Review Committee, September 23, 2003

Agenda:

14.30 SPARC project status and Lay-out *(L. Palumbo)*
15.00 Facilities, Schedule, WBS *(C. Sanelli)*
15.30 Status of "working point optimization" *(M. Boscolo)*
16.00 Ultra-short pulses *(L. Serafini)*
16.10 Coffee break
16.30 Diagnostic issues *(G.P. Di Pirro)*
16.45 RF Gun Emittance measurements *(A. Cianchi)*
17.00 Beam measurement simulations *(C. Vaccarezza)*
17.15 RF deflector design *(D. Alesini)*
17.30 Financial plans *(L. Palumbo, L. Serafini....)*
18.30 Closed discussion
19.30 End

Work done since last meeting (April 16, 2003):

Design and tests

- Studied an optimized working point
- New transfer line
- Simulations and first tests of LCM pulse shaping
- Started design of diagnostics components
- Simulations, first tests for Gun emittance measurements
- Simulations of beam measurements
- Prototype of RF deflector

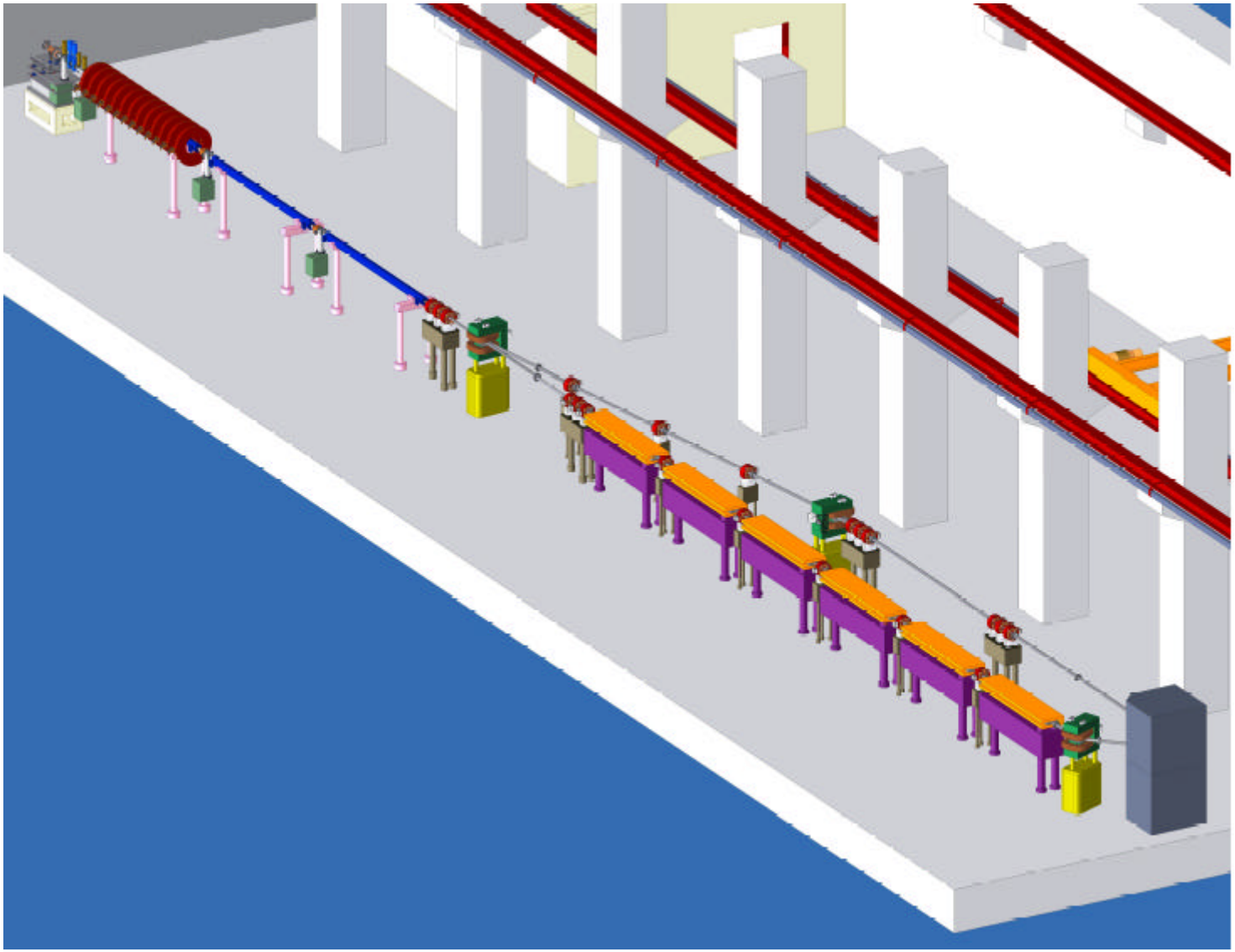
Mechanical drawings:

