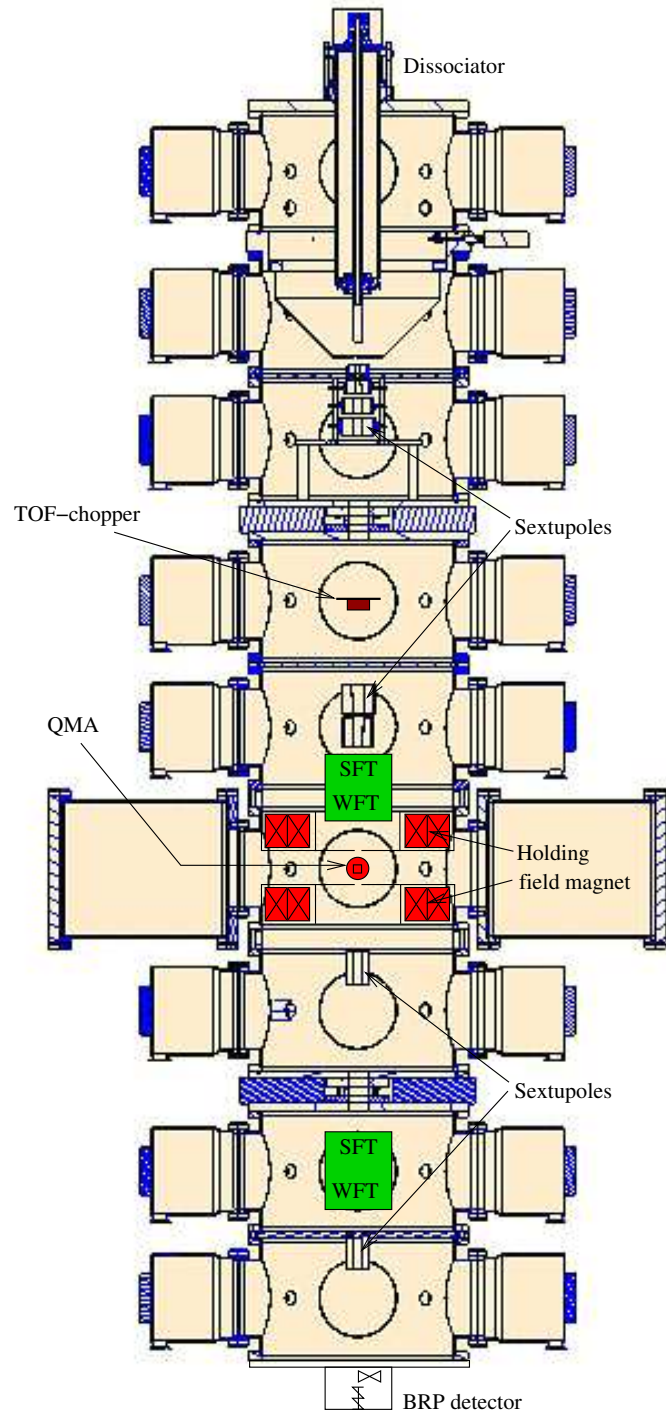


Update on the H-Jet

1. TOF measurements
2. First setup to measure the degree of dissociation using an electron gun (JET beam analyzer)



TOF Measurement

- TOF measurements done using a high frequency transition and BRP.

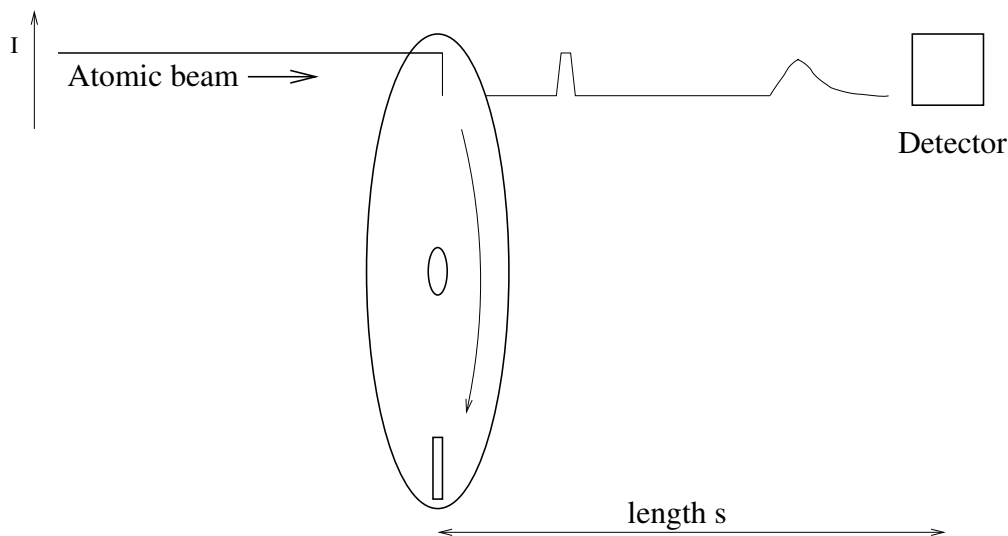
But: Velocity distribution was altered by the sextupole system of the BRP.

