Full wwPDB X-ray Structure Validation Report

Jul 3, 2023 – 10:32 pm BST

PDB ID	:	8AQ4
Title	:	In surfo structure of the membrane integral lipoprotein N-acyltransferase Lnt from E. coli in complex with TITC and lyso-PE
Authors	:	Huang, C.-Y.; Weichert, D.; Boland, C.; Smithers, L.; Olieric, V.; Wang, M.; Caffrey, M.
Deposited on	:	2022-08-11
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*
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:

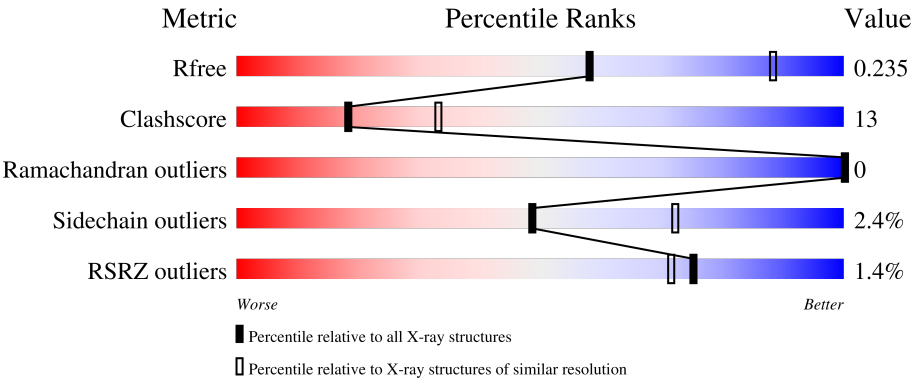
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.33
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.33

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.62 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 >=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 <=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	532	% 73% 21%

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
3	GOL	A	615	-	-	-	X
4	6OU	A	609	-	-	-	X
9	LMT	A	618	-	-	-	X
9	LMT	A	620	-	-	-	X

2 Entry composition (i)

There are 11 unique types of molecules in this entry. The entry contains 4329 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.

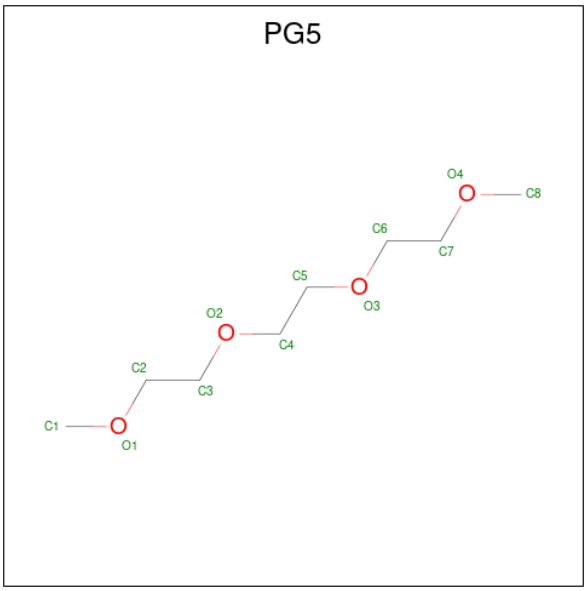
- Molecule 1 is a protein called Apolipoprotein N-acyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	509	Total	C	N	O	S	0	0	0
			4001	2631	662	692	16			

There are 20 discrepancies between the modelled and reference sequences:

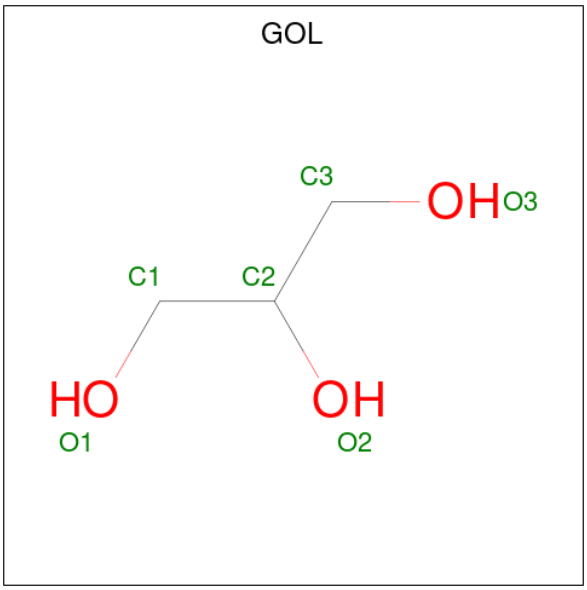
Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP P23930
A	-18	GLY	-	expression tag	UNP P23930
A	-17	SER	-	expression tag	UNP P23930
A	-16	SER	-	expression tag	UNP P23930
A	-15	HIS	-	expression tag	UNP P23930
A	-14	HIS	-	expression tag	UNP P23930
A	-13	HIS	-	expression tag	UNP P23930
A	-12	HIS	-	expression tag	UNP P23930
A	-11	HIS	-	expression tag	UNP P23930
A	-10	HIS	-	expression tag	UNP P23930
A	-9	SER	-	expression tag	UNP P23930
A	-8	SER	-	expression tag	UNP P23930
A	-7	GLY	-	expression tag	UNP P23930
A	-6	LEU	-	expression tag	UNP P23930
A	-5	VAL	-	expression tag	UNP P23930
A	-4	PRO	-	expression tag	UNP P23930
A	-3	ARG	-	expression tag	UNP P23930
A	-2	GLY	-	expression tag	UNP P23930
A	-1	SER	-	expression tag	UNP P23930
A	0	HIS	-	expression tag	UNP P23930

- Molecule 2 is 1-METHOXY-2-[2-(2-METHOXY-ETHOXY]-ETHANE (three-letter code: PG5) (formula: $C_8H_{18}O_4$).



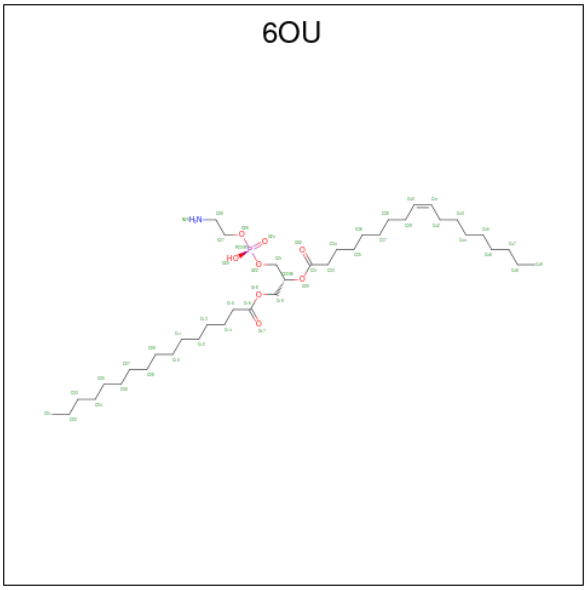
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 10 7 3	0	0
2	A	1	Total C O 10 7 3	0	0
2	A	1	Total C O 10 6 4	0	0
2	A	1	Total C O 10 6 4	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



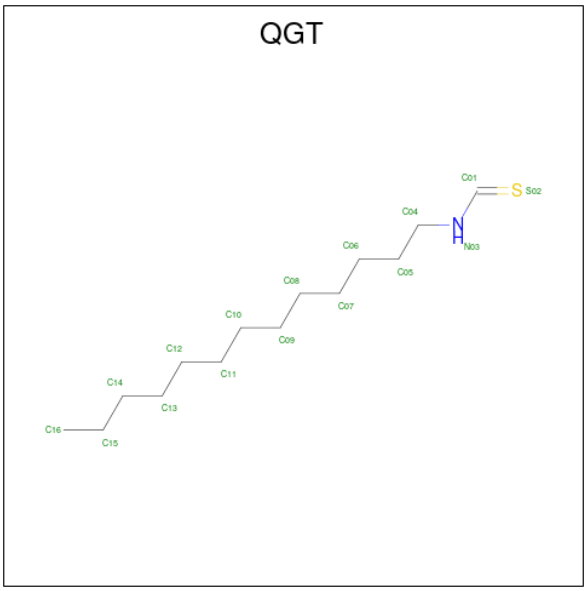
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0

- Molecule 4 is [(2 {R})-1-[2-azanylethoxy(oxidanyl)phosphoryl]oxy-3-hexadecanoyloxy-propan-2-yl] ({Z})-octadec-9-enoate (three-letter code: 6OU) (formula: $C_{39}H_{76}NO_8P$) (labeled as "Ligand of Interest" by depositor).



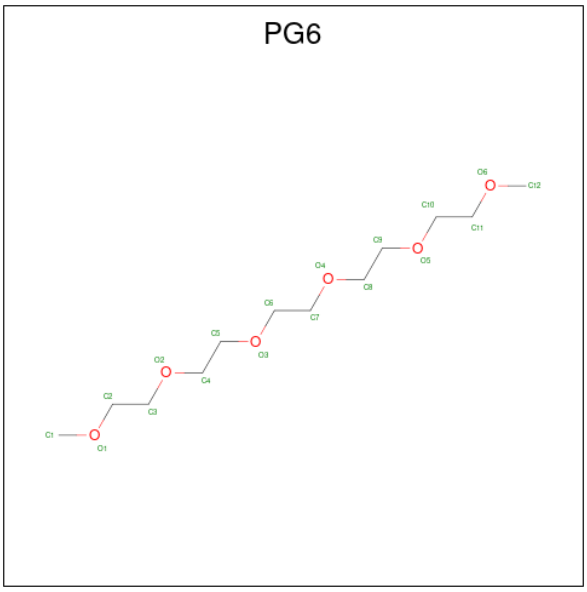
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O P 49 39 1 8 1	0	0
4	A	1	Total C N O P 32 23 1 7 1	0	0
4	A	1	Total C N O P 49 39 1 8 1	0	0

- Molecule 5 is {N}-tridecylmethanethioamide (three-letter code: QGT) (formula: $C_{14}H_{29}NS$) (labeled as "Ligand of Interest" by depositor).



