



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 03:29 PM UTC

PDB ID : 1AY0 / pdb_00001ay0
Title : IDENTIFICATION OF CATALYTICALLY IMPORTANT RESIDUES IN YEAST TRANSKETOLASE
Authors : Wikner, C.; Nilsson, U.; Meshalkina, L.; Udekwu, C.; Lindqvist, Y.; Schneider, G.
Deposited on : 1997-11-13
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 Phenix2.0
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

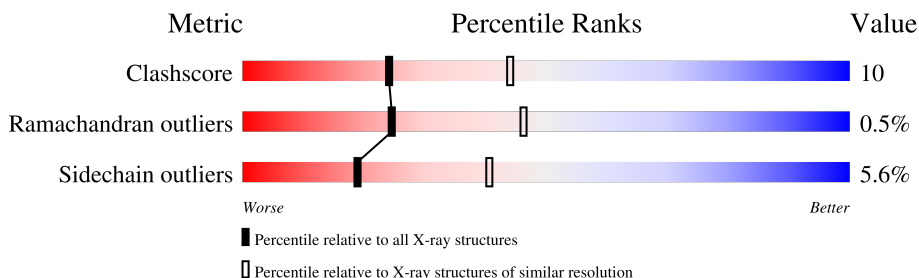
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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))
Clashscore	190562	4347 (2.60-2.60)
Ramachandran outliers	187476	4277 (2.60-2.60)
Sidechain outliers	187428	4277 (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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	680	
1	B	680	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 10440 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	678	Total	C	N	O	S	0	0	0
			5193	3309	882	990	12			
1	B	678	Total	C	N	O	S	0	0	0
			5193	3309	882	990	12			

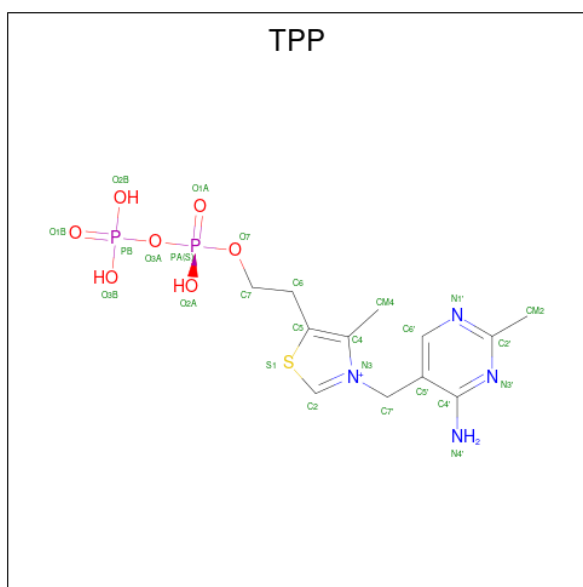
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	263	ALA	HIS	engineered mutation	UNP P23254
B	263	ALA	HIS	engineered mutation	UNP P23254

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

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



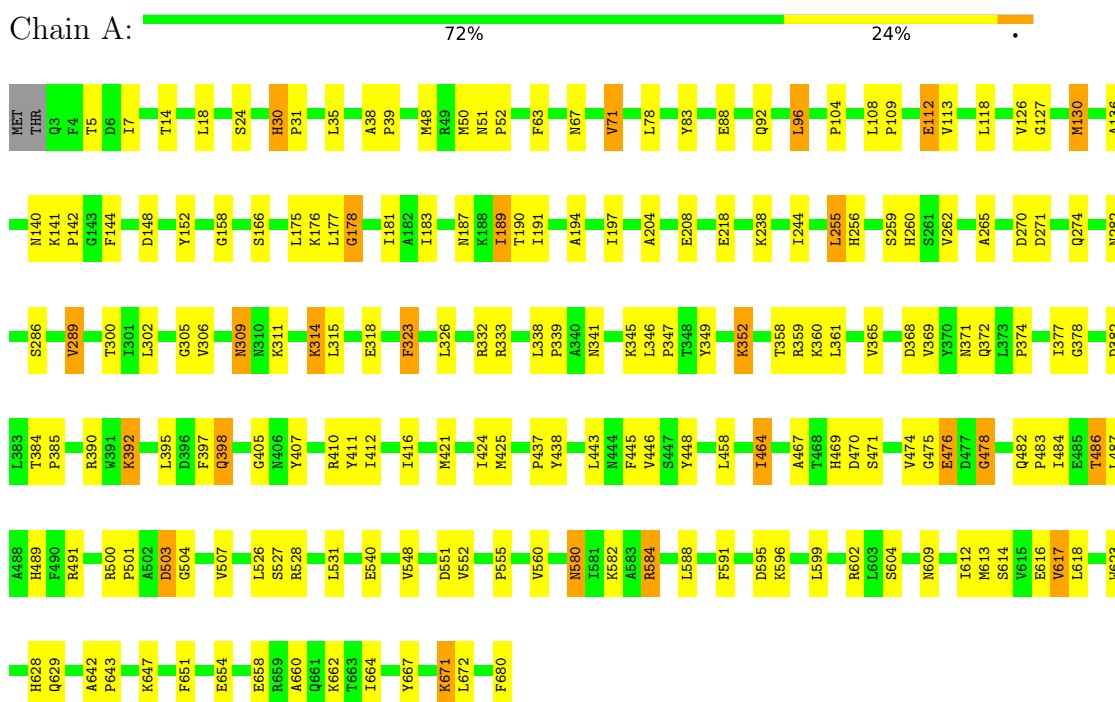
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total 26	C 12	N 4	O 7	P 2	S 1	0	0
3	B	1	Total 26	C 12	N 4	O 7	P 2	S 1	0	0

