



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 29, 2024 – 10:08 PM EST

PDB ID : 1FFT  
Title : The structure of ubiquinol oxidase from Escherichia coli  
Authors : Abramson, J.; Riistama, S.; Larsson, G.; Jasaitis, A.; Svensson-Ek, M.; Pustinen, A.; Iwata, S.; Wikstrom, M.  
Deposited on : 2000-07-26  
Resolution : 3.50 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

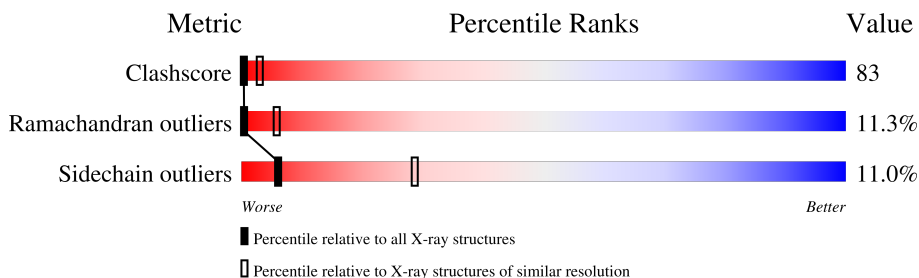
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.50 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))
Clashscore	141614	1036 (3.58-3.42)
Ramachandran outliers	138981	1005 (3.58-3.42)
Sidechain outliers	138945	1006 (3.58-3.42)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	663	16% 48% 11% • 24%
1	F	663	17% 47% 11% • 24%
2	B	315	16% 54% 10% • 18%
2	G	315	15% 54% 11% • 18%
3	C	204	22% 55% 12% • 9%
3	H	204	19% 58% 13% • 9%
4	D	109	70% 30%
4	I	109	70% 30%

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:

<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
7	HEO	A	1002	X	-	-	-
7	HEO	F	1002	X	-	-	-

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 16136 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 UBIQUINOL OXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	501	3954	2654	630	639	31	312	0	0
1	F	501	3954	2654	630	639	31	312	0	0

- Molecule 2 is a protein called UBIQUINOL OXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	257	2015	1320	324	361	10	155	0	0
2	G	257	2015	1320	324	361	10	155	0	0

- Molecule 3 is a protein called UBIQUINOL OXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	185	1451	970	229	240	12	157	0	0
3	H	185	1451	970	229	240	12	157	0	0

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	1	MET	-	cloning artifact	UNP P0ABJ3
C	2	ALA	-	cloning artifact	UNP P0ABJ3
C	3	THR	-	cloning artifact	UNP P0ABJ3
C	4	ASP	-	cloning artifact	UNP P0ABJ3
C	5	THR	-	cloning artifact	UNP P0ABJ3
C	6	LEU	-	cloning artifact	UNP P0ABJ3
C	7	THR	-	cloning artifact	UNP P0ABJ3
C	8	HIS	-	cloning artifact	UNP P0ABJ3

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Chain	Residue	Modelled	Actual	Comment	Reference
C	9	ALA	-	cloning artifact	UNP P0ABJ3
C	10	THR	-	cloning artifact	UNP P0ABJ3
C	11	ALA	-	cloning artifact	UNP P0ABJ3
C	12	HIS	-	cloning artifact	UNP P0ABJ3
C	13	ALA	-	cloning artifact	UNP P0ABJ3
C	14	HIS	-	cloning artifact	UNP P0ABJ3
C	15	GLU	-	cloning artifact	UNP P0ABJ3
C	16	HIS	-	cloning artifact	UNP P0ABJ3
C	17	GLY	-	cloning artifact	UNP P0ABJ3
C	18	HIS	-	cloning artifact	UNP P0ABJ3
C	19	HIS	-	cloning artifact	UNP P0ABJ3
C	20	ASP	-	cloning artifact	UNP P0ABJ3
C	21	ALA	-	cloning artifact	UNP P0ABJ3
C	22	GLY	-	cloning artifact	UNP P0ABJ3
C	23	GLY	-	cloning artifact	UNP P0ABJ3
C	24	THR	-	cloning artifact	UNP P0ABJ3
H	1	MET	-	cloning artifact	UNP P0ABJ3
H	2	ALA	-	cloning artifact	UNP P0ABJ3
H	3	THR	-	cloning artifact	UNP P0ABJ3
H	4	ASP	-	cloning artifact	UNP P0ABJ3
H	5	THR	-	cloning artifact	UNP P0ABJ3
H	6	LEU	-	cloning artifact	UNP P0ABJ3
H	7	THR	-	cloning artifact	UNP P0ABJ3
H	8	HIS	-	cloning artifact	UNP P0ABJ3
H	9	ALA	-	cloning artifact	UNP P0ABJ3
H	10	THR	-	cloning artifact	UNP P0ABJ3
H	11	ALA	-	cloning artifact	UNP P0ABJ3
H	12	HIS	-	cloning artifact	UNP P0ABJ3
H	13	ALA	-	cloning artifact	UNP P0ABJ3
H	14	HIS	-	cloning artifact	UNP P0ABJ3
H	15	GLU	-	cloning artifact	UNP P0ABJ3
H	16	HIS	-	cloning artifact	UNP P0ABJ3
H	17	GLY	-	cloning artifact	UNP P0ABJ3
H	18	HIS	-	cloning artifact	UNP P0ABJ3
H	19	HIS	-	cloning artifact	UNP P0ABJ3
H	20	ASP	-	cloning artifact	UNP P0ABJ3
H	21	ALA	-	cloning artifact	UNP P0ABJ3
H	22	GLY	-	cloning artifact	UNP P0ABJ3
H	23	GLY	-	cloning artifact	UNP P0ABJ3
H	24	THR	-	cloning artifact	UNP P0ABJ3

