



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 23, 2024 – 03:23 PM EDT

PDB ID : 1XMO  
Title : Crystal Structure of mnm5U34t6A37-tRNALysUUU Complexed with AAG-mRNA in the Decoding Center  
Authors : Murphy, F.V.; Ramakrishnan, V.; Malkiewicz, A.; Agris, P.F.  
Deposited on : 2004-10-04  
Resolution : 3.25 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](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 : 2.36.1  
buster-report : 1.1.7 (2018)  
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

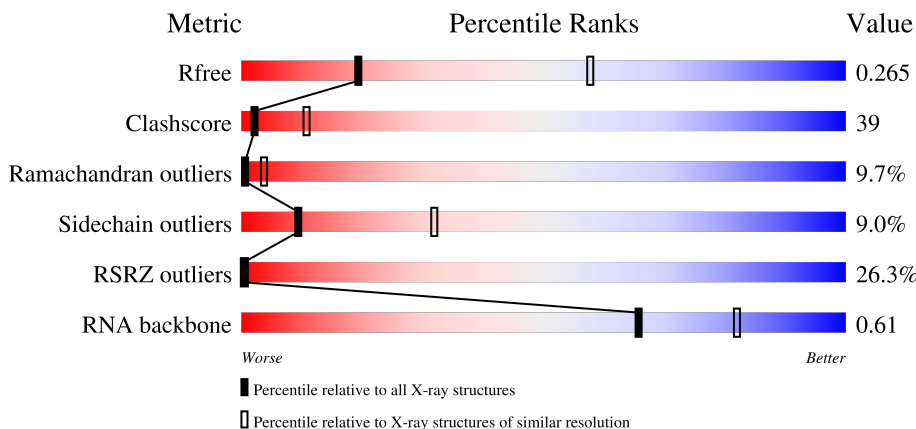
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.25 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.



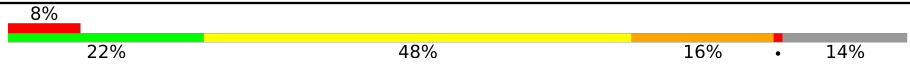
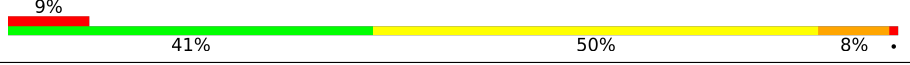
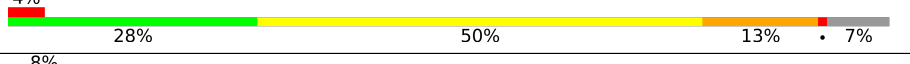
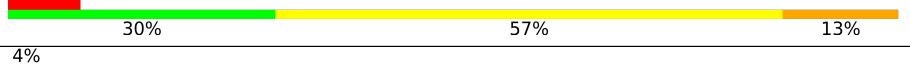
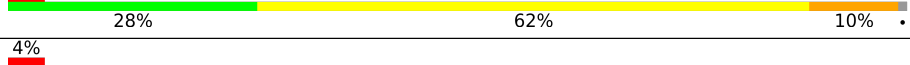
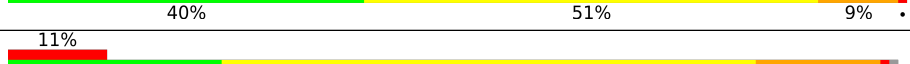
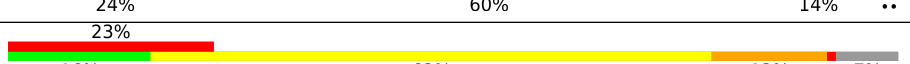
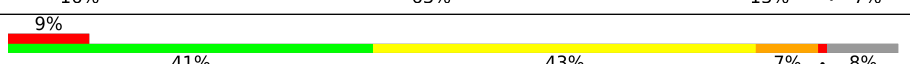
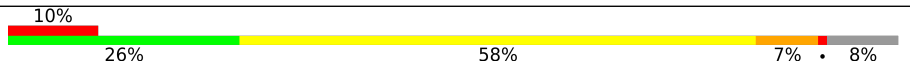
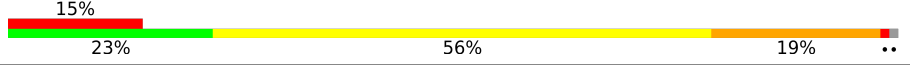
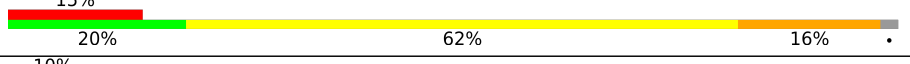
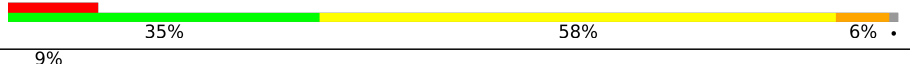
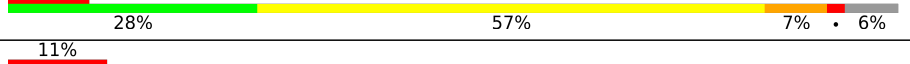

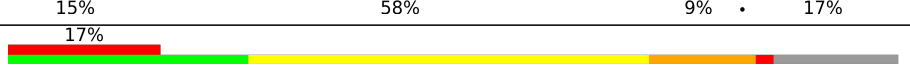
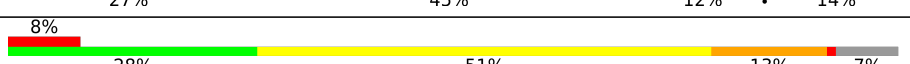
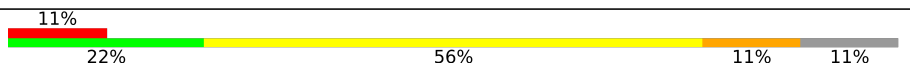

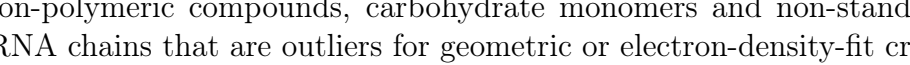
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1191 (3.30-3.22)
Clashscore	141614	1251 (3.30-3.22)
Ramachandran outliers	138981	1229 (3.30-3.22)
Sidechain outliers	138945	1228 (3.30-3.22)
RSRZ outliers	127900	1154 (3.30-3.22)
RNA backbone	3102	1072 (3.62-2.90)

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  $\geq 3$ , 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	1522	Upper bar: 52% Lower bar: 28% (green), 55% (yellow), 14% (orange), 3% (red), 2% (grey)
2	W	3	Upper bar: 100% Lower bar: 33% (green), 67% (yellow)
3	X	11	Upper bar: 27% Lower bar: 36% (green), 55% (yellow), 9% (orange), 1% (red)
4	B	256	Upper bar: 7% Lower bar: 15% (green), 65% (yellow), 9% (orange), 1% (red), 10% (grey)

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Mol	Chain	Length	Quality of chain
5	C	239	
6	D	209	
7	E	162	
8	F	101	
9	G	156	
10	H	138	
11	I	128	
12	J	105	
13	K	129	
14	L	135	
15	M	126	
16	N	61	
17	O	89	
18	P	88	
19	Q	105	
20	R	88	
21	S	93	
22	T	106	
23	V	27	

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
25	MG	A	1562	-	-	-	X
25	MG	A	1566	-	-	-	X
25	MG	A	1575	-	-	-	X
25	MG	A	1595	-	-	-	X
25	MG	A	1596	-	-	-	X