3 Residue-property plots

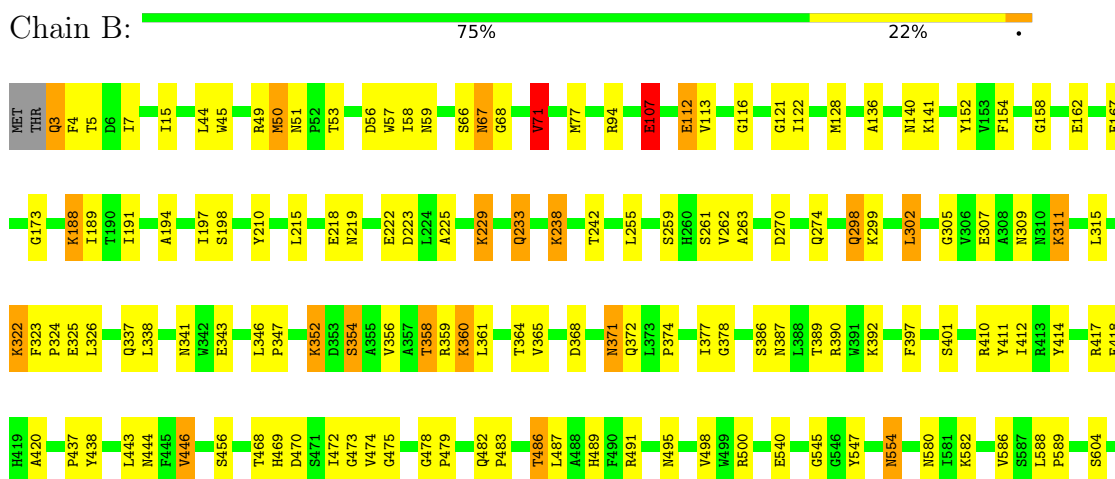
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded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



P607	D608	N609	I612	M613	E616	V617	L618	T621	C622	W623	H628	Q629	R635	S639	G640	K641	E644	V645	F646	K647	F648	E658	R659	K662	K671	I672	I673	K677	K678	A679	F680
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4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	76.10Å 113.60Å 162.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	5.50 – 2.60	Depositor
% Data completeness (in resolution range)	65.1 (5.50-2.60)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.193 , 0.263	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	10440	wwPDB-VP
Average B, all atoms (Å ²)	17.0	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: CA, 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	0.65	1/5318 (0.0%)	1.10	36/7222 (0.5%)
1	B	0.66	0/5318	1.10	37/7222 (0.5%)
All	All	0.65	1/10636 (0.0%)	1.10	73/14444 (0.5%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	289	VAL	CA-CB	5.72	1.58	1.54

All (73) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	478	GLY	CA-C-N	8.77	128.92	119.28
1	A	478	GLY	C-N-CA	8.77	128.92	119.28
1	A	475	GLY	N-CA-C	8.09	123.29	111.24
1	B	298	GLN	N-CA-C	-7.72	102.80	111.14
1	B	191	ILE	N-CA-C	7.52	117.64	110.42
1	A	112	GLU	N-CA-C	7.45	119.40	111.28
1	B	478	GLY	CA-C-N	7.08	128.69	119.84
1	B	478	GLY	C-N-CA	7.08	128.69	119.84
1	A	218	GLU	N-CA-C	6.84	121.45	113.18
1	A	623	TRP	N-CA-C	6.69	120.70	112.54
1	A	464	ILE	N-CA-C	6.61	117.64	108.12
1	B	315	LEU	N-CA-C	-6.54	104.23	111.36
1	B	365	VAL	N-CA-C	-6.34	104.67	110.82
1	A	609	ASN	N-CA-C	6.32	120.78	113.38
1	A	470	ASP	N-CA-C	6.26	120.59	113.15
1	B	446	VAL	N-CA-C	-6.26	103.23	111.05
1	A	24	SER	N-CA-C	6.25	118.10	111.28
1	A	392	LYS	N-CA-C	6.12	118.49	111.02

