



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 06:11 AM UTC

PDB ID : 1UPA / pdb_00001upa
Title : Carboxyethylarginine synthase from *Streptomyces clavuligerus* (SeMet structure)
Authors : Caines, M.E.C.; Elkins, J.M.; Hewitson, K.S.; Schofield, C.J.
Deposited on : 2003-09-29
Resolution : 2.35 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 Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

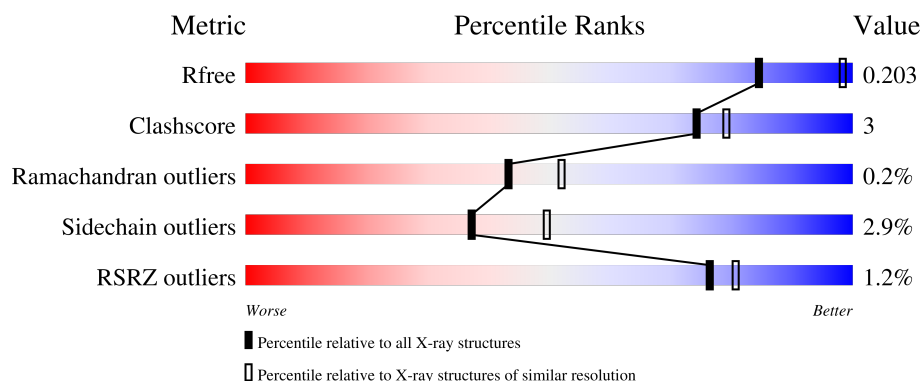
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.35 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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

Mol	Chain	Length	Quality of chain
1	A	573	% 89% 8% .
1	B	573	% 90% 6% ..
1	C	573	% 87% 8% . 5%
1	D	573	% 90% 7% .

2 Entry composition [i](#)

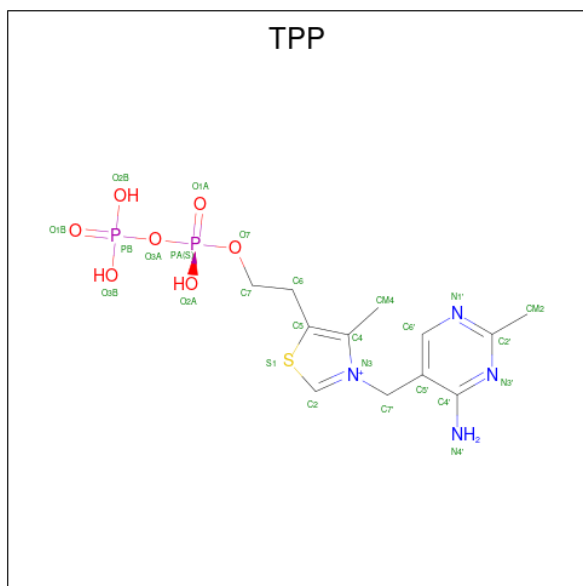
There are 5 unique types of molecules in this entry. The entry contains 17687 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 CARBOXYETHYLARGININE SYNTHASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	558	Total	C	N	O	S	Se	0	0	0
			4168	2646	722	787	3	10			
1	B	559	Total	C	N	O	S	Se	0	0	0
			4182	2654	724	791	3	10			
1	C	547	Total	C	N	O	S	Se	0	0	0
			4078	2592	709	764	3	10			
1	D	558	Total	C	N	O	S	Se	0	0	0
			4164	2644	721	786	3	10			

- Molecule 2 is THIAMINE DIPHOSPHATE (CCD ID: TPP) (formula: C₁₂H₁₉N₄O₇P₂S).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		
2	B	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		

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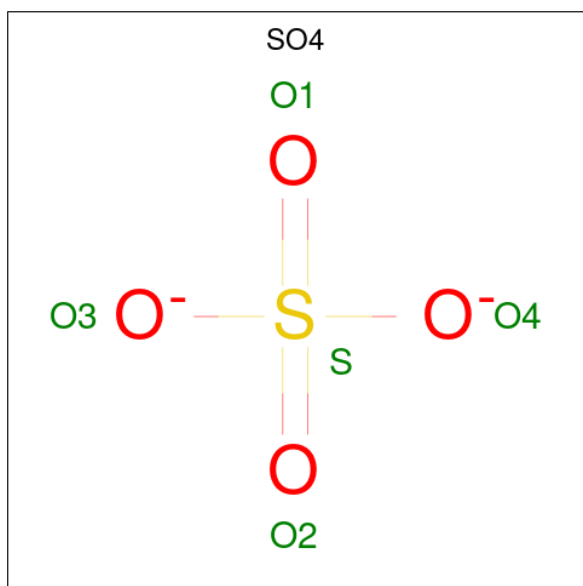
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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	C	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		
2	D	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	1		
3	B	1	Total	Mg	0	0
			1	1		
3	C	1	Total	Mg	0	0
			1	1		
3	D	1	Total	Mg	0	0
			1	1		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

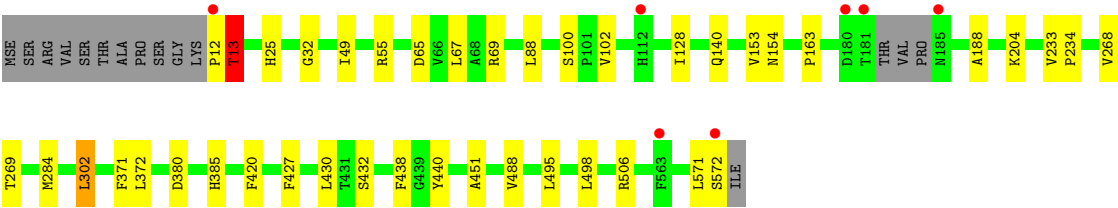
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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	250	Total	O	0	0
			250	250		
5	B	281	Total	O	0	0
			281	281		
5	C	197	Total	O	0	0
			197	197		
5	D	219	Total	O	0	0
			219	219		