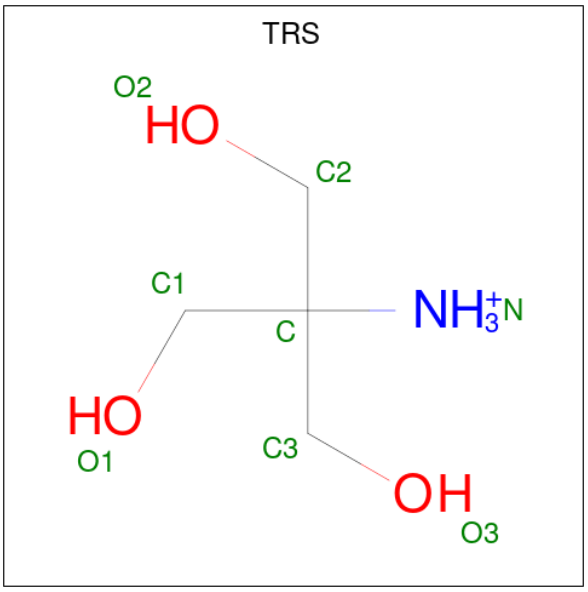
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	S		
5	A	1	16	14	1	1	0	0

- Molecule 6 is 1-(2-METHOXY-ETHOXY)-2-{2-[2-(2-METHOXY-ETHOXY]-ETHOXY}-ETHANE (three-letter code: PG6) (formula: $C_{12}H_{26}O_6$).



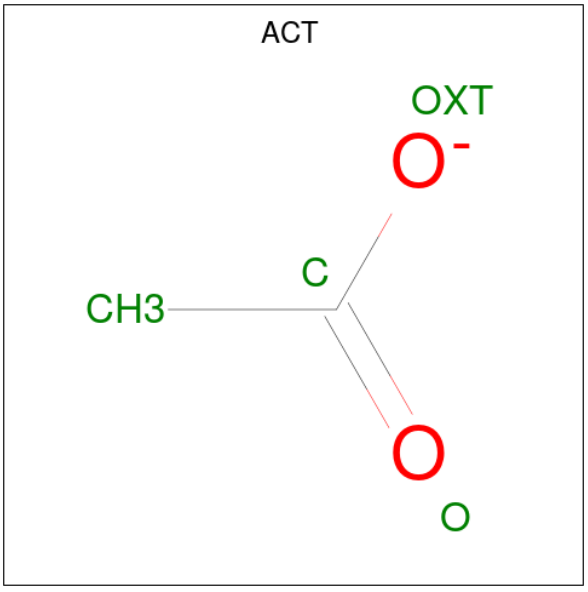
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	A	1	11	7	4	0	0

- Molecule 7 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: $C_4H_{12}NO_3$).



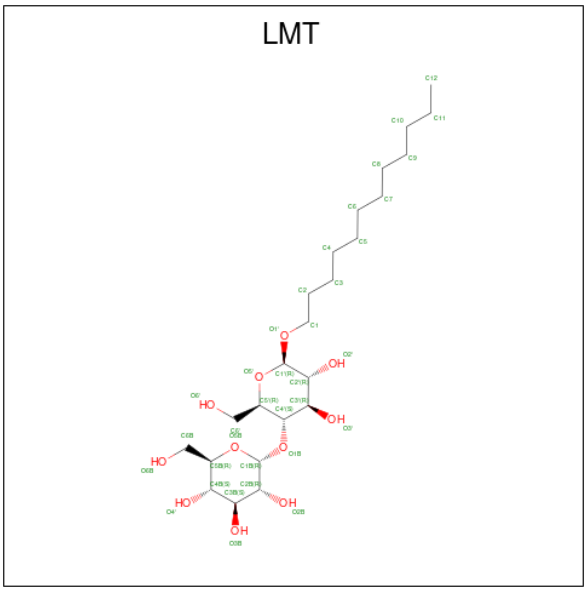
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total C N O 8 4 1 3	0	0

- Molecule 8 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).



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

- Molecule 9 is DODECYL-BETA-D-MALTOSIDE (three-letter code: LMT) (formula: $C_{24}H_{46}O_{11}$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	1	Total C 12 12	0	0
9	A	1	Total C 12 12	0	0
9	A	1	Total C O 35 24 11	0	0

- Molecule 10 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	2	Total Cl 2 2	0	0

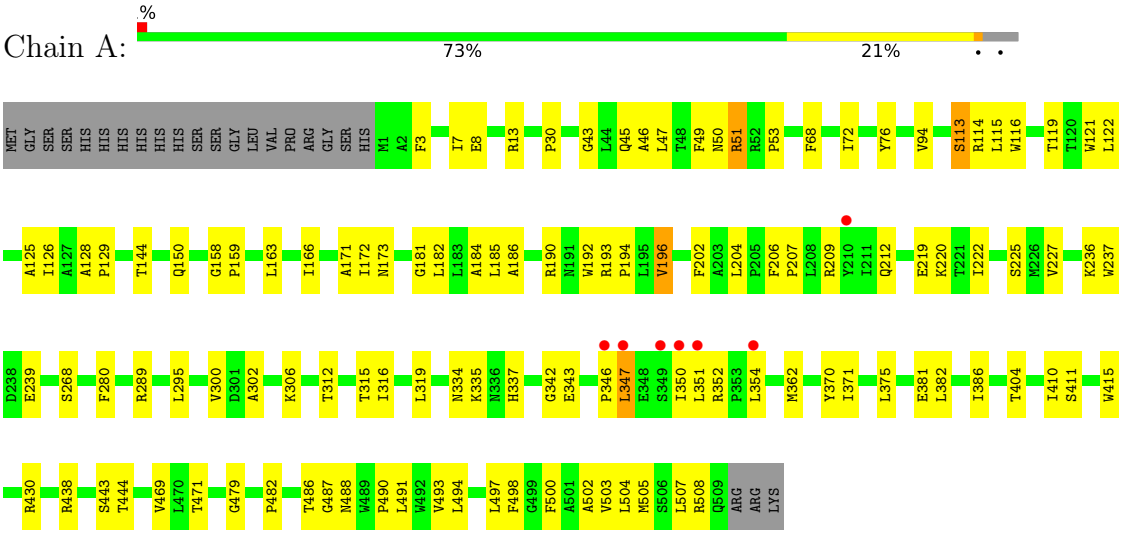
- Molecule 11 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	A	22	Total O 22 22	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: Apolipoprotein N-acyltransferase



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	160.11Å 160.11Å 90.93Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	55.13 – 2.62 55.13 – 2.62	Depositor EDS
% Data completeness (in resolution range)	60.1 (55.13-2.62) 60.1 (55.13-2.62)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.43 (at 2.61Å)	Xtriage
Refinement program	PHENIX 1.17.1_3600	Depositor
R, R_{free}	0.205 , 0.229 0.212 , 0.235	Depositor DCC
R_{free} test set	1350 reflections (5.50%)	wwPDB-VP
Wilson B-factor (Å^2)	60.3	Xtriage
Anisotropy	0.057	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 55.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	4329	wwPDB-VP
Average B, all atoms (Å^2)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.18% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: LMT, 6OU, CL, TRS, PG5, ACT, PG6, QGT, GOL

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	0.42	0/4116	0.62	0/5624

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

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	4001	0	4064	100	0
2	A	40	0	50	2	0
3	A	36	0	48	3	0
4	A	130	0	0	12	0
5	A	16	0	0	3	0
6	A	11	0	15	5	0
7	A	8	0	12	2	0
8	A	4	0	3	0	0
9	A	59	0	89	4	0
10	A	2	0	0	1	0
11	A	22	0	0	0	0
All	All	4329	0	4281	114	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 13.

