



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 03:10 AM UTC

PDB ID : 2A2D / pdb_00002a2d
Title : X-ray structure of human n-acetyl galactosamine kinase complexed with Mn-AMPPNP and n-acetyl galactosamine
Authors : Thoden, J.B.; Holden, H.M.
Deposited on : 2005-06-22
Resolution : 2.20 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

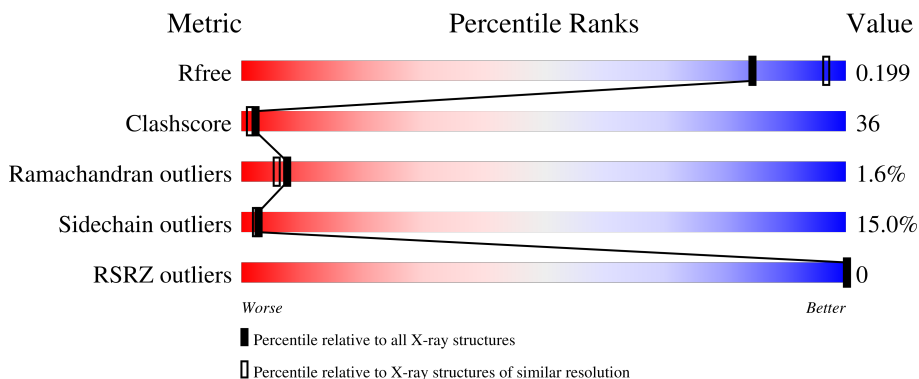
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	478	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	ANP	A	461	-	-	X	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3765 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.

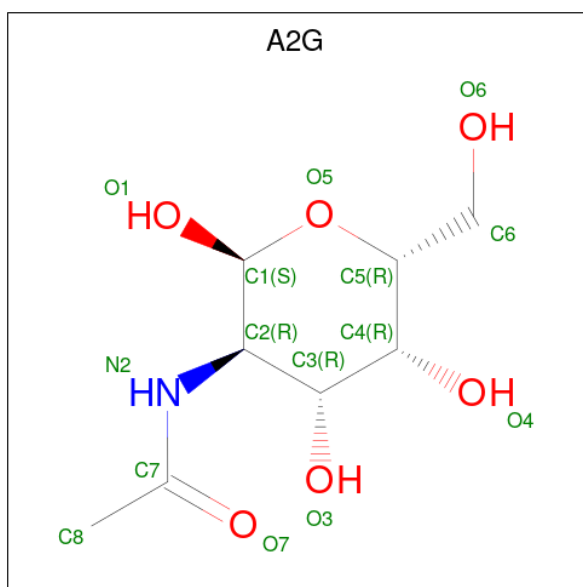
- Molecule 1 is a protein called N-acetylgalactosamine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	448	3462	2198	587	649	28	0	3	0

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	cloning artifact	UNP Q01415
A	-18	GLY	-	cloning artifact	UNP Q01415
A	-17	SER	-	cloning artifact	UNP Q01415
A	-16	SER	-	cloning artifact	UNP Q01415
A	-15	HIS	-	expression tag	UNP Q01415
A	-14	HIS	-	expression tag	UNP Q01415
A	-13	HIS	-	expression tag	UNP Q01415
A	-12	HIS	-	expression tag	UNP Q01415
A	-11	HIS	-	expression tag	UNP Q01415
A	-10	HIS	-	expression tag	UNP Q01415
A	-9	SER	-	cloning artifact	UNP Q01415
A	-8	SER	-	cloning artifact	UNP Q01415
A	-7	GLU	-	cloning artifact	UNP Q01415
A	-6	ASN	-	cloning artifact	UNP Q01415
A	-5	LEU	-	cloning artifact	UNP Q01415
A	-4	TYR	-	cloning artifact	UNP Q01415
A	-3	PHE	-	cloning artifact	UNP Q01415
A	-2	GLN	-	cloning artifact	UNP Q01415
A	-1	GLY	-	cloning artifact	UNP Q01415
A	0	HIS	-	cloning artifact	UNP Q01415

- Molecule 2 is 2-acetamido-2-deoxy-alpha-D-galactopyranose (CCD ID: A2G) (formula: C₈H₁₅NO₆).

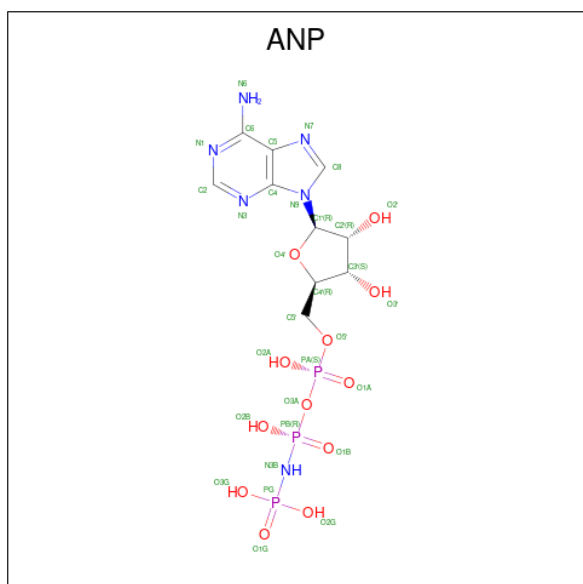


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	15	8	1	6	0	0

- Molecule 3 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

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

- Molecule 4 is PHOSPHOAMINOPHOSPHONIC ACID-ADENYLATE ESTER (CCD ID: ANP) (formula: C₁₀H₁₇N₆O₁₂P₃).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
4	A	1	31	10	6	12	3	0	0

- Molecule 5 is water.

