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Dose calculation using divergent beam model

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INTRODUCTION

At the HIMAC, to irradiate the target uniformly, the extracted beam from the accelerator is enlarged by the wobbler magnet and scatterers. The distance between the beam focus point and the isocenter is about 10m [1].

For dose calculation in our treatment planning system, we assume that heavy ion beam goes along parallel path. We evaluate the difference of the irradiation field sizes between the parallel beam and the divergent beam geometrically. We predict that the irradiation field size of the divergent beam is larger 5% than that of parallel beam at the isocenter. To irradiate the tissue near an organ at risk or to make patched irradiations, we should make a more precise treatment plan.

METHOD

Our treatment planning system is based on the "Dr.View" that is a product of Asahikasei Jyoho System Co., Ltd [2].

We use the ray-trace method [3] based on parallel beam model when we calculate dose distributions in our present treatment planning system. Then we make another dose calculation program based on divergent beam model.

RESULT and DISCUSSION

Figure.1 shows that the comparison of calculated dose profiles at the isocenter. We can find that the result of the calculated dose based on divergent beam model about wider 5% than that of parallel beam model.

So we must do several things as follows,

- including effects of scatters in the beam delivery system and in patient to the penumbra into this program,
- designing a bolus with the assumption of divergent beam,
- making experiments to verify this dose calculation program.

REFERENCE

[1] T.Kanai *et. al*, Biophysical characteristic of HIMAC clinical irradiation system for heavy-ion radiation therapy, Int. J. Radiation Biol. Phys. **Vol.44 No.1**(1999) 201-210

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[3] L.Hong *et. al*, A pencil beam algorithm for proton dose calculations, Phys. Med. Biol **41** (1996) 1305-1330

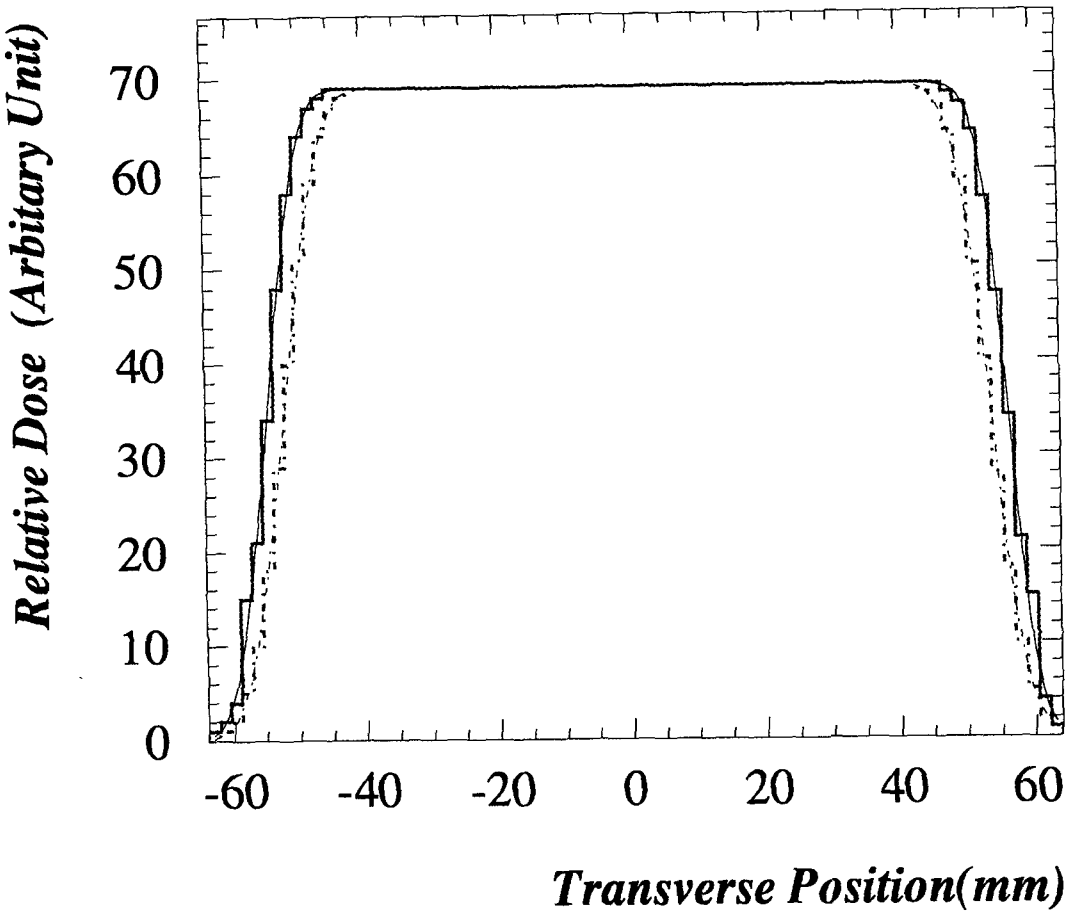

Figure 1: This figure shows the comparison of calculated dose profiles at the isocenter. We use a numerical phantom and a cubic ROI which has 10cm sides. The solid line is the result of calculation based on divergent beam model and the dashed line is the result of calculation based on parallel beam model.