



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 24, 2026 – 05:06 am BST

PDB ID : 2YEV / pdb_00002yev
Title : Structure of caa3-type cytochrome oxidase
Authors : Lyons, J.A.; Aragao, D.; Soulimane, T.; Caffrey, M.
Deposited on : 2011-03-31
Resolution : 2.36 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 : 1.8.4, 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

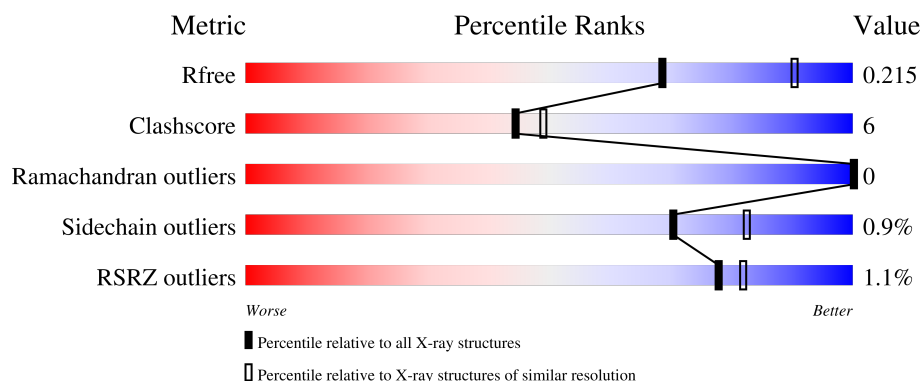
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.36 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 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	791	6% 85% 14% •
1	D	791	84% 14% •
2	B	337	83% 11% 5%
2	E	337	82% 12% 5% •
3	C	66	6% 85% 12% •

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Mol	Chain	Length	Quality of chain
3	F	66	

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
11	HEC	B	587	X	-	-	-
11	HEC	E	587	X	-	-	-
5	HAS	A	1015	X	-	-	-
5	HAS	A	1016	X	-	-	-
5	HAS	D	1015	X	-	-	-
5	HAS	D	1016	X	-	-	-
8	7E8	A	1300	X	-	-	-

2 Entry composition

There are 14 unique types of molecules in this entry. The entry contains 19587 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 CYTOCHROME C OXIDASE POLYPEPTIDE I+III.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	780	Total	C	N	O	S	0	1	0
			6281	4244	992	1022	23			
1	D	780	Total	C	N	O	S	0	0	0
			6276	4241	992	1020	23			

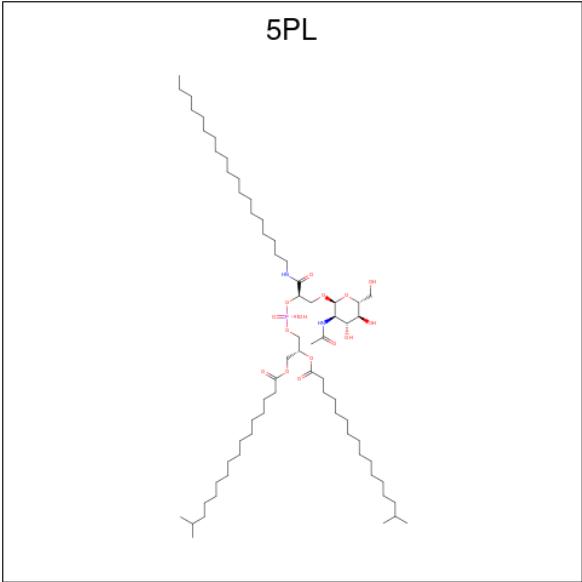
- Molecule 2 is a protein called CYTOCHROME C OXIDASE SUBUNIT 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	319	Total	C	N	O	S	0	0	0
			2507	1637	422	439	9			
2	E	319	Total	C	N	O	S	0	0	0
			2507	1637	422	439	9			

- Molecule 3 is a protein called CAA3-TYPE CYTOCHROME OXIDASE SUBUNIT IV.

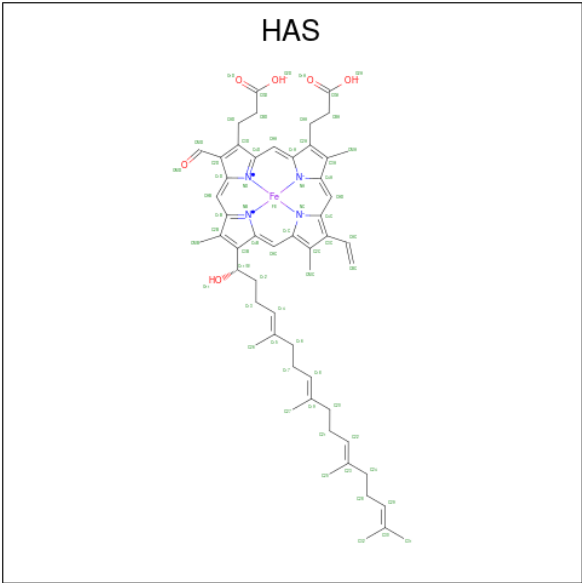
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	64	Total	C	N	O	S	0	0	0
			502	344	76	79	3			
3	F	63	Total	C	N	O	S	0	0	0
			492	338	73	78	3			

- Molecule 4 is (1R,4S,6R)-6-([2-(ACETYLAMINO)-2-DEOXY-ALPHA-D-GLUCOPYRANOSYL]OXY)METHYL)-4-HYDROXY-1-([(15-METHYLHEXADECANOYL)OXY]METHYL)-4-OXIDO-7-OXO-3,5-DIOXA-8-AZA-4-PHOSPHAHEPTACOS-1-YL 15-METHYLHEXADECANOATE (CCD ID: 5PL) (formula: C₆₇H₁₂₉N₂O₁₅P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			85	67	2	15	1		
4	D	1	Total	C	N	O	P	0	0
			85	67	2	15	1		

- Molecule 5 is HEME-AS (CCD ID: HAS) (formula: C₅₄H₆₄FeN₄O₆).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	Fe	N	O	0	0
			65	54	1	4	6		
5	A	1	Total	C	Fe	N	O	0	0
			65	54	1	4	6		

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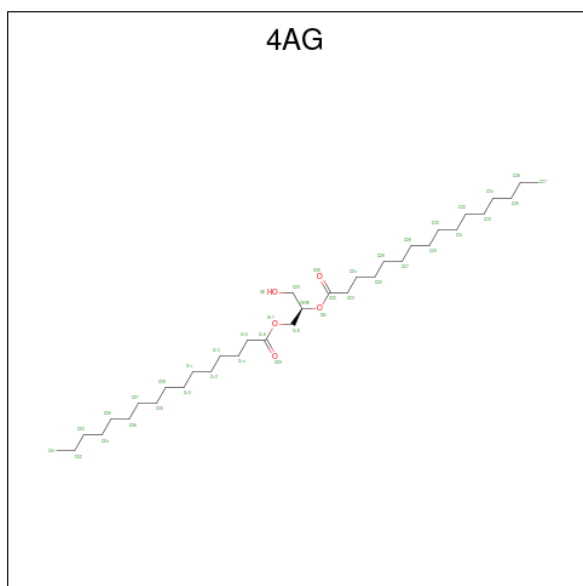
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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	D	1	Total	C	Fe	N	O	
			65	54	1	4	6	
5	D	1	Total	C	Fe	N	O	
			65	54	1	4	6	

- Molecule 6 is COPPER (II) ION (CCD ID: CU) (formula: Cu).

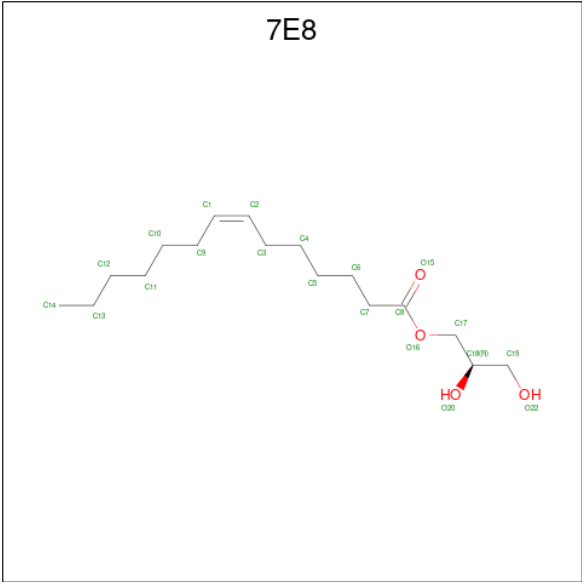
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Cu		
			1	1	0	0
6	D	1	Total	Cu		
			1	1	0	0

- Molecule 7 is (2R)-3-HYDROXYPROPANE-1,2-DIYL DIHEXADECANOATE (CCD ID: 4AG) (formula: C₃₅H₆₈O₅).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O		
			40	35	5	0	0

- Molecule 8 is (2R)-2,3-DIHYDROXYPROPYL (7Z)-TETRADEC-7-ENOATE (CCD ID: 7E8) (formula: C₁₇H₃₂O₄).

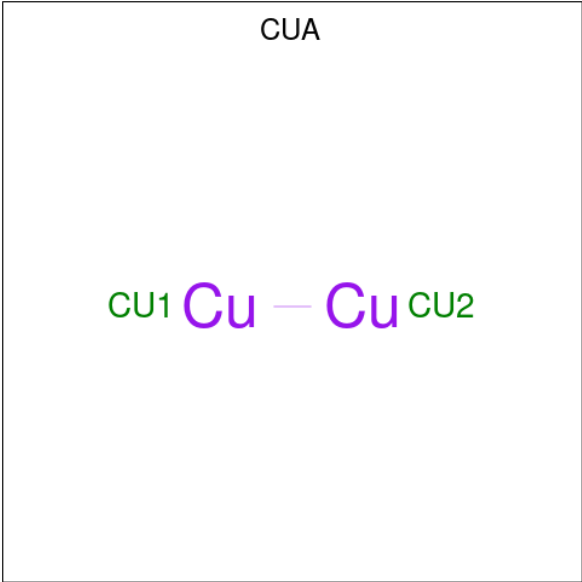


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total	C	O	0	0
			21	17	4		
8	A	1	Total	C	O	0	0
			21	17	4		

- Molecule 9 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

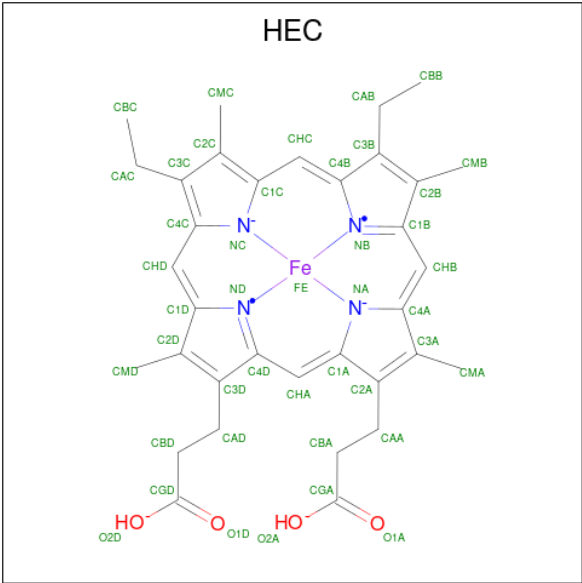
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	1	Total	Mg	0	0
			1	1		
9	D	1	Total	Mg	0	0
			1	1		

- Molecule 10 is DINUCLEAR COPPER ION (CCD ID: CUA) (formula: Cu₂).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	B	1	Total 2	Cu 2	0	0
10	E	1	Total 2	Cu 2	0	0

- Molecule 11 is HEME C (CCD ID: HEC) (formula: C₃₄H₃₆FeN₄O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	B	1	Total	C	Fe	N	O	0
			43	34	1	4	4	
11	E	1	Total	C	Fe	N	O	0
			43	34	1	4	4	

- 7E9
-
- The chemical structure of 7E9 is a long-chain molecule. It features a terminal hydroxyl group (OH) at the right end, attached to a carbon atom (C15). This carbon atom is also bonded to a hydrogen atom (H16) and a methyl group (C18). The chain continues through a series of carbon atoms (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14) to a terminal methyl group (C14). A double bond is present between carbon atoms C6 and C7. The structure is labeled with atom numbers 1 through 16, with the hydroxyl group and its associated atoms (O1, H16) highlighted in red.

