UM 2013

The Shape and Strength of the Ground Layer @ CFHT

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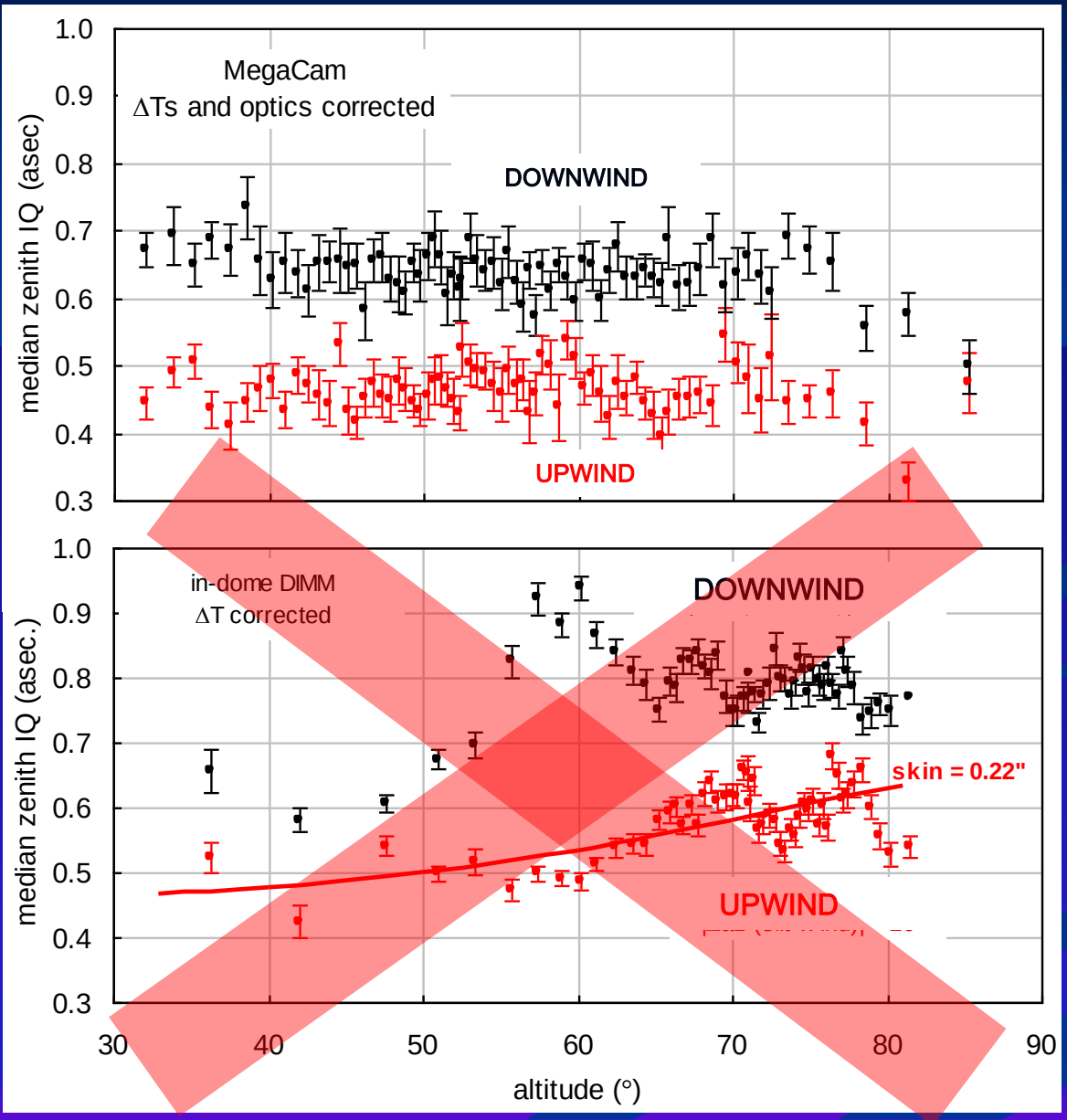
Association of Canadian Universities

for Research in Astronomy

misinterpreted
a ~~revealing~~ *altitude* trend
because the GL was assumed to be horizontally stratified

