



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 5, 2026 – 10:56 PM JST

PDB ID : 7WCA / pdb_00007wca
Title : CATPO mutant - E484A
Authors : Yuzugullu Karakus, Y.; Balci Unver, S.; Zengin Karatas, M.; Goc, G.; Pearson, A.R.; Yorke, B.
Deposited on : 2021-12-18
Resolution : 1.78 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 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)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.015 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.50

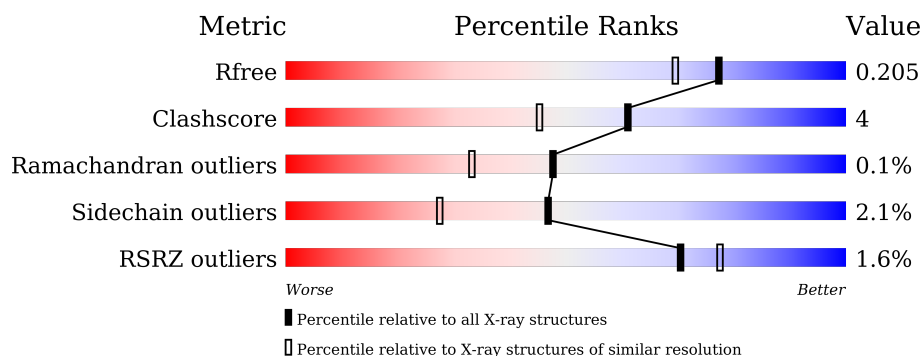
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.78 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}	180053	1365 (1.78-1.78)
Clashscore	190562	1395 (1.78-1.78)
Ramachandran outliers	187476	1382 (1.78-1.78)
Sidechain outliers	187428	1382 (1.78-1.78)
RSRZ outliers	180081	1365 (1.78-1.78)

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	720	3% 85% 9% 6%
1	B	720	% 86% 7% 6%
1	C	720	2% 84% 9% 6%
1	D	720	86% 7% 6%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 23643 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 Catalase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	678	Total	C	N	O	S	0	3	0
			5299	3345	929	1014	11			
1	B	679	Total	C	N	O	S	0	4	0
			5318	3355	936	1016	11			
1	C	677	Total	C	N	O	S	0	5	0
			5314	3352	934	1017	11			
1	D	677	Total	C	N	O	S	0	4	0
			5300	3346	931	1012	11			

There are 88 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-21	MET	-	initiating methionine	UNP M4GGR7
A	-20	GLY	-	expression tag	UNP M4GGR7
A	-19	SER	-	expression tag	UNP M4GGR7
A	-18	SER	-	expression tag	UNP M4GGR7
A	-17	HIS	-	expression tag	UNP M4GGR7
A	-16	HIS	-	expression tag	UNP M4GGR7
A	-15	HIS	-	expression tag	UNP M4GGR7
A	-14	HIS	-	expression tag	UNP M4GGR7
A	-13	HIS	-	expression tag	UNP M4GGR7
A	-12	HIS	-	expression tag	UNP M4GGR7
A	-11	SER	-	expression tag	UNP M4GGR7
A	-10	SER	-	expression tag	UNP M4GGR7
A	-9	GLY	-	expression tag	UNP M4GGR7
A	-8	GLU	-	expression tag	UNP M4GGR7
A	-7	ASN	-	expression tag	UNP M4GGR7
A	-6	LEU	-	expression tag	UNP M4GGR7
A	-5	TYR	-	expression tag	UNP M4GGR7
A	-4	PHE	-	expression tag	UNP M4GGR7
A	-3	GLN	-	expression tag	UNP M4GGR7
A	-2	GLY	-	expression tag	UNP M4GGR7
A	-1	HIS	-	expression tag	UNP M4GGR7

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Chain	Residue	Modelled	Actual	Comment	Reference
A	484	ALA	GLU	engineered mutation	UNP M4GGR7
B	-21	MET	-	initiating methionine	UNP M4GGR7
B	-20	GLY	-	expression tag	UNP M4GGR7
B	-19	SER	-	expression tag	UNP M4GGR7
B	-18	SER	-	expression tag	UNP M4GGR7
B	-17	HIS	-	expression tag	UNP M4GGR7
B	-16	HIS	-	expression tag	UNP M4GGR7
B	-15	HIS	-	expression tag	UNP M4GGR7
B	-14	HIS	-	expression tag	UNP M4GGR7
B	-13	HIS	-	expression tag	UNP M4GGR7
B	-12	HIS	-	expression tag	UNP M4GGR7
B	-11	SER	-	expression tag	UNP M4GGR7
B	-10	SER	-	expression tag	UNP M4GGR7
B	-9	GLY	-	expression tag	UNP M4GGR7
B	-8	GLU	-	expression tag	UNP M4GGR7
B	-7	ASN	-	expression tag	UNP M4GGR7
B	-6	LEU	-	expression tag	UNP M4GGR7
B	-5	TYR	-	expression tag	UNP M4GGR7
B	-4	PHE	-	expression tag	UNP M4GGR7
B	-3	GLN	-	expression tag	UNP M4GGR7
B	-2	GLY	-	expression tag	UNP M4GGR7
B	-1	HIS	-	expression tag	UNP M4GGR7
B	484	ALA	GLU	engineered mutation	UNP M4GGR7
C	-21	MET	-	initiating methionine	UNP M4GGR7
C	-20	GLY	-	expression tag	UNP M4GGR7
C	-19	SER	-	expression tag	UNP M4GGR7
C	-18	SER	-	expression tag	UNP M4GGR7
C	-17	HIS	-	expression tag	UNP M4GGR7
C	-16	HIS	-	expression tag	UNP M4GGR7
C	-15	HIS	-	expression tag	UNP M4GGR7
C	-14	HIS	-	expression tag	UNP M4GGR7
C	-13	HIS	-	expression tag	UNP M4GGR7
C	-12	HIS	-	expression tag	UNP M4GGR7
C	-11	SER	-	expression tag	UNP M4GGR7
C	-10	SER	-	expression tag	UNP M4GGR7
C	-9	GLY	-	expression tag	UNP M4GGR7
C	-8	GLU	-	expression tag	UNP M4GGR7
C	-7	ASN	-	expression tag	UNP M4GGR7
C	-6	LEU	-	expression tag	UNP M4GGR7
C	-5	TYR	-	expression tag	UNP M4GGR7
C	-4	PHE	-	expression tag	UNP M4GGR7
C	-3	GLN	-	expression tag	UNP M4GGR7

