



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:41 AM UTC

PDB ID : 2GSR / pdb_00002gsr
Title : Structure of porcine class pi glutathione s-transferase
Authors : Reinemer, P.; Dirr, H.W.; Huber, R.
Deposited on : 1996-03-21
Resolution : 2.11 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

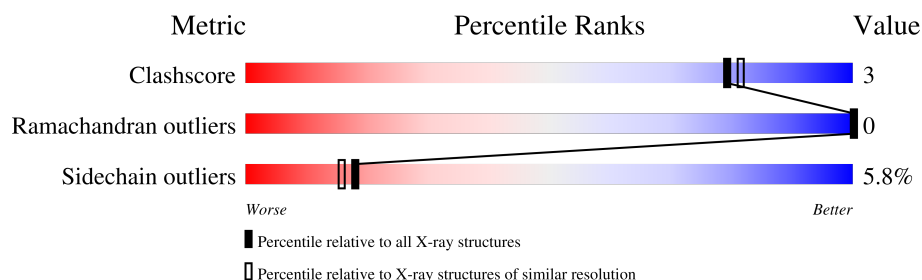
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.11 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	8817 (2.14-2.10)
Ramachandran outliers	187476	8738 (2.14-2.10)
Sidechain outliers	187428	8739 (2.14-2.10)

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	207	 81% 15% .
1	B	207	 78% 20% .

2 Entry composition [i](#)

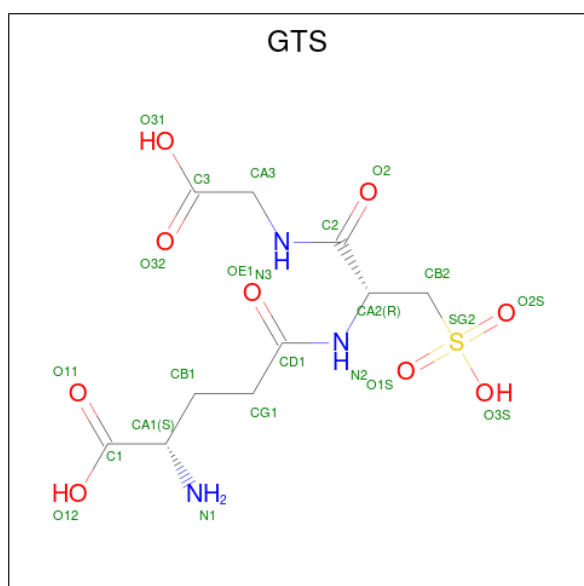
There are 3 unique types of molecules in this entry. The entry contains 3614 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 CLASS PI GST GLUTATHIONE S-TRANSFERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	207	Total	C	N	O	S	20	0	0
			1657	1061	284	304	8			
1	B	207	Total	C	N	O	S	28	0	0
			1657	1061	284	304	8			

- Molecule 2 is GLUTATHIONE SULFONIC ACID (CCD ID: GTS) (formula: $C_{10}H_{17}N_3O_9S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			23	10	3	9	1		
2	B	1	Total	C	N	O	S	0	0
			23	10	3	9	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	132	Total 132	O 132	0	0
3	B	122	Total 122	O 122	0	0

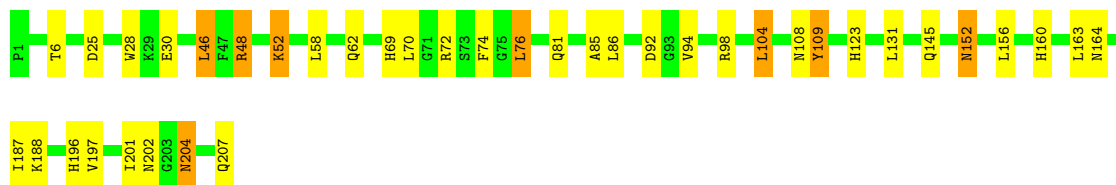
3 Residue-property plots [i](#)

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. 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.

