Dealing with tube current modulation in patient dose calculations

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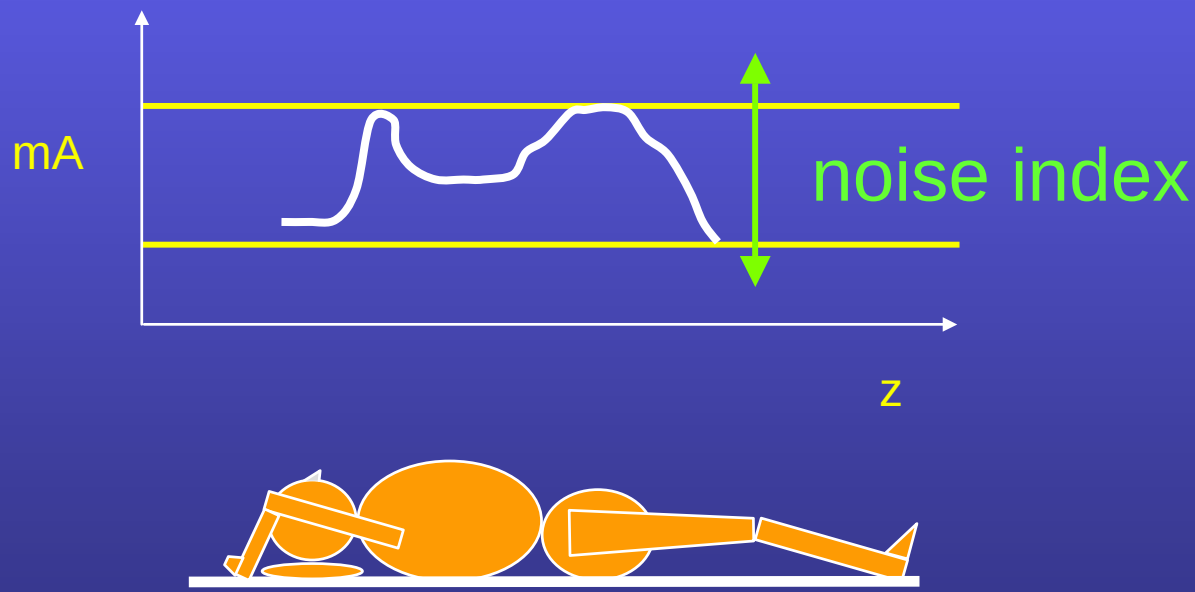
Materials

- GE LightSpeed 16
- Auto mA



Current situation

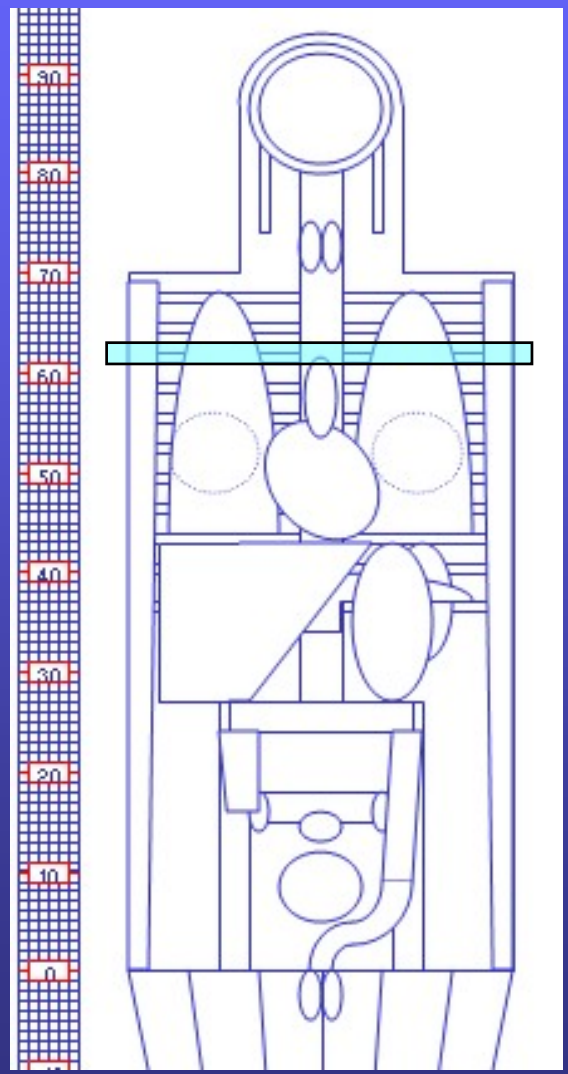
- Individual patient dose calculations
  - Typical mA for thorax / abdomen / pelvis
- Representative doses
  - Calculated using threshold mA values
  - Range for representative dose

