TRANSVERSE BEAM PROFILE MEASUREMENTS FOR HIGH POWER PROTON BEAM

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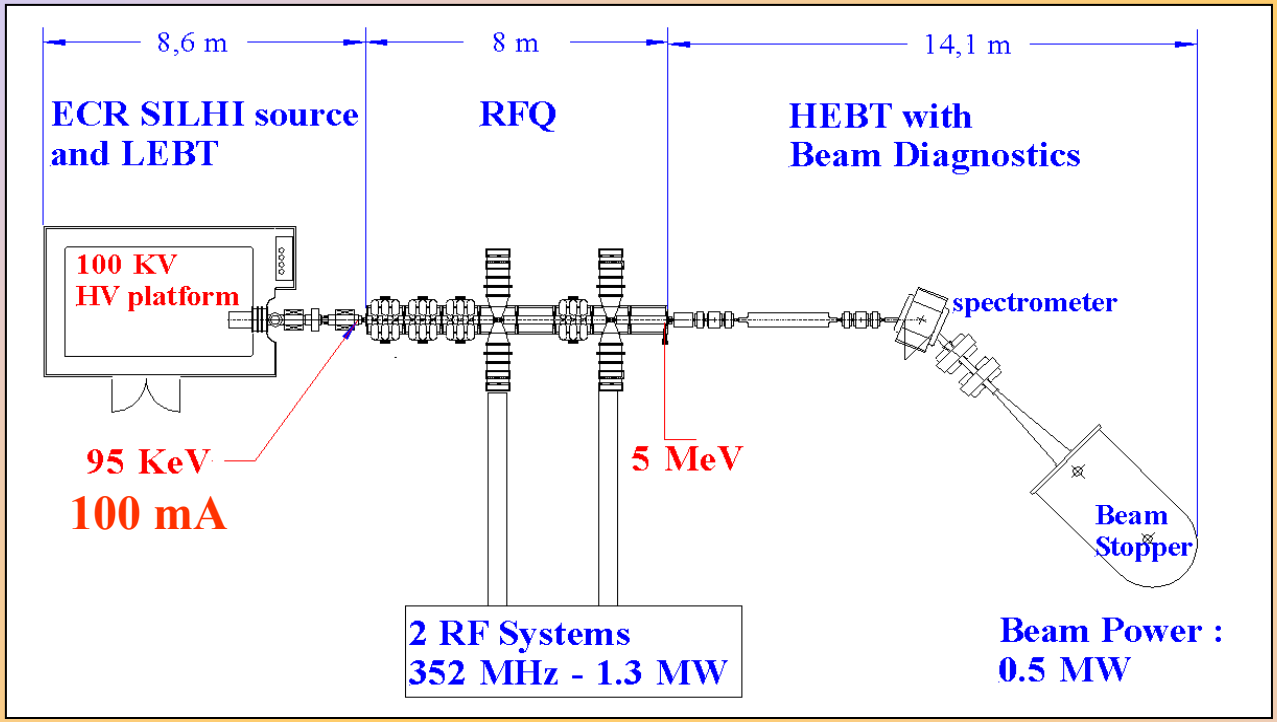
I.P.H.I. : « Injecteur de Protons Haute Intensité »



Parameters to be measured

- Intensity
- Beam position
- Energy
- Transverse Profiles

Mode Operation

- Pulsed Mode Operation (Beam Power 10kW)
- C.W. Mode Operation (Beam Power 0.5 MW)

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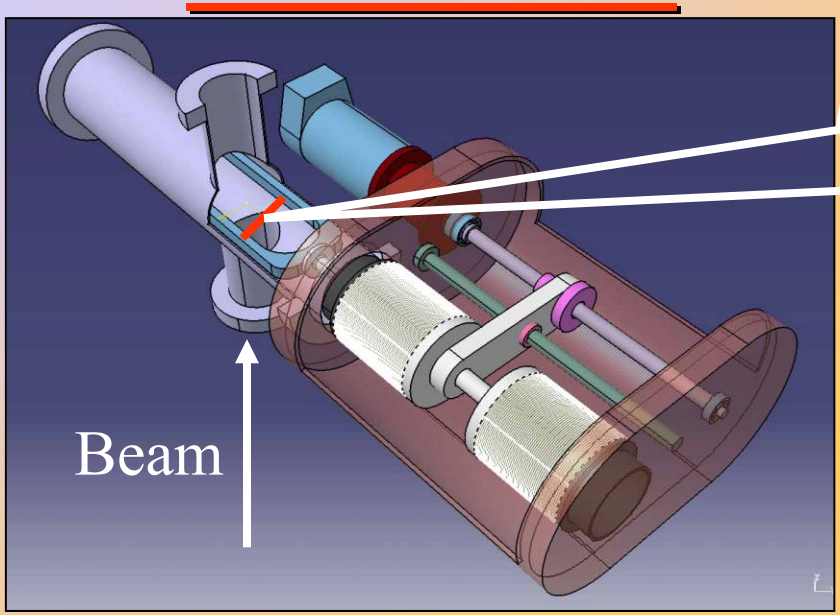
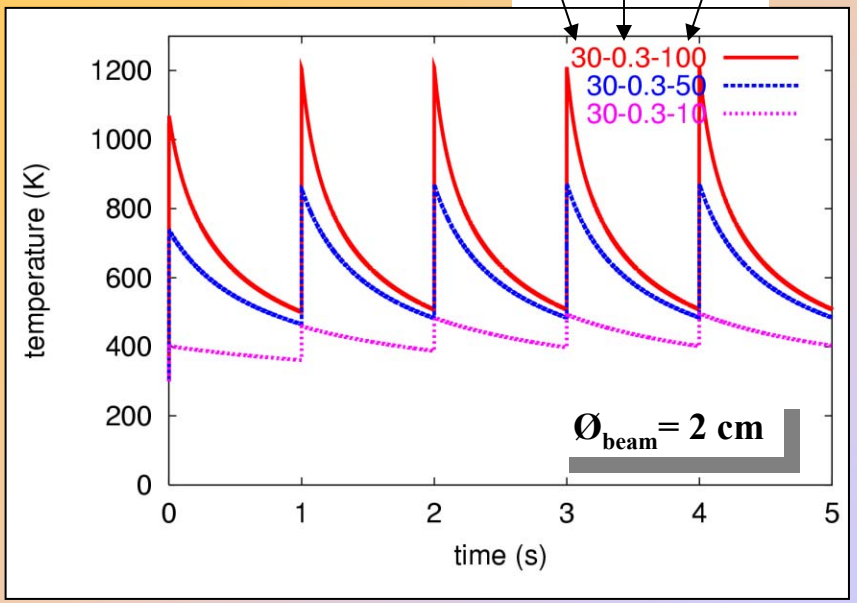
Wire scanner