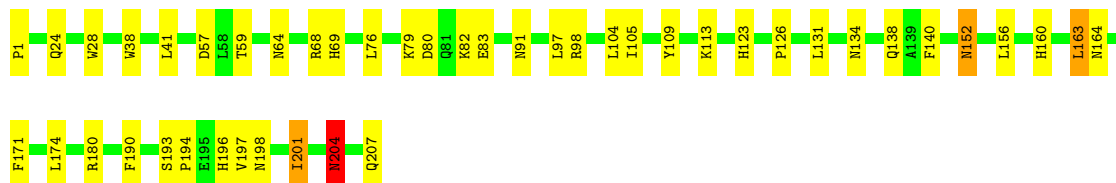
• Molecule 1: CLASS PI GST GLUTATHIONE S-TRANSFERASE

Chain A:  81% 15% .



• Molecule 1: CLASS PI GST GLUTATHIONE S-TRANSFERASE

Chain B:  78% 20% .



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	101.25Å 82.53Å 54.28Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.11	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-2.11)	Depositor
R_{merge}	0.08	Depositor
R_{sym}	0.04	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.165 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3614	wwPDB-VP
Average B, all atoms (Å ²)	22.0	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: GTS

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	0.88	4/1697 (0.2%)	1.59	22/2298 (1.0%)
1	B	0.90	5/1697 (0.3%)	1.64	27/2298 (1.2%)
All	All	0.89	9/3394 (0.3%)	1.61	49/4596 (1.1%)

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	196	HIS	CD2-NE2	-6.99	1.30	1.37
1	B	196	HIS	CD2-NE2	-6.72	1.30	1.37
1	A	123	HIS	CD2-NE2	-6.58	1.30	1.37
1	B	69	HIS	CD2-NE2	-6.56	1.30	1.37
1	B	123	HIS	CD2-NE2	-6.38	1.30	1.37
1	A	69	HIS	CD2-NE2	-6.28	1.30	1.37
1	B	105	ILE	CA-CB	6.17	1.61	1.54
1	B	160	HIS	CD2-NE2	-5.98	1.31	1.37
1	A	160	HIS	CD2-NE2	-5.64	1.31	1.37

