Full wwPDB EM Validation Report ⓘ

Jul 9, 2025 – 02:26 PM JST

PDB ID	:	8ZKS / pdb_00008zks
EMDB ID	:	EMD-60207
Title	:	Structure of Polycystin-1/Polycystin-2 complex with GOF mutation
Authors	:	Chen, M.Y.; Su, Q.; Shi, Y.G.
Deposited on	:	2024-05-17
Resolution	:	3.21 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp
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:

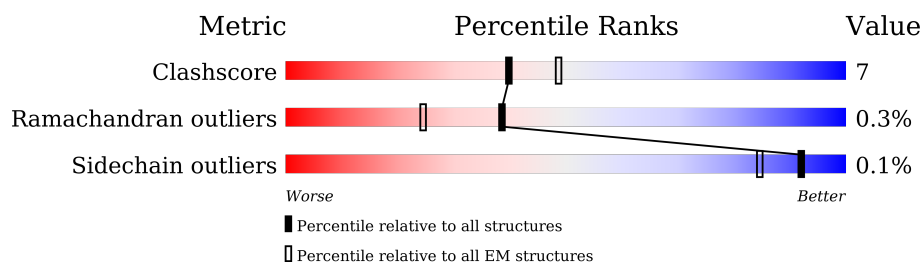|		
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.21 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	Percentile Ranks	Value
Clashscore		7
Ramachandran outliers		0.3%
Sidechain outliers		0.1%

Worse ... *Better*

▮ Percentile relative to all structures
❒ Percentile relative to all EM structures

Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	A	1261	49% 8% • 42%
2	B	1007	41% 7% 52%
2	C	1007	39% 8% 52%
2	D	1007	45% • 52%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 16170 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Polycystin-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	731	Total 5402	C 3483	N 980	O 923	S 16	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	3043	MET	-	initiating methionine	UNP P98161
A	3044	ASP	-	expression tag	UNP P98161
A	3045	TYR	-	expression tag	UNP P98161
A	3046	LYS	-	expression tag	UNP P98161
A	3047	ASP	-	expression tag	UNP P98161
A	3048	ASP	-	expression tag	UNP P98161
A	3049	ASP	-	expression tag	UNP P98161
A	3050	ASP	-	expression tag	UNP P98161
A	3051	LYS	-	expression tag	UNP P98161

- Molecule 2 is a protein called Polycystin-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	480	Total 3959	C 2607	N 626	O 705	S 21	0	0
2	C	480	Total 3959	C 2607	N 626	O 705	S 21	0	0
2	D	481	Total 2765	C 1714	N 508	O 536	S 7	0	0

There are 117 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-38	MET	-	initiating methionine	UNP Q13563
B	-37	GLY	-	expression tag	UNP Q13563
B	-36	ALA	-	expression tag	UNP Q13563
B	-35	SER	-	expression tag	UNP Q13563

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-34	SER	-	expression tag	UNP Q13563
B	-33	ALA	-	expression tag	UNP Q13563
B	-32	TRP	-	expression tag	UNP Q13563
B	-31	SER	-	expression tag	UNP Q13563
B	-30	HIS	-	expression tag	UNP Q13563
B	-29	PRO	-	expression tag	UNP Q13563
B	-28	GLN	-	expression tag	UNP Q13563
B	-27	PHE	-	expression tag	UNP Q13563
B	-26	GLU	-	expression tag	UNP Q13563
B	-25	LYS	-	expression tag	UNP Q13563
B	-24	GLY	-	expression tag	UNP Q13563
B	-23	GLY	-	expression tag	UNP Q13563
B	-22	GLY	-	expression tag	UNP Q13563
B	-21	SER	-	expression tag	UNP Q13563
B	-20	GLY	-	expression tag	UNP Q13563
B	-19	GLY	-	expression tag	UNP Q13563
B	-18	GLY	-	expression tag	UNP Q13563
B	-17	SER	-	expression tag	UNP Q13563
B	-16	GLY	-	expression tag	UNP Q13563
B	-15	GLY	-	expression tag	UNP Q13563
B	-14	SER	-	expression tag	UNP Q13563
B	-13	ALA	-	expression tag	UNP Q13563
B	-12	TRP	-	expression tag	UNP Q13563
B	-11	SER	-	expression tag	UNP Q13563
B	-10	HIS	-	expression tag	UNP Q13563
B	-9	PRO	-	expression tag	UNP Q13563
B	-8	GLN	-	expression tag	UNP Q13563
B	-7	PHE	-	expression tag	UNP Q13563
B	-6	GLU	-	expression tag	UNP Q13563
B	-5	LYS	-	expression tag	UNP Q13563
B	-4	GLY	-	expression tag	UNP Q13563
B	-3	SER	-	linker	UNP Q13563
B	-2	ALA	-	linker	UNP Q13563
B	-1	ALA	-	linker	UNP Q13563
B	0	ALA	-	linker	UNP Q13563
C	-38	MET	-	initiating methionine	UNP Q13563
C	-37	GLY	-	expression tag	UNP Q13563
C	-36	ALA	-	expression tag	UNP Q13563
C	-35	SER	-	expression tag	UNP Q13563
C	-34	SER	-	expression tag	UNP Q13563
C	-33	ALA	-	expression tag	UNP Q13563
C	-32	TRP	-	expression tag	UNP Q13563

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-31	SER	-	expression tag	UNP Q13563
C	-30	HIS	-	expression tag	UNP Q13563
C	-29	PRO	-	expression tag	UNP Q13563
C	-28	GLN	-	expression tag	UNP Q13563
C	-27	PHE	-	expression tag	UNP Q13563
C	-26	GLU	-	expression tag	UNP Q13563
C	-25	LYS	-	expression tag	UNP Q13563
C	-24	GLY	-	expression tag	UNP Q13563
C	-23	GLY	-	expression tag	UNP Q13563
C	-22	GLY	-	expression tag	UNP Q13563
C	-21	SER	-	expression tag	UNP Q13563
C	-20	GLY	-	expression tag	UNP Q13563
C	-19	GLY	-	expression tag	UNP Q13563
C	-18	GLY	-	expression tag	UNP Q13563
C	-17	SER	-	expression tag	UNP Q13563
C	-16	GLY	-	expression tag	UNP Q13563
C	-15	GLY	-	expression tag	UNP Q13563
C	-14	SER	-	expression tag	UNP Q13563
C	-13	ALA	-	expression tag	UNP Q13563
C	-12	TRP	-	expression tag	UNP Q13563
C	-11	SER	-	expression tag	UNP Q13563
C	-10	HIS	-	expression tag	UNP Q13563
C	-9	PRO	-	expression tag	UNP Q13563
C	-8	GLN	-	expression tag	UNP Q13563
C	-7	PHE	-	expression tag	UNP Q13563
C	-6	GLU	-	expression tag	UNP Q13563
C	-5	LYS	-	expression tag	UNP Q13563
C	-4	GLY	-	expression tag	UNP Q13563
C	-3	SER	-	linker	UNP Q13563
C	-2	ALA	-	linker	UNP Q13563
C	-1	ALA	-	linker	UNP Q13563
C	0	ALA	-	linker	UNP Q13563
D	-38	MET	-	initiating methionine	UNP Q13563
D	-37	GLY	-	expression tag	UNP Q13563
D	-36	ALA	-	expression tag	UNP Q13563
D	-35	SER	-	expression tag	UNP Q13563
D	-34	SER	-	expression tag	UNP Q13563
D	-33	ALA	-	expression tag	UNP Q13563
D	-32	TRP	-	expression tag	UNP Q13563
D	-31	SER	-	expression tag	UNP Q13563
D	-30	HIS	-	expression tag	UNP Q13563
D	-29	PRO	-	expression tag	UNP Q13563

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-28	GLN	-	expression tag	UNP Q13563
D	-27	PHE	-	expression tag	UNP Q13563
D	-26	GLU	-	expression tag	UNP Q13563
D	-25	LYS	-	expression tag	UNP Q13563
D	-24	GLY	-	expression tag	UNP Q13563
D	-23	GLY	-	expression tag	UNP Q13563
D	-22	GLY	-	expression tag	UNP Q13563
D	-21	SER	-	expression tag	UNP Q13563
D	-20	GLY	-	expression tag	UNP Q13563
D	-19	GLY	-	expression tag	UNP Q13563
D	-18	GLY	-	expression tag	UNP Q13563
D	-17	SER	-	expression tag	UNP Q13563
D	-16	GLY	-	expression tag	UNP Q13563
D	-15	GLY	-	expression tag	UNP Q13563
D	-14	SER	-	expression tag	UNP Q13563
D	-13	ALA	-	expression tag	UNP Q13563
D	-12	TRP	-	expression tag	UNP Q13563
D	-11	SER	-	expression tag	UNP Q13563
D	-10	HIS	-	expression tag	UNP Q13563
D	-9	PRO	-	expression tag	UNP Q13563
D	-8	GLN	-	expression tag	UNP Q13563
D	-7	PHE	-	expression tag	UNP Q13563
D	-6	GLU	-	expression tag	UNP Q13563
D	-5	LYS	-	expression tag	UNP Q13563
D	-4	GLY	-	expression tag	UNP Q13563
D	-3	SER	-	linker	UNP Q13563
D	-2	ALA	-	linker	UNP Q13563
D	-1	ALA	-	linker	UNP Q13563
D	0	ALA	-	linker	UNP Q13563

- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).

