



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 6, 2022 – 09:19 PM EDT

PDB ID : 5SDX
Title : Crystal Structure of human phosphodiesterase 10 in complex with 4-[6-[2-(1-methyl-4-phenylimidazol-2-yl)ethyl]pyridin-2-yl]morpholine
Authors : Joseph, C.; Groebke-Zbinden, K.; Benz, J.; Schlatter, D.; Rudolph, M.G.
Deposited on : 2022-01-21
Resolution : 2.19 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.31.2
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) : 2.31.2

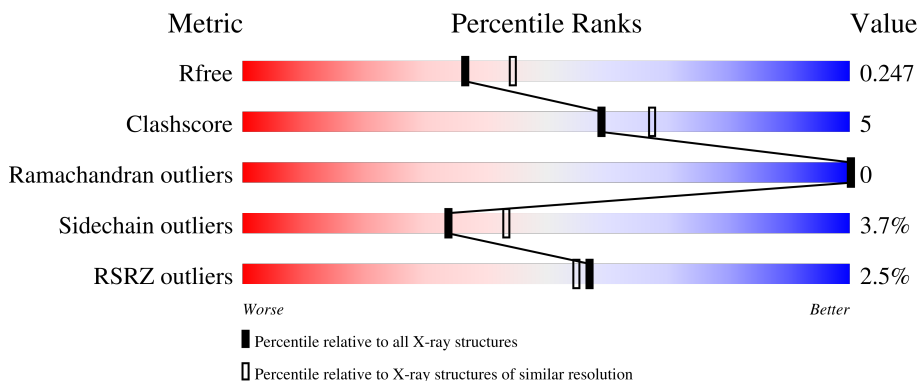
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


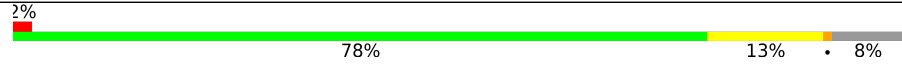
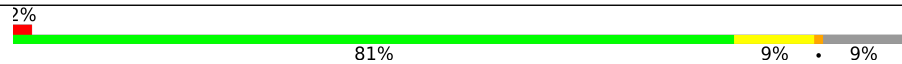

The reported resolution of this entry is 2.19 Å.

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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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

Mol	Chain	Length	Quality of chain
1	A	343	
1	B	343	
1	C	343	
1	D	343	

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
4	IAY	A	803	X	-	-	-
4	IAY	B	803	X	-	-	-
4	IAY	C	803	X	-	-	-
4	IAY	D	803	X	-	-	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 10669 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 cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	313	2549	1629	435	461	24	0	1	0
1	B	315	2559	1635	437	463	24	0	1	0
1	C	313	2549	1629	435	461	24	0	1	0
1	D	310	2519	1612	429	454	24	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	447	GLY	-	expression tag	UNP Q9Y233
A	448	SER	-	expression tag	UNP Q9Y233
B	447	GLY	-	expression tag	UNP Q9Y233
B	448	SER	-	expression tag	UNP Q9Y233
C	447	GLY	-	expression tag	UNP Q9Y233
C	448	SER	-	expression tag	UNP Q9Y233
D	447	GLY	-	expression tag	UNP Q9Y233
D	448	SER	-	expression tag	UNP Q9Y233

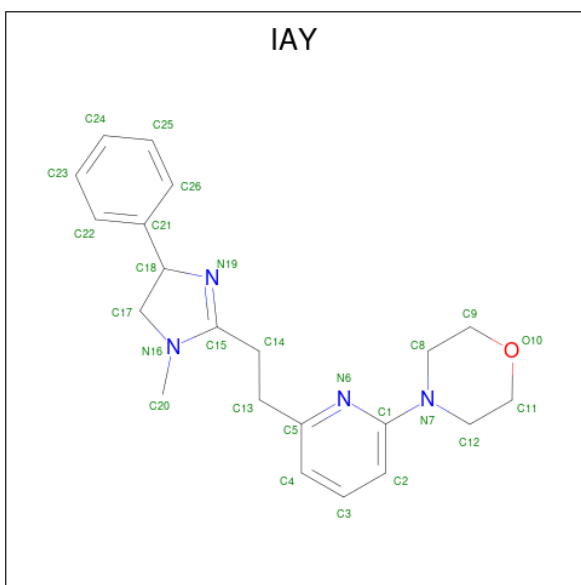
- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Zn 1	0	0
2	B	1	Total 1	Zn 1	0	0
2	C	1	Total 1	Zn 1	0	0
2	D	1	Total 1	Zn 1	0	0

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0
3	B	1	Total Mg 1 1	0	0
3	C	1	Total Mg 1 1	0	0
3	D	1	Total Mg 1 1	0	0

- Molecule 4 is 4-(6-{2-[(4S)-1-methyl-4-phenyl-4,5-dihydro-1H-imidazol-2-yl]ethyl}pyridin-2-yl)morpholine (three-letter code: IAY) (formula: C₂₁H₂₆N₄O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O 26 21 4 1	0	0
4	B	1	Total C N O 26 21 4 1	0	0
4	C	1	Total C N O 26 21 4 1	0	0
4	D	1	Total C N O 26 21 4 1	0	0


- Molecule 5 is water.

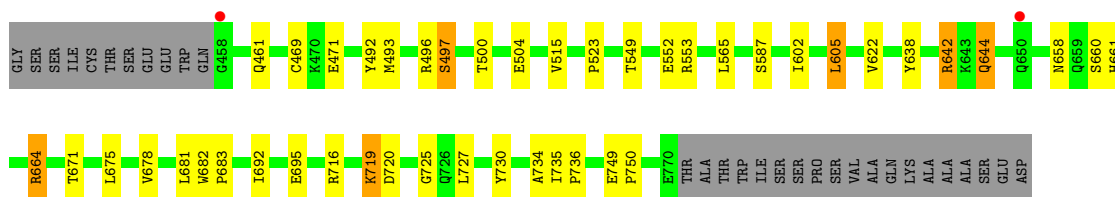
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	105	Total 105	O 105	0	0
5	B	108	Total 108	O 108	0	0
5	C	108	Total 108	O 108	0	0
5	D	60	Total 60	O 60	0	0

3 Residue-property plots [i](#)


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

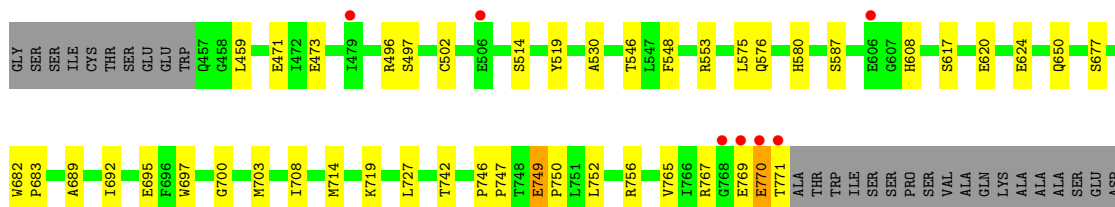
- Molecule 1: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A

