A comparision between a KVI-4D emittance meter and an ALLISON scanner.

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content

- introduction
- the KVI-4D Instrument
- the data analysis
- comparison between the ALLISON and the KVI-4D emittance measurements.
- correlations/aberrations in the 4D phase-space
- conclusions

introduction

- demand of intense beams
  - example: $^{208}Pb^{27+}$ 100 µA.

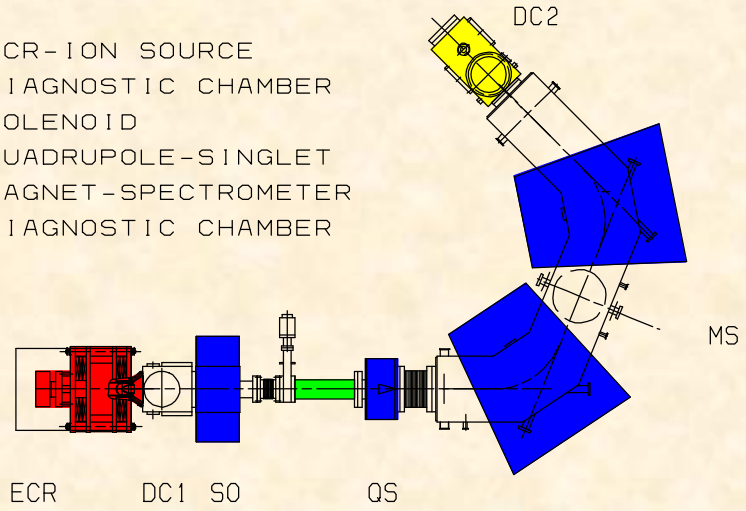
  - Injection (low energy)
    - upgrade of the existing AECR source to 18GHz.
      - > intensity
    - a high transport efficiency of intense beams
      - > quality
      - > matching

