Full wwPDB X-ray Structure Validation Report ⓘ

Sep 3, 2025 – 10:11 AM JST

PDB ID	:	9M7F / pdb_00009m7f
Title	:	Crystal structure of AsDMS D333N mutant in complex with farnesyl pyrophosphate
Authors	:	Fujiyama, K.; Vo, N.N.Q.; Takahashi, S.
Deposited on	:	2025-03-10
Resolution	:	2.60 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:

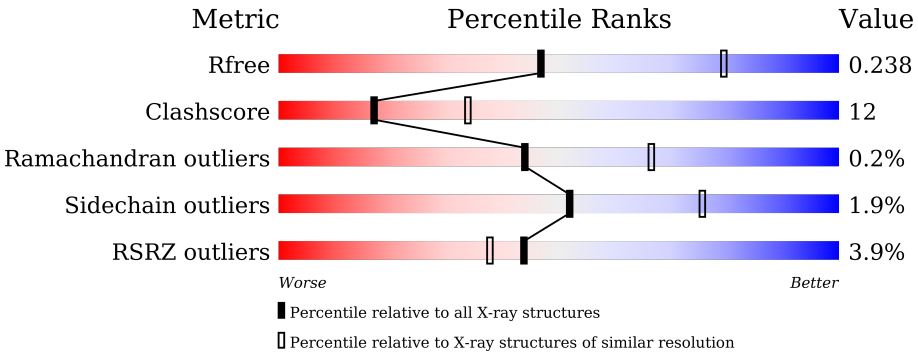
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.45.1

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 2.60 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}	164625	3775 (2.60-2.60)
Clashscore	180529	4181 (2.60-2.60)
Ramachandran outliers	177936	4129 (2.60-2.60)
Sidechain outliers	177891	4129 (2.60-2.60)
RSRZ outliers	164620	3775 (2.60-2.60)

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	521	4% 72% 25%
1	B	521	4% 75% 25%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 8907 atoms, of which 137 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.

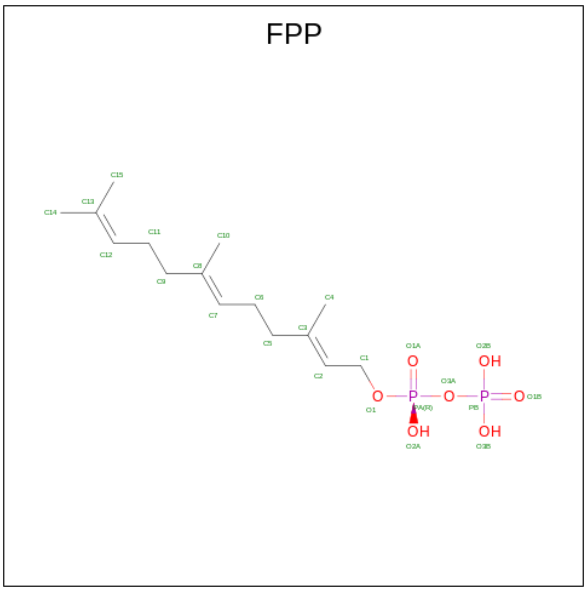
- Molecule 1 is a protein called Haloacid dehalogenase superfamily, subfamily IA, variant 3 with third motif having DD or ED.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	509	Total	C	N	O	S	0	0	0
			4154	2690	678	770	16			
1	B	520	Total	C	N	O	S	0	0	0
			4243	2748	693	786	16			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP A0A1M6CXF0
A	-1	SER	-	expression tag	UNP A0A1M6CXF0
A	0	HIS	-	expression tag	UNP A0A1M6CXF0
A	333	ASN	ASP	engineered mutation	UNP A0A1M6CXF0
B	-2	GLY	-	expression tag	UNP A0A1M6CXF0
B	-1	SER	-	expression tag	UNP A0A1M6CXF0
B	0	HIS	-	expression tag	UNP A0A1M6CXF0
B	333	ASN	ASP	engineered mutation	UNP A0A1M6CXF0

- Molecule 2 is FARNESYL DIPHOSPHATE (CCD ID: FPP) (formula: $C_{15}H_{28}O_7P_2$).

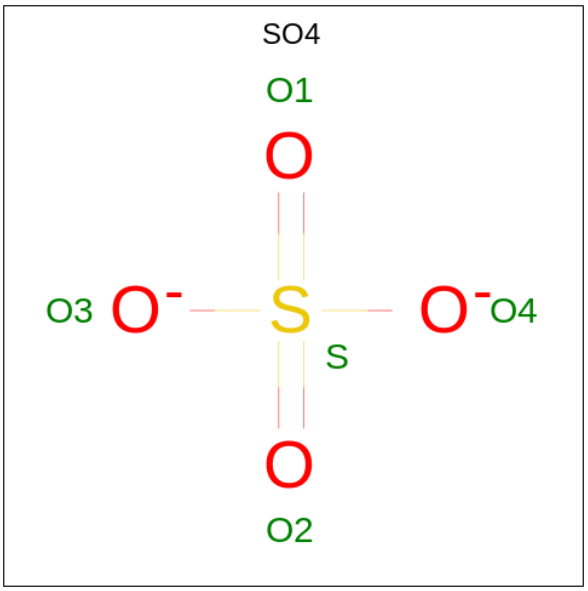


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C H O P 49 15 25 7 2	0	0
2	A	1	Total C H O P 49 15 25 7 2	0	0
2	B	1	Total C H O P 49 15 25 7 2	0	0
2	B	1	Total C H O P 49 15 25 7 2	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

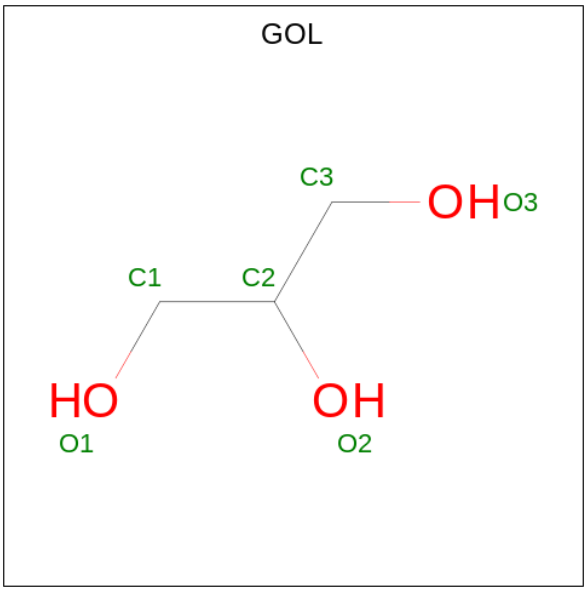
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	4	Total Cl 4 4	0	0
3	B	4	Total Cl 4 4	0	0

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



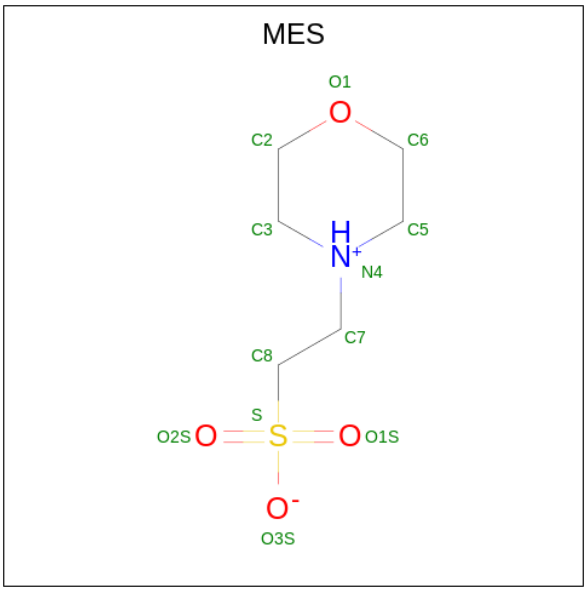
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C H O 14 3 8 3	0	0
5	B	1	Total C H O 14 3 8 3	0	0
5	B	1	Total C H O 14 3 8 3	0	0

- Molecule 6 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: $C_6H_{13}NO_4S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
6	B	1	Total	C	H	N	O	S	0	0
			25	6	13	1	4	1		

- Molecule 7 is water.

