



Full wwPDB EM Validation Report ⓘ

Jul 16, 2025 – 01:15 AM JST

PDB ID : 8WD9 / pdb_00008wd9
EMDB ID : EMD-37458
Title : Cryo-EM structure of Mycobacterium tuberculosis DppABCD in apo form
Authors : Hu, T.; Zhang, B.; Rao, Z.
Deposited on : 2023-09-14
Resolution : 3.35 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

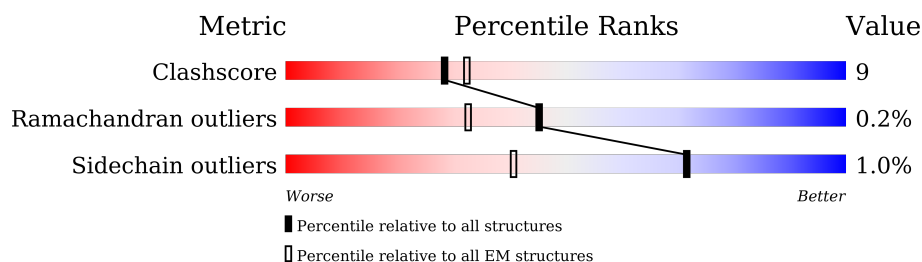
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.35 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	B	308	83% 16% .
2	C	287	83% 14% ..
3	D	548	78% 16% 6%
4	A	517	76% 23% .

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 12355 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Probable dipeptide-transport integral membrane protein ABC transporter DppB.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	B	308	Total	C	N	O	S	0	0
			2302	1517	392	388	5		

- Molecule 2 is a protein called Probable dipeptide-transport integral membrane protein ABC transporter DppC.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	C	284	Total	C	N	O	S	0	0
			2133	1398	369	360	6		

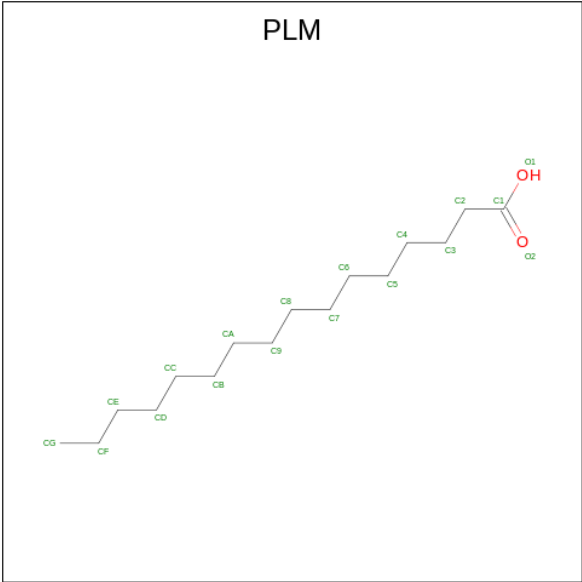
- Molecule 3 is a protein called Probable dipeptide-transport ATP-binding protein ABC transporter DppD.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	D	517	Total	C	N	O	S	0	0
			3913	2441	740	724	8		

- Molecule 4 is a protein called Probable periplasmic dipeptide-binding lipoprotein DppA.

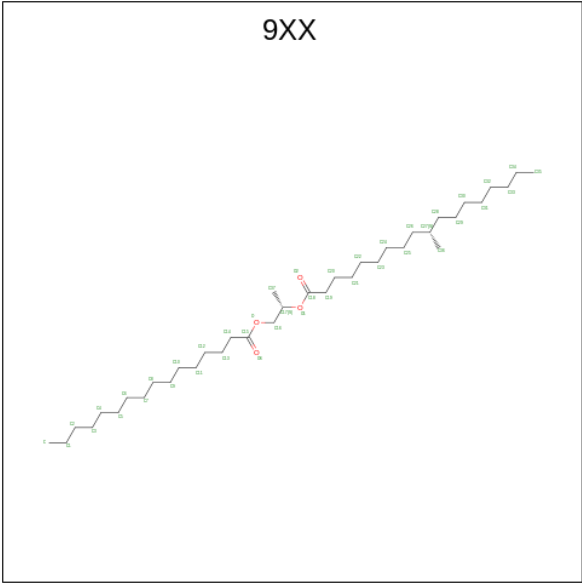
Mol	Chain	Residues	Atoms					AltConf	Trace
4	A	517	Total	C	N	O	S	0	0
			3964	2505	699	753	7		

- Molecule 5 is PALMITIC ACID (CCD ID: PLM) (formula: $C_{16}H_{32}O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			AltConf
5	A	1	Total	C	O	0
			11	10	1	

- Molecule 6 is (2S)-1-(hexadecanoyloxy)propan-2-yl (10S)-10-methyloctadecanoate (CCD ID: 9XX) (formula: C₃₈H₇₄O₄) (labeled as "Ligand of Interest" by depositor).

