



# wwPDB X-ray Structure Validation Summary Report

Aug 2, 2023 – 02:02 AM EDT

PDB ID : 1BO5  
Title : CRYSTAL STRUCTURE OF THE COMPLEX BETWEEN ESCHERICHIA COLI GLYCEROL KINASE AND THE ALLOSTERIC REGULATOR FRUCTOSE 1,6-BISPHOSPHATE.  
Authors : Ormo, M.; Bystrom, C.E.; Remington, S.J.  
Deposited on : 1998-08-10  
Resolution : 3.20 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](mailto: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  symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.34  
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) : 2.34

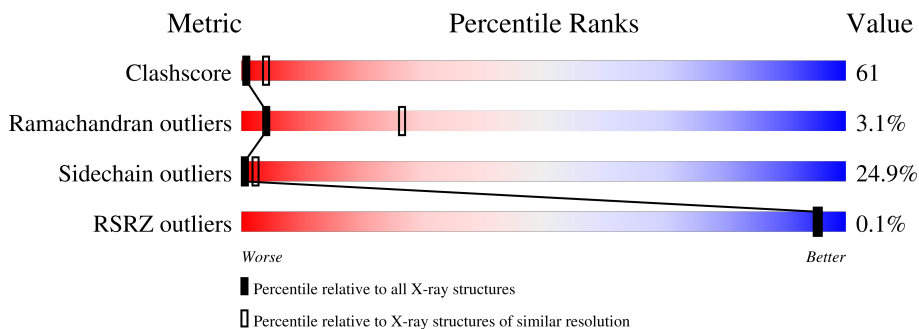
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

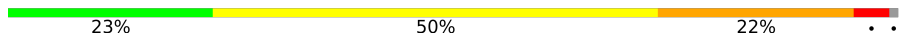
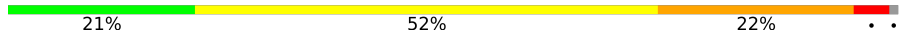
The reported resolution of this entry is 3.20 Å.

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))
Clashscore	141614	1253 (3.20-3.20)
Ramachandran outliers	138981	1234 (3.20-3.20)
Sidechain outliers	138945	1233 (3.20-3.20)
RSRZ outliers	127900	1095 (3.20-3.20)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	O	501	 23%                      50%                      22%                      . .
1	Z	501	 21%                      52%                      22%                      . .

## 2 Entry composition [i](#)

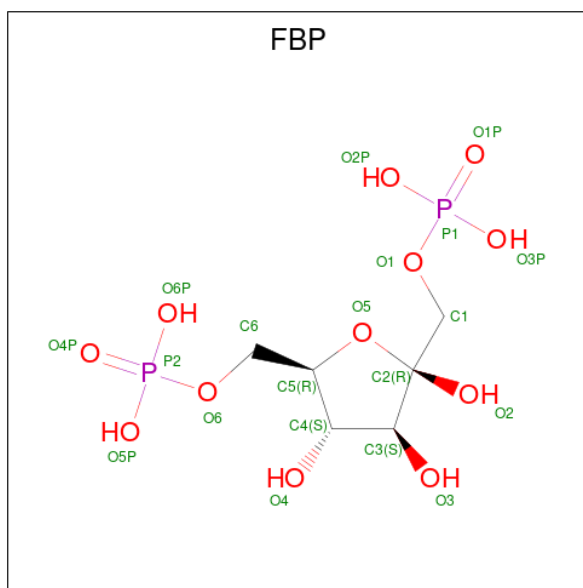
There are 3 unique types of molecules in this entry. The entry contains 7818 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PROTEIN (GLYCEROL KINASE).

