

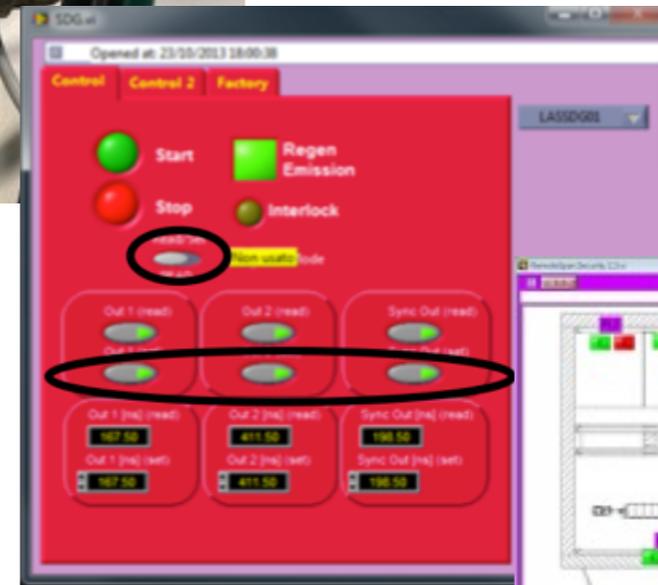


LNF - LNGS "Operazione di Acceleratori di elettroni e positroni"
Laboratori Nazionali del Gran Sasso , 21-22 Giugno 2018

Guida all'operazione di SPARC

*E. Chiadroni with a
little help from my
friends*
(INFN-LNF)

- ❖ Check up in the SPARC bunker
 - ❖ Chillers status and water level
 - ❖ SF6 pressure
 - ❖ any *weird* thing
- ❖ Laser start up
 - ❖ Weekly on Monday Morning
 - ❖ Daily (from Tue to Fri)
- ❖ Tunnel Search (Ronda)
- ❖ Shift initialization
- ❖ Reload working point
- ❖ Magnets cycling
- ❖ Vacuum check and valves opening
- ❖ RF start up
- ❖ Warm up
- ❖ Preliminary measurements



Check up in the SPARC bunker

SPARC LAB

- ❖ Check up in the SPARC bunker
 - ❖ Chillers status and water level
 - ❖ SF6 pressure in the circulator
 - ❖ 1.8 mbar
 - ❖ overlapping of black and red lines
 - ❖ if not, two taps must be open to let the flow goes in
- ❖ SF6 pressure in the RFD
- ❖ When needed: Turn on discharge circuit and hydrogen generator
- ❖ any *weird* thing

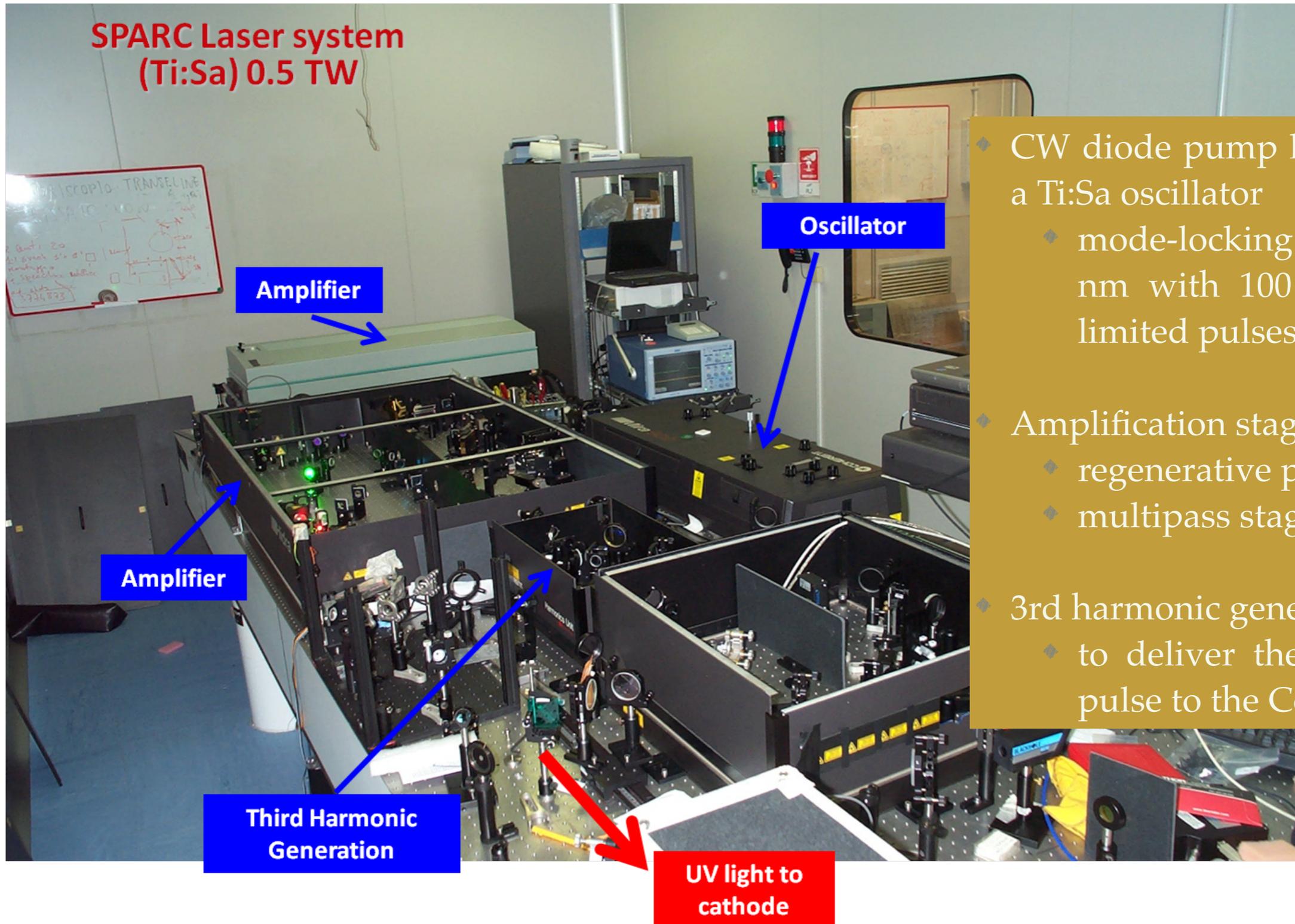


SAVE THE DATE!

On Monday 25th in the morning a tour of the SPARC bunker is foreseen with our two technical coordinator: G. Di Pirro and D. Di Giovenale

Photo-cathode Laser System

SPARC LAB



- ◆ CW diode pump laser to pump a Ti:Sa oscillator
 - ◆ mode-locking regime at 800 nm with 100 fs transform-limited pulses
- ◆ Amplification stages
 - ◆ regenerative pre-amplifier
 - ◆ multipass stage
- ◆ 3rd harmonic generation
 - ◆ to deliver the required UV pulse to the Copper cathode

