



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 4, 2026 – 10:36 PM EDT

PDB ID : 4LWY / pdb_00004lwy
Title : L(M196)H,H(M202)L Double Mutant Structure of Photosynthetic Reaction
Center From Rhodobacter Sphaeroides strain RV
Authors : Gabdulkhakov, A.G.
Deposited on : 2013-07-29
Resolution : 2.90 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 : 2022.3.0, CSD as543be (2022)
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

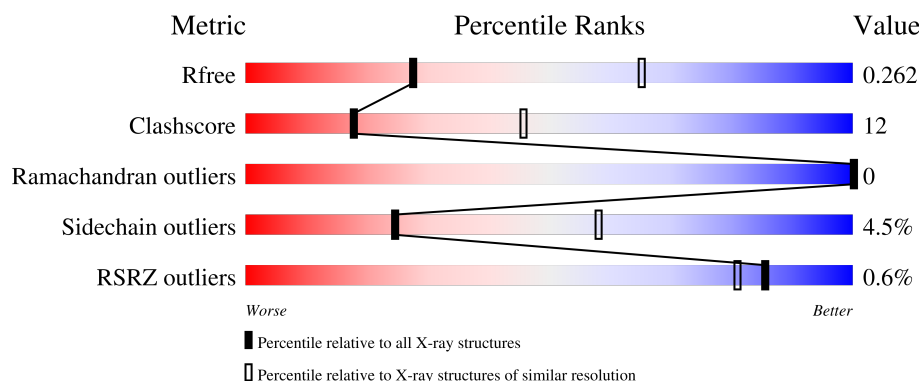
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	H	260	 68% 23% 8%
2	L	282	 69% 28%
3	M	303	 70% 27%

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
12	BPH	L	303	X	-	-	-
12	BPH	M	402	X	-	-	-
12	BPH	M	404	X	-	-	-

2 Entry composition

There are 17 unique types of molecules in this entry. The entry contains 7434 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 Reaction center protein H chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	240	Total	C	N	O	S	0	0	0
			1829	1169	314	337	9			

- Molecule 2 is a protein called Reaction center protein L chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	281	Total	C	N	O	S	0	0	0
			2233	1508	355	362	8			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	178	THR	SER	SEE REMARK 999	UNP P0C0Y8

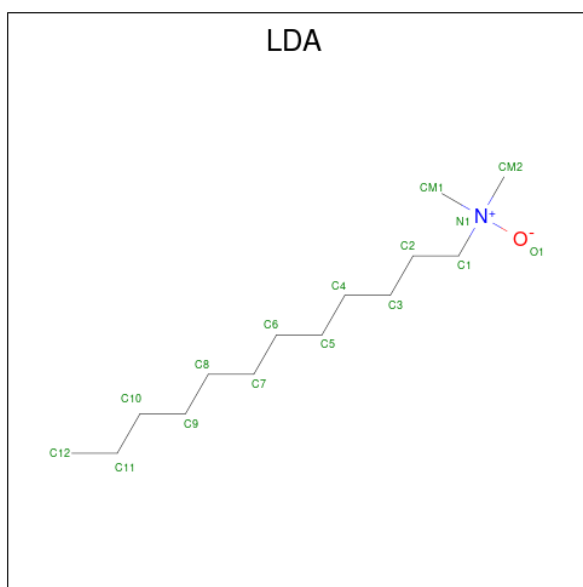
- Molecule 3 is a protein called Reaction center protein M chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	M	302	Total	C	N	O	S	0	0	0
			2409	1608	394	397	10			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
M	8	THR	SER	SEE REMARK 999	UNP P0C0Y9
M	196	HIS	LEU	engineered mutation	UNP P0C0Y9
M	202	LEU	HIS	engineered mutation	UNP P0C0Y9

- Molecule 4 is LAURYL DIMETHYLAMINE-N-OXIDE (CCD ID: LDA) (formula: C₁₄H₃₁NO).

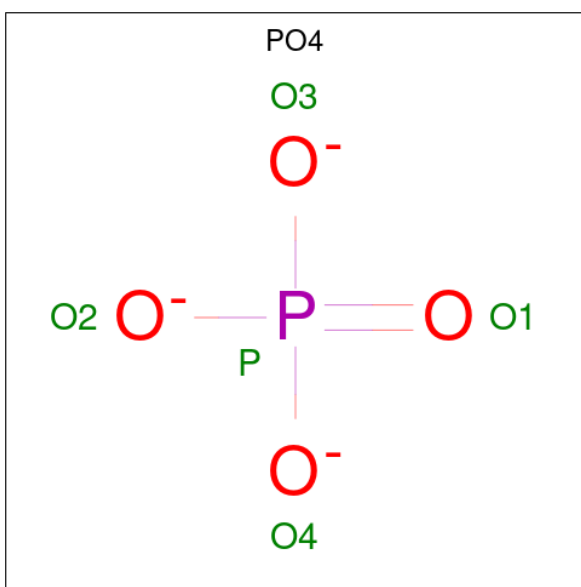


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	H	1	Total	C	N	O	0	0
			16	14	1	1		
4	M	1	Total	C	N	O	0	0
			16	14	1	1		
4	M	1	Total	C	N	O	0	0
			16	14	1	1		
4	M	1	Total	C	N	O	0	0
			16	14	1	1		
4	M	1	Total	C	N	O	0	0
			16	14	1	1		
4	M	1	Total	C	N	O	0	0
			16	14	1	1		

- Molecule 5 is UNKNOWN LIGAND (CCD ID: UNL) (formula:).

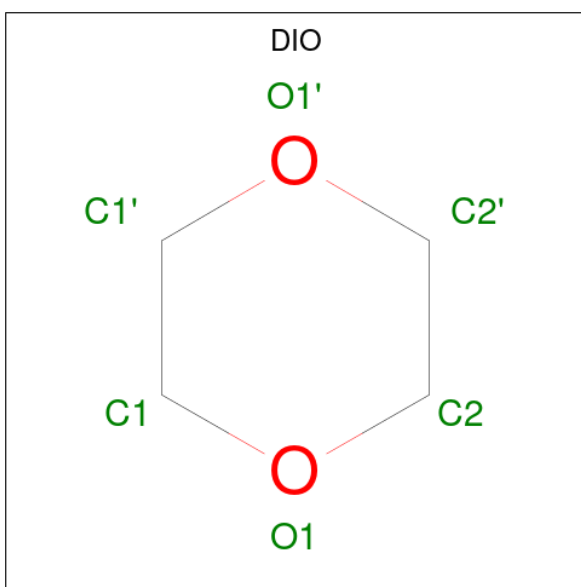
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	4	Total	C	0	0
			48	48		
5	L	4	Total	C	0	0
			46	46		
5	M	3	Total	C	0	0
			36	36		

- Molecule 6 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	H	1	Total	O	P	0	0
			5	4	1		
6	M	1	Total	O	P	0	0
			5	4	1		
6	M	1	Total	O	P	0	0
			5	4	1		

- Molecule 7 is 1,4-DIETHYLENE DIOXIDE (CCD ID: DIO) (formula: C₄H₈O₂).



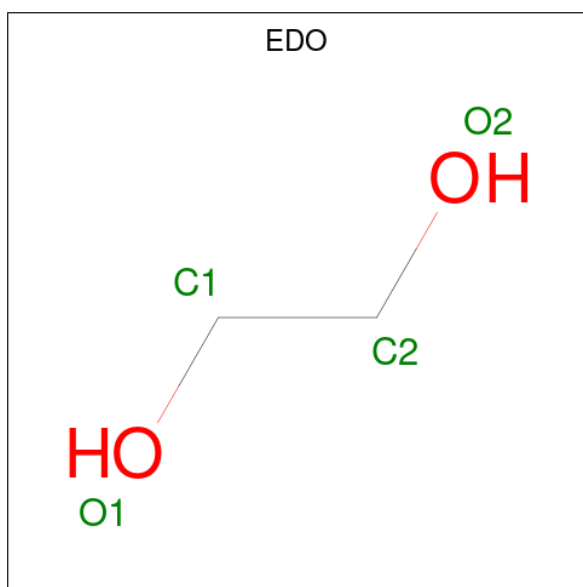
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	H	1	Total	C	O	0	0
			6	4	2		

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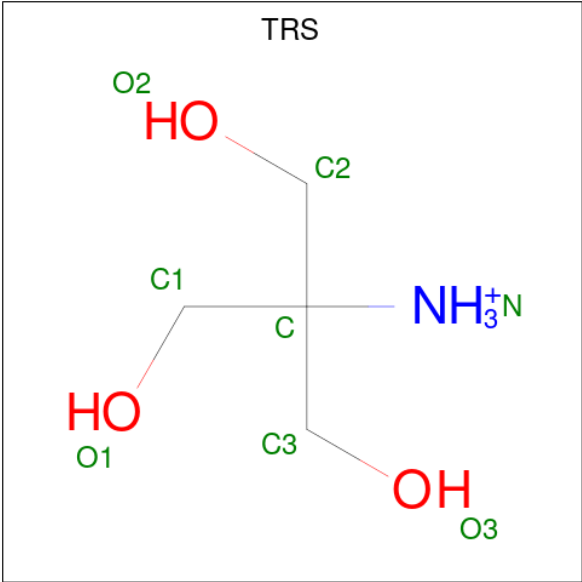
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	L	1	Total	C	O	0	0
			6	4	2		
7	L	1	Total	C	O	0	0
			6	4	2		
7	M	1	Total	C	O	0	0
			6	4	2		

- Molecule 8 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	H	1	Total	C	O	0	0
			4	2	2		
8	H	1	Total	C	O	0	0
			4	2	2		
8	H	1	Total	C	O	0	0
			4	2	2		
8	H	1	Total	C	O	0	0
			4	2	2		
8	L	1	Total	C	O	0	0
			4	2	2		
8	M	1	Total	C	O	0	0
			4	2	2		
8	M	1	Total	C	O	0	0
			4	2	2		

- Molecule 9 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: $C_4H_{12}NO_3$).

