



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:36 PM UTC

PDB ID : 8DAZ / pdb_00008daz
Title : Crystal structure of DMATS1 prenyltransferase in complex with L-Trp and GSPP
Authors : Eaton, S.A.; Ronnebaum, T.A.; Roose, B.W.; Christianson, D.W.
Deposited on : 2022-06-14
Resolution : 2.49 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

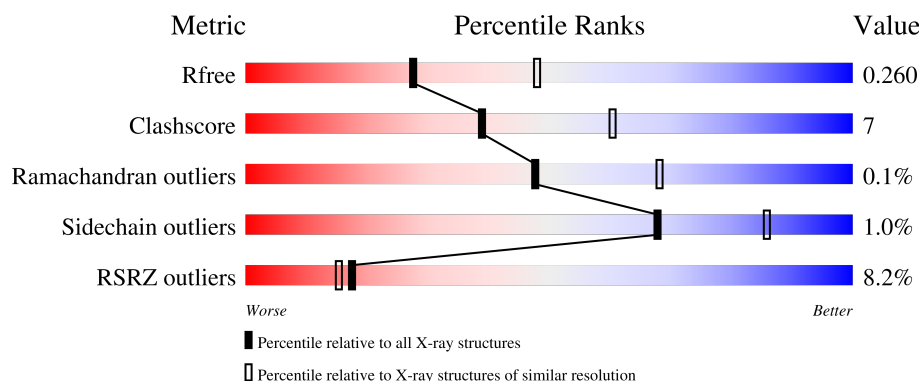
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

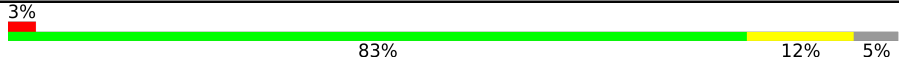



The reported resolution of this entry is 2.49 Å.

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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	419	
1	B	419	
1	C	419	
1	D	419	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GST	C	501	-	-	X	-

2 Entry composition [i](#)

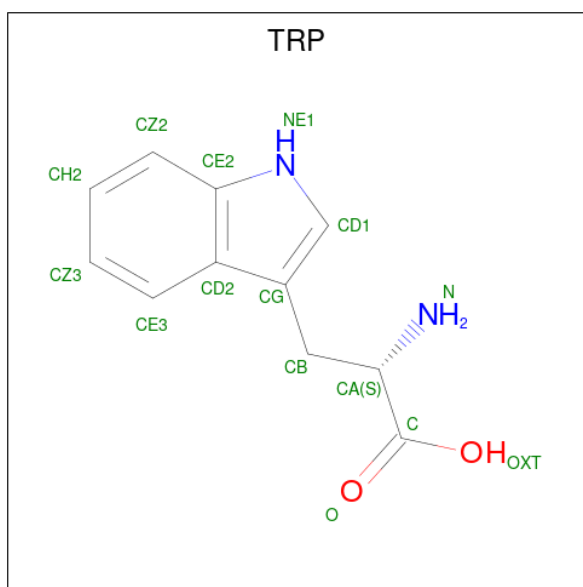
There are 4 unique types of molecules in this entry. The entry contains 11673 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Dimethylallyltryptophan synthase 1.

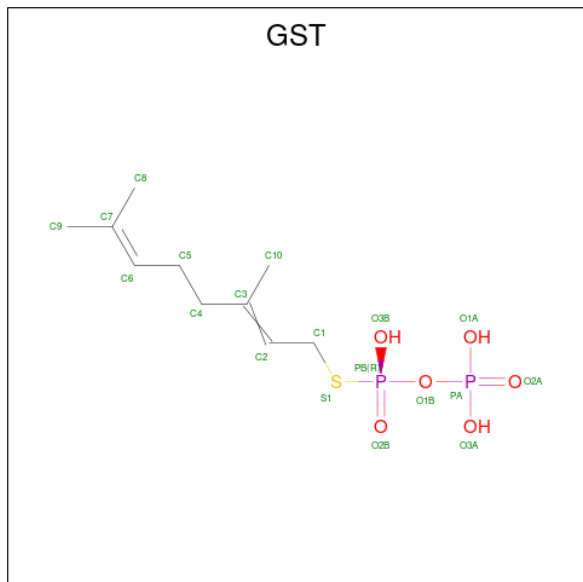
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	397	Total	C	N	O	S	0	0	0
			3099	2010	514	567	8			
1	B	363	Total	C	N	O	S	0	0	0
			2789	1817	461	504	7			
1	C	392	Total	C	N	O	S	0	0	0
			2978	1931	489	550	8			
1	D	355	Total	C	N	O	S	0	0	0
			2656	1737	432	480	7			

- Molecule 2 is TRYPTOPHAN (CCD ID: TRP) (formula: $C_{11}H_{12}N_2O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			15	11	2	2		
2	C	1	Total	C	N	O	0	0
			15	11	2	2		

- Molecule 3 is GERANYL S-THIOLODIPHOSPHATE (CCD ID: GST) (formula: $C_{10}H_{20}O_6P_2S$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	C	1	Total	C	O	P	S	0	0
			19	10	6	2	1		

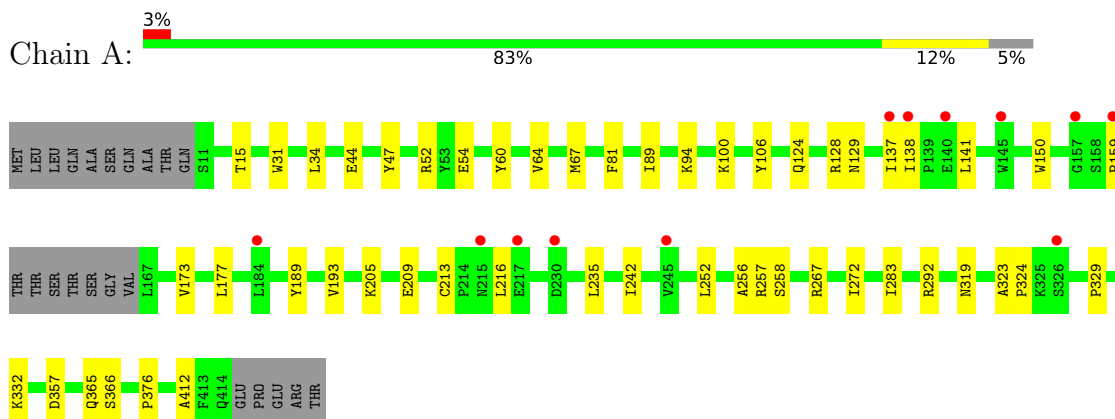
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	43	Total	O	0	0
			43	43		
4	B	22	Total	O	0	0
			22	22		
4	C	24	Total	O	0	0
			24	24		
4	D	13	Total	O	0	0
			13	13		