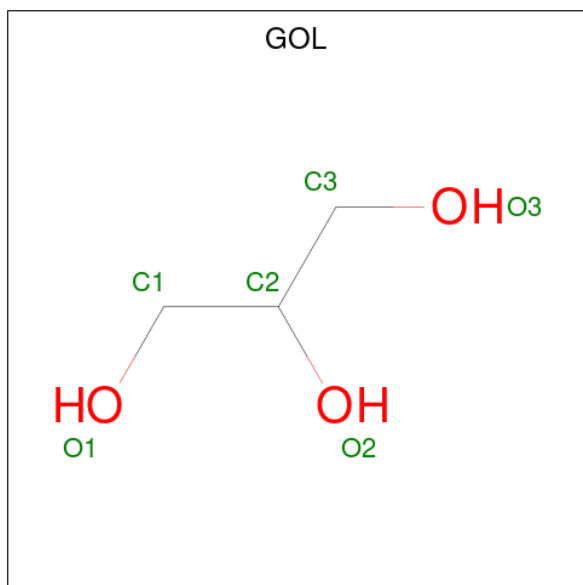
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	O	498	Total 3878	C 2453	N 671	O 735	S 19	0	0	0
1	Z	498	Total 3888	C 2456	N 674	O 739	S 19	0	0	0

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	P		
2	O	1	Total 40	C 12	O 24	P 4	0	1

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).

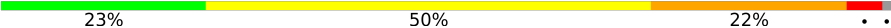


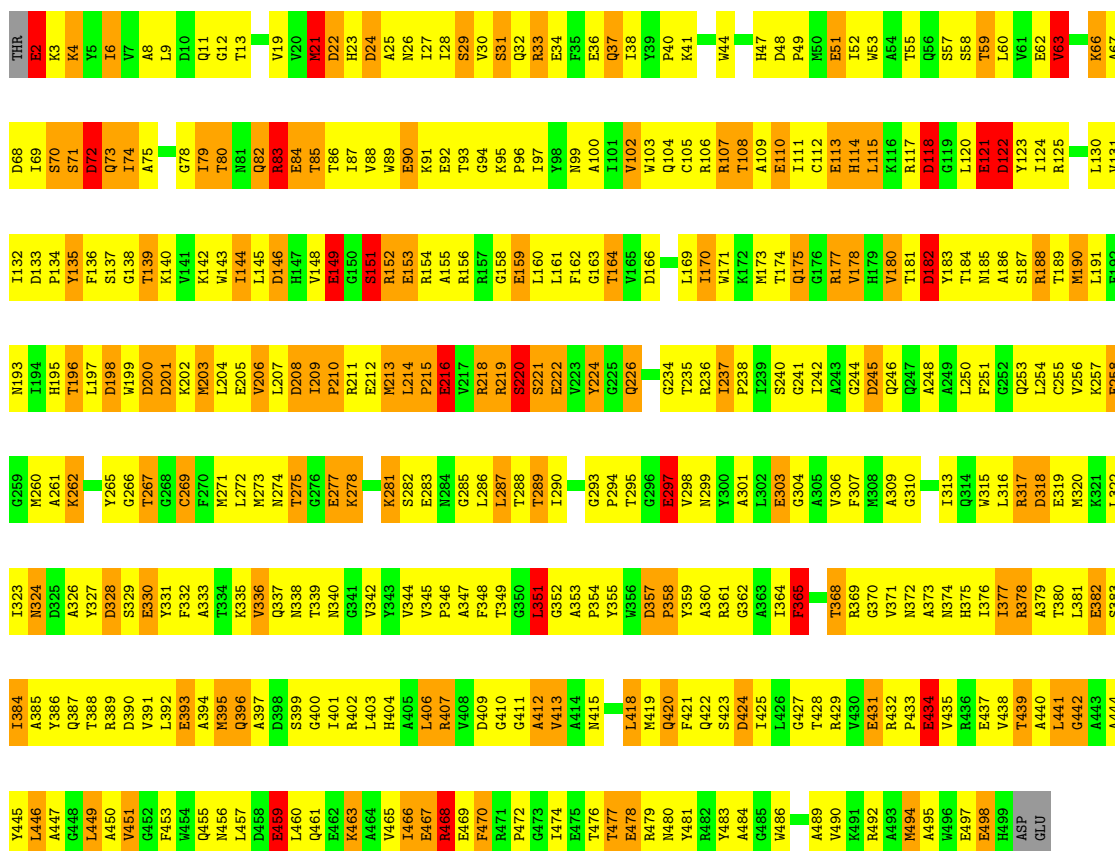
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	O	1	Total	C	O	0	0
			6	3	3		
3	Z	1	Total	C	O	0	0
			6	3	3		

### 3 Residue-property plots

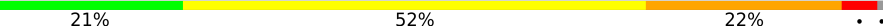
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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.

