



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 02:33 PM UTC

PDB ID : 4OL0 / pdb_00004ol0
Title : Crystal structure of transportin-SR2, a karyopherin involved in human disease, in complex with Ran
Authors : Tsirkone, V.G.; Strelkov, S.V.
Deposited on : 2014-01-23
Resolution : 2.90 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
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
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

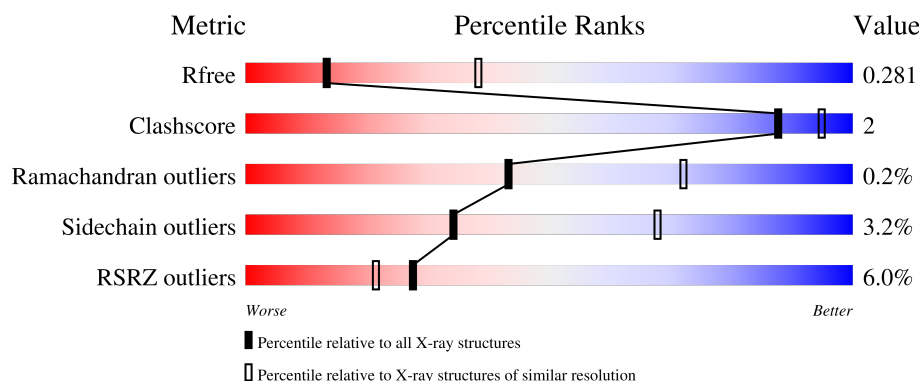
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

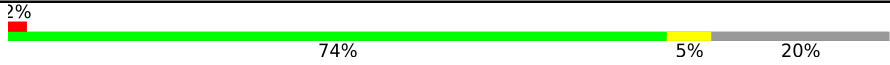
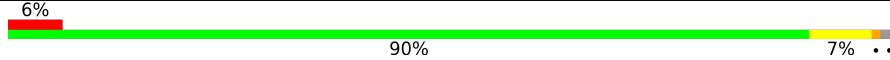
The reported resolution of this entry is 2.90 Å.

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	216	
2	B	921	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 8625 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 GTP-binding nuclear protein Ran.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	172	Total	C	N	O	S	0	0	0
			1399	908	246	240	5			

- Molecule 2 is a protein called Transportin-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	902	Total	C	N	O	S	0	0	0
			7160	4560	1221	1326	53			

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	1		

- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (CCD ID: GTP) (formula: C₁₀H₁₆N₅O₁₄P₃).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			32	10	5	14	3		

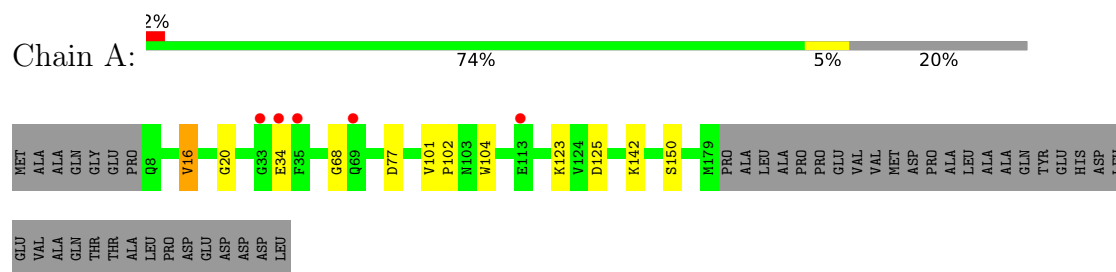
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	4	Total	O	0	0
			4	4		
5	B	29	Total	O	0	0
			29	29		