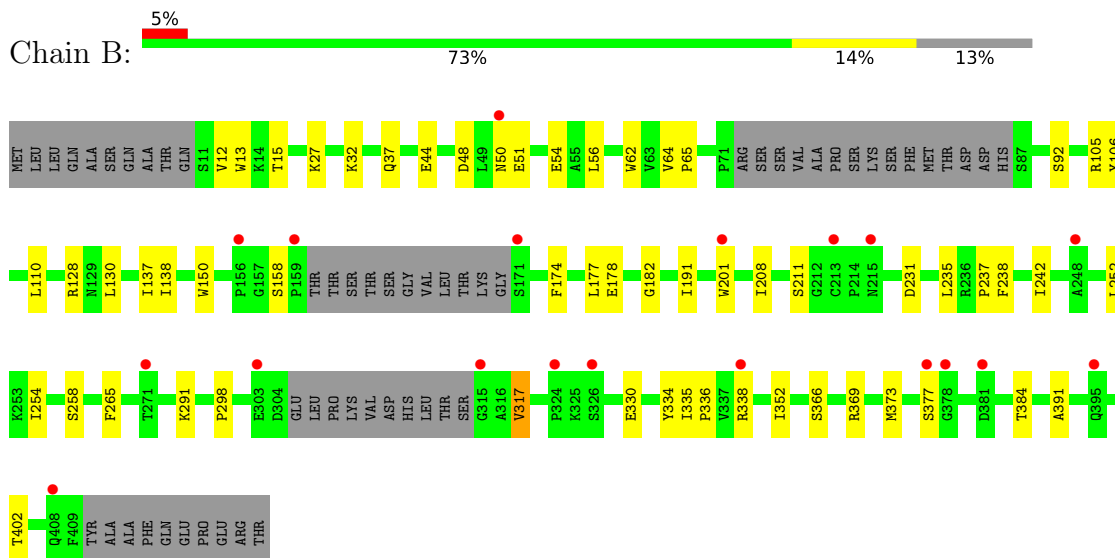
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

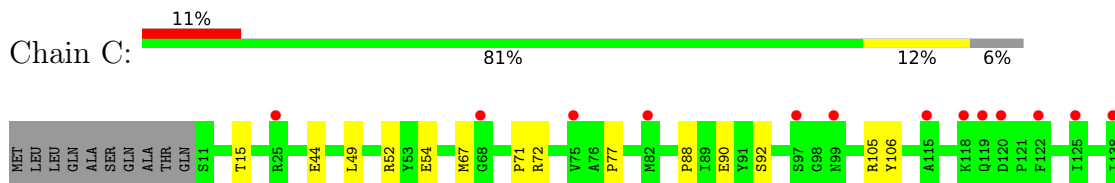
• Molecule 1: Dimethylallyltryptophan synthase 1

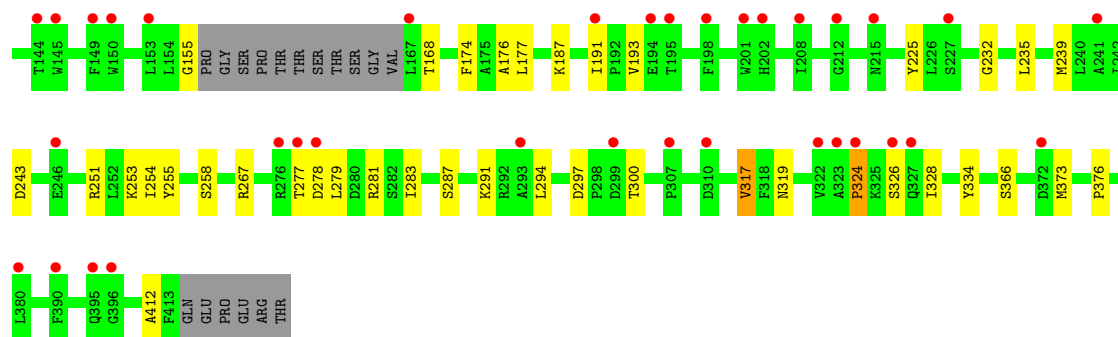


• Molecule 1: Dimethylallyltryptophan synthase 1

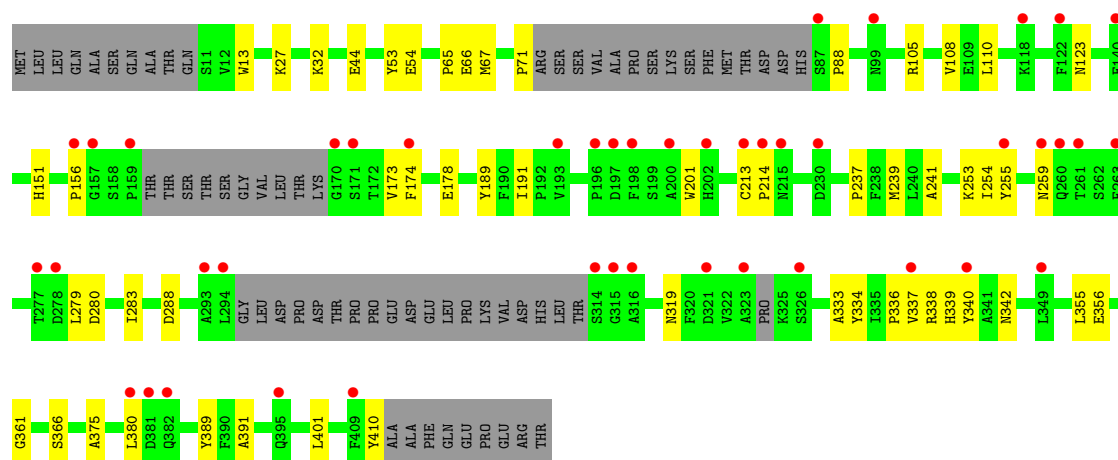
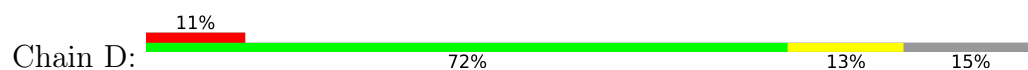


