



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 18, 2026 – 12:59 PM UTC

PDB ID : 2Q9Q / pdb_00002q9q
Title : The crystal structure of full length human GINS complex
Authors : Chang, Y.P.; Wang, G.; Chen, X.S.
Deposited on : 2007-06-13
Resolution : 2.36 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

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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
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

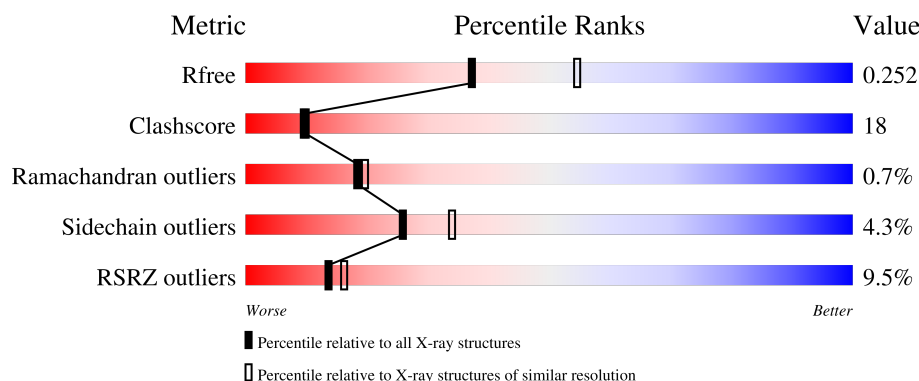
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.36 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.



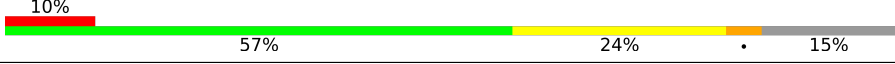
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	191	3% 60% 27% 5% 8%
1	E	191	5% 56% 34% • 8%
2	B	223	7% 56% 30% • 12%
2	F	223	4% 56% 30% • 12%
3	C	196	12% 51% 21% •• 26%

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Mol	Chain	Length	Quality of chain
3	G	196	 11% 50% 22% • 26%
4	D	220	 13% 56% 26% • 15%
4	H	220	 10% 57% 24% • 15%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 11883 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 DNA replication complex GINS protein PSF2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	175	Total	C	N	O	S	1	0	0
			1424	911	241	263	9			
1	E	175	Total	C	N	O	S	1	0	0
			1424	911	241	263	9			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	GLY	-	cloning artifact	UNP Q9Y248
A	-4	PRO	-	cloning artifact	UNP Q9Y248
A	-3	LEU	-	cloning artifact	UNP Q9Y248
A	-2	GLY	-	cloning artifact	UNP Q9Y248
A	-1	SER	-	cloning artifact	UNP Q9Y248
A	0	ASN	-	cloning artifact	UNP Q9Y248
E	-5	GLY	-	cloning artifact	UNP Q9Y248
E	-4	PRO	-	cloning artifact	UNP Q9Y248
E	-3	LEU	-	cloning artifact	UNP Q9Y248
E	-2	GLY	-	cloning artifact	UNP Q9Y248
E	-1	SER	-	cloning artifact	UNP Q9Y248
E	0	ASN	-	cloning artifact	UNP Q9Y248

- Molecule 2 is a protein called GINS complex subunit 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	196	Total	C	N	O	S	0	0	0
			1614	1027	273	304	10			
2	F	196	Total	C	N	O	S	0	0	0
			1614	1027	273	304	10			

- Molecule 3 is a protein called DNA replication complex GINS protein PSF1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	145	Total 1188	C 744	N 217	O 217	S 10	0	0	0
3	G	145	Total 1188	C 744	N 217	O 217	S 10	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	97	ILE	VAL	variant	UNP Q14691
G	97	ILE	VAL	variant	UNP Q14691

- Molecule 4 is a protein called GINS complex subunit 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	186	Total 1489	C 944	N 256	O 283	S 6	0	0	0
4	H	186	Total 1489	C 944	N 256	O 283	S 6	0	0	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	-3	GLY	-	cloning artifact	UNP Q9BRX5
D	-2	PRO	-	cloning artifact	UNP Q9BRX5
D	-1	GLY	-	cloning artifact	UNP Q9BRX5
D	0	GLY	-	cloning artifact	UNP Q9BRX5
D	1	GLY	-	cloning artifact	UNP Q9BRX5
H	-3	GLY	-	cloning artifact	UNP Q9BRX5
H	-2	PRO	-	cloning artifact	UNP Q9BRX5
H	-1	GLY	-	cloning artifact	UNP Q9BRX5
H	0	GLY	-	cloning artifact	UNP Q9BRX5
H	1	GLY	-	cloning artifact	UNP Q9BRX5

