Full wwPDB X-ray Structure Validation Report ⓘ

Jun 25, 2026 – 04:47 PM EDT

PDB ID	:	9MSK / pdb_00009msk
Title	:	Structure of hepatitis C virus envelope glycoprotein E2 core from isolate H77 bound to neutralizing antibody RM3-26
Authors	:	Nguyen, T.K.Y.; Wilson, I.A.
Deposited on	:	2025-01-09
Resolution	:	2.23 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:

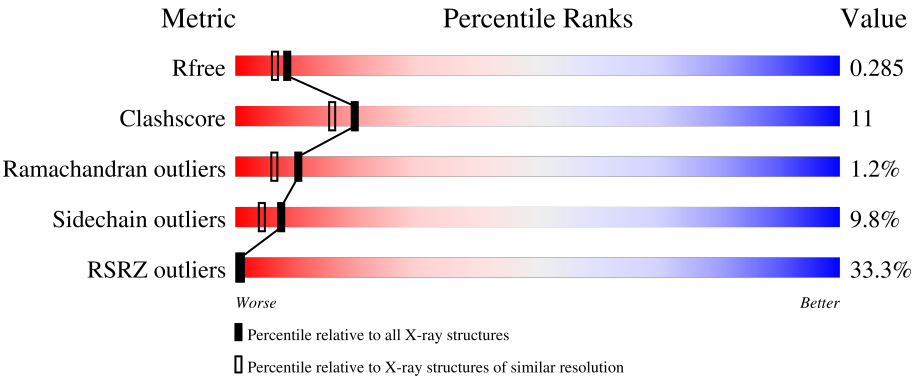
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal 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 (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.23 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	3416 (2.26-2.22)
Clashscore	190562	3556 (2.26-2.22)
Ramachandran outliers	187476	3500 (2.26-2.22)
Sidechain outliers	187428	3501 (2.26-2.22)
RSRZ outliers	180081	3415 (2.26-2.22)

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 <=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	H	223	27% 74% 23%
2	L	212	20% 79% 19%
3	E	191	37% 18% 20% 7% 54%

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	NAG	E	701	X	-	-	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 3981 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 RM3-26 fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	H	223	1656	1048	279	325	4	0	0	0

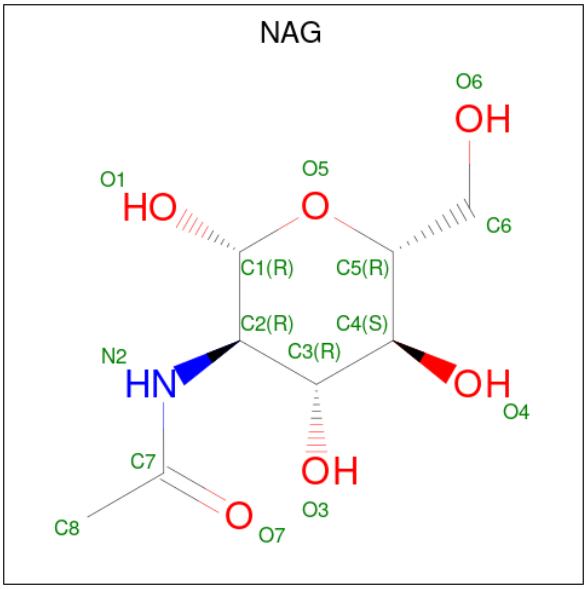
- Molecule 2 is a protein called RM3-26 fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	212	1623	1012	269	336	6	0	0	0

- Molecule 3 is a protein called Envelope glycoprotein E2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	87	678	443	115	110	10	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	E	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is water.

