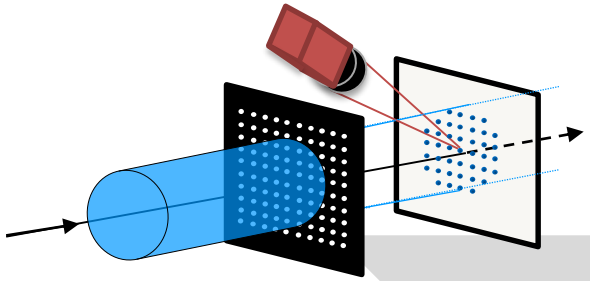
EMIT4D GOAL

Work : Design and realize a 4D emittance-meter for an energy from 100keV to 3MeV



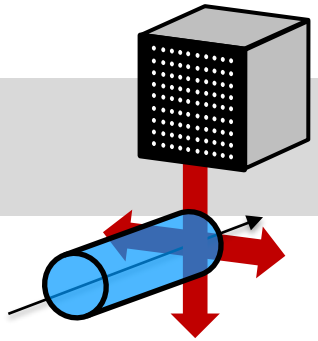
Pepper Pot selection

Impact and reaction on **scintillator**

Camera acquisition

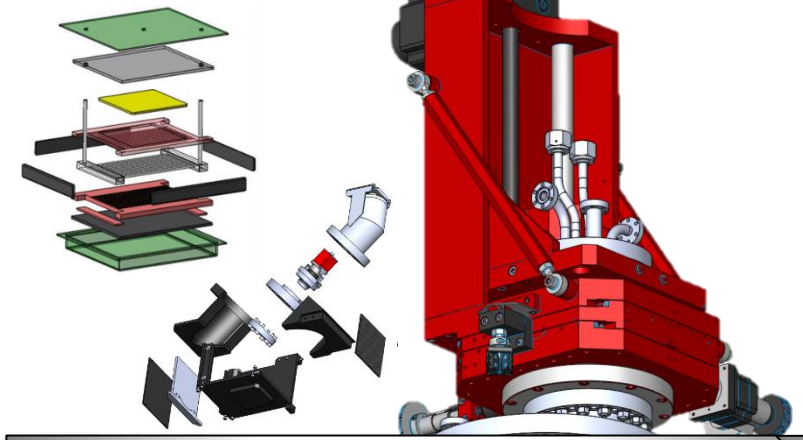
Data processing

XY motion



EMIT4D : PROGRESS

Work : Design and realize a 4D emittance-meter for an energy from 100keV to 3MeV



6th WP2 Meeting Myrte

7th WP2 Meeting Myrte

