



# Full wwPDB X-ray Structure Validation Report ⓘ

May 27, 2024 – 08:59 PM EDT

PDB ID : 6ME8  
Title : XFEL crystal structure of human melatonin receptor MT2 (N86D) in complex with 2-phenylmelatonin  
Authors : Johansson, L.C.; Stauch, B.; McCorvy, J.; Han, G.W.; Patel, N.; Batyuk, A.; Gati, C.; Li, C.; Grandner, J.; Hao, S.; Olsen, R.H.J.; Tribo, A.R.; Zaare, S.; Zhu, L.; Zatsepin, N.A.; Weierstall, U.; Liu, W.; Roth, B.L.; Katritch, V.; Cherezov, V.  
Deposited on : 2018-09-05  
Resolution : 3.10 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](mailto: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>.

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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 : 2.36.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)

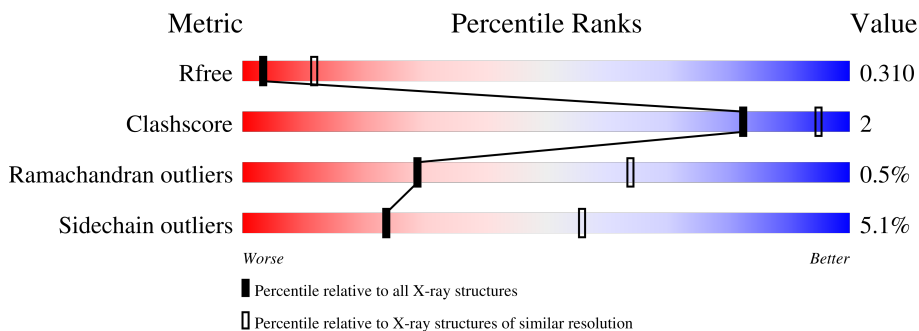
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.10 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))
$R_{free}$	130704	1094 (3.10-3.10)
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)

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  $\geq 3$ , 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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	460	87% (green), 10% (yellow), 3% (orange), 0% (red), 0% (grey)
1	B	460	78% (green), 7% (yellow), 14% (orange), 0% (red), 0% (grey)

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6089 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 Soluble cytochrome b562,Melatonin receptor type 1B,Rubredoxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	449	3292	2157	524	592	19	0	0	0
1	B	394	2750	1795	452	493	10	0	0	0

There are 30 discrepancies between the modelled and reference sequences:

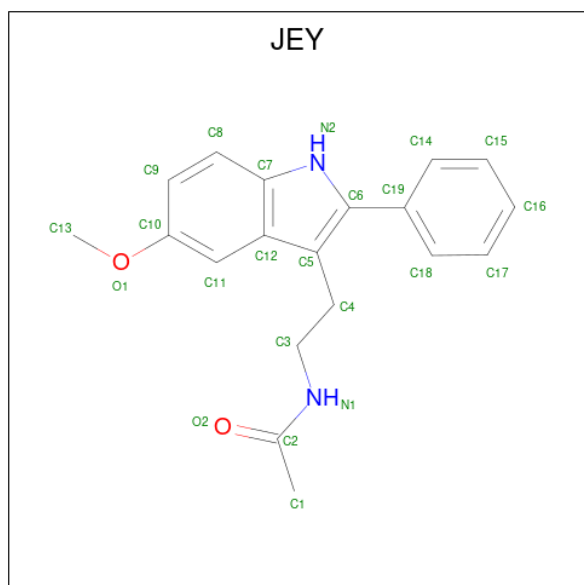
Chain	Residue	Modelled	Actual	Comment	Reference
A	2007	TRP	MET	engineered mutation	UNP P0ABE7
A	2102	ILE	HIS	engineered mutation	UNP P0ABE7
A	2106	LEU	ARG	engineered mutation	UNP P0ABE7
A	31	GLY	-	linker	UNP P0ABE7
A	32	ASP	-	linker	UNP P0ABE7
A	33	GLY	-	linker	UNP P0ABE7
A	34	ALA	-	linker	UNP P0ABE7
A	37	SER	PRO	engineered mutation	UNP P49286
A	108	PHE	LEU	engineered mutation	UNP P49286
A	129	TRP	PHE	engineered mutation	UNP P49286
A	137	ASP	ASN	engineered mutation	UNP P49286
A	140	LEU	CYS	engineered mutation	UNP P49286
A	264	PHE	TRP	engineered mutation	UNP P49286
A	305	PRO	ALA	engineered mutation	UNP P49286
A	312	ASP	ASN	engineered mutation	UNP P49286
B	2007	TRP	MET	engineered mutation	UNP P0ABE7
B	2102	ILE	HIS	engineered mutation	UNP P0ABE7
B	2106	LEU	ARG	engineered mutation	UNP P0ABE7
B	31	GLY	-	linker	UNP P0ABE7
B	32	ASP	-	linker	UNP P0ABE7
B	33	GLY	-	linker	UNP P0ABE7
B	34	ALA	-	linker	UNP P0ABE7
B	37	SER	PRO	engineered mutation	UNP P49286
B	108	PHE	LEU	engineered mutation	UNP P49286
B	129	TRP	PHE	engineered mutation	UNP P49286

