Max-Planck-Institut für Physik
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AWAKE

MPP Group Meeting

J. Moody

Happy New Year (Belated)

30 January 2019

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Administrative / Policy 1

- Laser Propagation Meeting
  - Final decision on Friday but highly probable that it will be on Tuesday 3-5pm CET
  - Will cover plans, models, current data sets, etc. in more detail than presented here
- Possibility of a Journal Club?
  - Helps with ‘professional development’ i.e growth as a scientist
  - Develops habit of checking for latest developments in our field and in physical sciences in general
  - PRL level or more detailed (please avoid policy / strategy / papers) ;)
  - Will send out Doodle Poll but I recommend Friday afternoons unless meeting conflicts
  - Maybe do it with a beer in hand (UCLA PBPL tradition, depends on time)

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Admin / Policy 2

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- Ideas on changes for AWAKE publication policy
  - I want to refine a suggestion for procedure changes at AWAKE before doing a formal submission to the Publication Committee
  - The changes would make the publication policy:
    - More formal than current setup
    - Have Internal peer review process under the responsibility of the PEB
    - Give the PEB 'teeth' possibly simple majority voting if necessary to not allow publication unless revision occurs
    - Make an early call for planned publications, conference proceedings
    - Setup timetables for easy integration and preparation of publications before each PEB meeting
    - Have contingencies for emergencies, unintended consequences etc, but make them have limited use:
      - eg, Each author gets 1 emergency urgent push through per year, etc.
    - Use of technology: easily accessed common databases to help organize and enforce policies

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Technical Page 1

Schlieren calibration at MPP

- Access issues
- Student contact and preparation
- Laser safety (apparently stricter than before)
- Write a small scale proposal?
  - Misha rightly pointed out that our postdocs have a skill-set deficiency as we have not had experience in proposal writing
  - Senior scientists could ‘play funding agency’ and review a small scale proposal
  - Proposal could include:
    - Purpose
    - Time table
    - Resources (Time, monetary budget load, computer time, etc)
    - Expected deliverables (AWAKE tech note, possibly journal paper)
    - What could be built on this (ties back to purpose)
  - At very least it’s an exercise and helps organize future work

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Tech Page 2

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- Laser Propagation July Preparations
  - Acquisition of FROG
    - Edu is looking into this
  - Streak camera of laser throughput and Schlieren signal
    - Dedicated properly terminated precise triggers pulled to Schlieren and LBDP3 tables (Heiko / Ben)
    - Computer migration (Alastair & Co.)
  - Back propagating interferometry
    - Build interferometer and place at table near MP1 in laser room (Hungarians?, someone else?)
    - Pull single mode fiber to laser room from diode laser source at LBDP3 table
    - Commissioning plan, establish background fringes without Rb, etc
  - Plans for recommissioning of:
    - Vapor source
    - Laser system
    - DAQ

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Laser System Improvements

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- OAP telescope still going in, possibly this month
- Planned to install, test on beamline in laser room
  - Valentin and Edu already have a two-path design beamline for laser room (extra slides)
  - One path for in-air with active adjustment feedback of alignment of telescope
  - One path for when we pump down (through MP1)
- Although TAG41 shut down for 5 weeks through Feb
  - Valentin said TAG42 will grant access to laser room but requires controlled area / active dosimeter training (Classroom, 8 hours)
- If successful the main control will still be the expansion telescope (but very small adjustments) as long as alignment of OAP telescope works so we will need to still motorize it sufficiently to control some beam parameters (waist position, minimize astigmatism, guard against back-reflection into amplifier, etc)

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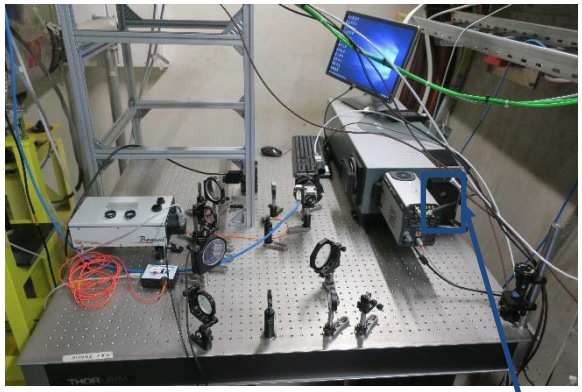
Tech Page 4

