



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 8, 2023 – 07:22 pm BST

PDB ID : 7QX3  
Title : Structure of the transaminase TR2E2 with EOS  
Authors : Roda, S.; Fernandez-Lopez, L.; Benedens, M.; Bollinger, A.; Thies, S.; Schumacher, J.; Coscolin, C.; Kazemi, M.; Santiago, G.; Gertzen, C.G.; Gonzalez-Alfonso, J.; Plou, F.J.; Jaeger, K.E.; Smits, S.H.; Ferrer, M.; Guallar, V.  
Deposited on : 2022-01-26  
Resolution : 3.60 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35

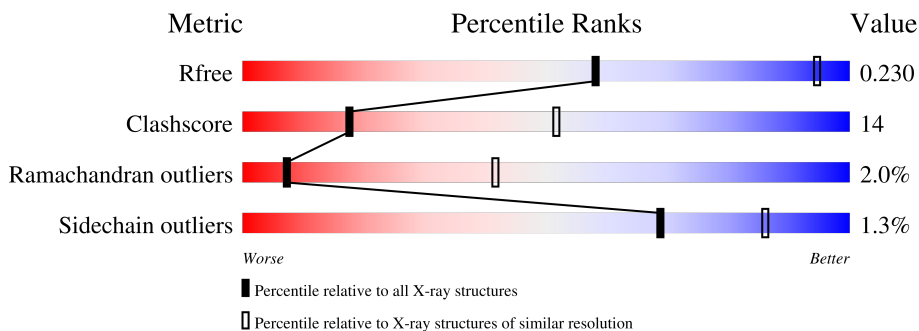
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.60 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))
$R_{free}$	130704	1257 (3.70-3.50)
Clashscore	141614	1353 (3.70-3.50)
Ramachandran outliers	138981	1307 (3.70-3.50)
Sidechain outliers	138945	1307 (3.70-3.50)

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  $\geq 3$ , 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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	465	67% (green), 22% (yellow), 9% (grey)
1	B	465	66% (green), 21% (yellow), 10% (grey)
1	C	465	68% (green), 20% (yellow), 10% (grey)
1	D	465	63% (green), 26% (yellow), 10% (grey)

## 2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 25981 atoms, of which 12904 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 Aminotransferase TR2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	B	418	6448	2058	3204	566	600	20	0	0	0
1	C	420	6476	2068	3214	571	603	20	0	0	0
1	A	422	6521	2079	3244	573	605	20	0	0	0
1	D	420	6476	2068	3214	571	603	20	0	0	0

There are 40 discrepancies between the modelled and reference sequences:

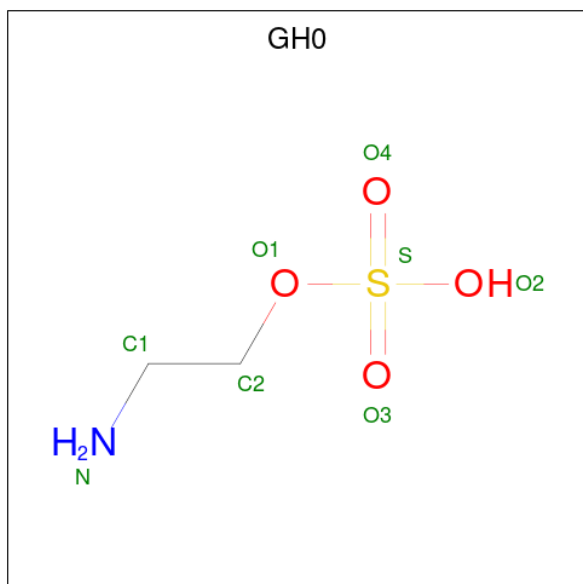
Chain	Residue	Modelled	Actual	Comment	Reference
B	172	SER	ALA	conflict	UNP A0A3G5BC54
B	173	HIS	GLN	conflict	UNP A0A3G5BC54
B	458	LEU	-	expression tag	UNP A0A3G5BC54
B	459	GLU	-	expression tag	UNP A0A3G5BC54
B	460	HIS	-	expression tag	UNP A0A3G5BC54
B	461	HIS	-	expression tag	UNP A0A3G5BC54
B	462	HIS	-	expression tag	UNP A0A3G5BC54
B	463	HIS	-	expression tag	UNP A0A3G5BC54
B	464	HIS	-	expression tag	UNP A0A3G5BC54
B	465	HIS	-	expression tag	UNP A0A3G5BC54
C	172	SER	ALA	conflict	UNP A0A3G5BC54
C	173	HIS	GLN	conflict	UNP A0A3G5BC54
C	458	LEU	-	expression tag	UNP A0A3G5BC54
C	459	GLU	-	expression tag	UNP A0A3G5BC54
C	460	HIS	-	expression tag	UNP A0A3G5BC54
C	461	HIS	-	expression tag	UNP A0A3G5BC54
C	462	HIS	-	expression tag	UNP A0A3G5BC54
C	463	HIS	-	expression tag	UNP A0A3G5BC54
C	464	HIS	-	expression tag	UNP A0A3G5BC54
C	465	HIS	-	expression tag	UNP A0A3G5BC54
A	172	SER	ALA	conflict	UNP A0A3G5BC54

