W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Feb 27, 2021 – 09:09 PM EST

PDB ID	:	1SQV
Title	:	Crystal Structure Analysis of Bovine Bc1 with UHDBT
Authors	:	Esser, L.; Quinn, B.; Li, Y.F.; Zhang, M.; Elberry, M.; Yu, L.; Yu, C.A.; Xia, D.
Deposited on	:	2004-03-19
Resolution	:	2.85 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (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)	:	2.17.1

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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.
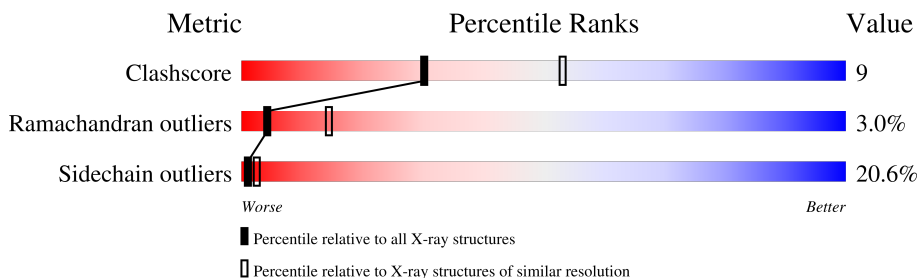
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3438 (2.90-2.82)
Ramachandran outliers	138981	3348 (2.90-2.82)
Sidechain outliers	138945	3351 (2.90-2.82)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	446	67% 27% 5% ·
2	B	439	64% 25% 7% · ·
3	C	379	65% 29% 6%
4	D	241	54% 33% 11% ·
5	E	196	65% 29% 6%
6	F	110	54% 34% 8% 5%
7	G	81	70% 19% · · 7%
8	H	78	58% 21% 8% 14%

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Mol	Chain	Length	Quality of chain
9	I	78	18% 36% 12% 8% 27%
10	J	62	52% 44%
11	K	56	59% 25% 5% 9%

2 Entry composition ⓘ

There are 16 unique types of molecules in this entry. The entry contains 16953 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-cytochrome c reductase complex core protein I, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	446	Total 3458	C 2161	N 609	O 668	S 20	0	0	0

- Molecule 2 is a protein called Ubiquinol-cytochrome c reductase complex core protein 2, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	423	Total 3172	C 1993	N 562	O 610	S 7	0	0	0

- Molecule 3 is a protein called Cytochrome b.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	378	Total 3003	C 2013	N 471	O 501	S 18	0	0	0

- Molecule 4 is a protein called Cytochrome c1, heme protein, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	241	Total 1918	C 1225	N 330	O 348	S 15	0	0	0

- Molecule 5 is a protein called Ubiquinol-cytochrome c reductase iron-sulfur subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	196	Total 1519	C 957	N 263	O 291	S 8	0	0	0

- Molecule 6 is a protein called Ubiquinol-cytochrome C reductase complex 14 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	105	Total 911	C 576	N 165	O 168	S 2	0	0	0

- Molecule 7 is a protein called Ubiquinol-cytochrome C reductase complex ubiquinone-binding protein QP-C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	75	Total 628	C 410	N 118	O 99	S 1	0	0	0

- Molecule 8 is a protein called Ubiquinol-cytochrome C reductase complex 11 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
8	H	67	Total 548	C 332	N 99	O 112	S 5	0	0	0

- Molecule 9 is a protein called Ubiquinol-cytochrome C reductase complex 8 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
9	I	57	Total 406	C 253	N 77	O 74	S 2	0	0	0

- Molecule 10 is a protein called Ubiquinol-cytochrome C reductase complex 7.2 kDa protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
10	J	61	Total 502	C 329	N 87	O 86	0	0	0

- Molecule 11 is a protein called Ubiquinol-cytochrome C reductase complex 6.4 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
11	K	51	Total 418	C 278	N 75	O 64	S 1	0	0	0

- Molecule 12 is HEME C (three-letter code: HEC) (formula: $C_{34}H_{34}FeN_4O_4$).

HEC

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

- Molecule 13 is 6-HYDROXY-5-UNDECYL-1,3-BENZOTHIAZOLE-4,7-DIONE (three-letter code: UHD) (formula: $C_{18}H_{25}NO_3S$).

UHD

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
13	C	1	23	18	1	3	1	0	0

- Molecule 14 is UBIQUINONE-2 (three-letter code: UQ2) (formula: $C_{19}H_{26}O_4$).

UQ2
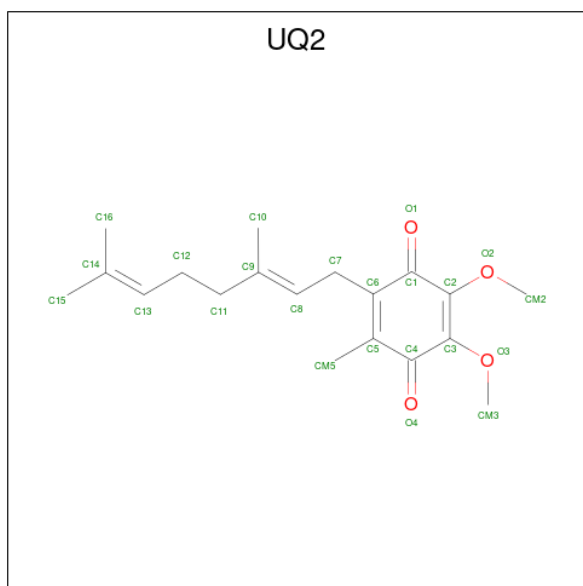
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
14	C	1	23	19	4	0	0

- Molecule 15 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe_2S_2).