臺北市
2010



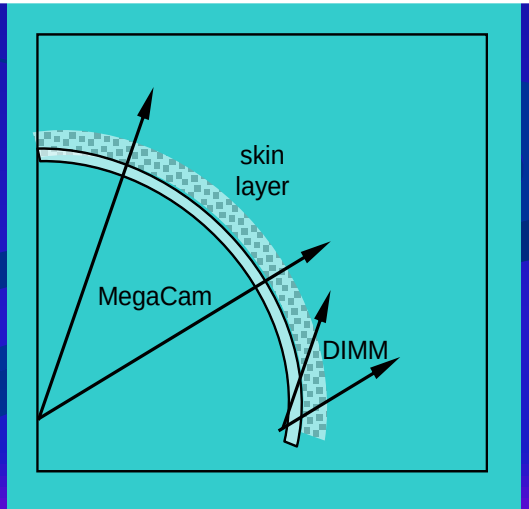
Upwind, for <u>both</u> MegaCam and the low altitude DIMM, the corrected IQ is 0.47".

But MegaCam, like the DIMM, ~~still sees a 0.22" thick skin layer~~.

THUS:

fully corrected 500 nm zenith IQ

~~$IQ_0 = (0.47^{5/3} - 0.22^{5/3})^{3/5} = 0.39$"~~



CFD simulations

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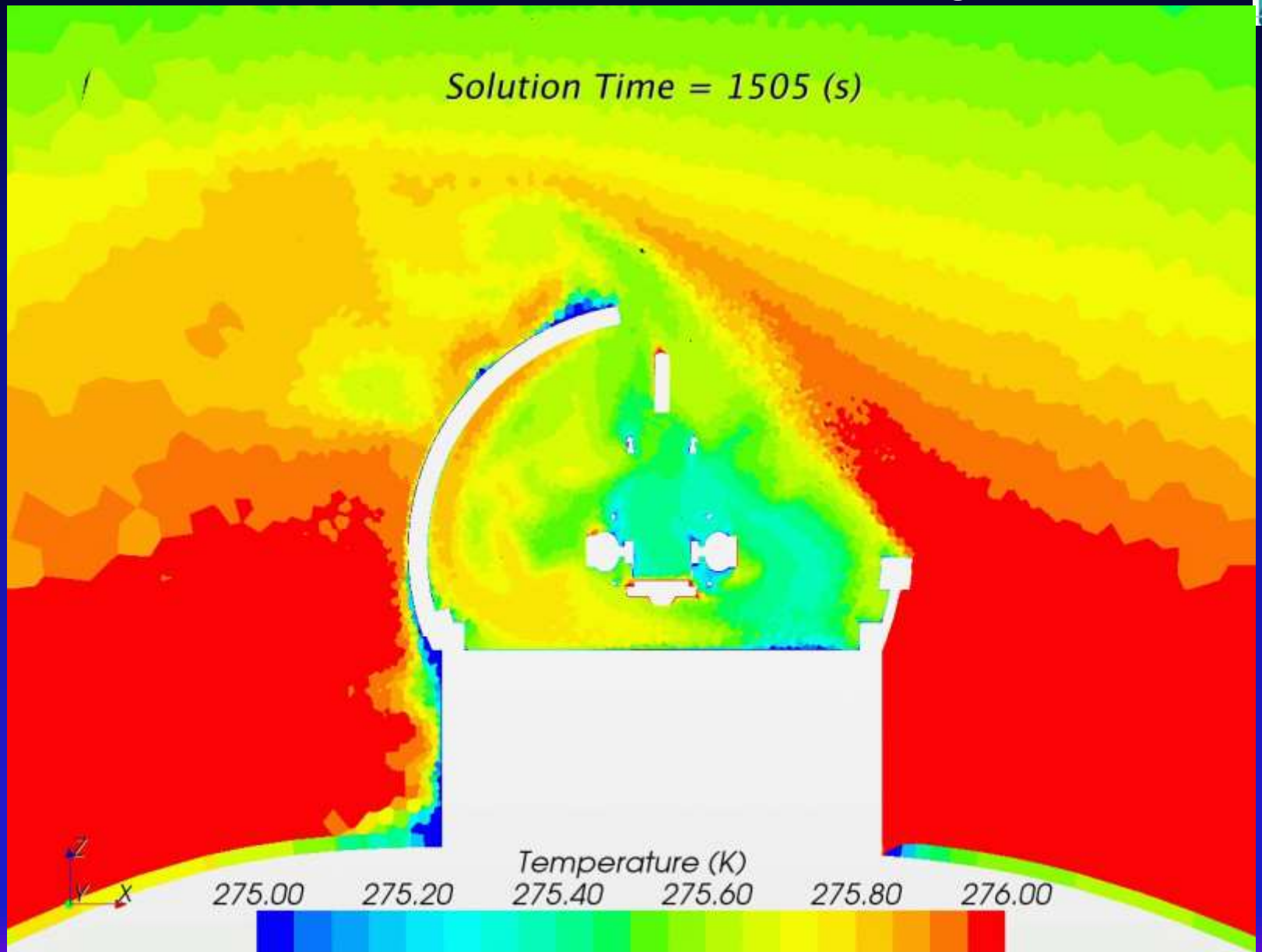

