Ring path length Adjustment

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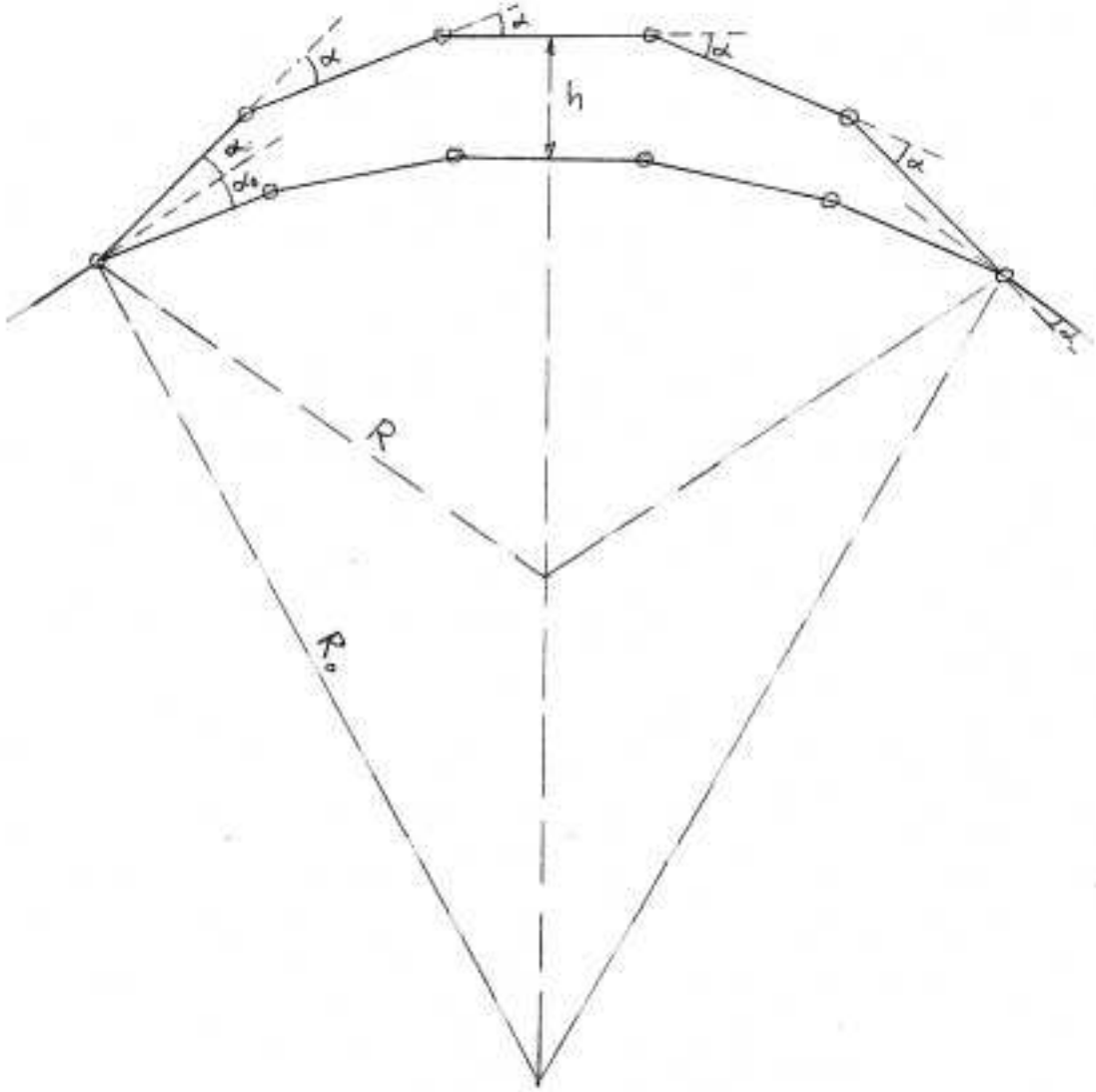
n=6 chicane



arc radius = R_0

arc length = $\ell_0 = 2(n-1) R_0 \sin \alpha_0/2 \cong (n-1) R_0 \alpha_0$

$$\Delta \ell = 2(n-1) R_0 \left[\sin \frac{\alpha}{2} \frac{\sin\left(\frac{n-1}{2}\alpha_0\right)}{\sin\left(\frac{n-1}{2}\alpha\right)} - \sin \alpha_0/2 \right]$$

$$h = R_0 \left[\frac{\sin\left(\frac{n-1}{2}\alpha_0\right) + \sin\left(2\frac{n-1}{n-4}\alpha_0\right)}{\sin\left(\frac{n-1}{2}\alpha\right)} - 1 \right]$$

