



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 24, 2023 – 08:32 pm BST

PDB ID : 8AKJ
Title : Acyl-enzyme complex of cephalothin bound to deacylation mutant KPC-2 (E166Q)
Authors : Tooke, C.L.; Hinchliffe, P.; Spencer, J.
Deposited on : 2022-07-29
Resolution : 1.35 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 : **FAILED**
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.35
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35

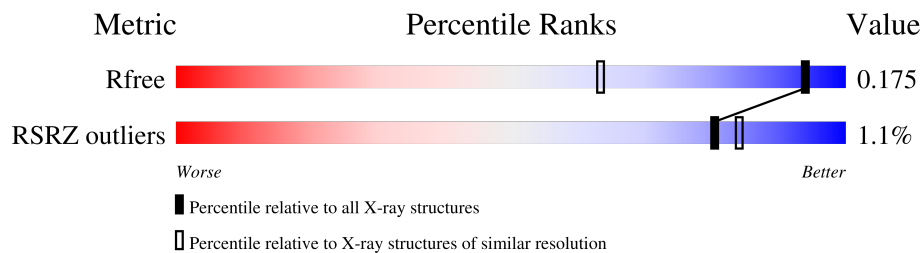
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.35 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}	130704	1509 (1.38-1.34)
RSRZ outliers	127900	1487 (1.38-1.34)

MolProbity failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4636 atoms, of which 2186 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 Carbapenem-hydrolyzing beta-lactamase KPC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	268	4263	1337	2138	378	403	7	0	33	0

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	4	MET	-	initiating methionine	UNP Q9F663
A	5	GLY	-	expression tag	UNP Q9F663
A	6	SER	-	expression tag	UNP Q9F663
A	7	SER	-	expression tag	UNP Q9F663
A	8	HIS	-	expression tag	UNP Q9F663
A	9	HIS	-	expression tag	UNP Q9F663
A	10	HIS	-	expression tag	UNP Q9F663
A	11	HIS	-	expression tag	UNP Q9F663
A	12	HIS	-	expression tag	UNP Q9F663
A	13	HIS	-	expression tag	UNP Q9F663
A	14	SER	-	expression tag	UNP Q9F663
A	15	SER	-	expression tag	UNP Q9F663
A	16	GLY	-	expression tag	UNP Q9F663
A	17	LEU	-	expression tag	UNP Q9F663
A	18	VAL	-	expression tag	UNP Q9F663
A	19	PRO	-	expression tag	UNP Q9F663
A	20	ARG	-	expression tag	UNP Q9F663
A	21	GLY	-	expression tag	UNP Q9F663
A	22	SER	-	expression tag	UNP Q9F663
A	23	HIS	-	expression tag	UNP Q9F663
A	24	MET	-	expression tag	UNP Q9F663
A	166	GLN	GLU	engineered mutation	UNP Q9F663

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



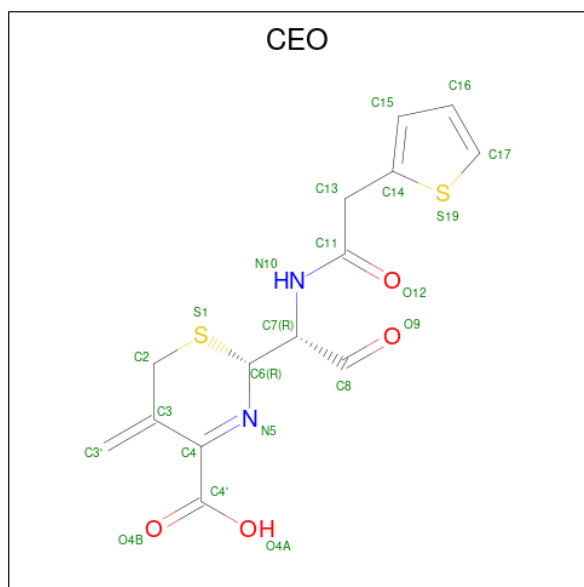
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	0	0
			14	3	8	3		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	0	0
			14	3	8	3		
3	A	1	Total	C	H	O	0	0
			14	3	8	3		