Titanium
Tungsten
Tantalum
Carbon

→ Heating

Ø ; τ_b; I_b
µm; ms; mA



T > 1200 °K

↳ Thermo-ionic Emission

↳ Mechanical Deformations

→ **Distorted Measurements**

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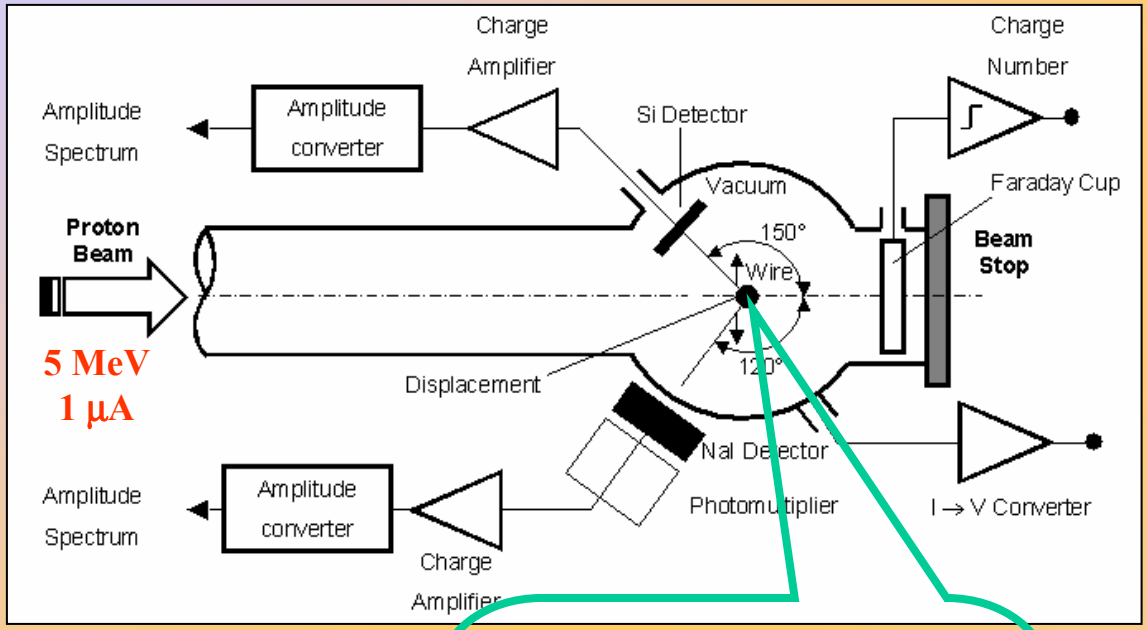
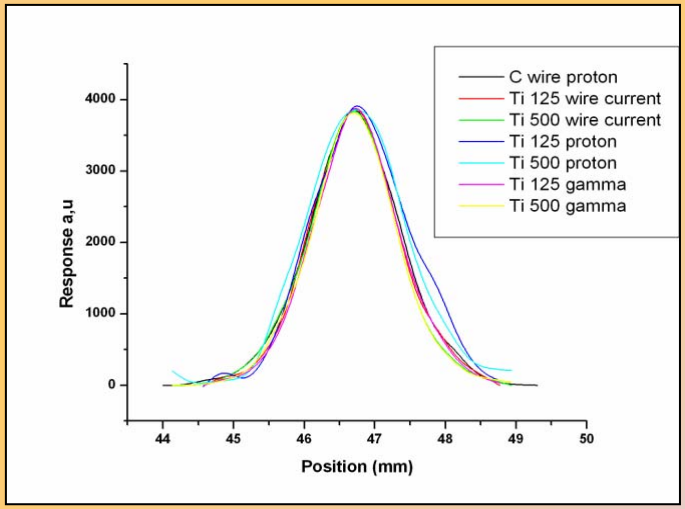
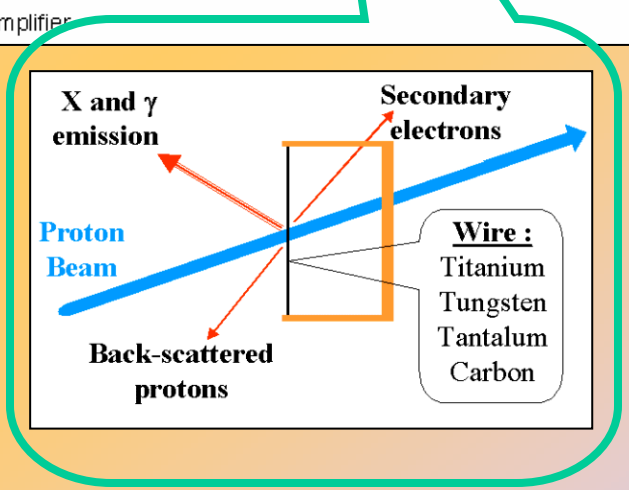
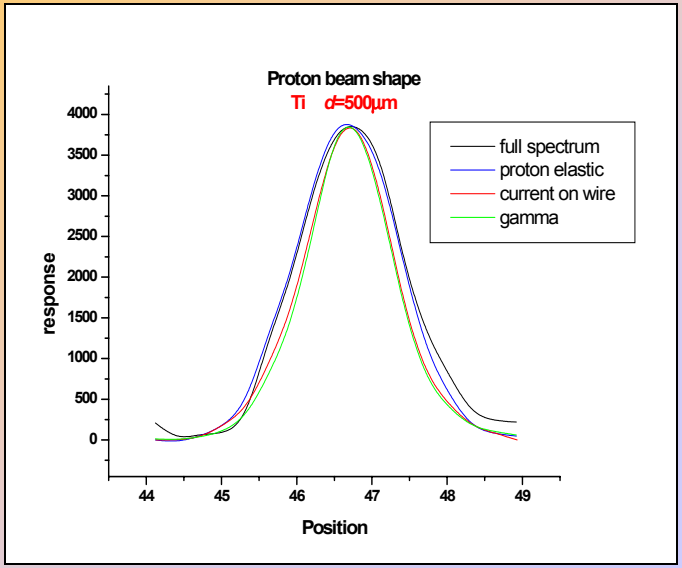
Tests I.P.N.O. : Tandem









