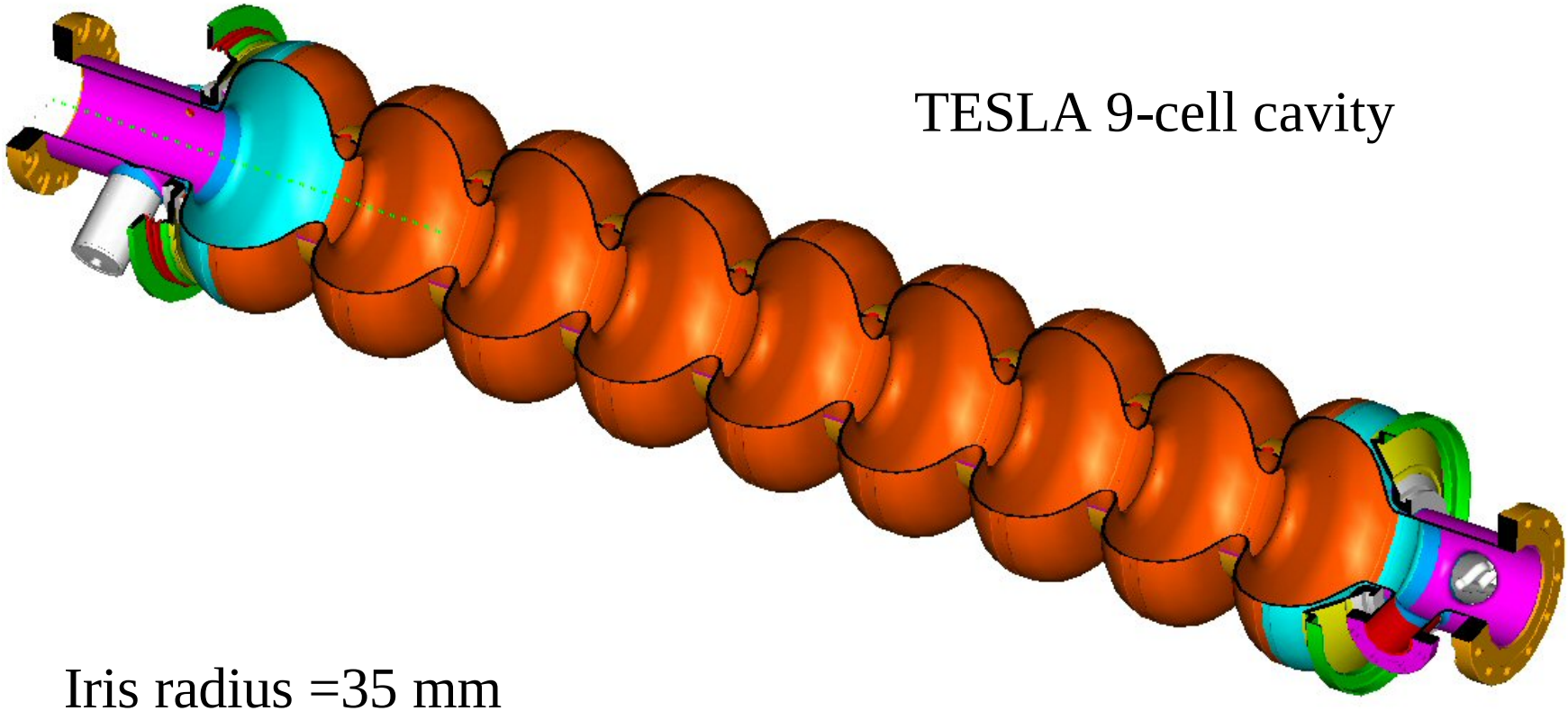
H^- stripping in TESLA cavity @ 8GeV

