

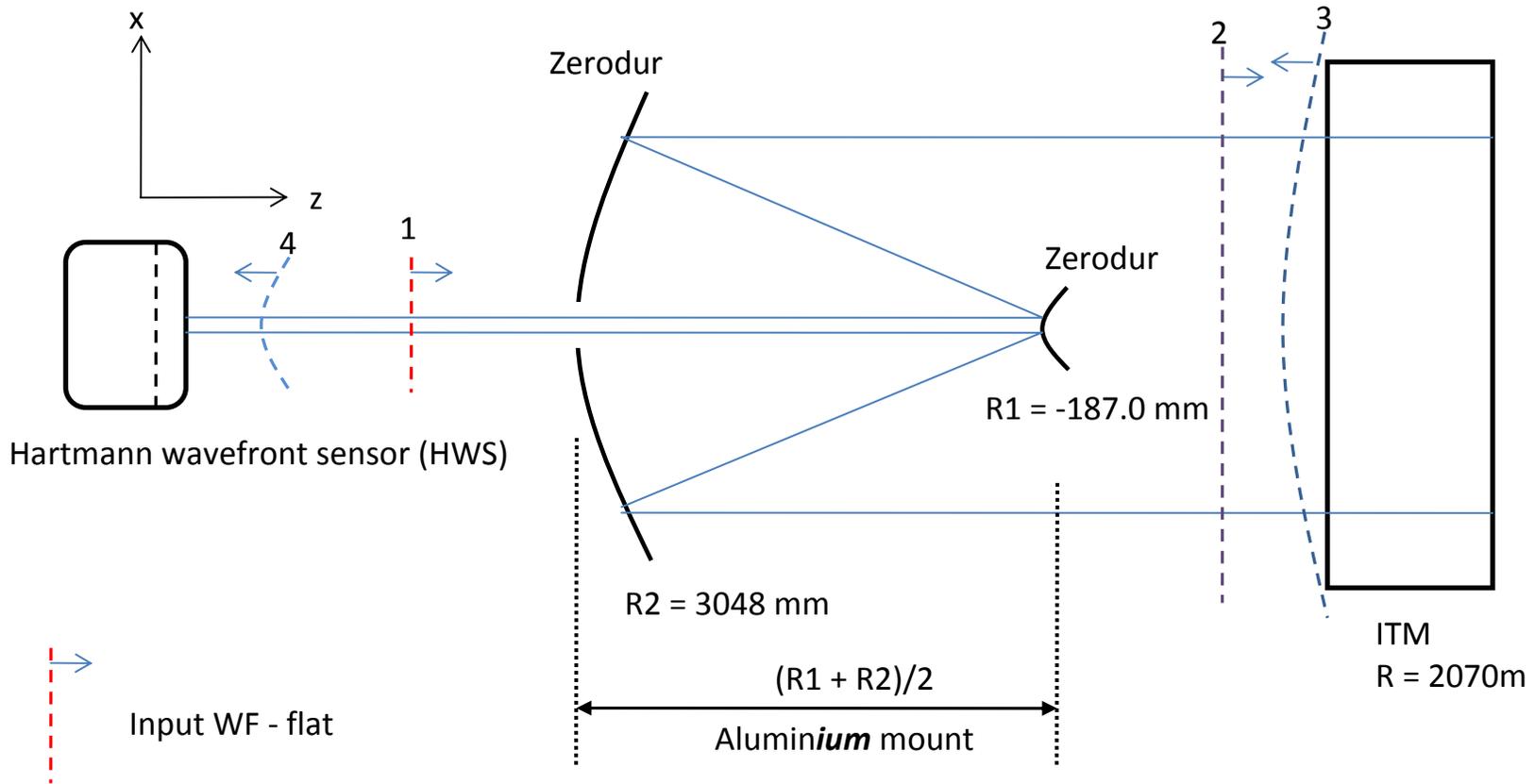
Thermal defocus of Hartmann telescope: AdvLIGO

AOS Teleconference

Thurs 13th Sept 2007

Aidan Brooks

HWS probe beam schematic



$$W_{initial} = \left(\frac{R_2}{R_1}\right)^2 \frac{1}{n_{ITM} R_1} x^2$$

-ium: for interested parties ...

