Istituto Nazionale di Fisica Nucleare

# FRIDA

*FLASH Radiotherapy with hIgh Dose-rate particle beAms*

*National: Dr A Sarti (Roma 1)*
*Local: Dr G Petringa*

# FRIDA main goals



## WP1: FLASH effects understanding
G Forte (CNR-IBFM and LNS), E Scifoni (TIFPA)

Understanding the phenomena at chemical and biological level

## WP2: FLASH beam delivery
GAP Cirrone (LNS), A Mostacci (RM1)

Implementing new solution to generate flash beam with conventional and laser-driven approaches

## WP3: FLASH beam monitoring and dosimetry
G Bisogni (INFN-PI), A Vignati (INFN-TO)

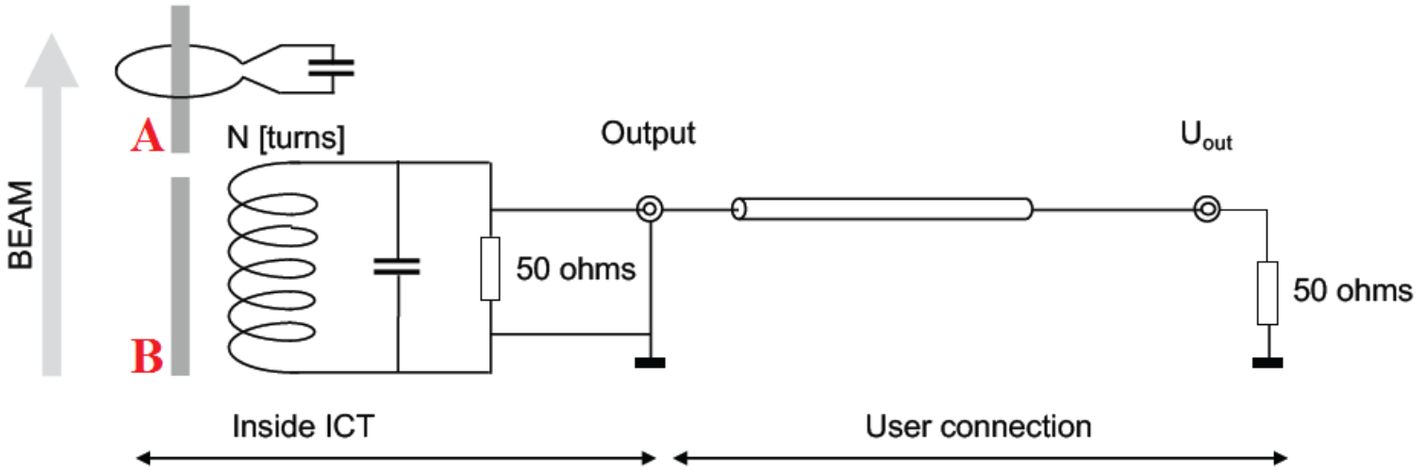
Developing new approaches for the absolute dosimetry and the monitoring of these new beams

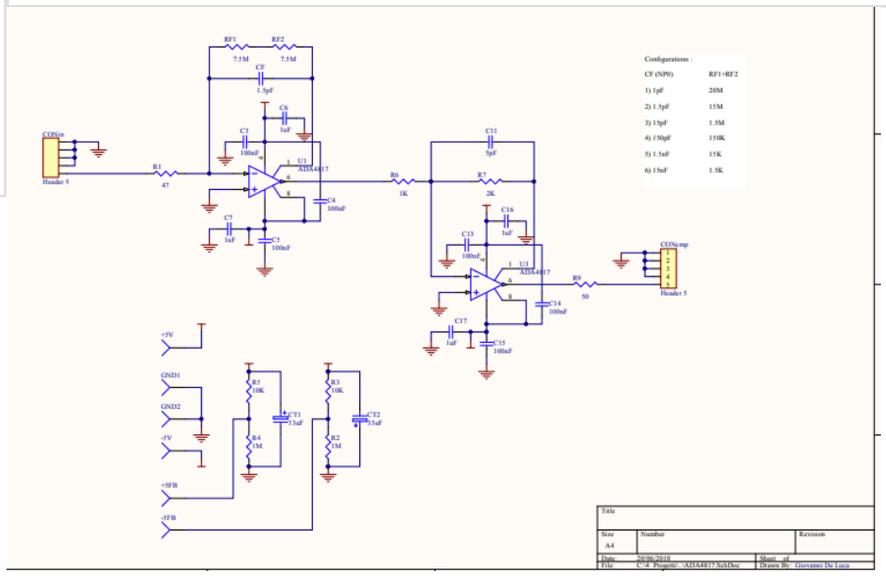
## WP4: FLASH Treatment planning
A Schiavi (RM1), M Schwarz (TIFPA)

