



Diffusione in Italia di apparecchiature e tecniche ad alta conformazione del fascio e loro impiego in RT palliativa

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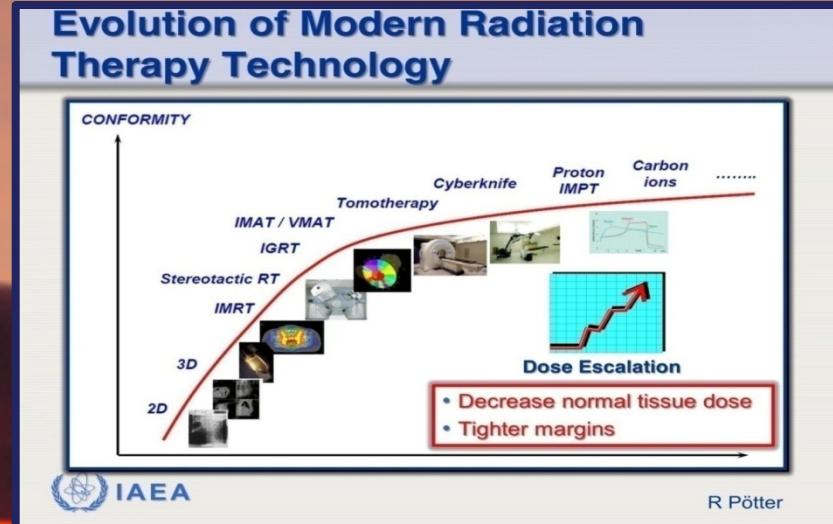
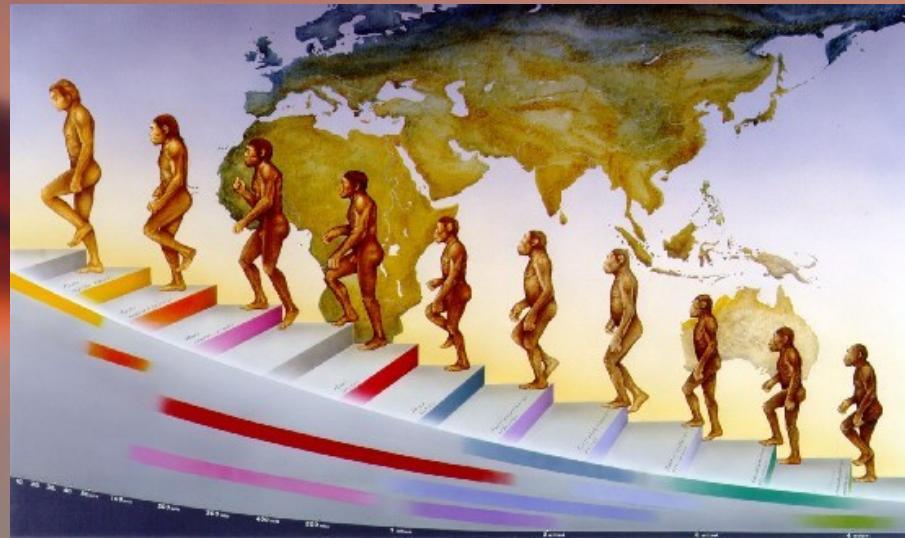
GRUPPO DI STUDIO
Cure Palliative e Terapia di Supporto





L' **EVOLUZIONE** tecnologica delle apparecchiature,
l' introduzione dell' *imaging* e lo sviluppo
dell' informatica per l' ottimizzazione dei trattamenti,
hanno determinato una **RIDEFINIZIONE DEL
RUOLO DELLA RADIOTERAPIA IN AMBITO
ONCOLOGICO**





1D: navigazione a vista

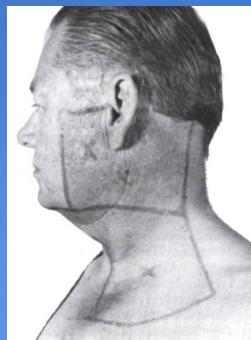


2D: navigazione su un piano

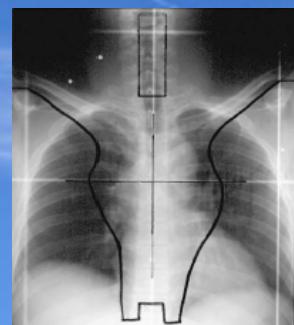
3D: navigazione in un volume

4D: navigazione nel tempo

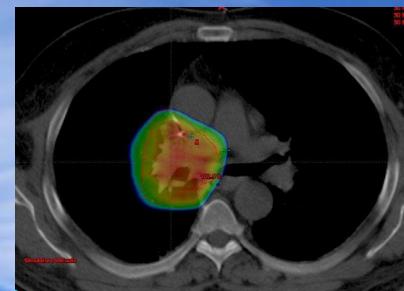
5D: navigazione nella biologia



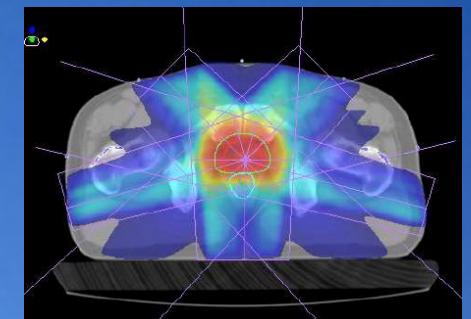
1D



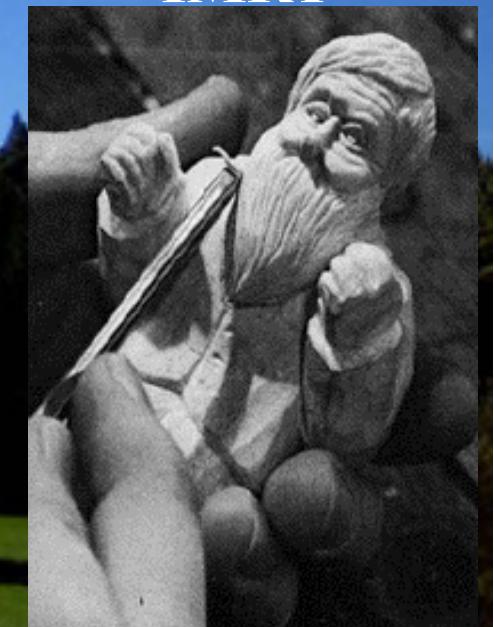
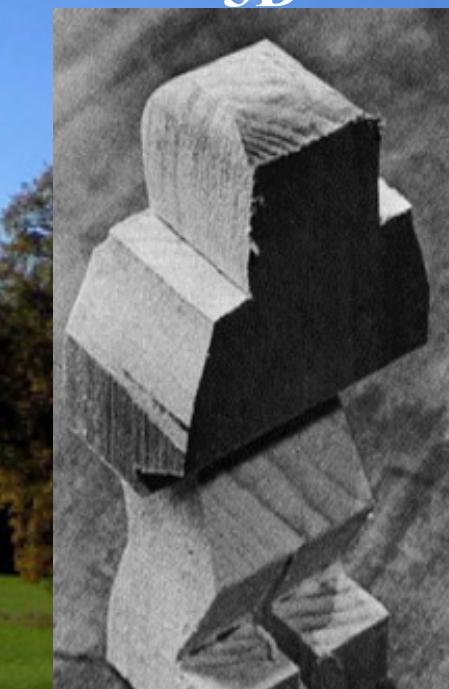
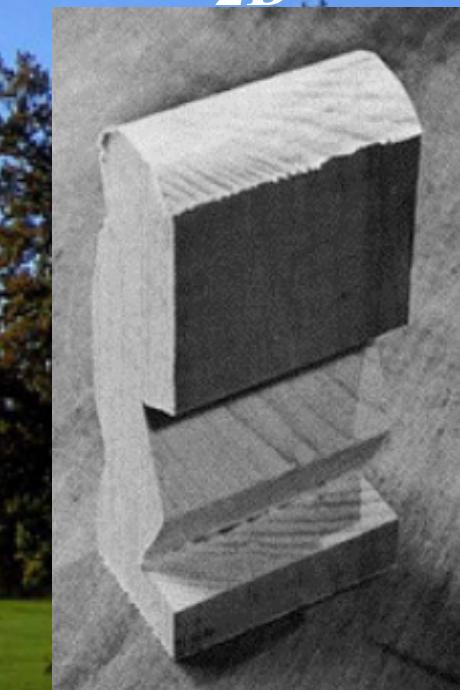
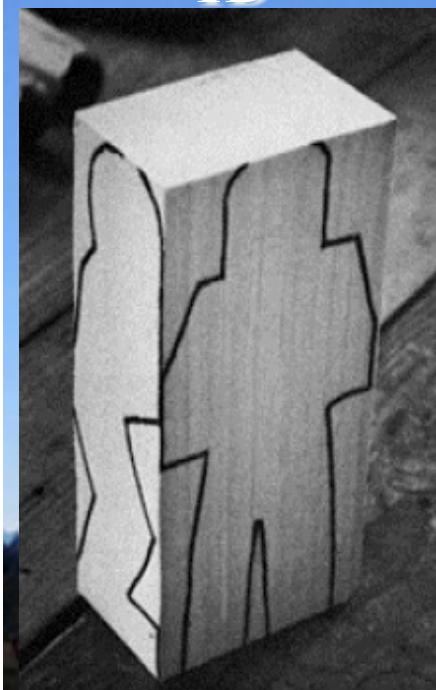
2D



3D



IMRT



3 “rivoluzioni” tecnologiche in Radioterapia

1. Inizio anni '90 → PIANIFICAZIONE → 3D-CRT

2. Fine anni '90 → EROGAZIONE → IMRT

3. > 2000 → VERIFICA → IGRT

PRECISIONE NEL DEPOSITARE LA DOSE
3D-CRT, IMRT, SRS...

PRECISIONE NEL “TARGETING”
IGRT



J Med Phys. 2012 Oct-Dec; 37(4): 1741-182

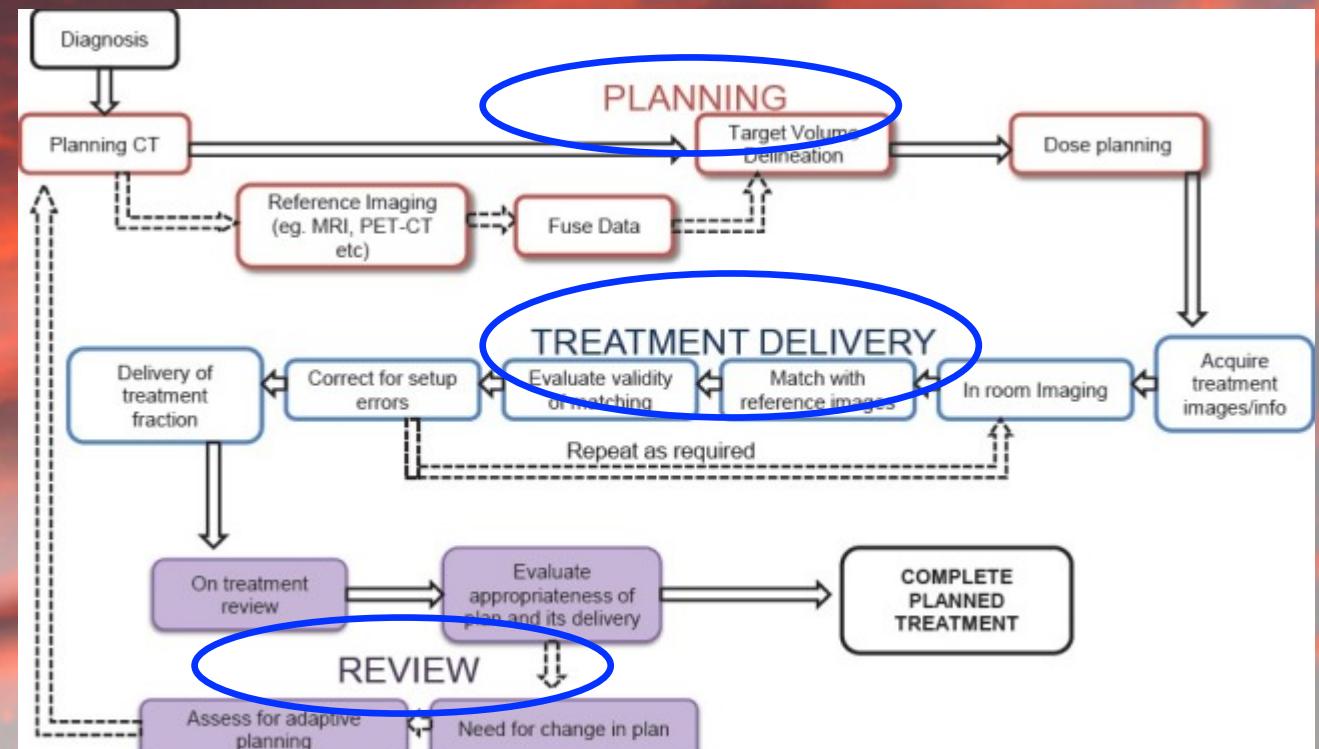
Image-guided radiation therapy: Physician's perspectives

T. Gupta and C. Anand Narayan

PIANIFICAZIONE

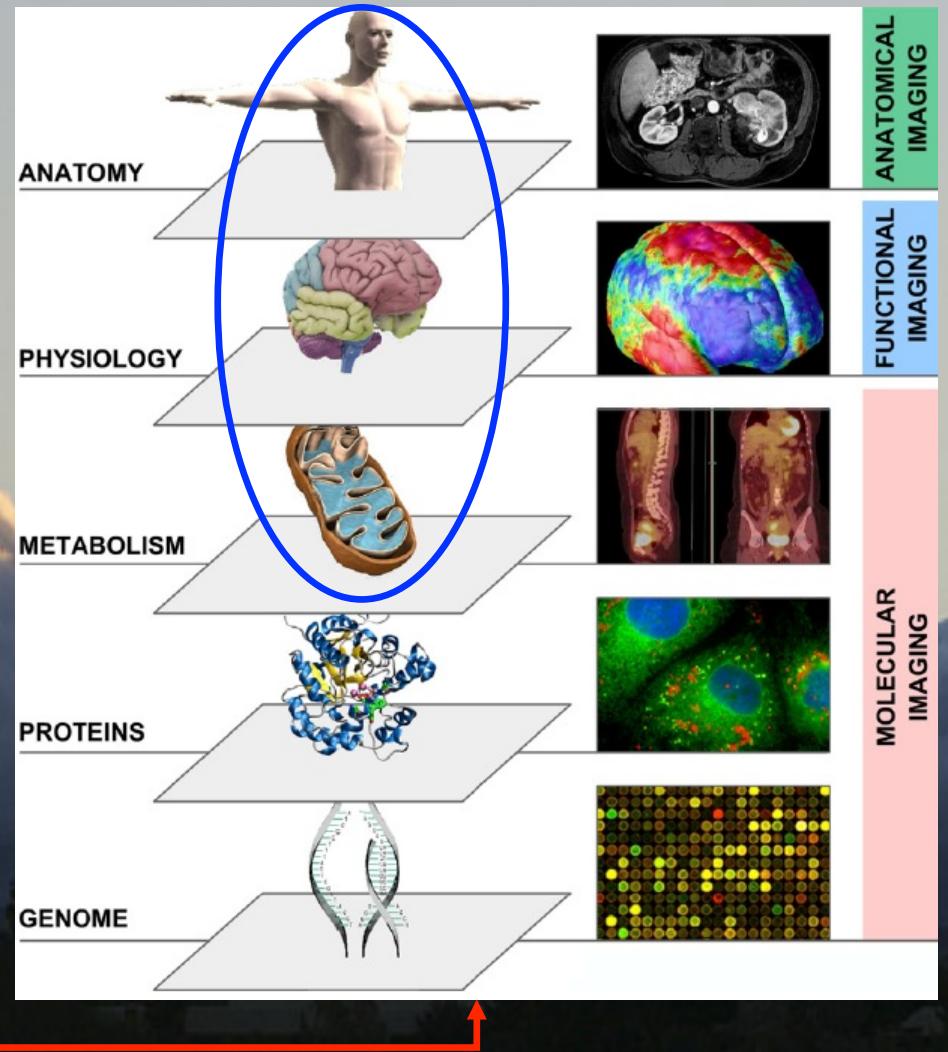
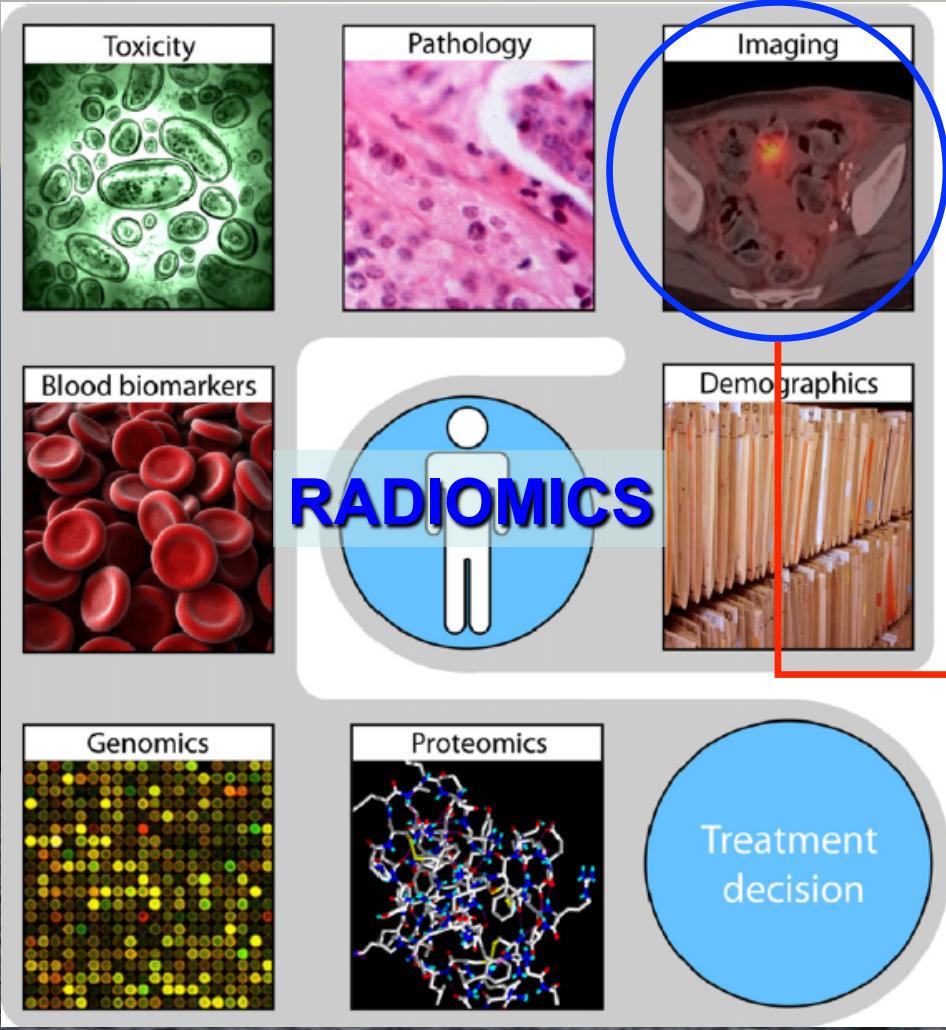
EROGAZIONE

VERIFICA



Process map and workflow of IGRT showing a series of inter-connected steps of **treatment planning**, **delivery**, and **verification** with a feedback loop

Differenti fonti di informazione utilizzate per selezionare il trattamento ottimale



IMAGING
→ Anatomico
→ Funzionale
→ Molecolare

P. Lambin, EJC, 2012

Come si inserisce la MODERNA RADIOTERAPIA nel trattamento delle metastasi

- Il concetto di **oligometastasi** e della possibile miglior prognosi ad esse associate
- La nozione che la **“palliazione”** oltre al controllo dei sintomi può aumentare la sopravvivenza del malato senza effetti collaterali di rilievo
- L’ utilizzo sempre più diffuso **di tecniche ad alta conformazione del fascio** (soprattutto la RT stereotassica) anche nel paziente metastatico
- La maggiore diffusione nella pratica clinica della **re-irradiazione** delle metastasi

“...the **GOALS OF RADIATION THERAPY** in patients with bone metastases are to palliate pain, decrease the use of narcotic analgesic, improve ambulation and restore function, and prevent complications of pathological fracture and spinal cord compression...”

Anderson PR, Coia LR - Semin Radiat Oncol - 2000

DALLA PALLIAZIONE ALLA CURA

Breast Cancer Res Treat (2009) 115:601–608
DOI 10.1007/s10549-008-0157-4

CLINICAL TRIAL

Oligometastatic breast cancer treated with curative-intent
stereotactic body radiation therapy

Michael T. Milano · Hong Zhang · Su K. Metcalfe
Ann G. Muhs · Paul Okunieff





2719 Dosimetric Comparison of Two-Dimensional (2D) vs. Three-Dimensional (3D) Planning for Bone Metastases

A. E. Potter, M. Holwell, D. Fitzpatrick, A. Bezjak, M. McLean, W. Levin, R. Dinniwell, L. Zurawel-Balaura, R. Wong

Department of Radiation Oncology, Princess Margaret Hospital/University Health Network and University of Toronto, Toronto, ON, Canada

Purpose/Objective(s): 2D field based planning remains standard practice in many radiotherapy (RT) centres for treatment of bone metastases. Even if simple plans (non conformal/non IMRT) remain the preferred technique, 3D CT based planning can improve target localization, dose coverage of targets and sparing of normal tissue. We prospectively evaluated the dosimetric impact of 2D field based vs 3D volume based RT planning for bone metastases.