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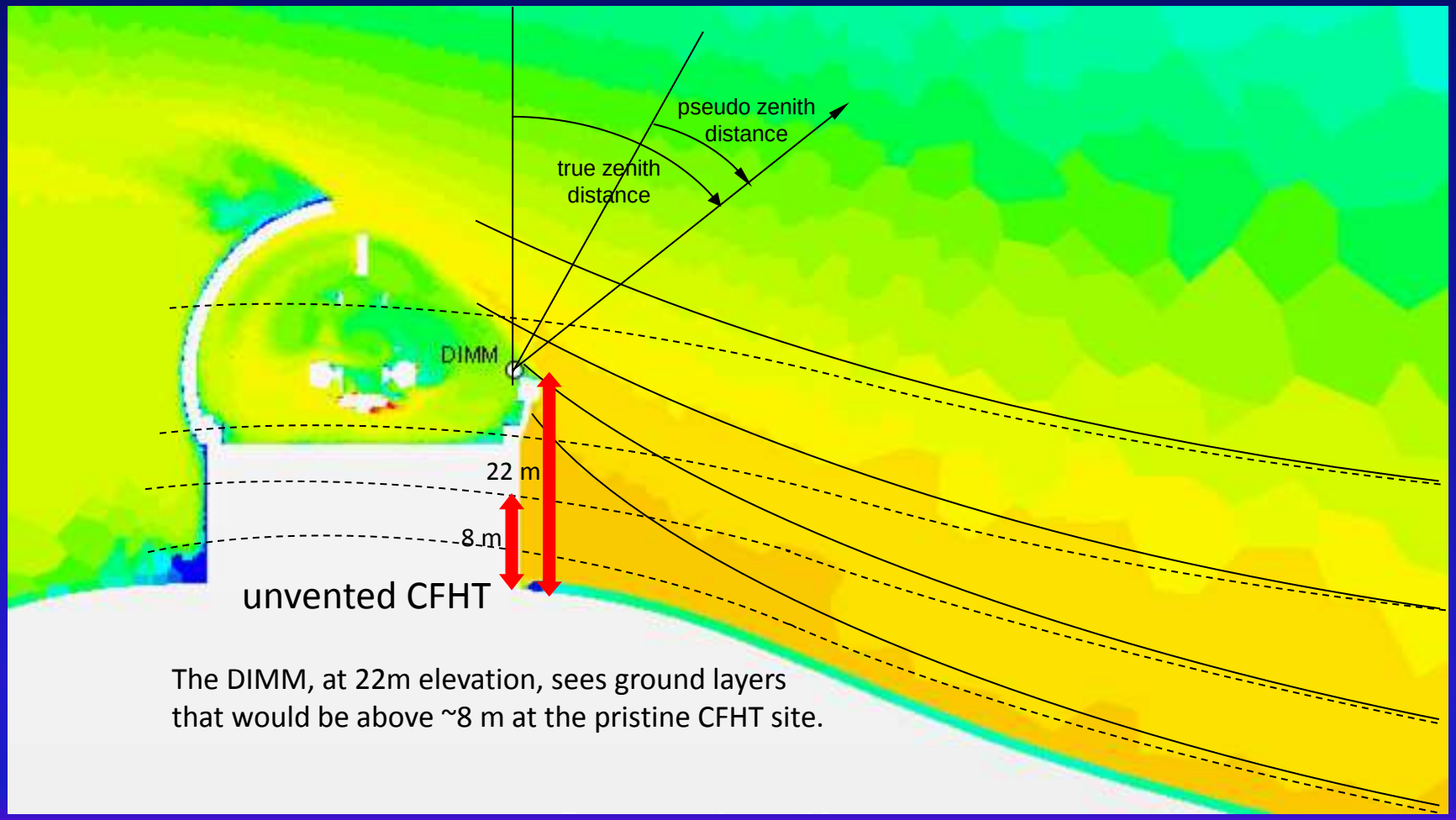
Upwind, the GL is TILTED and UPLIFTED by the building.