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<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
25	MG	A	1607	-	-	-	X
25	MG	A	1622	-	-	-	X
25	MG	A	1634	-	-	-	X
25	MG	A	210	-	-	-	X
25	MG	A	493	-	-	-	X
3	T6A	X	37	X	-	-	-

## 2 Entry composition [i](#)

There are 26 unique types of molecules in this entry. The entry contains 52063 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 RNA chain called 16S ribosomal RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	1507	32380	14414	5990	10470	1506	0	0	0

- Molecule 2 is a RNA chain called A-Site Messenger RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	W	3	64	30	15	17	2	0	0	0

- Molecule 3 is a RNA chain called Anticodon Transfer RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	X	11	239	110	38	81	10	0	0	0

- Molecule 4 is a protein called 30S ribosomal protein S2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	B	234	1900	1213	341	341	5	0	0	0

- Molecule 5 is a protein called 30S ribosomal protein S3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	C	206	1612	1016	314	281	1	0	0	0

- Molecule 6 is a protein called 30S ribosomal protein S4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
6	D	208	1703	1066	339	291	7	0	0	0

- Molecule 7 is a protein called 30S ribosomal protein S5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
7	E	150	1146	724	217	201	4	0	0	0

- Molecule 8 is a protein called 30S ribosomal protein S6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
8	F	101	843	531	155	154	3	0	0	0

- Molecule 9 is a protein called 30S ribosomal protein S7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
9	G	155	1257	781	252	218	6	0	0	0

- Molecule 10 is a protein called 30S ribosomal protein S8.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
10	H	138	1116	705	215	193	3	0	0	0

- Molecule 11 is a protein called 30S ribosomal protein S9.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
11	I	127	1011	639	198	174	0	0	0

- Molecule 12 is a protein called 30S ribosomal protein S10.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
12	J	98	792	498	156	137	1	0	0	0

- Molecule 13 is a protein called 30S ribosomal protein S11.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
13	K	119	885	549	168	165	3	0	0	0

- Molecule 14 is a protein called 30S ribosomal protein S12.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
14	L	124	970	611	195	163	1	0	0	0

- Molecule 15 is a protein called 30S ribosomal protein S13.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
15	M	125	997	617	207	171	2	0	0	0

- Molecule 16 is a protein called 30S ribosomal protein S14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
16	N	60	492	312	104	72	4	0	0	0

- Molecule 17 is a protein called 30S ribosomal protein S15.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
17	O	88	734	459	147	126	2	0	0	0

- Molecule 18 is a protein called 30S ribosomal protein S16.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
18	P	83	700	443	139	117	1	0	0	0

- Molecule 19 is a protein called 30S ribosomal protein S17.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
19	Q	104	857	547	161	147	2	0	0	0

- Molecule 20 is a protein called 30S ribosomal protein S18.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
20	R	73	597	380	118	99	0	0	0

- Molecule 21 is a protein called 30S ribosomal protein S19.





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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
25	X	2	Total 2	Mg 2	0	0
25	J	1	Total 1	Mg 1	0	0

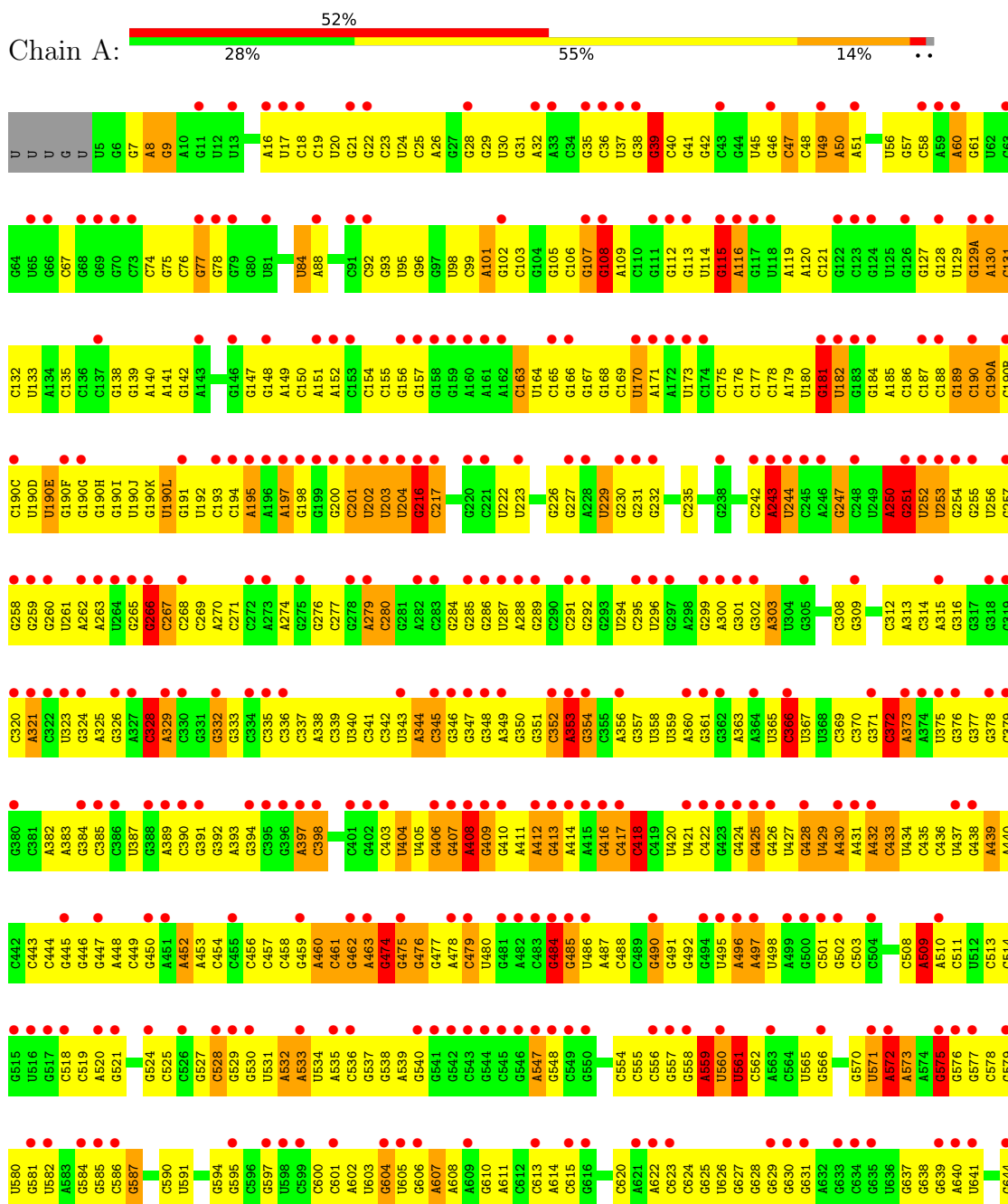
- Molecule 26 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
26	D	1	Total 1	Zn 1	0	0
26	N	1	Total 1	Zn 1	0	0

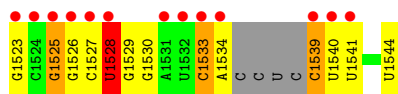
### 3 Residue-property plots [i](#)

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: 16S ribosomal RNA



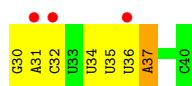




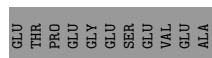
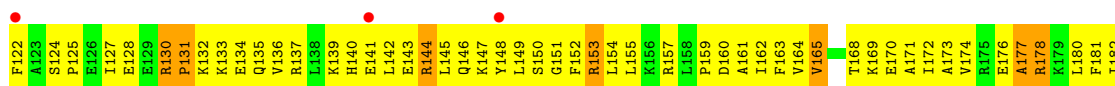
- Molecule 2: A-Site Messenger RNA