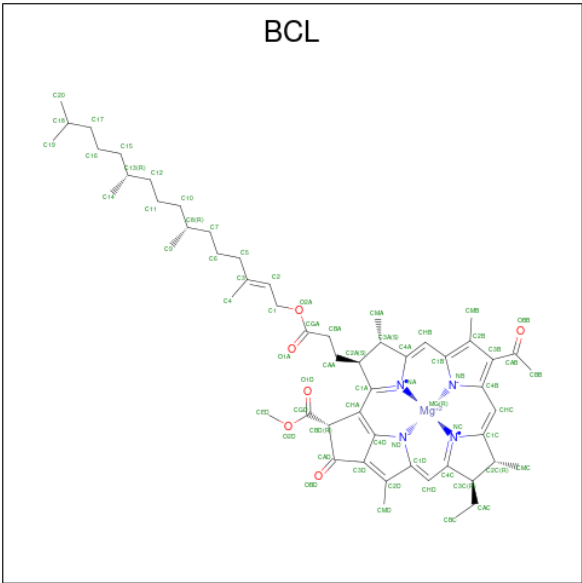


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
9	H	1	Total	C	N	O	0	0
			8	4	1	3		
9	L	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 10 is POTASSIUM ION (CCD ID: K) (formula: K).

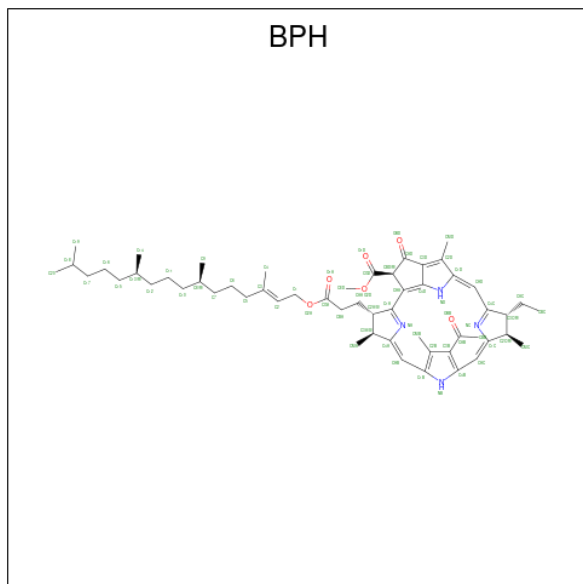
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	H	1	Total	K	0	0
			1	1		

- Molecule 11 is BACTERIOCHLOROPHYLL A (CCD ID: BCL) (formula: C₅₅H₇₄MgN₄O₆).



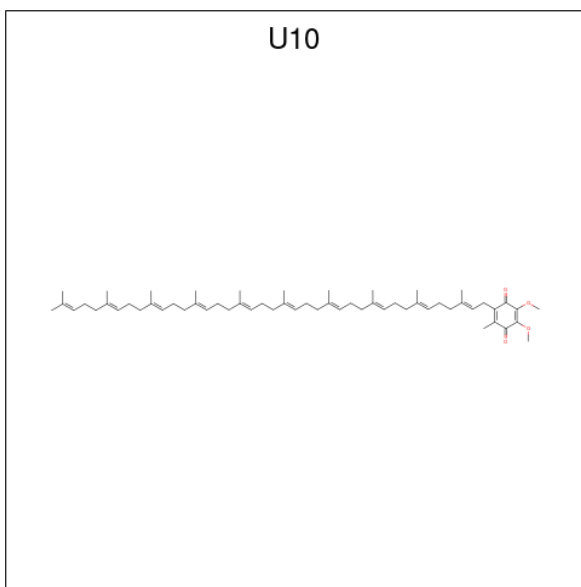
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
11	L	1	Total 66	C 55	Mg 1	N 4	O 6	0	0
11	L	1	Total 66	C 55	Mg 1	N 4	O 6	0	0
11	M	1	Total 66	C 55	Mg 1	N 4	O 6	0	0

- Molecule 12 is BACTERIOPHEOPHYTIN A (CCD ID: BPH) (formula: $C_{55}H_{76}N_4O_6$).



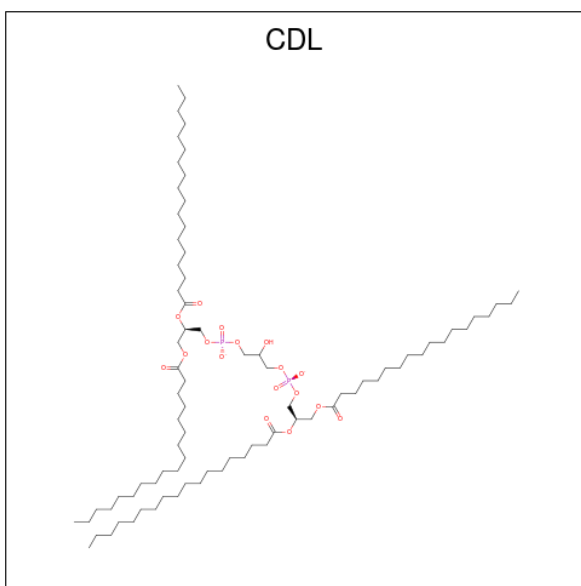
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
12	L	1	Total	C	N	O	0	0
			65	55	4	6		
12	M	1	Total	C	N	O	0	0
			65	55	4	6		
12	M	1	Total	C	N	O	0	0
			65	55	4	6		

- Molecule 13 is UBIQUINONE-10 (CCD ID: U10) (formula: $C_{59}H_{90}O_4$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
13	L	1	Total	C	O	0	0
			48	44	4		
13	M	1	Total	C	O	0	0
			48	44	4		

- Molecule 14 is CARDIOLIPIN (CCD ID: CDL) (formula: $C_{81}H_{156}O_{17}P_2$).

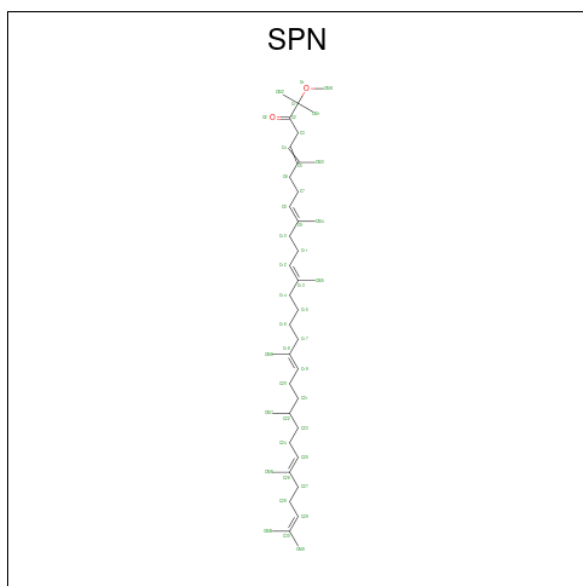


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
14	M	1	Total	C	O	P	0	0
			81	62	17	2		

- Molecule 15 is FE (III) ION (CCD ID: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
15	M	1	Total	Fe	0	0
			1	1		

- Molecule 16 is SPEROIDENONE (CCD ID: SPN) (formula: $C_{41}H_{70}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
16	M	1	Total	C	O	0	0
			43	41	2		

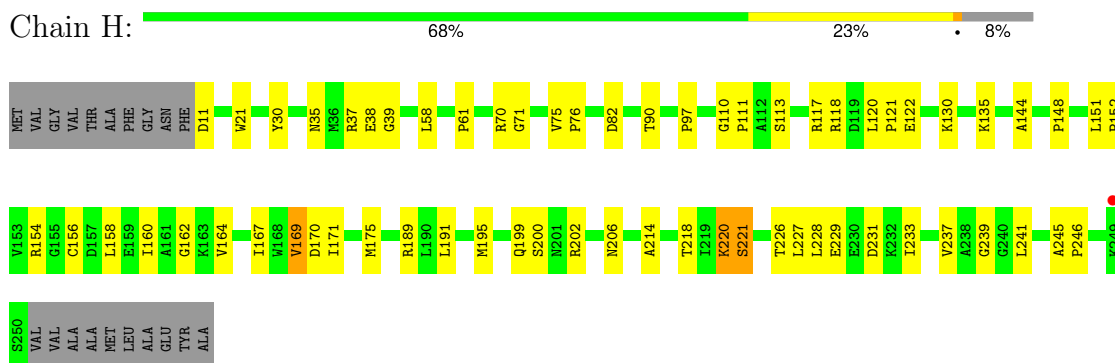
- Molecule 17 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
17	H	11	Total	O	0	0
			11	11		
17	L	10	Total	O	0	0
			10	10		
17	M	18	Total	O	0	0
			18	18		