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	68	Total 68	O 68	0	0
5	B	69	Total 69	O 69	0	0
5	C	47	Total 47	O 47	0	0

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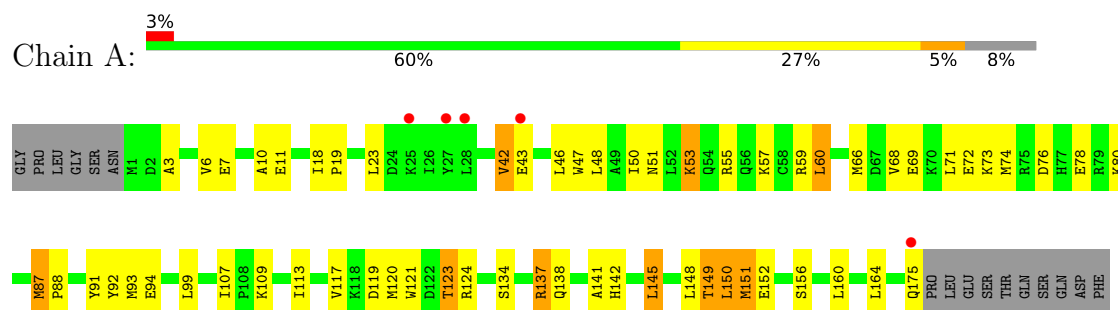
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	47	Total 47	O 47	0	0
5	E	53	Total 53	O 53	0	0
5	F	77	Total 77	O 77	0	0
5	G	45	Total 45	O 45	0	0
5	H	47	Total 47	O 47	0	0

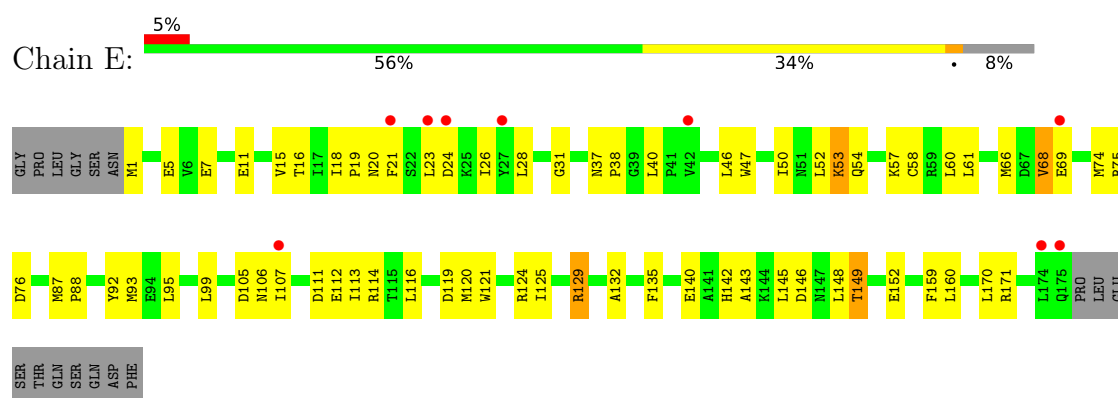
3 Residue-property plots [i](#)

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.

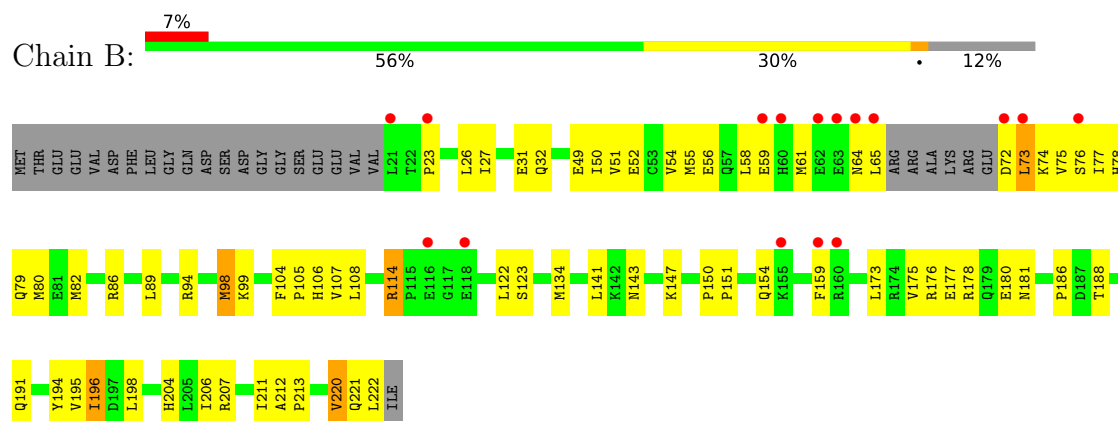
- Molecule 1: DNA replication complex GINS protein PSF2



