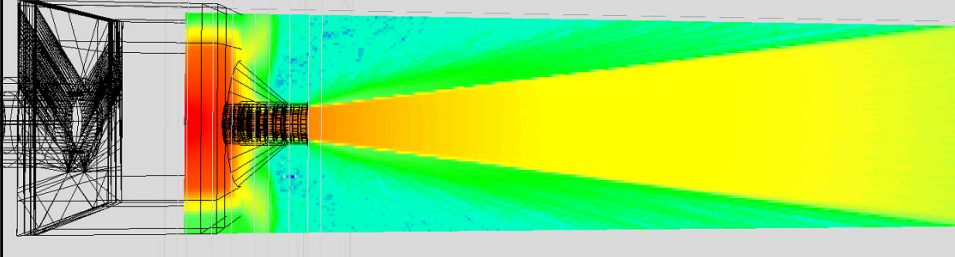


^{137}Cs Irradiation Facility – Comparison of Simulation and Experiments

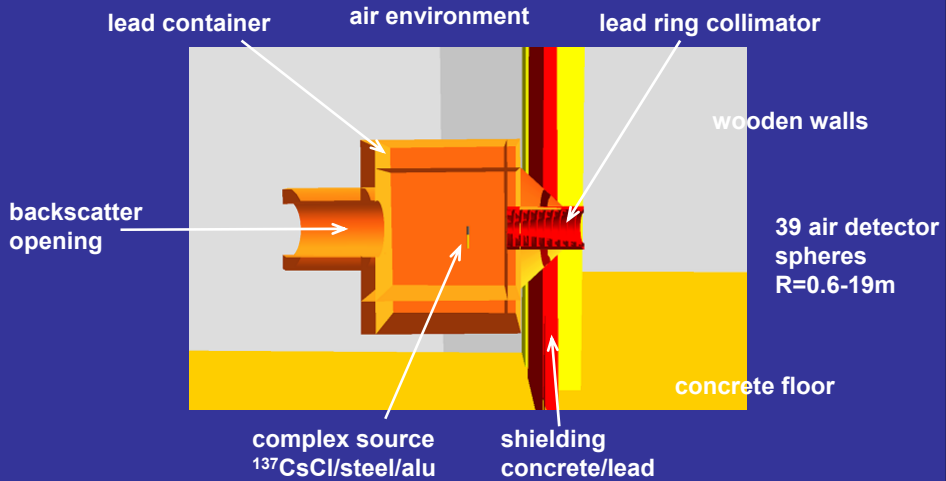
C. Hranitzky, H. Stadtmann
Austrian Research Centers - ARC
Dosimetry Laboratory Seibersdorf



Reference irradiation facility DEL

- 3 ^{137}Cs and 3 ^{60}Co nuclide sources
- collimated geometry ISO 4037
- 20 m measurement hall
- air kerma rates up to 1 Gy/h
- development, performance testing, calibration and legal verification of radiation protection dosimeters
- DEL - scientific and national accredited laboratory

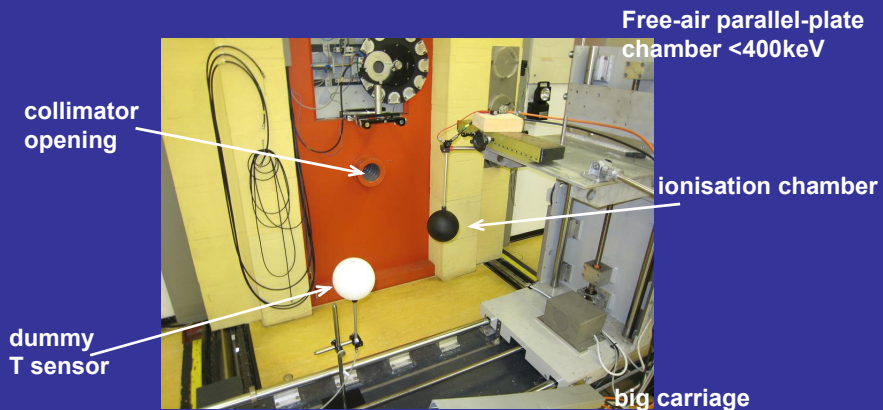
Facility components – MCNP5 simulation model