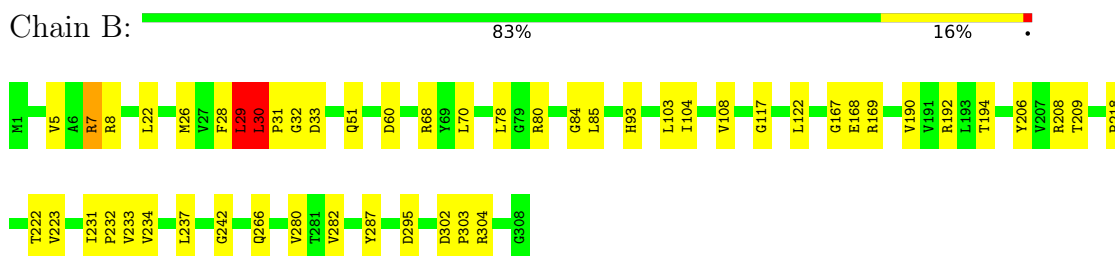


Mol	Chain	Residues	Atoms			AltConf
6	A	1	Total	C	O	0
			32	28	4	

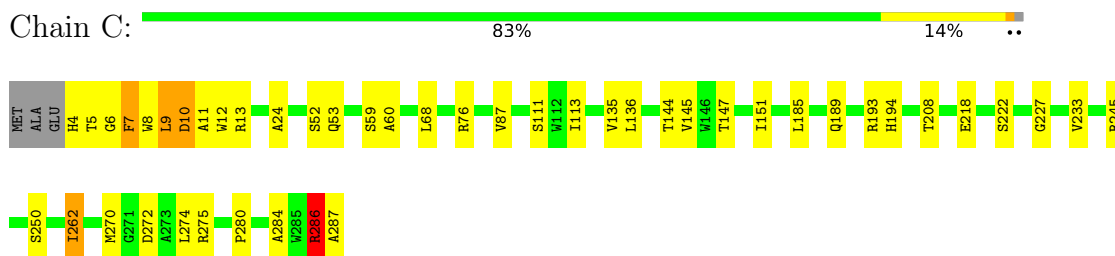
3 Residue-property plots

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. 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. 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.

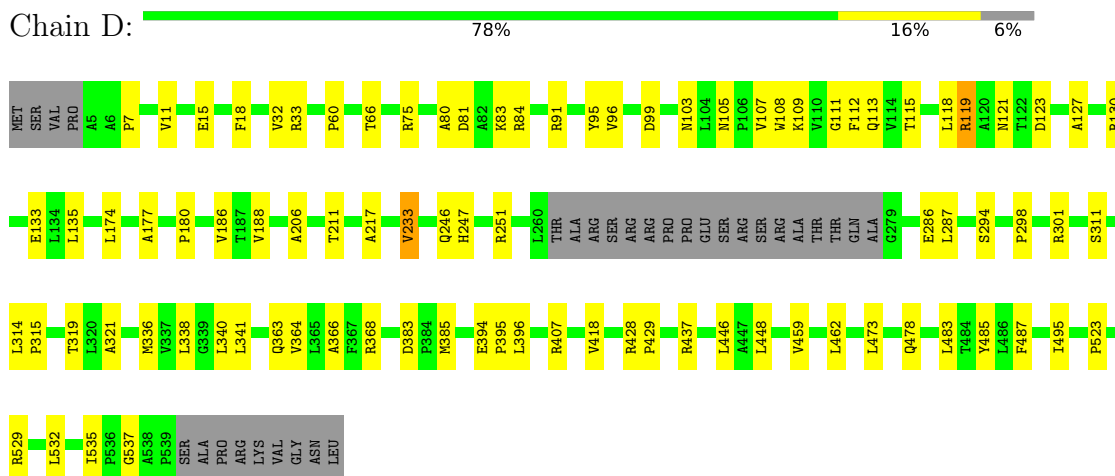
- Molecule 1: Probable dipeptide-transport integral membrane protein ABC transporter DppB



- Molecule 2: Probable dipeptide-transport integral membrane protein ABC transporter DppC



- Molecule 3: Probable dipeptide-transport ATP-binding protein ABC transporter DppD



- Molecule 4: Probable periplasmic dipeptide-binding lipoprotein DppA

S463	A345	G200	C25
N464	L348	Y209	G28
F473	R367	D213	V29
A480	R368	A219	L30
T485	R369	W220	V34
L486	L371	E221	R35
S489	V372	H222	L36
Q497	A373	N223	V37
L509	A375	V224	N38
W510	D376	N242	G39
V516	W381	F249	G40
G517	G382	D269	E41
W518	G383	L260	R42
S519	R384	L261	P43
S520	L387	L268	N44
Y535	A388	D269	P45
A541	Y389	T270	T51
	D392	I271	N52
	A393	Y279	D53
	V399	L283	S54
	A403	A287	N55
	T406	T288	G56
	K407	S289	R62
	N408	L294	M68
	W409	P301	D71
	L410	L302	E79
	D413	R303	V80
	A416	H306	L84
	T427	F307	L122
	Q428	E310	N125
	T429	E311	Q129
	T430	G312	D141
	N431	R313	V142
	R432	L314	P146
	A433	R315	K149
	T434	R316	S160
	D435	L319	R151
	S436	R325	R158
	A437	F333	F165
	R443	T336	L178
	S448	T374	S183
	F457		
	T458		

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	71030	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	1400	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PLM, 9XX