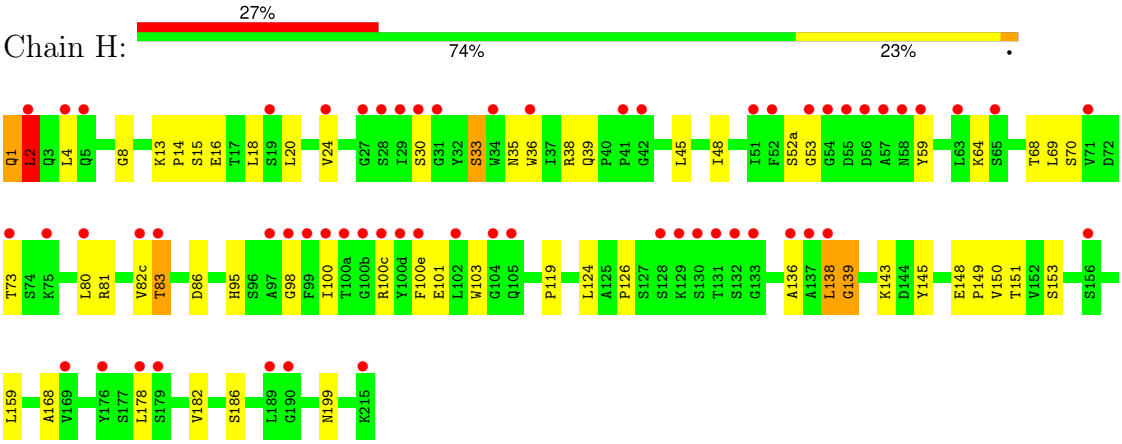
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	6	Total	O	0	0
			6	6		
5	L	3	Total	O	0	0
			3	3		
5	E	1	Total	O	0	0
			1	1		

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.

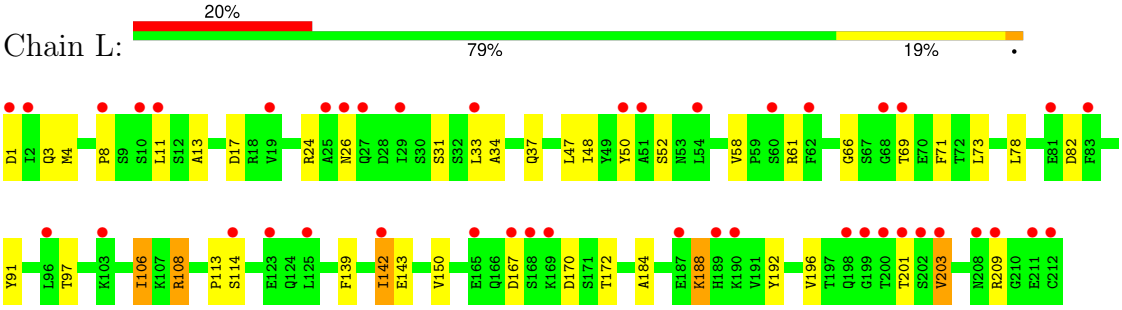
• Molecule 1: RM3-26 fab heavy chain

Chain H:



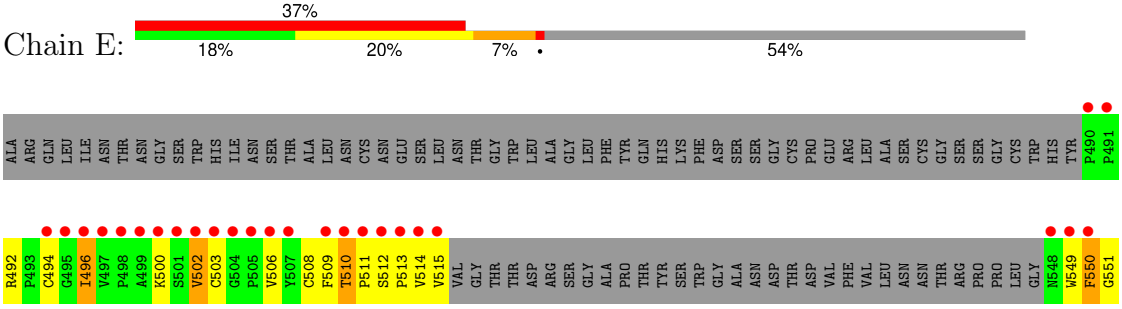
• Molecule 2: RM3-26 fab light chain

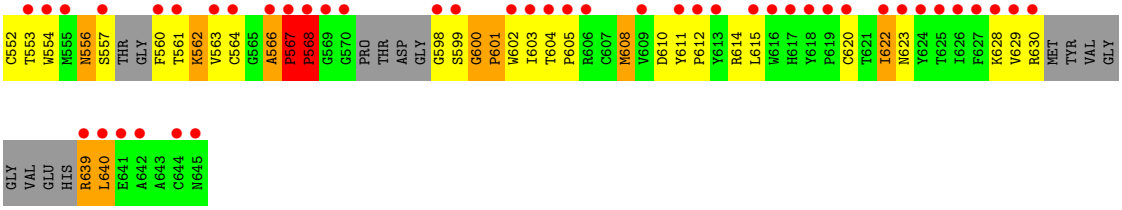
Chain L:



• Molecule 3: Envelope glycoprotein E2

Chain E:




C552
T553
W554
M555
N556
S557
THR
GLY
F560
T561
K562
V563
C564
G565
A566
P567
P568
G569
G570
PRO
THR
ASP
GLY
G598
S599
G600
P601
W602
I603
T604
P605
R606
C607
M608
V609
D610
Y611
P612
Y613
R614
L615
W616
H617
Y618
P619
C620
T621
I622
N623
Y624
T625
I626
P627
K628
V629
R630
MET
TYR
VAL
GLY

GLY
VAL
GLU
HIS
R639
L640
E641
A642
A643
C644
N645

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	79.54Å 73.95Å 122.45Å 90.00° 90.44° 90.00°	Depositor
Resolution (Å)	36.97 – 2.23 36.97 – 2.23	Depositor EDS
% Data completeness (in resolution range)	92.3 (36.97-2.23) 97.8 (36.97-2.23)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.16 (at 2.24Å)	Xtriage
Refinement program	PHENIX (1.19.2_4158: ???)	Depositor
R, R_{free}	0.263 , 0.276 0.276 , 0.285	Depositor DCC
R_{free} test set	1761 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	53.6	Xtriage
Anisotropy	0.207	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 38.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.024 for -h,-k,l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	3981	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 6.04% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: NAG

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	H	0.77	0/1698	1.13	9/2317 (0.4%)
2	L	0.75	0/1655	1.08	3/2246 (0.1%)
3	E	0.86	0/704	1.64	3/961 (0.3%)
All	All	0.78	0/4057	1.21	15/5524 (0.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	H	0	2
2	L	0	2
3	E	0	3
All	All	0	7

There are no bond length outliers.

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	E	550	PHE	N-CA-C	-31.00	71.75	110.19
3	E	550	PHE	CB-CA-C	11.37	136.66	111.30
1	H	101	GLU	N-CA-C	-9.13	102.29	113.97
2	L	52	SER	N-CA-C	7.58	120.09	110.61
1	H	100(e)	PHE	N-CA-C	-6.87	99.72	109.96
1	H	100(e)	PHE	CB-CA-C	6.78	119.93	110.16
1	H	139	GLY	N-CA-C	6.74	120.07	111.37
2	L	52	SER	N-CA-CB	-6.28	102.86	111.65
1	H	98	GLY	CA-C-O	-5.63	115.97	120.81
1	H	2	LEU	CB-CA-C	5.55	116.63	109.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	L	17	ASP	CB-CA-C	-5.48	100.88	109.70
1	H	149	PRO	CB-CA-C	-5.25	98.87	112.00
1	H	101	GLU	N-CA-CB	5.18	117.87	110.67
3	E	510	THR	N-CA-C	-5.17	101.50	109.41
1	H	2	LEU	N-CA-C	-5.15	103.02	110.64

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	E	492	ARG	Sidechain
3	E	630	ARG	Sidechain
3	E	639	ARG	Sidechain
1	H	100(c)	ARG	Sidechain
1	H	81	ARG	Sidechain
2	L	108	ARG	Sidechain
2	L	209	ARG	Sidechain

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	H	1656	0	1634	32	0
2	L	1623	0	1573	24	1
3	E	678	0	648	36	0
4	E	14	0	13	2	0
5	E	1	0	0	0	0
5	H	6	0	0	0	0
5	L	3	0	0	0	0
All	All	3981	0	3868	90	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 11.