• Molecule 1: Dimethylallyltryptophan synthase 1





• Molecule 1: Dimethylallyltryptophan synthase 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	89.83Å 107.36Å 179.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	92.11 – 2.49 92.11 – 2.49	Depositor EDS
% Data completeness (in resolution range)	94.8 (92.11-2.49) 84.2 (92.11-2.49)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.36 (at 2.48Å)	Xtriage
Refinement program	PHENIX 1.14_3260	Depositor
R, R_{free}	0.236 , 0.261 0.236 , 0.260	Depositor DCC
R_{free} test set	2000 reflections (3.25%)	wwPDB-VP
Wilson B-factor (Å ²)	50.7	Xtriage
Anisotropy	0.015	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 51.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	11673	wwPDB-VP
Average B, all atoms (Å ²)	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.72% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GST

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	0.32	0/3196	0.54	0/4372
1	B	0.38	0/2876	0.61	1/3941 (0.0%)
1	C	0.35	0/3067	0.59	2/4204 (0.0%)
1	D	0.41	1/2735 (0.0%)	0.65	4/3750 (0.1%)
All	All	0.36	1/11874 (0.0%)	0.59	7/16267 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	336	PRO	C-O	-7.89	1.17	1.24

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	336	PRO	CB-CA-C	-8.41	104.81	111.87
1	C	324	PRO	CB-CA-C	-8.01	99.66	113.20
1	D	342	ASN	CA-C-N	-6.59	110.53	121.80
1	D	342	ASN	C-N-CA	-6.59	110.53	121.80
1	C	72	ARG	N-CA-C	-5.10	107.60	113.88
1	B	238	PHE	CA-CB-CG	5.04	118.84	113.80
1	D	259	ASN	N-CA-C	-5.01	106.58	113.30

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	3099	0	2950	42	0
1	B	2789	0	2623	37	0
1	C	2978	0	2761	35	0
1	D	2656	0	2451	40	0
2	A	15	0	9	2	0
2	C	15	0	9	3	0
3	C	19	0	17	9	0
4	A	43	0	0	6	0
4	B	22	0	0	6	0
4	C	24	0	0	4	0
4	D	13	0	0	2	0
All	All	11673	0	10820	153	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 7.

