



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 26, 2023 – 04:54 PM EDT

PDB ID : 6BWJ  
Title : Crystal structure of the TRPV2 ion channel in complex with RTx  
Authors : Zubcevic, L.; Le, S.; Yang, H.; Lee, S.Y.  
Deposited on : 2017-12-15  
Resolution : 3.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 2.35.1  
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) : 2.35.1

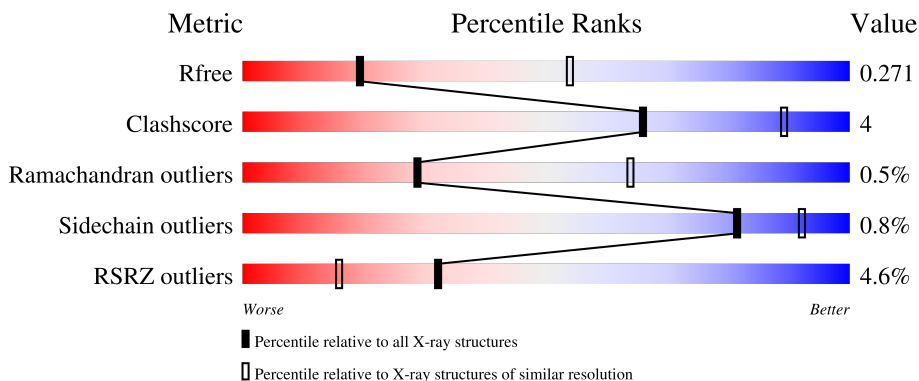
# 1 Overall quality at a glance

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)
RSRZ outliers	127900	1067 (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  $\leq 5\%$ . 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	776	
1	B	776	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 18348 atoms, of which 8952 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 Transient receptor potential cation channel subfamily V member 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	610	9229	3046	4535	790	830	28	0	0	0
1	B	617	8945	2985	4337	776	819	28	0	0	0

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	470	SER	PHE	engineered mutation	UNP G1SNM3
A	505	MET	LEU	engineered mutation	UNP G1SNM3
A	508	THR	LEU	engineered mutation	UNP G1SNM3
A	528	GLU	GLN	engineered mutation	UNP G1SNM3
A	763	ASP	-	expression tag	UNP G1SNM3
A	764	TYR	-	expression tag	UNP G1SNM3
A	765	LYS	-	expression tag	UNP G1SNM3
A	766	ASP	-	expression tag	UNP G1SNM3
A	767	ASP	-	expression tag	UNP G1SNM3
A	768	ASP	-	expression tag	UNP G1SNM3
A	769	ASP	-	expression tag	UNP G1SNM3
A	770	LYS	-	expression tag	UNP G1SNM3
A	771	ALA	-	expression tag	UNP G1SNM3
A	772	HIS	-	expression tag	UNP G1SNM3
A	773	HIS	-	expression tag	UNP G1SNM3
A	774	HIS	-	expression tag	UNP G1SNM3
A	775	HIS	-	expression tag	UNP G1SNM3
A	776	HIS	-	expression tag	UNP G1SNM3
A	777	HIS	-	expression tag	UNP G1SNM3
B	470	SER	PHE	engineered mutation	UNP G1SNM3
B	505	MET	LEU	engineered mutation	UNP G1SNM3
B	508	THR	LEU	engineered mutation	UNP G1SNM3
B	528	GLU	GLN	engineered mutation	UNP G1SNM3
B	763	ASP	-	expression tag	UNP G1SNM3