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	112	GLU	N-CA-C	6.10	119.91	112.23
1	B	71	VAL	CB-CA-C	-6.09	101.30	111.29
1	B	418	GLU	N-CA-C	6.07	117.90	111.28
1	B	470	ASP	N-CA-C	6.07	123.74	110.80
1	A	30	HIS	CA-C-N	6.03	127.38	119.84
1	A	30	HIS	C-N-CA	6.03	127.38	119.84
1	B	580	ASN	N-CA-C	6.02	119.95	112.24
1	B	473	GLY	N-CA-C	-6.00	107.46	115.32
1	A	166	SER	N-CA-C	-5.97	104.85	111.36
1	B	299	LYS	N-CA-C	5.97	117.46	111.07
1	B	495	ASN	N-CA-C	5.96	119.47	111.24
1	A	187	ASN	N-CA-C	5.96	120.25	112.92
1	A	531	LEU	CA-C-N	5.95	125.91	119.78
1	A	531	LEU	C-N-CA	5.95	125.91	119.78
1	A	300	THR	N-CA-C	5.92	120.23	112.89
1	B	621	THR	N-CA-C	5.88	119.56	112.38
1	B	486	THR	N-CA-C	5.87	117.37	110.97
1	B	604	SER	N-CA-C	-5.86	105.62	112.89
1	A	71	VAL	N-CA-C	5.84	116.49	110.36
1	A	476	GLU	N-CA-C	5.80	118.38	111.71
1	A	96	LEU	N-CA-C	5.79	118.99	110.30
1	A	446	VAL	N-CA-C	-5.77	103.96	112.04
1	B	354	SER	N-CA-C	5.76	119.01	110.48
1	A	503	ASP	N-CA-C	5.74	115.69	108.45
1	B	116	GLY	N-CA-C	-5.73	100.66	112.34
1	B	242	THR	N-CA-C	5.68	118.16	108.90
1	A	178	GLY	N-CA-C	5.66	120.80	113.27
1	B	623	TRP	N-CA-C	5.66	119.91	112.89
1	A	309	ASN	N-CA-C	-5.62	105.05	111.07
1	B	58	ILE	N-CA-C	5.60	118.08	111.09
1	A	306	VAL	N-CA-C	-5.58	105.06	110.42
1	B	107	GLU	N-CA-C	5.58	119.34	112.54
1	A	130	MET	N-CA-C	-5.56	105.14	111.14
1	B	372	GLN	N-CA-C	-5.47	105.74	112.90
1	A	584	ARG	N-CA-C	-5.42	100.87	109.76
1	B	607	PRO	N-CA-C	5.40	119.09	110.40
1	A	286	SER	N-CA-C	5.39	118.02	109.50
1	B	677	LYS	N-CA-C	5.36	117.05	108.41
1	A	71	VAL	CB-CA-C	-5.32	105.07	111.88
1	B	475	GLY	N-CA-C	5.31	119.98	110.95
1	A	323	PHE	CA-C-N	5.30	124.75	119.24
1	A	323	PHE	C-N-CA	5.30	124.75	119.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	346	LEU	CA-C-N	5.24	125.16	119.76
1	B	346	LEU	C-N-CA	5.24	125.16	119.76
1	B	609	ASN	N-CA-C	5.23	119.61	113.23
1	B	397	PHE	N-CA-C	-5.21	100.60	108.67
1	B	456	SER	N-CA-C	-5.18	105.81	111.82
1	B	4	PHE	N-CA-C	-5.14	102.58	110.14
1	A	412	ILE	N-CA-C	5.12	115.95	108.58
1	A	407	TYR	N-CA-C	5.10	118.60	112.38
1	A	368	ASP	N-CA-C	5.09	116.64	111.14
1	B	154	PHE	N-CA-C	-5.05	100.67	108.90
1	B	188	LYS	N-CA-C	5.03	119.36	113.23
1	A	580	ASN	N-CA-C	5.02	118.52	111.74
1	B	640	GLY	N-CA-C	-5.01	105.00	110.96

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	5193	0	5137	122	0
1	B	5193	0	5137	92	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	26	0	16	2	0
3	B	26	0	16	3	0
All	All	10440	0	10306	208	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 10.

All (208) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:48:MET:HE1	1:A:63:PHE:HB2	1.39	1.00

