



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 08:19 AM UTC

PDB ID : 5FTH / pdb_00005fth
Title : Crystal structure of the GluA2 K738M-T744K LBD in complex with glutamate (zinc form)
Authors : Nayeem, N.; Green, T.
Deposited on : 2016-01-13
Resolution : 2.90 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 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) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

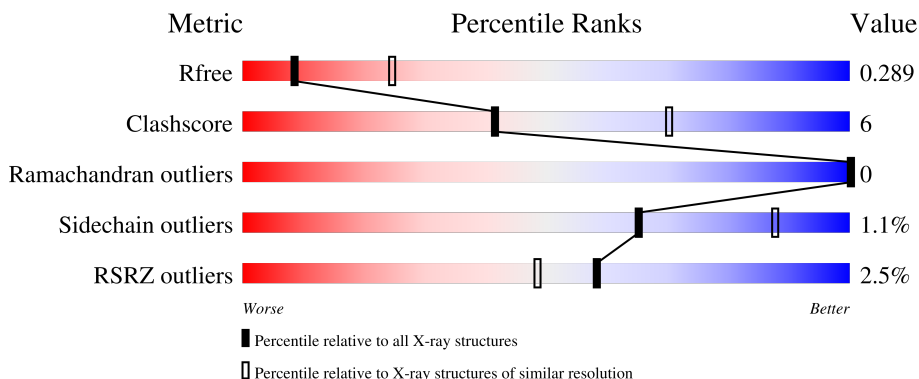
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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}	180053	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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 $\leq 5\%$. 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	291	
1	B	291	
1	C	291	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5908 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
			Total	C	N	O	S			
1	A	248	1944	1247	320	362	15	0	0	0
1	B	249	1947	1244	320	368	15	0	0	0
1	C	254	1982	1267	327	374	14	0	0	0

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	362	MET	-	expression tag	UNP P19491
A	363	HIS	-	expression tag	UNP P19491
A	364	HIS	-	expression tag	UNP P19491
A	365	HIS	-	expression tag	UNP P19491
A	366	HIS	-	expression tag	UNP P19491
A	367	HIS	-	expression tag	UNP P19491
A	368	HIS	-	expression tag	UNP P19491
A	369	HIS	-	expression tag	UNP P19491
A	370	HIS	-	expression tag	UNP P19491
A	371	SER	-	expression tag	UNP P19491
A	372	SER	-	expression tag	UNP P19491
A	373	GLY	-	expression tag	UNP P19491
A	374	LEU	-	expression tag	UNP P19491
A	375	VAL	-	expression tag	UNP P19491
A	376	PRO	-	expression tag	UNP P19491
A	377	ARG	-	expression tag	UNP P19491
A	378	GLY	-	expression tag	UNP P19491
A	379	SER	-	expression tag	UNP P19491
A	380	ALA	-	expression tag	UNP P19491
A	381	MET	-	expression tag	UNP P19491
A	382	GLY	-	expression tag	UNP P19491
A	389	ARG	GLY	engineered mutation	UNP P19491
A	390	GLY	LEU	engineered mutation	UNP P19491