Photo-cathode Laser Start up

SPARC LAB

- ❖ Laser start up
 - ❖ Weekly on Monday Morning => **Part I**

Video: Laser_Part1

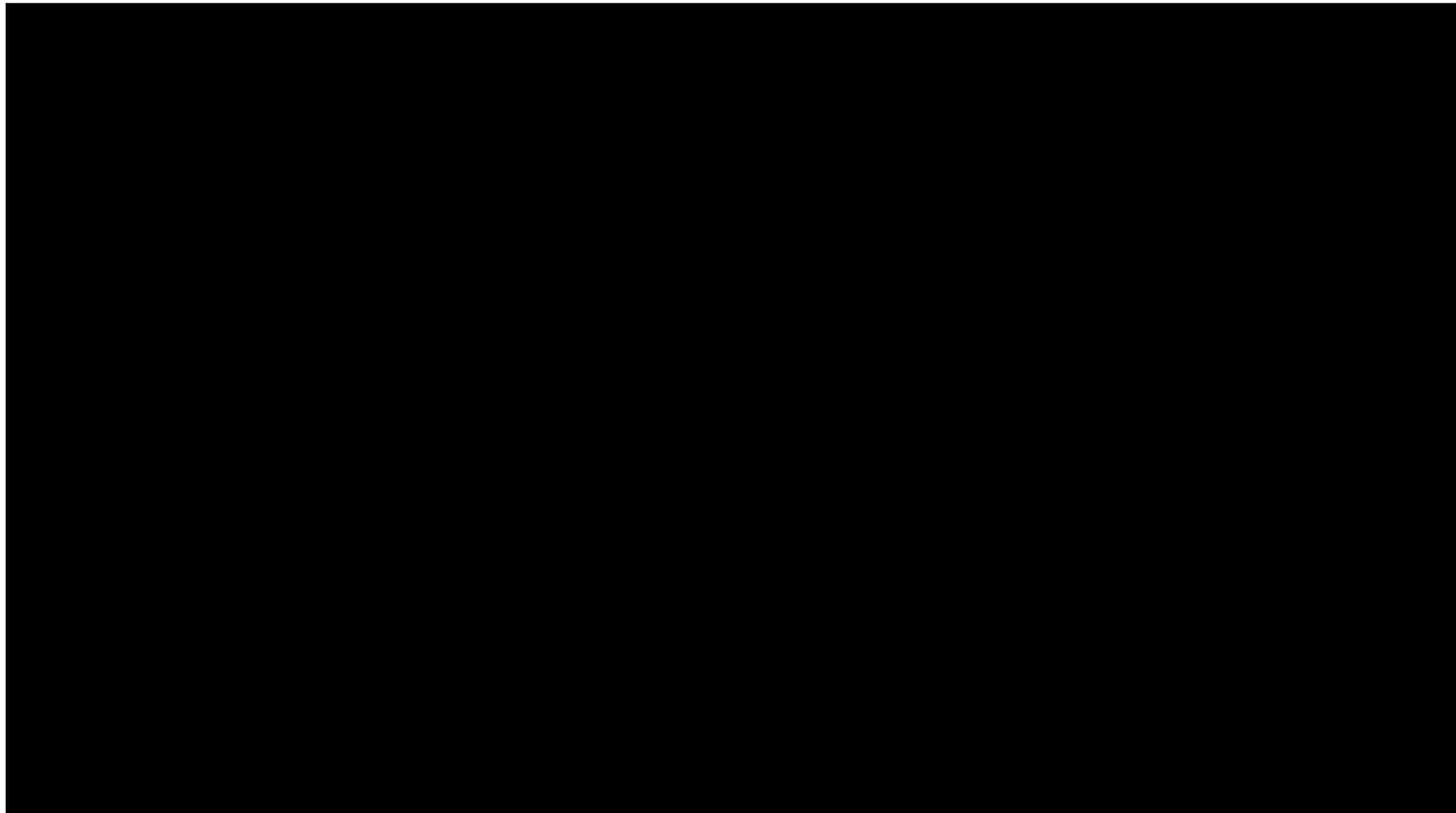


Photo-cathode Laser Start up

SPARC LAB

- ❖ Laser start up
 - ❖ Weekly on Monday Morning => **Part II**

Video: Laser_Part2_v2

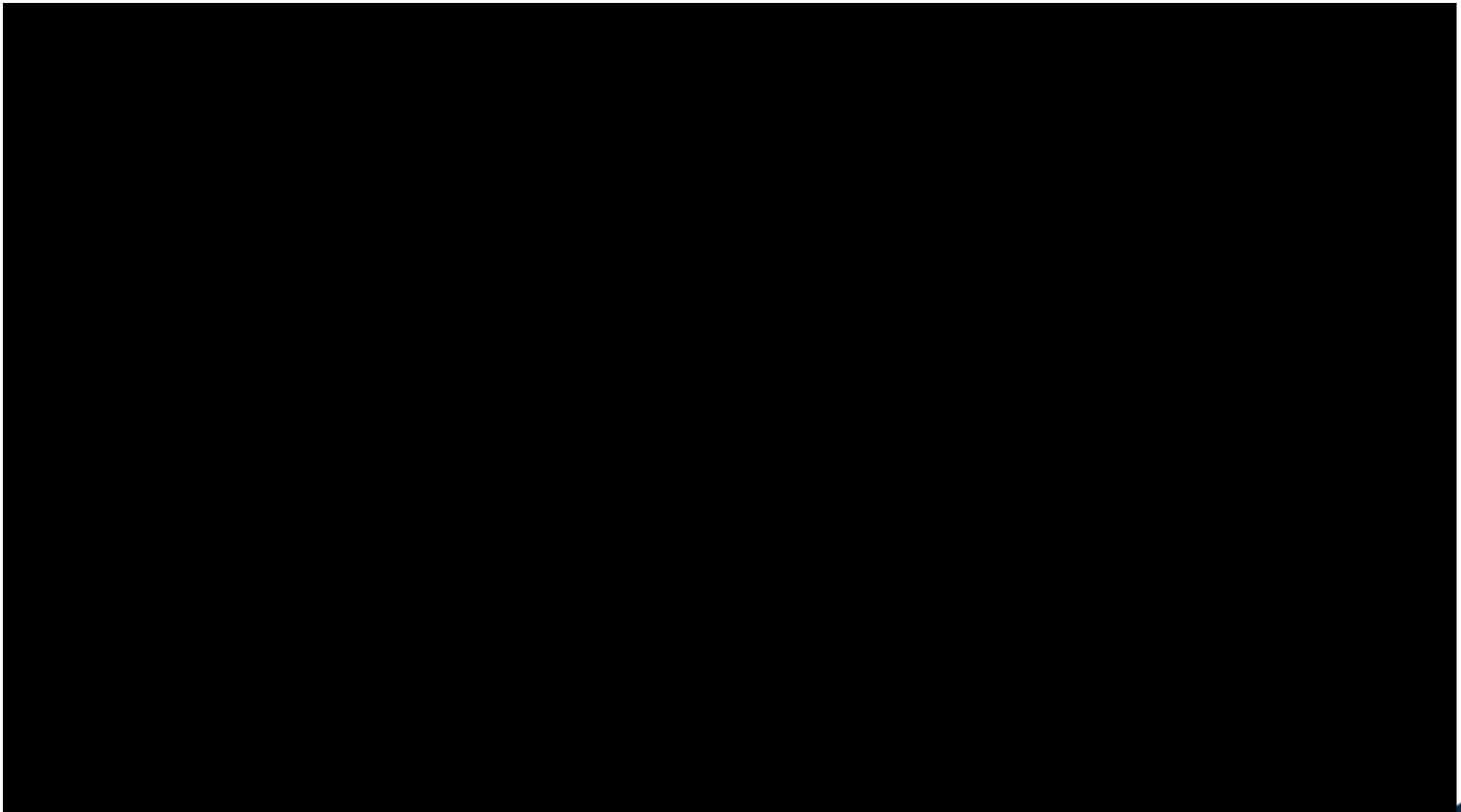


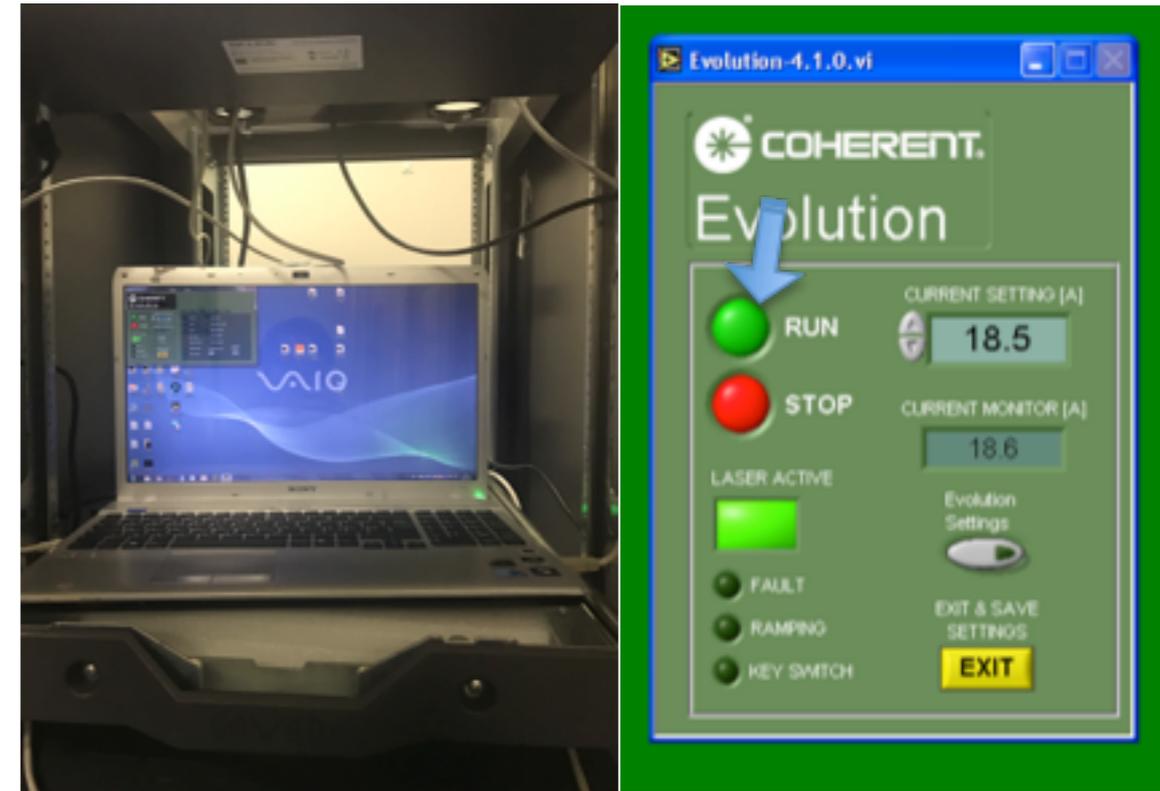
Photo-cathode Laser Start up

SPARC LAB

❖ Laser start up

❖ Every day around 7am

1. Fuori dalla camera pulita: controllare il livello d'acqua nel chiller
2. In camera pulita: Accendere l'Evolution
3. Accendere lo YAG: girare la chiave, attendere che le luci siano ferme, premere avvio, quindi il Q-switch
4. Ronda Laser



