PS/LP Note 93-55 (Min)
3.9.1993

THE CTF RUN NO. 2 1993 - RESULTS AND SOME COMMENTS

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1. GENERAL

Start: 28th July

End: 11th August

Beamline: extended with the probe beam, the solenoid on LAS connected to a power supply.

Gun: new (no. 3b) but similar to the previous one with as main difference that the rf contact-spring is under a force of 60 kg

Photocathode: Cu

Laser: pulse compressor installed, pulse length 8 - 10 ps FWHH, used in single pulse mode at 209 nm, typical energy of laser pulse on the pc: 12×10^{-6} J.

Vacuum in chamber downstream of gun: VGI04 7×10^{-10} T with rf.

The following new facilities eased the experimental work:

- x/y laser position scanner controlled from the HCR,
- energy of beam at the outlet of the laser system acquired in HCR (some bugs still in),
- x/y scanner programmed with e-beam charge acquisition and phase correction.

2. OBJECTIVES OF THE RUN

- RF conditioning of the new gun up to 100 MV/m.
- Adjusting the optical path for two laser spot sizes on the pc: diameter 4 mm and 10 mm.
- For maximum laser energy on the pc optimize the beam transmission to UMA455.

If time left:

- Bunch length and emittance measurements.
- Setting-up of the probe beam as far as possible with the available bunch intensity.

3. GUN PERFORMANCE

The gun was baked-out at 150 °C during 24 hours. The traditional multipactoring at low power was not present this time and the power was increased to PKI = 25.4 MW, 100 MV/m in the gun, in 5 hours. In contrary to gun 3a, the power reflected by the gun goes to zero at high-power as well (better cooling?).

4. PHOTOCATHODE

Page 17 of logbook, for a laser pulse energy of 12×10^{-6} J on the pc, the charge at UMA385 is 1.0 nC and thus the QE = 5×10^{-4}.
A comparison: in the photocathode lab. one found at 213 nm a QE = 4.2×10^{-4} for special cleaned Cu.

5. BEAM PERFORMANCES

5.1 Charge as function of the laser phase (LPh.)

The charge by UMA385 behind the gun,
UMA406 „ LAS,
UMA445 „ TRS.

LPh.: time the center of the laser pulse hits the pc minus the time the field is zero in the gun (values quoted are relative only).

Example: fig.1 (log book p. 36) - The off-set is mainly due to the dark current.

5.2 Beam transmission

The full laser energy was used all the time. The estimated energy on the pc varied from about 11 to 13×10^{-6} J.
During the run the laser spot size on the pc was varied from 2 - 5 mm ('large spot') to 2-1 mm ('small spot').
The wanted round spot could not be made.

Seen the low e^-bunch charge we started using the UMA's in the amplified mode. (High Gain, HG). HG was needed for getting horizontal and vertical position readings. However, we found the stability of the analogue signal in HG suspicious. Had the jitter in the laser energy become so small? Switching to Low Gain (LG) - no amplifier - showed that the jitter was as important as before. The rise-time limitation of the amplifiers makes them unsuitable for our application.

The contribution of the dark current to the digital reading of UMA385 is to be taken into account (integration over 70 ns).
Example, p. 35 UMA385 = -48.6 10+8 with laser and rf
= -16.2 10+8 with rf only

The beam transmission from UMA385 to 406 and 455 was in general 100%.
See p. 15, 16.

5.3 Bunch length

The e^-'s are emitted promptly by Cu. Thus, Cu is a reference for data with other types of cathodes as CsI and Cs2Te.

Three sessions were devoted to bunch length measurements.
To start with, for a given laser phase, the best phase between gun and LAS is found (criterion: max. E and smallest spread in E behind LAS).
Varying thereafter the LPh while keeping gun - LAS phase constant.

	LPh.	FWHH by TCM445C	Large laser spot
Session 1, p. 23, 24.	150 deg.	12.0 ps	
	180	14.5	
	200	19.5	
	210	23.0	(transm. to UMA406 60%)

Session 2, p.31, 33.	LPh.	FWHH by TCM445T	Large laser spot
	160 deg.	11.4 ps	
	170	13.6	
	180	12.5	
	200	14.1	

Session 3, p. 37.	LPh.	FWHH by TCM445T	Small laser spot
	190 deg.	12.9 ps	
	200	11.8	
	210	17.9	
	220	21.5	

The laser pulse at 523 nm was: 8 to 10 ps FWHH.

As with a CsI-pc: no bunch compression seen behind LAS and bunches longer than laser pulse.

Remark: the measurements with the streak-camera are delicate and results depend on correct setting of a number of adjustments. Between measurements is a spread of ± 2 ps (saturation in the pc of the camera thus to be avoided).