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	B	0.31	0/2350	0.54	1/3214 (0.0%)
2	C	0.48	2/2187 (0.1%)	0.64	4/2994 (0.1%)
3	D	0.26	0/3969	0.51	0/5390
4	A	0.34	2/4074 (0.0%)	0.57	6/5571 (0.1%)
All	All	0.34	4/12580 (0.0%)	0.56	11/17169 (0.1%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	42	PRO	C-O	-7.01	1.16	1.24
2	C	280	PRO	C-O	-6.50	1.15	1.24
2	C	262	ILE	C-O	-6.28	1.17	1.23
4	A	39	GLY	C-O	-5.21	1.20	1.24

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	286	ARG	N-CA-C	-9.60	90.35	110.80
4	A	79	GLU	CB-CA-C	-7.79	100.44	111.65
2	C	284	ALA	CB-CA-C	7.44	124.17	110.11
4	A	40	GLY	N-CA-C	-6.86	101.25	111.19
4	A	42	PRO	N-CA-C	-6.80	102.41	110.70
1	B	29	LEU	CB-CA-C	6.74	121.56	110.17
4	A	41	GLU	N-CA-C	-5.65	99.72	109.15
4	A	35	VAL	CA-C-N	-5.52	115.58	123.20
4	A	35	VAL	C-N-CA	-5.52	115.58	123.20
2	C	286	ARG	CB-CA-C	-5.06	100.34	110.42
2	C	284	ALA	N-CA-C	-5.00	105.50	112.45

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	B	2302	0	2443	42	0
2	C	2133	0	2202	40	0
3	D	3913	0	4026	63	0
4	A	3964	0	3806	97	0
5	A	11	0	16	0	0
6	A	32	0	0	0	0
All	All	12355	0	12493	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 9.

All (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:B:30:LEU:HB3	1:B:31:PRO:CD	1.70	1.21
4:A:41:GLU:OE2	4:A:42:PRO:CD	2.03	1.05
2:C:5:THR:HB	2:C:9:LEU:HD22	1.09	1.05
4:A:35:VAL:C	4:A:36:LEU:HD23	1.82	1.05
4:A:40:GLY:HA3	4:A:55:ASN:HD21	1.20	1.02
1:B:30:LEU:HB3	1:B:31:PRO:HD3	1.35	1.02
2:C:5:THR:CB	2:C:9:LEU:HD22	1.93	0.99
4:A:41:GLU:OE2	4:A:42:PRO:HD2	1.63	0.98
1:B:30:LEU:CB	1:B:31:PRO:CD	2.41	0.96
2:C:5:THR:HB	2:C:9:LEU:CD2	1.98	0.93
4:A:221:GLU:HG2	4:A:224:VAL:CG2	2.00	0.92
4:A:221:GLU:HG2	4:A:224:VAL:HB	1.56	0.86
1:B:30:LEU:CB	1:B:31:PRO:HD2	2.06	0.85
4:A:221:GLU:CG	4:A:224:VAL:HB	2.08	0.83
4:A:221:GLU:HG2	4:A:224:VAL:CB	2.10	0.81
3:D:321:ALA:HB1	3:D:495:ILE:HD11	1.62	0.80
2:C:286:ARG:HH21	2:C:286:ARG:HG3	1.45	0.79
4:A:36:LEU:HD23	4:A:36:LEU:N	1.99	0.77

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:221:GLU:HB3	4:A:224:VAL:HB	1.67	0.76
4:A:221:GLU:CB	4:A:224:VAL:HB	2.17	0.75
3:D:75:ARG:HD2	3:D:84:ARG:HH12	1.54	0.73
2:C:68:LEU:HD21	2:C:245:ARG:HG3	1.72	0.71
4:A:381:TRP:NE1	4:A:383:GLY:O	2.21	0.71
1:B:208:ARG:NH1	3:D:95:TYR:OH	2.24	0.71
4:A:51:THR:O	4:A:129:GLN:NE2	2.21	0.70
2:C:286:ARG:HH21	2:C:286:ARG:CG	2.04	0.69
2:C:9:LEU:C	2:C:9:LEU:HD23	2.17	0.68
4:A:34:VAL:O	4:A:35:VAL:HG23	1.94	0.68
4:A:370:ARG:NH2	4:A:374:GLN:OE1	2.28	0.66
4:A:268:LEU:HD23	4:A:271:ILE:HD13	1.76	0.66
2:C:6:GLY:HA2	3:D:428:ARG:HH21	1.60	0.65
4:A:319:LEU:HG	4:A:406:ILE:HD11	1.77	0.65
3:D:233:VAL:HG13	3:D:247:HIS:ND1	2.12	0.64
1:B:31:PRO:O	1:B:32:GLY:C	2.39	0.64
3:D:478:GLN:HB2	3:D:485:TYR:HE1	1.61	0.64
4:A:34:VAL:HG23	4:A:35:VAL:H	1.64	0.63
1:B:60:ASP:OD2	1:B:68:ARG:NH1	2.31	0.63
2:C:5:THR:CB	2:C:9:LEU:CD2	2.67	0.63
4:A:407:LYS:HD2	4:A:408:ASN:HB3	1.80	0.63
4:A:221:GLU:HG2	4:A:224:VAL:HG21	1.79	0.62
3:D:478:GLN:HB2	3:D:485:TYR:CE1	2.35	0.61
4:A:40:GLY:CA	4:A:55:ASN:HD21	2.05	0.61
1:B:117:GLY:HA3	1:B:194:THR:HG23	1.83	0.61
3:D:286:GLU:H	3:D:311:SER:HB3	1.65	0.61
4:A:392:ASP:OD1	4:A:393:ALA:N	2.34	0.60
2:C:194:HIS:ND1	3:D:383:ASP:OD2	2.33	0.60
4:A:122:LEU:HB3	4:A:125:ASN:HD22	1.66	0.59
4:A:310:GLU:OE2	4:A:313:ARG:NH2	2.35	0.59
4:A:42:PRO:HB3	4:A:56:GLY:HA3	1.85	0.59
4:A:434:ILE:HG13	4:A:435:ASP:H	1.68	0.59
3:D:211:THR:HG21	3:D:217:ALA:HB2	1.84	0.59
4:A:485:THR:HG22	4:A:486:LEU:H	1.68	0.59
3:D:338:LEU:HD12	3:D:340:LEU:HG	1.85	0.58
4:A:413:ASP:OD1	4:A:413:ASP:N	2.37	0.58
1:B:30:LEU:HB2	1:B:31:PRO:HD2	1.84	0.58
2:C:6:GLY:O	2:C:8:TRP:N	2.37	0.58
3:D:363:GLN:HA	3:D:366:ALA:HB3	1.85	0.58
1:B:8:ARG:O	1:B:8:ARG:NH1	2.33	0.57
3:D:121:ASN:ND2	3:D:123:ASP:H	2.02	0.57

