



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 16, 2021 – 02:04 pm BST

PDB ID : 7O1J  
Title : Structure of Mycobacterium tuberculosis beta-oxidation trifunctional enzyme beta-C92A mutant  
Authors : Dalwani, S.; Wierenga, R.K.; Venkatesan, R.  
Deposited on : 2021-03-29  
Resolution : 2.36 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](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.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.1

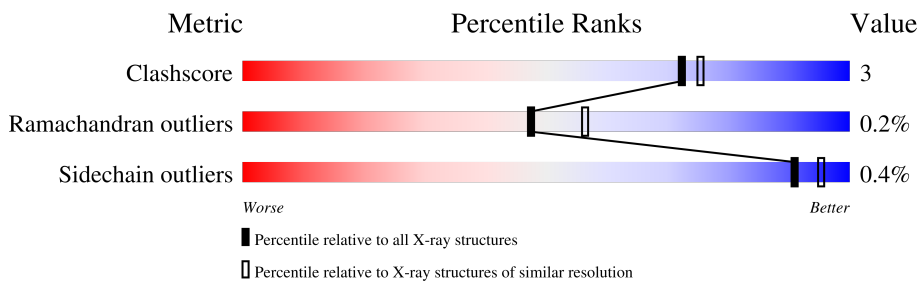
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.36 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	141614	1232 (2.36-2.36)
Ramachandran outliers	138981	1211 (2.36-2.36)
Sidechain outliers	138945	1212 (2.36-2.36)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	D	403	
2	A	736	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 8399 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 Putative acyltransferase Rv0859.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	D	402	2960	1848	525	573	14	0	2	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	92	ALA	CYS	engineered mutation	UNP O53871

- Molecule 2 is a protein called 3-hydroxyacyl-CoA dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	723	5213	3301	895	996	21	0	2	0

There are 16 discrepancies between the modelled and reference sequences:

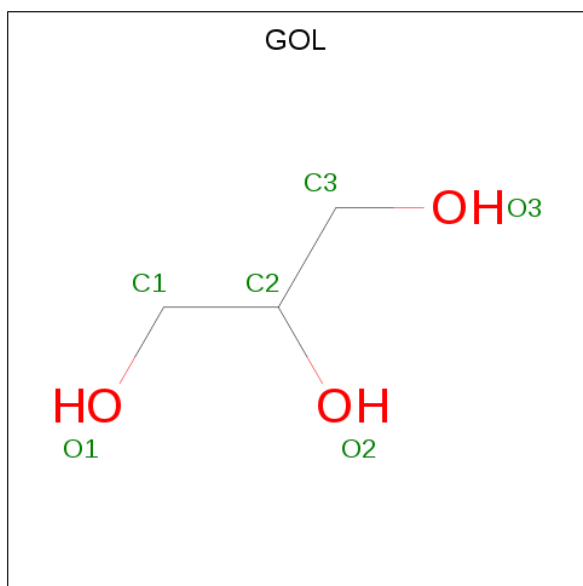
Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	MET	-	initiating methionine	UNP O53872
A	-14	GLY	-	expression tag	UNP O53872
A	-13	SER	-	expression tag	UNP O53872
A	-12	SER	-	expression tag	UNP O53872
A	-11	HIS	-	expression tag	UNP O53872
A	-10	HIS	-	expression tag	UNP O53872
A	-9	HIS	-	expression tag	UNP O53872
A	-8	HIS	-	expression tag	UNP O53872
A	-7	HIS	-	expression tag	UNP O53872
A	-6	HIS	-	expression tag	UNP O53872
A	-5	SER	-	expression tag	UNP O53872
A	-4	GLN	-	expression tag	UNP O53872
A	-3	ASP	-	expression tag	UNP O53872
A	-2	PRO	-	expression tag	UNP O53872
A	-1	ASN	-	expression tag	UNP O53872

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Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP O53872

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	D	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula:  $O_4S$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	D	1	5	4	1	0	0
4	A	1	5	4	1	0	0
4	A	1	5	4	1	0	0
4	A	1	5	4	1	0	0
4	A	1	5	4	1	0	0

- Molecule 5 is water.

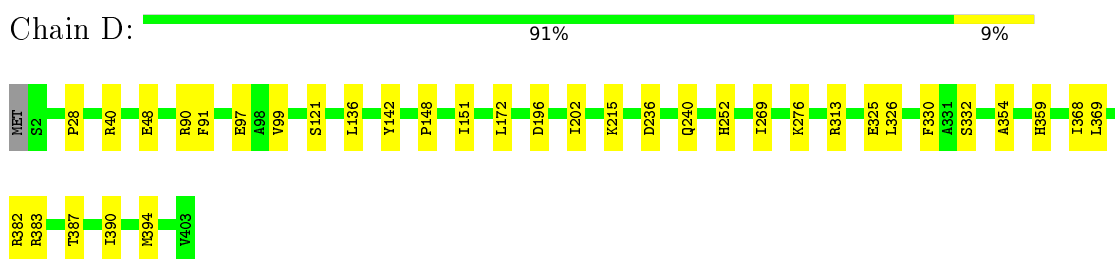
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
5	D	84	Total 84	O 84	0	0
5	A	59	Total 59	O 59	0	0