Chain A: 




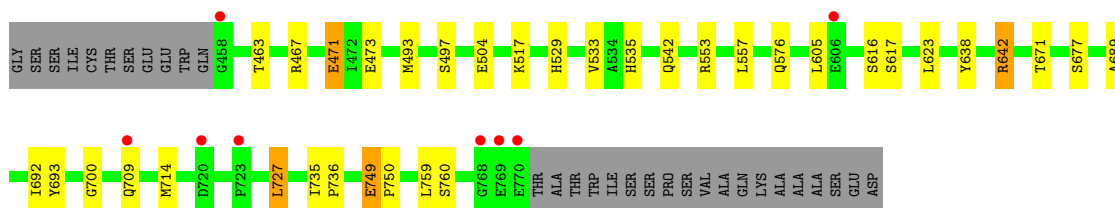
- Molecule 1: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A

Chain B: 




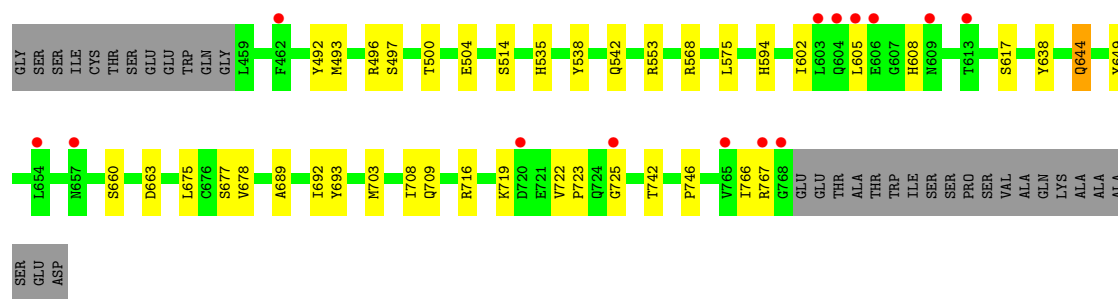
- Molecule 1: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A

Chain C: 



- Molecule 1: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A

Chain D: 



4 Data and refinement statistics i

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	135.38Å 135.38Å 235.36Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	43.68 – 2.19 43.68 – 2.19	Depositor EDS
% Data completeness (in resolution range)	96.3 (43.68-2.19) 96.3 (43.68-2.19)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.37 (at 2.20Å)	Xtrriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.187 , 0.242 0.194 , 0.247	Depositor DCC
R_{free} test set	4122 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	36.9	Xtrriage
Anisotropy	0.005	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 40.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.027 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10669	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.52% 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: MG, CME, ZN, IAY

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	0.83	0/2603	0.94	3/3521 (0.1%)
1	B	0.81	2/2613 (0.1%)	0.95	0/3535
1	C	0.81	1/2603 (0.0%)	0.92	1/3521 (0.0%)
1	D	0.81	0/2570	0.90	0/3478
All	All	0.81	3/10389 (0.0%)	0.93	4/14055 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	695	GLU	CD-OE2	-6.15	1.18	1.25
1	C	473	GLU	CD-OE2	-5.96	1.19	1.25
1	B	624	GLU	CD-OE2	-5.10	1.20	1.25

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	664	ARG	NE-CZ-NH1	5.72	123.16	120.30
1	C	642	ARG	NE-CZ-NH2	-5.57	117.52	120.30
1	A	719	LYS	CB-CA-C	-5.55	99.31	110.40
1	A	642	ARG	NE-CZ-NH2	-5.52	117.54	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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

the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2549	0	2524	27	0
1	B	2559	0	2528	20	0
1	C	2549	0	2524	20	0
1	D	2519	0	2496	29	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	26	0	0	1	0
4	B	26	0	0	0	0
4	C	26	0	0	3	0
4	D	26	0	0	5	0
5	A	105	0	0	1	0
5	B	108	0	0	1	0
5	C	108	0	0	0	0
5	D	60	0	0	2	0
All	All	10669	0	10072	95	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 5.