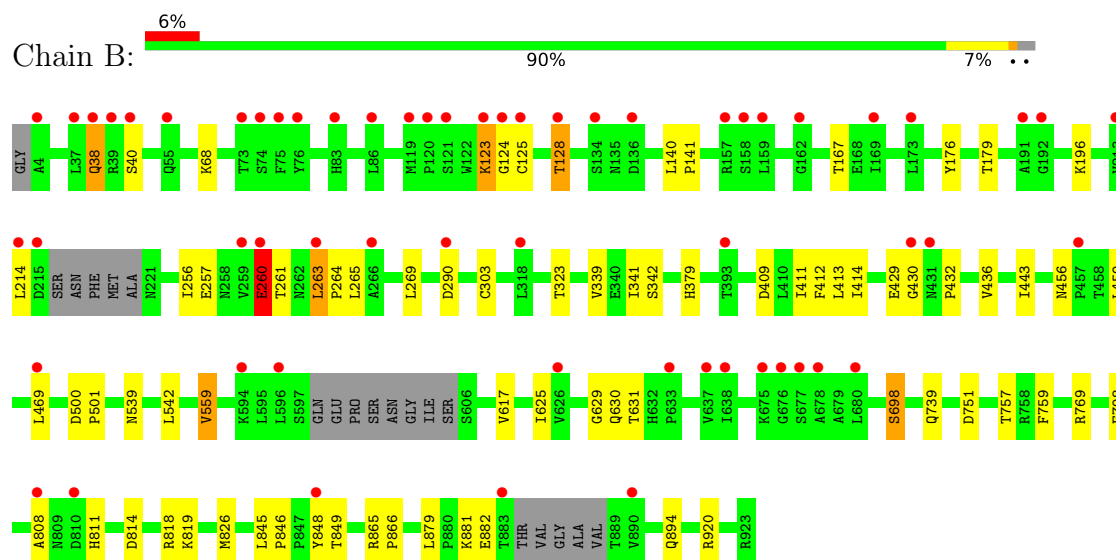
3 Residue-property plots

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: GTP-binding nuclear protein Ran



• Molecule 2: Transportin-3



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.20Å 109.97Å 148.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.18 – 2.90 44.18 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.6 (44.18-2.90) 99.6 (44.18-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.68 (at 2.90Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.4_1496)	Depositor
R, R_{free}	0.222 , 0.276 0.227 , 0.281	Depositor DCC
R_{free} test set	1383 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	61.2	Xtriage
Anisotropy	0.081	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 57.1	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	0.93	EDS
Total number of atoms	8625	wwPDB-VP
Average B, all atoms (Å ²)	73.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.87% 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: GTP, MG

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	0.28	0/1433	0.60	0/1934
2	B	0.31	0/7301	0.69	5/9914 (0.1%)
All	All	0.31	0/8734	0.68	5/11848 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	260	GLU	N-CA-C	5.93	117.75	111.28
2	B	456	ASN	CA-C-N	-5.35	113.52	119.19
2	B	456	ASN	C-N-CA	-5.35	113.52	119.19
2	B	125	CYS	N-CA-C	5.21	117.36	111.11
2	B	894	GLN	N-CA-C	-5.18	107.62	114.04

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	1399	0	1422	7	0
2	B	7160	0	7197	29	0
3	A	1	0	0	0	0
4	A	32	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	4	0	0	0	0
5	B	29	0	0	0	0
All	All	8625	0	8631	34	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 2.

All (34) 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)
2:B:808:ALA:O	2:B:818:ARG:NH2	2.23	0.71
2:B:256:ILE:O	2:B:261:THR:OG1	2.19	0.60
1:A:20:GLY:O	1:A:123:LYS:NZ	2.35	0.59
1:A:77:ASP:OD2	2:B:68:LYS:NZ	2.37	0.58
2:B:260:GLU:N	2:B:261:THR:HA	2.21	0.55
2:B:698:SER:OG	2:B:751:ASP:OD2	2.21	0.54
2:B:629:GLY:HA3	2:B:630:GLN:C	2.36	0.51
2:B:341:ILE:O	2:B:342:SER:OG	2.21	0.49
2:B:123:LYS:HB3	2:B:124:GLY:HA2	1.94	0.49
2:B:879:LEU:O	2:B:881:LYS:NZ	2.44	0.48
1:A:16:VAL:HG13	1:A:104:TRP:CE3	2.49	0.47
2:B:845:LEU:HD13	2:B:849:THR:HG21	1.96	0.47
2:B:559:VAL:HG13	2:B:617:VAL:HG21	1.97	0.47
1:A:68:GLY:N	4:A:302:GTP:O2G	2.46	0.46
2:B:176:TYR:O	2:B:179:THR:OG1	2.33	0.46
2:B:500:ASP:HB3	2:B:501:PRO:HD3	1.98	0.46
2:B:140:LEU:N	2:B:141:PRO:CD	2.80	0.45
2:B:757:THR:HG22	2:B:798:PHE:HA	1.99	0.45
2:B:432:PRO:HB2	2:B:436:VAL:HB	1.98	0.45
2:B:630:GLN:HB3	2:B:631:THR:HA	2.00	0.44
2:B:263:LEU:HG	2:B:264:PRO:HD3	2.00	0.44
2:B:303:CYS:SG	2:B:323:THR:HB	2.59	0.43
1:A:125:ASP:OD1	1:A:150:SER:OG	2.36	0.43
2:B:263:LEU:N	2:B:264:PRO:CD	2.82	0.42
2:B:38:GLN:C	2:B:40:SER:H	2.28	0.42
2:B:339:VAL:HG21	2:B:379:HIS:NE2	2.34	0.42
2:B:865:ARG:N	2:B:866:PRO:HD2	2.34	0.42
2:B:412:PHE:CE1	2:B:413:LEU:HG	2.55	0.41
1:A:101:VAL:N	1:A:102:PRO:HD2	2.35	0.41
2:B:409:ASP:O	2:B:412:PHE:CD2	2.74	0.41
1:A:142:LYS:NZ	2:B:290:ASP:OD1	2.50	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:256:ILE:CD1	2:B:269:LEU:HD12	2.51	0.41
2:B:124:GLY:O	2:B:128:THR:HG23	2.21	0.41
2:B:846:PRO:HG2	2:B:848:TYR:CE2	2.56	0.41