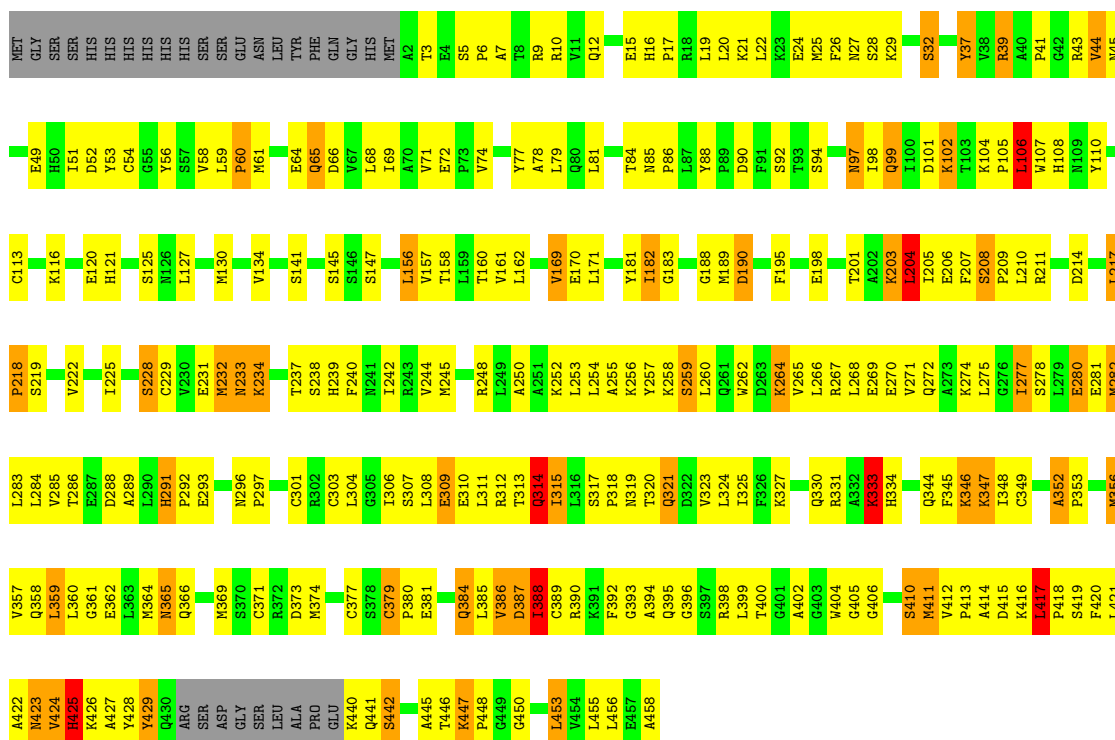
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	256	256	256	0	0

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: N-acetylgalactosamine kinase

Chain A: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	119.10Å 119.10Å 65.90Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 2.20 30.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	98.9 (30.00-2.20) 98.9 (30.00-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.59 (at 2.20Å)	Xtrriage
Refinement program	TNT	Depositor
R, R_{free}	0.203 , 0.247 0.198 , 0.199	Depositor DCC
R_{free} test set	2693 reflections (10.01%)	wwPDB-VP
Wilson B-factor (Å ²)	4.5	Xtrriage
Anisotropy	0.708	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 177.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.30$, $\langle L^2 \rangle = 0.14$	Xtrriage
Estimated twinning fraction	0.228 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.84	EDS
Total number of atoms	3765	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.70% 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: A2G, MN, ANP

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	1.18	1/3538 (0.0%)	1.75	57/4786 (1.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	425	HIS	CA-C	-5.29	1.45	1.52

All (57) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	387	ASP	CA-CB-CG	9.92	122.52	112.60
1	A	415	ASP	N-CA-C	9.28	123.70	112.38
1	A	423	ASN	CA-CB-CG	-8.82	103.78	112.60
1	A	314	GLN	CA-C-N	-8.35	114.01	122.77
1	A	314	GLN	C-N-CA	-8.35	114.01	122.77
1	A	415	ASP	CB-CA-C	-8.22	92.98	110.32
1	A	218	PRO	CA-C-N	8.15	131.20	120.28
1	A	218	PRO	C-N-CA	8.15	131.20	120.28
1	A	237	THR	CA-C-N	8.00	132.06	120.38
1	A	237	THR	C-N-CA	8.00	132.06	120.38
1	A	121	HIS	CA-CB-CG	-7.54	106.26	113.80
1	A	392	PHE	N-CA-C	7.42	122.05	112.41
1	A	291	HIS	CA-C-N	7.23	128.88	119.84
1	A	291	HIS	C-N-CA	7.23	128.88	119.84
1	A	157	VAL	CB-CA-C	-7.17	102.71	111.88
1	A	392	PHE	CA-CB-CG	-7.16	106.64	113.80
1	A	321	GLN	N-CA-C	7.16	119.99	111.33
1	A	98[A]	ILE	N-CA-C	7.04	118.60	107.98
1	A	98[B]	ILE	N-CA-C	7.04	118.60	107.98
1	A	315	ILE	N-CA-C	6.94	117.95	112.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	424	VAL	O-C-N	6.81	128.58	121.91
1	A	334	HIS	CA-CB-CG	-6.60	107.20	113.80
1	A	453	LEU	CB-CA-C	-6.50	96.48	110.45
1	A	405	GLY	CA-C-N	-6.48	111.38	121.42
1	A	405	GLY	C-N-CA	-6.48	111.38	121.42
1	A	190	ASP	N-CA-C	6.36	119.02	111.33
1	A	188	GLY	CA-C-N	-6.34	112.20	120.44
1	A	188	GLY	C-N-CA	-6.34	112.20	120.44
1	A	425	HIS	CB-CA-C	-6.20	100.45	110.74
1	A	315	ILE	CB-CA-C	-6.18	104.85	110.91
1	A	218	PRO	N-CA-CB	6.17	109.08	103.34
1	A	352	ALA	CA-C-N	6.10	126.29	120.31
1	A	352	ALA	C-N-CA	6.10	126.29	120.31
1	A	233	ASN	CA-C-N	6.06	128.72	120.54
1	A	233	ASN	C-N-CA	6.06	128.72	120.54
1	A	379	CYS	N-CA-CB	6.04	119.77	111.25
1	A	429	TYR	CB-CA-C	6.03	120.24	110.96
1	A	78	ALA	N-CA-C	6.02	118.54	108.73
1	A	325	ILE	N-CA-C	5.92	116.38	107.80
1	A	106	LEU	N-CA-C	-5.90	100.88	110.20
1	A	325	ILE	N-CA-CB	-5.89	104.04	111.46
1	A	333	LYS	N-CA-C	-5.77	104.99	111.28
1	A	365	ASN	O-C-N	5.69	128.16	122.12
1	A	323	VAL	N-CA-CB	5.69	116.73	110.53
1	A	237	THR	N-CA-C	5.66	118.70	108.69
1	A	373	ASP	N-CA-C	5.64	118.62	111.69
1	A	289	ALA	N-CA-C	5.52	117.38	111.36
1	A	402	ALA	N-CA-C	5.45	117.22	111.28
1	A	219	SER	N-CA-C	5.42	117.18	111.28
1	A	208	SER	C-N-CD	-5.30	108.95	120.60
1	A	64	GLU	CA-CB-CG	-5.29	103.52	114.10
1	A	99	GLN	N-CA-C	5.24	117.49	107.75
1	A	425	HIS	O-C-N	5.20	128.09	122.11
1	A	204	LEU	CA-C-N	-5.10	116.50	122.93
1	A	204	LEU	C-N-CA	-5.10	116.50	122.93
1	A	371	CYS	CA-C-O	5.04	125.89	120.55
1	A	45	ASN	CA-CB-CG	-5.00	107.60	112.60