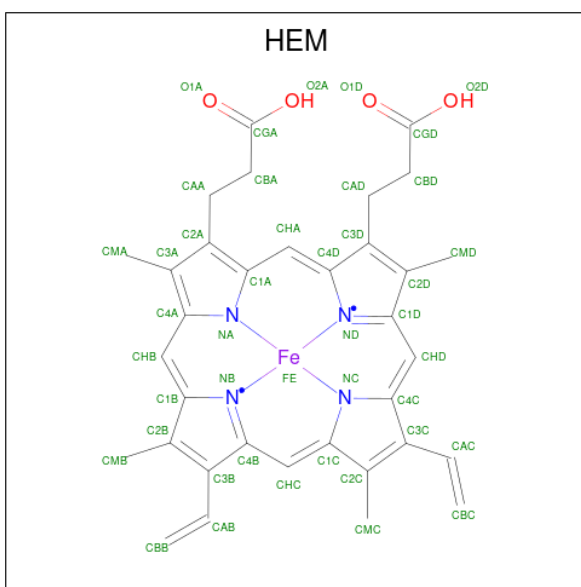
- Molecule 4 is a protein called UBIQUINOL OXIDASE.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	D	109	Total	C	N	O	0	0	0
			545	327	109	109			
4	I	109	Total	C	N	O	0	0	0
			545	327	109	109			

- Molecule 5 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

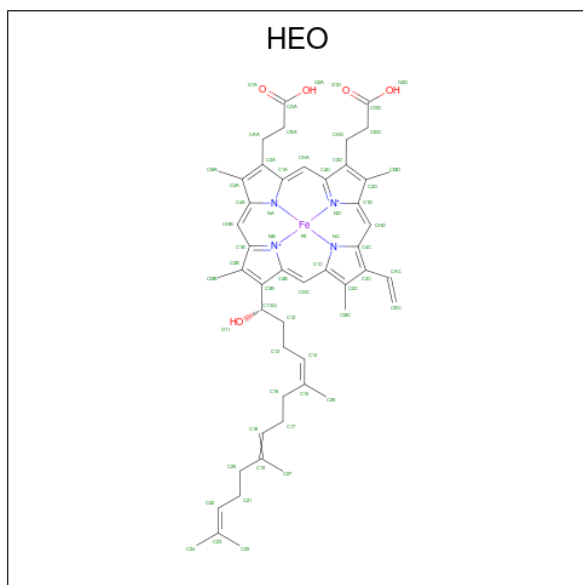
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Cu	0	0
			1	1		
5	F	1	Total	Cu	0	0
			1	1		

- Molecule 6 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: C<sub>34</sub>H<sub>32</sub>FeN<sub>4</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
6	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
6	F	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

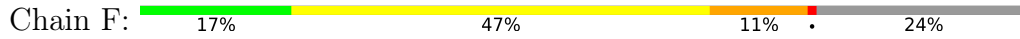
- Molecule 7 is HEME O (three-letter code: HEO) (formula: C<sub>49</sub>H<sub>58</sub>FeN<sub>4</sub>O<sub>5</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
7	A	1	59	49	1	4	5	0	0
7	F	1	59	49	1	4	5	0	0