FES
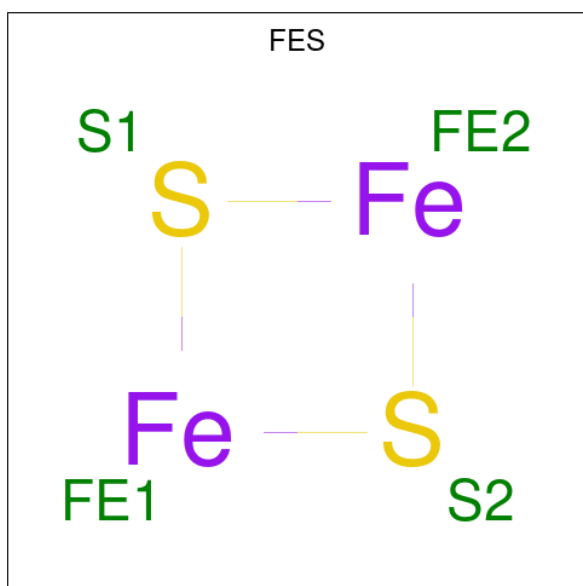
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
15	E	1	Total 4	Fe 2	S 2	0	0

- Molecule 16 is water.

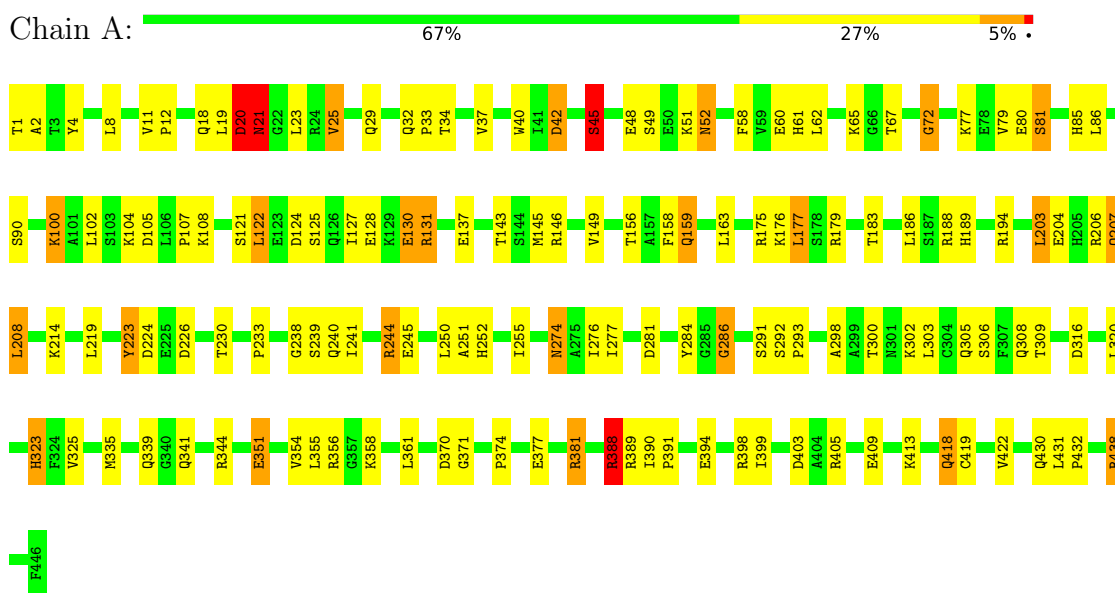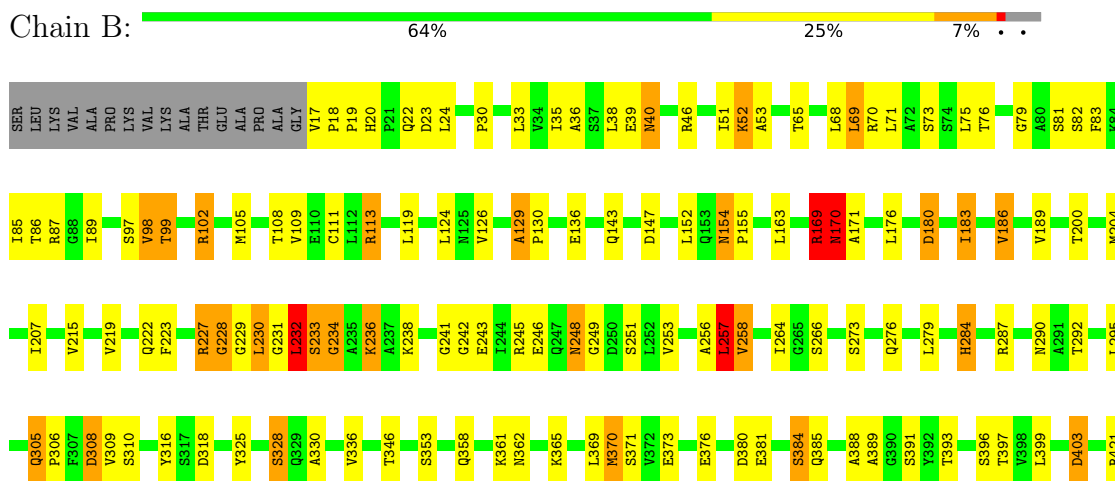| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
16	A	70	Total 70	O 70	0	0
16	B	103	Total 103	O 103	0	0
16	C	26	Total 26	O 26	0	0
16	D	21	Total 21	O 21	0	0
16	E	8	Total 8	O 8	0	0
16	F	31	Total 31	O 31	0	0
16	G	16	Total 16	O 16	0	0
16	I	10	Total 10	O 10	0	0
16	K	6	Total 6	O 6	0	0

3   Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.
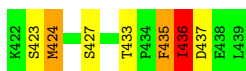
Note EDS was not executed.

