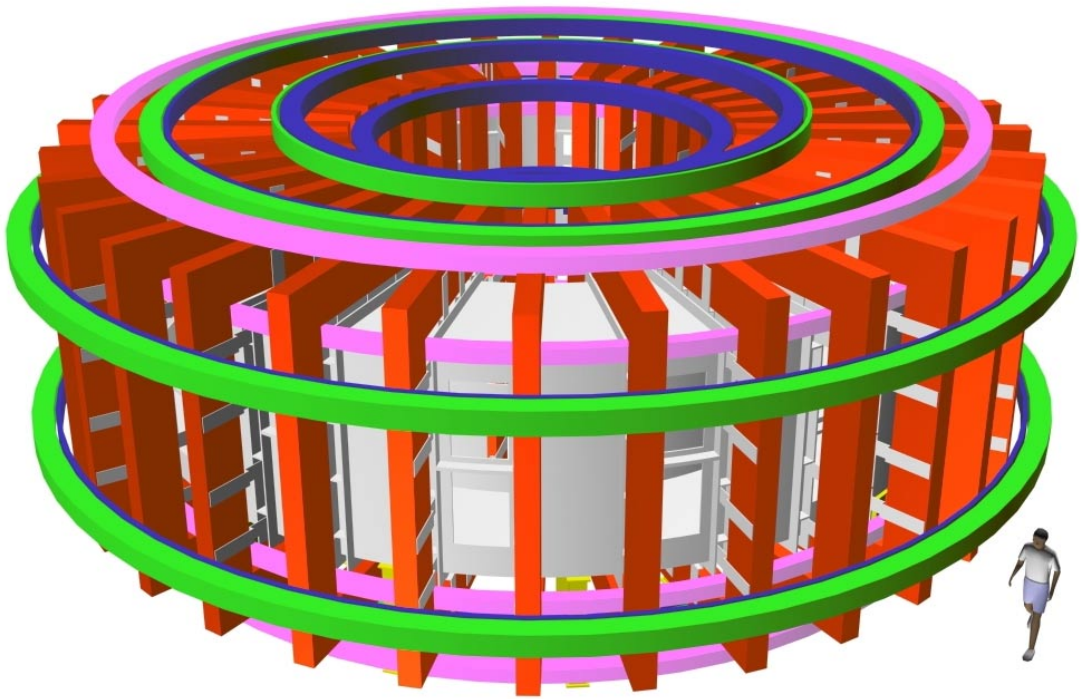
Pinch Discharges in the Electric Tokamak



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Summary

Pinch discharges in the Electric Tokamak.

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Initial experiments in the Electric Tokamak (ET) indicate that low q (<0.5) discharges can be produced which are quite stable when the neutral density is high. Good confinement and burn out of the neutrals require a few hundred kilo amperes plasmas whereas the burn out in a tokamak plasma has been accomplished at 40 KA plasma current or even lower. High current pinch discharges are possible in ET using its full ohmic system. Results of the initial attempts in achieving burn out in a pinch discharge will be presented.

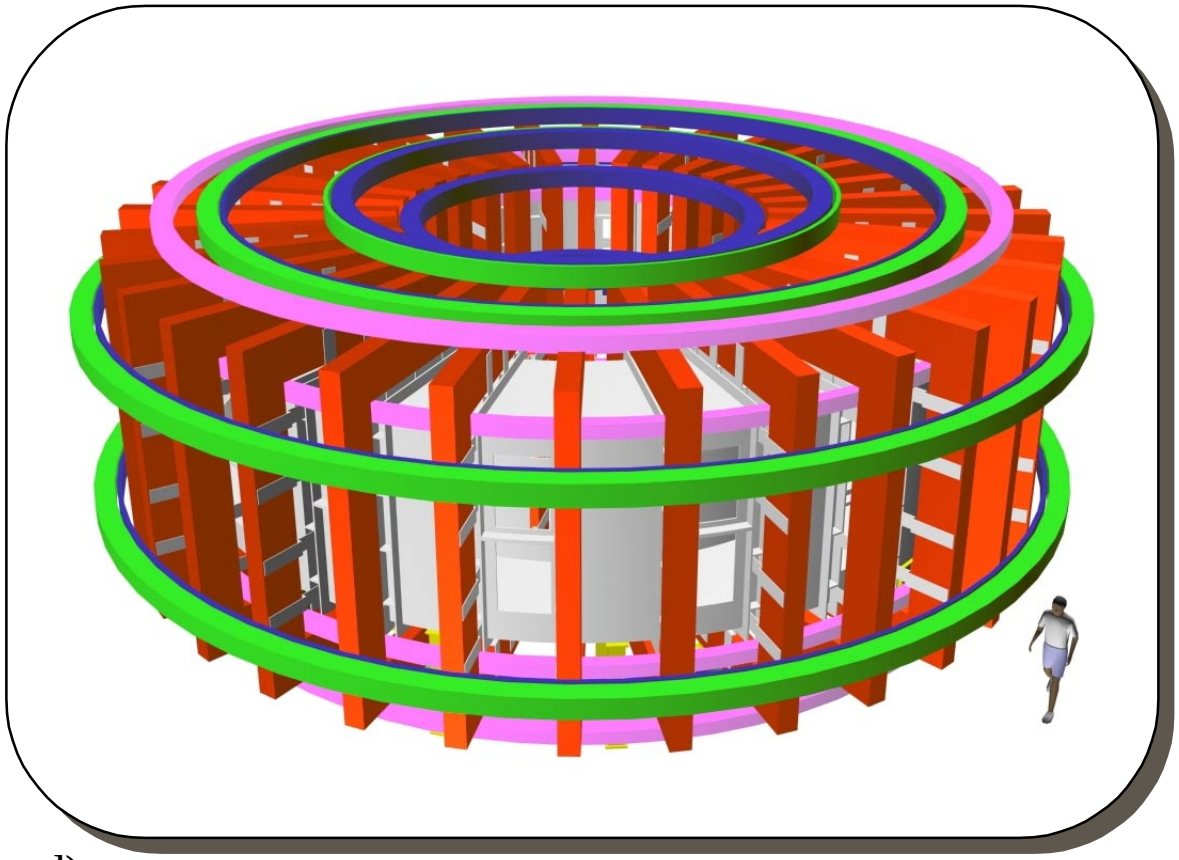
The *Electric Tokamak* (ET)