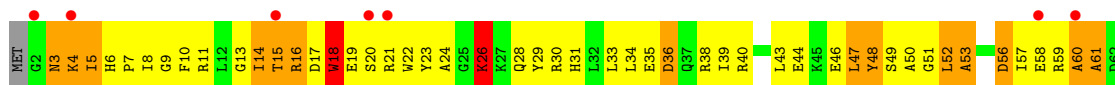
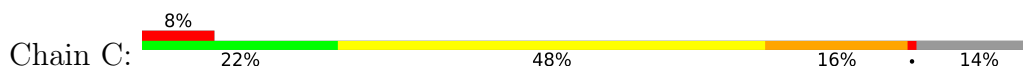
- Molecule 3: Anticodon Transfer RNA

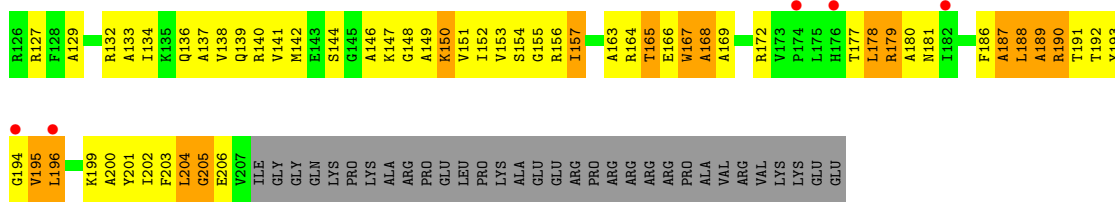


- Molecule 4: 30S ribosomal protein S2

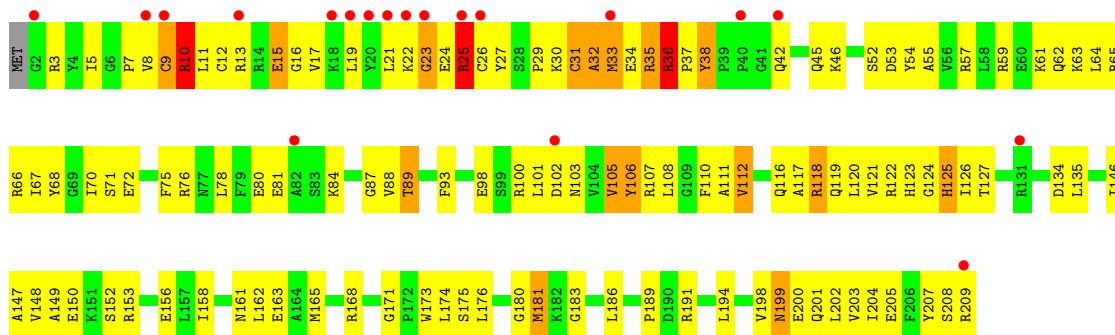


- Molecule 5: 30S ribosomal protein S3

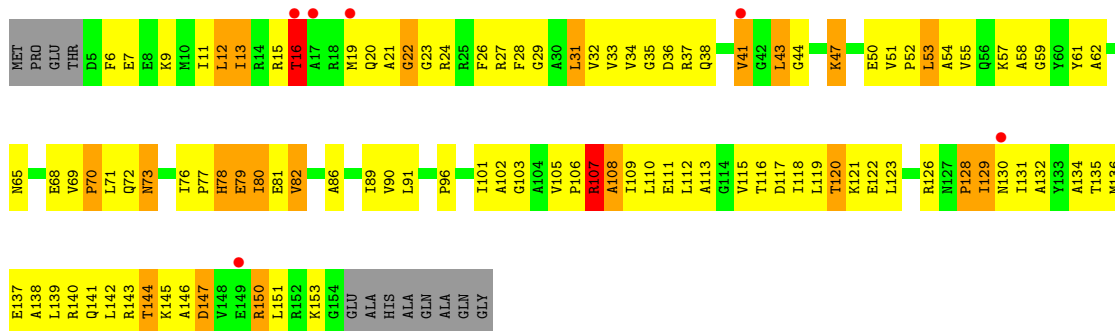




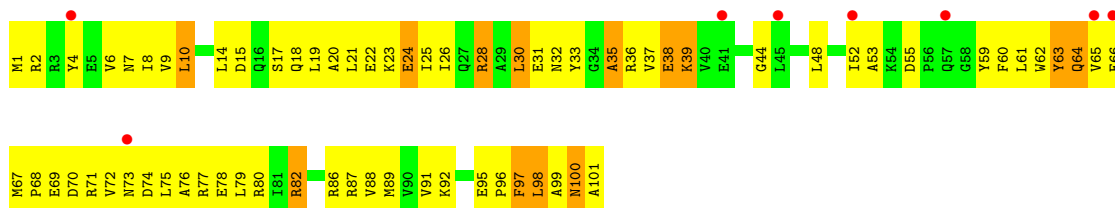
• Molecule 6: 30S ribosomal protein S4



• Molecule 7: 30S ribosomal protein S5

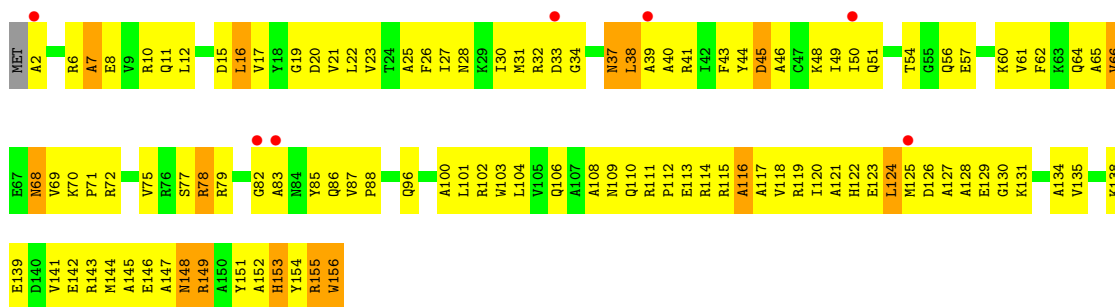


• Molecule 8: 30S ribosomal protein S6

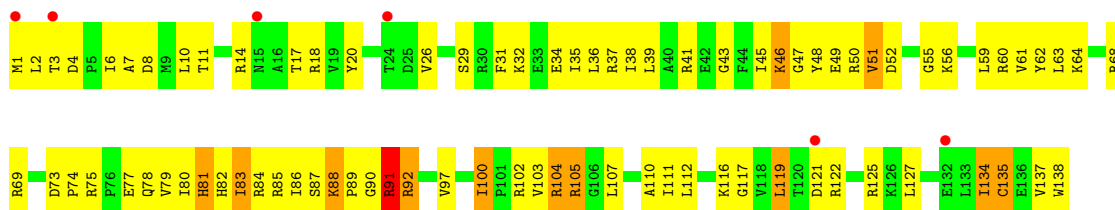


• Molecule 9: 30S ribosomal protein S7

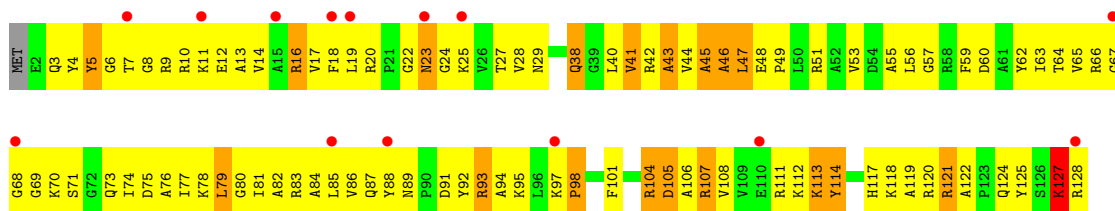




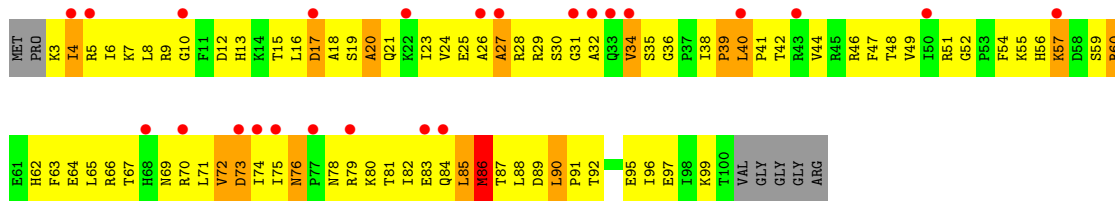
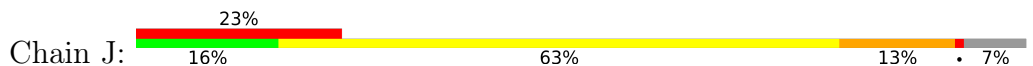
• Molecule 10: 30S ribosomal protein S8



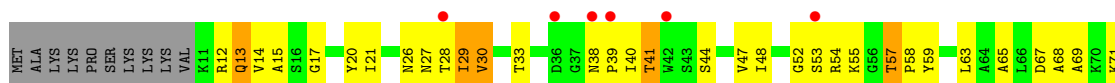
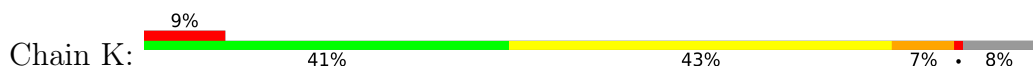