• Molecule 1: Ubiquinol-cytochrome c reductase complex core protein I, mitochondrial
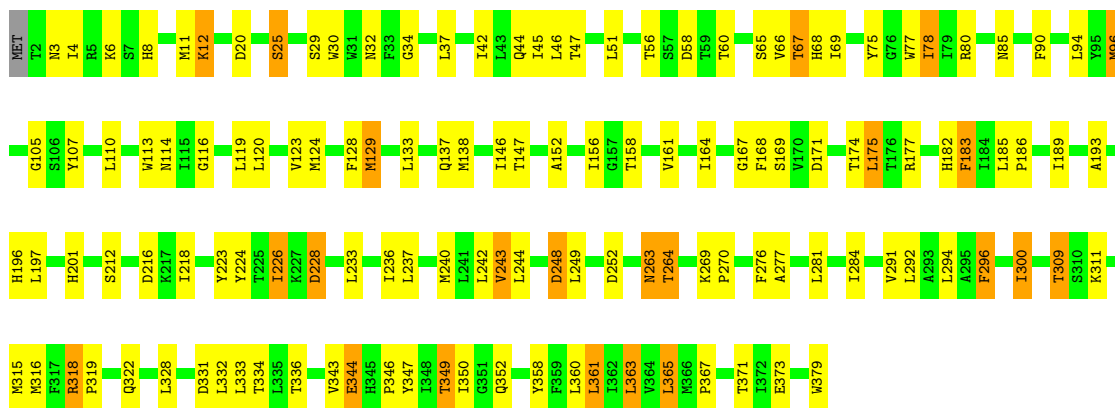

• Molecule 2: Ubiquinol-cytochrome c reductase complex core protein 2, mitochondrial
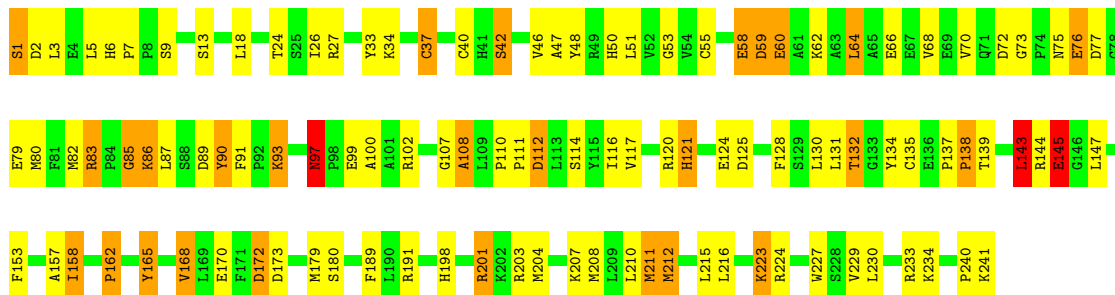
K422 S423 M424 S427 T433 P434 F435 I436 D437 E438 L439

• Molecule 3: Cytochrome b

Chain C: 65% 29% 6%

MET T2 N3 I4 R5 K6 S7 H8 M11 K12 D20 S25 S29 W30 W31 N32 F33 G34 L37 I42 L43 Q44 I45 L46 T47 L51 T56 S57 D58 T59 T60 S65 V66 T67 H68 I69 Y75 G76 W77 I78 I79 R80 N85 F90 L94 Y95 M96

G105 S106 Y107 L110 W113 N114 I115 G116 L119 L120 V123 M124 F128 M129 L133 Q137 M138 I146 T147 A152 I156 G157 T158 V161 I164 G167 F168 S169 V170 D171 T174 L175 T176 R177 H182 F183 I184 L185 P186 I189 A193

H196 L197 H201 S212 D216 K217 I218 Y223 Y224 T225 I226 K227 D228 L233 I236 L237 M240 L241 L242 V243 L244 D248 L249 D252 N263 T264 K269 P270 F276 A277 L281 I284 V291 L292 A293 L294 A295 F296 I300 T309 S310 K311

M315 M316 F317 R318 P319 Q322 L328 D331 L332 L333 T334 L335 T336 V343 E344 H345 P346 Y347 I348 T349 I350 G351 Q352 Y358 F359 L360 L361 I362 L363 V364 L365 M366 P367 T371 I372 E373 W379

• Molecule 4: Cytochrome c1, heme protein, mitochondrial

Chain D: 54% 33% 11% •

S1 D2 L3 E4 L5 H6 P7 P8 S9 S13 L18 T24 S25 I26 R27 Y33 K34 C37 C40 H41 S42 V46 A47 Y48 R49 H50 L51 V52 G53 V54 C55 E58 D59 E60 A61 K62 A63 L64 A65 E66 E67 V68 E69 V70 Q71 D72 G73 P74 N75 E76 D77 G78

E79 M80 F81 M82 R83 P84 G85 K86 L87 S88 D89 Y90 F91 P92 K93 N97 P98 E99 A100 A101 R102 G107 A108 L109 P110 P111 D112 L113 S114 Y115 I116 V117 R120 H121 E124 D125 F128 S129 L130 L131 T132 G133 Y134 C135 E136 P137 P138 T139 L143 R144 E145 G146 L147

F153 A157 I158 P162 Y165 V168 L169 E170 F171 D172 D173 M179 S180 F189 L190 R191 H198 R201 K202 R203 M204 K207 M208 L209 L210 M211 M212 L215 L216 K223 R224 W227 S228 V229 L230 R233 K234 P240 K241

