Ps velocimetry – summary of procedure

Benjamin Rienäcker

AEgIS collaboration meeting CERN - December 16/17, 2019

Image courtesy: Stefan Haider
Charge-exchange with Ps*

\[ \text{Ps}^* + \bar{p} \rightarrow \text{H}^* + e^- \]

UV: 204.9 - 205.2 nm
IR: 1680 - 1720 nm

Laser position, relative to the lower edge of the target (red point):
- z: -3.2 mm
- x: +1.7 mm

12.12.2018

MCP  electrode
Ps MCP-imaging technique

Average of 3 images on 1T-HDMCP:

- UV at resonance wavelength
- IR at 1064nm -> photoionization
- Here: Set delay on run-manager 2ns
- Resulting image tilted by 5.3°
Timing scan I

Set delay from -20ns to 250ns

Distances $x_0$ of roi = windows, in which MCP-image of photopositrons is evaluated

Used for BG subtraction
Timing calibration

Calibration via the derivatives towards the peaks

(see Ruggeros proceedings SLOPOS15)
Move positron spot up by changing CC2 deflection coil

\[ x_{Ps} = \frac{(CC2*c1+c2-940)}{43.5} \]
• Converting measured spatial distribution $n(x)$ to time distribution:

\[ n(t) \rightarrow n(x) \times \frac{x_0}{t} \]

• Correct for natural Ps decay in vacuum $n(t) = n(t) \times \exp(t/142\text{ns})$
Velocity I

- Converting time-distribution $n(t)$ to velocity-distribution $n(v)$:

$$n(v) = n(t) \times \frac{t^2}{x_0}$$
Velocity II

Averaged peak velocities: $1.7\times10^5$ m/s

Averaged mean velocities: $1.2\times10^5$ m/s

Averaged temperatures: 1900 K

Sliding average
Thank you