- Molecule 13 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

- Molecule 14 is water.

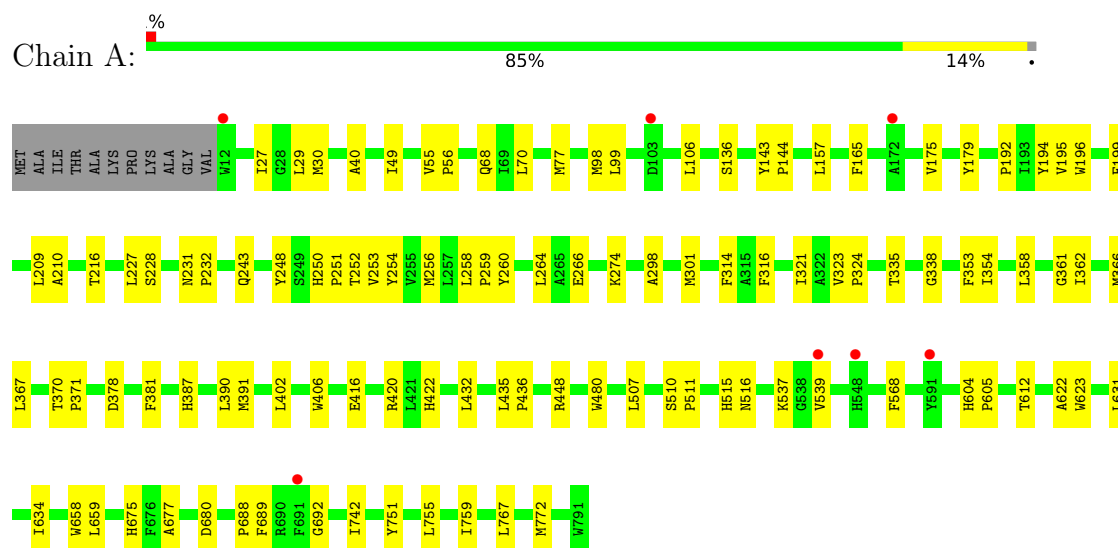


WORLDWIDE
PDB
PROTEIN DATA BANK

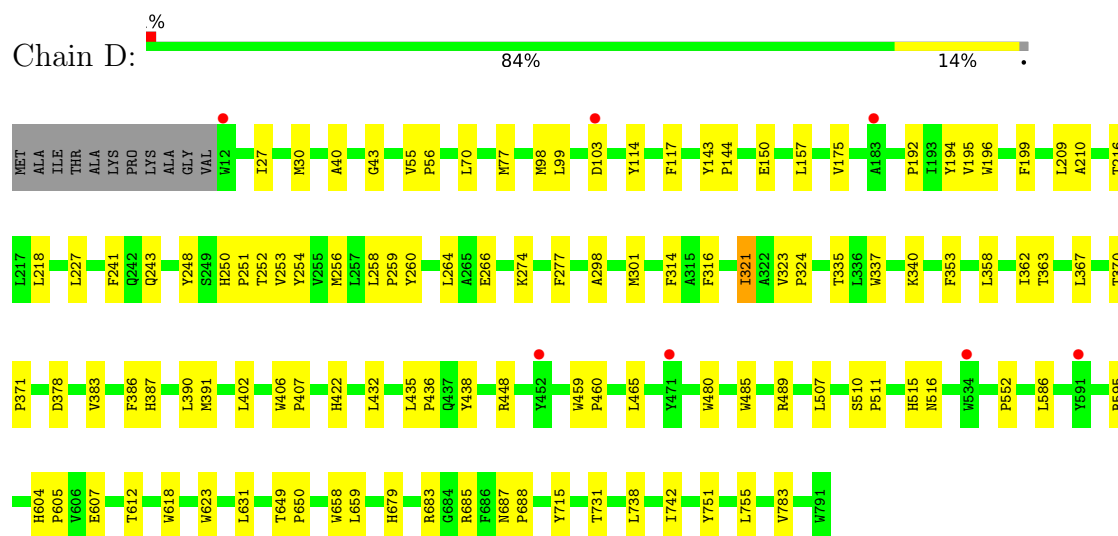
3 Residue-property plots [i](#)

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

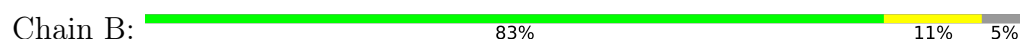
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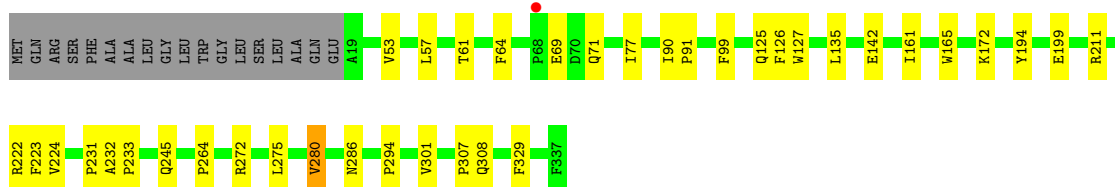


• Molecule 1: CYTOCHROME C OXIDASE POLYPEPTIDE I+III

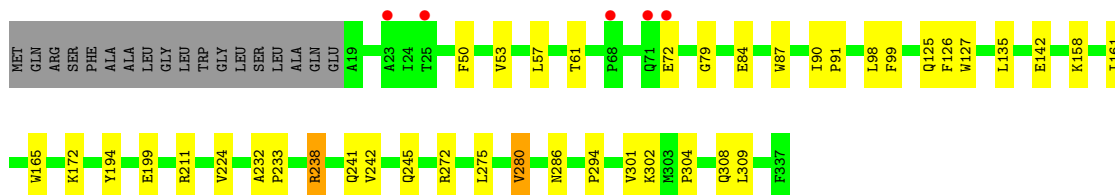
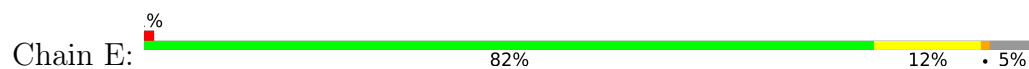


• Molecule 2: CYTOCHROME C OXIDASE SUBUNIT 2

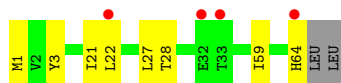
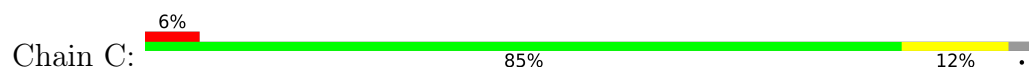




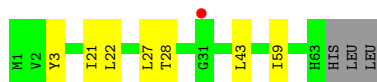
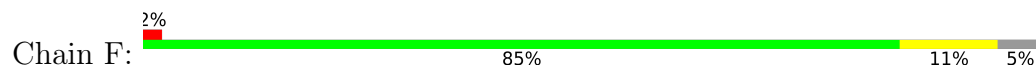
• Molecule 2: CYTOCHROME C OXIDASE SUBUNIT 2



• Molecule 3: CAA3-TYPE CYTOCHROME OXIDASE SUBUNIT IV



• Molecule 3: CAA3-TYPE CYTOCHROME OXIDASE SUBUNIT IV



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	127.25Å 76.03Å 300.27Å 90.00° 92.21° 90.00°	Depositor
Resolution (Å)	77.18 – 2.36 77.18 – 2.36	Depositor EDS
% Data completeness (in resolution range)	100.0 (77.18-2.36) 100.0 (77.18-2.36)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.19 (at 2.37Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE: 1.6.4_486)	Depositor
R, R_{free}	0.171 , 0.218 0.168 , 0.215	Depositor DCC
R_{free} test set	5970 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	50.2	Xtriage
Anisotropy	0.263	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 63.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.017 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	19587	wwPDB-VP
Average B, all atoms (Å ²)	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.82% 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: CL, CU, 5PL, HAS, CUA, MG, FME, 7E9, 4AG, 7E8, HEC

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	0.39	0/6523	0.70	0/8921
1	D	0.39	0/6515	0.70	0/8910
2	B	0.41	0/2586	0.74	0/3523
2	E	0.38	0/2586	0.75	0/3523
3	C	0.34	0/502	0.65	0/683
3	F	0.35	0/491	0.67	0/668
All	All	0.39	0/19203	0.71	0/26228

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	6281	0	6210	83	0
1	D	6276	0	6206	96	0
2	B	2507	0	2473	26	0
2	E	2507	0	2473	27	0
3	C	502	0	545	4	0
3	F	492	0	538	6	0
4	A	85	0	128	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	D	85	0	128	4	0
5	A	130	0	124	16	0
5	D	130	0	124	20	0
6	A	1	0	0	0	0
6	D	1	0	0	0	0
7	A	40	0	68	1	0
8	A	42	0	64	2	0
9	A	1	0	0	0	0
9	D	1	0	0	0	0
10	B	2	0	0	0	0
10	E	2	0	0	0	0
11	B	43	0	30	2	0
11	E	43	0	30	2	0
12	B	21	0	32	0	0
13	C	1	0	0	0	0
13	D	1	0	0	0	0
13	F	1	0	0	0	0
14	A	157	0	0	4	0
14	B	90	0	0	1	0
14	D	111	0	0	0	0
14	E	34	0	0	0	0
All	All	19587	0	19173	230	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 6.

