WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2023 – 08:06 am GMT

PDB ID	:	8QYQ
Title	:	Beta-cardiac myosin S1 fragment in the pre-powerstroke state complexed to Mavacamten
Authors	:	Robert-Paganin, J.; Kikuti, C.; Auguin, D.; Rety, S.; David, A.; Houdusse, A.
Deposited on	:	2023-10-26
Resolution	:	2.61 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1　Overall quality at a glance ⓘ

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

The reported resolution of this entry is 2.61 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.
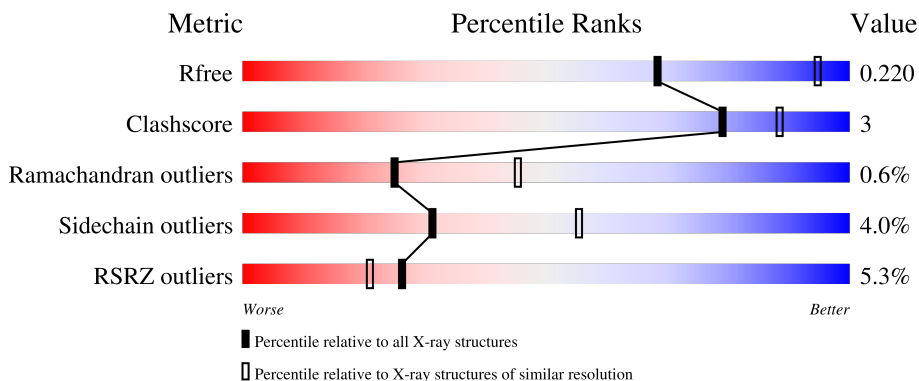
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3797 (2.64-2.60)
Clashscore	141614	4168 (2.64-2.60)
Ramachandran outliers	138981	4093 (2.64-2.60)
Sidechain outliers	138945	4093 (2.64-2.60)
RSRZ outliers	127900	3731 (2.64-2.60)

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	A	807	4% / 87% / 9% / ·
1	B	807	2% / 85% / 10% / 5%
2	C	199	4% / 65% / 13% / · / 21%
3	D	199	17% / 36% / 7% / 57%

2 Entry composition ⓘ

There are 10 unique types of molecules in this entry. The entry contains 14993 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 Myosin-7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	781	Total 6323	C 4043	N 1078	O 1168	S 34	0	3	0
1	B	770	Total 6219	C 3974	N 1062	O 1152	S 31	0	2	0

- Molecule 2 is a protein called Myosin light chain 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	157	Total 1240	C 781	N 205	O 244	S 10	0	0	0

- Molecule 3 is a protein called Myosin light chain 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	85	Total 601	C 370	N 103	O 125	S 3	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	151	VAL	THR	conflict	UNP P85100

- Molecule 4 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).

ADP

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
4	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 5 is BERYLLIUM TRIFLUORIDE ION (three-letter code: BEF) (formula: BeF_3) (labeled as "Ligand of Interest" by depositor).
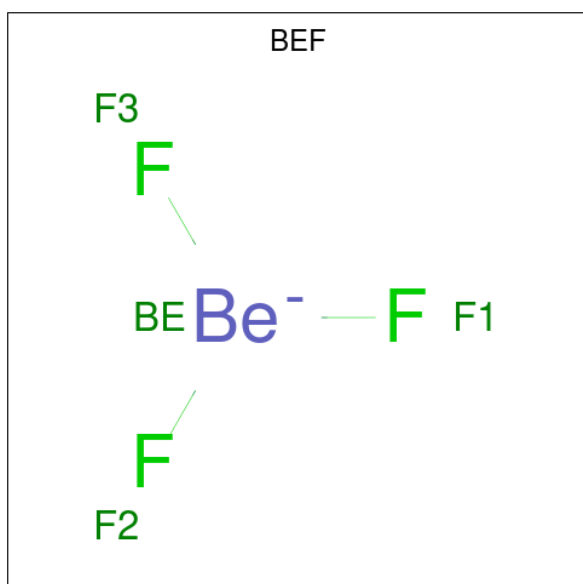
BEF

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	Be	F	0	0
			4	1	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total 4	Be 1	F 3	0	0

- Molecule 6 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total 1	Mg 1	0	0
6	B	1	Total 1	Mg 1	0	0

- Molecule 7 is 6-[[(1 {S})-1-phenylethyl]amino]-3-propan-2-yl-1 {H}-pyrimidine-2,4-d ione (three-letter code: XB2) (formula: $C_{15}H_{19}N_3O_2$) (labeled as "Ligand of Interest" by depositor).
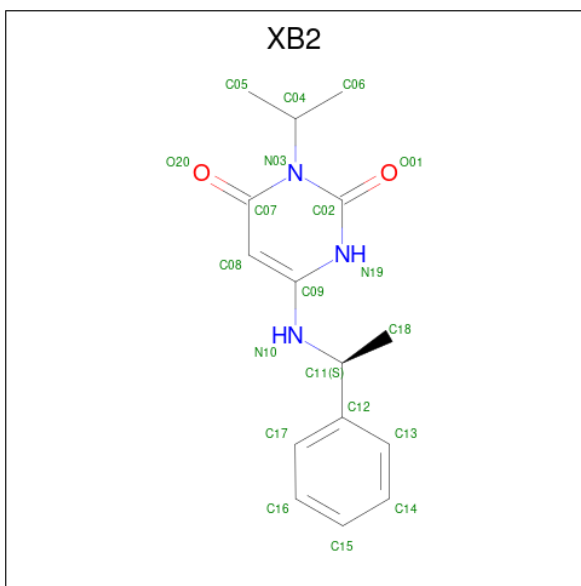
XB2

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total 20	C 15	N 3	O 2	0	0
7	B	1	Total 20	C 15	N 3	O 2	0	0

- Molecule 8 is FORMIC ACID (three-letter code: FMT) (formula: CH_2O_2).

FMT

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total 3	C 1	O 2	0	0
8	A	1	Total 3	C 1	O 2	0	0
8	A	1	Total 3	C 1	O 2	0	0
8	B	1	Total 3	C 1	O 2	0	0
8	B	1	Total 3	C 1	O 2	0	0

- Molecule 9 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

GOL
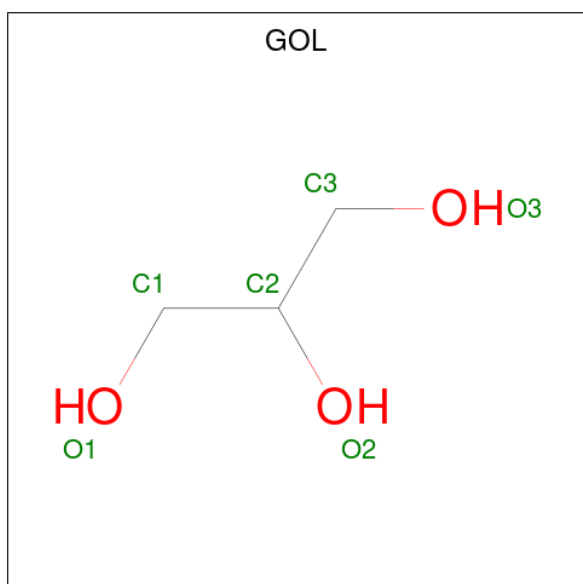
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	C	1	Total 6	C 3	O 3	0	0

- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	228	Total 228	O 228	0	0
10	B	242	Total 242	O 242	0	0
10	C	14	Total 14	O 14	0	0
10	D	1	Total 1	O 1	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Myosin-7
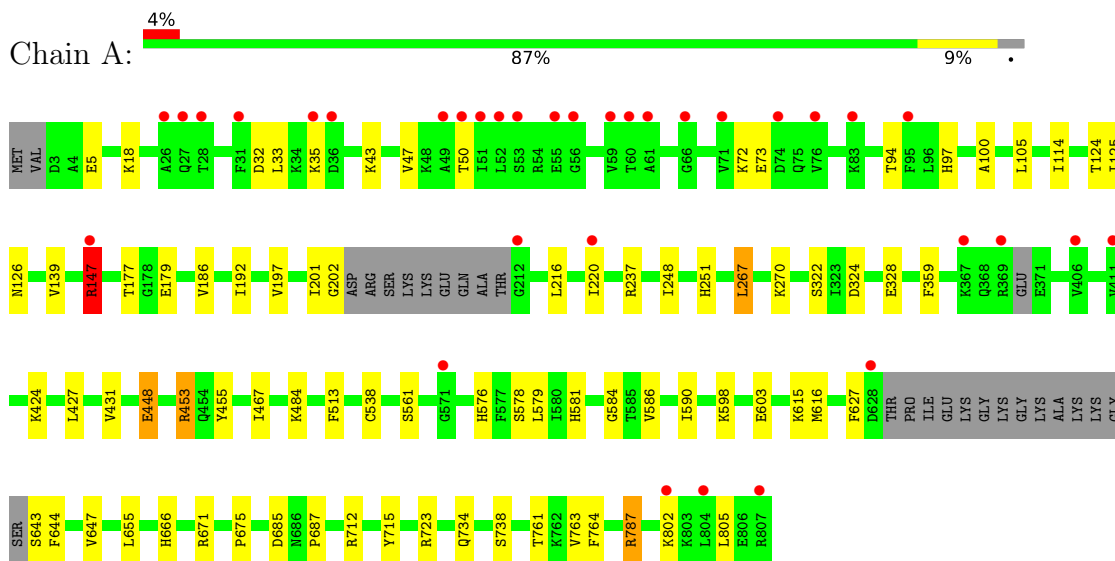
- Molecule 1: Myosin-7
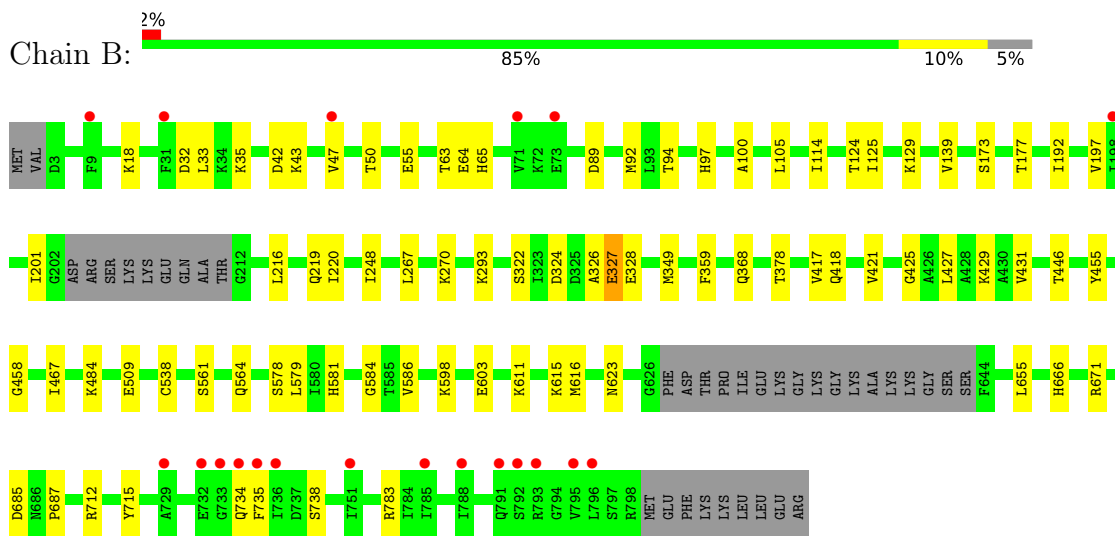
- Molecule 2: Myosin light chain 3

