



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 02:41 AM UTC

PDB ID : 5TXP / pdb_00005txp
Title : STRUCTURE OF Q151M complex (A62V, V75I, F77L, F116Y, Q151M)
mutant HIV-1 REVERSE TRANSCRIPTASE (RT) TERNARY COMPLEX
WITH A DOUBLE STRANDED DNA AND AN INCOMING DDATP
Authors : Das, K.; Martinez, S.M.; Arnold, E.
Deposited on : 2016-11-17
Resolution : 2.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

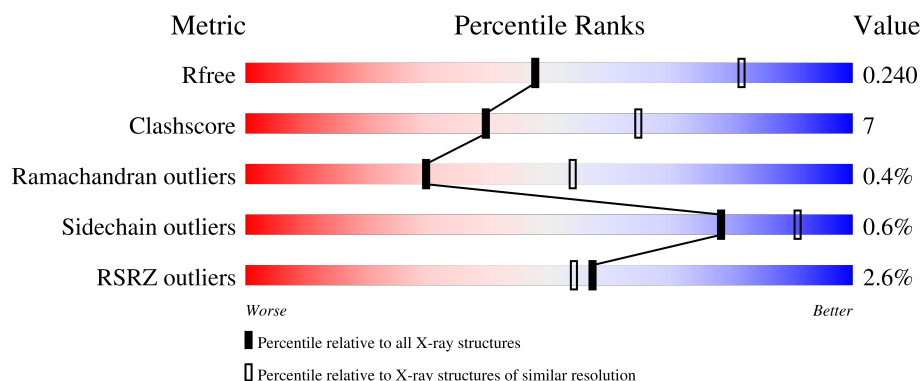
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

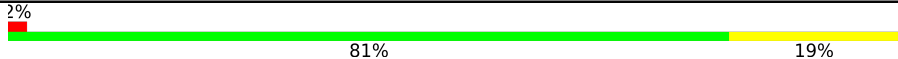
The reported resolution of this entry is 2.70 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



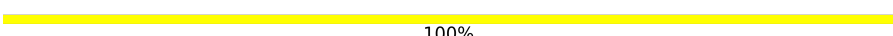
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	556	
1	C	556	
2	B	428	
2	D	428	

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
3	E	27	
3	T	27	
4	F	21	
4	P	21	
5	G	2	
5	H	2	

2 Entry composition

There are 10 unique types of molecules in this entry. The entry contains 17860 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 HIV-1 REVERSE TRANSCRIPTASE P51 SUBUNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	556	Total	C	N	O	S	0	0	0
			4516	2923	751	833	9			
1	C	556	Total	C	N	O	S	0	0	0
			4518	2925	751	833	9			

There are 20 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	62	VAL	ALA	engineered mutation	UNP P03366
A	75	ILE	VAL	engineered mutation	UNP P03366
A	77	LEU	PHE	engineered mutation	UNP P03366
A	116	TYR	PHE	engineered mutation	UNP P03366
A	151	MET	GLN	engineered mutation	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	62	VAL	ALA	engineered mutation	UNP P03366
C	75	ILE	VAL	engineered mutation	UNP P03366
C	77	LEU	PHE	engineered mutation	UNP P03366
C	116	TYR	PHE	engineered mutation	UNP P03366
C	151	MET	GLN	engineered mutation	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 HIV-1 REVERSE TRANSCRIPTASE P61 SUBUNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	412	Total	C	N	O	S	0	0	0
			3400	2212	563	619	6			
2	D	412	Total	C	N	O	S	0	0	0
			3394	2207	563	619	5			

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

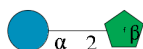
- Molecule 3 is a DNA chain called DNA (5'-D(*TP*GP*GP*TP*CP*GP*GP*CP*GP*CP*CP*GP*AP*AP*CP*AP*GP*GP*GP*AP*CP*TP*G)-3').

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

- 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*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	P	20	Total	C	N	O	P	S	0	0
			407	195	72	120	19	1		
4	F	20	Total	C	N	O	P	S	0	0
			407	195	72	120	19	1		

- Molecule 5 is an oligosaccharide called beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose.

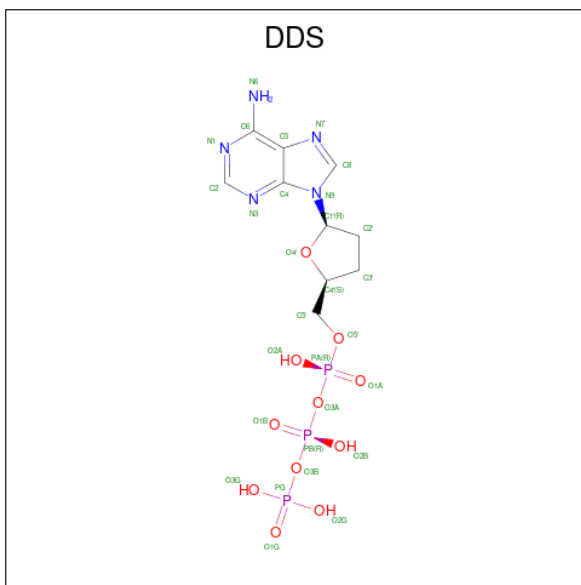


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf	Trace
5	G	2	Total	C O	0	0	0
			23	12 11			
5	H	2	Total	C O	0	0	0
			23	12 11			

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

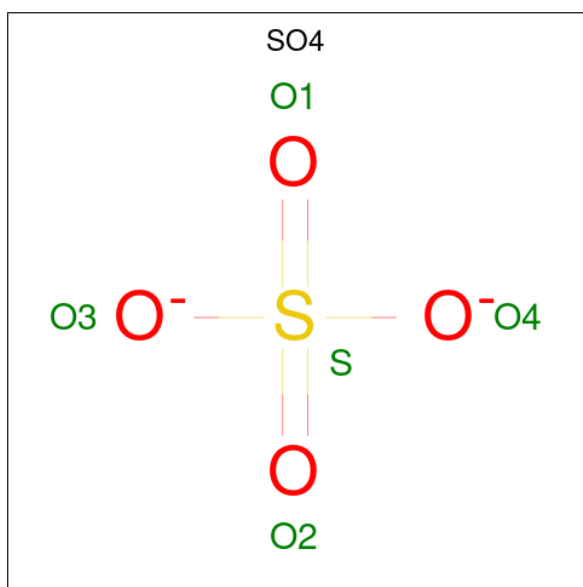
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	2	Total	Mg	0	0
			2	2		
6	C	2	Total	Mg	0	0
			2	2		

- Molecule 7 is 2',3'-dideoxyadenosine triphosphate (CCD ID: DDS) (formula: $C_{10}H_{16}N_5O_{11}P_3$).