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Chain	Residue	Modelled	Actual	Comment	Reference
A	173	HIS	GLN	conflict	UNP A0A3G5BC54
A	458	LEU	-	expression tag	UNP A0A3G5BC54
A	459	GLU	-	expression tag	UNP A0A3G5BC54
A	460	HIS	-	expression tag	UNP A0A3G5BC54
A	461	HIS	-	expression tag	UNP A0A3G5BC54
A	462	HIS	-	expression tag	UNP A0A3G5BC54
A	463	HIS	-	expression tag	UNP A0A3G5BC54
A	464	HIS	-	expression tag	UNP A0A3G5BC54
A	465	HIS	-	expression tag	UNP A0A3G5BC54
D	172	SER	ALA	conflict	UNP A0A3G5BC54
D	173	HIS	GLN	conflict	UNP A0A3G5BC54
D	458	LEU	-	expression tag	UNP A0A3G5BC54
D	459	GLU	-	expression tag	UNP A0A3G5BC54
D	460	HIS	-	expression tag	UNP A0A3G5BC54
D	461	HIS	-	expression tag	UNP A0A3G5BC54
D	462	HIS	-	expression tag	UNP A0A3G5BC54
D	463	HIS	-	expression tag	UNP A0A3G5BC54
D	464	HIS	-	expression tag	UNP A0A3G5BC54
D	465	HIS	-	expression tag	UNP A0A3G5BC54

- Molecule 2 is 2-azanylethyl hydrogen sulfate (three-letter code: GH0) (formula: C<sub>2</sub>H<sub>7</sub>NO<sub>4</sub>S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	H	N	O			S
2	B	1	15	2	7	1	4	1	0	0

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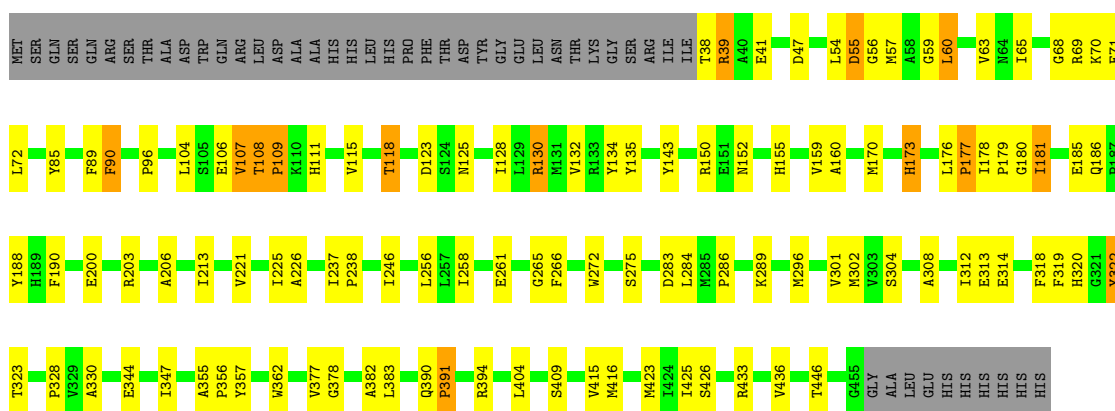
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>					<b>ZeroOcc</b>	<b>AltConf</b>	
2	C	1	Total	C	H	N	O	S	0	0
			15	2	7	1	4	1		
2	A	1	Total	C	H	N	O	S	0	0
			15	2	7	1	4	1		
2	D	1	Total	C	H	N	O	S	0	0
			15	2	7	1	4	1		

### 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.

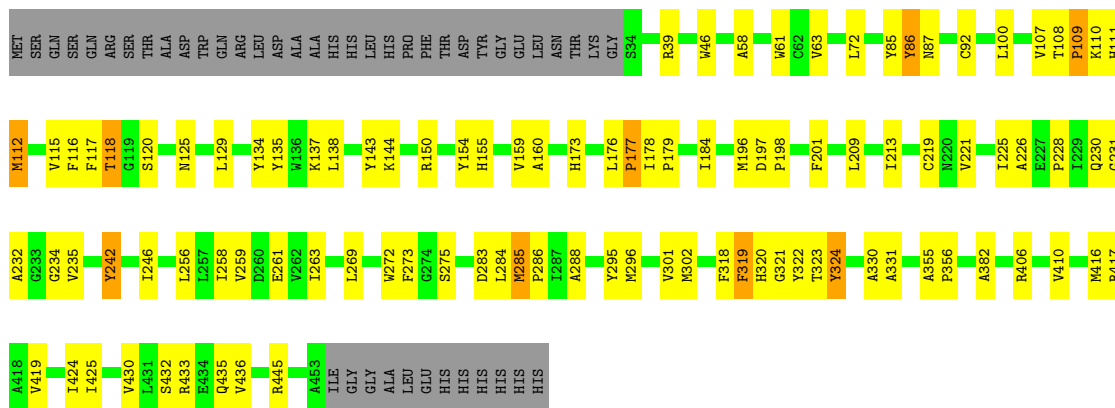
- Molecule 1: Aminotransferase TR2

Chain B: 



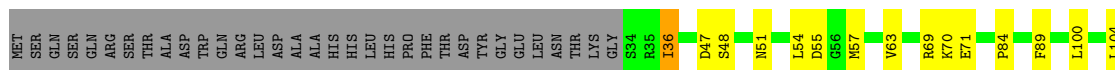
- Molecule 1: Aminotransferase TR2

Chain C: 