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	3462	0	3503	252	0
2	A	15	0	12	1	0
3	A	1	0	0	0	0
4	A	31	0	13	9	0
5	A	256	0	0	12	0
All	All	3765	0	3528	252	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 36.

All (252) 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:357:VAL:HG12	1:A:395:GLN:HG2	1.25	1.14
1:A:390:ARG:HA	1:A:394:ALA:HB3	1.32	1.09
1:A:447:LYS:HG3	1:A:448:PRO:HD2	1.40	1.02
1:A:65:GLN:H	1:A:65:GLN:HE21	1.12	0.97
1:A:271:VAL:HG12	1:A:282:MET:HE1	1.49	0.95
1:A:218:PRO:HG2	1:A:411:MET:CE	1.96	0.94
1:A:264:LYS:HD3	1:A:274:LYS:NZ	1.88	0.88
1:A:417:LEU:HB3	1:A:418:PRO:HD3	1.56	0.88
1:A:301:CYS:SG	1:A:308:LEU:HD23	2.16	0.85
1:A:417:LEU:HD12	1:A:421:LEU:HG	1.58	0.83
1:A:447:LYS:HG3	1:A:448:PRO:CD	2.08	0.83
1:A:234:LYS:H	1:A:234:LYS:HD3	1.45	0.82
1:A:271:VAL:HG12	1:A:282:MET:CE	2.09	0.81
1:A:7:ALA:HB3	1:A:453:LEU:CD2	2.10	0.80
1:A:275:LEU:HD12	1:A:282:MET:HE2	1.65	0.78
1:A:352:ALA:HA	1:A:356:MET:SD	2.23	0.77
1:A:390:ARG:CA	1:A:394:ALA:HB3	2.11	0.77
1:A:278:SER:OG	1:A:281:GLU:HG3	1.83	0.77
1:A:264:LYS:HD3	1:A:274:LYS:HZ3	1.49	0.77
1:A:318:PRO:HA	1:A:321:GLN:OE1	1.86	0.76
1:A:317:SER:O	1:A:321:GLN:HG3	1.88	0.74
1:A:306:ILE:CG2	1:A:310:GLU:HB2	2.18	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:357:VAL:CG1	1:A:395:GLN:HG2	2.12	0.74
1:A:418:PRO:HD3	5:A:532:HOH:O	1.88	0.73
1:A:218:PRO:HG2	1:A:411:MET:HE2	1.71	0.72
1:A:379:CYS:HB2	1:A:380:PRO:HD2	1.72	0.71
1:A:445:ALA:HB3	5:A:542:HOH:O	1.91	0.71
1:A:234:LYS:HD3	1:A:234:LYS:N	2.05	0.70
1:A:7:ALA:HB3	1:A:453:LEU:HD21	1.73	0.70
1:A:357:VAL:HG12	1:A:395:GLN:CG	2.16	0.70
1:A:44:VAL:HG11	1:A:225:ILE:HD11	1.74	0.70
1:A:393:GLY:HA2	1:A:416:LYS:HD3	1.75	0.68
1:A:364:MET:HE2	1:A:396:GLY:HA3	1.75	0.67
1:A:393:GLY:CA	1:A:416:LYS:HD3	2.24	0.66
1:A:422:ALA:O	1:A:426:LYS:HB2	1.94	0.66
1:A:346:LYS:O	1:A:349:CYS:N	2.28	0.66
1:A:198:GLU:HB2	1:A:203:LYS:HE3	1.78	0.66
1:A:233:ASN:ND2	4:A:461:ANP:O1A	2.30	0.65
1:A:44:VAL:CG1	1:A:225:ILE:HD11	2.27	0.64
1:A:387:ASP:O	1:A:390:ARG:N	2.31	0.64
1:A:352:ALA:N	1:A:353:PRO:HD3	2.12	0.64
1:A:9:ARG:HB3	1:A:455:LEU:HD23	1.80	0.64
1:A:307:SER:N	1:A:310:GLU:OE1	2.31	0.64
1:A:420:PHE:O	1:A:424:VAL:HG23	1.97	0.64
1:A:20:LEU:O	1:A:24:GLU:HG3	1.98	0.64
1:A:275:LEU:HD12	1:A:282:MET:CE	2.28	0.64
1:A:362:GLU:O	1:A:366:GLN:HG3	1.98	0.63
1:A:307:SER:OG	1:A:310:GLU:HG3	1.99	0.63
1:A:232:MET:SD	1:A:234:LYS:HD2	2.39	0.63
1:A:417:LEU:HD11	1:A:421:LEU:HD11	1.80	0.62
1:A:234:LYS:HE3	4:A:461:ANP:PG	2.39	0.62
1:A:420:PHE:HD2	1:A:421:LEU:HD23	1.65	0.62
1:A:104:LYS:O	1:A:106:LEU:HD12	2.01	0.61
1:A:440:LYS:N	5:A:541:HOH:O	2.32	0.61
1:A:365:ASN:OD1	1:A:390:ARG:NE	2.30	0.61
1:A:417:LEU:O	1:A:421:LEU:HG	2.01	0.61
1:A:222:VAL:HG21	1:A:417:LEU:HD22	1.82	0.61