5. Dopo ~20 min, dalla sala controllo va acceso l'SDG (tutti e 3 i tasti) che si trova sotto la barra di SPARC



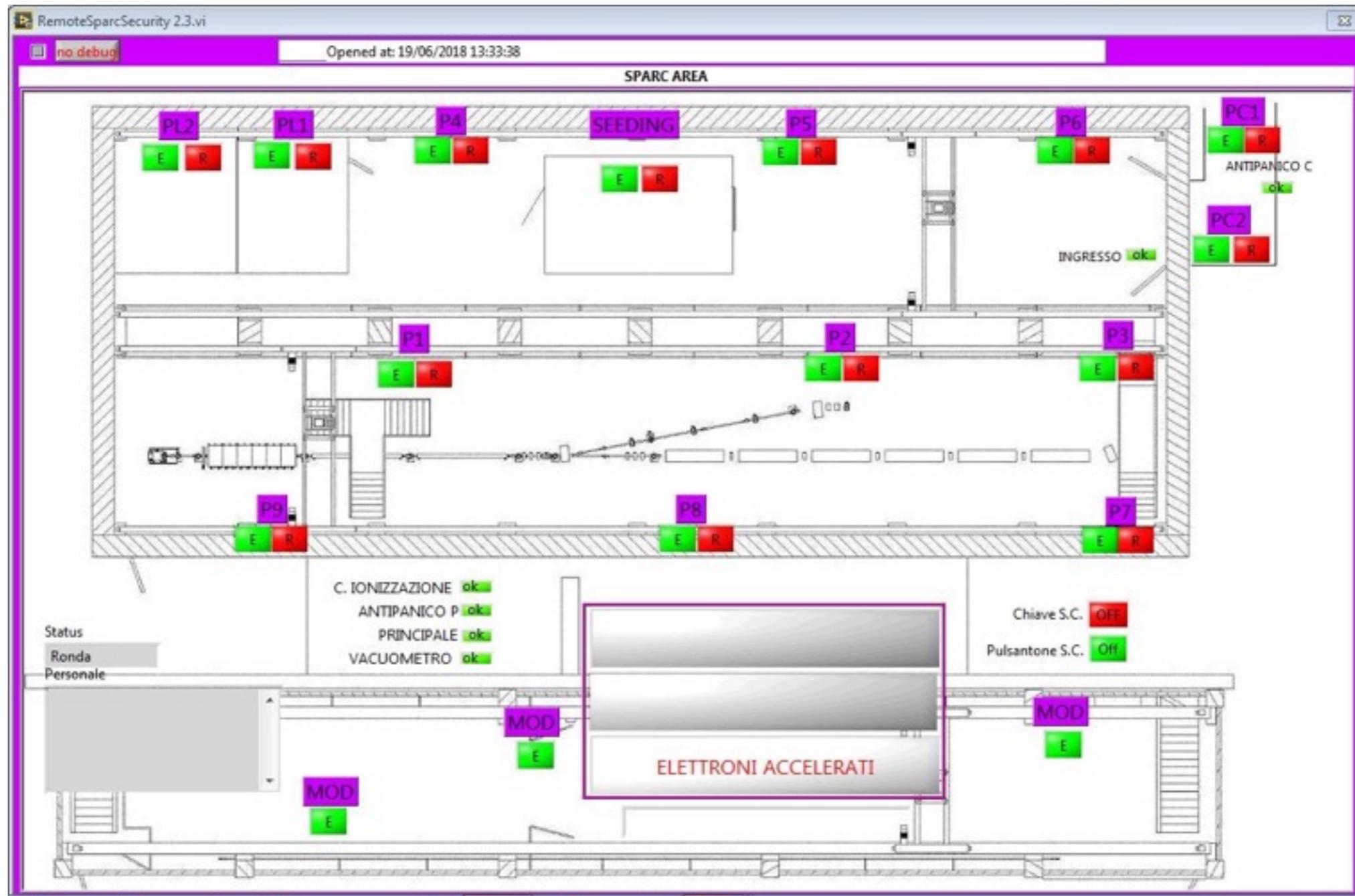
enrica.chiadroni@lnf.infn.it

❖ Tunnel Search (Ronda)

