



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 31, 2026 – 02:14 PM JST

PDB ID : 9UZ5 / pdb_00009uz5
Title : Crystal structure of the indoleamine 2,3-dioxygenase 2 (IDO2) complexed with 5-methyl-L-Trp
Authors : Takahashi, A.; Inoue, T.; Fukuda, Y.; Adachi, N.
Deposited on : 2025-05-16
Resolution : 2.50 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 : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (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) : 2.48.1

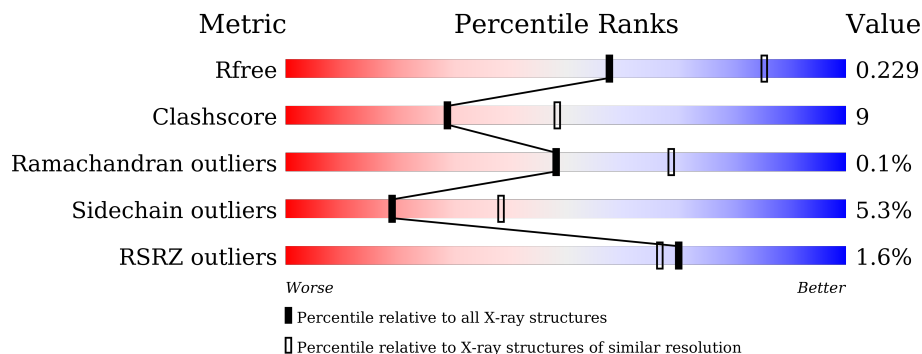
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5504 (2.50-2.50)
Clashscore	180529	6282 (2.50-2.50)
Ramachandran outliers	177936	6191 (2.50-2.50)
Sidechain outliers	177891	6193 (2.50-2.50)
RSRZ outliers	164620	5504 (2.50-2.50)

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 ≥ 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	782	 2% 76% 18% • 5%
2	B	2	 50% 50%

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 6045 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 Maltose/maltodextrin-binding periplasmic protein,Indoleamine 2,3-dioxygenase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	746	5837	3755	968	1096	18	0	0	0

There are 19 discrepancies between the modelled and reference sequences:

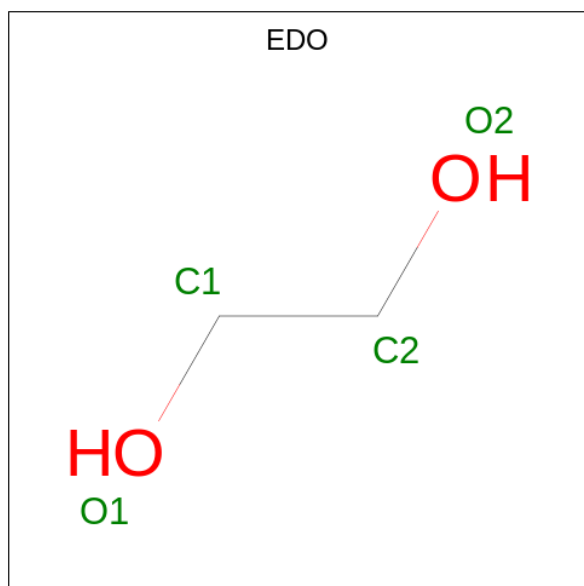
Chain	Residue	Modelled	Actual	Comment	Reference
A	-17	MET	-	initiating methionine	UNP P0AEY0
A	-16	GLY	-	expression tag	UNP P0AEY0
A	-15	SER	-	expression tag	UNP P0AEY0
A	-14	SER	-	expression tag	UNP P0AEY0
A	-13	HIS	-	expression tag	UNP P0AEY0
A	-12	HIS	-	expression tag	UNP P0AEY0
A	-11	HIS	-	expression tag	UNP P0AEY0
A	-10	HIS	-	expression tag	UNP P0AEY0
A	-9	HIS	-	expression tag	UNP P0AEY0
A	-8	HIS	-	expression tag	UNP P0AEY0
A	-7	GLU	-	expression tag	UNP P0AEY0
A	-6	ASN	-	expression tag	UNP P0AEY0
A	-5	LEU	-	expression tag	UNP P0AEY0
A	-4	TYR	-	expression tag	UNP P0AEY0
A	-3	PHE	-	expression tag	UNP P0AEY0
A	-2	GLN	-	expression tag	UNP P0AEY0
A	-1	GLY	-	expression tag	UNP P0AEY0
A	0	MET	-	expression tag	UNP P0AEY0
A	312	VAL	ALA	conflict	UNP P0AEY0

- Molecule 2 is an oligosaccharide called alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose.



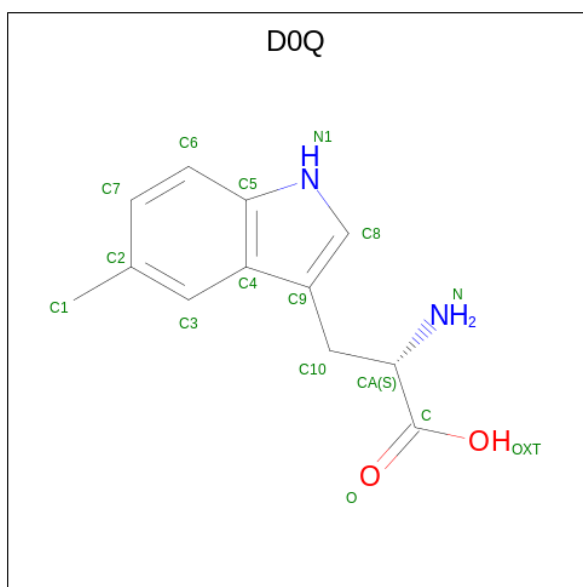
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	B	2	Total	C	O	0	0	0
			23	12	11			

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



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

- Molecule 4 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
6	A	1	16	12	2	2	0	0