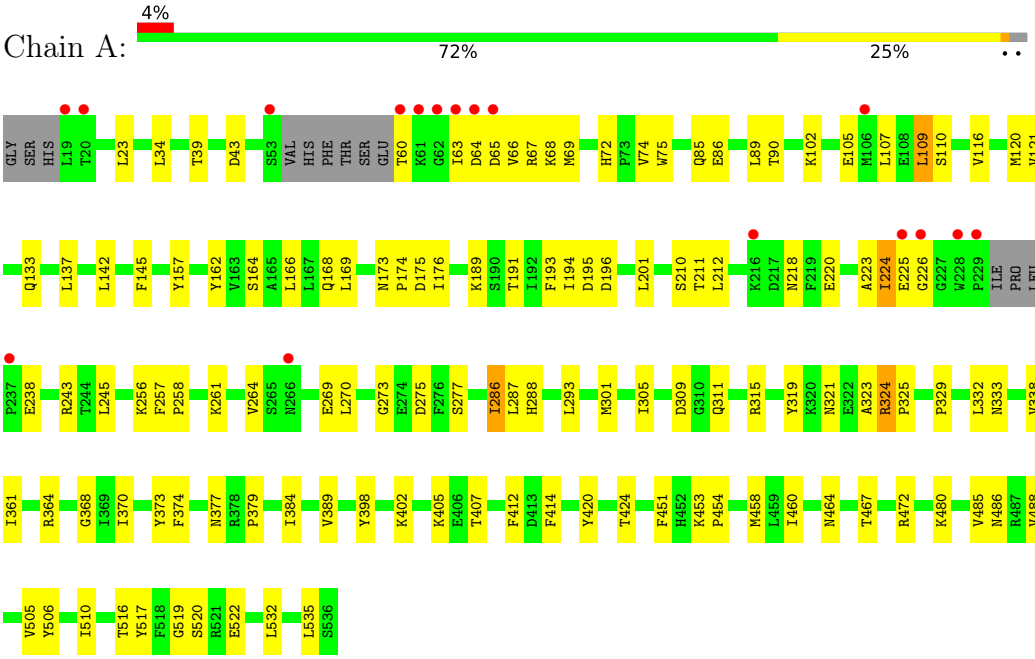
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	99	Total	O	0	0
			99	99		
7	B	95	Total	O	0	0
			95	95		

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.

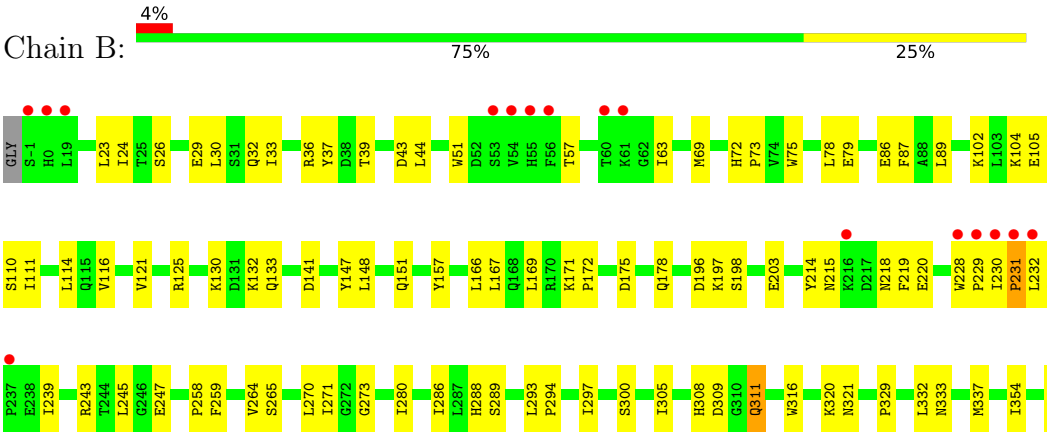
• Molecule 1: Haloacid dehalogenase superfamily, subfamily IA, variant 3 with third motif having DD or ED

Chain A:



• Molecule 1: Haloacid dehalogenase superfamily, subfamily IA, variant 3 with third motif having DD or ED

Chain B:




V389
M393
F414
Y420
L437
S438
R439
D443
K453
P454
L455
M458
M464
T467
F468
R472
K480
K481
I484
R487
F490
L491
G501
V505
Y506
G507
F518
G519
F527
I534
L535
S536

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	96.55Å 96.55Å 401.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.30 – 2.60 49.30 – 2.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (49.30-2.60) 100.0 (49.30-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.86 (at 2.61Å)	Xtriage
Refinement program	REFMAC 5.8.0352, PHENIX 1.11.1	Depositor
R, R_{free}	0.193 , 0.236 0.204 , 0.238	Depositor DCC
R_{free} test set	3043 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	53.6	Xtriage
Anisotropy	0.034	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 55.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	8907	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.61% 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: GOL, SO4, FPP, MES, CL

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	0.37	0/4248	0.54	0/5750
1	B	0.36	0/4343	0.53	0/5884
All	All	0.36	0/8591	0.53	0/11634

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	4154	0	4151	107	0
1	B	4243	0	4240	105	0
2	A	48	50	50	4	0
2	B	48	50	50	8	0
3	A	4	0	0	0	0
3	B	4	0	0	0	0
4	A	15	0	0	0	0
4	B	30	0	0	0	0
5	A	6	8	8	0	0
5	B	12	16	16	1	0
6	B	12	13	13	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	99	0	0	3	0
7	B	95	0	0	1	0
All	All	8770	137	8528	213	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 12.