All (114) 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:30:PRO:HB3	4:A:606:6OU:C08	1.76	1.14
1:A:347:LEU:HD22	1:A:350:ILE:CD1	1.92	0.99
1:A:415:TRP:HE1	4:A:608:6OU:C21	1.76	0.97
1:A:347:LEU:HD22	1:A:350:ILE:HD11	1.54	0.89
1:A:30:PRO:CB	4:A:606:6OU:C08	2.56	0.83
5:A:607:QGT:S02	4:A:608:6OU:C19	2.68	0.81
5:A:607:QGT:S02	4:A:608:6OU:O18	2.39	0.81
1:A:347:LEU:HB3	1:A:350:ILE:HG12	1.69	0.75
1:A:206:PHE:O	1:A:209:ARG:HG2	1.87	0.75
1:A:415:TRP:NE1	4:A:608:6OU:C21	2.50	0.74
1:A:13:ARG:HH22	6:A:612:PG6:H72	1.55	0.71
1:A:482:PRO:O	1:A:486:THR:HG22	1.90	0.71
1:A:347:LEU:HB2	1:A:351:LEU:HD12	1.72	0.70
1:A:347:LEU:HB3	1:A:350:ILE:CG1	2.22	0.70
1:A:163:LEU:HD23	1:A:172:ILE:HG12	1.75	0.67
1:A:508:ARG:HB3	1:A:508:ARG:NH1	2.10	0.67
1:A:8:GLU:O	1:A:51:ARG:NH2	2.26	0.67
1:A:335:LYS:HE2	1:A:343:GLU:OE1	1.96	0.66
1:A:347:LEU:HD22	1:A:350:ILE:HD13	1.76	0.66
1:A:430:ARG:HH11	4:A:606:6OU:C01	2.10	0.65
1:A:225:SER:OG	1:A:471:THR:HG22	1.97	0.64
1:A:121:TRP:HD1	10:A:622:CL:CL	2.19	0.63
1:A:76:TYR:HB2	1:A:94:VAL:HG21	1.82	0.62
1:A:375:LEU:HB2	1:A:382:LEU:HB2	1.81	0.61
1:A:239:GLU:OE2	1:A:239:GLU:N	2.30	0.61
1:A:45:GLN:OE1	1:A:181:GLY:CA	2.49	0.60
5:A:607:QGT:S02	4:A:608:6OU:O30	2.58	0.60
1:A:508:ARG:HB3	1:A:508:ARG:CZ	2.31	0.60
1:A:227:VAL:HG12	1:A:469:VAL:CG1	2.32	0.60
1:A:192:TRP:O	1:A:196:VAL:HG13	2.02	0.59
1:A:53:PRO:HA	1:A:113:SER:HB3	1.85	0.59
7:A:613:TRS:O2	7:A:613:TRS:O1	2.17	0.59
1:A:497:LEU:HD12	1:A:498:PHE:HD1	1.68	0.57
1:A:347:LEU:O	1:A:351:LEU:HB2	2.04	0.57
9:A:620:LMT:O6B	9:A:620:LMT:O4'	2.13	0.56
1:A:204:LEU:O	1:A:207:PRO:HD2	2.06	0.55
1:A:13:ARG:NH2	6:A:612:PG6:H72	2.20	0.55
1:A:125:ALA:HB2	1:A:182:LEU:HD21	1.88	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:144:THR:HG22	1:A:144:THR:O	2.07	0.54
1:A:193:ARG:HB3	1:A:194:PRO:HD3	1.89	0.53
1:A:347:LEU:O	1:A:351:LEU:N	2.32	0.53
1:A:316:ILE:HG13	1:A:386:ILE:HD11	1.91	0.52
1:A:500:PHE:CE2	1:A:504:LEU:HD11	2.44	0.52
1:A:43:GLY:O	1:A:47:LEU:HD13	2.08	0.52
1:A:315:THR:HG22	1:A:334:ASN:OD1	2.10	0.52
1:A:503:VAL:O	1:A:507:LEU:HB2	2.10	0.52
1:A:45:GLN:OE1	1:A:181:GLY:HA2	2.09	0.52
1:A:220:LYS:O	1:A:222:ILE:HG23	2.10	0.52
1:A:500:PHE:CZ	1:A:504:LEU:HD11	2.45	0.52
9:A:620:LMT:H1B	9:A:620:LMT:C6'	2.40	0.51
1:A:115:LEU:HB2	1:A:116:TRP:CE3	2.45	0.51
1:A:351:LEU:HD23	1:A:354:LEU:HD12	1.91	0.51
1:A:370:TYR:HD2	1:A:371:ILE:HG12	1.75	0.51
1:A:3:PHE:CE2	1:A:7:ILE:HD11	2.45	0.51
1:A:306:LYS:O	1:A:306:LYS:HD2	2.10	0.51
3:A:602:GOL:H32	3:A:605:GOL:C2	2.41	0.51
4:A:609:6OU:C49	4:A:609:6OU:C03	2.89	0.51
1:A:68:PHE:O	1:A:72:ILE:HG13	2.12	0.50
1:A:342:GLY:O	4:A:608:6OU:N29	2.44	0.50
4:A:606:6OU:C21	4:A:606:6OU:C27	2.90	0.50
1:A:166:ILE:HA	1:A:482:PRO:HB2	1.93	0.50
1:A:295:LEU:HD23	1:A:319:LEU:HD13	1.94	0.50
1:A:346:PRO:HG2	1:A:351:LEU:CD1	2.42	0.50
1:A:50:ASN:HD22	6:A:612:PG6:H71	1.78	0.49
1:A:315:THR:CG2	1:A:334:ASN:OD1	2.61	0.49
1:A:438:ARG:NH2	1:A:479:GLY:O	2.43	0.48
1:A:227:VAL:HA	1:A:469:VAL:HG12	1.95	0.48
1:A:50:ASN:ND2	6:A:612:PG6:H71	2.28	0.48
1:A:186:ALA:O	1:A:190:ARG:N	2.46	0.48
1:A:300:VAL:HG11	1:A:362:MET:CE	2.43	0.48
1:A:227:VAL:HG12	1:A:469:VAL:HG11	1.94	0.47
1:A:370:TYR:CD2	1:A:371:ILE:HG12	2.49	0.47
1:A:158:GLY:O	1:A:209:ARG:NH1	2.44	0.47
1:A:159:PRO:HG2	1:A:202:PHE:CE1	2.50	0.47
1:A:280:PHE:HE1	7:A:613:TRS:H11	1.79	0.47
3:A:602:GOL:H32	3:A:605:GOL:O2	2.15	0.46
1:A:114:ARG:HG3	1:A:115:LEU:HD23	1.96	0.46
1:A:302:ALA:HA	1:A:312:THR:HA	1.97	0.46
1:A:346:PRO:HG2	1:A:351:LEU:HD13	1.96	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:507:LEU:HD12	1:A:507:LEU:HA	1.81	0.46
1:A:335:LYS:HE3	1:A:337:HIS:O	2.17	0.45
1:A:410:ILE:HG22	1:A:443:SER:HB3	1.98	0.45
1:A:204:LEU:HD11	2:A:601:PG5:H32	1.99	0.44
1:A:381:GLU:HB2	1:A:404:THR:HA	1.99	0.44
1:A:46:ALA:HA	1:A:49:PHE:CE2	2.53	0.44
1:A:50:ASN:HD22	6:A:612:PG6:C7	2.30	0.44
1:A:49:PHE:HB3	1:A:119:THR:HG21	1.99	0.44
1:A:351:LEU:HD23	1:A:354:LEU:CD1	2.48	0.44
3:A:602:GOL:H32	3:A:605:GOL:H2	2.00	0.44
1:A:490:PRO:O	1:A:493:VAL:HG22	2.18	0.44
1:A:116:TRP:CZ2	1:A:502:ALA:HB1	2.52	0.44
1:A:171:ALA:HA	1:A:491:LEU:HD13	2.00	0.44
1:A:316:ILE:HG12	1:A:410:ILE:HD11	1.98	0.44
1:A:150:GLN:HB3	1:A:173:ASN:HD21	1.83	0.44
1:A:46:ALA:HB2	1:A:184:ALA:HB1	1.99	0.43
1:A:122:LEU:HD12	1:A:126:ILE:HB	1.99	0.43
1:A:236:LYS:NZ	1:A:268:SER:OG	2.50	0.42
1:A:128:ALA:HB3	1:A:129:PRO:HD3	2.02	0.42
1:A:410:ILE:HA	1:A:443:SER:O	2.20	0.42
1:A:411:SER:O	1:A:444:THR:HA	2.19	0.42
1:A:182:LEU:O	1:A:194:PRO:HB2	2.20	0.41
1:A:347:LEU:CD2	1:A:350:ILE:HD11	2.36	0.41
1:A:494:LEU:HD11	1:A:498:PHE:CE1	2.56	0.41
1:A:237:TRP:CZ3	1:A:362:MET:HG3	2.56	0.41
1:A:45:GLN:OE1	1:A:181:GLY:HA3	2.20	0.41
1:A:43:GLY:CA	1:A:47:LEU:HD13	2.50	0.41
1:A:486:THR:HG23	1:A:487:GLY:O	2.19	0.41
2:A:611:PG5:H52	2:A:611:PG5:H71	1.49	0.41
1:A:49:PHE:CD1	1:A:119:THR:HG22	2.56	0.41
1:A:430:ARG:HD3	4:A:606:6OU:C01	2.51	0.41
9:A:618:LMT:H111	9:A:618:LMT:H81	1.87	0.40
1:A:185:LEU:HD23	1:A:194:PRO:HG3	2.04	0.40
1:A:508:ARG:CZ	1:A:508:ARG:CB	2.99	0.40
9:A:620:LMT:H1B	9:A:620:LMT:H6E	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	507/532 (95%)	492 (97%)	15 (3%)	0	100 100

There are no Ramachandran outliers to report.

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	423/444 (95%)	413 (98%)	10 (2%)	49 72

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	51	ARG
1	A	113	SER
1	A	196	VAL
1	A	212	GLN
1	A	219	GLU
1	A	289	ARG
1	A	347	LEU
1	A	352	ARG
1	A	488	ASN
1	A	505	MET

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

Mol	Chain	Res	Type
1	A	50	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

Of 22 ligands modelled in this entry, 2 are monoatomic - leaving 20 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	$\#\|Z\| > 2$
3	GOL	A	605	-	5,5,5	0.37	0	5,5,5	0.35	0
3	GOL	A	617	-	5,5,5	0.41	0	5,5,5	0.26	0
2	PG5	A	611	-	9,9,11	0.54	0	8,8,10	0.60	0
3	GOL	A	603	-	5,5,5	0.42	0	5,5,5	0.20	0
9	LMT	A	618	-	11,11,36	0.12	0	10,10,47	0.66	0
4	6OU	A	608	-	31,31,48	1.10	2 (6%)	33,35,53	0.99	1 (3%)
5	QGT	A	607	1	15,15,15	2.32	2 (13%)	12,14,14	2.38	5 (41%)
7	TRS	A	613	-	7,7,7	0.58	0	9,9,9	0.73	0
3	GOL	A	616	-	5,5,5	0.36	0	5,5,5	0.15	0
2	PG5	A	610	-	9,9,11	0.53	0	8,8,10	0.52	0
3	GOL	A	615	-	5,5,5	0.32	0	5,5,5	0.17	0
2	PG5	A	604	-	9,9,11	0.55	0	8,8,10	0.33	0
4	6OU	A	609	-	48,48,48	1.12	3 (6%)	51,53,53	1.06	2 (3%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
3	GOL	A	602	-	5,5,5	0.52	0	5,5,5	1.00	0
4	6OU	A	606	-	48,48,48	1.12	3 (6%)	51,53,53	1.07	2 (3%)
8	ACT	A	614	-	3,3,3	0.90	0	3,3,3	0.77	0
9	LMT	A	620	-	36,36,36	1.21	6 (16%)	47,47,47	1.76	11 (23%)
9	LMT	A	619	-	11,11,36	0.13	0	10,10,47	0.45	0
2	PG5	A	601	-	9,9,11	0.55	0	8,8,10	0.57	0
6	PG6	A	612	-	10,10,17	0.59	0	9,9,16	0.92	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
3	GOL	A	605	-	-	0/4/4/4	-
3	GOL	A	617	-	-	2/4/4/4	-
2	PG5	A	611	-	-	5/7/7/9	-
3	GOL	A	603	-	-	0/4/4/4	-
9	LMT	A	618	-	-	4/9/9/61	-
4	6OU	A	608	-	-	18/34/34/52	-
5	QGT	A	607	1	-	6/12/13/13	-
7	TRS	A	613	-	-	6/9/9/9	-
3	GOL	A	616	-	-	0/4/4/4	-
2	PG5	A	610	-	-	6/7/7/9	-
3	GOL	A	615	-	-	1/4/4/4	-
2	PG5	A	604	-	-	4/7/7/9	-
4	6OU	A	609	-	-	29/52/52/52	-
3	GOL	A	602	-	-	0/4/4/4	-
4	6OU	A	606	-	-	32/52/52/52	-
9	LMT	A	620	-	-	14/21/61/61	0/2/2/2
9	LMT	A	619	-	-	5/9/9/61	-
2	PG5	A	601	-	-	3/7/7/9	-
6	PG6	A	612	-	-	4/8/8/15	-

