Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 09:53 am BST

PDB ID	:	4J3J
Title	:	Crystal Structure of DPP-IV with Compound C3
Authors	:	Xiong, B.; Zhu, L.R.; Chen, D.Q.; Zhao, Y.L.; Jiang, F.; Shen, J.K.
Deposited on	:	2013-02-05
Resolution	:	3.20 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 following versions of software and data (see references ⓘ) were used in the production of this report:

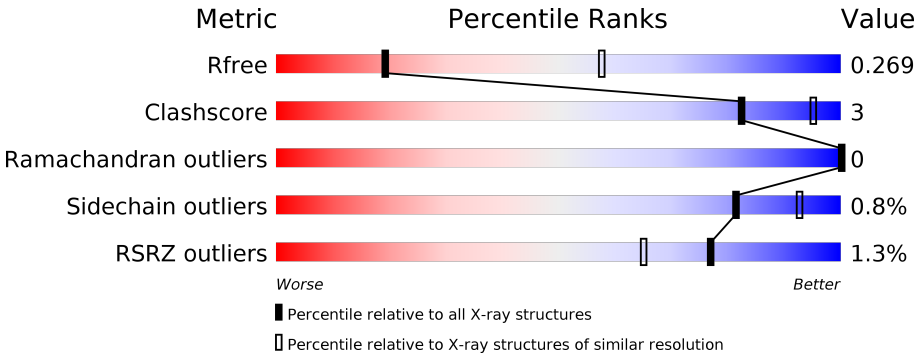
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

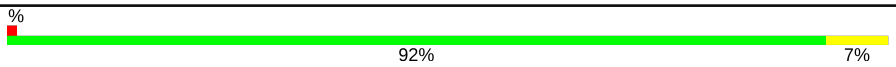
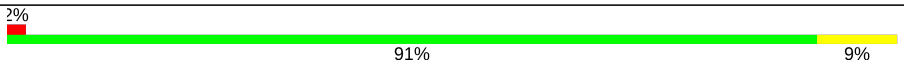
The reported resolution of this entry is 3.20 Å.

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	1133 (3.20-3.20)
Clashscore	141614	1253 (3.20-3.20)
Ramachandran outliers	138981	1234 (3.20-3.20)
Sidechain outliers	138945	1233 (3.20-3.20)
RSRZ outliers	127900	1095 (3.20-3.20)

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 on 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 <=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	728	
1	B	728	

2 Entry composition

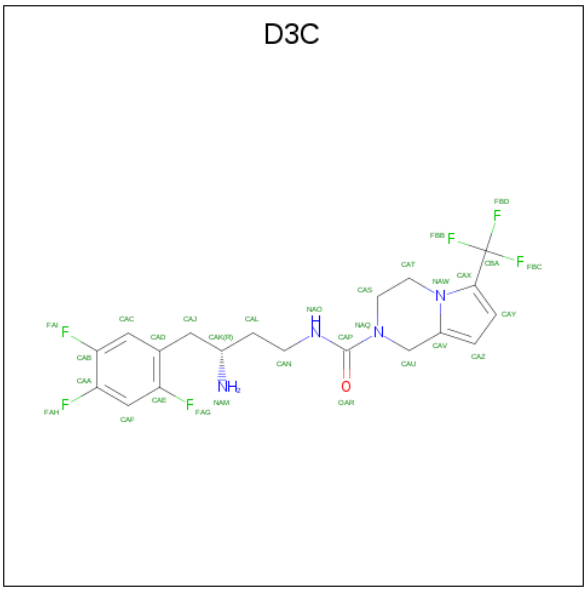
There are 2 unique types of molecules in this entry. The entry contains 11959 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Dipeptidyl peptidase 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	725	Total	C	N	O	S	0	0	0
			5942	3813	979	1124	26			
1	B	727	Total	C	N	O	S	0	0	0
			5957	3824	981	1126	26			

- Molecule 2 is N-[(3R)-3-amino-4-(2,4,5-trifluorophenyl)butyl]-6-(trifluoromethyl)-3,4-dihydropyrrolo[1,2-a]pyrazine-2(1H)-carboxamide (three-letter code: D3C) (formula: $C_{19}H_{20}F_6N_4O$).