All (213) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:360:MET:HE3	1:B:389:VAL:HG13	1.47	0.95
1:B:51:TRP:HB3	1:B:114:LEU:HD23	1.50	0.90
1:A:63:ILE:HD12	1:A:68:LYS:HD2	1.56	0.86
1:A:23:LEU:HD12	1:A:218:ASN:ND2	1.93	0.82
1:B:243:ARG:O	1:B:247:GLU:HG3	1.80	0.81
1:A:360:MET:HE2	1:A:389:VAL:HG13	1.63	0.79
1:A:269:GLU:HG3	7:A:756:HOH:O	1.83	0.79
1:B:57:THR:HG21	1:B:105:GLU:HG2	1.63	0.79
1:B:360:MET:HE2	1:B:393:MET:HE2	1.63	0.79
1:B:259:PHE:CE2	1:B:320:LYS:HE3	2.17	0.79
1:A:173:ASN:ND2	1:A:175:ASP:HB2	2.00	0.77
1:A:256:LYS:HD2	1:A:257:PHE:CE2	2.22	0.75
1:B:467:THR:HA	1:B:472:ARG:NH1	2.02	0.74
1:B:360:MET:CE	1:B:389:VAL:HG13	2.16	0.73
1:B:280:ILE:HD11	1:B:305:ILE:HA	1.71	0.73
1:A:454:PRO:O	1:A:458:MET:HG2	1.89	0.72
1:A:360:MET:CE	1:A:389:VAL:HG13	2.19	0.71
1:A:467:THR:HA	1:A:472:ARG:NH1	2.06	0.70
1:A:324:ARG:HG3	7:A:746:HOH:O	1.90	0.69
1:B:111:ILE:HG12	2:B:602:FPP:H141	1.75	0.68
1:A:189:LYS:HA	1:A:226:GLY:HA3	1.76	0.67
1:B:454:PRO:O	1:B:458:MET:HG2	1.94	0.67
1:A:23:LEU:HD12	1:A:218:ASN:HD21	1.58	0.66
1:A:107:LEU:HD12	2:A:602:FPP:H152	1.76	0.66
1:B:228:TRP:HB2	1:B:229:PRO:HD2	1.79	0.65
1:A:90:THR:HG21	1:B:271:ILE:HA	1.79	0.64
1:B:69:MET:HE1	1:B:89:LEU:CD2	2.28	0.64
1:A:72:HIS:CE1	1:A:74:VAL:HG23	2.33	0.63
1:B:230:ILE:HG23	1:B:231:PRO:HD2	1.81	0.63
1:B:506:TYR:O	1:B:519:GLY:HA3	1.99	0.62
1:B:332:LEU:CD2	1:B:360:MET:HG2	2.29	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:23:LEU:CD1	1:A:220:GLU:HG2	2.28	0.62
1:A:261:LYS:NZ	1:A:275:ASP:OD2	2.22	0.62
1:B:311:GLN:HG3	1:B:316:TRP:CZ2	2.35	0.61
1:A:142:LEU:HD13	1:A:166:LEU:HD21	1.82	0.61
1:B:360:MET:CE	1:B:393:MET:HE2	2.30	0.61
1:B:24:ILE:HD11	1:B:33:ILE:HD13	1.82	0.60
1:B:57:THR:CG2	1:B:105:GLU:HG2	2.31	0.60
1:A:194:ILE:HG12	1:A:212:LEU:HD23	1.83	0.60
1:A:315:ARG:HG2	1:A:374:PHE:CE2	2.37	0.59
1:B:24:ILE:HG23	1:B:29:GLU:HB3	1.85	0.59
1:B:289:SER:HA	1:B:439:ARG:HH22	1.67	0.59
1:A:364:ARG:HG2	1:A:368:GLY:O	2.02	0.59
1:B:245:LEU:HG	1:B:501:GLY:HA3	1.85	0.59
1:B:487:ARG:O	1:B:490:PHE:HB3	2.03	0.58
1:A:120:MET:HE3	1:A:120:MET:HA	1.84	0.58
1:A:69:MET:HE1	1:A:89:LEU:HD11	1.85	0.58
1:B:196:ASP:OD2	1:B:197:LYS:HD3	2.04	0.58
1:A:243:ARG:HG2	1:A:532:LEU:HD23	1.86	0.58
1:A:86:GLU:O	1:A:90:THR:HG23	2.04	0.57
1:A:361:ILE:O	1:A:364:ARG:HD3	2.04	0.57
1:B:270:LEU:CD1	1:B:505:VAL:HG22	2.34	0.57
1:A:243:ARG:CG	1:A:532:LEU:HD23	2.35	0.57
1:A:34:LEU:HD13	1:A:127:LEU:HD11	1.86	0.57
1:B:235:MET:HE1	1:B:491:LEU:CD2	2.35	0.57
1:A:360:MET:CE	1:A:389:VAL:HG22	2.35	0.57
1:A:264:VAL:O	1:A:273:GLY:HA2	2.05	0.56
1:B:172:PRO:O	1:B:203:GLU:HG2	2.04	0.56
1:A:235:MET:HE2	1:A:238:GLU:OE1	2.06	0.56
1:B:114:LEU:HD13	1:B:148:LEU:HD21	1.88	0.56
1:A:225:GLU:OE1	1:A:225:GLU:N	2.34	0.56
1:B:29:GLU:O	1:B:32:GLN:HG2	2.06	0.56
2:B:602:FPP:H143	2:B:602:FPP:C8	2.37	0.55
1:A:245:LEU:HG	1:A:501:GLY:CA	2.37	0.55
1:A:472:ARG:NH2	1:A:492:LYS:HD2	2.22	0.55
1:A:142:LEU:HD13	1:A:166:LEU:CD2	2.37	0.55
1:B:265:SER:HB3	1:B:273:GLY:HA2	1.89	0.55
1:A:520:SER:HB2	1:A:522:GLU:OE2	2.07	0.55
1:A:287:LEU:HD12	1:A:305:ILE:HD11	1.89	0.55
1:A:223:ALA:C	1:A:224:ILE:HG12	2.32	0.54
1:B:69:MET:HE1	1:B:89:LEU:HD21	1.88	0.54
1:B:360:MET:HE3	1:B:389:VAL:CG1	2.31	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:57:THR:HG21	1:B:105:GLU:CG	2.37	0.54
1:A:173:ASN:OD1	1:A:174:PRO:HD2	2.08	0.54
1:A:116:VAL:HG13	1:A:121:VAL:HG21	1.90	0.54
1:A:23:LEU:HD13	1:A:220:GLU:HG2	1.88	0.54
1:B:234:ASN:O	1:B:235:MET:HG3	2.08	0.53
1:B:332:LEU:HD23	1:B:360:MET:HG2	1.89	0.53
1:A:173:ASN:HD21	1:A:175:ASP:HB2	1.71	0.53
1:B:26:SER:OG	1:B:29:GLU:HB2	2.09	0.53
1:A:402:LYS:HA	1:A:405:LYS:HE2	1.90	0.53
1:A:110:SER:HB2	2:A:602:FPP:C15	2.39	0.53
1:B:230:ILE:CG2	1:B:231:PRO:HD2	2.38	0.52
1:A:323:ALA:O	1:A:325:PRO:HD3	2.09	0.52
1:B:75:TRP:O	1:B:79:GLU:HG3	2.10	0.52
1:A:510:ILE:HA	1:A:516:THR:O	2.09	0.52
1:A:72:HIS:HE1	1:A:74:VAL:HG23	1.73	0.52
1:A:85:GLN:O	1:A:89:LEU:HD23	2.10	0.52
1:A:360:MET:HE1	1:A:389:VAL:HG22	1.91	0.52
1:B:245:LEU:HG	1:B:501:GLY:CA	2.38	0.52
1:B:414:PHE:CE1	1:B:420:TYR:HA	2.45	0.52
1:B:453:LYS:N	1:B:454:PRO:HD2	2.25	0.51
1:B:104:LYS:O	1:B:108:GLU:HG3	2.11	0.51
1:A:142:LEU:CD1	1:A:166:LEU:HD21	2.40	0.51
1:B:114:LEU:CD1	1:B:148:LEU:HD21	2.40	0.51
1:B:228:TRP:HB2	1:B:229:PRO:CD	2.40	0.51
1:B:280:ILE:CD1	1:B:305:ILE:HA	2.41	0.51
1:A:319:TYR:CE2	1:A:325:PRO:HD2	2.46	0.51
1:B:215:ASN:HB2	1:B:218:ASN:O	2.11	0.51
1:B:270:LEU:HD13	1:B:505:VAL:CG2	2.41	0.51
1:A:354:ILE:HG23	1:A:398:TYR:OH	2.11	0.51
1:B:280:ILE:HD12	1:B:308:HIS:HB2	1.93	0.50
1:A:60:THR:N	1:A:102:LYS:HZ1	2.10	0.50
1:A:384:ILE:HG13	1:A:424:THR:HG21	1.92	0.50
1:B:102:LYS:O	1:B:106:MET:HG3	2.12	0.49
1:B:214:TYR:HD2	1:B:219:PHE:CE2	2.30	0.49
1:A:125:ARG:HG3	1:A:157:TYR:CZ	2.48	0.49
1:A:414:PHE:CE1	1:A:420:TYR:HA	2.47	0.49
