



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 26, 2016 – 10:43 PM EDT

PDB ID : 5L1G  
Title : AMPA subtype ionotropic glutamate receptor GluA2 in complex with GYKI-Br  
Authors : Yelshanskaya, M.V.; Singh, A.K.; Sampson, J.M.; Sobolevsky, A.I.  
Deposited on : 2016-07-29  
Resolution : 4.51 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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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 : 1.7.1 (RC1), CSD as537be (2016)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20027939  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027939

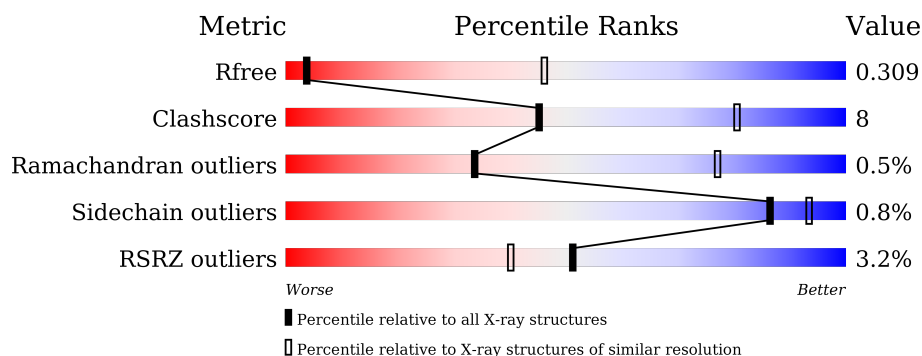
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 4.51 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))
$R_{free}$	91344	1071 (5.40-3.60)
Clashscore	102246	1003 (5.30-3.62)
Ramachandran outliers	100387	1117 (5.40-3.60)
Sidechain outliers	100360	1099 (5.40-3.60)
RSRZ outliers	91569	1075 (5.40-3.60)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	803	<div> <div>2%</div> <div>80% 16% .</div> </div>
1	B	803	<div> <div>3%</div> <div>76% 20% .</div> </div>
1	C	803	<div> <div>3%</div> <div>77% 19% .</div> </div>
1	D	803	<div> <div>3%</div> <div>78% 18% .</div> </div>

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	NAG	A	901	-	-	-	X
3	GYB	A	902	-	-	-	X
3	GYB	A	903	X	-	X	X
3	GYB	C	902	-	-	-	X

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 24087 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 Glutamate receptor 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	777	Total	C	N	O	S	0	0	0
			5987	3848	992	1118	29			
1	B	773	Total	C	N	O	S	0	0	0
			5990	3844	989	1128	29			
1	C	774	Total	C	N	O	S	0	0	0
			5952	3824	986	1114	28			
1	D	777	Total	C	N	O	S	0	0	0
			5967	3831	990	1119	27			

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	241	GLU	ASN	engineered mutation	UNP P19491
A	?	-	VAL	deletion	UNP P19491
A	?	-	THR	deletion	UNP P19491
A	?	-	LEU	deletion	UNP P19491
A	?	-	PRO	deletion	UNP P19491
A	?	-	SER	deletion	UNP P19491
A	?	-	GLY	deletion	UNP P19491
A	385	ASP	ASN	engineered mutation	UNP P19491
A	392	GLN	ASN	engineered mutation	UNP P19491
A	564	ASP	-	linker	UNP P19491
A	565	THR	-	linker	UNP P19491
A	566	ASP	-	linker	UNP P19491
A	589	ALA	CYS	engineered mutation	UNP P19491
A	827	GLY	-	cloning artifact	UNP P19491
A	828	LEU	-	cloning artifact	UNP P19491
A	829	VAL	-	cloning artifact	UNP P19491
A	830	PRO	-	cloning artifact	UNP P19491
A	831	ARG	-	cloning artifact	UNP P19491
B	241	GLU	ASN	engineered mutation	UNP P19491
B	?	-	VAL	deletion	UNP P19491
B	?	-	THR	deletion	UNP P19491

