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Controlling refractive index and reducing the GWP of Cerenkov gas radiators: challenge in an era of diminishing fluorocarbon availability

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COMPASS and LHCb use C_4F_10 and CF_4 Cherenkov gas radiators. These Saturated FuoroCarbons (Cn_F(2n+2)) have high GWPs, however (5000-9000*CO_2) so there is impetus to reduce their consumption.
Oxygenated fluorocarbons (C_nF_2nO) can offer similar optical performance, with GWPs equivalent to CO2. Their GWPs are geometry-specific however: closed molecular rings containing an oxygen atom link have GWPs as high as SFCs, and should be avoided.
Legislation and market forces will limit FC availability, maybe leaving "holes"in the C_nF_x spectrum unfilled by C_nF_2nO equivalents. Blending low molar concentrations of heritage-stock higher-order SFCs or 3M NOVEC®5110: C5F10O (GWPzero) with light gases like nitrogen would reduce the radiator volume GWP "load".
Sound velocity monitoring was used for controlling real-time blending C5F12 with N2 in the SLD CRID. The technique could be valuable in future operation to meet the optical and low GWP constraints of future blended Cherenkov gas radiators. Examples are explored.

Requested length

20 minutes

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