Method

- Retrospective study
- 15 patients
- TAP protocol
  - 120kV, 20mm collimation, 1.375 pitch, 7.5/7.5 mm slices
- Data collection
  - mA, scan range from images
  - mA apportioned to 1 of 7 regions
    - Shoulders, lungs, lung / liver overlap, liver, bowel, pelvis, femora
  - Total DLP from patient log book
- Effective dose calculation
  - ImPACT dose calculator
  - Neglect differences in patient size

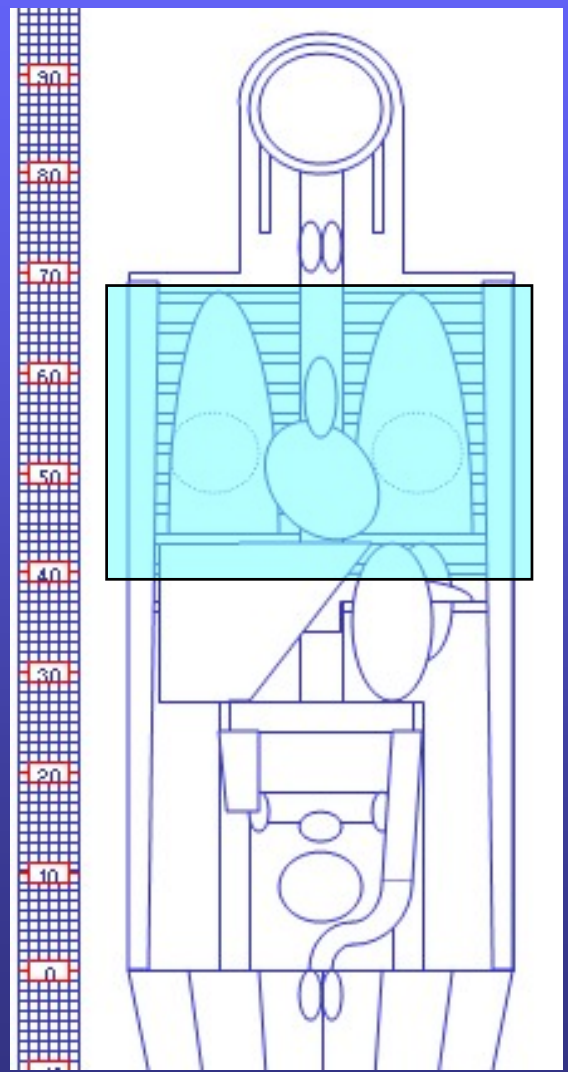
Strategy 1: thin slabs

- Calculate ED conversion factors in 27.5mm slabs (one rotation) per unit mA
- Calculate mean mA per rotation
- Allocate mA values to each slab from appropriate anatomical region
- Calculate ED for each patient
- Benchmark calculation