MET ALA PRO LYS LYS PRO ASP PRO LYS LYS ASP GLU ALA LYS ALA GLY ALA LYS LYS ALA ALA ALA PRO ALA PRO ALA PRO PRO ALA GLU PRO SER LYS GLU PRO GLU PHE ASP P43 S44 K45 I46 K47 I55 E56 A61 F62 T63 L64 M73 D82

R85 Q89 N90 V96 V99 E106 L119 P120 M121 D130 T131 G132 T133 Y134 E135 R142 E147 T151 G154 L157 R158 E174 I187 N188 Y189 K194 G199
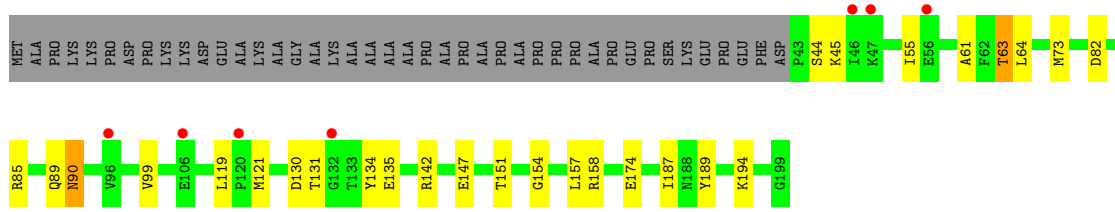
• Molecule 3: Myosin light chain 3

Chain D:

MET ALA PRO LYS LYS PRO ASP PRO LYS LYS ASP GLU ALA LYS ALA GLY ALA LYS LYS ALA ALA ALA PRO ALA PRO ALA PRO PRO ALA PRO GLU PRO SER LYS GLU PRO GLU PHE ASP PRO SER LYS ILE LYS ILE GLU PHE THR PRO GLU GLN ILE GLU GLU PHE LYS GLU

ALA PHE THR LEU PHE ASP ARG THR PRO LYS CYS GLU MET LYS ILE THR TYR GLY GLN C80 G81 D82 V83 L84 R85 A86 Q89 T92 Q93 A94 L97 R98 V99 K102 PRO LYS GLN GLU GLU LEU ASN SER LYS MET MET ASP PHE ASP THR PHE LEU PRO MET LEU GLN HIS

ILE SER LYS ASN K129 D130 T131 F137 L141 F144 D145 K146 E147 V151 V152 M153 G154 L157 R158 H159 V160 L161 A162 T163 L164 K167 LEU T169 E170 D171 E172 V173 GLU LYS LEU MET ALA GLY GLN E181 D182 C186 I187 N188 Y189 V193 I196 M197 A198 GLY

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	102.80Å 147.98Å 116.75Å 90.00° 91.62° 90.00°	Depositor
Resolution (Å)	91.64 – 2.61 91.64 – 2.61	Depositor EDS
% Data completeness (in resolution range)	66.0 (91.64-2.61) 66.0 (91.64-2.61)	Depositor EDS
R_{merge}	0.20	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.25 (at 2.62Å)	Xtriage
Refinement program	BUSTER 2.10.2	Depositor
R, R_{free}	0.178 , 0.217 0.185 , 0.220	Depositor DCC
R_{free} test set	3478 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	50.1	Xtriage
Anisotropy	0.106	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 73.3	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.021 for h,-k,-l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	14993	wwPDB-VP
Average B, all atoms (Å^2)	63.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.50% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: FMT, GOL, XB2, BEF, MG, M3L, ADP

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	0.52	0/6431	0.70	0/8662
1	B	0.51	0/6326	0.70	0/8528
2	C	0.50	0/1260	0.69	0/1690
3	D	0.44	0/605	0.67	0/813
All	All	0.51	0/14622	0.70	0/19693

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	6323	0	6298	36	0
1	B	6219	0	6190	31	0
2	C	1240	0	1226	15	0
3	D	601	0	522	4	0
4	A	27	0	12	1	0
4	B	27	0	12	0	0
5	A	4	0	0	0	0
5	B	4	0	0	0	0
6	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	1	0	0	0	0
7	A	20	0	0	0	0
7	B	20	0	0	0	0
8	A	9	0	6	1	0
8	B	6	0	4	0	0
9	C	6	0	8	0	0
10	A	228	0	0	2	0
10	B	242	0	0	0	0
10	C	14	0	0	0	0
10	D	1	0	0	0	0
All	All	14993	0	14278	81	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 3.

All (81) 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:C:154:GLY:HA2	2:C:187:ILE:HD12	1.71	0.72
1:A:513:PHE:H	8:A:1005:FMT:H	1.55	0.72
3:D:154:GLY:HA2	3:D:187:ILE:HD12	1.73	0.70
1:A:251:HIS:HB3	1:A:453:ARG:HG2	1.73	0.69
2:C:61:ALA:HA	2:C:64:LEU:HD12	1.79	0.62
1:B:417:VAL:O	1:B:421:VAL:HG23	2.01	0.61
1:A:179:GLU:HB3	1:A:237:ARG:NH2	2.18	0.58
1:A:147:ARG:HD3	10:A:1105:HOH:O	2.04	0.58
1:A:179:GLU:HB3	1:A:237:ARG:HH21	1.68	0.58
1:B:538:CYS:HA	1:B:598:LYS:HE2	1.88	0.56
1:B:192:ILE:HD11	1:B:248:ILE:HD13	1.87	0.56
1:A:685:ASP:OD1	1:A:687:PRO:HD2	2.08	0.54
1:A:627:PHE:HB2	1:A:644:PHE:H	1.71	0.54
1:A:538:CYS:HA	1:A:598:LYS:HE2	1.90	0.54
2:C:142:ARG:HG3	2:C:189:TYR:OH	2.07	0.54
1:A:192:ILE:HD11	1:A:248:ILE:HD13	1.91	0.53
1:B:685:ASP:OD1	1:B:687:PRO:HD2	2.07	0.53
1:A:202:GLY:HA3	10:A:1319:HOH:O	2.08	0.53
1:A:715:TYR:CE1	1:A:763:VAL:HG22	2.44	0.52
1:A:324:ASP:O	1:A:328:GLU:HG2	2.08	0.52
1:B:324:ASP:O	1:B:328:GLU:HG2	2.09	0.51
1:A:715:TYR:HB3	1:A:738:SER:HB3	1.92	0.51
1:A:761:THR:HG22	1:B:378:THR:HG23	1.92	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:D:157:LEU:HD23	3:D:187:ILE:HD13	1.93	0.51
2:C:157:LEU:HD23	2:C:187:ILE:HD13	1.93	0.50
1:B:734:GLN:HG2	1:B:735:PHE:N	2.26	0.49
1:B:35:LYS:HB3	1:B:50:THR:HG23	1.93	0.49
1:A:35:LYS:HB3	1:A:50:THR:HG23	1.95	0.49
2:C:158:ARG:HH12	2:C:174:GLU:HA	1.78	0.48
1:B:89:ASP:HB3	1:B:92:MET:CE	2.44	0.48
1:A:216:LEU:O	1:A:220:ILE:HG13	2.13	0.47
3:D:162:ALA:HB2	3:D:173:VAL:HG21	1.97	0.47
1:A:427:LEU:O	1:A:431:VAL:HG23	2.14	0.47
1:B:216:LEU:O	1:B:220:ILE:HG13	2.15	0.47
1:A:105:LEU:HB3	1:A:125:ILE:HD11	1.97	0.46
1:B:715:TYR:HB3	1:B:738:SER:HB3	1.96	0.46
1:A:177:THR:OG1	1:A:671:ARG:HD2	2.15	0.46
1:B:425:GLY:O	1:B:429:LYS:HG3	2.15	0.46
1:B:611:LYS:HB3	2:C:147:GLU:HB2	1.96	0.46
1:B:32:ASP:HB3	1:B:35:LYS:HB2	1.97	0.46
1:B:427:LEU:O	1:B:431:VAL:HG23	2.16	0.46
2:C:63:THR:HG23	2:C:73:MET:SD	2.56	0.45
1:A:32:ASP:HB3	1:A:35:LYS:HB2	1.98	0.45
1:A:186:VAL:HG11	4:A:1001:ADP:C5	2.52	0.45
1:B:89:ASP:HB3	1:B:92:MET:HE3	2.00	0.44
1:B:219:GLN:NE2	1:B:446:THR:HG22	2.32	0.44
1:B:97:HIS:CE1	1:B:100:ALA:HB2	2.53	0.44
1:A:267:LEU:HD11	1:A:647:VAL:HG13	2.00	0.43
1:B:293:LYS:HD3	1:B:326:ALA:HB1	2.00	0.43
1:A:627:PHE:HD2	1:A:643:SER:N	2.16	0.43
1:A:712:ARG:HD3	1:A:764:PHE:CE2	2.53	0.43
1:A:787:ARG:HD3	2:C:131:THR:HA	2.00	0.43
1:B:349:MET:HG2	1:B:616:MET:HE1	2.01	0.43
1:A:448:GLU:O	1:A:448:GLU:HG2	2.19	0.43
1:B:173:SER:HA	1:B:458:GLY:O	2.19	0.42
1:A:114:ILE:O	1:A:124:THR:HA	2.19	0.42
1:B:105:LEU:HB3	1:B:125:ILE:HD11	2.00	0.42
2:C:90:ASN:ND2	2:C:90:ASN:N	2.67	0.42
3:D:85:ARG:HA	3:D:89:GLN:O	2.19	0.42
1:B:581:HIS:HB2	1:B:584:GLY:O	2.19	0.42
1:B:564:GLN:HB2	1:B:578:SER:OG	2.20	0.42
1:A:97:HIS:CE1	1:A:100:ALA:HB2	2.55	0.42
1:A:467:ILE:HG12	1:A:586:VAL:HG22	2.02	0.42
1:B:324:ASP:OD2	1:B:327:GLU:HG2	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:581:HIS:HB2	1:A:584:GLY:O	2.20	0.41
2:C:85:ARG:HA	2:C:89:GLN:O	2.19	0.41
2:C:134:TYR:CE1	2:C:194:LYS:HG3	2.55	0.41
1:B:114:ILE:O	1:B:124:THR:HA	2.19	0.41
1:A:139:VAL:HG11	1:A:197:VAL:HB	2.02	0.41
1:B:467:ILE:HG12	1:B:586:VAL:HG22	2.03	0.41
1:B:177:THR:OG1	1:B:671:ARG:HD2	2.21	0.41
2:C:99:VAL:HB	2:C:121:MET:HG2	2.02	0.41
1:A:723:ARG:HH22	2:C:135:GLU:CG	2.34	0.41
1:A:802:LYS:HA	1:A:805:LEU:HD12	2.03	0.41
1:A:576:HIS:ND1	1:A:590:ILE:HG13	2.36	0.41
1:A:723:ARG:HH22	2:C:135:GLU:HG2	1.86	0.41
1:A:126:ASN:HB3	1:A:675:PRO:HD3	2.03	0.41
1:B:63:THR:C	1:B:65:HIS:H	2.24	0.40
1:B:139:VAL:HG11	1:B:197:VAL:HB	2.02	0.40
1:B:734:GLN:HG2	1:B:735:PHE:H	1.85	0.40
2:C:55:ILE:HG12	2:C:119:LEU:HD21	2.03	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 X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	774/807 (96%)	742 (96%)	28 (4%)	4 (0%)	29	50
1	B	764/807 (95%)	736 (96%)	23 (3%)	5 (1%)	22	41
2	C	155/199 (78%)	148 (96%)	6 (4%)	1 (1%)	25	45
3	D	77/199 (39%)	76 (99%)	1 (1%)	0	100	100
All	All	1770/2012 (88%)	1702 (96%)	58 (3%)	10 (1%)	25	45

