Gun 4.6 reconditioning

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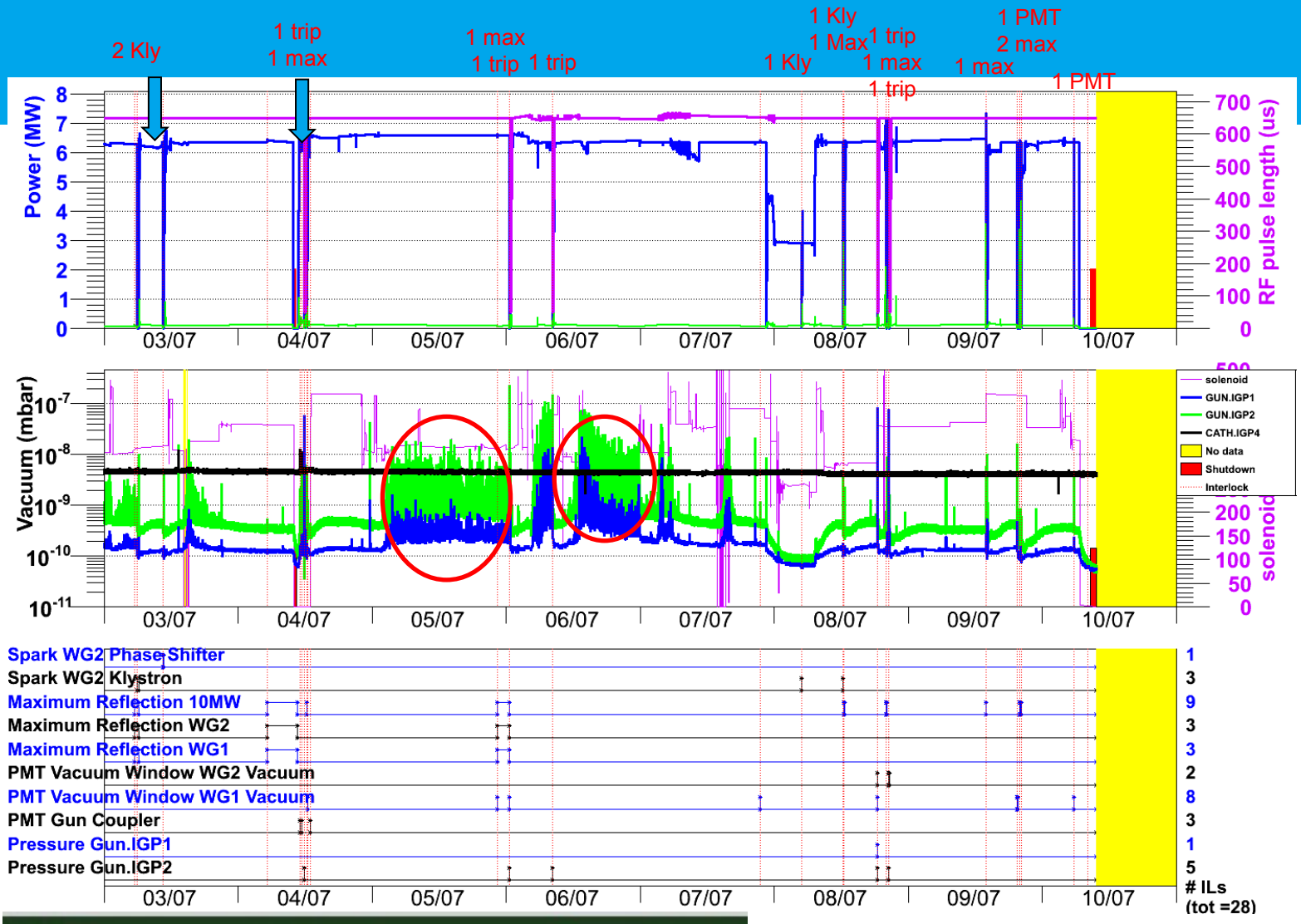
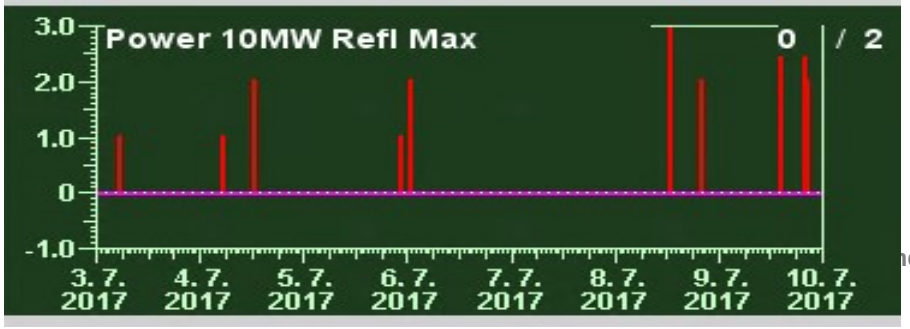
11.07.2017

