WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB EM Validation Summary Report (i)

Mar 17, 2025 – 04:13 PM EDT

PDB ID	:	9E2Z
EMDB ID	:	EMD-47473
Title	:	Cryo-EM structure of human CMG helicase stalled at G4-containing DNA template
Authors	:	Allwein, B.; Batra, S.; Remus, D.; Hite, R.
Deposited on	:	2024-10-23
Resolution	:	2.60 Å(reported)
Based on initial model	:	.

The following versions of software and data (see references (i)) were used in the production of this report:

|		
EMDB validation analysis	:	0.0.1.dev117
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4.02b-467
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)	:	2.41.4

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.60 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		4
Ramachandran outliers		0
Sidechain outliers		0.8%

Worse *Better*

■ Percentile relative to all structures
▯ Percentile relative to all EM structures
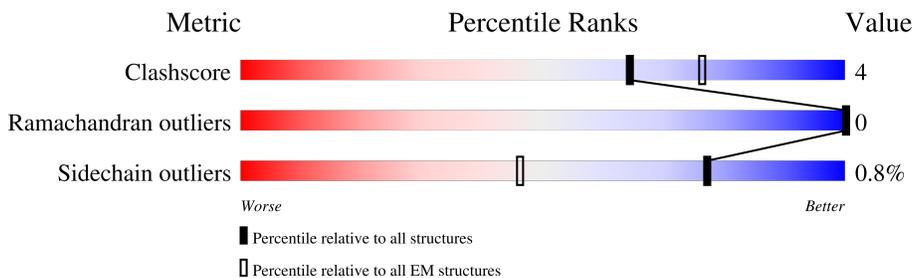
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	2	904	62% 7% 32%
2	3	853	70% 5% 25%
3	4	883	61% 8% 31%
4	5	734	78% 7% 15%
5	6	821	68% 7% 25%
6	7	719	68% 10% 21%
7	A	196	94% 6% •
8	B	222	75% 5% 21%
9	C	216	87% • 9%

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Mol	Chain	Length	Quality of chain
10	D	223	83% 8% 9%
11	E	566	86% 9% 6%
12	F	40	10% 68% 22%
13	G	13	23% 62% 15%

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
17	ZN	7	1003	-	-	X	-

2　Entry composition ⓘ

There are 19 unique types of molecules in this entry. The entry contains 81491 atoms, of which 40474 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 DNA replication licensing factor MCM2.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
1	2	616	9714	3062	4849	866	911	26	0	0

- Molecule 2 is a protein called Isoform 2 of DNA replication licensing factor MCM3.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
2	3	639	10064	3138	5047	884	969	26	0	0

- Molecule 3 is a protein called DNA replication licensing factor MCM4.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
3	4	607	9711	3055	4864	855	911	26	0	0

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
4	-19	MET	-	initiating methionine	UNP P33991
4	-18	HIS	-	expression tag	UNP P33991
4	-17	HIS	-	expression tag	UNP P33991
4	-16	HIS	-	expression tag	UNP P33991
4	-15	HIS	-	expression tag	UNP P33991
4	-14	HIS	-	expression tag	UNP P33991
4	-13	HIS	-	expression tag	UNP P33991
4	-12	HIS	-	expression tag	UNP P33991
4	-11	HIS	-	expression tag	UNP P33991
4	-10	GLU	-	expression tag	UNP P33991
4	-9	ASN	-	expression tag	UNP P33991
4	-8	LEU	-	expression tag	UNP P33991
4	-7	TYR	-	expression tag	UNP P33991
4	-6	PHE	-	expression tag	UNP P33991
4	-5	GLN	-	expression tag	UNP P33991

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Chain	Residue	Modelled	Actual	Comment	Reference
4	-4	GLY	-	expression tag	UNP P33991
4	-3	SER	-	expression tag	UNP P33991
4	-2	SER	-	expression tag	UNP P33991
4	-1	ALA	-	expression tag	UNP P33991
4	0	THR	-	expression tag	UNP P33991

- Molecule 4 is a protein called DNA replication licensing factor MCM5.

Mol	Chain	Residues	Atoms						AltConf	Trace
4	5	624	Total 9825	C 3055	H 4938	N 875	O 922	S 35	0	0

- Molecule 5 is a protein called DNA replication licensing factor MCM6.

Mol	Chain	Residues	Atoms						AltConf	Trace
5	6	617	Total 9881	C 3100	H 4949	N 875	O 931	S 26	0	0

- Molecule 6 is a protein called DNA replication licensing factor MCM7.

Mol	Chain	Residues	Atoms						AltConf	Trace
6	7	565	Total 9030	C 2830	H 4531	N 794	O 847	S 28	0	0

- Molecule 7 is a protein called DNA replication complex GINS protein PSF1.

Mol	Chain	Residues	Atoms						AltConf	Trace
7	A	195	Total 3193	C 1011	H 1589	N 289	O 293	S 11	0	0

- Molecule 8 is a protein called DNA replication complex GINS protein PSF2.

Mol	Chain	Residues	Atoms						AltConf	Trace
8	B	176	Total 2883	C 916	H 1452	N 242	O 264	S 9	0	0

There are 37 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	186	GLU	-	expression tag	UNP Q9Y248
B	187	ASN	-	expression tag	UNP Q9Y248

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Chain	Residue	Modelled	Actual	Comment	Reference
B	188	LEU	-	expression tag	UNP Q9Y248
B	189	TYR	-	expression tag	UNP Q9Y248
B	190	PHE	-	expression tag	UNP Q9Y248
B	191	GLN	-	expression tag	UNP Q9Y248
B	192	GLY	-	expression tag	UNP Q9Y248
B	193	SER	-	expression tag	UNP Q9Y248
B	194	ALA	-	expression tag	UNP Q9Y248
B	195	TRP	-	expression tag	UNP Q9Y248
B	196	SER	-	expression tag	UNP Q9Y248
B	197	HIS	-	expression tag	UNP Q9Y248
B	198	PRO	-	expression tag	UNP Q9Y248
B	199	GLN	-	expression tag	UNP Q9Y248
B	200	PHE	-	expression tag	UNP Q9Y248
B	201	GLU	-	expression tag	UNP Q9Y248
B	202	LYS	-	expression tag	UNP Q9Y248
B	203	GLY	-	expression tag	UNP Q9Y248
B	204	GLY	-	expression tag	UNP Q9Y248
B	205	GLY	-	expression tag	UNP Q9Y248
B	206	SER	-	expression tag	UNP Q9Y248
B	207	GLY	-	expression tag	UNP Q9Y248
B	208	GLY	-	expression tag	UNP Q9Y248
B	209	GLY	-	expression tag	UNP Q9Y248
B	210	SER	-	expression tag	UNP Q9Y248
B	211	GLY	-	expression tag	UNP Q9Y248
B	212	GLY	-	expression tag	UNP Q9Y248
B	213	SER	-	expression tag	UNP Q9Y248
B	214	ALA	-	expression tag	UNP Q9Y248
B	215	TRP	-	expression tag	UNP Q9Y248
B	216	SER	-	expression tag	UNP Q9Y248
B	217	HIS	-	expression tag	UNP Q9Y248
B	218	PRO	-	expression tag	UNP Q9Y248
B	219	GLN	-	expression tag	UNP Q9Y248
B	220	PHE	-	expression tag	UNP Q9Y248
B	221	GLU	-	expression tag	UNP Q9Y248
B	222	LYS	-	expression tag	UNP Q9Y248

- Molecule 9 is a protein called DNA replication complex GINS protein PSF3.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
9	C	196	3106	998	1534	275	293	6	0	0

- Molecule 10 is a protein called DNA replication complex GINS protein SLD5.

