



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:23 AM UTC

PDB ID : 1ITZ / pdb_00001itz
Title : Maize Transketolase in complex with TPP
Authors : Gerhardt, S.; Echt, S.; Bader, G.; Freigang, J.; Busch, M.; Bacher, A.; Huber, R.; Fischer, M.
Deposited on : 2002-02-15
Resolution : 2.30 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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

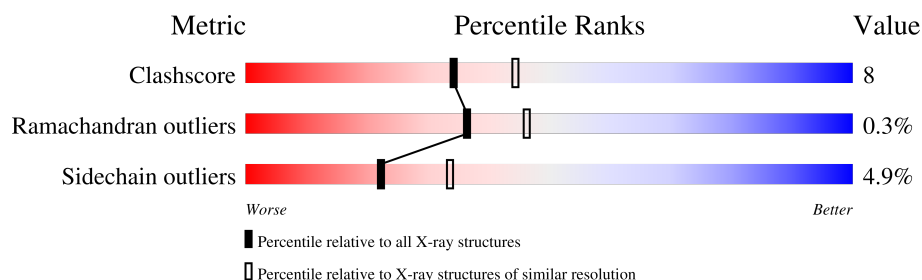
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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))
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	675	80% 16% ..
1	B	675	81% 15% ..
1	C	675	78% 17% ...

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 15767 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.

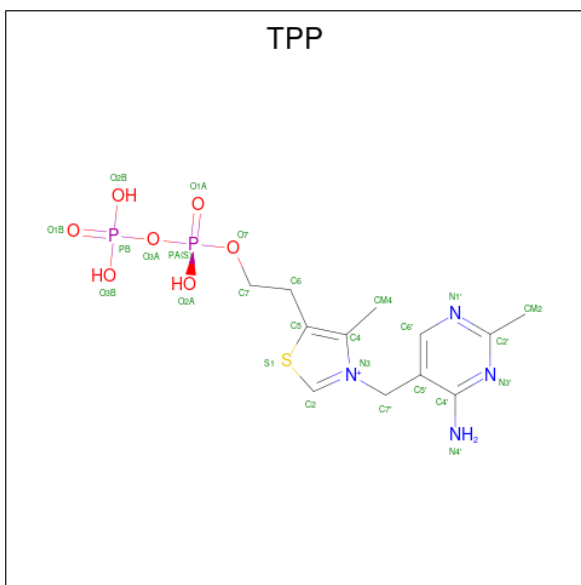
- Molecule 1 is a protein called Transketolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	666	Total	C	N	O	S	46	0	0
			5082	3216	868	977	21			
1	B	666	Total	C	N	O	S	46	0	0
			5082	3216	868	977	21			
1	C	666	Total	C	N	O	S	12	0	0
			5082	3216	868	977	21			

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

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

- Molecule 3 is THIAMINE DIPHOSPHATE (CCD ID: TPP) (formula: C₁₂H₁₉N₄O₇P₂S).



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

- Molecule 4 is water.

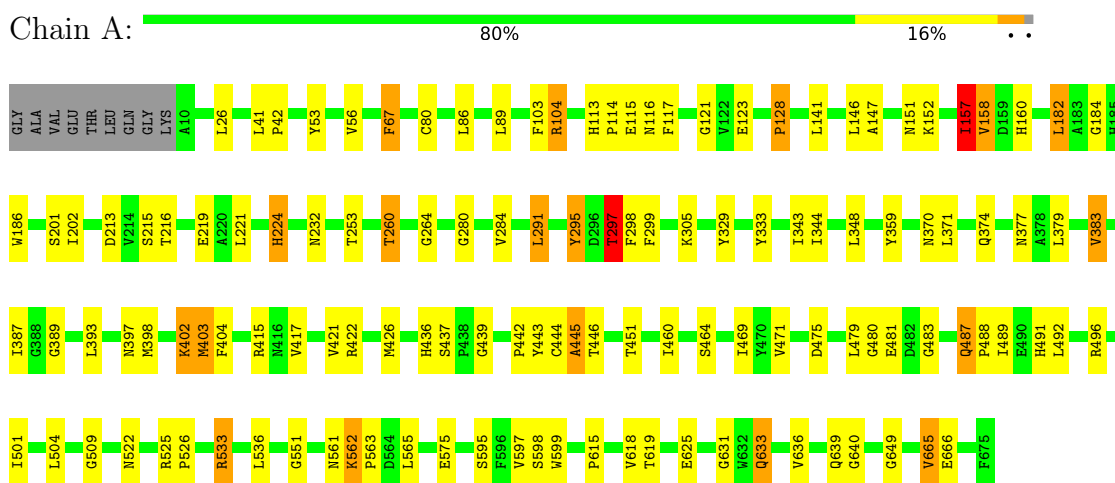
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	162	Total O 162 162	0	0
4	B	154	Total O 154 154	0	0
4	C	124	Total O 124 124	0	0

3 Residue-property plots

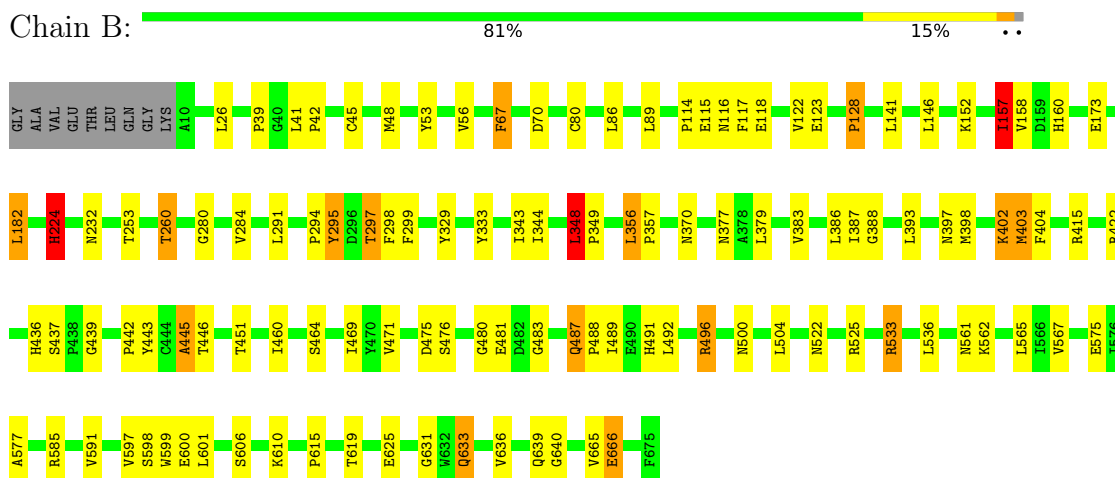
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

Note EDS was not executed.