All (95) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:469:CYS:SG	5:A:993:HOH:O	2.27	0.92
1:D:677:SER:OG	4:D:803:IAY:O10	2.10	0.70
1:A:461:GLN:NE2	1:A:461:GLN:HA	2.09	0.68
1:D:644:GLN:HE21	1:D:644:GLN:HA	1.59	0.67
1:C:677:SER:OG	4:C:803:IAY:O10	2.14	0.66
1:D:693:TYR:OH	4:D:803:IAY:N19	2.31	0.63
1:D:497:SER:HA	1:D:542:GLN:NE2	2.15	0.61
1:B:548:PHE:O	1:B:553:ARG:NH1	2.34	0.60
1:A:735:ILE:HB	1:A:736:PRO:HD3	1.83	0.60
1:A:493:MET:O	1:A:497:SER:HB2	2.02	0.59
1:A:461:GLN:HE22	1:A:500:THR:CG2	2.16	0.59
1:C:700:GLY:HA3	1:C:714:MET:O	2.02	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:493:MET:O	1:D:497:SER:HB3	2.03	0.58
1:B:770:GLU:HG3	1:B:771:THR:N	2.19	0.58
1:D:497:SER:O	1:D:553:ARG:HD2	2.04	0.57
1:A:461:GLN:HE22	1:A:500:THR:HG21	1.71	0.56
1:B:767:ARG:NH2	1:B:769:GLU:OE1	2.39	0.55
1:B:497:SER:O	1:B:553:ARG:HD2	2.06	0.55
1:B:546:THR:HG21	1:D:767:ARG:HH21	1.72	0.54
1:A:523:PRO:HD2	1:A:695:GLU:HG2	1.90	0.53
1:D:497:SER:HA	1:D:542:GLN:HE22	1.72	0.53
1:D:725:GLY:HA3	4:D:803:IAY:C18	2.39	0.53
1:D:594:HIS:ND1	5:D:902:HOH:O	2.34	0.52
1:A:497:SER:O	1:A:553:ARG:HD2	2.10	0.52
1:B:700:GLY:HA3	1:B:714:MET:O	2.09	0.51
1:A:730:TYR:HA	1:A:734:ALA:HB3	1.93	0.51
1:A:644:GLN:HE21	1:A:644:GLN:HA	1.74	0.51
1:A:461:GLN:NE2	1:A:461:GLN:CA	2.74	0.50
1:A:716:ARG:O	1:A:719:LYS:HG3	2.12	0.50
1:D:725:GLY:HA3	4:D:803:IAY:C21	2.41	0.50
1:A:602:ILE:HA	1:A:605:LEU:HD22	1.94	0.49
1:B:752:LEU:HD21	1:B:756[B]:ARG:NH2	2.27	0.49
1:A:492:TYR:CZ	1:A:496:ARG:HD2	2.49	0.47
1:B:742:THR:HG21	1:B:749:GLU:HG2	1.96	0.47
1:D:514:SER:HG	1:D:608:HIS:CD2	2.28	0.47
1:A:549:THR:OG1	1:A:552:GLU:HG3	2.15	0.47
1:C:497:SER:HA	1:C:542:GLN:HE22	1.80	0.47
1:C:638:TYR:CD1	1:C:671:THR:HG21	2.50	0.47
1:D:766:ILE:HG22	1:D:766:ILE:O	2.15	0.47
1:B:697:TRP:CZ2	1:B:719:LYS:HG2	2.49	0.46
1:D:493:MET:SD	1:D:535:HIS:HA	2.55	0.46
1:D:675:LEU:O	1:D:678:VAL:HG22	2.15	0.46
1:B:689:ALA:O	1:B:692:ILE:HG22	2.15	0.46
1:C:693:TYR:OH	4:C:803:IAY:N19	2.49	0.46
1:C:727:LEU:HD22	1:C:759:LEU:HD11	1.96	0.46
1:C:727:LEU:CD2	1:C:759:LEU:CD1	2.94	0.45
1:D:677:SER:OG	4:D:803:IAY:C11	2.64	0.45
1:C:497:SER:OG	1:C:557:LEU:HD11	2.16	0.45
1:B:682:TRP:HB3	1:B:683:PRO:HD3	1.99	0.45
1:A:660:SER:O	1:A:664:ARG:HG3	2.16	0.45
1:B:746:PRO:N	1:B:747:PRO:CD	2.80	0.45
1:B:473:GLU:OE2	1:B:496:ARG:NH1	2.50	0.45
1:A:675:LEU:O	1:A:678:VAL:HG22	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:492:TYR:CZ	1:D:496:ARG:HD2	2.53	0.44
1:C:689:ALA:HA	1:C:692:ILE:HG22	1.99	0.44
1:A:638:TYR:CD1	1:A:671:THR:HG21	2.52	0.44
1:B:514:SER:HG	1:B:608:HIS:CD2	2.33	0.44
1:C:749:GLU:HB3	1:C:750:PRO:HD3	2.00	0.44
1:B:703:MET:HE1	1:B:708:ILE:HG21	1.99	0.43
1:D:535:HIS:O	1:D:538:TYR:HB3	2.19	0.43
1:D:649:TYR:CD2	1:D:649:TYR:C	2.90	0.43
1:D:602:ILE:O	1:D:605:LEU:HB2	2.17	0.43
1:D:663:ASP:OD2	5:D:901:HOH:O	2.21	0.43
1:C:493:MET:SD	1:C:535:HIS:HA	2.58	0.43
1:D:689:ALA:HA	1:D:692:ILE:HG22	2.01	0.43
1:C:497:SER:O	1:C:553:ARG:CD	2.67	0.43
1:C:689:ALA:O	1:C:692:ILE:HG22	2.18	0.43
1:A:658:ASN:O	1:A:661:HIS:HB2	2.18	0.43
1:B:765:VAL:HG22	1:B:770:GLU:HG2	1.99	0.43
1:A:461:GLN:NE2	1:A:500:THR:HG21	2.34	0.42
1:B:575:LEU:HD13	1:B:580:HIS:CB	2.49	0.42
1:D:689:ALA:O	1:D:692:ILE:HG22	2.20	0.42
1:D:497:SER:O	1:D:553:ARG:CD	2.68	0.42
1:A:515:VAL:HG13	1:A:565:LEU:HD21	2.02	0.42
1:B:519:TYR:CZ	1:B:530:ALA:HB2	2.55	0.42
1:C:467:ARG:O	1:C:471:GLU:HB2	2.19	0.42
1:D:722:VAL:N	1:D:723:PRO:CD	2.83	0.42
1:D:742:THR:O	1:D:746:PRO:HA	2.20	0.42
1:C:638:TYR:OH	1:C:642:ARG:HD3	2.19	0.41
1:A:725:GLY:HA3	4:A:803:IAY:C18	2.50	0.41
1:D:568:ARG:HD3	1:D:568:ARG:N	2.35	0.41
1:D:703:MET:HE1	1:D:708:ILE:HG21	2.02	0.41
1:A:461:GLN:CA	1:A:461:GLN:HE21	2.33	0.41
1:A:682:TRP:N	1:A:683:PRO:CD	2.83	0.41
1:B:620:GLU:HG2	5:B:922:HOH:O	2.21	0.41
1:B:749:GLU:N	1:B:750:PRO:CD	2.83	0.41
1:C:529:HIS:O	1:C:533:VAL:HG23	2.21	0.41
1:C:677:SER:OG	4:C:803:IAY:C11	2.69	0.41
1:A:749:GLU:N	1:A:750:PRO:CD	2.83	0.41
1:A:461:GLN:HE22	1:A:500:THR:HG22	1.86	0.40
1:C:623:LEU:HD13	1:C:623:LEU:HA	1.98	0.40
1:A:638:TYR:OH	1:A:642:ARG:HD3	2.22	0.40
1:C:497:SER:HA	1:C:542:GLN:NE2	2.36	0.40
1:C:735:ILE:HB	1:C:736:PRO:HD3	2.04	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:716:ARG:O	1:D:719:LYS:HG3	2.21	0.40

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	311/343 (91%)	301 (97%)	10 (3%)	0	100	100
1	B	313/343 (91%)	301 (96%)	12 (4%)	0	100	100
1	C	311/343 (91%)	300 (96%)	11 (4%)	0	100	100
1	D	307/343 (90%)	295 (96%)	12 (4%)	0	100	100
All	All	1242/1372 (90%)	1197 (96%)	45 (4%)	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	A	282/305 (92%)	271 (96%)	11 (4%)	32	41
1	B	282/305 (92%)	271 (96%)	11 (4%)	32	41
1	C	282/305 (92%)	270 (96%)	12 (4%)	29	36
1	D	279/305 (92%)	271 (97%)	8 (3%)	42	54

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1125/1220 (92%)	1083 (96%)	42 (4%)	34 43