La 3D-CRT è da raccomandarsi in caso di prognosi favorevole, volumi di trattamento molto estesi...

Changes to the final CTV and the reasoning were recorded. A 3D plan was created using 2-5 non-IMRT beams to cover the final PTV with 95% while minimizing normal tissue dose. Dosimetric indices were calculated for 2D and 3D plans with 95% as the reference isodose (RI). Two indices assessed target coverage: the proportion of PTV covered by RI (PTV conformity factor: PTVCF), and the ratio of minimum isodose covering PTV to RI (RTOG quality of coverage: QC). Two indices compared dose to normal tissues: the healthy tissue volume covered by RI as a proportion of PTV (healthy tissue overdosage factor: HTOF) and the ratio of PTV to total volume covered by RI (healthy tissue conformity index: CIHT). Two sided *t* tests were used to compare means for each index.

Results: 51 patients receiving RT to 57 bone sites provided data. 29/57 (50.9%) cases received treatment to the spine. 38/57 had diagnostic CT and/or MRI scans available for review. After evaluating the full planning CT dataset, oncologists documented changes in fields and/or PTV in 31/57 (54.4%) cases, due to local disease extent in 22/31 (71.0%) and clinically important distant disease in others. The study 2D plans used single fields in 17/57 and parallel pairs in 40/57, compared to the final 3D plans which used fewer single fields (6/57), more parallel pairs (50/57) and one 3-field technique. PTV coverage in 3D plans was superior to 2D plans as measured by mean QC (88% vs 46%, $p < 0.001$) and mean PTVCF (93% vs 77%, $p < 0.001$). 3D plans improved healthy tissue sparing compared to 2D plans, with mean HTOF 2.56 vs 4.89 ($p = 0.112$) and mean CIHT 0.34 vs 0.25 ($p < 0.01$).

Conclusions: 3D planning for RT to bone metastases resulted in more plans with ≥ 2 fields compared to 2D field based plans. **3D plans provided superior PTV coverage and improved healthy tissue sparing.** The clinical impact of 3D planning in this setting requires further investigation.



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0360-3016/\$ - see front matter

doi:10.1016/j.ijrobp.2010.11.026

ASTRO GUIDELINE

PALLIATIVE RADIOTHERAPY FOR BONE METASTASES: AN ASTRO EVIDENCE-BASED GUIDELINE

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SIMON LO, M.B., CH.B., ‡‡ ARJUN SAHGAL, M.D., §§ LARRY SILVERMAN, M.D., ¶¶

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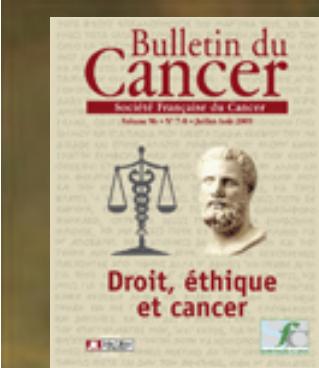
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3D-CRT

SBRT

Table 2 - ASTRO task force questions and guideline statements regarding palliative radiation therapy for bone metastasis

| Questions | Guideline statements |
|--|---|
| 1. Which fractionation schemes have been shown to be effective for the treatment of peripheral bone metastases? | Although various fractionation schemes can provide good rates of pain relief, it is recommended that 30 Gy be delivered in a single fraction if possible. |
| 2. When should patients receive repeat treatment with RT for painful bone metastases? | The Task Force recommends that, whenever possible, patients should be included in prospective randomized trials. |
| 3. Are there any differences in long-term toxicity between single fraction therapy and more prolonged RT courses for uncomplicated, painful bone metastases? | There is no significant difference in long-term toxicity between a single 8-Gy fraction and more prolonged RT courses for uncomplicated, painful bone metastases. No additional studies are suggested to confirm this recommendation at this time. |
| 4. When should patients receive repeat treatment with RT to spinal lesions causing recurrent pain? | The rates of repeat treatment have been 20% with single-fraction palliative RT schedules compared with 8% with lengthier RT courses. The Task Force recommends that, whenever possible, patients should be included in prospective randomized trials. |
| 5. What promise does highly conformal RT hold for the primary treatment of painful bone metastasis? | Sites of recurrent pain in spinal bones can be successfully palliated with EBRT repeat treatment. Care must be taken when the re-irradiated volume contains the spinal cord, and it might be appropriate to sum the biologically effective doses from the initial and repeat treatment regimens to estimate the risk of radiation myelopathy. |
| 6. When should highly conformal RT be considered for repeat treatment of spinal lesions causing recurrent pain? | Stereotactic body RT is a technology that delivers high doses to metastatic spinal disease with a steep dose gradient that might allow superior sparing of the adjacent neural structures, including the spinal cord and cauda equina. SBRT should not be the primary treatment of vertebral bone lesions causing spinal cord compression. |
| 7. Does the use of surgery, radionuclides, bisphosphonates, or kyphoplasty/vertebroplasty obviate the need for palliative RT for painful bone metastasis? | Some early data have suggested that repeat treatment to spinal lesions with SBRT might be feasible, effective, and safe, although the Task Force believes that the use of this approach should be limited to the setting of clinical trial participation. |
| | The available data have suggested that surgery, systemic radiopharmaceuticals, bisphosphonates, or kyphoplasty/vertebroplasty does not obviate the need for EBRT for patients with bone metastases. |



RADIOOTHÉRAPIE DES CANCERS MÉTASTATIQUES OU OLIGOMÉTASTATIQUES EN DEHORS DES IRRADIATIONS À VISÉE ANTALGIQUE. ÉTAT DES LIEUX EN 2010 AVEC FOCUS SUR L'ASCO 2010

BULLETIN DU CANCER.

Volume 97, Numéro 12, 1467-76, décembre 2010

J Thariat, PY Marcy, JL Lagrange

“...La radiothérapie est le plus souvent prescrite dans une intention palliative en cas de maladie métastatique...

Cependant, **DANS DES CAS SÉLECTIONNÉS DE MALADIE OLIGOMÉTASTATIQUE, ELLE PEUT ÊTRE PRESCRITE À INTENTION POTENTIELLEMENT CURATIVE EN UTILISANT LES NOUVELLES TECHNIQUES D'IRRADIATION** et notamment la radiothérapie stéréotactique extracrânienne (SBRT)...

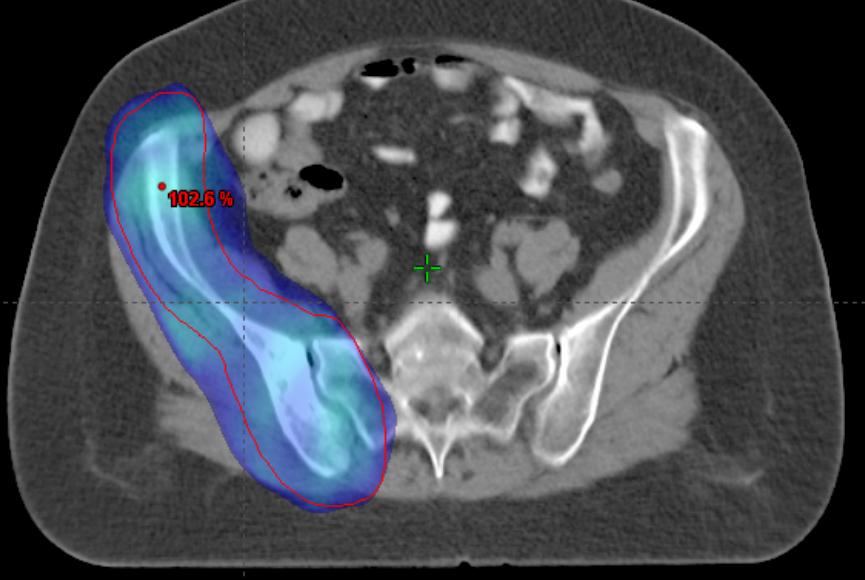
...Les nouvelles techniques sont aussi particulièrement intéressantes pour les métastases spinales... les **RÉIRRADIATIONS...**

Radiation therapy for bone metastases

Lucio Trodella¹, Sara Ramella¹, Rolando Maria D'Angelillo¹, Roberto Orecchia², Paolo Muto³,
Giovanni Mandoliti⁴

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RISPARMIO ORGANI CRITICI



ALTA CONFORMAZIONE DI DOSE



...Moreover, modern radiation therapy techniques may allow a high conformal dose distribution in order to reduce normal tissue toxicity...

CRITICAL REVIEW

STEREOTACTIC BODY RADIOSURGERY FOR SPINAL METASTASES: A CRITICAL REVIEW

ARJUN SAHGAL, M.D.,^{*†} DAVID A. LARSON, M.D. PH.D.,[†] AND ERIC L. CHANG, M.D.[‡]

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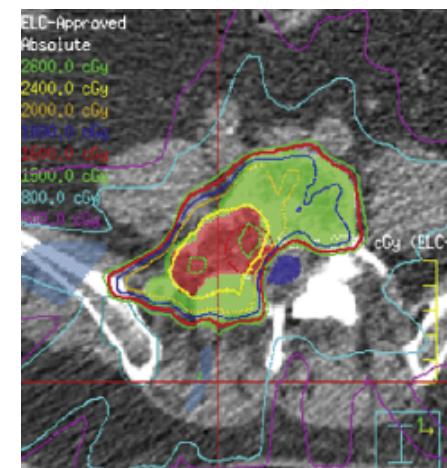
Table 2. A summary of specified relative inclusion and exclusion criteria for spine SBRS

Inclusion

- Solitary or oligometastatic disease or bone only disease in otherwise high-performance status patients*
- Maximum of two consecutive (28) or noncontiguous (8, 17) spinal segments involved by tumor
- Failure of prior XRT (up to one course and 45 Gy maximum) or surgery (8, 17)
- Nonmyeloma tumor type (8, 17)
- Gross residual disease or deemed high risk for recurrence postsurgery (17)
- Patient refusal or medical comorbidities precluding surgery (17)
- Gross tumor optimally more than 5 mm from the spinal cord (17)[†]
- Karnofsky performance status >40–50 (17, 50, 51)
- MRI- or CT-documented spinal tumor (17, 20)
- Histologic confirmation of neoplastic disease (17, 20)
- Age >18 (50)

Exclusion

- Pacemaker such that MRI cannot be performed or the treatment cannot be delivered safely (17)
- Scleroderma or connective tissue disease as a contraindication to radiotherapy*
- Unable to lie flat (*i.e.*, tolerate treatment)*
- Treated with ⁸⁹Sr or systemic chemotherapy within 30 days before SBRT (8, 17)
- External beam radiotherapy to the same area within 3 months before SBRT (8, 17, 28)
- Significant or progressive neurologic deficit (8, 17, 23)
- >25% spinal canal compromise (23)
- Malignant epidural spinal cord compression (8, 19) or cauda equina syndrome (19)[‡]
- Spine instability (8, 17, 19) or neurologic deficit resulting from bony compression of neural structures (50)



Abbreviations: SBRS = stereotactic body radiosurgery; XRT = X-ray therapy; MRI = magnetic resonance imaging; CT = computed tomography; SBRT = stereotactic body radiotherapy; MDACC = M.D. Anderson Cancer Center.

* These represent unpublished specific criteria and included per the authors' recommendation as general criteria to be considered.

† This criteria, according to the MDACC, is relaxed should the multidisciplinary team judge the case still suitable for spine SBRS.

‡ Malignant epidural spinal cord compression has been allowed by some investigators and treated with radiosurgery alone (11).

| PATOLOGIA | INCIDENZA | Trattabili con tecniche ad alto gradiente di dose |
|-----------------------------|-----------|---|
| MAV | 130 | 30% |
| Meningomi | 2.408 | 5% |
| Neurinomi | 300 | 15% |
| Adenoma ipofisario | 750 | 10% |
| Cordoma/condrosarcoma | 135 | 100% |
| Craniofaringioma | 30 | 100% |
| Tumori primitivi SNC | 2.600 | 10% |
| Metastasi cerebrali | 39.000 | 20% |
| Polmone primitivo | 31.000 | 5% |
| Metastasi polmonari | 33.406 | 20% |
| ORL (ritrattamenti) | 6.780 | 5% |
| Fegato | 10.617 | 5% |
| Tumori maligni dell' orbita | 310 | 100% |
| Pancreas | 9.050 | 56% |
| Metastasi ossee | 35.000 | 10% |
| Recidive pelviche | 700 | 50% |

18.512 pazienti

ASSOCIAZIONE ITALIANA REGISTRI TUMORI (AIRTUM)



Table 5. A comparison of medicare reimbursements* for 3 Gy in 10 fractions by single posterior-anterior field conventional CT planned radiation as opposed to SBRS for 3 and 3 fractions based on the 2007 Medicare Physician Fee Schedule, and CMS-1392 Federal Registry Ambulatory Payment Classification

| | Conventional radiotherapy (\$) | Stereotactic radiotherapy (\$) | 3-fraction stereotactic body radiosurgery |
|------------------------|-----------------------------------|-----------------------------------|--|
| Hospital and clinic | 3,119 | | 14,681 |
| Physician | 1,013 | | 2,204 |
| Total | 4,132 | | 17,065 |

| 4132 \$ | * Non-clinical consultation fees are based on a plan, computed tomography, device, treatment film, and weekly review. This includes all this therapy planning. Treatment planning 77200, physician consult level 1, simulation, three-dimensional planning, physics quantity codes. Stereotactic radiosurgery-modulated radiation therapy codes G0339 G0340, special physics consult, and complex treatment devices. |
|----------------|--|
|----------------|--|

3D-CRT

Radiosurgery

SBRS

Media

IN REGALO IL MAXI POSTER DI MARTINA
OTTobre 2010 € 4,20

1977
L'ANNO DELLA SVOGLIA
DAI SEX PISTOLS AGLI
INDUSTRI METROPOLITANI
ORA D'ARTE E RIVOLUZIONE
TRA POLITICA,
MUSICA, COSTUME

MARTINA STELLA
SONO BUDDISTA E
DI SINISTRA HO TROVATO
UN EQUILIBRIO LA MIA
GENERAZIONE NO

MAX ECONOMY
VIVERE GRATIS CON INTERNET
VAGLI CASE TELEFONICHE COME
CARAVAGGIO ALLA RETE

MOSCIA L'ABORSA DEL SESO
LA NUOVA CAPITALE DEL PIACERE

PIOCCHIANO LESTAR
ROSE McGOWAN
CATHERINE ZETA-JONES
EVA MENDES, PATO
DANIEL EZKORET
NICKIE NOVOV
FRANCESCO RENGA

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in Max

giri
occio
casting
anedusi
barsport
anizza
blog
ieri parole
oggi

MAX NEWS
04/06/10 21:00
sarà lui a interpretare...
"THE WALL" IN TOUR NEL 2011
04/06/10 11:01
Roger Waters ha annunciato che a partire dal marzo del 2011 riporterà in tour il suo capolavoro, The wall: sono più di...
SUPER EROI IN 4D A LONDRA
04/06/10 09:58
Si intitola Marvel Super Heroes 4D, ed è l'ultimissima attrazione di Madame Tussaud, il museo delle cere londinese. Ma...
ARRESTATA POCOHONTAS
03/06/10 18:30
Vi ricordate The New World, il film di Terrence Malick con **VEDI TUTTI**

Nessuna donna sarà più la stessa.

Cyberknife, chirurgo elettronico

IL ROBOT CHIRURGO CHE TAGLIA SENZA LAME

Il nome, CyberKnife, fa pensare a una specie di *Edward-man-i-di-forbici* in versione chirurgica. Ma visto da vicino, il bisturi cibernetico della Accuray appena installato (quarto in Italia) nella clinica *Spedali Civili* di Brescia, non ha nulla di spettrale. Il robot, controllato da un super tecnico di ab medica ricorda piuttosto, nella mole e nelle movenze, un mansueto dromedario. Che opera, sì, e con estrema precisione, facendo strage di alcuni tumori particolarmente insidiosi, ma senza colpo ferire. Perché i trattamenti di radioterapia che il robot può erogare sono chirurgia solo in senso figurato: il "coltello" non taglia, non è invasivo e non provoca dolore, ma riesce a centrare in modo molto mirato, con fasci ionizzanti di diverse ampiezza, le neoplasie da eliminare. E senza ledere i tessuti circostanti, grazie a un sofisticato sistema di tracciamento e visualizzazione 3D del corpo del paziente, che permette di correggere il tiro seguendone i minimi, involontari movimenti durante l'operazione. Una seduta, in genere, è risolutiva: dopo tre quadri d'ora il paziente scende dal lettino e se ne torna a casa con le proprie gambe. E il

Media

SALUTE PIÙ POTENTE E MENO TOSSICO DELLA RADIOTERAPIA CLASSICA, IL PRIMO APPARECCHIO ALL'
Tumori, il super-raggio intelligente che sostituisce il bisturi

CORRIERE DELLA SERA

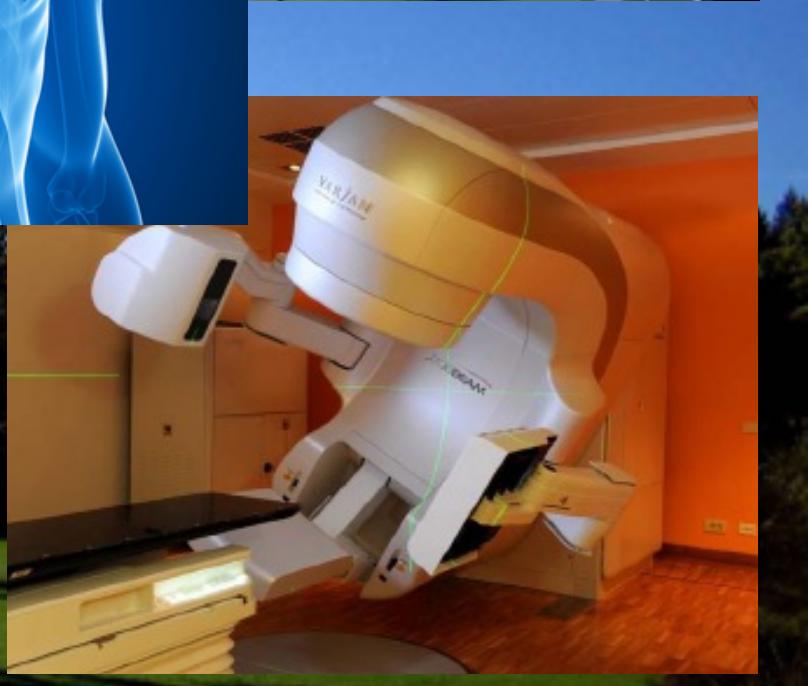
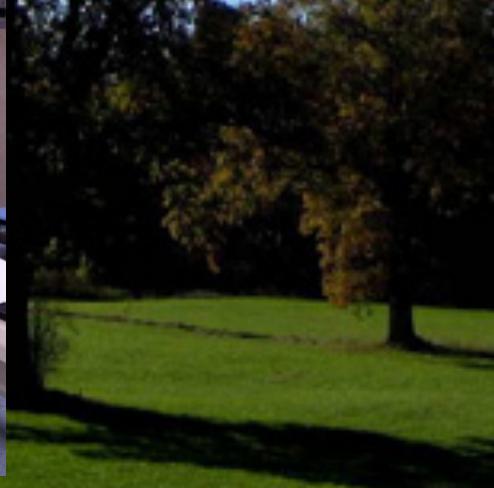