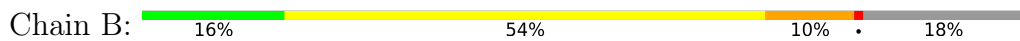




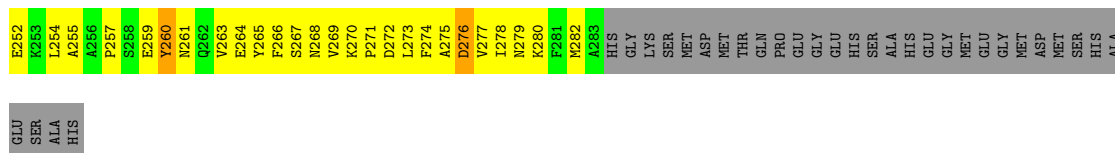


MET	PHE	GLY	LYS	SER	LEU	ASP	ALA	VAL	PRO	GLU	THR	ILE	LEU	LEU	GLY	ILE	THR	PHE	GLY	V52	D53	H54	K55	R56	L57	G58	I59	M60																																					
Y61	I62	I63	V64	M68	L69	L70	R71	G72	F73	A74	D75	A76	I77	M78	M79	R80	S81	Q82	P85	Q101	I102	F103	T104	A105	H106	G107	V108	I109	M110	I111	F112	F113	A114	T115	T116	V117	F118	V119	I120	G121	L122	M123	M124	L125	Q126	V127	P128	L129	Q130	I131	R134														
D135	V136	A137	F138	P139	M142	M143	L144	G145	F146	F147	F148	T149	V150	V151	M152	G153	L154	L155	V156	M157	V158	S159	L160	F165	Q167	T168	G169	M170	L171	A172	Y173	P174	L176	S177	G178	I179	G184	V187	D188	Y189	V190	I191	M192	S193	L194	Q195	L196	L199	G200	T201	L203														
T204	G205	I206	M207	F208	F209	V210	T211	K214	M215	R216	A217	M220	T221	M222	F223	K224	M225	P226	V227	F228	T229	W230	A231	S232	L233	C234	A235	M236	V237	L238	I239	I240	F243	P244	I245	L246	T247	V248	T249	V250	A251	L252	L253	T254	L255	D256	R257	Y258	L259	G260	T261	H262	F263	F264	T265	N266									
D267	N271	M272	M273	M274	Y275	L276	N277	K278	L279	R280	A281	W282	G283	H284	P285	E286	V287	Y288	L289	L290	L291	M292	P293	V294	F295	P296	T297	G298	F299	S300	L301	T304	F305	S306	R307	K308	R309	L310	F311	G312	Y313	T314	S315	L316	V317	V318	A319	M320	V321	C322	I323	T324	Y325	L326	S327	T328	T329	I329							
R330	W331	H332	H333	H334	F335	F336	T337	M338	G339	A340	G341	V344	M345	A346	F347	F348	G349	I350	T351	M352	M353	I354	I355	A356	I357	P358	T359	G360	F361	K362	L363	F364	M365	W366	L367	F368	T369	M370	Y371	Q372	G373	R374	I375	V376	F377	H378	S379	A380	M381	L382	W383	T384	I385	I388	V389	T390	F390	G454	K454						
V393	G394	G395	M396	T397	G398	V399	L400	L401	A402	A403	P404	G405	A406	D407	F408	V409	L410	H411	N412	L413	L414	F415	L416	I417	A418	H419	F420	R421	N422	A423	I424	I425	G426	F430	G431	C432	F433	A434	G435	M436	T437	Y438	M439	W440	P441	L442	K443	A444	G445	F446	K447	L448	N449	E450	T451	W452	G453	M516							
R455	A456	F457	W458	F459	W460	I461	I462	G463	F464	F465	V466	A467	F468	M469	P470	L471	Y472	A473	L474	G475	M476	G477	M478	T480	R481	R482	L483	S484	Q485	Q486	D487	F488	Q489	F491	H492	T493	M494	L495	M496	I497	A498	A499	S500	G501	A502	V503	L504	I505	I509	L510	C511	M512	V513	I514	G515	M516									
Y517	V518	S519	I520	Q525	I461	R537	T538	L539	E540	W541	A542	T543	S544	S545	P548	F549	Y550	M551	F552	ALA	VAL	VAL	PRO	HIS	GLY	PHE	THR	TRP	TRP	ALA	GLY	GLY	ASP	ALA	TRP	GLY	LYS	LYS	GLY	ASP	GLY	GLY	ASP	VAL	VAL	TYR	PRO	GLY	ILE	ILE	GLU	HIS	PRO	MET	LEU	LYS	GLU	ASN	GLN	GLY					
ALA	GLY	ILE	VAL	ILE	ALA	ALA	PHE	SER	THR	ASN	GLY	PHE	ALA	MET	ILE	TRP	HIS	ILE	TRP	ALA	LEU	VAL	VAL	GLY	GLY	PHE	THR	TRP	THR	ILE	ILE	TRP	TRP	ILE	VAL	LYS	SER	PHE	ASP	ASP	GLU	ASP	GLU	ASP	VAL	VAL	ASP	TYR	PRO	VAL	ALA	GLU	GLU	ILE	ILE	GLU	HIS	LYS	MET	PRO	LYS	GLU	ASN	GLN	HIS
PHE	ASP	GLU	ILE	THR	LYS	ALA	GLY	LEU	LEU	LYS	LEU	LEU	ALA	MET	ILE	TRP	ALA	GLY	THR	VAL	LEU	VAL	ASN	GLY	PHE	THR	TRP	THR	ILE	ILE	TRP	TRP	ILE	VAL	LYS	SER	PHE	ASP	GLU	ASP	GLU	ASP	VAL	VAL	ASP	TYR	PRO	VAL	ALA	GLU	GLU	ILE	ILE	GLU	HIS	LYS	MET	PRO	LYS	GLU	ASN	GLN	HIS		