• Molecule 5: Ubiquinol-cytochrome c reductase iron-sulfur subunit

Chain E: 65% 29% 6%

S1 K6 D9 F10 P16 E17 V18 L19 D20 S21 T22 K23 S24 S25 K26 E27 S28 S29 V39 T43 T44 V45 G46 V47 A50 A51 K52 N53 V54 Q57 F58 S63 A64 S65 V68 L69 A70 M71 S72 K73 I74 E75 I76 K77 L78 S79 D80 I81 P82 E83 G84

K85 K94 K103 K104 E105 I106 D107 Q108 V112 S115 Q116 L117 D123 K129 C139 C144 V145 P146 D152 Y156 Y157 C158 G162 S163 H164 Y165 S168 G169 R170 I171 R172 K173 E181 E186 F187 T188 S189 D190 D191 G196

• Molecule 6: Ubiquinol-cytochrome C reductase complex 14 kDa protein

Chain F: 54% 34% 8% 5%

ALA GLY ARG PRO ALA V6 S7 S10 R11 Y20 Y21 N22 N27 K28 R33 D34 D35 T36 I37 H38 K44 I47 P51 L54 V59 F60 R61 R64 A65 L66 D67 L68 S69 M70 R71 Q72 Q73 I74 L75 E78 K82 Y83 E84 D86 K87 S88 Y89

L90 E91 L94 K95 E96 R99 E100 E106 K109 K110

• Molecule 7: Ubiquinol-cytochrome C reductase complex ubiquinone-binding protein QP-C

Chain G:

70% 19% 7%

G1 V10 I14 S17 L18 E22 A25 F26 P27 S31 I34 P35 N36 V37 I45 V53 A54 F55 K72 N73 P74 A75 ALA TYR GLU ASN ASP ARG

• Molecule 8: Ubiquinol-cytochrome C reductase complex 11 kDa protein

Chain H:

58% 21% 8% 14%

GLY ASP PRO LYS GLU GLU GLU GLU GLU GLU E12 T18 Q26 L27 E28 K29 C30 L37 E38 L39 R43 R47 S48 Q49 E52 E57 L58 L59 D60 F61 L62 R65 D66 H67 C68 V69 K72 L77 K78

• Molecule 9: Ubiquinol-cytochrome C reductase complex 8 kDa protein

Chain I:

18% 36% 12% 8% 27%

M1 L2 S3 V4 A5 A6 R7 S8 G9 P10 F11 A12 P13 V14 L15 S16 A17 T18 S19 R20 A23 G24 A25 L26 R27 P28 L29 V30 Q31 P35 A36 T37 S40 P41 V42 L43 D44 L45 K46 R47 S48 V49 L50 C51 R52 E53 S54 L55 R56 G57 GLN ALA ALA GLY ARG PRO LEU

VAL ALA SER VAL SER LEU ASN VAL PRO ALA SER VAL ARG TYR
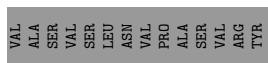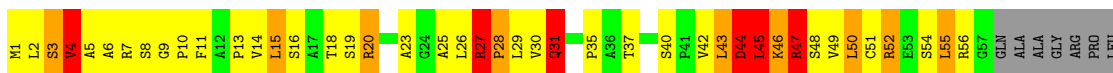
• Molecule 10: Ubiquinol-cytochrome C reductase complex 7.2 kDa protein

Chain J:

52% 44%

V1 A2 P3 T4 L5 T6 A7 R8 L9 Y10 S11 L12 L13 F14 R15 R16 T17 S18 I24 F31 E32 R33 G38 A39 D40 A41 I42 Y43 E44 H45 I46 N47 E48 G49 K50 L51 W52 K53 H54 I55 K56 H57 K58 Y59 E60 N61 LYS
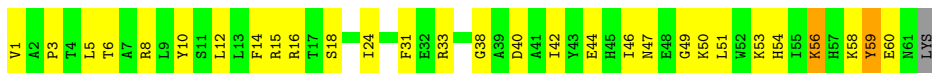
• Molecule 11: Ubiquinol-cytochrome C reductase complex 6.4 kDa protein

Chain K:

59% 25% 5% 9%

M1 L2 T3 R4 F5 L6 R11 Q12 V18 P19 T20 A21 S22 L23 W24 W38 R39 L40 I41 L42 D43 W44 Y47 I48 N49 G50 K51 PHE LYS LYS ASP ASP
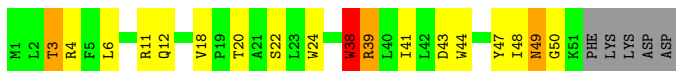
4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	I 41 2 2	Depositor
Cell constants a, b, c, α, β, γ	153.67Å 153.67Å 589.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.85	Depositor
% Data completeness (in resolution range)	85.5 (40.00-2.85)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.217 , 0.285	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	16953	wwPDB-VP
Average B, all atoms (Å^2)	33.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: FES, UQ2, UHD, 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	0.47	0/3531	0.89	5/4792 (0.1%)
2	B	0.52	0/3232	0.92	8/4386 (0.2%)
3	C	0.51	0/3100	0.88	3/4242 (0.1%)
4	D	0.46	0/1977	0.89	4/2684 (0.1%)
5	E	0.46	0/1553	0.86	4/2100 (0.2%)
6	F	0.52	0/930	0.94	3/1246 (0.2%)
7	G	0.57	0/649	0.87	0/878
8	H	0.50	1/553 (0.2%)	0.96	2/741 (0.3%)
9	I	0.62	0/411	1.22	2/558 (0.4%)
10	J	0.52	0/515	0.83	0/696
11	K	0.49	0/433	0.91	1/594 (0.2%)
All	All	0.50	1/16884 (0.0%)	0.90	32/22917 (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	A	0	8
2	B	0	12
3	C	0	3
4	D	0	21
5	E	0	5
6	F	0	1
8	H	0	5
9	I	0	16
10	J	0	1
11	K	0	3
All	All	0	75