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	607	QGT	C01-S02	-7.20	1.54	1.64
5	A	607	QGT	C01-N03	4.42	1.46	1.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	606	6OU	O18-C16	2.96	1.42	1.33
4	A	609	6OU	O18-C16	2.94	1.41	1.33
9	A	620	LMT	O3'-C3'	-2.91	1.36	1.43
9	A	620	LMT	O3B-C3B	-2.85	1.36	1.43
9	A	620	LMT	O4'-C4B	-2.56	1.36	1.43
9	A	620	LMT	O2'-C2'	-2.55	1.37	1.43
4	A	608	6OU	O30-C31	2.54	1.41	1.34
4	A	606	6OU	O30-C20	-2.50	1.40	1.46
4	A	609	6OU	O30-C20	-2.47	1.40	1.46
4	A	606	6OU	O30-C31	2.45	1.41	1.34
4	A	609	6OU	O30-C31	2.42	1.41	1.34
4	A	608	6OU	O30-C20	-2.41	1.40	1.46
9	A	620	LMT	O6'-C6'	-2.21	1.33	1.42
9	A	620	LMT	O2B-C2B	-2.11	1.38	1.43

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
9	A	620	LMT	C4B-C3B-C2B	-4.82	102.41	110.82
5	A	607	QGT	C05-C04-N03	4.78	130.28	112.84
9	A	620	LMT	C3B-C4B-C5B	-4.37	102.44	110.24
4	A	606	6OU	O30-C31-C33	3.97	120.05	111.50
4	A	609	6OU	O30-C31-C33	3.93	119.97	111.50
4	A	608	6OU	O30-C31-C33	3.71	119.50	111.50
9	A	620	LMT	C1'-C2'-C3'	-3.68	102.34	110.00
9	A	620	LMT	C2'-C3'-C4'	-3.44	101.83	109.68
9	A	620	LMT	O5B-C5B-C6B	3.31	114.67	106.44
5	A	607	QGT	C06-C05-C04	3.16	128.55	113.56
5	A	607	QGT	C09-C08-C07	-2.97	99.36	114.42
9	A	620	LMT	O1B-C1B-C2B	2.79	115.32	108.10
9	A	620	LMT	O1'-C1'-C2'	2.70	112.52	108.30
4	A	609	6OU	O18-C16-C15	2.59	120.05	111.91
4	A	606	6OU	O18-C16-C15	2.58	120.01	111.91
5	A	607	QGT	C13-C12-C11	-2.54	101.55	114.42
5	A	607	QGT	C12-C11-C10	-2.49	101.80	114.42
9	A	620	LMT	O5'-C5'-C4'	2.38	114.77	109.75
9	A	620	LMT	C1B-O5B-C5B	-2.33	109.11	113.69
9	A	620	LMT	C3'-C4'-C5'	-2.17	105.95	110.93
9	A	620	LMT	O5'-C1'-C2'	-2.06	106.00	110.35

There are no chirality outliers.

All (139) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	606	6OU	C21-O22-P23-O24
4	A	606	6OU	C27-O26-P23-O25
4	A	606	6OU	O26-C27-C28-N29
4	A	606	6OU	O32-C31-O30-C20
4	A	608	6OU	C21-O22-P23-O24
4	A	608	6OU	C21-O22-P23-O25
4	A	608	6OU	C21-O22-P23-O26
4	A	608	6OU	C27-O26-P23-O24
4	A	608	6OU	C27-O26-P23-O25
4	A	608	6OU	O26-C27-C28-N29
4	A	609	6OU	C27-O26-P23-O25
7	A	613	TRS	C1-C-C2-O2
7	A	613	TRS	N-C-C2-O2
7	A	613	TRS	C1-C-C3-O3
7	A	613	TRS	C2-C-C3-O3
7	A	613	TRS	N-C-C3-O3
9	A	620	LMT	O5'-C1'-O1'-C1
4	A	606	6OU	O17-C16-O18-C19
4	A	606	6OU	C15-C16-O18-C19
4	A	606	6OU	C33-C31-O30-C20
5	A	607	QGT	N03-C04-C05-C06
4	A	609	6OU	C06-C07-C08-C09
4	A	609	6OU	C44-C45-C46-C47
6	A	612	PG6	O1-C2-C3-O2
9	A	620	LMT	C2'-C1'-O1'-C1
4	A	609	6OU	C13-C14-C15-C16
9	A	618	LMT	C11-C10-C9-C8
2	A	611	PG5	O2-C4-C5-O3
4	A	609	6OU	C31-C33-C34-C35
2	A	610	PG5	O1-C2-C3-O2
4	A	606	6OU	C27-O26-P23-O22
4	A	608	6OU	C27-O26-P23-O22
4	A	609	6OU	C27-O26-P23-O22
6	A	612	PG6	O3-C6-C7-O4
2	A	611	PG5	C7-C6-O3-C5
4	A	608	6OU	C41-C42-C43-C44
4	A	606	6OU	C04-C05-C06-C07
4	A	609	6OU	C10-C11-C12-C13
9	A	620	LMT	C3-C4-C5-C6
4	A	609	6OU	C15-C16-O18-C19
4	A	609	6OU	C35-C36-C37-C38
5	A	607	QGT	C11-C12-C13-C14
9	A	618	LMT	C4-C5-C6-C7

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Mol	Chain	Res	Type	Atoms
4	A	608	6OU	C34-C35-C36-C37
3	A	617	GOL	C1-C2-C3-O3
4	A	608	6OU	C37-C38-C39-C40
9	A	618	LMT	C5-C6-C7-C8
4	A	606	6OU	C02-C03-C04-C05
9	A	619	LMT	C4-C5-C6-C7
4	A	606	6OU	C03-C04-C05-C06
9	A	620	LMT	C6-C7-C8-C9
4	A	609	6OU	C36-C37-C38-C39
4	A	606	6OU	C34-C35-C36-C37
4	A	609	6OU	C09-C10-C11-C12
4	A	609	6OU	C43-C44-C45-C46
4	A	609	6OU	O17-C16-O18-C19
4	A	606	6OU	C09-C10-C11-C12
9	A	620	LMT	O5'-C5'-C6'-O6'
4	A	606	6OU	C13-C14-C15-C16
4	A	608	6OU	C46-C47-C48-C49
5	A	607	QGT	C06-C07-C08-C09
5	A	607	QGT	C04-C05-C06-C07
4	A	609	6OU	C33-C31-O30-C20
4	A	608	6OU	C33-C34-C35-C36
5	A	607	QGT	C08-C09-C10-C11
4	A	609	6OU	O32-C31-O30-C20
4	A	606	6OU	C41-C42-C43-C44
4	A	609	6OU	C37-C38-C39-C40
4	A	606	6OU	C43-C44-C45-C46
4	A	609	6OU	C12-C13-C14-C15
9	A	620	LMT	C1-C2-C3-C4
5	A	607	QGT	C09-C10-C11-C12
4	A	609	6OU	C20-C21-O22-P23
4	A	606	6OU	C19-C20-C21-O22
9	A	619	LMT	C2-C3-C4-C5
2	A	610	PG5	O3-C6-C7-O4
2	A	611	PG5	O1-C2-C3-O2
2	A	604	PG5	O2-C4-C5-O3
9	A	618	LMT	C6-C7-C8-C9
3	A	617	GOL	O2-C2-C3-O3
9	A	620	LMT	O5B-C5B-C6B-O6B
4	A	606	6OU	C19-C20-O30-C31
4	A	606	6OU	C08-C09-C10-C11
4	A	606	6OU	C11-C12-C13-C14
9	A	620	LMT	C3'-C4'-O1B-C1B

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Mol	Chain	Res	Type	Atoms
6	A	612	PG6	C3-C2-O1-C1
4	A	608	6OU	C45-C46-C47-C48
4	A	606	6OU	C10-C11-C12-C13
4	A	606	6OU	O30-C20-C21-O22
4	A	609	6OU	O30-C20-C21-O22
9	A	620	LMT	C2B-C1B-O1B-C4'
9	A	620	LMT	O5B-C1B-O1B-C4'
9	A	620	LMT	C11-C10-C9-C8
9	A	620	LMT	C5'-C4'-O1B-C1B
4	A	606	6OU	C45-C46-C47-C48
2	A	601	PG5	C2-C3-O2-C4
4	A	606	6OU	O18-C19-C20-C21
2	A	610	PG5	C2-C3-O2-C4
2	A	610	PG5	C7-C6-O3-C5
2	A	611	PG5	C5-C4-O2-C3
4	A	609	6OU	C41-C42-C43-C44
7	A	613	TRS	C3-C-C2-O2
2	A	604	PG5	C6-C7-O4-C8
4	A	606	6OU	C27-O26-P23-O24
4	A	609	6OU	C19-C20-C21-O22
2	A	604	PG5	C5-C4-O2-C3
9	A	620	LMT	O1'-C1-C2-C3
2	A	601	PG5	O2-C4-C5-O3
2	A	610	PG5	C5-C4-O2-C3
9	A	620	LMT	C5-C6-C7-C8
4	A	606	6OU	C01-C02-C03-C04
9	A	619	LMT	C3-C4-C5-C6
2	A	604	PG5	O3-C6-C7-O4
4	A	608	6OU	C40-C41-C42-C43
4	A	609	6OU	C02-C03-C04-C05
4	A	609	6OU	C21-O22-P23-O26
4	A	609	6OU	C01-C02-C03-C04
4	A	608	6OU	C35-C36-C37-C38
4	A	609	6OU	C03-C04-C05-C06
2	A	610	PG5	O2-C4-C5-O3
4	A	606	6OU	O18-C19-C20-O30
9	A	619	LMT	C1-C2-C3-C4
3	A	615	GOL	O1-C1-C2-O2
4	A	609	6OU	C20-C19-O18-C16
4	A	609	6OU	C42-C43-C44-C45
4	A	608	6OU	C42-C43-C44-C45
4	A	606	6OU	O30-C31-C33-C34