- Molecule 7 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
7	A	1	1	1	0	0

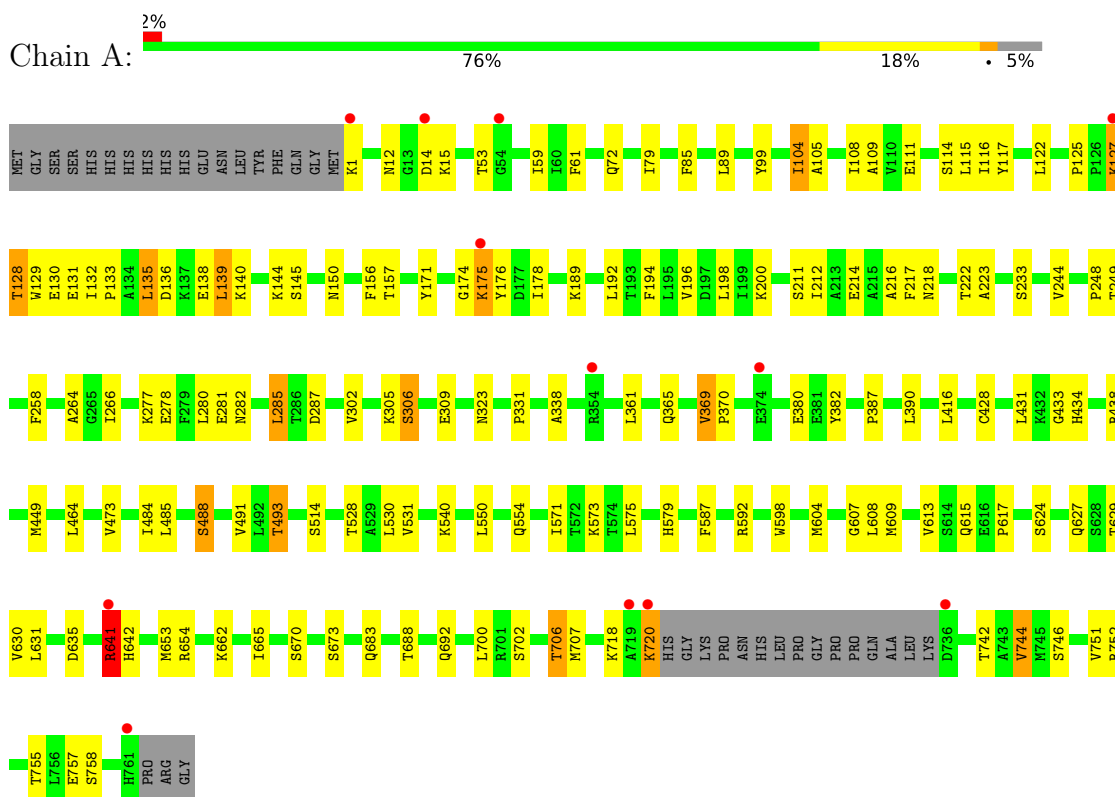
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
8	A	103	103	103	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: Maltose/maltodextrin-binding periplasmic protein, Indoleamine 2,3-dioxygenase 2



- Molecule 2: alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain B: 



4 Data and refinement statistics i

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	196.96Å 196.96Å 93.54Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	42.25 – 2.50 42.25 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.4 (42.25-2.50) 99.4 (42.25-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.78 (at 2.51Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, R_{free}	0.199 , 0.229 0.201 , 0.229	Depositor DCC
R_{free} test set	3535 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	78.4	Xtrriage
Anisotropy	0.075	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 51.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.018 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	6045	wwPDB-VP
Average B, all atoms (Å ²)	87.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.17% 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: D0Q, NA, GLC, CYN, HEM, EDO

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	0.46	0/5979	0.62	0/8119

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	A	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	641	ARG	Sidechain

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	5837	0	5815	99	0
2	B	23	0	21	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	20	0	30	1	0
4	A	43	0	30	4	0
5	A	2	0	0	0	0
6	A	16	0	0	1	0
7	A	1	0	0	0	0
8	A	103	0	0	11	0
All	All	6045	0	5896	102	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 9.