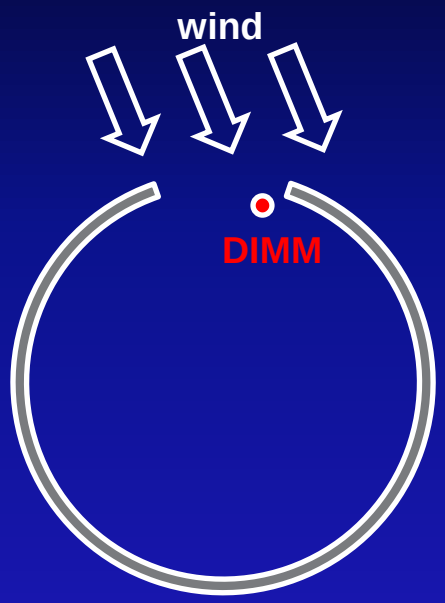
1- GL uplift brings lower elevation, stronger optical turbulence in the line of sight.

2- GL effective or “pseudo” zenith distance < true zenith distance *z* at large *z*.

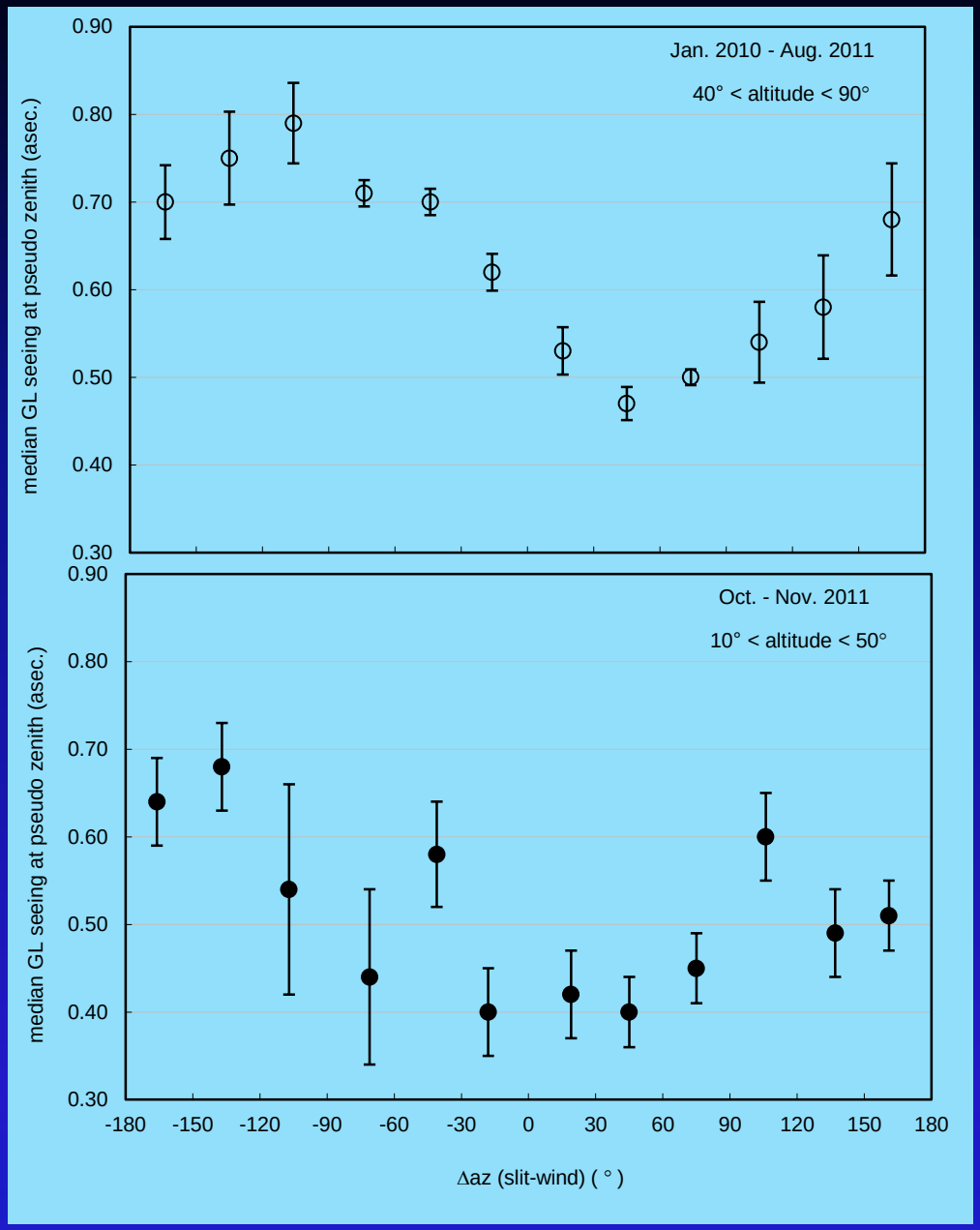
A $\sec(z)^{0.6}$ correction increasingly underestimates the GL strength at large *z*.