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:35:VAL:C	4:A:36:LEU:CD2	2.69	0.57
4:A:141:ASP:OD1	4:A:151:ARG:NH1	2.38	0.57
1:B:26:MET:HB3	2:C:136:LEU:HD13	1.85	0.56
2:C:6:GLY:C	2:C:8:TRP:H	2.13	0.56
3:D:174:LEU:HD12	3:D:206:ALA:HB3	1.88	0.56
1:B:51:GLN:HE22	1:B:80:ARG:HH11	1.53	0.55
4:A:279:TYR:O	4:A:283:LEU:HB2	2.06	0.55
3:D:7:PRO:HB3	3:D:33:ARG:HD2	1.89	0.55
3:D:459:VAL:HG23	3:D:462:LEU:HD13	1.89	0.55
1:B:167:GLY:O	1:B:168:GLU:HG3	2.06	0.54
4:A:68:MET:HE3	4:A:84:ILE:HD12	1.90	0.54
2:C:87:VAL:HG11	2:C:218:GLU:HG3	1.90	0.54
4:A:41:GLU:OE2	4:A:42:PRO:N	2.40	0.54
4:A:209:TYR:OH	4:A:242:ASN:OD1	2.24	0.53
4:A:367:ARG:HA	4:A:370:ARG:HG2	1.91	0.53
4:A:384:ARG:NH1	4:A:413:ASP:O	2.41	0.53
4:A:387:ILE:HA	4:A:437:ALA:O	2.09	0.53
3:D:96:VAL:HB	3:D:177:ALA:HA	1.89	0.53
4:A:294:ILE:HG12	4:A:443:ARG:HG3	1.92	0.52
4:A:306:HIS:ND1	4:A:382:SER:HB3	2.25	0.52
1:B:28:PHE:O	1:B:29:LEU:HD23	2.09	0.52
1:B:206:TYR:HA	1:B:209:THR:HG22	1.90	0.52
3:D:396:LEU:HD23	3:D:407:ARG:HG2	1.92	0.52
4:A:427:THR:HA	4:A:430:THR:OG1	2.10	0.52
3:D:336:MET:HG2	3:D:341:LEU:HB3	1.93	0.51
1:B:192:ARG:NH1	2:C:272:ASP:OD2	2.42	0.51
4:A:45:PRO:HB3	4:A:200:GLY:HA3	1.91	0.51
1:B:218:PRO:O	1:B:222:THR:HG22	2.10	0.51
3:D:418:VAL:HG12	3:D:473:LEU:HD21	1.92	0.51
4:A:345:ALA:HB3	4:A:348:LEU:HD23	1.92	0.51
2:C:24:ALA:HB1	2:C:270:MET:HB2	1.93	0.51
4:A:519:SER:OG	4:A:520:SER:N	2.42	0.51
2:C:6:GLY:C	2:C:8:TRP:N	2.67	0.51
4:A:457:PHE:HB2	4:A:473:PHE:HE2	1.75	0.50
2:C:275:ARG:HH12	2:C:286:ARG:HB3	1.76	0.50
4:A:268:LEU:HG	4:A:270:THR:O	2.12	0.50
2:C:208:THR:HG21	2:C:274:LEU:HD12	1.94	0.50
1:B:302:ASP:OD1	1:B:304:ARG:NH1	2.44	0.50
3:D:121:ASN:ND2	3:D:127:ALA:HB2	2.27	0.50
3:D:294:SER:OG	3:D:301:ARG:NH2	2.45	0.50
2:C:147:THR:O	2:C:151:ILE:HG12	2.12	0.49