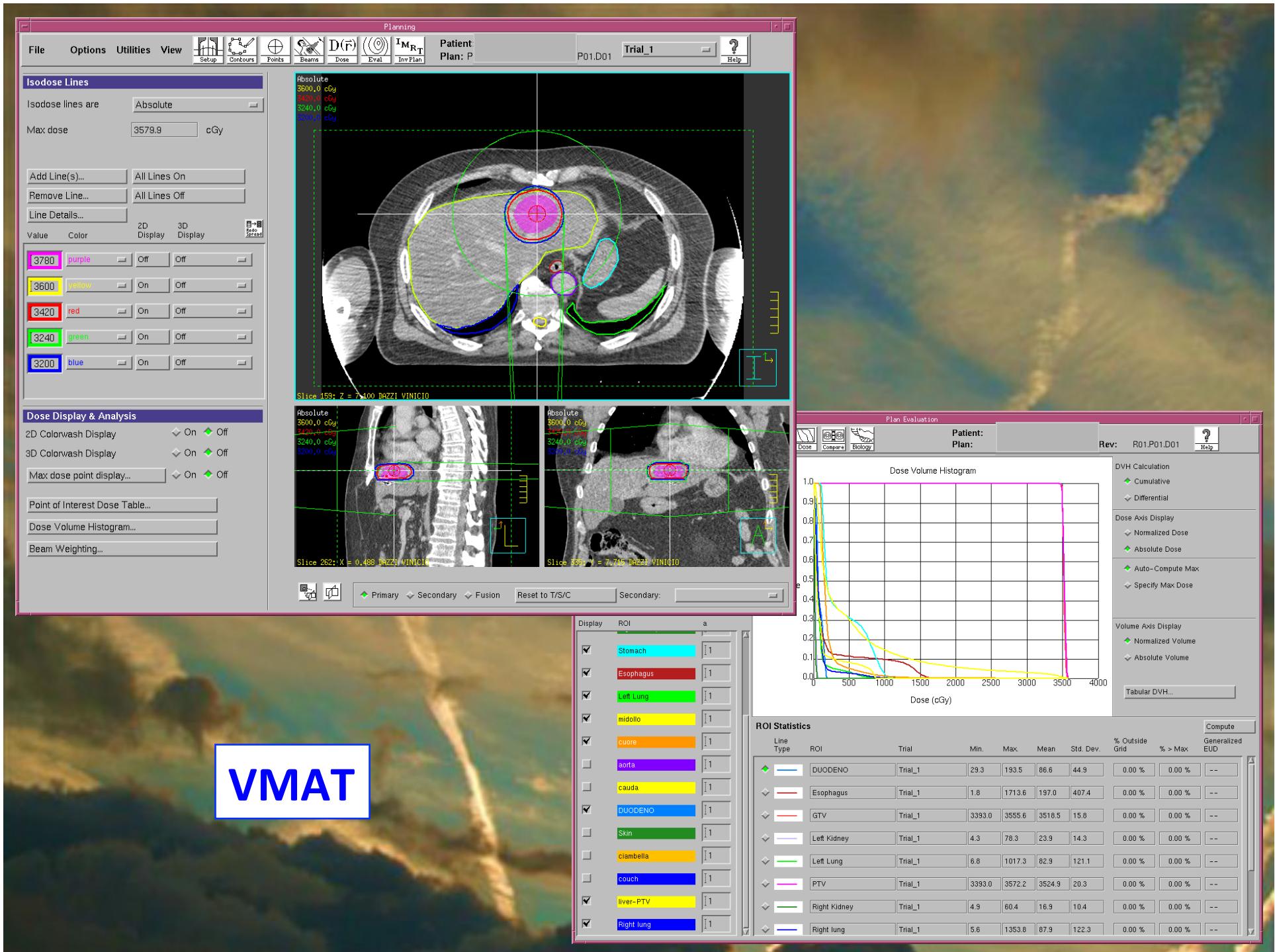
LA STAMPA dossier+

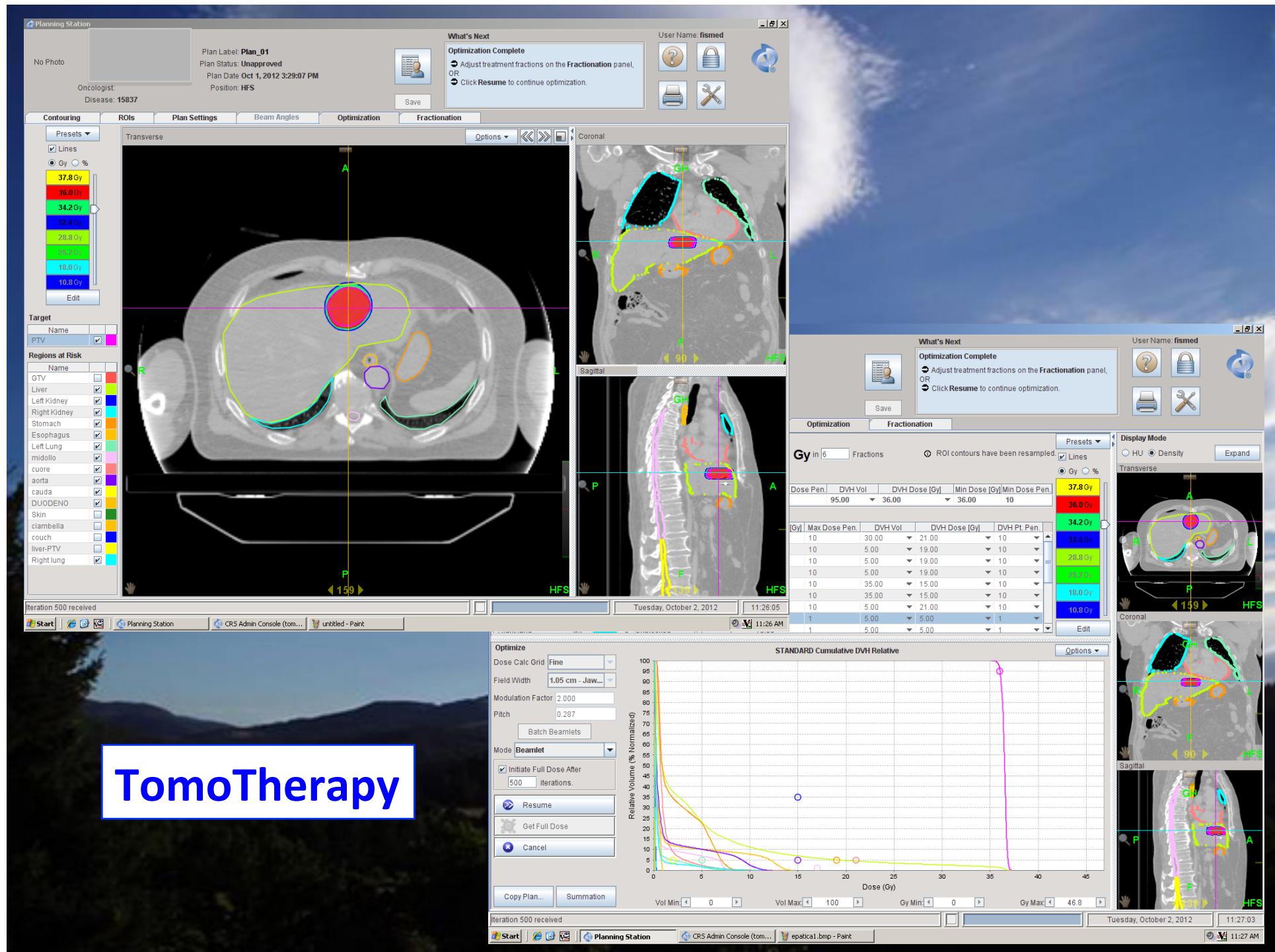
Interventi di precisione con il bisturi cibernetico

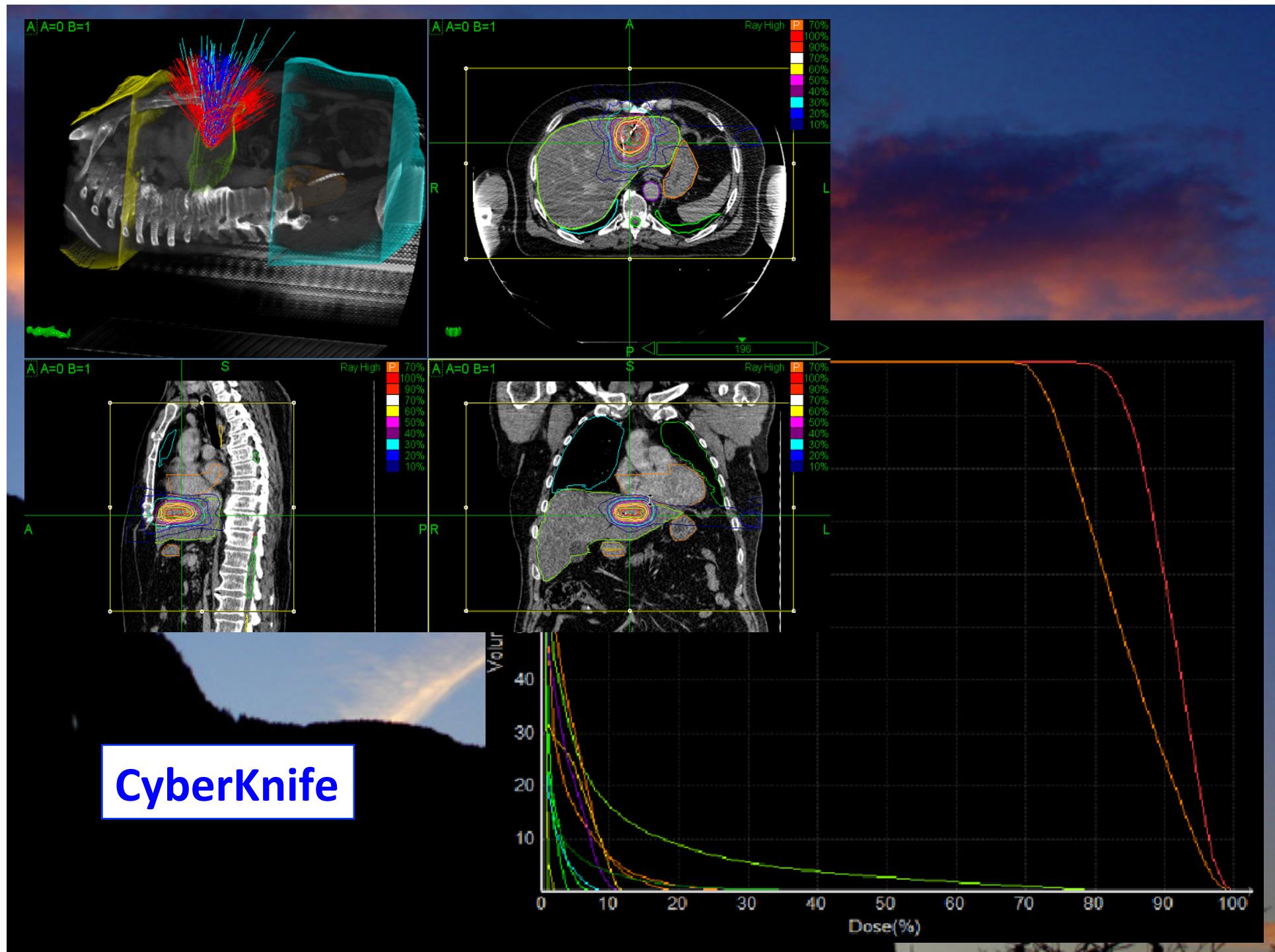
SI TRATTA DI UN TRATTAMENTO RADIOTERAPICO MIRATO, DEL TUTTO INDOLORE,
ESEGUITO IN REGIME AMBULATORIALE E ALTERNATIVO ALLA CHIRURGIA TRADIZIONALE

Data 18-05-2010
Pagina 11
Foglio 1









| | Liver <i>Dmax</i> 700 mL $< 15 \text{ Gy}$ | Heart <i>Dmax</i> $< 30 \text{ Gy}$ | Bowel <i>Dmax</i> $< 30 \text{ Gy}$ | Kidneys <i>D35</i> $< 15 \text{ Gy}$ | Stomach <i>Dmax</i> $< 30 \text{ Gy}$ |
|--------------------|---|---|---|--|---|
| CyberKnife | | | | | |
| VMAT | | | | | |
| TomoTherapy | | | | | |



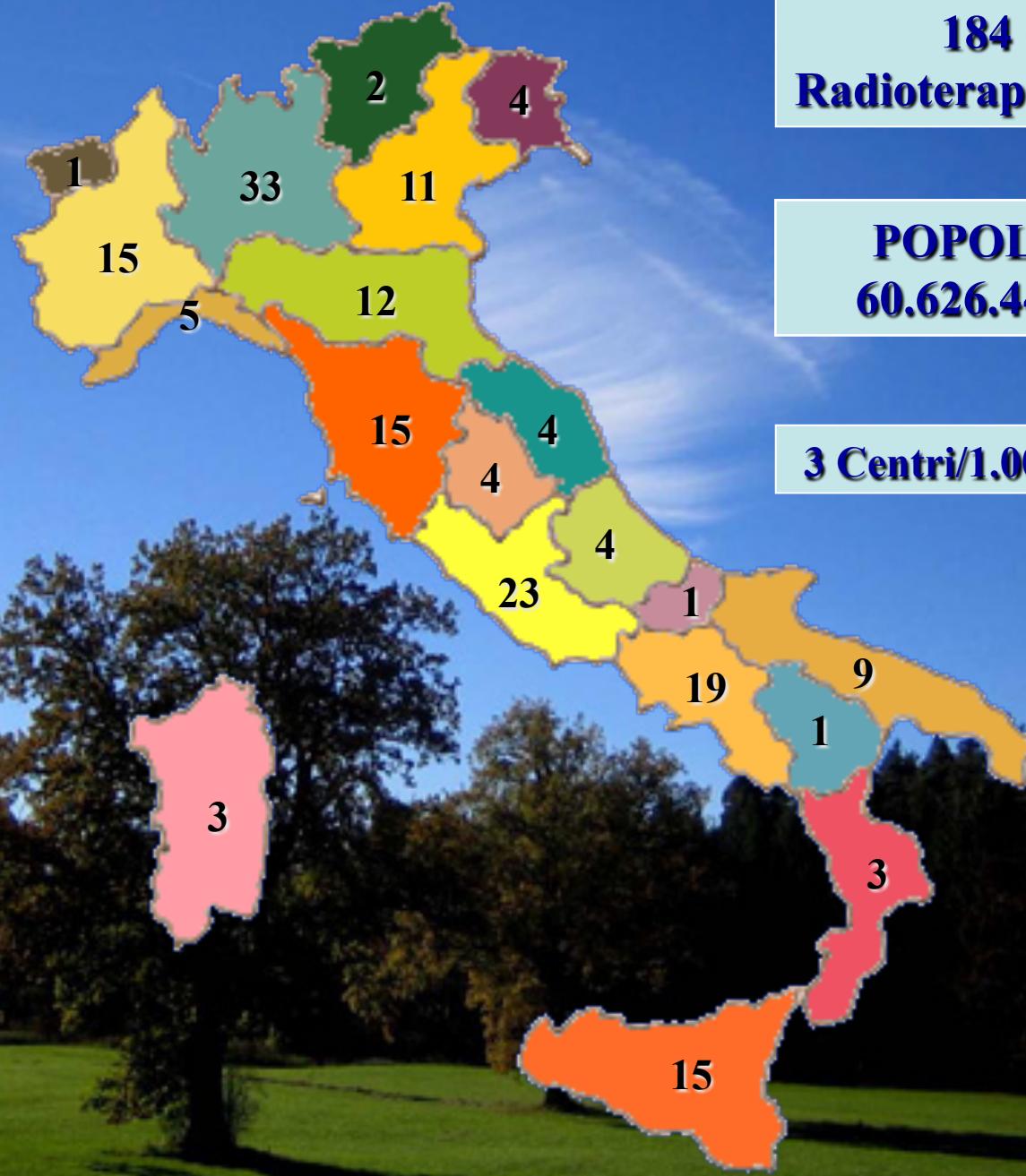
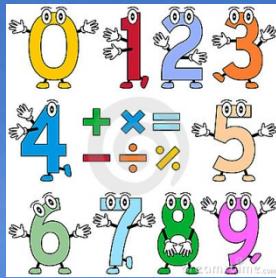
APPROPRIATEZZA

ASSOCIAZIONE ITALIANA DI RADIOTERAPIA ONCOLOGICA

L'APPROPRIATEZZA IN RADIOTERAPIA ONCOLOGICA:
INDICAZIONI E CONSIDERAZIONI
DELL'ASSOCIAZIONE ITALIANA DI RADIOTERAPIA
ONCOLOGICA (AIRO)

Versione 01.2012

- Privilegiare la qualità dei trattamenti effettuati tanto nell' ambito della prescrizione quanto in quello dell' impostazione e dell' esecuzione
- Identificare standard operativi di livello elevato, implementandoli progressivamente e verificandone costantemente l' applicazione
- Realizzare tecniche di irradiazione innovative utilizzando le migliori risorse tecnologiche disponibili



**184 Centri
Radioterapia Oncologica**

**POPOLAZIONE
60.626.442 abitanti**

3 Centri/1.000.000 abitanti



Media Nazionale
3 Centri/1.000.000 abitanti

~3 Centri/1.000.000 abitanti



83 Centri

27.763.261 ab.



51 Centri

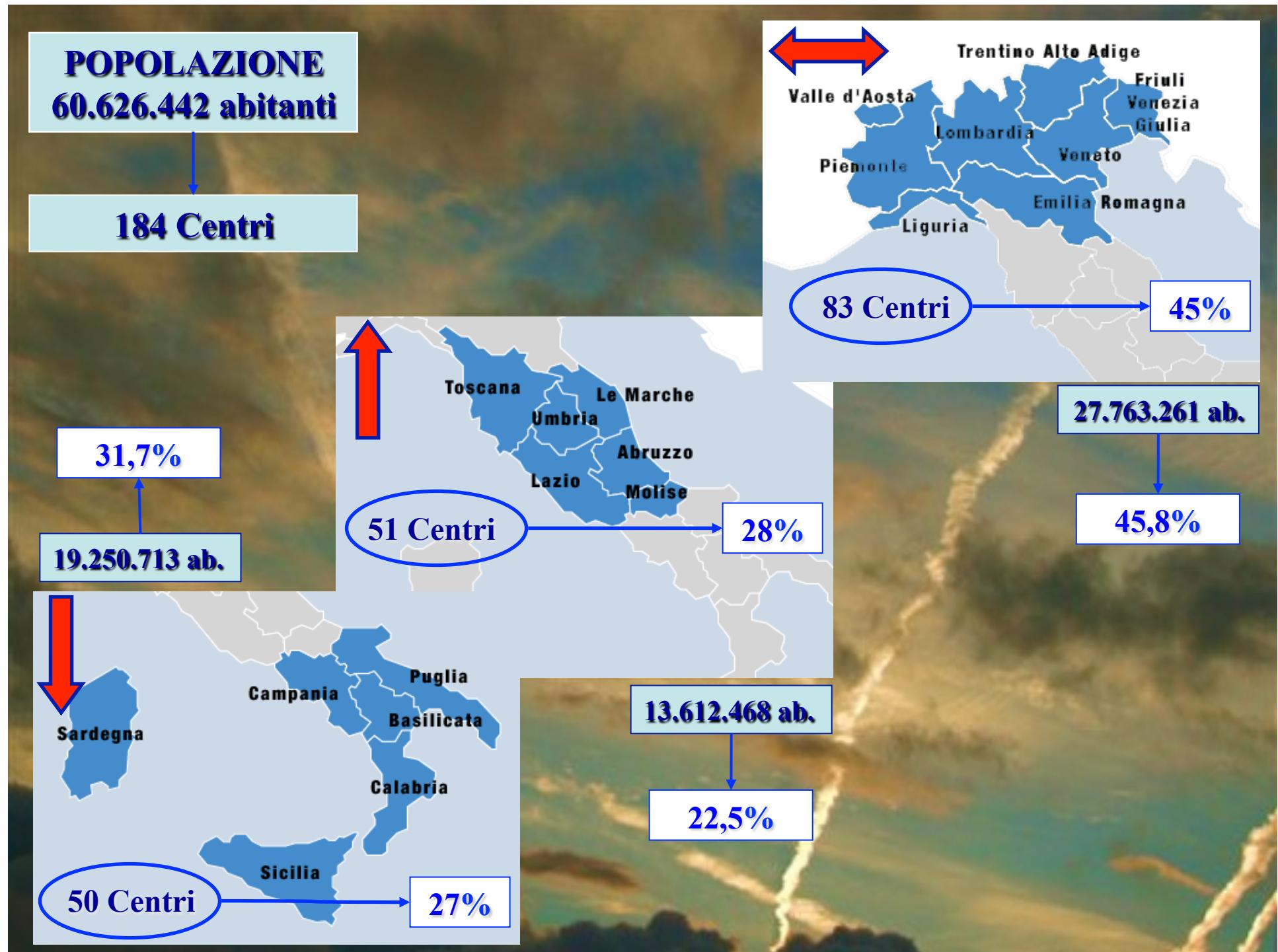
19.250.713 ab.

13.612.468 ab.