      KVI-4D emittance meter

Introduction

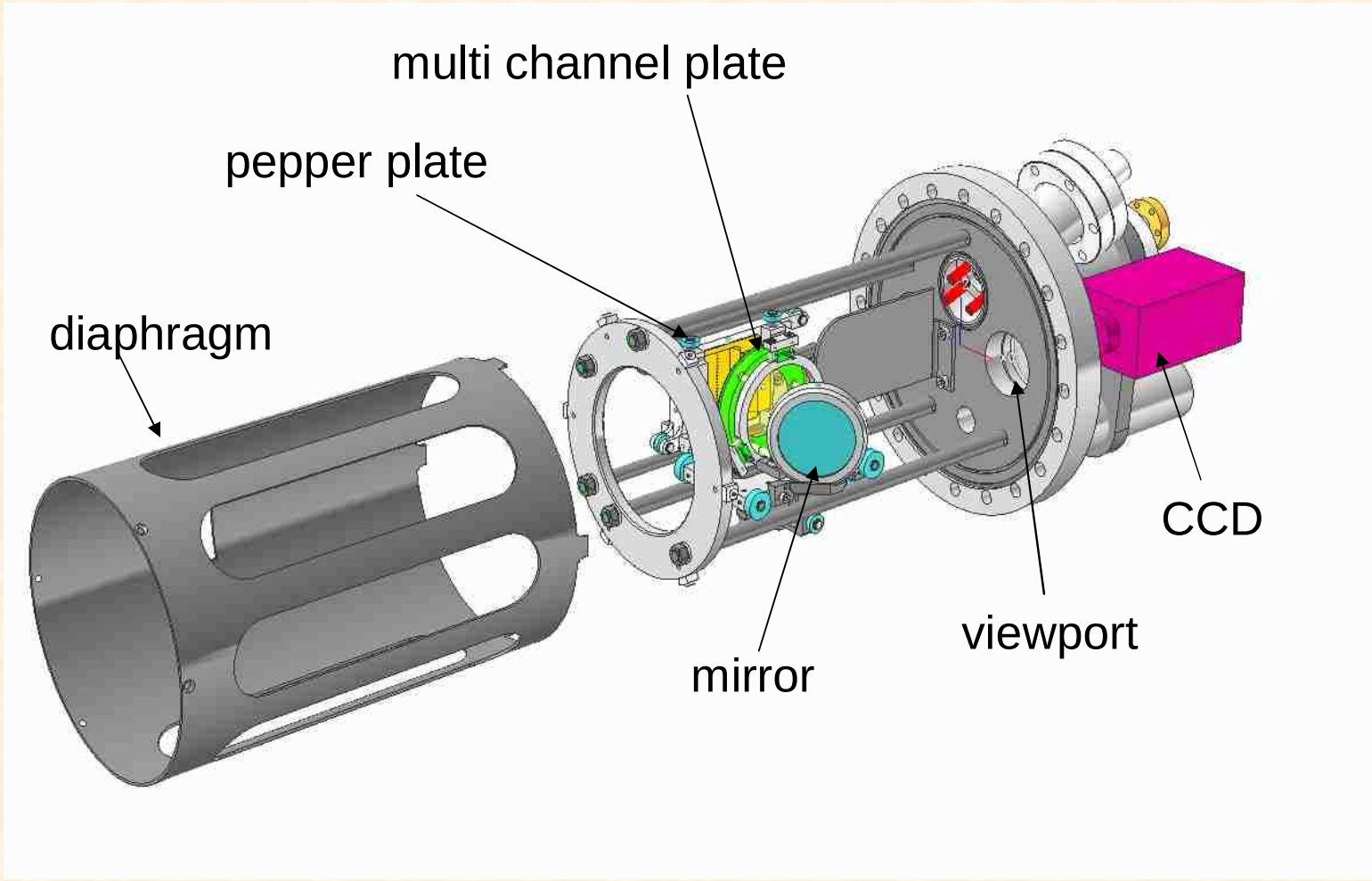
- at ISIBHI a need for a 4D emittance meter
- phase-space at test bench GSI.
  - $\Delta x = 5$ mm, $\Delta x' = +/- 50$ mrad
  - $\Delta y = 40$ mm, $\Delta y' = +/- 6$ mrad
  - $P_{beam} = 150$ W

ECR: ECR-ION SOURCE
DC1: DIAGNOSTIC CHAMBER
SO: SOLENOID
QS: QUADRUPOLE-SINGLET
MS: MAGNET-SPECTROMETER
DC2: DIAGNOSTIC CHAMBER



- conclusion :
  - vertical: an array of holes.
  - horizontal scanning method.