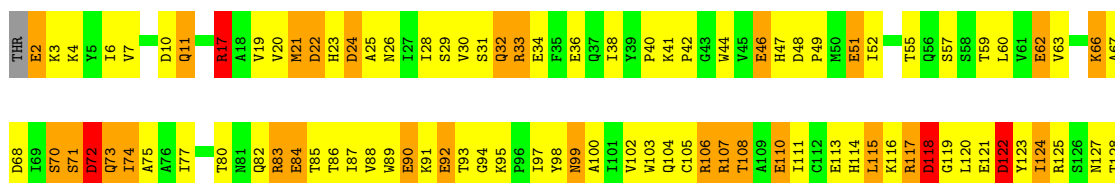
- Molecule 1: PROTEIN (GLYCEROL KINASE)

Chain O: 



- Molecule 1: PROTEIN (GLYCEROL KINASE)

Chain Z: 



L441	A379	R317	L254	M190	G129
G442	T380	D318	C255	L191	L130
A443	L381	E319	V256	F192	V131
A444	E382	M320	K257	N193	I132
Y445	S383	K321	E258	I194	D133
L446	I384	L322	G259	H195	P134
A447	A385	T323	K260	T196	Y135
G448	Y386	M324	A261	L197	F136
L449	Q387	D325	K262	D198	S137
A450	T388	A326	N263	W199	G138
V451	R389	Y327	T264	D200	T139
G452	D390	D328	Y265	D201	K140
F453	Y391	S329	G266	K202	V141
A454	L392	E330	T267	M203	K142
Q455	E393	Y331	G268	L204	W143
W456	A394	F332	E205	E205	I144
L457	N395	T334	F270	V206	L145
D458	Q396	A333	M271	L207	D146
E459	A397	K335	L272	D208	H147
L460	D398	V336	M273	L209	V148
Q461	S399	Q337	M274	P210	E149
E462	G400	N338	E277	R211	G150
K463	I401	T339		E212	S151
A464	R402	N340		M213	R152
Y465	L403	G341	V280	L214	E153
L466	L406	V342	K281	P215	R154
E467	R407	Y343	E282	E216	A155
R468	V408	V344	S283	V217	R156
E469	Y409	V345		R218	R157
F470	D409	P346	L286	R219	G158
R471	G410	A347	L287	S220	E159
P472	G411	F348	T288	S221	L160
	A412	T349	T289	E222	L161
E475	V413	G350	I290	Y223	F162
T476	A414	L351	A291	Y224	G163
T477	N415	G352	C292	G225	T164
E478		A353	G293	Q226	V165
R479	L418	P354	P294		D166
N480	M419	Y355	T295	K232	
Y481	Q420	W356	G296	G233	L169
R482	F421	D357	E297	G234	I170
Y483	Q422	P358	V298	T235	W171
A484	S423	Y359	N299	R236	M172
G485	D424	A360	Y300	I237	M173
W486	I425	R361	A301	P238	T174
	L426	G362	L302	I239	Q175
A489	G427	A363	E303	S240	G176
V490	T428	I364	G304	G241	R177
R491	R429	F365	A365	I242	V178
R492	V430		V306	A243	H179
A493	E431	T368	F307	G244	V180
M494	R432	V371	M308	D245	T181
A495	P433	N372	A309	Q246	D182
W496	E434	A373	G310	Q247	Y183
E497	V435	A374	A311	A248	T184
E498	R436	N374	S312	A249	M185
H499	E437	H375	I313	L250	A186
ASP	V438	I376	Q314	F251	S187
GLU	T439	R378	W315	G252	R188
	A440		L316	Q253	T189

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	169.41Å 169.41Å 204.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 3.20 19.97 – 3.00	Depositor EDS
% Data completeness (in resolution range)	94.0 (20.00-3.20) 90.3 (19.97-3.00)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.20 (at 2.98Å)	Xtrriage
Refinement program	TNT 5F	Depositor
R, $R_{free}$	0.211 , (Not available) 0.190 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	44.4	Xtrriage
Anisotropy	0.024	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 92.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	7818	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.38% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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: FBP, GOL

