Recently ESTRO, the European Society for Therapeutic Radiology, presented a formalism for the calculation of monitor units (ESTRO Booklet No. 3). The report gives in a comprehensive way the equations required for the computation of monitor units, MUs, in open, wedged and blocked fields for square and rectangular beams. Starting point of the formalism is that all quantities are defined at the reference depth of 10 cm. Furthermore it is recommended to separate head and phantom scatter at this depth, both normalized to unity for a reference field of 10 cm x 10 cm. These output factors should be obtained in a mini-phantom and under full scatter conditions. The reference conditions should preferably be an isocentric set-up, generally a source-detector distance of 100 cm and a 10 cm x 10 cm field at this distance. Alternatively, or in addition, a source-skin distance of 100 cm could be used and a 10 cm x 10 cm field at the surface. It will be explained that the formalism cannot be used in combination with quantities defined at the depth of dose maximum such as (normalised) peak scatter factors.

The report gives basically four sets of equations for MU determinations, based on measurements with the mini-phantom and in a large water phantom. All separate steps are indicated by a (correction) factor in the equations whereas a large number of figures illustrates these steps. Because both isocentric and fixed SSD techniques are allowed, separate sets of equations having either tissue-phantom ratios or percentage depth doses, normalized at 10 cm depth, are presented. Wedges are taken into account by applying a single wedge factor under reference conditions. Diferent procedures are then possible to correct for the variation of the wedge factor with field size and depth. The equations for blocked beams include correction factors for the effects of shielding blocks on head and phantom scatter. Rectangular fields are taken into account by applying different procedures for head and phantom scatter variation.

Practical aspects concerning the measurement procedures, including descriptions of the phantoms, will be discussed while a number of data for various treatment machines will be provided to show the magnitude of the various physical parameters and correction factors. The booklet finally discusses a number of quality control procedures of monitor unit computation.

The current formalism is restricted to MU calculation on the central beam axis of open, wedged and blocked beams. A working group is currently involved in extending the concepts to asymmetric fields, MLC-shaped fields and beams shaped by dynamic/virtual wedges. Another working group is collecting and reviewing data to summarize existing knowledge in the application of the formalism.

Educational objectives:
1. To develop a basic understanding of the physics underlying dose calculations.
2. To understand the equations required for monitor unit calculations.
3. To familiarize with the magnitude of the various physical parameters