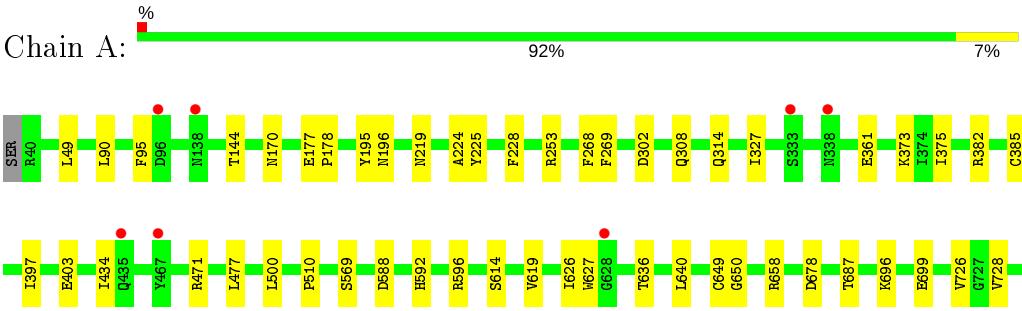
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	F	N	O	0	0
			30	19	6	4	1		
2	B	1	Total	C	F	N	O	0	0
			30	19	6	4	1		

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

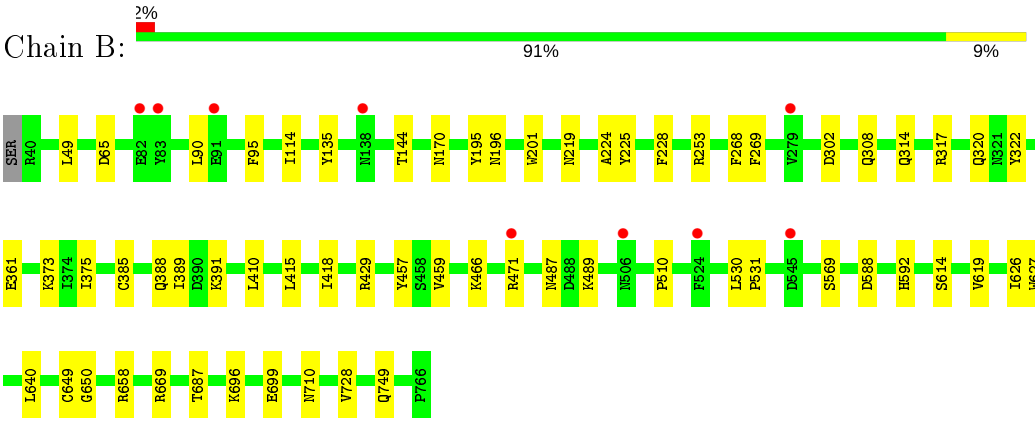
- Molecule 1: Dipeptidyl peptidase 4

Chain A:



- Molecule 1: Dipeptidyl peptidase 4

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α, β, γ	79.65Å 79.65Å 292.27Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.70 – 3.20 29.70 – 3.20	Depositor EDS
% Data completeness (in resolution range)	99.6 (29.70-3.20) 99.7 (29.70-3.20)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.39 (at 3.18Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.225 , 0.270 0.223 , 0.269	Depositor DCC
R_{free} test set	1695 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	99.7	Xtriage
Anisotropy	0.128	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 57.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.004 for -h,-k,l 0.076 for h,-h-k,-l 0.026 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	11959	wwPDB-VP
Average B, all atoms (Å^2)	119.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: D3C

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	0.28	0/6113	0.45	0/8313
1	B	0.28	0/6129	0.45	0/8336
All	All	0.28	0/12242	0.45	0/16649

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	5942	0	5662	27	0
1	B	5957	0	5680	33	0
2	A	30	0	20	0	0
2	B	30	0	20	0	0
All	All	11959	0	11382	59	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 3.