- Diagnostic and vacuum components
- Release B (2nd) of the machine lay-out

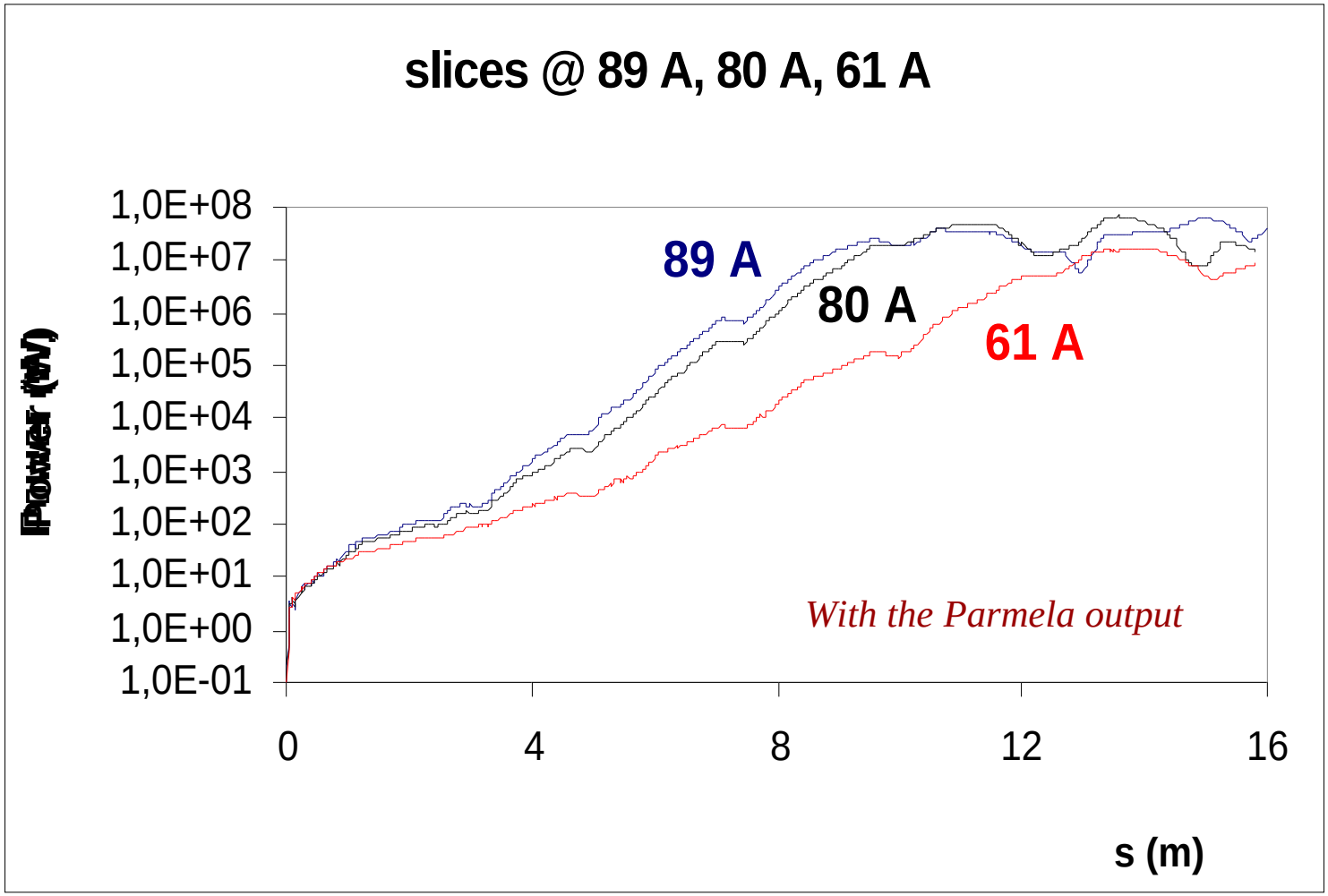
Tender and procurement procedures for a total of 2.862 M

- Clean room
- Laser system
- RF gun
- 2 accelerating sections
- 2 S band amplifiers
- 4 Power attenuators
- 2 modulators
- 1 ferrite circulator
- Dazzler

Completed documentation for fire protection and safety systems.
Progress in the design of conventional facilities.



Working point optimization



Taking into account tolerances, misalignments, errors,...