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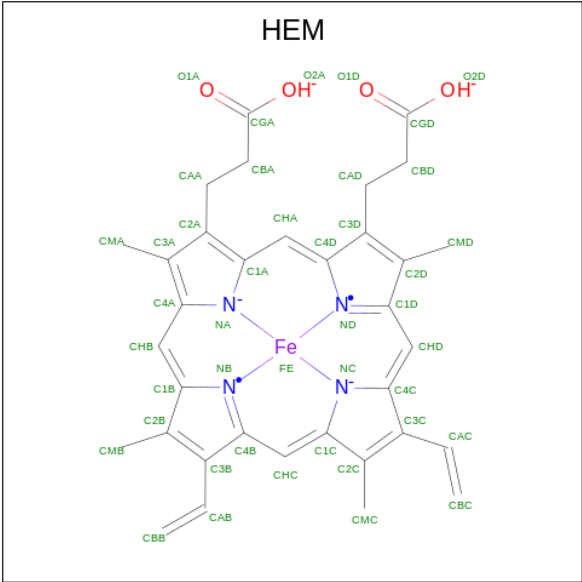
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Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	GLY	-	expression tag	UNP M4GGR7
C	-1	HIS	-	expression tag	UNP M4GGR7
C	484	ALA	GLU	engineered mutation	UNP M4GGR7
D	-21	MET	-	initiating methionine	UNP M4GGR7
D	-20	GLY	-	expression tag	UNP M4GGR7
D	-19	SER	-	expression tag	UNP M4GGR7
D	-18	SER	-	expression tag	UNP M4GGR7
D	-17	HIS	-	expression tag	UNP M4GGR7
D	-16	HIS	-	expression tag	UNP M4GGR7
D	-15	HIS	-	expression tag	UNP M4GGR7
D	-14	HIS	-	expression tag	UNP M4GGR7
D	-13	HIS	-	expression tag	UNP M4GGR7
D	-12	HIS	-	expression tag	UNP M4GGR7
D	-11	SER	-	expression tag	UNP M4GGR7
D	-10	SER	-	expression tag	UNP M4GGR7
D	-9	GLY	-	expression tag	UNP M4GGR7
D	-8	GLU	-	expression tag	UNP M4GGR7
D	-7	ASN	-	expression tag	UNP M4GGR7
D	-6	LEU	-	expression tag	UNP M4GGR7
D	-5	TYR	-	expression tag	UNP M4GGR7
D	-4	PHE	-	expression tag	UNP M4GGR7
D	-3	GLN	-	expression tag	UNP M4GGR7
D	-2	GLY	-	expression tag	UNP M4GGR7
D	-1	HIS	-	expression tag	UNP M4GGR7
D	484	ALA	GLU	engineered mutation	UNP M4GGR7

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

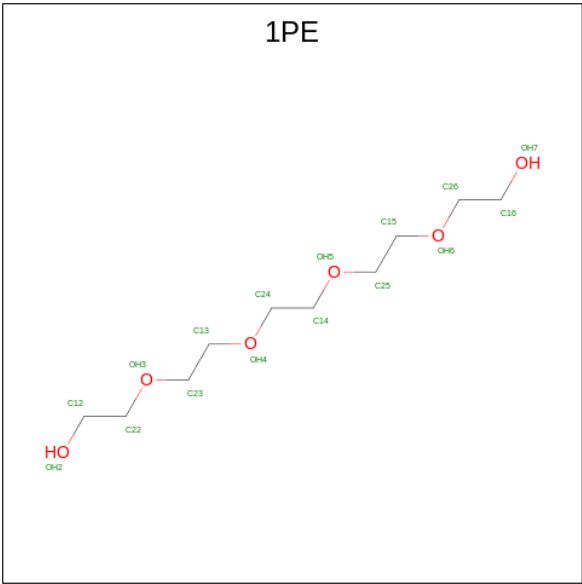
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	4	Total Ca 4 4	0	0
2	B	2	Total Ca 2 2	0	0
2	C	2	Total Ca 2 2	0	0
2	D	2	Total Ca 2 2	0	0

- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C₃₄H₃₂FeN₄O₄) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
3	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
3	C	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
3	D	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 4 is PENTAETHYLENE GLYCOL (CCD ID: 1PE) (formula: C₁₀H₂₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			16	10	6		
4	A	1	Total	C	O	0	0
			16	10	6		
4	A	1	Total	C	O	0	0
			16	10	6		
4	A	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	B	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	C	1	Total	C	O	0	0
			16	10	6		
4	D	1	Total	C	O	0	0
			16	10	6		
4	D	1	Total	C	O	0	0
			16	10	6		
4	D	1	Total	C	O	0	0
			16	10	6		
4	D	1	Total	C	O	0	0
			16	10	6		

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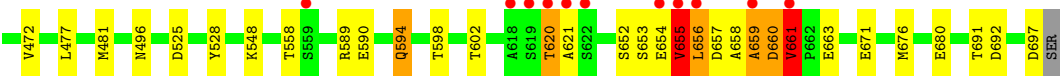
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	D	1	Total	C	O	0	0
			16	10	6		
4	D	1	Total	C	O	0	0
			16	10	6		

- Molecule 5 is water.