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	H	57	GLU	CD-OE2	5.20	1.31	1.25

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

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	105	ASP	CB-CG-OD2	6.28	123.95	118.30
1	A	203	LEU	CA-CB-CG	6.19	129.53	115.30
9	I	45	LEU	CA-CB-CG	6.17	129.48	115.30
2	B	180	ASP	CB-CG-OD2	6.16	123.84	118.30
2	B	147	ASP	CB-CG-OD2	6.00	123.70	118.30

There are no chirality outliers.

5 of 75 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	124	ASP	Peptide
1	A	137	GLU	Mainchain
1	A	20	ASP	Peptide
1	A	45	SER	Peptide
1	A	52	ASN	Peptide

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3458	0	3356	71	0
2	B	3172	0	3152	86	0
3	C	3003	0	3065	68	0
4	D	1918	0	1870	36	0
5	E	1519	0	1503	19	0
6	F	911	0	904	18	0
7	G	628	0	636	7	0
8	H	548	0	530	4	0
9	I	406	0	437	36	0
10	J	502	0	505	8	0
11	K	418	0	425	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
12	C	86	0	64	12	0
12	D	43	0	32	5	0
13	C	23	0	24	3	0
14	C	23	0	26	4	0
15	E	4	0	0	0	0
16	A	70	0	0	3	0
16	B	103	0	0	5	0
16	C	26	0	0	1	0
16	D	21	0	0	0	0
16	E	8	0	0	0	0
16	F	31	0	0	2	0
16	G	16	0	0	0	0
16	I	10	0	0	2	0
16	K	6	0	0	0	0
All	All	16953	0	16529	310	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 9.

The worst 5 of 310 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)
16:B:623:HOH:O	9:I:11:PHE:HB2	1.70	0.92
2:B:310:SER:HB3	9:I:28:PRO:HD3	1.52	0.90
16:B:627:HOH:O	9:I:4:VAL:HG21	1.75	0.85
2:B:385:GLN:HA	9:I:2:LEU:HD12	1.60	0.81
2:B:388:ALA:HB3	9:I:2:LEU:HD13	1.64	0.80

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	444/446 (100%)	397 (89%)	37 (8%)	10 (2%)	6	20
2	B	421/439 (96%)	383 (91%)	26 (6%)	12 (3%)	4	15
3	C	376/379 (99%)	332 (88%)	39 (10%)	5 (1%)	12	33
4	D	239/241 (99%)	199 (83%)	30 (13%)	10 (4%)	3	8
5	E	194/196 (99%)	168 (87%)	21 (11%)	5 (3%)	5	17
6	F	103/110 (94%)	98 (95%)	3 (3%)	2 (2%)	8	24
7	G	73/81 (90%)	66 (90%)	5 (7%)	2 (3%)	5	16
8	H	65/78 (83%)	57 (88%)	7 (11%)	1 (2%)	10	30
9	I	55/78 (70%)	28 (51%)	17 (31%)	10 (18%)	0	0
10	J	59/62 (95%)	48 (81%)	8 (14%)	3 (5%)	2	5
11	K	49/56 (88%)	42 (86%)	4 (8%)	3 (6%)	1	3
All	All	2078/2166 (96%)	1818 (88%)	197 (10%)	63 (3%)	4	14

5 of 63 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	159	GLN
2	B	52	LYS
2	B	232	LEU
2	B	437	ASP
3	C	347	TYR

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	370/370 (100%)	307 (83%)	63 (17%)	2	5
2	B	332/343 (97%)	280 (84%)	52 (16%)	2	6
3	C	326/327 (100%)	267 (82%)	59 (18%)	1	4
4	D	206/206 (100%)	145 (70%)	61 (30%)	0	0
5	E	168/168 (100%)	130 (77%)	38 (23%)	1	2

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles		
6	F	96/98 (98%)	73 (76%)	23 (24%)	0	1	
7	G	66/71 (93%)	56 (85%)	10 (15%)	3	7	
8	H	64/74 (86%)	50 (78%)	14 (22%)	1	2	
9	I	44/60 (73%)	29 (66%)	15 (34%)	0	0	
10	J	51/52 (98%)	34 (67%)	17 (33%)	0	0	
11	K	41/46 (89%)	29 (71%)	12 (29%)	0	1	
All	All	1764/1815 (97%)	1400 (79%)	364 (21%)	1	2	

5 of 364 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	223	LYS
6	F	78	GLU
5	E	19	LEU
5	E	112	VAL
7	G	36	ASN

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

Mol	Chain	Res	Type
5	E	53	ASN
11	K	16	ASN
5	E	57	GLN
6	F	72	GLN
2	B	143	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

6 ligands 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	#$|Z| > 2$
12	HEC	C	382	3	26,50,50	1.53	2 (7%)	18,82,82	1.77	4 (22%)
12	HEC	C	381	3	26,50,50	1.64	2 (7%)	18,82,82	1.30	2 (11%)
13	UHD	C	383	-	19,24,24	2.37	6 (31%)	20,31,31	1.75	3 (15%)
15	FES	E	197	5	0,4,4	0.00	-	-		
14	UQ2	C	384	-	23,23,23	2.31	5 (21%)	28,31,31	1.48	5 (17%)
12	HEC	D	242	4	26,50,50	1.60	2 (7%)	18,82,82	1.35	3 (16%)