Geometric Parameters:

$R = 5$ m,
$B = 0.25$ T,
$A = 5$,
$k = 1.5$
$a = 1$ m

Operating Parameters:

$n < 2e13 cm^{-3}$,
$T_e < 2$ kV,
$T_i < 3$ kV,
$P_{oh} < 200$ kW,
$P_{rf} < 2$ MW CW
<10 MW pulsed,
$P_{nb} < 200$ kW (fueling, pulsed)



Construction Costs (total): **$ 3 M (over 2 years)**

Introduction

This presentation illustrates the Electric Tokamak pinch discharges results obtained since the 1999 APS meeting.

ET state for APS 1999

Monitoring Devices

RF loading

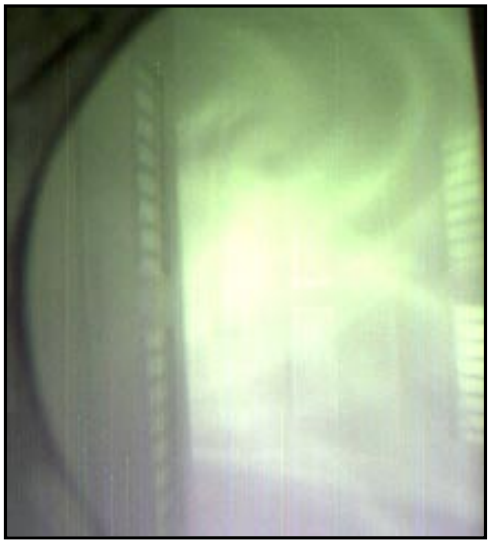
Light monitors

Interferometer

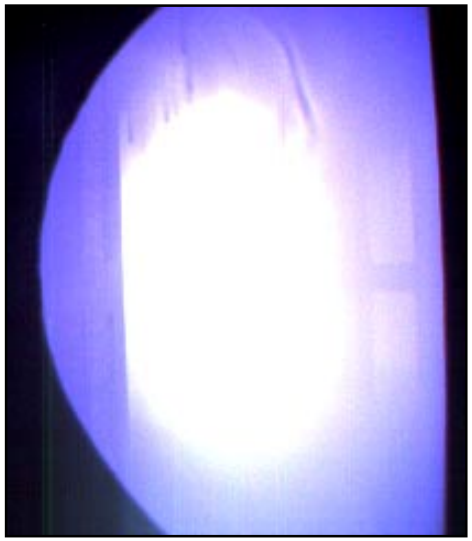
Voltage monitor

Current monitor

CCD cameras



Filamentation June 1999



Pinch February 2000

Vacuum Quality

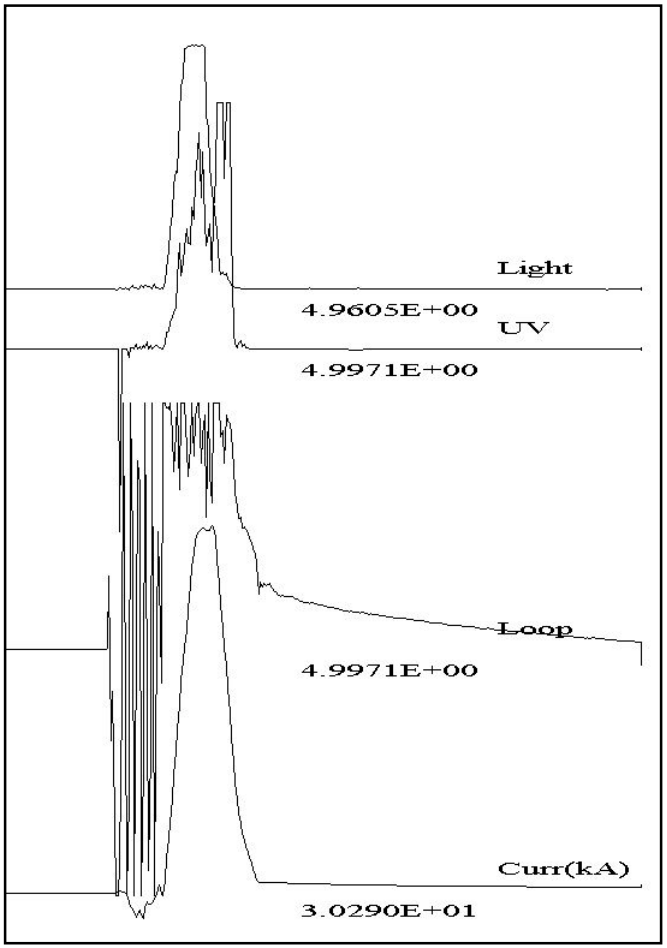
TiBalls

•Vacuum integrity is insured by four pumps and turbos
•Vacuum quality is maintained by discharge cleaning and TiBalls

Today's vacuum :

- N : 6.71 10^{-9} torr
- H_2O : 2.27 10^{-7} torr
- N_2 : 2.61 10^{-8} torr
- O_2 : 2.71 10^{-9} torr
- CO : 2.76 10^{-9} torr

