Full wwPDB X-ray Structure Validation Report (i)

Dec 22, 2022 – 03:13 am GMT

PDB ID	:	7QJQ
Title	:	Crystal structure of a cutinase enzyme from Thermobifida fusca NTU22 (702)
Authors	:	Zahn, M.; Gill, R.S.; Avilan, L.; Beckham, G.T.; McGeehan, J.E.
Deposited on	:	2021-12-17
Resolution	:	1.64 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

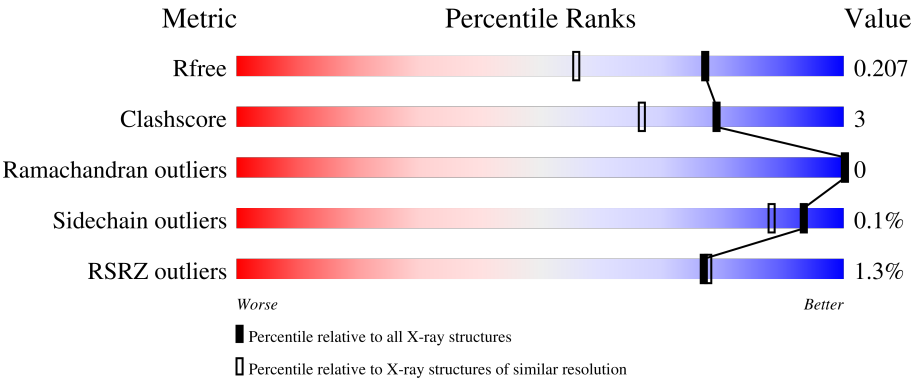
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.31.3
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.31.3

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.64 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	3122 (1.66-1.62)
Clashscore	141614	3268 (1.66-1.62)
Ramachandran outliers	138981	3215 (1.66-1.62)
Sidechain outliers	138945	3215 (1.66-1.62)
RSRZ outliers	127900	3079 (1.66-1.62)

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	271	89% 6% • 5%
1	B	271	94% • •
1	C	271	89% 7% •
1	D	271	91% 6% •
1	E	271	90% 6% •

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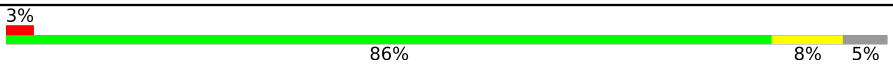
Mol	Chain	Length	Quality of chain
1	F	271	

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 13563 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 Acetylxylan esterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	S	0	6	0
			1993	1259	344	385	5			
1	B	263	Total	C	N	O	S	0	2	0
			2013	1273	349	386	5			
1	C	259	Total	C	N	O	S	0	4	0
			1992	1258	345	384	5			
1	D	262	Total	C	N	O	S	0	3	0
			2008	1269	348	386	5			
1	E	262	Total	C	N	O	S	0	5	0
			2024	1279	353	387	5			
1	F	257	Total	C	N	O	S	0	3	0
			1976	1248	344	379	5			

There are 54 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	initiating methionine	UNP E0Z5H1
A	263	LEU	-	expression tag	UNP E0Z5H1
A	264	GLU	-	expression tag	UNP E0Z5H1
A	265	HIS	-	expression tag	UNP E0Z5H1
A	266	HIS	-	expression tag	UNP E0Z5H1
A	267	HIS	-	expression tag	UNP E0Z5H1
A	268	HIS	-	expression tag	UNP E0Z5H1
A	269	HIS	-	expression tag	UNP E0Z5H1
A	270	HIS	-	expression tag	UNP E0Z5H1
B	0	MET	-	initiating methionine	UNP E0Z5H1
B	263	LEU	-	expression tag	UNP E0Z5H1
B	264	GLU	-	expression tag	UNP E0Z5H1
B	265	HIS	-	expression tag	UNP E0Z5H1
B	266	HIS	-	expression tag	UNP E0Z5H1
B	267	HIS	-	expression tag	UNP E0Z5H1
B	268	HIS	-	expression tag	UNP E0Z5H1
B	269	HIS	-	expression tag	UNP E0Z5H1

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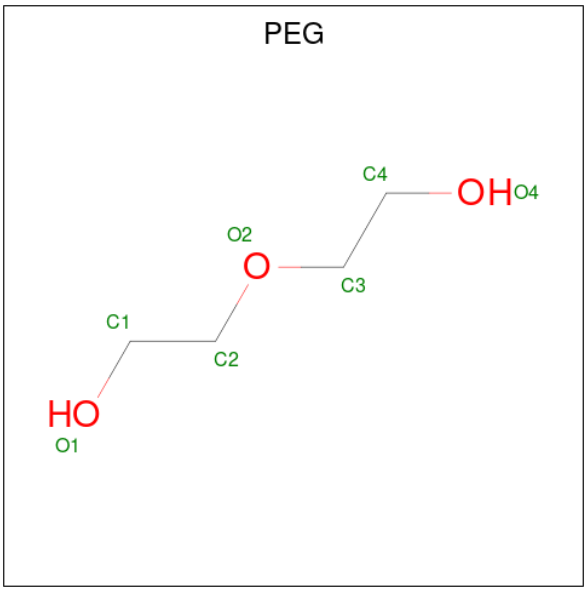
Chain	Residue	Modelled	Actual	Comment	Reference
B	270	HIS	-	expression tag	UNP E0Z5H1
C	0	MET	-	initiating methionine	UNP E0Z5H1
C	263	LEU	-	expression tag	UNP E0Z5H1
C	264	GLU	-	expression tag	UNP E0Z5H1
C	265	HIS	-	expression tag	UNP E0Z5H1
C	266	HIS	-	expression tag	UNP E0Z5H1
C	267	HIS	-	expression tag	UNP E0Z5H1
C	268	HIS	-	expression tag	UNP E0Z5H1
C	269	HIS	-	expression tag	UNP E0Z5H1
C	270	HIS	-	expression tag	UNP E0Z5H1
D	0	MET	-	initiating methionine	UNP E0Z5H1
D	263	LEU	-	expression tag	UNP E0Z5H1
D	264	GLU	-	expression tag	UNP E0Z5H1
D	265	HIS	-	expression tag	UNP E0Z5H1
D	266	HIS	-	expression tag	UNP E0Z5H1
D	267	HIS	-	expression tag	UNP E0Z5H1
D	268	HIS	-	expression tag	UNP E0Z5H1
D	269	HIS	-	expression tag	UNP E0Z5H1
D	270	HIS	-	expression tag	UNP E0Z5H1
E	0	MET	-	initiating methionine	UNP E0Z5H1
E	263	LEU	-	expression tag	UNP E0Z5H1
E	264	GLU	-	expression tag	UNP E0Z5H1
E	265	HIS	-	expression tag	UNP E0Z5H1
E	266	HIS	-	expression tag	UNP E0Z5H1
E	267	HIS	-	expression tag	UNP E0Z5H1
E	268	HIS	-	expression tag	UNP E0Z5H1
E	269	HIS	-	expression tag	UNP E0Z5H1
E	270	HIS	-	expression tag	UNP E0Z5H1
F	0	MET	-	initiating methionine	UNP E0Z5H1
F	263	LEU	-	expression tag	UNP E0Z5H1
F	264	GLU	-	expression tag	UNP E0Z5H1
F	265	HIS	-	expression tag	UNP E0Z5H1
F	266	HIS	-	expression tag	UNP E0Z5H1
F	267	HIS	-	expression tag	UNP E0Z5H1
F	268	HIS	-	expression tag	UNP E0Z5H1
F	269	HIS	-	expression tag	UNP E0Z5H1
F	270	HIS	-	expression tag	UNP E0Z5H1

- Molecule 2 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: $C_4H_{10}O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 7 4 3	0	0
2	B	1	Total C O 7 4 3	0	0
2	D	1	Total C O 7 4 3	0	0
2	E	1	Total C O 7 4 3	0	0
2	E	1	Total C O 7 4 3	0	0
2	F	1	Total C O 7 4 3	0	0