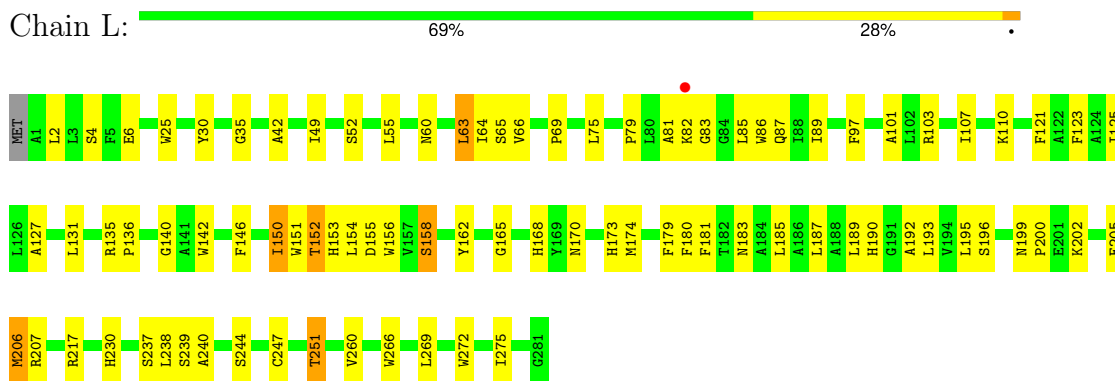
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

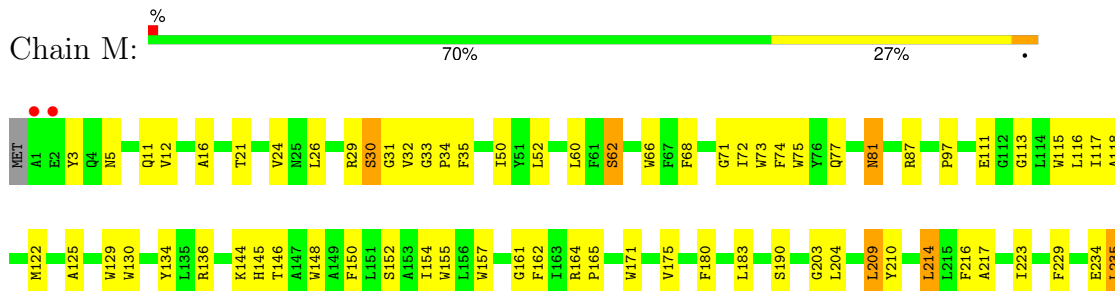
• Molecule 1: Reaction center protein H chain

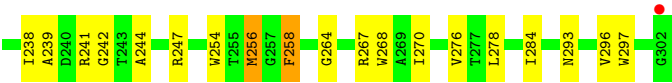


• Molecule 2: Reaction center protein L chain



• Molecule 3: Reaction center protein M chain





4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	140.04Å 140.04Å 184.62Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	43.19 – 2.90 43.19 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.8 (43.19-2.90) 99.8 (43.19-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.86 (at 2.90Å)	Xtriage
Refinement program	PHENIX (phenix.refine: dev_1389)	Depositor
R, R_{free}	0.214 , 0.262 0.215 , 0.262	Depositor DCC
R_{free} test set	2335 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	53.4	Xtriage
Anisotropy	0.261	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 55.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.41$, $\langle L^2 \rangle = 0.23$	Xtriage
Estimated twinning fraction	0.066 for -h,-k,l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	7434	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.63% 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: FE, EDO, SPN, LDA, BCL, U10, DIO, K, TRS, BPH, UNL, CDL, PO4

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	H	0.54	0/1877	0.99	5/2553 (0.2%)
2	L	0.57	0/2321	0.89	5/3177 (0.2%)
3	M	0.55	0/2501	0.94	5/3415 (0.1%)
All	All	0.56	0/6699	0.94	15/9145 (0.2%)

There are no bond length outliers.

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	M	81	ASN	CA-C-N	7.01	127.61	119.47
3	M	81	ASN	C-N-CA	7.01	127.61	119.47
1	H	221	SER	CA-C-N	-6.99	111.10	119.84
1	H	221	SER	C-N-CA	-6.99	111.10	119.84
1	H	171	ILE	CA-C-N	-6.32	113.18	119.56

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	H	1829	0	1836	42	0
2	L	2233	0	2189	67	0
3	M	2409	0	2323	79	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	H	16	0	31	2	0
4	M	80	0	155	9	0
5	H	48	0	0	0	0
5	L	46	0	0	0	0
5	M	36	0	0	0	0
6	H	5	0	0	0	0
6	M	10	0	0	0	0
7	H	6	0	8	0	0
7	L	12	0	16	3	0
7	M	6	0	8	1	0
8	H	16	0	24	3	0
8	L	4	0	6	1	0
8	M	8	0	12	1	0
9	H	8	0	12	1	0
9	L	8	0	12	0	0
10	H	1	0	0	0	0
11	L	132	0	148	10	0
11	M	66	0	74	3	0
12	L	65	0	76	10	0
12	M	130	0	152	12	0
13	L	48	0	63	1	0
13	M	48	0	63	5	0
14	M	81	0	106	7	0
15	M	1	0	0	0	0
16	M	43	0	70	5	0
17	H	11	0	0	0	0
17	L	10	0	0	0	0
17	M	18	0	0	1	0
All	All	7434	0	7384	181	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 12.

The worst 5 of 181 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:M:34:PRO:HA	4:M:412:LDA:H71	1.55	0.89
2:L:200:PRO:HD2	7:L:309:DIO:H22	1.64	0.80
1:H:202:ARG:HH12	9:H:312:TRS:H21	1.53	0.73
2:L:42:ALA:HA	12:L:303:BPH:H9C3	1.71	0.73
2:L:65:SER:HB2	2:L:152:THR:HG21	1.70	0.72

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	H	238/260 (92%)	233 (98%)	5 (2%)	0	100	100
2	L	279/282 (99%)	261 (94%)	18 (6%)	0	100	100
3	M	300/303 (99%)	280 (93%)	20 (7%)	0	100	100
All	All	817/845 (97%)	774 (95%)	43 (5%)	0	100	100

There are no Ramachandran outliers to report.

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	H	195/208 (94%)	187 (96%)	8 (4%)	27	61
2	L	220/221 (100%)	209 (95%)	11 (5%)	22	53
3	M	236/237 (100%)	226 (96%)	10 (4%)	26	60
All	All	651/666 (98%)	622 (96%)	29 (4%)	24	58

5 of 29 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	L	202	LYS
3	M	258	PHE
2	L	251	THR

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Mol	Chain	Res	Type
3	M	209	LEU
2	L	247	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	52	ASN
1	H	68	HIS
1	H	141	HIS
2	L	87	GLN
2	L	258	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 45 ligands modelled in this entry, 11 are unknown and 2 are monoatomic - leaving 32 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	DIO	L	309	-	6,6,6	0.84	0	6,6,6	0.83	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
11	BCL	L	301	3	69,74,74	1.32	6 (8%)	79,115,115	1.90	14 (17%)
13	U10	M	406	-	48,48,63	2.70	14 (29%)	60,61,79	1.82	14 (23%)
4	LDA	M	408	-	13,15,15	2.34	2 (15%)	14,17,17	0.57	0
7	DIO	M	418	-	6,6,6	0.88	0	6,6,6	0.88	0
6	PO4	M	417	-	4,4,4	0.92	0	6,6,6	0.38	0
9	TRS	H	312	-	7,7,7	0.32	0	9,9,9	0.43	0
11	BCL	M	403	2	69,74,74	1.31	7 (10%)	79,115,115	2.12	20 (25%)
8	EDO	H	310	-	3,3,3	0.43	0	2,2,2	0.52	0
7	DIO	L	310	-	6,6,6	0.72	0	6,6,6	1.11	0
4	LDA	M	409	-	13,15,15	2.28	2 (15%)	14,17,17	0.43	0
7	DIO	H	307	-	6,6,6	0.89	0	6,6,6	0.79	0
16	SPN	M	407	-	42,42,42	1.26	8 (19%)	50,52,52	1.66	14 (28%)
4	LDA	M	410	-	13,15,15	2.36	2 (15%)	14,17,17	0.60	0
8	EDO	L	311	-	3,3,3	0.51	0	2,2,2	0.15	0
8	EDO	H	309	-	3,3,3	0.41	0	2,2,2	0.58	0
4	LDA	M	411	-	13,15,15	2.34	2 (15%)	14,17,17	0.38	0
6	PO4	M	416	-	4,4,4	0.88	0	6,6,6	0.46	0
11	BCL	L	302	2	69,74,74	1.34	6 (8%)	79,115,115	1.83	18 (22%)
12	BPH	M	402	-	59,70,70	1.47	8 (13%)	59,101,101	1.65	12 (20%)
12	BPH	M	404	-	59,70,70	1.53	7 (11%)	59,101,101	1.75	13 (22%)
13	U10	L	304	-	48,48,63	2.66	13 (27%)	60,61,79	1.84	16 (26%)
8	EDO	M	420	-	3,3,3	0.49	0	2,2,2	0.25	0
8	EDO	H	308	-	3,3,3	0.44	0	2,2,2	0.33	0
12	BPH	L	303	-	59,70,70	1.55	7 (11%)	59,101,101	1.76	14 (23%)
8	EDO	M	419	-	3,3,3	0.47	0	2,2,2	0.32	0
6	PO4	H	306	-	4,4,4	0.98	0	6,6,6	0.34	0
4	LDA	M	412	-	13,15,15	2.32	2 (15%)	14,17,17	0.34	0
14	CDL	M	401	-	80,80,99	0.91	5 (6%)	86,92,111	1.32	7 (8%)
4	LDA	H	301	-	13,15,15	2.31	2 (15%)	14,17,17	0.54	0
9	TRS	L	312	-	7,7,7	0.34	0	9,9,9	0.35	0
8	EDO	H	311	-	3,3,3	0.51	0	2,2,2	0.22	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
7	DIO	L	309	-	-	-	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
11	BCL	L	301	3	-	8/41/137/137	-
13	U10	M	406	-	-	11/45/69/87	0/1/1/1
4	LDA	M	408	-	-	2/13/13/13	-
7	DIO	M	418	-	-	-	0/1/1/1
9	TRS	H	312	-	-	6/9/9/9	-
11	BCL	M	403	2	-	7/41/137/137	-
8	EDO	H	310	-	-	0/1/1/1	-
7	DIO	L	310	-	-	-	0/1/1/1
4	LDA	M	409	-	-	5/13/13/13	-
7	DIO	H	307	-	-	-	0/1/1/1
16	SPN	M	407	-	-	18/50/51/51	-
4	LDA	M	410	-	-	1/13/13/13	-
8	EDO	L	311	-	-	0/1/1/1	-
8	EDO	H	309	-	-	1/1/1/1	-
4	LDA	M	411	-	-	7/13/13/13	-
11	BCL	L	302	2	-	5/41/137/137	-
12	BPH	M	402	-	2/2/18/22	8/37/105/105	0/5/6/6
12	BPH	M	404	-	2/2/18/22	4/37/105/105	0/5/6/6
13	U10	L	304	-	-	9/45/69/87	0/1/1/1
8	EDO	M	420	-	-	1/1/1/1	-
8	EDO	H	308	-	-	0/1/1/1	-
12	BPH	L	303	-	2/2/18/22	7/37/105/105	0/5/6/6
8	EDO	M	419	-	-	1/1/1/1	-
4	LDA	M	412	-	-	6/13/13/13	-
14	CDL	M	401	-	-	42/91/91/110	-
4	LDA	H	301	-	-	8/13/13/13	-
9	TRS	L	312	-	-	9/9/9/9	-
8	EDO	H	311	-	-	0/1/1/1	-