All (49) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	68	ARG	NE-CZ-NH2	-9.00	111.10	119.20
1	B	152	ASN	OD1-CG-ND2	-8.23	114.37	122.60
1	B	68	ARG	NE-CZ-NH1	7.74	129.24	121.50
1	B	80	ASP	CA-CB-CG	7.53	120.13	112.60
1	B	201	ILE	N-CA-C	-7.31	103.66	110.53
1	A	196	HIS	CB-CG-CD2	-6.79	122.38	131.20
1	B	198	ASN	OD1-CG-ND2	-6.70	115.90	122.60
1	A	108	ASN	N-CA-CB	-6.68	103.77	111.79
1	A	152	ASN	OD1-CG-ND2	-6.53	116.08	122.60
1	A	204	ASN	OD1-CG-ND2	-6.51	116.09	122.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	204	ASN	OD1-CG-ND2	-6.36	116.25	122.60
1	B	38	TRP	CG-CD2-CE3	6.27	140.17	133.90
1	A	187	ILE	N-CA-C	-6.19	104.71	110.53
1	A	123	HIS	CB-CG-CD2	-6.17	123.18	131.20
1	A	25	ASP	CA-CB-CG	6.16	118.76	112.60
1	A	109	TYR	N-CA-C	6.12	117.65	110.97
1	B	28	TRP	CG-CD2-CE3	6.12	140.02	133.90
1	A	28	TRP	CG-CD2-CE3	6.11	140.01	133.90
1	A	197	VAL	N-CA-C	6.10	116.85	110.62
1	B	160	HIS	CB-CG-CD2	-6.05	123.33	131.20
1	B	138	GLN	OE1-CD-NE2	-5.95	116.65	122.60
1	A	202	ASN	OD1-CG-ND2	-5.92	116.67	122.60
1	A	164	ASN	OD1-CG-ND2	-5.85	116.75	122.60
1	B	196	HIS	CB-CG-CD2	-5.71	123.78	131.20
1	A	30	GLU	O-C-N	-5.66	116.00	123.13
1	B	69	HIS	CB-CG-CD2	-5.58	123.95	131.20
1	A	196	HIS	CB-CG-ND1	5.57	131.05	122.70
1	B	152	ASN	CB-CG-ND2	5.54	124.71	116.40
1	B	140	PHE	CA-CB-CG	-5.51	108.29	113.80
1	B	134	ASN	OD1-CG-ND2	-5.46	117.14	122.60
1	B	59	THR	CA-CB-OG1	-5.41	101.48	109.60
1	B	180	ARG	NE-CZ-NH2	-5.38	114.36	119.20
1	B	57	ASP	CA-CB-CG	5.31	117.91	112.60
1	A	52	LYS	CB-CG-CD	-5.29	99.13	111.30
1	B	64	ASN	CA-CB-CG	-5.29	107.31	112.60
1	A	28	TRP	CE2-CD2-CG	-5.22	100.93	107.20
1	B	24	GLN	OE1-CD-NE2	-5.18	117.42	122.60
1	A	62	GLN	OE1-CD-NE2	-5.17	117.44	122.60
1	A	30	GLU	N-CA-CB	-5.14	101.93	110.47
1	B	171	PHE	CA-C-N	5.14	124.75	119.05
1	B	171	PHE	C-N-CA	5.14	124.75	119.05
1	A	28	TRP	CB-CG-CD1	-5.10	119.25	126.90
1	B	164	ASN	OD1-CG-ND2	-5.10	117.50	122.60
1	A	28	TRP	CG-CD1-NE1	-5.07	103.62	110.20
1	A	160	HIS	CB-CG-CD2	-5.05	124.63	131.20
1	A	92	ASP	CA-CB-CG	5.04	117.64	112.60
1	B	109	TYR	N-CA-C	5.04	116.46	111.07
1	B	28	TRP	CB-CG-CD1	-5.03	119.35	126.90
1	B	91	ASN	OD1-CG-ND2	-5.01	117.59	122.60

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	1657	0	1657	10	0
1	B	1657	0	1657	11	0
2	A	23	0	14	0	0
2	B	23	0	14	0	0
3	A	132	0	0	0	0
3	B	122	0	0	1	0
All	All	3614	0	3342	18	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 (18) 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:58:LEU:HD13	1:B:82:LYS:HG3	1.76	0.68
1:A:74:PHE:HB2	1:A:76:LEU:HD22	1.91	0.51
1:B:201:ILE:HD12	1:B:207:GLN:HG3	1.93	0.51
1:A:46:LEU:O	1:B:126:PRO:HB3	2.11	0.51
1:A:104:LEU:HD22	1:A:109:TYR:HA	1.92	0.50
1:A:48:ARG:NH1	1:B:126:PRO:HD3	2.27	0.50
1:A:6:THR:HB	1:A:52:LYS:HB3	1.96	0.48
1:B:97:LEU:HD23	1:B:156:LEU:HD21	1.96	0.47
1:B:113:LYS:HE3	1:B:163:LEU:HD22	1.98	0.45
1:A:201:ILE:HD12	1:A:207:GLN:HG2	1.97	0.45
1:B:190:PHE:O	1:B:193:SER:HB2	2.17	0.44
1:B:194:PRO:HA	1:B:197:VAL:HG22	1.99	0.44
1:A:85:ALA:HA	3:B:283:HOH:O	2.19	0.43
1:B:98:ARG:HH21	1:B:152:ASN:ND2	2.18	0.42
1:B:204:ASN:HD22	1:B:204:ASN:H	1.66	0.42
1:B:79:LYS:HG2	1:B:83:GLU:CD	2.46	0.41
1:A:98:ARG:HH21	1:A:152:ASN:ND2	2.18	0.41
1:A:94:VAL:HG13	1:A:156:LEU:HG	2.03	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	205/207 (99%)	199 (97%)	6 (3%)	0	100	100
1	B	205/207 (99%)	200 (98%)	5 (2%)	0	100	100
All	All	410/414 (99%)	399 (97%)	11 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	180/180 (100%)	167 (93%)	13 (7%)	13	10
1	B	180/180 (100%)	172 (96%)	8 (4%)	25	25
All	All	360/360 (100%)	339 (94%)	21 (6%)	18	16

