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WHERE GEOMETRY NAD OPTIC MEET: FOUR FOLD REFLECTION OF LIGHT CONE IN PORRO TYPE BINOCULARS

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This work is devoted to a problem of four time reflection of a light cone that forms image in binoculars. This will be limited to binocular that as image reversing system use prism named after italian optician Ignazio Porro (1801-1875) – thus the popular and common name „porro binoculars" or "porro-type binoculars". As it turns out, binocular's objective lens diameter, its focal lenght and field of view size will determine shape of the light cone responsible for image creation. Outermost rays of light belong to a cone, whose base is the objective of the binoculars. This cone is cut by a plane perpendicular to its axis and the top base represents a circular field of view. Distance between bases – which is the height of the cone – gives limitations for the maximal size of porro prisms allowed to be used in a binoculars.

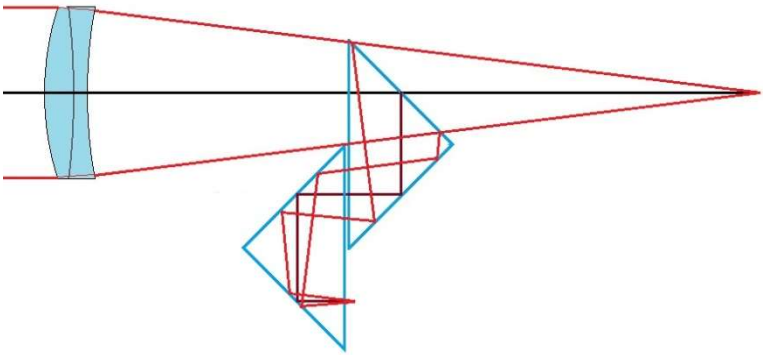

Fig 1. Simplified ray tracking through two porro prisms with four internal reflections.

On the practical side, prisms size have major influence on the equal light distribution in the whole field of view. Ideally prism as large as possible shall be used, what will allow for a lossless

bringing the whole cone of light from the objective, all the way through prisms to the field on view. In real life, however, manufacturers with respects to costs of prism, as well as size and weight of a binoculars, do tend to put much smaller prisms, what leads to vignetting. If diameter of the objective, focal length, field of view size are known as well as the size and position of porro prisms, it is quite easy to determine the amount of vignetting. This will be discussed upon one of author's favourite binoculars: Swift Saratoga Mk II 8x40, offering huge, 9,3° field of view.