

Allarme carenza Elio

Soluzioni per la GC & GC-MS

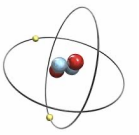
Davide Facciabene

Sales Support GC & GC-MS

Marsala, 21 – 22 Nov. 2013



Elio – dove & quanto



Gas nobile, inerte e relativamente abbondante nell'Universo...

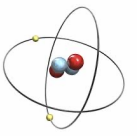
... compone circa un quarto della materia visibile (74% Idrogeno e 2% tutti gli altri elementi)



Sulla Terra, è relativamente raro... 4×10^{-7} % !!
presente nel sotto suolo...

...prodotto dal decadimento radioattivo di altri elementi

Elio – usi più comuni



Largamente utilizzato nell'industria aerospaziale

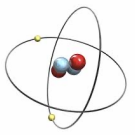


Fisica delle particelle

Avanzate apparecchiature mediche



Elio - Allarme carenza su scala mondiale



Elio è una risorsa finita, non rinnovabile ne riciclabile

EDITOR: INTERNATIONAL | U.S. | MEXICO | AMERIC
TV: CNN | CNN en Español
Set edition preference

Home | Video | World | U.S. | Africa | Asia | Europe | Latin America | Middle East | Business | World Sport | Entertainment | Tech

VOTENOW. MY MY WORLD. THE UNITED NATIONS GLOBAL SUMMIT FOR A BETTER WORLD. myworld2015.org

Don't deflate the party
By Daniel A. Flynn, Special to CNN
March 2, 2013 — Updated 10:29 GMT (02:29 HKT)

SHARE THIS
Facebook | Twitter | LinkedIn | Email

MAKE EVERYBODY'S BUSINESS... YOUR BUSINESS JUST CLICK HERE

A balloon seller in Tokyo Disneyland in 2011.

The Washington Times NEWS OPINION VIDEO SPORTS LIFE MEDIA

TRENDING: BARACK OBAMA JAPAN SENATE DAVID "DEACON" JONES CONGRESS

THE WALL STREET JOURNAL. FOR MORE PLAY AND LESS WORK
German Clubs Find the Winning Formula

EDITORS' PICKS: Fort Hood shooting suspect Maj. Nidal Hasan: I was protecting the Taliban

HOME | NEWS | POLITICS | RADIO | LOGIN | E-M

House votes to avert a worldwide helium shortage
COMMENTS (23) | SIZE: + / - | PRINT | REPRINTS | Facebook | Twitter | LinkedIn | Email

By Tom Howell Jr. - The Washington Times Friday, April 26, 2013

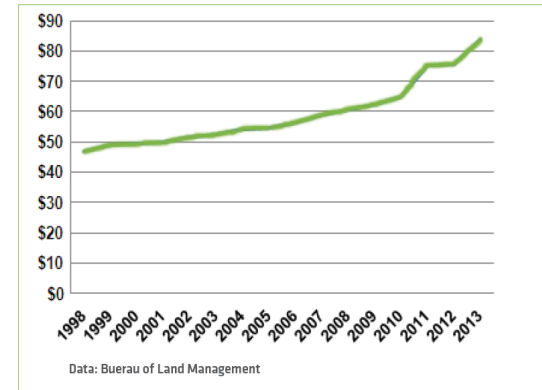
The House overwhelmingly passed legislation on Friday to sell off helium from a federal reserve in Texas while demanding a fair price for it, a seemingly arcane bill that exposed a global shortage of the second-most abundant element in the universe.

The 394-1 vote now sends the bill to the Senate.

SEE RELATED: Rep. Hank Johnson's sequester jester: 'Imagine a world without balloons'

It is intended to protect the country, if not the world, from a damaging dearth of helium that could derail key medical and scientific innovations

Bureau of Land Management BLM Open Market Price of Crude Helium



SCIENTIFIC AMERICAN™

Subscribe | News & Features | Topics | Blogs | Videos & Podcasts | Education | City

Technology | News | May 7, 2013 | 5 Comments | Email | Print

Hot Air in Washington, D.C., Might Keep Helium Supply Afloat
Inflated gas prices have put researchers and industry under pressure
By Mark Peplow and Nature magazine

US lawmakers have taken a significant step towards averting a global crisis in helium supply, thanks to a bill passed by the House of Representatives on 26 April. If it passes the Senate and becomes law, the bill would



NEWS | SCIENCE JOURNALS | CAREERS | BLOGS & COMMUNITIES | MULTIMEDIA | COLLECTIONS

ScienceInsider | Premium Content from Science | About Science News

er > April 2013 > U.S. House Passes Bill That Would Head Off Massive Helium Shortage

ScienceInsider
Breaking news and analysis from the world of science policy

U.S. House Passes Bill That Would Head Off Massive Helium Shortage

Elio - .oOo.oOo.oOo.



