



# Full wwPDB X-ray Structure Validation Report ⓘ

May 13, 2020 – 07:56 pm BST

PDB ID : 5LXE  
Title : F420-dependent glucose-6-phosphate dehydrogenase from *Rhodococcus jostii* RHA1  
Authors : Nguyen, Q.-T.; Trinco, G.; Binda, C.; Mattevi, A.; Fraaije, M.W.  
Deposited on : 2016-09-20  
Resolution : 1.47 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.

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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 : 2.11  
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) : 2.11

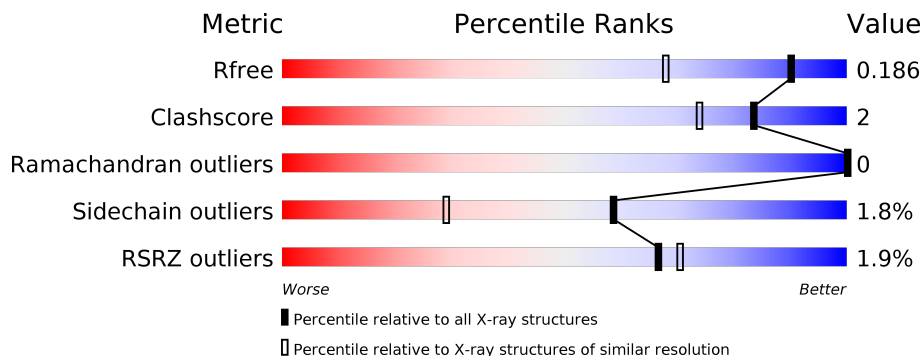
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.47 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	4690 (1.50-1.46)
Clashscore	141614	4955 (1.50-1.46)
Ramachandran outliers	138981	4846 (1.50-1.46)
Sidechain outliers	138945	4844 (1.50-1.46)
RSRZ outliers	127900	4614 (1.50-1.46)

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 on 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	A	335	 88% 8%
1	B	335	 84% 7% 9%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5527 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 F420-dependent glucose-6-phosphate dehydrogenase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	324	Total 2551	C 1629	N 438	O 469	S 15	0	5	0
1	B	304	Total 2383	C 1520	N 412	O 438	S 13	0	3	0

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	Total 6	C 3	O 3	0	0
2	B	1	Total 6	C 3	O 3	0	0

- 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		
3	B	1	Total	O	S	0	0
			5	4	1		

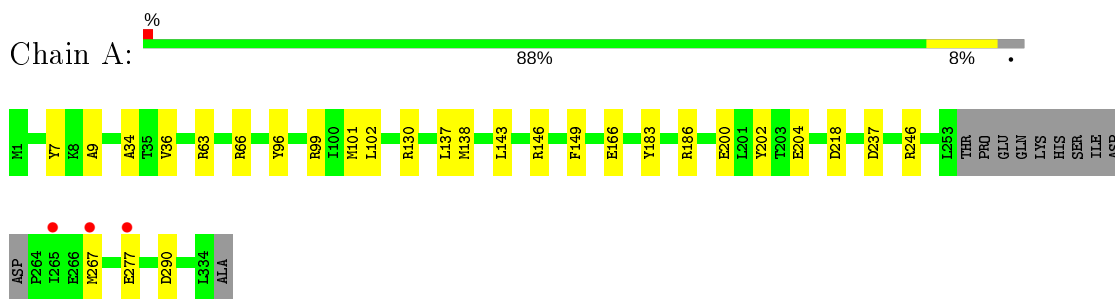
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	320	Total	O	0	0
			320	320		
4	B	251	Total	O	0	0
			251	251		

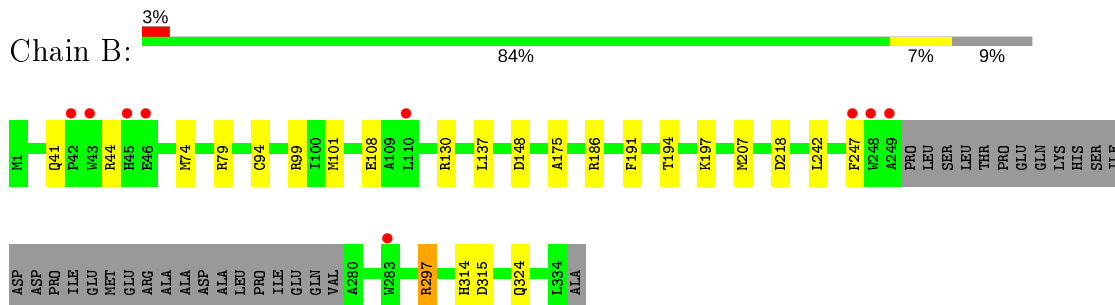
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: F420-dependent glucose-6-phosphate dehydrogenase 1



