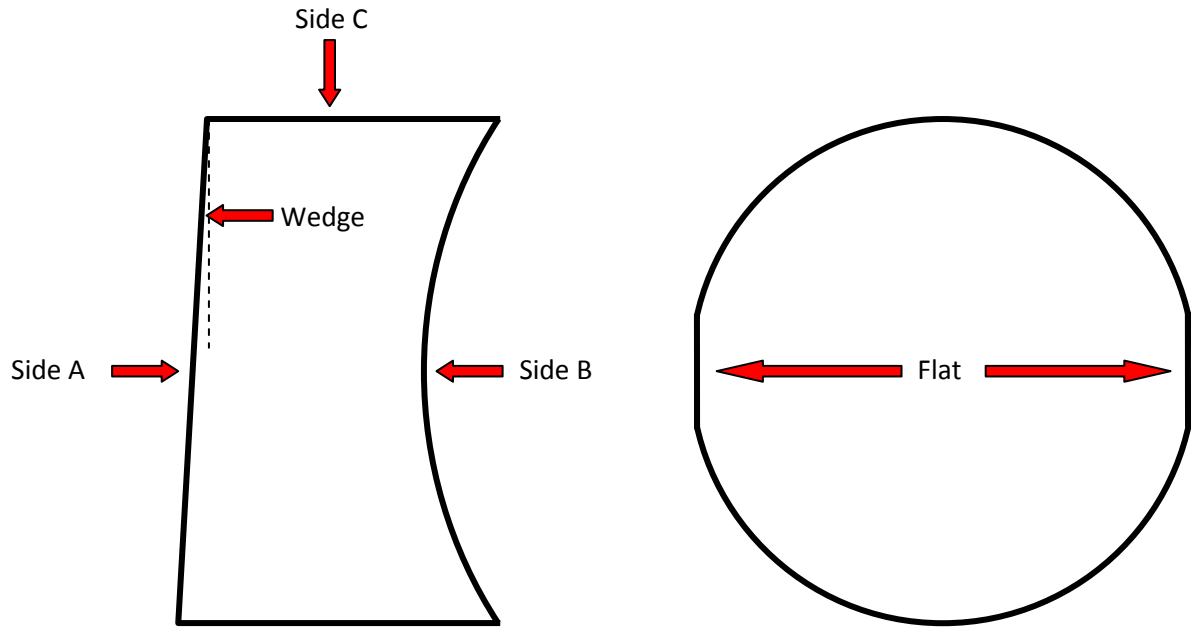
# Polishing and coating specification for Input Mode Cleaner End mirror of Advanced Virgo

Date: 24 June 2013
Version: 8

## General parameters

| **Mirror Substrates** | | | |
|---|---|---|---|
| Material | Herasil 102 | | |
| Outside diameter (mm) | 145 ± 0.1 | | |
| Thickness (mm) | 90 +4/-0 | | |
| Bevel | 0.5 to 1 mm x 45° | | |
| Wedge (mrad) | 1 ± 0.2 on side A | | |
| Flat (mm) | 20 ± 1 on side C | | |
| **Polishing** | | | |
| | **Side A** (AR surface) | **Side B** (HR surface) | **Side C** (side) |
| Curvature | Residual ROC>1km | See section: *Radius of curvature* | |
| Surface error (RMS) | < 20 nm on 50mm diameter | < 0.57nm See section: *Surface error* | polished |
| Surface defects | <= 10 scratches on 145mm diameter <= 5 digs on 145mm diameter | | |
| Roughness (RMS) | < 10 Å on 50mm diameter | < 3 Å ($10^4$-$10^6$ $m^{-1}$) See section: *Surface error* | |
| **Coating** | | | |
| Wavelength (nm) | 1064 + 680 | 1064 | |
| Coating type | AR @ 0° at 1064nm on 140mm Diameter R @ 15° at 680nm on 140mm diameter | HR @ 0° on 140mm diameter | none |
| Polarization | S | S | NA |
| Reflection | > 0.7 at 680nm < 1000ppm at 1064nm | | NA |
| Transmission | | 1 ppm < T < 2 ppm | |
| Absorption | < 10ppm | < 1ppm | |
| Scattering | < 5 ppm | See section: *Surface error* | |

An etched mark on Side C is required in order to give reference orientation for metrology




## Radius of curvature

### First requirement

Radius of curvature weighted by a Gaussian function:

$$I = e^{-\frac{2r^2}{\omega^2}}$$

Where $r$ is the distance from the mirror center and $\omega = 10.8mm$.
N.B. For initial assessment of specification, the RoC can be estimated by a simple fit over an aperture diameter of 33mm instead of the Gaussian weighting.
**Radius of curvature in ordinary and extraordinary axis → 187m +0m -1m**

### Second requirement

**Radius of curvature in ordinary and extraordinary axis using a quadratic fit over all aperture diameters from 33mm to 140mm → 187m +0m -1m**

## Surface error

The surface error is specified using the power spectral density plotted in figure 1
This is a "2D PSD" i.e. the integration of the whole curve gives the square rms of the surface.