The worst 5 of 230 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:77:MET:HB3	5:A:1015:HAS:CAC	1.99	0.93
1:D:77:MET:HB3	5:D:1015:HAS:CAC	2.00	0.91
1:D:367:LEU:CB	5:D:1016:HAS:HMD	2.15	0.77
1:D:70:LEU:HD13	5:D:1015:HAS:HBD1	1.66	0.77
1:A:77:MET:HB3	5:A:1015:HAS:HAC	1.68	0.73

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	779/791 (98%)	762 (98%)	17 (2%)	0	100	100
1	D	778/791 (98%)	759 (98%)	19 (2%)	0	100	100
2	B	317/337 (94%)	308 (97%)	9 (3%)	0	100	100
2	E	317/337 (94%)	307 (97%)	10 (3%)	0	100	100
3	C	62/66 (94%)	62 (100%)	0	0	100	100
3	F	61/66 (92%)	61 (100%)	0	0	100	100
All	All	2314/2388 (97%)	2259 (98%)	55 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	640/646 (99%)	637 (100%)	3 (0%)	81	89
1	D	639/646 (99%)	635 (99%)	4 (1%)	78	87
2	B	261/274 (95%)	257 (98%)	4 (2%)	57	72
2	E	261/274 (95%)	256 (98%)	5 (2%)	50	65
3	C	51/53 (96%)	50 (98%)	1 (2%)	48	63
3	F	50/53 (94%)	50 (100%)	0	100	100
All	All	1902/1946 (98%)	1885 (99%)	17 (1%)	70	82

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	238	ARG
2	E	280	VAL
3	C	64	HIS
1	D	321	ILE
1	D	378	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	764	HIS
3	F	63	HIS
2	E	244	GLN
3	C	63	HIS
1	D	679	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 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	$\# Z > 2$
3	FME	F	1	3	8,9,10	0.38	0	7,9,11	0.69	0
3	FME	C	1	3	8,9,10	0.36	0	7,9,11	1.31	1 (14%)

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	FME	F	1	3	-	0/7/9/11	-
3	FME	C	1	3	-	0/7/9/11	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
3	C	1	FME	CA-N-CN	-2.92	118.33	122.82

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 21 ligands modelled in this entry, 7 are monoatomic - leaving 14 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	HAS	D	1015	1	71,72,72	2.04	18 (25%)	84,109,109	2.39	29 (34%)
11	HEC	E	587	2	50,50,50	1.75	5 (10%)	68,82,82	1.62	7 (10%)
8	7E8	A	1300	-	20,20,20	1.05	1 (5%)	21,21,21	0.96	1 (4%)
8	7E8	A	1301	-	20,20,20	1.01	1 (5%)	21,21,21	1.04	2 (9%)
10	CUA	E	585	2	0,1,1	-	-	-	-	-
7	4AG	A	1200	-	39,39,39	1.06	2 (5%)	41,41,41	1.21	3 (7%)
10	CUA	B	585	2	0,1,1	-	-	-	-	-

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	5PL	A	900	-	84,85,85	0.81	2 (2%)	96,101,101	1.02	4 (4%)
5	HAS	D	1016	14,1	71,72,72	1.86	16 (22%)	84,109,109	2.46	29 (34%)
11	HEC	B	587	2	50,50,50	1.59	6 (12%)	68,82,82	1.51	7 (10%)
4	5PL	D	900	-	84,85,85	0.81	2 (2%)	96,101,101	1.09	9 (9%)
5	HAS	A	1016	14,1	71,72,72	2.02	15 (21%)	84,109,109	2.40	28 (33%)
12	7E9	B	701	-	20,20,20	1.06	1 (5%)	21,21,21	1.20	1 (4%)
5	HAS	A	1015	1	71,72,72	1.88	15 (21%)	84,109,109	2.38	33 (39%)

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
5	HAS	D	1015	1	1/1/8/18	11/42/82/82	-
11	HEC	E	587	2	1/1/3/7	4/14/54/54	-
8	7E8	A	1300	-	1/1/2/4	6/20/20/20	-
8	7E8	A	1301	-	-	6/20/20/20	-
7	4AG	A	1200	-	-	15/41/41/41	-
11	HEC	B	587	2	1/1/3/7	5/14/54/54	-
5	HAS	D	1016	14,1	1/1/8/18	10/42/82/82	-
4	5PL	A	900	-	-	30/87/107/107	0/1/1/1
12	7E9	B	701	-	-	7/21/21/21	-
4	5PL	D	900	-	-	26/87/107/107	0/1/1/1
5	HAS	A	1016	14,1	1/1/8/18	9/42/82/82	-
5	HAS	A	1015	1	1/1/8/18	13/42/82/82	-

The worst 5 of 84 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	E	587	HEC	C3D-C2D	7.70	1.53	1.36
5	D	1015	HAS	FE-NB	7.70	2.18	1.94
5	A	1015	HAS	FE-NB	7.54	2.18	1.94
11	B	587	HEC	C3D-C2D	7.30	1.52	1.36
5	A	1016	HAS	FE-NB	6.95	2.16	1.94

The worst 5 of 153 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	1016	HAS	C2D-C3D-C4D	-7.99	100.79	106.49
5	D	1016	HAS	C2D-C3D-C4D	-7.96	100.82	106.49
5	A	1015	HAS	C2D-C3D-C4D	-7.92	100.84	106.49
5	A	1016	HAS	CAD-CBD-CGD	-7.68	97.07	113.60
5	D	1015	HAS	C2D-C3D-C4D	-7.12	101.41	106.49

5 of 7 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	A	1015	HAS	NA
5	A	1016	HAS	NA
5	D	1015	HAS	NA
5	D	1016	HAS	NA
8	A	1300	7E8	C18

5 of 142 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	900	5PL	CBV-CBU-OCK-CBH
4	D	900	5PL	CBV-CBU-OCK-CBH
5	A	1015	HAS	C1D-C2D-CMD-OMD
5	A	1015	HAS	C3D-C2D-CMD-OMD
5	A	1015	HAS	C2D-C3D-CAD-CBD

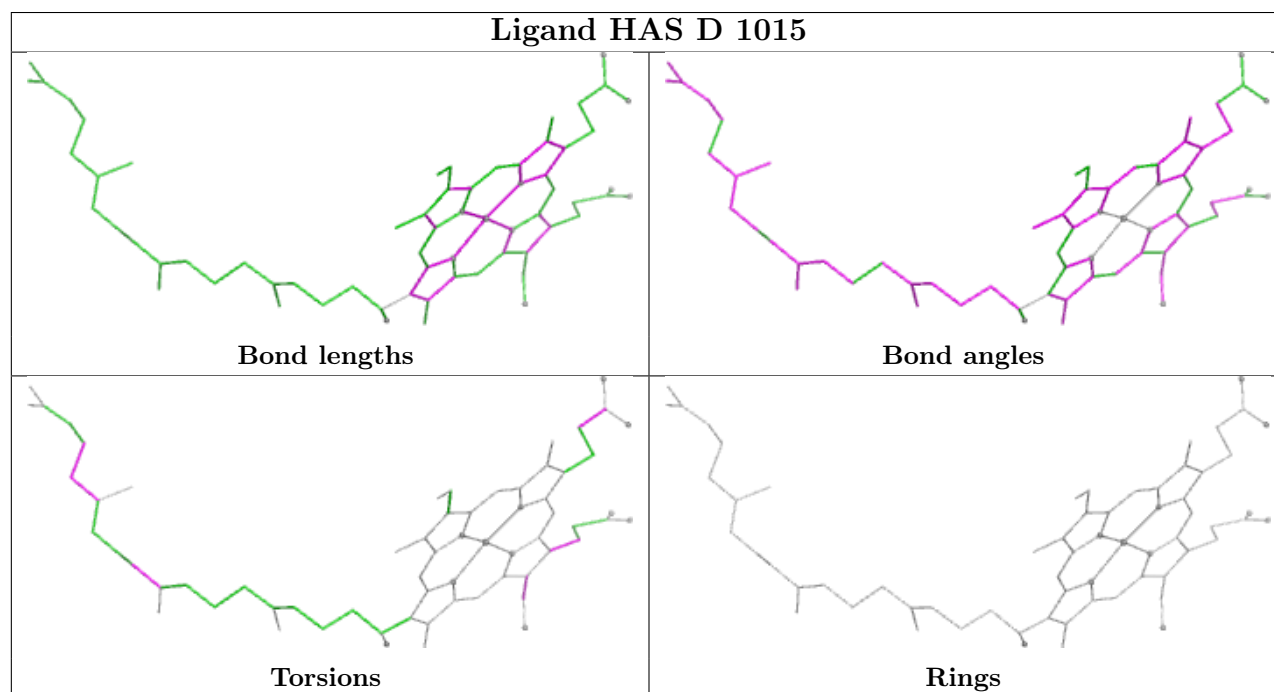
There are no ring outliers.

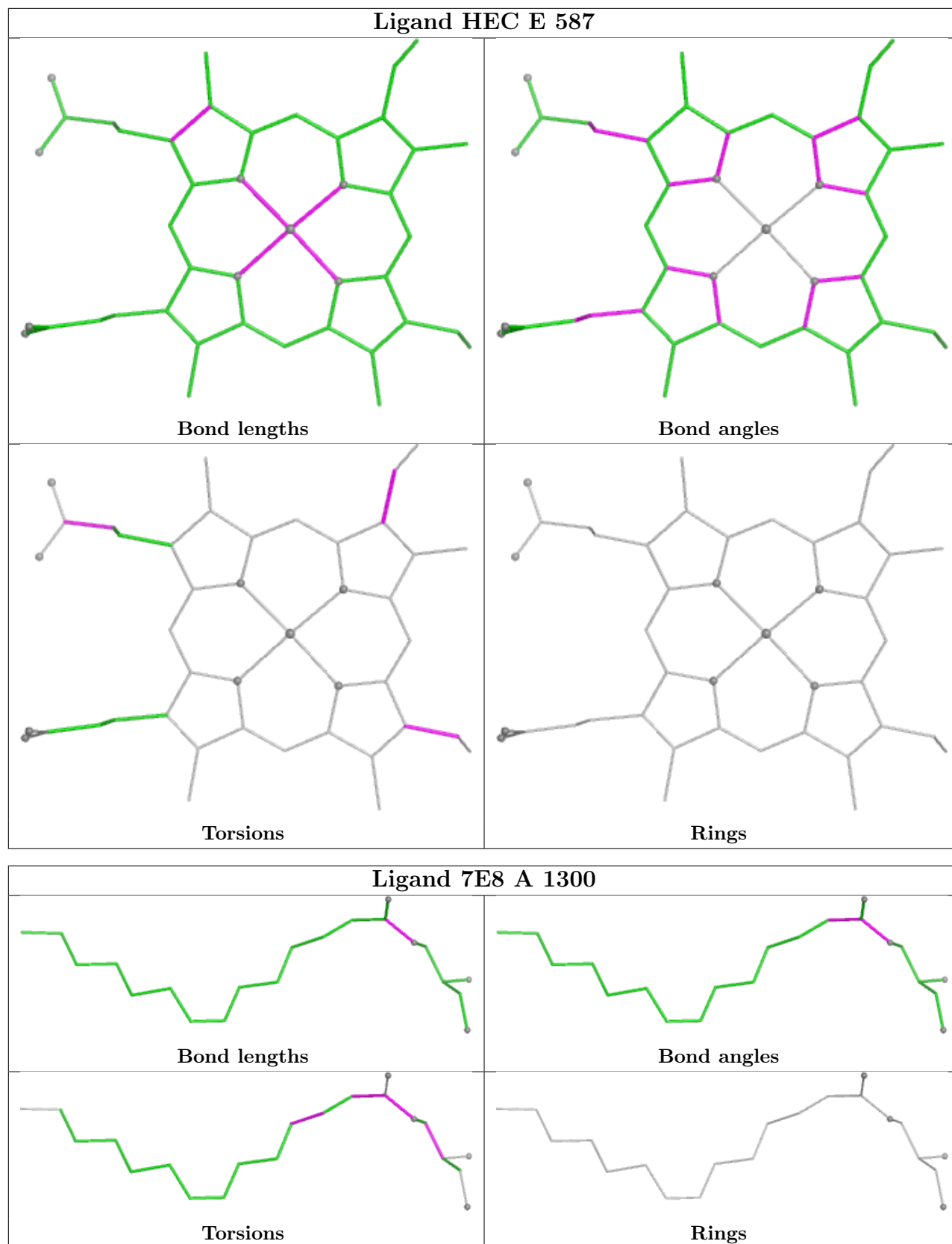
11 monomers are involved in 52 short contacts:

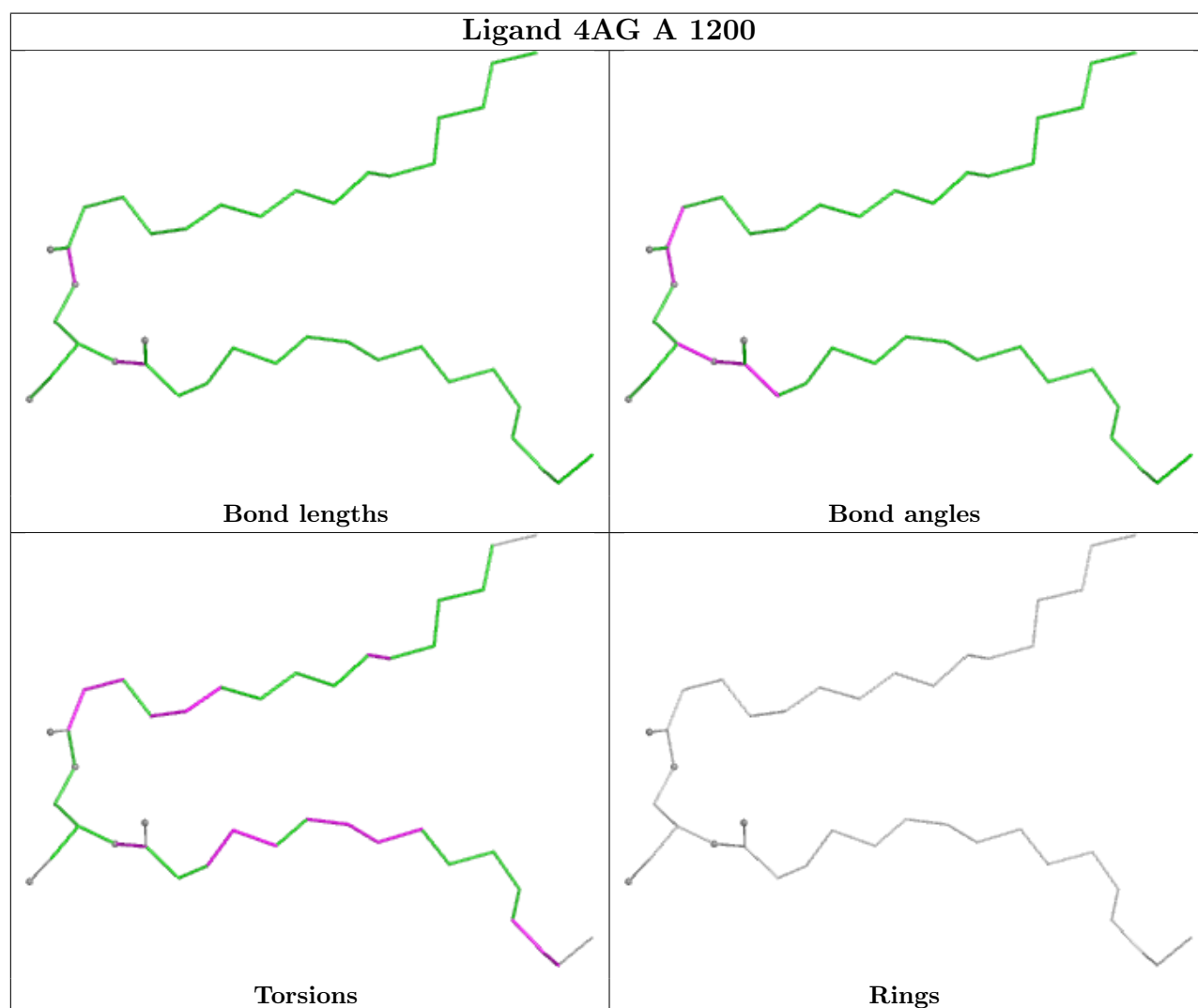
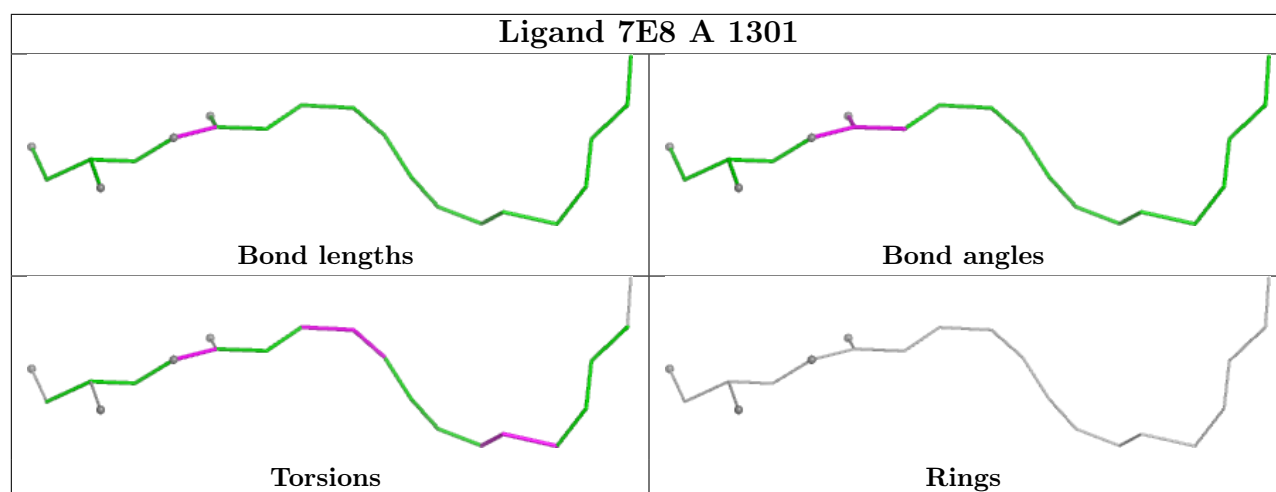
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	1015	HAS	7	0
11	E	587	HEC	2	0
8	A	1300	7E8	1	0
8	A	1301	7E8	1	0
7	A	1200	4AG	1	0
4	A	900	5PL	5	0
5	D	1016	HAS	13	0
11	B	587	HEC	2	0
4	D	900	5PL	4	0
5	A	1016	HAS	7	0
5	A	1015	HAS	9	0

