



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 04:16 PM UTC

PDB ID : 8TVM / pdb_00008tvm
Title : IRAK4 in complex with compound 24
Authors : Metrick, C.M.; Chodaparambil, J.V.
Deposited on : 2023-08-18
Resolution : 2.10 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)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

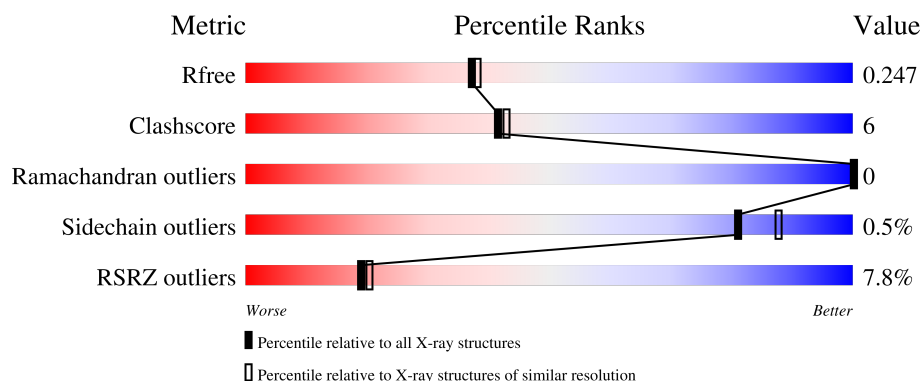
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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	307	8% 74% 19% 7%
1	B	307	8% 80% 14% 6%
1	C	307	6% 79% 13% 8%
1	D	307	7% 75% 15% 10%

2 Entry composition [i](#)

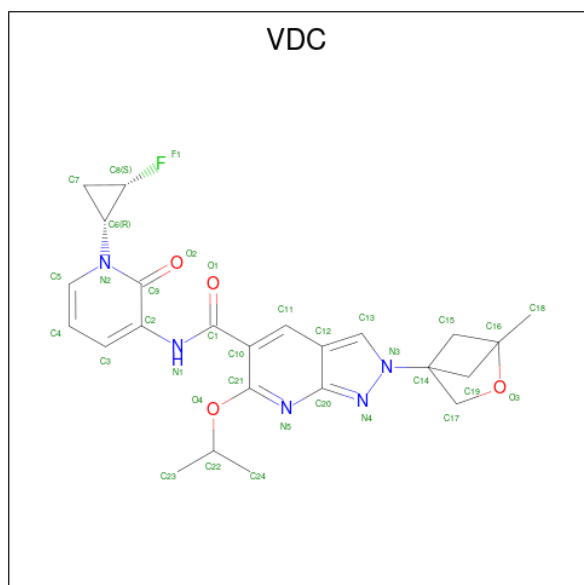
There are 3 unique types of molecules in this entry. The entry contains 9274 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Interleukin-1 receptor-associated kinase 4.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	287	Total	C	N	O	P	S	0	1	0
			2261	1414	383	447	3	14			
1	B	289	Total	C	N	O	P	S	0	0	0
			2233	1397	377	442	3	14			
1	C	281	Total	C	N	O	P	S	0	3	0
			2215	1390	373	434	3	15			
1	D	277	Total	C	N	O	P	S	0	0	0
			2154	1353	362	422	3	14			

- Molecule 2 is N-{1-[(1R,2R)-2-fluorocyclopropyl]-2-oxo-1,2-dihydropyridin-3-yl}-2-[(1R,4r)-1-methyl-2-oxabicyclo[2.1.1]hexan-4-yl]-6-[(propan-2-yl)oxy]-2H-pyrazolo[3,4-b]pyridine-5-carboxamide (CCD ID: VDC) (formula: C₂₄H₂₆FN₅O₄) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	F	N	O	0	0
			34	24	1	5	4		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	F	N	O	0	0
			34	24	1	5	4		
2	C	1	Total	C	F	N	O	0	0
			34	24	1	5	4		
2	D	1	Total	C	F	N	O	0	0
			34	24	1	5	4		

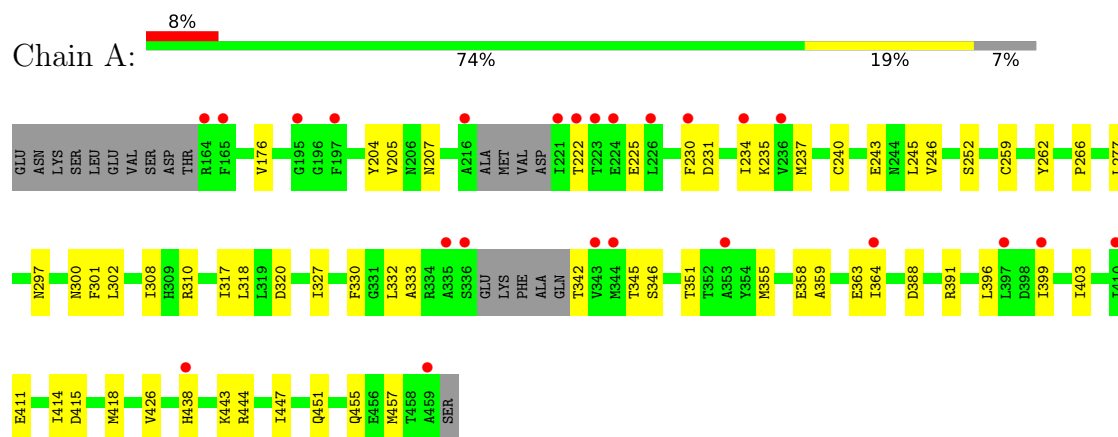
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	70	Total	O	0	0
			70	70		
3	B	87	Total	O	0	0
			87	87		
3	C	58	Total	O	0	0
			58	58		
3	D	60	Total	O	0	0
			60	60		

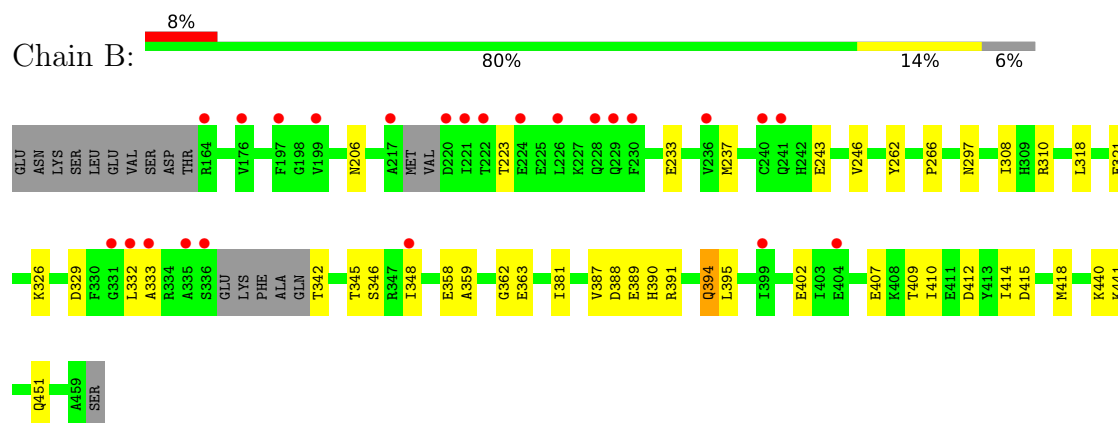
3 Residue-property plots

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.

