Beam, Multi-Beam and Broad Beam production with COMIC devices
Pascal Sortais, Thierry Lamy, Jérôme Médard, Julien Angot, Christophe Peaucelle

0 - Recall of the COMIC principle

1 - Mono-beam / Mono-cavity devices
   1.1 CO-MIMAC: a moveable beam line for detector tests
   1.2 Q-COMIC: the Quartzed COMIC for on-line applications

2 - Mono-beam / Multi-cavity devices
   2.1 T-COMIC: a plug & play device for implanter
   2.2 COMIC-Array: low energy broad beam for surface traitement

3 - Multi-beam / Multi-cavity device
   3.1 COMIC-Array: medium energy multi beam for implantation

4 - Conclusion
0 - The COMIC principle

The COMIC discharge: a drastic simplification and miniaturisation of a microwave discharge (plasma = matched load)

The discharge

The source

Patent request: N° 0857068
Very compact, low power (< 10 W)
- **but** -
delivering a current comparable to an filament ion source ~ mA

**Plasma source mode**
*Argon 10⁻² mbar / 5 W*

**Source 18.5 KV**

**Extraction electrode**

**Grounded electrode**

**17.8 KV**

**FC**

**0.20 mA**
Beam, Multi-Beam and Broad Beam production with COMIC devices

0 - The COMIC principle

The COMIC discharge: the « soft » ionisation, \( T_e \sim 5 \, \text{eV}, \ n_e \sim 5 \times 10^{10} \, \text{cm}^{-3} \) (measured at the exit of the cavity)

\( \tau_i \sim \text{very small, gas flux \sim can be relatively high} \)

Molecular production:

\( \text{H}_3^+ \) optimization
(on the charge breeding beam line)
1.1 CO-MIMAC
A moveable beam line for detectors calibrations
0-50 KV down to some p/s

CO-MIMAC: $^{19}$F$^+$ selectivity
1.2 Q-COMIC:

the Quartzed COMIC for on-line applications

Retrofit of a source inside an existing system

Q-COMIC inside the ISOLDE TISS
Beam, Multi-Beam and Broad Beam production with COMIC devices

1 - Mono beam Mono cavity devices

1.2 Q-COMIC: the Quartzed COMIC for on-line applications
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1 - Mono beam Mono cavity devices

Q-COMIC inside the Isolde TISS
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1 - Mono beam Mono cavity devices

Multicharged ions identification with Q-COMIC:

Q-COMIC: Air + impurities of CO2, Kr & Xe / 25 W / 4 x 10^{-6} mbar

For the efficiency measurements please refer to the Pekka Suominen poster
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2- Mono beam Multi cavity devices

**Triple-COMIC:**
Three cavities, one slit extractor

- **Slit extractor:** 2 x 12 mm
- **Focalization electrode**
- **Gas**
- **Cooling**
- **Up to 3 time 20 W 2.45 GHz**

**2.1 T-COMIC**
Beam, Multi-Beam and Broad Beam production with COMIC devices

2- Mono beam Multi cavity devices

2.1 T-COMIC: a plug & play device for implanter
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2- Mono beam Multi cavity devices

2.1 T-COMIC

T-COMIC flange on the IPNL 400 KV implanter

Preliminary experiments
Beam, Multi-Beam and Broad Beam production with COMIC devices

2- Mono beam Multi cavity devices

### Source
- 30 KV

### Extraction slit
- 4 \times 20 mm
- 5KV versus 30 KV

### Movable grounded slit
- 6 mm
- \sim 40 mm

#### Light from the plasma
- 6 mm \sim 40 mm

#### Source slit
- 2 \times 12 mm

#### Extractor plate

1 cavity exited - Air - 30 KV (5 KV) - 1 mA

#### Focused 30 \mu Ae ^{129}Xe beam at 100 KV after the THT column and matching line

### 2.1 T-COMIC

P. Sortais
ECRIS10 - 23/08/10
2- Mono beam Multi cavity devices

Plasma generation over an arbitrary size: COMIC-Array

41 discharges (5 excited)
Neon about 5 W

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2- Mono beam Multi cavity devices

2.2 COMIC-Array:
Introduction of the grid extractor

Electrode distortion around cavities 7 & 8
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2- Mono beam Multi cavity devices

2.2 COMIC-Array : low energy broad beam for surface traitement
Beam, Multi-Beam and Broad Beam production with COMIC devices

2- Mono beam Multi cavity devices

2.2 COMIC-Array: low energy broad beam for surface treatments
Distorsions around the cavities 7 & 8

2 KV / 22 mA - 10 W per cav. / monogap extraction 4 mm / net of holes 2 mm - 2.5 mm

Gas flux :
~ < 1 mbar l /s
1.2 $10^{-3}$ mbar
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3- Multi beam Multi cavity device

Source configured for 13 beams up to 70 KV
13 time $\Phi$ 2 mm with 2 electrodes

- Plasma electrode
- Intermediate electrode (focalisation)
- Grounded Electrode
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3- Multi beam Multi cavity device

Multi extraction and
- control of the focalization -
to assure homogeneity at an arbitrary distance

Nitrogen (air) 20 KV
~ 20 W per discharge
Pressure : 8 10^{-4} \text{ mbar}
φ 2 mm extraction hole
Example of operation
10 times Φ 2 mm with Argon

(13 gas feedings)
With 2 electrodes:
Source : 25.0 KV
$E_{\text{in-between}}$ : 12.0 KV
$\approx$150 µA per beam
$1.2 \times 10^{-3}$ mbar
4- Conclusion

1 - Very basic, but, very customizable

2 - High pressure source

3 - New industrial applications

4 - Lot of possible improvements:
   brightness, frequency, magnetic fields
   (up to reintroduction of a minimum B)
Small is beautiful