Spelling

Etymology and nomenclature history

The earliest citation given in the [Oxford English Dictionary](#) for any word used as a name for this element is *alumium*, which [Humphry Davy](#) employed in 1808 for the metal he was trying to isolate electrolytically from the mineral *alumina*. The citation is from his journal *Philosophical Transactions*: "Had I been so fortunate as..to have procured the metallic substances I was in search of, I should have proposed for them the names of silicium, alumium, zirconium, and glucium."^[19]

By 1812, Davy had settled on *aluminum*, which, as other sources note,^[citation needed] matches its [Latin](#) root. He wrote in the journal *Chemical Philosophy*: "As yet Aluminum has not been obtained in a perfectly free state."^[20] But the same year, an anonymous contributor to the [Quarterly Review](#), a British political-literary journal, objected to *aluminum* and proposed the name *aluminium*, "for so we shall take the liberty of writing the word, in preference to aluminum, which has a less classical sound."^[21]

The *-ium* suffix had the advantage of conforming to the precedent set in other newly discovered elements of the time: [potassium](#), [sodium](#), [magnesium](#), [calcium](#), and [strontium](#) (all of which Davy had isolated himself). Nevertheless, *-um* spellings for elements were not unknown at the time, as for example [platinum](#), known to Europeans since the sixteenth century, [molybdenum](#), discovered in 1778, and [tantalum](#), discovered in 1802.

Americans adopted *-ium* for most of the nineteenth century, with *aluminium* appearing in [Webster's Dictionary](#) of 1828. In 1892, however, [Charles Martin Hall](#) used the *-um* spelling in an advertising handbill for his new electrolytic method of producing the metal, despite his constant use of the *-ium* spelling in all the patents he filed between 1886 and 1903.^[22] It has consequently been suggested that the spelling reflects an easier to pronounce word with one fewer syllable, or that the spelling on the flier was a spelling mistake. Hall's domination of production of the metal ensured that the spelling *aluminum* became the standard in North America; the *Webster Unabridged Dictionary* of 1913, though, continued to use the *-ium* version.

In 1926, the [American Chemical Society](#) officially decided to use *aluminum* in its publications; American dictionaries typically label the spelling *aluminium* as a British variant.