All (90) 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)
3:E:552:CYS:H	3:E:564:CYS:HB3	1.15	1.07
3:E:549:TRP:C	3:E:550:PHE:O	1.79	1.04
3:E:551:GLY:HA3	3:E:600:GLY:HA2	1.48	0.94
1:H:138:LEU:HD22	1:H:139:GLY:H	1.52	0.73
3:E:552:CYS:N	3:E:564:CYS:HB3	1.99	0.72
3:E:510:THR:O	3:E:511:PRO:C	2.32	0.70
1:H:33:SER:HB2	1:H:95:HIS:CE1	2.28	0.68
3:E:604:THR:HG22	3:E:605:PRO:HD2	1.76	0.68
1:H:136:ALA:HB2	1:H:186:SER:HB3	1.76	0.67
1:H:16:GLU:O	1:H:82(c):VAL:HG22	1.95	0.66
3:E:512:SER:HB2	3:E:640:LEU:HD21	1.77	0.65
2:L:8:PRO:HG3	2:L:11:LEU:HD12	1.79	0.64
1:H:73:THR:HG21	4:E:701:NAG:C8	2.28	0.63
2:L:31:SER:OG	2:L:50:TYR:CZ	2.51	0.63
1:H:138:LEU:HD22	1:H:139:GLY:N	2.14	0.62
3:E:512:SER:HA	3:E:640:LEU:HD11	1.83	0.61
1:H:53:GLY:HA3	3:E:623:ASN:OD1	2.01	0.60
1:H:1:GLN:O	1:H:2:LEU:C	2.44	0.59
1:H:30:SER:HA	1:H:52(a):SER:HB2	1.85	0.59
3:E:557:SER:C	3:E:560:PHE:HB2	2.28	0.58
3:E:502:VAL:HA	3:E:556:ASN:HA	1.86	0.58
3:E:557:SER:O	3:E:560:PHE:HB2	2.05	0.56
3:E:567:PRO:HB2	3:E:568:PRO:HD2	1.88	0.56
2:L:167:ASP:OD2	2:L:170:ASP:OD1	2.24	0.56
2:L:33:LEU:HD22	2:L:71:PHE:CD2	2.41	0.56
3:E:629:VAL:HG22	3:E:640:LEU:O	2.06	0.56
3:E:513:PRO:HD3	3:E:640:LEU:HD13	1.87	0.55
3:E:512:SER:CB	3:E:640:LEU:HD21	2.37	0.54
3:E:566:ALA:HB1	3:E:567:PRO:CD	2.38	0.54
2:L:113:PRO:HB3	2:L:139:PHE:HB3	1.89	0.54
3:E:508:CYS:HA	3:E:552:CYS:HA	1.89	0.54
3:E:502:VAL:HG23	3:E:554:TRP:CD1	2.43	0.53
2:L:142:ILE:O	2:L:143:GLU:C	2.53	0.52
1:H:38:ARG:HB3	1:H:48:ILE:HD11	1.91	0.52
1:H:18:LEU:C	1:H:18:LEU:HD23	2.35	0.52
3:E:602:TRP:CD2	3:E:608:MET:HB3	2.46	0.51
1:H:126:PRO:HD3	1:H:138:LEU:HD21	1.91	0.51
2:L:61:ARG:NH1	2:L:82:ASP:OD2	2.43	0.51
1:H:119:PRO:HB3	1:H:145:TYR:HB3	1.93	0.51
3:E:602:TRP:HA	3:E:608:MET:HA	1.91	0.51
2:L:34:ALA:HB2	2:L:91:TYR:HE2	1.77	0.50
2:L:8:PRO:CG	2:L:11:LEU:HD12	2.40	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:36:TRP:CD1	1:H:80:LEU:HB2	2.48	0.49
1:H:83:THR:N	1:H:86:ASP:OD2	2.45	0.48
1:H:151:THR:OG1	1:H:199:ASN:HB3	2.14	0.48
3:E:610:ASP:HA	3:E:614:ARG:HD3	1.96	0.47
3:E:598:GLY:O	3:E:599:SER:C	2.57	0.47
2:L:170:ASP:O	2:L:172:THR:HG23	2.14	0.47
2:L:3:GLN:HB2	2:L:26:ASN:HB2	1.96	0.46
1:H:14:PRO:O	1:H:82(c):VAL:HG23	2.15	0.46
3:E:566:ALA:HB1	3:E:567:PRO:HD2	1.98	0.46
1:H:59:TYR:HB2	1:H:64:LYS:HE2	1.97	0.45
1:H:39:GLN:HB2	1:H:45:LEU:HD23	1.98	0.45
3:E:551:GLY:CA	3:E:600:GLY:HA2	2.34	0.45
1:H:73:THR:HG21	4:E:701:NAG:H83	1.97	0.45
1:H:138:LEU:HB3	1:H:182:VAL:CG1	2.46	0.45
1:H:124:LEU:HB2	1:H:139:GLY:C	2.42	0.45
2:L:66:GLY:HA3	2:L:71:PHE:HA	1.98	0.45
3:E:502:VAL:HG23	3:E:554:TRP:HD1	1.82	0.45
2:L:1:ASP:OD1	2:L:97:THR:HG21	2.17	0.45
3:E:611:TYR:O	3:E:612:PRO:C	2.60	0.45
3:E:567:PRO:O	3:E:568:PRO:C	2.59	0.44
1:H:8:GLY:HA3	1:H:20:LEU:HD23	1.98	0.44
2:L:37:GLN:HB2	2:L:47:LEU:HD11	2.00	0.44
1:H:168:ALA:HB2	1:H:178:LEU:HD12	2.00	0.44
3:E:554:TRP:CZ2	3:E:562:LYS:HB2	2.53	0.43
2:L:47:LEU:HA	2:L:58:VAL:HG21	2.00	0.43
2:L:47:LEU:C	2:L:48:ILE:HG13	2.43	0.43
1:H:59:TYR:HB2	1:H:64:LYS:HG2	2.01	0.43
3:E:496:ILE:HD13	3:E:496:ILE:HA	1.71	0.43
2:L:24:ARG:HA	2:L:69:THR:O	2.19	0.42
2:L:196:VAL:HB	2:L:203:VAL:HG23	2.00	0.42
3:E:622:ILE:H	3:E:622:ILE:HG12	1.64	0.42
1:H:18:LEU:HD21	1:H:20:LEU:HG	2.02	0.42
1:H:103:TRP:N	1:H:103:TRP:CD1	2.88	0.42
3:E:510:THR:C	3:E:512:SER:N	2.75	0.42
1:H:1:GLN:HE21	1:H:1:GLN:HB3	1.47	0.42
1:H:159:LEU:HD21	1:H:182:VAL:HG21	2.01	0.42
2:L:48:ILE:CD1	2:L:73:LEU:HD13	2.50	0.41
2:L:78:LEU:HD21	2:L:106:ILE:HD12	2.01	0.41
3:E:509:PHE:O	3:E:550:PHE:HB2	2.20	0.41
2:L:13:ALA:HB3	2:L:78:LEU:HD22	2.02	0.41
3:E:601:PRO:HG2	3:E:602:TRP:CD1	2.55	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:138:LEU:HB3	1:H:182:VAL:HG12	2.03	0.41
3:E:554:TRP:CE2	3:E:562:LYS:HB2	2.56	0.41
1:H:30:SER:HB3	3:E:615:LEU:HD11	2.02	0.41
2:L:150:VAL:HG22	2:L:192:TYR:CD2	2.56	0.41
2:L:106:ILE:N	2:L:106:ILE:HD13	2.36	0.40
1:H:4:LEU:HD12	1:H:24:VAL:HG12	2.03	0.40
2:L:184:ALA:O	2:L:188:LYS:HG2	2.22	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)
2:L:4:MET:O	2:L:188:LYS:NZ[2_556]	1.97	0.23

