## Appendix to part 4 - 160 meters Path Analysis



Four hypothesis:

- . 350° short path over the North Pole
- 300° skewed path over southern USA
- 3. 270° skewed path over northern South America
- 220° skewed path parallel to the Terminator
- n All cases for Jan.7,1994 at 05.15Z
  - SSN: 30 A Ind.: 5

Following in Appendix B

Path analysis for a IK2DFZ/KH6CC QSO of Jan.11,2005 at 16.41 Z

IV3PRK



#### 1 = from KH6 to IV3 – Short Path - bearing 7° 12500 km sweep 5-15-25° (best at 25°: 5.500 km via F – skew 50 km south)



IV3PRK

#### 1 = Proplab Plasma frequencies from KH6 bearing 7°to 24N /18E: 15.000 km. over IV3



#### 1 = from IV3 to KH6 – <u>Short Path</u> - bearing 350° 12500 km sweep 5°(3E)-15°(3F)-25° (4 F – skew 50 km south)



#### $= from/IV3/bearing/350^{\circ}$ to 1S 159W -15000km over KH6



#### = from KH6 to IV3 – Short Path - bearing 7° 12500 km from Prop7 by VE7VV: 48 dB between 05.00 and 05.15 Z

/	PROP 7R3. EXE				_ 🗆 ×
	QTH FROM: KH6 TO: IV3PRK	N.LAT 20.6 46.1	W.LONG SUNRI 157.5 1708 -13.1 0650	SE SUNSET ( 0404 - ) 1537 -	GRAYLINE 17-15 MINS 17-40 MINS
	DISTANCE: 12527 KM TRANS ANT GAIN: Ø DBd RCVR ANT GAIN: Ø DBd PREDICTING BY THE ZONE	BEARING ( ANT HT: 0 ANT HT: 0 METHOD SH	(TX/RX): 7 / 350 ) MIRS ) MIRS (FUED BEARING PRE	XMTR PWR: 1 POLARIZATION: UI POLARIZATION: UI	KW ERTICAL ERTICAL
	UTC RX SKEW TX S	KEW MOI	DE DEG	κ DAYS DB>0.5 ι	lŲ QI
	4.25 4.5 4.75 0 5.25 20 5.5 25 5.75 25 6	25 11F 20 5R 0 5R 0 11F 0 11F	23/23/23 19/ 0/19 19/ 0/19 23/23/23 23/23/23	34103348334834113311	¥ ₩
			IV3PRK		





# 2 = from KH6/beaming 64° to 1N 15W 15000 km crossing the 300° ray from IV3 at 7000 km over W4 (AL).





#### I = from IV3 beaming 300° to 14S – 126W 15000 km crossing at 8000 km the 64° ray from KH6 over W4 (AL)



2 – hypothesis of path over Southern US left: from KH6 on 64° ray with skew to south and short ducting right: from IV3 on 300° ray with skew to north : <u>It does not work</u>



#### 3 = from KH6 beaming 88° to 14S 21W – 15000 km crossing the 270° ray from IV3 over HK at 9000 km Sweep angle 5° (yellow) – 15° (green) – 25° (blue)





### $3 \neq KH6$ beaming 88° to cross 270° ray from IV3

sweep 5°(3E),15°(3F) and 25° (9000 km with ducting and skew to north )



## 3 = from KH6 beaming 88° to 14S 21W – 15000 km crossing the 270° ray from IV3 over HK at 9000 km



## 3 = from IV3 beaming 270° to 29S – 112 W 15000 km

sweep 5%,15° (over 3000km) and 25° (5800 km with 300 km skewing to north.)