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:40:GLY:O	4:A:249:PHE:CD1	2.65	0.49
1:B:22:LEU:O	1:B:26:MET:HG3	2.12	0.49
3:D:18:PHE:HE1	3:D:60:PRO:HG2	1.77	0.49
3:D:319:THR:HG23	3:D:485:TYR:HB2	1.93	0.49
4:A:122:LEU:HD12	4:A:142:VAL:HB	1.93	0.49
4:A:40:GLY:HA3	4:A:55:ASN:ND2	2.06	0.49
4:A:62:ARG:HH21	4:A:535:TYR:HD2	1.61	0.49
1:B:231:ILE:O	1:B:234:VAL:HG22	2.12	0.48
4:A:260:LEU:HD22	4:A:268:LEU:HB2	1.96	0.48
4:A:71:ASP:N	4:A:71:ASP:OD1	2.46	0.48
4:A:311:GLU:O	4:A:315:ARG:HG2	2.13	0.48
1:B:303:PRO:HD2	3:D:107:VAL:HG12	1.96	0.48
2:C:6:GLY:HA2	3:D:428:ARG:NH2	2.28	0.48
3:D:115:THR:OG1	3:D:127:ALA:HB1	2.13	0.48
1:B:231:ILE:HB	1:B:232:PRO:HD3	1.95	0.48
1:B:222:THR:HG23	1:B:223:VAL:H	1.79	0.48
2:C:222:SER:HA	2:C:227:GLY:HA3	1.96	0.48
4:A:146:PRO:HA	4:A:149:LYS:HG3	1.96	0.48
2:C:52:SER:OG	2:C:53:GLN:N	2.47	0.47
3:D:448:LEU:HD23	3:D:448:LEU:H	1.77	0.47
3:D:121:ASN:HD22	3:D:123:ASP:H	1.60	0.47
3:D:75:ARG:NH2	3:D:84:ARG:HH22	2.13	0.47
4:A:41:GLU:OE2	4:A:42:PRO:HD3	2.07	0.47
4:A:122:LEU:HB3	4:A:125:ASN:ND2	2.29	0.47
3:D:105:ASN:O	3:D:113:GLN:NE2	2.45	0.47
3:D:535:ILE:O	3:D:537:GLY:N	2.43	0.46
2:C:245:ARG:O	2:C:250:SER:OG	2.34	0.46
3:D:11:VAL:HG12	3:D:11:VAL:O	2.16	0.46
3:D:99:ASP:O	3:D:103:ASN:ND2	2.43	0.46
1:B:222:THR:HG23	1:B:223:VAL:N	2.30	0.46
4:A:158:ARG:O	4:A:165:PHE:HB2	2.15	0.46
1:B:80:ARG:HH21	1:B:84:GLY:HA2	1.80	0.46
2:C:7:PHE:O	2:C:7:PHE:CG	2.68	0.46
3:D:81:ASP:O	3:D:83:LYS:N	2.41	0.46
4:A:288:THR:HG22	4:A:518:TRP:HZ3	1.81	0.46
2:C:12:TRP:CD1	2:C:12:TRP:O	2.69	0.46
3:D:109:LYS:O	3:D:111:GLY:N	2.49	0.46
4:A:301:PRO:HB2	4:A:433:ALA:HB1	1.98	0.46
4:A:310:GLU:CD	4:A:313:ARG:HH21	2.24	0.46
2:C:6:GLY:O	2:C:9:LEU:N	2.35	0.45
3:D:130:ARG:NH2	3:D:133:GLU:OE1	2.49	0.45

