



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 1RE8 / pdb_00001re8
Title : Crystal structure of cAMP-dependent protein kinase complexed with balanol analog 2
Authors : Akamine, P.; Madhusudan; Brunton, L.L.; Ou, H.D.; Canaves, J.M.; Xuong, N.H.; Taylor, S.S.
Deposited on : 2003-11-06
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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

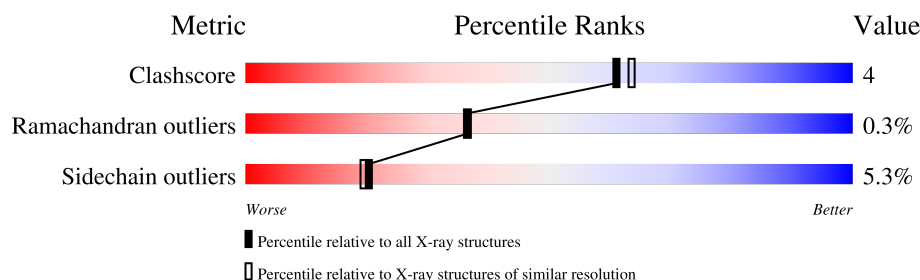
1 Overall quality at a glance

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))
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	350	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	BD2	A	351	X	-	-	-

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3050 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

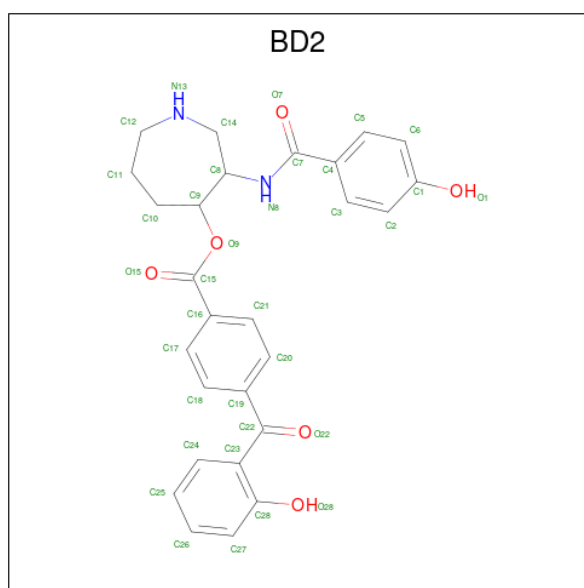
- Molecule 1 is a protein called cAMP-dependent protein kinase, alpha-catalytic subunit.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	P	S			
1	A	339	2733	1770	452	501	2	8	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

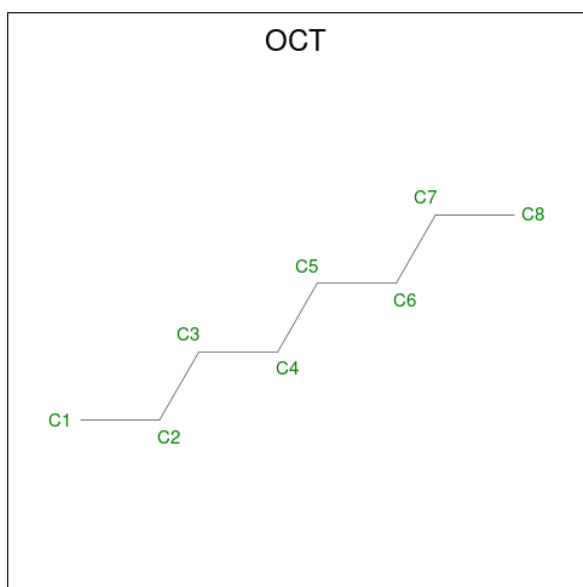
Chain	Residue	Modelled	Actual	Comment	Reference
A	197	TPO	THR	modified residue	UNP P05132
A	338	SEP	SER	modified residue	UNP P05132

- Molecule 2 is 3-[(4-HYDROXYBENZOYL)AMINO]AZEPAN-4-YL 4-(2-HYDROXYBENZOYL)BENZOATE (CCD ID: BD2) (formula: C₂₇H₂₆N₂O₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	35	27	2	6	0	0

- Molecule 3 is N-OCTANE (CCD ID: OCT) (formula: C₈H₁₈).