March 2018

October 2018

Studies, design and realization

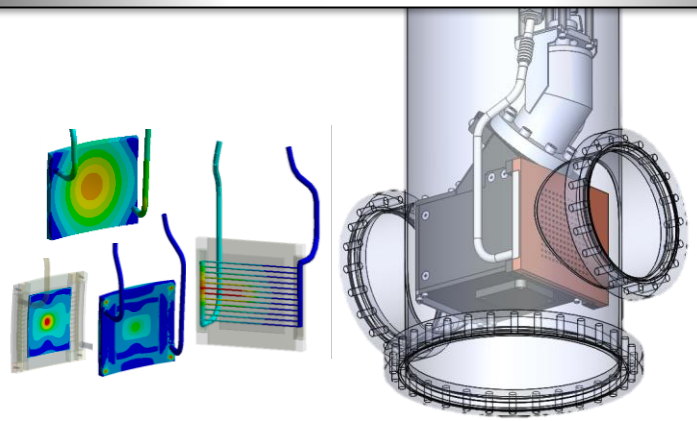
Settings and optimization

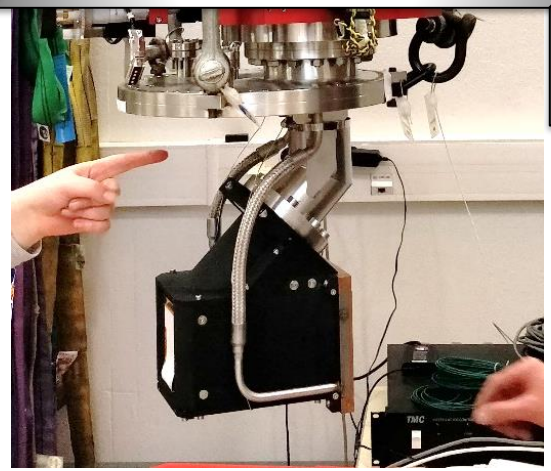
Test at 100KeV

Test at 3MeV

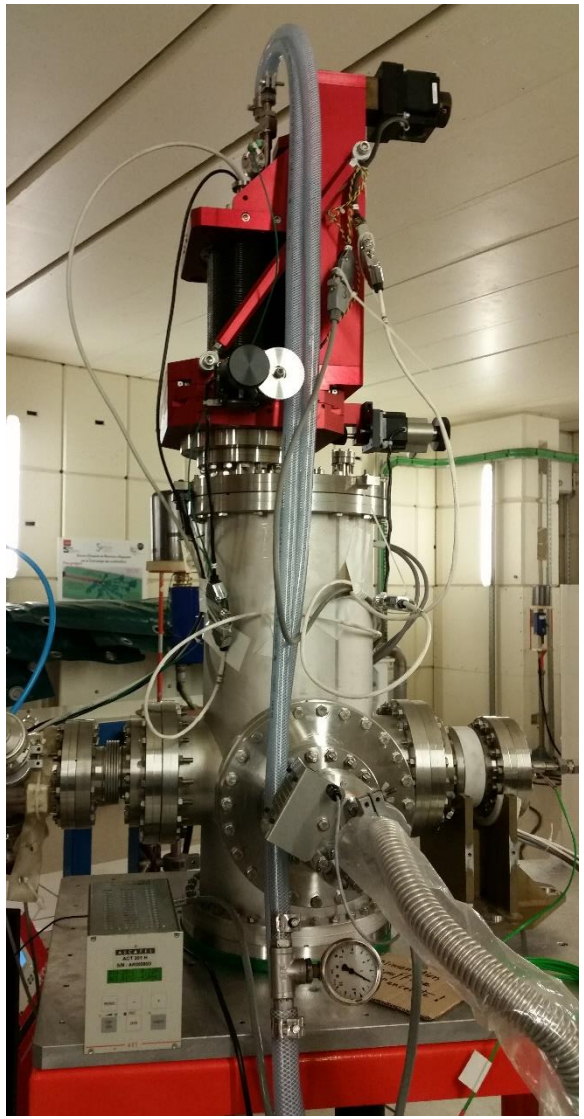
Data processing

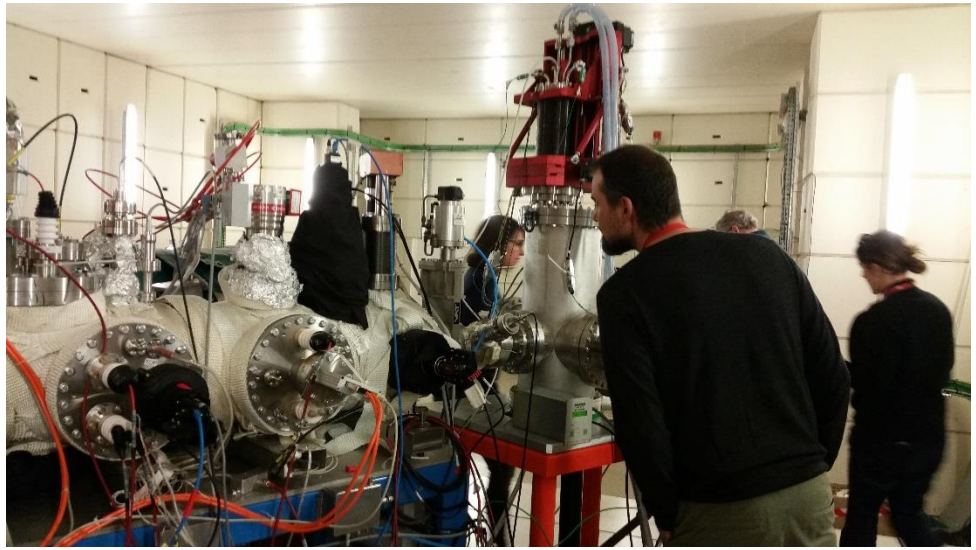
Simulation





EMIT4D : TEST IPHI





Test on IPHI at 3mev :

… later than planned

… some inconvenients with vacuum system and mechanics (especially the support)

