Status report on the 60 GHz ion source investigations

1) LPSC Grenoble plans

Presentation from T. Thuillier

1) Nizhniy Novgorod group

Slide from V. Zorin

Pierre Delahaye CERN/ISOLDE

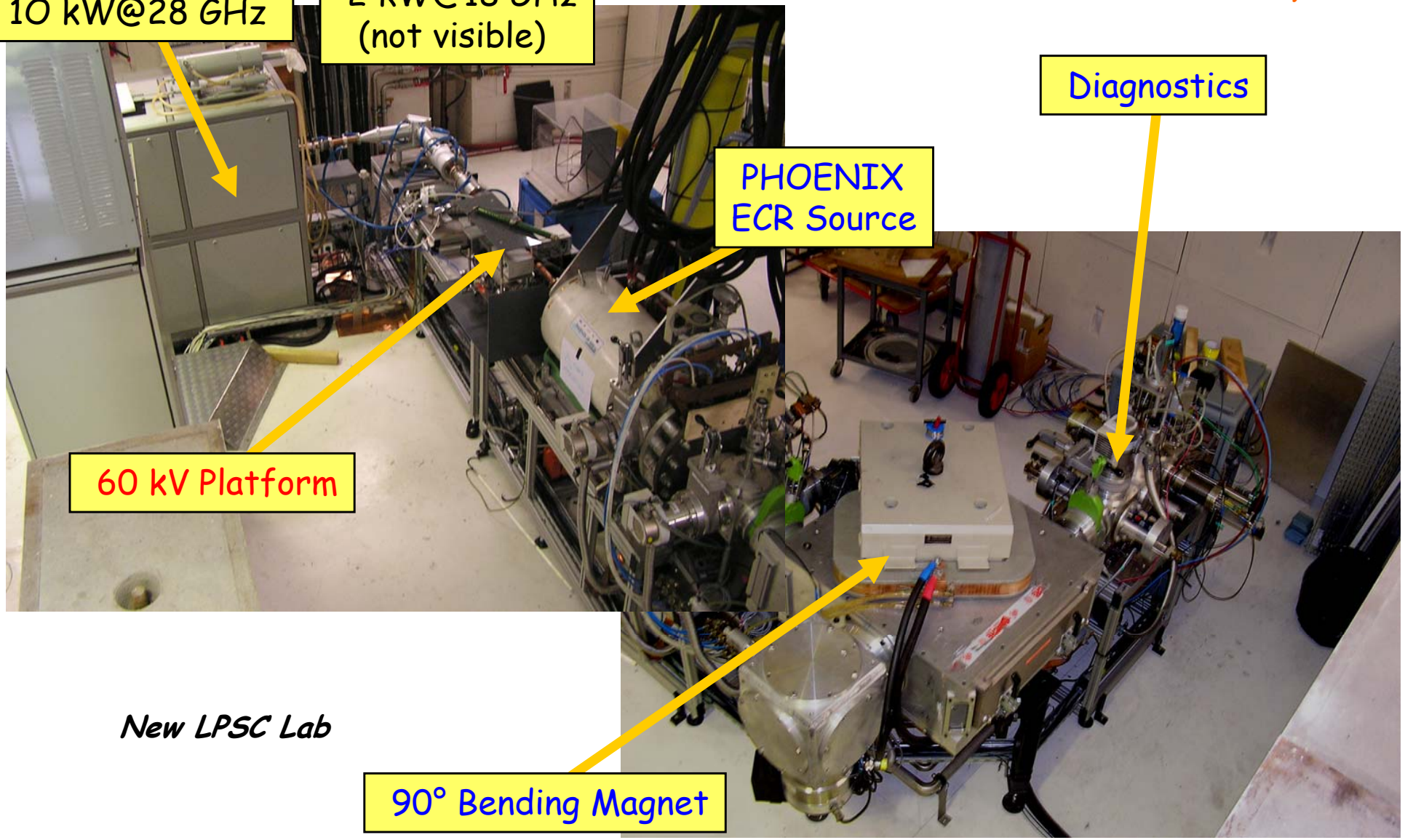
β-beam workshop, Saclay, 2005-10-17

LPSC Planning for the first 18 months

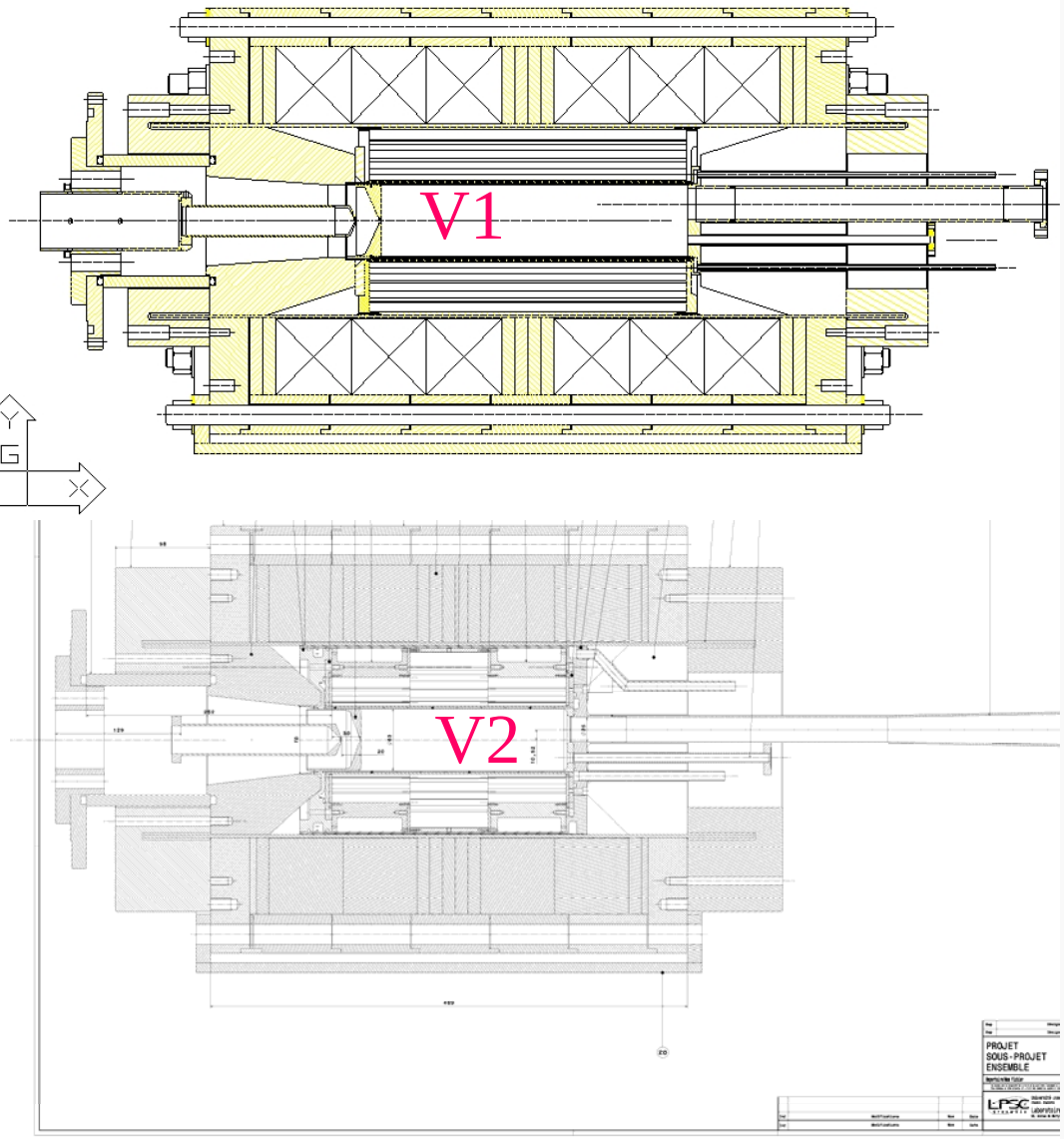
- PreGlow Study at 18 & 28 Ghz with the Phoenix ECR source
  - Gaz efficiency ionization study, vs :
    - ✓UHF Frequency 18 & 28 GHz
    - ✓UHF pulse power
    - ✓UHF pulse period
    - ✓UHF pulse duty cycle
    - ✓ plasma electrode Ø,
    - ✓ for ^{3}He and ^{22}Ne
- Intermediate report at T_0+12 months
- Report at T_0+18 months

At T_0+18 : 60 GHz Gyrotron order? with technical specifications depending on to the Report results

High Current ECR Test bench



PHOENIX upgrade V1->V2 (spring 2005)



- New compact hexapole : ~1.3 T at plasma chamber wall
- more compact plasma chamber (Ø 64 mm, L~240 mm)
- Same axial magnetic field => higher Bz gradient
- Higher security margin to hold safely 60 kV.
- 28 GHz waveguide reduced to 25 mm Ø
- enhanced Water cooling system (helicoid flow)