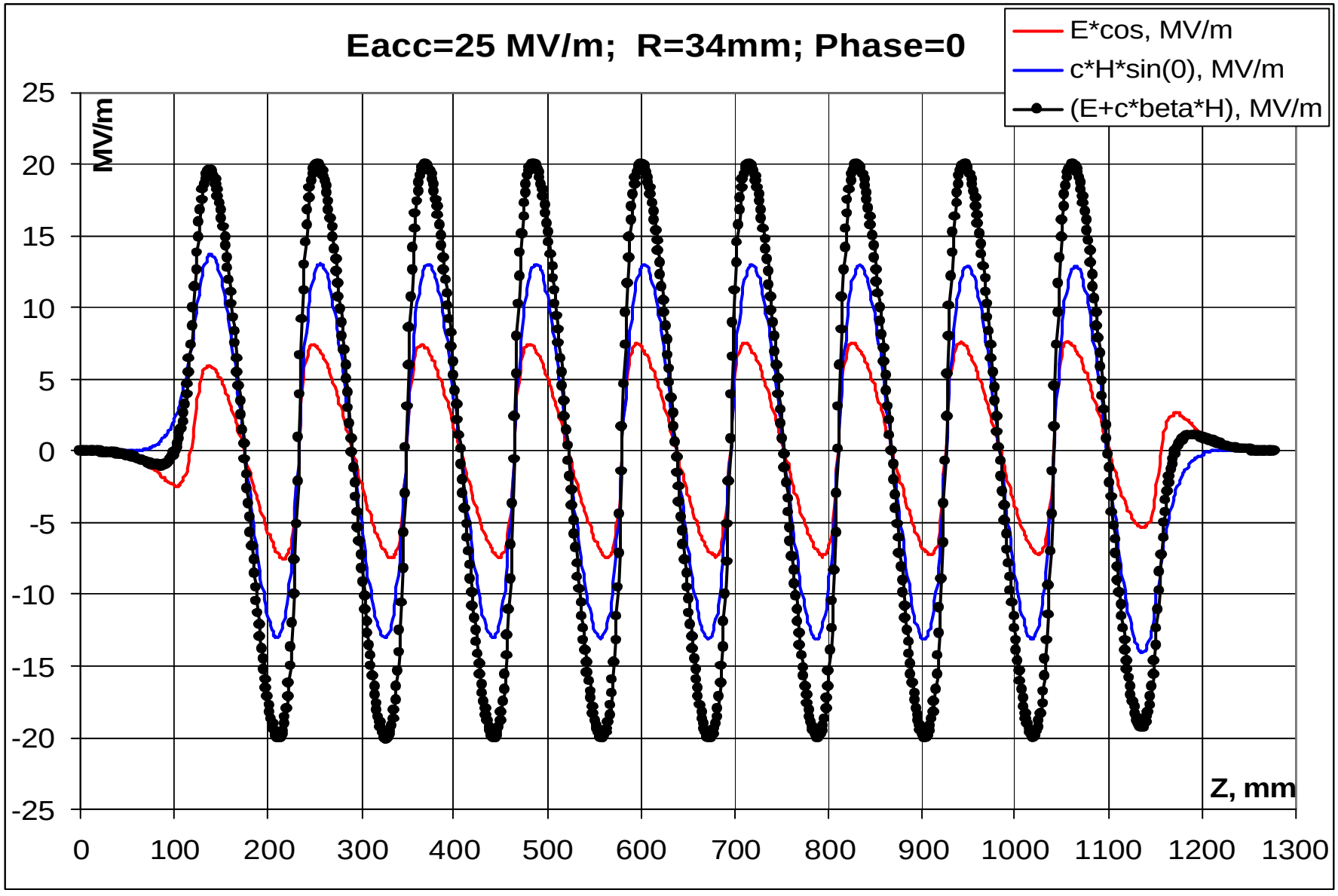
N.Solyak, T.Khabiboulline