• Molecule 11: 30S ribosomal protein S9



• Molecule 12: 30S ribosomal protein S10

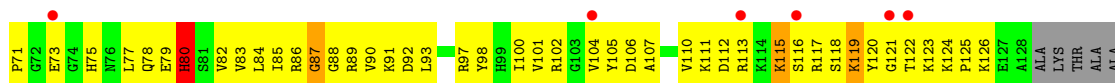
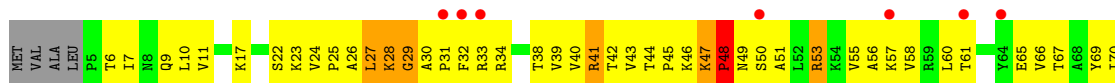


• Molecule 13: 30S ribosomal protein S11



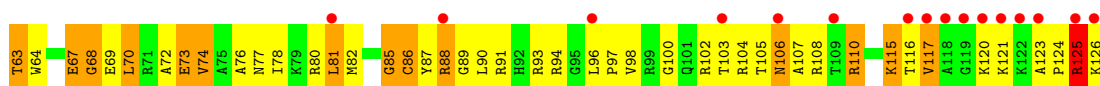


- Molecule 14: 30S ribosomal protein S12

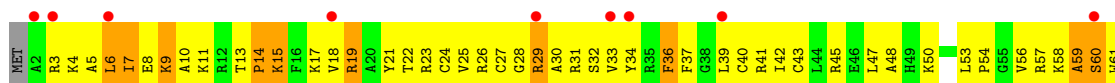


LYS  
LYS

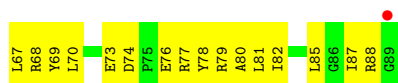
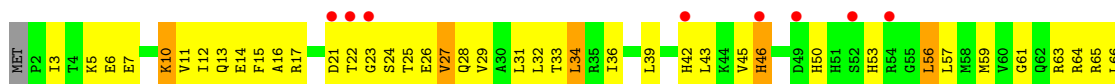
- Molecule 15: 30S ribosomal protein S13



- Molecule 16: 30S ribosomal protein S14

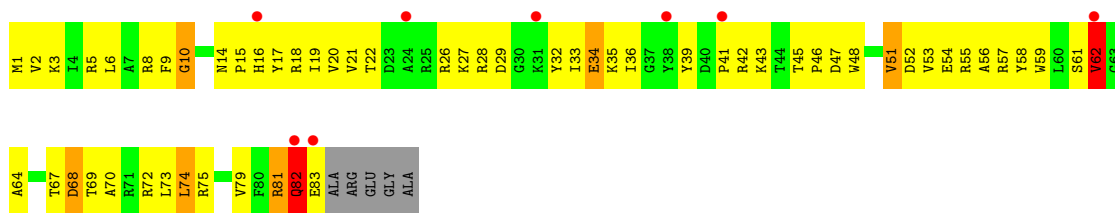


- Molecule 17: 30S ribosomal protein S15

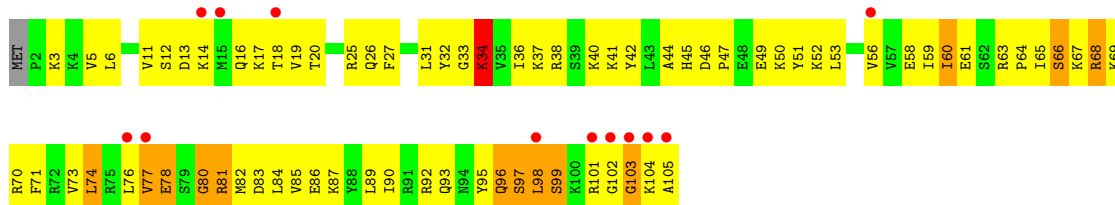


- Molecule 18: 30S ribosomal protein S16

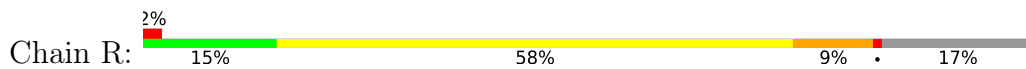




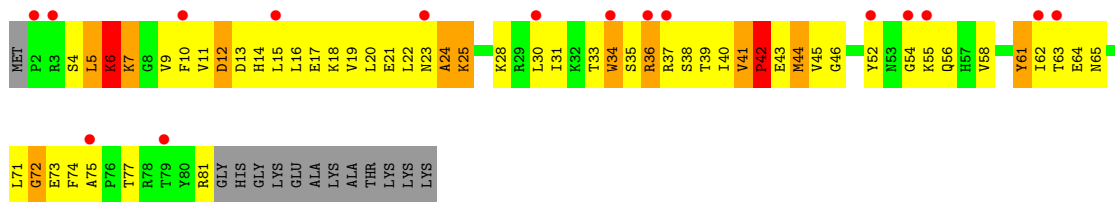
• Molecule 19: 30S ribosomal protein S17



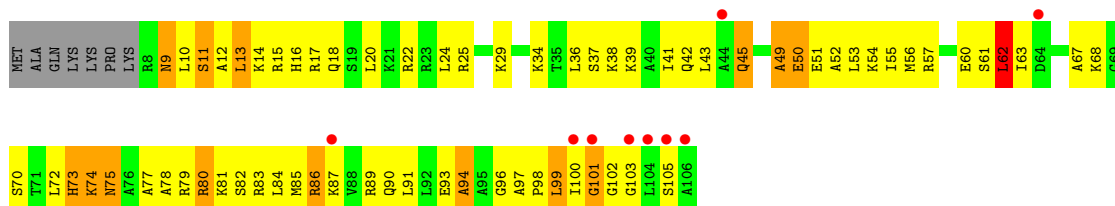
• Molecule 20: 30S ribosomal protein S18



