

Maintenance Log

Nov 17th 09 • Removed laser head cover, checked black circulatory fan motor for rotation. The motor seemed to turn fine w/o hesitation.

Nov 18th 09 • Brought HV power supply, vacuum pump, & hosing down to Dr. Barry Well's lab.
* Need to buy 6" exhaust end for Dr. Eyles, also need new compressor fittings. ← ALL SET!

What Needs to be Replaced/Fixed?

- Vacuum pump oil - replaced? ✓
- Halogen filter - replaced?
- Air inlet filter - replaced? ✓
- Thyatron cooling oil - replaced?

Nov 26th 09 • Excimer was lowered onto reinforced table using the 5 ton crane in Dr. Well's lab.
• Main exhaust was hooked up to vacuum line.
• H.V. power supply was reconnected to the laser.
• Air filter on laser head was replaced.
• ~~Excimer~~ Vacuum line installed to laser head.

What else needs to be installed.

- Vacuum pump needs oil ✓
- Vacuum pump exhaust line needs to be installed ✓
- Extension cord for H.V. ✓
- Compressor fittings for gas lines ✓
- Water Supply?

Dec 1st 09 • Filled vacuum pump with oil from metal can with part number 906788. Filled to 3/4 mark on sight glass as specified in instruction manual.

Dec 8th 09 • Installed gas cylinder mount near excimer & brought down 2 bottles Xenon, 1 bottle HCl. Have also found a loaner for Nelson (Quefery)

Dec 11th 09 • Received Swagelok fittings, all but PFA nuts

- Parts list for swagelok fittings
- SS-400-NFSET - stainless steel complete set (nut, part & back part)
 - PFA-423-1 - Front Ferrule
 - PFA-424-1 - Back Ferrule
 - PFA-422-1 Nut 1/4" - not the right one
 - B-400-3 - Brass T w/ compression nuts & fittings

Dec 11th 2009

• Finished connecting laser HV to power supply L-15-250V 20A 3φ connectors
• Filled w/ 2,500 mbar He @ 3:37 pm, will check for leaks the following day

Dec 15th 09

• Checked @ 11:30 (20 hrs) Pressure @ 2,000 mbar → 500 mbar / 20 hrs = 25 mbar / hour. the accepted leak rate is 5 mbar / hour so we have some work to do. My plan is as follows.

Dec 16th 09

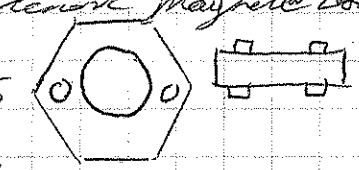
- First check all other solenoids for operation
- Check if pressure is coming back thru solenoids
- Take cover off, (charge system 2500 mbar) & check for leaks in obvious places first. (Make sure to ground caps!)

• Tested solenoids for gas through part. Yellow solenoid (Noble gas) did not let gas through. Surprisingly, the Red solenoid did! (Halogen)

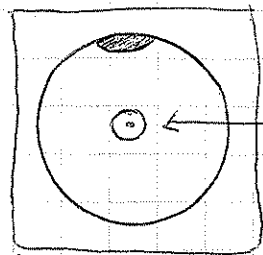
• Replaced red solenoid (yellow) w/ replacement part # 903113 (Honeywell Lucifer BSA) VS-60-5053

• Solenoid body has following specs
→ Valve # VS MLSK 892A, 220/250V, 175 Bnz, Ser# AHP
Orifice 1.2 (Honeywell Skinner valve)

- To replace internals of solenoid do as follows
- 1) remove laser head cover; ground out caps!
- 2) remove electrical connectors from solenoid body
- 3) Remove nut from solenoid & remove magnet body.
- 4) Place ring of the two plugs over shaft; align plugs into corresponding holes & loosen using a 7/8" socket w/ extension.
- 5) Be sure all pressure is evacuated or



After replacing solenoid I tested the throughput of helium @ 3 bar & there was no pressure. So, I took it apart again & noticed a tiny ripple that looked like a gas outlet. It appeared to be clogged so I turned on the gas (2 bar) to help push anything out & used a thin piece of wire to unclog the hole. All of a sudden POOF! & it was blasted w/ 10 year old crust! At least the valve works now. I left the new replacement stem in there just to be sure, so the old one was probably still good. This is what it looks like in case this happens again



this was clogged!