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Mol	Chain	Res	Type	Atoms
4	A	608	6OU	O30-C31-C33-C34
4	A	606	6OU	C40-C41-C42-C43
9	A	619	LMT	C9-C10-C11-C12
6	A	612	PG6	O2-C4-C5-O3
4	A	608	6OU	O32-C31-C33-C34
4	A	606	6OU	O32-C31-C33-C34
4	A	609	6OU	C28-C27-O26-P23
2	A	601	PG5	O3-C6-C7-O4
4	A	606	6OU	C14-C15-C16-O18
4	A	609	6OU	C45-C46-C47-C48
2	A	611	PG5	O3-C6-C7-O4
4	A	606	6OU	C14-C15-C16-O17

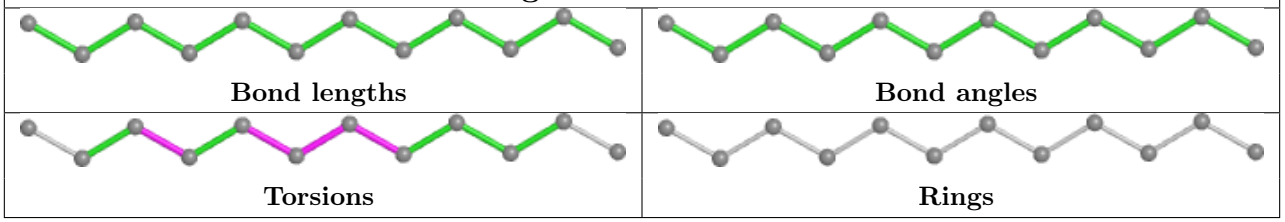
There are no ring outliers.

12 monomers are involved in 28 short contacts:

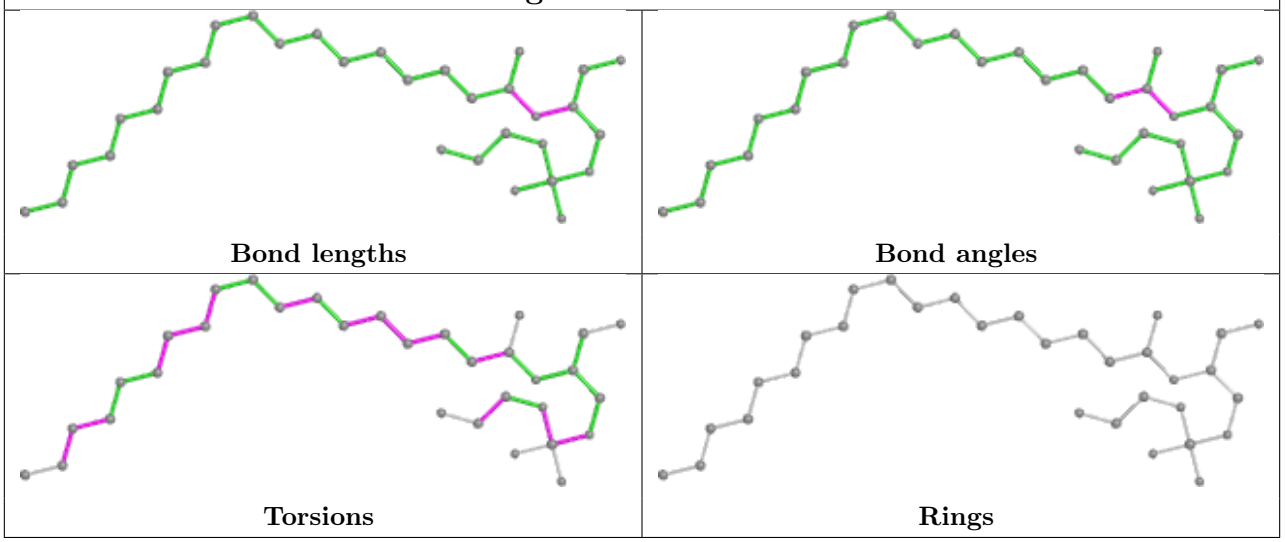
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	605	GOL	3	0
2	A	611	PG5	1	0
9	A	618	LMT	1	0
4	A	608	6OU	6	0
5	A	607	QGT	3	0
7	A	613	TRS	2	0
4	A	609	6OU	1	0
3	A	602	GOL	3	0
4	A	606	6OU	5	0
9	A	620	LMT	3	0
2	A	601	PG5	1	0
6	A	612	PG6	5	0

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 then 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.

