



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:46 AM UTC

PDB ID : 4Q32 / pdb_00004q32
Title : Crystal Structure of Inosine 5'-monophosphate Dehydrogenase from Clostridium perfringens Complexed with IMP and C91
Authors : Maltseva, N.; Kim, Y.; Makowska-Grzyska, M.; Mulligan, R.; Gu, M.; Zhang, M.; Mandapati, K.; Gollapalli, D.R.; Gorla, S.K.; Hedstrom, L.; Anderson, W.F.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2014-04-10
Resolution : 2.79 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	:	4-5-2 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	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)

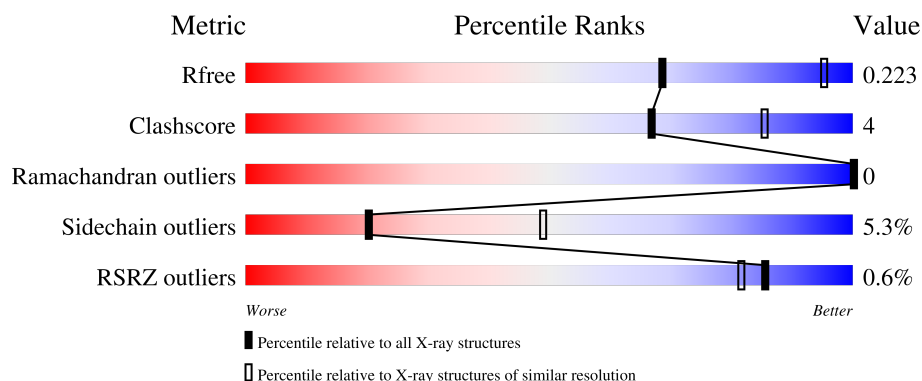
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.79 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	5248 (2.80-2.76)
Clashscore	190562	5693 (2.80-2.76)
Ramachandran outliers	187476	5590 (2.80-2.76)
Sidechain outliers	187428	5592 (2.80-2.76)
RSRZ outliers	180081	5251 (2.80-2.76)

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	363	
1	B	363	
1	C	363	

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Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
 Validation Pipeline (wwPDB-VP) : 2.49

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Mol	Chain	Length	Quality of chain
1	D	363	% 80% 12% • 7%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10326 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 Inosine-5'-monophosphate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	337	Total	C	N	O	S	0	0	0
			2476	1553	427	477	19			
1	B	341	Total	C	N	O	S	0	2	0
			2527	1585	440	483	19			
1	C	341	Total	C	N	O	S	0	2	0
			2529	1589	434	487	19			
1	D	339	Total	C	N	O	S	0	2	0
			2505	1572	431	483	19			

There are 24 discrepancies between the modelled and reference sequences:

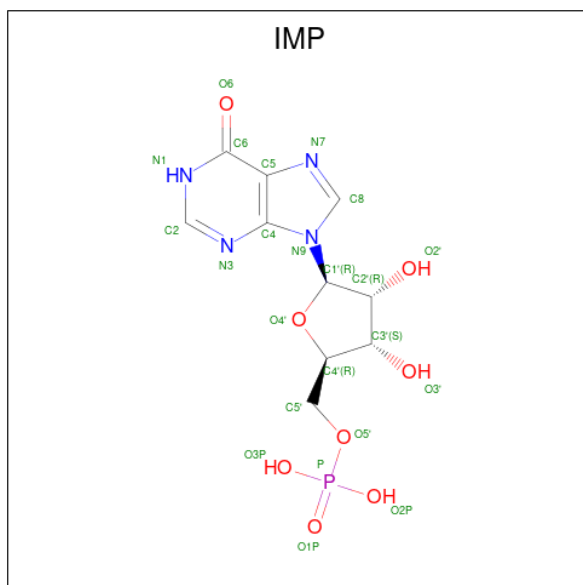
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q0TN42
A	-1	ASN	-	expression tag	UNP Q0TN42
A	0	ALA	-	expression tag	UNP Q0TN42
A	89	SER	-	linker	UNP Q0TN42
A	90	GLY	-	linker	UNP Q0TN42
A	91	GLY	-	linker	UNP Q0TN42
B	-2	SER	-	expression tag	UNP Q0TN42
B	-1	ASN	-	expression tag	UNP Q0TN42
B	0	ALA	-	expression tag	UNP Q0TN42
B	89	SER	-	linker	UNP Q0TN42
B	90	GLY	-	linker	UNP Q0TN42
B	91	GLY	-	linker	UNP Q0TN42
C	-2	SER	-	expression tag	UNP Q0TN42
C	-1	ASN	-	expression tag	UNP Q0TN42
C	0	ALA	-	expression tag	UNP Q0TN42
C	89	SER	-	linker	UNP Q0TN42
C	90	GLY	-	linker	UNP Q0TN42
C	91	GLY	-	linker	UNP Q0TN42
D	-2	SER	-	expression tag	UNP Q0TN42
D	-1	ASN	-	expression tag	UNP Q0TN42
D	0	ALA	-	expression tag	UNP Q0TN42

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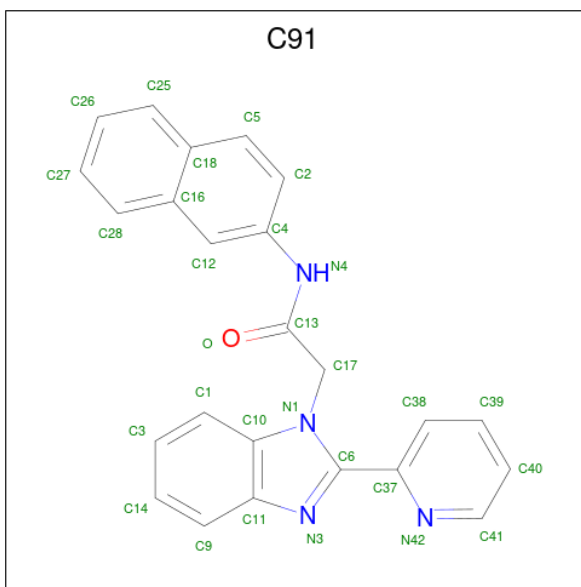
Chain	Residue	Modelled	Actual	Comment	Reference
D	89	SER	-	linker	UNP Q0TN42
D	90	GLY	-	linker	UNP Q0TN42
D	91	GLY	-	linker	UNP Q0TN42

- Molecule 2 is INOSINIC ACID (CCD ID: IMP) (formula: $C_{10}H_{13}N_4O_8P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			23	10	4	8	1		
2	B	1	Total	C	N	O	P	0	0
			23	10	4	8	1		
2	C	1	Total	C	N	O	P	0	0
			23	10	4	8	1		
2	D	1	Total	C	N	O	P	0	0
			23	10	4	8	1		

- Molecule 3 is N-(naphthalen-2-yl)-2-[2-(pyridin-2-yl)-1H-benzimidazol-1-yl]acetamide (CCD ID: C91) (formula: $C_{24}H_{18}N_4O$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			29	24	4	1		
3	A	1	Total	C	N	O	0	0
			29	24	4	1		
3	B	1	Total	C	N	O	0	0
			29	24	4	1		
3	D	1	Total	C	N	O	0	0
			29	24	4	1		

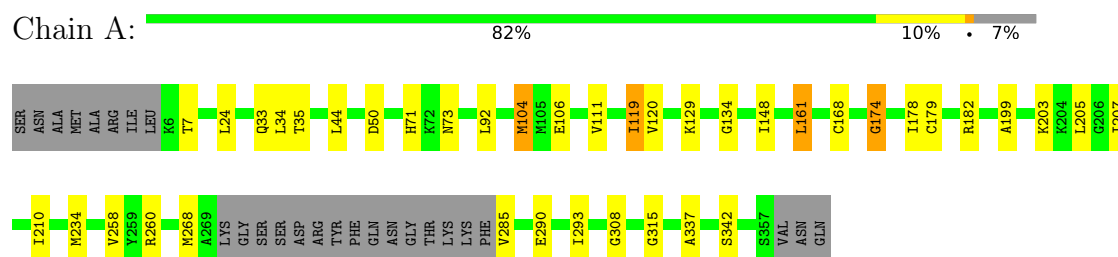
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	18	Total	O	0	0
			18	18		
4	B	15	Total	O	0	0
			15	15		
4	C	23	Total	O	0	0
			23	23		
4	D	25	Total	O	0	0
			25	25		

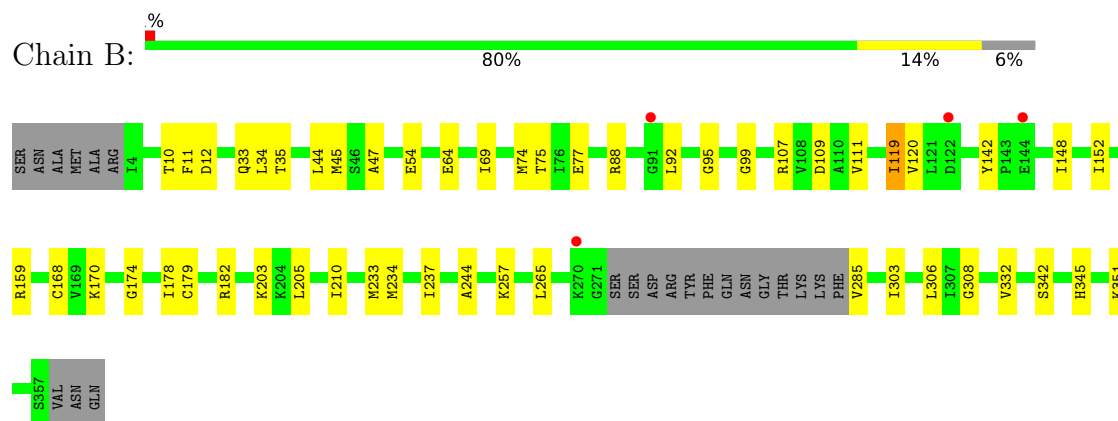
3 Residue-property plots [i](#)

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.