1:A:25:MET:HE1	1:A:84:THR:HB	1.81	0.60
1:A:65:GLN:H	1:A:65:GLN:NE2	1.92	0.60
1:A:414:ALA:HB3	5:A:710:HOH:O	2.01	0.60
1:A:272:GLN:O	1:A:272:GLN:HG2	2.02	0.60
1:A:361:GLY:O	1:A:365:ASN:ND2	2.34	0.60
1:A:310:GLU:HA	1:A:314:GLN:HG3	1.84	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:264:LYS:HD3	1:A:274:LYS:HZ1	1.65	0.59
1:A:16:HIS:HB2	1:A:19:LEU:HB2	1.85	0.59
1:A:44:VAL:HG23	1:A:61:MET:HG2	1.84	0.59
1:A:39:ARG:HD3	1:A:39:ARG:C	2.27	0.58
1:A:346:LYS:O	1:A:347:LYS:C	2.46	0.58
1:A:425:HIS:O	1:A:429:TYR:HB2	2.02	0.58
1:A:417:LEU:HB3	5:A:532:HOH:O	2.02	0.58
1:A:417:LEU:HB3	1:A:418:PRO:CD	2.32	0.58
1:A:379:CYS:HB2	1:A:380:PRO:CD	2.33	0.58
1:A:364:MET:HE2	1:A:396:GLY:CA	2.33	0.58
1:A:102:LYS:HE2	1:A:183:GLY:HA2	1.87	0.57
1:A:306:ILE:HG22	1:A:307:SER:H	1.69	0.57
1:A:107:TRP:CE3	4:A:461:ANP:H2	2.39	0.56
1:A:416:LYS:O	1:A:417:LEU:C	2.47	0.56
1:A:419:SER:O	1:A:423:ASN:N	2.28	0.56
1:A:421:LEU:O	1:A:425:HIS:HB2	2.05	0.56
1:A:84:THR:HG23	1:A:134:VAL:O	2.06	0.56
1:A:306:ILE:HG22	1:A:307:SER:N	2.20	0.56
1:A:330:GLN:HG3	1:A:374:MET:HE1	1.87	0.56
1:A:417:LEU:HD12	1:A:421:LEU:CG	2.34	0.56
1:A:306:ILE:HG23	1:A:310:GLU:HB2	1.86	0.56
1:A:12:GLN:NE2	1:A:458:ALA:O	2.36	0.56
1:A:234:LYS:HE3	4:A:461:ANP:N3B	2.21	0.56
1:A:386:VAL:O	1:A:390:ARG:HG3	2.06	0.56
1:A:280:GLU:CD	1:A:280:GLU:H	2.13	0.55
1:A:353:PRO:HD2	1:A:356:MET:HG3	1.89	0.55
1:A:417:LEU:O	1:A:420:PHE:HB3	2.05	0.55
1:A:304:LEU:HB2	1:A:306:ILE:HD12	1.89	0.55
1:A:441:GLN:HG2	5:A:486:HOH:O	2.05	0.55
1:A:97:ASN:HA	5:A:701:HOH:O	2.05	0.55
1:A:359:LEU:O	1:A:362:GLU:HB2	2.06	0.55
1:A:419:SER:O	1:A:420:PHE:C	2.49	0.55
1:A:381:GLU:OE1	1:A:381:GLU:N	2.30	0.55
1:A:189:MET:HE3	1:A:190:ASP:OD1	2.07	0.55
1:A:399:LEU:C	1:A:399:LEU:HD12	2.31	0.55
1:A:107:TRP:HB2	4:A:461:ANP:N3	2.22	0.54
1:A:238:SER:O	1:A:239:HIS:C	2.49	0.54
1:A:240:PHE:O	1:A:244:VAL:HG23	2.07	0.54
1:A:304:LEU:HB2	1:A:306:ILE:CD1	2.38	0.54
1:A:447:LYS:CG	1:A:448:PRO:HD2	2.28	0.54
1:A:267:ARG:O	1:A:270:GLU:HB2	2.07	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:65:GLN:HE21	1:A:65:GLN:N	1.94	0.54
1:A:206:GLU:O	1:A:210:LEU:HD12	2.07	0.54
1:A:358:GLN:HA	1:A:395:GLN:HE21	1.72	0.54
1:A:380:PRO:O	1:A:384:GLN:HG2	2.08	0.53
1:A:97:ASN:HD22	1:A:97:ASN:C	2.16	0.53
1:A:265:VAL:HA	1:A:270:GLU:OE1	2.09	0.53
1:A:357:VAL:O	1:A:358:GLN:C	2.51	0.53
1:A:310:GLU:O	1:A:314:GLN:HG3	2.09	0.53
1:A:54:CYS:HB3	1:A:268:LEU:HB2	1.90	0.53
1:A:257:TYR:C	1:A:259:SER:H	2.17	0.53
1:A:110:TYR:CE1	1:A:182:ILE:HG12	2.44	0.52
1:A:446:THR:HG22	1:A:447:LYS:N	2.24	0.52
1:A:313:THR:HG22	1:A:314:GLN:N	2.25	0.51
1:A:85:ASN:HB3	1:A:88:TYR:HD1	1.75	0.51
1:A:116:LYS:O	1:A:120:GLU:HG3	2.11	0.51
1:A:359:LEU:O	1:A:362:GLU:N	2.44	0.51
1:A:21:LYS:O	1:A:25:MET:HG3	2.11	0.50
1:A:56:TYR:CE1	1:A:269:GLU:HG2	2.46	0.50