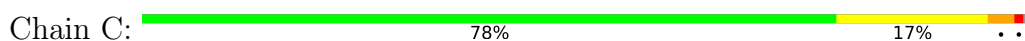
• Molecule 1: Transketolase

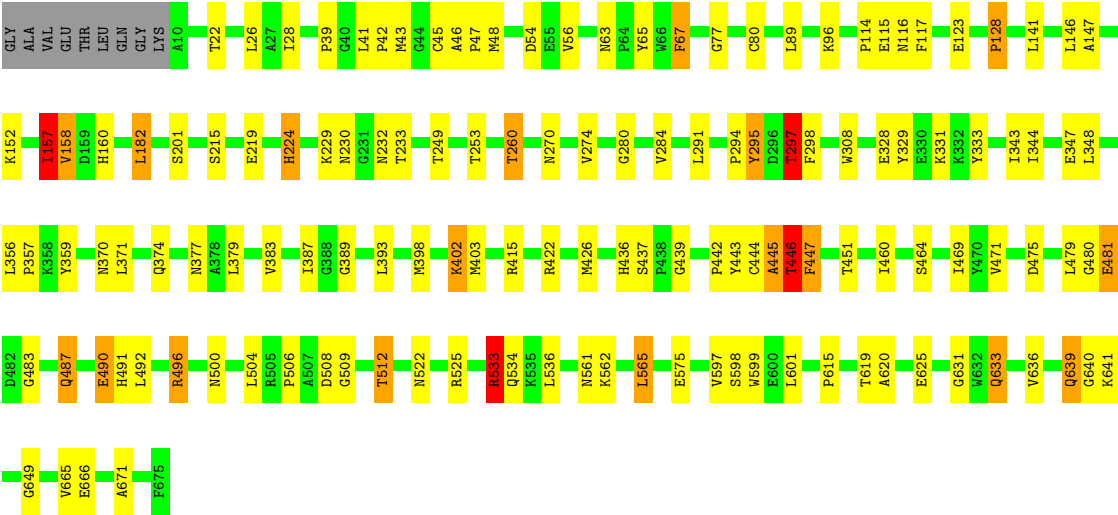


• Molecule 1: Transketolase



• Molecule 1: Transketolase





4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	136.44Å 136.44Å 203.73Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	33.52 – 2.30	Depositor
% Data completeness (in resolution range)	(Not available) (33.52-2.30)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.166 , 0.200	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	15767	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, 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	0.56	0/5202	0.99	21/7060 (0.3%)
1	B	0.54	0/5202	0.99	27/7060 (0.4%)
1	C	0.56	0/5202	1.02	27/7060 (0.4%)
All	All	0.55	0/15606	1.00	75/21180 (0.4%)

There are no bond length outliers.

All (75) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	56	VAL	N-CA-C	9.45	120.65	111.67
1	B	56	VAL	N-CA-C	9.42	120.62	111.67
1	C	481	GLU	N-CA-C	9.19	123.90	112.87
1	A	481	GLU	N-CA-C	8.89	123.14	111.75
1	B	481	GLU	N-CA-C	8.57	122.72	111.75
1	A	56	VAL	N-CA-C	8.45	119.70	111.67
1	C	491	HIS	N-CA-C	7.83	120.81	111.33
1	A	491	HIS	N-CA-C	7.66	119.63	111.28
1	B	451	THR	N-CA-C	-7.52	103.07	111.71
1	C	480	GLY	N-CA-C	7.34	123.44	110.95
1	B	480	GLY	N-CA-C	7.19	121.95	111.24
1	A	480	GLY	N-CA-C	7.04	122.91	110.95
1	C	446	THR	CB-CA-C	-7.03	97.44	111.91
1	A	297	THR	N-CA-C	7.01	121.02	110.64
1	B	491	HIS	N-CA-C	6.98	118.54	111.07
1	C	123	GLU	N-CA-C	6.97	118.96	111.36
1	B	475	ASP	N-CA-C	6.85	121.35	113.19
1	C	475	ASP	N-CA-C	6.74	121.21	113.19
1	A	201	SER	N-CA-C	-6.74	99.51	108.34
1	C	67	PHE	N-CA-C	6.64	119.08	111.11
1	A	451	THR	N-CA-C	-6.38	104.76	112.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	201	SER	N-CA-C	-6.35	100.02	108.34
1	B	224	HIS	N-CA-C	-6.10	99.71	109.96
1	C	224	HIS	N-CA-C	-6.01	99.86	109.96
1	A	128	PRO	N-CA-C	-5.97	101.13	110.50
1	C	451	THR	N-CA-C	-5.96	104.85	111.71
1	A	475	ASP	N-CA-C	5.94	120.26	113.19
1	C	415	ARG	N-CA-C	5.90	121.20	113.30
1	B	26	LEU	N-CA-C	-5.81	104.94	111.28
1	A	224	HIS	N-CA-C	-5.81	100.20	109.96
1	B	415	ARG	N-CA-C	5.75	121.00	113.30
1	B	402	LYS	N-CA-C	5.75	119.10	111.75
1	C	128	PRO	N-CA-C	-5.72	101.52	110.50
1	C	229	LYS	N-CA-C	5.68	118.41	111.82
1	C	500	ASN	N-CA-C	5.67	119.22	111.39
1	C	447	PHE	N-CA-C	-5.65	101.92	110.28
1	B	500	ASN	N-CA-C	5.64	119.18	111.39
1	A	26	LEU	N-CA-C	-5.64	105.21	111.36
1	B	67	PHE	N-CA-C	5.63	117.87	111.11
1	A	121	GLY	N-CA-C	-5.62	107.79	114.48
1	B	123	GLU	N-CA-C	5.58	118.56	111.69
1	B	487	GLN	N-CA-C	5.55	116.96	109.24
1	C	77	GLY	N-CA-C	5.55	120.51	113.24
1	C	402	LYS	N-CA-C	5.54	118.84	111.75
1	B	128	PRO	N-CA-C	-5.53	101.14	110.21
1	C	297	THR	N-CA-C	5.52	118.81	110.64
1	A	123	GLU	N-CA-C	5.49	118.44	111.69
1	C	249	THR	N-CA-C	5.47	119.96	113.28
1	B	356	LEU	CA-C-N	5.40	125.34	119.78
1	B	356	LEU	C-N-CA	5.40	125.34	119.78
1	A	402	LYS	N-CA-C	5.37	118.62	111.75
1	A	157	ILE	N-CA-C	5.31	117.72	111.09
1	B	533	ARG	N-CA-C	-5.29	104.42	112.04
1	C	487	GLN	N-CA-C	5.28	116.58	109.24
1	B	496	ARG	NE-CZ-NH2	5.28	123.95	119.20
1	C	445	ALA	N-CA-C	5.25	117.24	108.99
1	C	26	LEU	N-CA-C	-5.22	105.59	111.28
1	A	445	ALA	N-CA-C	5.20	116.97	109.07
1	C	157	ILE	CA-C-N	-5.16	116.80	123.19
1	C	157	ILE	C-N-CA	-5.16	116.80	123.19
1	A	487	GLN	N-CA-C	5.14	116.85	109.04
1	B	445	ALA	N-CA-C	5.12	116.86	109.07
1	B	122	VAL	N-CA-C	-5.12	100.52	107.99