50 Centri

2,6 Centri/1.000.000 abitanti



DOTAZIONE TECNOLOGICA

LinAc
361



~ 20%
 \geq 10 anni

~ 60 LinAc
dotati di
sistemi IGRT
*[Treatment Delivery
Review]*

Adroterapia
1



Tomotherapy
21



Cyberknife
8



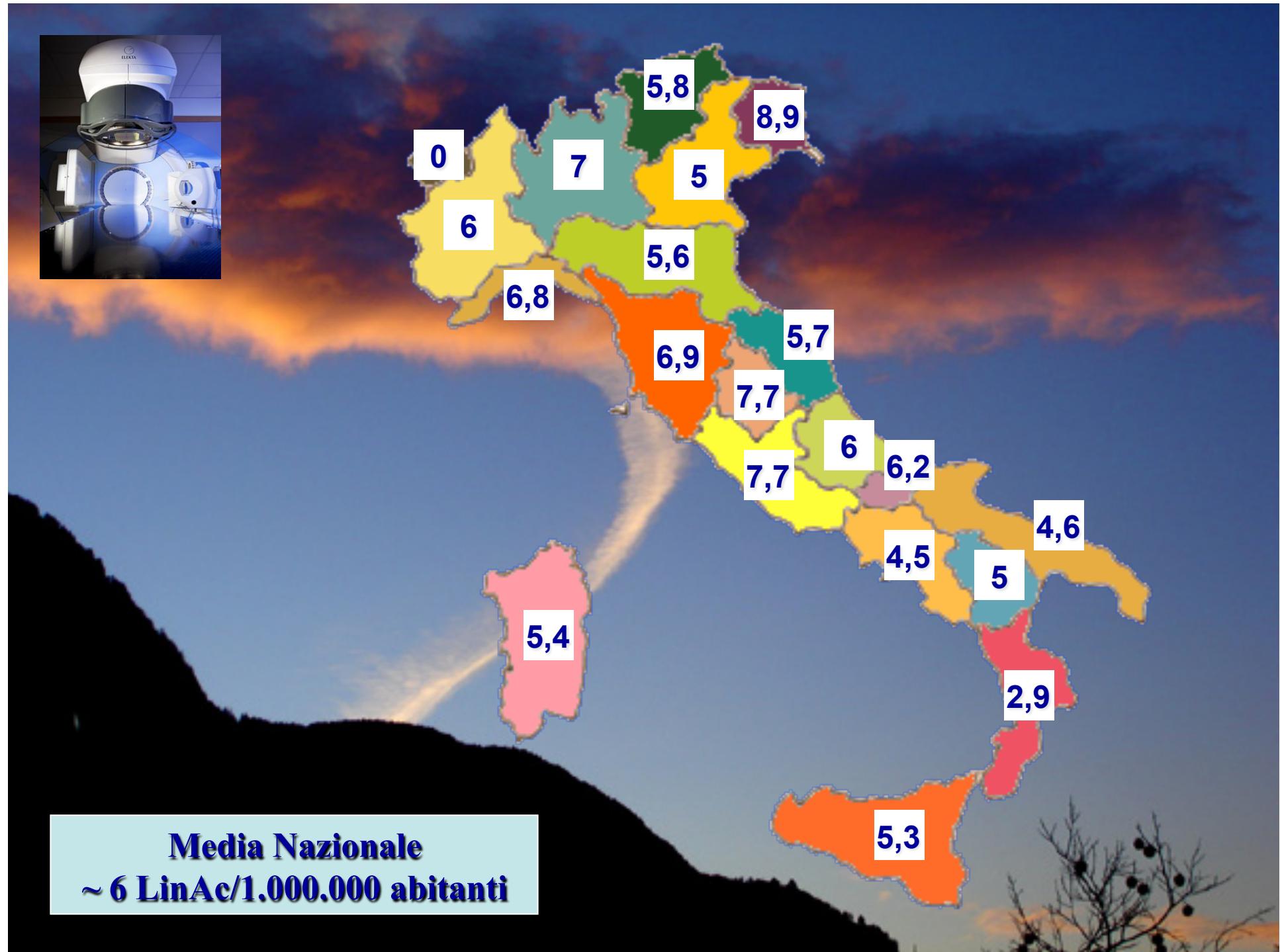
Vero
3



Gamma Knife
6









Radiotherapy capacity in European countries: an analysis of the Directory of Radiotherapy Centres (DIRAC) database

**E. Rosenblatt, Y. Anacak, Y. Pvinda,
P. Scalliet, M. Boniol, P. Autier**

Lancet Oncol Vol 14, Issue 2, Feb 2013



| | Total population ¹⁰ | Number of radiotherapy centres | Number of megavoltage teletherapy machines | Mean number of megavoltage teletherapy machines per centre | Megavoltage teletherapy machines per million people | Number of linear accelerators | Number of cobalt-60 megavoltage teletherapy machines |
|----------------|--------------------------------|--------------------------------|--|--|---|-------------------------------|--|
| Austria | 8 443 018 | 16 | 43 | 2.7 | 5.1 | 42 | 1 |
| Belgium | 11 041 266 | 36 | 96 | 2.7 | 8.7 | 92 | 4 |
| Bulgaria | 7 327 224 | 13 | 15 | 1.2 | 2.0 | 5 | 10 |
| Croatia | 4 412 137 | 7 | 18 | 2.6 | 4.1 | 16 | 2 |
| Cyprus | 862 011 | 1 | 3 | 3.0 | 3.5 | 3 | 0 |
| Czech Republic | 10 504 203 | 34 | 59 | 1.7 | 5.6 | 45 | 14 |
| Denmark | 5 580 516 | 10 | 54 | 5.4 | 9.7 | 53 | 1 |
| Estonia | 1 339 662 | 2 | 4 | 2.0 | 3.0 | 4 | 0 |
| Finland | 5 401 267 | 13 | 45 | 3.5 | 8.3 | 45 | 0 |
| France | 65 397 912 | 177 | 426 | 2.4 | 6.5 | 416 | 10 |
| Germany | 81 843 809 | 289 | 529 | 1.8 | 6.5 | 508 | 21 |
| Greece | 11 290 785 | 27 | 48 | 1.8 | 4.3 | 37 | 11 |
| Hungary | 9 962 000 | 13 | 38 | 2.9 | 3.8 | 27 | 11 |
| Iceland | 319 575 | 1 | 2 | 2.0 | 6.2 | 2 | 0 |
| Ireland | 4 495 351 | 10 | 26 | 2.6 | 5.8 | 25 | 1 |
| Italy | 60 850 782 | 172 | 396 | 2.3 | 6.5 | 381 | 15 |
| Latvia | 2 042 371 | 4 | 11 | 2.8 | 5.4 | 9 | 2 |
| Lithuania | 3 199 771 | 5 | 11 | 2.2 | 3.4 | 9 | 2 |
| Luxembourg | 524 853 | 1 | 3 | 3.0 | 5.7 | 3 | 0 |
| Macedonia | 2 059 794 | 1 | 3 | 3.0 | 1.5 | 2 | 1 |
| Malta | 420 085 | 1 | 2 | 2.0 | 4.8 | 1 | 1 |
| Norway | 4 985 870 | 10 | 38 | 3.8 | 7.6 | 37 | 1 |
| Poland | 38 208 618 | 29 | 107 | 3.7 | 2.8 | 101 | 6 |
| Portugal | 10 541 840 | 21 | 48 | 2.3 | 4.6 | 46 | 2 |
| Romania | 21 355 849 | 19 | 28 | 1.5 | 1.3 | 12 | 16 |
| Slovakia | 5 404 322 | 14 | 26 | 1.9 | 4.8 | 16 | 10 |
| Slovenia | 2 055 496 | 1 | 7 | 7.0 | 3.4 | 6 | 1 |
| Spain | 46 196 277 | 117 | 250 | 2.1 | 5.4 | 216 | 34 |
| Sweden | 9 482 855 | 19 | 78 | 4.1 | 8.2 | 78 | 0 |
| Switzerland | 7 952 555 | 30 | 75 | 2.5 | 9.4 | 70 | 5 |
| Netherlands | 16 730 348 | 22 | 127 | 5.8 | 7.6 | 127 | 0 |
| Turkey | 74 724 269 | 95 | 201 | 2.1 | 2.7 | 143 | 58 |
| United Kingdom | 62 435 709 | 76 | 340 | 4.5 | 5.4 | 335 | 5 |
| Total | 597 392 400 | 1286 | 3157 | 2.5 | 5.3 | 2912 | 245 |

Table 1: Teletherapy centres and equipment in 33 European countries (July, 2012)

Media Nazionale
~ 6 LinAc/1.000.000 abitanti

6,3 LinAc/1.000.000 abitanti

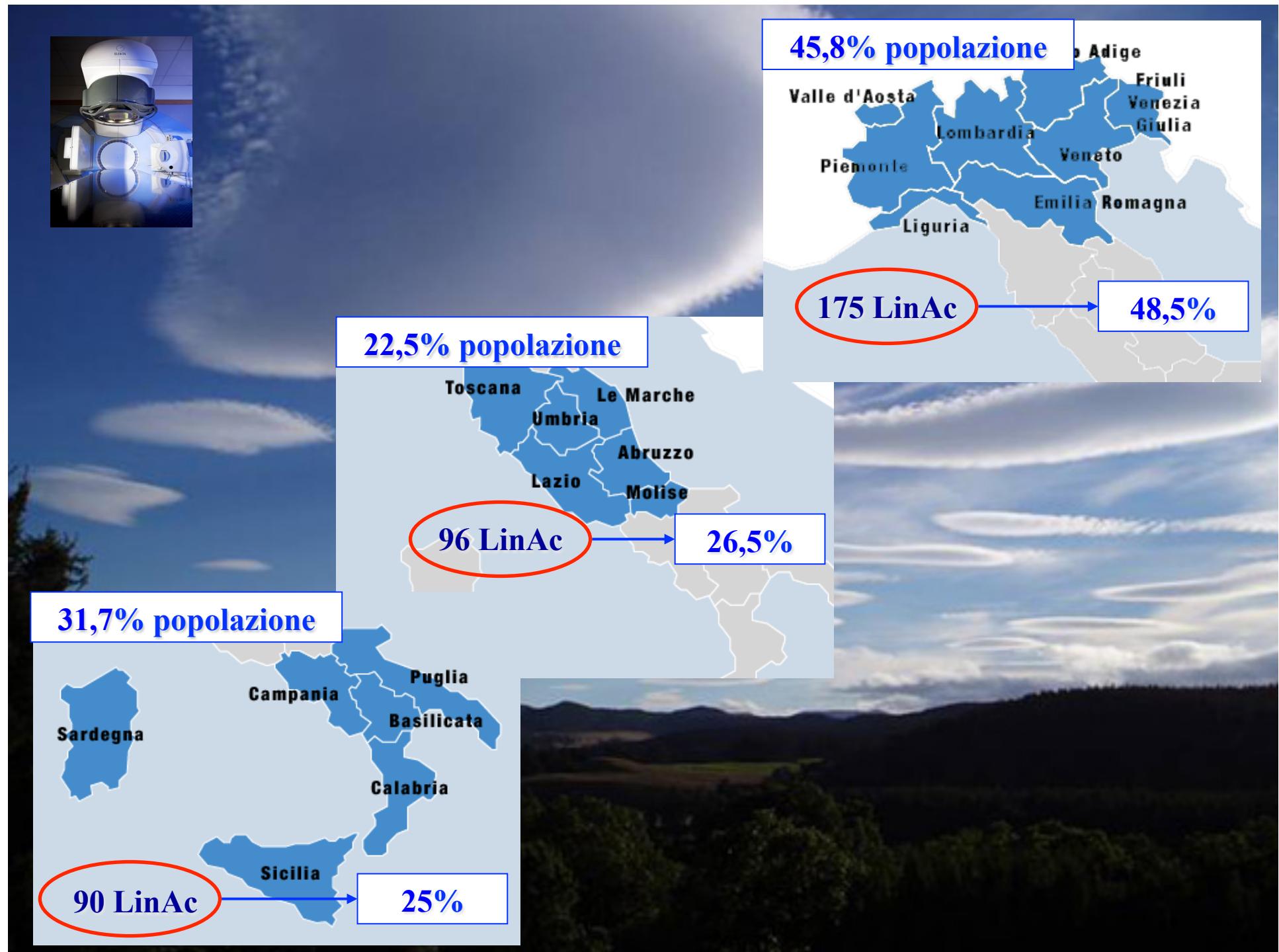


7 LinAc/1.000.000 abitanti



4,7 LinAc/1.000.000 abitanti







| Popolazione | Centri | LinAc |
|-------------|--------|---|
| 45,8% | 45% | 48,5%  |



| Popolazione | Centri | LinAc |
|-------------|---|---|
| 22,5% | 28%  | 26,5%  |



