



wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 13, 2019 – 10:38 PM EDT

PDB ID : 2C6G
Title : Membrane-bound glutamate carboxypeptidase II (GCPII) with bound glutamate
Authors : Mesters, J.R.; Barinka, C.; Li, W.; Tsukamoto, T.; Majer, P.; Slusher, B.S.; Konvalinka, J.; Hilgenfeld, R.
Deposited on : 2005-11-09
Resolution : 2.20 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

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 : 1.8.0 (224370), CSD as540be (2019)
Xtriage (Phenix) : 1.13
EDS : 2.3.2
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.3.2

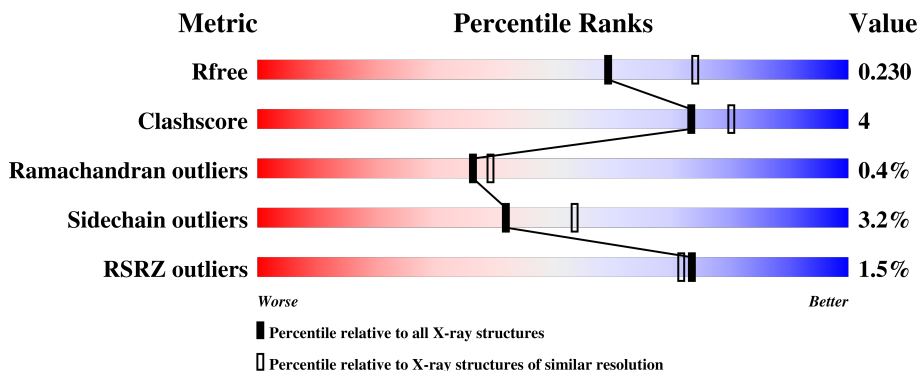
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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}	111664	4343 (2.20-2.20)
Clashscore	122126	5027 (2.20-2.20)
Ramachandran outliers	120053	4952 (2.20-2.20)
Sidechain outliers	120020	4953 (2.20-2.20)
RSRZ outliers	108989	4245 (2.20-2.20)

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. 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	707	<div> <div></div> <div>83%</div> <div>11%</div> <div>..</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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	NAG	A	1759	X	-	-	-

2 Entry composition [i](#)

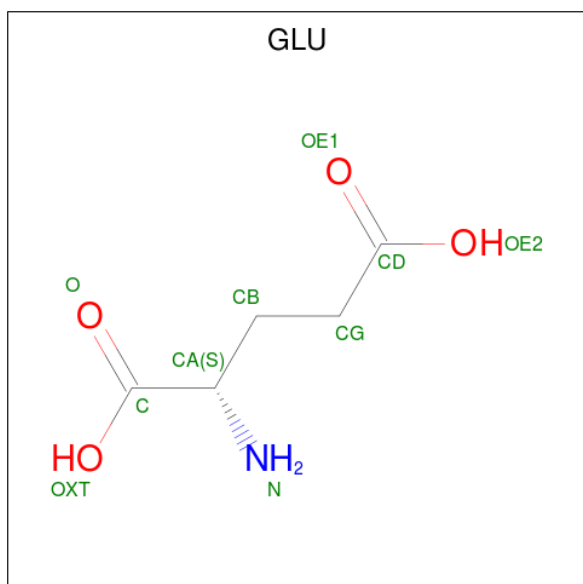
There are 9 unique types of molecules in this entry. The entry contains 5571 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 CARBOXYPEPTIDASE II.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	679	5266	3394	872	983	17	0	0	0

- Molecule 2 is GLUTAMIC ACID (three-letter code: GLU) (formula: $C_5H_9NO_4$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	10	5	1	4	0	0