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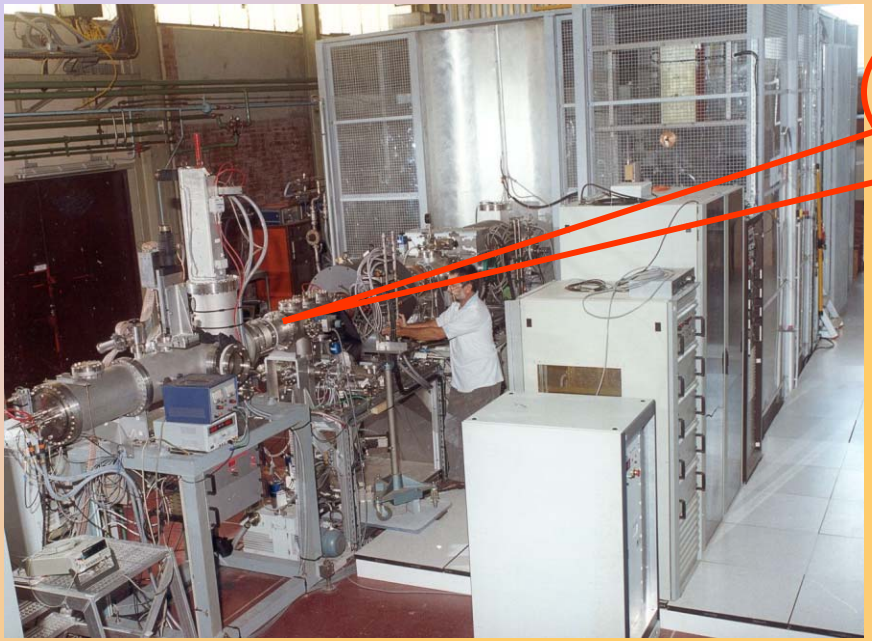
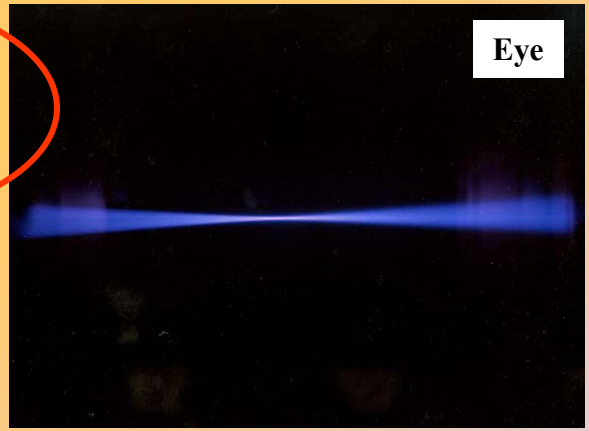
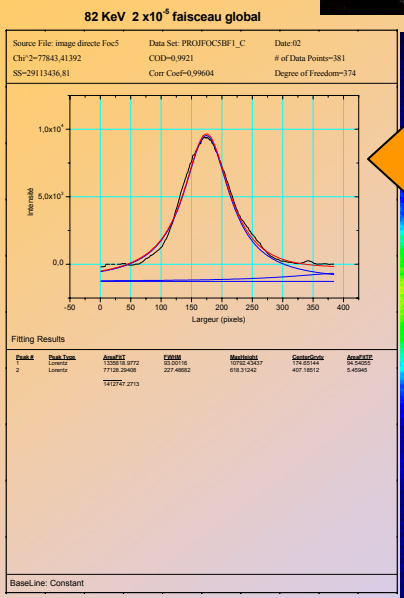
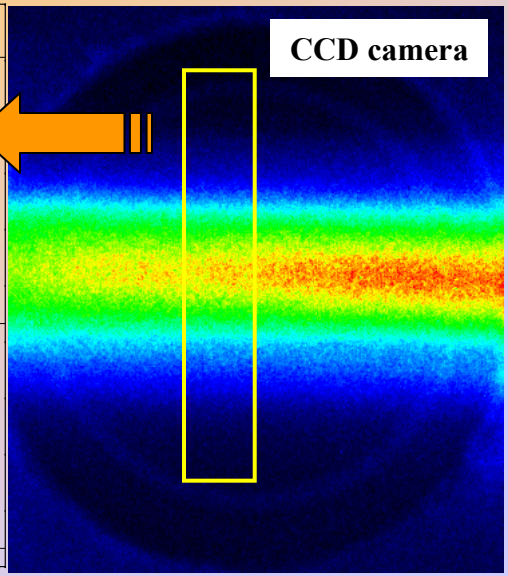
Optical based measurements : Fluorescence