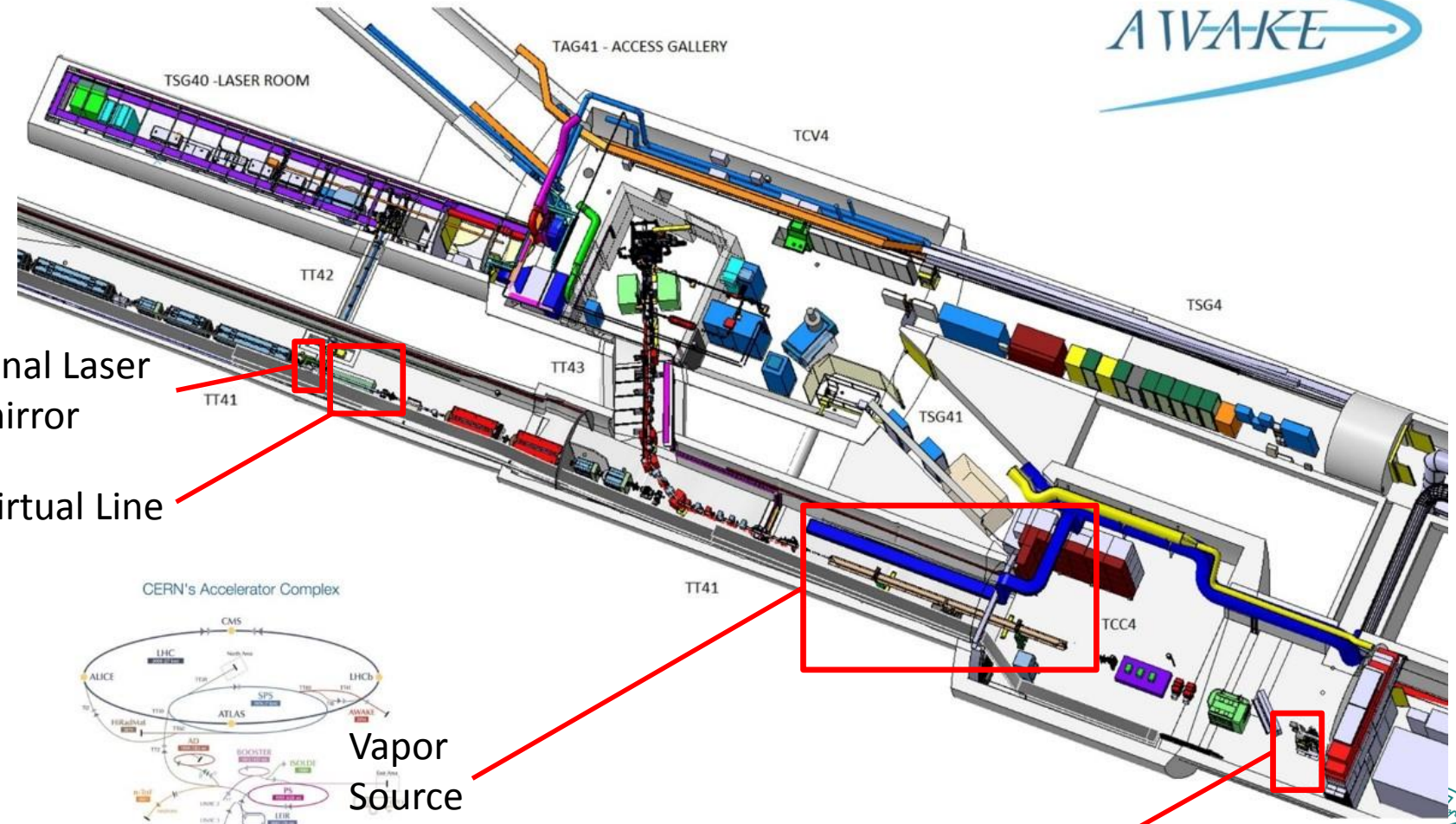
- Misc:
  - SRS Box repair order placed as DAI on EDH (Finally)
  - Gated Spectrometer is back to ‘Fully operational’ status
    - Motorized slit back on and works well
    - Feet back on to prevent damage to the ribbon cable to the motorized slit
    - A shutter on a not commonly used input port is still not working but is a minor issue to the functionality of the spectrometer