• Molecule 21: 30S ribosomal protein S19

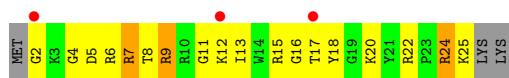
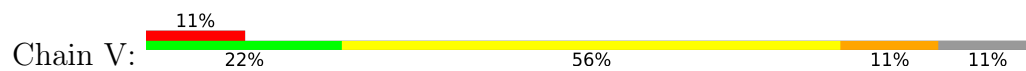


• Molecule 22: 30S ribosomal protein S20





## ● Molecule 23: 30S ribosomal protein Thx



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	400.81Å 400.81Å 176.12Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	99.00 – 3.25 200.41 – 3.23	Depositor EDS
% Data completeness (in resolution range)	5.0 (99.00-3.25) 88.5 (200.41-3.23)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.14	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.05 (at 3.26Å)	Xtrriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.231 , 0.284 0.215 , 0.265	Depositor DCC
$R_{free}$ test set	10562 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	85.2	Xtrriage
Anisotropy	0.267	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 146.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	52063	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	80.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.22% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PAR, MNU, T6A, ZN, MG

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	0.57	2/36244 (0.0%)	0.74	36/56567 (0.1%)
2	W	0.55	0/72	0.95	1/111 (0.9%)
3	X	0.41	0/203	0.78	0/311
4	B	0.34	0/1935	0.65	0/2609
5	C	0.36	0/1636	0.63	0/2205
6	D	0.39	0/1733	0.65	0/2318
7	E	0.44	0/1162	0.74	0/1564
8	F	0.32	0/856	0.59	0/1154
9	G	0.35	0/1276	0.61	0/1709
10	H	0.44	0/1136	0.75	0/1527
11	I	0.35	0/1029	0.63	0/1378
12	J	0.35	0/805	0.69	0/1082
13	K	0.41	0/900	0.68	0/1213
14	L	0.45	0/986	0.77	0/1320
15	M	0.35	0/1008	0.67	0/1347
16	N	0.43	0/501	0.74	0/664
17	O	0.36	0/745	0.63	0/992
18	P	0.47	0/716	0.74	0/963
19	Q	0.47	0/870	0.77	0/1159
20	R	0.35	0/603	0.65	0/799
21	S	0.32	0/661	0.63	0/890
22	T	0.41	0/764	0.77	0/1006
23	V	0.42	0/212	0.72	0/277
All	All	0.52	2/56053 (0.0%)	0.73	37/83165 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	4	60
3	X	1	0
All	All	5	60

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1361	G	C3'-O3'	5.22	1.49	1.42
1	A	1361	G	O3'-P	5.14	1.67	1.61

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	575	G	C2'-C3'-O3'	9.66	130.74	109.50
1	A	115	G	C2'-C3'-O3'	9.52	130.44	109.50
1	A	559	A	C2'-C3'-O3'	9.37	130.12	109.50
1	A	243	A	C2'-C3'-O3'	9.32	130.01	109.50
1	A	1528	U	C2'-C3'-O3'	8.97	129.23	109.50

All (5) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	181	G	C3'
1	A	243	A	C3'
1	A	559	A	C3'
1	A	1528	U	C3'
3	X	37	T6A	C14

5 of 60 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	107	G	Sidechain
1	A	108	G	Sidechain
1	A	39	G	Sidechain
1	A	77	G	Sidechain
1	A	84	U	Sidechain

## 5.2 Too-close contacts

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	32380	0	16346	1337	0
2	W	64	0	35	4	0
3	X	239	0	127	7	0
4	B	1900	0	1951	305	0
5	C	1612	0	1677	245	0
6	D	1703	0	1764	150	0
7	E	1146	0	1207	140	0
8	F	843	0	857	102	0
9	G	1257	0	1296	131	0
10	H	1116	0	1177	112	0
11	I	1011	0	1043	153	0
12	J	792	0	835	127	0
13	K	885	0	904	71	0
14	L	970	0	1057	130	0
15	M	997	0	1072	155	0
16	N	492	0	530	67	0
17	O	734	0	771	78	0
18	P	700	0	720	81	0
19	Q	857	0	930	125	0
20	R	597	0	668	100	0
21	S	647	0	673	83	0
22	T	762	0	856	87	0
23	V	208	0	221	19	0
24	A	42	0	45	2	0
25	A	104	0	0	0	0
25	J	1	0	0	0	0
25	X	2	0	0	0	0
26	D	1	0	0	0	0
26	N	1	0	0	1	0
All	All	52063	0	36762	3496	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 39.

The worst 5 of 3496 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:1489:G:H2'	1:A:1490:C:H5''	1.26	1.10
6:D:36:ARG:H	6:D:37:PRO:HD3	1.13	1.08
5:C:26:LYS:H	5:C:26:LYS:HD3	1.14	1.06

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:C:179:ARG:HG2	5:C:180:ALA:H	0.98	1.06
4:B:132:LYS:HA	4:B:135:GLN:HB3	1.36	1.05

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	
4	B	232/256 (91%)	129 (56%)	80 (34%)	23 (10%)	0	3
5	C	204/239 (85%)	123 (60%)	48 (24%)	33 (16%)	0	1
6	D	206/209 (99%)	151 (73%)	38 (18%)	17 (8%)	1	5
7	E	148/162 (91%)	120 (81%)	18 (12%)	10 (7%)	1	8
8	F	99/101 (98%)	68 (69%)	24 (24%)	7 (7%)	1	7
9	G	153/156 (98%)	99 (65%)	41 (27%)	13 (8%)	1	5
10	H	136/138 (99%)	106 (78%)	25 (18%)	5 (4%)	3	19
11	I	125/128 (98%)	85 (68%)	27 (22%)	13 (10%)	0	3
12	J	96/105 (91%)	57 (59%)	23 (24%)	16 (17%)	0	1
13	K	117/129 (91%)	85 (73%)	26 (22%)	6 (5%)	2	13
14	L	122/135 (90%)	85 (70%)	24 (20%)	13 (11%)	0	3
15	M	123/126 (98%)	75 (61%)	30 (24%)	18 (15%)	0	1
16	N	58/61 (95%)	34 (59%)	16 (28%)	8 (14%)	0	1
17	O	86/89 (97%)	54 (63%)	28 (33%)	4 (5%)	2	14
18	P	81/88 (92%)	59 (73%)	16 (20%)	6 (7%)	1	7
19	Q	102/105 (97%)	75 (74%)	17 (17%)	10 (10%)	0	3
20	R	71/88 (81%)	50 (70%)	16 (22%)	5 (7%)	1	7
21	S	78/93 (84%)	56 (72%)	14 (18%)	8 (10%)	0	3

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
22	T	97/106 (92%)	56 (58%)	30 (31%)	11 (11%)	0	2
23	V	22/27 (82%)	18 (82%)	2 (9%)	2 (9%)	1	4
All	All	2356/2541 (93%)	1585 (67%)	543 (23%)	228 (10%)	0	4

5 of 228 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	B	13	ALA
4	B	15	VAL
4	B	16	HIS
4	B	21	ARG
4	B	24	TRP