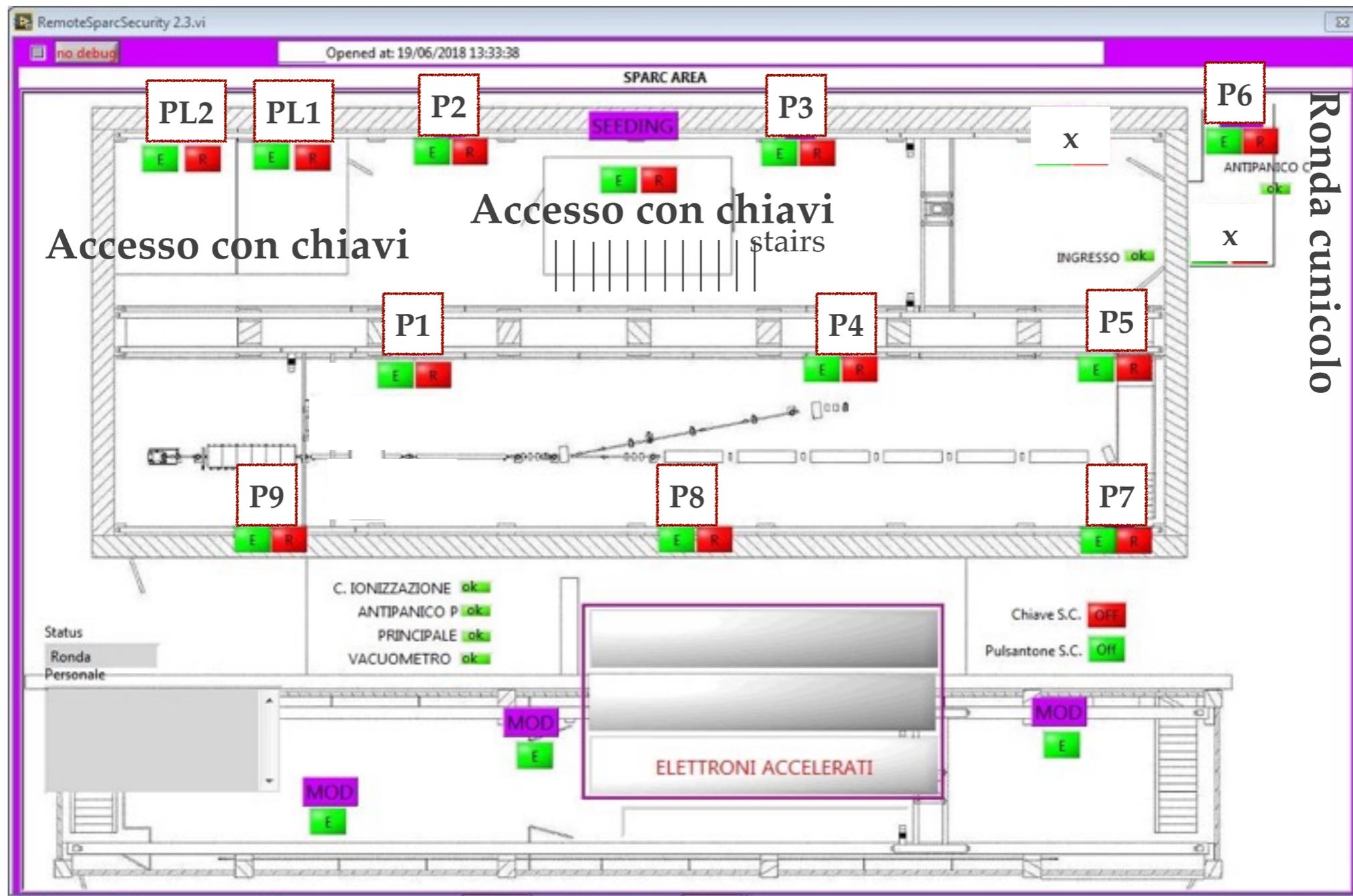
Video: SPARC_RONDA_FinalCut



- ❖ Tunnel Search (Ronda) => Check on the RemoteSecurity vi



- ❖ Tunnel Search (Ronda) => New position of the buttons



Preparatory Actions

- ❖ Preparatory Actions
 - ❖ Opening Interlock panels

Video: Preliminary_SPARC



Preparatory Actions

- ❖ Magnets cycling
- ❖ Modulators start up

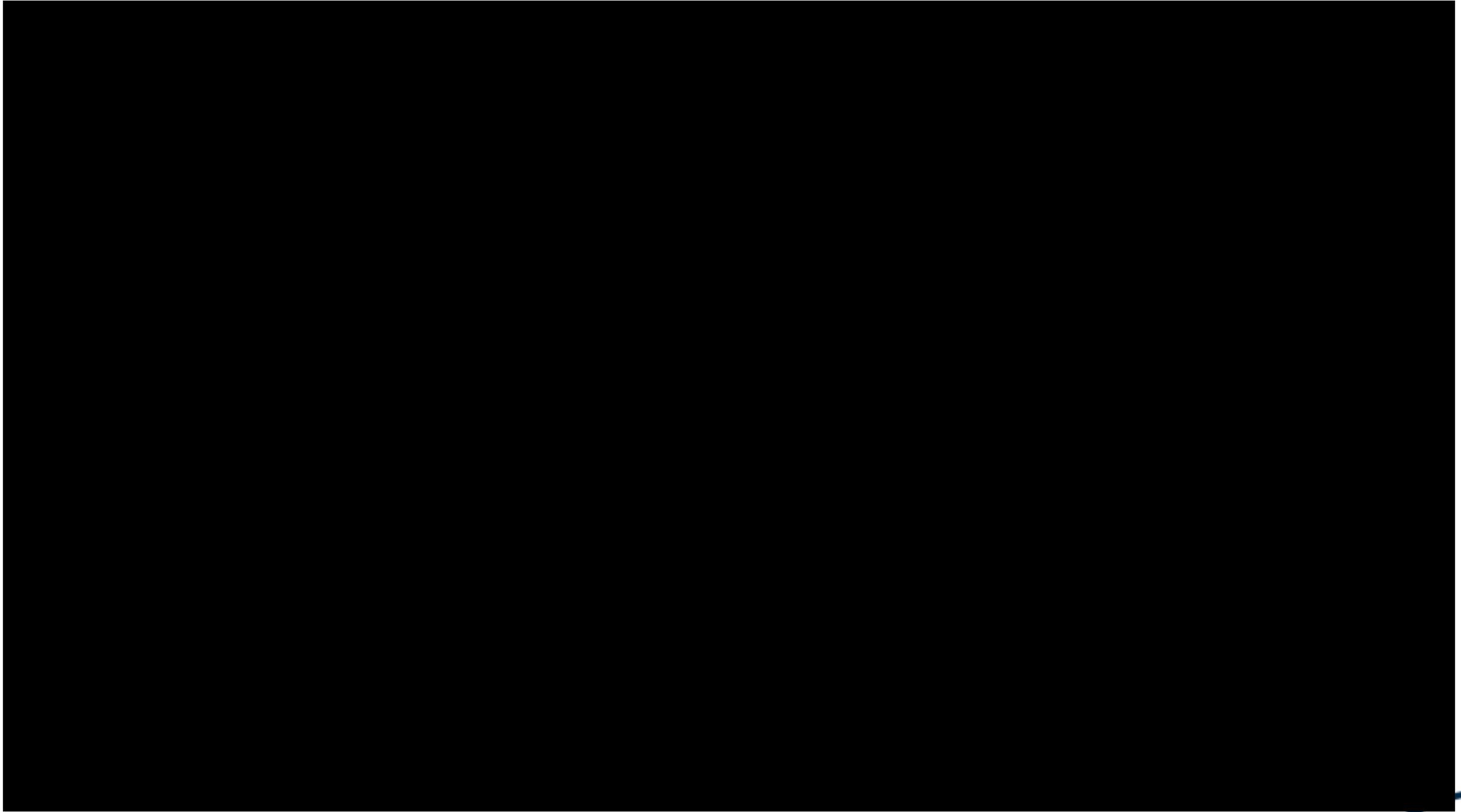
Video: Start_Modulator



Preparatory Actions

- ❖ Shift initialization
- ❖ Reload working point

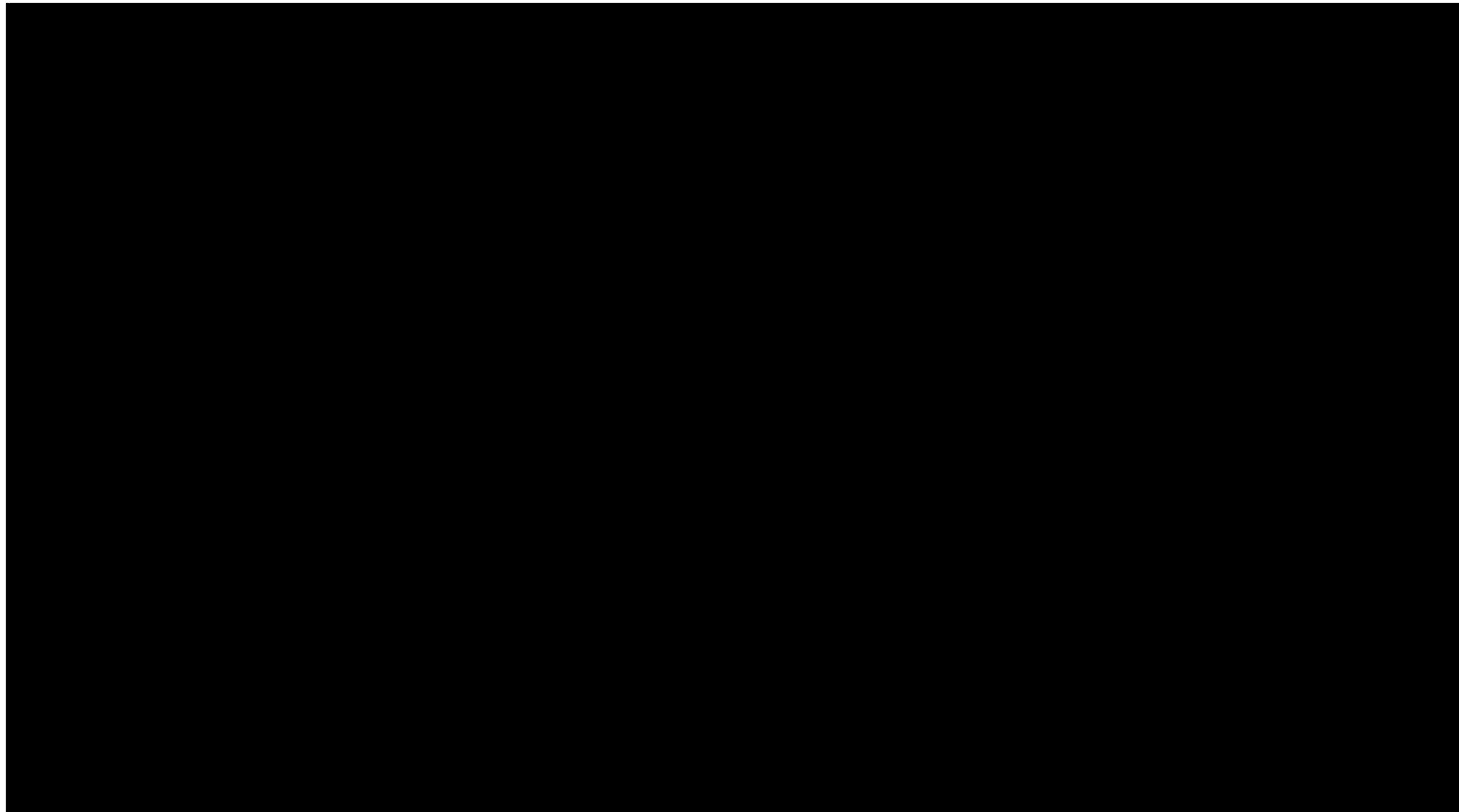
Video: ReloadWP



Preparatory Actions

- ❖ High Voltage modulator start up

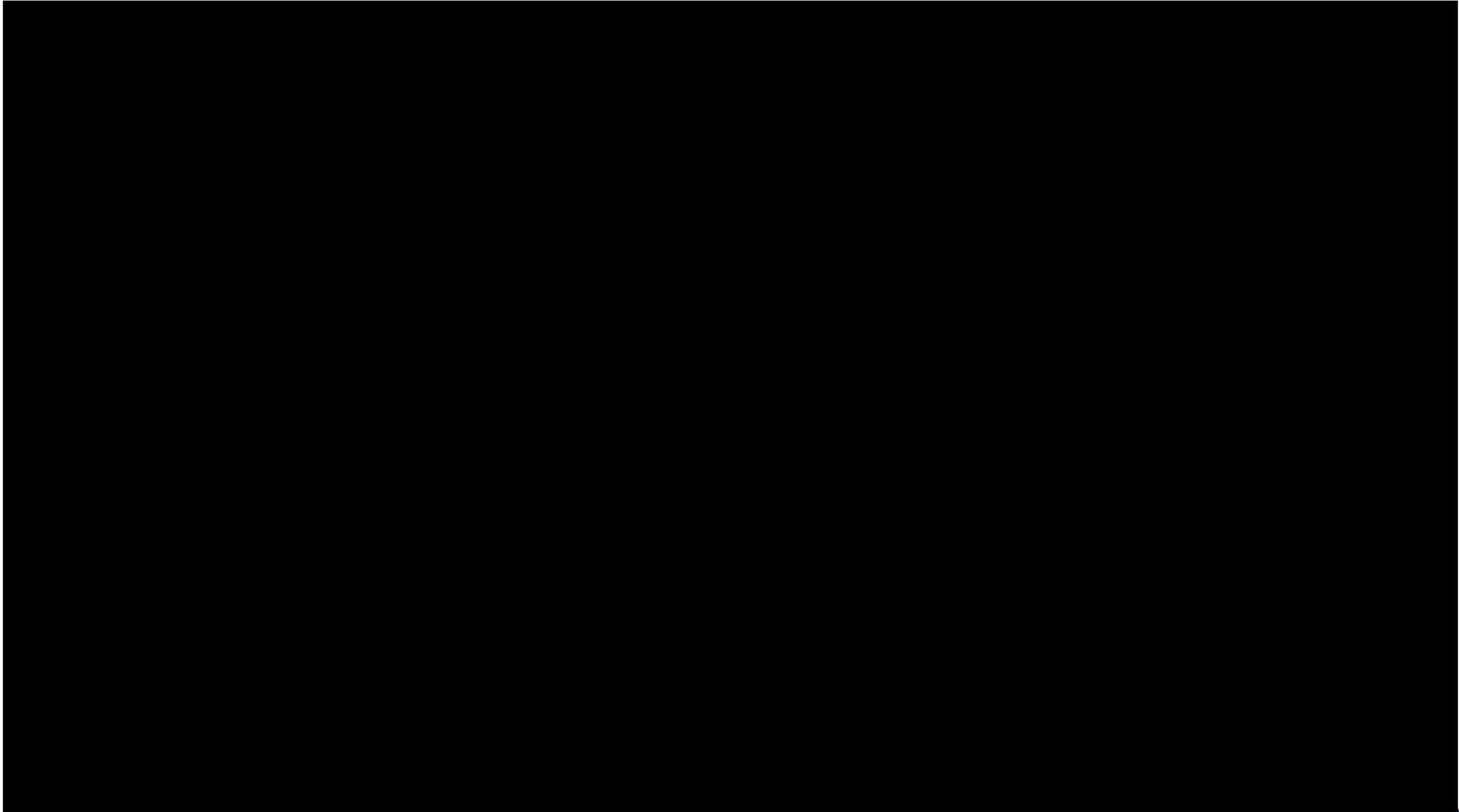
Video: Modulator_HV



Preparatory Actions

- ❖ RF Power on

Video: Start_RF



SPARC Friday evening shutdown

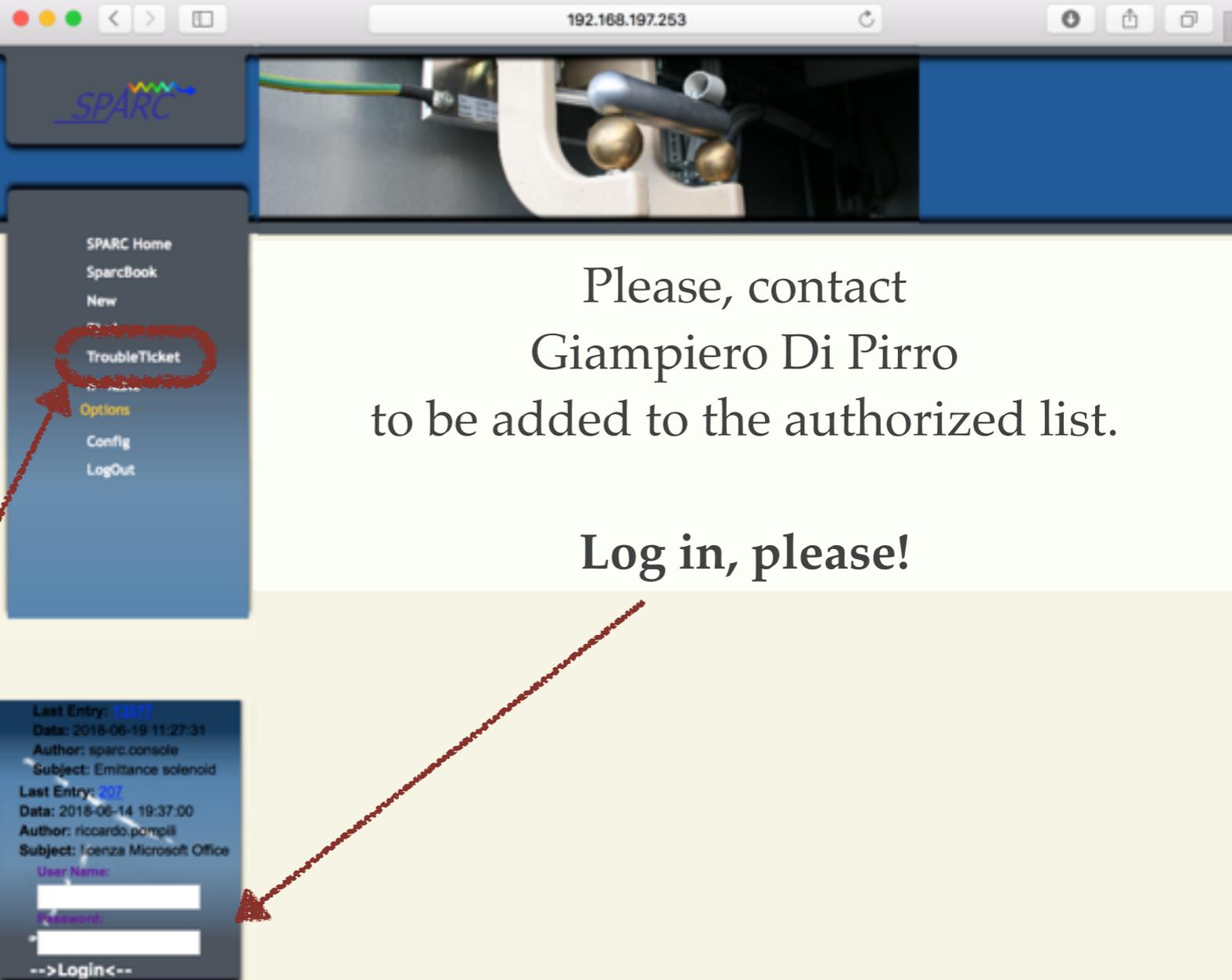
SPARC LAB

...in a nutshell

- ❖ RF shut down
 - ❖ Unlock all the feedback
- ❖ Modulators OFF
- ❖ Magnets down ramp to 0 A and stand-by
- ❖ Valves closing
- ❖ Shift report on the logbook
- ❖ Laser weekly shut down
 - ❖ Printed procedure in the Blue Notebook

Report

- ❖ Report on E-logbok
- ❖ <http://192.168.197.253/Ebook/>
- ❖ Use Trouble Ticket to report any problems and / or failure



The screenshot shows a web browser window with the URL 192.168.197.253. The page features a navigation menu on the left with the following items: SPARC Home, SparcBook, New, **TroubleTicket** (circled in red), Options, Config, and LogOut. Below the menu, there are two entries for 'Last