



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 07:17 PM UTC

PDB ID : 9UKQ / pdb_00009ukq
Title : Crystal structure of glycogen phosphorylase from Escherichia coli
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Deposited on : 2025-04-18
Resolution : 3.50 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

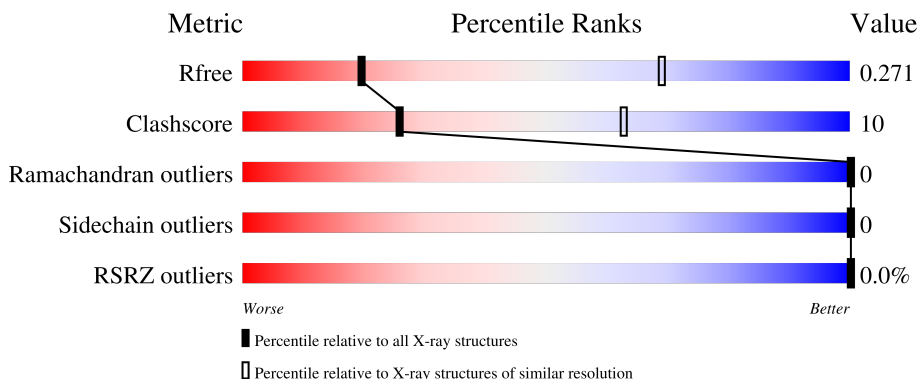
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION






The reported resolution of this entry is 3.50 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	1085 (3.54-3.46)
Clashscore	190562	1140 (3.54-3.46)
Ramachandran outliers	187476	1113 (3.54-3.46)
Sidechain outliers	187428	1114 (3.54-3.46)
RSRZ outliers	180081	1084 (3.54-3.46)

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	817	 78% 21% .
1	B	817	 75% 23% .
1	C	817	 74% 25% .
1	D	817	 76% 22% .
1	E	817	 74% 24% .

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Mol	Chain	Length	Quality of chain
1	F	817	 A horizontal bar chart showing the quality of the chain. The bar is divided into three segments: a green segment representing 75%, a yellow segment representing 24%, and a small grey segment at the end. A small black dot is visible at the far right end of the bar.

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 38963 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 Glycogen phosphorylase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	805	Total	C	N	O	P	S	0	0	0
			6506	4128	1128	1226	1	23			
1	B	804	Total	C	N	O	P	S	0	0	0
			6500	4125	1127	1224	1	23			
1	C	804	Total	C	N	O	P	S	0	0	0
			6500	4125	1127	1224	1	23			
1	D	803	Total	C	N	O	P	S	0	0	0
			6493	4120	1126	1223	1	23			
1	E	801	Total	C	N	O	P	S	0	0	0
			6478	4110	1124	1220	1	23			
1	F	802	Total	C	N	O	P	S	0	0	0
			6486	4116	1125	1221	1	23			