The worst 5 of 93 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	L	303	BPH	C1D-C2D	8.18	1.48	1.39
12	M	404	BPH	C1D-C2D	8.11	1.48	1.39
12	M	402	BPH	C1D-C2D	7.59	1.47	1.39
4	M	408	LDA	O1-N1	-6.80	1.25	1.42
4	M	410	LDA	O1-N1	-6.78	1.25	1.42

The worst 5 of 142 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
11	M	403	BCL	C1D-ND-C4D	-9.38	99.73	106.31
11	L	301	BCL	C1D-ND-C4D	-8.56	100.31	106.31
11	L	302	BCL	C1D-ND-C4D	-7.83	100.82	106.31
11	M	403	BCL	C1C-NC-C4C	6.45	109.62	106.68
12	M	404	BPH	C4D-CHA-CBD	6.04	111.35	108.45

5 of 6 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
12	L	303	BPH	C8
12	L	303	BPH	C13
12	M	402	BPH	C8
12	M	402	BPH	C13
12	M	404	BPH	C8

5 of 166 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	H	301	LDA	C2-C1-N1-O1
4	H	301	LDA	C2-C1-N1-CM1
4	H	301	LDA	C2-C1-N1-CM2
4	M	409	LDA	N1-C1-C2-C3
9	H	312	TRS	C2-C-C1-O1

There are no ring outliers.

21 monomers are involved in 65 short contacts:

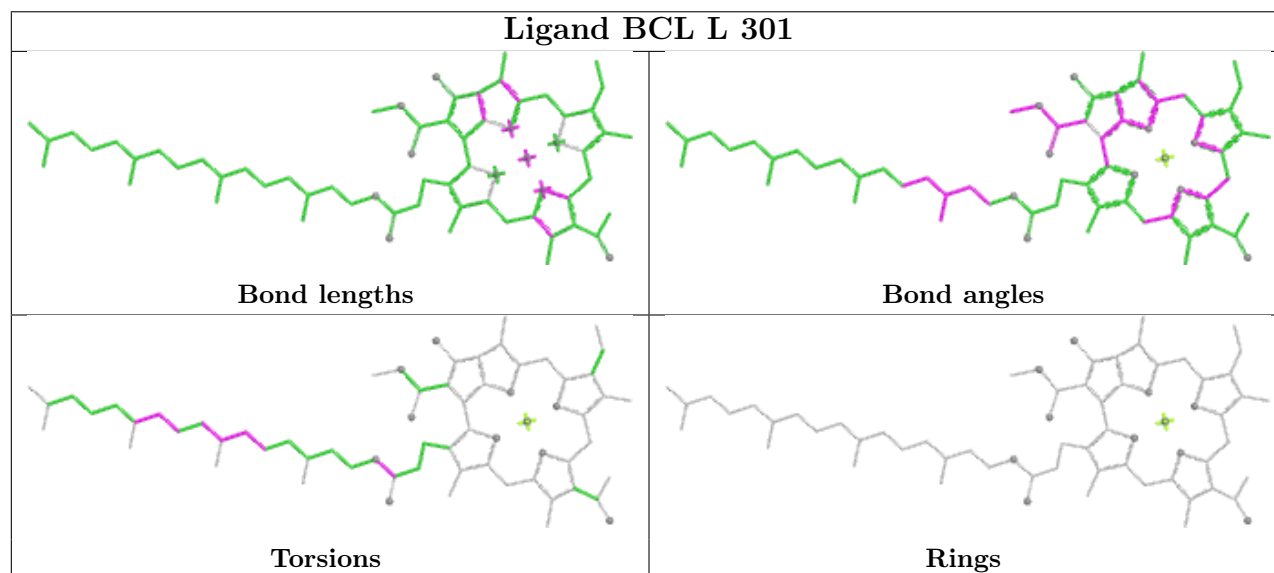
Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	L	309	DIO	3	0
11	L	301	BCL	4	0
13	M	406	U10	5	0
4	M	408	LDA	4	0
7	M	418	DIO	1	0
9	H	312	TRS	1	0
11	M	403	BCL	3	0
8	H	310	EDO	2	0
16	M	407	SPN	5	0
4	M	410	LDA	1	0
8	L	311	EDO	1	0
11	L	302	BCL	6	0
12	M	402	BPH	6	0