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Chain	Residue	Modelled	Actual	Comment	Reference
B	137	ASP	ASN	engineered mutation	UNP P49286
B	140	LEU	CYS	engineered mutation	UNP P49286
B	264	PHE	TRP	engineered mutation	UNP P49286
B	305	PRO	ALA	engineered mutation	UNP P49286
B	312	ASP	ASN	engineered mutation	UNP P49286

- Molecule 2 is N-[2-(5-methoxy-2-phenyl-1H-indol-3-yl)ethyl]acetamide (three-letter code: JEY) (formula: C<sub>19</sub>H<sub>20</sub>N<sub>2</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	23	19	2	2	0	0
2	B	1	23	19	2	2	0	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

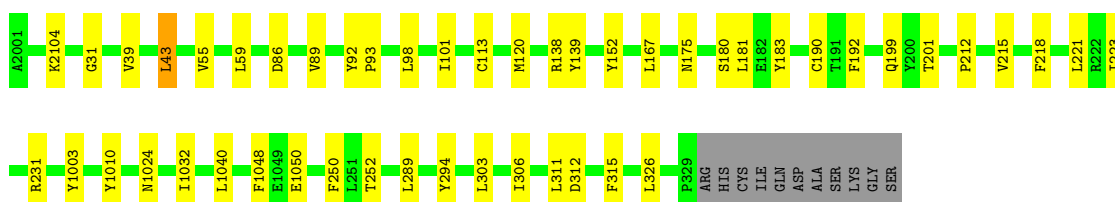
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	A	1	1	1	0	0

### 3 Residue-property plots [i](#)


These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

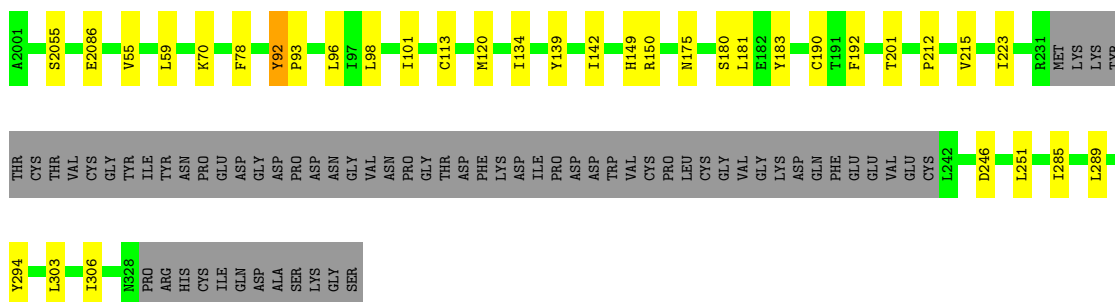
- Molecule 1: Soluble cytochrome b562,Melatonin receptor type 1B,Rubredoxin