There are no symmetry-related clashes.

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	170/216 (79%)	158 (93%)	12 (7%)	0	100	100
2	B	894/921 (97%)	845 (94%)	47 (5%)	2 (0%)	43	72
All	All	1064/1137 (94%)	1003 (94%)	59 (6%)	2 (0%)	43	72

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	38	GLN
2	B	430	GLY

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	151/185 (82%)	149 (99%)	2 (1%)	61	86

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	805/819 (98%)	776 (96%)	29 (4%)	31	65
All	All	956/1004 (95%)	925 (97%)	31 (3%)	34	68

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	VAL
1	A	34	GLU
2	B	123	LYS
2	B	128	THR
2	B	167	THR
2	B	196	LYS
2	B	214	LEU
2	B	257	GLU
2	B	260	GLU
2	B	263	LEU
2	B	265	LEU
2	B	411	ILE
2	B	414	ILE
2	B	429	GLU
2	B	443	ILE
2	B	459	LEU
2	B	469	LEU
2	B	539	ASN
2	B	542	LEU
2	B	559	VAL
2	B	625	ILE
2	B	698	SER
2	B	739	GLN
2	B	759	PHE
2	B	769	ARG
2	B	811	HIS
2	B	814	ASP
2	B	819	LYS
2	B	826	MET
2	B	882	GLU
2	B	920	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	84	GLN
2	B	42	HIS
2	B	258	ASN
2	B	344	ASN
2	B	588	GLN
2	B	744	ASN
2	B	809	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	$\# Z > 2$
4	GTP	A	302	3	33,34,34	0.99	3 (9%)	50,54,54	1.62	10 (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
4	GTP	A	302	3	-	6/22/38/38	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	302	GTP	PA-O3A	2.26	1.61	1.59
4	A	302	GTP	C2-N3	2.17	1.38	1.33
4	A	302	GTP	PB-O3B	2.08	1.61	1.59

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	302	GTP	C5-C4-N3	-4.92	120.57	128.39
4	A	302	GTP	C2-N3-C4	4.62	120.26	112.30
4	A	302	GTP	N9-C4-N3	3.21	132.36	125.95
4	A	302	GTP	C2-N1-C6	-2.87	119.91	125.11
4	A	302	GTP	N9-C8-N7	-2.69	108.41	113.40
4	A	302	GTP	C5-C6-N1	2.51	119.63	113.25
4	A	302	GTP	C8-N7-C5	2.50	108.71	104.26
4	A	302	GTP	O2B-PB-O3B	2.43	113.85	107.27
4	A	302	GTP	O6-C6-C5	-2.37	120.29	126.53
4	A	302	GTP	C3'-C2'-C1'	2.08	105.39	101.46

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	302	GTP	PG-O3B-PB-O1B
4	A	302	GTP	PB-O3B-PG-O1G
4	A	302	GTP	PB-O3B-PG-O2G
4	A	302	GTP	PB-O3B-PG-O3G
4	A	302	GTP	O4'-C4'-C5'-O5'
4	A	302	GTP	PG-O3B-PB-O2B