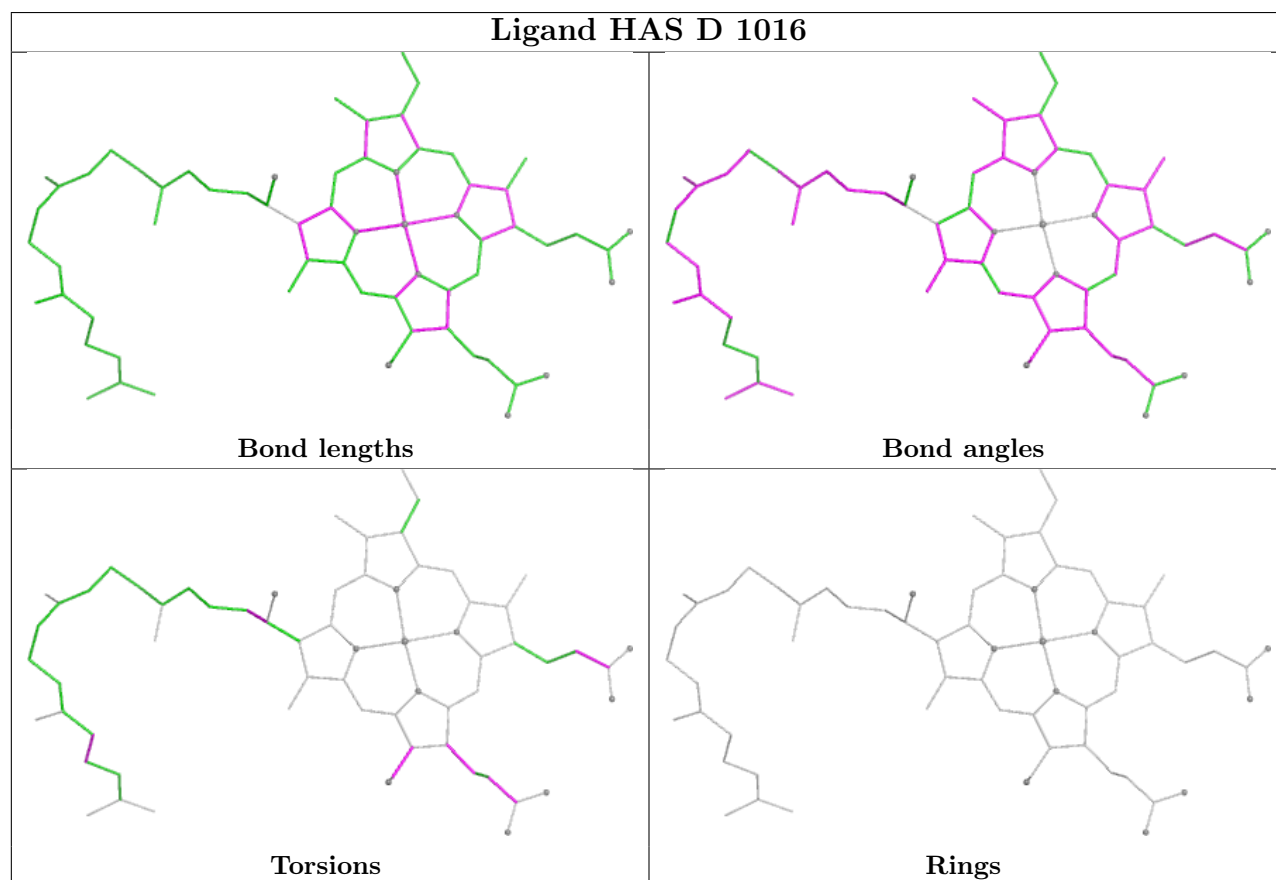
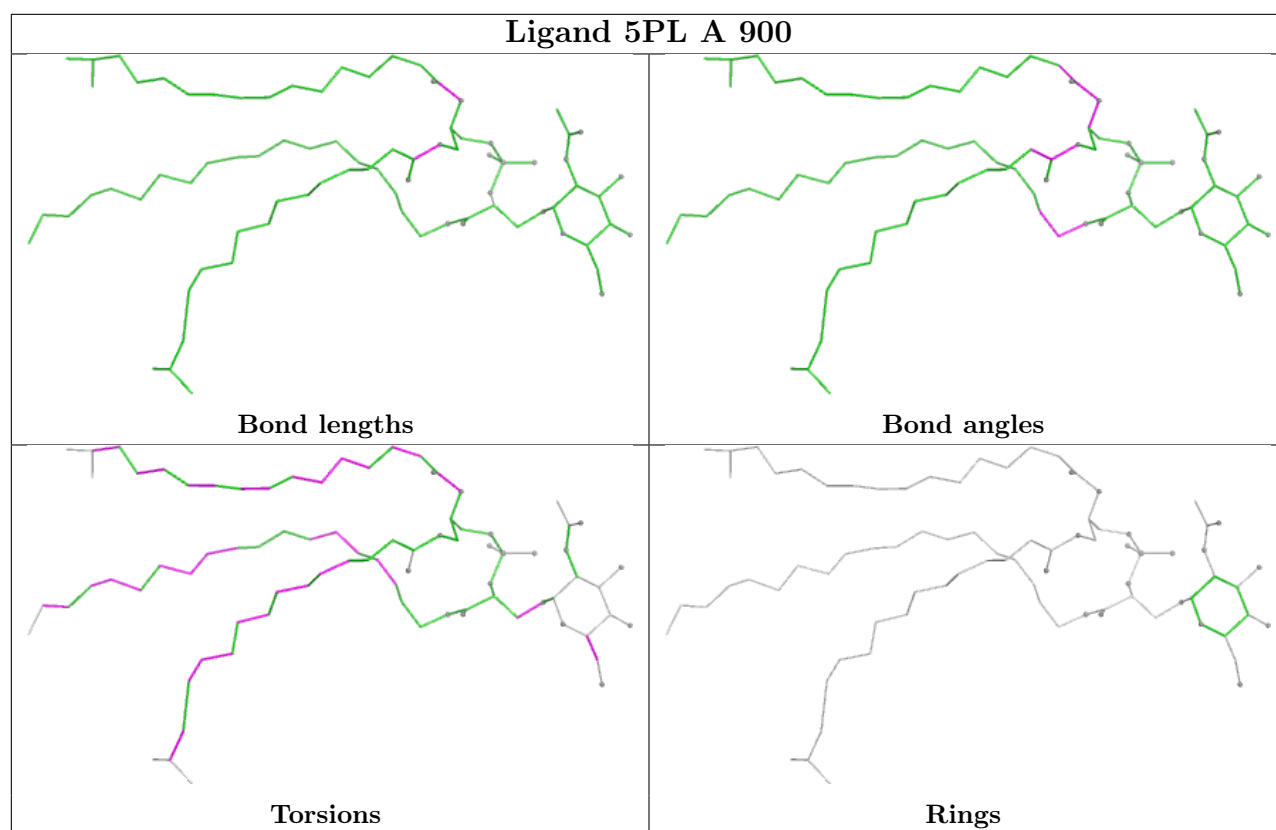
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will

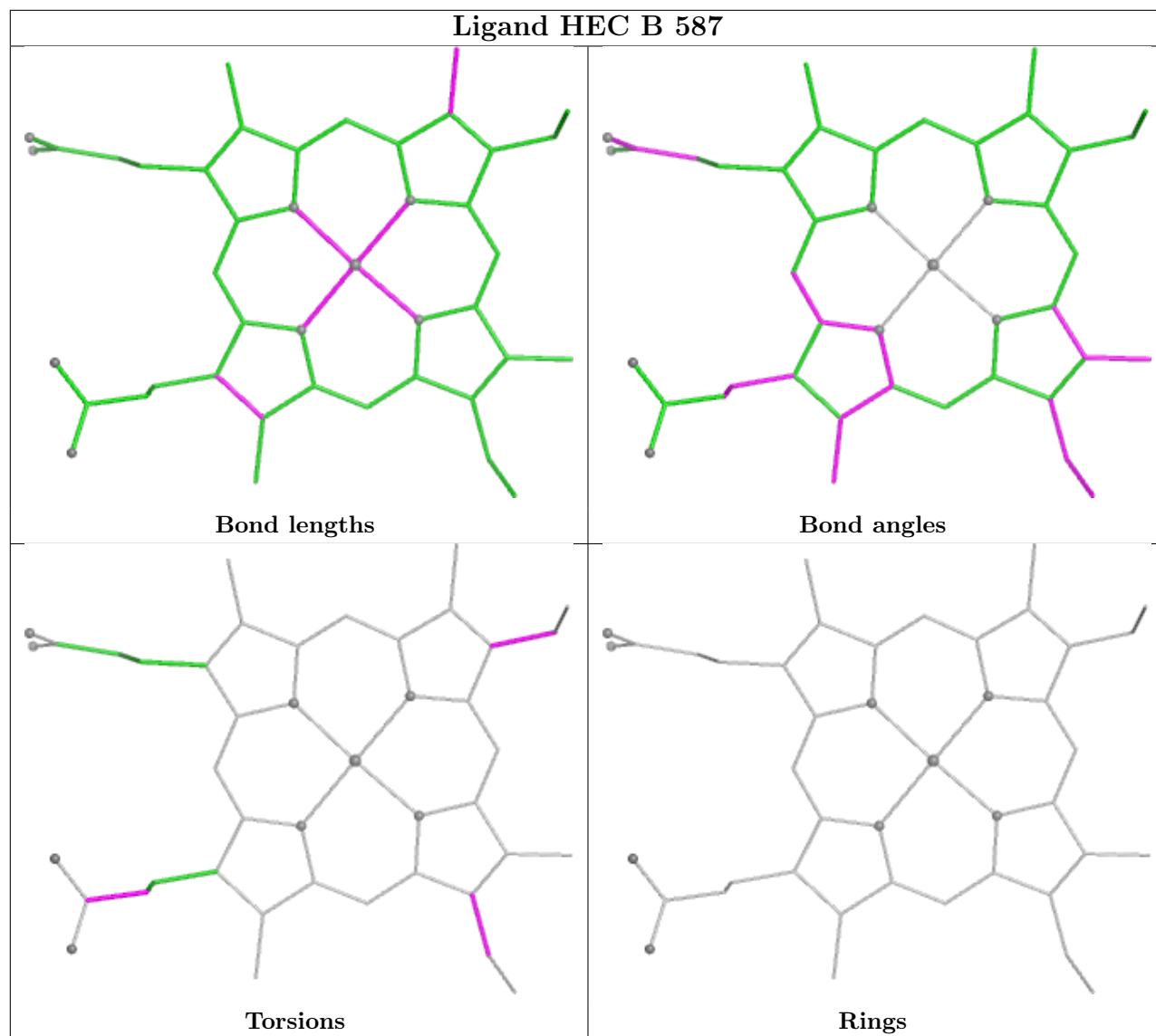
also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted 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.