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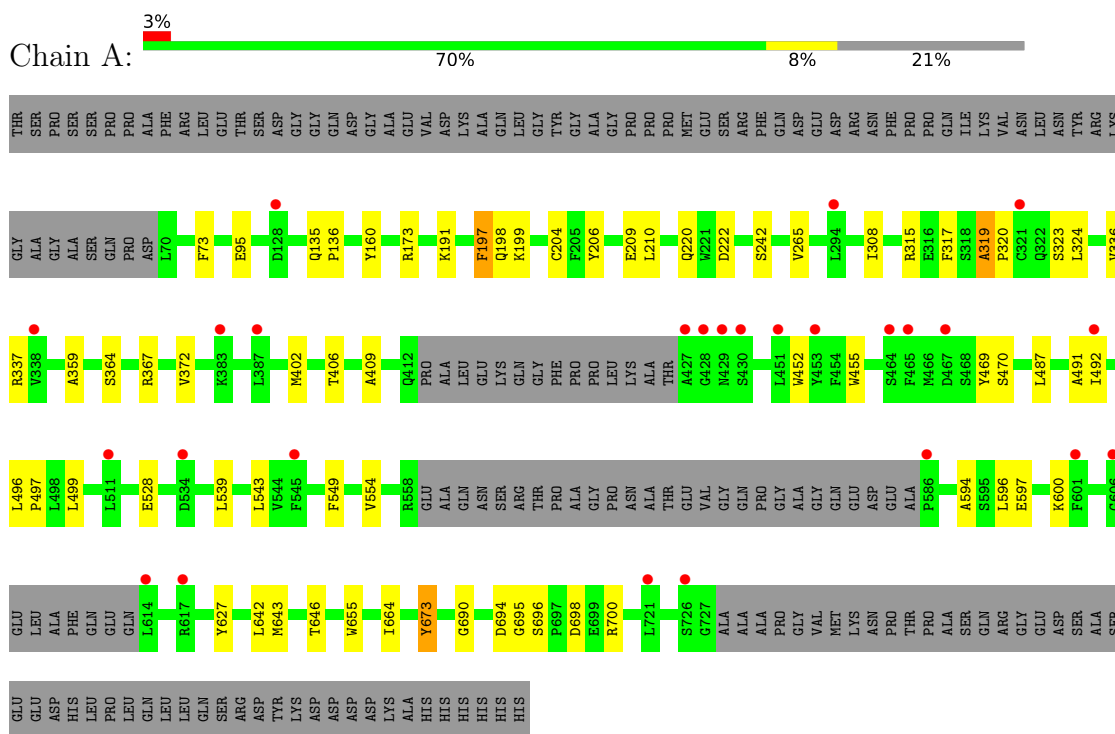


<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	B	2	Total 2	Ca 2	0	0

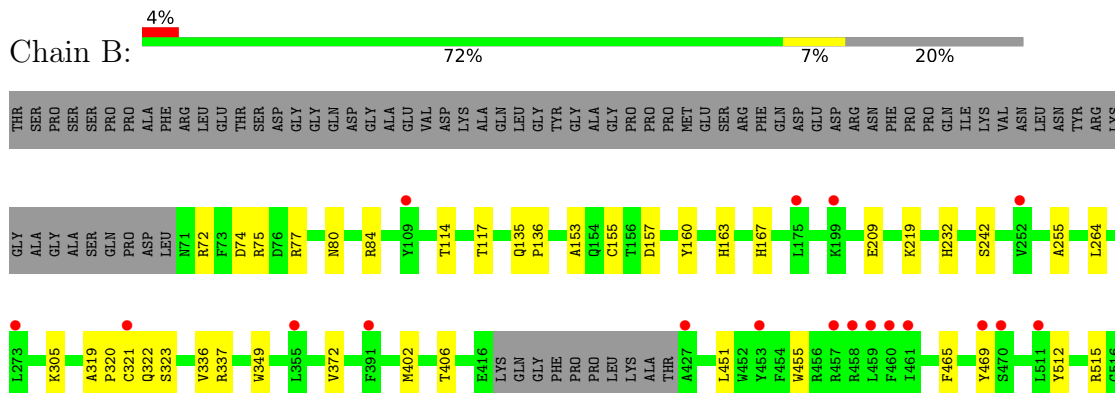
### 3 Residue-property plots [i](#)