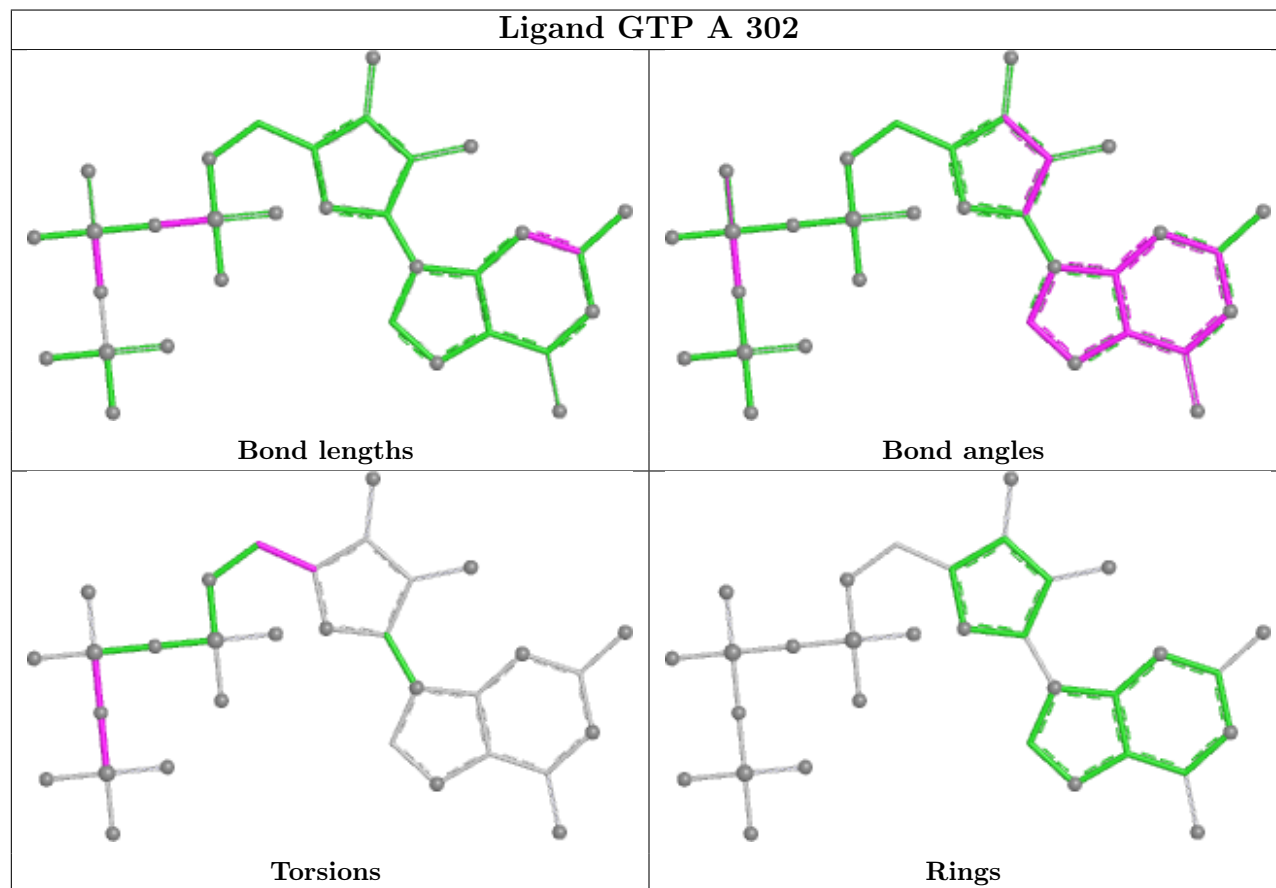
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	302	GTP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In

addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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 ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	172/216 (79%)	0.13	5 (2%)	53 45	35, 54, 100, 172	0
2	B	902/921 (97%)	0.35	59 (6%)	25 20	35, 66, 144, 265	0
All	All	1074/1137 (94%)	0.31	64 (5%)	27 21	35, 63, 138, 265	0

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	677	SER	6.1
2	B	676	GLY	5.0
2	B	39	ARG	4.3
2	B	157	ARG	3.7
2	B	128	THR	3.7
2	B	637	VAL	3.5
2	B	83	HIS	3.4
1	A	69	GLN	3.3
1	A	33	GLY	3.3
2	B	430	GLY	3.2
2	B	158	SER	3.2
2	B	808	ALA	3.2
2	B	86	LEU	3.0
2	B	596	LEU	3.0
2	B	191	ALA	3.0
2	B	124	GLY	2.9
1	A	113	GLU	2.9
1	A	35	PHE	2.9
2	B	55	GLN	2.8
2	B	626	VAL	2.8
2	B	675	LYS	2.8
2	B	119	MET	2.8
2	B	633	PRO	2.8
2	B	173	LEU	2.8