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	117.69Å 127.27Å 196.77Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.14 – 2.35 35.14 – 2.35	Depositor EDS
% Data completeness (in resolution range)	96.4 (35.14-2.35) 96.5 (35.14-2.35)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.52 (at 2.34Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.157 , 0.198 0.167 , 0.203	Depositor DCC
R_{free} test set	5782 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å ²)	20.5	Xtriage
Anisotropy	0.159	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 28.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	17687	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.10% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, SO4, TPP

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	0.75	1/4252 (0.0%)	0.87	0/5789
1	B	0.74	1/4267 (0.0%)	0.89	3/5809 (0.1%)
1	C	0.73	0/4160	0.87	3/5666 (0.1%)
1	D	0.74	1/4248 (0.0%)	0.87	3/5784 (0.1%)
All	All	0.74	3/16927 (0.0%)	0.88	9/23048 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1
1	D	0	1
All	All	0	2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	284	MSE	SE-CE	5.59	2.12	1.95
1	B	284	MSE	SE-CE	5.11	2.10	1.95
1	D	284	MSE	SE-CE	5.02	2.10	1.95

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	32	GLY	N-CA-C	6.61	119.48	110.69
1	B	478	ARG	NE-CZ-NH2	6.14	124.73	119.20
1	B	478	ARG	NE-CZ-NH1	-6.05	115.45	121.50
1	C	441	GLY	N-CA-C	5.89	119.33	112.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	13	THR	N-CA-CB	-5.30	103.10	111.05
1	B	13	THR	N-CA-CB	-5.13	103.35	111.05
1	C	32	GLY	N-CA-C	5.11	117.49	110.69
1	C	13	THR	N-CA-CB	-5.10	103.39	111.05
1	D	284	MSE	CG-SE-CE	-5.01	87.90	98.92

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	12	PRO	Peptide
1	D	12	PRO	Peptide

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	4168	0	4109	25	0
1	B	4182	0	4125	22	0
1	C	4078	0	4025	25	0
1	D	4164	0	4103	22	0
2	A	26	0	16	3	0
2	B	26	0	16	6	0
2	C	26	0	16	3	0
2	D	26	0	16	4	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	10	0	0	0	0
4	B	10	0	0	0	0
4	C	10	0	0	0	0
4	D	10	0	0	0	0
5	A	250	0	0	2	0
5	B	281	0	0	2	0
5	C	197	0	0	5	0
5	D	219	0	0	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	17687	0	16426	102	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 3.