• Molecule 2: UBIQUINOL OXIDASE

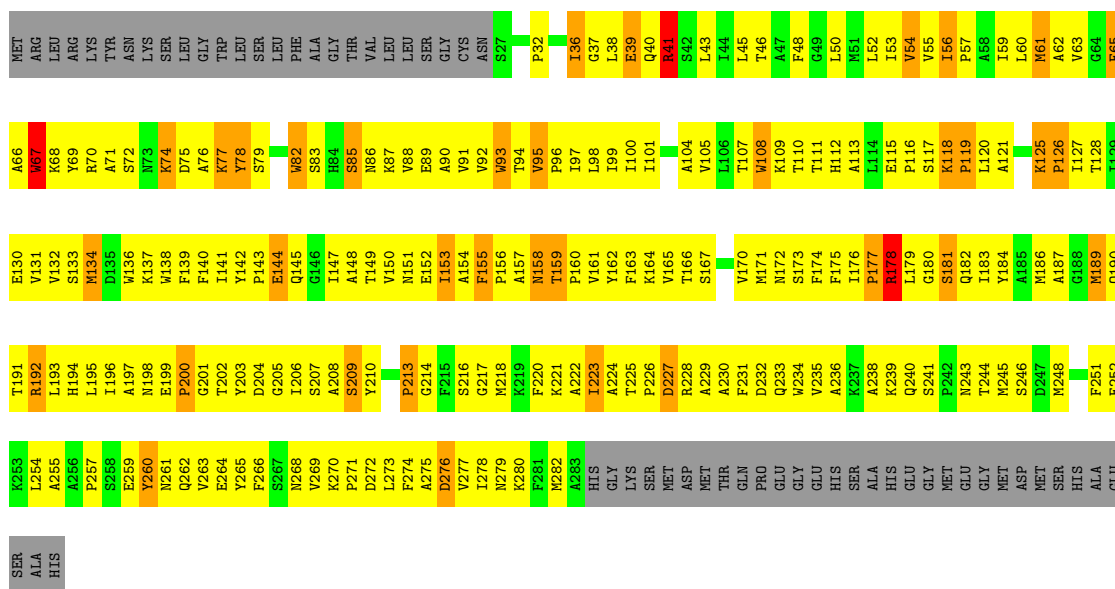


MET	ARG	K68	ARG	THR	TYR	ASN	LYS	LYS	LEU	PHE	LEU	LEU	PHE	THR	ALA	GLY	THR	VAL	LEU	LEU	ASN	S27	P32	I36	G37	L38	E39	Q40	R41	S42	L43	I44	L45	T46	F47	F48	T110	G109	T111	L50	M51	L52	I53	V54	V55	I56	P57	A58	L59	L60	A121	M61	A62	V63	G64	F65		
A66	W67	K68	Y69	R70	A71	S72	M73	K74	D75	A76	K77	S79	W82	S83	H84	S85	R86	K87	R88	V88	E89	A90	V91	V92	W93	T94	I99	I100	A101	F102	S103	A104	V105	L106	L45	T46	F48	K109	T110	G109	T111	L50	M51	L52	I53	V54	V55	I56	P57	A58	L59	L60	A121	M61	A62	V63	G64	F65
L129	E130	V131	V132	M133	S134	D135	W136	K137	W138	F139	T140	I141	Y142	E143	E144	G145	H146	I147	A148	T149	V150	M151	E152	I153	A154	F155	P156	A157	N158	P159	I160	L161	Y162	F163	K164	V165	T166	V170	M171	M172	S173	F174	F175	H112	M113	L114	E115	V116	S117	K118	P119	I183	L184	A185	M186	A187	G188	M189
Q190	T191	R192	L193	H194	L195	I196	A197	N198	E199	P200	G201	T202	Y203	D204	G205	S206	I207	S208	S209	Y210	P213	G214	F215	S216	G217	M218	K219	F220	K221	A222	I223	A224	T225	P226	D227	R228	A229	A230	F231	Q232	Q233	W234	V235	A236	K237	I176	A177	K239	Q240	S241	P242	N243	T244	M245	S246	D247	M248	F251