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	46	LEU
1	A	48	ARG
1	A	70	LEU
1	A	72	ARG
1	A	76	LEU
1	A	81	GLN
1	A	86	LEU
1	A	104	LEU

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Mol	Chain	Res	Type
1	A	131	LEU
1	A	145	GLN
1	A	163	LEU
1	A	188	LYS
1	A	204	ASN
1	B	1	PRO
1	B	41	LEU
1	B	76	LEU
1	B	104	LEU
1	B	131	LEU
1	B	163	LEU
1	B	174	LEU
1	B	204	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	135	GLN
1	A	152	ASN
1	A	164	ASN
1	A	198	ASN
1	A	204	ASN
1	A	207	GLN
1	B	24	GLN
1	B	26	GLN
1	B	49	GLN
1	B	134	ASN
1	B	152	ASN
1	B	204	ASN

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	GTS	B	208	-	20,22,22	1.14	3 (15%)	26,30,30	1.34	3 (11%)
2	GTS	A	208	-	20,22,22	1.18	2 (10%)	26,30,30	1.71	5 (19%)

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	GTS	B	208	-	-	0/27/27/27	-
2	GTS	A	208	-	-	0/27/27/27	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	208	GTS	CB2-CA2	-3.11	1.51	1.53
2	B	208	GTS	CB2-CA2	-3.04	1.51	1.53
2	A	208	GTS	O12-C1	-2.62	1.22	1.30
2	B	208	GTS	O12-C1	-2.37	1.23	1.30
2	B	208	GTS	O31-C3	-2.23	1.23	1.30

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	208	GTS	CG1-CD1-N2	-4.20	108.47	115.86
2	A	208	GTS	O1S-SG2-CB2	3.62	112.15	106.76

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	208	GTS	O3S-SG2-CB2	3.20	112.15	105.97
2	B	208	GTS	CG1-CD1-N2	-3.07	110.45	115.86
2	A	208	GTS	OE1-CD1-N2	2.83	127.75	122.95
2	B	208	GTS	O3S-SG2-CB2	2.78	111.33	105.97
2	A	208	GTS	O31-C3-CA3	2.32	121.62	112.81
2	B	208	GTS	O1S-SG2-CB2	2.27	110.15	106.76

