wwPDB X-ray Structure Validation Summary Report (i)

Oct 8, 2026 – 10:44 AM EDT

PDB ID	:	14CO / pdb_000014co
Title	:	Structure of liver pyruvate kinase in complex with allosteric activator 8a
Authors	:	Lulla, A.; Rodriguez Rivero, A.; Grotli, M.; Hyvonen, M.
Deposited on	:	2026-04-28
Resolution	:	1.89 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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:

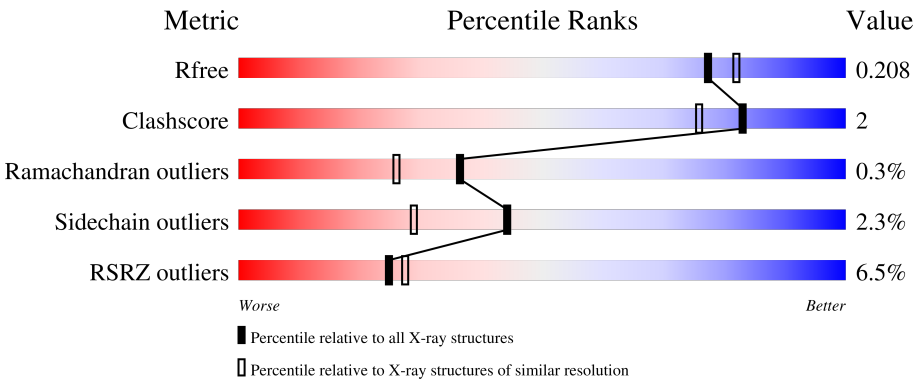
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 1.89 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1220 (1.88-1.88)
Clashscore	190562	1234 (1.88-1.88)
Ramachandran outliers	187476	1222 (1.88-1.88)
Sidechain outliers	187428	1222 (1.88-1.88)
RSRZ outliers	180081	1220 (1.88-1.88)

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	447	10% 87% 7% • 6%
1	B	447	13% 91% 6% • •
1	C	447	4% 90% 5% 5%
1	D	447	3% 89% 6% • 5%
1	E	447	6% 88% 5% 6%

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Mol	Chain	Length	Quality of chain
1	F	447	6% 90% 6%
1	G	447	4% 89% 7%
1	H	447	3% 88% 7% 5%

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
3	OXL	A	602	-	X	-	-
3	OXL	B	602	-	X	-	-
3	OXL	C	602	-	X	-	-
3	OXL	D	602	-	X	-	-
3	OXL	E	602	-	X	-	-
3	OXL	G	602	-	X	-	-
3	OXL	H	602	-	X	-	-

2 Entry composition (i)

There are 8 unique types of molecules in this entry. The entry contains 29248 atoms, of which 106 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 Isoform L-type of Pyruvate kinase PKLR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	421	3267	2055	587	605	20	0	13	0
1	B	436	3350	2104	604	622	20	3	8	0
1	C	425	3284	2068	588	609	19	0	10	0
1	D	425	3261	2048	590	604	19	0	8	0
1	E	419	3265	2054	587	604	20	0	14	0
1	F	433	3338	2100	601	617	20	0	8	0
1	G	430	3311	2082	593	617	19	0	10	0
1	H	425	3269	2053	593	604	19	0	9	0

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP P30613
A	0	SER	-	expression tag	UNP P30613
A	12	ASP	SER	conflict	UNP P30613
A	130	GLY	-	linker	UNP P30613
A	131	SER	-	linker	UNP P30613
A	132	GLY	-	linker	UNP P30613
B	-1	GLY	-	expression tag	UNP P30613
B	0	SER	-	expression tag	UNP P30613
B	12	ASP	SER	conflict	UNP P30613
B	130	GLY	-	linker	UNP P30613
B	131	SER	-	linker	UNP P30613
B	132	GLY	-	linker	UNP P30613
C	-1	GLY	-	expression tag	UNP P30613

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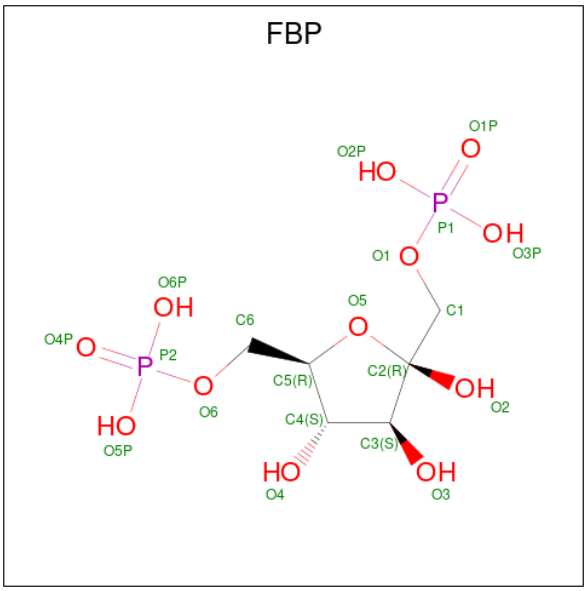
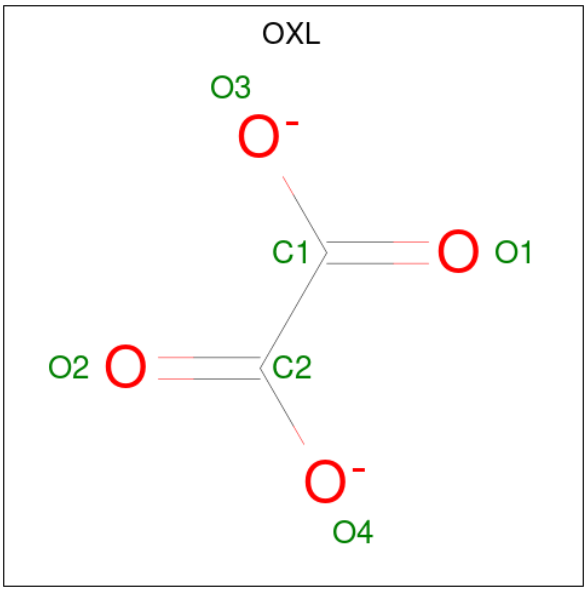
Chain	Residue	Modelled	Actual	Comment	Reference
C	0	SER	-	expression tag	UNP P30613
C	12	ASP	SER	conflict	UNP P30613
C	130	GLY	-	linker	UNP P30613
C	131	SER	-	linker	UNP P30613
C	132	GLY	-	linker	UNP P30613
D	-1	GLY	-	expression tag	UNP P30613
D	0	SER	-	expression tag	UNP P30613
D	12	ASP	SER	conflict	UNP P30613
D	130	GLY	-	linker	UNP P30613
D	131	SER	-	linker	UNP P30613
D	132	GLY	-	linker	UNP P30613
E	-1	GLY	-	expression tag	UNP P30613
E	0	SER	-	expression tag	UNP P30613
E	12	ASP	SER	conflict	UNP P30613
E	130	GLY	-	linker	UNP P30613
E	131	SER	-	linker	UNP P30613
E	132	GLY	-	linker	UNP P30613
F	-1	GLY	-	expression tag	UNP P30613
F	0	SER	-	expression tag	UNP P30613
F	12	ASP	SER	conflict	UNP P30613
F	130	GLY	-	linker	UNP P30613
F	131	SER	-	linker	UNP P30613
F	132	GLY	-	linker	UNP P30613
G	-1	GLY	-	expression tag	UNP P30613
G	0	SER	-	expression tag	UNP P30613
G	12	ASP	SER	conflict	UNP P30613
G	130	GLY	-	linker	UNP P30613
G	131	SER	-	linker	UNP P30613
G	132	GLY	-	linker	UNP P30613
H	-1	GLY	-	expression tag	UNP P30613
H	0	SER	-	expression tag	UNP P30613
H	12	ASP	SER	conflict	UNP P30613
H	130	GLY	-	linker	UNP P30613
H	131	SER	-	linker	UNP P30613
H	132	GLY	-	linker	UNP P30613

- Molecule 2 is 1,6-di-O-phosphono-beta-D-fructofuranose (CCD ID: FBP) (formula: $C_6H_{14}O_{12}P_2$).



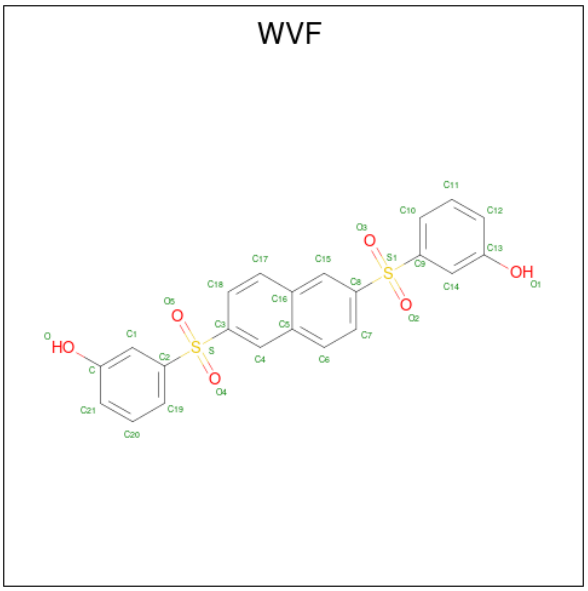
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	P		
2	A	1	20	6	12	2	0	0
			Total	C	O	P		
2	B	1	20	6	12	2	0	0
			Total	C	O	P		
2	C	1	20	6	12	2	0	0
			Total	C	O	P		
2	D	1	20	6	12	2	0	0
			Total	C	O	P		
2	E	1	20	6	12	2	0	0
			Total	C	O	P		
2	F	1	20	6	12	2	0	0
			Total	C	O	P		
2	G	1	20	6	12	2	0	0
			Total	C	O	P		
2	H	1	20	6	12	2	0	0

- Molecule 3 is OXALATE ION (CCD ID: OXL) (formula: C_2O_4).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	6	2	4	0	0
3	B	1	6	2	4	0	0
3	C	1	6	2	4	0	0
3	D	1	6	2	4	0	0
3	E	1	6	2	4	0	0
3	F	1	6	2	4	0	0
3	G	1	6	2	4	0	0
3	H	1	6	2	4	0	0

- Molecule 4 is 3,3'-(naphthalene-2,6-diyldisulfonyl)diphenol (CCD ID: WVF) (formula: $C_{22}H_{16}O_6S_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	H	O	S		
4	A	1	46	22	16	6	2	16	0
4	B	1	46	22	16	6	2	16	0
4	E	1	46	22	16	6	2	16	0
4	F	1	46	22	16	6	2	16	0

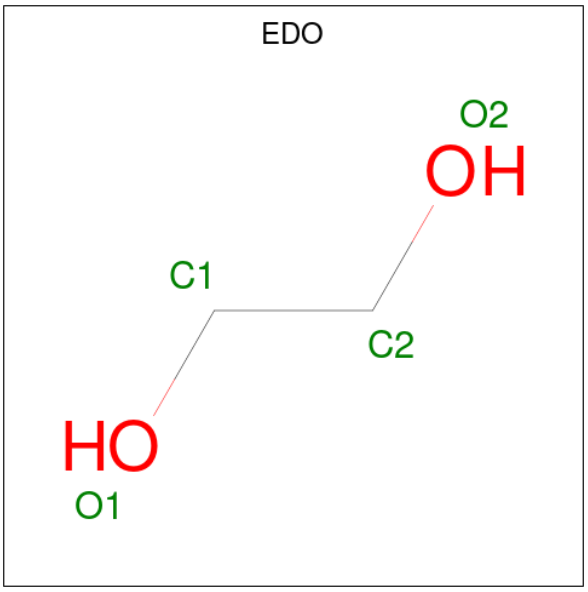
- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
5	A	1	1	1	0	0
5	B	1	1	1	0	0
5	C	1	1	1	0	0
5	D	1	1	1	0	0
5	E	1	1	1	0	0
5	F	1	1	1	0	0
5	G	1	1	1	0	0
5	H	1	1	1	0	0

- Molecule 6 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total K 1 1	0	0
6	B	1	Total K 1 1	0	0
6	C	1	Total K 1 1	0	0
6	D	1	Total K 1 1	0	0
6	E	1	Total K 1 1	0	0
6	F	1	Total K 1 1	0	0
6	G	1	Total K 1 1	0	0
6	H	1	Total K 1 1	0	0

- Molecule 7 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total C H O 10 2 6 2	6	0
7	C	1	Total C H O 10 2 6 2	6	0
7	D	1	Total C H O 10 2 6 2	6	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
7	E	1	10	2	6	2	6	0
			Total	C	H	O		
7	F	1	10	2	6	2	6	0
			Total	C	H	O		
7	G	1	10	2	6	2	6	0
			Total	C	H	O		
7	H	1	10	2	6	2	6	0

- Molecule 8 is water.

