



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 03:57 PM EDT

PDB ID : 7AII  
Title : HIV-1 REVERSE TRANSCRIPTASE COMPLEX WITH DNA AND L-METHIONINE TENOFOVIR WITH BOUND MANGANESE  
Authors : Gu, W.; Martinez, S.E.; Nguyen, H.; Xu, H.; Herdewijn, P.; de Jonghe, S.; Das, K.  
Deposited on : 2020-09-27  
Resolution : 2.62 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 : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.20.1  
EDS : 2.37.1  
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) : 2.37.1

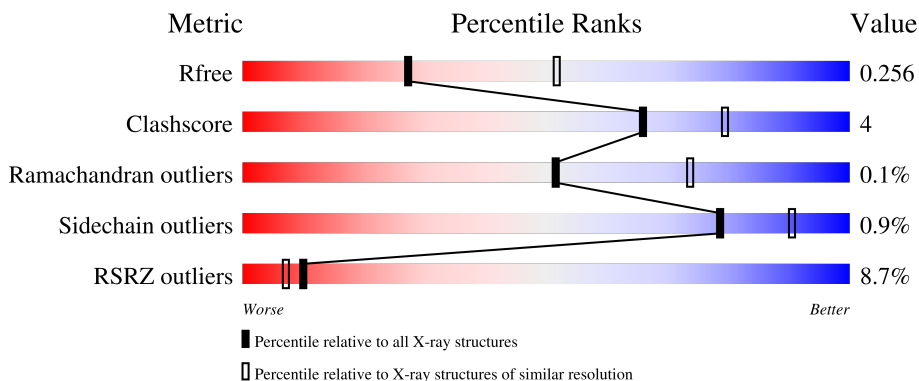
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.62 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.



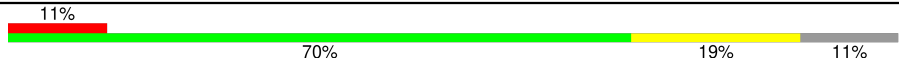


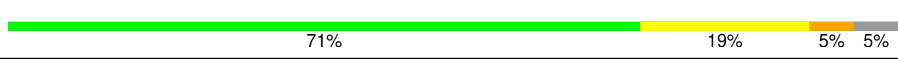
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	3797 (2.64-2.60)
Clashscore	141614	4168 (2.64-2.60)
Ramachandran outliers	138981	4093 (2.64-2.60)
Sidechain outliers	138945	4093 (2.64-2.60)
RSRZ outliers	127900	3731 (2.64-2.60)

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	556	
1	C	556	
2	B	428	
2	D	428	

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Mol	Chain	Length	Quality of chain
3	E	27	
3	T	27	
4	F	21	
4	P	21	

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 17785 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 Gag-Pol polyprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	555	Total	C	N	O	S	0	0	0
			4513	2922	751	832	8			
1	C	556	Total	C	N	O	S	0	0	0
			4521	2927	752	833	9			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	initiating methionine	UNP P03366
A	0	VAL	-	expression tag	UNP P03366
A	258	CYS	GLN	engineered mutation	UNP P03366
A	280	SER	CYS	engineered mutation	UNP P03366
A	498	ASN	ASP	engineered mutation	UNP P03366
C	-1	MET	-	initiating methionine	UNP P03366
C	0	VAL	-	expression tag	UNP P03366
C	258	CYS	GLN	engineered mutation	UNP P03366
C	280	SER	CYS	engineered mutation	UNP P03366
C	498	ASN	ASP	engineered mutation	UNP P03366

- Molecule 2 is a protein called Gag-Pol polyprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	411	Total	C	N	O	S	0	0	0
			3401	2215	563	616	7			
2	D	412	Total	C	N	O	S	0	0	0
			3400	2212	563	619	6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	280	SER	CYS	engineered mutation	UNP P03366
D	280	SER	CYS	engineered mutation	UNP P03366

- Molecule 3 is a DNA chain called DNA (5'-D(P\*GP\*GP\*TP\*CP\*GP\*GP\*CP\*GP\*CP\*CP\*CP\*GP\*AP\*AP\*CP\*AP\*GP\*GP\*GP\*AP\*CP\*TP\*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	T	23	Total 477	C 223	N 95	O 136	P 23	0	0	0
3	E	24	Total 494	C 233	N 97	O 141	P 23	0	0	0

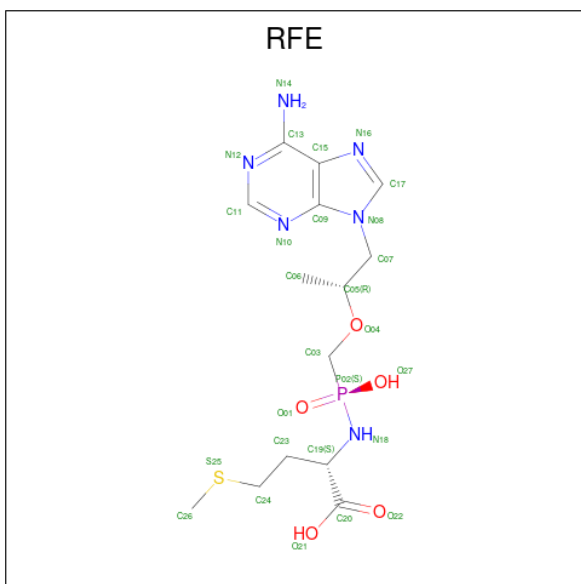
- Molecule 4 is a DNA chain called DNA (5'-D(\*CP\*AP\*GP\*TP\*CP\*CP\*CP\*TP\*GP\*TP\*TP\*CP\*GP\*GP\*(MRG)P\*CP\*GP\*CP\*CP\*(DDG))-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	P	20	Total 403	C 192	N 72	O 120	P 19	0	0	0
4	F	20	Total 403	C 192	N 72	O 120	P 19	0	0	0

- Molecule 5 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mn		
5	A	2	Total 2	Mn 2	0	0
5	C	2	Total 2	Mn 2	0	0

- Molecule 6 is L-Methionine Tenofovir (three-letter code: RFE) (formula: C<sub>14</sub>H<sub>23</sub>N<sub>6</sub>O<sub>5</sub>PS) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
6	A	1	Total	C	N	O	P	S	0	0
			27	14	6	5	1	1		
6	C	1	Total	C	N	O	P	S	0	0
			27	14	6	5	1	1		