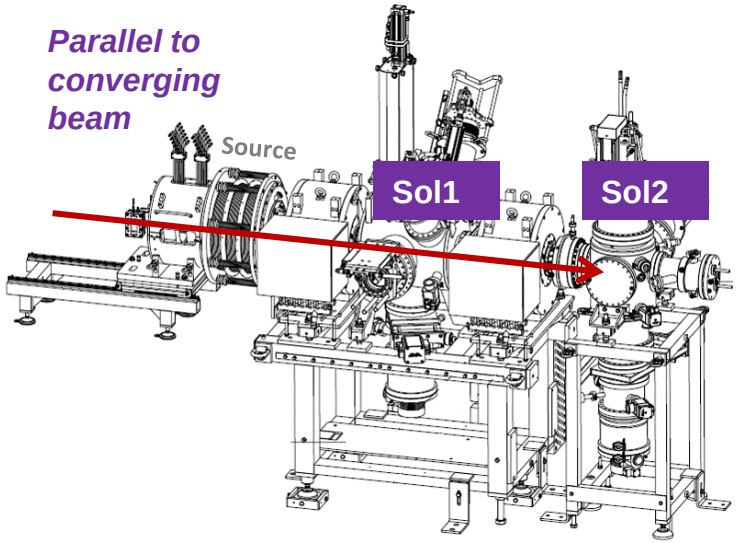
… 1st results was saturated but we had add a filter 1/1000 after 1 day of measure.

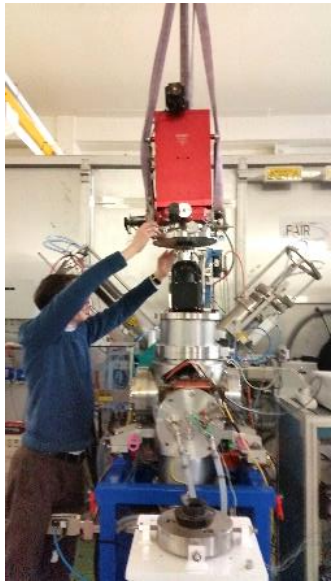
➔ MORE THAN 4000 pictures acquired !

EMIT4D : TESTS SETTINGS

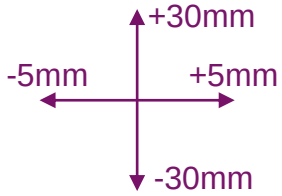
Test at 100KeV
March 2018

BEAM :
- 95KeV - 90 to 140mA
- 4Hz-2,5ms



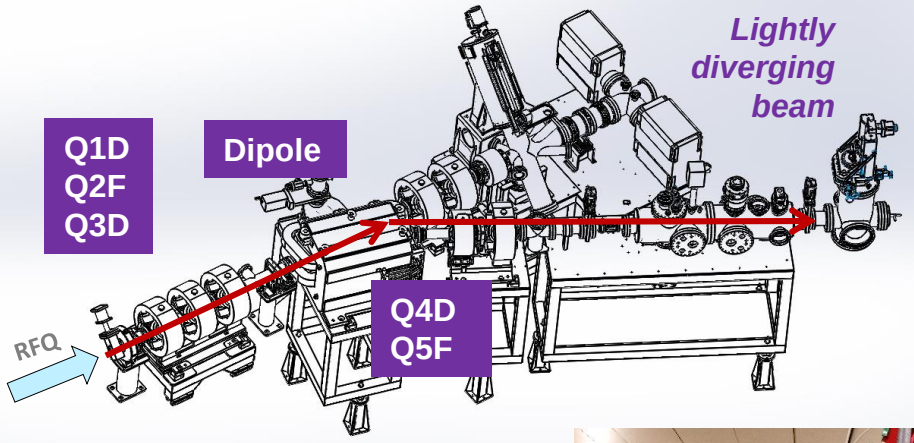


DEVICE :
- Exposure=1µs to 2ms
- Delay = 1,5ms
- Closed diaphragm

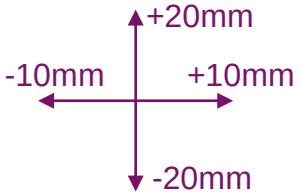


Test at 3MeV
October 2018

BEAM :
- 3MeV – 1 to 9mA
- 1Hz-100µs to 3ms



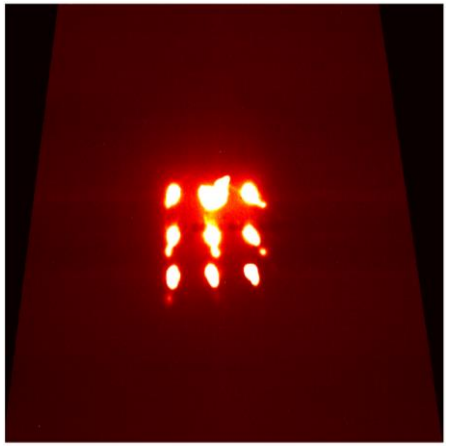
DEVICE :
- Exposure=10µs to 1ms
- Delay = 0
- Closed diaphragm + optic filter (1/1000)