HELMHOLTZ ASSOCIATION

DESY





18 RF interruptions:

7 max reflection (2WCS, 2phase tuning, 3noreason)

5 trips

4 WG spark (no limiter)

2 WG1 vac PMT

Progress & Problems

- Most slice emittance measurements were done successfully, under analysis
- ELLA laser tuning
- QE & Thermal emittance vs gradient
- 1st beam tuning for electron diffraction

Problems:

- MBI flicker: bad connections/cables at rack; cables under tension (03.07.2017 23:30, 04.07.2017 03:00)
- Charge drift from 10 pC to 25 pC, laser drift off BSA
- VC2 dust
- High2.ST2 overheated at max current (3.65 A) for 10 min
- Fastscan/Emcalc slow
- ELLA synchronization lost 10 times during one shift
- Low charge (~0.1 pC) diagnostics, noise

SLEM program

- A) Steerer calibration for H1.ST1 & H1.STA1, H1.ST2 & H1.STA2
- B) Compare slit-scan and multi-quad scan between High1.Scr1 and High1.Scr5(LYSO)
- C) Reproduce quad-scan from Feb23N/24M, try to understand transfer matrix issues

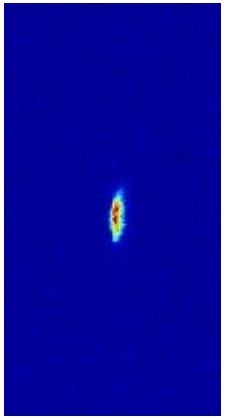
  - All measurements done successfully, analysis TBD!
  - …despite several problems and delays:

    - Two quads at first didn‘t work, fixed in second week
    - High1.Q4 only allows 10 A max. (unlike 12A-calibration routine, some scripts needed to be changed and might not provide correct gradient)
    - Matlab/ttfr issues (missing library, fixed by Bagrat)
    - Lots of „noisy frames“ from GetImage.m (maybe adjust it?)
    - Different emittance than in Feb.(0.8 vs. 0.6 for 10pc/BSA2.0)
    - Some data taken at MMMG-10°

SLEM program

> D) TDS+slit emittance measurement EMSY2->PST.Scr1

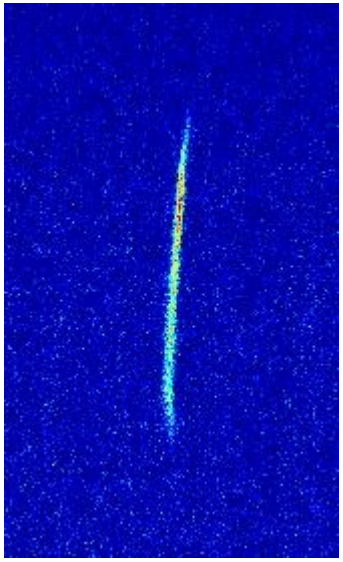
- Manual slit scan (VC) done with TDS on and off
- Images look promising, even without LYSO
- Analysis TBD



TDS off

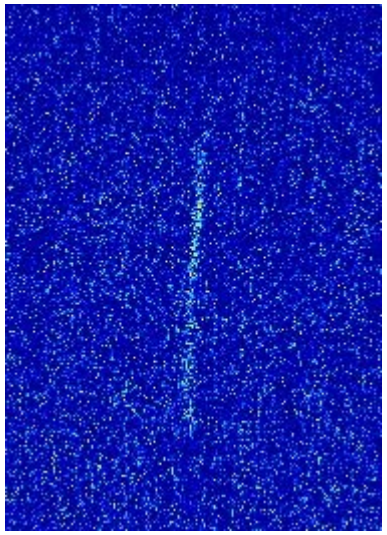
Central slit (50 µm)

PST.Scr1(YAG)



TDS on

Averaged over 30 images



TDS on

Single shot

New version of TDS matlab tool

- ✓ New filename: TDS.m
- ✓ Improved visibility of noise(-cut)
- ✓ Automatic camera gain adjustment (please test!)

