Charge increase / emittance measurement guideline

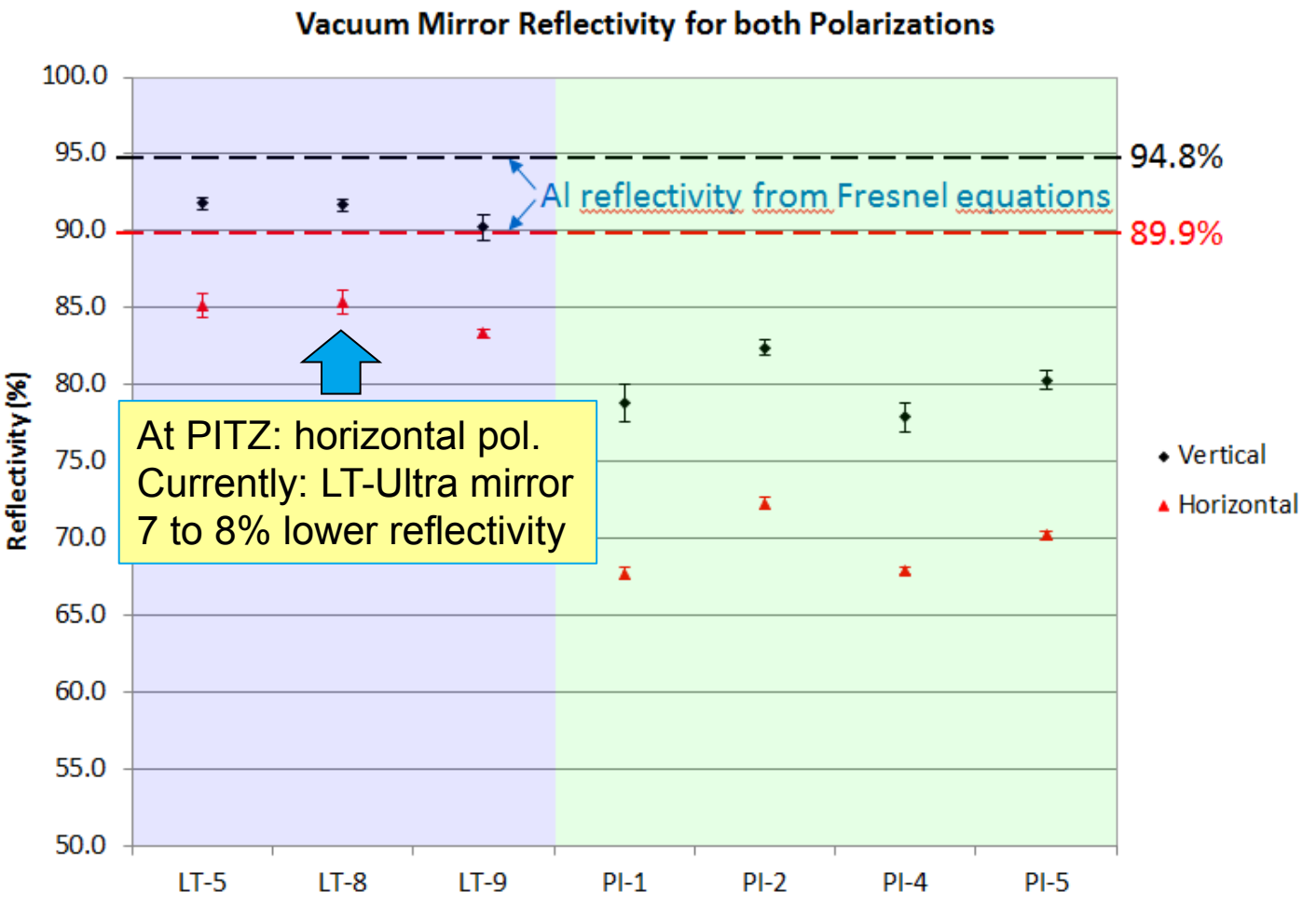
1. **Increase of laser pulse energy at photocathode by adjusting polarization**
2. **Choosing the right light level for beamlets in emittance measurements**