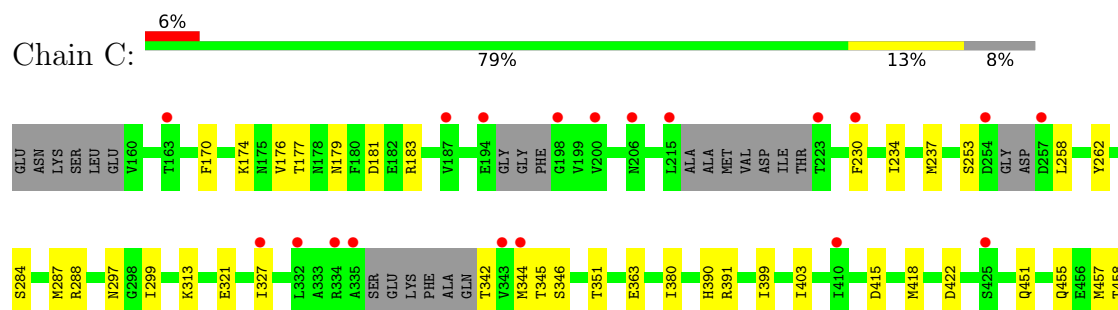
- Molecule 1: Interleukin-1 receptor-associated kinase 4



- Molecule 1: Interleukin-1 receptor-associated kinase 4

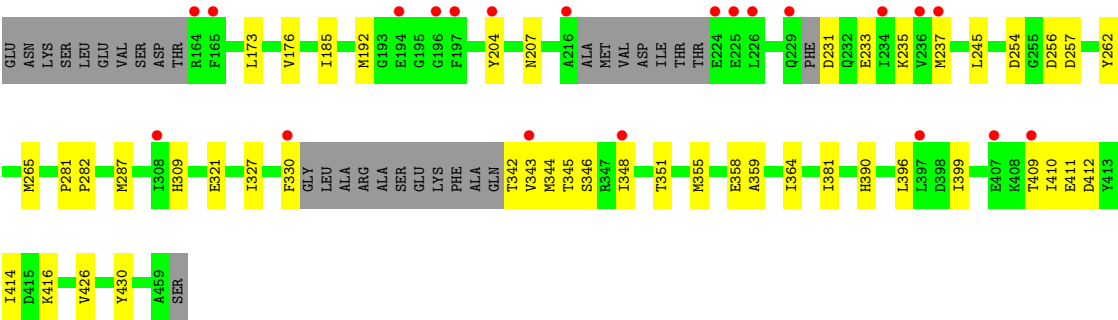


- Molecule 1: Interleukin-1 receptor-associated kinase 4



ALA
SER

● Molecule 1: Interleukin-1 receptor-associated kinase 4



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	136.38Å 141.98Å 87.78Å 90.00° 126.37° 90.00°	Depositor
Resolution (Å)	48.52 – 2.10 48.52 – 2.10	Depositor EDS
% Data completeness (in resolution range)	97.7 (48.52-2.10) 97.8 (48.52-2.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.59 (at 2.10Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.221 , 0.246 0.221 , 0.247	Depositor DCC
R_{free} test set	3827 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	45.3	Xtriage
Anisotropy	0.473	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 41.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9274	wwPDB-VP
Average B, all atoms (Å ²)	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.19% 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: TPO, VDC, SEP

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	0.20	0/2266	0.41	0/3054
1	B	0.15	0/2236	0.38	0/3018
1	C	0.18	0/2216	0.38	0/2987
1	D	0.24	0/2156	0.43	1/2906 (0.0%)
All	All	0.19	0/8874	0.40	1/11965 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	256	ASP	N-CA-C	-5.60	106.44	113.28

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	2261	0	2200	39	0
1	B	2233	0	2157	27	0
1	C	2215	0	2148	23	0
1	D	2154	0	2095	30	0
2	A	34	0	0	0	0
2	B	34	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	34	0	0	0	0
2	D	34	0	0	0	0
3	A	70	0	0	0	0
3	B	87	0	0	3	0
3	C	58	0	0	3	0
3	D	60	0	0	1	0
All	All	9274	0	8600	113	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 6.