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
12	HEC	C	382	3	-	2/6/54/54	-
12	HEC	C	381	3	-	0/6/54/54	-
13	UHD	C	383	-	-	8/11/31/31	0/2/2/2
15	FES	E	197	5	-	-	0/1/1/1
14	UQ2	C	384	-	-	7/15/39/39	0/1/1/1
12	HEC	D	242	4	-	2/6/54/54	-

The worst 5 of 17 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
14	C	384	UQ2	C6-C5	8.60	1.50	1.35
13	C	383	UHD	C4-C4A	-7.36	1.40	1.50
12	C	381	HEC	C3C-C2C	-5.27	1.35	1.40
12	D	242	HEC	C3C-C2C	-4.64	1.35	1.40
12	C	382	HEC	C3B-C2B	-4.48	1.36	1.40

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
13	C	383	UHD	O4-C4A-C4	-4.76	116.80	121.84
13	C	383	UHD	C8-C5-C6	-4.03	118.52	123.08
12	C	382	HEC	CMD-C2D-C1D	-3.86	122.54	128.46
14	C	384	UQ2	C5-C6-C1	-3.82	115.98	119.58
12	C	381	HEC	CAD-CBD-CGD	-3.42	106.94	112.67

There are no chirality outliers.

5 of 19 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
12	C	382	HEC	C2D-C3D-CAD-CBD
12	C	382	HEC	C4D-C3D-CAD-CBD
12	D	242	HEC	C3D-CAD-CBD-CGD
14	C	384	UQ2	C1-C6-C7-C8
14	C	384	UQ2	C5-C6-C7-C8

There are no ring outliers.

5 monomers are involved in 24 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	C	382	HEC	8	0
12	C	381	HEC	4	0
13	C	383	UHD	3	0
14	C	384	UQ2	4	0
12	D	242	HEC	5	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 then 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.

