



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 3, 2024 – 10:26 PM EST

PDB ID : 1FHW  
Title : Structure of the pleckstrin homology domain from GRP1 in complex with inositol(1,3,4,5,6)pentakisphosphate  
Authors : Ferguson, K.M.; Kavran, J.M.; Sankaran, V.G.; Fournier, E.; Isakoff, S.J.; Skolnik, E.Y.; Lemmon, M.A.  
Deposited on : 2000-08-02  
Resolution : 1.90 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](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>.

---

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

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

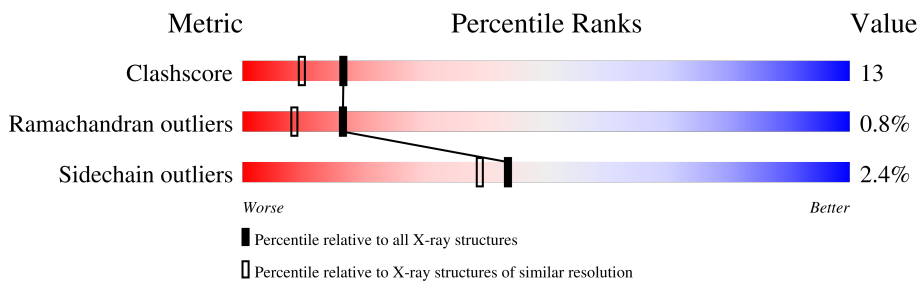
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	129	69% 22% 5%
1	B	129	77% 19% . .

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
2	I5P	A	1001	X	-	-	-

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 2245 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.

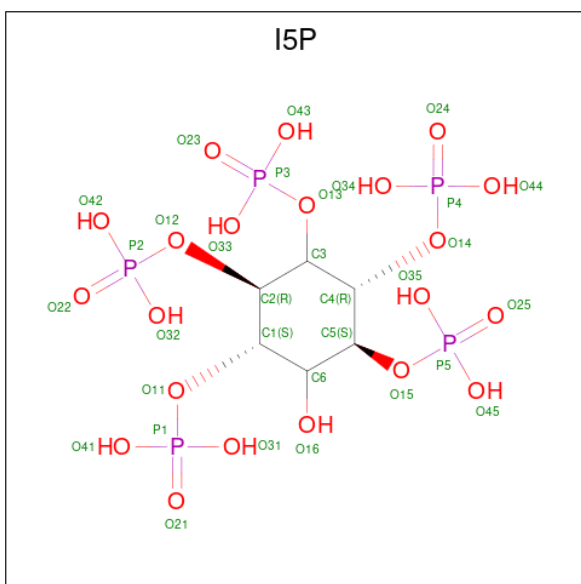
- Molecule 1 is a protein called GUANINE NUCLEOTIDE EXCHANGE FACTOR AND INTEGRIN BINDING PROTEIN HOMOLOG GRP1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	122	Total 985	C 628	N 173	O 180	S 4	0	0	0
1	B	126	Total 1027	C 656	N 179	O 187	S 5	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	263	MET	-	cloning artifact	GB 2183209
B	263	MET	-	cloning artifact	GB 2183209

- Molecule 2 is INOSITOL-(1,3,4,5,6)-PENTAKISPHOSPHATE (three-letter code: I5P) (formula: C<sub>6</sub>H<sub>17</sub>O<sub>21</sub>P<sub>5</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O	P	0	0
			32	6	21	5		
2	B	1	Total	C	O	P	0	0
			32	6	21	5		

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	82	Total	O	0	0
			82	82		
4	B	82	Total	O	0	0
			82	82		

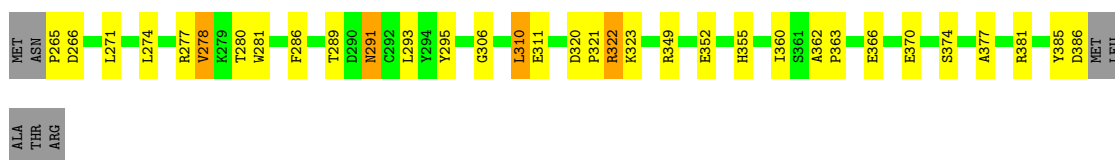
### 3 Residue-property plots [i](#)

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. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.