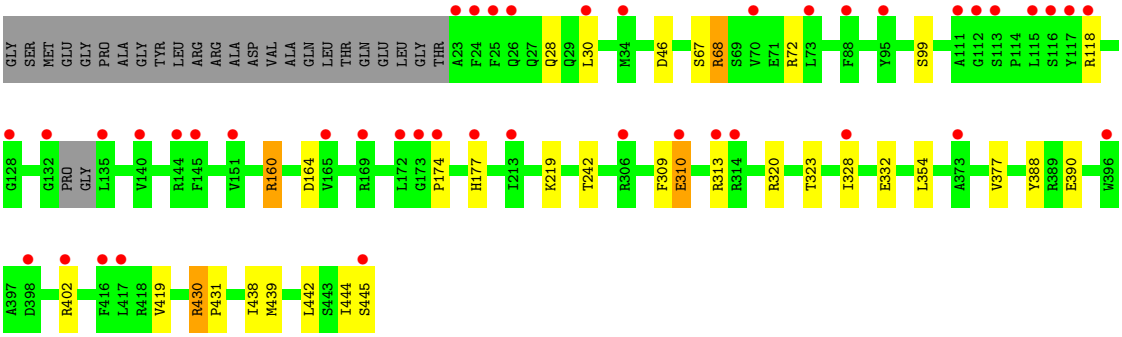
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
8	A	235	235	235	0	0
			Total	O		
8	B	227	227	227	0	0
			Total	O		
8	C	323	323	323	0	0
			Total	O		
8	D	355	355	355	0	0
			Total	O		
8	E	261	261	261	0	0
			Total	O		
8	F	304	304	304	0	0
			Total	O		
8	G	340	340	340	0	0
			Total	O		
8	H	380	380	380	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.

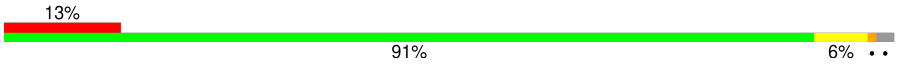
• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

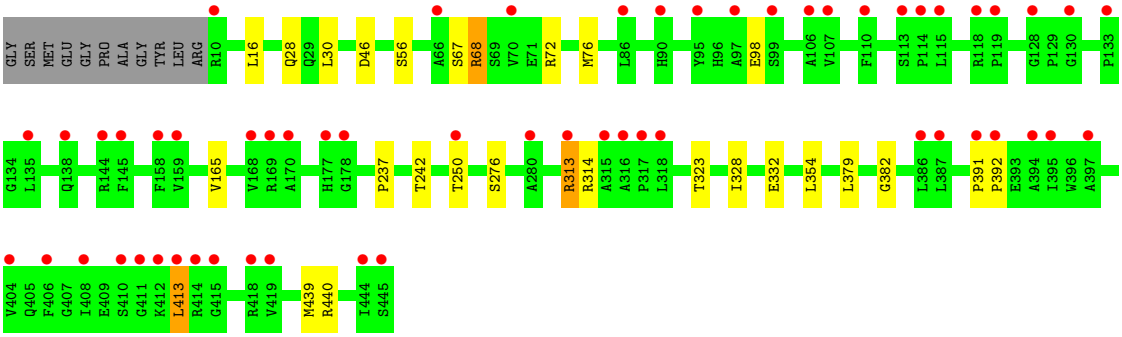
Chain A:



• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

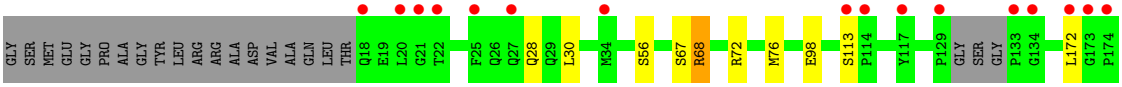
Chain B:

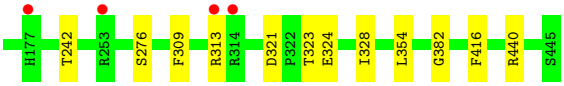




• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

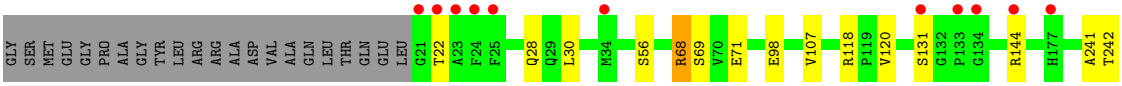
Chain C:





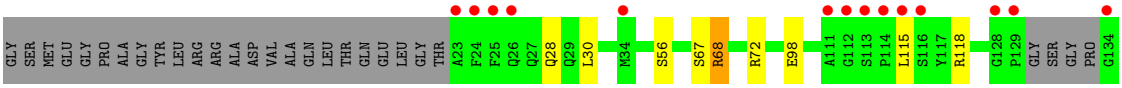
• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

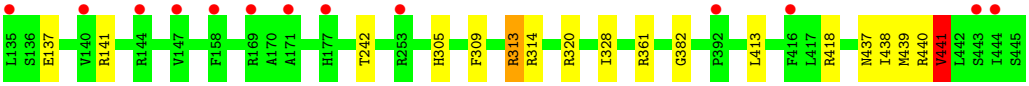
Chain D:



• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

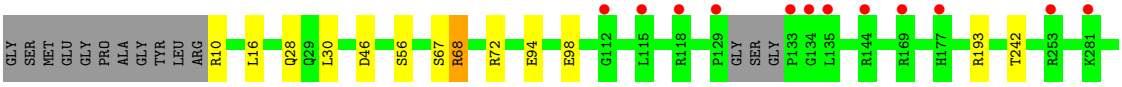
Chain E:

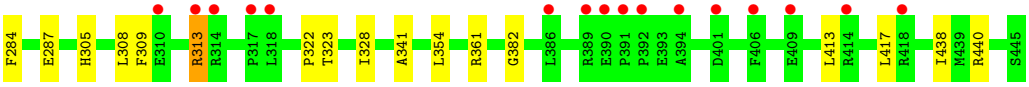




• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

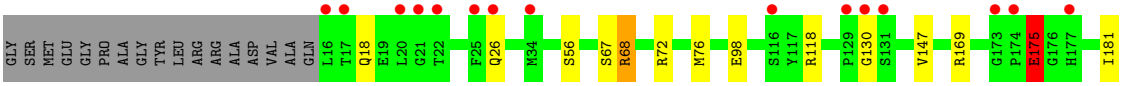
Chain F:





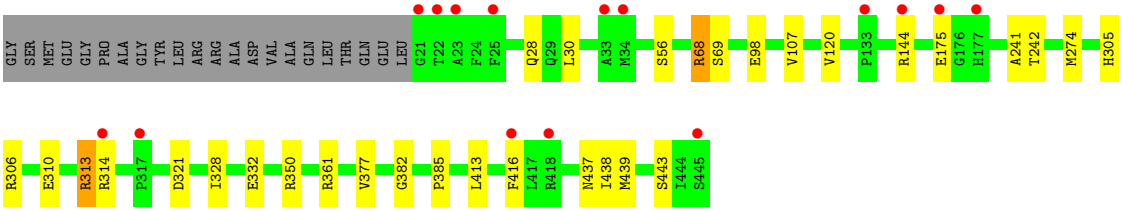
• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

Chain G:



• Molecule 1: Isoform L-type of Pyruvate kinase PKLR

Chain H:


GLY SER MET GLU GLY PRO ALA GLY TYR LEU ARG ARG ALA ASP VAL ALA GLN LEU THR GLN GLU LEU G21 T22 A23 F24 F25 Q28 Q29 L30 A33 M34 S56 R68 S69 E98 V107 V120 P133 R144 E175 G176 H177 A241 T242 M274 H305
R306 E310 R313 R314 P317 D321 I328 E332 R350 R361 V377 G382 P385 L413 F416 L417 R418 N437 I438 M439 S443 I444 S445

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	207.43Å 112.95Å 188.28Å 90.00° 91.92° 90.00°	Depositor
Resolution (Å)	188.17 – 1.89 188.17 – 1.89	Depositor EDS
% Data completeness (in resolution range)	70.6 (188.17-1.89) 70.6 (188.17-1.89)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.58 (at 1.88Å)	Xtriage
Refinement program	BUSTER 2.10.4	Depositor
R, R_{free}	0.188 , 0.220 0.178 , 0.208	Depositor DCC
R_{free} test set	12149 reflections (3.49%)	wwPDB-VP
Wilson B-factor (Å^2)	33.4	Xtriage
Anisotropy	0.031	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 46.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.000 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	29248	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 44.42 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.5297e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: EDO, MG, WVF, OXL, FBP, K

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	0.71	0/3359	0.97	3/4538 (0.1%)
1	B	0.75	2/3429 (0.1%)	0.98	1/4636 (0.0%)
1	C	0.80	1/3369 (0.0%)	0.97	1/4554 (0.0%)
1	D	0.81	0/3341	1.00	0/4517
1	E	0.71	0/3361	0.97	1/4541 (0.0%)
1	F	0.76	0/3416	1.00	1/4617 (0.0%)
1	G	0.81	1/3397 (0.0%)	0.98	2/4594 (0.0%)
1	H	0.84	0/3352	1.00	1/4531 (0.0%)
All	All	0.77	4/27024 (0.0%)	0.98	10/36528 (0.0%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	276	SER	CA-C	8.16	1.56	1.52
1	B	276[A]	SER	CA-C	5.97	1.55	1.52
1	B	276[B]	SER	CA-C	5.97	1.55	1.52
1	G	391	PRO	CA-C	5.94	1.55	1.51

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	G	175	GLU	CB-CG-CD	6.26	123.25	112.60
1	E	441	VAL	N-CA-CB	6.21	118.48	111.21
1	C	416	PHE	CA-CB-CG	6.18	119.98	113.80
1	A	46	ASP	CA-CB-CG	5.87	118.47	112.60
1	G	416	PHE	CA-CB-CG	5.85	119.65	113.80

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3267	0	3342	21	0
1	B	3350	0	3417	19	0
1	C	3284	0	3351	13	0
1	D	3261	0	3321	13	0
1	E	3265	0	3337	16	0
1	F	3338	0	3412	21	0
1	G	3311	0	3374	22	0
1	H	3269	0	3334	22	0
2	A	20	0	10	0	0
2	B	20	0	10	0	0
2	C	20	0	10	0	0
2	D	20	0	10	0	0
2	E	20	0	10	0	0
2	F	20	0	10	0	0
2	G	20	0	10	0	0
2	H	20	0	10	0	0
3	A	6	0	0	0	0
3	B	6	0	0	0	0
3	C	6	0	0	0	0
3	D	6	0	0	0	0
3	E	6	0	0	0	0
3	F	6	0	0	0	0
3	G	6	0	0	0	0
3	H	6	0	0	0	0
4	A	30	16	0	0	0
4	B	30	16	0	0	0
4	E	30	16	0	0	0
4	F	30	16	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
5	E	1	0	0	0	0
5	F	1	0	0	0	0
5	G	1	0	0	0	0
5	H	1	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
6	C	1	0	0	0	0
6	D	1	0	0	0	0
6	E	1	0	0	0	0
6	F	1	0	0	0	0
6	G	1	0	0	0	0
6	H	1	0	0	0	0
7	B	4	6	6	0	0
7	C	4	6	6	0	0
7	D	4	6	6	0	0
7	E	4	6	6	0	0
7	F	4	6	6	1	0
7	G	4	6	6	1	0
7	H	4	6	6	0	0
8	A	235	0	0	1	0
8	B	227	0	0	0	0
8	C	323	0	0	1	0
8	D	355	0	0	0	0
8	E	261	0	0	0	0
8	F	304	0	0	2	0
8	G	340	0	0	0	0
8	H	380	0	0	0	0
All	All	29142	106	27010	126	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 2.

The worst 5 of 126 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:C:313:ARG:HG3	1:C:328:ILE:HD11	1.52	0.91
1:F:313:ARG:HG2	1:F:328:ILE:HD11	1.55	0.88
1:B:313:ARG:HG2	1:B:328:ILE:HD11	1.59	0.84
1:E:320[B]:ARG:HG3	1:F:16:LEU:HD11	1.69	0.74
1:A:438:ILE:HG12	1:B:440:ARG:HG2	1.69	0.73

There are no symmetry-related clashes.