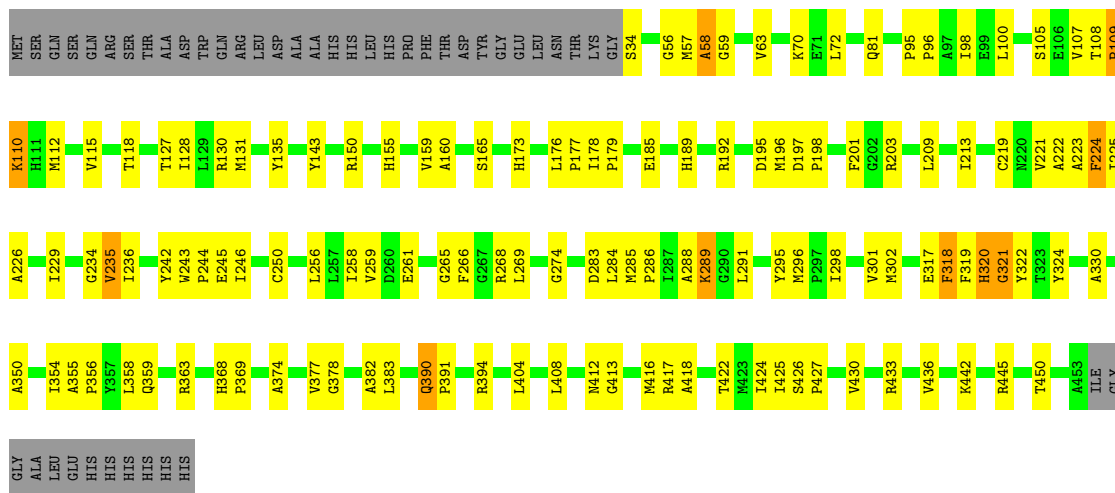
- Molecule 1: Aminotransferase TR2

Chain A: 





• Molecule 1: Aminotransferase TR2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	100.61Å 109.50Å 211.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.94 – 3.60 48.94 – 2.86	Depositor EDS
% Data completeness (in resolution range)	99.8 (48.94-3.60) 99.9 (48.94-2.86)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.42 (at 2.86Å)	Xtrriage
Refinement program	PHENIX 1.19.2_4158, PHENIX 1.19.2_4158	Depositor
R, $R_{free}$	0.161 , 0.218 0.181 , 0.230	Depositor DCC
$R_{free}$ test set	1907 reflections (3.49%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	72.1	Xtrriage
Anisotropy	0.402	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 36.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	25981	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	77.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.08% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: GH0

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	0.76	0/3353	0.93	5/4538 (0.1%)
1	B	0.80	3/3320 (0.1%)	0.95	2/4494 (0.0%)
1	C	0.74	0/3338	0.90	4/4518 (0.1%)
1	D	0.78	2/3338 (0.1%)	0.91	1/4518 (0.0%)
All	All	0.77	5/13349 (0.0%)	0.92	12/18068 (0.1%)

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

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

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	47	ASP	CB-CG	6.43	1.65	1.51
1	B	41	GLU	CG-CD	6.23	1.61	1.51
1	B	90	PHE	CA-CB	5.49	1.66	1.53
1	D	250	CYS	CB-SG	-5.27	1.73	1.81
1	D	224	PHE	CA-CB	-5.09	1.42	1.53

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	123	ASP	CB-CG-OD1	-7.62	111.44	118.30
1	A	408	LEU	CB-CG-CD1	-5.73	101.25	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	185	GLU	OE1-CD-OE2	5.59	130.01	123.30
1	B	55	ASP	CB-CG-OD1	5.57	123.31	118.30
1	B	185	GLU	OE1-CD-OE2	5.50	129.90	123.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	320	HIS	Peptide
1	C	322	TYR	Peptide

## 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	3277	3244	3244	84	1
1	B	3244	3204	3204	99	1
1	C	3262	3214	3221	88	0
1	D	3262	3214	3221	101	0
2	A	8	7	0	0	0
2	B	8	7	0	0	0
2	C	8	7	0	0	0
2	D	8	7	0	0	0
All	All	13077	12904	12890	356	1

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 14.

The worst 5 of 356 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:C:115:VAL:HG12	1:C:302:MET:SD	1.93	1.08
1:C:115:VAL:CG1	1:C:302:MET:SD	2.51	0.98
1:B:38:THR:OG1	1:C:92:CYS:O	1.82	0.96
1:A:159:VAL:HG11	1:D:160:ALA:HB2	1.52	0.91
1:B:225:ILE:HG22	1:B:258:ILE:HB	1.52	0.90

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:314:GLU:OE2	1:A:314:GLU:OE2[4_445]	2.14	0.06

## 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	420/465 (90%)	385 (92%)	27 (6%)	8 (2%)	8	42
1	B	416/465 (90%)	371 (89%)	36 (9%)	9 (2%)	6	39
1	C	418/465 (90%)	366 (88%)	45 (11%)	7 (2%)	9	45
1	D	418/465 (90%)	380 (91%)	29 (7%)	9 (2%)	6	39
All	All	1672/1860 (90%)	1502 (90%)	137 (8%)	33 (2%)	7	41

5 of 33 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	87	ASN
1	C	112	MET
1	A	320	HIS
1	D	58	ALA
1	D	109	PRO

### 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	342/378 (90%)	340 (99%)	2 (1%)	86	94
1	B	338/378 (89%)	331 (98%)	7 (2%)	53	78
1	C	340/378 (90%)	336 (99%)	4 (1%)	71	87
1	D	340/378 (90%)	335 (98%)	5 (2%)	65	84
All	All	1360/1512 (90%)	1342 (99%)	18 (1%)	69	86