Low density Pinch



300 Gauss Toroidal Field

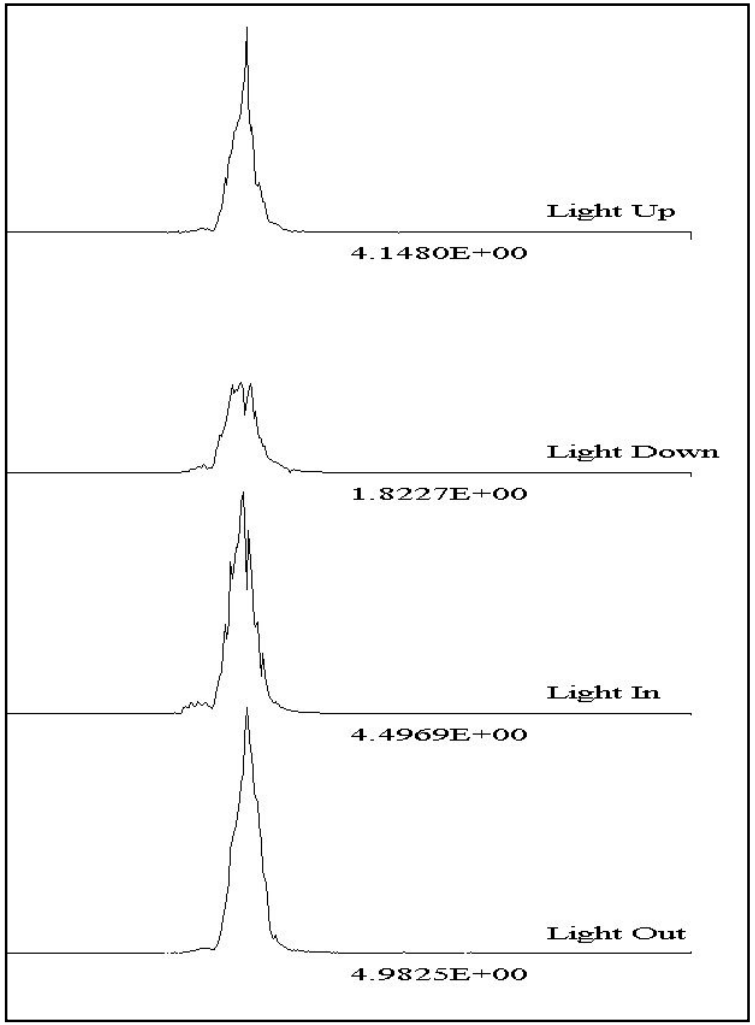
Hydrogen Pressure 2.10^{-5} Torr

Primary Voltage 3kV

Secondary Voltage 200V

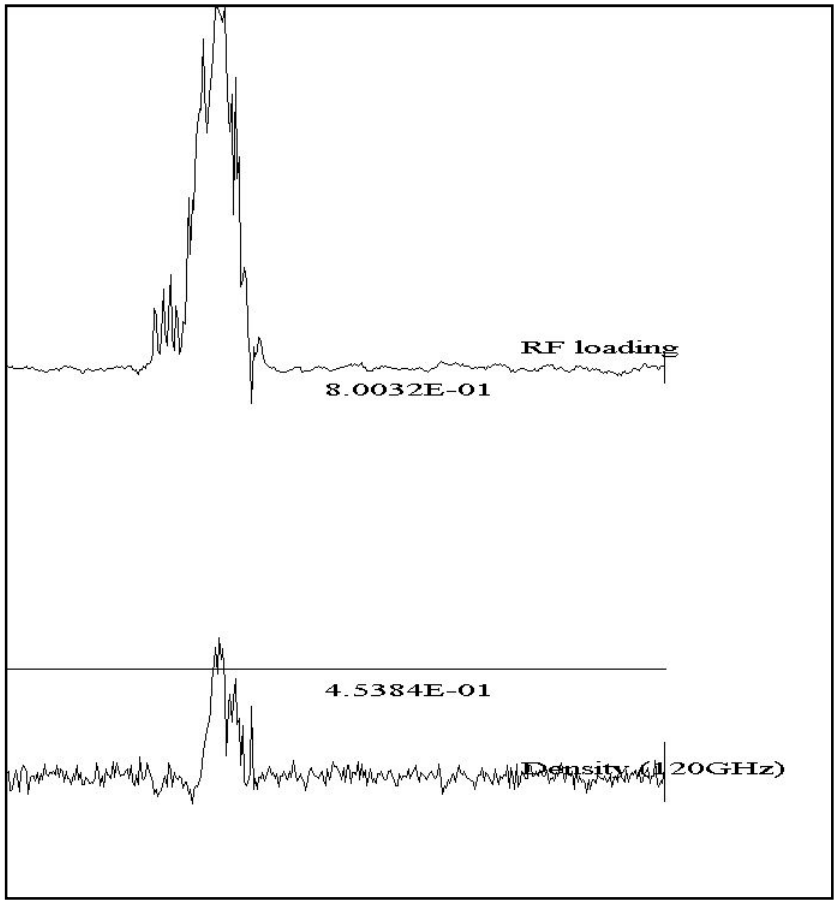
Discharge Time ~10ms