| Popolazione | Centri | LinAc |
|-------------|---|---|
| 31,7% | 27%  | 25%  |





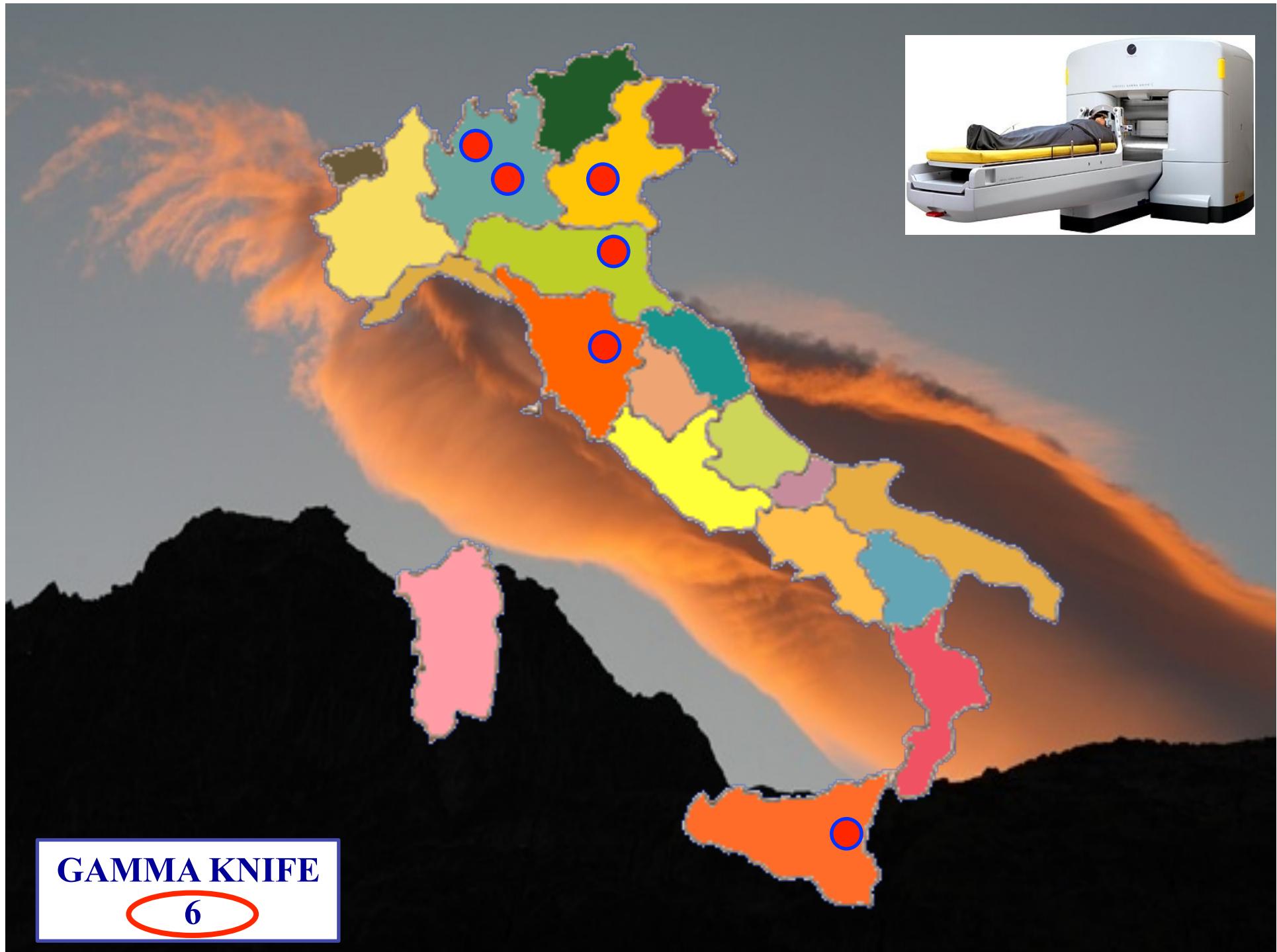
TOMOTHERAPY

21



CYBERKNIFE

10



GAMMA KNIFE

6



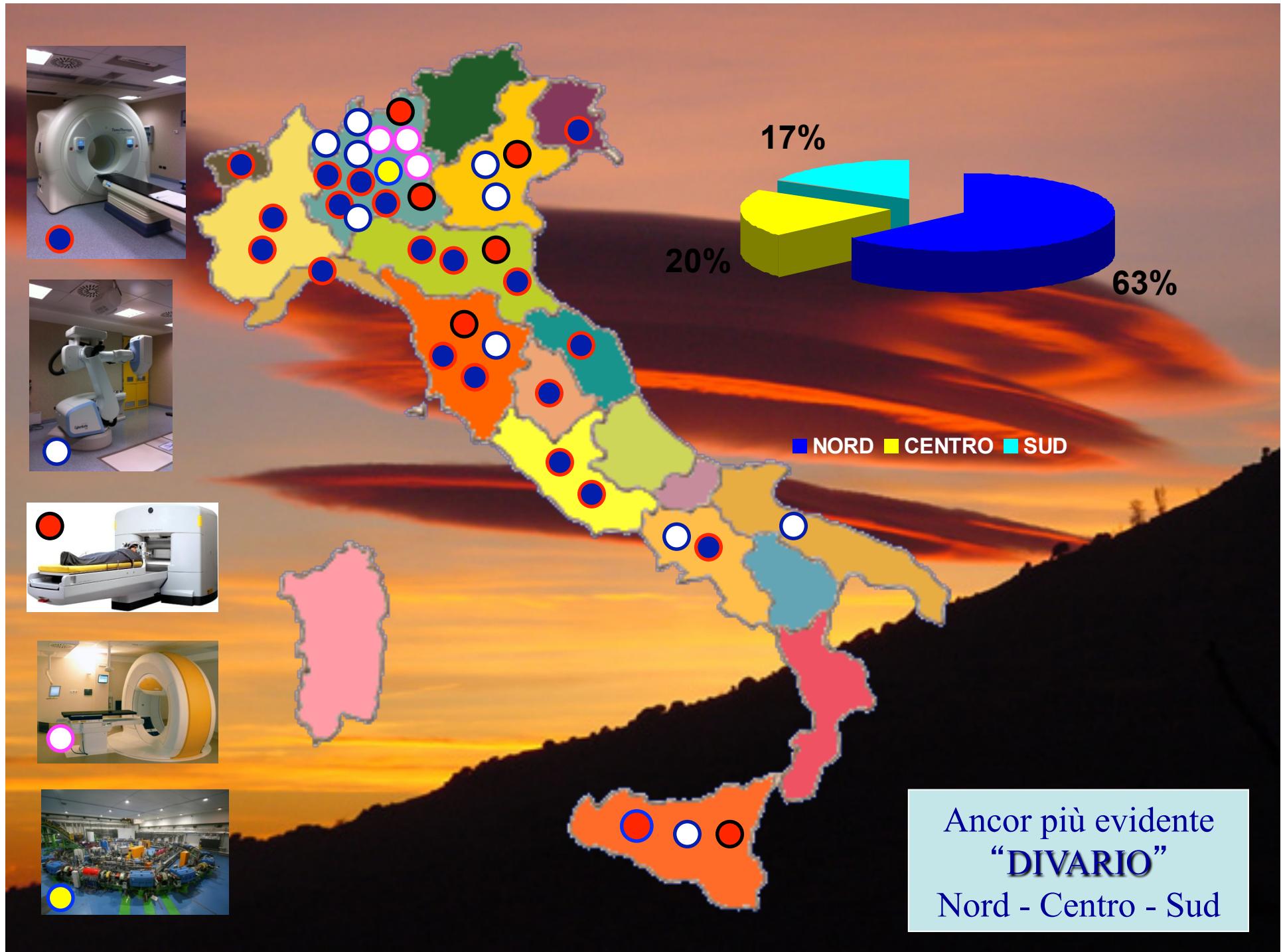
VERO

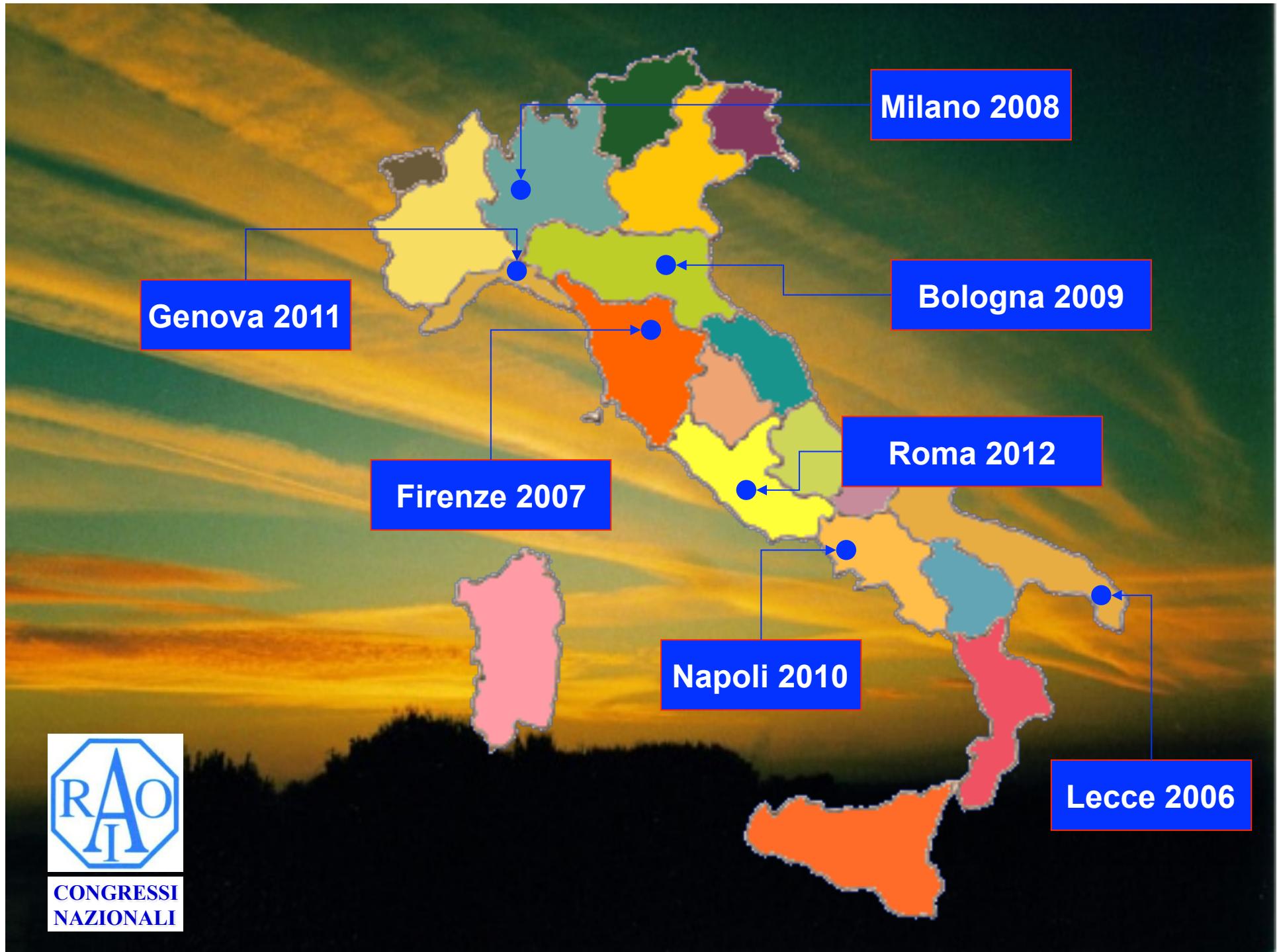
3



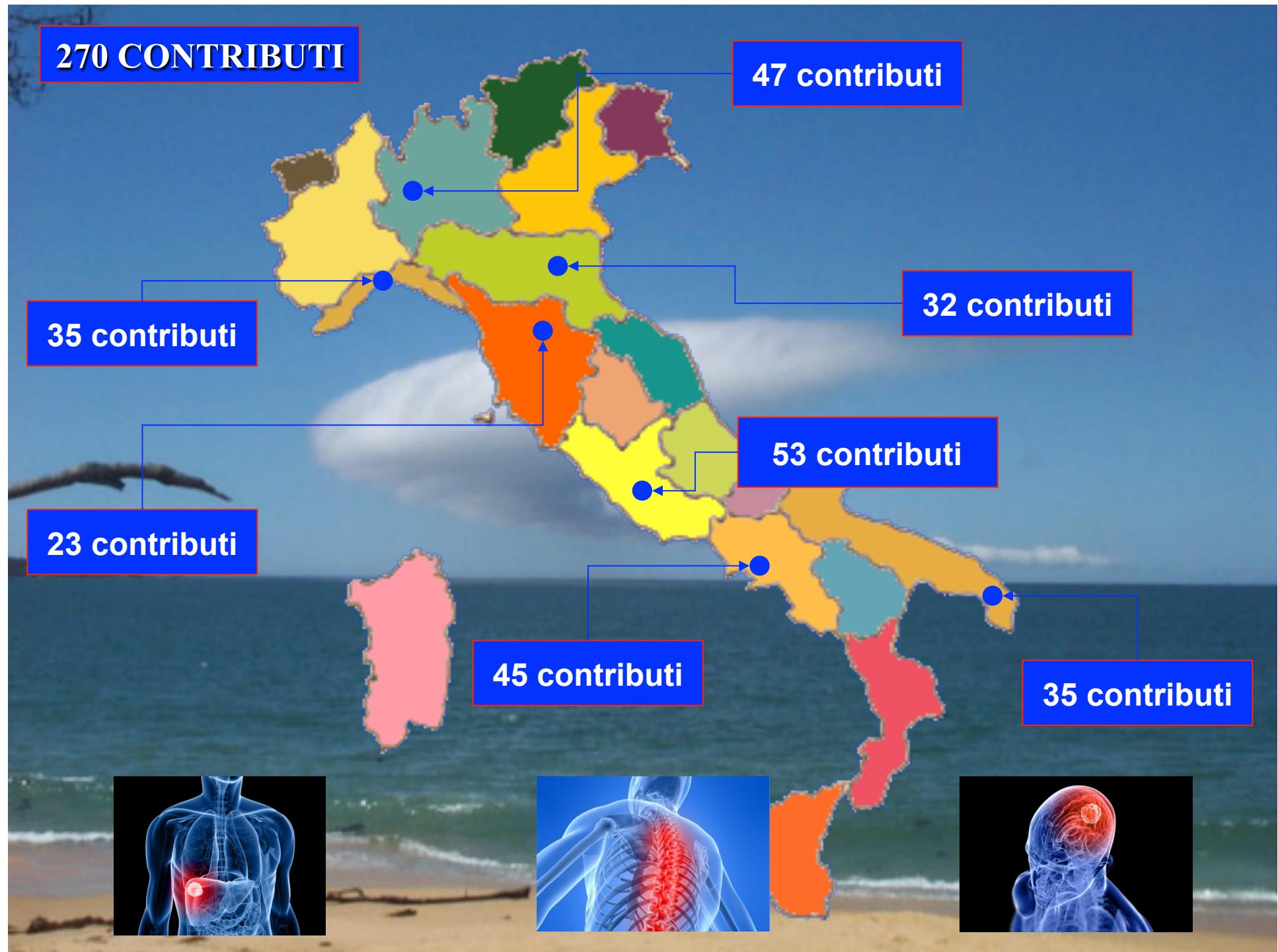
ADROTERAPIA

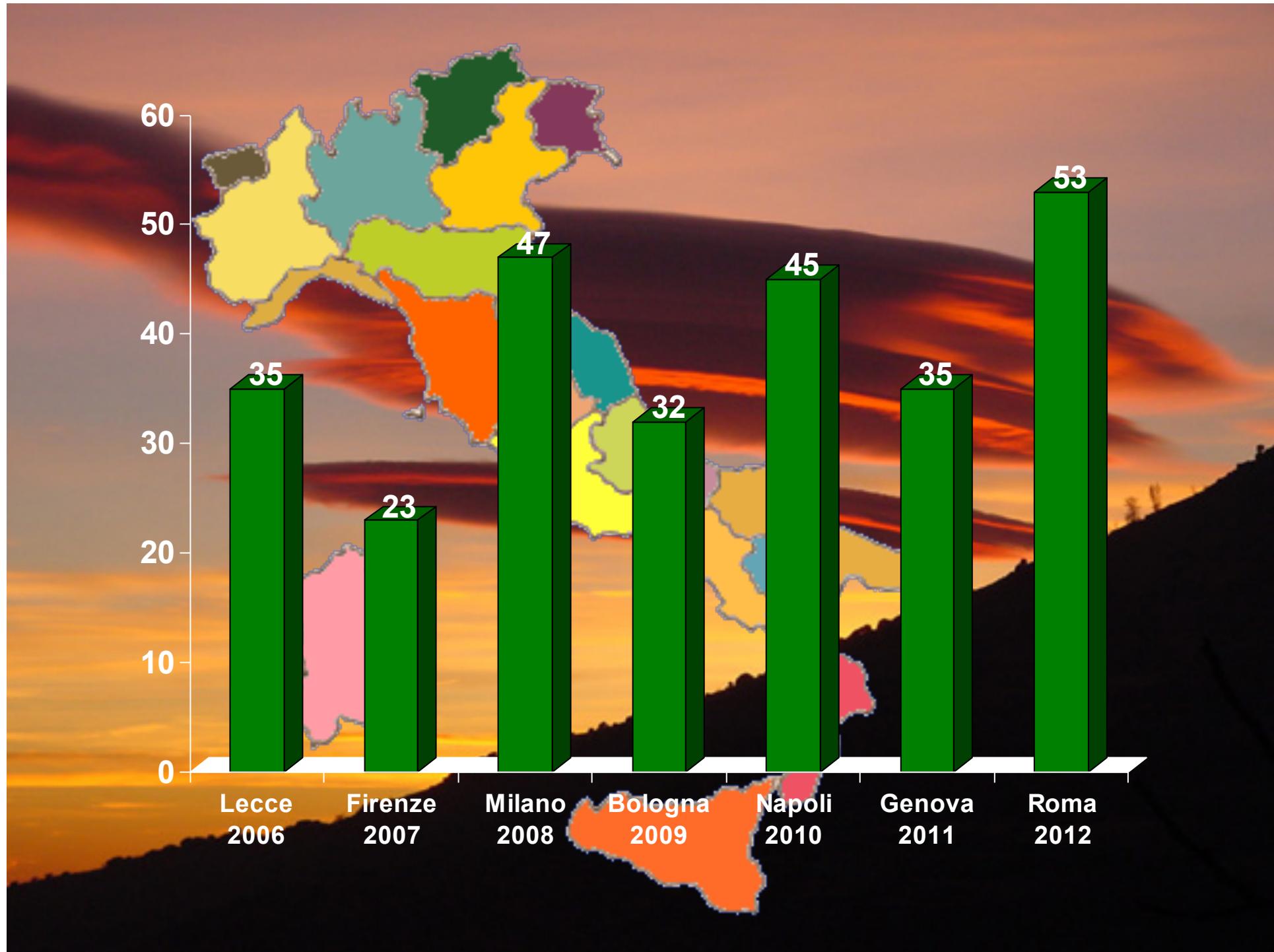
1

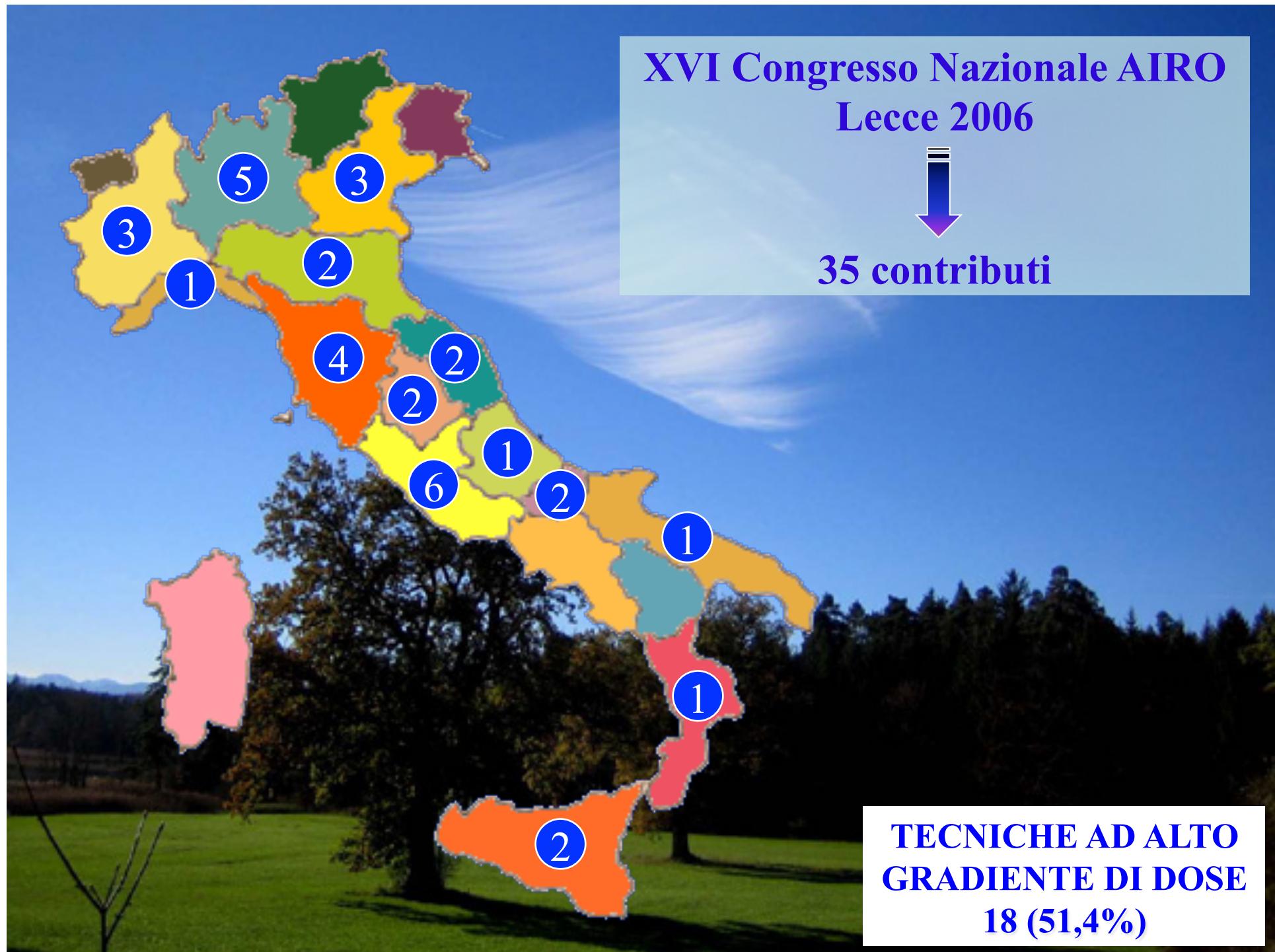




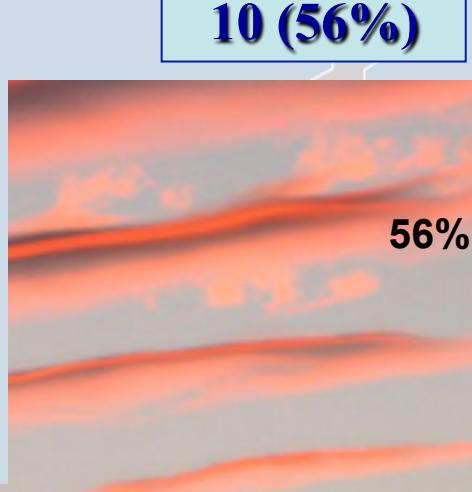
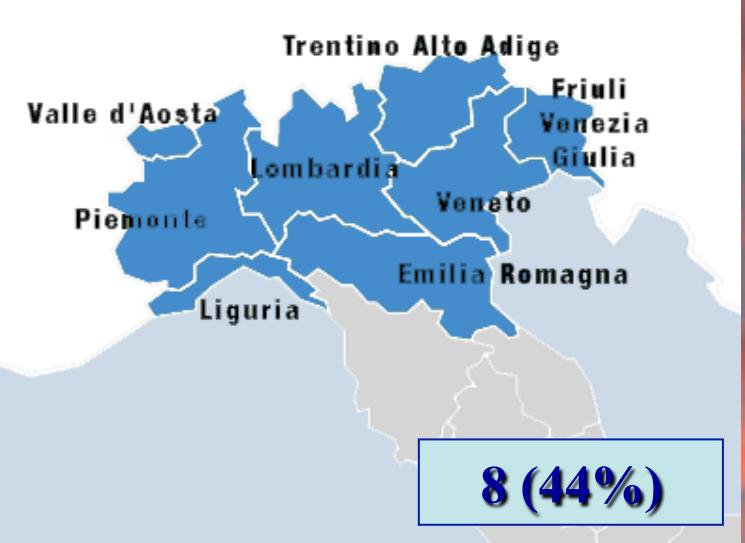
CONGRESSI
NAZIONALI

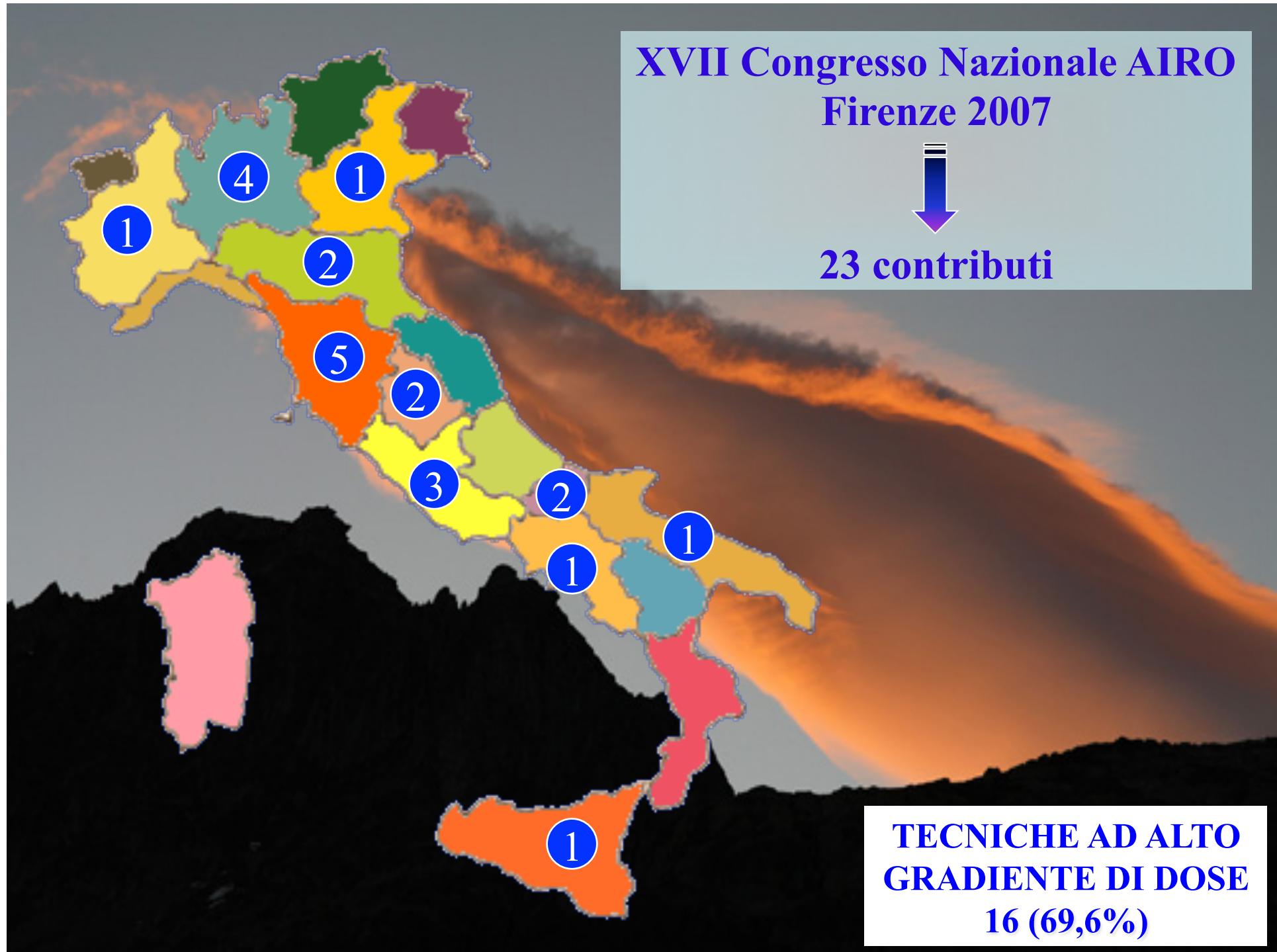






TECNICHE AD ALTO GRADIENTE DI DOSE **18 (51,4%)**

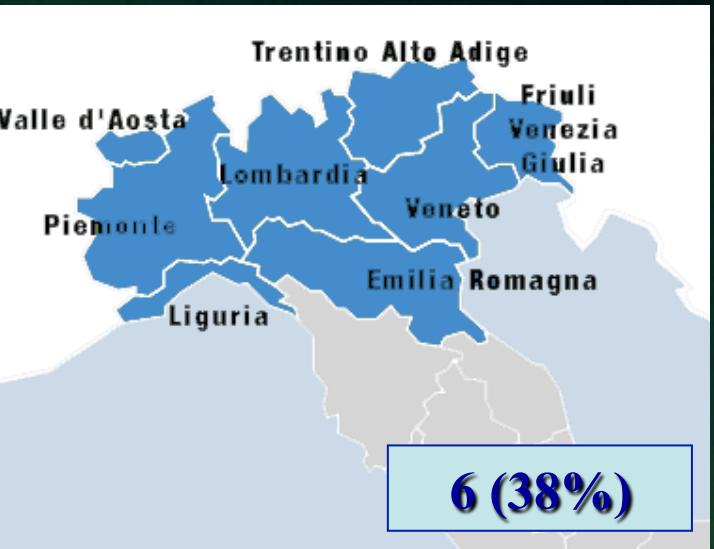




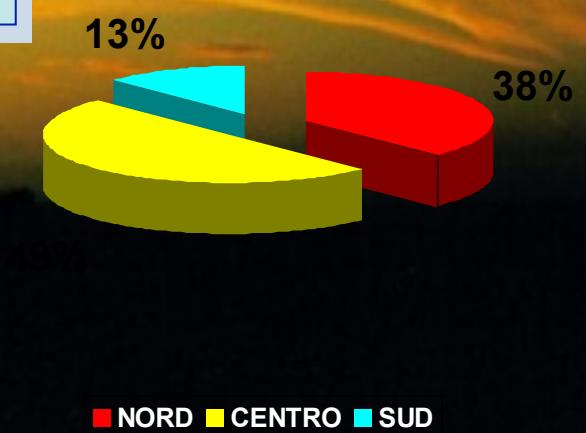
TECNICHE AD ALTO GRADIENTE DI DOSE 16 (69,6%)

