



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:13 PM UTC

PDB ID : 4NF4 / pdb_00004nf4
Title : Crystal structure of GluN1/GluN2A ligand-binding domain in complex with DCKA and glutamate
Authors : Annie, J.; Tajima, N.; Furukawa, H.
Deposited on : 2013-10-30
Resolution : 2.00 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

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

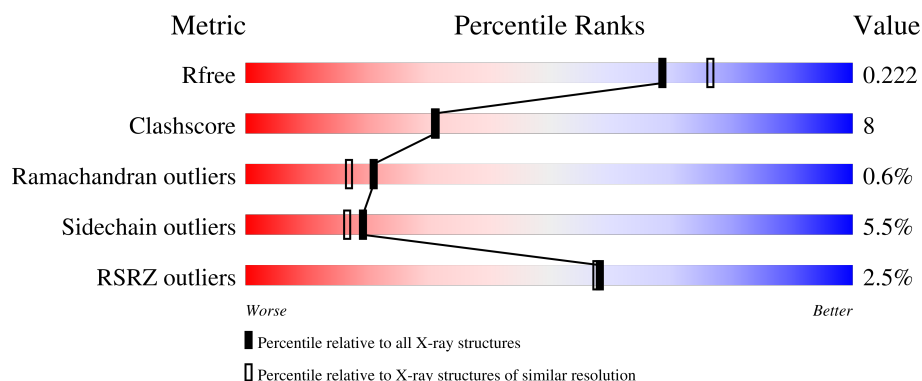
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

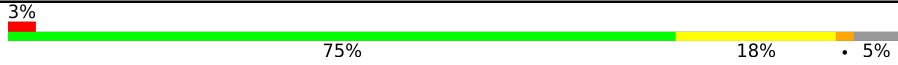
The reported resolution of this entry is 2.00 Å.

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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	292	
2	B	283	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5062 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 ionotropic, NMDA 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	277	Total	C	N	O	S	90	1	0
			2198	1401	373	408	16			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP P35439
A	153	GLY	-	expression tag	UNP P35439
A	154	THR	-	expression tag	UNP P35439

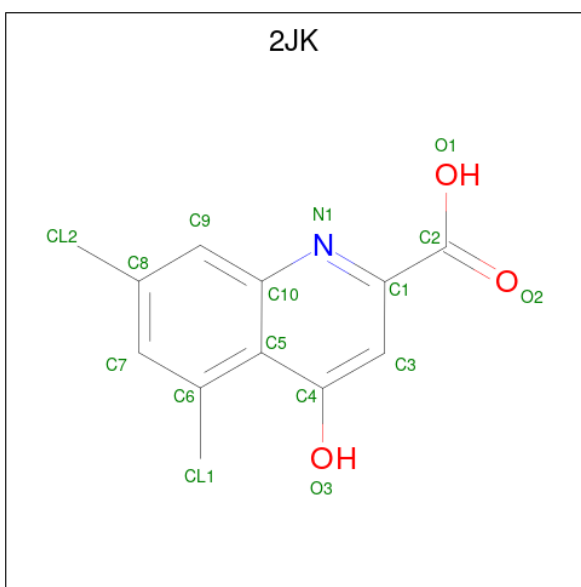
- Molecule 2 is a protein called Glutamate receptor ionotropic, NMDA 2A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	277	Total	C	N	O	S	41	2	0
			2181	1386	373	407	15			

There are 2 discrepancies between the modelled and reference sequences:

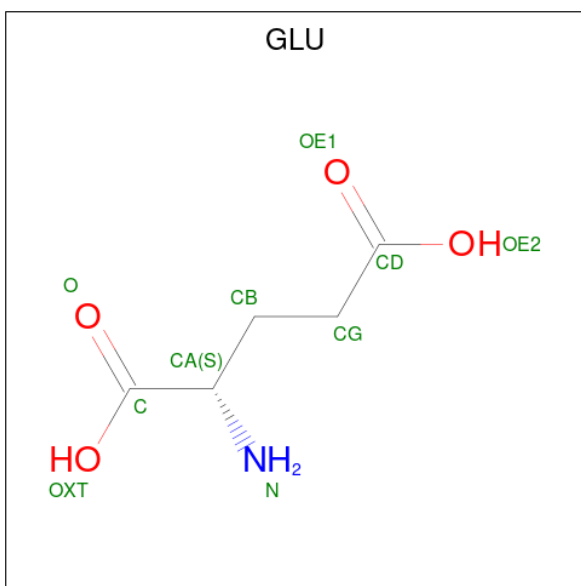
Chain	Residue	Modelled	Actual	Comment	Reference
B	4	SER	-	expression tag	UNP Q00959
B	242	THR	SER	engineered mutation	UNP Q00959

