

Dipartimento di Scienze di Base e Applicate per l'Ingegneria

mərgəritə



The margarita detector

A. Sarti on behalf of many many people



FOOT ToF measurements (I)

- Resolution on mass number A heavily depends on TOF resolution.
 - From the CDR: "the variation on σ_A as a function of TOF is the steepest one, worsening by about 70% when moving the TOF resolution from 80 to 150 ps."
 - It is mandatory to keep the TOF resolution at the level needed to achieve the desired A resolution
 - Crucial for high A fragments!





FOOT ToF measurements (II)

- TOF will be measured by
 - The SC detector
 (Margarita in the following)
 - The TOF detector
 (providing the 'stop' for the TOF measurement)
- The SC detector aims for a time resolution below 100 ps for the incoming beam particles (C, O ions)





The ancestor: Margherita

Used in FIRST

- 250 μm thick plastic scintillator (EJ 228) disc with 46 mm radius.
- light collected by means of 360 optical fibers (1 mm diameter), radially glued in four bundles and then connected to four fast Hamamatsu UBA HlO721-201 photomultipliers (40% QE).
- Layout optimised to maximise the light collection, minimising the out of target fragmentation probability
- → Proton test @ Trento: encouraging results (expected <100 ps reso for $^{12}C \text{ and } ^{16}O)$



0.2

250

500 ber

FOOT: Margarita



- → Same operational principle as in FIRST:
 - Thin detector (to be optimised using MC studies/TB results)
 - Fast (largest light output possibile)
- ➡ Active mean:
 - EJ-204
 - 700 ps rise time
 - − Thick: 250 μm ↔1 mm
 - 10 000 ph/MeV



3 mm sandwich:

1 layer 250 μm ↔ 1 mm scintillator
2 layers of 3D printed clear (transparent) photopolymer



Margarita mechanics





Margarita readout



 $(3x3 mm^2 active area)$



INFN Roma1 (LABE) board that holds the SiPMs 8 boards in total (2x side)





6 SiPMs are held together (per board). **3.6 cm / 5 cm are instrumented for each side**

The powering and readout of the SiPMs is performed through the Wavedream board



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→ Mechanics:

- The box is being designed (2 weeks needed). Once the design will be ready, 2 more weeks for completion. We need to finalise the full IR geometry (height wrt beam) before completion
- Scintillator is already available: will start ASAP the tests with the 250 μm thick detector to see if a thickness increase is needed.
- SiPMs are already there.
- LABE board: order is being placed + 1 month
- ➡ For a test beam
 - Wavedream boards will be needed for powering/readout (cables are already available!)

Preliminary tests are being considered for September.