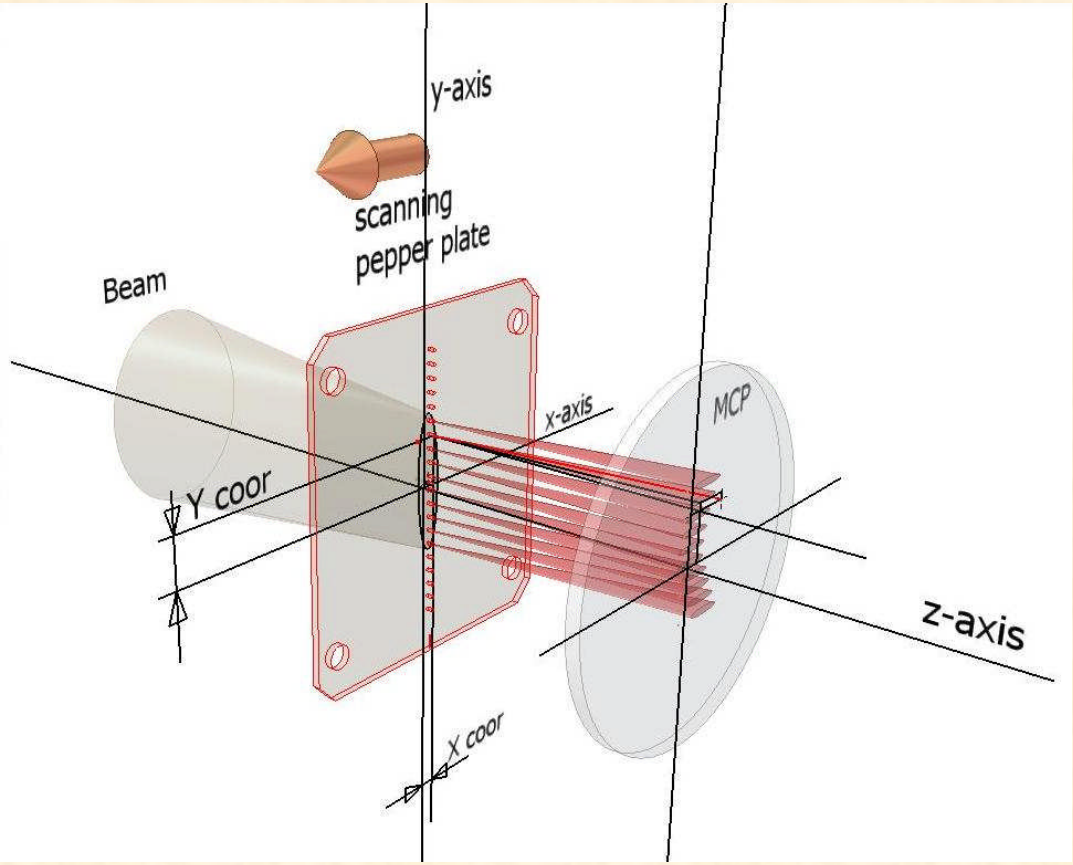
KVI-4D emittance meter

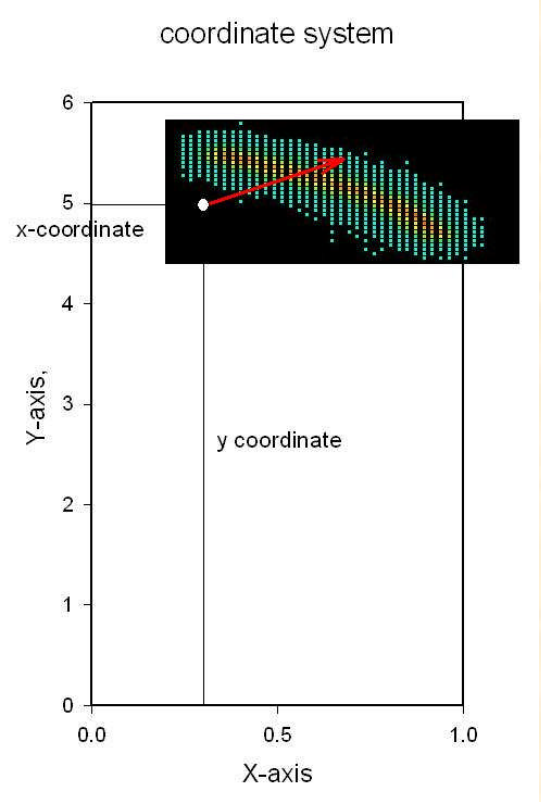


the instrument ; characteristics

- dynamical range — single ion < > 500 µA
- time — 5 min
- size — CF150
- resolution
  - angular — 0.7 mrad
  - spatial — 2 mm (vert), 0.1 mm (hor) (variable)
- power absorption — 150 W (20 W (tested))