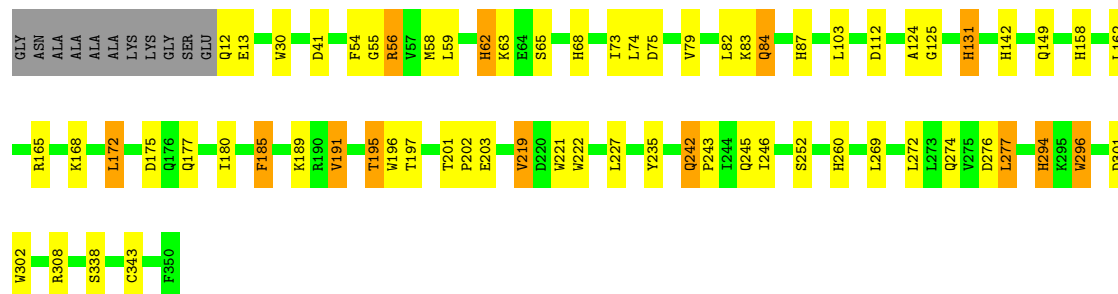
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C 7 7	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	275	Total O 275 275	0	0

Note EDS was not executed.

- Molecule 1: cAMP-dependent protein kinase, alpha-catalytic subunit



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	51.80Å 71.60Å 97.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.10	Depositor
% Data completeness (in resolution range)	(Not available) (50.00-2.10)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.197 , 0.252	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3050	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: OCT, BD2, TPO, 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	0.79	9/2781 (0.3%)	1.46	34/3761 (0.9%)

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	62	HIS	CD2-NE2	-7.07	1.30	1.37
1	A	294	HIS	CD2-NE2	-6.81	1.30	1.37
1	A	260	HIS	CD2-NE2	-6.67	1.30	1.37
1	A	87	HIS	CD2-NE2	-6.62	1.30	1.37
1	A	68	HIS	CD2-NE2	-6.29	1.30	1.37
1	A	158	HIS	CD2-NE2	-6.25	1.30	1.37
1	A	142	HIS	CD2-NE2	-6.16	1.31	1.37
1	A	131	HIS	CD2-NE2	-6.11	1.31	1.37
1	A	62	HIS	CG-ND1	-5.30	1.32	1.38

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	13	GLU	N-CA-C	9.12	121.30	111.36
1	A	41	ASP	CA-CB-CG	7.34	119.94	112.60
1	A	175	ASP	CA-CB-CG	7.31	119.91	112.60
1	A	112	ASP	CA-CB-CG	6.96	119.56	112.60
1	A	235	TYR	CA-C-N	6.83	124.58	119.66
1	A	235	TYR	C-N-CA	6.83	124.58	119.66
1	A	63	LYS	N-CA-C	6.60	118.48	111.28
1	A	252	SER	O-C-N	-6.34	115.56	122.79
1	A	302	TRP	N-CA-C	6.12	117.95	111.28
1	A	165	ARG	N-CA-C	6.12	119.45	112.97
1	A	84	GLN	CA-CB-CG	5.95	125.99	114.10
1	A	260	HIS	CB-CG-CD2	-5.77	123.70	131.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	301	ASP	CA-CB-CG	5.56	118.16	112.60
1	A	221	TRP	CG-CD2-CE3	5.55	139.45	133.90
1	A	343	CYS	CA-C-N	5.54	126.13	119.98
1	A	343	CYS	C-N-CA	5.54	126.13	119.98
1	A	219	VAL	N-CA-CB	-5.49	103.07	110.54
1	A	196	TRP	CG-CD2-CE3	5.49	139.39	133.90
1	A	124	ALA	N-CA-C	5.48	119.06	112.38
1	A	196	TRP	CE2-CD2-CG	-5.35	100.78	107.20
1	A	201	THR	CA-C-N	5.35	126.53	119.84
1	A	201	THR	C-N-CA	5.35	126.53	119.84
1	A	221	TRP	CE2-CD2-CG	-5.30	100.84	107.20
1	A	68	HIS	CB-CG-CD2	-5.30	124.31	131.20
1	A	242	GLN	CA-C-N	5.29	125.35	119.32
1	A	242	GLN	C-N-CA	5.29	125.35	119.32
1	A	222	TRP	CG-CD2-CE3	5.24	139.14	133.90
1	A	185	PHE	CA-CB-CG	-5.17	108.63	113.80
1	A	296	TRP	CE2-CD2-CG	-5.15	101.02	107.20
1	A	158	HIS	CB-CG-CD2	-5.15	124.51	131.20
1	A	296	TRP	CG-CD2-CE3	5.12	139.02	133.90
1	A	30	TRP	CE2-CD2-CG	-5.07	101.12	107.20
1	A	222	TRP	CE2-CD2-CG	-5.03	101.17	107.20
1	A	302	TRP	CE2-CD2-CG	-5.01	101.19	107.20