LPSC activity report T_0+10 months

- PHOENIX V2 upgrade

- Summer 05 : PHOENIX V2 commissioning at 18-28 Ghz

  - Power supply breakdown of 28 GHz : 3 monthes lost
  - commissioning skipped to 18 Ghz (CW)

  - ^{4}He study of ionization efficiency => abandoned (peak contamination with O,C)

  - ^{3}He and ^{22}Ne bottles have been ordered

- Autumn 05 : First experiments with ^{3}He @ 18 Ghz pulsed

We are late, but we will do our best to accelerate experiments
Participation to experiments at Grenoble are welcomed !
We look for a post-doc in 2006 on this topic

LPSC warnings on 60 GHz source -1

o 60 GHz Source needs clarification concerning the expected performances

- Pulsed Time structure in the range 100 μs is not guaranteed.
- frequency rate : 10 Hz ok
- CHARGE STATE expected for Ne :

Even at 60 GHz, Neon beam will be composed with several charge states. At best, One can expect to have 20%-30% on one specific charge state (Ne5+ for instance).

- Ionic current expected?

Beam will not be space charge compensated, special extraction system has to be designed to extract high currents

LPSC warnings on 60 GHz source -2

o 60 GHz Source needs clarification concerning its magnetic structure

- a minimum B structure would be safer :

3-4 T hexapolar field by means of *pulsed copper coils*

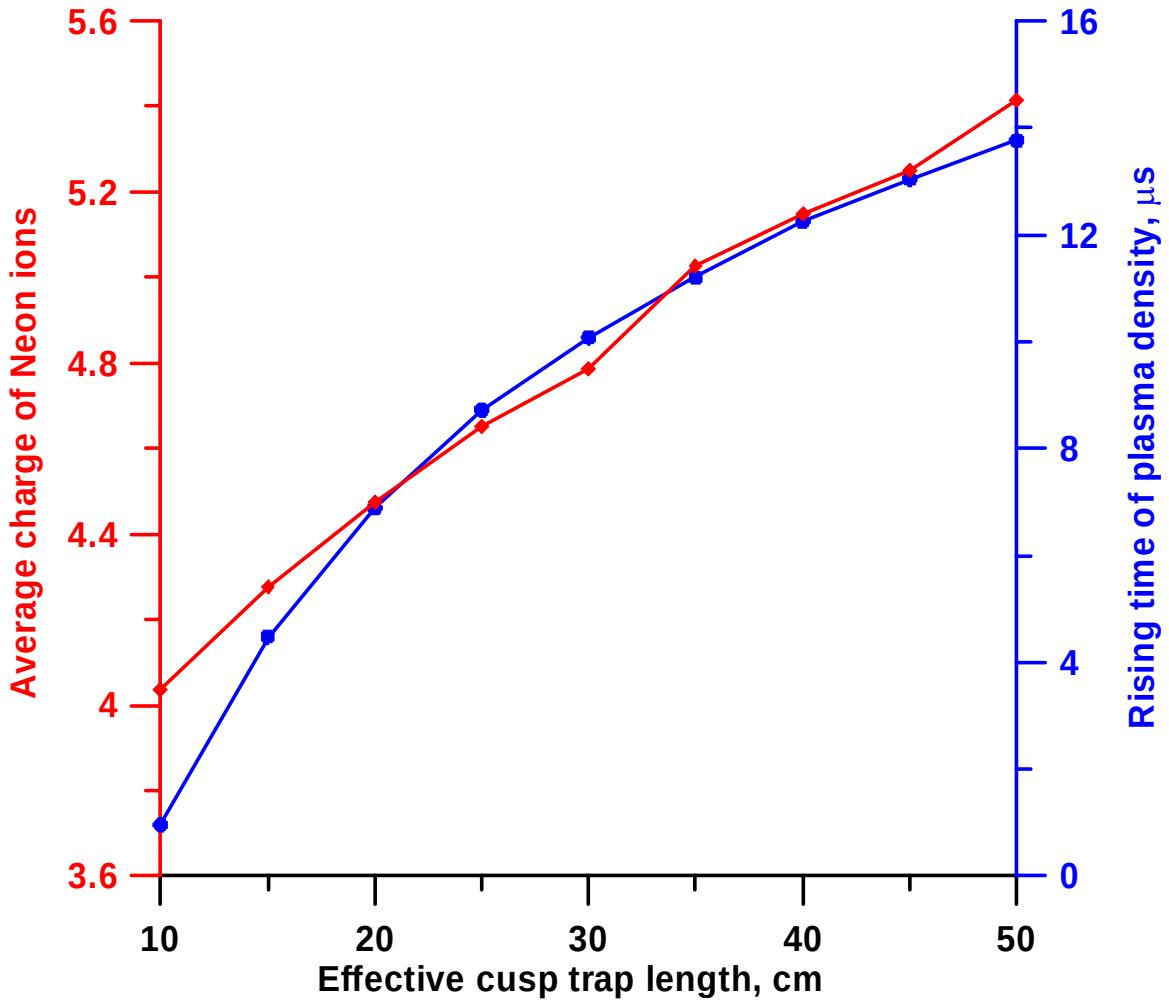
- pulsed copper coil to make 6-8 Tesla axial field