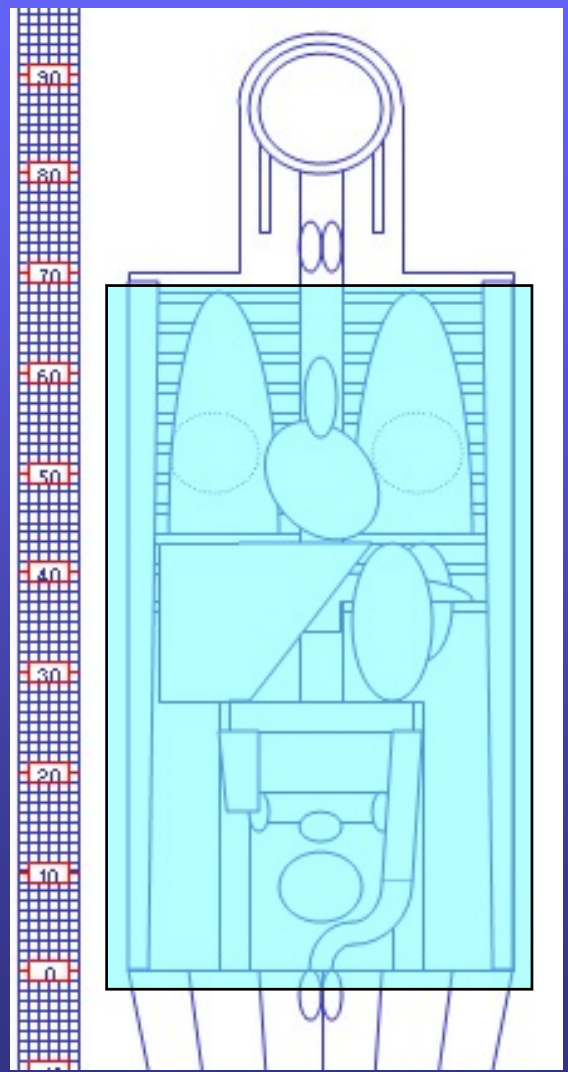
Strategy 2: three regions

- Calculate ED conversion factors for thorax, abdomen, pelvis per unit mA
- Calculate mean mA per region
- Allocate mA values to each anatomical region
- Calculate ED for each patient



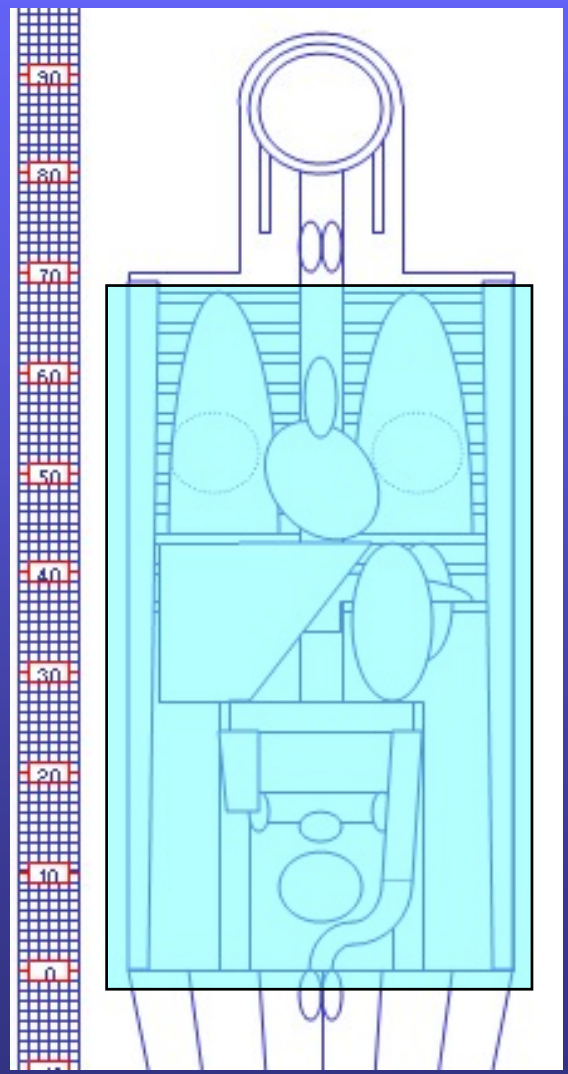
Strategy 3: one region

- Calculate ED conversion factors for TAP per unit mA
- Calculate mean mA for scan
- Allocate mA value
- Calculate ED for each patient