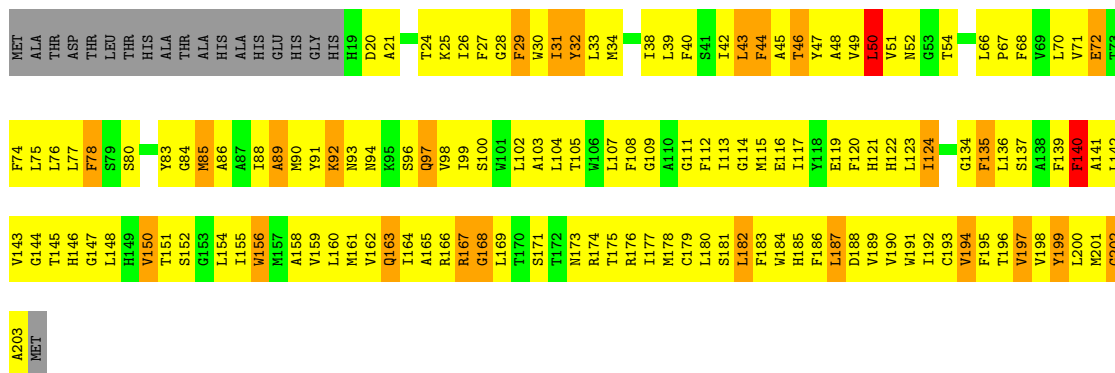
### • Molecule 2: UBIQUINOL OXIDASE

Chain G: 15% 54% 11% 18%



### • Molecule 3: UBIQUINOL OXIDASE

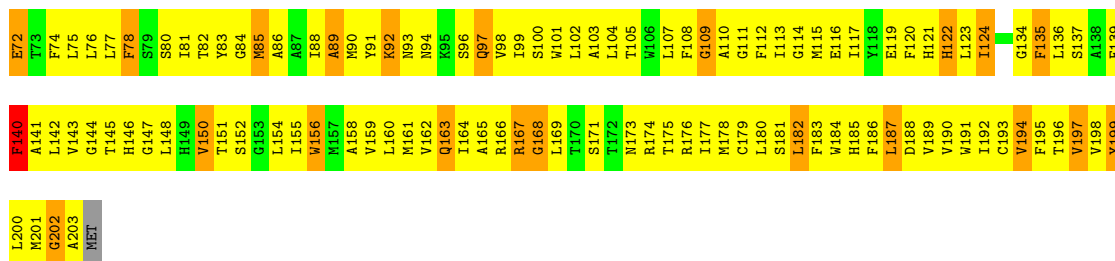
Chain C: 22% 55% 12% 9%



### • Molecule 3: UBIQUINOL OXIDASE

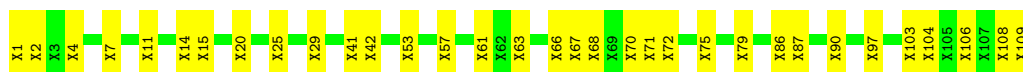
Chain H: 19% 58% 13% 9%





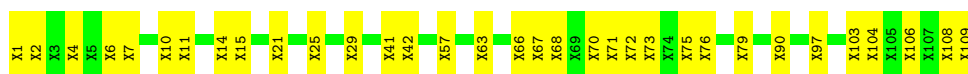
- Molecule 4: UBIQUINOL OXIDASE

Chain D:  70%  30%



- Molecule 4: UBIQUINOL OXIDASE

Chain I:  70%  30%



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	92.10Å 372.50Å 232.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 3.50	Depositor
% Data completeness (in resolution range)	(Not available) (40.00-3.50)	Depositor
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program		Depositor
R, $R_{free}$	(Not available) , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	16136	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

## 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: HEM, HEO, CU

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	1/4086 (0.0%)	0.71	4/5573 (0.1%)
1	F	0.44	0/4086	0.68	2/5573 (0.0%)
2	B	0.43	0/2074	0.65	0/2825
2	G	0.43	0/2074	0.67	0/2825
3	C	0.47	0/1494	0.66	0/2030
3	H	0.43	0/1494	0.65	0/2030
All	All	0.45	1/15308 (0.0%)	0.68	6/20856 (0.0%)

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
1	F	0	1
All	All	0	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	174	PRO	C-N	-9.24	1.16	1.34

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	174	PRO	C-N-CD	-12.28	93.59	120.60
1	A	175	PRO	CB-CA-C	7.79	131.48	112.00
1	F	175	PRO	CB-CA-C	7.42	130.56	112.00
1	F	174	PRO	C-N-CD	-6.30	106.74	120.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	547	PRO	CA-N-CD	-6.28	102.72	111.50

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	174	PRO	Mainchain
1	F	174	PRO	Mainchain

## 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	3954	0	3975	658	0
1	F	3954	0	3975	661	0
2	B	2015	0	2016	317	0
2	G	2015	0	2016	348	0
3	C	1451	0	1458	254	0
3	H	1451	0	1458	265	0
4	D	545	0	114	57	0
4	I	545	0	115	55	0
5	A	1	0	0	0	0
5	F	1	0	0	0	0
6	A	43	0	30	18	0
6	F	43	0	30	17	0
7	A	59	0	56	16	0
7	F	59	0	56	14	0
All	All	16136	0	15299	2417	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 83.

The worst 5 of 2417 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)
3:H:86:ALA:HB1	3:H:91:TYR:CD1	1.43	1.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:78:PHE:HZ	4:D:57:UNK:CB	1.44	1.30
3:H:83:TYR:HE1	4:I:14:UNK:CB	1.44	1.30
1:A:55:LYS:NZ	1:A:551:ASN:HA	1.44	1.29
3:C:78:PHE:CZ	4:D:57:UNK:CB	2.20	1.24

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	499/663 (75%)	331 (66%)	110 (22%)	58 (12%)	0	5
1	F	499/663 (75%)	333 (67%)	108 (22%)	58 (12%)	0	5
2	B	255/315 (81%)	162 (64%)	66 (26%)	27 (11%)	0	7
2	G	255/315 (81%)	167 (66%)	58 (23%)	30 (12%)	0	5
3	C	183/204 (90%)	112 (61%)	52 (28%)	19 (10%)	0	7
3	H	183/204 (90%)	107 (58%)	56 (31%)	20 (11%)	0	6
All	All	1874/2364 (79%)	1212 (65%)	450 (24%)	212 (11%)	0	6

5 of 212 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	96	PRO
1	A	102	ILE
1	A	106	HIS
1	A	135	ASP
1	A	175	PRO

### 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	413/547 (76%)	373 (90%)	40 (10%)	8	33
1	F	413/547 (76%)	373 (90%)	40 (10%)	8	33
2	B	215/262 (82%)	188 (87%)	27 (13%)	4	22
2	G	215/262 (82%)	187 (87%)	28 (13%)	4	21
3	C	152/166 (92%)	133 (88%)	19 (12%)	4	23
3	H	152/166 (92%)	134 (88%)	18 (12%)	5	25
All	All	1560/1950 (80%)	1388 (89%)	172 (11%)	6	29

5 of 172 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	359	THR
2	G	144	GLU
1	F	416	LEU
2	G	67	TRP
2	G	189	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 36 such sidechains are listed below:

Mol	Chain	Res	Type
2	G	190	GLN
3	H	185	HIS
2	G	198	ASN
2	G	268	ASN
2	B	190	GLN

### 5.3.3 RNA [i](#)

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](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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
7	HEO	F	1002	1	63,66,66	1.09	3 (4%)	71,102,102	1.22	7 (9%)
6	HEM	F	1001	1	41,50,50	1.47	3 (7%)	45,82,82	1.16	2 (4%)
7	HEO	A	1002	1	63,66,66	1.08	2 (3%)	71,102,102	1.21	7 (9%)
6	HEM	A	1001	1	41,50,50	1.44	3 (7%)	45,82,82	1.12	2 (4%)

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
7	HEO	F	1002	1	2/2/17/25	7/32/114/114	-
7	HEO	A	1002	1	2/2/17/25	6/32/114/114	-
6	HEM	A	1001	1	-	6/12/54/54	-
6	HEM	F	1001	1	-	6/12/54/54	-

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	1001	HEM	CBB-CAB	4.68	1.53	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	F	1001	HEM	CBB-CAB	4.58	1.53	1.30
7	A	1002	HEO	C3C-CAC	-4.12	1.39	1.47
7	F	1002	HEO	C3C-CAC	-4.07	1.39	1.47
6	F	1001	HEM	C3C-CAC	-3.90	1.39	1.47

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1001	HEM	CBB-CAB-C3B	-3.59	109.76	127.62
6	F	1001	HEM	CBB-CAB-C3B	-3.55	109.95	127.62
7	A	1002	HEO	C1D-ND-C4D	-2.94	102.03	105.07
7	F	1002	HEO	C1D-ND-C4D	-2.86	102.12	105.07
7	A	1002	HEO	C3C-C4C-NC	2.52	112.47	109.21

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
7	A	1002	HEO	ND
7	A	1002	HEO	NB
7	F	1002	HEO	ND
7	F	1002	HEO	NB

5 of 25 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1001	HEM	C2B-C3B-CAB-CBB
6	F	1001	HEM	C2B-C3B-CAB-CBB
7	A	1002	HEO	C15-C16-C17-C18
7	F	1002	HEO	C15-C16-C17-C18
6	A	1001	HEM	C4B-C3B-CAB-CBB

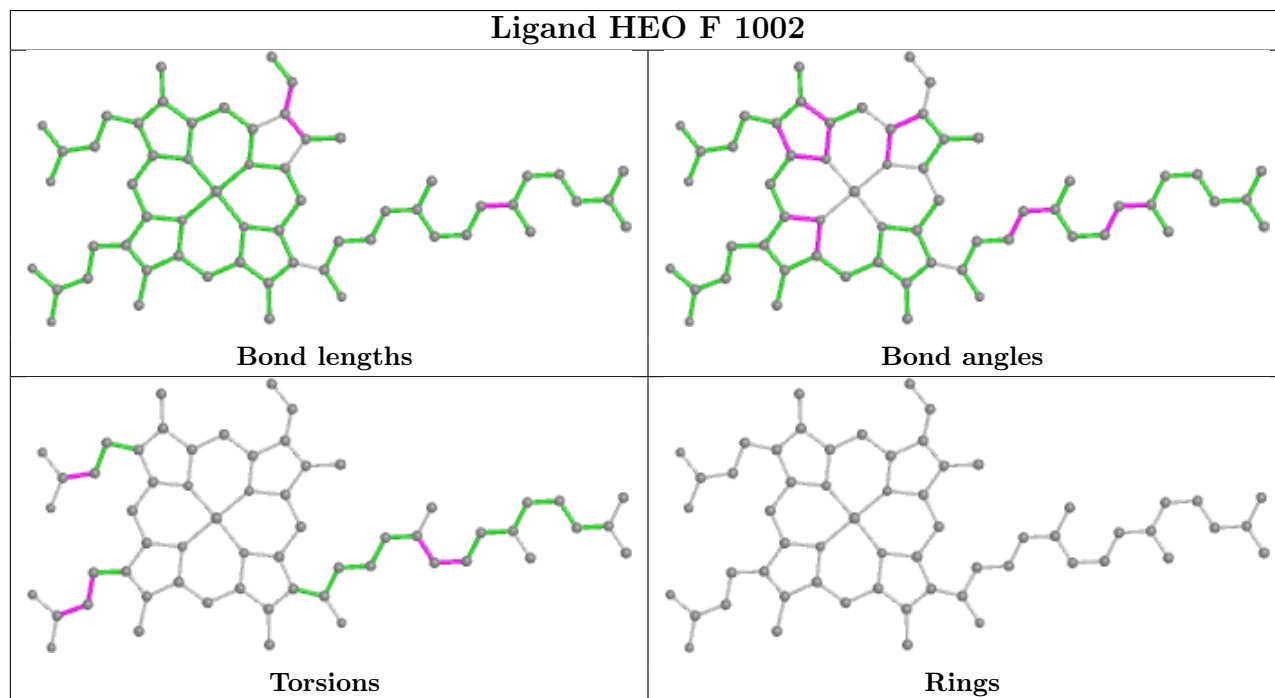
There are no ring outliers.

