



wwPDB X-ray Structure Validation Summary Report ⓘ

May 15, 2020 – 11:55 pm BST

PDB ID : 3QG5
Title : The Mre11:Rad50 complex forms an ATP dependent molecular clamp in DNA double-strand break repair
Authors : Lammens, K.
Deposited on : 2011-01-24
Resolution : 3.40 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

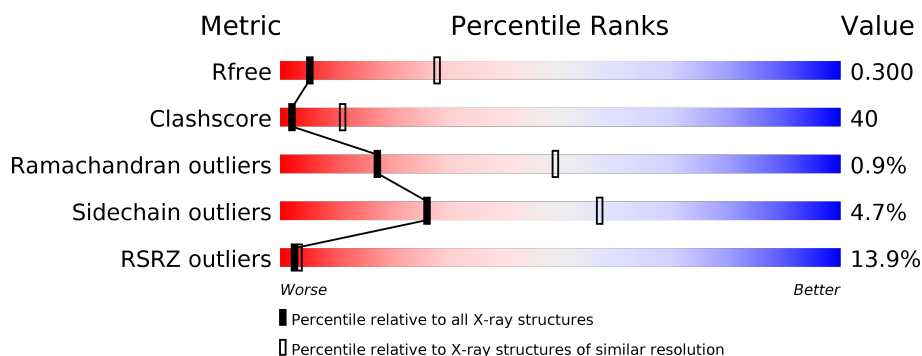
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.40 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	1026 (3.48-3.32)
Clashscore	141614	1055 (3.48-3.32)
Ramachandran outliers	138981	1038 (3.48-3.32)
Sidechain outliers	138945	1038 (3.48-3.32)
RSRZ outliers	127900	2173 (3.50-3.30)

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 on 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	365	
1	B	365	
2	C	379	
2	D	379	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 11601 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 rad50.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	349	Total	C	N	O	Se	95	0	0
			2799	1784	486	525	4			
1	B	349	Total	C	N	O	Se	371	0	0
			2799	1784	486	525	4			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	678	GLY	-	LINKER	UNP Q9X1X1
A	679	GLY	-	LINKER	UNP Q9X1X1
A	680	ALA	-	LINKER	UNP Q9X1X1
A	681	GLY	-	LINKER	UNP Q9X1X1
A	682	GLY	-	LINKER	UNP Q9X1X1
A	683	ALA	-	LINKER	UNP Q9X1X1
A	684	GLY	-	LINKER	UNP Q9X1X1
A	685	GLY	-	LINKER	UNP Q9X1X1
B	678	GLY	-	LINKER	UNP Q9X1X1
B	679	GLY	-	LINKER	UNP Q9X1X1
B	680	ALA	-	LINKER	UNP Q9X1X1
B	681	GLY	-	LINKER	UNP Q9X1X1
B	682	GLY	-	LINKER	UNP Q9X1X1
B	683	ALA	-	LINKER	UNP Q9X1X1
B	684	GLY	-	LINKER	UNP Q9X1X1
B	685	GLY	-	LINKER	UNP Q9X1X1

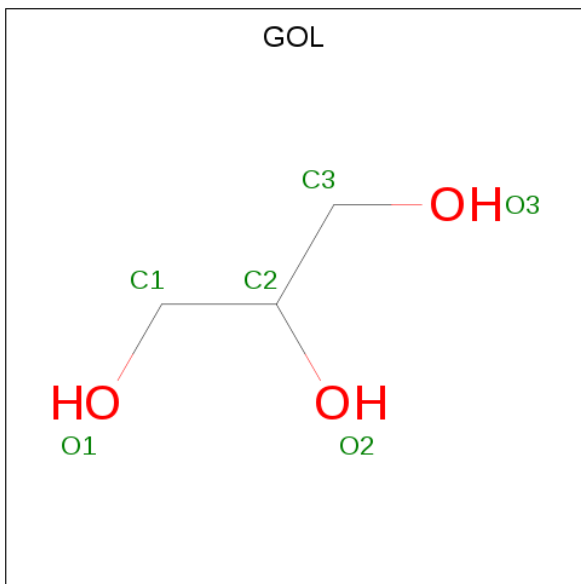
- Molecule 2 is a protein called Mre11.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	362	Total	C	N	O	S Se	127	0	0
			2985	1915	505	558	1 6			
2	D	366	Total	C	N	O	S Se	114	0	0
			3006	1928	512	559	1 6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	7	MSE	-	INITIATING METHIONINE	UNP Q9X1X0
D	7	MSE	-	INITIATING METHIONINE	UNP Q9X1X0