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	O	1.17	35/3958 (0.9%)	1.51	55/5373 (1.0%)
1	Z	1.18	32/3968 (0.8%)	1.53	55/5387 (1.0%)
All	All	1.18	67/7926 (0.8%)	1.52	110/10760 (1.0%)

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	O	1	1

The worst 5 of 67 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	Z	51	GLU	CD-OE1	8.97	1.35	1.25
1	Z	92	GLU	CD-OE1	8.22	1.34	1.25
1	Z	382	GLU	CD-OE2	8.19	1.34	1.25
1	O	51	GLU	CD-OE1	8.05	1.34	1.25
1	Z	212	GLU	CD-OE2	7.96	1.34	1.25

The worst 5 of 110 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	Z	22	ASP	CB-CG-OD1	8.79	126.21	118.30
1	O	201	ASP	CB-CG-OD1	-8.59	110.57	118.30
1	Z	10	ASP	CB-CG-OD1	-8.38	110.76	118.30
1	Z	409	ASP	CB-CG-OD2	-8.35	110.79	118.30
1	O	24	ASP	CB-CG-OD1	-7.97	111.12	118.30



All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	O	21	MET	CA

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	O	351	LEU	Mainchain

## 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	O	3878	0	3774	472	0
1	Z	3888	0	3778	463	0
2	O	40	0	20	3	0
3	O	6	0	8	2	0
3	Z	6	0	8	0	0
All	All	7818	0	7588	935	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 61.

The worst 5 of 935 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:O:83:ARG:HG3	1:O:83:ARG:HH11	1.04	1.11
1:O:145:LEU:HD11	1:O:213:MET:HE1	1.30	1.11
1:Z:438:VAL:HA	1:Z:441:LEU:HD12	1.30	1.06
1:Z:71:SER:HB2	1:Z:235:THR:HG21	1.32	1.05
1:O:255:CYS:HB3	1:O:260:MET:HB3	1.39	1.03

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	O	496/501 (99%)	406 (82%)	74 (15%)	16 (3%)	4	26
1	Z	496/501 (99%)	414 (84%)	67 (14%)	15 (3%)	4	28
All	All	992/1002 (99%)	820 (83%)	141 (14%)	31 (3%)	4	26

5 of 31 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	O	99	ASN
1	O	121	GLU
1	O	151	SER
1	Z	149	GLU
1	O	72	ASP

### 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	O	396/412 (96%)	301 (76%)	95 (24%)	0	3
1	Z	398/412 (97%)	295 (74%)	103 (26%)	0	2
All	All	794/824 (96%)	596 (75%)	198 (25%)	0	2

5 of 198 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	Z	115	LEU

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Mol	Chain	Res	Type
1	Z	224	TYR
1	Z	130	LEU
1	Z	159	GLU
1	Z	287	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 30 such sidechains are listed below:

Mol	Chain	Res	Type
1	Z	104	GLN
1	Z	461	GLN
1	Z	228	ASN
1	Z	499	HIS
1	Z	420	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

4 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
3	GOL	O	601	-	5,5,5	0.38	0	5,5,5	0.51	0
2	FBP	O	502[A]	-	18,20,20	1.04	0	23,32,32	1.44	2 (8%)
3	GOL	Z	601	-	5,5,5	0.34	0	5,5,5	0.39	0
2	FBP	O	502[B]	-	18,20,20	0.96	0	23,32,32	1.21	2 (8%)

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	GOL	O	601	-	-	2/4/4/4	-
2	FBP	O	502[A]	-	-	10/13/32/32	0/1/1/1
3	GOL	Z	601	-	-	0/4/4/4	-
2	FBP	O	502[B]	-	-	9/13/32/32	0/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	O	502[A]	FBP	O3P-P1-O2P	4.86	126.22	107.64
2	O	502[A]	FBP	O6P-P2-O5P	3.11	119.54	107.64
2	O	502[B]	FBP	O6P-P2-O5P	3.06	119.34	107.64
2	O	502[B]	FBP	O3P-P1-O2P	2.96	118.94	107.64

There are no chirality outliers.

5 of 21 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	O	502[A]	FBP	O1-C1-C2-O2
2	O	502[A]	FBP	O1-C1-C2-O5
2	O	502[A]	FBP	C4-C5-C6-O6
2	O	502[A]	FBP	O5-C5-C6-O6
2	O	502[A]	FBP	C6-O6-P2-O5P

There are no ring outliers.