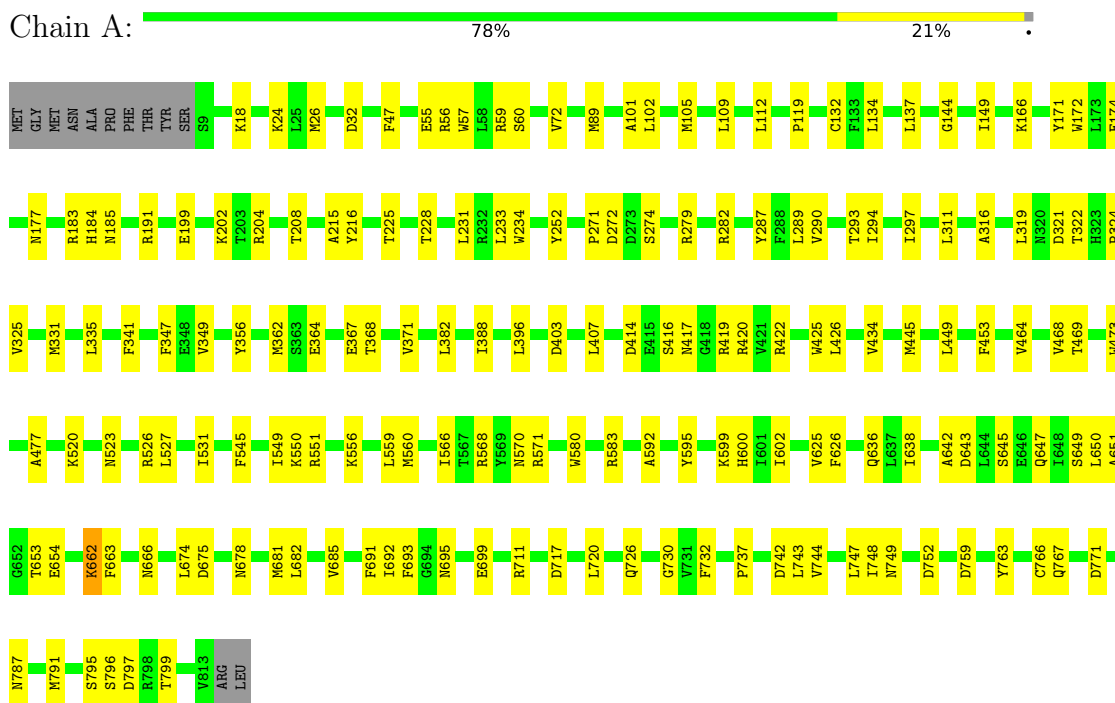
There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	initiating methionine	UNP P0AC86
A	0	GLY	-	expression tag	UNP P0AC86
B	-1	MET	-	initiating methionine	UNP P0AC86
B	0	GLY	-	expression tag	UNP P0AC86
C	-1	MET	-	initiating methionine	UNP P0AC86
C	0	GLY	-	expression tag	UNP P0AC86
D	-1	MET	-	initiating methionine	UNP P0AC86
D	0	GLY	-	expression tag	UNP P0AC86
E	-1	MET	-	initiating methionine	UNP P0AC86
E	0	GLY	-	expression tag	UNP P0AC86
F	-1	MET	-	initiating methionine	UNP P0AC86
F	0	GLY	-	expression tag	UNP P0AC86

3 Residue-property plots

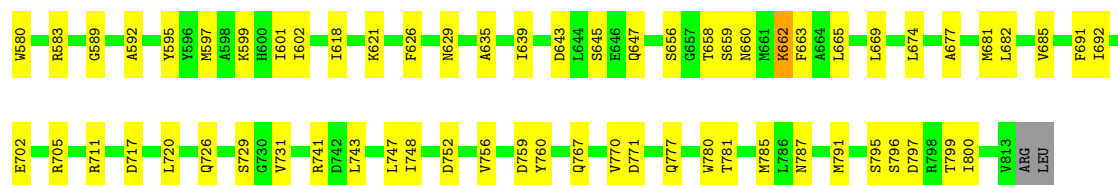
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Glycogen phosphorylase