Motorized slit on and working

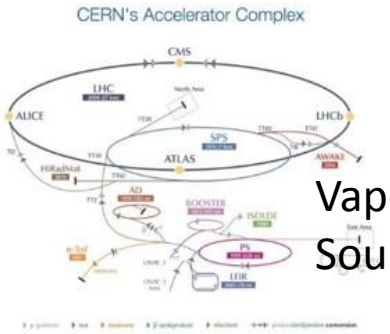
Shutter on this port still inoperational

Laser Propagation



Final Laser mirror

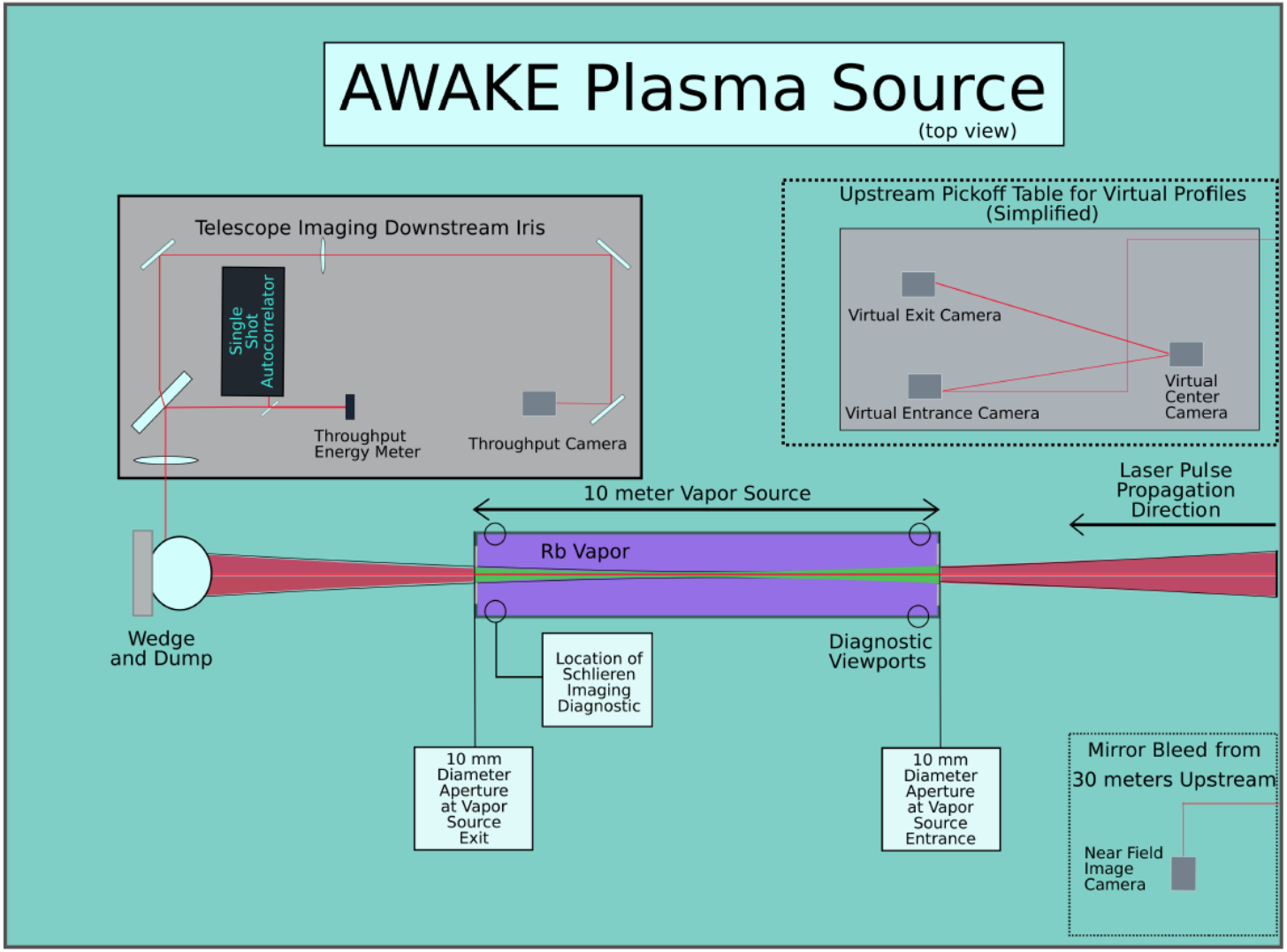
Virtual Line



Vapor Source

Downstream Pickoff, LBDP3

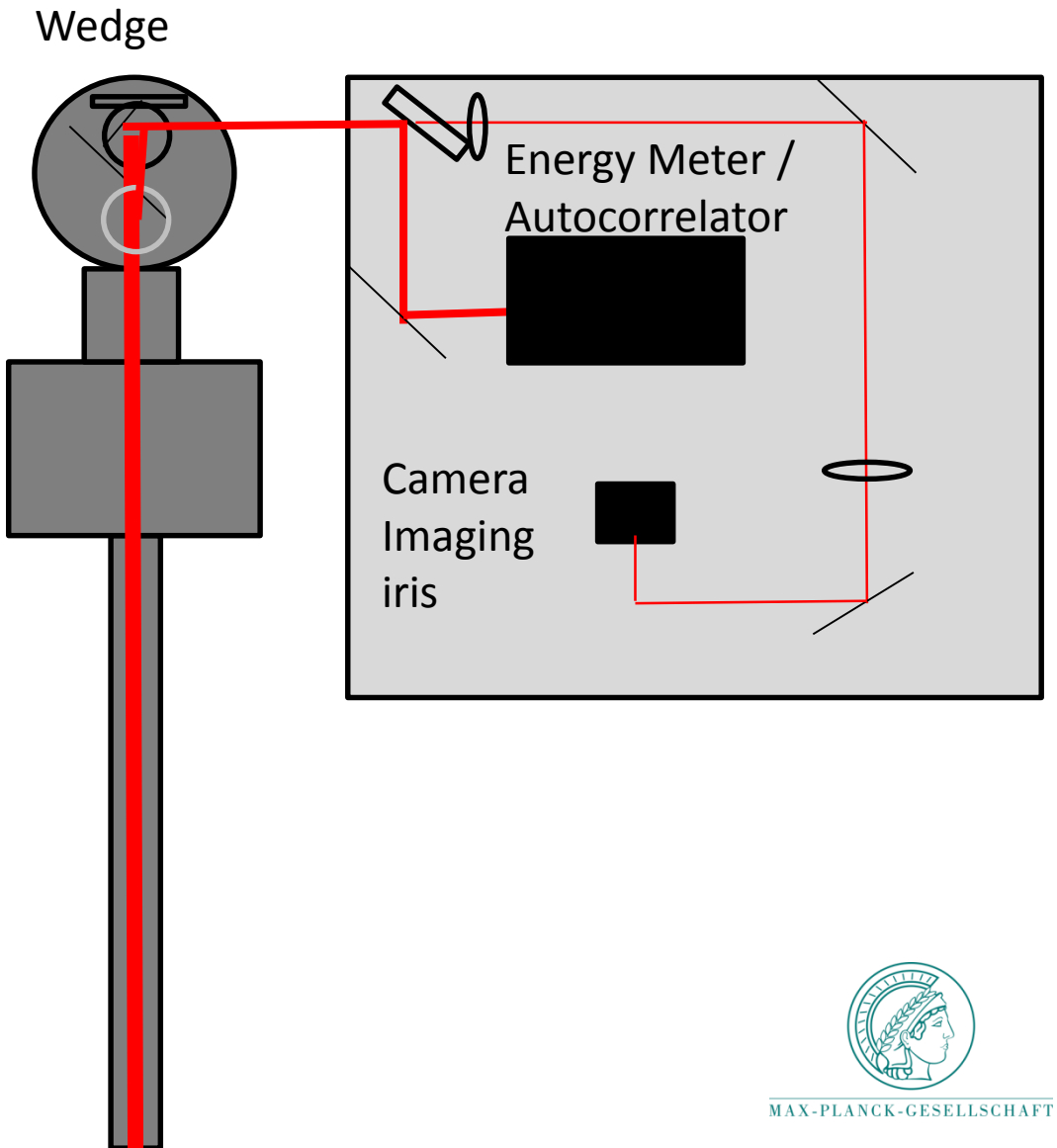
Previous Investigation Setup



Previous Pickoff Setup

Avoid nonlinearity in sampling by:

- Wedge picked off .5% of laser (close to Brewster's angle)
- Mirror splits beam to autocorrelator and energy meter and bleedthrough goes to transverse measurement, gated spectrometer, fiber spectrometer
- Telescope images downstream iris of the vapor source