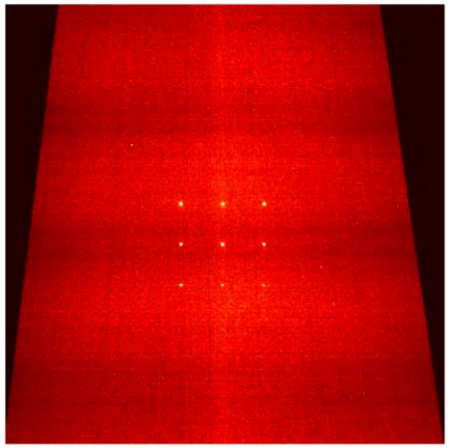
EMIT4D : COLLECTED DATA

Test at 100KeV
March 2018

95KeV
90 to 140mA
4Hz-2,5ms



1st picture of FAIR's test



1st picture of IPHI's test

- 3MeV – 1 to 9mA
- 1Hz-100µs to 3ms

Test at 3MeV
October 2018

1822 images

4032 images

120x120mm to 90x90mm	Beam size	10x45mm to 20x32mm
round	Beam shape	oval
60x24 mm	Mesuring range	40x34mm
Converging	divergence	Lightly diverging
yes	Saturation	No
∞	Signal to noise ratio	2-3
120pxl max.	Spot size	12pxl max.
>1000pxl	Spot movement	<50pxl

Wrong emittance←

→ Possibly right emittance

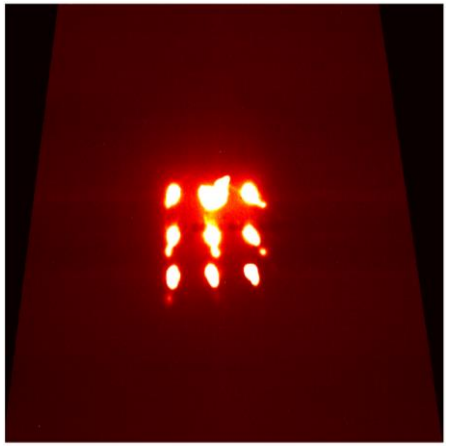
Detection of spots

Targeting of spots

EMIT4D : USEABLE DATA

Test at 100KeV
March 2018

95KeV
90 to 140mA
4Hz-2,5ms

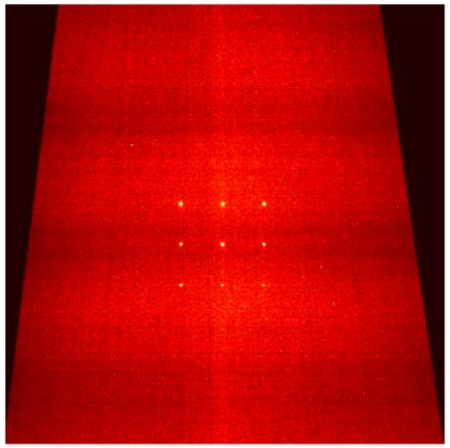


1st picture of FAIR's test

1822 pictures (All saturated)

- 224 with open diaphragm (blurred spots)
- most done with damaged scintillator (no spots, holes in spots, …)

≈ 500 useable



1st picture of IPHI's test

- 3MeV – 1 to 9mA
- 1Hz-100µs to 3ms

Test at 3MeV
October 2018

4032 pictures

- 590 without filter (saturated)
- 243 pictures of control mesurement

= 3199 useable

Data processing

From march 2018 to now …

EMIT4D : DATA PROCESSING AND ANALYSIS

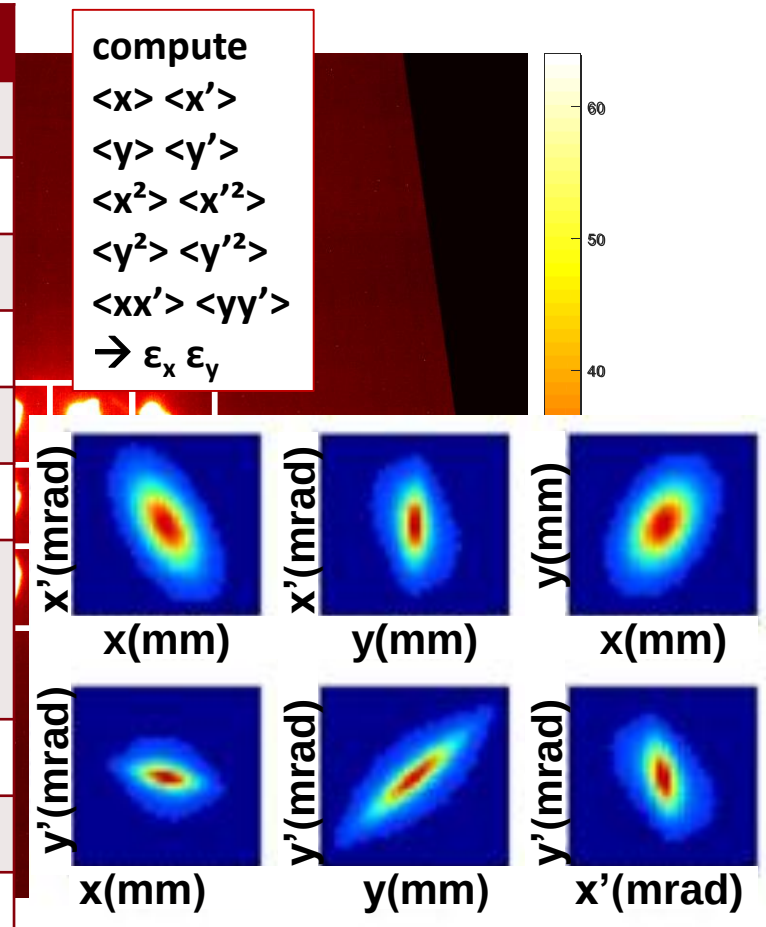
Data processing — From march 2018 to now …