the instrument how does it work





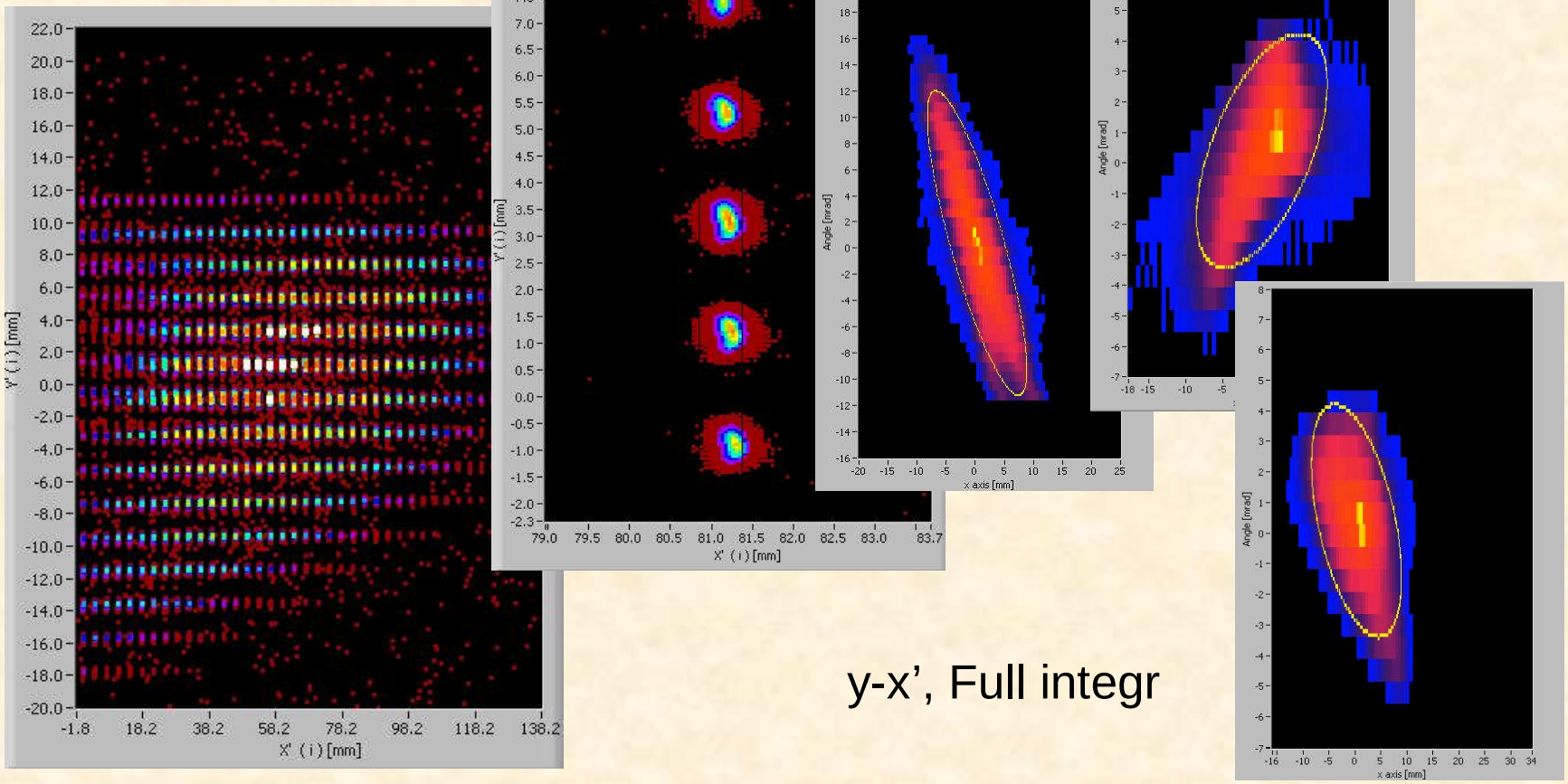
the instrument : the dataset

2D profile of 24 kV O^{6+}, 28 µA

Detail of the 2D profile

x-x', Full integ

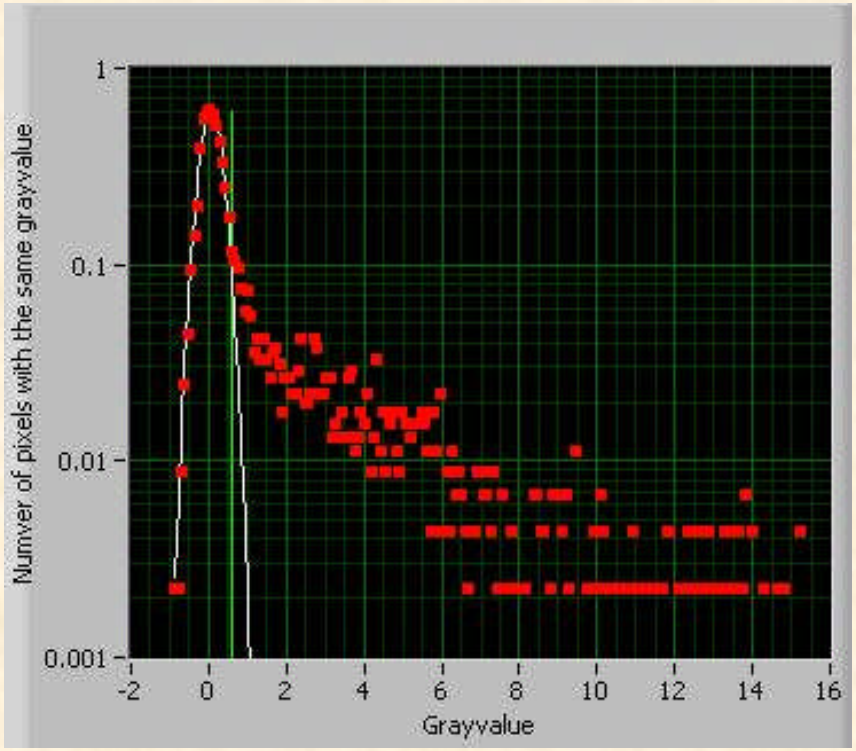