1:A:464:ASN:OD1	1:A:472:ARG:NH2	2.45	0.49
1:B:111:ILE:HG12	2:B:602:FPP:C14	2.41	0.49
1:A:309:ASP:OD2	1:A:321:ASN:HB2	2.13	0.49
1:B:197:LYS:NZ	2:B:602:FPP:O1B	2.44	0.49
1:B:270:LEU:HD12	1:B:505:VAL:HG22	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:277:SER:HA	7:A:721:HOH:O	2.13	0.49
1:B:464:ASN:OD1	1:B:472:ARG:NH2	2.46	0.49
1:A:39:THR:HB	1:A:191:THR:OG1	2.12	0.48
1:A:63:ILE:CD1	1:A:68:LYS:HD2	2.37	0.48
1:B:51:TRP:HB3	1:B:114:LEU:CD2	2.34	0.48
1:A:319:TYR:CD2	1:A:325:PRO:HD2	2.48	0.48
2:A:602:FPP:H103	2:A:602:FPP:C2	2.44	0.48
1:A:453:LYS:HB2	1:A:454:PRO:HD3	1.96	0.48
1:B:270:LEU:HD13	1:B:505:VAL:HG22	1.95	0.48
1:B:24:ILE:CD1	1:B:33:ILE:HD13	2.44	0.47
1:A:377:ASN:C	1:A:379:PRO:HD3	2.38	0.47
1:B:24:ILE:HD11	1:B:33:ILE:CD1	2.43	0.47
1:B:24:ILE:CD1	1:B:33:ILE:CD1	2.92	0.47
1:B:233:GLN:HB3	1:B:236:THR:OG1	2.14	0.47
1:B:114:LEU:HD21	2:B:602:FPP:H62	1.97	0.47
1:A:506:TYR:O	1:A:519:GLY:HA3	2.14	0.47
1:A:270:LEU:HD12	1:A:505:VAL:HG22	1.97	0.47
1:B:125:ARG:HD2	5:B:614:GOL:H2	1.95	0.47
1:A:195:ASP:OD1	1:A:196:ASP:N	2.48	0.46
1:B:178:GLN:NE2	1:B:232:LEU:O	2.33	0.46
1:B:232:LEU:C	1:B:232:LEU:HD12	2.41	0.46
1:B:39:THR:HA	1:B:133:GLN:O	2.16	0.46
1:B:329:PRO:HG2	1:B:373:TYR:CD1	2.51	0.46
1:B:265:SER:OG	1:B:270:LEU:HA	2.16	0.46
1:A:66:VAL:HG12	1:A:66:VAL:O	2.16	0.45
1:B:72:HIS:ND1	1:B:73:PRO:HD2	2.31	0.45
1:B:110:SER:HB3	2:B:602:FPP:H153	1.98	0.45
1:A:116:VAL:HG13	1:A:121:VAL:CG2	2.46	0.45
1:B:280:ILE:CD1	1:B:308:HIS:HB2	2.47	0.45
1:B:309:ASP:HB2	1:B:321:ASN:ND2	2.32	0.45
1:B:63:ILE:O	1:B:102:LYS:HE2	2.16	0.45
1:B:30:LEU:HD22	1:B:219:PHE:CE1	2.52	0.45
1:B:114:LEU:HD13	1:B:148:LEU:CD2	2.46	0.45
1:B:116:VAL:HB	1:B:121:VAL:HG21	1.99	0.45
1:B:235:MET:HE3	1:B:235:MET:HB2	1.52	0.45
1:B:264:VAL:O	1:B:273:GLY:HA2	2.16	0.45
1:A:287:LEU:HD12	1:A:305:ILE:CD1	2.46	0.44
1:B:78:LEU:HG	1:B:141:ASP:HB3	1.99	0.44
1:A:145:PHE:CE1	1:A:460:ILE:HD13	2.52	0.44
1:A:305:ILE:HG21	1:A:338:VAL:HG13	1.99	0.44
1:B:293:LEU:HD13	1:B:297:ILE:HG22	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:468:PHE:O	1:B:472:ARG:HG3	2.17	0.44
1:A:286:ILE:HB	1:A:301:MET:HE1	2.00	0.44
1:B:258:PRO:HB3	1:B:300:SER:OG	2.18	0.44
1:A:39:THR:O	1:A:191:THR:HA	2.18	0.44
1:A:264:VAL:HA	1:A:517:TYR:O	2.18	0.44
1:B:44:LEU:HD23	1:B:44:LEU:HA	1.88	0.43
1:B:360:MET:HE2	1:B:393:MET:CE	2.42	0.43
1:B:23:LEU:C	1:B:24:ILE:HG13	2.43	0.43
1:B:32:GLN:O	1:B:36:ARG:HG3	2.19	0.43
1:B:169:LEU:HD22	1:B:175:ASP:HB3	2.00	0.43
1:A:258:PRO:O	1:A:301:MET:HG2	2.18	0.43
1:B:147:TYR:CZ	1:B:151:GLN:HG3	2.53	0.43
1:B:333:ASN:HD22	2:B:601:FPP:C13	2.32	0.43
1:A:168:GLN:HG3	1:A:488:VAL:HG22	1.99	0.43
1:A:116:VAL:CG1	1:A:121:VAL:HG21	2.49	0.43
1:A:162:TYR:CE1	1:A:485:VAL:HG21	2.54	0.43
1:B:294:PRO:HD2	1:B:297:ILE:HD12	2.00	0.42
1:A:245:LEU:HG	1:A:501:GLY:HA3	2.00	0.42
1:B:110:SER:CB	2:B:602:FPP:H153	2.49	0.42
1:A:23:LEU:N	1:A:23:LEU:HD22	2.35	0.42
1:A:39:THR:HA	1:A:133:GLN:O	2.19	0.42
1:A:137:LEU:HD11	1:A:176:ILE:HG12	2.00	0.42
1:B:235:MET:O	1:B:239:ILE:HG13	2.19	0.42
1:A:287:LEU:CD1	1:A:305:ILE:HD12	2.49	0.42
1:A:293:LEU:HD23	1:A:293:LEU:HA	1.87	0.42
1:A:333:ASN:HD22	2:A:601:FPP:C13	2.33	0.42
1:B:481:LYS:HG2	7:B:789:HOH:O	2.20	0.42
1:B:507:GLY:HA2	1:B:518:PHE:O	2.20	0.42
1:B:215:ASN:ND2	1:B:220:GLU:HG3	2.34	0.42
1:B:480:LYS:HG2	1:B:534:ILE:HG12	2.02	0.42
1:A:65:ASP:OD2	1:A:67:ARG:HG2	2.19	0.42
1:B:289:SER:HB3	1:B:527:PHE:CE1	2.55	0.42
1:A:467:THR:HA	1:A:472:ARG:HH11	1.81	0.42
1:B:125:ARG:HG3	1:B:157:TYR:CZ	2.54	0.42
1:A:256:LYS:HD2	1:A:257:PHE:CZ	2.53	0.41
1:A:412:PHE:HB2	1:A:451:PHE:CZ	2.55	0.41
1:A:120:MET:HE3	1:A:120:MET:CA	2.49	0.41
1:A:210:SER:HA	1:A:224:ILE:HG13	2.03	0.41
1:A:329:PRO:HG2	1:A:373:TYR:CD1	2.55	0.41
1:A:69:MET:HE2	1:A:75:TRP:HZ3	1.86	0.41
1:A:105:GLU:O	1:A:109:LEU:HD23	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:189:LYS:HA	1:A:226:GLY:CA	2.50	0.41
1:A:332:LEU:HD23	1:A:360:MET:HE3	2.03	0.41
1:A:164:SER:HB2	1:A:169:LEU:O	2.21	0.41
1:A:193:PHE:CD1	1:A:201:LEU:HD23	2.55	0.41
1:A:305:ILE:CG2	1:A:338:VAL:HG13	2.50	0.41
1:A:402:LYS:O	1:A:405:LYS:HG2	2.21	0.41
1:B:37:TYR:O	1:B:132:LYS:HE3	2.20	0.41
1:A:270:LEU:CD1	1:A:505:VAL:HG22	2.50	0.40
1:B:166:LEU:HD22	1:B:484:ILE:CG2	2.51	0.40
1:A:360:MET:HE2	1:A:389:VAL:CG1	2.42	0.40
1:A:370:ILE:HG13	1:A:407:THR:OG1	2.22	0.40
1:B:167:LEU:HA	1:B:487:ARG:HB3	2.03	0.40
1:B:439:ARG:O	1:B:443:ASP:HB2	2.22	0.40
1:A:201:LEU:HD22	1:A:211:THR:HB	2.03	0.40
1:A:486:ASN:OD1	1:A:486:ASN:C	2.64	0.40
1:A:480:LYS:HD3	1:A:535:LEU:CD2	2.51	0.40
1:B:171:LYS:HE3	1:B:171:LYS:HB2	1.87	0.40
1:B:437:LEU:HD23	1:B:455:LEU:HD13	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	503/521 (96%)	489 (97%)	14 (3%)	0	100	100
1	B	518/521 (99%)	496 (96%)	20 (4%)	2 (0%)	30	52
All	All	1021/1042 (98%)	985 (96%)	34 (3%)	2 (0%)	44	66

