Purpose
To characterize and correct for the physical and geometrical effects impairing the quality of electronic portal image devices (EPIDs).

Methods
EPID image blurring is due to: a) lateral transport of secondary electrons within the EPID, and its pixel size, b) geometric penumbra, c) scattering of photons in the patient's body. At an ARTISTE accelerator (Siemens) a) - c) were characterized via the edge-spread-function (ESF). Assuming that the line-spread function (LSF) takes the form of a Lorentz function $1/(1+x^2/\lambda^2)$, each blurring component can be characterized by parameter lambda. For blurring correction the acquired raw image I(x,y), the convolution product of the true image I0(x,y) and the two dimensional convolution kernel K(x,y), is iteratively deconvolved. The iteration algorithm consists in a sequence of approximations I0,n(x,y), each of which is numerically convolved with K(x,y), resulting in an approximation In(x,y) to the blurred image. The next approximation I0,n+1(x,y) is derived by adding to I0,n(x,y) the difference I(x,y) - In(x,y). The iteration converges towards the desired I0(x,y) and is terminated using a X^2-criterion.

Results
Geometrical penumbra and secondary electron transport plus pixel size in the EPID are the major contributors to image blurring. The lambda-values of the combined effects amount to 0.5 mm for 6 MV and 0.65 mm for 15 MV. The evaluation of a line-pairs phantom revealed that, after the deconvolution, the relative modulation transfer function (RMTF) of the system is approaching the one of an ideal detector. Clinical portal images show enhancement of contrast and sharpness, allowing for easier identification of anatomical landmarks.

Conclusions
The blurring effects of EPIDs were characterized and corrected by an iterative deconvolution algorithm. The fast algorithm accomplishes corrections in real-time, allowing routine patient positioning verification to be performed with increased accuracy.