1) Image correction due to angle
2) Areas selection !!!!
3) Data collection from spots XX'YY'
4) Generalization to all pictures of one measure (depending on the position of the device)
5) Comparison with pepper pot data
6) Compute emittance
7) Emittance projections

A little calculus …

250pxl * 250pxl * 9areas * 5 data * 1 to 800pictures = **2 812 500 to 2 250 000 000** data to collect and compute the emittance once

pxl	x	x'	y	y'	a
1	x_1	x'_1	y_1	y'_1	a_1
2	x_2	x'_2	y_2	y'_2	a_2
3	x_3	x'_3	y_3	y'_3	a_3
4	x_4	x'_4	y_4	y'_4	a_4
5	x_5	x'_5	y_5	y'_5	a_5
6	x_6	x'_6	y_6	y'_6	a_6
. . .	. . .	. . .	. . .	. . .	. . .
n-2	x_{n-2}	x'_{n-2}	y_{n-2}	y'_{n-2}	a_{n-2}
n-1	x_{n-1}	x'_{n-1}	y_{n-1}	y'_{n-1}	a_{n-1}
n	x_n	x'_n	y_n	y'_n	a_n



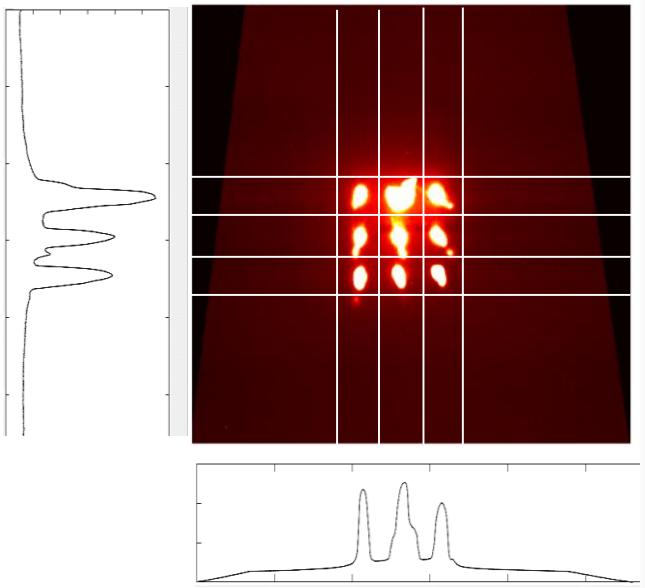
EMIT4D : DATA PROCESSING DIFFERENCES

Data processing — From march 2018 to now …

Test at 100KeV
March 2018

Big Signal to noise ratio
Big spots movement

Detection of spots



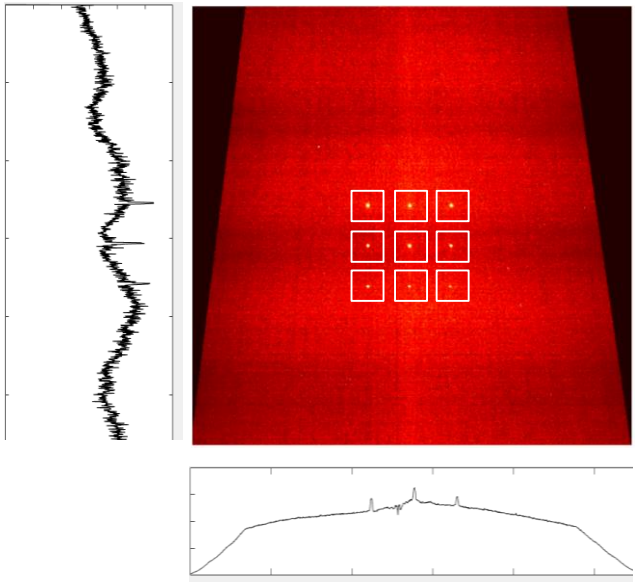
1) Spots detection
2) Automatic ROI definition for each picture
3) Use of all the pixels of the ROI

➔ Done, need debug.