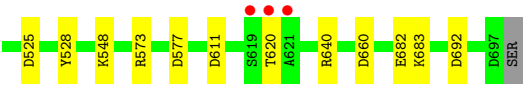
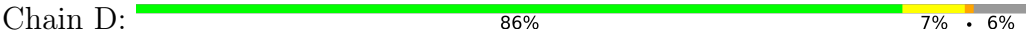
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	450	Total	O	0	0
			450	450		
5	B	462	Total	O	0	0
			462	462		
5	C	471	Total	O	0	0
			471	471		
5	D	463	Total	O	0	0
			463	463		

- Molecule 1: Catalase





● Molecule 1: Catalase



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	124.79Å 120.20Å 184.08Å 90.00° 101.72° 90.00°	Depositor
Resolution (Å)	46.43 – 1.78 46.43 – 1.78	Depositor EDS
% Data completeness (in resolution range)	98.8 (46.43-1.78) 98.8 (46.43-1.78)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.24 (at 1.78Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.162 , 0.202 0.171 , 0.205	Depositor DCC
R_{free} test set	12365 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å ²)	17.1	Xtriage
Anisotropy	0.123	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 38.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	23643	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 42.90 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.9061e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 1PE, HEM, CA

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	1.04	0/5437	1.30	5/7393 (0.1%)
1	B	1.03	1/5459 (0.0%)	1.26	4/7420 (0.1%)
1	C	1.05	1/5449 (0.0%)	1.29	5/7409 (0.1%)
1	D	1.05	0/5441	1.28	4/7398 (0.1%)
All	All	1.04	2/21786 (0.0%)	1.28	18/29620 (0.1%)

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

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

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	661	VAL	N-CA	5.51	1.53	1.46
1	B	190	HIS	CE1-NE2	5.31	1.37	1.32

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	697	ASP	CA-C-O	-8.92	105.63	120.80
1	C	659	ALA	CA-C-O	-6.95	110.57	120.51
1	D	611	ASP	CA-CB-CG	6.64	119.24	112.60
1	D	259	GLU	CB-CA-C	-6.32	100.29	110.79
1	C	697	ASP	CA-C-O	-6.23	110.20	120.80

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	292	VAL	Peptide
1	C	653	SER	Peptide

5.2 Too-close contacts

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	5299	0	5082	38	0
1	B	5318	0	5109	41	0
1	C	5314	0	5092	61	0
1	D	5300	0	5091	41	0
2	A	4	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	43	0	30	1	0
3	B	43	0	30	2	0
3	C	43	0	30	1	0
3	D	43	0	30	2	0
4	A	80	0	110	3	0
4	B	96	0	132	5	0
4	C	112	0	154	17	0
4	D	96	0	132	5	0
5	A	450	0	0	4	0
5	B	462	0	0	5	0
5	C	471	0	0	8	0
5	D	463	0	0	5	0
All	All	23643	0	21022	180	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 4.

The worst 5 of 180 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:659:ALA:C	1:C:660[A]:ASP:OD1	1.70	1.32
1:B:127[B]:ARG:NH2	5:B:801:HOH:O	1.59	1.26
1:C:127[A]:ARG:NH2	5:C:801:HOH:O	1.59	1.23
1:C:660[A]:ASP:OD1	1:C:660[A]:ASP:N	1.79	1.13
1:B:127[B]:ARG:O	5:B:802:HOH:O	1.67	1.10

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	679/720 (94%)	659 (97%)	19 (3%)	1 (0%)	48	33
1	B	681/720 (95%)	656 (96%)	25 (4%)	0	100	100
1	C	680/720 (94%)	654 (96%)	23 (3%)	3 (0%)	30	16
1	D	679/720 (94%)	663 (98%)	16 (2%)	0	100	100
All	All	2719/2880 (94%)	2632 (97%)	83 (3%)	4 (0%)	48	33

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	621	ALA
1	A	622	SER
1	C	620	THR
1	C	655	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	563/596 (94%)	557 (99%)	6 (1%)	65	51
1	B	565/596 (95%)	553 (98%)	12 (2%)	47	27
1	C	564/596 (95%)	548 (97%)	16 (3%)	38	17
1	D	563/596 (94%)	549 (98%)	14 (2%)	42	22
All	All	2255/2384 (95%)	2207 (98%)	48 (2%)	47	27

5 of 48 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	620	THR
1	D	70	HIS
1	C	655	VAL
1	C	660[B]	ASP
1	D	108	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 34 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	284	ASN
1	D	301	GLN
1	D	569	GLN
1	B	301	GLN
1	B	113	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry

Of 38 ligands modelled in this entry, 10 are monoatomic - leaving 28 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	$\# Z > 2$
4	1PE	A	707	-	15,15,15	0.20	0	14,14,14	0.21	0
4	1PE	B	704	-	15,15,15	0.23	0	14,14,14	0.10	0
4	1PE	A	709	-	15,15,15	0.26	0	14,14,14	0.13	0
4	1PE	C	707	-	15,15,15	0.37	0	14,14,14	0.32	0
4	1PE	D	706	-	15,15,15	0.40	0	14,14,14	0.29	0
4	1PE	A	710	-	15,15,15	0.19	0	14,14,14	0.16	0
4	1PE	C	708	-	15,15,15	0.34	0	14,14,14	0.36	0
4	1PE	C	705	-	15,15,15	0.25	0	14,14,14	0.32	0
4	1PE	B	706	-	15,15,15	0.24	0	14,14,14	0.22	0
4	1PE	D	708	-	15,15,15	0.29	0	14,14,14	0.29	0
4	1PE	B	705	-	15,15,15	0.37	0	14,14,14	0.24	0
4	1PE	B	709	-	15,15,15	0.35	0	14,14,14	0.22	0
4	1PE	B	707	-	15,15,15	0.34	0	14,14,14	0.20	0
4	1PE	C	704	-	15,15,15	0.23	0	14,14,14	0.31	0
4	1PE	D	707	-	15,15,15	0.41	0	14,14,14	0.21	0
4	1PE	C	706	-	15,15,15	0.32	0	14,14,14	0.16	0
3	HEM	B	703	1	50,50,50	1.53	6 (12%)	66,82,82	1.88	13 (19%)
3	HEM	D	703	1	50,50,50	1.66	8 (16%)	66,82,82	1.84	13 (19%)
4	1PE	A	708	-	15,15,15	0.27	0	14,14,14	0.21	0
4	1PE	D	709	-	15,15,15	0.25	0	14,14,14	0.18	0
4	1PE	C	710	-	15,15,15	0.37	0	14,14,14	0.28	0
4	1PE	C	709	-	15,15,15	0.23	0	14,14,14	0.19	0
3	HEM	A	705	1	50,50,50	1.72	11 (22%)	66,82,82	1.86	15 (22%)
3	HEM	C	703	1	50,50,50	1.55	7 (14%)	66,82,82	1.82	18 (27%)
4	1PE	B	708	-	15,15,15	0.25	0	14,14,14	0.17	0
4	1PE	D	705	-	15,15,15	0.25	0	14,14,14	0.19	0
4	1PE	D	704	-	15,15,15	0.30	0	14,14,14	0.10	0
4	1PE	A	706	-	15,15,15	0.38	0	14,14,14	0.41	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	1PE	A	707	-	-	7/13/13/13	-
4	1PE	B	704	-	-	2/13/13/13	-
4	1PE	A	709	-	-	6/13/13/13	-
4	1PE	C	707	-	-	8/13/13/13	-
4	1PE	D	706	-	-	5/13/13/13	-
4	1PE	A	710	-	-	6/13/13/13	-
4	1PE	C	708	-	-	9/13/13/13	-
4	1PE	C	705	-	-	8/13/13/13	-
4	1PE	B	706	-	-	8/13/13/13	-
4	1PE	D	708	-	-	5/13/13/13	-
4	1PE	B	705	-	-	6/13/13/13	-
4	1PE	B	709	-	-	10/13/13/13	-
4	1PE	B	707	-	-	9/13/13/13	-
4	1PE	C	704	-	-	9/13/13/13	-
4	1PE	D	707	-	-	8/13/13/13	-
4	1PE	C	706	-	-	5/13/13/13	-
3	HEM	B	703	1	-	2/14/54/54	-
3	HEM	D	703	1	-	2/14/54/54	-
4	1PE	A	708	-	-	4/13/13/13	-
4	1PE	D	709	-	-	9/13/13/13	-
4	1PE	C	710	-	-	8/13/13/13	-
4	1PE	C	709	-	-	6/13/13/13	-
3	HEM	A	705	1	-	2/14/54/54	-
3	HEM	C	703	1	-	3/14/54/54	-
4	1PE	B	708	-	-	5/13/13/13	-
4	1PE	D	705	-	-	4/13/13/13	-
4	1PE	D	704	-	-	7/13/13/13	-
4	1PE	A	706	-	-	10/13/13/13	-