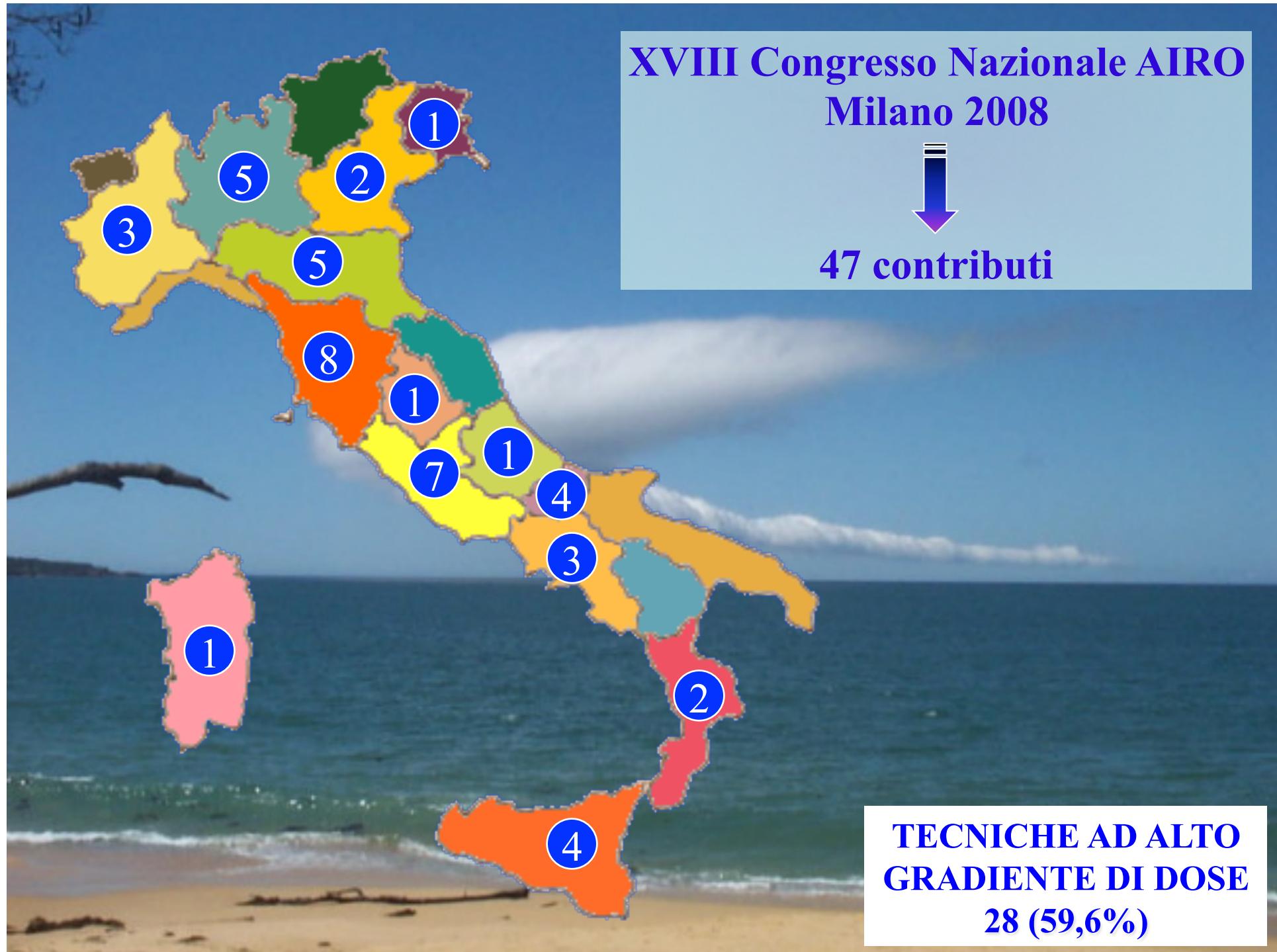


2 (13%)



6 (38%)

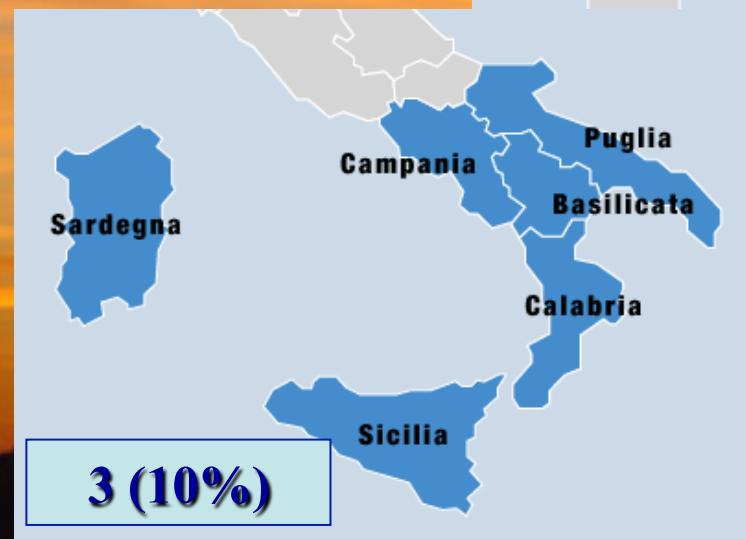




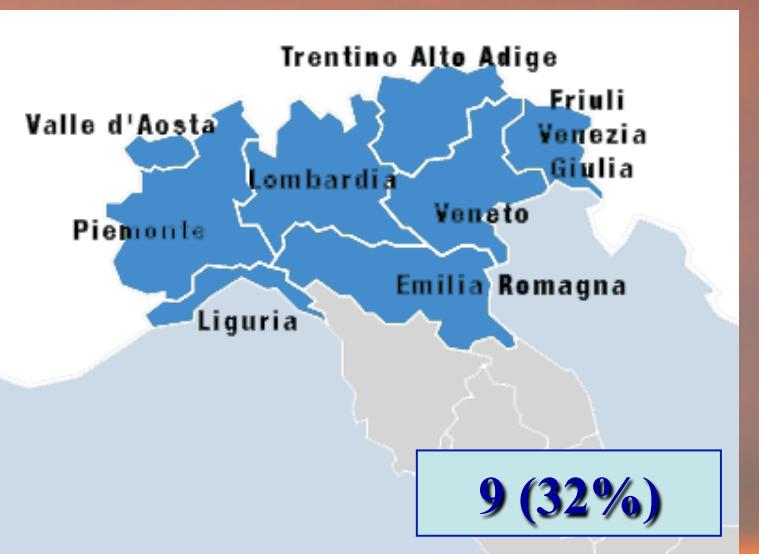
TECNICHE AD ALTO GRADIENTE DI DOSE **28 (59,6%)**



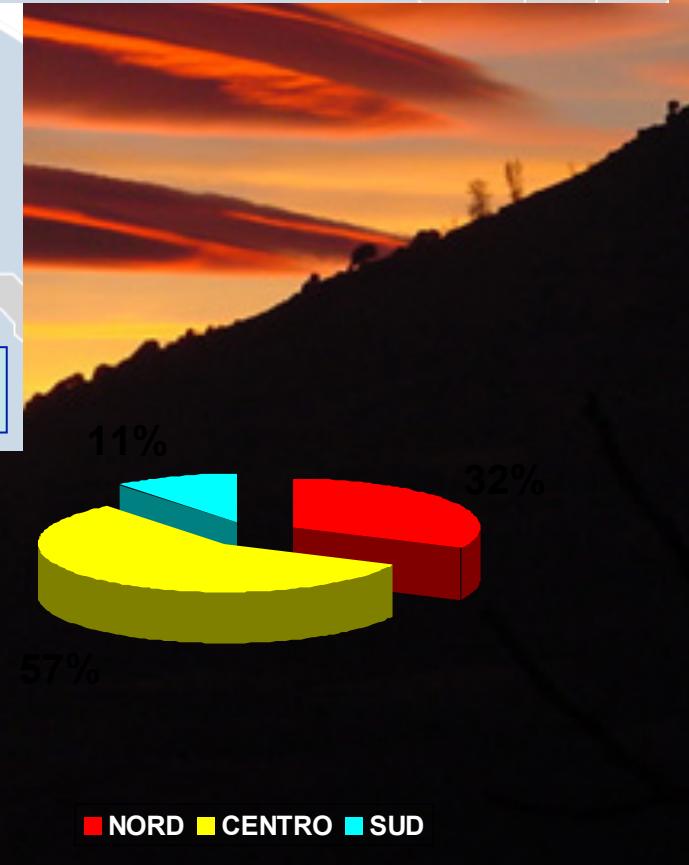
16 (57%)



3 (10%)

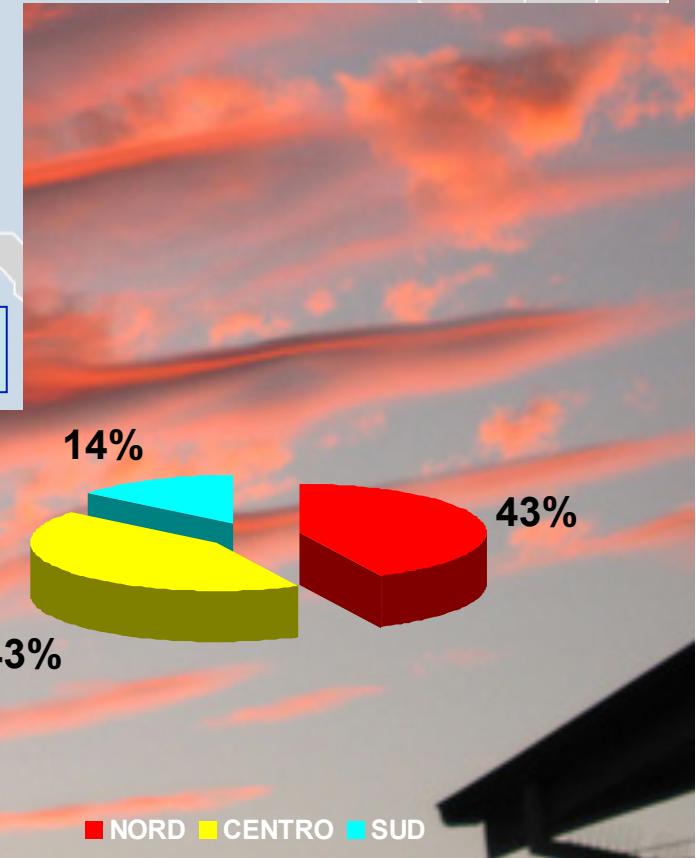
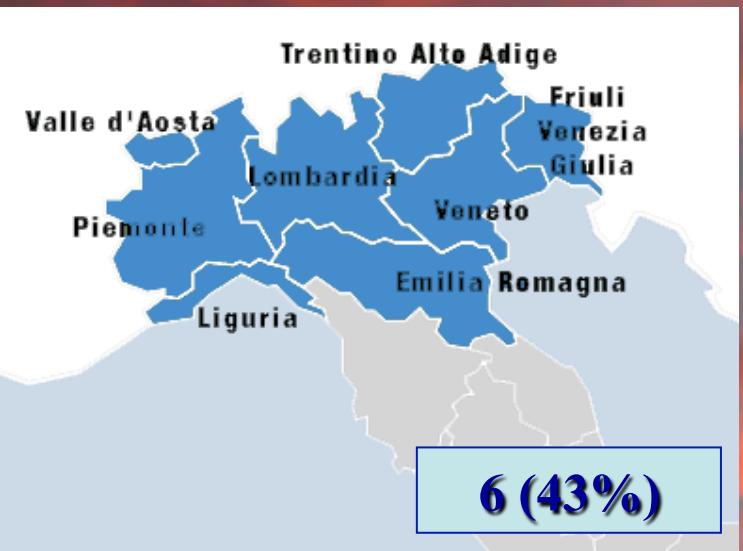
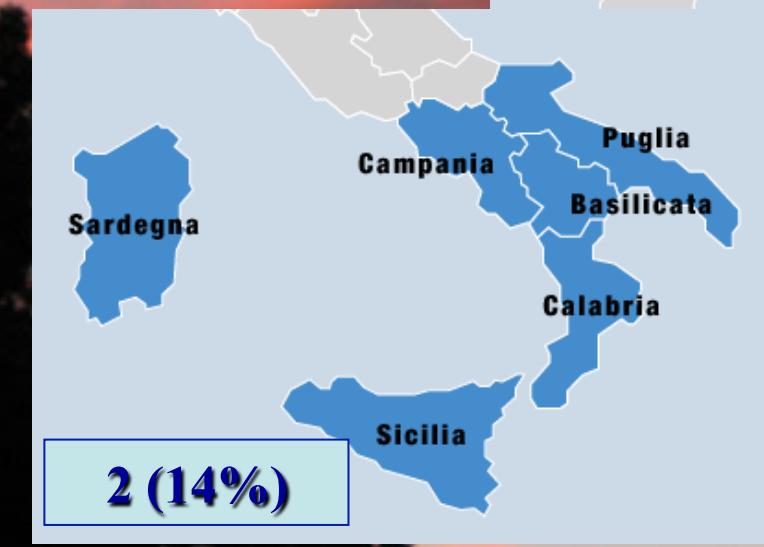


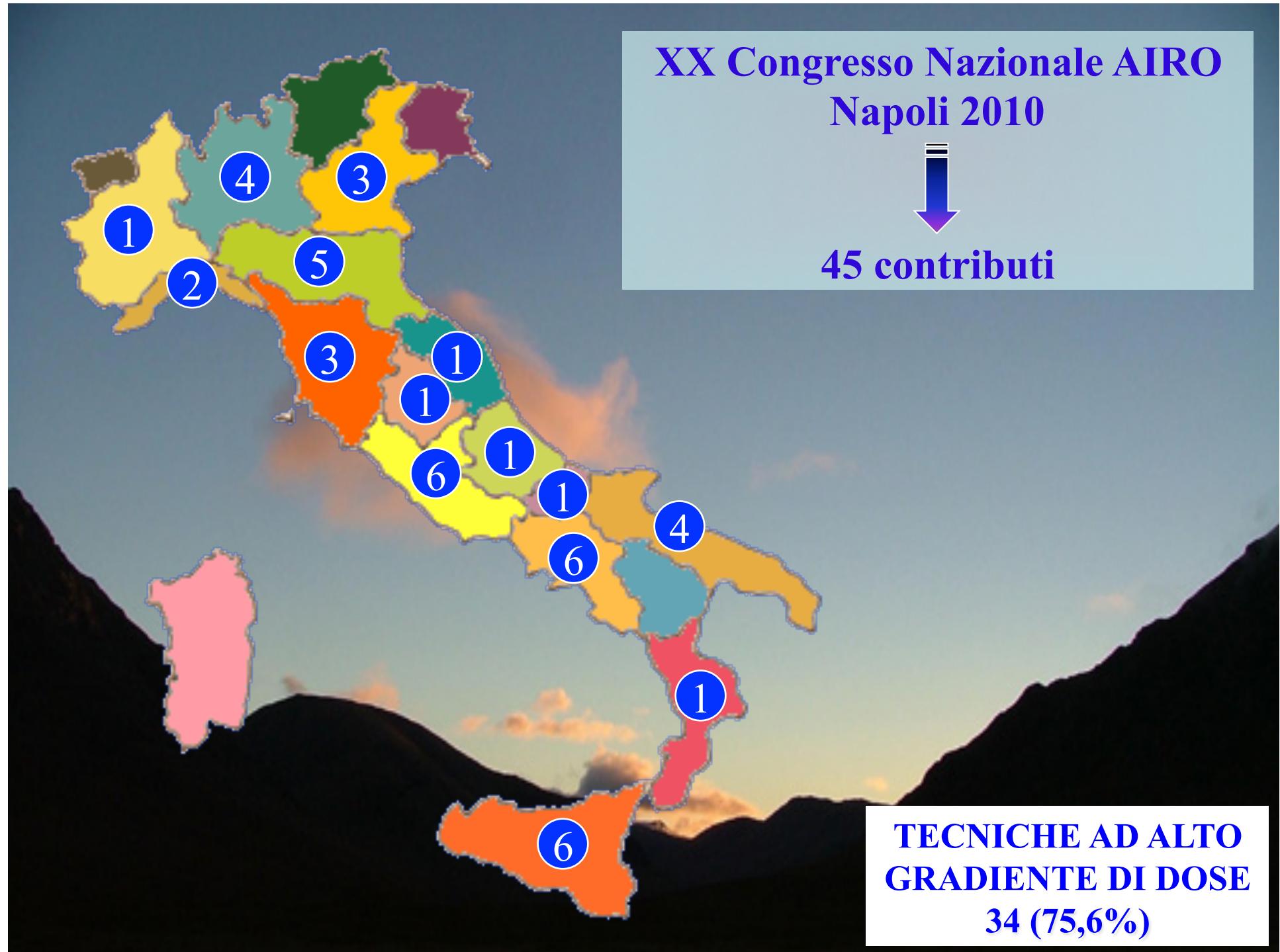
9 (32%)





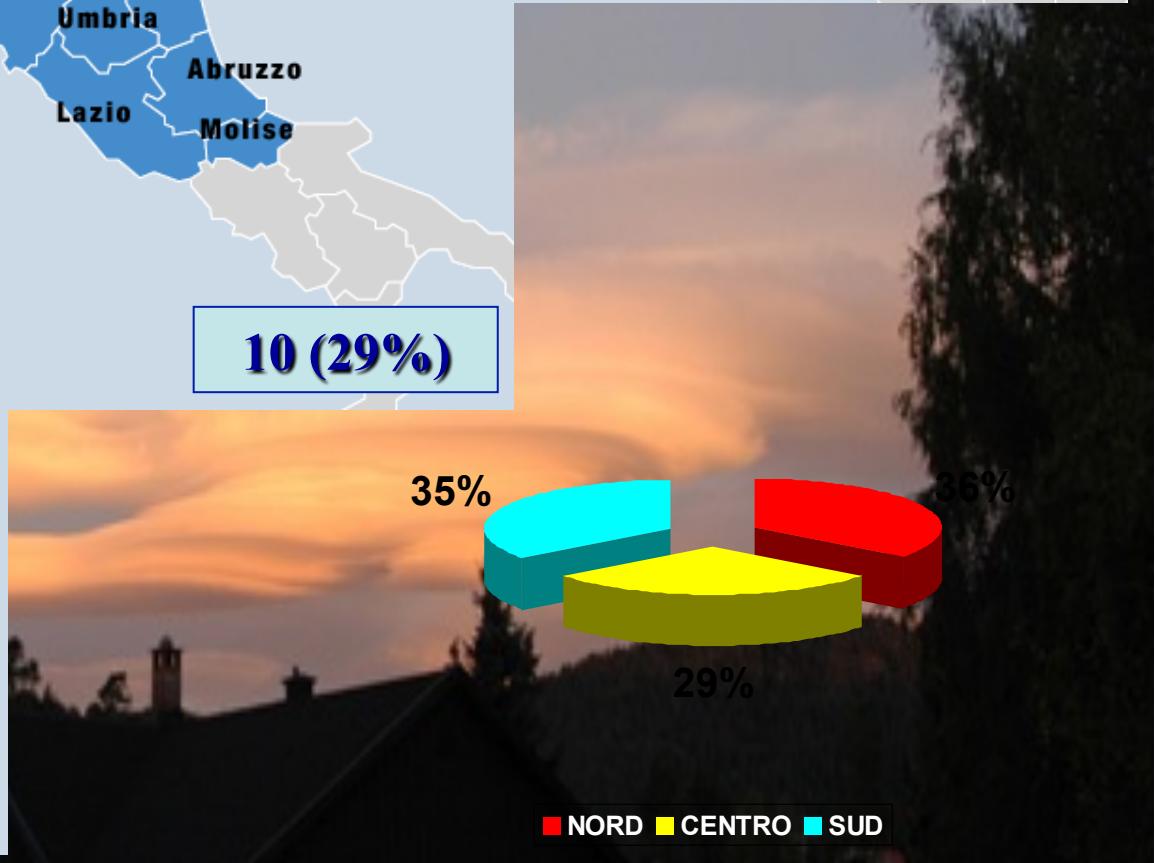
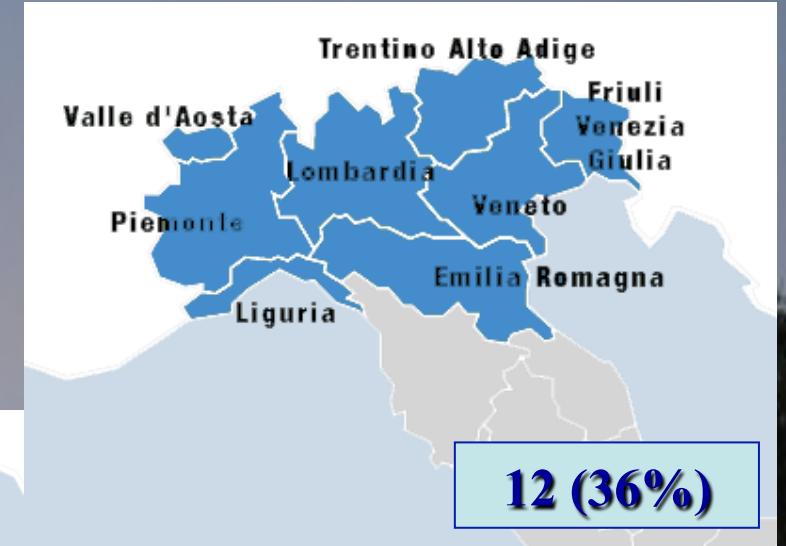
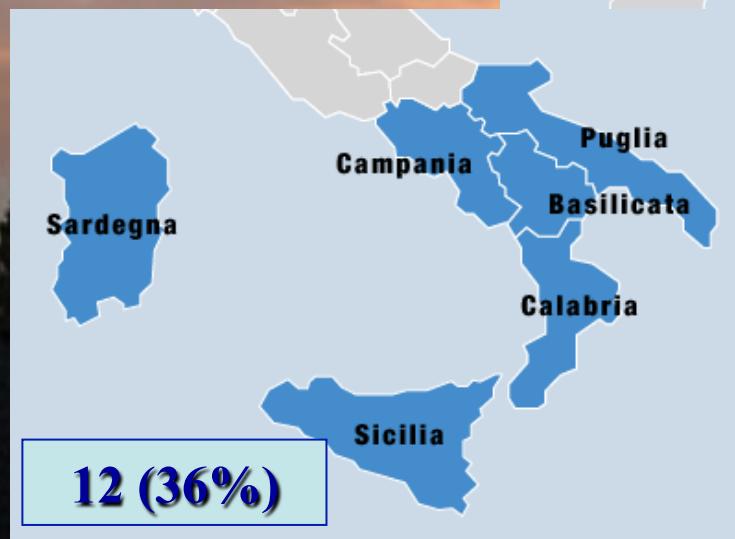
TECNICHE AD ALTO GRADIENTE DI DOSE 14 (43,8%)