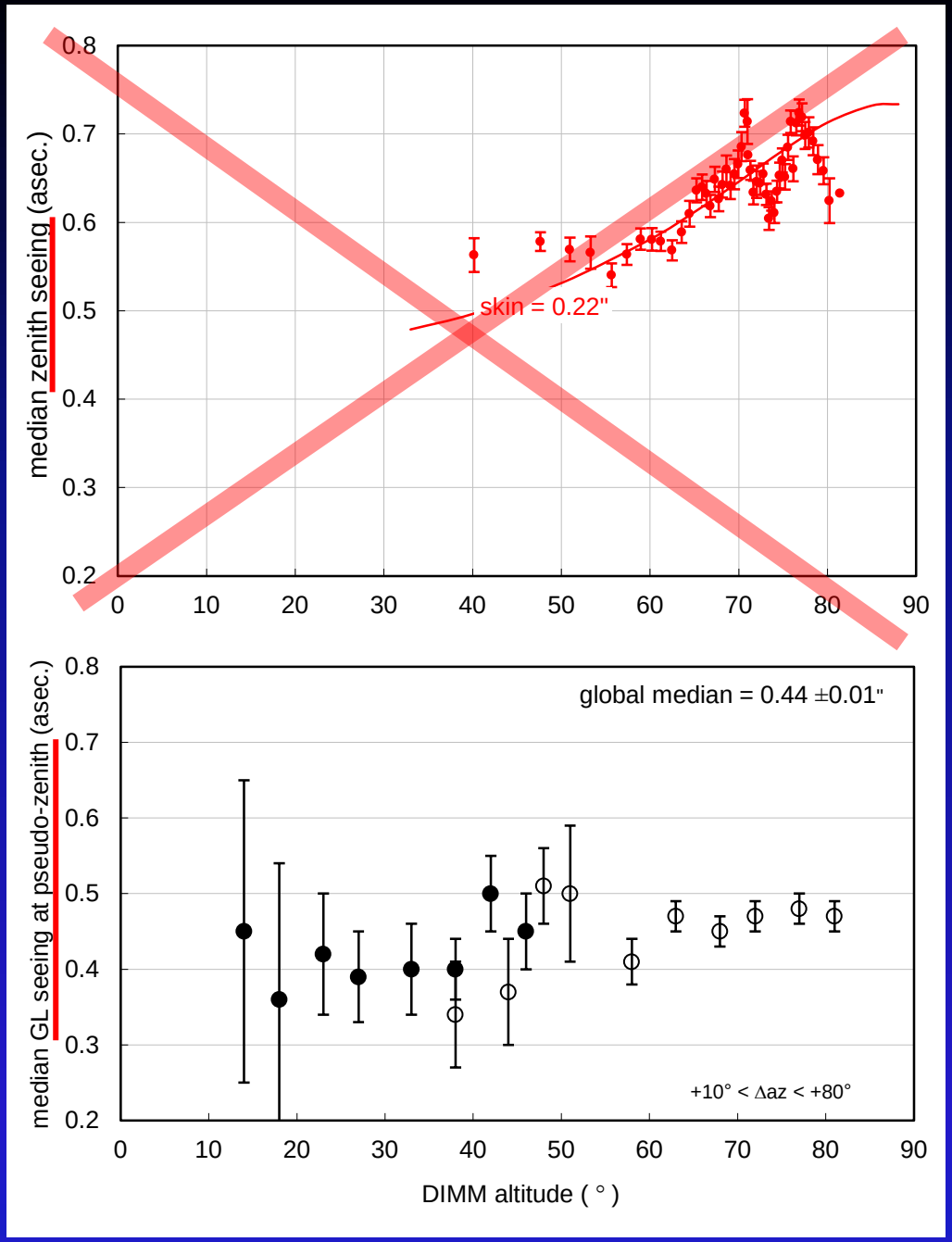


The DIMM, at 22m elevation, sees ground layers that would be above ~8 m at the pristine CFHT site.



CFHT DIMM
best vented when slit is ~30° downwind





Reducing GL DIMM seeing to the pseudo-zenith much reduces the altitude trend that has been attributed to a dome skin effect

Median 500 nm Zenith Seeing (arcsec. FWHM) at 8 m Elevation for Various Sites.

Site	Dates	DIMM	FA	GL
CFHT	**2010 – 2011**	**0.57**	**0.29**	**0.44**
MKAM	2010 – 2011	0.62	0.29	0.50
Cerro Tolar	2003 – 2007	0.63	0.44	0.34
Cerro Armazones	2004 – 2008	0.64	0.43	0.35
Cerro Tolonchar	2006 – 2008	0.64	0.48	0.32
Cerro Las Campanas	2007 - 2009	0.67	0.45	0.38
Mauna Kea 13N	2005 – 2008	0.75	0.33	0.54
San Pedro Mártir	2005 – 2008	0.79	0.37	0.57

Median Zenith Seeing and IQ Values at 8 m Elevation at the Pristine CFHT Site.

500 nm seeing (")			**IQ (")**					
FA	GL	Total	374 nm *u*	487 nm g	770 nm *i*	1.2 μm J	1.6 μm H	2.2 μm K
0.29	**0.44**	**0.57**	**0.51**	**0.47**	**0.41**	**0.34**	**0.30**	**0.25**

Median Zenith Seeing and IQ Values at 22 m Elevation at the Pristine CFHT Site.

500 nm seeing (")			**IQ (")**					
FA	GL	Total	374 nm *u*	487 nm g	770 nm *i*	1.2 μm J	1.6 μm H	2.2 μm K
0.29	**0.33**	**0.47**	**0.41**	**0.38**	**0.32**	**0.27**	**0.23**	**0.19**