Buttons to load old measurements, and to mask certain data points from the linear regression

Automatic camera gain adjustment

Matlab function *SVN/MatlabScripts/TDS/GetImage_AutoGain.m*

```
% Requires GetImage() from SVN/MatlabFunctions
% Only the <camera> parameter (same than in GetImage()) is not optional
function [a, info, gain] = GetImage_AutoGain(camera, sat_min, sat_max, gain_max, sat_color, delay, debug)
% Automatically adjusts the gain of <camera> to a level (0..<gain_max>) at which the
% acquired image contains <sat_min> to <sat_max> saturated pixels (i.e. color >= <sat_color>).
% Waits <delay> seconds between gain adjustment and next image acquisition.
% [a, info,..] contains the final image & info just like avine_tine_read_images
% [..,gain] contains the actual camera gain upon return.
if ~exist('sat_min','var')
   sat_min=1;
end
if ~exist('sat_max','var')
   sat_max=9;
end
if ~exist('gain_max','var')
   gain_max=23;
end
if ~exist('sat_color','var')
   sat_color=4095;
end
if ~exist('delay','var')
   delay=0.1;
end
if ~exist('debug','var')
   debug=0;
end
```

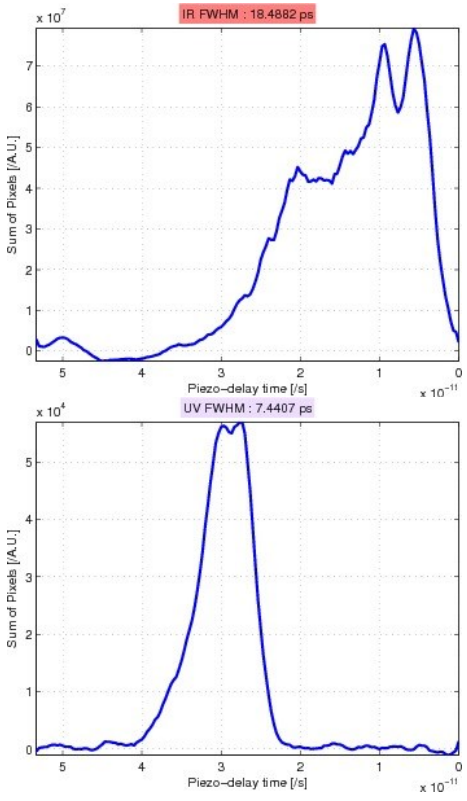
(a slightly modified version exists under *SVN/MatlabFucntions/fauto_gain.m…who did that?)*

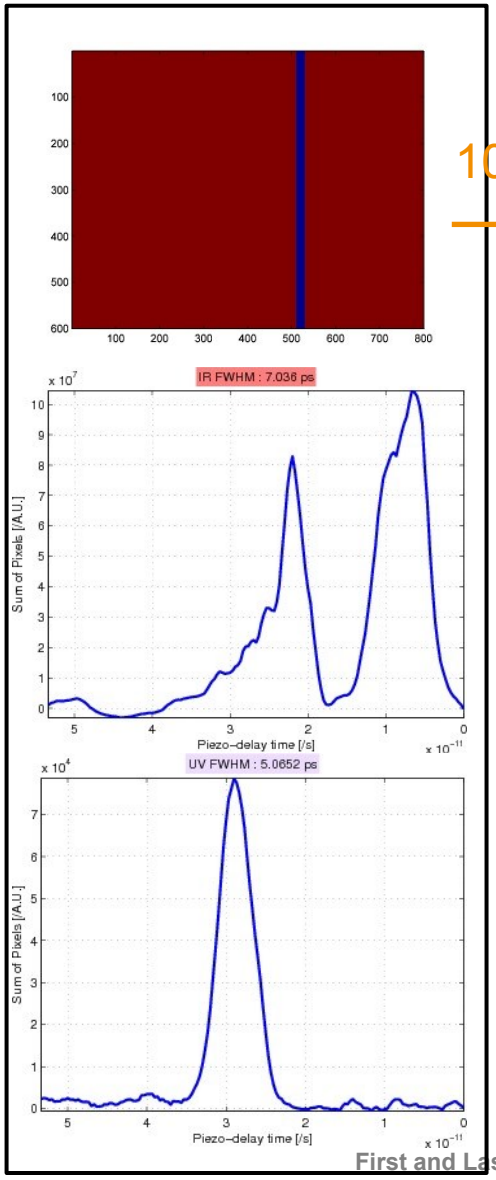
ELLA Overview

- Alignment & stability issues (as always)
- UV cross-correlator in operation (destructive)
- No synchronization till wed (MO source)
- Faulty JAI UV cross-correlator camera cable (fri)
  - Exchanged Proscilica Sat
- Pockel cell driver fault (cause: negative timing pulse width)
- ELLA MMMG phase-shifted to MBI MMMG phase via uTCA
  - general synchronization stability/jitter is poor (PCIe timouts, slow main loop)
- Spectrograph rebuilt (fri)
  - Temporal axis calibrated (Yve!)
  - Transport rebuilt (Sun)
- LT controller fixed (Sun)