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	22	THR	N-CA-C	-5.11	105.79	111.36
1	A	415	ARG	N-CA-C	5.09	120.12	113.30
1	C	533	ARG	N-CA-C	-5.09	105.38	112.45
1	A	67	PHE	N-CA-C	5.08	117.21	111.11
1	B	70	ASP	N-CA-C	-5.08	102.97	110.48
1	A	202	ILE	N-CA-C	5.04	115.81	110.72
1	B	348	LEU	CA-C-N	5.04	125.04	119.90
1	B	348	LEU	C-N-CA	5.04	125.04	119.90
1	B	157	ILE	CA-C-N	-5.02	116.59	123.12
1	B	157	ILE	C-N-CA	-5.02	116.59	123.12
1	B	476	SER	N-CA-C	5.02	114.87	108.24
1	A	104	ARG	NE-CZ-NH2	5.01	123.71	119.20

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	5082	0	4957	73	0
1	B	5082	0	4957	67	0
1	C	5082	0	4957	84	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	26	0	16	2	0
3	B	26	0	16	1	0
3	C	26	0	16	2	0
4	A	162	0	0	3	0
4	B	154	0	0	1	0
4	C	124	0	0	7	0
All	All	15767	0	14919	228	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 8.

All (228) 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:297:THR:HG23	1:B:298:PHE:HD1	1.26	0.99
1:A:377:ASN:HD21	1:A:402:LYS:H	1.13	0.91
1:C:377:ASN:HD21	1:C:402:LYS:H	1.15	0.90
1:A:297:THR:HG23	1:A:298:PHE:HD1	1.35	0.90
1:B:297:THR:HG23	1:B:298:PHE:CD1	2.07	0.88
1:C:297:THR:HG23	1:C:298:PHE:HD1	1.40	0.87
1:C:331:LYS:N	4:C:1063:HOH:O	2.08	0.85
1:B:377:ASN:HD21	1:B:402:LYS:H	1.21	0.84
1:C:522:ASN:HD21	1:C:525:ARG:HH11	1.27	0.83
1:B:379:LEU:O	1:B:383:VAL:HG12	1.79	0.82
1:A:297:THR:HG23	1:A:298:PHE:CD1	2.13	0.82
1:C:328:GLU:O	4:C:1063:HOH:O	1.99	0.80
1:C:232:ASN:HD21	1:C:260:THR:CG2	1.94	0.80
1:C:297:THR:HG23	1:C:298:PHE:CD1	2.17	0.78
1:B:232:ASN:HD21	1:B:260:THR:CG2	1.97	0.77
1:B:631:GLY:H	1:B:633:GLN:HE22	1.31	0.77
1:C:639:GLN:H	1:C:639:GLN:HE21	1.33	0.76
1:A:232:ASN:HD21	1:A:260:THR:CG2	1.98	0.76
1:C:379:LEU:O	1:C:383:VAL:HG12	1.86	0.75
1:A:232:ASN:HD21	1:A:260:THR:HG23	1.51	0.74
1:B:522:ASN:HD21	1:B:525:ARG:HH11	1.36	0.72
1:C:508:ASP:O	1:C:512:THR:HG23	1.88	0.72
1:A:379:LEU:O	1:A:383:VAL:HG12	1.90	0.71
1:C:446:THR:HG22	1:C:447:PHE:H	1.53	0.71
1:A:522:ASN:HD21	1:A:525:ARG:HH11	1.37	0.71
1:C:232:ASN:HD21	1:C:260:THR:HG23	1.55	0.71
1:A:377:ASN:HD21	1:A:402:LYS:N	1.87	0.70
1:C:152:LYS:HG2	1:C:333:TYR:CZ	2.28	0.68
3:C:1004:TPP:H2	4:C:1117:HOH:O	1.92	0.67
1:B:377:ASN:HD21	1:B:402:LYS:N	1.93	0.66
1:C:377:ASN:HD21	1:C:402:LYS:N	1.92	0.66
1:A:116:ASN:HD21	1:A:464:SER:HB2	1.61	0.66
1:A:232:ASN:ND2	1:A:260:THR:HG23	2.12	0.65
1:C:639:GLN:HE21	1:C:639:GLN:N	1.95	0.65
1:B:116:ASN:HD21	1:B:464:SER:HB2	1.61	0.65
1:C:328:GLU:C	4:C:1063:HOH:O	2.41	0.64
1:B:160:HIS:NE2	1:B:436:HIS:HE1	1.94	0.64
1:A:152:LYS:HG2	1:A:333:TYR:CZ	2.33	0.63
1:C:80:CYS:HB3	1:C:114:PRO:HD3	1.80	0.63
1:C:631:GLY:H	1:C:633:GLN:HE22	1.46	0.62
1:A:631:GLY:H	1:A:633:GLN:HE22	1.47	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:224:HIS:HD2	1:A:253:THR:OG1	1.81	0.62
1:C:141:LEU:C	1:C:141:LEU:HD23	2.25	0.62
1:A:160:HIS:NE2	1:A:436:HIS:HE1	1.99	0.61
1:C:232:ASN:ND2	1:C:260:THR:HG23	2.15	0.60
1:C:160:HIS:NE2	1:C:436:HIS:HE1	2.00	0.59
1:B:232:ASN:HD21	1:B:260:THR:HG22	1.68	0.59
1:B:504:LEU:HD23	1:B:598:SER:HB2	1.84	0.59
1:A:483:GLY:O	1:A:487:GLN:HG3	2.02	0.59
1:C:639:GLN:N	1:C:639:GLN:NE2	2.50	0.59
1:C:343:ILE:HA	1:C:439:GLY:HA3	1.83	0.59
1:B:232:ASN:HD21	1:B:260:THR:HG23	1.67	0.58
1:B:80:CYS:HB3	1:B:114:PRO:HD3	1.85	0.58
1:C:445:ALA:HB2	1:C:471:VAL:HB	1.85	0.58
1:B:496:ARG:HD2	1:B:599:TRP:CD2	2.38	0.57
1:C:116:ASN:HD21	1:C:464:SER:HB2	1.68	0.57
1:A:496:ARG:HD3	4:A:1010:HOH:O	2.05	0.56
1:C:232:ASN:ND2	1:C:260:THR:CG2	2.68	0.56
1:B:297:THR:CG2	1:B:298:PHE:HD1	2.11	0.56
1:C:232:ASN:HD21	1:C:260:THR:HG22	1.71	0.56
1:B:41:LEU:HD23	1:B:41:LEU:C	2.31	0.56
1:C:96:LYS:HD2	4:C:1097:HOH:O	2.06	0.55