CFD simulations

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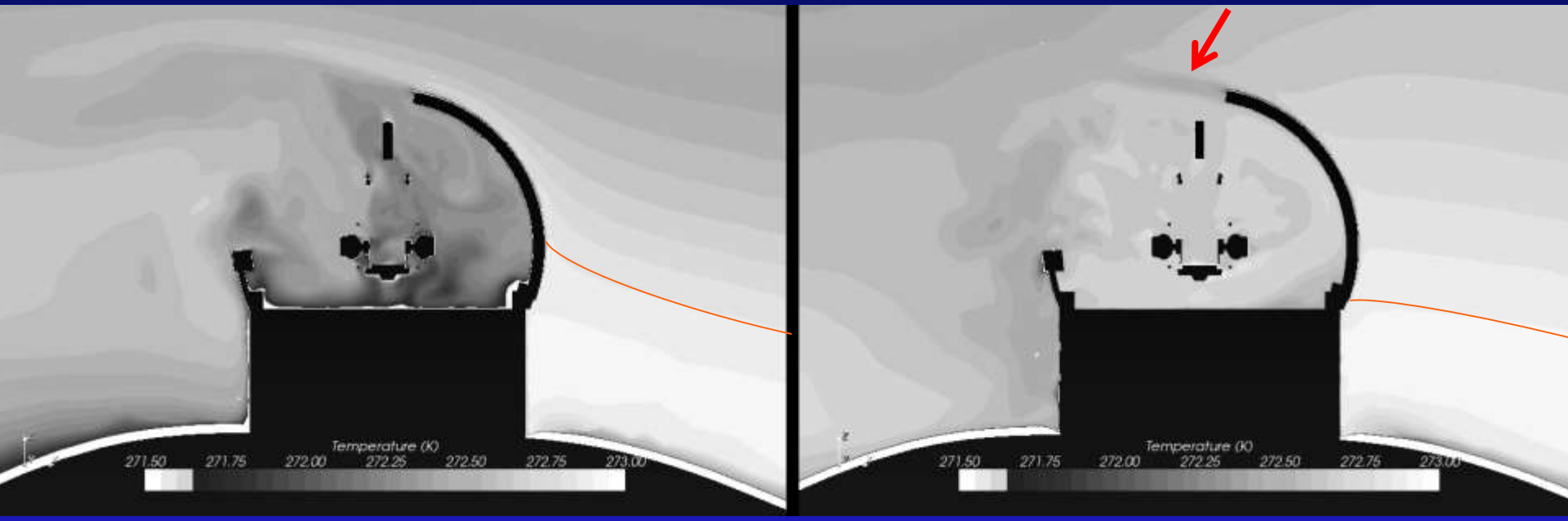
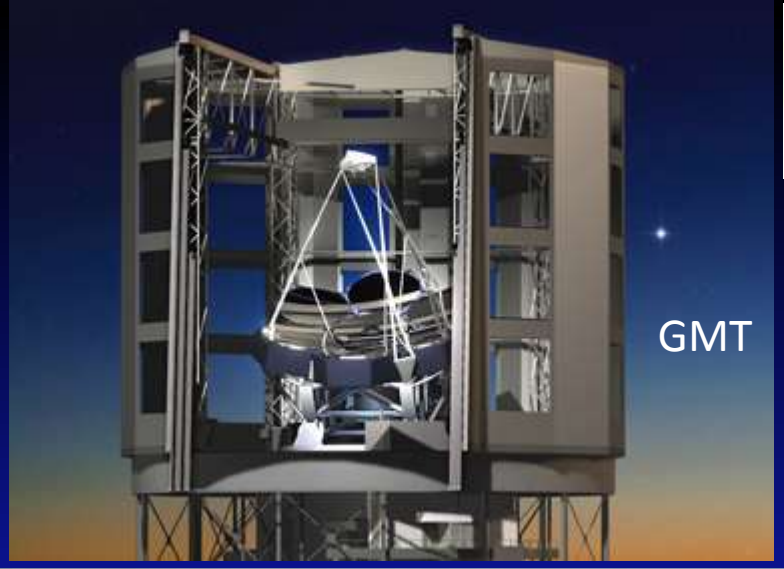


no vents
thermal IQ = 0.46”

with 8 “small” vents
thermal IQ = 0.28”



GMT

CFHT

Magellan

(ground layer management)