- Molecule 4 is 5-METHYLENE-2-[2-OXO-1-(2-THIOPHEN-2-YL-ACETYLAMINO)-ETHYL]-5,6-DIHYDRO-2H-[1,3]THIAZINE-4-CARBOXYLIC ACID (three-letter code: CEO) (formula: $C_{14}H_{14}N_2O_4S_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
4	A	1	Total	C	H	N	O	S	0	1
			68	28	24	4	8	4		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	248	Total	O	0	0
			248	248		

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3 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	60.51Å 79.58Å 55.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.17 – 1.35 48.17 – 1.35	Depositor EDS
% Data completeness (in resolution range)	98.8 (48.17-1.35) 98.8 (48.17-1.35)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.68 (at 1.35Å)	Xtrriage
Refinement program	PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.150 , 0.178 0.149 , 0.175	Depositor DCC
R_{free} test set	3027 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å ²)	11.6	Xtrriage
Anisotropy	1.043	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 56.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	4636	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.34% 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.

4 Model quality [i](#)

4.1 Standard geometry [i](#)

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4.2 Too-close contacts [i](#)

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4.3 Torsion angles [i](#)

4.3.1 Protein backbone [i](#)

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4.3.2 Protein sidechains [i](#)

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4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

4.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

4.6 Ligand geometry [i](#)

8 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
4	CEO	A	305[A]	1	18,23,23	1.93	4 (22%)	13,31,31	2.00	5 (38%)
2	SO4	A	301	-	4,4,4	0.26	0	6,6,6	0.29	0
3	GOL	A	304	-	5,5,5	1.31	1 (20%)	5,5,5	1.11	0
4	CEO	A	305[B]	1	18,23,23	1.69	4 (22%)	13,31,31	1.86	4 (30%)
2	SO4	A	302	-	4,4,4	0.19	0	6,6,6	0.09	0
2	SO4	A	303	-	4,4,4	0.16	0	6,6,6	0.15	0
3	GOL	A	307	-	5,5,5	1.22	0	5,5,5	0.85	0
3	GOL	A	306	-	5,5,5	0.76	0	5,5,5	0.85	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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	CEO	A	305[A]	1	-	2/9/31/31	0/1/2/2
3	GOL	A	304	-	-	2/4/4/4	-
4	CEO	A	305[B]	1	-	2/9/31/31	0/1/2/2
3	GOL	A	307	-	-	3/4/4/4	-
3	GOL	A	306	-	-	2/4/4/4	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	305[A]	CEO	C4-C4'	5.56	1.60	1.48
4	A	305[B]	CEO	C4-C4'	5.41	1.60	1.48
4	A	305[A]	CEO	C13-C14	-4.37	1.48	1.51
3	A	304	GOL	O2-C2	-2.45	1.36	1.43
4	A	305[B]	CEO	C13-C14	-2.30	1.49	1.51
4	A	305[A]	CEO	C11-N10	2.29	1.38	1.34
4	A	305[A]	CEO	O4A-C4'	-2.21	1.24	1.30
4	A	305[B]	CEO	C11-N10	2.07	1.38	1.34
4	A	305[B]	CEO	O4A-C4'	-2.05	1.24	1.30

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	305[A]	CEO	C2-S1-C6	4.21	102.73	94.47
4	A	305[B]	CEO	C2-S1-C6	3.79	101.91	94.47
4	A	305[A]	CEO	C13-C11-N10	3.56	121.61	115.88
4	A	305[B]	CEO	C13-C11-N10	3.23	121.08	115.88
4	A	305[B]	CEO	O12-C11-N10	-2.53	118.68	122.95
4	A	305[A]	CEO	O4A-C4'-O4B	2.52	129.37	123.61
4	A	305[A]	CEO	O12-C11-N10	-2.39	118.93	122.95
4	A	305[B]	CEO	O4A-C4'-O4B	2.37	129.02	123.61
4	A	305[A]	CEO	O4B-C4'-C4	-2.10	115.33	120.86

There are no chirality outliers.

