



# Status of existing detectors

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Thank to C. Weiss, C. Guerrero, E. Berthoumieux  
for their help in finding and identifying the detectors!

# Outline

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- **Introduction**
- **Detectors needed for the first measurements in 2014:**
  - $^{70,72,73,74,76}\text{Ge}$  (INTC-P-381)
  - $^{242}\text{Pu}$  (INTC-P-387)
  - $^{233}\text{U}$  (INTC-P-397)
- **Detectors available at CERN:**
  - TAC
  - C6D6
  - MicroMegas
  - SiMon
  - FIC
- **Summary & next steps**

# Introduction

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- Starting from July, n\_TOF operations will take place concurrently in two experimental areas:
  - **ready availability of detectors, samples and instrumentation is fundamental!**
- In order to reach this goal, few **milestones**:
  - **identify the needs** of the approved measurements,
  - **make an inventory** of material present at CERN,
  - **verify the working conditions** of the equipment at CERN (and learn how to operate it),
  - **support the integration of new devices.**

# Introduction

- **General reorganization** of the areas and the material:
  - **Old Control Room** --> detectors, samples and mechanical supports;
  - **Electronics Laboratory** --> MicroMegas, chemicals and electronics;
  - **“Grillage”** --> cables, packaging material, vacuum chambers.
- Chemicals, mechanical supports and samples inventory in December.
- **Status of detector inventory is given in this presentation.**



Measurements approved for 2014

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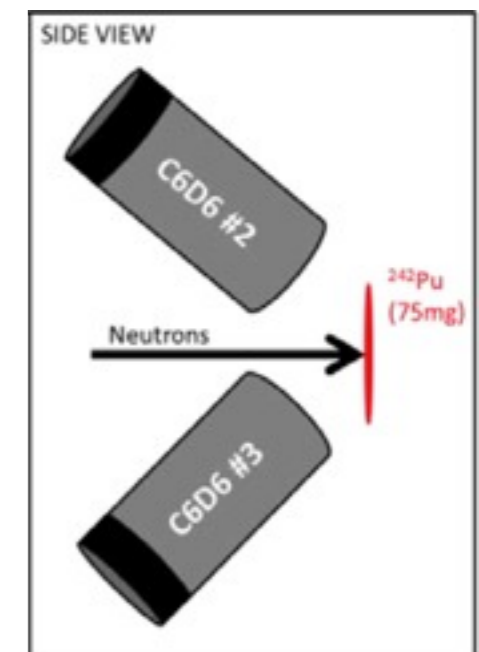
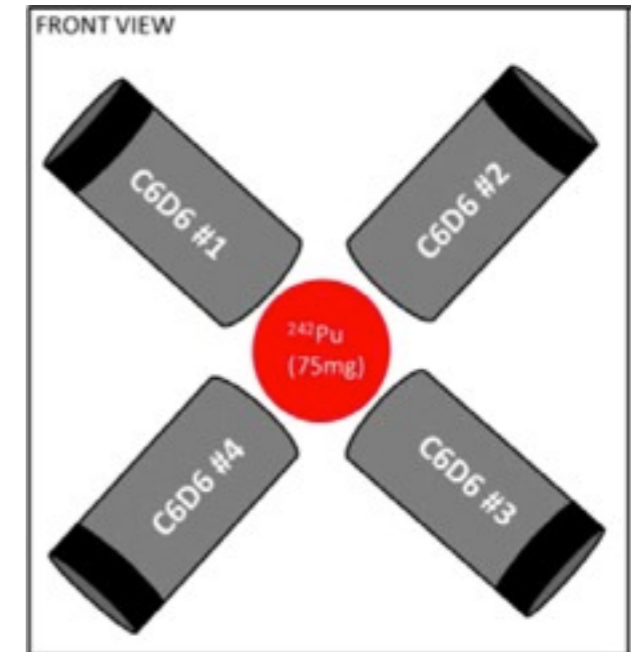
# Measurements in 2014: $^{70,72,73,74,76}\text{Ge}$ (INTC-P-381)

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- Neutron capture cross section of  $^{70,72,73,74,76}\text{Ge}$  at n\_TOF EAR-1.
- Needed detectors:
  - **2 C6D6** detectors.
- Needed samples:
  - **GeO<sub>2</sub> pellets** enriched in  $^{70,72,73,74,76}\text{Ge}$  (2g, 2 cm diameter),
  - **Au sample** (2 cm diameter) for normalization,
  - **<sup>nat</sup>Ge sample** for pellet density estimation,
  - **C sample** for n scattering background.