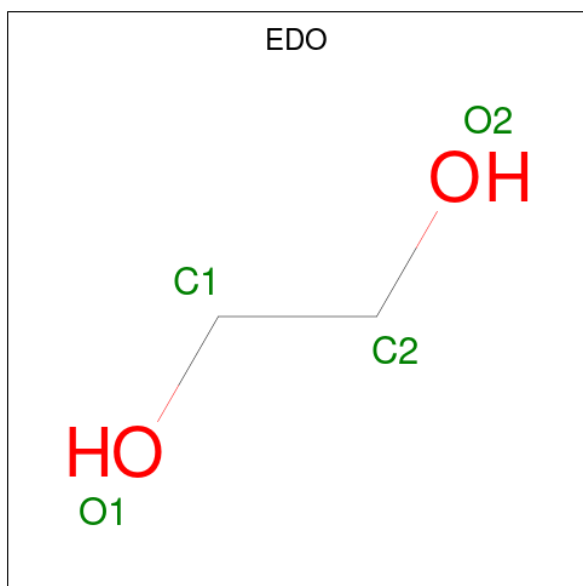
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
7	A	1	Total	C	N	O	P	0	0
			29	10	5	11	3		
7	C	1	Total	C	N	O	P	0	0
			29	10	5	11	3		

- Molecule 8 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 9 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	C	O	0	0
			4	2	2		
9	T	1	Total	C	O	0	0
			4	2	2		
9	D	1	Total	C	O	0	0
			4	2	2		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	D	1	Total	C	O	0	0
			4	2	2		

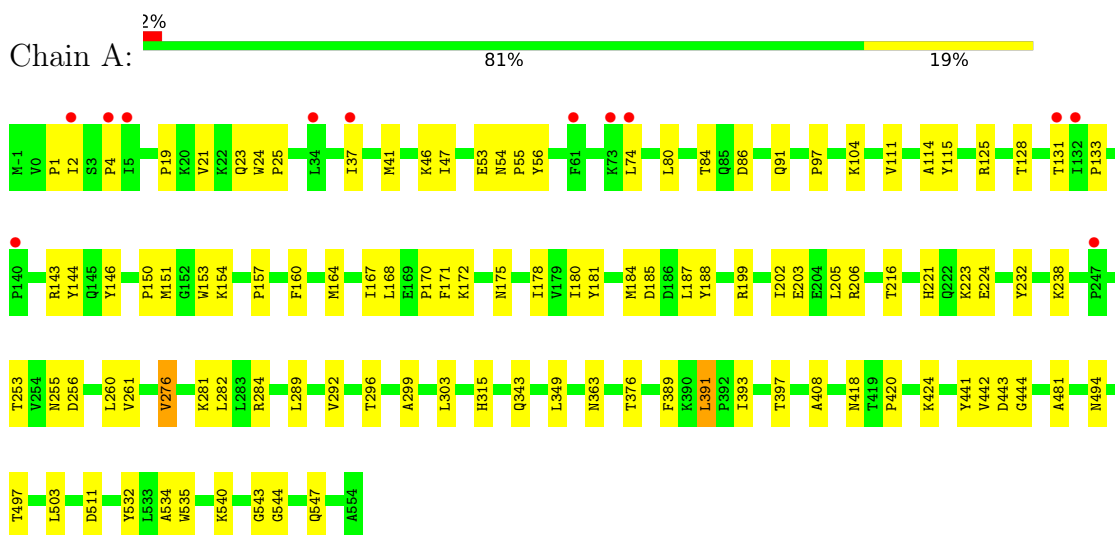
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	34	Total	O	0	0
			34	34		
10	B	20	Total	O	0	0
			20	20		
10	T	2	Total	O	0	0
			2	2		
10	C	26	Total	O	0	0
			26	26		
10	D	18	Total	O	0	0
			18	18		
10	E	1	Total	O	0	0
			1	1		

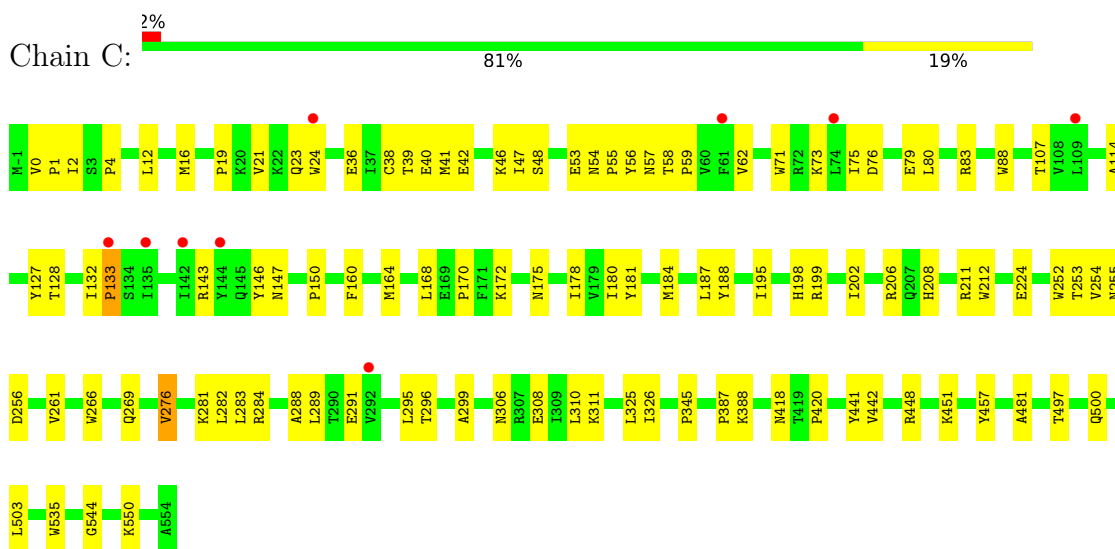
3 Residue-property plots

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.

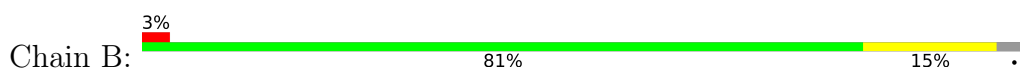
• Molecule 1: HIV-1 REVERSE TRANSCRIPTASE P51 SUBUNIT