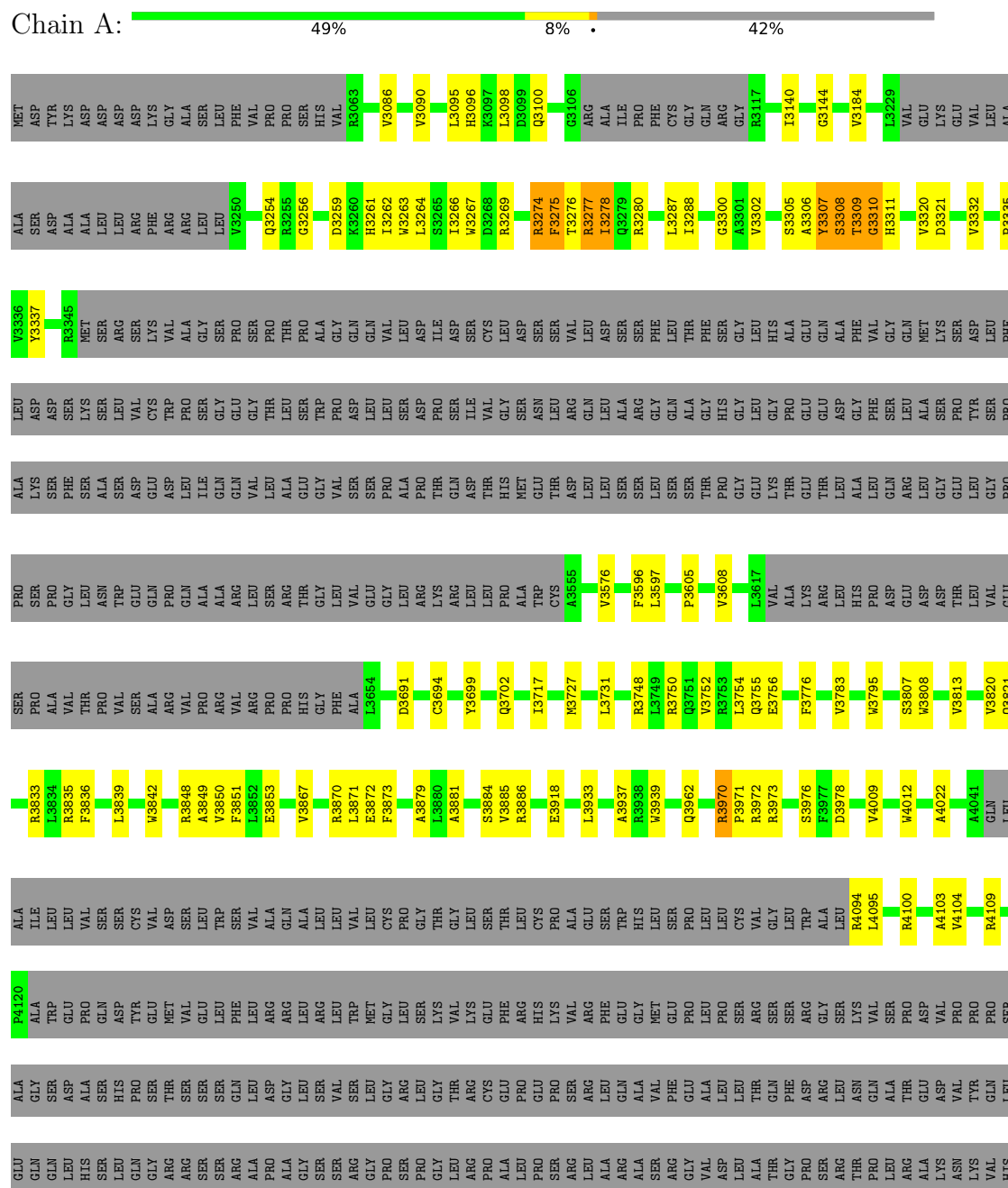| Mol	Chain	Residues	Atoms				AltConf
3	B	1	Total	C	N	O	0
			14	8	1	5	
3	B	1	Total	C	N	O	0
			14	8	1	5	
3	B	1	Total	C	N	O	0
			14	8	1	5	
3	C	1	Total	C	N	O	0
			14	8	1	5	
3	C	1	Total	C	N	O	0
			14	8	1	5	
3	C	1	Total	C	N	O	0
			14	8	1	5	

- Molecule 4 is CALCIUM ION (CCD ID: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
4	C	1	Total	Ca	0
			1	1	

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. 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. 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: Polycystin-1

PRO SER THR

- Molecule 2: Polycystin-2

Chain B:　　　41%　　　7%　　　52%

MET GLY ALA SER ALA TRP SER HIS PRO GLN PHE GLU LYS GLY GLY GLY SER GLY GLY SER GLY SER ALA TRP SER HIS PRO GLN PHE GLU LYS GLY SER ALA ALA MET VAL ASN SER ARG VAL GLN PRO GLN GLN PRO GLY ASP ALA LYS ARG PRO PRO ALA PRO

ARG ALA PRO ASP PRO GLY ARG LEU MET ALA GLY CYS ALA ALA VAL GLY ALA SER LEU ALA ALA PRO GLY LEU CYS GLU GLN ARG GLY LEU GLU ILE GLU MET GLN ILE ARG GLY ALA ALA ARG ASP PRO ALA GLY ALA ALA SER PRO SER PRO LEU SER

CYS SER ARG GLN ALA TRP SER ARG ASP PRO GLY ASN PRO GLY PHE GLU ALA GLU GLU GLU GLU GLU GLY VAL GLY GLY MET VAL GLU MET ASP VAL GLU MET TRP ARG PRO GLY SER ARG ARG ARG SER ALA ALA SER ALA VAL SER SER VAL GLY ALA ARG SER ARG GLY LEU

GLY GLY TYR HIS GLY ALA GLY HIS PRO SER GLY ARG ARG ARG ARG GLU ASP GLN GLY PRO PRO CYS PRO SER PRO VAL GLY GLY ASP PRO LEU HIS ARG HIS LEU PRO LEU GLU GLY GLN PRO PRO ARG VAL ALA TRP ALA GLU ARG LEU VAL ARG GLY LEU ARG GLY LEU TRP

GLY THR ARG LEU MET GLU GLU SER SER THR ASN ARG GLU GLU LYS TYR LEU LYS **S219** **V220** **L221** **R222** **E223** **L224** **V225** **T226** **Y227** **L228** **L234** **Y249** **S263** **E266** **R306** **I309** **E312** **R322** **R325** **I333** **R338** **K342** **P360** **A389** **R397** **N412**

L415 **D416** **T419** **F423** **V428** **A431** **N432** **C437** **L442** **V443** **V451** **K461** **R464** **Y465** **V466** **T467** **D470** **Y487** **E490** **E491** **I492** **I495** **K499** **L500** **H501** **Y502** **F503** **R504** **N525** **R528** **T529** **V532** **A563** **V569** **I577** **Q585** **C593**