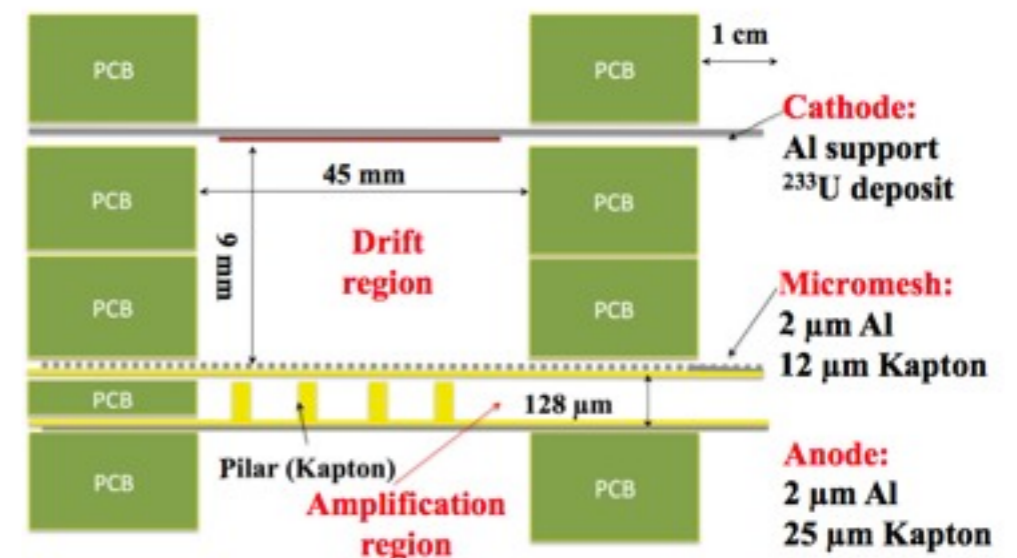
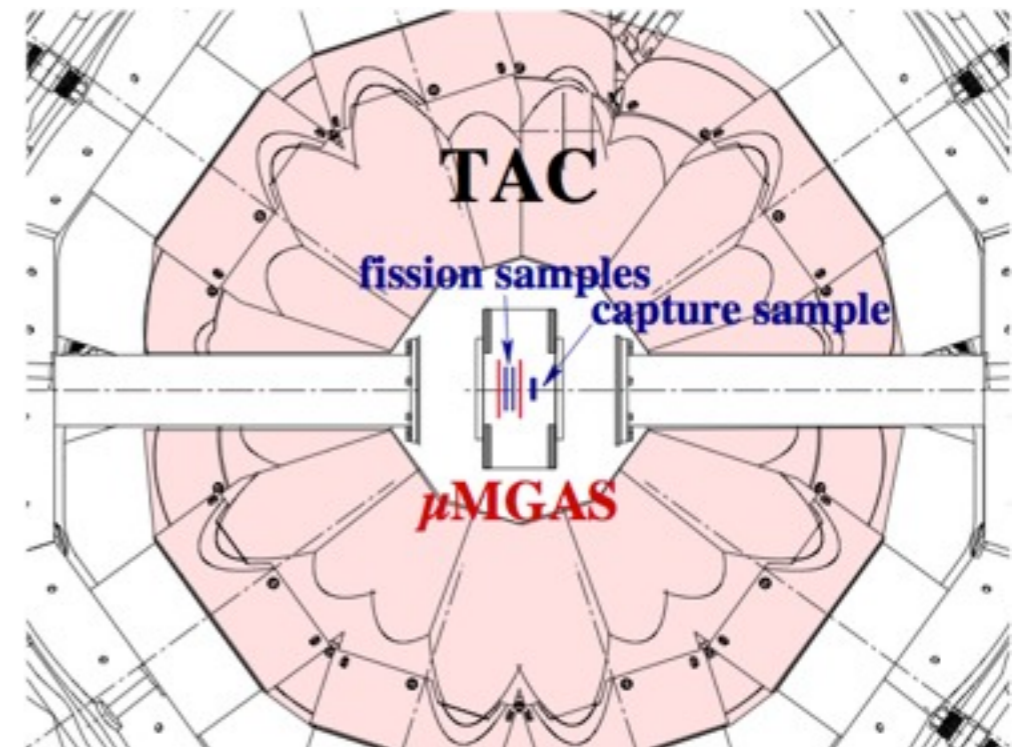
# Measurements in 2014: $^{242}\text{Pu}$ (INTC-P-387)

- Radiative capture on  $^{242}\text{Pu}$  for MOX fuel reactors.
- Possible detectors:
  - **4 C6D6** detectors (preferred option at present),
  - **TAC** (if gated PMTs reduce  $\gamma$ -flash recovery time).
- Needed samples:
  - **$^{242}\text{PuO}_2$  samples** (in collaboration with nELBE and the University of Mainz):
    - 75 mg, 76 mm diameter (under preparation),
    - 100 mg, 40 mm diameter.
  - **$^{197}\text{Au}$  sample** (1 g, 45 mm diameter) for normalization.
  - **C, Pb, empty samples** for background.



# Measurements in 2014: $^{233}\text{U}$ (INTC-P-397)

- Measurement of neutron induced capture and fission reactions on  $^{233}\text{U}$  (EAR1).
- Needed detectors & samples:
  - **TAC** (possibly with gated photomultipliers),
  - **2 MicroMegas** (4.5 cm diameter active area, Al electrodes,  $^{233}\text{U}$  loaded),
  - **$^{233}\text{U}$  capture sample:**
    - now at ILL Grenoble, could be prepared at PSI,
  - **C, Au, empty (canning) samples.**