Chain A:  87% 10%



- Molecule 1: Soluble cytochrome b562,Melatonin receptor type 1B,Rubredoxin

Chain B:  78% 7% 14%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.70Å 145.80Å 77.00Å 90.00° 107.40° 90.00°	Depositor
Resolution (Å)	22.00 – 3.10 21.87 – 3.10	Depositor EDS
% Data completeness (in resolution range)	100.0 (22.00-3.10) 100.0 (21.87-3.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.19 (at 3.10Å)	Xtrriage
Refinement program	BUSTER 2.10.2	Depositor
R, $R_{free}$	0.234 , 0.262 0.284 , 0.310	Depositor DCC
$R_{free}$ test set	1309 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	93.2	Xtrriage
Anisotropy	0.504	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.27 , 106.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.44$ , $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	6089	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	130.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.26% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: ZN, JEY

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	0.44	0/3379	0.57	0/4652
1	B	0.45	0/2814	0.57	0/3881
All	All	0.45	0/6193	0.57	0/8533

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	2055	SER	Mainchain

### 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	3292	0	3065	16	0
1	B	2750	0	2478	13	0
2	A	23	0	0	0	0
2	B	23	0	0	0	0
3	A	1	0	0	0	0
All	All	6089	0	5543	29	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 2.

All (29) 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:139:TYR:HA	1:A:223:ILE:HD11	1.79	0.65
1:B:139:TYR:HA	1:B:223:ILE:HD11	1.79	0.63
1:B:78:PHE:HB3	1:B:134:ILE:HD11	1.82	0.61
1:B:55:VAL:O	1:B:59:LEU:HB2	2.10	0.52
1:A:192:PHE:CZ	1:A:201:THR:HG22	2.45	0.51
1:B:142:ILE:HG21	1:B:223:ILE:HG23	1.92	0.51
1:A:98:LEU:HA	1:A:101:ILE:HD12	1.93	0.51
1:A:55:VAL:O	1:A:59:LEU:HB2	2.12	0.50
1:B:192:PHE:CZ	1:B:201:THR:HG22	2.46	0.49
1:A:252:THR:HG22	1:A:311:LEU:HB3	1.95	0.49
1:B:183:TYR:HA	1:B:190:CYS:HA	1.95	0.49
1:A:183:TYR:HA	1:A:190:CYS:HA	1.95	0.48
1:B:93:PRO:HB2	1:B:120:MET:HE3	1.96	0.48
1:A:93:PRO:HB2	1:A:120:MET:HE3	1.95	0.47
1:A:39:VAL:O	1:A:43:LEU:HB2	2.16	0.45
1:A:1003:TYR:CZ	1:A:1050:GLU:HB3	2.52	0.45
1:A:192:PHE:HZ	1:A:201:THR:HG22	1.83	0.44
1:A:1010:TYR:HB2	1:A:1040:LEU:HD12	1.99	0.43
1:A:303:LEU:HA	1:A:306:ILE:HD12	2.01	0.43
1:A:175:ASN:HB3	1:A:181:LEU:HG	2.00	0.43
1:B:192:PHE:HZ	1:B:201:THR:HG22	1.84	0.43
1:B:175:ASN:HB3	1:B:181:LEU:HG	2.00	0.43
1:A:312:ASP:HB3	1:A:315:PHE:HB2	2.01	0.42
1:A:212:PRO:HA	1:A:215:VAL:HG22	2.01	0.42
1:B:303:LEU:HA	1:B:306:ILE:HD12	2.02	0.42
1:B:98:LEU:HA	1:B:101:ILE:HD12	2.02	0.41
1:B:92:TYR:O	1:B:96:LEU:HG	2.21	0.41
1:A:86:ASP:O	1:A:89:VAL:HG12	2.21	0.40
1:B:212:PRO:HA	1:B:215:VAL:HG22	2.03	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	447/460 (97%)	419 (94%)	25 (6%)	3 (1%)	22	57
1	B	390/460 (85%)	371 (95%)	18 (5%)	1 (0%)	41	73
All	All	837/920 (91%)	790 (94%)	43 (5%)	4 (0%)	29	64