5 of 18 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	320	HIS
1	D	445	ARG
1	D	394	ARG
1	C	318	PHE
1	D	131	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	111	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

4 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	GH0	A	501	-	7,7,7	1.54	1 (14%)	7,9,9	1.87	4 (57%)
2	GH0	C	501	-	7,7,7	1.50	1 (14%)	7,9,9	1.67	3 (42%)
2	GH0	D	501	-	7,7,7	1.85	1 (14%)	7,9,9	1.98	2 (28%)
2	GH0	B	501	-	7,7,7	1.76	1 (14%)	7,9,9	1.88	3 (42%)

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	GH0	A	501	-	-	3/5/5/5	-
2	GH0	C	501	-	-	0/5/5/5	-
2	GH0	D	501	-	-	0/5/5/5	-
2	GH0	B	501	-	-	2/5/5/5	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	501	GH0	O1-S	4.57	1.69	1.56
2	B	501	GH0	O1-S	4.44	1.68	1.56
2	C	501	GH0	O1-S	3.63	1.66	1.56
2	A	501	GH0	O1-S	3.62	1.66	1.56

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	GH0	O1-S-O4	3.55	117.62	106.88
2	B	501	GH0	O1-S-O3	3.41	117.22	106.88
2	A	501	GH0	O1-S-O3	2.88	115.61	106.88
2	A	501	GH0	O1-S-O4	2.52	114.52	106.88
2	C	501	GH0	O1-S-O3	2.46	114.34	106.88

There are no chirality outliers.

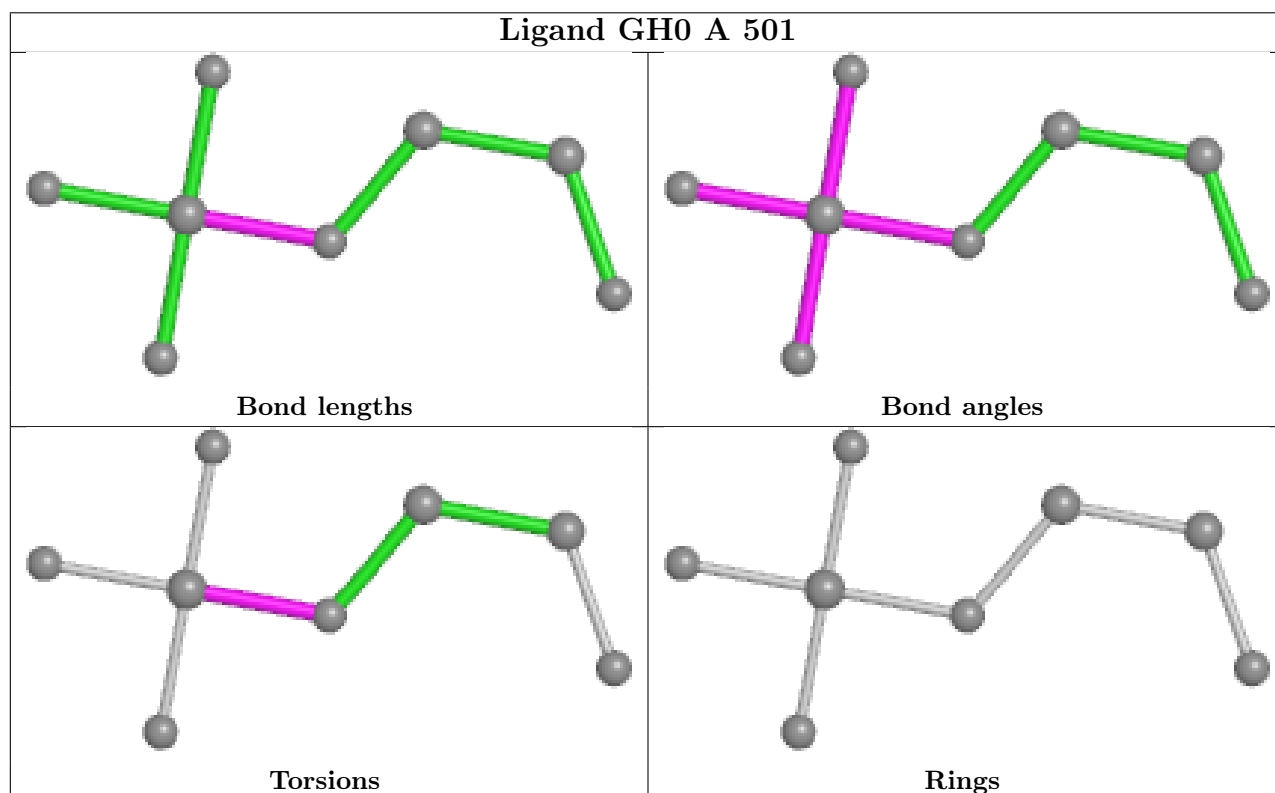
All (5) torsion outliers are listed below:

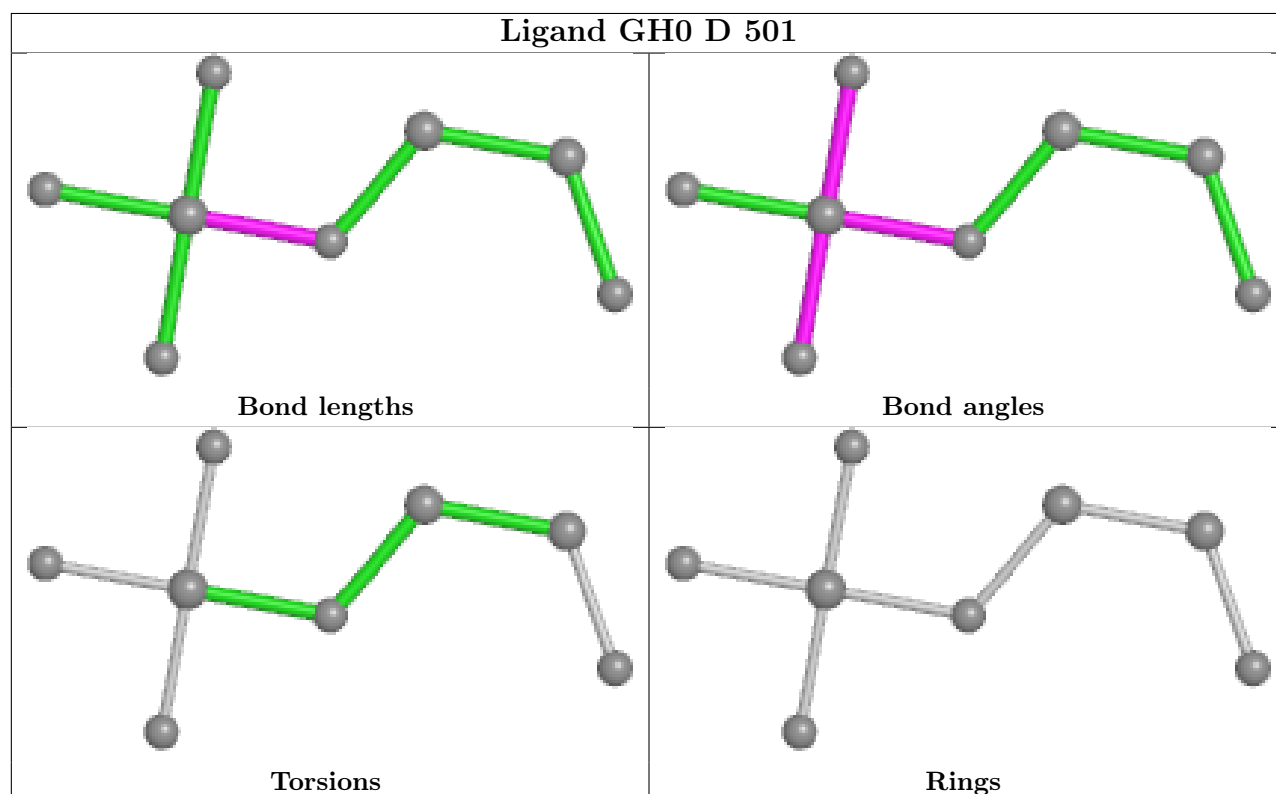
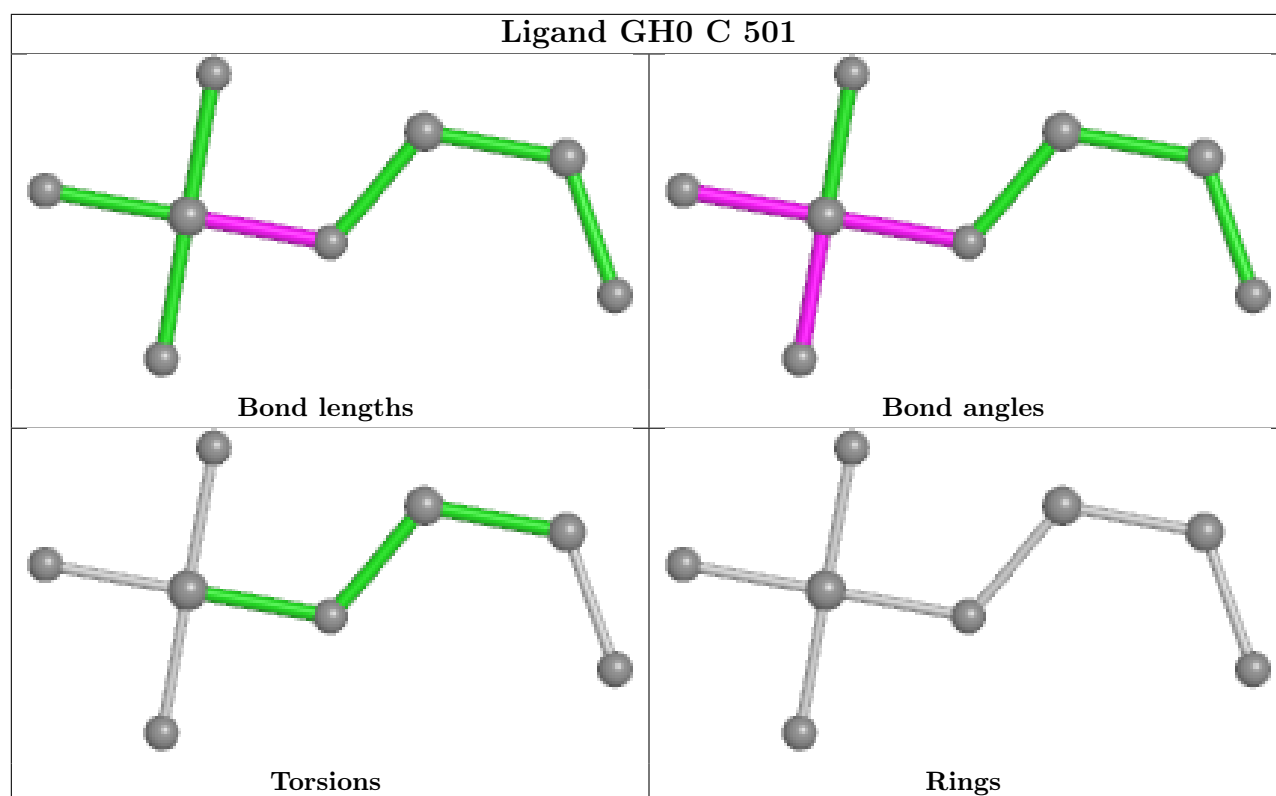
Mol	Chain	Res	Type	Atoms
2	A	501	GH0	C2-O1-S-O2
2	A	501	GH0	C2-O1-S-O3
2	B	501	GH0	C2-O1-S-O4
2	A	501	GH0	C2-O1-S-O4
2	B	501	GH0	C2-O1-S-O3