# Detectors needs in 2014

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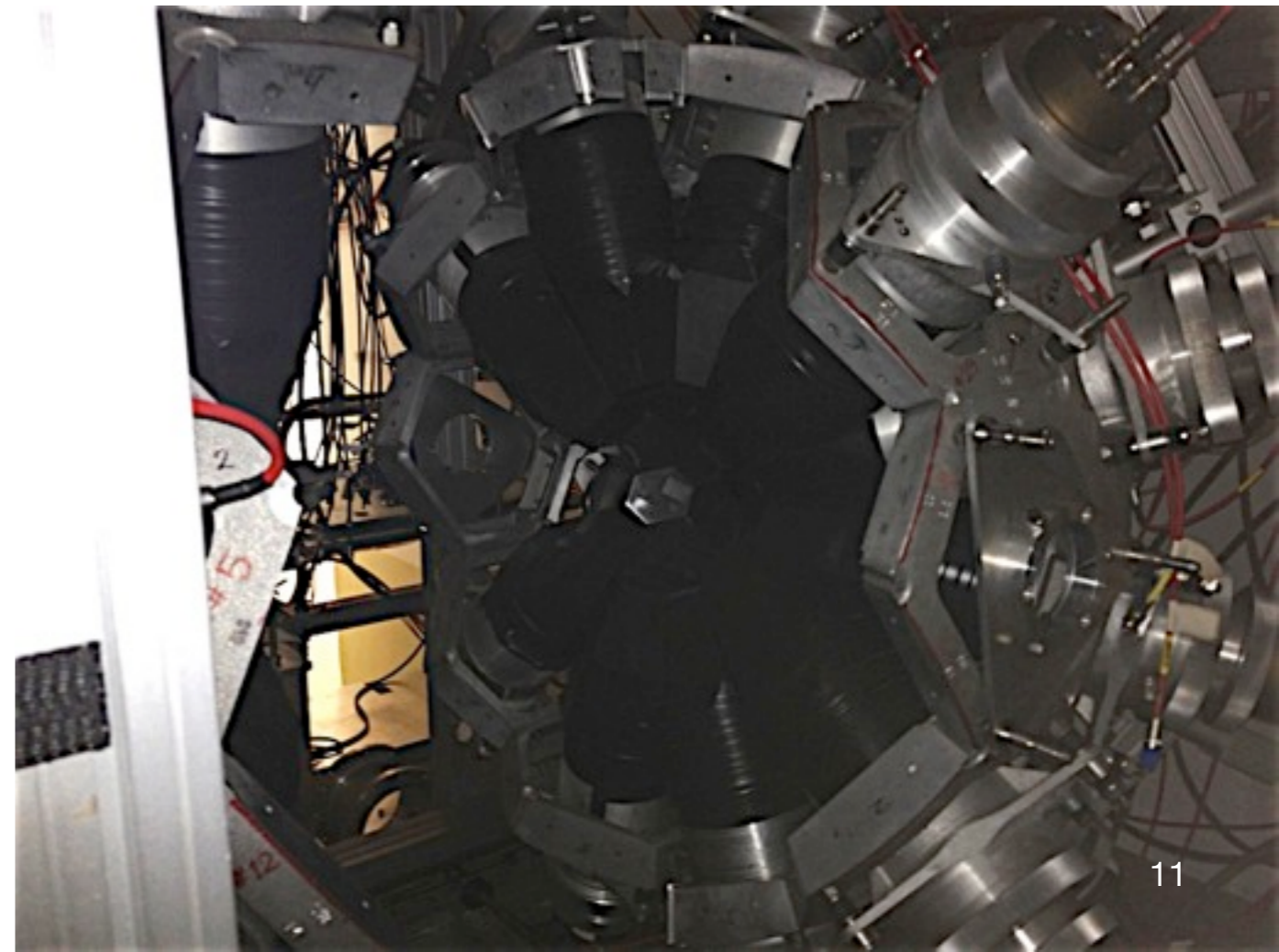
- Measurement proposals in 2014:
  - **4 C6D6** detectors:
    - 4 “different” detectors at CERN,
    - mechanical supports missing.
  - **TAC** (possibly with gated PMTs):
    - spares: 2 crystals and 1 PMT,
    - tests for gated PMTs ongoing.
  - **2 MicroMegas** (4.5 cm, Aluminum):
    - detectors under construction,
    - fission chamber should be at CERN (not found until now!).
- Neutron flux monitor:
  - **SiMon** or **MicroMegas**.
- **Re-commissioning of EAR1**:
  - other detectors needed?
- **Commissioning of EAR2** will be concurrent to these measurements:
  - detectors needed?
  - any common detector with EAR1 measurements?

# Detectors at CERN

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# Detectors at CERN: TAC

- **Full detector components:**
  - 40 BaF<sub>2</sub> crystals (12 “pentagons”, 28 “hexagons”),
  - 40 PMTs,
  - mechanical “honeycomb” supports.
- **Spares:**
  - **2 crystals** (1 per type),
  - **1 PMT** (with VD),
  - few “honeycomb” cells,
  - shielding material.
- Should **optical coupling** be improved?
- Tests for **gated PMTs** ongoing (CERN EN/STI-ECE).



# Detectors at CERN: C6D6

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# K6D6 (FZK)

- Homemade detector produced in FZK:
  - **2 detectors at CERN:**
    - 1 is leaking, 1 is not working (the same?)
    - only 1 Voltage Divider (?).
- Spares:
  - **2 PMTs** (no VD?),
  - few bottles of liquid  $C_6D_6$  (inventory in December),
  - 2 broken PMTs.



# L6D6 (LNL)

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- Homemade detector produced in LNL:
  - **1 detector at CERN,**
  - **1 detector in Gelina** for testing,
  - **4 detectors in preparation in LNL.**
- Leakage test (dummy detector) at CERN:
  - clear leakage, under investigation.



# C6D6 (CEA - Bicron)

- Commercial detectors from Bicron, provided by CEA:
  - **2 detectors at CERN,**
  - **2 detectors in Saclay.**



- **2 carbon-fiber mechanical supports:**
  - compatible with C6D6 and K6D6.
- **Sample exchangers:**
  - 1 “in air” sample exchanger,
  - 2 “in vacuum” sample exchanger
    - 1 broken sample holder!



# Detectors at CERN: C6D6

	<b>N. of detectors at CERN</b>	<b>N. of detectors not at CERN</b>	Notes
K6D6 (Custom made in FZK)	1 + 1 broken and leaking	0	2 spare PMT Only 1 voltage divider (in TOTAL)
L6D6 (Custom made in LNL)	1	4 (Legnaro) 1 (Geel)	No compatible mechanical supports
C6D6 (CEA - Bicron)	2	2 (Saclay)	
<b>Total working detectors</b>	<b>4</b>	<b>7</b>	

- 11 working detectors expected in 2014.
- Missing mechanical supports for L6D6 and for 4 detector setup.
- 2 sample exchangers available (only 1 routinely used).
- Some liquid C<sub>6</sub>D<sub>6</sub> available at CERN.