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Latest Setup Pictures

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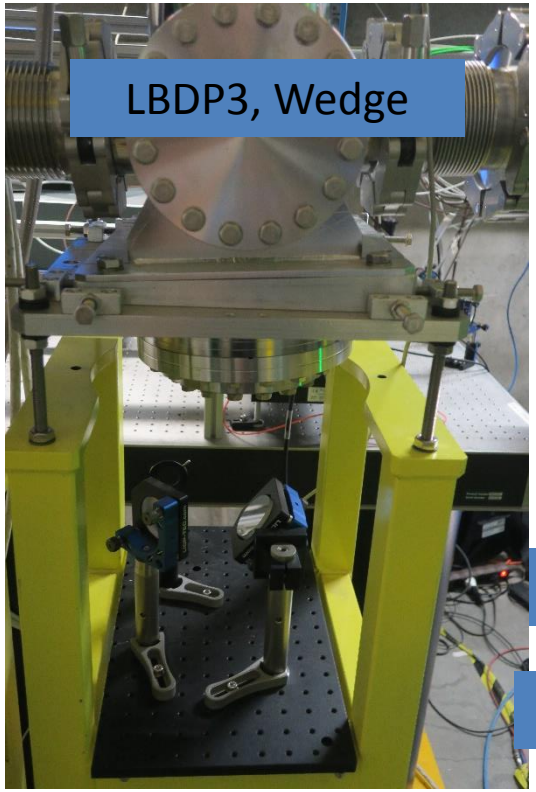