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	471	GLU
1	A	497	SER
1	A	504	GLU
1	A	587	SER
1	A	605	LEU
1	A	622	VAL
1	A	644	GLN
1	A	681	LEU
1	A	692	ILE
1	A	720	ASP
1	A	727	LEU
1	B	459	LEU
1	B	471	GLU
1	B	502	CYS
1	B	576	GLN
1	B	587	SER
1	B	617	SER
1	B	650	GLN
1	B	677	SER
1	B	727	LEU
1	B	749	GLU
1	B	770	GLU
1	C	463	THR
1	C	471	GLU
1	C	504	GLU
1	C	517	LYS
1	C	576	GLN
1	C	605	LEU
1	C	616	SER
1	C	617	SER
1	C	709	GLN
1	C	727	LEU
1	C	749	GLU
1	C	760	SER
1	D	500	THR
1	D	504	GLU
1	D	575	LEU

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Mol	Chain	Res	Type
1	D	617	SER
1	D	638	TYR
1	D	644	GLN
1	D	660	SER
1	D	709	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	461	GLN
1	A	484	ASN
1	A	495	HIS
1	A	542	GLN
1	A	604	GLN
1	A	644	GLN
1	A	743	GLN
1	B	484	ASN
1	B	495	HIS
1	B	542	GLN
1	B	576	GLN
1	B	604	GLN
1	B	650	GLN
1	C	542	GLN
1	C	576	GLN
1	C	604	GLN
1	C	726	GLN
1	C	743	GLN
1	D	484	ASN
1	D	542	GLN
1	D	604	GLN
1	D	644	GLN
1	D	724	GLN
1	D	726	GLN
1	D	743	GLN
1	D	761	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
1	CME	C	509	1	8,9,10	0.53	0	5,9,11	0.85	0
1	CME	B	509	1	8,9,10	0.43	0	5,9,11	0.56	0
1	CME	D	509	1	8,9,10	0.55	0	5,9,11	0.57	0
1	CME	A	509	1	8,9,10	0.60	0	5,9,11	0.94	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
1	CME	C	509	1	-	2/5/8/10	-
1	CME	B	509	1	-	1/5/8/10	-
1	CME	D	509	1	-	1/5/8/10	-
1	CME	A	509	1	-	2/5/8/10	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	509	CME	SD-CE-CZ-OH
1	B	509	CME	SD-CE-CZ-OH
1	C	509	CME	CE-SD-SG-CB
1	C	509	CME	CZ-CE-SD-SG
1	A	509	CME	CZ-CE-SD-SG
1	D	509	CME	CZ-CE-SD-SG

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 8 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
4	IAY	D	803	-	26,29,29	2.22	8 (30%)	35,39,39	3.38	16 (45%)
4	IAY	A	803	-	26,29,29	2.36	6 (23%)	35,39,39	3.59	20 (57%)
4	IAY	B	803	-	26,29,29	2.34	6 (23%)	35,39,39	2.91	12 (34%)
4	IAY	C	803	-	26,29,29	2.00	6 (23%)	35,39,39	3.16	18 (51%)

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
4	IAY	D	803	-	1/1/4/4	6/13/33/33	0/4/4/4
4	IAY	A	803	-	1/1/4/4	6/13/33/33	0/4/4/4
4	IAY	B	803	-	1/1/4/4	5/13/33/33	0/4/4/4
4	IAY	C	803	-	1/1/4/4	4/13/33/33	0/4/4/4

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	803	IAY	C18-N19	-8.57	1.38	1.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	803	IAY	C21-C18	-7.44	1.42	1.51
4	D	803	IAY	C18-N19	-6.94	1.40	1.48
4	B	803	IAY	C18-N19	-6.59	1.40	1.48
4	C	803	IAY	C18-N19	-5.61	1.41	1.48
4	C	803	IAY	C21-C18	-5.06	1.45	1.51
4	D	803	IAY	C21-C18	-4.25	1.46	1.51
4	A	803	IAY	C1-N6	3.92	1.40	1.34
4	A	803	IAY	C21-C18	-3.66	1.47	1.51
4	C	803	IAY	C14-C15	-3.36	1.45	1.49
4	B	803	IAY	C17-N16	-3.30	1.38	1.46
4	D	803	IAY	C2-C1	3.19	1.46	1.39
4	D	803	IAY	C12-N7	-3.02	1.42	1.46
4	A	803	IAY	C4-C5	2.75	1.44	1.38
4	D	803	IAY	C1-N6	2.71	1.38	1.34
4	B	803	IAY	C1-N7	2.69	1.43	1.37
4	A	803	IAY	C17-N16	-2.59	1.39	1.46
4	C	803	IAY	C4-C5	2.58	1.44	1.38
4	C	803	IAY	C2-C1	2.56	1.45	1.39
4	D	803	IAY	C4-C5	2.41	1.44	1.38
4	B	803	IAY	C2-C1	2.31	1.44	1.39
4	A	803	IAY	C2-C1	2.30	1.44	1.39
4	D	803	IAY	C14-C15	-2.29	1.46	1.49
4	B	803	IAY	C14-C15	-2.28	1.46	1.49
4	D	803	IAY	C1-N7	2.22	1.42	1.37
4	C	803	IAY	C17-N16	-2.20	1.40	1.46

All (66) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	803	IAY	C17-C18-C21	12.75	130.35	113.98
4	D	803	IAY	C17-C18-C21	12.26	129.73	113.98
4	B	803	IAY	C21-C18-N19	9.06	126.42	111.76
4	C	803	IAY	C17-C18-C21	8.51	124.90	113.98
4	C	803	IAY	C21-C18-N19	8.06	124.81	111.76
4	B	803	IAY	C17-C18-C21	6.94	122.89	113.98
4	B	803	IAY	C17-C18-N19	6.87	110.65	104.92
4	A	803	IAY	C14-C15-N16	6.56	132.98	122.86
4	C	803	IAY	C17-C18-N19	6.43	110.29	104.92
4	D	803	IAY	C14-C15-N16	6.14	132.33	122.86
4	A	803	IAY	C17-C18-N19	5.74	109.72	104.92
4	D	803	IAY	C21-C18-N19	5.64	120.88	111.76
4	A	803	IAY	C21-C18-N19	4.91	119.70	111.76