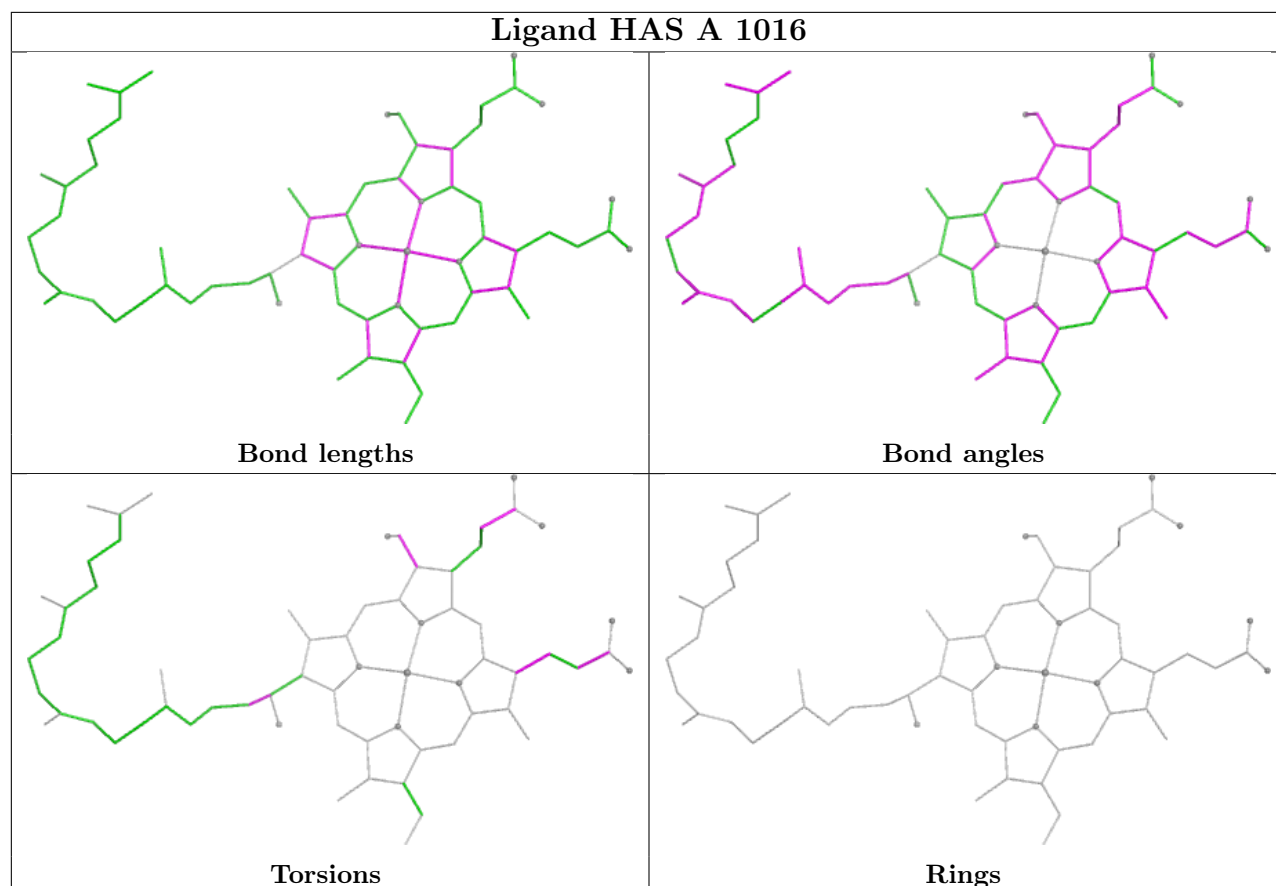
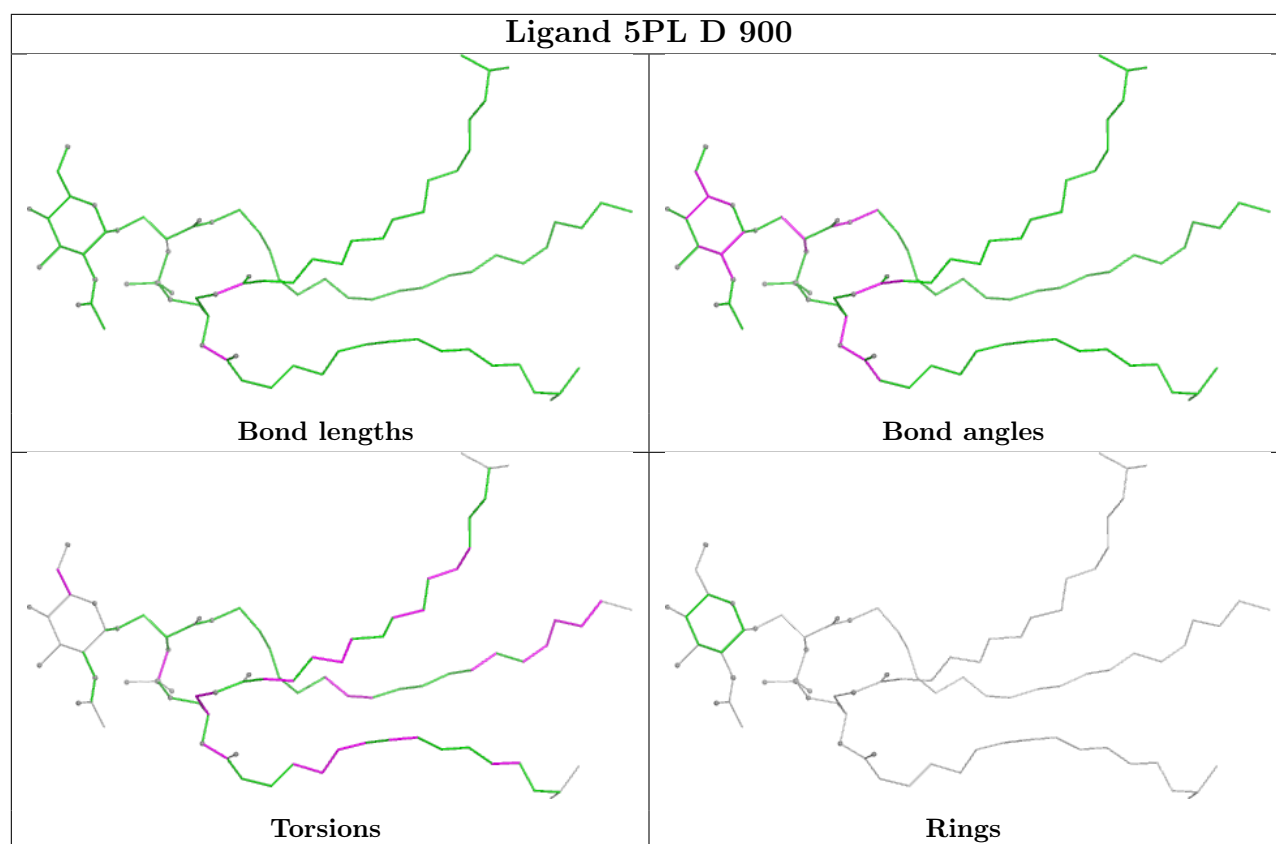


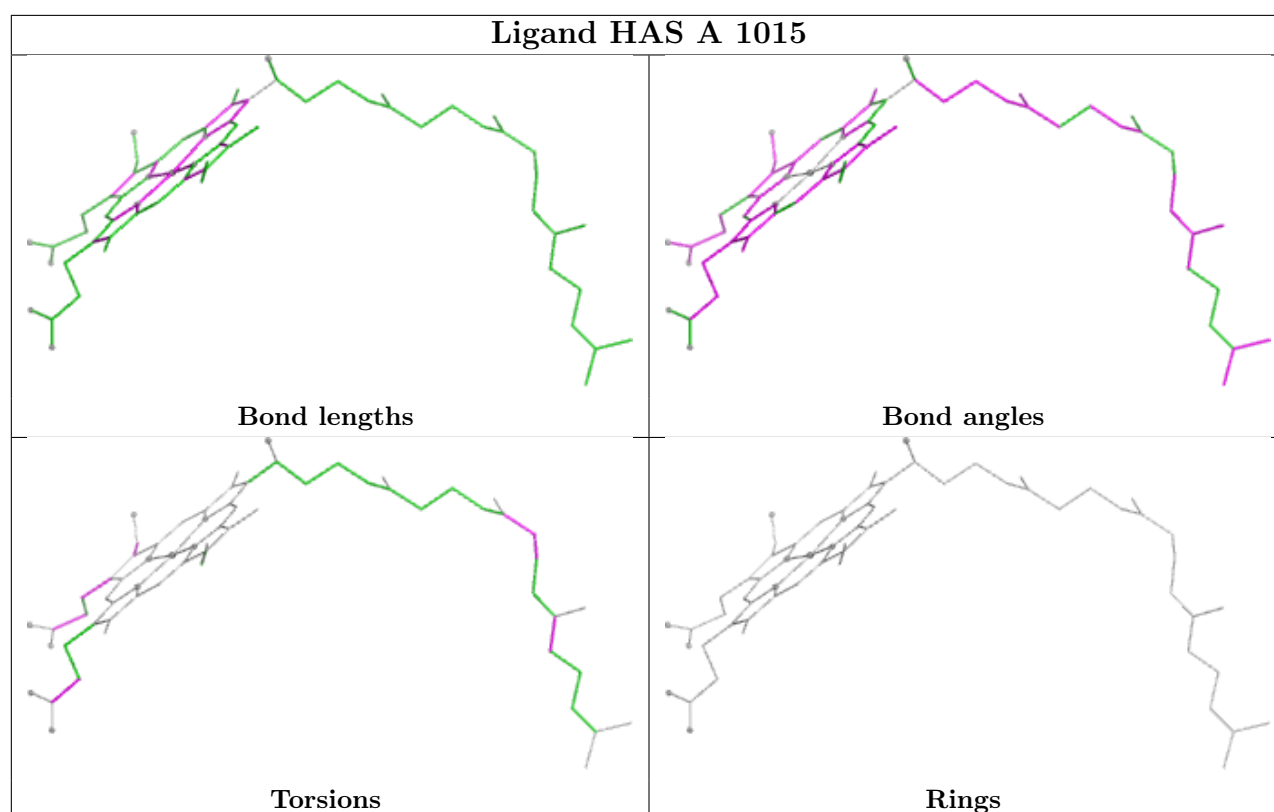
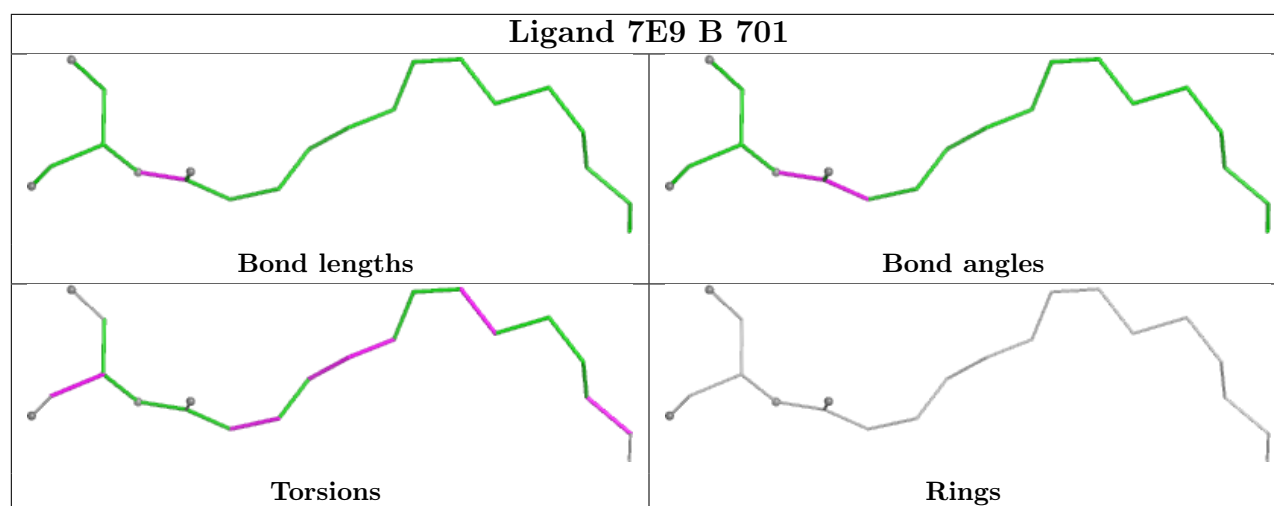












5.7 Other polymers [i](#)

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	780/791 (98%)	-0.20	7 (0%) 81 84	32, 47, 91, 174	1 (0%)
1	D	780/791 (98%)	-0.20	7 (0%) 81 84	33, 53, 89, 153	0
2	B	319/337 (94%)	-0.17	1 (0%) 90 92	33, 50, 85, 163	0
2	E	319/337 (94%)	0.09	5 (1%) 70 76	38, 67, 105, 189	0
3	C	63/66 (95%)	0.39	4 (6%) 26 29	44, 62, 112, 152	0
3	F	62/66 (93%)	0.30	1 (1%) 70 76	45, 65, 104, 153	0
All	All	2323/2388 (97%)	-0.13	25 (1%) 78 82	32, 53, 94, 189	1 (0%)

The worst 5 of 25 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	12	TRP	4.6
1	A	691	PHE	3.7
2	E	23	ALA	3.4
1	A	539	VAL	3.4
1	D	103	ASP	3.0

6.2 Non-standard residues in protein, DNA, RNA chains [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(Å ²)	Q<0.9
3	FME	F	1	10/11	0.81	0.14	72,91,112,160	0
3	FME	C	1	10/11	0.84	0.12	69,92,107,171	0