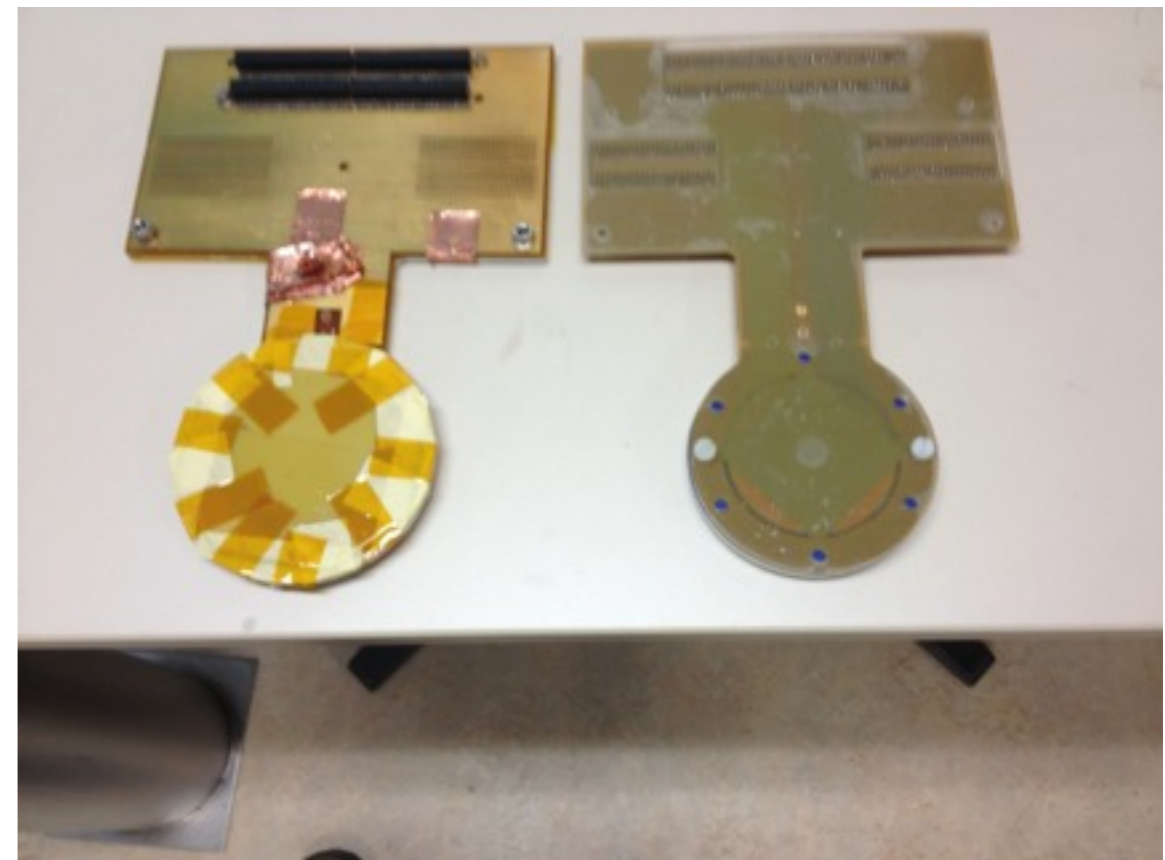


# Detectors at CERN: MicroMegas

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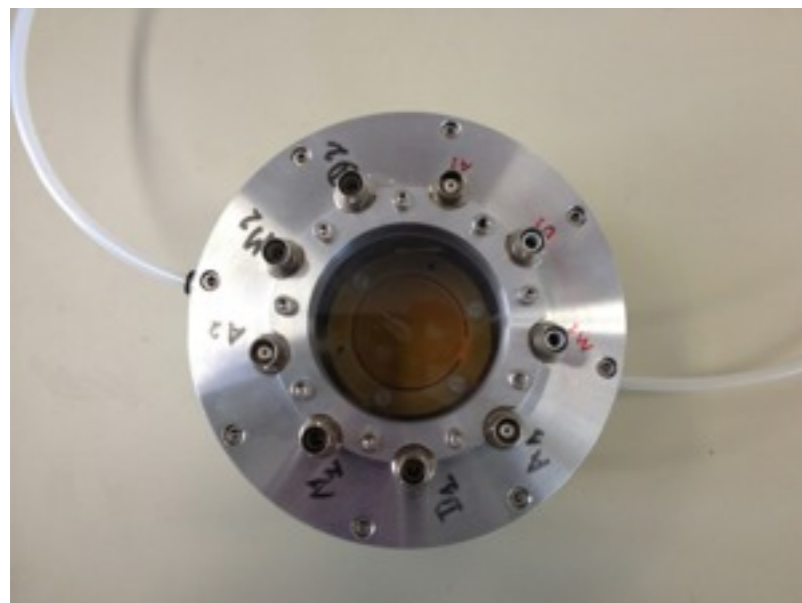
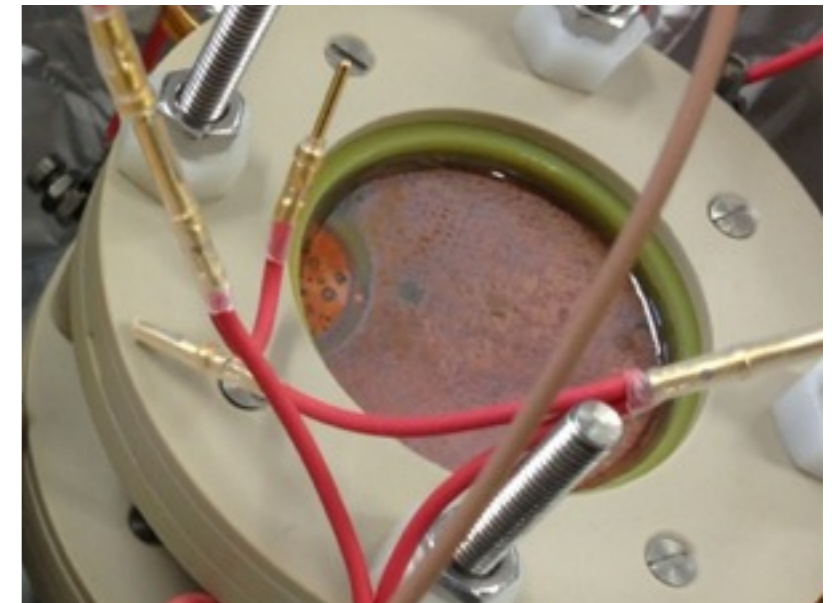
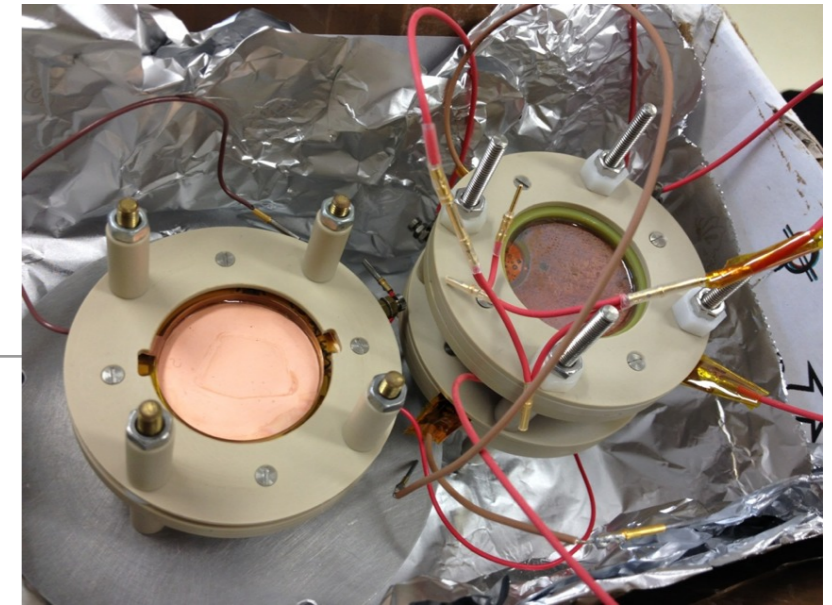
# 2D MicroMegas (6 cm)

- Beam profile monitoring.
- **Pixel MicroMegas:**
  - assembled with chamber,