Matthias Gross
Charge increase / emittance measurement guideline
Place, Date

HELMHOLTZ ASSOCIATION

DESY

Characterization of Vacuum Mirror Reflection (from 2011)



Beam position:

Vacuum Mirror Info:

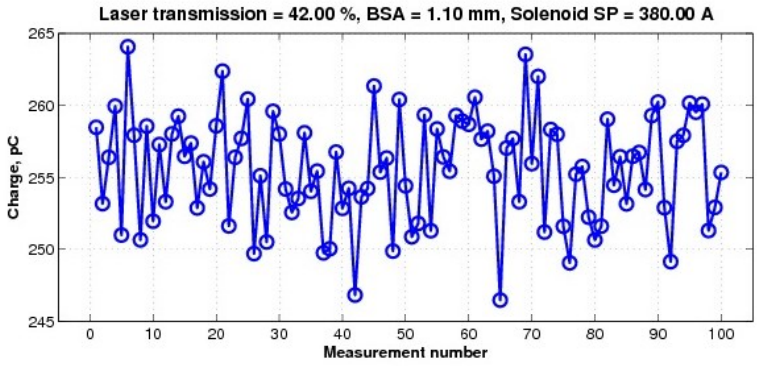
LT-#: LT-Ultra Precision Technology GmbH
→ Al-coated stainless steel 1.4429

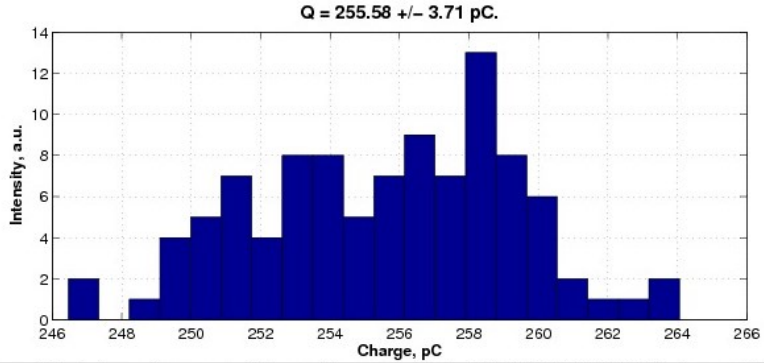
PI-#: Pilz Optics
→ Al-coated monocrystalline silicon

LT-Ultra mirrors have significantly higher reflectivity, close to the theoretical value

Idea: Insert λ/2 plate at Laser to Rotate Polarization

24.05.2015 05:57	M. Gross, O. Lishilin	Charge check



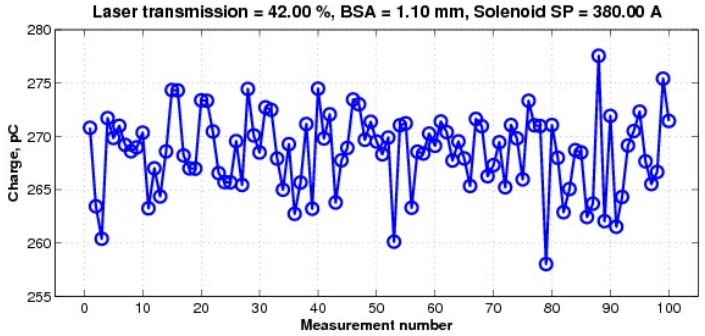


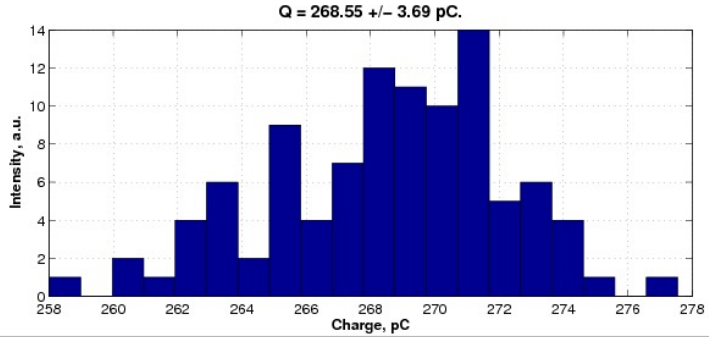
Data saved to /doocs/measure/ChargeMeasurements/2015/20150523N/charge_0555.txt
Charge measurement using Low.FC2.