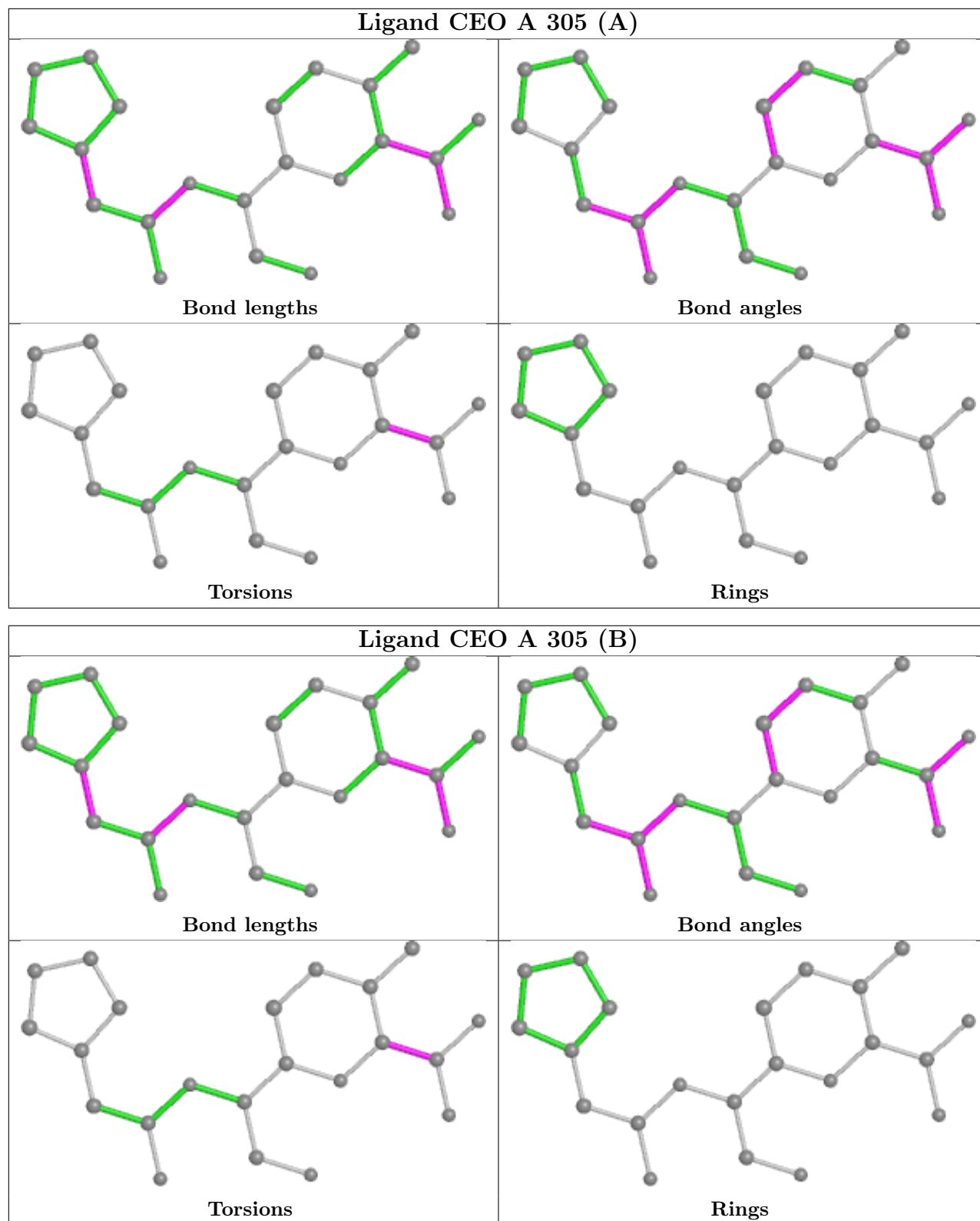
All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	306	GOL	C1-C2-C3-O3
4	A	305[A]	CEO	N5-C4-C4'-O4A
4	A	305[B]	CEO	N5-C4-C4'-O4A
3	A	304	GOL	C1-C2-C3-O3
3	A	307	GOL	O1-C1-C2-C3
3	A	307	GOL	O1-C1-C2-O2
4	A	305[A]	CEO	C3-C4-C4'-O4B
4	A	305[B]	CEO	C3-C4-C4'-O4B
3	A	304	GOL	O2-C2-C3-O3
3	A	306	GOL	O2-C2-C3-O3
3	A	307	GOL	C1-C2-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

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.



4.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

4.8 Polymer linkage issues

There are no chain breaks in this entry.