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	803	IAY	C12-N7-C8	4.90	122.34	111.52
4	C	803	IAY	O10-C9-C8	4.87	122.51	111.80
4	D	803	IAY	C17-C18-N19	4.85	108.97	104.92
4	C	803	IAY	C1-N6-C5	-4.81	110.64	118.07
4	B	803	IAY	C12-N7-C1	-4.64	109.61	120.39
4	D	803	IAY	C14-C13-C5	4.61	124.84	112.99
4	A	803	IAY	O10-C9-C8	4.52	121.74	111.80
4	D	803	IAY	C12-N7-C1	-4.49	109.96	120.39
4	D	803	IAY	O10-C9-C8	4.41	121.52	111.80
4	A	803	IAY	C11-C12-N7	4.30	117.95	110.02
4	B	803	IAY	C11-C12-N7	4.01	117.42	110.02
4	D	803	IAY	C13-C14-C15	3.95	116.82	111.97
4	A	803	IAY	C2-C1-N7	-3.92	114.67	121.70
4	D	803	IAY	C13-C5-C4	-3.82	114.08	121.58
4	A	803	IAY	C13-C5-N6	3.76	121.55	115.95
4	B	803	IAY	C13-C14-C15	3.75	116.57	111.97
4	C	803	IAY	C4-C5-N6	3.74	127.16	122.41
4	A	803	IAY	O10-C11-C12	3.71	119.97	111.80
4	C	803	IAY	C12-N7-C1	-3.50	112.28	120.39
4	A	803	IAY	C12-N7-C1	-3.48	112.31	120.39
4	A	803	IAY	C13-C5-C4	-3.29	115.13	121.58
4	B	803	IAY	O10-C9-C8	3.28	119.02	111.80
4	C	803	IAY	C11-C12-N7	3.27	116.05	110.02
4	A	803	IAY	C12-N7-C8	3.27	118.73	111.52
4	D	803	IAY	C11-C12-N7	3.18	115.89	110.02
4	A	803	IAY	C13-C14-C15	3.10	115.77	111.97
4	D	803	IAY	C1-N6-C5	-3.06	113.34	118.07
4	D	803	IAY	C13-C5-N6	2.94	120.33	115.95
4	A	803	IAY	C14-C13-C5	2.91	120.47	112.99
4	A	803	IAY	C9-C8-N7	2.84	115.26	110.02
4	C	803	IAY	C8-N7-C1	-2.69	114.13	120.39
4	D	803	IAY	C2-C1-N7	-2.66	116.93	121.70
4	A	803	IAY	N16-C15-N19	-2.62	110.01	114.18
4	B	803	IAY	C26-C21-C22	2.60	121.53	118.29
4	B	803	IAY	C12-N7-C8	2.56	117.16	111.52
4	D	803	IAY	C4-C5-N6	2.50	125.58	122.41
4	A	803	IAY	C3-C4-C5	2.46	122.00	118.93
4	C	803	IAY	C9-O10-C11	2.43	118.02	109.89
4	A	803	IAY	C4-C3-C2	-2.42	116.81	120.25
4	C	803	IAY	C4-C3-C2	-2.38	116.87	120.25
4	A	803	IAY	C1-N6-C5	-2.34	114.46	118.07
4	C	803	IAY	C2-C1-N7	-2.33	117.52	121.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	803	IAY	C14-C13-C5	2.29	118.87	112.99
4	C	803	IAY	C20-N16-C17	2.27	125.49	121.03
4	C	803	IAY	C13-C14-C15	2.27	114.76	111.97
4	B	803	IAY	O10-C11-C12	2.22	116.67	111.80
4	B	803	IAY	C4-C5-N6	2.16	125.16	122.41
4	C	803	IAY	C2-C1-N6	2.15	127.04	123.53
4	C	803	IAY	O10-C11-C12	2.14	116.51	111.80
4	D	803	IAY	C4-C3-C2	-2.09	117.29	120.25
4	A	803	IAY	C2-C1-N6	2.07	126.91	123.53
4	C	803	IAY	C14-C13-C5	2.07	118.30	112.99
4	D	803	IAY	C8-N7-C1	-2.04	115.65	120.39

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	803	IAY	C18
4	B	803	IAY	C18
4	C	803	IAY	C18
4	D	803	IAY	C18

All (21) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	803	IAY	C17-C18-C21-C22
4	A	803	IAY	C17-C18-C21-C26
4	B	803	IAY	C17-C18-C21-C22
4	B	803	IAY	C17-C18-C21-C26
4	C	803	IAY	C17-C18-C21-C22
4	C	803	IAY	C17-C18-C21-C26
4	D	803	IAY	C17-C18-C21-C22
4	D	803	IAY	C17-C18-C21-C26
4	B	803	IAY	N6-C1-N7-C8
4	A	803	IAY	N19-C18-C21-C22
4	B	803	IAY	C2-C1-N7-C8
4	D	803	IAY	C14-C13-C5-N6
4	C	803	IAY	N19-C18-C21-C22
4	A	803	IAY	N6-C1-N7-C8
4	C	803	IAY	N19-C18-C21-C26
4	D	803	IAY	N19-C18-C21-C22
4	D	803	IAY	C14-C13-C5-C4
4	A	803	IAY	C2-C1-N7-C8
4	B	803	IAY	N19-C18-C21-C22

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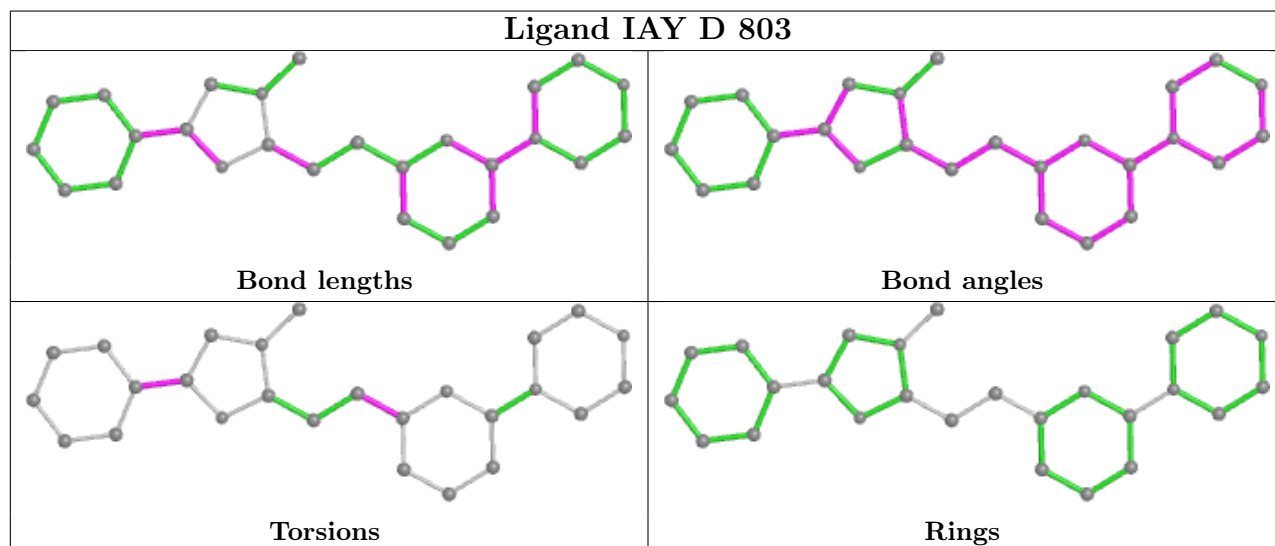
Mol	Chain	Res	Type	Atoms
4	A	803	IAY	N19-C18-C21-C26
4	D	803	IAY	N19-C18-C21-C26