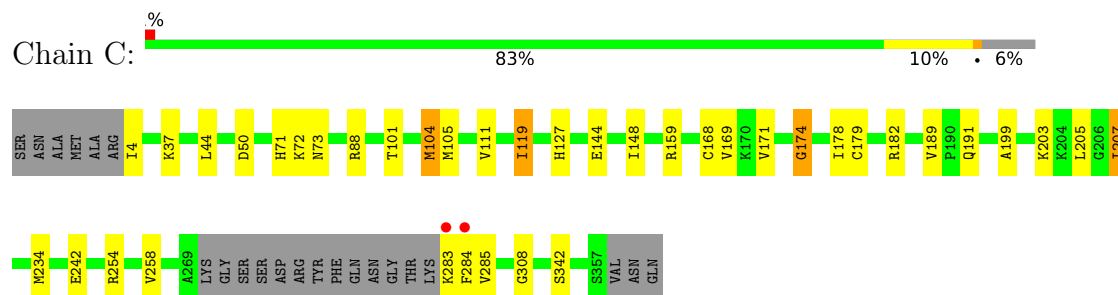
- Molecule 1: Inosine-5'-monophosphate dehydrogenase



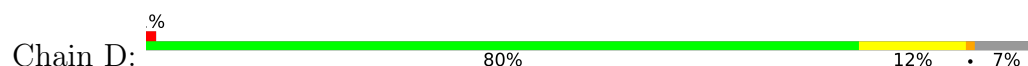
- Molecule 1: Inosine-5'-monophosphate dehydrogenase

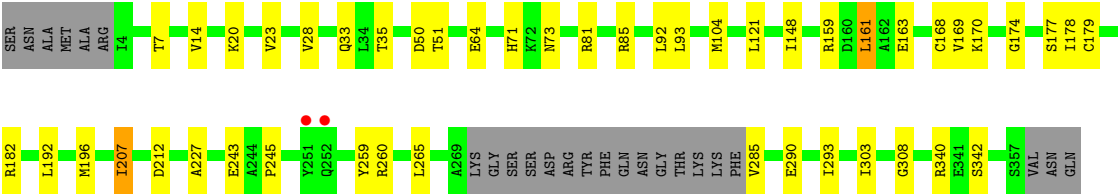


- Molecule 1: Inosine-5'-monophosphate dehydrogenase



- Molecule 1: Inosine-5'-monophosphate dehydrogenase





4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	77.61Å 77.61Å 222.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.71 – 2.79 34.71 – 2.79	Depositor EDS
% Data completeness (in resolution range)	99.4 (34.71-2.79) 99.4 (34.71-2.79)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtriage
Refinement program	PHENIX (phenix.refine: dev_1593)	Depositor
R, R_{free}	0.173 , 0.223 0.178 , 0.223	Depositor DCC
R_{free} test set	1652 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	(Not available)	Xtriage
Anisotropy	(Not available)	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 30.2	EDS
L-test for twinning ¹	$\langle L \rangle =$ (Not available), $\langle L^2 \rangle =$ (Not available)	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10326	wwPDB-VP
Average B, all atoms (Å ²)	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *(Not available)*

¹Theoretical 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: IMP, C91

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	0.31	0/2508	0.74	2/3385 (0.1%)
1	B	0.31	0/2559	0.71	0/3451
1	C	0.31	0/2562	0.75	2/3457 (0.1%)
1	D	0.31	0/2537	0.74	2/3425 (0.1%)
All	All	0.31	0/10166	0.74	6/13718 (0.0%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	174	GLY	CA-C-N	-7.75	111.51	120.89
1	C	174	GLY	C-N-CA	-7.75	111.51	120.89
1	A	174	GLY	CA-C-N	-6.81	112.69	120.04
1	A	174	GLY	C-N-CA	-6.81	112.69	120.04
1	D	174	GLY	CA-C-N	-6.59	112.99	119.64
1	D	174	GLY	C-N-CA	-6.59	112.99	119.64

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	2476	0	2534	21	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2527	0	2596	25	0
1	C	2529	0	2586	19	0
1	D	2505	0	2566	23	0
2	A	23	0	11	1	0
2	B	23	0	11	1	0
2	C	23	0	11	0	0
2	D	23	0	11	2	0
3	A	58	0	36	2	0
3	B	29	0	18	0	0
3	D	29	0	18	0	0
4	A	18	0	0	0	0
4	B	15	0	0	0	0
4	C	23	0	0	0	0
4	D	25	0	0	1	0
All	All	10326	0	10398	76	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 4.

All (76) 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:C:148:ILE:HG12	1:C:168:CYS:HB3	1.71	0.72
1:D:148:ILE:HG12	1:D:168:CYS:HB3	1.74	0.69
1:A:308:GLY:HA3	1:B:285:VAL:HG21	1.78	0.66
1:B:308:GLY:HA3	1:D:285:VAL:HG21	1.78	0.66
1:D:51[A]:THR:HG21	1:D:259:TYR:HA	1.83	0.60
1:A:285:VAL:HG21	1:C:308:GLY:HA3	1.85	0.58
1:C:111:VAL:HG21	1:C:119:ILE:HD11	1.85	0.57
1:A:44:LEU:HD22	1:A:234:MET:HE1	1.85	0.56
1:B:47:ALA:HA	1:B:233:MET:HE2	1.88	0.55
1:A:104:MET:HE1	1:A:134:GLY:HA2	1.88	0.55
1:A:205:LEU:HB2	1:A:207:ILE:HG22	1.90	0.54
1:B:44:LEU:HD22	1:B:234:MET:HE1	1.90	0.54
1:C:44:LEU:HD22	1:C:234:MET:HE1	1.90	0.53
1:B:237:ILE:HG21	1:B:306:LEU:HD11	1.90	0.53
1:D:81:ARG:HE	1:D:85:ARG:NH2	2.07	0.53
1:D:64:GLU:HG2	1:D:303:ILE:HG13	1.91	0.52
1:C:285:VAL:HG21	1:D:308:GLY:HA3	1.90	0.51
1:A:182:ARG:HD2	1:C:342:SER:HA	1.92	0.51
1:B:174:GLY:HA3	1:B:182:ARG:NE	2.26	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:244:ALA:O	1:B:257:LYS:NZ	2.43	0.51
1:B:45:MET:HG3	1:B:233:MET:HG3	1.92	0.50
1:A:50:ASP:HA	1:A:71:HIS:CD2	2.46	0.50
1:A:315:GLY:C	3:A:403:C91:H4	2.36	0.50
1:B:109:ASP:OD1	1:B:142:TYR:OH	2.28	0.50
1:D:179:CYS:SG	2:D:502:IMP:H2	2.52	0.50
1:D:260:ARG:HB3	1:D:290:GLU:HG3	1.93	0.49
1:B:111:VAL:HG21	1:B:119:ILE:HD11	1.94	0.49
1:B:159[A]:ARG:HG3	1:B:205:LEU:HD11	1.95	0.48
1:B:33:GLN:HG3	1:B:35:THR:O	2.14	0.48
1:B:345:HIS:O	1:D:177:SER:HB2	2.14	0.47
1:D:159:ARG:NH1	1:D:163:GLU:OE2	2.47	0.47
1:A:111:VAL:HG21	1:A:119:ILE:HD11	1.96	0.47
1:D:169:VAL:HG13	1:D:207:ILE:HD11	1.96	0.47
1:A:199:ALA:O	1:A:203:LYS:HG2	2.15	0.47
1:B:74:MET:O	1:B:107[A]:ARG:NH1	2.47	0.47
1:B:64:GLU:HG2	1:B:303:ILE:HG13	1.96	0.47
1:B:99:GLY:H	1:B:107[B]:ARG:HH11	1.62	0.46
1:B:342:SER:HA	1:D:182:ARG:HD2	1.98	0.46
1:B:351:LYS:HB2	1:D:290:GLU:HB3	1.96	0.46
1:A:106:GLU:N	1:A:106:GLU:OE1	2.49	0.46
1:D:33:GLN:HG3	1:D:35:THR:O	2.16	0.45
1:A:148:ILE:HG12	1:A:168:CYS:HB3	1.97	0.45
1:C:199:ALA:O	1:C:203:LYS:HG2	2.17	0.45
1:C:182:ARG:NH2	1:C:189:VAL:O	2.50	0.44
1:D:51[A]:THR:O	1:D:245:PRO:HD2	2.17	0.44
1:C:159:ARG:HG2	1:C:205:LEU:HD11	2.00	0.44
1:D:196:MET:HG2	1:D:227:ALA:HB1	2.00	0.44
1:A:161:LEU:HD12	1:A:161:LEU:HA	1.81	0.44
1:A:34:LEU:HD11	1:A:210:ILE:HD11	2.00	0.43
1:A:337:ALA:HB1	1:B:12:ASP:HB2	2.00	0.43
1:C:191:GLN:HB3	4:D:625:HOH:O	2.18	0.43
1:A:268:MET:HE2	3:A:402:C91:C1	2.48	0.43
1:D:161:LEU:HD23	1:D:169:VAL:HG12	2.00	0.43
1:C:174:GLY:HA2	1:C:179:CYS:SG	2.58	0.43
1:A:260:ARG:HB3	1:A:290:GLU:HG3	1.99	0.43
1:A:342:SER:HA	1:B:182:ARG:HD2	2.00	0.43
1:B:170:LYS:HG3	1:B:210:ILE:HB	2.01	0.43
1:A:33:GLN:HG3	1:A:35:THR:O	2.19	0.42
1:C:254:ARG:HA	1:C:254:ARG:HD2	1.95	0.42
1:B:148:ILE:HG12	1:B:168:CYS:HB3	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:10:THR:OG1	1:B:11:PHE:N	2.52	0.42
1:C:104:MET:HG3	1:C:105:MET:N	2.34	0.41
1:D:64:GLU:HG2	1:D:303:ILE:HG21	2.02	0.41
1:B:179:CYS:SG	2:B:500:IMP:H2	2.60	0.41
1:C:50:ASP:HA	1:C:71:HIS:CD2	2.55	0.41
1:D:212:ASP:OD2	2:D:502:IMP:O2'	2.30	0.41
1:A:174:GLY:HA3	1:A:182:ARG:HE	1.86	0.41
1:A:179:CYS:SG	2:A:401:IMP:H2	2.61	0.41
1:C:37:LYS:NZ	1:C:144:GLU:OE1	2.54	0.41
1:C:127:HIS:CE1	1:D:20:LYS:HB2	2.56	0.41
1:D:243:GLU:OE1	1:D:243:GLU:N	2.53	0.41
1:D:50:ASP:HA	1:D:71:HIS:CD2	2.56	0.40
1:B:69:ILE:HD13	1:B:95:GLY:HA3	2.03	0.40
1:C:119:ILE:HD13	1:C:119:ILE:HA	1.84	0.40
1:C:169:VAL:HG23	1:C:207:ILE:HD11	2.03	0.40
1:C:182:ARG:HD2	1:D:342:SER:HA	2.03	0.40