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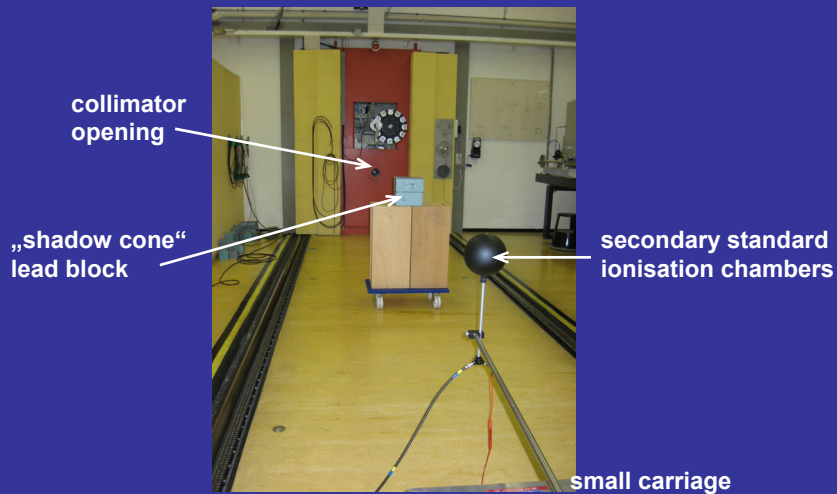
Experimental set-up - Big carriage



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„Scatter“ set-up – Measurement hall 20m



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MCNP5 simulation parameters

- all results in 1 run (no detector details)
- mode p: only photon transport (incl. bremsstrahlung)
- PCUT=10 keV
- 189 cells
- 8 materials (CsCl, air, steel, Pb, Al, ordinary concrete, fir wood, earth)
- isotropically emitting, homogeneous source 661.66 keV (85.21%)
- increasing detector diameter with R: 5-20cm
- tally fxx6: average volume track-length estimator for kerma in air
- Spectra with 1 keV bins
- collision numbering: ft inc/fu
- cell flagging: cf
- NPS=3E9

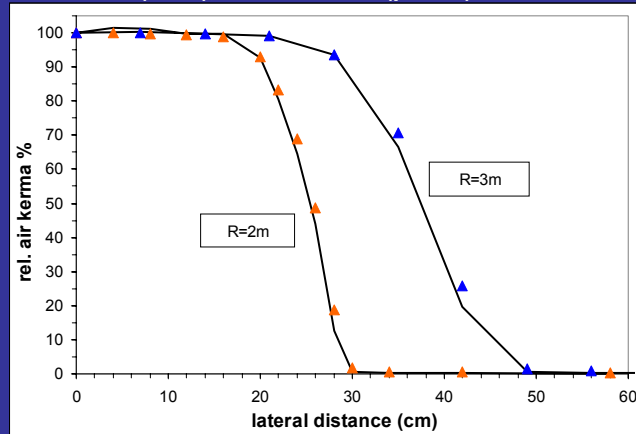


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Lateral field shapes

Simulation (lines), Measurement (points)

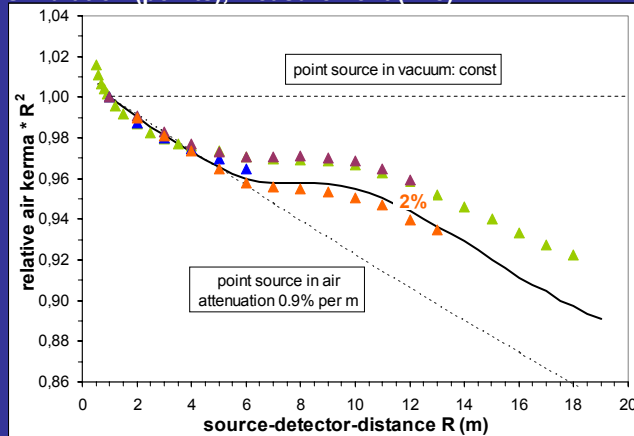


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Air kerma · R² along the main beam axis R=0.6-19m