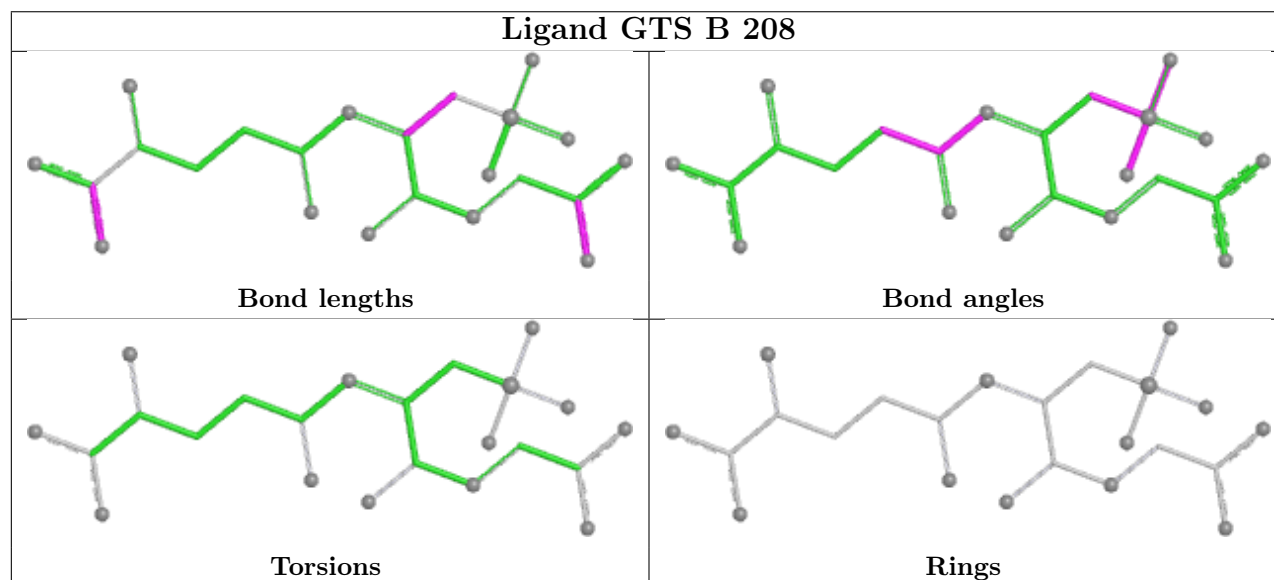
There are no chirality outliers.

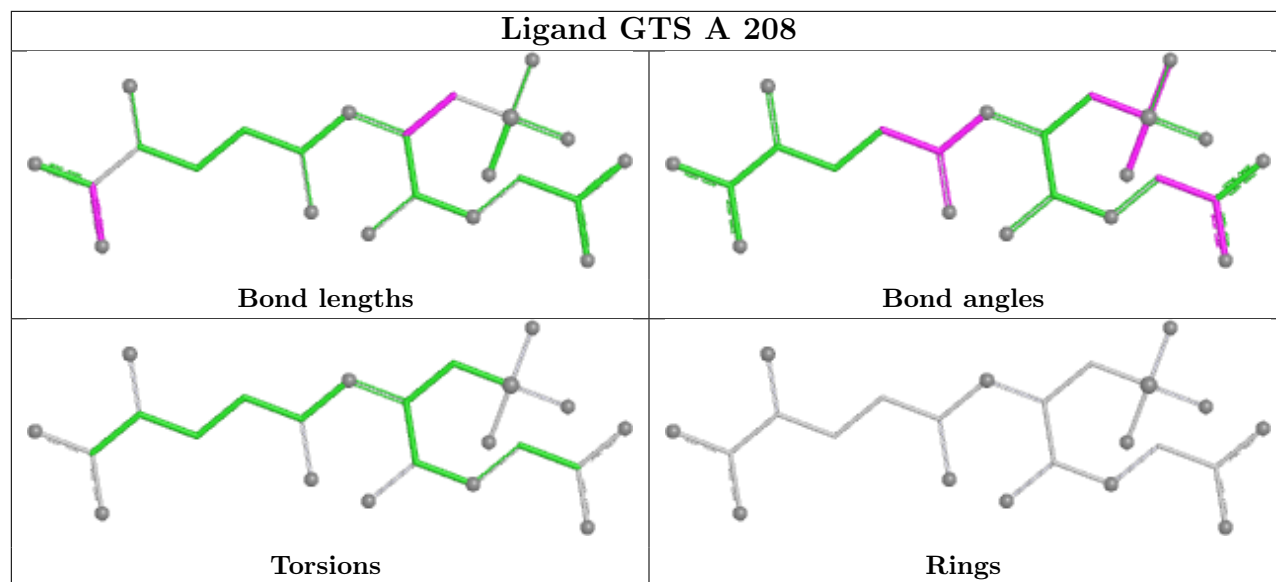
There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

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.