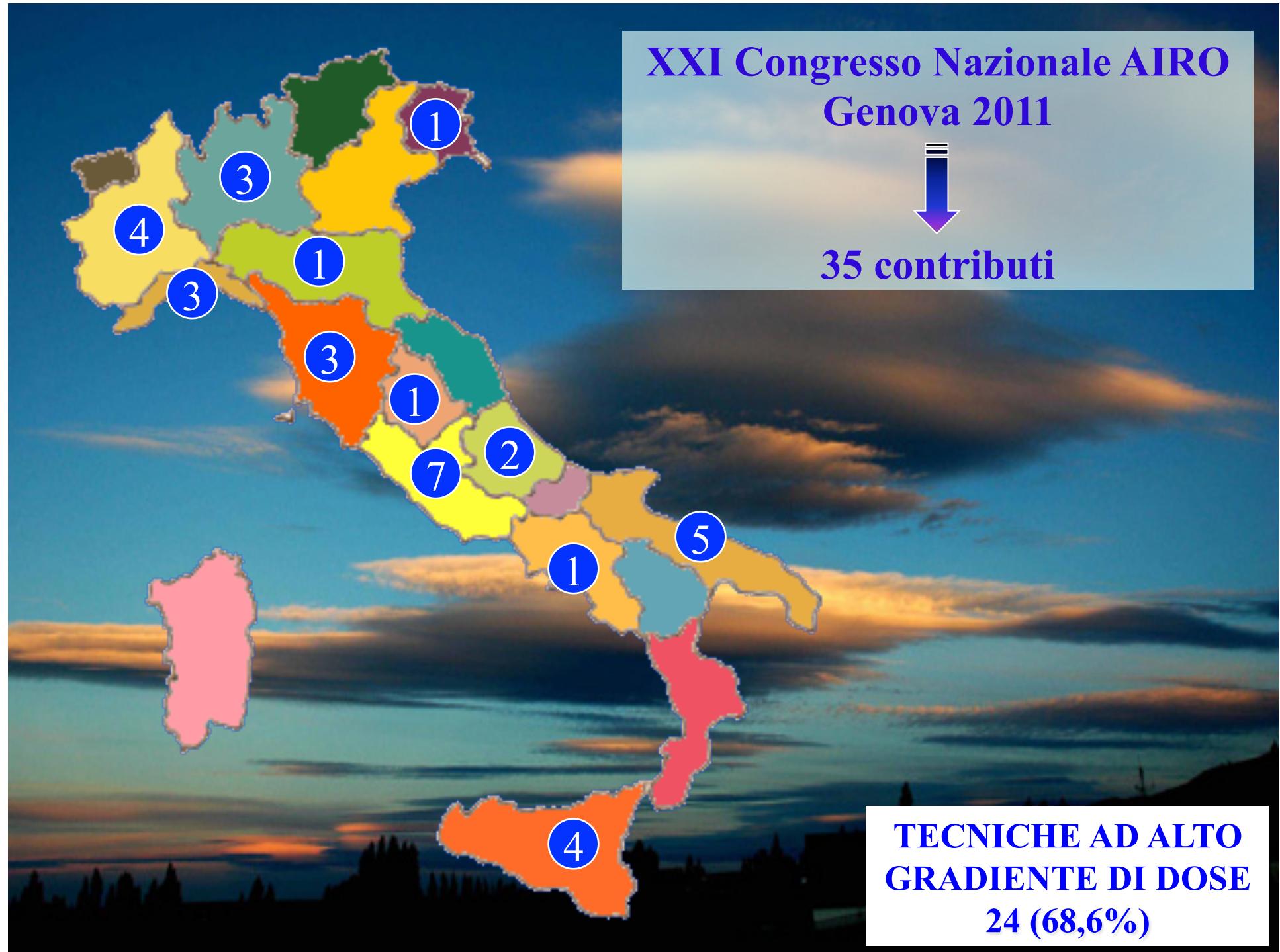




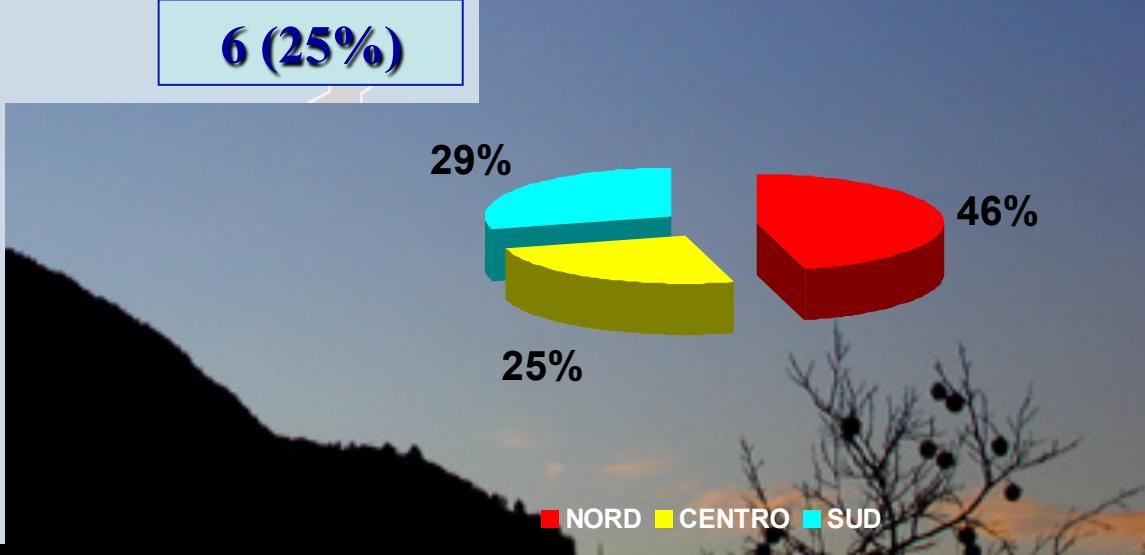
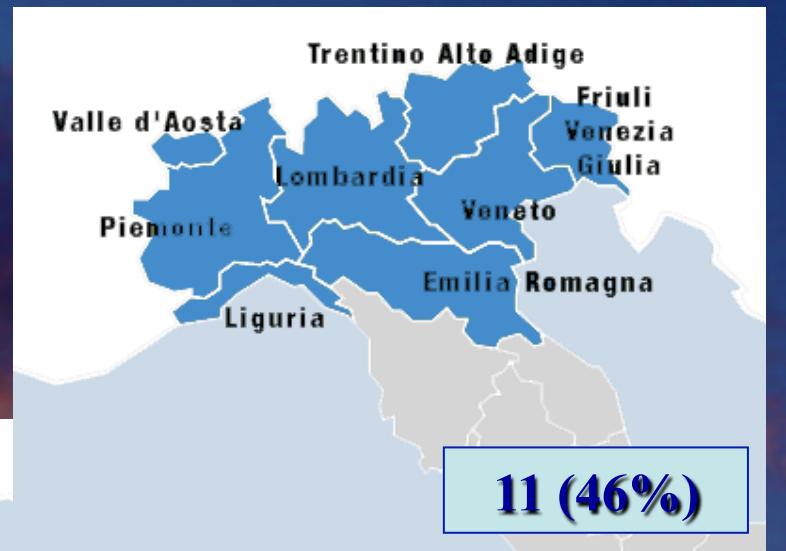
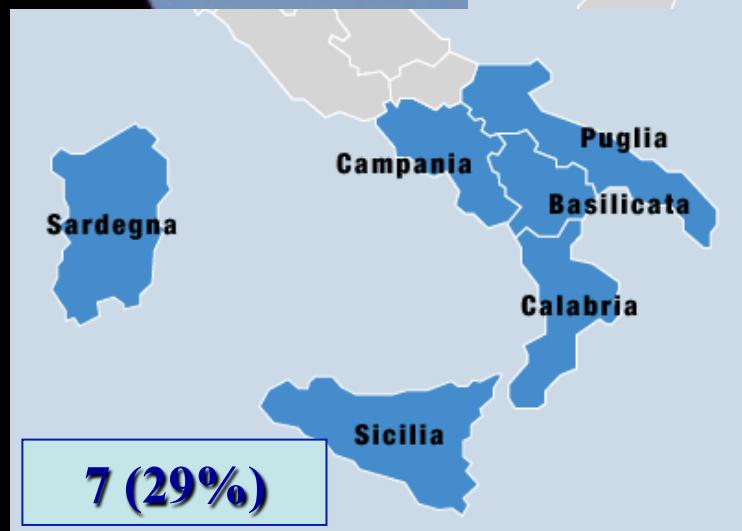
TECNICHE AD ALTO GRADIENTE DI DOSE

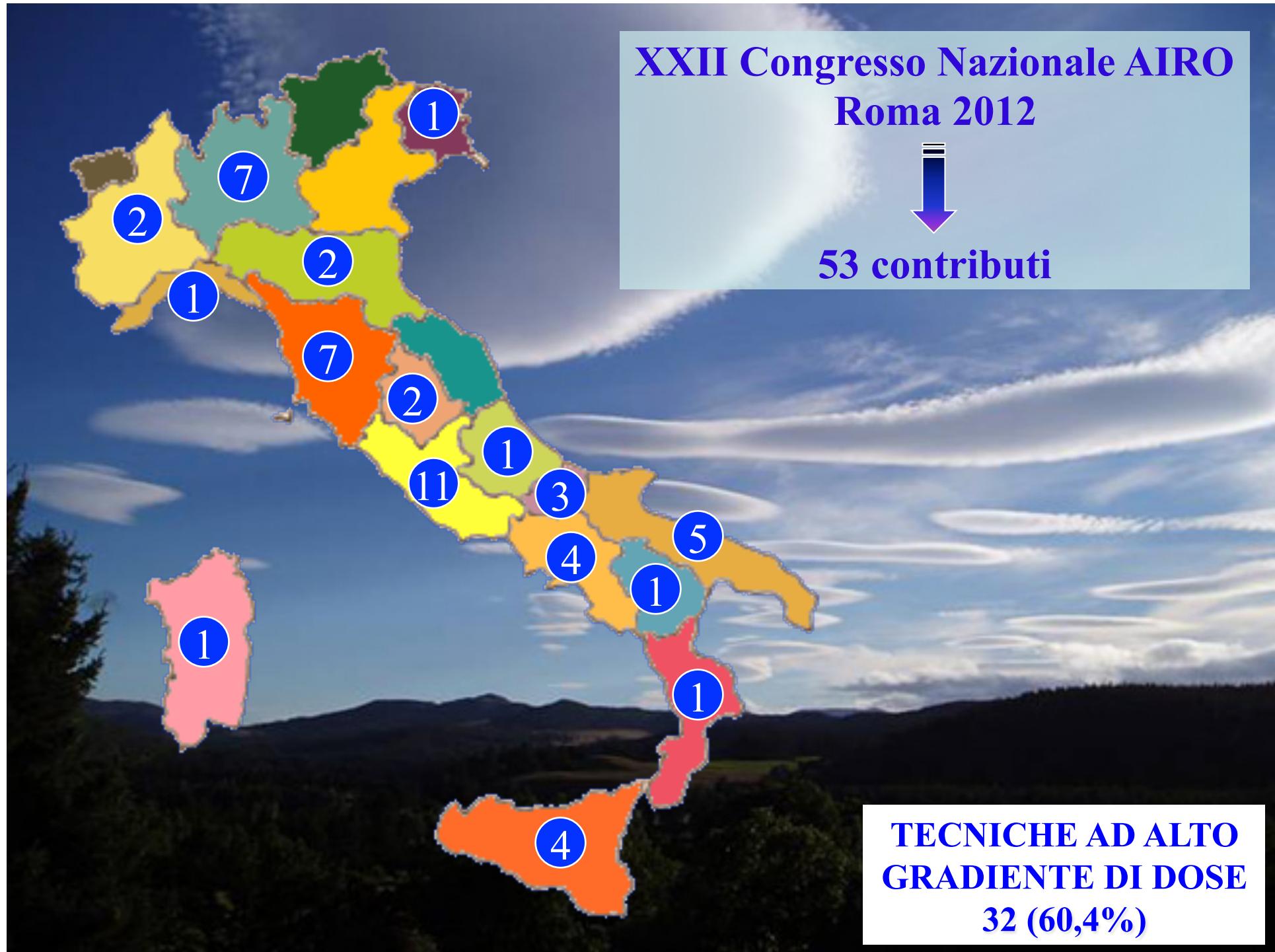
34 (75,6%)



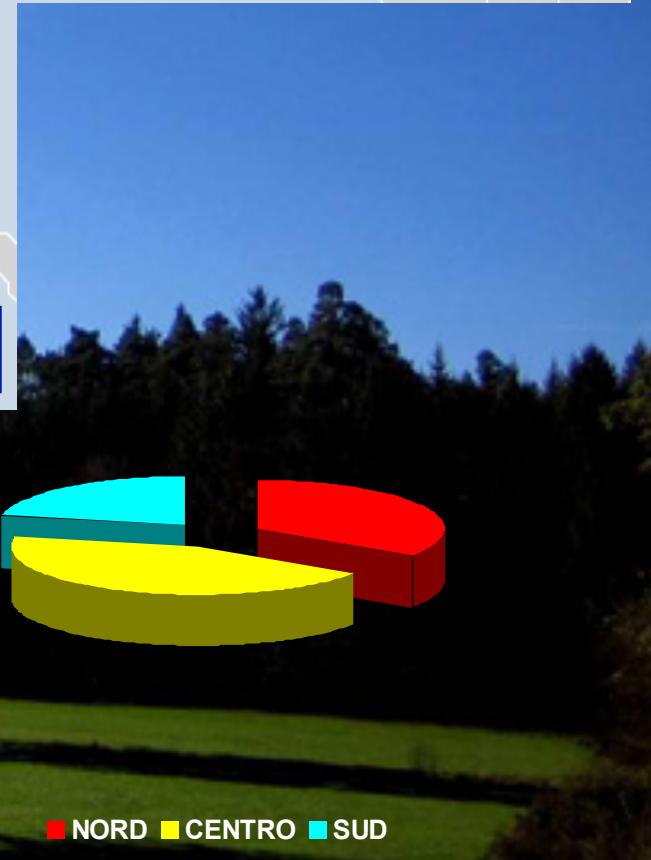
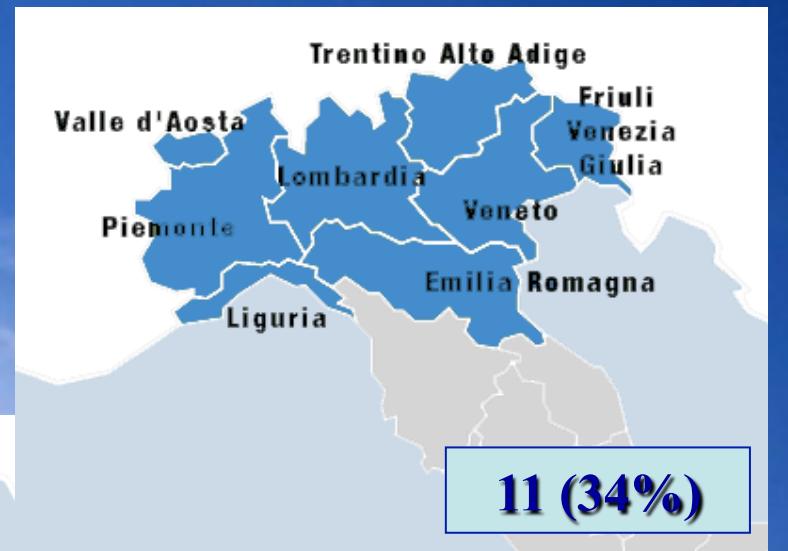
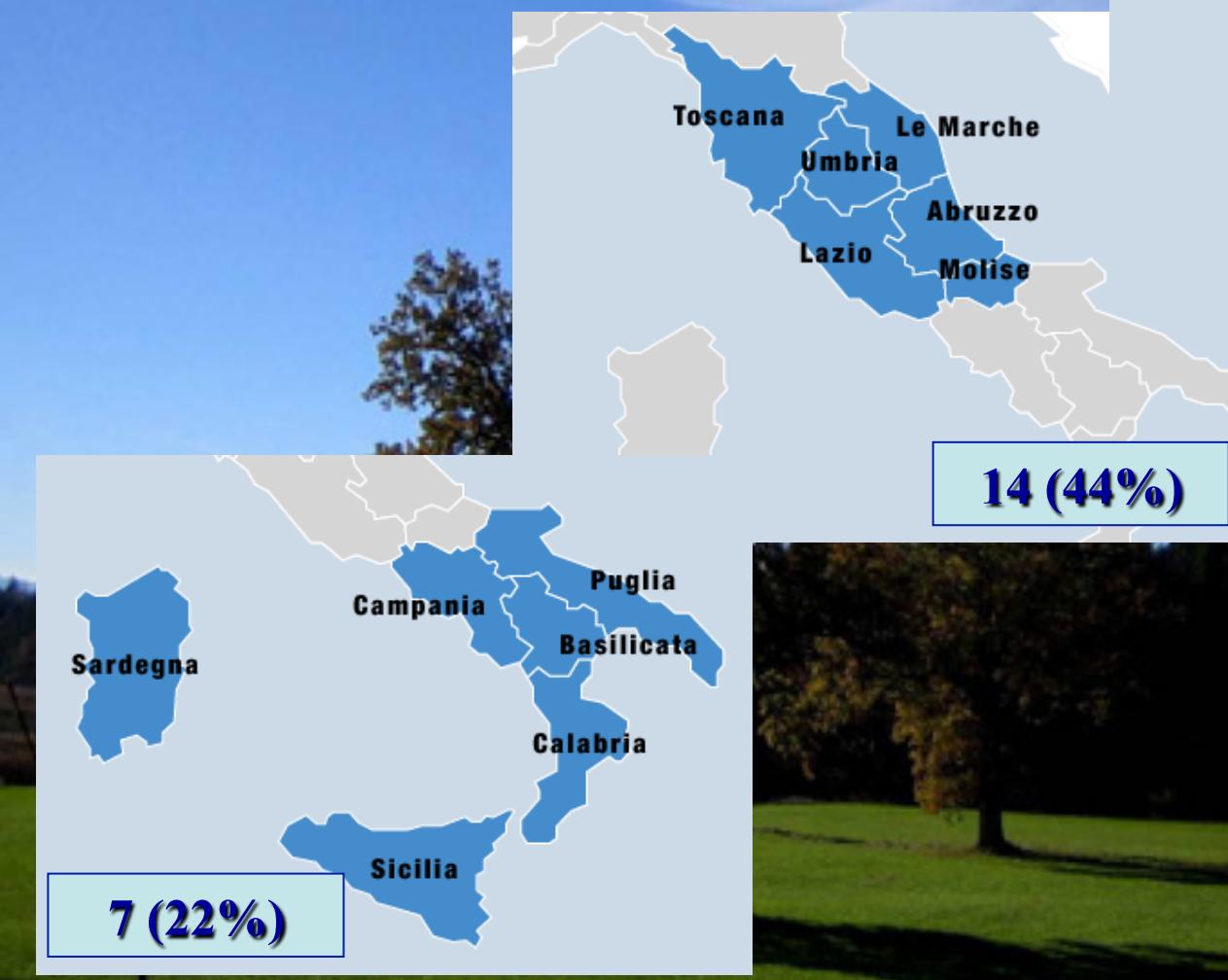