$$\alpha = \alpha_0 \frac{n}{n-4}$$

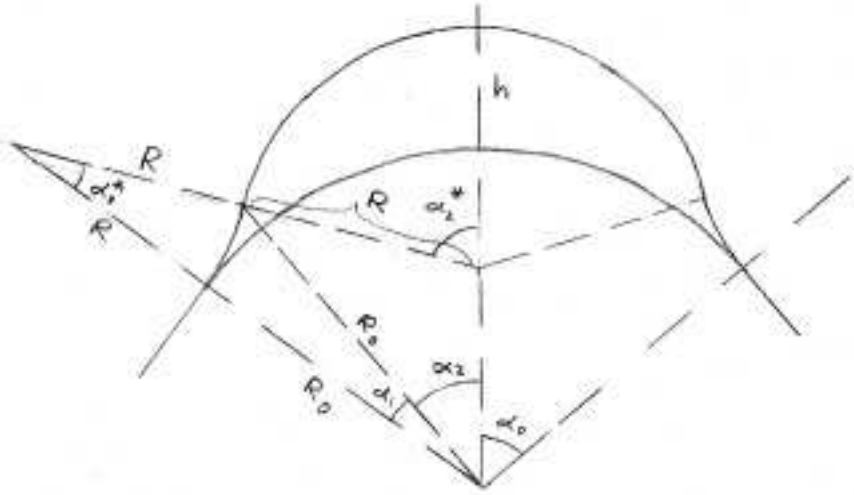
<u>Numbers</u>: $R_0 = 134\,m$

$\alpha_0 = \frac{360°}{168} = 2.143°$

$\Delta \ell = 0.90\,m$ for 25 GeV → 250 GeV

n	6	8	10	12	14	16	18
α/α_0	3	2	1.67	1.5	1.4	1.33	1.29
$(\alpha/\alpha_0)^2$	9	4	2.78	2.25	1.96	1.78	1.65
$\Delta \ell$ (m)	.283	.297	.377	.486	.619	.773	.948
h (m)	1.18	1.16	1.28	1.43	1.60	1.78	1.97
$n \frac{0.9m}{\Delta \ell}$	19	24	24	22	20	19	17
$(2n-3) \frac{0.9m}{\Delta \ell}$	29	45	41	39	36	34	31

Superbend Chicane



$$\alpha_1 + \alpha_2 = \alpha_0 = \alpha_2^* - \alpha_1^*$$

$$\alpha_1 \equiv \varepsilon\alpha_0$$
$$\alpha_2 \equiv (1-\varepsilon)\alpha_0$$

$$\frac{\sin\alpha_2^*}{\sin\alpha_2} = \frac{\sin\alpha_1^*}{\sin\alpha_1} \qquad \frac{R+R_0}{2R} = \frac{\sin\alpha_2^*}{\sin\alpha_0}$$

$$\Rightarrow \operatorname{tg}\alpha_2^* = \frac{\sin\alpha_2\sin\alpha_0}{\sin\alpha_2\cos\alpha_0 - \sin\alpha_1} \qquad \frac{R}{R_0} = \frac{\sin\alpha_0}{2\sin\alpha_2^* - \sin\alpha_0} \cong \frac{\alpha_0}{2\alpha_2^* - \alpha_0}$$

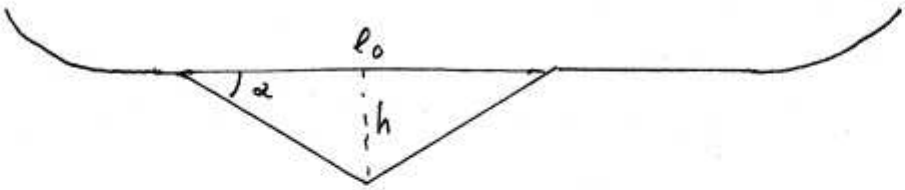
1. order in α_0: $\quad \alpha_2^* \cong \alpha_0\frac{1-\varepsilon}{1-2\varepsilon} \qquad P_s/P_{s0} = \left(R/R_0\right)^{-2} \cong (1-2\varepsilon)^2$

$$h/R_0 = R/R_0\left(\frac{2\sin\alpha_1^*}{\sin\alpha_0} + 1\right) - 1 \qquad \Delta L = 2\pi R_0\left[\frac{R}{R_0}\,\frac{2\alpha_2^* - \alpha_0}{\alpha_0} - 1\right]$$

Numbers: $R_0 = 80$ m $\quad \Delta L = 0.9$ m $\qquad \Delta L = .22$ m

ε	1/4	1/6	1/10
P/P_0	4	2.25	1.56
α_0	4.34°	6.12°	8.58
$2\alpha_0 R_0$	12.1 m	17.1 m	24.0 m
h/R_0	.172 m	.19 m	.20 m

1/4	1/6
4	2.25
2.14	3.0
5.98 m	8.38 m
.042 m	.044 m



$$\Delta L = l_0\left(\frac{1}{\cos\alpha} - 1\right) \simeq l_0 \frac{\alpha^2}{2} \qquad h = \frac{l_0}{2}\,\mathrm{tg}\,\alpha \simeq l_0 \frac{\alpha}{2}$$

Numbers:

Strength $L = 220\,m$ $\quad \Delta L = 0.9\,m$ $\quad \rho = 80\,m$

$l_0 = 110\,m \rightarrow \alpha = 7.3^\circ \quad h = 7.05\,m \quad arcs = 41\,m$

$l_0 = 58\,m \rightarrow \alpha = 10.0^\circ \quad h = 5.0\,m \quad arcs = 56\,m$