All (102) 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:449:MET:HE1	1:A:484:ILE:HG13	1.61	0.82
1:A:1:LYS:CG	8:A:969:HOH:O	2.29	0.81
1:A:449:MET:HE3	1:A:485:LEU:H	1.46	0.79
4:A:806:HEM:HBC2	4:A:806:HEM:HHD	1.68	0.75
1:A:531:VAL:HG13	1:A:571:ILE:HG23	1.76	0.67
1:A:1:LYS:HG2	8:A:969:HOH:O	1.90	0.67
1:A:15:LYS:NZ	1:A:111:GLU:OE2	2.28	0.66
1:A:380:GLU:HG3	1:A:540:LYS:HE2	1.78	0.65
1:A:130:GLU:O	1:A:133:PRO:HD2	1.98	0.63
1:A:1:LYS:CB	8:A:969:HOH:O	2.46	0.62
1:A:122:LEU:HD12	1:A:223:ALA:HB1	1.79	0.62
1:A:629:THR:HG23	1:A:665:ILE:HD11	1.82	0.61
1:A:627:GLN:HG3	1:A:653:MET:HE3	1.84	0.60
1:A:175:LYS:HD3	1:A:176:TYR:N	2.17	0.60
1:A:641:ARG:HH12	1:A:757:GLU:HG3	1.67	0.59
1:A:382:TYR:CD2	1:A:387:PRO:HB3	2.38	0.59
1:A:575:LEU:HD13	1:A:707:MET:HE1	1.85	0.58
1:A:449:MET:CE	1:A:485:LEU:H	2.14	0.57
1:A:654:ARG:HB3	1:A:662:LYS:HG3	1.87	0.57
1:A:99:TYR:HB3	1:A:104:ILE:HD13	1.88	0.56
1:A:116:ILE:HG22	1:A:217:PHE:CZ	2.42	0.55
1:A:287:ASP:OD1	1:A:306:SER:OG	2.25	0.55
1:A:61:PHE:HE2	1:A:108:ILE:HG13	1.72	0.54
1:A:1:LYS:HD3	8:A:969:HOH:O	2.06	0.53
1:A:434:HIS:HB2	8:A:980:HOH:O	2.07	0.53
1:A:127:LYS:O	1:A:249:THR:HG22	2.09	0.53
1:A:122:LEU:HD22	1:A:125:PRO:HA	1.91	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:473:VAL:HG21	1:A:613:VAL:HG11	1.92	0.52
1:A:1:LYS:CD	8:A:969:HOH:O	2.56	0.52
1:A:116:ILE:HG12	1:A:244:VAL:HG22	1.91	0.52
1:A:488:SER:O	1:A:493:THR:HG23	2.11	0.51
1:A:718:LYS:O	1:A:720:LYS:HE2	2.10	0.51
1:A:390:LEU:N	8:A:906:HOH:O	2.38	0.51
1:A:105:ALA:HB1	1:A:264:ALA:O	2.11	0.51
1:A:115:LEU:HD22	1:A:248:PRO:HD3	1.93	0.50
1:A:109:ALA:HA	1:A:302:VAL:HA	1.92	0.50
1:A:1:LYS:HB3	8:A:969:HOH:O	2.11	0.50
1:A:464:LEU:HB2	1:A:608:LEU:HD21	1.94	0.49
1:A:554:GLN:OE1	1:A:683:GLN:HG3	2.12	0.49
1:A:579:HIS:HB2	8:A:941:HOH:O	2.12	0.49
1:A:192:LEU:O	1:A:196:VAL:HG23	2.12	0.49
1:A:280:LEU:O	1:A:285:LEU:HB2	2.13	0.49
1:A:117:TYR:CE2	1:A:125:PRO:HD3	2.48	0.49
1:A:89:LEU:HD21	1:A:285:LEU:HD22	1.94	0.49
1:A:189:LYS:HG2	1:A:361:LEU:HD12	1.95	0.49
1:A:214:GLU:O	1:A:218:ASN:HB2	2.12	0.48
1:A:128:THR:HB	1:A:131:GLU:OE1	2.13	0.48
1:A:587:PHE:CE1	1:A:592:ARG:HG3	2.48	0.48
1:A:136:ASP:OD2	1:A:140:LYS:HE3	2.13	0.48
1:A:438:ARG:HE	1:A:493:THR:HG21	1.78	0.48
1:A:122:LEU:HD12	1:A:223:ALA:CB	2.43	0.48
1:A:742:THR:OG1	4:A:806:HEM:O1A	2.29	0.48
1:A:128:THR:O	1:A:131:GLU:HG2	2.15	0.47
1:A:720:LYS:HE3	1:A:720:LYS:HB2	1.51	0.47
1:A:79:ILE:HG22	1:A:266:ILE:HD12	1.96	0.47
1:A:491:VAL:HG21	1:A:528:THR:HG21	1.97	0.47
1:A:178:ILE:HD12	1:A:370:PRO:HG3	1.98	0.46
1:A:624:SER:HA	6:A:808:DOQ:C3	2.46	0.46
1:A:217:PHE:CD1	1:A:217:PHE:O	2.69	0.45
1:A:135:LEU:O	1:A:139:LEU:HB2	2.15	0.45
1:A:449:MET:CE	1:A:484:ILE:HG13	2.41	0.45
1:A:217:PHE:CD1	1:A:217:PHE:C	2.94	0.45
1:A:216:ALA:HB1	1:A:222:THR:HG22	1.98	0.45
1:A:598:TRP:HB2	1:A:607:GLY:HA2	1.99	0.44
1:A:338:ALA:CB	1:A:550:LEU:HD13	2.47	0.44
1:A:171:TYR:HE1	1:A:174:GLY:C	2.25	0.44
1:A:642:HIS:NE2	1:A:751:VAL:HG13	2.32	0.44
1:A:200:LYS:HD3	1:A:200:LYS:HA	1.81	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:635:ASP:OD2	1:A:642:HIS:HE1	2.00	0.44
1:A:85:PHE:CE1	1:A:281:GLU:HG2	2.53	0.43
1:A:688:THR:O	1:A:692:GLN:HG2	2.18	0.43
1:A:305:LYS:O	1:A:309:GLU:HG3	2.18	0.43
1:A:365:GLN:O	1:A:369:VAL:HG13	2.18	0.43
3:A:803:EDO:H12	8:A:918:HOH:O	2.17	0.43
1:A:194:PHE:CE1	1:A:198:LEU:HD21	2.54	0.43
1:A:755:THR:O	1:A:758:SER:HB2	2.19	0.43
1:A:129:TRP:CD1	1:A:248:PRO:HB2	2.54	0.42
1:A:129:TRP:O	1:A:132:ILE:HG13	2.19	0.42
1:A:130:GLU:OE1	1:A:130:GLU:N	2.48	0.42
1:A:217:PHE:HB2	1:A:222:THR:HG23	2.02	0.42
1:A:59:ILE:HD13	1:A:280:LEU:HD11	2.01	0.42
1:A:575:LEU:HD23	1:A:575:LEU:HA	1.88	0.42
1:A:277:LYS:HE3	1:A:281:GLU:OE2	2.19	0.42
1:A:700:LEU:C	1:A:700:LEU:HD23	2.45	0.42
1:A:702:SER:OG	1:A:752:ARG:HD3	2.19	0.42
1:A:744:VAL:HG22	4:A:806:HEM:HMA3	2.02	0.42
4:A:806:HEM:HMB1	4:A:806:HEM:HBB2	2.01	0.42
1:A:579:HIS:CD2	1:A:579:HIS:H	2.37	0.42
1:A:114:SER:HA	1:A:323:ASN:ND2	2.35	0.42
1:A:176:TYR:CE2	1:A:331:PRO:HB3	2.55	0.42
1:A:604:MET:HE2	1:A:604:MET:HB3	1.65	0.42
1:A:216:ALA:C	1:A:218:ASN:H	2.28	0.41
1:A:702:SER:O	1:A:706:THR:HG23	2.20	0.41
1:A:150:ASN:HB3	1:A:156:PHE:CD2	2.54	0.41
1:A:175:LYS:HD3	1:A:176:TYR:H	1.86	0.41
1:A:609:MET:HE2	1:A:617:PRO:HG3	2.03	0.41
1:A:428:CYS:HB3	1:A:431:LEU:HD12	2.03	0.41
1:A:12:ASN:ND2	1:A:14:ASP:OD1	2.53	0.41
1:A:615:GLN:H	1:A:615:GLN:CD	2.28	0.41
1:A:278:GLU:CD	1:A:282:ASN:HD22	2.28	0.41
1:A:309:GLU:HG3	1:A:309:GLU:H	1.60	0.40
1:A:433:GLY:HA3	8:A:918:HOH:O	2.21	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	A	742/782 (95%)	714 (96%)	27 (4%)	1 (0%)	48 69

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	744	VAL

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	619/649 (95%)	586 (95%)	33 (5%)	19 38