3 monomers are involved in 5 short contacts:

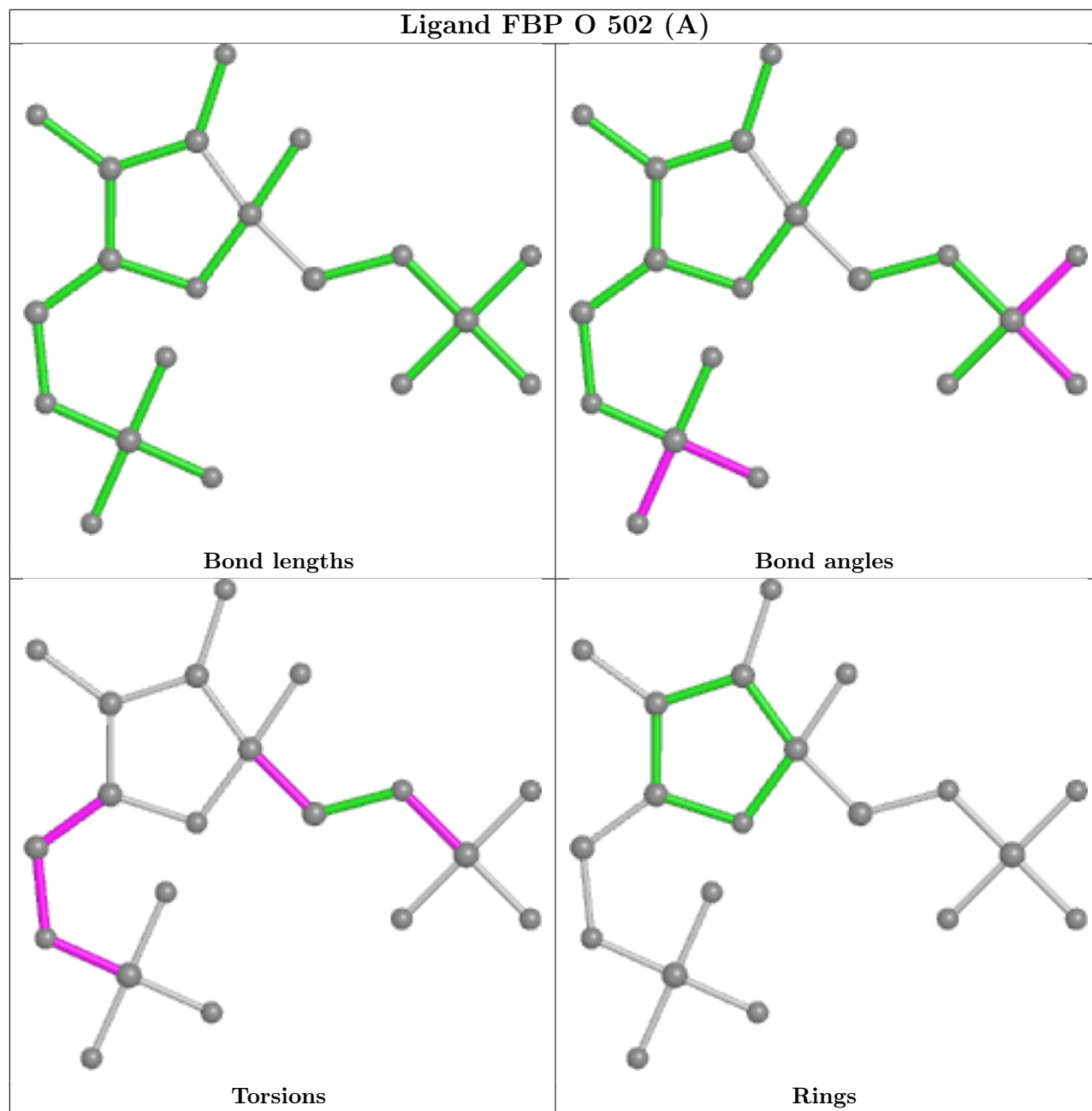
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	O	601	GOL	2	0