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	A	2	2	2	0	0

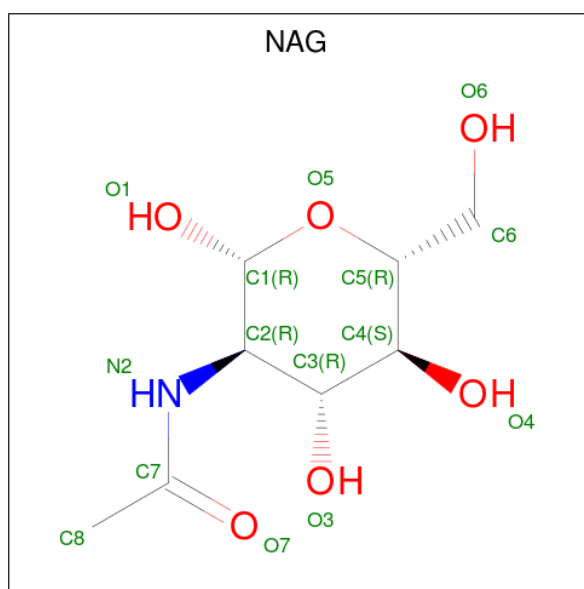
- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Ca	0	0
			1	1		

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Cl	0	0
			1	1		

- Molecule 6 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula: C₈H₁₅NO₆).



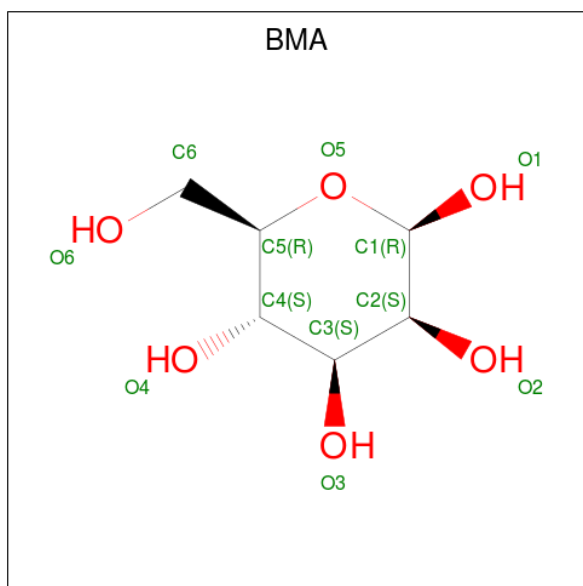
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

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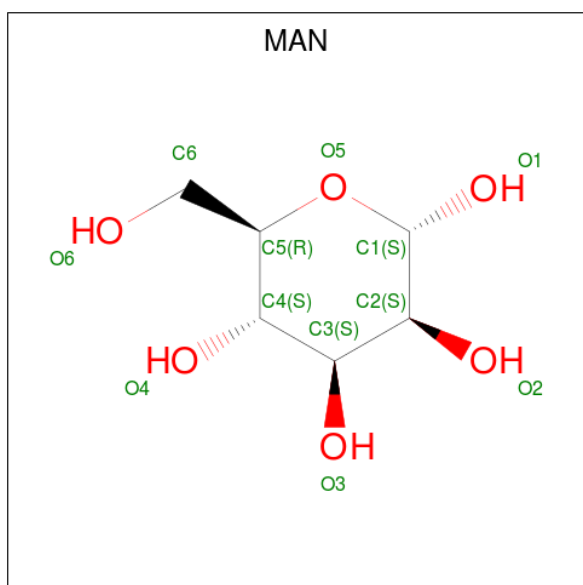
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 7 is BETA-D-MANNOSE (three-letter code: BMA) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			11	6	5		

- Molecule 8 is ALPHA-D-MANNOSE (three-letter code: MAN) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total	C	O	0	0
			11	6	5		