Test at 3MeV
October 2018

Little signal to noise ratio
Little spots movement

Targeting of spots

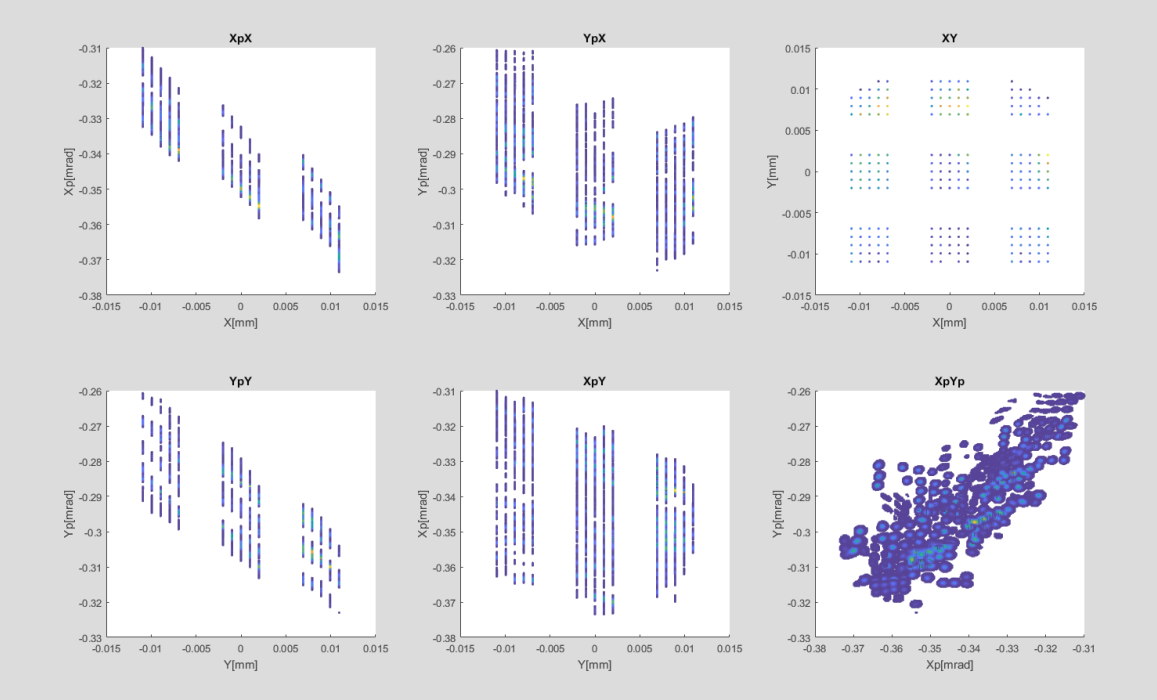


1) Manual ROI definition for each spot but for all pictures
2) Spots detection
3) Use of only spot's pixels