Entry' with their respective dates, authors, and subjects. At the bottom, there is a login form with fields for 'User Name' and 'Password', and a '-->Login<--' button. A red arrow points from the 'TroubleTicket' menu item to the login form.

Please, contact
Giampiero Di Pirro
to be added to the authorized list.

Log in, please!

- ❖ **Morning and Afternoon shifts**
 - ❖ Support to SPARC operators (8-16 / 15-23)
- ❖ **Night shift**
 - ❖ Short term: Photo-cathode laser OFF
 - ❖ RF stability measurements
 - ❖ Amplitude power jitter
 - ❖ Dark current monitoring
 - ❖ RF deflecting cavity conditioning
 - ❖ C-band conditioning
 - ❖ Any other action based on your experience to fix any bugs
 - ❖ Long term: Photo-cathode laser ON
 - ❖ Laser energy stability measurements
 - ❖ Electron beam stability measurements (charge, energy, positioning, ...)
 - ❖ Set up machine for morning shift: preparatory measurements

- ❖ **Morning and Afternoon shifts**
 - ❖ Support to SPARC operators (8-16 / 15-23)
- ❖ **Night shift**
 - ❖ Short term: Photo-cathode laser OFF
 - ❖ RF stability measurements
 - ❖ Amplitude power jitter
 - ❖ Dark current monitoring
 - ❖ RF deflecting cavity conditioning
 - ❖ C-band conditioning
 - ❖ Any other action based on your experience to fix any bugs
 - ❖ Long term: Photo-cathode laser ON
 - ❖ Laser energy stability measurements
 - ❖ Electron beam stability measurements (charge, energy, positioning, ...)
 - ❖ Set up machine for morning shift: **preparatory measurements**