24.05.2015 06:33	M. Gross, O. Lishilin	Maximal achievable charge (measure with Low.FC2) for lambda half plate at 42deg - increased by 5%

Lambda half plate rotation angle a little off what expected: crystal inserted with an offset? Or other polarization rotation effects in laser beam line?

Standard: 256pC
With lambda half plate: 269pC





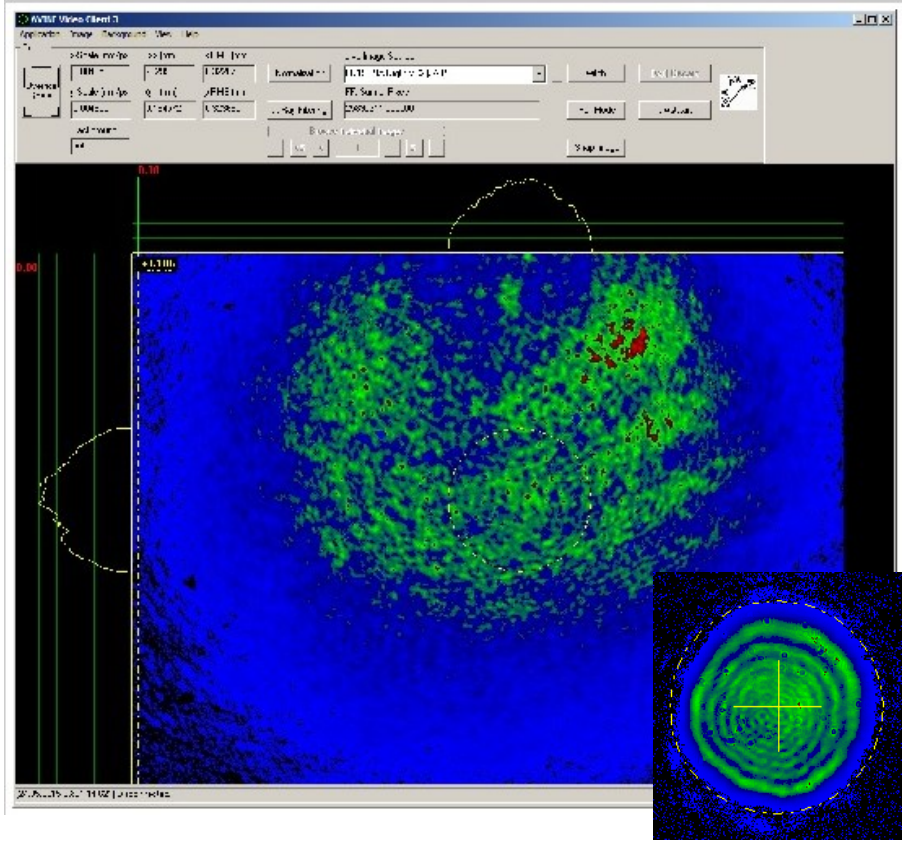
Data saved to /doocs/measure/ChargeMeasurements/2015/20150523N/charge_0633.txt
Charge measurement using Low.FC2.

- Increase from 256pC to 269pC → 5% higher
- Higher charge corresponding to reflection increase (single measurement)

Check of laser distribution at VC2 (open aperture; 1.1mm)

