Application of SPARC Data Analysis Tool to Benchmark PITZ Data

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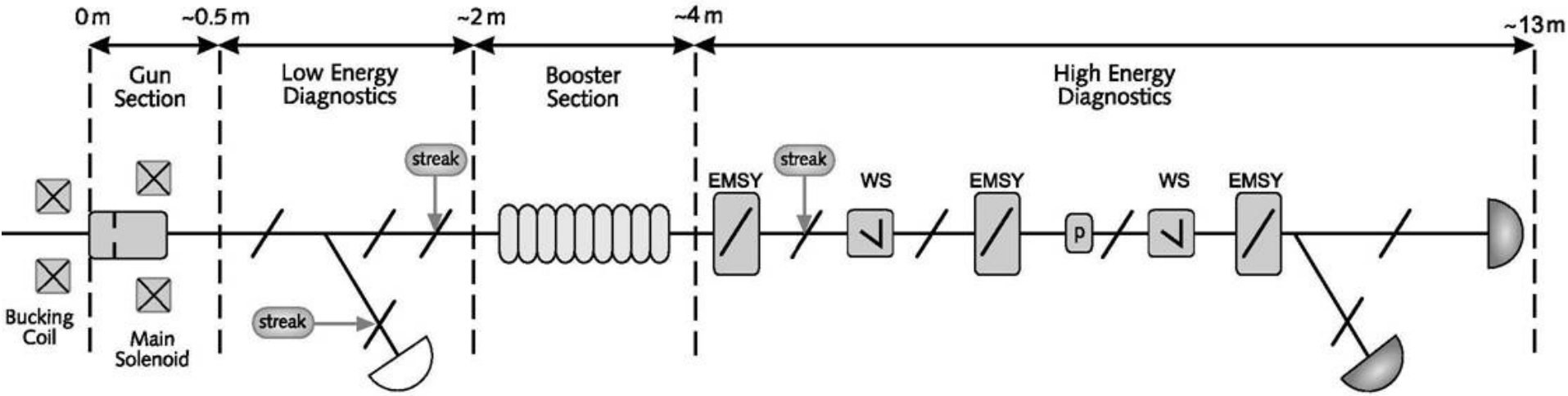
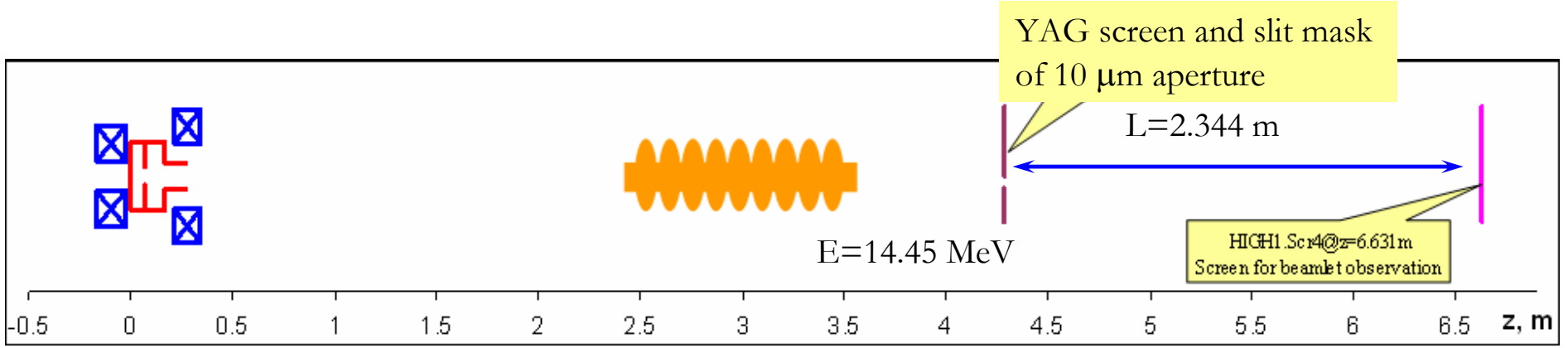
Outline

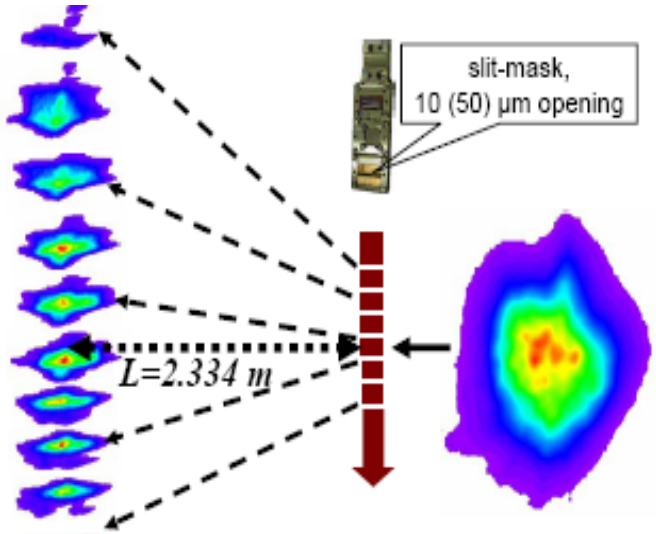
- Application of the SPARC tool to PITZ experimental setup
- Vertical and horizontal emittance analysis results
- Comparison with PITZ results
- Conclusions