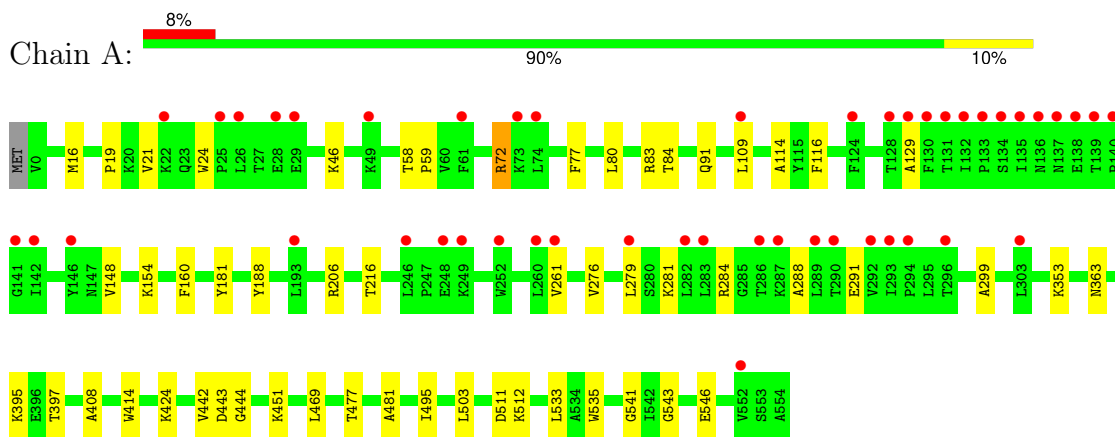
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	39	Total	O	0	0
			39	39		
7	B	38	Total	O	0	0
			38	38		
7	C	16	Total	O	0	0
			16	16		
7	D	16	Total	O	0	0
			16	16		
7	T	3	Total	O	0	0
			3	3		
7	P	1	Total	O	0	0
			1	1		
7	E	1	Total	O	0	0
			1	1		
7	F	1	Total	O	0	0
			1	1		

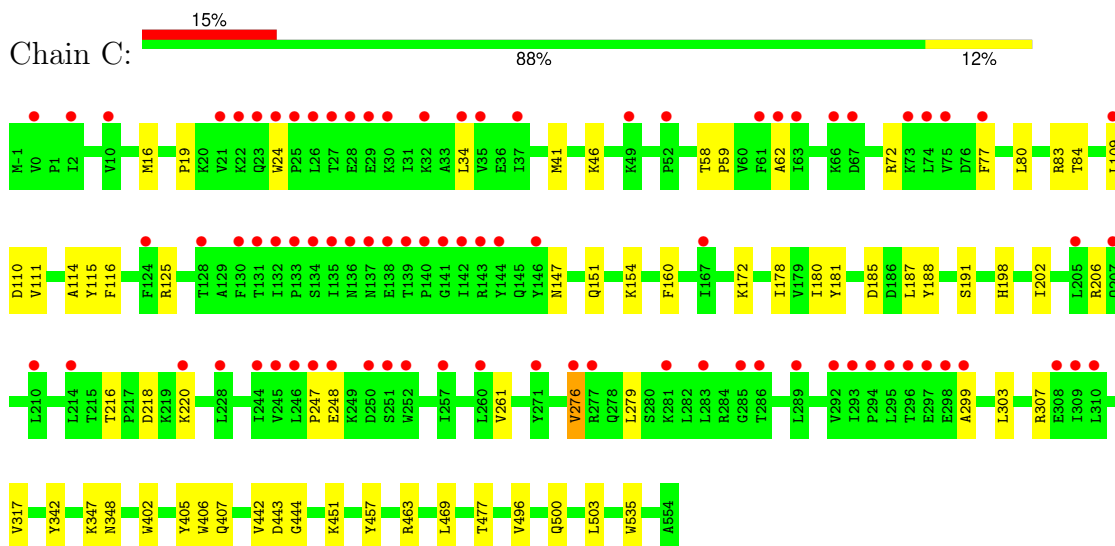
### 3 Residue-property plots [i](#)

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.

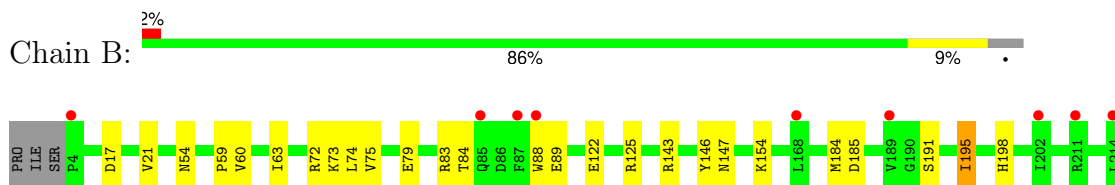
- Molecule 1: Gag-Pol polyprotein

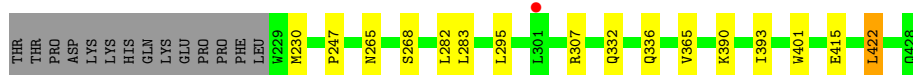


- Molecule 1: Gag-Pol polyprotein

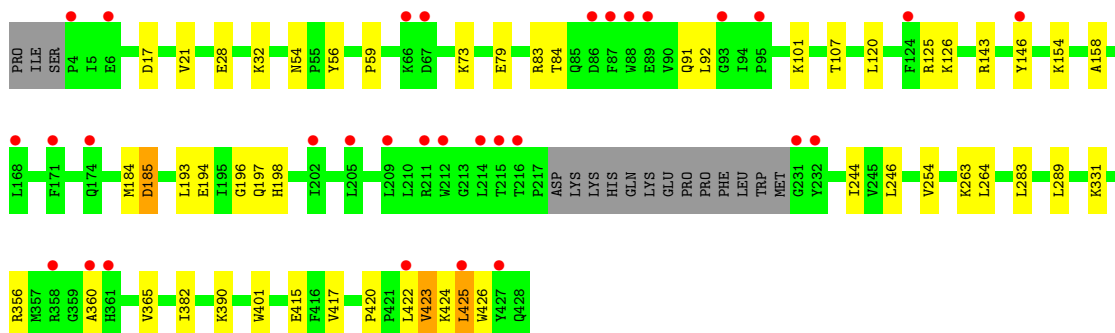
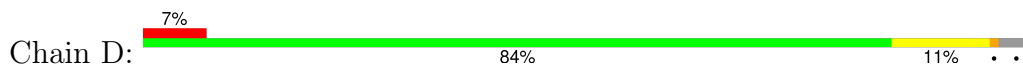


- Molecule 2: Gag-Pol polyprotein

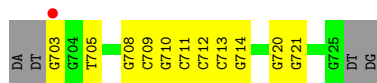




- Molecule 2: Gag-Pol polyprotein



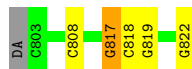
- Molecule 3: DNA (5'-D(P\*GP\*GP\*TP\*CP\*GP\*GP\*CP\*GP\*CP\*CP\*GP\*AP\*AP\*CP\*A P\*GP\*GP\*GP\*AP\*CP\*TP\*G)-3')