→ *very high pulsed, high power, current generator necessary*

ECR Ion Source, 75 GHz, 400 kW, Nizhniy Novgorod

Design of a cusp magnetic trap for gasdynamic ECR ion source for Beta Beam Project

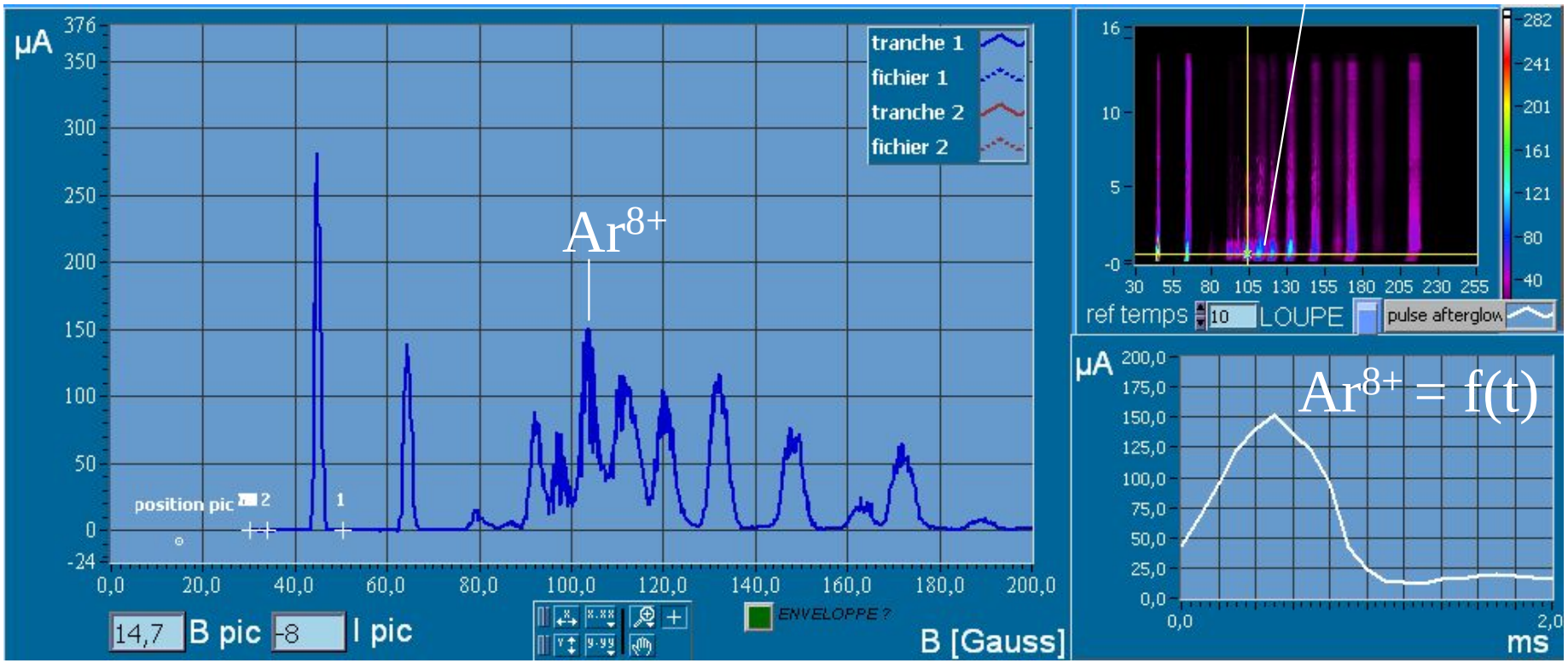
Average Neon ion charge in plasma and plasma density rising time up to stationary level versus effective cusp trap length