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:190:VAL:O	1:B:194:THR:HG22	2.16	0.45
4:A:430:THR:C	4:A:432:ARG:H	2.23	0.45
4:A:509:LEU:HB3	4:A:510:TRP:CE3	2.51	0.45
3:D:246:GLN:O	3:D:251:ARG:NH1	2.48	0.45
3:D:314:LEU:HD12	3:D:315:PRO:HD2	1.99	0.45
3:D:321:ALA:HA	3:D:487:PHE:O	2.17	0.45
4:A:221:GLU:O	4:A:222:HIS:HB2	2.17	0.45
1:B:8:ARG:NE	1:B:295:ASP:OD2	2.42	0.45
2:C:59:SER:OG	2:C:60:ALA:N	2.48	0.45
2:C:185:LEU:HD23	2:C:185:LEU:HA	1.83	0.45
1:B:233:VAL:O	1:B:237:LEU:HG	2.18	0.45
1:B:85:LEU:HD13	4:A:30:LEU:HD23	1.99	0.44
2:C:4:HIS:CG	2:C:4:HIS:O	2.69	0.44
4:A:53:ASP:OD1	4:A:53:ASP:N	2.48	0.44
1:B:167:GLY:C	1:B:169:ARG:H	2.24	0.44
3:D:429:PRO:O	3:D:437:ARG:NH1	2.49	0.44
3:D:459:VAL:O	3:D:459:VAL:HG13	2.17	0.44
4:A:428:GLN:HG2	4:A:434:ILE:HD11	1.99	0.44
4:A:79:GLU:HG2	4:A:80:VAL:HG23	2.00	0.44
4:A:213:ASP:H	4:A:219:ALA:HB2	1.82	0.44
4:A:458:THR:H	4:A:464:ASN:HD22	1.66	0.44
3:D:532:LEU:O	3:D:535:ILE:HG12	2.18	0.44
4:A:40:GLY:O	4:A:249:PHE:CE1	2.71	0.43
1:B:104:ILE:O	1:B:108:VAL:HG12	2.19	0.43
3:D:383:ASP:O	3:D:385:MET:N	2.51	0.43
1:B:78:LEU:HD21	1:B:282:VAL:HG21	2.01	0.43
2:C:76:ARG:NH2	2:C:233:VAL:HG12	2.33	0.43
3:D:91:ARG:CG	3:D:119:ARG:HH12	2.31	0.43
3:D:105:ASN:ND2	3:D:108:TRP:HD1	2.16	0.43
3:D:298:PRO:HA	3:D:301:ARG:CZ	2.48	0.43
3:D:177:ALA:HB1	3:D:180:PRO:HG3	2.01	0.43
2:C:144:THR:OG1	2:C:145:VAL:N	2.51	0.43
4:A:222:HIS:O	4:A:223:ASN:HB2	2.18	0.43
4:A:301:PRO:O	4:A:303:ARG:N	2.51	0.43
4:A:43:PRO:HD2	4:A:53:ASP:OD2	2.18	0.43
4:A:302:LEU:HD11	4:A:316:ARG:NH1	2.33	0.43
2:C:9:LEU:CD2	2:C:9:LEU:C	2.85	0.43
3:D:118:LEU:HD23	3:D:118:LEU:H	1.84	0.43
3:D:394:GLU:HB3	3:D:395:PRO:HD3	2.01	0.43
4:A:458:THR:H	4:A:464:ASN:ND2	2.16	0.43
4:A:389:TYR:HE1	4:A:416:ALA:HB1	1.84	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:480:ALA:O	4:A:489:SER:OG	2.28	0.42
2:C:189:GLN:OE1	2:C:193:ARG:NH2	2.48	0.42
2:C:286:ARG:O	2:C:287:ALA:HB3	2.20	0.42
1:B:93:HIS:CD2	4:A:28:GLY:HA3	2.54	0.42
4:A:325:ARG:HD3	4:A:509:LEU:O	2.19	0.42
2:C:11:ALA:C	2:C:13:ARG:N	2.78	0.42
3:D:33:ARG:HD2	3:D:33:ARG:HA	1.84	0.42
4:A:302:LEU:HD11	4:A:316:ARG:CZ	2.50	0.42
3:D:7:PRO:HB2	3:D:32:VAL:O	2.20	0.42
1:B:280:VAL:HG11	2:C:135:VAL:HG21	2.02	0.41
3:D:135:LEU:HD23	3:D:135:LEU:HA	1.86	0.41
3:D:523:PRO:HB2	3:D:529:ARG:HG3	2.02	0.41
4:A:315:ARG:HH22	4:A:376:ASP:HB3	1.84	0.41
3:D:186:VAL:C	3:D:188:VAL:H	2.27	0.41
4:A:178:LEU:HD23	4:A:448:SER:HB3	2.02	0.41
4:A:314:LEU:HD23	4:A:314:LEU:HA	1.89	0.41
1:B:122:LEU:HD23	1:B:122:LEU:HA	1.89	0.41
2:C:111:SER:C	2:C:113:ILE:H	2.28	0.41
3:D:364:VAL:O	3:D:368:ARG:HG2	2.20	0.41
4:A:261:LEU:HD23	4:A:261:LEU:HA	1.91	0.41
4:A:333:PHE:O	4:A:336:THR:HG22	2.20	0.41
1:B:5:VAL:C	1:B:7:ARG:H	2.29	0.41
1:B:117:GLY:HA3	1:B:194:THR:CG2	2.50	0.41
3:D:483:LEU:HD23	3:D:483:LEU:HA	1.84	0.41
3:D:15:GLU:O	3:D:66:THR:OG1	2.36	0.41
4:A:457:PHE:HB2	4:A:473:PHE:CE2	2.55	0.41
1:B:31:PRO:O	1:B:33:ASP:N	2.52	0.41
3:D:287:LEU:HD12	3:D:287:LEU:HA	1.90	0.41
3:D:112:PHE:O	3:D:115:THR:HG22	2.20	0.41
4:A:283:LEU:HD13	4:A:287:ALA:HB2	2.03	0.41
4:A:288:THR:OG1	4:A:289:SER:N	2.54	0.41
4:A:307:PHE:O	4:A:312:GLY:HA3	2.19	0.41
1:B:7:ARG:O	1:B:7:ARG:HG3	2.21	0.41
1:B:70:LEU:HD23	1:B:70:LEU:HA	1.87	0.41
3:D:32:VAL:HG11	3:D:206:ALA:HB1	2.03	0.41
4:A:368:ALA:HB1	4:A:410:LEU:HD11	2.02	0.41
4:A:389:TYR:CE1	4:A:399:VAL:HG11	2.56	0.41
1:B:242:GLY:HA3	1:B:287:TYR:CE1	2.55	0.41
2:C:286:ARG:HB3	2:C:287:ALA:H	1.63	0.41
4:A:403:ALA:O	4:A:406:ILE:HG22	2.20	0.41
1:B:103:LEU:HD23	1:B:103:LEU:HA	1.83	0.40

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:D:446:LEU:HD23	3:D:446:LEU:O	2.21	0.40
4:A:43:PRO:O	4:A:44:ASN:CG	2.64	0.40
4:A:315:ARG:HD2	4:A:372:TRP:CZ3	2.56	0.40
4:A:463:SER:O	4:A:463:SER:OG	2.35	0.40
2:C:9:LEU:HD23	2:C:10:ASP:N	2.36	0.40
3:D:80:ALA:O	3:D:81:ASP:C	2.64	0.40
4:A:183:SER:O	4:A:183:SER:OG	2.36	0.40
4:A:269:ASP:HA	4:A:516:VAL:HG22	2.03	0.40
4:A:344:THR:HG23	4:A:497:GLN:NE2	2.36	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 PDB entries followed by that with respect to all EM entries.