Top View

Checked (w/ soapy water) most of the connections for leaks & found none. Maybe the gas is passing back thru the solenoid valves overnight.

I will connect all the lines to a dead end; re-charge it to see if that is true

Charged to 2,500 mbar @ 4:30 12/16/09

Dec 17th 09

Pressure dropped to 1,900 mbar in 18.5 hrs = 32.4 mbar/hour which is worse (could be exponential & so just less likely)

Probably not too safe.

Taking patterned metal shield off of cap screws to check for corrosion = possible leak sites.

No apparent leak sites, to remove Cap. cover simply loosen the machine screws; pull out shield

Need to speak of Lambda Physik rep. Jeff Edberg to see where to go next. Maybe he can shed some light.

Just got off the phone of Amy from Coherent. She recommends the following:

- Check window seals (usually 1st to go)
- Check pins connecting laser tube w/ He meter.

Removed front laser window cover, plan to review window & attenuation procedures & check seals soon. Possibly a good time to switch out the optics? Will bring it up in today's meeting.

Dec 21st 09

Thought about the idea of changing the optics out. Then realized that I don't have any other mirrors lying around. Then remembered the test data sheet performed by X Physik for XeCl (308nm) & ArF (192nm). Both tests were performed using the same front & rear mirrors! Meaning we probably won't have to do any optics switching at all! Types of mirrors are below

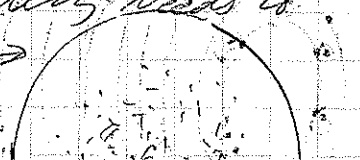
front: CaF₂ 36.0mm x 5mm

rear: Al-MgF₂ 36.0mm x 5mm

New plan is to remove & clean mirrors, reseal (of queue) o-rings; re-tighten. Then pressurize; check for pressure drop.

Tightened 6 allen bolts on laser window output & rear. They turned a 1/4 more before stopping. Maybe they were just a little too loose, but I doubt it. Anyways, recharged the system to 2,500 mbar @ 2:15pm. Will check again tomorrow.

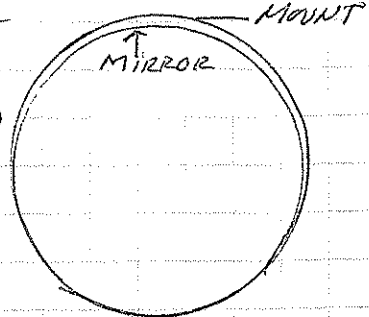
Pressure dropped ~ 400 mbar before 3 hrs! Brought system down to 1,000 mbar, then put ~ 100 mbar He. removed end mirror as in directions. Mirror looked very dirty w/ powder like spotting. Needs to be cleaned. looked like this →



O-ring also looked dried out needs replacement. Gilled

• Also seemed that mirror was not seated "nicely" in mount, it looked like it was sagging down off center

• O-ring has the following specs: $\phi 32 \times 2$ Viton



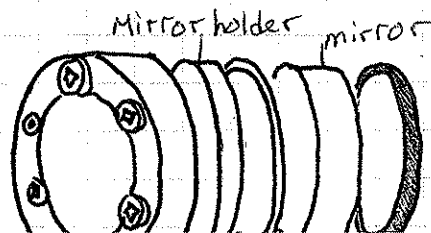
* Note: When new o-rings arrive & the system is opened up again, double check that mylar ~~ring~~ ring is in place.