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	92	TYR
1	A	231	ARG
1	B	92	TYR
1	A	31	GLY

### 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	314/391 (80%)	297 (95%)	17 (5%)	22	53
1	B	236/391 (60%)	225 (95%)	11 (5%)	26	59
All	All	550/782 (70%)	522 (95%)	28 (5%)	24	56

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2104	LYS
1	A	43	LEU
1	A	113	CYS
1	A	138	ARG
1	A	152	TYR
1	A	167	LEU
1	A	180	SER
1	A	199	GLN
1	A	218	PHE
1	A	221	LEU
1	A	1024	ASN
1	A	1032	ILE
1	A	1048	PHE
1	A	250	PHE
1	A	289	LEU
1	A	294	TYR
1	A	326	LEU
1	B	2086	GLU
1	B	70	LYS
1	B	113	CYS
1	B	149	HIS
1	B	150	ARG
1	B	180	SER
1	B	246	ASP
1	B	251	LEU
1	B	285	ILE
1	B	289	LEU
1	B	294	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	JEY	B	2201	-	23,25,25	0.87	1 (4%)	29,34,34	1.00	1 (3%)
2	JEY	A	2201	-	23,25,25	0.82	0	29,34,34	1.00	1 (3%)

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	JEY	B	2201	-	-	2/12/12/12	0/3/3/3
2	JEY	A	2201	-	-	2/12/12/12	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2201	JEY	C11-C10	2.13	1.40	1.37

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	2201	JEY	C6-N2-C7	2.40	108.83	103.90
2	B	2201	JEY	C6-N2-C7	2.38	108.80	103.90

There are no chirality outliers.

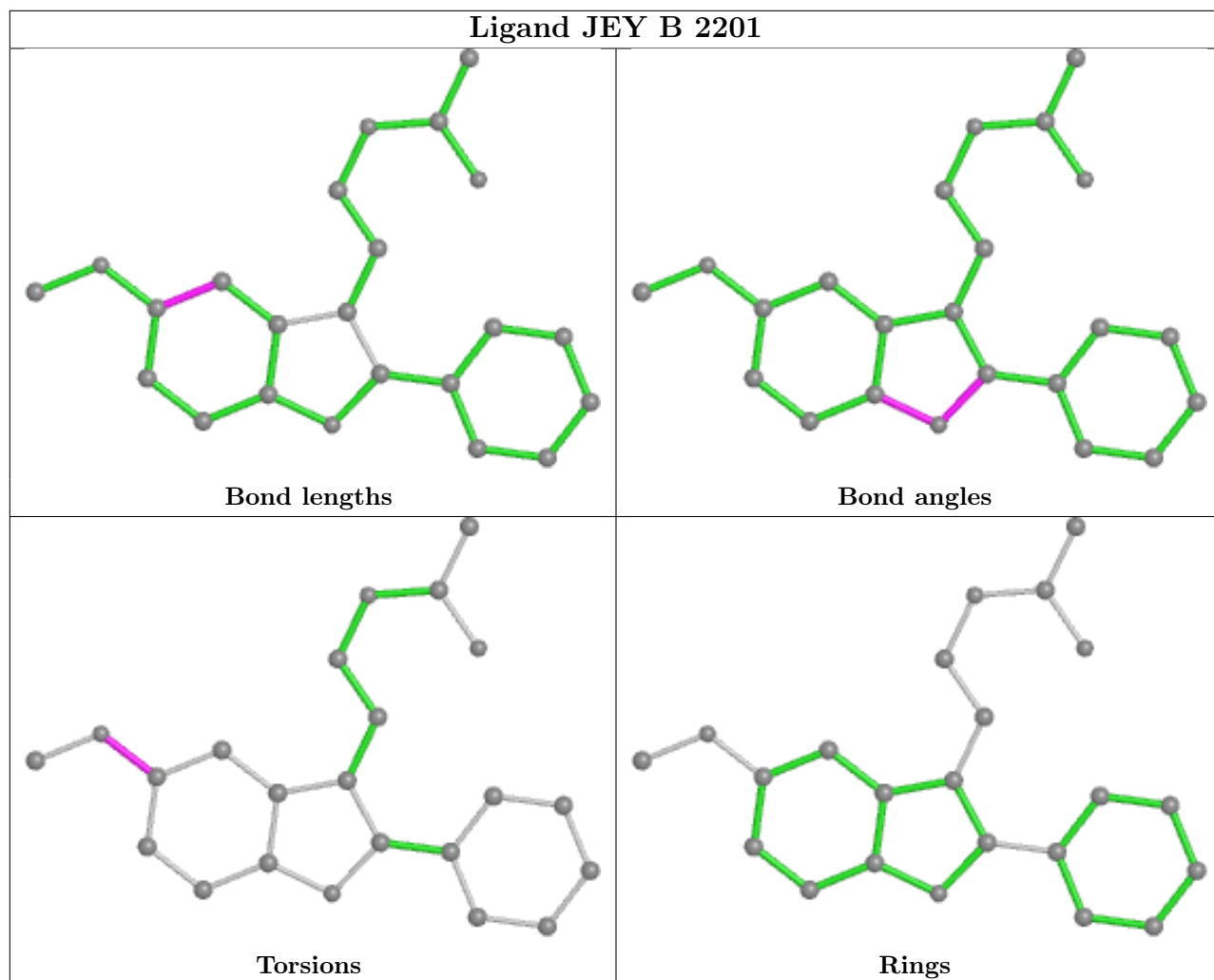
All (4) torsion outliers are listed below:

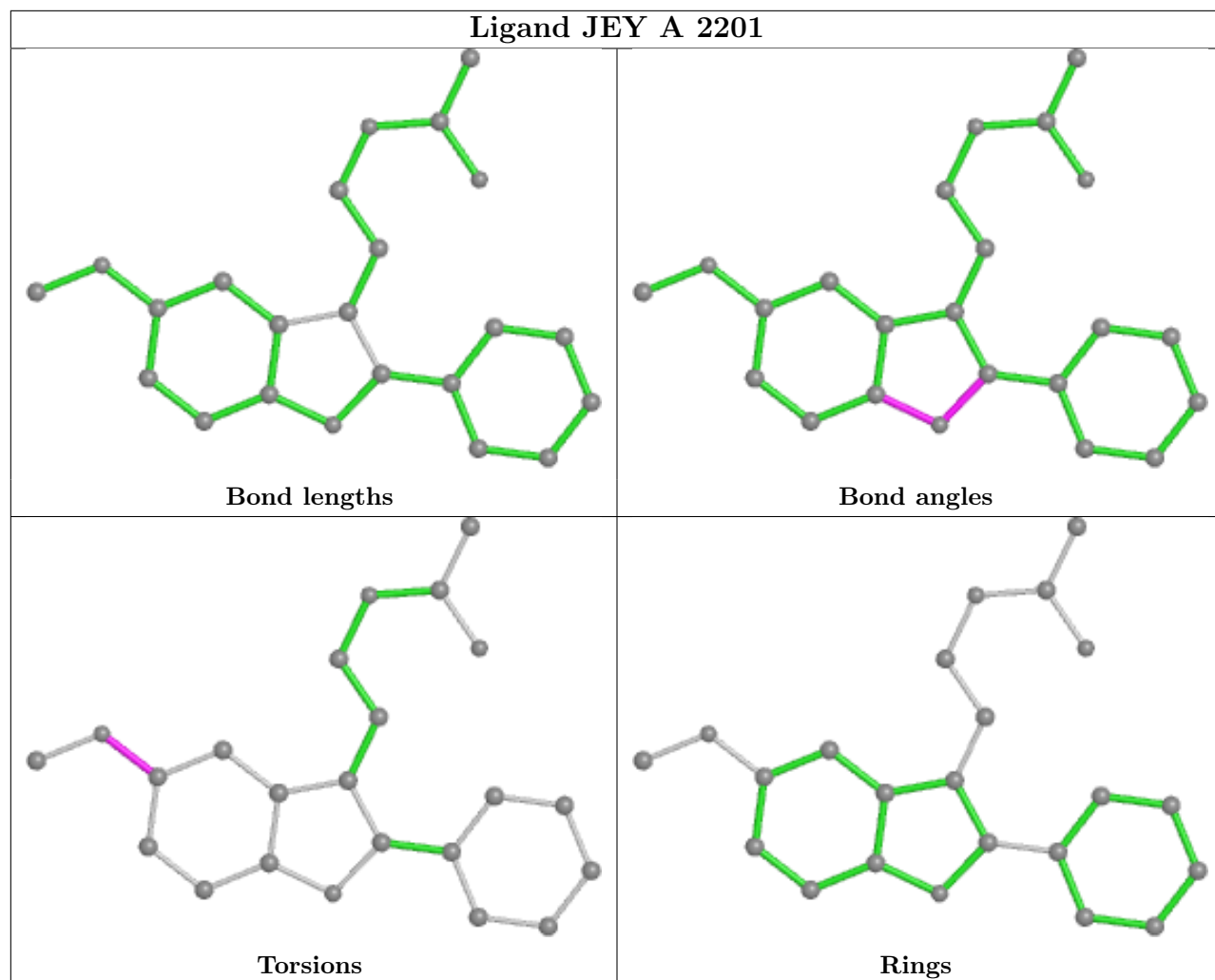
Mol	Chain	Res	Type	Atoms
2	B	2201	JEY	C9-C10-O1-C13
2	A	2201	JEY	C11-C10-O1-C13
2	B	2201	JEY	C11-C10-O1-C13
2	A	2201	JEY	C9-C10-O1-C13