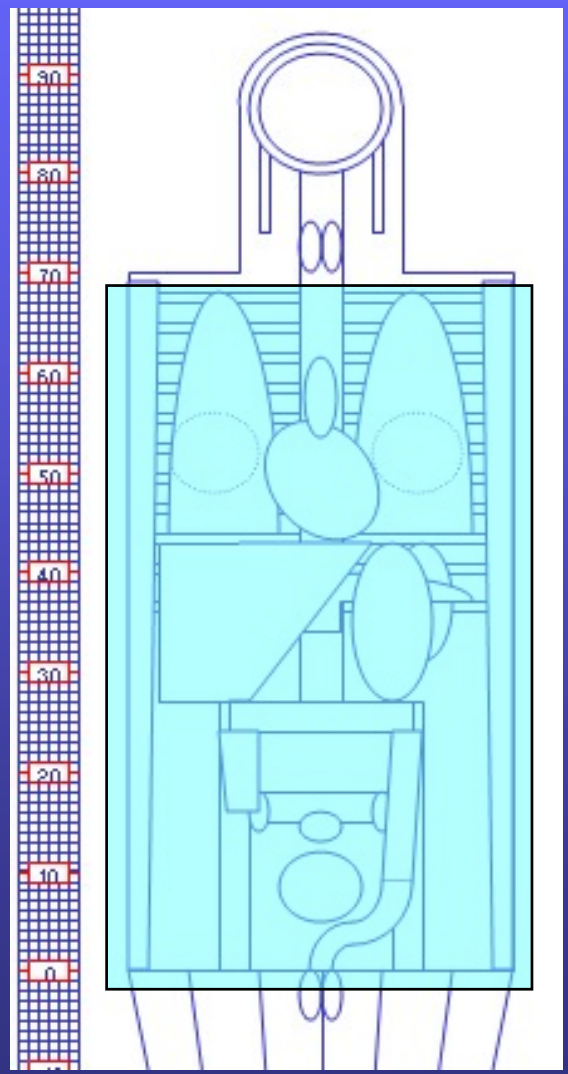
Strategy 4: mA from DLP

- Calculate ED conversion factors for TAP per unit mA
- Estimate mean mA from DLP, scan range
- Allocate mA value
- Calculate ED for each patient