## 3' = from IV3 beaming 270° to 29S – 112 W 15000 km crossing the 88° ray from KH6 over HK at 9500 km



## 3 – hypothesis of <u>path skewind</u> (red line) and <u>ducting</u> left: from KH6 on 88° ray with duct– right: from IV3 on 270° ray





IV3PRK

**4** = from KH6 beaming 138° to VP8- 51S 58W crossing the 220° ray from IV3 at 12400 km –<u>Parallel to Terminator</u> Sweep angle 5° (yellow) – 15° (green = best) – 25° (blue)

SRC Lat : +20.6000 SRC Lon : 157.5000 DST Lat : -51.0000 DST Lon : 58.0000	27		Mag LAT : -27.35 Mag LON : 29.05 Sol Elv.: -25.93 Sig Qual: BLKOUT
Distance : 12418.35 Azimuth : 138.0646	Km. Deg.		Height : 501.00 Ne : 7.43e+8 Plasma : 0.245
Frequency: 1.8300 CUB Lat: -37.1483 CUB Lon: 102.5519	MHz		Sig Elev: 25.00 Aur LAT : NoZone Aur LON : NoZone
Air Dist.: 9636.00 CUR Angle: +27.3512	Km. Deg.		Aur Dist: 0.0 Iono Dst:6176.0



#### 4 = from KH6 beaming 138° to VP8: 51S 58W - 12400 km Sweep 5°-15°-25° (skew north + duct) – Parallel to the terminator







## 





### 4 – hypothesis with <u>bath skewing</u> (red line) and <u>ducting</u> left: from KH6 on 138° ray with duct– right: from IV3 on 220° ray

![](_page_25_Figure_1.jpeg)

## Thus, in conclusion, and according to Proplab: could this be the most probable path as from <u>hypothesis nr. 2</u> ? (from DXAtlas: shadows are FoF2 contours)

![](_page_26_Figure_1.jpeg)

### Summary from IV3PRK (46.1N 13.1E) to KH6 (20.6N 157.5W

350° - short path through the polar cap is possible, as expected, only with low numbers during the low solar cycle

1)

2)

4)

- n / But the signal apparently does not come from that direction: some <u>scatter mechanism</u>?
- 300° supposed path over W4, seems not to work as the rays are skewed on opposite directions
- More feasible a path going up, around the aurora belt to meet the typical short-path ray from KH6.
- 3) 270° over northern S.A., appears to be the best one, <u>along</u> the same <u>gradients of low ionization</u>, with the right skewing on both sides and a good ducting on the Pacific side which reduces some of the absorptions on a 18.000 km path
  - n Does trigonometry match the two rays over the Caribbean?
  - 220° parallel to terminator (but 1600 km or 1.30 hour distant), is an impossible 25000 km path <u>across</u> many steep <u>gradients in</u> <u>the highly ionized areas</u> of the southern hemisphere.

June 2005, Pierluigi "Luis" Mansutti, IV3PRK

#### Appendix B to part 4b – **160 m. evening path** analysis from IK2DFZ (45.3N 9.1E) to KH6 (20.6N 157.5W)

![](_page_28_Picture_1.jpeg)

QSO with KH6CC on january 11, 2005 at 16.41 Z

43 minutes after sunset in Milan and 27 minutes before sunrise on Hawaii

n SSN: 31 - A Ind.: 13 Solar Flux: 94

 The most reliable path results to be the typical Short-Path with eastward skewing

IV3PRK

**Prop7R** : from IK2DFZ a KH6 Short Path - 11/01/2005 – SSN: 31 Path possibility is given via ducting and 25°/30° skewing, with a 29° radiation angle. <u>Probability is only of one day per month with very weak</u> signals rising/from 16.30 to 16.45 Z