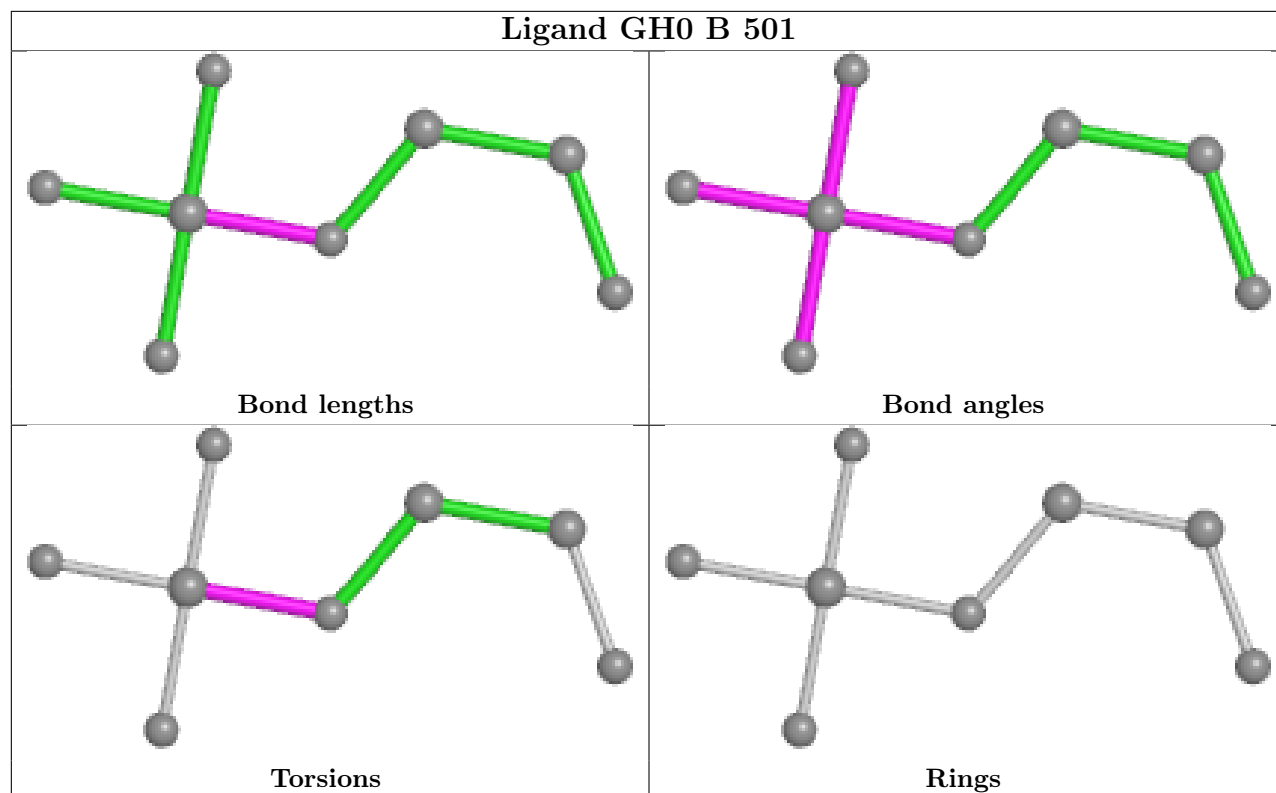
There are no ring outliers.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