PHOENIX 28 GHz / 1 KW / 15 ms UHF at 4 Hz
(Φ 6mm /20 KV/ monogap/ Argon gas)

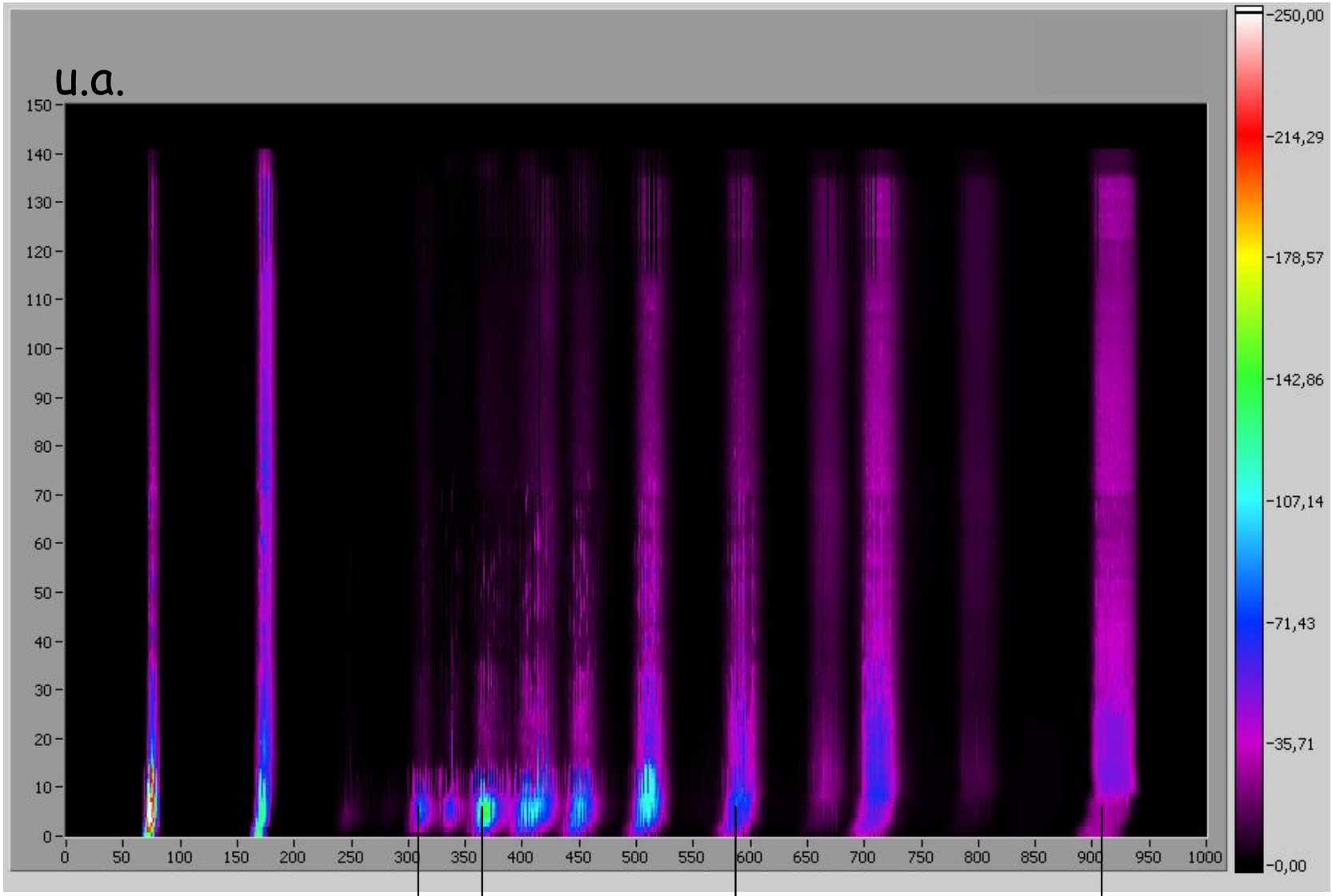
« Pre-glow » of Ar during 1 ms
At the beginning of a 15 ms UHF bunch

