	HIS	-	expression tag	UNP Q9HD40
D	-10	HIS	-	expression tag	UNP Q9HD40
D	-9	SER	-	expression tag	UNP Q9HD40
D	-8	SER	-	expression tag	UNP Q9HD40
D	-7	GLY	-	expression tag	UNP Q9HD40
D	-6	LEU	-	expression tag	UNP Q9HD40
D	-5	VAL	-	expression tag	UNP Q9HD40
D	-4	PRO	-	expression tag	UNP Q9HD40
D	-3	ARG	-	expression tag	UNP Q9HD40
D	-2	GLY	-	expression tag	UNP Q9HD40
D	-1	SER	-	expression tag	UNP Q9HD40
D	0	HIS	-	expression tag	UNP Q9HD40
D	491	ALA	VAL	engineered mutation	UNP Q9HD40

- Molecule 2 is a RNA chain called RNA (90-MER).

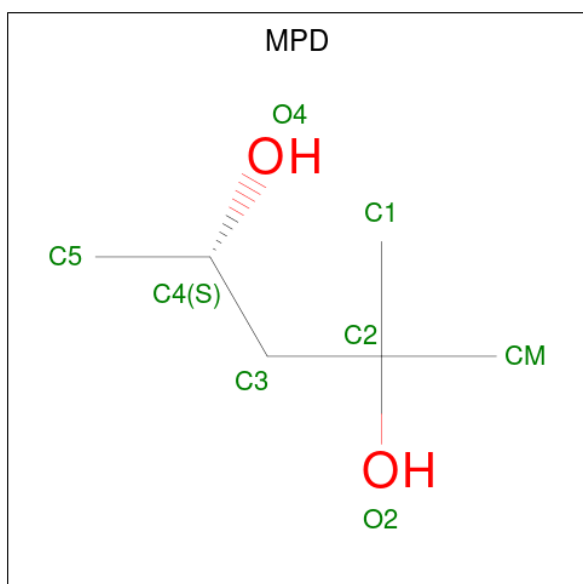
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	E	87	3640	1614	638	1214	174	0	87	0

- Molecule 3 is (5-HYDROXY-4,6-DIMETHYLPYRIDIN-3-YL)METHYL DIHYDROGEN PHOSPHATE (three-letter code: PLR) (formula: C<sub>8</sub>H<sub>12</sub>NO<sub>5</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
3	A	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	B	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	C	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	D	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

- Molecule 4 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula:  $C_6H_{14}O_2$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			8	6	2		
4	B	1	Total	C	O	0	0
			8	6	2		
4	C	1	Total	C	O	0	0
			8	6	2		
4	D	1	Total	C	O	0	0
			8	6	2		

- Molecule 5 is water.

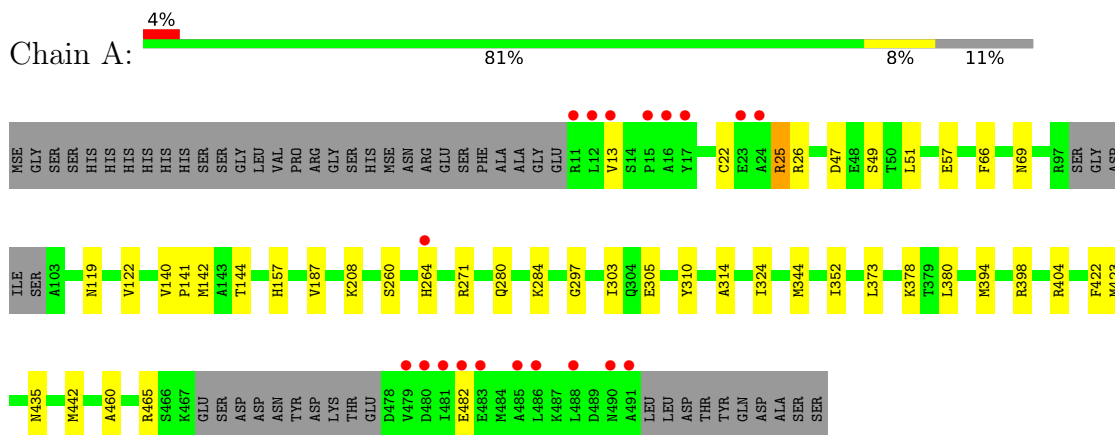
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	318	Total	O	0	0
			318	318		
5	B	330	Total	O	0	0
			330	330		
5	C	340	Total	O	0	0
			340	340		
5	D	326	Total	O	0	0
			326	326		
5	E	17	Total	O	0	0
			17	17		