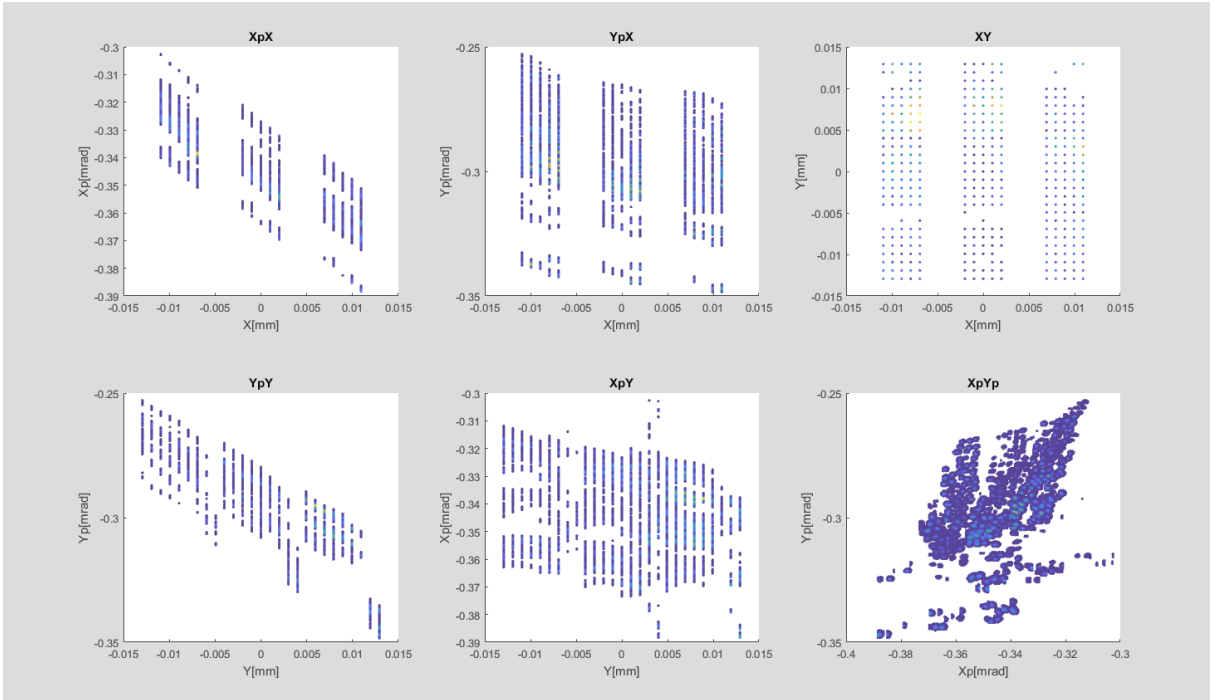
➔ Not ready

EMIT4D : DATA PROCESSING AND ANALYSIS RESULTS

FAIR Data



25 pictures (12”) ➔ εx = 0,5716 εy = 0,6047



45 pictures (22”) ➔ εx = 0,7303 εy = 0,9296

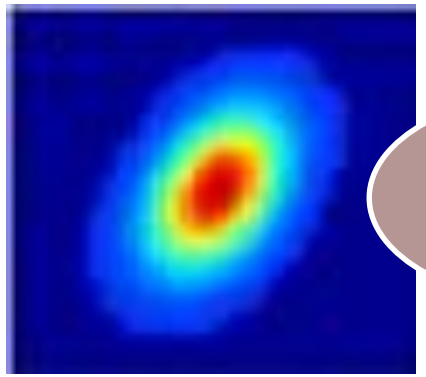
Simulation

From april 2018 to now …

EMIT4D : SIMULATION PROCESS

Simulation

From april 2018 to now …

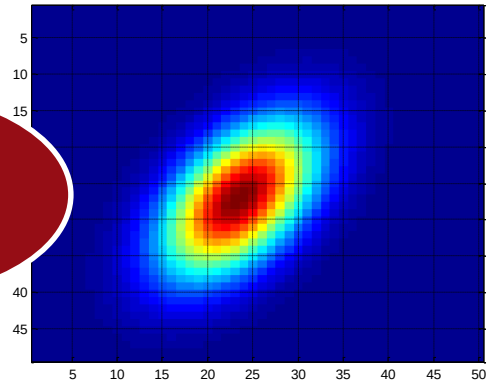


Pixelated emittance projections

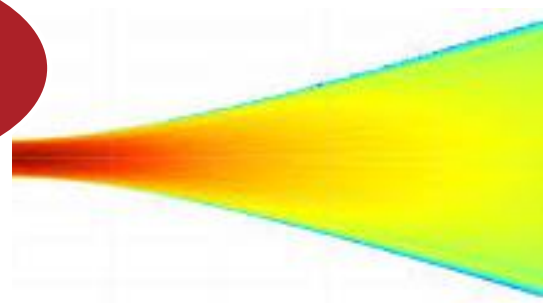
Beam data

ε_x ε_y N_p

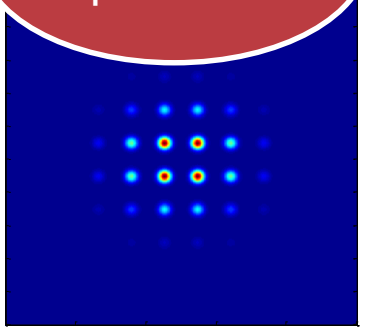
Real emittance projections



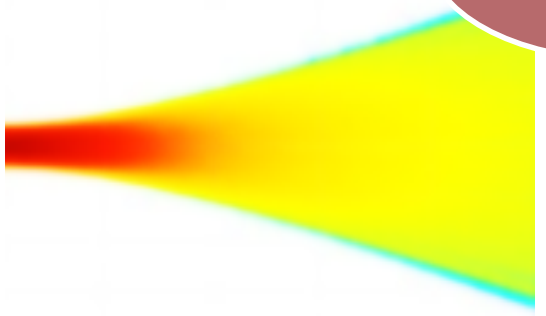
Particles distribution



Spots pictures



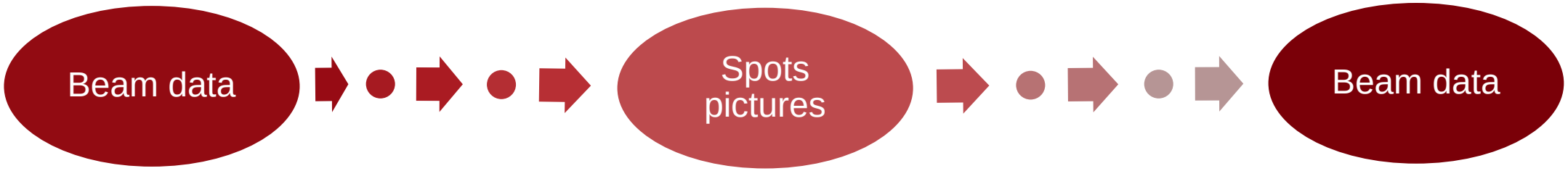