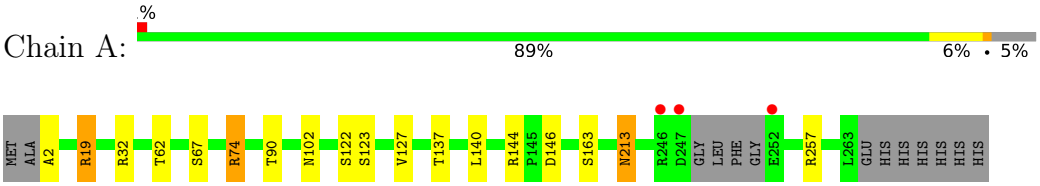
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	277	Total O 277 277	0	0
3	B	289	Total O 289 289	0	0
3	C	269	Total O 269 269	0	0
3	D	259	Total O 259 259	0	0
3	E	237	Total O 237 237	0	0
3	F	184	Total O 184 184	0	0

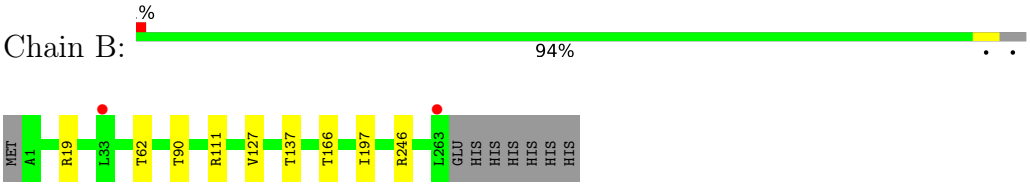
3 Residue-property plots (i)

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

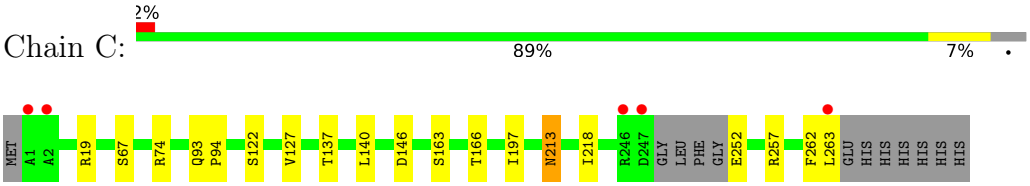
• Molecule 1: Acetylxylan esterase



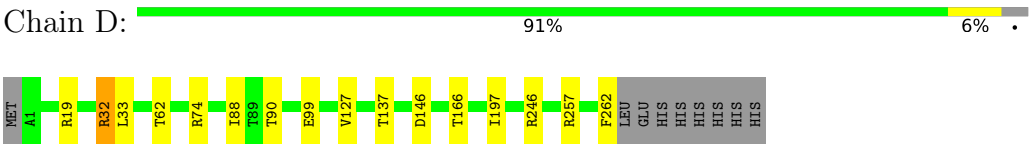
• Molecule 1: Acetylxylan esterase



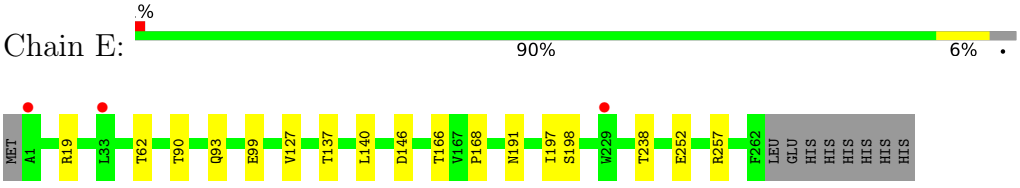
• Molecule 1: Acetylxylan esterase



• Molecule 1: Acetylxylan esterase

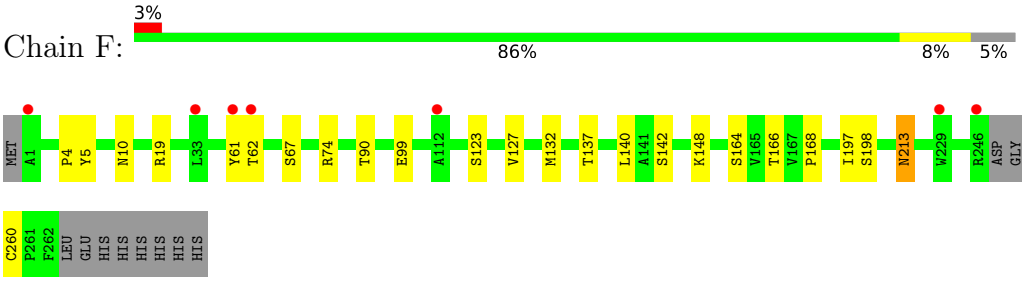


• Molecule 1: Acetylxylan esterase



• Molecule 1: Acetylxylan esterase

Chain F:


3%
86%
8%
5%
MET A1 P4 Y5 N10 R19 L33 Y61 T62 S67 R74 T90 E99 A112 S123 V127 M132 T137 L140 A141 S142 K148 S164 V165 T166 V167 P168 I197 S198 N213 W229 R246 ASP GLY LEU PHE GLY E252
C260 P261 F262 LEU GLU HIS HIS HIS HIS HIS HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	40.35Å 79.75Å 120.13Å 86.28° 87.94° 89.50°	Depositor
Resolution (Å)	119.80 – 1.64 49.42 – 1.64	Depositor EDS
% Data completeness (in resolution range)	76.6 (119.80-1.64) 75.9 (49.42-1.64)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.28 (at 1.63Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.165 , 0.199 0.175 , 0.207	Depositor DCC
R_{free} test set	6753 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å^2)	18.1	Xtriage
Anisotropy	0.032	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 53.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.53$, $< L^2 > = 0.36$	Xtriage
Estimated twinning fraction	0.009 for h,-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	13563	wwPDB-VP
Average B, all atoms (Å^2)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.81% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PEG

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	0.81	0/2062	0.85	3/2814 (0.1%)
1	B	0.81	0/2072	0.85	1/2829 (0.0%)
1	C	0.81	0/2055	0.89	3/2805 (0.1%)
1	D	0.83	1/2070 (0.0%)	0.88	4/2826 (0.1%)
1	E	0.78	1/2092 (0.0%)	0.85	1/2856 (0.0%)
1	F	0.81	1/2036 (0.0%)	0.85	2/2780 (0.1%)
All	All	0.81	3/12387 (0.0%)	0.86	14/16910 (0.1%)

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	A	0	1
1	C	0	1
1	F	0	1
All	All	0	3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	252	GLU	CD-OE2	-5.59	1.19	1.25
1	F	99	GLU	CD-OE2	-5.57	1.19	1.25
1	D	99	GLU	CD-OE2	-5.54	1.19	1.25

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	74	ARG	NE-CZ-NH2	-12.53	114.04	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	74	ARG	NE-CZ-NH1	10.55	125.58	120.30
1	F	74	ARG	NE-CZ-NH2	-7.77	116.41	120.30
1	D	74	ARG	NE-CZ-NH1	-7.37	116.62	120.30
1	A	74	ARG	NE-CZ-NH2	-7.13	116.73	120.30
1	A	19	ARG	NE-CZ-NH2	6.50	123.55	120.30
1	D	32	ARG	NE-CZ-NH1	-6.18	117.21	120.30
1	C	74	ARG	CB-CG-CD	6.12	127.51	111.60
1	D	19	ARG	NE-CZ-NH1	-5.77	117.42	120.30
1	D	257	ARG	NE-CZ-NH2	-5.69	117.46	120.30
1	E	19	ARG	NE-CZ-NH1	-5.33	117.64	120.30
1	A	32	ARG	NE-CZ-NH1	5.30	122.95	120.30
1	F	19	ARG	NE-CZ-NH1	-5.28	117.66	120.30
1	B	19	ARG	NE-CZ-NH1	-5.01	117.80	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	213	ASN	Sidechain
1	C	213	ASN	Sidechain
1	F	213	ASN	Sidechain