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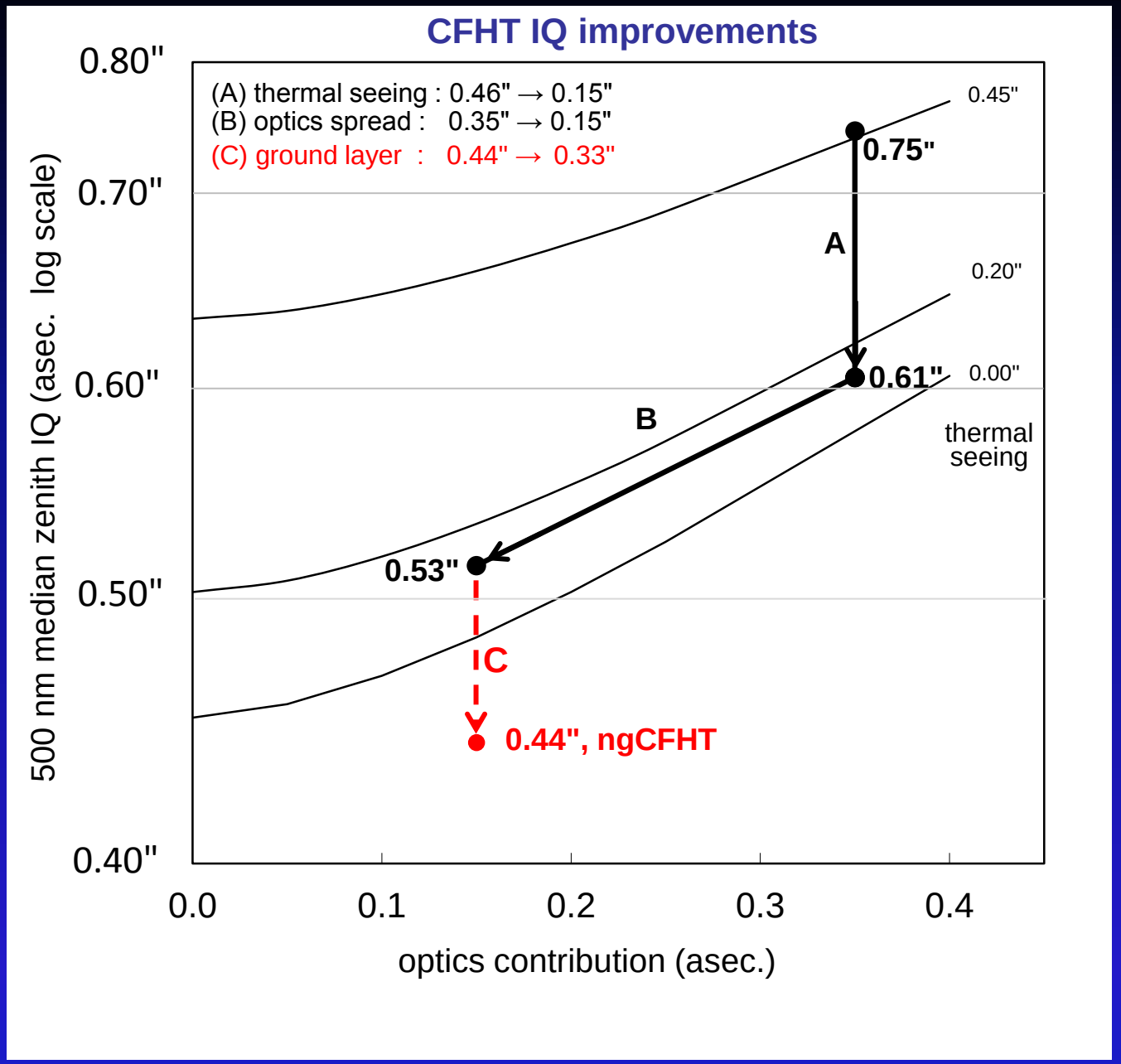
CFHT IQ improvements
(A) thermal seeing : 0.46" → 0.15"
(B) optics spread : 0.35" → 0.15"
(C) ground layer : 0.44" → 0.33"
0.80"
0.70"
0.60"
0.50"
0.40"
500 nm median zenith IQ (asec. log scale)
0.45"
0.20"
0.00"
thermal seeing
0.75"
0.61"
0.53"
A
B
C
0.44", ngCFHT
0.0
0.1
0.2
0.3
0.4
optics contribution (asec.)