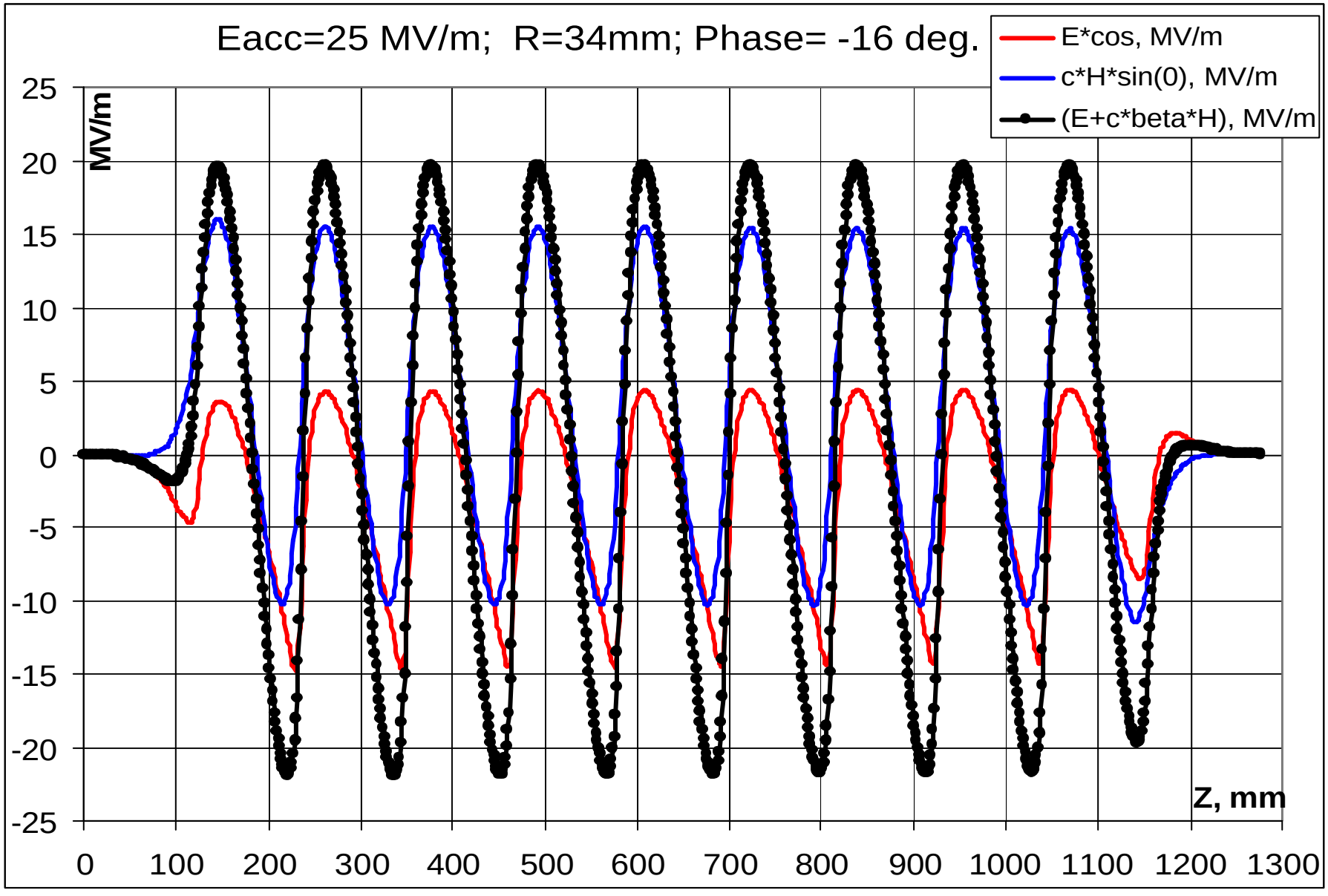
TESLA 9-cell cavity

Iris radius =35 mm