A610 **Q613** **F619** **V623** **M668** **L672** **L673** **N674** **L677** **T683** **M698** GLU LEU SER ASP LEU ILE ARG LYS GLY TYR HIS LYS ALA LEU VAL LYS LEU LEU LYS ASN THR VAL ASP ILE SER SER LEU ARG GLY GLY LYS LEU ASN PHE ASP

GLU LEU ARG GLN ASP LEU LYS GLY LYS GLY HIS THR ASP ALA GLU ILE GLU ALA ILE PHE THR LYS TYR ASP GLN ASP GLY ASP GLN GLU LEU THR GLU HIS GLU HIS GLN GLN MET ARG ASP ASP LEU GLU LYS GLU ARG GLU ASP LEU ASP LEU ASP HIS SER SER LEU PRO ARG PRO

MET SER SER ARG SER PHE PRO ARG SER LEU ASP ASP SER GLU GLU ASP ASP GLU ASP SER GLY HIS SER SER ARG ARG ARG GLY SER ILE SER SER GLY VAL SER TYR GLU GLU PHE GLN VAL LEU VAL ARG ARG VAL ASP ARG MET GLU HIS SER ILE GLY SER ILE VAL SER LYS

ILE ASP ALA VAL ILE VAL LYS LEU GLU ILE MET GLU ARG ALA LYS LEU LYS ARG ARG GLU VAL LEU GLY ARG LEU LEU ASP GLY VAL ALA GLU ASP GLU ARG LEU GLY ARG ASP SER GLU ILE HIS ARG GLU GLN MET GLU ARG LEU VAL ARG GLU GLU LEU GLU ARG TRP GLU SER ASP

ASP ALA ALA SER GLN ILE SER HIS GLY LEU GLY THR PRO VAL GLY LEU ASN GLY GLN PRO ARG PRO ARG SER SER ARG PRO SER SER GLN SER THR GLU GLY MET GLU GLY ALA GLY GLY ASN GLY SER SER ASN VAL HIS VAL

- Molecule 2: Polycystin-2

Chain C:　　　39%　　　8%　　　52%

MET GLY ALA SER ALA TRP SER HIS PRO GLN PHE GLU LYS GLY GLY GLY SER GLY GLY SER GLY SER ALA TRP SER HIS PRO GLN PHE GLU LYS GLY SER ALA ALA MET VAL ASN SER ARG VAL GLN PRO GLN GLN PRO GLY ASP ALA LYS ARG PRO PRO ALA PRO

ARG ALA PRO ASP PRO GLY ARG LEU MET ALA GLY CYS ALA ALA VAL GLY ALA SER LEU ALA ALA PRO GLY LEU CYS GLU GLN ARG GLY LEU GLU ILE GLU MET GLN ILE ARG GLY ALA ALA ARG ASP PRO ALA GLY ALA ALA SER PRO SER PRO LEU SER

CYS SER ARG GLN ALA TRP SER ARG ASP PRO GLY ASN PRO GLY PHE GLU ALA GLU GLU GLU GLU GLU GLY VAL GLY GLY MET VAL GLU MET ASP VAL GLU MET TRP ARG PRO GLY SER ARG ARG ARG SER ALA ALA SER ALA VAL SER SER VAL GLY ALA ARG SER ARG GLY LEU

GLY GLY TYR HIS GLY ALA GLY HIS PRO SER GLY ARG ARG ARG ARG GLU ASP GLN GLY PRO PRO CYS PRO SER PRO VAL GLY GLY ASP PRO LEU HIS ARG HIS LEU PRO LEU GLU GLY GLN PRO PRO ARG VAL ALA TRP ALA GLU ARG LEU VAL ARG GLY LEU ARG GLY LEU TRP

• Molecule 2: Polycystin-2

Chain D: 45% • 52%

HIS GLY LEU GLY THR PRO VAL GLY LEU ASN GLY GLN PRO ARG PRO ARG SER SER ARG PRO SER SER SER GLN SER THR GLU GLY MET GLU GLY ALA GLY ASN GLY SER SER ASN VAL HIS VAL

4　Experimental information　ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	113707	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CA, 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	A	0.20	1/5530 (0.0%)	0.43	9/7544 (0.1%)
2	B	0.12	0/4064	0.31	0/5516
2	C	0.11	0/4064	0.30	0/5516
2	D	0.10	0/2787	0.30	1/3843 (0.0%)
All	All	0.15	1/16445 (0.0%)	0.35	10/22419 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	3274	ARG	N-CA	-5.83	1.39	1.46

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	3275	PHE	N-CA-C	-7.34	99.48	109.54
1	A	3310	GLY	CA-C-N	-7.26	111.89	124.82
1	A	3310	GLY	C-N-CA	-7.26	111.89	124.82
1	A	3310	GLY	N-CA-C	6.54	120.58	112.73
1	A	3277	ARG	CA-C-N	5.94	132.65	121.97
1	A	3277	ARG	C-N-CA	5.94	132.65	121.97
1	A	3306	ALA	CA-C-N	5.46	131.96	121.54
1	A	3306	ALA	C-N-CA	5.46	131.96	121.54
1	A	3309	THR	CB-CA-C	-5.29	100.81	109.53
2	D	310	PHE	N-CA-C	5.21	115.89	108.54

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	5402	0	5195	109	0
2	B	3959	0	3900	44	0
2	C	3959	0	3900	56	0
2	D	2765	0	1731	20	0
3	B	42	0	39	0	0
3	C	42	0	39	1	0
4	C	1	0	0	0	0
All	All	16170	0	14804	215	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 7.

All (215) 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:3269:ARG:CZ	1:A:3276:THR:HG22	1.41	1.45
1:A:3267:TRP:HA	1:A:3277:ARG:NH2	1.31	1.41
1:A:3275:PHE:CE2	1:A:3280:ARG:HG2	1.54	1.39
1:A:3269:ARG:NH2	1:A:3276:THR:HG22	1.45	1.29
1:A:3095:LEU:CD2	1:A:3277:ARG:HD3	1.65	1.24
1:A:3305:SER:OG	1:A:3308:SER:HB3	1.42	1.16
1:A:3275:PHE:CE2	1:A:3280:ARG:CG	2.31	1.14
1:A:3305:SER:OG	1:A:3308:SER:CB	1.94	1.14
1:A:3275:PHE:HE2	1:A:3280:ARG:CG	1.62	1.12
1:A:3310:GLY:O	1:A:3311:HIS:HB2	1.46	1.11
1:A:3095:LEU:HD22	1:A:3277:ARG:CD	1.84	1.06
1:A:3095:LEU:HD22	1:A:3277:ARG:HD3	1.22	1.06
1:A:3269:ARG:NH2	1:A:3276:THR:CG2	2.19	1.05
1:A:3269:ARG:CZ	1:A:3276:THR:CG2	2.38	1.01
1:A:3095:LEU:CD2	1:A:3277:ARG:CD	2.43	0.97
1:A:3305:SER:O	1:A:3308:SER:N	1.99	0.96
1:A:3267:TRP:CA	1:A:3277:ARG:NH2	2.27	0.96
1:A:3267:TRP:HA	1:A:3277:ARG:HH21	1.25	0.93
1:A:3269:ARG:NH1	1:A:3276:THR:HG22	1.81	0.93
1:A:3266:ILE:O	1:A:3277:ARG:NE	2.06	0.87