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	H	221/223 (99%)	206 (93%)	14 (6%)	1 (0%)	24 23
2	L	210/212 (99%)	196 (93%)	14 (7%)	0	100 100
3	E	77/191 (40%)	59 (77%)	13 (17%)	5 (6%)	1 0
All	All	508/626 (81%)	461 (91%)	41 (8%)	6 (1%)	10 6

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	100	ILE
3	E	568	PRO
3	E	601	PRO
3	E	567	PRO
3	E	566	ALA

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Mol	Chain	Res	Type
3	E	600	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	H	188/188 (100%)	173 (92%)	15 (8%)	11 8
2	L	186/186 (100%)	179 (96%)	7 (4%)	29 34
3	E	75/159 (47%)	53 (71%)	22 (29%)	0 0
All	All	449/533 (84%)	405 (90%)	44 (10%)	7 4

All (44) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	1	GLN
1	H	2	LEU
1	H	13	LYS
1	H	15	SER
1	H	33	SER
1	H	35	ASN
1	H	68	THR
1	H	69	LEU
1	H	70	SER
1	H	83	THR
1	H	138	LEU
1	H	143	LYS
1	H	148	GLU
1	H	150	VAL
1	H	153	SER
2	L	106	ILE
2	L	108	ARG
2	L	114	SER
2	L	142	ILE
2	L	188	LYS
2	L	201	THR

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Mol	Chain	Res	Type
2	L	203	VAL
3	E	494	CYS
3	E	496	ILE
3	E	500	LYS
3	E	502	VAL
3	E	503	CYS
3	E	506	VAL
3	E	514	VAL
3	E	515	VAL
3	E	553	THR
3	E	556	ASN
3	E	561	THR
3	E	562	LYS
3	E	563	VAL
3	E	567	PRO
3	E	568	PRO
3	E	603	ILE
3	E	608	MET
3	E	620	CYS
3	E	622	ILE
3	E	628	LYS
3	E	639	ARG
3	E	640	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	1	GLN
2	L	208	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)

1 ligand is 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	NAG	E	701	3	14,14,15	0.40	0	17,19,21	0.81	0

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	NAG	E	701	3	1/1/5/7	0/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	E	701	NAG	C1

There are no torsion outliers.