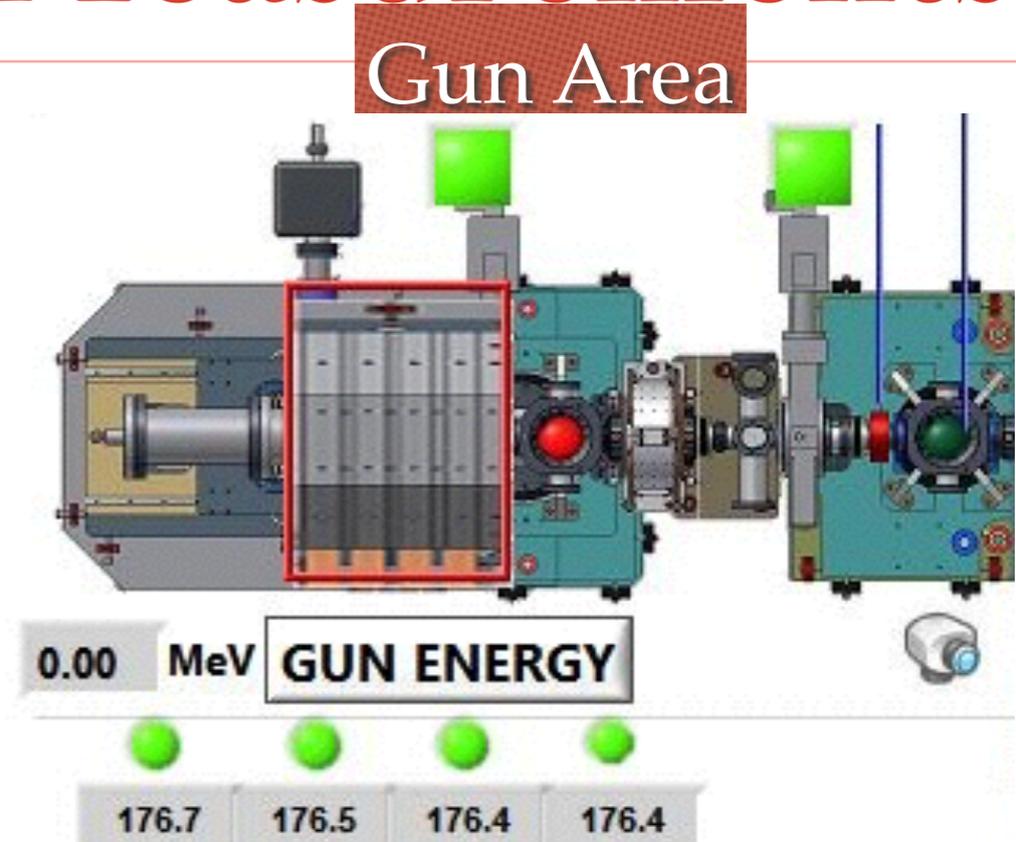
Preparatory Measurements

SPARC LAB

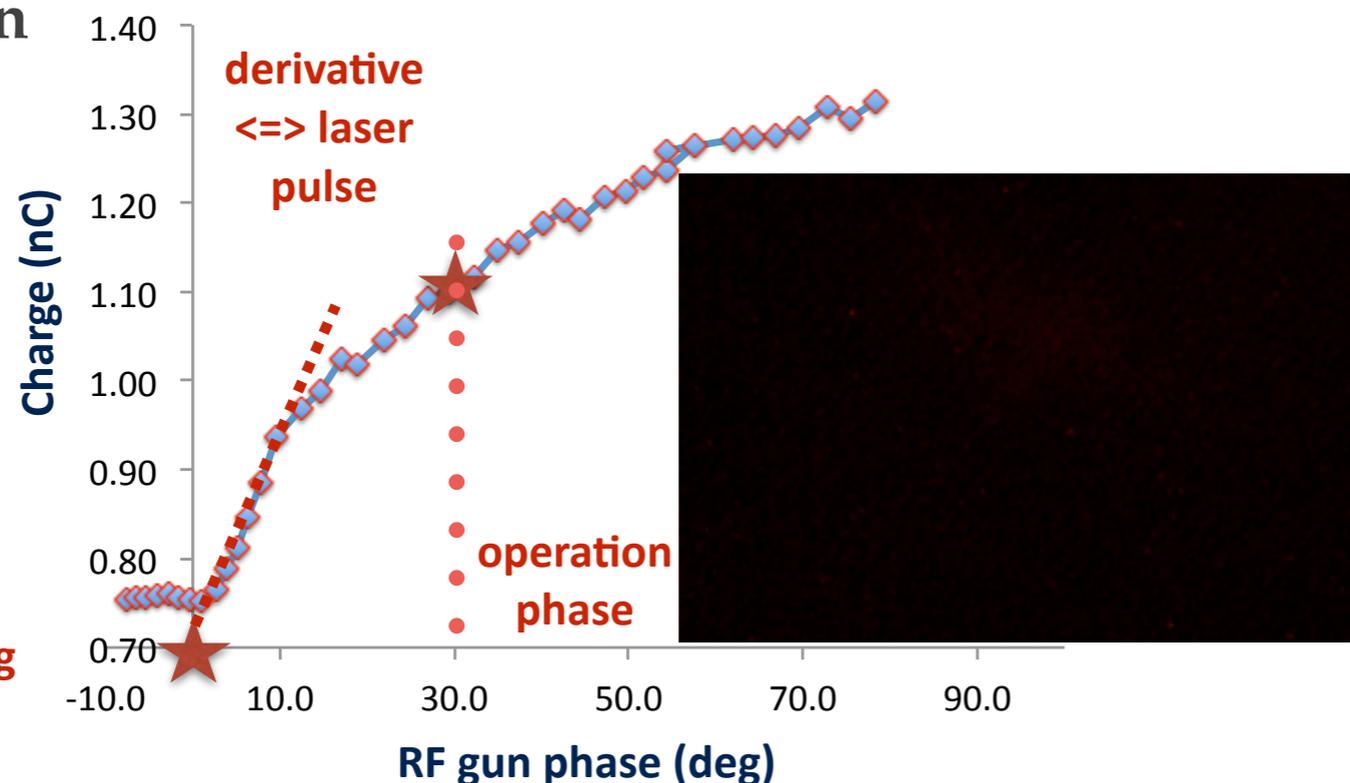
Measurements to be performed
(once RF is turned ON)

Scintillating screen (AC1FLG01) inserted

- ◆ **Check laser centering on the cathode**
 - ◆ Beam fills radially symmetric RF field
 - ◆ centroid does not move
- ◆ **Phase scan**
 - ◆ Charge VS RF gun launch phase
- ◆ **Charge**
 - ◆ Beam Current Monitor named as AC1BCM