PITZ Layout


0m
~0.5m
~2m
~4m
~13m
Gun Section
Low Energy Diagnostics
Booster Section
High Energy Diagnostics
streak
streak
streak
EMSY
EMSY
EMSY
WS
WS
P
Bucking Coil
Main Solenoid


YAG screen and slit mask of 10 μm aperture
L=2.344 m
E=14.45 MeV
HIGH1.Scr4@z=6.631m
Screen for beamlet observation
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
z, m

Emittance Measurement Setup



Single slit scan technique

- 11 equidistant beamlets over the full beam size
- 10 μm slit aperture

- **B-scan @ fixed position**: 6 emittance measurements (in both planes) VS main solenoid current and a detailed slit scan in the waist

- At each signal measurement corresponds a background measurement

Profile Filtering

- Minimum area of beamlets increased

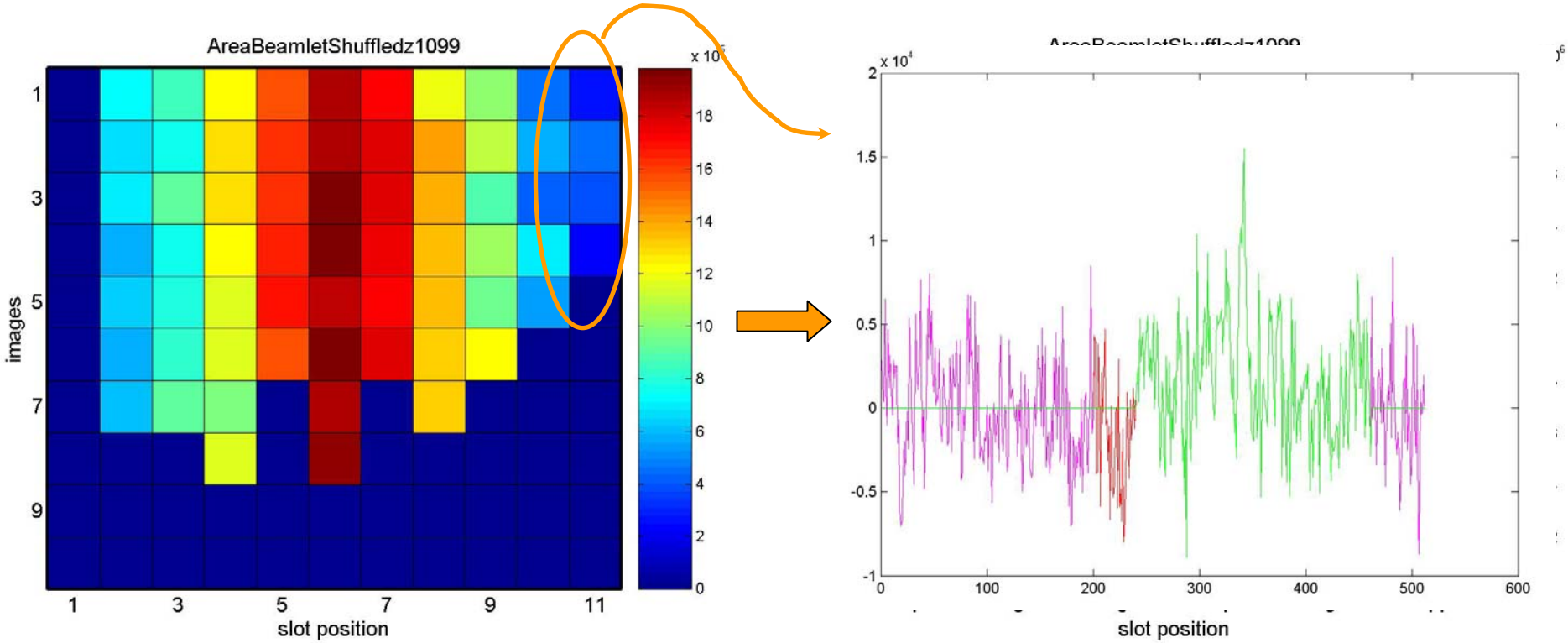
(8 bit SPARC images ➔16 bit PITZ images)

- Choice of ROI beamlet sigma: guess value of the Gaussian fit decreased to be adapted to the typical PITZ beam divergence