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1993	0	1956	12	1
1	B	2013	0	1971	6	0
1	C	1992	0	1954	12	1
1	D	2008	0	1965	8	0
1	E	2024	0	1987	12	0
1	F	1976	0	1937	22	0
2	A	7	0	10	0	0
2	B	7	0	10	0	0
2	D	7	0	10	0	0
2	E	14	0	20	0	0
2	F	7	0	10	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	277	0	0	6	0
3	B	289	0	0	1	2
3	C	269	0	0	3	2
3	D	259	0	0	2	0
3	E	237	0	0	4	0
3	F	184	0	0	3	0
All	All	13563	0	11830	67	4

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 (67) 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:F:61:TYR:HB2	1:F:132:MET:HE2	1.22	1.13
1:F:61:TYR:HB2	1:F:132:MET:CE	1.89	1.01
1:F:61:TYR:CD1	1:F:132:MET:HE1	2.12	0.84
1:F:61:TYR:HD1	1:F:132:MET:HE1	1.42	0.83
1:F:61:TYR:CB	1:F:132:MET:HE2	2.08	0.82
1:D:32:ARG:NH1	1:D:88:ILE:O	2.16	0.79
1:E:93[B]:GLN:NE2	3:E:402:HOH:O	2.16	0.78
1:E:191[A]:ASN:ND2	1:F:4:PRO:HG3	2.02	0.74
1:F:61:TYR:CB	1:F:132:MET:CE	2.65	0.72
1:D:146:ASP:OD1	3:D:401:HOH:O	2.08	0.71
1:E:146:ASP:OD1	3:E:401:HOH:O	2.10	0.70
1:A:146:ASP:HB2	3:A:614:HOH:O	1.91	0.69
1:F:260:CYS:O	3:F:401:HOH:O	2.13	0.67
1:E:238:THR:HG22	3:E:428:HOH:O	1.97	0.65
1:D:262:PHE:HB3	3:D:570:HOH:O	1.97	0.64
1:E:62:THR:HA	1:E:90:THR:HB	1.79	0.62
1:C:262:PHE:O	1:C:263:LEU:HG	2.00	0.62
1:C:122:SER:HB3	3:C:400:HOH:O	2.02	0.59
1:A:62:THR:HA	1:A:90:THR:HB	1.84	0.58
1:C:257:ARG:NH2	3:C:302:HOH:O	2.34	0.58
1:F:123:SER:HB3	3:F:416:HOH:O	2.05	0.55
1:B:246:ARG:CZ	1:C:146:ASP:OD2	2.57	0.52
1:F:62:THR:HA	1:F:90:THR:HB	1.92	0.51
1:F:142[A]:SER:HB2	1:F:164:SER:HG	1.76	0.50
1:E:257[B]:ARG:NH2	1:F:5:TYR:OH	2.45	0.50
1:A:257:ARG:NH2	3:A:404:HOH:O	2.44	0.50
1:F:164:SER:OG	3:F:403:HOH:O	2.20	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:122:SER:HB3	3:A:548:HOH:O	2.13	0.48
1:F:61:TYR:CB	1:F:132:MET:HE1	2.39	0.48
1:A:146:ASP:OD2	1:D:246:ARG:CZ	2.62	0.47
1:B:62:THR:HA	1:B:90:THR:HB	1.95	0.47
1:F:123:SER:O	1:F:148:LYS:NZ	2.47	0.47
1:A:2:ALA:N	3:A:410:HOH:O	2.48	0.46
1:F:67[A]:SER:HB2	1:F:213:ASN:ND2	2.31	0.46
1:A:127:VAL:HG11	1:A:140:LEU:HD23	1.97	0.46
1:D:62:THR:HA	1:D:90:THR:HB	1.98	0.46
1:E:127:VAL:HG23	1:E:137:THR:HG23	1.98	0.45
1:B:246:ARG:NE	1:C:146:ASP:OD2	2.50	0.45
1:B:166:THR:HA	1:B:197:ILE:HG21	1.98	0.45
1:A:67[A]:SER:HB2	1:A:213:ASN:ND2	2.32	0.45
1:B:111:ARG:NH1	3:B:410:HOH:O	2.49	0.45
1:C:127:VAL:HG23	1:C:137:THR:HG23	1.99	0.45
1:A:123[B]:SER:OG	3:A:401:HOH:O	2.19	0.44
1:D:166:THR:HA	1:D:197:ILE:HG21	1.98	0.44
1:C:262:PHE:O	1:C:263:LEU:CB	2.66	0.44
1:C:67[A]:SER:HB2	1:C:213:ASN:ND2	2.33	0.44
1:C:127:VAL:HG11	1:C:140:LEU:HD23	1.99	0.43
1:C:93:GLN:HB3	1:C:94:PRO:HD2	1.99	0.43
1:B:127:VAL:HG23	1:B:137:THR:HG23	2.00	0.43
1:D:127:VAL:HG23	1:D:137:THR:HG23	2.01	0.43
1:F:127:VAL:HG11	1:F:140:LEU:HD23	1.99	0.43
1:E:127:VAL:HG11	1:E:140:LEU:HD23	2.01	0.43
1:A:102:ASN:OD1	1:A:144:ARG:HD2	2.18	0.43
1:A:127:VAL:HG23	1:A:137:THR:HG23	2.01	0.43
1:F:127:VAL:HG23	1:F:137:THR:HG23	2.00	0.42
1:E:93[A]:GLN:NE2	3:E:414:HOH:O	2.52	0.42
1:E:166:THR:HA	1:E:197:ILE:HG21	2.00	0.42
3:C:442:HOH:O	1:E:99:GLU:HG3	2.20	0.41
1:E:168:PRO:HA	1:E:198:SER:O	2.20	0.41
1:F:67[A]:SER:HB2	1:F:213:ASN:HD22	1.86	0.41
1:A:74:ARG:HD2	3:A:464:HOH:O	2.21	0.41
1:D:33:LEU:HA	1:D:33:LEU:HD23	1.84	0.41
1:F:61:TYR:CG	1:F:132:MET:HE1	2.55	0.40
1:C:218:ILE:HD11	1:C:252:GLU:HB3	2.03	0.40
1:F:166:THR:HA	1:F:197:ILE:HG21	2.03	0.40
1:F:168:PRO:HA	1:F:198:SER:O	2.21	0.40
1:C:166:THR:HA	1:C:197:ILE:HG21	2.03	0.40

All (4) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:B:677:HOH:O	3:C:559:HOH:O[1_655]	1.98	0.22
1:C:19:ARG:NH1	1:C:163:SER:OG[1_455]	2.08	0.12
1:A:19:ARG:NH1	1:A:163:SER:OG[1_655]	2.13	0.07
3:B:676:HOH:O	3:C:504:HOH:O[1_655]	2.16	0.04

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	260/271 (96%)	255 (98%)	5 (2%)	0	100	100
1	B	263/271 (97%)	256 (97%)	7 (3%)	0	100	100
1	C	259/271 (96%)	254 (98%)	5 (2%)	0	100	100
1	D	263/271 (97%)	257 (98%)	6 (2%)	0	100	100
1	E	265/271 (98%)	259 (98%)	6 (2%)	0	100	100
1	F	256/271 (94%)	251 (98%)	5 (2%)	0	100	100
All	All	1566/1626 (96%)	1532 (98%)	34 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	219/223 (98%)	219 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	B	217/223 (97%)	217 (100%)	0	100 100
1	C	217/223 (97%)	217 (100%)	0	100 100
1	D	217/223 (97%)	217 (100%)	0	100 100
1	E	219/223 (98%)	219 (100%)	0	100 100
1	F	214/223 (96%)	213 (100%)	1 (0%)	88 80
All	All	1303/1338 (97%)	1302 (100%)	1 (0%)	93 88