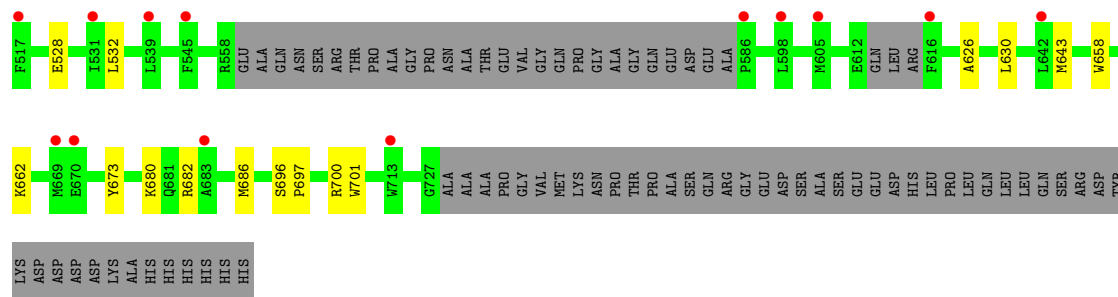
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Transient receptor potential cation channel subfamily V member 2



- Molecule 1: Transient receptor potential cation channel subfamily V member 2





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.05Å 121.23Å 185.56Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.00 – 3.10 101.49 – 3.10	Depositor EDS
% Data completeness (in resolution range)	99.6 (47.00-3.10) 87.1 (101.49-3.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.55 (at 3.13Å)	Xtrriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, $R_{free}$	0.247 , 0.272 0.248 , 0.271	Depositor DCC
$R_{free}$ test set	2003 reflections (5.33%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	72.7	Xtrriage
Anisotropy	0.247	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 41.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.83	EDS
Total number of atoms	18348	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	96.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% 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: CA, 6EU

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	0.26	0/4803	0.46	0/6542
1	B	0.26	0/4712	0.45	0/6431
All	All	0.26	0/9515	0.45	0/12973

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 [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	4694	4535	4542	39	0
1	B	4608	4337	4368	36	0
2	A	46	40	0	1	0
2	B	46	40	0	0	0
3	B	2	0	0	0	0
All	All	9396	8952	8910	74	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.

The worst 5 of 74 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:469:TYR:HB3	1:B:528:GLU:OE2	1.52	1.09
1:A:469:TYR:HB3	1:A:528:GLU:OE2	1.59	1.02
1:B:512:TYR:O	1:B:515:ARG:NH1	2.14	0.80
1:B:323:SER:O	1:B:700:ARG:NH2	2.20	0.73
1:B:114:THR:HG23	1:B:155:CYS:HB3	1.76	0.68

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	602/776 (78%)	580 (96%)	18 (3%)	4 (1%)	22	57
1	B	609/776 (78%)	586 (96%)	21 (3%)	2 (0%)	41	73
All	All	1211/1552 (78%)	1166 (96%)	39 (3%)	6 (0%)	29	64

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	319	ALA
1	A	492	ILE
1	A	695	GLY
1	B	321	CYS
1	B	673	TYR

### 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	473/666 (71%)	468 (99%)	5 (1%)	73	89
1	B	449/666 (67%)	447 (100%)	2 (0%)	91	96
All	All	922/1332 (69%)	915 (99%)	7 (1%)	81	92

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	204	CYS
1	A	673	TYR
1	B	232	HIS
1	B	160	TYR
1	A	197	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	361	HIS
1	A	450	GLN
1	B	314	GLN
1	A	200	ASN
1	A	163	HIS

### 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 4 ligands modelled in this entry, 2 are 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	6EU	B	803	-	43,52,52	3.90	14 (32%)	42,83,83	1.74	5 (11%)
2	6EU	A	1001	-	43,52,52	3.83	16 (37%)	42,83,83	1.55	6 (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
2	6EU	B	803	-	-	15/20/101/101	0/8/7/7
2	6EU	A	1001	-	-	6/20/101/101	0/8/7/7

The worst 5 of 30 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	803	6EU	CAS-CAX	16.63	1.60	1.33
2	A	1001	6EU	CAS-CAX	16.22	1.59	1.33
2	B	803	6EU	CAM-CAL	9.40	1.66	1.54
2	A	1001	6EU	CAM-CAL	9.07	1.66	1.54
2	B	803	6EU	CAW-CBA	8.27	1.52	1.33

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	803	6EU	OAC-CAM-CAP	-6.06	105.73	109.59
2	B	803	6EU	OAF-CBK-CBM	5.55	120.48	111.07
2	A	1001	6EU	OAF-CBK-CBM	4.84	119.28	111.07
2	A	1001	6EU	OAC-CAM-CAP	-4.57	106.68	109.59
2	A	1001	6EU	OAH-CBQ-CBS	3.82	120.10	114.57

There are no chirality outliers.