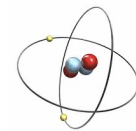
Japan 2011



No Gas
No Balloons



Elio in Gas Cromatografia



E' utilizzato nella quasi totalità dei GC e GC-MS come gas di trasporto



Problemi di approvvigionamento

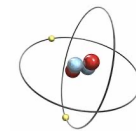
Almeno due settimane di anticipo, anche per piccoli ordini

(qualche bombola al mese !!)

Nessuna garanzia nella fornitura per grossi ordini

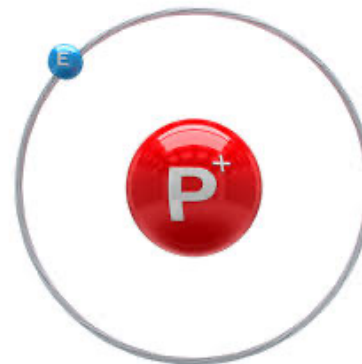
(rischio discontinuità del lavoro per i grandi laboratori)

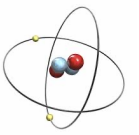
Interesse da parte dei laboratori per trovare soluzioni



Soluzione definitiva

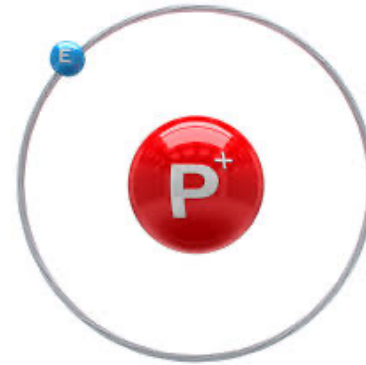
uso di Idrogeno come alternativa





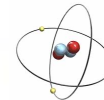
Soluzione definitiva

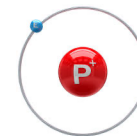
Uso di Idrogeno come alternativa



Soluzione “al risparmio”

Consumo minimo di Elio





VANTAGGI

Risparmio - l'Idrogeno viene autoprodotta mediante generatori di idrogeno

Illimitato - i generatori di Idrogeno creano idrogeno per idrolisi dell'acqua

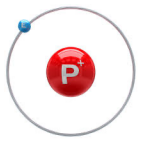
Migliori performance cromatografiche (risoluzione, efficienza e tempi più brevi)

SVANTAGGI

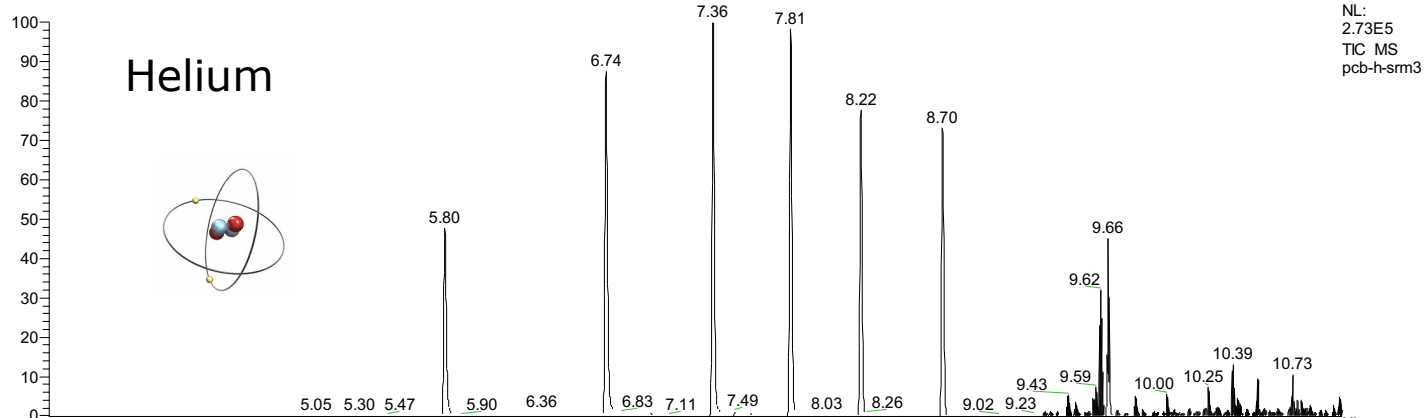
Sicurezza – richiede sonda rilevatrice di fughe