Mol	Chain	Residues	Atoms						AltConf	Trace
10	D	204	Total 3389	C 1070	H 1704	N 291	O 314	S 10	0	0

- Molecule 11 is a protein called Cell division control protein 45 homolog.

Mol	Chain	Residues	Atoms						AltConf	Trace
11	E	533	Total 8607	C 2760	H 4268	N 744	O 804	S 31	0	0

- Molecule 12 is a DNA chain called Leading strand DNA template.

Mol	Chain	Residues	Atoms						AltConf	Trace
12	F	40	Total 1292	C 397	H 453	N 155	O 247	P 40	0	0

- Molecule 13 is a DNA chain called Lagging strand DNA template.

Mol	Chain	Residues	Atoms						AltConf	Trace
13	G	13	Total 413	C 127	H 146	N 53	O 74	P 13	0	0

- Molecule 14 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms						AltConf
14	2	1	Total 39	C 10	H 12	N 5	O 10	P 2	0

- Molecule 15 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
15	2	1	Total 1	Mg 1	0
15	3	1	Total 1	Mg 1	0
15	4	1	Total 1	Mg 1	0
15	5	1	Total 1	Mg 1	0
15	6	1	Total 1	Mg 1	0
15	7	1	Total 1	Mg 1	0

- Molecule 16 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).
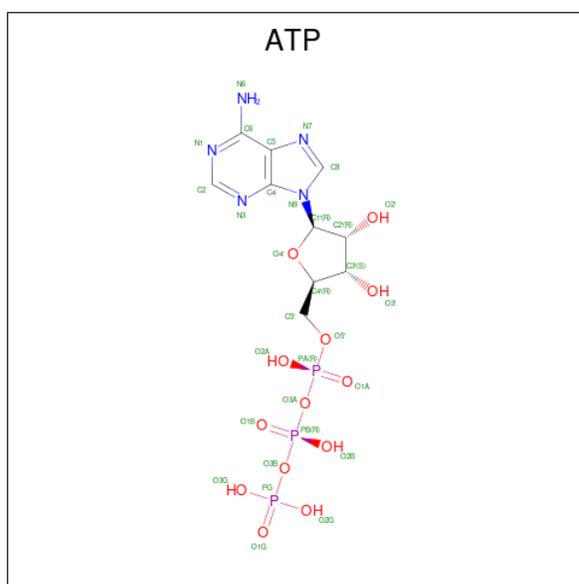
Mol	Chain	Residues	Atoms						AltConf
16	3	1	Total 43	C 10	H 12	N 5	O 13	P 3	0
16	4	1	Total 43	C 10	H 12	N 5	O 13	P 3	0
16	5	1	Total 43	C 10	H 12	N 5	O 13	P 3	0
16	6	1	Total 43	C 10	H 12	N 5	O 13	P 3	0

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Mol	Chain	Residues	Atoms						AltConf
			Total	C	H	N	O	P	
16	7	1	43	10	12	5	13	3	0

- Molecule 17 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
17	4	1	1	1	0
			Total	Zn	
17	5	1	1	1	0
			Total	Zn	
17	6	1	1	1	0
			Total	Zn	
17	7	1	1	1	0

- Molecule 18 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		AltConf
			Total	K	
18	F	2	2	2	0

- Molecule 19 is water.

Mol	Chain	Residues	Atoms			AltConf
			Total	H	O	
19	2	7	21	14	7	0
			Total	H	O	
19	3	8	24	16	8	0
			Total	H	O	
19	4	4	12	8	4	0
			Total	H	O	
19	5	8	24	16	8	0
			Total	H	O	
19	6	7	21	14	7	0
			Total	H	O	
19	7	5	15	10	5	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. 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: DNA replication licensing factor MCM2

• Molecule 2: Isoform 2 of DNA replication licensing factor MCM3

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

MET VAL SER GLY ILE ILE PHE LEU ILE

• Molecule 3: DNA replication licensing factor MCM4

Chain 4: 61%   8%   31%

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

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

GLY THR PRO ARG SER GLY VAL ARG GLY THR PRO VAL ARG GLN ARG PRO ASP LEU GLY SER ALA GLN LYS GLY LEU GLN VAL ASP LEU GLN SER ASP GLY ALA ALA GLU ASP ILE VAL ALA GLU GLN SER LEU GLY LYS LEU VAL ILE **W153** **F166** **Q167** **R168** **F169** **L170** **Q171**

R172 **P176** LEU ALA LYS GLU GLU ASN VAL GLY ILE ASP THR **E190** **R224** **A240** **R248** **Y249** **P250** ASP SER ILE **L254** **K269** **N270** **M271** **R272** **N275** **D278** **I283** **E298** **F304** **D318** **I322** **R330** **K349** **Q350** **M351** **E359** **Q365** **V370**

F373 **D386** **I399** **R404** **S410** **D425** ALA LYS ARG LEU HIS GLY LEU ASP GLU ALA GLU LEU LYS LEU **F441** **E460** **R489** **K490** **D491** **F492** SER HIS THR GLY ARG GLY LYS **F500** **R501** **C509** **R529** **T533** **S534** **G535** **K536** **L543** **Y546** VAL MET LYS

ASP PRO GLU THR ARG GLN **L556** **D567** **E575** **I620** **E621** **K628** **E632** **N633** **I634** **Q635** **L636** **L649** **Y671** **Q672** **S673** **E674** **E675** **E678** **L682** **D683** **Y693** **T697** **A713** **Y714** **V715** **D716** **M717** **K718** **K719** **I720** **G721** **R724** GLY **M726** **V727** **S728** **R732** **E735**

T774 **R777** **I780** **T788** **S794** **R795** **K807** LEU ILE LEU SER LYS GLY LYS THR PRO ALA LEU LYS TYR GLN LEU LEU PHE GLU ASP ILE ARG GLY GLN SER ASP ILE ALA ILE THR LYS ASP MET PHE GLU GLU ALA LEU ALA LEU ALA ASP ASP PHE LEU THR VAL

