



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 6, 2025 – 01:45 pm BST

PDB ID : 9HGP / pdb\_00009hgp  
Title : Human Carbonic Anhydrase II in complex with a synthetic aromatic oligoamide foldamer  
Authors : Sigl, J.C.; Wang, L.; Huc, I.  
Deposited on : 2024-11-20  
Resolution : 2.05 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.

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	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
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)	:	2.46

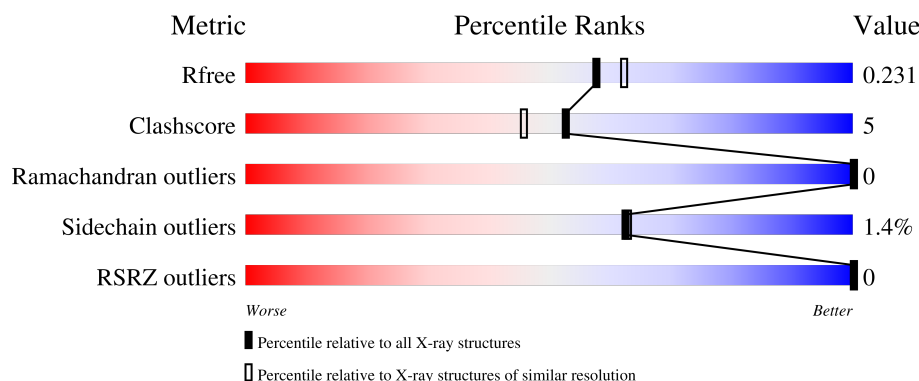
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.05 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))
$R_{free}$	164625	2096 (2.04-2.04)
Clashscore	180529	2229 (2.04-2.04)
Ramachandran outliers	177936	2217 (2.04-2.04)
Sidechain outliers	177891	2217 (2.04-2.04)
RSRZ outliers	164620	2096 (2.04-2.04)

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  $\leq 5\%$ . 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	260	 89% 9% ..
2	D	15	 80% 20%

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
2	QVS	D	10	-	X	-	-
2	QVS	D	4	-	X	-	-
2	QVS	D	8	-	X	-	-

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 2669 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 Carbonic anhydrase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	257	Total	C	N	O	S	0	2	0
			2056	1319	354	381	2			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP P00918
A	2	ALA	-	expression tag	UNP P00918

- Molecule 2 is a protein called Synthetic aromatic oligoamide foldamer.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	15	Total	C	N	O	S	0	0	0
			242	177	32	32	1			

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

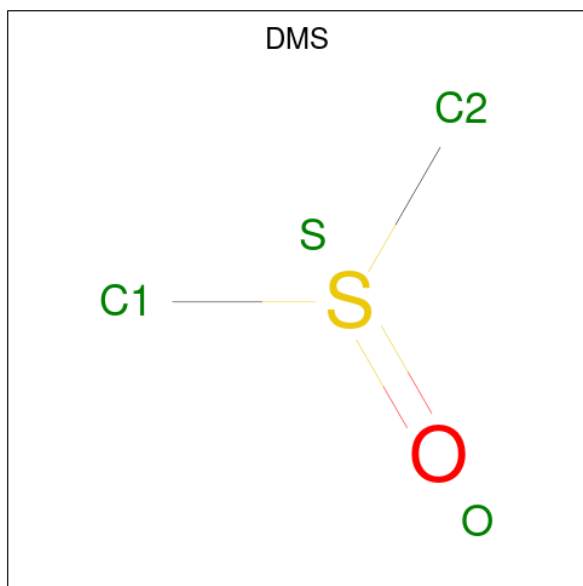
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Zn	0	0
			1	1		

- Molecule 4 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: C<sub>4</sub>H<sub>12</sub>NO<sub>3</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 5 is DIMETHYL SULFOXIDE (CCD ID: DMS) (formula: C<sub>2</sub>H<sub>6</sub>OS) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	315	Total 315	O 315	0	0
6	D	43	Total 43	O 43	0	0

### 3 Residue-property plots


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.

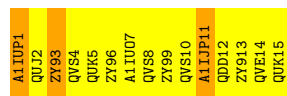
- Molecule 1: Carbonic anhydrase 2

Chain A:  89% 9% ..



- Molecule 2: Synthetic aromatic oligoamide foldamer

Chain D:  80% 20%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.68Å 78.97Å 46.12Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	17.17 – 2.05 17.17 – 2.05	Depositor EDS
% Data completeness (in resolution range)	99.0 (17.17-2.05) 98.8 (17.17-2.05)	Depositor EDS
$R_{merge}$	0.15	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.76 (at 2.05Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, $R_{free}$	0.171 , 0.231 0.171 , 0.231	Depositor DCC
$R_{free}$ test set	1917 reflections (9.88%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	24.1	Xtriage
Anisotropy	0.476	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 47.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.019 for k,h,-l	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2669	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.35% 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: A1IJP, DMS, ZY9, QDD, A1IUP, ZN, A1IUO, QUK, TRS, QUJ, QVS, QVE

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	0.31	0/2118	0.52	0/2877

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
2	D	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	11	A1IJP	Mainchain
2	D	3	ZY9	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	2056	0	1989	21	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	242	0	0	1	0
3	A	1	0	0	0	0
4	A	8	0	12	0	0
5	A	4	0	6	0	0
6	A	315	0	0	5	2
6	D	43	0	0	0	0
All	All	2669	0	2007	21	2

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 5.