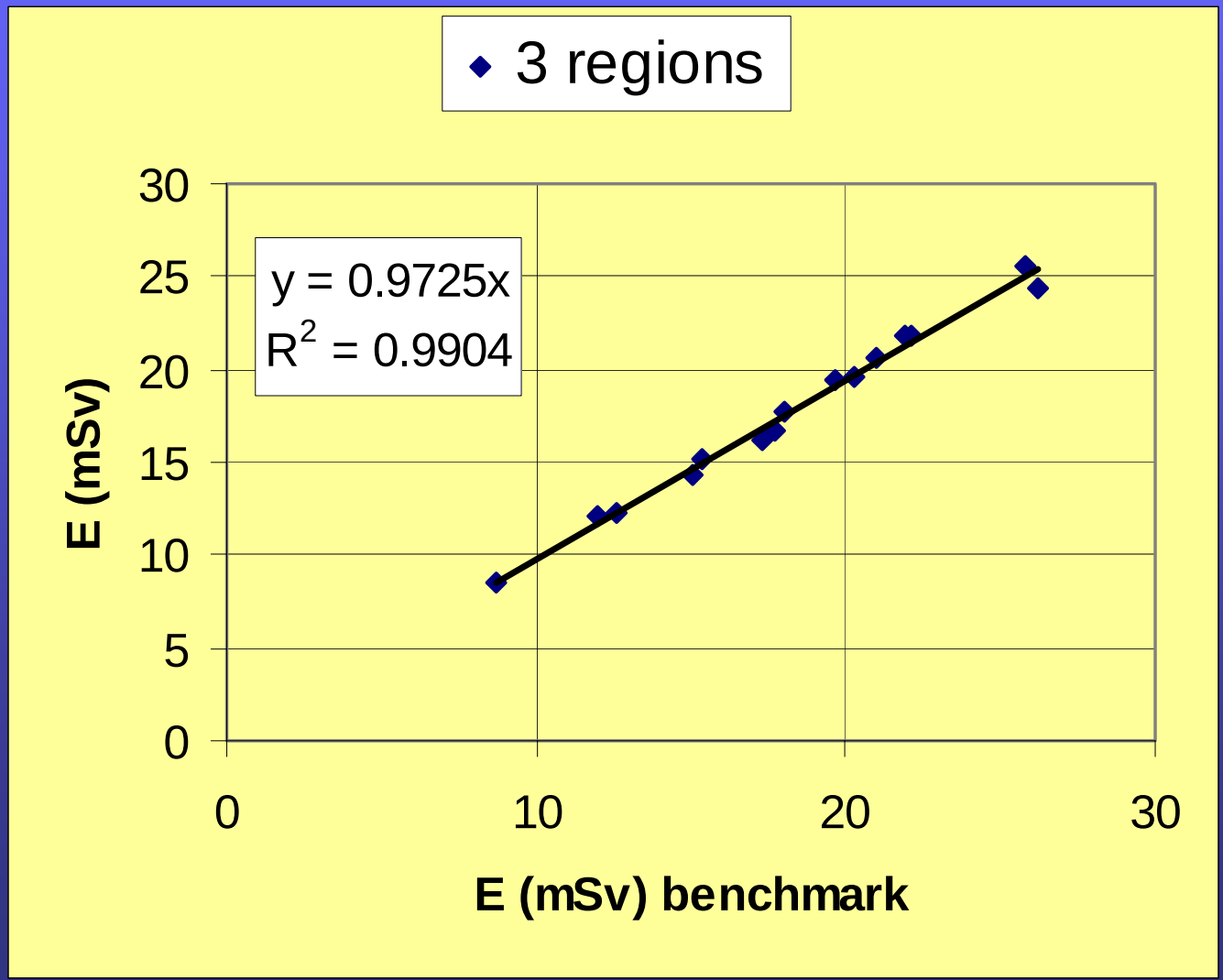


Strategy 5: DLP

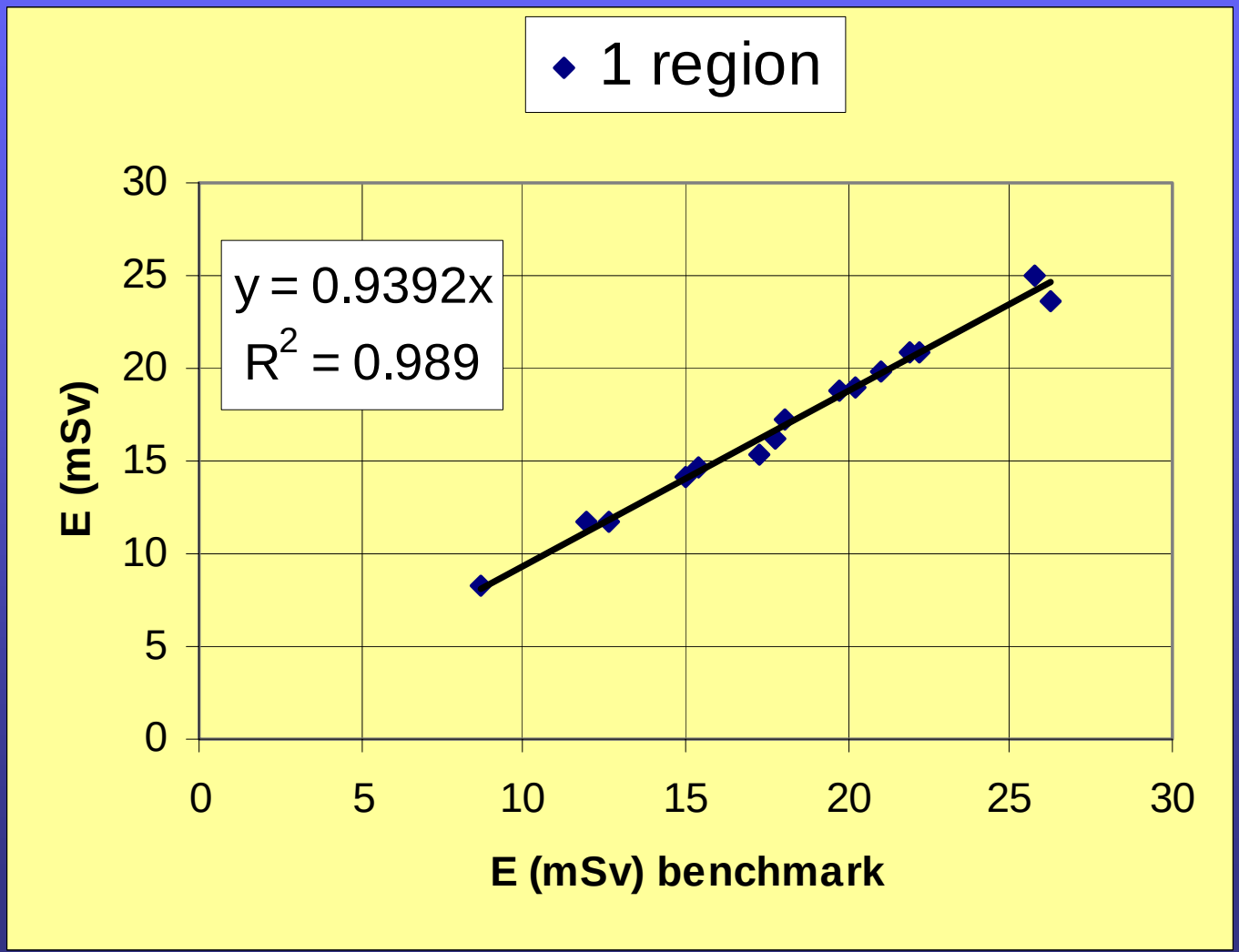
- Calculate ED conversion factors for TAP per unit DLP
  - Correct for scanner specific $CTDI_w$
- Allocate DLP value
- Calculate ED for each patient