- Molecule 3: DNA (5'-D(P\*GP\*GP\*TP\*CP\*GP\*GP\*CP\*GP\*CP\*CP\*GP\*AP\*AP\*CP\*A P\*GP\*GP\*GP\*AP\*CP\*TP\*G)-3')



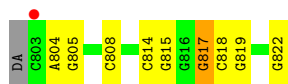
- Molecule 4: DNA (5'-D(\*CP\*AP\*GP\*TP\*CP\*CP\*CP\*TP\*GP\*TP\*TP\*CP\*GP\*GP\*(MRG) P\*CP\*GP\*CP\*CP\*(DDG))-3')



- Molecule 4: DNA (5'-D(\*CP\*AP\*GP\*TP\*CP\*CP\*CP\*TP\*GP\*TP\*TP\*CP\*GP\*GP\*(MRG) P\*CP\*GP\*CP\*CP\*(DDG))-3')







## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	89.48Å 132.67Å 139.02Å 90.00° 98.62° 90.00°	Depositor
Resolution (Å)	69.78 – 2.62 69.78 – 2.62	Depositor EDS
% Data completeness (in resolution range)	99.6 (69.78-2.62) 99.6 (69.78-2.62)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.21 (at 2.62Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.223 , 0.255 0.224 , 0.256	Depositor DCC
$R_{free}$ test set	2888 reflections (3.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	56.5	Xtrriage
Anisotropy	0.188	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 56.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	17785	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	81.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.98% 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: DDG, MN, MRG, RFE

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	0.23	0/4631	0.40	0/6293
1	C	0.23	0/4639	0.40	0/6303
2	B	0.23	0/3499	0.40	0/4752
2	D	0.23	0/3497	0.40	0/4751
3	E	0.50	0/555	0.80	0/856
3	T	0.48	0/536	0.78	0/826
4	F	0.55	0/400	0.94	0/612
4	P	0.51	0/400	0.89	0/612
All	All	0.27	0/18157	0.47	0/25005

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	4513	0	4578	33	0
1	C	4521	0	4587	37	0
2	B	3401	0	3431	23	0
2	D	3400	0	3433	28	0
3	E	494	0	269	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	T	477	0	256	8	0
4	F	403	0	224	8	0
4	P	403	0	224	4	0
5	A	2	0	0	0	0
5	C	2	0	0	0	0
6	A	27	0	0	1	0
6	C	27	0	0	1	0
7	A	39	0	0	0	0
7	B	38	0	0	0	0
7	C	16	0	0	0	0
7	D	16	0	0	0	0
7	E	1	0	0	0	0
7	F	1	0	0	0	0
7	P	1	0	0	0	0
7	T	3	0	0	0	0
All	All	17785	0	17002	135	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 4.