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	130	LYS
1	B	231	PRO

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	465/476 (98%)	456 (98%)	9 (2%)	52	75
1	B	476/476 (100%)	467 (98%)	9 (2%)	52	75
All	All	941/952 (99%)	923 (98%)	18 (2%)	52	75

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	43	ASP
1	A	64	ASP
1	A	109	LEU
1	A	224	ILE
1	A	286	ILE
1	A	288	HIS
1	A	311	GLN
1	A	324	ARG
1	A	354	ILE
1	B	43	ASP
1	B	86	GLU
1	B	87	PHE
1	B	198	SER
1	B	286	ILE
1	B	288	HIS
1	B	311	GLN
1	B	337	MET
1	B	354	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	128	HIS
1	A	133	GLN
1	A	178	GLN
1	B	55	HIS
1	B	218	ASN
1	B	333	ASN
1	B	371	GLN
1	B	388	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 25 ligands modelled in this entry, 8 are monoatomic - leaving 17 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	$\#\|Z\| > 2$
5	GOL	B	613	-	5,5,5	0.29	0	5,5,5	0.38	0
5	GOL	A	610	-	5,5,5	0.36	0	5,5,5	0.27	0
4	SO4	A	608	-	4,4,4	0.16	0	6,6,6	0.10	0
2	FPP	A	602	-	21,23,23	2.06	2 (9%)	27,31,31	1.52	4 (14%)
5	GOL	B	614	-	5,5,5	0.32	0	5,5,5	0.24	0
4	SO4	B	610	-	4,4,4	0.14	0	6,6,6	0.08	0
4	SO4	B	611	-	4,4,4	0.17	0	6,6,6	0.23	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
4	SO4	A	609	-	4,4,4	0.17	0	6,6,6	0.25	0
6	MES	B	615	-	12,12,12	1.93	1 (8%)	14,16,16	1.69	4 (28%)
2	FPP	A	601	-	21,23,23	2.20	2 (9%)	27,31,31	1.49	5 (18%)
4	SO4	A	607	-	4,4,4	0.15	0	6,6,6	0.24	0
4	SO4	B	607	-	4,4,4	0.15	0	6,6,6	0.16	0
2	FPP	B	602	-	21,23,23	2.17	2 (9%)	27,31,31	1.57	5 (18%)
4	SO4	B	612	-	4,4,4	0.16	0	6,6,6	0.17	0
4	SO4	B	608	-	4,4,4	0.15	0	6,6,6	0.22	0
4	SO4	B	609	-	4,4,4	0.17	0	6,6,6	0.17	0
2	FPP	B	601	-	21,23,23	2.09	2 (9%)	27,31,31	1.64	5 (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
5	GOL	B	613	-	-	0/4/4/4	-
2	FPP	A	602	-	-	6/25/25/25	-
5	GOL	B	614	-	-	2/4/4/4	-
6	MES	B	615	-	-	5/6/14/14	0/1/1/1
2	FPP	A	601	-	-	3/25/25/25	-
2	FPP	B	602	-	-	5/25/25/25	-
5	GOL	A	610	-	-	0/4/4/4	-
2	FPP	B	601	-	-	1/25/25/25	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	602	FPP	O1-C1	-7.25	1.33	1.43
2	A	601	FPP	O1-C1	-7.21	1.33	1.43
2	A	602	FPP	PA-O1	6.55	1.85	1.59
2	B	601	FPP	PA-O1	6.37	1.85	1.59
6	B	615	MES	C8-S	-6.30	1.68	1.77
2	B	601	FPP	O1-C1	-6.03	1.34	1.43
2	A	602	FPP	O1-C1	-6.00	1.34	1.43
2	B	602	FPP	PA-O1	5.94	1.83	1.59
2	A	601	FPP	PA-O1	5.88	1.83	1.59

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	602	FPP	O3B-PB-O3A	-3.95	91.40	104.64
2	B	601	FPP	O1-PA-O1A	-3.93	93.70	109.07
2	B	601	FPP	O3B-PB-O3A	-3.74	92.08	104.64
2	A	602	FPP	O1-PA-O1A	-3.67	94.73	109.07
2	B	602	FPP	O1-PA-O1A	-3.48	95.49	109.07
6	B	615	MES	O3S-S-C8	3.36	111.20	105.77
2	B	602	FPP	O2A-PA-O1	-3.29	92.47	107.75
2	A	601	FPP	O1-PA-O1A	-3.27	96.30	109.07
2	A	601	FPP	O3B-PB-O3A	-3.20	93.90	104.64
2	B	602	FPP	O3B-PB-O3A	-3.04	94.44	104.64
2	A	602	FPP	O3B-PB-O2B	2.74	118.13	107.64
2	A	601	FPP	O2A-PA-O1	-2.73	95.05	107.75
2	B	601	FPP	O2A-PA-O1	-2.61	95.62	107.75
6	B	615	MES	O1S-S-C8	2.60	110.04	106.92
2	A	601	FPP	O3B-PB-O2B	2.59	117.52	107.64
6	B	615	MES	O2S-S-C8	2.43	109.84	106.92
2	B	601	FPP	O3B-PB-O1B	2.43	120.17	110.68
2	A	602	FPP	O2A-PA-O1	-2.36	96.80	107.75
2	B	602	FPP	O3B-PB-O2B	2.19	116.01	107.64
2	B	601	FPP	O3B-PB-O2B	2.18	115.98	107.64
6	B	615	MES	C5-N4-C3	2.11	113.58	108.83
2	B	602	FPP	C10-C8-C7	-2.01	118.51	123.68
2	A	601	FPP	C4-C3-C2	-2.01	118.53	123.68

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	FPP	C1-O1-PA-O3A
2	A	601	FPP	PA-O3A-PB-O3B
2	A	602	FPP	C1-O1-PA-O1A
2	A	602	FPP	C1-O1-PA-O2A
2	B	602	FPP	O1-C1-C2-C3
2	B	602	FPP	C1-O1-PA-O3A
5	B	614	GOL	O1-C1-C2-O2
6	B	615	MES	C7-C8-S-O3S
5	B	614	GOL	O1-C1-C2-C3
2	A	602	FPP	PB-O3A-PA-O1A
6	B	615	MES	C8-C7-N4-C3
2	A	601	FPP	C1-O1-PA-O1A
2	B	602	FPP	C1-O1-PA-O1A
2	B	602	FPP	C1-O1-PA-O2A
6	B	615	MES	C7-C8-S-O1S

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Mol	Chain	Res	Type	Atoms
6	B	615	MES	C7-C8-S-O2S
2	A	602	FPP	C3-C5-C6-C7
6	B	615	MES	C8-C7-N4-C5
2	B	601	FPP	C4-C3-C5-C6
2	A	602	FPP	C1-O1-PA-O3A
2	B	602	FPP	C10-C8-C9-C11
2	A	602	FPP	PB-O3A-PA-O2A