1:C:41:LEU:C	1:C:41:LEU:HD23	2.31	0.55
1:A:561:ASN:ND2	1:A:615:PRO:HB3	2.21	0.55
1:A:496:ARG:HD2	1:A:599:TRP:CD2	2.42	0.55
1:A:421:VAL:HG12	1:B:173:GLU:OE2	2.07	0.55
1:B:232:ASN:ND2	1:B:260:THR:HG23	2.22	0.55
1:A:479:LEU:HA	1:A:533:ARG:HG2	1.89	0.55
1:A:103:PHE:CZ	1:A:104:ARG:HD2	2.42	0.55
1:A:665:VAL:HG12	4:A:1114:HOH:O	2.06	0.55
1:C:496:ARG:NH2	1:C:625:GLU:OE1	2.39	0.54
1:B:152:LYS:HG2	1:B:333:TYR:CZ	2.43	0.54
1:B:496:ARG:NH1	1:B:625:GLU:OE1	2.39	0.54
1:A:297:THR:CG2	1:A:298:PHE:HD1	2.15	0.54
1:A:343:ILE:HA	1:A:439:GLY:HA3	1.90	0.54
1:C:641:LYS:HD3	1:C:671:ALA:HB1	1.91	0.53
1:C:483:GLY:O	1:C:487:GLN:HG3	2.08	0.53
1:A:80:CYS:HB3	1:A:114:PRO:HD3	1.91	0.53
1:A:128:PRO:HG2	1:A:460:ILE:HD11	1.91	0.53
1:A:496:ARG:NH2	1:A:625:GLU:OE1	2.41	0.53
1:A:636:VAL:O	1:A:640:GLY:HA3	2.08	0.53
1:B:383:VAL:O	1:B:383:VAL:HG13	2.09	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:359:TYR:OH	1:C:374:GLN:NE2	2.42	0.53
1:C:639:GLN:H	1:C:639:GLN:NE2	2.02	0.53
1:B:631:GLY:N	1:B:633:GLN:HE22	2.05	0.53
1:C:492:LEU:O	1:C:496:ARG:HG3	2.09	0.53
1:C:280:GLY:O	1:C:284:VAL:HG23	2.10	0.52
1:A:141:LEU:C	1:A:141:LEU:HD23	2.35	0.52
1:C:215:SER:O	1:C:219:GLU:HG3	2.10	0.52
1:A:182:LEU:HG	1:A:186:TRP:CH2	2.45	0.52
1:B:53:TYR:CD1	1:B:86:LEU:HD13	2.44	0.52
1:C:479:LEU:HA	1:C:533:ARG:HG2	1.92	0.52
1:C:522:ASN:ND2	1:C:525:ARG:HH11	2.03	0.51
1:A:371:LEU:HD13	1:A:509:GLY:HA2	1.92	0.51
1:C:46:ALA:HB3	1:C:47:PRO:HD3	1.91	0.51
1:A:41:LEU:HB3	1:A:42:PRO:HD3	1.92	0.50
1:B:522:ASN:ND2	1:B:525:ARG:HH11	2.07	0.50
1:C:63:ASN:ND2	1:C:65:TYR:H	2.09	0.50
1:C:224:HIS:HD2	1:C:253:THR:OG1	1.95	0.50
1:C:506:PRO:HB2	1:C:512:THR:HG22	1.94	0.50
1:A:397:ASN:HD21	1:A:446:THR:HA	1.75	0.50
1:A:147:ALA:HB2	1:A:158:VAL:HG22	1.94	0.50
1:C:436:HIS:HD2	1:C:437:SER:OG	1.94	0.50
1:B:116:ASN:H	1:B:116:ASN:HD22	1.59	0.49
1:B:232:ASN:ND2	1:B:260:THR:CG2	2.69	0.49
1:C:28:ILE:HD11	1:C:43:MET:HE3	1.93	0.49
1:A:53:TYR:CD1	1:A:86:LEU:HD13	2.47	0.49
1:C:147:ALA:HB2	1:C:158:VAL:HG22	1.95	0.49
1:B:280:GLY:O	1:B:284:VAL:HG23	2.13	0.49
1:B:636:VAL:O	1:B:640:GLY:HA3	2.12	0.49
1:A:41:LEU:C	1:A:41:LEU:HD23	2.38	0.49
1:B:141:LEU:HD23	1:B:141:LEU:C	2.38	0.49
1:A:280:GLY:O	1:A:284:VAL:HG23	2.12	0.48
3:B:1003:TPP:H2	3:B:1003:TPP:HN42	1.78	0.48
1:A:633:GLN:H	1:A:633:GLN:NE2	2.11	0.48
1:B:496:ARG:HH12	1:B:625:GLU:CD	2.21	0.48
1:A:445:ALA:HB2	1:A:471:VAL:HB	1.95	0.48
3:A:1002:TPP:H2	4:A:1145:HOH:O	2.14	0.48
1:C:387:ILE:O	1:C:442:PRO:HA	2.14	0.48
1:C:230:ASN:HD21	1:C:233:THR:HG1	1.61	0.47
1:C:182:LEU:HD13	1:C:422:ARG:NH1	2.29	0.47
1:C:370:ASN:HD22	1:C:398:MET:HG3	1.78	0.47
1:B:157:ILE:HD11	1:B:329:TYR:CZ	2.49	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:483:GLY:O	1:B:487:GLN:HG3	2.14	0.47
1:B:496:ARG:HD3	4:B:1020:HOH:O	2.15	0.47
1:A:370:ASN:ND2	1:A:398:MET:HG3	2.29	0.47
1:C:39:PRO:C	1:C:42:PRO:HD2	2.40	0.47
1:C:39:PRO:O	1:C:42:PRO:HD2	2.15	0.47
1:C:504:LEU:HD23	1:C:598:SER:HB2	1.96	0.47
1:A:504:LEU:HD23	1:A:598:SER:HB2	1.97	0.47
1:C:274:VAL:O	1:C:274:VAL:HG22	2.15	0.47
1:C:641:LYS:HD3	1:C:671:ALA:CB	2.44	0.47
1:C:446:THR:HG22	1:C:447:PHE:N	2.28	0.46
1:B:128:PRO:HG2	1:B:460:ILE:HD11	1.98	0.46
1:C:116:ASN:HD22	1:C:116:ASN:H	1.64	0.46
1:B:356:LEU:HA	1:B:357:PRO:HD3	1.83	0.46
1:C:496:ARG:HD2	1:C:599:TRP:CD2	2.51	0.46
1:C:371:LEU:HD13	1:C:509:GLY:HA2	1.98	0.46
1:C:329:TYR:C	4:C:1063:HOH:O	2.58	0.46
3:A:1002:TPP:H2	3:A:1002:TPP:HN42	1.81	0.46
1:A:113:HIS:O	1:A:115:GLU:HG3	2.16	0.45
1:A:370:ASN:HD22	1:A:398:MET:HG3	1.81	0.45
1:B:585:ARG:NH1	1:B:591:VAL:O	2.49	0.45
1:B:666:GLU:CD	1:B:666:GLU:H	2.24	0.45
1:C:460:ILE:HG21	4:C:1119:HOH:O	2.15	0.45
1:A:563:PRO:HD2	1:A:618:VAL:HG21	1.98	0.45
1:B:343:ILE:HA	1:B:439:GLY:HA3	1.97	0.45