[edit] Present-day spelling

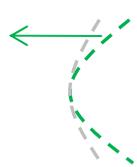
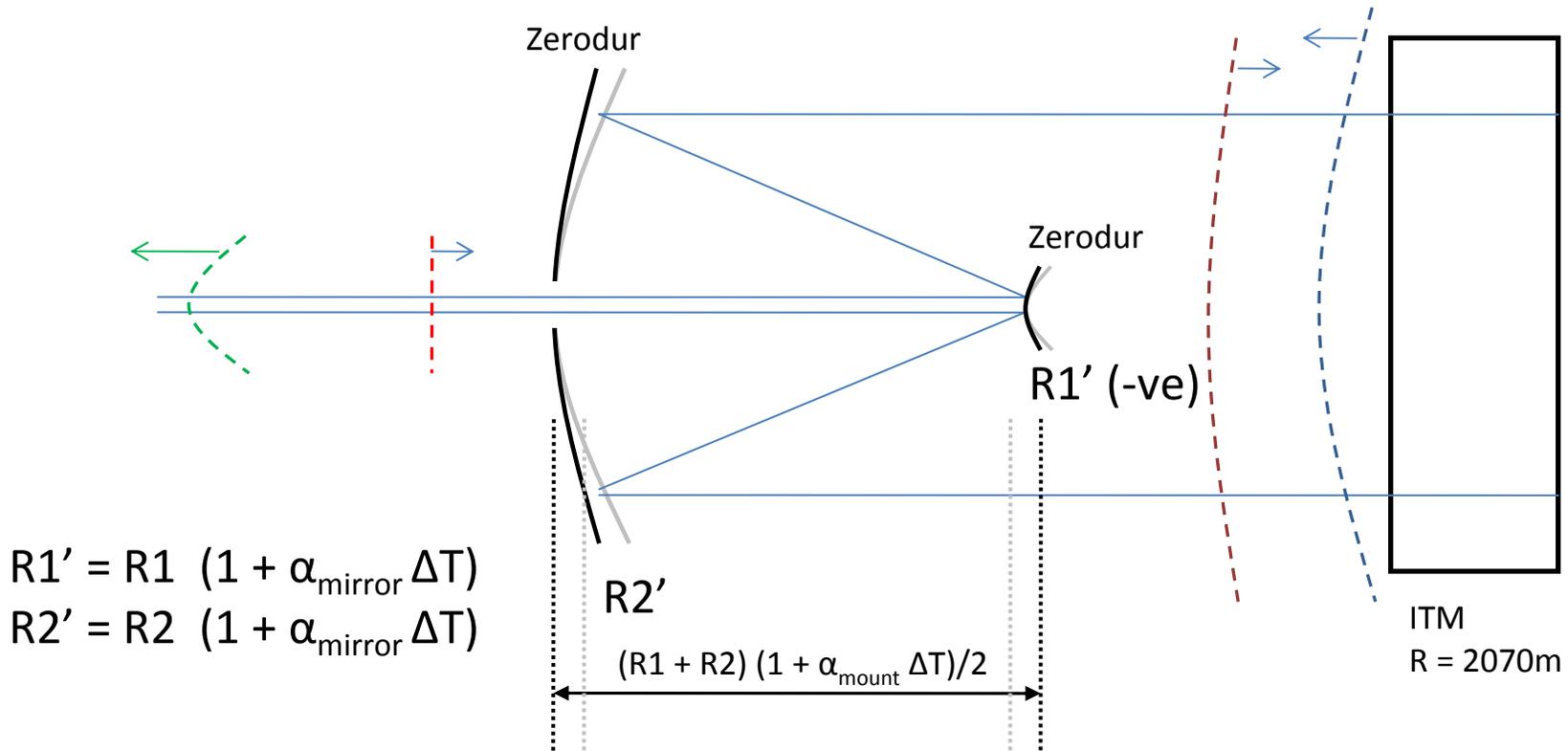
In the UK and other countries using [British spelling](#), only *aluminium* is used. In the United States, the spelling *aluminum* is largely unknown, and the spelling *aluminium* predominates.^{[23][24]} The [Canadian Oxford Dictionary](#) prefers *aluminum*, whereas the [Australian Macquarie Dictionary](#) prefers *aluminium*.

In other [English-speaking](#) countries, the spellings (and associated pronunciations) *aluminium* and *aluminum* are both in common use in scientific and non-scientific contexts.^[25] The spelling in virtually all other languages is analogous to the *-ium* ending.

The [International Union of Pure and Applied Chemistry](#) (IUPAC) adopted *aluminium* as the standard international name for the element in 1990, but three years later recognized *aluminum* as an acceptable variant. Hence their periodic table includes both, but places *aluminium* first.^[26] IUPAC officially prefers the use of *aluminium* in its internal publications, although several IUPAC publications use the spelling *aluminum*.^[27]

Thermal expansion of glass

Temperature change: ΔT



$$W_{\Delta T} = W_{initial} + \Delta W$$

$$\Delta W = \frac{4 (R_1 + R_2) \Delta \alpha \Delta T}{R_1^2} x^2$$

$$\Delta \alpha = \alpha_{mirror} - \alpha_{mount}$$

Some values of defocus

$$W = S x^2$$
$$\text{defocus} = S$$

Current design

- $\Delta T = 1\text{K}$
- Mirrors are Zerodur: $\alpha_{\text{mirror}} = 0.05 * 10^{-6} \text{K}^{-1}$
- $\alpha_{\text{mount}} = 23 * 10^{-6} \text{K}^{-1}$
- Defocus (at ITM) = $3 * 10^{-5} \text{m}^{-1}$

Sensitivity limits

- Need better than $\lambda/467 = 1.3 \text{ nm}$ (T060083-00)
- Defocus due to 1.3nm Gaussian bump with a width of 60 mm = $7 * 10^{-7} \text{m}^{-1}$

Defocus more generally ...

Defocus Induced by Telescope