Spectrum at t=400 µs



400 µs rising time of Ar^{8+}

PHOENIX 28 GHz preglow effect

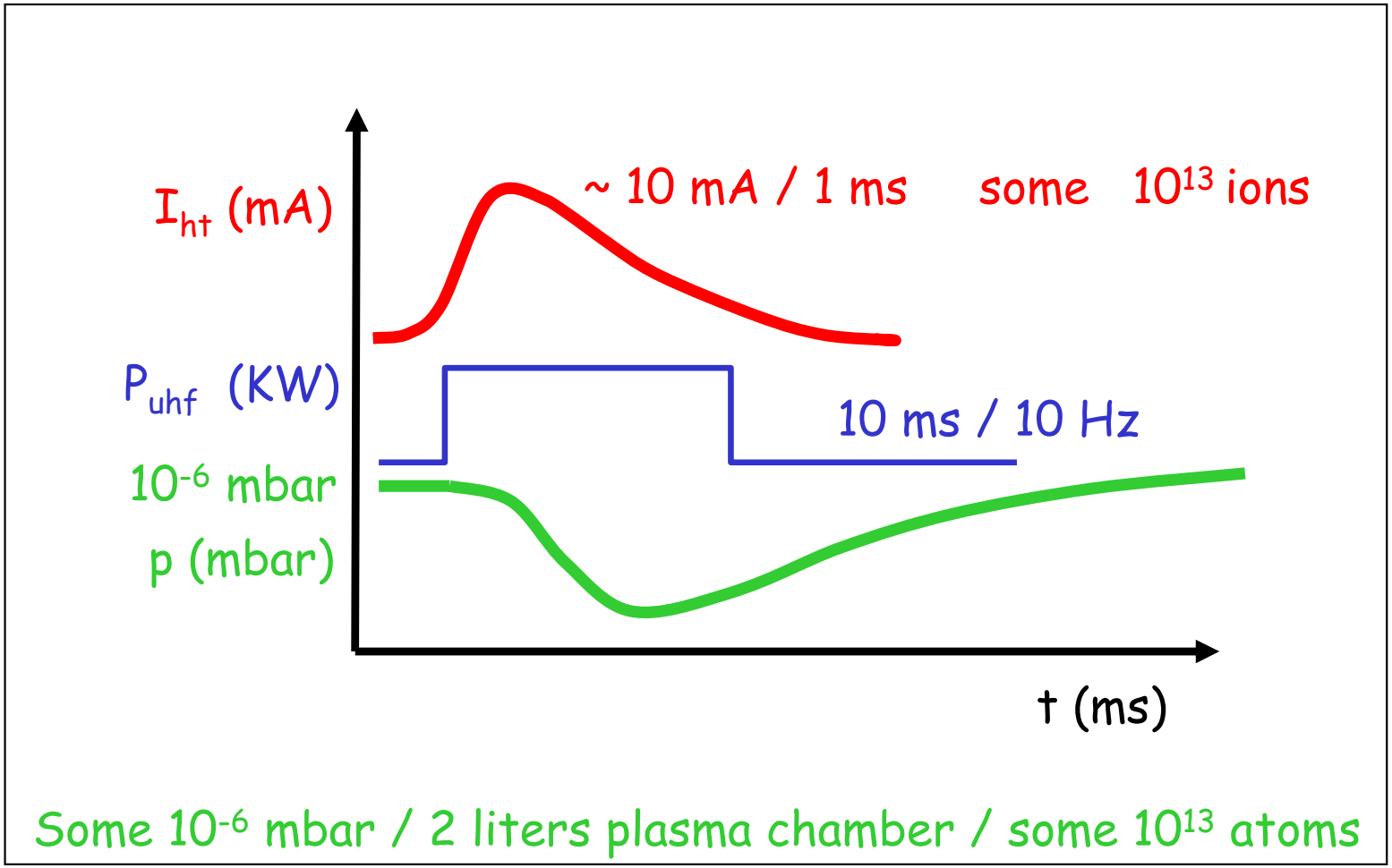


Low pressure Discharge i.e. low density without MCI

Pre glow with MCI

H^+ H_2^+ Ar^{9+} Ar^{8+} Ar^{4+} Ar^{2+}

PHOENIX 28 GHz ionic pumping during preglow effect



Some 10^{-6} mbar / 2 liters plasma chamber / some 10^{13} atoms

Proposed by Pascal Sortais, but he's gone

This concept has to be totally revisited : anyway, preliminary study @18 & 28 GHz is mandatory

60 GHz « ECR Duoplasmatron » for gaseous RIB

Eurisol / Isolde / LPSC collaboration