All (135) 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:C:181:TYR:HB2	1:C:188:TYR:HB3	1.73	0.70
1:C:125:ARG:HE	1:C:147:ASN:HA	1.56	0.69
1:A:181:TYR:HB2	1:A:188:TYR:HB3	1.76	0.67
1:C:451:LYS:NZ	4:F:808:DC:OP1	2.30	0.64
1:A:72:ARG:NH2	6:A:603:RFE:S25	2.72	0.63
1:C:172:LYS:HE2	1:C:180:ILE:HB	1.79	0.63
2:B:79:GLU:HG3	2:B:83:ARG:HE	1.65	0.62
1:C:178:ILE:HG13	1:C:191:SER:HB3	1.83	0.61
1:A:503:LEU:HD22	1:A:535:TRP:HB2	1.84	0.60
2:B:125:ARG:HE	2:B:147:ASN:HA	1.64	0.60
1:A:84:THR:HB	1:A:154:LYS:HE2	1.83	0.60
1:A:46:LYS:HD3	1:A:116:PHE:HB3	1.83	0.59
2:B:73:LYS:NZ	2:B:146:TYR:OH	2.35	0.59
1:A:451:LYS:NZ	4:P:808:DC:OP1	2.35	0.58
1:C:72:ARG:NH2	6:C:603:RFE:O21	2.29	0.58
2:B:21:VAL:HB	2:B:59:PRO:HD3	1.86	0.57
2:B:122:GLU:OE1	2:B:125:ARG:NH1	2.37	0.56
2:D:244:ILE:HD13	2:D:425:LEU:HD11	1.87	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:503:LEU:HD22	1:C:535:TRP:HB2	1.88	0.56
1:A:443:ASP:OD1	1:A:444:GLY:N	2.38	0.56
1:C:206:ARG:NH2	1:C:216:THR:O	2.39	0.55
1:A:288:ALA:HB3	1:A:291:GLU:HB2	1.90	0.54
1:A:206:ARG:NH2	1:A:216:THR:O	2.41	0.54
1:C:84:THR:HB	1:C:154:LYS:HE2	1.89	0.54
2:D:356:ARG:HD2	2:D:360:ALA:HB1	1.91	0.53
2:B:247:PRO:O	2:B:307:ARG:NH2	2.40	0.53
1:C:247:PRO:O	1:C:307:ARG:NH2	2.43	0.52
1:A:543:GLY:N	2:B:283:LEU:O	2.30	0.52
1:C:110:ASP:HB3	1:C:220:LYS:HB3	1.90	0.52
2:D:21:VAL:HB	2:D:59:PRO:HD3	1.91	0.52
1:C:402:TRP:O	2:D:331:LYS:NZ	2.33	0.52
2:D:254:VAL:HG13	2:D:283:LEU:HD22	1.92	0.51
2:B:191:SER:OG	2:B:198:HIS:ND1	2.42	0.51
2:D:28:GLU:HG2	2:D:32:LYS:HE2	1.92	0.51
1:A:469:LEU:HD12	1:A:477:THR:HG22	1.92	0.51
2:B:282:LEU:HD21	2:B:295:LEU:HA	1.91	0.51
2:D:263:LYS:HG3	2:D:425:LEU:HB2	1.93	0.51
1:A:261:VAL:HG13	1:A:276:VAL:HG11	1.93	0.51
1:A:21:VAL:HB	1:A:59:PRO:HD3	1.93	0.50
1:A:395:LYS:NZ	1:A:414:TRP:O	2.45	0.50
4:F:818:DC:H2'	4:F:819:DG:C8	2.47	0.50
2:D:185:ASP:N	2:D:185:ASP:OD1	2.44	0.50
4:P:818:DC:H2'	4:P:819:DG:C8	2.47	0.50
3:E:718:DA:H1'	3:E:719:DG:C8	2.47	0.49
4:F:818:DC:H2'	4:F:819:DG:H8	1.77	0.49
1:C:115:TYR:HD2	1:C:151:GLN:HG2	1.78	0.49
2:B:154:LYS:HG2	2:B:184:MET:SD	2.53	0.49
1:C:109:LEU:HD11	1:C:187:LEU:HD12	1.95	0.49
2:B:390:LYS:NZ	2:B:415:GLU:OE2	2.34	0.48
1:A:19:PRO:HD3	1:A:80:LEU:HD13	1.96	0.47
2:B:60:VAL:HG22	2:B:75:VAL:HG22	1.94	0.47
2:B:422:LEU:H	2:B:422:LEU:HG	1.51	0.47
2:D:17:ASP:O	2:D:83:ARG:HD3	2.15	0.47
1:C:342:TYR:HB3	1:C:348:ASN:HA	1.96	0.47
1:C:406:TRP:CZ2	2:D:420:PRO:HG3	2.50	0.47
1:A:116:PHE:HA	1:A:148:VAL:HG21	1.97	0.47
1:C:457:TYR:HE1	1:C:463:ARG:HG2	1.79	0.47
3:T:711:DC:H2'	3:T:712:DC:C6	2.49	0.47
1:A:541:GLY:HA2	1:A:546:GLU:HB2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:F:814:DC:H2''	4:F:815:DG:H8	1.80	0.47
1:C:19:PRO:HG3	1:C:80:LEU:HB2	1.97	0.46
1:A:58:THR:HG21	1:A:77:PHE:CE1	2.50	0.46
1:A:80:LEU:O	1:A:84:THR:OG1	2.27	0.46
1:C:261:VAL:HG13	1:C:276:VAL:HG11	1.97	0.46
2:D:56:TYR:HE2	2:D:126:LYS:HE2	1.81	0.46
3:T:713:DC:H2'	3:T:714:DG:C8	2.51	0.46
1:C:41:MET:HB3	1:C:46:LYS:HB2	1.97	0.46
2:D:91:GLN:HG2	2:D:92:LEU:HG	1.97	0.46
3:T:709:DC:H2'	3:T:710:DG:C8	2.50	0.46
1:C:114:ALA:HB1	1:C:160:PHE:CZ	2.51	0.46
1:A:16:MET:HB3	1:A:83:ARG:HD3	1.98	0.46
1:A:397:THR:HG21	1:A:424:LYS:HA	1.97	0.46
2:D:365:VAL:HG11	2:D:401:TRP:HB2	1.98	0.46
1:C:442:VAL:HG12	1:C:457:TYR:HB3	1.98	0.45
2:D:79:GLU:HG3	2:D:83:ARG:HE	1.81	0.45
4:P:818:DC:H2'	4:P:819:DG:H8	1.79	0.45
4:F:804:DA:H4'	4:F:805:DG:OP1	2.16	0.45
2:B:265:ASN:O	2:B:268:SER:OG	2.30	0.45
1:A:114:ALA:HB1	1:A:160:PHE:CZ	2.51	0.45
1:C:279:LEU:HD23	1:C:299:ALA:HB1	1.98	0.45
1:A:276:VAL:HG23	1:A:353:LYS:HE2	1.99	0.45
2:B:54:ASN:HB3	2:B:143:ARG:HH21	1.81	0.45
2:D:120:LEU:HD23	2:D:125:ARG:HG2	1.98	0.45
3:E:722:DA:N6	4:F:805:DG:O6	2.49	0.45
1:C:496:VAL:HG21	2:D:289:LEU:HD21	1.99	0.45
1:A:91:GLN:O	3:T:708:DG:H4'	2.17	0.44
1:C:443:ASP:OD1	1:C:444:GLY:N	2.50	0.44
3:E:711:DC:H2'	3:E:712:DC:C6	2.53	0.44
1:C:405:TYR:CE2	1:C:407:GLN:HB2	2.53	0.44
2:D:154:LYS:HG2	2:D:184:MET:SD	2.58	0.44
1:C:24:TRP:HD1	1:C:59:PRO:HB3	1.82	0.44
1:C:469:LEU:HD12	1:C:477:THR:HG22	2.00	0.43
2:D:92:LEU:HB2	2:D:158:ALA:HB1	2.00	0.43
1:A:363:ASN:HA	1:A:511:ASP:OD1	2.18	0.43
1:A:495:ILE:HB	1:A:533:LEU:HD23	2.00	0.43
1:A:503:LEU:HD12	1:A:533:LEU:HD13	1.99	0.43
1:C:58:THR:HG21	1:C:77:PHE:CD1	2.53	0.43
2:B:365:VAL:HG11	2:B:401:TRP:HB2	2.00	0.43
2:D:246:LEU:HD11	2:D:264:LEU:HD21	2.00	0.43
3:T:720:DG:H2''	3:T:721:DG:C8	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:F:817:MRG:H2'	4:F:818:DC:C6	2.52	0.43
2:D:101:LYS:HD3	2:D:382:ILE:HG23	2.01	0.43
2:D:73:LYS:NZ	2:D:146:TYR:OH	2.37	0.43
3:T:710:DG:H2'	3:T:711:DC:C6	2.54	0.43
1:C:16:MET:HB3	1:C:83:ARG:HG2	2.01	0.42
1:C:46:LYS:HD3	1:C:116:PHE:HB3	2.01	0.42
4:P:817:MRG:H2'	4:P:818:DC:C6	2.54	0.42
2:B:332:GLN:HB2	2:B:336:GLN:HB2	2.01	0.42
2:D:423:VAL:HB	2:D:426:TRP:CD1	2.54	0.42
1:A:24:TRP:HD1	1:A:59:PRO:HB3	1.84	0.42
2:B:63:ILE:HD13	2:B:74:LEU:HD22	2.02	0.42
2:D:194:GLU:OE1	2:D:196:GLY:N	2.34	0.42
4:F:814:DC:H2''	4:F:815:DG:C8	2.55	0.42
1:C:198:HIS:O	1:C:202:ILE:HG12	2.19	0.42
3:T:709:DC:H2'	3:T:710:DG:H8	1.85	0.42
2:B:17:ASP:O	2:B:83:ARG:HD3	2.19	0.42
1:C:34:LEU:HD21	1:C:62:ALA:HB2	2.01	0.42
1:A:58:THR:HG22	1:A:129:ALA:O	2.19	0.42
3:E:718:DA:H4'	3:E:719:DG:OP1	2.20	0.42
1:C:111:VAL:HB	1:C:185:ASP:HB2	2.00	0.41
1:A:442:VAL:HB	1:A:481:ALA:HB1	2.01	0.41
1:C:317:VAL:HG11	1:C:347:LYS:HB3	2.01	0.41
1:A:408:ALA:O	2:B:393:ILE:HG13	2.20	0.41
2:B:88:TRP:CE3	2:B:89:GLU:HG3	2.56	0.41
2:B:185:ASP:OD1	2:B:185:ASP:N	2.53	0.41
3:T:703:DG:H21	3:T:705:DT:H73	1.86	0.41
2:D:54:ASN:HB3	2:D:143:ARG:HH21	1.86	0.41
2:D:193:LEU:HB3	2:D:197:GLN:HB2	2.02	0.41
2:D:390:LYS:NZ	2:D:415:GLU:OE2	2.33	0.41
1:C:500:GLN:CD	2:D:422:LEU:HD21	2.42	0.40
1:A:279:LEU:HD23	1:A:299:ALA:HB1	2.02	0.40
2:B:195:ILE:H	2:B:195:ILE:HG12	1.48	0.40
1:C:303:LEU:HD23	1:C:307:ARG:HG3	2.03	0.40
2:D:107:THR:OG1	2:D:198:HIS:NE2	2.50	0.40
1:A:281:LYS:O	1:A:284:ARG:HG2	2.22	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	553/556 (100%)	539 (98%)	14 (2%)	0	100	100
1	C	554/556 (100%)	536 (97%)	18 (3%)	0	100	100
2	B	407/428 (95%)	390 (96%)	16 (4%)	1 (0%)	47	69
2	D	408/428 (95%)	390 (96%)	17 (4%)	1 (0%)	47	69
All	All	1922/1968 (98%)	1855 (96%)	65 (3%)	2 (0%)	51	74