All (59) 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:65:ASP:HB2	1:B:466:LYS:HG3	1.68	0.74
1:B:219:ASN:HB2	1:B:308:GLN:OE1	1.97	0.65
1:A:219:ASN:HB2	1:A:308:GLN:OE1	1.98	0.63
1:A:302:ASP:HB3	1:A:314:GLN:HB2	1.80	0.61
1:A:696:LYS:HG3	1:A:728:VAL:HG22	1.82	0.60
1:B:302:ASP:HB3	1:B:314:GLN:HB2	1.85	0.58
1:B:614:SER:HA	1:B:619:VAL:HB	1.86	0.58
1:B:696:LYS:HG3	1:B:728:VAL:HG22	1.86	0.57
1:B:224:ALA:HB1	1:B:268:PHE:CZ	2.42	0.54
1:A:510:PRO:HD3	1:A:569:SER:HB2	1.89	0.54
1:A:614:SER:HA	1:A:619:VAL:HB	1.90	0.53
1:A:726:VAL:HG23	1:A:728:VAL:HG23	1.92	0.52
1:A:327:ILE:HD13	1:A:389:ILE:HG12	1.92	0.51
1:B:640:LEU:HD11	1:B:650:GLY:HA3	1.93	0.51
1:B:49:LEU:HD22	1:B:749:GLN:HA	1.93	0.49
1:B:195:TYR:HB2	1:B:228:PHE:HB2	1.94	0.49
1:B:487:ASN:HD21	1:B:489:LYS:HE3	1.77	0.49
1:A:640:LEU:HD11	1:A:650:GLY:HA3	1.95	0.48
1:A:388:GLN:HB2	1:A:391:LYS:HB2	1.96	0.48
1:B:626:ILE:O	1:B:650:GLY:HA2	2.14	0.48
1:A:90:LEU:HD21	1:A:95:PHE:HE2	1.79	0.47
1:A:373:LYS:HD3	1:A:375:ILE:HD11	1.97	0.47
1:B:429:ARG:HB2	1:B:457:TYR:H	1.78	0.47
1:B:510:PRO:HD3	1:B:569:SER:HB2	1.97	0.46
1:A:195:TYR:HB2	1:A:228:PHE:HB2	1.96	0.46
1:A:49:LEU:HD22	1:A:749:GLN:HA	1.98	0.46
1:B:327:ILE:HD13	1:B:389:ILE:HG12	1.98	0.46
1:B:388:GLN:HB2	1:B:391:LYS:HB2	1.97	0.46
1:B:418:ILE:HD11	1:B:459:VAL:HG12	1.98	0.46
1:A:658:ARG:HG3	1:A:687:THR:HG22	1.97	0.45
1:B:658:ARG:HG3	1:B:687:THR:HG22	1.99	0.45
1:B:201:TRP:CZ2	1:B:710:ASN:HA	2.51	0.45
1:B:317:ARG:HD2	1:B:322:TYR:HB3	2.00	0.44
1:A:170:ASN:O	1:A:196:ASN:HB2	2.18	0.44
1:B:224:ALA:HB1	1:B:268:PHE:HZ	1.83	0.44
1:A:626:ILE:O	1:A:650:GLY:HA2	2.17	0.44
1:B:649:CYS:HB3	1:B:699:GLU:HB2	1.98	0.44
1:B:588:ASP:O	1:B:592:HIS:HB2	2.18	0.44
1:B:373:LYS:HD3	1:B:375:ILE:HD11	2.00	0.43
1:A:253:ARG:HH12	1:B:253:ARG:HH12	1.67	0.43
1:A:649:CYS:HB3	1:A:699:GLU:HB2	2.00	0.43
1:A:588:ASP:O	1:A:592:HIS:HB2	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:596:ARG:NH2	1:A:678:ASP:OD1	2.52	0.43
1:A:626:ILE:HG23	1:A:636:THR:HG23	2.00	0.42
1:A:177:GLU:HA	1:A:178:PRO:HD3	1.93	0.42
1:A:225:TYR:CZ	1:A:269:PHE:HB2	2.54	0.42
1:A:477:LEU:HD22	1:A:500:LEU:HD23	2.02	0.42
1:B:225:TYR:CZ	1:B:269:PHE:HB2	2.55	0.42
1:B:90:LEU:HD21	1:B:95:PHE:HE2	1.84	0.41
1:A:382:ARG:H	1:A:403:GLU:HG2	1.85	0.41
1:B:410:LEU:HD13	1:B:415:LEU:HD12	2.02	0.41
1:B:170:ASN:O	1:B:196:ASN:HB2	2.20	0.41
1:A:224:ALA:HB1	1:A:268:PHE:CZ	2.56	0.41
1:A:397:ILE:HD12	1:A:434:ILE:HD13	2.02	0.41
1:B:530:LEU:HA	1:B:531:PRO:HD3	1.95	0.41
1:B:201:TRP:HZ2	1:B:710:ASN:HA	1.87	0.40
1:B:320:GLN:OE1	1:B:669:ARG:HG3	2.21	0.40
1:B:114:ILE:HG23	1:B:135:TYR:HB3	2.02	0.40
1:B:357:PHE:O	1:B:669:ARG:NH1	2.54	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	723/728 (99%)	690 (95%)	33 (5%)	0	100	100
1	B	725/728 (100%)	692 (95%)	33 (5%)	0	100	100
All	All	1448/1456 (100%)	1382 (95%)	66 (5%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	650/653 (100%)	644 (99%)	6 (1%)	78 91
1	B	652/653 (100%)	647 (99%)	5 (1%)	81 93
All	All	1302/1306 (100%)	1291 (99%)	11 (1%)	81 93