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	B	306/308 (99%)	282 (92%)	23 (8%)	1 (0%)	37	65
2	C	282/287 (98%)	257 (91%)	24 (8%)	1 (0%)	30	59
3	D	513/548 (94%)	433 (84%)	79 (15%)	1 (0%)	44	71
4	A	515/517 (100%)	441 (86%)	73 (14%)	1 (0%)	44	71
All	All	1616/1660 (97%)	1413 (87%)	199 (12%)	4 (0%)	45	71

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	30	LEU
2	C	7	PHE
3	D	119	ARG
4	A	35	VAL

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 PDB entries followed by that with respect to all EM entries.

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	B	237/237 (100%)	233 (98%)	4 (2%)	56	74
2	C	212/214 (99%)	208 (98%)	4 (2%)	52	72
3	D	409/435 (94%)	408 (100%)	1 (0%)	92	96
4	A	413/413 (100%)	409 (99%)	4 (1%)	73	84
All	All	1271/1299 (98%)	1258 (99%)	13 (1%)	71	84

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	7	ARG
1	B	29	LEU
1	B	30	LEU
1	B	266	GLN
2	C	9	LEU
2	C	10	ASP
2	C	262	ILE
2	C	286	ARG
3	D	233	VAL
4	A	36	LEU
4	A	37	VAL
4	A	41	GLU
4	A	259	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	51	GLN
1	B	57	HIS
1	B	93	HIS
1	B	152	GLN
1	B	228	ASN
1	B	266	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	C	138	GLN
3	D	36	GLN
3	D	121	ASN
4	A	55	ASN
4	A	125	ASN
4	A	223	ASN
4	A	252	ASN
4	A	264	ASN
4	A	330	GLN
4	A	464	ASN
4	A	490	HIS
4	A	497	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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](#)

2 ligands 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	PLM	A	601	4	10,10,17	0.40	0	9,9,17	0.46	0
6	9XX	A	602	4	31,31,41	1.11	4 (12%)	34,34,44	1.38	3 (8%)

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	PLM	A	601	4	-	3/7/8/15	-
6	9XX	A	602	4	-	13/33/33/43	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	602	9XX	O1-C17	-3.92	1.40	1.47
6	A	602	9XX	O-C15	2.50	1.40	1.33
6	A	602	9XX	O1-C18	2.12	1.40	1.34
6	A	602	9XX	O-C16	-2.04	1.40	1.45

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	602	9XX	O1-C18-C19	4.08	120.29	111.50
6	A	602	9XX	O-C15-C14	2.96	121.20	111.91
6	A	602	9XX	C17-O1-C18	-2.82	114.25	117.88

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	602	9XX	C14-C15-O-C16
6	A	602	9XX	O6-C15-O-C16
5	A	601	PLM	C4-C5-C6-C7
6	A	602	9XX	C19-C20-C21-C22
6	A	602	9XX	C21-C22-C23-C24
6	A	602	9XX	C11-C10-C9-C8
5	A	601	PLM	C7-C8-C9-CA
6	A	602	9XX	C7-C8-C9-C10
6	A	602	9XX	C5-C6-C7-C8
6	A	602	9XX	C18-C19-C20-C21
6	A	602	9XX	C26-C27-C28-C29
6	A	602	9XX	C36-C27-C28-C29
5	A	601	PLM	C6-C7-C8-C9
6	A	602	9XX	C24-C25-C26-C27
6	A	602	9XX	C13-C14-C15-O

Continued on next page...