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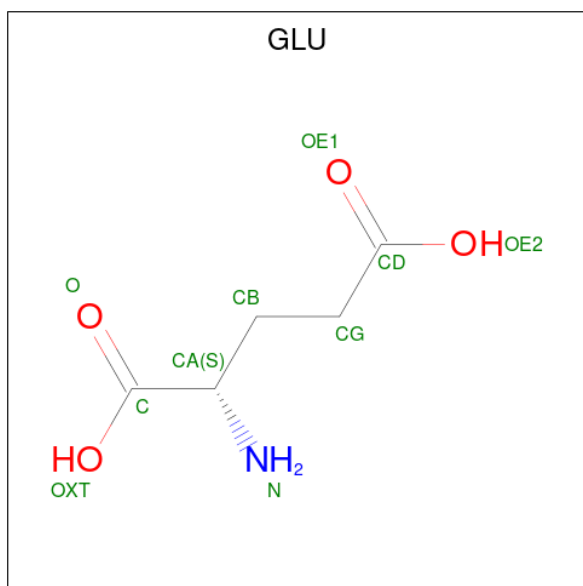
Chain	Residue	Modelled	Actual	Comment	Reference
A	391	ALA	GLU	engineered mutation	UNP P19491
A	555	GLY	-	linker	UNP P19491
A	566	THR	-	linker	UNP P19491
A	738	MET	LYS	engineered mutation	UNP P19491
A	744	LYS	THR	engineered mutation	UNP P19491
B	362	MET	-	expression tag	UNP P19491
B	363	HIS	-	expression tag	UNP P19491
B	364	HIS	-	expression tag	UNP P19491
B	365	HIS	-	expression tag	UNP P19491
B	366	HIS	-	expression tag	UNP P19491
B	367	HIS	-	expression tag	UNP P19491
B	368	HIS	-	expression tag	UNP P19491
B	369	HIS	-	expression tag	UNP P19491
B	370	HIS	-	expression tag	UNP P19491
B	371	SER	-	expression tag	UNP P19491
B	372	SER	-	expression tag	UNP P19491
B	373	GLY	-	expression tag	UNP P19491
B	374	LEU	-	expression tag	UNP P19491
B	375	VAL	-	expression tag	UNP P19491
B	376	PRO	-	expression tag	UNP P19491
B	377	ARG	-	expression tag	UNP P19491
B	378	GLY	-	expression tag	UNP P19491
B	379	SER	-	expression tag	UNP P19491
B	380	ALA	-	expression tag	UNP P19491
B	381	MET	-	expression tag	UNP P19491
B	382	GLY	-	expression tag	UNP P19491
B	389	ARG	GLY	engineered mutation	UNP P19491
B	390	GLY	LEU	engineered mutation	UNP P19491
B	391	ALA	GLU	engineered mutation	UNP P19491
B	555	GLY	-	linker	UNP P19491
B	566	THR	-	linker	UNP P19491
B	738	MET	LYS	engineered mutation	UNP P19491
B	744	LYS	THR	engineered mutation	UNP P19491
C	362	MET	-	expression tag	UNP P19491
C	363	HIS	-	expression tag	UNP P19491
C	364	HIS	-	expression tag	UNP P19491
C	365	HIS	-	expression tag	UNP P19491
C	366	HIS	-	expression tag	UNP P19491
C	367	HIS	-	expression tag	UNP P19491
C	368	HIS	-	expression tag	UNP P19491
C	369	HIS	-	expression tag	UNP P19491
C	370	HIS	-	expression tag	UNP P19491

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Chain	Residue	Modelled	Actual	Comment	Reference
C	371	SER	-	expression tag	UNP P19491
C	372	SER	-	expression tag	UNP P19491
C	373	GLY	-	expression tag	UNP P19491
C	374	LEU	-	expression tag	UNP P19491
C	375	VAL	-	expression tag	UNP P19491
C	376	PRO	-	expression tag	UNP P19491
C	377	ARG	-	expression tag	UNP P19491
C	378	GLY	-	expression tag	UNP P19491
C	379	SER	-	expression tag	UNP P19491
C	380	ALA	-	expression tag	UNP P19491
C	381	MET	-	expression tag	UNP P19491
C	382	GLY	-	expression tag	UNP P19491
C	389	ARG	GLY	engineered mutation	UNP P19491
C	390	GLY	LEU	engineered mutation	UNP P19491
C	391	ALA	GLU	engineered mutation	UNP P19491
C	555	GLY	-	linker	UNP P19491
C	566	THR	-	linker	UNP P19491
C	738	MET	LYS	engineered mutation	UNP P19491
C	744	LYS	THR	engineered mutation	UNP P19491

- Molecule 2 is GLUTAMIC ACID (CCD ID: GLU) (formula: C₅H₉NO₄).



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

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

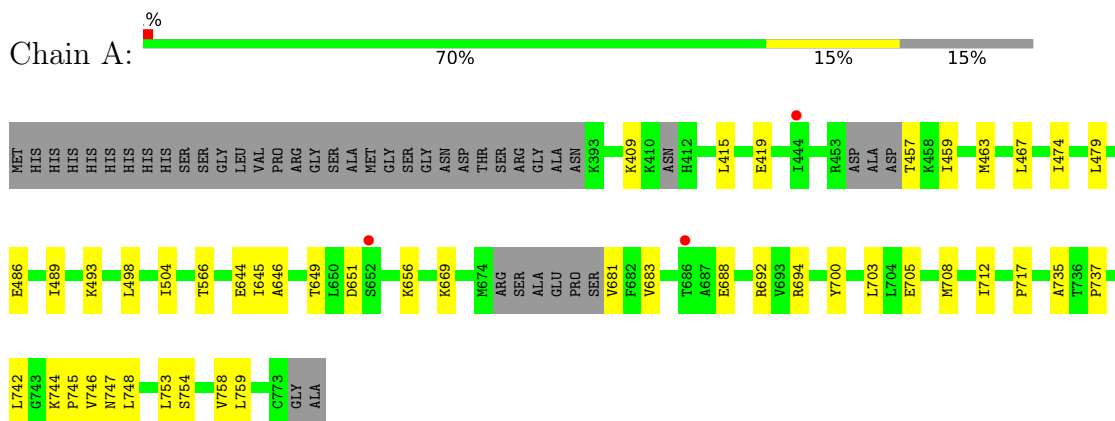
- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Zn	0	0
			2	2		
3	B	2	Total	Zn	0	0
			2	2		
3	C	1	Total	Zn	0	0
			1	1		