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	144	THR
1	A	361	GLU
1	A	385	CYS
1	A	389	ILE
1	A	471	ARG
1	A	627	TRP
1	B	144	THR
1	B	361	GLU
1	B	385	CYS
1	B	471	ARG
1	B	627	TRP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	103	ASN
1	A	138	ASN
1	A	388	GLN
1	A	508	GLN
1	A	612	GLN
1	B	138	ASN
1	B	388	GLN
1	B	508	GLN
1	B	586	GLN
1	B	612	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry

2 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	D3C	A	801	-	30,32,32	1.17	2 (6%)	41,47,47	1.91	10 (24%)
2	D3C	B	801	-	30,32,32	1.15	2 (6%)	41,47,47	2.34	11 (26%)

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	D3C	A	801	-	-	1/20/29/29	0/2/3/3
2	D3C	B	801	-	-	1/20/29/29	0/2/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	D3C	CBA-CAX	3.51	1.54	1.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	801	D3C	CBA-CAX	3.11	1.53	1.49
2	A	801	D3C	CAY-CAX	-2.88	1.33	1.39
2	B	801	D3C	CAY-CAX	-2.85	1.33	1.39

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	801	D3C	CAV-CAU-NAQ	-9.72	103.90	111.66
2	A	801	D3C	CAV-CAU-NAQ	-6.48	106.48	111.66
2	B	801	D3C	NAO-CAP-NAQ	6.27	120.69	117.67
2	A	801	D3C	NAO-CAP-NAQ	4.61	119.88	117.67
2	A	801	D3C	CAY-CAZ-CAV	3.68	108.76	106.76
2	B	801	D3C	OAR-CAP-NAQ	-3.39	117.02	121.78
2	B	801	D3C	CAY-CAZ-CAV	3.25	108.53	106.76
2	A	801	D3C	OAR-CAP-NAQ	-3.10	117.42	121.78
2	A	801	D3C	CAV-NAW-CAX	-2.90	103.21	107.44
2	B	801	D3C	CAV-NAW-CAX	-2.82	103.32	107.44
2	A	801	D3C	CAF-CAE-CAD	-2.58	120.60	123.98
2	B	801	D3C	CAF-CAE-CAD	-2.48	120.72	123.98
2	B	801	D3C	CAS-CAT-NAW	2.31	113.77	109.07
2	A	801	D3C	CAN-NAO-CAP	2.30	122.97	120.84
2	A	801	D3C	CAS-CAT-NAW	2.29	113.73	109.07
2	A	801	D3C	CAC-CAD-CAE	2.23	119.18	116.58
2	B	801	D3C	CAT-NAW-CAV	-2.21	122.24	125.46
2	B	801	D3C	CAN-NAO-CAP	2.16	122.84	120.84
2	B	801	D3C	CAC-CAD-CAE	2.15	119.08	116.58
2	A	801	D3C	CBA-CAX-NAW	2.05	125.56	122.95
2	B	801	D3C	CAT-NAW-CAX	2.01	134.44	128.07

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	801	D3C	CAL-CAN-NAO-CAP
2	A	801	D3C	CAL-CAN-NAO-CAP

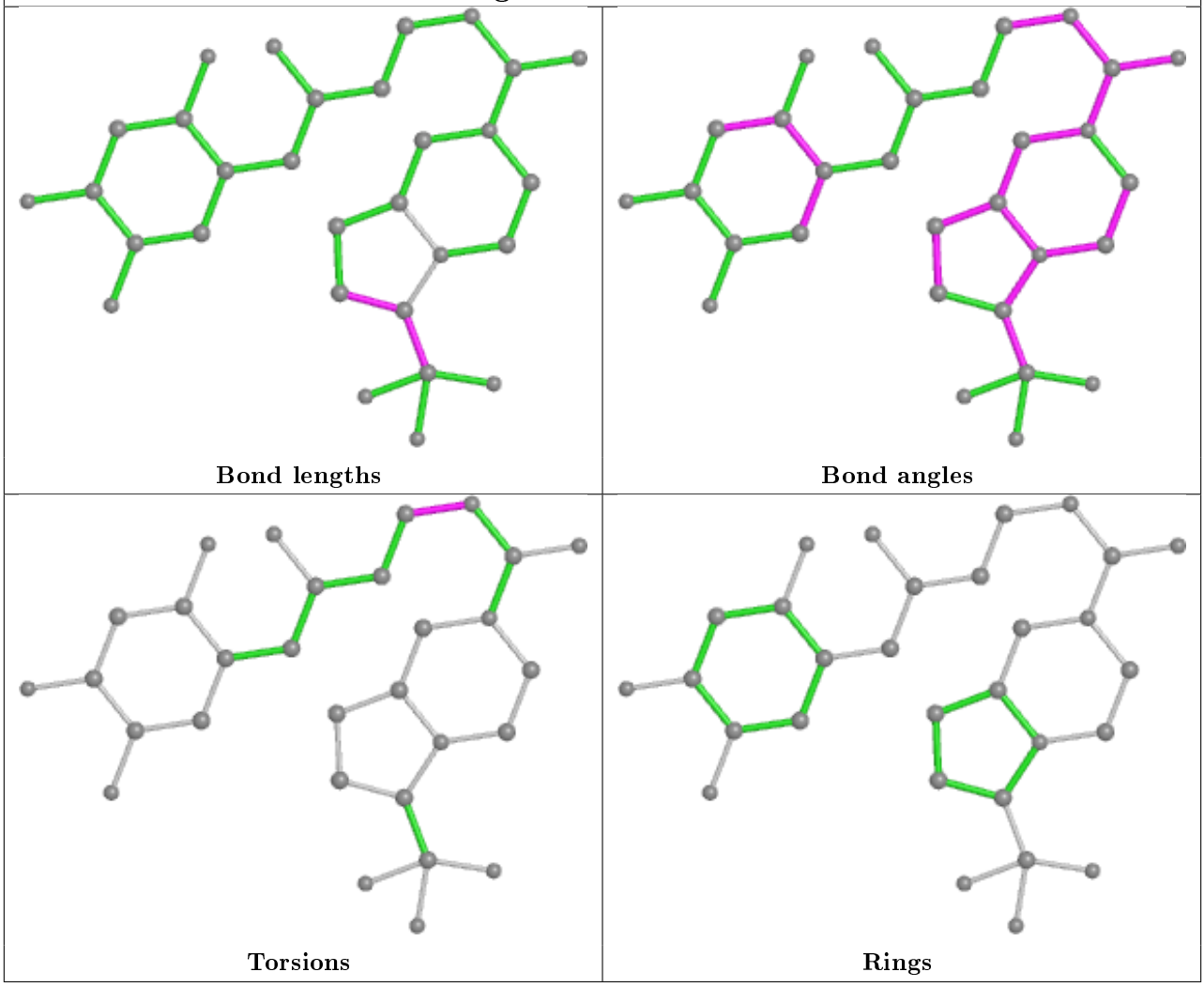
There are no ring outliers.