All (113) 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:B:326:LYS:NZ	3:B:602:HOH:O	2.20	0.73
1:A:411:GLU:HA	1:A:414:ILE:HD12	1.72	0.71
1:A:252:SER:HB3	1:A:259:CYS:HB2	1.78	0.65
1:B:402:GLU:HG2	1:B:407:GLU:OE1	1.99	0.62
1:A:237:MET:HE3	1:A:262:TYR:HE2	1.63	0.62
1:B:415:ASP:HB3	1:B:418:MET:HE2	1.81	0.61
1:A:231:ASP:HB3	1:A:235:LYS:HE2	1.83	0.60
1:C:297:ASN:OD1	1:C:451:GLN:NE2	2.28	0.60
1:B:233:GLU:OE1	1:B:262:TYR:OH	2.20	0.60
1:C:170:PHE:O	1:C:174:LYS:HG3	2.02	0.59
1:D:235:LYS:N	1:D:235:LYS:HD3	2.16	0.59
1:D:343:VAL:HG13	1:D:364:ILE:HB	1.84	0.59
1:D:309:HIS:CD2	1:D:330:PHE:HD1	2.20	0.59
1:B:381:ILE:HG21	1:B:410:ILE:HD11	1.85	0.59
1:D:414:ILE:HD11	1:D:426:VAL:HG11	1.85	0.58
1:B:237:MET:HA	1:B:237:MET:HE2	1.85	0.58
1:B:389:GLU:O	1:B:394:GLN:NE2	2.37	0.58
1:A:243:GLU:HG3	1:C:321:GLU:O	2.04	0.58
1:D:233:GLU:OE1	1:D:262:TYR:OH	2.24	0.56
1:D:351:THR:O	1:D:355:MET:HG3	2.05	0.56
1:D:409:THR:HG23	1:D:411:GLU:H	1.71	0.55
1:B:310:ARG:HD3	1:B:332:LEU:O	2.06	0.55
1:A:297:ASN:ND2	1:A:451:GLN:HE21	2.05	0.55
1:D:245:LEU:HD22	1:D:330:PHE:CZ	2.42	0.55
1:A:245:LEU:HD22	1:A:330:PHE:HZ	1.72	0.55
1:C:313:LYS:NZ	3:C:601:HOH:O	2.39	0.55
1:B:390:HIS:O	1:C:391:ARG:HA	2.08	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:455:GLN:O	1:C:458:THR:OG1	2.23	0.53
1:A:451:GLN:O	1:A:455:GLN:HG2	2.08	0.53
1:C:176:VAL:HG23	1:C:177:THR:HG23	1.89	0.53
1:C:422:ASP:HB3	3:C:602:HOH:O	2.09	0.53
1:C:284:SER:H	1:C:287[A]:MET:HE3	1.73	0.52
1:C:399:ILE:O	1:C:403:ILE:HG12	2.07	0.52
1:A:414:ILE:HG12	1:A:426:VAL:HG11	1.89	0.52
1:A:222:THR:OG1	1:A:225:GLU:HG3	2.11	0.51
1:B:391:ARG:HA	1:C:390:HIS:O	2.10	0.50
1:B:409:THR:HG23	1:B:412:ASP:H	1.78	0.49
1:A:277:LEU:HD13	1:D:416:LYS:HE3	1.95	0.49
1:B:409:THR:OG1	3:B:601:HOH:O	2.20	0.48
1:C:237:MET:HE3	1:C:262:TYR:HE1	1.78	0.48
1:A:388:ASP:HB3	1:A:391:ARG:HB3	1.95	0.48
1:A:358:GLU:HG2	1:A:359:ALA:N	2.28	0.48
1:A:399:ILE:O	1:A:403:ILE:HG12	2.12	0.48
1:D:265:MET:HE2	1:D:265:MET:HA	1.95	0.48
1:D:287:MET:HE1	3:D:659:HOH:O	2.12	0.48
1:D:409:THR:HG23	1:D:411:GLU:N	2.28	0.48
1:A:358:GLU:OE2	1:A:444:ARG:NH2	2.47	0.48
1:D:309:HIS:CD2	1:D:330:PHE:CD1	3.02	0.47
1:A:230:PHE:O	1:A:234:ILE:HG12	2.14	0.47
1:B:246:VAL:HG11	1:B:318:LEU:HD12	1.96	0.47
1:A:300:ASN:HA	1:A:447:ILE:HG21	1.96	0.47
1:A:310:ARG:HD3	1:A:332:LEU:O	2.13	0.47
1:B:348:ILE:HG22	1:B:362:GLY:HA2	1.96	0.47
1:B:387:VAL:HG23	1:B:395:LEU:HD12	1.96	0.47
1:B:388:ASP:HB3	1:B:391:ARG:HB3	1.97	0.47
1:D:381:ILE:HG21	1:D:410:ILE:HD11	1.96	0.46
1:B:410:ILE:O	1:B:414:ILE:HG13	2.15	0.46
1:D:409:THR:HG22	1:D:412:ASP:OD2	2.16	0.46
1:D:358:GLU:HG2	1:D:359:ALA:N	2.31	0.45
1:D:344:MET:HE3	1:D:344:MET:HB3	1.81	0.45
1:A:308:ILE:O	1:A:333:ALA:HA	2.16	0.45
1:A:391:ARG:HA	1:D:390:HIS:O	2.17	0.45
1:A:302:LEU:HD11	1:A:330:PHE:HE2	1.82	0.45
1:A:266:PRO:HD2	1:A:320:ASP:HA	1.98	0.45
1:D:231:ASP:HB3	1:D:235:LYS:HE2	1.99	0.45
1:C:174:LYS:HE3	1:C:179:ASN:OD1	2.16	0.44
1:C:351:THR:OG1	3:C:601:HOH:O	2.21	0.44
1:A:438[A]:HIS:CD2	1:A:443:LYS:HB3	2.52	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:348:ILE:HD12	1:B:348:ILE:O	2.17	0.44
1:D:204:TYR:CE2	1:D:207:ASN:HA	2.52	0.44
1:D:348:ILE:HD12	1:D:348:ILE:H	1.81	0.44
1:C:253:SER:HA	1:C:258:LEU:HD23	2.00	0.44
1:B:206:ASN:OD1	3:B:603:HOH:O	2.21	0.43
1:B:440:LYS:HE2	1:B:440:LYS:H	1.83	0.43
1:A:240:CYS:HA	1:A:301:PHE:HE2	1.84	0.43
1:C:181:ASP:OD2	1:C:183:ARG:NH2	2.52	0.43
1:C:288:ARG:HB3	1:C:380:ILE:HG23	1.99	0.43
1:D:204:TYR:CZ	1:D:207:ASN:HA	2.54	0.43
1:D:396:LEU:O	1:D:399:ILE:HG12	2.18	0.43
1:C:299:ILE:HG13	1:C:327[B]:ILE:HD11	2.00	0.43
1:A:351:THR:O	1:A:355:MET:HG3	2.19	0.43
1:C:230:PHE:O	1:C:234:ILE:HG13	2.18	0.43
1:C:237:MET:CE	1:C:262:TYR:HE1	2.30	0.43
1:A:363:GLU:O	1:A:364:ILE:HD13	2.19	0.42
1:B:358:GLU:HG2	1:B:359:ALA:N	2.33	0.42
1:A:302:LEU:HD21	1:A:330:PHE:HE2	1.84	0.42
1:C:344:MET:HG2	1:C:363:GLU:HA	2.00	0.42
1:D:327:ILE:HG22	1:D:330:PHE:HE1	1.84	0.42
1:B:308:ILE:O	1:B:333:ALA:HA	2.19	0.42
1:D:185:ILE:CD1	1:D:192:MET:HG2	2.50	0.42
1:B:363:GLU:OE1	1:B:441:LYS:NZ	2.43	0.42
1:C:457:MET:HB3	1:C:457:MET:HE3	1.72	0.42
1:A:246:VAL:HG11	1:A:318:LEU:HD12	2.01	0.42
1:A:317:ILE:HG12	1:A:327:ILE:HD13	2.01	0.42
1:B:266:PRO:HG2	1:B:321:GLU:HG2	2.02	0.42
1:A:297:ASN:HD22	1:A:451:GLN:HE21	1.66	0.42
1:A:176:VAL:HG21	1:A:205:VAL:HG22	2.02	0.41
1:B:243:GLU:HG3	1:D:321:GLU:O	2.20	0.41
1:A:363:GLU:C	1:A:364:ILE:HD13	2.44	0.41
1:A:457:MET:HB2	1:A:457:MET:HE3	1.82	0.41
1:A:235:LYS:N	1:A:235:LYS:HD3	2.35	0.41
1:B:297:ASN:ND2	1:B:451:GLN:HE21	2.19	0.41
1:D:173:LEU:HA	1:D:176:VAL:HG22	2.03	0.41
1:A:396:LEU:O	1:A:399:ILE:HG12	2.21	0.41
1:A:204:TYR:CZ	1:A:207:ASN:HA	2.56	0.41
1:B:409:THR:HG22	1:B:412:ASP:OD2	2.21	0.41
1:A:245:LEU:HD22	1:A:330:PHE:CZ	2.52	0.41
1:A:302:LEU:HD21	1:A:330:PHE:CE2	2.55	0.41
1:D:233:GLU:O	1:D:237:MET:HG2	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:415:ASP:HB3	1:A:418:MET:HE2	2.03	0.40
1:C:415:ASP:HB3	1:C:418:MET:HE2	2.02	0.40
1:D:281:PRO:HA	1:D:282:PRO:HD3	1.97	0.40
1:D:410:ILE:HD13	1:D:430:TYR:CD1	2.56	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	280/307 (91%)	276 (99%)	4 (1%)	0	100	100
1	B	281/307 (92%)	275 (98%)	6 (2%)	0	100	100
1	C	272/307 (89%)	262 (96%)	10 (4%)	0	100	100
1	D	267/307 (87%)	257 (96%)	10 (4%)	0	100	100
All	All	1100/1228 (90%)	1070 (97%)	30 (3%)	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	243/265 (92%)	243 (100%)	0	100	100
1	B	235/265 (89%)	232 (99%)	3 (1%)	61	69