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	53	THR
1	A	72	GLN
1	A	104	ILE
1	A	127	LYS
1	A	128	THR
1	A	135	LEU
1	A	138	GLU
1	A	139	LEU
1	A	144	LYS
1	A	145	SER

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Mol	Chain	Res	Type
1	A	157	THR
1	A	175	LYS
1	A	211	SER
1	A	212	ILE
1	A	233	SER
1	A	258	PHE
1	A	285	LEU
1	A	306	SER
1	A	369	VAL
1	A	416	LEU
1	A	488	SER
1	A	493	THR
1	A	514	SER
1	A	530	LEU
1	A	573	LYS
1	A	630	VAL
1	A	631	LEU
1	A	641	ARG
1	A	670	SER
1	A	673	SER
1	A	706	THR
1	A	720	LYS
1	A	746	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	152	GLN
1	A	335	GLN
1	A	419	HIS
1	A	459	GLN
1	A	544	GLN
1	A	642	HIS

5.3.3 RNA

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](#)

2 monosaccharides 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	GLC	B	1	2	12,12,12	0.26	0	17,17,17	0.40	0
2	GLC	B	2	2	11,11,12	0.81	1 (9%)	15,15,17	1.05	1 (6%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GLC	B	1	2	-	1/2/22/22	0/1/1/1
2	GLC	B	2	2	-	2/2/19/22	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	GLC	C2-C3	-2.42	1.48	1.52

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	GLC	C1-O5-C5	2.67	115.81	112.19

There are no chirality outliers.

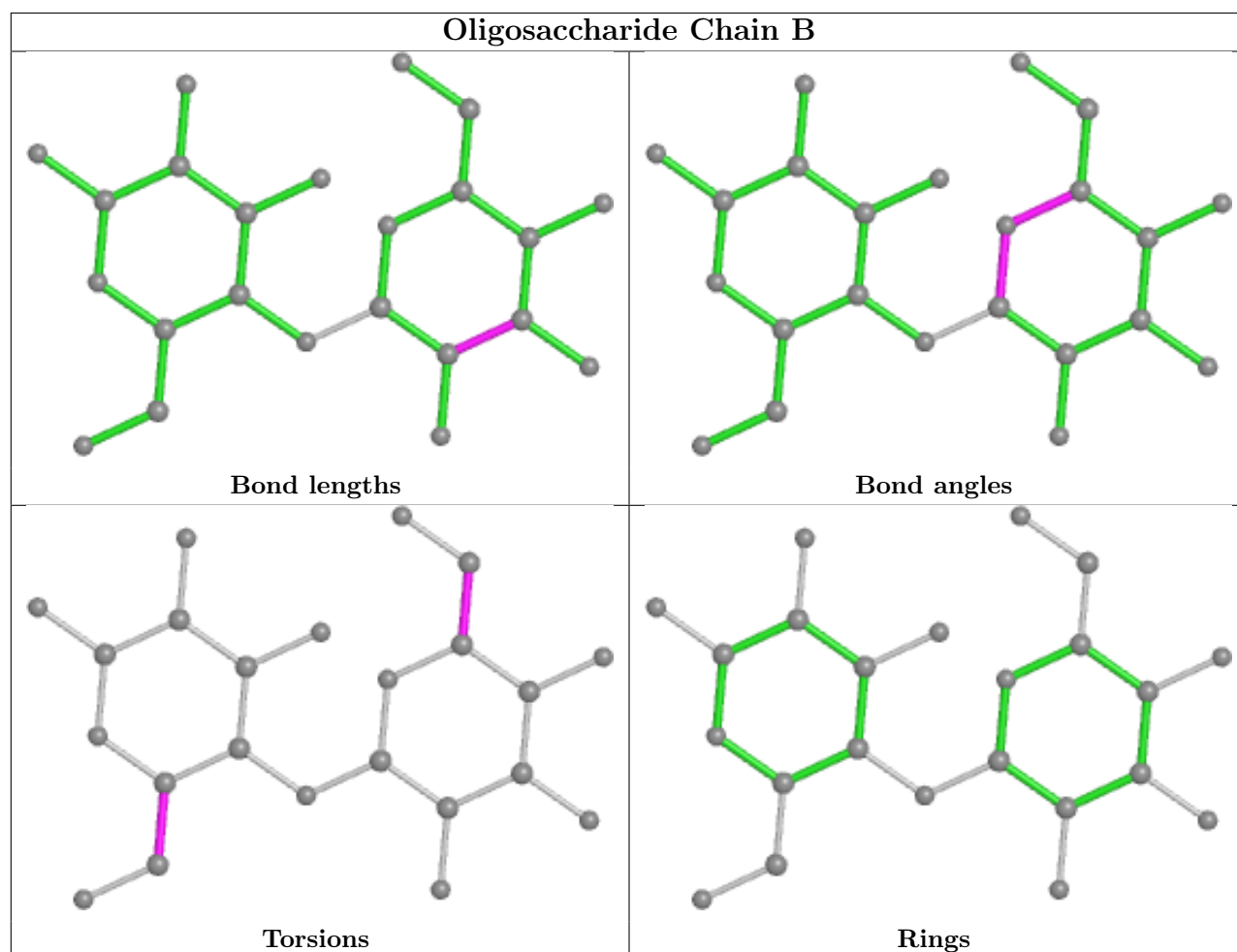
All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	2	GLC	O5-C5-C6-O6
2	B	2	GLC	C4-C5-C6-O6
2	B	1	GLC	O5-C5-C6-O6

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 oligosaccharide.