THR GLY LYS THR VAL ARG LEU LEU

• Molecule 4: DNA replication licensing factor MCM5

Chain 5: 78%   7%   15%

MET SER GLY PHE ASP ASP PRO GLY ILE PHE TYR SER ASP SER SER PHE GLY GLY ASP ALA GLN ALA **D22** **R27** **E37** **R40** **Q41** **V110** **T111** **R112** **P113** **R114** **P115** **D131** **R167** **C172** **C175** **C197** **N198** **T199** **R204** **F224** **G239** **D255** **T277** **R280**

G281 **R282** **D283** **R284** **R290** **D304** GLY SER GLY ARG SER PHE ALA GLY **A313** **E321** **K337** **S342** **I375** **S410** **R420** **R425** **M429** **E452** **V456** **A457** **I458** **I474** **D515** **E523** **H524** **N525** **Q546** **E553** **K558** **Y565** **K569** **K581**

R594 **R603** **S604** **R618** **E638** **L653** SER GLY THR LEU SER GLY VAL GLU GLY PHE THR SER GLN GLU ASP GLN GLU MET LEU SER ARG ILE GLU LYS LEU LEU LYS ARG ARG PHE ALA GLY SER GLN VAL VAL SER GLU HIS SER ILE ILE LYS ASP PHE THR LYS GLN LYS TYR

PRO GLU HIS ALA ILE HIS VAL LYS VAL LEU GLN MET LEU ARG ARG GLY GLU ILE GLN HIS ARG MET GLN ARG LYS VAL LEU TYR ARG LEU LYS

• Molecule 5: DNA replication licensing factor MCM6

Chain 6:

68%   7%   25%

MET ASP LEU ALA ALA ALA GLU PRO GLY ALA GLY SER GLN HIS LEU E17 D20 E24 S39 S40 D41 E51 I54 R55 P56 E57 E82 V86 V98 K99 D100 R101 I104 T135 R136 I137 S138 R143 K173 Y174 T175 I179 N182 P183 V184

R188 D194 K197 R217 D243 T266 ASN SER ARG VAL SER GLY VAL ASP GLY TYR GLU THR E279 R282 D291 P308 ARG PHE GLY GLY LYS GLU LEU ARG ASP GLU E319 V331 E335 Y347 E363 R366 D397 T400 A401 I444

E461 I473 V489 I535 N541 E542 V543 Y546 I552 I559 K588 E589 S590 E591 R604 D605 GLY SER VAL THR LYS SER S613 W614 R615 R619 N653 P662 ASP VAL ASN LEU ASP GLN GLU GLU GLU ILE GLN MET GLU VAL ASP GLU ALA GLY

GLY ILE ASN GLY HIS ALA ASP SER PRO ALA PRO VAL ASN GLY ILE ASN GLY TYR ASN GLU ASP ILE ASN GLN GLU SER ALA PRO LYS ALA SER LEU ARG LEU GLY PHE SER GLU TYR CYS ARG ILE SER ASN LEU ILE VAL LEU HIS LEU GLN ALA GLY LYS VAL GLU GLU GLU ASP GLU SER

ALA LEU LYS ARG SER GLU LEU VAL ASN TRP TYR LEU LYS GLU ILE GLU ASN GLY ILE GLU ASP SER GLU GLU LEU ILE ASN LYS LYS ARG ILE ILE GLU LYS VAL ILE HIS ARG LEU THR HIS TYR ASP HIS VAL LEU ILE GLU LEU THR GLN ALA GLY LEU LYS GLY SER THR GLU GLY

SER GLU SER TYR GLU GLU ASP PRO TYR LEU VAL VAL ASN PRO ASN TYR LEU GLU ASP

• Molecule 6: DNA replication licensing factor MCM7

Chain 7:

68%   10%   21%

MET ALA LEU K4 K10 K14 D23 G27 K28 A41 H42 R43 D59 D64 E68 F77 E83 K89 V93 V94 N95 K96 L99 D100 E104 H105 ARG LEU MET GLU GLN ARG SER ARG ASP PRO GLY MET VAL ARG SER PRO GLN ASN Q125

L136 V148 E151 I166 R169 E172 C184 C187 C211 N214 ARG SER GLY G218 L222 Q223 M235 H240 R263 R282 R286 Q290 M306 ASN LYS SER GLU ASP ASP GLU SER GLY ALA GLY GLU LEU THR ARG E322 R325

E334 K335 L358 V359 G360 G361 G384 Y403 T404 T405 G406 G411 VAL GLY LEU THR ALA ALA VAL LEU ARG ASP SER VAL SER GLY GLU LEU THR LEU GLU GLU G432 D445 D446 K449 E460 T466 R481 A491 TYR GLY ARG TYR ASN PRO ARG ARG SER LEU

GLU GLN ASN ILE Q506 D528 F551 D555 L558 M559 R560 R561 Y562 R567 V573 P574 E575 S576 L577 A578 D579 E587 R618 L619 R620 MET VAL ASP V624 V625 E626 K627 E628 I634 R635 L636 M637 E638 M639 S640 K641 D642 SER LEU LEU GLY ASP LYS GLY GLN THR

ALA ARG THR GLN ARG PRO ALA ASP VAL ILE PHE ALA THR VAL ARG GLU LEU VAL SER GLY ARG SER VAL ARG PHE SER GLU ALA GLU GLN ARG CYS VAL SER ARG GLY PHE THR PRO ALA GLN PHE GLN ALA ALA LEU ASP GLU TYR GLU GLU LEU ASN VAL TRP GLN VAL ASN ALA

SER ARG THR ARG ILE THR PHE VAL

• Molecule 7: DNA replication complex GINS protein PSF1

Chain A:

94%   6%   •

MET F2 A6 E18 D27 G28 N43 V47 N48 E49 C75 K144 L168 L169 K170 S196

• Molecule 8: DNA replication complex GINS protein PSF2

Chain B:

75%   5%   21%

M1 E7 T85 E112 D119 R124 H142 L145 E152 T155 Q175 P176 LEU GLU SER THR GLN SER GLN ASP PHE GLU ASN LEU TYR PHE GLN SER ALA TRP SER HIS PRO GLN PHE GLU LYS GLY GLY SER GLY GLY SER GLY GLY SER ALA

TRP SER HIS PRO GLN PHE GLU LYS

• Molecule 9: DNA replication complex GINS protein PSF3

Chain C: 87% · 9%

MET SER GLU A4 R7 V8 E9 M40 P41 R42 L43 F47 LEU GLU ARG SER ALA GLY ALA GLU THR ASP N58 L66 Y117 D169 R209 LYS PHE THR ASP MET GLU ASP