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

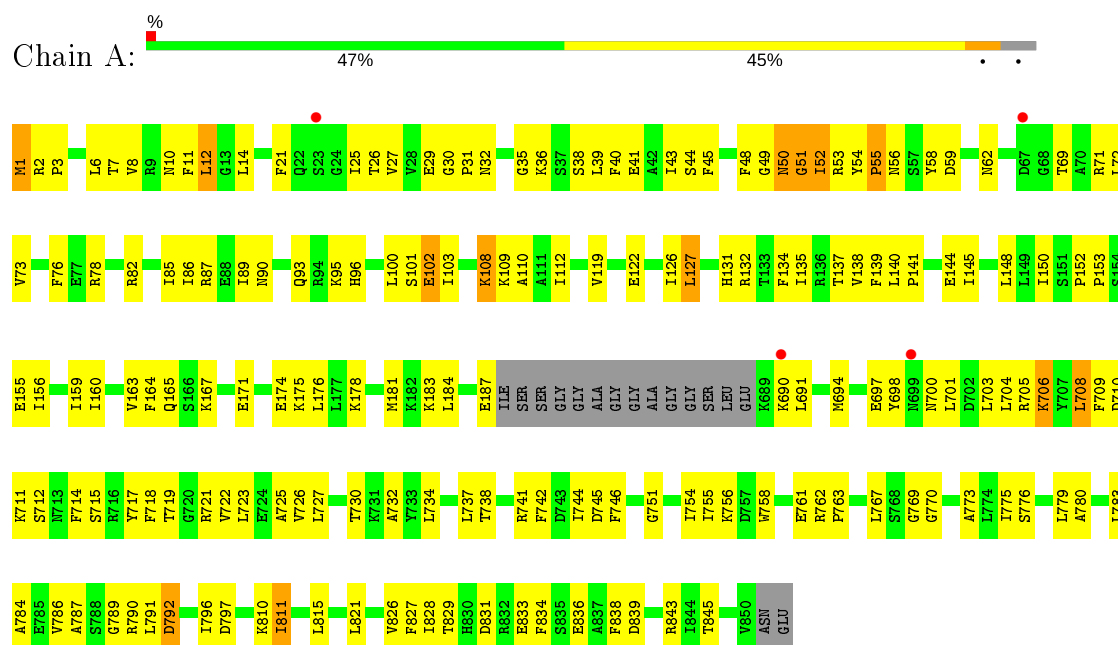


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		

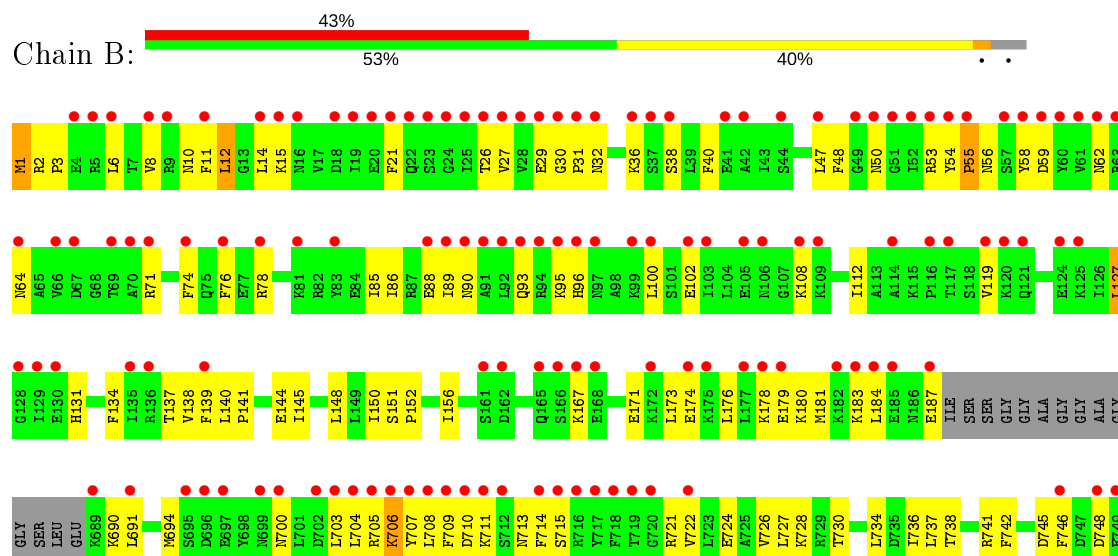
3 Residue-property plots [i](#)