y-y', full integ



y-x', Full integr

Instrument : how to deal with background

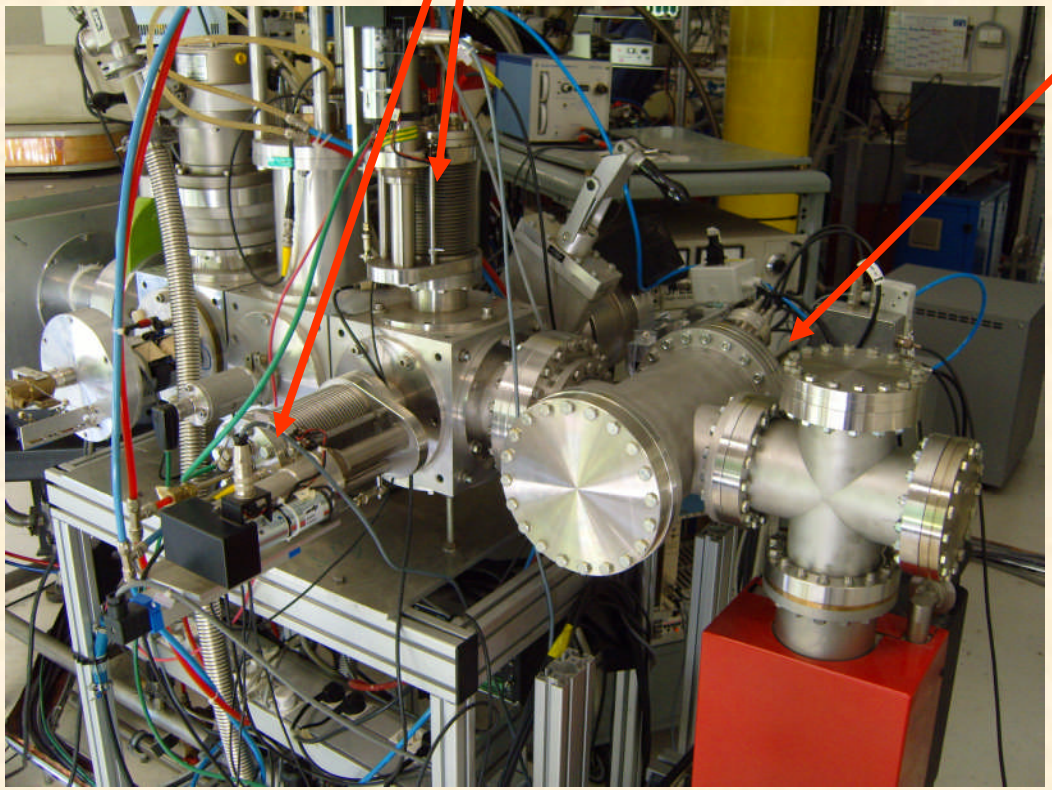
- CCD empty frame subtraction
- Frequency distribution
  - Gaussian fit
  - Threshold 3σ
- Signal to noise.