There are no ring outliers.

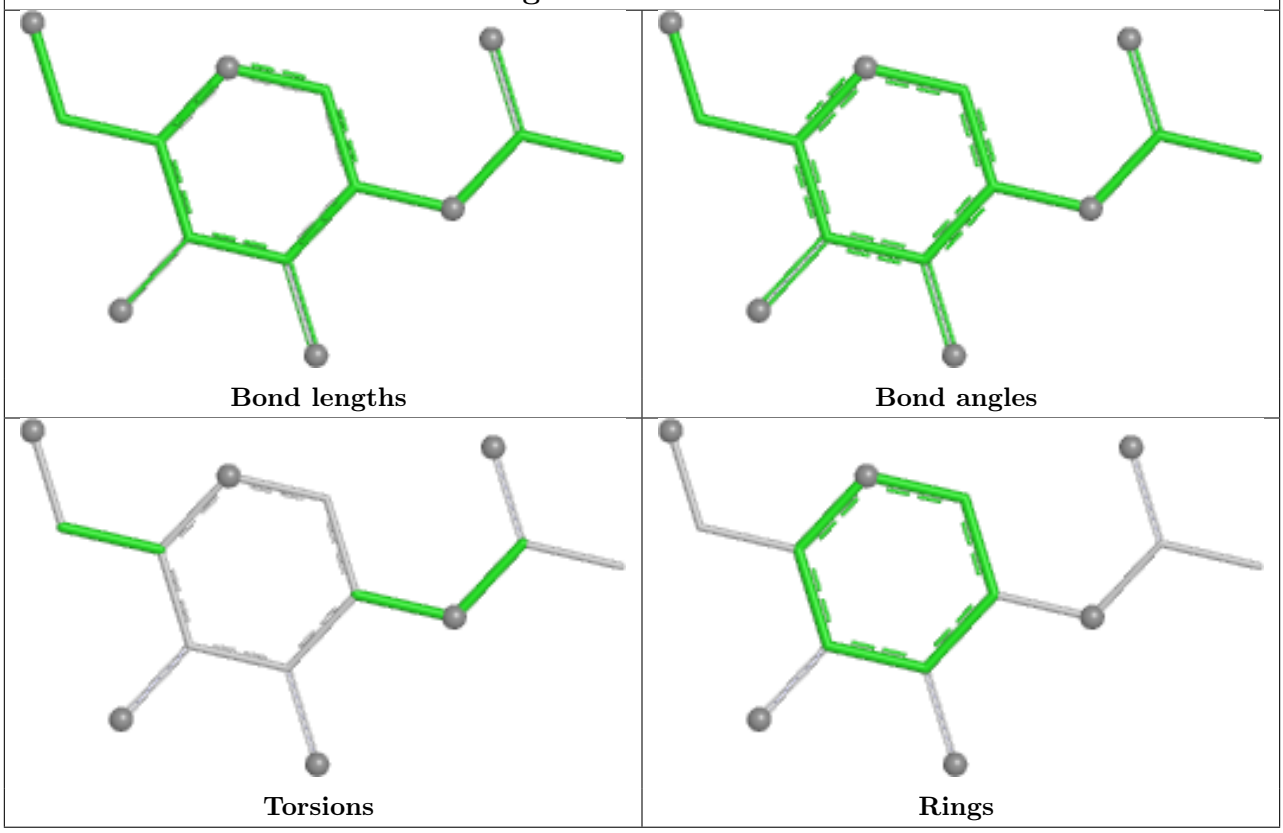
1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	E	701	NAG	2	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 then 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.