All (102) 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)
2:D:600:TPP:C2	2:D:600:TPP:HN42	1.59	1.14
2:A:600:TPP:HN42	2:A:600:TPP:C2	1.61	1.12
2:D:600:TPP:HN42	2:D:600:TPP:H2	1.09	1.11
2:B:600:TPP:HN42	2:B:600:TPP:C2	1.65	1.08
2:B:600:TPP:HN42	2:B:600:TPP:H2	1.20	1.03
2:D:600:TPP:C2	2:D:600:TPP:N4'	2.24	1.00
2:C:600:TPP:HN42	2:C:600:TPP:C2	1.77	0.98
2:A:600:TPP:HN42	2:A:600:TPP:H2	1.26	0.98
2:C:600:TPP:HN42	2:C:600:TPP:H2	1.31	0.94
2:A:600:TPP:C2	2:A:600:TPP:N4'	2.33	0.91
2:B:600:TPP:C2	2:B:600:TPP:N4'	2.34	0.90
1:D:25:HIS:CD2	1:D:153:VAL:HG21	2.13	0.83
1:A:205:ALA:HA	1:A:208:GLN:HE21	1.43	0.81
2:D:600:TPP:H2	2:D:600:TPP:N4'	1.92	0.81
2:C:600:TPP:C2	2:C:600:TPP:N4'	2.44	0.80
1:B:120:HIS:CD2	1:B:121:GLN:HG3	2.22	0.74
1:D:13:THR:HG21	5:D:2008:HOH:O	1.86	0.74
1:D:25:HIS:CE1	1:D:188:ALA:HB1	2.27	0.70
1:C:13:THR:HG21	5:C:2008:HOH:O	1.91	0.69
1:C:271:TYR:CE1	1:C:415:HIS:CE1	2.81	0.68
1:C:268:VAL:HG22	1:C:302:LEU:HD22	1.78	0.65
1:B:13:THR:HG21	5:B:2020:HOH:O	1.96	0.65
1:A:504:HIS:CD2	1:B:42:LEU:HG	2.32	0.64
1:D:140:GLN:NE2	5:D:2062:HOH:O	2.32	0.62
1:D:25:HIS:ND1	1:D:188:ALA:HB1	2.16	0.60
1:A:268:VAL:HB	1:A:302:LEU:HD22	1.85	0.58
1:C:268:VAL:HG12	1:C:284:MSE:HE3	1.85	0.58
1:D:371:PHE:HD2	1:D:385:HIS:CD2	2.21	0.57
1:C:252:ILE:HD11	1:C:433:ALA:HB3	1.87	0.57
1:B:322:VAL:HG11	1:D:154:ASN:HB3	1.85	0.57
1:D:204:LYS:HE3	5:D:2084:HOH:O	2.04	0.57
1:B:372:LEU:HD21	1:B:420:PHE:HB3	1.87	0.57
1:A:70:ILE:HD11	1:A:430:LEU:HD11	1.87	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:272:MSE:HE2	1:C:280:ALA:HB1	1.87	0.56
1:A:252:ILE:HG12	5:A:2132:HOH:O	2.06	0.55
1:C:372:LEU:HD21	1:C:420:PHE:HB3	1.87	0.55
1:D:268:VAL:HB	1:D:302:LEU:HD22	1.90	0.54
2:B:600:TPP:H2	2:B:600:TPP:N4'	2.04	0.53
1:A:372:LEU:HD21	1:A:420:PHE:HB3	1.90	0.53
1:A:205:ALA:HA	1:A:208:GLN:NE2	2.21	0.53
1:A:380:ASP:HB3	1:A:560:ASN:OD1	2.08	0.52
1:C:132:MSE:HE2	1:D:128:ILE:HD13	1.92	0.51
1:B:53:LEU:O	1:B:478:ARG:NH1	2.34	0.51
1:B:42:LEU:O	1:B:43:PHE:HB2	2.11	0.50
1:B:25:HIS:CD2	1:B:153:VAL:HG21	2.47	0.50
1:D:372:LEU:HD21	1:D:420:PHE:HB3	1.95	0.49
1:C:268:VAL:HG12	1:C:284:MSE:CE	2.42	0.49
1:B:25:HIS:ND1	1:B:188:ALA:HB1	2.29	0.48
1:B:282:GLN:NE2	5:B:2152:HOH:O	2.44	0.48
1:A:322:VAL:HG11	1:C:154:ASN:HB3	1.94	0.48
1:C:271:TYR:CE1	1:C:415:HIS:NE2	2.82	0.47
1:A:272:MSE:HE2	1:A:280:ALA:HB1	1.97	0.47
1:D:65:ASP:OD2	1:D:100:SER:CB	2.62	0.47
1:B:66:VAL:HG13	1:B:430:LEU:HD21	1.97	0.46
1:B:268:VAL:HB	1:B:302:LEU:HD22	1.97	0.46
1:D:69:ARG:CZ	1:D:69:ARG:HB2	2.46	0.46
1:B:85:MSE:HE3	1:B:85:MSE:HB3	1.87	0.46
1:B:561:TYR:OH	2:B:600:TPP:O1B	2.12	0.46
1:C:473:LEU:HD13	1:C:523:ALA:HA	1.97	0.46
1:B:130:ALA:N	1:B:131:PRO:CD	2.79	0.45
5:C:2159:HOH:O	1:D:55:ARG:HD2	2.16	0.45
1:C:233:VAL:HB	1:C:234:PRO:HD3	1.98	0.45
1:D:371:PHE:CD2	1:D:385:HIS:CD2	3.03	0.45
1:C:42:LEU:O	1:C:43:PHE:HB2	2.17	0.45
1:C:298:TYR:CG	1:C:325:ILE:HD13	2.52	0.45
1:C:130:ALA:N	1:C:131:PRO:CD	2.80	0.44
1:A:277:ASN:HB2	1:A:564:GLN:HE22	1.83	0.44
1:C:85:MSE:HE3	1:C:85:MSE:HB3	1.91	0.44
1:B:25:HIS:CE1	1:B:188:ALA:HB1	2.53	0.43
1:C:430:LEU:HD22	5:C:2157:HOH:O	2.17	0.43
1:C:442:ILE:N	1:C:443:PRO:HD2	2.32	0.43
1:A:532:ARG:NH2	5:A:2226:HOH:O	2.52	0.43
1:D:432:SER:HB2	1:D:440:TYR:CE1	2.54	0.43
1:A:249:THR:HB	1:A:253:ALA:HB3	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:233:VAL:HB	1:A:234:PRO:HD3	2.00	0.42
1:D:67:LEU:HD12	1:D:451:ALA:HB2	2.01	0.42
1:A:57:GLU:OE2	2:B:600:TPP:N1'	2.53	0.42
1:A:433:ALA:O	1:B:120:HIS:CE1	2.73	0.42
1:B:252:ILE:HD12	1:B:431:THR:O	2.20	0.42
1:A:506:ARG:NH1	1:B:44:ASP:OD2	2.52	0.42
1:B:380:ASP:HB2	1:B:560:ASN:OD1	2.20	0.42
1:A:271:TYR:CE1	1:A:415:HIS:NE2	2.88	0.42
1:D:427:PHE:HB3	1:D:430:LEU:HD21	2.02	0.42
1:B:233:VAL:HB	1:B:234:PRO:HD3	2.02	0.42
1:B:474:GLU:OE2	1:B:478:ARG:HD3	2.20	0.42
1:C:271:TYR:CD1	1:C:415:HIS:CE1	3.08	0.42
1:A:16:HIS:CD2	1:A:16:HIS:C	2.98	0.41
1:C:303:ARG:HD3	5:D:2039:HOH:O	2.20	0.41
1:C:197:VAL:CG2	1:C:321:THR:HA	2.51	0.41
1:D:102:VAL:O	1:D:163:PRO:HA	2.20	0.41
1:A:102:VAL:O	1:A:163:PRO:HA	2.19	0.41
1:A:432:SER:HB2	1:A:440:TYR:CE1	2.56	0.41
1:A:286:ALA:HB3	1:A:287:PRO:HD3	2.02	0.41
1:D:233:VAL:HB	1:D:234:PRO:HD3	2.02	0.41
1:C:271:TYR:HE1	1:C:415:HIS:CE1	2.35	0.41
1:C:262:GLU:HG2	5:C:2097:HOH:O	2.21	0.40
1:D:488:VAL:O	1:D:488:VAL:HG23	2.22	0.40
1:C:532:ARG:NH2	5:C:2185:HOH:O	2.54	0.40
1:A:62:VAL:HB	1:A:443:PRO:HB2	2.03	0.40
1:A:85:MSE:HE3	1:A:85:MSE:HB3	1.96	0.40
1:A:473:LEU:HD13	1:A:523:ALA:HA	2.04	0.40
1:D:571:LEU:O	1:D:572:SER:C	2.64	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	554/573 (97%)	539 (97%)	14 (2%)	1 (0%)	43	52
1	B	555/573 (97%)	541 (98%)	13 (2%)	1 (0%)	43	52
1	C	543/573 (95%)	529 (97%)	12 (2%)	2 (0%)	30	34
1	D	554/573 (97%)	538 (97%)	15 (3%)	1 (0%)	43	52
All	All	2206/2292 (96%)	2147 (97%)	54 (2%)	5 (0%)	43	52

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	380	ASP
1	B	380	ASP
1	C	380	ASP
1	C	562	ASP
1	D	380	ASP

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	433/441 (98%)	424 (98%)	9 (2%)	47	61
1	B	436/441 (99%)	420 (96%)	16 (4%)	30	40
1	C	422/441 (96%)	406 (96%)	16 (4%)	29	39
1	D	432/441 (98%)	423 (98%)	9 (2%)	47	61
All	All	1723/1764 (98%)	1673 (97%)	50 (3%)	37	49

All (50) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	179	ILE
1	A	217	LYS
1	A	269	THR
1	A	282	GLN
1	A	302	LEU
1	A	438	PHE