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:3275:PHE:HE2	1:A:3280:ARG:HG2	0.74	0.87
1:A:3267:TRP:HA	1:A:3277:ARG:HH22	1.38	0.86
1:A:3305:SER:OG	1:A:3308:SER:HB2	1.73	0.85
1:A:3095:LEU:HD21	1:A:3277:ARG:HD3	1.60	0.84
1:A:3872:GLU:O	1:A:3879:ALA:HA	1.84	0.77
1:A:3310:GLY:O	1:A:3311:HIS:CB	2.25	0.75
1:A:3305:SER:HG	1:A:3308:SER:HB3	1.52	0.73
1:A:3750:ARG:HB2	1:A:3820:VAL:HG12	1.72	0.70
1:A:3848:ARG:NH1	1:A:3873:PHE:O	2.24	0.70
1:A:4100:ARG:HH21	2:B:677:LEU:HD22	1.56	0.70
2:B:219:SER:O	2:B:221:LEU:N	2.25	0.70
1:A:3275:PHE:HD2	1:A:3280:ARG:NE	1.90	0.70
2:C:681:ASN:HD21	2:D:681:ASN:HD22	1.40	0.69
2:D:431:ALA:HB3	2:D:435:LEU:HA	1.74	0.69
1:A:3754:LEU:HA	1:A:3776:PHE:HA	1.77	0.67
1:A:3269:ARG:NH1	1:A:3276:THR:CG2	2.55	0.66
1:A:3269:ARG:HH22	1:A:3276:THR:CG2	2.09	0.65
2:C:467:THR:HG22	2:C:468:THR:H	1.62	0.65
1:A:3320:VAL:HG22	1:A:3321:ASP:H	1.62	0.64
1:A:3266:ILE:O	1:A:3277:ARG:CZ	2.45	0.64
2:C:462:LEU:HD12	2:C:532:VAL:HG13	1.80	0.64
1:A:3098:LEU:HD13	1:A:3277:ARG:NH1	2.12	0.64
1:A:3884:SER:OG	1:A:3886:ARG:NH1	2.31	0.63
2:B:219:SER:C	2:B:221:LEU:H	2.05	0.63
2:C:430:ASN:ND2	2:C:432:ASN:OD1	2.32	0.63
1:A:3261:HIS:O	1:A:3263:TRP:N	2.32	0.62
1:A:3970:ARG:H	1:A:3973:ARG:HH12	1.47	0.62
2:C:254:SER:O	2:C:258:LEU:HB2	2.00	0.62
2:B:461:LYS:HE2	2:B:464:ARG:HA	1.82	0.61
2:B:322:ARG:NH1	2:B:389:ALA:O	2.32	0.61
1:A:3886:ARG:NH2	1:A:3978:ASP:OD1	2.31	0.60
2:C:570:TRP:NE1	2:D:613:GLN:OE1	2.35	0.60
1:A:3144:GLY:O	1:A:3254:GLN:NE2	2.35	0.59
1:A:3305:SER:C	1:A:3307:TYR:H	2.11	0.59
1:A:3835:ARG:O	1:A:3839:LEU:HB2	2.01	0.58
1:A:3962:GLN:NE2	1:A:3976:SER:O	2.36	0.58
1:A:3275:PHE:CD2	1:A:3280:ARG:CG	2.86	0.57
1:A:3305:SER:C	1:A:3308:SER:H	2.12	0.57
2:C:681:ASN:HD21	2:D:681:ASN:ND2	2.02	0.56
2:C:593:CYS:HB3	2:C:683:THR:HG21	1.87	0.56
1:A:3821:GLN:OE1	1:A:3833:ARG:NH2	2.38	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:312:GLU:OE1	2:B:432:ASN:ND2	2.38	0.56
2:C:623:VAL:HG12	2:C:625:ASP:H	1.69	0.56
1:A:3261:HIS:HE1	1:A:3605:PRO:HD3	1.70	0.55
2:B:467:THR:OG1	2:B:470:ASP:OD1	2.25	0.55
1:A:3305:SER:C	1:A:3307:TYR:N	2.63	0.55
1:A:3305:SER:O	1:A:3308:SER:CA	2.54	0.55
2:C:619:PHE:HB3	2:C:623:VAL:HG21	1.89	0.55
2:B:492:ILE:HA	2:B:495:ILE:HG22	1.89	0.55
2:C:648:GLU:HA	2:C:651:GLU:HG2	1.89	0.54
1:A:3275:PHE:CD2	1:A:3280:ARG:NE	2.74	0.54
1:A:3274:ARG:HG3	1:A:3274:ARG:O	2.08	0.54
2:C:335:GLN:HA	2:C:338:ARG:HB2	1.90	0.54
1:A:3300:GLY:HA3	1:A:3576:VAL:HG22	1.90	0.53
2:C:319:PRO:HB3	2:C:426:PHE:HB3	1.89	0.53
1:A:3754:LEU:HD13	1:A:3848:ARG:HD3	1.90	0.53
2:B:249:TYR:HE2	2:B:437:CYS:HB2	1.75	0.52
1:A:4022:ALA:HB2	1:A:4109:ARG:HG3	1.92	0.52
2:C:668:MET:SD	2:C:672:LEU:HD12	2.50	0.52
2:C:238:THR:HG21	2:C:566:VAL:HG21	1.91	0.52
1:A:4009:VAL:HB	1:A:4012:TRP:HB2	1.90	0.52
2:B:227:TYR:OH	2:B:569:VAL:O	2.28	0.52
2:B:360:PRO:HG3	2:B:412:ASN:ND2	2.25	0.52
2:D:648:GLU:HA	2:D:651:GLU:HG2	1.91	0.52
1:A:3918:GLU:OE2	1:A:3939:TRP:NE1	2.43	0.52
2:B:431:ALA:HB2	2:C:341:ILE:HD13	1.92	0.51
1:A:3261:HIS:CD2	1:A:3264:LEU:HG	2.46	0.51
2:B:249:TYR:HD1	2:C:448:THR:HB	1.75	0.51
2:B:443:VAL:HG13	2:B:451:VAL:HG13	1.93	0.51
2:B:309:ILE:HD12	2:B:428:VAL:HG11	1.92	0.51
2:C:579:PHE:O	2:C:581:ARG:NH2	2.44	0.51
2:C:320:ARG:NH1	2:C:394:ASP:OD1	2.45	0.51
1:A:3140:ILE:HA	1:A:3184:VAL:HA	1.93	0.50
1:A:3096:HIS:O	1:A:3100:GLN:HG3	2.12	0.50
1:A:3605:PRO:HA	1:A:3608:VAL:HG22	1.93	0.50
2:C:589:THR:HG21	2:C:684:TYR:HD2	1.77	0.50
2:C:415:LEU:HA	2:C:419:THR:HG21	1.93	0.50
2:D:427:SER:HA	2:D:438:VAL:HA	1.94	0.50
2:C:252:MET:HG3	2:C:310:PHE:HE1	1.77	0.50
2:B:577:ILE:HG13	2:B:577:ILE:O	2.12	0.49
1:A:3095:LEU:HD22	1:A:3277:ARG:CB	2.42	0.49
2:B:668:MET:HA	2:B:672:LEU:HD13	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:589:THR:HG23	2:D:683:THR:HG23	1.95	0.49
2:C:604:PHE:HD1	2:C:672:LEU:HD13	1.77	0.49
2:B:312:GLU:OE2	2:C:417:ARG:NE	2.39	0.49
1:A:3266:ILE:O	1:A:3277:ARG:NH2	2.46	0.49
1:A:3850:VAL:HG22	1:A:3871:LEU:HB2	1.94	0.49
1:A:3261:HIS:CE1	1:A:3605:PRO:HD3	2.47	0.49
1:A:3807:SER:OG	1:A:3870:ARG:NH1	2.43	0.49
2:B:219:SER:C	2:B:221:LEU:N	2.71	0.49
2:B:593:CYS:HB3	2:B:683:THR:HG21	1.95	0.48
2:C:462:LEU:HD11	2:C:535:LEU:HD22	1.95	0.48
1:A:3752:VAL:HG23	1:A:3848:ARG:HB2	1.95	0.48
2:B:487:TYR:O	2:B:490:GLU:HG3	2.12	0.48
2:B:585:GLN:NE2	2:C:596:ASP:OD1	2.46	0.48
2:B:610:ALA:O	2:B:613:GLN:HG3	2.14	0.48
1:A:3098:LEU:HD13	1:A:3277:ARG:HH12	1.76	0.48
