# Longitudinal Measurement

J. Moody, M Kedves, B. Raczeki, M. Aladi, A-M, Bachmann

#### Purpose

- As of now, other than the self-modulation frequency (seeded and otherwise) we have no way of determining the level of ionization resulting from the ionizing laser propagating through the vapor source.
- A longitudinal measurement can be performed by sending a narrow band (~10's of kHz line width) and known detuning from the D2 line of Rb (780nm, 5s->5p3/2)

# Longitudinal Pump "Probe" CW Probe Beam

at

- Tune wavelength of probe didoe beam
- Time resolution is by trigger and sampling
- Here we are looking at the imaginary part of the k as we look at wavelength dependent absorption



First diode laser light detected on screen in laser room

#### Pulse Propagation in the Linear Regime



We would expect pi phase shift across the bandwidth within a cm







# Ti:Sa (ionizing laser) Reflections

- Reflections
- Several Reflections on camera
- Placed photodiode in front of camera in laser room

	DP0410	4B-L CONTROIS - MOZIIIA FIRETOX	(on cs-ccr-dev1.cern.cn)		
bout:sessionrestore	🗙 🛛 LXI - Tektronix DPO4104B-L (🛙 🗙	DPO4104B-L Controls	× Welcome	× +	
-> C @	(i) 172.26.164.100:81/control/cont	rol.html		🛡 🟠 🔍 Search	\ □ ≡
Tektronix nabiling Innovation Home	Data Configure Status Cor	Applications Help			
		Control: (172.26.164.1	00) Aug 29, 2019		
Tek Run	ompressor	Entrance source	vapor Exit Va	Trig? □ ① −148.4ns 0.205 V ○ ○ 0.1.20ns 4.925 V △ 209.6ns △ 1.280	
			Source	Wedge / Telescope	
3 Coll 3 Coll 3 DC subsystem SEARCH TRIG MISS. 1	Value         Mean           SoomV Ω         2         20.0mVΩ         3           vequency        Hz         No period           requency        S         No period           rpling         Termination         Inve           ACI         1MΩ         50Ω         On           Period         200M         4.4.4         S	I.00 V Ω       Min     Max       found       found       off       Bandwidth       Full       @       multipurpose A       ELECT       A       SELECT       A	40.0ns 16.4000ns 16.4000ns 16.4000ns 18.80 18.80 19.80 10.80 10.4000 10.4000 10.4000 10.400 10.40	2.50GS/s 10k points 1 J 310 More 29 Aug 20 17:21:05	nv nv 19

Aut seasonessore

x

x

x

x

x

x

x

</t

microsecond timescale, no additional reflections

Reflections when opened (no Rb)

# Proof of Reflections' Sources









#### SEARCE THE LESS VERTICAL 200M A . A CART STORE A COLLEGE A COLLEGE

#### Upstream Plunger In

Downstream Plunger In

## **Trigger Parameter Selection**

- Ideally our first diode laser signal through plasma should appear once ionizing laser exits vapor source
- Reflection from wedge / telescope forces us to push gated trigger back by about 80ns
- Since CW signal, we can get a strong signal with 1 microsecond exposure, but can potentially go to 10ns with at a cost of signal loss
- If we spend the 19k euro on the tunable 420 nm laser, we can avoid several reflections through filtering (and all of the ones from the compressor due to a change in position)

# Detuning

- We use a toptica pro diode laser, coarse tuned to 780nm, sub MHz linewidth
- Piezo controller can detune laser by about 100 GHz
- We can select a detuning setting (slowly) to avoid mode-hopping
- Anna-Maria has shown most of this previously in regards to Schlieren measurements



Scan of Rb absorption in room temperature cell

### Preliminary Results





Detuned to weaker absorption

With 80 mJ

## Closed Valves (reduced Rb)



**Closed Valves No ionization laser** 

## Alignment

- Very difficult, ill equipped for good alignment
- Can implement two 'corner screen' fingers
  - Fairly standard way of performing alignment for ICS experiments but now two to establish lines.

## Rb Valves closed still affect the laser

- With valves closed Residual rubidium steers the diode laser severely
- So of course in need to wait out the low density Rb outgassing



Steering of beam by ionizing laser with valves closed

### Fun times from CERN

- CV dumped water down the elevator shaft, made waterfall in control room, dropped on timing racks, lost triggers for a few days
- Access system drops to closed
  - Twice with people inside
  - Once prevented us from getting in
  - Once just when no one was in
  - Tomasz claims its some network issue in loop