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Mol	Chain	Res	Type
1	A	467	HIS
1	A	495	LEU
1	A	498	LEU
1	B	13	THR
1	B	65	ASP
1	B	88	LEU
1	B	179	ILE
1	B	252	ILE
1	B	269	THR
1	B	302	LEU
1	B	357	GLN
1	B	358	ARG
1	B	380	ASP
1	B	430	LEU
1	B	438	PHE
1	B	495	LEU
1	B	498	LEU
1	B	506	ARG
1	B	564	GLN
1	C	13	THR
1	C	23	ARG
1	C	49	ILE
1	C	65	ASP
1	C	88	LEU
1	C	268	VAL
1	C	269	THR
1	C	284	MSE
1	C	302	LEU
1	C	306	MSE
1	C	371	PHE
1	C	422	ARG
1	C	438	PHE
1	C	467	HIS
1	C	495	LEU
1	C	498	LEU
1	D	13	THR
1	D	49	ILE
1	D	88	LEU
1	D	269	THR
1	D	302	LEU
1	D	438	PHE
1	D	495	LEU

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Mol	Chain	Res	Type
1	D	498	LEU
1	D	506	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	16	HIS
1	A	208	GLN
1	A	218	HIS
1	A	282	GLN
1	A	308	GLN
1	A	385	HIS
1	A	504	HIS
1	A	564	GLN
1	B	16	HIS
1	B	112	HIS
1	B	140	GLN
1	B	282	GLN
1	B	308	GLN
1	B	385	HIS
1	C	16	HIS
1	C	140	GLN
1	C	282	GLN
1	C	385	HIS
1	D	16	HIS
1	D	112	HIS
1	D	308	GLN
1	D	385	HIS

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 oligosaccharides in this entry.

5.6 Ligand geometry

Of 16 ligands modelled in this entry, 4 are monoatomic - leaving 12 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
2	TPP	A	600	3	26,27,27	1.98	9 (34%)	38,40,40	1.96	7 (18%)
4	SO4	C	602	-	4,4,4	0.31	0	6,6,6	0.28	0
2	TPP	C	600	3	26,27,27	1.94	11 (42%)	38,40,40	1.81	8 (21%)
4	SO4	B	603	-	4,4,4	0.28	0	6,6,6	0.14	0
4	SO4	D	603	-	4,4,4	0.25	0	6,6,6	0.26	0
4	SO4	A	603	-	4,4,4	0.31	0	6,6,6	0.32	0
4	SO4	C	603	-	4,4,4	0.25	0	6,6,6	0.26	0
2	TPP	D	600	3	26,27,27	1.96	11 (42%)	38,40,40	1.74	7 (18%)
4	SO4	B	602	-	4,4,4	0.21	0	6,6,6	0.22	0
2	TPP	B	600	3	26,27,27	1.90	11 (42%)	38,40,40	1.72	7 (18%)
4	SO4	D	602	-	4,4,4	0.29	0	6,6,6	0.41	0
4	SO4	A	602	-	4,4,4	0.29	0	6,6,6	0.33	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
2	TPP	C	600	3	-	3/17/17/17	0/2/2/2
2	TPP	D	600	3	-	4/17/17/17	0/2/2/2
2	TPP	B	600	3	-	5/17/17/17	0/2/2/2
2	TPP	A	600	3	-	3/17/17/17	0/2/2/2

All (42) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	600	TPP	C5-S1	-4.90	1.59	1.72
2	C	600	TPP	C5-S1	-4.89	1.60	1.72

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	600	TPP	C5-S1	-4.89	1.60	1.72
2	A	600	TPP	C5-S1	-4.88	1.60	1.72
2	A	600	TPP	C7'-N3	-3.58	1.40	1.48
2	C	600	TPP	C2-S1	-3.01	1.59	1.69
2	D	600	TPP	C2-S1	-3.00	1.59	1.69
2	A	600	TPP	C2-S1	-3.00	1.59	1.69
2	B	600	TPP	C2-S1	-3.00	1.60	1.69
2	D	600	TPP	C7'-N3	-2.95	1.42	1.48
2	C	600	TPP	C2-N3	2.80	1.39	1.32
2	B	600	TPP	C7'-N3	-2.70	1.42	1.48
2	C	600	TPP	C2'-N1'	2.70	1.38	1.34
2	B	600	TPP	C2'-N1'	2.69	1.38	1.34
2	A	600	TPP	C2'-N1'	2.68	1.38	1.34
2	D	600	TPP	C2'-N1'	2.65	1.38	1.34
2	D	600	TPP	C4'-N3'	2.60	1.38	1.35
2	C	600	TPP	C7'-N3	-2.59	1.43	1.48
2	C	600	TPP	C4'-N3'	2.59	1.38	1.35
2	D	600	TPP	C2'-N3'	2.58	1.38	1.34
2	B	600	TPP	C2'-N3'	2.57	1.38	1.34
2	A	600	TPP	C4'-N3'	2.56	1.38	1.35
2	A	600	TPP	C4-N3	-2.56	1.34	1.39
2	B	600	TPP	C4'-N3'	2.56	1.38	1.35
2	A	600	TPP	C2'-N3'	2.55	1.38	1.34
2	C	600	TPP	C2'-N3'	2.55	1.38	1.34
2	A	600	TPP	C6'-N1'	2.48	1.39	1.34
2	B	600	TPP	C4-N3	-2.42	1.34	1.39
2	D	600	TPP	C6'-N1'	2.40	1.39	1.34
2	D	600	TPP	C4-N3	-2.34	1.35	1.39
2	D	600	TPP	C2-N3	2.32	1.38	1.32
2	C	600	TPP	C4-N3	-2.30	1.35	1.39
2	B	600	TPP	C2-N3	2.27	1.37	1.32
2	D	600	TPP	PB-O2B	-2.20	1.46	1.54
2	C	600	TPP	C6'-N1'	2.16	1.38	1.34
2	C	600	TPP	C5-C4	2.16	1.39	1.35
2	B	600	TPP	C6'-N1'	2.14	1.38	1.34
2	A	600	TPP	C5'-C4'	-2.10	1.39	1.42
2	C	600	TPP	C5'-C4'	-2.09	1.39	1.42
2	D	600	TPP	C5'-C4'	-2.08	1.39	1.42
2	B	600	TPP	C5'-C4'	-2.07	1.39	1.42
2	B	600	TPP	PB-O2B	-2.00	1.47	1.54