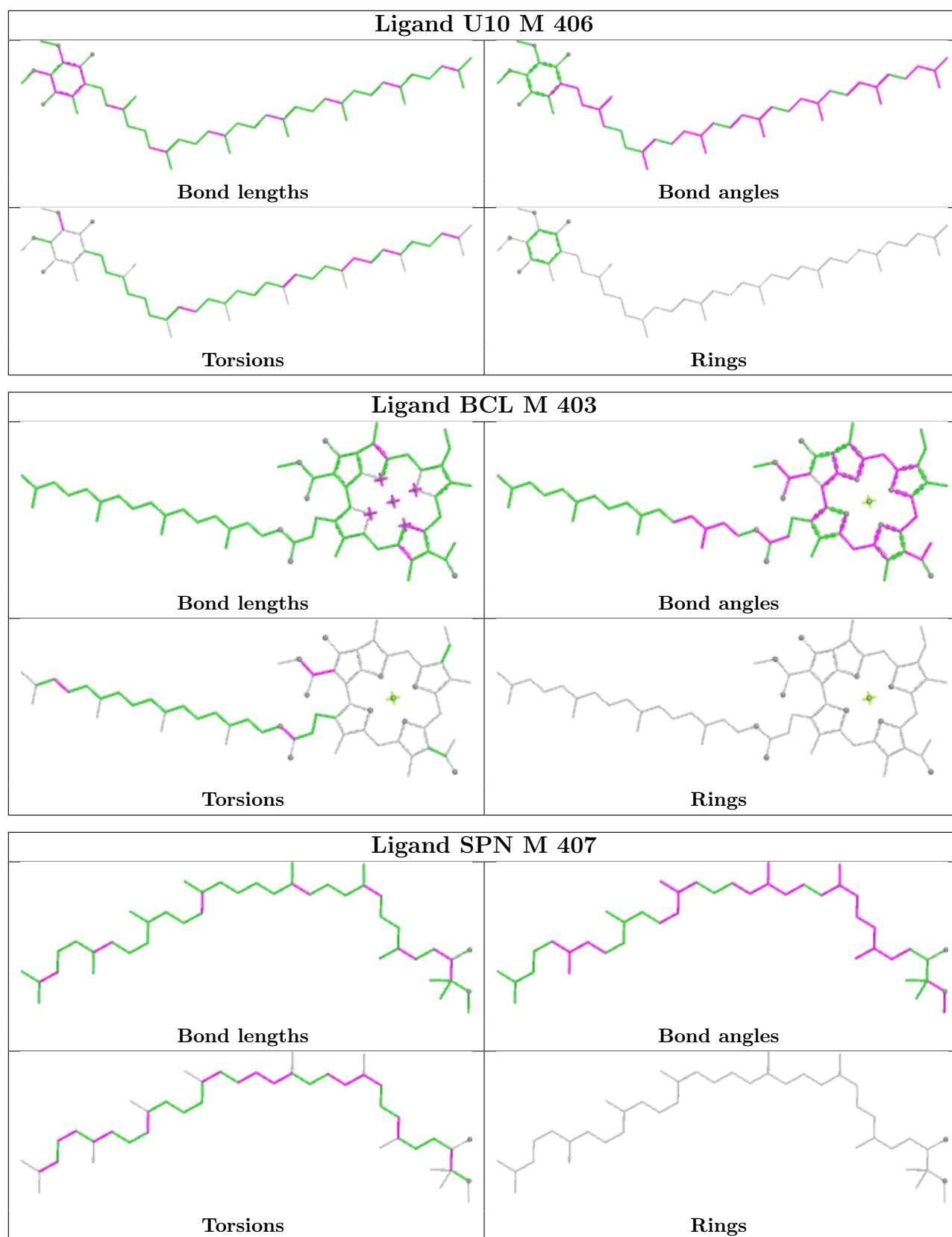
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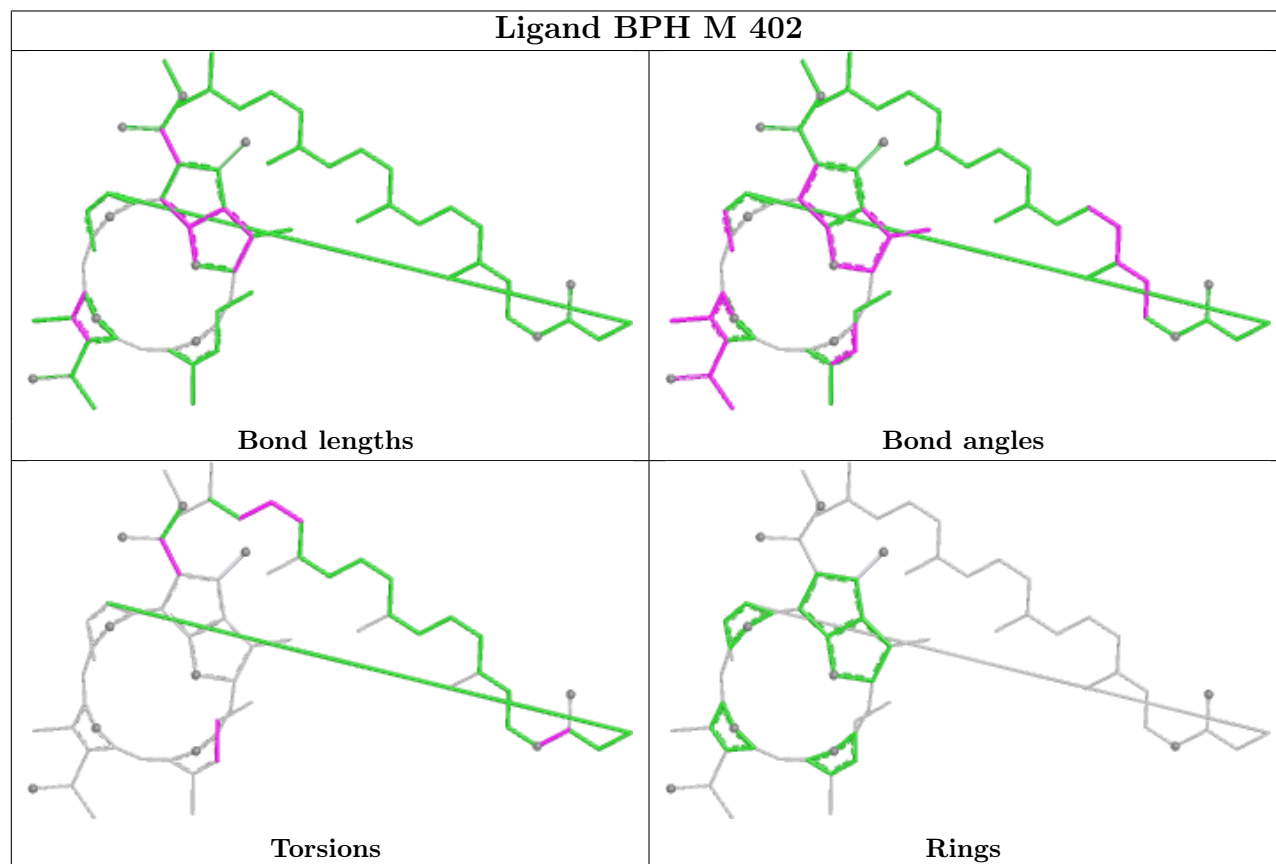
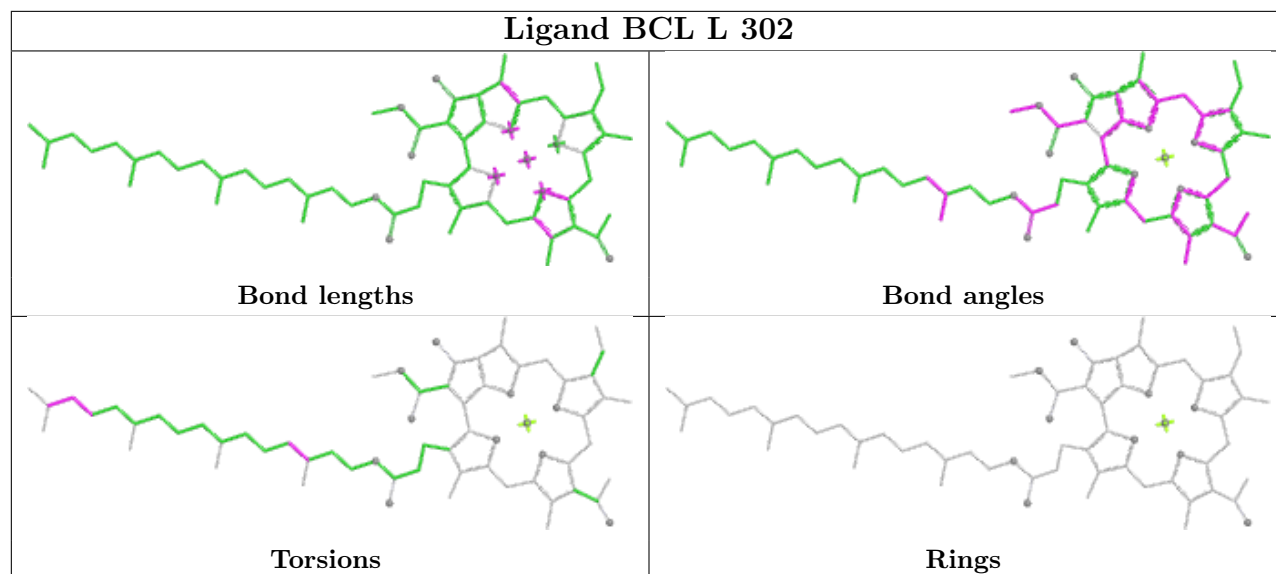
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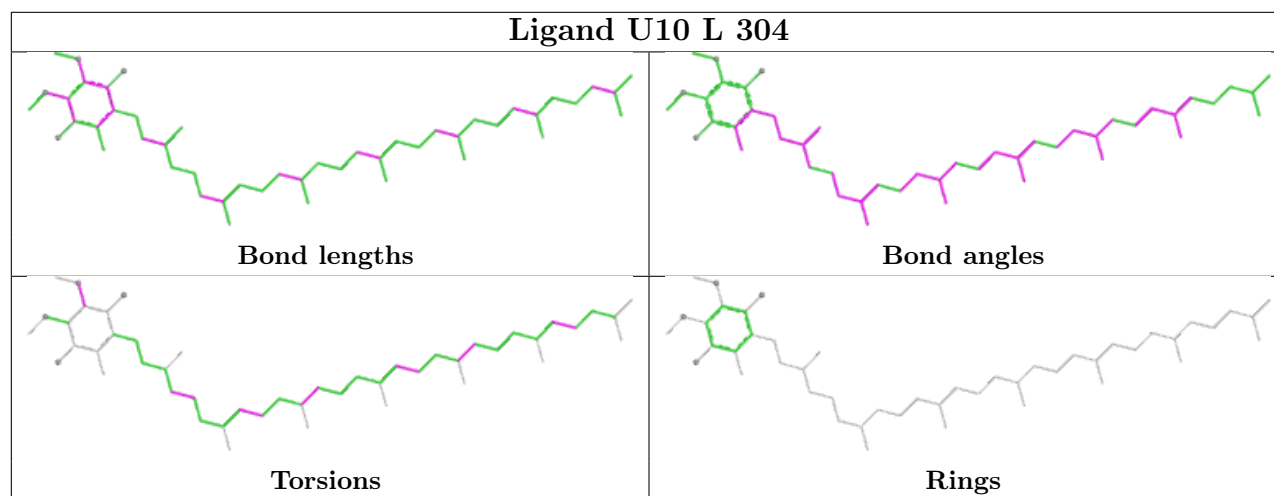
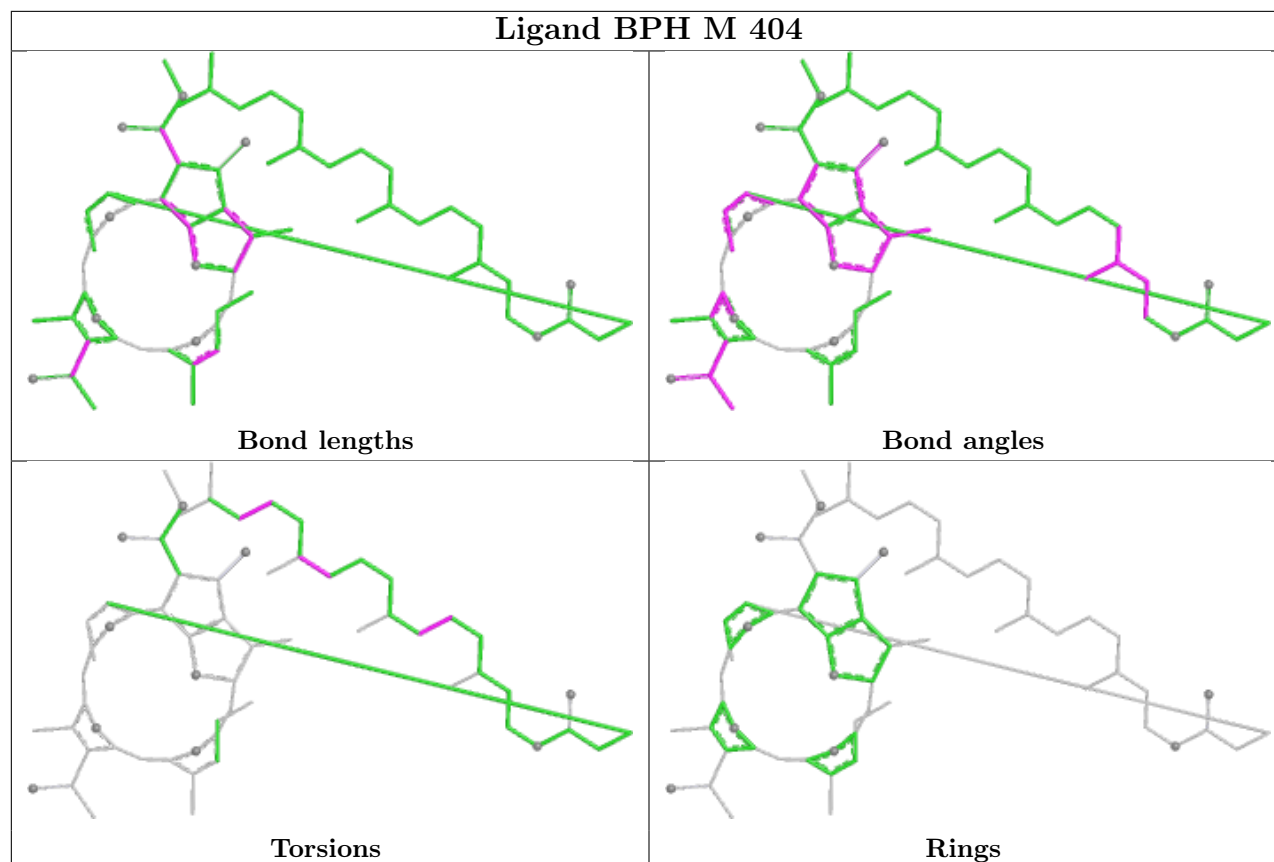
Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	M	404	BPH	7	0
13	L	304	U10	1	0
12	L	303	BPH	10	0
8	M	419	EDO	1	0
4	M	412	LDA	4	0
14	M	401	CDL	7	0
4	H	301	LDA	2	0
8	H	311	EDO	1	0