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	10	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

6 ligands 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	$\#\|Z\|>2$
2	PEG	F	301	-	6,6,6	0.26	0	5,5,5	0.33	0
2	PEG	D	301	-	6,6,6	0.33	0	5,5,5	0.26	0
2	PEG	A	301	-	6,6,6	0.20	0	5,5,5	0.14	0
2	PEG	E	301	-	6,6,6	0.35	0	5,5,5	0.36	0
2	PEG	B	301	-	6,6,6	0.14	0	5,5,5	0.37	0
2	PEG	E	302	-	6,6,6	0.19	0	5,5,5	0.18	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
2	PEG	F	301	-	-	2/4/4/4	-
2	PEG	D	301	-	-	1/4/4/4	-
2	PEG	A	301	-	-	1/4/4/4	-
2	PEG	E	301	-	-	3/4/4/4	-
2	PEG	B	301	-	-	1/4/4/4	-
2	PEG	E	302	-	-	0/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	E	301	PEG	O2-C3-C4-O4
2	D	301	PEG	O2-C3-C4-O4
2	B	301	PEG	O2-C3-C4-O4
2	F	301	PEG	O2-C3-C4-O4
2	A	301	PEG	O2-C3-C4-O4
2	E	301	PEG	O1-C1-C2-O2
2	F	301	PEG	O1-C1-C2-O2
2	E	301	PEG	C4-C3-O2-C2

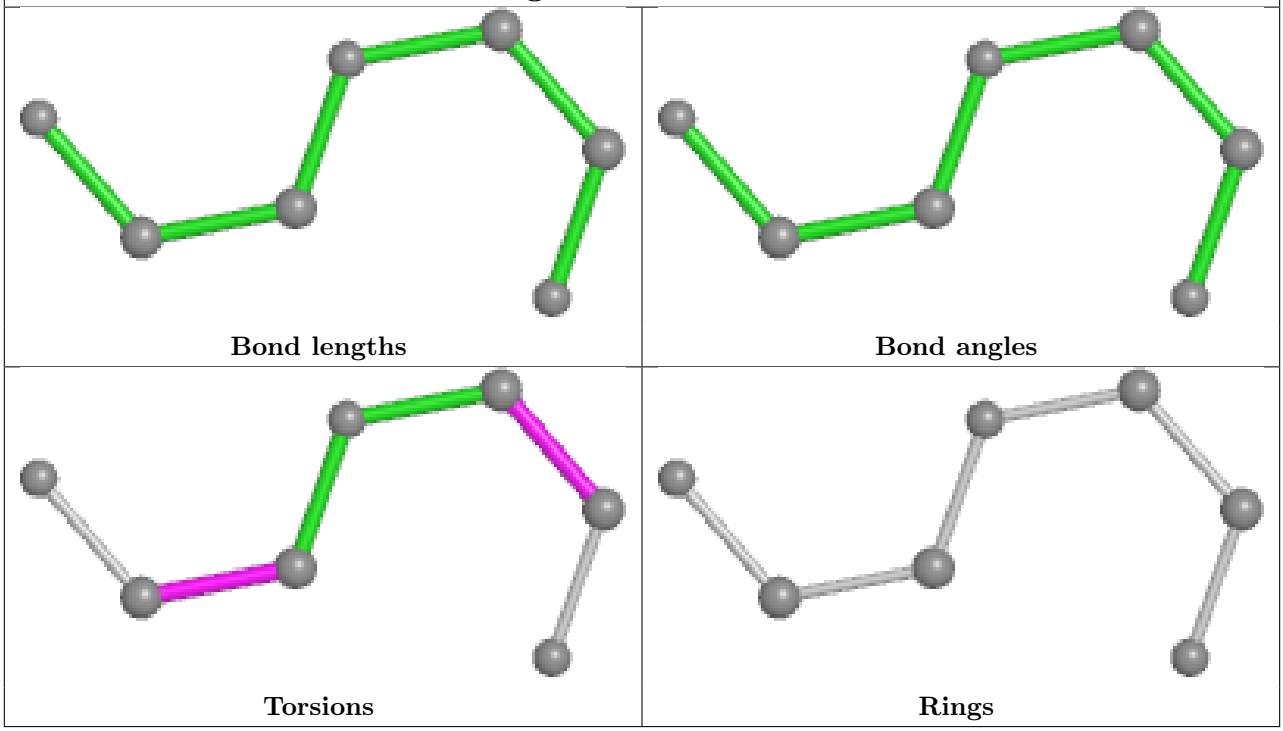
There are no ring outliers.

No monomer is involved in short contacts.

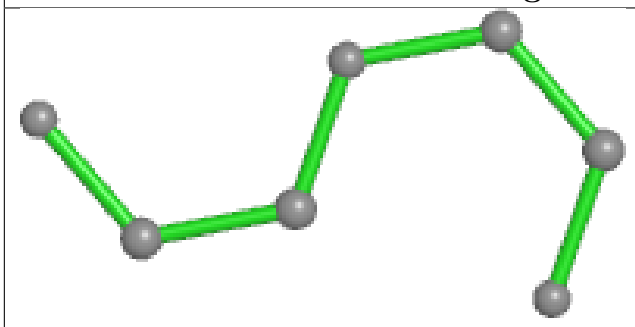
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will

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.