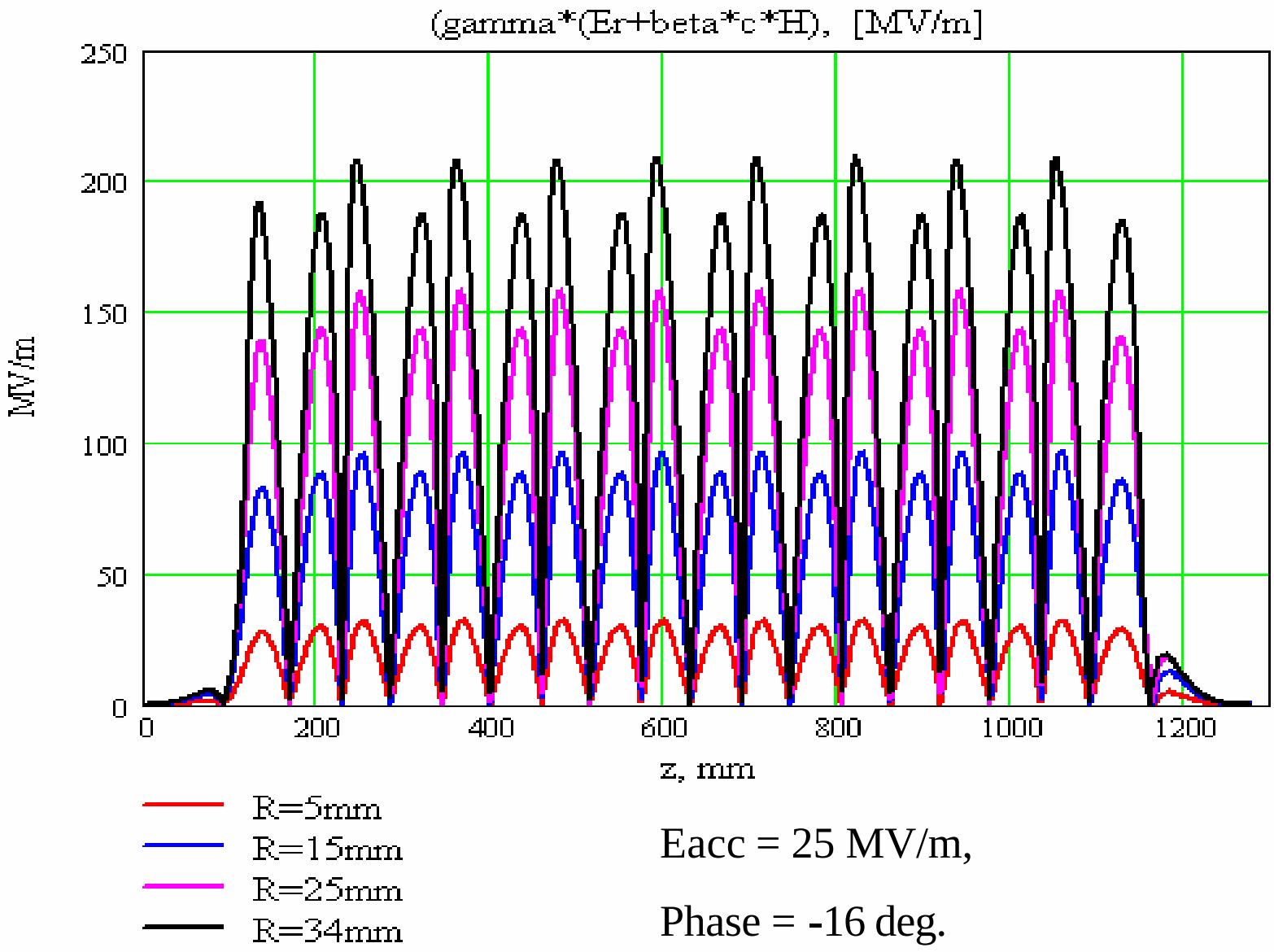
Electric, Magnetic and Sum field seen by beam, Phase 0°