Standard setup

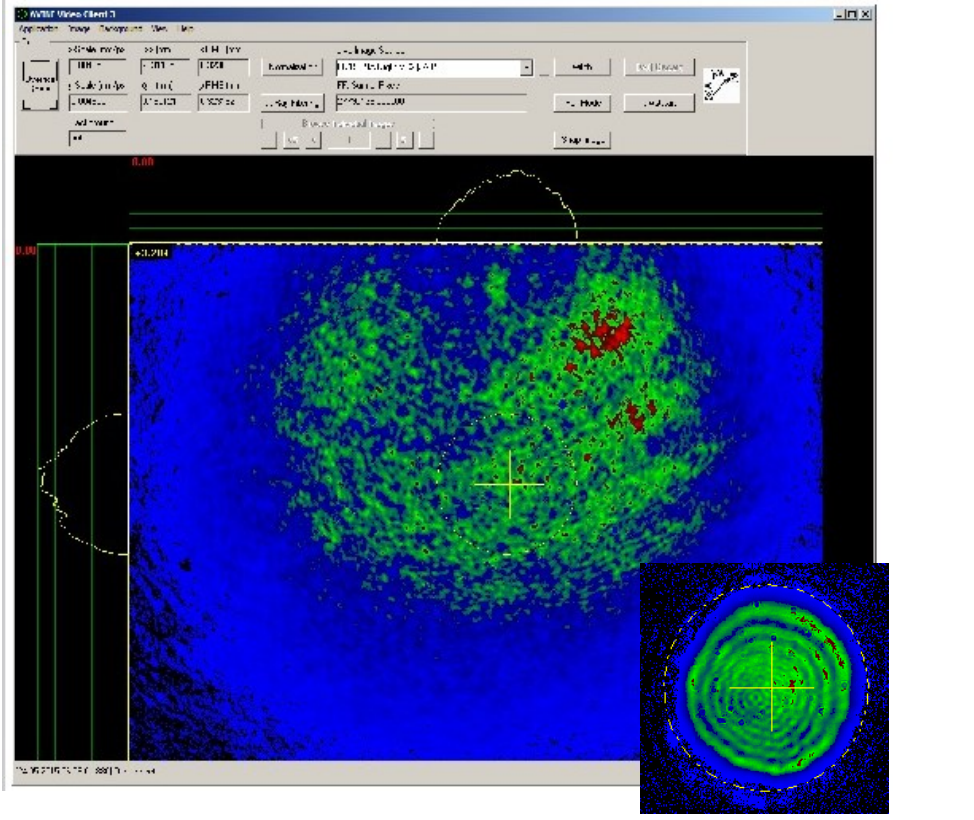
24.05.2015 06:01	M. Gross, O. Lishilin	**Laser on VC2; open aperture**



λ/2 plate inserted

24.05.2015 06:09	M. Gross, O. Lishilin	**Laser on VC2; open aperture - lambda half plate inserted folding mirrors in UV**