• Molecule 10: DNA replication complex GINS protein SLD5

Chain D: 83% 8% 9%

MET THR GLU GLU VAL ASP PHE LEU GLY GLN ASP SER ASP GLY GLY SER GLU GLU VAL V58 L59 E63 R67 E80 L81 L82 E101 R104 R134 K137 F142 P143 H144 V145 L160 Y178 V182 R216 T226 Q241 I261

• Molecule 11: Cell division control protein 45 homolog

Chain E: 86% 9% 6%

M1 F2 V3 E9 V14 V19 L20 T48 E57 A79 D99 T100 H101 R102 R135 ASP GLU GLU GLU ASP GLU GLU HIS SER GLY ASN ASP SER ASP GLY SER GLU PRO SER GLU LYS ARG THR ARG LEU GLU GLU ILE VAL GLU GLN THR M175 R178

R186 I190 E195 N262 R283 L284 V285 L286 W290 W309 R316 Q330 V331 K334 M338 L342 M349 K395 A431 S438 T442 P469 S486 N489 R490 R491 S504 M505 E506 T509 S522 D523 R524 F532 R542 M543

L544 D549 V552 D559 S572

• Molecule 12: Leading strand DNA template

Chain F: 10% 68% 22%

G24 T25 C26 A27 T28 A29 T30 C31 T32 G33 C34 T35 T36 T37 G38 G39 G40 T41 G42 G43 G44 T45 G46 G47 G48 T49 G52 T53 T54 G55 A56 G57 G58 C59 A60 A61 T62 A63

• Molecule 13: Lagging strand DNA template

Chain G: 23% 62% 15%

A1 A2 G3 C4 A5 G6 A7 T8 A9 A12 C13

4   Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	187345	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	66	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	29000	Depositor
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: ZN, ADP, MG, K, ATP

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	2	0.70	0/4954	0.74	4/6695 (0.1%)
2	3	0.57	0/5093	0.70	3/6872 (0.0%)
3	4	0.36	0/4929	0.55	1/6657 (0.0%)
4	5	0.90	1/4962 (0.0%)	0.81	8/6679 (0.1%)
5	6	0.53	0/5012	0.62	0/6763
6	7	0.42	0/4569	0.60	1/6164 (0.0%)
7	A	0.30	0/1636	0.53	0/2200
8	B	0.27	0/1462	0.47	0/1981
9	C	0.27	0/1607	0.50	0/2167
10	D	0.29	0/1717	0.51	0/2315
11	E	0.30	0/4431	0.51	0/5982
12	F	1.39	4/942 (0.4%)	2.08	58/1458 (4.0%)
13	G	1.44	4/300 (1.3%)	1.93	19/460 (4.1%)
All	All	0.59	9/41614 (0.0%)	0.73	94/56393 (0.2%)

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	2	0	1
2	3	0	5
3	4	0	5
4	5	0	8
6	7	0	3
10	D	0	1
11	E	0	1
12	F	0	7
13	G	0	2
All	All	0	33

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	5	115	PRO	N-CD	-38.31	0.94	1.47
12	F	32	DT	C5-C7	-6.72	1.46	1.50
13	G	4	DC	C5-C6	-6.64	1.29	1.34
13	G	5	DA	C6-N6	-6.27	1.28	1.33
12	F	56	DA	C6-N6	-6.08	1.29	1.33

The worst 5 of 94 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	5	115	PRO	N-CD-CG	15.49	126.44	103.20
12	F	54	DT	N3-C2-O2	-10.28	116.13	122.30
4	5	280	ARG	NE-CZ-NH1	9.23	124.92	120.30
6	7	286	ARG	NE-CZ-NH1	8.84	124.72	120.30
12	F	38	DG	O4'-C1'-N9	8.66	114.06	108.00

There are no chirality outliers.

5 of 33 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	2	765	ARG	Sidechain
2	3	114	ARG	Sidechain
2	3	336	ARG	Sidechain
2	3	364	ARG	Sidechain
2	3	458	ARG	Sidechain

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	2	4865	4849	4881	36	0
2	3	5017	5047	5055	40	0
3	4	4847	4864	4878	61	0
4	5	4887	4938	4954	30	0
5	6	4932	4949	4958	35	0
6	7	4499	4531	4535	66	0
7	A	1604	1589	1594	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	B	1431	1452	1456	8	0
9	C	1572	1534	1537	7	0
10	D	1685	1704	1709	11	0
11	E	4339	4268	4289	35	0
12	F	839	453	447	5	0
13	G	267	146	140	0	0
14	2	27	12	12	1	0
15	2	1	0	0	0	0
15	3	1	0	0	0	0
15	4	1	0	0	0	0
15	5	1	0	0	0	0
15	6	1	0	0	0	0
15	7	1	0	0	0	0
16	3	31	12	12	1	0
16	4	31	12	12	0	0
16	5	31	12	12	2	0
16	6	31	12	12	3	0
16	7	31	12	12	0	0
17	4	1	0	0	0	0
17	5	1	0	0	0	0
17	6	1	0	0	0	0
17	7	1	0	0	2	0
18	F	2	0	0	0	0
19	2	7	14	0	0	0
19	3	8	16	0	1	0
19	4	4	8	0	1	0
19	5	8	16	0	2	0
19	6	7	14	0	1	0
19	7	5	10	0	3	0
All	All	41017	40474	40505	317	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 4.

The worst 5 of 317 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:3:600:GLN:CG	2:3:603:MET:HB3	1.65	1.25
6:7:187:CYS:SG	17:7:1003:ZN:ZN	1.34	1.15
3:4:269:LYS:HZ2	3:4:283:ILE:CG2	1.62	1.10
11:E:14:VAL:HG13	11:E:19:VAL:HG11	1.32	1.10

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:3:600:GLN:HG3	2:3:603:MET:HB3	1.36	1.05