- Molecule 1: F420-dependent glucose-6-phosphate dehydrogenase 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.54Å 88.12Å 88.78Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	62.54 – 1.47 62.54 – 1.47	Depositor EDS
% Data completeness (in resolution range)	98.5 (62.54-1.47) 98.5 (62.54-1.47)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.81 (at 1.48Å)	Xtriage
Refinement program	REFMAC 5.8.0155	Depositor
R, $R_{free}$	0.156 , 0.185 0.157 , 0.186	Depositor DCC
$R_{free}$ test set	5293 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.6	Xtriage
Anisotropy	0.046	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 39.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.013 for -h,l,k	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	5527	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.21% 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: GOL, SO4

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	1.05	2/2616 (0.1%)	1.11	10/3544 (0.3%)
1	B	1.05	0/2445	1.10	10/3311 (0.3%)
All	All	1.05	2/5061 (0.0%)	1.10	20/6855 (0.3%)

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

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	202	TYR	CE1-CZ	7.16	1.47	1.38
1	A	183	TYR	CG-CD1	-5.65	1.31	1.39

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	99	ARG	NE-CZ-NH2	13.90	127.25	120.30
1	A	99	ARG	NE-CZ-NH1	-11.76	114.42	120.30
1	B	99	ARG	NE-CZ-NH2	10.17	125.39	120.30
1	B	207	MET	CG-SD-CE	-7.67	87.93	100.20
1	A	63	ARG	NE-CZ-NH1	6.94	123.77	120.30
1	B	130	ARG	NE-CZ-NH1	6.84	123.72	120.30
1	B	79	ARG	NE-CZ-NH1	6.82	123.71	120.30
1	A	246	ARG	NE-CZ-NH2	-6.50	117.05	120.30
1	B	315	ASP	CB-CG-OD1	6.47	124.12	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	66	ARG	NE-CZ-NH1	6.13	123.36	120.30
1	A	290	ASP	CB-CG-OD1	6.10	123.79	118.30
1	B	148	ASP	CB-CG-OD1	5.89	123.60	118.30
1	B	186	ARG	NE-CZ-NH1	5.87	123.23	120.30
1	A	130	ARG	NE-CZ-NH1	5.86	123.23	120.30
1	A	237	ASP	CB-CG-OD1	5.83	123.55	118.30
1	A	143	LEU	CB-CG-CD2	5.65	120.61	111.00
1	A	186	ARG	NE-CZ-NH1	5.65	123.12	120.30
1	B	74[A]	MET	CG-SD-CE	5.62	109.19	100.20
1	B	74[B]	MET	CG-SD-CE	5.62	109.19	100.20
1	B	99	ARG	NE-CZ-NH1	-5.07	117.77	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	96	TYR	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	2551	0	2508	14	0
1	B	2383	0	2329	10	0
2	A	6	0	8	0	0
2	B	6	0	8	0	0
3	B	10	0	0	1	0
4	A	320	0	0	7	2
4	B	251	0	0	6	1
All	All	5527	0	4853	24	2

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.