1:A:3275:PHE:CE2	1:A:3280:ARG:HG3	2.38	0.48
2:C:374:LEU:HD12	3:C:1002:NAG:H82	1.96	0.47
2:C:499:LYS:O	2:C:502:TYR:HB3	2.14	0.47
1:A:3305:SER:O	1:A:3308:SER:HB2	2.15	0.47
1:A:4104:VAL:HG11	2:D:684:TYR:HB3	1.96	0.47
2:B:325:ARG:HH22	2:B:416:ASP:HB2	1.79	0.47
2:C:664:PHE:O	2:C:668:MET:HB2	2.15	0.47
1:A:3748:ARG:NH2	1:A:3853:GLU:OE2	2.34	0.47
2:B:306:ARG:HG2	2:B:397:ARG:NH2	2.30	0.47
2:B:333:ILE:O	2:B:338:ARG:NH2	2.47	0.47
2:B:525:ASN:O	2:B:529:THR:OG1	2.32	0.47
2:C:538:PHE:HE2	2:C:546:PRO:HB3	1.80	0.47
2:D:325:ARG:HA	2:D:419:THR:HA	1.96	0.46
2:D:597:LEU:HD11	2:D:676:PHE:CE1	2.49	0.46
2:C:288:LEU:HD22	2:C:292:TYR:HE2	1.80	0.46
1:A:3750:ARG:O	1:A:3851:PHE:HB2	2.16	0.46
1:A:3970:ARG:H	1:A:3973:ARG:NH1	2.13	0.46
1:A:3867:VAL:HG22	1:A:3885:VAL:HG22	1.97	0.46
2:D:671:ILE:O	2:D:675:MET:HG2	2.16	0.46
2:C:369:THR:HG21	2:C:392:TYR:HE1	1.81	0.46
2:B:464:ARG:HH22	2:B:528:ARG:HH22	1.62	0.46
2:C:528:ARG:O	2:C:532:VAL:HG23	2.15	0.46
1:A:3699:TYR:O	1:A:3702:GLN:HG3	2.15	0.45
2:C:317:GLY:HA2	2:C:542:GLN:HB3	1.99	0.45
2:C:462:LEU:H	2:C:462:LEU:HD23	1.80	0.45
1:A:3691:ASP:HB2	1:A:3694:CYS:HB2	1.97	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:3275:PHE:HD2	1:A:3280:ARG:CZ	2.28	0.45
1:A:3808:TRP:HD1	1:A:3813:VAL:HG22	1.82	0.45
2:C:641:LEU:HD21	2:D:669:PHE:CE2	2.51	0.45
1:A:3269:ARG:HG3	1:A:3280:ARG:NH2	2.32	0.45
2:B:415:LEU:HA	2:B:419:THR:HG21	1.98	0.45
2:C:276:MET:HE3	2:C:276:MET:HB2	1.87	0.45
1:A:3263:TRP:CZ2	1:A:3287:LEU:HD23	2.52	0.44
2:C:667:PHE:HD1	2:C:671:ILE:HD12	1.82	0.44
1:A:3848:ARG:HA	1:A:3873:PHE:HB2	1.99	0.44
2:C:619:PHE:HZ	2:C:657:GLY:HA2	1.82	0.44
1:A:3302:VAL:HG13	1:A:3302:VAL:O	2.17	0.44
2:B:532:VAL:HG12	2:B:532:VAL:O	2.17	0.44
2:C:258:LEU:HB3	2:C:271:LYS:HE3	2.00	0.44
2:D:619:PHE:HZ	2:D:657:GLY:HA2	1.82	0.44
1:A:3263:TRP:HH2	1:A:3288:ILE:HG13	1.82	0.44
2:B:499:LYS:O	2:B:502:TYR:HB2	2.17	0.44
1:A:3095:LEU:HD22	1:A:3277:ARG:HB3	1.99	0.44
1:A:3305:SER:O	1:A:3308:SER:CB	2.66	0.44
2:C:306:ARG:HE	2:C:308:PHE:HB2	1.83	0.43
2:C:324:LEU:HD12	2:C:423:PHE:HE1	1.83	0.43
2:C:567:PHE:O	2:C:571:ILE:HG12	2.17	0.43
2:C:397:ARG:NH1	2:C:542:GLN:OE1	2.51	0.43
1:A:3795:TRP:CH2	1:A:3842:TRP:HD1	2.37	0.43
2:B:234:LEU:HD12	2:B:234:LEU:HA	1.87	0.43
2:C:362:ASN:OD1	2:C:363:GLY:N	2.51	0.43
1:A:4109:ARG:HA	1:A:4109:ARG:HD3	1.90	0.43
1:A:3275:PHE:CD2	1:A:3275:PHE:O	2.72	0.43
2:C:423:PHE:CE2	2:C:442:LEU:HD13	2.53	0.43
1:A:3849:ALA:HA	1:A:3871:LEU:O	2.18	0.43
2:D:665:VAL:HG13	2:D:669:PHE:HD2	1.84	0.43
1:A:3086:VAL:O	1:A:3090:VAL:HG23	2.19	0.42
2:C:615:ALA:HB2	2:C:660:TYR:CZ	2.54	0.42
1:A:3971:PRO:C	1:A:3972:ARG:HG2	2.45	0.42
2:C:316:LEU:HD11	2:C:429:TYR:HB2	2.01	0.42
1:A:4094:ARG:HB3	1:A:4095:LEU:H	1.69	0.42
2:D:611:TYR:CD2	2:D:664:PHE:HD1	2.38	0.42
1:A:4103:ALA:HB1	2:B:677:LEU:HD23	2.01	0.42
1:A:3754:LEU:O	1:A:3754:LEU:HD23	2.20	0.42
2:C:315:LEU:HD21	2:C:319:PRO:HD3	2.01	0.42
2:D:665:VAL:HG13	2:D:669:PHE:CD2	2.54	0.42
2:B:223:GLU:HA	2:B:226:THR:HG22	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:258:LEU:HD21	2:C:455:TRP:CD2	2.55	0.42
2:D:581:ARG:O	2:D:585:GLN:HG3	2.20	0.42
1:A:3933:LEU:HG	1:A:3937:ALA:HB2	2.00	0.42
2:B:466:VAL:HG12	2:B:467:THR:HG23	2.01	0.42
1:A:3727:MET:HG2	1:A:3731:LEU:HD22	2.02	0.41
1:A:3332:VAL:O	1:A:3335:PRO:HD2	2.21	0.41
1:A:3691:ASP:OD1	1:A:3691:ASP:N	2.50	0.41
1:A:3754:LEU:O	1:A:3755:GLN:HG3	2.20	0.41
1:A:3754:LEU:HD23	1:A:3756:GLU:HB2	2.02	0.41
2:B:499:LYS:HE3	2:B:502:TYR:H	1.85	0.41
2:C:540:GLU:H	2:C:540:GLU:CD	2.28	0.41
1:A:3256:GLY:HA2	1:A:3259:ASP:OD1	2.21	0.41
1:A:3717:ILE:HG22	1:A:3881:ALA:HB2	2.03	0.41
1:A:4103:ALA:HA	2:B:674:ASN:HB3	2.02	0.41
2:B:619:PHE:HB3	2:B:623:VAL:HG21	2.01	0.41
2:C:489:VAL:HA	2:C:492:ILE:HG12	2.01	0.41
2:B:563:ALA:HB1	2:C:614:LEU:HD12	2.01	0.41
2:C:681:ASN:ND2	2:D:681:ASN:HD22	2.14	0.41
1:A:3095:LEU:HD21	1:A:3266:ILE:HG23	2.02	0.41
2:B:342:LYS:HA	2:B:342:LYS:HD3	1.90	0.41
1:A:3596:PHE:HD2	1:A:3597:LEU:HD12	1.84	0.41
2:D:586:LEU:HD12	2:D:586:LEU:HA	1.90	0.41
2:C:636:GLN:OE1	2:C:660:TYR:OH	2.32	0.40
1:A:3287:LEU:HD13	1:A:3337:TYR:CD1	2.56	0.40
1:A:3783:VAL:HG23	1:A:3836:PHE:HZ	1.86	0.40
2:B:224:LEU:O	2:B:228:LEU:HD23	2.21	0.40
2:B:423:PHE:CE2	2:B:442:LEU:HD13	2.56	0.40
2:B:263:SER:HB2	2:B:266:GLU:HB2	2.03	0.40
2:C:458:GLN:HG2	2:C:552:ALA:HB1	2.01	0.40
2:D:673:LEU:O	2:D:677:LEU:HG	2.21	0.40
2:B:501:HIS:CD2	2:B:504:ARG:HG3	2.57	0.40