During the bunch length measurements the 30 GHz peak power generated by the TRS was displayed.

The power changed slowly over the phase range but was highest for low LPh phases thus short bunches.

Example p. 33: LPh. 170: 14 kW for 0.6 nC through TRS, 13.6 ps FWHH (F = 0.55).
For an infinitesimal short bunch (F=1) the expected power is 30.74 (0.6) ×2 = 11 kW and for F = 0.55: 3.3 kW.

The accuracy of the charge measurement is not high and we defer the discussion on the discrepancy until data with CsI are available.

5.3 Bunch position

The beam position at TCM445 and MTV510 seems stable. (straight line). However, an horizontal position jitter is seen on MTV605 (after first 90 deg. bend) and on TCM 630 (after second 90 deg. bend).

5.4 The probe beam

A very low charge was transported up to the end and seen on MTV715, p. 39.

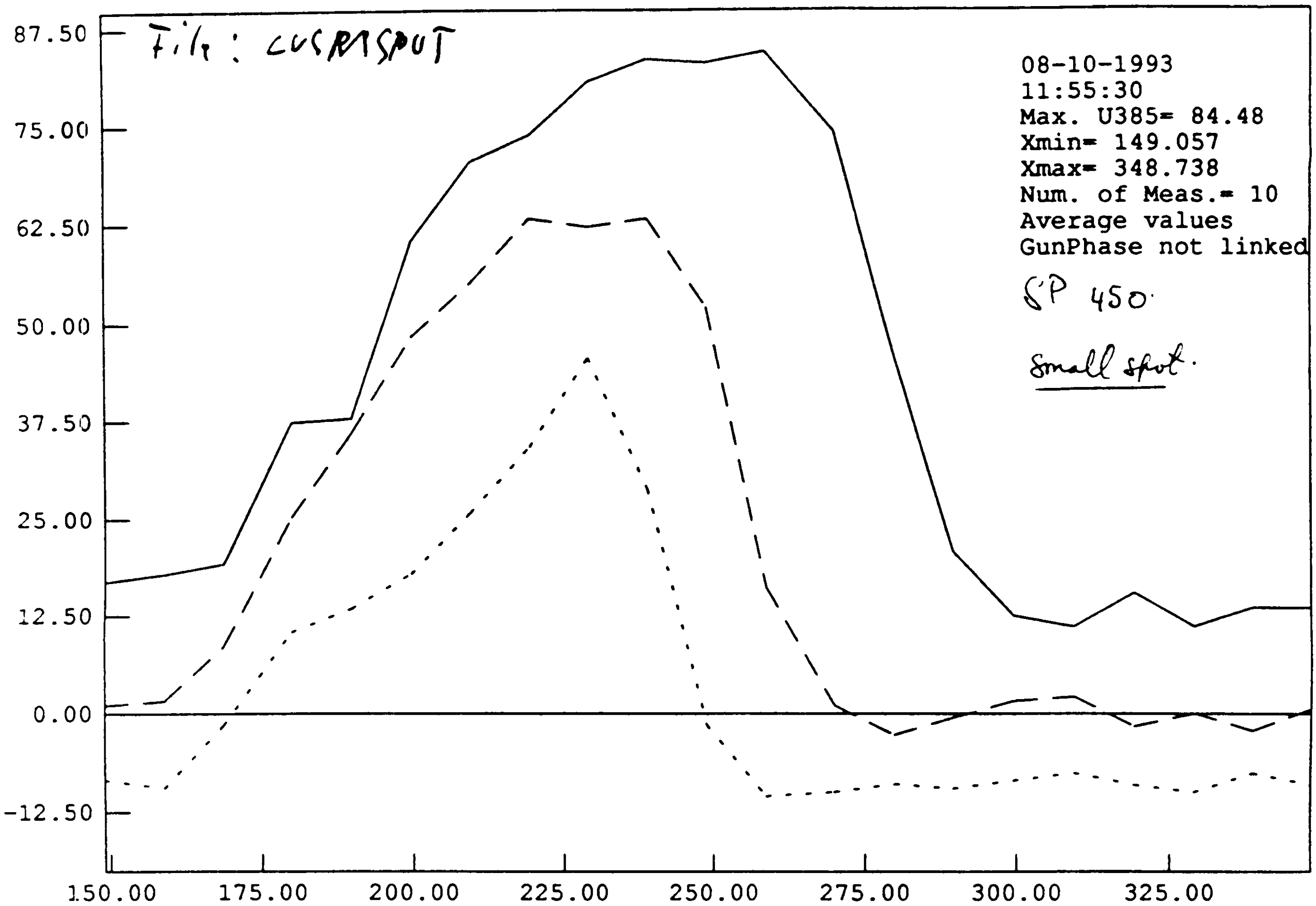
6. POWERING THE LAS-SOLENOID (SNL400)