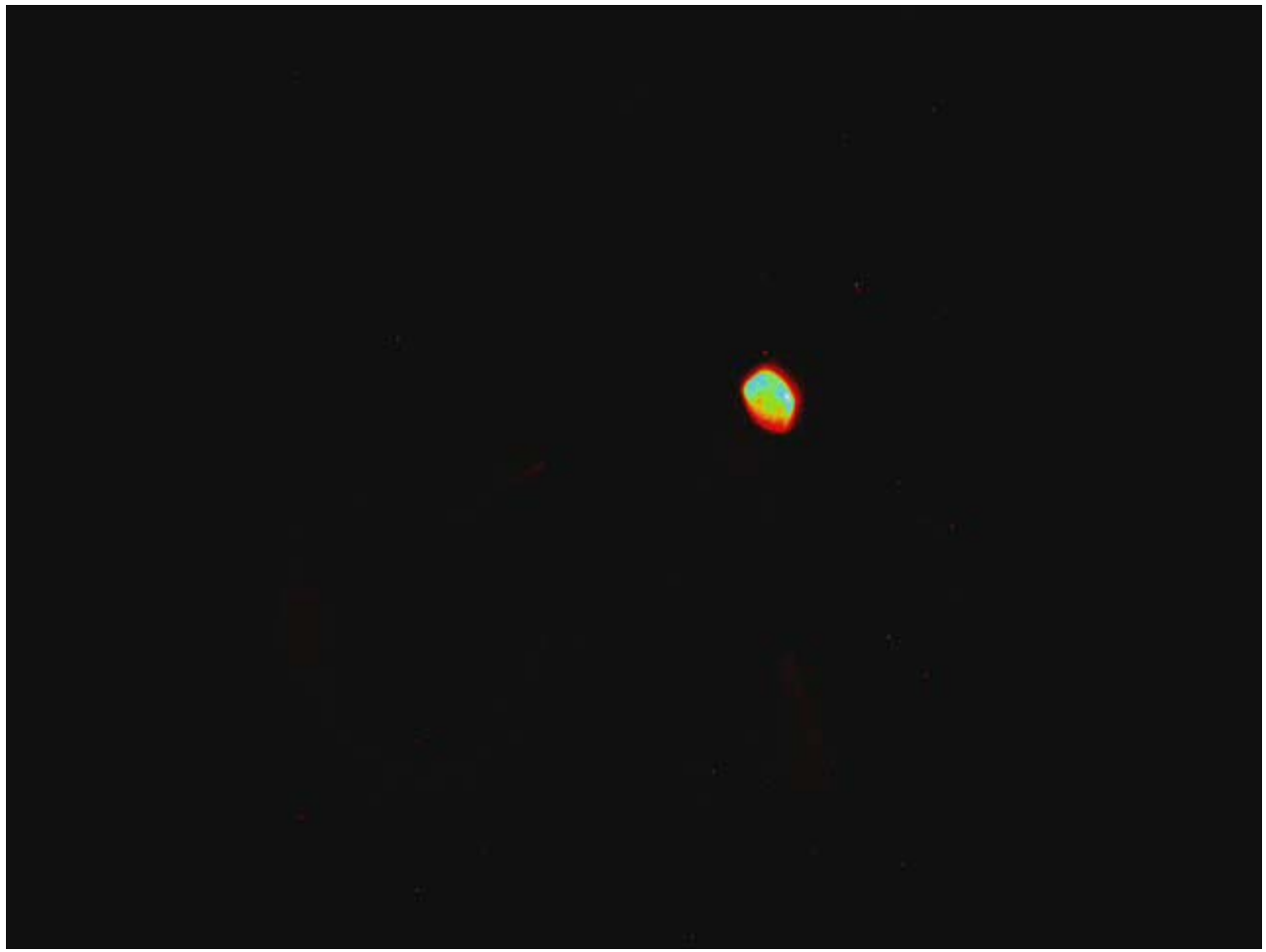
Image Selection

- Use of footprint to study the effect of thresholds
- *Single* image correction: look for "noise-dominated" beamlets
- *Average* image correction: average beamlet area increased