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	430/447 (96%)	424 (99%)	5 (1%)	1 (0%)	43	34
1	B	442/447 (99%)	435 (98%)	6 (1%)	1 (0%)	43	34
1	C	431/447 (96%)	425 (99%)	5 (1%)	1 (0%)	43	34
1	D	431/447 (96%)	425 (99%)	5 (1%)	1 (0%)	43	34
1	E	429/447 (96%)	423 (99%)	5 (1%)	1 (0%)	43	34
1	F	437/447 (98%)	433 (99%)	3 (1%)	1 (0%)	43	34
1	G	438/447 (98%)	428 (98%)	8 (2%)	2 (0%)	24	13
1	H	432/447 (97%)	427 (99%)	4 (1%)	1 (0%)	43	34
All	All	3470/3576 (97%)	3420 (99%)	41 (1%)	9 (0%)	36	26

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	G	130	GLY
1	A	242	THR
1	B	242	THR
1	C	242	THR
1	D	242	THR

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	347/352 (99%)	336 (97%)	11 (3%)	34	17

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	353/352 (100%)	345 (98%)	8 (2%)	44	29
1	C	348/352 (99%)	344 (99%)	4 (1%)	65	56
1	D	344/352 (98%)	331 (96%)	13 (4%)	29	13
1	E	347/352 (99%)	337 (97%)	10 (3%)	37	20
1	F	352/352 (100%)	346 (98%)	6 (2%)	53	40
1	G	351/352 (100%)	345 (98%)	6 (2%)	53	40
1	H	345/352 (98%)	336 (97%)	9 (3%)	40	24
All	All	2787/2816 (99%)	2720 (98%)	67 (2%)	44	27

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	377	VAL
1	H	69	SER
1	H	439	MET
1	D	68	ARG
1	D	22	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	27	GLN
1	D	90	HIS
1	G	18	GLN
1	C	90	HIS
1	C	27	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 43 ligands modelled in this entry, 16 are monoatomic - leaving 27 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	OXL	C	602	5	5,5,5	1.81	1 (20%)	6,6,6	2.22	2 (33%)
3	OXL	H	602	5	5,5,5	1.80	2 (40%)	6,6,6	1.83	2 (33%)
2	FBP	C	601	-	18,20,20	0.67	0	21,32,32	0.63	0
7	EDO	H	603	-	3,3,3	0.39	0	2,2,2	0.22	0
2	FBP	B	601	-	18,20,20	0.45	0	21,32,32	0.72	0
2	FBP	E	601	-	18,20,20	0.58	0	21,32,32	0.67	0
7	EDO	B	603	-	3,3,3	0.16	0	2,2,2	0.20	0
2	FBP	D	601	-	18,20,20	0.62	0	21,32,32	1.02	1 (4%)
7	EDO	G	603	-	3,3,3	0.31	0	2,2,2	0.32	0
7	EDO	F	604	-	3,3,3	0.21	0	2,2,2	0.40	0
2	FBP	H	601	-	18,20,20	0.68	0	21,32,32	0.75	1 (4%)
4	WVF	E	604	-	33,33,33	0.28	0	48,50,50	0.42	0
3	OXL	F	602	5	5,5,5	2.02	1 (20%)	6,6,6	2.44	3 (50%)
3	OXL	E	602	5	5,5,5	2.21	2 (40%)	6,6,6	1.36	1 (16%)
7	EDO	D	603	-	3,3,3	0.30	0	2,2,2	0.25	0
4	WVF	F	603	-	33,33,33	0.33	0	48,50,50	0.41	0
7	EDO	E	603	-	3,3,3	0.33	0	2,2,2	0.31	0
4	WVF	B	604	-	33,33,33	0.27	0	48,50,50	0.41	0
3	OXL	G	602	5	5,5,5	2.43	2 (40%)	6,6,6	1.67	2 (33%)
3	OXL	A	602	5	5,5,5	1.86	2 (40%)	6,6,6	2.35	3 (50%)
2	FBP	G	601	-	18,20,20	0.43	0	21,32,32	0.65	0
7	EDO	C	603	-	3,3,3	0.41	0	2,2,2	0.38	0
3	OXL	B	602	5	5,5,5	2.24	2 (40%)	6,6,6	1.64	2 (33%)
3	OXL	D	602	5	5,5,5	2.18	2 (40%)	6,6,6	2.02	2 (33%)
4	WVF	A	603	-	33,33,33	0.27	0	48,50,50	0.39	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	FBP	A	601	-	18,20,20	0.47	0	21,32,32	0.63	0
2	FBP	F	601	-	18,20,20	0.46	0	21,32,32	0.61	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
3	OXL	C	602	5	-	4/4/4/4	-
3	OXL	H	602	5	-	4/4/4/4	-
2	FBP	C	601	-	-	2/13/32/32	0/1/1/1
7	EDO	H	603	-	-	0/1/1/1	-
2	FBP	B	601	-	-	2/13/32/32	0/1/1/1
2	FBP	E	601	-	-	2/13/32/32	0/1/1/1
7	EDO	B	603	-	-	0/1/1/1	-
2	FBP	D	601	-	-	2/13/32/32	0/1/1/1
7	EDO	G	603	-	-	0/1/1/1	-
7	EDO	F	604	-	-	0/1/1/1	-
2	FBP	H	601	-	-	2/13/32/32	0/1/1/1
4	WVF	E	604	-	-	0/24/24/24	0/4/4/4
3	OXL	F	602	5	-	0/4/4/4	-
3	OXL	E	602	5	-	4/4/4/4	-
7	EDO	D	603	-	-	0/1/1/1	-
4	WVF	F	603	-	-	0/24/24/24	0/4/4/4
7	EDO	E	603	-	-	1/1/1/1	-
4	WVF	B	604	-	-	0/24/24/24	0/4/4/4
3	OXL	G	602	5	-	4/4/4/4	-
3	OXL	A	602	5	-	4/4/4/4	-
2	FBP	G	601	-	-	2/13/32/32	0/1/1/1
7	EDO	C	603	-	-	0/1/1/1	-
3	OXL	B	602	5	-	4/4/4/4	-
3	OXL	D	602	5	-	4/4/4/4	-
4	WVF	A	603	-	-	0/24/24/24	0/4/4/4
2	FBP	A	601	-	-	2/13/32/32	0/1/1/1
2	FBP	F	601	-	-	2/13/32/32	0/1/1/1

The worst 5 of 14 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	602	OXL	O2-C2	4.84	1.34	1.22
3	B	602	OXL	O2-C2	4.11	1.32	1.22
3	F	602	OXL	O2-C2	3.98	1.32	1.22
3	E	602	OXL	O4-C2	-3.51	1.21	1.30
3	A	602	OXL	O2-C2	3.47	1.31	1.22

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	F	602	OXL	O4-C2-C1	4.47	121.50	112.83
3	C	602	OXL	O4-C2-C1	4.38	121.33	112.83
3	A	602	OXL	O4-C2-C1	4.34	121.24	112.83
3	H	602	OXL	O4-C2-C1	3.88	120.35	112.83
3	D	602	OXL	O4-C2-C1	3.19	119.01	112.83

There are no chirality outliers.

5 of 45 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	FBP	C4-C5-C6-O6
2	C	601	FBP	C4-C5-C6-O6
2	D	601	FBP	C4-C5-C6-O6
2	E	601	FBP	C4-C5-C6-O6
2	F	601	FBP	C4-C5-C6-O6

There are no ring outliers.

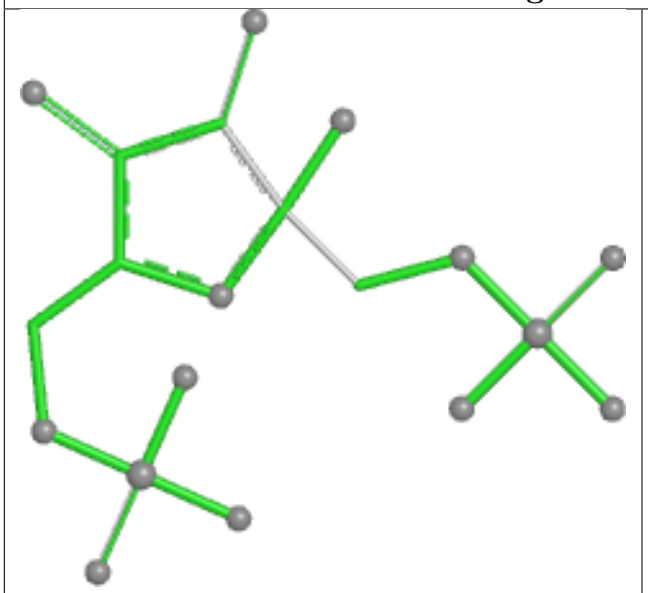
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	G	603	EDO	1	0
7	F	604	EDO	1	0

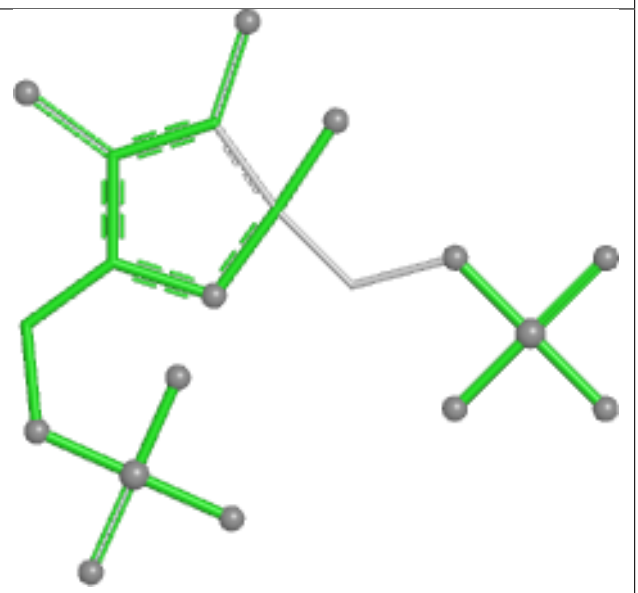
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

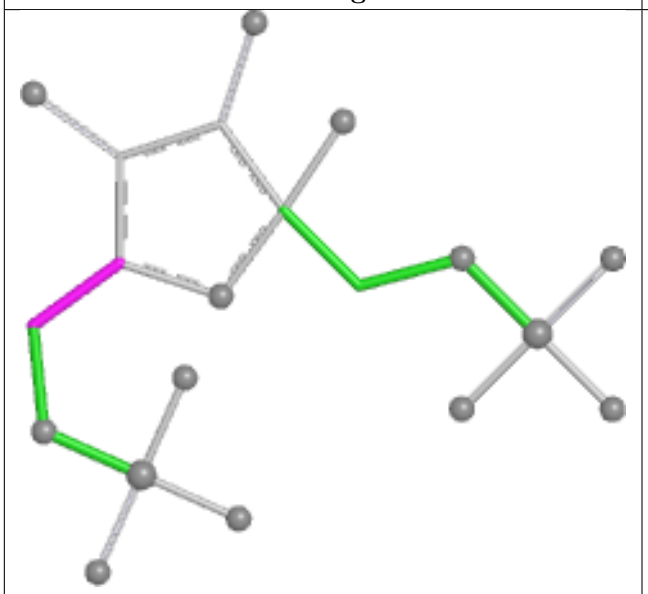
Ligand FBP C 601



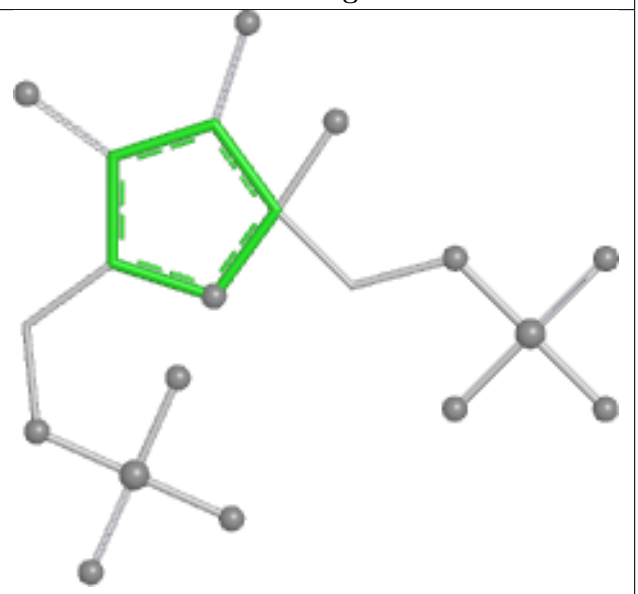
Bond lengths



Bond angles

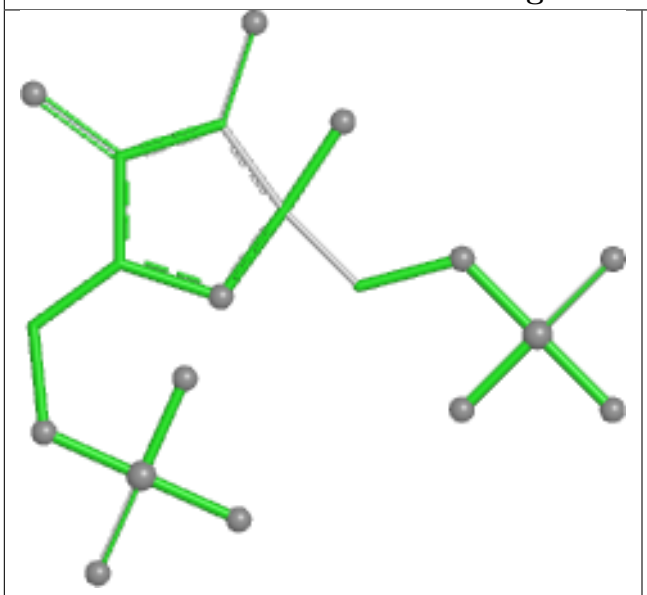


Torsions



Rings

Ligand FBP B 601



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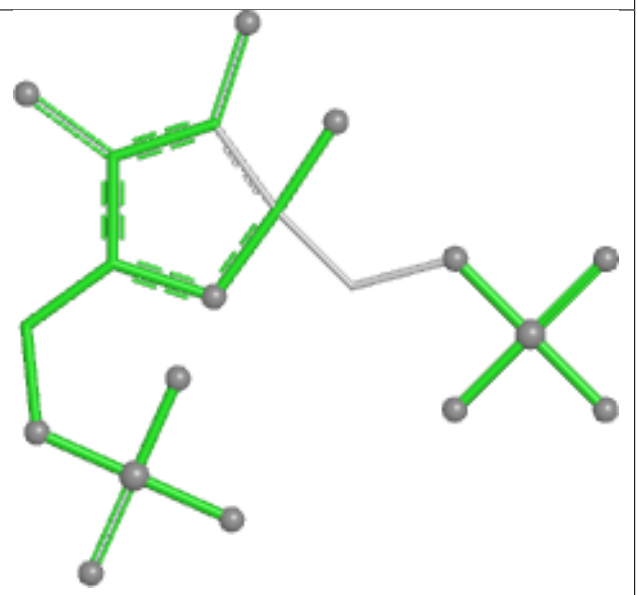