All (21) 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:45:LYS:O	6:A:401:HOH:O	1.98	0.81
1:A:219:SER:O	1:A:223:LEU:HD23	1.93	0.68
1:A:158:LYS:HG2	6:A:408:HOH:O	1.92	0.67
1:A:36[A]:HIS:HD2	6:A:604:HOH:O	1.85	0.59
1:A:163:LEU:HD22	1:A:228:LEU:HD11	1.87	0.55
1:A:250:LEU:HD11	1:A:255:ILE:HD11	1.90	0.53
1:A:60:LEU:HD21	1:A:62:ASN:HB3	1.92	0.52
1:A:169:LYS:NZ	6:A:406:HOH:O	2.42	0.51
1:A:71:ASP:OD2	1:A:76:LYS:NZ	2.36	0.49
1:A:227:LYS:HE3	1:A:227:LYS:HA	1.95	0.49
1:A:193:TYR:HB3	1:A:255:ILE:HD12	1.96	0.47
1:A:74:GLN:HG2	1:A:76:LYS:NZ	2.29	0.47
1:A:30:PRO:HG3	1:A:106:GLU:HB3	1.97	0.46
1:A:74:GLN:HG3	1:A:76:LYS:HG3	1.98	0.45
1:A:224:LYS:HE2	1:A:224:LYS:HB2	1.73	0.44
1:A:256:LYS:HD2	1:A:256:LYS:HA	1.67	0.43
1:A:255:ILE:N	1:A:255:ILE:HD13	2.35	0.42
1:A:198:THR:OG1	2:D:1:A1IUP:N26	2.53	0.42
1:A:74:GLN:HB2	6:A:574:HOH:O	2.19	0.41
1:A:13:PRO:HA	1:A:16:TRP:CD2	2.55	0.41
1:A:111:LYS:HE3	1:A:111:LYS:HB2	1.56	0.40

All (2) 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)
6:A:557:HOH:O	6:A:606:HOH:O[4_455]	1.97	0.23
6:A:459:HOH:O	6:A:663:HOH:O[3_555]	2.16	0.04

## 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	257/260 (99%)	247 (96%)	10 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	221/224 (99%)	218 (99%)	3 (1%)	62	63

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

Mol	Chain	Res	Type
1	A	60	LEU
1	A	160	VAL
1	A	255	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	229	ASN
1	A	254	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

15 non-standard protein/DNA/RNA residues 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	ZY9	D	9	2	10,10,11	1.59	1 (10%)	11,12,14	1.96	4 (36%)
2	A1IUP	D	1	2,3	29,29,30	1.94	3 (10%)	37,38,40	1.84	6 (16%)
2	A1IUO	D	7	2	22,23,24	5.24	12 (54%)	30,32,34	5.65	16 (53%)
2	ZY9	D	13	2	10,10,11	1.48	1 (10%)	11,12,14	2.51	4 (36%)
2	ZY9	D	6	2	10,10,11	1.46	1 (10%)	11,12,14	2.48	4 (36%)
2	QUK	D	5	2	19,19,20	1.72	2 (10%)	22,25,27	6.04	8 (36%)
2	QVE	D	14	2	19,19,20	1.58	4 (21%)	23,26,28	3.24	6 (26%)
2	QUK	D	15	2	20,20,20	1.01	1 (5%)	26,27,27	2.01	6 (23%)
2	QDD	D	12	2	18,18,19	1.76	2 (11%)	22,25,27	5.88	10 (45%)
2	QVS	D	4	2	15,15,16	4.66	11 (73%)	19,21,23	6.90	13 (68%)
2	QUJ	D	2	2	19,19,20	1.70	2 (10%)	23,26,28	5.37	4 (17%)
2	QVS	D	10	2	15,15,16	4.64	11 (73%)	19,21,23	6.88	12 (63%)
2	ZY9	D	3	2	10,10,11	1.35	1 (10%)	11,12,14	2.11	3 (27%)
2	A1IJP	D	11	2	23,23,24	1.62	2 (8%)	30,31,33	3.05	10 (33%)
2	QVS	D	8	2	15,15,16	4.76	10 (66%)	19,21,23	8.17	12 (63%)

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	ZY9	D	9	2	-	0/4/4/6	0/1/1/1
2	A1IUP	D	1	2,3	-	4/23/23/24	0/2/2/2
2	A1IUO	D	7	2	-	2/8/18/20	0/3/3/3
2	ZY9	D	13	2	-	0/4/4/6	0/1/1/1
2	ZY9	D	6	2	-	0/4/4/6	0/1/1/1
2	QUK	D	5	2	-	4/7/7/9	0/2/2/2
2	QVE	D	14	2	-	0/7/7/9	0/2/2/2
2	QUK	D	15	2	-	6/9/9/9	0/2/2/2
2	QDD	D	12	2	-	0/6/6/8	0/2/2/2
2	QVS	D	4	2	-	0/2/2/4	0/2/2/2
2	QUJ	D	2	2	-	2/7/7/9	0/2/2/2
2	QVS	D	10	2	-	0/2/2/4	0/2/2/2
2	ZY9	D	3	2	-	0/4/4/6	0/1/1/1
2	A1IJP	D	11	2	-	0/7/7/9	0/3/3/3
2	QVS	D	8	2	-	0/2/2/4	0/2/2/2