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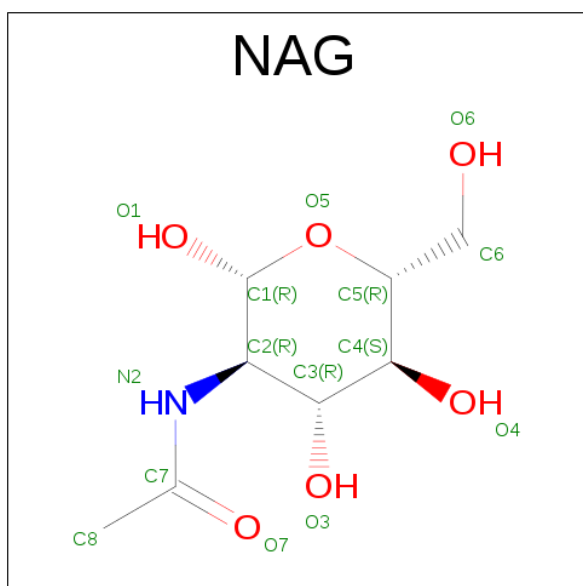
Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	LEU	deletion	UNP P19491
B	?	-	PRO	deletion	UNP P19491
B	?	-	SER	deletion	UNP P19491
B	?	-	GLY	deletion	UNP P19491
B	385	ASP	ASN	engineered mutation	UNP P19491
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B	828	LEU	-	cloning artifact	UNP P19491
B	829	VAL	-	cloning artifact	UNP P19491
B	830	PRO	-	cloning artifact	UNP P19491
B	831	ARG	-	cloning artifact	UNP P19491
C	241	GLU	ASN	engineered mutation	UNP P19491
C	?	-	VAL	deletion	UNP P19491
C	?	-	THR	deletion	UNP P19491
C	?	-	LEU	deletion	UNP P19491
C	?	-	PRO	deletion	UNP P19491
C	?	-	SER	deletion	UNP P19491
C	?	-	GLY	deletion	UNP P19491
C	385	ASP	ASN	engineered mutation	UNP P19491
C	392	GLN	ASN	engineered mutation	UNP P19491
C	564	ASP	-	linker	UNP P19491
C	565	THR	-	linker	UNP P19491
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C	829	VAL	-	cloning artifact	UNP P19491
C	830	PRO	-	cloning artifact	UNP P19491
C	831	ARG	-	cloning artifact	UNP P19491
D	241	GLU	ASN	engineered mutation	UNP P19491
D	?	-	VAL	deletion	UNP P19491
D	?	-	THR	deletion	UNP P19491
D	?	-	LEU	deletion	UNP P19491
D	?	-	PRO	deletion	UNP P19491
D	?	-	SER	deletion	UNP P19491
D	?	-	GLY	deletion	UNP P19491
D	385	ASP	ASN	engineered mutation	UNP P19491
D	392	GLN	ASN	engineered mutation	UNP P19491