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	230	MET
2	D	423	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	496/497 (100%)	493 (99%)	3 (1%)	86	94
1	C	497/497 (100%)	494 (99%)	3 (1%)	86	94
2	B	373/390 (96%)	369 (99%)	4 (1%)	73	88
2	D	374/390 (96%)	369 (99%)	5 (1%)	69	85
All	All	1740/1774 (98%)	1725 (99%)	15 (1%)	78	90

All (15) residues with a non-rotameric sidechain are listed below:



Mol	Chain	Res	Type
1	A	72	ARG
1	A	109	LEU
1	A	512	LYS
2	B	72	ARG
2	B	84	THR
2	B	195	ILE
2	B	422	LEU
1	C	218	ASP
1	C	248	GLU
1	C	276	VAL
2	D	84	THR
2	D	185	ASP
2	D	417	VAL
2	D	424	LYS
2	D	425	LEU

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

Mol	Chain	Res	Type
1	C	373	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

4 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$
4	DDG	P	822	3,4	17,23,24	1.23	2 (11%)	16,33,36	1.55	3 (18%)
4	MRG	P	817	3,4	18,24,29	1.11	3 (16%)	19,35,42	0.71	1 (5%)
4	MRG	F	817	3,4	18,24,29	1.12	3 (16%)	19,35,42	0.71	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	DDG	F	822	3,4	17,23,24	1.24	2 (11%)	16,33,36	1.57	3 (18%)

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
4	DDG	P	822	3,4	-	2/3/18/19	0/3/3/3
4	MRG	P	817	3,4	-	0/3/21/27	0/3/3/3
4	MRG	F	817	3,4	-	0/3/21/27	0/3/3/3
4	DDG	F	822	3,4	-	0/3/18/19	0/3/3/3

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	817	MRG	C5-C6	-2.76	1.42	1.47
4	P	817	MRG	C5-C6	-2.75	1.42	1.47
4	F	822	DDG	C5-C6	-2.73	1.42	1.47
4	P	822	DDG	C5-C6	-2.72	1.42	1.47
4	F	822	DDG	C8-N7	-2.69	1.30	1.34
4	P	822	DDG	C8-N7	-2.66	1.30	1.34
4	F	817	MRG	C8-N7	-2.51	1.30	1.34
4	P	817	MRG	C8-N7	-2.50	1.30	1.34
4	F	817	MRG	C5-C4	-2.03	1.38	1.43
4	P	817	MRG	C5-C4	-2.02	1.38	1.43

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	822	DDG	C8-N7-C5	3.85	109.10	102.55
4	P	822	DDG	C8-N7-C5	3.84	109.08	102.55
4	F	822	DDG	C2-N1-C6	-2.72	120.14	125.11
4	P	822	DDG	C2-N1-C6	-2.69	120.19	125.11
4	F	822	DDG	C5-C6-N1	2.32	118.50	114.07
4	P	822	DDG	C5-C6-N1	2.30	118.46	114.07
4	F	817	MRG	O6-C6-C5	2.01	128.31	124.32
4	P	817	MRG	O6-C6-C5	2.00	128.29	124.32

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	P	822	DDG	O4'-C4'-C5'-O5'
4	P	822	DDG	C3'-C4'-C5'-O5'

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	P	817	MRG	1	0
4	F	817	MRG	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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
6	RFE	A	603	5	22,28,28	1.43	6 (27%)	18,39,39	1.85	4 (22%)
6	RFE	C	603	5	22,28,28	1.44	6 (27%)	18,39,39	1.84	4 (22%)

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
6	RFE	A	603	5	-	7/18/23/23	0/2/2/2
6	RFE	C	603	5	-	6/18/23/23	0/2/2/2

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	603	RFE	P02-O27	-2.54	1.50	1.56
6	C	603	RFE	P02-O27	-2.53	1.50	1.56
6	A	603	RFE	C23-C19	2.43	1.59	1.53
6	C	603	RFE	C23-C19	2.34	1.58	1.53
6	C	603	RFE	C19-C20	2.33	1.58	1.52
6	C	603	RFE	C09-N10	2.21	1.38	1.35
6	A	603	RFE	C09-N10	2.19	1.38	1.35
6	A	603	RFE	C19-C20	2.18	1.58	1.52
6	C	603	RFE	C11-N12	2.15	1.37	1.33
6	A	603	RFE	C11-N12	2.13	1.37	1.33
6	C	603	RFE	C11-N10	2.08	1.35	1.32
6	A	603	RFE	C11-N10	2.04	1.35	1.32

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	C	603	RFE	O27-P02-O01	5.58	126.83	112.36
6	A	603	RFE	O27-P02-O01	5.52	126.69	112.36
6	A	603	RFE	C23-C19-C20	-2.42	104.62	110.35
6	A	603	RFE	C23-C19-N18	2.30	115.19	111.00
6	C	603	RFE	C23-C19-C20	-2.25	105.02	110.35
6	A	603	RFE	C15-C13-N14	2.18	123.63	120.31
6	C	603	RFE	C15-C13-N14	2.17	123.62	120.31
6	C	603	RFE	C23-C19-N18	2.17	114.95	111.00

There are no chirality outliers.