All (64) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	7	A1IUO	C13-C12	12.63	1.71	1.50
2	D	7	A1IUO	C06-C07	-8.63	1.36	1.50
2	D	7	A1IUO	C08-C07	8.47	1.53	1.39
2	D	10	QVS	C6-C7	8.30	1.62	1.42
2	D	4	QVS	C6-C7	8.11	1.62	1.42
2	D	8	QVS	C6-C7	8.07	1.61	1.42
2	D	7	A1IUO	C07-C12	7.98	1.54	1.39
2	D	7	A1IUO	C10-C11	-7.82	1.22	1.38
2	D	4	QVS	C4-C3	-7.43	1.23	1.38
2	D	7	A1IUO	C06-C05	-7.26	1.39	1.54
2	D	8	QVS	C4-C3	-7.01	1.24	1.38
2	D	10	QVS	C4-C3	-6.89	1.24	1.38
2	D	5	QUK	C10-C	6.20	1.55	1.48
2	D	11	A1IJP	CA-C	6.10	1.55	1.48
2	D	10	QVS	C9-CA	-6.09	1.28	1.39
2	D	4	QVS	C3-C2	-6.06	1.24	1.38
2	D	7	A1IUO	C09-C10	-5.85	1.22	1.38
2	D	8	QVS	C9-C8	-5.79	1.24	1.37
2	D	10	QVS	C9-C8	-5.77	1.24	1.37
2	D	1	A1IUP	C-N3	5.75	1.45	1.33
2	D	8	QVS	C3-C2	-5.75	1.25	1.38
2	D	8	QVS	C8-C6	-5.73	1.31	1.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	4	QVS	C9-C8	-5.63	1.24	1.37
2	D	4	QVS	C8-C6	-5.58	1.31	1.42
2	D	10	QVS	C8-C6	-5.55	1.31	1.42
2	D	4	QVS	C9-CA	-5.53	1.29	1.39
2	D	1	A1IUP	C16-N15	5.45	1.45	1.33
2	D	8	QVS	C7-N11	5.44	1.47	1.37
2	D	10	QVS	C3-C2	-5.38	1.25	1.38
2	D	8	QVS	CA-C	5.32	1.54	1.48
2	D	8	QVS	C9-CA	-5.32	1.30	1.39
2	D	12	QDD	C10-C	5.26	1.54	1.48
2	D	1	A1IUP	S24-N26	5.19	1.70	1.60
2	D	2	QUJ	CA-C	5.11	1.54	1.48
2	D	7	A1IUO	OET-CST	-4.82	1.38	1.47
2	D	10	QVS	C7-N11	4.49	1.46	1.37
2	D	8	QVS	C5-C6	4.37	1.51	1.42
2	D	10	QVS	C5-C6	4.14	1.50	1.42
2	D	4	QVS	C7-N11	4.13	1.45	1.37
2	D	4	QVS	CA-C	4.06	1.52	1.48
2	D	9	ZY9	CA-C	4.05	1.52	1.48
2	D	4	QVS	C2-C7	-3.98	1.35	1.42
2	D	7	A1IUO	C13-C05	3.93	1.62	1.54
2	D	7	A1IUO	OET-C2	3.86	1.44	1.37
2	D	10	QVS	CA-C	3.77	1.52	1.48
2	D	4	QVS	C5-C6	3.67	1.49	1.42
2	D	6	ZY9	CA-C	3.64	1.52	1.48
2	D	13	ZY9	CA-C	3.56	1.52	1.48
2	D	7	A1IUO	CA-N	3.47	1.49	1.37
2	D	14	QVE	CA-C	3.41	1.52	1.48
2	D	10	QVS	C2-C7	-3.40	1.36	1.42
2	D	8	QVS	C2-C7	-3.26	1.36	1.42
2	D	7	A1IUO	C6-C5	2.96	1.43	1.39
2	D	3	ZY9	CA-C	2.94	1.51	1.48
2	D	10	QVS	C2-N	2.94	1.47	1.38
2	D	14	QVE	C2-N	2.57	1.46	1.38
2	D	2	QUJ	C2-C7	-2.56	1.38	1.42
2	D	14	QVE	C6-C7	-2.47	1.36	1.42
2	D	12	QDD	C2-C7	-2.43	1.38	1.42
2	D	4	QVS	C2-N	2.36	1.45	1.38
2	D	15	QUK	C6-C7	-2.36	1.36	1.42
2	D	11	A1IJP	C6-C7	-2.35	1.36	1.42
2	D	14	QVE	CA-N11	-2.27	1.30	1.33
2	D	5	QUK	C6-C7	-2.10	1.37	1.42