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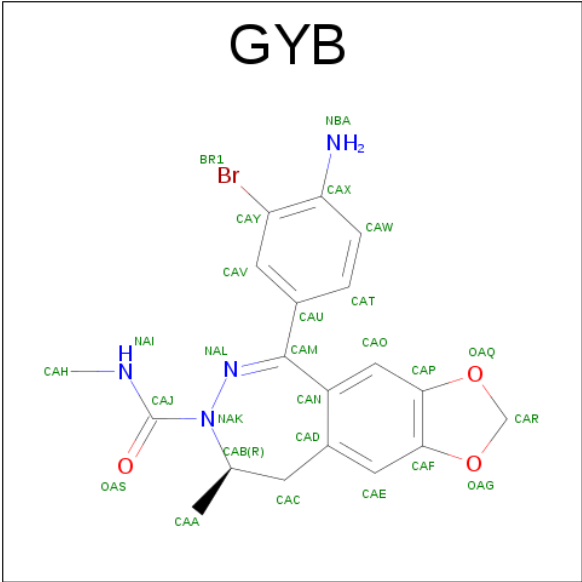
Chain	Residue	Modelled	Actual	Comment	Reference
D	564	ASP	-	linker	UNP P19491
D	565	THR	-	linker	UNP P19491
D	566	ASP	-	linker	UNP P19491
D	589	ALA	CYS	engineered mutation	UNP P19491
D	827	GLY	-	cloning artifact	UNP P19491
D	828	LEU	-	cloning artifact	UNP P19491
D	829	VAL	-	cloning artifact	UNP P19491
D	830	PRO	-	cloning artifact	UNP P19491
D	831	ARG	-	cloning artifact	UNP P19491

- Molecule 2 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	C	1	Total	C	N	O	0	0
			14	8	1	5		
2	D	1	Total	C	N	O	0	0
			14	8	1	5		

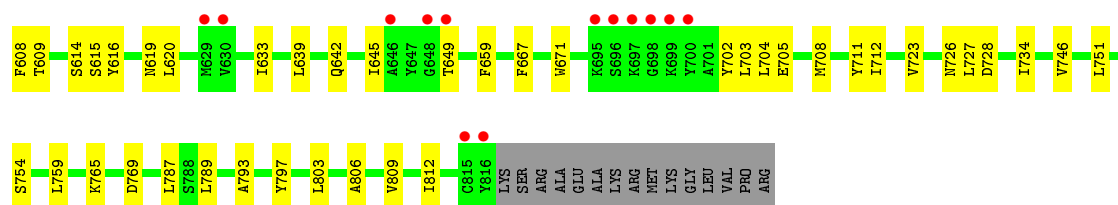
- Molecule 3 is (8R)-5-(4-amino-3-bromophenyl)-N,8-dimethyl-8,9-dihydro-2H,7H-[1,3]dioxolo[4,5-h][2,3]benzodiazepine-7-carboxamide (three-letter code: GYB) (formula:  $C_{19}H_{19}BrN_4O_3$ ).



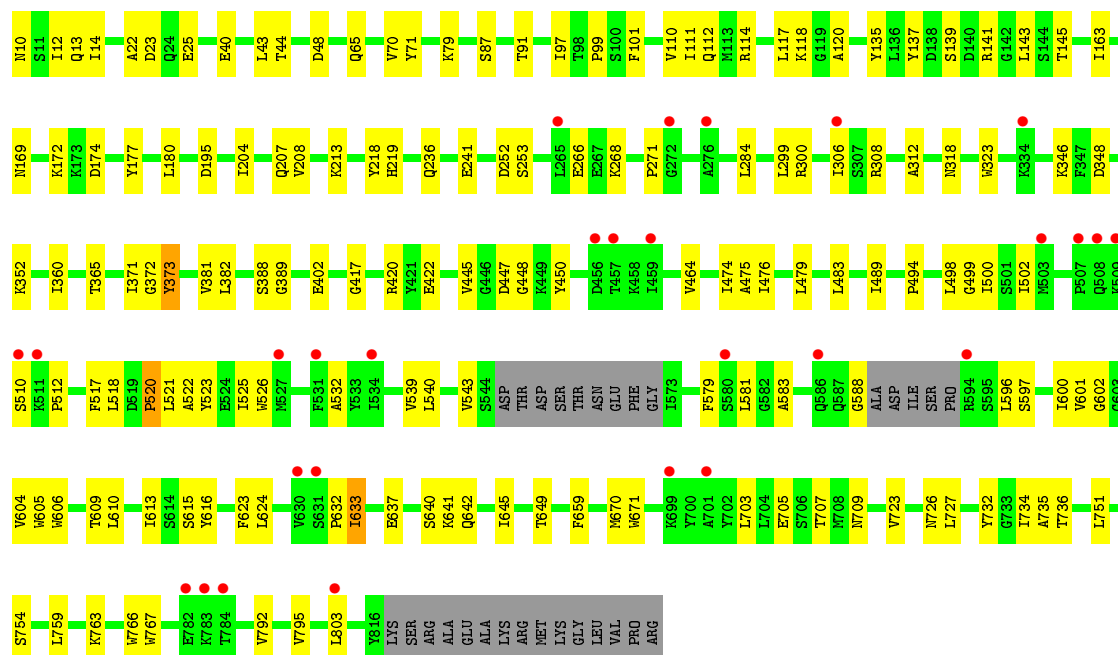
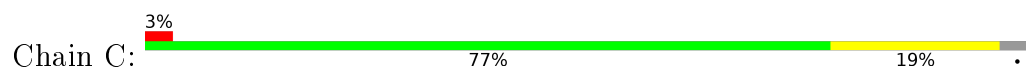
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	Br	C	N	O	0	0
			27	1	19	4	3		
3	A	1	Total	Br	C	N	O	0	0
			27	1	19	4	3		
3	B	1	Total	Br	C	N	O	0	0
			27	1	19	4	3		
3	C	1	Total	Br	C	N	O	0	0
			27	1	19	4	3		
3	D	1	Total	Br	C	N	O	0	0
			27	1	19	4	3		