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	333/363 (92%)	323 (97%)	10 (3%)	0	100	100
1	B	339/363 (93%)	328 (97%)	11 (3%)	0	100	100
1	C	339/363 (93%)	329 (97%)	10 (3%)	0	100	100
1	D	337/363 (93%)	329 (98%)	8 (2%)	0	100	100
All	All	1348/1452 (93%)	1309 (97%)	39 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	260/282 (92%)	248 (95%)	12 (5%)	24	55
1	B	265/282 (94%)	252 (95%)	13 (5%)	22	52
1	C	266/282 (94%)	252 (95%)	14 (5%)	20	49
1	D	264/282 (94%)	247 (94%)	17 (6%)	16	41
All	All	1055/1128 (94%)	999 (95%)	56 (5%)	20	49

All (56) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	THR
1	A	24	LEU
1	A	73	ASN
1	A	92	LEU
1	A	104	MET
1	A	119	ILE
1	A	120	VAL
1	A	129	LYS
1	A	161	LEU
1	A	178	ILE
1	A	258	VAL
1	A	293	ILE
1	B	34	LEU
1	B	54	GLU
1	B	75	THR
1	B	77	GLU
1	B	88	ARG
1	B	92	LEU
1	B	119	ILE
1	B	120	VAL
1	B	152	ILE
1	B	178	ILE
1	B	203	LYS
1	B	265	LEU

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Mol	Chain	Res	Type
1	B	332	VAL
1	C	4	ILE
1	C	72	LYS
1	C	73	ASN
1	C	88	ARG
1	C	101	THR
1	C	104	MET
1	C	119	ILE
1	C	171	VAL
1	C	178	ILE
1	C	207	ILE
1	C	242	GLU
1	C	258	VAL
1	C	283	LYS
1	C	284	PHE
1	D	7	THR
1	D	14	VAL
1	D	23	VAL
1	D	28	VAL
1	D	73	ASN
1	D	92	LEU
1	D	93	LEU
1	D	104	MET
1	D	121	LEU
1	D	161	LEU
1	D	170	LYS
1	D	178	ILE
1	D	192	LEU
1	D	207	ILE
1	D	265	LEU
1	D	293	ILE
1	D	340	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	33	GLN
1	A	73	ASN
1	A	324	ASN
1	B	33	GLN
1	B	146	GLN
1	B	324	ASN

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Mol	Chain	Res	Type
1	C	334	GLN
1	D	39	GLN
1	D	127	HIS
1	D	305	GLN
1	D	328	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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	$\# Z > 2$
3	C91	A	403	-	33,33,33	1.97	12 (36%)	46,46,46	1.62	10 (21%)
3	C91	A	402	-	33,33,33	2.01	11 (33%)	46,46,46	1.59	9 (19%)
3	C91	B	501	-	33,33,33	2.01	12 (36%)	46,46,46	1.58	9 (19%)
3	C91	D	501	-	33,33,33	2.01	12 (36%)	46,46,46	1.57	9 (19%)
2	IMP	A	401	-	25,25,25	1.11	1 (4%)	37,38,38	2.04	9 (24%)
2	IMP	D	502	-	25,25,25	1.09	1 (4%)	37,38,38	2.02	10 (27%)
2	IMP	C	500	-	25,25,25	1.10	1 (4%)	37,38,38	2.02	9 (24%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	IMP	B	500	-	25,25,25	1.09	1 (4%)	37,38,38	2.02	10 (27%)

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
3	C91	A	403	-	-	0/12/12/12	0/5/5/5
3	C91	A	402	-	-	0/12/12/12	0/5/5/5
3	C91	B	501	-	-	0/12/12/12	0/5/5/5
3	C91	D	501	-	-	0/12/12/12	0/5/5/5
2	IMP	A	401	-	-	5/10/26/26	0/3/3/3
2	IMP	D	502	-	-	5/10/26/26	0/3/3/3
2	IMP	C	500	-	-	2/10/26/26	0/3/3/3
2	IMP	B	500	-	-	5/10/26/26	0/3/3/3

All (51) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	501	C91	C37-C6	5.24	1.54	1.47
3	D	501	C91	C37-C6	5.21	1.54	1.47
3	A	402	C91	C37-C6	5.16	1.54	1.47
3	A	403	C91	C37-C6	4.88	1.54	1.47
2	A	401	IMP	C2-N3	4.50	1.38	1.30
2	C	500	IMP	C2-N3	4.48	1.38	1.30
2	D	502	IMP	C2-N3	4.38	1.38	1.30
2	B	500	IMP	C2-N3	4.36	1.38	1.30
3	A	402	C91	C13-N4	3.81	1.43	1.35
3	D	501	C91	C13-N4	3.72	1.43	1.35
3	B	501	C91	C13-N4	3.69	1.43	1.35
3	D	501	C91	C9-C11	3.68	1.45	1.40
3	B	501	C91	C9-C11	3.65	1.45	1.40
3	A	403	C91	C9-C11	3.64	1.45	1.40
3	A	403	C91	C13-N4	3.59	1.43	1.35
3	A	402	C91	C9-C11	3.56	1.45	1.40
3	A	403	C91	C26-C25	3.07	1.43	1.36
3	A	402	C91	C26-C25	3.03	1.43	1.36
3	D	501	C91	C26-C25	3.01	1.43	1.36
3	B	501	C91	C26-C25	2.99	1.43	1.36
3	A	403	C91	C16-C18	-2.78	1.36	1.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	C91	C16-C18	-2.78	1.36	1.42
3	A	402	C91	C5-C2	2.70	1.42	1.36
3	D	501	C91	C5-C2	2.68	1.42	1.36
3	B	501	C91	C5-C2	2.65	1.42	1.36
3	D	501	C91	C16-C18	-2.63	1.36	1.42
3	B	501	C91	C16-C18	-2.62	1.36	1.42
3	A	403	C91	C5-C2	2.59	1.42	1.36
3	D	501	C91	C28-C16	2.54	1.47	1.42
3	B	501	C91	C28-C16	2.51	1.47	1.42
3	A	402	C91	C28-C16	2.50	1.47	1.42
3	A	403	C91	C6-N1	-2.50	1.35	1.38
3	A	403	C91	C28-C16	2.50	1.47	1.42
3	B	501	C91	C1-C10	2.43	1.43	1.39
3	B	501	C91	C6-N1	-2.39	1.35	1.38
3	D	501	C91	C1-C10	2.36	1.43	1.39
3	A	403	C91	C6-N3	2.35	1.36	1.32
3	D	501	C91	C6-N3	2.32	1.36	1.32
3	A	402	C91	C6-N3	2.31	1.36	1.32
3	A	402	C91	C6-N1	-2.29	1.35	1.38
3	B	501	C91	C6-N3	2.25	1.36	1.32
3	A	402	C91	C1-C10	2.21	1.43	1.39
3	A	403	C91	C1-C10	2.16	1.43	1.39
3	D	501	C91	C17-C13	-2.13	1.48	1.52
3	A	403	C91	C27-C28	2.09	1.41	1.36
3	D	501	C91	C6-N1	-2.09	1.36	1.38
3	A	402	C91	C27-C28	2.09	1.41	1.36
3	D	501	C91	C27-C28	2.09	1.41	1.36
3	B	501	C91	C27-C28	2.07	1.41	1.36
3	A	403	C91	C17-C13	-2.06	1.48	1.52
3	B	501	C91	C17-C13	-2.03	1.48	1.52