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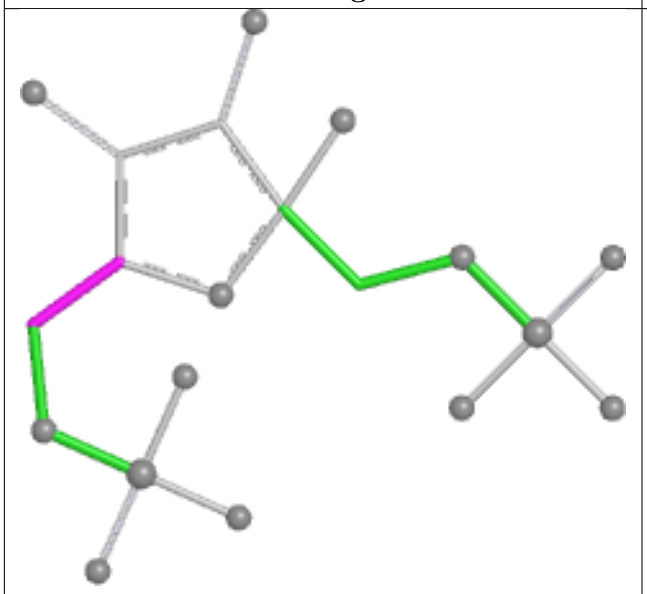

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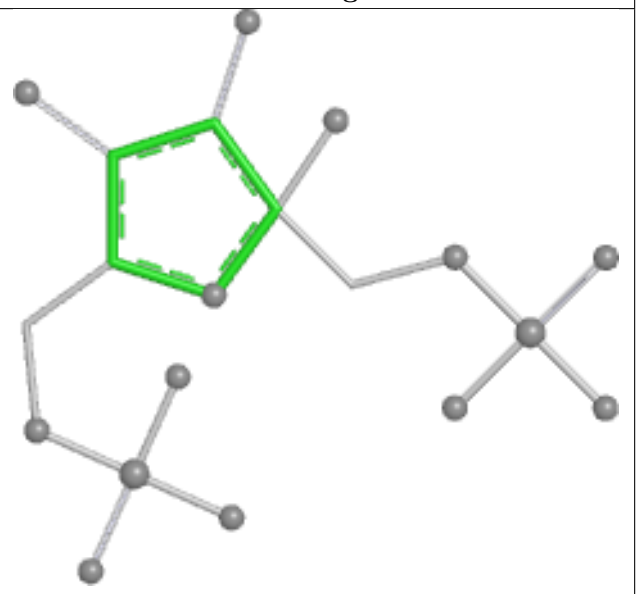
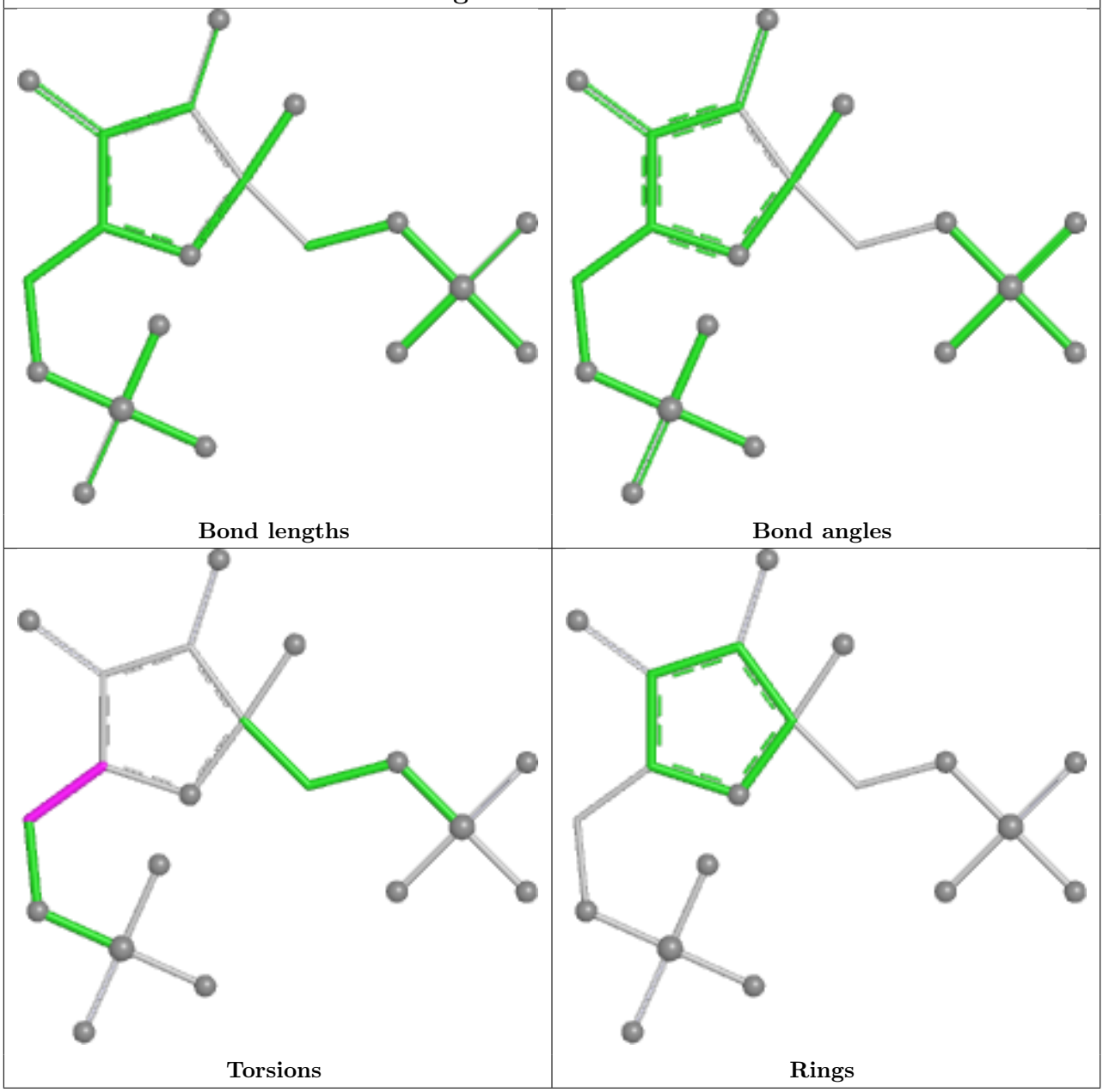


Rings

Ligand FBP E 601



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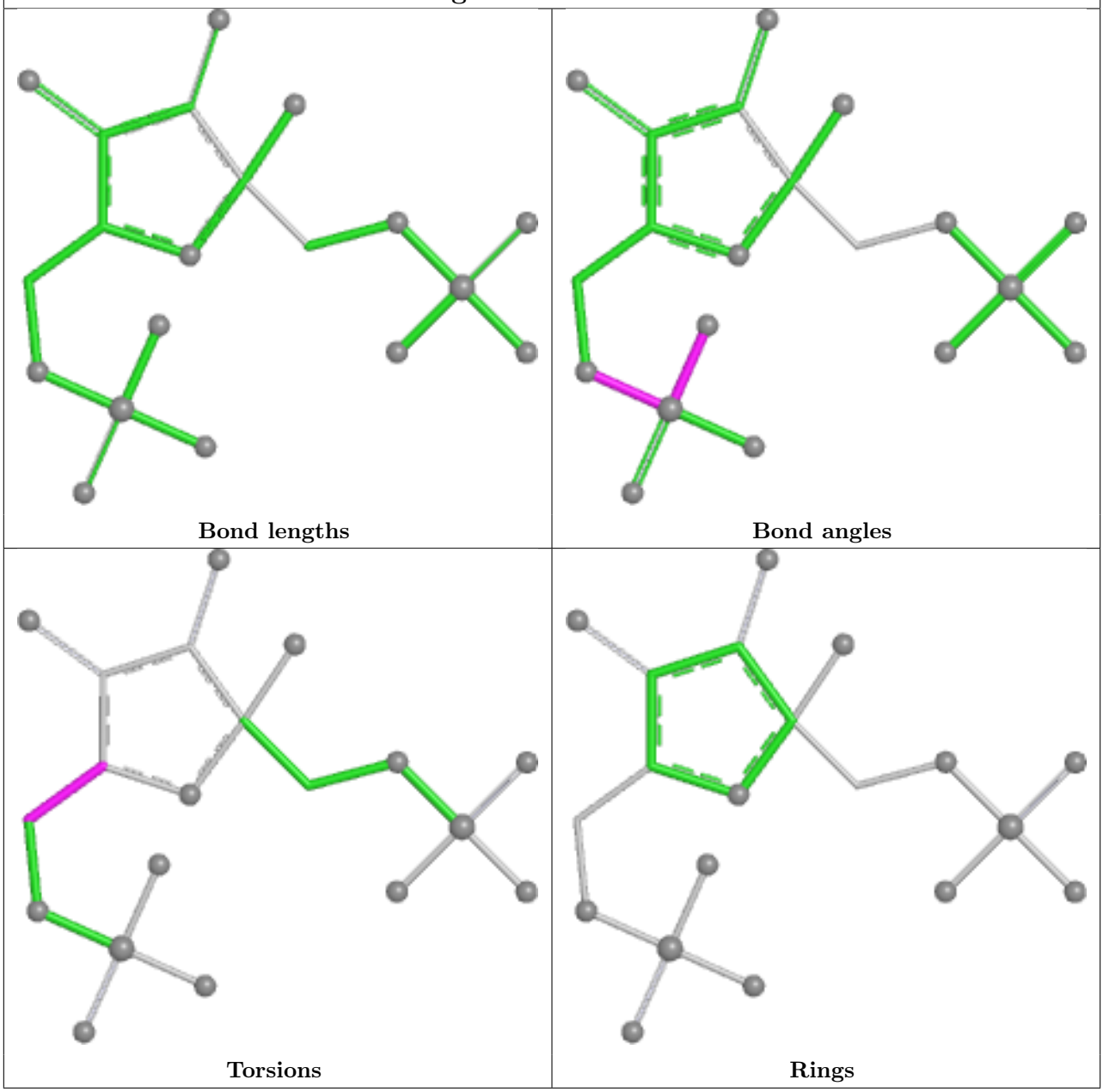

