Origins of the project : MYRRAH (Multi purpose Hybrid Research reactor for High tech Applications) 600 MeV, a sub-critical nuclear reactor controlled by a LINAC [1]

- G : Avoid thermal stress in the reactor. Additional time to restart the reactor could need 3 days.
- MYRRAH goal for the limit of acceptable stops (93 s) of 40 trip/year.
- Transmutation of the Long-life isotopes in nuclear waste and producing Electricity with it.
- Radioisotope production for medical purpose in Europe.

Phase 1 [MINERVA] [2], 100 MeV-proton MYRRAH demonstrator to evaluate its reliability:
- Beam : \( E_{max} = 4 \) MeV, \( E_{100} \) MeV, \( \Phi_{acc} = 178 \) MHz (bunch repetition)
- Concern : of the Gaussian bunches induced diagnostics

\[ E_{p}(y) = \left( \frac{1}{4\pi \varepsilon_{0}} \right) \sum_{i} \left( \frac{1}{\sigma_{x}} \right) \exp \left( \frac{-2}{\sigma_{x}^{2}} \right) \left( \frac{1}{\sigma_{y}} \right) \exp \left( \frac{-2}{\sigma_{y}^{2}} \right) \left( \frac{1}{\sigma_{z}} \right) \exp \left( \frac{-2}{\sigma_{z}^{2}} \right) \]

\( I_{f} \) represents the contribution of the E-Field particles inside a Gaussian beam \( (\sigma_{x}, \sigma_{y}, \sigma_{z}, \sigma_{0}) \) are the particles coordinates, \( (x_{0}, y_{0}, z_{0}) \) are the bunch center coordinates, \( \gamma_{L} \) is the Lorentz factor. \( L_{acc} \) is length between 2 bunches in the beam axis. \( \gamma \) is position of the bunch in the train \( (2N_{bunch}+1) \) bunches. \( N \) is the number of particles in the bunch. \( a \) is the radius of the BPM.

- Evaluates the Electric field induced by the particles beam on the electrodes surfaces at the point \( M(x,y,z) \).
- Calculates the number of induced image charges on the electrodes: \( E_{p} \cdot \sigma_{x} \cdot \sigma_{y} \cdot \sigma_{z} \)
- \( Q_{acc}(t) = E_{p} \cdot \sigma_{x} \cdot \sigma_{y} \cdot \sigma_{z} \)
- \( U(t) \times I(t) = d\Phi_{acc} \) (for the harmonic : \( h = 0 \) (acc) \( h = \sqrt{2} F_{acc} \))
- Aims to consider all beam cases and to reduce usual hypothesis [4, 5]
- Allows to realize fast parametric studies of the button type BPM.

Use the same acquisition electronics as the BPM built for the MINERVA LINAC [11, 12], for input power from -47 dBm up to +9 dBm.

- Possibility to measure the beam ellipticity.
- Further studies with BPMOK will evaluate the possibility to measure the bunch length using the ratio \( h_{1}/h_{2} \) [7].


BPMOK MODEL APPLIED FOR THE BPM OPTIMIZATION FOR THE 100 MeV HEBT FOR THE MYRRAH PROJECT

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