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 PDB entries followed by that with respect to all EM entries.

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	719/1261 (57%)	643 (89%)	71 (10%)	5 (1%)	19	53
2	B	478/1007 (48%)	431 (90%)	46 (10%)	1 (0%)	44	74
2	C	478/1007 (48%)	440 (92%)	38 (8%)	0	100	100
2	D	479/1007 (48%)	437 (91%)	42 (9%)	0	100	100
All	All	2154/4282 (50%)	1951 (91%)	197 (9%)	6 (0%)	38	68

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	3278	ILE
1	A	3970	ARG
2	B	220	VAL
1	A	3262	ILE
1	A	3307	TYR
1	A	3308	SER

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 PDB entries followed by that with respect to all EM entries.

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	499/1041 (48%)	497 (100%)	2 (0%)	89	93
2	B	434/860 (50%)	434 (100%)	0	100	100
2	C	434/860 (50%)	434 (100%)	0	100	100
2	D	104/860 (12%)	104 (100%)	0	100	100
All	All	1471/3621 (41%)	1469 (100%)	2 (0%)	92	97

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3278	ILE
1	A	3309	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3668	HIS
1	A	3736	HIS
1	A	3790	ASN
1	A	3840	HIS
1	A	3864	HIS
1	A	3962	GLN
1	A	4111	HIS
2	B	305	ASN
2	B	335	GLN
2	B	430	ASN
2	B	622	GLN
2	B	636	GLN
2	C	323	GLN
2	C	430	ASN
2	C	555	GLN
2	C	681	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 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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	#$|Z| > 2$
3	NAG	B	1003	2	14,14,15	0.20	0	17,19,21	0.43	0
3	NAG	C	1004	2	14,14,15	0.21	0	17,19,21	0.44	0
3	NAG	C	1002	2	14,14,15	0.25	0	17,19,21	0.43	0
3	NAG	B	1002	2	14,14,15	0.31	0	17,19,21	0.58	0
3	NAG	B	1001	2	14,14,15	0.22	0	17,19,21	0.38	0
3	NAG	C	1003	2	14,14,15	0.96	1 (7%)	17,19,21	1.14	1 (5%)

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
3	NAG	B	1003	2	-	2/6/23/26	0/1/1/1
3	NAG	C	1004	2	-	2/6/23/26	0/1/1/1
3	NAG	C	1002	2	-	1/6/23/26	0/1/1/1
3	NAG	B	1002	2	-	3/6/23/26	0/1/1/1
3	NAG	B	1001	2	-	3/6/23/26	0/1/1/1
3	NAG	C	1003	2	-	0/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	1003	NAG	O5-C1	3.34	1.49	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	1003	NAG	C1-O5-C5	4.46	118.24	112.19

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	1004	NAG	C4-C5-C6-O6
3	C	1004	NAG	O5-C5-C6-O6
3	B	1002	NAG	C4-C5-C6-O6

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Mol	Chain	Res	Type	Atoms
3	B	1001	NAG	C8-C7-N2-C2
3	B	1001	NAG	O7-C7-N2-C2
3	B	1003	NAG	O5-C5-C6-O6
3	C	1002	NAG	O5-C5-C6-O6
3	B	1002	NAG	O5-C5-C6-O6
3	B	1001	NAG	O5-C5-C6-O6
3	B	1003	NAG	C4-C5-C6-O6
3	B	1002	NAG	C3-C2-N2-C7

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	1002	NAG	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 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 B 1003

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG C 1004

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG C 1002

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG B 1002

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG B 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG C 1003