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	2	608/904 (67%)	596 (98%)	12 (2%)	0	100	100
2	3	631/853 (74%)	617 (98%)	14 (2%)	0	100	100
3	4	593/883 (67%)	586 (99%)	7 (1%)	0	100	100
4	5	620/734 (84%)	611 (98%)	9 (2%)	0	100	100
5	6	609/821 (74%)	595 (98%)	14 (2%)	0	100	100
6	7	551/719 (77%)	546 (99%)	5 (1%)	0	100	100
7	A	193/196 (98%)	188 (97%)	5 (3%)	0	100	100
8	B	174/222 (78%)	172 (99%)	2 (1%)	0	100	100
9	C	192/216 (89%)	187 (97%)	5 (3%)	0	100	100
10	D	202/223 (91%)	199 (98%)	3 (2%)	0	100	100
11	E	529/566 (94%)	519 (98%)	10 (2%)	0	100	100
All	All	4902/6337 (77%)	4816 (98%)	86 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	2	537/781 (69%)	534 (99%)	3 (1%)	84	94
2	3	552/742 (74%)	549 (100%)	3 (0%)	86	95
3	4	538/771 (70%)	530 (98%)	8 (2%)	60	81
4	5	532/625 (85%)	528 (99%)	4 (1%)	79	91
5	6	550/724 (76%)	545 (99%)	5 (1%)	75	90
6	7	490/619 (79%)	485 (99%)	5 (1%)	73	88
7	A	173/174 (99%)	173 (100%)	0	100	100
8	B	160/195 (82%)	159 (99%)	1 (1%)	84	94
9	C	169/186 (91%)	166 (98%)	3 (2%)	54	77
10	D	189/205 (92%)	189 (100%)	0	100	100
11	E	486/517 (94%)	481 (99%)	5 (1%)	73	88
All	All	4376/5539 (79%)	4339 (99%)	37 (1%)	77	91

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
8	B	142	HIS
11	E	395	LYS
9	C	7	ARG
11	E	262	ASN
3	4	534	SER

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

Mol	Chain	Res	Type
2	3	453	ASN
6	7	270	HIS

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 18 ligands modelled in this entry, 12 are 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	$\#|Z| > 2$
14	ADP	2	1001	15	24,29,29	0.88	0	29,45,45	1.21	2 (6%)
16	ATP	5	1001	15	28,33,33	0.79	0	34,52,52	0.91	1 (2%)
16	ATP	4	1001	15	28,33,33	0.75	0	34,52,52	0.93	1 (2%)
16	ATP	3	1001	15	28,33,33	0.75	0	34,52,52	0.92	1 (2%)
16	ATP	7	1001	15	28,33,33	0.73	0	34,52,52	0.90	2 (5%)
16	ATP	6	1001	15	28,33,33	0.83	0	34,52,52	0.92	1 (2%)

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
14	ADP	2	1001	15	-	2/12/32/32	0/3/3/3
16	ATP	5	1001	15	-	1/18/38/38	0/3/3/3
16	ATP	4	1001	15	-	6/18/38/38	0/3/3/3
16	ATP	3	1001	15	-	2/18/38/38	0/3/3/3
16	ATP	7	1001	15	-	2/18/38/38	0/3/3/3
16	ATP	6	1001	15	-	8/18/38/38	0/3/3/3

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
14	2	1001	ADP	N3-C2-N1	-4.07	123.14	128.67
14	2	1001	ADP	C4-C5-N7	-2.59	106.60	109.34
16	3	1001	ATP	C5-C6-N6	2.41	123.99	120.31
16	5	1001	ATP	C5-C6-N6	2.39	123.95	120.31
16	6	1001	ATP	C5-C6-N6	2.34	123.88	120.31

There are no chirality outliers.

5 of 21 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
14	2	1001	ADP	C5'-O5'-PA-O3A
16	4	1001	ATP	C5'-O5'-PA-O1A
16	4	1001	ATP	C5'-O5'-PA-O2A
16	4	1001	ATP	C5'-O5'-PA-O3A
16	6	1001	ATP	C5'-O5'-PA-O1A

There are no ring outliers.

4 monomers are involved in 7 short contacts:

| Mol	Chain	Res	Type	Clashes	Symm-Clashes
14	2	1001	ADP	1	0
16	5	1001	ATP	2	0
16	3	1001	ATP	1	0
16	6	1001	ATP	3	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 ADP 2 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 5 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 4 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 3 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 7 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 6 1001