5 Fit of model and data [i](#)

5.1 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	268/290 (92%)	-0.12	3 (1%) 80 84	9, 15, 32, 58	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	88[A]	ALA	2.9
1	A	105	TRP	2.7
1	A	292	VAL	2.0

5.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.4 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.

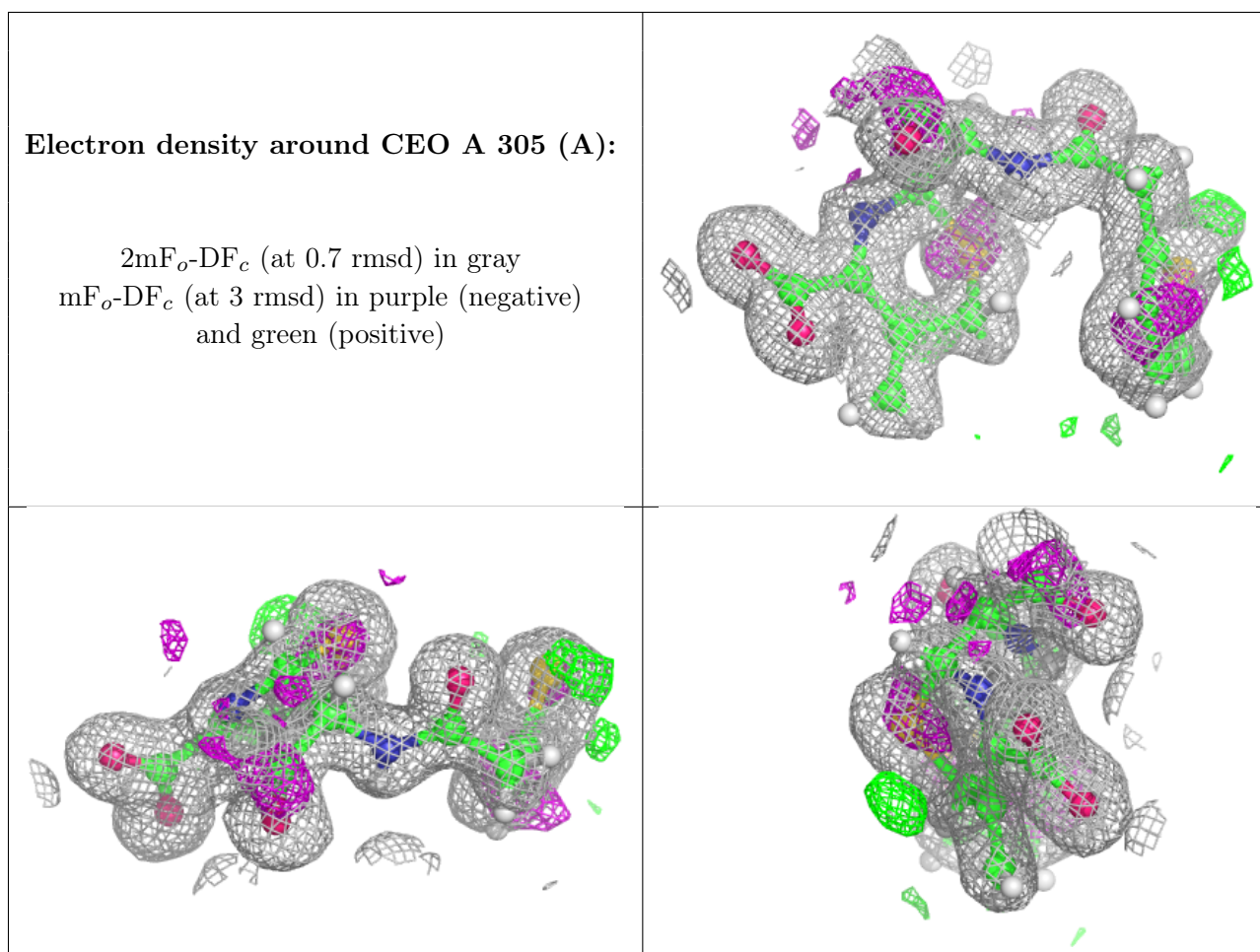
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GOL	A	307	6/6	0.69	0.21	36,44,46,46	0
2	SO4	A	302	5/5	0.77	0.18	42,44,45,45	0
3	GOL	A	306	6/6	0.82	0.14	32,38,39,40	0
3	GOL	A	304	6/6	0.90	0.15	24,29,33,34	0