MS – minor sensibilità con ionizzazione EI, mediamente 5 volte inferiore

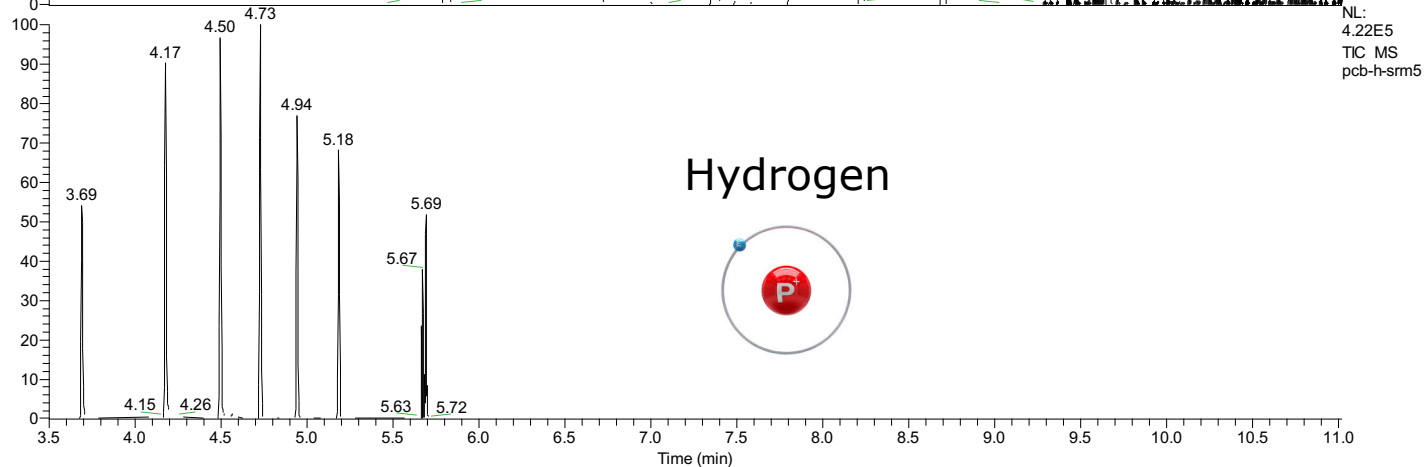
Idrogeno come alternativa - FAST GC



RT: 3.50 - 11.02



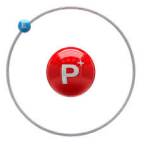
@ 25 °C/min



@ 50 °C/min

PCB-mix: nessuna perdita in risoluzione e tempi quasi dimezzati

Idrogeno come alternativa – GC-MS

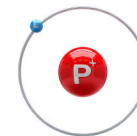


ISQ – singolo quadrupolo



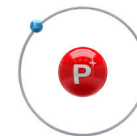
TSQ 8000 – triplo quadrupolo

Idrogeno come alternativa – Specifiche MS

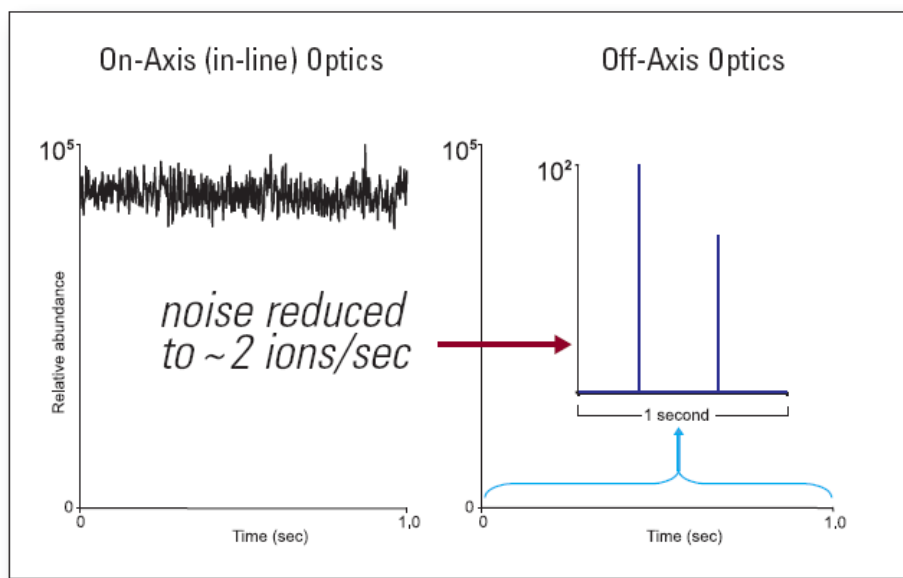
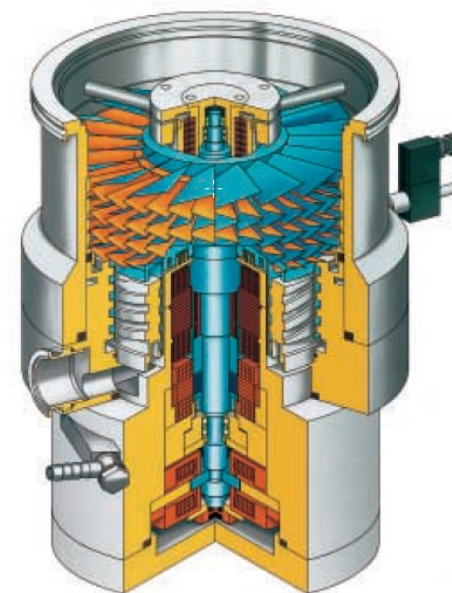