Pixelated distribution

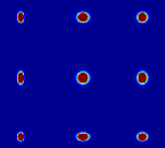


EMIT4D : SIMULATION RESULTS

Simulation

From april 2018 to now …



εx = 0,5 εy = 0,5	5 pictures (5*1)	εx = 0,5715 εy = 0,5584
εx = 0,5 εy = 0,5	25 pictures (5*5)	εx = 0,5459 εy = 0,5582
		
εx = 0,5 εy = 0,5	24 pictures (6*4)	εx = 0,5694 εy = 0,5601
εx = 0,5 εy = 0,5	45 pictures (9*5)	εx = 0,5422 εy = 0,5198

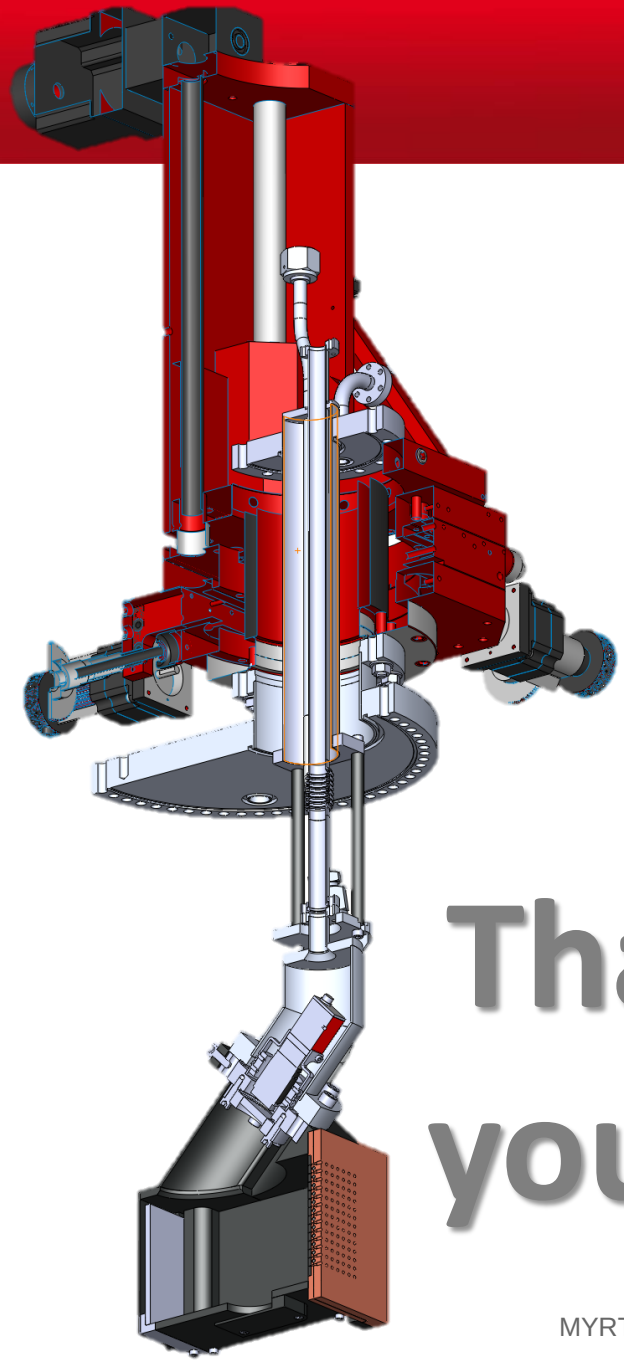
SOON …

Next weeks :

- Debugg data analysis program
- Debugg simulation
- Compare with other data (acquired by allison scanner and Tracewin simulation)

Improvements :

- Add filter and support
- Change lens



Thank you for your attention