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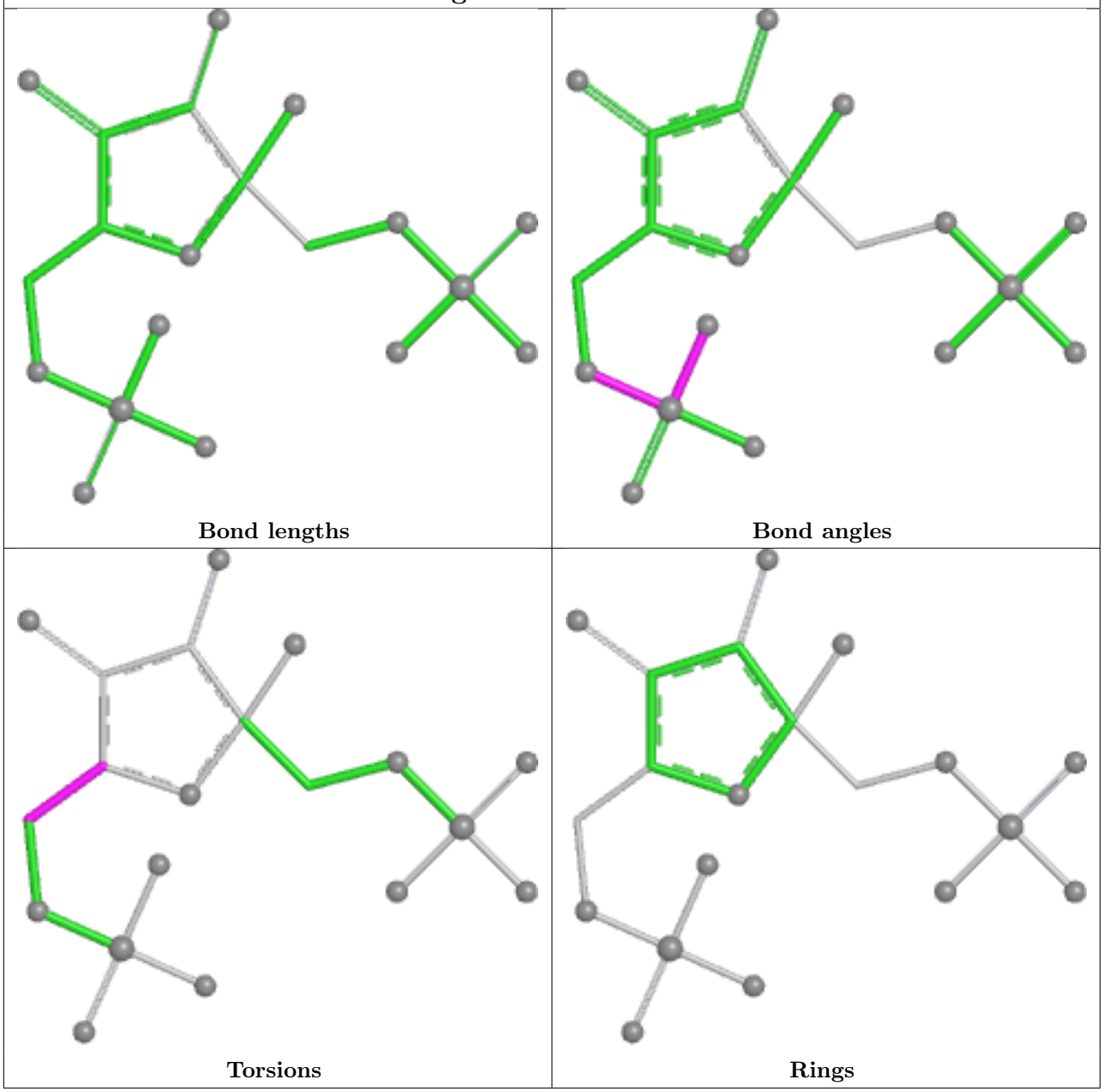
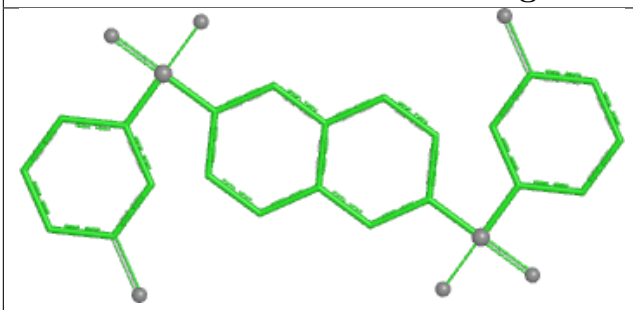
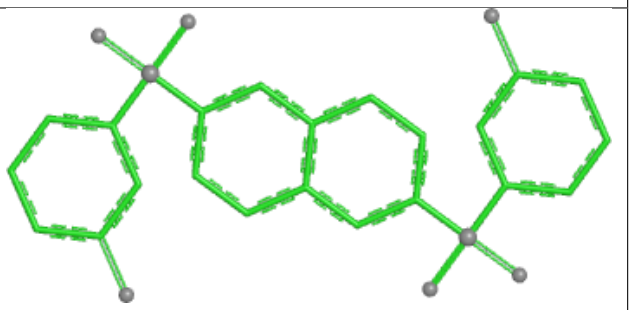


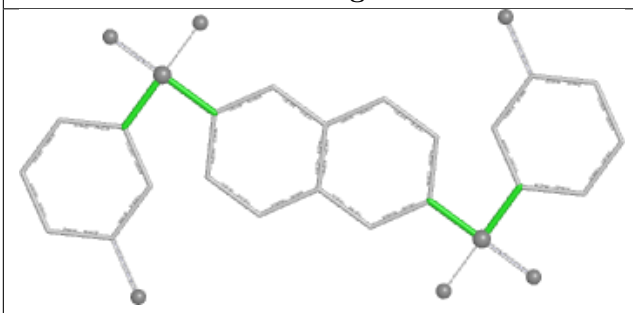
Ligand WVF E 604



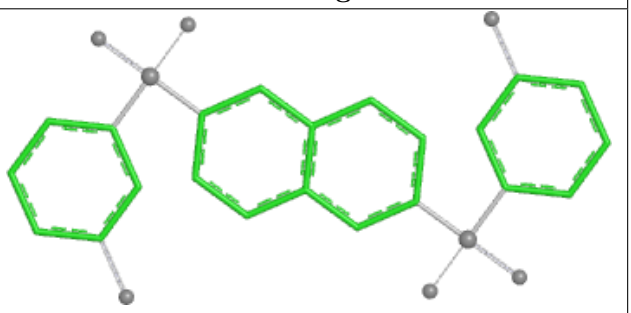
Bond lengths



Bond angles

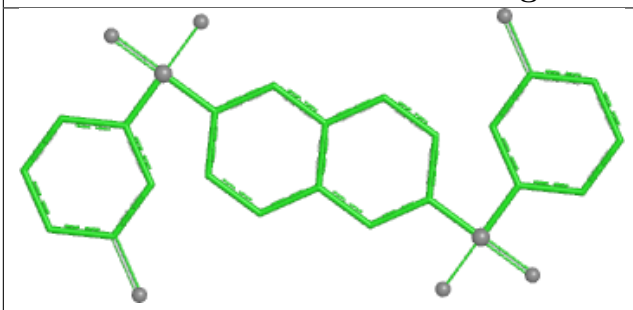


Torsions

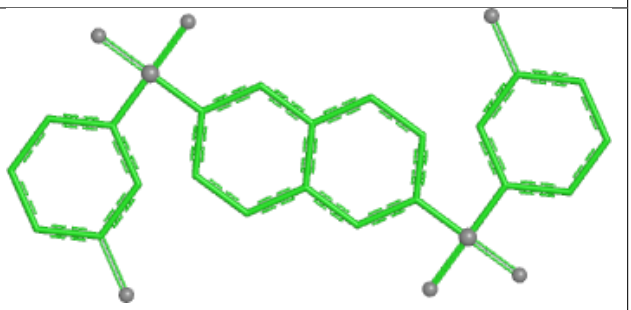


Rings

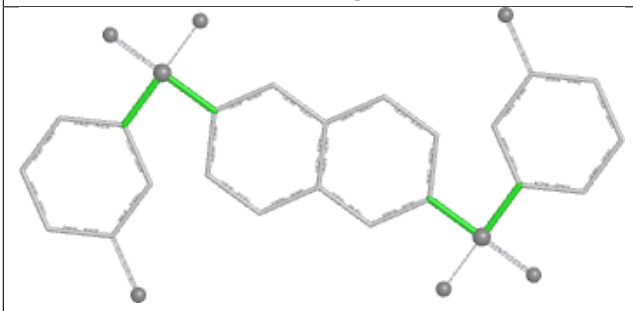
Ligand WVF F 603



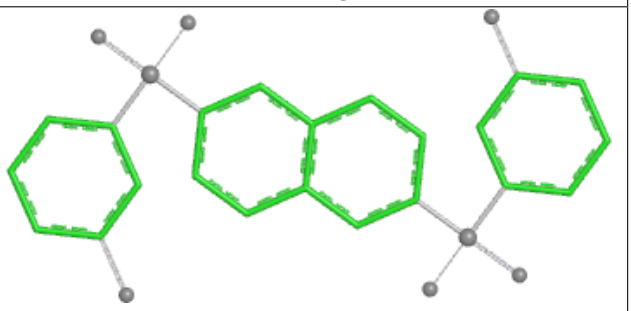
Bond lengths



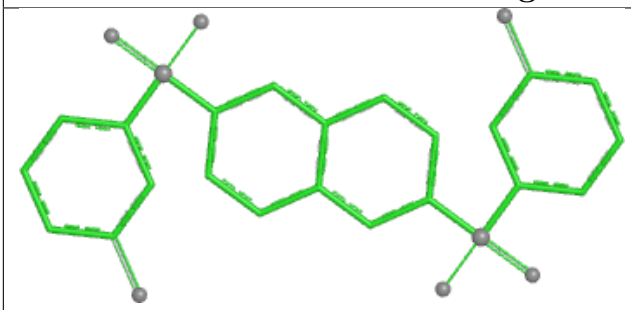
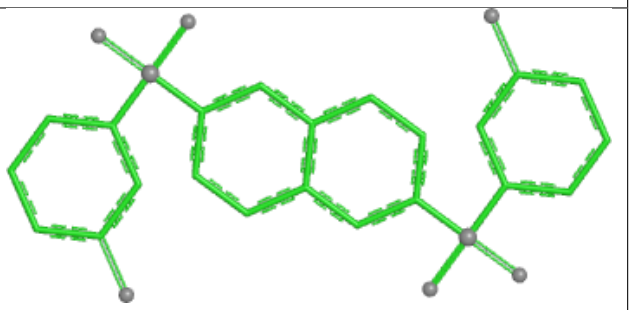
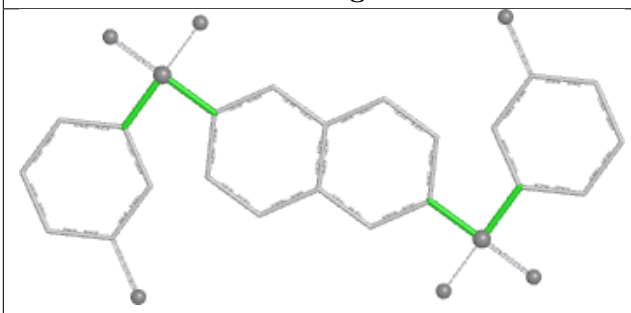
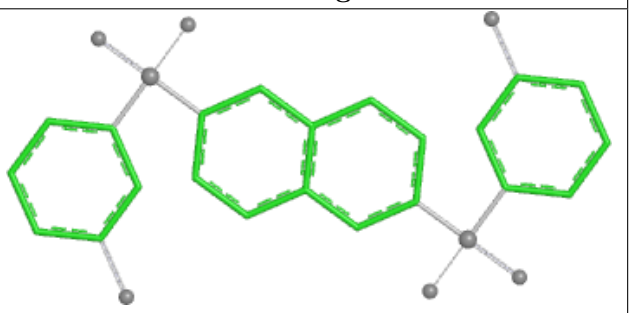
Bond angles