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

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

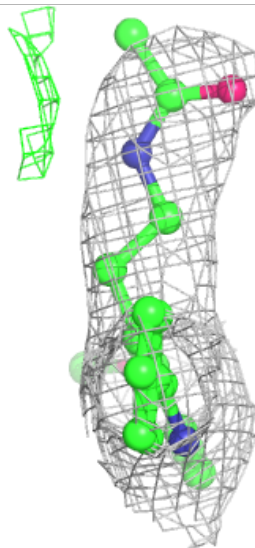
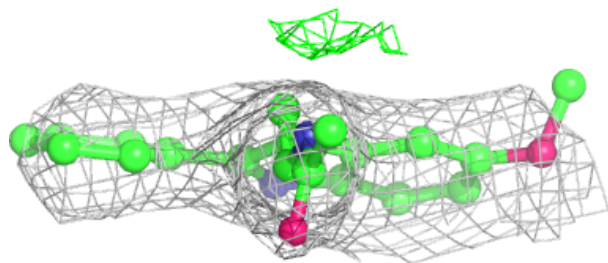
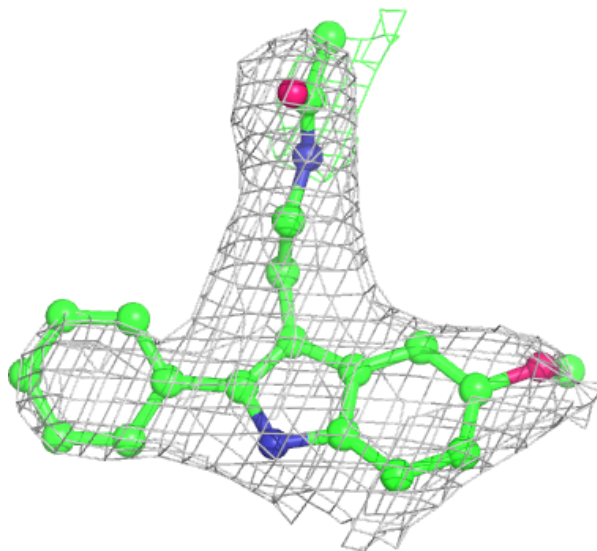
### 6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