1:C:370:ASN:ND2	1:C:398:MET:HG3	2.31	0.45
1:C:496:ARG:HH22	1:C:625:GLU:CD	2.24	0.45
1:A:182:LEU:HD13	1:A:422:ARG:NH1	2.31	0.45
1:B:436:HIS:HD2	1:B:437:SER:OG	2.00	0.45
1:A:387:ILE:O	1:A:442:PRO:HA	2.17	0.45
1:B:224:HIS:HD2	1:B:253:THR:OG1	2.00	0.45
1:B:492:LEU:O	1:B:496:ARG:HG3	2.17	0.44
1:B:633:GLN:H	1:B:633:GLN:NE2	2.14	0.44
1:A:371:LEU:HD13	1:A:509:GLY:CA	2.47	0.44
1:A:492:LEU:O	1:A:496:ARG:HG3	2.17	0.44
1:C:128:PRO:HG2	1:C:460:ILE:HD11	1.99	0.44
1:A:436:HIS:HD2	1:A:437:SER:OG	2.01	0.44
1:A:501:ILE:HG13	1:A:526:PRO:HG2	1.98	0.44
1:B:388:GLY:HA3	1:B:443:TYR:O	2.17	0.44
1:B:445:ALA:HB2	1:B:471:VAL:HB	1.98	0.44
1:A:389:GLY:O	1:A:444:CYS:HA	2.18	0.44
1:C:45:CYS:SG	1:C:48:MET:HE3	2.57	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:294:PRO:HG2	1:B:295:TYR:H	1.83	0.44
1:A:215:SER:O	1:A:219:GLU:HG3	2.17	0.44
1:B:397:ASN:HD21	1:B:446:THR:HA	1.82	0.44
1:B:561:ASN:ND2	1:B:615:PRO:HB3	2.32	0.44
1:C:522:ASN:ND2	1:C:525:ARG:HE	2.16	0.44
1:B:41:LEU:HB3	1:B:42:PRO:HD3	2.00	0.44
3:C:1004:TPP:H2	3:C:1004:TPP:HN42	1.83	0.44
1:A:562:LYS:O	1:A:562:LYS:HG2	2.16	0.44
1:A:147:ALA:O	1:A:151:ASN:HB2	2.18	0.43
1:A:157:ILE:HD11	1:A:329:TYR:CZ	2.53	0.43
1:C:356:LEU:HA	1:C:357:PRO:HD3	1.86	0.43
1:B:115:GLU:HB3	1:B:117:PHE:CE2	2.54	0.43
1:A:443:TYR:HA	1:A:469:ILE:O	2.18	0.43
1:A:487:GLN:HA	1:A:488:PRO:HD3	1.87	0.43
1:B:45:CYS:SG	1:B:48:MET:HE3	2.59	0.43
1:B:403:MET:HG2	1:B:404:PHE:CE1	2.54	0.43
1:C:636:VAL:O	1:C:640:GLY:HA3	2.19	0.43
1:A:359:TYR:OH	1:A:374:GLN:NE2	2.52	0.42
1:B:348:LEU:HA	1:B:349:PRO:HD3	1.91	0.42
1:A:561:ASN:HD21	1:A:615:PRO:HB3	1.85	0.42
1:B:160:HIS:NE2	1:B:436:HIS:CE1	2.83	0.42
1:B:383:VAL:HG13	1:B:386:LEU:HB2	2.01	0.42
1:C:67:PHE:CD2	1:C:344:ILE:HG12	2.54	0.42
1:B:370:ASN:ND2	1:B:398:MET:HG3	2.34	0.42
1:B:487:GLN:HA	1:B:488:PRO:HD3	1.90	0.42
1:C:436:HIS:CD2	1:C:437:SER:OG	2.71	0.42
1:A:67:PHE:CD2	1:A:344:ILE:HG12	2.54	0.42
1:C:152:LYS:HG2	1:C:333:TYR:CE2	2.54	0.42
1:C:294:PRO:HG2	1:C:295:TYR:H	1.84	0.42
1:C:490:GLU:H	1:C:490:GLU:CD	2.28	0.42
1:A:403:MET:HG2	1:A:404:PHE:CE1	2.55	0.42
1:A:522:ASN:ND2	1:A:525:ARG:HH11	2.10	0.42
1:B:387:ILE:O	1:B:442:PRO:HA	2.20	0.42
1:C:533:ARG:HG3	1:C:534:GLN:N	2.34	0.42
1:A:426:MET:SD	1:A:444:CYS:HB2	2.60	0.42
1:B:295:TYR:CD2	1:B:299:PHE:CE2	3.08	0.42
1:C:54:ASP:HB2	1:C:308:TRP:CH2	2.55	0.42
1:C:63:ASN:ND2	1:C:63:ASN:C	2.76	0.42
1:B:39:PRO:C	1:B:42:PRO:HD2	2.44	0.41
1:B:67:PHE:CD2	1:B:344:ILE:HG12	2.54	0.41
1:A:487:GLN:OE1	1:A:649:GLY:HA3	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:295:TYR:HB3	1:B:299:PHE:CD2	2.55	0.41
1:B:567:VAL:HG12	1:B:577:ALA:HB1	2.01	0.41
1:A:115:GLU:HB3	1:A:117:PHE:CE2	2.55	0.41
1:A:389:GLY:HA3	1:A:417:VAL:O	2.20	0.41
1:A:213:ASP:OD2	1:A:216:THR:OG1	2.36	0.41
1:C:157:ILE:HD11	1:C:329:TYR:CZ	2.56	0.41
1:B:182:LEU:HD13	1:B:422:ARG:NH1	2.35	0.41
1:A:184:GLY:HA3	1:A:221:LEU:O	2.20	0.41
1:A:305:LYS:HE3	1:A:305:LYS:HB2	1.85	0.41
1:B:600:GLU:H	1:B:600:GLU:CD	2.29	0.41
1:C:487:GLN:OE1	1:C:649:GLY:HA3	2.21	0.41
1:A:295:TYR:HB3	1:A:299:PHE:CD2	2.55	0.41
1:C:115:GLU:HB3	1:C:117:PHE:CE2	2.56	0.41
1:C:565:LEU:HD23	1:C:620:ALA:O	2.20	0.41
1:A:551:GLY:HA2	1:A:595:SER:O	2.20	0.41
1:B:606:SER:O	1:B:610:LYS:HG3	2.21	0.40
1:C:443:TYR:HA	1:C:469:ILE:O	2.21	0.40
1:C:561:ASN:ND2	1:C:615:PRO:HB3	2.36	0.40
1:C:426:MET:SD	1:C:444:CYS:HB2	2.62	0.40
1:A:264:GLY:HA3	1:A:291:LEU:HD21	2.03	0.40
1:A:633:GLN:HE21	1:A:633:GLN:HB2	1.72	0.40
1:B:443:TYR:HA	1:B:469:ILE:O	2.21	0.40
1:C:389:GLY:O	1:C:444:CYS:HA	2.22	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	664/675 (98%)	641 (96%)	21 (3%)	2 (0%)	36 46
1	B	664/675 (98%)	643 (97%)	19 (3%)	2 (0%)	36 46