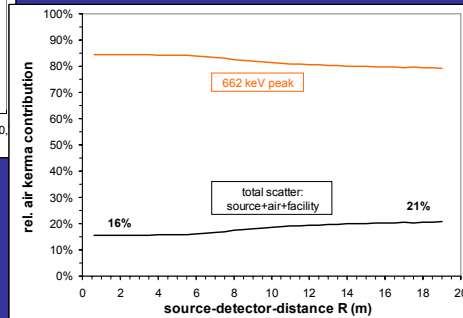
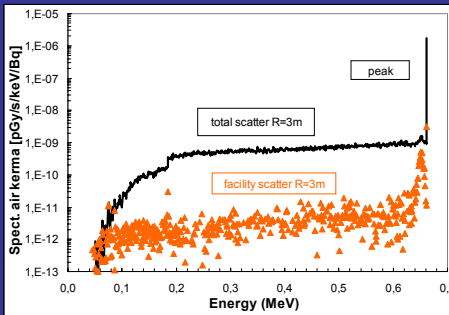
Simulation (points), Measurement (line)



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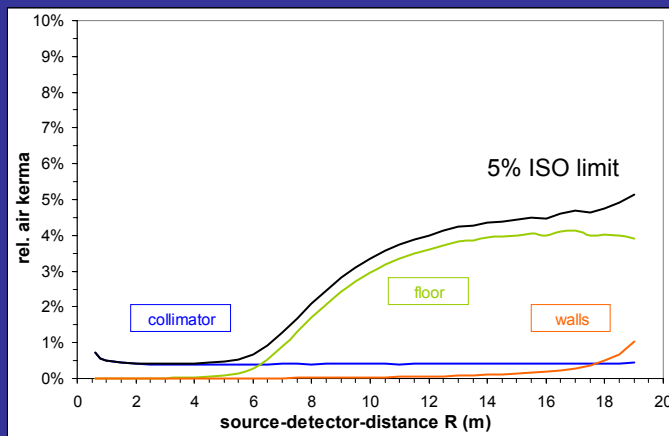
Total scatter contributions – peak ratios



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Facility scatter contribution – cell flagging

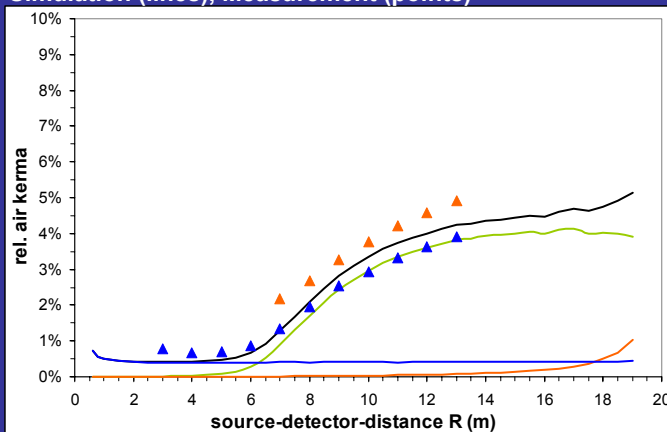


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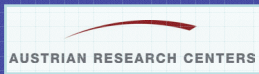


Facility scatter contribution – shadow cone exp.

Simulation (lines), Measurement (points)



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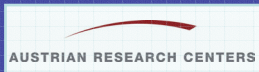
Uncertainty budget

- relative simulation uncertainty estimation: ~1% (k=2, 95%)
for relative results $K_a(R)/K_a(1m)$ only

<u>contrib.</u>	<u>influence</u>	<u>sim./meas.</u>	<u>geometry</u>	<u>reference/uncertainty</u>
<0.3%	statistics	sim.	full	ALARA
~0.3%	physics & x-sections	sim.	-	literature?, codes
<0.2%	CsCl density	sim.	simplified	certificate, literature
-	detector size	sim./meas.	simplified	zero
0%	cutoff energy	sim.	simplified	zero
-	source position	meas.	full	meas., experience
-	source activity	abs.sim.	-	certificate
<0.5% (k=1)				



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Uncertainty - final

- absolute measurement uncertainty: 1% ($k=2$, 95%)
relative measurement uncertainty: <1%
- simulation errors:
 - geometry errors increase complexity step-by-step,
understand results/physics,
analytical checks
 - source errors visual checks
 - tally errors different tally types
 - generally compare to literature, experiment, ...
- overall uncertainty:
 - full simulation uncertainty budget
 - different methods/codes/users (Workshop!)



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