All (13) torsion outliers are listed below:

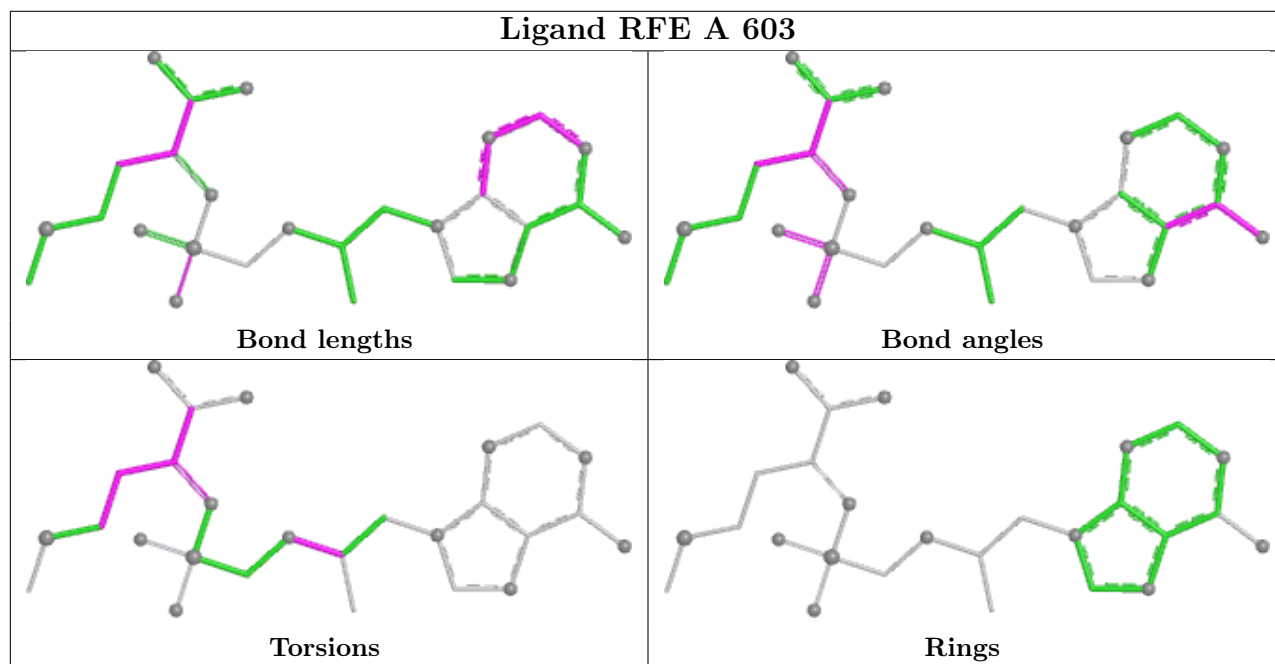
Mol	Chain	Res	Type	Atoms
6	A	603	RFE	C20-C19-C23-C24
6	A	603	RFE	N18-C19-C23-C24
6	A	603	RFE	C20-C19-N18-P02
6	C	603	RFE	N18-C19-C20-O21
6	C	603	RFE	N18-C19-C20-O22
6	C	603	RFE	C19-C23-C24-S25
6	C	603	RFE	C23-C19-C20-O22
6	A	603	RFE	C19-C23-C24-S25
6	C	603	RFE	C23-C19-C20-O21
6	C	603	RFE	O04-C03-P02-O01
6	A	603	RFE	N18-C19-C20-O22
6	A	603	RFE	C06-C05-O04-C03
6	A	603	RFE	N18-C19-C20-O21

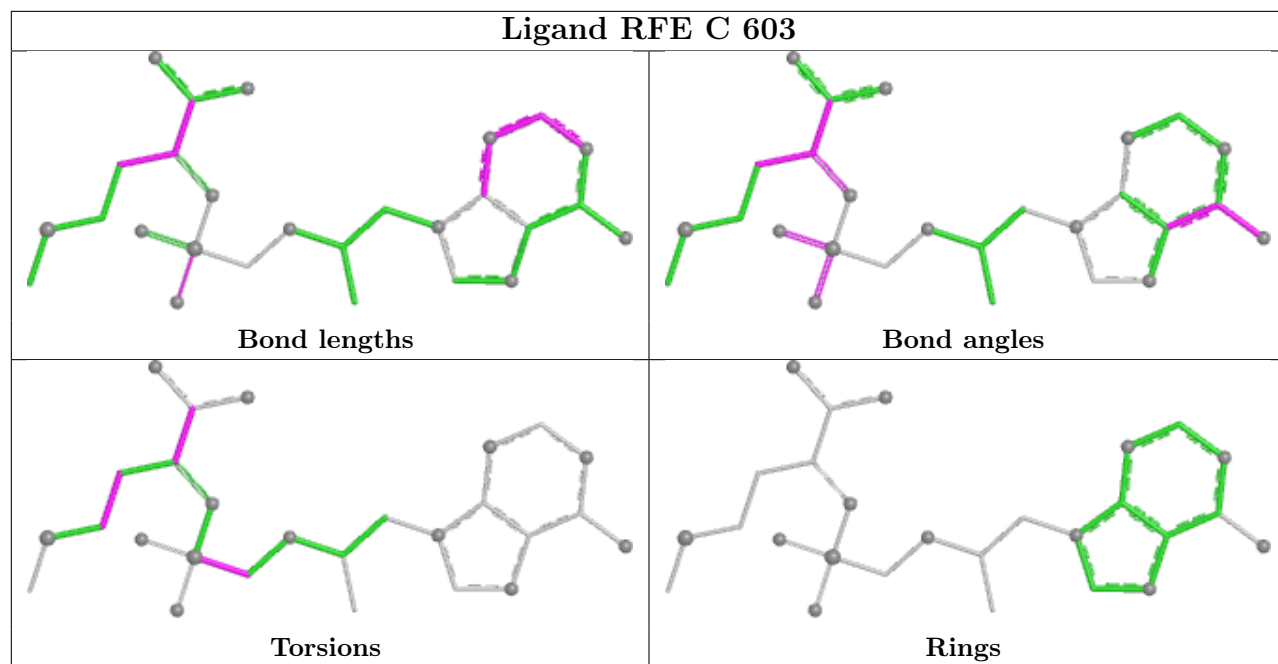
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	603	RFE	1	0
6	C	603	RFE	1	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

### 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	555/556 (99%)	0.38	47 (8%) 10 7	28, 69, 136, 186	0
1	C	556/556 (100%)	0.76	83 (14%) 2 1	31, 90, 162, 193	0
2	B	411/428 (96%)	0.18	10 (2%) 59 53	22, 57, 112, 140	0
2	D	412/428 (96%)	0.46	31 (7%) 14 10	32, 74, 123, 162	0
3	E	24/27 (88%)	-0.21	3 (12%) 3 2	73, 120, 181, 194	0
3	T	23/27 (85%)	-0.48	1 (4%) 35 29	61, 109, 170, 191	0
4	F	18/21 (85%)	-0.57	1 (5%) 24 19	62, 103, 157, 174	0
4	P	18/21 (85%)	-0.83	0 100 100	62, 88, 159, 162	0
All	All	2017/2064 (97%)	0.42	176 (8%) 10 7	22, 72, 150, 194	0