### 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	
4	B	202/220 (92%)	181 (90%)	21 (10%)	7	25
5	C	160/188 (85%)	145 (91%)	15 (9%)	8	30
6	D	180/181 (99%)	164 (91%)	16 (9%)	9	32
7	E	115/123 (94%)	96 (84%)	19 (16%)	2	10
8	F	90/90 (100%)	83 (92%)	7 (8%)	12	38
9	G	126/127 (99%)	115 (91%)	11 (9%)	10	34
10	H	119/119 (100%)	107 (90%)	12 (10%)	7	27
11	I	98/99 (99%)	87 (89%)	11 (11%)	6	23
12	J	87/92 (95%)	85 (98%)	2 (2%)	50	73
13	K	90/99 (91%)	79 (88%)	11 (12%)	5	20
14	L	104/111 (94%)	100 (96%)	4 (4%)	33	62
15	M	100/101 (99%)	88 (88%)	12 (12%)	5	20
16	N	49/50 (98%)	47 (96%)	2 (4%)	30	60
17	O	79/80 (99%)	76 (96%)	3 (4%)	33	62

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
18	P	72/74 (97%)	66 (92%)	6 (8%)	11	36
19	Q	96/97 (99%)	90 (94%)	6 (6%)	18	47
20	R	64/77 (83%)	59 (92%)	5 (8%)	12	38
21	S	71/80 (89%)	63 (89%)	8 (11%)	6	22
22	T	75/82 (92%)	67 (89%)	8 (11%)	6	25
23	V	19/22 (86%)	18 (95%)	1 (5%)	22	53
All	All	1996/2112 (94%)	1816 (91%)	180 (9%)	9	32

5 of 180 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
13	K	29	ILE
17	O	10	LYS
13	K	57	THR
15	M	19	LEU
18	P	81	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 59 such sidechains are listed below:

Mol	Chain	Res	Type
8	F	64	GLN
21	S	47	HIS
12	J	13	HIS
21	S	23	ASN
17	O	53	HIS

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	1506/1522 (98%)	240 (15%)	62 (4%)
2	W	2/3 (66%)	1 (50%)	0
3	X	9/11 (81%)	0	0
All	All	1517/1536 (98%)	241 (15%)	62 (4%)

5 of 241 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	8	A

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Mol	Chain	Res	Type
1	A	9	G
1	A	31	G
1	A	32	A
1	A	39	G

5 of 62 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	701	C
1	A	1397	C
1	A	975	A
1	A	1380	U
1	A	1504	G

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

2 non-standard protein/DNA/RNA residues 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	MNU	X	34	3,2	20,24,25	0.55	0	28,34,37	0.44	0
3	T6A	X	37	3	27,34,35	1.46	5 (18%)	29,49,52	3.83	10 (34%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	T6A	X	37	3	1/1/9/11	3/19/41/42	0/3/3/3
3	MNU	X	34	3,2	-	3/9/28/29	0/2/2/2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	X	37	T6A	O14-C14	-3.02	1.34	1.43
3	X	37	T6A	ODA-C13	2.97	1.31	1.22
3	X	37	T6A	C15-C14	-2.78	1.43	1.51
3	X	37	T6A	ODB-C13	-2.69	1.21	1.30
3	X	37	T6A	C12-N11	-2.41	1.40	1.45

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	X	37	T6A	O14-C14-C15	11.99	145.26	109.74
3	X	37	T6A	O14-C14-C12	-6.94	95.20	109.13
3	X	37	T6A	ODA-C13-C12	-6.61	98.94	121.70
3	X	37	T6A	N6-C10-N11	6.46	122.78	113.76
3	X	37	T6A	C12-N11-C10	6.44	132.66	121.94

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	X	37	T6A	C14

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	X	34	MNU	C4-C5-C7-N8
3	X	37	T6A	C13-C12-C14-O14
3	X	37	T6A	N11-C12-C14-O14
3	X	37	T6A	C3'-C4'-C5'-O5'
3	X	34	MNU	C2'-C1'-N1-C2

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	X	34	MNU	3	0
3	X	37	T6A	2	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 110 ligands modelled in this entry, 109 are monoatomic - leaving 1 for Mogul analysis.

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
24	PAR	A	1545	-	45,45,45	1.75	11 (24%)	64,67,67	1.21	5 (7%)

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
24	PAR	A	1545	-	-	4/18/94/94	0/4/4/4

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
24	A	1545	PAR	C64-C54	4.62	1.58	1.52
24	A	1545	PAR	O54-C14	4.06	1.52	1.41
24	A	1545	PAR	C31-C21	3.66	1.58	1.53
24	A	1545	PAR	O51-C11	2.97	1.49	1.41
24	A	1545	PAR	O33-C14	2.86	1.49	1.41

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
24	A	1545	PAR	O52-C13-C23	4.21	116.68	107.96
24	A	1545	PAR	O54-C54-C64	3.48	112.49	106.01
24	A	1545	PAR	O52-C13-O43	-3.27	107.89	111.43
24	A	1545	PAR	C14-O54-C54	3.13	119.83	113.69
24	A	1545	PAR	O33-C14-C24	2.97	113.33	108.22

There are no chirality outliers.

All (4) torsion outliers are listed below:

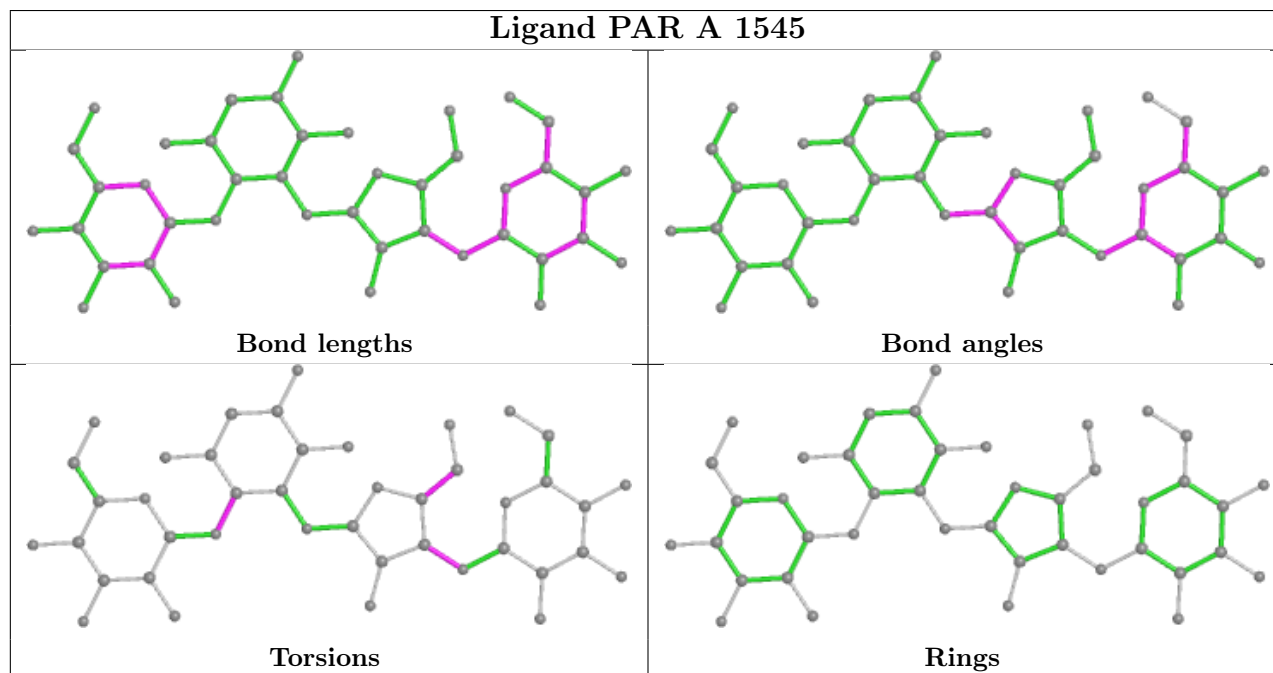
Mol	Chain	Res	Type	Atoms
24	A	1545	PAR	O43-C43-C53-O53
24	A	1545	PAR	C52-C42-O11-C11
24	A	1545	PAR	C23-C33-O33-C14
24	A	1545	PAR	C33-C43-C53-O53