"Diagnostic box"







Proton Beam-Residual Gas Interaction

(Hydrogen: 2.10^{-3} Pa)

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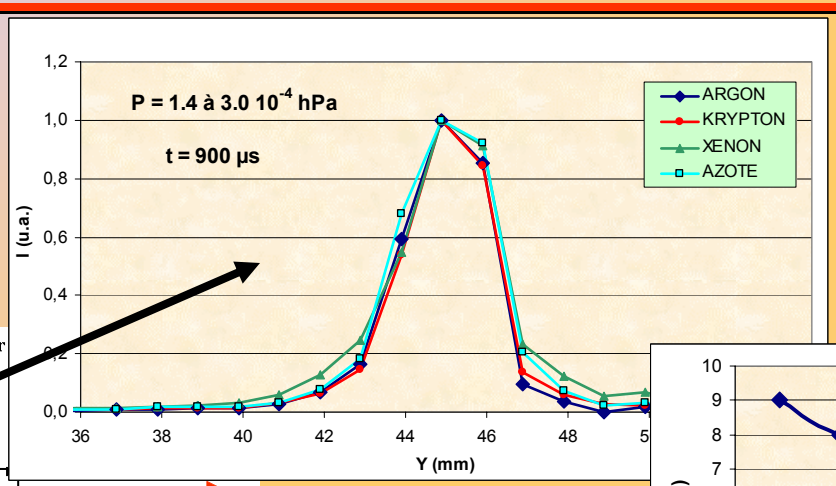
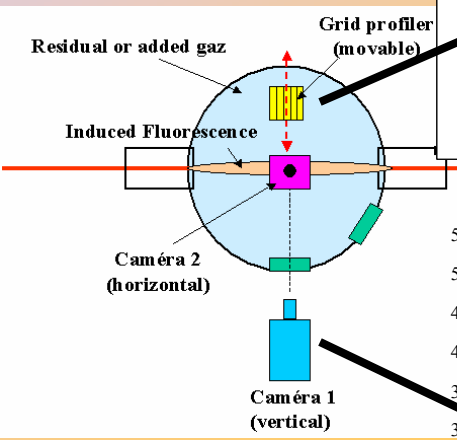
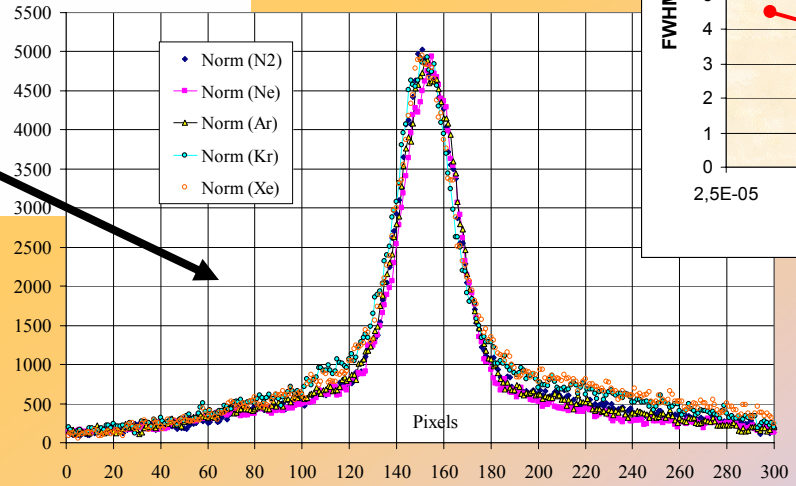
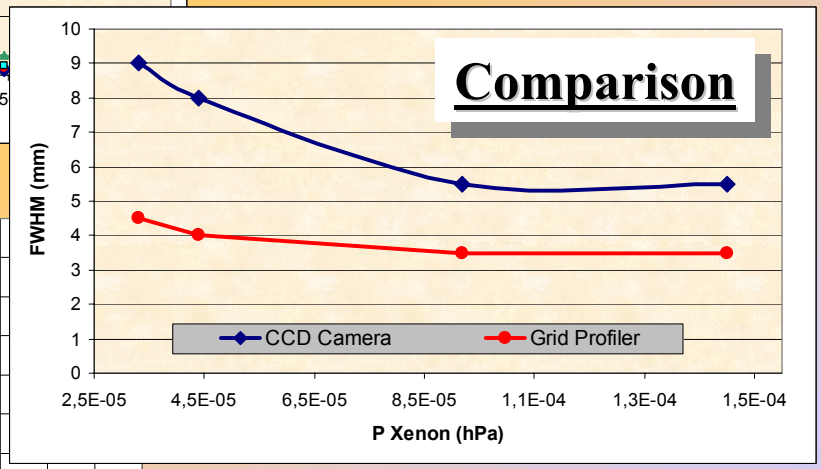
Optical Based Profiles Measurements