Jan 4th 10

Welcome back & happy New Year! Anyways I've been trying to find out if the Halocarbon grease is the same as fluorocarbon grease which I was told by Amy would help w/ the O-ring leak. Turns out, you are not to use grease on any of the o-rings! It can ruin the laser tube if any grease gets in there.

Problem is, according to the past records the grease (fluorocarbon) was used. So, this may pose some trouble. For now, I must acquire new o-rings. Trouble is, Coherent has zero parts for EMGs. Looking at the packers list, I've found the following dimensions for o-rings
2x O-rings 32x2 mm ✓
5x O-rings 6x1.5 mm

• Found a missing mylar ring, maybe I forgot it after the first install or maybe that was the problem the whole time. Charged system to > 2500 mbar @ 3:15 pm today.
• This is how the window assembly goes



O-Ring dimensions are 32x2 mm

• Just remembered that there was a lot of corrosion on the o-ring groove. This could lead to improper sealing of the windows. Once the helium arrives I'll plan to clean out the gaffe w/ Q-Tips & Ethanol (low moisture) & replace the o-ring w/ the one that's been cleaned w/ rubber rejuvenator.

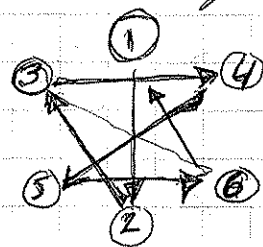
Jan 7th 2010

• Helium arrived last Friday, today (Monday) I will clean the o-ring groove w/ acetone, blow off the mirror w/ compressed air (electronics grade) & replace old o-ring w/ "new o-ring" also will charge system to 2500 mbar for tomorrow's leak check w/ Di-Hexes.

Jan 18th 2010

* Regulator reads - 2600 psi 1/18/10

• Filled system to 2100 mbar after doing the following ← 1:00 pm
→ Cleaned window mount (w/ laser) w/ acetone
→ Replaced o-rings w/ "new" o-rings
→ ~~Replaced~~ Dusted off mirror w/ compressed air
→ Re-sealed mount w/ following pattern



• Depending on the leak rate I might attempt to clear off the port hose tomorrow.

• 12:00 pm, gauge reads 1500 mbar, a 600 mbar drop in 23 hours
= 26 mbar/hour

Jan 19th 2010

This is at least a decrease from the 45 mbar/hr ~~seen~~ seen previously. Now I plan on taking the port window off & cleaning the o-ring bore.

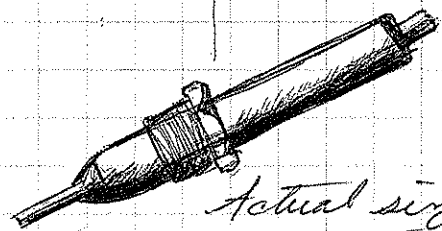
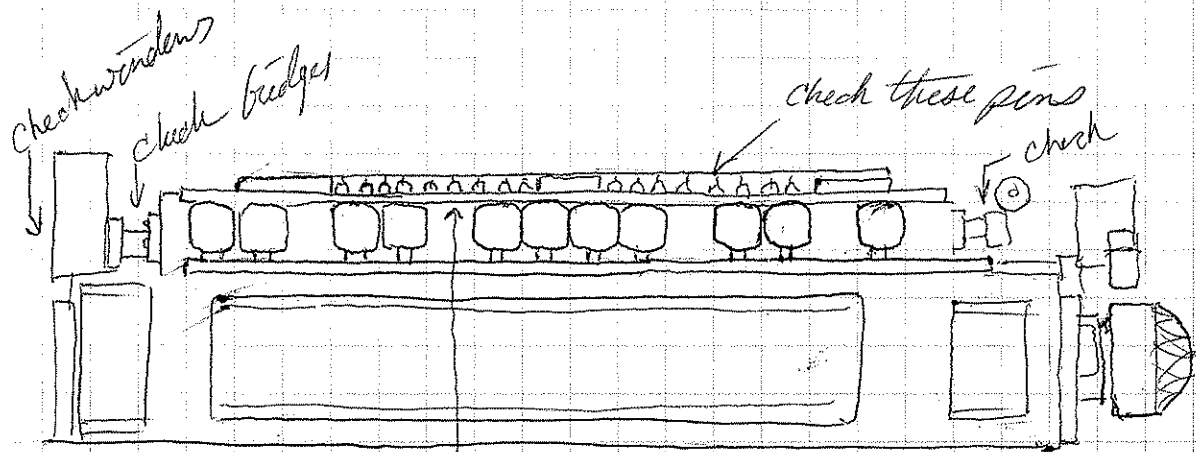
Cleaned most of it out by creating pressure & then removing the ~~plug~~ cork. Puff!