λ_r=3cm

K=2

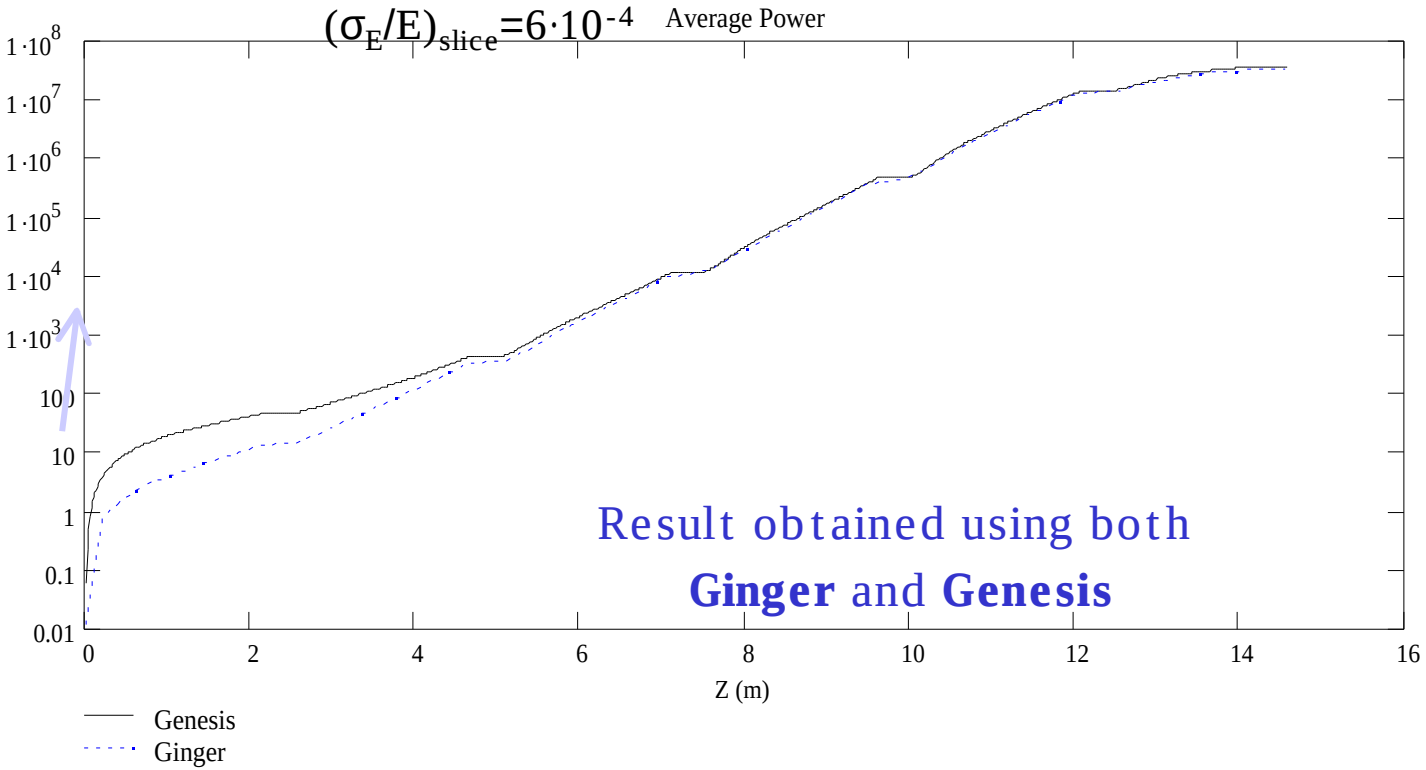
L_u=14.5 m

I=85A

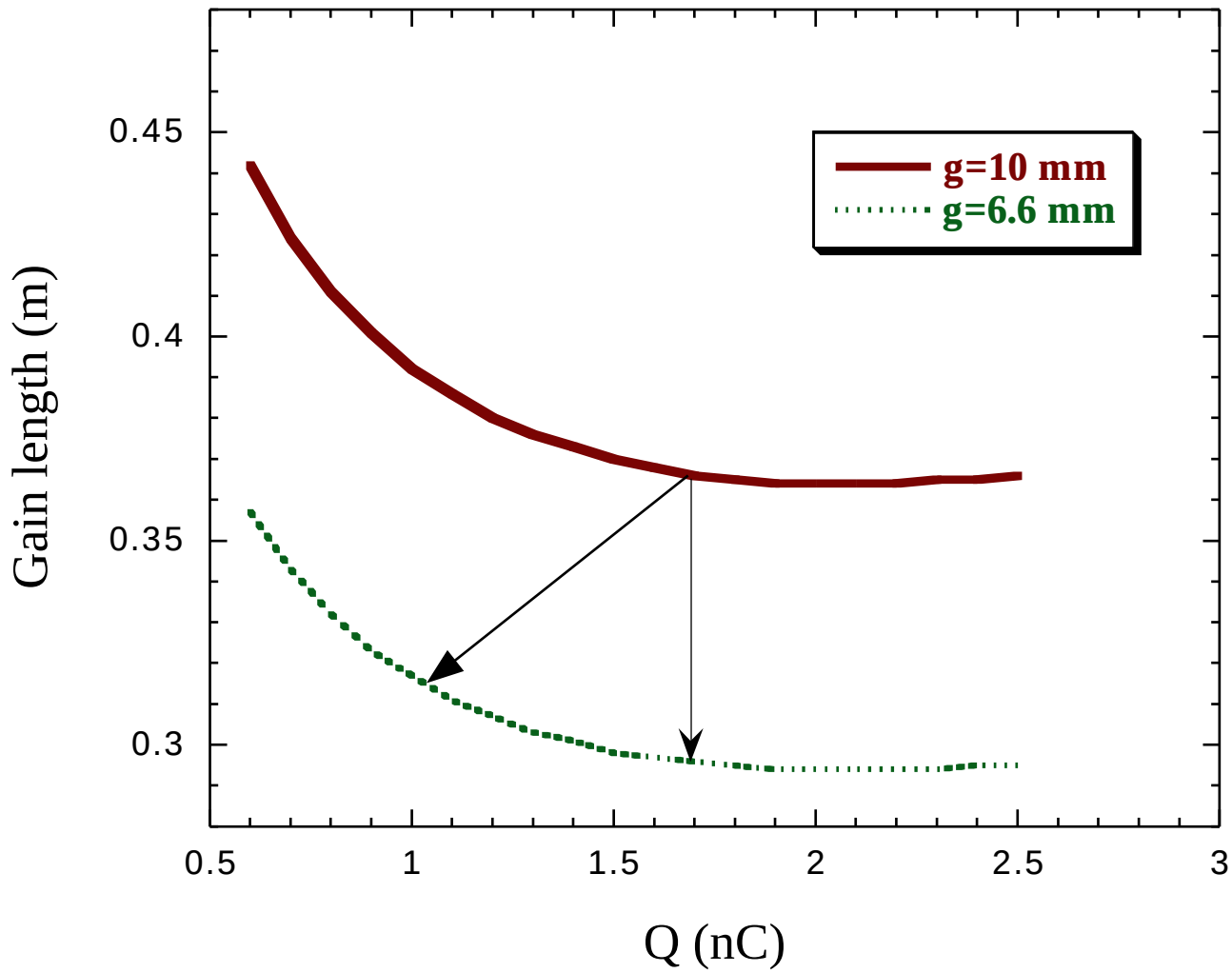
ε_{slice}=1 mm-mrad

$(\sigma_E/E)_{slice}=6\cdot10^{-4}$

Lsat ~ 14.2 m



Result obtained using both **Ginger** and **Genesis**

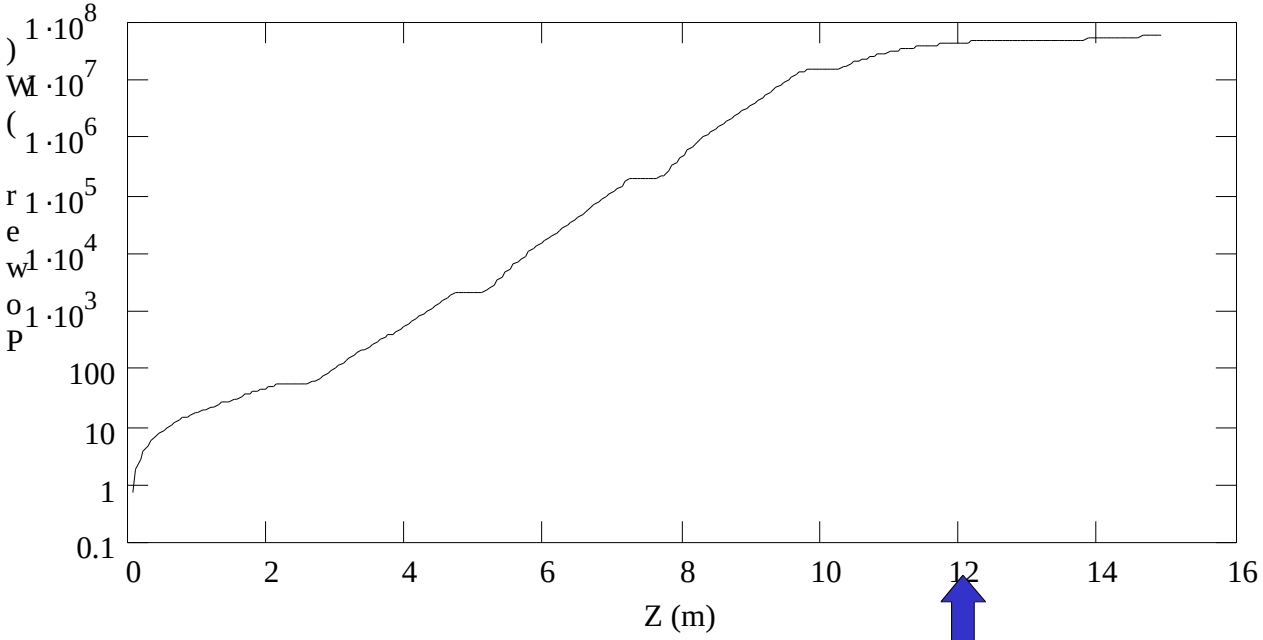

g=10 mm
g=6.6 mm
Gain length (m)
0.45
0.4
0.35
0.3
0.5
1
1.5
2
2.5
3
Q (nC)

Q=1.1 nC - 10 ps - $\lambda_{u=}$ 2.8 cm -gap 9 mm

–Peak current 110 A / 100 A (50% bunch)