Electric, Magnetic and Sum field seen by beam, Phase -16°

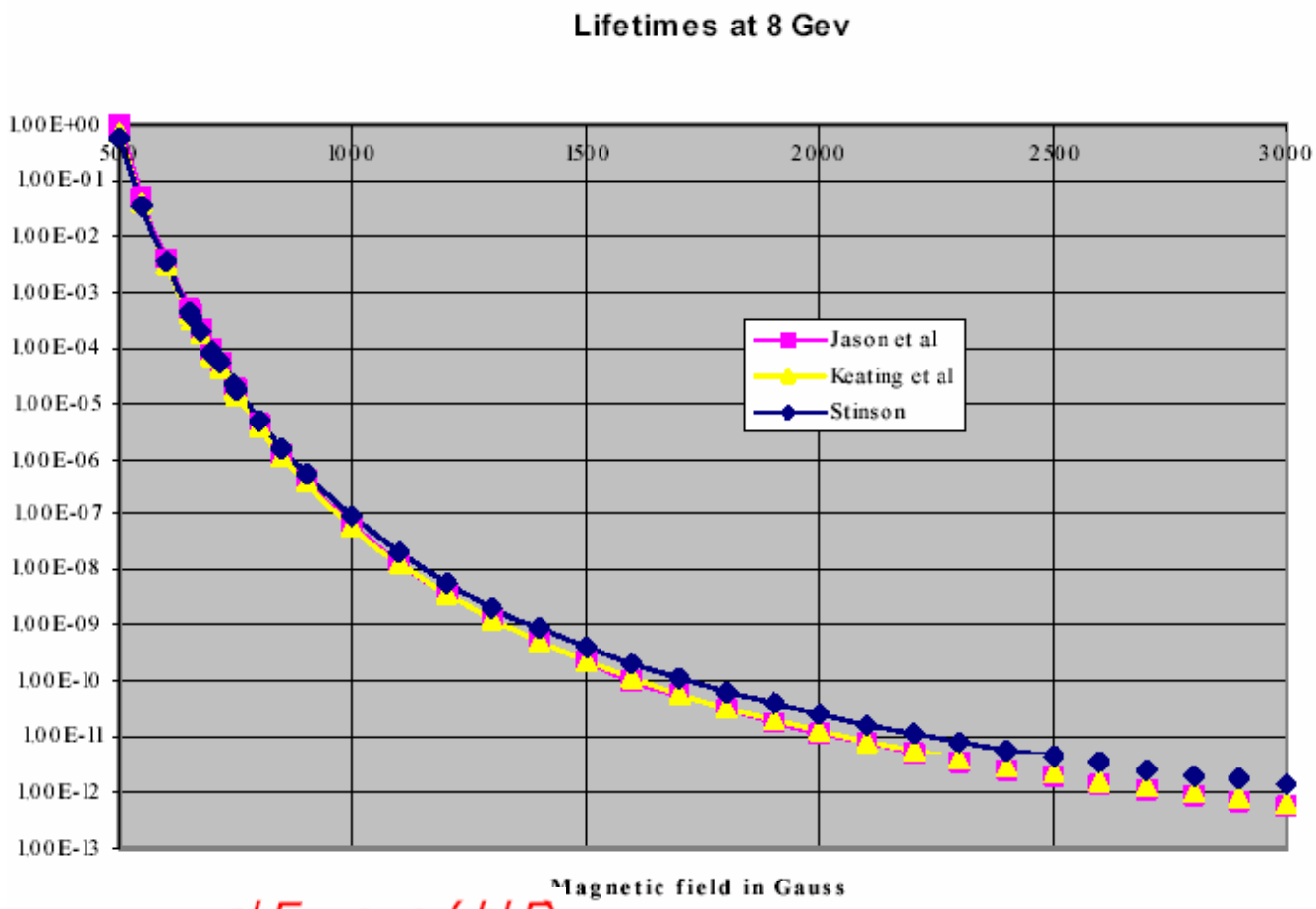


Effective field in the beam rest frame system for different off-sets.



Eacc = 25 MV/m,

Phase = -16 deg.