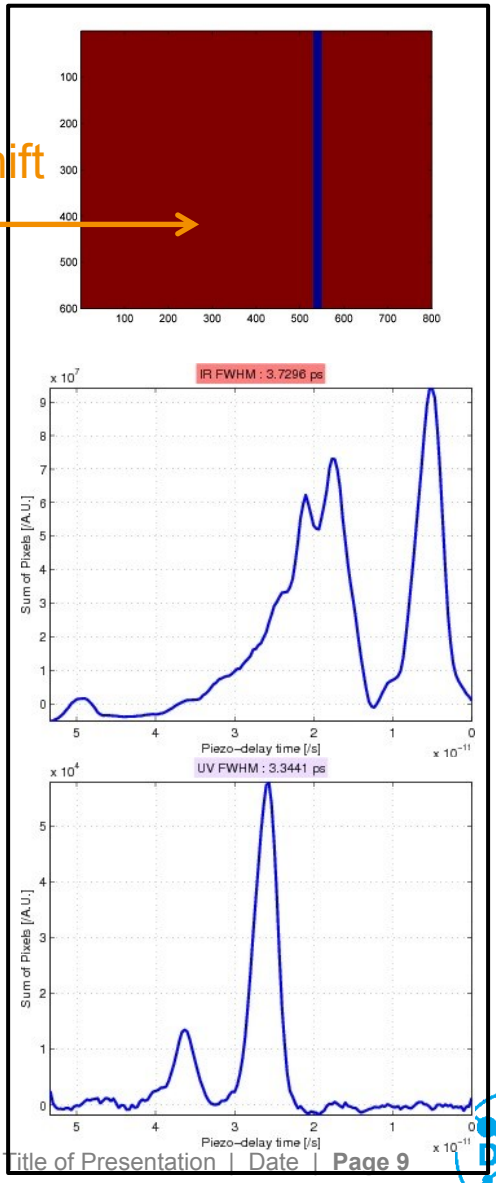
ELLA spectral band mask

Maskless

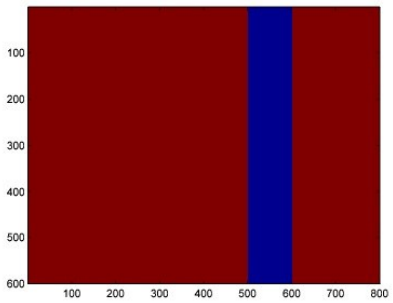


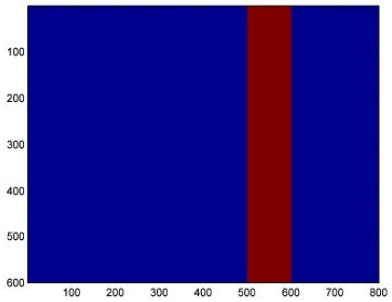


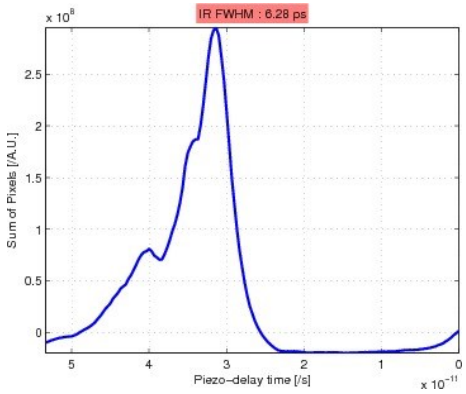
10px shift

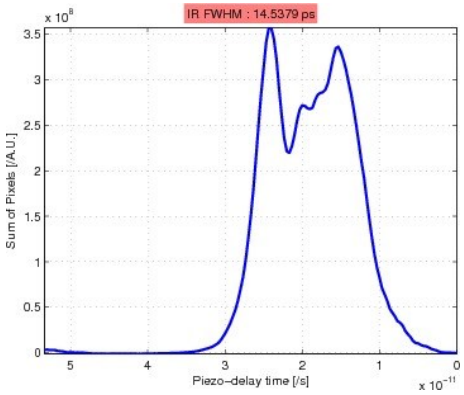