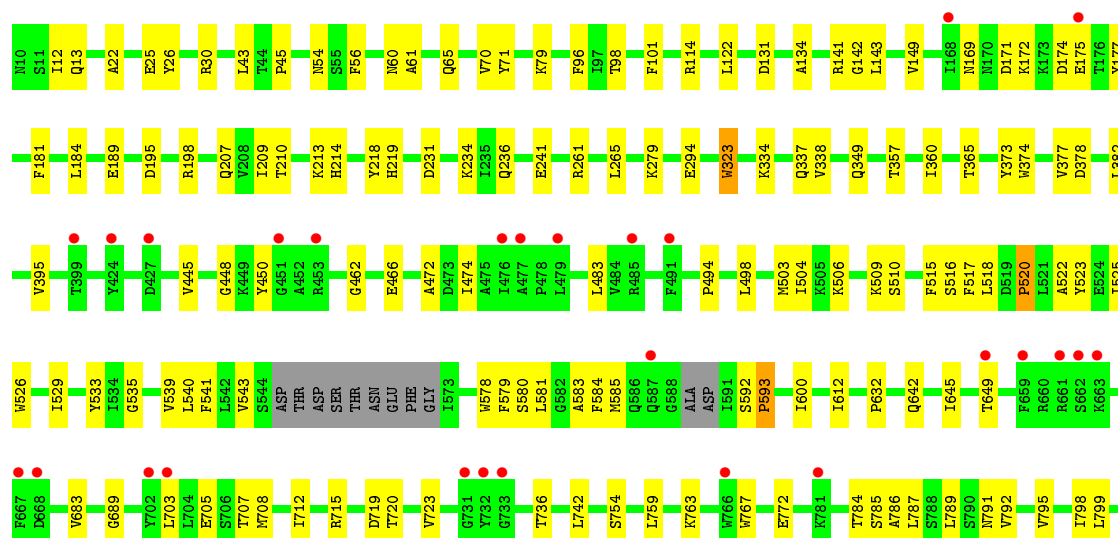
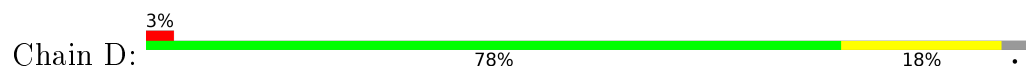