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	236/265 (89%)	236 (100%)	0	100	100
1	D	229/265 (86%)	227 (99%)	2 (1%)	70	78
All	All	943/1060 (89%)	938 (100%)	5 (0%)	81	88

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	223	THR
1	B	329	ASP
1	B	394	GLN
1	D	254	ASP
1	D	257	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	179	ASN
1	A	286	HIS
1	A	297	ASN
1	A	300	ASN
1	A	305	ASN
1	A	390	HIS
1	A	455	GLN
1	B	241	GLN
1	B	297	ASN
1	B	307	HIS
1	B	390	HIS
1	B	394	GLN
1	B	452	GLN
1	B	455	GLN
1	C	190	ASN
1	C	241	GLN
1	D	178	ASN
1	D	241	GLN
1	D	267	ASN
1	D	455	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

12 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	TPO	A	345	1	8,10,11	1.12	0	10,14,16	1.85	2 (20%)
1	SEP	C	346	1	8,9,10	1.61	1 (12%)	7,12,14	0.98	0
1	SEP	A	346	1	8,9,10	1.61	1 (12%)	7,12,14	1.20	1 (14%)
1	TPO	C	345	1	8,10,11	1.25	0	10,14,16	1.98	1 (10%)
1	TPO	D	345	1	8,10,11	1.14	0	10,14,16	1.89	2 (20%)
1	TPO	D	342	1	8,10,11	1.20	0	10,14,16	1.58	1 (10%)
1	TPO	C	342	1	8,10,11	1.24	0	10,14,16	1.43	1 (10%)
1	TPO	B	342	1	8,10,11	1.17	0	10,14,16	1.46	1 (10%)
1	TPO	B	345	1	8,10,11	1.13	0	10,14,16	1.90	2 (20%)
1	TPO	A	342	1	8,10,11	1.14	0	10,14,16	1.91	2 (20%)
1	SEP	B	346	1	8,9,10	1.63	1 (12%)	7,12,14	1.34	1 (14%)
1	SEP	D	346	1	8,9,10	1.62	1 (12%)	7,12,14	1.16	1 (14%)

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	TPO	A	345	1	-	2/9/11/13	-
1	SEP	C	346	1	-	3/6/8/10	-
1	SEP	A	346	1	-	0/6/8/10	-
1	TPO	C	345	1	-	2/9/11/13	-
1	TPO	D	345	1	-	2/9/11/13	-
1	TPO	D	342	1	-	7/9/11/13	-
1	TPO	C	342	1	-	5/9/11/13	-
1	TPO	B	342	1	-	2/9/11/13	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	TPO	B	345	1	-	3/9/11/13	-
1	TPO	A	342	1	-	4/9/11/13	-
1	SEP	B	346	1	-	4/6/8/10	-
1	SEP	D	346	1	-	0/6/8/10	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	346	SEP	P-O1P	3.56	1.61	1.50
1	D	346	SEP	P-O1P	3.54	1.61	1.50
1	A	346	SEP	P-O1P	3.52	1.61	1.50
1	C	346	SEP	P-O1P	3.50	1.61	1.50

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	345	TPO	P-OG1-CB	-5.59	108.12	123.33
1	B	345	TPO	P-OG1-CB	-5.18	109.25	123.33
1	A	345	TPO	P-OG1-CB	-5.01	109.72	123.33
1	D	345	TPO	P-OG1-CB	-4.98	109.80	123.33
1	A	342	TPO	P-OG1-CB	-4.87	110.10	123.33
1	D	342	TPO	P-OG1-CB	-4.35	111.52	123.33
1	B	342	TPO	P-OG1-CB	-4.06	112.29	123.33
1	C	342	TPO	P-OG1-CB	-3.78	113.07	123.33
1	B	346	SEP	OG-CB-CA	2.80	110.87	108.14
1	D	345	TPO	CG2-CB-CA	-2.51	108.37	113.26
1	A	342	TPO	CG2-CB-CA	-2.50	108.39	113.26
1	A	346	SEP	OG-CB-CA	2.30	110.39	108.14
1	B	345	TPO	CG2-CB-CA	-2.22	108.93	113.26
1	A	345	TPO	CG2-CB-CA	-2.21	108.96	113.26
1	D	346	SEP	OG-CB-CA	2.15	110.24	108.14

There are no chirality outliers.

All (34) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	342	TPO	N-CA-CB-OG1
1	A	342	TPO	C-CA-CB-CG2
1	A	345	TPO	N-CA-CB-OG1
1	A	345	TPO	O-C-CA-CB

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Mol	Chain	Res	Type	Atoms
1	B	345	TPO	N-CA-CB-OG1
1	B	345	TPO	O-C-CA-CB
1	B	346	SEP	CB-OG-P-O2P
1	B	346	SEP	CB-OG-P-O3P
1	C	342	TPO	N-CA-CB-OG1
1	C	342	TPO	C-CA-CB-CG2
1	C	342	TPO	O-C-CA-CB
1	C	342	TPO	CA-CB-OG1-P
1	C	345	TPO	N-CA-CB-OG1
1	C	345	TPO	O-C-CA-CB
1	C	346	SEP	CB-OG-P-O1P
1	C	346	SEP	CB-OG-P-O2P
1	C	346	SEP	CB-OG-P-O3P
1	D	342	TPO	N-CA-CB-OG1
1	D	342	TPO	C-CA-CB-CG2
1	D	342	TPO	O-C-CA-CB
1	D	345	TPO	N-CA-CB-OG1
1	B	346	SEP	CB-OG-P-O1P
1	A	342	TPO	N-CA-CB-CG2
1	C	342	TPO	N-CA-CB-CG2
1	D	342	TPO	N-CA-CB-CG2
1	B	342	TPO	C-CA-CB-CG2
1	B	346	SEP	N-CA-CB-OG
1	D	342	TPO	CB-OG1-P-O1P
1	D	342	TPO	CB-OG1-P-O2P
1	D	342	TPO	CB-OG1-P-O3P
1	A	342	TPO	O-C-CA-CB
1	B	342	TPO	O-C-CA-CB
1	D	345	TPO	O-C-CA-CB
1	B	345	TPO	CB-OG1-P-O1P

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 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$
2	VDC	B	501	-	35,39,39	1.02	2 (5%)	34,62,62	2.23	8 (23%)
2	VDC	D	501	-	35,39,39	1.01	2 (5%)	34,62,62	2.29	8 (23%)
2	VDC	A	501	-	35,39,39	1.01	2 (5%)	34,62,62	2.23	8 (23%)
2	VDC	C	501	-	35,39,39	1.01	2 (5%)	34,62,62	2.33	7 (20%)

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
2	VDC	B	501	-	-	4/20/46/46	0/7/6/6
2	VDC	D	501	-	-	3/20/46/46	0/7/6/6
2	VDC	A	501	-	-	4/20/46/46	0/7/6/6
2	VDC	C	501	-	-	4/20/46/46	0/7/6/6