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	2733	0	2637	23	0
2	A	35	0	22	0	0
3	A	7	0	13	0	0
4	A	275	0	0	2	0
All	All	3050	0	2672	23	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 (23) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:149:GLN:HE22	1:A:180:ILE:H	1.34	0.76
1:A:82:LEU:O	1:A:84:GLN:HG2	1.88	0.74
1:A:294:HIS:HD2	1:A:296:TRP:H	1.45	0.63
1:A:277:LEU:HD12	4:A:632:HOH:O	1.99	0.61
1:A:149:GLN:NE2	1:A:180:ILE:H	2.00	0.60
1:A:191:VAL:HG11	1:A:195:THR:HG23	1.84	0.60
1:A:189:LYS:HD3	1:A:195:THR:HG21	1.85	0.57
1:A:274:GLN:HE21	1:A:276:ASP:H	1.52	0.56
1:A:62:HIS:HD2	1:A:65:SER:H	1.58	0.52
1:A:242:GLN:H	1:A:245:GLN:HE21	1.57	0.52
1:A:294:HIS:CD2	1:A:296:TRP:H	2.29	0.48
1:A:103:LEU:HD22	1:A:185:PHE:HZ	1.80	0.46
1:A:125:GLY:O	1:A:131:HIS:HE1	1.99	0.45
1:A:56:ARG:HD2	4:A:399:HOH:O	2.16	0.44
1:A:54:PHE:CE2	1:A:84:GLN:HG3	2.53	0.44
1:A:242:GLN:H	1:A:245:GLN:NE2	2.16	0.42
1:A:243:PRO:HA	1:A:246:ILE:HD12	2.02	0.42
1:A:177:GLN:HE21	1:A:308:ARG:NH2	2.17	0.42
1:A:55:GLY:HA3	1:A:73:ILE:O	2.20	0.41
1:A:168:LYS:O	1:A:172:LEU:HD22	2.21	0.41
1:A:58:MET:HE3	1:A:58:MET:HB2	1.90	0.41
1:A:62:HIS:CD2	1:A:65:SER:H	2.36	0.40
1:A:75:ASP:O	1:A:79:VAL:HG23	2.22	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	335/350 (96%)	320 (96%)	14 (4%)	1 (0%)	36	36

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	83	LYS

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	282/303 (93%)	267 (95%)	15 (5%)	20	19

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	GLN
1	A	56	ARG
1	A	59	LEU
1	A	74	LEU
1	A	162	LEU
1	A	172	LEU
1	A	191	VAL
1	A	195	THR
1	A	202	PRO
1	A	203	GLU
1	A	219	VAL
1	A	227	LEU
1	A	269	LEU
1	A	272	LEU
1	A	277	LEU

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	35	GLN
1	A	39	GLN
1	A	42	GLN
1	A	62	HIS
1	A	77	GLN
1	A	84	GLN
1	A	87	HIS
1	A	90	ASN
1	A	96	GLN
1	A	131	HIS
1	A	149	GLN
1	A	171	ASN
1	A	177	GLN
1	A	245	GLN
1	A	274	GLN
1	A	283	ASN
1	A	289	ASN
1	A	293	ASN
1	A	294	HIS
1	A	326	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 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	SEP	A	338	1	8,9,10	1.02	0	7,12,14	2.69	2 (28%)
1	TPO	A	197	1	8,10,11	1.17	0	10,14,16	1.25	1 (10%)

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	SEP	A	338	1	-	2/6/8/10	-
1	TPO	A	197	1	-	1/9/11/13	-

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	338	SEP	OG-CB-CA	6.30	114.27	108.14
1	A	197	TPO	CG2-CB-CA	-2.17	109.03	113.26
1	A	338	SEP	O3P-P-O2P	2.07	115.57	107.80

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	338	SEP	N-CA-CB-OG
1	A	338	SEP	CA-CB-OG-P
1	A	197	TPO	O-C-CA-CB

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](#)

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
3	OCT	A	555	-	6,6,7	0.36	0	5,5,6	0.56	0
2	BD2	A	351	-	38,38,38	1.93	5 (13%)	46,52,52	1.84	7 (15%)

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	OCT	A	555	-	-	2/4/4/5	-
2	BD2	A	351	-	2/2/5/7	6/24/36/36	0/4/4/4

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	351	BD2	C19-C22	-5.75	1.39	1.49
2	A	351	BD2	C4-C7	-5.01	1.39	1.50
2	A	351	BD2	C23-C22	-4.89	1.40	1.49
2	A	351	BD2	C16-C15	-4.67	1.39	1.50
2	A	351	BD2	O9-C15	4.10	1.43	1.34

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	351	BD2	O9-C9-C8	6.47	119.65	107.16
2	A	351	BD2	C14-C8-N8	5.72	120.19	109.55
2	A	351	BD2	O9-C15-C16	4.97	119.89	111.90
2	A	351	BD2	O9-C9-C10	4.29	120.68	107.67
2	A	351	BD2	C9-O9-C15	-2.20	112.55	117.33
2	A	351	BD2	C23-C22-C19	2.16	123.02	119.56
2	A	351	BD2	O9-C15-O15	-2.08	120.16	123.55