⇒ No clear information about velocity at IP.

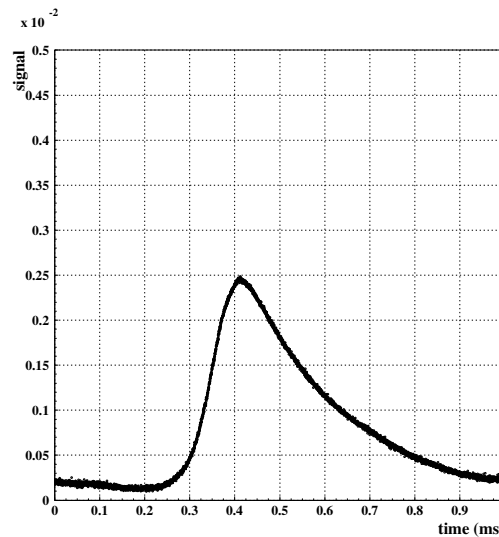
- New setup includes insertion of a fast chopper (up to 300 Hz) in chamber #4 and measurement of the TOF distribution at the IP.

⇒ Direct measurement of the velocity distribution at the IP.

⇒ Exact determination of the target density.



TOF Measurement



- Light break on the chopper gives reference time
- Time measured until atoms arrive at the QMA
- Signal is a convolution of the velocity distribution of the atoms and the so-called opening function of the chopper window

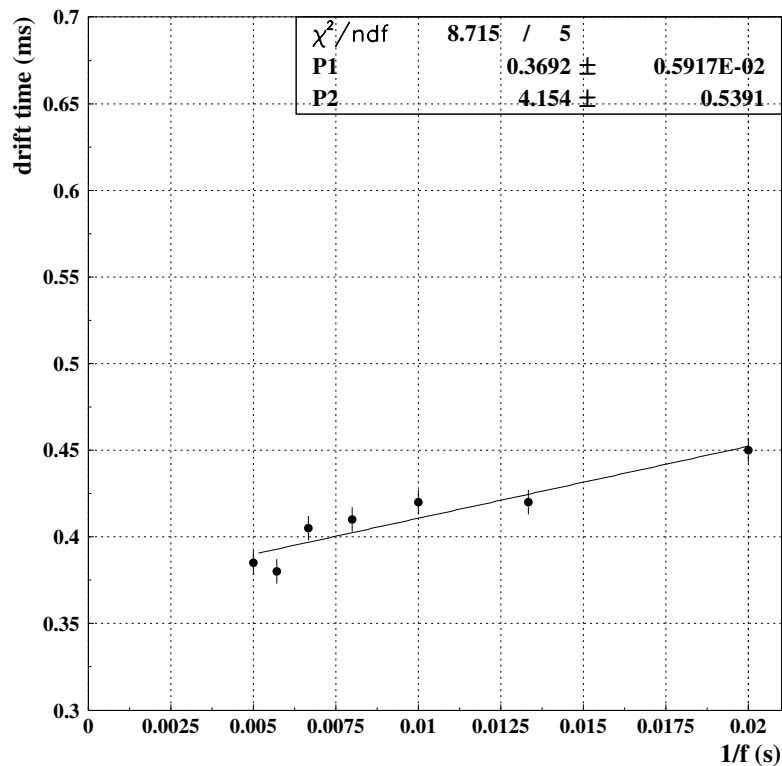


⇒ Deconvolution necessary

TOF Measurement

- Parametrization of the TOF signal necessary for deconvolution, but difficult due to non-Maxwellian distribution.
- Influence of the opening function is decreasing as the speed of the chopper increases.