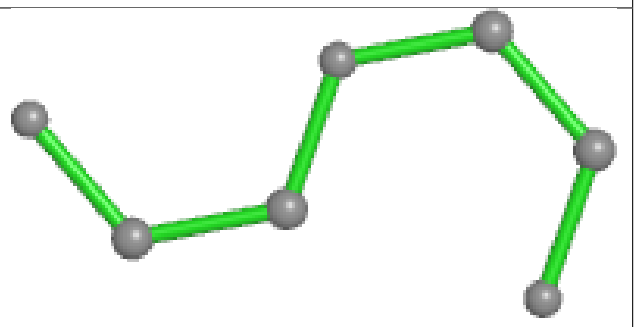
Ligand PEG F 301



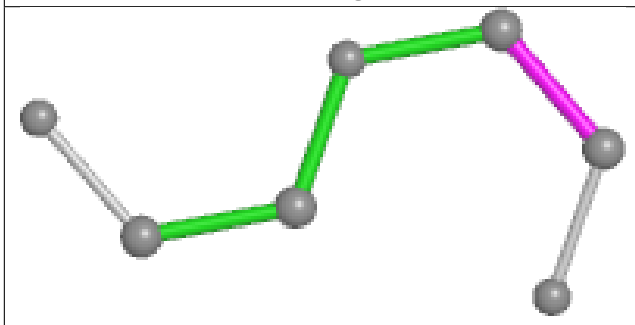
Ligand PEG D 301



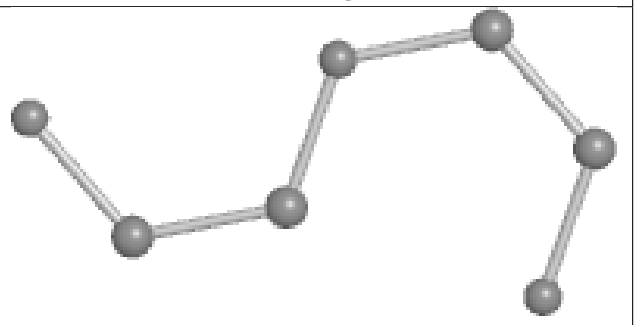
Bond lengths



Bond angles

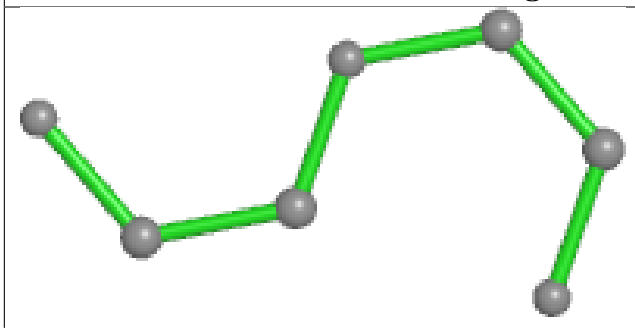


Torsions

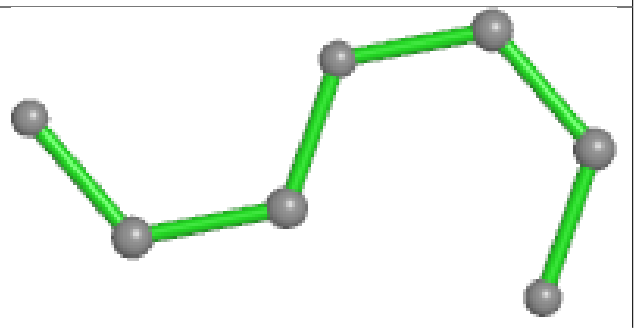


Rings

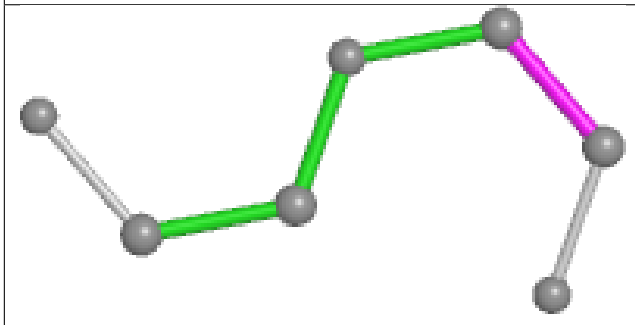
Ligand PEG A 301



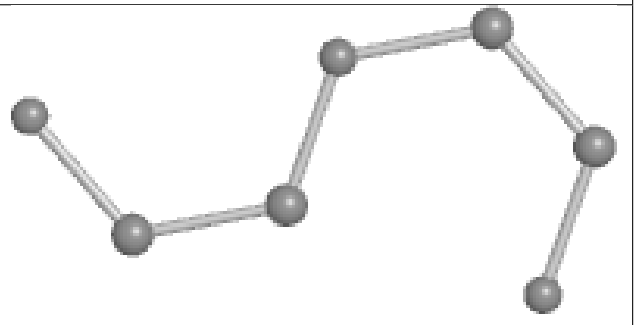
Bond lengths



Bond angles

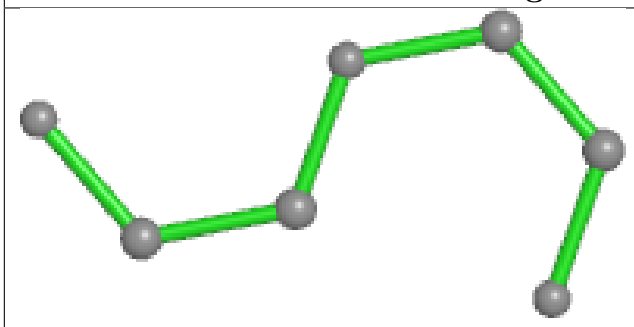


Torsions

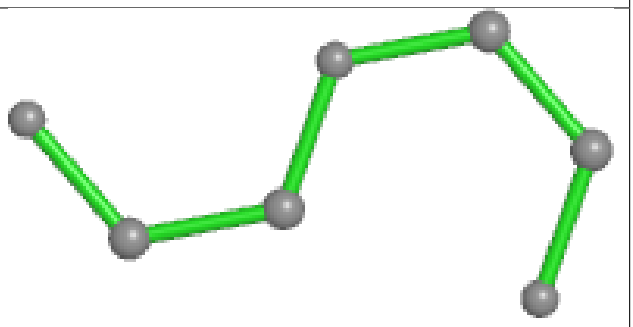


Rings

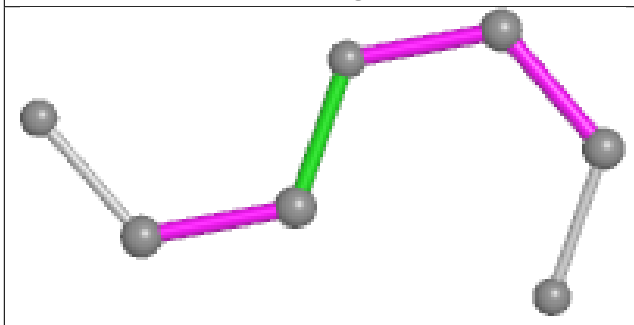
Ligand PEG E 301



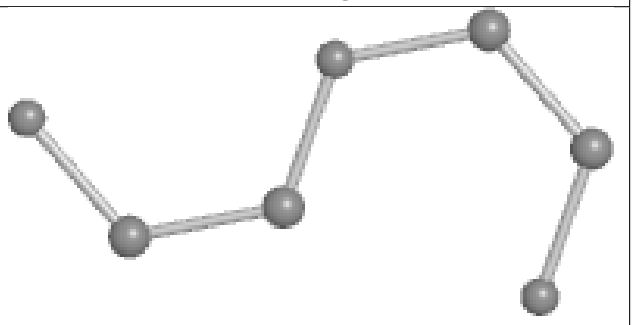
Bond lengths



Bond angles

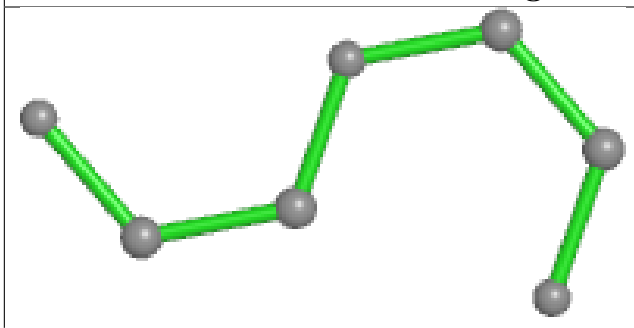


Torsions

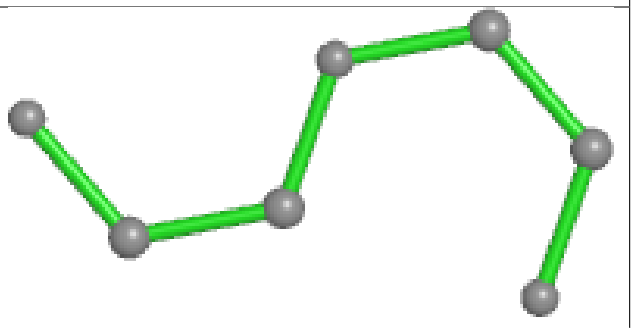


Rings

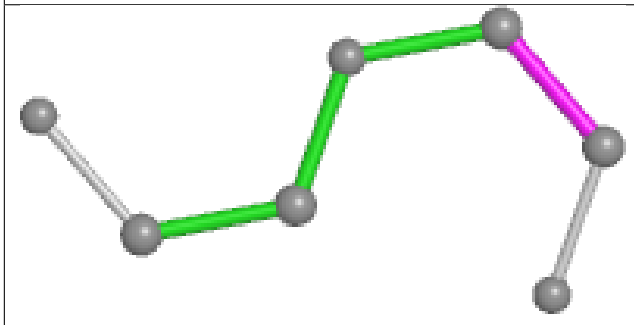
Ligand PEG B 301



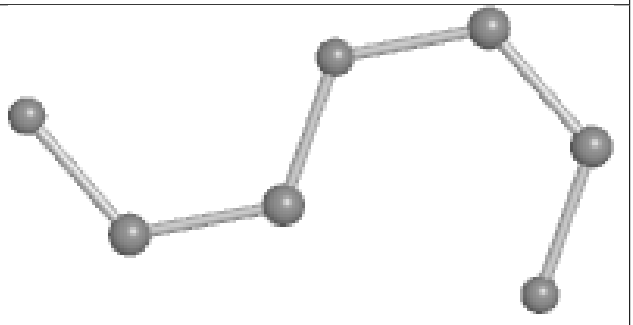
Bond lengths



Bond angles

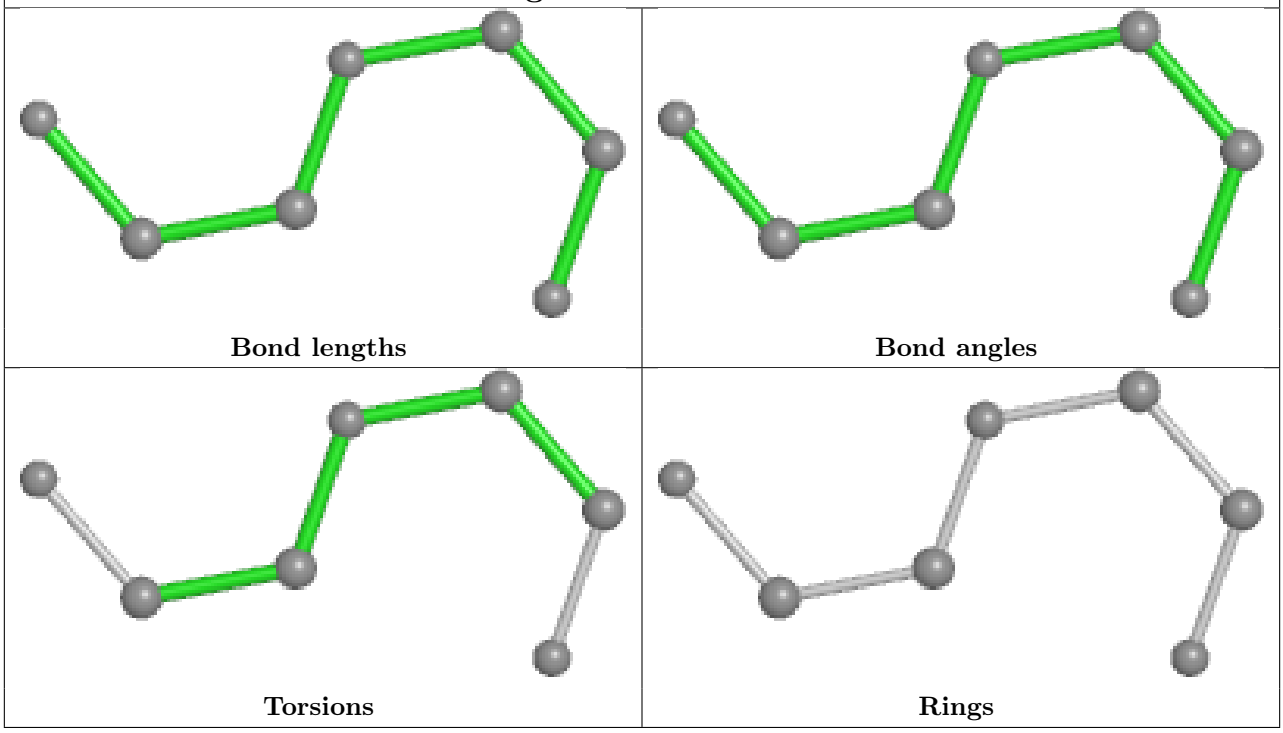


Torsions



Rings

Ligand PEG E 302



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	A	258/271 (95%)	-0.52	3 (1%) 79 79	10, 17, 29, 74	0
1	B	263/271 (97%)	-0.53	2 (0%) 86 87	11, 18, 30, 62	0