All (10) Ramachandran outliers are listed below:

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Mol	Chain	Res	Type
1	A	201	ILE
1	A	267	LEU
1	B	55	GLU
1	B	267	LEU
1	A	72	LYS
1	B	201	ILE
1	B	43	LYS
2	C	44	SER
1	B	64	GLU
1	A	147	ARG

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	677/695 (97%)	651 (96%)	26 (4%)	33	57
1	B	665/695 (96%)	642 (96%)	23 (4%)	36	60
2	C	136/165 (82%)	130 (96%)	6 (4%)	28	52
3	D	54/165 (33%)	48 (89%)	6 (11%)	6	10
All	All	1532/1720 (89%)	1471 (96%)	61 (4%)	31	55

All (61) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	GLU
1	A	18	LYS
1	A	33	LEU
1	A	43	LYS
1	A	47	VAL
1	A	73	GLU
1	A	94	THR
1	A	147	ARG
1	A	270	LYS
1	A	322	SER
1	A	359	PHE
1	A	424	LYS

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Mol	Chain	Res	Type
1	A	448	GLU
1	A	453	ARG
1	A	455	TYR
1	A	484	LYS
1	A	561	SER
1	A	578	SER
1	A	579	LEU
1	A	603	GLU
1	A	615	LYS
1	A	616	MET
1	A	655	LEU
1	A	666	HIS
1	A	734	GLN
1	A	787	ARG
1	B	18	LYS
1	B	33	LEU
1	B	42	ASP
1	B	47	VAL
1	B	94	THR
1	B	270	LYS
1	B	322	SER
1	B	327	GLU
1	B	359	PHE
1	B	368	GLN
1	B	418	GLN
1	B	455	TYR
1	B	484	LYS
1	B	509	GLU
1	B	561	SER
1	B	579	LEU
1	B	603	GLU
1	B	615	LYS
1	B	623	ASN
1	B	655	LEU
1	B	666	HIS
1	B	712	ARG
1	B	783	ARG
2	C	45	LYS
2	C	63	THR
2	C	82	ASP
2	C	90	ASN
2	C	130	ASP

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Mol	Chain	Res	Type
2	C	151	THR
3	D	92	THR
3	D	130	ASP
3	D	151	VAL
3	D	182	ASP
3	D	196	ILE
3	D	197	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	75	GLN
1	B	160	ASN
1	B	415	GLN
2	C	54	GLN
2	C	105	GLN
2	C	109	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues are 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	$\#|Z| > 2$
1	M3L	A	129	1	10,11,12	0.64	0	9,14,16	0.79	0
1	M3L	A	549	1	10,11,12	0.46	0	9,14,16	0.42	0
1	M3L	B	549	1	10,11,12	0.43	0	9,14,16	0.44	0
1	M3L	B	129	1	10,11,12	0.84	1 (10%)	9,14,16	0.78	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
1	M3L	A	129	1	-	0/9/10/12	-
1	M3L	A	549	1	-	1/9/10/12	-
1	M3L	B	549	1	-	1/9/10/12	-
1	M3L	B	129	1	-	0/9/10/12	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	129	M3L	CB-CA	2.20	1.56	1.53

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	549	M3L	CA-CB-CG-CD
1	B	549	M3L	CA-CB-CG-CD

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 14 ligands modelled in this entry, 2 are monoatomic - leaving 12 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
5	BEF	B	1002	4	0,3,3	-	-	-		
7	XB2	A	1004	-	19,21,21	4.15	6 (31%)	23,29,29	2.02	6 (26%)
8	FMT	A	1005	-	2,2,2	1.32	0	1,1,1	1.06	0
8	FMT	B	1004	-	2,2,2	1.24	0	1,1,1	1.03	0
5	BEF	A	1002	4	0,3,3	-	-	-		
4	ADP	B	1001	6,5	24,29,29	0.84	1 (4%)	29,45,45	0.70	0
8	FMT	A	1006	-	2,2,2	1.44	1 (50%)	1,1,1	1.09	0
8	FMT	A	1007	-	2,2,2	1.48	1 (50%)	1,1,1	0.79	0
7	XB2	B	1003	-	19,21,21	4.12	6 (31%)	23,29,29	2.08	7 (30%)
9	GOL	C	201	-	5,5,5	0.13	0	5,5,5	0.33	0
8	FMT	B	1005	-	2,2,2	1.43	0	1,1,1	1.02	0
4	ADP	A	1001	6,5	24,29,29	0.63	0	29,45,45	0.85	2 (6%)

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
7	XB2	A	1004	-	-	0/10/12/12	0/2/2/2
4	ADP	B	1001	6,5	-	2/12/32/32	0/3/3/3
7	XB2	B	1003	-	-	0/10/12/12	0/2/2/2
9	GOL	C	201	-	-	1/4/4/4	-
4	ADP	A	1001	6,5	-	2/12/32/32	0/3/3/3

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	1003	XB2	O01-C02	14.01	1.48	1.23
7	A	1004	XB2	O01-C02	13.60	1.47	1.23
7	A	1004	XB2	O20-C07	7.67	1.40	1.23
7	B	1003	XB2	O20-C07	7.30	1.39	1.23
7	A	1004	XB2	C02-N03	-5.78	1.32	1.39
7	B	1003	XB2	C02-N03	-4.79	1.33	1.39
7	A	1004	XB2	C13-C12	4.59	1.46	1.39
7	B	1003	XB2	C13-C12	4.17	1.45	1.39
7	A	1004	XB2	C16-C15	3.14	1.46	1.38
7	B	1003	XB2	C16-C15	3.03	1.46	1.38
7	B	1003	XB2	C07-N03	-2.93	1.36	1.40
7	A	1004	XB2	C07-N03	-2.82	1.36	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1001	ADP	PB-O2B	-2.23	1.46	1.54
8	A	1006	FMT	O2-C	2.02	1.38	1.28
8	A	1007	FMT	O2-C	2.01	1.38	1.28

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	A	1004	XB2	C07-C08-C09	-5.27	116.62	121.47
7	B	1003	XB2	N19-C02-N03	4.88	121.22	115.54
7	B	1003	XB2	C07-C08-C09	-4.78	117.07	121.47
7	A	1004	XB2	N19-C02-N03	4.69	120.99	115.54
7	B	1003	XB2	C08-C07-N03	3.24	120.92	115.64
7	A	1004	XB2	C08-C07-N03	3.06	120.62	115.64
7	B	1003	XB2	O20-C07-C08	-3.00	118.04	125.72
7	A	1004	XB2	O01-C02-N03	-2.98	119.98	122.72
7	A	1004	XB2	C06-C04-N03	-2.68	107.91	111.67
7	A	1004	XB2	C05-C04-N03	2.66	115.41	111.67
7	B	1003	XB2	O01-C02-N19	-2.56	116.73	121.50
7	B	1003	XB2	C18-C11-C12	-2.49	106.55	112.25
7	B	1003	XB2	C17-C12-C13	2.42	121.31	118.29
4	A	1001	ADP	O3B-PB-O2B	2.19	116.01	107.64
4	A	1001	ADP	C5-C6-N6	2.08	123.52	120.35

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1001	ADP	PA-O3A-PB-O3B
4	B	1001	ADP	PA-O3A-PB-O3B
4	A	1001	ADP	PA-O3A-PB-O1B
9	C	201	GOL	C1-C2-C3-O3
4	B	1001	ADP	PA-O3A-PB-O1B

There are no ring outliers.