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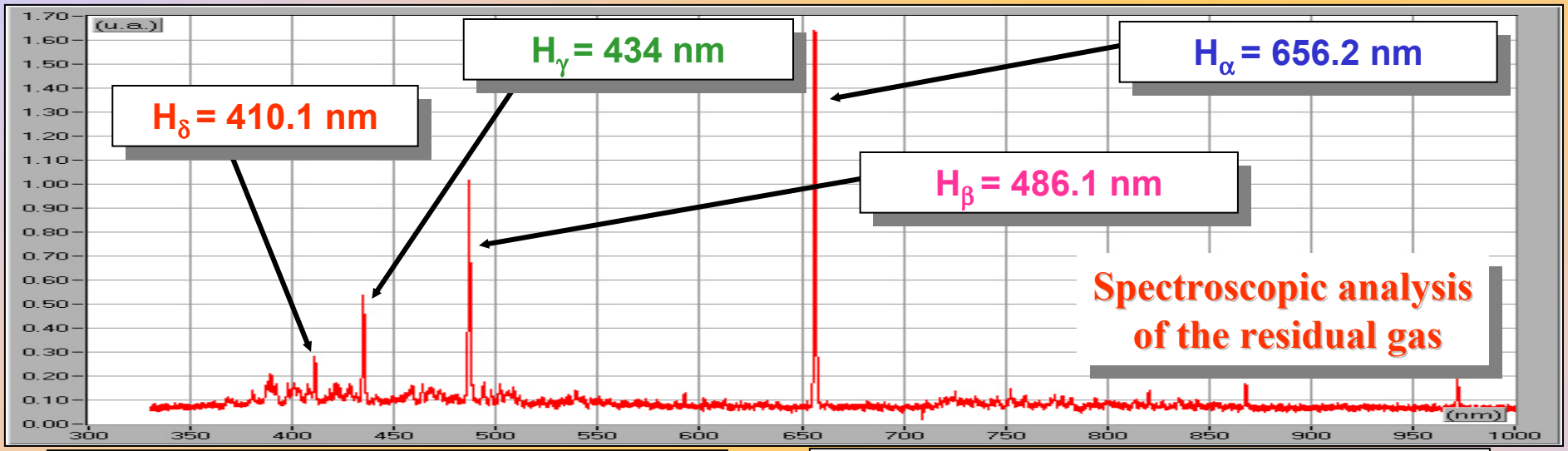
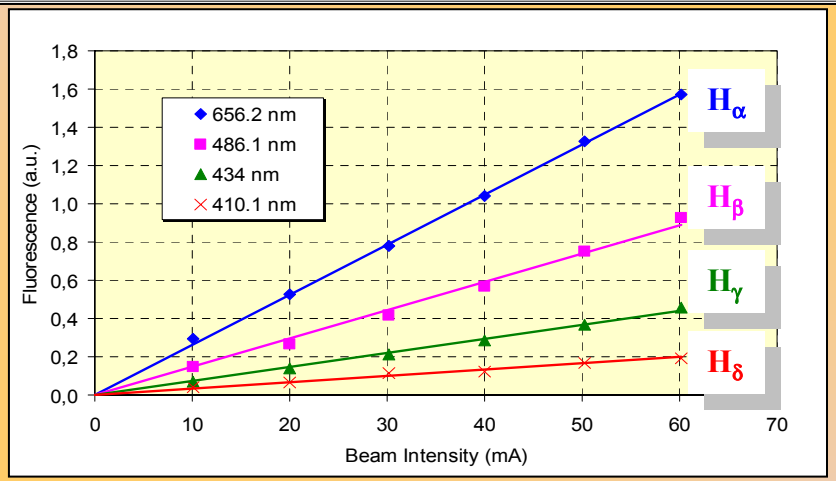
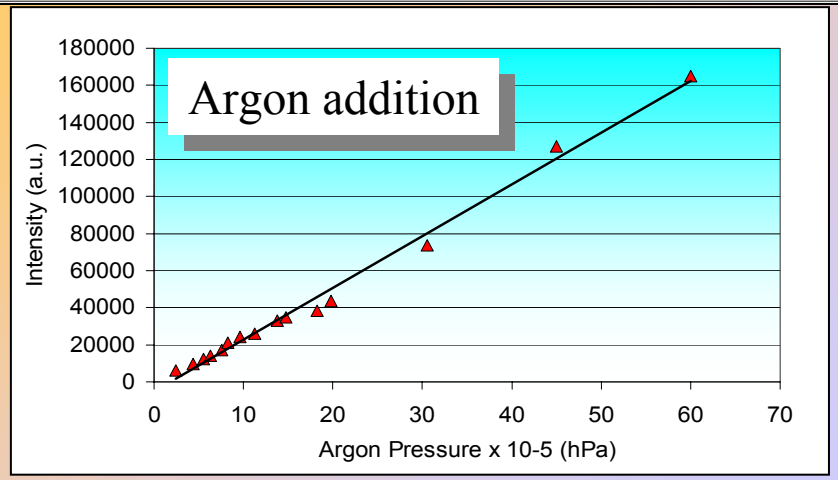
Optical based measurements : Luminescence analysis