1	C	259/271 (95%)	-0.43	5 (1%) 66 67	11, 18, 32, 70	0
1	D	262/271 (96%)	-0.48	0 100 100	10, 19, 29, 41	0
1	E	262/271 (96%)	-0.40	3 (1%) 80 81	12, 19, 33, 52	0
1	F	257/271 (94%)	-0.08	7 (2%) 54 53	15, 26, 42, 60	0
All	All	1561/1626 (96%)	-0.41	20 (1%) 77 78	10, 19, 35, 74	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1	ALA	6.1
1	B	263	LEU	4.9
1	C	263	LEU	4.7
1	F	33	LEU	4.4
1	F	61	TYR	3.9
1	F	1	ALA	3.2
1	A	252	GLU	3.2
1	F	246	ARG	3.2
1	F	112	ALA	3.1
1	C	247	ASP	3.0
1	B	33	LEU	3.0
1	E	33	LEU	3.0
1	C	246	ARG	2.6
1	A	246	ARG	2.5
1	A	247	ASP	2.4
1	C	2	ALA	2.2
1	E	1	ALA	2.2
1	F	62	THR	2.1
1	E	229	TRP	2.1

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Mol	Chain	Res	Type	RSRZ
1	F	229	TRP	2.1

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

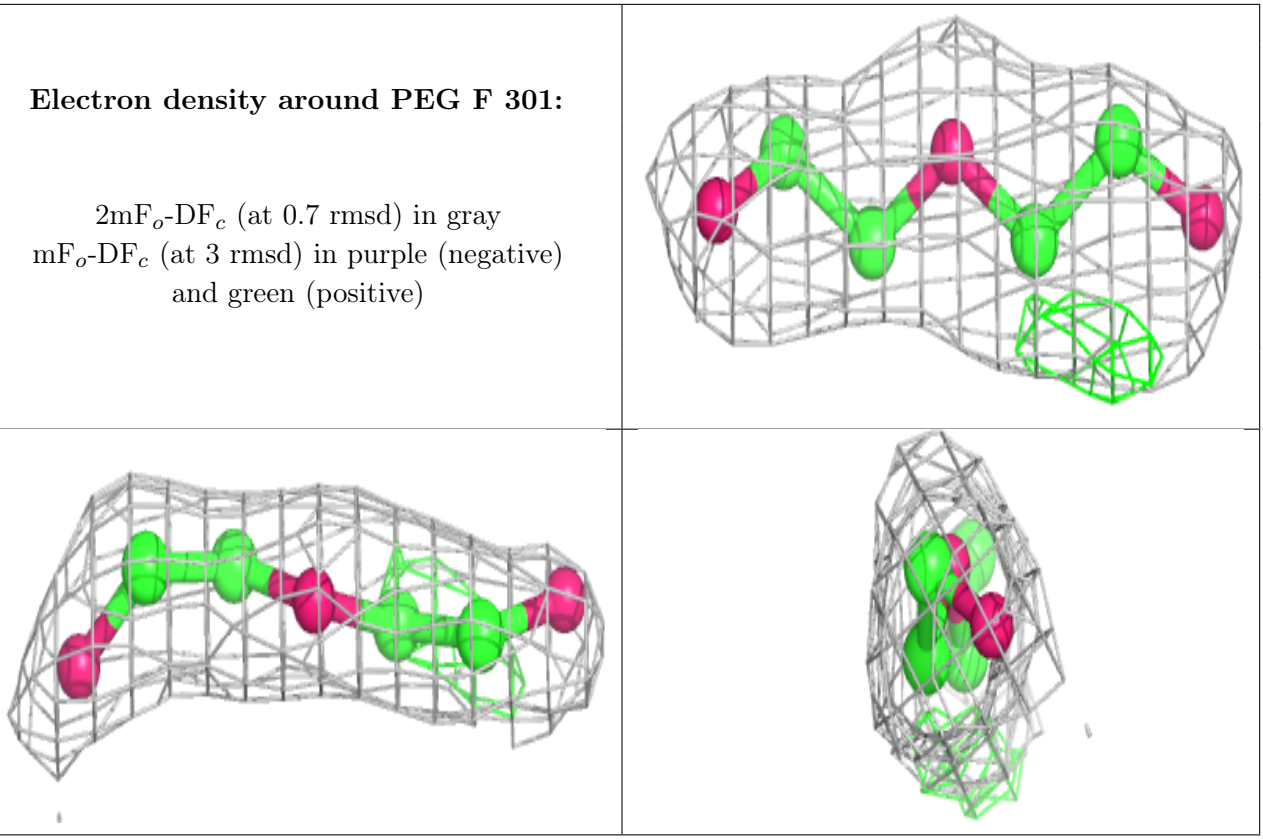
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	PEG	F	301	7/7	0.76	0.13	48,49,50,52	0
2	PEG	E	301	7/7	0.87	0.15	43,44,51,55	0
2	PEG	A	301	7/7	0.87	0.13	45,47,51,52	0
2	PEG	B	301	7/7	0.88	0.14	44,49,53,54	0
2	PEG	D	301	7/7	0.89	0.20	41,45,64,69	0
2	PEG	E	302	7/7	0.90	0.15	45,47,52,56	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.