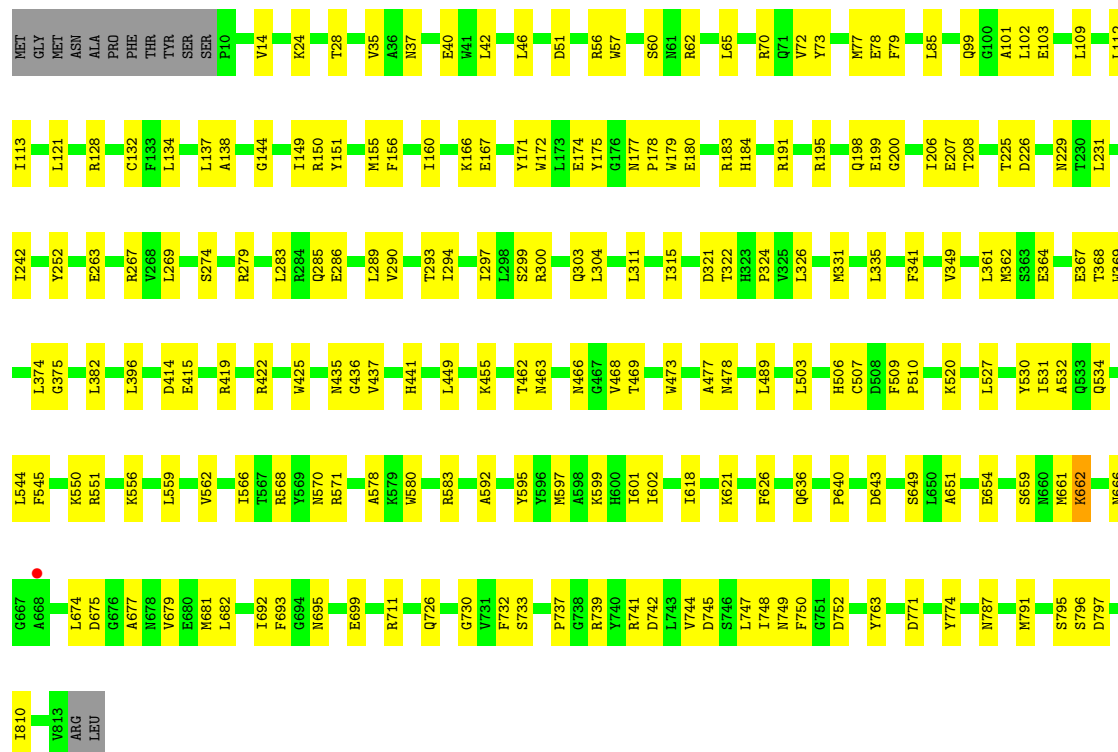
- Molecule 1: Glycogen phosphorylase





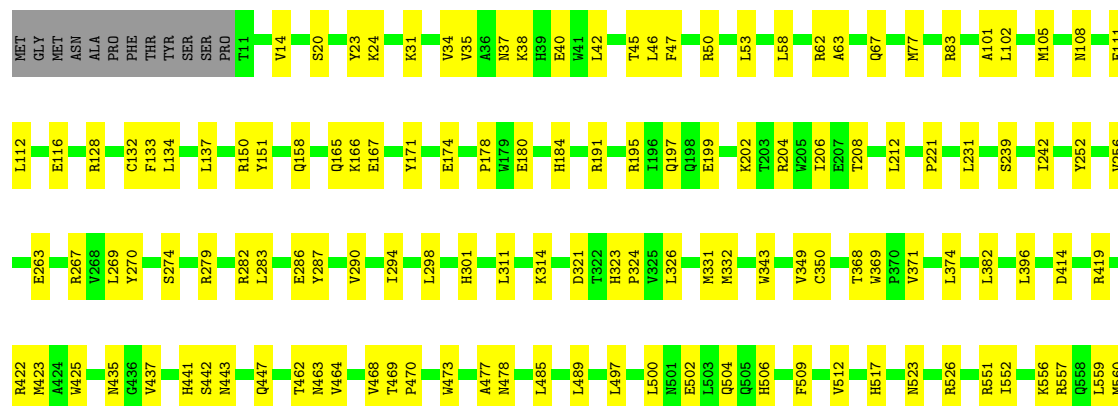
- Molecule 1: Glycogen phosphorylase

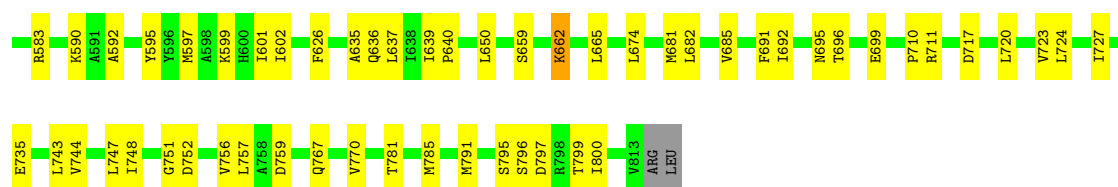
Chain C: 74% 25% .