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	664/675 (98%)	642 (97%)	21 (3%)	1 (0%)	43	55
All	All	1992/2025 (98%)	1926 (97%)	61 (3%)	5 (0%)	36	46

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	295	TYR
1	C	295	TYR
1	A	295	TYR
1	B	489	ILE
1	A	489	ILE

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	528/534 (99%)	505 (96%)	23 (4%)	25	38
1	B	528/534 (99%)	503 (95%)	25 (5%)	23	35
1	C	528/534 (99%)	498 (94%)	30 (6%)	18	27
All	All	1584/1602 (99%)	1506 (95%)	78 (5%)	22	34

All (78) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	89	LEU
1	A	146	LEU
1	A	157	ILE
1	A	158	VAL
1	A	182	LEU
1	A	260	THR
1	A	291	LEU
1	A	297	THR
1	A	348	LEU
1	A	383	VAL

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Mol	Chain	Res	Type
1	A	393	LEU
1	A	403	MET
1	A	533	ARG
1	A	536	LEU
1	A	562	LYS
1	A	565	LEU
1	A	575	GLU
1	A	597	VAL
1	A	619	THR
1	A	633	GLN
1	A	639	GLN
1	A	665	VAL
1	A	666	GLU
1	B	89	LEU
1	B	118	GLU
1	B	146	LEU
1	B	157	ILE
1	B	158	VAL
1	B	182	LEU
1	B	224	HIS
1	B	260	THR
1	B	291	LEU
1	B	297	THR
1	B	348	LEU
1	B	393	LEU
1	B	403	MET
1	B	533	ARG
1	B	536	LEU
1	B	562	LYS
1	B	565	LEU
1	B	575	GLU
1	B	597	VAL
1	B	601	LEU
1	B	619	THR
1	B	633	GLN
1	B	639	GLN
1	B	665	VAL
1	B	666	GLU
1	C	89	LEU
1	C	146	LEU
1	C	157	ILE
1	C	158	VAL

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Mol	Chain	Res	Type
1	C	182	LEU
1	C	260	THR
1	C	270	ASN
1	C	291	LEU
1	C	297	THR
1	C	347	GLU
1	C	348	LEU
1	C	393	LEU
1	C	403	MET
1	C	446	THR
1	C	481	GLU
1	C	490	GLU
1	C	496	ARG
1	C	512	THR
1	C	533	ARG
1	C	536	LEU
1	C	562	LYS
1	C	565	LEU
1	C	575	GLU
1	C	597	VAL
1	C	601	LEU
1	C	619	THR
1	C	633	GLN
1	C	639	GLN
1	C	665	VAL
1	C	666	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (52) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	63	ASN
1	A	116	ASN
1	A	135	ASN
1	A	224	HIS
1	A	232	ASN
1	A	267	ASN
1	A	270	ASN
1	A	370	ASN
1	A	373	GLN
1	A	374	GLN
1	A	377	ASN
1	A	381	ASN

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Mol	Chain	Res	Type
1	A	397	ASN
1	A	431	ASN
1	A	436	HIS
1	A	522	ASN
1	A	633	GLN
1	B	63	ASN
1	B	116	ASN
1	B	135	ASN
1	B	224	HIS
1	B	232	ASN
1	B	270	ASN
1	B	370	ASN
1	B	373	GLN
1	B	374	GLN
1	B	377	ASN
1	B	381	ASN
1	B	397	ASN
1	B	431	ASN
1	B	436	HIS
1	B	500	ASN
1	B	522	ASN
1	B	633	GLN
1	C	63	ASN
1	C	116	ASN
1	C	135	ASN
1	C	224	HIS
1	C	230	ASN
1	C	232	ASN
1	C	267	ASN
1	C	270	ASN
1	C	370	ASN
1	C	374	GLN
1	C	377	ASN
1	C	381	ASN
1	C	397	ASN
1	C	431	ASN
1	C	436	HIS
1	C	522	ASN
1	C	633	GLN
1	C	639	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](#)