Note EDS was not executed.

- Molecule 1: GUANINE NUCLEOTIDE EXCHANGE FACTOR AND INTEGRIN BINDING PROTEIN HOMOLOG GRP1

Chain A: 



- Molecule 1: GUANINE NUCLEOTIDE EXCHANGE FACTOR AND INTEGRIN BINDING PROTEIN HOMOLOG GRP1

Chain B: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	37.97Å 72.22Å 46.90Å 90.00° 93.21° 90.00°	Depositor
Resolution (Å)	46.83 – 1.90	Depositor
% Data completeness (in resolution range)	91.9 (46.83-1.90)	Depositor
$R_{merge}$	0.05	Depositor
$R_{sym}$	0.05	Depositor
Refinement program	CNS 0.9	Depositor
R, $R_{free}$	0.229 , 0.270	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2245	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	27.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, I5P

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	0.35	0/1012	0.60	0/1372
1	B	0.36	0/1054	0.58	0/1425
All	All	0.35	0/2066	0.59	0/2797

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	985	0	935	31	0
1	B	1027	0	1002	22	0
2	A	32	0	7	2	0
2	B	32	0	7	1	0
3	B	5	0	0	0	0
4	A	82	0	0	2	0
4	B	82	0	0	2	0
All	All	2245	0	1951	51	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 13.

All (51) 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:B:315:ILE:HD11	1:B:329:LEU:HG	1.71	0.73
1:A:366:GLU:O	1:A:370:GLU:HG3	1.92	0.69
1:A:265:PRO:CA	1:A:266:ASP:N	2.57	0.67
1:B:373:LYS:HB3	1:B:373:LYS:NZ	2.11	0.66
1:B:295:TYR:CZ	1:B:306:GLY:HA3	2.35	0.61
1:A:321:PRO:HG2	1:A:322:ARG:HH11	1.65	0.61
1:B:363:PRO:HG3	4:B:85:HOH:O	2.03	0.58
1:B:366:GLU:O	1:B:370:GLU:HG3	2.03	0.56
1:B:368:LYS:HE3	1:B:372:MET:HE1	1.88	0.56
1:A:265:PRO:HA	1:A:266:ASP:N	2.21	0.56
1:A:265:PRO:O	1:A:289:THR:CB	2.54	0.55
1:A:277:ARG:O	1:A:278:VAL:CB	2.55	0.55
1:B:382:ASP:N	1:B:383:PRO:HD2	2.22	0.54
1:A:355:HIS:HE1	2:A:1001:I5P:O24	1.90	0.54
1:A:265:PRO:O	1:A:289:THR:HB	2.07	0.54
1:B:278:VAL:HG12	1:B:280:THR:HG23	1.91	0.53
1:A:277:ARG:HB2	2:A:1001:I5P:O42	2.09	0.53
1:B:381:ARG:NH2	4:B:130:HOH:O	2.42	0.52
1:B:315:ILE:CD1	1:B:329:LEU:HG	2.38	0.51
1:A:385:TYR:O	1:A:386:ASP:HB2	2.12	0.50
1:A:265:PRO:N	1:A:266:ASP:N	2.60	0.49
1:A:322:ARG:H	1:A:322:ARG:HD3	1.78	0.49
1:A:291:ASN:O	1:A:310:LEU:HB2	2.13	0.48
1:B:360:ILE:HD12	1:B:361:SER:N	2.29	0.48
1:B:318:VAL:HG21	1:B:328:GLU:HG3	1.96	0.47
1:B:363:PRO:HB2	1:B:367:GLU:OE2	2.14	0.47
1:A:321:PRO:HG2	1:A:322:ARG:HD3	1.96	0.46
1:B:373:LYS:HB3	1:B:373:LYS:HZ2	1.79	0.46
1:B:355:HIS:HE1	2:B:1002:I5P:O24	1.99	0.45
1:A:271:LEU:HD13	1:A:360:ILE:HG21	1.99	0.45
1:A:322:ARG:HD3	1:A:322:ARG:N	2.32	0.45
1:A:366:GLU:HB2	4:A:76:HOH:O	2.17	0.44
1:B:391:ARG:OXT	1:B:391:ARG:HG3	2.18	0.44
1:B:313:LEU:HD13	1:B:329:LEU:HD22	2.00	0.43
1:B:349:ARG:NH1	1:B:351:VAL:HG12	2.33	0.43
1:B:315:ILE:HD13	1:B:329:LEU:HA	2.00	0.43
1:A:377:ALA:O	1:A:381:ARG:HB2	2.19	0.43
1:A:295:TYR:CZ	1:A:306:GLY:HA3	2.55	0.42
1:A:281:TRP:HE1	1:A:322:ARG:HH21	1.68	0.42
1:A:286:PHE:HD2	1:A:293:LEU:HG	1.85	0.42