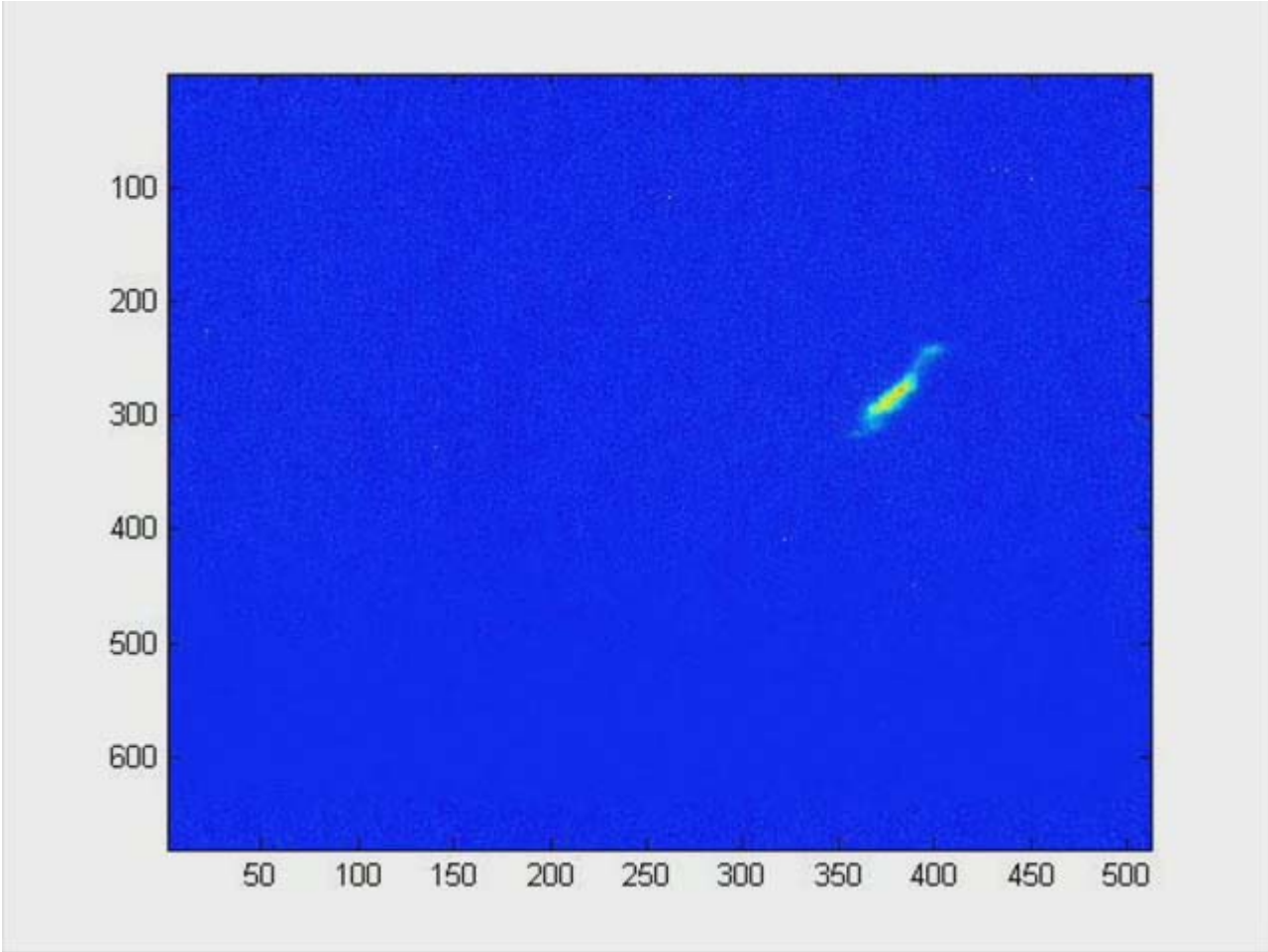
Image Selection



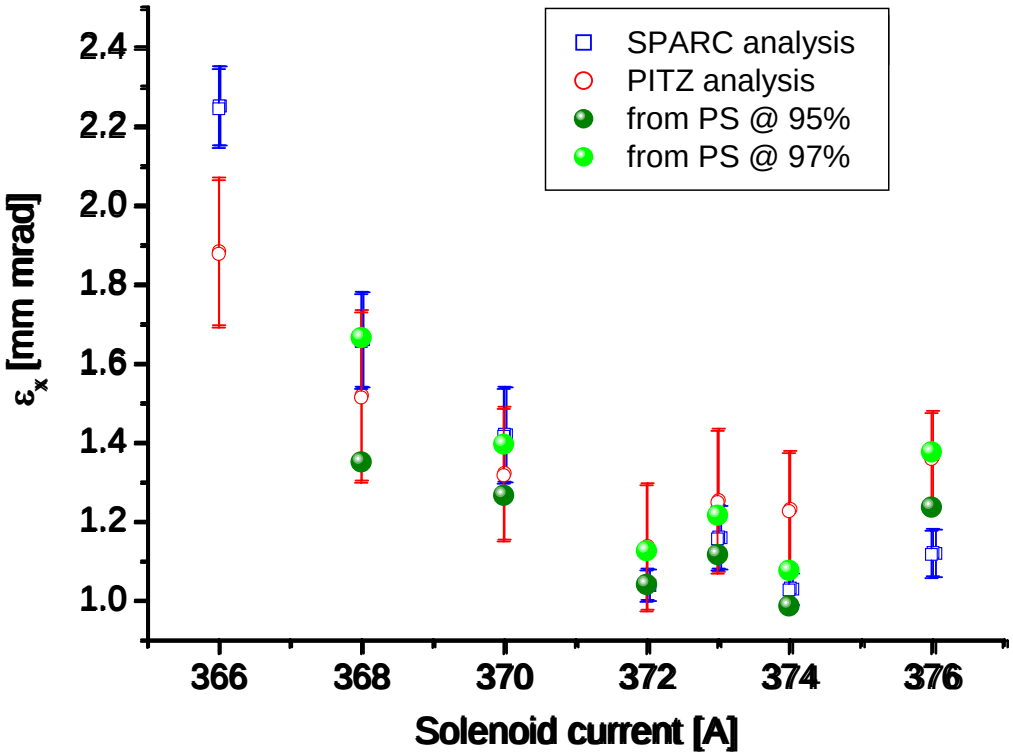
Beam Envelope @ EMSY1

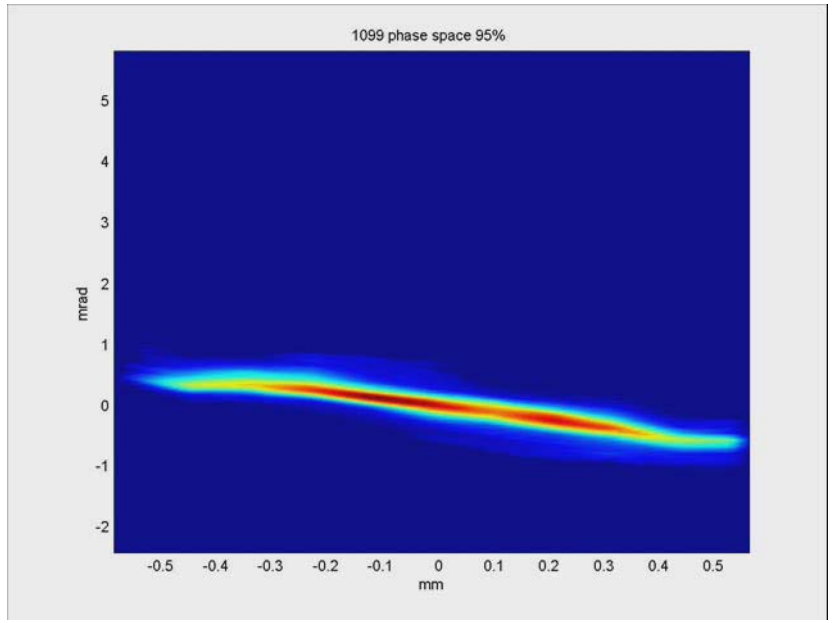


Horizontal Emittance

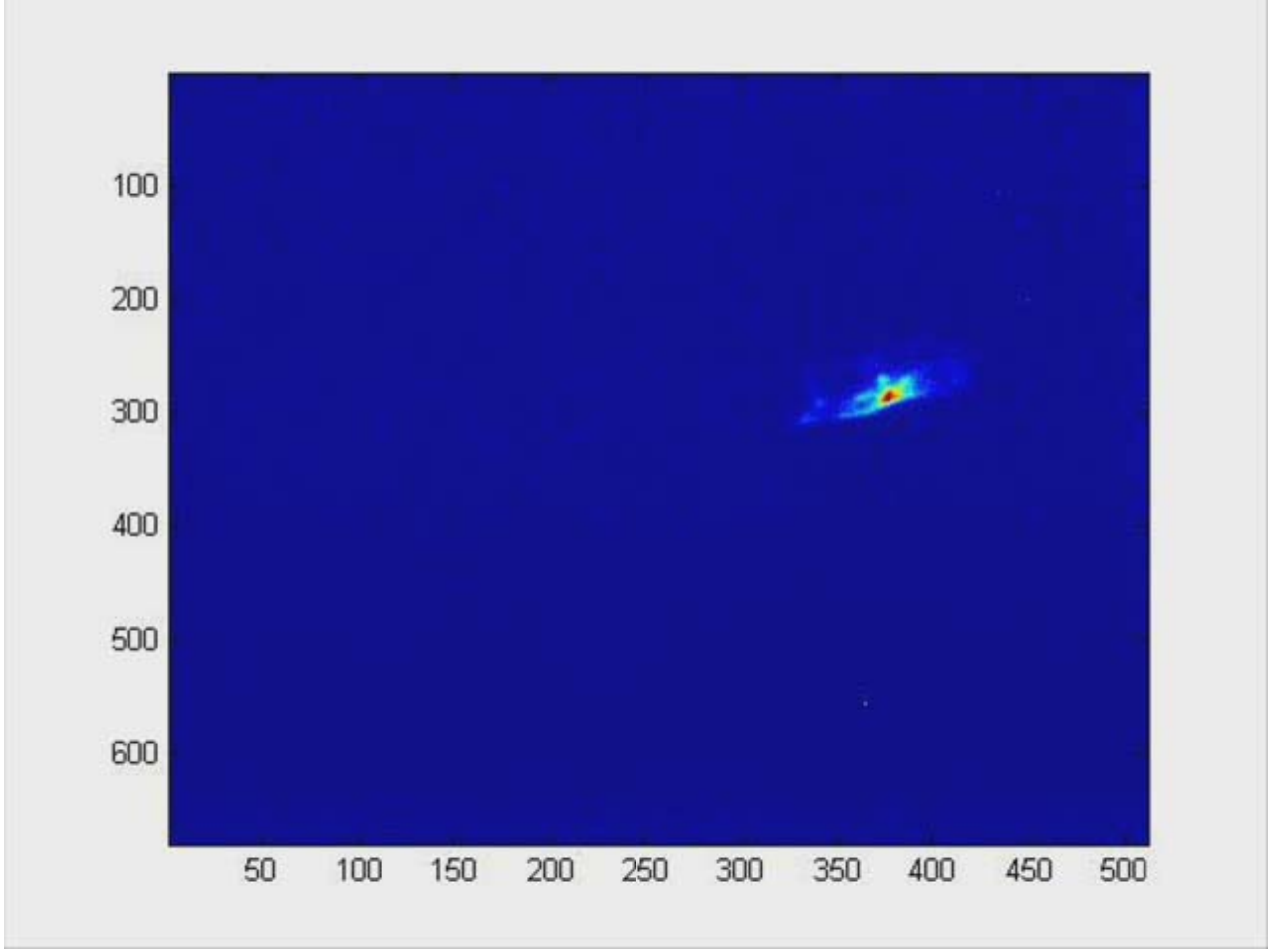


Analysis Results