All (153) 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:338:ARG:HG2	4:B:507:HOH:O	1.45	1.17
1:A:94:LYS:HE2	4:A:632:HOH:O	1.60	1.00
1:D:105:ARG:HG2	1:D:178:GLU:HG2	1.50	0.91
1:C:317:VAL:HG13	1:C:334:TYR:HB2	1.63	0.81
1:C:279:LEU:HB2	4:C:616:HOH:O	1.80	0.80
1:C:281:ARG:CD	4:C:620:HOH:O	2.30	0.78
1:A:129:ASN:HB2	4:A:608:HOH:O	1.84	0.77
1:A:138:ILE:CG2	1:A:141:LEU:HD13	2.17	0.74
1:A:257:ARG:NH2	2:A:501:TRP:O	2.21	0.73
1:A:376:PRO:HB3	1:A:412:ALA:HB1	1.69	0.72
1:B:317:VAL:HG13	1:B:334:TYR:HB2	1.70	0.72
1:D:280:ASP:O	1:D:283:ILE:HG22	1.92	0.70
1:A:44:GLU:HB3	1:A:366:SER:HB3	1.75	0.69
1:A:34:LEU:HD21	1:A:89:ILE:CD1	2.23	0.69
1:D:280:ASP:HA	1:D:283:ILE:CG2	2.23	0.67
1:D:375:ALA:HB2	1:D:380:LEU:HD21	1.77	0.67
1:A:138:ILE:HG22	1:A:141:LEU:HD13	1.77	0.67
1:A:94:LYS:CG	4:A:632:HOH:O	2.43	0.67
1:D:280:ASP:HA	1:D:283:ILE:HG22	1.77	0.67
1:C:235:LEU:HD23	1:C:258:SER:HB2	1.76	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:280:ASP:C	1:D:283:ILE:HG22	2.20	0.66
1:A:235:LEU:HD23	1:A:258:SER:HB2	1.78	0.66
1:B:377:SER:CB	4:B:519:HOH:O	2.43	0.65
1:C:155:GLY:C	4:C:614:HOH:O	2.39	0.64
1:D:280:ASP:O	1:D:283:ILE:CG2	2.46	0.63
1:A:34:LEU:HD21	1:A:89:ILE:HD12	1.80	0.62
1:D:280:ASP:CA	1:D:283:ILE:HG22	2.30	0.62
1:A:34:LEU:CD2	1:A:89:ILE:HD13	2.29	0.62
1:D:44:GLU:HB3	1:D:366:SER:HB3	1.82	0.62
1:B:235:LEU:HD23	1:B:258:SER:HB3	1.83	0.60
1:C:267:ARG:HG3	1:C:283:ILE:HG21	1.83	0.60
1:D:27:LYS:HE3	1:D:65:PRO:HA	1.84	0.59
1:A:81:PHE:O	2:A:501:TRP:N	2.36	0.59
3:C:501:GST:H11	2:C:502:TRP:CZ2	2.38	0.59
1:A:34:LEU:HD11	1:A:89:ILE:HD11	1.86	0.58
1:A:15:THR:HG23	1:C:54:GLU:HG2	1.84	0.58
1:A:100:LYS:HD3	1:D:288:ASP:HA	1.86	0.58
1:A:34:LEU:CD2	1:A:89:ILE:CD1	2.83	0.57
1:B:44:GLU:HB3	1:B:366:SER:HB3	1.87	0.57
1:D:334:TYR:HB3	1:D:389:TYR:CD1	2.40	0.57
1:A:94:LYS:HG2	4:A:632:HOH:O	2.03	0.57
1:B:15:THR:HG23	1:D:54:GLU:HG2	1.87	0.56
1:A:47:TYR:O	1:A:52:ARG:NH1	2.34	0.55
1:D:410:TYR:C	4:D:508:HOH:O	2.49	0.55
1:C:92:SER:HB3	3:C:501:GST:H82	1.89	0.55
1:A:34:LEU:HD22	1:A:89:ILE:HD13	1.89	0.54
1:D:254:ILE:O	1:D:319:ASN:HA	2.08	0.54
1:B:158:SER:HA	4:B:510:HOH:O	2.08	0.53
1:B:231:ASP:HB3	1:B:265:PHE:CE1	2.43	0.53
1:C:44:GLU:HB3	1:C:366:SER:HB3	1.89	0.53
1:D:151:HIS:HE1	1:D:156:PRO:HB2	1.73	0.53
1:D:333:ALA:O	1:D:391:ALA:HA	2.08	0.53
1:D:279:LEU:O	1:D:283:ILE:HG22	2.08	0.53
1:B:50:ASN:OD1	1:D:53:TYR:OH	2.25	0.53
1:B:92:SER:OG	1:B:105:ARG:NE	2.34	0.53
1:A:128:ARG:HH21	1:A:150:TRP:CD1	2.27	0.52
1:D:105:ARG:HD2	4:D:502:HOH:O	2.10	0.52
1:A:267:ARG:HG3	1:A:283:ILE:HG21	1.92	0.51
1:D:355:LEU:HD21	1:D:401:LEU:HD12	1.92	0.51
1:C:287:SER:OG	1:C:291:LYS:NZ	2.44	0.50
1:D:356:GLU:HG2	1:D:361:GLY:HA3	1.91	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:62:TRP:HE1	1:B:137:ILE:HD12	1.77	0.50
1:B:291:LYS:HD2	1:B:298:PRO:HA	1.93	0.49
1:A:138:ILE:HG21	1:A:141:LEU:HD13	1.91	0.49
1:B:27:LYS:HG2	1:B:65:PRO:HA	1.94	0.49
1:B:51:GLU:CD	1:B:182:GLY:H	2.20	0.49
1:B:128:ARG:HH21	1:B:150:TRP:CD1	2.31	0.48
1:D:105:ARG:CG	1:D:178:GLU:HG2	2.31	0.48
1:D:174:PHE:CE2	1:D:191:ILE:HD11	2.49	0.48
1:C:174:PHE:HZ	3:C:501:GST:H101	1.79	0.48
1:A:292:ARG:NH2	1:A:357:ASP:OD2	2.43	0.48
1:B:231:ASP:HB3	1:B:265:PHE:HE1	1.78	0.48
1:D:239:MET:HB3	1:D:255:TYR:HB2	1.96	0.48
1:A:173:VAL:HA	1:A:189:TYR:O	2.14	0.47
1:D:151:HIS:CE1	1:D:156:PRO:HB2	2.49	0.47
1:C:168:THR:HG22	1:C:193:VAL:HG22	1.95	0.47
1:D:201:TRP:HB2	1:D:237:PRO:HB2	1.96	0.47
1:B:12:VAL:HG12	1:B:56:LEU:HD12	1.95	0.47
1:B:208:ILE:O	1:B:211:SER:OG	2.30	0.47
1:C:174:PHE:CZ	3:C:501:GST:H101	2.49	0.47
1:C:243:ASP:OD2	1:C:251:ARG:HD3	2.15	0.47
1:C:277:THR:OG1	1:C:278:ASP:N	2.48	0.47
1:C:326:SER:C	1:C:328:ILE:H	2.23	0.47
1:C:297:ASP:O	1:C:300:THR:OG1	2.31	0.47
1:B:110:LEU:HD11	1:B:130:LEU:HD22	1.96	0.46
1:B:242:ILE:HG22	1:B:252:LEU:HD23	1.97	0.46
1:C:49:LEU:HD23	1:C:52:ARG:CZ	2.45	0.46
1:A:159:PRO:HG2	1:A:193:VAL:HG23	1.98	0.46
1:B:106:TYR:CZ	1:B:177:LEU:HD12	2.50	0.46
1:C:90:GLU:O	3:C:501:GST:H83	2.16	0.46
3:C:501:GST:H2	3:C:501:GST:H52	1.41	0.46
1:C:176:ALA:HB1	3:C:501:GST:H92	1.98	0.46
1:C:239:MET:HB3	1:C:255:TYR:HB2	1.98	0.46
1:A:213:CYS:HB2	1:A:216:LEU:HD21	1.98	0.46
1:A:31:TRP:CZ3	1:A:60:TYR:HB2	2.51	0.45
1:B:158:SER:CA	4:B:510:HOH:O	2.65	0.45
1:C:67:MET:HE1	1:C:88:PRO:HG2	1.99	0.45
1:B:373:MET:HB3	1:B:373:MET:HE3	1.66	0.45
3:C:501:GST:H102	2:C:502:TRP:CG	2.52	0.45
1:A:81:PHE:HA	4:A:607:HOH:O	2.17	0.45
1:A:67:MET:HE2	1:A:89:ILE:HD11	1.98	0.45
1:B:37:GLN:HA	1:B:373:MET:SD	2.57	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:129:ASN:CB	4:A:608:HOH:O	2.53	0.45
1:C:251:ARG:HH21	1:C:253:LYS:HD3	1.81	0.45
1:D:213:CYS:SG	1:D:214:PRO:HD2	2.56	0.45
1:A:54:GLU:HG2	1:C:15:THR:HG23	1.98	0.45
1:C:373:MET:HB3	1:C:373:MET:HE3	1.75	0.45
1:C:225:TYR:O	1:C:232:GLY:HA3	2.17	0.44
1:C:251:ARG:NH2	1:C:253:LYS:HD3	2.33	0.44
1:A:34:LEU:HD11	1:A:89:ILE:CD1	2.47	0.44
1:A:124:GLN:HB3	1:A:150:TRP:CZ2	2.53	0.44
1:B:369:ARG:NH1	4:B:502:HOH:O	2.50	0.44
1:D:338:ARG:C	1:D:340:TYR:H	2.26	0.44
1:C:106:TYR:CZ	1:C:177:LEU:HD12	2.53	0.44
1:D:13:TRP:CZ2	1:D:32:LYS:HA	2.52	0.44
1:B:105:ARG:HD2	4:B:504:HOH:O	2.18	0.44
1:C:254:ILE:O	1:C:319:ASN:HA	2.17	0.43
1:B:174:PHE:CE2	1:B:191:ILE:HD11	2.54	0.43
1:D:66:GLU:HB2	1:D:110:LEU:HD22	2.00	0.43
1:C:174:PHE:CE2	1:C:191:ILE:HD11	2.54	0.43
1:D:110:LEU:O	1:D:123:ASN:ND2	2.48	0.43
1:B:48:ASP:OD1	1:B:48:ASP:N	2.51	0.43
1:D:173:VAL:HA	1:D:189:TYR:O	2.19	0.43
1:A:205:LYS:HE2	1:A:209:GLU:OE2	2.19	0.43
1:B:338:ARG:HA	1:B:384:THR:HB	2.01	0.43
1:D:108:VAL:O	1:D:174:PHE:HB2	2.19	0.43
1:A:106:TYR:CZ	1:A:177:LEU:HD12	2.54	0.42
1:D:67:MET:HE1	1:D:88:PRO:HG2	2.00	0.42
1:B:64:VAL:HG22	1:B:65:PRO:HD3	2.01	0.42
1:C:77:PRO:HG2	4:C:621:HOH:O	2.18	0.42
1:C:92:SER:HG	1:C:105:ARG:HE	1.64	0.42
1:B:335:ILE:HA	1:B:336:PRO:HD3	1.89	0.42
1:C:324:PRO:C	1:C:326:SER:H	2.28	0.42
1:D:356:GLU:CG	1:D:361:GLY:HA3	2.50	0.42
1:B:201:TRP:HB2	1:B:237:PRO:HB2	2.01	0.42
1:D:375:ALA:HB2	1:D:380:LEU:CD2	2.49	0.41
1:A:124:GLN:O	1:A:150:TRP:HH2	2.03	0.41
1:B:64:VAL:CG2	1:B:65:PRO:HD3	2.51	0.41
1:A:242:ILE:HG22	1:A:252:LEU:HD23	2.02	0.41
1:C:376:PRO:HB3	1:C:412:ALA:HB1	2.03	0.41
1:B:13:TRP:CZ2	1:B:32:LYS:HA	2.56	0.41
1:B:201:TRP:HZ3	1:B:254:ILE:HD13	1.86	0.41
1:A:272:ILE:HD13	1:A:329:PRO:HG2	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:105:ARG:HG2	1:B:178:GLU:HG2	2.03	0.41
1:B:391:ALA:HB3	1:B:402:THR:HB	2.02	0.41
3:C:501:GST:H102	2:C:502:TRP:CD2	2.56	0.41
1:A:323:ALA:HA	1:A:324:PRO:HD2	1.91	0.40
1:C:294:LEU:HA	1:C:294:LEU:HD23	1.82	0.40
1:D:71:PRO:HB3	1:D:410:TYR:CE1	2.57	0.40
1:A:235:LEU:HB3	1:A:256:ALA:HB1	2.04	0.40
1:D:241:ALA:HB3	1:D:253:LYS:HB2	2.04	0.40
1:D:375:ALA:CB	1:D:380:LEU:HD21	2.48	0.40
1:A:319:ASN:OD1	1:A:332:LYS:HB3	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	393/419 (94%)	378 (96%)	15 (4%)	0	100	100
1	B	355/419 (85%)	342 (96%)	13 (4%)	0	100	100
1	C	388/419 (93%)	374 (96%)	14 (4%)	0	100	100
1	D	345/419 (82%)	330 (96%)	14 (4%)	1 (0%)	36	55
All	All	1481/1676 (88%)	1424 (96%)	56 (4%)	1 (0%)	48	68