Of 6 ligands modelled in this entry, 3 are monoatomic - leaving 3 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
3	TPP	B	1003	2	26,27,27	1.88	5 (19%)	38,40,40	1.39	4 (10%)
3	TPP	C	1004	2	26,27,27	1.79	6 (23%)	38,40,40	1.35	4 (10%)
3	TPP	A	1002	2	26,27,27	1.89	5 (19%)	38,40,40	1.45	5 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	TPP	B	1003	2	-	5/17/17/17	0/2/2/2
3	TPP	C	1004	2	-	4/17/17/17	0/2/2/2
3	TPP	A	1002	2	-	4/17/17/17	0/2/2/2

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1003	TPP	PA-O3A	-5.37	1.53	1.59
3	C	1004	TPP	C4-N3	4.79	1.49	1.39
3	A	1002	TPP	PA-O3A	-4.60	1.54	1.59
3	B	1003	TPP	C4-N3	4.44	1.49	1.39
3	A	1002	TPP	C4-N3	4.03	1.48	1.39
3	A	1002	TPP	C2-N3	3.33	1.40	1.32
3	A	1002	TPP	CM4-C4	3.16	1.56	1.49
3	C	1004	TPP	PA-O3A	-3.12	1.56	1.59
3	B	1003	TPP	C2-N3	3.10	1.39	1.32
3	C	1004	TPP	C2-N3	3.09	1.39	1.32
3	A	1002	TPP	C2-S1	2.84	1.77	1.69
3	B	1003	TPP	CM4-C4	2.75	1.55	1.49
3	C	1004	TPP	CM4-C4	2.65	1.55	1.49
3	C	1004	TPP	C2-S1	2.35	1.76	1.69
3	B	1003	TPP	C2-S1	2.25	1.76	1.69
3	C	1004	TPP	C6'-C5'	2.05	1.41	1.37

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1002	TPP	C4-C5-S1	3.75	116.40	110.56
3	B	1003	TPP	C4-C5-S1	3.38	115.84	110.56
3	C	1004	TPP	C4-C5-S1	3.14	115.47	110.56
3	A	1002	TPP	C6-C5-S1	-3.06	113.75	120.90
3	B	1003	TPP	C6-C5-S1	-2.97	113.95	120.90
3	A	1002	TPP	C6'-N1'-C2'	2.93	120.89	116.07
3	A	1002	TPP	O3B-PB-O3A	2.85	114.20	104.64
3	C	1004	TPP	O3B-PB-O3A	2.85	114.18	104.64
3	B	1003	TPP	C6'-N1'-C2'	2.76	120.61	116.07
3	C	1004	TPP	C6'-N1'-C2'	2.69	120.49	116.07
3	C	1004	TPP	C6-C5-S1	-2.57	114.87	120.90
3	A	1002	TPP	C2-S1-C5	-2.23	89.74	91.22
3	B	1003	TPP	O3B-PB-O3A	2.21	112.06	104.64

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1002	TPP	C7-O7-PA-O1A
3	A	1002	TPP	C7-O7-PA-O2A
3	A	1002	TPP	C7-O7-PA-O3A
3	B	1003	TPP	C7-O7-PA-O1A

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Mol	Chain	Res	Type	Atoms
3	B	1003	TPP	C7-O7-PA-O2A
3	B	1003	TPP	C7-O7-PA-O3A
3	C	1004	TPP	C5-C6-C7-O7
3	C	1004	TPP	C7-O7-PA-O1A
3	C	1004	TPP	C7-O7-PA-O2A
3	C	1004	TPP	C7-O7-PA-O3A
3	A	1002	TPP	C5-C6-C7-O7
3	B	1003	TPP	C5-C6-C7-O7
3	B	1003	TPP	PB-O3A-PA-O7

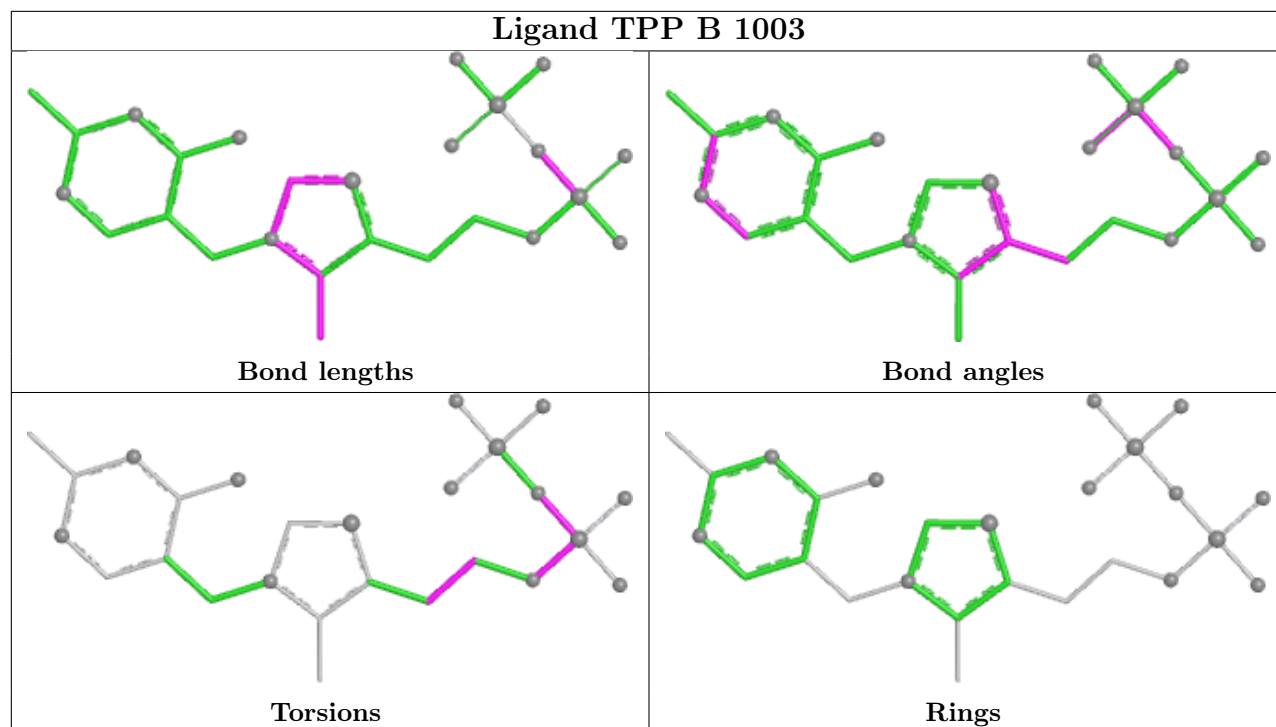
There are no ring outliers.