All (118) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	2	QUJ	O-C-CA	-23.67	101.78	124.22
2	D	5	QUK	O-C-C10	-23.53	101.92	124.22
2	D	12	QDD	O-C-C10	-22.56	102.84	124.22
2	D	8	QVS	O-C-CA	-22.36	103.03	124.22
2	D	4	QVS	C2-C7-N11	19.48	137.90	118.64
2	D	8	QVS	C2-C7-N11	19.09	137.52	118.64
2	D	10	QVS	C2-C7-N11	18.94	137.37	118.64
2	D	7	A1IUO	C07-C06-C05	15.49	122.89	103.76
2	D	7	A1IUO	C08-C07-C12	-15.13	102.38	120.11
2	D	7	A1IUO	C06-C07-C08	12.81	153.16	129.18
2	D	14	QVE	O-C-CA	-12.68	112.21	124.22
2	D	10	QVS	O-C-CA	-12.16	112.70	124.22
2	D	4	QVS	O-C-CA	-11.93	112.92	124.22
2	D	8	QVS	C7-C2-N	-11.45	96.24	118.07
2	D	11	A1IJP	O-C-CA	-10.74	114.05	124.22
2	D	5	QUK	C-C10-N11	10.56	125.00	114.66
2	D	12	QDD	C-C10-N11	10.15	124.61	114.66
2	D	8	QVS	C3-C2-N	10.03	140.40	120.36
2	D	7	A1IUO	C06-C07-C12	-8.87	104.47	110.56
2	D	10	QVS	C7-C2-N	-8.47	101.92	118.07
2	D	4	QVS	C6-C7-N11	-8.28	105.69	122.78
2	D	2	QUJ	C-CA-N11	8.28	122.77	114.66
2	D	10	QVS	C6-C7-N11	-8.26	105.74	122.78
2	D	10	QVS	C3-C2-N	8.12	136.60	120.36
2	D	1	A1IUP	O25-S24-O27	-7.75	106.02	118.76
2	D	4	QVS	C7-C2-N	-7.59	103.59	118.07
2	D	7	A1IUO	C13-C12-C07	-7.53	105.39	110.56
2	D	8	QVS	C6-C7-N11	-7.49	107.34	122.78
2	D	4	QVS	C3-C2-N	7.16	134.67	120.36
2	D	10	QVS	CA-N11-C7	7.07	123.47	118.11
2	D	4	QVS	C-CA-N11	-6.84	107.96	114.66
2	D	7	A1IUO	CA-C6-C5	-6.73	117.98	122.24
2	D	4	QVS	CA-N11-C7	6.14	122.76	118.11
2	D	7	A1IUO	C2-CA-N	-6.07	114.26	119.46
2	D	10	QVS	C5-C6-C8	5.89	130.31	122.21
2	D	12	QDD	C7-C2-N	-5.86	106.90	118.07
2	D	15	QUK	C7-CA-N	-5.82	106.96	118.07
2	D	5	QUK	C7-CA-N	-5.79	107.04	118.07
2	D	4	QVS	C9-CA-C	5.77	126.22	121.23
2	D	12	QDD	C3-C2-N	5.66	131.68	120.36
2	D	11	A1IJP	C-CA-N11	5.60	120.15	114.66
2	D	11	A1IJP	C7-C2-N	-5.58	107.42	118.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	6	ZY9	O-C-CA	-5.56	118.96	124.22
2	D	8	QVS	C5-C6-C8	5.48	129.74	122.21
2	D	5	QUK	C9-C10-C	-5.39	116.57	121.23
2	D	5	QUK	C3-CA-N	5.36	131.07	120.36
2	D	7	A1IUO	C6-CA-C2	5.28	122.44	118.18
2	D	4	QVS	C5-C6-C8	5.10	129.21	122.21
2	D	12	QDD	C9-C10-C	-4.96	116.94	121.23
2	D	13	ZY9	O-C-CA	-4.84	119.63	124.22
2	D	11	A1IJP	C3-C2-N	4.69	129.74	120.36
2	D	13	ZY9	C9-CA-C	-4.68	117.02	121.19
2	D	5	QUK	C10-N11-C7	4.65	121.63	118.11
2	D	3	ZY9	C2-C7-N11	4.63	123.76	115.89
2	D	10	QVS	C-CA-N11	-4.57	110.19	114.66
2	D	8	QVS	CA-N11-C7	4.51	121.53	118.11
2	D	15	QUK	C3-CA-N	4.45	129.25	120.36
2	D	4	QVS	C4-C3-C2	4.44	129.74	121.19
2	D	10	QVS	C9-C8-C6	4.43	125.77	120.52
2	D	10	QVS	C9-CA-C	4.35	124.99	121.23
2	D	4	QVS	C5-C6-C7	-4.34	109.97	118.98
2	D	10	QVS	C5-C6-C7	-4.19	110.29	118.98
2	D	14	QVE	C7-C2-N	-4.18	110.11	118.07
2	D	10	QVS	C4-C3-C2	4.15	129.19	121.19
2	D	14	QVE	C3-C2-N	4.06	128.47	120.36
2	D	8	QVS	C9-C8-C6	4.01	125.27	120.52
2	D	11	A1IJP	CA-N11-C7	3.98	121.13	118.11
2	D	15	QUK	C-C10-N11	3.97	122.61	116.28
2	D	14	QVE	C2-C7-N11	-3.96	114.72	118.64
2	D	8	QVS	C5-C6-C7	-3.93	110.83	118.98
2	D	11	A1IJP	C4-C3-C2	-3.93	116.16	121.17
2	D	8	QVS	C4-C3-C2	3.93	128.75	121.19
2	D	9	ZY9	C2-C7-N11	3.82	122.39	115.89
2	D	12	QDD	C2-C7-N11	-3.81	114.87	118.64
2	D	6	ZY9	C9-CA-C	-3.68	117.92	121.19
2	D	1	A1IUP	O27-S24-N26	3.67	112.80	107.36
2	D	7	A1IUO	OET-CST-CME	3.60	113.08	106.59
2	D	4	QVS	C9-C8-C6	3.59	124.78	120.52
2	D	2	QUJ	CA-N11-C7	3.57	120.81	118.11
2	D	2	QUJ	C9-CA-C	-3.46	118.23	121.23
2	D	12	QDD	C8-C6-C7	-3.46	116.93	119.75
2	D	1	A1IUP	O25-S24-N26	3.46	112.49	107.36
2	D	12	QDD	C10-N11-C7	3.45	120.72	118.11
2	D	13	ZY9	C2-C7-N11	3.40	121.68	115.89