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	600	TPP	C5'-C7'-N3	-6.20	99.62	112.97
2	A	600	TPP	C5'-C7'-N3	-5.98	100.07	112.97
2	A	600	TPP	CM2-C2'-N1'	5.82	123.39	117.20
2	B	600	TPP	C5'-C7'-N3	-5.66	100.77	112.97
2	C	600	TPP	C5'-C7'-N3	-5.58	100.94	112.97
2	A	600	TPP	N1'-C2'-N3'	-4.15	118.63	125.53
2	B	600	TPP	CM2-C2'-N1'	4.02	121.48	117.20
2	C	600	TPP	CM2-C2'-N1'	4.00	121.46	117.20
2	D	600	TPP	CM2-C2'-N1'	3.71	121.15	117.20
2	C	600	TPP	N1'-C2'-N3'	-3.68	119.40	125.53
2	B	600	TPP	N1'-C2'-N3'	-3.65	119.45	125.53
2	D	600	TPP	N1'-C2'-N3'	-3.25	120.13	125.53
2	A	600	TPP	C4-C5-S1	3.22	115.58	110.56
2	C	600	TPP	C6'-N1'-C2'	3.11	121.18	116.07
2	A	600	TPP	C6'-N1'-C2'	2.94	120.90	116.07
2	C	600	TPP	C4-C5-S1	2.86	115.02	110.56
2	B	600	TPP	C4-C5-S1	2.74	114.84	110.56
2	B	600	TPP	C6'-N1'-C2'	2.67	120.47	116.07
2	A	600	TPP	C5-C4-N3	-2.67	106.82	111.67
2	B	600	TPP	C6-C5-S1	-2.65	114.71	120.90
2	D	600	TPP	C4-C5-S1	2.61	114.63	110.56
2	C	600	TPP	C6-C5-S1	-2.59	114.83	120.90
2	D	600	TPP	C6'-N1'-C2'	2.38	119.98	116.07
2	A	600	TPP	CM4-C4-N3	2.29	125.85	120.57
2	D	600	TPP	CM4-C4-N3	2.21	125.67	120.57
2	C	600	TPP	C5'-C6'-N1'	-2.20	120.26	123.83
2	C	600	TPP	C2-N3-C4	-2.05	111.28	114.06
2	D	600	TPP	C6-C5-S1	-2.02	116.18	120.90
2	B	600	TPP	CM4-C4-N3	2.00	125.18	120.57

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	600	TPP	PB-O3A-PA-O7
2	A	600	TPP	C4'-C5'-C7'-N3
2	B	600	TPP	C4'-C5'-C7'-N3
2	C	600	TPP	C4'-C5'-C7'-N3
2	D	600	TPP	C4'-C5'-C7'-N3
2	A	600	TPP	PA-O3A-PB-O1B
2	A	600	TPP	C6'-C5'-C7'-N3
2	D	600	TPP	PB-O3A-PA-O7
2	B	600	TPP	C6'-C5'-C7'-N3