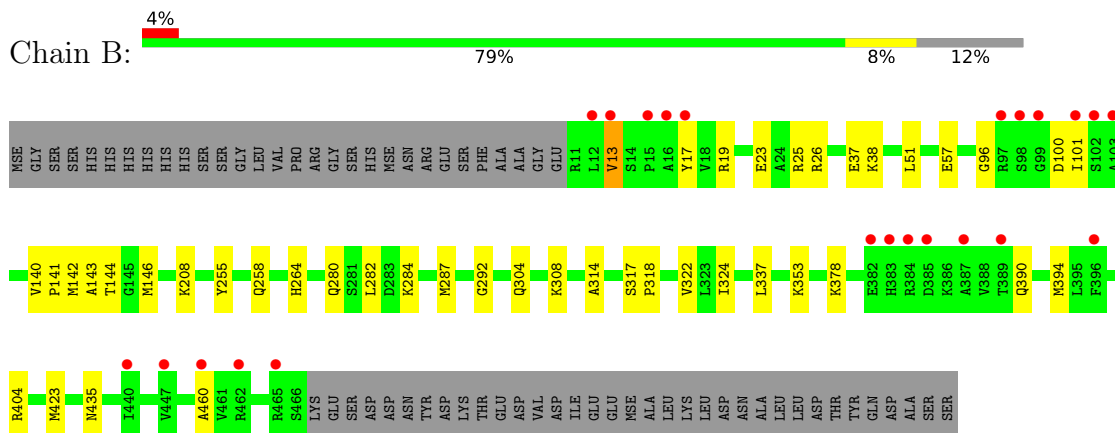
### 3 Residue-property plots

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.

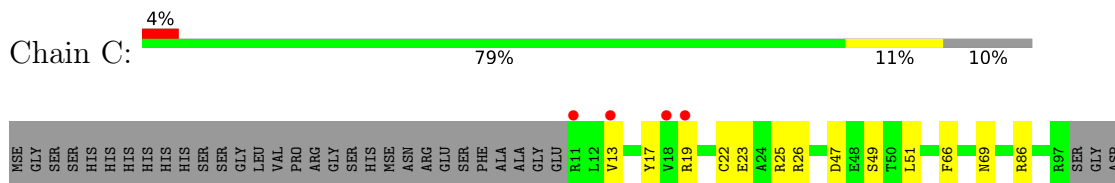
- Molecule 1: O-phosphoseryl-tRNA(Sec) selenium transferase

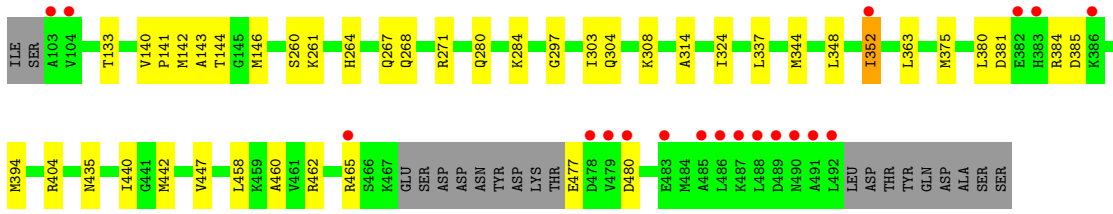


- Molecule 1: O-phosphoseryl-tRNA(Sec) selenium transferase

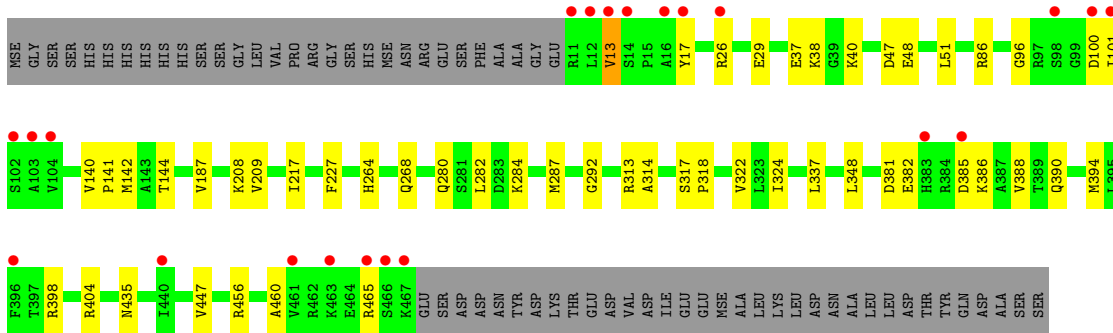
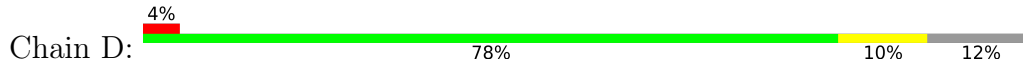