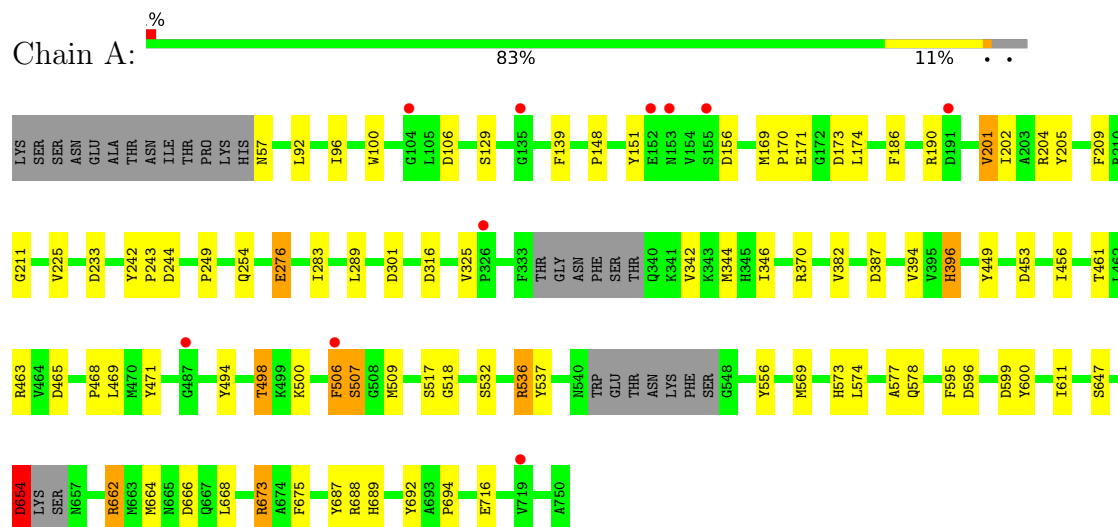
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	143	Total	O	0	0
			143	143		

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: GLUTAMATE CARBOXYPEPTIDASE II



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	102.44Å 130.43Å 159.78Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	100.00 – 2.20 47.25 – 2.20	Depositor EDS
% Data completeness (in resolution range)	95.6 (100.00-2.20) 95.6 (47.25-2.20)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.16 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.186 , 0.228 0.193 , 0.230	Depositor DCC
R_{free} test set	1324 reflections (2.55%)	wwPDB-VP
Wilson B-factor (Å ²)	33.9	Xtriage
Anisotropy	0.032	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 34.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5571	wwPDB-VP
Average B, all atoms (Å ²)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.03% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, BMA, NAG, CL, CA, MAN

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	0.94	0/5412	0.95	21/7354 (0.3%)

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	A	0	4

There are no bond length outliers.

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	662	ARG	NE-CZ-NH1	9.72	125.16	120.30
1	A	387	ASP	CB-CG-OD2	8.65	126.08	118.30
1	A	599	ASP	CB-CG-OD2	8.29	125.76	118.30
1	A	662	ARG	NE-CZ-NH2	-8.27	116.16	120.30
1	A	106	ASP	CB-CG-OD2	7.90	125.41	118.30

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	201	VAL	Peptide
1	A	289	LEU	Peptide
1	A	346	ILE	Peptide
1	A	506	PHE	Peptide

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	5266	0	4957	38	1
2	A	10	0	5	0	0
3	A	2	0	0	0	0
4	A	1	0	0	0	0
5	A	1	0	0	0	0
6	A	126	0	113	0	0
7	A	11	0	9	0	1
8	A	11	0	10	0	0
9	A	143	0	0	2	0
All	All	5571	0	5094	38	1

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 38 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:569:MET:CE	1:A:569:MET:SD	2.05	1.42
1:A:494:TYR:O	1:A:498:THR:CG2	2.36	0.73
1:A:494:TYR:O	1:A:498:THR:HG22	1.92	0.69
1:A:100:TRP:HE1	1:A:396:HIS:HD2	1.43	0.65
1:A:654:ASP:N	1:A:654:ASP:OD1	2.35	0.59

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:276:GLU:OE2	7:A:1764:BMA:O2[2_565]	2.12	0.08

5.3 Torsion angles

5.3.1 Protein backbone

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	671/707 (95%)	636 (95%)	32 (5%)	3 (0%)	36	39

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	506	PHE
1	A	507	SER
1	A	382	VAL

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	531/603 (88%)	514 (97%)	17 (3%)	42	54