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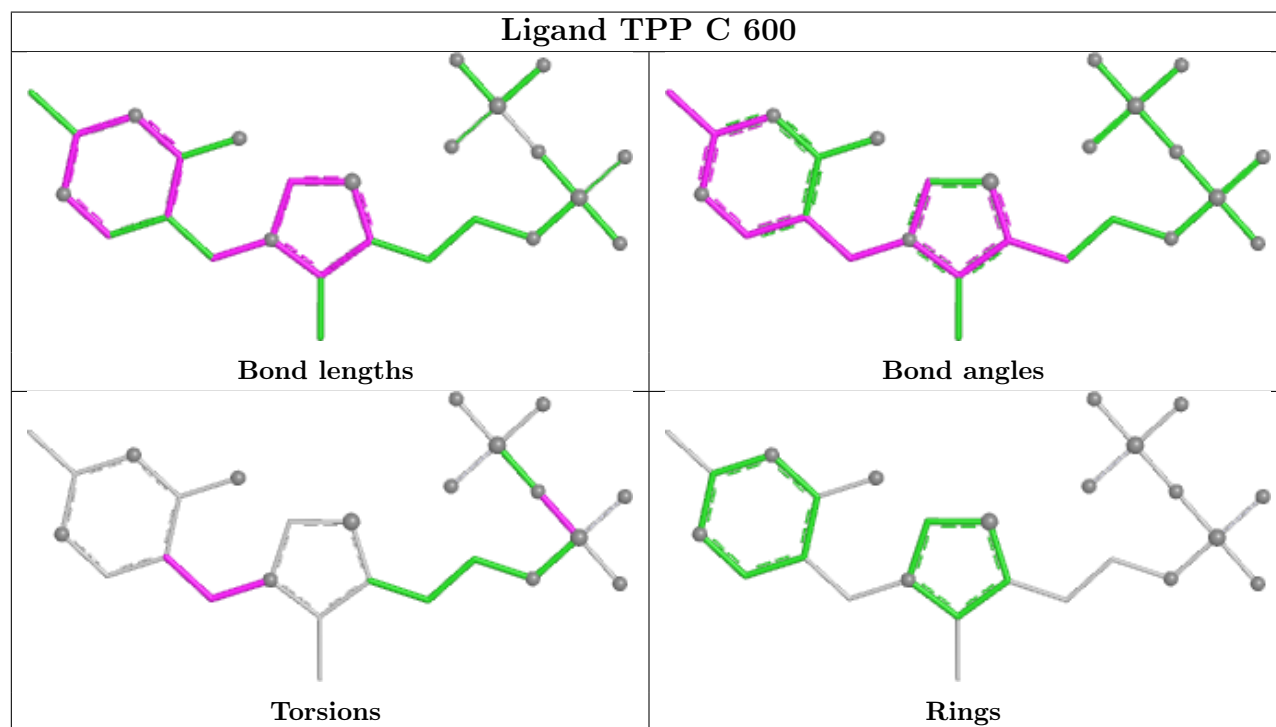
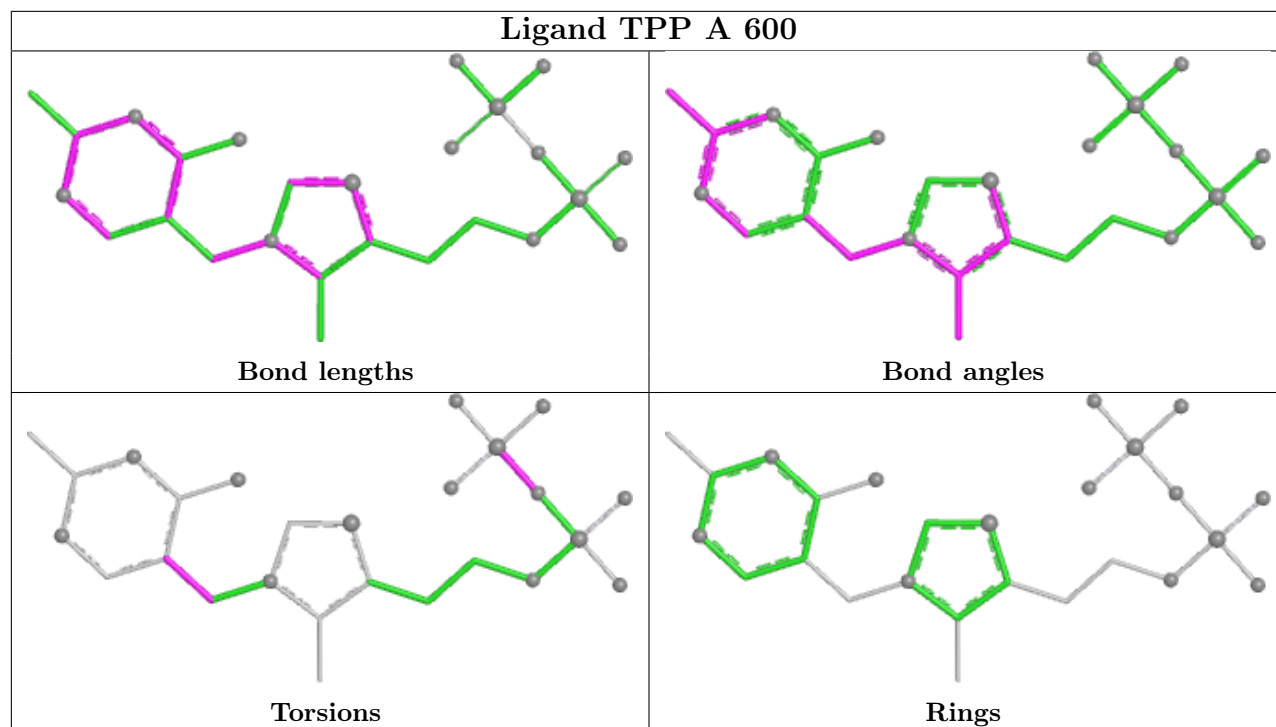
Mol	Chain	Res	Type	Atoms
2	B	600	TPP	PB-O3A-PA-O7
2	D	600	TPP	C6'-C5'-C7'-N3
2	B	600	TPP	PA-O3A-PB-O1B
2	B	600	TPP	C5'-C7'-N3-C2
2	C	600	TPP	C5'-C7'-N3-C2
2	D	600	TPP	C5'-C7'-N3-C2

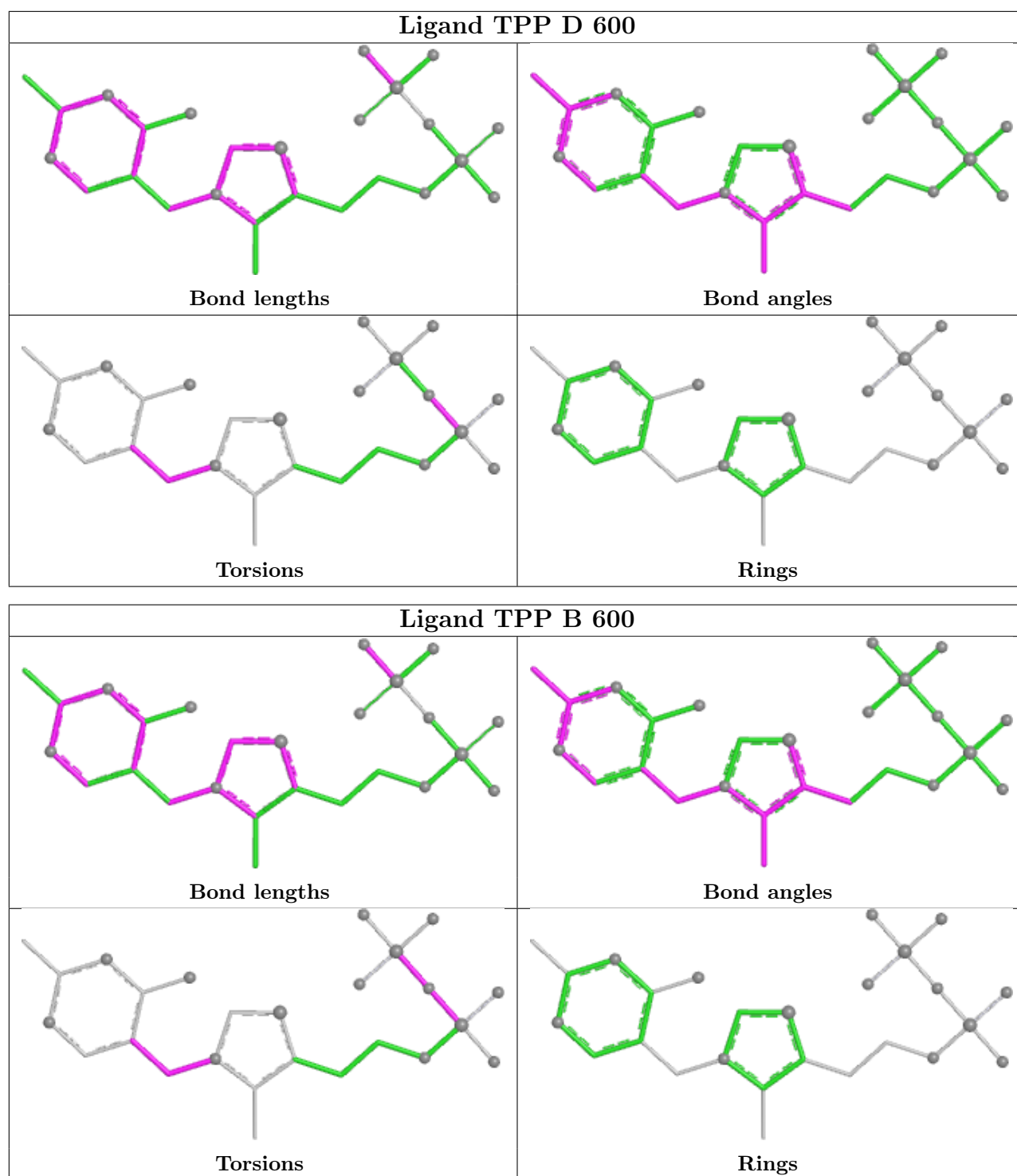
There are no ring outliers.