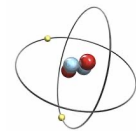
Mode / Concentration	He	H ₂
In EI mode, 1 μL of 1 $\text{pg}/\mu\text{L}$ octafluoronaphthalene (OFN) will produce the following minimum signal to noise for m/z 272 when scanning 50–300 u	600:1	100:1
In PCI mode, 1 μL of 100 $\text{pg}/\mu\text{L}$ benzophenone will produce the following minimum signal to noise for m/z 183 when scanning 80–230 u using methane reagent gas	300:1	300:1
In NCI mode, 2 μL of 100 $\text{fg}/\mu\text{L}$ of OFN will produce the following minimum signal to noise for m/z 272 when scanning 50–300 u using methane reagent gas	600:1	600:1

Idrogeno come alternativa – Le chiavi della MS



- Pompa turbomolecolare da 300 L/s
- Prefiltro quadrupolare S-Shape





VANTAGGI

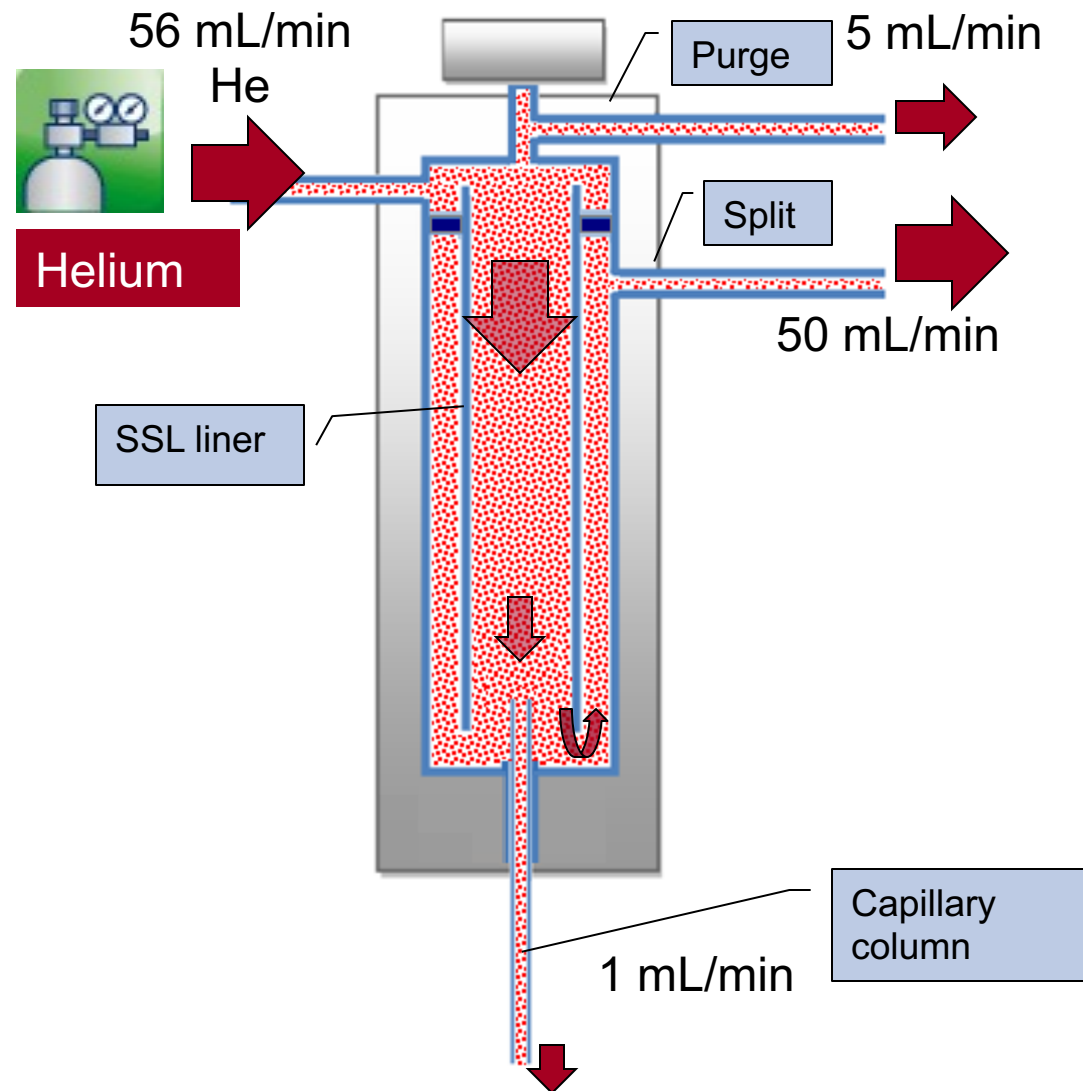
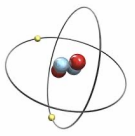
Risparmio - bassissimo consumo di Elio