3 monomers are involved in 5 short contacts:

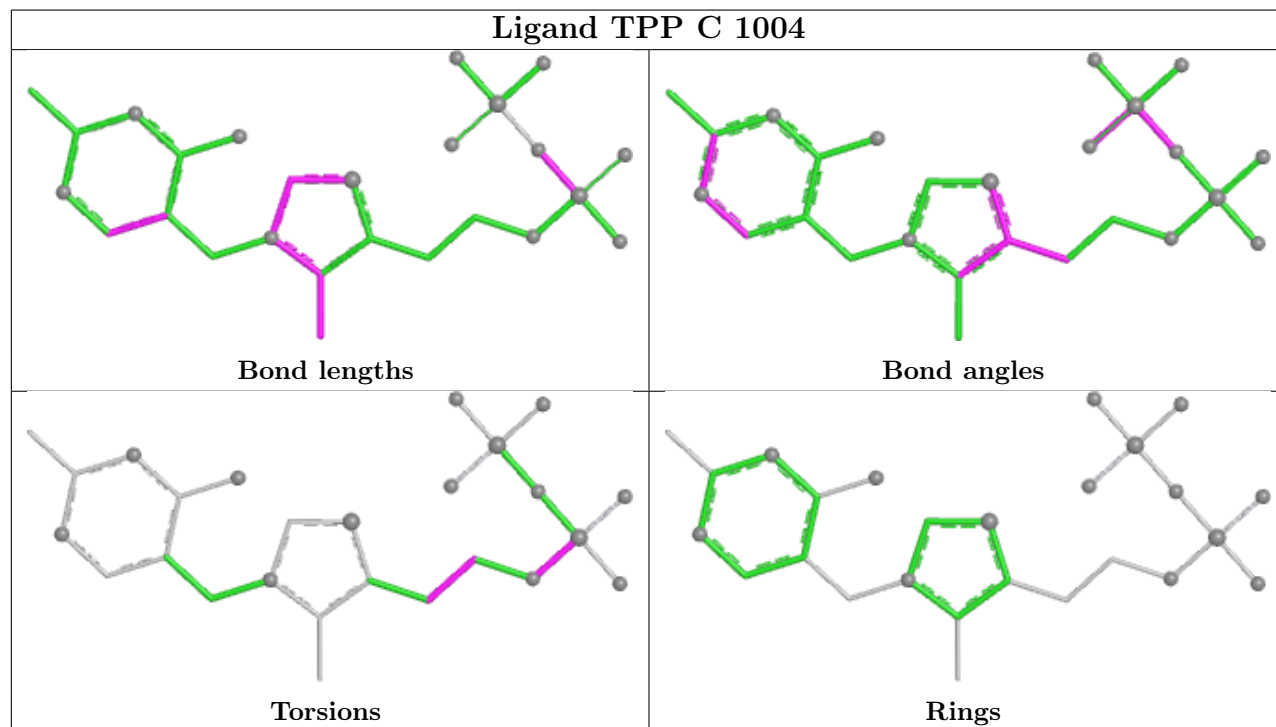
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	1003	TPP	1	0
3	C	1004	TPP	2	0
3	A	1002	TPP	2	0

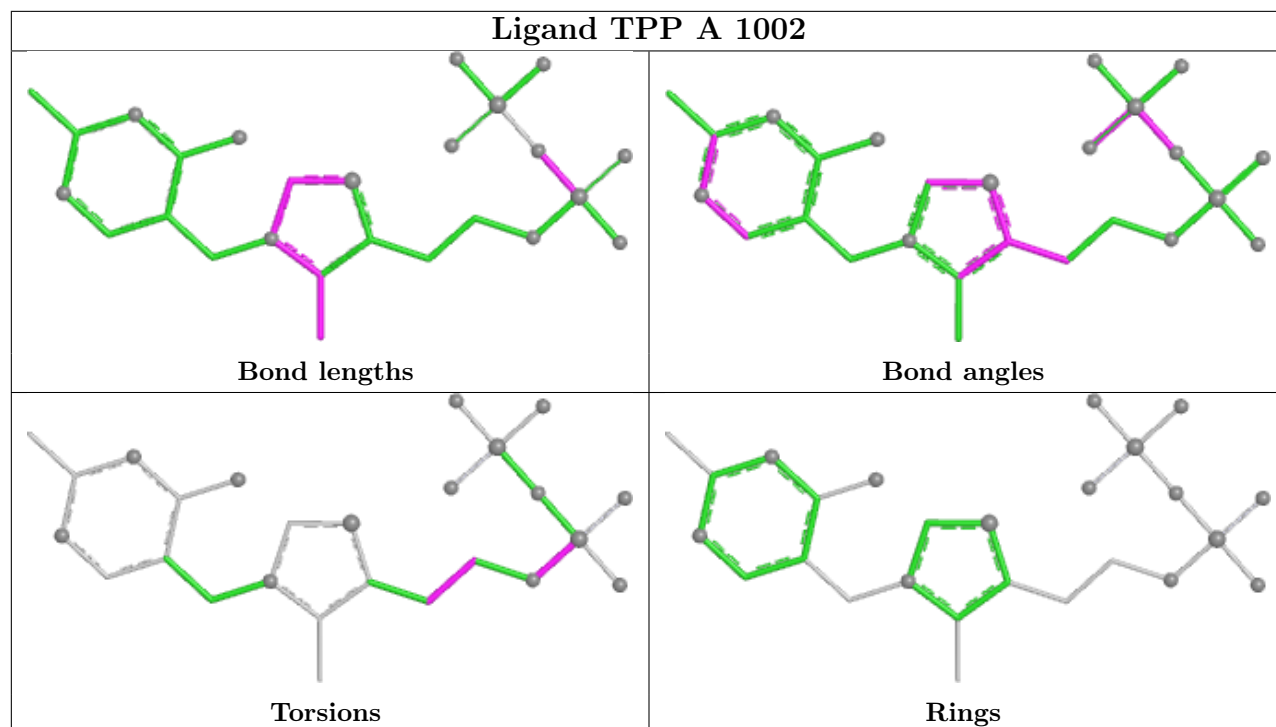
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

Ligand TPP B 1003



Ligand TPP C 1004





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.