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	339	HIS

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	320/363 (88%)	317 (99%)	3 (1%)	70	87
1	B	280/363 (77%)	275 (98%)	5 (2%)	51	77
1	C	292/363 (80%)	289 (99%)	3 (1%)	68	86
1	D	254/363 (70%)	253 (100%)	1 (0%)	84	93
All	All	1146/1452 (79%)	1134 (99%)	12 (1%)	68	86

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	VAL
1	A	137	ILE
1	A	365	GLN
1	B	54	GLU
1	B	138	ILE
1	B	317	VAL
1	B	330	GLU
1	B	352	ILE
1	C	71	PRO
1	C	187	LYS
1	C	317	VAL
1	D	337	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	221	HIS
1	A	387	GLN
1	B	151	HIS
1	B	221	HIS
1	B	360	HIS
1	B	387	GLN
1	C	37	GLN

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Mol	Chain	Res	Type
1	C	148	HIS
1	C	151	HIS
1	C	379	GLN
1	D	151	HIS

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](#)

3 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	$\# Z > 2$
3	GST	C	501	-	15,18,18	1.58	2 (13%)	18,25,25	2.11	8 (44%)
2	TRP	C	502	-	15,16,16	1.56	3 (20%)	18,22,22	1.51	5 (27%)
2	TRP	A	501	-	15,16,16	1.55	2 (13%)	18,22,22	1.23	4 (22%)

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	GST	C	501	-	-	5/13/19/19	-
2	TRP	C	502	-	-	0/8/8/8	0/2/2/2
2	TRP	A	501	-	-	0/8/8/8	0/2/2/2

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	501	GST	C1-S1	-3.91	1.79	1.84
2	C	502	TRP	CD2-CE2	-3.90	1.36	1.41
2	A	501	TRP	CD2-CE2	-3.77	1.36	1.41
3	C	501	GST	PB-O3B	-3.34	1.48	1.56
2	A	501	TRP	CD1-NE1	-2.86	1.32	1.37
2	C	502	TRP	CD1-NE1	-2.65	1.32	1.37
2	C	502	TRP	CD2-CG	-2.24	1.40	1.44

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	501	GST	C10-C3-C4	4.06	122.28	115.23
3	C	501	GST	C5-C4-C3	-3.73	100.83	113.19
3	C	501	GST	C8-C7-C6	-3.47	112.23	122.66
3	C	501	GST	C8-C7-C9	3.14	121.81	114.59
3	C	501	GST	C5-C6-C7	-2.93	117.88	127.64
2	C	502	TRP	CG-CD1-NE1	-2.86	107.17	110.31
2	C	502	TRP	CZ2-CE2-CD2	-2.75	119.52	122.19
2	A	501	TRP	CG-CD1-NE1	-2.43	107.64	110.31
3	C	501	GST	C2-C1-S1	-2.21	101.08	111.87
3	C	501	GST	O1A-PA-O1B	2.15	111.85	104.64
2	C	502	TRP	CE3-CD2-CE2	2.15	121.07	118.84
2	C	502	TRP	CD2-CG-CD1	2.10	108.31	106.16
3	C	501	GST	C4-C3-C2	-2.07	116.52	121.17
2	A	501	TRP	OXT-C-O	-2.06	119.41	124.08
2	A	501	TRP	CZ2-CE2-CD2	-2.04	120.22	122.19
2	A	501	TRP	CA-CB-CG	2.03	117.34	113.49
2	C	502	TRP	OXT-C-O	-2.01	119.53	124.08