Nessuna modifica dei metodi strumentali di analisi (RT, programmata, ecc.)

SVANTAGGI

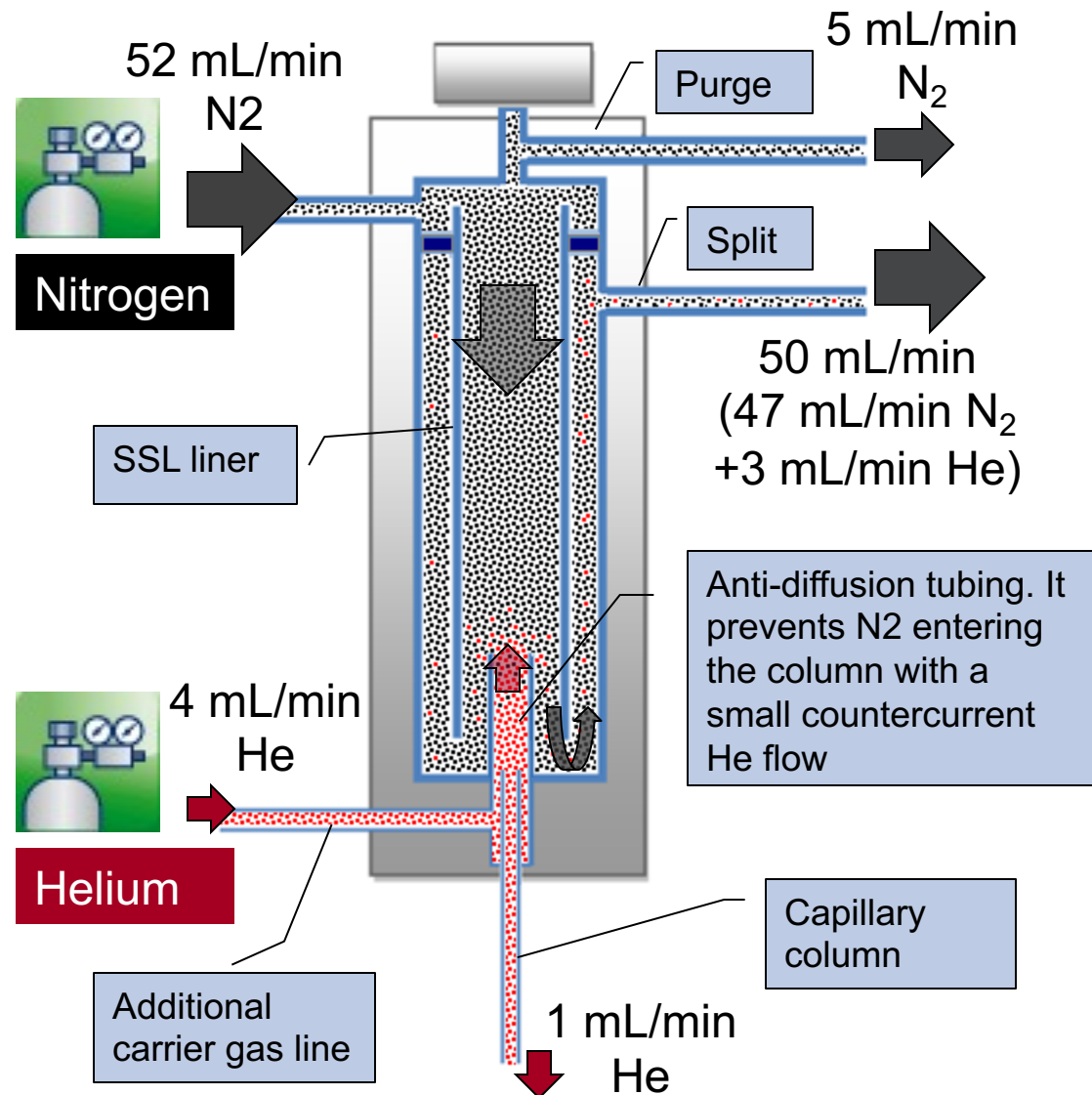
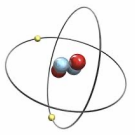
Non è una soluzione a lungo termine, comunque si rimane vincolati alle bombole di Elio