The worst 5 of 32 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	703	HEM	FE-NB	5.28	2.11	1.94
3	D	703	HEM	FE-NB	5.28	2.11	1.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	703	HEM	FE-NB	4.87	2.10	1.94
3	A	705	HEM	FE-NB	4.66	2.09	1.94
3	B	703	HEM	C1B-NB	-4.41	1.32	1.40

The worst 5 of 59 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	703	HEM	CBD-CAD-C3D	-6.24	95.28	112.63
3	A	705	HEM	C1B-NB-C4B	5.91	111.18	105.07
3	C	703	HEM	CBD-CAD-C3D	-5.85	96.37	112.63
3	D	703	HEM	C1B-NB-C4B	5.78	111.05	105.07
3	B	703	HEM	CBD-CAD-C3D	-5.76	96.63	112.63

There are no chirality outliers.

5 of 173 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	706	1PE	C15-C25-OH5-C14
4	B	708	1PE	C24-C14-OH5-C25
4	B	705	1PE	OH5-C14-C24-OH4
4	C	704	1PE	OH6-C15-C25-OH5
4	C	708	1PE	OH6-C15-C25-OH5

There are no ring outliers.

15 monomers are involved in 36 short contacts:

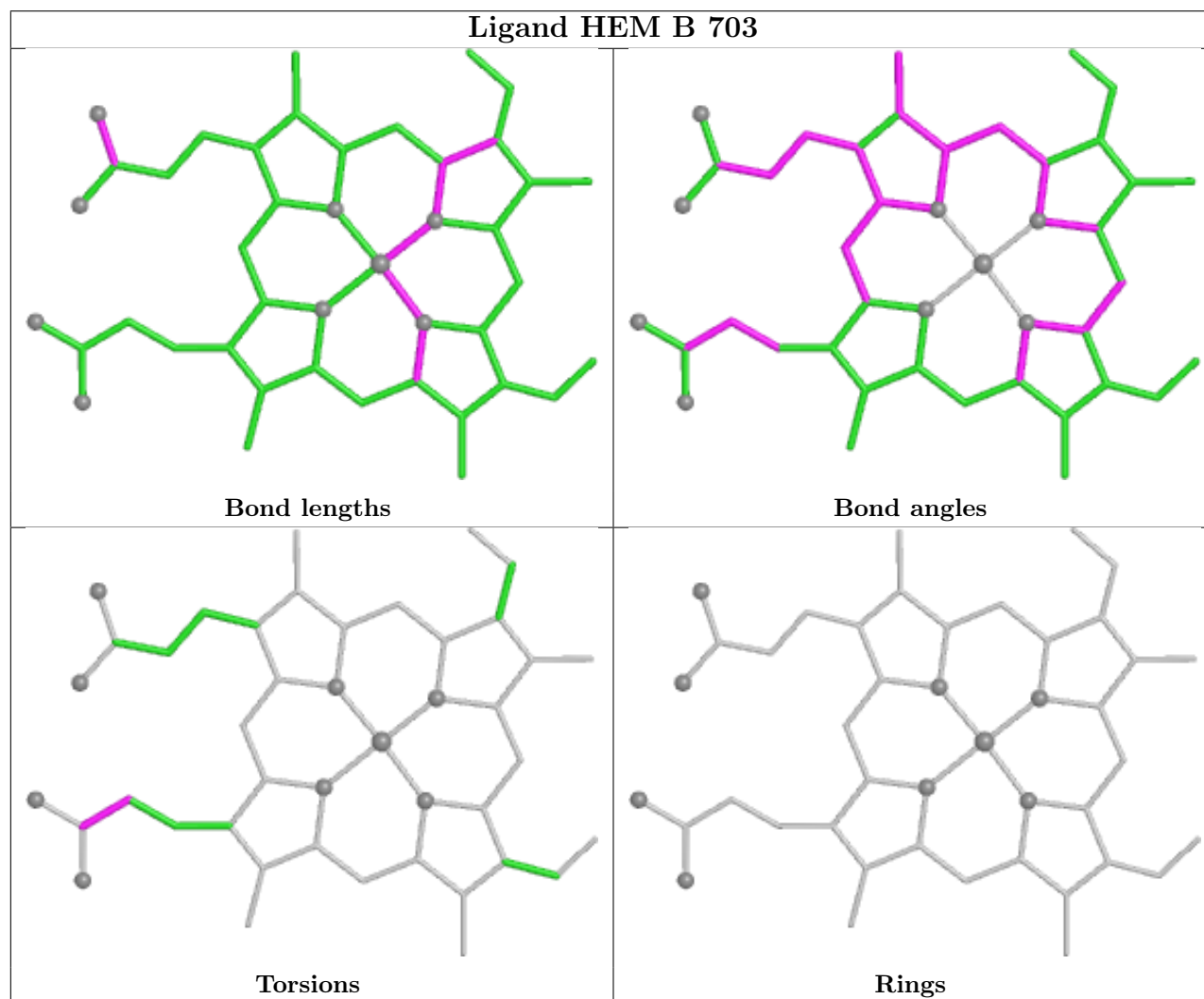
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	707	1PE	4	0
4	C	708	1PE	5	0
4	C	705	1PE	1	0
4	B	706	1PE	1	0
4	D	708	1PE	4	0
4	B	707	1PE	4	0
4	C	704	1PE	1	0
3	B	703	HEM	2	0
3	D	703	HEM	2	0
4	A	708	1PE	2	0
4	C	710	1PE	6	0
3	A	705	HEM	1	0
3	C	703	HEM	1	0
4	D	705	1PE	1	0