Ligand NAG E 701



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, 95^{th} 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	H	223/223 (100%)	1.39	60 (26%)	1	1	39, 59, 94, 103	0
2	L	212/212 (100%)	1.34	43 (20%)	3	2	39, 66, 88, 173	0
3	E	87/191 (45%)	3.36	71 (81%)	0	0	30, 122, 146, 155	0
All	All	522/626 (83%)	1.70	174 (33%)	1	0	30, 67, 132, 173	0

All (174) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	E	549	TRP	8.9
3	E	567	PRO	8.8
3	E	548	ASN	8.0
3	E	568	PRO	7.7
3	E	550	PHE	6.9
2	L	212	CYS	6.7
3	E	569	GLY	6.6
3	E	622	ILE	6.1
3	E	560	PHE	5.6
3	E	598	GLY	5.6
1	H	137	ALA	5.5
1	H	131	THR	5.4
3	E	499	ALA	5.2
2	L	51	ALA	5.1
3	E	618	TYR	5.1
1	H	138	LEU	4.8
3	E	490	PRO	4.8
1	H	100(a)	THR	4.6
1	H	128	SER	4.6
1	H	176	TYR	4.6
3	E	515	VAL	4.6
1	H	29	ILE	4.6
3	E	505	PRO	4.5

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Mol	Chain	Res	Type	RSRZ
3	E	495	GLY	4.5
3	E	496	ILE	4.4
2	L	54	LEU	4.3
3	E	603	ILE	4.3
2	L	1	ASP	4.3
1	H	97	ALA	4.2
3	E	566	ALA	4.2
1	H	99	PHE	4.2
1	H	132	SER	4.2
3	E	625	THR	4.2
3	E	511	PRO	4.1
2	L	201	THR	4.1
2	L	69	THR	4.0
3	E	570	GLY	3.9
3	E	627	PHE	3.9
3	E	506	VAL	3.9
2	L	62	PHE	3.9
1	H	36	TRP	3.8
1	H	53	GLY	3.7
3	E	604	THR	3.7
1	H	100(b)	GLY	3.7
3	E	497	VAL	3.7
3	E	623	ASN	3.7
3	E	504	GLY	3.7
3	E	557	SER	3.7
3	E	599	SER	3.7
3	E	563	VAL	3.6
3	E	629	VAL	3.6
2	L	68	GLY	3.6
3	E	602	TRP	3.6
3	E	498	PRO	3.6
1	H	130	SER	3.5
2	L	33	LEU	3.5
1	H	54	GLY	3.5
3	E	645	ASN	3.5
3	E	553	THR	3.4
2	L	203	VAL	3.4
3	E	554	TRP	3.4
1	H	133	GLY	3.4
1	H	2	LEU	3.4
3	E	616	TRP	3.4
1	H	178	LEU	3.3

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Mol	Chain	Res	Type	RSRZ
1	H	100	ILE	3.3
3	E	640	LEU	3.3
1	H	100(e)	PHE	3.3
1	H	34	TRP	3.3
2	L	26	ASN	3.3
1	H	136	ALA	3.2
3	E	503	CYS	3.2
3	E	555	MET	3.2
3	E	500	LYS	3.2
1	H	63	LEU	3.2
2	L	25	ALA	3.2
2	L	11	LEU	3.2
2	L	27	GLN	3.2
3	E	611	TYR	3.1
1	H	31	GLY	3.1
3	E	512	SER	3.1
3	E	564	CYS	3.1
3	E	514	VAL	3.1
3	E	639	ARG	3.1
2	L	50	TYR	3.0
2	L	208	ASN	3.0
2	L	29	ILE	3.0
2	L	142	ILE	3.0
3	E	624	TYR	3.0
3	E	628	LYS	3.0
3	E	494	CYS	3.0
3	E	626	ILE	3.0
2	L	83	PHE	2.9
1	H	100(c)	ARG	2.8
3	E	613	TYR	2.8
1	H	169	VAL	2.8
3	E	502	VAL	2.8
2	L	19	VAL	2.8
2	L	190	LYS	2.8
3	E	510	THR	2.8
1	H	27	GLY	2.8
3	E	642	ALA	2.8
1	H	55	ASP	2.8
1	H	105	GLN	2.8
2	L	187	GLU	2.8
1	H	179	SER	2.7
1	H	52	PHE	2.7