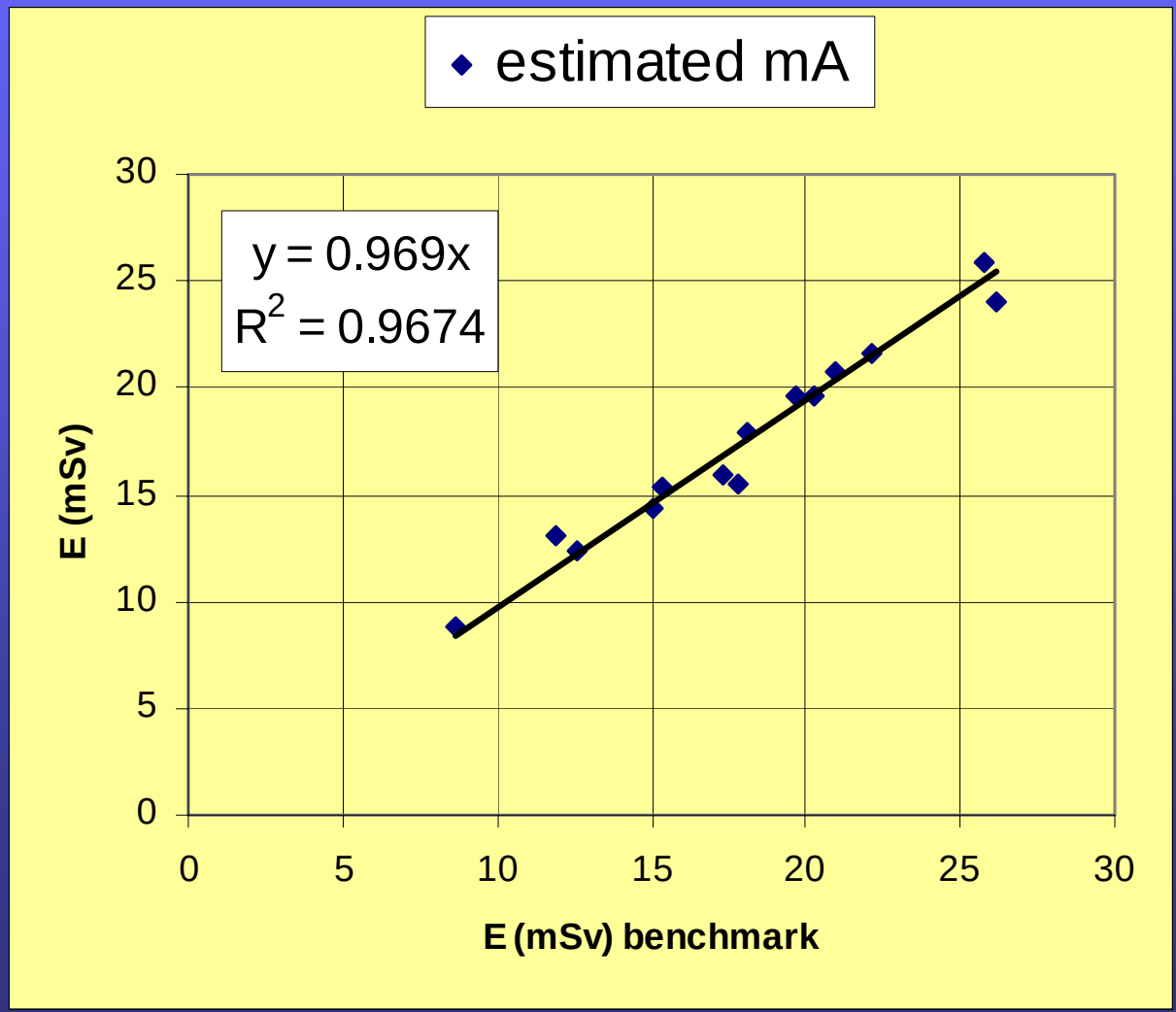
Results: strategy 2



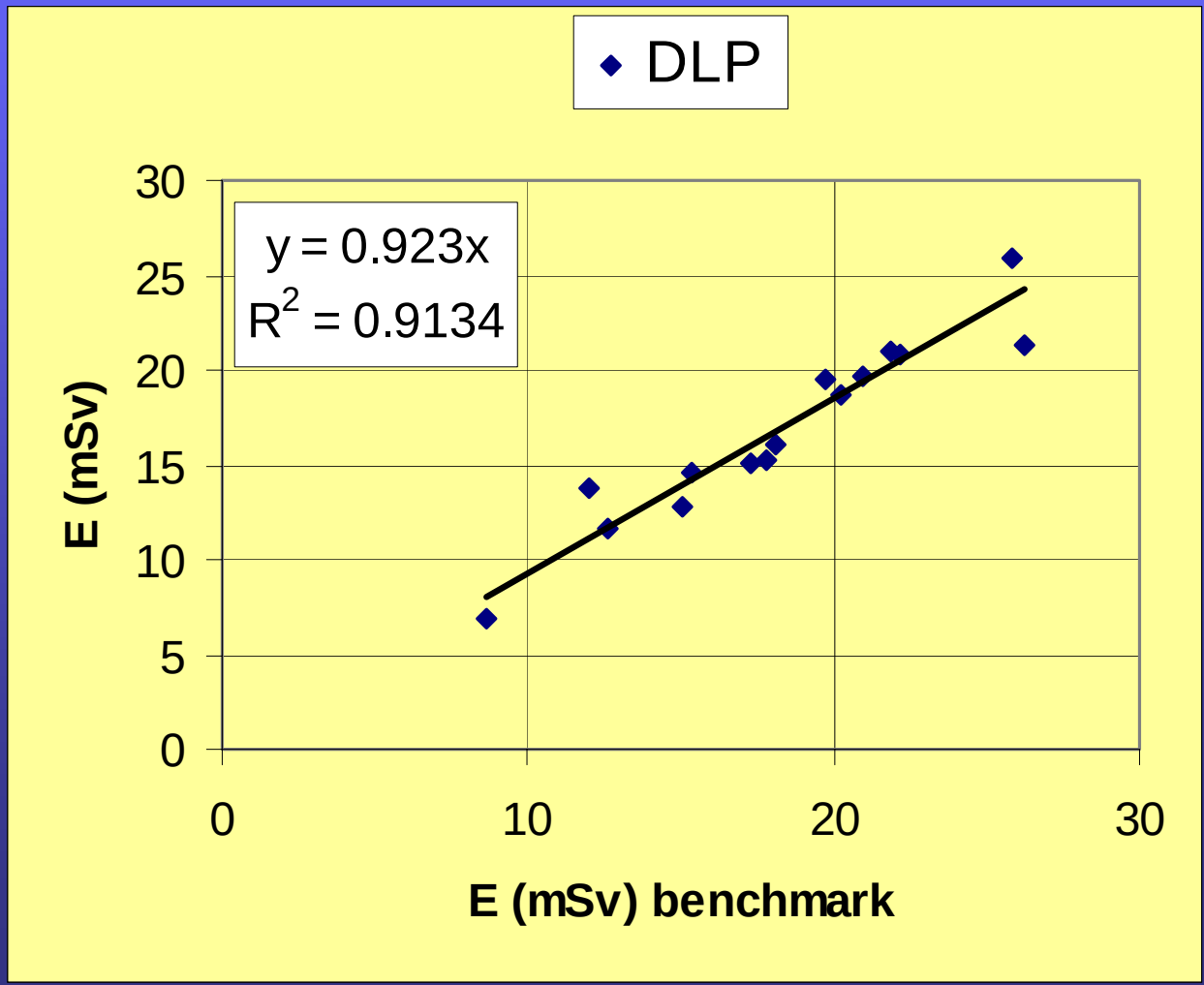
Results: strategy 3



Results: strategy 4



Results: strategy 5



Results: representative doses

Strategy	ED calculation	E (mSv)
1- thin slabs	Per subject	18.3
2- 3 regions	Per subject	17.8
3- 1 region	Per subject	17.2
4- estimated mA	Per subject	17.5
5- DLP	Per subject	16.9
Typical mA	One	16.9
Typical DLP	One	16.9

Conclusions

- Simplified calculation strategies possible
- E underestimated by 3-8%
- DLP and scan range info most practical
  - E underestimated by typically 3%
- DLP info only least accurate
  - Variations in scan length included