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:320:ASP:CG	1:A:321:PRO:HD2	2.41	0.42
1:A:349:ARG:HD3	4:A:79:HOH:O	2.19	0.42
1:A:362:ALA:HA	1:A:363:PRO:HD3	1.85	0.41
1:B:381:ARG:C	1:B:383:PRO:HD2	2.41	0.41
1:A:291:ASN:HD22	1:A:291:ASN:HA	1.70	0.41
1:A:274:LEU:HD13	1:A:281:TRP:CE2	2.55	0.41
1:A:311:GLU:HG2	1:B:337:GLN:NE2	2.36	0.40
1:A:322:ARG:HG2	1:A:323:LYS:N	2.36	0.40
1:A:266:ASP:OD2	1:A:374:SER:HB3	2.21	0.40
1:A:352:GLU:OE2	1:B:292:CYS:SG	2.79	0.40
1:A:265:PRO:C	1:A:266:ASP:N	2.75	0.40

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	119/129 (92%)	113 (95%)	4 (3%)	2 (2%)	<span style="border: 1px solid red; padding: 2px;">7</span> <span style="border: 1px solid red; padding: 2px;">2</span>
1	B	124/129 (96%)	122 (98%)	2 (2%)	0	<span style="border: 1px solid blue; padding: 2px;">100</span> <span style="border: 1px solid blue; padding: 2px;">100</span>
All	All	243/258 (94%)	235 (97%)	6 (2%)	2 (1%)	<span style="border: 1px solid red; padding: 2px;">16</span> <span style="border: 1px solid red; padding: 2px;">8</span>

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	278	VAL
1	A	280	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	103/117 (88%)	100 (97%)	3 (3%)	37	31
1	B	109/117 (93%)	107 (98%)	2 (2%)	54	52
All	All	212/234 (91%)	207 (98%)	5 (2%)	44	39

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	291	ASN
1	A	310	LEU
1	A	322	ARG
1	B	329	LEU
1	B	360	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	291	ASN
1	A	355	HIS
1	B	355	HIS

### 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

3 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	I5P	B	1002	-	32,32,32	1.02	4 (12%)	53,53,53	1.03	4 (7%)
2	I5P	A	1001	-	32,32,32	1.00	4 (12%)	53,53,53	0.73	0
3	SO4	B	2001	-	4,4,4	0.36	0	6,6,6	0.09	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	I5P	B	1002	-	-	1/25/49/49	0/1/1/1
2	I5P	A	1001	-	2/2/11/11	3/25/49/49	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1002	I5P	P3-O13	2.43	1.63	1.59
2	A	1001	I5P	P1-O11	2.29	1.63	1.59
2	B	1002	I5P	P2-O12	2.29	1.63	1.59
2	A	1001	I5P	P3-O13	2.26	1.63	1.59
2	B	1002	I5P	P1-O11	2.24	1.63	1.59
2	B	1002	I5P	P5-O15	2.24	1.63	1.59
2	A	1001	I5P	P2-O12	2.21	1.63	1.59
2	A	1001	I5P	P4-O14	2.14	1.63	1.59

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1002	I5P	C3-C2-C1	3.64	118.42	110.43
2	B	1002	I5P	C4-C3-C2	2.85	116.68	110.43

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1002	I5P	C6-C1-C2	2.18	116.61	111.72
2	B	1002	I5P	C5-C6-C1	2.14	113.44	109.11

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	1001	I5P	C2
2	A	1001	I5P	C1

All (4) torsion outliers are listed below:

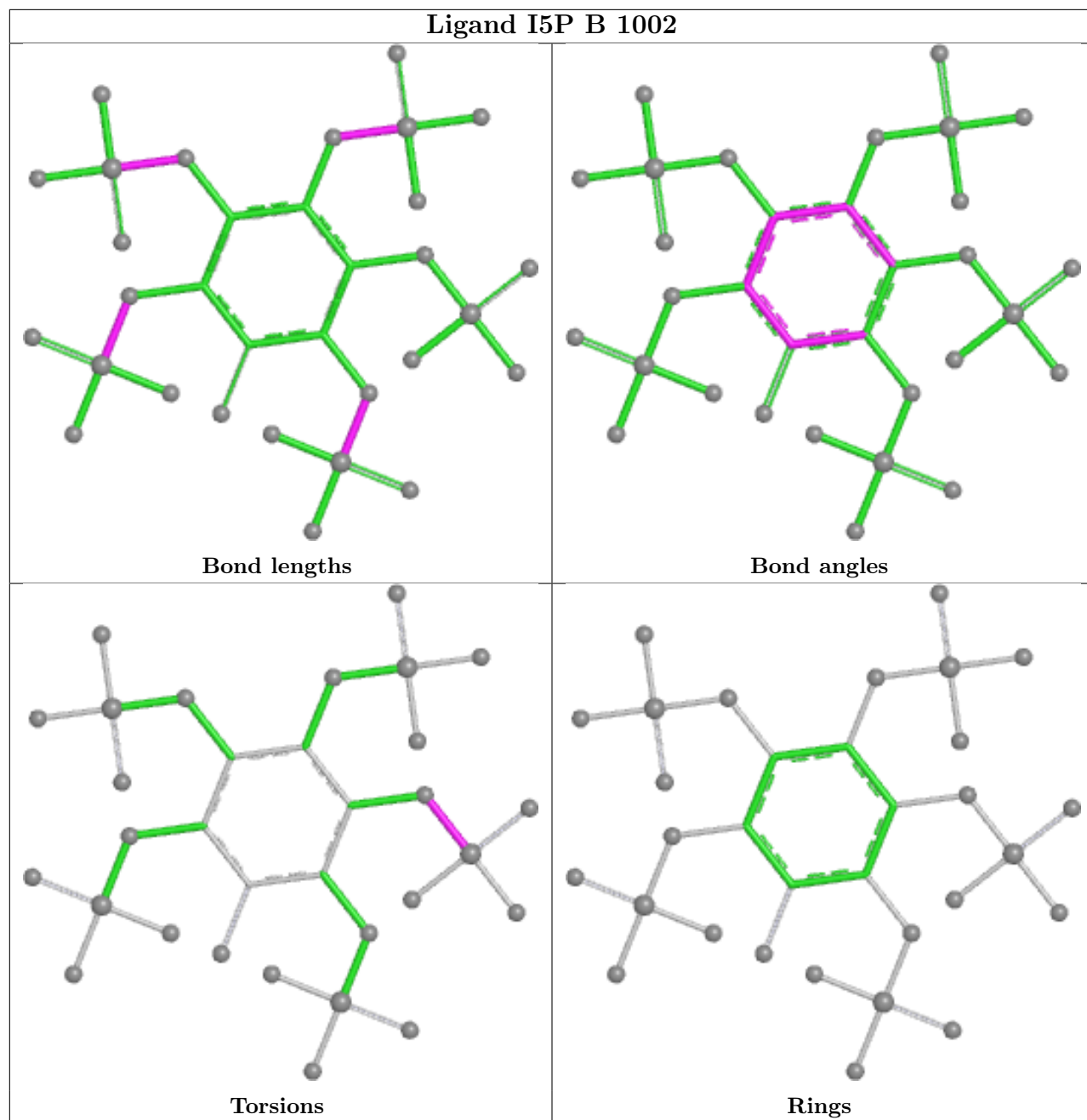
Mol	Chain	Res	Type	Atoms
2	A	1001	I5P	C3-O13-P3-O43
2	A	1001	I5P	C3-O13-P3-O23
2	A	1001	I5P	C3-O13-P3-O33
2	B	1002	I5P	C4-O14-P4-O24

