AbstractID: 11546 Title: Modeling and error analysis of the clinical process in Radiation Therapy

Purpose: To evaluate use of Petri nets industrial system modeling tool for error pathway analysis and error prevention in radiation therapy (RT).

Materials and Methods: Petri nets are a common and easily accessible tool for modeling state and event based systems. A Petri net includes “state-like” objects and “event-like” objects and the dependencies between the objects. The complete system is represented as a graph consisting of places (states) and transitions (state changes due to occurring events) that are connected by directed arcs. The places on the net can contain any number of mobile elements of the system, referred to as tokens. These tokens are moved from place to place by the "firing" of the transition representing an event in the system. A transition does not have to fire immediately when a token is added to an input place. It may instead have a deterministic or stochastic time delay. Petri nets with randomness in the transitions are called Stochastic Petri Nets. This representation would allow thorough analysis of the system activities.

We designed a Petri net representation of our clinical workflow and represented events as transitions and cause for the events as the states. We have collected more than 1000 events through our electronic error reporting software and used Petri Nets to analyze the data.

Results: We could identify the fault events and their propagation through the system. We could estimate the corresponding failure probabilities at different stages and their impact on the treatment process. In addition, we can investigate the effects of workflow alteration and patient load on the system performance, and identify optimal system design schemes.

Conclusions: The proposed Petri Net approach can achieve early failure detection as well as facilitate event quantification. This can be used for the improvement of patient care and processes in RT.