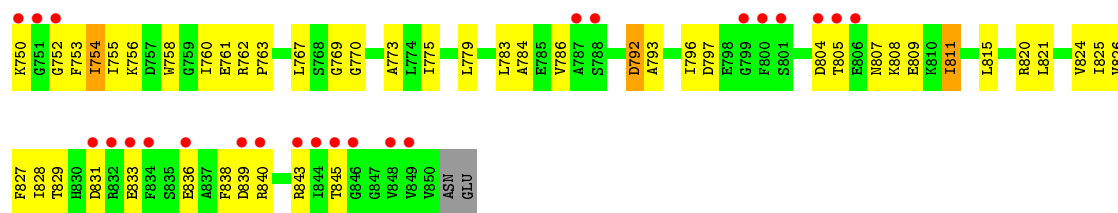
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are 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: rad50

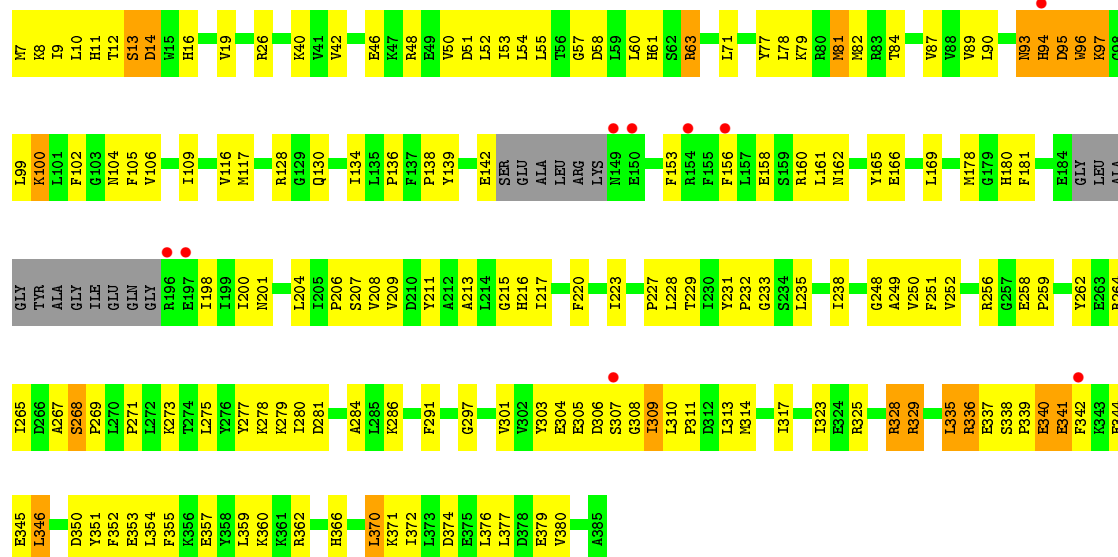


• Molecule 1: rad50

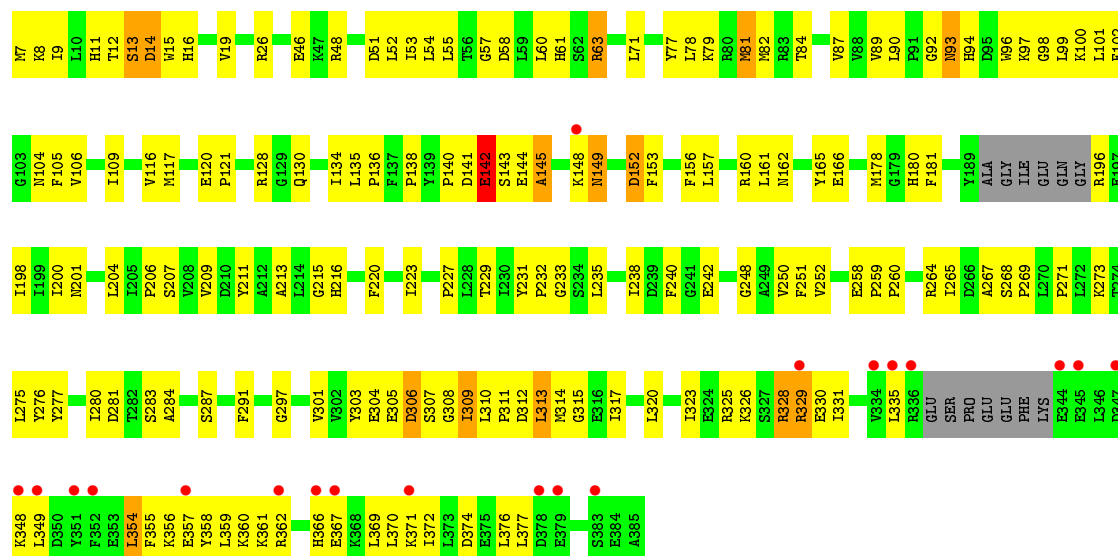




● Molecule 2: Mre11



● Molecule 2: Mre11



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	105.19 Å 187.00 Å 300.17 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 3.40 20.00 – 3.40	Depositor EDS
% Data completeness (in resolution range)	98.8 (20.00-3.40) 98.9 (20.00-3.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.21 (at 3.44 Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, R_{free}	0.258 , 0.295 0.269 , 0.300	Depositor DCC
R_{free} test set	2020 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	93.7	Xtriage
Anisotropy	0.096	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.18 , 63.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	11601	wwPDB-VP
Average B, all atoms (Å ²)	111.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.80% 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: GOL