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	8	QVS	C8-C9-CA	3.25	122.21	119.05
2	D	7	A1IUO	C12-C13-C05	-3.21	99.79	103.76
2	D	7	A1IUO	C11-C12-C07	3.12	123.78	120.11
2	D	3	ZY9	C9-CA-C	-3.10	118.43	121.19
2	D	11	A1IJP	C2-C7-N11	-3.04	115.64	118.64
2	D	7	A1IUO	C06-C05-C5	-2.99	108.82	115.12
2	D	11	A1IJP	C5-C6-C7	-2.95	117.34	119.75
2	D	9	ZY9	O-C-CA	-2.91	121.46	124.22
2	D	14	QVE	C-CA-N11	2.79	117.40	114.66
2	D	6	ZY9	C2-C7-N11	2.78	120.61	115.89
2	D	1	A1IUP	C12-C14-N15	2.76	118.97	113.05
2	D	11	A1IJP	C9-CA-N11	-2.74	119.28	122.79
2	D	5	QUK	OB-C8-C6	2.71	122.60	115.01
2	D	11	A1IJP	C9-C8-C6	-2.65	117.44	121.13
2	D	6	ZY9	C9-CA-N11	-2.59	118.77	122.47
2	D	5	QUK	CA-C7-N11	-2.57	116.09	118.64
2	D	3	ZY9	C2-C7-C6	-2.55	116.05	121.24
2	D	1	A1IUP	O-C-N3	-2.50	122.36	124.89
2	D	15	QUK	C4-C3-CA	-2.42	116.53	121.19
2	D	7	A1IUO	C10-C09-C08	2.42	123.88	120.19
2	D	1	A1IUP	O27-S24-C21	2.40	110.03	107.35
2	D	4	QVS	C8-C6-C7	2.33	120.81	117.85
2	D	15	QUK	C3-CA-C7	2.32	123.71	120.06
2	D	12	QDD	C4-C3-C2	-2.27	116.82	121.19
2	D	7	A1IUO	C3-C2-CA	-2.26	119.13	120.88
2	D	13	ZY9	C2-C7-C6	-2.24	116.69	121.24
2	D	9	ZY9	C9-CA-N11	-2.21	119.30	122.47
2	D	9	ZY9	C9-CA-C	-2.21	119.22	121.19
2	D	7	A1IUO	C13-C05-C5	-2.17	110.54	115.12
2	D	7	A1IUO	CME-CST-C	-2.17	105.16	113.19
2	D	8	QVS	C3-C2-C7	2.10	123.35	120.06
2	D	12	QDD	OD2-CG-CB	2.09	121.94	114.02
2	D	14	QVE	C4-C3-C2	-2.06	117.23	121.19
2	D	15	QUK	OB-C8-C6	2.04	120.72	115.01

There are no chirality outliers.

All (18) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	15	QUK	O-C-C10-N11
2	D	15	QUK	O-C-C10-C9
2	D	15	QUK	OXT-C-C10-C9

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Mol	Chain	Res	Type	Atoms
2	D	15	QUK	CE-CD-CG-OB
2	D	2	QUJ	C9-C8-OB-CG
2	D	2	QUJ	C6-C8-OB-CG
2	D	15	QUK	OXT-C-C10-N11
2	D	5	QUK	C9-C8-OB-CG
2	D	5	QUK	C6-C8-OB-CG
2	D	5	QUK	CE-CD-CG-OB
2	D	1	A1IUP	C4-C5-C6-C7
2	D	7	A1IUO	CME-CST-OET-C2
2	D	5	QUK	CD-CG-OB-C8
2	D	15	QUK	CG-CD-CE-N1
2	D	1	A1IUP	C20-C21-S24-O25
2	D	1	A1IUP	C22-C21-S24-O25
2	D	7	A1IUO	C06-C05-C5-C4
2	D	1	A1IUP	C5-C4-N3-C

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	1	A1IUP	1	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

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	$\# Z  > 2$
5	DMS	A	303	-	3,3,3	0.67	0	3,3,3	0.78	0
4	TRS	A	302	-	7,7,7	0.28	0	9,9,9	0.46	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
4	TRS	A	302	-	-	0/9/9/9	-

There are no bond length outliers.

There are no bond angle outliers.