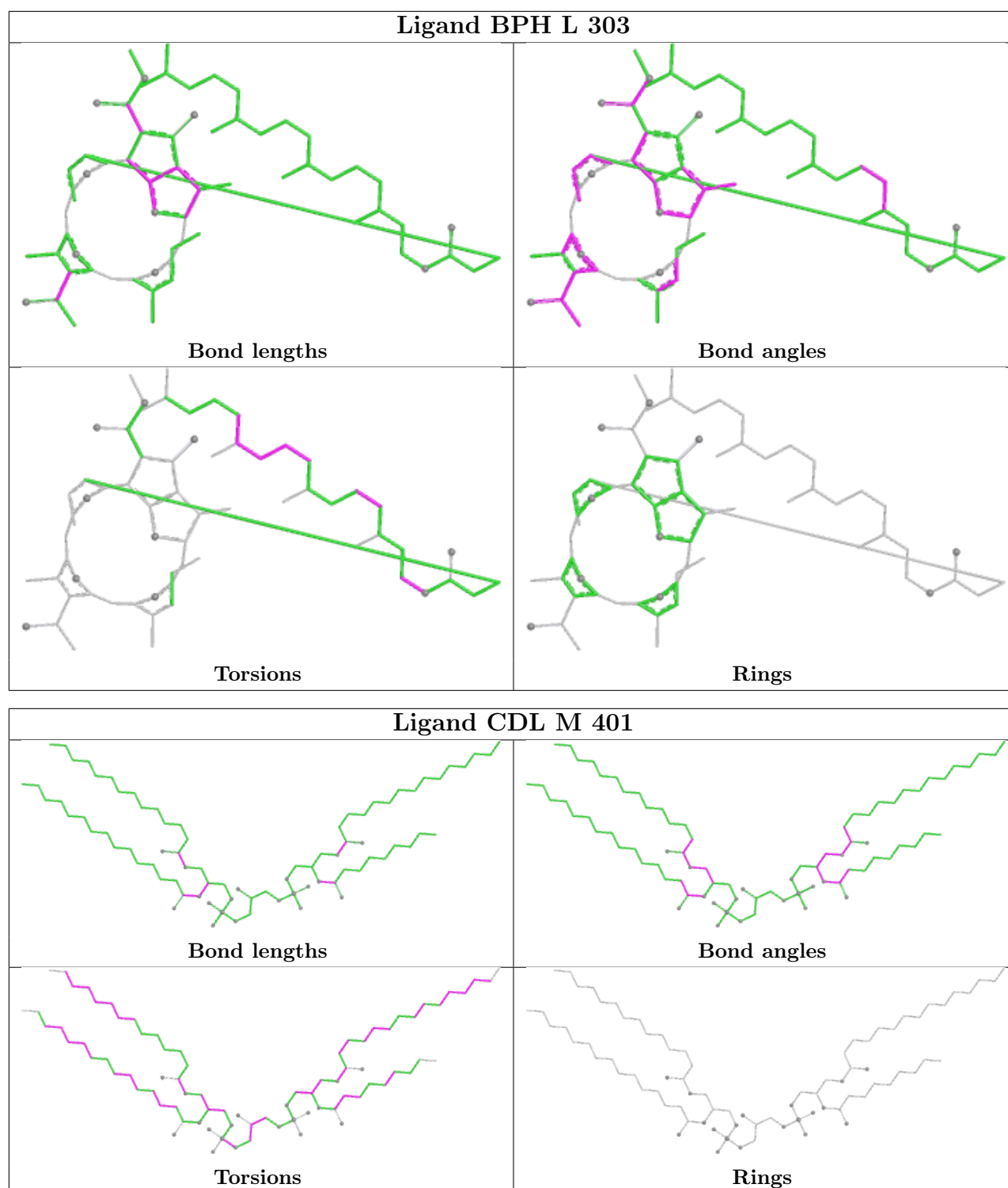
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

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 [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	H	240/260 (92%)	-0.44	1 (0%) 88 85	19, 45, 74, 127	0
2	L	281/282 (99%)	-0.39	1 (0%) 88 85	13, 42, 83, 130	0
3	M	302/303 (99%)	-0.43	3 (0%) 79 73	18, 45, 84, 118	0
All	All	823/845 (97%)	-0.42	5 (0%) 85 81	13, 44, 82, 130	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	M	302	GLY	3.3
3	M	1	ALA	3.1
1	H	249	LYS	2.5
3	M	2	GLU	2.4
2	L	82	LYS	2.2

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.