PREDI CT	ING	SHORT	PATH	FOR:	11	JAN	2005	FR	EQ:	1.83	MHz	SOLAR	FLUX	87	
Q FROM: I TO: K	(TH K2D] (H6C)	FZ		N.) 4 2	LAT 5.3 0.6		W.LONG -9.1 157.5		SU  01 11	NRI SE 702 708	SU 1 0	NSET 558 1405	GRAY +/- +/-	LINE 38 MI 15 MI	NS NS
DISTANC TRANS A RCVR A PREDICT	E: 1 NT ( NT ( ING	L2552 GAIN: GAIN: BY TH	KM Ø DBå Ø DBå IE Zom	be I An' I An' I An' Ie Meti	ARIN T HI T HI HOD,	IG (1 1:0 1:0 1:0 . SKI	IX∕RX): MTRS MTRS EWED BE	34) Ari	5 / NG 1	10 PO PO PREDI	XMT LARIZ LARIZ CTION	R PWR: ATION: ATION:	1 KW Verti Verti	ICAL ICAL	
UTC	RX S	SKEW	TΧ	SKEW		MODI	[4]	D	EG	7.	DAYS	DB>0.	5 uV	QI	
16 16.25 16.5 16.75 17 17.25 17.5		20 25 25 30 35		35 30 30 25 25		R R R R R R		37/ 37/ 29/ 29/ 23/	0/1 0/2 0/2 0/2	L9 23 29 29 37	20 20 20 20 20 20 20 20 20 20 20 20 20 2	2 -1 6 9			

IV3PRK

PropLab: from IK2DFZ (45.3N 9.1E to KH6 (20.6N 157.5W) 11/01 - 16.40z Sweeping angles:  $5^{\circ}$  (signal lost after 4 E layer refl.) –  $15^{\circ}$  (gets into ducting with too much skew and does not find the way to get out on KH6) –  $25^{\circ}$  (lost after 1500 km.)

![](_page_30_Figure_1.jpeg)

PropLab: from IK2DFZ (45.3N 9.1E to KH6 (20.6N 157.5W) 11/01 - 16.40z Sweeping angles: <u>10°</u> (low altitude ducting but perforates at 10.000km) – <u>15°</u> (gets into ducting over 200 km, with too much eastward skewing) – <u>20°</u> (lost aftero 1500 km.)

![](_page_31_Figure_1.jpeg)

### PropLab: plasma frequencies looking from IK2DFZ towards KH6 via North Pole

![](_page_32_Figure_1.jpeg)

PropLab: reversed from KH6 (20.6N 157.5W) to IK2DFZ (45.3N 9.1E Sweep angles: 5° (possible with 9 E reflections!) - 15° (ducting with too much skewing) - 25° (gets out of the screen) - almost the same results as seen from IK2 side. 5 n. 50 S OnO 3.0 100 50 NO Q 150 200 5 0 500 500 500 500 ΩO 300 WARNING: Bay went unds during the tracing! 29.1947 dB Ray Type: Ordinary Absorption: Elev. Angle: 25.0000° Phase Path: 9952.4541 km Azimuth: +10.1986° Sig.Strength: -15.5468 dB (1)() Ray Lat: +79.1263° Ray Lon: 248.0996° Ground Range: 7771.2153 km Frequency: 1.8300 MHz Local Elev: +0.1088° Bearing: 348.4122° Ray Azimuth: -21.7864° **IV3PRK** 

**PropLab:** map of the critical frequencies (FoF2) with superimposed the path from IK2 to KH6 –short path- which matches the sunset <u>Gray-line of</u> <u>January, 11</u> (but we see too much ionization around it at that time ....)

![](_page_34_Figure_1.jpeg)

## **PropLab:** polar map of FoF2 (yet another vision) <u>White line</u>: short-path IK2-KH6 – <u>Red line</u>: short-path with eastward skewing, keeping out of the aurora oval and going through a lower ionized region.

![](_page_35_Figure_1.jpeg)

#### DX Atlas/: January, 11 – at 16.41 Z JK2 – KH6 path exactly along the gray-line: beaming 346°

![](_page_36_Figure_1.jpeg)

It looks like an ideal one, but that's only true on 40 or 80 meters

It does NOT WORK on 160 !

#### DX Atlas : January, 11 – at 16.41 Ż The most reliable IK2 – KH6 short-path with eastward skewing

![](_page_37_Figure_1.jpeg)

The signal turns around the aurora oval

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and crosses a
region well in the deep dark with
lower ionization

n <u>but higher losses</u> with more noise and disturbs originated in North-Eastern Europe