### 3 Residue-property plots [i](#)

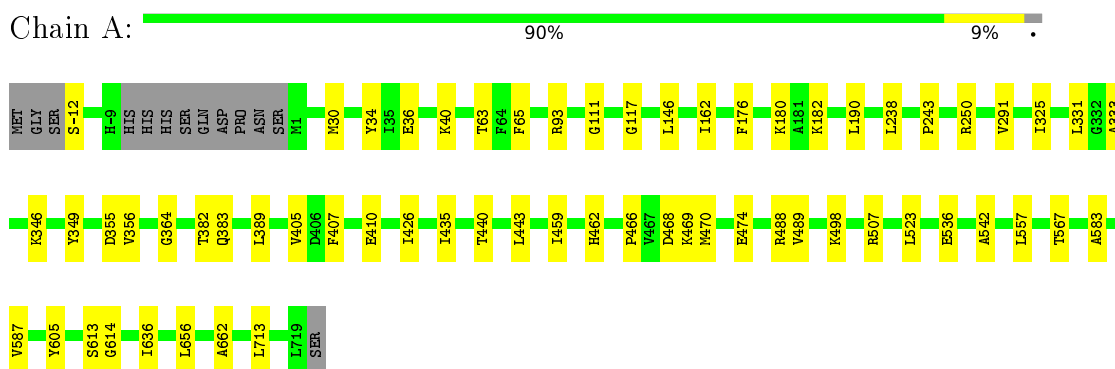
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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: Putative acyltransferase Rv0859



- Molecule 2: 3-hydroxyacyl-CoA dehydrogenase



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	101.33Å 209.28Å 133.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	66.73 – 2.36	Depositor
% Data completeness (in resolution range)	99.4 (66.73-2.36)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.211 , 0.250	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	8399	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP



## 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: GOL, SO4, CSO

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	D	0.24	0/3002	0.45	0/4065
2	A	0.25	0/5316	0.41	0/7221
All	All	0.24	0/8318	0.43	0/11286

There are no bond length outliers.

There are no bond angle outliers.

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	D	2960	0	2980	25	0
2	A	5213	0	5123	33	0
3	A	6	0	8	0	0
3	D	12	0	16	2	0
4	A	20	0	0	0	0
4	D	45	0	0	0	0
5	A	59	0	0	0	0
5	D	84	0	0	0	0
All	All	8399	0	8127	56	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 (56) 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)
2:A:507:ARG:HD2	2:A:567:THR:HG22	1.74	0.69
2:A:-12:SER:O	2:A:93:ARG:NH1	2.28	0.66
1:D:90:ARG:HH11	1:D:394:MET:HE1	1.62	0.63
1:D:252:HIS:HE1	1:D:332:SER:H	1.48	0.61
2:A:36:GLU:HG3	2:A:40:LYS:HE3	1.87	0.56
1:D:99:VAL:HG13	1:D:269:ILE:HD11	1.88	0.56
2:A:182:LYS:HD2	2:A:190:LEU:HG	1.86	0.55
1:D:252:HIS:CE1	1:D:332:SER:H	2.25	0.54
2:A:176:PHE:HD1	2:A:180:LYS:HE3	1.75	0.52
1:D:148:PRO:HG2	1:D:151:ILE:HD12	1.92	0.52
1:D:172:LEU:HD22	1:D:215:LYS:HG2	1.92	0.51
1:D:354:ALA:HB1	1:D:359:HIS:HB2	1.93	0.51
2:A:440:THR:HG21	2:A:443:LEU:HB2	1.91	0.51
1:D:90:ARG:HD3	1:D:394:MET:HE2	1.94	0.49
2:A:557:LEU:HG	2:A:587:VAL:HG13	1.94	0.49
2:A:146:LEU:HD22	2:A:291:VAL:HG22	1.95	0.49
1:D:91:PHE:HB2	1:D:390:ILE:HG23	1.95	0.49
2:A:470:MET:O	2:A:498:LYS:NZ	2.41	0.48
2:A:462:HIS:HB3	2:A:474:GLU:HB3	1.93	0.48
2:A:63:THR:HA	2:A:111:GLY:HA3	1.94	0.48
2:A:65:PHE:HB3	2:A:117:GLY:HA2	1.96	0.48
1:D:136:LEU:HD12	2:A:243:PRO:HG3	1.95	0.48
1:D:326:LEU:HD13	1:D:387:THR:HG23	1.96	0.47
2:A:405:VAL:HG12	2:A:407:PHE:H	1.79	0.47
1:D:28:PRO:HG3	1:D:121[B]:SER:HB3	1.97	0.47
2:A:459:ILE:HG21	2:A:489:VAL:HG21	1.96	0.47
1:D:142:TYR:O	2:A:250:ARG:NH1	2.48	0.47
2:A:162:ILE:HD12	2:A:238:LEU:HD21	1.97	0.46
1:D:382:ARG:HG3	1:D:383:ARG:HG3	1.98	0.46
1:D:28:PRO:HG3	1:D:121[A]:SER:HB3	1.97	0.45
1:D:48:GLU:HG2	3:D:501:GOL:H32	1.98	0.45
1:D:40:ARG:HG2	3:D:501:GOL:H31	1.97	0.45
2:A:435:ILE:HD11	2:A:488:ARG:HD3	1.99	0.45
2:A:613:SER:OG	2:A:614:GLY:N	2.50	0.45
1:D:90:ARG:HH21	1:D:97:GLU:CD	2.20	0.44
2:A:346:LYS:HA	2:A:389:LEU:HD13	1.99	0.44
2:A:65:PHE:HB3	2:A:117:GLY:CA	2.47	0.44
2:A:466:PRO:HG2	2:A:469:LYS:HB2	1.99	0.44
1:D:252:HIS:CE1	1:D:330:PHE:HB3	2.52	0.44
2:A:536:GLU:OE2	2:A:605:TYR:OH	2.21	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:333:ALA:HB1	2:A:364:GLY:HA3	1.99	0.44
1:D:236:ASP:O	1:D:240:GLN:HG3	2.18	0.43
1:D:390:ILE:HB	1:D:394:MET:HB2	1.98	0.43
2:A:325:ILE:HB	2:A:349:TYR:CE1	2.54	0.43
2:A:355:ASP:OD1	2:A:356:VAL:HG22	2.19	0.42
2:A:542:ALA:HB2	2:A:636:ILE:HG23	2.00	0.42
1:D:276:LYS:HE2	1:D:276:LYS:HB3	1.86	0.42
2:A:355:ASP:OD1	2:A:356:VAL:N	2.50	0.41
2:A:331:LEU:HB2	2:A:410:GLU:HA	2.03	0.41
2:A:523:LEU:HB2	2:A:583:ALA:HB1	2.02	0.41
1:D:325:GLU:HG2	1:D:368:ILE:HB	2.03	0.41
2:A:656:LEU:HD13	2:A:662:ALA:HB2	2.03	0.41
2:A:30:MET:HG3	2:A:34:TYR:CD2	2.56	0.40
1:D:196:ASP:HB3	1:D:202:ILE:HD11	2.03	0.40
1:D:99:VAL:HG11	1:D:369:LEU:HD22	2.04	0.40
2:A:713:LEU:HD23	2:A:713:LEU:HA	1.88	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	D	401/403 (100%)	387 (96%)	14 (4%)	0	100 100
2	A	721/736 (98%)	690 (96%)	29 (4%)	2 (0%)	41 47
All	All	1122/1139 (98%)	1077 (96%)	43 (4%)	2 (0%)	47 56