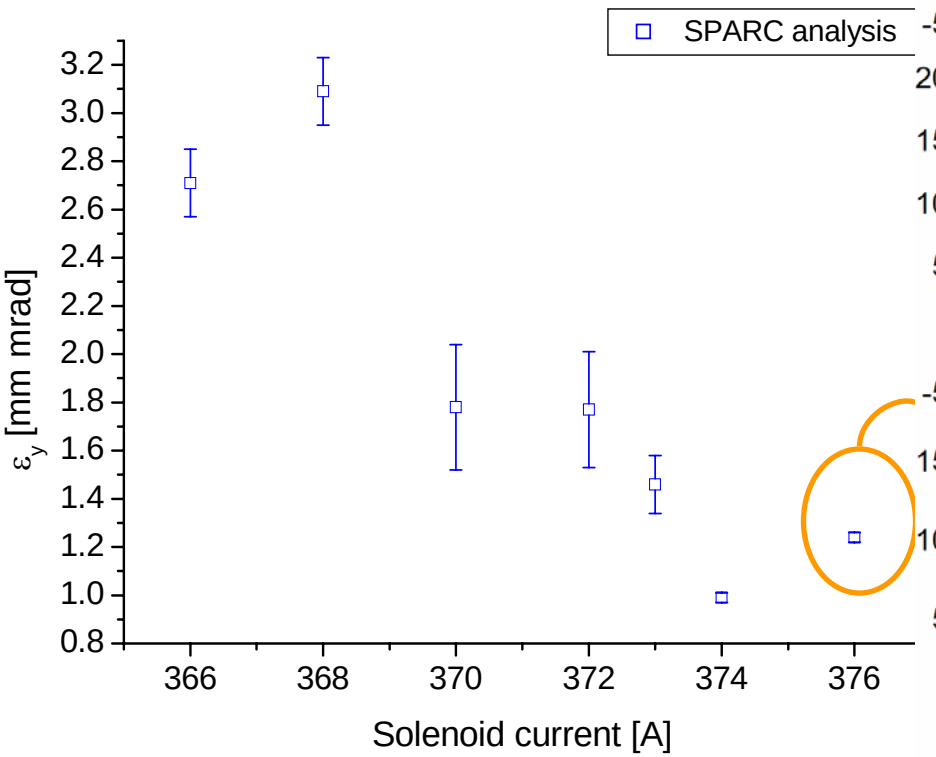


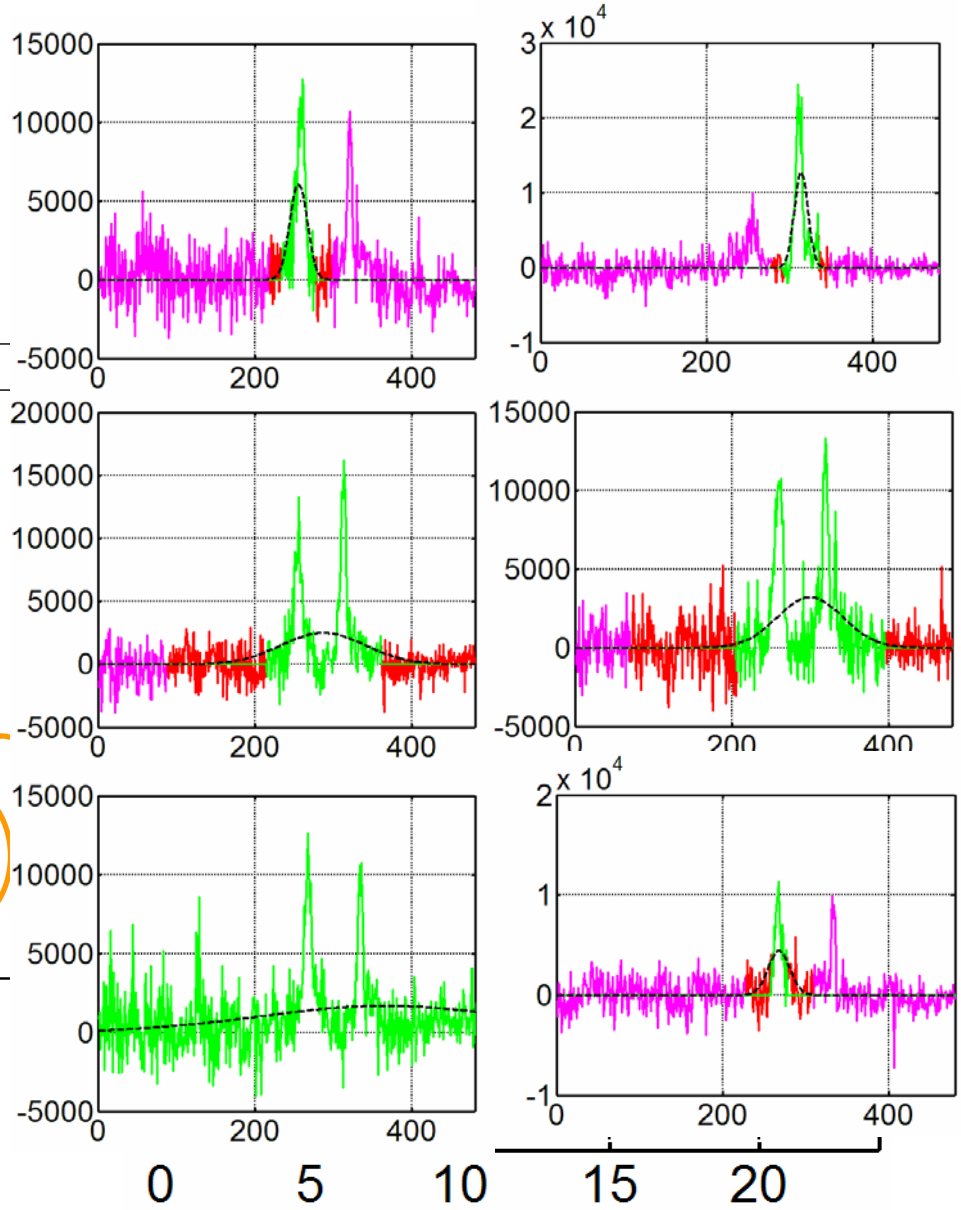


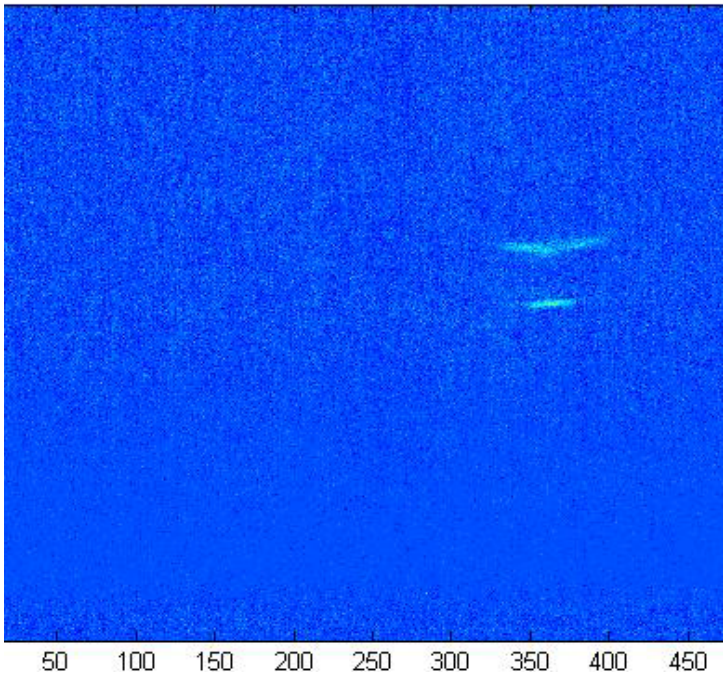
Vertical Emittance

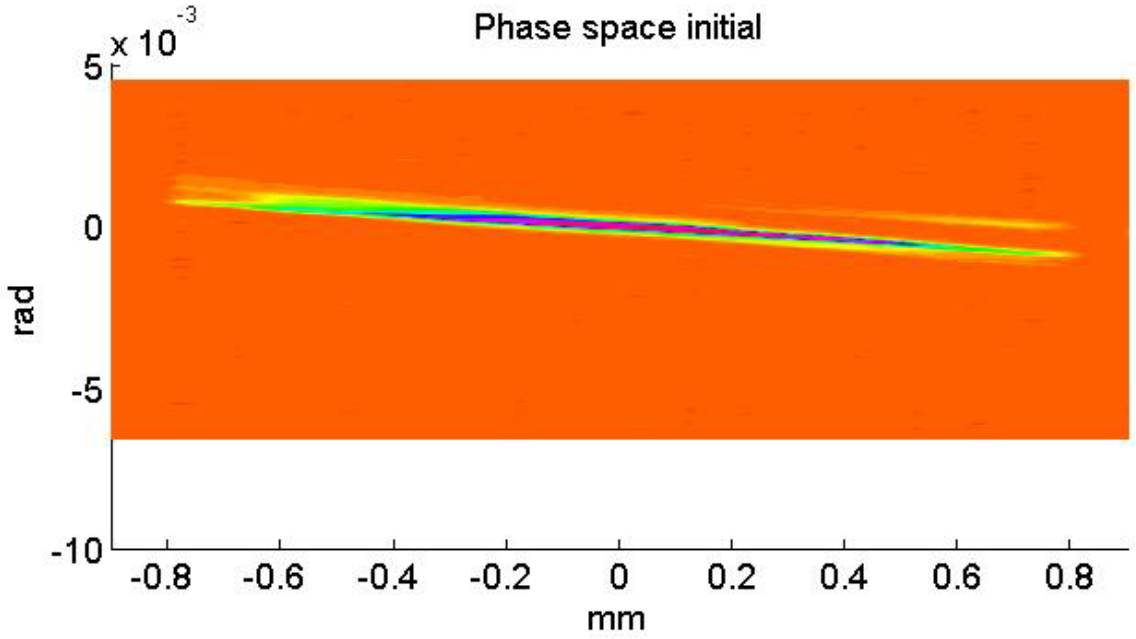


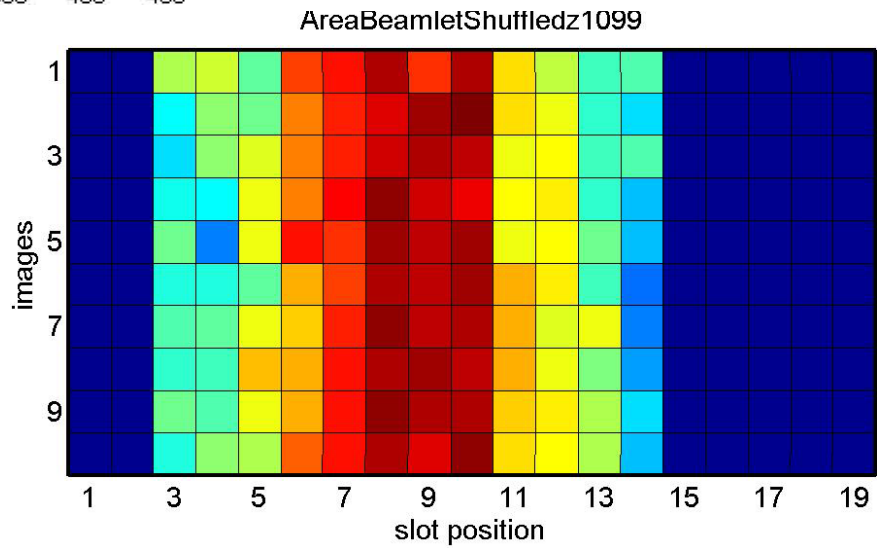
Analysis Results