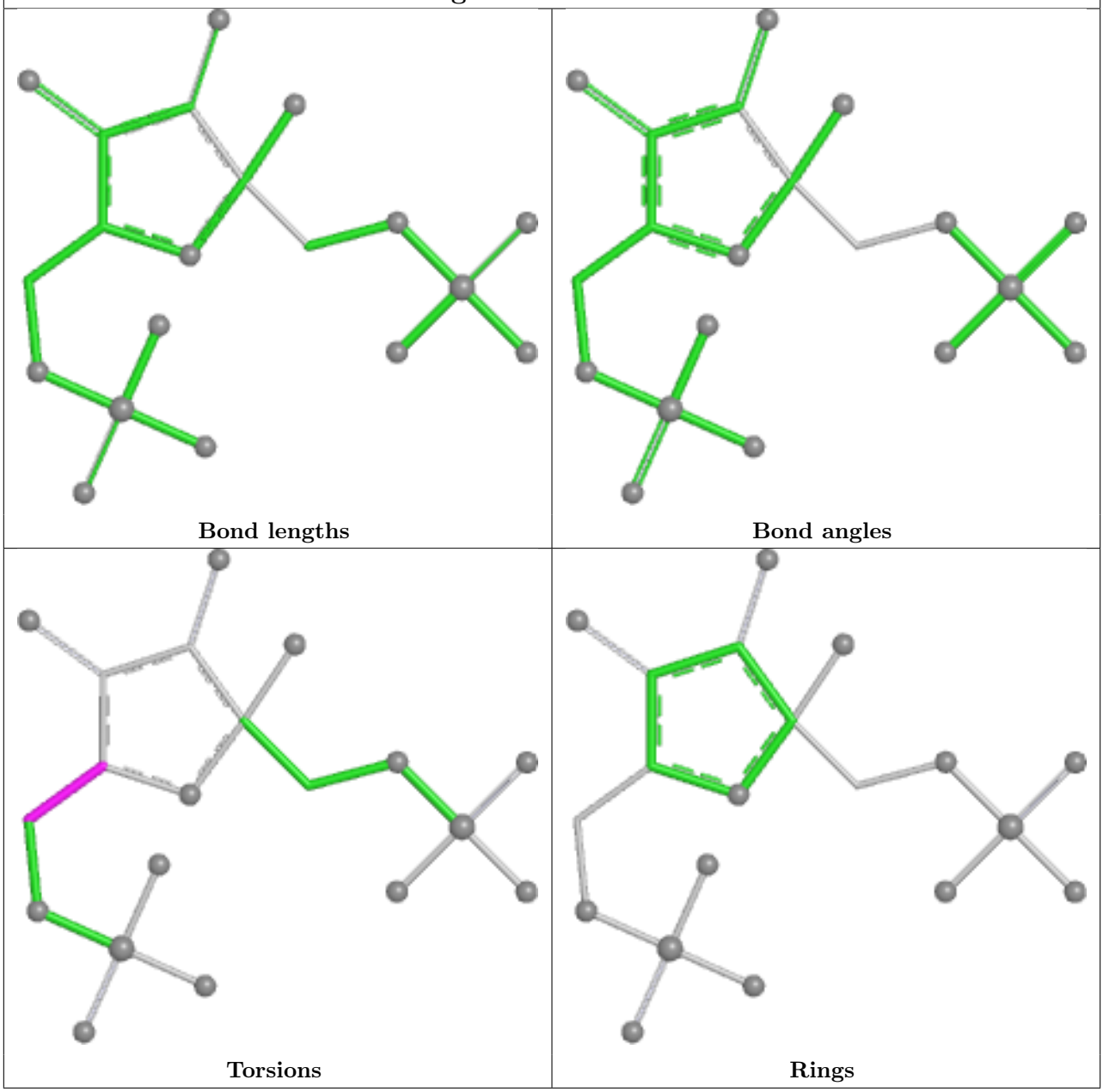
Torsions



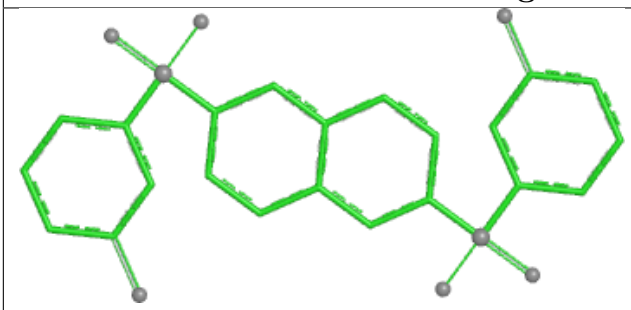
Rings

Ligand WVF B 604	
 Bond lengths	 Bond angles
 Torsions	 Rings

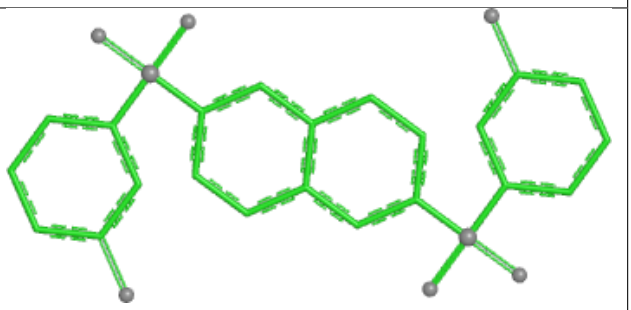
Ligand FBP G 601



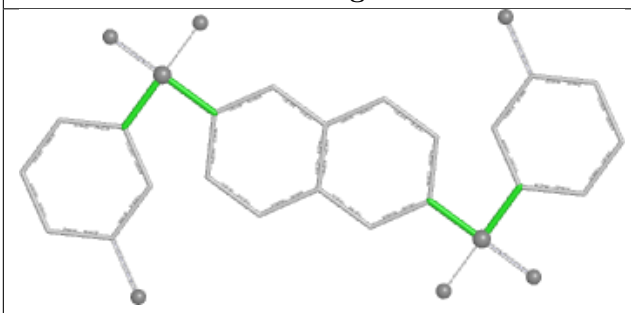
Ligand WVF A 603



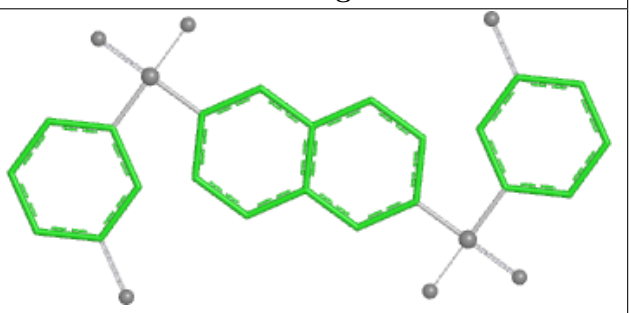
Bond lengths



Bond angles

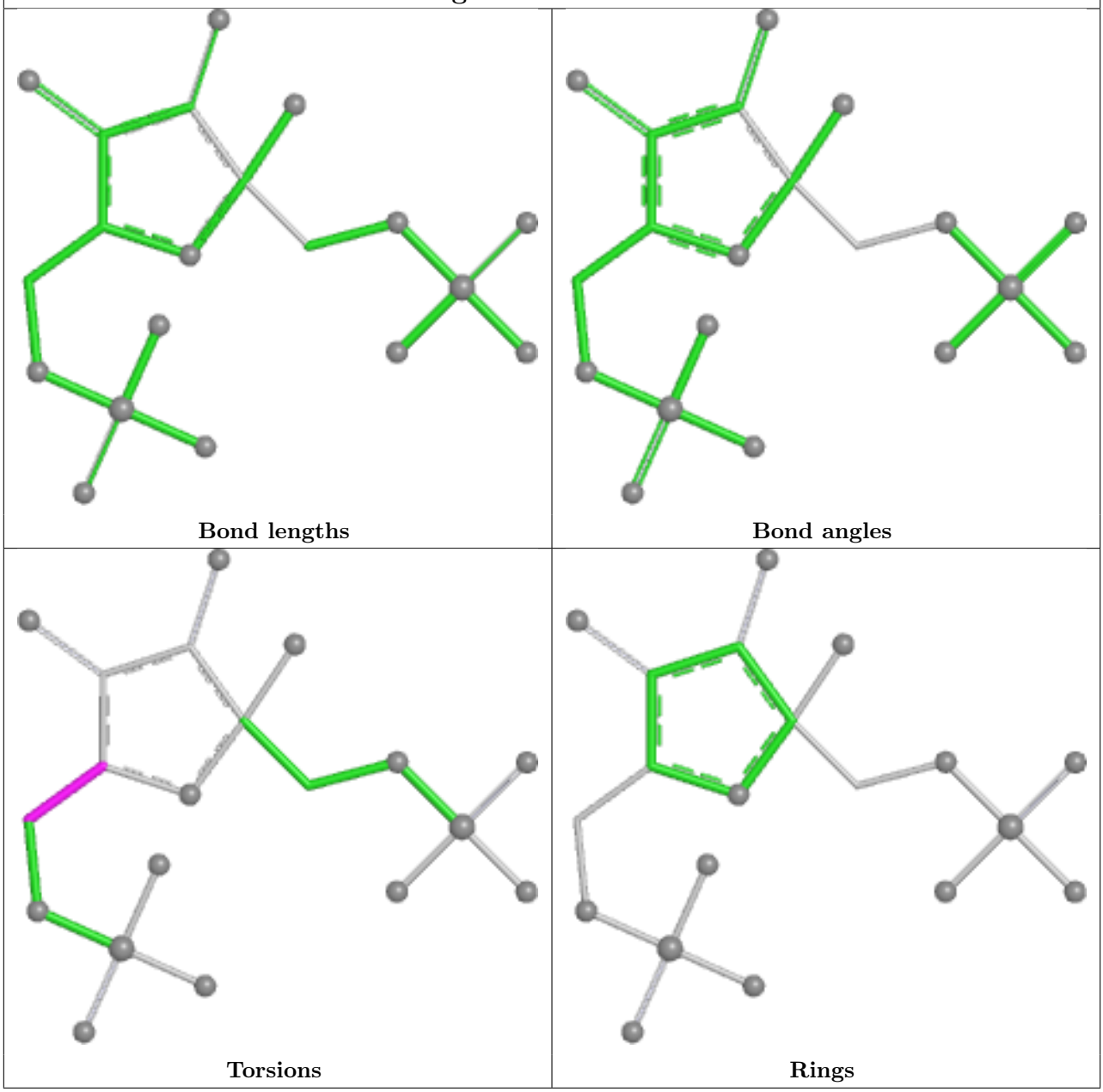


Torsions

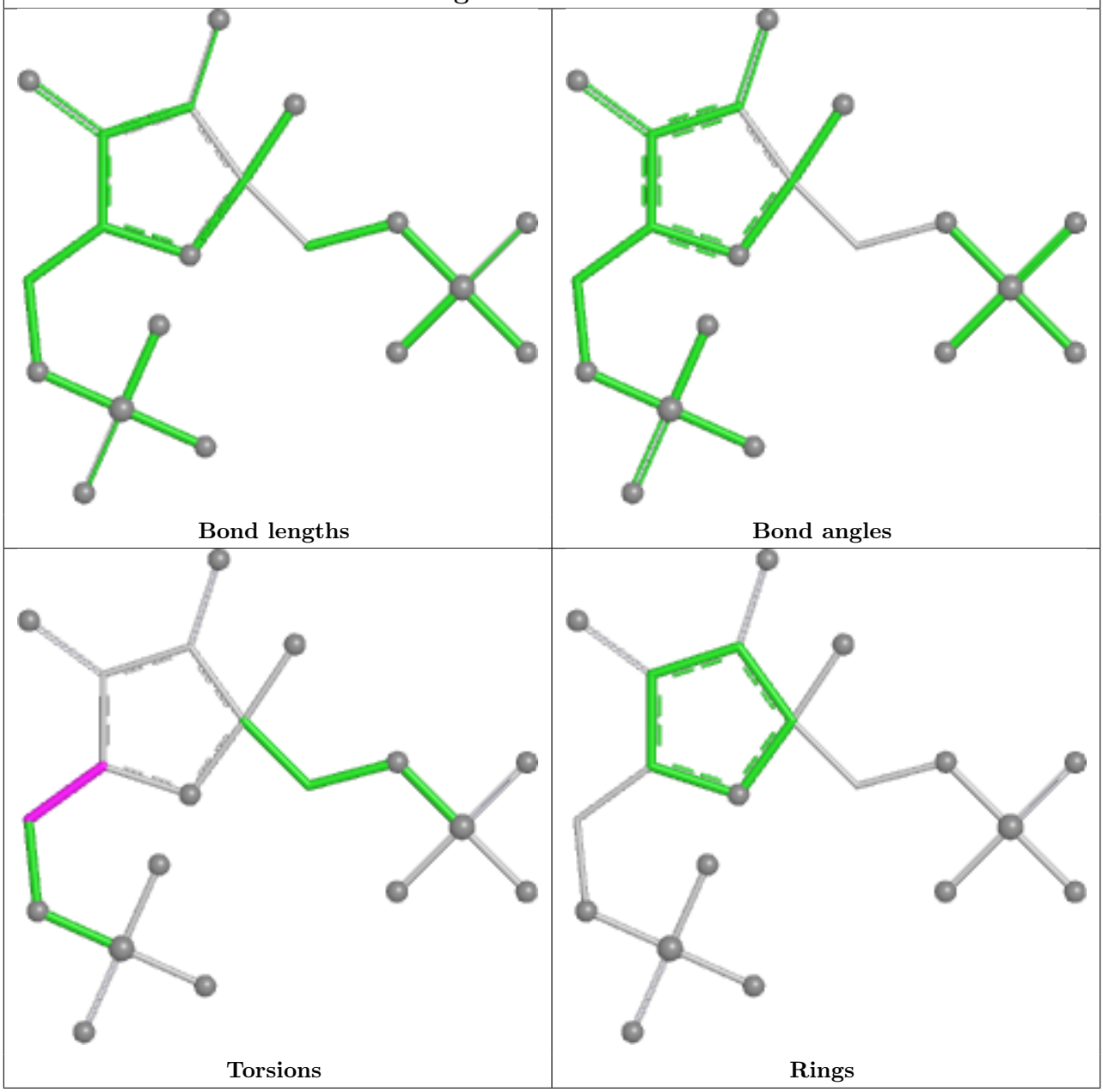


Rings

Ligand FBP A 601



Ligand FBP F 601



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 (i)

6.1 Protein, DNA and RNA chains (i)

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(Å^2)	Q<0.9
1	A	421/447 (94%)	0.74	43 (10%)	12	14	20, 42, 68, 84	13 (3%)
1	B	436/447 (97%)	0.80	57 (13%)	7	8	19, 42, 72, 82	8 (1%)
1	C	425/447 (95%)	0.16	20 (4%)	36	38	19, 34, 53, 85	10 (2%)
1	D	425/447 (95%)	-0.07	12 (2%)	55	59	17, 30, 50, 82	8 (1%)
1	E	419/447 (93%)	0.50	27 (6%)	25	28	20, 39, 65, 80	14 (3%)
1	F	433/447 (96%)	0.40	28 (6%)	25	27	19, 37, 60, 79	8 (1%)
1	G	430/447 (96%)	0.07	19 (4%)	39	42	18, 32, 51, 87	11 (2%)
1	H	425/447 (95%)	-0.16	15 (3%)	47	52	15, 28, 49, 72	9 (2%)
All	All	3414/3576 (95%)	0.31	221 (6%)	25	27	15, 35, 63, 87	81 (2%)