- Molecule 1: O-phosphoseryl-tRNA(Sec) selenium transferase

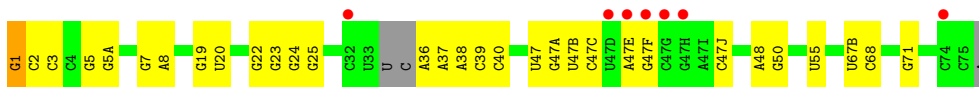




- Molecule 1: O-phosphoseryl-tRNA(Sec) selenium transferase



- Molecule 2: RNA (90-MER)



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 1 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	167.18Å 167.18Å 239.09Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	34.25 – 2.07 38.07 – 2.07	Depositor EDS
% Data completeness (in resolution range)	99.9 (34.25-2.07) 90.9 (38.07-2.07)	Depositor EDS
$R_{merge}$	0.99	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.75 (at 2.06Å)	Xtrriage
Refinement program	PHENIX DEV_3951	Depositor
R, $R_{free}$	0.177 , 0.190 0.178 , 0.188	Depositor DCC
$R_{free}$ test set	2015 reflections (0.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.5	Xtrriage
Anisotropy	0.308	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.28 , 51.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.450 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	19942	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	58.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.79% 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: MPD, PLR

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	0.25	0/3847	0.49	0/5168
1	B	0.25	0/3806	0.49	0/5116
1	C	0.27	0/3932	0.50	0/5282
1	D	0.25	0/3838	0.49	0/5157
2	E	0.28	2/4060 (0.0%)	0.72	0/6320
All	All	0.26	2/19483 (0.0%)	0.55	0/27043

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	1[A]	G	OP3-P	-10.63	1.48	1.61
2	E	1[B]	G	OP3-P	-10.63	1.48	1.61