–Energy spread 6 10^{-4}

–Emittances 1 mm mrad



We gained ~15% in the saturation length

Lsat ~ 12 m

Q (n C)	**τ (psec) FWHM ***	**Beam fraction with I ≥ 100 A**	**rms norm. emittance (mm-mrad)**	**Total rms energy spread**	**Max. slice rms energy spread****
1	11.7	0% (max. slice current ≈92 A) (average bunch current ≈86 A)	0.6	0.002	0.0005
1	10	23% (max. slice current ≈102 A) (average bunch current ≈94 A)	0.67	0.00162	0.0005
1.1	**10**	**54% (max. slice current ≈110 A) (average bunch current ≈102 A)**	**0.75**	0.00165	0.00052
1.2	10	60% (max. slice current ≈120 A) (average bunch current ≈110 A)	0.81	0.00166	0.00054
1	9	50% (max. slice current ≈110 A) (average bunch current ≈101 A)	0.8	0.00167	0.00042
1.1	9	58% (max. slice current ≈120 A) (average bunch current ≈110 A)	0.86	0.00167	0.00043

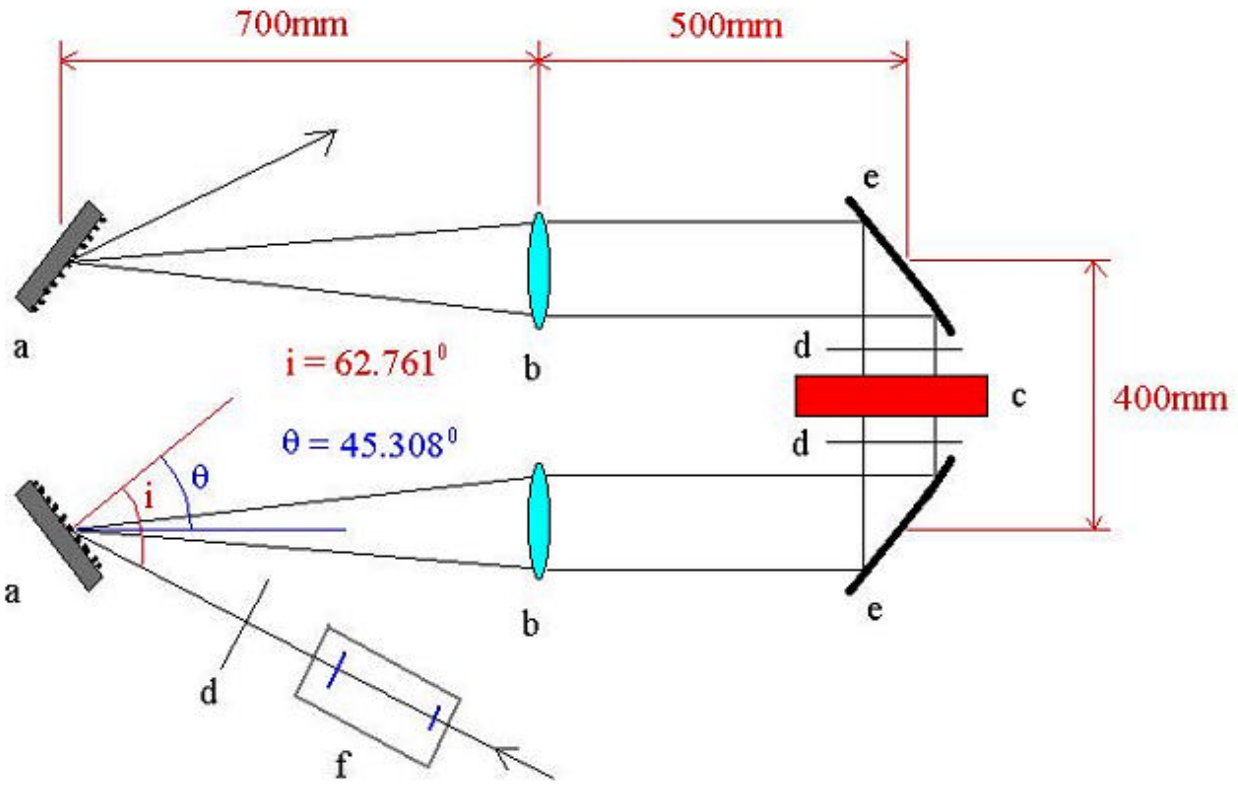
ELECTRON BEAM	
Electron Beam Energy (MeV)	155
Bunch charge (nC)	**1.1**
Repetition rate (Hz)	1-10
Cathode peak field (MV/m)	120
Peak solenoid field @ 0.19 m (T)	0.273
Photocathode spot size (mm, hard edge radius)	**1.13**
Central RF launch phase (RF deg)	**33**
Laser pulse duration, flat top (ps)	**10**
Laser pulse rise time (ps) 10%→90%	1
Bunch energy @ gun exit (MeV)	5.6
Bunch peak current @ linac exit (A) (50% beam fraction)	**100**
Rms normalized transverse emittance @ linac exit (mm-mrad); includes thermal comp. (0.3)	**< 2**
Rms slice norm. emittance (300 μm slice)	**< 1**
Rms longitudinal emittance (deg.keV)	1000
Rms total correlated energy spread (%)	**0.2**
Rms incorrelated energy spread (%)	**0.06**
Rms beam spot size @ linac exit (mm)	0.4
Rms bunch length @ linac exit (mm)	1

UPDATED PARAMETER LIST (15-07-03)

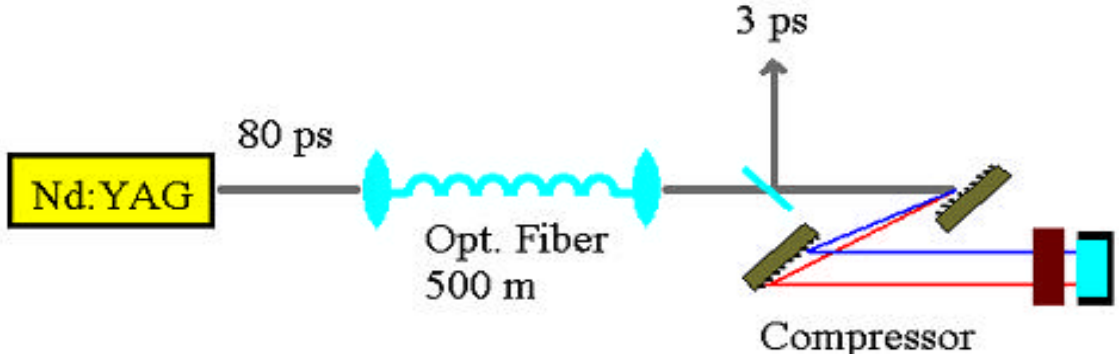
Red: modified parameters
Blue: confirmed old relevant parameters
Black: no change