Iniettore, come lavora normalmente con Elio



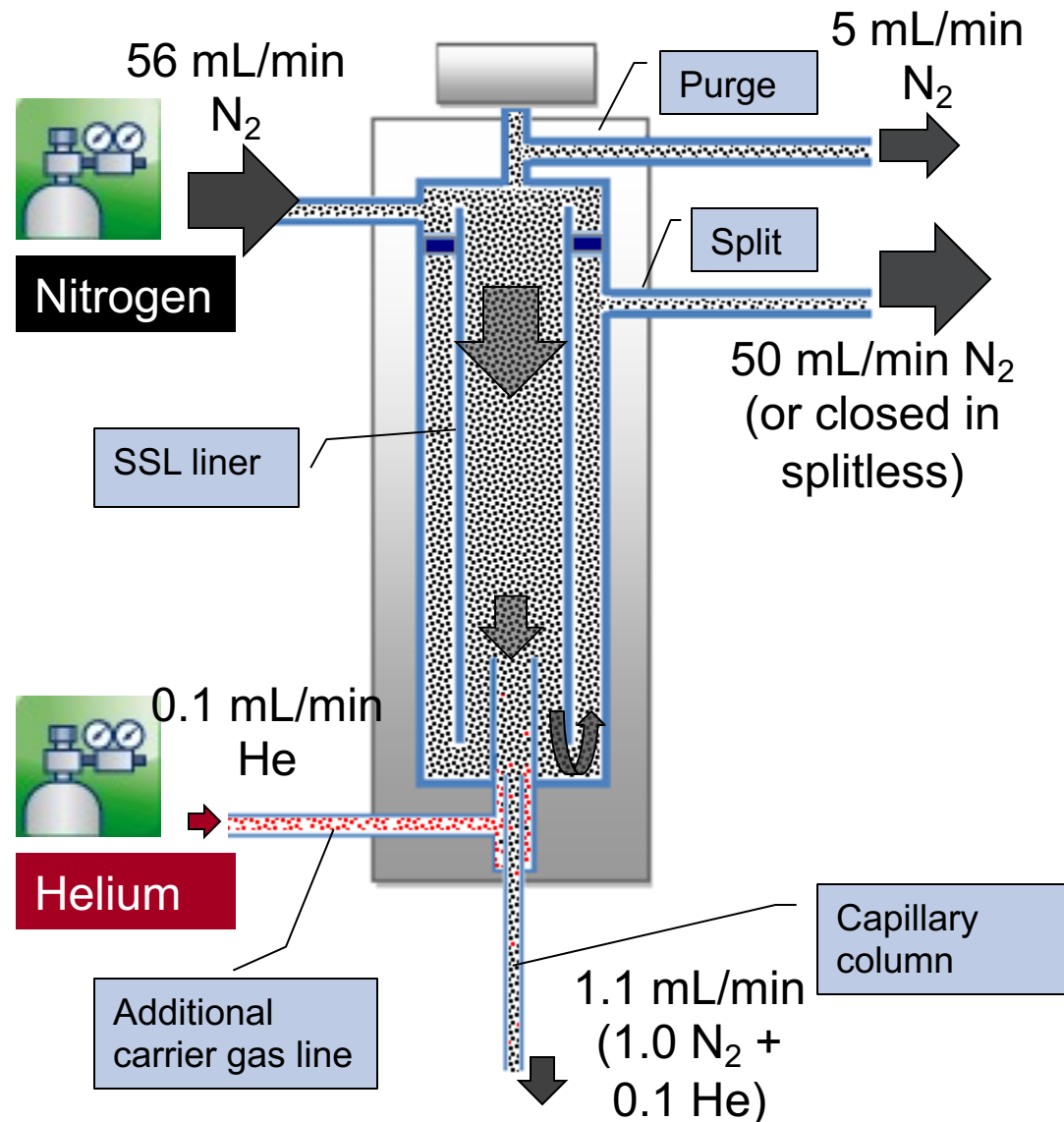
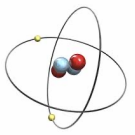
- The same gas is used in the carrier path, septum purge path, and split path.
- Typically, only $\sim 1/10 \dots 1/50$ of the total flow is used for the analytical column carrier flow.
- Purge and split flows cannot be reduced beyond a certain limit without introducing contamination into column/detector (sample matrix accumulated in liner and lines, septa particles, air diffusing from septa, seals off gassing, ...).