Low Density Pinch

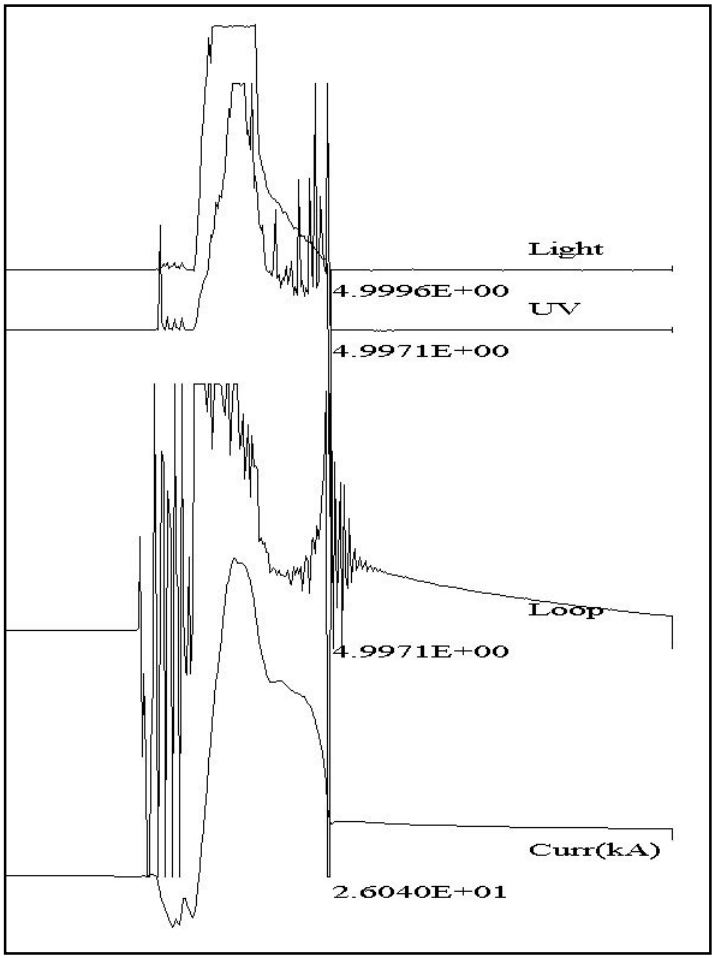


RF Inboard loading 9MHz/300Ohms

Interferometer @ 120GHz



Medium density Pinch



300 Gauss Toroidal Field

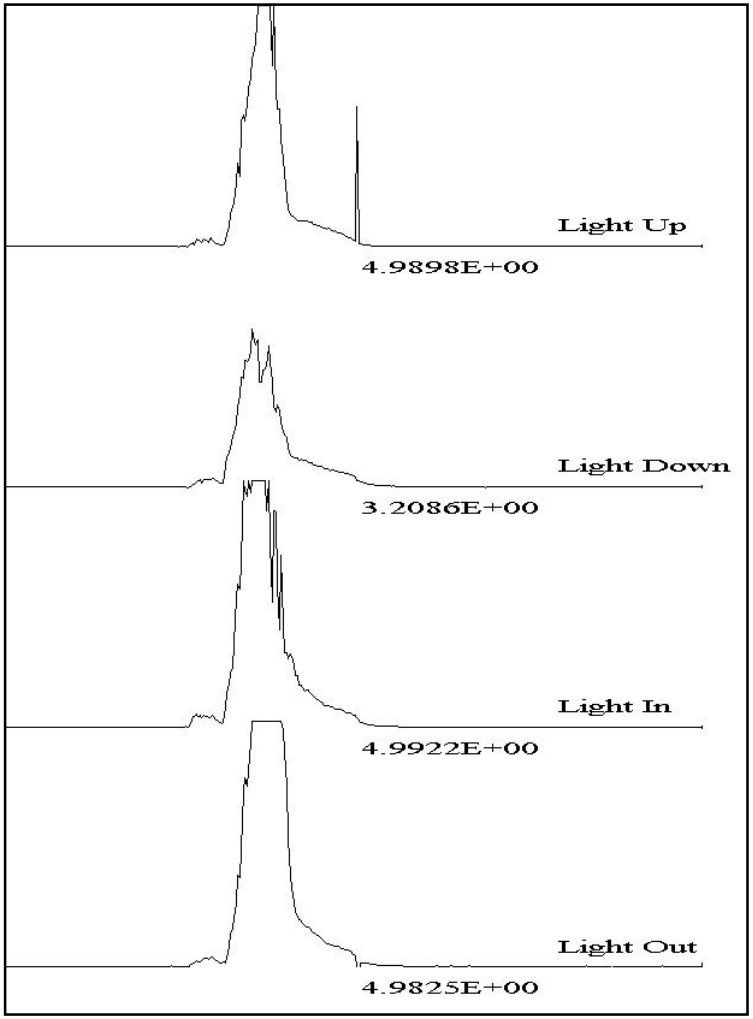