1:A:102:LYS:CE	1:A:183:GLY:HA2	2.41	0.50
1:A:245:MET:CA	1:A:245:MET:HE2	2.41	0.50
1:A:385:LEU:HD13	1:A:428:TYR:CG	2.45	0.50
1:A:310:GLU:CA	1:A:314:GLN:HG3	2.41	0.50
1:A:271:VAL:CG1	1:A:282:MET:HE1	2.31	0.50
1:A:41:PRO:HA	1:A:66:ASP:HB3	1.94	0.50
1:A:423:ASN:O	1:A:427:ALA:N	2.40	0.50
1:A:281:GLU:HA	1:A:284:LEU:HD12	1.94	0.49
1:A:306:ILE:HG22	1:A:310:GLU:HB2	1.94	0.49
1:A:388:ILE:HG22	1:A:389:CYS:N	2.27	0.49
1:A:238:SER:O	1:A:242:ILE:HG13	2.13	0.49
1:A:250:ALA:O	1:A:254:LEU:HD12	2.11	0.49
1:A:306:ILE:CG2	1:A:307:SER:H	2.25	0.49
1:A:393:GLY:HA3	1:A:416:LYS:HD3	1.93	0.49
1:A:43:ARG:C	1:A:43:ARG:HD2	2.37	0.49
1:A:308:LEU:O	1:A:311:LEU:HB3	2.13	0.49
1:A:69:ILE:HG12	1:A:134:VAL:HG22	1.94	0.49
1:A:27:ASN:HA	1:A:32:SER:O	2.12	0.49
1:A:37:TYR:N	1:A:37:TYR:CD1	2.80	0.48
1:A:204:LEU:HD13	1:A:346:LYS:CD	2.43	0.48
1:A:16:HIS:N	1:A:16:HIS:CD2	2.82	0.48
1:A:296:ASN:HB2	1:A:297:PRO:HD2	1.95	0.48
1:A:256:LYS:HD3	1:A:262:TRP:CD1	2.47	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:VAL:HG21	1:A:61:MET:HE2	1.94	0.48
1:A:225:ILE:HD12	1:A:446:THR:OG1	2.13	0.48
1:A:234:LYS:HE2	4:A:461:ANP:O3A	2.13	0.48
1:A:348:ILE:HG22	1:A:349:CYS:N	2.29	0.48
1:A:5:SER:HB3	1:A:6:PRO:HD2	1.95	0.48
1:A:275:LEU:HB3	1:A:277:ILE:HG12	1.94	0.47
1:A:208:SER:O	1:A:208:SER:OG	2.30	0.47
1:A:238:SER:HB3	1:A:319:ASN:HD22	1.79	0.47
1:A:256:LYS:HE3	1:A:303:CYS:O	2.14	0.47
1:A:292:PRO:O	1:A:293:GLU:C	2.54	0.47
1:A:85:ASN:OD1	1:A:86:PRO:HD2	2.15	0.47
1:A:309:GLU:O	1:A:313:THR:HB	2.15	0.47
1:A:284:LEU:HB3	5:A:607:HOH:O	2.13	0.47
1:A:447:LYS:HE3	1:A:448:PRO:HD2	1.97	0.47
1:A:44:VAL:CG2	1:A:61:MET:HG2	2.45	0.47
1:A:104:LYS:O	1:A:106:LEU:N	2.47	0.47
1:A:171:LEU:HB3	1:A:195:PHE:CZ	2.50	0.47
1:A:204:LEU:HD13	1:A:346:LYS:HD2	1.95	0.47
1:A:218:PRO:HG3	1:A:360:LEU:CD1	2.44	0.47
1:A:26:PHE:HZ	1:A:72:GLU:HB3	1.78	0.47
1:A:113:CYS:SG	1:A:181:TYR:HB2	2.55	0.47
1:A:217:LEU:HD13	1:A:217:LEU:N	2.29	0.47
1:A:387:ASP:O	1:A:388:ILE:C	2.57	0.46
1:A:49:GLU:HB2	1:A:398:ARG:NH2	2.29	0.46
1:A:52:ASP:OD2	2:A:459:A2G:O3	2.33	0.46
1:A:29:LYS:NZ	1:A:90:ASP:OD1	2.40	0.46
1:A:377:CYS:HA	1:A:404:TRP:CE2	2.51	0.46
1:A:10:ARG:HB3	1:A:458:ALA:HB3	1.98	0.46
1:A:217:LEU:N	1:A:217:LEU:CD1	2.79	0.46
1:A:266:LEU:HD23	1:A:266:LEU:HA	1.68	0.46
1:A:352:ALA:N	1:A:353:PRO:CD	2.78	0.46
1:A:97:ASN:ND2	5:A:684:HOH:O	2.39	0.45
1:A:58:VAL:HG21	1:A:189:MET:HB2	1.98	0.45
1:A:422:ALA:O	1:A:425:HIS:HB2	2.16	0.45
1:A:447:LYS:HG3	1:A:448:PRO:N	2.32	0.45
1:A:228:SER:O	1:A:229:CYS:HB2	2.16	0.45
1:A:218:PRO:HG2	1:A:411:MET:HE1	1.93	0.45
1:A:234:LYS:CE	4:A:461:ANP:N3B	2.80	0.45
1:A:208:SER:HA	1:A:209:PRO:HA	1.79	0.45
1:A:201:THR:O	1:A:448:PRO:HB3	2.17	0.44
1:A:278:SER:HG	1:A:281:GLU:HG3	1.80	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:25:MET:CE	1:A:84:THR:HG22	2.48	0.44