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Mol	Chain	Res	Type	RSRZ
2	B	192	GLY	2.8
2	B	678	ALA	2.7
2	B	810	ASP	2.7
2	B	37	LEU	2.7
2	B	73	THR	2.7
2	B	121	SER	2.7
2	B	638	ILE	2.6
2	B	680	LEU	2.7
2	B	4	ALA	2.6
2	B	134	SER	2.6
2	B	74	SER	2.5
2	B	883	THR	2.5
2	B	162	GLY	2.5
2	B	259	VAL	2.5
2	B	125	CYS	2.5
2	B	40	SER	2.4
2	B	159	LEU	2.4
2	B	136	ASP	2.4
2	B	213	VAL	2.4
1	A	34	GLU	2.4
2	B	890	VAL	2.4
2	B	76	TYR	2.4
2	B	169	ILE	2.4
2	B	120	PRO	2.2
2	B	123	LYS	2.2
2	B	260	GLU	2.2
2	B	848	TYR	2.2
2	B	75	PHE	2.2
2	B	214	LEU	2.2
2	B	38	GLN	2.2
2	B	431	ASN	2.1
2	B	469	LEU	2.1
2	B	457	PRO	2.1
2	B	393	THR	2.1
2	B	266	ALA	2.1
2	B	263	LEU	2.0
2	B	290	ASP	2.0
2	B	594	LYS	2.0
2	B	318	LEU	2.0
2	B	215	ASP	2.0

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](#)

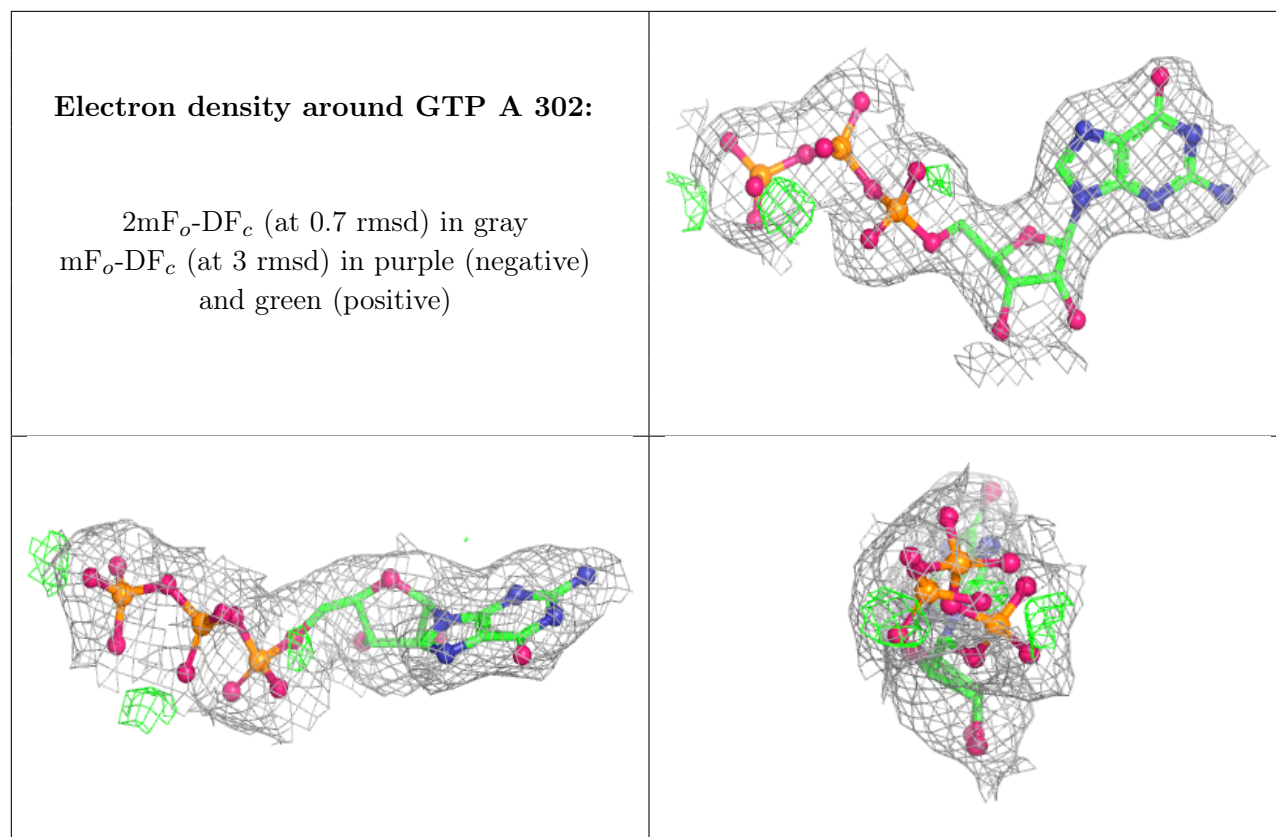
There are no oligosaccharides in this entry.

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
4	GTP	A	302	32/32	0.95	0.08	31,47,56,63	0
3	MG	A	301	1/1	0.96	0.12	54,54,54,54	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



6.5 Other polymers [i](#)

There are no such residues in this entry.