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	501	GST	PB-O1B-PA-O1A
3	C	501	GST	C3-C4-C5-C6

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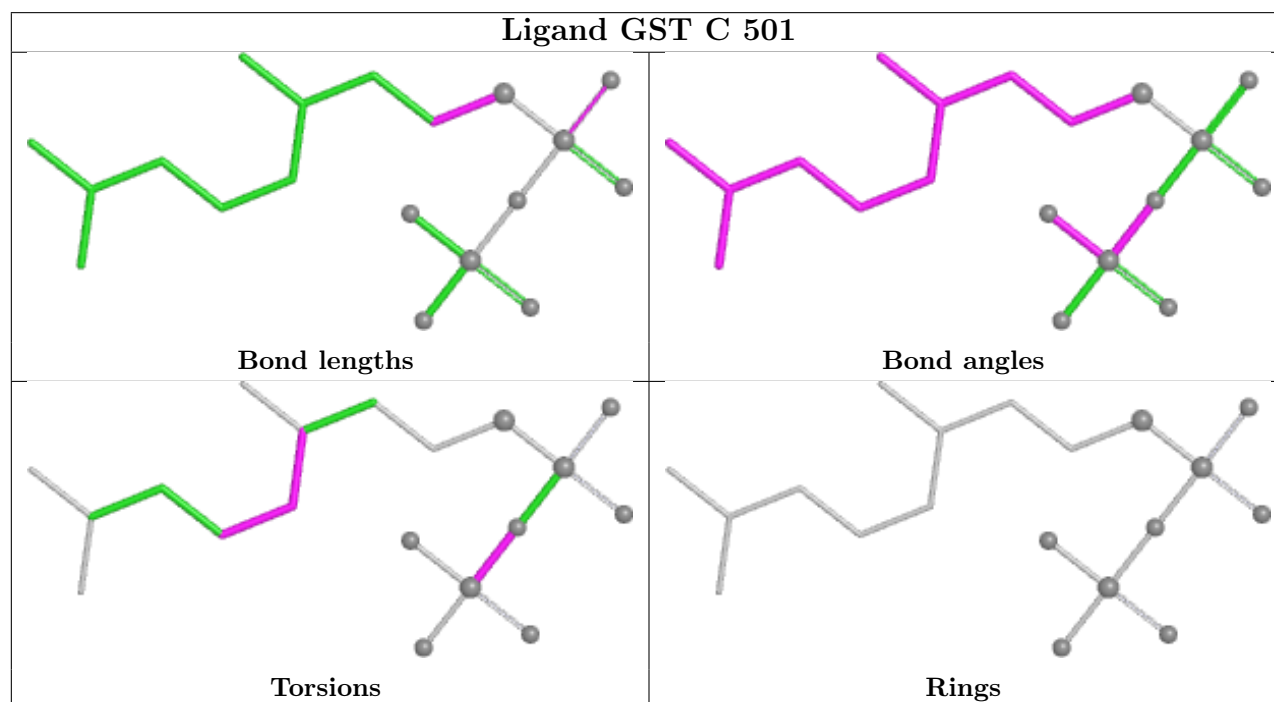
Mol	Chain	Res	Type	Atoms
3	C	501	GST	C10-C3-C4-C5
3	C	501	GST	C2-C3-C4-C5
3	C	501	GST	PB-O1B-PA-O3A

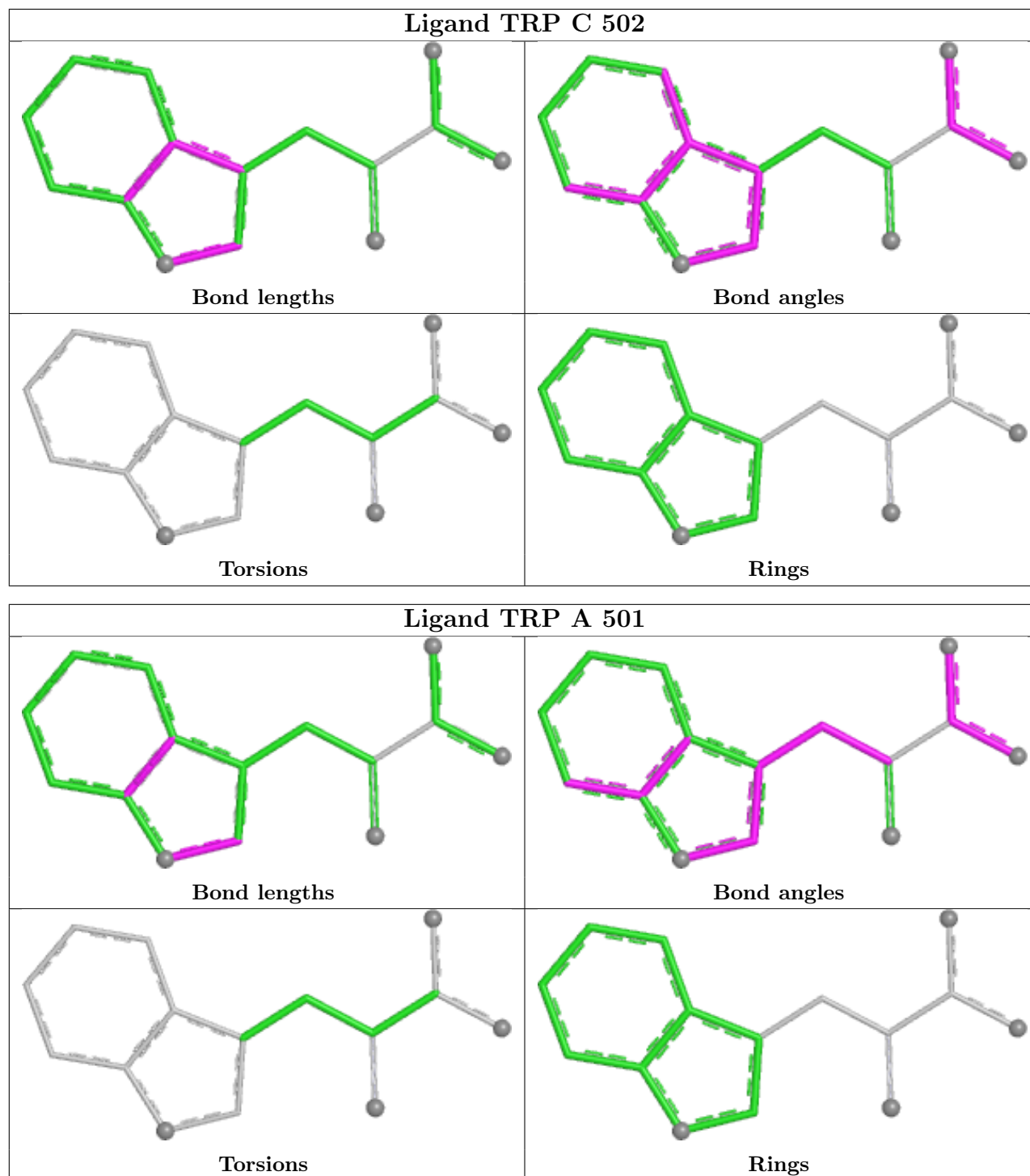
There are no ring outliers.