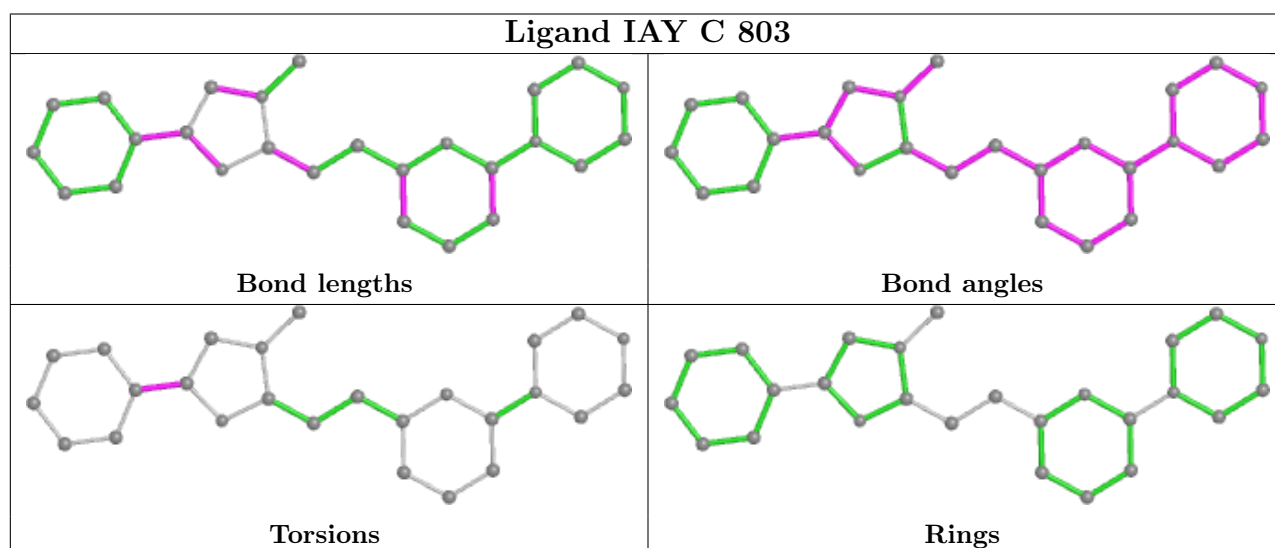
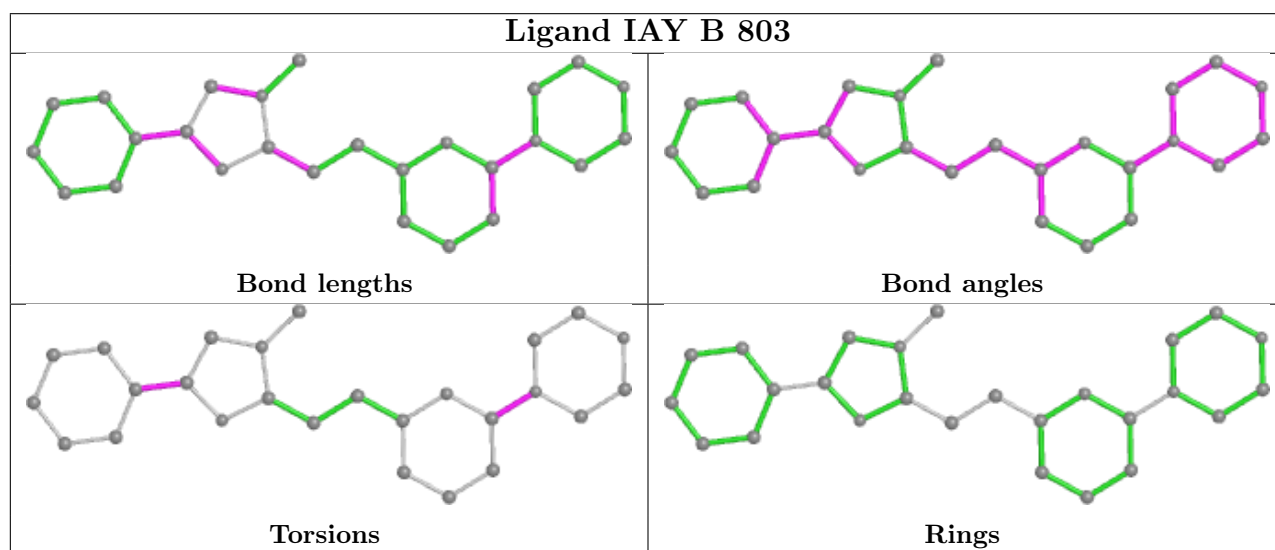
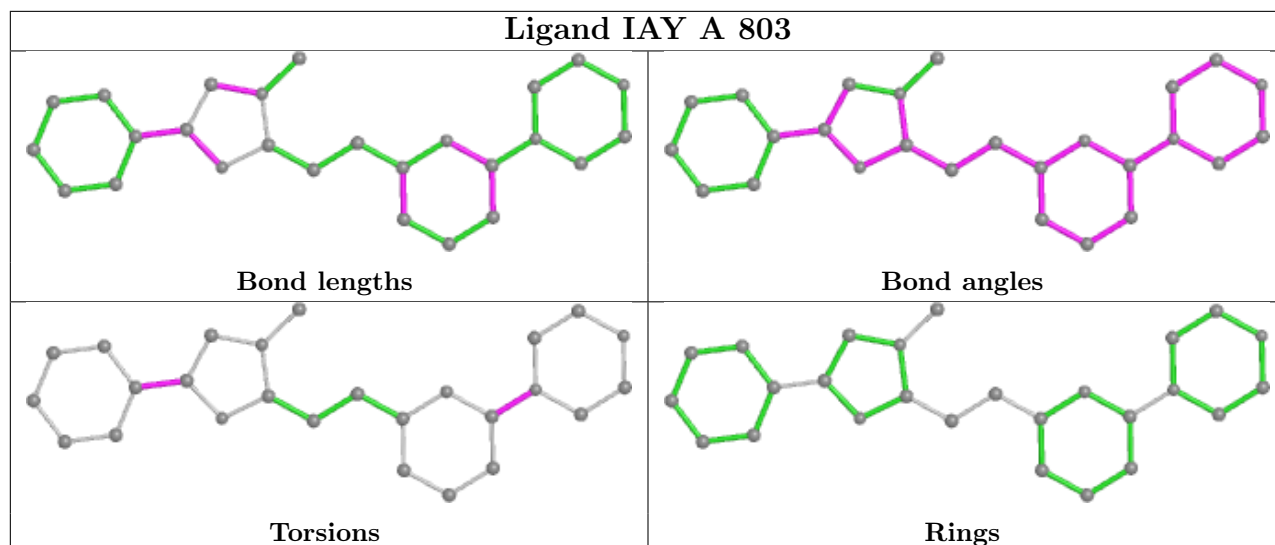
There are no ring outliers.