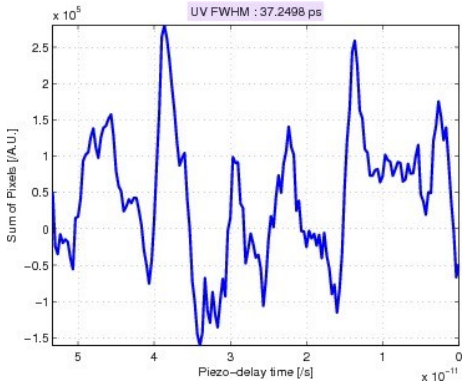
Spectral masking contd

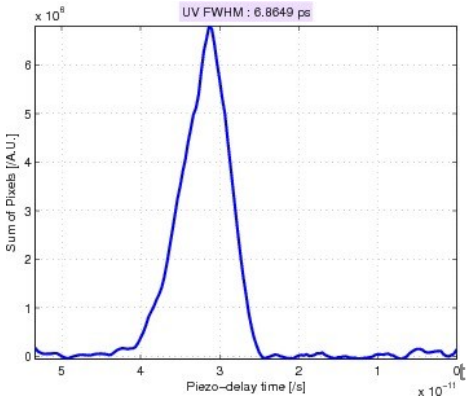




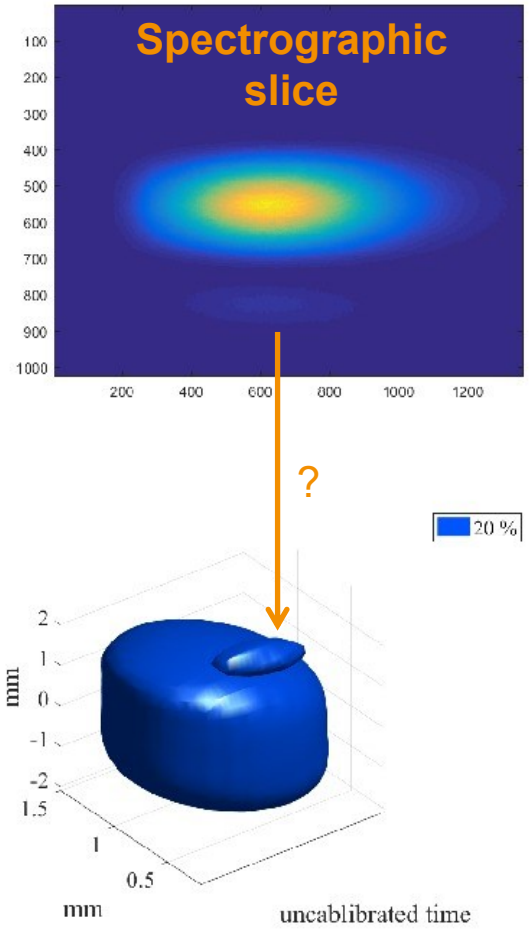


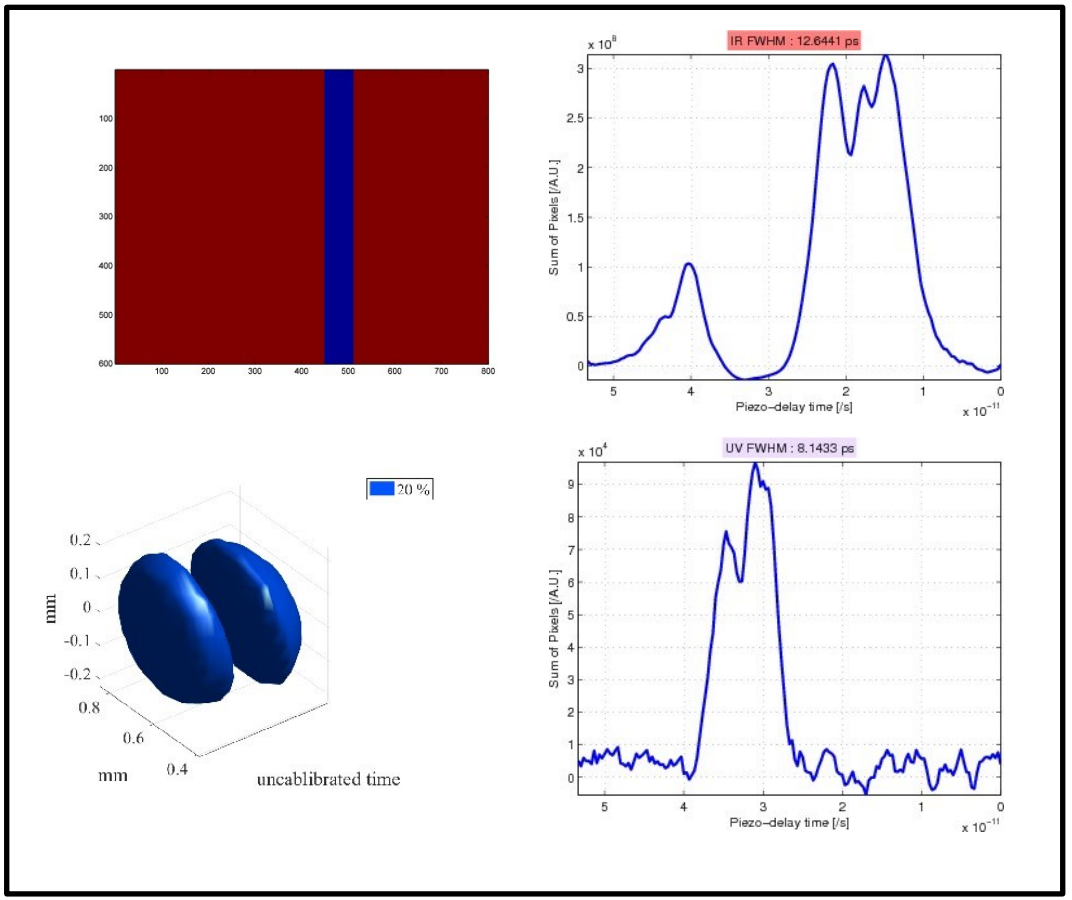




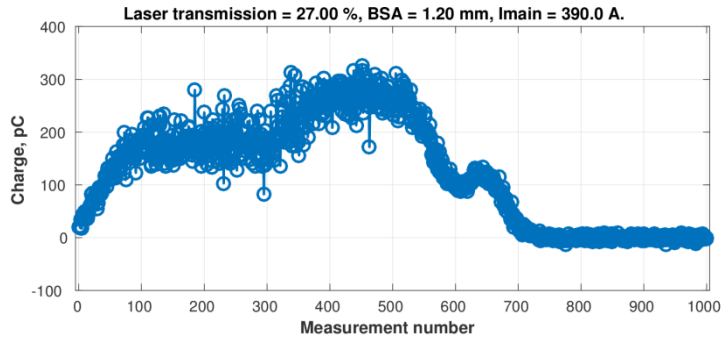