5 of 21 torsion outliers are listed below:

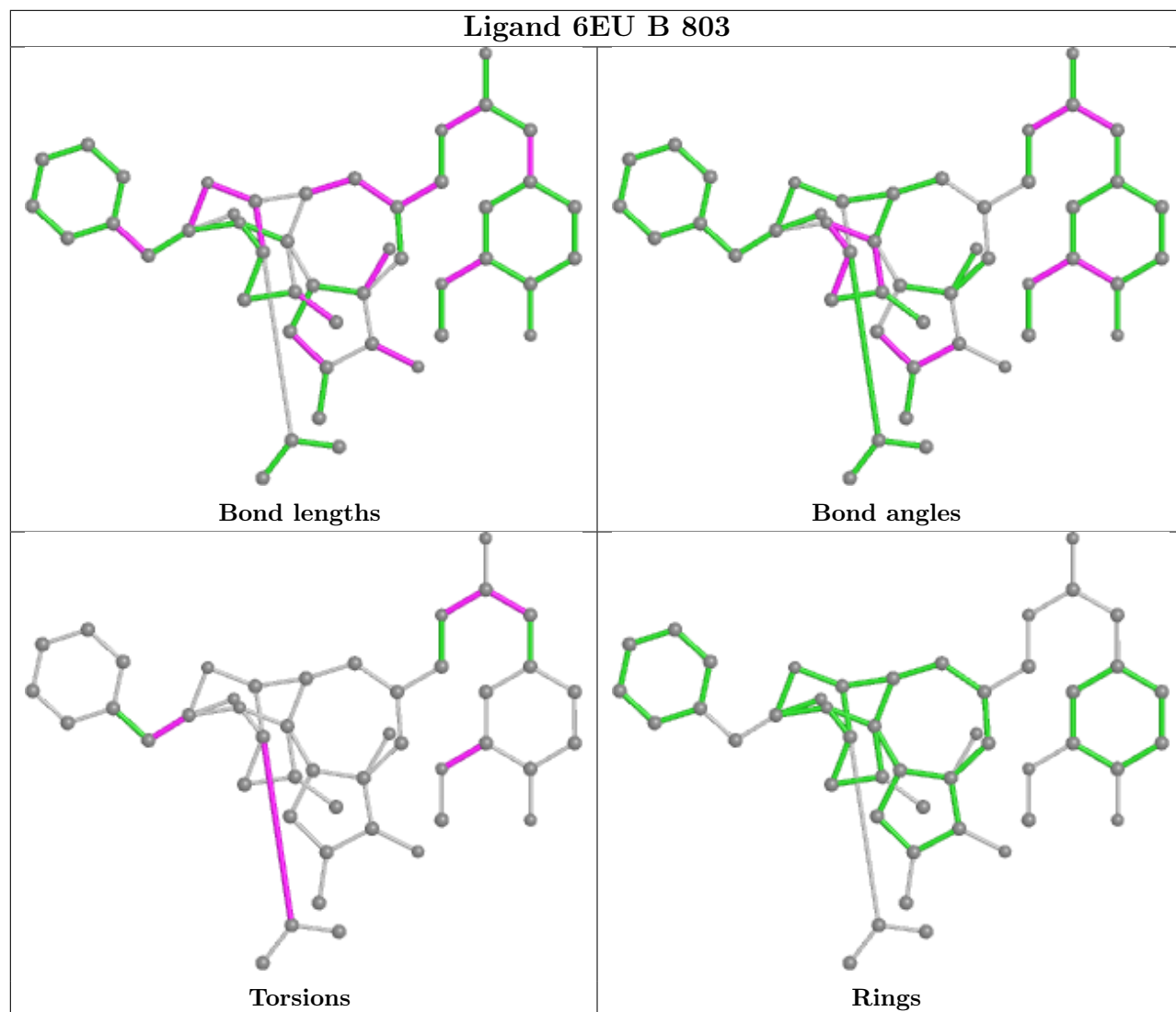
Mol	Chain	Res	Type	Atoms
2	A	1001	6EU	CAP-CAM-CAV-CBB
2	B	803	6EU	CAP-CAM-CAV-CBB
2	B	803	6EU	OAC-CAM-CAV-CBB
2	B	803	6EU	OAC-CAM-CAV-CBD
2	B	803	6EU	CAL-CAM-CAV-CBB