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:51:ASN:HD22	1:A:309:ASN:HD22	1.09	0.92
1:B:112:GLU:HB3	1:B:128:MET:HE1	1.54	0.88
1:B:51:ASN:HD22	1:B:309:ASN:HD22	1.22	0.86
1:A:332:ARG:NH1	1:A:339:PRO:HG3	1.92	0.84
1:B:554:ASN:HD22	1:B:554:ASN:N	1.74	0.84
1:A:476:GLU:HB3	1:B:94:ARG:HD3	1.60	0.83
1:B:67:ASN:HD22	1:B:67:ASN:H	1.22	0.82
1:A:599:LEU:HD13	1:A:602:ARG:HH21	1.43	0.81
1:A:71:VAL:HG13	1:A:104:PRO:HD3	1.64	0.79
1:B:238:LYS:H	1:B:238:LYS:HD3	1.48	0.78
1:B:255:LEU:HD11	1:B:274:GLN:HG2	1.64	0.78
1:B:387:ASN:HA	1:B:468:THR:HG21	1.65	0.77
1:B:487:LEU:O	1:B:491:ARG:HG3	1.85	0.77
1:B:371:ASN:ND2	1:B:371:ASN:H	1.83	0.76
1:B:49:ARG:HH22	1:B:59:ASN:ND2	1.84	0.75
1:B:259:SER:O	1:B:262:VAL:HG22	1.85	0.75
1:A:680:PHE:CD1	1:B:659:ARG:HG2	2.24	0.73
1:A:671:LYS:HG3	1:A:671:LYS:O	1.89	0.72
1:B:371:ASN:H	1:B:371:ASN:HD22	1.34	0.72
1:A:332:ARG:HH12	1:A:339:PRO:HG3	1.55	0.70
1:A:108:LEU:HD12	1:A:109:PRO:HD2	1.74	0.69
1:A:38:ALA:HB3	1:A:39:PRO:HD3	1.73	0.69
1:A:680:PHE:CG	1:B:659:ARG:HG2	2.29	0.68
1:A:358:THR:HG21	1:A:501:PRO:HG2	1.75	0.68
1:A:500:ARG:NH1	1:A:616:GLU:HG3	2.09	0.68
1:A:487:LEU:O	1:A:491:ARG:HG3	1.94	0.67
1:A:491:ARG:NH1	1:A:591:PHE:CE1	2.63	0.66
1:B:371:ASN:HD22	1:B:371:ASN:N	1.94	0.66
1:B:444:ASN:HB2	1:B:483:PRO:HG3	1.78	0.66
1:A:612:ILE:H	1:A:628:HIS:HD2	1.42	0.65
1:A:314:LYS:HG3	1:A:315:LEU:N	2.10	0.65
1:B:472:ILE:HA	1:B:482:GLN:HG2	1.79	0.64
1:A:361:LEU:HD13	1:A:504:GLY:HA2	1.80	0.64
1:A:471:SER:HA	1:A:483:PRO:HD2	1.81	0.63
1:A:67:ASN:N	1:A:67:ASN:HD22	1.98	0.62
1:B:374:PRO:HA	1:B:410:ARG:NH1	2.13	0.62
1:A:358:THR:HG23	1:A:507:VAL:CG2	2.29	0.62
1:B:352:LYS:NZ	1:B:352:LYS:HB3	2.15	0.62
1:A:358:THR:HG23	1:A:507:VAL:HG22	1.82	0.62
1:A:189:ILE:HD12	1:A:260:HIS:HB3	1.83	0.61
1:B:45:TRP:CE3	1:B:50:MET:HE1	2.36	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:49:ARG:NH2	1:B:59:ASN:ND2	2.47	0.61
1:B:641:LYS:HB2	1:B:644:GLU:HG3	1.84	0.60
1:B:371:ASN:ND2	1:B:371:ASN:N	2.51	0.59
1:A:642:ALA:HB3	1:A:643:PRO:HD3	1.83	0.59
1:B:613:MET:HA	1:B:629:GLN:O	2.03	0.59
1:A:67:ASN:ND2	1:A:67:ASN:H	2.00	0.58
1:A:595:ASP:HA	1:A:602:ARG:HH11	1.67	0.58
1:B:68:GLY:O	1:B:71:VAL:HG22	2.03	0.58
1:B:500:ARG:NH1	1:B:616:GLU:HG3	2.18	0.58
1:B:67:ASN:HD22	1:B:67:ASN:N	1.99	0.58
1:B:554:ASN:N	1:B:554:ASN:ND2	2.47	0.58
1:B:647:LYS:HB3	1:B:647:LYS:NZ	2.18	0.58
1:B:219:ASN:OD1	1:B:222:GLU:HG2	2.04	0.57
1:B:5:THR:OG1	1:B:7:ILE:HG22	2.04	0.57
1:A:377:ILE:O	1:A:437:PRO:HA	2.05	0.57
1:B:671:LYS:HE3	1:B:673:ILE:HD11	1.86	0.56
1:A:443:LEU:HA	1:A:467:ALA:HB1	1.88	0.56
1:A:660:ALA:O	1:A:664:ILE:HG13	2.06	0.56
1:A:127:GLY:HA2	1:A:424:ILE:HG23	1.87	0.55
1:A:67:ASN:HD22	1:A:67:ASN:H	1.54	0.55
1:A:191:ILE:HG13	3:A:682:TPP:H62	1.89	0.55
1:A:358:THR:HG22	1:A:526:LEU:HD22	1.89	0.55
1:B:307:GLU:HG2	1:B:311:LYS:HE2	1.88	0.55
1:A:332:ARG:HH21	1:A:333:ARG:HG2	1.72	0.55
1:A:130:MET:HE3	1:A:175:LEU:CD1	2.37	0.55
1:B:51:ASN:ND2	1:B:309:ASN:HD22	2.00	0.55
1:A:359:ARG:HB2	1:A:527:SER:O	2.08	0.54
1:A:647:LYS:NZ	1:A:647:LYS:HB3	2.23	0.54
1:A:445:PHE:O	1:A:448:TYR:HB2	2.07	0.54