Phase scan



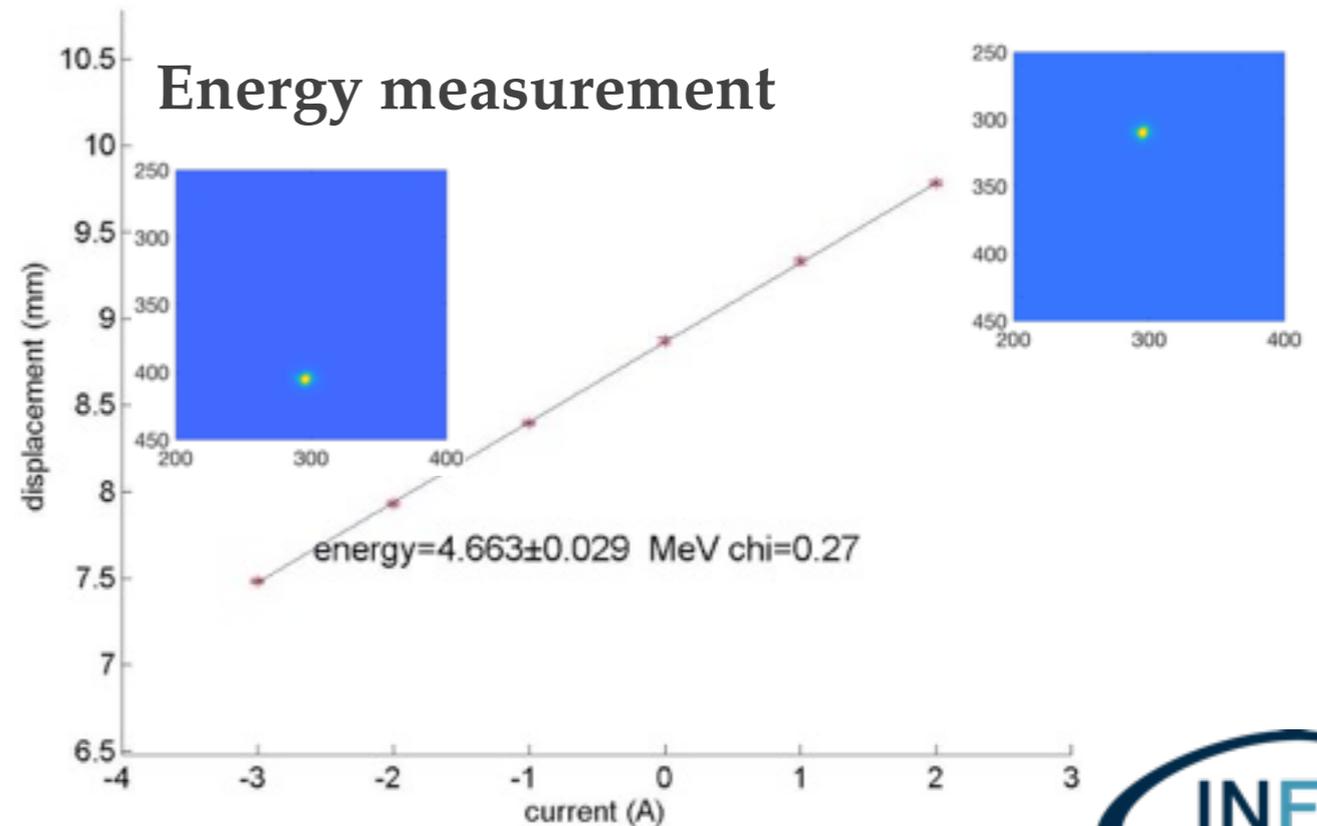
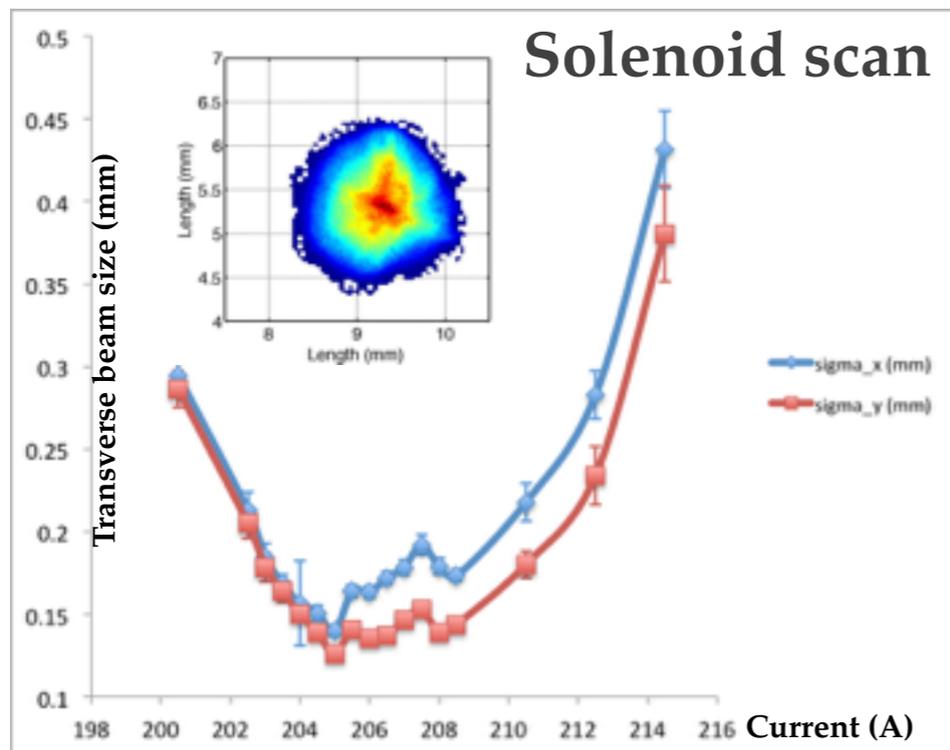
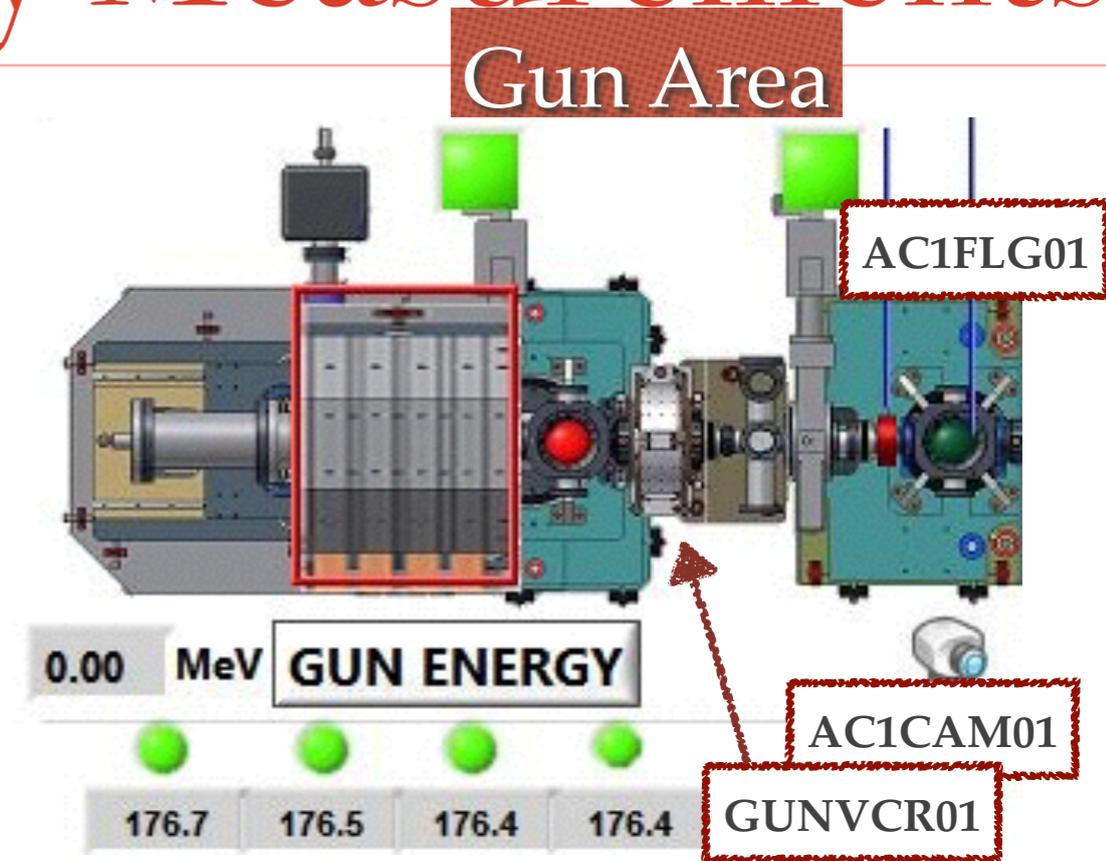
enrica.chiadroni@lnf.infn.it

Preparatory Measurements

Measurements to be performed
(once RF is turned ON)

Scintillating screen (AC1FLG01) inserted

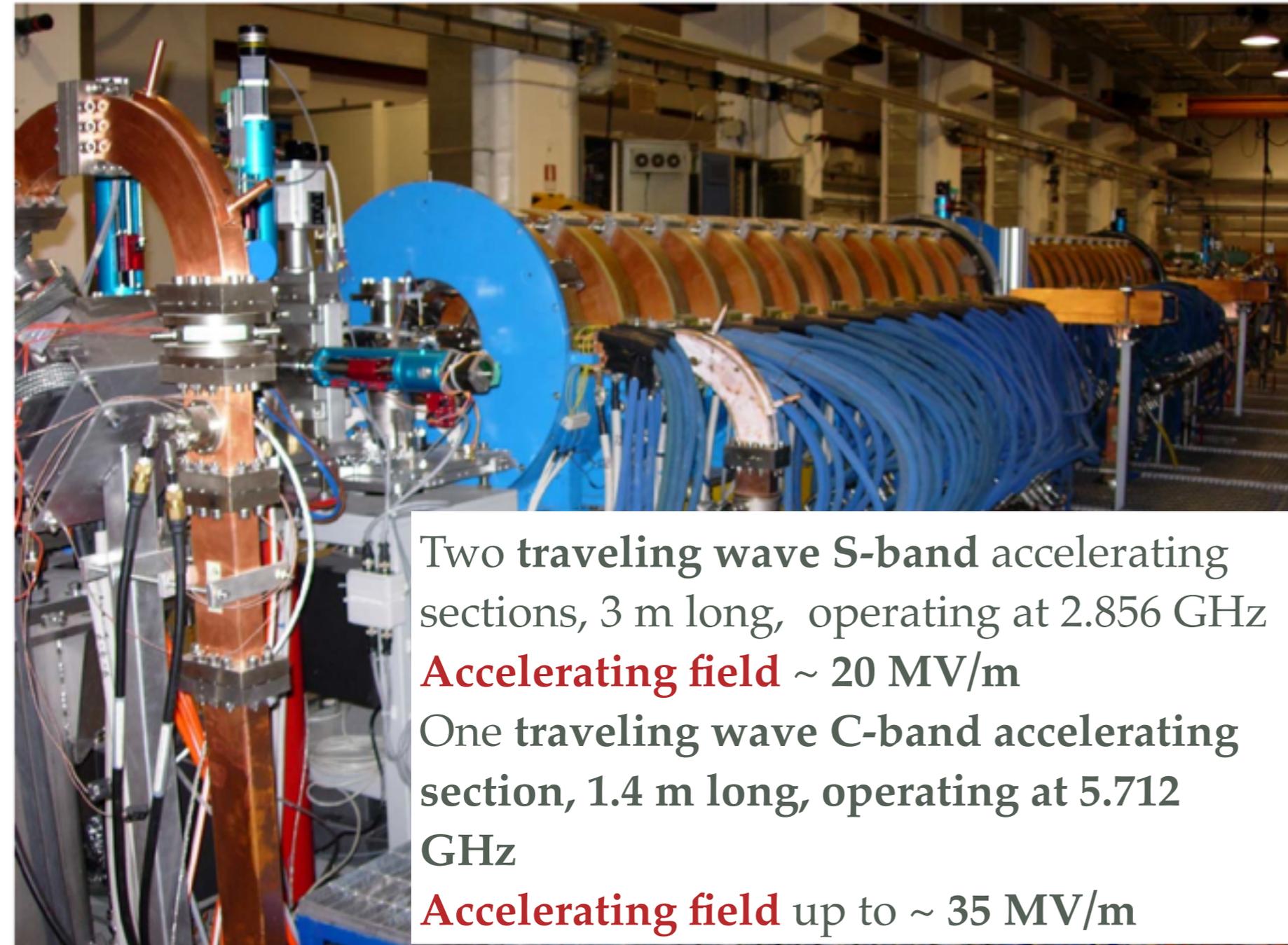
- ◆ **Solenoid scan**
 - ◆ Beam size VS gun solenoid current
- ◆ **Energy measurement**
 - ◆ Vertical beam centroid VS GUNVCR01 steering current