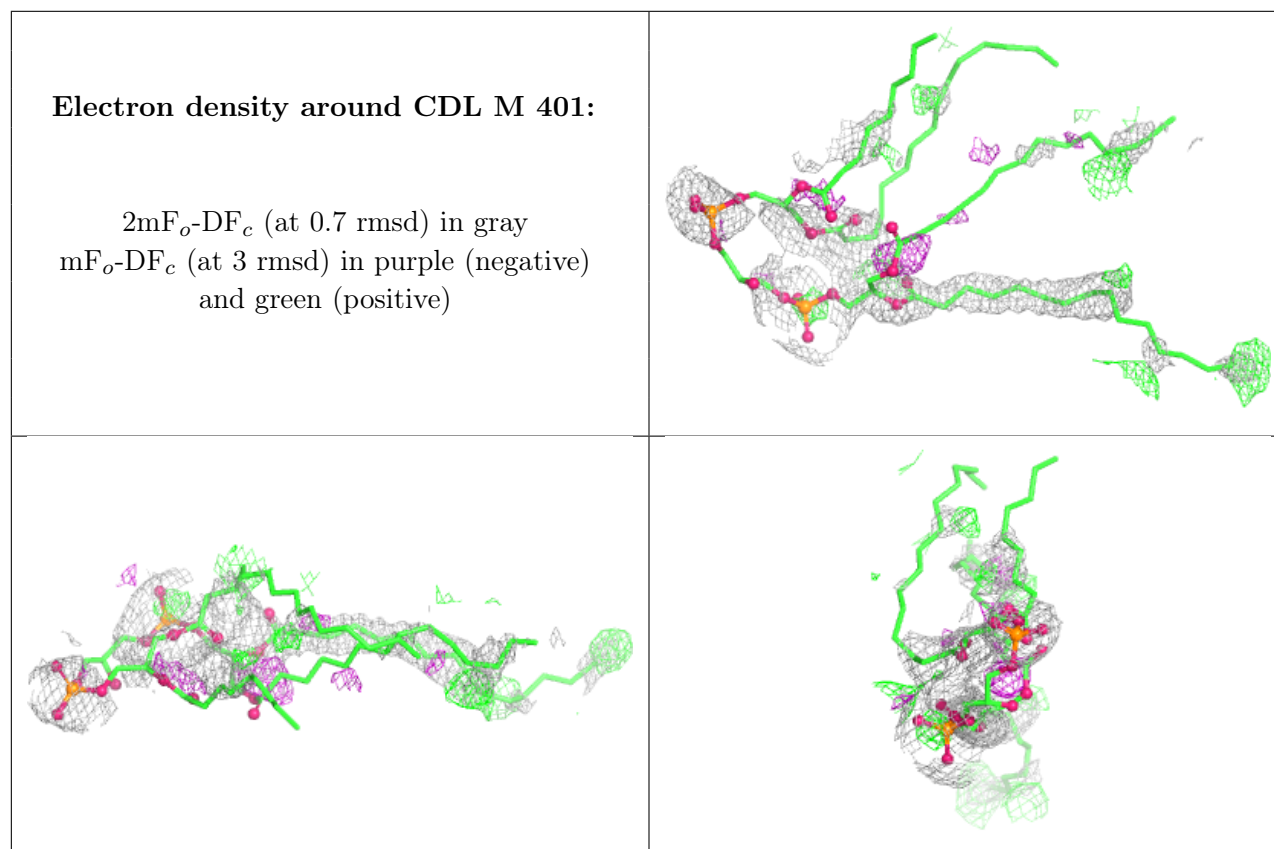
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	UNL	L	308	12/-	0.66	0.37	39,70,76,79	0
8	EDO	H	308	4/4	0.73	0.28	79,79,82,86	0
6	PO4	M	416	5/5	0.74	0.09	95,108,121,134	0
8	EDO	L	311	4/4	0.74	0.28	68,73,73,81	0
9	TRS	H	312	8/8	0.75	0.10	76,84,92,102	0
4	LDA	M	412	16/16	0.76	0.28	63,87,99,105	0
5	UNL	M	413	12/-	0.77	0.25	32,47,55,58	0
7	DIO	L	310	6/6	0.78	0.27	64,68,73,82	0
5	UNL	L	305	12/-	0.80	0.35	67,78,91,94	0
4	LDA	M	409	16/16	0.80	0.18	34,45,80,83	0
5	UNL	H	303	12/-	0.81	0.20	43,54,70,73	0
6	PO4	H	306	5/5	0.82	0.12	94,105,115,120	0
4	LDA	M	410	16/16	0.82	0.21	48,66,88,98	0
5	UNL	L	306	12/-	0.82	0.27	35,54,67,68	0
6	PO4	M	417	5/5	0.83	0.12	94,102,115,118	0
14	CDL	M	401	81/100	0.83	0.26	58,97,140,158	0
7	DIO	M	418	6/6	0.84	0.28	99,104,105,112	0
5	UNL	H	305	12/-	0.84	0.25	54,66,81,82	0
5	UNL	H	302	12/-	0.84	0.22	53,59,78,82	0
7	DIO	H	307	6/6	0.84	0.24	100,102,102,102	0
4	LDA	M	411	16/16	0.84	0.34	63,106,135,139	0
8	EDO	H	311	4/4	0.86	0.18	58,60,62,63	0
7	DIO	L	309	6/6	0.87	0.21	34,36,40,46	6
9	TRS	L	312	8/8	0.87	0.16	73,77,88,89	0
13	U10	L	304	48/63	0.87	0.24	53,70,84,90	0
5	UNL	H	304	12/-	0.87	0.21	39,53,80,83	0
10	K	H	313	1/1	0.88	0.11	64,64,64,64	0
5	UNL	L	307	10/-	0.88	0.34	53,79,104,107	0
5	UNL	M	415	12/-	0.88	0.28	70,82,90,92	0
5	UNL	M	414	12/-	0.90	0.24	45,66,80,85	0
8	EDO	M	419	4/4	0.91	0.21	60,73,77,78	0
8	EDO	H	310	4/4	0.92	0.15	61,65,68,70	0
4	LDA	H	301	16/16	0.94	0.13	48,58,63,69	0
12	BPH	L	303	65/65	0.95	0.09	25,31,44,51	0
12	BPH	M	404	65/65	0.95	0.12	39,54,101,113	0
8	EDO	H	309	4/4	0.95	0.16	55,56,59,61	0
13	U10	M	406	48/63	0.95	0.12	28,39,57,64	0
4	LDA	M	408	16/16	0.95	0.15	45,55,64,66	0
16	SPN	M	407	43/43	0.96	0.12	30,52,74,78	0
11	BCL	L	301	66/66	0.97	0.09	21,34,65,72	0
11	BCL	L	302	66/66	0.97	0.07	24,32,42,46	0
11	BCL	M	403	66/66	0.97	0.08	19,24,37,41	0
8	EDO	M	420	4/4	0.97	0.12	37,40,46,47	0

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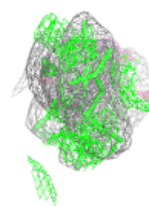
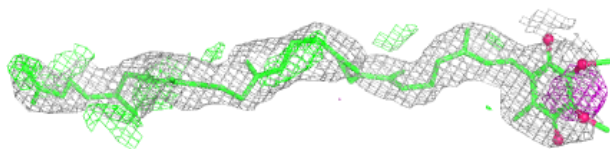
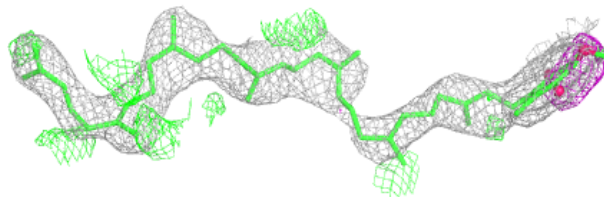
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
12	BPH	M	402	65/65	0.97	0.08	27,33,55,67	0
15	FE	M	405	1/1	1.00	0.01	25,25,25,25	0

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.



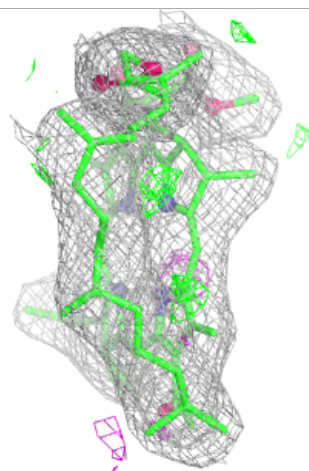
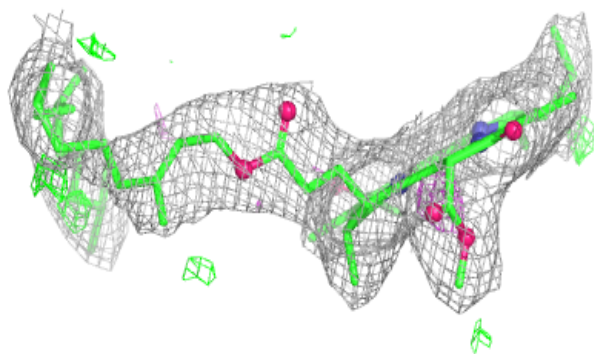
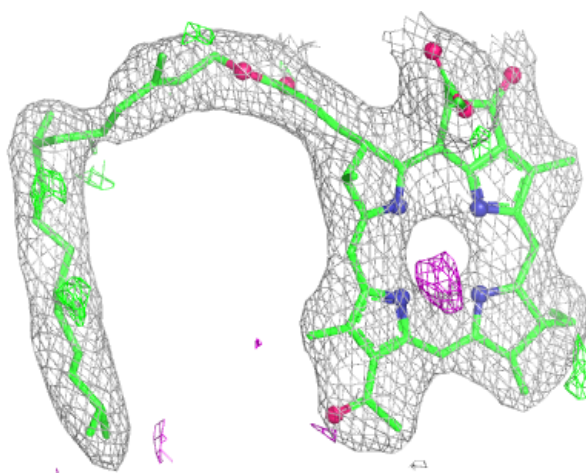
Electron density around U10 L 304:

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



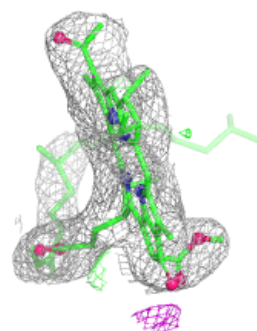
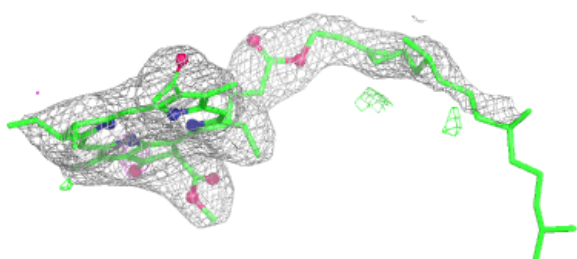
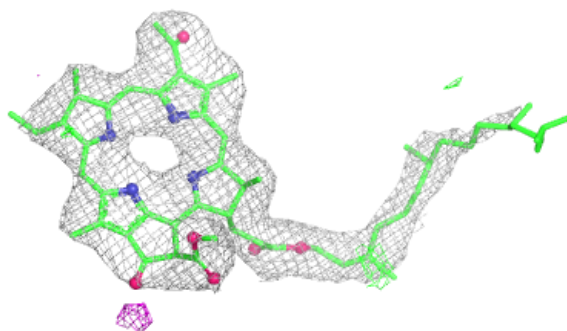
Electron density around BPH L 303:

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

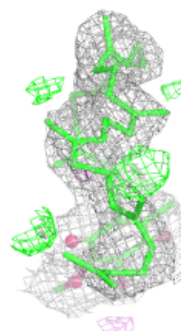
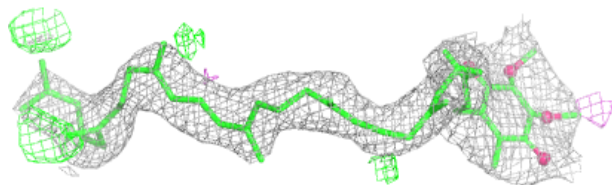
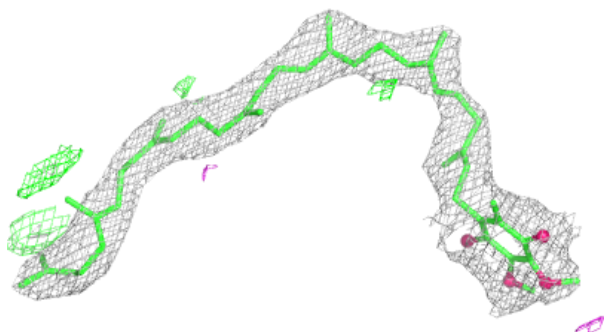


Electron density around BPH M 404:

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

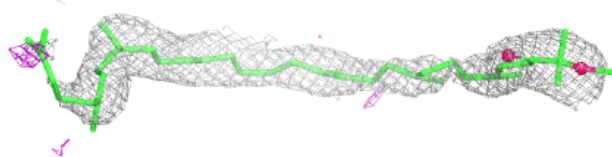
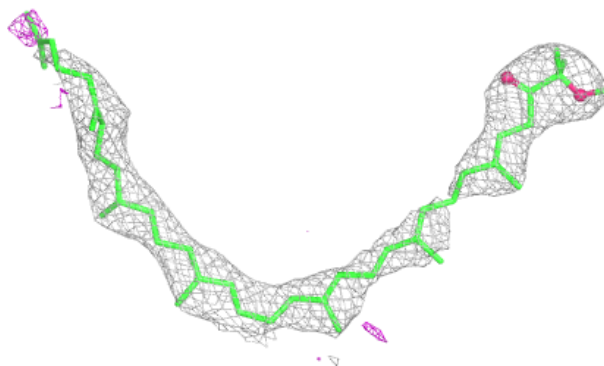
**Electron density around U10 M 406:**

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



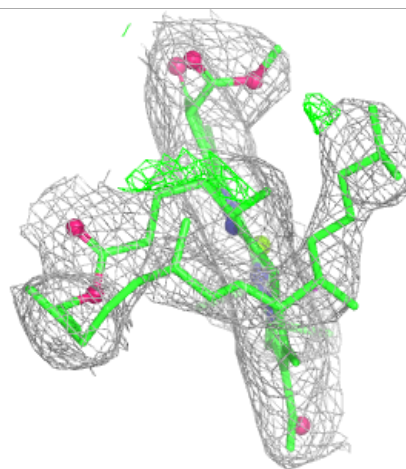
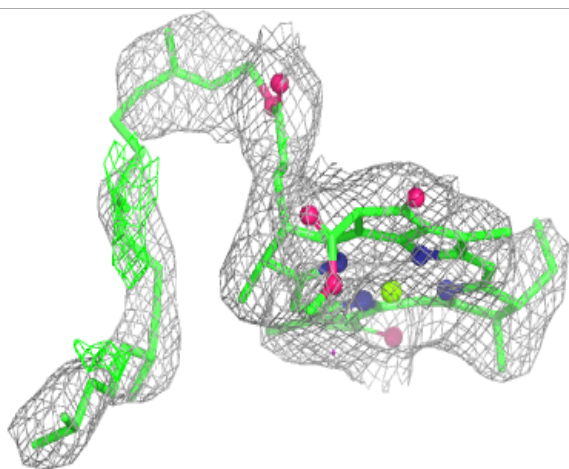
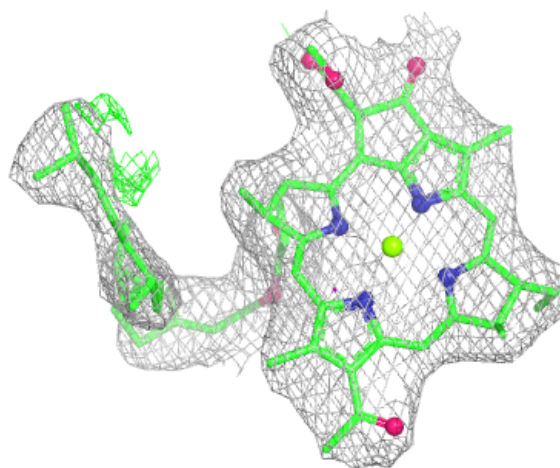
Electron density around SPN M 407:

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and green (positive)



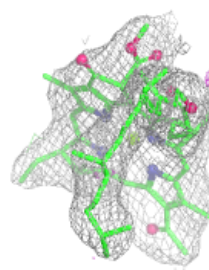
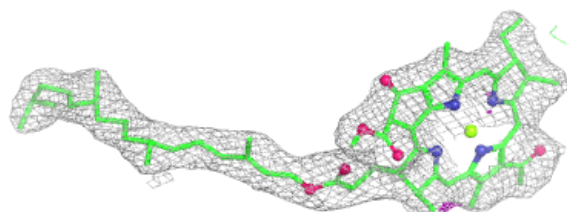
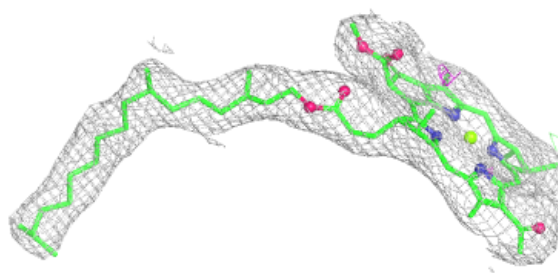
Electron density around BCL L 301:

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



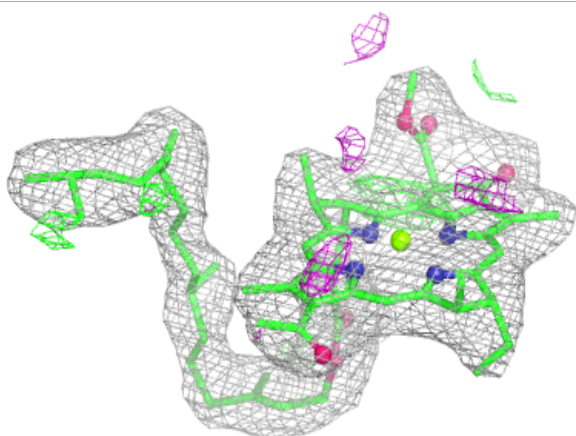
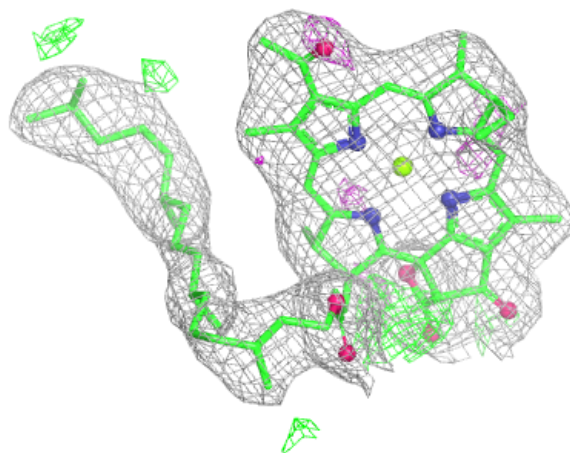
Electron density around BCL L 302:

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



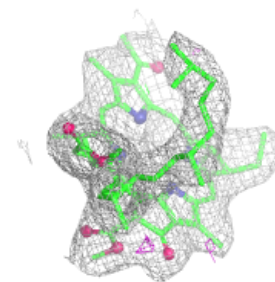
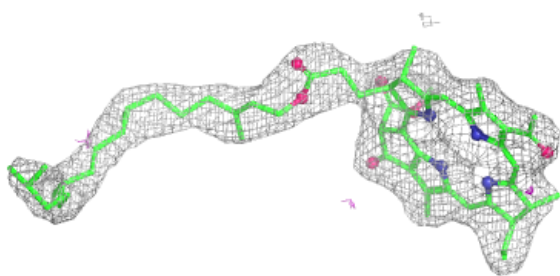
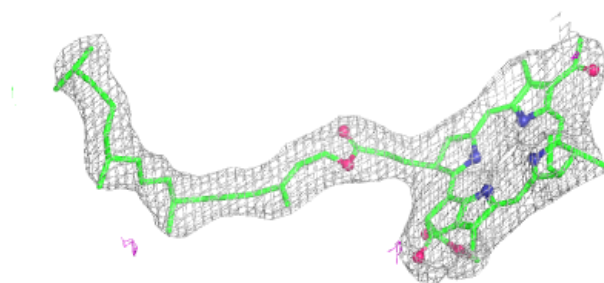
Electron density around BCL M 403:

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



Electron density around BPH M 402:

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



6.5 Other polymers ⓘ

There are no such residues in this entry.