1:A:486:THR:O	1:A:489:HIS:HB3	2.08	0.54
1:A:484:ILE:HA	1:A:618:LEU:HD23	1.90	0.54
1:A:421:MET:O	1:A:425:MET:HG3	2.08	0.53
1:A:51:ASN:HD22	1:A:309:ASN:ND2	1.91	0.53
1:A:378:GLY:HA3	1:A:438:TYR:CE2	2.43	0.53
1:B:324:PRO:HB2	1:B:325:GLU:OE2	2.09	0.53
1:A:78:LEU:O	1:A:83:TYR:HB2	2.08	0.53
1:A:617:VAL:HG12	1:A:651:PHE:CD2	2.43	0.53
1:A:358:THR:HG22	1:A:526:LEU:CD2	2.40	0.52
1:B:617:VAL:HG11	1:B:646:PHE:CE1	2.45	0.52
1:A:51:ASN:ND2	1:A:309:ASN:HD22	1.91	0.52
1:A:503:ASP:O	1:A:507:VAL:HG23	2.10	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:50:MET:O	1:B:305:GLY:HA3	2.10	0.52
1:B:219:ASN:HB3	1:B:223:ASP:HB2	1.91	0.52
1:B:645:VAL:O	1:B:648:PHE:HB3	2.09	0.52
1:B:487:LEU:HD22	1:B:498:VAL:CG1	2.39	0.52
1:A:540:GLU:CD	1:A:540:GLU:H	2.18	0.51
1:A:204:ALA:O	1:A:208:GLU:HG3	2.10	0.51
1:A:194:ALA:O	1:A:197:ILE:HB	2.11	0.51
1:A:478:GLY:O	1:A:482:GLN:HG3	2.10	0.51
1:A:658:GLU:O	1:A:662:LYS:HG2	2.11	0.51
1:B:641:LYS:O	1:B:645:VAL:HG23	2.10	0.51
1:A:612:ILE:H	1:A:628:HIS:CD2	2.26	0.51
1:A:52:PRO:HD2	1:A:302:LEU:CD1	2.41	0.51
1:B:612:ILE:H	1:B:628:HIS:HD2	1.58	0.51
1:A:52:PRO:HD2	1:A:302:LEU:HD12	1.93	0.50
1:A:71:VAL:CG1	1:A:104:PRO:HD3	2.40	0.50
1:A:613:MET:HA	1:A:629:GLN:O	2.11	0.50
1:B:51:ASN:OD1	1:B:53:THR:HB	2.12	0.50
1:A:31:PRO:HG3	1:A:265:ALA:O	2.12	0.49
1:B:188:LYS:O	1:B:189:ILE:HD13	2.13	0.49
1:A:395:LEU:HD11	1:A:405:GLY:HA2	1.94	0.49
1:B:540:GLU:CD	1:B:540:GLU:H	2.20	0.49
1:A:365:VAL:O	1:A:369:VAL:HG22	2.10	0.49
1:B:359:ARG:HD2	1:B:386:SER:O	2.13	0.49
1:A:67:ASN:N	1:A:67:ASN:ND2	2.58	0.49
1:A:152:TYR:CE1	1:A:181:ILE:HD12	2.48	0.48
1:A:397:PHE:C	1:A:398:GLN:HG2	2.39	0.48
1:B:414:TYR:O	1:B:417:ARG:HD2	2.14	0.48
1:A:667:TYR:CD1	1:A:672:LEU:HD21	2.49	0.48
1:B:44:LEU:HD11	1:B:152:TYR:CD1	2.49	0.48
1:B:173:GLY:HA3	1:B:210:TYR:O	2.13	0.48
1:B:322:LYS:HB3	1:B:323:PHE:CD1	2.49	0.48
1:A:108:LEU:HD12	1:A:109:PRO:CD	2.41	0.48
1:B:378:GLY:HA3	1:B:438:TYR:CZ	2.49	0.47
1:B:469:HIS:HB3	1:B:474:VAL:HG22	1.97	0.47
1:B:554:ASN:O	1:B:582:LYS:HE2	2.14	0.47
1:A:617:VAL:HG12	1:A:651:PHE:CE2	2.49	0.47
1:B:238:LYS:H	1:B:238:LYS:CD	2.15	0.47
1:A:141:LYS:HG2	1:A:323:PHE:CE2	2.49	0.47
1:A:382:ASP:OD2	3:B:682:TPP:HM41	2.15	0.47
1:B:194:ALA:O	1:B:197:ILE:HB	2.15	0.47
1:A:14:THR:O	1:A:18:LEU:HB2	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:382:ASP:OD2	3:B:682:TPP:H62	2.15	0.47
1:B:347:PRO:HG3	1:B:368:ASP:OD2	2.14	0.46
1:B:671:LYS:O	1:B:671:LYS:HG3	2.09	0.46
1:A:144:PHE:HE2	1:A:318:GLU:HB2	1.81	0.46
1:A:127:GLY:CA	1:A:424:ILE:HG23	2.45	0.46
1:A:130:MET:HE3	1:A:175:LEU:HD13	1.96	0.46
1:A:500:ARG:HH12	1:A:616:GLU:HG3	1.81	0.46
1:A:190:THR:HG22	3:A:682:TPP:O1A	2.16	0.45
1:A:141:LYS:HG3	1:A:142:PRO:HD2	1.98	0.45
1:B:635:ARG:HH12	1:B:648:PHE:HE2	1.63	0.45
1:A:141:LYS:HG2	1:A:323:PHE:CZ	2.52	0.45
1:A:552:VAL:CG2	1:A:555:PRO:HB3	2.47	0.45
1:B:140:ASN:O	1:B:141:LYS:HD2	2.17	0.45
1:A:256:HIS:O	1:A:259:SER:HB3	2.17	0.45
1:A:487:LEU:HD12	1:A:491:ARG:HH21	1.81	0.45
1:A:50:MET:O	1:A:305:GLY:HA3	2.16	0.45
1:A:397:PHE:O	1:A:398:GLN:HG2	2.17	0.45
1:A:5:THR:OG1	1:A:7:ILE:HG22	2.17	0.45