Hydrogen Pressure 2.10^{-5} Torr

Primary Voltage 3kV

Secondary Voltage 400V

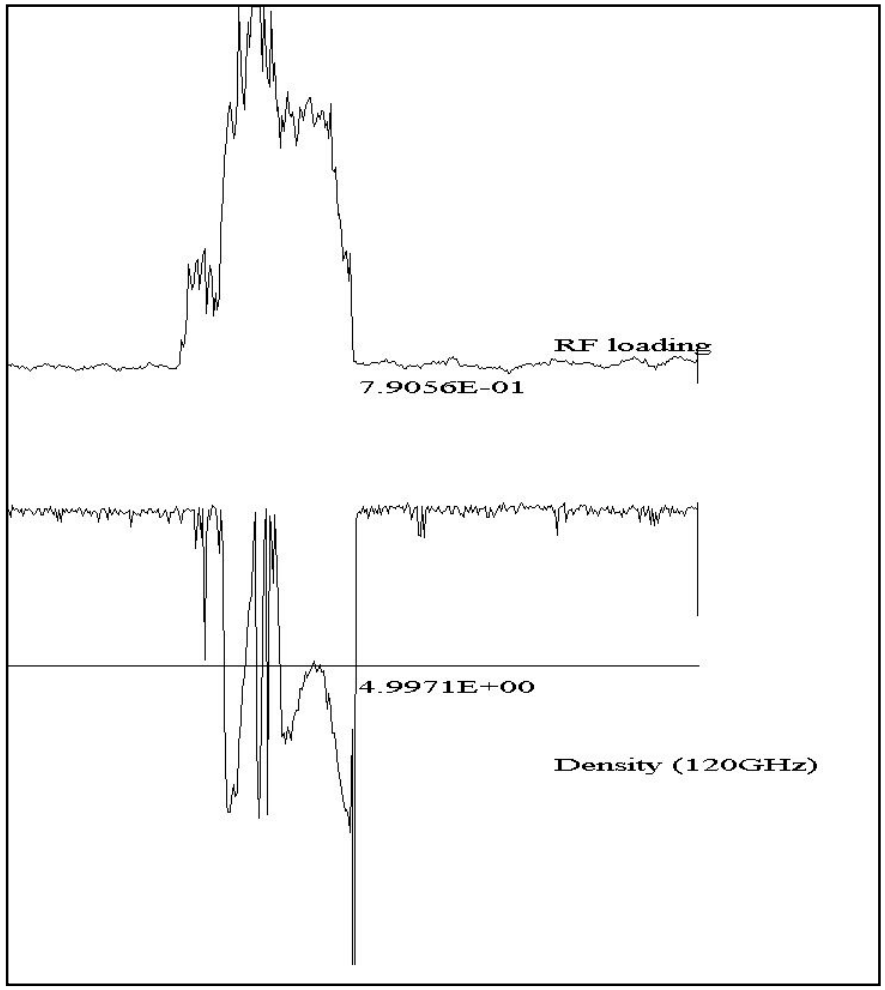
Discharge Time ~15ms

Medium Density Pinch

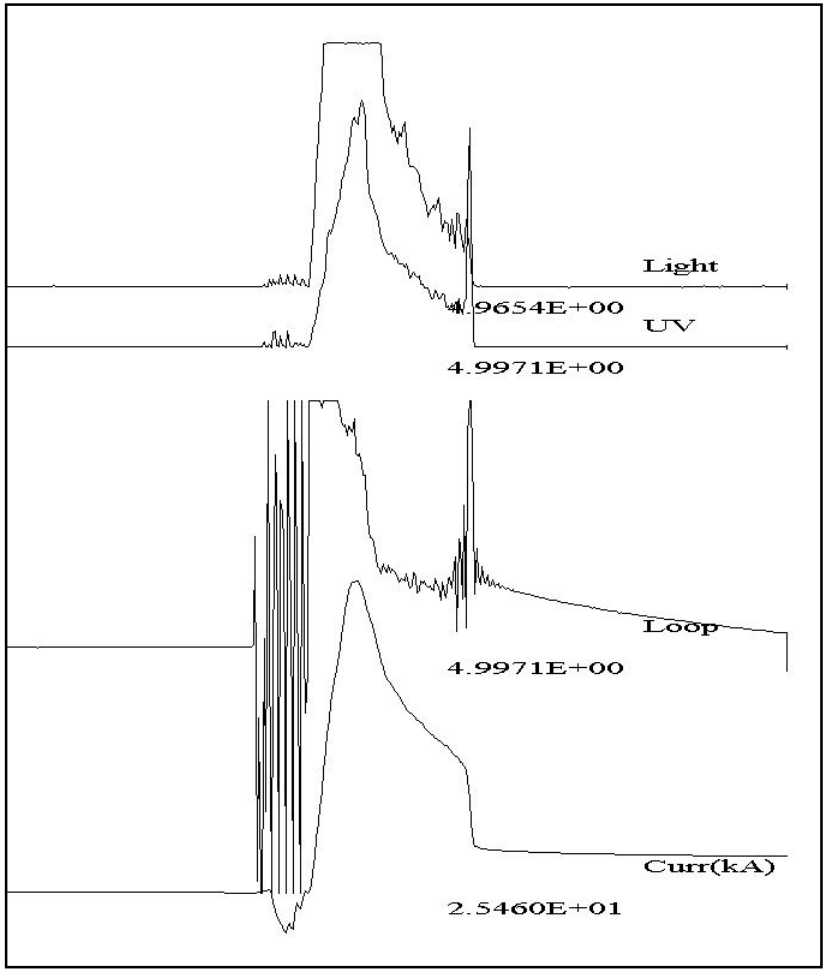


RF Inboard loading 9MHz/300Ohms