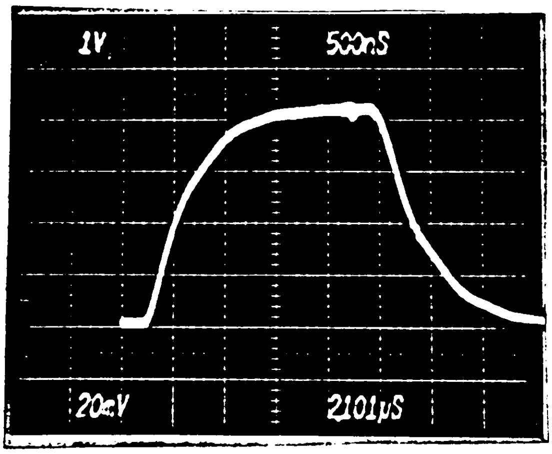
Putting current into SNL400 with rf requires to condition the section. At low currents, 100 - 200 A, multipactoring occurs and causes a pressure rise resulting in an automatic closing of valves VVS1 and 2.

The rf power reflected by the section varies with the SNL400 current, p. 26, SNL400 = 500 A reached.

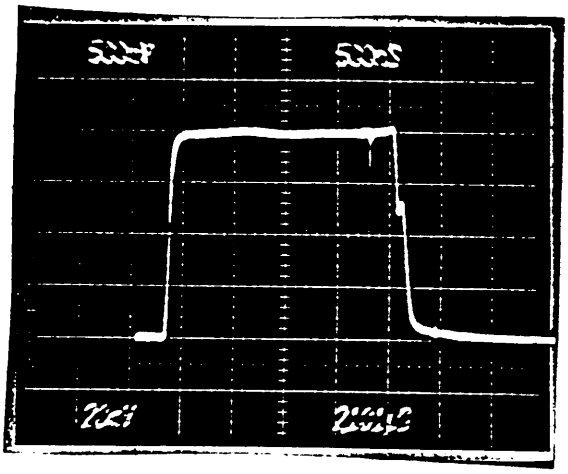
The solenoid has a steering effect on the beam. For SNL400 = 100 A, we could easily compensate this effect by using the long dipoles on LAS but for higher currents this remained to be tried out.

P 36.
10/08/93



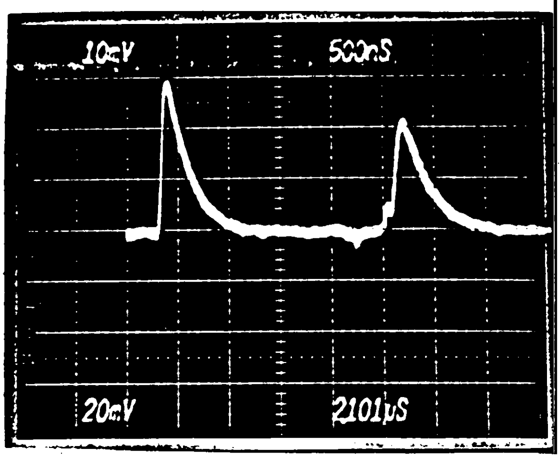


PGL



PSI

PKI =
PFN = 32.6 kV



PGR (10 mV)
UMA 385

Fig 1

Distribution:

Autin B.	PS
Battisti S.	PS
Bossart R.	PS
Braun H.	PS
Brouet M.	AT
Caspers F.	PS
Corsini Roberto	PS
Delahaye J.-P.	PS
Devlin-Hill P. M.	PS
Fischer C.	SL
Garoby, R.	PS
Geissler K.K.	AT
Godot J.-C.	PS
Guignard G.	SL
Hübner K.	PS
Hutchins S.	PS
Jensen E.	PS
Johnson C. D.	PS
Joly Pierre	PS
Kamber I.	PS
Koziol H.	PS
Kugler H.	PS
Lütgert S.	PS
Madsen J.H.B.	PS
Millich A.	SL
Pearce P.	PS
Pirkl, W.	PS
Potier J.-P.	PS
Riche A.J.	PS
Riege H.	AT
Rinolfi L.	PS
Schnell W.	SL
Schreiber S.	AT
Suberlucq G.	PS
Thorndahl L.	PS
Van Rooy M.	AT
Warner D.	PS
Wilson E.J.N.	PS
Wilson I.	SL
Wuensch W.	SL