Distribution is unchanged
Lambda half plate at 0deg

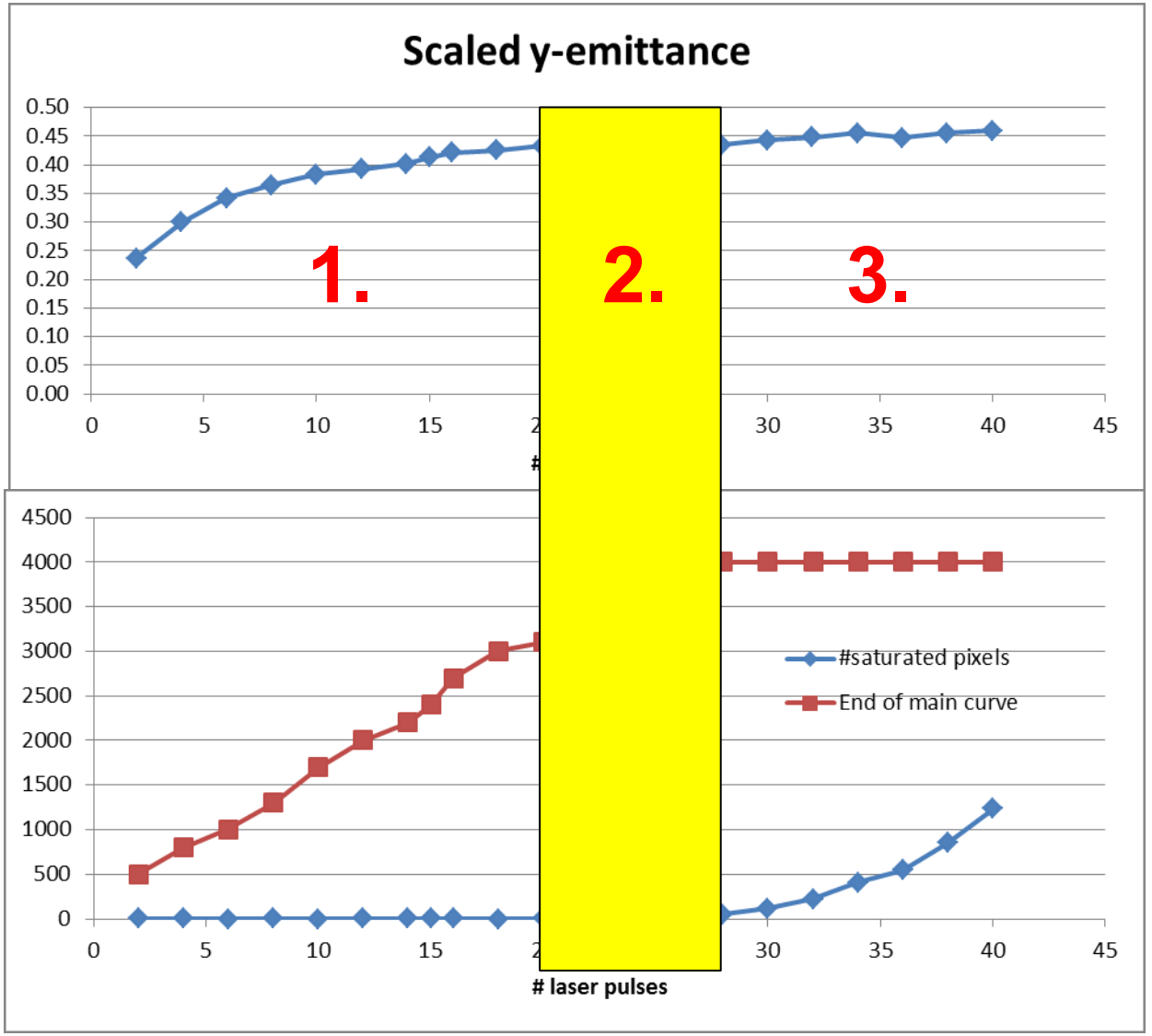


- No loss of beam quality

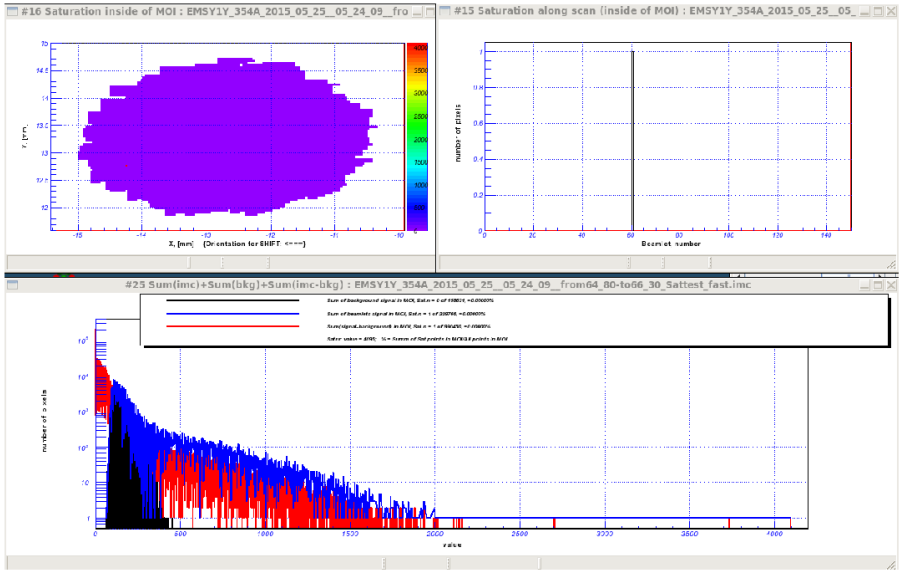
What is the correct intensity to measure emittance?