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	0.26	0/2837	0.43	0/3797
1	B	0.25	0/2837	0.42	0/3797
2	C	0.29	0/3041	0.55	3/4086 (0.1%)
2	D	0.29	0/3061	0.62	7/4112 (0.2%)
All	All	0.27	0/11776	0.51	10/15792 (0.1%)

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	329	ARG	NE-CZ-NH1	-12.34	114.13	120.30
2	C	329	ARG	NE-CZ-NH2	-12.16	114.22	120.30
2	D	329	ARG	NE-CZ-NH2	12.10	126.35	120.30
2	C	329	ARG	NE-CZ-NH1	11.94	126.27	120.30
2	D	196	ARG	NE-CZ-NH1	-11.60	114.50	120.30

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	2799	0	2870	253	0
1	B	2799	0	2870	179	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	2985	0	3006	254	0
2	D	3006	0	3038	265	0
3	A	6	0	8	0	0
3	D	6	0	8	0	0
All	All	11601	0	11800	869	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 40.

The worst 5 of 869 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:174:GLU:HG2	1:A:709:PHE:CE1	1.61	1.34
2:D:306:ASP:HB2	2:D:325:ARG:NH1	1.40	1.30
1:A:3:PRO:HB2	1:A:21:PHE:CE1	1.67	1.29
2:D:306:ASP:CB	2:D:325:ARG:NH1	1.96	1.27
2:D:14:ASP:OD2	2:D:57:GLY:HA3	1.29	1.27

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	345/365 (94%)	314 (91%)	27 (8%)	4 (1%)	13	41
1	B	345/365 (94%)	315 (91%)	28 (8%)	2 (1%)	25	57
2	C	356/379 (94%)	330 (93%)	23 (6%)	3 (1%)	19	51
2	D	360/379 (95%)	330 (92%)	27 (8%)	3 (1%)	19	51
All	All	1406/1488 (94%)	1289 (92%)	105 (8%)	12 (1%)	17	49

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	268	SER
2	C	309	ILE
1	A	51	GLY
2	C	336	ARG
2	D	145	ALA

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	303/307 (99%)	290 (96%)	13 (4%)	29	59
1	B	303/307 (99%)	293 (97%)	10 (3%)	38	66
2	C	331/335 (99%)	310 (94%)	21 (6%)	18	47
2	D	331/335 (99%)	315 (95%)	16 (5%)	25	56
All	All	1268/1284 (99%)	1208 (95%)	60 (5%)	26	57

5 of 60 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	93	ASN
2	C	142	GLU
2	D	313	LEU
2	C	96	TRP
2	C	256	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	121	GLN
2	C	93	ASN
2	D	72	HIS
1	B	96	HIS
2	C	366	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

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	$\# Z > 2$
3	GOL	A	3968	-	5,5,5	0.39	0	5,5,5	0.30	0
3	GOL	D	3968	-	5,5,5	0.41	0	5,5,5	0.22	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	A	3968	-	-	2/4/4/4	-
3	GOL	D	3968	-	-	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	3968	GOL	O1-C1-C2-C3
3	D	3968	GOL	O1-C1-C2-C3
3	A	3968	GOL	O1-C1-C2-O2
3	D	3968	GOL	O1-C1-C2-O2

There are no ring outliers.

No monomer is involved in short contacts.

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	345/365 (94%)	-0.37	4 (1%) 79 77	30, 83, 211, 328	75 (21%)
1	B	318/365 (87%)	2.30	158 (49%) 0 0	51, 134, 217, 391	277 (87%)
2	C	354/379 (93%)	-0.31	9 (2%) 57 55	33, 87, 193, 279	85 (24%)
2	D	355/379 (93%)	-0.15	20 (5%) 24 25	30, 88, 225, 363	81 (22%)
All	All	1372/1488 (92%)	0.32	191 (13%) 2 3	30, 100, 213, 391	518 (37%)

The worst 5 of 191 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	702	ASP	16.4
1	B	187	GLU	11.8
1	B	16	ASN	11.0
1	B	845	THR	10.3
1	B	103	ILE	9.9

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 carbohydrates 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(\AA^2)	Q<0.9
3	GOL	D	3968	6/6	0.85	0.28	56,83,86,86	0
3	GOL	A	3968	6/6	0.95	0.17	53,55,58,65	0

6.5 Other polymers [i](#)

There are no such residues in this entry.