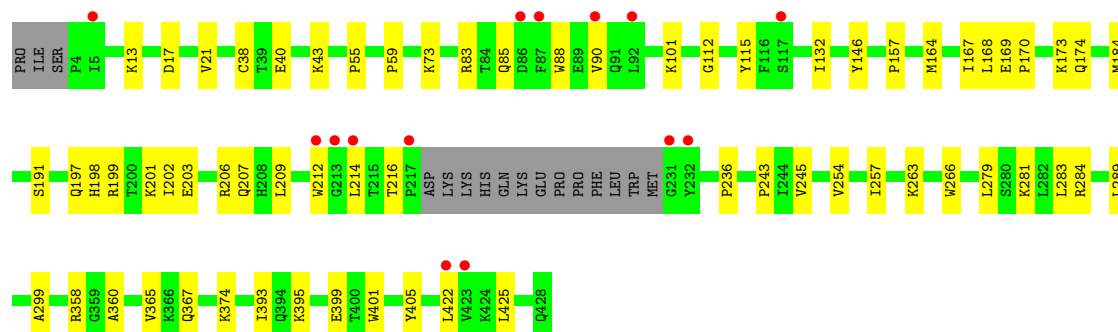


• Molecule 1: HIV-1 REVERSE TRANSCRIPTASE P51 SUBUNIT

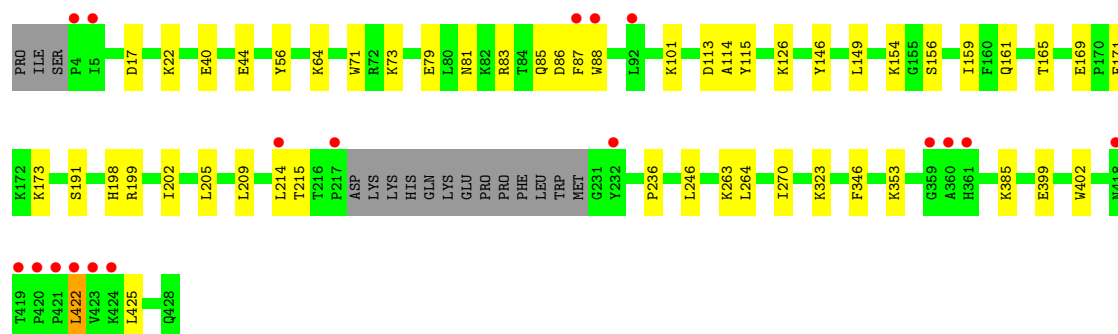
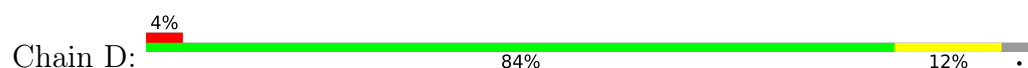


• Molecule 2: HIV-1 REVERSE TRANSCRIPTASE P61 SUBUNIT

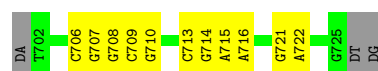




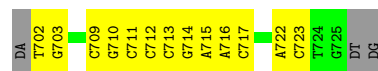
• Molecule 2: HIV-1 REVERSE TRANSCRIPTASE P61 SUBUNIT



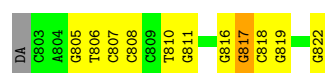
• Molecule 3: DNA (5'-D(*TP*GP*GP*TP*CP*GP*GP*CP*GP*CP*CP*GP*AP*AP*CP*AP*GP*GP*GP*AP*CP*TP*G)-3')



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

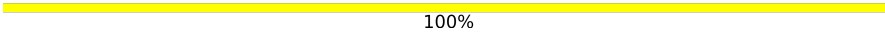


- Molecule 4: DNA (5'-D(*CP*AP*GP*TP*CP*CP*CP*TP*GP*TP*TP*CP*GP*GP*(MRG)P*CP*GP*CP*CP*G)-3')

Chain F:  38% 52% 5% 5%



- Molecule 5: beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain G:  100%



- Molecule 5: beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain H:  50% 50%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	89.94Å 133.27Å 139.06Å 90.00° 97.59° 90.00°	Depositor
Resolution (Å)	37.62 – 2.70 37.62 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.2 (37.62-2.70) 99.3 (37.62-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 2.69Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, R_{free}	0.196 , 0.239 0.199 , 0.240	Depositor DCC
R_{free} test set	1789 reflections (1.99%)	wwPDB-VP
Wilson B-factor (Å ²)	66.7	Xtriage
Anisotropy	0.217	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 83.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	17860	wwPDB-VP
Average B, all atoms (Å ²)	99.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.60% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, EDO, GLC, FRU, MRG, DDS, 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	0.14	0/4633	0.37	2/6296 (0.0%)
1	C	0.15	0/4635	0.41	2/6299 (0.0%)
2	B	0.14	0/3497	0.36	0/4751
2	D	0.14	0/3491	0.36	0/4744
3	E	0.19	0/555	0.37	0/856
3	T	0.19	0/555	0.41	1/856 (0.1%)
4	F	0.34	0/424	0.52	0/649
4	P	0.19	0/424	0.48	1/649 (0.2%)
All	All	0.16	0/18214	0.39	6/25100 (0.0%)

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	224	GLU	CA-C-N	7.15	124.81	119.66
1	C	224	GLU	C-N-CA	7.15	124.81	119.66
3	T	722	DA	C5'-C4'-O4'	6.55	119.23	109.40
4	P	805	DG	C5'-C4'-O4'	6.07	118.50	109.40
1	A	224	GLU	CA-C-N	5.45	123.59	119.66

There are no chirality outliers.

There are no planarity outliers.

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	4516	0	4581	64	0
1	C	4518	0	4588	65	0
2	B	3400	0	3433	40	0
2	D	3394	0	3417	30	0
3	E	494	0	269	9	0
3	T	494	0	269	7	0
4	F	407	0	229	15	0
4	P	407	0	229	10	0
5	G	23	0	21	0	0
5	H	23	0	21	0	0
6	A	2	0	0	0	0
6	C	2	0	0	0	0
7	A	29	0	12	2	0
7	C	29	0	12	2	0
8	B	5	0	0	0	0
9	B	4	0	6	0	0
9	D	8	0	12	0	0
9	T	4	0	6	0	0
10	A	34	0	0	0	0
10	B	20	0	0	1	0
10	C	26	0	0	0	0
10	D	18	0	0	1	0
10	E	1	0	0	0	0
10	T	2	0	0	0	0
All	All	17860	0	17105	232	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 7.

The worst 5 of 232 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:56:TYR:O	1:C:143:ARG:NH2	2.21	0.74
1:C:19:PRO:HG3	1:C:80:LEU:HB2	1.73	0.70
1:A:164:MET:HE2	1:A:187:LEU:HD11	1.74	0.70
1:A:199:ARG:HH12	1:A:223:LYS:HD3	1.57	0.70
1:A:54:ASN:HB3	1:A:143:ARG:HH12	1.59	0.68

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	554/556 (100%)	536 (97%)	14 (2%)	4 (1%)	18	41
1	C	554/556 (100%)	536 (97%)	15 (3%)	3 (0%)	24	48
2	B	408/428 (95%)	397 (97%)	11 (3%)	0	100	100
2	D	408/428 (95%)	396 (97%)	12 (3%)	0	100	100
All	All	1924/1968 (98%)	1865 (97%)	52 (3%)	7 (0%)	30	54

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	4	PRO
1	A	4	PRO
1	A	1	PRO
1	A	150	PRO
1	C	150	PRO

5.3.2 Protein sidechains

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	496/498 (100%)	492 (99%)	4 (1%)	73	88
1	C	497/498 (100%)	493 (99%)	4 (1%)	73	88
2	B	374/390 (96%)	373 (100%)	1 (0%)	86	94
2	D	372/390 (95%)	371 (100%)	1 (0%)	86	94
All	All	1739/1776 (98%)	1729 (99%)	10 (1%)	78	91

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	75	ILE
1	C	276	VAL
2	D	422	LEU
1	A	391	LEU
2	B	422	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	197	GLN
2	D	278	GLN
1	C	407	GLN
2	D	348	ASN
1	C	545	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

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	MRG	F	817	4,1,3	25,28,29	2.72	7 (28%)	32,39,42	2.23	12 (37%)
4	MRG	P	817	4,1,3	25,28,29	2.73	7 (28%)	32,39,42	2.29	12 (37%)