2 monomers are involved in 2 short contacts:

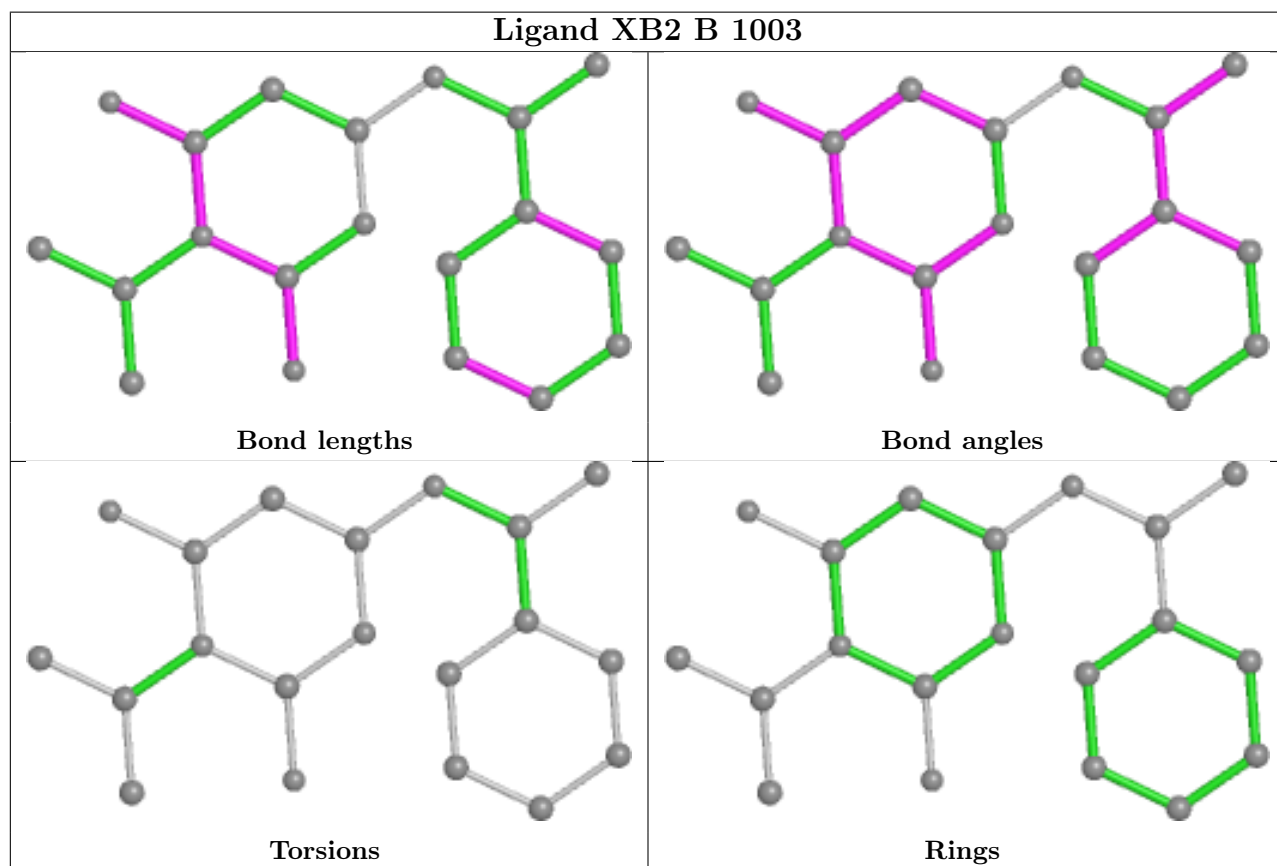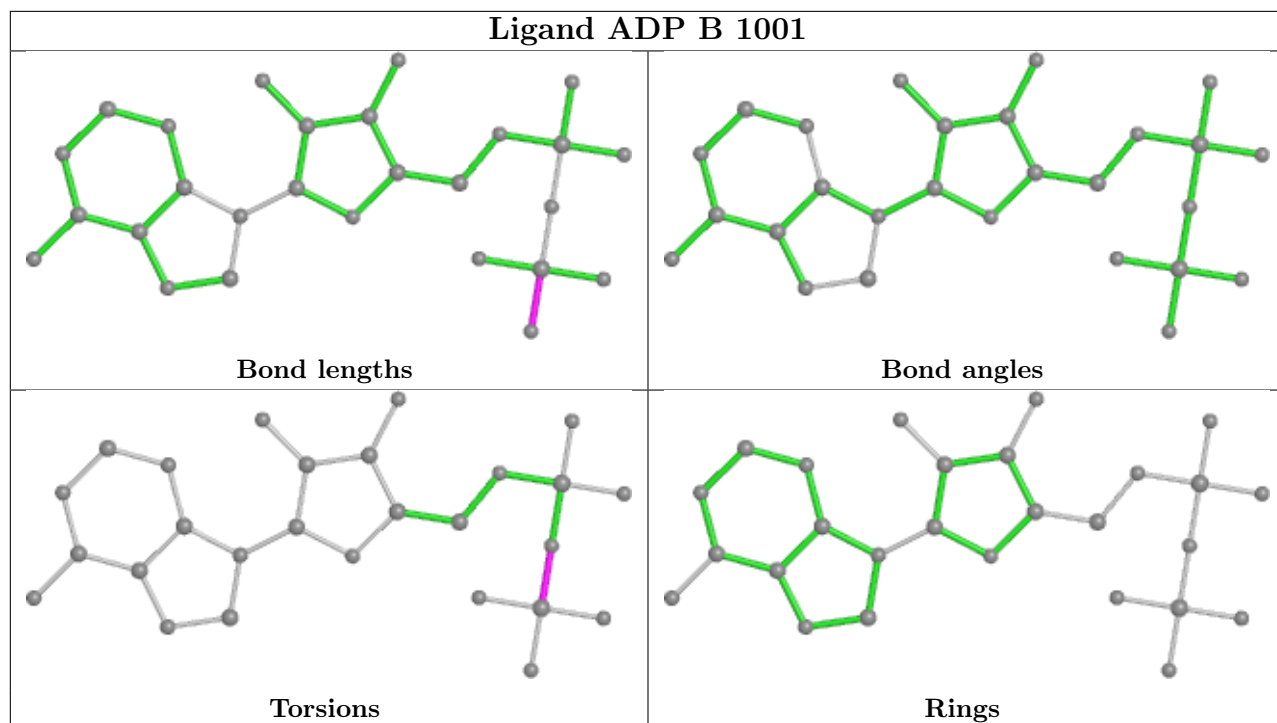| Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	A	1005	FMT	1	0
4	A	1001	ADP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,
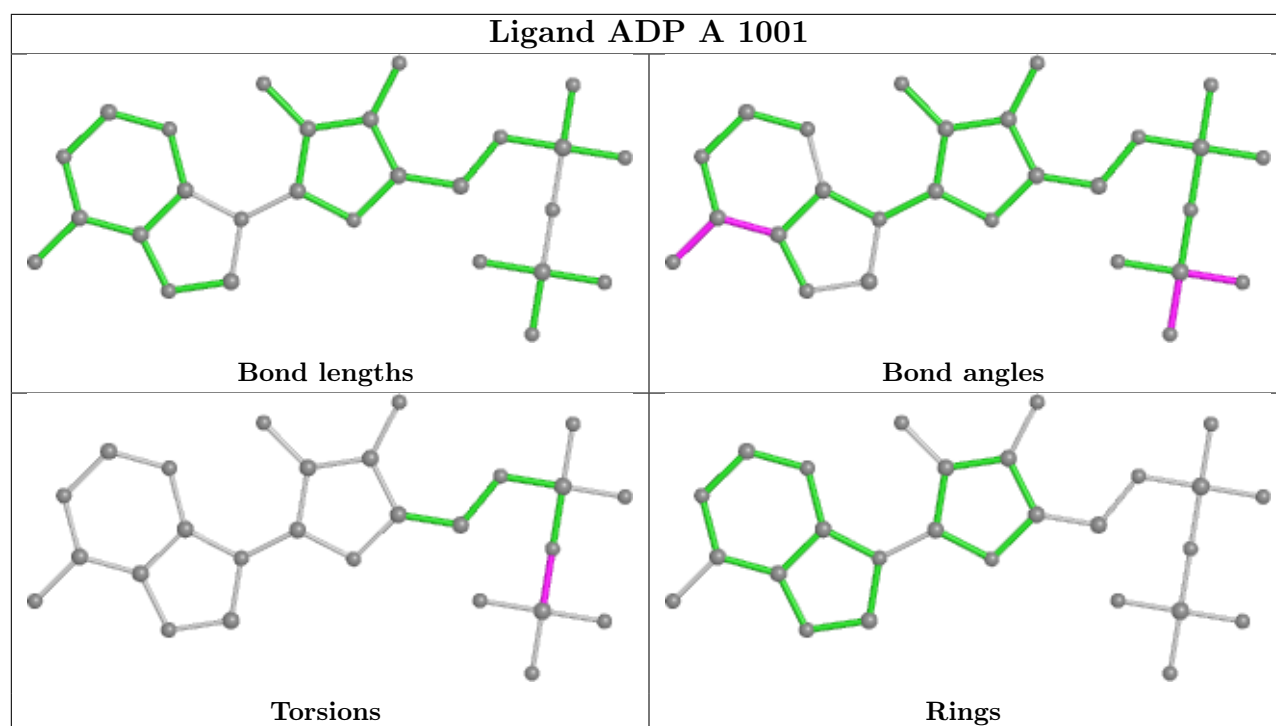
bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 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 BEF B 1002