3 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	803	IAY	5	0
4	A	803	IAY	1	0
4	C	803	IAY	3	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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	312/343 (90%)	-0.13	2 (0%) 89 88	30, 42, 72, 100	0
1	B	314/343 (91%)	-0.01	7 (2%) 62 59	28, 41, 73, 102	0
1	C	312/343 (90%)	-0.29	8 (2%) 56 53	29, 42, 67, 106	0
1	D	309/343 (90%)	0.00	14 (4%) 33 32	36, 52, 76, 102	0
All	All	1247/1372 (90%)	-0.11	31 (2%) 57 55	28, 45, 73, 106	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	771	THR	5.4
1	B	768	GLY	3.5
1	C	769	GLU	3.4
1	C	770	GLU	3.4
1	D	768	GLY	3.1
1	C	768	GLY	3.0
1	B	770	GLU	2.8
1	D	765	VAL	2.7
1	D	654	LEU	2.7
1	B	769	GLU	2.6
1	C	720	ASP	2.5
1	B	606	GLU	2.5
1	D	603	LEU	2.4
1	D	720	ASP	2.4
1	A	458	GLY	2.4
1	D	605	LEU	2.4
1	D	767	ARG	2.4
1	D	604	GLN	2.3
1	D	609	ASN	2.3
1	C	723	PRO	2.2
1	D	613	THR	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	506	GLU	2.2
1	D	462	PHE	2.2
1	D	606	GLU	2.2
1	D	725	GLY	2.2
1	A	650	GLN	2.1
1	B	479	ILE	2.0
1	D	657	ASN	2.0
1	C	458	GLY	2.0
1	C	606	GLU	2.0
1	C	709	GLN	2.0

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	CME	D	509	10/11	0.90	0.16	53,59,99,107	0
1	CME	C	509	10/11	0.93	0.12	47,53,78,81	0
1	CME	B	509	10/11	0.93	0.15	42,52,91,106	0
1	CME	A	509	10/11	0.96	0.11	46,56,81,85	0

6.3 Carbohydrates [i](#)

There are no monosaccharides 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.

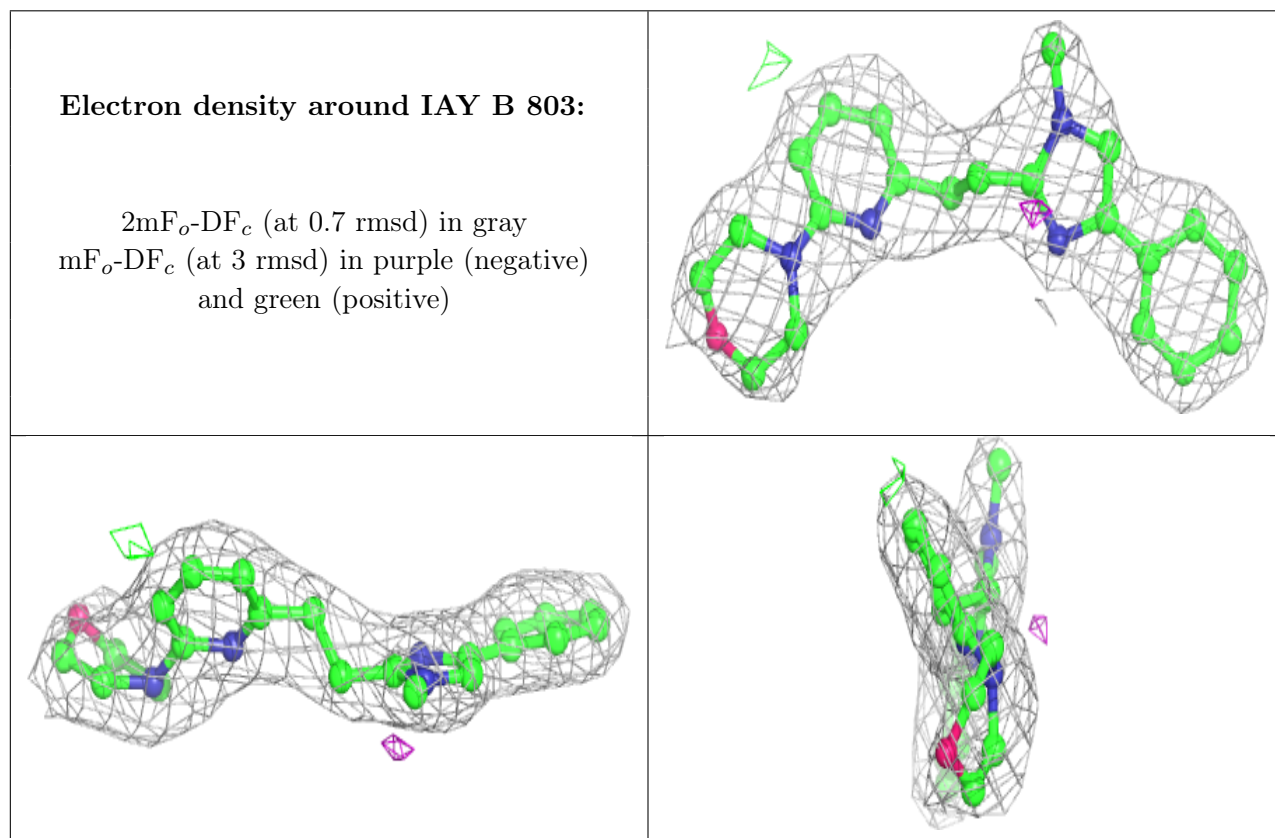
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	IAY	B	803	26/26	0.87	0.15	39,47,72,88	0
4	IAY	D	803	26/26	0.89	0.20	56,64,74,88	0
4	IAY	C	803	26/26	0.90	0.20	48,58,69,82	0
4	IAY	A	803	26/26	0.91	0.13	39,46,61,67	0