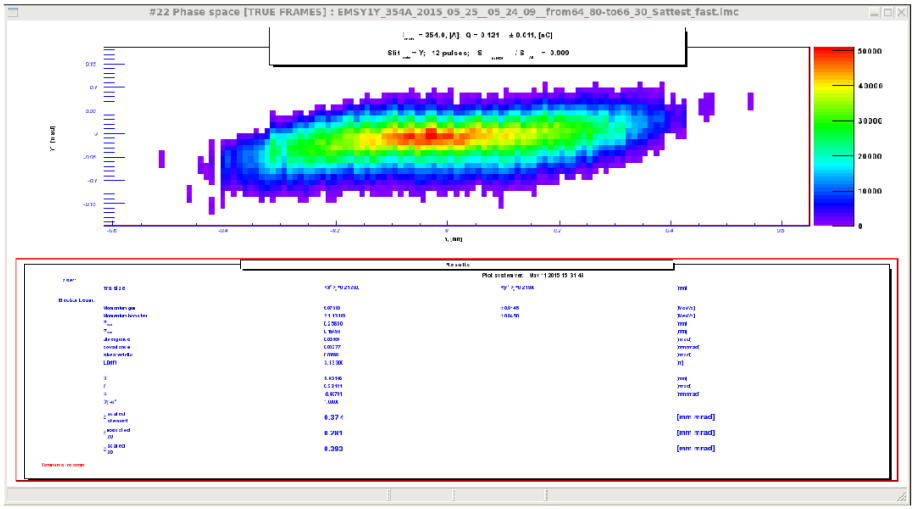
- To have saturation has less effect on the measured emittance than having not enough signal.

1. Saturation curve must not end below 3000
2. Saturation (hot spot) up to about 50 pixels can be tolerated - has no effect on measured emittance