Allison and KVI-4D inline.

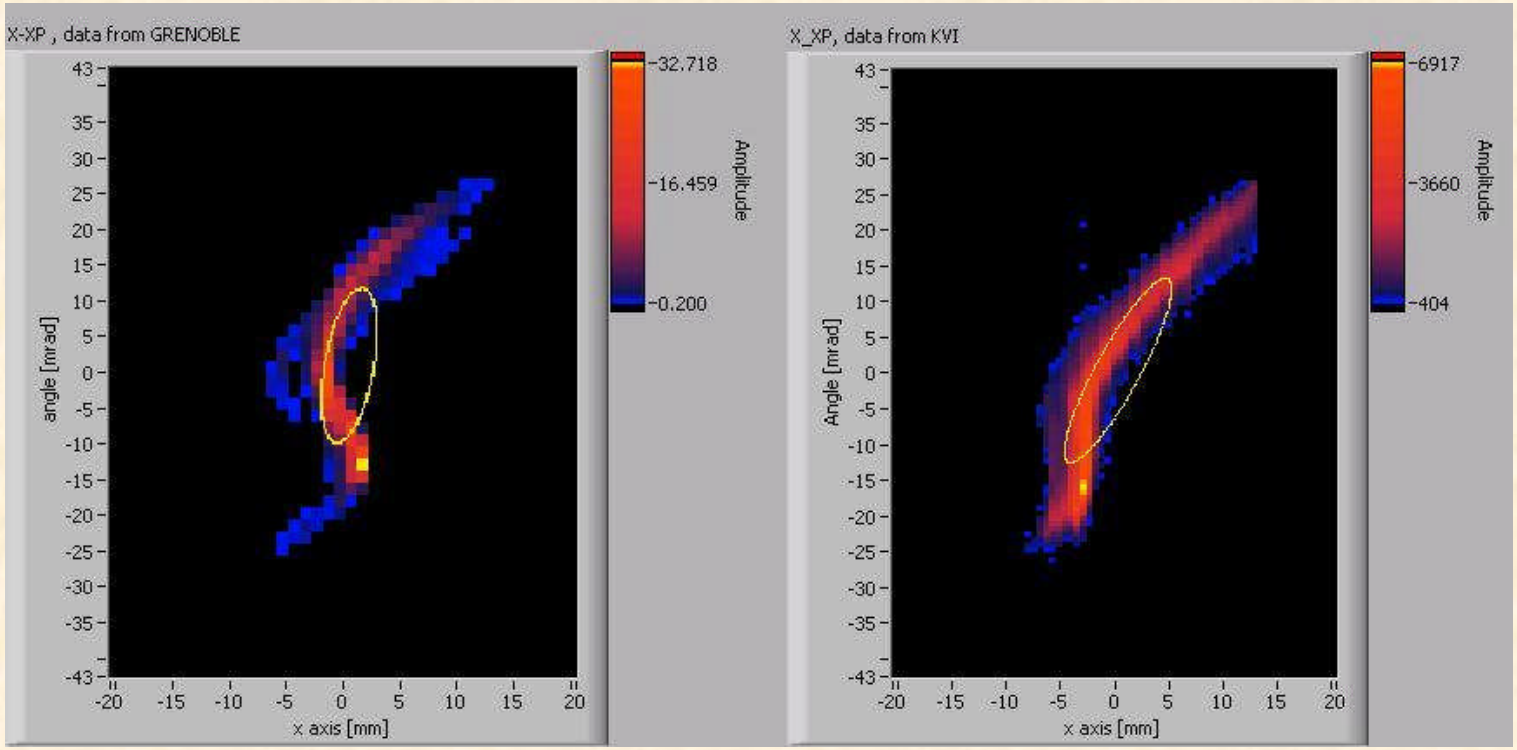
ALLISON scanners

KVI-4D emitance meter



Measurements : comparison

- Comparison x-x' between an ALLISON scanner and the 4D emittance meter. 35 kV Ne 8+, 18 microA