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	382	THR
2	A	383	GLN

### 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	D	306/308 (99%)	305 (100%)	1 (0%)	92 96
2	A	512/566 (90%)	510 (100%)	2 (0%)	91 95
All	All	818/874 (94%)	815 (100%)	3 (0%)	91 95

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	313	ARG
2	A	426	ILE
2	A	468	ASP

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

Mol	Chain	Res	Type
2	A	28	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

1 non-standard protein/DNA/RNA residue is 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
1	CSO	D	389	1	3,6,7	0.62	0	0,6,8	0.00	-

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
1	CSO	D	389	1	-	0/1/5/7	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

16 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
4	SO4	D	504	-	4,4,4	0.14	0	6,6,6	0.05	0
4	SO4	D	509	-	4,4,4	0.14	0	6,6,6	0.05	0
3	GOL	A	801	-	5,5,5	0.90	0	5,5,5	0.99	0
4	SO4	D	510	-	4,4,4	0.14	0	6,6,6	0.05	0
4	SO4	D	505	-	4,4,4	0.15	0	6,6,6	0.04	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	SO4	A	805	-	4,4,4	0.14	0	6,6,6	0.05	0
4	SO4	D	507	-	4,4,4	0.14	0	6,6,6	0.04	0
4	SO4	D	502	-	4,4,4	0.14	0	6,6,6	0.06	0
4	SO4	D	503	-	4,4,4	0.14	0	6,6,6	0.06	0
4	SO4	A	803	-	4,4,4	0.14	0	6,6,6	0.04	0
4	SO4	D	506	-	4,4,4	0.14	0	6,6,6	0.05	0
4	SO4	A	802	-	4,4,4	0.13	0	6,6,6	0.06	0
3	GOL	D	511	-	5,5,5	0.94	0	5,5,5	0.97	0
4	SO4	D	508	-	4,4,4	0.14	0	6,6,6	0.04	0
4	SO4	A	804	-	4,4,4	0.14	0	6,6,6	0.05	0
3	GOL	D	501	-	5,5,5	0.92	0	5,5,5	0.95	0

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	GOL	D	501	-	-	0/4/4/4	-
3	GOL	D	511	-	-	2/4/4/4	-
3	GOL	A	801	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	801	GOL	C1-C2-C3-O3
3	D	511	GOL	C1-C2-C3-O3
3	A	801	GOL	O2-C2-C3-O3
3	D	511	GOL	O2-C2-C3-O3

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	501	GOL	2	0

## 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.