Preparatory Measurements

Linac Area

- ◆ **Trajectory**
 - ◆ Monitor and Correct Beam Position Monitors through steering magnets
- ◆ **Charge**
 - ◆ Beam Current Monitor named as AC3BCM and PTLBCM
- ◆ **Envelope scan**
 - ◆ YAG and OTR screens along the linac
- ◆ **Energy measurement**
 - ◆ Horizontal beam centroid VS PTLDPL01 dipole current



Two traveling wave S-band accelerating sections, 3 m long, operating at 2.856 GHz

Accelerating field ~ 20 MV/m

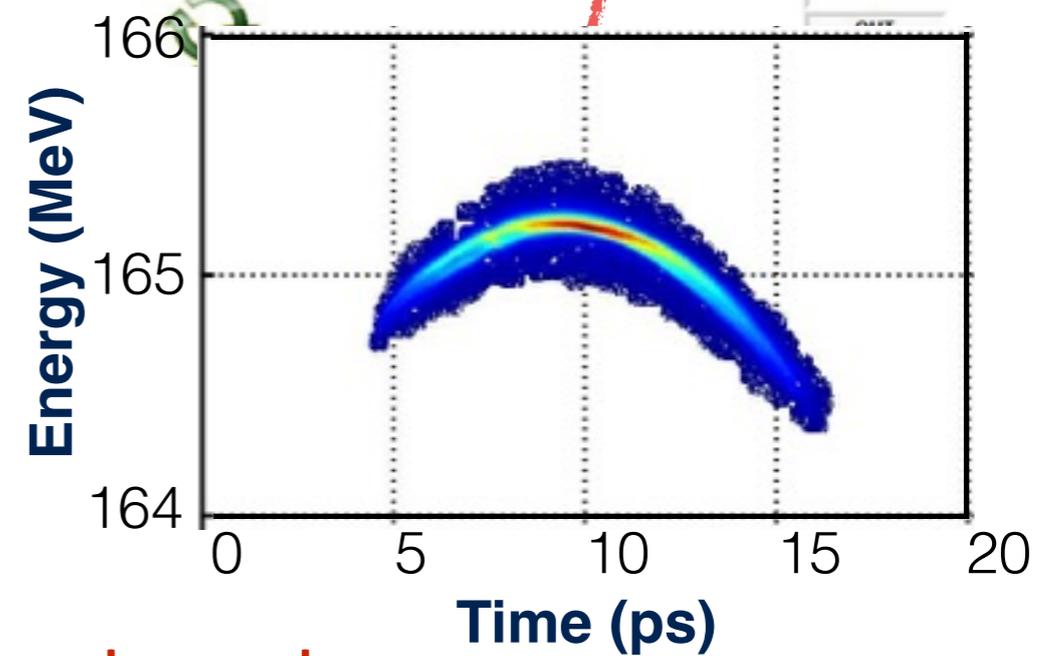
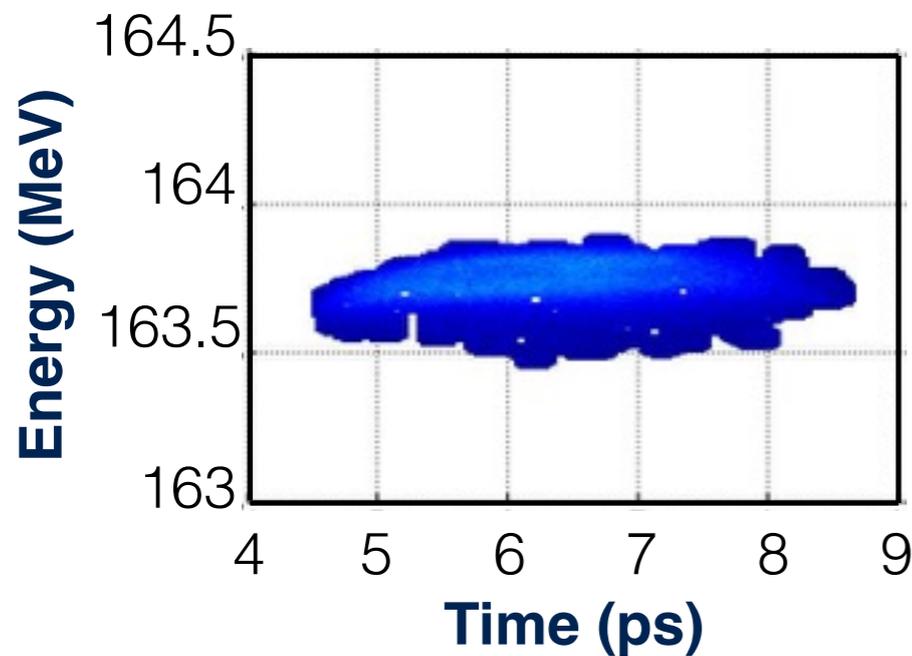
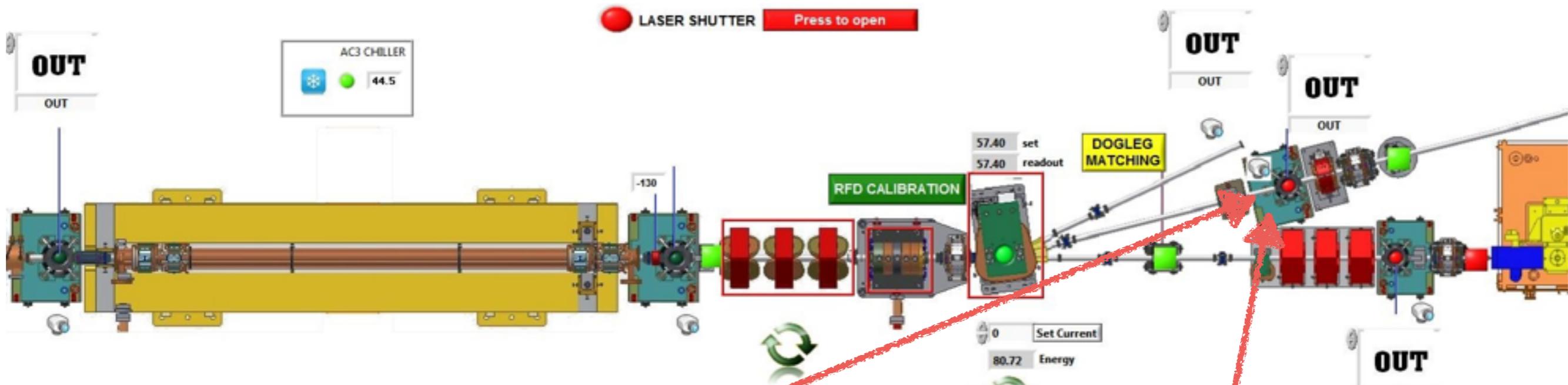
One traveling wave C-band accelerating section, 1.4 m long, operating at 5.712 GHz

Accelerating field up to ~ 35 MV/m

Preparatory Measurements

Linac Area

SPARC LAB



Sub-ps laser pulse

=> The electron beam does not experience RF non-linearities: **linear longitudinal phase space**

few ps laser pulse

=> The electron beam experiences RF non-linearities: **C-shape longitudinal phase space**

Preparatory Measurements

SPARC LAB

The image shows a screenshot of the SPARC control room software. The main window is titled 'SPARC_2.2.vi' and displays a grid of control buttons numbered 1301 to 1334. A smaller window titled 'MeasurementsPanel4.2.vi' is overlaid on the main interface. This window, labeled 'MEASUREMENTS PANEL 4.2', features a blue background and a grid of buttons for various measurements. The buttons are: THERMAL EMITTANCE, SOLENOID SCAN (debug), PROJECTED EMITTANCE, BEAM MATCHING, GUN ENERGY (highlighted in green), ENERGY & LPS, COMB DISTANCE, BUNCH LENGTH, SLICE EMITTANCE, COMB EMITTANCE X, SLICE EMITTANCE SETUP, ENVELOPE EMITTANCE, and COMPARE EMITTANCE. The interface also shows a 'SPARC time' of 2018-06-19 12:49:24 and a 'disabilitato spegnimento automatico' status.

...and much more
in the SPARC
control room!!

enrica.chiadroni@lnf.infn.it

Acknowledgment

- ❖ **Marco Bellaveglia**, *Main actor*
- ❖ **Donato Pellegrini**, *Camera operator*
- ❖ **Luca Piersanti**, *Supporting Actor*
- ❖ **Fabio Villa**, *Main Actor*

That's (almost) all Folks!

Grazie per la cooperazione!