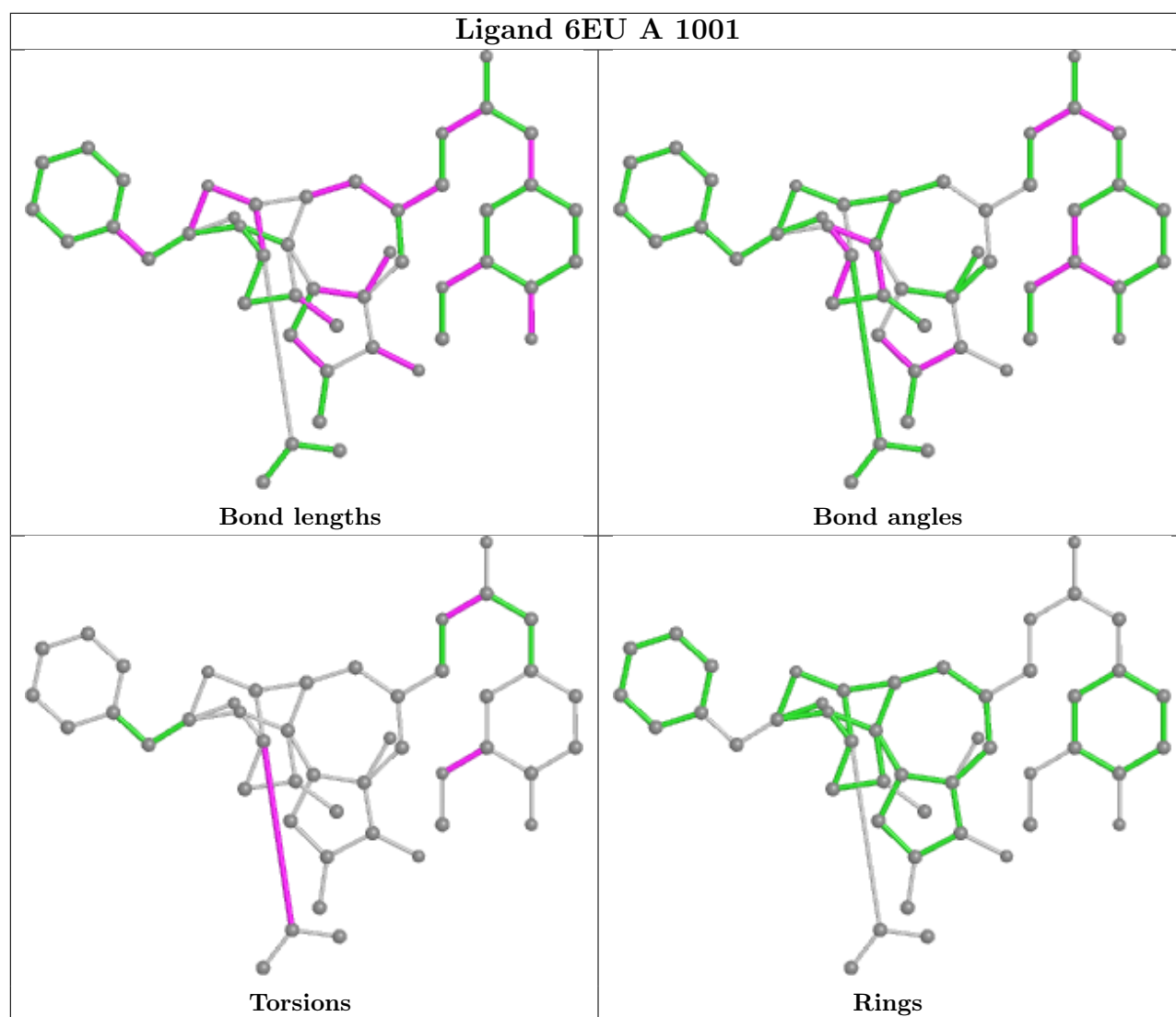
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1001	6EU	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	610/776 (78%)	0.38	26 (4%) 35 17	41, 81, 146, 177	0
1	B	617/776 (79%)	0.44	31 (5%) 28 13	43, 85, 152, 190	0
All	All	1227/1552 (79%)	0.41	57 (4%) 32 16	41, 83, 149, 190	0