1:A:182:ILE:HD12	1:A:182:ILE:HA	1.72	0.44
1:A:330:GLN:CB	1:A:374:MET:HE3	2.47	0.44
1:A:22:LEU:CD2	1:A:68:LEU:HG	2.48	0.44
1:A:56:TYR:CE1	1:A:269:GLU:CG	3.00	0.44
1:A:248:ARG:O	1:A:252:LYS:HG3	2.17	0.44
1:A:399:LEU:HD12	1:A:399:LEU:O	2.16	0.44
1:A:156:LEU:O	1:A:156:LEU:HD12	2.18	0.44
1:A:447:LYS:HE3	5:A:641:HOH:O	2.18	0.44
1:A:255:ALA:O	1:A:256:LYS:C	2.61	0.44
1:A:446:THR:CG2	1:A:447:LYS:N	2.80	0.44
1:A:291:HIS:ND1	1:A:293:GLU:O	2.49	0.44
1:A:238:SER:HA	1:A:319:ASN:HD21	1.83	0.43
1:A:285:VAL:O	1:A:288:ASP:N	2.50	0.43
1:A:286:THR:HG21	1:A:333:LYS:HD3	2.00	0.43
1:A:387:ASP:O	1:A:390:ARG:HB2	2.17	0.43
1:A:71:VAL:HG12	1:A:72:GLU:N	2.32	0.43
1:A:160:THR:O	1:A:161:VAL:C	2.60	0.43
1:A:417:LEU:CD1	1:A:421:LEU:HD11	2.45	0.43
1:A:266:LEU:N	1:A:270:GLU:OE1	2.42	0.43
1:A:52:ASP:OD1	1:A:53:TYR:N	2.51	0.43
1:A:74:VAL:HG22	1:A:130:MET:N	2.33	0.43
1:A:310:GLU:O	1:A:314:GLN:N	2.51	0.43
1:A:238:SER:HA	5:A:508:HOH:O	2.18	0.43
1:A:256:LYS:HD3	1:A:262:TRP:NE1	2.33	0.43
1:A:41:PRO:HG3	1:A:450:GLY:O	2.17	0.43
1:A:189:MET:HB3	1:A:189:MET:HE2	1.72	0.43
1:A:306:ILE:CG2	1:A:307:SER:N	2.80	0.43
1:A:327:LYS:HB3	1:A:330:GLN:OE1	2.18	0.43
1:A:396:GLY:O	1:A:410:SER:HB3	2.19	0.43
1:A:412:VAL:HG21	1:A:420:PHE:CG	2.54	0.43
1:A:145:SER:OG	1:A:190:ASP:OD2	2.37	0.43
1:A:364:MET:HE2	1:A:396:GLY:C	2.44	0.43
1:A:61:MET:HE3	1:A:446:THR:HG22	2.01	0.42
1:A:286:THR:CG2	1:A:333:LYS:HD3	2.49	0.42
1:A:60:PRO:HD2	1:A:205:ILE:HD12	2.01	0.42
1:A:79:LEU:HD11	1:A:81:LEU:HD21	2.01	0.42
1:A:198:GLU:O	1:A:201:THR:HG22	2.20	0.42
1:A:27:ASN:C	1:A:27:ASN:HD22	2.27	0.42
1:A:388:ILE:O	1:A:389:CYS:C	2.58	0.42
1:A:280:GLU:O	1:A:283:LEU:HB2	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:330:GLN:HA	1:A:374:MET:HE3	2.02	0.42
1:A:345:PHE:C	1:A:345:PHE:CD2	2.98	0.42
1:A:77:TYR:O	1:A:127:LEU:HD23	2.20	0.41
1:A:16:HIS:O	1:A:17:PRO:C	2.59	0.41
1:A:277:ILE:HD12	1:A:282:MET:HG2	2.01	0.41
1:A:158:THR:O	1:A:162:LEU:HG	2.20	0.41
1:A:207:PHE:O	1:A:208:SER:C	2.62	0.41
1:A:301:CYS:SG	1:A:308:LEU:HA	2.60	0.41
1:A:413:PRO:O	1:A:414:ALA:C	2.64	0.41
1:A:429:TYR:CE2	1:A:442:SER:HB2	2.56	0.41
1:A:234:LYS:HE2	4:A:461:ANP:PA	2.60	0.41
1:A:228:SER:HB3	1:A:406:GLY:O	2.20	0.41
1:A:238:SER:HB3	1:A:319:ASN:ND2	2.36	0.41
1:A:456:LEU:HD23	1:A:456:LEU:HA	1.85	0.41
1:A:6:PRO:HB3	5:A:477:HOH:O	2.20	0.41
1:A:77:TYR:O	1:A:94:SER:HA	2.21	0.40
1:A:79:LEU:O	1:A:92:SER:HA	2.21	0.40
1:A:147:SER:HB3	4:A:461:ANP:O5'	2.21	0.40
1:A:169:VAL:HG12	1:A:170:GLU:N	2.36	0.40
1:A:25:MET:HE1	1:A:84:THR:CB	2.48	0.40
1:A:210:LEU:HD12	1:A:210:LEU:HA	1.84	0.40
1:A:277:ILE:CD1	1:A:282:MET:HG2	2.51	0.40
1:A:25:MET:HE3	1:A:84:THR:HG22	2.03	0.40
1:A:81:LEU:HD12	1:A:108:HIS:HB2	2.03	0.40