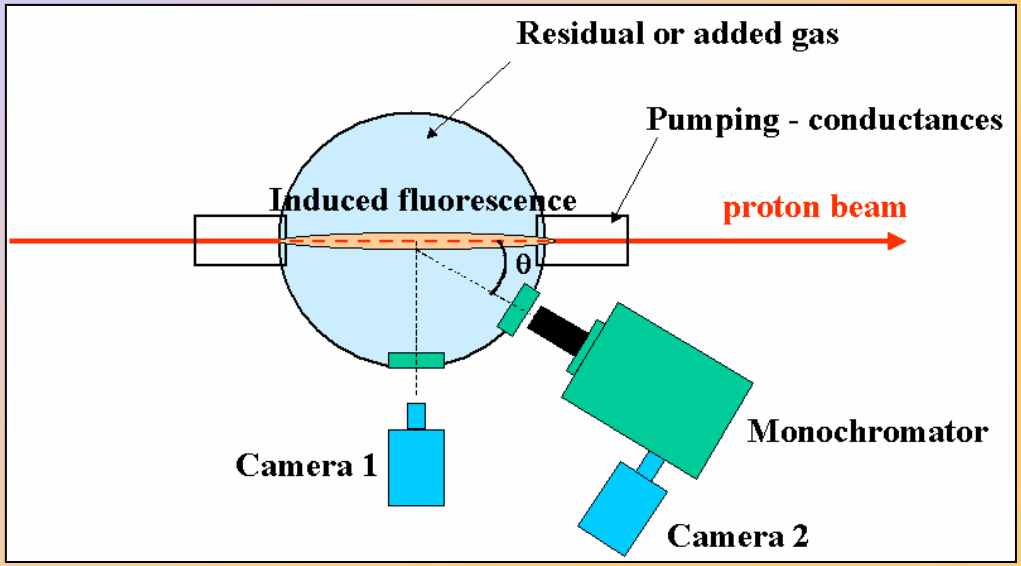




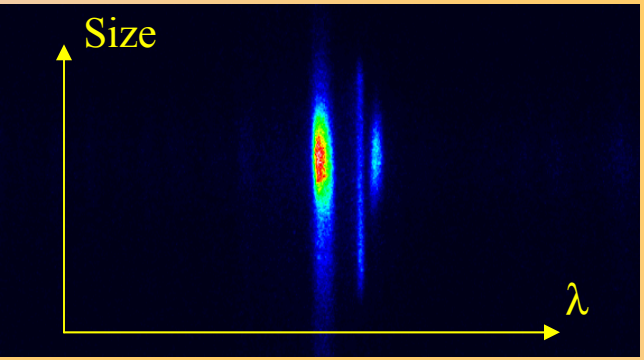


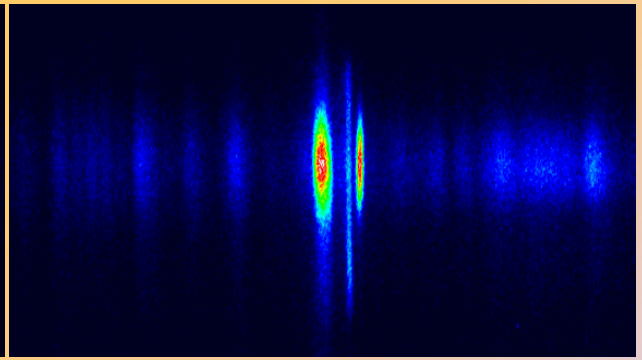
TRANSVERSE BEAM PROFILE MEASUREMENTS FOR HIGH POWER PROTON BEAM