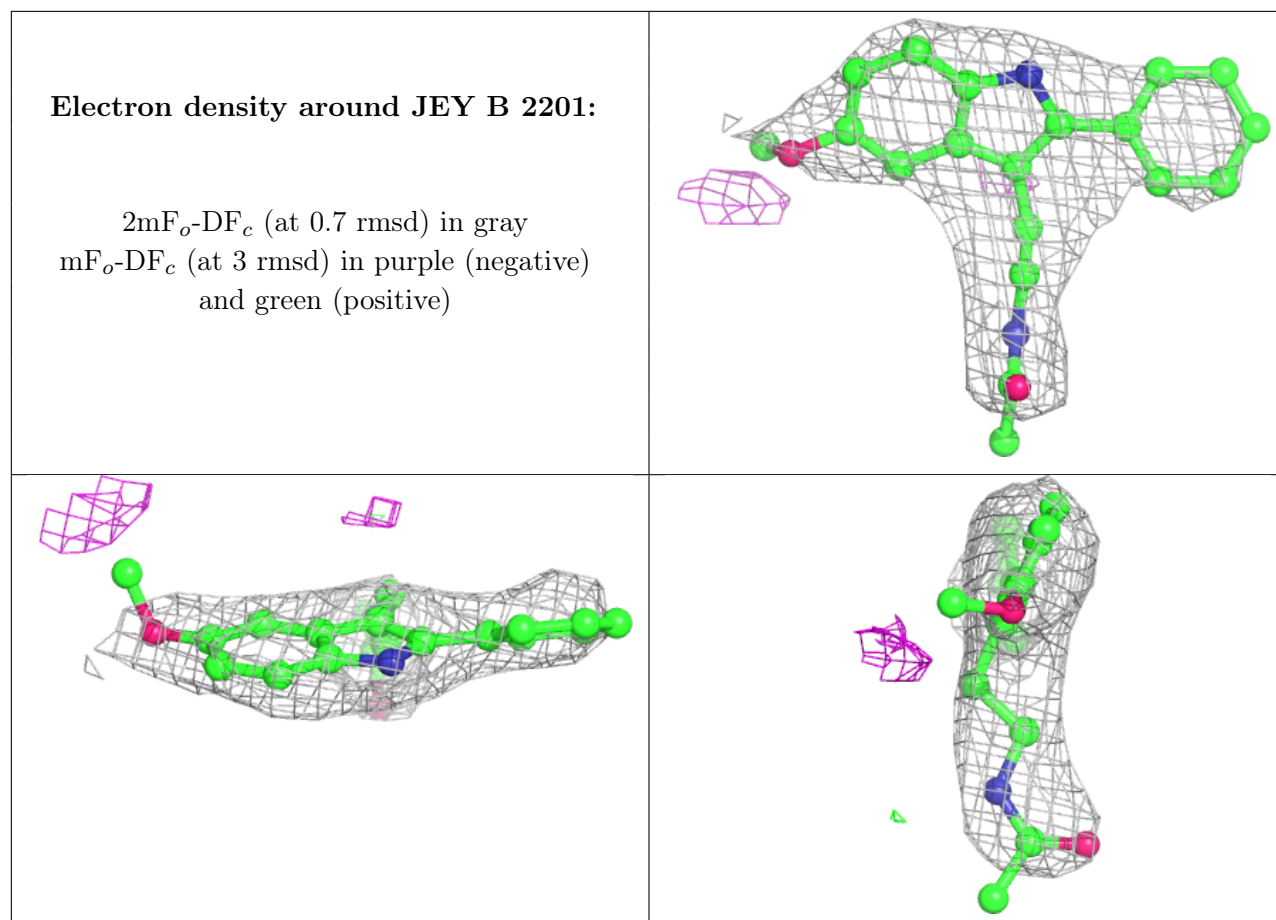
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around JEY A 2201:**

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







## 6.5 Other polymers [i](#)

Unable to reproduce the depositor's R factor - this section is therefore empty.