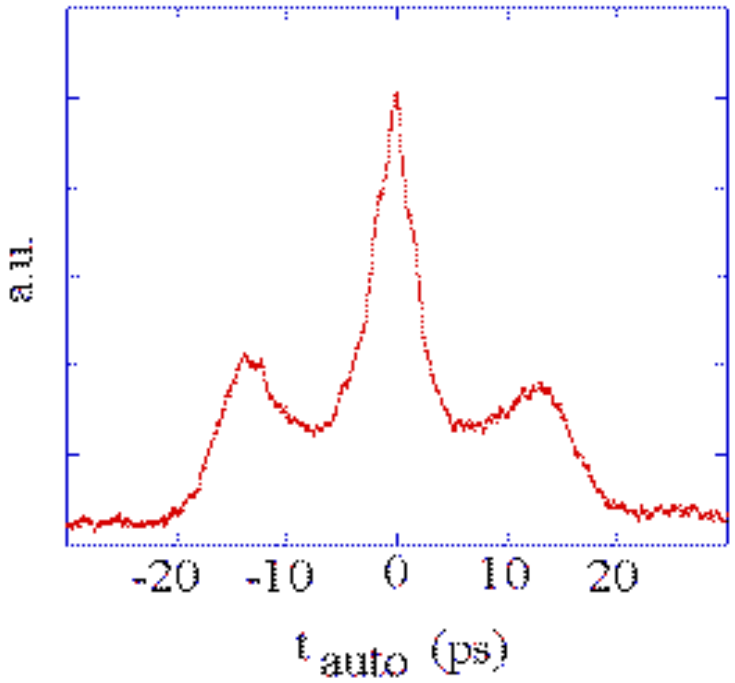
Pulse shaping status at September 2003

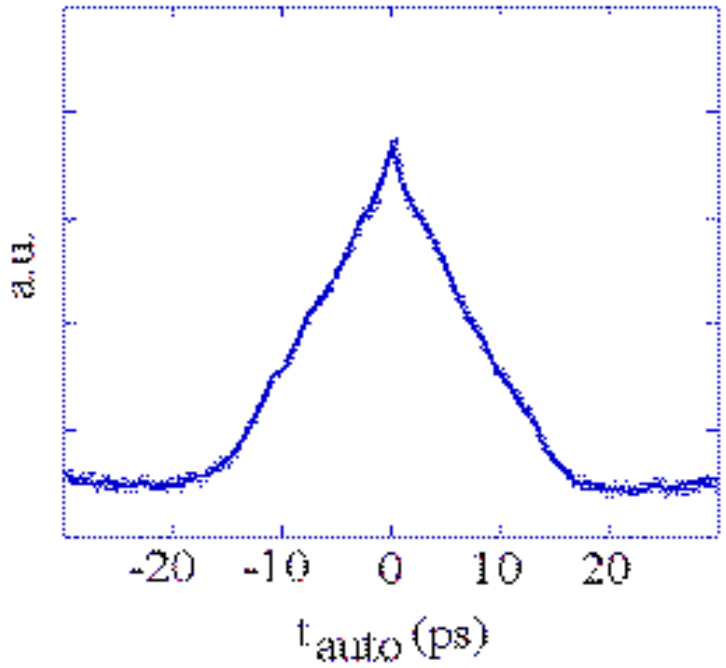
Final SPARC shaper design of 4f-system



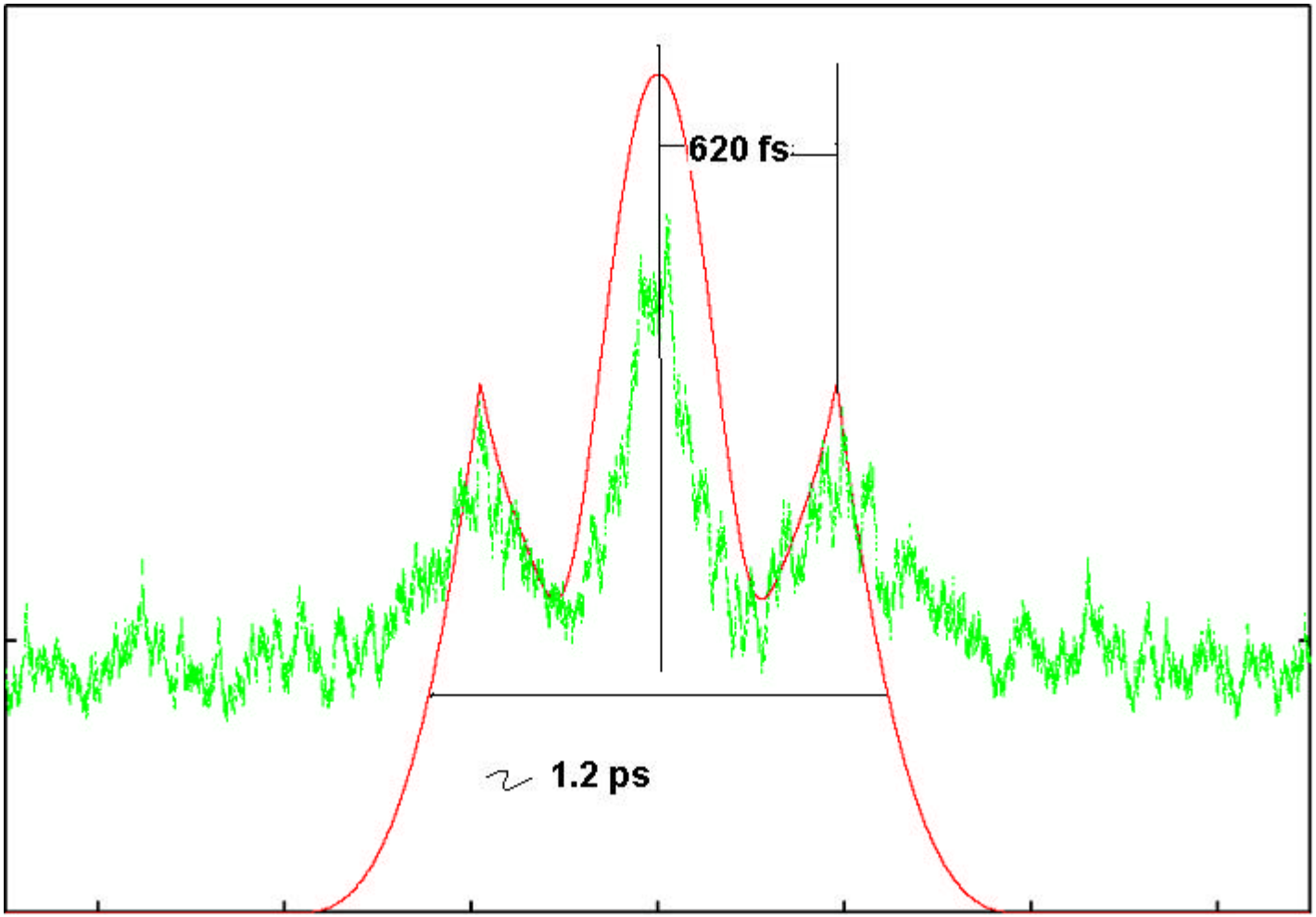
Positive Test at UCLA



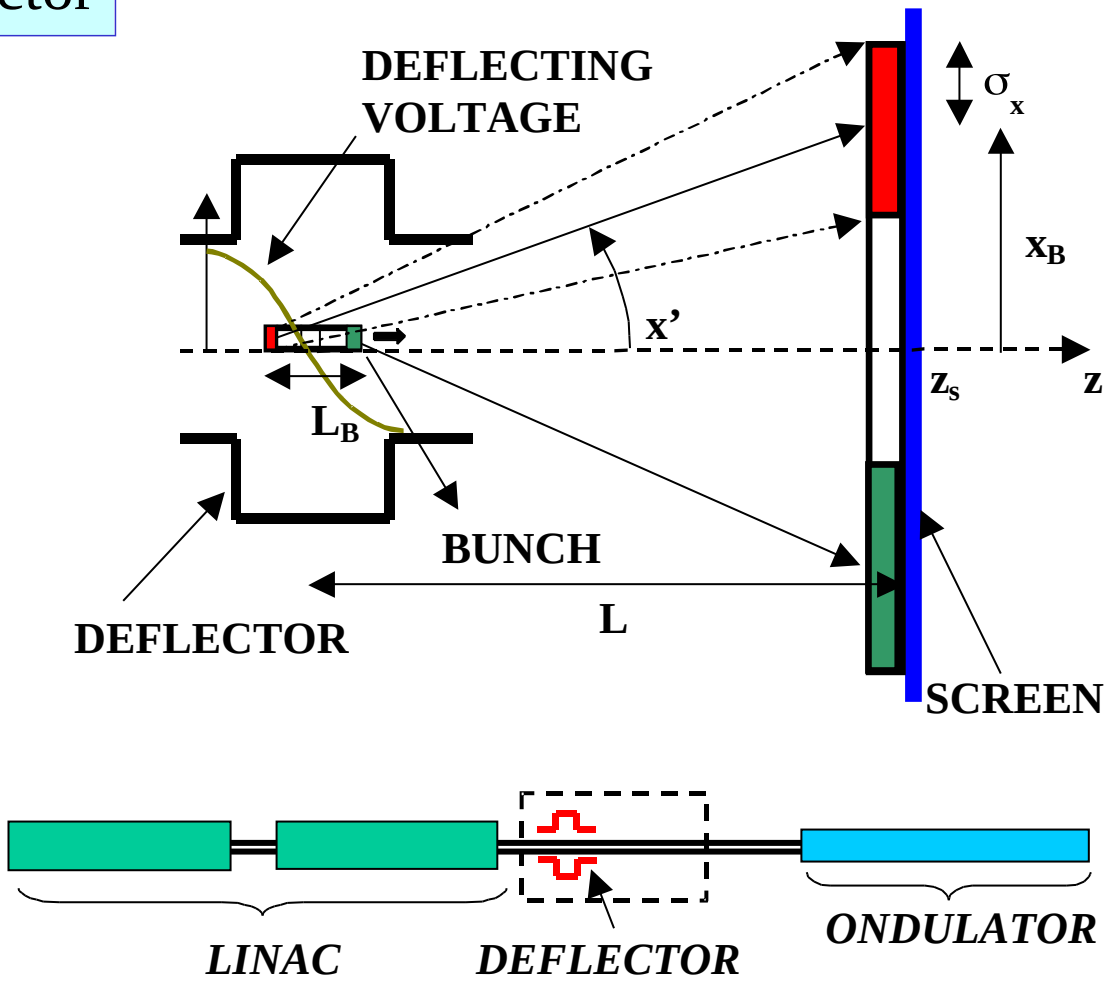


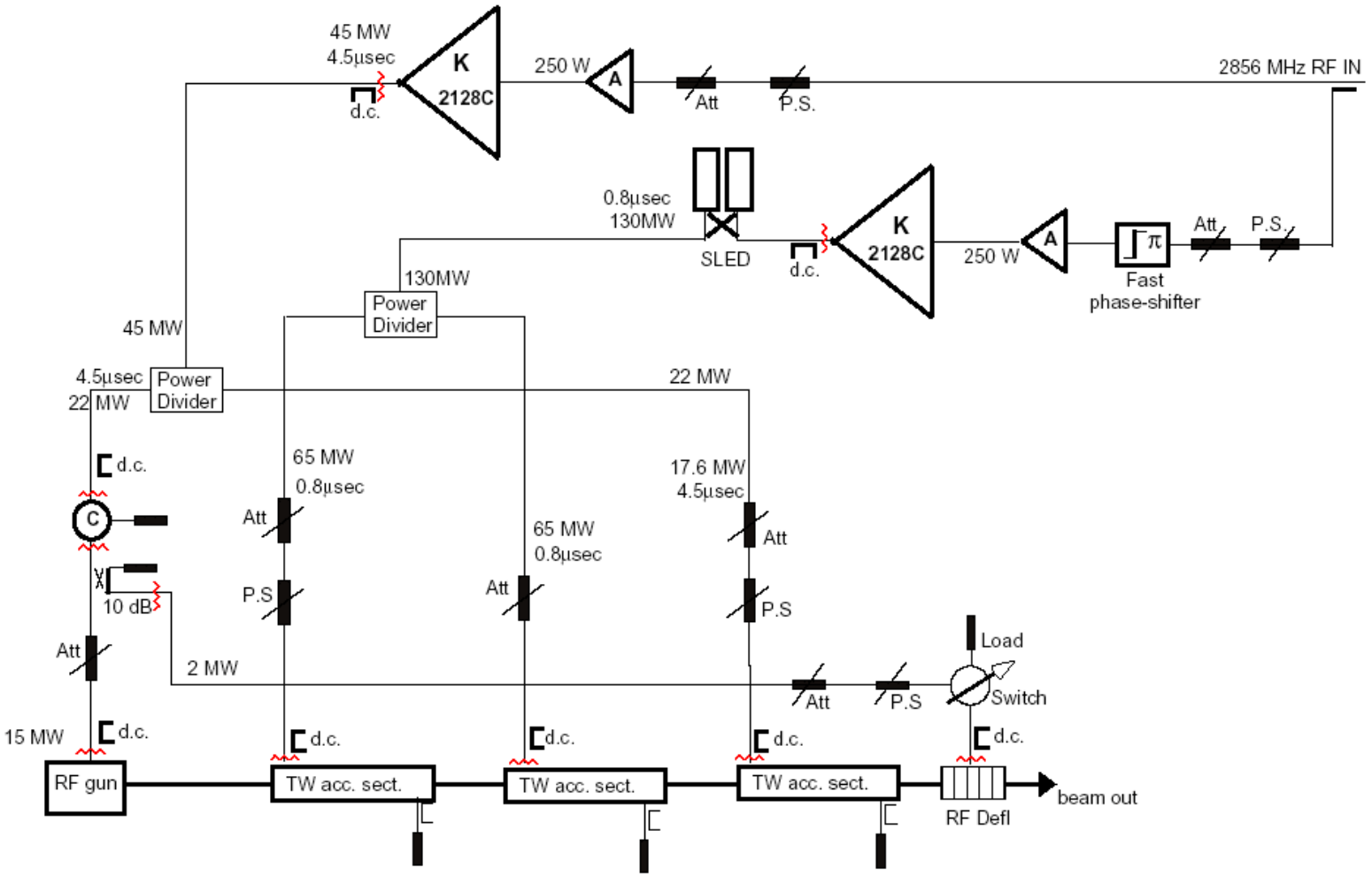


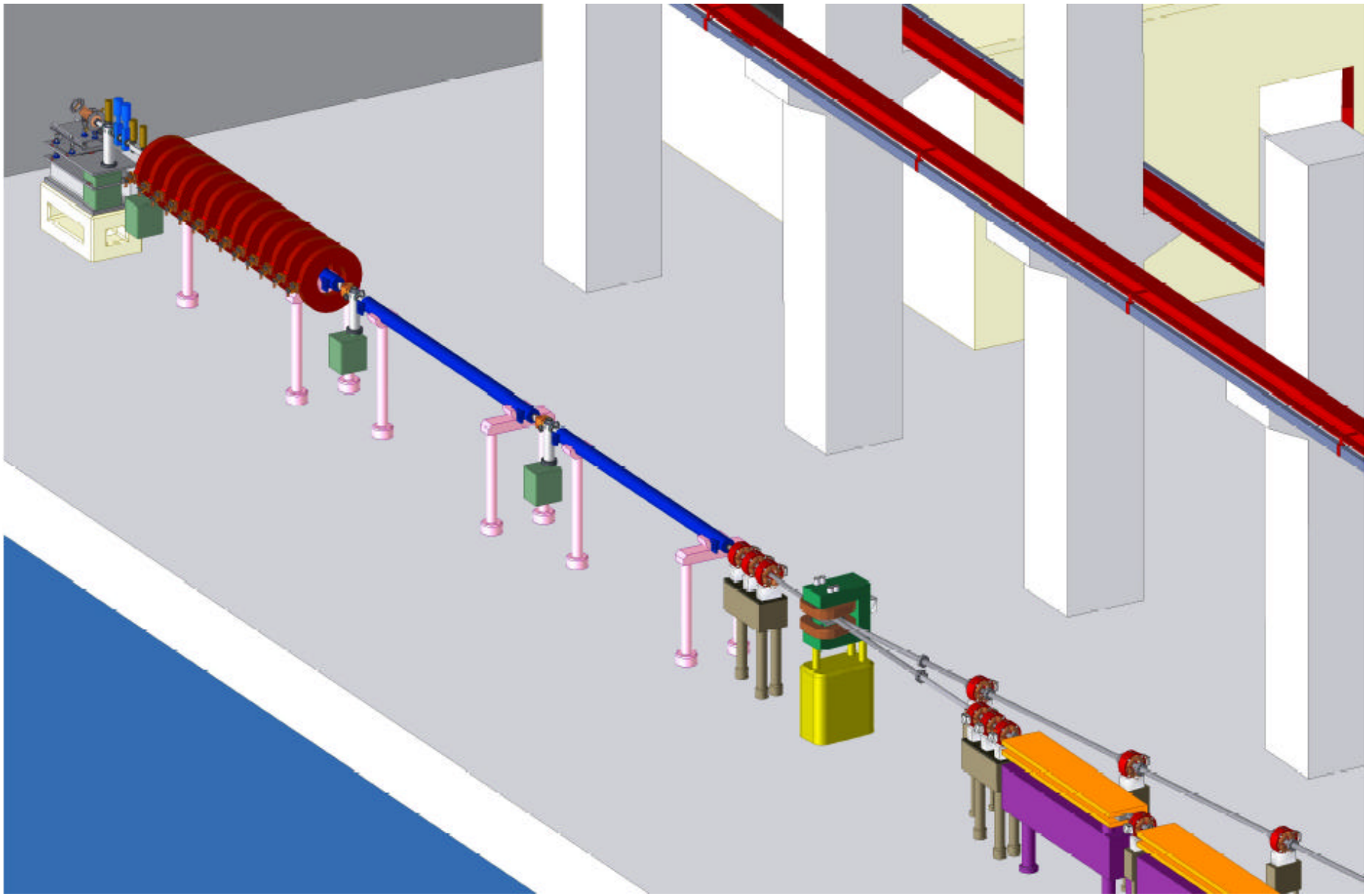
Positive test in Trieste

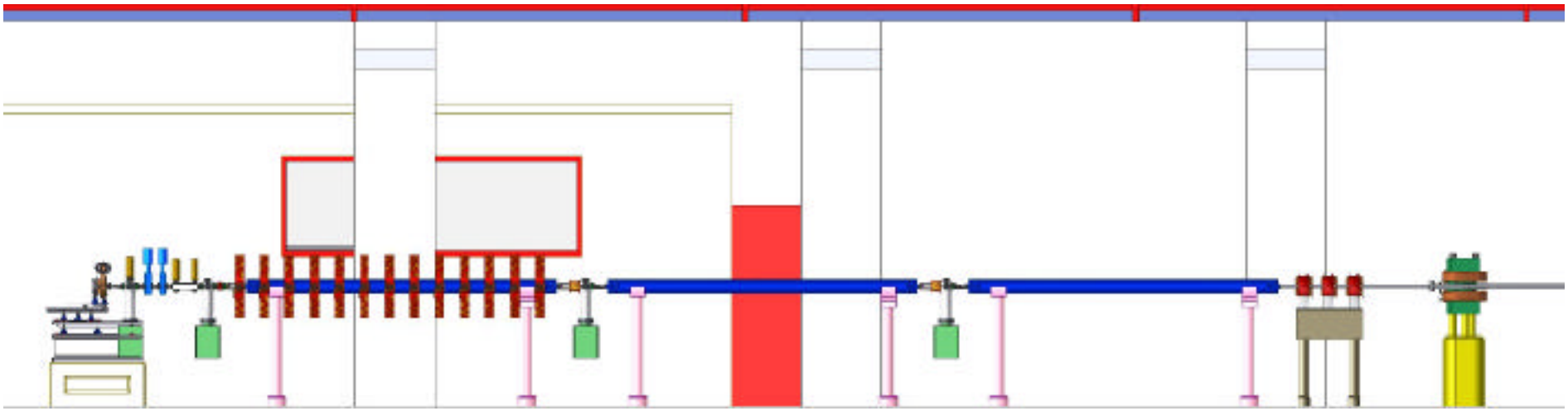


RF Deflector




45 MW
4.5µsec
d.c.
K
2128C
250 W
A
Att
P.S.
2856 MHz RF IN