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	VDC	C2-C9	-3.60	1.39	1.48
2	C	501	VDC	C2-C9	-3.60	1.39	1.48
2	D	501	VDC	C2-C9	-3.60	1.39	1.48
2	A	501	VDC	C2-C9	-3.58	1.39	1.48
2	C	501	VDC	F1-C8	-2.27	1.35	1.40
2	D	501	VDC	F1-C8	-2.27	1.35	1.40
2	B	501	VDC	F1-C8	-2.27	1.35	1.40
2	A	501	VDC	F1-C8	-2.24	1.35	1.40

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	VDC	C9-C2-N1	7.23	118.72	112.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	VDC	C9-C2-N1	7.16	118.65	112.00
2	B	501	VDC	C9-C2-N1	6.45	117.99	112.00
2	A	501	VDC	C9-C2-N1	6.40	117.95	112.00
2	C	501	VDC	C19-C14-C15	-5.72	84.89	88.59
2	D	501	VDC	C19-C14-C15	-5.69	84.92	88.59
2	A	501	VDC	C19-C14-C15	-5.63	84.96	88.59
2	B	501	VDC	C19-C14-C15	-5.63	84.96	88.59
2	B	501	VDC	C12-C20-N5	-5.33	122.03	126.31
2	A	501	VDC	C12-C20-N5	-5.33	122.03	126.31
2	D	501	VDC	C12-C20-N5	-4.91	122.37	126.31
2	C	501	VDC	C12-C20-N5	-4.87	122.40	126.31
2	C	501	VDC	C19-C14-N3	-4.09	116.92	126.04
2	C	501	VDC	C3-C2-N1	-3.89	122.21	127.12
2	D	501	VDC	C3-C2-N1	-3.89	122.21	127.12
2	B	501	VDC	C19-C14-N3	-3.85	117.44	126.04
2	A	501	VDC	C19-C14-N3	-3.85	117.45	126.04
2	B	501	VDC	C3-C2-N1	-3.49	122.71	127.12
2	A	501	VDC	C3-C2-N1	-3.46	122.75	127.12
2	D	501	VDC	C19-C14-N3	-3.32	118.63	126.04
2	C	501	VDC	C5-N2-C9	-2.78	120.25	122.22
2	C	501	VDC	O3-C17-C14	-2.59	99.51	106.40
2	D	501	VDC	O3-C17-C14	-2.57	99.59	106.40
2	A	501	VDC	O3-C17-C14	-2.48	99.81	106.40
2	B	501	VDC	O3-C17-C14	-2.48	99.81	106.40
2	B	501	VDC	C5-N2-C9	-2.41	120.51	122.22
2	A	501	VDC	C5-N2-C9	-2.40	120.52	122.22
2	D	501	VDC	C5-N2-C9	-2.33	120.57	122.22
2	A	501	VDC	C18-C16-C15	2.19	123.83	116.07
2	B	501	VDC	C18-C16-C15	2.18	123.79	116.07
2	D	501	VDC	C10-C21-N5	-2.01	122.51	124.40

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	VDC	C17-C14-N3-C13
2	A	501	VDC	C7-C6-N2-C5
2	B	501	VDC	C17-C14-N3-C13
2	B	501	VDC	C7-C6-N2-C5
2	C	501	VDC	C17-C14-N3-C13
2	C	501	VDC	C7-C6-N2-C5
2	D	501	VDC	C17-C14-N3-C13