  - electronics included.
- **Strip MicroMegas:**
  - 2 “microbulks”:
    - both damaged (flatness??),
  - 1 cathode,
  - chamber and electronics shared with Pixel.
- **New strip MicroMegas** in construction at CEA (with electronics and chamber).



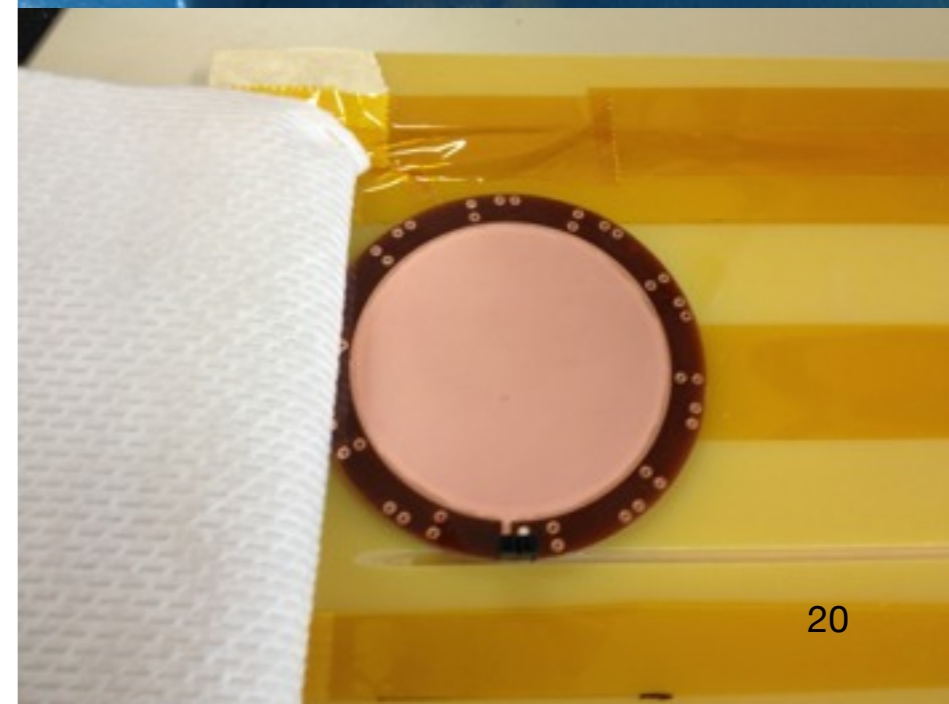
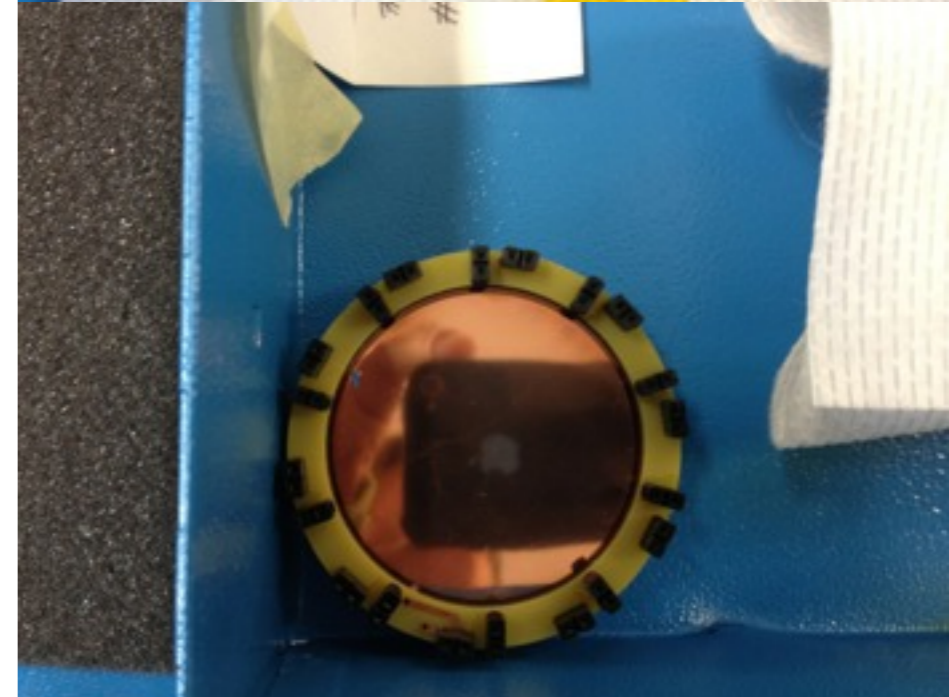
# Small MicroMegas (3 cm)