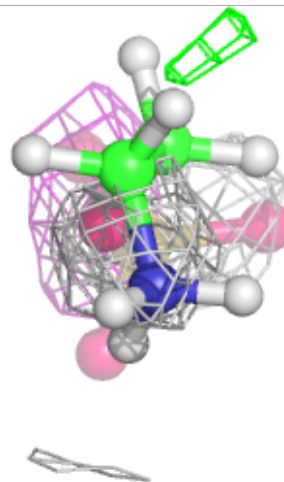
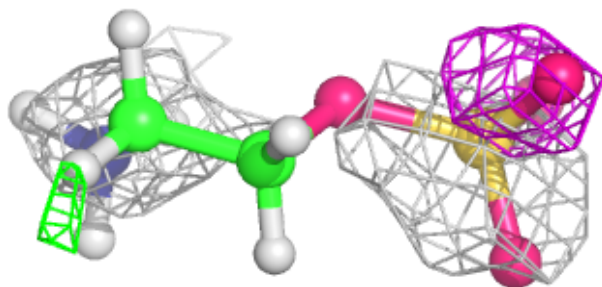
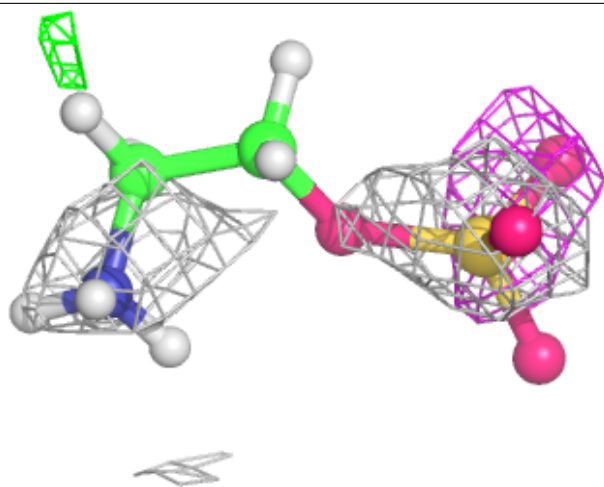
### 6.4 Ligands

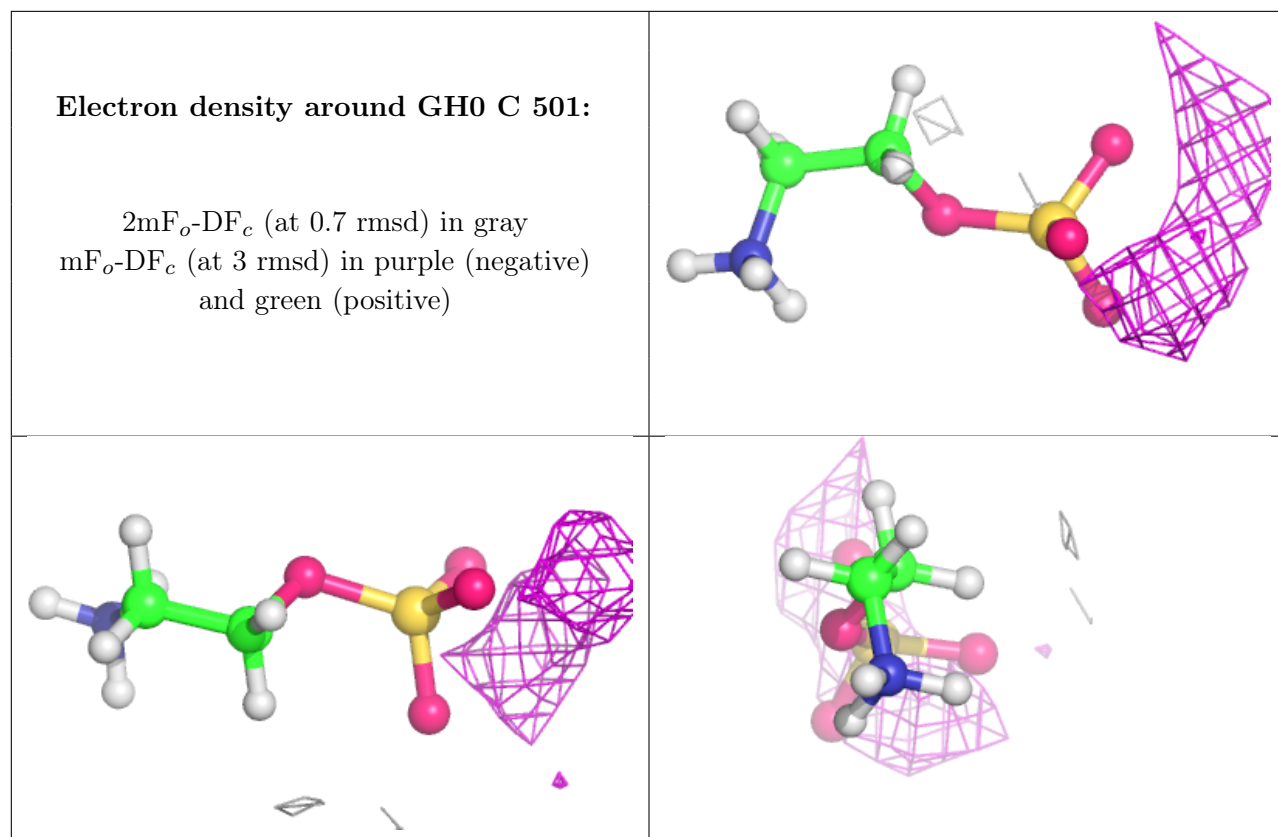
Unable to reproduce the depositors R factor - this section is therefore empty.