The worst 5 of 221 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	173	GLY	6.6
1	C	173	GLY	6.0
1	F	133	PRO	5.8
1	C	133	PRO	5.7
1	A	25	PHE	5.6

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

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

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 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
3	OXL	E	602	6/6	0.88	0.11	48,49,49,49	0
5	MG	B	605	1/1	0.89	0.12	50,50,50,50	0
3	OXL	F	602	6/6	0.91	0.10	43,44,46,47	0
7	EDO	E	603	4/4	0.91	0.12	44,45,45,45	6
3	OXL	A	602	6/6	0.93	0.08	48,49,49,50	0
3	OXL	C	602	6/6	0.94	0.08	42,43,44,45	0
3	OXL	D	602	6/6	0.94	0.07	35,36,38,38	0
7	EDO	D	603	4/4	0.94	0.11	39,39,40,40	6
3	OXL	B	602	6/6	0.94	0.08	41,43,45,46	0
7	EDO	G	603	4/4	0.94	0.10	38,38,40,40	6
7	EDO	H	603	4/4	0.94	0.13	35,35,36,36	6
3	OXL	H	602	6/6	0.95	0.07	35,36,36,37	0
3	OXL	G	602	6/6	0.95	0.07	39,40,41,42	0
6	K	A	605	1/1	0.95	0.09	72,72,72,72	0
7	EDO	B	603	4/4	0.95	0.10	35,36,38,38	6
4	WVF	A	603	30/30	0.96	0.08	27,31,35,35	16
6	K	C	605	1/1	0.96	0.12	57,57,57,57	0
7	EDO	F	604	4/4	0.96	0.09	37,37,38,38	6
2	FBP	B	601	20/20	0.96	0.07	39,40,44,45	0
7	EDO	C	603	4/4	0.96	0.08	33,33,34,34	6
6	K	F	606	1/1	0.97	0.10	72,72,72,72	0
6	K	G	605	1/1	0.97	0.12	57,57,57,57	0
4	WVF	E	604	30/30	0.97	0.07	30,33,35,36	16
4	WVF	F	603	30/30	0.97	0.07	28,32,35,35	16
2	FBP	F	601	20/20	0.97	0.06	34,39,44,44	0
2	FBP	A	601	20/20	0.97	0.06	37,39,40,40	0
6	K	B	606	1/1	0.97	0.08	58,58,58,58	0
4	WVF	B	604	30/30	0.97	0.07	27,31,33,33	16
6	K	E	606	1/1	0.97	0.15	71,71,71,71	0
2	FBP	E	601	20/20	0.98	0.05	33,35,37,37	0
6	K	H	605	1/1	0.98	0.11	47,47,47,47	0
2	FBP	G	601	20/20	0.98	0.04	23,26,28,29	0
5	MG	E	605	1/1	0.99	0.03	40,40,40,40	0
5	MG	F	605	1/1	0.99	0.03	36,36,36,36	0
5	MG	G	604	1/1	0.99	0.03	33,33,33,33	0
2	FBP	C	601	20/20	0.99	0.03	25,26,31,33	0
2	FBP	H	601	20/20	0.99	0.04	22,24,26,27	0

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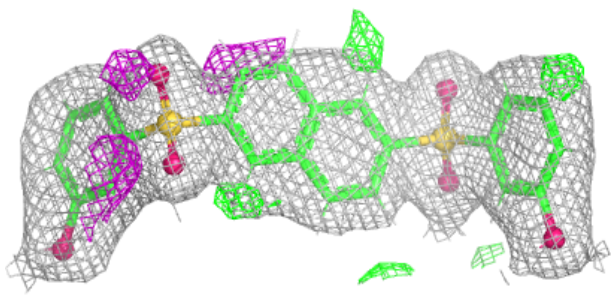
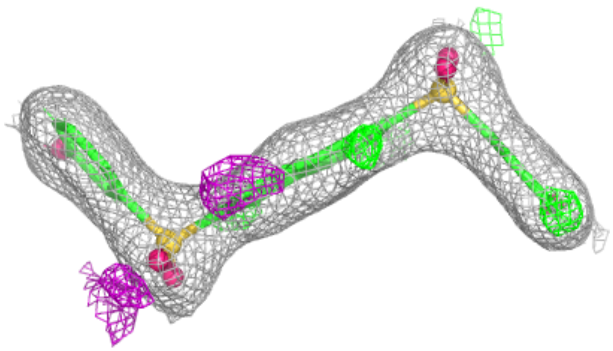
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	MG	A	604	1/1	0.99	0.04	50,50,50,50	0
6	K	D	605	1/1	0.99	0.10	43,43,43,43	0
2	FBP	D	601	20/20	0.99	0.04	23,25,29,29	0
5	MG	C	604	1/1	0.99	0.03	37,37,37,37	0
5	MG	H	604	1/1	1.00	0.03	31,31,31,31	0
5	MG	D	604	1/1	1.00	0.02	35,35,35,35	0

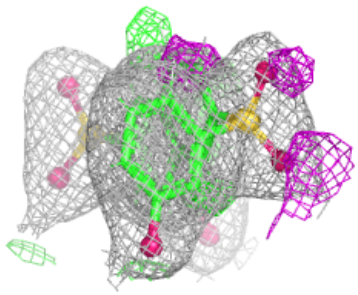
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around WVF A 603:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)

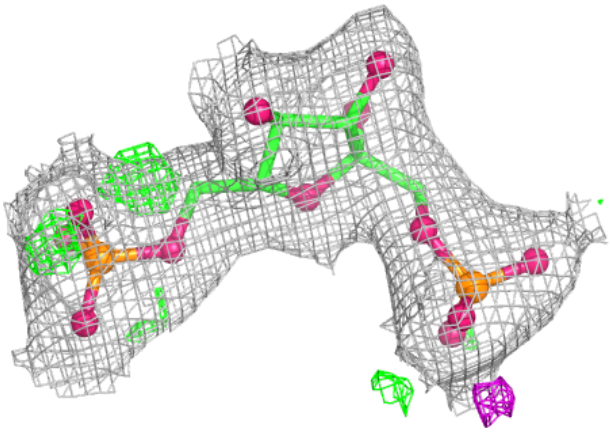


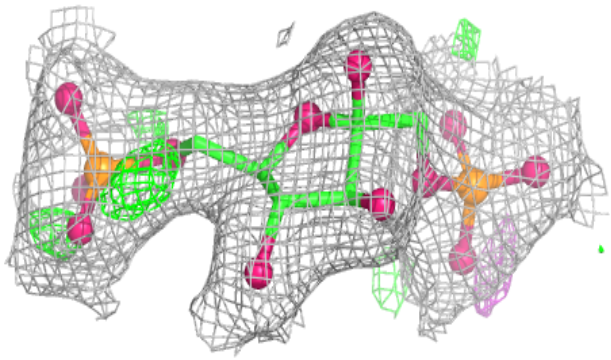


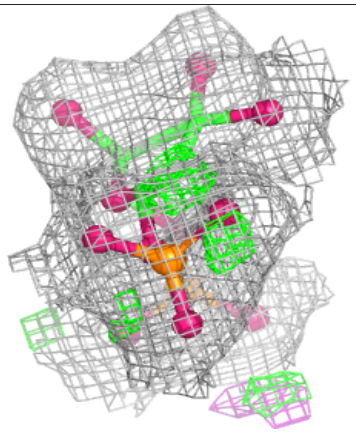


Electron density around FBP B 601:

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

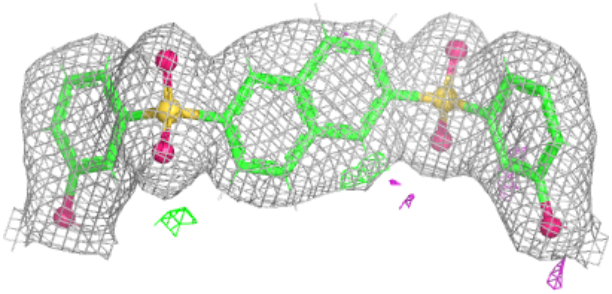


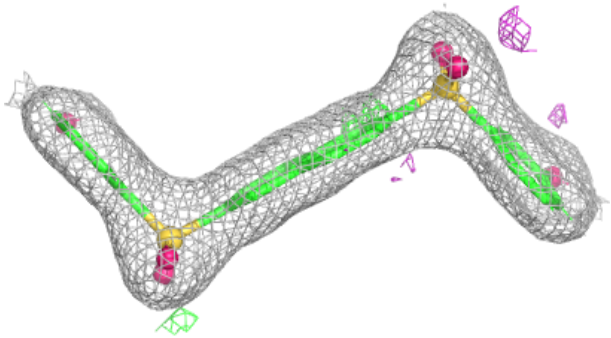


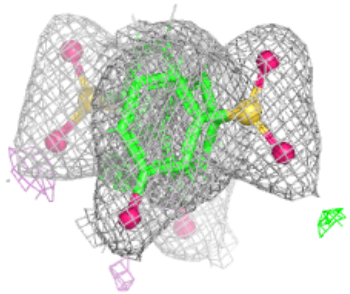


Electron density around WVF E 604:

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

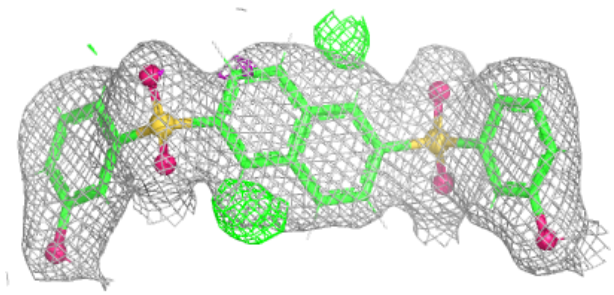


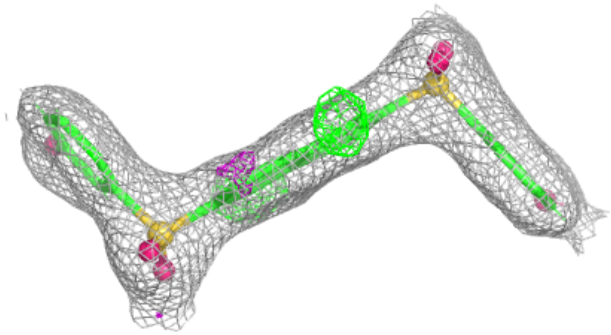


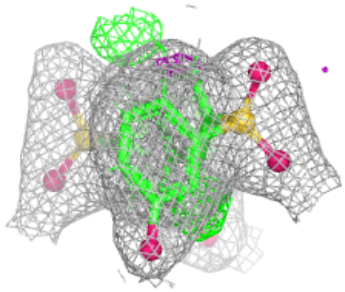


Electron density around WVF F 603:

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

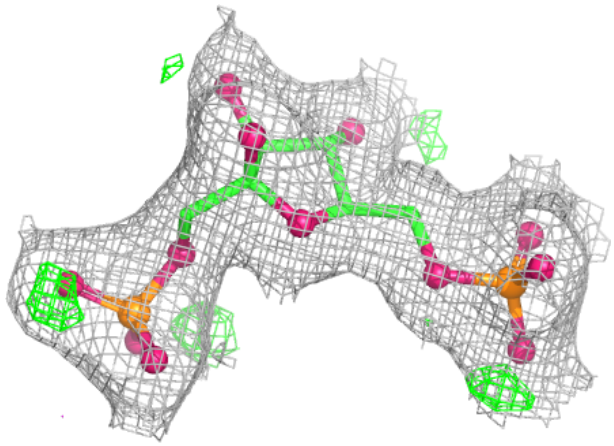


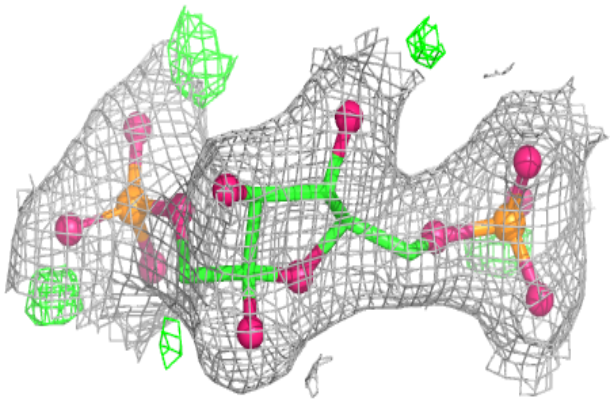


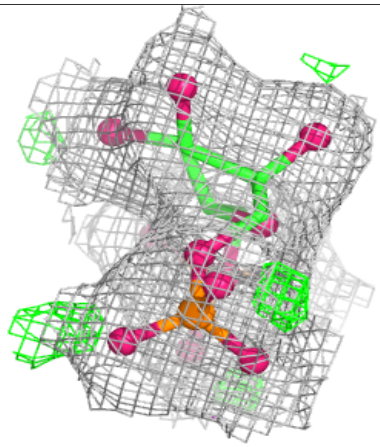


Electron density around FBP F 601:

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

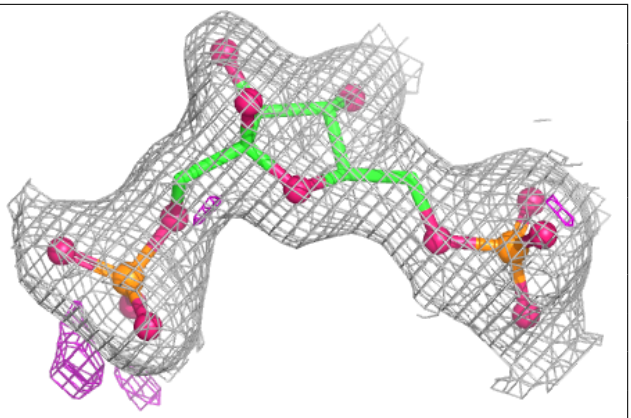


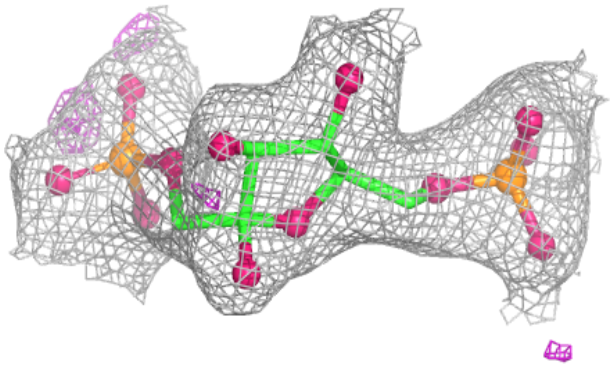


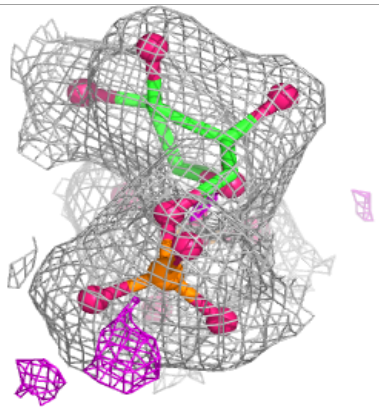


Electron density around FBP A 601:

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







Electron density around WVF B 604:

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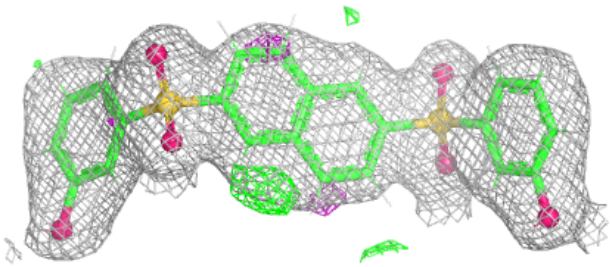
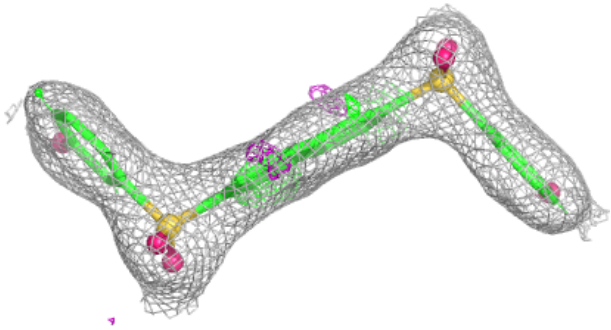
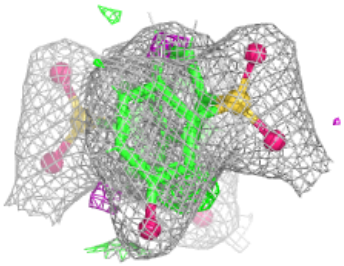
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

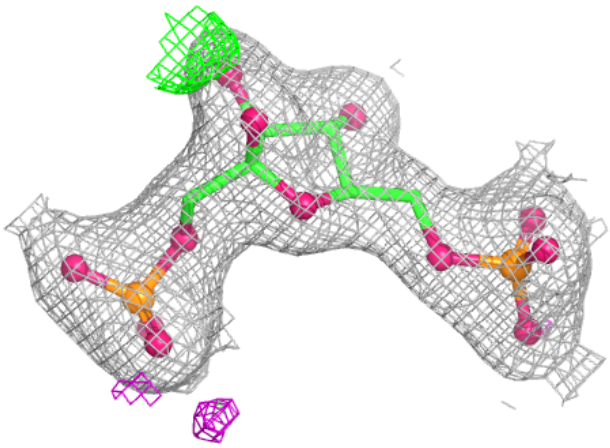


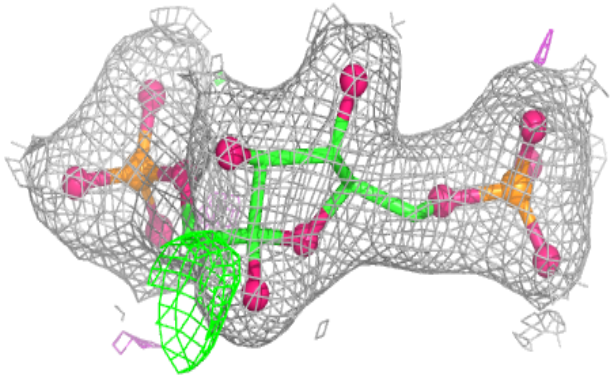




Electron density around FBP E 601:

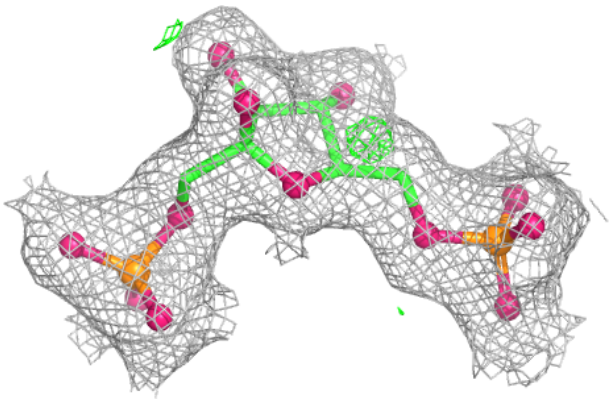
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

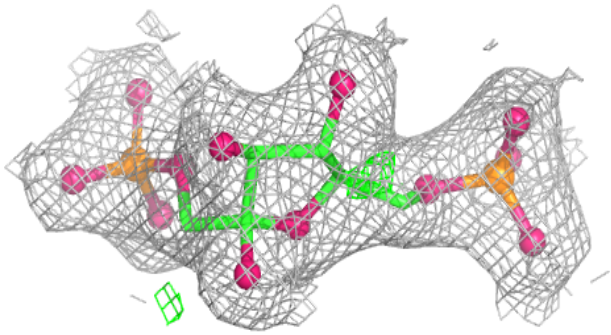


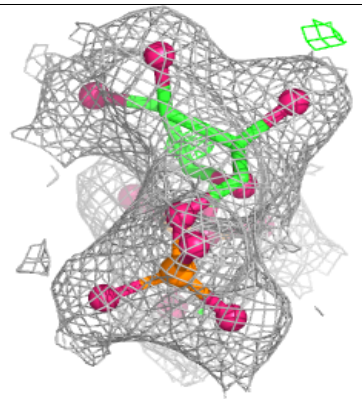


Electron density around FBP G 601:

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

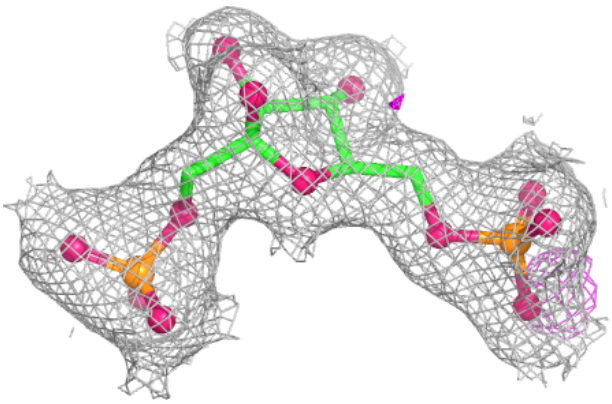


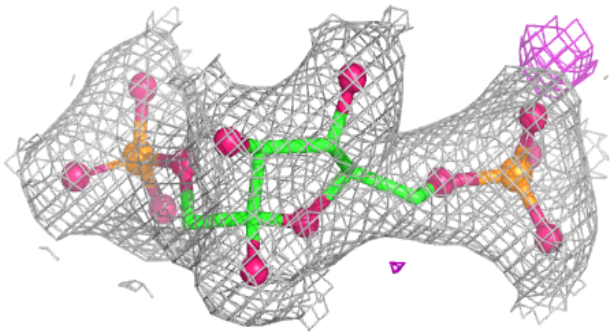


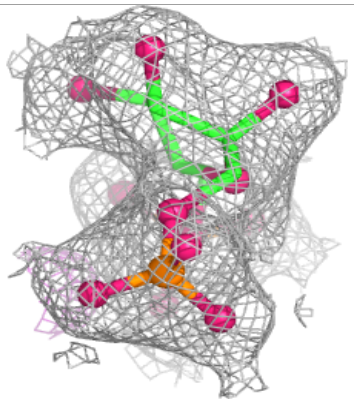


Electron density around FBP C 601:

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

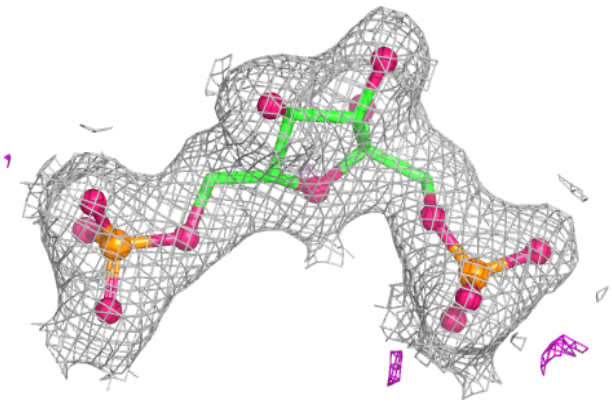


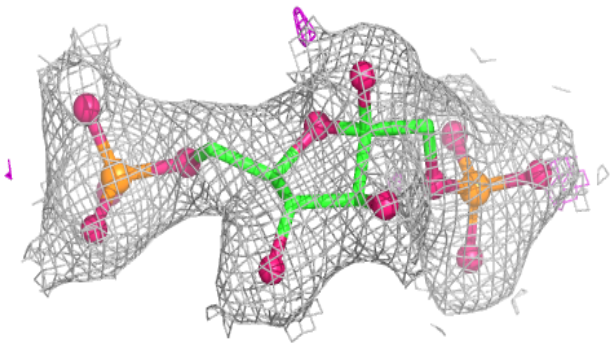


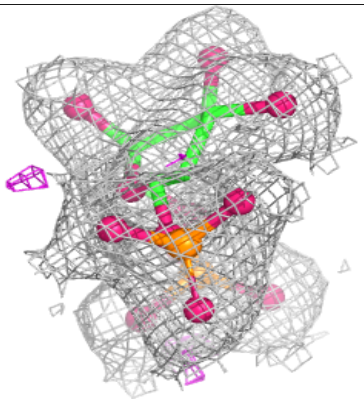


Electron density around FBP H 601:

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

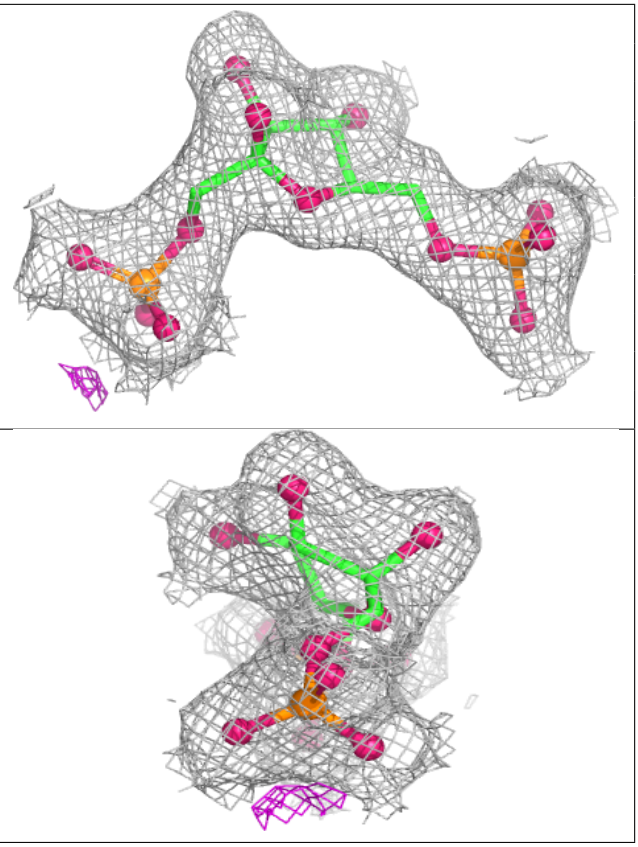






Electron density around FBP D 601:

$2mF_o$-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.