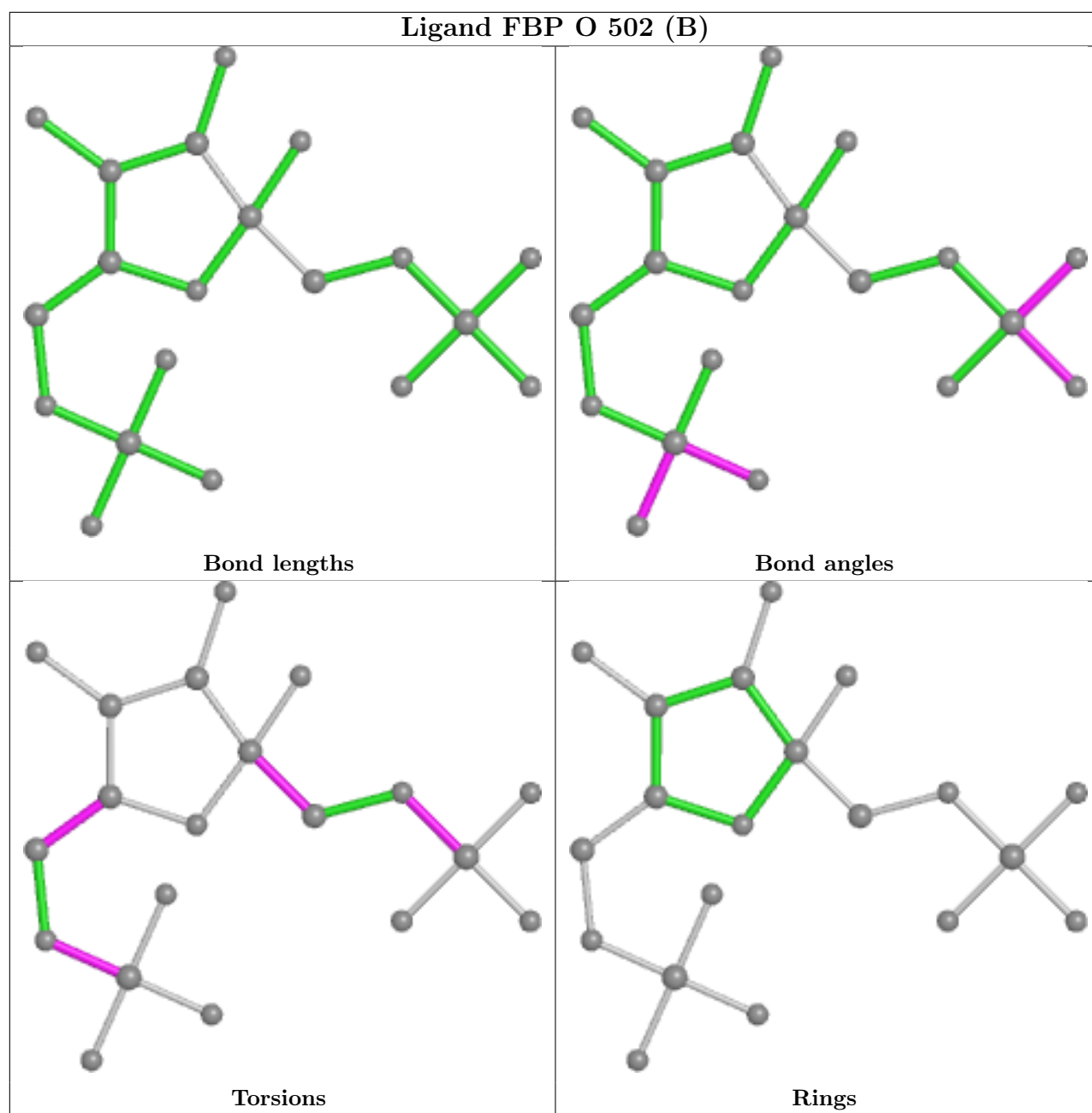
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	O	502[A]	FBP	2	0
2	O	502[B]	FBP	1	0

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 than 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.





## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	O	498/501 (99%)	-0.85	0 <a href="#">100</a>   <a href="#">100</a>	12, 28, 62, 90	0
1	Z	498/501 (99%)	-0.89	1 (0%) <a href="#">95</a>   <a href="#">94</a>	10, 26, 60, 89	0
All	All	996/1002 (99%)	-0.87	1 (0%) <a href="#">95</a>   <a href="#">95</a>	10, 27, 61, 90	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	Z	325	ASP	2.3

### 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.

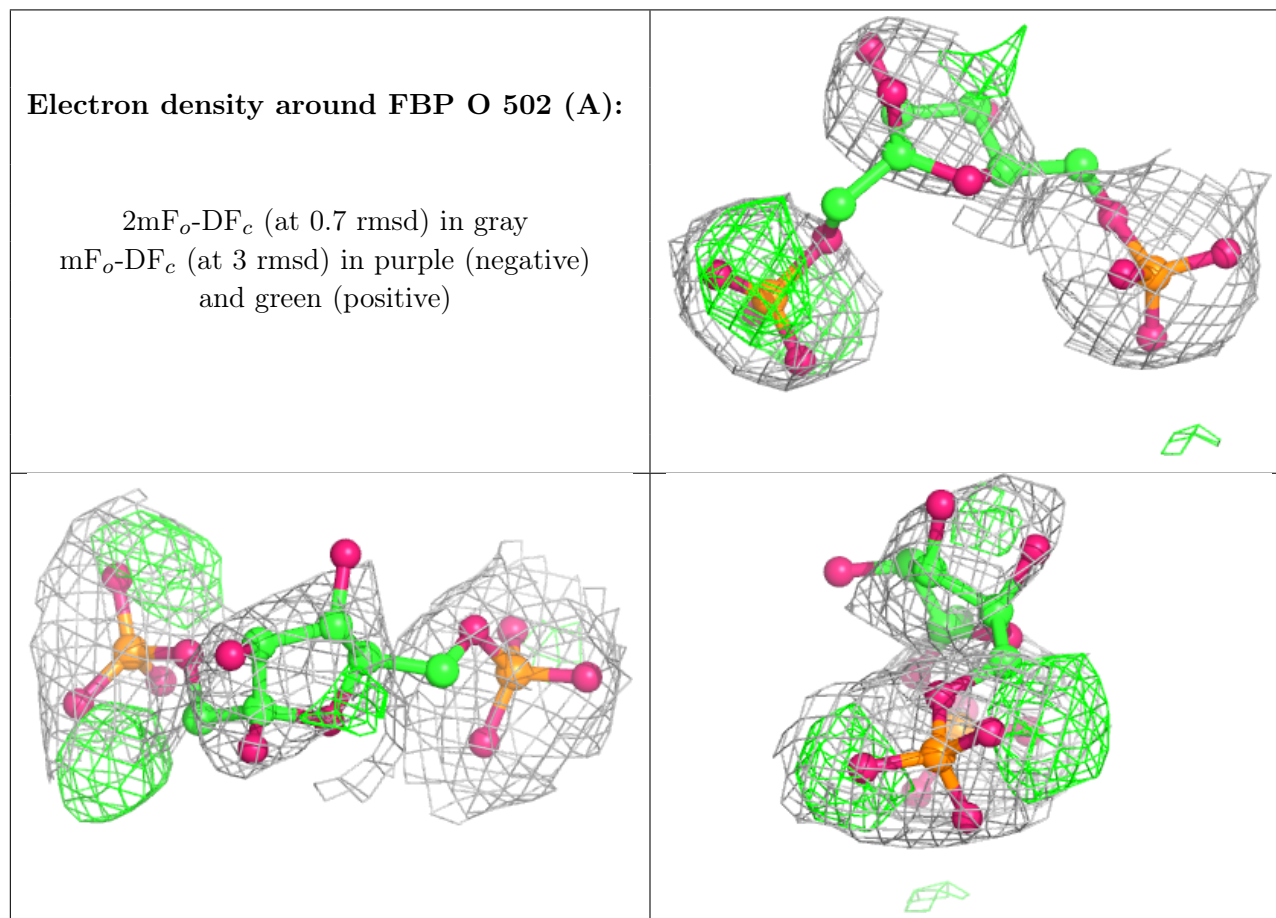
### 6.4 Ligands [i](#)