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 GH0 B 501:**

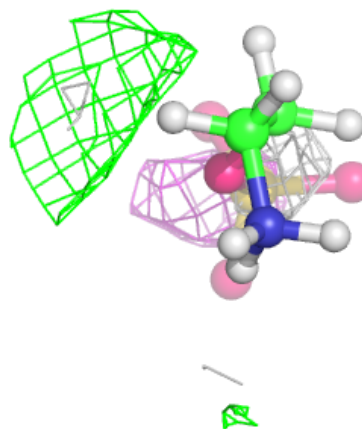
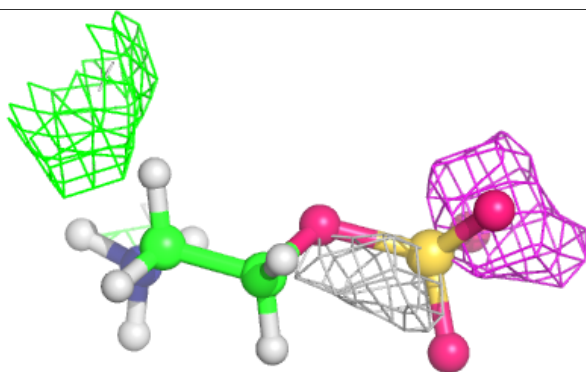
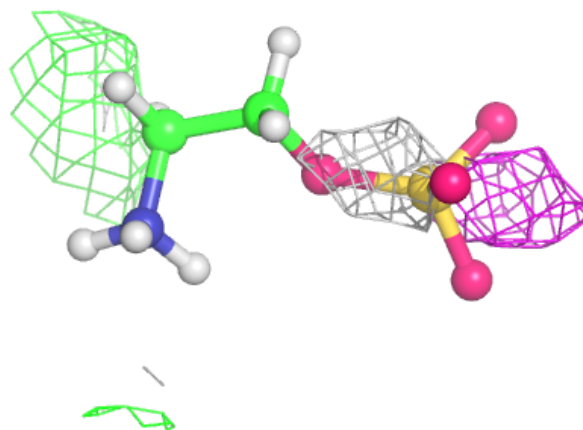
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

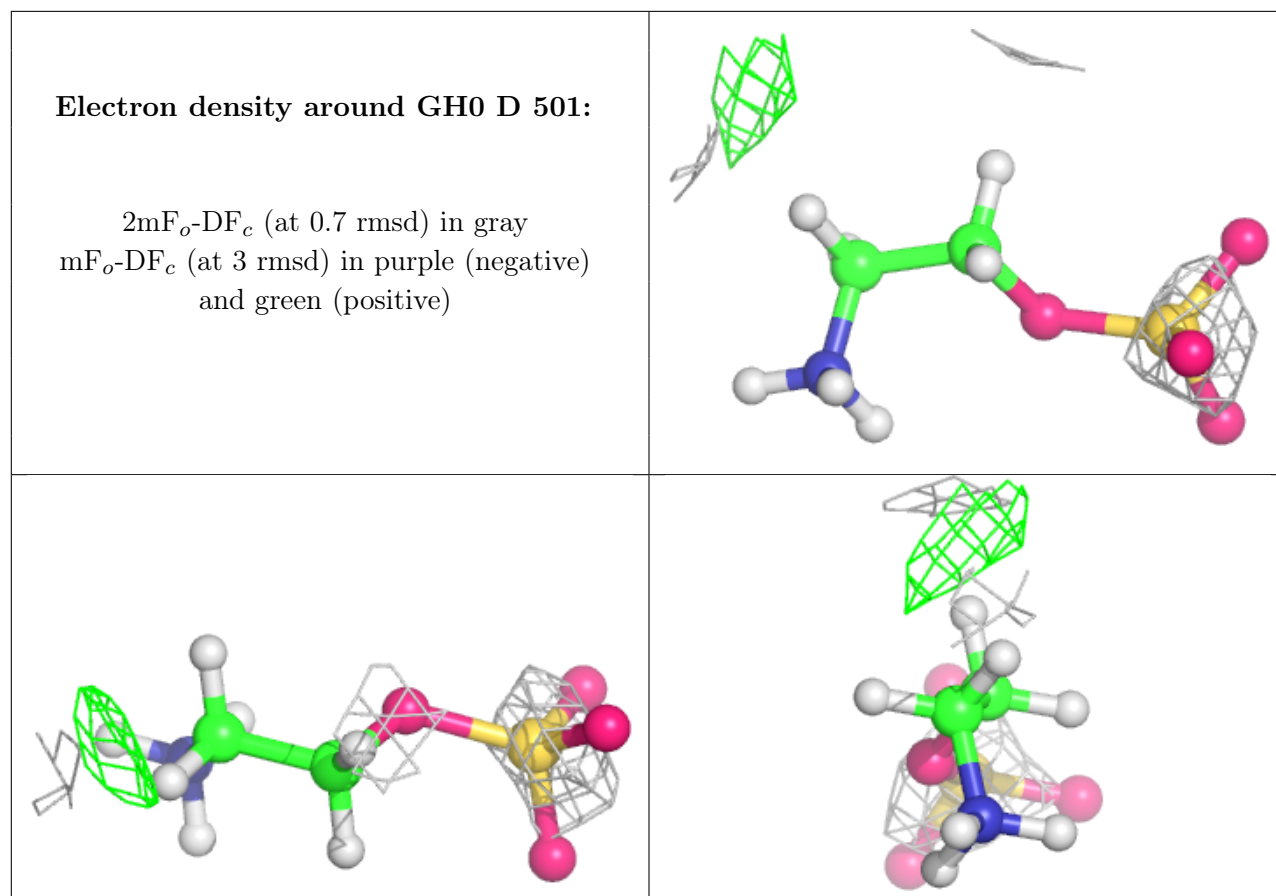




**Electron density around GH0 A 501:**

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





## 6.5 Other polymers [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.