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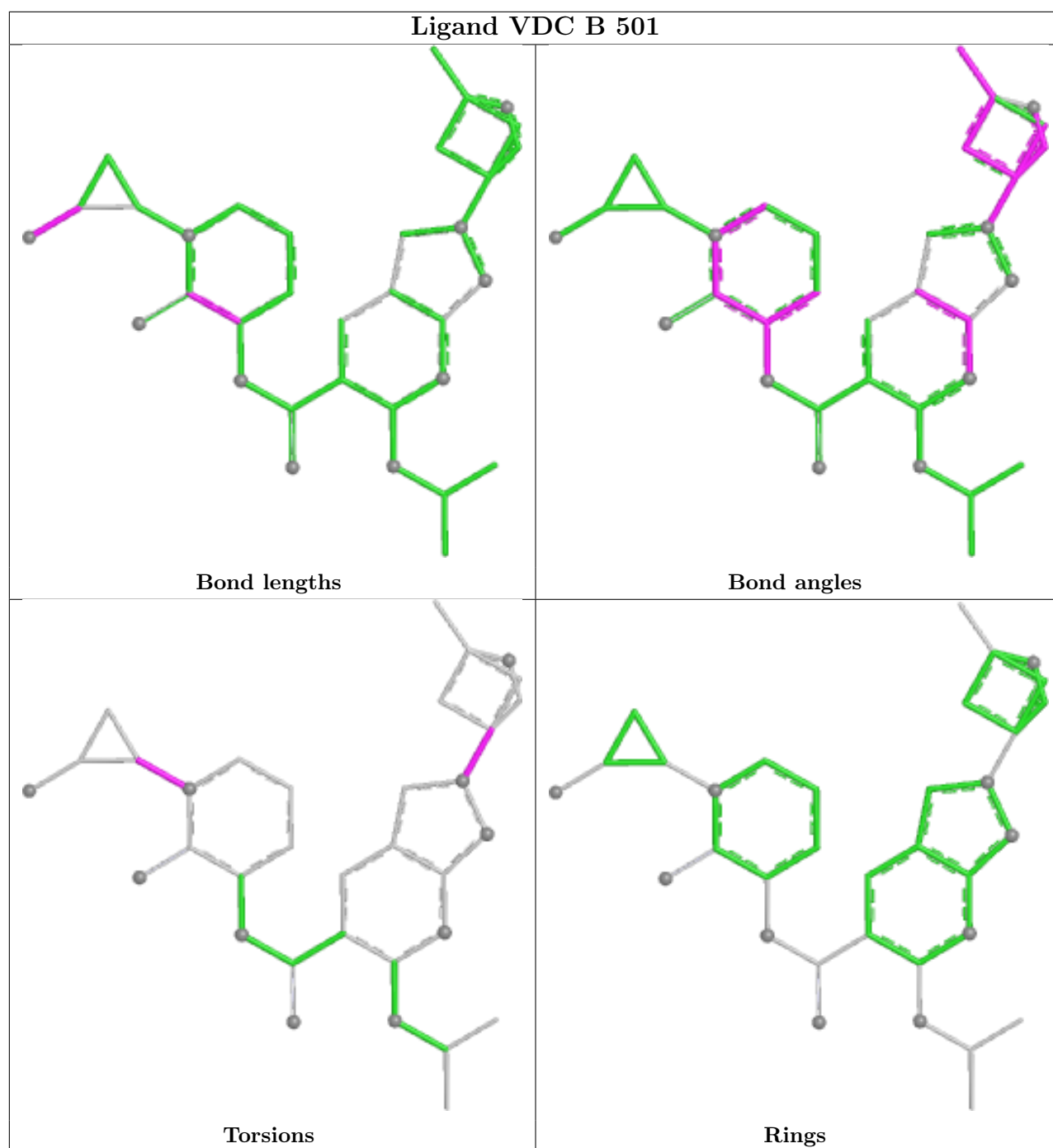
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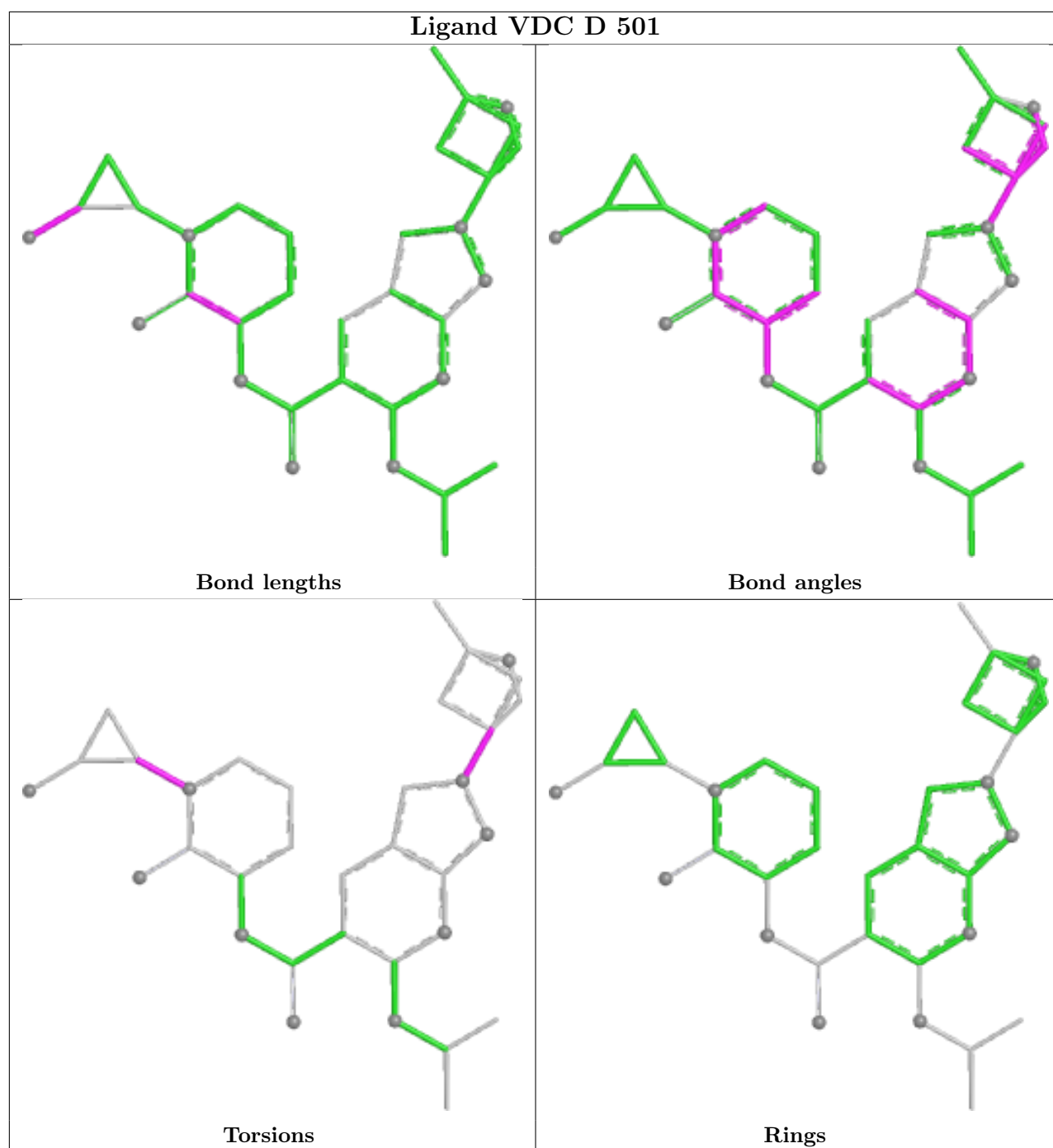
Mol	Chain	Res	Type	Atoms
2	D	501	VDC	C7-C6-N2-C5
2	A	501	VDC	C17-C14-N3-N4
2	B	501	VDC	C17-C14-N3-N4
2	C	501	VDC	C17-C14-N3-N4
2	D	501	VDC	C17-C14-N3-N4
2	A	501	VDC	C7-C6-N2-C9
2	B	501	VDC	C7-C6-N2-C9
2	C	501	VDC	C7-C6-N2-C9

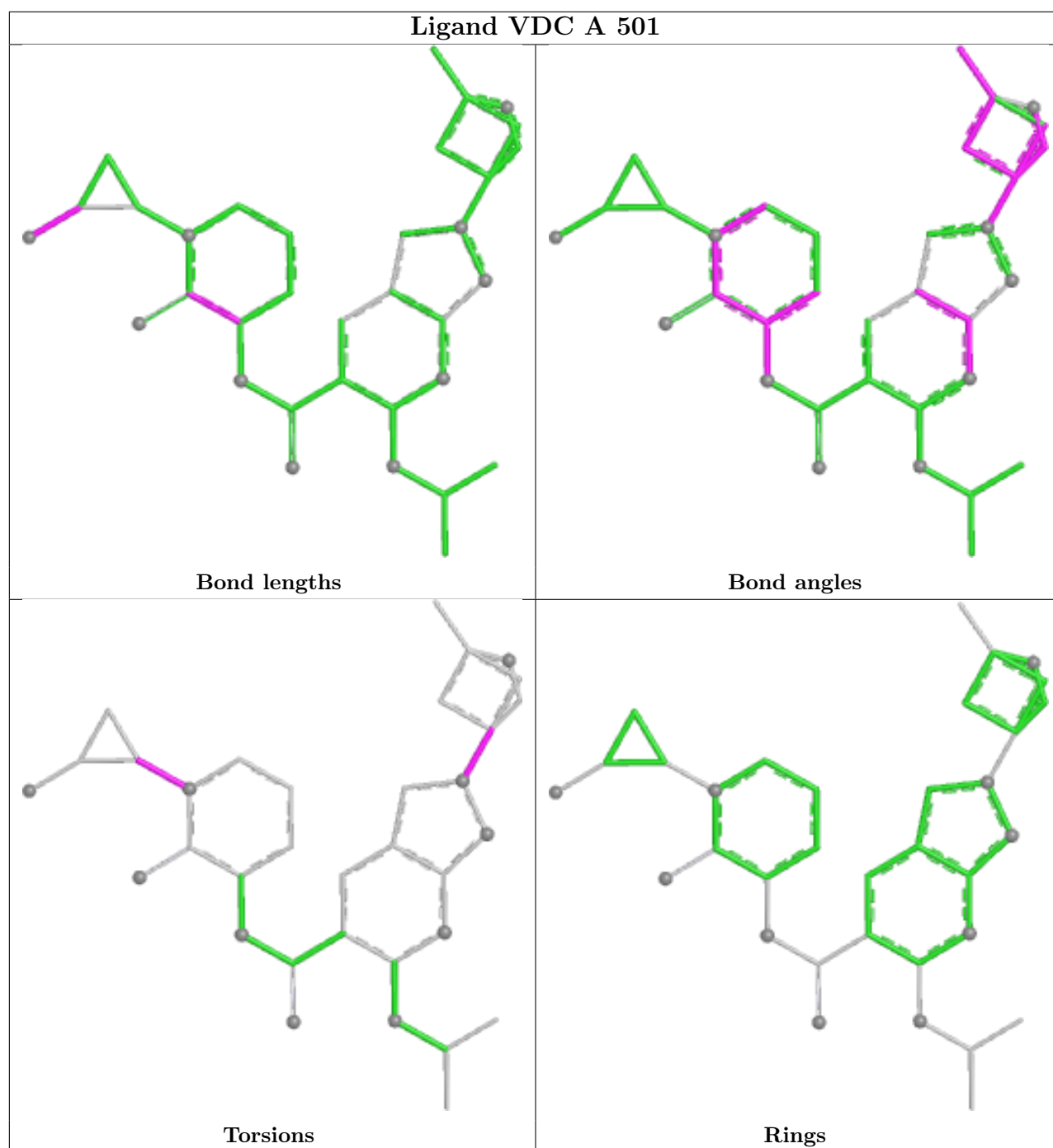
There are no ring outliers.