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
24	A	1545	PAR	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 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	1507/1522 (99%)	2.20	794 (52%) 0 0	30, 65, 160, 200	0
2	W	3/3 (100%)	2.48	3 (100%) 0 0	56, 56, 63, 72	0
3	X	9/11 (81%)	1.94	3 (33%) 0 0	64, 101, 157, 157	0
4	B	234/256 (91%)	0.64	17 (7%) 15 14	37, 100, 173, 200	0
5	C	206/239 (86%)	0.70	18 (8%) 10 10	44, 93, 169, 200	0
6	D	208/209 (99%)	0.71	19 (9%) 9 10	33, 71, 149, 200	0
7	E	150/162 (92%)	0.71	6 (4%) 38 35	27, 63, 122, 200	0
8	F	101/101 (100%)	0.69	8 (7%) 12 12	48, 103, 154, 174	0
9	G	155/156 (99%)	0.63	7 (4%) 33 31	41, 81, 152, 200	0
10	H	138/138 (100%)	0.73	6 (4%) 35 33	20, 54, 113, 174	0
11	I	127/128 (99%)	0.81	14 (11%) 5 5	35, 90, 149, 178	0
12	J	98/105 (93%)	1.22	24 (24%) 0 0	44, 117, 186, 200	0
13	K	119/129 (92%)	0.82	12 (10%) 7 7	30, 67, 138, 187	0
14	L	124/135 (91%)	0.95	13 (10%) 6 6	31, 64, 139, 175	0
15	M	125/126 (99%)	1.23	19 (15%) 2 2	44, 85, 169, 200	0
16	N	60/61 (98%)	1.02	9 (15%) 2 2	42, 82, 139, 179	0
17	O	88/89 (98%)	0.85	9 (10%) 6 7	23, 76, 142, 192	0
18	P	83/88 (94%)	0.95	8 (9%) 8 8	27, 52, 96, 173	0
19	Q	104/105 (99%)	1.29	12 (11%) 4 4	22, 61, 146, 200	0
20	R	73/88 (82%)	0.74	2 (2%) 54 51	40, 79, 175, 188	0
21	S	80/93 (86%)	1.00	16 (20%) 1 1	62, 111, 162, 193	0
22	T	99/106 (93%)	0.84	9 (9%) 9 10	32, 58, 136, 168	0
23	V	24/27 (88%)	1.04	3 (12%) 3 3	41, 69, 118, 136	0
All	All	3915/4077 (96%)	1.37	1031 (26%) 0 0	20, 73, 159, 200	0

The worst 5 of 1031 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
19	Q	103	GLY	13.3
19	Q	104	LYS	12.9
15	M	120	LYS	11.3
1	A	202	U	11.2
19	Q	105	ALA	10.6

## 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
3	T6A	X	37	32/33	0.89	0.34	76,80,80,80	0
3	MNU	X	34	23/24	0.90	0.37	56,96,115,115	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
25	MG	A	210	1/1	0.41	0.53	23,23,23,23	1
25	MG	A	1575	1/1	0.43	1.13	23,23,23,23	1
25	MG	A	1607	1/1	0.45	0.69	23,23,23,23	1
25	MG	A	1621	1/1	0.48	0.33	23,23,23,23	1
25	MG	A	493	1/1	0.57	1.21	23,23,23,23	1
25	MG	A	1596	1/1	0.58	1.50	23,23,23,23	1
25	MG	A	87	1/1	0.58	0.33	23,23,23,23	1
25	MG	A	1622	1/1	0.62	0.51	23,23,23,23	1
25	MG	A	1611	1/1	0.64	0.31	23,23,23,23	1
25	MG	A	1627	1/1	0.67	0.28	23,23,23,23	1

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
25	MG	A	211	1/1	0.67	0.34	23,23,23,23	0
25	MG	A	1595	1/1	0.69	1.31	23,23,23,23	1
25	MG	A	1619	1/1	0.74	0.23	23,23,23,23	1
25	MG	A	1620	1/1	0.74	0.29	23,23,23,23	1
25	MG	A	1616	1/1	0.74	0.30	23,23,23,23	1
25	MG	A	1632	1/1	0.76	0.26	23,23,23,23	1
25	MG	A	1634	1/1	0.76	0.43	23,23,23,23	1
25	MG	A	1566	1/1	0.76	0.53	23,23,23,23	1
25	MG	A	71	1/1	0.78	0.34	23,23,23,23	1
25	MG	A	441	1/1	0.78	0.22	23,23,23,23	1
25	MG	A	1633	1/1	0.79	0.34	23,23,23,23	1
25	MG	A	1562	1/1	0.79	0.77	23,23,23,23	1
25	MG	A	1615	1/1	0.79	0.27	23,23,23,23	1
25	MG	A	1580	1/1	0.80	0.31	23,23,23,23	1
25	MG	A	470	1/1	0.80	0.42	23,23,23,23	1
25	MG	A	1561	1/1	0.80	0.28	23,23,23,23	1
25	MG	A	1585	1/1	0.82	0.39	23,23,23,23	1
25	MG	A	1558	1/1	0.83	0.18	23,23,23,23	0
25	MG	A	1592	1/1	0.84	0.23	23,23,23,23	0
25	MG	A	1559	1/1	0.84	0.33	23,23,23,23	0
25	MG	A	1605	1/1	0.85	0.44	23,23,23,23	1
25	MG	A	1564	1/1	0.85	0.28	23,23,23,23	0
25	MG	A	1604	1/1	0.85	0.36	23,23,23,23	1
25	MG	A	1613	1/1	0.85	0.40	23,23,23,23	1
25	MG	A	1628	1/1	0.85	0.30	23,23,23,23	1
25	MG	A	1550	1/1	0.86	0.30	23,23,23,23	1
25	MG	A	471	1/1	0.86	0.29	23,23,23,23	1
25	MG	A	1597	1/1	0.86	0.30	23,23,23,23	1
25	MG	A	1548	1/1	0.88	0.32	23,23,23,23	1
25	MG	A	1612	1/1	0.88	0.28	23,23,23,23	1
25	MG	A	1560	1/1	0.88	0.26	23,23,23,23	0
25	MG	A	466	1/1	0.89	0.42	23,23,23,23	1
25	MG	A	467	1/1	0.89	0.92	23,23,23,23	1
25	MG	A	1549	1/1	0.90	0.41	23,23,23,23	1
25	MG	A	1581	1/1	0.90	0.46	23,23,23,23	1
25	MG	A	1569	1/1	0.90	0.23	23,23,23,23	1
25	MG	A	1554	1/1	0.90	0.31	23,23,23,23	1
25	MG	A	1593	1/1	0.91	0.33	23,23,23,23	1
25	MG	A	1610	1/1	0.91	0.53	23,23,23,23	1
25	MG	A	1631	1/1	0.91	0.14	23,23,23,23	1
25	MG	A	1630	1/1	0.91	0.26	23,23,23,23	1
25	MG	A	1556	1/1	0.91	0.24	23,23,23,23	0