H^- Stripping fraction losses

$$\Delta N(s) = \frac{N(s)}{\lambda(s)} \Delta s$$

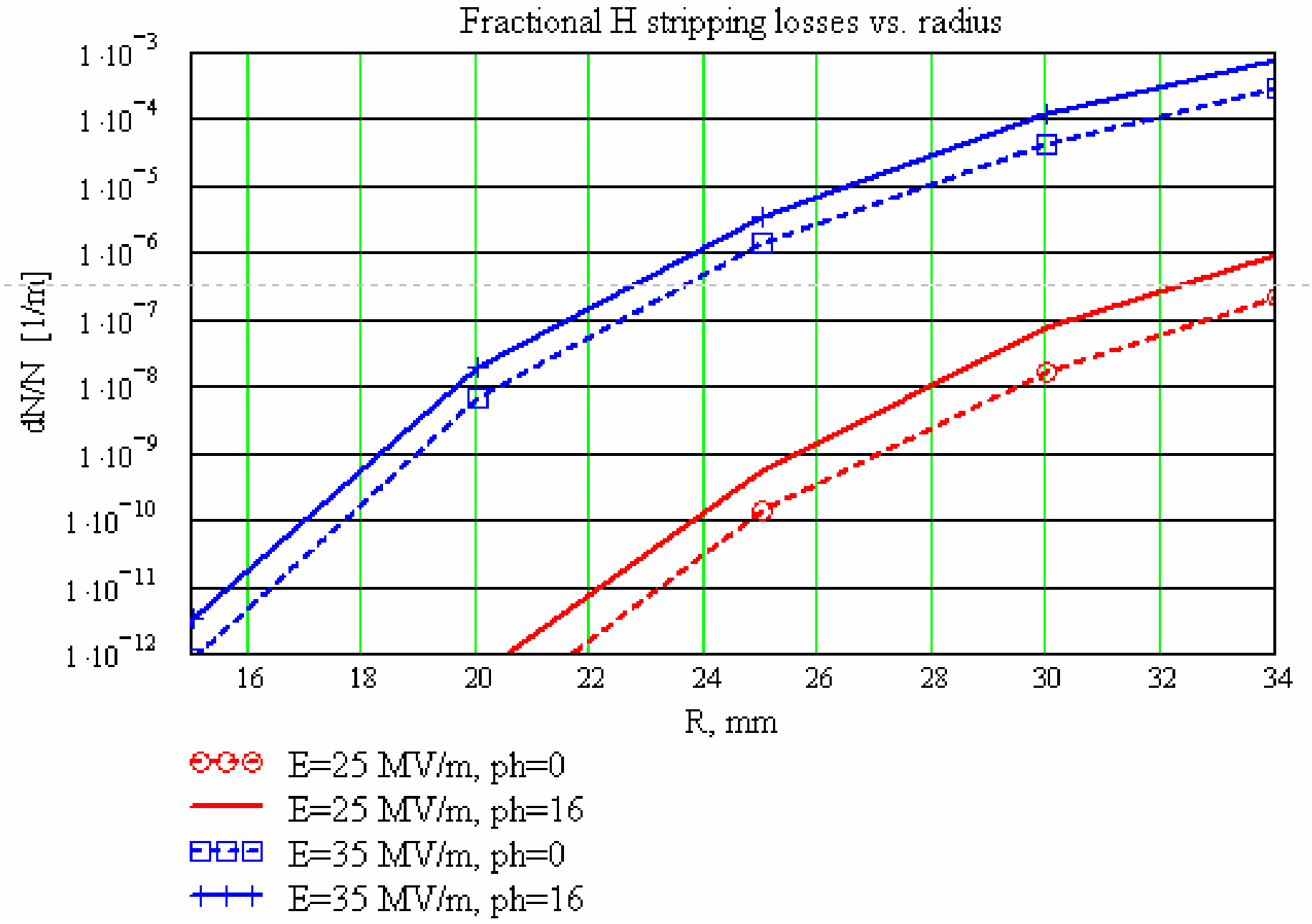
Where:

$$\lambda = \gamma \beta c \tau$$

$$\tau = a/E \times \exp(b/E)$$

Where: $E = g*(E + b*c*H)$ *– field in the rest frame coordinate system*

	a (10^{-14} s-MV/cm)	b (MV/cm)
Jason et al. (1981) H-, 800 MeV, 1.87-7.02 MV/cm	2.47(±4%)	44.94(±0.25%)
Keating et al. (1998) H-, 800 MeV	3.073	44.14


Fractional H stripping losses vs. radius
dN/N [1/m]
1·10^-3
1·10^-4
1·10^-5
1·10^-6
1·10^-7
1·10^-8
1·10^-9
1·10^-10
1·10^-11
1·10^-12
16
18
20
22
24
26
28
30
32
34
R, mm
E=25 MV/m, ph=0
E=25 MV/m, ph=16
E=35 MV/m, ph=0
E=35 MV/m, ph=16

For comparison other sources of stripping in PD:

Summary of H^- Stripping Losses

Blackbody	0.8×10^{-6} m^{-1}
Magnetic field	0.3×10^{-6} m^{-1}
Residual gas	0.3×10^{-6} m^{-1}
Total	**1.4×10^{-6} m^{-1}**

H^- Beam intensity: 1×10^{14} s^{-1}

Loss rate: 1.4×10^{8} particles m^{-1}s^{-1}

@ 8 GeV: **~ 0.2 W/m**

Concern: Activation on bare beam pipe

W. Chou H- injection mini-workshop, December 9-10, 2004, Fermilab