All (176) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	142	ILE	12.7
1	C	132	ILE	9.1
2	D	4	PRO	9.1
1	A	133	PRO	8.6
1	A	140	PRO	8.5
1	C	138	GLU	8.1
2	D	361	HIS	7.7
1	A	128	THR	6.9
1	C	30	LYS	6.7
1	C	309	ILE	6.5
1	C	74	LEU	6.5
2	B	214	LEU	6.5
1	C	293	ILE	6.5
1	C	136	ASN	6.3
1	C	252	TRP	6.3
1	A	249	LYS	6.2

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	C	49	LYS	5.9
1	C	24	TRP	5.8
1	C	133	PRO	5.7
2	D	214	LEU	5.7
1	C	144	TYR	5.4
1	A	282	LEU	5.3
1	C	61	PHE	5.3
1	A	131	THR	5.2
1	C	141	GLY	5.2
2	D	168	LEU	5.2
1	C	246	LEU	5.2
2	D	215	THR	5.2
3	E	702	DT	5.2
1	A	138	GLU	5.1
1	A	73	LYS	5.1
1	C	139	THR	5.1
1	C	131	THR	5.0
1	C	276	VAL	5.0
1	A	283	LEU	5.0
1	C	247	PRO	5.0
1	A	134	SER	4.9
1	A	287	LYS	4.9
1	A	142	ILE	4.8
1	C	34	LEU	4.8
1	C	27	THR	4.8
1	C	205	LEU	4.7
1	A	26	LEU	4.5
1	C	137	ASN	4.4
1	A	252	TRP	4.4
2	D	89	GLU	4.4
1	A	286	THR	4.2
1	A	135	ILE	4.2
1	A	28	GLU	4.2
1	C	140	PRO	4.2
1	C	292	VAL	4.1
1	C	124	PHE	4.1
1	C	22	LYS	4.1
2	D	66	LYS	4.1
1	C	52	PRO	4.0
2	D	202	ILE	4.0
2	D	360	ALA	4.0
1	A	292	VAL	4.0

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	C	26	LEU	3.8
1	C	135	ILE	3.7
1	C	146	TYR	3.7
1	C	109	LEU	3.7
1	C	310	LEU	3.6
2	B	88	TRP	3.6
2	D	425	LEU	3.6
1	C	214	LEU	3.6
3	E	703	DG	3.6
4	F	803	DC	3.5
1	C	296	THR	3.5
2	D	93	GLY	3.4
1	A	22	LYS	3.4
2	B	4	PRO	3.3
1	C	286	THR	3.3
1	C	75	VAL	3.3
1	A	25	PRO	3.3
1	C	283	LEU	3.3
2	D	67	ASP	3.2
1	C	28	GLU	3.2
1	C	128	THR	3.2
2	D	95	PRO	3.2
1	A	136	ASN	3.2
2	B	85	GLN	3.1
1	C	248	GLU	3.1
1	C	32	LYS	3.1
1	A	293	ILE	3.0
1	C	23	GLN	3.0
1	C	220	LYS	3.0
2	D	216	THR	3.0
2	D	231	GLY	3.0
2	D	211	ARG	3.0
1	C	67	ASP	3.0
1	C	77	PHE	2.9
1	C	295	LEU	2.9
2	D	88	TRP	2.9
1	C	66	LYS	2.9
1	C	25	PRO	2.9
1	C	35	VAL	2.9
1	A	137	ASN	2.9
1	C	299	ALA	2.9
1	A	130	PHE	2.9

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
2	D	124	PHE	2.8
2	D	209	LEU	2.8
2	D	232	TYR	2.8
1	C	21	VAL	2.8
1	C	143	ARG	2.8
1	C	294	PRO	2.7
1	A	139	THR	2.7
2	B	87	PHE	2.7
1	A	248	GLU	2.7
2	D	358	ARG	2.7
1	C	308	GLU	2.7
1	A	261	VAL	2.6
1	A	289	LEU	2.6
1	C	37	ILE	2.6
1	A	61	PHE	2.6
1	A	141	GLY	2.6
1	A	303	LEU	2.6
2	B	301	LEU	2.6
1	A	294	PRO	2.6
1	C	281	LYS	2.6
2	B	211	ARG	2.6
1	A	129	ALA	2.5
1	A	290	THR	2.5
1	C	228	LEU	2.5
3	T	703	DG	2.5
1	A	132	ILE	2.5
3	E	725	DG	2.5
2	D	422	LEU	2.4
1	A	279	LEU	2.4
1	C	257	ILE	2.4
2	D	146	TYR	2.4
1	C	260	LEU	2.4
1	C	298	GLU	2.4
2	D	87	PHE	2.4
1	C	62	ALA	2.4
1	C	271	TYR	2.3
1	A	74	LEU	2.3
2	D	205	LEU	2.3
1	C	29	GLU	2.3
1	C	134	SER	2.3
1	A	260	LEU	2.3
1	A	124	PHE	2.3

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Mol	Chain	Res	Type	RSRZ
1	C	289	LEU	2.3
2	B	168	LEU	2.3
1	C	244	ILE	2.3
1	C	245	VAL	2.3
1	C	210	LEU	2.3
2	D	174	GLN	2.3
1	C	207	GLN	2.3
1	C	63	ILE	2.2
2	D	171	PHE	2.2
1	A	193	LEU	2.2
1	C	73	LYS	2.2
1	C	130	PHE	2.2
1	C	251	SER	2.2
1	A	246	LEU	2.2
1	A	296	THR	2.2
1	A	109	LEU	2.1
2	D	212	TRP	2.1
1	C	2	ILE	2.1
2	B	189	VAL	2.1
1	A	552	VAL	2.1
1	C	167	ILE	2.1
1	C	285	GLY	2.1
1	C	297	GLU	2.1
1	A	49	LYS	2.1
1	C	250	ASP	2.1
1	C	277	ARG	2.1
2	D	427	TYR	2.1
1	C	0	VAL	2.1
2	B	202	ILE	2.1
2	D	6	GLU	2.1
2	D	86	ASP	2.1
1	A	29	GLU	2.0
1	A	146	TYR	2.0
1	C	10	VAL	2.0

## 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( $\text{\AA}^2$ )	Q<0.9
4	MRG	F	817	22/27	0.89	0.09	92,122,139,158	0
4	MRG	P	817	22/27	0.92	0.11	70,95,119,132	0
4	DDG	F	822	21/22	0.93	0.15	81,89,103,108	0
4	DDG	P	822	21/22	0.95	0.16	56,65,73,79	0