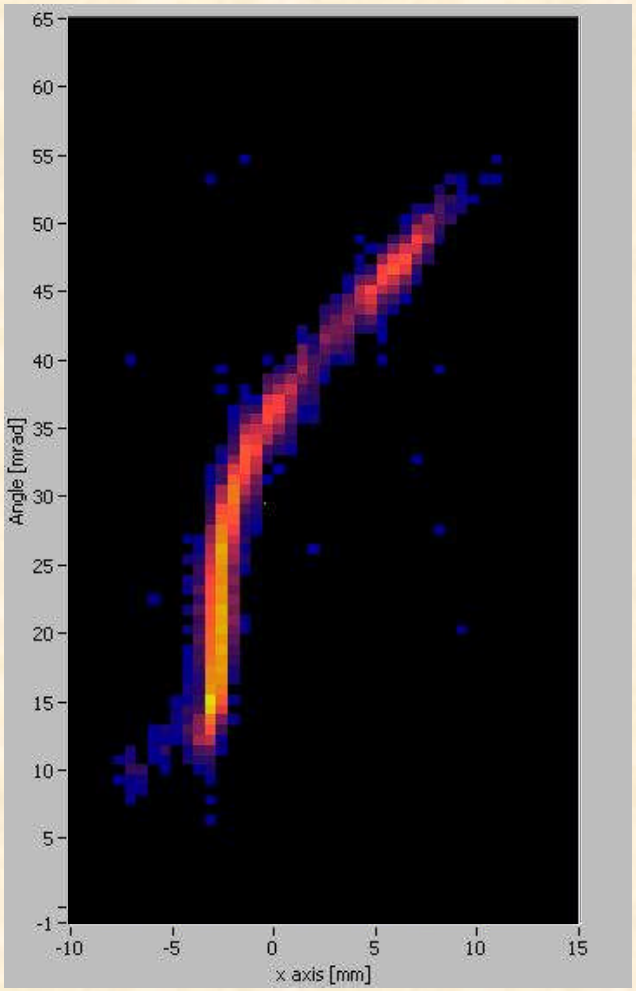
no	E	Beam cur	Charge	HV MCP	KVI-4D x-x'	ALLISON x-x‘
	keV	µA			π[mmmrad]	π [mmmrad]
A41	140	500	4+	5.1	0.17	0.15
A42	140	500	4+	4.8	0.16	
A43	140	500	4+	4.6	0.15	
A51	120	500	4+	5.2	0.16	0.13
A52	120	500	4+	4.9	0.15	
A61	210	180	6+	5.3	0.16	0.18
A62	210	200	6+	4.7	0.14	
A71	280	18	8+	5.7	0.19	0.13
A72	280	18	8+	5.1	0.16	

Charge state 4+

ALLISON : 0.14+/- 0.02 π mmmrad

KVI-4D : 0.16+/-0.01 π mmmrad.

Measurements: explore 4D



x-x' (-20<y<20 mm, -16<y'<+16 mrad)

x-x' (-20<y<20 mm, -15<y'<-10 mrad)

x-x' (0<y<20 mm , -15 <y'< -10 mrad)

x-x' (-20<y<0mm , -15 <y'<-10 mrad)

conclusions/ outlook

- instrument is ready for use
- consistency in the results from ALLISON and KVI-4D
- beam power tests (20W)
- no dependency in charge, intensity, energy
- correlations/ aberration

outlook

- correct for the gain dependency
- measurement and interpretation of the 4D structures