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

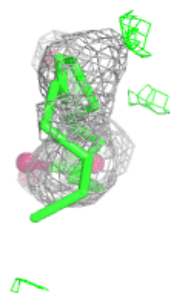
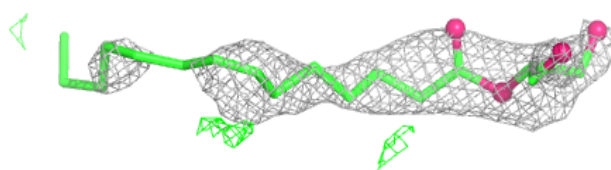
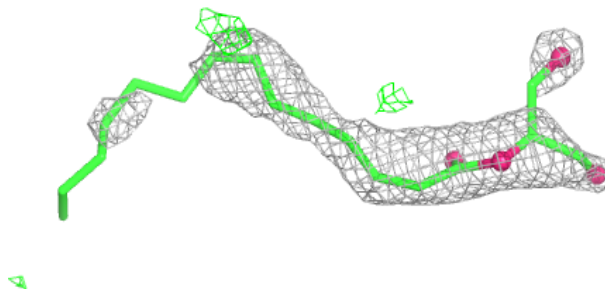
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
12	7E9	B	701	21/21	0.86	0.18	58,90,108,109	0
8	7E8	A	1300	21/21	0.87	0.18	48,79,102,115	0
8	7E8	A	1301	21/21	0.89	0.15	44,80,96,118	0
7	4AG	A	1200	40/40	0.91	0.17	33,68,115,123	0
4	5PL	D	900	85/85	0.91	0.14	37,62,107,128	0
4	5PL	A	900	85/85	0.92	0.14	35,65,105,134	0
5	HAS	D	1015	65/65	0.95	0.12	30,55,128,138	0
13	CL	D	1701	1/1	0.95	0.15	86,86,86,86	0
11	HEC	E	587	43/43	0.96	0.10	21,54,80,91	0
13	CL	F	101	1/1	0.96	0.21	70,70,70,70	0
5	HAS	D	1016	65/65	0.97	0.09	24,47,86,103	0
5	HAS	A	1015	65/65	0.97	0.11	24,35,102,151	0
9	MG	D	1801	1/1	0.98	0.10	50,50,50,50	0
11	HEC	B	587	43/43	0.98	0.06	22,34,48,52	0
5	HAS	A	1016	65/65	0.98	0.07	22,38,59,62	0
13	CL	C	101	1/1	0.99	0.15	60,60,60,60	0
10	CUA	E	585	2/2	0.99	0.03	43,43,43,44	0
9	MG	A	1801	1/1	0.99	0.09	39,39,39,39	0
6	CU	A	1017	1/1	1.00	0.03	37,37,37,37	0
10	CUA	B	585	2/2	1.00	0.03	35,35,35,36	0
6	CU	D	1017	1/1	1.00	0.02	42,42,42,42	0

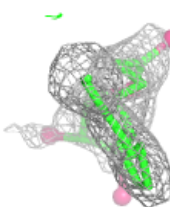
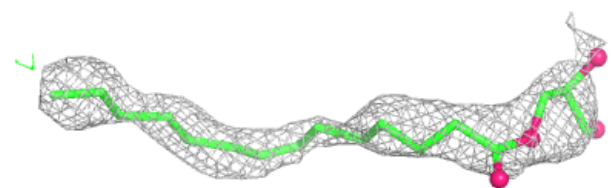
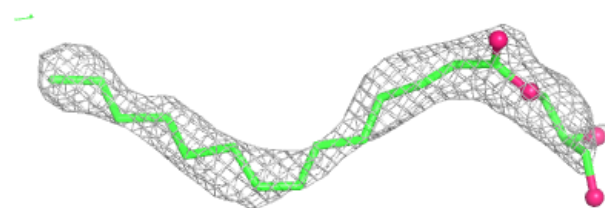
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 7E9 B 701:

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

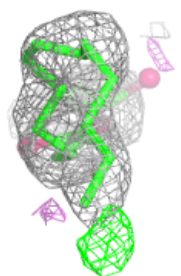
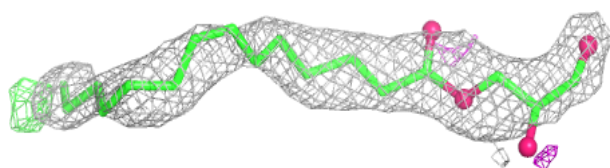
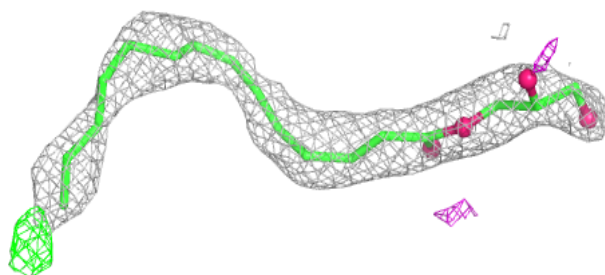
**Electron density around 7E8 A 1300:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

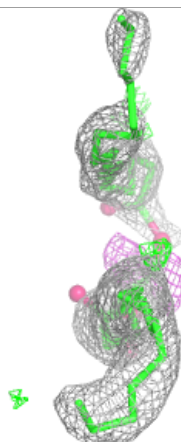
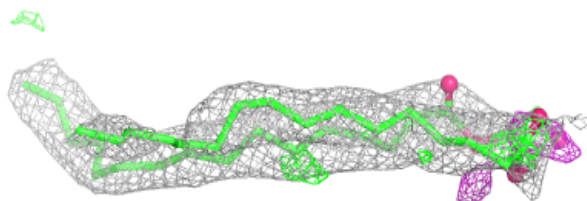
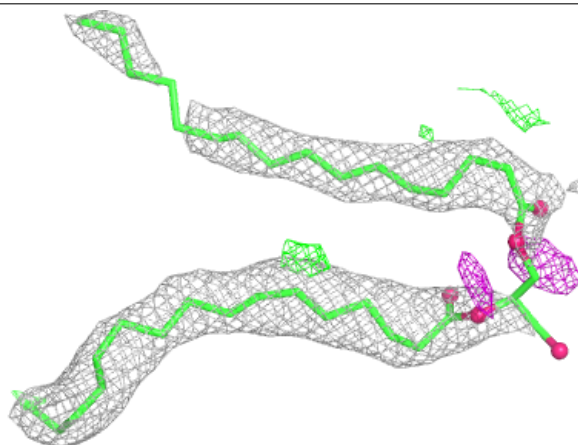


Electron density around 7E8 A 1301:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

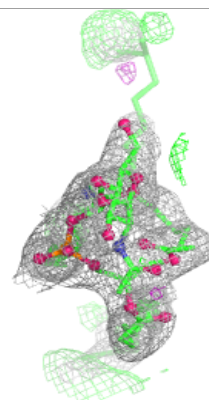
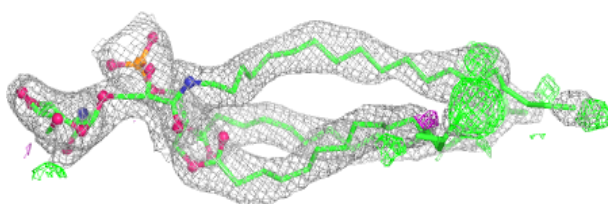
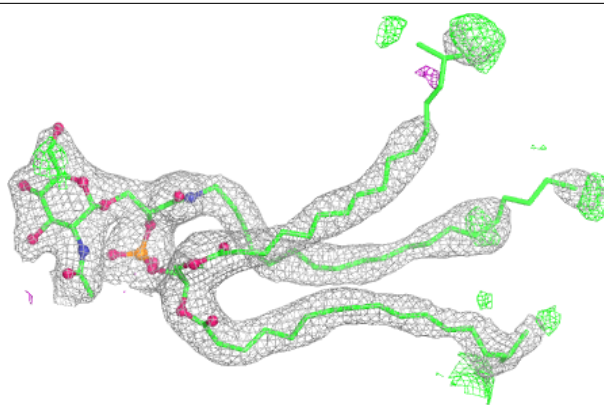
**Electron density around 4AG A 1200:**

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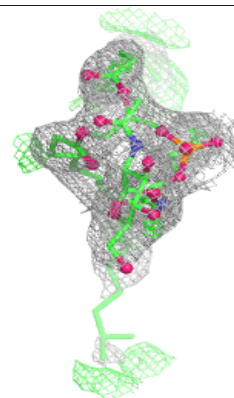
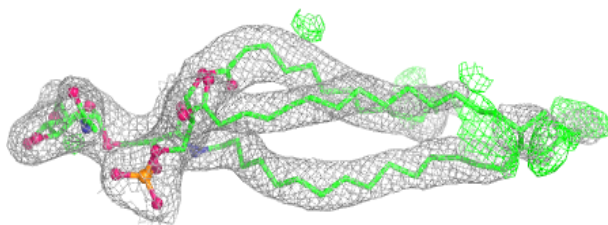
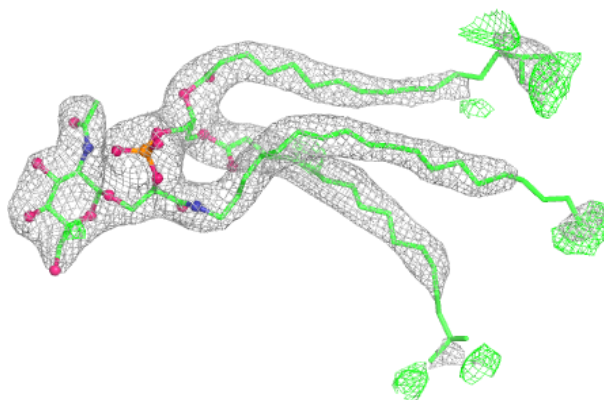


Electron density around 5PL D 900:

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and green (positive)

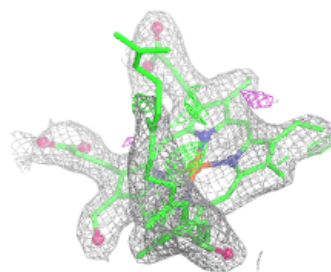
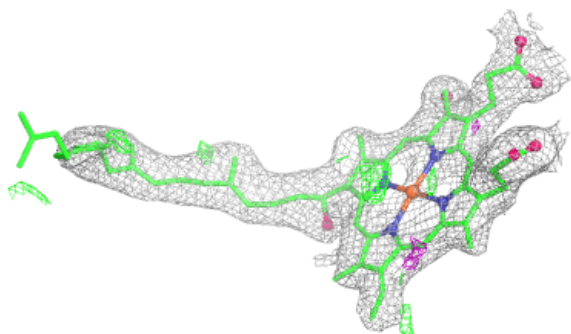
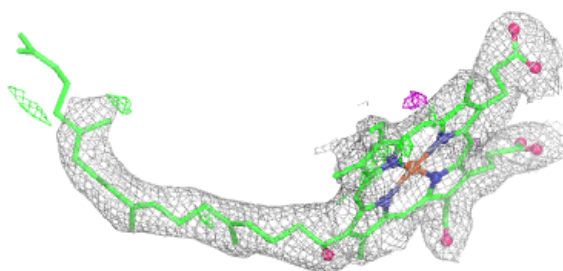
**Electron density around 5PL A 900:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