5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 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$
3	EDO	A	804	-	3,3,3	0.55	0	2,2,2	0.25	0
4	HEM	A	806	1,5	41,50,50	1.43	4 (9%)	45,82,82	1.57	8 (17%)
3	EDO	A	805	-	3,3,3	0.52	0	2,2,2	0.39	0
5	CYN	A	807	4	0,1,1	-	-	-	-	-
3	EDO	A	802	-	3,3,3	0.66	0	2,2,2	0.11	0
3	EDO	A	803	-	3,3,3	0.47	0	2,2,2	0.60	0
3	EDO	A	801	-	3,3,3	0.62	0	2,2,2	0.05	0
6	D0Q	A	808	-	15,17,17	1.13	0	17,24,24	1.20	2 (11%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	EDO	A	804	-	-	0/1/1/1	-
4	HEM	A	806	1,5	-	5/12/54/54	-
3	EDO	A	805	-	-	0/1/1/1	-
3	EDO	A	802	-	-	0/1/1/1	-
3	EDO	A	803	-	-	1/1/1/1	-
3	EDO	A	801	-	-	0/1/1/1	-
6	D0Q	A	808	-	-	4/7/8/8	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	806	HEM	C3C-C2C	-4.44	1.34	1.40
4	A	806	HEM	C3C-CAC	3.39	1.54	1.47
4	A	806	HEM	CAB-C3B	2.67	1.54	1.47
4	A	806	HEM	C4A-NA	2.13	1.40	1.36

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	806	HEM	C4C-CHD-C1D	4.18	128.08	122.56
6	A	808	D0Q	C10-C9-C8	-3.43	123.73	127.97
4	A	806	HEM	CHC-C4B-NB	3.29	128.01	124.43
4	A	806	HEM	CHD-C1D-ND	2.60	127.26	124.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	806	HEM	CAD-CBD-CGD	-2.53	108.16	113.60
4	A	806	HEM	CMA-C3A-C4A	-2.39	124.79	128.46
4	A	806	HEM	CBA-CAA-C2A	-2.37	108.57	112.62
6	A	808	D0Q	C10-C9-C4	2.30	129.83	126.25
4	A	806	HEM	CAA-CBA-CGA	-2.23	107.50	113.76
4	A	806	HEM	C4A-C3A-C2A	2.01	108.39	107.00

There are no chirality outliers.

All (10) torsion outliers are listed below:

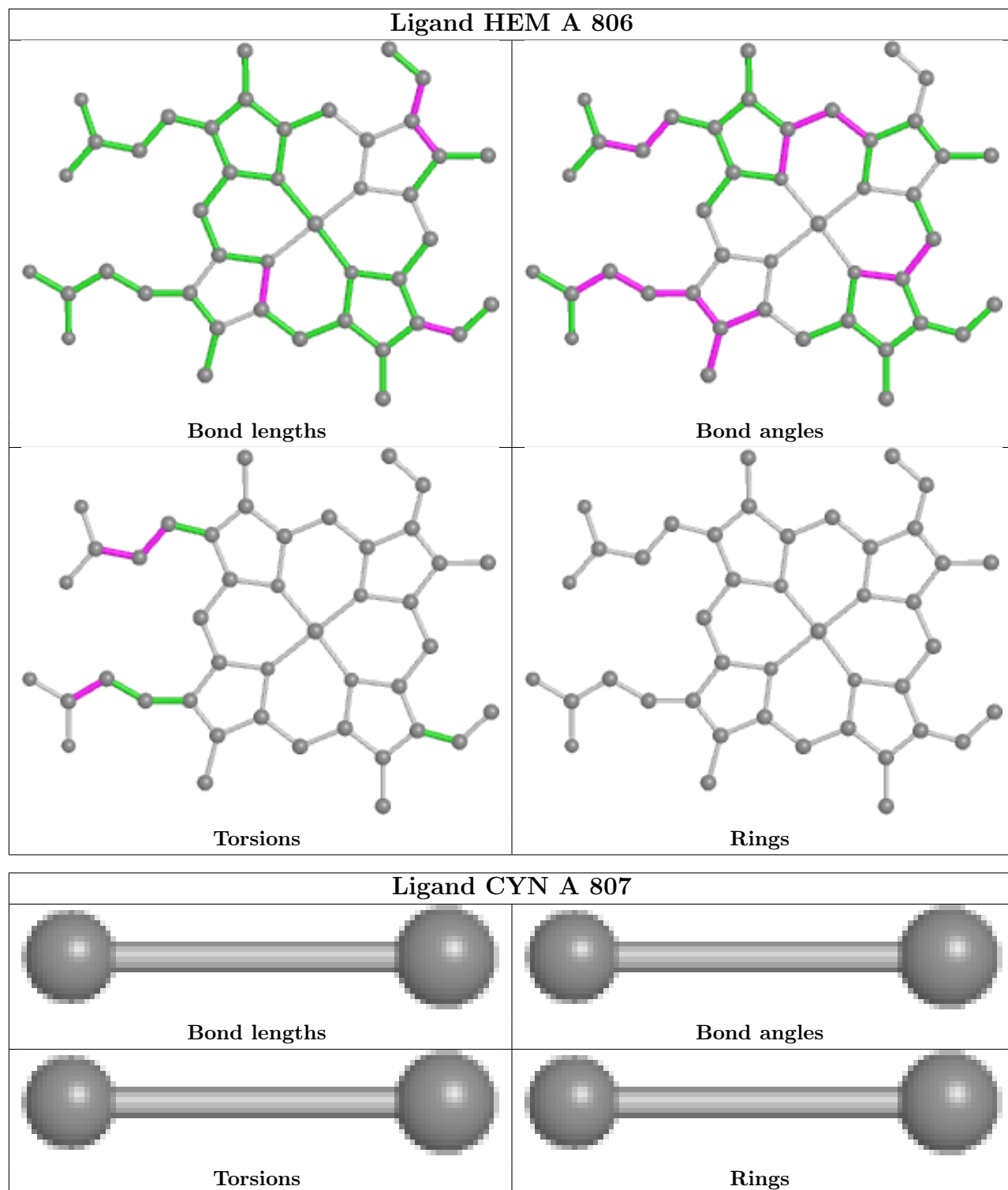
Mol	Chain	Res	Type	Atoms
6	A	808	D0Q	C9-C10-CA-N
6	A	808	D0Q	O-C-CA-C10
6	A	808	D0Q	OXT-C-CA-C10
4	A	806	HEM	C3D-CAD-CBD-CGD
4	A	806	HEM	CAA-CBA-CGA-O2A
4	A	806	HEM	CAA-CBA-CGA-O1A
6	A	808	D0Q	C9-C10-CA-C
3	A	803	EDO	O1-C1-C2-O2
4	A	806	HEM	CAD-CBD-CGD-O1D
4	A	806	HEM	CAD-CBD-CGD-O2D