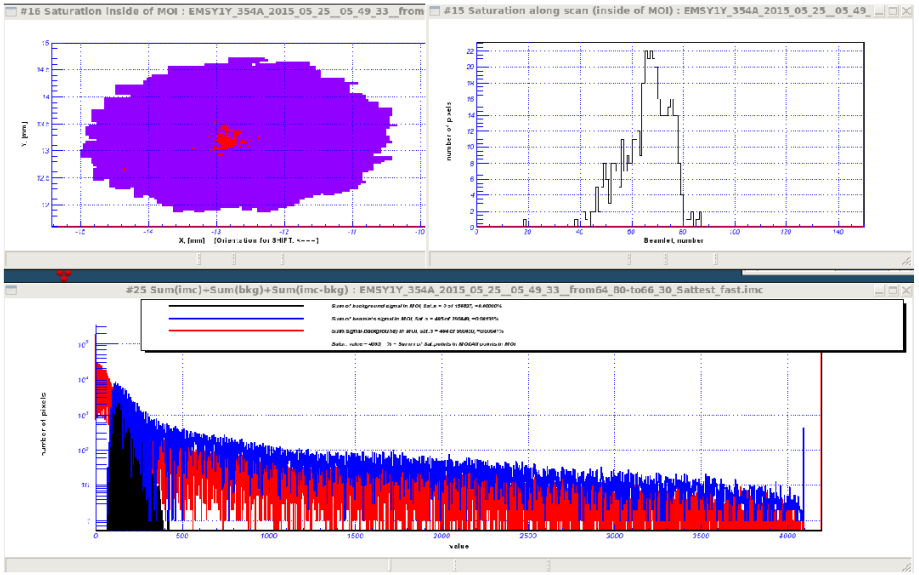


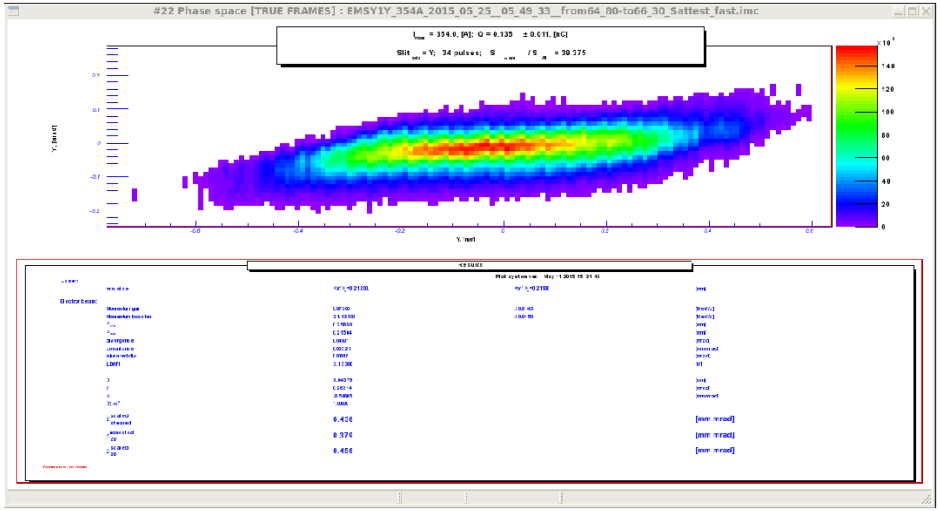
1. Intensity too low



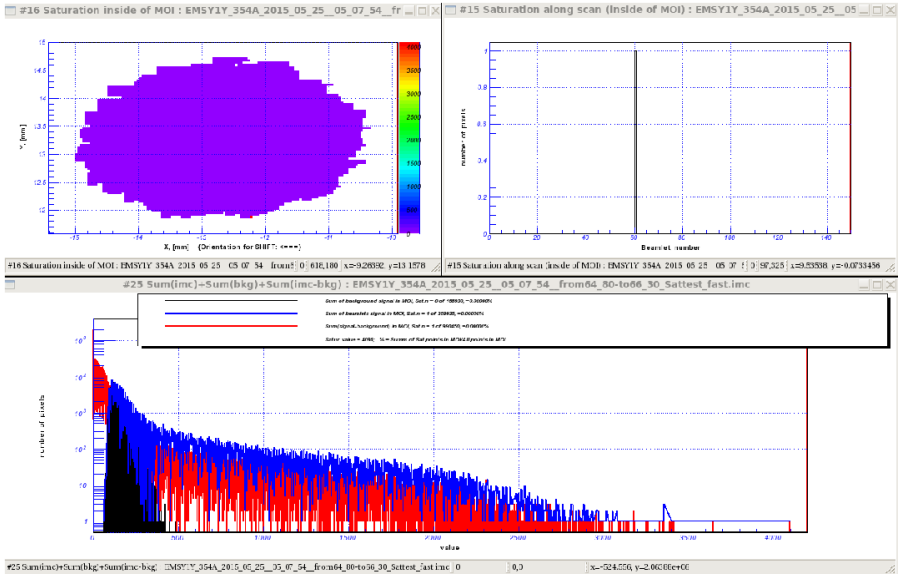


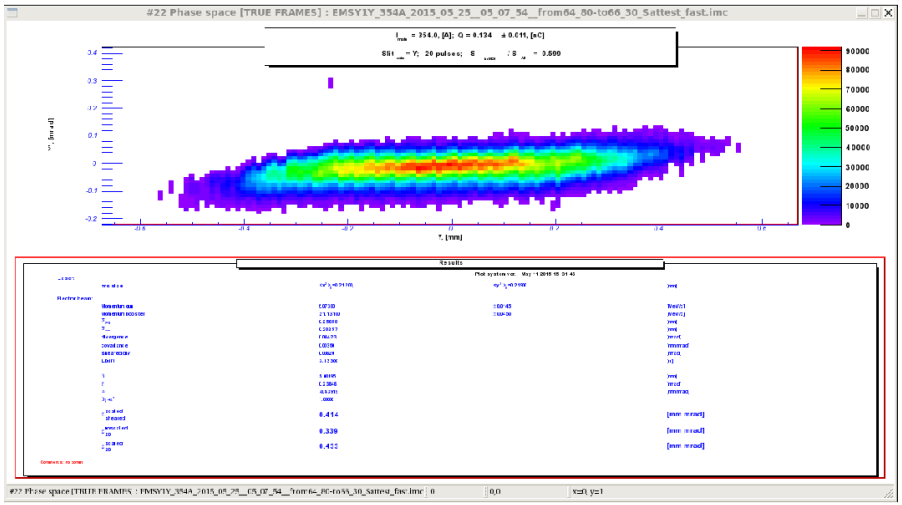
3. Intensity too high





2. Intensity ok (lower end)





2. Intensity ok (higher end)