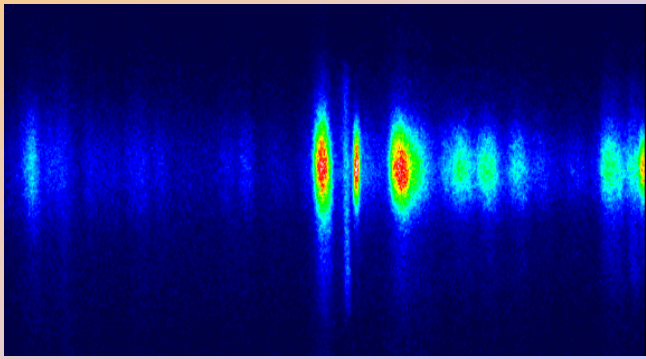
Optical based measurements : Shifted Doppler lines



$$\Delta\lambda \approx \lambda_0 \cdot {}^{v}\!/_{c} \cdot \cos\theta$$







H_α : 656.2 nm

H_β: 486.1 nm

H_γ : 434 nm

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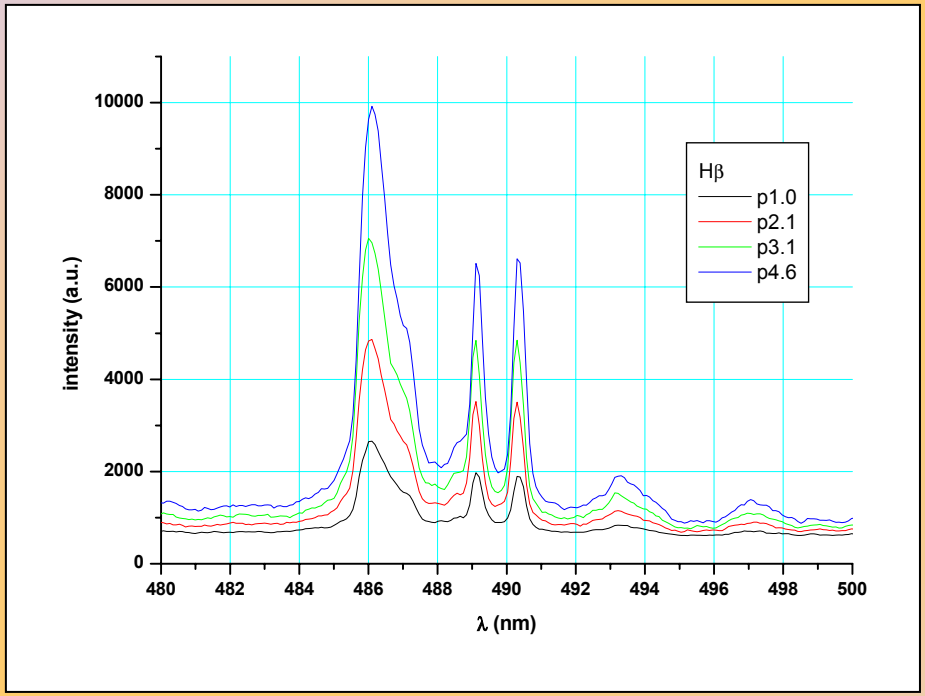
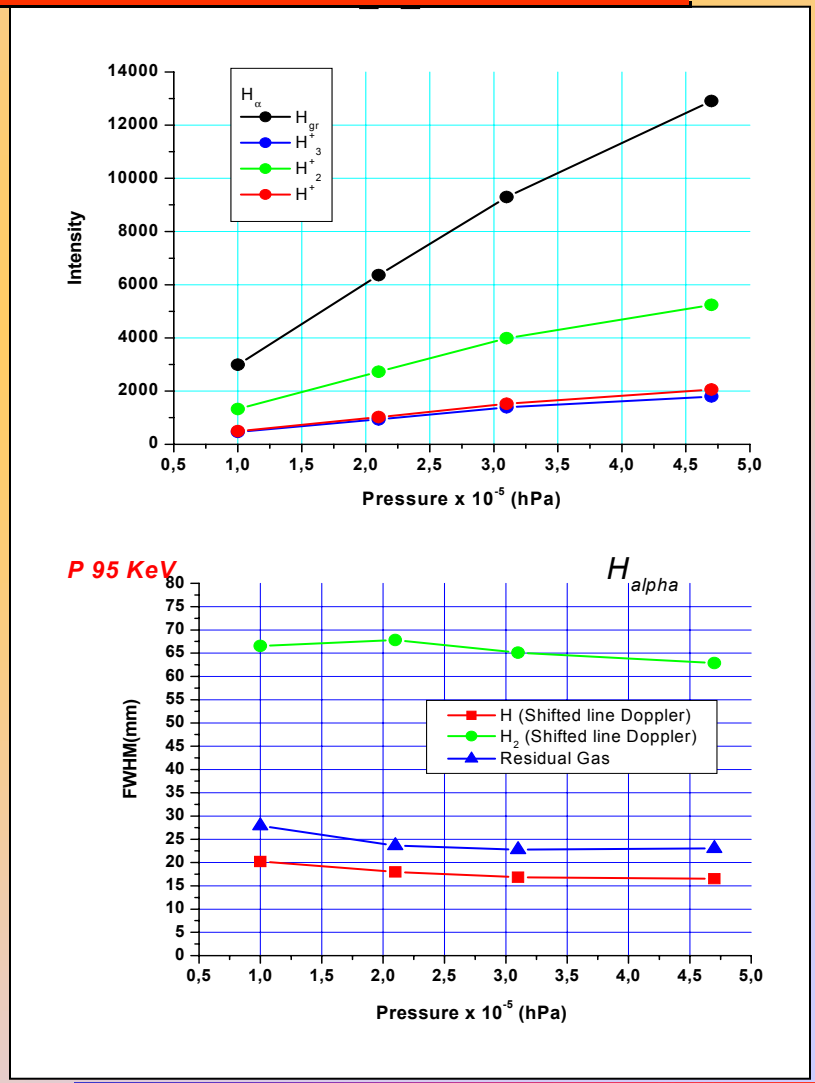
Optical based measurements : Shifted Doppler lines