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	MRG	F	817	4,1,3	-	2/12/26/27	0/3/3/3
4	MRG	P	817	4,1,3	-	3/12/26/27	0/3/3/3

The worst 5 of 14 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	817	MRG	C2-N2	7.15	1.49	1.34
4	P	817	MRG	C2-N2	7.10	1.49	1.34
4	P	817	MRG	C2-N3	6.83	1.45	1.32
4	F	817	MRG	C2-N3	6.54	1.44	1.32
4	P	817	MRG	C4-N3	4.99	1.45	1.34

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	P	817	MRG	C2-N3-C4	6.95	120.70	112.00
4	F	817	MRG	C2-N3-C4	6.74	120.43	112.00
4	P	817	MRG	C5-C4-N3	-5.37	119.85	128.39
4	F	817	MRG	C5-C4-N3	-4.72	120.87	128.39
4	F	817	MRG	C22-C21-N2	3.97	123.33	112.20

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	P	817	MRG	C22-C21-N2-C2
4	P	817	MRG	C21-C22-C23-S24
4	F	817	MRG	C22-C21-N2-C2
4	F	817	MRG	N2-C21-C22-C23
4	P	817	MRG	N2-C21-C22-C23

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	F	817	MRG	2	0
4	P	817	MRG	3	0

5.5 Carbohydrates

4 monosaccharides 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	$\# Z > 2$
5	GLC	G	1	5	11,11,12	0.93	1 (9%)	15,15,17	1.13	1 (6%)
5	FRU	G	2	5	11,12,12	2.26	3 (27%)	10,18,18	4.85	3 (30%)
5	GLC	H	1	5	11,11,12	0.85	0	15,15,17	1.00	0
5	FRU	H	2	5	11,12,12	2.48	4 (36%)	10,18,18	5.06	4 (40%)

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
5	GLC	G	1	5	-	0/2/19/22	0/1/1/1
5	FRU	G	2	5	-	1/5/24/24	0/1/1/1
5	GLC	H	1	5	-	1/2/19/22	0/1/1/1
5	FRU	H	2	5	-	2/5/24/24	0/1/1/1

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	H	2	FRU	O2-C2	5.44	1.50	1.40
5	G	2	FRU	O5-C2	5.22	1.51	1.43
5	H	2	FRU	O5-C2	4.42	1.50	1.43
5	G	2	FRU	O2-C2	3.89	1.47	1.40
5	H	2	FRU	O3-C3	2.32	1.47	1.42

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	H	2	FRU	O2-C2-O5	-13.80	82.83	109.33
5	G	2	FRU	O2-C2-O5	-13.42	83.56	109.33
5	H	2	FRU	O5-C5-C4	-6.57	88.84	105.42
5	G	2	FRU	O5-C5-C4	-6.40	89.27	105.42
5	H	2	FRU	O3-C3-C4	3.34	125.03	113.25

There are no chirality outliers.

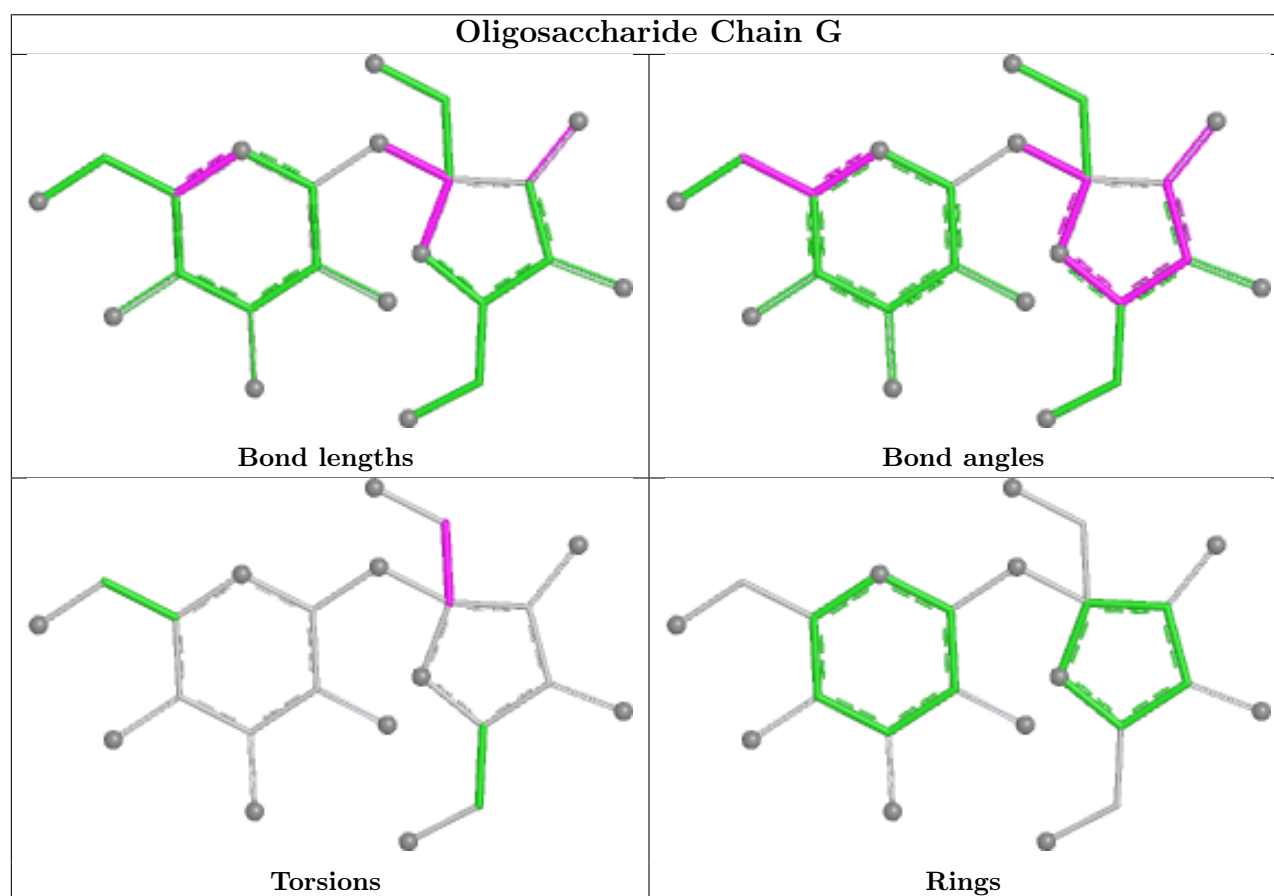
All (4) torsion outliers are listed below:

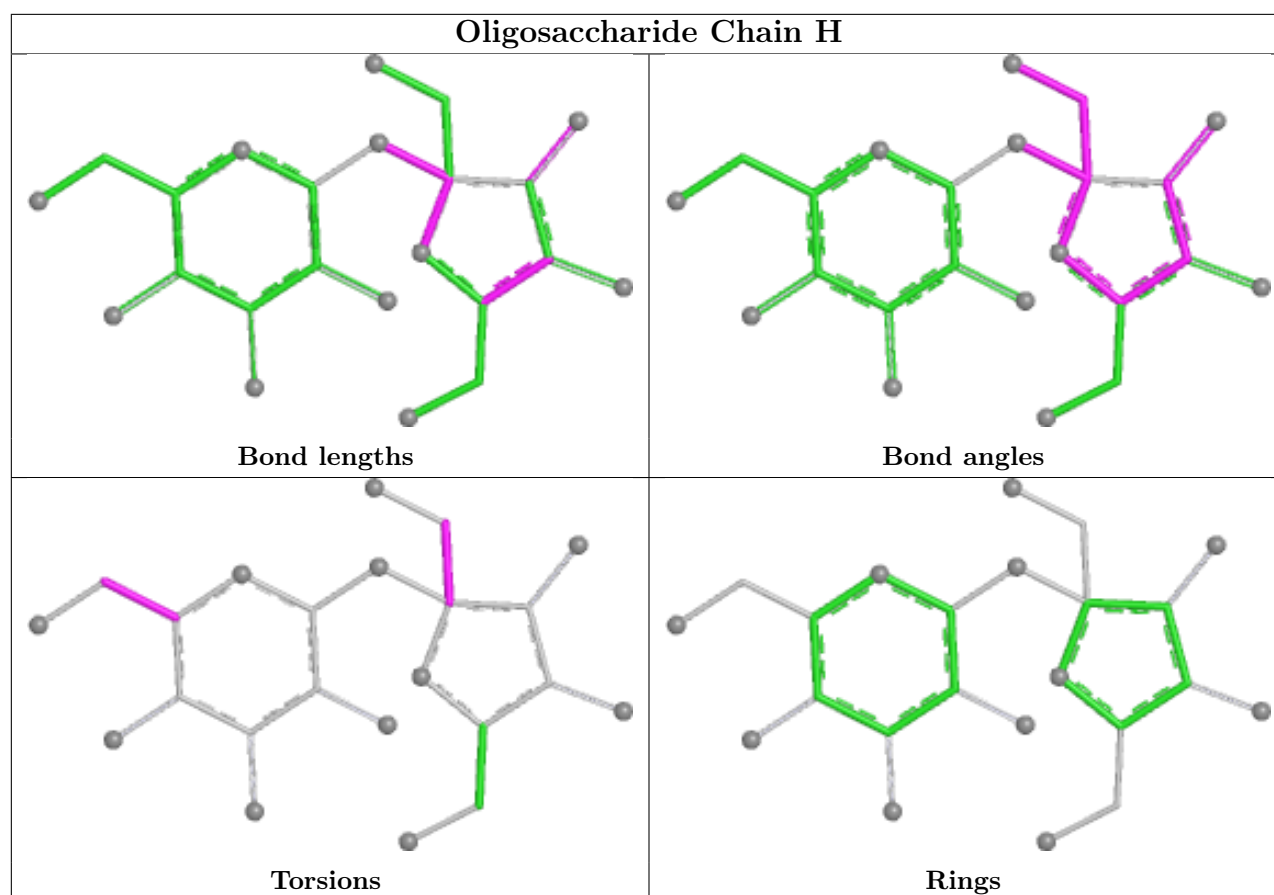
Mol	Chain	Res	Type	Atoms
5	G	2	FRU	O1-C1-C2-O2
5	H	1	GLC	O5-C5-C6-O6
5	H	2	FRU	O1-C1-C2-O2
5	H	2	FRU	O1-C1-C2-C3

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.





5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 4 are monoatomic - leaving 7 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	$\# Z > 2$
9	EDO	T	801	-	3,3,3	0.42	0	2,2,2	0.38	0
8	SO4	B	502	-	4,4,4	0.22	0	6,6,6	0.24	0
9	EDO	D	503	-	3,3,3	0.43	0	2,2,2	0.37	0
7	DDS	C	601	-	30,31,31	1.78	5 (16%)	42,48,48	2.00	11 (26%)
9	EDO	D	502	-	3,3,3	0.43	0	2,2,2	0.39	0
7	DDS	A	603	-	30,31,31	1.78	5 (16%)	42,48,48	2.02	11 (26%)
9	EDO	B	503	-	3,3,3	0.43	0	2,2,2	0.39	0

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
9	EDO	T	801	-	-	0/1/1/1	-
9	EDO	D	503	-	-	0/1/1/1	-
7	DDS	C	601	-	-	10/22/31/31	0/3/3/3
9	EDO	D	502	-	-	0/1/1/1	-
7	DDS	A	603	-	-	8/22/31/31	0/3/3/3
9	EDO	B	503	-	-	0/1/1/1	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	C	601	DDS	PB-O3A	-5.19	1.53	1.59
7	A	603	DDS	PB-O3A	-5.05	1.54	1.59
7	C	601	DDS	C6-N6	4.99	1.47	1.34
7	A	603	DDS	C6-N6	4.94	1.46	1.34
7	C	601	DDS	C5'-C4'	-2.85	1.41	1.50

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	C	601	DDS	C5-C4-N3	-5.67	118.92	126.72
7	A	603	DDS	C5-C4-N3	-5.59	119.02	126.72
7	A	603	DDS	N3-C2-N1	-4.49	121.78	128.58
7	A	603	DDS	N3-C4-N9	4.35	134.57	127.17
7	C	601	DDS	N3-C2-N1	-4.32	122.04	128.58

There are no chirality outliers.

5 of 18 torsion outliers are listed below:

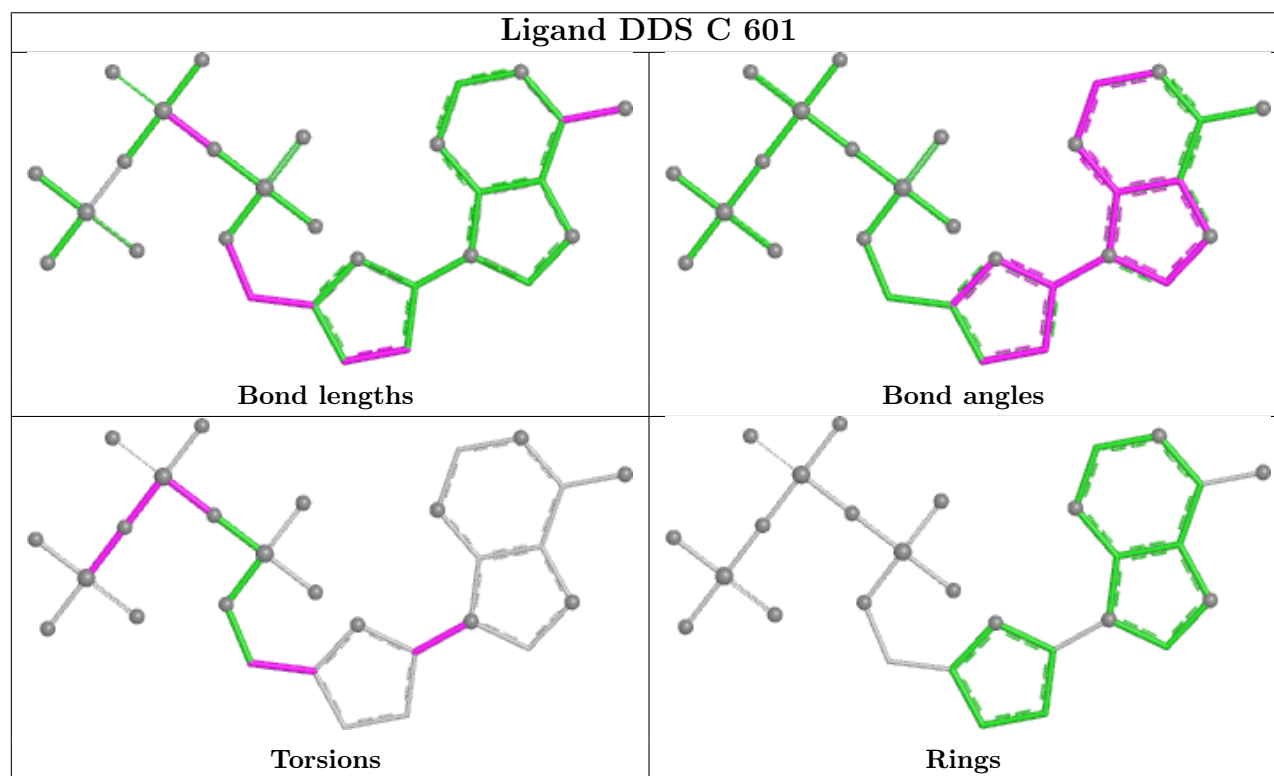
Mol	Chain	Res	Type	Atoms
7	A	603	DDS	C5'-O5'-PA-O1A
7	A	603	DDS	C3'-C4'-C5'-O5'
7	A	603	DDS	O4'-C4'-C5'-O5'
7	C	601	DDS	PB-O3B-PG-O2G
7	C	601	DDS	PB-O3B-PG-O3G

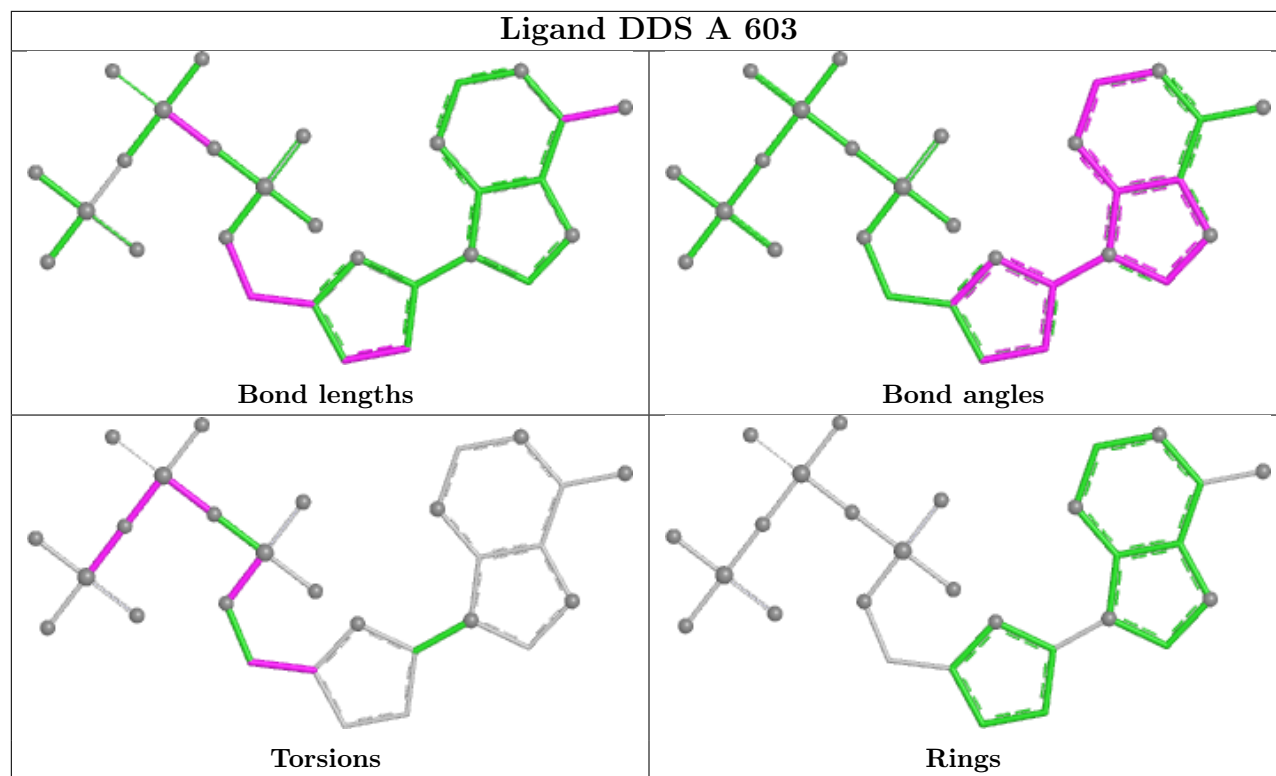
There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	C	601	DDS	2	0
7	A	603	DDS	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 ⓘ

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, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	556/556 (100%)	0.00	12 (2%) 62 59	37, 93, 186, 291	0
1	C	556/556 (100%)	0.06	9 (1%) 70 68	39, 101, 190, 281	0
2	B	412/428 (96%)	-0.09	14 (3%) 48 44	35, 77, 140, 267	0
2	D	412/428 (96%)	0.05	18 (4%) 39 35	39, 87, 168, 245	0
3	E	24/27 (88%)	0.05	0 100 100	89, 127, 211, 274	0
3	T	24/27 (88%)	-0.13	0 100 100	84, 122, 247, 251	0
4	F	19/21 (90%)	-0.15	0 100 100	67, 110, 201, 212	0
4	P	19/21 (90%)	-0.18	0 100 100	78, 110, 184, 206	0
All	All	2022/2064 (97%)	0.01	53 (2%) 57 54	35, 89, 181, 291	0

The worst 5 of 53 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	423	VAL	5.6
2	B	232	TYR	4.8
1	A	73	LYS	4.7
2	D	359	GLY	4.2
2	B	423	VAL	3.9

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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, 95th 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 ²)	Q<0.9
4	MRG	F	817	26/27	0.84	0.12	111,137,161,167	0

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	MRG	P	817	26/27	0.89	0.11	109,133,153,170	0