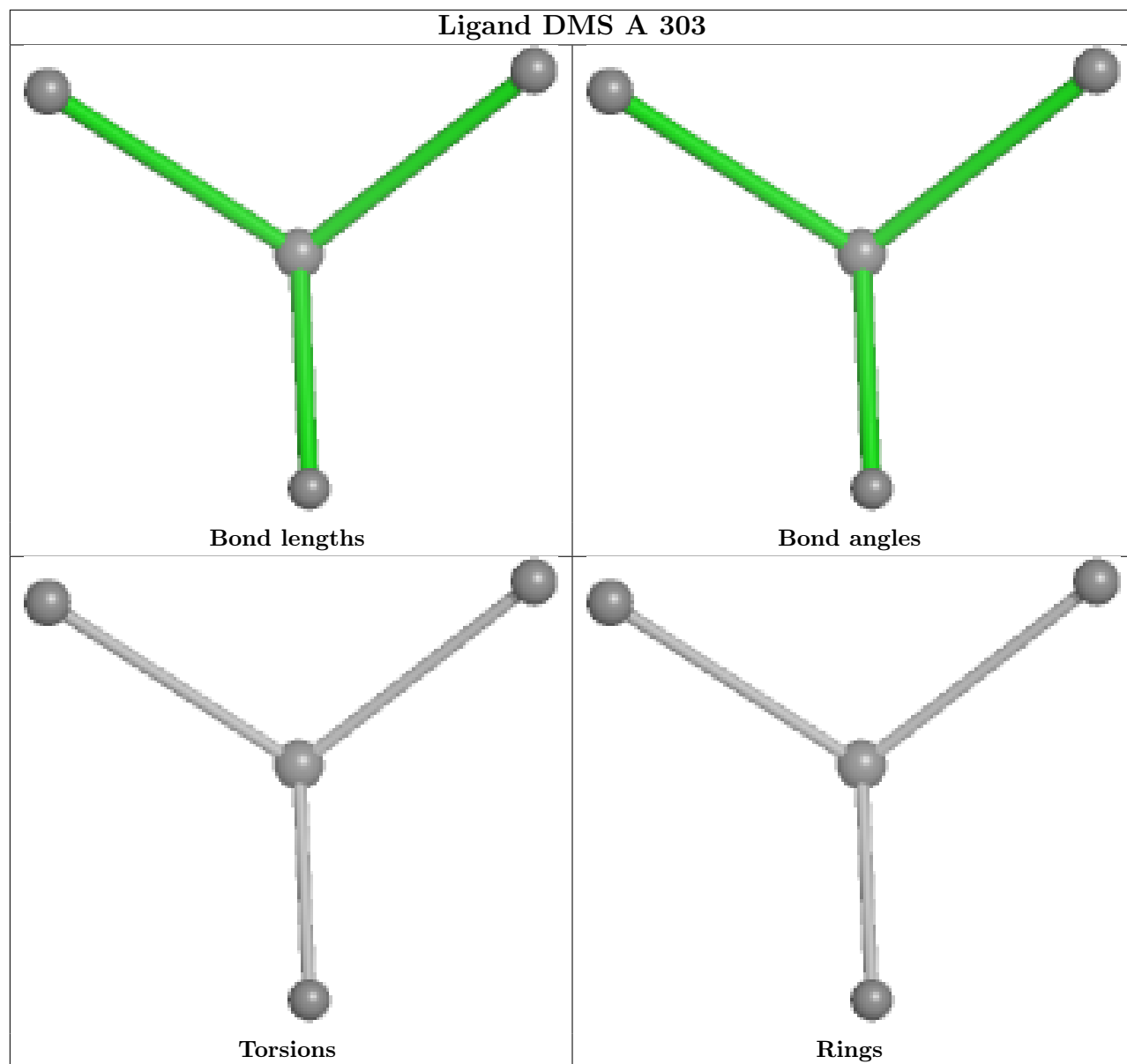
There are no chirality outliers.

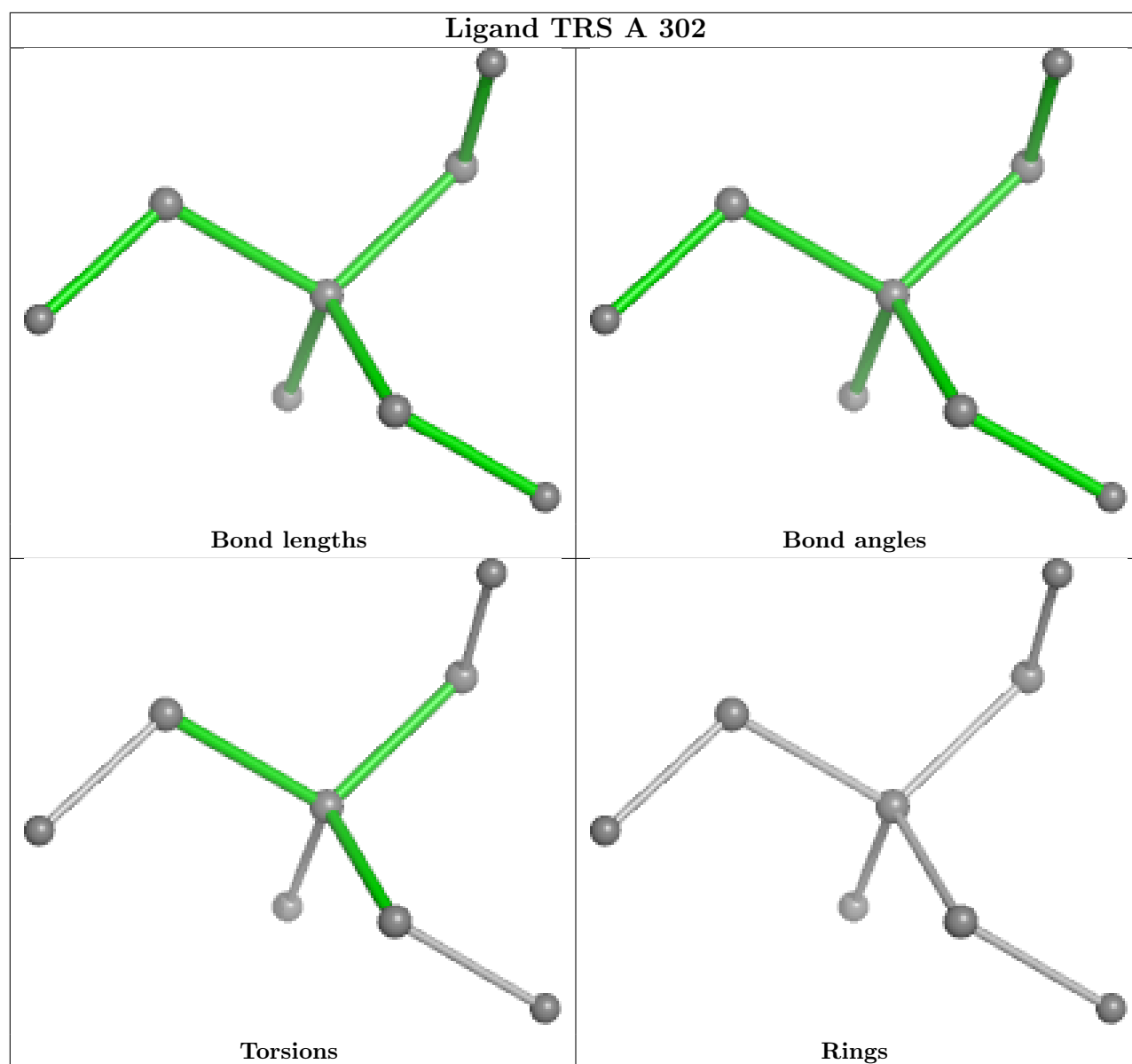
There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 ⓘ

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	257/260 (98%)	-0.54	0 100 100	10, 22, 34, 43	2 (0%)
2	D	0/15	-	-	-	-
All	All	257/275 (93%)	-0.54	0 100 100	10, 22, 34, 43	2 (0%)

There are no RSRZ outliers to report.