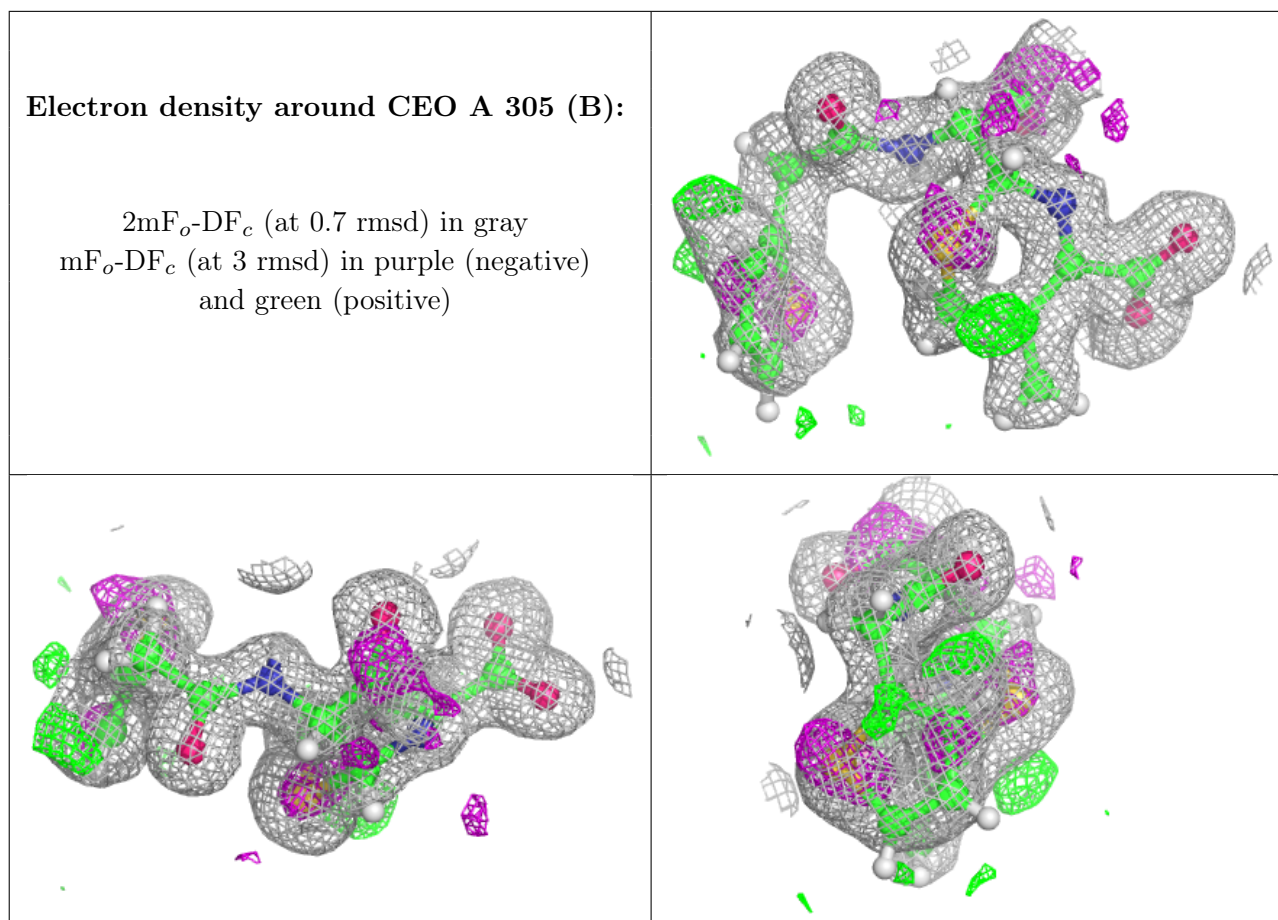
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	CEO	A	305[A]	22/22	0.95	0.10	13,18,26,27	34
4	CEO	A	305[B]	22/22	0.95	0.10	13,19,34,35	34
2	SO4	A	303	5/5	0.97	0.12	54,54,54,55	0
2	SO4	A	301	5/5	0.98	0.07	19,20,20,21	5

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.





5.5 Other polymers [\(i\)](#)

There are no such residues in this entry.