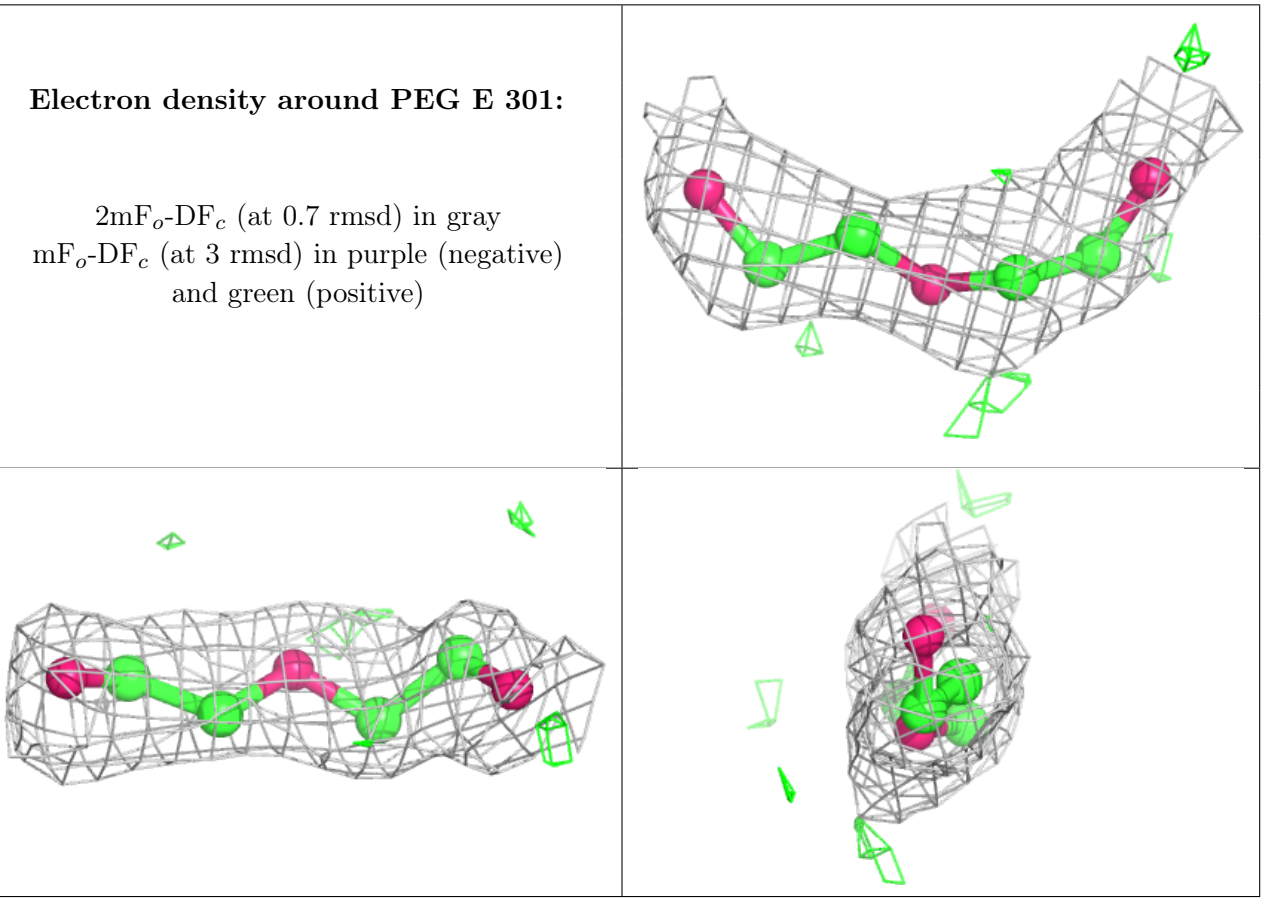
Electron density around PEG F 301:

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



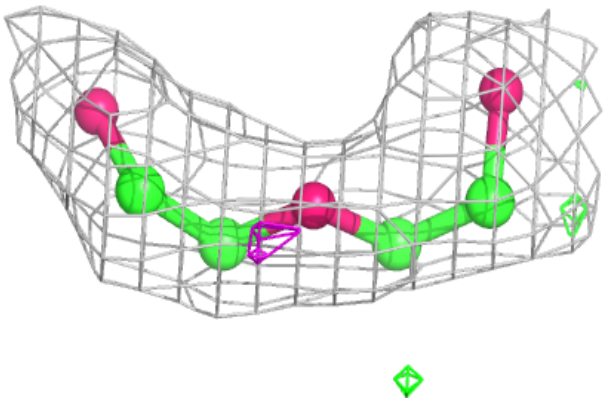
Electron density around PEG E 301:

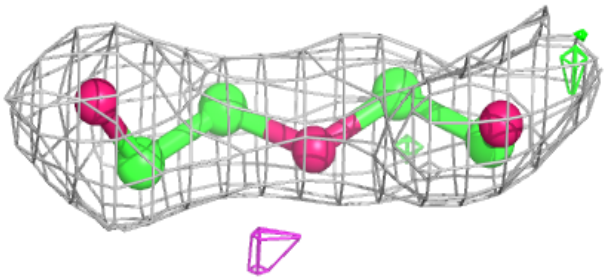
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

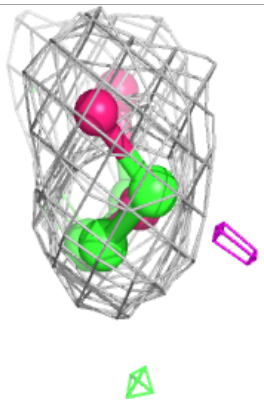


Electron density around PEG A 301:

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

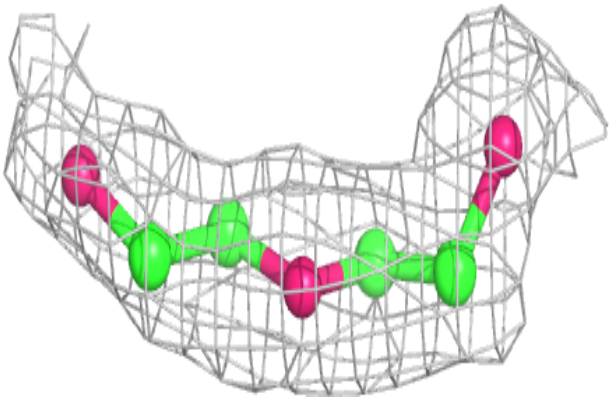


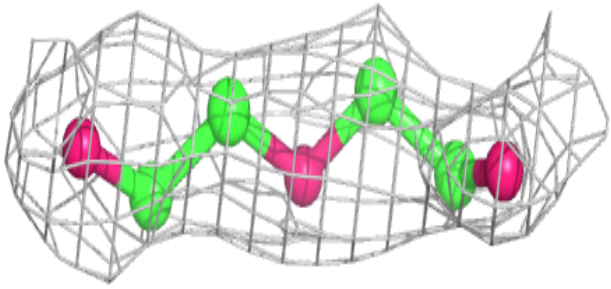


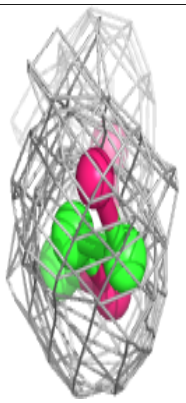


Electron density around PEG B 301:

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

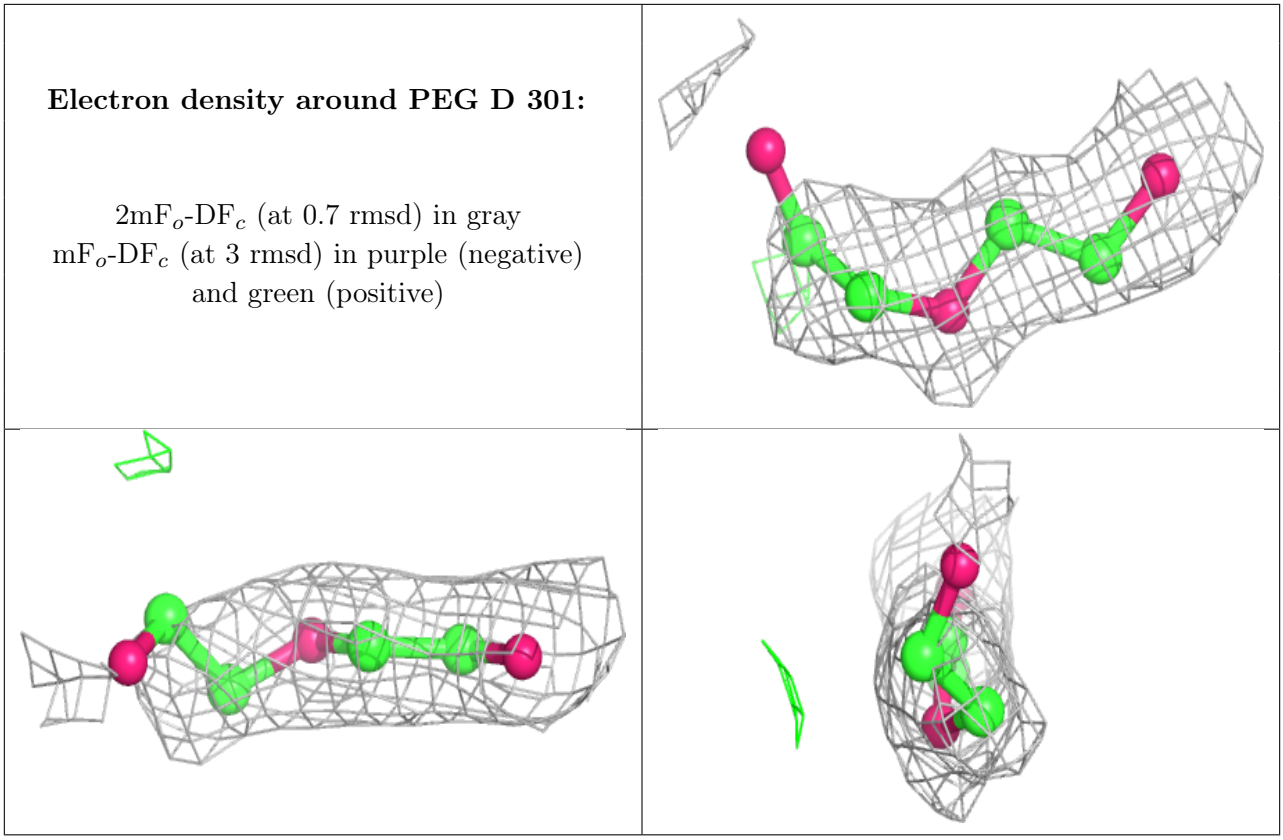






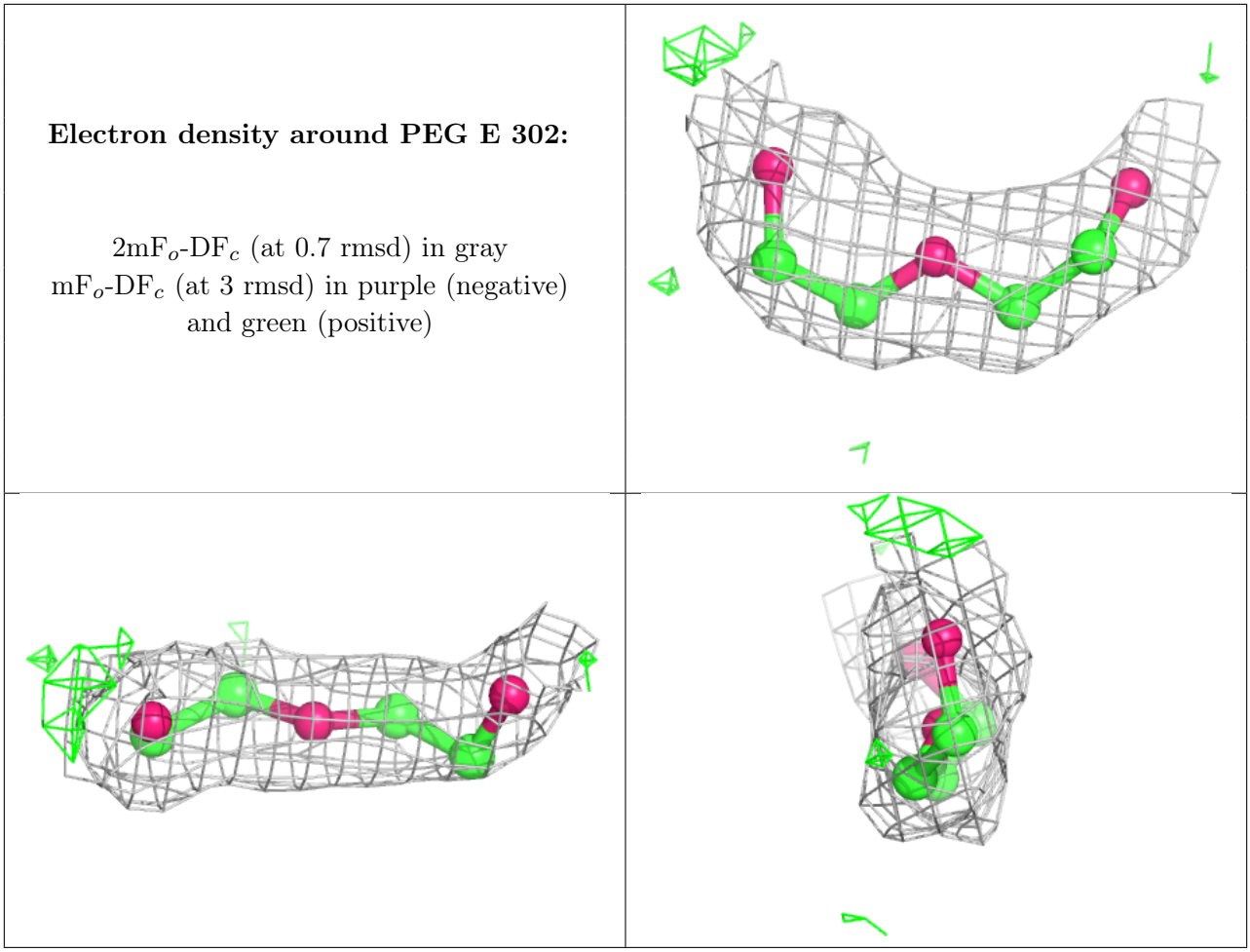
Electron density around PEG D 301:

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



Electron density around PEG E 302:

$2mF_o$-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 (i)

There are no such residues in this entry.