0.8µsec
130MW
SLED
d.c.
K
2128C
250 W
A
Fast
phase-shifter
Att
P.S.
130MW
Power
Divider
45 MW
4.5µsec
22 MW
Power
Divider
22 MW
d.c.
65 MW
0.8µsec
17.6 MW
4.5µsec
Att
P.S
65 MW
0.8µsec
Att
P.S
Att
P.S
10 dB
Att
2 MW
Load
Switch
Att
P.S
15 MW
d.c.
d.c.
d.c.
d.c.
d.c.
RF gun
TW acc. sect.
TW acc. sect.
TW acc. sect.
RF Defl
beam out

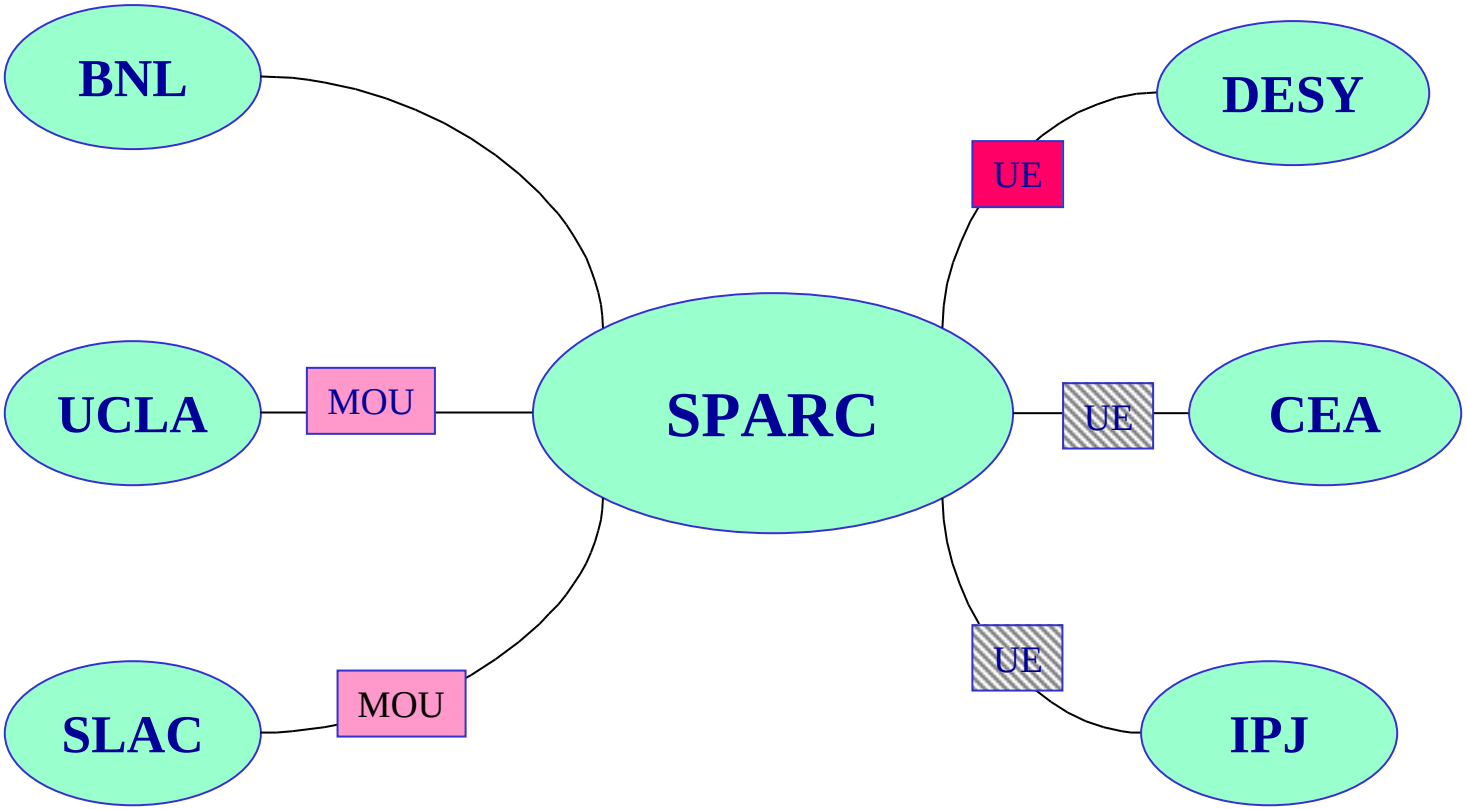




Milestones _ Schedule

June, 1, 2004	Complete Project Engineering Design
June, 1, 2004	Clean room installation
Oct , 1, 2004	Gun installation and rf tests
Dec, 15, 2004	Emittance-meter installation, calibration and tests
Feb, 1, 2005	1st modulator installation and tests
June, 1, 2005	2 accelerating section + RF deflector installation and tests
June, 1, 2005	Drive Laser System installation and tests
June, 8, 2005	2nd Modulator Installation and tests
July, 1, 2005	rf Gun power tests
Sept, 30, 2005	rf Gun emittance measurement
Nov, 25, 2005	3rd accelerating section installation and power tests
Dec, 12, 2005	rf deflector test, start beam measurements

Collaborations and UE programs



EU program I3 ⟹ Joint Research Activity

1) SRRT-JRAs of photocathodes: SPARC, PITZ2, LEG
INFN, DESY, PSI
2) ESGARD - PHIN CERN, CNRS, RAL

SPARC not funded since "design of a not yet existing facility"
⟹ Resubmit to next call on "Design Studies"

PITZ2 proposed 1.3 M€ funding (310 k€ INFN)
90 k€ (man-power) to LNF, collaboration with Zeuthen

LEG given a very low priority (not funded)

PHIN 6-y mp (300 k€) INFN, collaboration on photoinjectors