# Phase Space Measurement with two BPM's

## M. Biagini, A. Drago, M. Preger

# Transfer matrix from BPBPS108 to BPBPS202

387095	1.15367	0	0	0
-1.19565	.980074	0	0	0
0	0	1	0	0
0	0	0	2.06241	2.32772
0	0	0	398721	.0348576

$$X'_{108} = \frac{X_{202} + 0.387095X_{108}}{1.15367}$$
$$X'_{202} = -1.19565X_{108} + 0.980074X'_{108}$$

#### Synchronization of the two oscilloscopes outputs



#### Offset subtraction



Offset estimated from the first ≈30 turns acquired before the kicker pulse and subtracted from the whole file "Best ellipse" fit to measured points in phase space on the first 100 turns

$$S = \sum \left( ax_i^2 + by_i^2 + cx_iy_i - 1 \right)^2 \Rightarrow \min$$



$$\beta = \frac{X_{\max}}{X'_o}$$

$$\alpha = \sqrt{\left(\frac{X_{\max}}{X_o}\right)^2 - 1}$$

#### Kicker PL101 @ 10 KV



### Kicker PL101 @ 15 KV



#### Kicker PL101 @ 20 KV



### Kicker PL101 @ 20 KV



#### Kicker PL202 @ 10 KV



#### Kicker PL202 @ 15 KV



### Kicker PL202 @ 20 KV



# $\beta$ and $\alpha$ versus maximum amplitude



## Vertical plane vs horizontal



#### Fourier Transform - horizontal



 $\Delta v_{x}$ =.1075

# $\Delta v_x$ =.1079 measured

#### Fourier Transform - vertical



# Conclusions - O.K.

- Measurement of phase space ellipse with two BPMs reliable
- Synchronization and offset correction easy
- No significant non-linearity up to ≈20 mm at beta values 4÷5 m
- Observed dependence of measured optical functions on amplitude compatible with "operational" structure with octupoles on

# Conclusions - Open questions

- Non negligible noise in the beam position measurement; may prevent the detection of weak non-linearities
- Measured optical functions depend on which kicker is fired
- Strong amplitude modulation observed in the vertical plane; does it indicate the presence of strong coupling terms outside KLOE interaction region ?
- a.o.b.