Power spectral density weighted by a Gaussian function:

$$I = e^{-\frac{2r^2}{\omega^2}}$$

Where $r$ is the distance from the mirror center and $\omega = 10.8mm$.
N.B. For initial assessment of specification, the RoC can be estimated by a simple fit over an aperture diameter of 33mm instead of the Gaussian weighting.

The total rms of the given PSD is 0.57nm

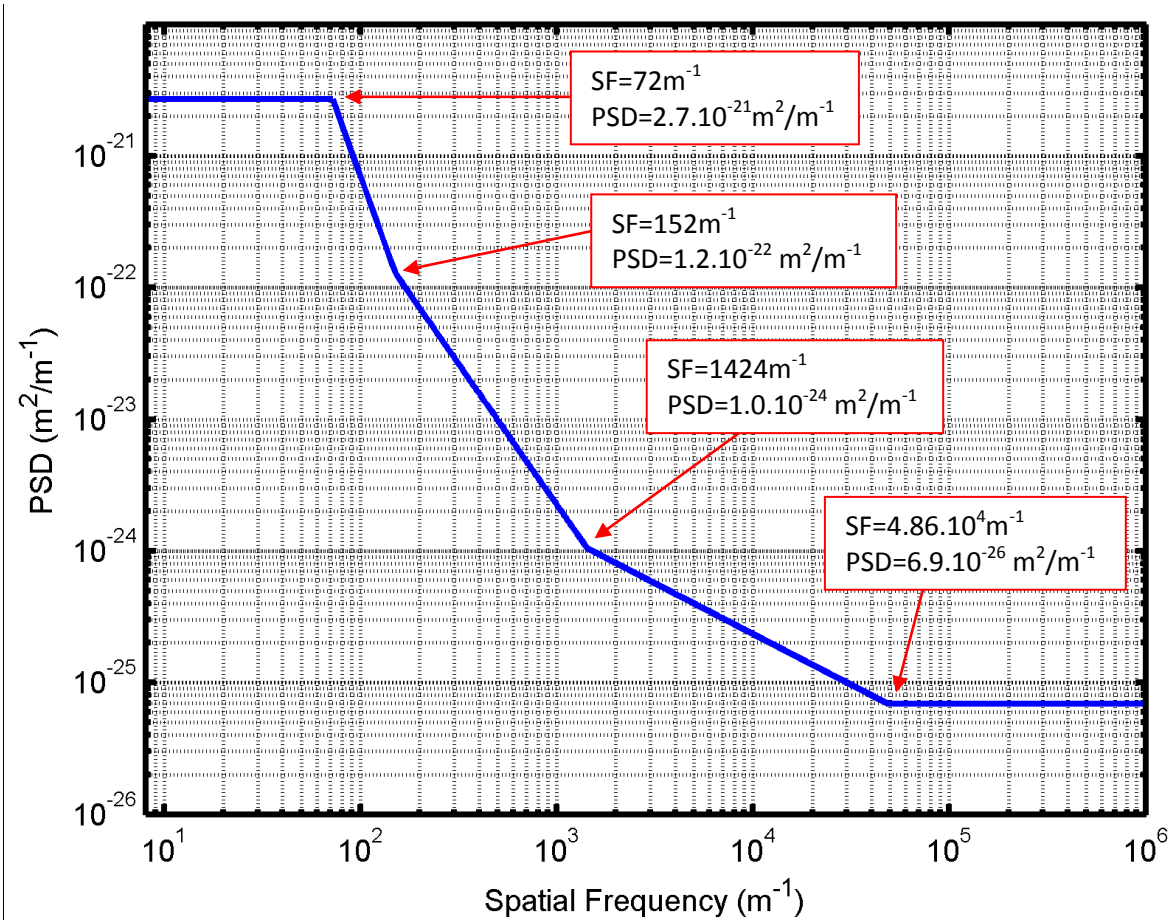


Figure 1. Power Spectral Density specification for side B of the substrate.