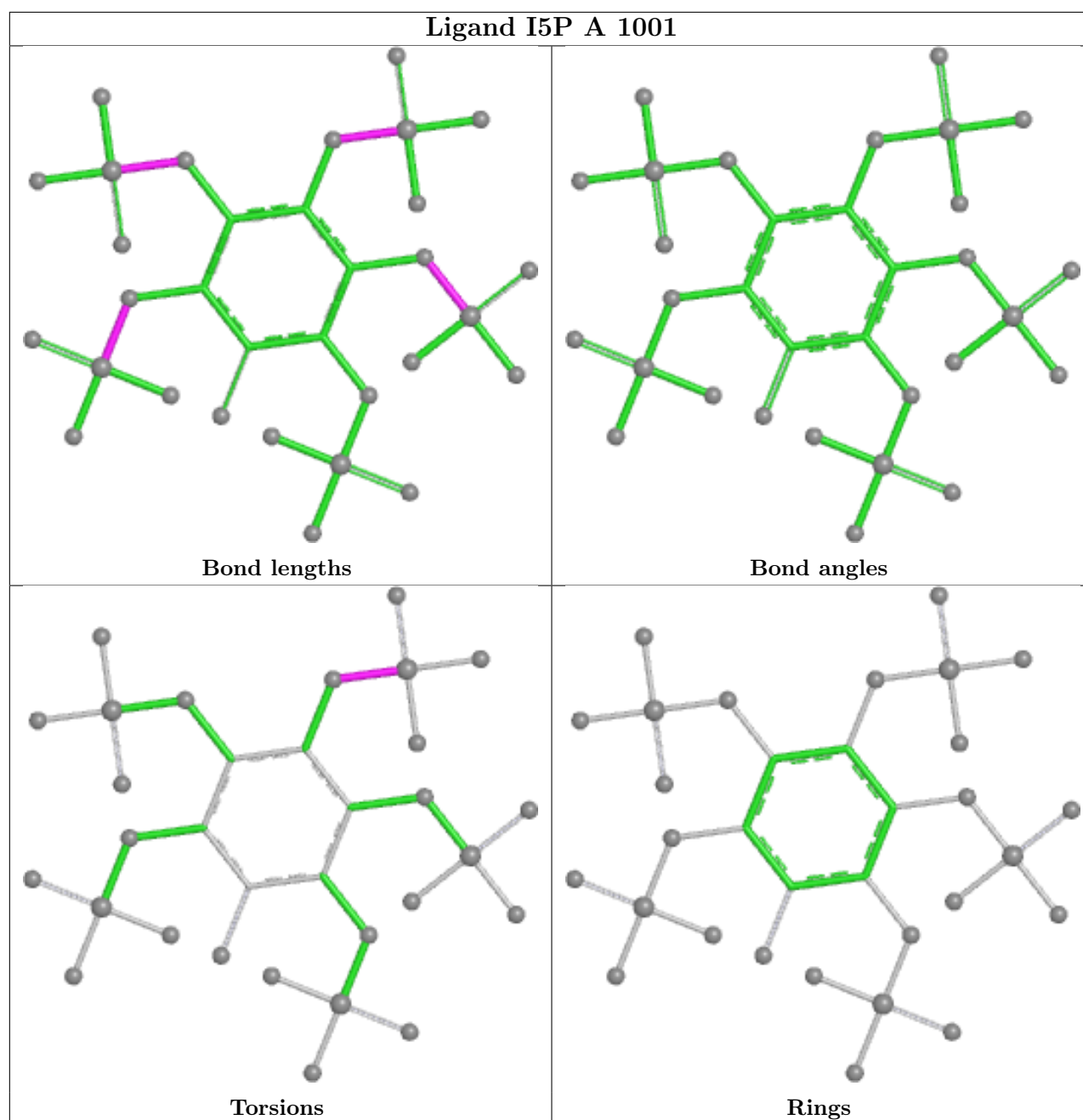
There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1002	I5P	1	0
2	A	1001	I5P	2	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](#)

The following chains have linkage breaks:  
*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Number of breaks
-----	-------	------------------

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	265:PRO	C	266:ASP	N	2.75

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.