All (24) 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:94:CYS:SG	4:B:712:HOH:O	2.35	0.84
1:A:218:ASP:HB3	4:A:712:HOH:O	1.86	0.73
1:B:194[A]:THR:HG23	4:B:501:HOH:O	1.92	0.69
1:B:247:PHE:HB2	4:B:573:HOH:O	1.93	0.68
1:A:277:GLU:CD	4:A:501:HOH:O	2.45	0.54
1:A:277:GLU:OE1	4:A:501:HOH:O	2.18	0.54
1:B:108:GLU:HB2	4:B:517:HOH:O	2.09	0.53
1:B:324:GLN:HG2	3:B:402:SO4:O2	2.08	0.52
1:B:242:LEU:HD13	1:B:242:LEU:C	2.34	0.48
1:A:102:LEU:CD2	1:A:138[B]:MET:HE1	2.43	0.48
1:A:9:ALA:HB3	1:A:36[B]:VAL:HG12	1.95	0.48
1:A:166:GLU:CG	4:A:510:HOH:O	2.63	0.46
1:B:137:LEU:HD23	1:B:137:LEU:C	2.36	0.46
1:A:166:GLU:HG2	4:A:510:HOH:O	2.16	0.46
1:A:200:GLU:HG2	1:A:204:GLU:HB2	1.98	0.46
1:B:175:ALA:HB3	1:B:191:PHE:HE1	1.82	0.45
1:A:218:ASP:CB	4:A:712:HOH:O	2.56	0.44
1:B:297:ARG:NH1	4:B:503:HOH:O	2.35	0.44
1:A:7:TYR:O	1:A:34:ALA:HA	2.19	0.43
1:A:137[B]:LEU:HD13	1:A:149:PHE:CG	2.54	0.43
1:A:9:ALA:HB3	1:A:36[B]:VAL:CG1	2.50	0.42
1:B:314:HIS:CE1	4:B:510:HOH:O	2.73	0.41
1:A:277:GLU:OE1	4:A:502:HOH:O	2.22	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:777:HOH:O	4:B:705:HOH:O[2_454]	2.11	0.09
4:A:550:HOH:O	4:A:603:HOH:O[3_555]	2.18	0.02

## 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	325/335 (97%)	316 (97%)	9 (3%)	0	100	100
1	B	303/335 (90%)	289 (95%)	14 (5%)	0	100	100
All	All	628/670 (94%)	605 (96%)	23 (4%)	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	258/263 (98%)	255 (99%)	3 (1%)	71	46
1	B	239/263 (91%)	233 (98%)	6 (2%)	47	16
All	All	497/526 (94%)	488 (98%)	9 (2%)	59	29

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	101	MET
1	A	146	ARG
1	A	267	MET
1	B	41	GLN
1	B	44	ARG
1	B	101	MET
1	B	197	LYS
1	B	218	ASP
1	B	297	ARG

Some 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 carbohydrates 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	SO4	B	401	-	4,4,4	0.63	0	6,6,6	0.50	0
3	SO4	B	402	-	4,4,4	0.52	0	6,6,6	1.47	2 (33%)
2	GOL	B	403	-	5,5,5	0.90	0	5,5,5	1.06	1 (20%)
2	GOL	A	401	-	5,5,5	0.64	0	5,5,5	1.63	1 (20%)

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	GOL	B	403	-	-	4/4/4/4	-
2	GOL	A	401	-	-	0/4/4/4	-

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	402	SO4	O4-S-O3	2.49	119.67	109.06
2	A	401	GOL	O2-C2-C1	2.35	119.46	109.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	403	GOL	O2-C2-C3	-2.18	99.51	109.12
3	B	402	SO4	O3-S-O2	-2.09	98.39	109.31

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	403	GOL	C1-C2-C3-O3
2	B	403	GOL	O1-C1-C2-C3
2	B	403	GOL	O1-C1-C2-O2
2	B	403	GOL	O2-C2-C3-O3

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	402	SO4	1	0

## 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	A	324/335 (96%)	-0.39	3 (0%) 84 86	14, 21, 40, 72	0
1	B	304/335 (90%)	-0.27	9 (2%) 50 54	14, 22, 46, 71	0
All	All	628/670 (93%)	-0.33	12 (1%) 66 70	14, 21, 43, 72	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	43	TRP	5.4
1	B	248	TRP	3.7
1	B	283	TRP	3.3
1	A	267	MET	3.1
1	B	249	ALA	2.8
1	B	247	PHE	2.6
1	B	42	PRO	2.4
1	A	265	ILE	2.4
1	B	110	LEU	2.4
1	A	277	GLU	2.3
1	B	46	GLU	2.3
1	B	45	HIS	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 carbohydrates 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( $\text{\AA}^2$ )	Q<0.9
2	GOL	B	403	6/6	0.84	0.14	37,39,45,54	0
2	GOL	A	401	6/6	0.85	0.15	35,44,48,57	0
3	SO4	B	402	5/5	0.98	0.10	28,29,34,47	0
3	SO4	B	401	5/5	0.99	0.05	18,19,21,21	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.