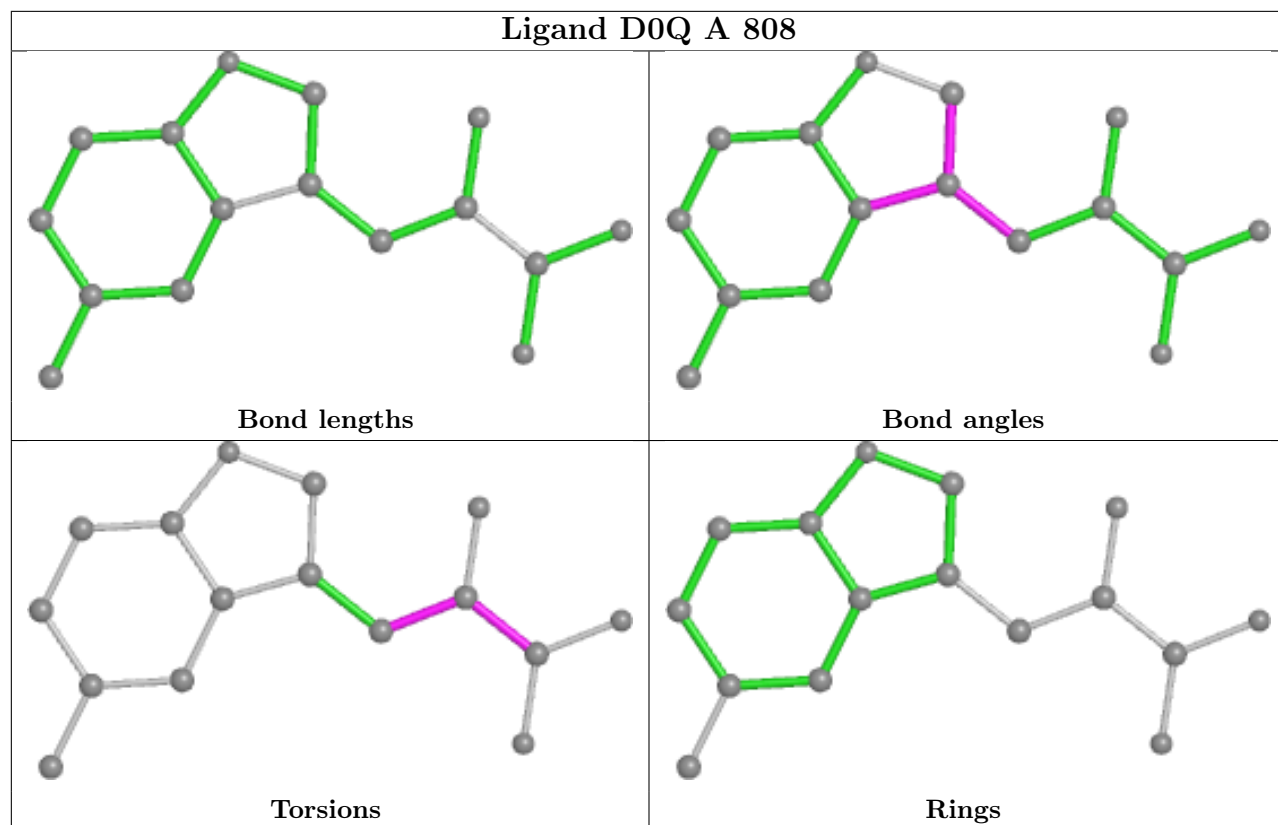
There are no ring outliers.

3 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	806	HEM	4	0
3	A	803	EDO	1	0
6	A	808	D0Q	1	0

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 [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	746/782 (95%)	-0.14	12 (1%) 70 67	63, 85, 112, 131	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	641	ARG	4.5
1	A	720	LYS	2.9
1	A	761	HIS	2.8
1	A	127	LYS	2.7
1	A	175	LYS	2.7
1	A	54	GLY	2.6
1	A	1	LYS	2.5
1	A	736	ASP	2.3
1	A	14	ASP	2.3
1	A	719	ALA	2.0
1	A	374	GLU	2.0
1	A	354	ARG	2.0

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

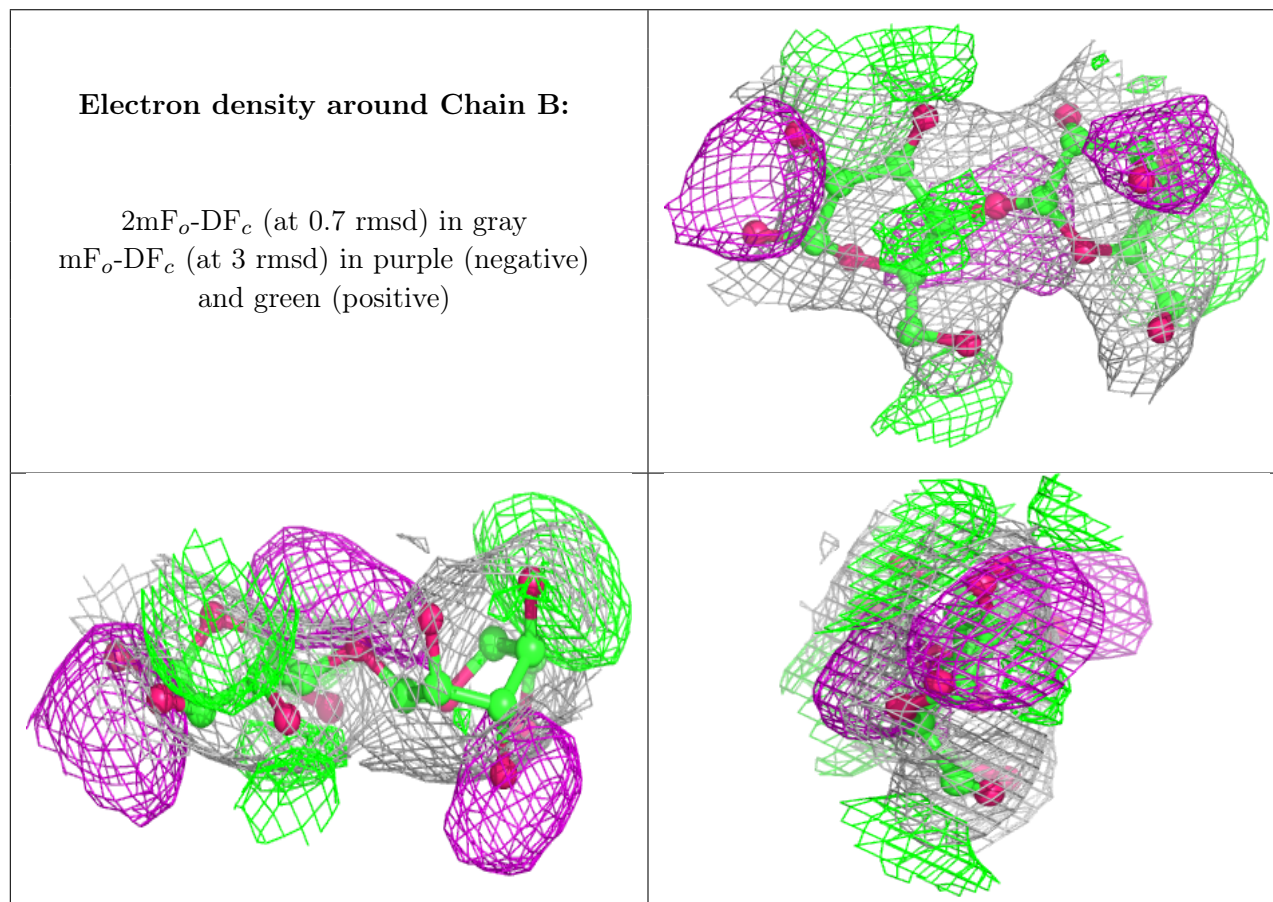
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