Bond lengths

Bond angles

Torsions

Rings
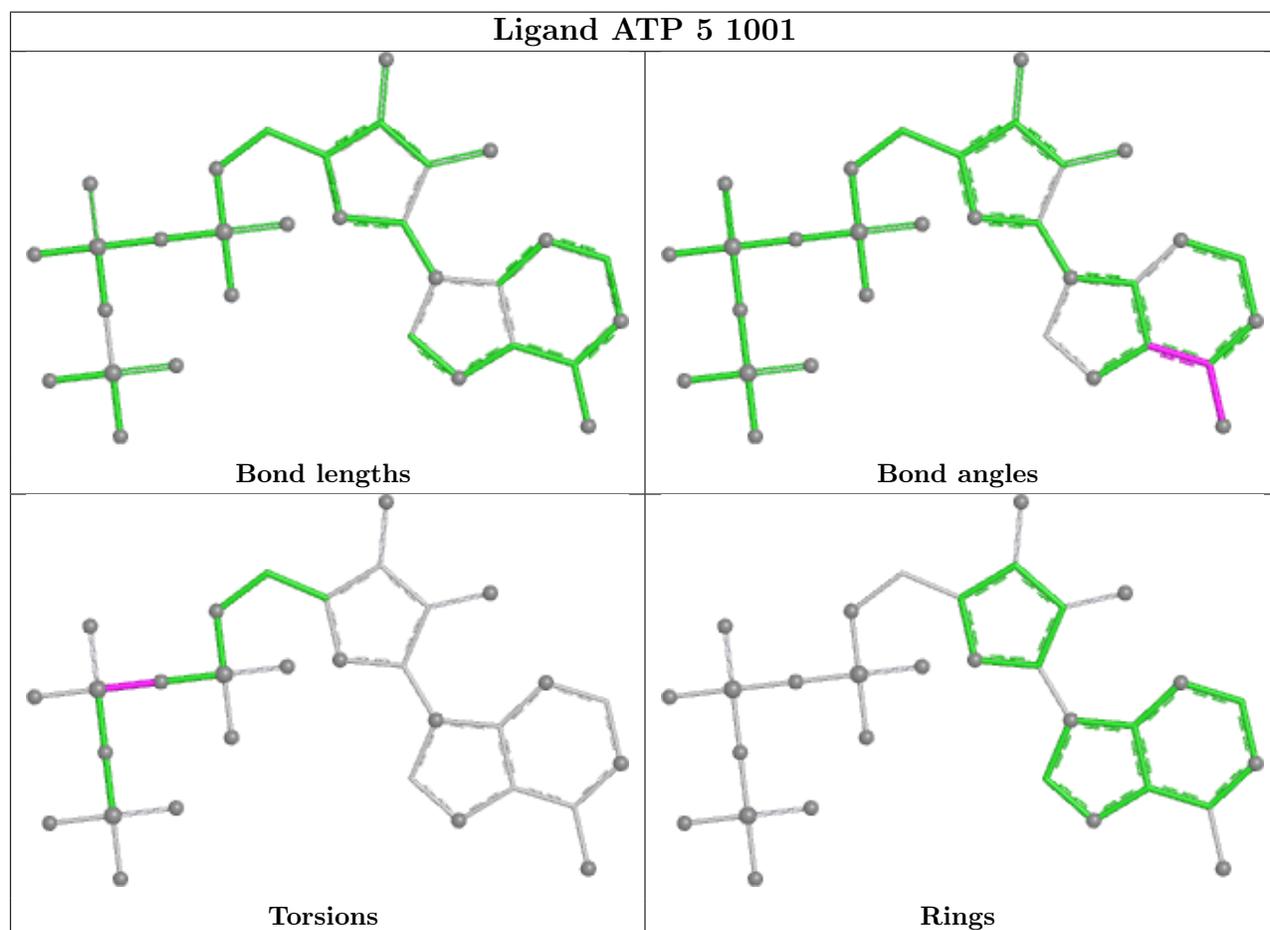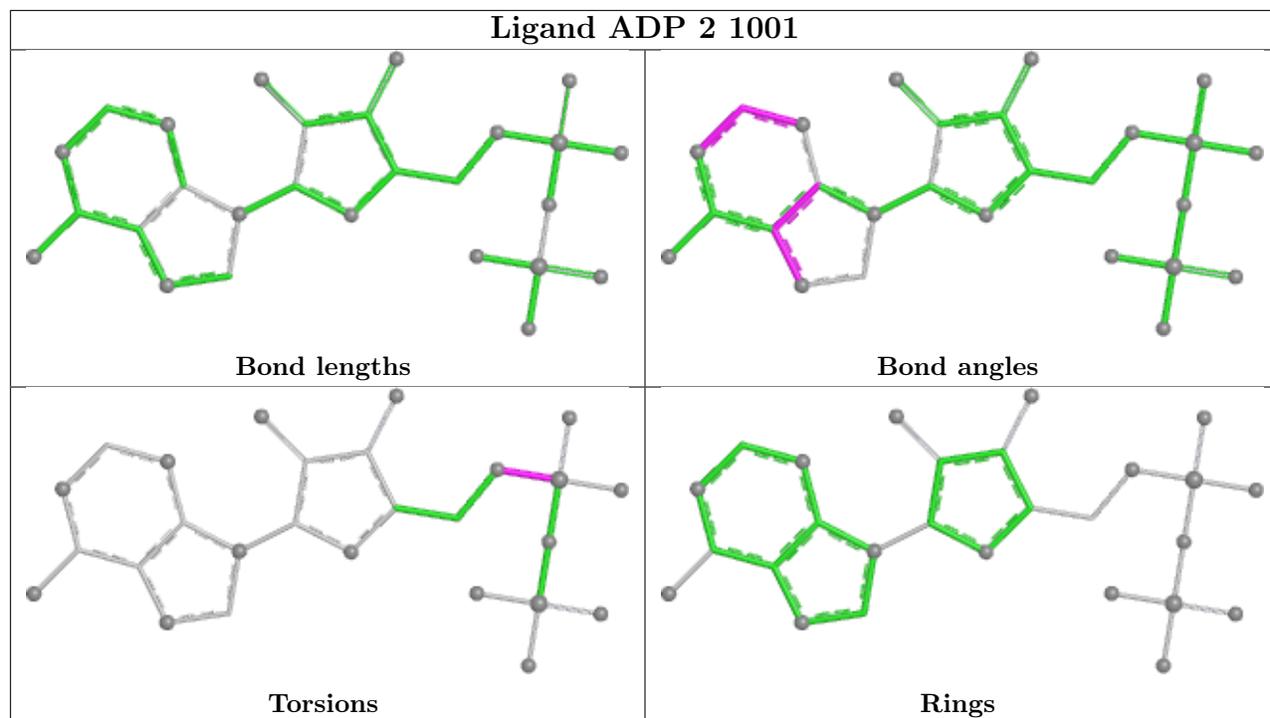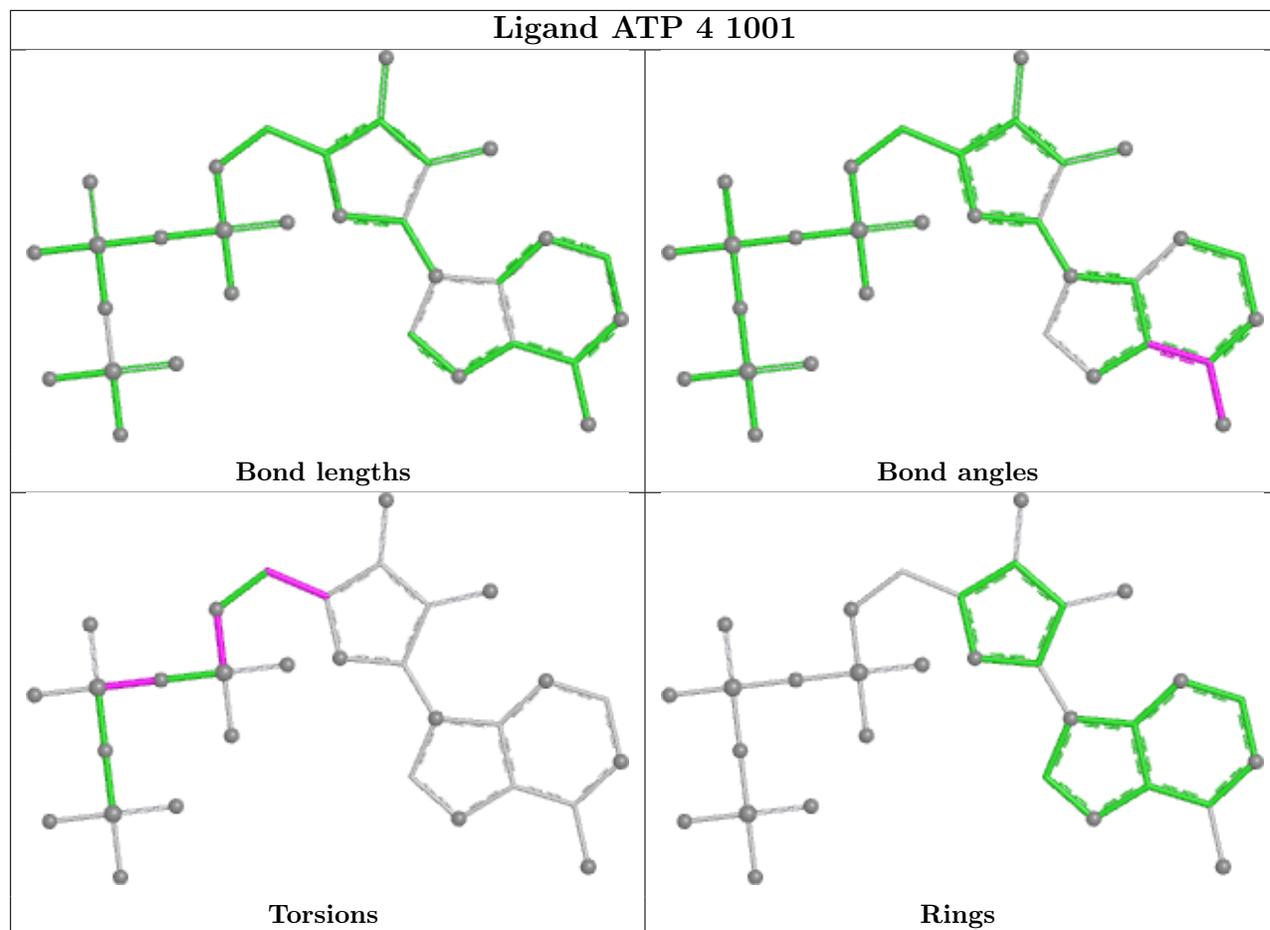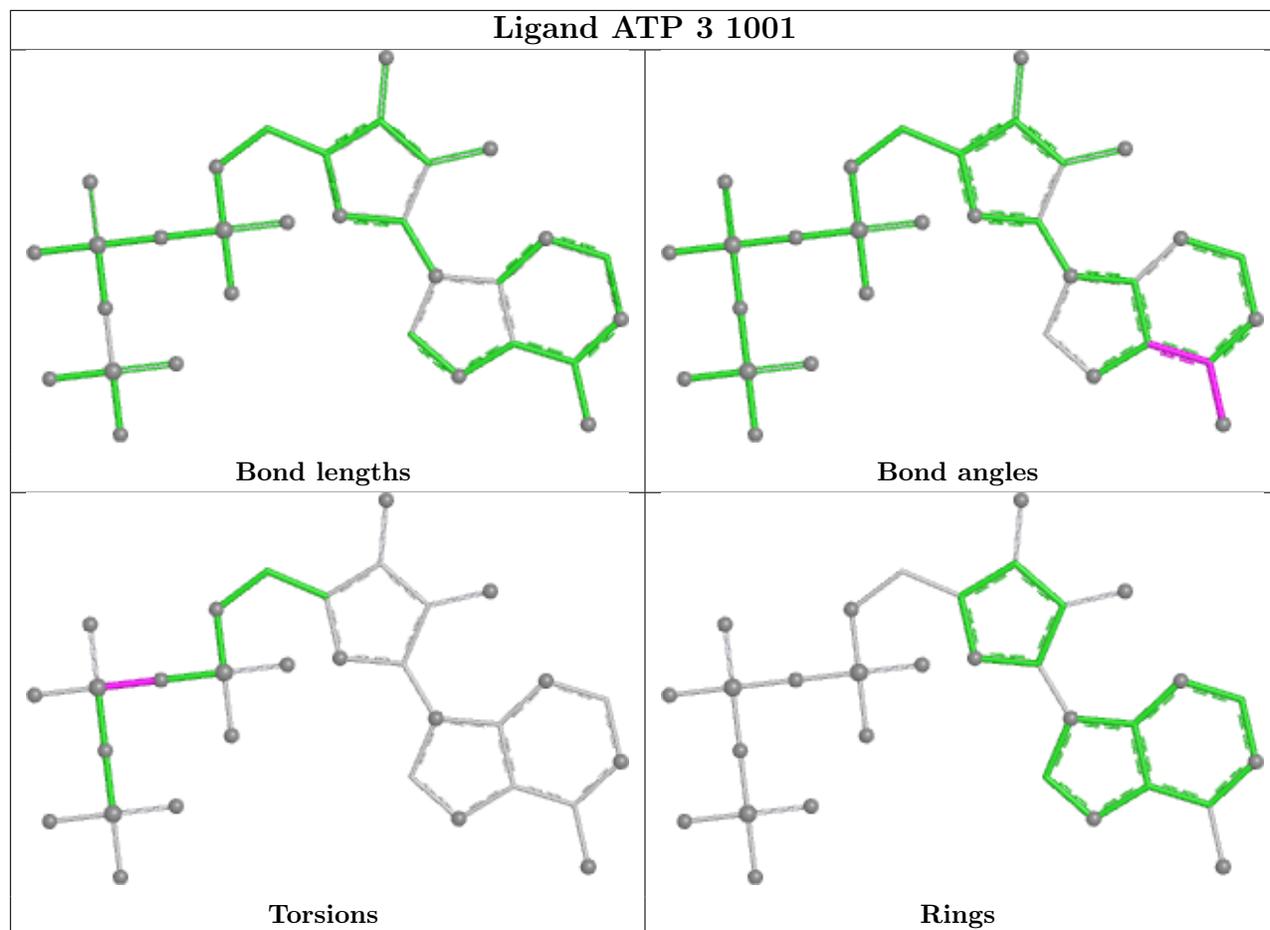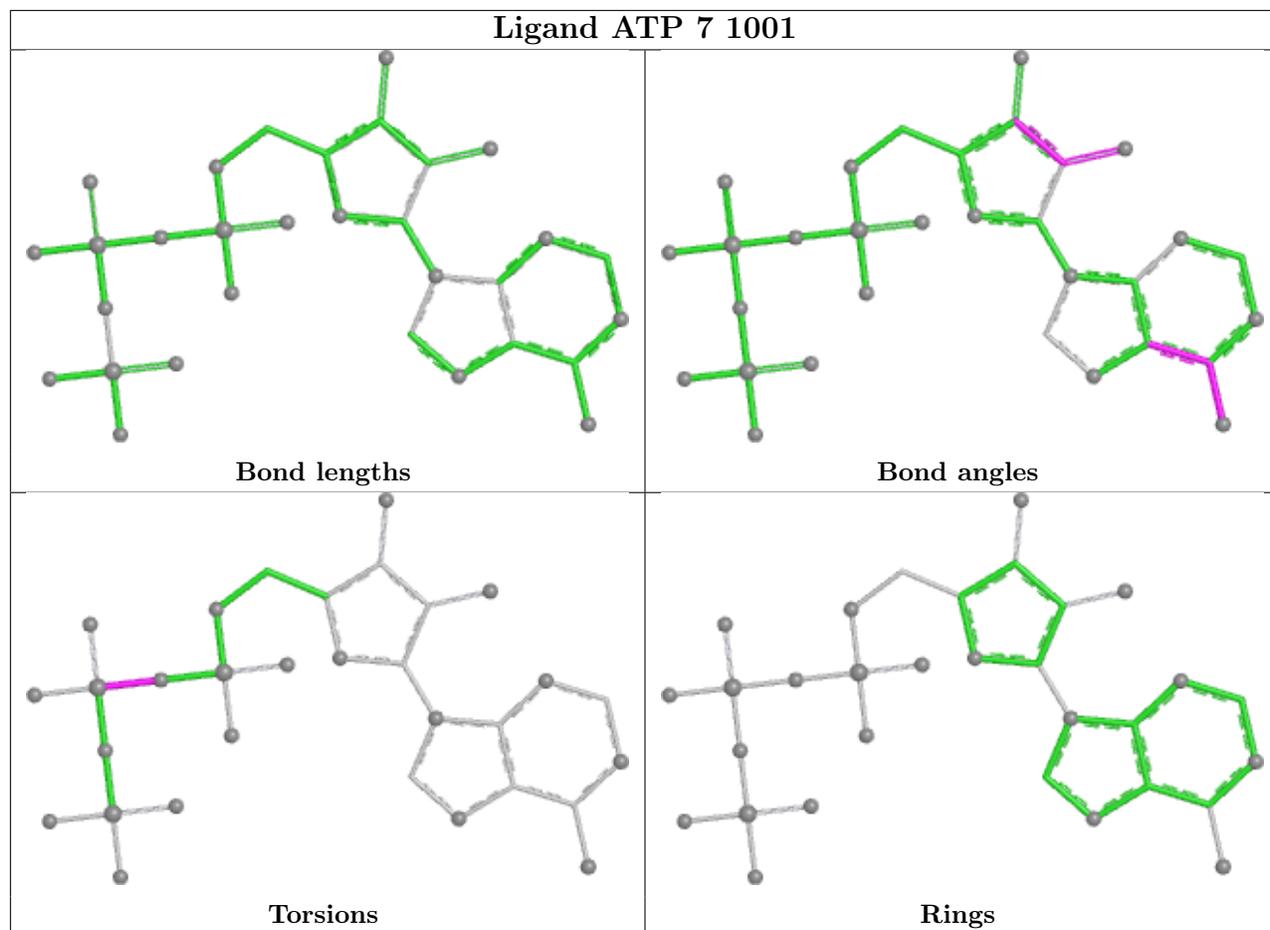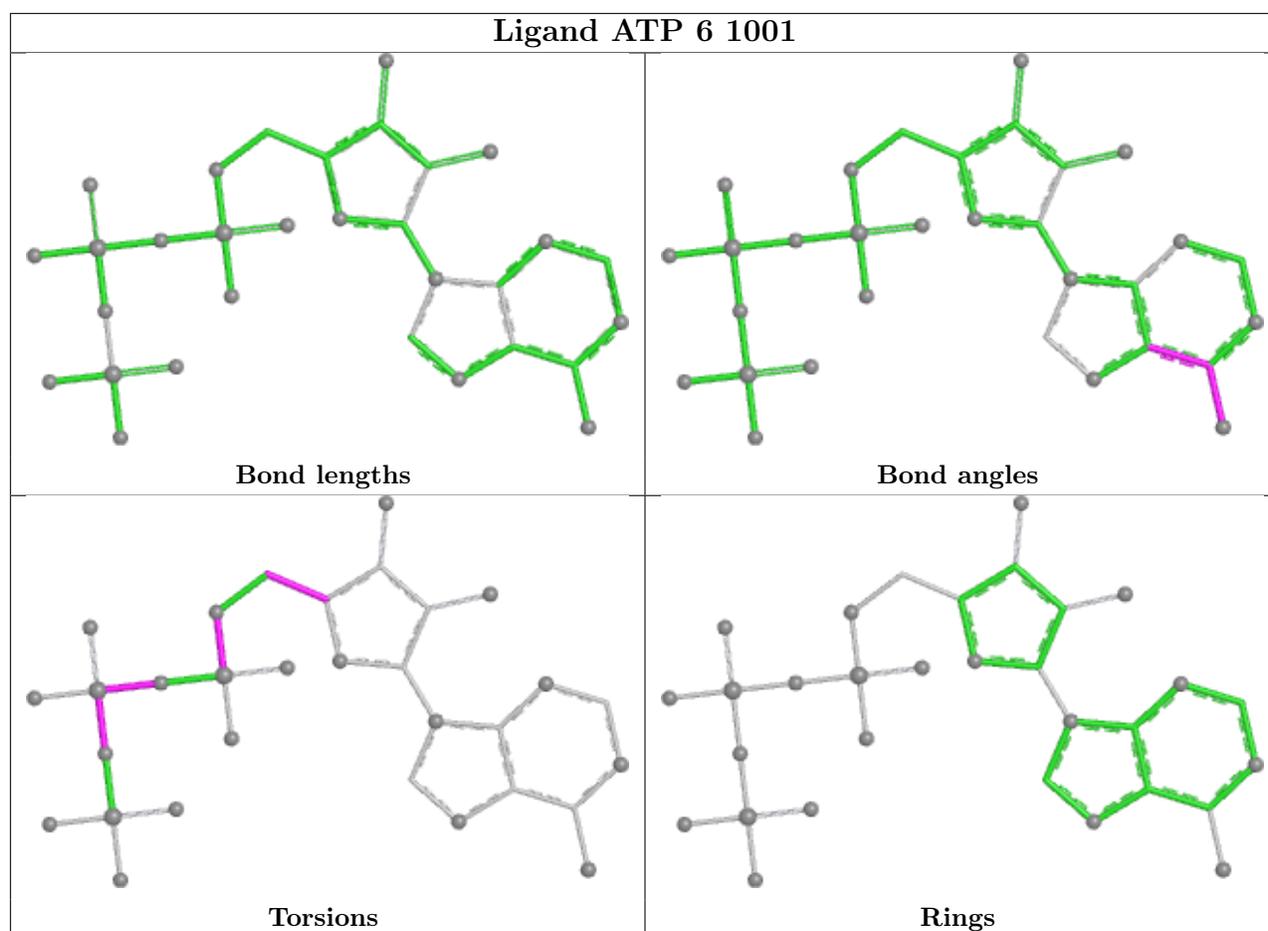
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-47473. These allow visual inspection of the internal detail of the map and identification of artifacts.

No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections ⓘ

This section was not generated.

6.2 Central slices ⓘ

This section was not generated.

6.3 Largest variance slices ⓘ

This section was not generated.

6.4 Orthogonal standard-deviation projections (False-color) ⓘ

This section was not generated.

6.5 Orthogonal surface views ⓘ

This section was not generated.

6.6 Mask visualisation ⓘ

This section was not generated. No masks/segmentation were deposited.

7 Map analysis ⓘ

This section contains the results of statistical analysis of the map.

7.1 Map-value distribution ⓘ

This section was not generated.

7.2 Volume estimate versus contour level ⓘ

This section was not generated.

7.3 Rotationally averaged power spectrum ⓘ

This section was not generated. The rotationally averaged power spectrum had issues being displayed.

8   Fourier-Shell correlation (i)

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit ⓘ

This section was not generated.