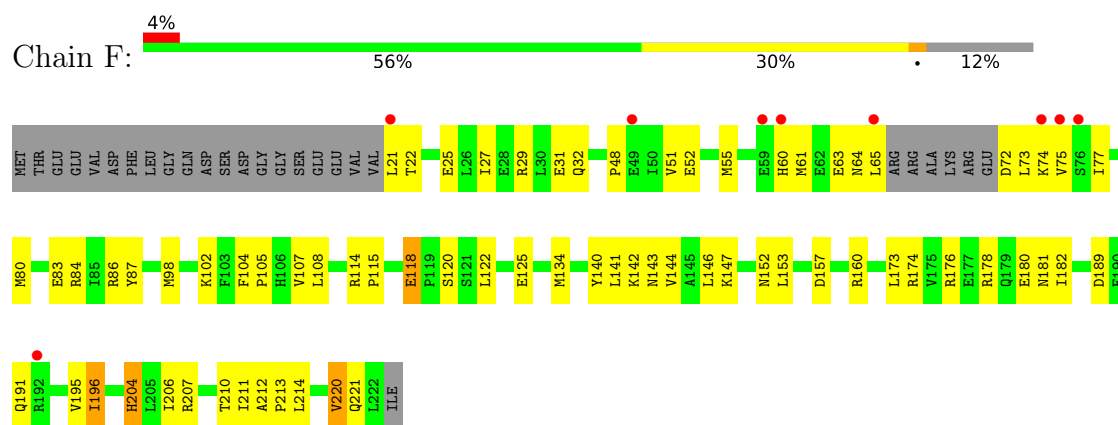
- Molecule 1: DNA replication complex GINS protein PSF2