Bond lengths

Bond angles

Torsions

Rings

Ligand XB2 A 1004

Bond lengths

Bond angles

Torsions

Rings

Ligand BEF A 1002

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP B 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand XB2 B 1003

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP A 1001

Bond lengths

Bond angles

Torsions

Rings
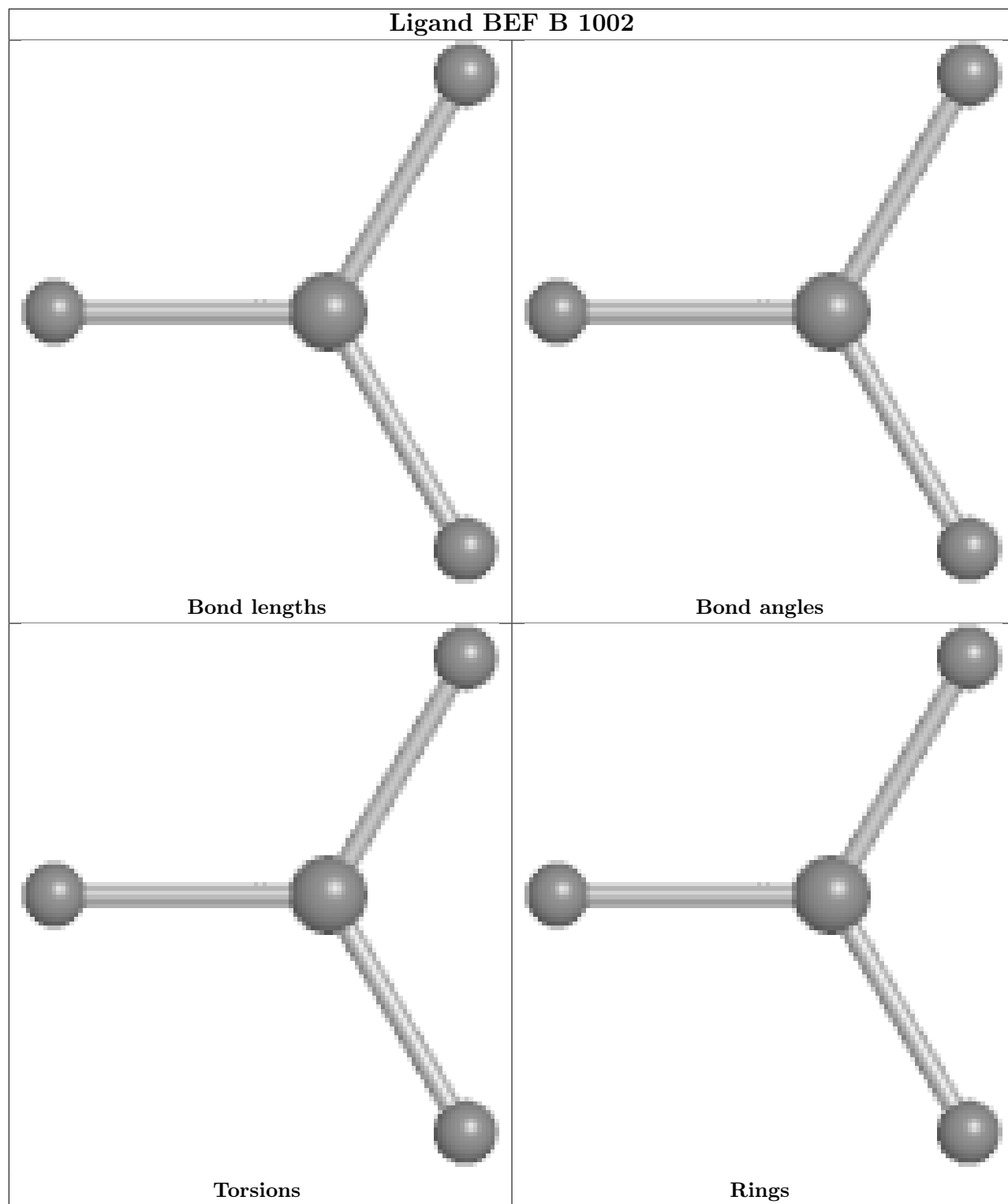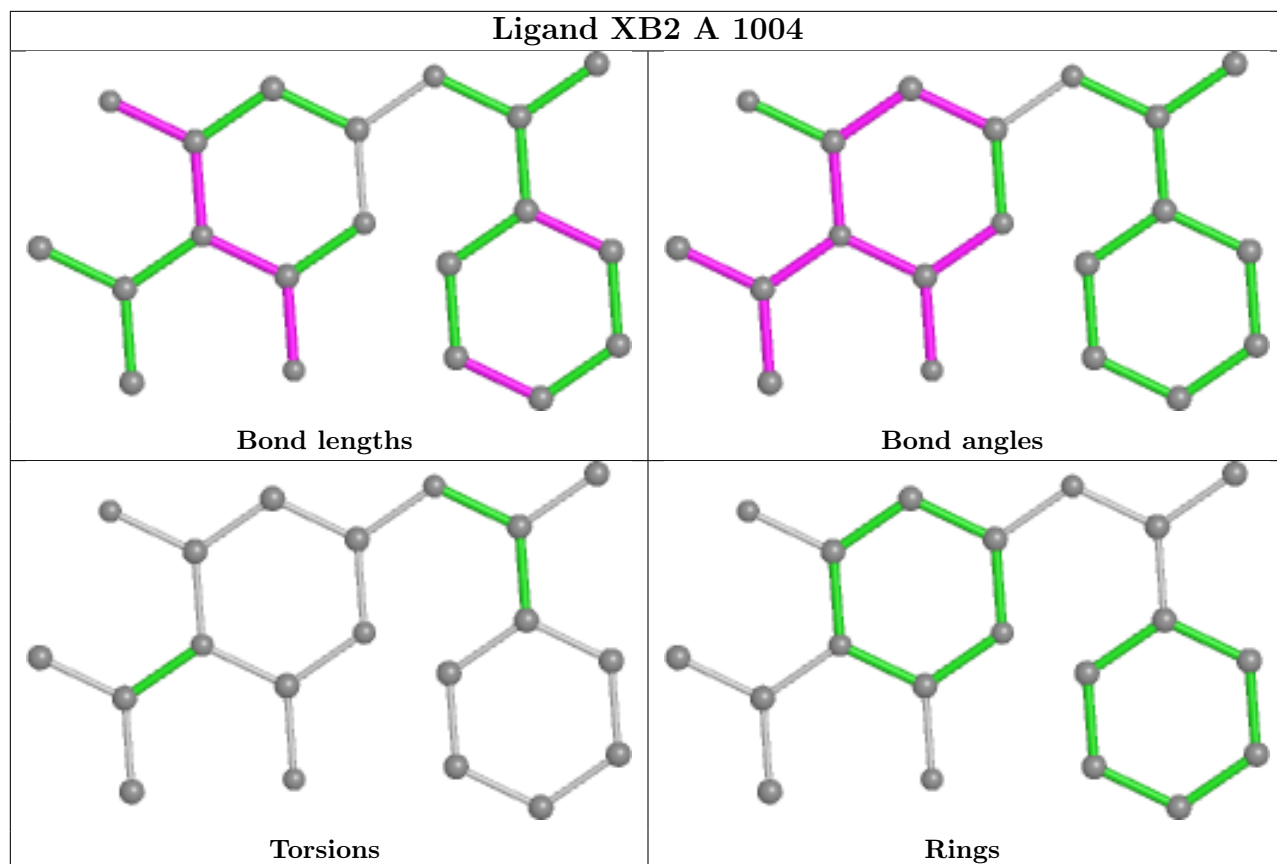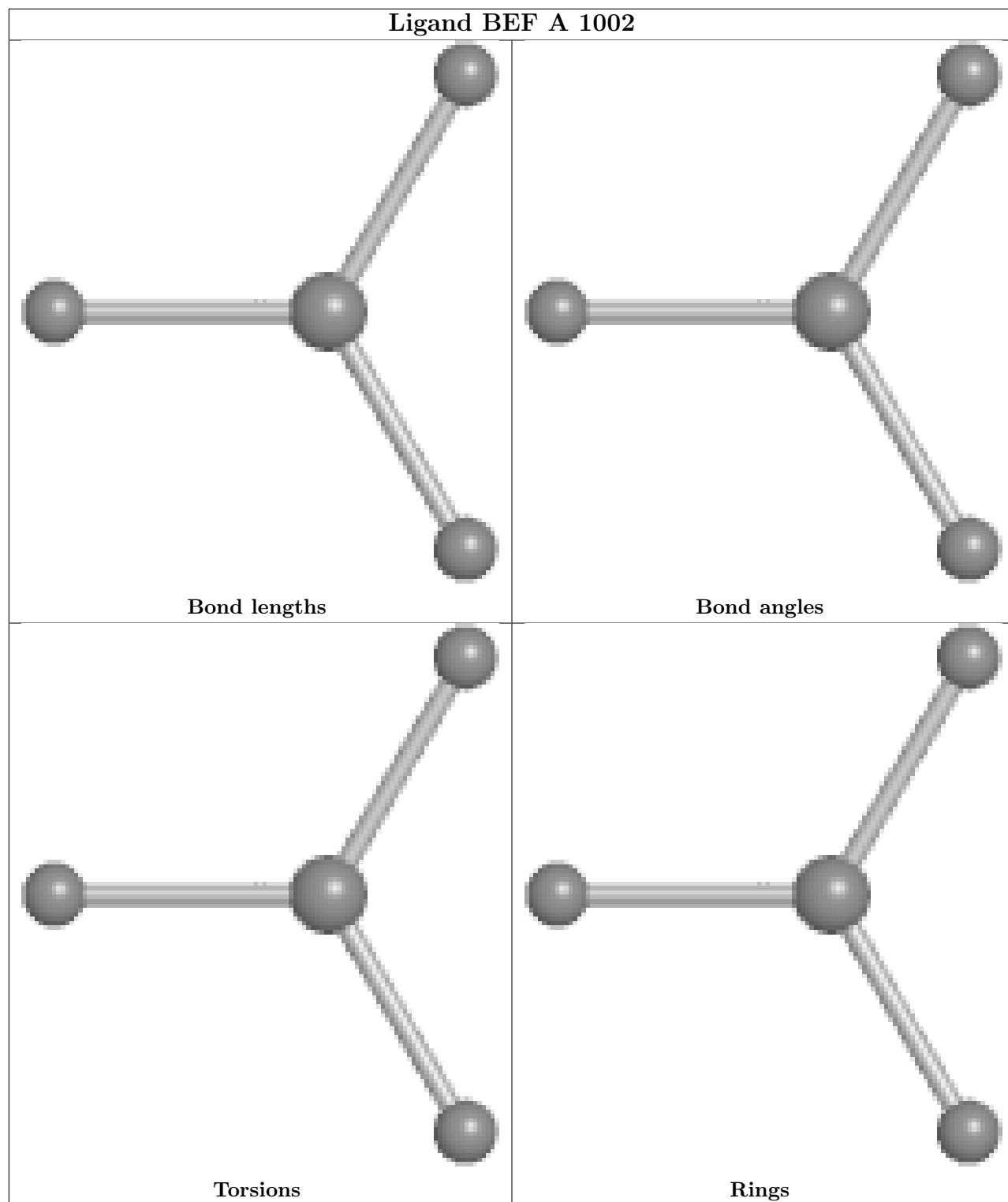
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å²)	Q<0.9
1	A	779/807 (96%)	0.43	34 (4%)	34	28	24, 51, 117, 163	0
1	B	768/807 (95%)	0.40	20 (2%)	56	50	20, 49, 108, 200	0
2	C	157/199 (78%)	0.43	7 (4%)	33	27	42, 79, 127, 163	0
3	D	85/199 (42%)	1.82	33 (38%)	0	0	101, 149, 178, 196	0
All	All	1789/2012 (88%)	0.49	94 (5%)	26	21	20, 54, 138, 200	0