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
2	GLC	B	1	12/12	0.76	0.25	80,97,102,106	0
2	GLC	B	2	11/12	0.82	0.18	81,93,101,103	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



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.

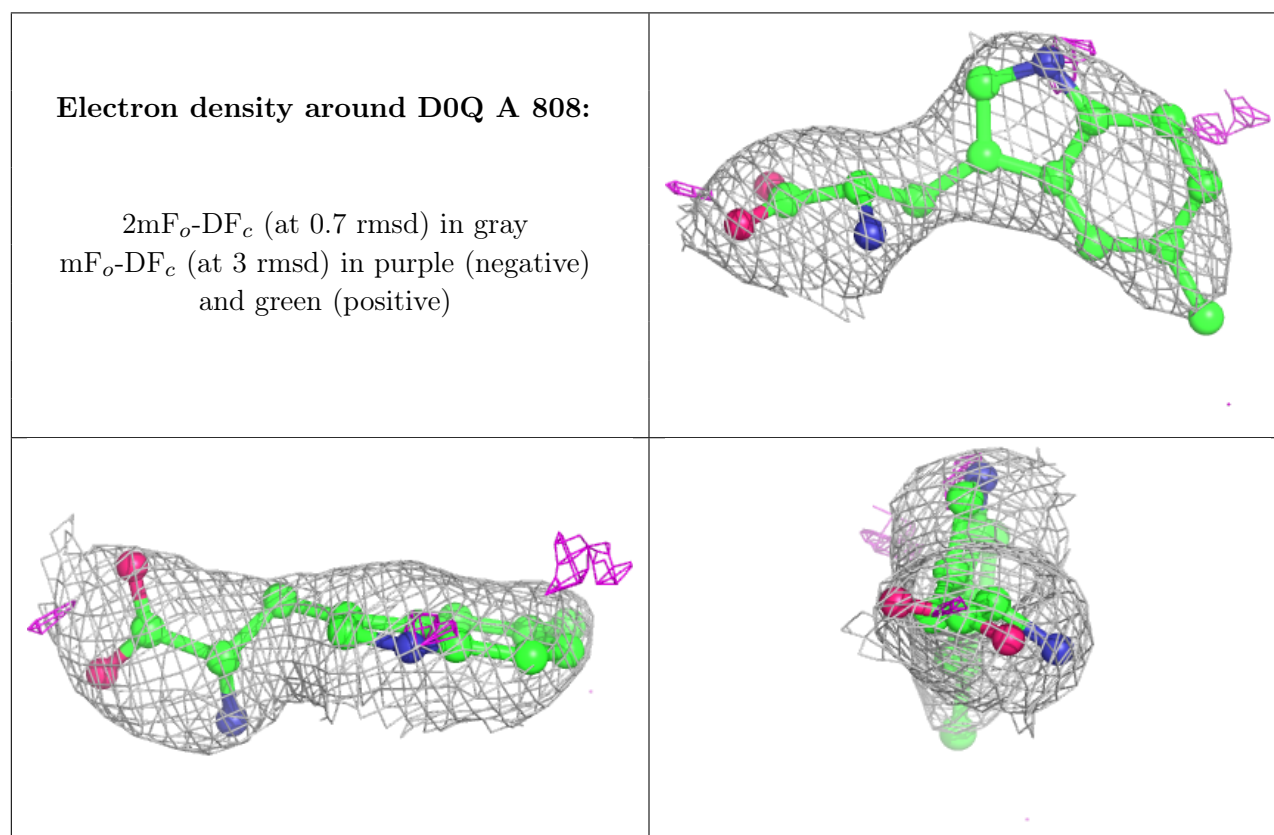
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	EDO	A	801	4/4	0.69	0.23	95,100,102,108	0
7	NA	A	809	1/1	0.73	0.16	83,83,83,83	0
3	EDO	A	803	4/4	0.84	0.16	95,97,105,106	0
3	EDO	A	805	4/4	0.85	0.22	110,112,112,116	0
3	EDO	A	802	4/4	0.87	0.24	90,94,100,103	0
3	EDO	A	804	4/4	0.89	0.28	96,103,104,110	0