- Molecule 3 is 4-hydroxy-5,7-dimethylquinoline-2-carboxylic acid (CCD ID: 2JK) (formula: C₁₂H₁₁NO₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			16	12	1	3		

- Molecule 4 is GLUTAMIC ACID (CCD ID: GLU) (formula: $C_5H_9NO_4$).

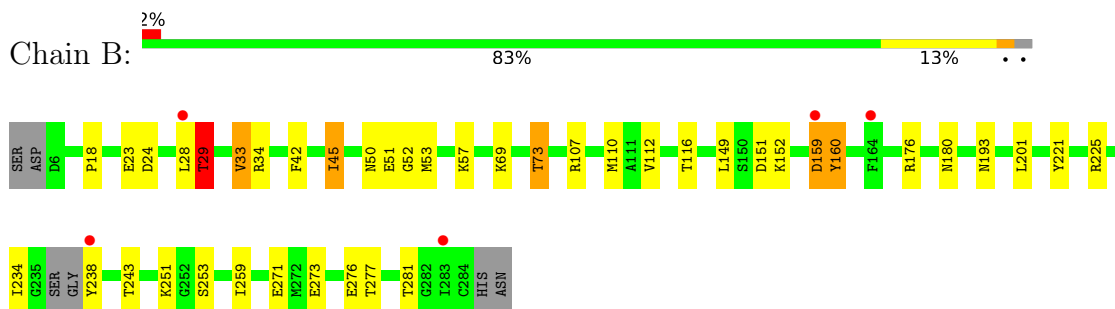


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	N	O	0	0
			10	5	1	4		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	296	Total 296	O 296	0	0
5	B	361	Total 361	O 361	0	0

- Molecule 1: Glutamate receptor ionotropic, NMDA 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	54.26Å 87.49Å 136.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.90 – 2.00 19.90 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.5 (19.90-2.00) 99.3 (19.90-2.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.39 (at 2.00Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.183 , 0.217 0.187 , 0.222	Depositor DCC
R_{free} test set	2240 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	23.9	Xtriage
Anisotropy	0.455	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 53.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5062	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.36% 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: 2JK

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	0.47	0/2248	0.79	3/3037 (0.1%)
2	B	0.46	0/2226	0.82	3/3013 (0.1%)
All	All	0.47	0/4474	0.81	6/6050 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	159	ASP	N-CA-C	-6.14	102.43	110.53
2	B	253	SER	CA-C-N	6.08	125.70	119.56
2	B	253	SER	C-N-CA	6.08	125.70	119.56
1	A	210	ILE	N-CA-C	5.76	115.95	110.53
1	A	37	ASP	N-CA-C	5.39	116.48	109.64
1	A	261	LYS	N-CA-C	5.29	117.05	111.28

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	2198	0	2145	35	0
2	B	2181	0	2154	35	0
3	A	16	0	10	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	10	0	5	1	0
5	A	296	0	0	11	0
5	B	361	0	0	18	1
All	All	5062	0	4314	69	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 8.