The worst 5 of 57 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	427	ALA	13.1
1	B	460	PHE	11.4
1	A	429	ASN	6.1
1	A	428	GLY	6.0
1	B	459	LEU	5.8

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

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

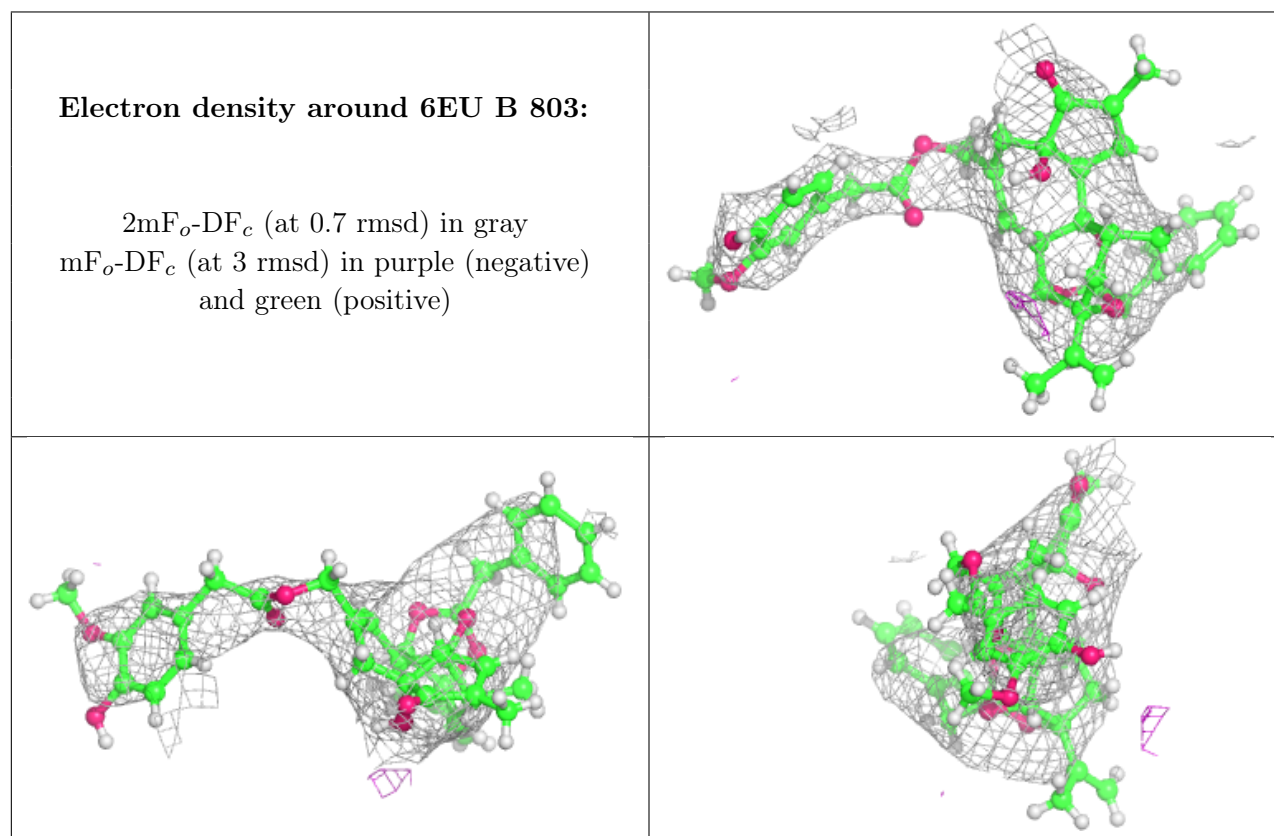
### 6.4 Ligands [i](#)