All (94) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	628	ASP	7.1
3	D	171	ASP	6.1
3	D	160	VAL	6.0
2	C	46	ILE	5.9
1	B	733	GLY	5.5
3	D	144	PHE	5.4
3	D	161	LEU	5.4
3	D	141	LEU	5.3
1	B	735	PHE	5.0
1	A	50	THR	4.8
3	D	164	LEU	4.8
1	A	52	LEU	4.6
1	A	71	VAL	4.5
1	A	49	ALA	4.4
1	A	369	ARG	4.3
3	D	187	ILE	4.0
3	D	189	TYR	4.0
3	D	130	ASP	3.9
1	B	792	SER	3.9
1	A	804	LEU	3.8
3	D	94	ALA	3.8

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Mol	Chain	Res	Type	RSRZ
3	D	84	LEU	3.8
1	A	56	GLY	3.8
1	A	411	VAL	3.8
1	A	60	THR	3.8
3	D	86	ALA	3.7
1	A	35	LYS	3.6
1	B	788	ILE	3.4
1	A	95	PHE	3.3
1	B	71	VAL	3.2
3	D	152	VAL	3.2
3	D	193	VAL	3.2
1	A	27	GLN	3.2
1	A	31	PHE	3.2
1	A	61	ALA	3.1
3	D	159	HIS	3.1
3	D	97	LEU	3.1
1	B	732	GLU	3.1
1	B	785	ILE	3.1
1	A	51	ILE	3.1
3	D	157	LEU	3.0
3	D	81	GLY	2.9
3	D	83	VAL	2.9
3	D	137	PHE	2.9
1	B	791	GLN	2.9
3	D	162	ALA	2.8
2	C	47	LYS	2.8
1	B	736	ILE	2.8
1	B	795	VAL	2.8
2	C	96	VAL	2.8
3	D	197	MET	2.8
3	D	186	CYS	2.8
1	A	28	THR	2.7
1	A	76	VAL	2.7
3	D	146	LYS	2.7
1	B	734	GLN	2.7
1	A	36	ASP	2.7
1	A	66	GLY	2.6
1	A	59	VAL	2.6
1	A	212	GLY	2.6
3	D	154	GLY	2.6
3	D	153	MET	2.5
3	D	158	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
2	C	106	GLU	2.5
1	A	26	ALA	2.5
1	B	751	ILE	2.5
1	A	802	LYS	2.5
3	D	99	VAL	2.4
2	C	56	GLU	2.4
3	D	131	THR	2.4
1	A	147	ARG	2.3
3	D	147	GLU	2.3
3	D	163	THR	2.3
1	A	367	LYS	2.3
3	D	196	ILE	2.3
1	B	73	GLU	2.3
1	B	31	PHE	2.3
1	B	198	ILE	2.3
1	B	796	LEU	2.2
1	B	793	ARG	2.2
1	A	220	ILE	2.2
1	A	83	LYS	2.1
2	C	132	GLY	2.1
1	B	47	VAL	2.1
1	A	55	GLU	2.1
1	A	807	ARG	2.1
1	B	729	ALA	2.1
1	A	53	SER	2.1
1	A	571	GLY	2.1
1	A	406	VAL	2.1
3	D	98	ARG	2.1
1	A	74	ASP	2.0
2	C	120	PRO	2.0
1	B	9	PHE	2.0

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

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
1	M3L	B	549	12/13	0.97	0.21	50,56,61,63	0
1	M3L	A	549	12/13	0.98	0.17	53,58,65,65	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
1	M3L	B	129	12/13	0.98	0.21	47,50,54,58	0
1	M3L	A	129	12/13	0.98	0.24	47,50,53,54	0