• Molecule 1: Glutamate receptor 2



• Molecule 1: Glutamate receptor 2



G802	L803	A806	V809	I812	E813	<b>Y816</b>	LYS	SER	ARG	ALA	GLU	ALA	LYS	ARG	MET	LYS	GLY	LEU	VAL	PRO	ARG
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## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	92.79Å 110.40Å 600.14Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.91 – 4.51 48.91 – 4.51	Depositor EDS
% Data completeness (in resolution range)	99.1 (48.91-4.51) 99.2 (48.91-4.51)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.90 (at 4.45Å)	Xtriage
Refinement program	PHENIX (1.10.1 _2155: ???)	Depositor
R, $R_{free}$	0.257 , 0.295 0.273 , 0.309	Depositor DCC
$R_{free}$ test set	1865 reflections (5.00%)	DCC
Wilson B-factor (Å <sup>2</sup> )	206.9	Xtriage
Anisotropy	0.233	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.22 , 181.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.43$ , $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.84	EDS
Total number of atoms	24087	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	246.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.38% 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: NAG, GYB

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	0.25	0/6110	0.42	0/8271
1	B	0.26	0/6112	0.45	0/8270
1	C	0.25	0/6074	0.43	0/8225
1	D	0.25	0/6090	0.42	0/8248
All	All	0.25	0/24386	0.43	0/33014

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	5987	0	5885	83	0
1	B	5990	0	5902	108	0
1	C	5952	0	5823	124	0
1	D	5967	0	5830	100	0
2	A	14	0	13	0	0
2	B	14	0	13	0	0
2	C	14	0	13	1	0
2	D	14	0	13	1	0
3	A	54	0	0	22	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	27	0	0	3	0
3	C	27	0	0	1	0
3	D	27	0	0	3	0
All	All	24087	0	23492	371	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 8.

The worst 5 of 371 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)
3:A:903:GYB:CAR	1:C:610:LEU:HA	1.68	1.22
3:A:903:GYB:OAQ	1:C:613:ILE:CD1	1.89	1.20
3:A:903:GYB:CAP	1:C:613:ILE:HD11	1.72	1.19
3:A:903:GYB:CAR	1:C:613:ILE:HD11	1.76	1.15
3:A:903:GYB:OAQ	1:C:613:ILE:HD11	0.92	1.09

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	771/803 (96%)	715 (93%)	52 (7%)	4 (0%)	34	77
1	B	767/803 (96%)	708 (92%)	57 (7%)	2 (0%)	46	83
1	C	768/803 (96%)	715 (93%)	48 (6%)	5 (1%)	26	71
1	D	771/803 (96%)	720 (93%)	48 (6%)	3 (0%)	39	80
All	All	3077/3212 (96%)	2858 (93%)	205 (7%)	14 (0%)	34	77

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	510	SER
1	A	596	LEU
1	D	593	PRO
1	C	373	TYR
1	A	520	PRO

### 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	627/683 (92%)	622 (99%)	5 (1%)	86	93
1	B	634/683 (93%)	627 (99%)	7 (1%)	80	90
1	C	619/683 (91%)	617 (100%)	2 (0%)	94	96
1	D	620/683 (91%)	613 (99%)	7 (1%)	80	90
All	All	2500/2732 (92%)	2479 (99%)	21 (1%)	86	93

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	523	TYR
1	B	585	MET
1	D	533	TYR
1	B	491	PHE
1	D	541	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	791	ASN
1	C	207	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 ⓘ

9 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	NAG	A	901	1	14,14,15	0.75	1 (7%)	15,19,21	0.66	0
3	GYB	A	902	-	25,30,30	3.77	12 (48%)	34,44,44	3.21	14 (41%)
3	GYB	A	903	-	25,30,30	2.31	6 (24%)	34,44,44	3.75	9 (26%)
2	NAG	B	901	1	14,14,15	0.35	0	15,19,21	0.55	0
3	GYB	B	902	-	25,30,30	3.85	12 (48%)	34,44,44	3.11	14 (41%)
2	NAG	C	901	1	14,14,15	0.35	0	15,19,21	0.59	1 (6%)
3	GYB	C	902	-	25,30,30	3.63	12 (48%)	34,44,44	3.42	15 (44%)
2	NAG	D	901	1	14,14,15	0.50	0	15,19,21	0.57	0
3	GYB	D	902	-	25,30,30	3.70	12 (48%)	34,44,44	3.54	14 (41%)