All (75) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	IMP	C5-C6-N1	6.18	119.67	110.78
2	B	500	IMP	C5-C6-N1	5.91	119.28	110.78
2	C	500	IMP	C5-C6-N1	5.78	119.09	110.78
2	D	502	IMP	C5-C6-N1	5.78	119.09	110.78
2	C	500	IMP	C2-N3-C4	4.81	120.00	111.53
2	A	401	IMP	C2-N3-C4	4.78	119.94	111.53
2	C	500	IMP	C5-C4-N3	-4.72	120.32	127.27
2	A	401	IMP	C5-C4-N3	-4.64	120.43	127.27

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	500	IMP	C2-N3-C4	4.63	119.67	111.53
2	D	502	IMP	C2-N3-C4	4.58	119.59	111.53
2	D	502	IMP	C5-C4-N3	-4.56	120.56	127.27
2	B	500	IMP	C5-C4-N3	-4.54	120.58	127.27
3	B	501	C91	N1-C6-N3	-4.26	108.70	112.96
3	A	402	C91	N1-C6-N3	-4.20	108.76	112.96
2	A	401	IMP	C2-N1-C6	-4.19	119.35	125.09
2	C	500	IMP	N1-C2-N3	-4.14	120.73	125.50
3	D	501	C91	N1-C6-N3	-4.13	108.83	112.96
3	A	403	C91	N1-C6-N3	-4.10	108.86	112.96
2	B	500	IMP	N1-C2-N3	-4.01	120.88	125.50
2	A	401	IMP	N1-C2-N3	-3.97	120.93	125.50
2	D	502	IMP	N1-C2-N3	-3.91	120.99	125.50
2	B	500	IMP	C2-N1-C6	-3.86	119.80	125.09
2	D	502	IMP	C2-N1-C6	-3.78	119.91	125.09
2	C	500	IMP	C2-N1-C6	-3.75	119.94	125.09
3	B	501	C91	C11-N3-C6	3.73	109.53	104.55
3	A	402	C91	C11-N3-C6	3.70	109.49	104.55
3	A	403	C91	C11-N3-C6	3.63	109.40	104.55
3	D	501	C91	C11-N3-C6	3.63	109.40	104.55
3	A	403	C91	C11-C10-N1	3.62	108.41	105.55
3	A	403	C91	C10-C11-N3	-3.53	105.71	110.19
3	D	501	C91	C11-C10-N1	3.42	108.25	105.55
3	A	402	C91	C11-C10-N1	3.41	108.24	105.55
3	A	402	C91	C10-C11-N3	-3.37	105.91	110.19
3	B	501	C91	C10-C11-N3	-3.35	105.93	110.19
3	D	501	C91	C10-C11-N3	-3.33	105.96	110.19
3	B	501	C91	C11-C10-N1	3.19	108.07	105.55
3	A	403	C91	C6-C37-N42	3.02	121.53	117.25
3	B	501	C91	C41-N42-C37	2.92	120.70	116.93
3	D	501	C91	C41-N42-C37	2.89	120.65	116.93
3	A	402	C91	C41-N42-C37	2.87	120.63	116.93
3	A	403	C91	C41-N42-C37	2.69	120.40	116.93
2	B	500	IMP	N9-C8-N7	-2.66	108.47	113.40
3	D	501	C91	C6-C37-N42	2.64	121.00	117.25
2	A	401	IMP	N9-C8-N7	-2.63	108.52	113.40
3	A	402	C91	C13-C17-N1	2.61	119.99	112.48
3	A	402	C91	C6-C37-N42	2.59	120.92	117.25
2	A	401	IMP	C8-N7-C5	2.56	108.83	104.26
2	B	500	IMP	C8-N7-C5	2.53	108.76	104.26
2	C	500	IMP	C8-N7-C5	2.52	108.74	104.26
2	D	502	IMP	N9-C8-N7	-2.50	108.77	113.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	501	C91	C6-C37-N42	2.50	120.79	117.25
2	D	502	IMP	C8-N7-C5	2.49	108.70	104.26
2	D	502	IMP	O6-C6-C5	-2.49	119.97	126.53
2	C	500	IMP	N9-C8-N7	-2.44	108.88	113.40
3	B	501	C91	C10-N1-C6	2.39	107.77	106.25
2	B	500	IMP	O6-C6-C5	-2.36	120.29	126.53
3	A	403	C91	C13-C17-N1	2.33	119.18	112.48
2	C	500	IMP	O6-C6-C5	-2.33	120.38	126.53
2	D	502	IMP	O3P-P-O2P	2.33	116.53	107.80
2	A	401	IMP	N9-C4-N3	2.29	132.12	126.90
3	D	501	C91	C13-C17-N1	2.26	118.98	112.48
2	B	500	IMP	N9-C4-N3	2.25	132.03	126.90
2	C	500	IMP	N9-C4-N3	2.22	131.96	126.90
2	A	401	IMP	O6-C6-C5	-2.21	120.70	126.53
2	B	500	IMP	O3P-P-O2P	2.20	116.05	107.80
3	A	403	C91	C10-N1-C6	2.15	107.62	106.25
3	A	403	C91	C9-C11-N3	2.15	134.32	128.21
3	B	501	C91	C13-C17-N1	2.14	118.63	112.48
3	A	402	C91	C10-N1-C6	2.10	107.58	106.25
2	D	502	IMP	N9-C4-N3	2.10	131.68	126.90
3	A	403	C91	C1-C10-C11	-2.08	119.82	122.23
3	A	402	C91	C9-C11-N3	2.07	134.09	128.21
3	B	501	C91	C9-C11-N3	2.06	134.06	128.21
3	D	501	C91	C10-N1-C6	2.06	107.56	106.25
3	D	501	C91	C9-C11-N3	2.06	134.05	128.21

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	IMP	C5'-O5'-P-O2P
2	A	401	IMP	C5'-O5'-P-O3P
2	B	500	IMP	C5'-O5'-P-O1P
2	B	500	IMP	C5'-O5'-P-O2P
2	B	500	IMP	C5'-O5'-P-O3P
2	D	502	IMP	C5'-O5'-P-O1P
2	D	502	IMP	C5'-O5'-P-O2P
2	D	502	IMP	C5'-O5'-P-O3P
2	A	401	IMP	C5'-O5'-P-O1P
2	A	401	IMP	C3'-C4'-C5'-O5'
2	B	500	IMP	C3'-C4'-C5'-O5'
2	D	502	IMP	C3'-C4'-C5'-O5'

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Mol	Chain	Res	Type	Atoms
2	C	500	IMP	C5'-O5'-P-O1P
2	A	401	IMP	O4'-C4'-C5'-O5'
2	B	500	IMP	O4'-C4'-C5'-O5'
2	C	500	IMP	C5'-O5'-P-O3P
2	D	502	IMP	O4'-C4'-C5'-O5'

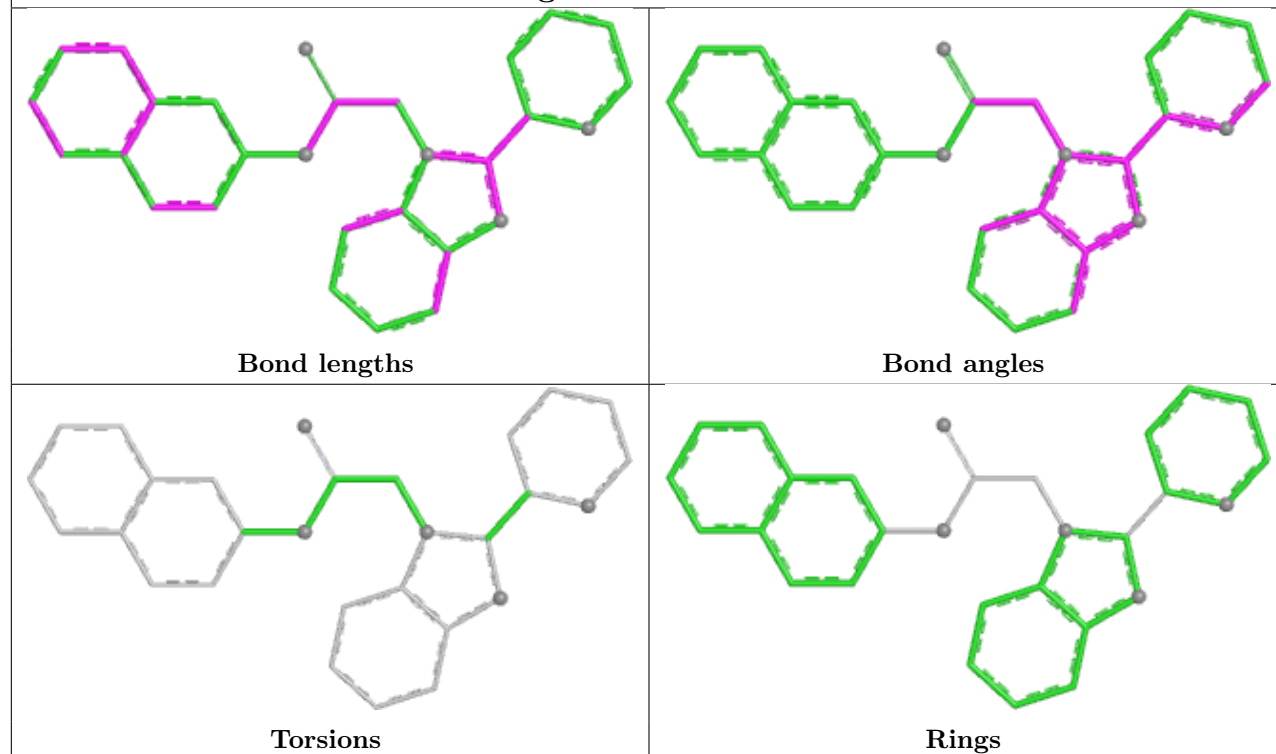
There are no ring outliers.