Bond lengths

Bond angles

Torsions

Rings
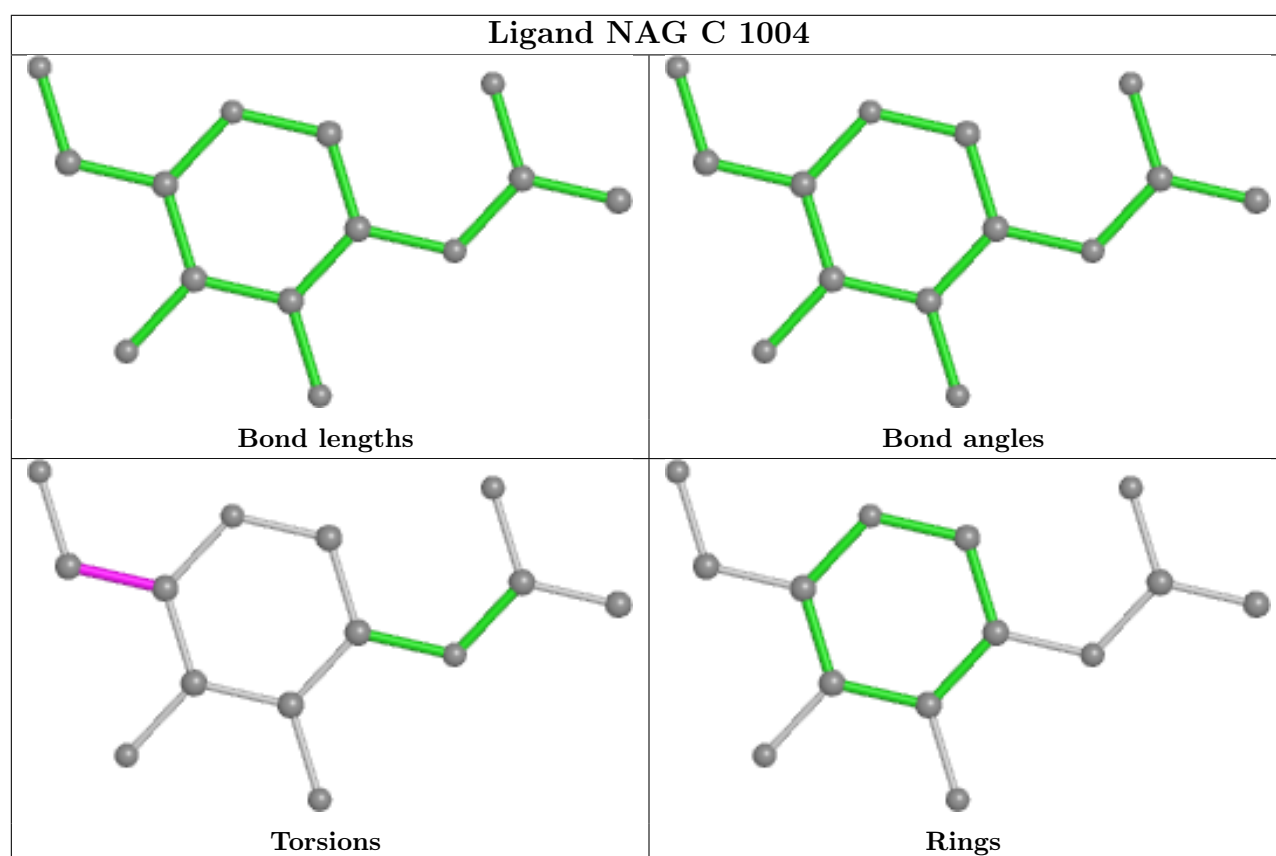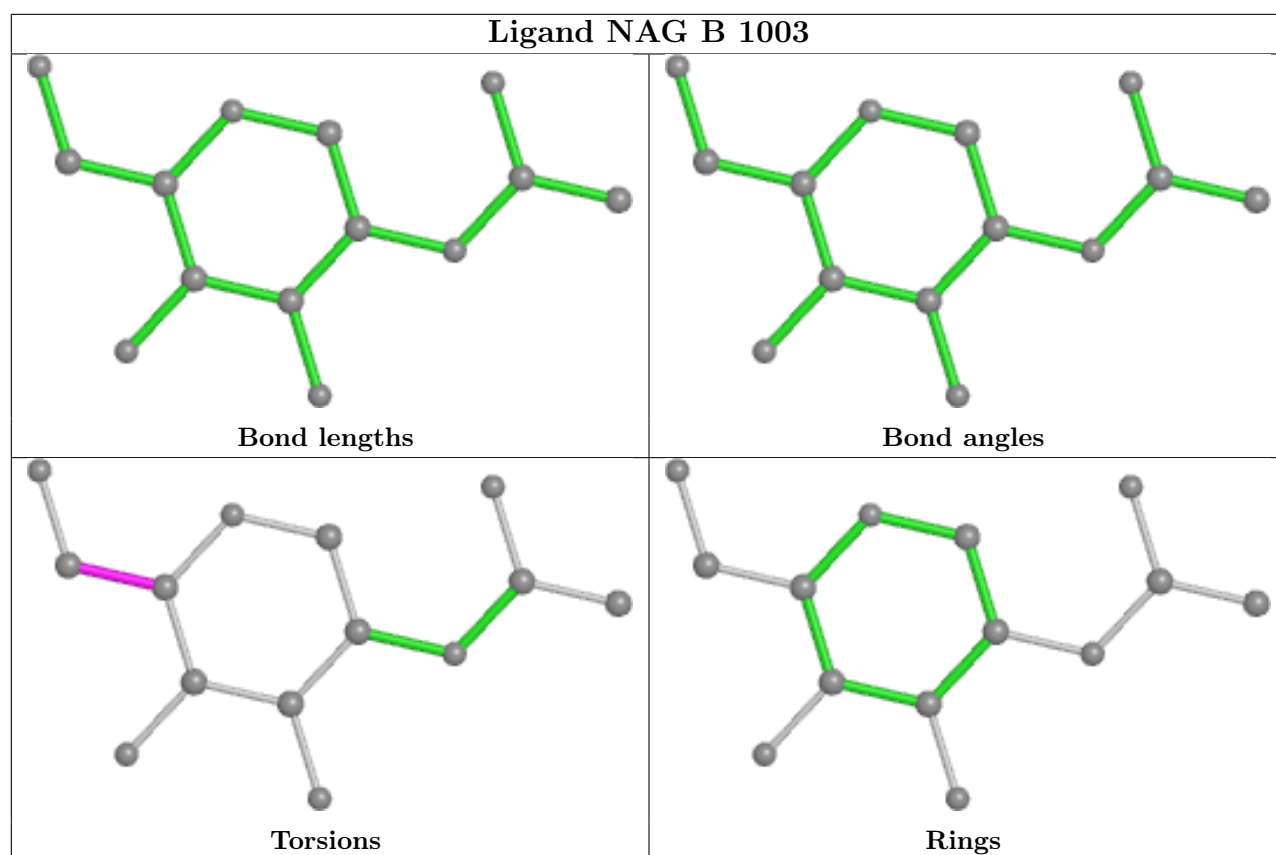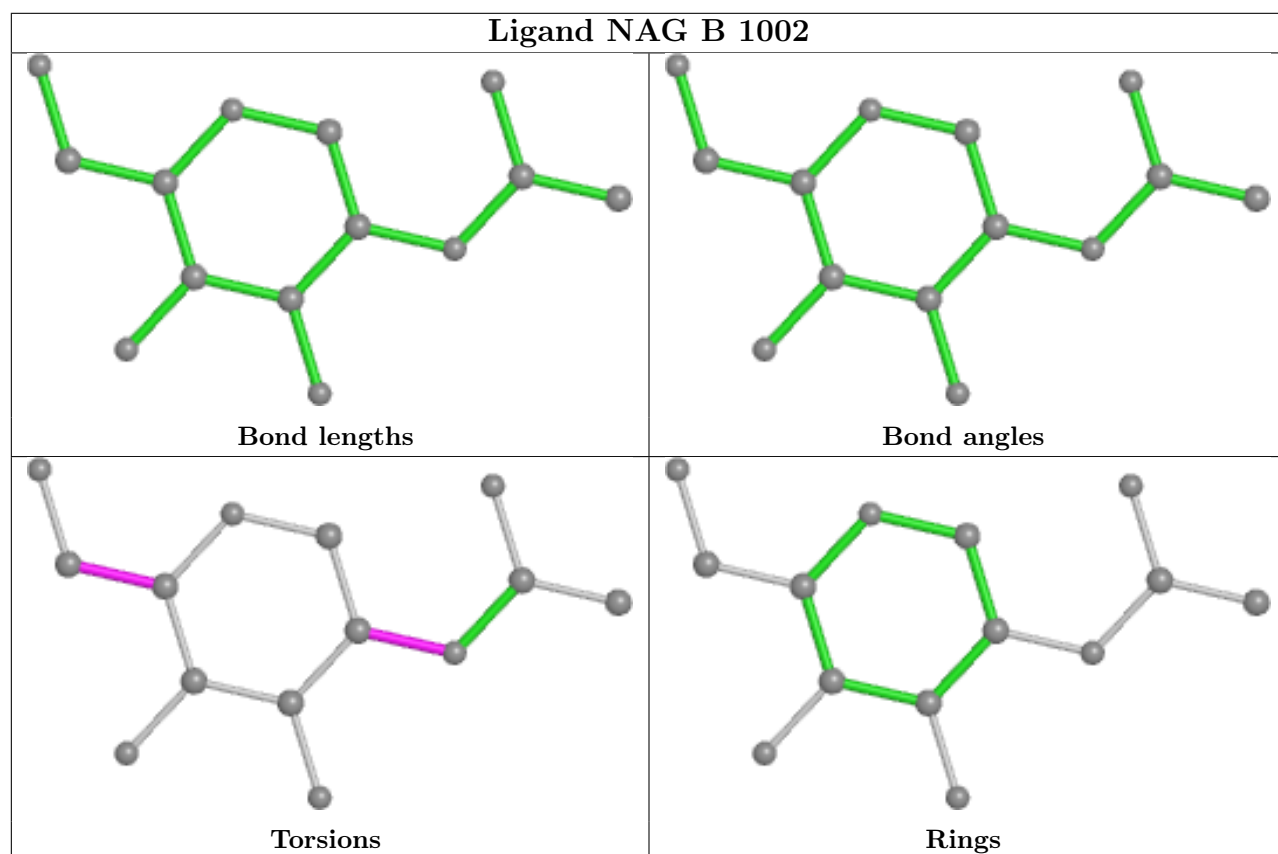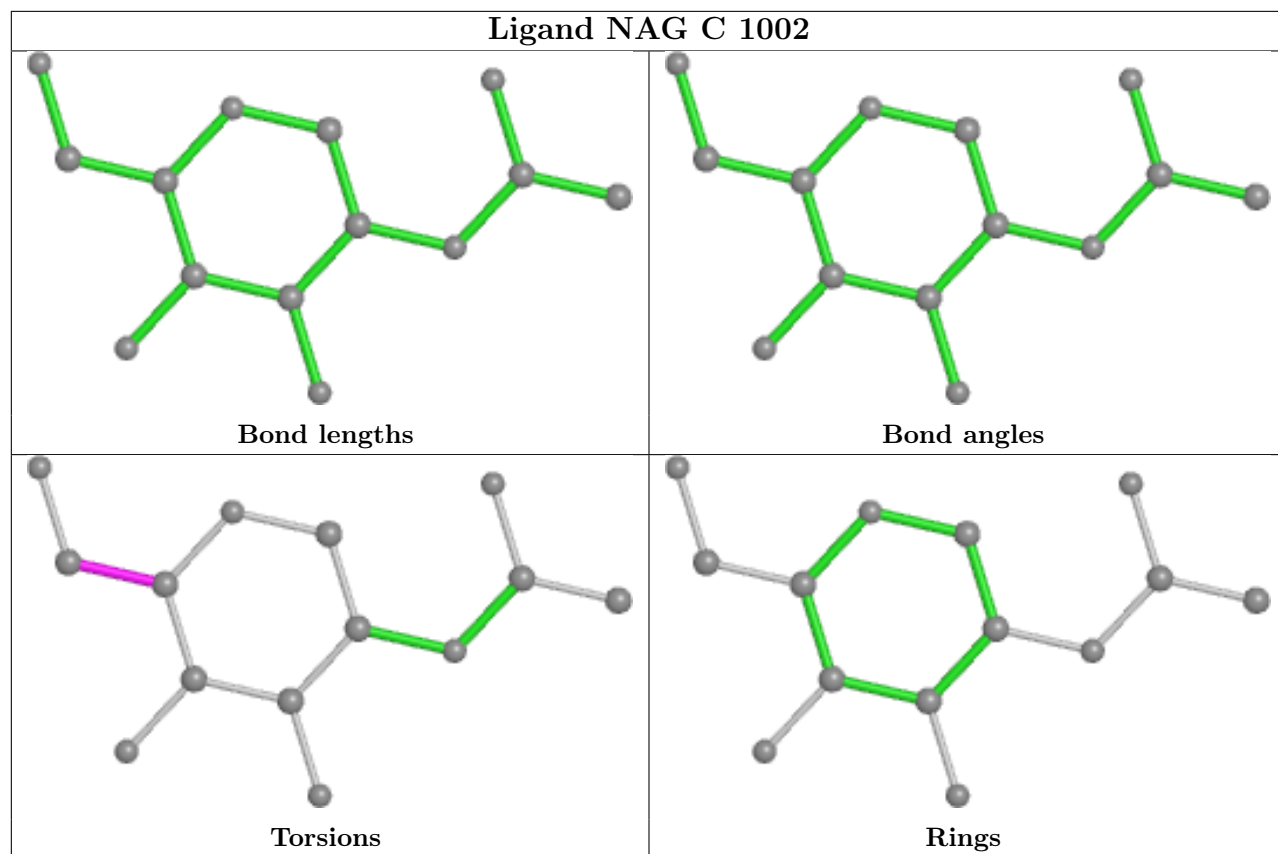