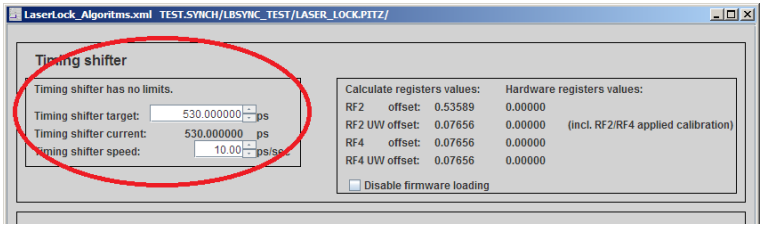
Spectrograph

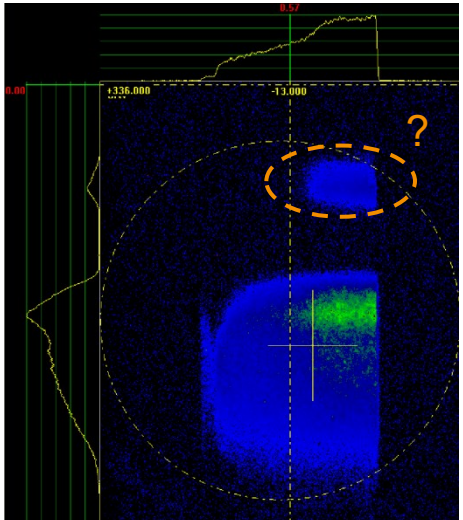


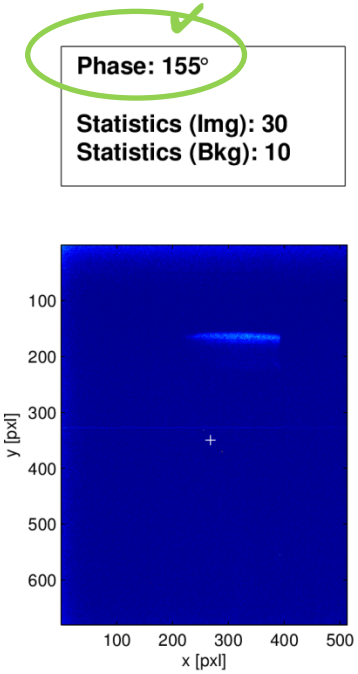


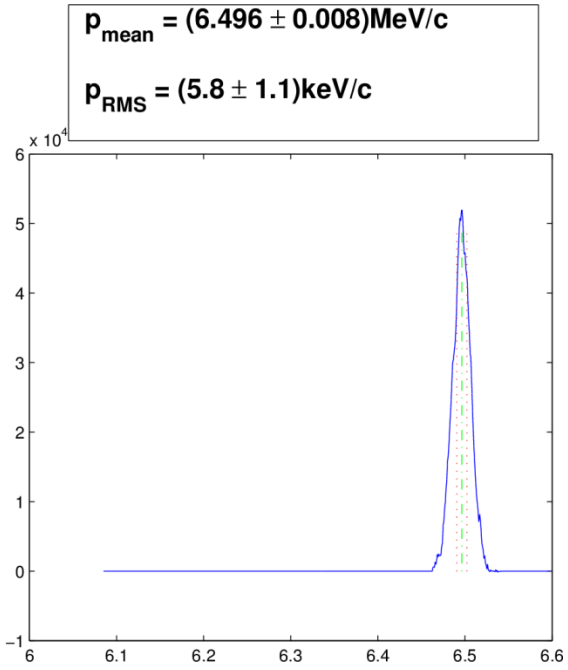
uTCA phase shifter results



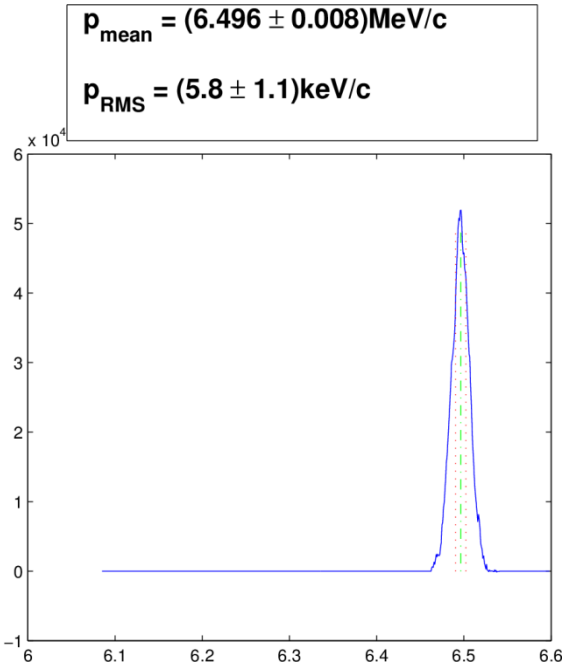