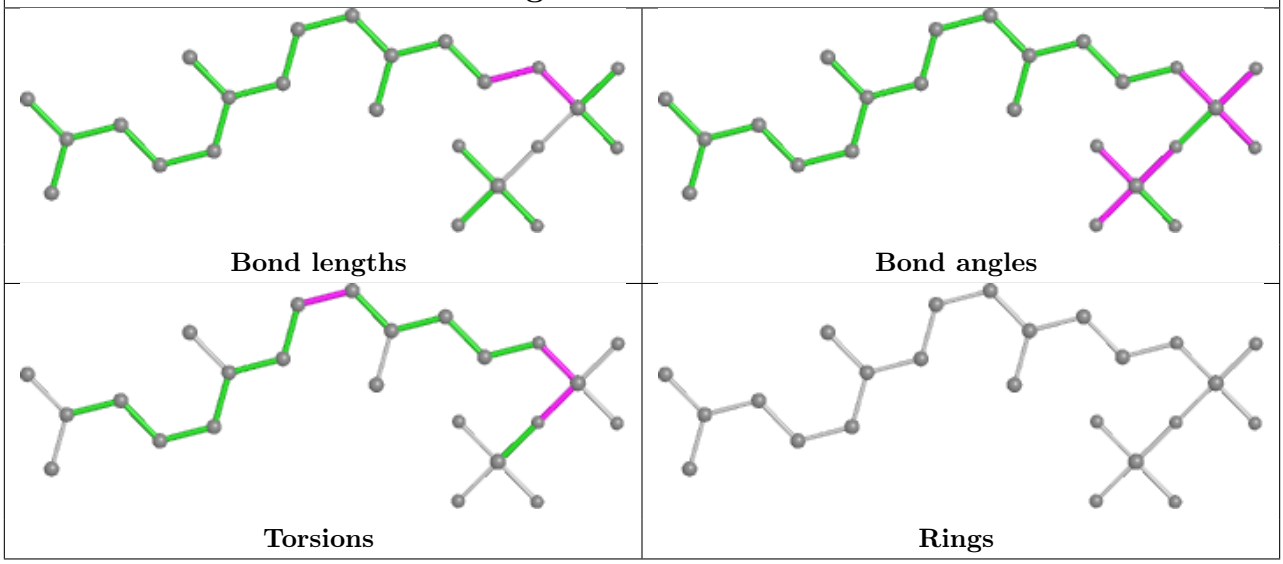
There are no ring outliers.

5 monomers are involved in 13 short contacts:

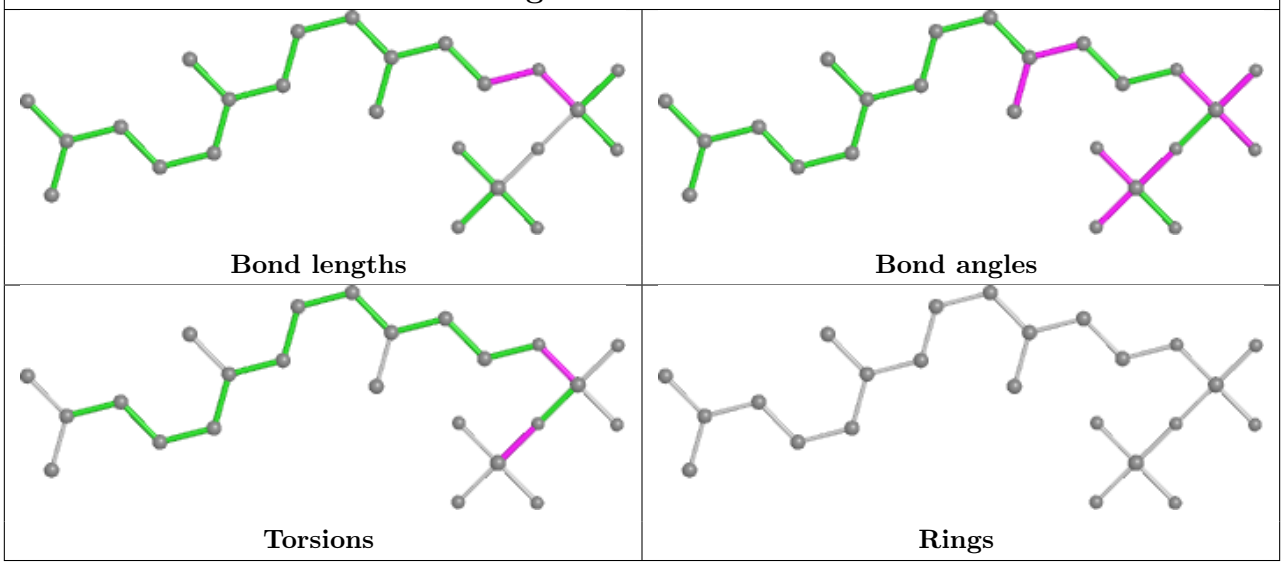
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	602	FPP	3	0
5	B	614	GOL	1	0
2	A	601	FPP	1	0
2	B	602	FPP	7	0
2	B	601	FPP	1	0

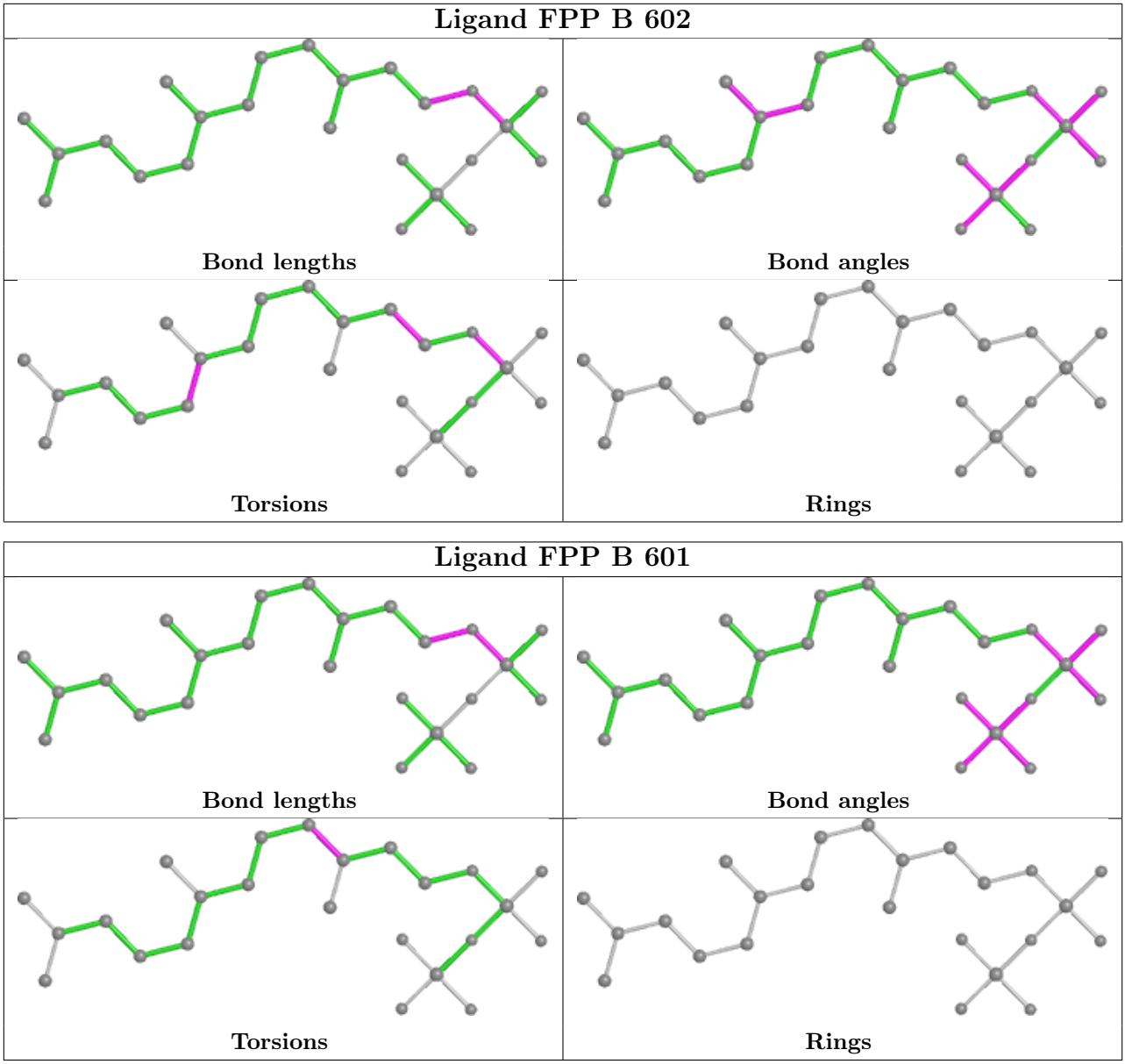
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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 FPP A 602