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	3725	0	3804	30	0
1	B	3672	0	3773	34	0
1	C	3788	0	3897	53	0
1	D	3694	0	3808	40	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	E	3640	0	1790	42	0
3	A	15	0	8	2	0
3	B	15	0	8	3	0
3	C	15	0	8	3	0
3	D	15	0	8	2	0
4	A	8	0	14	0	0
4	B	8	0	14	0	0
4	C	8	0	14	0	0
4	D	8	0	14	0	0
5	A	318	0	0	1	0
5	B	330	0	0	4	0
5	C	340	0	0	5	0
5	D	326	0	0	5	0
5	E	17	0	0	1	0
All	All	19942	0	17160	184	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 (184) 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:B:308:LYS:HD2	5:B:1132:HOH:O	1.79	0.81
1:B:287:MSE:HE1	1:B:337:LEU:HD13	1.63	0.81
1:A:380:LEU:HA	1:A:465:ARG:HH22	1.46	0.78
1:D:13:VAL:HG13	1:D:17:TYR:HB2	1.66	0.78
1:D:287:MSE:HE1	1:D:337:LEU:HD13	1.65	0.77
1:D:227:PHE:CD2	5:D:1325:HOH:O	2.39	0.75
1:D:96:GLY:O	1:D:313[A]:ARG:NH1	2.21	0.74
1:D:144:THR:HB	3:D:1001:PLR:H5A2	1.72	0.72
1:C:267[B]:GLN:NE2	5:C:1101:HOH:O	2.22	0.72
1:C:308:LYS:HD2	5:C:1197:HOH:O	1.91	0.71
1:A:26:ARG:NH2	2:E:3[A]:C:OP1	2.25	0.70
1:B:404:ARG:NH1	1:B:435:ASN:OD1	2.25	0.70
1:B:37[A]:GLU:HG3	1:B:38:LYS:HG3	1.74	0.70
1:B:353:LYS:HE2	5:B:1130:HOH:O	1.92	0.69
1:B:282:LEU:HD22	1:B:322[B]:VAL:HG11	1.73	0.69
1:D:37[B]:GLU:HG3	1:D:38:LYS:HG3	1.75	0.69
1:C:385:ASP:HB2	1:C:465:ARG:HH21	1.59	0.68
1:D:282:LEU:HD22	1:D:322[A]:VAL:HG11	1.73	0.68
1:D:404:ARG:NH1	1:D:435:ASN:OD1	2.25	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:260:SER:O	1:A:264[B]:HIS:ND1	2.27	0.67
1:B:404:ARG:HH21	1:B:423[B]:MSE:HE3	1.60	0.67
2:E:7[B]:G:HO2'	2:E:50[B]:G:H5'	1.60	0.67
2:E:48[A]:A:H4'	2:E:50[A]:G:H5''	1.76	0.66
1:C:465:ARG:HD3	5:C:1181:HOH:O	1.97	0.65
1:C:268:GLN:OE1	1:C:271[A]:ARG:NH1	2.30	0.65
1:D:404:ARG:HB2	1:D:435:ASN:HB2	1.78	0.64
1:C:404:ARG:HB3	1:C:435:ASN:HB2	1.80	0.64
1:D:268:GLN:NE2	5:D:1104:HOH:O	2.31	0.63
2:E:37[A]:A:H3'	2:E:38[A]:A:H8	1.64	0.62
1:D:96:GLY:HA3	1:D:101:ILE:HA	1.82	0.62
1:B:144:THR:HB	3:B:1001:PLR:H5A2	1.82	0.61
1:C:394:MSE:HE1	1:C:460:ALA:HB3	1.82	0.61
1:B:404:ARG:HB2	1:B:435:ASN:HB2	1.83	0.61
1:D:394:MSE:HG2	2:E:37[A]:A:H2	1.65	0.60
1:C:381:ASP:H	1:C:465:ARG:HH22	1.48	0.59
1:B:96:GLY:HA3	1:B:101:ILE:HA	1.85	0.59
1:C:66:PHE:HB2	1:C:69:ASN:HB2	1.85	0.58
1:D:398:ARG:NH1	2:E:38[A]:A:O2'	2.36	0.58
1:A:66:PHE:HB2	1:A:69:ASN:HB2	1.85	0.58
1:B:25[B]:ARG:NH2	1:B:57:GLU:OE2	2.31	0.58
1:C:271[B]:ARG:NH1	2:E:47(J)[B]:C:O3'	2.37	0.58
1:A:394:MSE:HE1	1:A:460:ALA:HB3	1.86	0.57
1:A:271[B]:ARG:NH2	2:E:55[B]:U:O3'	2.36	0.57
1:C:86[A]:ARG:HH21	1:D:86[A]:ARG:NH1	2.02	0.57
1:C:144:THR:HB	3:C:1001:PLR:H5A2	1.85	0.57
2:E:2[A]:C:H2'	2:E:3[A]:C:C6	2.40	0.56
1:B:353:LYS:CE	5:B:1130:HOH:O	2.50	0.56
1:C:404:ARG:NH1	1:C:435:ASN:OD1	2.38	0.56
1:C:261:LYS:HG3	2:E:47(C)[B]:C:H5''	1.86	0.56
1:C:381:ASP:H	1:C:465:ARG:HH12	1.52	0.56
2:E:8[A]:A:H1'	2:E:48[A]:A:N3	2.21	0.55
1:A:144:THR:HB	3:A:1001:PLR:H5A2	1.87	0.54
2:E:22[B]:G:H2'	2:E:23[B]:G:H8	1.72	0.54
1:A:22:CYS:O	1:A:26:ARG:HG3	2.06	0.54