- Molecule 1: Glycogen phosphorylase

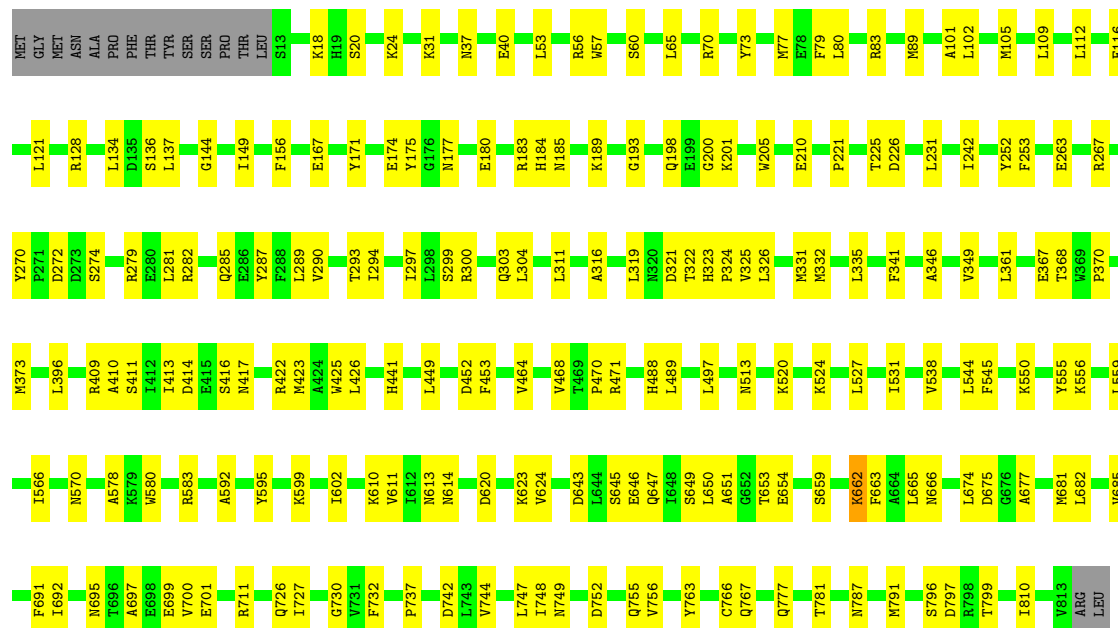
Chain D: 76% 22% .