4 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	600	TPP	3	0
2	C	600	TPP	3	0
2	D	600	TPP	4	0
2	B	600	TPP	6	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers ⓘ

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	548/573 (95%)	-0.36	5 (0%) 81 84	12, 20, 33, 47	0
1	B	549/573 (95%)	-0.36	7 (1%) 75 79	12, 20, 34, 48	0
1	C	537/573 (93%)	-0.32	8 (1%) 72 77	13, 20, 32, 45	0
1	D	548/573 (95%)	-0.30	7 (1%) 75 79	12, 20, 34, 49	0
All	All	2182/2292 (95%)	-0.34	27 (1%) 76 81	12, 20, 34, 49	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	562	ASP	4.4
1	B	181	THR	4.3
1	C	180	ASP	4.3
1	C	563	PHE	4.2
1	A	185	ASN	4.1
1	D	572	SER	4.0
1	A	181	THR	3.9
1	D	181	THR	3.7
1	B	184	PRO	3.6
1	C	380	ASP	3.4
1	D	185	ASN	3.4
1	C	379	GLU	3.3
1	B	562	ASP	3.3
1	D	180	ASP	2.9
1	B	380	ASP	2.9
1	B	12	PRO	2.7
1	C	271	TYR	2.7
1	A	380	ASP	2.6
1	B	565	PRO	2.4
1	D	12	PRO	2.3
1	A	562	ASP	2.2

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Mol	Chain	Res	Type	RSRZ
1	C	505	HIS	2.2
1	B	252	ILE	2.2
1	D	112	HIS	2.2
1	A	381	GLY	2.1
1	C	189	ASN	2.1
1	D	563	PHE	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](#)

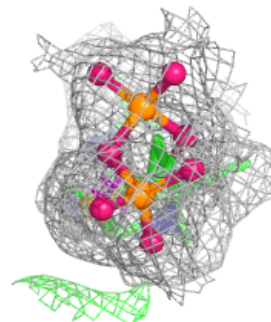
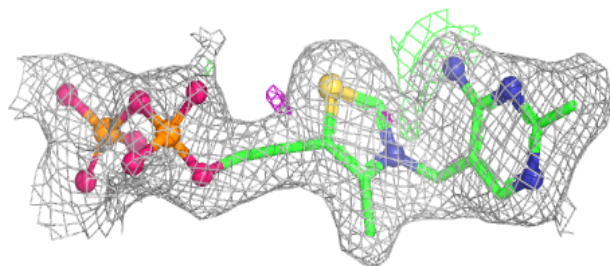
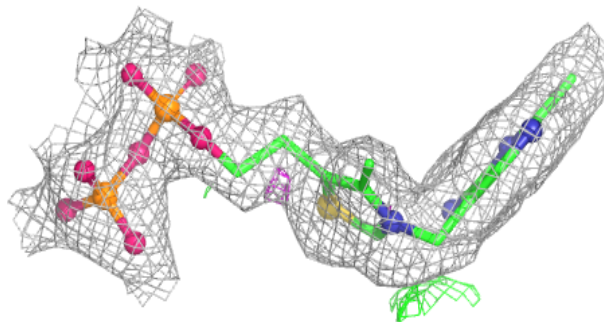
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	SO4	C	603	5/5	0.51	0.25	87,88,89,89	0
4	SO4	A	603	5/5	0.85	0.17	66,67,67,68	0
4	SO4	B	603	5/5	0.87	0.20	67,67,68,68	0
4	SO4	D	603	5/5	0.90	0.17	55,55,55,56	0
4	SO4	C	602	5/5	0.94	0.10	52,52,53,53	0
2	TPP	B	600	26/26	0.98	0.06	15,19,25,27	0
2	TPP	C	600	26/26	0.98	0.06	15,19,26,31	0
2	TPP	D	600	26/26	0.98	0.06	15,18,24,27	0
4	SO4	D	602	5/5	0.98	0.06	24,26,26,26	0
2	TPP	A	600	26/26	0.98	0.06	14,17,24,26	0
4	SO4	A	602	5/5	0.99	0.05	25,25,27,27	0
3	MG	A	601	1/1	0.99	0.05	6,6,6,6	0
4	SO4	B	602	5/5	0.99	0.04	29,31,32,33	0
3	MG	C	601	1/1	0.99	0.01	9,9,9,9	0
3	MG	B	601	1/1	1.00	0.03	7,7,7,7	0
3	MG	D	601	1/1	1.00	0.05	7,7,7,7	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.