5 monomers are involved in 6 short contacts:

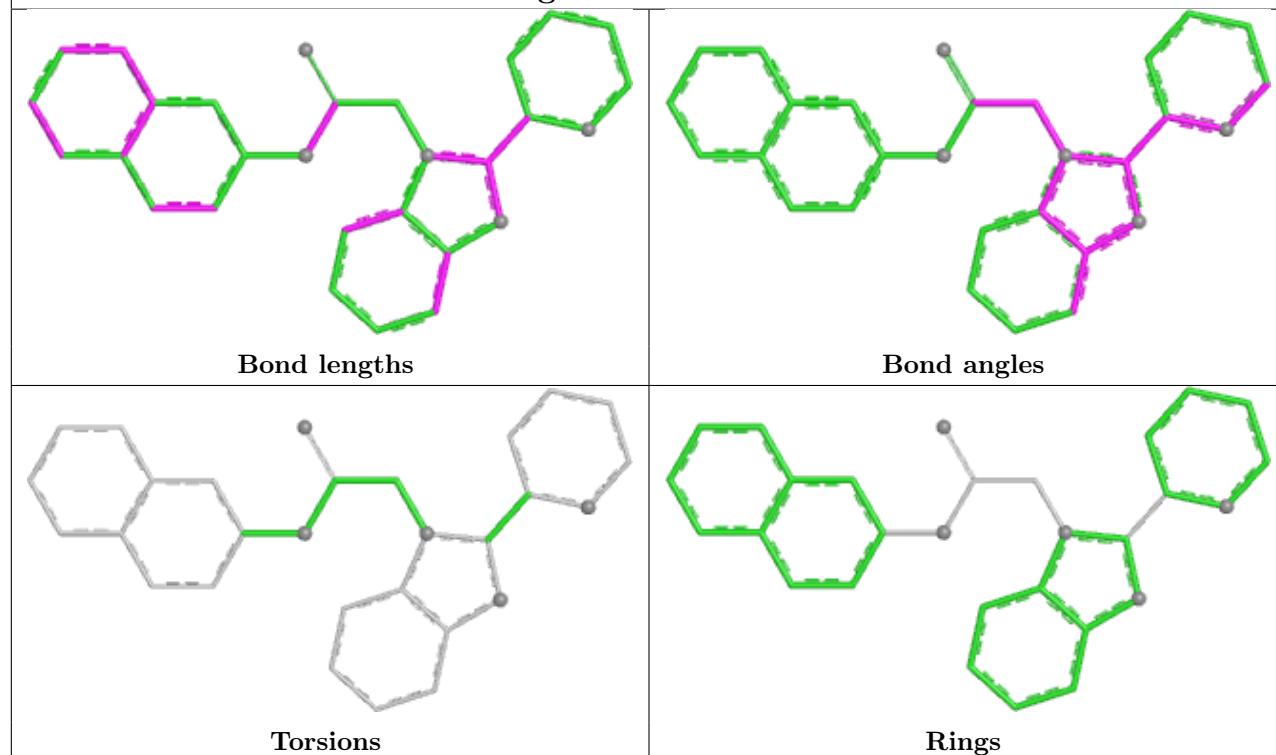
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	403	C91	1	0
3	A	402	C91	1	0
2	A	401	IMP	1	0
2	D	502	IMP	2	0
2	B	500	IMP	1	0

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.