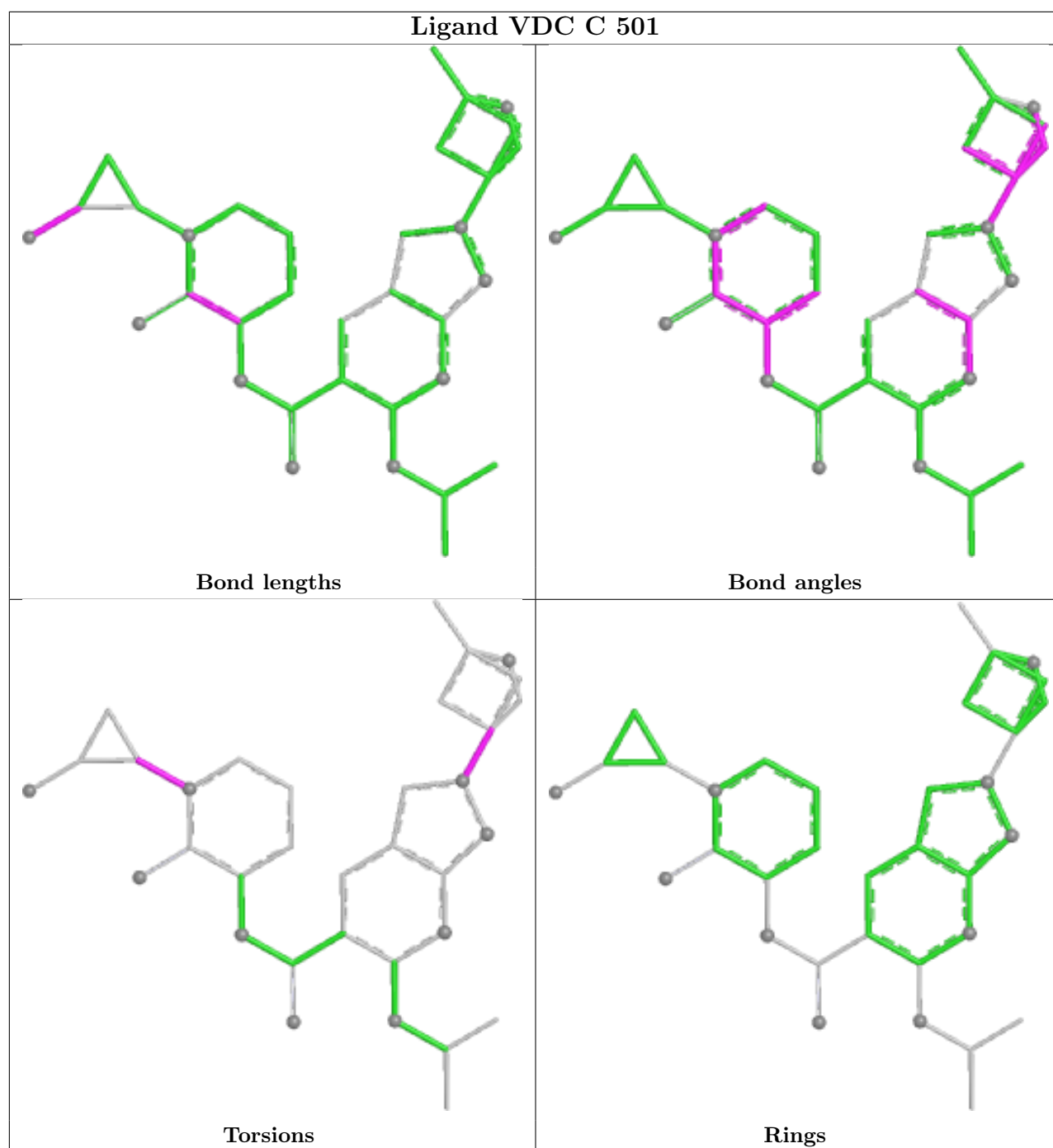
No monomer is involved in short contacts.

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.









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	284/307 (92%)	0.60	24 (8%) 16 17	35, 58, 104, 137	1 (0%)
1	B	286/307 (93%)	0.51	24 (8%) 17 18	35, 55, 99, 137	0
1	C	278/307 (90%)	0.58	19 (6%) 23 25	23, 60, 101, 120	3 (1%)
1	D	274/307 (89%)	0.60	21 (7%) 19 21	37, 59, 109, 173	0
All	All	1122/1228 (91%)	0.57	88 (7%) 19 20	23, 58, 102, 173	4 (0%)

All (88) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	330	PHE	5.4
1	C	198	GLY	4.7
1	A	226	LEU	4.6
1	D	216	ALA	4.6
1	C	257	ASP	4.3
1	A	223	THR	4.2
1	C	343	VAL	4.0
1	B	217	ALA	4.0
1	D	343	VAL	3.9
1	A	230	PHE	3.9
1	B	197	PHE	3.8
1	C	335	ALA	3.6
1	B	236	VAL	3.5
1	D	197	PHE	3.5
1	C	223	THR	3.4
1	A	221	ILE	3.3
1	A	224	GLU	3.2
1	A	335	ALA	3.2
1	A	336	SER	3.2
1	A	197	PHE	3.1
1	B	335	ALA	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	399	ILE	3.1
1	B	229	GLN	3.0
1	C	410	ILE	3.0
1	A	234	ILE	3.0
1	D	226	LEU	2.9
1	D	165	PHE	2.9
1	C	425[A]	SER	2.9
1	D	397	LEU	2.9
1	B	399	ILE	2.9
1	B	220	ASP	2.8
1	D	224	GLU	2.8
1	B	224	GLU	2.8
1	D	164	ARG	2.7
1	A	438[A]	HIS	2.7
1	B	176	VAL	2.7
1	D	225	GLU	2.7
1	B	228	GLN	2.7
1	A	164	ARG	2.7
1	A	410	ILE	2.6
1	C	254	ASP	2.6
1	B	333	ALA	2.6
1	A	165	PHE	2.6
1	D	348	ILE	2.5
1	D	204	TYR	2.5
1	A	364	ILE	2.5
1	C	187	VAL	2.4
1	B	332	LEU	2.4
1	C	230	PHE	2.4
1	C	200	VAL	2.4
1	C	344	MET	2.4
1	C	163	THR	2.4
1	C	332	LEU	2.4
1	B	221	ILE	2.4
1	A	222	THR	2.4
1	A	353	ALA	2.3
1	B	336	SER	2.3
1	D	236	VAL	2.3
1	D	229	GLN	2.3
1	A	344	MET	2.3
1	B	348	ILE	2.3
1	B	222	THR	2.3
1	C	215	LEU	2.3