No monomer is involved in short contacts.

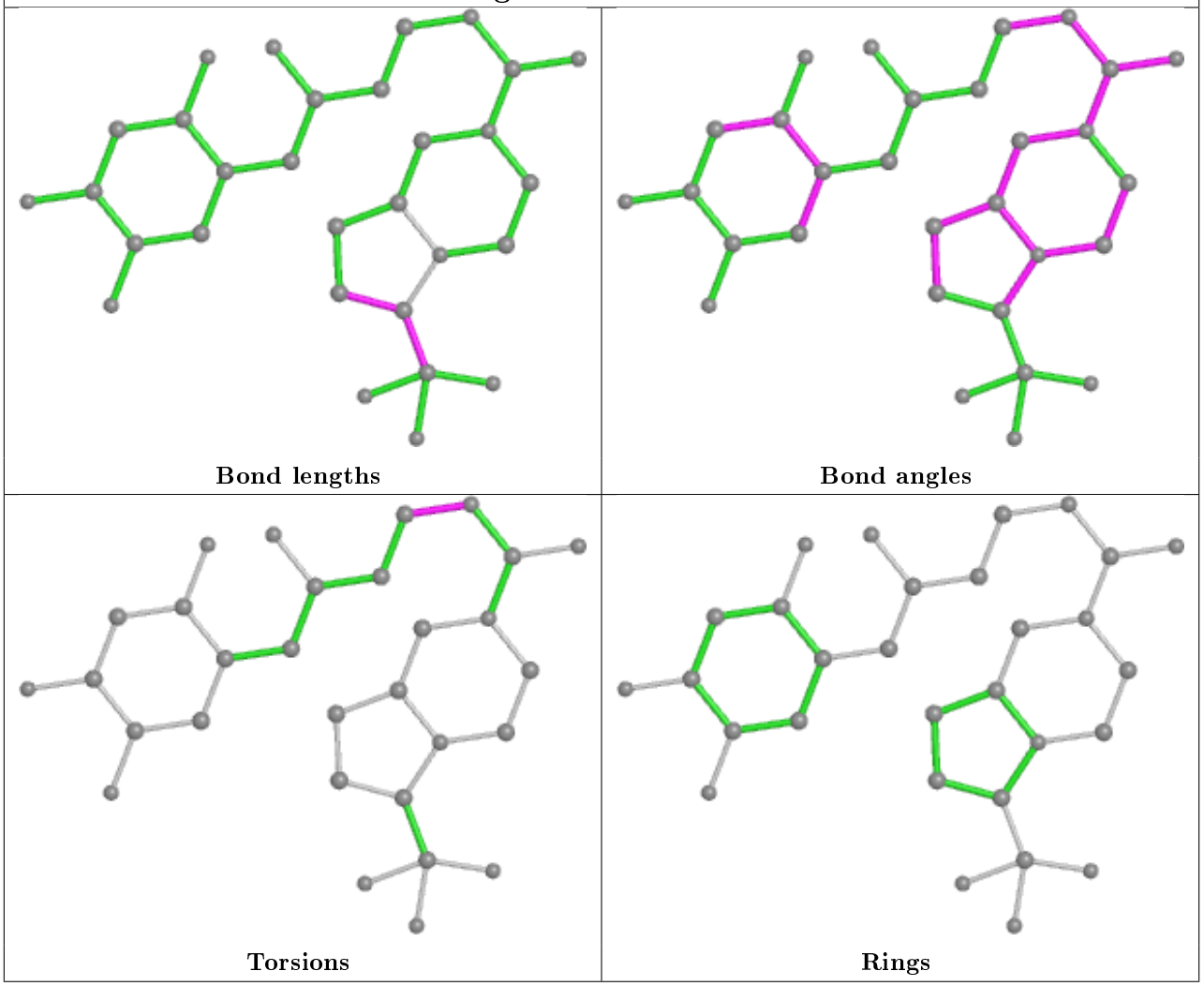
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will