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
9	GOL	C	201	6/6	0.91	0.17	70,78,80,82	0
8	FMT	A	1007	3/3	0.92	0.18	69,69,72,75	0
8	FMT	B	1005	3/3	0.95	0.19	60,60,60,61	0
8	FMT	A	1006	3/3	0.96	0.23	50,50,52,54	0
8	FMT	B	1004	3/3	0.97	0.19	51,51,53,55	0
7	XB2	B	1003	20/20	0.98	0.28	33,42,49,51	0
5	BEF	B	1002	4/4	0.98	0.12	34,37,38,41	0
8	FMT	A	1005	3/3	0.99	0.20	42,42,43,43	0
5	BEF	A	1002	4/4	0.99	0.15	31,32,34,38	0
4	ADP	A	1001	27/27	0.99	0.18	35,41,45,52	0
6	MG	B	1006	1/1	0.99	0.12	35,35,35,35	0
7	XB2	A	1004	20/20	0.99	0.23	20,29,44,45	0
4	ADP	B	1001	27/27	0.99	0.20	35,40,45,48	0
6	MG	A	1003	1/1	1.00	0.17	27,27,27,27	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.
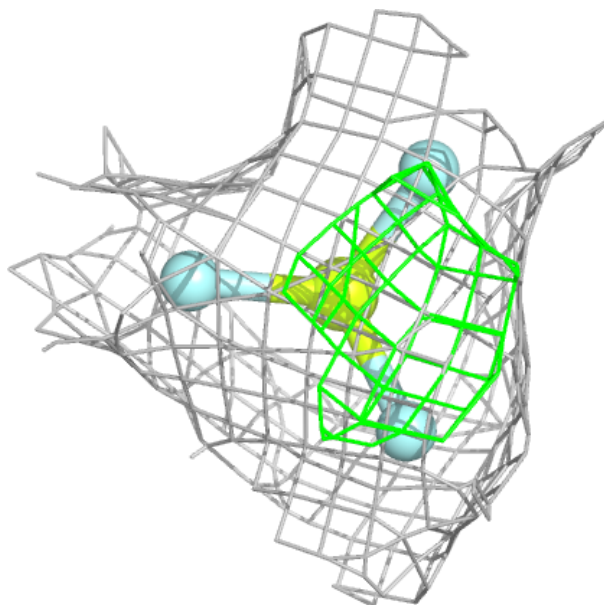
Electron density around XB2 B 1003:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
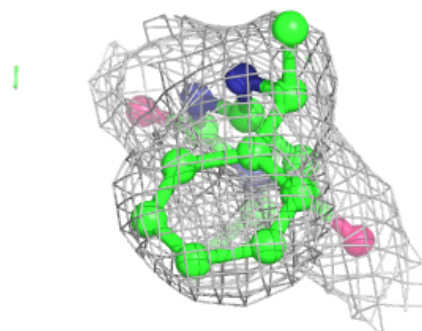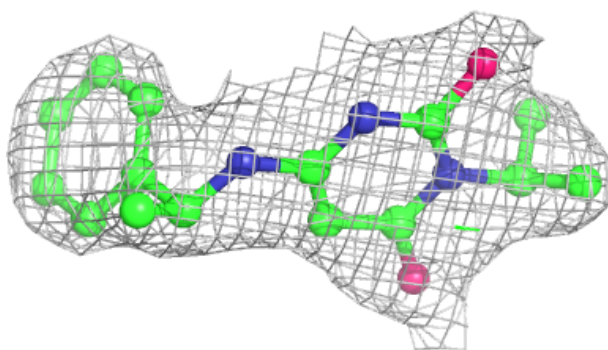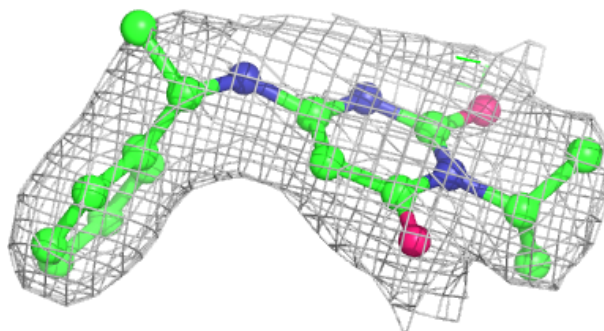
Electron density around BEF B 1002:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
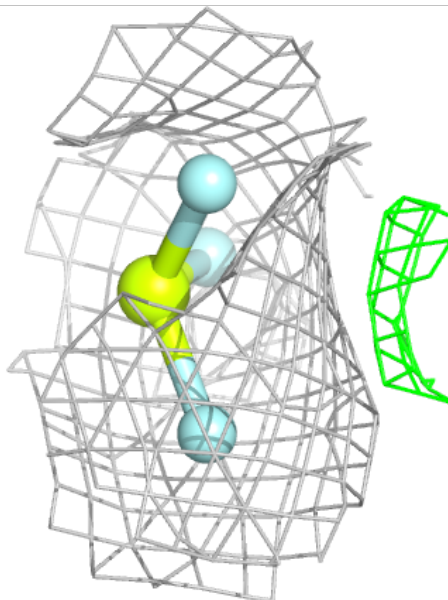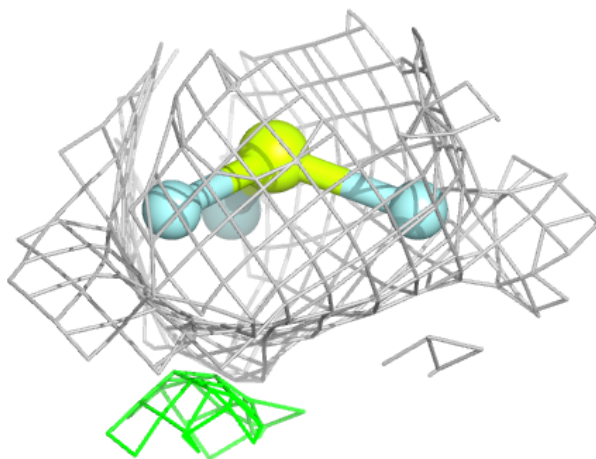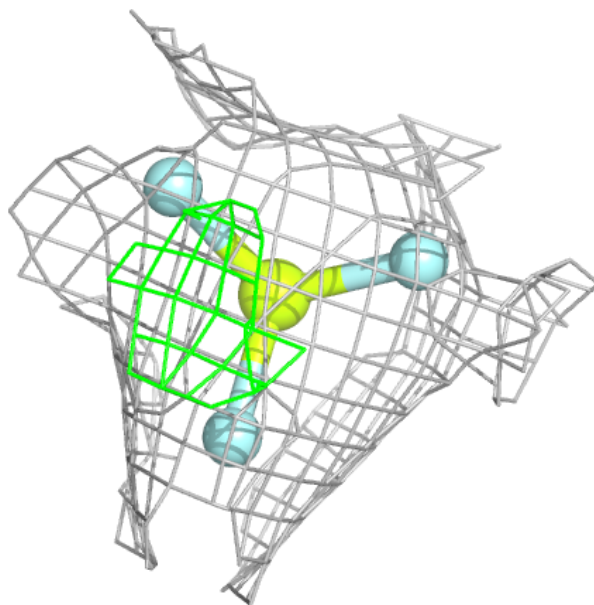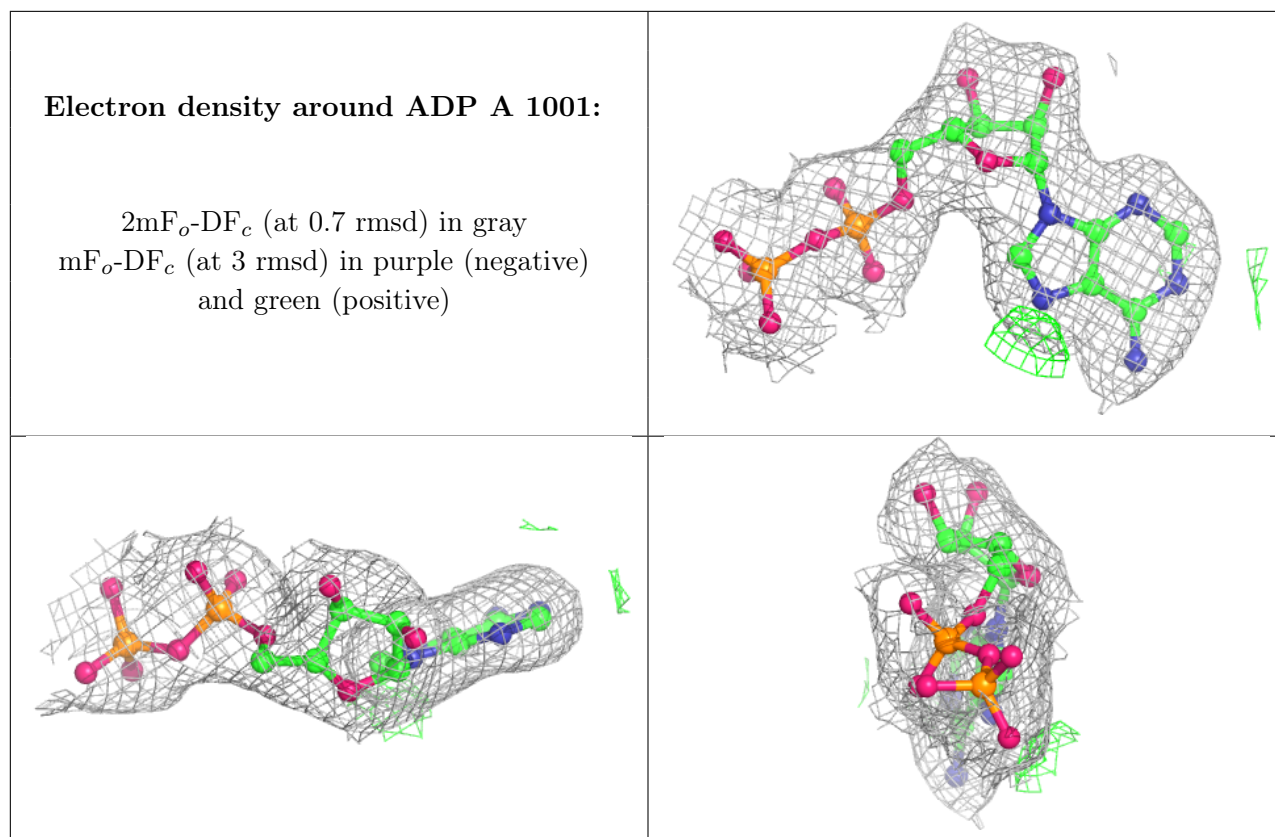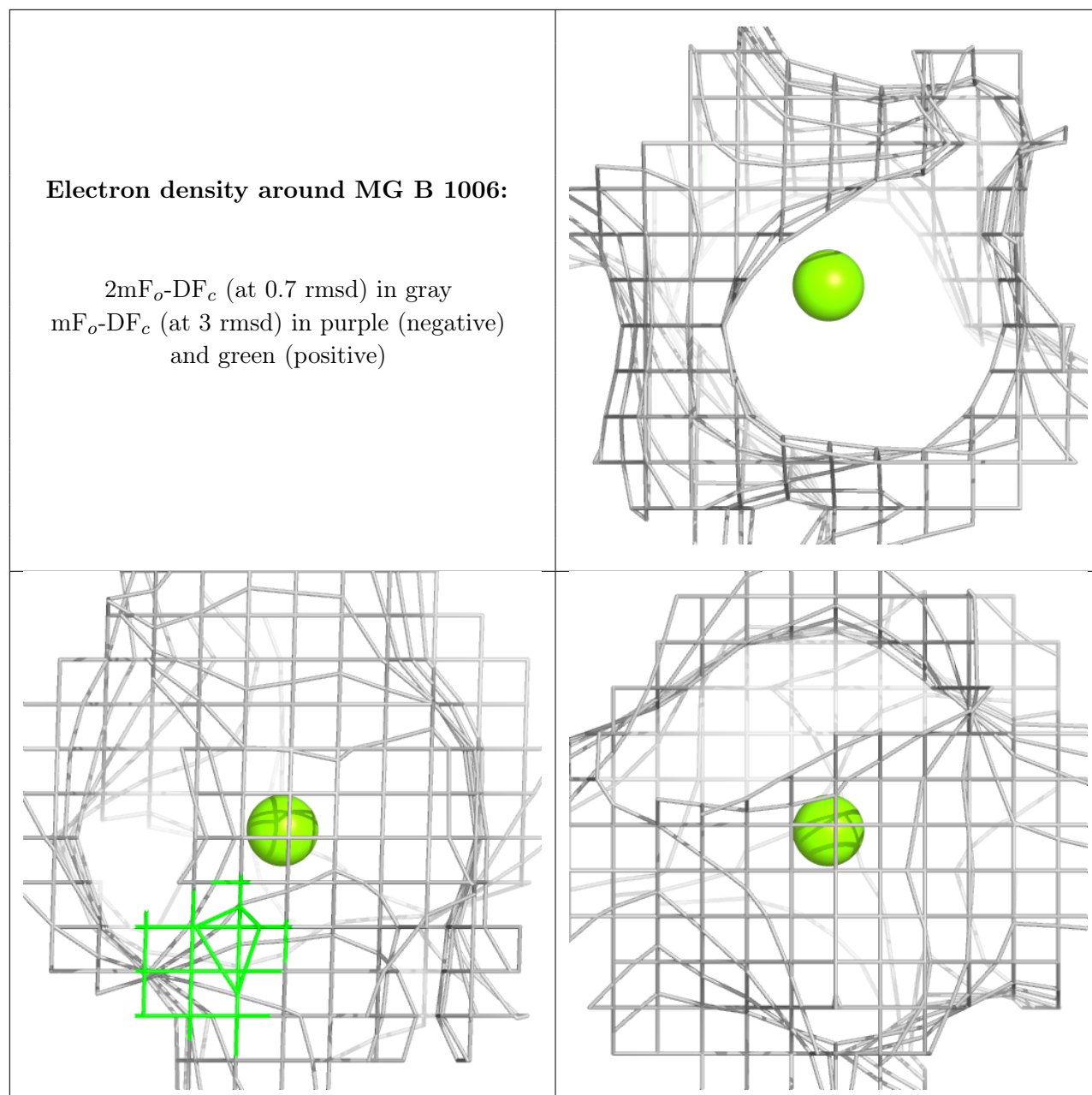and green (positive)
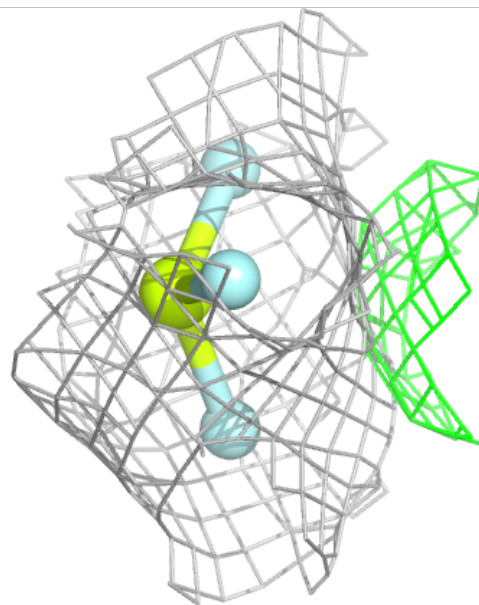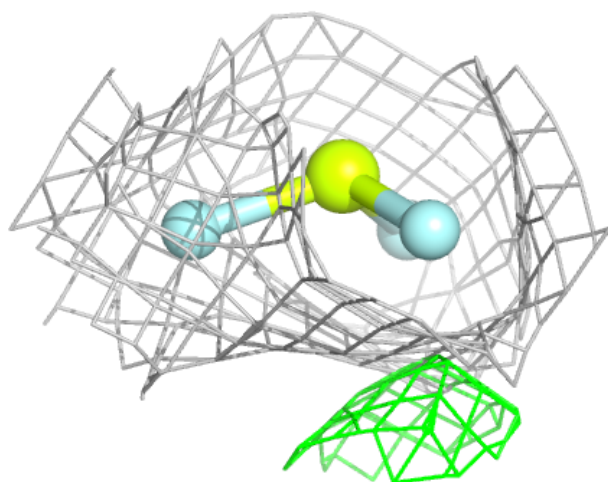
Electron density around BEF A 1002:

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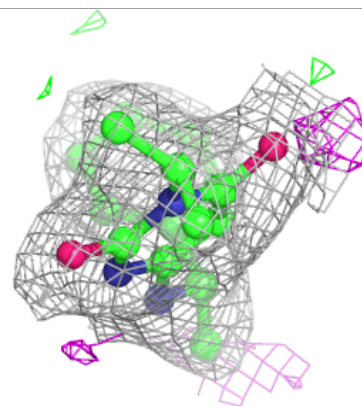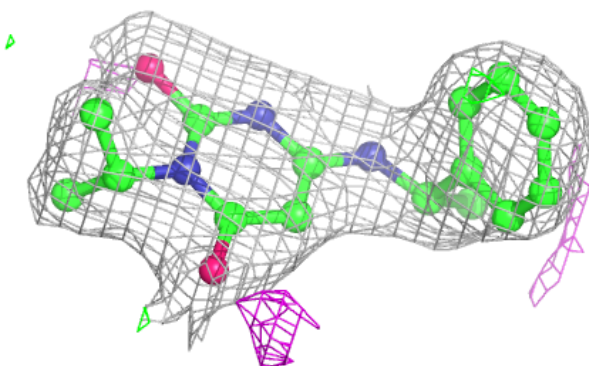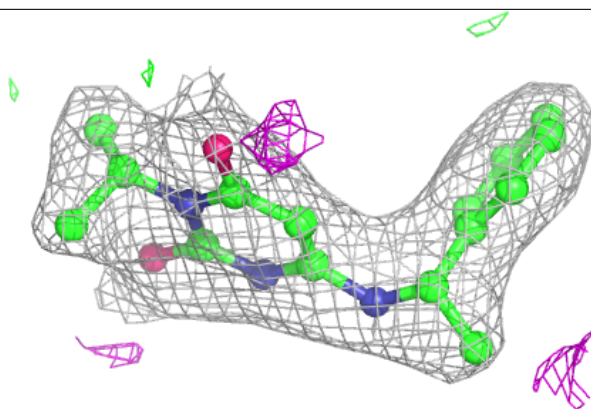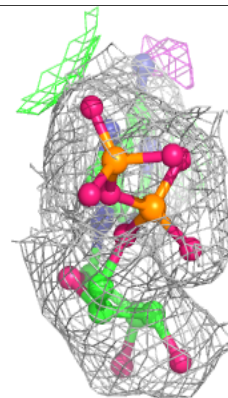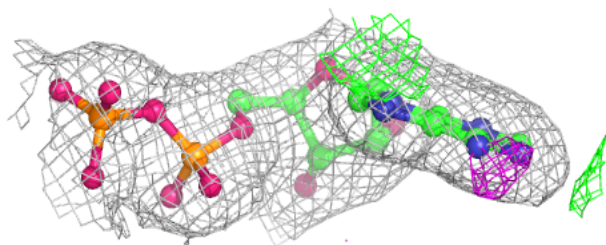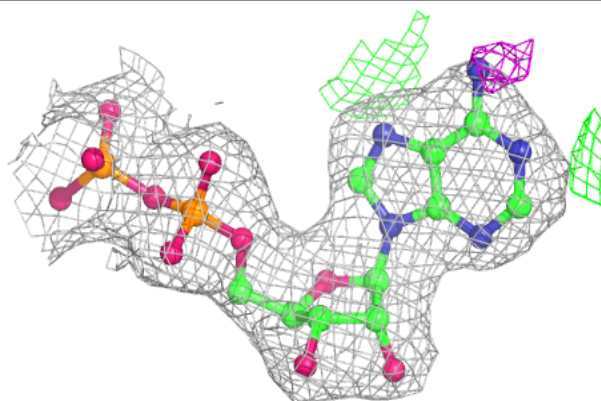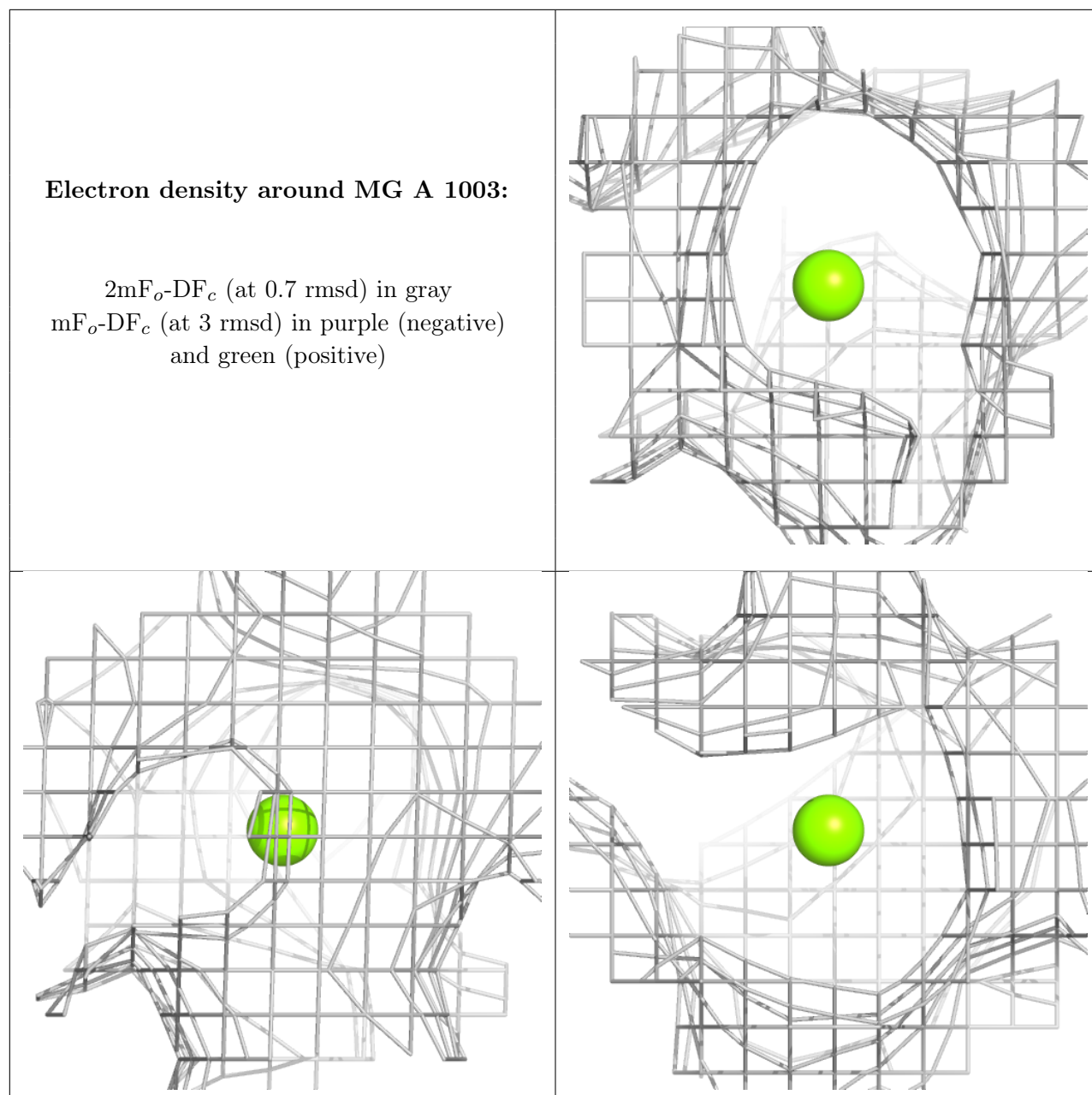mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around ADP A 1001:

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

Electron density around MG B 1006:

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

Electron density around XB2 A 1004:

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

Electron density around ADP B 1001:

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

Electron density around MG A 1003:

$2mF_o$-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.