1:A:255:LEU:HD13	1:A:274:GLN:CD	2.42	0.45
1:A:416:ILE:HG22	1:B:162:GLU:OE2	2.16	0.45
1:B:658:GLU:O	1:B:662:LYS:HG2	2.17	0.45
1:B:377:ILE:HD11	1:B:412:ILE:HD11	1.99	0.45
1:A:126:VAL:O	1:A:130:MET:HG3	2.17	0.44
1:B:641:LYS:HD2	1:B:644:GLU:OE2	2.17	0.44
1:B:136:ALA:O	1:B:140:ASN:HB2	2.17	0.44
1:B:545:GLY:O	1:B:589:PRO:HD2	2.18	0.44
1:B:612:ILE:H	1:B:628:HIS:CD2	2.35	0.44
1:B:616:GLU:HG2	1:B:618:LEU:HD12	1.99	0.44
1:A:349:TYR:N	1:A:349:TYR:CD1	2.85	0.44
1:B:215:LEU:HD11	1:B:233:GLN:HG2	2.00	0.44
1:A:35:LEU:HD23	1:A:35:LEU:HA	1.84	0.43
1:A:390:ARG:HD2	1:A:411:TYR:CD2	2.52	0.43
1:A:560:VAL:O	1:A:614:SER:HA	2.18	0.43
1:B:66:SER:HA	1:B:121:GLY:HA3	1.99	0.43
3:B:682:TPP:H2	3:B:682:TPP:HN42	1.83	0.43
1:A:384:THR:N	1:A:385:PRO:HD2	2.32	0.43
1:B:358:THR:HA	1:B:361:LEU:HD12	1.99	0.43
1:A:183:ILE:HG12	1:A:244:ILE:HD12	1.99	0.43
1:B:229:LYS:C	1:B:229:LYS:HD2	2.43	0.43
1:B:322:LYS:HB3	1:B:323:PHE:CE1	2.53	0.43
1:B:107:GLU:H	1:B:107:GLU:HG3	1.44	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:352:LYS:NZ	1:A:352:LYS:CB	2.81	0.43
1:A:374:PRO:HA	1:A:410:ARG:NH1	2.34	0.43
1:B:377:ILE:O	1:B:437:PRO:HA	2.18	0.43
1:A:88:GLU:OE1	1:A:92:GLN:NE2	2.52	0.43
1:B:364:THR:HG22	1:B:364:THR:O	2.18	0.43
1:B:141:LYS:HG2	1:B:323:PHE:CE2	2.55	0.42
1:A:176:LYS:O	1:A:178:GLY:N	2.52	0.42
1:B:225:ALA:O	1:B:229:LYS:HB2	2.20	0.42
1:A:96:LEU:HA	1:B:639:SER:O	2.19	0.42
1:A:136:ALA:O	1:A:140:ASN:HB2	2.19	0.42
1:A:469:HIS:HB3	1:A:474:VAL:HG22	2.02	0.42
1:A:118:LEU:HD13	1:A:158:GLY:HA3	2.02	0.42
1:A:548:VAL:CG2	1:A:584:ARG:HH21	2.32	0.42
1:B:443:LEU:HA	1:B:446:VAL:HG23	2.02	0.42
1:A:30:HIS:HA	1:A:31:PRO:HD2	1.93	0.41
1:A:458:LEU:HD11	1:B:479:PRO:HB2	2.01	0.41
1:B:15:ILE:HD13	1:B:77:MET:SD	2.60	0.41
1:B:238:LYS:HB2	1:B:238:LYS:HE3	1.82	0.41
1:B:547:TYR:O	1:B:586:VAL:HG13	2.20	0.41
1:B:356:VAL:CG1	1:B:360:LYS:HB3	2.50	0.41
1:A:416:ILE:HD12	1:A:416:ILE:H	1.85	0.41
1:B:3:GLN:N	1:B:3:GLN:OE1	2.54	0.41
1:A:282:ASN:OD1	1:A:282:ASN:C	2.63	0.41
1:A:345:LYS:NZ	1:A:371:ASN:OD1	2.48	0.41
1:A:584:ARG:NH2	1:A:604:SER:O	2.53	0.41
1:B:167:GLU:HB2	1:B:420:ALA:HB2	2.03	0.41
1:A:14:THR:HG21	1:A:289:VAL:HG13	2.03	0.41
1:A:112:GLU:O	1:A:113:VAL:HG13	2.20	0.41
1:A:271:ASP:O	1:A:274:GLN:HG3	2.21	0.41
1:A:345:LYS:HD3	1:A:372:GLN:CD	2.45	0.41
1:A:482:GLN:HA	1:A:483:PRO:HD3	1.89	0.41
1:B:390:ARG:HD2	1:B:411:TYR:CD2	2.56	0.41
1:A:612:ILE:N	1:A:628:HIS:HD2	2.14	0.41
1:B:489:HIS:CD2	1:B:489:HIS:C	2.99	0.41
1:A:346:LEU:HA	1:A:347:PRO:HD3	1.84	0.40
1:A:416:ILE:HD13	1:B:158:GLY:HA2	2.02	0.40
1:B:56:ASP:O	1:B:57:TRP:C	2.61	0.40
1:A:259:SER:O	1:A:262:VAL:HG22	2.22	0.40
1:A:438:TYR:HA	1:A:464:ILE:O	2.22	0.40
1:A:471:SER:O	1:A:474:VAL:HG23	2.22	0.40
1:A:491:ARG:NH1	1:A:591:PHE:CZ	2.89	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:551:ASP:OD1	1:A:584:ARG:HD2	2.22	0.40
1:B:298:GLN:OE1	1:B:302:LEU:HD22	2.21	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	676/680 (99%)	630 (93%)	43 (6%)	3 (0%)	30	51
1	B	676/680 (99%)	635 (94%)	37 (6%)	4 (1%)	21	42
All	All	1352/1360 (99%)	1265 (94%)	80 (6%)	7 (0%)	24	46