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	447/478 (94%)	399 (89%)	41 (9%)	7 (2%)	7 6

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	359	LEU
1	A	346	LYS
1	A	60	PRO
1	A	347	LYS
1	A	105	PRO
1	A	417	LEU
1	A	388	ILE

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	383/407 (94%)	326 (85%)	57 (15%)	3 2

All (57) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	THR
1	A	15	GLU
1	A	28	SER
1	A	32	SER
1	A	37	TYR
1	A	39	ARG
1	A	44	VAL
1	A	51	ILE
1	A	59	LEU
1	A	65	GLN
1	A	97	ASN
1	A	99	GLN
1	A	101	ASP
1	A	102	LYS
1	A	106	LEU
1	A	125	SER
1	A	141	SER
1	A	156	LEU

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Mol	Chain	Res	Type
1	A	169	VAL
1	A	182	ILE
1	A	203	LYS
1	A	204	LEU
1	A	211	ARG
1	A	214	ASP
1	A	217	LEU
1	A	228	SER
1	A	231	GLU
1	A	232	MET
1	A	234	LYS
1	A	253	LEU
1	A	258	LYS
1	A	259	SER
1	A	260	LEU
1	A	264	LYS
1	A	277	ILE
1	A	280	GLU
1	A	282	MET
1	A	309	GLU
1	A	312	ARG
1	A	314	GLN
1	A	315	ILE
1	A	324	LEU
1	A	331	ARG
1	A	333	LYS
1	A	344	GLN
1	A	356	MET
1	A	369	MET
1	A	384	GLN
1	A	386	VAL
1	A	388	ILE
1	A	400	THR
1	A	410	SER
1	A	411	MET
1	A	417	LEU
1	A	425	HIS
1	A	442	SER
1	A	447	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	16	HIS
1	A	27	ASN
1	A	65	GLN
1	A	80	GLN
1	A	97	ASN
1	A	165	ASN
1	A	233	ASN
1	A	241	ASN
1	A	319	ASN
1	A	366	GLN
1	A	395	GLN
1	A	423	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](#)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 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	A2G	A	459	-	15,15,15	1.08	1 (6%)	21,21,21	2.92	6 (28%)
4	ANP	A	461	3	33,33,33	1.32	5 (15%)	45,52,52	1.60	7 (15%)

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	A2G	A	459	-	-	1/6/26/26	0/1/1/1
4	ANP	A	461	3	-	5/18/38/38	0/3/3/3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	461	ANP	C6-N6	-3.38	1.25	1.34
2	A	459	A2G	C1-C2	2.81	1.56	1.52
4	A	461	ANP	PB-O1B	2.55	1.50	1.46
4	A	461	ANP	PG-O1G	2.31	1.49	1.46
4	A	461	ANP	C2-N3	-2.25	1.29	1.33
4	A	461	ANP	PB-O2B	-2.08	1.51	1.56

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	459	A2G	O5-C1-C2	8.40	117.96	109.52
2	A	459	A2G	O5-C5-C4	6.11	120.70	109.70
2	A	459	A2G	C1-C2-C3	5.78	118.42	110.54
4	A	461	ANP	C2-N1-C6	4.73	126.49	118.73
4	A	461	ANP	O3A-PB-N3B	3.93	117.49	106.59
4	A	461	ANP	O1B-PB-N3B	-3.80	106.17	111.77
2	A	459	A2G	O3-C3-C2	-3.52	102.58	109.58
4	A	461	ANP	N3-C2-N1	-2.99	124.06	128.58
4	A	461	ANP	C5-C6-N6	2.81	130.24	123.29
4	A	461	ANP	C5-C6-N1	-2.52	111.11	117.51
4	A	461	ANP	O3G-PG-O1G	-2.38	107.47	113.45
2	A	459	A2G	C8-C7-N2	2.36	120.03	116.12
2	A	459	A2G	O7-C7-C8	-2.31	117.95	122.05

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	461	ANP	PA-O3A-PB-O2B
4	A	461	ANP	C5'-O5'-PA-O1A
2	A	459	A2G	O5-C5-C6-O6

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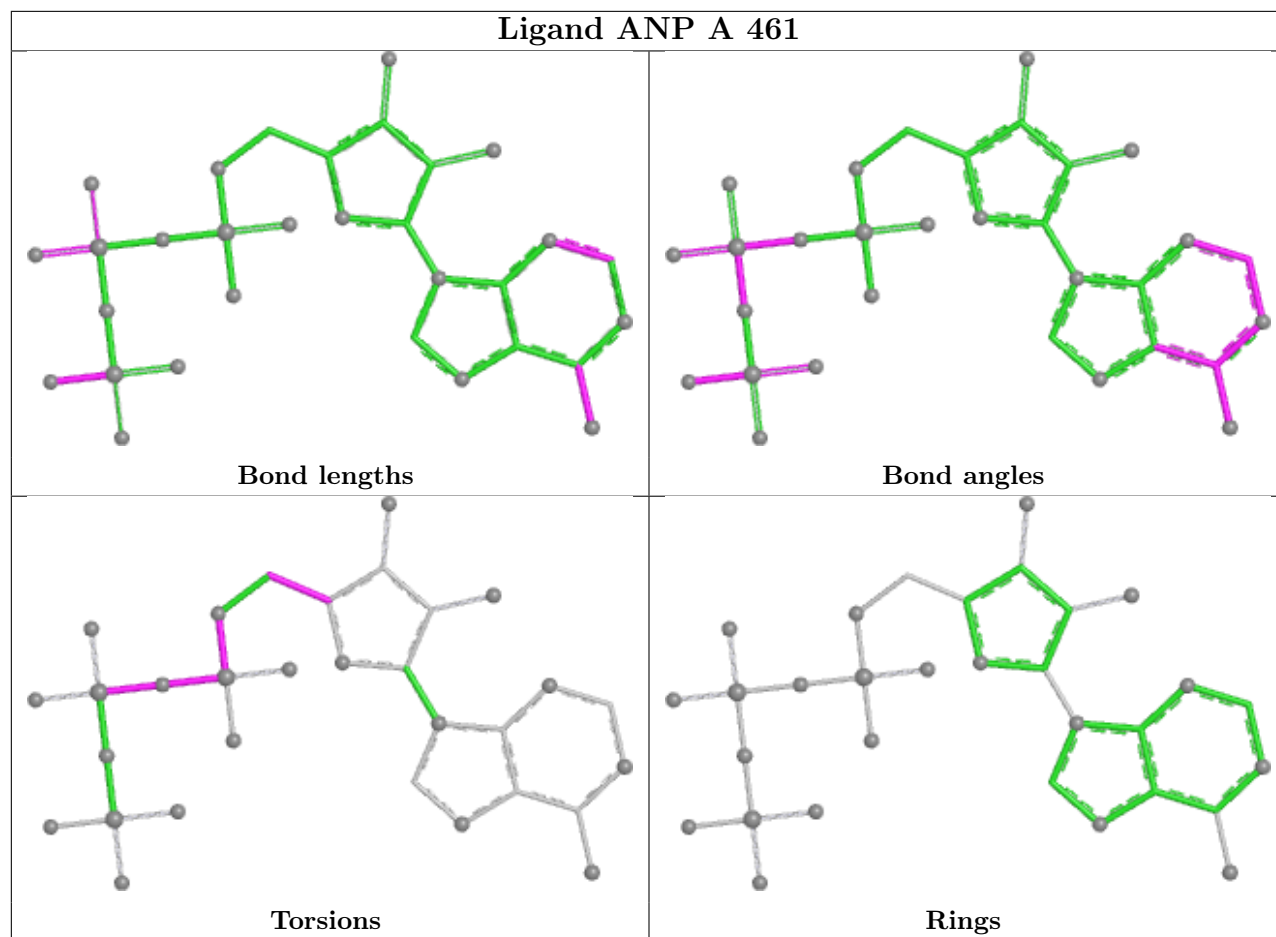
Mol	Chain	Res	Type	Atoms
4	A	461	ANP	PB-O3A-PA-O1A
4	A	461	ANP	C5'-O5'-PA-O3A
4	A	461	ANP	C3'-C4'-C5'-O5'