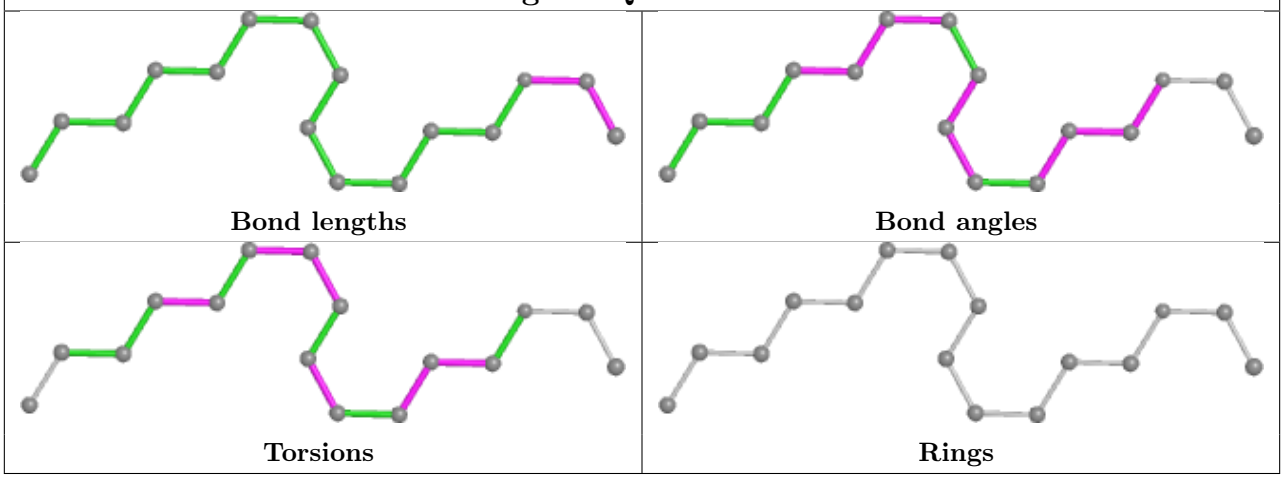
Ligand LMT A 618



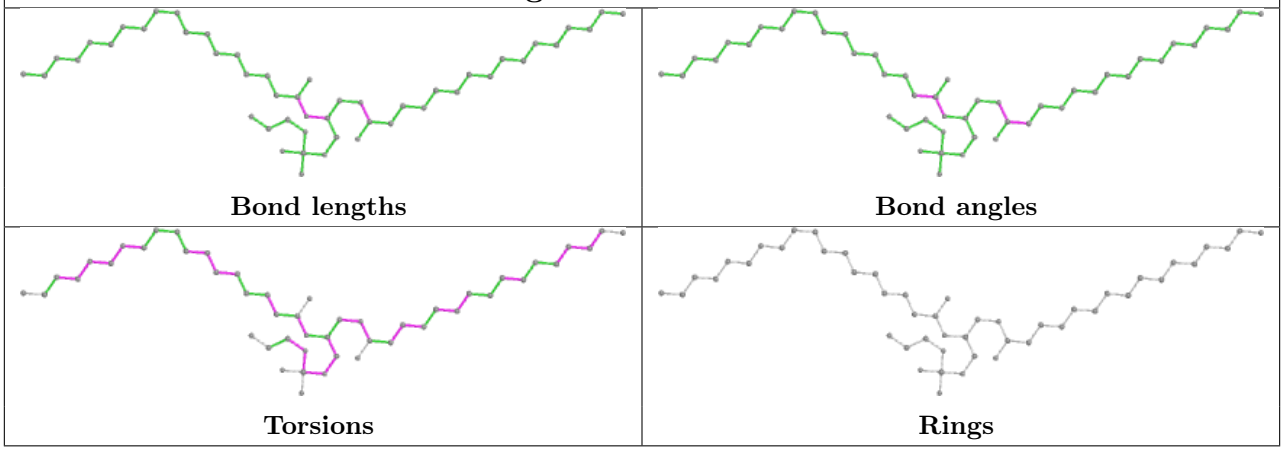
Ligand 6OU A 608



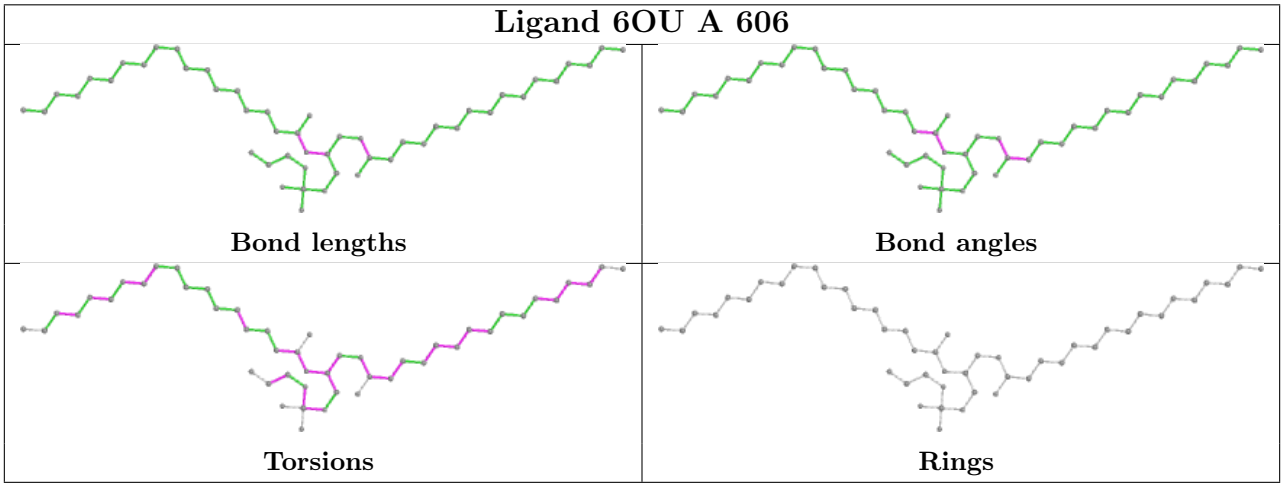
Ligand QGT A 607



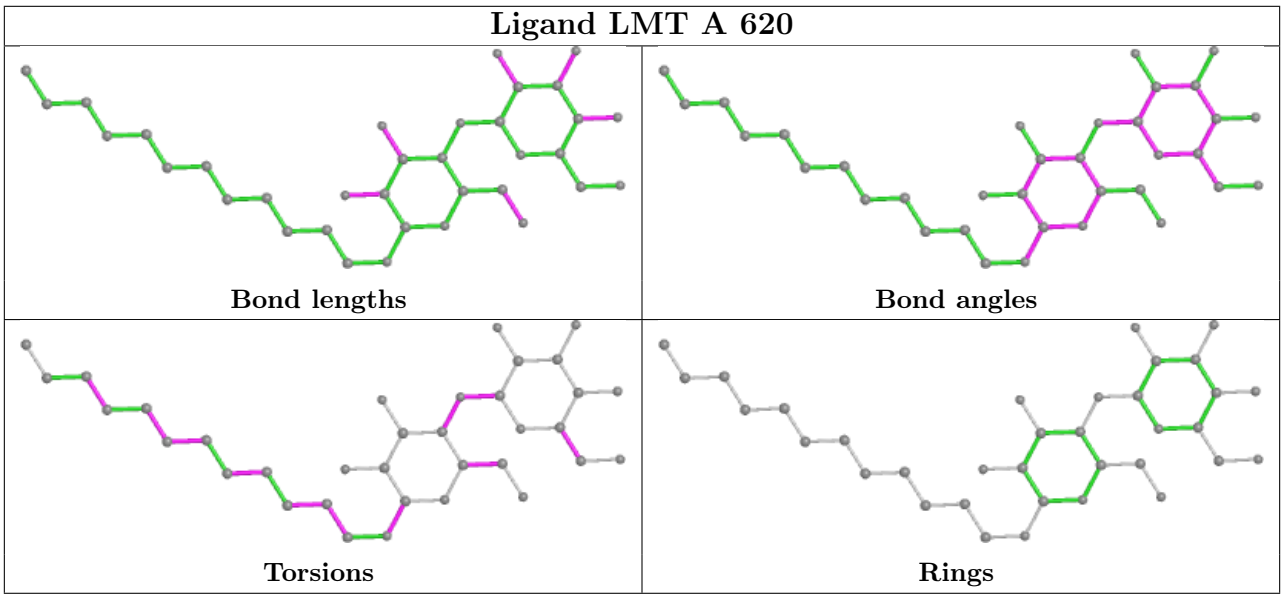
Ligand 6OU A 609

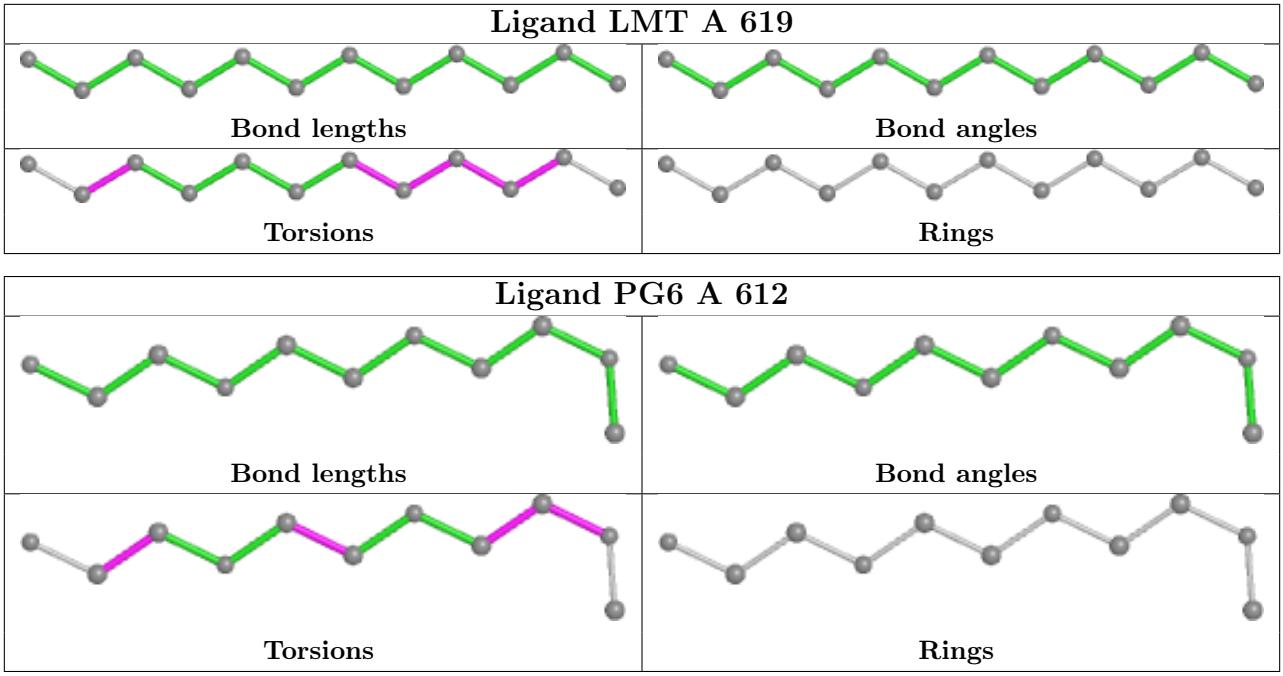


Ligand 6OU A 606



Ligand LMT A 620





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^{th} 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	509/532 (95%)	-0.45	7 (1%)	75 71	21, 50, 89, 121	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	350	ILE	3.7
1	A	210	TYR	3.3
1	A	354	LEU	3.2
1	A	349	SER	3.1
1	A	351	LEU	2.4
1	A	346	PRO	2.4
1	A	347	LEU	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

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^{th} 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
9	LMT	A	618	12/35	0.43	0.67	43,67,78,82	0

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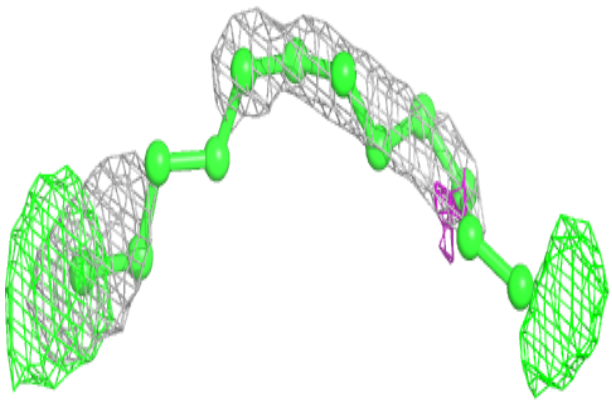
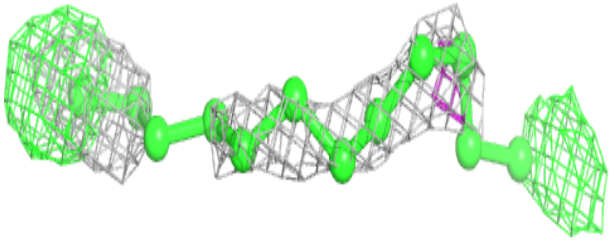
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
7	TRS	A	613	8/8	0.54	0.35	67,97,102,107	0
3	GOL	A	616	6/6	0.58	0.29	77,95,107,123	0
8	ACT	A	614	4/4	0.59	0.19	74,92,99,103	0
3	GOL	A	617	6/6	0.60	0.30	59,80,83,100	0
3	GOL	A	615	6/6	0.61	0.59	90,101,112,118	0
3	GOL	A	605	6/6	0.69	0.27	100,127,129,142	0
4	6OU	A	606	49/49	0.72	0.29	68,79,88,110	0
2	PG5	A	604	10/12	0.74	0.35	60,91,101,103	0
3	GOL	A	603	6/6	0.75	0.14	89,104,115,122	0
9	LMT	A	620	35/35	0.76	0.52	55,121,140,143	0
4	6OU	A	609	49/49	0.79	0.47	53,83,130,145	0
5	QGT	A	607	16/16	0.81	0.30	44,51,87,110	0
3	GOL	A	602	6/6	0.82	0.17	90,105,112,115	0
10	CL	A	622	1/1	0.83	0.26	120,120,120,120	0
6	PG6	A	612	11/18	0.84	0.33	62,75,90,98	0
2	PG5	A	610	10/12	0.84	0.72	81,102,113,116	0
9	LMT	A	619	12/35	0.85	0.29	41,68,78,81	0
2	PG5	A	611	10/12	0.87	0.26	81,84,87,88	0
4	6OU	A	608	32/49	0.92	0.32	37,62,77,81	0
10	CL	A	621	1/1	0.93	0.13	65,65,65,65	0
2	PG5	A	601	10/12	0.94	0.32	66,79,92,92	0

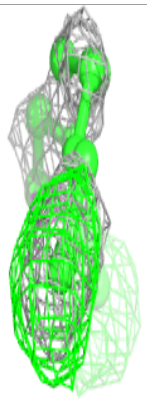
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around LMT A 618:

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

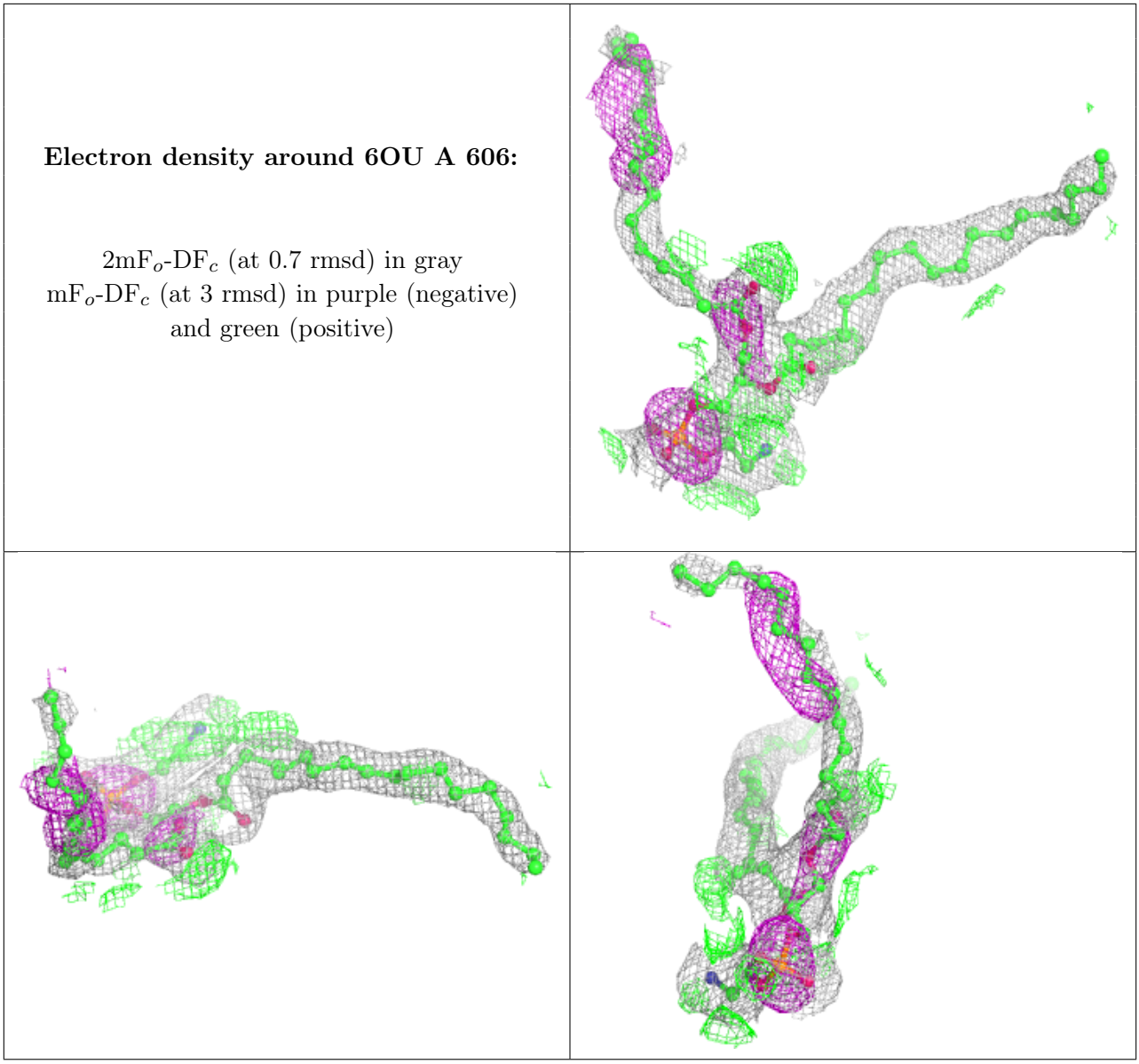






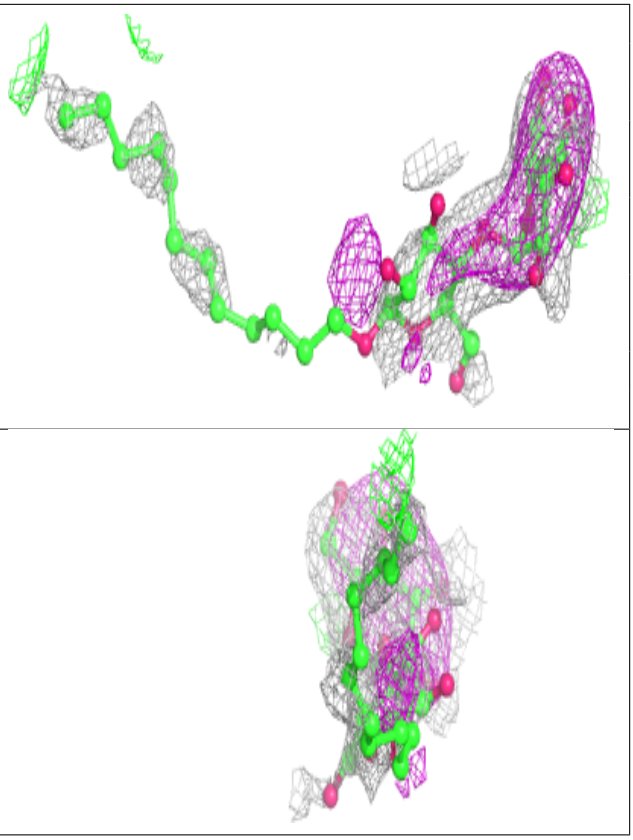
Electron density around 6OU A 606:

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



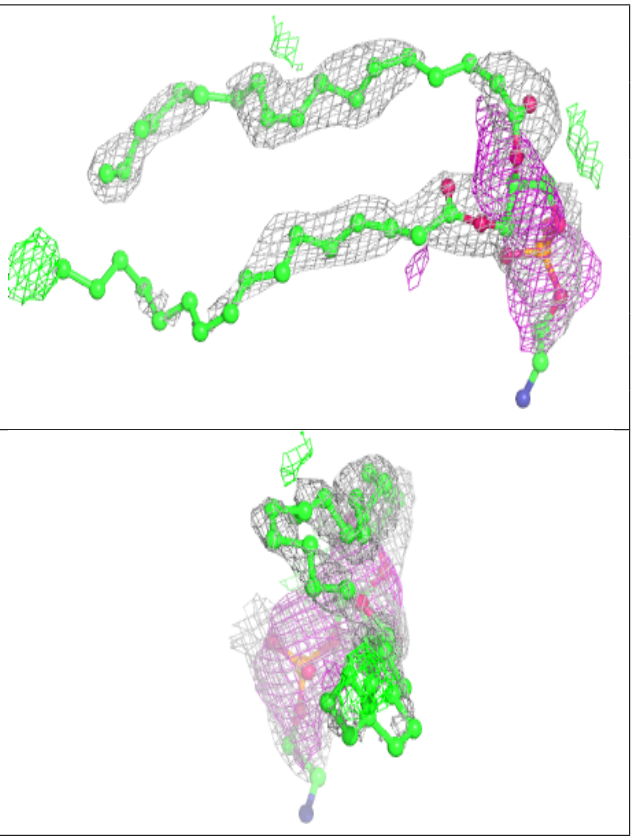
Electron density around LMT A 620:

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



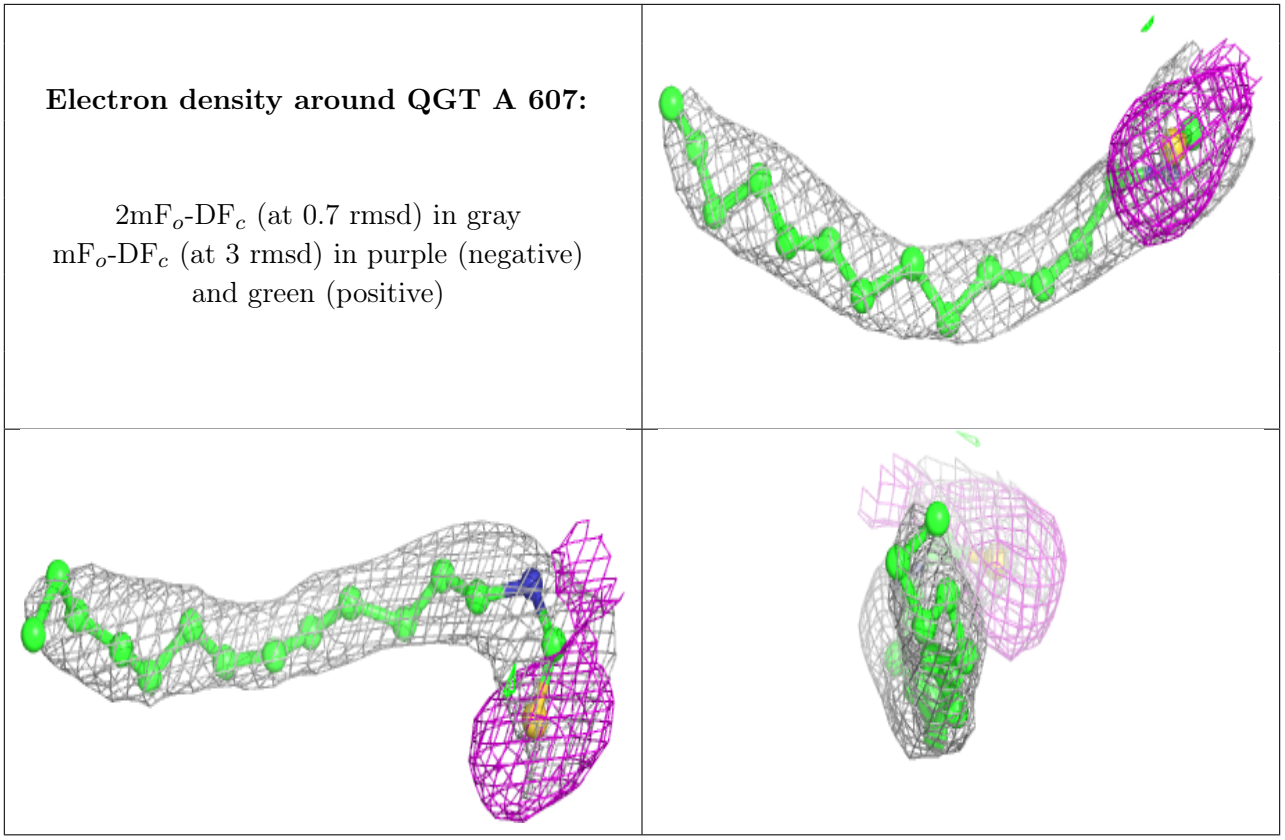
Electron density around 6OU A 609:

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



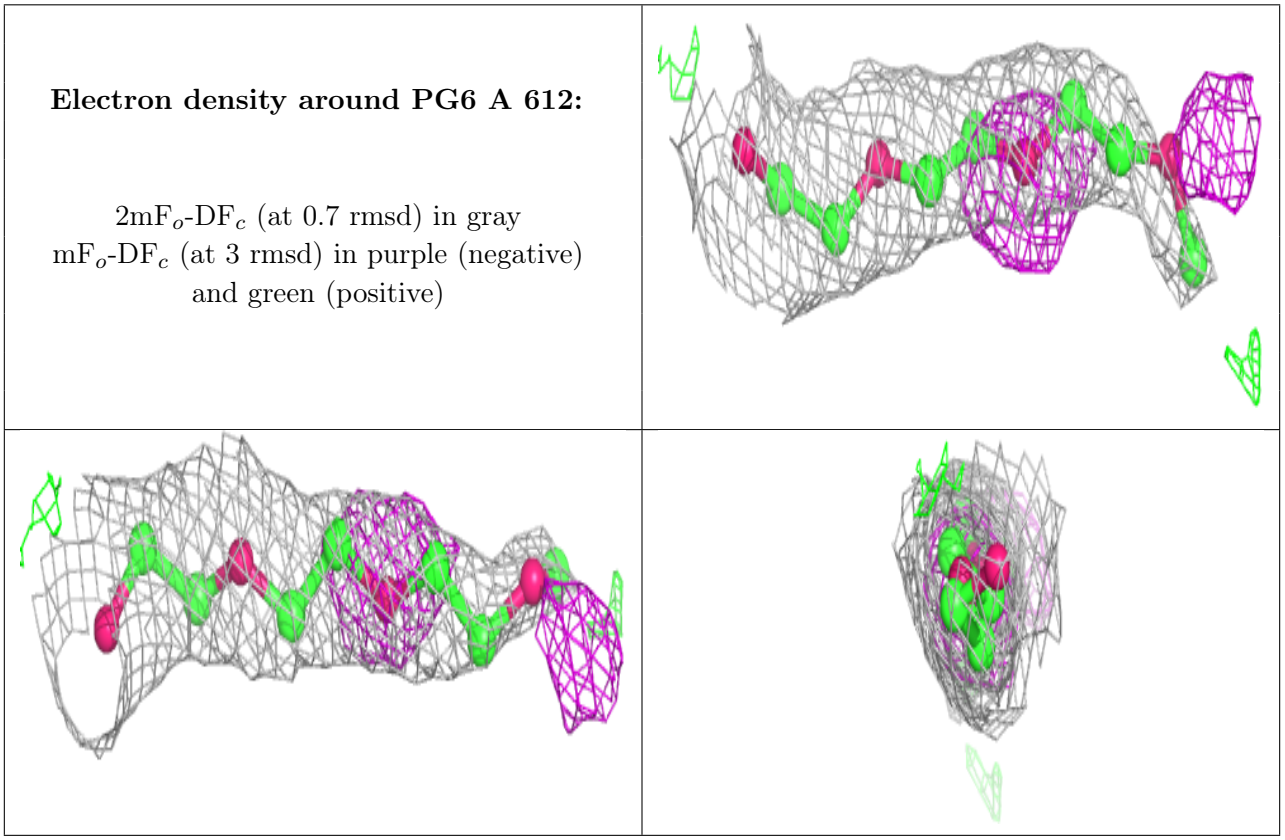
Electron density around QGT A 607:

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



Electron density around PG6 A 612:

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



Electron density around LMT A 619:

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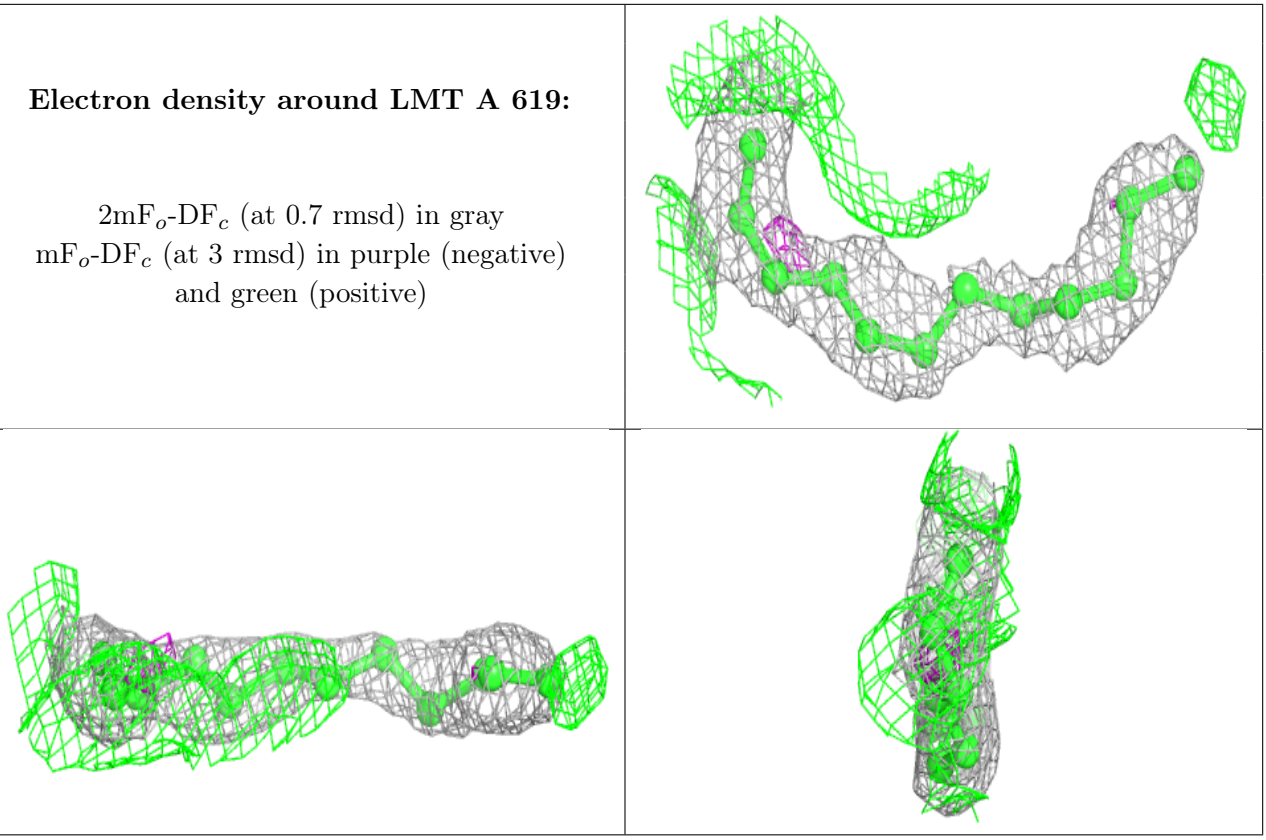
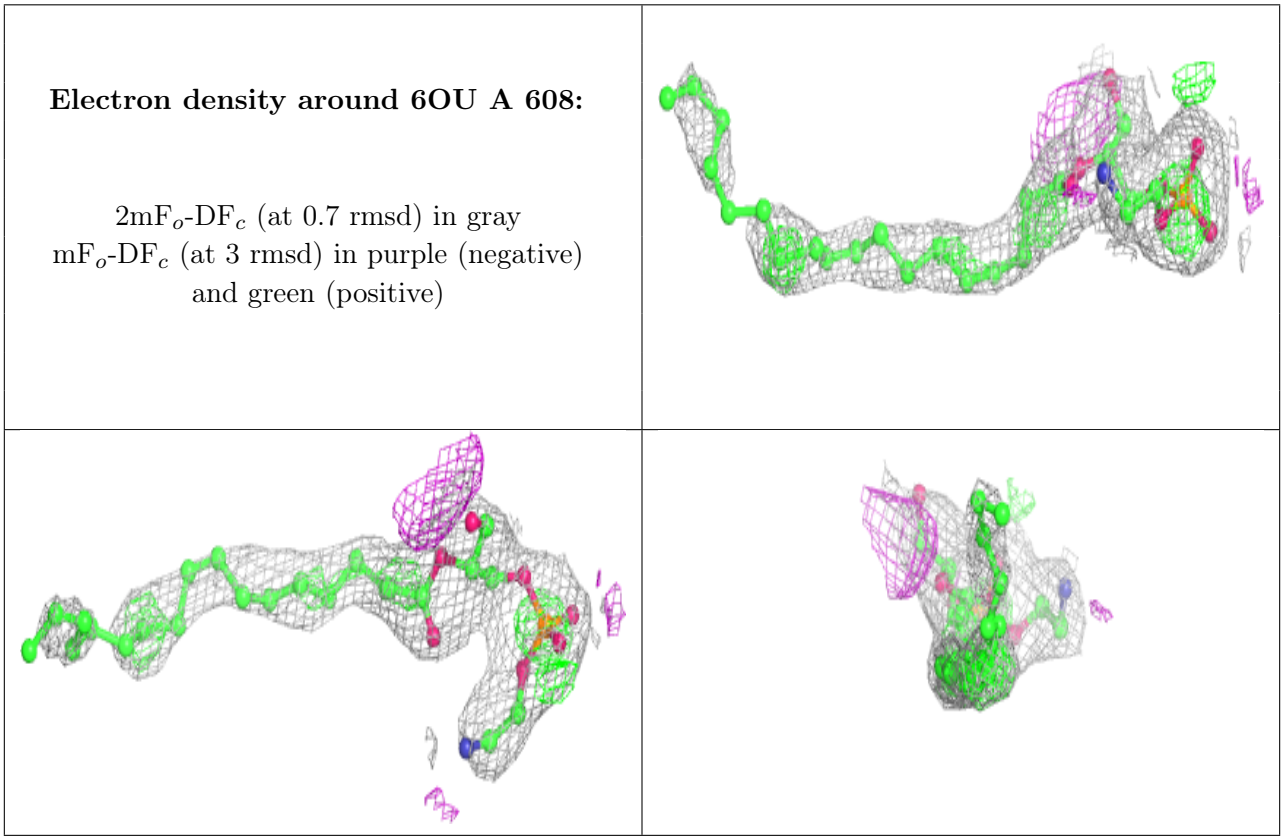
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



Electron density around 6OU A 608:

$2mF_o$-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.