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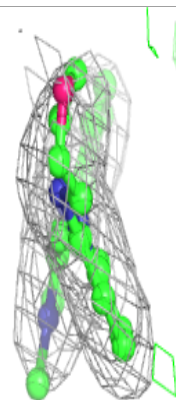
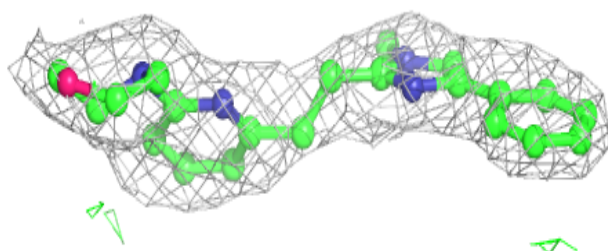
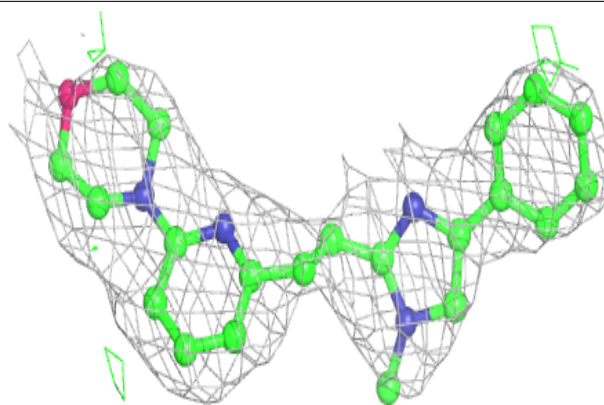
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	MG	D	802	1/1	0.94	0.03	44,44,44,44	0
3	MG	C	802	1/1	0.95	0.07	29,29,29,29	0
3	MG	B	802	1/1	0.96	0.11	25,25,25,25	0
3	MG	A	802	1/1	0.98	0.06	30,30,30,30	0
2	ZN	C	801	1/1	0.99	0.09	37,37,37,37	0
2	ZN	D	801	1/1	0.99	0.09	45,45,45,45	0
2	ZN	A	801	1/1	1.00	0.11	36,36,36,36	0
2	ZN	B	801	1/1	1.00	0.11	35,35,35,35	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.

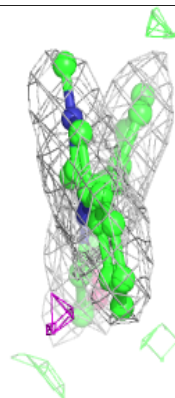
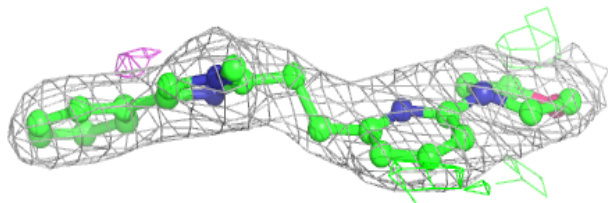
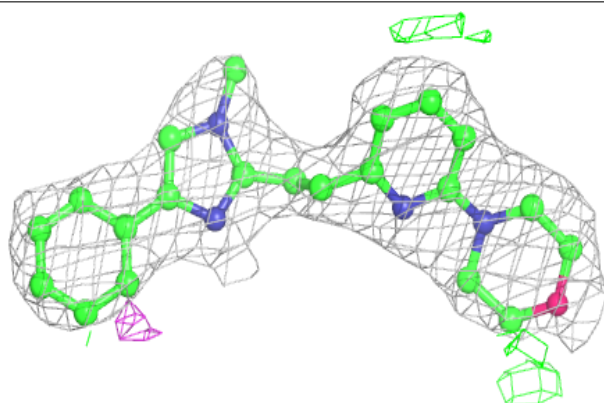


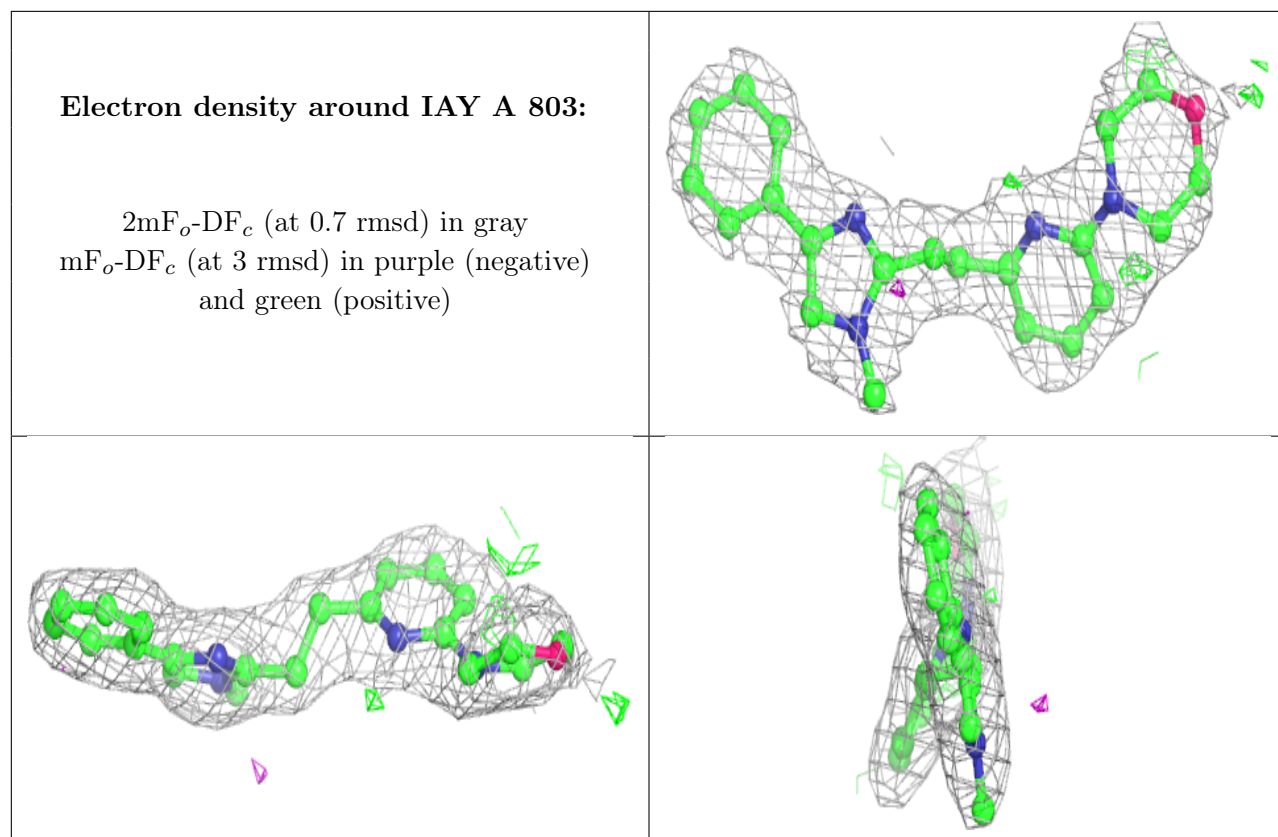
Electron density around IAY D 803:

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

**Electron density around IAY C 803:**

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





6.5 Other polymers [i](#)

There are no such residues in this entry.