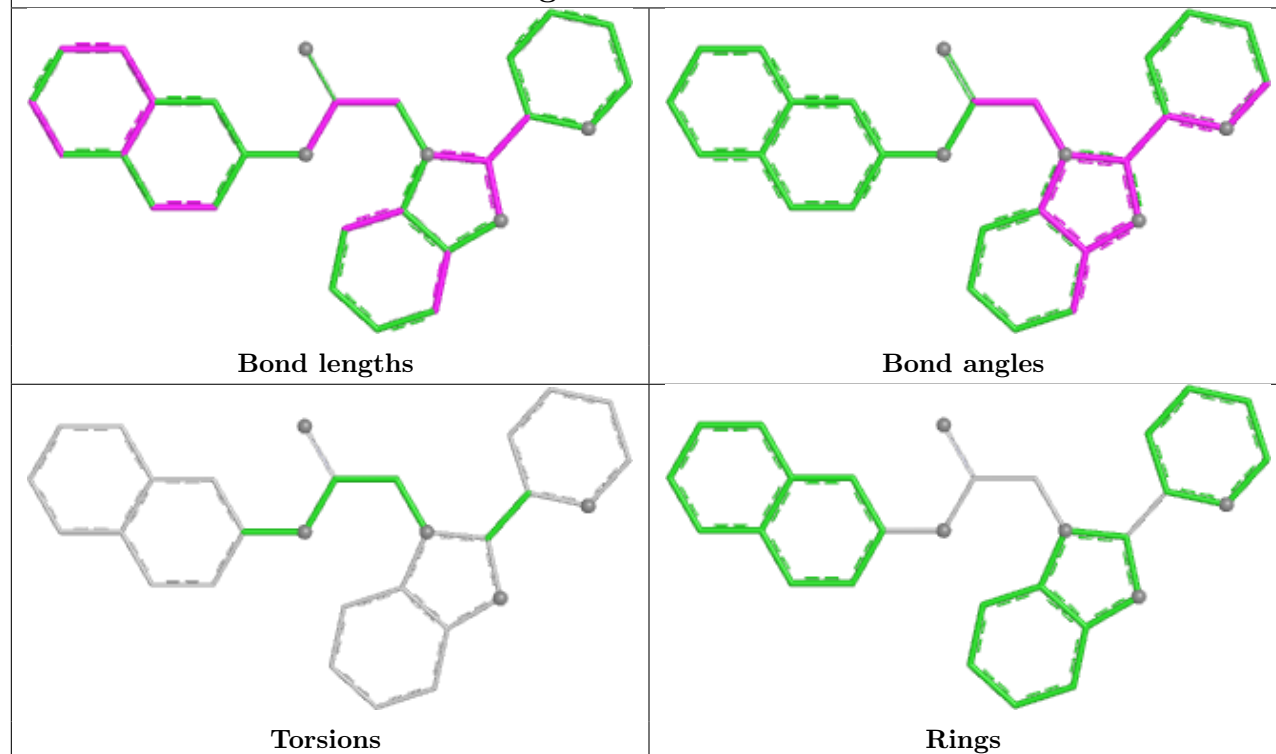
Ligand C91 A 403



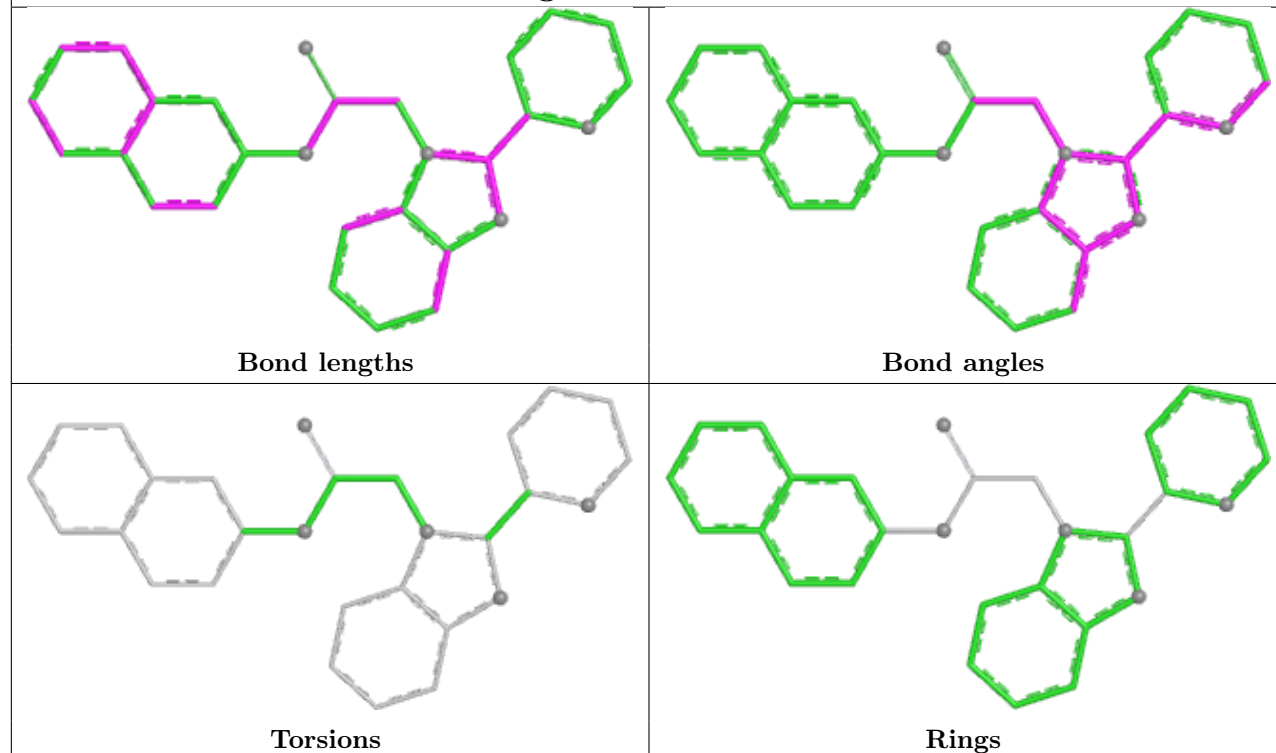
Ligand C91 A 402



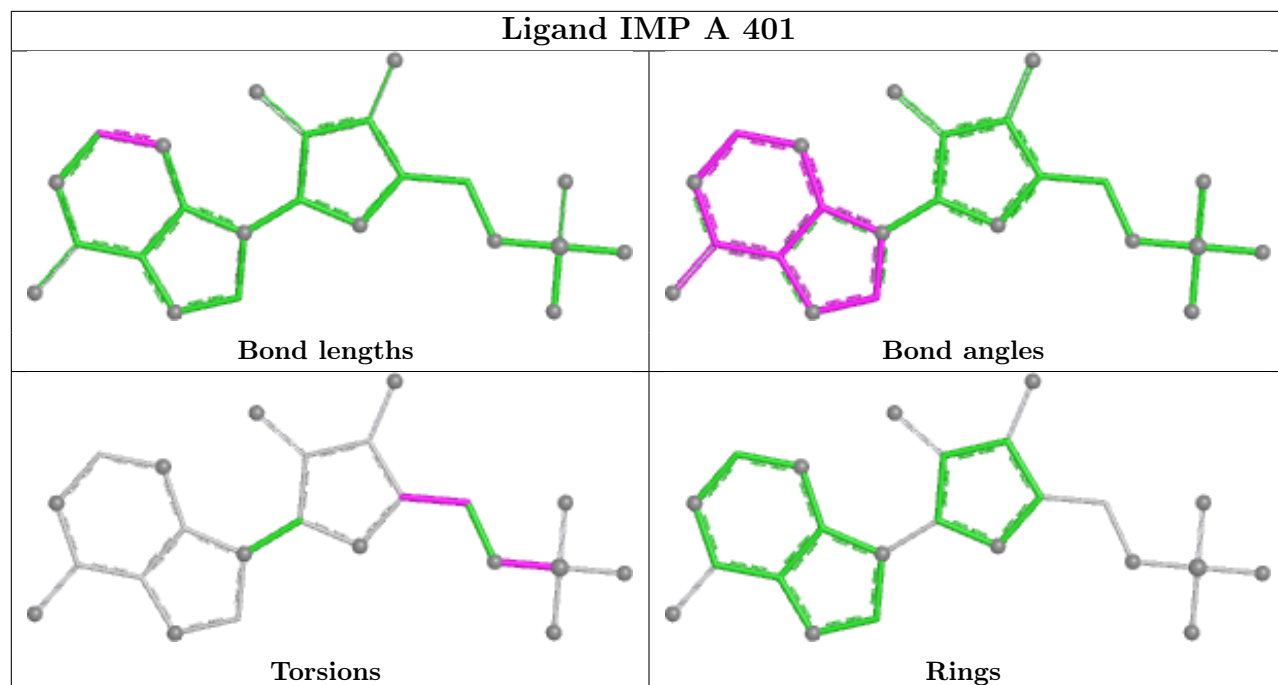
Ligand C91 B 501



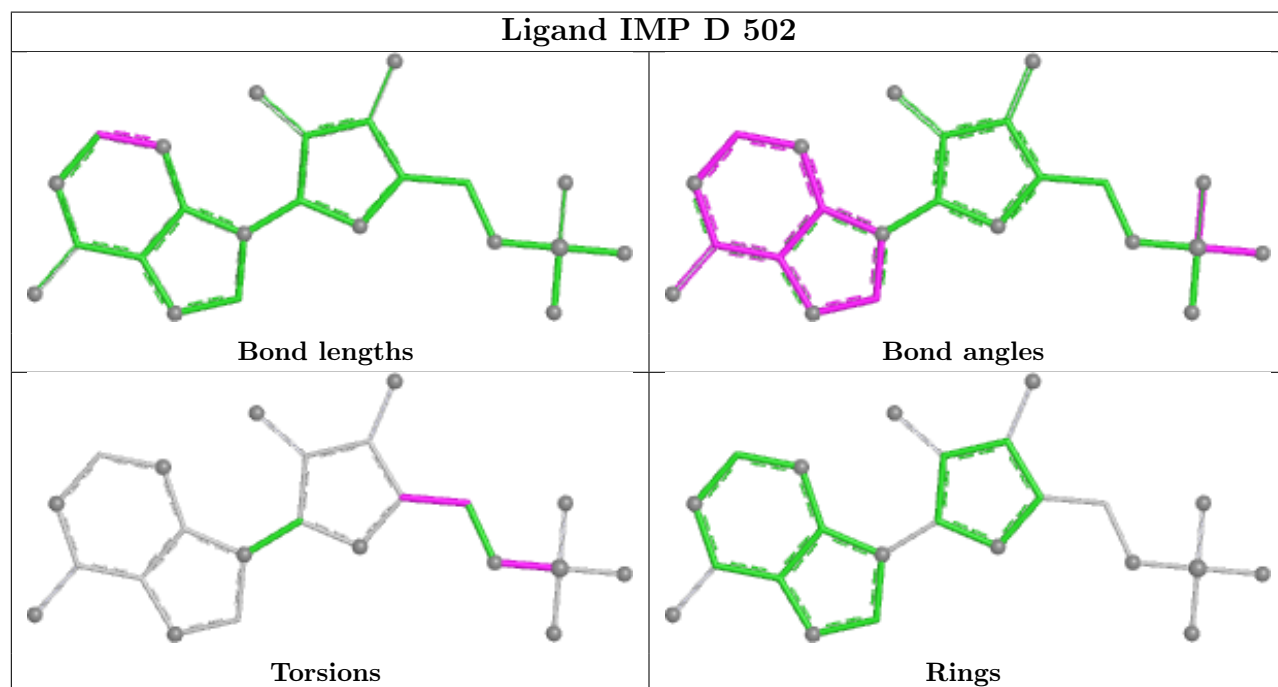
Ligand C91 D 501

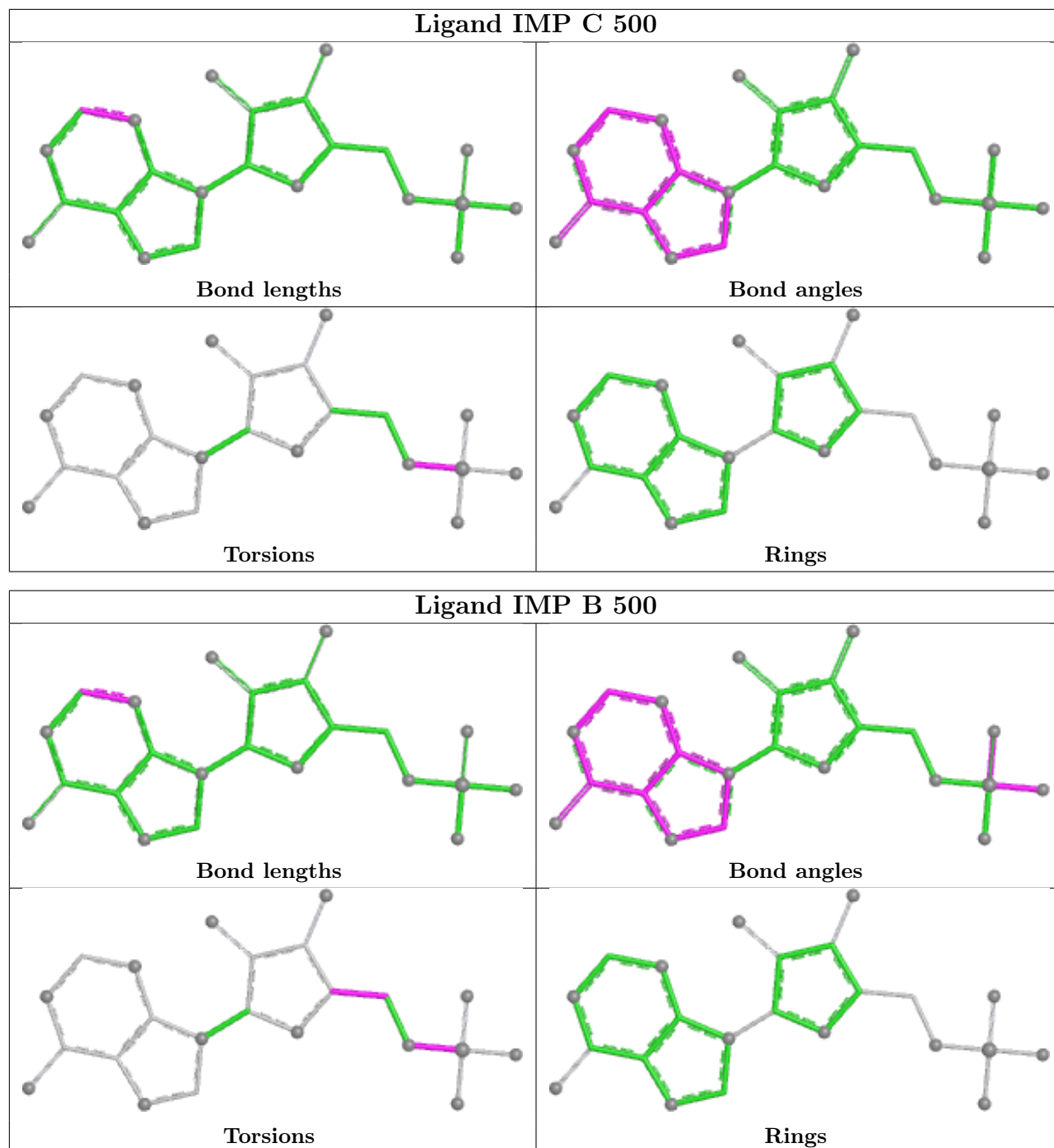


Ligand IMP A 401



Ligand IMP D 502





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 [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	A	337/363 (92%)	-0.46	0 100 100	43, 60, 84, 97	8 (2%)
1	B	341/363 (93%)	-0.37	4 (1%) 76 70	26, 63, 89, 114	11 (3%)
1	C	341/363 (93%)	-0.41	2 (0%) 85 81	29, 56, 84, 106	10 (2%)
1	D	339/363 (93%)	-0.50	2 (0%) 85 81	22, 54, 79, 120	14 (4%)
All	All	1358/1452 (93%)	-0.44	8 (0%) 85 81	22, 58, 86, 120	43 (3%)