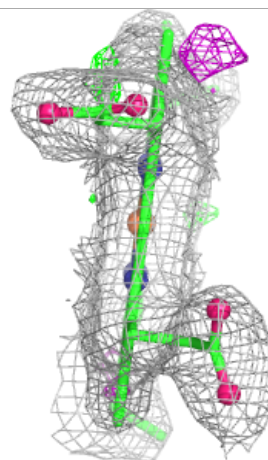
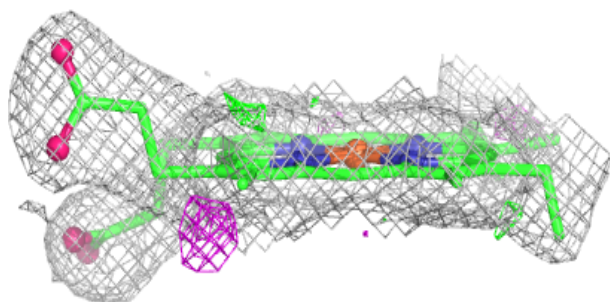
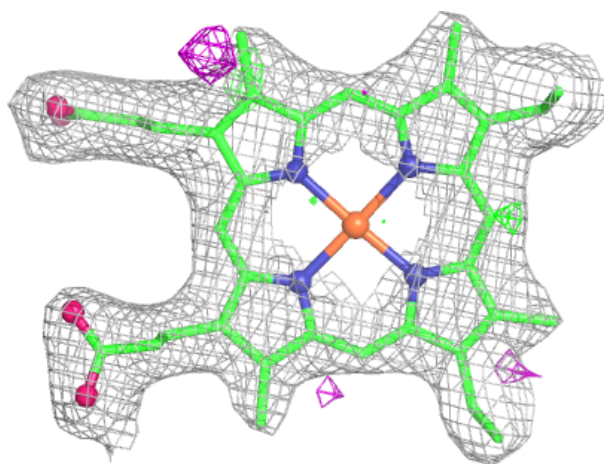
Electron density around HAS D 1015:

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and green (positive)



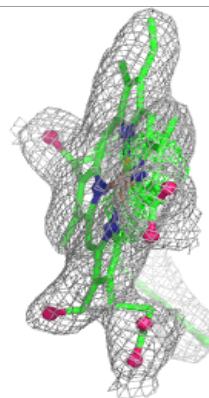
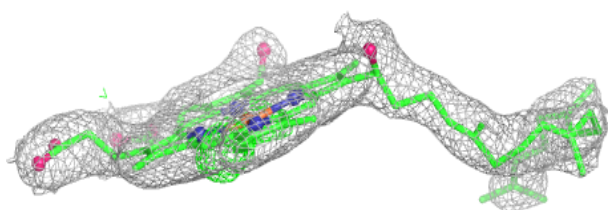
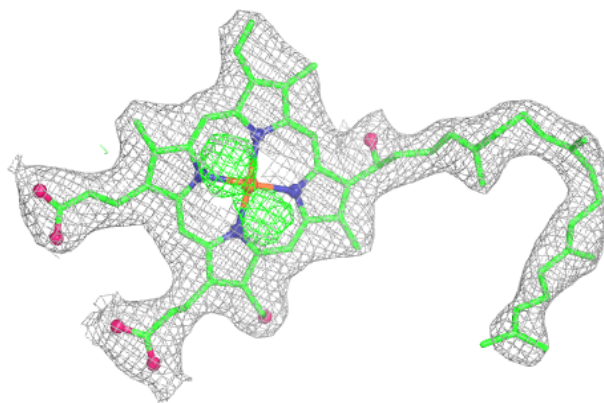
Electron density around HEC E 587:

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and green (positive)

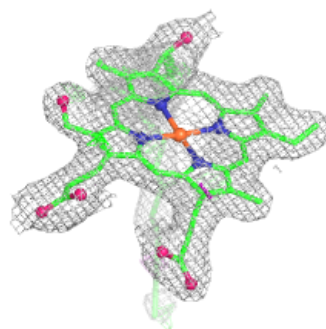
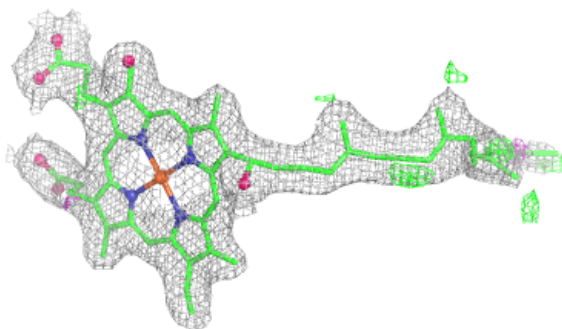
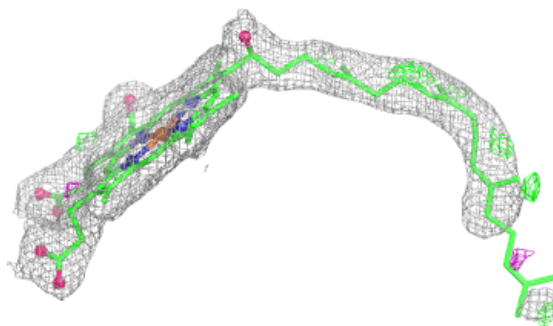


Electron density around HAS D 1016:

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and green (positive)

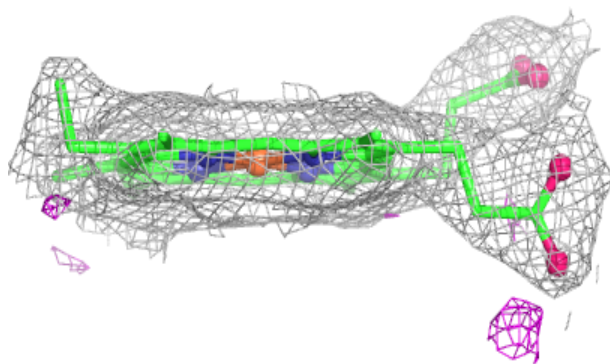
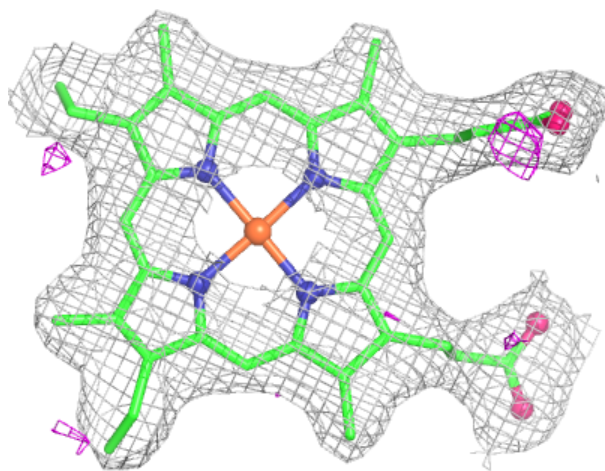
**Electron density around HAS A 1015:**

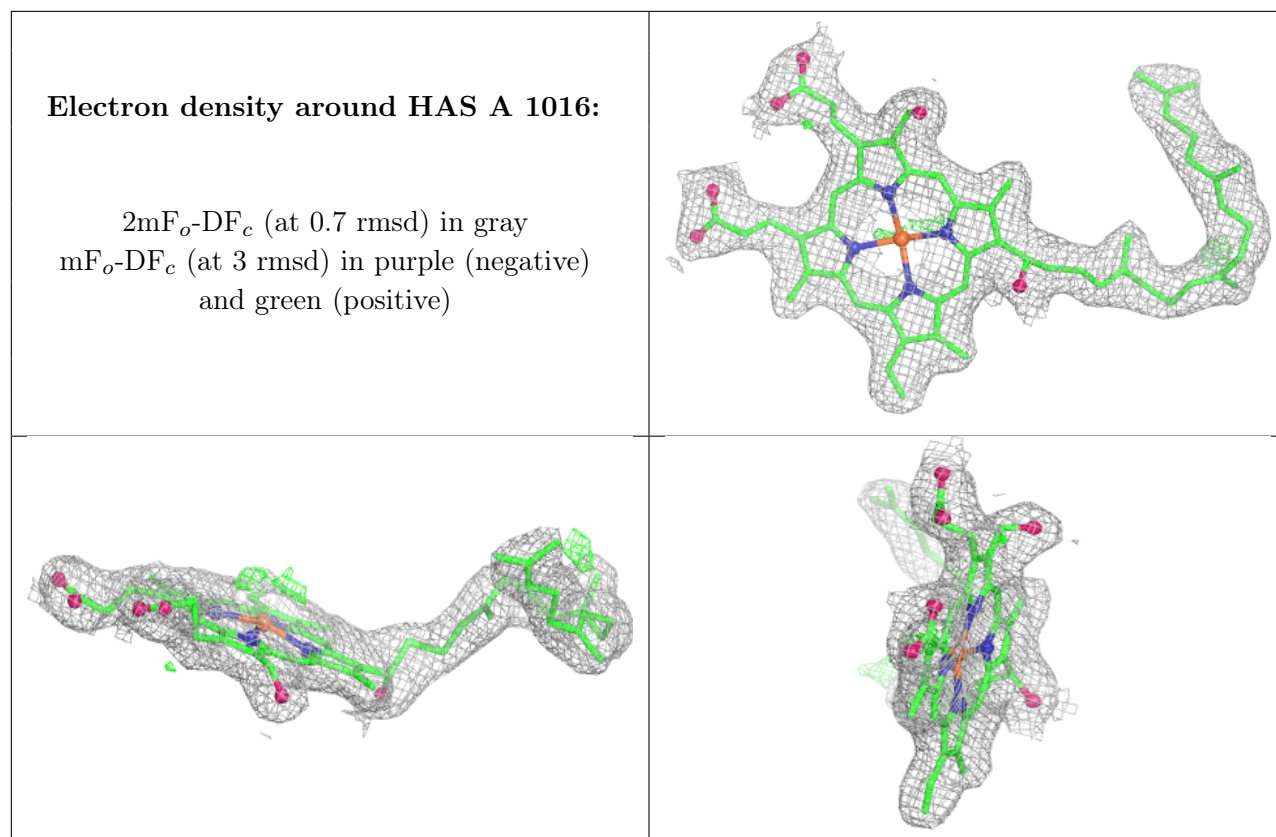
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEC B 587:

$2mF_o-DF_c$ (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.