3 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	501	GST	9	0
2	C	502	TRP	3	0
2	A	501	TRP	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 [i](#)

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	397/419 (94%)	0.37	12 (3%)	52	48	22, 46, 87, 115	0
1	B	363/419 (86%)	0.56	19 (5%)	33	29	20, 51, 94, 119	0
1	C	392/419 (93%)	0.83	48 (12%)	8	7	31, 67, 100, 153	0
1	D	355/419 (84%)	0.87	44 (12%)	8	6	32, 63, 103, 137	0
All	All	1507/1676 (89%)	0.65	123 (8%)	17	15	20, 58, 99, 153	0

All (123) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	159	PRO	4.9
1	D	314	SER	4.5
1	A	137	ILE	4.1
1	C	99	ASN	4.1
1	B	215	ASN	4.0
1	C	122	PHE	3.9
1	D	380	LEU	3.8
1	D	259	ASN	3.8
1	C	323	ALA	3.7
1	B	378	GLY	3.7
1	C	145	TRP	3.6
1	C	153	LEU	3.5
1	D	159	PRO	3.5
1	D	409	PHE	3.3
1	C	194	GLU	3.3
1	D	277	THR	3.3
1	B	156	PRO	3.3
1	D	323	ALA	3.3
1	D	382	GLN	3.2
1	A	159	PRO	3.2
1	C	276	ARG	3.1

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Mol	Chain	Res	Type	RSRZ
1	C	144	THR	3.1
1	D	340	TYR	3.1
1	D	230	ASP	3.1
1	C	97	SER	3.0
1	D	294	LEU	3.0
1	C	215	ASN	3.0
1	B	171	SER	3.0
1	B	326	SER	3.0
1	C	241	ALA	3.0
1	A	184	LEU	2.9
1	C	372	ASP	2.9
1	D	170	GLY	2.9
1	C	195	THR	2.9
1	D	157	GLY	2.9
1	A	138	ILE	2.8
1	C	125	ILE	2.8
1	B	381	ASP	2.8
1	D	156	PRO	2.8
1	C	307	PRO	2.8
1	D	193	VAL	2.8
1	D	260	GLN	2.8
1	C	138	ILE	2.7
1	D	198	PHE	2.7
1	B	303	GLU	2.7
1	C	299	ASP	2.7
1	D	99	ASN	2.7
1	D	395	GLN	2.7
1	D	215	ASN	2.7
1	D	255	TYR	2.7
1	D	263	PHE	2.6
1	B	395	GLN	2.6
1	C	310	ASP	2.6
1	D	196	PRO	2.6
1	D	171	SER	2.6
1	A	157	GLY	2.5
1	C	277	THR	2.5
1	C	120	ASP	2.5
1	D	200	ALA	2.5
1	A	217	GLU	2.5
1	B	201	TRP	2.4
1	D	213	CYS	2.4
1	D	118	LYS	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	167	LEU	2.4
1	D	381	ASP	2.4
1	C	198	PHE	2.4
1	C	201	TRP	2.4
1	C	75	VAL	2.3
1	D	293	ALA	2.3
1	B	377	SER	2.3
1	C	227	SER	2.3
1	C	119	GLN	2.3
1	C	202	HIS	2.3
1	A	215	ASN	2.3
1	B	50	ASN	2.3
1	B	315	GLY	2.3
1	D	315	GLY	2.3
1	D	202	HIS	2.3
1	C	118	LYS	2.3
1	D	337	VAL	2.3
1	B	324	PRO	2.3
1	B	271	THR	2.3
1	D	174	PHE	2.3
1	A	145	TRP	2.2
1	D	321	ASP	2.2
1	A	140	GLU	2.2
1	D	214	PRO	2.2
1	D	316	ALA	2.2
1	C	326	SER	2.2
1	D	122	PHE	2.2
1	C	115	ALA	2.2
1	B	408	GLN	2.2
1	C	327	GLN	2.2
1	D	349	LEU	2.2
1	A	326	SER	2.2
1	A	230	ASP	2.2
1	C	390	PHE	2.2
1	C	278	ASP	2.2
1	D	278	ASP	2.2
1	C	150	TRP	2.2
1	C	246	GLU	2.1
1	D	197	ASP	2.1
1	C	149	PHE	2.1
1	C	82	MET	2.1
1	B	248	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	C	68	GLY	2.1
1	D	87	SER	2.1
1	C	293	ALA	2.1
1	C	380	LEU	2.1
1	D	261	THR	2.1
1	C	25	ARG	2.1
1	C	208	ILE	2.1
1	C	324	PRO	2.1
1	A	245	VAL	2.1
1	C	395	GLN	2.0
1	C	322	VAL	2.0
1	C	212	GLY	2.0
1	C	396	GLY	2.0
1	C	191	ILE	2.0
1	D	326	SER	2.0
1	B	213	CYS	2.0
1	B	338	ARG	2.0
1	D	140	GLU	2.0

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.