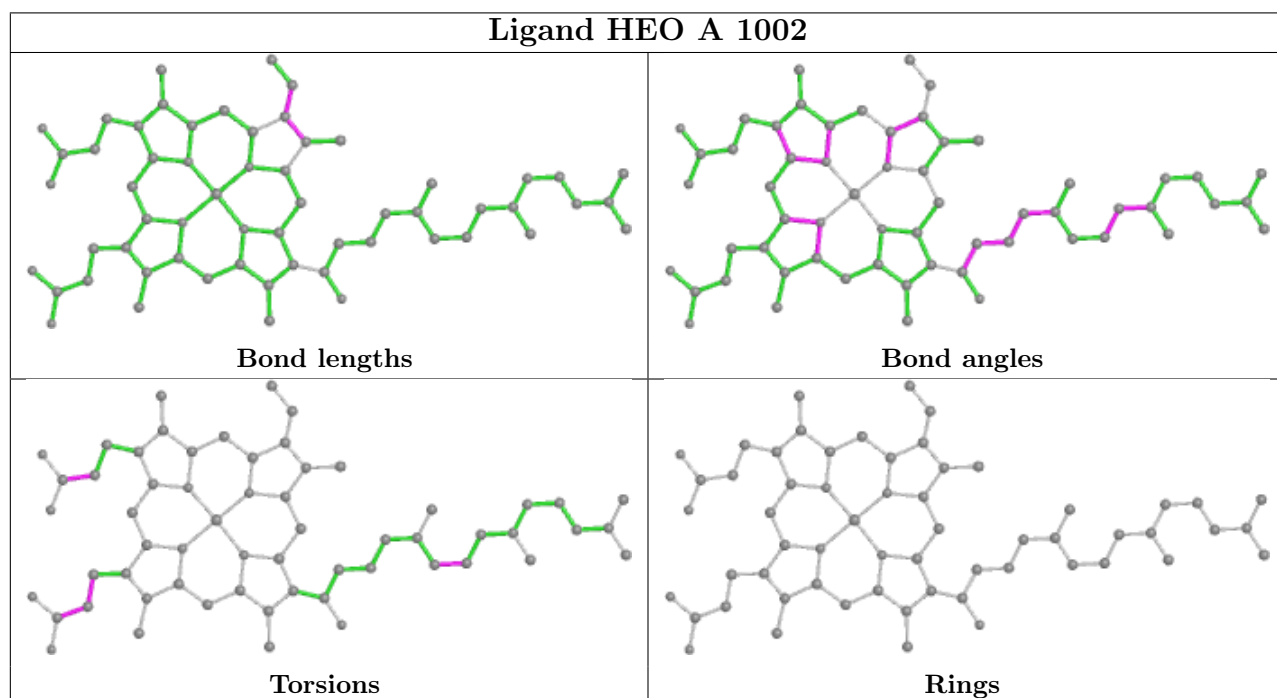
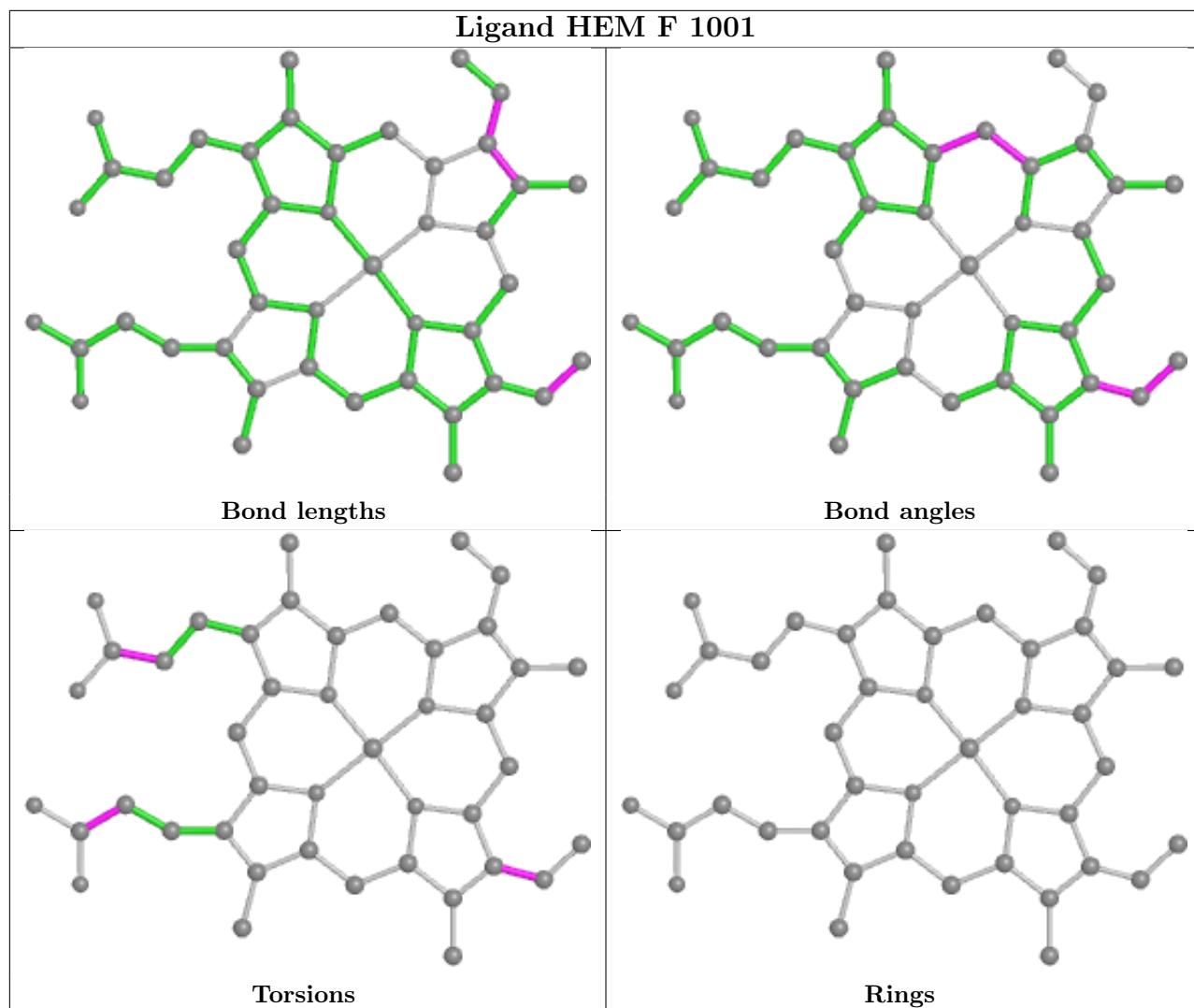
4 monomers are involved in 65 short contacts:

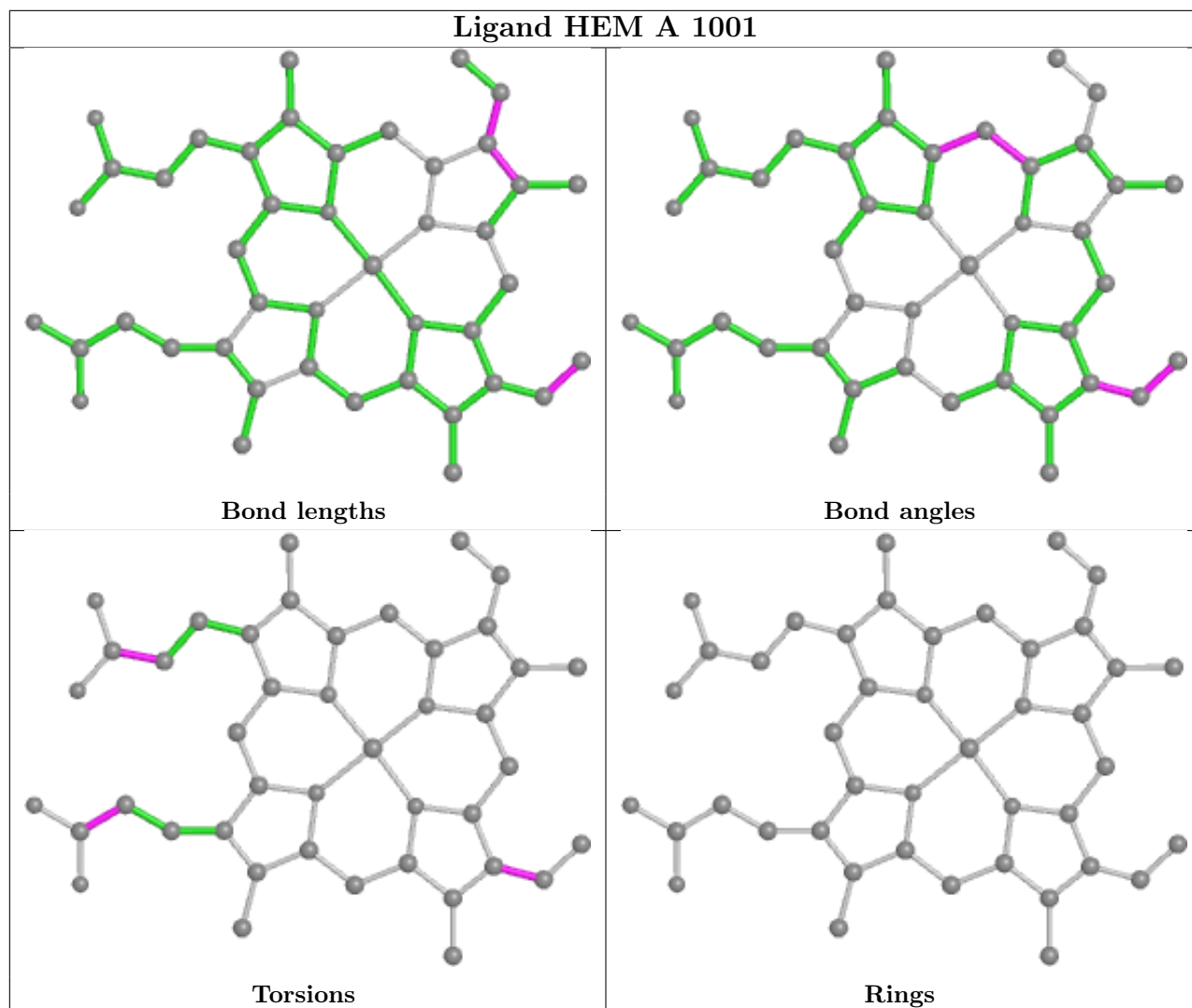
Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	F	1002	HEO	14	0
6	F	1001	HEM	17	0
7	A	1002	HEO	16	0
6	A	1001	HEM	18	0

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	174:PRO	C	175:PRO	N	1.16

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.