- **1+2 assembled detectors:**
  - fission tagging in 2010,
  - clearly damaged,
  - vacuum chamber for cables available,
  - chamber?
- **1 assembled detector** (with chamber):
  - flux measurement in 2009.
- **Spares:**
  - 2 microbulks,
  - several samples and cathodes.



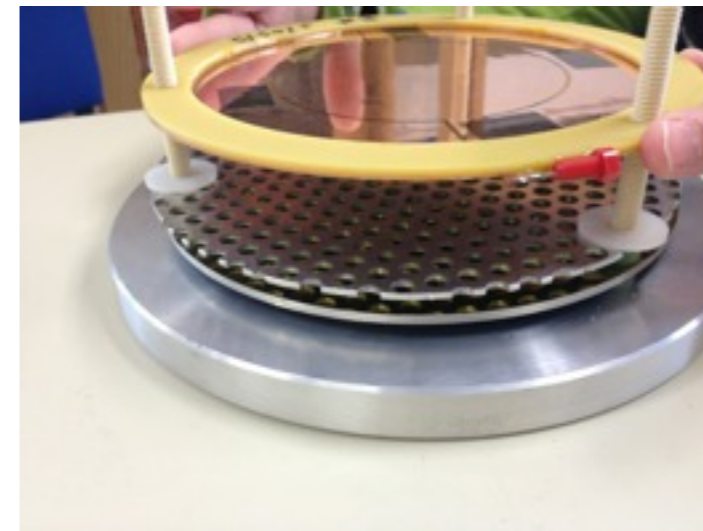
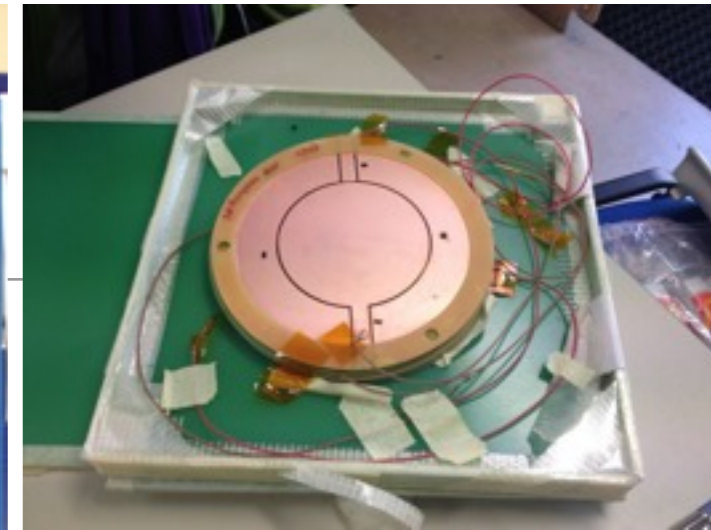
# FTMG (4.5 cm)

- Fission tagging in 2012.
- **Long detector assembly:**
  - 4 cathodes,
  - 7 microbulks.
- **Short detector assembly:**
  - 1 cathode,
  - 1 microbulk.
- **Spares:**
  - 1 microbulk.
- **Missing parts:**
  - 2 detectors with chamber,
  - 1 spare microbulk.



# Big Micromegas (10 cm)

- Flux monitors:
  - 3 + 1 + 3 microbulks;**
  - 1 + 2 + 1 cathodes:
    - 2 very thin and deformed,
    - 1 with boron (peeling off);
  - “small” chamber.**
- 4 detectors used for  $^{240}\text{Pu}$**  in the MicroMegas lab at CERN (damaged by  $\alpha$  particles?).
- Few detectors in Sevilla (with “big” chamber and preamplifier box).
- 2 detectors in Athens (with preamplifier box).