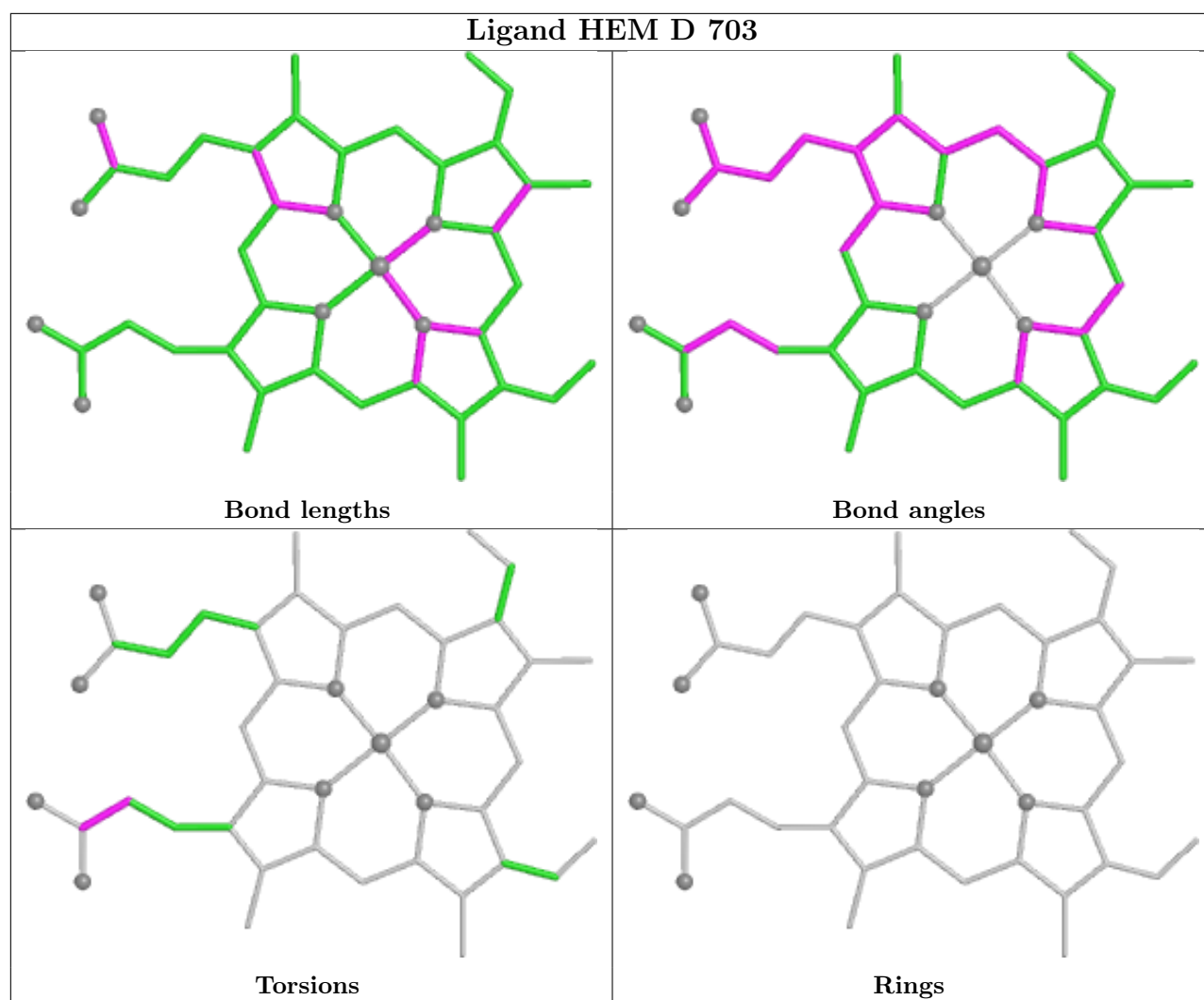
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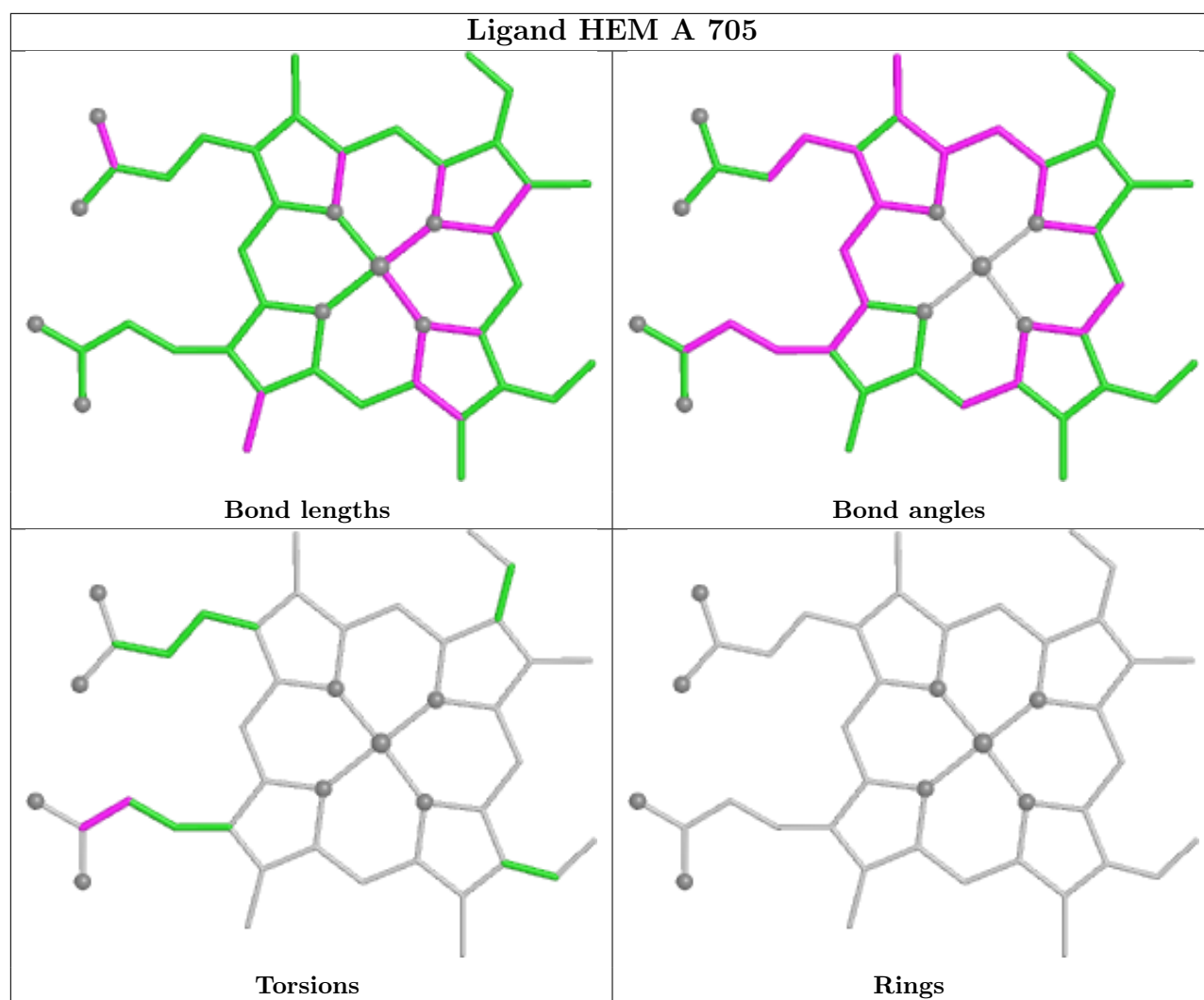