Implementing solutions for the FLASH-oriented treatment planning

# WP3 and WP2





**1fs ≤ Tw ≤ 70 ns**
**Sensitivity: 5 Vs/C**
**N. of turns: 5**
**Electr. noise: 0,55 $pC_{rms}$**

**The electronical readout will already realized @LNS-INFN**

**Fast Charge Amplifier**
**High Speed Peak Detector**

**Coil targets were realized and will be tested @ TARANIS (Queen's University) => December 2023**

# WP2 - RF accelerator: Obiettivi Generali

## WP2: Erogazione del fascio FLASH

**<u>Compito - Compressore di impulso RF SLED per VHEE LINAC in banda C</u>**

1. Progettazione di un compressore di impulso.
2. Realizzazione e “cold” test (low-power, no-beam) di un prototipo.

1. <u>Increasing the **Available Peak Power *P***</u>

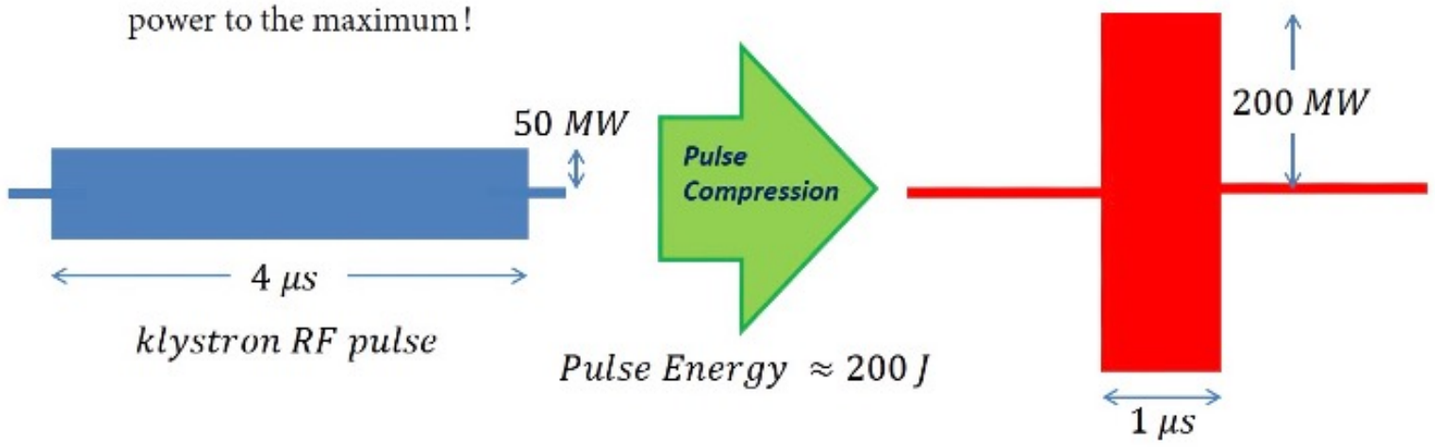
2. High Accelerating Gradients ***E*** require very high RF power **(*E* ∝ $\sqrt{P}$)**

3. RF peak power available from klystrons is typically limited

4. Duration of the **klystron RF pulsed (≈ few µs)** largely exceeds the typical filling time of **an accelerating structures (< 1 µs)**