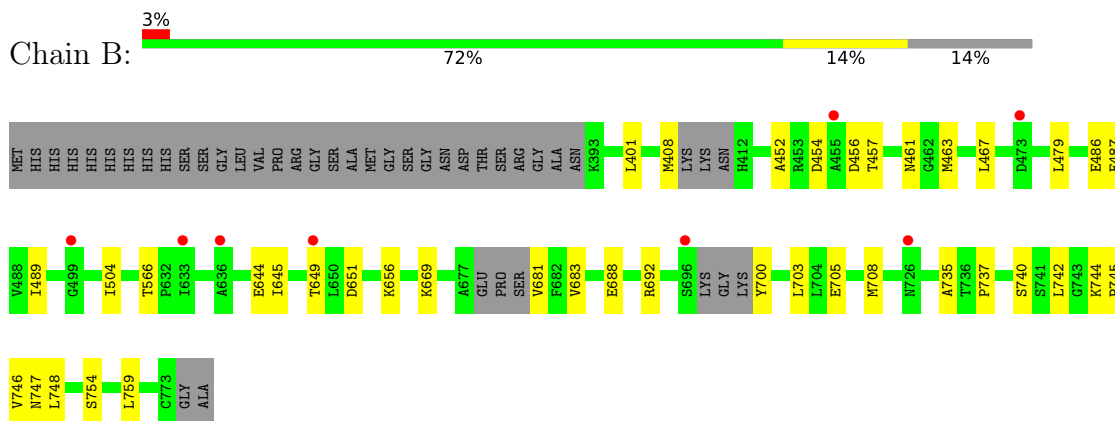
3 Residue-property plots [i](#)

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.

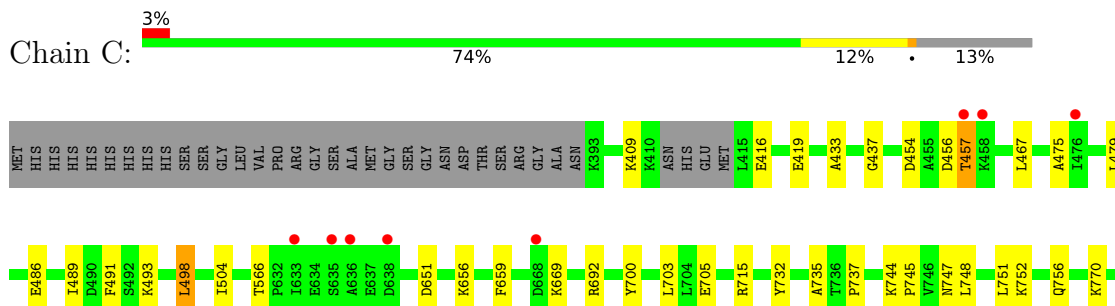
- Molecule 1: GLUTAMATE RECEPTOR 2



- Molecule 1: GLUTAMATE RECEPTOR 2



- Molecule 1: GLUTAMATE RECEPTOR 2



C773
GLY
ALA

4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α , β , γ	46.38Å 110.52Å 167.25Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	92.21 – 2.90 92.21 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.3 (92.21-2.90) 99.6 (92.21-2.90)	Depositor EDS
R_{merge}	0.22	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.36 (at 2.91Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.243 , 0.283 0.247 , 0.289	Depositor DCC
R_{free} test set	979 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	71.4	Xtrriage
Anisotropy	0.752	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 62.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	5908	wwPDB-VP
Average B, all atoms (Å ²)	97.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.21% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section:
ZN

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	0.39	0/1977	0.79	0/2652
1	B	0.38	0/1980	0.76	0/2661
1	C	0.44	0/2017	0.82	1/2711 (0.0%)
All	All	0.40	0/5974	0.79	1/8024 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	416	GLU	N-CA-C	5.02	117.01	109.23

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	1944	0	1989	31	0
1	B	1947	0	1970	26	0
1	C	1982	0	2023	22	1
2	A	10	0	5	0	0
2	B	10	0	5	0	0
2	C	10	0	5	1	0
3	A	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	2	0	0	0	0
3	C	1	0	0	0	0
All	All	5908	0	5997	76	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 6.