Iniettore con HeSaver, come lavora in GC run



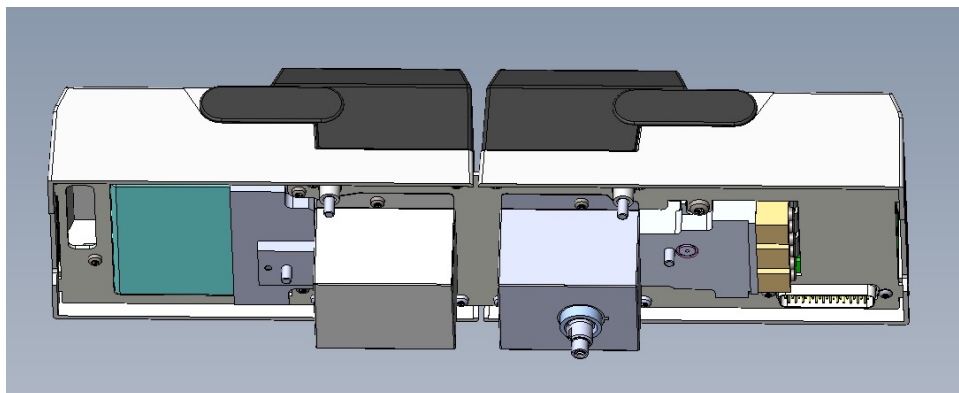
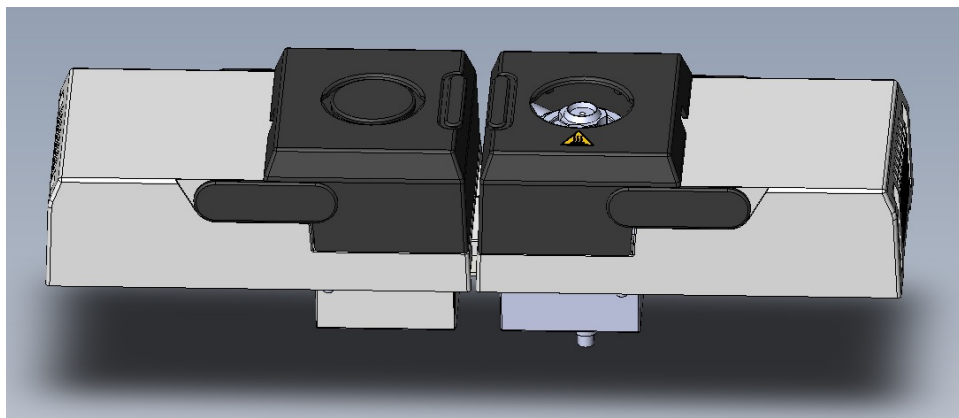
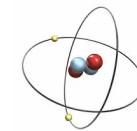
- Inlet is supplied with **2 different gases: Nitrogen and Helium**
- Nitrogen purges the injector while Helium only feeds the column for separation
- During all “non-injection” periods, Helium is supplied with a flow that is just slightly higher than the column flow (determined by the column head pressure regulation)
- Helium consumption is typically only 1/14 of standard-plumbed SSL