1:B:282:LEU:HD12	1:B:292:GLY:HA3	1.88	0.54
2:E:19[B]:G:H4'	2:E:20[B]:U:O5'	2.07	0.54
1:A:404:ARG:HB3	1:A:435:ASN:HB2	1.90	0.54
1:B:23[A]:GLU:OE1	1:B:26:ARG:NH1	2.36	0.53
1:C:348:LEU:O	1:C:352[A]:ILE:HG23	2.08	0.53
1:D:382:GLU:HG3	1:D:388:VAL:HB	1.89	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:465:ARG:CD	5:C:1181:HOH:O	2.56	0.53
1:D:187:VAL:HG11	1:D:208:LYS:HG2	1.91	0.53
1:D:100:ASP:HA	5:D:1119:HOH:O	2.08	0.53
1:C:51:LEU:HD21	1:C:324:ILE:HG23	1.91	0.52
1:D:40:LYS:NZ	5:D:1107:HOH:O	2.43	0.52
1:C:352[A]:ILE:HD13	1:C:375:MSE:HB2	1.91	0.52
1:C:47[B]:ASP:OD2	1:C:49:SER:OG	2.28	0.52
1:A:404:ARG:NH1	1:A:435:ASN:OD1	2.43	0.51
2:E:39[B]:C:H2'	2:E:40[B]:C:C6	2.45	0.51
1:B:100:ASP:HA	5:B:1193:HOH:O	2.10	0.51
1:C:348:LEU:HD13	1:C:447:VAL:HG22	1.91	0.51
1:A:47[B]:ASP:OD2	1:A:49:SER:OG	2.27	0.51
2:E:39[A]:C:H2'	2:E:40[A]:C:C6	2.47	0.50
2:E:47[A]:U:H2'	2:E:47(A)[A]:G:H8	1.77	0.50
1:C:260:SER:O	1:C:264[B]:HIS:ND1	2.27	0.50
1:B:13:VAL:HG23	1:B:17:TYR:HB2	1.94	0.50
1:D:390:GLN:O	1:D:394:MSE:HG3	2.12	0.50
1:B:304[A]:GLN:HG2	1:B:308:LYS:HE3	1.94	0.49
2:E:47[B]:U:H2'	2:E:47(A)[B]:G:C8	2.47	0.49
1:B:394:MSE:HG2	2:E:37[B]:A:H2	1.77	0.49
1:D:282:LEU:HD12	1:D:292:GLY:HA3	1.93	0.49
2:E:47[A]:U:H2'	2:E:47(A)[A]:G:C8	2.48	0.48
2:E:67(B)[A]:U:H2'	2:E:68[A]:C:C6	2.48	0.48
1:B:51:LEU:HD21	1:B:324:ILE:HG23	1.96	0.48
1:C:462:ARG:HA	1:C:465:ARG:HG3	1.95	0.48
1:C:142:MSE:SE	1:C:146:MSE:HG3	2.63	0.48
2:E:36[B]:A:H2'	2:E:37[B]:A:H8	1.79	0.48
1:B:404:ARG:NH2	1:B:423[B]:MSE:HE3	2.27	0.48
1:A:51:LEU:HD21	1:A:324:ILE:HG23	1.95	0.47
1:B:394:MSE:HE1	1:B:460:ALA:HB3	1.96	0.47
1:D:394:MSE:HE1	1:D:460:ALA:HB3	1.96	0.47
1:D:456:ARG:NH1	2:E:25[A]:G:OP1	2.43	0.47
1:C:458:LEU:O	1:C:462:ARG:HG2	2.15	0.47
1:D:140:VAL:HG21	1:D:142:MSE:HE2	1.97	0.47
2:E:19[B]:G:N2	2:E:20[B]:U:O4	2.43	0.47
1:D:385:ASP:OD2	1:D:465:ARG:NE	2.48	0.47
2:E:2[A]:C:H2'	2:E:3[A]:C:H6	1.78	0.47
1:C:133:THR:OG1	1:C:267[B]:GLN:NE2	2.40	0.46
1:B:142:MSE:SE	1:B:146:MSE:HG3	2.65	0.46
1:C:26:ARG:HH22	2:E:3[B]:C:C5'	2.28	0.46
1:C:264[B]:HIS:CE1	2:E:47(B)[B]:U:H4'	2.51	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:86[A]:ARG:HH21	1:D:86[A]:ARG:CZ	2.28	0.46
1:C:22:CYS:O	1:C:26:ARG:HG3	2.14	0.46
1:B:140:VAL:HG21	1:B:142:MSE:HE2	1.96	0.46
1:D:51:LEU:HD21	1:D:324:ILE:HG23	1.97	0.46
2:E:7[B]:G:H3'	2:E:8[B]:A:H2'	1.97	0.46
1:B:23[A]:GLU:CD	1:B:26:ARG:HH12	2.16	0.46
1:C:352[A]:ILE:HD11	1:C:363:LEU:HB2	1.98	0.46
1:D:284:LYS:NZ	3:D:1001:PLR:O3	2.48	0.46
1:D:394:MSE:HG2	2:E:37[A]:A:C2	2.49	0.46
1:A:344:MSE:HB3	1:A:442:MSE:CE	2.45	0.45
1:A:422:PHE:CE2	1:A:423[A]:MSE:HE3	2.51	0.45
1:C:344:MSE:HB3	1:C:442:MSE:CE	2.47	0.45
1:C:381:ASP:N	1:C:465:ARG:HH22	2.13	0.45
1:A:140:VAL:HG21	1:A:142:MSE:HE2	1.96	0.45
1:B:390:GLN:O	1:B:394:MSE:HG3	2.16	0.45
1:C:352[A]:ILE:HD11	1:C:363:LEU:HD13	1.98	0.45
1:D:209:VAL:HA	1:D:217[A]:ILE:HD11	1.97	0.45
2:E:47[B]:U:H2'	2:E:47(A)[B]:G:H8	1.81	0.44
1:A:187:VAL:HG11	1:A:208:LYS:HG2	1.98	0.44
2:E:47(B)[B]:U:H2'	2:E:47(C)[B]:C:C6	2.52	0.44
