This work focuses on Iso-C3D C-arm technology. It is expected to combine the advantages of CT based and C-arm based computer aided surgery. No preoOP hardware requirements and associated logistics are required. Inherent registration technology removes the need for intraoperative matching procedure and the lack of real 3D visualization. This work consists of 3 experimental studies and an accompanying basic engineering and computer science part:

1) 5 full body cadavers are scanned with the Iso-C3D C-arm. Special focus will be on spine, pelvis as well as joint and long bone regions. Image quality and resolution will be analysed and optimised.

2) In situ planning and simulation of severe spinal interventions will be investigated for minimally- and even non-invasive image guided spinal surgery.

3) The 3rd part is on the practical use of the inherently registered navigated Iso-C3D technology for surgical interventions. In in vitro settings using plastic bone specimens severe spine screw placements, pelvic fixation procedures and locking of intramedullary nails are simulated.

4) The basic engineering and computer science work involves: (a) development and optimisation of a software module and GUI, which gives novel intraoperative planning means, such as the possibility to intraoperatively plan osteosynthesis after reduction manoeuvres; (b) development of an IAP (Cedara, Mississauga, ON, CAN) based routine, which will allow the effective merger of multiple tomographic data sets into one enlarged three-dimensional ‘navigation volume’; and (c) the development of a novel non-invasive referencing technology for future minimal- and in particular non-invasive procedures.