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	NAG	A	901	1	-	0/6/23/26	0/1/1/1
3	GYB	A	902	-	-	0/6/32/32	0/3/4/4
3	GYB	A	903	-	1/1/4/5	0/6/32/32	0/3/4/4
2	NAG	B	901	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GYB	B	902	-	-	0/6/32/32	0/3/4/4
2	NAG	C	901	1	-	0/6/23/26	0/1/1/1
3	GYB	C	902	-	-	0/6/32/32	0/3/4/4
2	NAG	D	901	1	-	0/6/23/26	0/1/1/1
3	GYB	D	902	-	-	0/6/32/32	0/3/4/4

The worst 5 of 55 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	903	GYB	CAU-CAM	-6.74	1.40	1.49
3	D	902	GYB	OAG-CAR	-5.41	1.33	1.43
3	C	902	GYB	OAG-CAR	-5.41	1.33	1.43
3	A	902	GYB	OAG-CAR	-5.41	1.33	1.43
3	C	902	GYB	OAQ-CAR	-5.40	1.33	1.43

The worst 5 of 67 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	902	GYB	CAN-CAM-NAL	-10.39	112.83	126.13
3	B	902	GYB	CAN-CAM-NAL	-10.27	112.98	126.13
3	C	902	GYB	CAH-NAI-CAJ	-9.17	111.55	120.78
3	C	902	GYB	CAN-CAM-NAL	-9.03	114.57	126.13
3	A	902	GYB	CAN-CAM-NAL	-8.73	114.95	126.13

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	903	GYB	CAB

There are no torsion outliers.

There are no ring outliers.

7 monomers are involved in 31 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	902	GYB	2	0
3	A	903	GYB	20	0
3	B	902	GYB	3	0
2	C	901	NAG	1	0
3	C	902	GYB	1	0
2	D	901	NAG	1	0
3	D	902	GYB	3	0



## 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	777/803 (96%)	-0.13	18 (2%) 64 54	153, 228, 329, 363	0
1	B	773/803 (96%)	-0.06	27 (3%) 48 38	172, 212, 312, 365	0
1	C	774/803 (96%)	0.07	28 (3%) 46 37	146, 255, 314, 341	0
1	D	777/803 (96%)	-0.04	27 (3%) 48 38	202, 266, 336, 372	0
All	All	3101/3212 (96%)	-0.04	100 (3%) 51 40	146, 242, 325, 372	0

The worst 5 of 100 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	733	GLY	7.3
1	A	781	LYS	5.6
1	C	276	ALA	5.6
1	B	816	TYR	5.0
1	D	731	GLY	4.9

### 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 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
3	GYB	A	903	27/27	0.62	0.78	7.61	58,205,248,257	27
2	NAG	A	901	14/15	0.33	1.03	4.72	344,344,346,352	0
3	GYB	A	902	27/27	0.64	0.62	2.58	259,264,270,279	0
3	GYB	C	902	27/27	0.70	0.88	2.23	252,261,270,281	0
3	GYB	B	902	27/27	0.72	0.40	1.63	253,263,269,275	0
3	GYB	D	902	27/27	0.72	0.19	-0.56	253,264,269,292	0
2	NAG	B	901	14/15	0.81	0.34	-	285,285,287,290	0
2	NAG	D	901	14/15	0.52	0.64	-	358,358,359,362	0
2	NAG	C	901	14/15	0.32	0.89	-	505,505,507,515	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.