1:B:284:LYS:NZ	3:B:1001:PLR:O3	2.50	0.44
1:C:86[A]:ARG:HH21	1:D:86[A]:ARG:HH12	1.66	0.44
1:C:141:PRO:CG	1:C:314:ALA:HB1	2.48	0.44
1:D:381:ASP:N	1:D:381:ASP:OD1	2.49	0.44
2:E:37[B]:A:H3'	2:E:38[B]:A:O4'	2.17	0.44
1:C:380:LEU:HA	1:C:465:ARG:HH12	1.82	0.44
1:D:348:LEU:HD13	1:D:447:VAL:HG22	2.00	0.44
2:E:8[B]:A:H1'	2:E:48[B]:A:N3	2.33	0.44
1:C:380:LEU:HA	1:C:465:ARG:NH1	2.32	0.44
1:C:19:ARG:O	1:C:23:GLU:HG2	2.18	0.44
1:D:141:PRO:CG	1:D:314:ALA:HB1	2.48	0.44
2:E:47(E)[B]:A:H2'	2:E:47(F)[B]:G:O4'	2.18	0.44
1:A:352:ILE:HD12	1:A:373[B]:LEU:HD13	2.00	0.43
1:B:394:MSE:HG2	2:E:37[B]:A:C2	2.52	0.43
1:A:284:LYS:NZ	3:A:1001:PLR:O3	2.51	0.43
1:C:13:VAL:HG13	1:C:17:TYR:HB2	2.01	0.43
1:C:477:GLU:HA	1:C:480:ASP:HB3	2.00	0.43
1:B:141:PRO:CG	1:B:314:ALA:HB1	2.48	0.43
1:C:143:ALA:HB1	3:C:1001:PLR:O3P	2.19	0.43
1:A:398:ARG:NH2	1:A:482:GLU:OE2	2.50	0.43
1:A:404:ARG:HH21	1:A:423[A]:MSE:SE	2.52	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:2[A]:C:H42	2:E:71[A]:G:H1	1.67	0.43
1:A:25[A]:ARG:NH2	1:A:57:GLU:OE2	2.50	0.43
1:A:141:PRO:CG	1:A:314:ALA:HB1	2.49	0.42
2:E:38[A]:A:H2'	2:E:39[A]:C:O4'	2.19	0.42
1:B:143:ALA:HB1	3:B:1001:PLR:O3P	2.19	0.42
1:D:394:MSE:O	1:D:398:ARG:HD3	2.19	0.42
1:B:208:LYS:HD3	1:B:208:LYS:HA	1.90	0.42
2:E:48[B]:A:H4'	2:E:50[B]:G:H5''	2.00	0.42
2:E:23[B]:G:H2'	2:E:24[B]:G:C8	2.54	0.42
1:B:255:TYR:HB2	1:B:258:GLN:HE21	1.85	0.42
1:D:264[A]:HIS:HE1	5:D:1382:HOH:O	2.03	0.42
1:C:304[A]:GLN:HG2	1:C:308:LYS:HE3	2.02	0.42
1:D:382:GLU:HG2	1:D:386:LYS:HA	2.02	0.42
2:E:1[A]:G:OP3	5:E:101:HOH:O	2.22	0.42
1:C:297:GLY:HA3	1:C:303:ILE:HD11	2.01	0.41
1:A:157[B]:HIS:NE2	1:A:305[B]:GLU:OE2	2.52	0.41
1:C:140:VAL:HG21	1:C:142:MSE:HE2	2.02	0.41
1:D:26:ARG:O	1:D:29[B]:GLU:HG2	2.20	0.41
2:E:22[B]:G:H2'	2:E:23[B]:G:C8	2.54	0.41
1:B:317:SER:HB3	1:B:318:PRO:HD3	2.02	0.41
1:C:25[A]:ARG:HG3	5:C:1158:HOH:O	2.20	0.41
1:C:337:LEU:HB3	1:C:440[A]:ILE:HG13	2.02	0.41
1:C:381:ASP:N	1:C:465:ARG:HH12	2.19	0.41
2:E:5[A]:G:H2'	2:E:5(A)[A]:G:O4'	2.21	0.41
1:D:141:PRO:HG3	1:D:314:ALA:HB1	2.02	0.41
1:C:284:LYS:NZ	3:C:1001:PLR:O3	2.54	0.41
1:C:384:ARG:NH1	1:C:385:ASP:OD1	2.53	0.41
1:A:297:GLY:HA3	1:A:303:ILE:HD11	2.02	0.41
1:A:378:LYS:HE3	1:A:378:LYS:HB2	1.89	0.41
1:C:141:PRO:HG3	1:C:314:ALA:HB1	2.02	0.41
1:A:310:TYR:OH	5:A:1101:HOH:O	2.22	0.40
1:A:422:PHE:O	1:A:423[A]:MSE:HB2	2.20	0.40
1:D:47[A]:ASP:OD1	1:D:48:GLU:N	2.54	0.40
1:A:119:ASN:HA	1:A:122[A]:VAL:HG22	2.02	0.40
1:B:19:ARG:O	1:B:23[A]:GLU:HG2	2.21	0.40
1:C:381:ASP:H	1:C:465:ARG:NH2	2.15	0.40
2:E:67(B)[B]:U:H2'	2:E:68[B]:C:C6	2.57	0.40
1:B:378:LYS:HB2	1:B:378:LYS:HE3	1.77	0.40
1:D:317:SER:HB3	1:D:318:PRO:HD3	2.03	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	484/521 (93%)	472 (98%)	12 (2%)	0	100	100
1	B	481/521 (92%)	469 (98%)	11 (2%)	1 (0%)	47	39
1	C	493/521 (95%)	481 (98%)	12 (2%)	0	100	100
1	D	485/521 (93%)	473 (98%)	11 (2%)	1 (0%)	47	39
All	All	1943/2084 (93%)	1895 (98%)	46 (2%)	2 (0%)	51	45