There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	459	A2G	1	0
4	A	461	ANP	9	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 [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	448/478 (93%)	-1.48	0 100 100	8, 26, 70, 94	3 (0%)

There are no RSRZ outliers to report.

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](#)

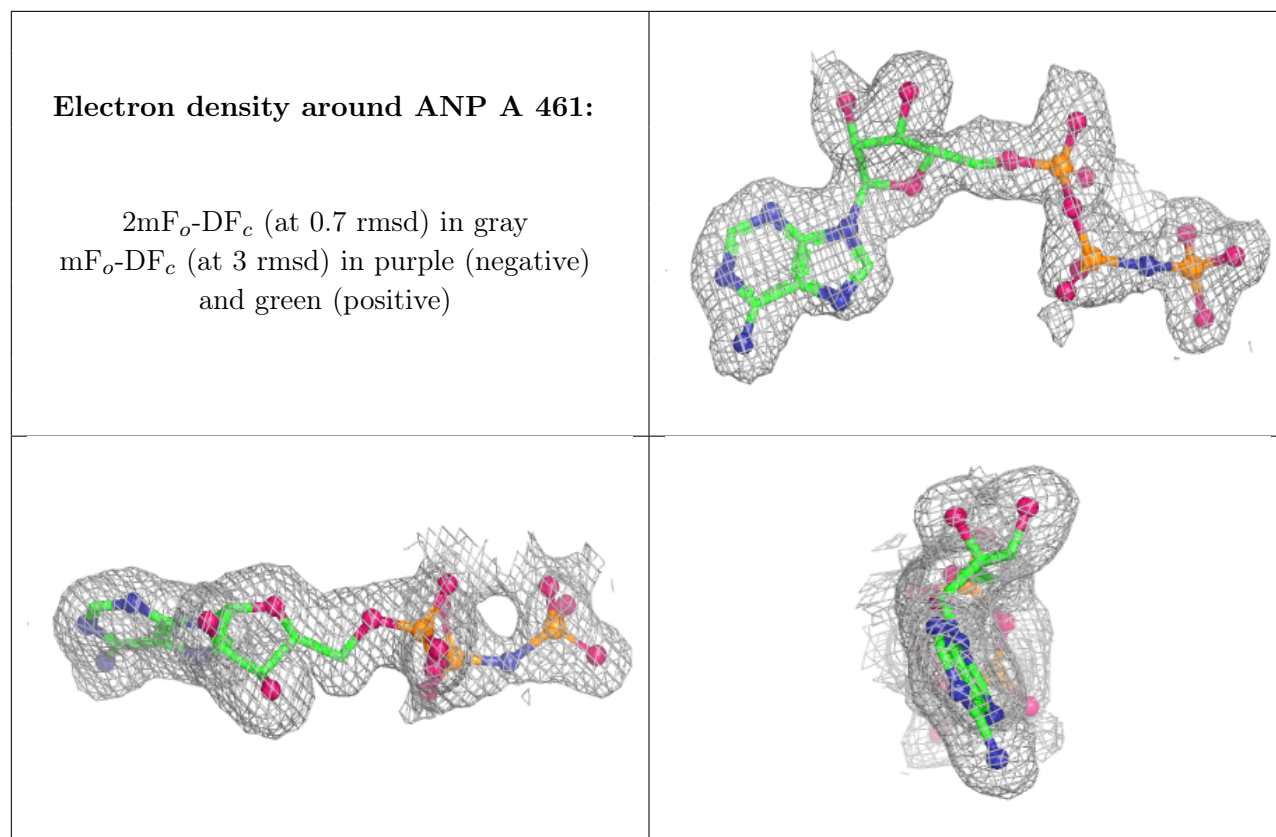
There are no oligosaccharides in this entry.

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(Å ²)	Q<0.9
2	A2G	A	459	15/15	1.00	0.02	3,13,22,29	0
3	MN	A	460	1/1	1.00	0.01	27,27,27,27	0
4	ANP	A	461	31/31	1.00	0.02	6,26,43,67	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.