6.3 Carbohydrates [i](#)

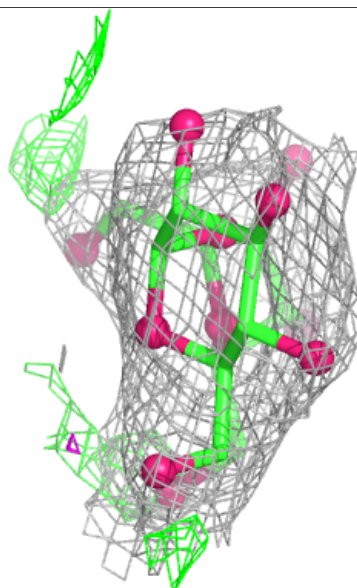
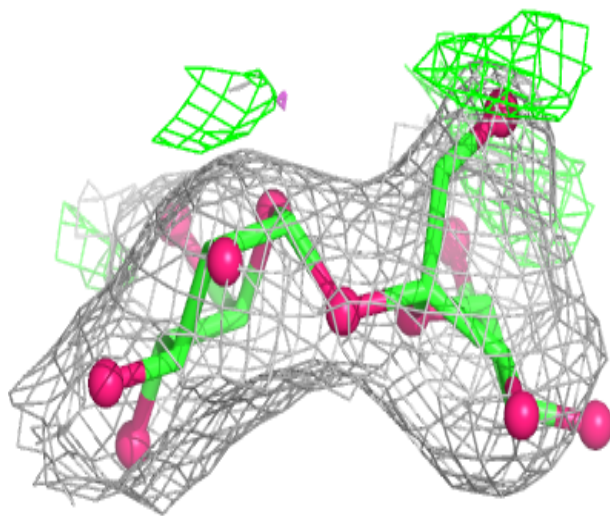
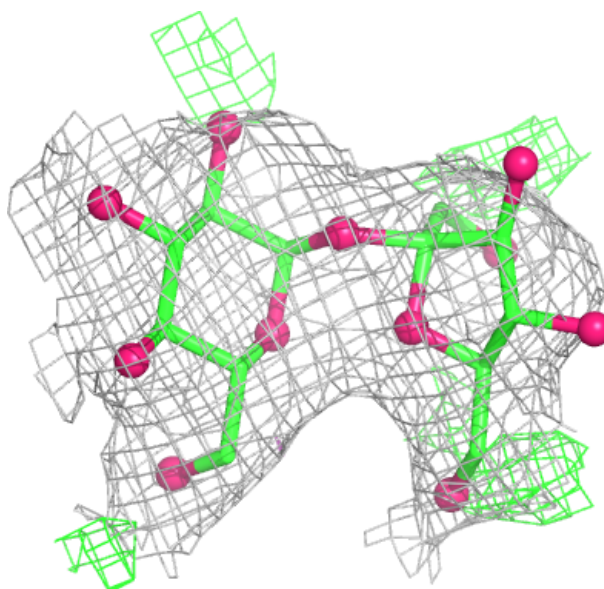
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

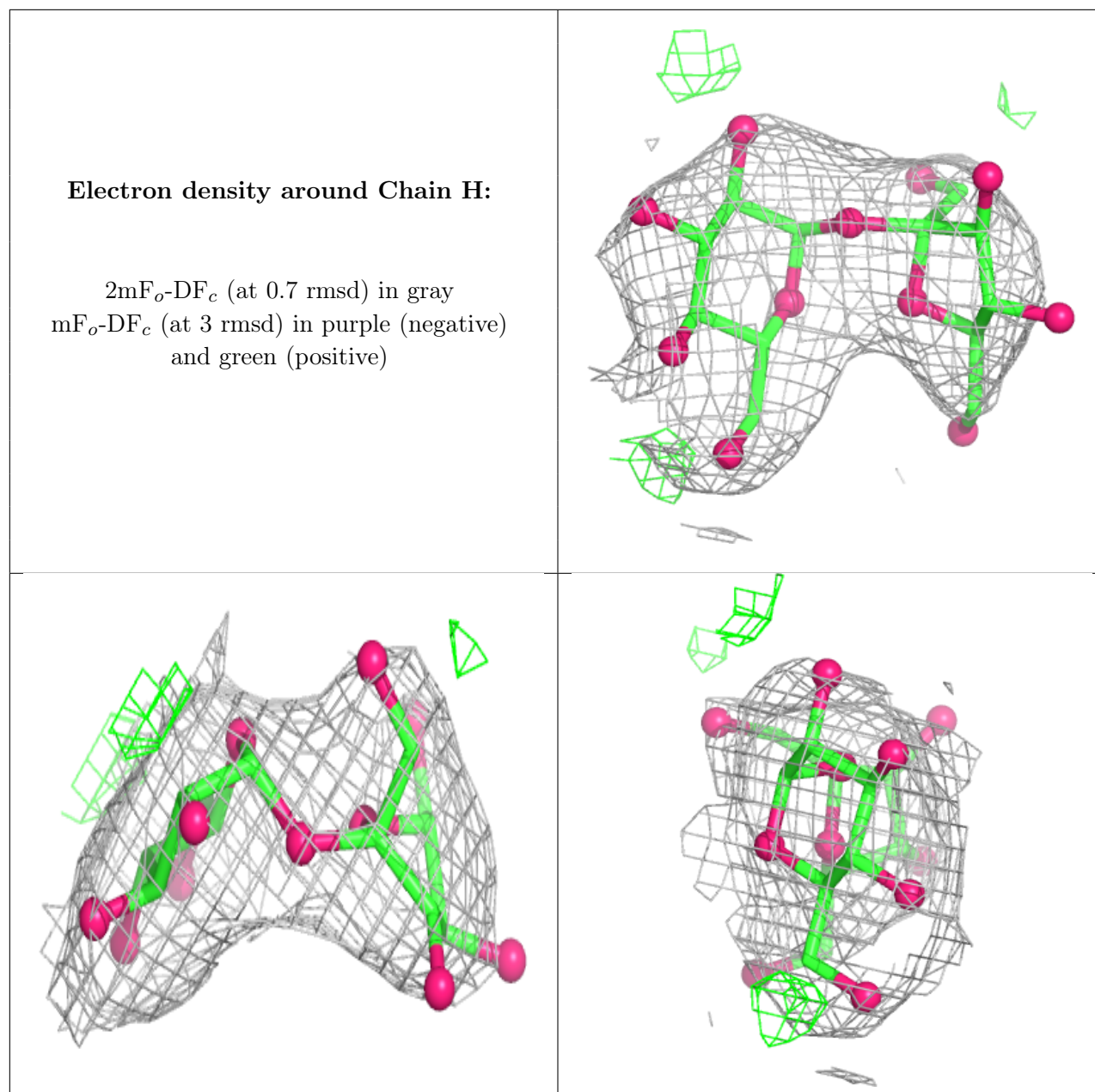
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	GLC	G	1	11/12	-	-	75,102,117,123	0
5	FRU	G	2	12/12	-	-	101,128,136,138	0
5	GLC	H	1	11/12	-	-	96,111,122,126	0
5	FRU	H	2	12/12	-	-	98,120,130,135	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around Chain G:

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





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, 95th 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.