All (69) 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:143:TYR:OH	2:B:243:THR:O	1.85	0.94
2:B:238:TYR:N	5:B:630:HOH:O	2.05	0.88
1:A:142:LYS:NZ	5:A:534:HOH:O	2.16	0.78
1:A:78:MET:SD	5:A:690:HOH:O	2.46	0.72
2:B:45:ILE:HD13	2:B:51:GLU:HG2	1.69	0.72
2:B:50:ASN:O	5:B:622:HOH:O	2.08	0.70
1:A:78:MET:HE3	1:A:80:PHE:HE2	1.55	0.69
2:B:277:THR:HG21	5:B:614:HOH:O	1.94	0.68
2:B:276:GLU:OE2	5:B:482:HOH:O	2.12	0.67
2:B:176:ARG:CZ	5:B:642:HOH:O	2.43	0.66
1:A:4:THR:N	5:A:641:HOH:O	2.29	0.65
2:B:69:LYS:NZ	5:B:570:HOH:O	1.93	0.65
1:A:120:MET:HE2	1:A:254[B]:MET:HE3	1.78	0.65
1:A:260:TRP:HE3	5:A:690:HOH:O	1.79	0.64
2:B:45:ILE:HD12	2:B:52:GLY:HA2	1.81	0.63
1:A:49:ASP:O	5:A:665:HOH:O	2.15	0.63
2:B:160:TYR:N	5:B:729:HOH:O	2.32	0.63
2:B:271:GLU:OE1	5:B:570:HOH:O	2.16	0.62
1:A:156:ILE:H	1:A:241:THR:HG21	1.64	0.62
2:B:23:GLU:OE1	5:B:579:HOH:O	2.16	0.61
1:A:174:ALA:HA	1:A:198:MET:HG2	1.81	0.61
1:A:225:SER:O	1:A:229:GLU:HG2	2.01	0.60
2:B:251:LYS:NZ	5:B:662:HOH:O	2.13	0.60
1:A:58:THR:HG22	5:A:589:HOH:O	2.03	0.59
1:A:265:SER:HB3	5:A:477:HOH:O	2.03	0.59
2:B:225:ARG:NH2	2:B:281:THR:O	2.35	0.59
2:B:176:ARG:NH1	5:B:642:HOH:O	2.35	0.58
2:B:238:TYR:N	5:B:679:HOH:O	2.37	0.58
1:A:231:GLU:O	1:A:234:GLN:HG2	2.03	0.58
2:B:33:VAL:HG13	2:B:34:ARG:HG3	1.85	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:24:ASP:OD1	2:B:57:LYS:NZ	2.37	0.57
1:A:143:TYR:CE1	5:A:651:HOH:O	2.53	0.56
1:A:254[B]:MET:HE1	1:A:260:TRP:HB2	1.88	0.55
1:A:160:ASN:HA	1:A:165:ARG:HE	1.71	0.55
2:B:193:ASN:OD1	5:B:401:HOH:O	2.18	0.54
2:B:18:PRO:HD3	2:B:221:TYR:CD2	2.43	0.54
1:A:121:ILE:HG21	1:A:125:LEU:HD22	1.91	0.53
2:B:238:TYR:HA	5:B:705:HOH:O	2.08	0.53
1:A:173:TYR:OH	1:A:194:MET:HG3	2.10	0.51
1:A:78:MET:HE3	1:A:80:PHE:CE2	2.42	0.51
2:B:69:LYS:O	2:B:73:THR:HG23	2.11	0.50
1:A:95:GLN:HG3	1:A:106:TRP:CE2	2.47	0.50
2:B:151:ASP:OD1	2:B:152:LYS:N	2.44	0.50
1:A:166:ASN:ND2	5:A:522:HOH:O	2.28	0.50
2:B:116:THR:HG1	4:B:301:GLU:N	2.10	0.49
1:A:285:VAL:HG13	5:A:609:HOH:O	2.12	0.49
1:A:147:THR:HG22	1:A:225:SER:HA	1.96	0.47
1:A:174:ALA:HA	1:A:198:MET:CG	2.45	0.47
2:B:28:LEU:O	2:B:29:THR:HG23	2.15	0.47
2:B:159:ASP:C	5:B:729:HOH:O	2.58	0.47
1:A:230:PHE:O	1:A:233:SER:OG	2.30	0.46
2:B:33:VAL:HG22	5:B:734:HOH:O	2.15	0.46
1:A:234:GLN:HG3	1:A:235:LYS:H	1.81	0.46
2:B:234:ILE:O	2:B:238:TYR:N	2.48	0.45
2:B:110:MET:HE1	2:B:259:ILE:HD11	1.98	0.45
1:A:234:GLN:HG3	1:A:235:LYS:N	2.31	0.45
2:B:243:THR:HB	5:B:428:HOH:O	2.16	0.45
2:B:112:VAL:HA	5:B:479:HOH:O	2.18	0.44
1:A:74:LEU:HB3	1:A:78:MET:CE	2.48	0.44
1:A:54:SER:HA	1:A:55:PRO:HD3	1.82	0.43
2:B:176:ARG:NH1	2:B:180:ASN:OD1	2.51	0.43
1:A:181:VAL:HG23	5:A:450:HOH:O	2.18	0.43
1:A:165:ARG:HD3	1:A:194:MET:HE1	2.01	0.43
1:A:185:PHE:CD2	1:A:198:MET:HE1	2.53	0.42
1:A:177:LYS:HG3	1:A:203:TYR:O	2.19	0.42
2:B:42:PHE:CZ	2:B:52:GLY:HA3	2.54	0.42
2:B:273:GLU:O	2:B:277:THR:HG23	2.20	0.41
2:B:53:MET:HE2	2:B:53:MET:HB3	1.93	0.41
1:A:254[B]:MET:CE	1:A:260:TRP:HB2	2.52	0.40