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	498	THR
1	A	509	MET
1	A	654	ASP
1	A	465	ASP
1	A	664	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	136	ASN
1	A	396	HIS
1	A	573	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 4 are monoatomic - leaving 12 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
6	NAG	A	1755	1,6	14,14,15	0.64	0	17,19,21	1.80	4 (23%)
6	NAG	A	1756	6	14,14,15	0.77	0	17,19,21	2.31	5 (29%)
6	NAG	A	1757	1	14,14,15	0.75	0	17,19,21	2.42	8 (47%)
6	NAG	A	1758	1	14,14,15	1.03	1 (7%)	17,19,21	1.68	3 (17%)
6	NAG	A	1759	1	14,14,15	0.69	0	17,19,21	2.52	8 (47%)
6	NAG	A	1760	1,6	14,14,15	1.13	1 (7%)	17,19,21	1.85	4 (23%)
6	NAG	A	1761	6	14,14,15	0.65	0	17,19,21	1.02	1 (5%)
6	NAG	A	1762	1,6	14,14,15	0.57	0	17,19,21	1.61	2 (11%)
6	NAG	A	1763	7,6	14,14,15	0.77	0	17,19,21	1.71	4 (23%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	BMA	A	1764	8,6	11,11,12	0.84	0	15,15,17	2.09	3 (20%)
8	MAN	A	1765	7	11,11,12	0.68	0	15,15,17	1.47	3 (20%)

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
6	NAG	A	1755	1,6	-	2/6/23/26	0/1/1/1
6	NAG	A	1756	6	-	2/6/23/26	0/1/1/1
6	NAG	A	1757	1	-	2/6/23/26	0/1/1/1
6	NAG	A	1758	1	-	0/6/23/26	0/1/1/1
6	NAG	A	1759	1	1/1/5/7	2/6/23/26	0/1/1/1
6	NAG	A	1760	1,6	-	2/6/23/26	0/1/1/1
6	NAG	A	1761	6	-	0/6/23/26	0/1/1/1
6	NAG	A	1762	1,6	-	2/6/23/26	0/1/1/1
6	NAG	A	1763	7,6	-	2/6/23/26	0/1/1/1
7	BMA	A	1764	8,6	-	0/2/19/22	0/1/1/1
8	MAN	A	1765	7	-	0/2/19/22	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	1760	NAG	O5-C1	-2.92	1.39	1.43
6	A	1758	NAG	C4-C5	2.13	1.57	1.53

The worst 5 of 45 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1757	NAG	C1-O5-C5	6.80	121.44	112.20
6	A	1759	NAG	C1-O5-C5	6.22	120.65	112.20
7	A	1764	BMA	C1-C2-C3	6.12	117.19	109.66
6	A	1762	NAG	C1-O5-C5	4.88	118.83	112.20
6	A	1760	NAG	O5-C1-C2	-4.73	103.93	111.36

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	A	1759	NAG	C1

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1759	NAG	C4-C5-C6-O6
6	A	1760	NAG	C8-C7-N2-C2
6	A	1755	NAG	O5-C5-C6-O6
6	A	1760	NAG	O7-C7-N2-C2
6	A	1759	NAG	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	1764	BMA	0	1

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, 95th 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	679/707 (96%)	-0.36	10 (1%) 73 72	20, 36, 63, 75	0

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	153	ASN	4.3
1	A	506	PHE	3.4
1	A	155	SER	3.4
1	A	719	VAL	3.0
1	A	135	GLY	2.9

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. The B-factors column lists the minimum, median, 95th 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
6	NAG	A	1758	14/15	0.75	0.19	61,64,66,68	0
6	NAG	A	1756	14/15	0.79	0.31	62,70,73,73	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
6	NAG	A	1757	14/15	0.80	0.33	73,77,82,83	0
7	BMA	A	1764	11/12	0.85	0.12	68,71,72,72	0
6	NAG	A	1759	14/15	0.86	0.14	44,58,68,70	0
6	NAG	A	1763	14/15	0.90	0.13	54,60,64,65	0
8	MAN	A	1765	11/12	0.91	0.11	74,75,78,80	0
6	NAG	A	1761	14/15	0.93	0.11	57,61,63,64	0
6	NAG	A	1755	14/15	0.94	0.14	47,54,57,60	0
6	NAG	A	1760	14/15	0.94	0.10	44,50,55,55	0
6	NAG	A	1762	14/15	0.96	0.08	32,37,49,49	0
2	GLU	A	1766	10/10	0.97	0.11	25,27,28,28	0
3	ZN	A	1751	1/1	0.99	0.12	27,27,27,27	0
4	CA	A	1753	1/1	1.00	0.09	21,21,21,21	0
5	CL	A	1754	1/1	1.00	0.15	31,31,31,31	0
3	ZN	A	1752	1/1	1.00	0.10	25,25,25,25	0

6.5 Other polymers [i](#)

There are no such residues in this entry.