Interferometer @ 120GHz



High density Pinch



300 Gauss Toroidal Field

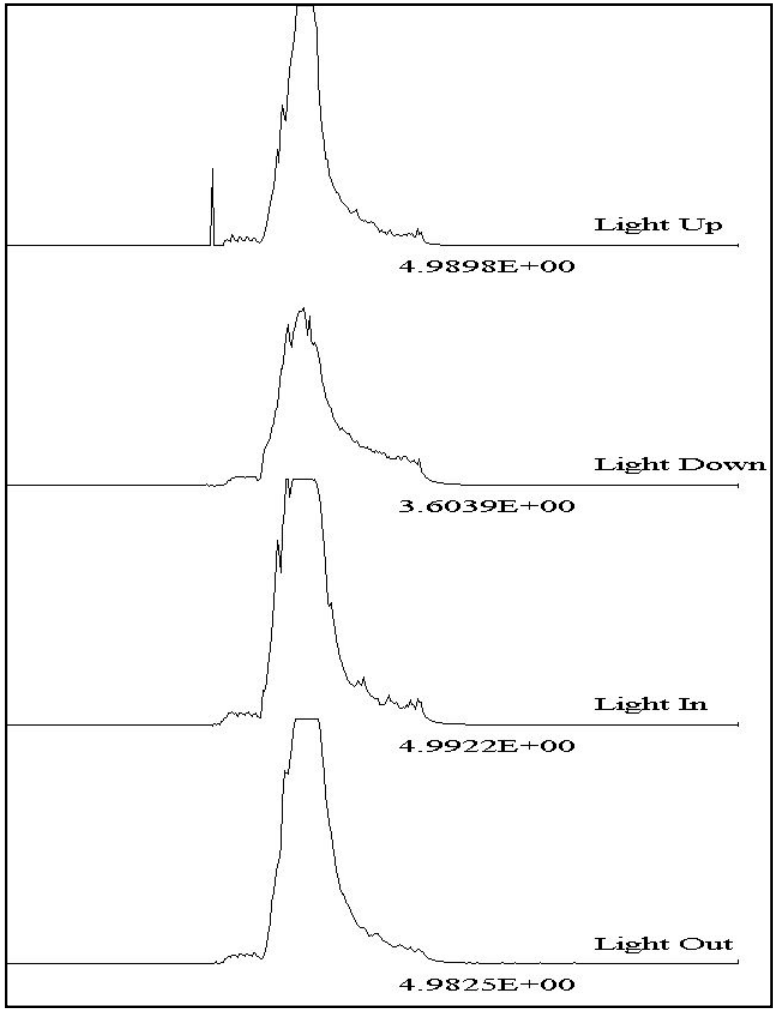
Hydrogen Pressure 4.10^{-5} Torr

Primary Voltage 3kV

Secondary Voltage 400V

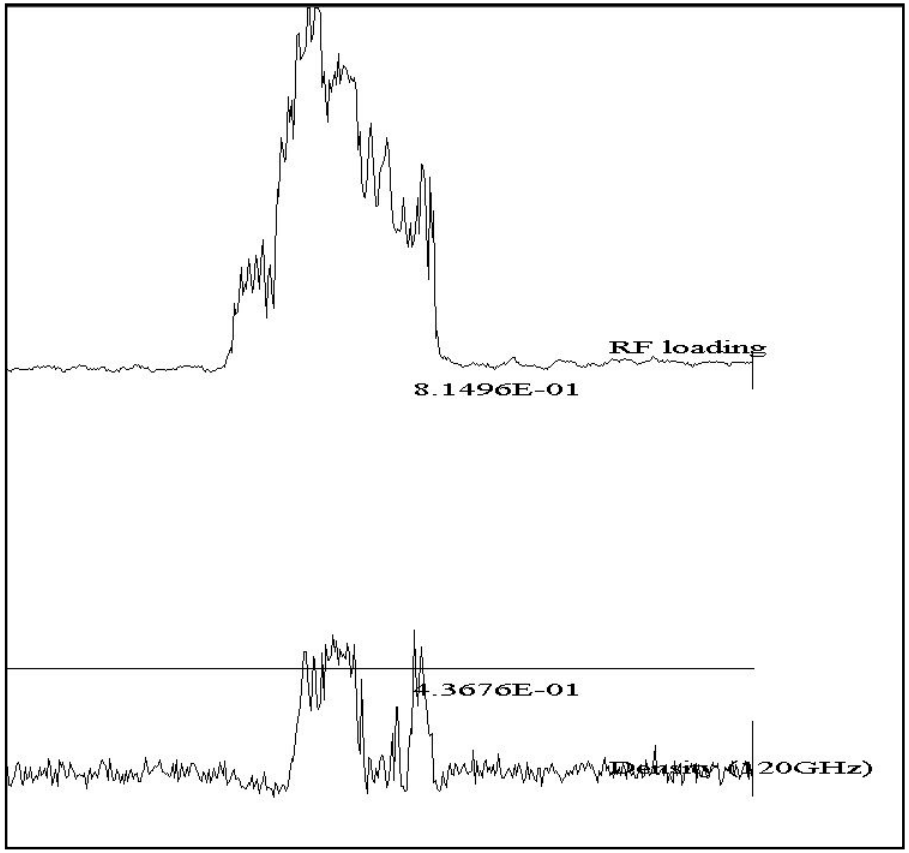