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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
2	ZY9	D	13	10/11	0.89	0.07	18,19,23,23	0
2	QVS	D	8	14/15	0.90	0.08	15,17,22,23	0
2	QUJ	D	2	18/19	0.90	0.09	17,28,42,42	0
2	QUK	D	5	18/19	0.92	0.09	16,20,46,49	0
2	QUK	D	15	19/19	0.92	0.08	19,23,33,36	0
2	A1IUO	D	7	21/22	0.93	0.10	17,24,56,62	0
2	QDD	D	12	17/18	0.93	0.06	13,18,23,29	0
2	QVS	D	10	14/15	0.94	0.07	15,18,21,23	0
2	A1IJP	D	11	21/22	0.94	0.07	14,17,22,26	0
2	QVS	D	4	14/15	0.94	0.06	20,22,27,27	0
2	ZY9	D	3	10/11	0.94	0.07	18,21,24,27	0
2	ZY9	D	9	10/11	0.94	0.06	14,18,22,22	0
2	QVE	D	14	18/19	0.95	0.06	16,19,23,23	0
2	ZY9	D	6	10/11	0.95	0.07	16,18,20,21	0
2	A1IUP	D	1	28/29	0.97	0.06	9,15,26,30	0

### 6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

### 6.4 Ligands [i](#)

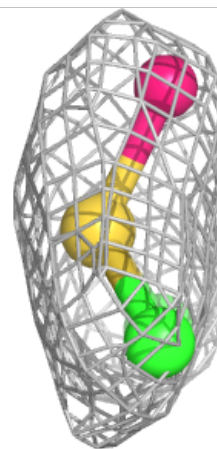
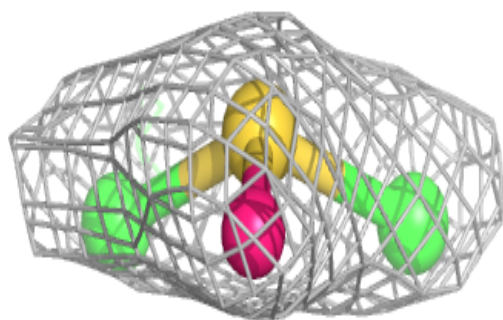
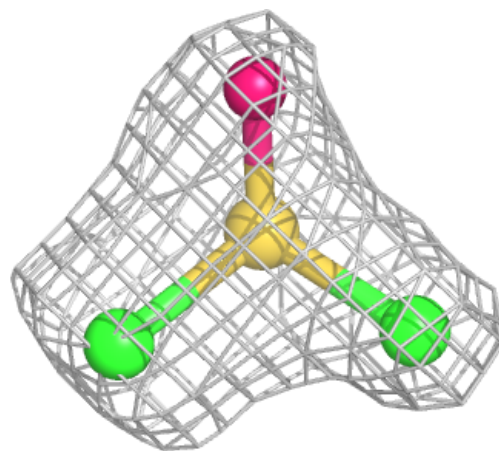
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	DMS	A	303	4/4	0.71	0.17	39,45,51,67	0
4	TRS	A	302	8/8	0.93	0.07	21,28,30,31	0
3	ZN	A	301	1/1	1.00	0.02	15,15,15,15	0

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 DMS A 303:**

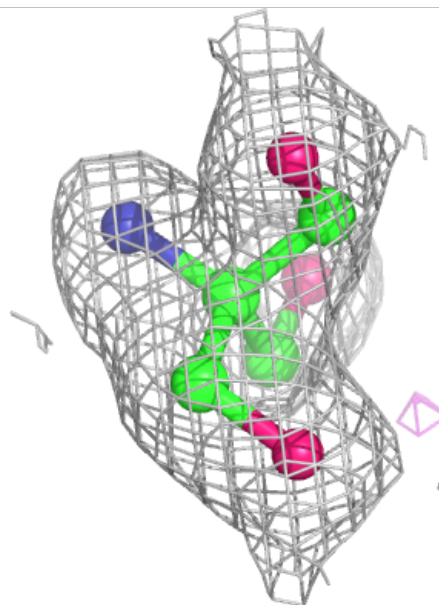
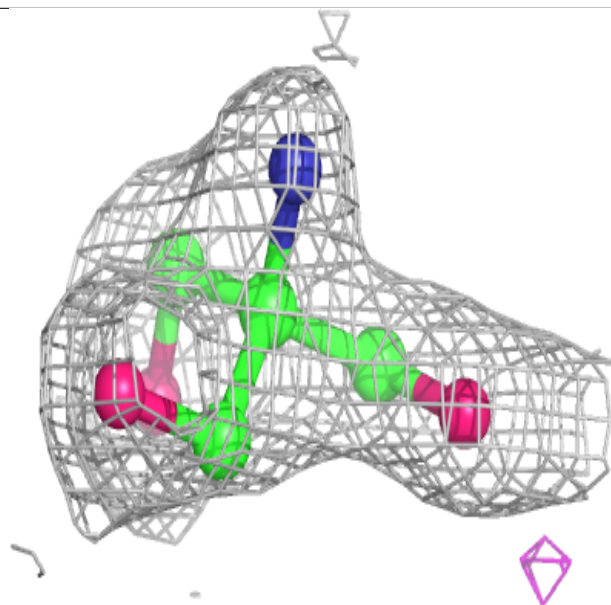
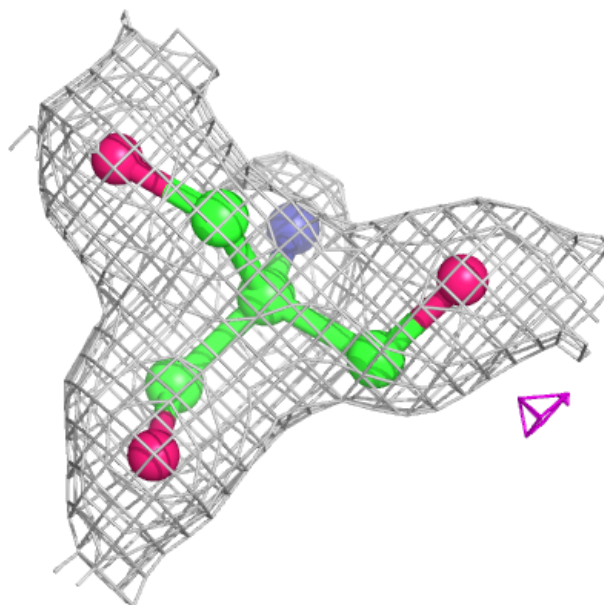
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