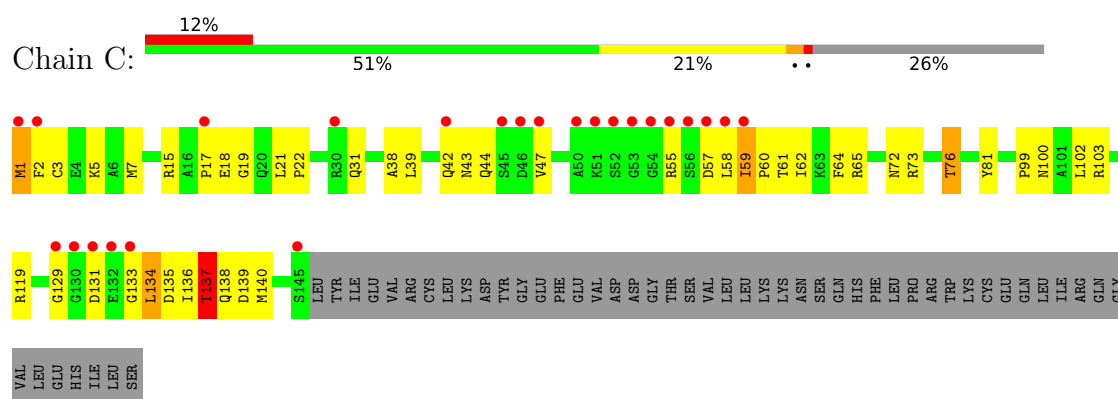
- Molecule 2: GINS complex subunit 4



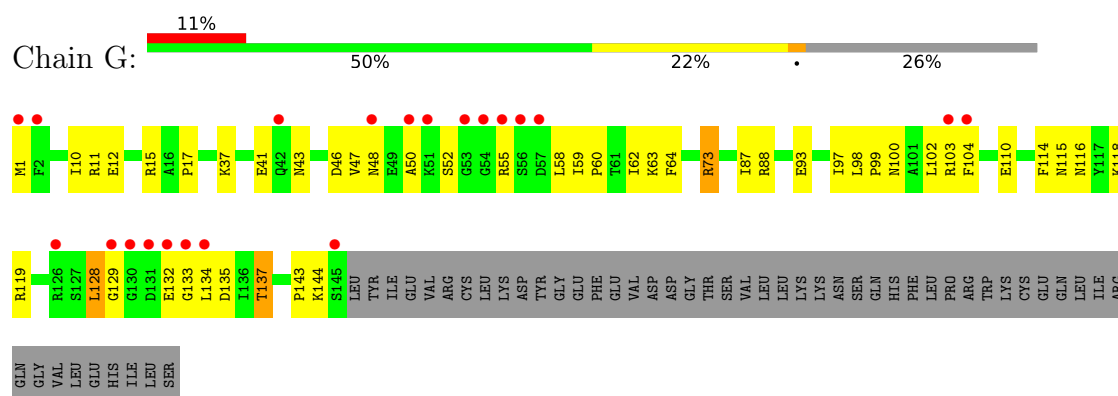
- Molecule 2: GINS complex subunit 4



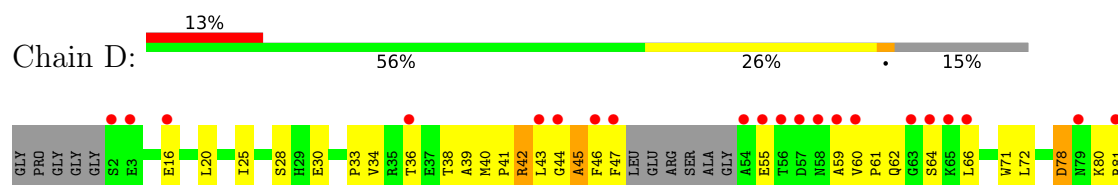
- Molecule 3: DNA replication complex GINS protein PSF1

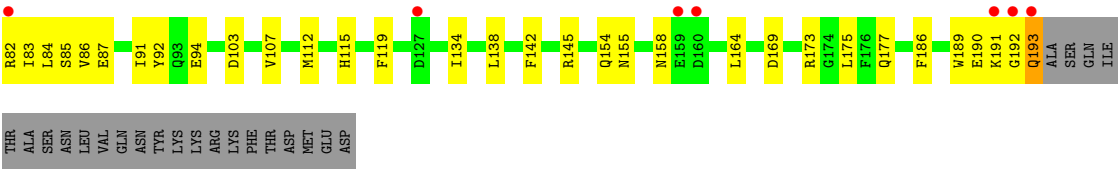


- Molecule 3: DNA replication complex GINS protein PSF1

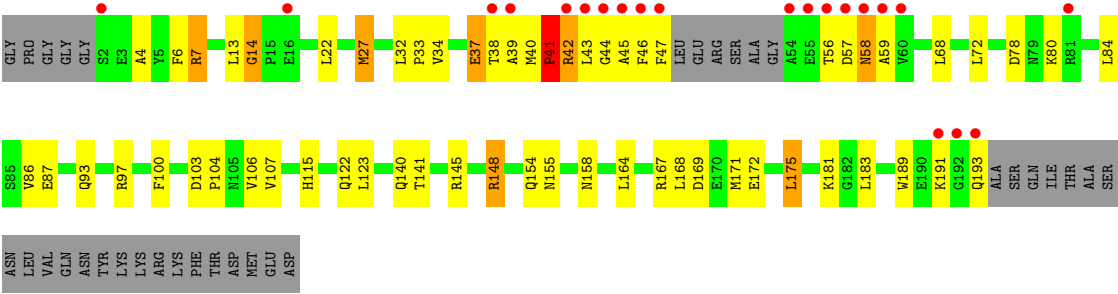


- Molecule 4: GINS complex subunit 3





● Molecule 4: GINS complex subunit 3



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	58.27Å 89.10Å 103.80Å 105.02° 103.58° 95.07°	Depositor
Resolution (Å)	29.58 – 2.36 29.58 – 2.36	Depositor EDS
% Data completeness (in resolution range)	90.6 (29.58-2.36) 91.6 (29.58-2.36)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.30 (at 2.37Å)	Xtriage
Refinement program	CNS 1.2	Depositor
R, R_{free}	0.210 , 0.248 0.215 , 0.252	Depositor DCC
R_{free} test set	12899 reflections (8.38%)	wwPDB-VP
Wilson B-factor (Å ²)	24.1	Xtriage
Anisotropy	0.222	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 61.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	11883	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.09% 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](#)

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	0.46	1/1454 (0.1%)	0.84	2/1969 (0.1%)
1	E	0.44	0/1454	0.87	2/1969 (0.1%)
2	B	0.41	0/1645	0.87	2/2219 (0.1%)
2	F	0.48	0/1645	0.86	4/2219 (0.2%)
3	C	0.46	0/1211	0.85	2/1626 (0.1%)
3	G	0.43	0/1211	0.83	2/1626 (0.1%)
4	D	0.41	0/1523	0.89	3/2055 (0.1%)
4	H	0.44	0/1523	0.94	4/2055 (0.2%)
All	All	0.44	1/11666 (0.0%)	0.87	21/15738 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	151	MET	SD-CE	-6.33	1.63	1.79