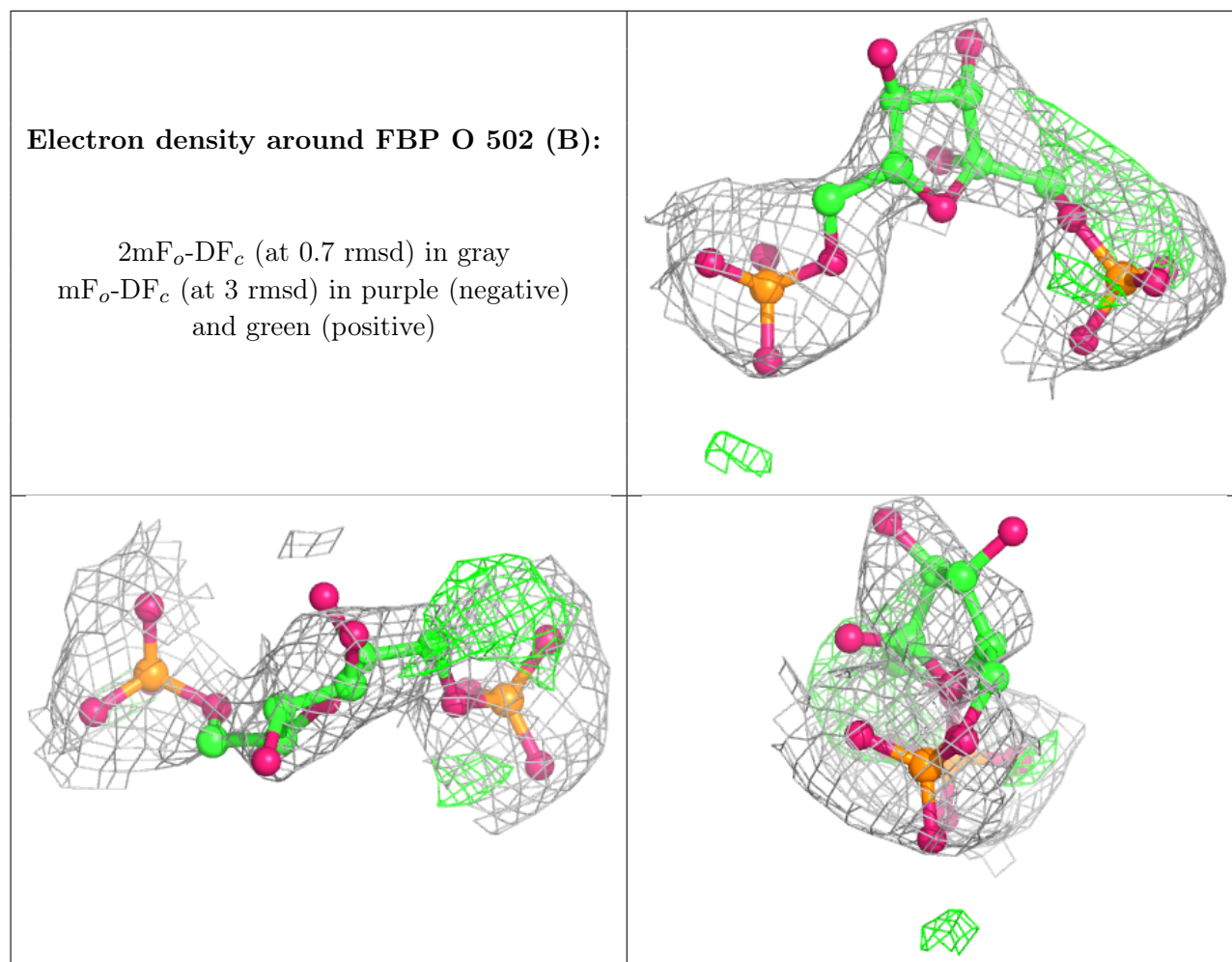
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	FBP	O	502[A]	20/20	0.87	0.26	49,49,49,49	20
2	FBP	O	502[B]	20/20	0.87	0.26	49,49,49,49	20
3	GOL	O	601	6/6	0.97	0.15	10,18,32,41	0
3	GOL	Z	601	6/6	0.97	0.14	10,11,15,34	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.





## 6.5 Other polymers [i](#)

There are no such residues in this entry.