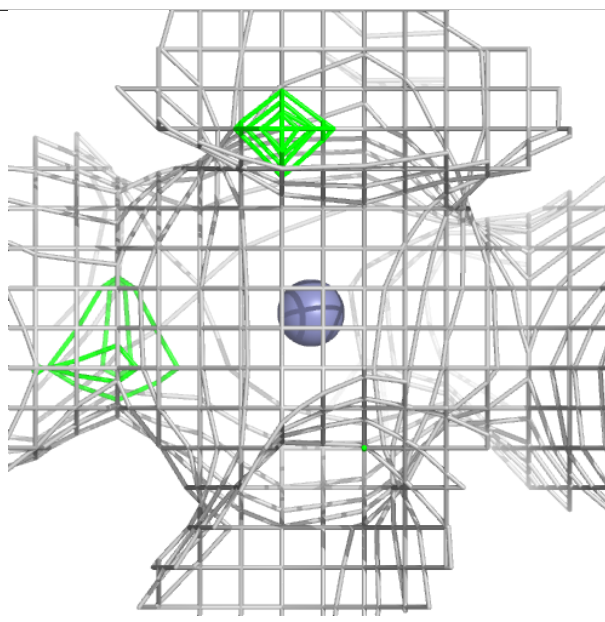
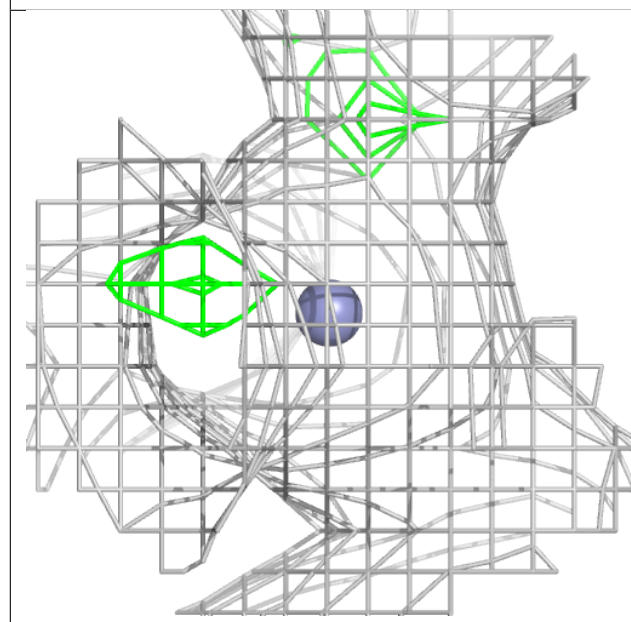
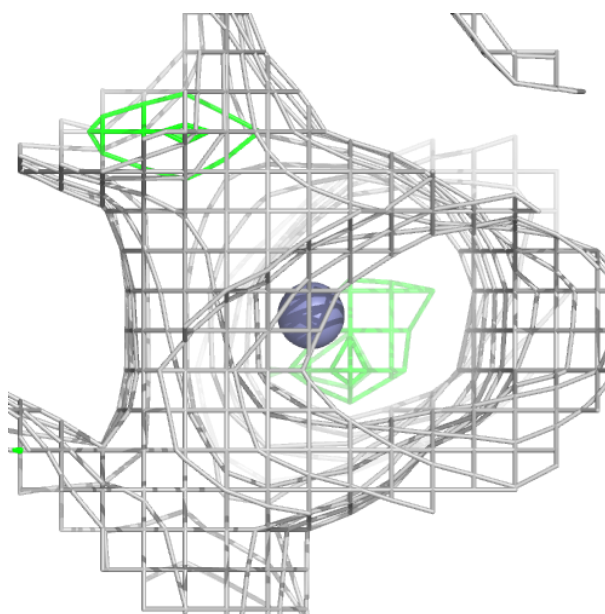
**Electron density around TRS A 302:**

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



**Electron density around ZN A 301:**

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



## 6.5 Other polymers ⓘ

There are no such residues in this entry.