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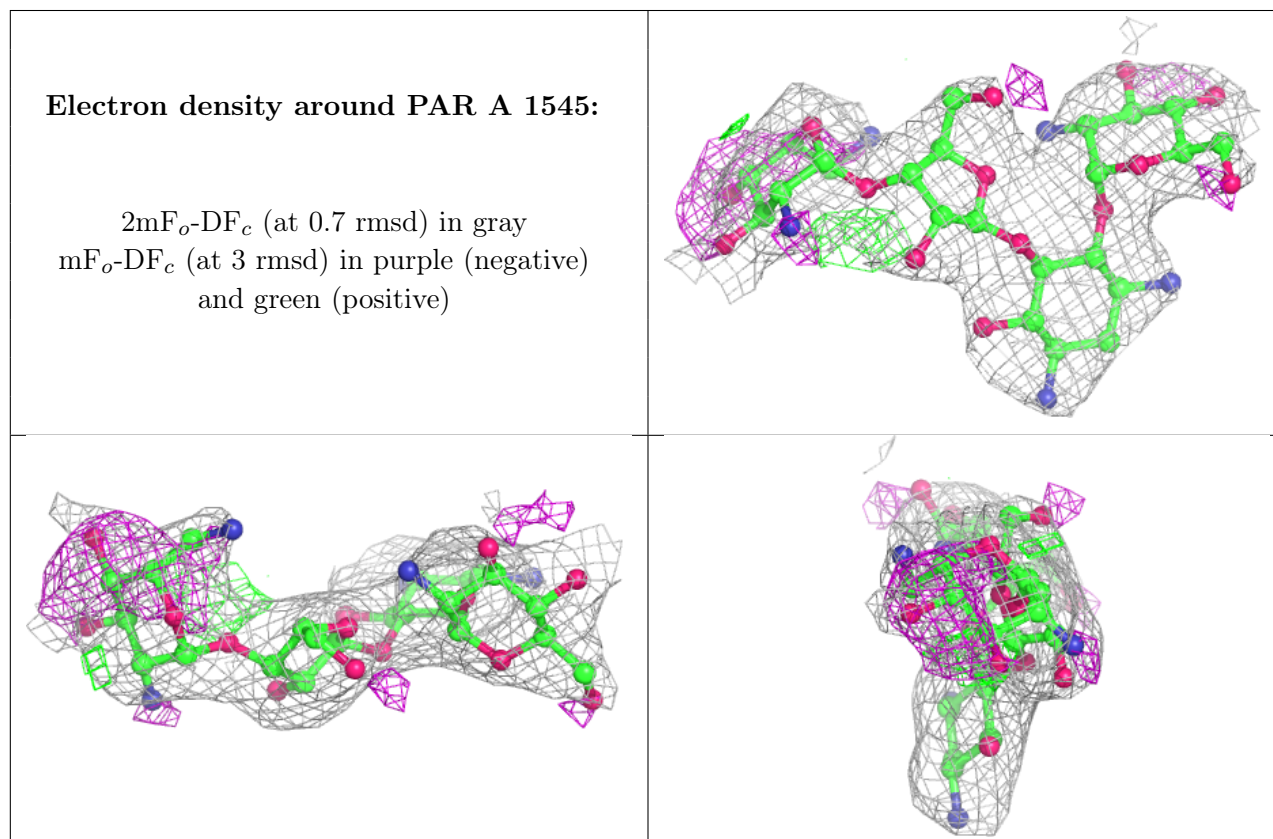
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
25	MG	A	1582	1/1	0.91	0.11	23,23,23,23	0
25	MG	A	469	1/1	0.91	0.24	23,23,23,23	1
25	MG	A	1635	1/1	0.91	0.42	23,23,23,23	1
25	MG	A	1606	1/1	0.92	0.50	23,23,23,23	1
25	MG	A	1573	1/1	0.92	0.23	23,23,23,23	0
25	MG	A	473	1/1	0.92	0.36	23,23,23,23	1
25	MG	A	1608	1/1	0.92	0.29	23,23,23,23	1
25	MG	A	1629	1/1	0.92	0.23	23,23,23,23	0
25	MG	A	1609	1/1	0.92	0.27	23,23,23,23	0
25	MG	A	1600	1/1	0.92	0.38	23,23,23,23	1
24	PAR	A	1545	42/42	0.92	0.39	25,25,25,25	0
25	MG	A	1571	1/1	0.92	0.15	23,23,23,23	0
25	MG	A	1578	1/1	0.93	0.21	23,23,23,23	0
25	MG	A	1598	1/1	0.93	0.40	23,23,23,23	0
25	MG	A	1599	1/1	0.93	0.26	23,23,23,23	1
25	MG	A	1565	1/1	0.93	0.27	23,23,23,23	0
25	MG	A	1624	1/1	0.93	0.20	23,23,23,23	1
25	MG	A	1602	1/1	0.93	0.19	23,23,23,23	0
25	MG	A	214	1/1	0.93	0.37	23,23,23,23	1
25	MG	A	1577	1/1	0.94	0.15	23,23,23,23	0
25	MG	A	1583	1/1	0.94	0.16	23,23,23,23	0
25	MG	A	1552	1/1	0.94	0.21	23,23,23,23	0
25	MG	A	1601	1/1	0.94	0.67	23,23,23,23	1
25	MG	A	1589	1/1	0.94	0.33	23,23,23,23	0
25	MG	A	1603	1/1	0.94	0.30	23,23,23,23	1
25	MG	A	1568	1/1	0.94	0.16	23,23,23,23	0
25	MG	A	1563	1/1	0.94	0.47	23,23,23,23	1
25	MG	X	502	1/1	0.94	0.31	23,23,23,23	1
25	MG	A	1553	1/1	0.95	0.35	23,23,23,23	0
25	MG	A	86	1/1	0.95	0.30	23,23,23,23	1
25	MG	A	1625	1/1	0.95	0.27	23,23,23,23	1
25	MG	A	1570	1/1	0.95	0.20	23,23,23,23	0
25	MG	A	1547	1/1	0.95	0.34	23,23,23,23	0
25	MG	A	1546	1/1	0.96	0.28	23,23,23,23	0
25	MG	A	1579	1/1	0.96	0.29	23,23,23,23	1
25	MG	A	1617	1/1	0.96	0.18	23,23,23,23	1
25	MG	A	1551	1/1	0.96	0.24	23,23,23,23	0
25	MG	A	1586	1/1	0.96	0.18	23,23,23,23	1
25	MG	A	1587	1/1	0.96	0.13	23,23,23,23	0
25	MG	A	1567	1/1	0.96	0.32	23,23,23,23	0
25	MG	A	1590	1/1	0.96	0.25	23,23,23,23	0
25	MG	X	500	1/1	0.96	0.23	23,23,23,23	1

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
25	MG	A	1591	1/1	0.96	0.29	23,23,23,23	1
25	MG	A	1574	1/1	0.97	0.22	23,23,23,23	0
25	MG	A	1555	1/1	0.97	0.27	23,23,23,23	0
25	MG	A	1623	1/1	0.97	0.40	23,23,23,23	1
25	MG	A	1618	1/1	0.97	0.23	23,23,23,23	0
25	MG	A	1557	1/1	0.97	0.22	23,23,23,23	0
25	MG	A	1626	1/1	0.97	0.19	23,23,23,23	1
25	MG	A	1588	1/1	0.97	0.28	23,23,23,23	0
25	MG	A	1594	1/1	0.97	0.23	23,23,23,23	1
25	MG	J	449	1/1	0.97	0.33	23,23,23,23	1
25	MG	A	1614	1/1	0.98	0.21	23,23,23,23	1
25	MG	A	1576	1/1	0.98	0.26	23,23,23,23	0
25	MG	A	1572	1/1	0.98	0.16	23,23,23,23	0
25	MG	A	1584	1/1	0.99	0.15	23,23,23,23	0
26	ZN	D	306	1/1	0.99	0.33	23,23,23,23	1
26	ZN	N	307	1/1	1.00	0.24	23,23,23,23	1

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.5 Other polymers [i](#)

There are no such residues in this entry.