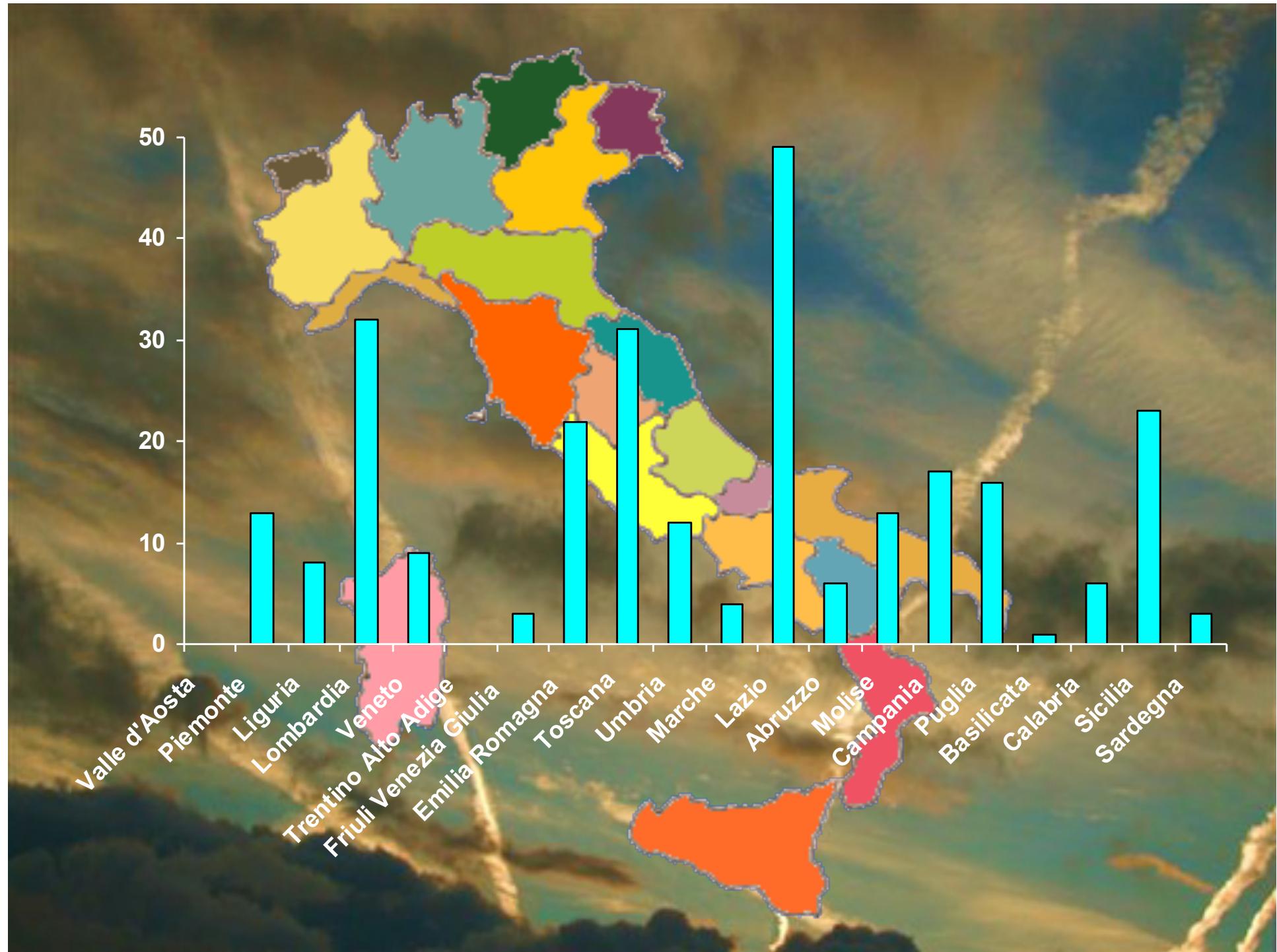
TECNICHE AD ALTO GRADIENTE DI DOSE **24 (68,6%)**



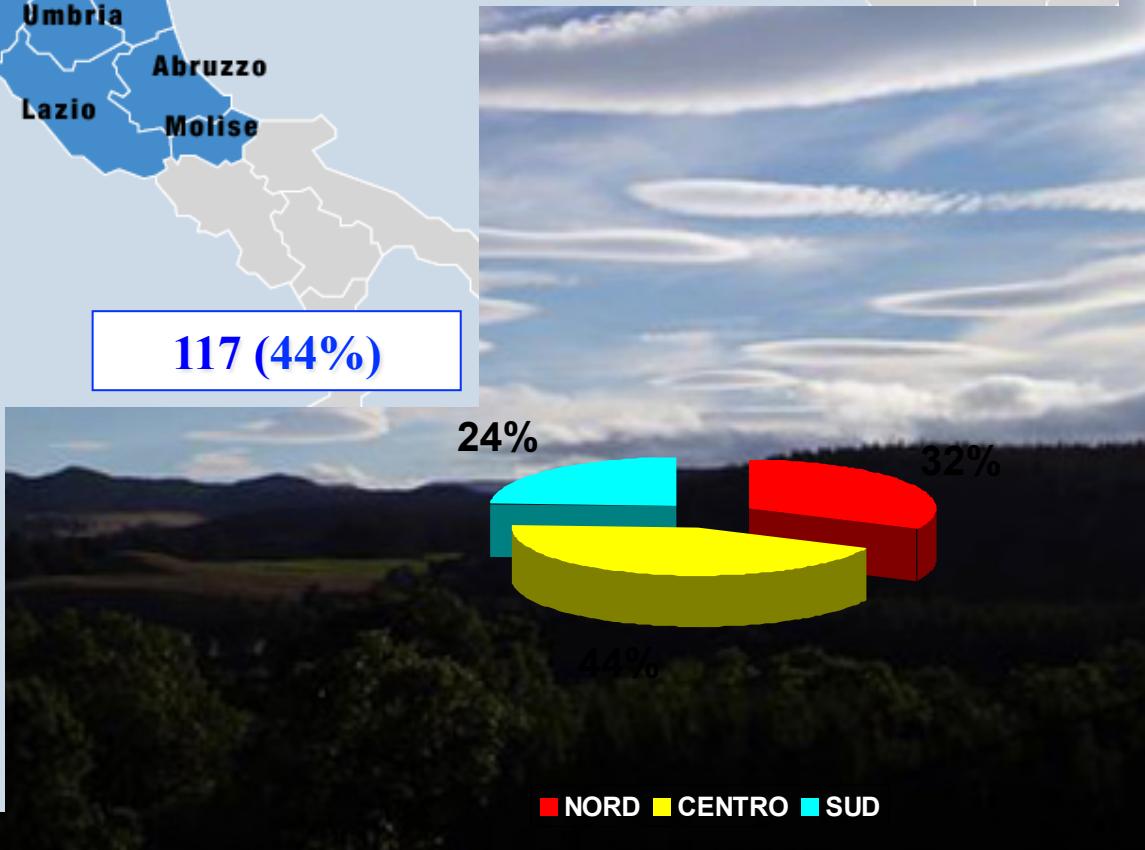
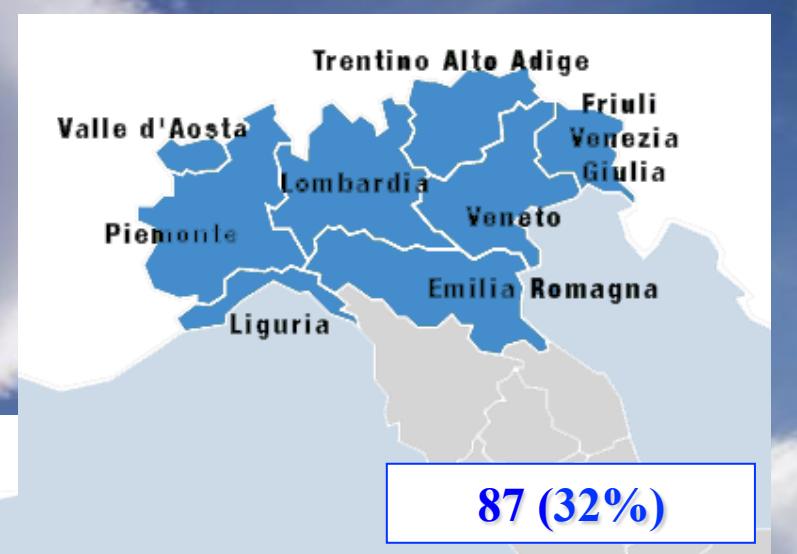
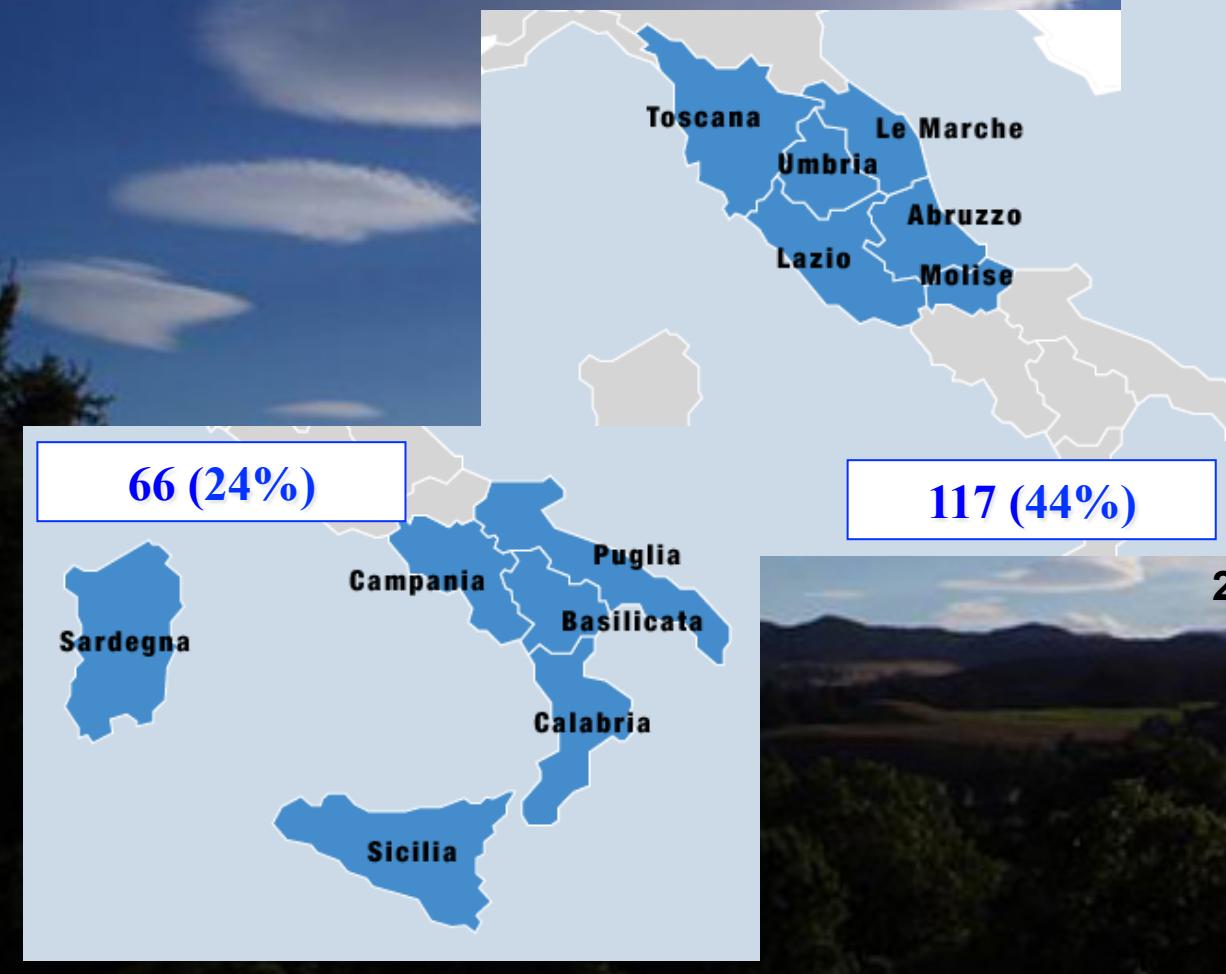


TECNICHE AD ALTO GRADIENTE DI DOSE 32 (60,4%)



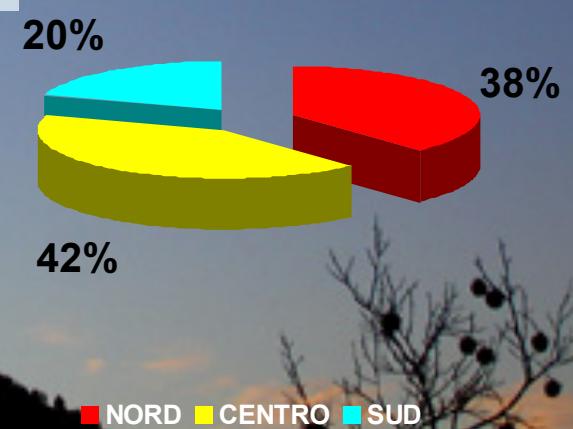
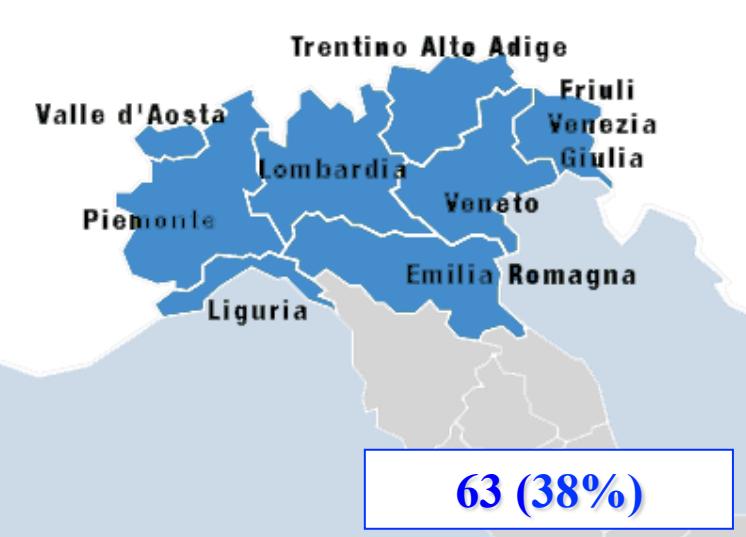
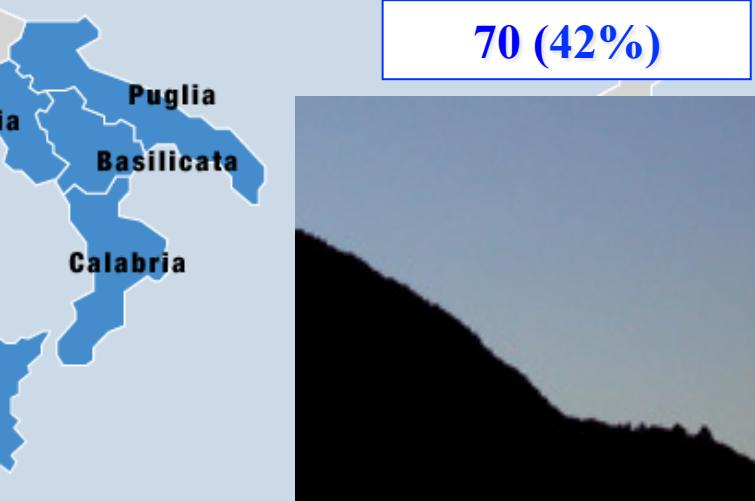


270 Contributi Congressi Nazionali AIRO 2006-2012



Congressi Nazionali AIRO 2006-2012

166 Contributi
TECNICHE AD ALTO
GRADIENTE DI DOSE





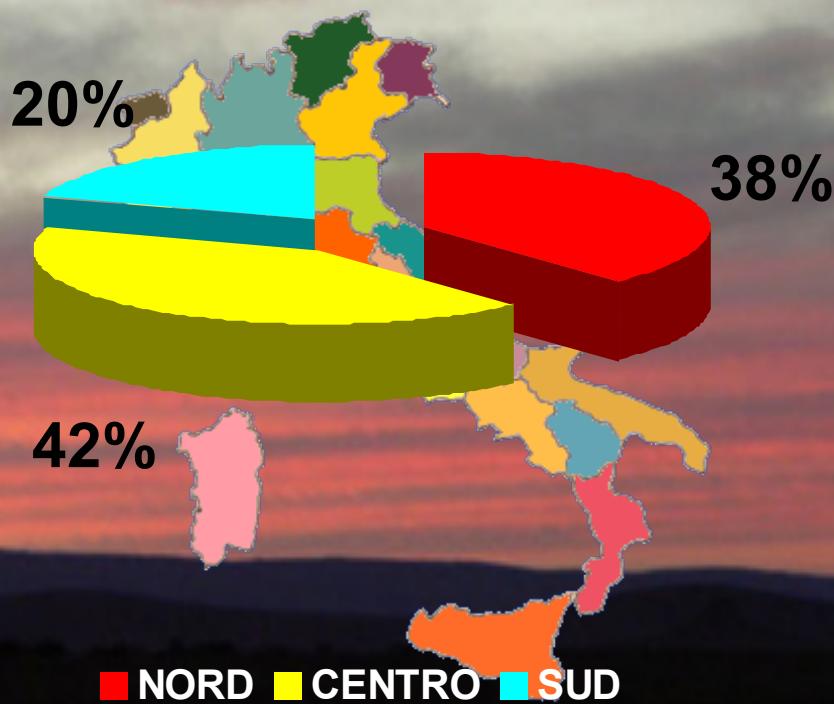
| Popolazione | Centri | LinAc | High Technology |
|--------------|------------|--------------|-----------------|
| 45,8% | 45% | 48,5% | 65% |



| Popolazione | Centri | LinAc | High Technology |
|--------------|------------|--------------|-----------------|
| 22,5% | 28% | 26,5% | 20% |



| Popolazione | Centri | LinAc | High Technology |
|--------------|------------|------------|-----------------|
| 31,7% | 27% | 25% | 15% |



CONCLUSIONI

- BUON LIVELLO DI INNOVAZIONE TECNOLOGICA,
SEPPUR CON DISOMOGENEA DISTRIBUZIONE SUL
TERRITORIO NAZIONALE
- BUON LIVELLO DI PRODUZIONE SCIENTIFICA,
MA ANCORA PIÙ EVIDENTE DISOMOGENEITÀ
TERRITORIALE

PAESE A DIVERSE VELOCITÀ...





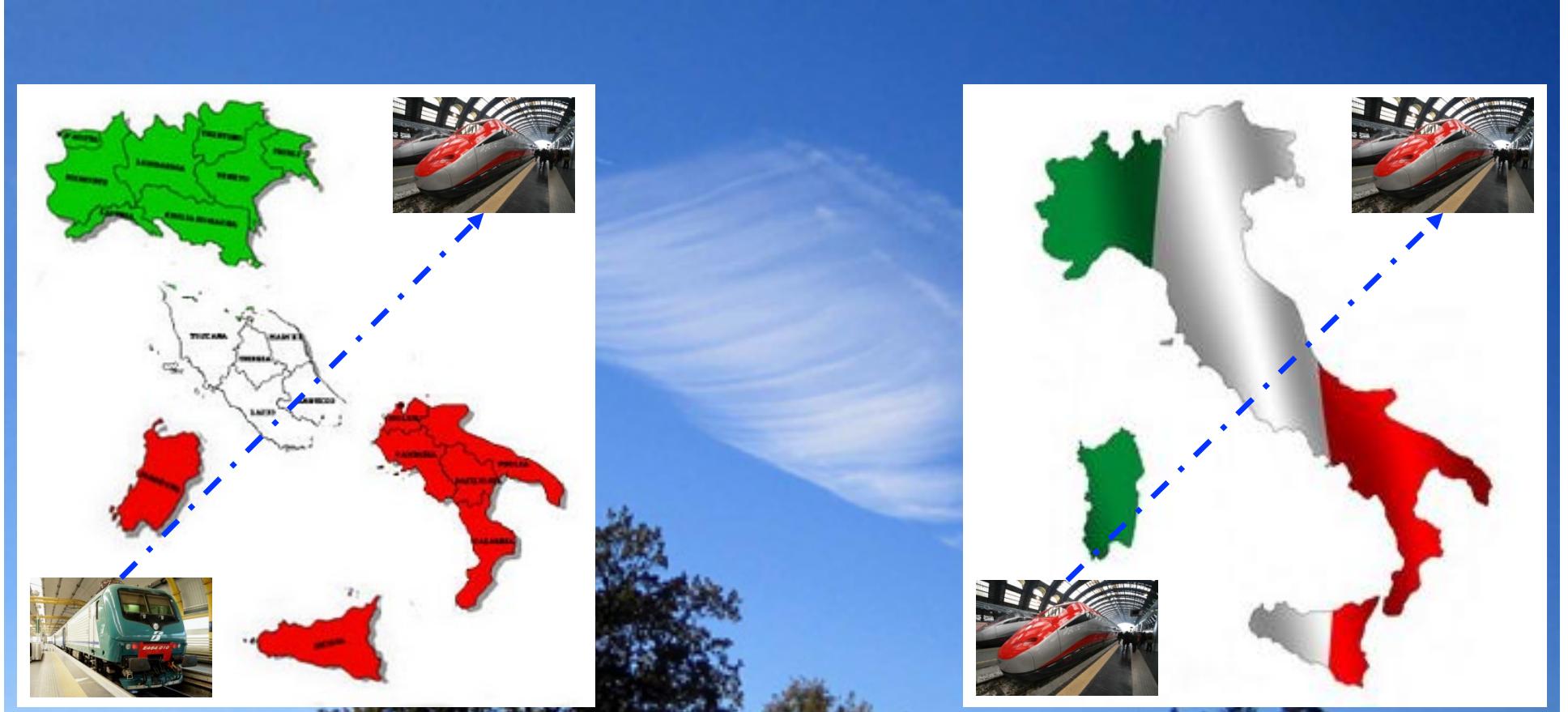
Johann Wolfgang von Goethe
(1749-1842)

*“Es ist nicht genug zu wissen; man muß auch anwenden;
es ist nicht genug zu wollen: man muß auch tun”*

*“La conoscenza non è sufficiente, dobbiamo applicarla.
La volontà non è abbastanza, dobbiamo agire”*

PER ANDARE OLTRE LE DIFFICOLTÀ





GRAZIE PER L'ATTENZIONE