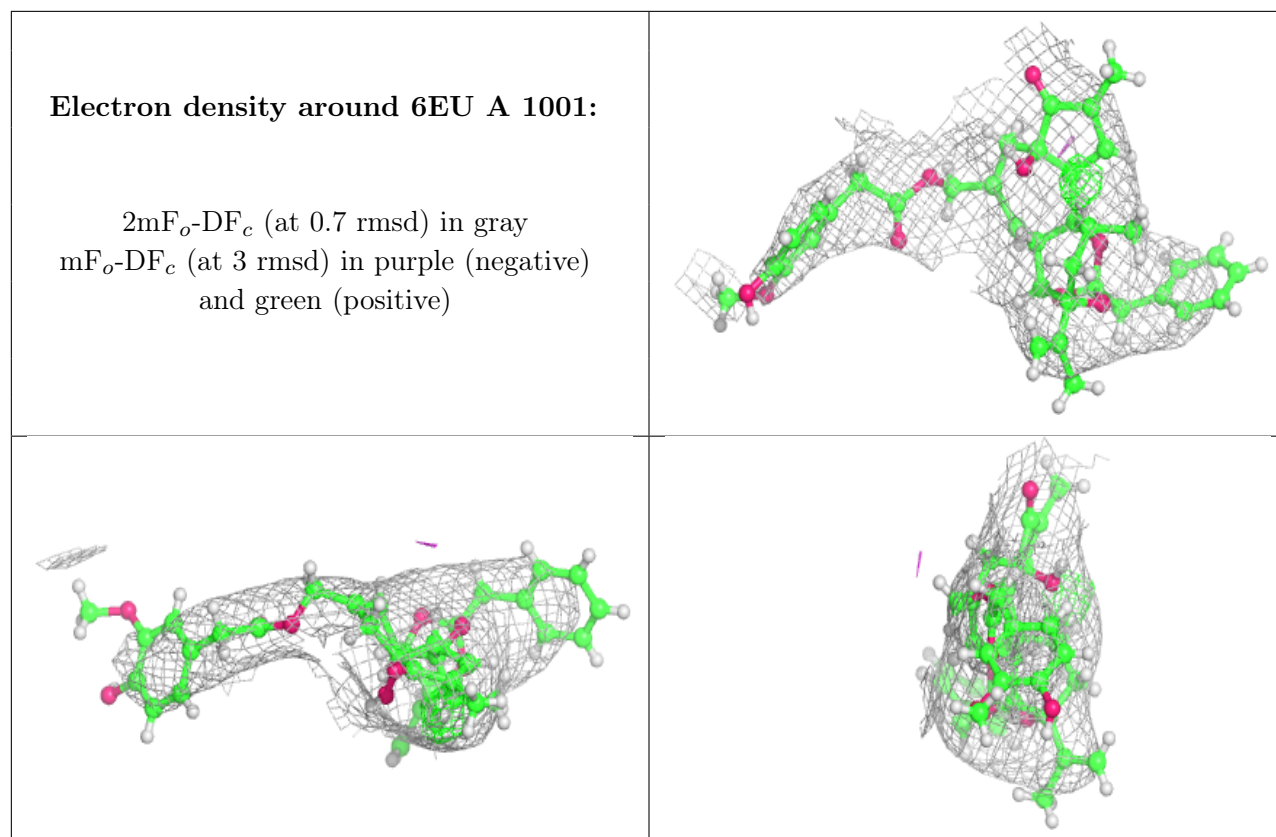
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 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
3	CA	B	802	1/1	0.65	0.37	101,101,101,101	1
3	CA	B	801	1/1	0.81	0.41	97,97,97,97	1
2	6EU	B	803	46/46	0.89	0.47	95,124,150,160	0
2	6EU	A	1001	46/46	0.90	0.34	86,108,131,141	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.





## 6.5 Other polymers [i](#)

There are no such residues in this entry.