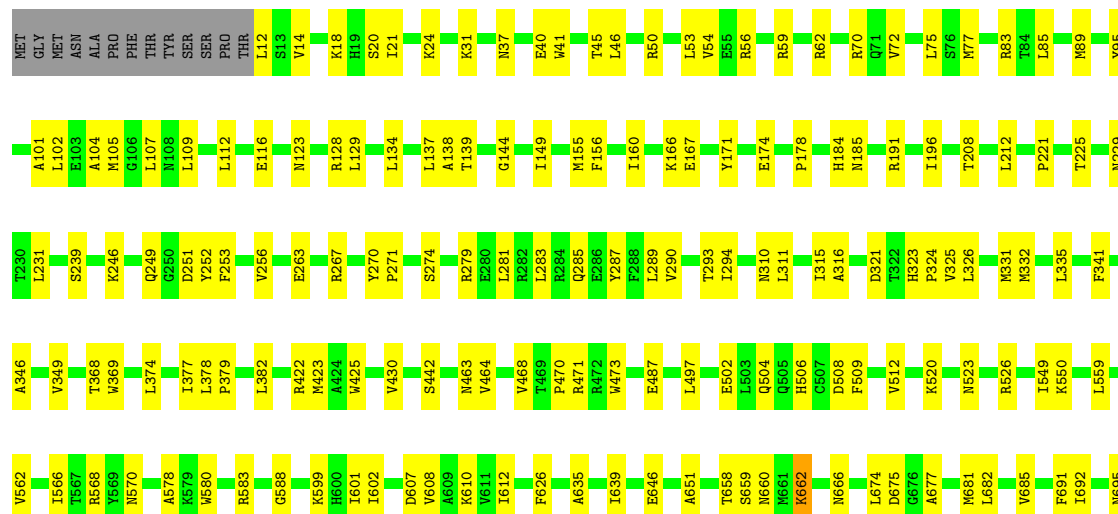
- Molecule 1: Glycogen phosphorylase

Chain E: 74% 24% .



- Molecule 1: Glycogen phosphorylase

Chain F: 75% 24% .





4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	134.77Å 205.60Å 264.07Å 90.00° 104.35° 90.00°	Depositor
Resolution (Å)	46.21 – 3.50 46.21 – 3.50	Depositor EDS
% Data completeness (in resolution range)	99.1 (46.21-3.50) 99.0 (46.21-3.50)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 3.48Å)	Xtriage
Refinement program	PHENIX (1.19.2_4158: ???)	Depositor
R, R_{free}	0.231 , 0.273 0.230 , 0.271	Depositor DCC
R_{free} test set	4441 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	98.8	Xtriage
Anisotropy	0.455	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 31.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.047 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	38963	wwPDB-VP
Average B, all atoms (Å ²)	108.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.46% 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: LLP

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	0.15	0/6627	0.37	0/8988
1	B	0.15	0/6621	0.38	0/8979
1	C	0.14	0/6621	0.37	0/8979
1	D	0.15	0/6613	0.39	0/8968
1	E	0.13	0/6598	0.35	0/8947
1	F	0.13	0/6606	0.36	0/8958
All	All	0.14	0/39686	0.37	0/53819

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

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	6506	0	6358	112	0
1	B	6500	0	6354	138	0
1	C	6500	0	6354	138	1
1	D	6493	0	6346	129	0
1	E	6478	0	6328	125	0
1	F	6486	0	6339	130	1
All	All	38963	0	38079	734	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 10.

The worst 5 of 734 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:F:212:LEU:HD13	1:F:239:SER:HA	1.22	1.14
1:E:252:TYR:HB2	1:F:167:GLU:HG3	1.59	0.85
1:C:167:GLU:HG3	1:D:252:TYR:HB2	1.56	0.84
1:C:191:ARG:HH11	1:C:208:THR:HG21	1.43	0.83
1:A:711:ARG:NH2	1:A:749:ASN:OD1	2.14	0.80

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:62:ARG:NH1	1:F:487:GLU:O[2_456]	2.11	0.09

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	802/817 (98%)	771 (96%)	31 (4%)	0	100	100
1	B	801/817 (98%)	775 (97%)	26 (3%)	0	100	100
1	C	801/817 (98%)	771 (96%)	30 (4%)	0	100	100
1	D	800/817 (98%)	770 (96%)	30 (4%)	0	100	100
1	E	798/817 (98%)	770 (96%)	28 (4%)	0	100	100
1	F	799/817 (98%)	771 (96%)	28 (4%)	0	100	100
All	All	4801/4902 (98%)	4628 (96%)	173 (4%)	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	699/709 (99%)	699 (100%)	0	100	100
1	B	698/709 (98%)	698 (100%)	0	100	100
1	C	698/709 (98%)	698 (100%)	0	100	100
1	D	697/709 (98%)	697 (100%)	0	100	100
1	E	695/709 (98%)	695 (100%)	0	100	100
1	F	696/709 (98%)	696 (100%)	0	100	100
All	All	4183/4254 (98%)	4183 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 61 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	285	GLN
1	F	389	ASN
1	D	790	ASN
1	F	359	HIS
1	F	749	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