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Mol	Chain	Res	Type	RSRZ
1	C	334	ARG	2.3
1	A	343	VAL	2.3
1	A	459	ALA	2.3
1	B	230	PHE	2.2
1	D	234	ILE	2.2
1	B	331	GLY	2.2
1	D	196	GLY	2.2
1	B	240	CYS	2.2
1	D	194	GLU	2.2
1	C	327[A]	ILE	2.1
1	B	404	GLU	2.1
1	D	409	THR	2.1
1	B	199	VAL	2.1
1	A	216	ALA	2.1
1	A	397	LEU	2.1
1	B	226	LEU	2.1
1	D	237	MET	2.1
1	B	241	GLN	2.1
1	C	194	GLU	2.0
1	C	206	ASN	2.0
1	A	195	GLY	2.0
1	D	308	ILE	2.0
1	A	236	VAL	2.0
1	D	407	GLU	2.0
1	B	164	ARG	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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	TPO	A	342	11/12	0.28	0.21	116,123,148,154	0
1	TPO	C	342	11/12	0.45	0.19	96,105,126,137	0
1	TPO	D	342	11/12	0.48	0.18	97,108,122,132	0
1	SEP	D	346	10/11	0.60	0.11	105,114,129,141	0
1	SEP	B	346	10/11	0.64	0.12	103,112,138,167	0
1	SEP	C	346	10/11	0.66	0.13	112,118,129,133	0
1	TPO	B	342	11/12	0.69	0.14	100,109,117,134	0
1	SEP	A	346	10/11	0.70	0.10	116,122,126,136	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
1	TPO	C	345	11/12	0.86	0.14	100,108,121,122	0
1	TPO	A	345	11/12	0.86	0.11	101,111,118,124	0
1	TPO	D	345	11/12	0.87	0.12	96,104,115,119	0
1	TPO	B	345	11/12	0.90	0.11	91,98,114,117	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

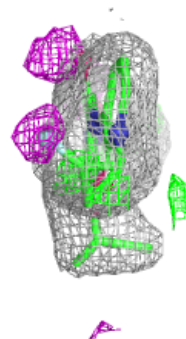
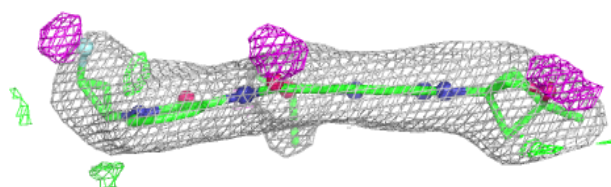
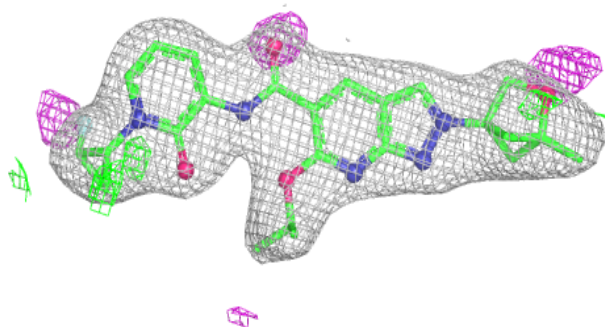
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
2	VDC	A	501	34/34	0.92	0.10	35,41,54,59	0
2	VDC	B	501	34/34	0.94	0.08	35,41,54,59	0
2	VDC	C	501	34/34	0.95	0.09	45,50,58,65	0
2	VDC	D	501	34/34	0.96	0.08	39,47,55,67	0

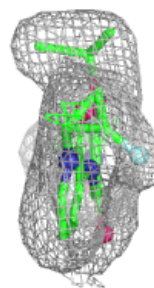
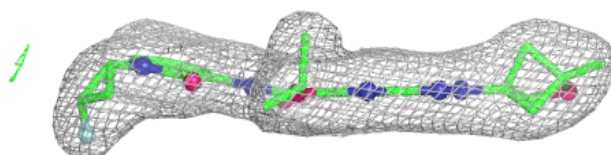
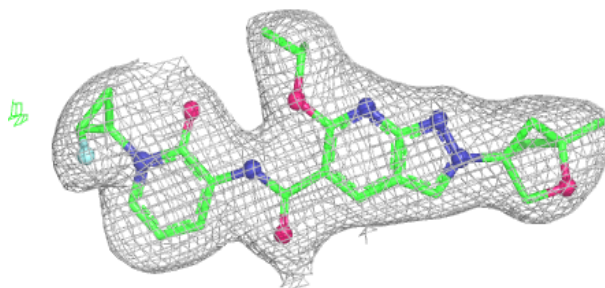
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around VDC A 501:

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

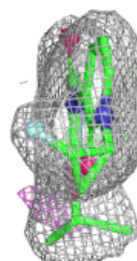
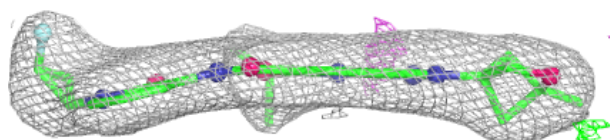
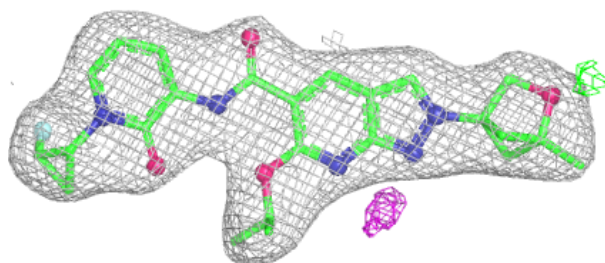
**Electron density around VDC B 501:**

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

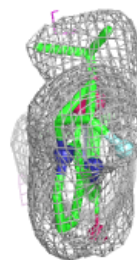
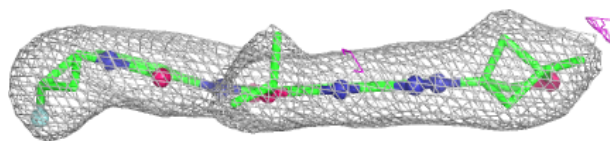
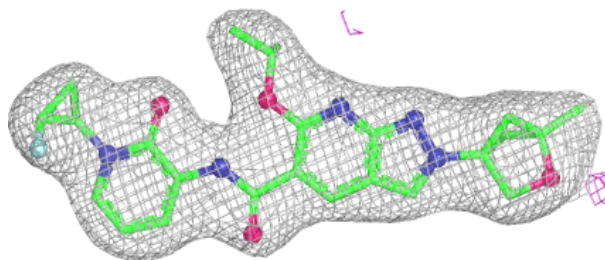


Electron density around VDC C 501:

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

**Electron density around VDC 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)



6.5 Other polymers [i](#)

There are no such residues in this entry.