Ligand FPP A 601





5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	509/521 (97%)	-0.15	21 (4%)	42	36	36, 50, 82, 121	0
1	B	520/521 (99%)	-0.22	19 (3%)	45	39	35, 50, 92, 127	0
All	All	1029/1042 (98%)	-0.18	40 (3%)	44	38	35, 50, 89, 127	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	232	LEU	7.2
1	B	230	ILE	7.2
1	A	19	LEU	6.3
1	A	60	THR	5.0
1	A	229	PRO	4.4
1	B	235	MET	4.2
1	A	61	LYS	4.0
1	A	53	SER	3.9
1	B	237	PRO	3.9
1	B	56	PHE	3.8
1	A	233	GLN	3.8
1	B	234	ASN	3.7
1	B	61	LYS	3.6
1	A	63	ILE	3.5
1	A	62	GLY	3.3
1	A	65	ASP	3.3
1	B	236	THR	3.2
1	B	19	LEU	3.2
1	A	20	THR	3.0
1	B	54	VAL	2.9
1	A	228	TRP	2.8
1	B	231	PRO	2.8
1	A	225	GLU	2.8
1	B	53	SER	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	235	MET	2.8
1	B	216	LYS	2.7
1	A	216	LYS	2.6
1	B	229	PRO	2.5
1	A	236	THR	2.4
1	B	228	TRP	2.4
1	B	0	HIS	2.3
1	B	55	HIS	2.3
1	A	106	MET	2.2
1	A	226	GLY	2.2
1	A	234	ASN	2.2
1	A	266	ASN	2.1
1	A	64	ASP	2.1
1	A	237	PRO	2.1
1	B	60	THR	2.1
1	B	-1	SER	2.1

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

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

6.3 Carbohydrates (i)

There are no oligosaccharides 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^{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
6	MES	B	615	12/12	0.48	0.29	99,131,153,155	0
4	SO4	B	610	5/5	0.69	0.13	109,114,138,149	0
4	SO4	B	612	5/5	0.69	0.12	84,86,119,124	0
4	SO4	B	608	5/5	0.69	0.12	94,102,130,131	0
5	GOL	A	610	6/6	0.70	0.15	84,101,118,119	0
4	SO4	B	611	5/5	0.71	0.13	101,104,142,143	0
4	SO4	B	607	5/5	0.73	0.11	114,118,132,145	0

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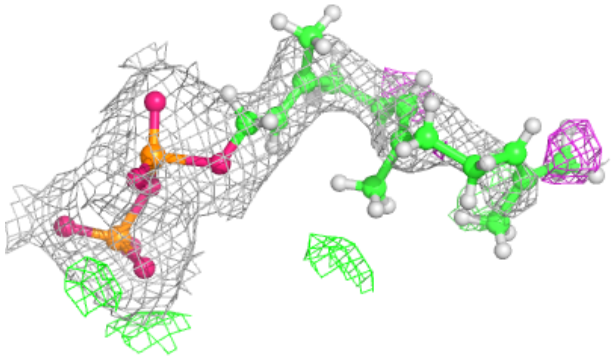
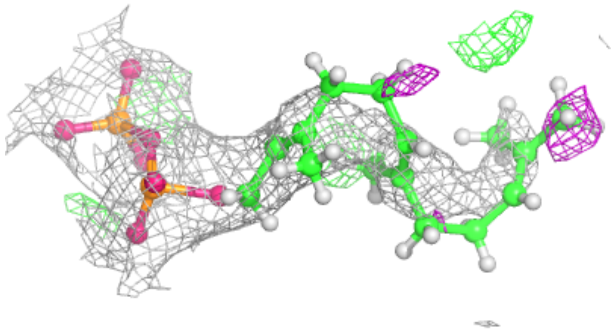
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	SO4	A	609	5/5	0.74	0.15	86,96,127,133	0
5	GOL	B	613	6/6	0.76	0.14	80,97,114,118	0
4	SO4	A	608	5/5	0.82	0.10	89,95,138,142	0
4	SO4	A	607	5/5	0.82	0.22	73,88,100,101	0
5	GOL	B	614	6/6	0.82	0.14	71,88,105,106	0
4	SO4	B	609	5/5	0.82	0.13	90,98,100,116	0
3	CL	A	606	1/1	0.91	0.11	55,55,55,55	0
2	FPP	A	602	24/24	0.94	0.14	51,84,108,115	0
3	CL	A	605	1/1	0.94	0.10	55,55,55,55	0
2	FPP	B	602	24/24	0.95	0.14	46,81,99,100	0
3	CL	B	606	1/1	0.96	0.09	62,62,62,62	0
3	CL	B	604	1/1	0.97	0.05	54,54,54,54	0
2	FPP	B	601	24/24	0.97	0.07	39,50,60,63	0
2	FPP	A	601	24/24	0.97	0.09	40,54,65,67	0
3	CL	A	603	1/1	0.98	0.07	53,53,53,53	0
3	CL	B	605	1/1	0.98	0.04	48,48,48,48	0
3	CL	A	604	1/1	0.98	0.04	37,37,37,37	0
3	CL	B	603	1/1	0.98	0.05	29,29,29,29	0

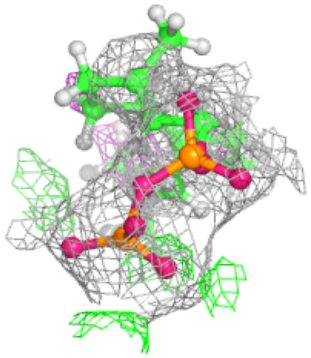
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FPP A 602:

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

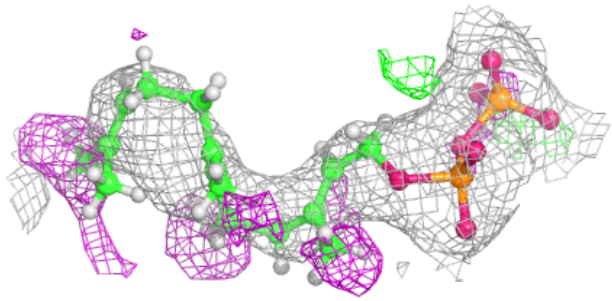


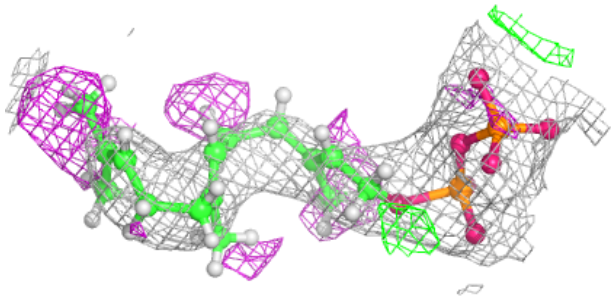


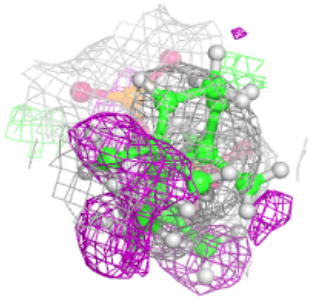


Electron density around FPP B 602:

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

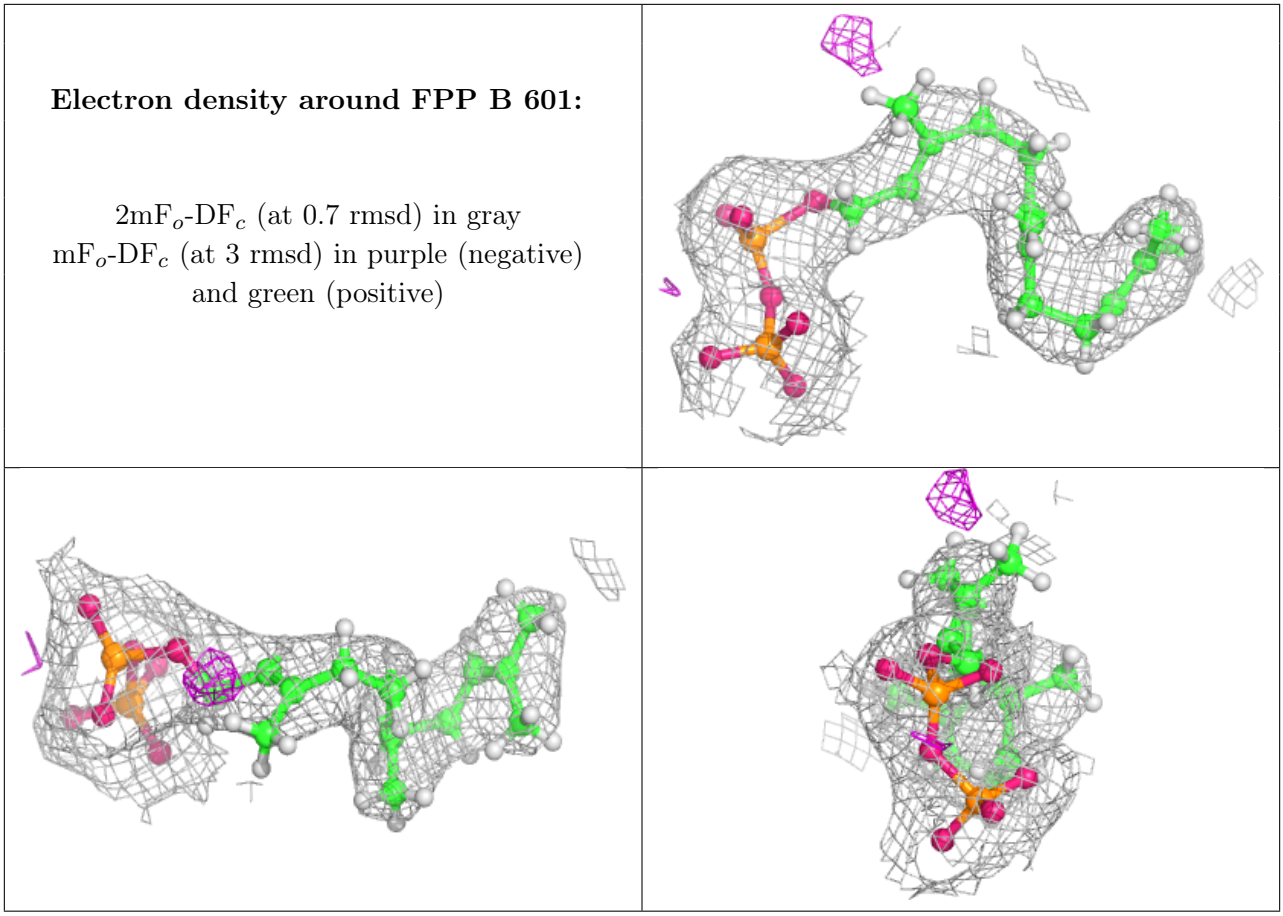






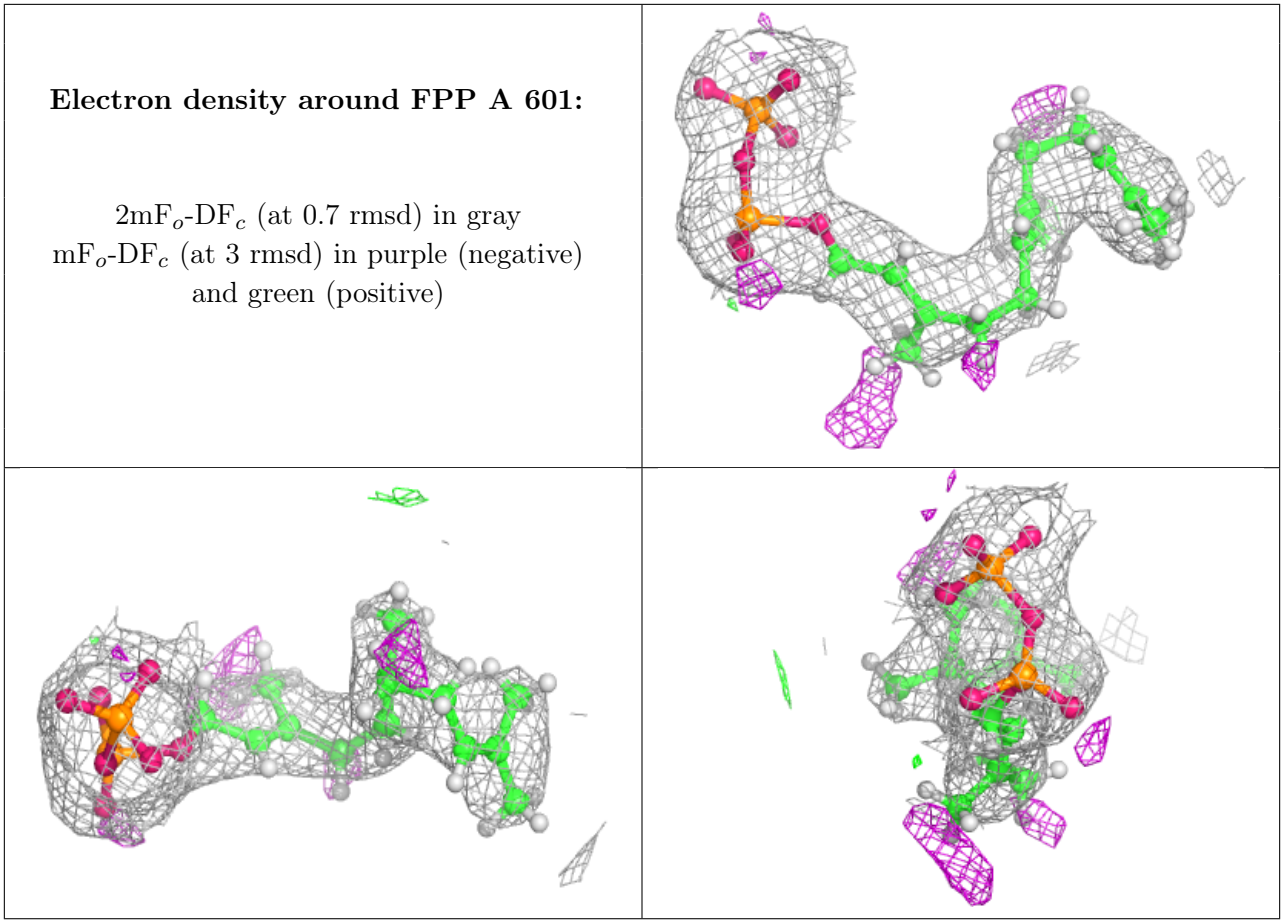
Electron density around FPP B 601:

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



Electron density around FPP A 601:

$2mF_o$-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.