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	617	VAL
1	A	148	ASP
1	B	263	ALA
1	A	177	LEU
1	A	617	VAL
1	B	198	SER
1	B	71	VAL

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	410/553 (74%)	389 (95%)	21 (5%)	21	45
1	B	551/553 (100%)	518 (94%)	33 (6%)	17	37
All	All	961/1106 (87%)	907 (94%)	54 (6%)	19	40

All (54) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	189	ILE
1	A	238	LYS
1	A	255	LEU
1	A	270	ASP
1	A	311	LYS
1	A	314	LYS
1	A	326	LEU
1	A	338	LEU
1	A	341	ASN
1	A	352	LYS
1	A	360	LYS
1	A	392	LYS
1	A	398	GLN
1	A	486	THR
1	A	528	ARG
1	A	580	ASN
1	A	582	LYS
1	A	588	LEU
1	A	596	LYS
1	A	654	GLU
1	A	671	LYS
1	B	3	GLN
1	B	50	MET
1	B	67	ASN
1	B	71	VAL
1	B	107	GLU
1	B	113	VAL
1	B	122	ILE
1	B	218	GLU
1	B	229	LYS
1	B	233	GLN
1	B	238	LYS
1	B	261	SER
1	B	270	ASP
1	B	302	LEU

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Mol	Chain	Res	Type
1	B	311	LYS
1	B	322	LYS
1	B	326	LEU
1	B	337	GLN
1	B	338	LEU
1	B	341	ASN
1	B	343	GLU
1	B	352	LYS
1	B	354	SER
1	B	358	THR
1	B	360	LYS
1	B	371	ASN
1	B	389	THR
1	B	392	LYS
1	B	401	SER
1	B	486	THR
1	B	554	ASN
1	B	588	LEU
1	B	678	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (25) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	309	ASN
1	A	313	ASN
1	A	320	GLN
1	A	387	ASN
1	A	398	GLN
1	A	419	HIS
1	A	489	HIS
1	A	533	GLN
1	A	628	HIS
1	B	3	GLN
1	B	54	ASN
1	B	67	ASN
1	B	95	GLN
1	B	124	ASN
1	B	132	GLN
1	B	256	HIS
1	B	296	HIS
1	B	309	ASN
1	B	371	ASN

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Mol	Chain	Res	Type
1	B	387	ASN
1	B	489	HIS
1	B	554	ASN
1	B	580	ASN
1	B	597	GLN
1	B	628	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 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	682	2	26,27,27	1.87	8 (30%)	38,40,40	1.73	7 (18%)
3	TPP	A	682	2	26,27,27	1.64	6 (23%)	38,40,40	1.35	8 (21%)

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	682	2	-	5/17/17/17	0/2/2/2
3	TPP	A	682	2	-	3/17/17/17	0/2/2/2

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	682	TPP	PA-O3A	-5.00	1.54	1.59
3	A	682	TPP	C4-N3	-3.84	1.32	1.39
3	B	682	TPP	C4-N3	-3.62	1.32	1.39
3	A	682	TPP	C4'-N3'	3.29	1.39	1.35
3	B	682	TPP	C7'-N3	3.05	1.55	1.48
3	B	682	TPP	C2'-N3'	-2.48	1.29	1.34
3	A	682	TPP	CM2-C2'	-2.42	1.43	1.49
3	B	682	TPP	CM2-C2'	-2.41	1.43	1.49
3	B	682	TPP	C2-N3	2.25	1.37	1.32
3	A	682	TPP	CM4-C4	-2.19	1.45	1.49
3	A	682	TPP	C4'-N4'	-2.15	1.28	1.34
3	B	682	TPP	PB-O2B	-2.14	1.46	1.54
3	A	682	TPP	PB-O2B	-2.07	1.47	1.54
3	B	682	TPP	C4'-N3'	2.04	1.37	1.35

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	682	TPP	O2A-PA-O3A	6.40	124.58	107.27
3	B	682	TPP	C2-S1-C5	-4.55	88.20	91.22
3	A	682	TPP	C5'-C7'-N3	-3.22	106.04	112.97
3	A	682	TPP	C6'-N1'-C2'	2.83	120.72	116.07
3	A	682	TPP	O2A-PA-O3A	2.77	114.76	107.27
3	B	682	TPP	C5'-C7'-N3	2.47	118.29	112.97
3	A	682	TPP	C2-S1-C5	-2.44	89.60	91.22
3	A	682	TPP	N1'-C2'-N3'	-2.43	121.48	125.53
3	A	682	TPP	O3B-PB-O2B	2.40	116.78	107.80
3	A	682	TPP	O7-PA-O1A	-2.36	99.60	108.94
3	B	682	TPP	C6'-N1'-C2'	2.34	119.91	116.07
3	B	682	TPP	O7-PA-O1A	-2.27	99.94	108.94
3	B	682	TPP	C5'-C6'-N1'	-2.18	120.28	123.83
3	B	682	TPP	N1'-C2'-N3'	-2.10	122.03	125.53
3	A	682	TPP	CM2-C2'-N3'	2.00	120.12	117.13

There are no chirality outliers.