# Detectors at CERN: MicroMegas

	<b>N. of detectors at CERN</b>	<b>N. of detectors not at CERN</b>	Notes
2D - 6 cm (beam profile monitor)	1 pixel detector 2 strip "microbulks"	1 (Saclay)	1 electronics and 1 chamber (shared) strip "microbulk" are damaged
Small - 3 cm (beam monitor in 2009, fission tagging in 2010)	1 + 2 + 1 detectors 2 microbulks several cathodes	0	3 detectors are damaged beam monitor with chamber fission chamber is missing
FTMG - 4.5 cm (fission tagging in 2012)	7 + 1 detectors 1 microbulk	0	1 missing microbulk 2 detectors with chamber are missing
Big - 10 cm (beam monitor, $^{240}\text{Pu}$ fission)	7 microbulks 4 cathodes 4 detectors	3 (?) (Sevilla) 2 (Athen)	1 chamber at CERN 1 preamp box + 1 chamber in Sevilla 1 preamp box in Athens 4 damaged detectors ( $^{240}\text{Pu}$ ) 3 cathodes deformed or damaged
Aluminum MicroMegas	1 cathode	1 (Lodz)	prototype (with chamber)

# Detectors at CERN: SiMon

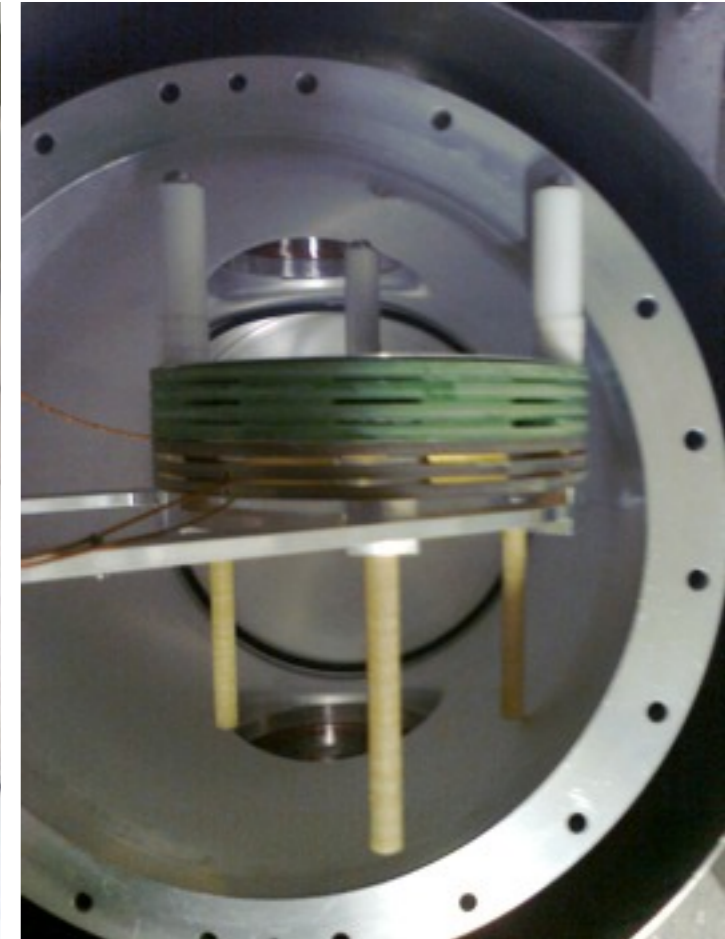
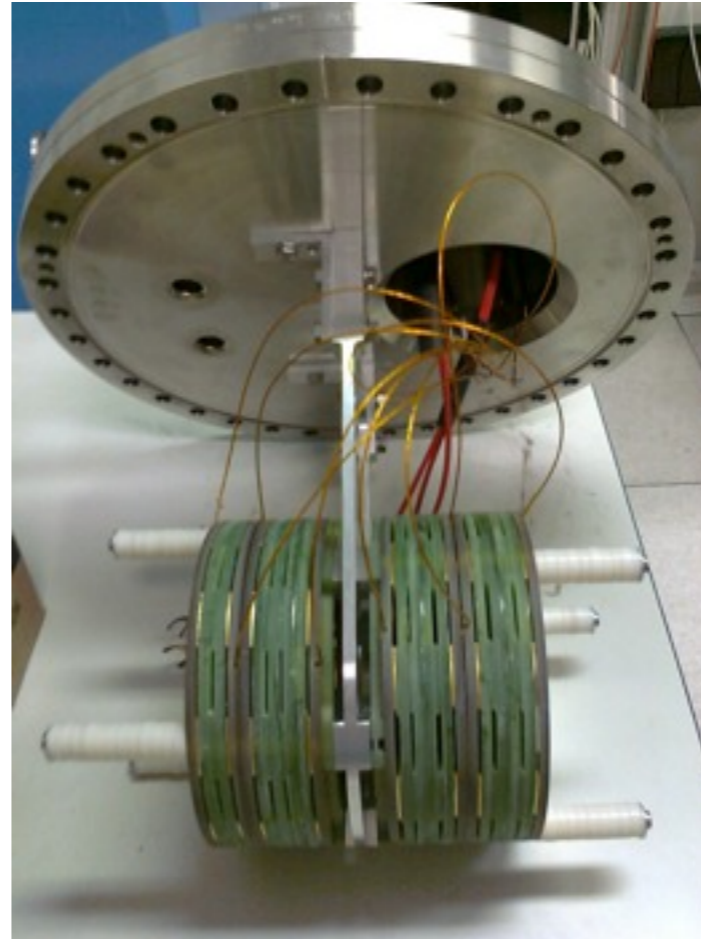
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- **Full detector components:**
  - mylar foil with  $^6\text{Li}$  deposit (coated with C),
  - 4 silicon detectors,
  - preamplifiers
  - carbon-fiber vacuum chamber.
- Ongoing activity (INFN Bari):
  - **silicon detectors tested** with a source:
    - signal is good for all detectors (**no replacement needed**),
    - 2 detectors have a higher leakage current (after 9 years of operations!);
  - **preamplifiers shielding:**
    - not easy to improve current hardware,
    - **same preamplifiers as MicroMegas could be used** (tests on feedback resistor ongoing);
  - **the foil with  $^6\text{Li}$  deposit should be replaced.**