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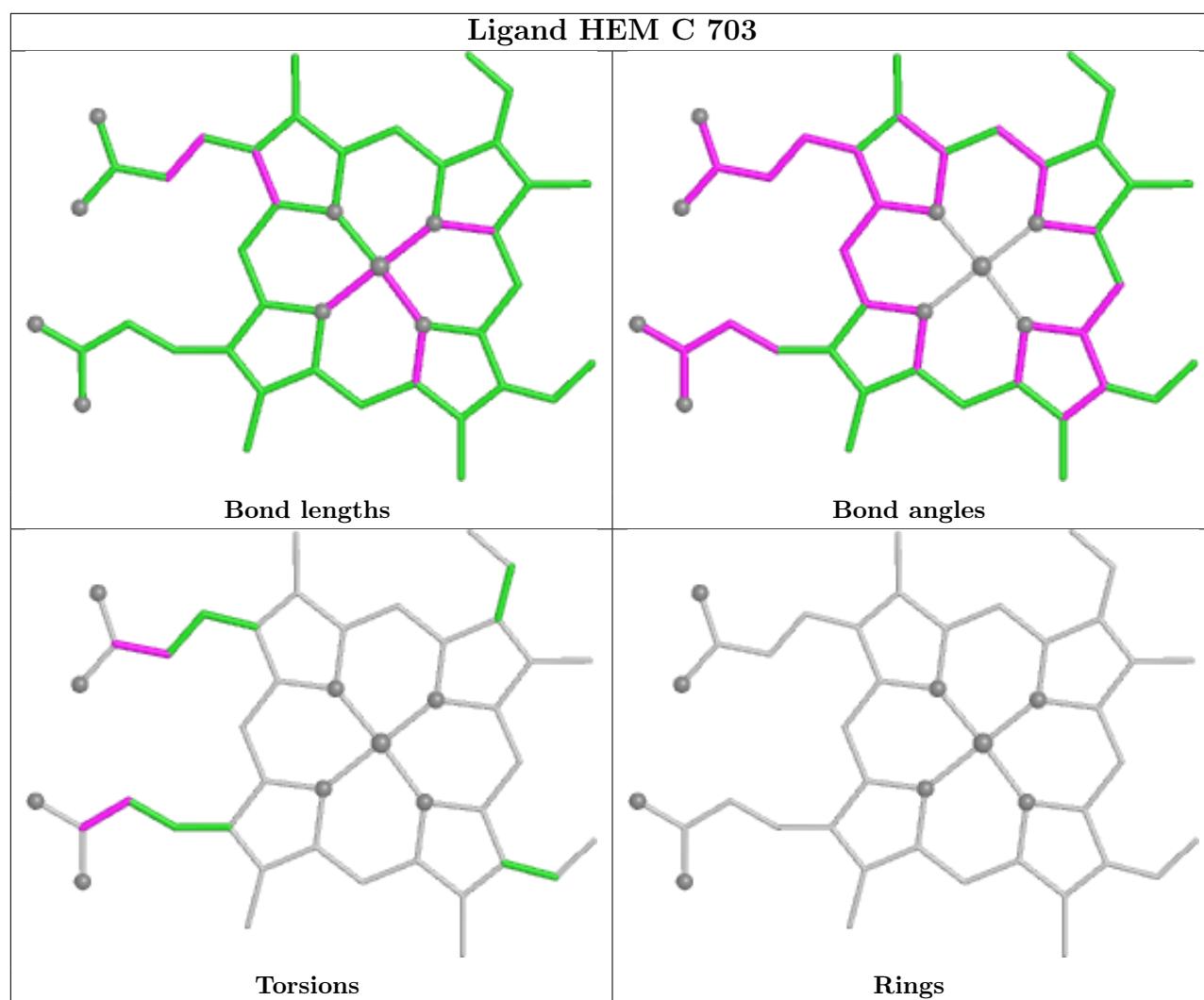
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	706	1PE	1	0