Evolution with the gas pressure



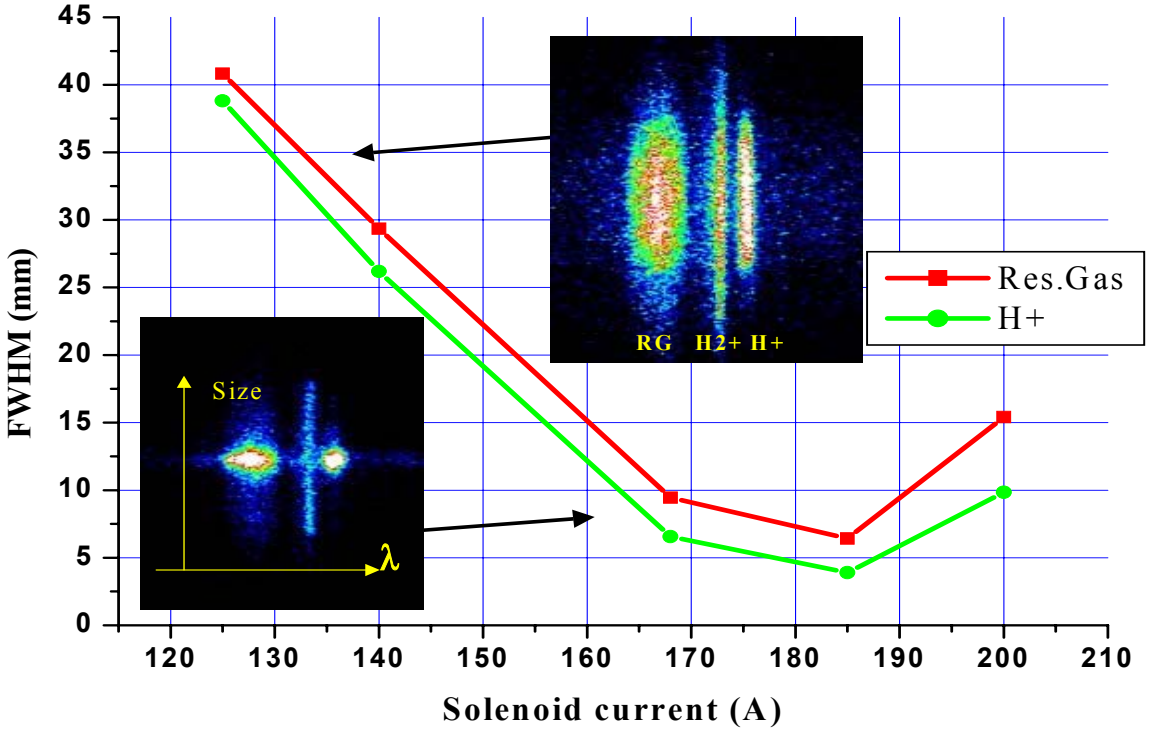


TRANSVERSE BEAM PROFILE MEASUREMENTS FOR HIGH POWER PROTON BEAM

ifted Doppler fluorescence beam profile measurement

First result on the SILHI beam

Size of the "halo" around the "core" of the beam remains constant



Conclusion

- **Wire scanner** (*low power beam*) :
  - **γ rays and back scattered protons cross check the classical measurements.**
- **Fluorescence measurements** (*high power beam*) :
  - **Beam centroid position measurements.**
  - **Qualitative beam profile measurements.**
- **Fluorescence shifted Doppler line** (*high power beam*) :
  - **Species identification.**
  - **Beam energy and energy spread.**
  - **Beam profile measurements are in progress.**

Acknowledgements

This work could not have been done without the collaboration of :

- **ACCELERATOR DIVISION (Technical support and theory)**
- **SILHI team**
- **TANDEM team**