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	13	VAL
1	D	13	VAL

### 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	409/429 (95%)	405 (99%)	4 (1%)	76	75
1	B	407/429 (95%)	404 (99%)	3 (1%)	84	84
1	C	419/429 (98%)	416 (99%)	3 (1%)	84	84
1	D	412/429 (96%)	411 (100%)	1 (0%)	93	94
All	All	1647/1716 (96%)	1636 (99%)	11 (1%)	88	84

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	VAL
1	A	25[A]	ARG
1	A	25[B]	ARG
1	A	280	GLN
1	B	264[A]	HIS
1	B	264[B]	HIS
1	B	280	GLN
1	C	280	GLN
1	C	352[A]	ILE
1	C	352[B]	ILE
1	D	280	GLN

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

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	E	0/90	-	-

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

## 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](#)

8 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	PLR	C	1001	1	15,15,15	1.05	1 (6%)	20,22,22	1.12	3 (15%)
4	MPD	A	1002	-	7,7,7	0.69	0	9,10,10	0.35	0
4	MPD	D	1002	-	7,7,7	0.68	0	9,10,10	0.36	0
4	MPD	B	1002	-	7,7,7	0.69	0	9,10,10	0.35	0
4	MPD	C	1002	-	7,7,7	0.69	0	9,10,10	0.36	0
3	PLR	A	1001	1	15,15,15	1.05	1 (6%)	20,22,22	1.15	3 (15%)
3	PLR	D	1001	1	15,15,15	1.01	1 (6%)	20,22,22	1.10	1 (5%)
3	PLR	B	1001	1	15,15,15	1.04	1 (6%)	20,22,22	1.13	3 (15%)

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	PLR	C	1001	1	-	0/6/6/6	0/1/1/1
4	MPD	A	1002	-	-	0/5/5/5	-
4	MPD	D	1002	-	-	2/5/5/5	-
4	MPD	B	1002	-	-	3/5/5/5	-
4	MPD	C	1002	-	-	0/5/5/5	-
3	PLR	A	1001	1	-	0/6/6/6	0/1/1/1
3	PLR	D	1001	1	-	0/6/6/6	0/1/1/1
3	PLR	B	1001	1	-	0/6/6/6	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	1001	PLR	C2-N1	2.44	1.38	1.33
3	B	1001	PLR	C2-N1	2.41	1.38	1.33
3	A	1001	PLR	C2-N1	2.39	1.38	1.33
3	D	1001	PLR	C2-N1	2.33	1.38	1.33

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1001	PLR	O4P-C5A-C5	2.72	114.53	109.35
3	D	1001	PLR	O4P-C5A-C5	2.70	114.49	109.35
3	A	1001	PLR	O4P-C5A-C5	2.63	114.37	109.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	1001	PLR	O4P-C5A-C5	2.62	114.34	109.35
3	C	1001	PLR	C6-C5-C4	2.42	120.06	118.16
3	B	1001	PLR	C6-C5-C4	2.35	120.00	118.16
3	A	1001	PLR	C6-C5-C4	2.34	120.00	118.16
3	C	1001	PLR	C5-C6-N1	-2.14	120.26	123.82
3	A	1001	PLR	C5-C6-N1	-2.13	120.27	123.82
3	B	1001	PLR	C5-C6-N1	-2.12	120.28	123.82

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	1002	MPD	O2-C2-C3-C4
4	B	1002	MPD	C1-C2-C3-C4
4	B	1002	MPD	CM-C2-C3-C4
4	D	1002	MPD	CM-C2-C3-C4
4	D	1002	MPD	O2-C2-C3-C4

There are no ring outliers.