also be included. For torsion angles, if less then 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 D3C A 801



Ligand D3C B 801



5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

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, 95^{th} 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	725/728 (99%)	-0.05	7 (0%) 82 72	72, 116, 154, 185	0
1	B	727/728 (99%)	-0.02	12 (1%) 70 57	71, 120, 168, 210	0
All	All	1452/1456 (99%)	-0.04	19 (1%) 77 65	71, 118, 163, 210	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	83	TYR	5.7
1	B	524	PHE	3.2
1	A	467	TYR	3.2
1	B	471	ARG	2.8
1	B	138	ASN	2.8
1	B	632	GLY	2.7
1	B	545	ASP	2.6
1	A	628	GLY	2.4
1	B	279	VAL	2.4
1	B	82	GLU	2.4
1	A	435	GLN	2.4
1	B	506	ASN	2.4
1	B	628	GLY	2.3
1	B	633	GLY	2.3
1	A	96	ASP	2.3
1	A	138	ASN	2.2
1	B	91	GLU	2.2
1	A	333	SER	2.1
1	A	338	ASN	2.0

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

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

6.3 Carbohydrates (i)

There are no carbohydrates in this entry.

6.4 Ligands (i)

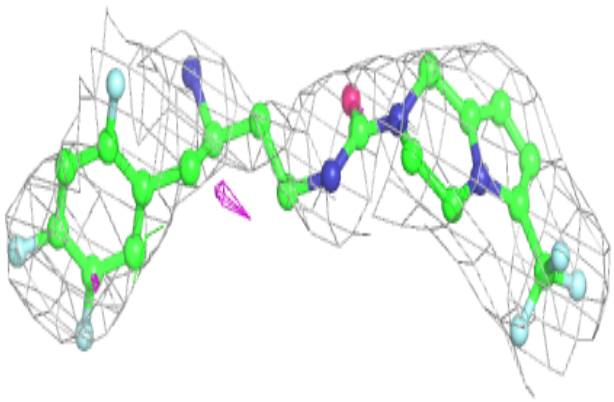
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

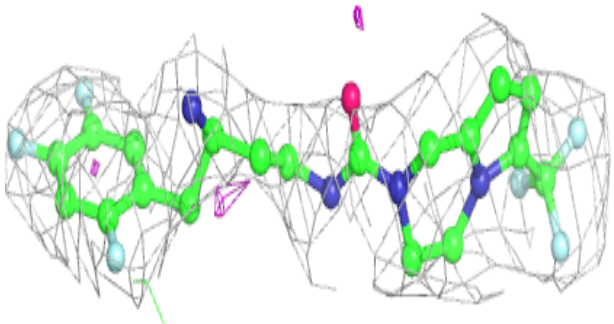
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	D3C	A	801	30/30	0.92	0.31	86,113,129,131	0
2	D3C	B	801	30/30	0.92	0.25	82,108,137,139	0