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Mol	Chain	Res	Type	RSRZ
1	H	42	GLY	2.7
1	H	30	SER	2.7
3	E	507	TYR	2.6
2	L	202	SER	2.6
2	L	168	SER	2.6
2	L	125	LEU	2.6
3	E	615	LEU	2.6
3	E	612	PRO	2.6
1	H	58	ASN	2.5
3	E	617	HIS	2.5
3	E	609	VAL	2.5
1	H	100(d)	TYR	2.5
3	E	513	PRO	2.5
1	H	57	ALA	2.4
2	L	169	LYS	2.4
1	H	4	LEU	2.4
1	H	189	LEU	2.4
2	L	103	LYS	2.4
3	E	644	CYS	2.4
1	H	71	VAL	2.4
2	L	209	ARG	2.4
2	L	199	GLY	2.4
1	H	51	ILE	2.4
2	L	165	GLU	2.3
2	L	189	HIS	2.3
3	E	641	GLU	2.3
1	H	73	THR	2.3
3	E	606	ARG	2.3
1	H	80	LEU	2.3
1	H	102	LEU	2.3
2	L	200	THR	2.3
1	H	28	SER	2.3
1	H	5	GLN	2.3
1	H	24	VAL	2.3
2	L	211	GLU	2.2
3	E	501	SER	2.2
2	L	8	PRO	2.2
3	E	605	PRO	2.2
1	H	56	ASP	2.2
3	E	561	THR	2.2
3	E	491	PRO	2.2
1	H	215	LYS	2.2

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Mol	Chain	Res	Type	RSRZ
3	E	620	CYS	2.2
1	H	83	THR	2.2
1	H	75	LYS	2.1
3	E	619	PRO	2.1
1	H	98	GLY	2.1
2	L	10	SER	2.1
2	L	2	ILE	2.1
2	L	81	GLU	2.1
2	L	167	ASP	2.1
1	H	104	GLY	2.1
1	H	190	GLY	2.1
1	H	156	SER	2.1
1	H	129	LYS	2.1
2	L	123	GLU	2.1
1	H	59	TYR	2.1
1	H	19	SER	2.0
1	H	65	SER	2.0
2	L	60	SER	2.0
2	L	198	GLN	2.0
2	L	96	LEU	2.0
1	H	82(c)	VAL	2.0
3	E	630	ARG	2.0
3	E	509	PHE	2.0
2	L	114	SER	2.0
1	H	41	PRO	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)

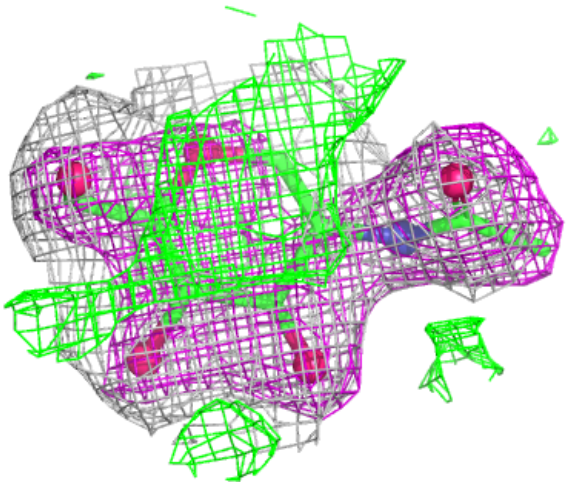
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

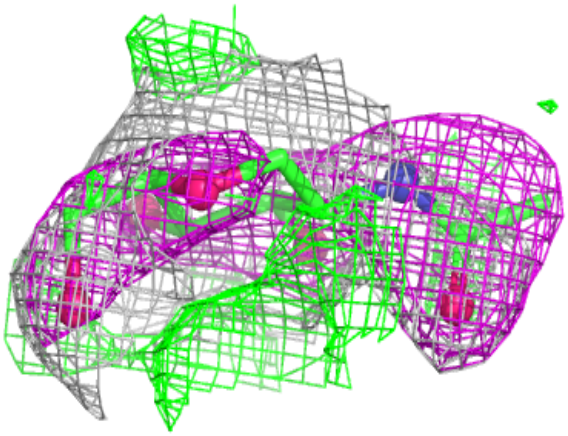
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	NAG	E	701	14/15	0.57	0.15	30,30,30,30	0

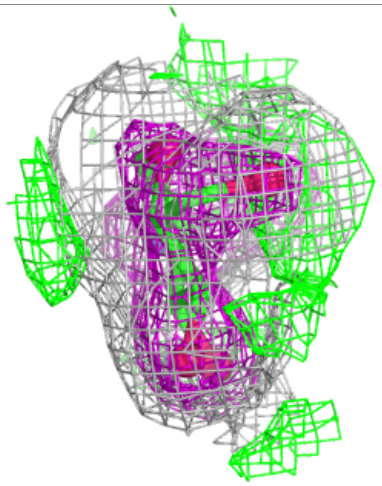
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAG E 701:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)







6.5 Other polymers

There are no such residues in this entry.