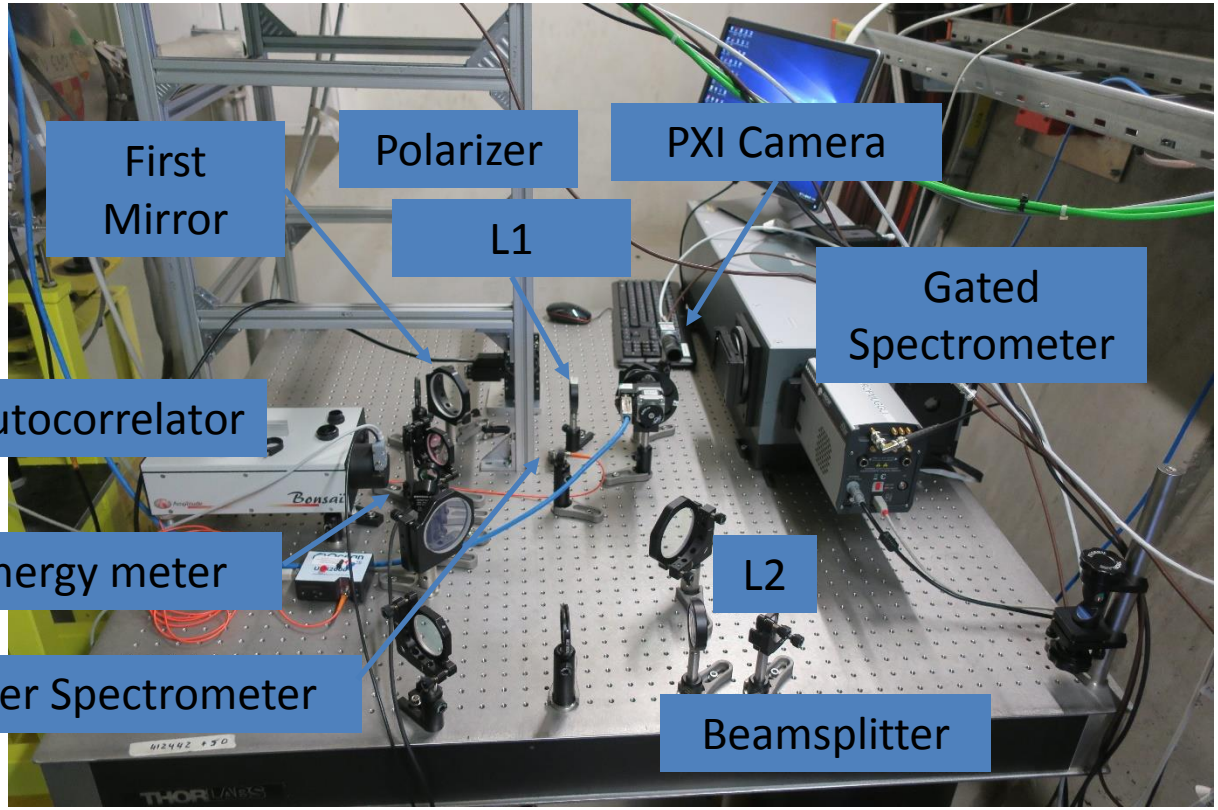

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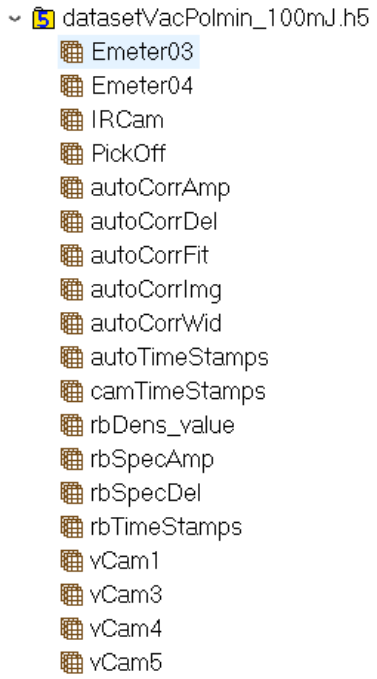
Laser Propagation Data

- Data sets from Laser Propagation
  - Three data file types:
    - .hd5 files including:
      - 6 transverse profile images at known distances
        - » 5 virtual line images to reconstruct the laser field at entrance of vapor source
        - » One image
      - Input and output energy of pulses into and out of vapor source
      - Autocorrelator data
      - Neutral Rb Data
      - Timestamps for data verification
    - Ocean optics “long timescale” spectrum
      - Simple files, ASCII two column - wavelength and signal
    - Andor gated camera spectrum ‘.sif’ files
      - Python .sif reader class from github needed to be modified (fujisoup’s version lightingghost’s version did not work on our .sifs) to read out the gating information, as standard versions do not
      - This problem highlights some of the issues Anna had with controlling the gated camera on a previous run with the CERN BI developed GUI. The properties for the gating are different than that of standard control / data sets for Andor devices such as exposure.



Python .sif reader

- .sif reader can be used on any data set that relies on the andor gated camera until integration into event builder can be completed via C++ SDK and file grabber
- .sif files have a complicated header / data sets with mixed ASCII and binary structures
- Most readers will only look for data and the standard header, ignoring the spectrometer and gating headers
- Needed to modify existing gihub reader to extract the gate delay and gatewidth

Standard header, sufficient for most andor cameras

Some Preliminary Comments on Data

Transverse Mode Analysis

- Transverse mode data appears to be qualitatively consistent with previous sets
  - Depletion
  - Blowup below depletion
- New data allows for much better quantitative analysis due to reconstruction of initial laser field at vapor source entrance
- Initial conditions can be precisely fed into numerical models from Wigner and UniGe and examine results as a function of laser energy, rubidium density, used for model verification

Polarization Data

- A cube polarizer was placed, runs were done in both parallel and cross configurations with respect to the vacuum laser polarization
- A polarization effect is definitely observed. A spot can be observed with increased intensity when Rb is present where it was not in vacuum. Care must be taken to consider all of the 'polarization filters' present in our system

Spectral Data

- The spectral changes previously found with the fiber spectrometer that are accumulated on longer timescales were found to be prompt, not some sort of recombination light (it is within the first ~10 ns of the laser pulse)
- This is consistent with the very small numerical aperture of our imaging system
  - ~12 meters between object plane and objective lens
  - Aperture stop is basically 50mm / sqrt 2 located ~10 meters from objective
  - This would heavily suppress any isotropic emission light gathering over directional light gathering
- The laser appears to have very large self phase modulation over most of the energy in the pulse

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Moving Forward

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Organization:

- Trying to organize, and use my resources as effectively as possible to get my goals done, including analysis, future measurement, etc
- Bi-weekly meetings should be motivational driver to make progress toward two papers for laser propagation:
  - One for the time plasma density / velocity distribution (may be important for initial conditions of plasma column expansion problem)
  - One for the dynamics of the laser / neutral rubidium/ plasma interactions, focusing on laser pulse, spectrum and phase evolution

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