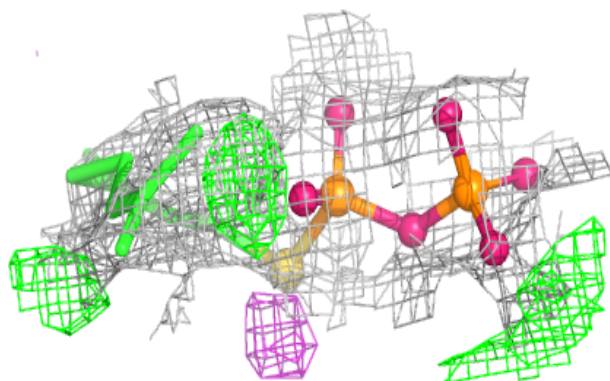
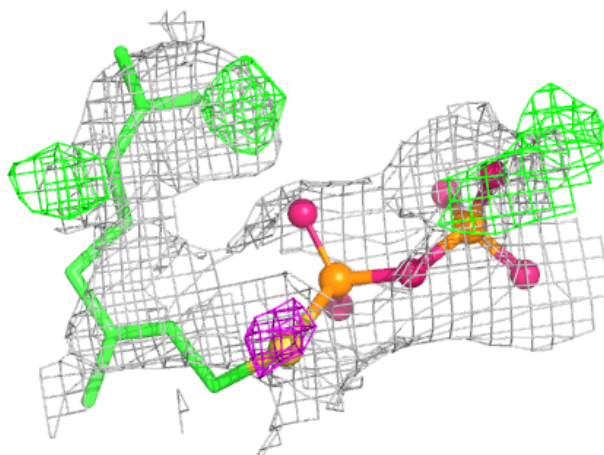
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GST	C	501	19/19	0.75	0.20	40,74,101,104	19
2	TRP	C	502	15/15	0.91	0.12	49,56,59,60	15
2	TRP	A	501	15/15	0.91	0.17	60,60,60,60	15

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.

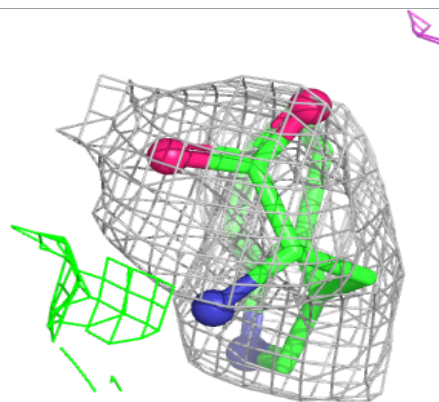
Electron density around GST C 501:

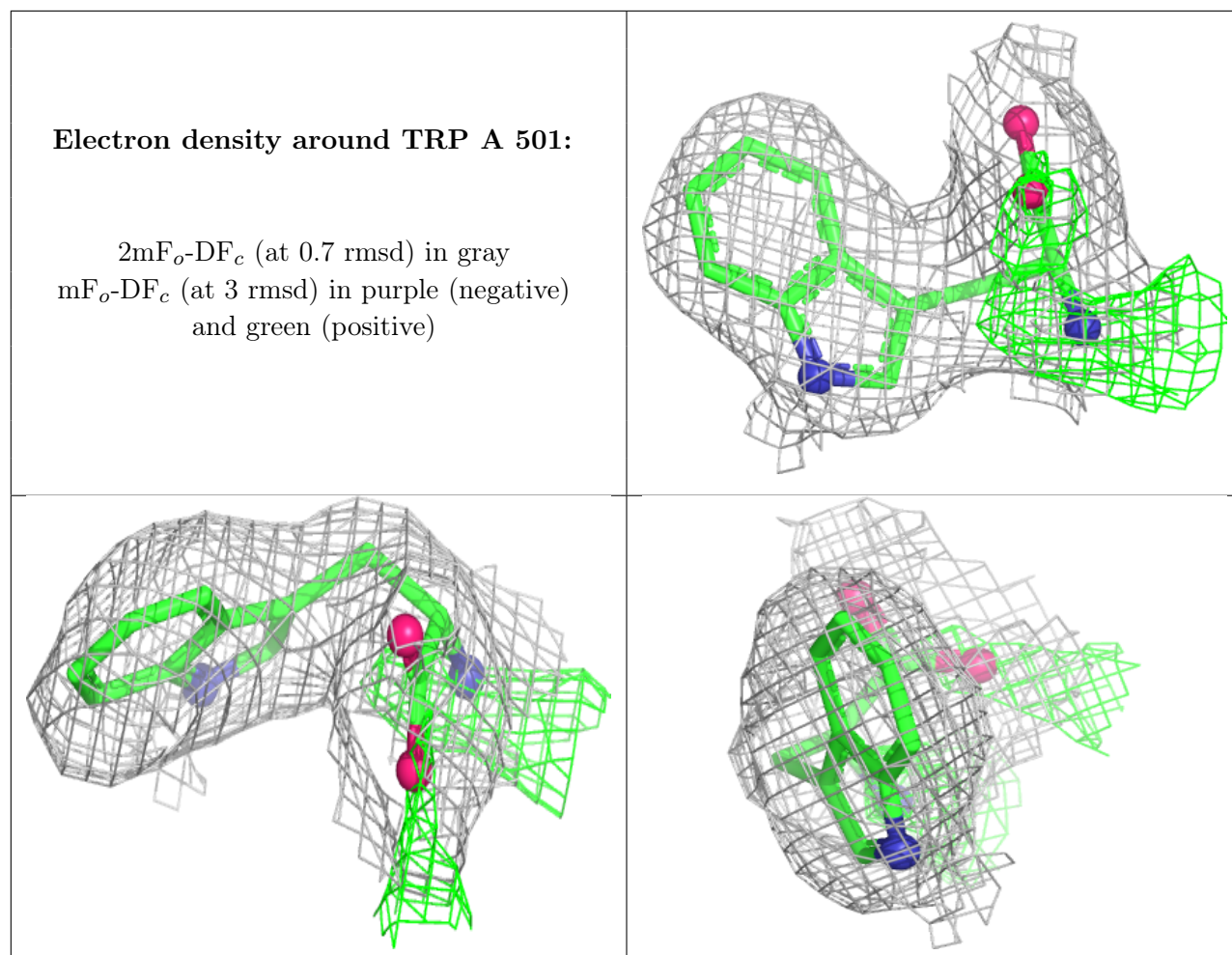
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around TRP C 502:

$2mF_o-DF_c$ (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.