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	146	ASP	N-CA-C	7.45	120.34	111.33
4	H	14	GLY	CA-C-N	7.43	126.70	118.97
4	H	14	GLY	C-N-CA	7.43	126.70	118.97
4	H	40	MET	CA-C-N	6.93	128.50	119.84
4	H	40	MET	C-N-CA	6.93	128.50	119.84

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	1424	0	1449	62	0
1	E	1424	0	1449	68	0
2	B	1614	0	1625	65	0
2	F	1614	0	1625	56	0
3	C	1188	0	1180	55	0
3	G	1188	0	1180	36	0
4	D	1489	0	1436	55	0
4	H	1489	0	1436	59	0
5	A	68	0	0	1	0
5	B	69	0	0	4	0
5	C	47	0	0	4	0
5	D	47	0	0	3	0
5	E	53	0	0	4	0
5	F	77	0	0	1	0
5	G	45	0	0	3	0
5	H	47	0	0	1	0
All	All	11883	0	11380	400	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 18.

The worst 5 of 400 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:71:LEU:HD22	1:A:120:MET:HE1	1.34	1.06
1:A:51:ASN:HD21	1:A:55:ARG:HH21	1.13	0.90
1:A:119:ASP:O	1:A:123:THR:HG22	1.69	0.90
4:H:44:GLY:N	4:H:58:ASN:HB3	1.87	0.90
3:G:15:ARG:HD3	5:G:199:HOH:O	1.73	0.89

There are no symmetry-related clashes.

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	173/191 (91%)	168 (97%)	5 (3%)	0	100	100
1	E	173/191 (91%)	168 (97%)	5 (3%)	0	100	100
2	B	192/223 (86%)	185 (96%)	7 (4%)	0	100	100
2	F	192/223 (86%)	188 (98%)	4 (2%)	0	100	100
3	C	143/196 (73%)	136 (95%)	6 (4%)	1 (1%)	18	20
3	G	143/196 (73%)	135 (94%)	8 (6%)	0	100	100
4	D	182/220 (83%)	169 (93%)	10 (6%)	3 (2%)	7	6
4	H	182/220 (83%)	169 (93%)	8 (4%)	5 (3%)	4	2
All	All	1380/1660 (83%)	1318 (96%)	53 (4%)	9 (1%)	18	20

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	H	41	PRO
4	H	42	ARG
4	H	59	ALA
4	D	45	ALA
4	H	58	ASN

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	159/173 (92%)	149 (94%)	10 (6%)	16	19
1	E	159/173 (92%)	154 (97%)	5 (3%)	35	47
2	B	182/205 (89%)	174 (96%)	8 (4%)	25	33
2	F	182/205 (89%)	178 (98%)	4 (2%)	45	59
3	C	126/174 (72%)	122 (97%)	4 (3%)	34	46
3	G	126/174 (72%)	120 (95%)	6 (5%)	23	29

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
4	D	160/186 (86%)	154 (96%)	6 (4%)	29	39
4	H	160/186 (86%)	149 (93%)	11 (7%)	14	16
All	All	1254/1476 (85%)	1200 (96%)	54 (4%)	26	34

5 of 54 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	52	LEU
2	F	210	THR
4	H	148	ARG
1	E	53	LYS
1	E	149	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 46 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	101	ASN
3	G	14	HIS
1	E	142	HIS
2	F	64	ASN
3	G	48	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](#)

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](#)

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	175/191 (91%)	0.29	5 (2%) 53 60	16, 31, 61, 81	1 (0%)
1	E	175/191 (91%)	0.54	9 (5%) 33 39	17, 33, 60, 83	1 (0%)
2	B	196/223 (87%)	0.35	16 (8%) 17 20	13, 30, 66, 97	0
2	F	196/223 (87%)	0.16	9 (4%) 37 43	14, 25, 62, 90	0
3	C	145/196 (73%)	0.70	24 (16%) 4 5	16, 33, 87, 114	0
3	G	145/196 (73%)	0.87	21 (14%) 6 7	14, 34, 80, 117	0
4	D	186/220 (84%)	0.67	28 (15%) 5 6	12, 32, 83, 109	0
4	H	186/220 (84%)	0.66	21 (11%) 10 11	14, 31, 78, 113	0
All	All	1404/1660 (84%)	0.51	133 (9%) 14 16	12, 31, 74, 117	2 (0%)

The worst 5 of 133 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	H	47	PHE	8.4
4	D	47	PHE	8.0
3	G	104	PHE	7.4
4	D	54	ALA	6.1
3	G	130	GLY	5.9

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 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.