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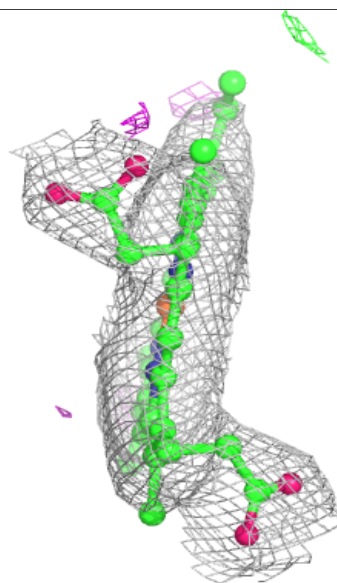
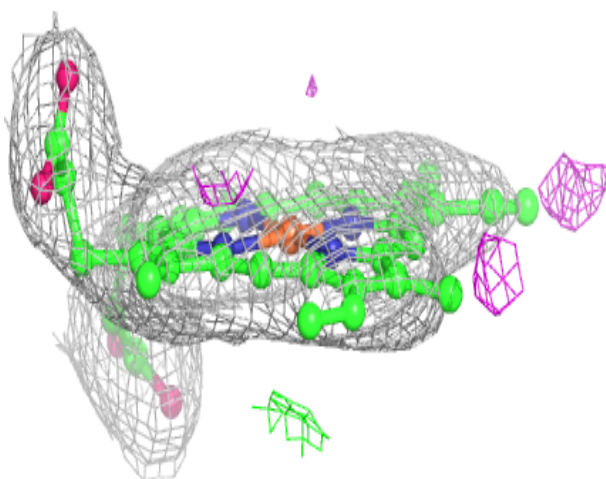
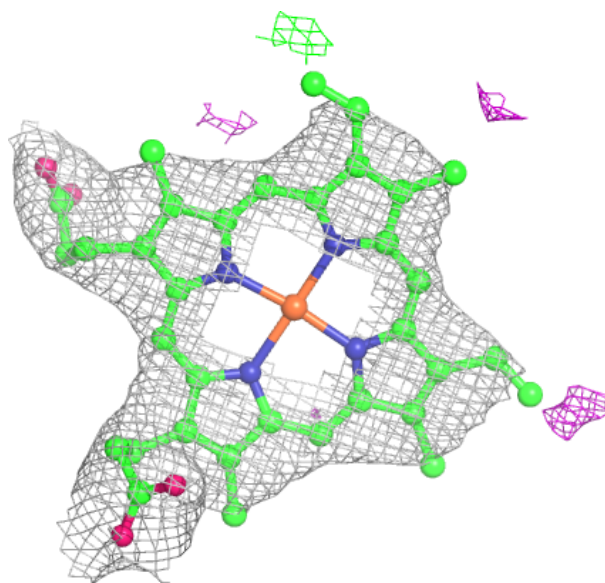
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
6	D0Q	A	808	16/16	0.98	0.08	72,82,86,87	0
4	HEM	A	806	43/43	0.99	0.06	67,74,81,82	0
5	CYN	A	807	2/2	0.99	0.05	74,74,74,75	0

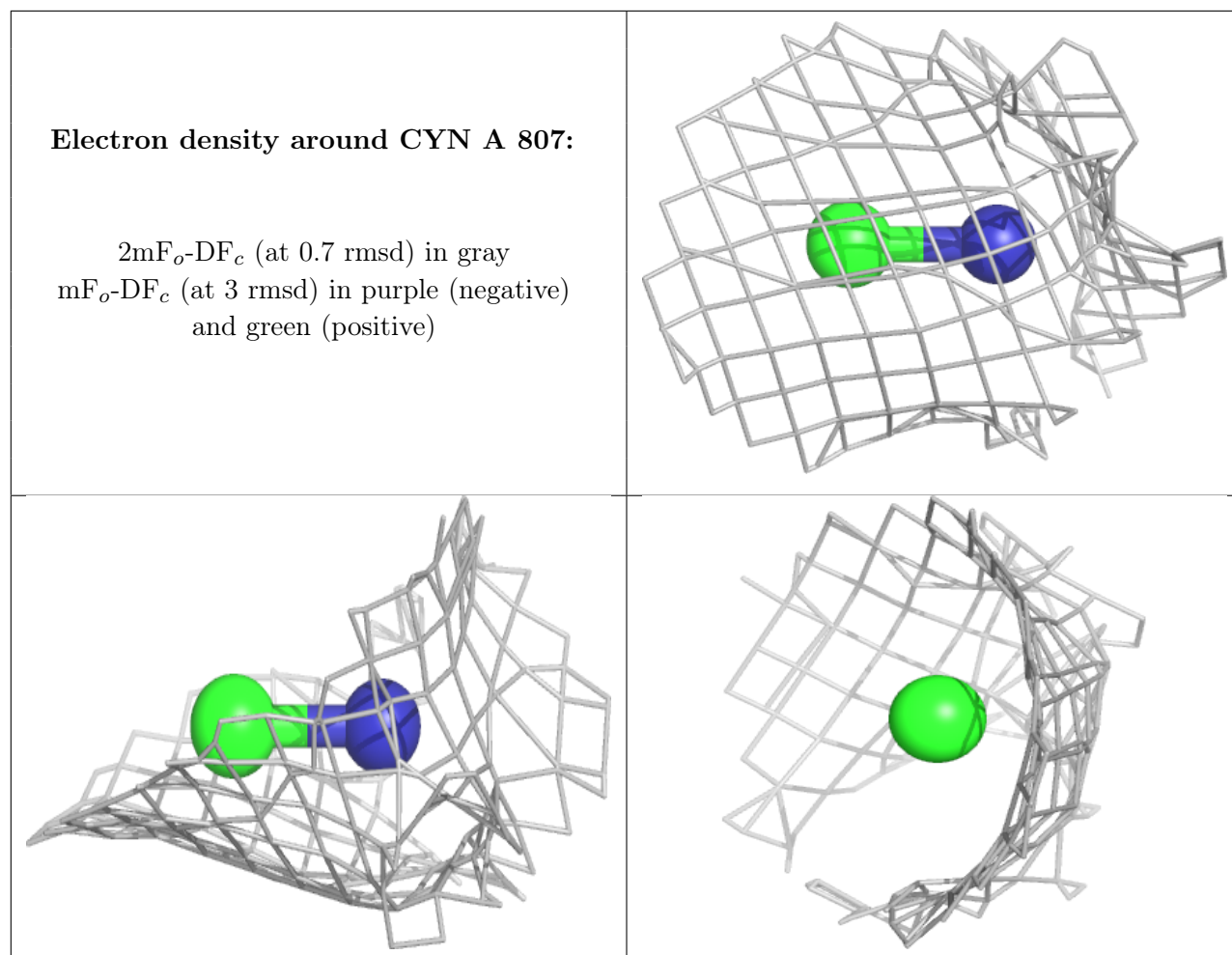
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



Electron density around HEM A 806:

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





6.5 Other polymers [i](#)

There are no such residues in this entry.