• Re-pressurized the system again to 2100 mbar @ 12:15 pm. Kept original o-ring in because it didn't look so bad once washed w/ warm water.

Jan 20th 2010

• Gauge reads 1500 mbar after 25 hrs = 24 mbar/hr → pretty much the same.

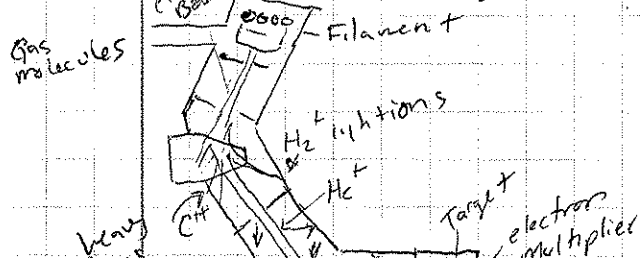
• Today we (Dr. Hines & I) are supposed to leak check in the following places:



Actual size drawing of one of the pins

• Dr. Hines is here, we are going to check the leaks

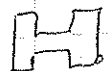
How it works, kind of cool.



Leak Rates

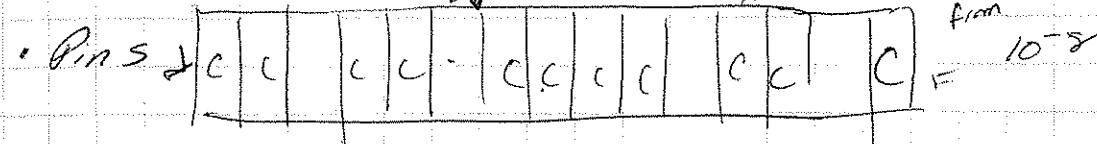
- Rear window mount ≈ 1 cc/sec $\times 10^{-8}$ Scale
- Front window mount ≈ 1.5 cc/sec $\times 10^{-8}$
- > 1 $\times 10^{-8}$
- ~~10X~~ rear window

• Rear Tube bridge (white) — X



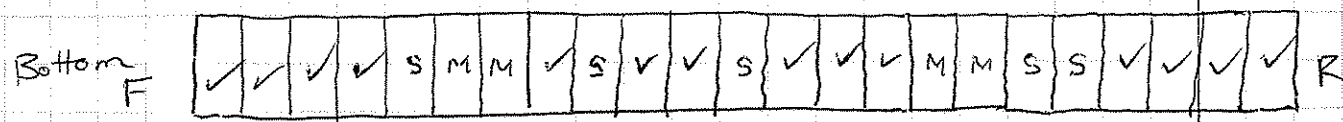
• Front Tube bridge — X

← cover (marked) ≈ 4
Corroded plug $< 5 \times 10^{-8}$
 $\approx 2 \times 10^{-8}$
30% ← firm



• Rear tubes to laser gas processor — X

• Front " — X



Top - 6th From Rear - major leak.

• After testing the system it was clear we had some potential causes. My plan is as follows:

- 1) Get New o-rings, re-seal

Jan 22nd 2010

• Removed front window, "rejuvenated" the
o-ring, looked brand new, replaced.
Charged system to 72100 mbar @ 1:30pm.