4 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	1001	PLR	3	0
3	A	1001	PLR	2	0
3	D	1001	PLR	2	0
3	B	1001	PLR	3	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

### 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, 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	451/521 (86%)	-0.06	19 (4%) 36 38	29, 42, 115, 202	0
1	B	442/521 (84%)	-0.04	23 (5%) 27 27	26, 44, 101, 168	1 (0%)
1	C	453/521 (86%)	0.01	23 (5%) 28 28	27, 42, 121, 194	0
1	D	443/521 (85%)	-0.04	22 (4%) 28 29	27, 44, 95, 169	8 (1%)
2	E	87/90 (96%)	0.48	7 (8%) 12 12	54, 92, 116, 151	0
All	All	1876/2174 (86%)	-0.01	94 (5%) 28 29	26, 44, 114, 202	9 (0%)

All (94) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	383	HIS	12.6
1	C	488	LEU	10.4
1	C	489	ASP	10.2
1	A	482	GLU	8.7
1	A	485	ALA	8.4
1	D	385	ASP	8.3
1	C	492	LEU	8.2
1	D	13	VAL	8.2
1	C	479	VAL	7.9
1	D	12	LEU	7.1
1	A	486	LEU	7.1
1	B	99	GLY	6.7
1	D	17	TYR	6.5
1	A	17	TYR	6.5
1	C	383	HIS	6.4
1	A	16	ALA	6.3
1	A	483	GLU	5.9
1	D	104	VAL	5.8
1	C	491	ALA	5.7
1	D	461	VAL	5.1

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	C	490	ASN	5.1
1	B	384	ARG	5.1
1	C	478	ASP	5.1
1	A	480	ASP	4.9
1	D	11	ARG	4.9
1	D	98	SER	4.9
1	B	98	SER	4.8
1	A	491	ALA	4.7
1	C	487	LYS	4.6
1	D	102	SER	4.6
1	B	101	ILE	4.6
1	A	12	LEU	4.6
2	E	47(H)[A]	G	4.5
1	B	17	TYR	4.4
1	B	15	PRO	4.3
1	B	382	GLU	4.2
1	B	16	ALA	4.1
1	B	12	LEU	3.9
1	C	480	ASP	3.9
1	A	15	PRO	3.9
1	A	479	VAL	3.9
1	B	465	ARG	3.9
1	C	382	GLU	3.9
1	C	483	GLU	3.9
1	A	13	VAL	3.7
1	D	467	LYS	3.7
1	D	396	PHE	3.6
1	B	13	VAL	3.6
1	B	462	ARG	3.5
1	A	490	ASN	3.4
1	A	481	ILE	3.3
1	B	103	ALA	3.3
1	C	486	LEU	3.3
1	D	14	SER	3.3
1	D	101	ILE	3.3
1	C	485	ALA	3.3
1	A	24	ALA	3.2
1	C	103	ALA	3.2
1	B	102	SER	3.2
1	B	387	ALA	3.0
1	B	460	ALA	3.0
1	A	488	LEU	3.0

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Mol	Chain	Res	Type	RSRZ
1	D	465	ARG	3.0
1	D	26	ARG	2.9
2	E	47(F)[A]	G	2.9
2	E	47(G)[A]	C	2.9
1	C	13	VAL	2.8
2	E	74[A]	C	2.8
1	B	97	ARG	2.8
1	B	385	ASP	2.7
2	E	47(E)[A]	A	2.7
1	B	383	HIS	2.7
1	D	466	SER	2.6
1	B	440[A]	ILE	2.5
1	C	386	LYS	2.5
1	D	103	ALA	2.5
1	D	440[A]	ILE	2.5
1	A	11	ARG	2.5
1	C	11	ARG	2.5
1	C	352[A]	ILE	2.4
1	A	23	GLU	2.4
1	C	465	ARG	2.4
1	C	104	VAL	2.3
1	D	100	ASP	2.3
1	B	447	VAL	2.2
1	C	18	VAL	2.2
1	A	264[A]	HIS	2.2
1	D	463	LYS	2.2
1	D	16	ALA	2.1
2	E	47(D)[A]	U	2.1
1	B	396	PHE	2.1
2	E	32[A]	C	2.1
1	B	389	THR	2.0
1	C	19	ARG	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 [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
4	MPD	C	1002	8/8	0.61	0.68	59,77,89,92	0
4	MPD	D	1002	8/8	0.73	0.20	64,80,104,113	0
4	MPD	A	1002	8/8	0.81	0.23	69,87,92,102	0
4	MPD	B	1002	8/8	0.88	0.28	59,82,103,112	0
3	PLR	B	1001	15/15	0.97	0.07	29,37,45,47	0
3	PLR	D	1001	15/15	0.97	0.12	28,39,46,49	0
3	PLR	C	1001	15/15	0.98	0.08	30,39,46,49	0
3	PLR	A	1001	15/15	0.98	0.09	31,39,48,50	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.