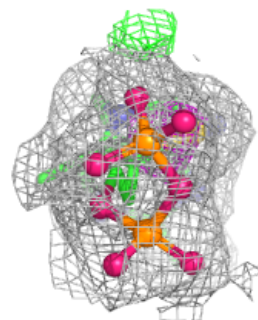
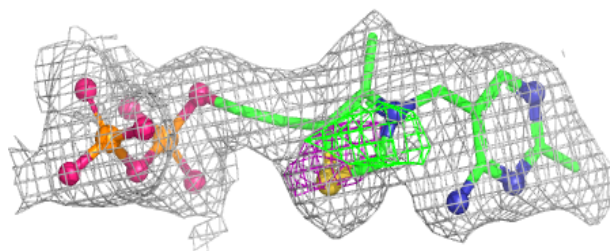
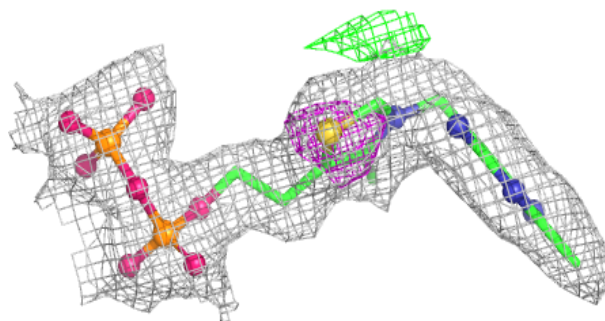
Electron density around TPP B 600:

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

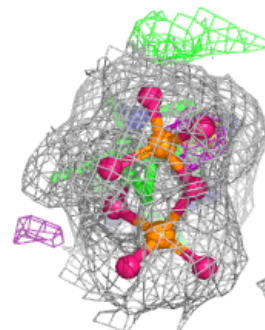
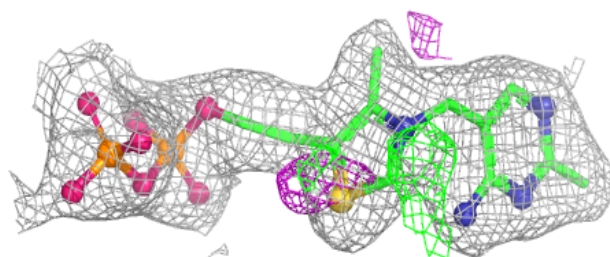
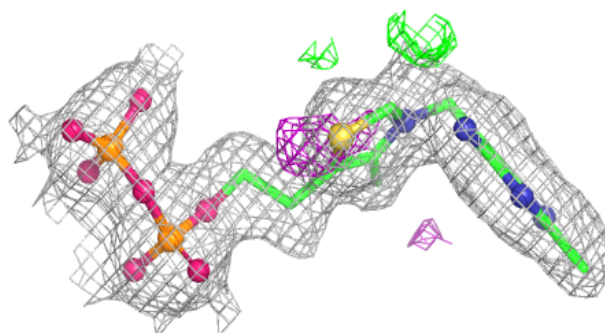


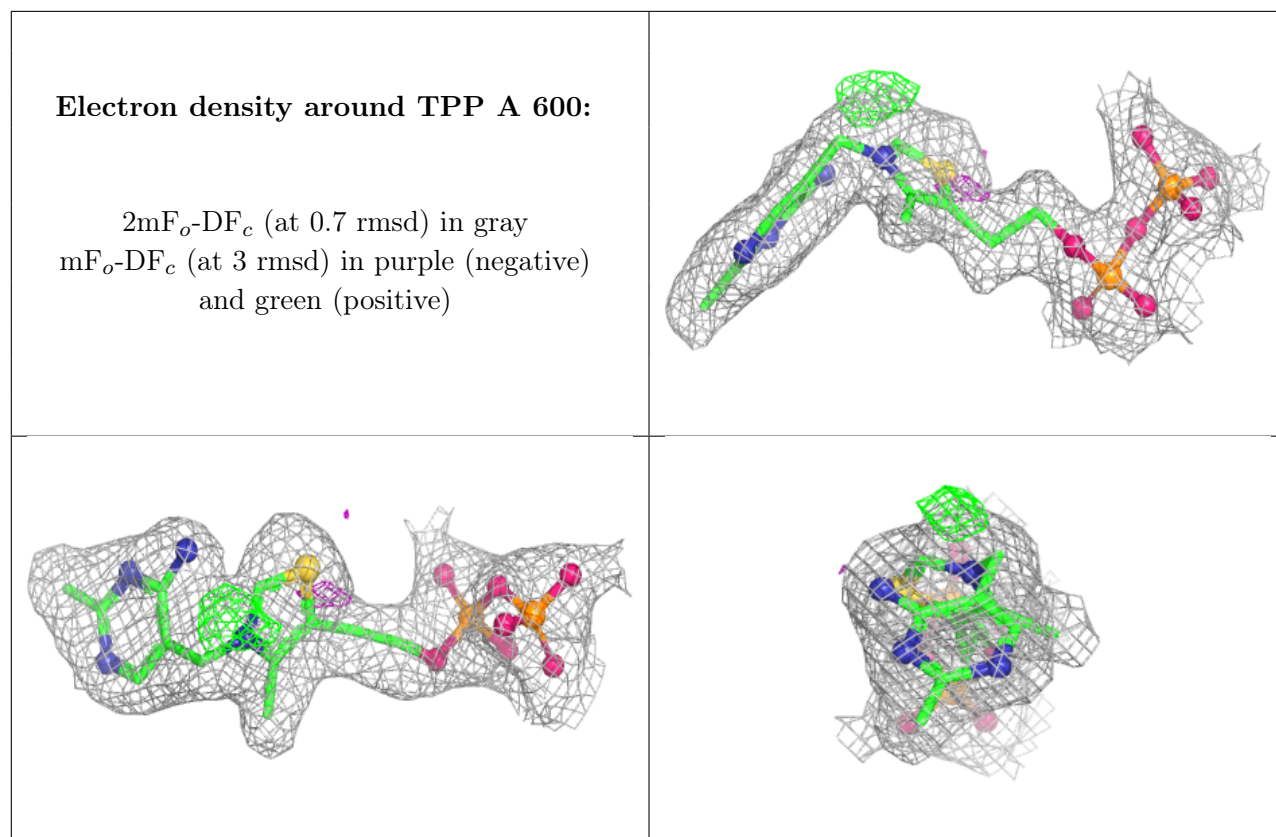
Electron density around TPP C 600:

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

**Electron density around TPP D 600:**

$2mF_o-DF_c$ (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.