Ligand HEC C 382

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC C 381

Bond lengths

Bond angles

Torsions

Rings

Ligand UHD C 383

Bond lengths

Bond angles

Torsions

Rings

Ligand UQ2 C 384

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC D 242

Bond lengths

Bond angles

Torsions

Rings
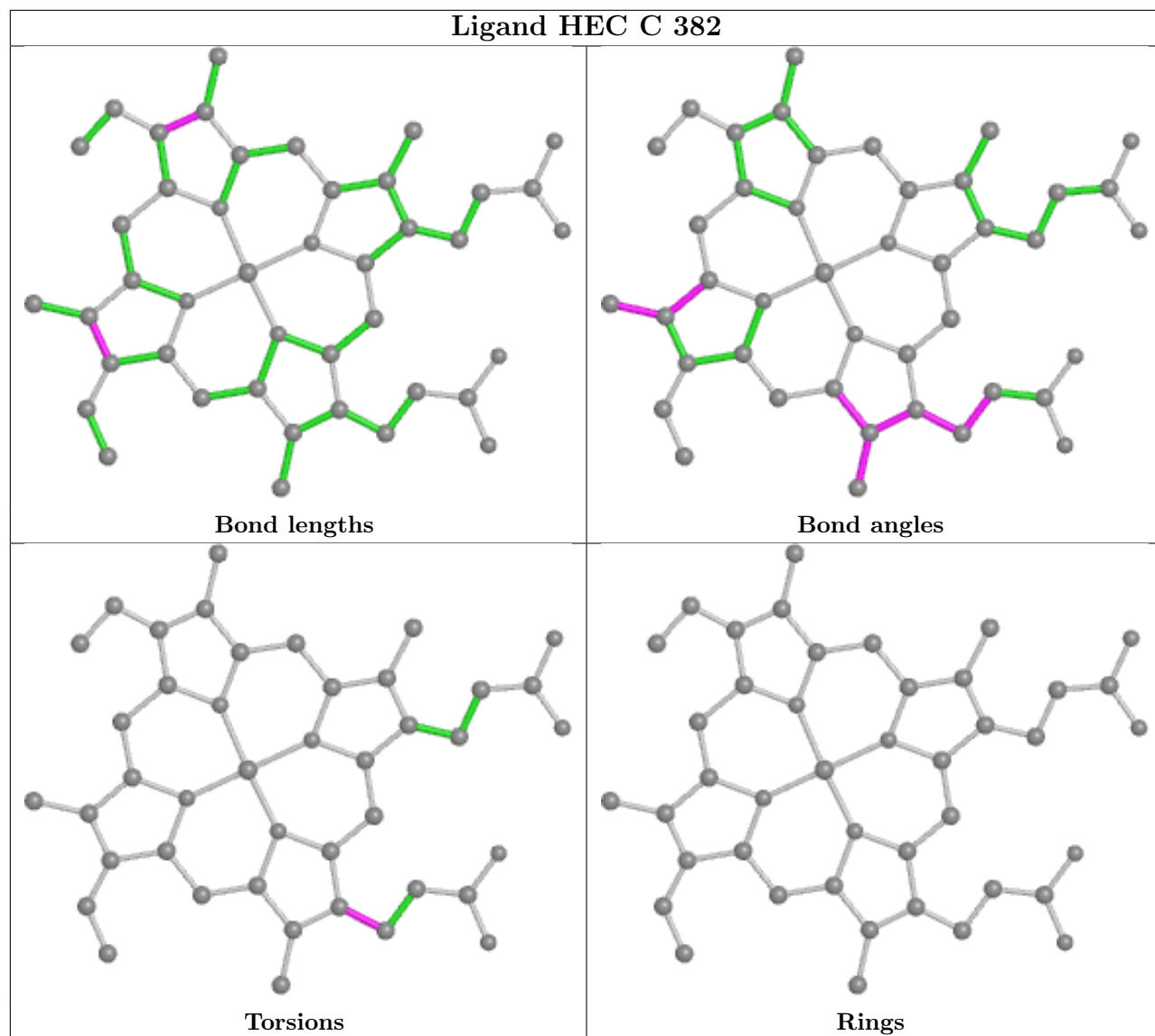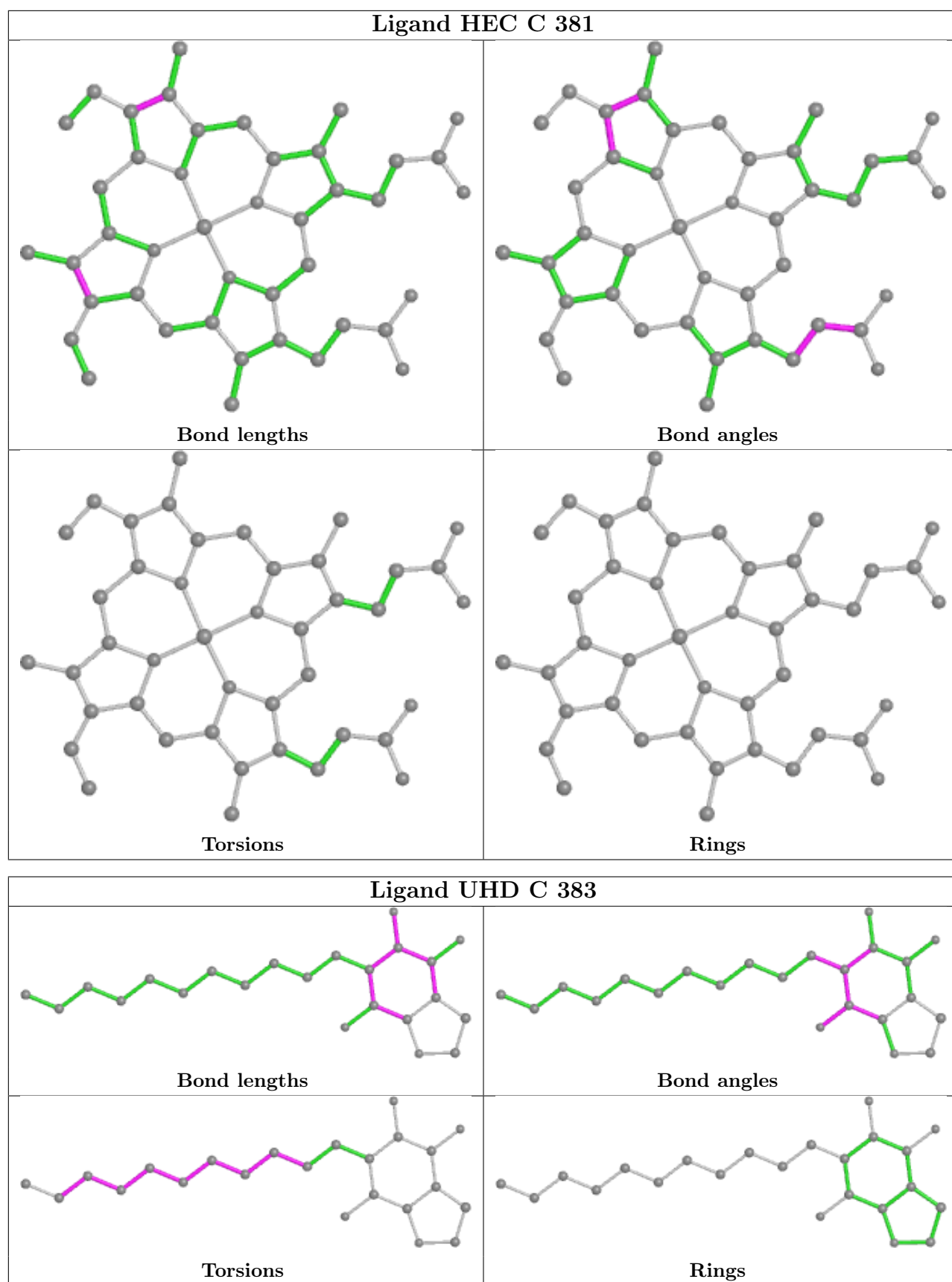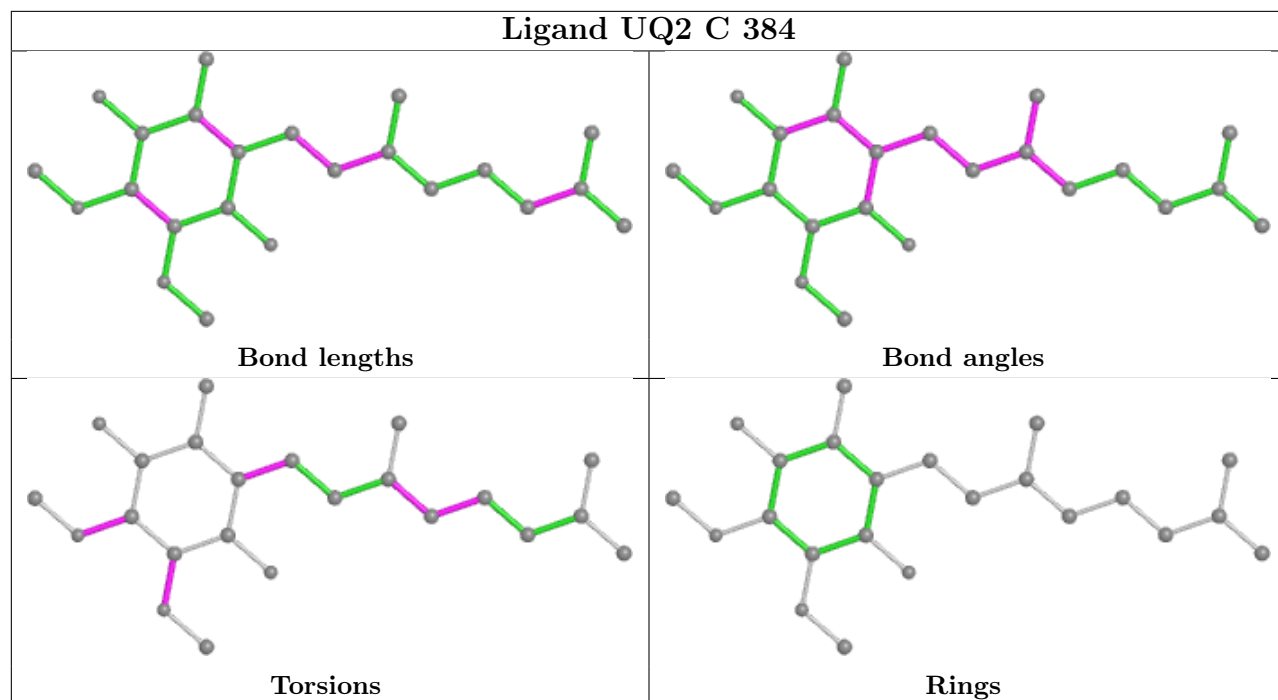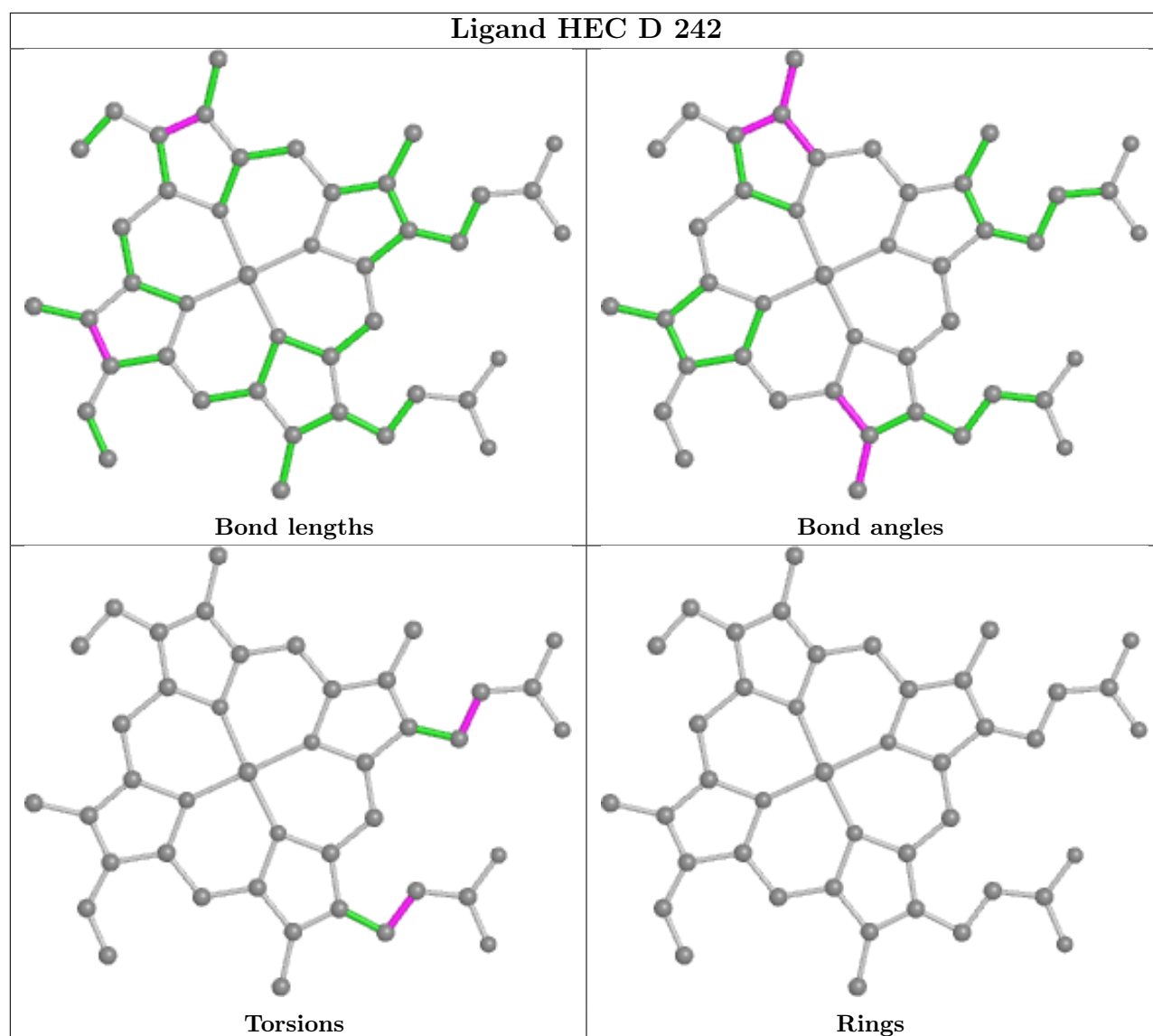
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

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.