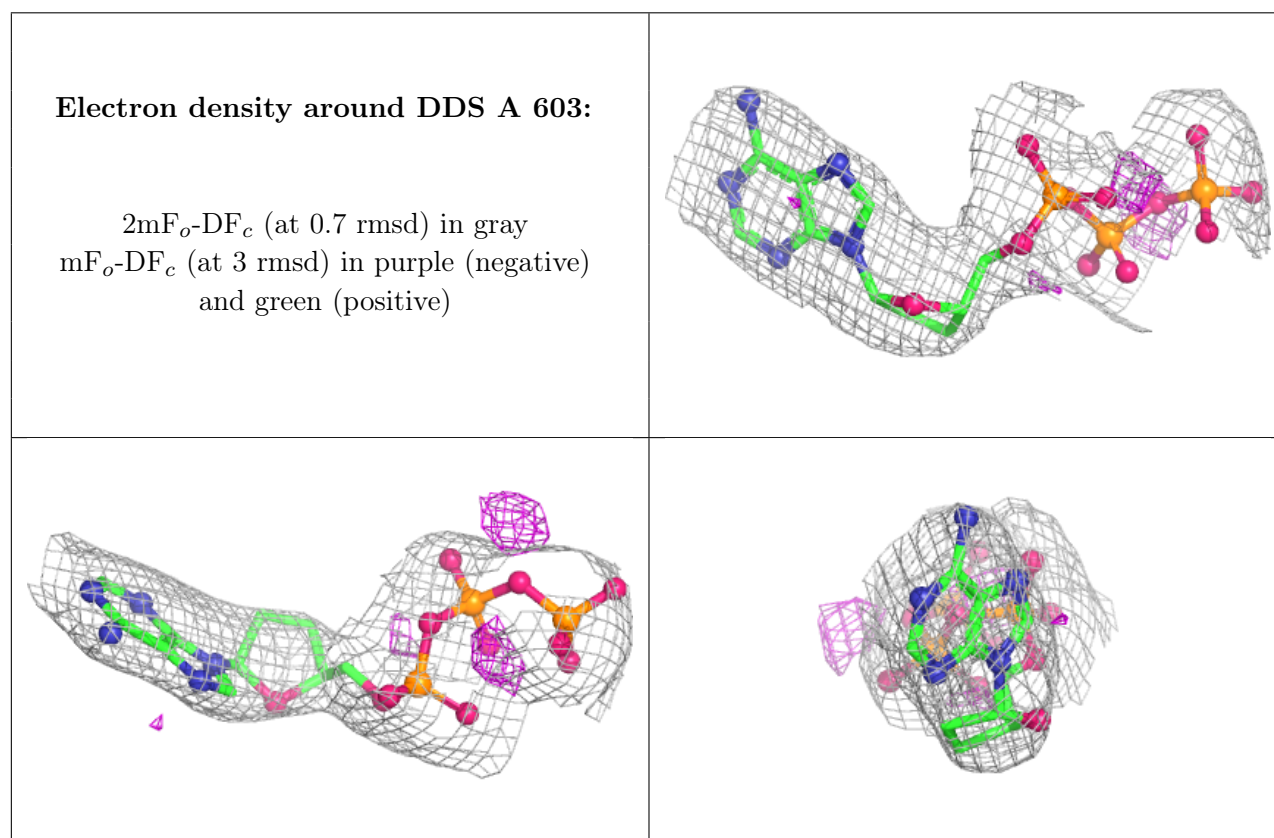
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	MG	A	602	1/1	0.64	0.18	149,149,149,149	0
9	EDO	T	801	4/4	0.75	0.17	79,83,88,91	0
8	SO4	B	502	5/5	0.79	0.21	153,159,165,167	0

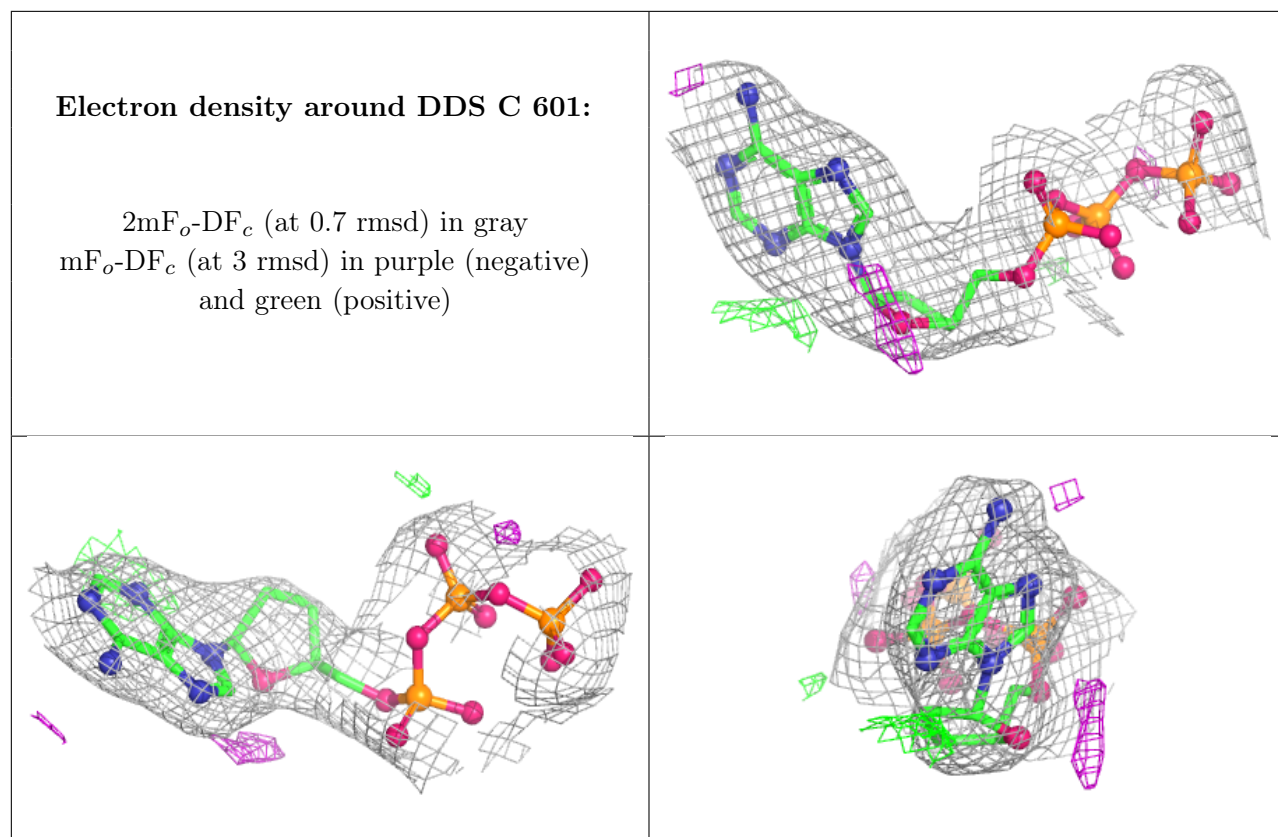
Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
9	EDO	D	502	4/4	0.80	0.29	84,84,95,95	0
9	EDO	B	503	4/4	0.83	0.21	70,70,78,85	0
9	EDO	D	503	4/4	0.86	0.21	76,81,81,82	0
7	DDS	A	603	29/29	0.89	0.09	75,116,162,164	0
7	DDS	C	601	29/29	0.90	0.09	83,106,162,163	0
6	MG	C	603	1/1	0.90	0.13	117,117,117,117	0
6	MG	C	602	1/1	0.93	0.06	105,105,105,105	0
6	MG	A	601	1/1	0.95	0.06	122,122,122,122	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.