6 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	LLP	E	662	1	23,24,25	2.53	7 (30%)	25,32,34	1.28	4 (16%)
1	LLP	D	662	1	23,24,25	2.49	6 (26%)	25,32,34	1.40	4 (16%)
1	LLP	F	662	1	23,24,25	2.51	6 (26%)	25,32,34	1.29	4 (16%)
1	LLP	A	662	1	23,24,25	2.52	6 (26%)	25,32,34	1.29	3 (12%)
1	LLP	C	662	1	23,24,25	2.53	6 (26%)	25,32,34	1.23	3 (12%)
1	LLP	B	662	1	23,24,25	2.54	6 (26%)	25,32,34	1.16	3 (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
1	LLP	E	662	1	-	5/16/17/19	0/1/1/1
1	LLP	D	662	1	-	4/16/17/19	0/1/1/1
1	LLP	F	662	1	-	5/16/17/19	0/1/1/1
1	LLP	A	662	1	-	4/16/17/19	0/1/1/1
1	LLP	C	662	1	-	4/16/17/19	0/1/1/1
1	LLP	B	662	1	-	4/16/17/19	0/1/1/1

The worst 5 of 37 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	662	LLP	C4-C4'	7.54	1.62	1.46
1	C	662	LLP	C4-C4'	7.47	1.62	1.46
1	A	662	LLP	C4-C4'	7.23	1.62	1.46
1	F	662	LLP	C4-C4'	7.20	1.62	1.46
1	E	662	LLP	C4-C4'	7.20	1.62	1.46

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	662	LLP	CE-NZ-C4'	-3.19	108.50	118.72
1	A	662	LLP	C4-C4'-NZ	-3.18	109.35	124.04
1	F	662	LLP	C4-C4'-NZ	-3.17	109.43	124.04
1	C	662	LLP	CE-NZ-C4'	-3.03	109.02	118.72
1	D	662	LLP	C4-C4'-NZ	-3.02	110.08	124.04

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	662	LLP	C4-C4'-NZ-CE
1	B	662	LLP	C4-C4'-NZ-CE
1	C	662	LLP	C4-C4'-NZ-CE
1	D	662	LLP	C4-C4'-NZ-CE
1	E	662	LLP	C4-C4'-NZ-CE

There are no ring outliers.

6 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	E	662	LLP	1	0
1	D	662	LLP	4	0
1	F	662	LLP	2	0
1	A	662	LLP	1	0
1	C	662	LLP	3	0
1	B	662	LLP	2	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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	804/817 (98%)	-0.32	0 100 100	53, 98, 134, 173	0
1	B	803/817 (98%)	-0.40	0 100 100	54, 91, 130, 177	0
1	C	803/817 (98%)	-0.27	1 (0%) 92 86	58, 106, 142, 177	0
1	D	802/817 (98%)	-0.36	0 100 100	55, 91, 129, 165	0
1	E	800/817 (97%)	-0.19	0 100 100	86, 126, 160, 173	0
1	F	801/817 (98%)	-0.20	0 100 100	88, 132, 156, 179	0
All	All	4813/4902 (98%)	-0.29	1 (0%) 100 100	53, 107, 150, 179	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	668	ALA	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	LLP	F	662	24/25	0.90	0.11	115,124,140,152	0
1	LLP	E	662	24/25	0.91	0.10	100,112,133,144	0
1	LLP	C	662	24/25	0.92	0.09	77,96,114,128	0
1	LLP	D	662	24/25	0.94	0.09	64,76,99,112	0
1	LLP	B	662	24/25	0.94	0.10	69,82,97,105	0
1	LLP	A	662	24/25	0.94	0.09	74,92,105,123	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.