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	678/720 (94%)	-0.15	20 (2%) 53 61	8, 20, 43, 85	3 (0%)
1	B	679/720 (94%)	-0.18	9 (1%) 75 81	8, 20, 44, 74	4 (0%)
1	C	677/720 (94%)	-0.28	11 (1%) 70 77	8, 19, 32, 84	5 (0%)
1	D	677/720 (94%)	-0.27	3 (0%) 88 92	8, 20, 33, 52	4 (0%)
All	All	2711/2880 (94%)	-0.22	43 (1%) 70 77	8, 20, 38, 85	16 (0%)

The worst 5 of 43 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	655	VAL	12.1
1	A	621	ALA	4.9
1	C	621	ALA	4.8
1	A	618	ALA	4.4
1	B	659	ALA	3.7

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

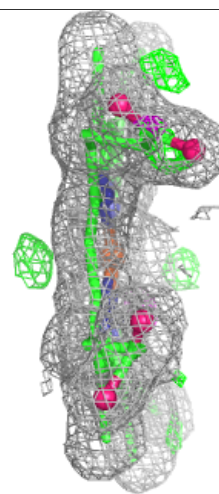
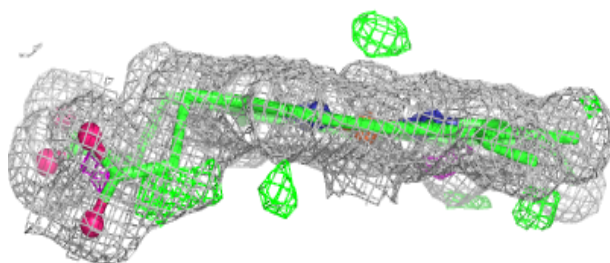
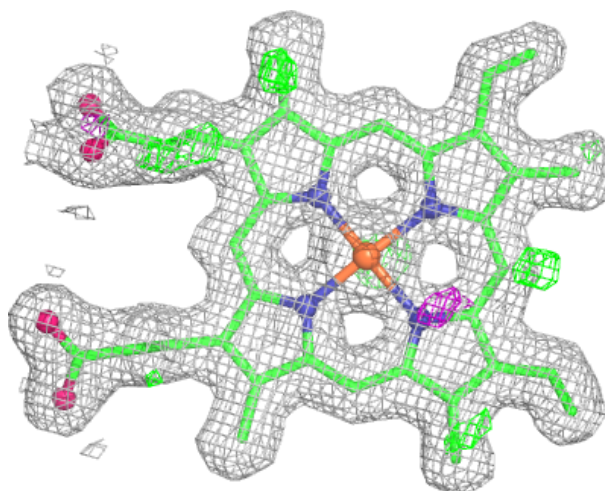
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	1PE	A	706	16/16	0.67	0.20	48,68,86,89	0
4	1PE	B	709	16/16	0.68	0.23	65,75,88,88	0
4	1PE	B	708	16/16	0.69	0.20	70,74,85,85	0
4	1PE	C	707	16/16	0.69	0.23	57,76,79,81	0
4	1PE	D	704	16/16	0.72	0.21	62,80,94,94	0
4	1PE	A	709	16/16	0.74	0.21	48,68,74,74	0
4	1PE	C	706	16/16	0.75	0.18	59,66,78,78	0
4	1PE	D	705	16/16	0.75	0.18	59,67,83,89	0
4	1PE	C	710	16/16	0.76	0.17	44,57,68,69	0
4	1PE	D	706	16/16	0.76	0.19	35,53,88,91	0
4	1PE	D	707	16/16	0.76	0.21	47,67,89,99	0
4	1PE	D	709	16/16	0.76	0.18	50,79,101,103	0
4	1PE	B	707	16/16	0.77	0.18	49,57,69,75	0
4	1PE	C	705	16/16	0.77	0.18	43,52,75,75	0
4	1PE	A	708	16/16	0.78	0.19	51,56,62,63	0
4	1PE	A	710	16/16	0.78	0.18	48,62,74,76	0
4	1PE	B	705	16/16	0.78	0.18	49,62,67,70	0
4	1PE	C	708	16/16	0.79	0.18	38,51,62,65	0
4	1PE	C	709	16/16	0.79	0.18	50,76,84,85	0
4	1PE	B	706	16/16	0.81	0.19	51,56,75,77	0
4	1PE	C	704	16/16	0.85	0.14	46,51,60,61	0
4	1PE	A	707	16/16	0.86	0.15	47,61,78,79	0
4	1PE	D	708	16/16	0.88	0.13	41,57,65,66	0
4	1PE	B	704	16/16	0.92	0.11	28,38,66,70	0
3	HEM	D	703	43/43	0.98	0.06	13,14,17,24	0
2	CA	A	701	1/1	0.98	0.12	40,40,40,40	0
3	HEM	A	705	43/43	0.98	0.06	12,14,20,29	0
3	HEM	B	703	43/43	0.98	0.05	11,14,18,26	0
3	HEM	C	703	43/43	0.98	0.06	11,14,16,22	0
2	CA	C	701	1/1	0.99	0.08	25,25,25,25	0
2	CA	C	702	1/1	0.99	0.08	29,29,29,29	0
2	CA	D	701	1/1	0.99	0.06	23,23,23,23	0
2	CA	D	702	1/1	0.99	0.08	28,28,28,28	0
2	CA	A	703	1/1	0.99	0.10	32,32,32,32	0
2	CA	A	704	1/1	0.99	0.18	34,34,34,34	0
2	CA	B	701	1/1	0.99	0.06	23,23,23,23	0
2	CA	B	702	1/1	0.99	0.07	30,30,30,30	0
2	CA	A	702	1/1	1.00	0.07	23,23,23,23	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.