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)
5:B:637:HOH:O	5:B:639:HOH:O[4_455]	2.10	0.10

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	272/292 (93%)	262 (96%)	9 (3%)	1 (0%)	30	27
2	B	275/283 (97%)	265 (96%)	8 (3%)	2 (1%)	18	14
All	All	547/575 (95%)	527 (96%)	17 (3%)	3 (0%)	21	21

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	29	THR
1	A	235	LYS
2	B	160	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	238/260 (92%)	219 (92%)	19 (8%)	11	8
2	B	239/248 (96%)	232 (97%)	7 (3%)	37	40
All	All	477/508 (94%)	451 (94%)	26 (6%)	19	17

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	ARG
1	A	35	ASN
1	A	43	ILE
1	A	49	ASP
1	A	76	ARG
1	A	96	GLU
1	A	97	ARG
1	A	136	GLU
1	A	157	THR
1	A	163	ARG
1	A	178	GLN
1	A	189	VAL
1	A	198	MET
1	A	216	ASN
1	A	236	CYS
1	A	239	VAL
1	A	241	THR
1	A	265	SER
1	A	281	ASP
2	B	29	THR
2	B	33	VAL
2	B	45	ILE
2	B	73	THR
2	B	107	ARG
2	B	149	LEU
2	B	201	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	234	GLN
1	A	272	HIS
2	B	85	ASN
2	B	193	ASN

5.3.3 RNA ⓘ

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](#)

2 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	$\# Z > 2$
4	GLU	B	301	-	8,9,9	1.09	0	8,11,11	1.03	1 (12%)
3	2JK	A	301	-	17,17,17	1.06	1 (5%)	23,25,25	1.52	5 (21%)

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
4	GLU	B	301	-	-	2/9/9/9	-
3	2JK	A	301	-	-	0/4/4/4	0/2/2/2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	301	2JK	C7-C6	2.20	1.40	1.37

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	301	2JK	C1-N1-C10	3.33	122.60	117.56

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	301	2JK	CL1-C6-C7	-3.06	115.73	120.60
3	A	301	2JK	C2-C1-N1	2.59	121.94	116.82
3	A	301	2JK	O3-C4-C3	-2.56	113.70	121.38
4	B	301	GLU	OXT-C-O	-2.23	119.03	124.08
3	A	301	2JK	O1-C2-C1	2.01	119.49	114.71

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	301	GLU	OE1-CD-CG-CB
4	B	301	GLU	OE2-CD-CG-CB

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	301	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	277/292 (94%)	-0.14	9 (3%)	50	49	8, 22, 40, 52	32 (11%)
2	B	277/283 (97%)	-0.44	5 (1%)	67	67	6, 17, 33, 47	15 (5%)
All	All	554/575 (96%)	-0.29	14 (2%)	58	58	6, 19, 39, 52	47 (8%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	238	TYR	4.8
1	A	98	VAL	3.1
1	A	236	CYS	2.9
1	A	143	TYR	2.8
1	A	237	ASP	2.6
2	B	159	ASP	2.6
1	A	235	LYS	2.5
1	A	34	VAL	2.5
2	B	164	PHE	2.5
1	A	36	GLY	2.4
1	A	103	LYS	2.4
1	A	35	ASN	2.2
2	B	283	ILE	2.2
2	B	28	LEU	2.1

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($\text{\AA}^2$)	Q<0.9
3	2JK	A	301	16/16	0.87	0.07	0,16,22,24	0
4	GLU	B	301	10/10	0.98	0.04	6,8,12,12	0

6.5 Other polymers [i](#)

There are no such residues in this entry.