⇒ Measurements at different speeds and extrapolation.



⇒ Result: $v = 0.65\text{m}/0.369\text{ms} = 1760 \pm 20 \text{ m/s}$

Variations in dissociator parameters (H_2 flux, T_{nozzle} , P_{RF}) changed this value by 50 m/s maximum since the velocity is almost fixed by the transmission function of the sextupole magnets.

Areal density of the JET

- FWHM of the JET (measured): 5.5 mm
- Measured intensity of full beam: $12.5 \cdot 10^{16}$ atoms/s
- Using measured velocity: $\rho_z = 7.35 \cdot 10^{10}$ atoms/mm
- Assuming Gaussian distribution:

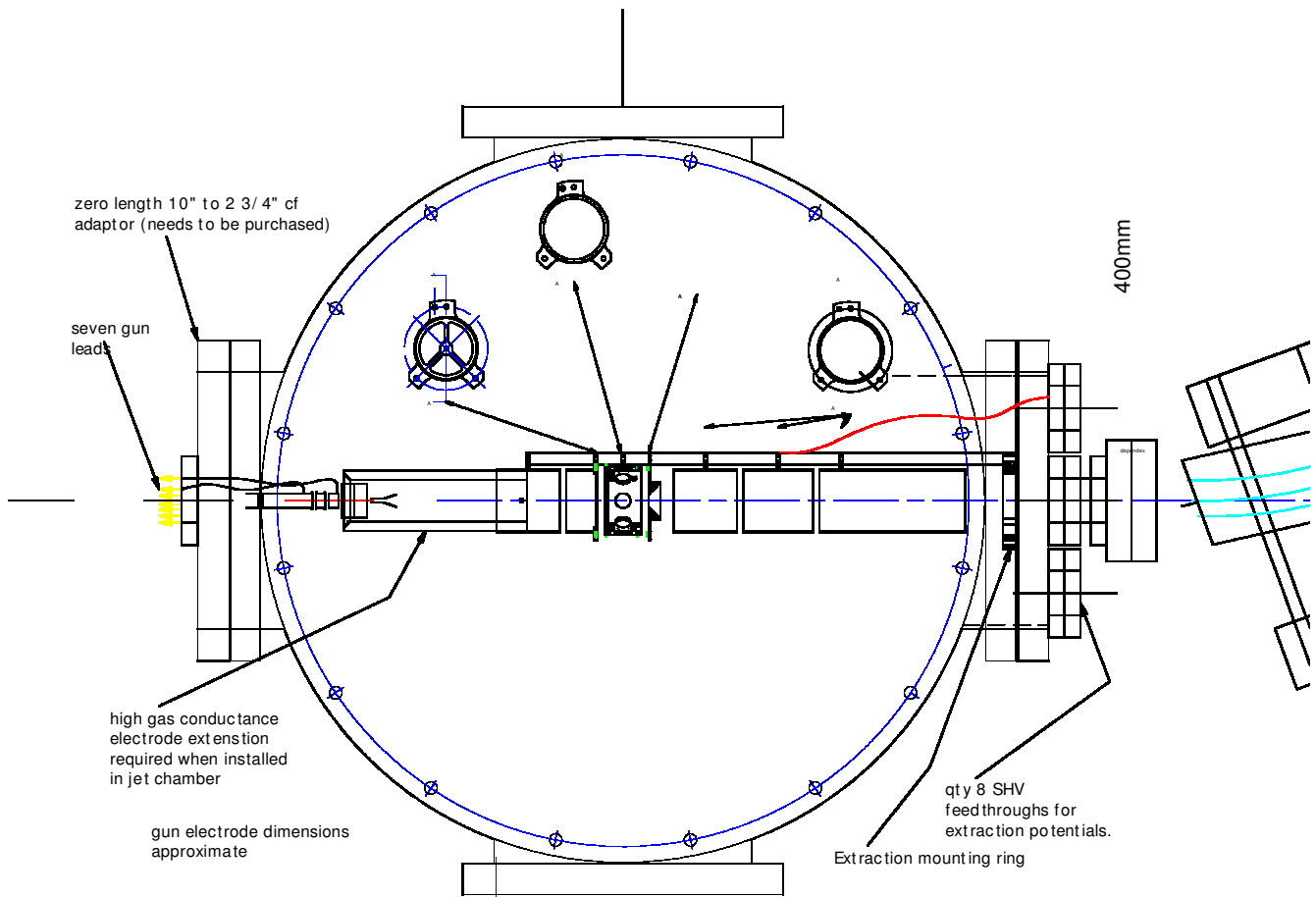
$$f(x, y) = \frac{\rho_z}{2\pi\sigma^2} \exp\left(\frac{-(x^2 + y^2)}{2\sigma^2}\right) \quad (1)$$