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	351	BD2	C8
2	A	351	BD2	C9

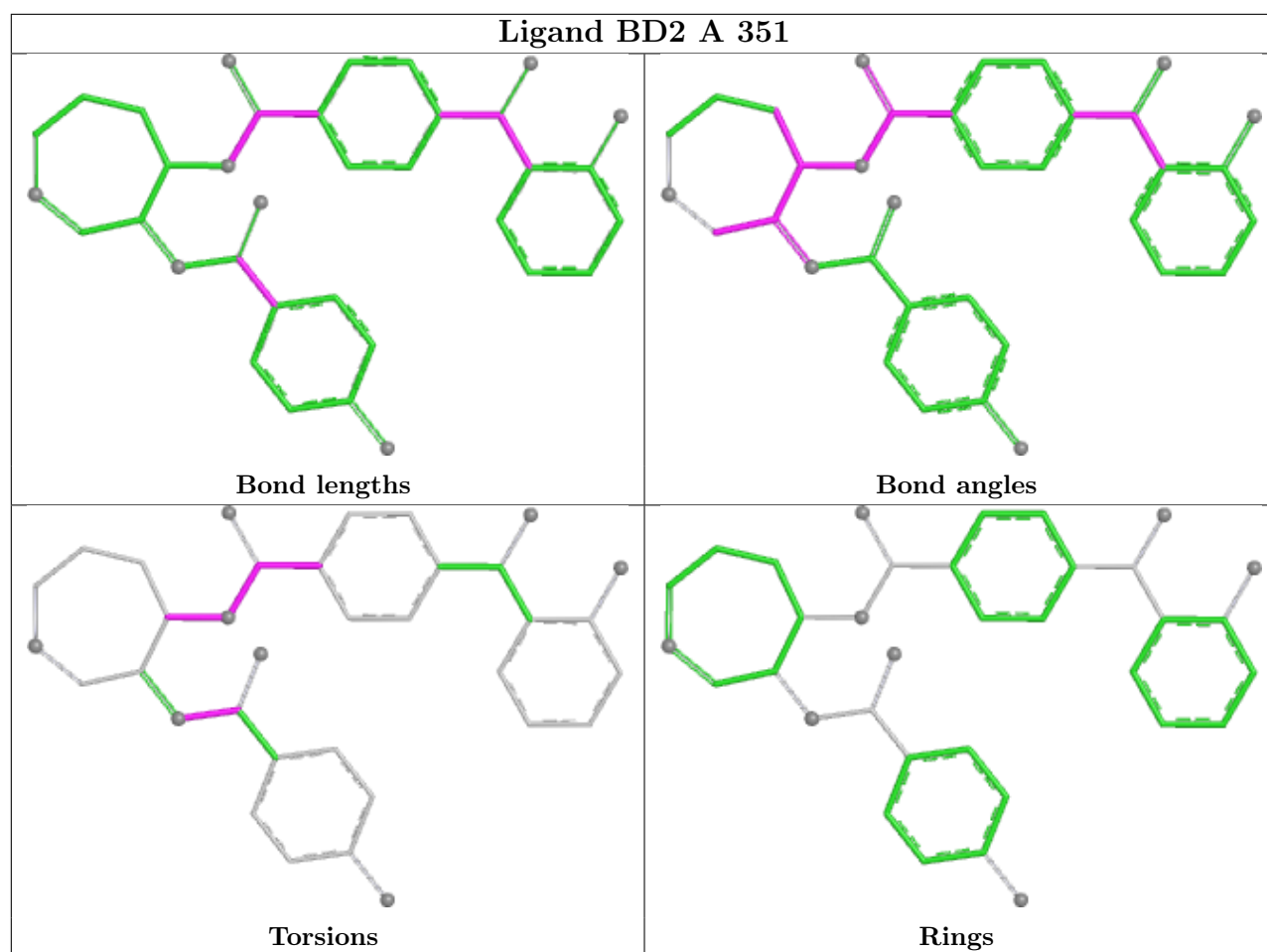
All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	351	BD2	C10-C9-O9-C15
2	A	351	BD2	C16-C15-O9-C9
2	A	351	BD2	O15-C15-O9-C9
2	A	351	BD2	C4-C7-N8-C8
2	A	351	BD2	O7-C7-N8-C8
3	A	555	OCT	C2-C3-C4-C5
2	A	351	BD2	O9-C15-C16-C17
3	A	555	OCT	C4-C5-C6-C7

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.