Discharge Time ~10ms

High Density Pinch



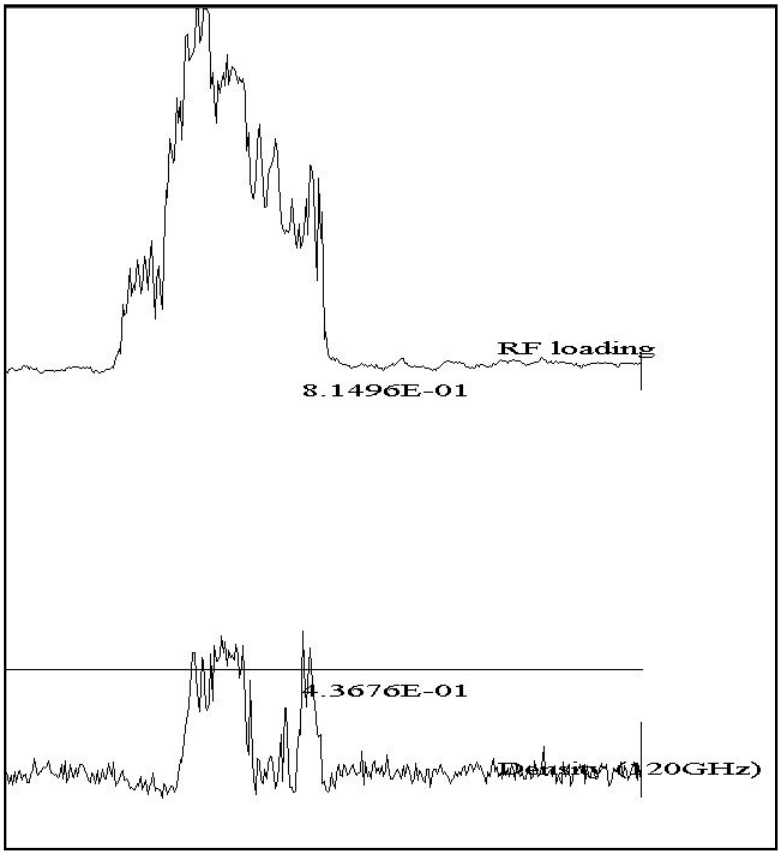
RF Inboard loading 9MHz/300Ohms

Interferometer @ 120GHz

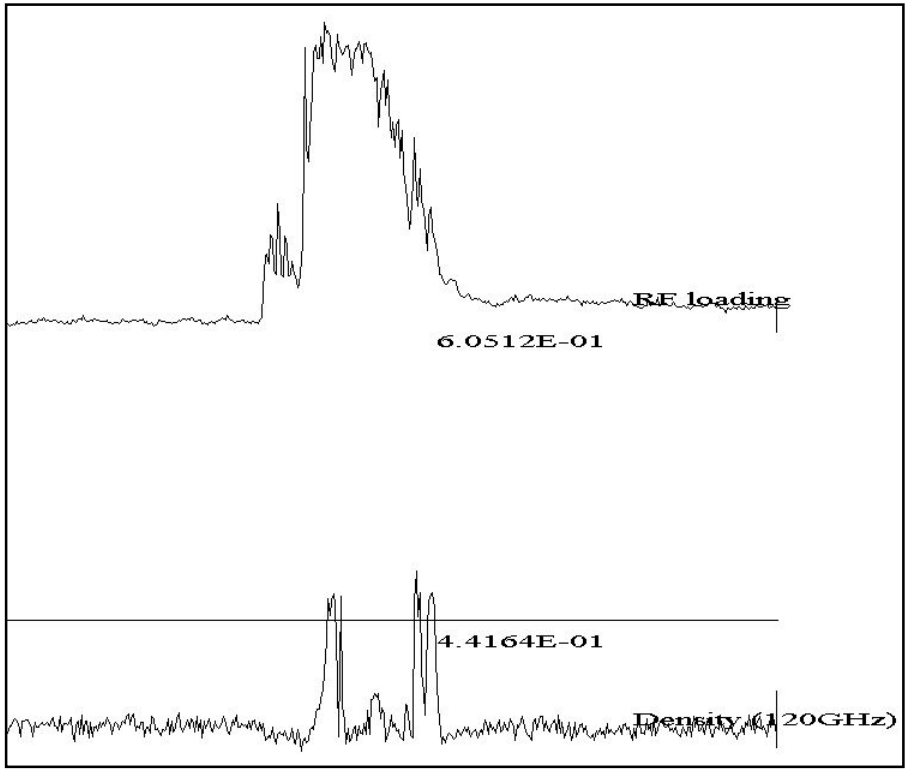


RF loading in Pinch Mode

RF inboard loading



RF outboard loading



Future Pinches

- We achieved good burn out but need better stabilization
- Offers great gas dynamics and RF loading
- Stability will be improved using
    - Cusp stabilization
    - RF stabilization