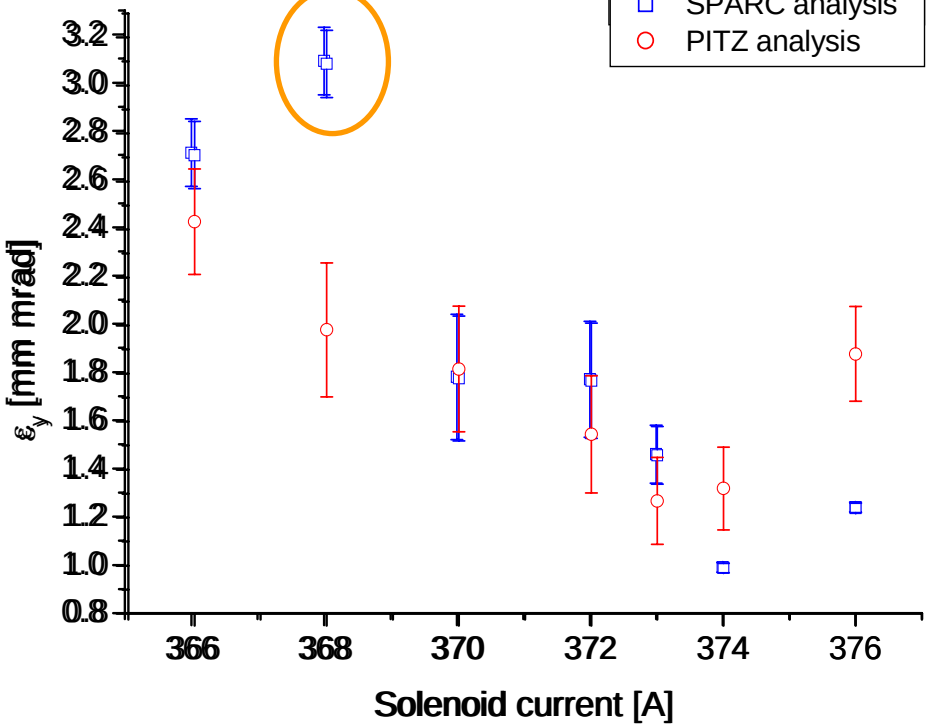


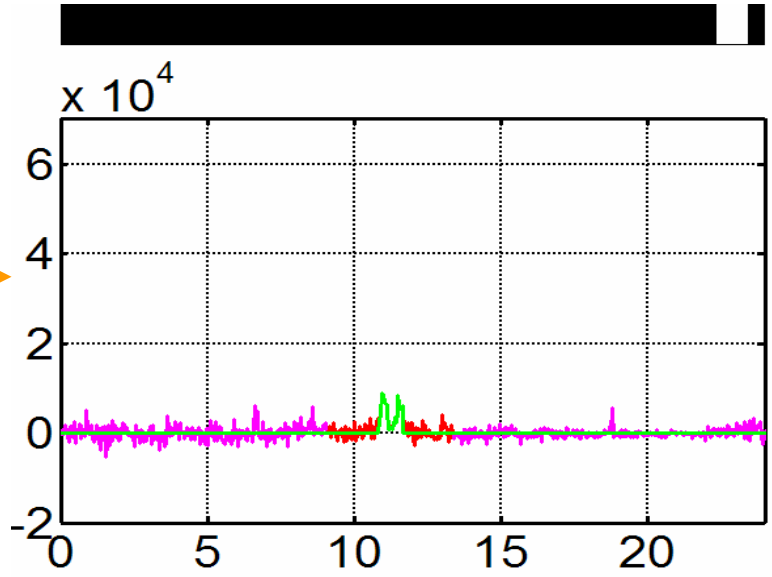

50
100
150
200
250
300
350
400
450

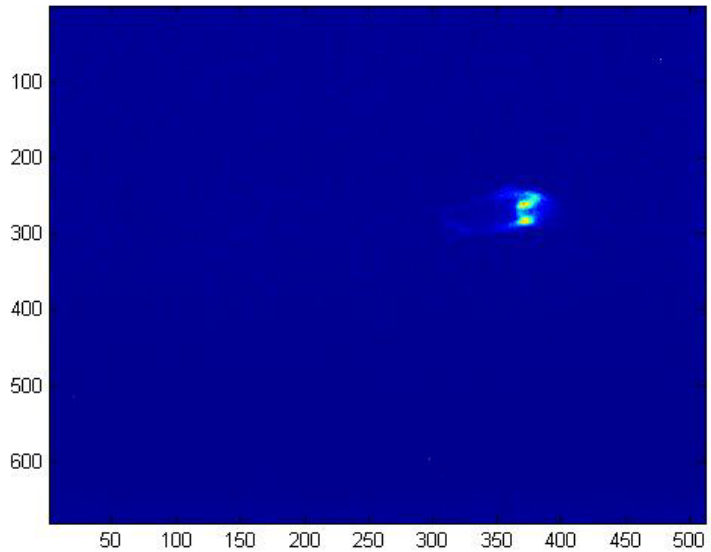

Phase space initial
x 10^-3
5
0
-5
-10
rad
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
mm


AreaBeamletShuffledz1099
1
3
5
7
9
images
1
3
5
7
9
11
13
15
17
19
slot position

Analysis Results







Conclusions

- The SPARC analysis tool has been adapted to PITZ benchmark data to take into account the different experimental setup
- Even though algorithms are tailored on specific cases, the agreement has been found to be within 20% (in the worst case) and 10% (in the best case)
- Beamlets show a correlation between the two planes,
  - where does it come from and how do you explain it?
  - how do you treat tilted beamlets?