Iniettore con HeSaver in standby



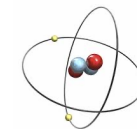
- During injection period, Helium is (almost) closed off and nitrogen flows into the column for sample introduction.
- Helium is supplied at a bare minimum flow of 0.1 mL/min only to keep the connection swept and avoid dead volume negative effects during injection.
- When GC is in stand-by (not running samples) it can be left in this condition with almost zero consumption of Helium

HeSaver Inlet Module



- Double-size module derived from an SSL module and having a special base plate.
- It takes both positions of front (or back) inlet and detector.
- Electrically connected only to inlet connector, pneumatically connected to both.
 - Inlet side supplied with Nitrogen using carrier port, detector side connect to Helium using make up port

Helium Saving Calculator



GC Flow conditions		EPA 8270 Standard
He carrier gas flow	ml/min	1
He split flow	ml/min	60
Gas saver flow	ml/min	20
Gas saver on	min	3
Purge flow	ml/min	5
Run time	min	25
Gas volume in cylinder	L	7300
Runs per Day		57
He cylinder cost	\$	300
N ₂ cylinder cost	\$	60

• **Example:** EPA 8270

Widely used for semi-volatiles analysis with GCMS

• **Total analysis time:** 25 minutes

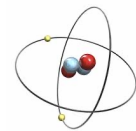
• **Round the clock analysis x day:** 57

Helium cylinder life time extended from 5.2 months to 3.5 years

7 times benefit to the lab

3 times benefit to the lab

		Standard He consumption	HeSaver Consumption
Daily He usage	L	46.56	5.76
He cylinder life	Days	157	1267
Daily N ₂ usage	L	0	40.8
N ₂ cylinder life	Days	0	179
Yearly Total Costs	\$	688.8	205.9



Durata di una bombola di Elio, scenari

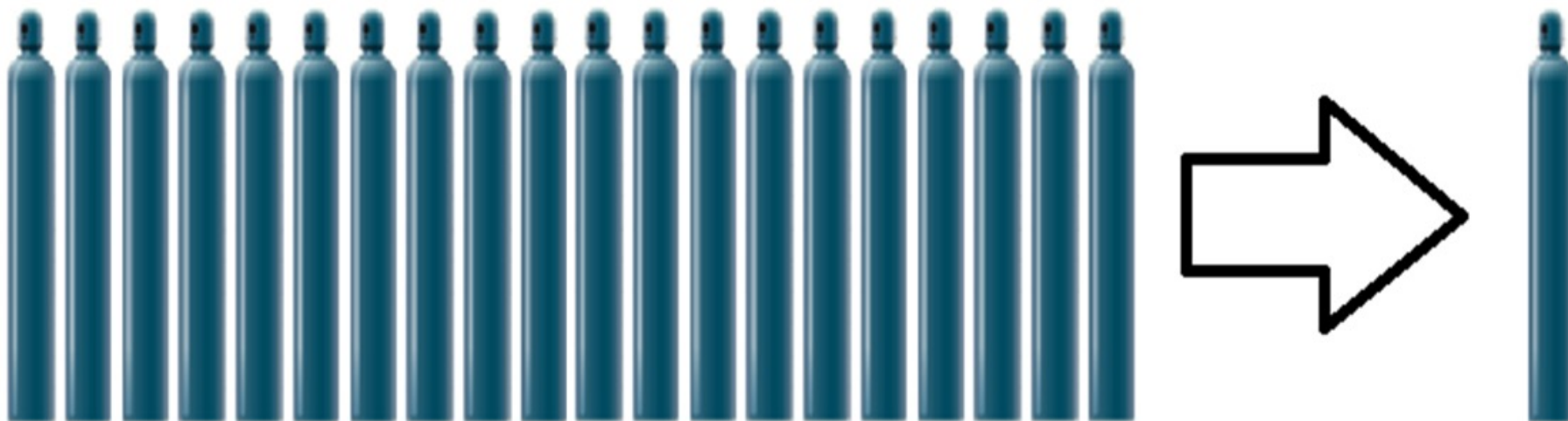
Per un bombola tipo Praxair 3AL-2216 (48.14L) 2250psig (153 atm)
4 ml/min (sccm):

3.5 years continuous duty

5.4 years shutting off during weekends

10.5 years shutting off at end of workday (8hrs. Operation)

16.3 years shutting off at end of workdays and weekends



*Grazie per
l'attenzione*