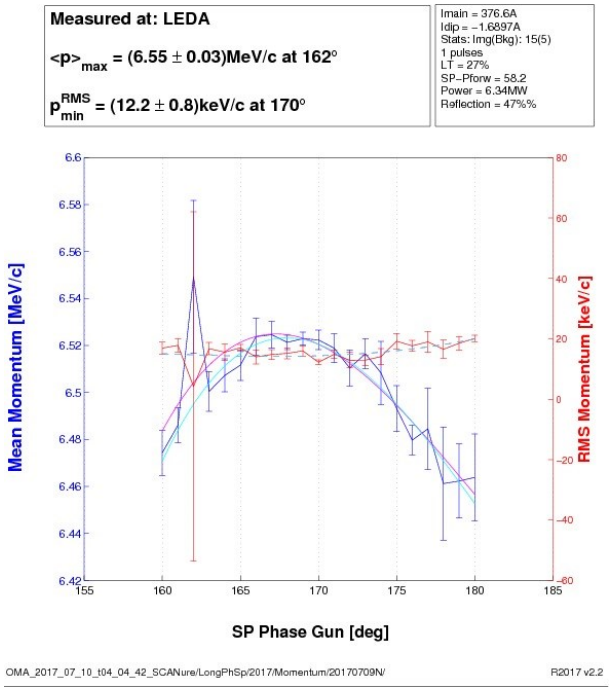


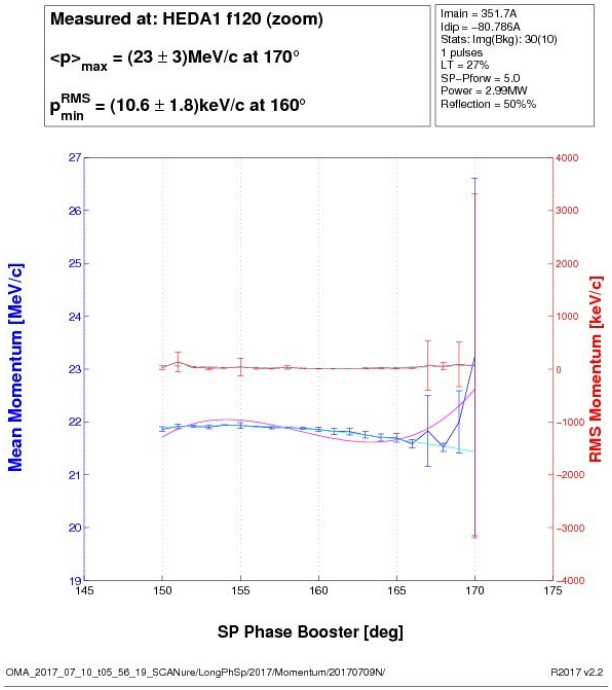




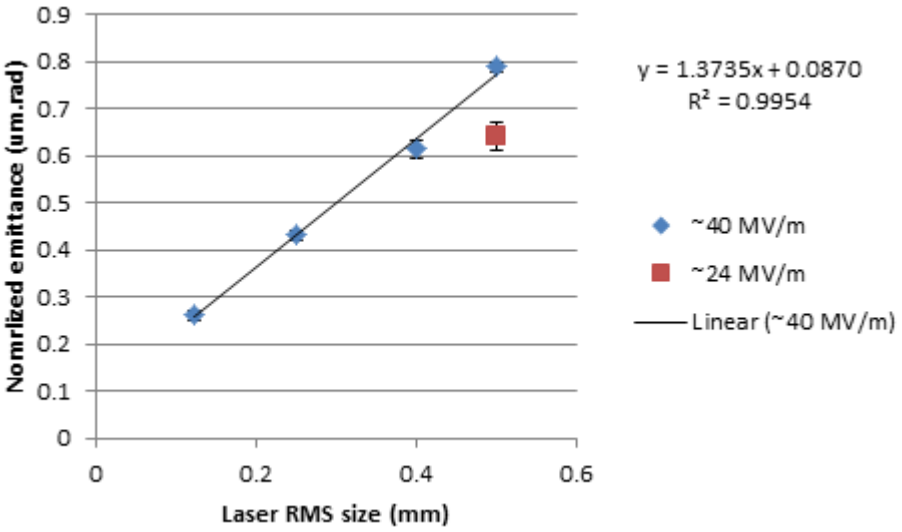
ELLA LEDA/HEDA

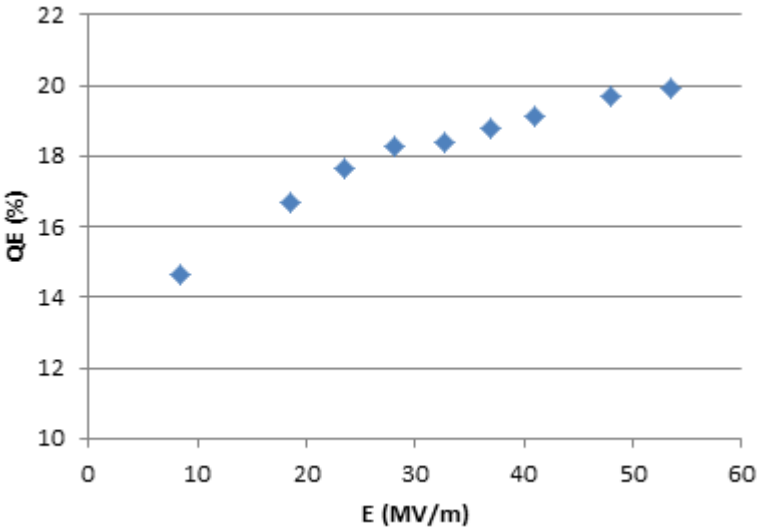


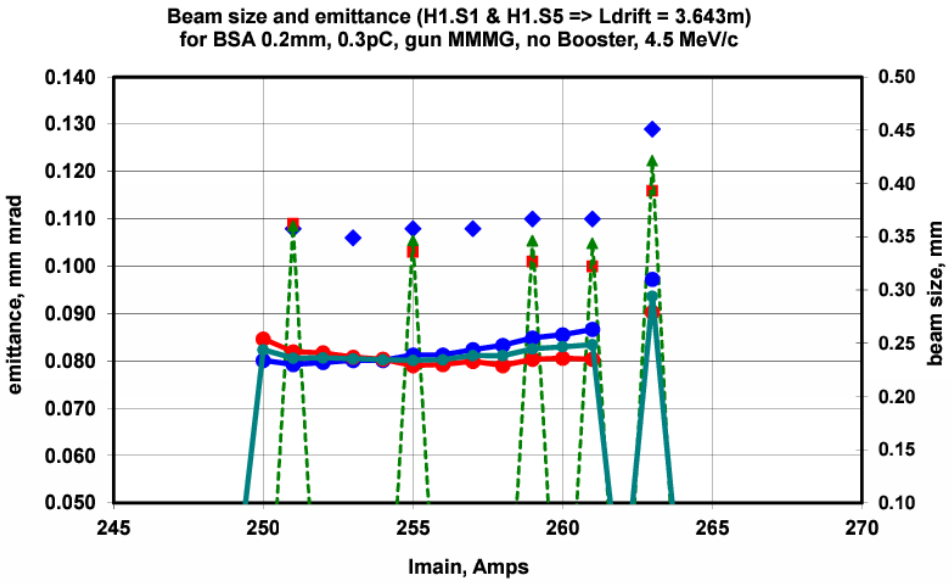




QE & thermal emittance vs gradient





1st e diffraction beam tuning

- Min BSA 0.2 mm, ~50 um rms
- ~0.3 pC, ~100 nm.rad, target < 50 nm.rad
- Beam focusing on sample (H1.S3), ~350 um, target <250 um
- Beam focusing on detector (H1.S5), ~170 um, target <50 um