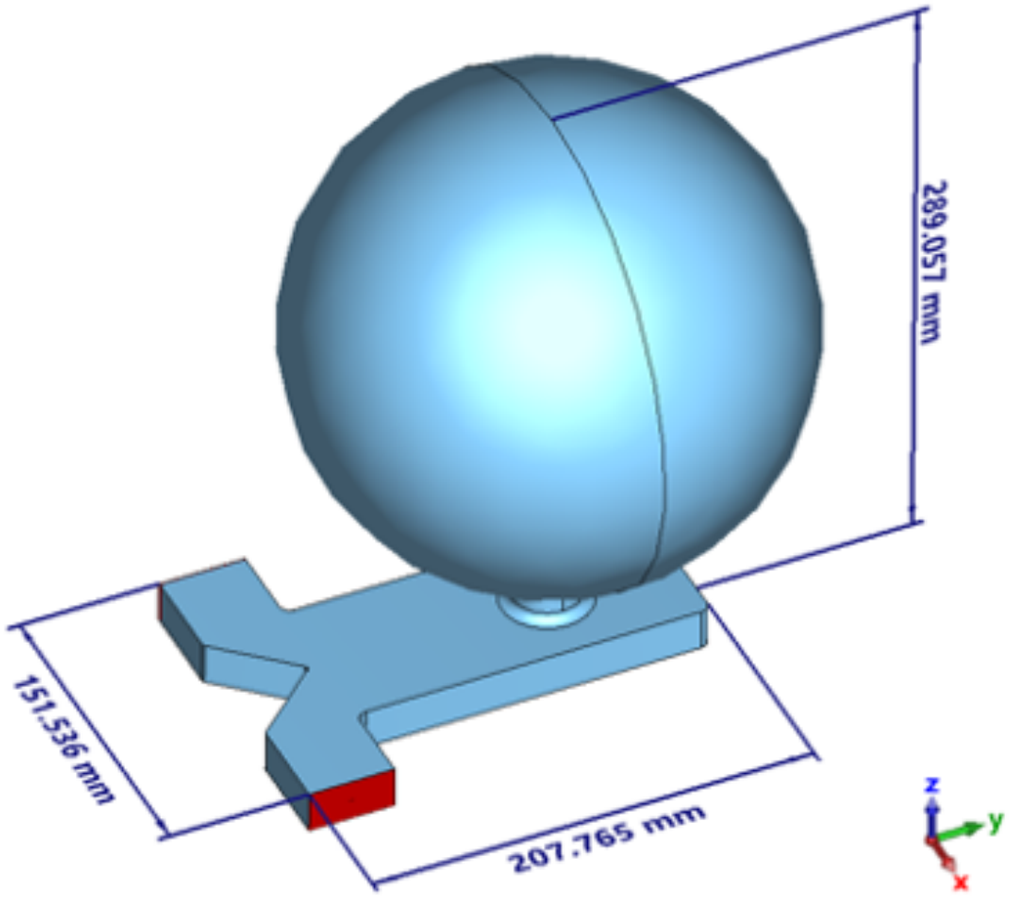
### The Idea: SLED (Stanford Linac Energy Doubler)

- Let’s compress the energy of the RF pulse in about 1 filling time to increase the peak power to the maximum!



# WP2 - RF accelerator: Attività 2023

## Selection of the spherical pulse compressor



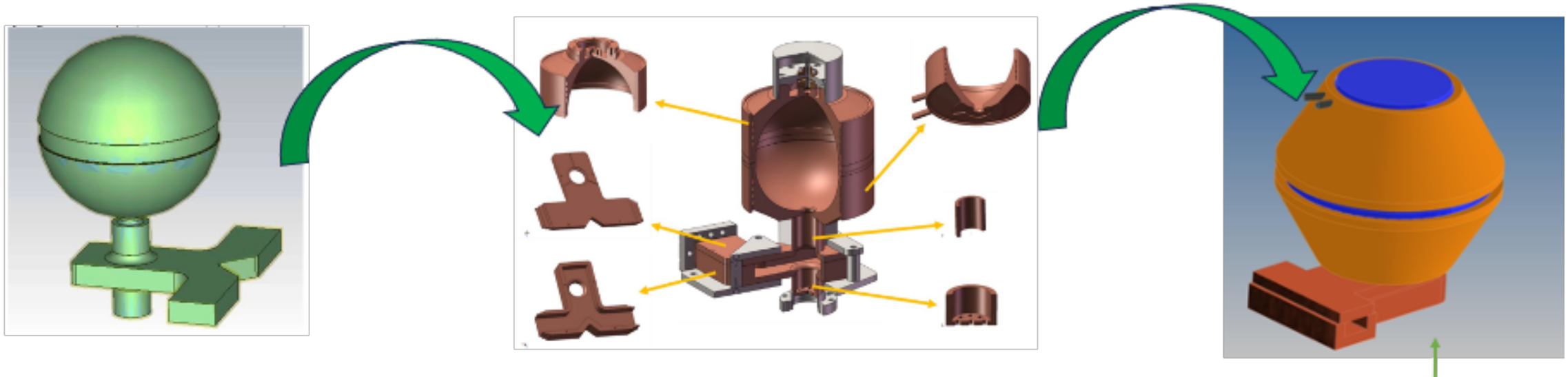

ADVANTAGES:

- **Compactness**
- **ease of fabrication**
- the frequency of the two modes varied by the same number when the temperature fluctuated during operation, which can make the **output power of the pulse compressor stable**
- **simple cooling system**

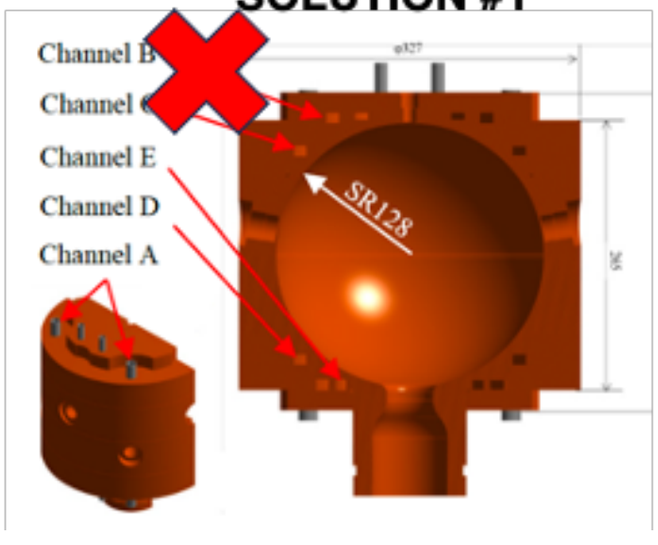
We hence selected the **spherical pulse compressor**

# WP2 - RF accelerator: Attività 2023/2024

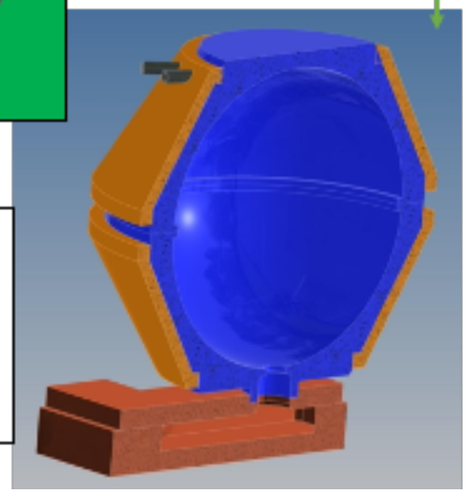
- **MANUFACTURING OF THE PULSE COMPRESSOR PROTOTYPE (M28)**



**SOLUTION #1**




**SOLUTION #2**



***Courtesy of S. Passarello***

- Efficient cooling
- avoid welding/brazing in the water cooling system
- Ease of dis/assembling

**D2.2.3 RF COMPRESSOR TEST: Low power RF test of the SLED prototype (M36)**

# Attività 2023

| Milestone | | % di completamento |
|---|---|---|
| D.2.2.2 | Manufacturing of the pulse compressor “cold”prototype ~~(M24)~~ => M28 | |
| M2.2.2.2 | Time domain simulation complete ~~(M16)~~ => M18 | 100% |
| M2.2.2.1 | Definition of the required fabrication tolerances ~~(M18)~~ => M29 | 100% |
| M2.2.2.2 | Starting of the tender procedure ~~(M20)~~ => M25 | |
| M2.3.1.2 | Acquisition of the new developed targets from RAL Laboratory (M15) | 100% |
| M2.4.2 | Modelling of the dosimetric set-up with MC simulations | 50% |

| | | |
|---|---|---|
| Assegnazioni | SLED RF pulse compressor prototype (WP2) | il finanziamento di 30 keuro è rinviato al 2024 in accordo con i proponenti |

# Richieste 2024

consumo
40k€ prototype
12k€ coil target + mechanics

**FTE 2024?????**

| | |
|---|---|
| Giorgio S. Mauro | 5% |
| Gino Sorbello | 10% |
| Giuseppe Torrisi | 5% |

missioni
3k€ misure a LNF, BO
5k€ misure alla Queen’s university
3k€ misure a INO-CNR
6k€ misure di radiobiologia a TIFPA

trasporto
3k€ misure sperimentali a INO-CNR
3k€ misure sperimentali alla Queen’s University