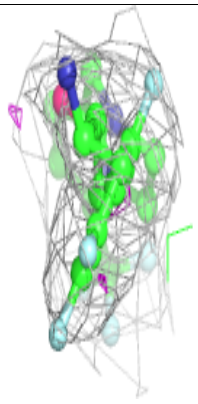
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around D3C A 801:

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

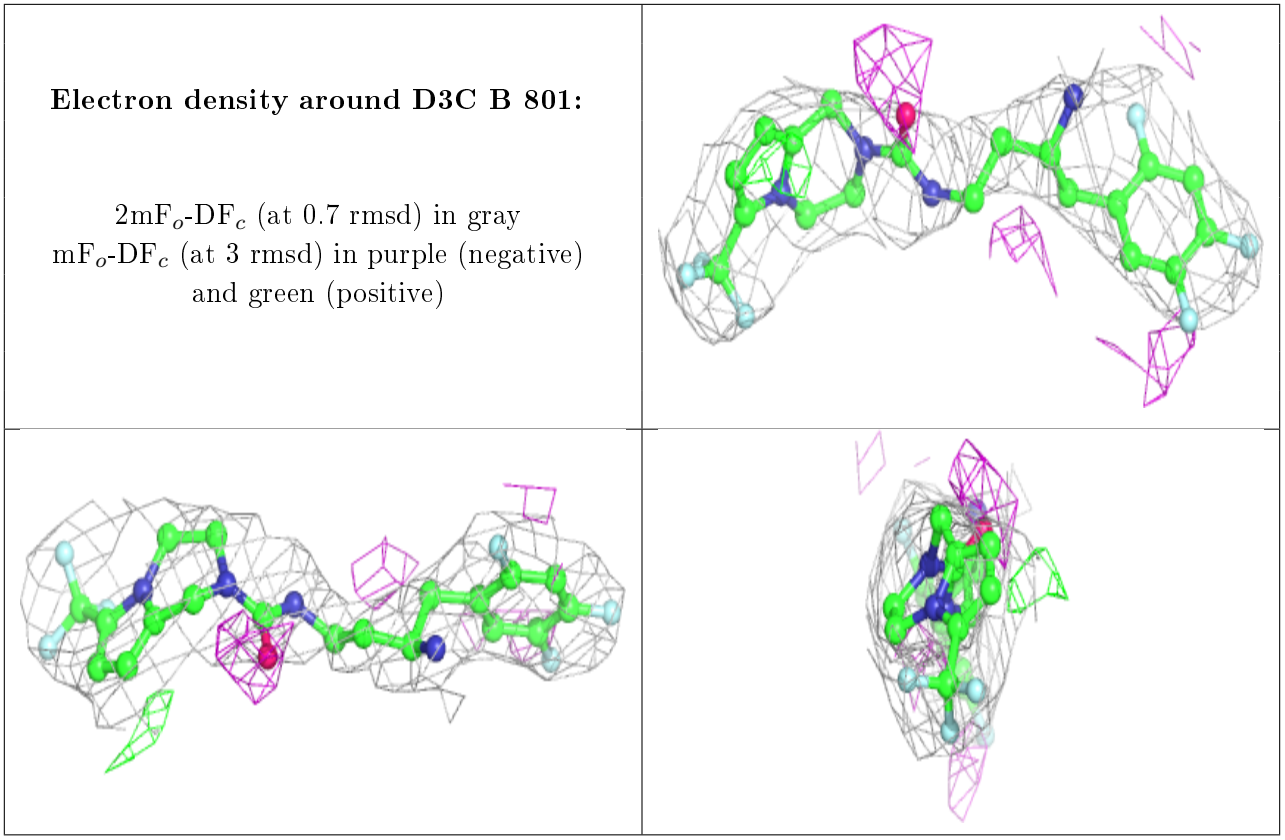






Electron density around D3C B 801:

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



6.5 Other polymers

There are no such residues in this entry.