- Density for RHIC interaction (square of 1mm x 1mm):

$$\begin{aligned} \rho_{\text{RHIC}} &= \int_{-0.5}^{0.5} \int_{-0.5}^{0.5} \int_{-\infty}^{\infty} f(x, y) dx dy dz \\ &= 1.19 \cdot 10^{12} \text{ atoms/cm}^2 \quad (\text{centered beam}) \\ &= 1.09 \cdot 10^{12} \text{ atoms/cm}^2 \quad (1\text{mm off center}) \\ &= 0.84 \cdot 10^{12} \text{ atoms/cm}^2 \quad (2\text{mm off center}) \end{aligned}$$

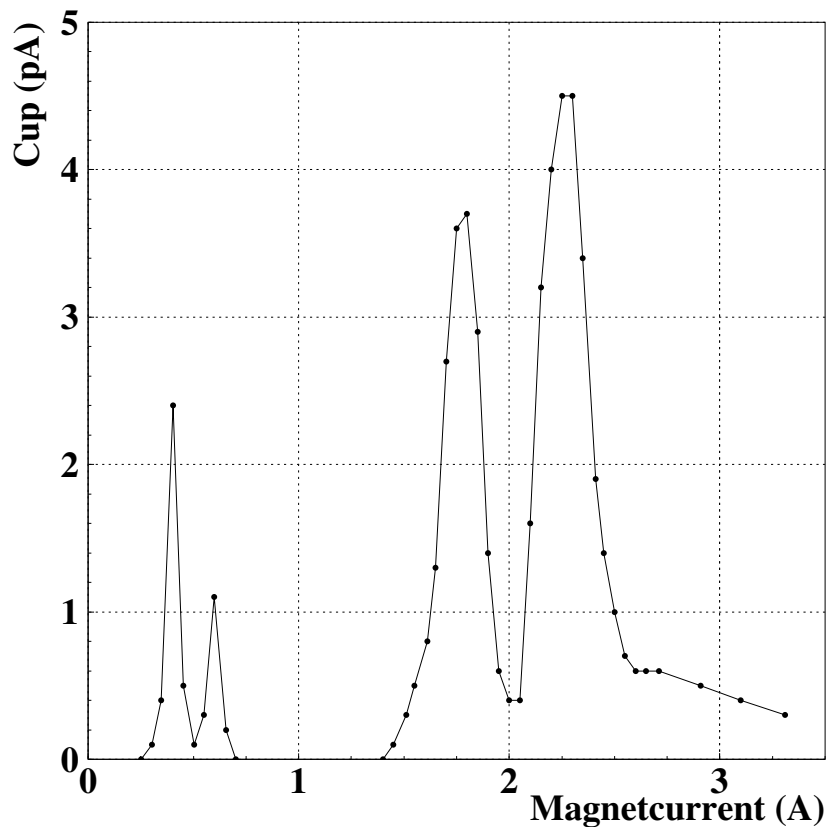
⇒ Centering very important

JET beam analyzer setup (Wisconsin)



Electrons have same path as RHIC protons \Rightarrow measurement independent of beam profile

JET beam analyzer setup (Wisconsin)



- Resolution of mass 1, 2, (14+16+18), (28+32) achieved
- Next tasks:
 - Improve resolution (separate mass 14,16,18,28,32)
 - Verify that the peak heights and/or peak integrals reflect the gas composition. Will be done with water vapor whose cracking ratio at our e- energy of 600V is known to 2%.