The worst 5 of 76 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:486:GLU:OE2	1:B:747:ASN:ND2	2.12	0.81
1:C:409:LYS:NZ	1:C:419:GLU:OE2	2.14	0.79
1:A:747:ASN:ND2	1:B:486:GLU:OE2	2.15	0.78
1:B:454:ASP:HB3	1:B:457:THR:HG22	1.68	0.76
1:A:649:THR:HG22	1:A:703:LEU:HB2	1.71	0.72

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:C:486:GLU:OE2	1:C:747:ASN:ND2[2_558]	2.19	0.01

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	240/291 (82%)	238 (99%)	2 (1%)	0	100	100
1	B	241/291 (83%)	239 (99%)	2 (1%)	0	100	100
1	C	250/291 (86%)	248 (99%)	2 (1%)	0	100	100
All	All	731/873 (84%)	725 (99%)	6 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	210/242 (87%)	208 (99%)	2 (1%)	68	89
1	B	210/242 (87%)	209 (100%)	1 (0%)	81	93
1	C	214/242 (88%)	210 (98%)	4 (2%)	50	79
All	All	634/726 (87%)	627 (99%)	7 (1%)	65	88

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

Mol	Chain	Res	Type
1	C	457	THR
1	C	489	ILE
1	C	669	LYS
1	C	498	LEU
1	B	669	LYS

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 5 are monoatomic - leaving 3 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	GLU	B	900	-	8,9,9	1.07	1 (12%)	8,11,11	1.13	1 (12%)
2	GLU	C	900	-	8,9,9	1.09	1 (12%)	8,11,11	1.15	1 (12%)
2	GLU	A	900	-	8,9,9	1.05	1 (12%)	8,11,11	0.99	1 (12%)

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	GLU	B	900	-	-	0/9/9/9	-
2	GLU	C	900	-	-	0/9/9/9	-
2	GLU	A	900	-	-	0/9/9/9	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	900	GLU	OXT-C	-2.23	1.23	1.30
2	B	900	GLU	OXT-C	-2.16	1.23	1.30
2	A	900	GLU	OXT-C	-2.09	1.24	1.30

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	900	GLU	OXT-C-O	-2.52	118.36	124.08
2	B	900	GLU	OXT-C-O	-2.43	118.56	124.08
2	A	900	GLU	OXT-C-O	-2.04	119.46	124.08

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	900	GLU	1	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, 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	248/291 (85%)	0.25	3 (1%) 76 69	66, 90, 126, 141	0
1	B	249/291 (85%)	0.34	8 (3%) 50 41	65, 103, 142, 166	0
1	C	254/291 (87%)	0.19	8 (3%) 51 42	70, 88, 113, 142	0
All	All	751/873 (86%)	0.26	19 (2%) 58 48	65, 92, 132, 166	0

The worst 5 of 19 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	636	ALA	4.4
1	B	633	ILE	3.6
1	C	633	ILE	2.9
1	B	473	ASP	2.7
1	A	652	SER	2.7

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 oligosaccharides 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(\AA^2)	Q<0.9
2	GLU	B	900	10/10	0.80	0.12	80,89,92,95	0
2	GLU	A	900	10/10	0.82	0.12	85,88,98,114	0
2	GLU	C	900	10/10	0.88	0.11	74,87,89,90	0
3	ZN	B	901	1/1	0.92	0.07	126,126,126,126	0
3	ZN	B	902	1/1	0.95	0.11	141,141,141,141	0
3	ZN	A	901	1/1	0.96	0.08	122,122,122,122	0
3	ZN	C	902	1/1	0.96	0.05	114,114,114,114	0
3	ZN	A	902	1/1	0.98	0.11	93,93,93,93	0

6.5 Other polymers [i](#)

There are no such residues in this entry.