All (8) torsion outliers are listed below:

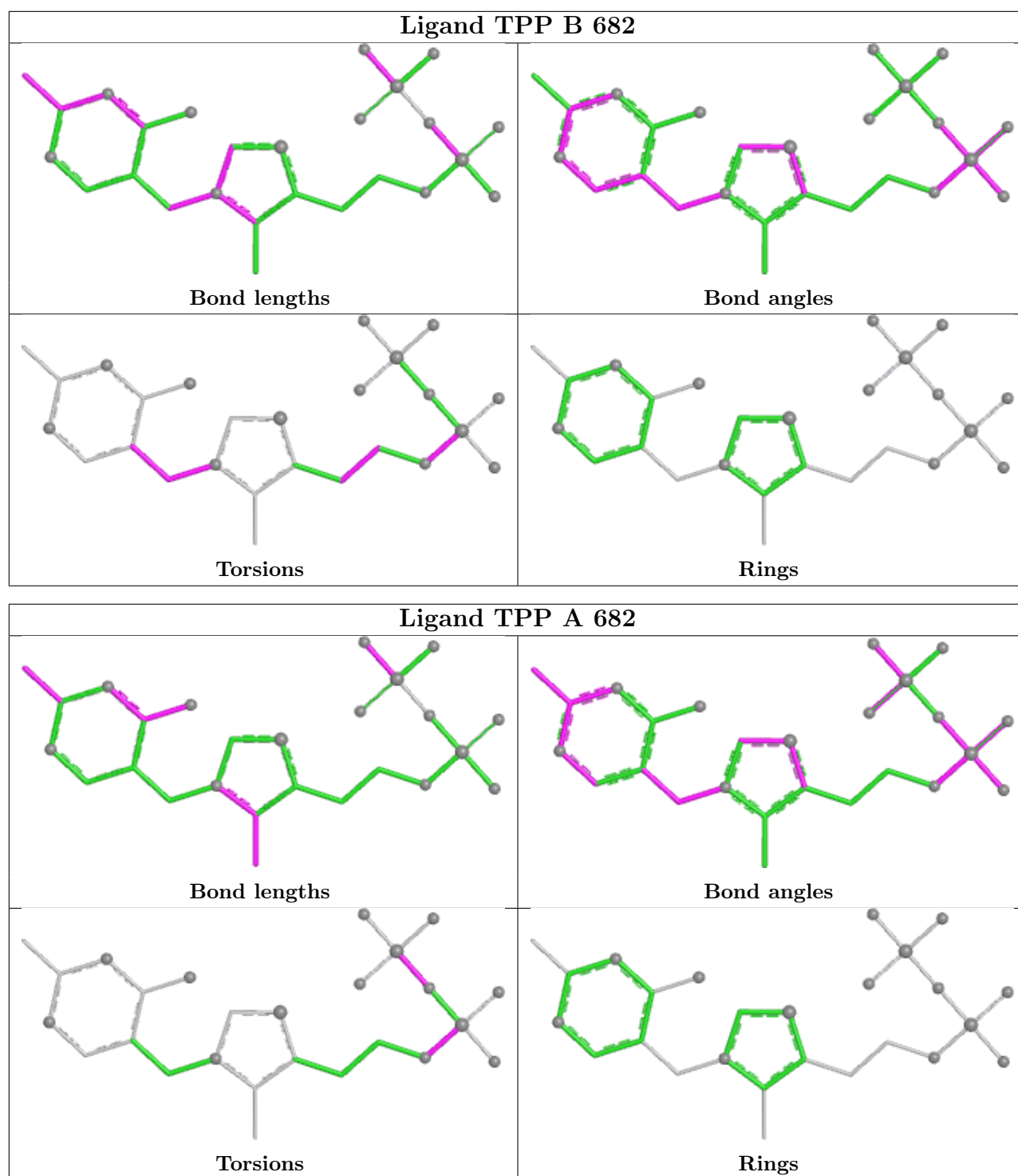
Mol	Chain	Res	Type	Atoms
3	A	682	TPP	C7-O7-PA-O1A
3	B	682	TPP	C5-C6-C7-O7
3	A	682	TPP	C7-O7-PA-O3A
3	B	682	TPP	C7-O7-PA-O1A
3	A	682	TPP	PA-O3A-PB-O1B
3	B	682	TPP	C5'-C7'-N3-C4
3	B	682	TPP	C4'-C5'-C7'-N3
3	B	682	TPP	C5'-C7'-N3-C2

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	682	TPP	3	0
3	A	682	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.



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

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.