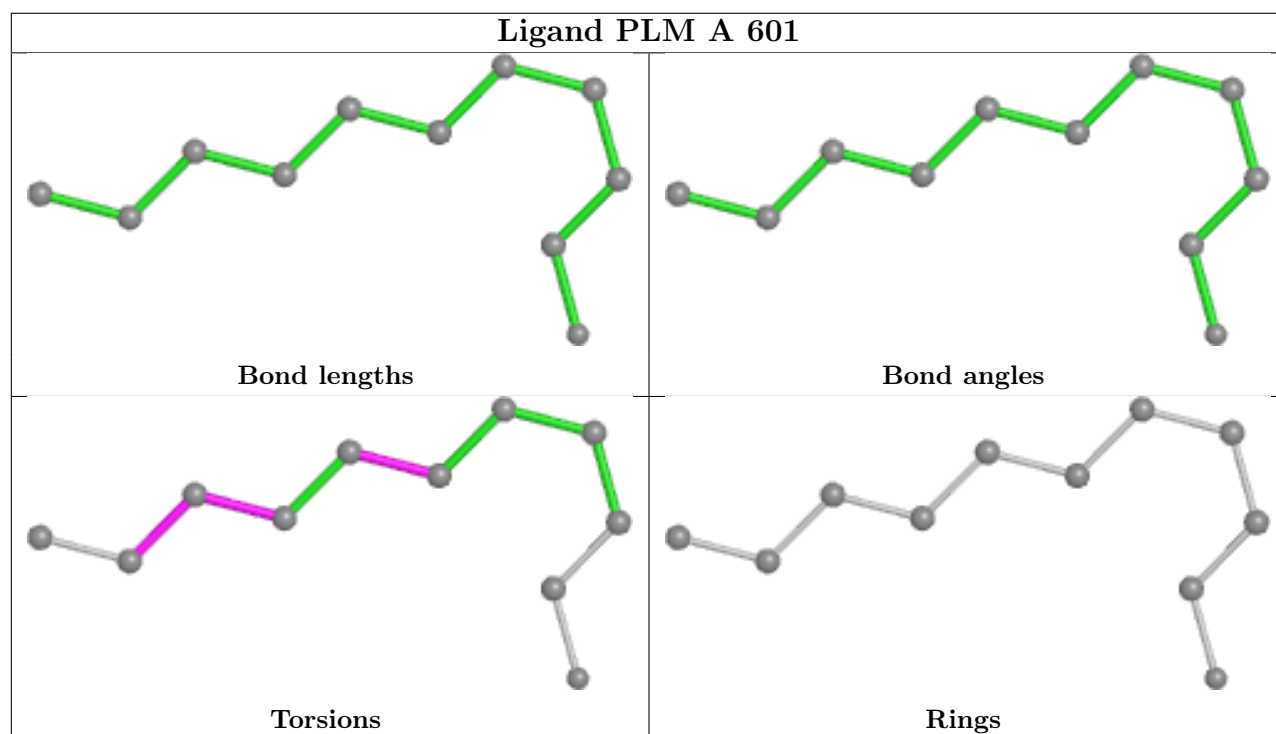
Continued from previous page...

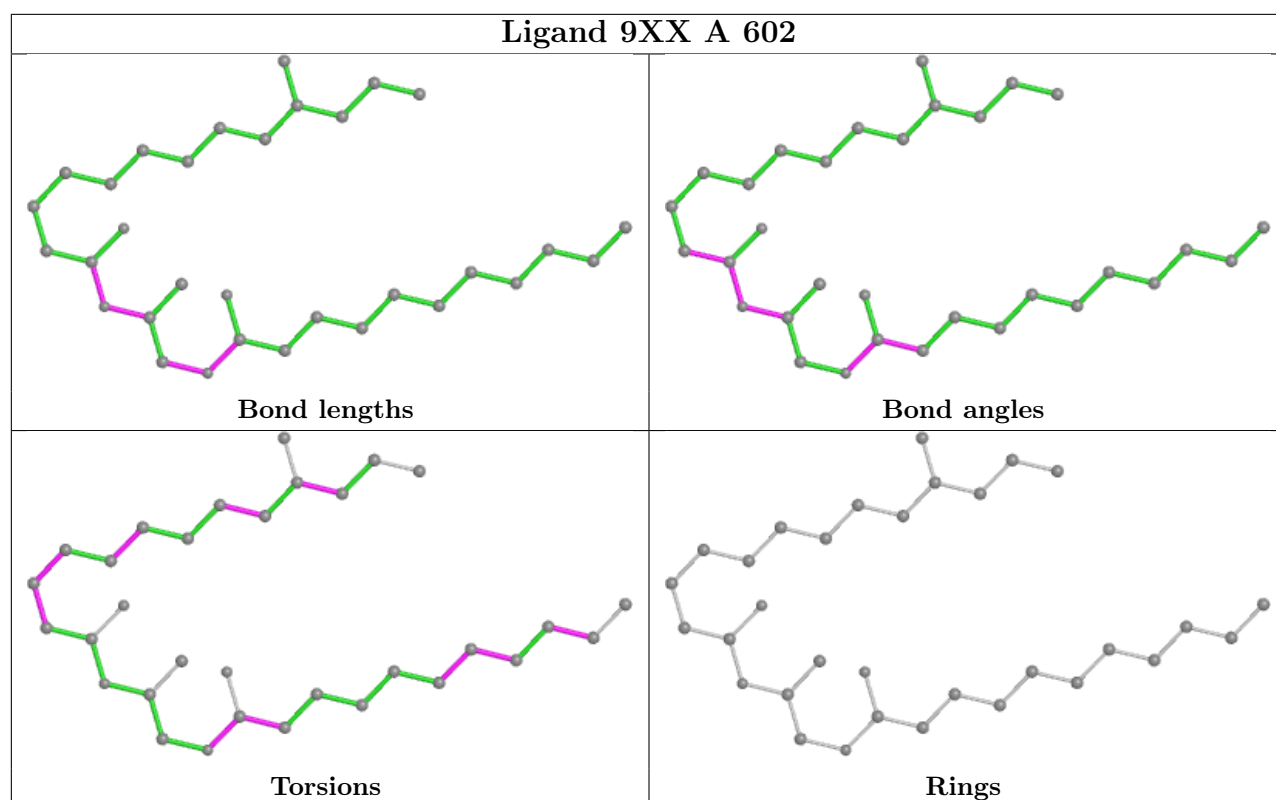
Mol	Chain	Res	Type	Atoms
6	A	602	9XX	C13-C14-C15-O6

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 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.