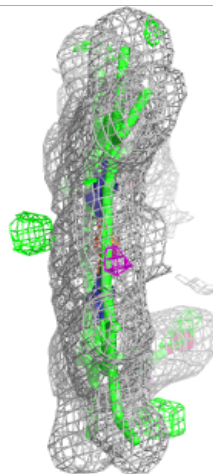
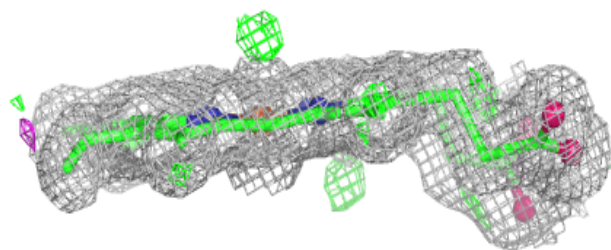
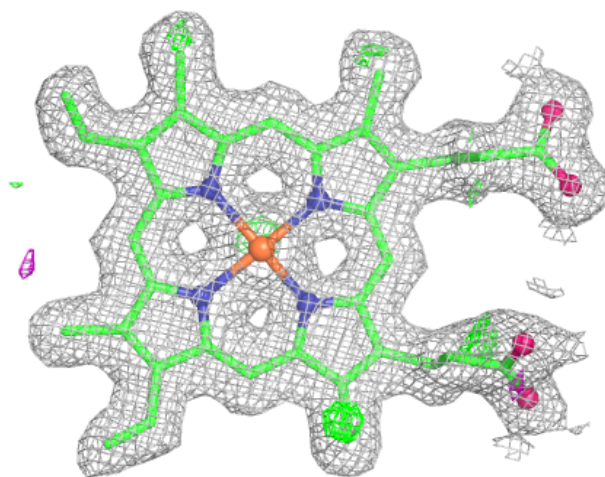
Electron density around HEM D 703:

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



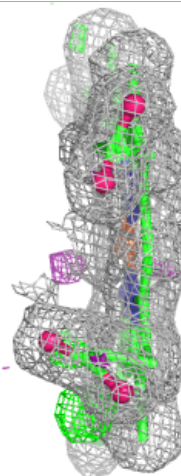
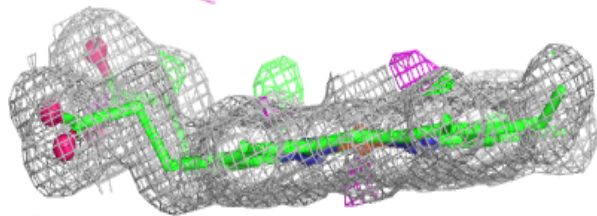
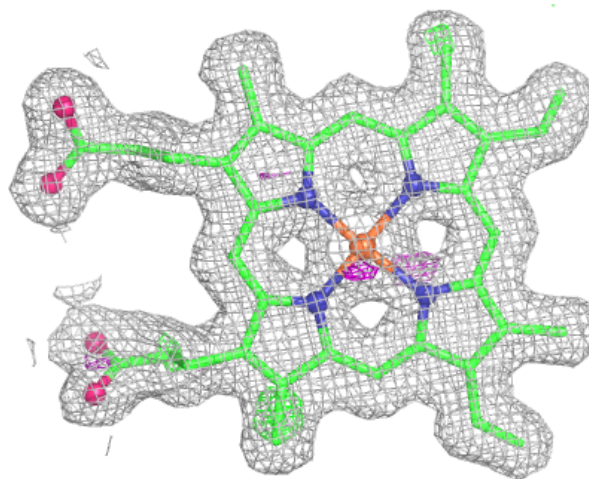
Electron density around HEM A 705:

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



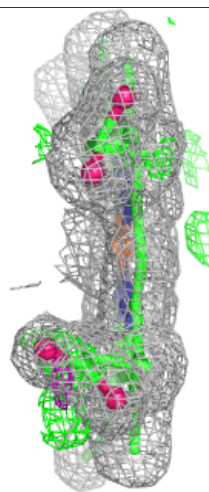
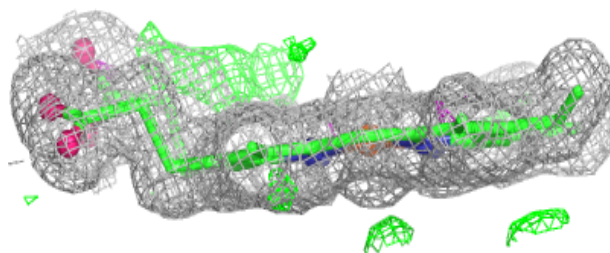
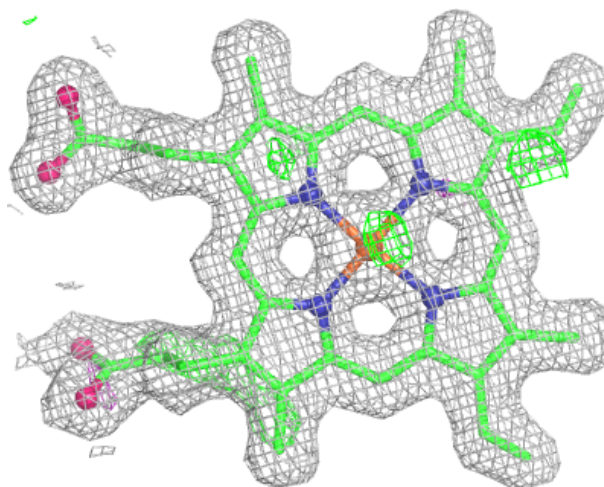
Electron density around HEM B 703:

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



Electron density around HEM C 703:

$2mF_o-DF_c$ (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.