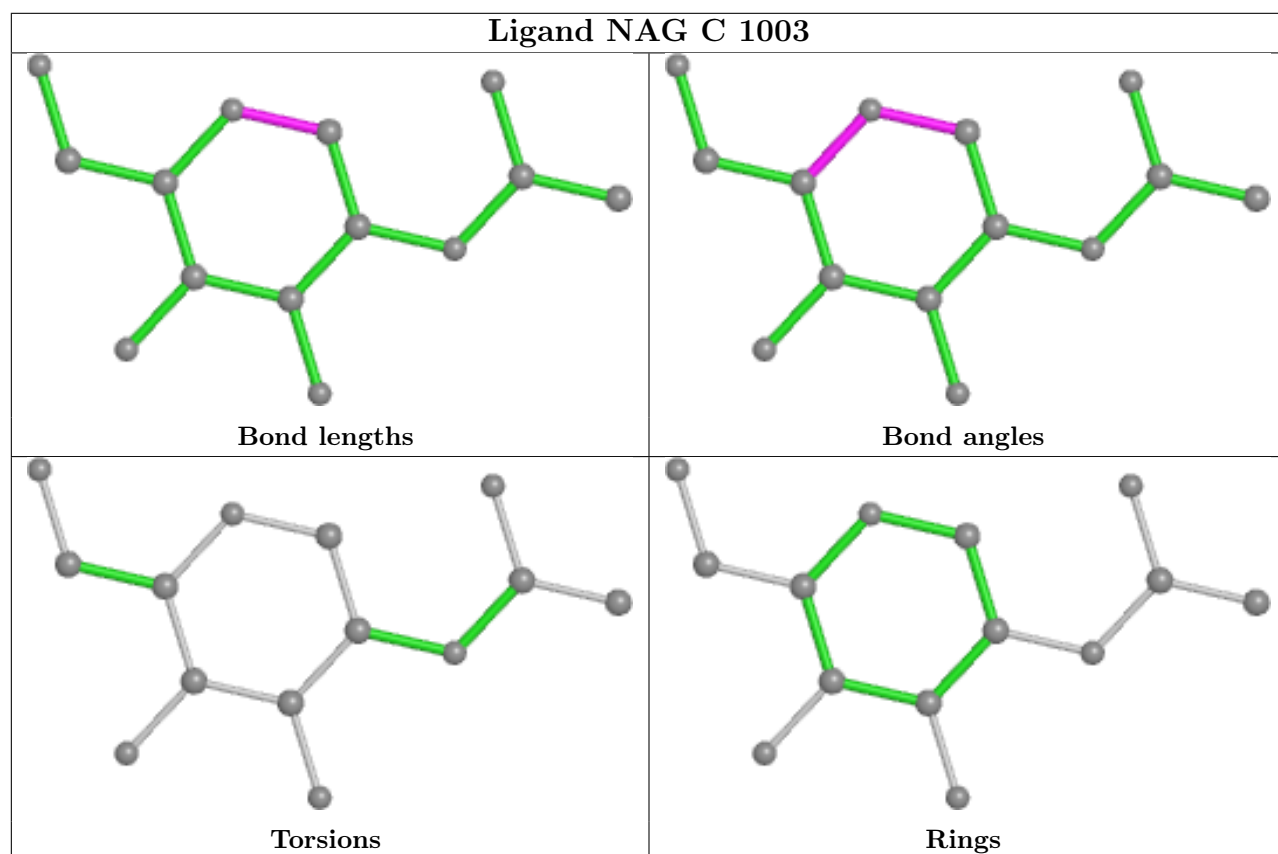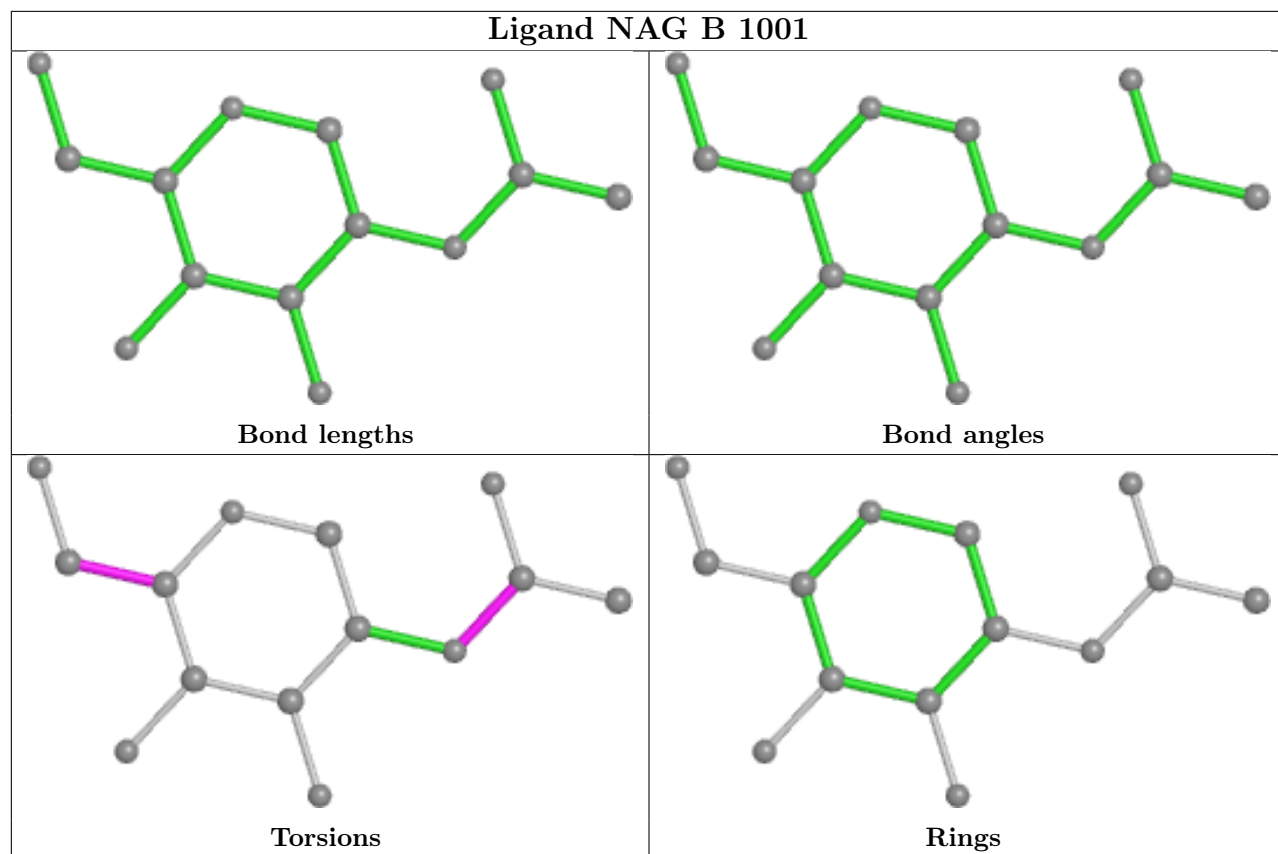
5.7　Other polymers ⓘ

There are no such residues in this entry.

5.8　Polymer linkage issues ⓘ

There are no chain breaks in this entry.