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

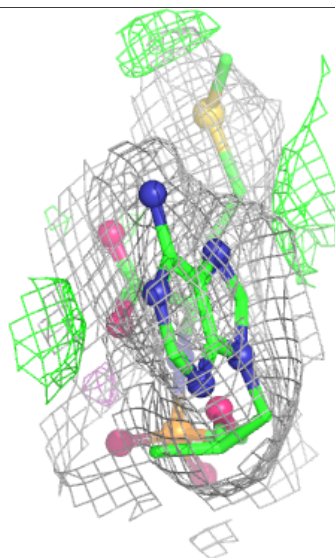
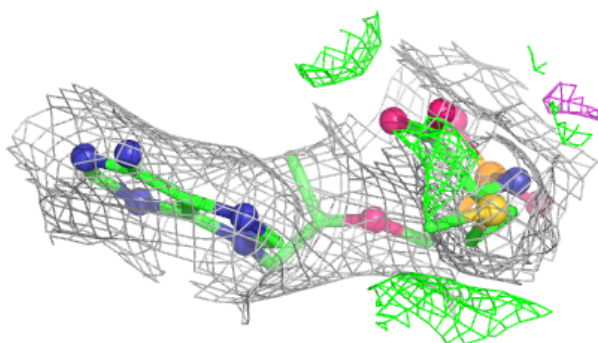
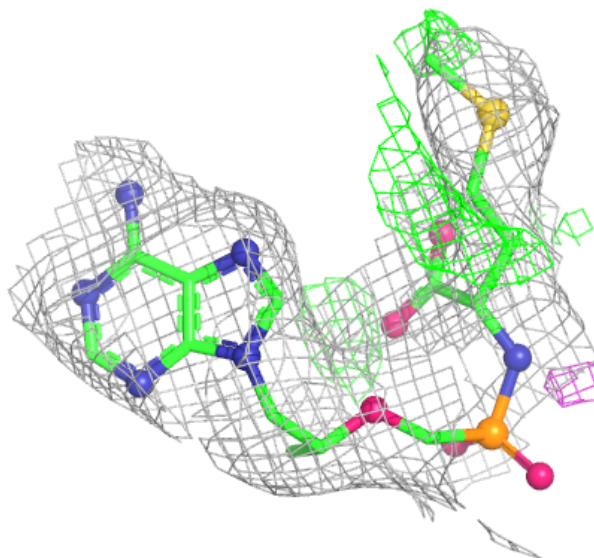
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

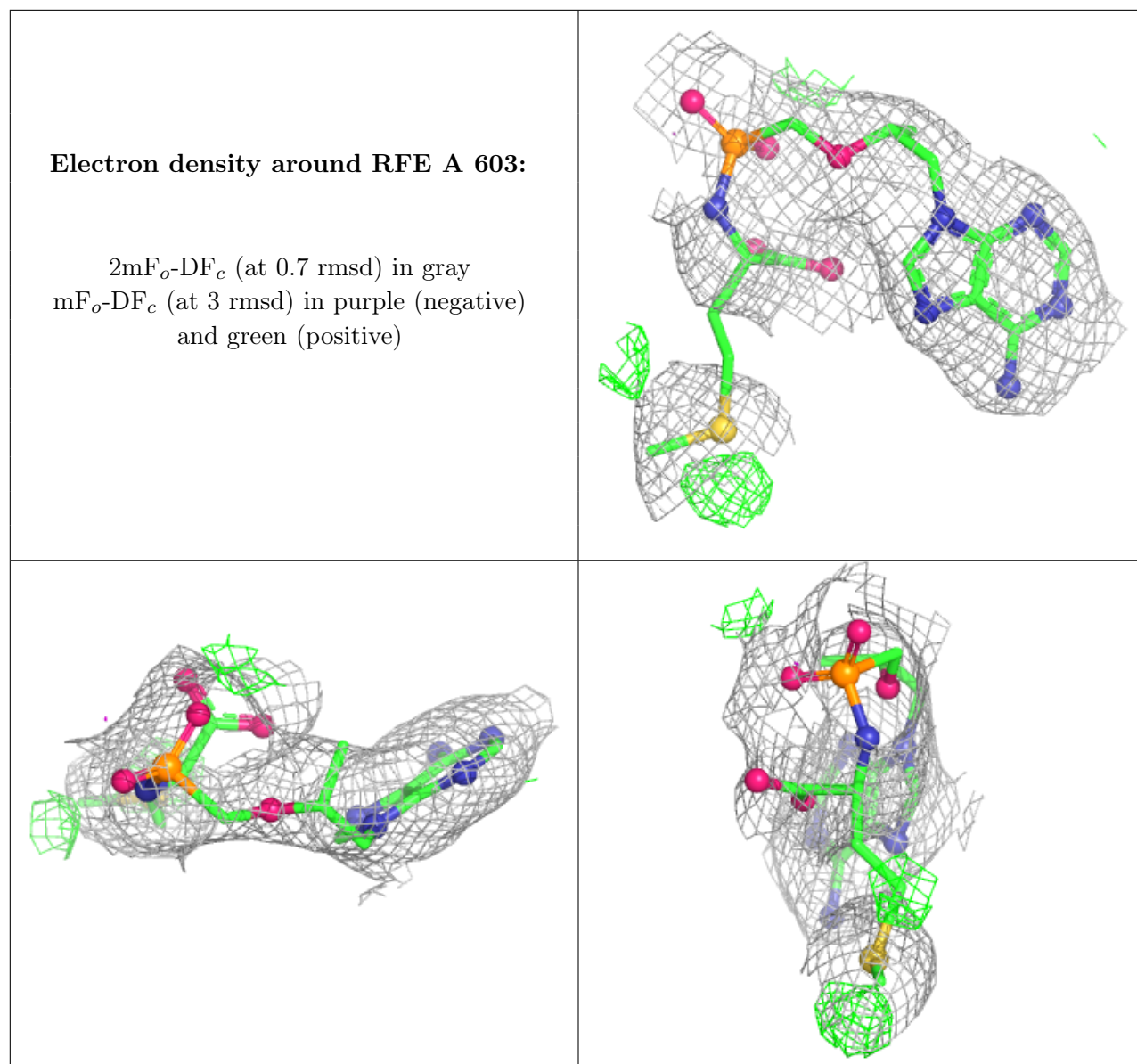
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	MN	A	602	1/1	0.87	0.13	130,130,130,130	0
6	RFE	C	603	27/27	0.91	0.14	84,103,133,140	0
6	RFE	A	603	27/27	0.92	0.20	61,82,105,121	0
5	MN	C	602	1/1	0.93	0.19	85,85,85,85	0
5	MN	A	601	1/1	0.94	0.14	92,92,92,92	0
5	MN	C	601	1/1	0.98	0.05	133,133,133,133	0

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.

**Electron density around RFE C 603:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.