# Detectors at CERN: FIC

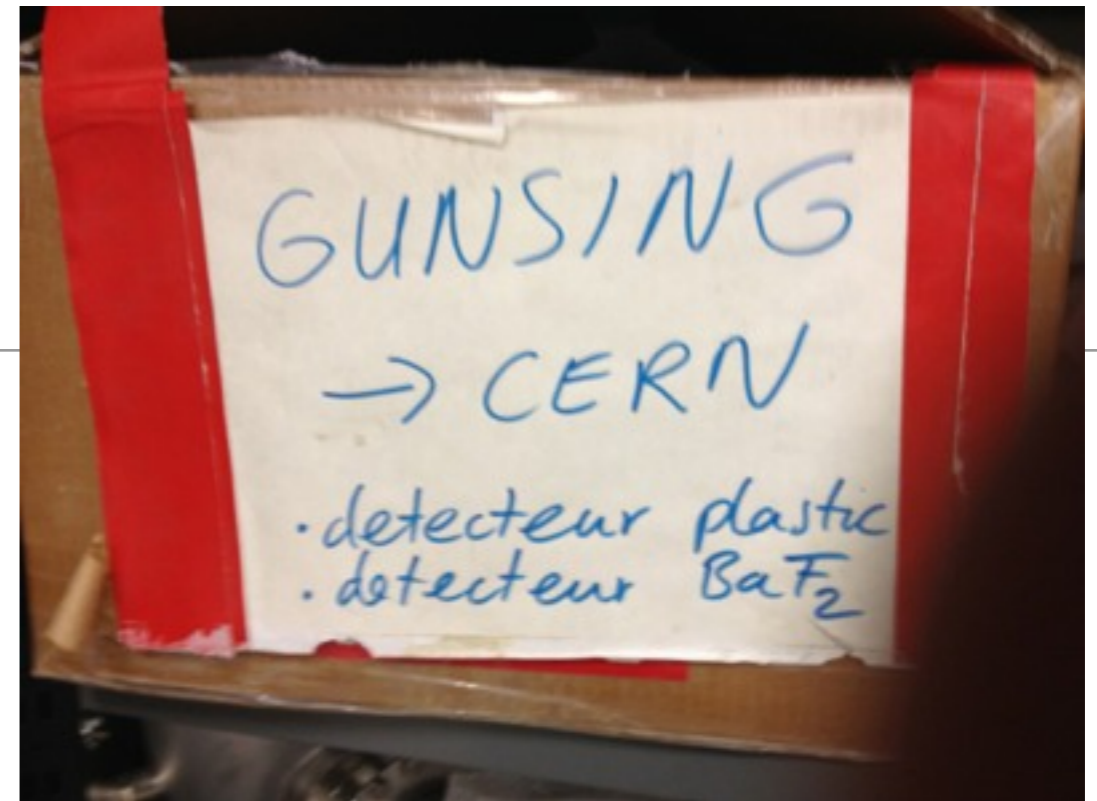
- **Fast Ionization Chambers** (sealed):
  - **FIC0** used for highly radioactive samples:
    - **vacuum chamber and detector in the Old Control Room** (long assembly)
  - FIC1 used for highly radioactive samples:
    - the detector is in a controlled storage (contaminated).
  - **FIC2** used as flux monitor:
    - **vacuum chamber still in the beam line,**
    - **chamber for gas and detector in the Old Control Room** (short assembly).





# Other detectors at CERN

- Other detectors stored in the Old Control Room:
  - Several small plastic scintillators.
  - BaF<sub>2</sub> scintillator.
  - Plastic scintillator.
  - 2 unidentified detectors.
- Several detector supports stored in the Old Control Room or in front of EAR1.
- Few electronic modules stored in the Old Control Room.



# Summary

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- An **initial inventory of the detectors** available at CERN has been presented:
  - **TAC, 4 C6D6 detectors** (capture measurements)
  - **MicroMegas, FIC** (fission measurements)
  - **Silicon Monitor, MicroMegas** (beam monitor)
- More detectors of the same type are being build (or tested):
  - **2+1+4 C6D6 detectors,**
  - **Different types of MicroMegas.**
- A review of the **needs for the approved measurement** has started :
  - **4 C6D6 detectors,**
  - **TAC,**
  - **Aluminum MicroMegas,**
  - **Other detectors for commissioning and beam monitoring?**

# Next steps

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- **Conclude the inventory** and the reorganization of the material at CERN:
  - possibly before Christmas break.
- **Finalize the review of the measurements** approved for 2014:
  - possibly before Christmas break.
- **Verify the working conditions** of the detectors at CERN and learn their operation:
  - possibly before the next technical meeting,
  - is it possible to **arrange working meetings with the detector experts** in 2014?

**Thank you for you attention!**