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	252	GLN	6.1
1	C	284	PHE	5.6
1	D	251	TYR	5.1
1	B	122	ASP	4.6
1	B	144	GLU	4.5
1	C	283	LYS	4.4
1	B	270	LYS	3.6
1	B	91	GLY	2.8

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](#)

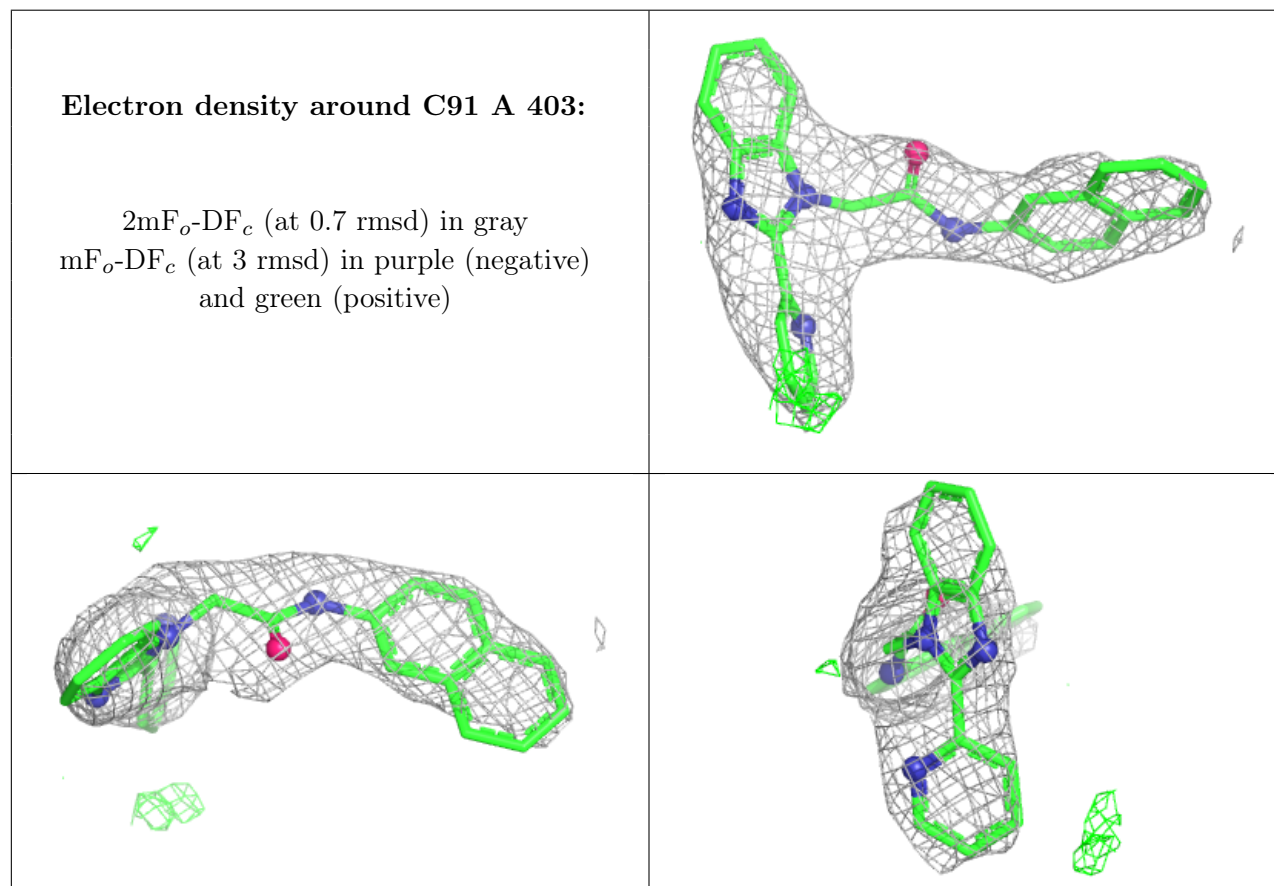
There are no oligosaccharides in this entry.

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.

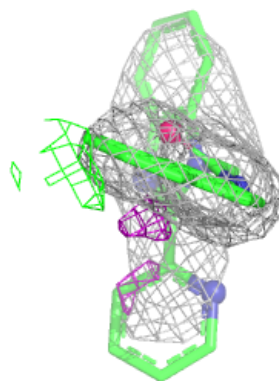
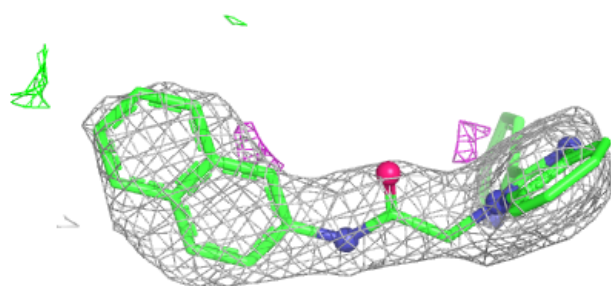
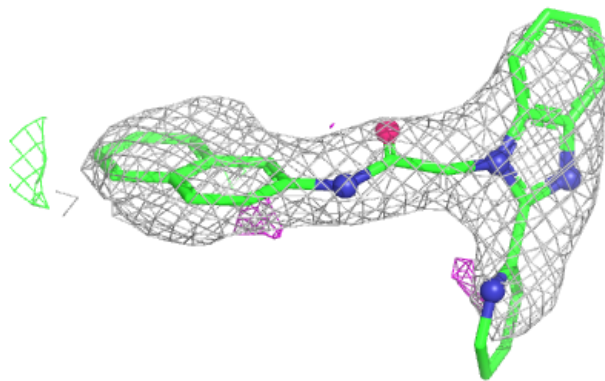
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	C91	A	403	29/29	0.87	0.11	75,80,85,86	0
3	C91	A	402	29/29	0.89	0.10	64,76,93,95	0
3	C91	B	501	29/29	0.91	0.10	61,76,82,83	0
3	C91	D	501	29/29	0.92	0.09	60,72,85,87	0
2	IMP	A	401	23/23	0.96	0.06	37,49,57,62	0
2	IMP	B	500	23/23	0.96	0.06	50,56,61,65	0
2	IMP	C	500	23/23	0.96	0.06	35,41,53,55	0
2	IMP	D	502	23/23	0.96	0.06	36,47,53,56	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.



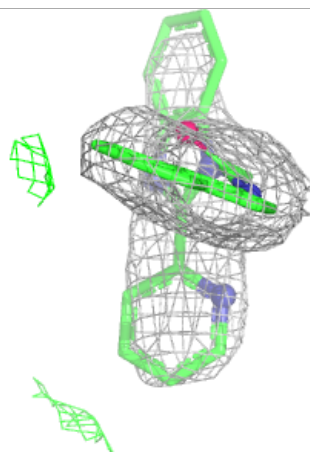
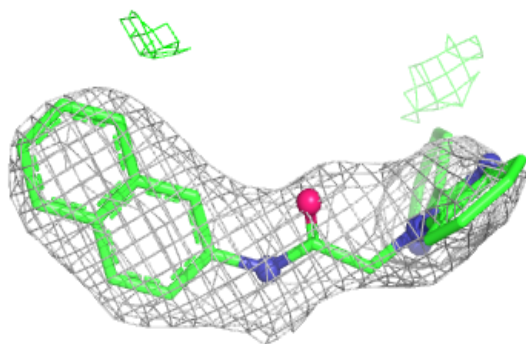
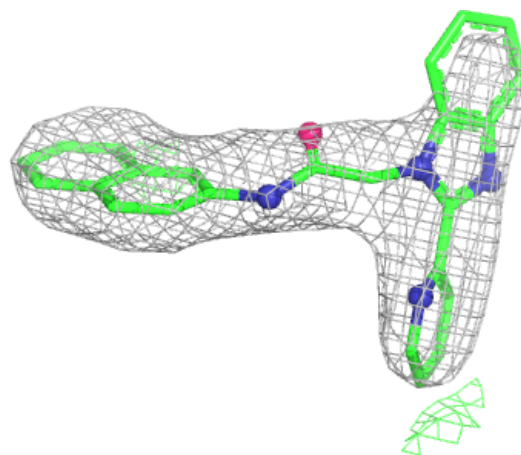
Electron density around C91 A 402:

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



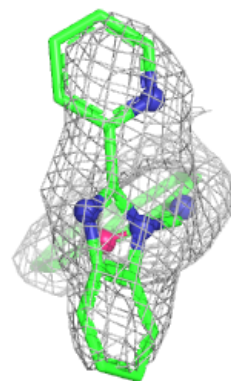
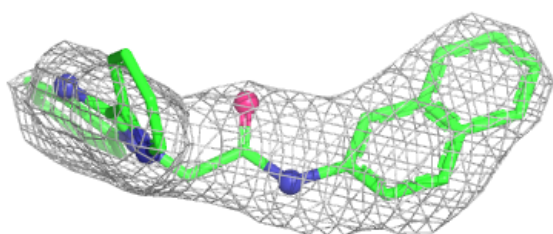
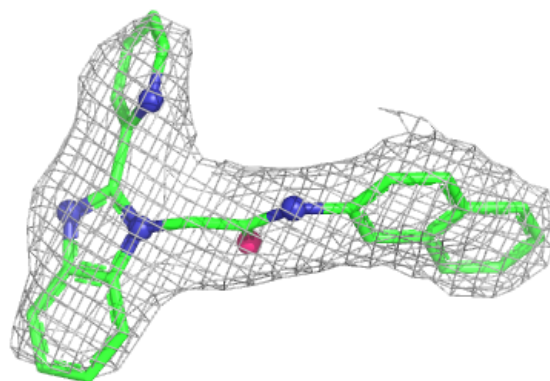
Electron density around C91 B 501:

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

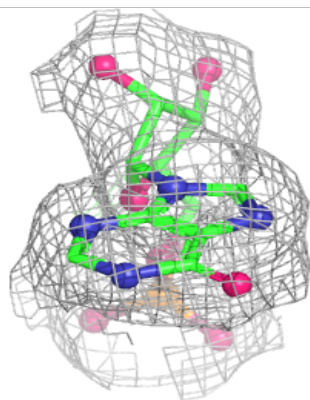
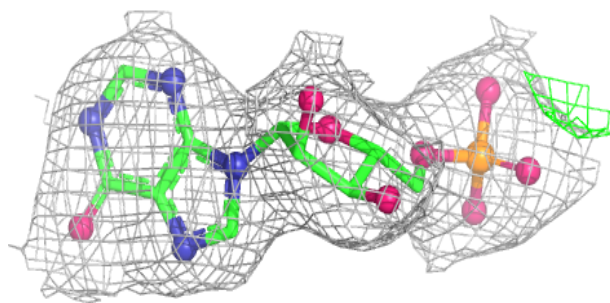
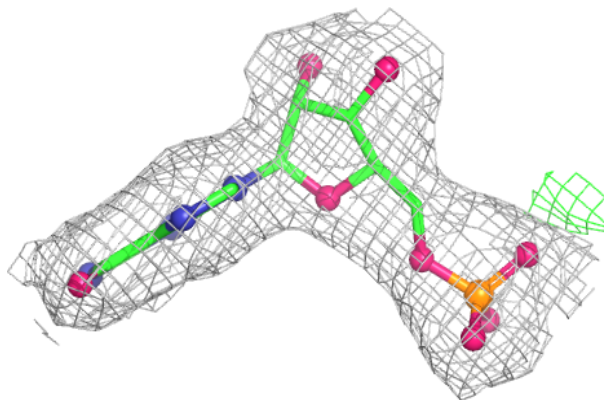


Electron density around C91 D 501:

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

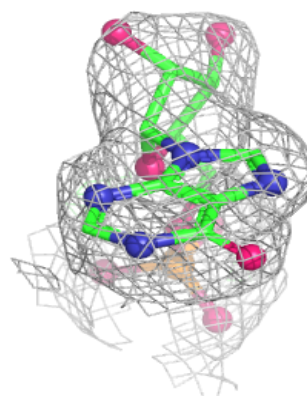
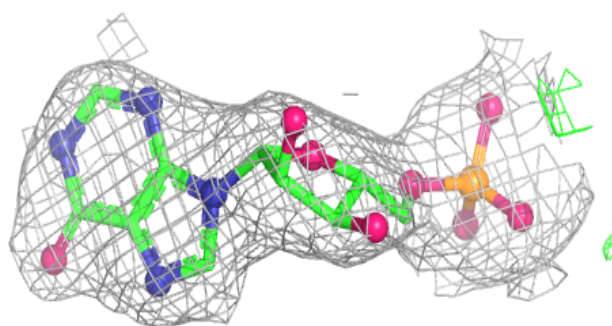
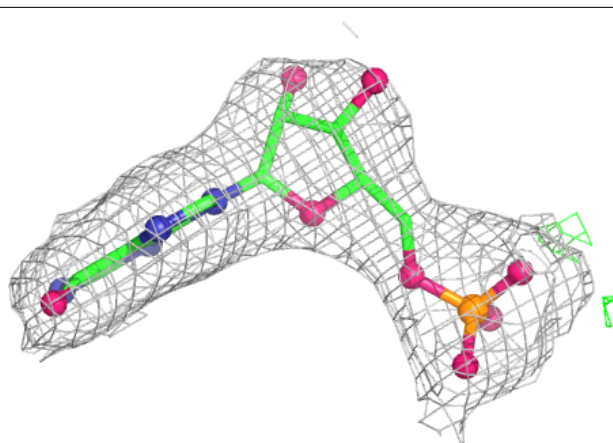
**Electron density around IMP A 401:**

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

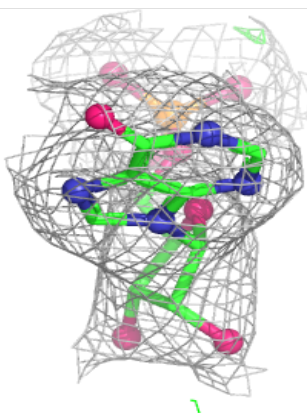
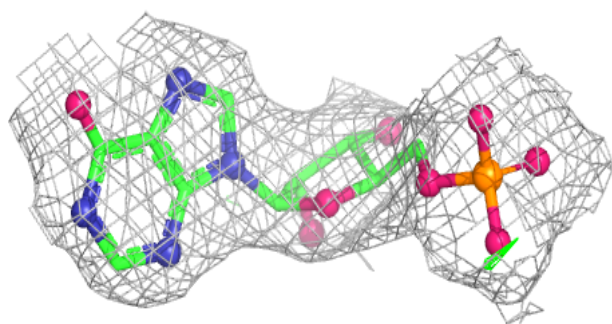
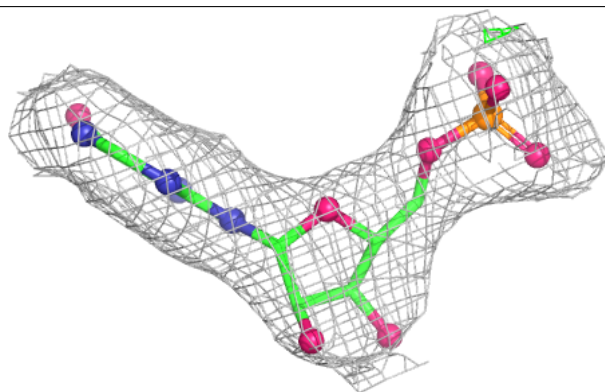


Electron density around IMP B 500:

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

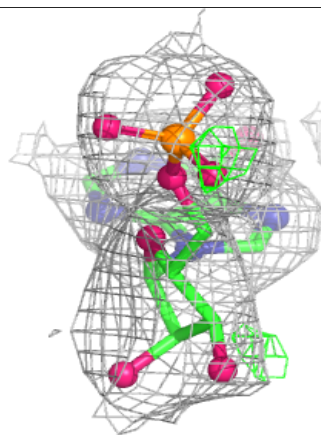
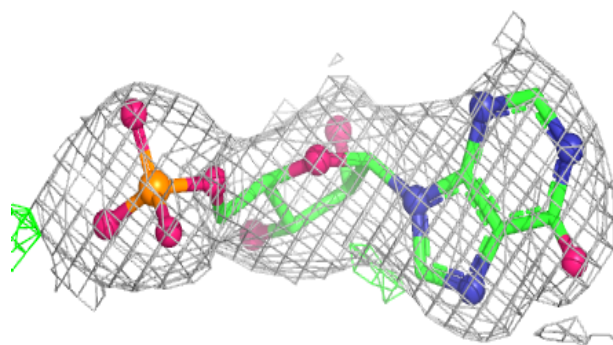
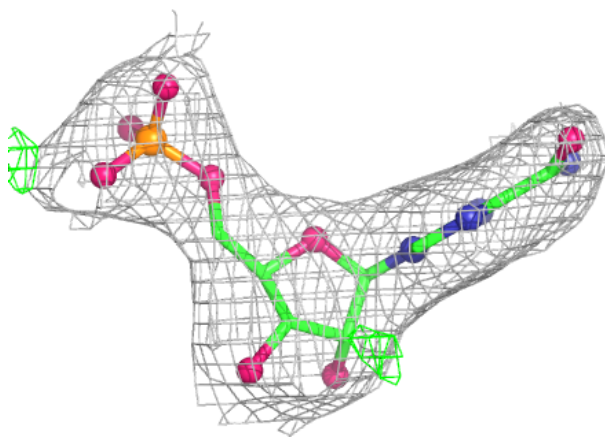
**Electron density around IMP C 500:**

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



Electron density around IMP D 502:

$2mF_o-DF_c$ (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.